Ashtabula Closure Project

FINAL RMI REPORT

PHASE II

SEPETEMBER 2003

PHASE II GROUNDWATER INVESTIGATION REPORT
FOR THE
RMI EXTRUSION PLANT SITE

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SHARP AND ASSOCIATES, INC.
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3 9/3/03	Final Issue - Review and respond to RMI comments	Text

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AT THE RMI EXTRUSION PLANT SITE

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EXECUTIVE SUMMARY

Sharp and Associates, Inc., (SHARP) and RMI Environmental Services (RMIES) performed Phase II of a Groundwater Investigation at the RMI Extrusion Plant Site (Site) in accordance with the approved work plans. This *Phase II Groundwater Investigation Report for the RMI Extrusion Plant Site* documents work performed at the site and compares the results obtained from this work to recent and historic Site groundwater data. The report comments on the Site and regional geologic setting, and evaluates the nature and extent of remaining Site contamination (and likely sources of that contamination). The report also identifies groundwater data gaps, compares all detected contamination against regulatory requirements and potentially relevant criteria, and provides recommendations for future work.

Table A summarizes the work performed during this phase of the investigation.

Table A. Summary of Activities Conducted in Phase II
RMI Extrusion Plant Site Groundwater Investigation

Task	Amount	Summary of Activity	Data Available
#1 Well Evaluation/Repair	7 wells	Replaced casing, installed drains	N/A
#2 Plug/Abandon Damaged Wells	17 wells	Abandoned damaged/compromised wells	Appendix B
#3 Install New Wells	16 wells	Installed replacement wells (for Task 2 wells) and new wells to fill data gaps.	Appendix A
#4 Well Sampling, Side by Side Sampling Test	14 wells	Sampled MW-101, MW-402, MW-901 through MW-909, MW-912, MW-913, MW-915	Table 11
#5 Pre-mob and Surveying	49 wells	Spotted new well locations. Surveyed entire well network.	Appendix E
#5a Measure water levels	48 wells	Data used for Potentiometric Mapping January and May 2003	Figs. 4.1, 4.1A, 4.2, 4.2A, 4.3, 4.3A
#6 Seep Mapping	12 seeps	Flagged and mapped seeps	Figure 3.11
#7 Hydraulic Testing	10 tests	Collected and analyzed Shelby tubes, conduct Slug tests	Table 2A, Appendix H
#8 Collect/Analyze Groundwater Samples	14 wells	Review of MW laboratory data	Table 10, Appendix J
#9 Utility Investigation Transect Soil Sampling	49 boreholes 120 samples	Borehole advancement, soil and groundwater sampling	Tables 7, 8; Figs 3.1 - 3.9 Table 9 / Fig 6.3
#9a Field XRF Readings	50 readings / lab samples	Record XRF results; compare to lab	Table 5
#9b MIPS Survey Readings	411 readings	MIPS survey run in conjunction with transects	Table 2
# 10 FEP WMU area Transect	9 boreholes	Borehole advancement, soil sampling	Figure 3.10
#11 Correlation between geology and contaminant concentrations in FEP WMU	NA	Prepared cross sections and isoconcentration maps to determine correlation between geologic units and contamination	Appendix I

As a result of this investigation, SHARP confirmed:

- Except for some near-surface soils, the site setting is one of generally low-permeability matrices;
- Migration of Site constituents of concern (COCs) via a groundwater pathway does not occur to any great extent;
- Trichloroethene (TCE) is the most mobile in groundwater of the principal Site COCs – more mobile than either Technetium-99 (Tc-99) and Uranium (Total U) and thus has the greatest potential to migrate from its source(s) via a groundwater pathway; and
- Most contamination is found in the vicinity of its source.

This investigation also determined that the 18-inch outfall lines that had been suspected to contain permeable backfill do not. The backfill consists of relatively impermeable native materials. The backfill acts more as a plug – potentially allowing contaminants to migrate along the contact with the plug. As a result, the *outfall pipe itself* may have been a significant conduit and contaminants may migrate along the backfill plug contact to the outfall line and *away* from the site, but the backfill around the pipe does not act as a major conduit.

Activities completed during Phase II of the site wide groundwater investigation for the RMI Extrusion Plant can be summarized as follows:

1. All of the monitoring wells scheduled for installation and abandonment were completed;
2. The well sampling and side-by-side testing of sampling methods have been completed, with the exception of monitoring wells (MWs) 900, 910, 911 and 914 which had not generated sufficient groundwater for sampling at the time of this report revision;
3. Seep locations at the swale and escarpment have been mapped and shown to correlate with the more permeable zones located near the Former Evaporation Pond (FEP) Waste Management Unit (WMU), previously referred to as the Corrective Action Management Unit (CAMU);
4. Groundwater flow is to the north/northwest in all units with a rate of migration on the order of 0.01-0.07 ft/year;
5. Investigation of the extent of contamination associated with the 18-inch outfall line was completed with the following results:

    - Twelve of the 51 soil samples exceed the 43 mg/kg standard for Uranium but most of these results are in the FEP WMU area, and only one of these is located at a depth greater than 5-feet;
    - One Tc-99 result slightly exceeds the soil standard of 65 pCi/g in the FEP WMU;
    - Only one TCE soil result exceeds the 22.6 mg/kg standard in one location (in the FEP WMU, near the surface); and
    - TCE in groundwater exceeds the 5 µg/L standard in the FEP WMU and in one other area located near the substation.

6. The extent of groundwater contamination as determined by the groundwater monitoring results are listed below:

- Total Uranium (U) exceeds the groundwater cleanup standard of 30 ug/L in the vicinity of the FEP WMU. Exceedances are limited to the till wells.
- Tc-99 exceeds the groundwater cleanup standard of 900 pCi/L in the vicinity of the FEP WMU. The plume is delineated within the till wells.
- TCE in groundwater wells exceeds the 5 ug/L standard is limited to the FEP WMU.

SHARP found that Site contamination does not travel far from its source(s) in the absence of conduits. As a result, strategies to remediate site media may need to be altered to best accommodate this condition.

The FEP WMU groundwater plume areas include surficial fill and silt lenses at shallow depths that allow migration of VOC and radionuclide contaminants via a groundwater pathway. The fill and silt lenses also seep and feed a ditch located at the top of the swale and seeps located on the face of the escarpment north of the FEP WMU. The seeps may allow migration of contaminants to lower Area C if not controlled (see Section 3.4 and Figures 1.1 and 3.11 for details).

1.0 INTRODUCTION

Sharp and Associates, Inc., (SHARP) performed much of Phase II of a Groundwater Investigation at the RMI Extrusion Plant Site (Site) in accordance with the approved *Work Plan for the Phase II Groundwater Investigation at the RMIES Main Extrusion Plant Site, Ashtabula, Ohio (dated September 10, 2002) and Work Plan for the Phase II Groundwater Investigation at the RMI Extrusion Plant (dated November 22, 2002).* This Phase II work was a follow-on to the Phase I evaluation SHARP completed in 2002.

This *Phase II Groundwater Investigation Report for the RMI Extrusion Plant Site* documents work performed at the Site and compares the results obtained from this work to recent and historic Site groundwater data. The report comments on the Site and regional geologic setting and evaluates the nature and extent of remaining Site contamination (and likely sources of that contamination). The report also identifies groundwater data gaps, compares all detected contamination against regulatory requirements and potentially-relevant criteria, and provides recommendations for future work.

1.1 BACKGROUND

RMIES is working toward securing environmental closure at the Site. Figure 1.1 provides a Site map. RMIES contracted with SHARP to perform a groundwater investigation. Phase I of the groundwater investigation included: a review of documents related to Site groundwater information; inspection of Site wells; and review of potentially relevant data. The following conclusions are based on the work in Phase I:

- ***Site groundwater is typically present in very-low-permeability matrices.*** Contaminant transport within these matrices is slow; thus, contaminant transport beyond the source areas typically occurs via more-permeable conduits.

- ***The more permeable areas include:***
  - granular fill, typically found in the top 3-5 feet of soil;
  - silt lenses present in the oxidized portion of the native till;
  - utility lines and the utility backfilled areas; and
  - vertical soil fractures.

  Roof drains historically extended from the Main Plant that discharge into an 18-inch effluent line and may explain some of the historic contaminant transport. Although both ends of this line have been plugged, there is still some potential for migration within the pipe between the plugged ends and to a lesser extent, through the utility line backfill. This effluent line (and its surrounding backfill) may have acted (and may continue to act to some degree) as a "French Drain" – dewatering a portion of the Site and allowing contaminants to preferentially transport along this conduit. This effluent line bisects the southern portions of the FEP WMU area.

- ***The major source of Site contamination is the soil in the FEP WMU*** area – a portion of the site that is contaminated with chlorinated solvents: trichloroethylene (TCE), tetrachloroethylene (PCE), and related constituents. This waste management unit has been identified in the in-place Resource Conservation and Recovery Act [RCRA] hazardous waste permit renewal for the site [OHD 980 683 544], dated August 13, 2002. In the permit, the only identified cleanup goal for this WMU is TCE at 22.6 mg/kg. The FEP WMU is also contaminated (from historic operations) with radiological parameters: Uranium (U) and Technetium-99 (Tc-99). There is an approved decommissioning plan that addresses the radiological parameters on the site; radiological decontamination and decommissioning activities are supervised by the Ohio Department of Health. *Affected groundwater associated with the FEP WMU* is identified as a separate WMU by Ohio EPA in the RCRA permit. The cleanup standard for TCE in groundwater is 5 µg/L.

- ***The seepage pond at the base of the escarpment*** (a 3rd WMU listed in the RCRA permit) has been remediated to meet radiological cleanup standards.

- ***Another Area of Concern – the "L"-shaped area*** has also been remediated to RCRA and ODH standards for lead and uranium.

- ***Surface soils provide an additional source area at the site.*** *Soils within ~5 feet of the surface* are contaminated with Total U and Tc-99, presumably due to deposition of airborne fine particulate from historic operations. These surface soils have the potential to contaminate groundwater with radiological parameters.

- ***Lead and barium*** are naturally-occurring constituents whose detection may also be associated with historic Site operations. Monitoring well construction and historic sampling methods may have caused some false-positive detections of these constituents (refer to the Sharp and Associates report for the *Phase 1 Groundwater Investigation at the RMI Extrusion Plant Site*, dated 7/22/02, for details). The in-place RCRA permit does not identify cleanup standards for barium or lead in water. The USEPA drinking water standard maximum contaminant levels (MCLs) will be used for screening purposes.

- There have been detections of barium and lead that exceed the MCLs in some of the wells. There is not a distinct pattern of these inorganics and most of the recent detections are believed to be related to methods that may not provide samples that are representative of groundwater. Natural background concentrations of these constituents may be responsible for some above-MCL detections. To evaluate this inference, side-by-side sampling using bailers and low flow techniques was conducted on selected wells.

1.2 INVESTIGATION SCOPE AND OBJECTIVES, PHASE II

The overall objective of the Phase II investigation is to fill in the data gaps (identified in Phase I) to define the nature and extent of groundwater contamination at the site. The primary COCs at the site include: TCE, Total U, and Tc-99. Additional potential site COCs include PCE, breakdown products of TCE and PCE (e.g., dichloroethene and vinyl chloride), lead, barium, and nitrates/nitrites. PCE's presence on site is attributed to its being a component of the 'technical

grade' TCE used as a degreasing agent during historic operations at the site. Although not reported during Phase 1 of the groundwater investigation, groundwater concentrations of nitrates/nitrites in some FEP WMU area wells exceed the MCL and may be considered a constituent of concern. This is based on historical sampling by Eckenfelder and recent sampling to support the bioremediation project.

The scope of work performed in this Phase II investigation is summarized below and in Table A.

Task 1. Evaluate Wells / Repair: One of the conclusions of the Phase I report was that there are potentially compromised wells at the site. A total of seven (7) wells were repaired in the Phase II field effort. The above-grade protective casing was replaced on MW-403. A section of the outer protective casing for MW-404 was found to be radioactively contaminated and thus was removed for disposal. In addition, drains were installed in the flush-mount vaults of MW-106, MW-801, MW-802, MW-803, and MW-804 to allow standing water to drain from the casing.

Task 2. Plug and Abandon Damaged Wells: The Phase I report identified a number of wells that were compromised and in need of abandonment. The following wells were abandoned during the field work; MW-100, MW-103, MW-104, MW-202, MW-204, MW-205, MW-206, MW-207, MW-301, MW-309, MW-310, MW-311, MW-312, MW-313, MW-500, MW-511, and MW-512. Water Well Sealing Reports, which document the closure of these wells are included in Appendix B of this report.

Task 3. Install New Monitoring Wells: A total of sixteen monitoring wells were installed as part of this investigation to fill data gaps and to replace wells that were damaged beyond repair or otherwise compromised. The wells were installed in the order of the potentially least contaminated to the potentially most contaminated. The order that the wells were installed is as follows: MW-910, MW-911, MW-913, MW-904, MW-908, MW-907, MW-914, MW-912, MW-906, MW-903, MW-905, MW-915, MW-901, MW-900, MW-902, and MW-909. Logs documenting the installation of these wells are included in Appendix A of this report.

Task 4. Sample Wells. Side-by-Side Method Test: Because some wells produce turbid samples when collected with a bailer, samples from these wells have the potential to yield results that may not be representative of site groundwater conditions. A side-by-side sampling test was conducted to compare bailer-collected samples to samples collected using low-flow techniques. The January 2003 samples were collected from the same well at about the same time. The May 2003 wells were bailed and sampled after sufficient time for groundwater recovery. MW-902 did not yield sufficient water for the bailed sample to be collected. Both filtered and unfiltered samples (collected using both techniques) were submitted to the laboratory for analysis. MW-101, MW-402, MW-901, MW-902, MW-903, MW-904, MW-905, MW-906, MW-907, MW-908, MW-909, MW-912, MW-913, and MW-915 were sampled during this side-by-side test.

Task 5. Conduct Premobilization Activities and Survey Afterward: Prior to beginning installation of the new MWs, an underground utility survey was completed per site

procedures to prevent damage to existing utilities from drilling operations. The well locations were physically staked based on the utility survey and drill rig accessibility. Following the completion of the new wells, the entire well network was surveyed for northing, easting, and elevation by Westfall Surveying of Jefferson, Ohio. In addition to surveying the MW network, Westfall completed a topographic survey of the FEP WMU area. The survey data are included in Appendix G of this report. The survey results, including the FEP WMU topography are depicted in Figure 1.1.

Task 6. Map Seeps: A SHARP field geologist mapped the silt seams along the escarpment to further define the Site hydrogeology. The seep locations were also surveyed.

Task 7. Conduct Hydraulic Testing: To address a data gap identified in Phase I, rising and falling head tests (slug tests) on the new wells are planned following their development. Slug tests were performed on wells MW-900 through MW-915. Additionally, ten Shelby Tubes collected during the well installation were laboratory tested for permeability following ASTM method D-5084 in order to support Site groundwater flow (hydraulic) interpretations. These results are presented in Section 4. Water levels were recorded on January 3, 2003, and in May 2003 and used to produce potentiometric surface maps.

Task 8. Collect and Analyze Groundwater Data: RMIES and SHARP sampled wells in the network (listed in Table A below). Many of the wells were slow to develop. Wells MW-900, MW-910, MW-911 and MW-914 did not yield sufficient water to be sampled.

Task 9. Investigate Utility Line and FEP WMU: The buried 18-inch outfall lines were identified in Phase I as a potential conduit for contaminant transport. The FEP WMU is a major source of Site contamination; and a portion of the utility line is located along the southern portion of the FEP WMU. The Utility Line and FEP WMU investigation was performed in order to:

- Further define the nature and extent of contamination in the vicinity of the line;
- Refine the lithology of the native materials located immediately outside the trench;
- Confirm the topography of the trench flank and of the gray/brown till interface;
- Define the hydraulic characteristics of the trench fill material; and
- Provide information to support development of appropriate methods to remediate these areas.

Task 10. Investigate the area of the FEP WMU, between the ditch area and the northern escarpment/swale: The water within this area has been sampled and reported to contain TCE and vinyl chloride. This contaminated water from the FEP WMU has the potential to migrate via both groundwater and surface water pathways. This water may potentially re-contaminate the Lower Area C. The potential for this to occur will remain until the upper portion of the site has been remediated or the transport pathways have been interrupted. The purposes of this portion of the investigation are to:

- Further define the relationship of the silt lenses within the oxidized till to groundwater and contaminant flow in this area; and

- Collect information that will support development of appropriate methods that RMIES may apply as interim control measures within this area to minimize the potential for Lower Area C recontamination until the final remedy is in place.

Task 11. Evaluate the correlation between geologic units and contamination in the FEP WMU. This task was conducted to determine whether the geologic subunits will be a field indicator of the occurrence of soil contamination in the FEP WMU. Geologic cross sections with the contaminants posted as well as isoconcnntration maps of contaminants within the geologic units were prepared to evaluate the correlation.

Table A provides a summary of the testing conducted during Phase II. This report has been updated with the data received and compiled as of July 2003. Refer to Table 1 for a summary of the samples collected for analysis.

Table A. Summary of Activities Conducted in *Phase II*
RMI Extrusion Plant Site Groundwater Investigation

Task	Amount	Summary of Activity	Data Available
#1 Well Evaluation/Repair	7 wells	Replaced casing, installed drains	N/A
#2 Plug/Abandon Damaged Wells	17 wells	Abandoned damaged/compromised wells	Appendix B
#3 Install New Wells	16 wells	Installed replacement wells (for Task 2 wells) and new wells to fill data gaps.	Appendix A
#4 Well Sampling, Side by Side Sampling Test	14 wells	Sampled MW-101, MW-402, MW-901 through MW-909, MW-912, MW-913, MW-915	Table 11
#5 Pre-mob and Surveying	49 wells	Spotted new well locations. Surveyed entire well network.	Appendix E
#5a Measure water levels	48 wells	Data used for Potentiometric Mapping January and May 2003	Figs. 4.1, 4.1A, 4.2, 4.2A, 4.3, 4.3A
#6 Seep Mapping	12 seeps	Flagged and mapped seeps	Figure 3.11
#7 Hydraulic Testing	10 tests	Collected and analyzed Shelby tubes, conduct Slug tests	Table 2A, Appendix H
#8 Collect/Analyze Groundwater Samples	14 wells	Review of MW laboratory data	Table 10, Appendix J
#9 Utility Investigation Transect Soil Sampling	49 boreholes 112 samples	Borehole advancement, soil and groundwater sampling	Tables 7, 8; Figs 3.1 - 3.9 Table 9 / Fig 6.3
#9a Field XRF Readings	50 readings / lab samples	Record XRF results; compare to lab	Table 5
#9b MIPS Survey Readings	411 readings	MIPS survey run in conjunction with transects	Table 2
# 10 FEP WMU area Transect	9 boreholes	Borehole advancement, soil sampling	Figure 3.10
#11 Correlation between geologic subunits and contamination	Interpretation of existing data	Prepare cross sections and isoconcentration maps in the FEP WMU	Appendix I

2.0 UPDATED GEOLOGIC SITE SETTING

SHARP reviewed Site documents and performed a Site visit as part of the Phase I to evaluate the geologic setting and well conditions and compare them to similar site (and constituent) conditions that it has encountered in Northeast Ohio. Based on this work, the following conditions were found to be present at the site;

- The matrix materials of the till, the weathered shale, and the shale formations across the site have very-low-permeability. This limits both groundwater and groundwater-associated contaminant transport by way of typical groundwater pathways;
- Depth to first-encountered groundwater is typically only a few feet;
- Some wells do NOT provide samples that are representative of actual Site groundwater conditions due to damage, age, and/or remediation activities; these include well installations with near-surface bentonite seals subject to frost heave, long screen lengths that straddle more than one unit, the nearby presence of utility conduits, and heterogeneous surface water / groundwater interfaces;
- Constituent transport of more that a few feet likely occurs via atypical pathways; e.g., via surface water or storm water infiltration at conduit locations or groundwater transport through more-permeable zones (native and created); and
- Fill materials present at the surface have higher permeability than underlying natural strata and allow higher near-surface transport of constituents in groundwater.

To further elucidate Site conditions, SHARP and RMIES performed Phase II work as described in Section 1. The locations for the new wells were chosen to resolve questions about well completions, to determine if contaminants were present in outlier areas away from the FEP WMUs, and to further determine the characteristics of groundwater flow across the site. The Geoprobe® boring investigations were designed to determine if the utility trench between Manholes 1 (MH1) and 11 (MH11), and MH1 and MH2 are pathways for contaminant migration and to determine the extent of the silt lenses in the brown till across the northern boundary of the FEP WMU.

2.1 STRATIGRAPHY AND HYDROGEOLOGY

Topsoil/Fill:

The topsoil at the site has generally been described as having a high clay content that is derived from the Ashtabula Till. The permeability of this native topsoil is similar to the underlying tills below the root zone of plants. The topsoil/fill has characteristically high runoff and low percolation rates during (and shortly after) precipitation events.

Much of the site has been re-graded; some regrading where native material has been moved from high to low areas. During the drilling of the recent wells, Shelby tubes were pushed into the fill material as well as native material. Table 2 summarizes the hydraulic conductivity alues found in the fill and in the native materials at different depths from the slug tests and Shelby tube samples. The results indicate that native materials are typically low-permeability materials, in a range of 10^{-6} through 10^{-8} cm/sec. This is consistent with previous work that generally found the hydraulic conductivity of the soil at 10^{-6} cm/s. (Summary Report of WIDE Soil Flushing, 1999).

Materials with this permeability will have the characteristics of low infiltration and high runoff. (Krynine and Judd, 1957)

The extensive use of crushed limestone and gravel as surface fill in some areas of the site has significantly altered the runoff/percolation balance in localized areas. Where this permeable material has been added, there is significantly less surface runoff and evaporation, making more water available for infiltration into the deeper sections over a longer period of time. The primary areas where this has been identified are:

- within the FEP WMU, around the L-series borings 1 through 11, 16, and 21 through 24); and
- the area around the CEI substation (borings for wells 909 and 913).

This gravel fill likely accounts for some of the increased volume of water produced from the subsurface in these areas.

Till:

The till stratigraphy of the Site has been extensively described in previous reports (Dames and Moore, 1985, Eckenfelder, 1989, AWARE, 1988). The results of re-evaluating those assessments, along with the additional data from the additional Phase II borings and wells, indicate that the glacial till unit should be subdivided into two subunits:

- an upper, oxidized, brown till that contains extensive silt stringers; and
- a lower, unoxidized, gray till that does not appear to have significant silt lenses.

The USCS classification for both of these subunits is CL, or clay. Soil profiling and grain size analysis were performed during the subsurface investigation by North Carolina State University (NC State University, 1999). The report found that the two clay till types were compositionally heterogeneous to a depth of about 8 feet and very homogenous from that depth downward. The heterogeneity in the upper section may be attributed to the backfill that was applied over the area as well as the silt lenses that are present in the upper section.

Within this subdivided depositional model, the major percentage of the water and contamination in the till can be shown to be constrained to the silts within the upper oxidized brown till subunit. The piezometric surface for the till units is at a depth of about 3 to 5 feet below grade. Below this depth, the till is saturated; but water only represents about 10 to 20 per cent of the total density of the till section because of the high overall percentage of clay throughout. Table 2 summarizes the initial saturation of the Shelby tube samples and also the percent water for the boring performed as part of the Phase II groundwater investigation. The only sample that was not saturated was the sample taken from 0-2 feet in boring MW-911, which is above the water table. A sample was taken from boring MW-902 in native material with some silt (4 to 6 feet) but was inadvertently remolded at the laboratory so that the silt and clay till were homogenized. The reported permeability of 10^{-7} cm/s for this sample represents the permeability of that homogenized sample and is not representative of the hydraulic conductivity of silt that is typically in the range of 10^{-3} to 10^{-5} cm/s (Applied Hydrogeology, 3rd Edition, C.W. Fetter, 1994).

A series of geologic cross sections were constructed to further illustrate the relationship between the brown oxidized till and the silt lenses within the till, the gray unweathered till, and the bedrock shale. Figure 2.1 is a base map with the trace and well boring locations used to construct these cross sections.

Figure 2.2 is a north-south cross-section and Figure 2.3 is an east-west cross-section. The locations of silt sections within the till have been documented on these sections where existing boring logs allow. Figure 2.2 has also been modified to include the location and depth of the 18-inch effluent line that bi-sects the Site. Figures 2.4 and 2.5 are new cross sections to provide further information in vertical view across the site, and are constructed to link more of the Phase II boring data with existing logs.

Oxidized Brown Till:

Based on information from the monitoring wells that were installed as part of this Phase II investigation (Wells 900 through 915), the Geoprobe® investigations along the utility trench (Transects 1 through 9), and a re-examination of the existing logs from historic borings and wells, there appears to be strong evidence that the silt intervals present in the till are primarily within the oxidized brown till section as described above. Our review of a published geologic report on the tills in Ashtabula (Glacial Geology of Northeastern Ohio, George White, 1982) indicates that this interpretation conforms to the published regional geologic deposition of the Ashtabula and the Hiram Tills. The silt intervals have lower clay content than the till, and likely represent a beach of an earlier lake episode that washed and reworked the till, as described in the physiography section of an earlier assessment report (Eckenfelder, 1989).

Based on a review of the soil borings and wells, there is a high correlation between the presence of contamination and the presence of silt lenses. The silt lenses are generally limited to the brown till subunit. In the investigation performed by NC State (1999) they found that in the area of the borings that they drilled, the major part of the contamination was at depths of 5-9 feet. The exception was in Boring T5 where they found TCE 16 feet. Tc-99 was found at relatively the same depths. Uranium was found to be present at shallower depths (at 3 feet in boring T3).

The Geoprobe® transect of borings that were collected across the north side of the FEP WMU has shown that these silt lenses are present along the escarpment and have the potential to become seeps following rain events. The surface ditch located north of the FEP WMU, at the top of the swale, may also be fed by one or more seeps, both through the surficial gravels and deeper silts present over some of this area. The ditch contents have been sampled and have reportedly been found to contain volatile organic compounds (VOCs) and Total U. This ditch can potentially overflow during a rain event and may allow transport of any contaminants present therein down the escarpment.

In addition, seeps along the escarpment have the potential to allow transport of contaminants down the escarpment and re-contaminate previously-remediated areas. A preliminary visual estimate of the seeps along the escarpment indicated that the discharge is intermittent, and may be a combination of surface discharge from the ditch north of the FEP WMU and seepage from the silts within the brown till. There is a more detailed discussion of the seeps in Section 3.

Figure 2.6 is a structure map of the surface of the gray till. The topography of this surface likely influenced the location of the silts in the brown till and to some extent their thickness. The major features of this map are the high area in the south part of the main plant building slab and the drainage feature underneath the FEP WMU.

Figure 2.7 is a net isopach map that portrays the combined thickness of the silts in the brown till. The trend of the thickness indicates that silt lenses are present within the brown till over the entire site. They are generally greater than 6 feet thick in the east, and thin to the northwest where they are less than 1 foot thick. The thickness of the silt lenses in the area of the FEP WMU is variable, but generally thicker across the north and south sides.

Figure 2.8 is a structure map of the base of the silt lenses, portraying the lowest elevation that silt occurs within the brown till. The area of contouring is specific to the FEP WMU area and the trench of the utility line connecting MH1 and MH11. The trend of the silt is to deepen from the FEP WMU to the east, with the deepest area along the north side of the utility trench and around abandoned monitoring well MW-210.

There are numerous descriptions from borings across the Site that describe a high density of iron-stained fractures in the interval from 2 to about 15 feet, which is primarily in the oxidized brown till. Although these fractures may significantly increase the ***vertical*** permeability of the till locally, ***there is no evidence*** in the data from the Phase II borings and wells ***that these fractures significantly affect horizontal contaminant transport.*** The FEP WMU is an area where there is a high density of wells and borings in a small area, and the depth of fractures cannot be correlated from one boring to another.

Unoxidized Gray Till:

The gray till has had little exposure to water and air after historic deposition, and thus, apparently represents the uppermost portion of the Hiram Till. The Ashtabula Till is essentially Hiram Till scraped from the lake bottom by an ice advance and redeposited a few miles south (White, 1982). The lower gray till has few silt lenses, and when encountered in the new borings, lenses were characterized as less than 1 foot thick, with no free water.

There are vertically-oriented fractures that extend into the upper part of the gray till which may provide a mechanism for localized vertical contaminant transport from the overlying brown till and silt lenses into the top of the gray till. There is no evidence, however, that these fractures are interconnected to the extent that they influence contaminant flow horizontally. A review of the well and boring logs across the site indicate that the fractures occasionally extend to a maximum depth of 14 to 15 feet below grade (MW-907, MW-403, MP-10, MP-11, SB-2).

Shale and Interface:

The Chagrin Shale directly underlies the till and is several hundred feet thick. It is comprised of dark gray, dense shale with thin interbeds of fine grained siltstone and sandstone. There is a weathered zone (Interface) at the top of the shale that several of the monitoring wells are completed in. Based upon the permeability testing reported by Eckenfelder (1989), the shale section has lower permeability than the overlying tills.

The weathered interface zone is thin or absent in the deep 900 series borings (900, 902, 912, 915). The interface section is also considered to be a low-permeability stratum.

2.2 PRELIMINARY INTERPRETATION OF POTENTIAL TRANSPORT MECHANISMS

The primary source of Site contamination has been identified as the FEP WMU – an area historically contaminated with radiological parameters (Total U and Tc-99) and chlorinated solvents. Based upon the work completed during Phase I and Phase II of this investigation, there are limited mechanisms for the significant transport of contaminants from source areas (including the FEP WMU). The mechanisms for contaminant transport are summarized as:

- Localized areas where coarse material has been used for fill. These areas are likely creating more infiltration of surface water into the upper brown till; and within limited areas this changes the runoff/infiltration balance when compared to native materials. The FEP WMU is one area where this has been identified from existing and new borings and is likely contributing to the water in the ditch across the northwestern side of the FEP WMU. A second coarse fill area is located in the vicinity of the CEI substation.

- The silt lenses in the brown upper till subunit likely provide a pathway for migration to the escarpment and possibly along the utility trench south of the FEP WMU. Although silt is generally considered to be low permeability, at this site, it is the most permeable native matrix material and thus the most likely path of contaminant migration away from the FEP WMU.

- The vertical fractures found throughout the brown till and the top part of the gray till may provide a pathway for localized vertical migration as they provide a conduit for contaminants to migrate from the silt lenses in the brown till into the top of the gray till. There is no evidence that the fractures are interconnected and provide a viable pathway for horizontal migration within the till subunits.

- The numerous penetrations in the shallow sections of the FEP WMU (prefabricated vertical drains, HRC injection points, wells screened across various features, boring locations, re-grading, etc.) may allow migration of CoCs via more permeable conduits.

3.0 FIELD INVESTIGATION, SEEP MAPPING, AND SAMPLE COLLECTION

The Phase I investigation identified the potential for contaminant transport via conduits. Two areas of concern are:

- buried 18-inch outfall line that runs through the southern portion of the FEP WMU and eastern half of the site; and
- seeps located north of the FEP WMU near the escarpment.

SHARP and RMIES investigated these potential conduits in a "Geoprobe®" investigation conducted in accordance with the approved work plan.

3.1 BACKGROUND, INVESTIGATION, AND OBJECTIVES

Background, 18-inch Outfall Lines:
Recent samples collected at the RMIES NPDES outfall have contained concentrations of TCE above permitted discharge limits. In response to these results, RMIES plugged the 18-inch outfall lines between MH1 and MH11, and MH2 and MH1 in August 2002 and re-routed the wastewater flows to limit further release of TCE. However, water samples collected in the outfall line after the line was plugged still contain detectable concentrations of TCE. The outfall line investigation was conducted to identify possible source(s) and extent(s) of TCE contamination in the vicinity of the 18-inch outfall lines.

Previous investigations at the site (i.e.; underground utilities map, D-00248-T-01) have identified above-background concentrations of Total U in soil borings located in close proximity to buried utilities and building foundations. SHARP and RMIES suspected that these elevated concentrations could be the result of utility backfill material providing a preferential path for the vertical and horizontal transport of contaminants. The utility investigation sought to investigate the extent of contamination and the nature of the backfill material associated with the outfall lines located between MH1 and MH11 and MH1 and MH2. Nine sets (transects) of boreholes were advanced during the investigation of the outfall lines.

Utility Investigation:
The investigation included:

- advancement of Geoprobe® Macro-Core® samplers;
- collection of 3-foot acetate-liner-enclosed samples;
- description of the subsurface lithology;
- screening of the Macro-Cores® using a PID and Geiger-Mueller meter;
- collection of Encore® samples, analyzed for VOCs;
- Membrane Interface Probe (MIP) characterization;
- screening of samples with an XRF; and
- collection of samples for laboratory analysis of radiological parameters.

MIP Characterization:
In parallel with the collection of soil borings along the outfall lines, the Geoprobe® was outfitted with a MIP operated by personnel from the DOE's Savannah River Technology Center. The MIP provides for real time detection of total VOC concentrations versus depth. The results of this investigation are detailed in Appendix D. A summary of the MIP data is also presented in Table 3.

The MIP survey utilized a photoionization (PID) detector, and a Bruel & Kjaer photoacoustic analyzer that are useful for delineating relatively high concentrations of unspeciated VOCs. Although no VOCs were detected using the MIP along the 18-inch outfall lines, the MIP could be used to delineate VOCs present at levels near the TCE soil cleanup level. Some modification to the MIP may be required to obtain the sensitivity needed for this purpose. The MIP outfitted with a gas chromatograph has reported VOC detection limits of ~50 ppb in groundwater. Use of the machine in this mode could result in savings of laboratory costs as well as provide immediate data analysis.

SHARP and RMIES conducted the Geoprobe® portion of the investigation from December 3, 2002, to January 31, 2003, in accordance with the approved work plan. Ten transects of borings were installed: Transects 1-9 and the FEP WMU Transect. Due to conditions encountered in the field, the following modifications were made to the plan:

- MIP borings were installed in the A, B, C, and D locations on Transects 1 and 6.
- MIP borings were installed in the C and D locations of Transects 2, 3, 4, 5, 7, 8, and 9.
- Due to the interpreted (smaller than expected) width of the utility trench, the distance to the B and E borings was 6-feet from the centerline of the trench and the distance from the center of the trench to the A and F borings was 10-feet in transects 2, 3, 4, 5, 7, 8, and 9.

Background, Seeps Located North of the FEP WMU:
Seeps present along the face of the escarpment may allow contaminated groundwater to migrate via a surface water pathway to the Lower Area C. The investigation sought to identify the locations of these seeps and attempt to correlate them with the more permeable subsurface zones north of the FEP WMU area. One transect of boreholes was installed north of the FEP WMU area (North FEP WMU Transect). The lithology was logged and the locations of site seeps were mapped.

3.2 Utility Line Transect Cross Sections

The results of the lithologic descriptions of the borings were combined to generate geologic cross sections for Transects 1 through 9. These are presented in Figures 3.1 through 3.9 and discussed in the next section. Note that the higher permeability zones are shown in blue (sand, silt, gravel).

Geologic Cross Section of Transect #1 (See Figure 1.1 and Figure 3.1)
Transect #1 is located 60-feet east of MH11, south of the FEP WMU. The top three feet is fill material consisting primarily of gravel and silty clay. The deepest point of backfilled material associated with the 18-inch outfall line was found at 12.2-feet in BH1C. The trench backfill

material consists of a heterogeneous mixture of black, gray, and brown silty clay with varying amounts of sand and gravel as a minor component. No more-permeable (sandy/granular) pipe bedding was found in the base of the "trench" (the area apparently excavated and backfilled during installation of the outfall line).

Native materials were first encountered in the A, B, E, and F borings at ~3-feet bgs. South of the trench, a thin layer of organic clay (likely the topsoil present at the site prior to adding fill to the site surface) underlies the uppermost (gravelly) fill. This layer of "topsoil" was absent on the north side of the trench in this transect. Mottled brown and gray silty clay underlies the former topsoil and extends to nominally 6-feet bgs. Brown glacial till consisting of silty clay with sand and gravel as minor components extends to nominally 11-feet bgs. This till typically contains intermittent fractures with iron precipitates. Underlying the brown till is gray till consisting of silty clay with sand and gravel as minor components. Intermittent fractures containing iron precipitate were observed as deep as 14-feet bgs. Field screening with the hand held PID detected VOCs in the fractures as deep as 14-feet bgs north of the centerline of the trench. The field and laboratory data are presented in Tables 4 through 9. The field data are also presented on the boring logs in Appendix C.

A water sample was collected from a temporary piezometer that was installed from 3-feet to 8-feet bgs in a borehole offset 1 foot west of BH1B. The analytical results of the water sample are presented in Table 10. The water encountered in this borehole was from a perched zone at the contact between the top three feet of fill and the mottled brown and gray silty clay. The brown and gray mottled silty clay apparently acts as a confining layer preventing the vertical migration of groundwater. Water-producing deposits were not present in native materials or trench backfill in any of the Transect 1 boreholes at depths beneath this confining layer.

Geologic Cross Section of Transect #2 (See Figure 1.1 and Figure 3.2)

Transect #2 is located 150-feet east of MH11. Due to time constraints, boreholes A, E, and F were not completed. The geologic data collected from the B, C, and D boreholes are suitable to accurately define the geometry of the section. Trench backfill extended to 4-feet bgs in boring D and 7-feet bgs in boring C. Fill material consisting of gravel and silty clay extended to 3-feet below ground surface in boring B. The bottom depth of the trench on this cross section has been interpolated to nominally 12-feet bgs based on the estimated invert elevation of the 18-inch outfall. The fact that the C and D borings missed the bottom of the trench indicate a narrow trench with steep banking at this transect location. Trench fill material consists of heterogeneous mixture of gray and brown silty clay with varying amounts of sand and gravel as a minor component. No potential water producing zones were identified in the trench backfill.

Native undisturbed soils were encountered in boreholes B and D at 3-feet bgs. and 4-feet bgs respectively. A silt lens is present from 5.5-feet to 7-feet bgs in BH2B. This lens is not continuous across the profile and was not identified in BH2D, south of the trench. However, an increase in the moisture content of the silty clay was identified at a similar depth interval (7.0-feet to 7.6-feet bgs) in BH2D. A groundwater sample was collected from a piezometer offset 1-foot east of BH2B. The screened interval was set between 4-feet and 9-feet bgs to isolate the saturated silt lens.

Geologic Cross Section of Transect #3 (See Figure 1.1 and Figure 3.3)

Transect #3 was located 265-feet east of MH11. Across the section, surface fill consisting of aggregate base above silty clay with sand and gravel as a minor component was identified up to 3.5-feet bgs. The deepest trench backfill, encountered in boring D, extended to 9.5-feet bgs. The bottom of the trench has been projected on Figure 3.3 to 11-feet bgs based on the suspected depth of the 18-inch outfall line at this location. Trench backfill material consisted of a heterogeneous mixture of brown and gray silty clay with sand and gravel as a minor component. The moisture content increased with depth; however, no potential water producing material (silt/sand containing free water) was identified in the backfill.

Topsoil was identified beneath the surface fill on the north side in borings A and C. A layer of mottled brown and gray silty clay is intercepted by the trench and extends across the cross section. Underlying this unit is a lens of saturated silt that thickens to the north. The silt lens was identified from 6.0-feet to 7.2-feet bgs (1.2-feet thick) in boring F and from 4.7-feet to >9.0-feet bgs in boring A (>4.3-feet thick). The silt lens does not appear to be hydraulically connected north and south of the trench due to the less permeable trench backfill materials that intercept this unit. Brown silty clay (till) was identified beneath the silt unit on the south side of the transect to a depth of nominally 10-feet bgs. On the north side of the trench, the silt is underlain by gray clay and gray silty clay (till). Both the brown and gray tills identified beneath the silt have significantly lower moisture content than the silt unit and appear to act as confining layers.

A groundwater sample was collected from the saturated silt unit from a temporary piezometer installed in BH3C. The screen interval was set from 6-feet to 11-feet in the saturated silt from 7.2-feet to 10.5-feet bgs.

Geologic Cross Section of Transect #4 (See Figure 1.1 and Figure 3.4)

Transect #4 is located 360-feet east of MH11. Surface fill, consisting of aggregate base brown silty clay was identified to a depth of 1.7-feet on the north side of the trench and extended to 4.5-feet bgs on the south side of the trench. Refusal was encountered in boring F at 4.5-feet bgs on what is assumed to be the footer of a former structure. Trench backfill extends to a maximum depth of 16.1-feet bgs in boring D. A layer of black stained silty clay is present beneath the backfill in this boring from 16.1 to 16.4-feet bgs. Pipe bedding was not found in the bottom of the trench. Backfill material consists of brown and gray silty clay with sand and gravel as a minor component. A layer of gravel fill is located from 6.4 to 7.3-feet bgs in the fill material in boring C. Topsoil was identified beneath the surface fill in borings A, B and E. A continuous layer of mottled brown and gray silty clay underlies the surface fill and topsoil and extends to a maximum depth of 6.6-feet bgs in boring E. A thin lens of saturated silt is present in borings B and E and is likely in hydraulic communication with the gravel identified in the fill material in boring C, based on similar depth intervals. A confining layer consisting of brown silty clay (till) is present beneath the silt lens to a maximum depth of 9.3-feet bgs. The brown till is underlain by gray silty clay (till).

A groundwater sample was collected from a temporary piezometer installed in BH4B. The screen interval was set from 7-feet to 12-feet bgs and included the silt lens found in this borehole from 6.3 to 8.1-feet bgs.

Geologic Cross Section of Transect #5 (See Figure 1.1 and Figure 3.5)

Transect #5 is located 500-feet east of MH11. Aggregate base fill is present across the section up to 0.9-feet bgs. The maximum depth that fill material was encountered was 4.5-feet bgs in boring E. Trench backfill material was not encountered in this transect. Because of the presence of a shallow utility pipeline at this transect location, boring C was offset 4-feet north of the trench. The absence of trench backfill material in borings C and D suggests that the trench had little slope when the pipe was installed and the maximum width at the top of the trench was less than 6-feet.

Native materials encountered across the transect consisted of brown and gray mottled silty clay to a depth of nominally 3.8-feet underlain by a saturated silt layer to a maximum depth of 6.3-feet north of the trench and 9.0-feet south of the trench in boring D. Underlying the saturated silt is brown silty clay till over gray silty clay till. Both the brown and gray tills are significantly less permeable than the saturated silt and are likely acting as confining layers.

A groundwater sample was collected from a temporary piezometer installed in boring D with a screen interval of 6-feet to 11-feet.

Geologic Cross Section of Transect #6 (See Figure 1.1 and Figure 3.6)

Transect #6 is located 24-feet northeast of MH1 in Area D. Four of the six proposed borehole pairs (MIP and Macrocore) were installed (BH6A through BH6D). Boreholes BH6E and BH6F were not installed due to the presence of buried utilities. Fill material was encountered in all 4 borings and ranged in depth from 8.5-feet below ground surface (bgs) to 10.9-feet bgs. The fill material consists of a heterogeneous mixture of silty clay containing varying amounts of sand and fine gravel. Pipe bedding was not found in this transect. The geometry of the trench (wide and deep) suggests that the fill is associated with the excavation and removal of the former outfall pipe in Area D.

An increase in moisture content was identified at the base of the fill material. The silty clay matrix is defined as "moist to wet" in these samples. It should be noted that "moist to wet" is a qualitative description that indicates that the moisture content of the silty clay is between the plastic limit (PL) and liquid limit (LL) as defined in ASTM D-4318 and does not suggest that this material contains free water. Because there was no free water in any of the transect 6 boreholes, a temporary piezometer was not installed.

Geologic Cross Section of Transect #7 (See Figure 1.1 and Figure 3.7)

Transect #7 is located 64-feet southwest of MH1 on the RF-3 pad. The concrete floor slab, 0.75-feet thick, was cored with a nominal 4-inch core bit at each of the boring locations. Surface fill consisting of brown and gray silty clay extends across the cross section to a maximum depth of 3.0-feet bgs. The deepest trench backfill was identified in boring C at 9.7-feet bgs. Trench backfill material consists of a heterogeneous mixture of brown black and gray silty clay with sand and gravel as a minor component. Saturated sand was present within the trench backfill in boring C from 1.4-feet to 3.9-feet bgs and in boring D from 3.7-feet to 6.0-feet bgs. No pipe bedding was identified in the trench.

Native materials consist of brown and gray mottled silty clay to a maximum depth of 4.5-feet bgs in boring E. A continuous lens of saturated brown silt is present in borings A, B, E, and F and ranges in thickness from 1.1-feet in boring F to 1.7-feet in boring B. This saturated silt lens is likely hydraulically connected to the sand located in the trench backfill due to similar depth intervals. The maximum depth at which the saturated silt was encountered was 6.0-feet in boring E. A layer of brown silty clay (till) is found beneath the silt lens southeast of the trench backfill and a layer of highly plastic clay (fat clay) northwest of the trench backfill. Both act as relatively impermeable layers (confining layers) and have considerably lower moisture content. The brown till is underlain by gray silty clay starting at 6.3-feet southeast of the trench. Northwest of the trench, brown till underlies the fat clay from 7.2-feet to 9.0-feet. Gray silty clay till is found below 9.0-feet.

A groundwater sample was collected from a temporary piezometer installed in boring B and screened from 6-feet to 11-feet. Because of poor water recovery, only VOC samples were collected from this piezometer.

Geologic Cross Section of Transect #8 (See Figure 1.1 and Figure 3.8)

Transect #8 is located 112-feet southwest of MH1. The total depth of surface fill across this transect ranges from 2.3-feet in boring F to 7.0 feet in boring B. This variation is most likely the result of excavations related to other utilities and building foundations. The trench backfill material was identified to a maximum depth of 13.5-feet in boring D and consists of a heterogeneous mixture of soft black brown and gray silty clay with fine to coarse sand as a minor component. Moisture content ranges from moist to wet (i.e. >PL to >LL). Pipe bedding was not found in the bottom of the trench. A temporary piezometer was installed in the fill material of boring D from 8-feet to 13-feet. This piezometer did not produce water and could not be sampled.

Southeast of the trench, a saturated silt lens was encountered from 3-feet to 4.3-feet. A similar saturated silt lens was identified in boring A, northwest of the trench from 3.9-feet to 4.6-feet. Prior to excavation for the trench and other utilities/building foundations, these silt lenses were likely a locally-continuous unit.

Geologic Cross Section of Transect #9 (See Figure 1.1 and Figure 3.9)

Transect #9 is located 190-feet southwest of MH1. Surface fill, consisting of aggregate base is encountered across the entire section up to 1.7-feet. Trench backfill material was encountered up to 14.7-feet bgs in boring D and consists of a heterogeneous mix of soft, dark gray clayey silt to 12.0-feet. Gray and black silty clay containing decomposed organic material was present from 12.0-feet to 14.7-feet. The fill material is saturated below 6.0-feet.

Native materials consist of mottled brown and gray silty clay and brown clay to a maximum depth of 4.3-feet. A saturated silt lens, ranging in thickness from 3.8-feet in boring A and thinning to 0.5-feet in boring F is present in native materials across the transect. Beneath the silt lens, in borings located northwest of the trench, gray silty clay (till) is present at nominally 8-feet bgs. Brown silty clay underlies the silt lens southeast of the trench to a maximum depth of 8.2-feet where gray till is encountered. Both the brown and gray silty clay have significantly lower moisture contents than the overlying silt and likely act as confining layers.

A groundwater sample was collected from a temporary piezometer installed in the fill material of boring C. The screen interval was set from 6-feet to 11-feet to straddle the section in this boring where the most water was observed during boring installation. Due to poor recharge, only enough sample volume for VOC analysis was collected.

3.3 NORTH FEP WMU TRANSECT

Nine Geoprobe® borings were installed north of the FEP WMU (North FEP WMU Transect) to document the lithology and potentially identify the presence of saturated/permeable soils between the FEP WMU that may be sources of seeps from the face of the escarpment north of the FEP WMU. The location of these boreholes is shown on Figure 1.1. Figure 3.10, North FEP WMU Transect, was developed using the lithology encountered in BH11, BH12, BH14 - BH20, and MW-901. The distance between each boring is nominally 10-feet. BH13 was not completed because the location was inaccessible for the Geoprobe® due to surface topography.

Fill material is present across the majority of the transect ranging from 1.1-feet to 3-feet and is absent in BH14 and BH15. The one exception is boring BH17 where fill was present to a depth of 7.5-feet. West of BH17, brown and gray mottled silty clay is present to the maximum depth of 6.0 feet. A saturated silt lens is present in BH12, BH14, BH15, and BH16. The maximum thickness of this saturated silt is 2.5 feet in BH15. Following removal, water was observed on drill rods and sample barrels in borings where this silt deposit was present.

A thin silt lens is present east of BH17 in BH19, MW-901 and BH20. The maximum thickness of this deposit is 0.9-feet in MW-901. Brown silty clay till is present across the cross section generally at depths greater than 5-feet. Underlying the brown till is gray silty clay till, generally encountered at depths greater than 7.6-feet. Groundwater was not present in samples collected in the brown and gray till.

3.4 SEEP MAPPING

October 2002 Examination

SHARP conducted a field survey of the escarpment north of the FEP WMU on October 7-8, 2002, after recorded precipitation on October 5, 2002 of 0.06 inches. During this survey, locations were flagged near the top of the swale on the escarpment where there was an active seep or evidence of an active seep. Potential seeps located near the base of the escarpment were also noted and flagged. These location flags were later numbered and surveyed.

The areas around the active seeps were typically iron-stained and had accompanying algal bloom on the surface, around the riprap that had been placed in the swale (following remediation of radiologically contaminated soils by RMIES and SHARP in 2002). The uppermost seep locations (flag numbers 3 and 4) are located at the interface between fill and native clay noted in the escarpment excavation and the native material and had an observed flow of about ½ liter per minute. The exact location of the seeps at flags 1 and 2 were harder to define because they are located in the riprap covering the escarpment and generally had low flows (estimated to be on the order of only several cc's per minute at the time of observation). There were no obvious cracks or openings in the clay located behind the riprap at these locations.

Locations 5 through 9 were flagged at the base of the escarpment where there was a slope break, vegetation change, and indirect evidence of seepage. At the time of observation, no open flow was present. Locations 10, 11, and 12 were flagged in an area at the base of the escarpment where there was a vegetation change and indirect evidence of seepage without open flow. All of the flagged locations are shown on Figure 3.11.

Cross sections A-A' (Figure 2.2), D-D' (Figure 2.5) and the North FEP WMU Transect (Figure 3.10) show the relationship of Seep Locations 1 through 4 to the geology, in plan view. Cross section A-A' shows that seep locations 3 and 4 (which had open flow at the time of observation) are at the same elevation as the sandy silt lens encountered in well borings MW-209, 303, 306, and 307. Cross Section D-D' indicates that these same seeps are also co-incident with the silt described in well boring 900, which was drilled as part of this Phase II investigation. Nine Geoprobe® borings were drilled along this transect to further define the silt lenses and other possible saturated lithologies in the brown till subunit. The section of this transect (Figure 3.10) indicates that seep locations 1 and 2 are at the same elevation as the interface between the base of the fill encountered in BH-17 and the native brown silty clay.

Cross sections E-E' (Figure 3.12), F-F' (Figure 3.13), and G-G' (Figure 3.14) are detailed sections across the FEP WMU to further show the relationship between the silt lenses in the till and the seep locations. Each of these sections run South to North and tie to the Geoprobe location on the North FEP WMU Transect. Section G-G' traverses through BH-17, which is the closest location along the North Transect to the mapped seep locations. This section shows that seeps flagged as "3" and "4" are at the same elevation as the silt lenses found in boring L-19, and at the same elevation as a "wet" zone in the fill as logged in Borehole BH-17 along the North Transect.

On November 2, 2002, RMIES attempted to collect seep samples during a rainfall that totaled 0.19 inches. However, there was insufficient seep flow during this event to collect the minimum sample volume and therefore the collected samples consisted of seep water mixed with surface runoff. One sample was collected near seep flags 1 thru 4 at the top of the swale. A second surface runoff sample was collected in the swale halfway down the escarpment.

May 2003 Follow Up Examination

On May 22nd 2003 and May 27th 2003 the escarpment was again examined to determine the influence of runoff and seeps on the ponded water at the base of the escarpment. There was 0.32 inches of precipitation on May 21st and 0.53 inches of precipitation on May 24th, 2003. The precipitation data is measured at the plant outfall for the site's NPDES monitoring program. During these examinations it was determined that the water flowing down the escarpment was originating from 3 areas, as shown on Figure 3.11.

It was estimated that at the time of the examination, greater than 90 % of the water was coming from surface water runoff from Area 1, the ditch in the FEP WMU, and Area 2, the low lying areas east of the ditch but in the same general area of the FEP WMU. Area 3 was a smaller area further to the east, adjacent to the FEP WMU area and off the corner of the soil staging pad where there was seepage observed from the sloping surface. These areas are identified on Figure 3.11, and the surface flow is to flags 3 and 4. At the time the escarpment was examined it could

not be determined if there were additional seeps that contributed to the volume of flow at flags 1 and 2, as these were covered with surface flow from further up the escarpment. A water sample was collected at flagged location 4, and consisted of water that had consolidated from the 3 areas described.

Flagged locations 5 through 9 were under standing water during the time periods that the escarpment was examined and could not be evaluated.

Locations 10, 11, and 12 were previously flagged in an area at the base of the escarpment where there was a vegetation change and indirect evidence of seepage without open flow. During the examination on May 22, 2003, it was determined that there was a drainage gully on the slope above these flags concealed by vegetation, and that the wet soils at this location were caused by runoff from the surface area above the escarpment. The drainage course is shown on Figure 3.11.

3.5 Soil Sample Collection During The Geoprobe Investigation

Following the completion of each Macro-Core® boring, the acetate liners containing the soil cores were taken to an on-site laboratory where the liners were opened in the order from shallowest to deepest drive interval. Information on lithology including color, predominant soil type, minor components, density, and moisture content were recorded in a field book. RMIES sampling technicians screened the Macro-Core soil samples with a Thermo-Environmental 580B Photoionization Detector (PID) and recorded the readings in 1-foot intervals on a field log (See Table 4). The entire length of the cores was screened with a Geiger-Mueller frisker and the location on each core with the highest response was screened to determine the counts per minute (cpm). These data were recorded on a field log. Soil sampling locations for laboratory analysis of VOCs were selected based on the highest PID readings in each borehole. In borings where PID readings were at background, soil sample locations were biased towards visible signs of contamination, the base of the fill material, soil directly beneath saturated silt lenses, and the invert elevation of the outfall line.

Three En-Core® soil samples were collected at each sample location and sealed in a single zipper bag. The borehole, depth interval, and time of collection were recorded on the label and on RMI chain of custody forms. Samples were collected for x-ray refraction (XRF) screening and submission for analysis for Tc-99 and Total U from the soil immediately above and below the En-Core® sample location. En-Core® samples were collected from a total of 91 locations. Total U and Tc-99 samples were collected from 107 locations.

3.6 Monitoring Well Installation, Repairs and Abandonment

Sixteen monitoring wells were installed as part of this investigation to fill data gaps and to replace wells that were damaged beyond repair or otherwise compromised. The wells were installed in the order of the potentially least contaminated to the potentially most contaminated. The order that the wells were installed is as follows: MW-910, MW-911, MW-913, MW-904, MW-908, MW-907, MW-914, MW-912, MW-906, MW-903, MW-905, MW-915, MW-901,

MW-900, MW-902, and MW-909. Logs documenting the installation of these wells are included in Appendix A of this report.

Seven (7) wells were repaired in the Phase II field effort. The above-grade protective casing was replaced on MW-403. A section of the outer protective casing for MW-404 was found to be radioactively contaminated and thus was removed for disposal. In addition, drains were installed in the flush-mount vaults of MW-106, MW-801, MW-802, MW-803, and MW-804 to allow standing water to drain from the casing.

The following wells were abandoned during the field work; MW-100, MW-103, MW-104, MW-202, MW-204, MW-205, MW-206, MW-207, MW-301, MW-309, MW-310, MW-311, MW-312, MW-313, MW-500, MW-511, and MW-512. Water Well Sealing Reports, which document the closure of these wells are included in Appendix B of this report.

3.7 Monitoring Well Development

RMIES and SHARP began developing the sixteen (16) new monitoring wells on November 11, 2002. Slow recovery rates were observed in all of the new wells. During previous sampling events, RMIES technicians have observed seasonally variable recovery rates in many existing site monitoring wells. Because of theses conditions, development was conducted by surging and bailing each well dry on multiple occasions. The frequency of development was dependent on the recovery rate of each well.

Development consisted of surging the wells to suspend solids followed by bailing using disposable and dedicated bailers. Prior to bailing, water levels were measured and recorded in the logbook. In-situ field parameters were measured using an YSI 556 Multi-Parameter Water Quality Meter and recorded in the logbook. Parameters included temperature, barometric pressure, conductivity, pH, oxidation/reduction potential (ORP), and dissolved oxygen (D.O.). See Table B for a listing of the amounts of water purged from these wells.

3.8 Groundwater Sample Collection Along Geoprobe® Transects

SHARP installed temporary piezometers in boreholes at locations to the depth interval in each transect where the most water was likely to be present based on observations from Macro-Core® soil samples.

Groundwater samples were collected from the temporary piezometers using a QED ¾-inch bladder pump. The pump was set at the lowest possible sample rate (~10 ml/minute) and the groundwater level was monitored with an electronic water level tape. Prior to collecting the groundwater samples, field parameters of pH, temperature, conductivity, dissolved oxygen and oxygen-reduction potential were measured and recorded in a field book.

3.9 YIELD TEST

A yield test was conducted on MW-508 on January 22, 2003. MW-508 was selected for the yield test due to the higher rate of recharge, relative to other site monitoring wells, as reported by RMIES sampling technicians.

The yield test was conducted using a QED Sample Pro MicroPurge® bladder pump and a model MP10 Controller. This pump/controller combination allows a maximum pumping rate of 0.16 gallons per minute (6 cycles per minute @ 0.026 gallons per cycle). Results from the yield test are discussed in Section 4.7.

3.10 SIDE-BY-SIDE SAMPLING TEST

Side-by-side samples were collected from MW-101, MW-402, MW-901, MW-903, MW-904, MW-905, MW-906, MW-907, MW-908, MW-909, MW-912, MW-913, and MW-915 to compare the effects (if any) on the results when using a bailer vs. when using low-flow techniques. Note MW-902 yielded sufficient water for the low-flow sample only. Low-flow groundwater samples were collected using a QED Sample Pro MicroPurge® bladder pump and a model MP10 Controller. The MP10 controller was equipped with a MP-30 Drawdown/Water Level Meter to minimize disturbance to the formation during sampling. The probe on the Drawdown/Water Level Meter was placed at a level that allowed control of drawdown to a level below the top of the well screens. Field parameters were monitored using a QED MP 20 Flow Cell and recorded in the logbook. Turbidity was measured using a Hach Model 2100P Portable Turbidity Meter (Hach) and recorded in the logbook and presented in Table 11. Samples were collected for VOCs, total and dissolved uranium, lead and barium, and Tc-99.

Following the collection of the low flow samples, each well was bailed "dry" and allowed to sufficient recovery time before bailer samples were collected. Prior to collecting the bailed samples, in-situ field parameters were measured using the YSI 556 Multi-Parameter Water Quality Meter and NTU using the Hach. Results were recorded in the logbook. A disposable bailer was then lowered until the top of the bailer was slightly below the static water level. The bailer was then removed and samples were collected for the same constituents collected using the low flow methods. At the completion of sample collection, in-situ field parameters and NTU were measured a second time for comparison purposes. Field parameters and NTU recorded during the side-by-side sample collection are summarized in Table 11.

3.11 SLUG TESTING

The Bouwer and Rice slug test was utilized for the hydraulic conductivity testing at the RMI. The "slug-out", or "rising head" test to be used at the Site was based on quickly withdrawing a volume of water from the well and measuring the subsequent rate of rise in the water level in the well. A pressure transducer/data logger was utilized to monitor and record the rate of rise of the water level in the well. The specific procedures used are described in more detail in the standard operating procedures for conducting slug tests at the RMI Facility.

Each well was bailed so that water levels dropped by at least 40% of the total column of water in the well, based upon static conditions. The rising head test is typically logged until 90% recovery of the water level has been achieved. The rate of change in water level will decrease as the test proceeds, and in some wells, after the rate of change decreased to what was essentially a constant low rate (e.g., 0.01 ft per hour for 24 hours) the test was terminated. Therefore, the actual termination time of the slug tests at the RMI facility were either based on 90% recovery of water levels or a field decision based upon the rate of change of the water levels. Results from the slug tests are further discussed in Section 4.10 of this report. The graphical analysis of the tests and summary table and graph are contained in Appendix H.

4.0 RESULTS AND INTERPRETATIONS

4.1 GROUNDWATER POTENTIOMETRIC SURFACES

Static water levels were measured at the Site on January 3, 2003, and on May 18-20, 2003. The measured water levels were converted to elevations in the state plane coordinate system and plotted on a three base maps. Potentiometric surface maps were produced using wells completed in each of the three geologic units. Figures 4.1 and 4.1A present the potentiometric surface for the glacial till wells, Figures 4.2 and 4.2A present the potentiometric surface for the interface wells, and Figures 4.3 and 4.3A present the potentiometric surface for wells completed in bedrock.

Till:

The potentiometric surface for the Glacial Till wells (Figure 4.1) has been plotted using two-foot contour intervals. The groundwater surface elevation in MW-907, located on the southwest corner of the Site, is 634.61 feet. This represents the highest groundwater elevation in Glacial Till wells in January 2003. The well with the highest water level elevation in May 2003 is MW-906. The lowest groundwater surface elevation in January and May is 604.18 and 603.24, respectively, in MW-914, located on the northwest corner of the site. The overall configuration of groundwater flow remained the same for those measurement periods.

In general, the potentiometric surface slopes to the north in a pattern that is similar to the site ground surface elevation pattern. The slope that is portrayed generally indicates the direction of groundwater flow, which is toward Fields Brook. The potentiometric surface gradient increases in Area C, along the escarpment, reflecting the surface topography. On the southeast portion of Area B, and the south portion of Area D, the groundwater surface is relatively flat, as is the surface topography. The potentiometric surface gradient increases in Area C, along the escarpment, reflecting ground surface topography. On the southeast portion of Area B, and the south portion of Area D, the groundwater surface is relatively flat, as is the surface topography.

The gradient (slope) of the groundwater surface and the permeability derived from the Shelby tubes may be used to determine the velocity that groundwater is moving within the till section. A derivation of the Darcy Equation is used for this analysis, as follows;

$$v = 1035354 * \frac{ki}{n}$$

where:

v= average velocity of groundwater (GW), feet/year
i = gradient (slope) of GW table between two defined points in a given area, feet/feet.
k = permeability, centimeters per second
n= porosity, .30 (as previously used) unitless
1,035,354= conversion from cm/sec to feet/year

For the FEP WMU area, the groundwater gradient in the till is 0.0048, measured between MW-501 and MW-901 (reference Figure 4.1). The averaged permeability derived from Shelby tubes

taken in till/native undisturbed material is 8.61E-07 cm/sec. Using the equation above, the horizontal groundwater flow through the ***undisturbed*** till material under the FEP WMU is about 0.01 foot/year. The gradient across the main part of the site (south of the escarpment and outside of the FEP WMU) is generally lower than that used in the calculation in the FEP WMU area, and would result in a lower groundwater velocity in that area.

The velocity derived by using a hydraulic conductivity value based upon the geometric mean of slug tests from 10 wells was 0.07 ft/year (Eckenfelder, 1989). This slightly higher velocity (same order of magnitude) reflects the influence of higher permeability silt lenses in the brown till that some of the wells are screened in. Hydraulic conductivity results for a series of slug tests were also reported in the Eckenfelder report (1989). Wells MW-100, MW-101, MW-103, MW-104, MW-105 and MW-106 all have filter packs and screens that extend across from the brown till and associated silt seams. These wells have significantly higher hydraulic conductivity (10^{-5} to 10^{-6} cm/sec) than wells MW-306, MW-307, MW-314, and MW-315 that are screened only in the lower, gray till (10^{-7} to 10^{-8} cm/sec).

The amount of water that may be produced from an aquifer is normally defined as the yield of a single production or extraction well screened within the aquifer, for a sustained period (8-hours). With regard to the till underlying the RMI facility (WIDE, 1999), it has been difficult to produce enough water from some of the wells for complete development. The closest "test" that has been performed at the facility is the Demonstration of the Well Injection Depth Extraction (WIDE) soil flushing. The flow rate for **all of the PVWs in a quadrant** for a six-hour period decreased to 25 gallons per hour (0.4 gallons per minute) with a high vacuum applied and no injection. Based upon the existing information from the WIDE tests, the tills k underlying the site are not capable of producing a sustained yield in a single well of even close to 0.5 gallons per minute.

The results of the slug tests SHARP performed on the newly installed 900 series wells were analyzed to determine what the yield from those wells could be. The 20% recovery level (after baildown) was used. Using the time from the cessation of bailing (or pumping) to 20% recovery will derive a higher yield than the averaged data, as the water level recovery from a slug test is typically logarithmic in nature. Based upon this analysis, the highest yield in any of these wells was found in MW-906. MW-906 was completed in a silt unit within the till. The yield from this well was < 0.6 gallons per hour, or < 0.01 gpm. The yields from the till, interface, and bedrock wells were an order of magnitude less than those from the wells completed in the silt unit

Interface:

The potentiometric surface for the interface wells (Figures 4.2 and 4.2a) has been plotted for January and May 2003 in two-foot contour intervals. Six wells were used to produce the maps. All six wells are located at the top of the escarpment in the vicinity of the FEP WMU. In general, the potentiometric surface slopes to the north with a channel-like drainage pattern beneath the FEP WMU. These maps are controlled by levels in well MW-902. Potentiometric measurements collected seasonally will help determine whether this changes over time.

Bedrock:

The potentiometric surfaces for the bedrock wells (Figures 4.3 and 4.3a) have been plotted in one-foot contour intervals. We question the groundwater elevation data for MW-405 and MW-

200. MW-200 has a groundwater elevation significantly higher than all other bedrock wells for both measurement periods– potentially due to a compromised completion, and so this data point was not included on the potentiometric surface map. MW-200 was completed as a single cased well with only a grout seal from the surface into bedrock. MW-405 is located within 10-feet of MW-404 and is screened at the same depth interval; however in January 2003 the static water elevation is 4.51-feet greater in MW-405. Well MW-402 was used. This well is completed with a double casing so that the well is sealed into the top of bedrock with a steal casing, as well as the grout between the outer casing and the riser. It is unlikely that this difference is representative of the actual potentiometric surface. The groundwater elevation in MW-405 is shown on the map but was not used in the contours. When water levels were taken in May well MW-405 was not accessible because of deep standing water around the well. Water level elevations from January and May 2003 from the bedrock indicate that over most of the site, the gradient in the shale is very low, with flow to the northeast.

The newly installed monitoring well MW-900 is double cased, with the outer casing grouted into the top of bedrock.

4.2 TCE Concentrations in Soil Transects

A discussion of the analytical results in transects where TCE was detected follows (see Figures 3.1 through 3.10 for the individual transects and Figures 6.1 and 6.3). Concentration data are provided on these figures as well as in Tables 7 and 9. TCE data collected from temporary piezometers may differ somewhat from data collected in the same vicinity using a typically constructed monitoring well.

Transect #1:
TCE is present at concentrations ranging from 4.25 ug/kg to 112,000 ug/kg in the A and B borings in Transect #1. Both borings are located north of the trench and are within the FEP WMU. TCE was detected at a concentration of 112,000 ug/kg in the sample collected at 14-feet in boring A. This sample was collected from an area where fractures are present in the till and is the only sample location (out of all the soil samples collected from these transects) where the TCE concentration exceeds the soil cleanup criteria of 22,600 ug/kg. TCE is also present at the base of the surface fill at a concentration of 4.25 ug/kg (2.9-feet) and at 4,200 ug/kg in a fractured zone at 6.5-feet. TCE was present at 27.8 µg/L in the ***groundwater*** sample collected from boring B. The screened interval was set from 3-feet to 8-feet; however the only water observed in this boring was perched at the base of the fill material from 2.3-feet to 2.9-feet. Groundwater was not present below the surface fill in any of the borings installed in Transect #1. Both groundwater and soils are TCE-contaminated above standards.

Transect #2:
TCE was detected in three soil samples collected from borings installed in Transect #2. At the base of the fill material, TCE was present at concentrations of 4.83 ug/kg and 1.27 ug/kg in borings B and D, respectively. TCE was detected at a concentration of 212 ug/kg in boring B at 6.5-feet. This sample was collected from a saturated silt lens. The groundwater sample collected from a piezometer screed in this silt lens contained TCE at a concentration of 230 µg/L. TCE contamination is present above standards in the groundwater but not the soil.

Transect #3:
TCE was detected in five soil samples collected from borings installed in Transect #3. Two of these samples were collected from the native soil encountered directly beneath the surface fill and concentrations are significantly below cleanup criteria. Three samples with detectable concentrations of TCE were collected from a saturated silt lens. The highest TCE concentration from the samples collected from the silt lens is 114 ug/kg in boring F at 6.5-feet. This concentration is significantly below the soil cleanup criterion. TCE was not detected in the groundwater sample collected from this transect.

Transect #4:
TCE was not detected in the any soil samples collected from borings installed in this transect. TCE was not detected in the groundwater sample collected from this transect.

Transect #5:
TCE was detected in 5 soil samples collected from borings installed in this transect. Two of these samples were collected from the native soil encountered directly beneath the surface fill and concentrations are significantly below cleanup criteria. Three of the samples with detectable concentrations were collected from the soil located directly beneath a saturated silt lens. Concentrations of TCE beneath the saturated section ranged from 56.9 ug/kg in boring D at 7-feet to 739 ug/kg in boring E at 7.5-feet. TCE was not detected above the cleanup criterion in any soil samples collected from this transect.

TCE is present at a concentration of 12.8 µg/L in the groundwater sample collected from boring D. Groundwater was present in this boring in the silt lens from 4.1-feet to 9-feet. The outfall line in the vicinity of Transect 5 is present at more than 12 feet deep. Thus, unless the groundwater flows upward from the utility line (possible at certain times of the year) the shallower groundwater is unlikely to have become contaminated by the deeper utility line. Transect 5 is located near visible surface water drainage ways that may have allowed TCE deposition (from spills or airborne deposition) that percolated through the more permeable zones noted in the this transect.

Transect #6:
TCE was detected in one soil sample collected in Transect #6. Boring A contained TCE at a concentration of 1.57 ug/kg in the sample collected at 12.5-feet. Fill material extended to 11.0-feet at this location. Due to the absence of any groundwater in this transect a temporary piezometer was not installed.

Transect #7:
TCE was detected in four samples collected from boreholes in Transect #7. The highest concentration is 4.68 ug/kg in boring F at 5.0-feet. This represents the soil at the base of the saturated silt located from 4.1-feet to 5.2-feet. TCE was not detected in the groundwater sample collected from transect #7.

Transect #8:
TCE was not detected in the any soil samples collected from borings installed Transect #8. TCE was not detected in the groundwater sample collected from this transect.

Transect #9:
TCE was not detected in the any soil samples collected from borings installed in Transect #9. TCE was not detected in the groundwater sample collected from this transect.

4.3 TCE CONCENTRATIONS IN MONITORING WELLS

TCE data from the most recent groundwater samples from monitoring wells are presented in Figures 4.4-4.6. These data include August 2001, September 2002 and May 2003 sample events. Results prior to August 2001 that were used are indicated on the figure along with the sample date. Note that all the new 900 series wells were non detect for TCE with the exception of MW-903 which was 0.478 ug/L. The TCE delineated plume is limited to the FEP WMU area.

TCE is present in groundwater at levels above its MCL principally in the FEP WMU. Figure 4.4 shows isoconcentrations as high as 475,000 µg/L in till wells and is limited to the FEP WMU. However, MW 502 (located ~40' from the zone of maximum TCE concentration) has TCE at only 1,190 µg/L. This heterogeneity is consistent with the site conceptual model that show that groundwater migration of TCE (and other soluble constituents) occurs at a significant rate only through more permeable zones; i.e., the TCE has been present at the site for decades but has not migrated even 40 feet using a typical groundwater plume migration mechanism.

MW-206 (in lower Area C) has a TCE detection of 6.49 µg/L. With the non-detects in wells located at the top of the escarpment (MW-306 and MW-307) and the site conceptual model that shows very slow migration in the absence of conduits, the TCE in MW-206 is potentially the result of seep/surface-water-associated transport of TCE down the escarpment to the Lower Area C and percolation into the subsurface.

TCE has been detected in bedrock MW-200 historically above the clean-up standard (MCL), 738 ug/L in 2000. However, as noted in Section 4.1 above, MW-200 was installed as a singled cased well through a highly contaminated till layer (next to abandoned MW 104 with a TCE groundwater concentration around 140,000 ug/L). It is more likely that the TCE contamination in MW-200 is due to transport from the till layer due to MW construction, rather than general plume migration through bedrock. By contrast, the newly installed monitoring well MW-900 is double cased, with the outer casing grouted into the top of bedrock. MW-900 did not produce sufficient groundwater to complete sampling for this report.

Interface MWs 309, 310 and 311, which were abandoned during this investigation due to compromised integrity, historically indicated TCE contamination levels above the MCL. However, as these wells were also not double cased through the contaminated till zone, the apparent contamination is more likely due to well construction than naturally occurring plume migration.

Figure 4.5 presents the TCE concentrations in the Interface unit. MW-902 resulted in a non-detect. Figure 4.6 presents TCE concentrations in the Shale unit wells.

One groundwater sample collected during the transect study that has a TCE concentration above its MCL is located at a depth of 3-8 feet in the FEP WMU (at Boring 1B). The only water

sample from a temporary piezometer that has a TCE concentration (of 12.8 µg/L) that exceeds its MCL (of 5 µg/L) is located at a depth of 5 – 11 feet in Boring 5D. Figure 3.5 shows that the sample was collected from a more-permeable zone in Transect 5.

4.4 TOTAL U / TC-99 CONCENTRATIONS IN SOIL TRANSECTS

The Total U and Tc-99 *soil* concentration results are summarized on Figure 6.2 and on Figures 3.1-3.10. Thirty of the 120 Total U results from the SHARP samples exceed the 43 mg/kg soil standard; however, only one of these detections (BH8B) is from a sample located at a depth greater than 5 feet.

Note the Tc-99 data used to prepare maps and tables in this report contains concentrations with negative values and a non-detect ("U") qualifier. These data were obtained from the laboratory electronic deliverable (EDD) as a direct data transfer from the laboratory information system (LIMS) and concentrations reported as negative values and non-detect are not unusual in radiochemistry analyses and are considered non-detect and less than the minimum detectable activity (MDA).

Uranium in groundwater exceeds the standard in Transect 3, Transect 5, and Transect 8 (see Figure 6.3). Transect 8 has uranium in soil at depth; Transect 5 has more permeable sections and TCE results that exceed its MCL. The Transect 3 water result is not as clearly correlated with the soil contamination or geology noted above for Transects 8 and 5. However, false positive results associated with turbid samples may occur when sampling from temporary piezometers.

Tc-99 in soil exceeds its standard in one location only (Transect 1) at a depth of 3.2' and only by a small amount (value of 65.1 pCi/g vs. the 65 pCi/g standard). One Tc-99 groundwater result exceeds the standard: Transect 2 (within the FEP WMU) at 4-9'.

Concentration data for Uranium and Tc-99 are provided in Table 8.

4.5 TOTAL U /TC-99 CONCENTRATIONS IN MONITORING WELLS

Figures 4.7 through 4.9 present the total U concentrations in monitoring wells for the till, interface and shale aquifers, respectively. Total U is present above the cleanup standard in wells in the vicinity of the FEP WMU. The highest concentrations are in MW-503 at 7510 ug/L. The new wells MW-901 and MW-903 were installed to complete the delineation of the northern and eastern edge of the plume.

Based on historical MW data, the total U plume appears to be limited to the till unit. Uranium concentrations within MW-200 are below the site's cleanup standard. However, Uranium concentrations in abandoned interface MWs 309, 310 and 311 exceed the cleanup standard, based on historical sample data, although again this may be attributed to MW construction.

Total U is not present above the cleanup standard in MWs outside of the vicinity of the FEP WMU. This is in contrast with historical MW data that indicates that Uranium contaminated

groundwater is also located outside the FEP WMU in MWs 101, and abandoned MW 103 and 512 (see also the Sharp & Associates Report for the Phase 1 Groundwater Investigation at the RMI Extrusion Plant Site). However, the following observations should be noted:

1. MW 103 and 512 were abandoned due to damage during the Phase 2 Groundwater Investigation. Additionally, the bentonite seal for MW-103 was installed close to the surface, above the frost line. It is suspected that these MWs may have provided pathways for surface contamination due to suspect integrity. These MWs were replaced by new MWs 909 and 913. Initial sample results for these wells indicate that the Uranium contamination in groundwater is within the site cleanup standard (see Table 10). Addtional sampling is recommended to confirm this initial assessment.

2. MW-101 is located beneath the ESH Modular Office and was installed prior to installation of the building. The bentonite seal for the well is located near the surface. The soil in the vicinity of the ESH Modular Office was contaminated with Uranium in excess of the site soil cleanup standard, but was remediated (excavated) in December, 1990 to the existing soil cleanup standard for the site. Historic groundwater data for MW-101 indicated Uranium contamination above the site cleanup standard. From 1985 to 1997 Uranium concentrations in groundwater averaged 62 ug/L with a maximum value of 331 ug/L recorded in 1996. Since 1997, the average Uranium concentration was 26 ug/L with a maximum value of 28 ug/L. The most recent sample results, using low flow sampling and bail-sampling methods were 14 ug/L (during this investigation). It is suspected that the earlier, higher contamination levels resulted from transport of surface or near surface contamination through the shallow MW seal.

Figures 4.10 through 4.12 present the Tc-99 concentrations in monitoring wells for the till, interface and shale aquifers, respectively. The Tc-99 footprint is similar to total U and limited to the till unit. The peak concentration is in MW-501 at 224,000 pCi/L.

4.6 SIDE-BY-SIDE SAMPLE RESULTS

Table 11A presents the completed results of samples collected "side-by-side" using different techniques. Results from MW-101 show little difference in results irrespective of how the sample was collected or whether the sample was filtered. The results for MW-101 are apparently representative of actual groundwater conditions. Similarly, the results for MW-906 differ only slightly irrespective of the sampling method. However, the results from the MW-905 samples illustrate how sampling method can have an effect on results. The unfiltered bailed sample had concentrations of lead nearly an order of magnitude higher than the filtered sample. Barium concentrations in the unfiltered sample were ~3x that of the filtered sample. The low-flow samples (whether filtered or unfiltered) are much closer to the results of the bailed/filtered sample. The detections of lead and barium in the unfiltered bailed sample are false positives associated with suspended sediments; constituents present in sediments are falsely reported as being associated with groundwater.

Observations of the side-by-side sample data are as follows:

- All lead sample results are below the groundwater cleanup goal of 15 µg/L (highest concentration at 13.6 µg/L in well MW-903).
- All barium sample results are below the groundwater cleanup goal of 2000 µg/L.
- All Tc-99 results for these wells were non-detect.
- The barium in MW-402 was 61.5 µg/L for low-flow/unfiltered; the bailed/unfiltered result for this well was 417 µg/L. Wells such as MW-904, MW-905, MW-908, MW-912, and MW-913 all have results that the bailed/unfiltered result was higher in barium concentrations than the low-flow/unfiltered result. This indicates that the barium was more likely from the soil rather than from the groundwater.
- Uranium results were all below the cleanup goal with the exception of well MW-901 which is located within the FEP WMU area.
- Turbidity levels gradually decreased during sample collection when samples were collected using the low flow method and increased significantly during sample collection when using the bailer method.
- There is significantly less variability in field parameters in samples collected using the low flow method when compared to samples collected using the bailer method.

In general, the four samples (bailed/filtered, bailed/unfiltered, low-flow/filtered, and low-flow/unfiltered) taken at each of the wells were similar in concentrations when compared with their respective results.

4.7 YIELD TEST RESULTS

A yield test was performed on Monitoring Well MW-508 by utilizing a low flow sampling pump to draw down the water level in the well. Due to single digit temperature conditions, the discharge hose froze during the test, resulting in an incomplete data set. The test was conducted for a period of less than 10 minutes prior to the discharge hose freezing. However, during this period, the pump rate varied from 0.156 gallons per minute at the start of the test to 0.026 gallons per minute just prior to the line freezing. The drawdown just prior to the line freezing was 3.31 feet and had not stabilized. Therefore, the estimated yield from this monitoring well is < .026 gpm.

As described in Section 4.1 of this report, another test of groundwater yield was the operation of the WIDE system. The maximum sustained yield of the wick drains (35 drains, 15' deep in a 35' X 35'grid) was 25 gallons per hour (0.417 gpm), or less than 0.01 gpm per drain. This testing supports the statement that the yield of the glacial till at the Site is below 0.50 gpm.

4.8 RESULTS FROM "SEEP/SURFACE WATER" SAMPLE

As noted above, RMIES collected what they identified as a "seep/surface water" runoff sample on November 6, 2002 from the vicinity of the seeps located at the top of the escarpment with the following results: Total Uranium: 681 µg/L and TCE: 1.98 µg/L. RMIES also collected a seep/surface water runoff sample at a location ~halfway down the swale with the following results: Total Uranium: 565 µg/L and TCE: none detected.

There were site rain events on May 21 and 27, 2003 yielding 0.32 and 0.53 inches of precipitation. During the site visits the day following each of these rain events, SHARP field personnel estimated that greater than 90 % of the water was coming from surface water runoff from Area 1, the ditch in the FEP WMU, and Area 2, the low lying areas east of the ditch but in the same general area of the FEP WMU. Area 3 was a smaller area further to the east, adjacent to the FEP WMU area and off the corner of the soil staging pad where there was seepage observed from the sloping surface. These areas are identified on Figure 3.11, and the surface flow is to flags 3 and 4. At the time the escarpment was examined it could not be determined if there were additional seeps that contributed to the volume of flow at flags 1 and 2, as these were covered with surface flow from further up the escarpment. A water sample was collected at flagged location 4, and consisted of water that had consolidated from the 3 areas described. The water sample from Flag location #4 contained 58.8 ug/L of U and was non detect for TCE.

These results indicate some potential for surface-water-associated sediments to migrate from the top of the escarpment. It is unclear whether this level of migration will unacceptably re-contaminate the Lower Area C. The low levels of TCE may evaporate with the surface water. However, if the water is allowed to stand in the lower Area C, it may percolate into the subsurface before evaporating.

Once the water evaporates or percolates into the soil, any Uranium present in the sediments will be deposited (or attenuated) in the near-surface soils, but at levels that are unlikely to be detectable in soils in the short term.

4.9 NITRATE AND NITRITE IN GROUNDWATER RESULTS

Historical and current groundwater concentrations of Nitrate and Nitrite (or Nitrates) at the site were reviewed and found to exceed the EPA Drinking Water MCL in the Groundwater Plume associated with the FEP WMU. Nitrate and nitrite concentrations are the likely result of historic discharges of neutralized and reduced nitric acid to the FEP; by the same process which also resulted in the release of TCE, Uranium and Tc-99 COCs.

Drinking Water standards for Nitrate/Nitrite were promulgated in 1992 (Source: USEPA Ground Water & Drinking Water website). Consequently, Nitrates were not identified as a COC during the RFI/Hydrogeologic Investigation for the site completed by Eckenfelder, Inc. The current MCL's for Nitrate's are: Nitrate-10 mg/L, Nitrite-1 mg/L, and Total Nitrate/Nitrite-10 mg/L.

The USEPA Technical Fact Sheet for Nitrates identifies the compounds as highly soluble with weak retention to soil, moving at approximately the same rate as water. Nitrates do not volatilize and are likely to remain in water until consumed by plants or other organisms. Nitrate degradation is fastest in anaerobic conditions. Due to these properties, Nitrate groundwater concentrations may provide a good marker for the maximum extent of the Groundwater Plume associated with the FEP WMU.

Nitrate concentrations were initially analyzed by Eckenfelder to evaluate the overall chemical quality of groundwater at the site. Initial sampling was completed from 1985 thru 1988 and included Monitoring Wells 100 thru 106, 200 thru 210, 300 thru 315 and 401 thru 403. Subsequent monitoring for Nitrate and Nitrite was also included by Safety and Ecology, Inc.

(SEC) in 2002 to evaluate progress of bioremediation associated with injection of Hydrogen Release Compound (HRC®). MWs sampled included 104, 307, 501 thru 505, 507,508 and 803. Samples for both campaigns were collected using bailers.

Nitrate data for both sampling campaigns were grouped for evaluation, as follows:

1. Eckenfelder data was segregated by MW location (i.e. within the FEP WMU source area, downstream of the FEP WMU, Fields Brook flood plain and background, relative to the FEP WMU locations. Data was also segregated by screen interval within each location (till, interface and shale). Sample results with matrix interferences or data outliers from the Eckenfelder data set were not included.

2. SEC data was also segregated for locations within the FEP WMU and downstream of the FEP. All MWs sampled were screened in the till. MWs 104 and 307 were the only two MWs common to both sampling campaigns.

Nitrate concentrations in wells located in the FEP WMU (from September 2002 SEC sampling) are detailed in Figures 4-13 and 4-14. These concentrations are similar in distribution to TCE concentrations – being located in more-permeable strata in the FEP WMU. The overall averages for MWs segregated by location and screen interval (for both Eckenfelder and SEC sampling) is also summarized in the table below:

TABLE – NITRATE GROUNDWATER CONCENTRATIONS (mg/L)

	1985-1988		2002	
MW LOCATION/CONFINING LAYER	AVG.	MAX.	AVG.	MAX.
Within FEPA WMU:				
Till	3753.9	6530	1911	7800
Interface	38.6	289	NS	NS
Shale	75.4	230	NS	NS
Downstream of FEPA WMU:				
Till	9.1	80.7	0.34	0.89
Interface	1.58	8.2	NS	NS
Shale	NS	NS	NS	NS
Fields Brook Floodplain:				
Till	1.1	2.6	NS	NS
Interface	NS	NS	NS	NS
Shale	NS	NS	NS	NS
Background MWs:				
Till	0.69	2.43	NS	NS
Interface	ND	ND	NS	NS
Shale	ND	ND	NS	NS

Notes: A summary of all MWs and data reviewed is included in Table 13 of this groundwater investigation report.
NS – Not sampled.
ND – Not detected.

(SEC) in 2002 to evaluate progress of bioremediation associated with injection of Hydrogen Release Compound (HRC®). MWs sampled included 104, 307, 501 thru 505, 507,508 and 803. SEC Samples for both campaigns were collected using bailers.

Nitrate data for both sampling campaigns were grouped for evaluation, as follows:

1. Eckenfelder data was segregated by MW location (i.e. within the FEP WMU source area, downstream of the FEP WMU, Fields Brook flood plain and background, relative to the FEP WMU locations. Data was also segregated by screen interval within each location (till, interface and shale). Sample results with matrix interferences or data outliers from the Eckenfelder data set were not included.

2. SEC data was also segregated for locations within the FEP WMU and downstream of the FEP. All MWs sampled were screened in the till. MWs 104 and 307 were the only two MWs common to both sampling campaigns.

Nitrate concentrations in wells located in the FEP WMU (from September 2002 SEC sampling) are detailed in Figures 4-13 and 4-14. These concentrations are similar in distribution to TCE concentrations – being located in more-permeable strata in the FEP WMU. The overall averages for MWs segregated by location and screen interval (for both Eckenfelder and SEC sampling) is also summarized in the table below:

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Interface	38.6	289	NS	NS
Shale	75.4	230	NS	NS
Downstream of FEPA WMU:				
Till	9.1	80.7	0.34	0.89
Interface	1.58	8.2	NS	NS
Shale	NS	NS	NS	NS
Fields Brook Floodplain:				
Till	1.1	2.6	NS	NS
Interface	NS	NS	NS	NS
Shale	NS	NS	NS	NS
Background MWs:				
Till	0.69	2.43	NS	NS
Interface	ND	ND	NS	NS
Shale	ND	ND	NS	NS

Notes: A summary of all MWs and data reviewed is included in Table 13 of this groundwater investigation report.
NS – Not sampled.
ND – Not detected.

The MW sample populations for the two referenced campaigns included different MWs due to new MW installation/abandonment and different sample objectives. A comparison of the Nitrate data for both campaigns allows some observations listed below.

1. Nitrate concentrations, both historical and present, are significantly higher in the Groundwater Plume associated with the FEP WMU, than for other areas of the site. There was little, if any Nitrate contamination in background MWs and MWs located in the Fields Brook Flood Plain based on the 1985-88 results. This confirms the former evaporation pond as the most likely source of the Nitrate groundwater contamination.

2. Concentrations of Nitrite also exceed the MCL (1.0 mg/L) within the FEP, with an average value of 5.6 mg/L and a maximum value of 39 mg/L (MW 505, 2002). Downstream MWs averaged 0.02 mg/L, with a maximum value of 0.16 mg/L.

3. The Nitrate concentrations have not appreciably changed in the fifteen years between sampling campaigns, although some degradation may have occurred. For MW 104, Nitrate concentrations averaged 1955 mg/L (1985-1988), with a maximum value of 6530 mg/L. In 2002, the average value was 1560 mg/L, with a maximum value of 1590 mg/L. For MW 307, the Nitrate concentration averaged 2.2 mg/L ('85-88) vs. 0.1 in 2002.

4. Although there appears to be some migration of Nitrate to downstream MWs, this probably represents the maximum extent of the groundwater plume to date. Two (2) exceptions this observation are MWs 209 and 206, in which Nitrate concentrations averaged 26 and 71 mg/L during the 1985-88 campaign (see Table 13). Excluding these MWs, the average Nitrate concentration (for the 85-88 samples) was 1.0 mg/L. Since this sampling campaign, both MWs were abandoned due to compromised integrity of the MWs.

5. Some vertical migration of Nitrates for MWs within the FEPA WMU is apparent. Interface MWs located within the FEPA WMU averaged 38.6 mg/L. The average concentration for MW 200 (screened in the shale) was 78.4 mg/L; although this value may reflect contaminant migration due to MW integrity.

Nitrates are typically a good marker for water migration from the nitrate source. However, because surface water or seep migration at the site, as noted elsewhere in this report, may confound the picture, the nitrate concentration distribution provides only a general view of historic groundwater migration. SHARP recommends that sampling of MWs downgradient of the FEP, including 509, 510, 900-902, 912, and 914 be sampled by RMIES, using low flow sampling techniques, to further evaluate the extent of Nitrate/Nitrite contamination.

Analysis by SEC and others indicate that deposited nitrate or nitrite may interfere with HRC reduction of TCE. The likely mechanism of interference is reduction of nitrate to nitrite in preference to reductive dechlorination of TCE. If this were occurring to a great extent, one would expect to see increasing levels of nitrite and decreasing levels of nitrate. This has not yet been observed. However, as previously noted, degradation of Nitrates should be accelerated under anaerobic or reducing conditions. Injection of HRC may provide a remedial strategy for

Nitrate contamination. Ex-situ treatment technologies for Nitrates include ion exchange and reverse osmosis.

4.10 Comparison of Bail-down (Slug) and Shelby Tube Test Results

Table 2 presents a summary of the slug and Shelby tube tests at the site. Figure 4.14A presents these data graphically. The results are grouped by lithology. The graphs and analyses of the slug tests are contained in Appendix H. Appendix H also contains a summary table and a summary graph of the results, and are also discussed by lithology below.

Fill

Monitoring well MW-910 is completed in fill material that was described in the well log as gray silty clay. The well was very slow to recover from development and so could not be slug tested. An analysis of the recovery data after bailing for development indicates that the Hydraulic Conductivity is less than 5E-08 cm/sec. There were 6 Shelby tubes from 3 wells analyzed. The Shelby tube from MW-910 that was taken from 5 to 7 feet corresponds very well with the slug test (screened interval from 7.5 to 9.5 feet). The other Shelby tube analyses show a wide range of values within the fill.

Silt

MW-903, MW-905, and MW-912 are completed in the till with some silt present in the screened interval. MW-906 is completed in the till, and the screened interval may have some connection to the overlying silt through fractures. The hydraulic conductivity of the silts influenced the results of these tests and these were the highest conductivities seen in any of the wells that were slug tested. The values ranged from 3.6E-07 to 9.4E-06 cm/sec.

Till with Fractures Present

MW-908 and MW-907 were completed in the till but fractures were identified within the completion interval. The hydraulic conductivities derived from the slug tests are intermediate between the higher values in the silt and the lower values seen in the gray till without fracturing.

Gray Till

The Hydraulic Conductivity values derived from the slug tests of all of the wells completed in the Till range from 1.8E-07 to 8.7E-07, with the exception of MW-914. MW-914 was very slow to recover from development and so could not be slug tested. An analysis of the recovery data after bailing for development indicates that the Hydraulic Conductivity in the till at this location is less than 7E-08 cm/sec.

Interface

MW-902 was screened across from the interface between the unweathered gray till and bedrock. The recovery from development was very slow and so the well could not be slug tested. However an analysis of the recovery data from development indicates that the Hydraulic Conductivity is less than 3E-08 cm/sec.

Bedrock

MW-900 is completed within bedrock. The recovery from development was very slow. The analysis of recovery data from development indicates that the hydraulic conductivity of the bedrock interval that this well is screened across from is less than 4E-08 cm/sec.

5.0 CONTAMINANT FATE AND TRANSPORT

Based on its review of historic and recent site data, SHARP has determined that:

- ***Site groundwater is typically present in very-low-permeability matrices;*** contaminant transport within these matrices is slow; thus, contaminant transport beyond the source areas typically occurs via more-permeable conduits. Identification of the degree that the effluent line that traverses the site (and the roof drains of the Main Plant that empty into the drain) may have acted as a constituent conduit was one of the goals of the Phase II investigation.
- ***Several wells were*** buried, contaminated with grout, affected by frost heave, screened close to the surface, or otherwise ***compromised.*** In addition, many site wells have well screens that span more than one matrix – potentially allowing contaminants present in one horizon to be mis-attributed to another. Compromised/damaged wells were repaired or replaced as necessary.
- ***False-positive "hits"*** above cleanup standards in many site wells may have resulted from compromised well completions and a sampling technique that may not always provide samples that are representative of groundwater conditions.

The determinations listed above combine to show that ***found contamination in soil or groundwater does not typically travel far from site source areas under most conditions*** and even this transport does not occur via conventional groundwater transport mechanisms (that assume a homogenous hydraulic conductivity). These findings have several implications concerning the eventual cleanup of the site and the potential applications of risk-based strategies.

5.1 SITE CONSTITUENTS OF CONCERN / MIGRATION MECHANISMS

The primary CoCs detected at the Site include RCRA parameters (primarily TCE) and radiological parameters Total U and Tc-99. Their presence above cleanup standards in site media must be addressed prior to site closure.

Uranium is naturally-occurring in northern Ohio soils but its detection in soil and groundwater at levels that exceed the cleanup standard for the Site is attributable to historic RMI Site operations. Uranium oxides are typically particulate-associated. Historic Site operations produced uranium fumes (fine particulates) that were transported in air over short distances from the source and then deposited on Site surfaces (including surface soils) over the years. These particulates may have been transported with other suspended solids in surface water. Due to typically low solubility, the presence of uranium in groundwater far from a uranium source is unlikely.

Because uranium is an element, its mass is conserved. Natural attenuation mechanisms are limited to retardation processes.

Tc-99 does not have a natural source; it is a by-product of the nuclear industry. Its presence at the RMI Site is attributed to past operations associated with processing of uranium. It was also deposited at the site as a fine particulate. Oxides of Tc-99 are slightly soluble in water; thus, the

detection of Tc-99 at a distance from its source can result from transport via sediments, or less likely via dissolution and migration with groundwater.

Because Tc-99 is an element, its mass is conserved. Natural attenuation mechanisms are limited to retardation processes.

TCE does not have a natural source. Its presence is entirely associated with historic RMI Site operations or contamination associated with the Fields Brook Superfund Site. TCE is a dense, non-aqueous-phase liquid (DNAPL) at ambient conditions with a significant water solubility of greater than 1,500,000 µg/L. It can be transported in groundwater in the liquid or dissolved phase. There is some potential for transport with surface water sediments; however, transport with sediments is expected to be a minor mechanism compared to transport as the free liquid or dissolved in water. Given that all detected concentrations of TCE in groundwater are less than 1,500,000 µg/L and concentrations of TCE are higher nearer the surface, there is no need to infer the presence of *substantial* free-phase TCE as a DNAPL layer beneath the Site to account for the Site TCE. TCE sources resulted from two types of activities:

- The placement of liquid phase TCE onto site surface soils (like into the FEP WMU area) – allowing percolation of free-phase TCE and dissolved-phase TCE into the groundwater; and
- The deposition of airborne TCE exhausted from Site operations by the action of rainwater. Thus, roof-drain or other rainwater may be an alternative source of site TCE. Most TCE deposition by rainwater onto uncontaminated media (surface soil) is not present at a high enough concentration to be detected; however, this mechanism could account for ppb concentrations in roof drain water.

In addition to retardation processes, TCE will also be attenuated in the environment by biodegradation and volatilization processes. In the absence of non-chlorinated substrates [or other electron donors (e.g., HRC) that generate reducing conditions] the biodegradation of TCE is very slow.

Distribution Coefficients (Kd) are often used to describe how constituents will partition among two different phases. They describe the ratio of "equilibrium" concentrations in each phase. Although Kds can be effectively determined in a laboratory for distribution that occurs between two different *liquid* phases, their use to describe distribution between groundwater and the groundwater unit matrix cannot be reliably determined in the laboratory because these values are affected by changes in both groundwater chemistry and matrix composition. In addition, even if Kds are derived empirically using actual Site groundwater and actual Site matrix measurements, their values can be affected dramatically by changes to pH, oxidation-reduction potential, constituent oxidation state, etc. Finally, Kds describe only *equilibrium* conditions; in the environment, kinetic factors may make the Kd values useless as a predictive tool because equilibrium may never be attained under actual Site conditions.

Relative Distribution Coefficients: For groundwater conditions prevalent at the Site, TCE is much more soluble than Tc-99 containing species which are more soluble in water than uranium-containing species. Transport at the Site can be model calibrated by evaluating the relative migration of these constituents. Where constituent transport is occurring according to dissolved-

phase *groundwater* movement, the leading edge of the TCE plume would appear ahead of the leading edge of the Tc-99 plume; and the uranium plume would have the smallest areal extent.

5.2 SITE CLEANUP STANDARDS

The currently-established Site cleanup standards are listed below. These may be adjustable depending upon the results of a site-specific risk-based evaluation (See Section 5.3)

Radiological Parameters in Groundwater:
The in-place Site Decommissioning Management Plan was initially submitted in December 1991 and eventually approved by the NRC prior to Ohio becoming an agreement state. The current radioactive license issued by ODH (dated Aug 21, 2000) has unrestricted release *groundwater* cleanup criteria listed as 30 pCi/L Total U and 900 pCi/L of Tc-99. At the direction of RMI, SHARP used ***30 µg/L for the uranium cleanup standard and 900 pCi/L for the Tc-99*** cleanup standards to allow unrestricted future use of the Site under the approved plan.

Radiological Parameters in Soil:
Per the decommissioning plan, the soil cleanup standards are *30 pCi/g for uranium and 65 pCi/g for Tc-99.* The specific activity of 30 pCi/g equals *43 mg/kg of uranium.* ((~0.7 pCi/g-ppm for naturally occurring uranium).

The cleanup standards (in soil only) are ***targets*** (per the NRC implementation policy). Areas of residual activity exceeding the guideline value (but less than 3x the guideline value) may be allowed to remain on site provided that they do not exceed the guideline value by greater than a factor of $(100/A)^{½}$ where A = area of the exceedance in m^2. Thus, for example, as much as 129 mg/kg of uranium may be left on a small portion of the Site and still meet the soil criterion.

Residual uranium/Tc-99 concentrations in both soils and groundwater must also meet the unity rule, e.g., the sum of the ratios of the constituents to their cleanup standard must be less than 1.

$$\text{Example (for groundwater):} \quad \frac{[\text{U in } \mu g/L]}{30\ \mu g/L} + \frac{[\text{Tc-99 in pCi/L}]}{900\ \text{pCi/L}} < 1$$

TCE in Soil, OhioEPA RCRA Generic Cleanup Number GCNs:
The current RCRA permit identifies a TCE in soil cleanup standard of 22.6 mg/kg. This value is identical to the GCN for TCE in soil in the absence of a groundwater pathway. GCNs are typically used as single-chemical screening standards, usually adjusted to account for additivity of different chemicals to ensure that the site-wide risk across all exposure pathways does not exceed 1.0×10^{-5} cancer risk or 1.0 hazard index. The TCE GCNs are:

TCE soil: 22.6 mg/kg (single chemical, no groundwater)
0.02 – 0.399 mg/kg (single chemical, protective of groundwater)

SHARP used 22.6 mg/kg for the provisional cleanup standard to be consistent with historic RMIES practices and the value present in their RCRA permit. OhioEPA RCRA has often required adjustment to the GCNs (at other sites) when using them as cleanup standards.

TCE Cleanup Level in Groundwater:
TCE in GW = 5 µg/L (equal to the USEPA drinking water standard maximum contaminant level [MCL]).

Other Potentially-Applicable Groundwater Cleanup Standards:
Other potential CoCs in groundwater that are related to historic Site operations include lead, barium, nitrate, and nitrite. The MCLs for these constituents are:

Nitrate (as N): 10,000 µg/L
Nitrite (as N): 1,000 µg/L
Lead (at tap): 15 µg/L mg/L (action level); OhioEPA GCN of 5 µg/L
Barium: 2,000 µg/L

OhioEPA has updated the CGN for lead in groundwater to 5 µg/L with site-specific evaluations allowing cleanup levels as high as the MCL of 15 µg/L.

5.3 Groundwater Use in the Vicinity

SHARP evaluated the regional groundwater use (See Appendix E). The RMI Plant site is located in Ashtabula Township, immediately east of the City of Ashtabula, approximately one mile south of Lake Erie and immediately south of Fields Brook. Lake Erie acts as the primary drinking water source for the area. Well locations shown on Map 3, Appendix E show that there are no reported groundwater wells located within at least a one mile radius of the RMI site; and the testing and production records for the located wells show that the potential for groundwater usage is low owing to poor production, questionable water quality, and discontinuous occurrence of the shallow groundwater units.

5.4 Risk-Based Changes to Cleanup Standards

RCRA Parameters:
RCRA guidance allows site-specific risk-assessment at sites like RMI where not all exposure pathways are completed. This may allow higher cleanup standards than those presented above. However, OhioEPA has NOT historically accepted limitations on exposure pathways in the absence of a site-specific risk assessment (and they may not accept them even within the context of a risk assessment).

Potential Risk-Based Cleanup Standards, Soil:
SHARP has not performed any risk-based calculations to determine what potential cleanup standards may be successfully negotiated. However, SHARP believes that OhioEPA will not accept a TCE-in-soil cleanup standard greater than the 22.6 mg/kg standard listed in the RCRA permit. In fact, OhioEPA may require RMIES to adjust that value for the presence of other RCRA parameters or for the potential for TCE to leach to groundwater.

Potential Risk-Based Cleanup Standards, Groundwater:
There is *some* potential for increasing the cleanup standard for TCE in groundwater above the MCL of 5 µg/L. USEPA drinking water standard Maximum Contaminant Level (***MCLs***) are

extremely conservative standards when applied to this site because there are no ***current*** shallow-groundwater users in the area; and this groundwater will ***never*** yield enough water to provide a potable source for future groundwater users. A documentation of the lack of a completed pathway may allow TCE in shallow groundwater to exceed the MCL.

If OhioEPA retains the MCL standard for TCE, they may also require RMIES to clean up groundwater until all Site-related constituents meet MCLs. This might require additional activities to address nitrite and nitrate contamination and monitoring for lead and barium.

Radiological Parameters (RESRAD):
ODH has also indicated that it will accept calculations of site-specific exposure to radionuclides using the RESidual RADioactivity (RESRAD) computer code as developed by Argonne National Laboratory. RESRAD is a risk-based approach based on the following principles:

- that the annual radiation dose received by a member of the critical population group should be kept as low as reasonably achievable (ALARA); and
- that the annual radiation dose received by a member of the critical population group from the residual radioactive material encountered through nine potential pathways as predicted by a realistic but reasonably conservative analysis and calculated as a committed effective dose equivalents should be below target levels for expected future use scenarios.

ODH has indicated that it considers the appropriate dose standard to be 25 mRem/year for unrestricted future use under a "resident-farmer" scenario. ODH has not indicated any willingness to consider alternative scenarios even tied to significant future site use restrictions.

5.5 GEOLOGIC SETTING / IMPLICATIONS FOR CONSTITUENT TRANSPORT

As described above, SHARP developed a conceptual understanding for the Site lithologic setting that has ~3-5' of surficial, more-permeable soils underlain by oxidized till that has silt lenses. This is in-turn underlain by an unoxidized till that, in its undisturbed form, is essentially impermeable to groundwater (or constituent transport). Thus, in general, there is little transport from contaminant sources through the subsurface. The exceptions to the general lack of subsurface constituent transport are associated with the following:

- Surface water migration of sediment-associated or dissolved constituents, including those present in seep waters;
- Migration via vertical fractures, silt lenses, and other conduits in the FEP WMU; and
- Migration via utility lines or through other areas with disturbed soils;

Particulate-associated contaminants deposited on site surface soils:
Fine-particulate-associated contamination (U, Tc-99) is expected to migrate through more-permeable *surface* soils but is attenuated as soon as the constituents reach the less permeable tills; however, some localized migration may then occur in the disturbed soils or in the oxidized till through the more permeable silt seams.

Particulate-associated contaminants also will migrate as suspended solids via surface water pathways and (to a more limited extent) as airborne dusts. Thus, for Total U and Tc-99, SHARP expects that most of the site contamination above cleanup standards will be found in the uppermost soils and that groundwater wells that are NOT in communication with the surficial soils will likely not have Total U or Tc-99 in dissolved phase. Some Total U and Tc-99 may be found in the subsurface in the vicinity of utility drain lines – however, this is not expected to migrate far from these drain locations.

This Site Conceptual Model for migration and transport of the radiological parameters is confirmed by a review of recent soil boring data. SHARP collected all the data from 3 boring programs:

- The "L-series" borings installed in the FEP WMU;
- The SHARP boring program described in this report; and
- The "Baker" series borings installed across the site.

Approximately 220 borings were installed in these three programs with ~1287 soil samples collected and analyzed. SHARP graphed the Uranium concentrations of the "L-series" borings versus depth of sample (See Figure 5.1). This figure shows that of the 173 collected samples, 24 exceed the cleanup standard of 43 mg/kg. However, only 7 samples collected from a depth greater than 5' exceed the cleanup standard; and each of these samples was collected from a more-permeable stratum (silt & clay, sand & clay, or gravel & clay).

The results of the other two boring programs are similar (see the following table):

Summary of Uranium Results from Boring Programs

Type of Boring	Results Range (mg/kg)	# of Samples	# Exceeding 43 mg/kg	% of Total	# Exceeding 43 mg/kg @>5'	% of Total	# Locations* >43 mg/kg & >5'
SHARP 2002	ND - 550	122	30	24.59%	1	0.82%	1
Baker Series Vertical	ND-501	578	51	8.82%	1	0.17%	1
Baker Series Slant	ND-3754	414	65	15.70%	9	2.17%	5
L-Series	ND-4980	173	24	13.87%	7	4.05%	4
All Boring Samples	ND-4980	1287	170	13.21%	18	1.32%	11

Only one SHARP boring sample collected from a depth greater than 5' had a result that exceeded the cleanup standard. Only one *vertical* Baker boring sample collected from a depth greater than 5' had a result greater than 43 mg/kg.

The *slant* Baker series borings are assumed to have been installed on a slant because of the proximity to either surface structures or buried utilities. Thus, these structures (and their

foundations) or the utilities may be acting as conduits for migration of particulates to depths greater than 5'. The 9 slant borings that exhibit uranium above its standard at a depth greater than 5' likely result from particulate-associated migration through disturbance of site soils, more-permeable zones in the vicinity of structures, or buried utilities.

A graph of the uranium results from all borings is presented as Figure 5.2. These results show that perhaps as much as 13% of the site surface soil may be uranium contaminated above 43 mg/kg and this contamination may have migrated to depths of up to 5' through relatively permeable surficial soils. In relatively few areas, more-permeable conduits may exist that allow migration to >5'. However, there is no need to postulate any groundwater migration pathway to explain any of the site uranium contamination (See additional discussion in next section).

Liquid and dissolved-phase contaminants (TCE):

TCE (as the free liquid or dissolved in water) will percolate through surface soils to the unoxidized till. It will follow groundwater migration pathways through silt lenses until the groundwater in these lenses reaches a surface water seep or until it reaches the unoxidized till contact. In the FEP WMU area, the site subsurface has been disturbed by:

- well completions that span permeable and non-permeable zones,
- prefabricated vertical drains;
- HRC injection points;
- utility line installation; and
- other historic site work.

At other Site locations there is little evidence of any constituent migration via traditional groundwater migration pathways. Although TCE is more mobile than the other site constituents due to its water solubility, it still does not transport significant distances in the subsurface at the Site in the absence of a conduit. Thus, most of the TCE has been found in the vicinity of its source(s).

This is evident in the FEP WMU area. This area has very high groundwater concentrations of TCE; however, wells located ~40' away have concentrations that are orders of magnitude lower. This concentration gradient would not persist in the absence of significant confining units. The TCE concentrations are typically found in more-permeable strata at the contact with an impermeable layer (See cross sections).

Similarly, dissolved constituents (like nitrates and nitrites) are also found in groundwater only at locations associated with the more permeable zones in the FEP WMU area.

Although the site conceptual model accounts for most of the found Site contamination, historic, undocumented (secondary) sources may be the cause of the anomalous detections. These secondary sources may be due to small historic spills or due to depositions with rainwater.

Utility Line as Conduit for Migration:

As a result of the lithologic setting, there is a potential for contaminant migration over long distances (from the source) only via conduits. One likely conduit is the outfall line located

between MH11 and MH1. However, this investigation has shown that the outfall line's ability to act as a conduit is limited because it is NOT filled with a more-permeable backfill that could also act as a conduit. Instead, the backfill is native material that may have originally contained silt lenses that were destroyed in the backfilling process. As a result, ***the backfill is acting more as a plug*** – causing any migration to occur at the interface between the backfill and the native materials. The backfill is NOT saturated. The plug may still allow the sewer line to act as a conduit, but *away from the site.* The line is not the likely cause of any found contamination at shallower depths at locations *on the site.*

5.6 IMPLICATIONS OF SITE CONTAMINANT TRANSPORT UNDERSTANDING

This conceptual Site understanding that shows only limited groundwater transport of constituents and much more significant surface-water and surface-water/sediment transport has several implications to the decontamination of the facility and its eventual release, as follows:

- Little additional characterization (if any) of *surface* soils is needed prior to remediation (by excavation) for *radiological* parameters as long as real-time or near-real-time methods can be used to screen site soils. Prior to excavation, the approximate areal extent of hotspots can be calculated to identify the maximum allowable concentration of uranium allowed at that location. After surgical excavation, the concentrations of residual uranium and Tc-99 should be documented and evaluated against cleanup standards. Excavation to 5 feet may be all that is needed in most areas of the site.
- When removing site utilities, structures, or other potential conduits, the presence of uranium or Tc-99 at depth should be monitored and removed if site cleanup levels are exceeded.
- Groundwater concentrations of uranium and Tc-99 are not expected to exceed standards as long as the sources are removed. Surface soil uranium has not migrated to a large extent into site wells (even those as shallow as 5 feet).
- If excavation of Site soils is part of the remedial approach to managing TCE, this excavation of TCE-contaminated soil (and more-permeable silt lenses) is likely to remediate the majority of the TCE in groundwater at the same time.

6.0 DISCUSSION OF RESULTS

6.1 GROUNDWATER FLOW / CONSTITUENT TRANSPORT

The Phase II work confirms the conceptual model of the site as one where groundwater flow is severely limited (0.01 – 0.07 ft/year in the till) by the low hydraulic conductivity of the subsurface strata. Groundwater flow is to the north / northwest but is not a significant mechanism of groundwater transport of constituents of concern.

Percolating rainwater may be allowing some constituent transport of suspended solids and dissolved phase constituents to the water table; but, outside the FEP WMU area, this transport effectively ends at the surface fill / till interface. Groundwater in the FEP WMU does transport through the relatively-more-permeable silt seams. Groundwater feeds seeps noted along the face of the escarpment. These seeps have the potential to allow constituents to migrate much more quickly as surface water. Site data shows TCE and Total U detected in the seeps sampled (November 2002).

Portions of the subsurface in the FEP WMU is a special case: portions of the groundwater in the FEP WMU may not exhibit the same characteristics of limited transport due to the presence of numerous potential conduits including the prefabricated vertical drains (installed to ~15'), borings used for injection of Hydrogen Release Compound (HRC), and wells installed (and/or screened/sandpacked) from the surface fill across multiple lithologic contacts.

Other potential conduits that may allow significant flow are:

- Silt lenses expressed at the surface that may allow rainwater (or surface water) percolation;
- Seep waters;
- Utility lines, including the 18-inch line that crosses the FEP WMU; and
- Several indications of seep flow were mapped; rates of seep flow were estimated. The end of the 18-inch outfall line has been plugged at MH-1.

6.2 GROUNDWATER RESULTS

Transects:
Eight groundwater samples were collected from temporary piezometers with the following results:

- TCE was found above the MCL at three locations,
  - Transect 1 [within the FEP WMU (Borehole 1B) at 3'-8'], 27.8 µg/L;
  - Transect 2 [within the FEP WMU (Borehole 2) at 4'-9'], 130 µg/L;
  - Transect 5 [near CEI Substation (Borehole 5D) at 5'-11' in a more-permeable zone], 12.8 µg/L.

The TCE source in the FEP WMU has been well documented. The TCE source near the Substation is unknown. This secondary source of TCE may be from percolation of TCE from atmospheric deposition of TCE with rainwater, or from TCE carried with roof drain

water to the subsurface, or from some other localized TCE source (historic spill?) in the vicinity of the substation, or from some complex migration from the FEP WMU via the drain.

- Total U was found above its MCL at four locations
  - Transect 2 [within the FEP WMU (Borehole 2B) at 4'-9', same location as TCE exceedance], 130 µg/L;
  - Transect 3 [not associated with any other groundwater contamination at 6'-11'], 105 µg/L;
  - Transect 5 [at same location as TCE exceedance in more-permeable stratum], 2490 µg/L;
  - Transect 8 [not associated with any other groundwater contamination at 4'-9', 103 µg/L.

The sources of these detections are not consistent with any other contaminant pattern. SHARP suspects that these uranium detections are associated with uranium contaminated soils that are present at depth due to historic rework of the site surface soils, perhaps including the excavations for installation of utilities. These detections may also be false positives due to uranium-contaminated sediments.

- Tc-99 was found above its MCL in one transect, Transect 2, associated with other groundwater contamination, 14,300 pCi/L.

Groundwater Monitoring Wells:

Sixteen (16) additional monitoring wells were installed to complete the delineation of contamination at the Site. The general conclusions are listed below.

- TCE plume is limited to the vicinity of the FEP WMU and predominantly in the till unit.
- Toal U plume is limited to the FEP WMU and in the till unit
- Tc-99 plume is limited to the vicinity of the FEP WMU and in the till unit.
- MW-200, located within the FEP WMU and completed in the shale, is interpreted to be compromised based on the lack of water in the downgradient well MW-900 and the fact that the water level in the well more closely matches the till unit than other bedrock wells.

6.3 SOIL RESULTS

TCE:
One TCE sample (of 91 borehole soil samples analyzed for TCE) has concentrations that exceed the soil GCN (no groundwater) of 22.6 mg/kg [22,600 ug/kg]. That sample was collected from 14' in Borehole 1A (112,000 ug/kg).

Several other samples exceeded the most-conservative (leaching to groundwater) soil GCN of 20 ug/kg, but these results were limited to FEP WMU-area soils and soils around Transect 5 (near the substation). In combination with the groundwater results, these results support the conceptual model that shows little migration of constituents (away from site sources) via a traditional groundwater pathway.

Total U and Tc-99:
Thirty (of 122) uranium samples exceeded the soil standard of 43 mg/kg; however only 1 sample has Uranium present at >43 mg/kg at a depth greater than 5'– indicating that transport from the source via groundwater mechanisms is not significant (i.e., transport stopped at the surface fill/till interface for these samples). Once Tc-99 sample slightly exceeds the soil standard of 65 pCi/g; however, this sample was collected from 3.2-feet. The groundwater sample results do NOT mirror the soil results. However, the soil results support the conceptual model that shows little migration of constituents via a traditional groundwater pathway.

6.4 CONSISTENCY WITH EARLIER RESULTS

Recent results are similar to historic data that support the conceptual model, as follows:

- ***Wells*** close to and downgradient from contaminated wells ***are not as contaminated***; e.g., MW-501 had TCE at 173,000 µg/L in September 2002, but MW-502, a till well located less than 40 feet downgradient has a TCE concentration of 1190 µg/L;

- Areas ***just downgradient of the FEP WMU are clean***, although portions of the FEP WMU area have been contaminated for over 17 years. An interface well screened only 16-feet deeper than MW-104 (MW-301) has TCE concentrations that are orders of magnitude less than those found in MW-104. This suggests that within the till unit, groundwater moves at a very slow rate.

- No TCE-contaminated wells are located outside the WMU areas. Transport via groundwater must therefore be slow since TCE was released to the Site in the early 1970s. Recent detections of TCE in the temporary piezometer (5B) at just above the MCL are not necessarily attributable to the FEP WMU source; other site spills or airborne deposition could account for it also.

Although the FEP WMU *soils* are significantly contaminated with TCE, Total U, and Tc-99, wells located downgradient, ***within 200'*** of the source are not contaminated. Wells located within 50' of

one another are contaminated at levels that vary over 3 orders of magnitude. This indicates that conduit flows are controlling.

- Although many Site soils have ***surface*** contamination of Total U and Tc-99 above cleanup standards, till wells completed within a few feet of the surface in those locations are not necessarily contaminated above cleanup standards, indicating that under current conditions, groundwater migration is very slow.

- A preliminary review of the Site setting and data against similar site and constituent conditions in Northeast Ohio shows other sites with similar contaminant migration behavior.

7.0 CONCLUSIONS AND RECOMMENDATIONS

The results of Phase II of the groundwater investigation at the RMI Site expand understanding of Site conditions and verify the conceptual groundwater model, which includes the following observations :

1. Groundwater transport (and associated contaminant transport) is very slow in the absence of conduits.
2. Site *groundwater* contamination is not laterally extensive – site contaminants remain close to source areas. Thus, contaminant sources do not have to be very extensive to account for all of the found groundwater contamination.
3. Other pathways (silt seams expressed at the surface, seeps / utility lines / other conduits) provide greater potential for contaminants to migrate.
4. Once source areas are cleaned up, residual groundwater contamination should not be extensive.
5. Major source areas are the FEP WMU and surface soils (for Total U and Tc-99)
6. A minor area of TCE contamination has been identified near the CEI substation. During its remediation, the source of this contamination may be elucidated.

The Phase II activities that are incomplete, are expected, when completed, to further confirm the site conceptual model and potentially identify and delineate additional minor source areas.

SHARP recommends that RMIES continue Phase II investigations until RMIES is confident that it can estimate the volumes of source areas contaminated above cleanup standards. That information will be needed to support remedial decision making.

8.0 REFERENCES

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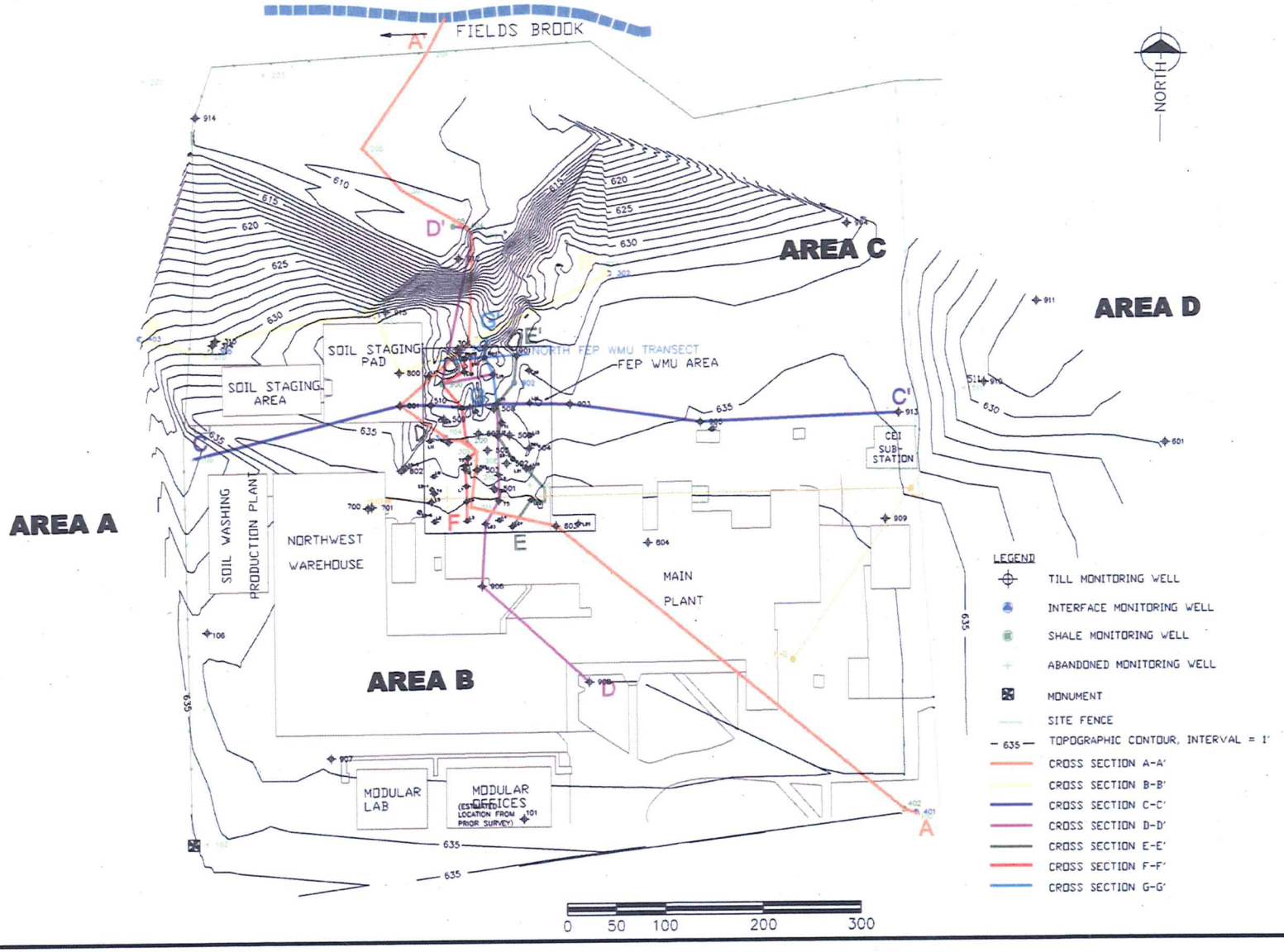

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RMI ENVIRONMENTAL SERVICES
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BASE MAP SHOWING LOCATIONS OF GEOLOGIC CROSS SECTIONS

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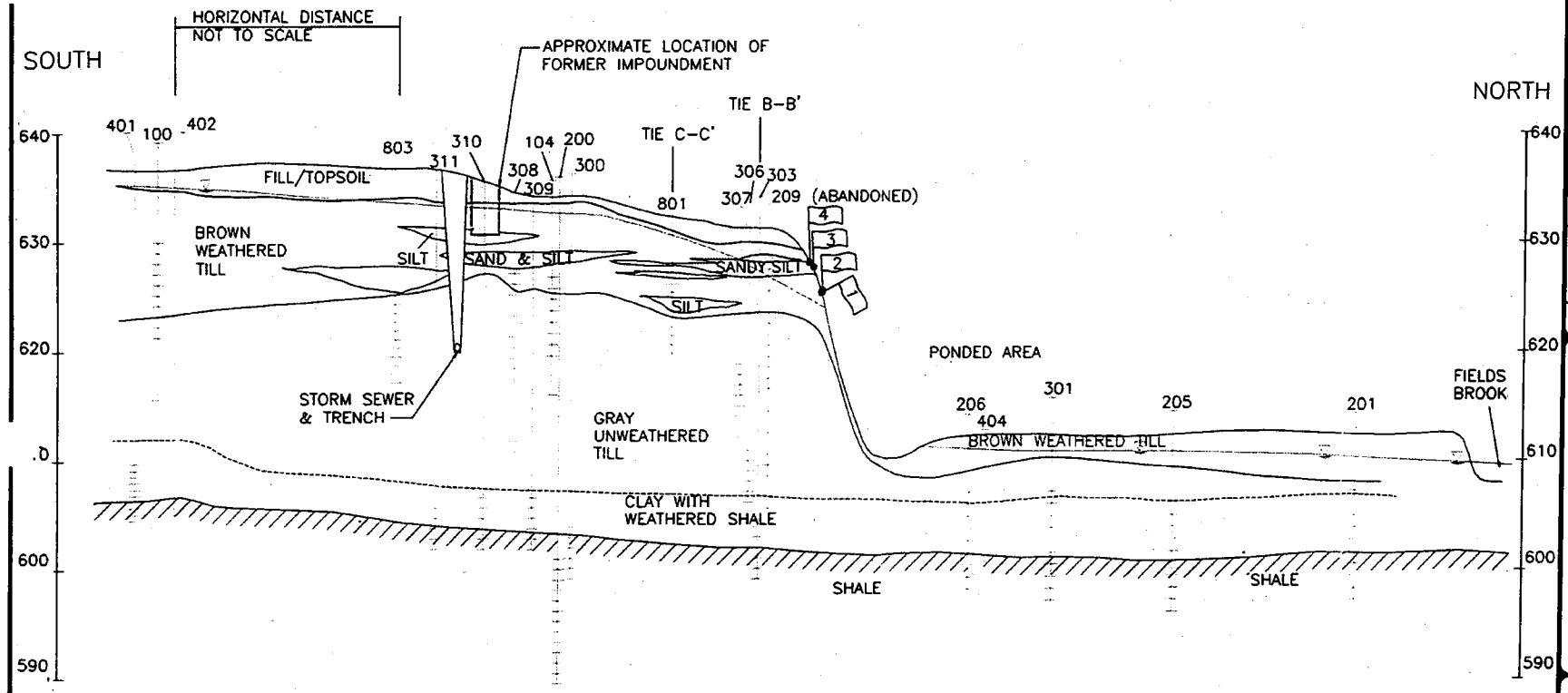
Revision: 1

CROSS-SECTION A-A'



LEGEND

WELL SCREEN INTERVAL

APPROX. WATER TABLE SURFACE, 1997–1998

SEEPAGE POINTS

HORIZONTAL SCALE

0 25 50 100 150

5X VERTICAL EXAGGERATION

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GEOLOGIC CROSS-SECTION A-A'

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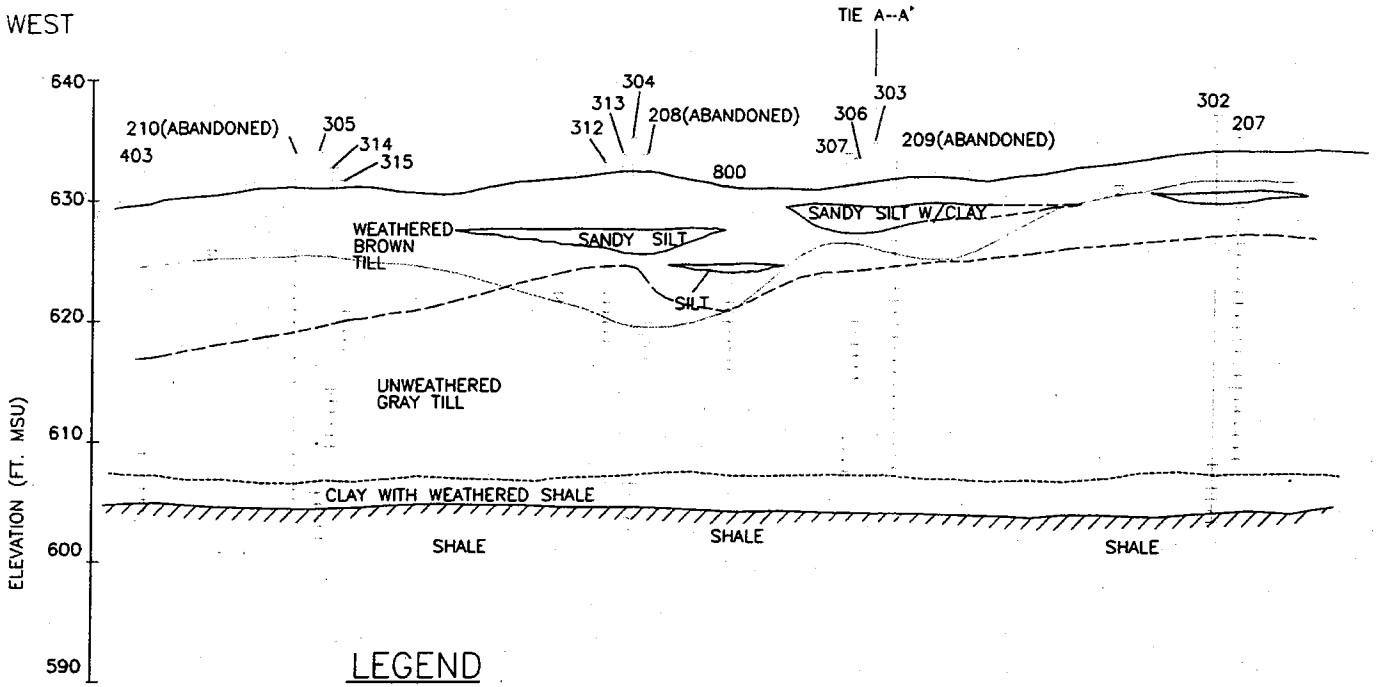
CROSS-SECTION B-B'



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WELL SCREEN INTERVAL

APPROX. WATER TABLE SURFACE, 1997–1998

HORIZONTAL SCALE

0 25 50 100 150

5X VERTICAL EXAGGERATION

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GEOLOGIC CROSS-SECTION B-B'

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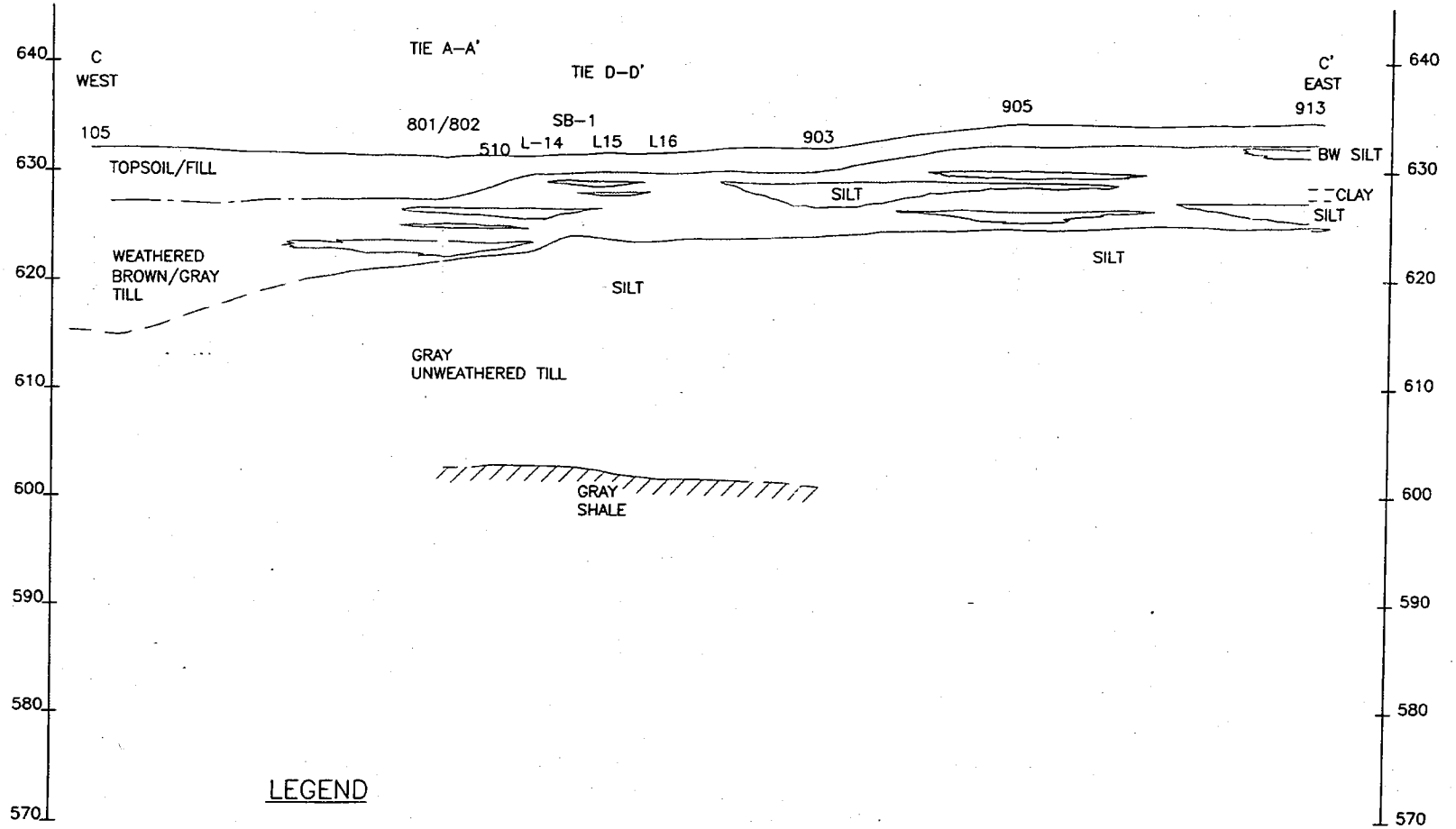
CROSS SECTION C-C'



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WELL SCREEN INTERVAL

SB, L, AND T SERIES ARE BORINGS WITHOUT WELL COMPLETIONS

HORIZONTAL SCALE
0 20 40 80 120
8x VERTICAL EXAGGERATION

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GEOLOGIC CROSS-SECTION C-C'

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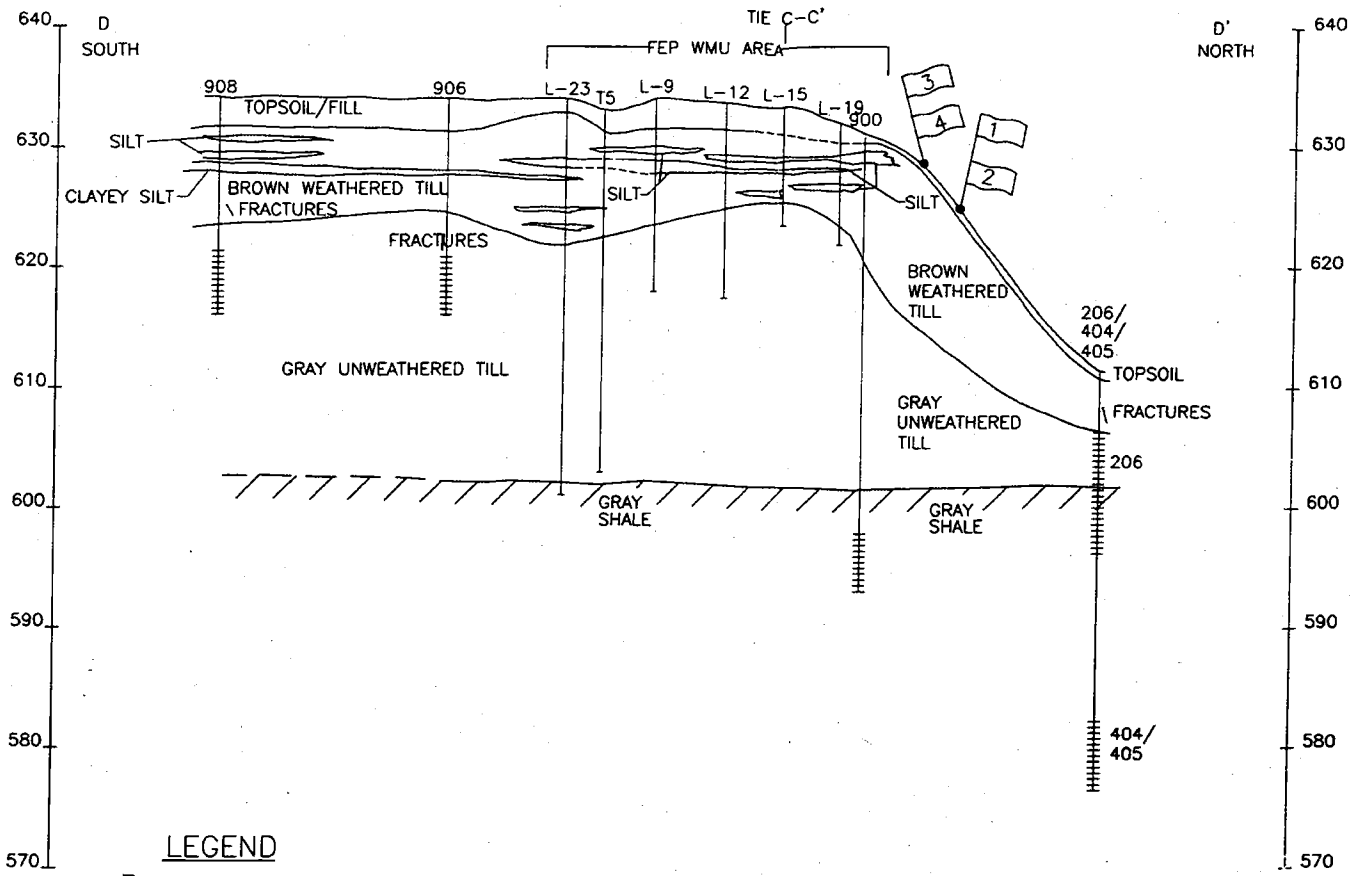
CROSS SECTION D-D'



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WELL SCREEN INTERVAL

1 PROJECTED SEEPAGE POINTS

SB, L, AND T SERIES ARE BORINGS WITHOUT WELL COMPLETIONS

HORIZONTAL SCALE
0 20 40 80 120
8x VERTICAL EXAGGERATION

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GEOLOGIC CROSS-SECTION D-D'

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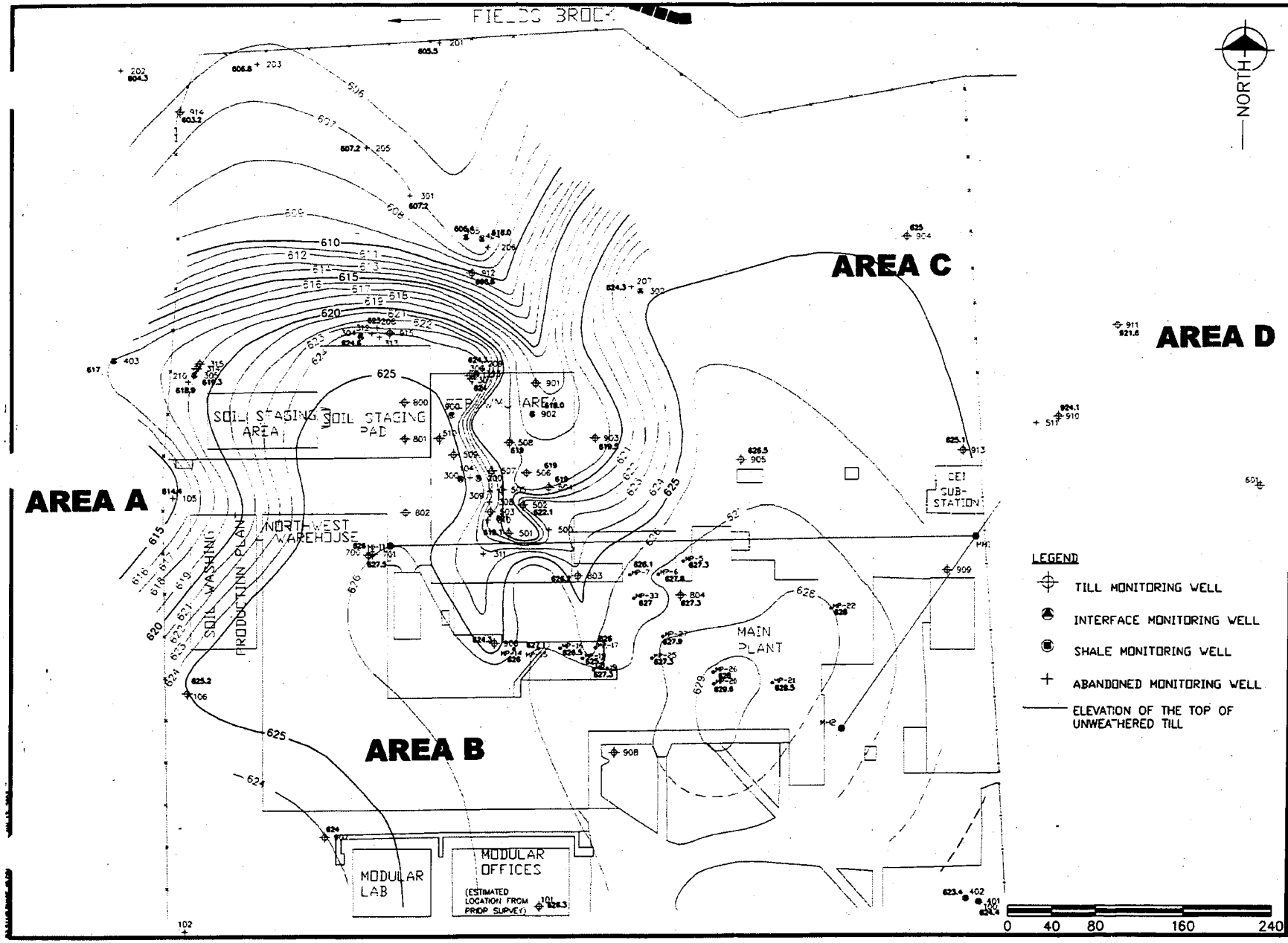

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STRUCTURE MAP, TOP OF THE UNWEATHERED GRAY TILL

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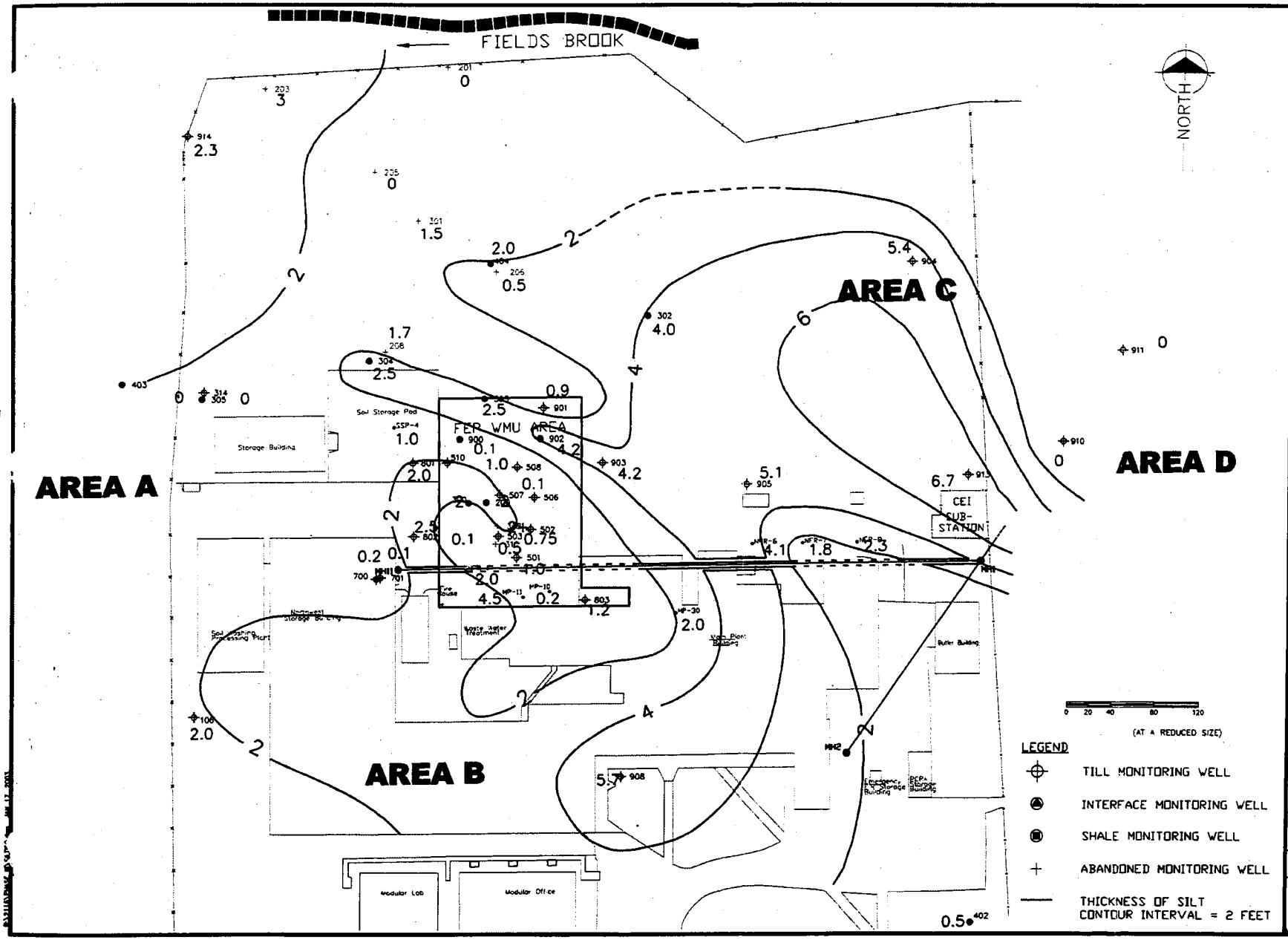

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NET ISOPACH MAP OF THE TOTAL SILT THICKNESS

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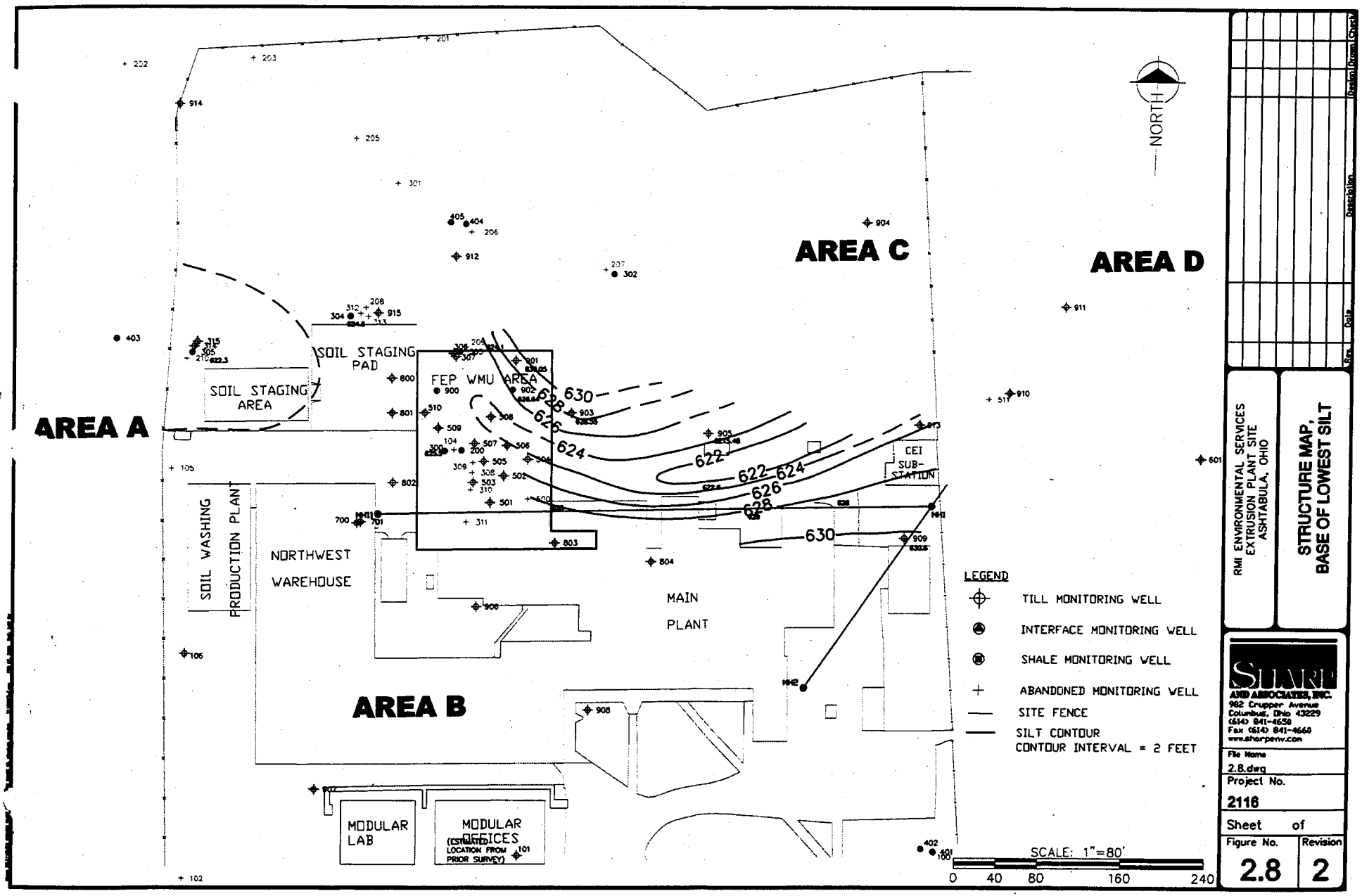

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STRUCTURE MAP, BASE OF LOWEST SILT

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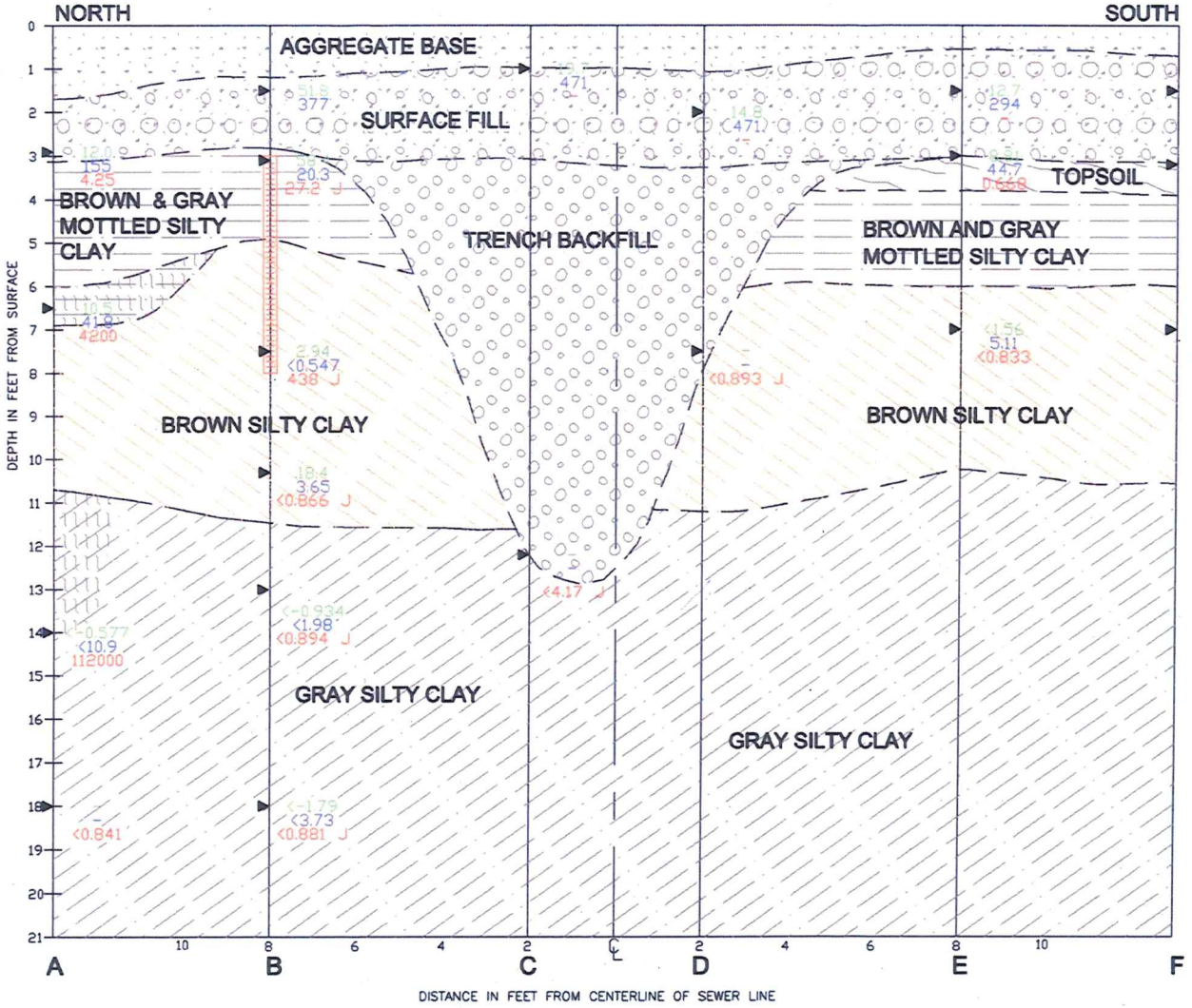

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XXX = TC-99 IN SOILS, pci/g

XXX = TOTAL U IN SOILS, ug/g

XXX = TCE IN SOILS, ug/kg

▶ = AVERAGE SAMPLE DEPTH

- AGGREGATE BASE
- SURFACE FILL MATERIALS
- TRENCH FILL MATERIALS
- BROWN AND GRAY MOTTLED SILTY CLAY
- GRAY SILTY CLAY
- BROWN SILTY CLAY
- SAND
- SILT
- TOPSOIL-(SILTY CLAY)
- CLAYEY SILT
- CLAY
- GRAY SILTY CLAY WITH IRON
- FRACTURES

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GEOLOGIC CROSS SECTION OF TRANSECT #1

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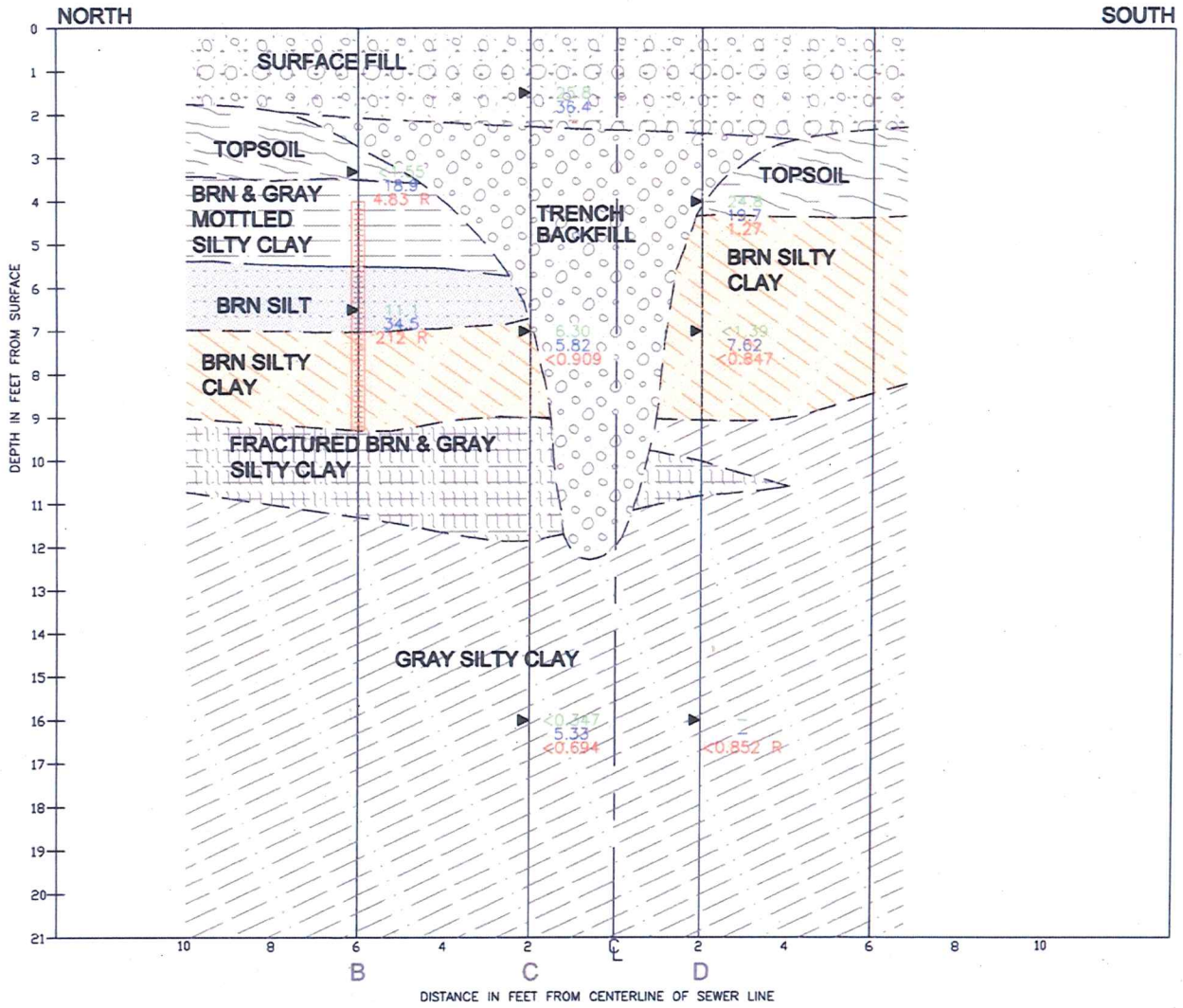

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XXX = TC-99 IN SOILS, pci/g
XXX = TOTAL U IN SOILS, ug/g
XXX = TCE IN SOILS, ug/kg
▶ = AVERAGE SAMPLE DEPTH

- AGGREGATE BASE
- SURFACE FILL MATERIALS
- TRENCH FILL MATERIALS
- BROWN AND GRAY MOTTLED SILTY CLAY
- GRAY SILTY CLAY
- BROWN SILTY CLAY
- SAND
- SILT
- TOPSOIL–(SILTY CLAY)
- CLAYEY SILT
- CLAY
- GRAY SILTY CLAY WITH IRON
- FRACTURES

No.	Date	Description	Drawn	Chkd

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EXTRUSION PLANT SITE
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GEOLOGIC CROSS SECTION OF TRANSECT #2

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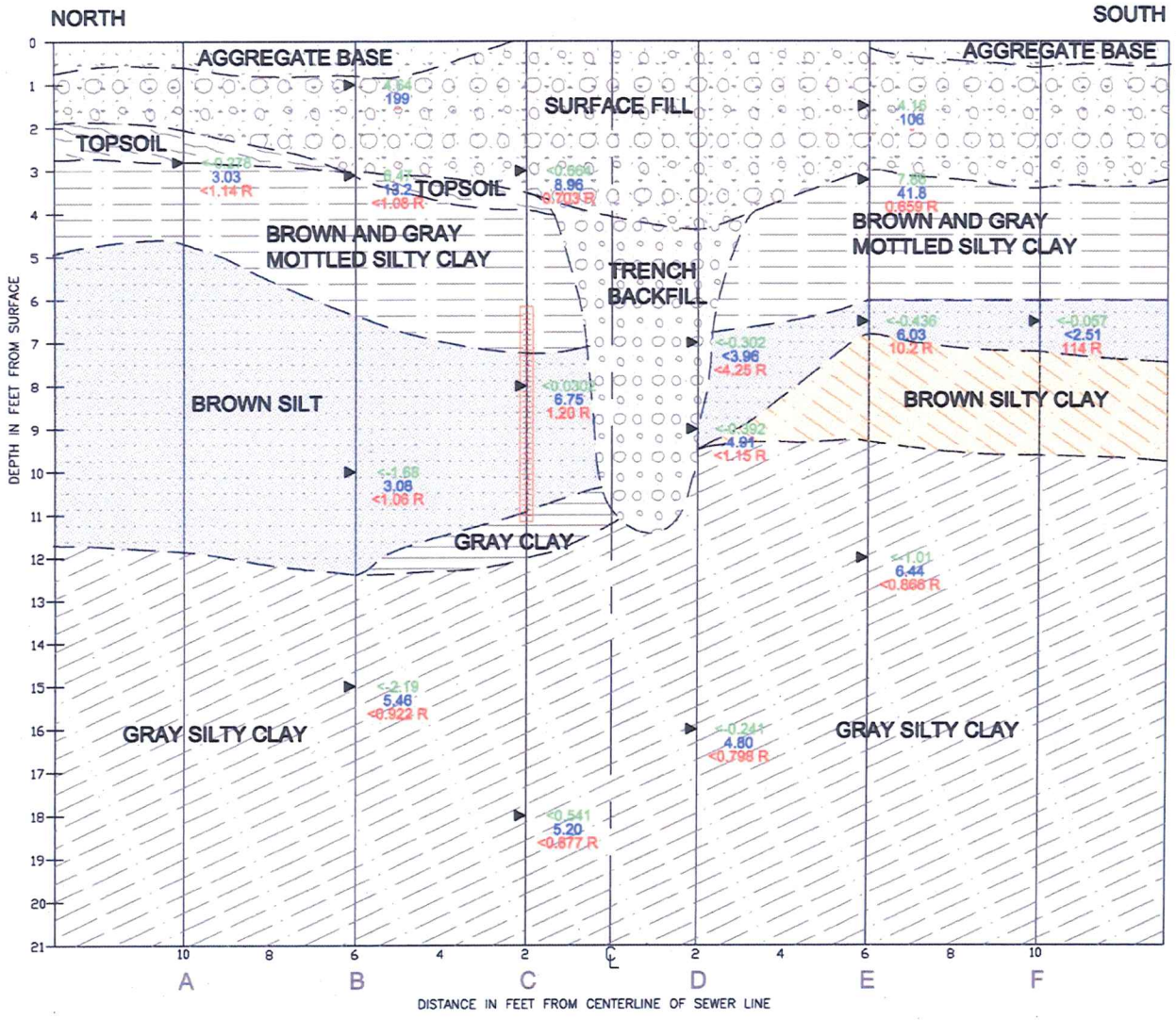

LEGEND

XXX = TC-99 IN SOILS, pci/g
XXX = TOTAL U IN SOILS, ug/g
XXX = TCE IN SOILS, ug/kg
▶ = AVERAGE SAMPLE DEPTH

- AGGREGATE BASE
- SURFACE FILL MATERIALS
- TRENCH FILL MATERIALS
- GRAY SILTY CLAY
- BROWN SILTY CLAY
- SAND
- SILT
- TOPSOIL–(SILTY CLAY)
- CLAYEY SILT
- CLAY
- BROWN AND GRAY MOTTLED SILTY CLAY

Rev.	Date	Description	Design	Drawn	Check

RMI ENVIRONMENTAL SERVICES
EXTRUSION PLANT SITE
ASHTABULA, OH

GEOLOGIC CROSS SECTION OF TRANSECT #3

SHARP AND ASSOCIATES, INC.
982 Crupper Avenue
Columbus, Ohio 43229
(614) 841-4650
Fax (614) 841-4660
www.sharpenv.com

File Name: 3.3.dwg
Project No.: 2116
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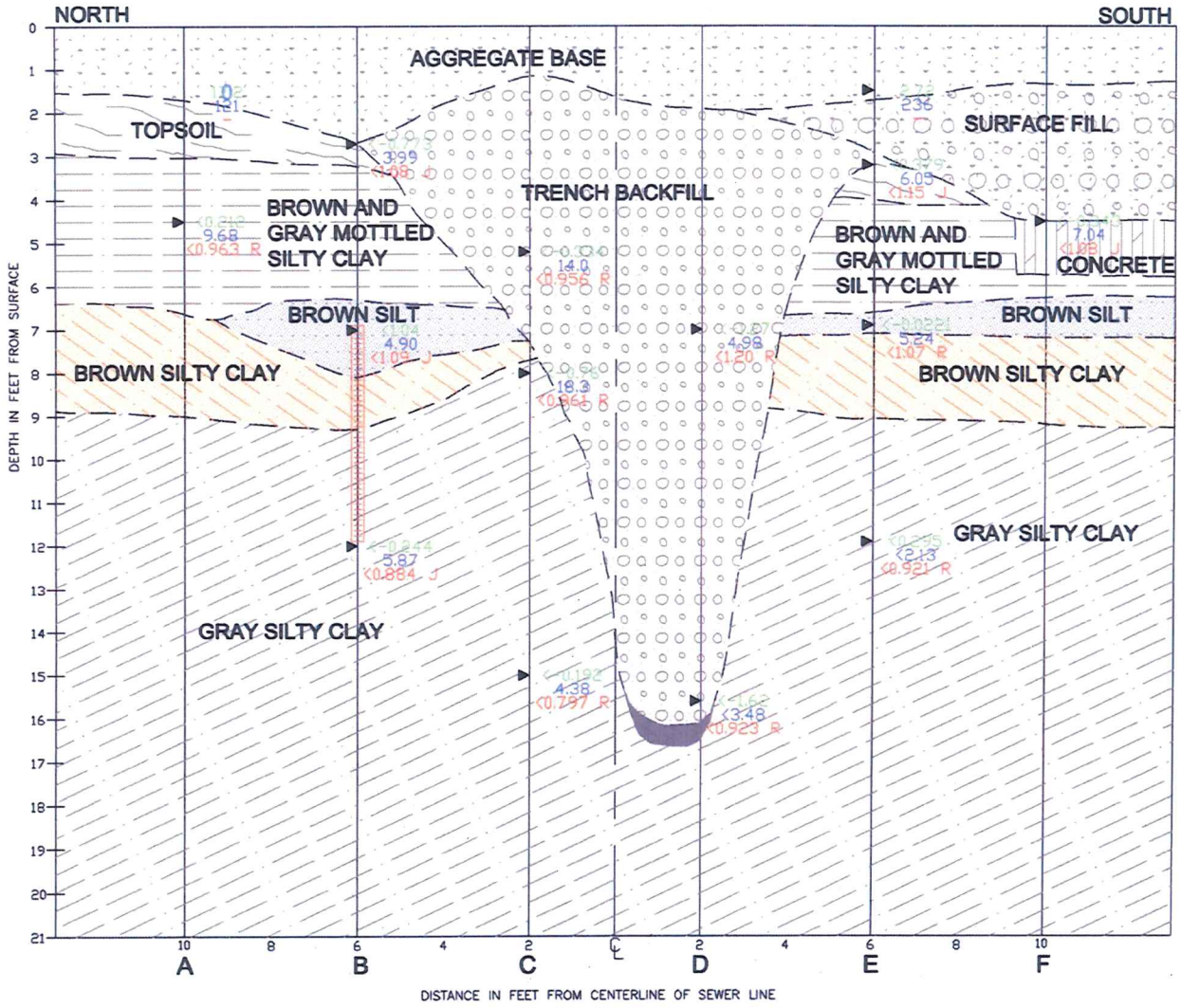
Figure No.: 3.3
Revision: 2



LEGEND

XXX = TC-99 IN SOILS, pci/g

XXX = TOTAL U IN SOILS, ug/g

XXX = TCE IN SOILS, ug/kg

▶ = AVERAGE SAMPLE DEPTH

- AGGREGATE BASE
- SURFACE FILL MATERIALS
- TRENCH FILL MATERIALS
- BROWN AND GRAY MOTTLED SILTY CLAY
- GRAY SILTY CLAY
- BROWN SILTY CLAY
- SAND
- SILT
- TOPSOIL–(SILTY CLAY)
- CLAYEY SILT
- CONCRETE FOOTER
- NATIVE BLACK STAINED SILTY CLAY

Rev. | Date | Description | Design | Drawn | Check

RMI ENVIRONMENTAL SERVICES
EXTRUSION PLANT SITE
ASHTABULA, OH

GEOLOGIC CROSS SECTION OF TRANSECT #4

SHARP AND ASSOCIATES, INC.
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Columbus, Ohio 43229
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File Name: 3.4.dwg

Project No.: 2116

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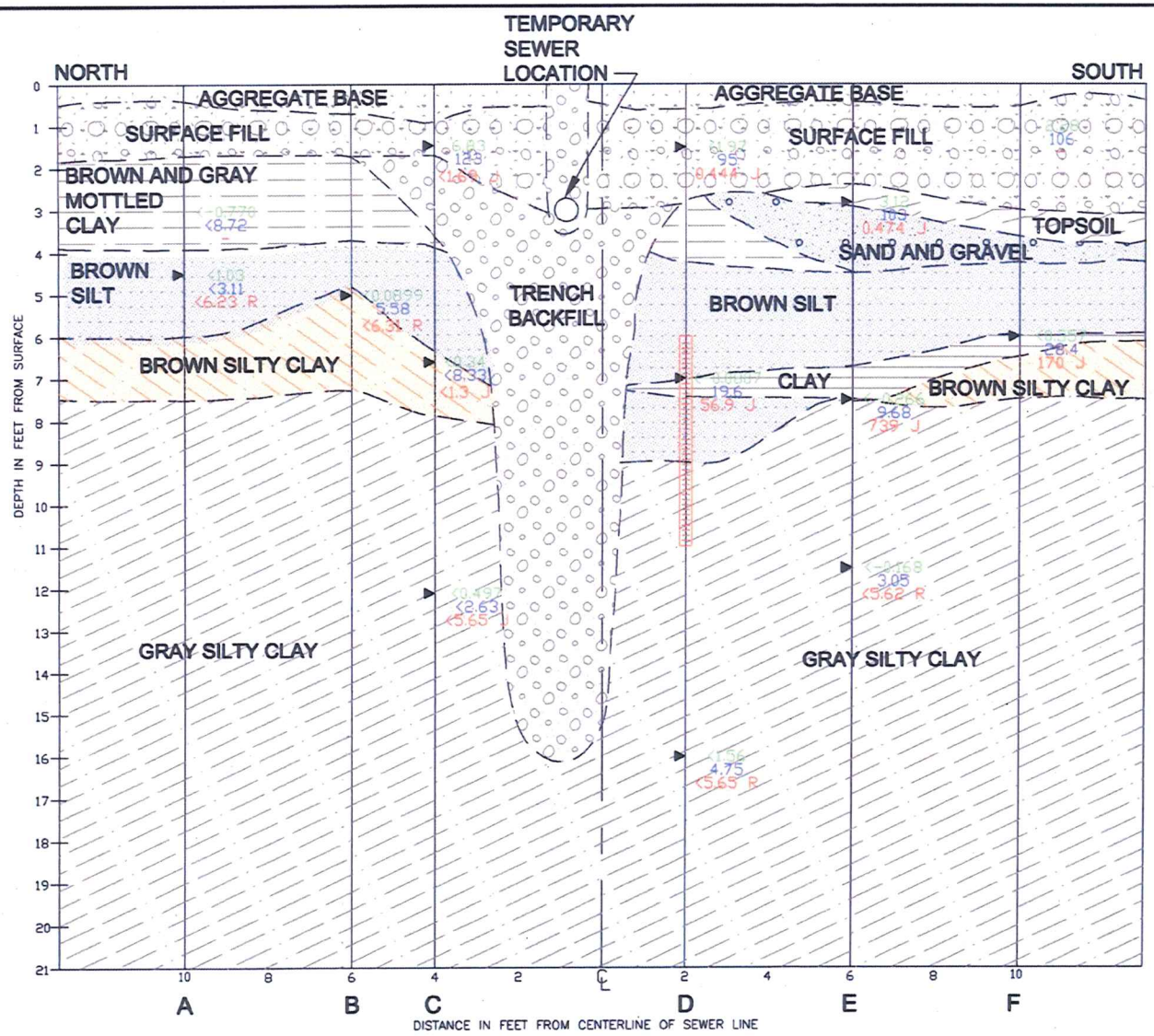
Figure No.: 3.4

Revision: 2



LEGEND

XXX = TC-99 IN SOILS, pci/g

XXX = TOTAL U IN SOILS, ug/g

XXX = TCE IN SOILS, ug/kg

▶ = AVERAGE SAMPLE DEPTH

- AGGREGATE BASE
- SURFACE FILL MATERIALS
- TRENCH FILL MATERIALS
- BROWN AND GRAY MOTTLED SILTY CLAY
- GRAY SILTY CLAY
- BROWN SILTY CLAY
- SAND
- SILT
- TOPSOIL–(SILTY CLAY)
- CLAYEY SILT
- CLAY
- SAND AND GRAVEL

RMI ENVIRONMENTAL SERVICES
EXTRUSION PLANT SITE
ASHTABULA, OH

GEOLOGIC CROSS SECTION OF TRANSECT #5

SHARP AND ASSOCIATES, INC.
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File Name: 3.5.dwg

Project No.: 2116

Sheet of

Figure No.: 3.5

Revision: 2

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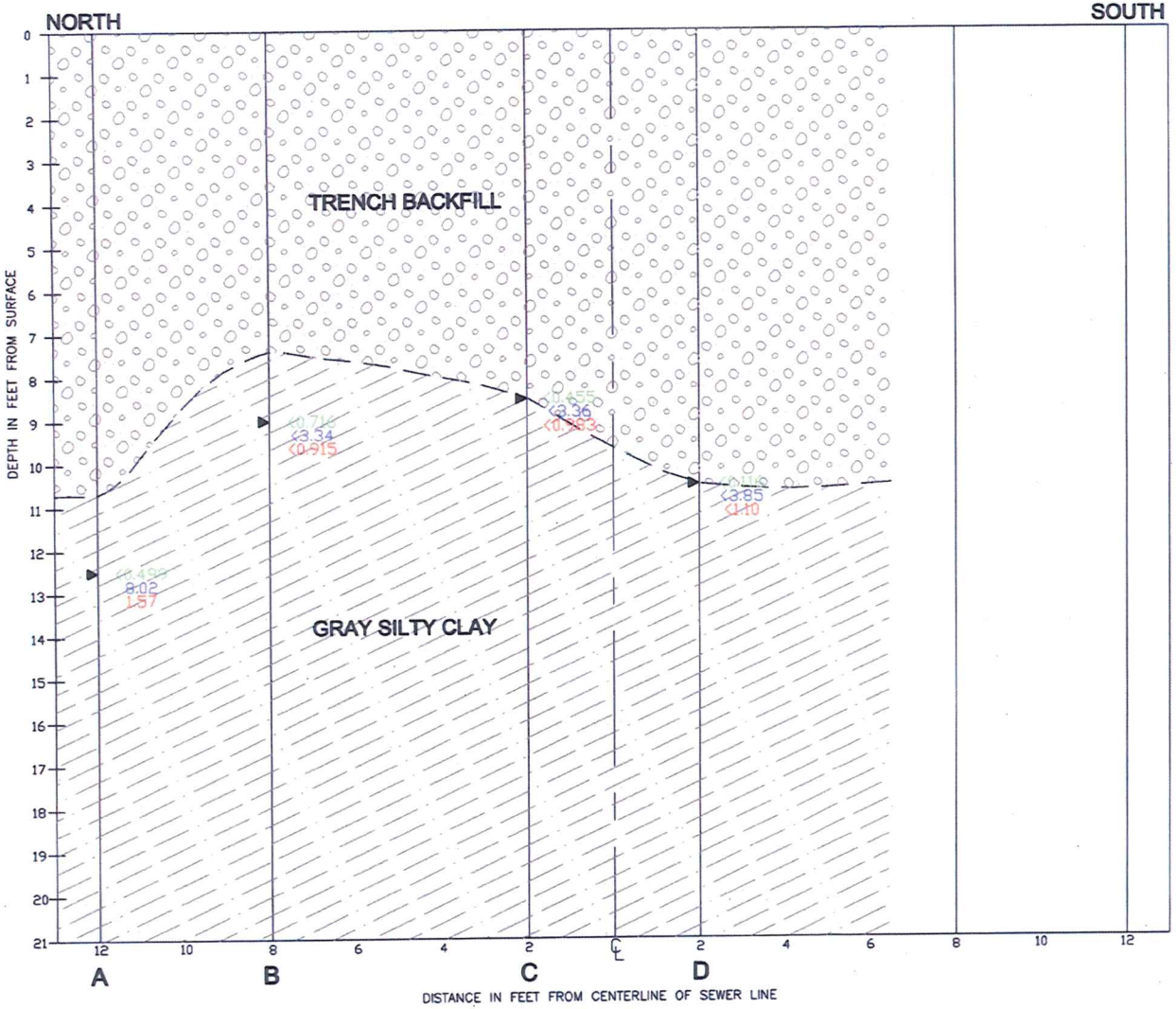


LEGEND

XXX = TC-99 IN SOILS, pci/g

XXX = TOTAL U IN SOILS, ug/g

XXX = TCE IN SOILS, ug/kg

▶ = AVERAGE SAMPLE DEPTH

- AGGREGATE BASE
- SURFACE FILL MATERIALS
- TRENCH FILL MATERIALS
- BROWN AND GRAY MOTTLED SILTY CLAY
- GRAY SILTY CLAY
- BROWN SILTY CLAY
- SAND
- SILT
- TOPSOIL–(SILTY CLAY)
- CLAYEY SILT
- CLAY
- GRAY SILTY CLAY WITH IRON

Rev.	Date	Description	Design	Drawn	Check

RMI ENVIRONMENTAL SERVICES
EXTRUSION PLANT SITE
ASHTABULA, OH

GEOLOGIC CROSS SECTION OF TRANSECT #6

SHARP AND ASSOCIATES, INC.
982 Crupper Avenue
Columbus, Ohio 43229
(614) 841-4650
Fax (614) 841-4660
www.sharpenv.com

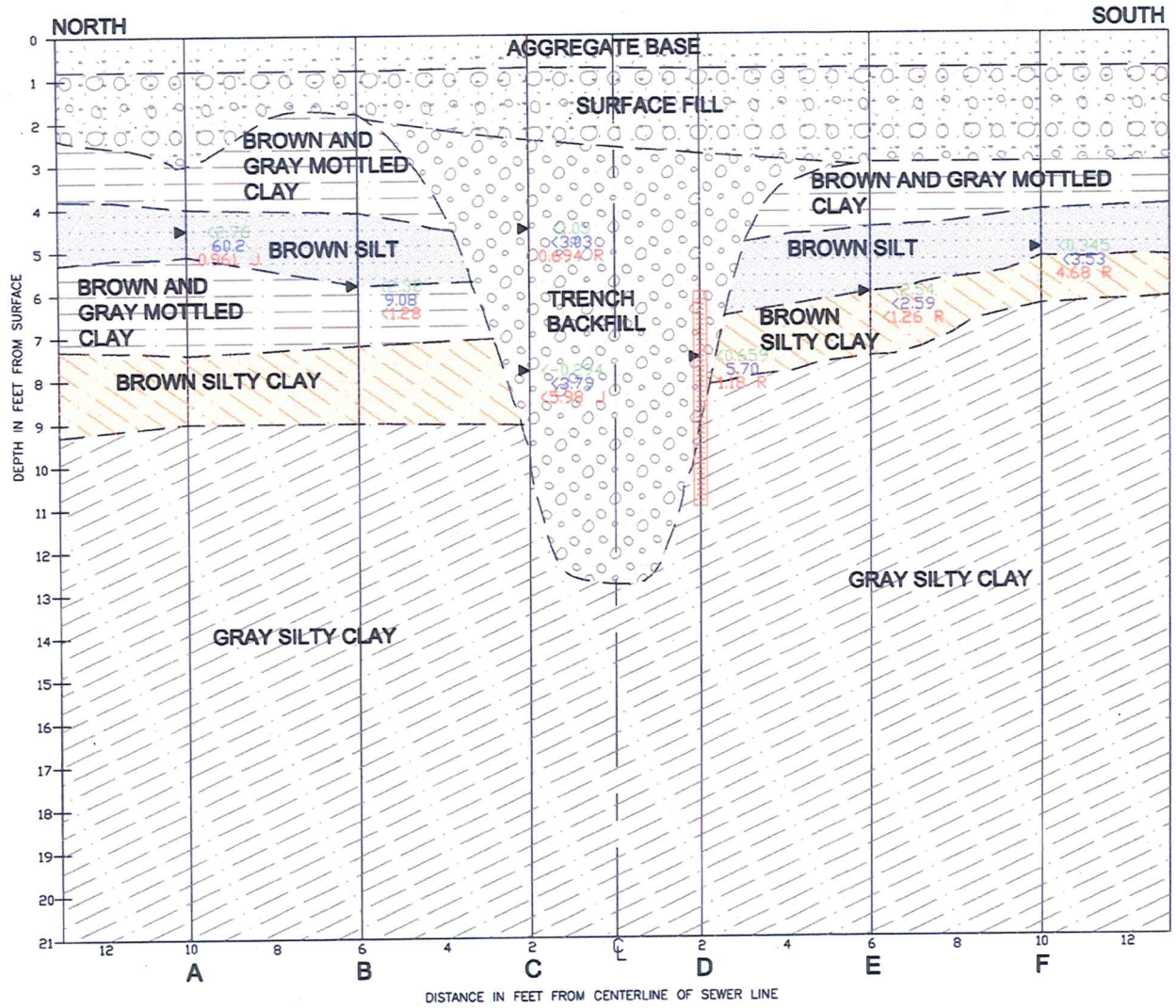
File Name: 3.6.dwg

Project No.: 2116

Sheet of

Figure No.: 3.6

Revision: 2



LEGEND

XXX = TC-99 IN SOILS, pCi/g
XXX = TOTAL U IN SOILS, ug/g
XXX = TCE IN SOILS, ug/kg
▶ = AVERAGE SAMPLE DEPTH

- AGGREGATE BASE
- SURFACE FILL MATERIALS
- TRENCH FILL MATERIALS
- BROWN AND GRAY MOTTLED SILTY CLAY
- GRAY SILTY CLAY
- BROWN SILTY CLAY
- SAND
- SILT
- TOPSOIL–(SILTY CLAY)
- CLAYEY SILT
- CLAY
- GRAY SILTY CLAY WITH IRON

RMI ENVIRONMENTAL SERVICES
EXTRUSION PLANT SITE
ASHTABULA, OH

GEOLOGIC CROSS SECTION OF TRANSECT #7

SHARP AND ASSOCIATES, INC.
982 Crupper Avenue
Columbus, Ohio 43229
(614) 841-4650
Fax (614) 841-4660
www.sharpenv.com

File Name: 3.7.dwg
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Sheet of
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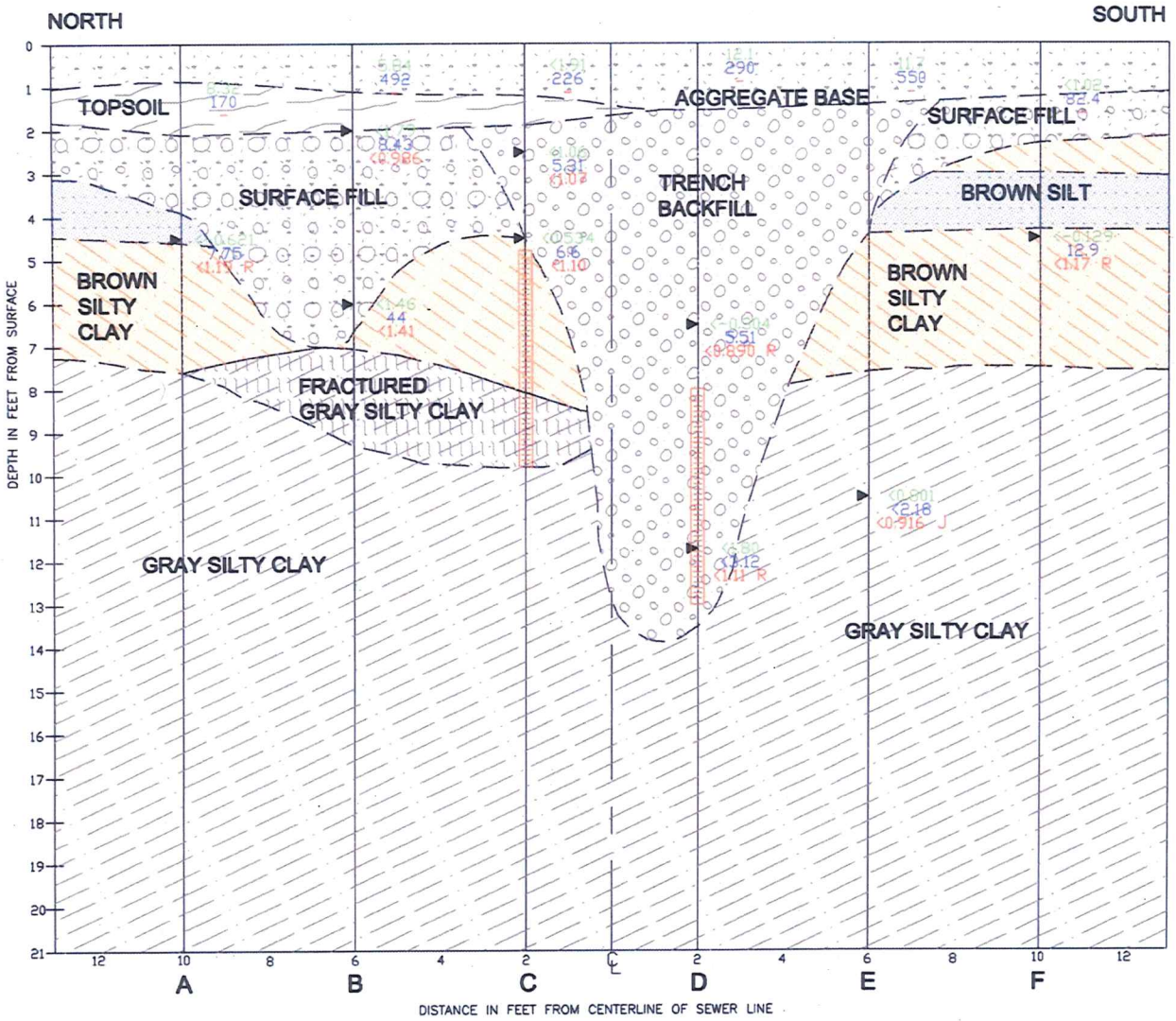
Revision: 2



LEGEND

XXX = TC-99 IN SOILS, pCi/g

XXX = TOTAL U IN SOILS, ug/g

XXX = TCE IN SOILS, ug/kg

▶ = AVERAGE SAMPLE DEPTH

- AGGREGATE BASE
- SURFACE FILL MATERIALS
- TRENCH FILL MATERIALS
- BROWN AND GRAY MOTTLED SILTY CLAY
- GRAY SILTY CLAY
- BROWN SILTY CLAY
- SAND
- SILT
- TOPSOIL–(SILTY CLAY)
- CLAYEY SILT
- CLAY
- FRACTURES

Rev. | Date | Description | Drawn | Check

RMI ENVIRONMENTAL SERVICES
EXTRUSION PLANT SITE
ASHTABULA, OH

GEOLOGIC CROSS SECTION OF TRANSECT #8

SHARP AND ASSOCIATES, INC.
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Columbus, Ohio 43229
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Fax (614) 841-4660
www.sharpenv.com

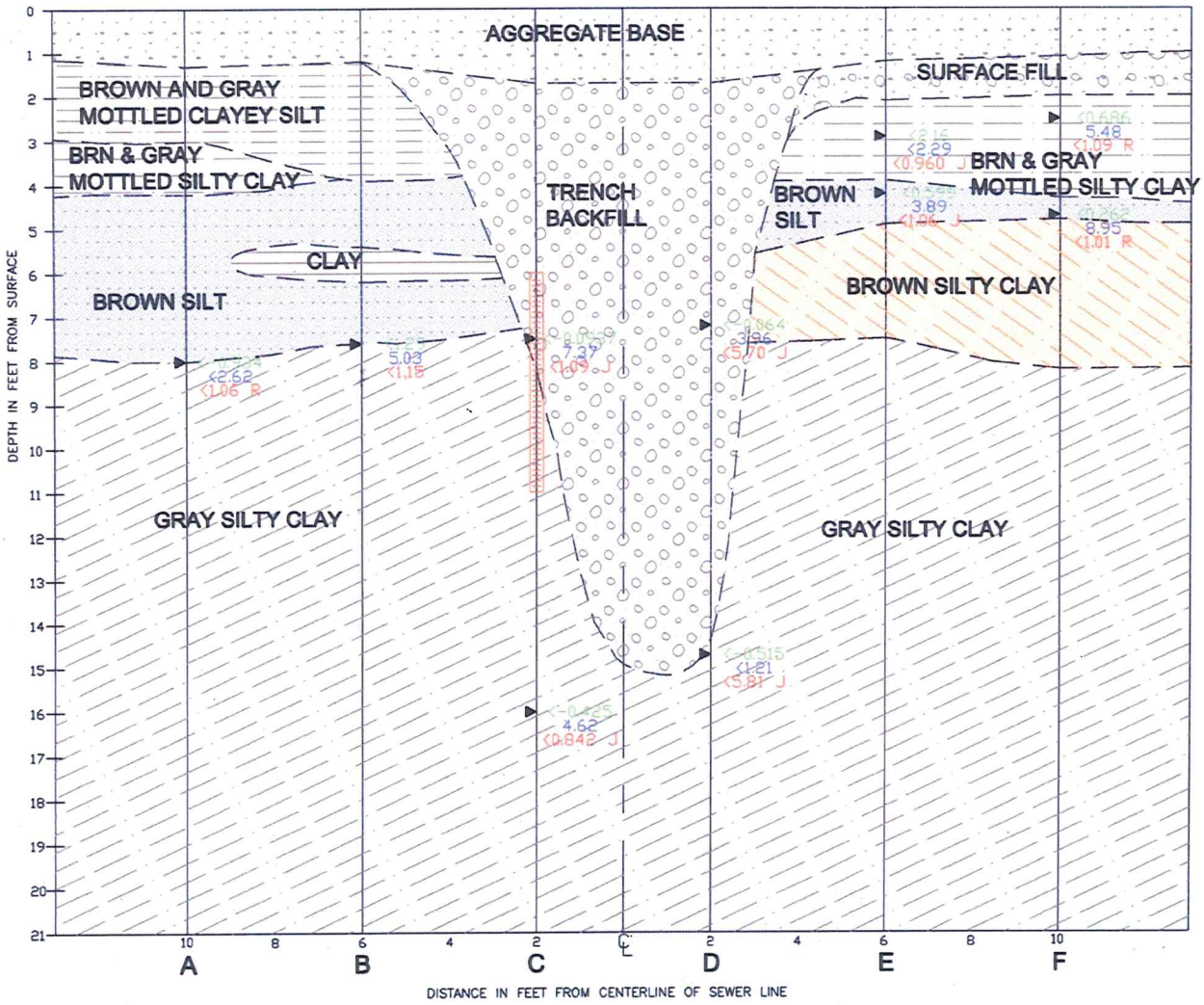
File Name: 3.8.dwg

Project No.: 2116

Sheet of

Figure No.: 3.8

Revision: 2



LEGEND

XXX = TC-99 IN SOILS, pCi/g
XXX = TOTAL U IN SOILS, ug/g
XXX = TCE IN SOILS, ug/kg
▶ = AVERAGE SAMPLE DEPTH

- AGGREGATE BASE
- SURFACE FILL MATERIALS
- TRENCH FILL MATERIALS
- BROWN AND GRAY MOTTLED SILTY CLAY
- GRAY SILTY CLAY
- BROWN SILTY CLAY
- SAND
- SILT
- TOPSOIL-(SILTY CLAY)
- CLAYEY SILT
- CLAY
- GRAY SILTY CLAY WITH IRON

Rev. | Date | Description | Design | Drawn | Check

RMI ENVIRONMENTAL SERVICES
EXTRUSION PLANT SITE
ASHTABULA, OH

GEOLOGIC CROSS SECTION OF TRANSECT #9

SHARP AND ASSOCIATES, INC.
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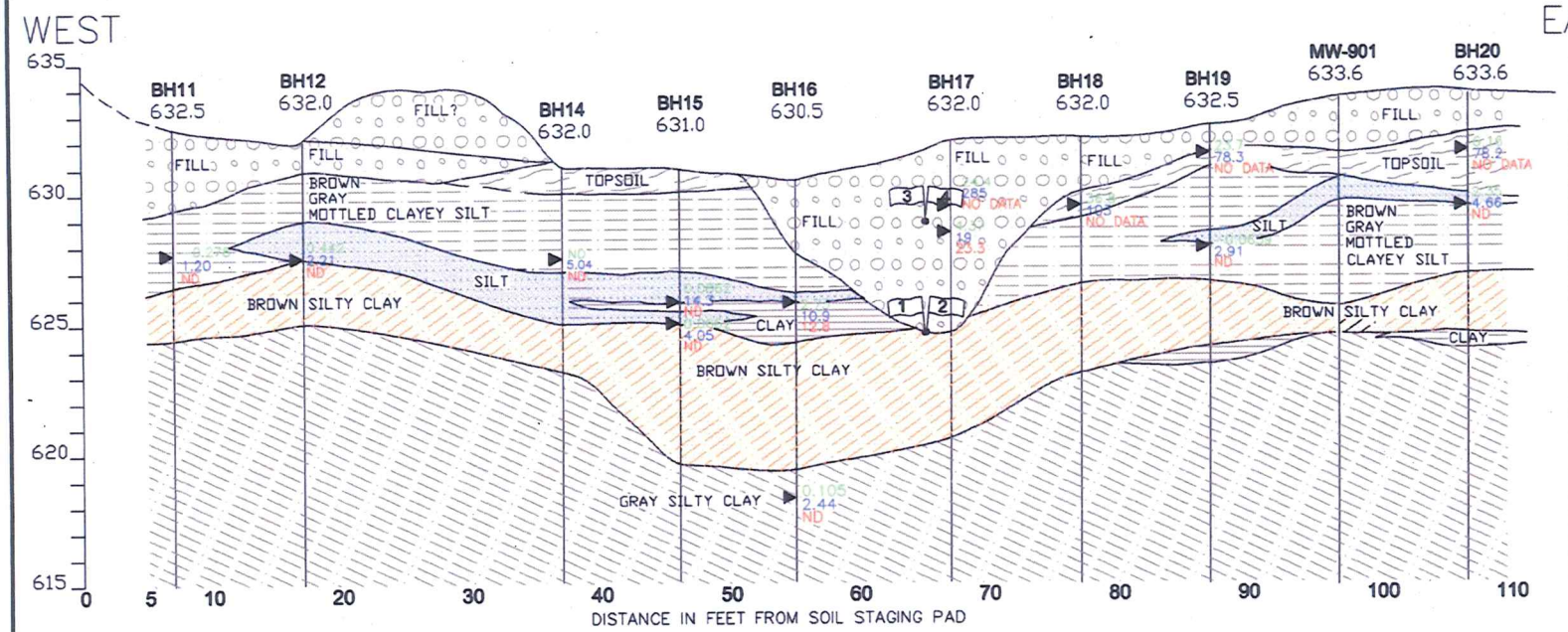
Fax (614) 841-4660
www.sharpenv.com

File Name: 3.9.dwg
Project No.: 2116
Sheet of
Figure No.: 3.9
Revision: 2



LEGEND

- FILL
- BROWN AND GRAY MOTTLED SILTY CLAY
- GRAY SILTY CLAY
- BROWN SILTY CLAY
- SAND
- SILT
- TOPSOIL–(SILTY CLAY)
- CLAYEY SILT
- CLAY
- GRAY SILTY CLAY WITH IRON
- PROJECTED SEEPAGE POINTS
- AVERAGE SAMPLE DEPTH

ND = NON DETECT
XXX = TC-99 IN SOILS, pci/g
XXX = TOTAL U IN SOILS, ug/g
XXX = TCE IN SOILS, ug/kg

Rev. | Date | Description | Drawn | Check

RMI ENVIRONMENTAL SERVICES
EXTRUSION PLANT SITE
ASHTABULA, OHIO

NORTH FEP WMU TRANSECT

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Fax (614) 841-4660
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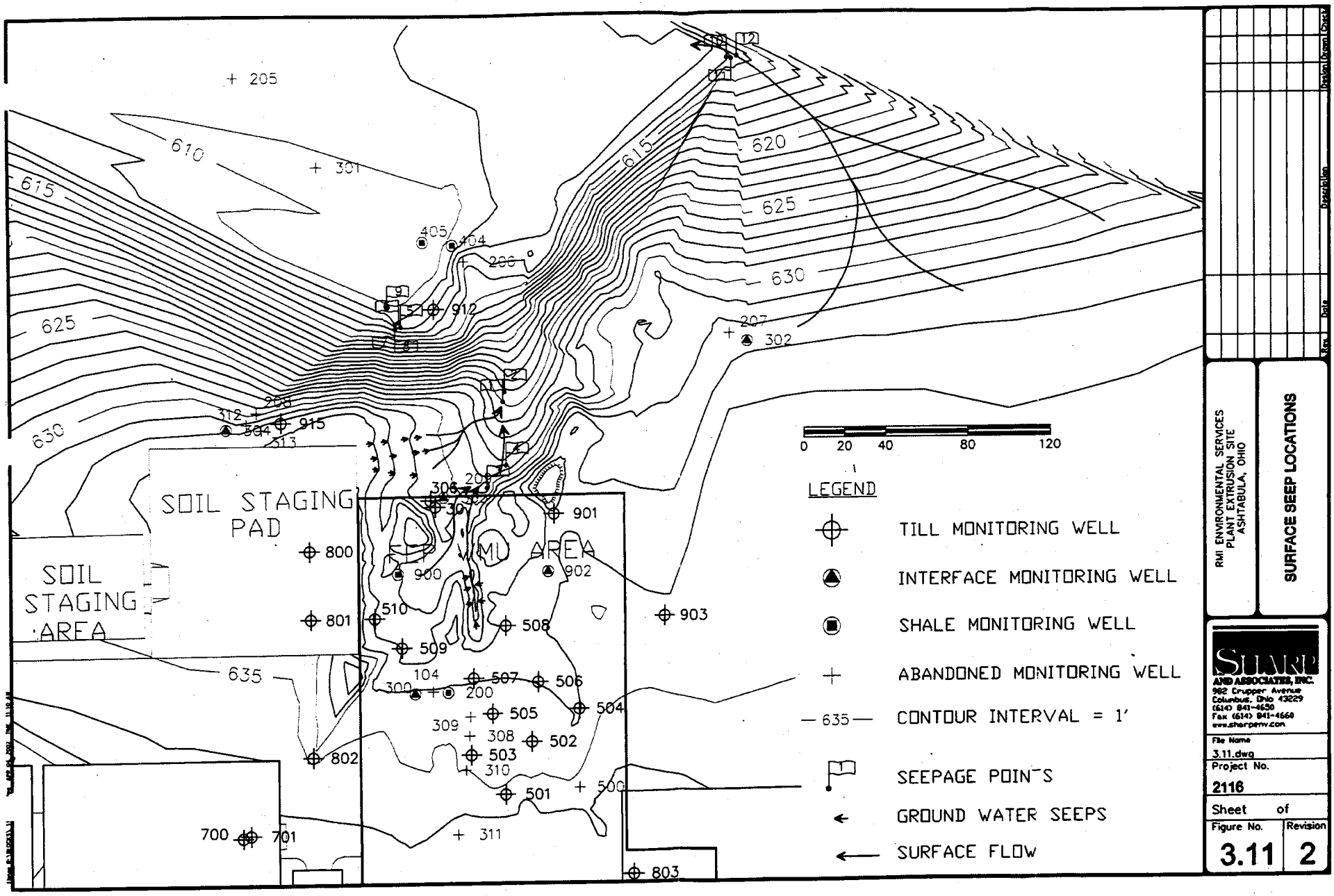
File Name
2116-TXS10
Project No.
2116
Sheet of
Drawing No. 3.10
Revision 2



RMI ENVIRONMENTAL SERVICES
PLANT EXTRUSION SITE
ASHTABULA, OHIO

SURFACE SEEP LOCATIONS

SHARP AND ASSOCIATES, INC.
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Columbus, Ohio 43229
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File Name: 3.11.dwg
Project No.: 2116
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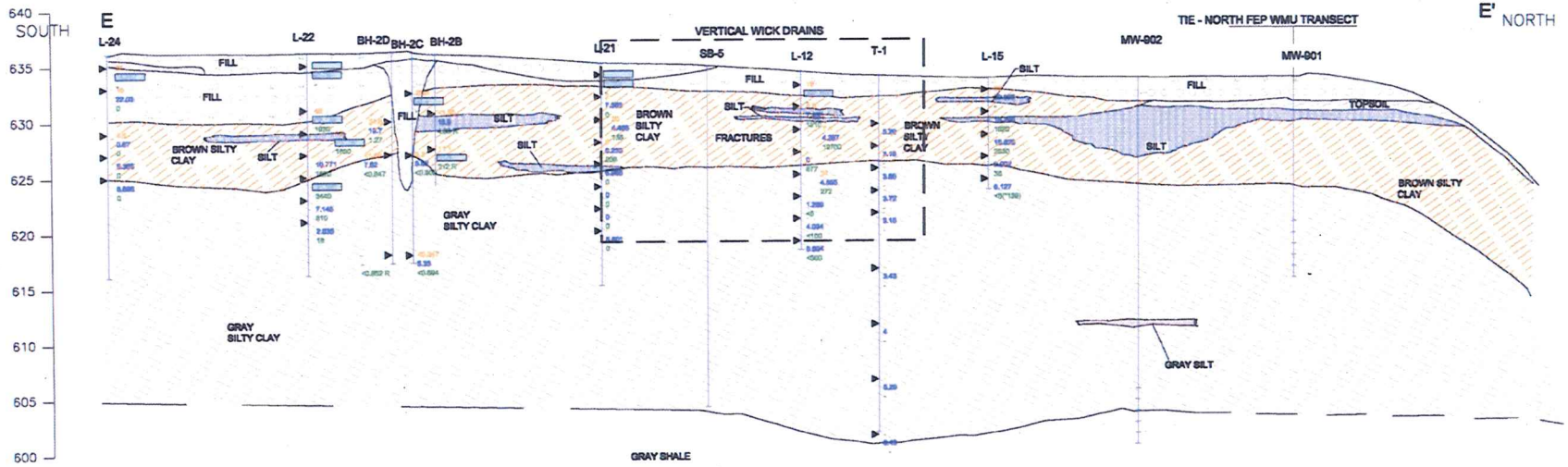
Revision: 2



LEGEND

XXX = TC-99 IN SOILS, pCi/g

XXX = TOTAL U IN SOILS, ug/g

XXX = TCE IN SOILS, ug/kg

▶ = AVERAGE SAMPLE DEPTH

- TRENCH FILL MATERIALS
- SURFACE FILL MATERIALS
- BROWN AND GRAY MOTTLED SILTY CLAY
- GRAY SILTY CLAY
- BROWN SILTY CLAY
- SAND
- SILT
- TOPSOIL–(SILTY CLAY)
- CLAYEY SILT
- CLAY
- GRAY SILTY CLAY WITH IRON

(*) Duplicate result; unable to verify concentration.

Rev.	Date	Description	Design	Drawn	Check

RMI ENVIRONMENTAL SERVICES
EXTRUSION PLANT SITE
ASHTABULA, OHIO

GEOLOGIC CROSS-SECTION E-E'

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File Name: 3.12rev2.dwg
Project No.: 2116
Sheet of
Figure No.: 3.12
Revision: 2

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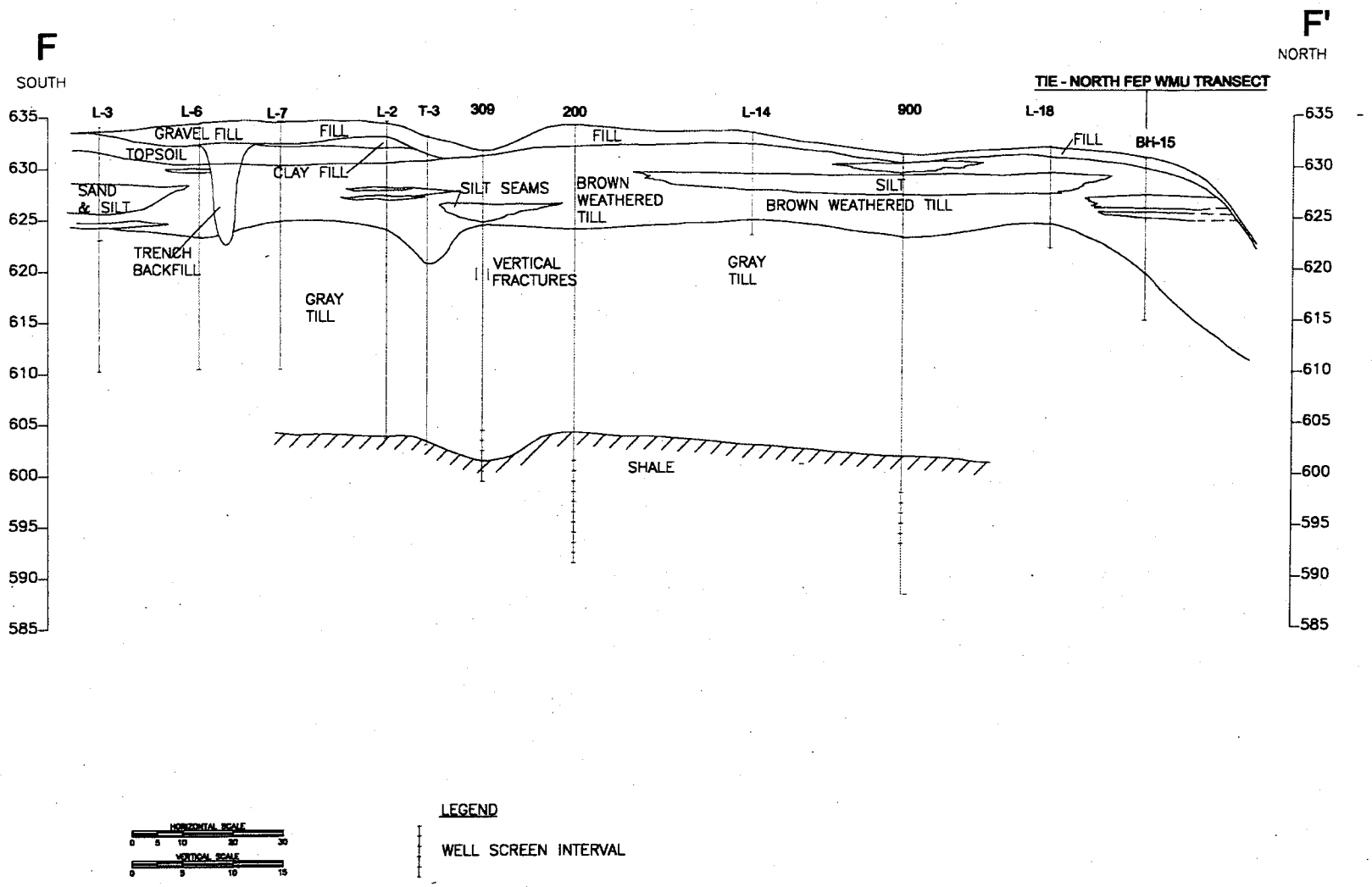
FEP - WMU DETAIL CROSS SECTION F-F'



LEGEND

WELL SCREEN INTERVAL

NOTE: SHEET REDUCED BY HALF FOR PRINTING

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EXTRUSION PLANT SITE
ASHTABULA, OH

GEOLOGIC CROSS-SECTION F-F'

SHARP AND ASSOCIATES, INC.
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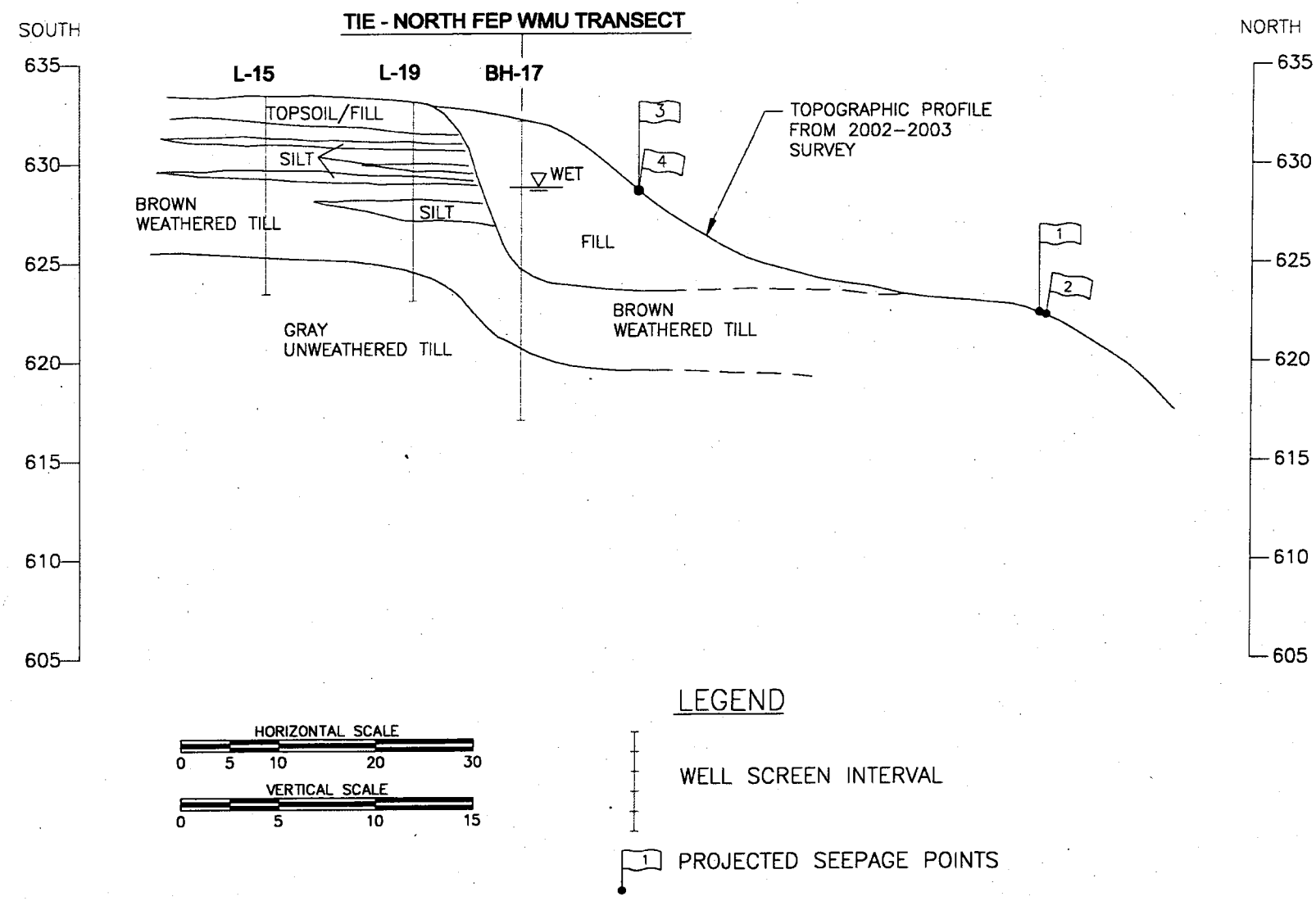
File Name: 2116-XSCA.dwg
Project No.: 2116
Sheet of
Figure No.: 3.13
Revision: 1

FEP - WMU DETAIL CROSS SECTION G-G'



RMI ENVIRONMENTAL SERVICES
EXTRUSION PLANT SITE
ASHTABULA, OH

GEOLOGIC CROSS-SECTION G-G'

SHARP AND ASSOCIATES, INC.
982 Crupper Avenue
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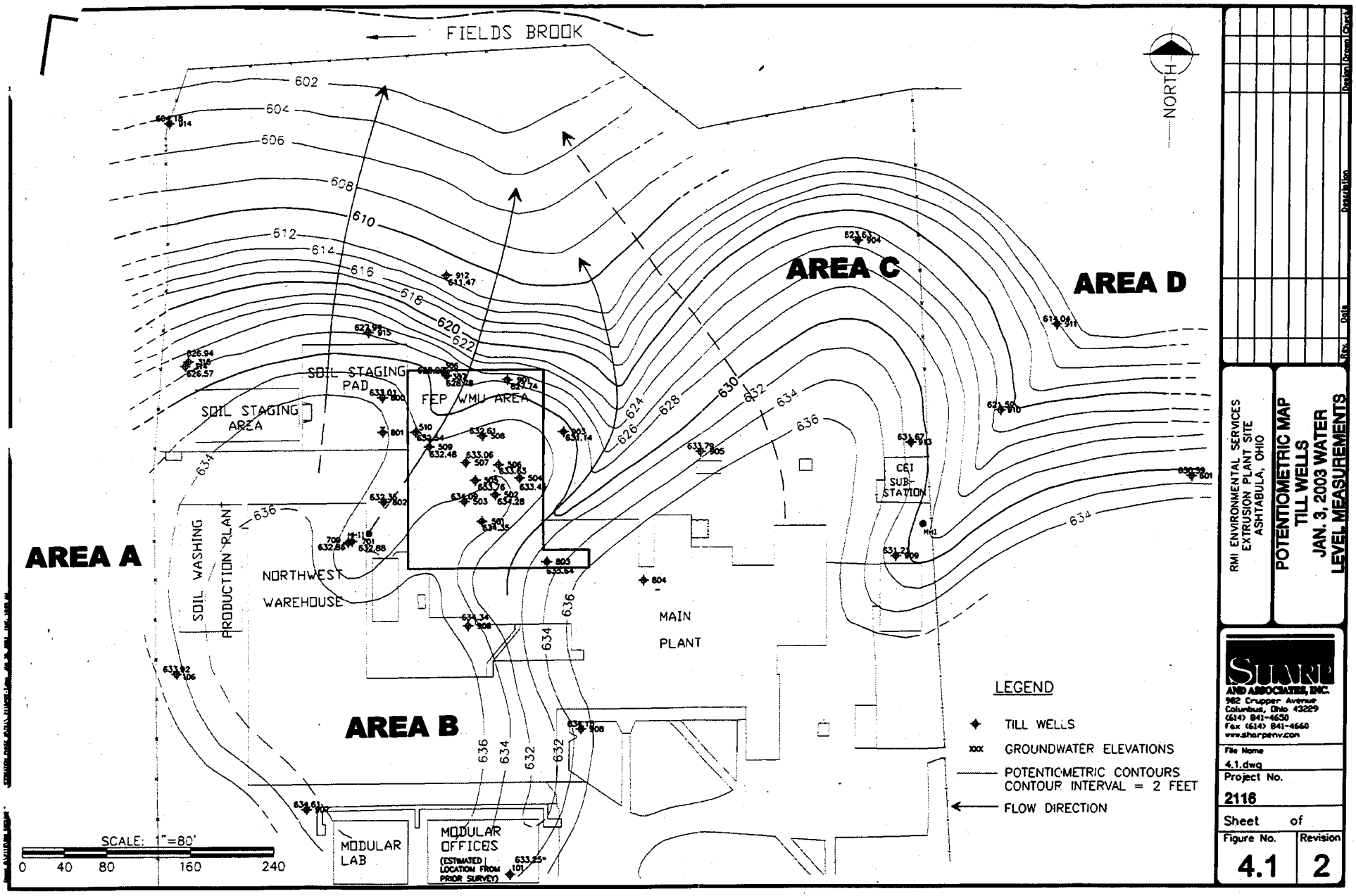
File Name
2116-XSCA.dwg

Project No.
2116

Sheet of

Figure No. 3.14

Revision 1



RMI ENVIRONMENTAL SERVICES
EXTRUSION PLANT SITE
ASHTABULA, OHIO

POTENTIOMETRIC MAP
TILL WELLS
JAN. 3, 2003 WATER LEVEL MEASUREMENTS

SHARP AND ASSOCIATES, INC.
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Columbus, Ohio 43229
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File Name: 4.1.dwg
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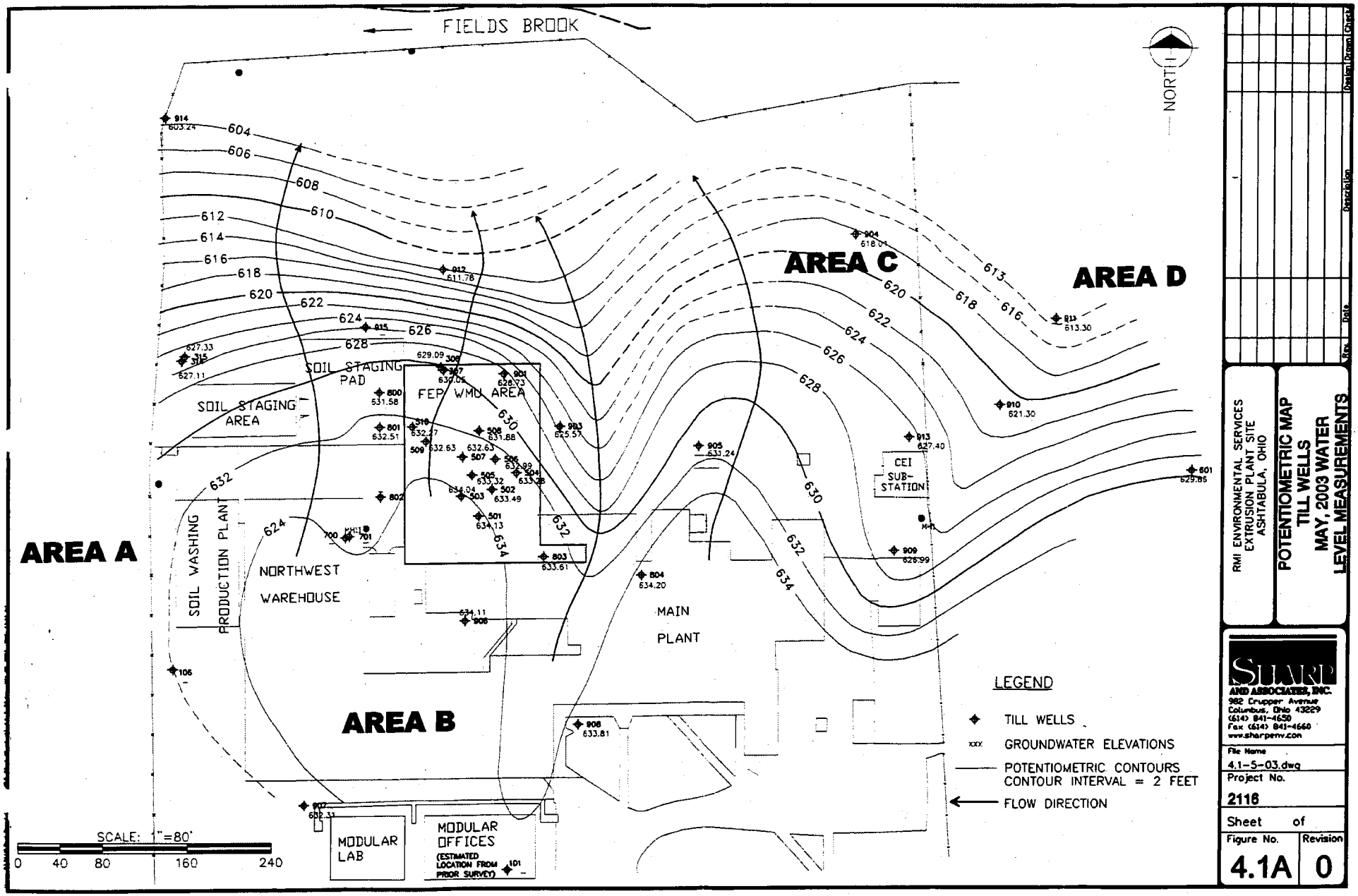
Revision: 2



RMI ENVIRONMENTAL SERVICES
EXTRUSION PLANT SITE
ASHTABULA, OHIO

POTENTIOMETRIC MAP TILL WELLS MAY, 2003 WATER LEVEL MEASUREMENTS

SHARP AND ASSOCIATES, INC.
982 Crupper Avenue
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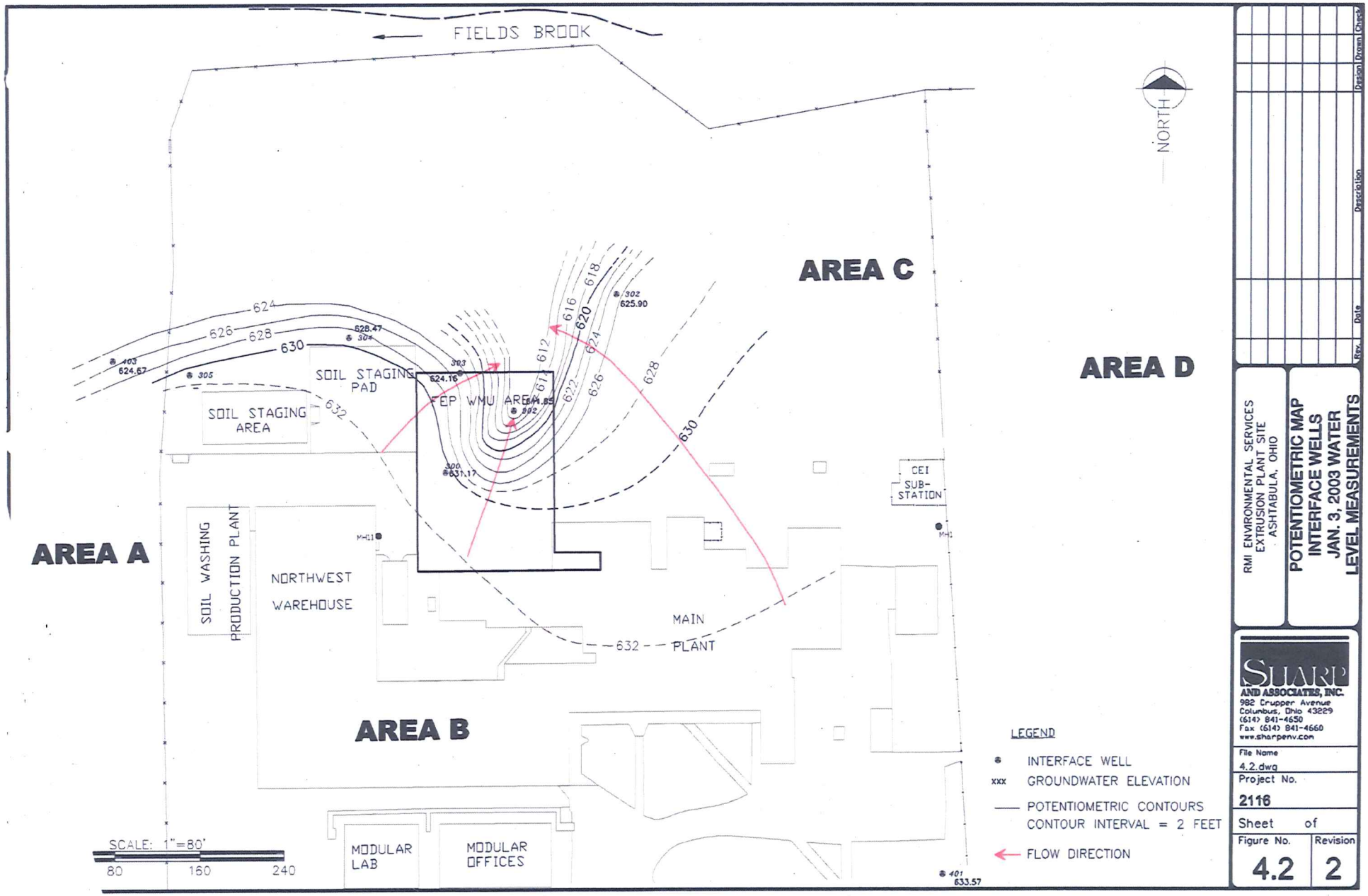

Rev.	Date	Description	Drawn	Chk'd

RMI ENVIRONMENTAL SERVICES
EXTRUSION PLANT SITE
ASHTABULA, OHIO

POTENTIOMETRIC MAP INTERFACE WELLS JAN. 3, 2003 WATER LEVEL MEASUREMENTS

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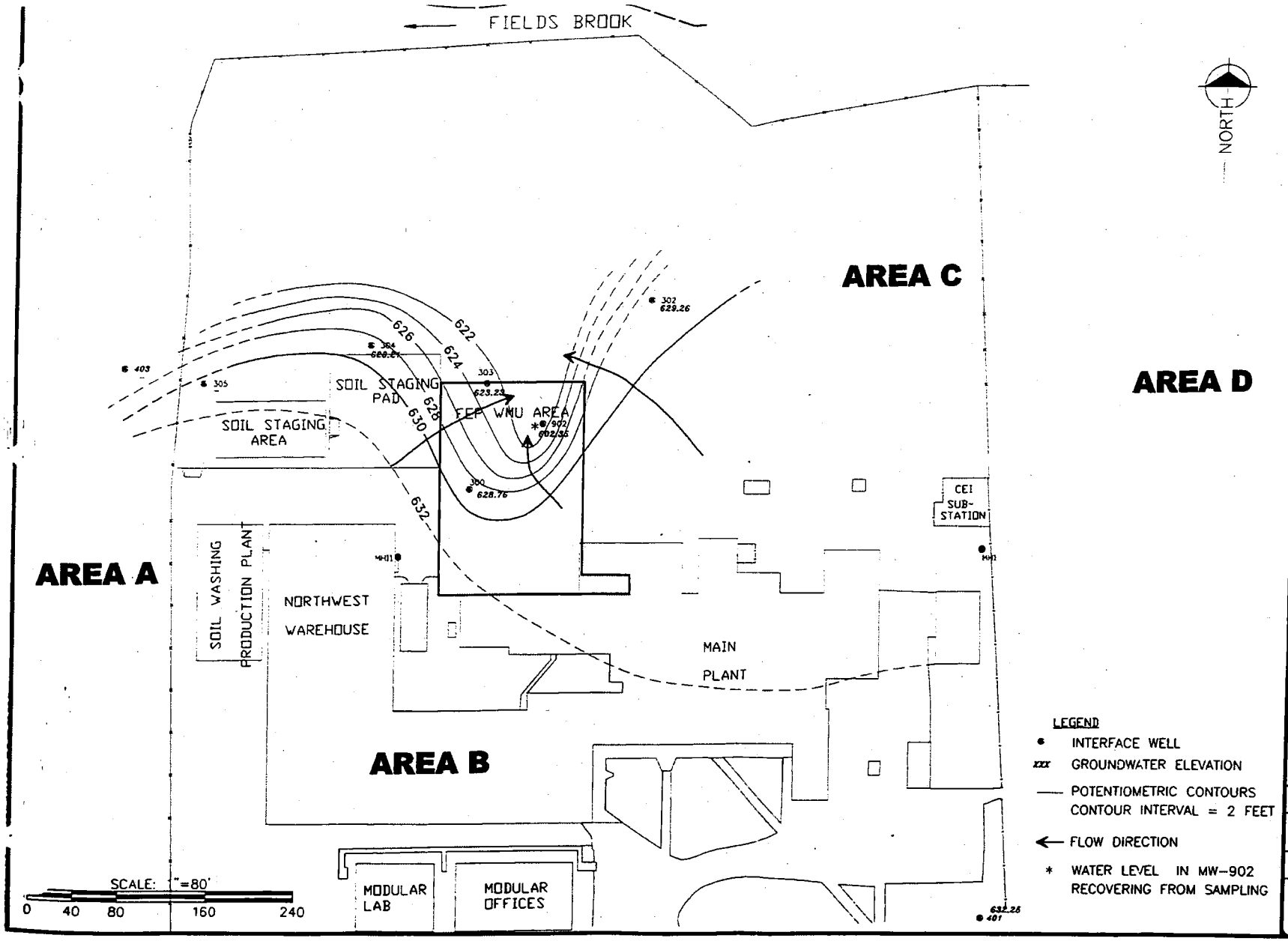

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EXTRUSION PLANT SITE
ASHTABULA, OHIO

POTENTIOMETRIC MAP INTERFACE WELLS MAY, 2003 WATER LEVEL MEASUREMENTS

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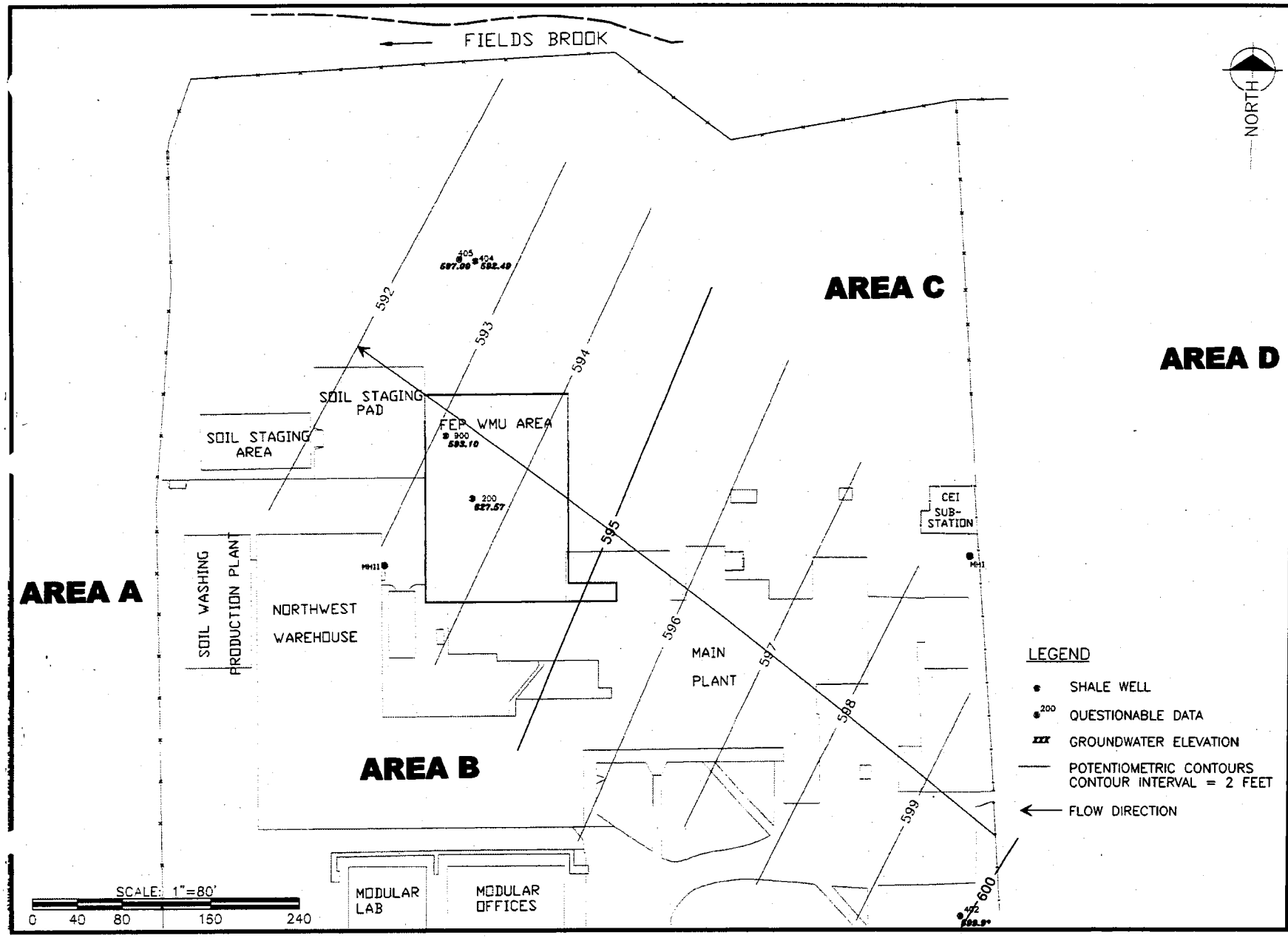

RMI ENVIRONMENTAL SERVICES
PLANT EXTRUSION SITE
ASHTABULA, OHIO

POTENTIOMETRIC MAP
SHALE WELLS
JAN. 3, 2003 WATER LEVEL MEASUREMENTS

SHARP AND ASSOCIATES, INC.
982 Crupper Avenue
Columbus, Ohio 43229
(614) 841-4630
Fax (614) 841-4660
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File Name	
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Sheet	of
Figure No.	Revision
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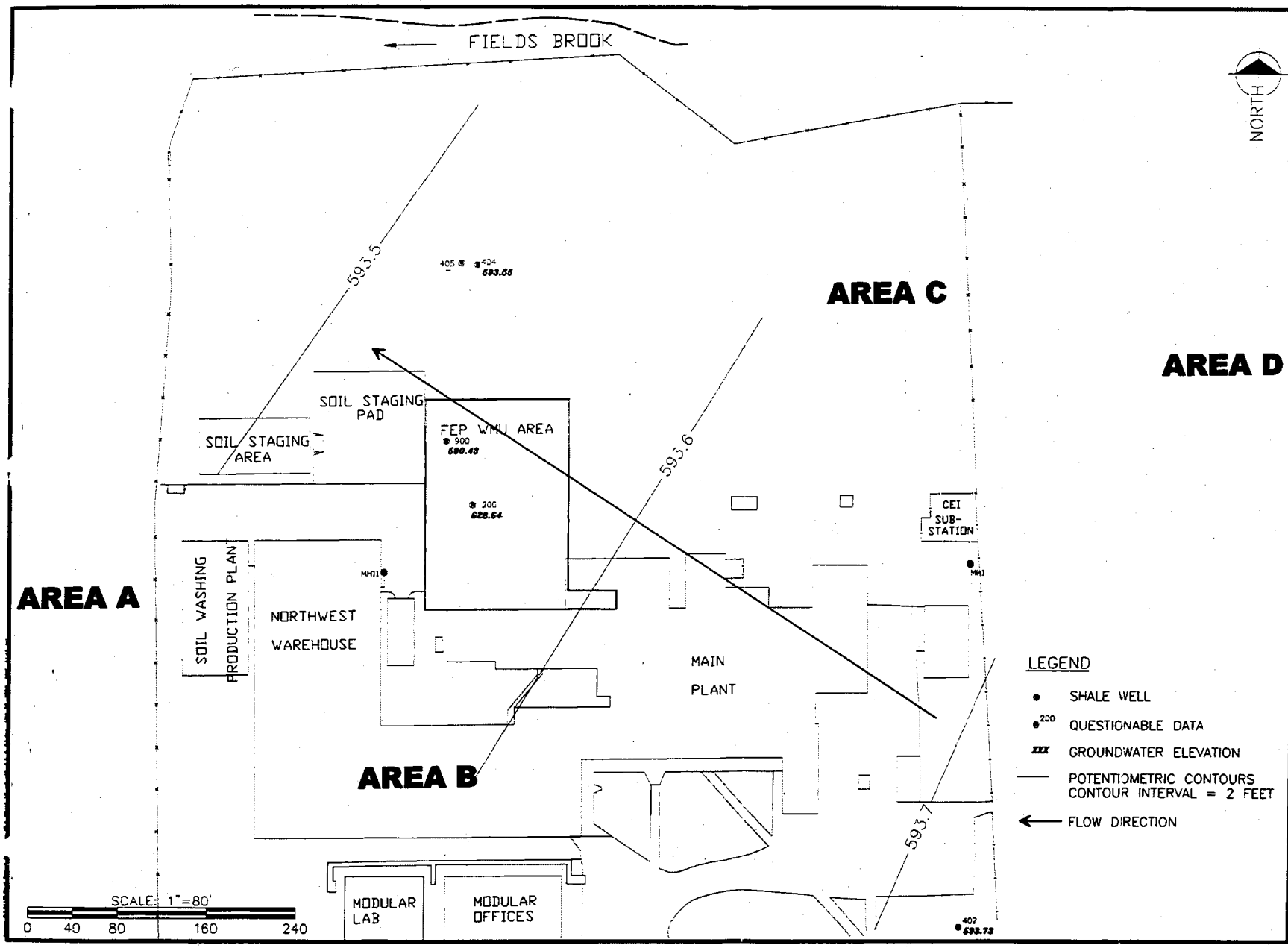

RMI ENVIRONMENTAL SERVICES
PLANT EXTRUSION SITE
ASHTABULA, OHIO

POTENTIOMETRIC MAP SHALE WELLS MAY, 2003 WATER LEVEL MEASUREMENTS

SHARP AND ASSOCIATES, INC.
982 Crupper Avenue
Columbus, Ohio 43229
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File Name: 4.3-5-03.dwg
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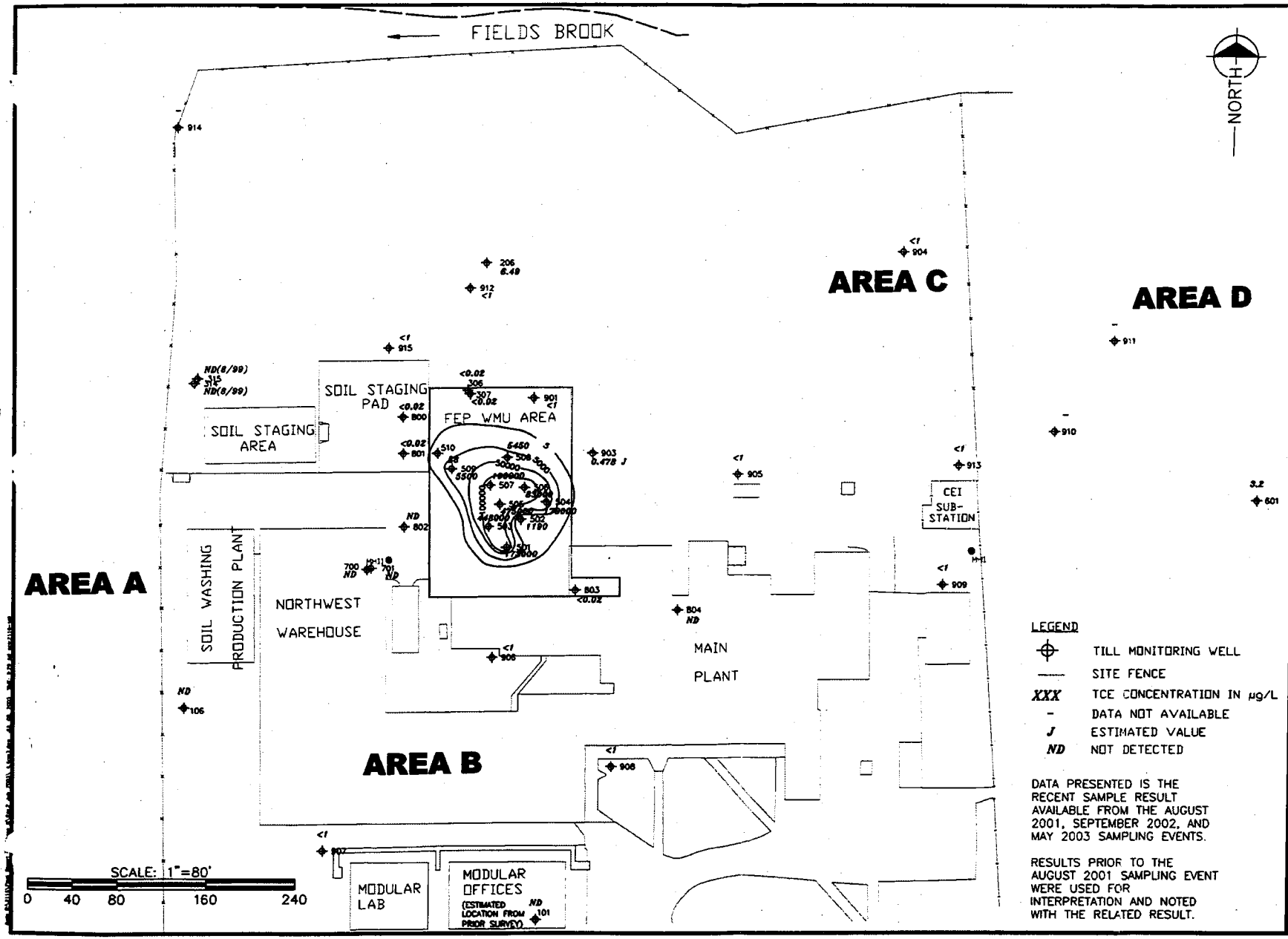
Figure No.: 4.3A
Revision: 0



LEGEND

- TILL MONITORING WELL
- SITE FENCE
- XXX TCE CONCENTRATION IN µg/L
- \- DATA NOT AVAILABLE
- J ESTIMATED VALUE
- ND NOT DETECTED

DATA PRESENTED IS THE RECENT SAMPLE RESULT AVAILABLE FROM THE AUGUST 2001, SEPTEMBER 2002, AND MAY 2003 SAMPLING EVENTS.

RESULTS PRIOR TO THE AUGUST 2001 SAMPLING EVENT WERE USED FOR INTERPRETATION AND NOTED WITH THE RELATED RESULT.

RMI ENVIRONMENTAL SERVICES
EXTRUSION PLANT SITE
ASHTABULA, OHIO

TCE ISOCONCENTRATION IN TILL WELLS

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Columbus, Ohio 43229
(614) 841-4650
Fax (614) 841-4660
www.sharpenv.com

File Name: 4.4rev3.dwg
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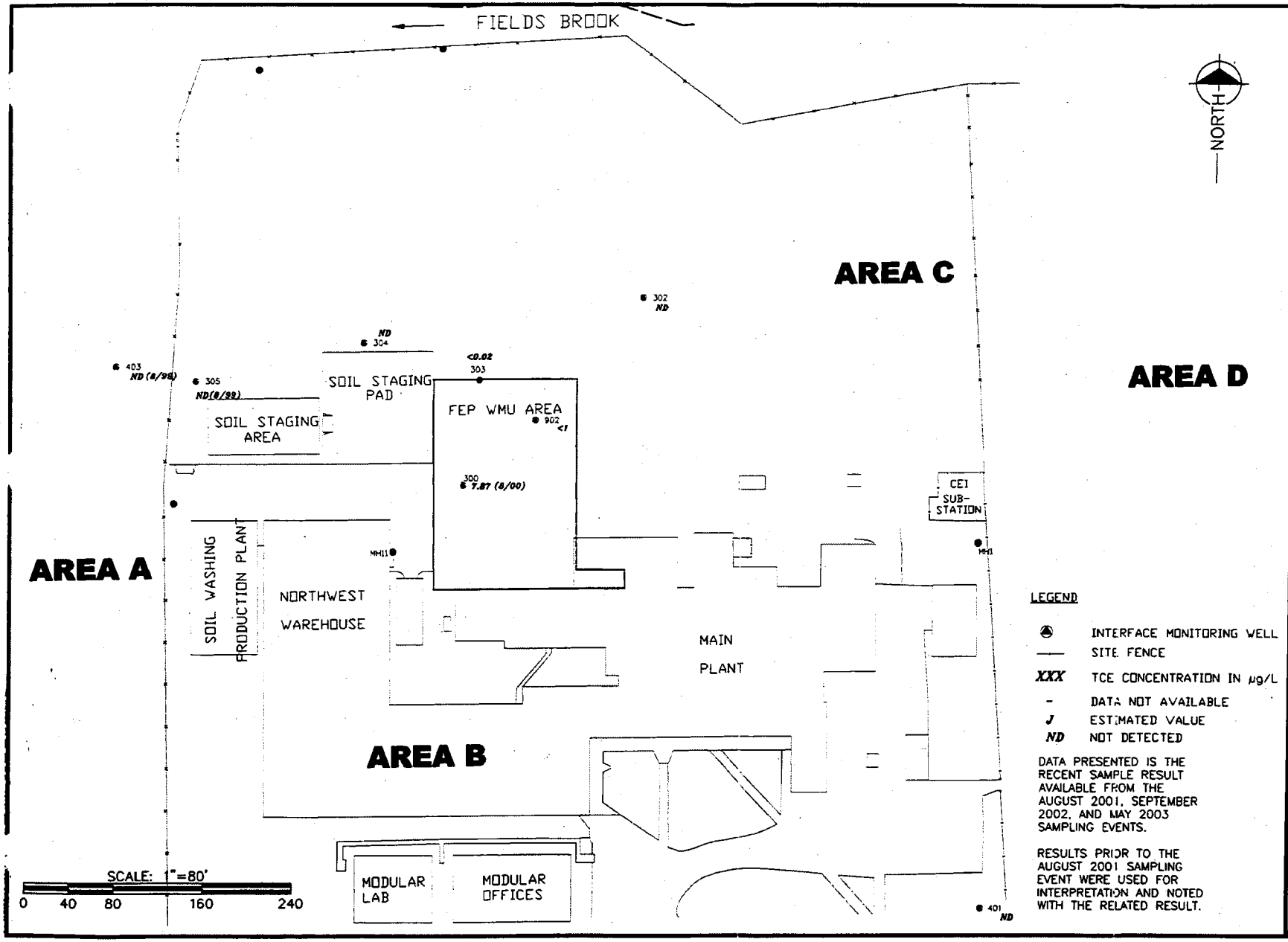
Revision: 3



RMI ENVIRONMENTAL SERVICES
EXTRUSION PLANT SITE
ASHTABULA, OHIO

TCE CONCENTRATIONS IN INTERFACE WELLS

SHARP AND ASSOCIATES, INC.
982 Crupper Avenue
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File Name: 4.5rev3.dwg
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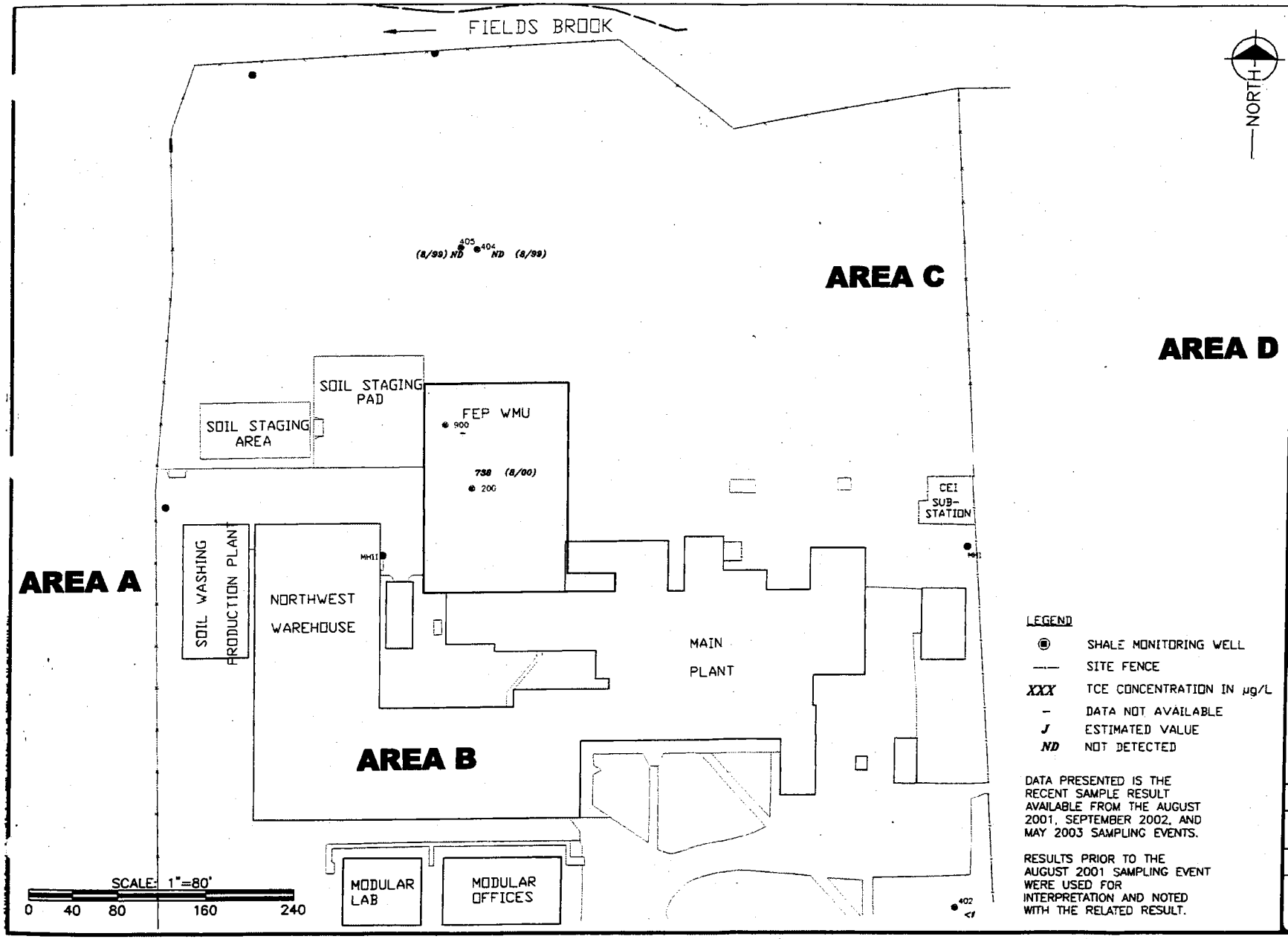
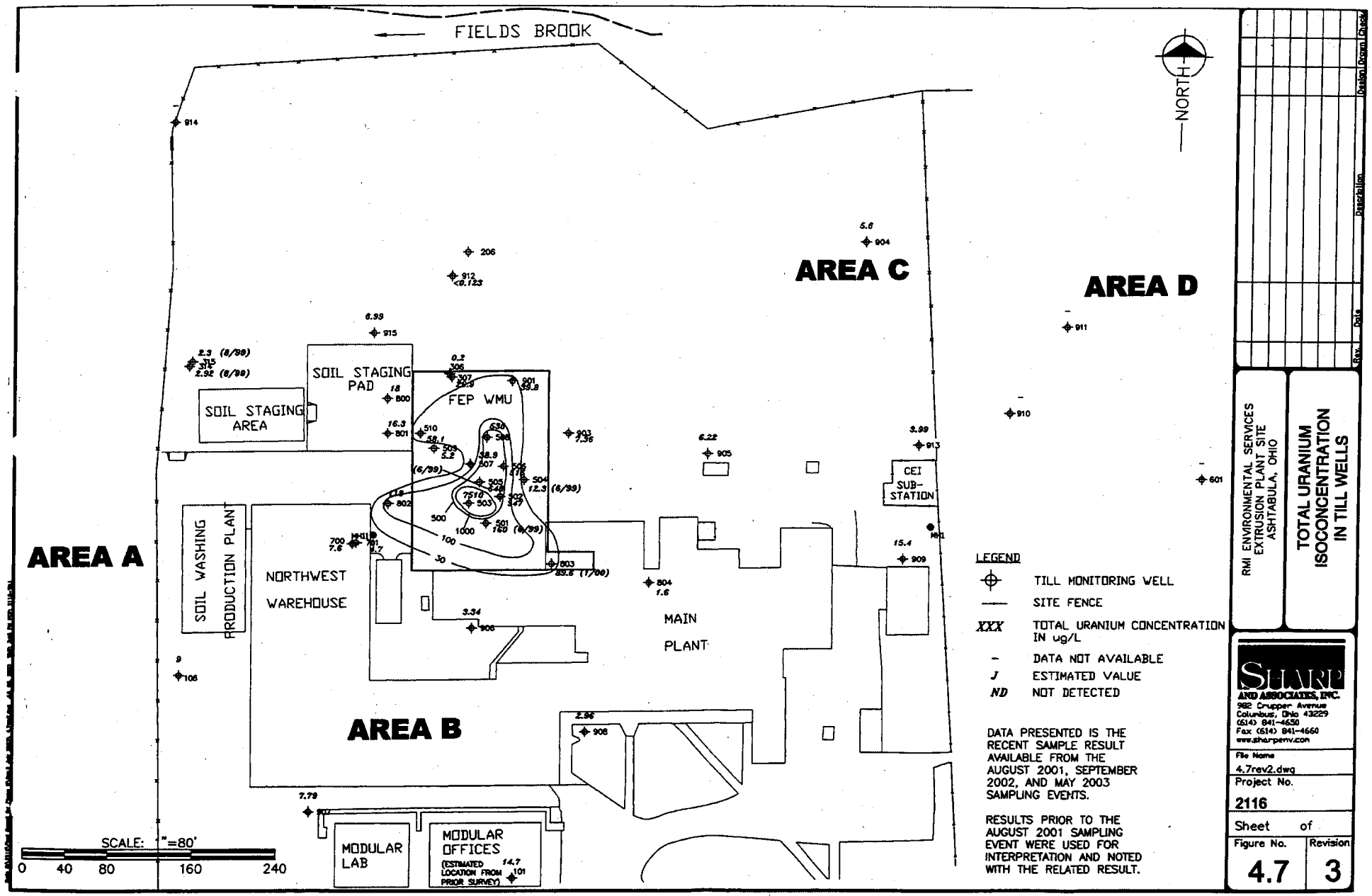
Revision: 3


FIELDS BROOK
NORTH
AREA A
AREA B
AREA C
AREA D
SOIL STAGING PAD
SOIL STAGING AREA
FEP WMU
SOIL WASHING PRODUCTION PLANT
NORTHWEST WAREHOUSE
MAIN PLANT
CEI SUB-STATION
MODULAR LAB
MODULAR OFFICES
(8/99) ND
405
404
ND (8/99)
900
736 (8/00)
200
MH1
MH1
402
<1
SCALE: 1"=80'
0 40 80 160 240
LEGEND
SHALE MONITORING WELL
SITE FENCE
XXX TCE CONCENTRATION IN µg/L
- DATA NOT AVAILABLE
J ESTIMATED VALUE
ND NOT DETECTED
DATA PRESENTED IS THE RECENT SAMPLE RESULT AVAILABLE FROM THE AUGUST 2001, SEPTEMBER 2002, AND MAY 2003 SAMPLING EVENTS.
RESULTS PRIOR TO THE AUGUST 2001 SAMPLING EVENT WERE USED FOR INTERPRETATION AND NOTED WITH THE RELATED RESULT.
Rev. Date Description Design Drawn Check
RMI ENVIRONMENTAL SERVICES EXTRUSION PLANT SITE ASHTABULA, OHIO
TCE CONCENTRATIONS IN SHALE WELLS
SHARP AND ASSOCIATES, INC.
962 Crupper Avenue
Columbus, Ohio 43229
(614) 841-4650
Fax (614) 841-4660
www.sharpenv.com
File Name 4.6rev2.dwg
Project No. 2116
Sheet of
Figure No. 4.6
Revision 3



Rev. Date Description Design Drawn Check

RMI ENVIRONMENTAL SERVICES
EXTRUSION PLANT SITE
ASHTABULA, OHIO

TOTAL URANIUM ISOCONCENTRATION IN TILL WELLS

SHARP AND ASSOCIATES, INC.
982 Crupper Avenue
Columbus, Ohio 43229
(614) 841-4650
Fax (614) 841-4660
www.sharpenv.com

File Name: 4.7rev2.dwg
Project No.: 2116
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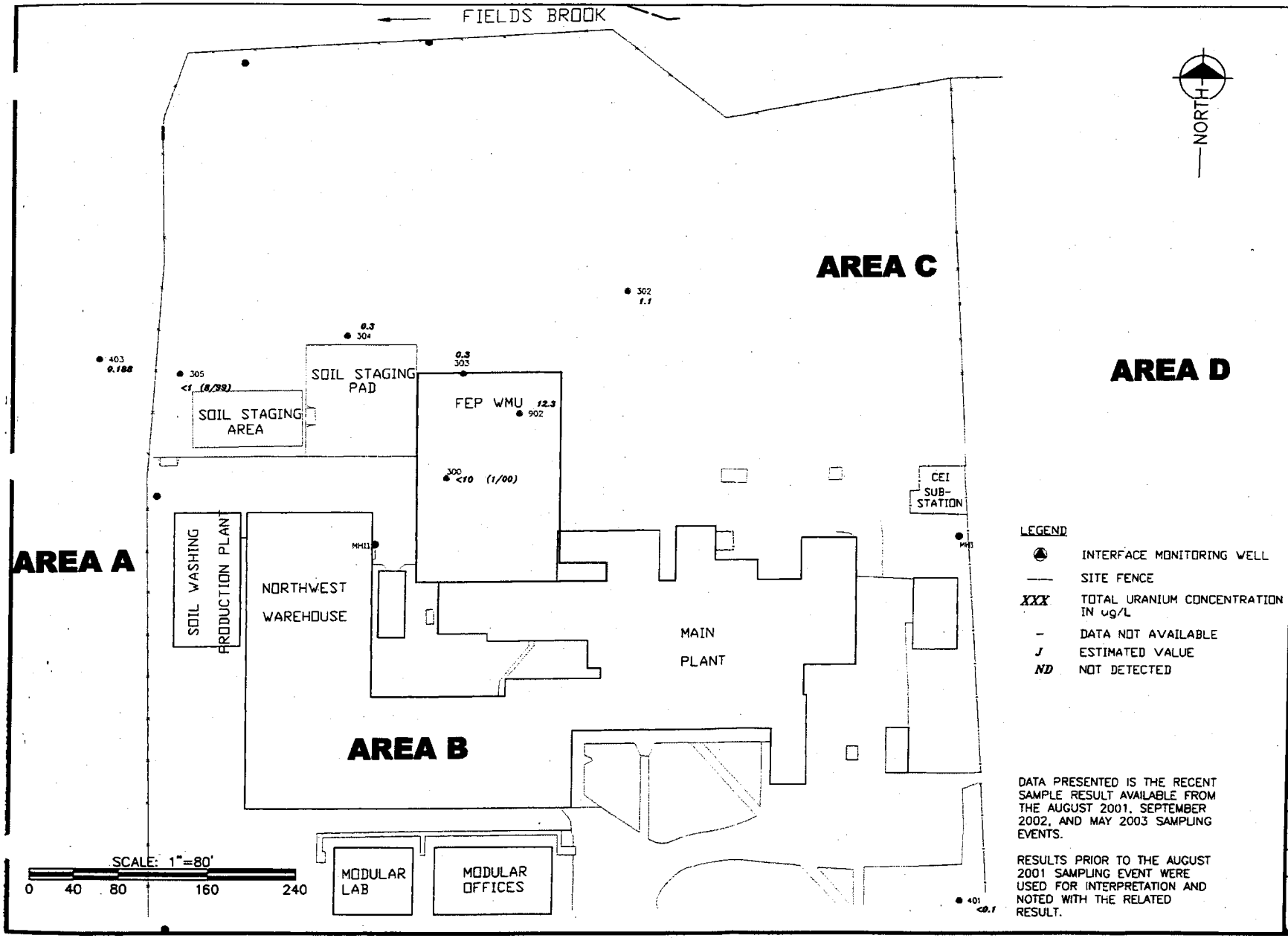
Figure No.: 4.7
Revision: 3



LEGEND

- INTERFACE MONITORING WELL
- SITE FENCE
- XXX TOTAL URANIUM CONCENTRATION IN ug/L
- – DATA NOT AVAILABLE
- J ESTIMATED VALUE
- ND NOT DETECTED

DATA PRESENTED IS THE RECENT SAMPLE RESULT AVAILABLE FROM THE AUGUST 2001, SEPTEMBER 2002, AND MAY 2003 SAMPLING EVENTS.

RESULTS PRIOR TO THE AUGUST 2001 SAMPLING EVENT WERE USED FOR INTERPRETATION AND NOTED WITH THE RELATED RESULT.

Rev.	Date	Description	Drawn	Check

RMI ENVIRONMENTAL SERVICES
EXTRUSION PLANT SITE
ASHTABULA, OHIO

TOTAL URANIUM CONCENTRATIONS IN INTERFACE WELLS

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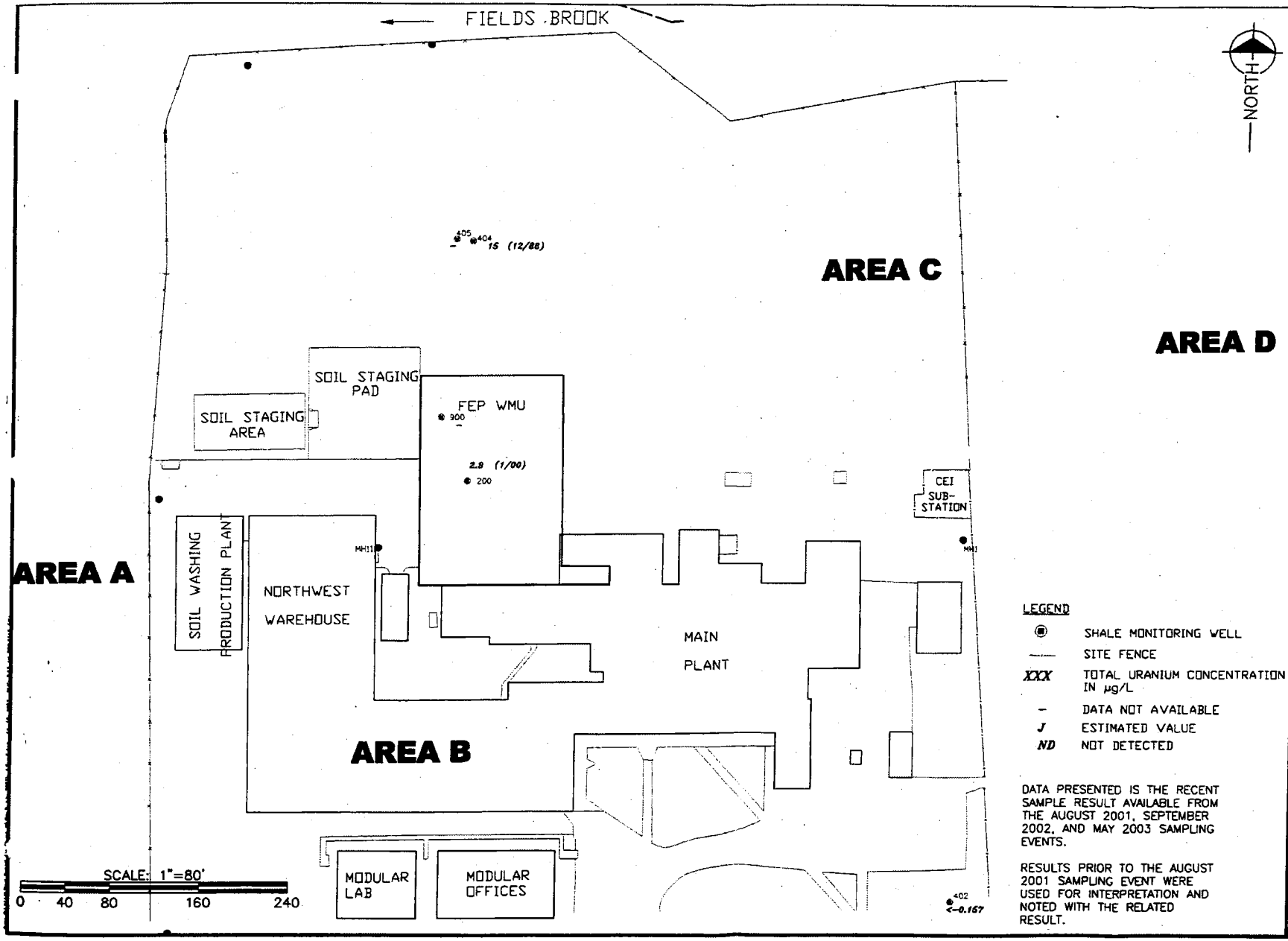
File Name: 4.8rev2.dwg
Project No.: 2116
Sheet of
Figure No.: 4.8
Revision: 3



LEGEND

◉	SHALE MONITORING WELL
——	SITE FENCE
XXX	TOTAL URANIUM CONCENTRATION IN µg/L
–	DATA NOT AVAILABLE
J	ESTIMATED VALUE
ND	NOT DETECTED

DATA PRESENTED IS THE RECENT SAMPLE RESULT AVAILABLE FROM THE AUGUST 2001, SEPTEMBER 2002, AND MAY 2003 SAMPLING EVENTS.

RESULTS PRIOR TO THE AUGUST 2001 SAMPLING EVENT WERE USED FOR INTERPRETATION AND NOTED WITH THE RELATED RESULT.

Rev. | Date | Description | Design | Drawn | Check

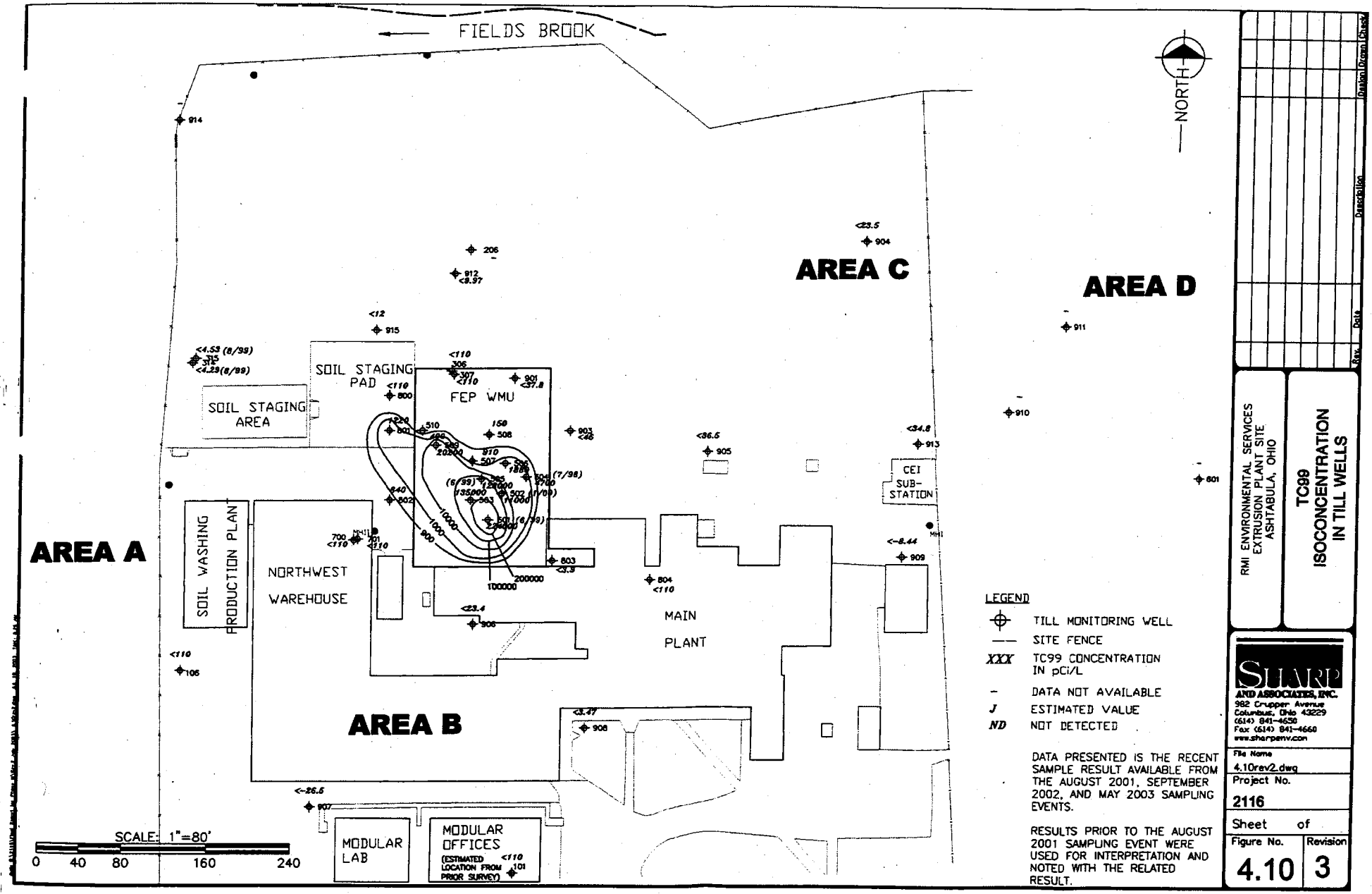
RMI ENVIRONMENTAL SERVICES
EXTRUSION PLANT SITE
ASHTABULA, OHIO

TOTAL URANIUM CONCENTRATIONS IN SHALE WELLS

SHARP AND ASSOCIATES, INC.
982 Crupper Avenue
Columbus, Ohio 43229
(614) 841-4658
Fax (614) 841-4660
www.sharpenv.com

File Name: 4.9rev2.dwg
Project No.: 2116
Sheet of

Figure No.	Revision
4.9	3



RMI ENVIRONMENTAL SERVICES
EXTRUSION PLANT SITE
ASHTABULA, OHIO

TC99 ISOCONCENTRATION IN TILL WELLS

SHARP AND ASSOCIATES, INC.
982 Crupper Avenue
Columbus, Ohio 43229
(614) 841-4650
Fax (614) 841-4660
www.sharpenv.com

File Name: 4.10rev2.dwg
Project No.: 2116
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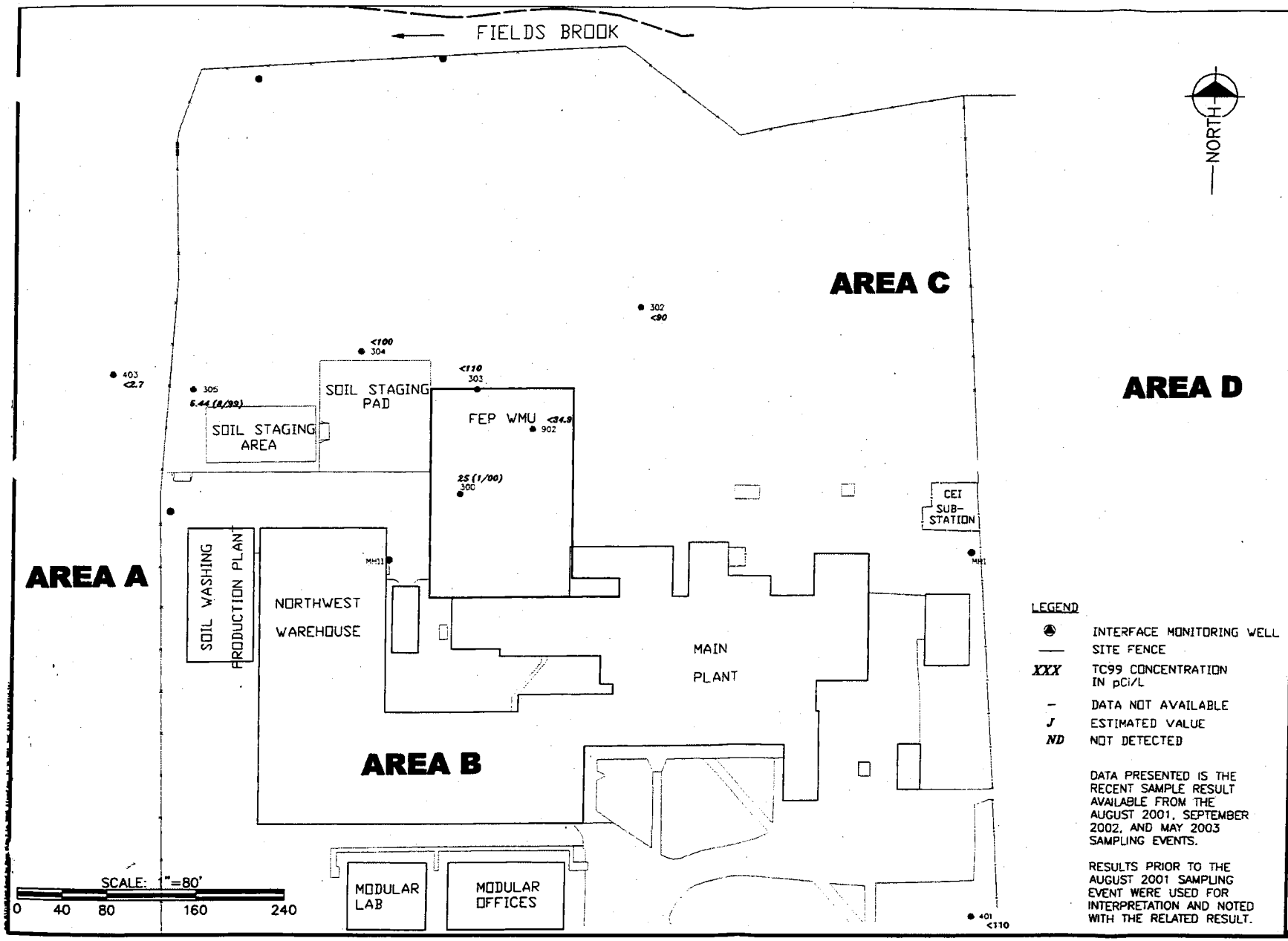
Revision: 3



LEGEND

- INTERFACE MONITORING WELL
- SITE FENCE
- XXX TC99 CONCENTRATION IN pCi/L
- – DATA NOT AVAILABLE
- J ESTIMATED VALUE
- ND NOT DETECTED

DATA PRESENTED IS THE RECENT SAMPLE RESULT AVAILABLE FROM THE AUGUST 2001, SEPTEMBER 2002, AND MAY 2003 SAMPLING EVENTS.

RESULTS PRIOR TO THE AUGUST 2001 SAMPLING EVENT WERE USED FOR INTERPRETATION AND NOTED WITH THE RELATED RESULT.

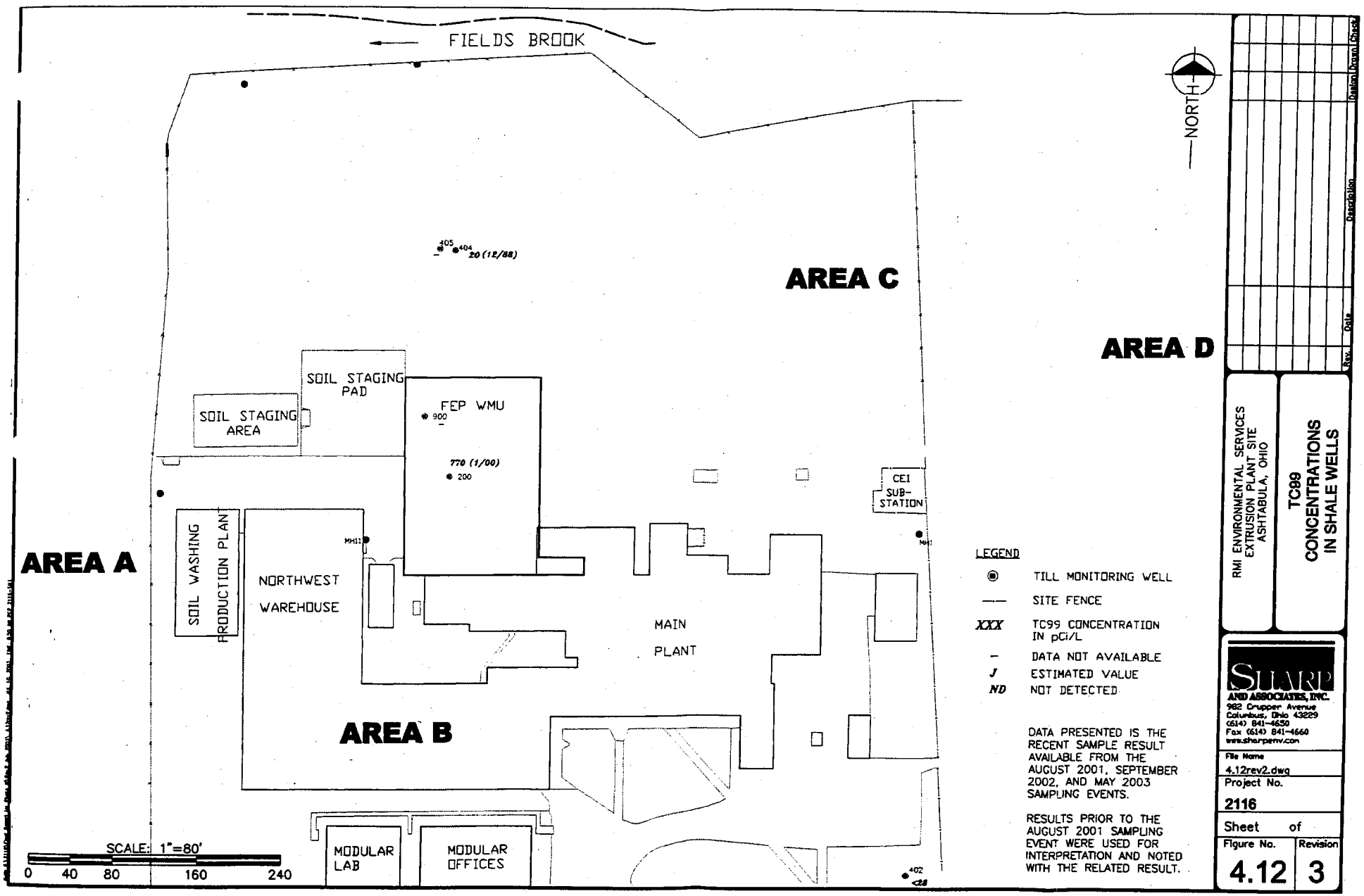
Revision | Description | Drawn | Checked | Date

RMI ENVIRONMENTAL SERVICES
EXTRUSION PLANT SITE
ASHTABULA, OHIO

TC-99 CONCENTRATIONS IN INTERFACE WELLS

SHARP AND ASSOCIATES, INC.
982 Crupper Avenue
Columbus, Ohio 43229
(614) 841-4650
Fax (614) 841-4660
www.sharpenv.com

File Name: 4.11rev2.dwg
Project No.: 2116
Sheet of
Figure No.: 4.11
Revision: 3



RMI ENVIRONMENTAL SERVICES
EXTRUSION PLANT SITE
ASHTABULA, OHIO

TC99 CONCENTRATIONS IN SHALE WELLS

SHARP AND ASSOCIATES, INC.
982 Crupper Avenue
Columbus, Ohio 43229
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Fax (614) 841-4660
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File Name: 4.12rev2.dwg
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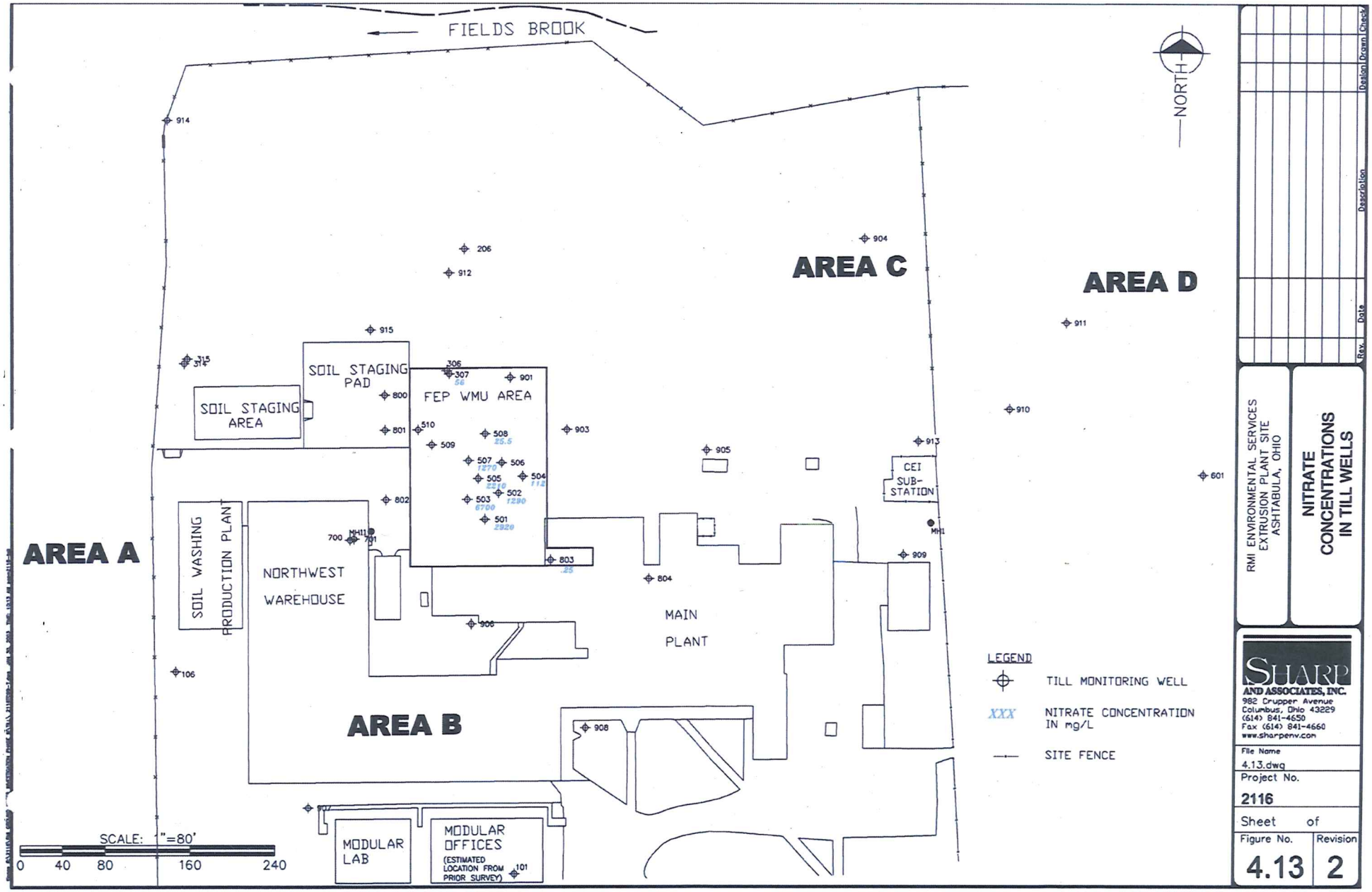
Figure No.: 4.12
Revision: 3



Rev.	Date	Description	Design Drawn Check

RMI ENVIRONMENTAL SERVICES
EXTRUSION PLANT SITE
ASHTABULA, OHIO

NITRATE CONCENTRATIONS IN TILL WELLS

SHARP AND ASSOCIATES, INC.
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Columbus, Ohio 43229
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Fax (614) 841-4660
www.sharpenv.com

File Name
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Project No.
2116

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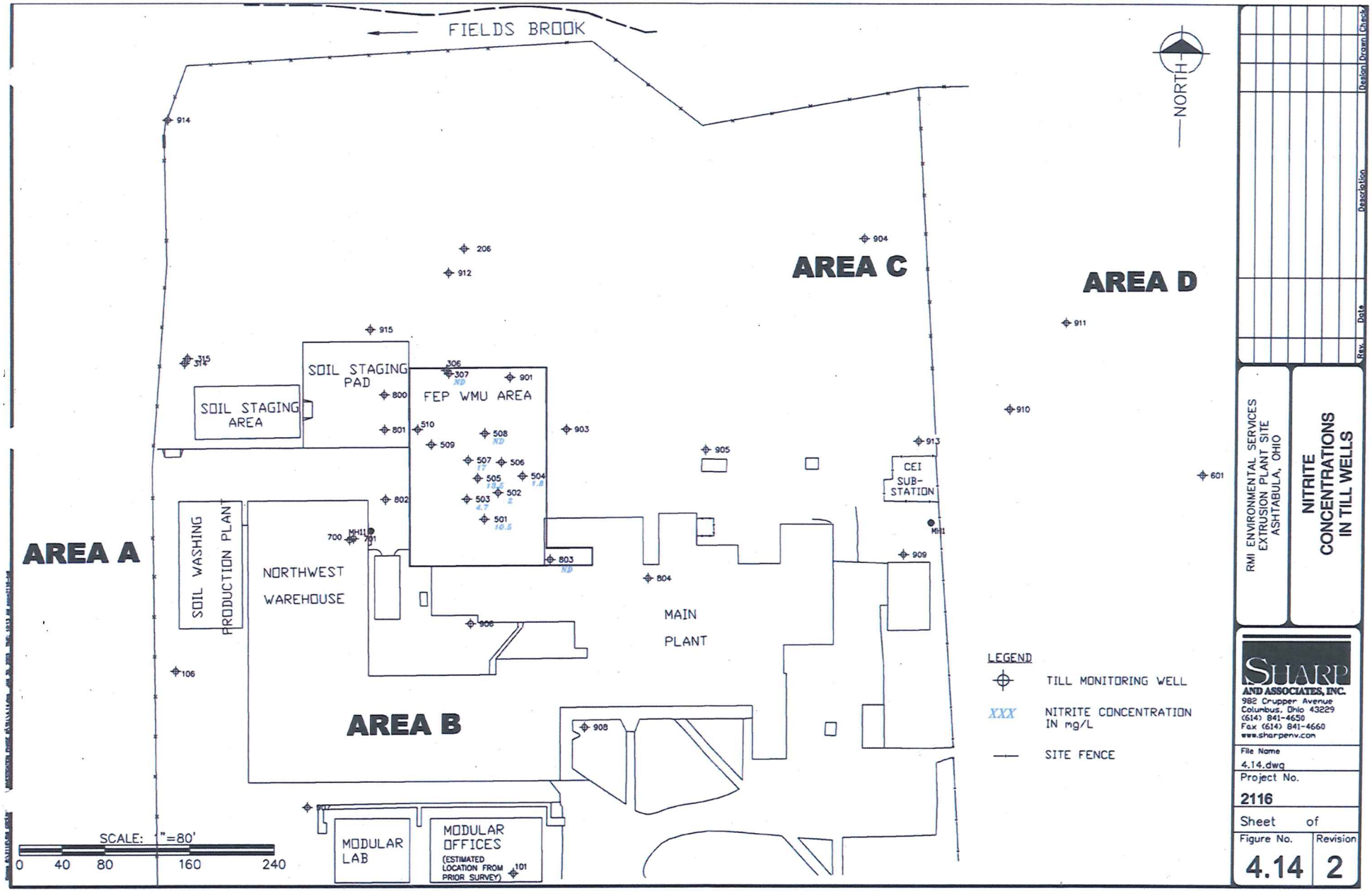
Figure No. 4.13

Revision 2



Rev.	Date	Description	Design	Drawn	Check

RMI ENVIRONMENTAL SERVICES
EXTRUSION PLANT SITE
ASHTABULA, OHIO

NITRITE CONCENTRATIONS IN TILL WELLS

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Columbus, Ohio 43229
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File Name: 4.14.dwg

Project No.: 2116

Sheet of

Figure No.: 4.14

Revision: 2

Figure 5.1. Uranium Concentration vs Depth, L series Borings, RMI Ashtabula Site

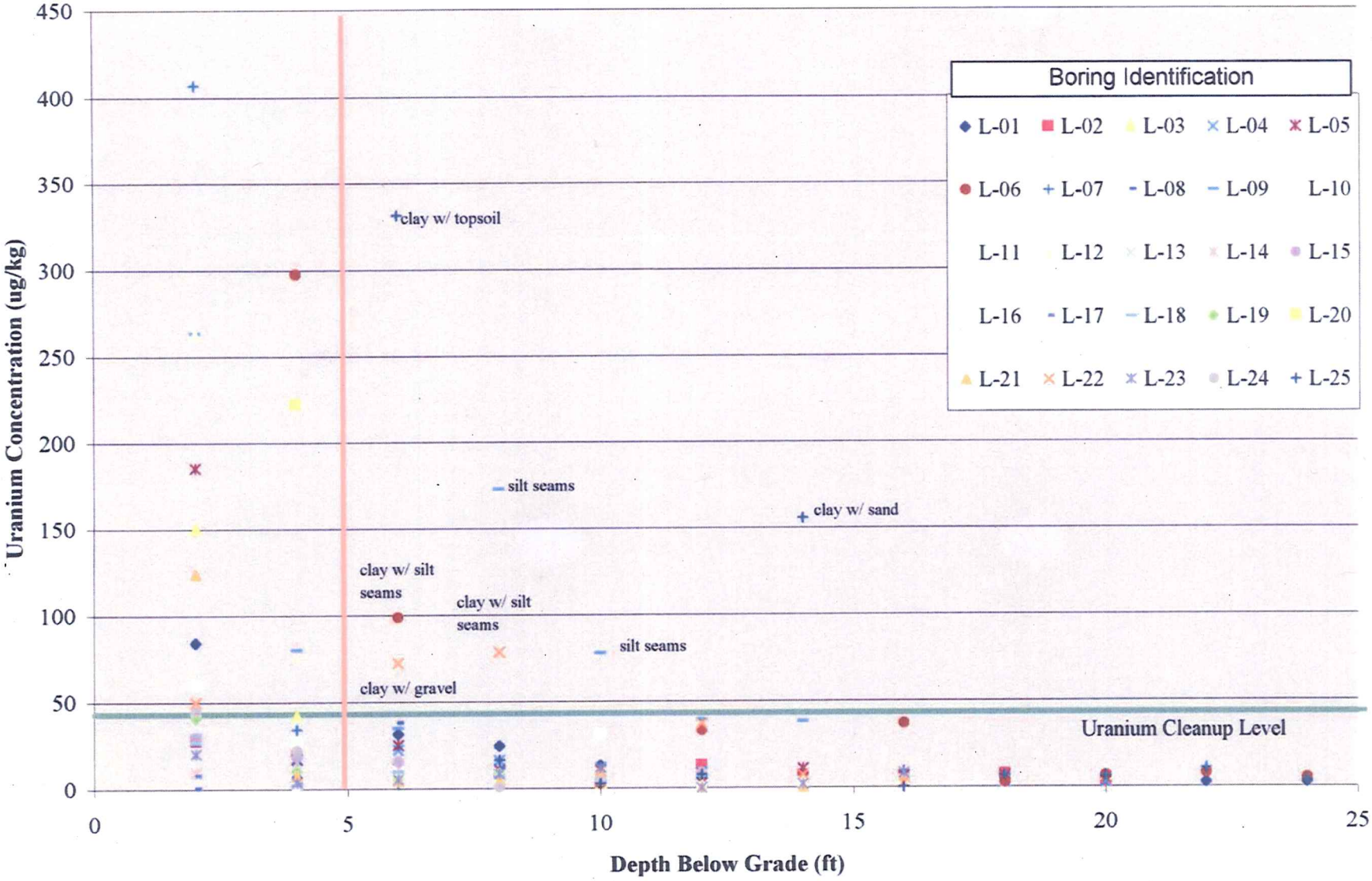
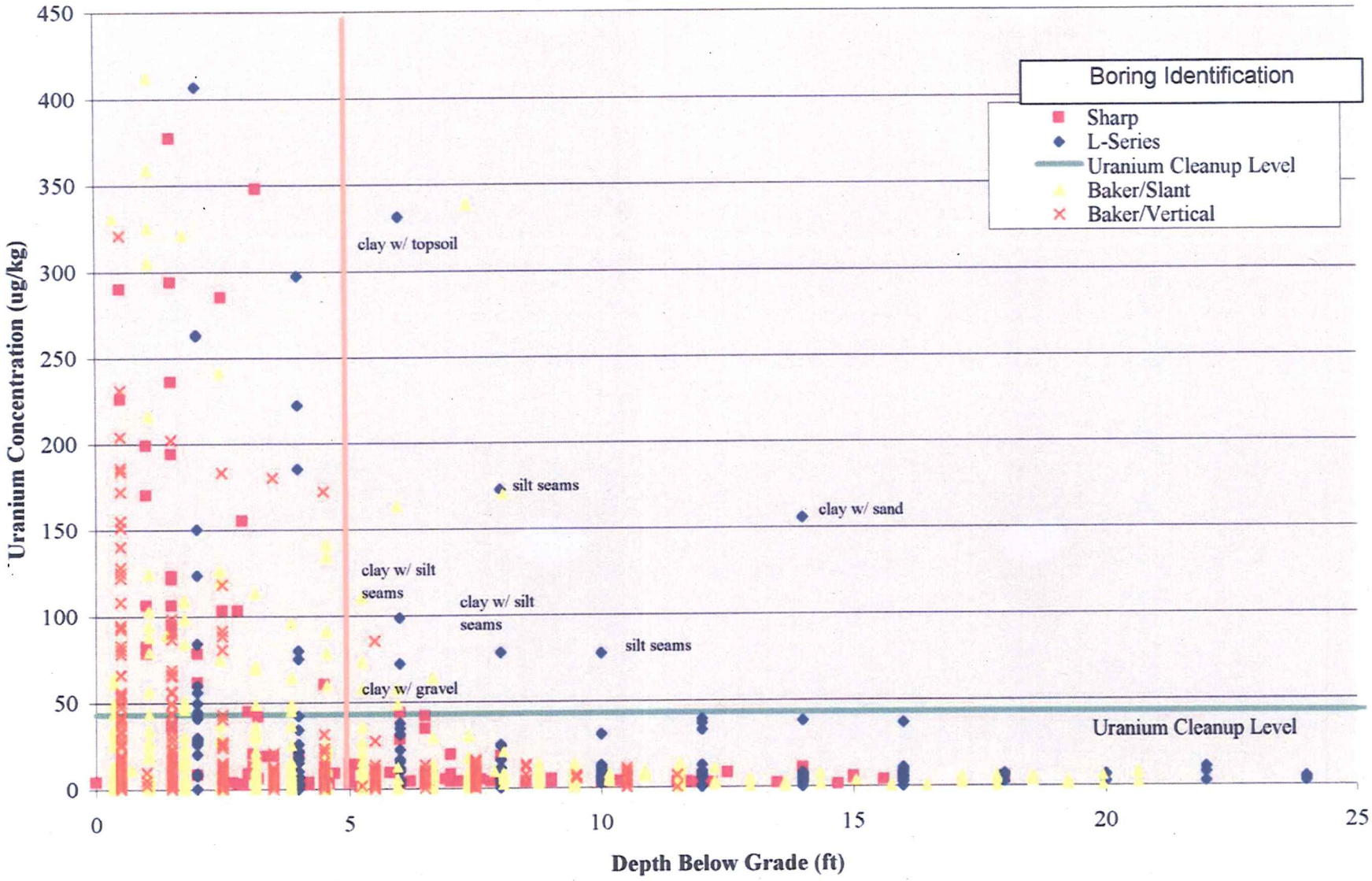
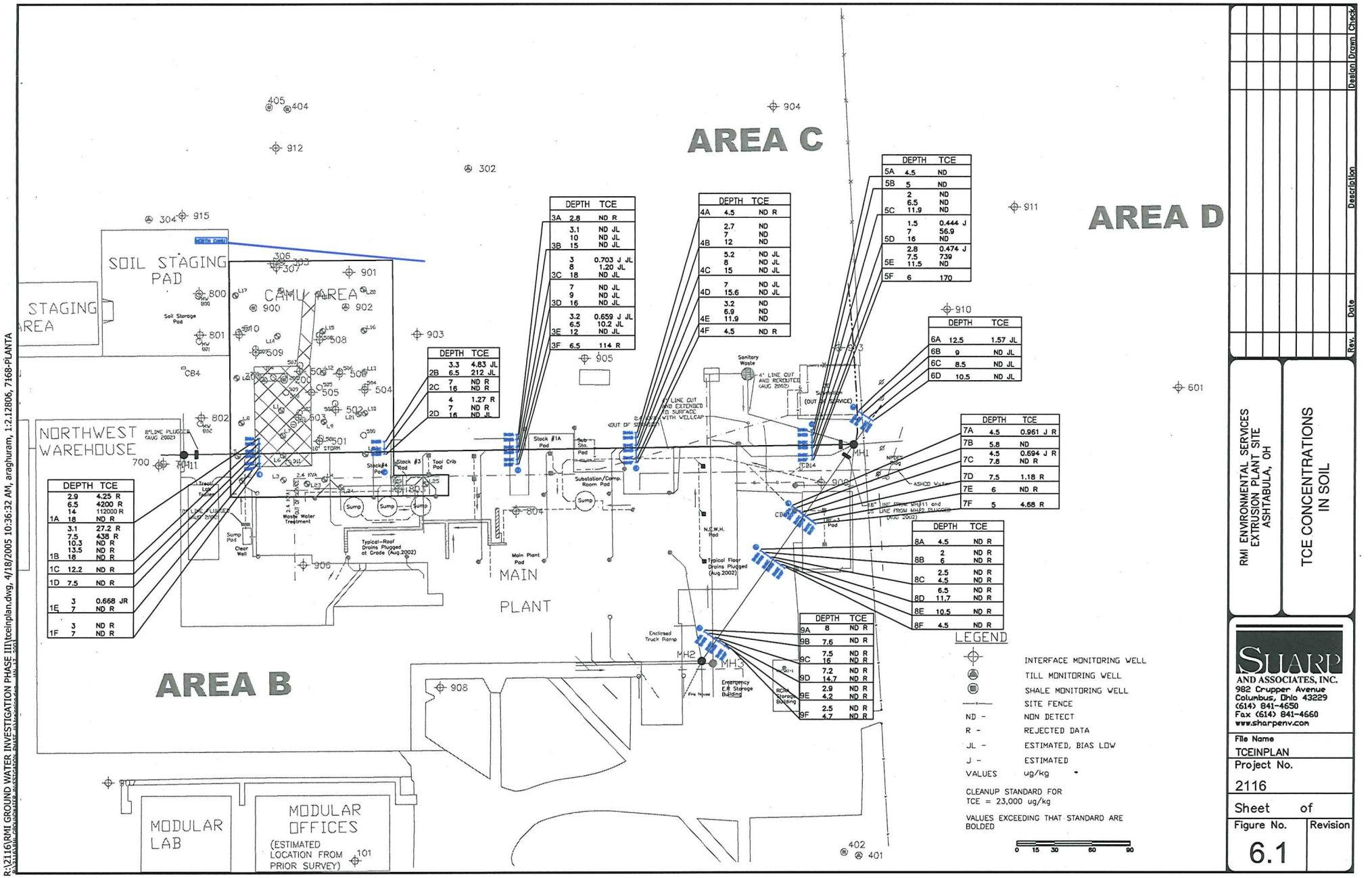


Figure 5.2. Uranium Concentration vs Depth, All Borings, RMI Ashtabula Site



jw rpt\uvs.depth.allborings.xls uranium soils over



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Rev.	Date	Description	Design	Drawn	Check

RMI ENVIRONMENTAL SERVICES
EXTRUSION PLANT SITE
ASHTABULA, OH

TCE CONCENTRATIONS IN SOIL

SHARP AND ASSOCIATES, INC.
982 Crupper Avenue
Columbus, Ohio 43229
(614) 841-4650
Fax (614) 841-4660
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File Name: TCEINPLAN
Project No.: 2116
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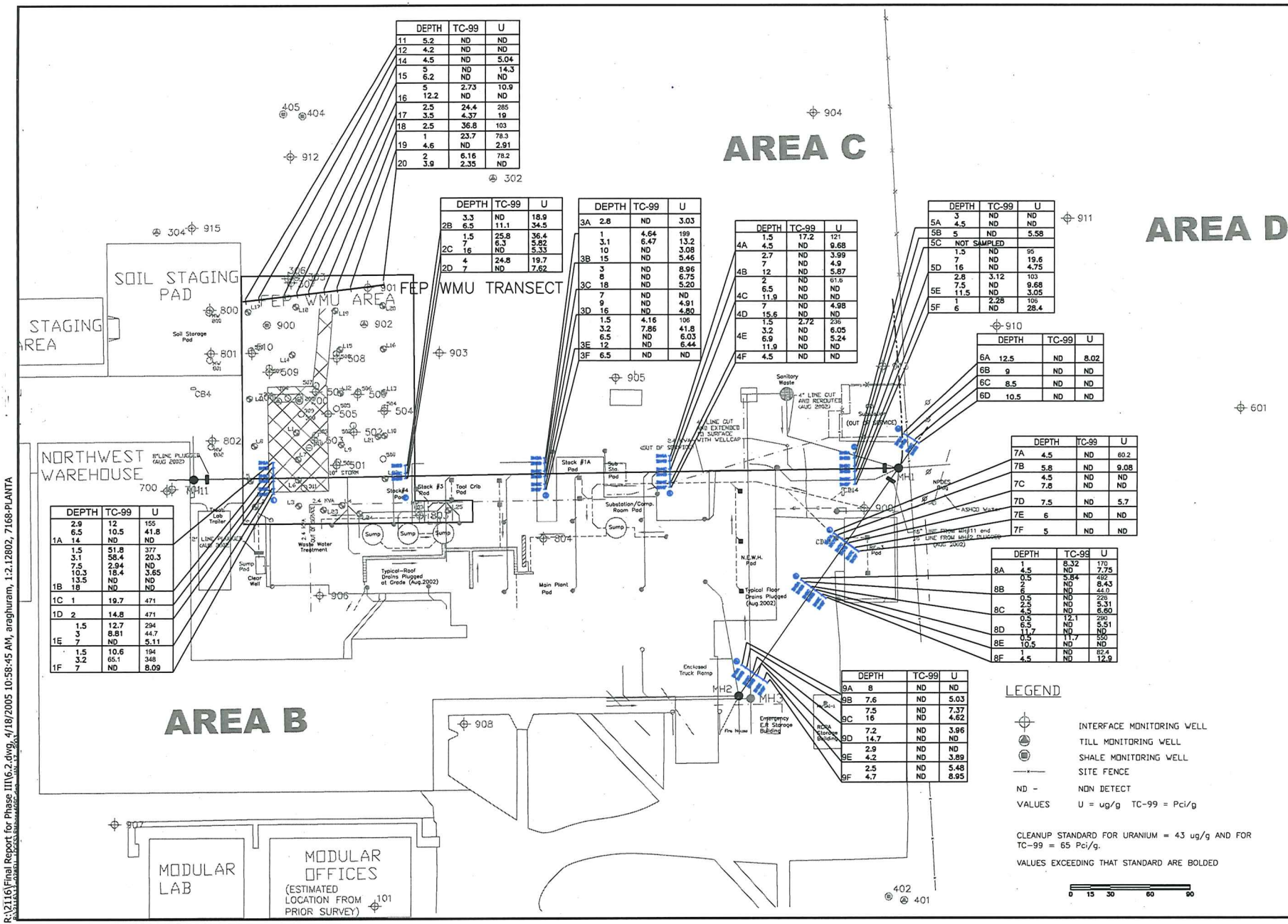
Figure No.: 6.1
Revision:



DEPTH	TC-99	U
11 5.2	ND	ND
12 4.2	ND	ND
14 4.5	ND	5.04
15 5	ND	14.3
6.2	ND	ND
16 5	2.73	10.9
12.2	ND	ND
17 2.5	24.4	285
3.5	4.37	19
18 2.5	36.8	103
19 1	23.7	78.3
4.6	ND	2.91
20 2	6.16	78.2
3.9	2.35	ND

DEPTH	TC-99	U
2B 3.3	ND	18.9
6.5	11.1	34.5
2C 1.5	25.8	36.4
7	6.3	5.82
16	ND	5.33
2D 4	24.8	19.7
7	ND	7.62

DEPTH	TC-99	U
3A 2.8	ND	3.03
1	4.64	199
3.1	6.47	13.2
10	ND	3.08
3B 15	ND	5.46
3	ND	8.96
8	ND	6.75
3C 18	ND	5.20
7	ND	ND
9	ND	4.91
3D 16	ND	4.80
1.5	4.16	106
3.2	7.86	41.8
6.5	ND	6.03
3E 12	ND	6.44
3F 6.5	ND	ND

DEPTH	TC-99	U
1.5	17.2	121
4A 4.5	ND	9.68
2.7	ND	3.99
7	ND	4.9
4B 12	ND	5.87
2	ND	61.6
6.5	ND	ND
4C 11.9	ND	ND
7	ND	4.98
4D 15.6	ND	ND
1.5	2.72	236
3.2	ND	6.05
4E 6.9	ND	5.24
11.9	ND	ND
4F 4.5	ND	ND

DEPTH	TC-99	U
5A 3	ND	ND
4.5	ND	ND
5B 5	ND	5.58
5C NOT SAMPLED		
1.5	ND	95
7	ND	19.6
5D 16	ND	4.75
2.8	3.12	103
7.5	ND	9.68
5E 11.5	ND	3.05
1	2.28	106
5F 6	ND	28.4

DEPTH	TC-99	U
6A 12.5	ND	8.02
6B 9	ND	ND
6C 8.5	ND	ND
6D 10.5	ND	ND

DEPTH	TC-99	U
7A 4.5	ND	60.2
7B 5.8	ND	9.08
4.5	ND	ND
7C 7.8	ND	ND
7D 7.5	ND	5.7
7E 6	ND	ND
7F 5	ND	ND

DEPTH	TC-99	U
1	8.32	170
8A 4.5	ND	7.75
0.5	5.84	492
8B 2	ND	8.43
4.5	ND	44.0
0.5	ND	226
8C 2.5	ND	5.31
4.5	ND	6.60
0.5	12.1	290
8D 6.5	ND	5.51
11.7	ND	ND
0.5	11.7	550
8E 10.5	ND	ND
1	ND	62.4
8F 4.5	ND	12.9

DEPTH	TC-99	U
1.5	12	155
6.5	10.5	41.8
1A 14	ND	ND
1.5	51.8	377
3.1	58.4	20.3
7.5	2.94	ND
10.3	18.4	3.65
13.5	ND	ND
1B 18	ND	ND
1C 1	19.7	471
1D 2	14.8	471
1.5	12.7	294
3	8.81	44.7
1E 7	ND	5.11
1.5	10.6	194
3.2	65.1	348
1F 7	ND	8.09

DEPTH	TC-99	U
9A 8	ND	ND
9B 7.6	ND	5.03
7.5	ND	7.37
9C 16	ND	4.62
7.2	ND	3.96
9D 14.7	ND	ND
2.9	ND	ND
9E 4.2	ND	3.89
2.5	ND	5.48
9F 4.7	ND	8.95

LEGEND

- INTERFACE MONITORING WELL
- TILL MONITORING WELL
- SHALE MONITORING WELL
- SITE FENCE
- ND - NON DETECT
- VALUES U = ug/g TC-99 = Pci/g

CLEANUP STANDARD FOR URANIUM = 43 ug/g AND FOR TC-99 = 65 Pci/g.

VALUES EXCEEDING THAT STANDARD ARE BOLDED

0 15 30 60 90

Rev.	Date	Description	Design Drawn Check

RMI ENVIRONMENTAL SERVICES
EXTRUSION PLANT SITE
ASHTABULA, OH

TOTAL URANIUM & TC-99 IN SOILS

SHARP AND ASSOCIATES, INC.
982 Crupper Avenue
Columbus, Ohio 43229
(614) 841-4650
Fax (614) 841-4660
www.sharpenv.com

File Name
6.2.dwg
Project No.
2116
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Figure No. 6.2
Revision 2

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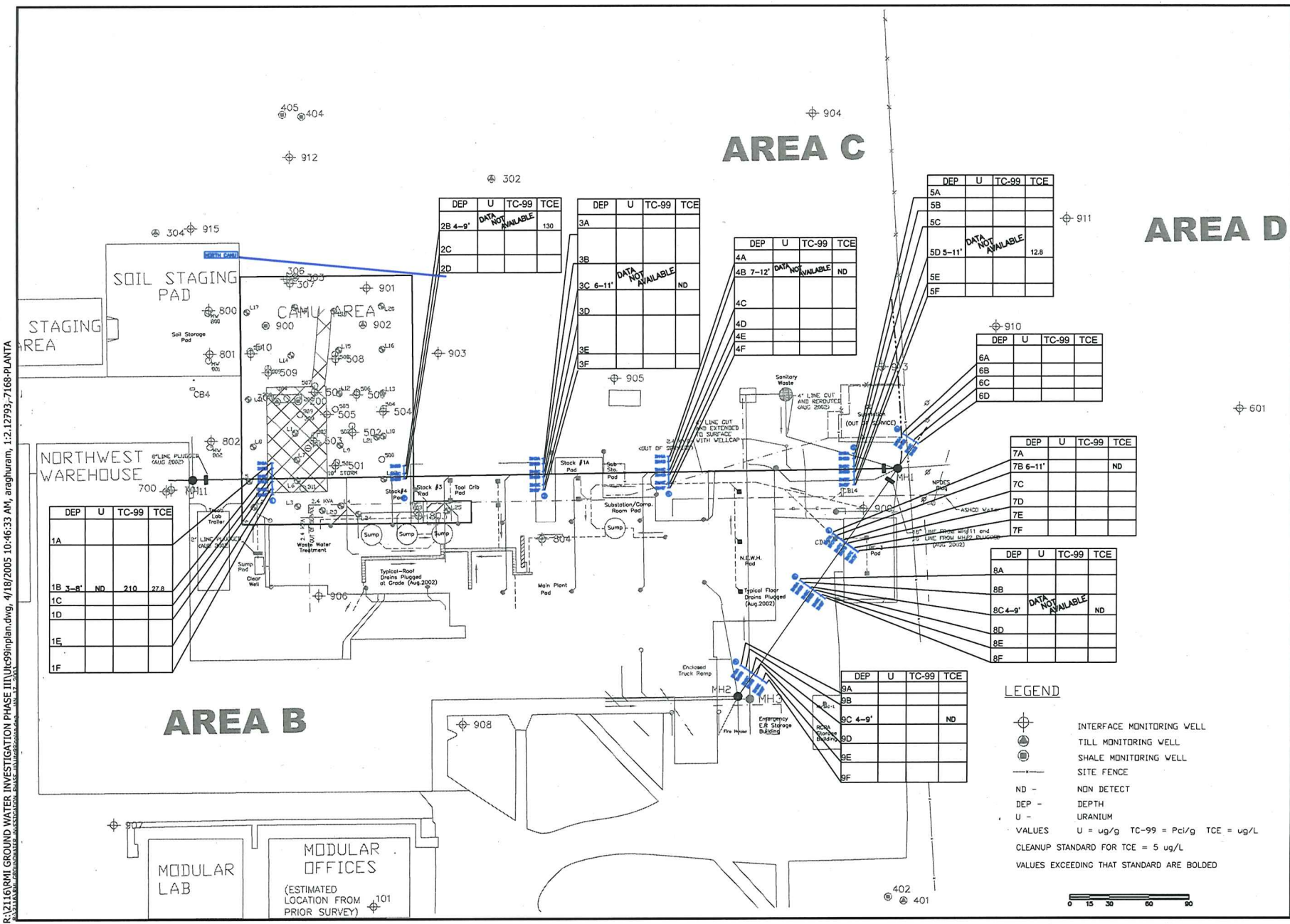

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Rev.	Date	Description	Design Drawn Check

RMI ENVIRONMENTAL SERVICES
EXTRUSION PLANT SITE
ASHTABULA, OH

GROUNDWATER CONCENTRATIONS, TCE, URANIUM & TC-99 FROM TEMPORARY PIEZOMETERS

SHARP AND ASSOCIATES, INC.
982 Crupper Avenue
Columbus, Ohio 43229
(614) 841-4650
Fax (614) 841-4660
www.sharpenv.com

File Name: Utc99inplan.dwg
Project No.: 2116
Sheet of
Drawing No.: 6.3
Revision:

Ashtabula Closure Project

FINAL RMI REPORT

PHASE II

SEPETEMBER 2003

Appendix A

MW-900

RMI Phase II

Project Number	9116-15	Drill Rig	CME 45C
Geologist	Kevin Smith	Ground Elevation	- Feet
Date Drilled	10-14-02	Total Depth of Borehole	43 Feet
Borehole Diameter	8 Inches	Depth to Water	Feet

Graphic Log	Description	Depth	Sample	PID	Blow Counts	Completion
	topsoil					
	Medium stiff brown CLAYEY SILT (ML), little fine sand; moist.			0.4	1,3,3,8	
	@ 2.4, 3.1, 3.3 - seepage/wet			0.4	2,4,4,7	
	Stiff brown/gray/orange mottled SILTY CLAY (CL), little fine-coarse sand, damp to moist; iron staining throughout.	5		0.5	3,6,9,10	
	Very stiff brown and gray SILTY CLAY (CL), little f-c sand, trace gravel; damp.			2.4	4,11,12,10	
	@ 8.0 - Sharp vertical contact between brown and gray clay.			3.2	5,8,9,9	
		10				
	Stiff gray SILTY CLAY (CL), little f-c sand, trace gravel; danp to moist			1.0	3,7,7,9	
	@ 14.0' - moist			1.4	3,5,6,8	
		15			5,6,7,8	
	Stiff gray CLAY (CH), little silt, trace sand; moist. Laminated, medium to high plasticity.				4,5,6,7	
	Very stiff gray SILTY CLAY (CL), little f-c sand, trace gravel; damp to moist.				8,11,12,15	

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Sharp and Associates, Inc.

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MW-900

RMI Phase II

Project Number	9116-15	Drill Rig	CME 45C
Geologist	Kevin Smith	Ground Elevation	- Feet
Date Drilled	10-14-02	Total Depth of Borehole	43 Feet
Borehole Diameter	8 Inches	Depth to Water	Feet

Graphic Log	Description	Depth	Sample	PID	Blow Counts	Completion
	@ 20.0' - Contains angular shale fragments.				10,11,15, 18 10,15,19, 27 10,15,17, 23 9,10,16,1 6 7,11,17, 50/4"	
	Top of Rock - 29.6' Dark gray SHALE, soft, highly weathered, dry.	25 30			50/3"	
	Gray and dark gray SHALE, laminated, moderately to highly weathered.					
	Gray and dark gray SHALE, laminated. Contains thin interbeds of fine grained sandstone and siltstone. Clay filled fractures throughout (mechanical)	35				

MW-900

RMI Phase II

Project Number	9116-15	Drill Rig	CME 45C
Geologist	Kevin Smith	Ground Elevation	- Feet
Date Drilled	10-14-02	Total Depth of Borehole	43 Feet
Borehole Diameter	8 Inches	Depth to Water	Feet

Graphic Log	Description	Depth	Sample	PID	Blow Counts	Completion
	@ 40.85' to 41.15' - Gray SILTSTONE, hard. Gray and dark gray SHALE, laminated. Contains thin interbeds of fine grained sandstone and siltstone.	45 50 55				

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TYPE OR USE PEN
SELF TRANSCRIBING
PRESS HARD

Ohio Department of Natural Resources
Divison of Water, 1939 Fountain Square Drive
Columbus, Ohio 43224-9971 Voice (614) 265-6739 Fax (614) 447-9503

956776

WELL LOCATION

Ashtabula Township Ashtabula

...ler RMI Environmental Services
First Last

...ddress of ...ell Location 1601 E 21st St
Number Street Name

...ty Ashtabula Zip Code +4 44004

...rmit No. NA Section/Lot No. (Circle One or Both)

...cation of Well in State Plane ...ordinates, if available: Use of Well Monitoring; MW-900

☐ X _____ . _____ +/- _____ ft. or m

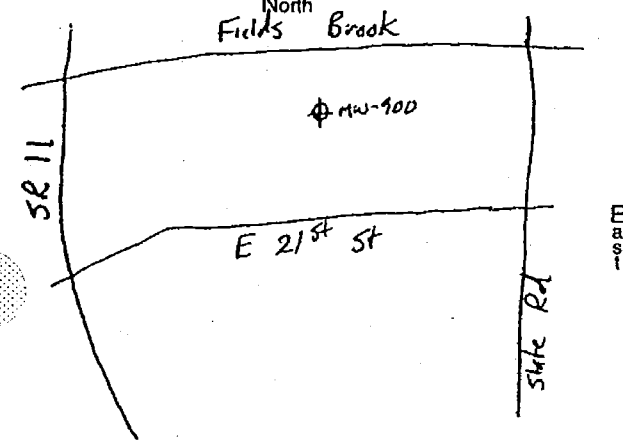
☐ Y _____ . _____ +/- _____ ft. or m

...vation of Well _____ . _____ +/- _____ ft. or m

...tum Plain: ☐ NAD27 ☐ NAD83 Elevation Source _____

...urce of Coordinates: ☐ GPS ☐ Survey ☐ Other _____

...ketch a map showing distance well lies from numbered state highways, street ...tersections, county roads, buildings or other notable landmarks. If latitude and ...ngitude are available please include here: Lat: _____ Long: _____



WELL TEST*

Pumping Static Level NA ft. Date _____

...sured from: ☐ Top of Casing ☐ Ground Level ☐ Other _____

...r ☐ Bailing ☐ Pumping* ☐ Other _____

Rate _____ gpm Duration of Test _____ hrs.

...of Drawdown _____ ft. Sustainable Yield _____ gpm

...ch a copy of the pumping test record, per section 1521.05, ORC)

...py Attached? ☐ Yes ☐ No Flowing Well? ☐ Yes ☐ No

...ity _____

PUMP/PITLESS

...of pump NA Capacity _____ gpm

...set at _____ ft. Pitless Type _____

...installed by _____

...reby certify the information given is accurate and correct to the best of my knowledge.

...g Firm Sharp and Associates, Inc

...ss 982 Crupper Ave

...Zip Columbus, Ohio 43229

...d [signature] Date _____

...ration Number _____

CONSTRUCTION DETAILS

☒ Rotary ☐ Cable ☒ Augered ☐ Driven ☐ Other _____

BOREHOLE/CASING (measured from ground surface)

1☒ Borehole Diameter 8 inches Depth 33 ft.
Casing Diameter 6 in. Length 33 ft. Thickness 0.28 in.

2☒ Borehole Diameter 5 inches Depth 43 ft.
Casing Diameter 2 in. Length 43 ft. Thickness 0.154 in.

Casing Height Above Ground 2.5 ft.

Type: 1☐ 2☒ Steel; 1☐ 2☐ Galv.; 1☒ 2☐ PVC; 1☐ 2☐ Other _____

Joints: 1☒ 2☒ Threaded; 1☐ 2☐ Welded; 1☐ 2☐ Solvent; 1☐ 2☐ Other _____

SCREEN

Diameter 2-inch Slot Size 0.010 Screen Length 5 ft.

Type wire wrapped Material Stainless steel

Set Between 38 ft. and 43 ft.

GRAVEL PACK (Filter Pack)

Material/Size #4 Silica Volume/Weight Used 125 lbs

Method of Installation Gravity

Depth: Placed FROM 43 ft. TO 36.5 ft.

GROUT

Material Bentonite Volume/Weight Used 4.5 ft^3

Method of Installation tremmie pipe

Depth: Placed FROM 32.5 ft. TO 0 ft.

DRILLING LOG*

INDICATE DEPTH(S) AT WHICH WATER IS ENCOUNTERED.

Show color, texture, hardness, and formation: sandstone, shale, limestone, gravel, clay, sand, etc.	From	To
Brown Clayey Silt, ltl. fg sand	0	4
Brown/gry/orange Silty Clay, ltl. snd	4	11.5
Gray silty Clay, ltl. f-c snd, trace gvl.	11.5	16
Gray Clay, ltl. silt, trace f snd	16	17.5
Gray Silty Clay, ltl f-c sand trace gravel	17.5	29.6
Gray and dark gray Shale w/ thin interbeds of Sandstone	29.6	43

000004

*(If more space is needed to complete drilling log, use next consecutively numbered form.)

Date of Well Completion _____ Total Depth of Well 43 ft.

Completion of this form is required by section 1521.05, Ohio Revised Code - file within 30 days after completion of drilling.

ORIGINAL COPY TO - ODNR, DIVISION OF WATER, 1939 FOUNTAIN SQ. DRIVE, COLS., OHIO 43224-9971

Blue - Customer's copy Pink - Driller's copy Green - Local Health Dept. copy

MW-901

RMI Phase II

Project Number	9116-15	Drill Rig	CME 45C
Geologist	Kevin Smith	Ground Elevation	Feet
Date Drilled	10/10/02	Total Depth of Borehole	18 Feet
Borehole Diameter	2 Inches	Depth to Water	Feet

Graphic Log	Description	Depth	Sample	PID	Blow Counts	Completion
	Fill - Brown SILTY CLAY (CL), little to some gravel, little f-c sand.			0.3	6,5,6,5	
	Topsoil - Dark gray SILTY CLAY (CL). Contains roots/organics.			0.3	5,4,5,4	
	Stiff brown and gray mottled CLAYEY SILT (ML), trace f sand; damp					
	Stiff brown/orange/gray mottled SILTY CLAY (CL), trace f sand; damp to moist.	5		0.3	3,4,7,9	
				0.3	2,7,9,10	
	Very stiff brown SILTY CLAY (CL), trace f-c sand; damp to moist.					
	Very stiff gray SILTY CLAY (CL), little f-c sand, trace gravel; damp.			0.2	4,8,10,11	
	@ 10.0 to 12.0' - Sharp vertical contact between brown and gray clay	10		0.3	4,6,7,10	
	Same as Above - Iron stains and fractures throughout.			0.3	3,7,10,9	
	Stiff gray SILTY CLAY (CL), little f-c sand, little gravel; damp to moist.	15			4,6,8,8	
					2,5,8,10	

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Sharp and Associates, Inc.

000005

DNR 7802.96
TYPE OR USE PEN
SELF TRANSCRIBING
PRESS HARD

WELL LOG AND DRILLING REPORT

Ohio Department of Natural Resources
Divison of Water, 1939 Fountain Square Drive
Columbus, Ohio 43224-9971 Voice (614) 265-6739 Fax (614) 447-9503

956777

WELL LOCATION

Ashtabula County: Ashtabula Township: Ashtabula

Owner/Builder (Circle One or Both): First: Rmt Environmental Last: Services

Address of Well Location: Number: 1601 Street Name: E 21st St

City: Ashtabula Zip Code +4: 44004

Permit No.: NA Section/Lot No. (Circle One or Both):

Location of Well in State Plane coordinates, if available: Use of Well: Monitoring; MW-901

N ☐ X _____ . _____ +/- _____ ft. or m

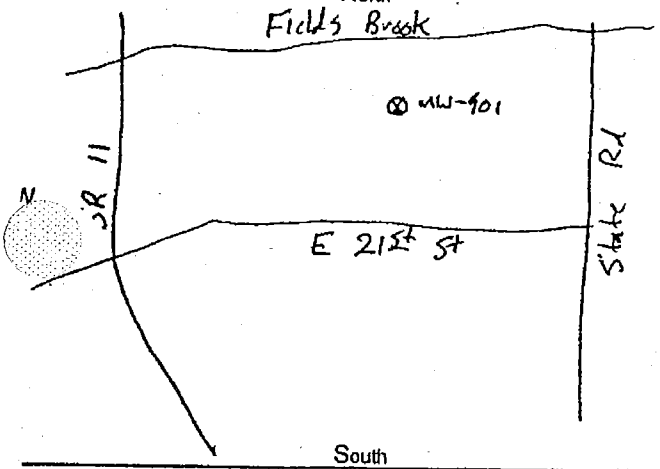
S ☐ Y _____ . _____ +/- _____ ft. or m

Elevation of Well _____ . _____ +/- _____ ft. or m

Datum Plain: ☐ NAD27 ☐ NAD83 Elevation Source _____

Source of Coordinates: ☐ GPS ☐ Survey ☐ Other _____

Sketch a map showing distance well lies from numbered state highways, street intersections, county roads, buildings or other notable landmarks. If latitude and longitude are available please include here: Lat: _____ Long: _____



WELL TEST*

Pre-Pumping Static Level: NA ft. Date _____

Measured from: ☐ Top of Casing ☐ Ground Level ☐ Other _____

Air ☐ Bailing ☐ Pumping* ☐ Other _____

Test Rate _____ gpm Duration of Test _____ hrs.

Level of Drawdown _____ ft. Sustainable Yield _____ gpm

(Attach a copy of the pumping test record, per section 1521.05, ORC)

Copy Attached? ☐ Yes ☐ No Flowing Well? ☐ Yes ☐ No

Quality _____

PUMP/PITLESS

Type of pump: NA Capacity _____ gpm

Pump set at _____ ft. Pitless Type _____

Pump installed by _____

I hereby certify the information given is accurate and correct to the best of my knowledge.

Drilling Firm: Sharp and Associates, Inc.

Address: 982 Cropper Ave

City/State/Zip: Columbus, Ohio 43227

Signature: _____ Date: 11/4/02

Registration Number: NA

CONSTRUCTION DETAILS

☐ Rotary ☐ Cable ☒ Augered ☐ Driven ☐ Other _____

BOREHOLE/CASING (measured from ground surface)

1 ☒ Borehole Diameter 8 inches Depth 18 ft.

Casing Diameter 2 in. Length 20 ft. Thickness 0.154 in.

2 ☐ Borehole Diameter _____ inches Depth _____ ft.

Casing Diameter _____ in. Length _____ ft. Thickness _____ in.

Casing Height Above Ground 2 ft.

Type: 1 ☒ Steel 1 ☐ Galv. 1 ☐ PVC 1 ☐ 2 ☐ 2 ☐ 2 ☐ 2 ☐ Other _____

Joints: 1 ☒ Threaded 1 ☐ Welded 1 ☐ Solvent 1 ☐ 2 ☐ 2 ☐ 2 ☐ 2 ☐ Other _____

SCREEN

Diameter 2 Slot Size 0.010 Screen Length 5 ft.

Type Wire wrapped Material Stainless

Set Between 13 ft. and 18 ft.

GRAVEL PACK (Filter Pack)

Material/Size #4 Silica Volume/Weight Used 150 lbs

Method of Installation Gravity

Depth: Placed FROM 18 ft. TO 12 ft.

GROUT

Material Bentonite Volume/Weight Used 2.25 ft³

Method of Installation Tremmie Pipe

Depth: Placed FROM 10 ft. TO 3.5 ft.

DRILLING LOG*

INDICATE DEPTH(S) AT WHICH WATER IS ENCOUNTERED. Show color, texture, hardness, and formation: sandstone, shale, limestone, gravel, clay, sand, etc.	From	To
Fill - Brn Silty Clay, ltl. f-c Sand, ltl. gravel	0	2
Topsoil	2	3
Brown & gray Clayey Silt, trace f.g. Sand	3	4
Brown/orange/gray mottled Silty Clay trace f.g. Sand	4	8
Brown Silty Clay, trace f-c Sand	8	9
Gray Silty Clay, ltl. fg-cg Sand, trace to ltl. gravel	9	18

000006

*(If more space is needed to complete drilling log, use next consecutively numbered form.)

Date of Well Completion 10/10/02 Total Depth of Well 18 ft.

Completion of this form is required by section 1521.05, Ohio Revised Code - file within 30 days after completion of drilling.
ORIGINAL COPY TO - ODNR, DIVISION OF WATER, 1939 FOUNTAIN SQ. DRIVE, COLS., OHIO 43224-9971

MW-902

RMI Phase II

Project Number	9116-15	Drill Rig	CME 45C
Geologist	Kevin Smith	Ground Elevation	Feet
Date Drilled	10-16-02	Total Depth of Borehole	Feet
Borehole Diameter	8 Inches	Depth to Water	Feet

Graphic Log	Description	Depth	Sample	PID	Blow Counts	Completion
	Fill - Stiff brown/orange/gray SILTY CLAY (CL), some to and gravel; moist.				6,4,5,5	
	Stiff brown/orange/gray mottled CLAYEY SILT (CL-ML); moist.				3,4,5,4	
	Loose brown/orange/gray mottled SILT (ML), trace f sand; moist. Non-plastic, non-cohesive. @ 4.8', 5.3', 5.6', 6.3', and 6.8' - seepage/wet Collected Shelby Tube in offset borehole from 4.0' - 6.0'.	5			3,4,4,4	
	@ 6.8' - Confining Layer. Stiff brown and gray mottled CLAY (CH), trace f sand; damp to moist.				3,5,7,6	
	Stiff brown and gray SILTY CLAY (CL), trace f-m sand; damp.				3,5,7,9	
	Stiff gray SILTY CLAY (CL), trace to little f-m sand; moist.	10			3,6,6,8	
					2,3,5,6	
		15			3,4,7,9	
					2,3,5,8	
	Same As Above - Contains trace angular Shale fragments.				5,9,11,10	

j:\2002\2116 RMI GW\Well Logs\RMI.wl2

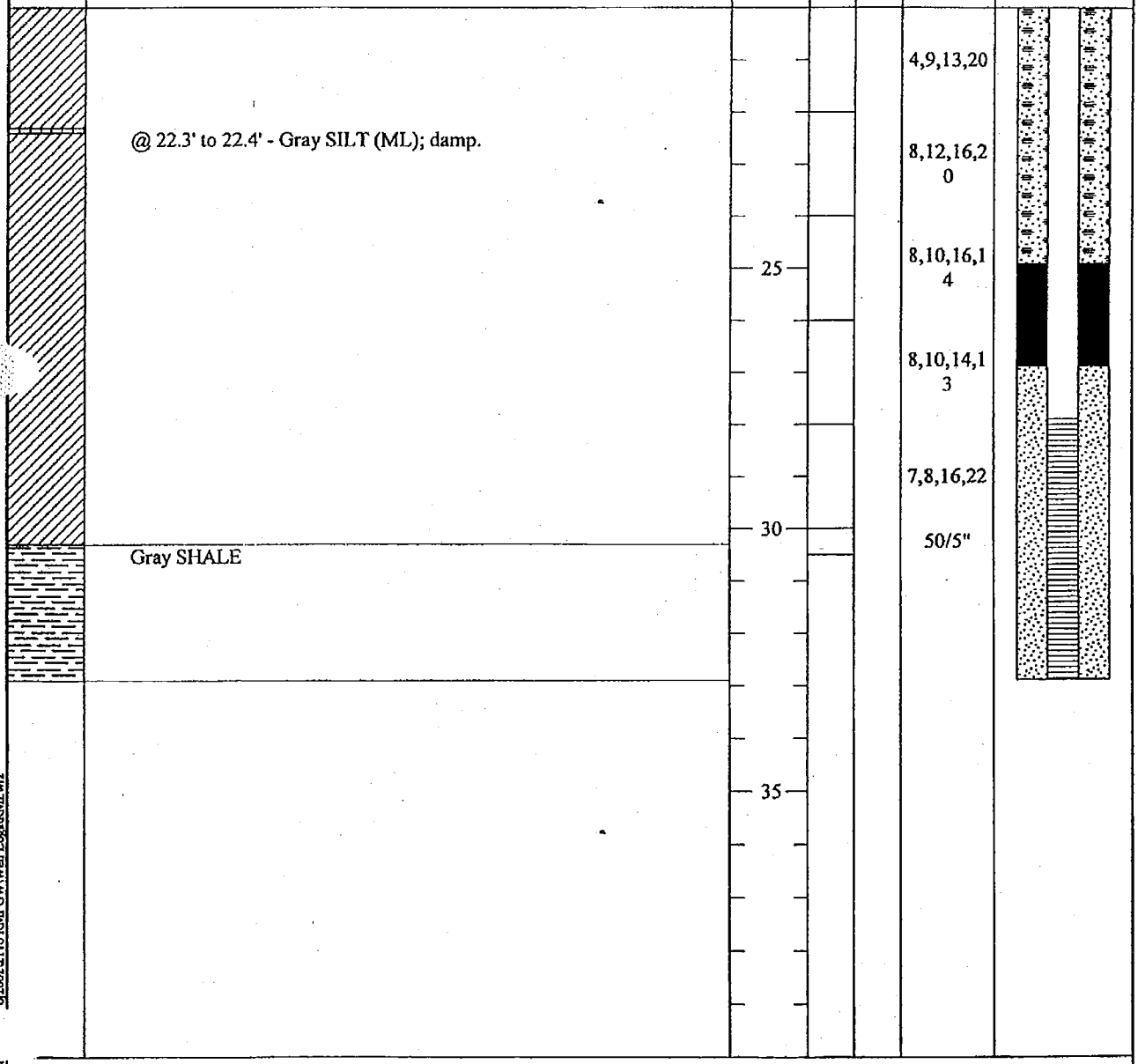
Sharp and Associates, Inc.

000007

MW-902

RMI Phase II

Project Number	9116-15	Drill Rig	CME 45C
Geologist	Kevin Smith	Ground Elevation	Feet
Date Drilled	10-16-02	Total Depth of Borehole	Feet
Borehole Diameter	8 Inches	Depth to Water	Feet



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Sharp and Associates, Inc.

000008

DNR 7802.96
TYPE OR USE PEN
SELF TRANSCRIBING
PRESS HARD

WELL LOG AND DRILLING REPORT

Ohio Department of Natural Resources
Divison of Water, 1939 Fountain Square Drive
Columbus, Ohio 43224-9971 Voice (614) 265-6739 Fax (614) 447-9503

956778

WELL LOCATION

County Ashtabula Township Ashtabula

Owner/Builder (Circle One or Both) RMI Environmental (First) Services (Last)

Address of Well Location 1601 (Number) E 21st St (Street Name)

City Ashtabula Zip Code +4 44004

Permit No. NA Section/Lot No. (Circle One or Both)

Location of Well in State Plane Coordinates, if available: Use of Well Monitoring; MW-902

☐ X _____ . _____ +/- _____ ft. or m

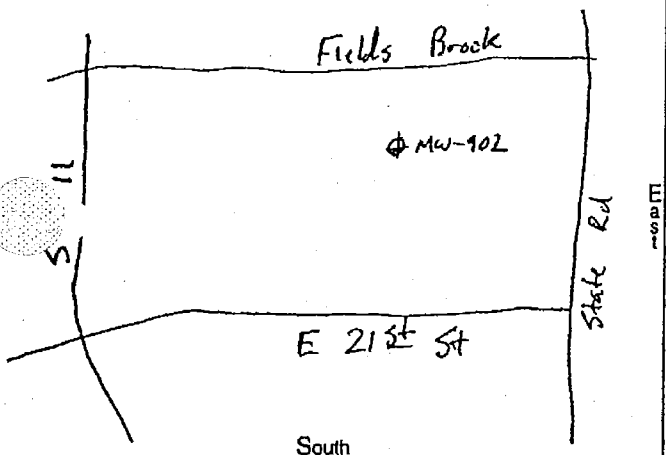
☐ Y _____ . _____ +/- _____ ft. or m

Elevation of Well _____ . _____ +/- _____ ft. or m

Datum Plain: ☐ NAD27 ☐ NAD83 Elevation Source _____

Source of Coordinates: ☐ GPS ☐ Survey ☐ Other _____

Sketch a map showing distance well lies from numbered state highways, street intersections, county roads, buildings or other notable landmarks. If latitude and longitude are available please include here: Lat: _____ Long: _____



WELL TEST*

Pumping Static Level NA ft. Date _____

Measured from: ☐ Top of Casing ☐ Ground Level ☐ Other _____

☐ Bailing ☐ Pumping* ☐ Other _____

Yield Rate _____ gpm Duration of Test _____ hrs.

Level of Drawdown _____ ft. Sustainable Yield _____ gpm

*(Attach a copy of the pumping test record, per section 1521.05, ORC)

Copy Attached? ☐ Yes ☐ No Flowing Well? ☐ Yes ☐ No

Quality _____

PUMP/PITLESS

Type of pump NA Capacity _____ gpm

Depth set at _____ ft. Pitless Type _____

Pump installed by _____

I hereby certify the information given is accurate and correct to the best of my knowledge.

Drilling Firm Sharp and Associates, Inc

Address 992 Crupper Ave

City Columbus, OH 43229

Signature _____ Date 11/4/02

Registration Number NA

CONSTRUCTION DETAILS

☐ Rotary ☐ Cable ☒ Augered ☐ Driven ☐ Other _____

BOREHOLE/CASING (measured from ground surface)

1 ☒ Borehole Diameter 8 inches Depth 32.9 ft.
Casing Diameter 2 in. Length 35 ft. Thickness 0.154 in.

2 ☐ Borehole Diameter _____ inches Depth _____ ft.
Casing Diameter _____ in. Length _____ ft. Thickness _____ in.

Casing Height Above Ground 2 ft.

Type: 1 ☒ Steel 1 ☐ Galv. 1 ☐ PVC 1 ☐
2 ☐ 2 ☐ 2 ☐ 2 ☐ Other _____

Joints: 1 ☒ Threaded 1 ☐ Welded 1 ☐ Solvent 1 ☐
2 ☐ 2 ☐ 2 ☐ 2 ☐ Other _____

SCREEN

Diameter 2-inch Slot Size 0.010 Screen Length 5 ft.
Type Wire wrapped Material Stainless
Set Between 32.9 ft. and 27.9 ft.

GRAVEL PACK (Filter Pack)

Material/Size #4 Silica Volume/Weight Used 155 lbs
Method of Installation Gravity
Depth: Placed FROM 32.9 ft. TO 26.9 ft.

GROUT

Material Bentonite Volume/Weight Used 4 ft 3
Method of Installation Tremmie Pipe
Depth: Placed FROM 24.9' ft. TO 3.5' ft.

DRILLING LOG*

INDICATE DEPTH(S) AT WHICH WATER IS ENCOUNTERED. Show color, texture, hardness, and formation: sandstone, shale, limestone, gravel, clay, sand, etc.	From	To
Fill - brown/orange/gray Silty Clay and Gravel	0	2.5
Brown/orange/gray Clayey Silt	2.5	4.5
Brown/orange/gray Silt, trace f-g. Sand	4.5	6.8
Brown and gray Clay, trace f. Sand	6.8	8
Brown and gray Silty Clay, trace f-g. Sand	8	10.5
Gray Silty Clay, lit. f-m Sand	10.5	30.3
Gray Shale	30.3	32.9

000009

*(If more space is needed to complete drilling log, use next consecutively numbered form.)

Date of Well Completion 10/16/02 Total Depth of Well 32.9 ft.

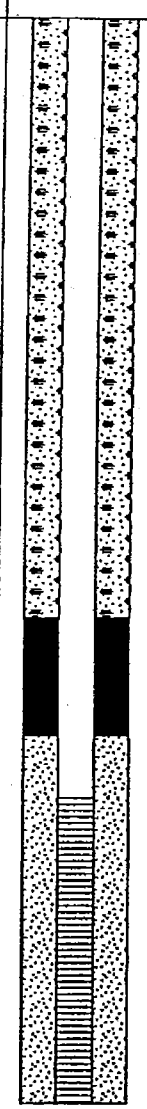
Completion of this form is required by section 1521.05, Ohio Revised Code - file within 30 days after completion of drilling.
ORIGINAL COPY TO - ODNR, DIVISION OF WATER, 1939 FOUNTAIN SQ. DRIVE, COLS., OHIO 43224-9971

MW-903

RMI Phase II

Project Number	9116-15	Drill Rig	CME 45C
Geologist	Kevin Smith	Ground Elevation	Feet
Date Drilled	10/7/02	Total Depth of Borehole	18 Feet
Borehole Diameter	2 Inches	Depth to Water	Feet

Graphic Log	Description	Depth	Sample	PID	Blow Counts	Completion
	Fill - Medium stiff brown SILTY CLAY (CL), "and" f-c sand, some gravel; damp. Contains roots/organics.			0.5	3,3,4,3	
	Topsoil - Soft gray and black SILTY CLAY (CL); organic.					
	Loose brown/orange/gray mottled SILT (ML), some clay, little f-c sand; moist.			0.7	1,1,3,3	
	@ 5.0' - wet	5		0.6	2,4,3,3	
	Soft brown SILTY CLAY (CL); wet @ 6.0' - Confining layer, damp. @ 6.8' to 7.0' - Brown SILT (ML); damp. Stiff grayish brown SILTY CLAY(CL), little f-c sand, trace gravel; damp. contains iron stained fractures.			0.6	3,4,6,8	
	Stiff gray SILTY CLAY (CL), trace f sand; laminated. @ 8.5' to 8.6' - 1/8" - 1/16" silt lenses.			0.5	2,4,5,7	
		10			2,3,5,7	
	@ 12.3' to 12.5' - seepage, moist to wet				2,4,8,10	
	Medium dense gray SILT (ML), and f-c sand, little gravel; damp to moist.					
	Very stiff gray SILTY CLAY (CL), little f-c sand, trace gravel; damp.	15			4,9,10,11	
					4,8,10,11	



1002\2116RM-1\WELLLO-1\RMI.wl2

TYPE OR USE PEN
SELF TRANSCRIBING
PRESS HARD

WELL LOG AND DRILLING REPORT

Ohio Department of Natural Resources
Divison of Water, 1939 Fountain Square Drive
Columbus, Ohio 43224-9971 Voice (614) 265-6739 Fax (614) 447-9503

956799

WELL LOCATION

County Ashtabula Township Ashtabula

Owner/Builder (Circle One or Both) RMI Environmental Services (First / Last)

Address of Well Location 1601 (Number) E 21st St (Street Name)

City Ashtabula Zip Code +4 44004

Permit No. NA Section/Lot No. (Circle One or Both)

Location of Well in State Plane coordinates, if available: Use of Well Monitoring; MW-903

N ☐ X _____ . _____ +/- _____ ft. or m

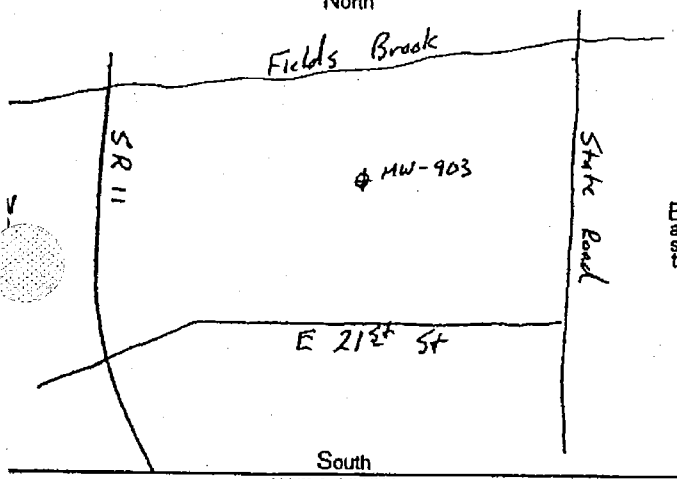
S ☐ Y _____ . _____ +/- _____ ft. or m

Elevation of Well _____ . _____ +/- _____ ft. or m

Datum Plain: ☐ NAD27 ☐ NAD83 Elevation Source _____

Source of Coordinates: ☐ GPS ☐ Survey ☐ Other _____

Sketch a map showing distance well lies from numbered state highways, street intersections, county roads, buildings or other notable landmarks. If latitude and longitude are available please include here: Lat: _____ Long: _____



WELL TEST*

Pumping Static Level NA ft. Date _____

Measured from: ☐ Top of Casing ☐ Ground Level ☐ Other _____

Air ☐ Bailing ☐ Pumping* ☐ Other _____

Yield Rate _____ gpm Duration of Test _____ hrs.

Depth of Drawdown _____ ft. Sustainable Yield _____ gpm

*Attach a copy of the pumping test record, per section 1521.05, ORC)

Copy Attached? ☐ Yes ☐ No Flowing Well? ☐ Yes ☐ No

Quality _____

PUMP/PITLESS

Type of pump NA Capacity _____ gpm

Pump set at _____ ft. Pitless Type _____

Pump Installed by _____

I hereby certify the information given is accurate and correct to the best of my knowledge.

Drilling Firm Sharp and Associates, Inc

Address 982 Cooper Ave

Zip Columbus, OH 43229

Signature _____ Date 11/4/02

Registration Number NA

CONSTRUCTION DETAILS

☐ Rotary ☐ Cable ☒ Augered ☐ Driven ☐ Other _____

BOREHOLE/CASING (measured from ground surface)

1 ☒ Borehole Diameter 8 inches Depth 18 ft.

Casing Diameter 2" in. Length 20 ft. Thickness 0.154 in.

2 ☐ Borehole Diameter _____ inches Depth _____ ft.

Casing Diameter _____ in. Length _____ ft. Thickness _____ in.

Casing Height Above Ground 2 ft.

Type 1 ☒ Steel 1 ☐ Galv. 1 ☐ PVC 1 ☐
2 ☐ 2 ☐ 2 ☐ 2 ☐ Other _____

Joints 1 ☒ Threaded 1 ☐ Welded 1 ☐ Solvent 1 ☐
2 ☐ 2 ☐ 2 ☐ 2 ☐ Other _____

SCREEN

Diameter 2-inch Slot Size 0.010 Screen Length 5 ft.

Type Wire wrapped Material Stainless Steel

Set Between _____ ft. and _____ ft.

GRAVEL PACK (Filter Pack)

Material/Size #4 Silica Volume/Weight Used 150 lbs

Method of Installation Gravity

Depth: Placed FROM 18 ft. TO 12 ft.

GROUT

Material Bentonite Volume/Weight Used 2 ft³

Method of Installation Tremmie pipe

Depth: Placed FROM 10 ft. TO 3.5 ft.

DRILLING LOG*

INDICATE DEPTH(S) AT WHICH WATER IS ENCOUNTERED. Show color, texture, hardness, and formation: sandstone, shale, limestone, gravel, clay, sand, etc.	From	To
Fill- Brown Silty clay and fg-cg Sand, some gravel.	0	1.5
Topsoil	1.5	2.5
Brown/orange/grey SILT, some clay, ltl. fg-cg sand	2.5	5.8
Brown Silty Clay, ltl. f-c sand	5.8	8.0
Gray SILTy Clay, trace fg Sand	8.0	13.6
Gray SILT and fg ltl fg-cg Sand, trace gravel	13.6	14.5
Gray Silty Clay, ltl f-c Sand, trace gravel.	14.5	18

000011

*(If more space is needed to complete drilling log, use next consecutively numbered form.)

Date of Well Completion 10/7/02 Total Depth of Well 18 ft.

Completion of this form is required by section 1521.05, Ohio Revised Code - file within 30 days after completion of drilling.

ORIGINAL COPY TO - ODNR, DIVISION OF WATER, 1939 FOUNTAIN SQ. DRIVE, COLS., OHIO 43224-9971

Blue - Customer's copy, Pink - Driller's copy, Green - Local Health Dept. copy

MW-904

RMI Phase II

Project Number	9116-15	Drill Rig	CME 45C
Geologist	Kevin Smith	Ground Elevation	Feet
Date Drilled	9/30/02	Total Depth of Borehole	18 Feet
Borehole Diameter	2 Inches	Depth to Water	Feet

Graphic Log	Description	Depth	Sample	PID	Blow Counts	Completion
	Stiff brown/gray mottled CLAYEY SILT (CL-ML), trace f sand; damp				2,4,6,4	
					4,4,6,7	
		5			4,7,8,9	
	Very stiff brown/gray mottled SILTY CLAY (CL); moist. Confining layer.					
	Stiff gray SILTY CLAY (CL); moist. High plasticity				2,4,6,6	
	Stiff gray SILTY CLAY (CL), little f-c sand, trace gravel; moist				3,5,6,7	
		10			2,4,5,6	
	decreasing moisture with depth				3,5,7,9	
		15			3,7,10,11	
	@ 15.7' - 1/16" sand stringer.					
	Same As Above - Increasing angular shale fragments.				6,6,10,11	

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Sharp and Associates, Inc.

TYPE OR USE PEN
SELF TRANSCRIBING
PRESS HARD

WELL LOG AND DRILLING REPORT

Ohio Department of Natural Resources
Divison of Water, 1939 Fountain Square Drive
Columbus, Ohio 43224-9971 Voice (614) 265-6739 Fax (614) 447-9503

956779

WELL LOCATION

County Ashtabula Township Ashtabula

Owner/Driller (Circle One or Both) RMI Environmental Services
First Last

Address of Well Location 1601 E. 21st St
Number Street Name

City Ashtabula Zip Code +4 44004

Permit No. NA Section/Lot No. (Circle One or Both)

Location of Well in State Plane Coordinates, if available: Use of Well Monitoring; MW-904

☐ X _____ . _____ +/- _____ ft. or m

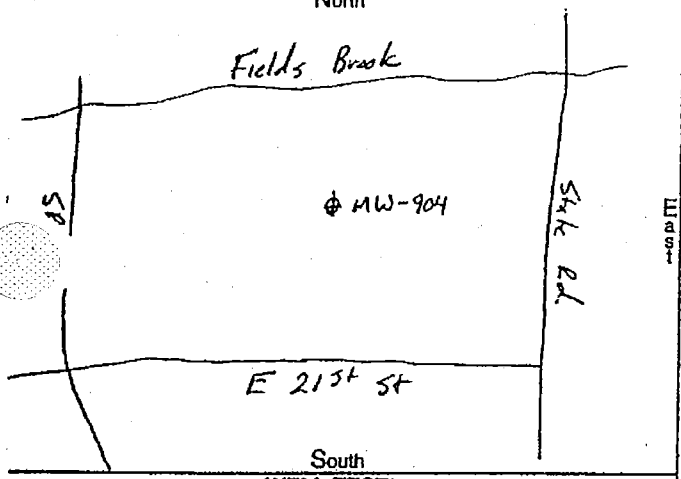
☐ Y _____ . _____ +/- _____ ft. or m

Elevation of Well _____ . _____ +/- _____ ft. or m

Datum Plain: ☐ NAD27 ☐ NAD83 Elevation Source _____

Source of Coordinates: ☐ GPS ☐ Survey ☐ Other _____

Sketch a map showing distance well lies from numbered state highways, street intersections, county roads, buildings or other notable landmarks. If latitude and longitude are available please include here: Lat: _____ Long: _____



WELL TEST*

Pumping Static Level NA ft. Date _____

Measured from: ☐ Top of Casing ☐ Ground Level ☐ Other _____

Air ☐ Bailing ☐ Pumping* ☐ Other _____

Test Rate _____ gpm Duration of Test _____ hrs.

Test of Drawdown _____ ft. Sustainable Yield _____ gpm

(Attach a copy of the pumping test record, per section 1521.05, ORC)

Copy Attached? ☐ Yes ☐ No Flowing Well? ☐ Yes ☐ No

Utility _____

PUMP/PITLESS

Type of pump NA Capacity _____ gpm

Pump set at _____ ft. Pitless Type _____

Pump installed by _____

I hereby certify the information given is accurate and correct to the best of my knowledge.

Drilling Firm Shaw and Associates, Inc

Address 982 Crupper Ave

City Columbus, OH 43229

Signature _____ Date 11/4/02

Registration Number NA

CONSTRUCTION DETAILS

☐ Rotary ☐ Cable ☒ Augered ☐ Driven ☐ Other _____

BOREHOLE/CASING (measured from ground surface)

1 ☒ Borehole Diameter 8 inches Depth 18 ft.
Casing Diameter 2 in. Length 20 ft. Thickness 0.154 in.

2 ☐ Borehole Diameter _____ inches Depth _____ ft.
Casing Diameter _____ in. Length _____ ft. Thickness _____ in.

Casing Height Above Ground 2 ft.

Type 1 ☒ Steel 1 ☐ Galv. 1 ☐ PVC 1 ☐
2 ☐ 2 ☐ 2 ☐ 2 ☐ Other _____

Joints 1 ☒ Threaded 1 ☐ Welded 1 ☐ Solvent 1 ☐
2 ☐ 2 ☐ 2 ☐ 2 ☐ Other _____

SCREEN

Diameter 2 Slot Size 0.010 Screen Length 5 ft.
Type Wire wrapped Material Stainless
Set Between 13 ft. and 18 ft.

GRAVEL PACK (Filter Pack)

Material/Size #4 Silica Volume/Weight Used 150 lbs
Method of Installation Gravity
Depth: Placed FROM 12 ft. TO 18 ft.

GROUT

Material Bentonite Volume/Weight Used 2 ft³
Method of Installation Tremmie Pipe
Depth: Placed FROM 10 ft. TO 3.5 ft.

DRILLING LOG*

INDICATE DEPTH(S) AT WHICH WATER IS ENCOUNTERED. Show color, texture, hardness, and formation: sandstone, shale, limestone, gravel, clay, sand, etc.	From	To
Brown & gray Clayey Silt, trace f. sand	0	5.4
Brown & gray Silty Clay	5.4	6.0
Gray Silty Clay	6.0	8.5
Gray Silty Clay, little f-c sand, trace gravel	8.5	18.0

000013

*(If more space is needed to complete drilling log, use next consecutively numbered form.)

Date of Well Completion 9/30/02 Total Depth of Well 18 ft.

Completion of this form is required by section 1521.05, Ohio Revised Code - file within 30 days after completion of drilling.

ORIGINAL COPY TO - ODNR, DIVISION OF WATER, 1939 FOUNTAIN SQ. DRIVE, COLS., OHIO 43224-9971

Blue - Customer's copy Pink - Driller's copy Green - Local Health Dept. copy

MW-905

RMI Phase II

Project Number	9116-15	Drill Rig	CME 45C
Geologist	Kevin Smith	Ground Elevation	Feet
Date Drilled	10/8/02	Total Depth of Borehole	16 Feet
Borehole Diameter	2 Inches	Depth to Water	Feet

Graphic Log	Description	Depth	Sample	PID	Blow Counts	Completion
	Fill - GRAVEL and brown silty clay; damp					
	Possible fill - Stiff dark gray SILTY CLAY (CL) trace f-c sand; damp. Contains wood/organics.				4,6,7,6	
	Stiff gray/brown/orange mottled SILTY CLAY (CL), little to some f sand; damp to moist.				3,4,7,6	
	@ 3.3' to 3.5' - Seepage/wet					
	Loose brown SILT (ML), some f sand; wet.					
	Soft brown SILTY CLAY; moist.	5			2,2,2,4	
	Loose brown SILT (ML), "and" f sand; wet.					
	Loose brown/gray/orange mottled SILT (ML), trace f sand, trace clay; wet. Non-cohesive, non-plastic.				4,5,5,8	
	Medium dense gray SILT (ML); wet.				5,6,5,6	
	Stiff gray CLAY (CL); moist. Confining layer.	10				
	Stiff gray SILTY CLAY (CL), little f-c sand, trace gravel; moist.				3,4,7,9	
					5,5,7,9	
		15			3,5,7,8	

2002\2116RM-1\WELLLOG-1\RM1.wd2

Sharp and Associates, Inc.

000014

TYPE OR USE PEN
SELF TRANSCRIBING
PRESS HARD

WELL LOG AND DRILLING REPORT

Ohio Department of Natural Resources
Divison of Water, 1939 Fountain Square Drive
Columbus, Ohio 43224-9971 Voice (614) 265-6739 Fax (614) 447-9503

956780

WELL LOCATION

County Ashtabula Township Ashtabula

Owner/Builder (Circle One or Both) RMI Environmental Services
First Last

Address of Well Location 1601 E 21st St
Number Street Name

City Ashtabula Zip Code +4 44004

Permit No. NA Section/Lot No. (Circle One or Both)

Location of Well in State Plane coordinates, if available: Use of Well Monitoring; MW-905

N ☐ X _____ . _____ +/- _____ ft. or m

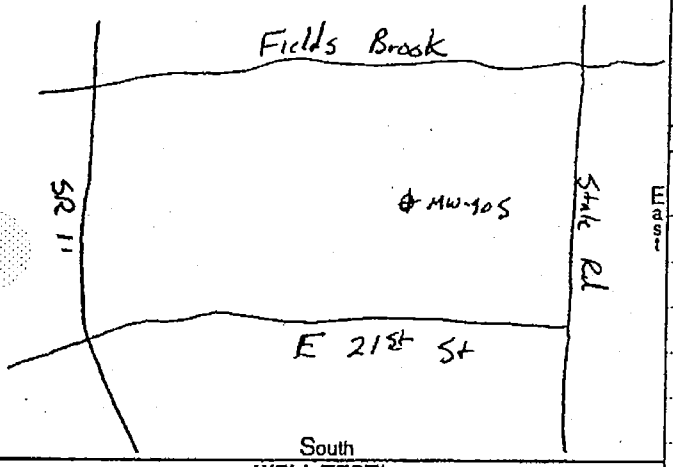
S ☐ Y _____ . _____ +/- _____ ft. or m

Elevation of Well _____ . _____ +/- _____ ft. or m

Datum Plain: ☐ NAD27 ☐ NAD83 Elevation Source _____

Source of Coordinates: ☐ GPS ☐ Survey ☐ Other _____

Sketch a map showing distance well lies from numbered state highways, street intersections, county roads, buildings or other notable landmarks. If latitude and longitude are available please include here: Lat: _____ Long: _____



WELL TEST*

Pre-Pumping Static Level NA ft. Date _____

Measured from: ☐ Top of Casing ☐ Ground Level ☐ Other _____

Air ☐ Bailing ☐ Pumping* ☐ Other _____

Test Rate _____ gpm Duration of Test _____ hrs.

Yield of Drawdown _____ ft. Sustainable Yield _____ gpm

(Attach a copy of the pumping test record, per section 1521.05, ORC)

Copy Attached? ☐ Yes ☐ No Flowing Well? ☐ Yes ☐ No

Quality _____

PUMP/PITLESS

Type of pump NA Capacity _____ gpm

Pump set at _____ ft. Pitless Type _____

Pump installed by _____

I hereby certify the information given is accurate and correct to the best of my knowledge.

Drilling Firm Sharp and Associates, Inc.

Address 982 Crupper Ave

City Columbus OH Zip 43229

Signature _____ Date 11/14/02

Registration Number NA

CONSTRUCTION DETAILS

☐ Rotary ☐ Cable ☑ Augered ☐ Driven ☐ Other _____

BOREHOLE/CASING (measured from ground surface)

1 ☐ Borehole Diameter 8 inches Depth 16 ft.
Casing Diameter 2 in. Length 18 ft. Thickness 0.154 in.

2 ☐ Borehole Diameter _____ inches Depth _____ ft.
Casing Diameter _____ in. Length _____ ft. Thickness _____ in.

Casing Height Above Ground _____ ft.

Type 1 ☒ Steel 1 ☐ Galv. 1 ☐ PVC 1 ☐
2 ☐ 2 ☐ 2 ☐ 2 ☐ Other _____

Joints 1 ☒ Threaded 1 ☐ Welded 1 ☐ Solvent 1 ☐
2 ☐ 2 ☐ 2 ☐ 2 ☐ Other _____

SCREEN

Diameter 2-inch Slot Size 0.010 Screen Length 5 ft.
Type Wire wrapped Material Stainless
Set Between 14 ft. and 9 ft.

GRAVEL PACK (Filter Pack)

Material/Size #4 Silica Volume/Weight Used 150 lbs
Method of Installation Gravity
Depth: Placed FROM 6 ft. TO 3.5 ft.

GROUT

Material Bentonite Volume/Weight Used 1 ft³
Method of Installation Tremie Pipe
Depth: Placed FROM 6 ft. TO 3.5 ft.

DRILLING LOG*

INDICATE DEPTH(S) AT WHICH WATER IS ENCOUNTERED. Show color, texture, hardness, and formation: sandstone, shale, limestone, gravel, clay, sand, etc.	From	To
Fill - Gravel and brown Silty Clay	0	2
Brown/orange/grey Silty Clay, some fg. Sand	2	4.2
Brown + Gray SILT	4.2	9.6
Gray Silty Clay	9.6	16

000015

*(If more space is needed to complete drilling log, use next consecutively numbered form.)

Date of Well Completion 10/8/02 Total Depth of Well 16 ft.

Completion of this form is required by section 1521.05, Ohio Revised Code - file within 30 days after completion of drilling.

ORIGINAL COPY TO - ODNR, DIVISION OF WATER, 1939 FOUNTAIN SQ. DRIVE, COLS., OHIO 43224-9971

Blue - Customer's copy Pink - Driller's copy Green - Local Health Dept. copy

MW-906

RMI Phase II

Project Number	9116-15	Drill Rig	CME 45C
Geologist	Kevin Smith	Ground Elevation	Feet
Date Drilled	10/7/02	Total Depth of Borehole	18 Feet
Borehole Diameter	2 Inches	Depth to Water	Feet

Graphic Log	Description	Depth	Sample	PID	Blow Counts	Completion
	FILL - stiff brown SILTY CLAY (CL), little f-c sand, little gravel. Contains roots, organics, iron staining.				4,4,6,5	
	Medium stiff brown/gray/orange mottled SILTY CLAY (CL), trace to little f-c sand; moist. Iron staining.				2,12,5,5	
	@ 5.2' - sand lens 1/16" sand lens, seepage/wet	5			1,2,3,4	
	@ 6.0' to 6.2' - brown SILT - wet/seepage				1,3,3,4	
	Very stiff grayish brown SILTY CLAY (CL), little f-c sand, trace gravel; damp. Vertical and horizontal iron stains, fractures throughout				6,9,12,13	
	Very stiff gray SILTY CLAY (CL), little f-c sand, trace gravel; moist.	10				
	@ 9.7' - Sharp contact between brown and gray clay.				3,4,6,7	
	@ 12.4' to 13.7' - Iron stained vertical fracture, slight seep.				3,4,7,7	
		15			3,4,6,7	
	@ 16.4' - Slight seepage/increase in moisture.				3,4,5,7	

DNR 7002.90

TYPE OR USE PEN
SELF TRANSCRIBING
PRESS HARD

WELL LOG AND DRILLING REPORT

Ohio Department of Natural Resources
Divison of Water, 1939 Fountain Square Drive
Columbus, Ohio 43224-9971 Voice (614) 265-6739 Fax (614) 447-9503

956781

WELL LOCATION

County Ashtabula Township Ashtabula

Owner/Builder (Circle One or Both) RMI Environmental Services (First / Last)

Address of Well Location 1601 (Number) E 21st St (Street Name)

City Ashtabula Zip Code +4 44004

Permit No. NA Section/Lot No. (Circle One or Both)

Location of Well in State Plane coordinates, if available: Use of Well Monitoring: MW-906

N ☐ X _____ . _____ +/- _____ ft. or m

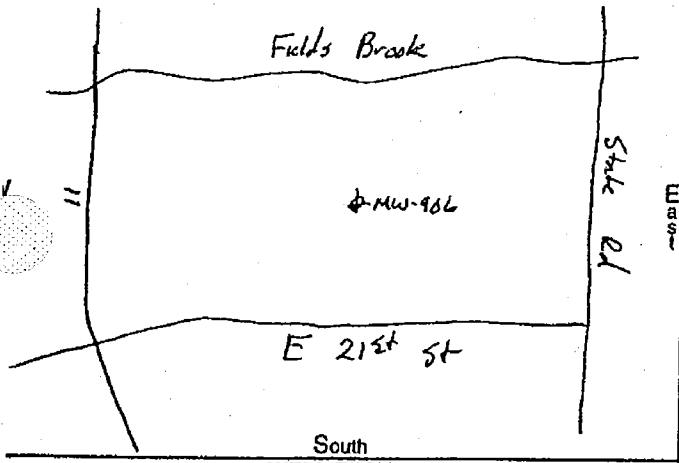
S ☐ Y _____ . _____ +/- _____ ft. or m

Elevation of Well _____ . _____ +/- _____ ft. or m

Datum Plain: ☐ NAD27 ☐ NAD83 Elevation Source _____

Source of Coordinates: ☐ GPS ☐ Survey ☐ Other _____

Sketch a map showing distance well lies from numbered state highways, street intersections, county roads, buildings or other notable landmarks. If latitude and longitude are available please include here: Lat: _____ Long: _____



WELL TEST*

Pumping Static Level NA ft. Date _____

Measured from: ☐ Top of Casing ☐ Ground Level ☐ Other _____

Air ☐ Bailing ☐ Pumping* ☐ Other _____

Yield Rate _____ gpm Duration of Test _____ hrs.

Level of Drawdown _____ ft. Sustainable Yield _____ gpm

(Attach a copy of the pumping test record, per section 1521.05, ORC)

Copy Attached? ☐ Yes ☐ No Flowing Well? ☐ Yes ☐ No

Quality _____

PUMP/PITLESS

Make of pump NA Capacity _____ gpm

Pump set at _____ ft. Pitless Type _____

Pump installed by _____

I hereby certify the information given is accurate and correct to the best of my knowledge.

Drilling Firm Shaw and Associates, Inc

Address 982 Crupper Ave

City Columbus, OH 43229

Signature _____ Date 11/4/02

Registration Number NA

CONSTRUCTION DETAILS

☐ Rotary ☐ Cable ☒ Augered ☐ Driven ☐ Other _____

BOREHOLE/CASING (measured from ground surface)

1 ☒ Borehole Diameter 8 inches Depth 18 ft.

Casing Diameter 2 in. Length 20 ft. Thickness 0.154 in.

2 ☐ Borehole Diameter _____ inches Depth _____ ft.

Casing Diameter _____ in. Length _____ ft. Thickness _____ in.

Casing Height Above Ground 2 ft.

Type 1 ☒ Steel 1 ☐ Galv. 1 ☐ PVC 1 ☐ 2 ☐ 2 ☐ 2 ☐ 2 ☐ Other _____

Joints 1 ☒ Threaded 1 ☐ Welded 1 ☐ Solvent 1 ☐ 2 ☐ 2 ☐ 2 ☐ 2 ☐ Other _____

SCREEN

Diameter 2-inch Slot Size 0.010 Screen Length 5 ft.

Type Wire wrapped Material Stainless

Set Between 18 ft. and 13 ft.

GRAVEL PACK (Filter Pack)

Material/Size #4 Silica Volume/Weight Used 150 lbs

Method of Installation Gravity

Depth: Placed FROM 18 ft. TO 12 ft.

GROUT

Material Bentonite Volume/Weight Used 2 ft³

Method of Installation Tremmie Pipe

Depth: Placed FROM 10 ft. TO 3.5 ft.

DRILLING LOG*

INDICATE DEPTH(S) AT WHICH WATER IS ENCOUNTERED. Show color, texture, hardness, and formation: sandstone, shale, limestone, gravel, clay, sand, etc.	From	To
Fill – Brown silty clay, ltl. fg-cg sand, ltl gravel	0	2.8
Brown/orange/gray silty clay, ltl. fg-cg sand	2.8	7.8
Brown & gray silty clay, ltl. fg-cg sand, trace gravel	7.8	9.7
Gray silty clay, ltl. fg-cg sand, trace gravel	9.7	18

000017

*(If more space is needed to complete drilling log, use next consecutively numbered form.)

Date of Well Completion 10/7/02 Total Depth of Well 18 ft.

Completion of this form is required by section 1521.05, Ohio Revised Code - file within 30 days after completion of drilling.
ORIGINAL COPY TO - ODNR, DIVISION OF WATER, 1939 FOUNTAIN SQ. DRIVE, COLS., OHIO 43224-9971

MW-907

RMI Phase II

Project Number	9116-15	Drill Rig	CME 45C
Geologist	Kevin Smith	Ground Elevation	Feet
Date Drilled	10/1/02	Total Depth of Borehole	18 Feet
Borehole Diameter	2 Inches	Depth to Water	Feet

Graphic Log	Description	Depth	Sample	PID	Blow Counts	Completion
	Fill - Gravel					
	Very stiff brown SILTY CLAY (CL), and f-c sand.				5,7,9,7	
	Fill - Medium stiff brown/gray/green mottled SILTY CLAY (CL), little to some f-c sand, little gravel; moist. Contains roots, organic odor.				3,3,2,3	
	@ 4.3' - Native/fill interface; wet. Stiff brown/gray mottled SILTY CLAY (CL), trace f-m sand; moist.	5			2,3,6,6	
	Stiff brown SILTY CLAY (CL), little f-c sand, trace gravel; moist.				3,5,6,5	
	@ 8.0' to 11.7' - Vertical and horizontal Iron stains.				3,6,8,11	
		10			5,10,12,12	
	Very Stiff gray SILTY CLAY (CL), little f-c sand, little gravel; damp. Iron stains and fractures from 11.7' to 12.0'				5,7,9,10	
	@ 14.0' to 14.2' - angular Iron stained fracture.	15			5,7,9,11	
	@ 16.0' - Slightly increased moisture content.				3,6,6,8	

2002\116RM-1\WELLLO-1RM1.wl2

Sharp and Associates, Inc.

DNR 7602.96

TYPE OR USE PEN
SELF TRANSCRIBING
PRESS HARD

WELL LOG AND DRILLING REPORT

Ohio Department of Natural Resources
Divison of Water, 1939 Fountain Square Drive
Columbus, Ohio 43224-9971 Voice (614) 265-6739 Fax (614) 447-9503

956782

WELL LOCATION

County Ashtabula Township Ashtabula

Owner/Builder (Circle One or Both) RMI Environmental Services
First Last

Address of Well Location 1601 E 21st St
Number Street Name

City Ashtabula Zip Code +4 44004

Permit No. NA Section/Lot No. (Circle One or Both)

Location of Well in State Plane Coordinates, if available: Use of Well Monitoring; MW-907

☐ X _____ . _____ +/- _____ ft. or m

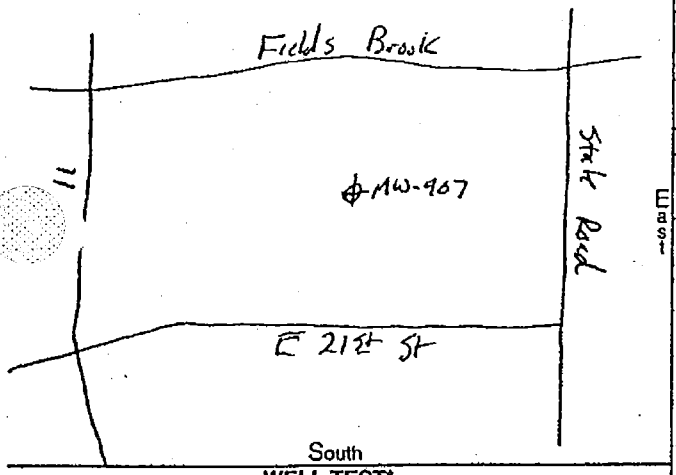
☐ Y _____ . _____ +/- _____ ft. or m

Elevation of Well _____ . _____ +/- _____ ft. or m

Datum Plain: ☐ NAD27 ☐ NAD83 Elevation Source _____

Source of Coordinates: ☐ GPS ☐ Survey ☐ Other _____

Sketch a map showing distance well lies from numbered state highways, street intersections, county roads, buildings or other notable landmarks. If latitude and longitude are available please include here: Lat: _____ Long: _____



WELL TEST*

Pre-Pumping Static Level NA ft. Date _____

Measured from: ☐ Top of Casing ☐ Ground Level ☐ Other _____

Air ☐ Bailing ☐ Pumping* ☐ Other _____

Test Rate _____ gpm Duration of Test _____ hrs.

Test of Drawdown _____ ft. Sustainable Yield _____ gpm

*Attach a copy of the pumping test record, per section 1521.05, ORC)

Copy Attached? ☐ Yes ☐ No Flowing Well? ☐ Yes ☐ No

Quality _____

PUMP/PITLESS

Type of pump NA Capacity _____ gpm

Pump set at _____ ft. Pitless Type _____

Pump installed by _____

I hereby certify the information given is accurate and correct to the best of my knowledge.

Drilling Firm Sharp and Associates, Inc

Address 982 Crupper Ave

City Columbus OH 43229

Signature _____ Date 11/4/02

Registration Number NA

CONSTRUCTION DETAILS

☐ Rotary ☐ Cable ☑ Augered ☐ Driven ☐ Other _____

BOREHOLE/CASING (measured from ground surface)

1☑ Borehole Diameter 8 inches Depth 18 ft.
Casing Diameter 2 in. Length 20 ft. Thickness 0.154 in.

2☐ Borehole Diameter _____ inches Depth _____ ft.
Casing Diameter _____ in. Length _____ ft. Thickness _____ in.

Casing Height Above Ground _____ ft.

Type 1☒ Steel 1☐ Galv. 1☐ PVC 1☐
2☐ 2☐ 2☐ 2☐ Other _____

Joints 1☒ Threaded 1☐ Welded 1☐ Solvent 1☐
2☐ 2☐ 2☐ 2☐ Other _____

SCREEN

Diameter 2 Slot Size 0.010 Screen Length 5 ft.
Type Wire wrapped Material Stainless
Set Between 18 ft. and 13 ft.

GRAVEL PACK (Filter Pack)

Material/Size #4 Silica Volume/Weight Used 150 lbs
Method of Installation Gravity
Depth: Placed FROM 12 ft. TO 18 ft.

GROUT

Material Bentonite Volume/Weight Used 2 ft³
Method of Installation Tremmie pipe
Depth: Placed FROM 10 ft. TO 3.5 ft.

DRILLING LOG*

INDICATE DEPTH(S) AT WHICH WATER IS ENCOUNTERED. Show color, texture, hardness, and formation: sandstone, shale, limestone, gravel, clay, sand, etc.	From	To
Fill - Gravel	0	0.8
Fill - Brown & gray Silty clay lt. fg-cg. Sand, lt. gravel	0.8	4.3
Brown & gray Silty Clay, trace fg-cg Sand,	4.3	6
Brown Silty Clay, lt. fg-cg Sand, trace gravel	6	11.7
Gray Silty Clay, lt. fg-cg Sand lt. gravel	11.7	18

000019

*(If more space is needed to complete drilling log, use next consecutively numbered form.)

Date of Well Completion 10/1/02 Total Depth of Well 18 ft.

Completion of this form is required by section 1521.05, Ohio Revised Code - file within 30 days after completion of drilling.
ORIGINAL COPY TO - ODNR, DIVISION OF WATER, 1939 FOUNTAIN SQ. DRIVE, COLS., OHIO 43224-9971

MW-908

RMI Phase II

Project Number	9116-15	Drill Rig	CME 45C
Geologist	Kevin Smith	Ground Elevation	Feet
Date Drilled	9/30/02	Total Depth of Borehole	18 Feet
Borehole Diameter	2 Inches	Depth to Water	Feet

Graphic Log	Description	Depth	Sample	PID	Blow Counts	Completion
	Topsoil					
	Medium stiff brown CLAYEY SILT (CL-ML), little f-c sand, trace gravel; moist.				2,4,4,3	
	Loose orange/brown mottled SILT (ML), little to some clay; moist. Low plasticity.				1,3,4,3	
	Loose orange/brown mottled SILT (ML); wet.	5			2,2,3,4	
	Loose brown/gray mottled CLAYEY SILT (CL-ML); moist. Confining layer.					
	Stiff brown/orange/gray mottled SILTY CLAY (CL); damp to moist.				2,4,6,8	
	Very stiff gray SILTY CLAY (CL), trace f-c sand; damp to moist. Vertical and horizontal iron stained fractures throughout sample.				4,7,10,11	
	Stiff gray SILTY CLAY (CL), little f-c sand, trace gravel; damp.	10				
					3,6,7,6	
					2,6,7,9	
		15			4,5,8,8	
					4,7,7,9	

Sharp and Associates, Inc. Page 1

000020

TYPE OR USE PEN
SELF TRANSCRIBING
PRESS HARD

WELL LOG AND DRILLING REPORT

Ohio Department of Natural Resources
Divison of Water, 1939 Fountain Square Drive
Columbus, Ohio 43224-9971 Voice (614) 265-6739 Fax (614) 447-9503

956783

WELL LOCATION

County: Ashtabula Township: Ashtabula

Owner/Builder (Circle One or Both): RMI Environmental Services (First / Last)

Address of Well Location: 1661 (Number) E 21st St (Street Name)

City: Ashtabula Zip Code +4: 44004

Permit No.: NA Section/Lot No. (Circle One or Both):

Location of Well in State Plane Coordinates, if available: Use of Well:

☐ X _____ . _____ +/- _____ ft. or m

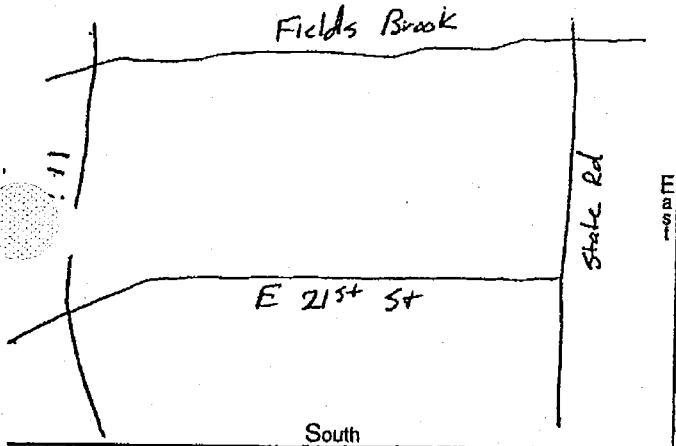
☐ Y _____ . _____ +/- _____ ft. or m

Elevation of Well _____ . _____ +/- _____ ft. or m

Datum Plain: ☐ NAD27 ☐ NAD83 Elevation Source:

Source of Coordinates: ☐ GPS ☐ Survey ☐ Other:

Sketch a map showing distance well lies from numbered state highways, street intersections, county roads, buildings or other notable landmarks. If latitude and longitude are available please include here: Lat: Long:



WELL TEST*

Pumping Static Level NA ft. Date

Measured from: ☐ Top of Casing ☐ Ground Level ☐ Other

Air ☐ Bailing ☐ Pumping* ☐ Other

Flow Rate _____ gpm Duration of Test _____ hrs.

Level of Drawdown _____ ft. Sustainable Yield _____ gpm

*(Attach a copy of the pumping test record, per section 1521.05, ORC)

Copy Attached? ☐ Yes ☐ No Flowing Well? ☐ Yes ☐ No

Quality

PUMP/PITLESS

Type of pump NA Capacity _____ gpm

Pump set at _____ ft. Pitless Type

Pump installed by

I hereby certify the information given is accurate and correct to the best of my knowledge.

Drilling Firm: Sharp and Associates

Address: 982 Cruppa Ave
Columbus, OH 43229

Signature: _____ Date: 11/4/02

Registration Number: NA

CONSTRUCTION DETAILS

☐ Rotary ☐ Cable ☒ Augered ☐ Driven ☐ Other:

BOREHOLE/CASING (measured from ground surface)

1 ☒ Borehole Diameter 8 inches Depth 18 ft.
Casing Diameter 2 in. Length 20 ft. Thickness 0.154 in.

2 ☐ Borehole Diameter _____ inches Depth _____ ft.
Casing Diameter _____ in. Length _____ ft. Thickness _____ in.

Casing Height Above Ground 2 ft.

Type: 1 ☒ Steel 1 ☐ Galv. 1 ☐ PVC 1 ☐
2 ☐ 2 ☐ 2 ☐ 2 ☐ Other

Joints: 1 ☒ Threaded 1 ☐ Welded 1 ☐ Solvent 1 ☐
2 ☐ 2 ☐ 2 ☐ 2 ☐ Other

SCREEN

Diameter 2-inch Slot Size 0.010 Screen Length 5 ft.
Type Wire wrapped Material Stainless steel
Set Between 18 ft. and 13 ft.

GRAVEL PACK (Filter Pack)

Material/Size #4 Silica Volume/Weight Used 150 lbs
Method of Installation Gravity
Depth: Placed FROM 12 ft. TO 18 ft.

GROUT

Material Bentonite Volume/Weight Used 2 ft3
Method of Installation Tremmie pipe
Depth: Placed FROM 10 ft. TO 3.5 ft.

DRILLING LOG*

INDICATE DEPTH(S) AT WHICH WATER IS ENCOUNTERED. Show color, texture, hardness, and formation: sandstone, shale, limestone, gravel, clay, sand, etc.	From	To
Top Soil	0	0.4
Brown Clayey Silt, ltl fg-cg Sand, trace gravel	0.4	2.5
Brown + orange Silt, ltl to some clay	2.5	6.2
Brown/orange/gray Silty Clay	6.2	8.8
Gray Silty Clay, trace fg-cg sand.	8.8	10
Gray Silty Clay, ltl fg-cg Sand, trace gravel	10	18

000021

*(If more space is needed to complete drilling log, use next consecutively numbered form.)

Date of Well Completion 9/30/02 Total Depth of Well 18 ft.

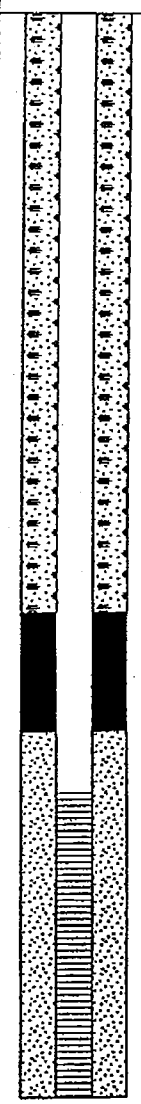
Completion of this form is required by section 1521.05, Ohio Revised Code - file within 30 days after completion of drilling.
ORIGINAL COPY TO - ODNR, DIVISION OF WATER, 1939 FOUNTAIN SQ. DRIVE, COLS., OHIO 43224-9971

MW-909

RMI Phase II

Project Number	9116-15	Drill Rig	CME 45C
Geologist	Kevin Smith	Ground Elevation	Feet
Date Drilled	10/21/02	Total Depth of Borehole	18 Feet
Borehole Diameter	2 Inches	Depth to Water	Feet

Graphic Log	Description	Depth	Sample	PID	Blow Counts	Completion
	Fill - GRAVEL					
	Fill - Stiff brown SILTY CLAY (CL), little f-m sand; damp to moist. Contains ash.				10,6,7,8	
	Topsoil - Dark gray SILTY CLAY (CL).					
	Medium stiff brown/gray/orange mottled SILTY CLAY (CL); moist. low plasticity.				3,3,4,5	
	Medium stiff brown/gray/orange mottled SILTY CLAY (CL), little f-m sand; moist. @ 4.5' to 4.7' and 4.9 to 5.1 - SILT lens, seepage/wet	5			2,2,5,4	
	Confining Layer Stiff brown SILTY CLAY (CL), little f-c sand, trace gravel; damp to moist.				2,4,7,8	
	Stiff brown and gray SILTY CLAY (CL), little f-c sand, trace gravel; moist. Vertical and horizontal iron stains.				4,6,8,6	
	Stiff gray CLAY (CH); moist. Laminated, high plasticity.	10				
	Stiff gray SILTY CLAY (CL), little f-c sand, little gravel; damp				3,4,6,6	
					3,5,5,5	
	@ 13.3' - possible seepage/increased moisture.					
		15			3,5,6,5	
					2,3,7,9	



2002\2116RM-1\WELLLO-1\RMI.wl2

Sharp and Associates, Inc.

DNR 7602.96
TYPE OR USE PEN
SELF TRANSCRIBING
PRESS HARD

WELL LOG AND DRILLING REPORT

Ohio Department of Natural Resources
Divison of Water, 1939 Fountain Square Drive
Columbus, Ohio 43224-9971 Voice (614) 265-6739 Fax (614) 447-9503

956784

WELL LOCATION

County: Ashtabula Township: Ashtabula

Owner/Builder (Circle One or Both): RMI Environmental / Services (First / Last)

Address of Well Location: 1601 (Number) E 21st St (Street Name)

City: Ashtabula Zip Code +4: 44004

Permit No.: NA Section/Lot No. (Circle One or Both):

Location of Well in State Plane Coordinates, if available: Use of Well: Monitoring : MW-909

☐ X _____ . _____ +/- _____ ft. or m

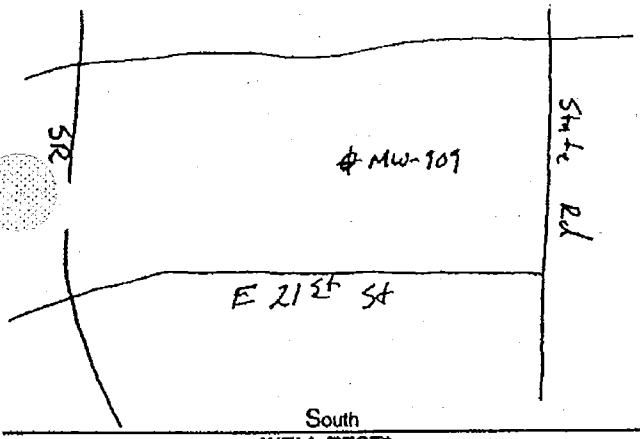
☐ Y _____ . _____ +/- _____ ft. or m

Elevation of Well _____ . _____ +/- _____ ft. or m

Datum Plain: ☐ NAD27 ☐ NAD83 Elevation Source _____

Source of Coordinates: ☐ GPS ☐ Survey ☐ Other _____

Sketch a map showing distance well lies from numbered state highways, street intersections, county roads, buildings or other notable landmarks. If latitude and longitude are available please include here: Lat: _____ Long: _____



WELL TEST*

Pumping Static Level: NA ft. Date _____

Measured from: ☐ Top of Casing ☐ Ground Level ☐ Other _____

Air ☐ Bailing ☐ Pumping* ☐ Other _____

Yield Rate _____ gpm Duration of Test _____ hrs.

Level of Drawdown _____ ft. Sustainable Yield _____ gpm

(Attach a copy of the pumping test record, per section 1521.05, ORC)

Copy Attached? ☐ Yes ☐ No Flowing Well? ☐ Yes ☐ No

Quality _____

PUMP/PITLESS

Type of pump: NA Capacity _____ gpm

Pump set at _____ ft. Pitless Type _____

Pump installed by _____

I hereby certify the information given is accurate and correct to the best of my knowledge.

Drilling Firm: Shaw and Associates, Inc

922 Crupper Ave

Columbus, OH 43229

Signature _____ Date: 11/4/02

Registration Number: NA

CONSTRUCTION DETAILS

☐ Rotary ☐ Cable ☒ Augered ☐ Driven ☐ Other _____

BOREHOLE/CASING (measured from ground surface)

1 ☒ Borehole Diameter 8 inches Depth 18 ft.
Casing Diameter 2 in. Length 20 ft. Thickness 0.154 in.

2 ☐ Borehole Diameter _____ inches Depth _____ ft.
Casing Diameter _____ in. Length _____ ft. Thickness _____ in.

Casing Height Above Ground 2 ft.

Type: 1 ☒ Steel 1 ☐ Galv. 1 ☐ PVC 1 ☐ 2 ☐ Other _____

Joints: 1 ☒ Threaded 1 ☐ Welded 1 ☐ Solvent 1 ☐ 2 ☐ Other _____

SCREEN

Diameter 2 Slot Size 0.010 Screen Length 5 ft.
Type Wire Wrapped Material Stainless Steel
Set Between 18 ft. and 13 ft.

GRAVEL PACK (Filter Pack)

Material/Size #4 Silica Volume/Weight Used 156 lbs
Method of Installation Gravity
Depth: Placed FROM 12 ft. TO 18 ft.

GROUT

Material Bentonite Volume/Weight Used 2 ft 3
Method of Installation Tremmie pipe
Depth: Placed FROM 10 ft. TO 3.5 ft.

DRILLING LOG*

INDICATE DEPTH(S) AT WHICH WATER IS ENCOUNTERED. Show color, texture, hardness, and formation: sandstone, shale, limestone, gravel, clay, sand, etc.	From	To
Fill - Gravel	0	0.5
Fill - Brown Silty Clay, ltl fg-mg Sand.	0.5	2.0
Topsoil	2.0	2.5
Brown/orange/gray Silty Clay	2.5	4.0
Brown/orange/gray Silty Clay w/ silt lenses, ltl fg-mg Sand	4.0	6.0
Brown Silty Clay, ltl fg-cg sand, trace gravel	6.0	8.3
Brown & gray Silty clay, ltl fg-cg Sand, trace gravel	8.3	9.5
Gray Clay	9.5	10.0
Gray Silty Clay, ltl fg-cg Sand ltl. gravel.	10.0	18.0

000023

*(If more space is needed to complete drilling log, use next consecutively numbered form.)

Date of Well Completion 10/21/02 Total Depth of Well 18 ft.

Completion of this form is required by section 1521.05, Ohio Revised Code - file within 30 days after completion of drilling.
ORIGINAL COPY TO - ODNR, DIVISION OF WATER, 1939 FOUNTAIN SQ. DRIVE, COLS., OHIO 43224-9971

MW-910

RMI Phase II

Project Number	9116-15	Drill Rig	PA Drilling Company
Geologist	Kevin Smith	Ground Elevation	Feet
Date Drilled	9/24/02	Total Depth of Borehole	12 Feet
Borehole Diameter	8 Inches	Depth to Water	Feet

Graphic Log	Description	Depth	Sample	PID	Blow Counts	Completion
	: Light gray SILTY CLAY (CL)					
	Light gray SILTY CLAY(CL); moist					
	Fill - Medium stiff gray SILTY CLAY (CL), little f-m sand; damp. Low plasticity.				3,3,3,3	
	Collected Shelby Press Tube - Gray SILTY CLAY (CL), little f-m sand; damp.	5				
	Fill - Soft brown and gray SILTY CLAY (CL), trace f-m sand; moist.				1,2	
	Collected Shelby Press Tube					
	Bottom of fill estimated at 9.5 feet below grade based on down pressure.					
	Very stiff gray SILTY CLAY (CL), little f-c sand, trace gravel; dry to damp.	10			7,8,11,12	
		15				

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DNR 7802.96
TYPE OR USE PEN
SELF TRANSCRIBING
PRESS HARD

WELL LOG AND DRILLING REPORT

Ohio Department of Natural Resources
Divison of Water, 1939 Fountain Square Drive
Columbus, Ohio 43224-9971 Voice (614) 265-6739 Fax (614) 447-9503

956785

WELL LOCATION

County Ashtabula Township Ashtabula

Owner/Builder (Circle One or Both) RMI Environmental Services
First Last

Address of Well Location 1661 E 21st St
Number Street Name

City Ashtabula Zip Code +4 44004

Permit No. NA Section/Lot No. (Circle One or Both)

Location of Well in State Plane Coordinates, if available: Use of Well Monitoring : MW-910

☐ X _____ . _____ +/- _____ ft. or m

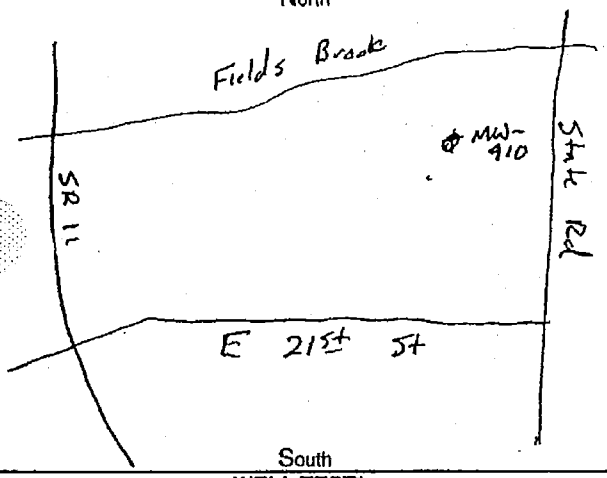
☐ Y _____ . _____ +/- _____ ft. or m

Elevation of Well _____ . _____ +/- _____ ft. or m

Datum Plain: ☐ NAD27 ☐ NAD83 Elevation Source _____

Source of Coordinates: ☐ GPS ☐ Survey ☐ Other _____

Sketch a map showing distance well lies from numbered state highways, street intersections, county roads, buildings or other notable landmarks. If latitude and longitude are available please include here: Lat: _____ Long: _____



WELL TEST*

Pre-Pumping Static Level NA ft. Date _____

Measured from: ☐ Top of Casing ☐ Ground Level ☐ Other _____

Air ☐ Bailing ☐ Pumping* ☐ Other _____

Yield Rate _____ gpm Duration of Test _____ hrs.

Depth of Drawdown _____ ft. Sustainable Yield _____ gpm

(Attach a copy of the pumping test record, per section 1521.05, ORC)

Copy Attached? ☐ Yes ☐ No Flowing Well? ☐ Yes ☐ No

Quality _____

PUMP/PITLESS

Type of pump NA Capacity _____ gpm

Pump set at _____ ft. Pitless Type _____

Pump installed by _____

I hereby certify the information given is accurate and correct to the best of my knowledge.

Drilling Firm Sharp and Associates, Inc

Address 982 Gruppur Ave

City Columbus, OH 43229

Signature _____ Date 11/4/02

Registration Number NA

CONSTRUCTION DETAILS

☐ Rotary ☐ Cable ☒ Augered ☐ Driven ☐ Other _____

BOREHOLE/CASING (measured from ground surface)

1 ☒ Borehole Diameter 8 inches Depth 12 ft.
Casing Diameter 2 in. Length 14 ft. Thickness 0.154 in.

2 ☐ Borehole Diameter _____ inches Depth _____ ft.
Casing Diameter _____ in. Length _____ ft. Thickness _____ in.

Casing Height Above Ground _____ ft.

Type 1 ☐ Steel 1 ☐ Galv. 1 ☒ PVC 1 ☐
2 ☐ 2 ☐ 2 ☐ 2 ☐ Other _____

Joints 1 ☒ Threaded 1 ☐ Welded 1 ☐ Solvent 1 ☐
2 ☐ 2 ☐ 2 ☐ 2 ☐ Other _____

SCREEN

Diameter 2-inch Slot Size 0.010 Screen Length 2 ft.
Type Machine Slot Material PVC
Set Between 7.5 ft. and 9.5 ft.

GRAVEL PACK (Filter Pack)

Material/Size #4 Silica Volume/Weight Used 75 lbs
Method of Installation Gravity
Depth: Placed FROM 9.5 ft. TO 6.5 ft.

GROUT

Material Bentonite Volume/Weight Used 0.5 ft³
Method of Installation Tremmie pipe
Depth: Placed FROM 4.5 ft. TO 3.0 ft.

DRILLING LOG*

INDICATE DEPTH(S) AT WHICH WATER IS ENCOUNTERED. Show color, texture, hardness, and formation: sandstone, shale, limestone, gravel, clay, sand, etc.	From	To
Fill – Gray Silty Clay, ltl. fg-mg Sand	0	9.5
Gray Silty Clay, ltl. fg-cg Sand, trace gravel	9.5	12

000025

*(If more space is needed to complete drilling log, use next consecutively numbered form.)

Date of Well Completion 9/24/02 Total Depth of Well 9.5 ft.

Completion of this form is required by section 1521.05, Ohio Revised Code - file within 30 days after completion of drilling.
ORIGINAL COPY TO - ODNR, DIVISION OF WATER, 1939 FOUNTAIN SQ. DRIVE, COLS., OHIO 43224-9971

MW-911

RMI Phase II

Project Number	9116-15	Drill Rig	CME 45C
Geologist	Kevin Smith	Ground Elevation	Feet
Date Drilled	8/25/02	Total Depth of Borehole	18 Feet
Borehole Diameter	8 Inches	Depth to Water	Feet

Graphic Log	Description	Depth	Sample	PID	Blow Counts	Completion
	Fill - Medium stiff brown and gray SILTY CLAY (CL), little f-c sand. Contains roots/organics. Collected Shelby Press Tube from 0' - 2'				4,4,4,4	
	Collected Shelby Press Tube from 5' - 7'	5				
	Medium stiff gray SILTY CLAY (CL), trace to little f-c sand, trace gravel; moist. Low plasticity, Vertical Iron stained fracture length of sample. Collected Shelby Press Tube from 8' - 10'				2,3	
	Stiff gray SILTY CLAY (CL), little f-c sand, trace gravel; damp. Low plasticity.	10			3,4,5,5	
					4,6,8,12	
		15			7,8,11,14	
	Hard dark gray SILTY CLAY (CL), little f-c sand, little gravel; damp. Contains angular Shale fragments.				7,16,17,20	

\\2002\2116 RMI GW\Well Logs\RMI.wl2

ONR 7802.96
TYPE OR USE PEN
SELF TRANSCRIBING
PRESS HARD

WELL LOG AND DRILLING REPORT

Ohio Department of Natural Resources
Divison of Water, 1939 Fountain Square Drive
Columbus, Ohio 43224-9971 Voice (614) 265-6739 Fax (614) 447-9503

956786

WELL LOCATION

Ashtabula County: Ashtabula Township: Ashtabula

Owner/Builder (Circle One or Both): RMI Environmental (First) Services (Last)

Address of Well Location: 1601 (Number) E 21st St (Street Name)

City: Ashtabula Zip Code +4: 44004

Permit No.: NA Section/Lot No. (Circle One or Both):

Location of Well in State Plane Coordinates, if available: Use of Well: Monitoring; MW-911

☐ X _____ . _____ +/- _____ ft. or m

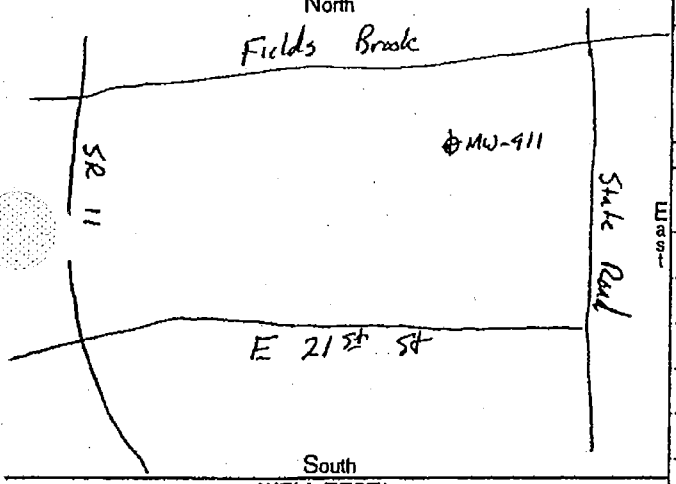
☐ Y _____ . _____ +/- _____ ft. or m

Elevation of Well _____ . _____ +/- _____ ft. or m

Datum Plain: ☐ NAD27 ☐ NAD83 Elevation Source _____

Source of Coordinates: ☐ GPS ☐ Survey ☐ Other _____

Sketch a map showing distance well lies from numbered state highways, street intersections, county roads, buildings or other notable landmarks. If latitude and longitude are available please include here: Lat: _____ Long: _____



WELL TEST*

Pumping Static Level: NA ft. Date _____

Measured from: ☐ Top of Casing ☐ Ground Level ☐ Other _____

Air ☐ Bailing ☐ Pumping* ☐ Other _____

Flow Rate _____ gpm Duration of Test _____ hrs.

Level of Drawdown _____ ft. Sustainable Yield _____ gpm

(Attach a copy of the pumping test record, per section 1521.05, ORC)

Copy Attached? ☐ Yes ☐ No Flowing Well? ☐ Yes ☐ No

Quality _____

PUMP/PITLESS

Type of pump: NA Capacity _____ gpm

Pump set at _____ ft. Pitless Type _____

Pump installed by _____

I hereby certify the information given is accurate and correct to the best of my knowledge.

Drilling Firm: Sharp and Associates, Inc.
982 Crupper Ave.
Columbus, OH 43229

Signature: _____ Date: 11/4/02

Registration Number: UA

CONSTRUCTION DETAILS

☐ Rotary ☐ Cable ☒ Augered ☐ Driven ☐ Other _____

BOREHOLE/CASING (measured from ground surface)

1 ☐ Borehole Diameter 8 inches Depth 18 ft.
Casing Diameter 2 in. Length 20 ft. Thickness 0.154 in.

2 ☐ Borehole Diameter _____ inches Depth _____ ft.
Casing Diameter _____ in. Length _____ ft. Thickness _____ in.

Casing Height Above Ground 2 ft.

	1	2
Type	☑ Steel	☐ Other
	☐ Galv.	
	☐ PVC	
Joints	☒ Threaded	☐ Other
	☐ Welded	
	☐ Solvent	

SCREEN

Diameter 2-in Slot Size 0.010 Screen Length 5 ft.
Type Wire wrapped Material Stainless steel
Set Between 18 ft. and 13 ft.

GRAVEL PACK (Filter Pack)

Material/Size #4 silica Volume/Weight Used 150 lbs (~~2 ft³~~)
Method of Installation ~~Tremmie pipe~~ Gravity
Depth: Placed FROM ~~18~~ ft. TO ~~3.5~~ 12 ft.

GROUT

Material Bentonite Volume/Weight Used 2 ft³
Method of Installation Tremmie Pipe
Depth: Placed FROM 16 ft. TO 3.5 ft.

DRILLING LOG*

INDICATE DEPTH(S) AT WHICH WATER IS ENCOUNTERED. Show color, texture, hardness, and formation: sandstone, shale, limestone, gravel, clay, sand, etc.	From	To
Fill - Brown and Gray Silty Clay	0	5.0
ltl. fg- cg. Sand		
Gray Silty Clay, ltl. fg-cg	5	16
Sand, trace gravel		
Gray Silty Clay, ltl. fg-cg	16	18
Sand, ltl. gravel		

00002

*(If more space is needed to complete drilling log, use next consecutively numbered form.)

Date of Well Completion 9/25/02 Total Depth of Well 18' ft.

Completion of this form is required by section 1521.05, Ohio Revised Code - file within 30 days after completion of drilling.
ORIGINAL COPY TO - ODNR, DIVISION OF WATER, 1939 FOUNTAIN SQ. DRIVE, COLS., OHIO 43224-9971

MW-912

RMI Phase II

Project Number	9116-15	Drill Rig	CME 45C
Geologist	Kevin Smith	Ground Elevation	Feet
Date Drilled	10/2/02	Total Depth of Borehole	11.2 Feet
Borehole Diameter	8 Inches	Depth to Water	Feet

Graphic Log	Description	Depth	Sample	PID	Blow Counts	Completion
	Fill - Medium stiff brown/gray mottled SILTY CLAY (CL), little f-c sand. Collected Shelby Tube from 0'-2'				1,2,4,1	
					WH,2	
	Collected Shelby Press Tube from 5' - 7'	5				
	Very stiff gray SILTY CLAY (CL), little f-c sand, little gravel; moist.				3,7	
	Collected Shelby Press Tube from 8' - 10'. Refusal at 9.1 feet.					
	Very stiff gray SILTY CLAY (CL), little f-c sand, little gravel; moist.				9,11	
	Gray SHALE	10			50/5"	
		15				

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Sharp and Associates, Inc.

000028

ONR 7802.96

TYPE OR USE PEN
SELF TRANSCRIBING
PRESS HARD

WELL LOG AND DRILLING REPORT

Ohio Department of Natural Resources
Divison of Water, 1939 Fountain Square Drive
Columbus, Ohio 43224-9971 Voice (614) 265-6739 Fax (614) 447-9503

956787

WELL LOCATION

County: Ashtabula Township: Ashtabula

Owner/Builder (Circle One or Both): RMI Environmental (First) Services (Last)

Address of Well Location: 1601 (Number) E 21st St (Street Name)

City: Ashtabula Zip Code +4: 44004

Permit No.: NA Section/Lot No. (Circle One or Both):

Location of Well in State Plane Coordinates, if available: Use of Well: Monitoring, MW-912

☐ X _____ . _____ +/- _____ ft. or m

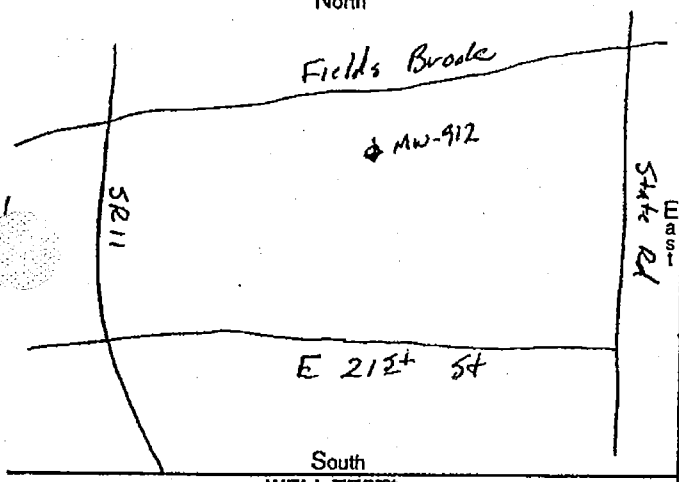
☐ Y _____ . _____ +/- _____ ft. or m

Elevation of Well _____ . _____ +/- _____ ft. or m

Datum Plain: ☐ NAD27 ☐ NAD83 Elevation Source _____

Source of Coordinates: ☐ GPS ☐ Survey ☐ Other _____

Sketch a map showing distance well lies from numbered state highways, street intersections, county roads, buildings or other notable landmarks. If latitude and longitude are available please include here: Lat: _____ Long: _____



WELL TEST*

Pre-Pumping Static Level: NA ft. Date: _____

Measured from: ☐ Top of Casing ☐ Ground Level ☐ Other _____

Air ☐ Bailing ☐ Pumping* ☐ Other _____

Test Rate _____ gpm Duration of Test _____ hrs.

Test of Drawdown _____ ft. Sustainable Yield _____ gpm

*Attach a copy of the pumping test record, per section 1521.05, ORC)

Copy Attached? ☐ Yes ☐ No Flowing Well? ☐ Yes ☐ No

Utility _____

PUMP/PITLESS

Type of pump: NA Capacity _____ gpm

Pump set at _____ ft. Pitless Type _____

Pump installed by _____

I hereby certify the information given is accurate and correct to the best of my knowledge.

Drilling Firm: Sharp and Associates, Inc

Address: 982 Crupper Ave.

City: Columbus, OH 43229

Signature: _____ Date: 11/4/02

Registration Number _____

CONSTRUCTION DETAILS

☐ Rotary ☐ Cable ☒ Augered ☐ Driven ☐ Other _____

BOREHOLE/CASING (measured from ground surface)

1 ☒ Borehole Diameter 8 inches Depth 11.2 ft.
Casing Diameter 2 in. Length 12 ft. Thickness .154 in.

2 ☐ Borehole Diameter _____ inches Depth _____ ft.
Casing Diameter _____ in. Length _____ ft. Thickness _____ in.

Casing Height Above Ground 2.5 ft.

Type: 1 ☐ 2 ☐ Steel; 1 ☐ 2 ☐ Galv.; 1 ☒ 2 ☐ PVC; 1 ☐ 2 ☐ Other _____

Joints: 1 ☒ 2 ☐ Threaded; 1 ☐ 2 ☐ Welded; 1 ☐ 2 ☐ Solvent; 1 ☐ 2 ☐ Other _____

SCREEN

Diameter 2-in Slot Size 0.010 Screen Length 2 ft.
Type Machine Slot Material PVC
Set Between 9.5 ft. and 7.5 ft.

GRAVEL PACK (Filter Pack)

Material/Size #4 Silica Volume/Weight Used 75 lbs
Method of Installation Gravity
Depth: Placed FROM 9.5 ft. TO 6.5 ft.

GROUT

Material Bentonite Volume/Weight Used 0.5 ft3
Method of Installation Tremmie pipe
Depth: Placed FROM 4.5 ft. TO 3.0 ft.

DRILLING LOG*

INDICATE DEPTH(S) AT WHICH WATER IS ENCOUNTERED. Show color, texture, hardness, and formation: sandstone, shale, limestone, gravel, clay, sand, etc.	From	To
Fill – Brown & gray Silty Clay	0	5
lt fg-cg. Sand		
Gray Silty Clay, lt. fg-cg sand, lt gravel	5	10.2
Gray Shale	10.2	11.2

000029

*(If more space is needed to complete drilling log, use next consecutively numbered form.)

Date of Well Completion 10/2/02 Total Depth of Well 9.5 ft.

Completion of this form is required by section 1521.05, Ohio Revised Code - file within 30 days after completion of drilling.
ORIGINAL COPY TO - ODNR, DIVISION OF WATER, 1939 FOUNTAIN SQ. DRIVE, COLS., OHIO 43224-9971

MW-913

RMI Phase II

Project Number	9116-15	Drill Rig	CME 45C
Geologist	Kevin Smith	Ground Elevation	Feet
Date Drilled	9/25/02	Total Depth of Borehole	18 Feet
Borehole Diameter	8 Inches	Depth to Water	Feet

Graphic Log	Description	Depth	Sample	PID	Blow Counts	Completion
	Topsoil Fill - Gravel				4,4,3,6	
	Very loose light brown SILT (ML), little clay, little f sand; moist.				WH,3,3,3	
	Loose light brown SILT (ML), little clay, little f sand; moist. Laminated, cohesive, non-plastic. @ 4.5' to 4.7' - seepage/wet	5			3,4,5,9	
	Stiff brown SILTY CLAY (CL), little f sand; wet. Medium plasticity. Medium dense gray SILT (ML), little f sand; wet. cohesive, non-plastic.				2,5,7,9	
					3,4,6,6	
	Very stiff gray SILTY CLAY (CL), little f-c sand, little gravel; moist.	10			3,6,9,9	
	Same As Above - Damp				4,7,9,11	
		15			4,8,8,9	
					4,7,9,9	

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Sharp and Associates, Inc.

DNR 7802.96
TYPE OR USE PEN
SELF TRANSCRIBING
PRESS HARD

WELL LOG AND DRILLING REPORT

Ohio Department of Natural Resources
Divison of Water, 1939 Fountain Square Drive
Columbus, Ohio 43224-9971 Voice (614) 265-6739 Fax (614) 447-9503

956788

WELL LOCATION

County: Ashtabula Township: Ashtabula

Owner/Builder (Circle One or Both): First: RMI Environmental Services Last:

Address of Well Location: Number: 1601 E Street Name: 21st St

City: Ashtabula Zip Code +4: 44004

Permit No. Section/Lot No. (Circle One or Both)

Location of Well in State Plane Coordinates, if available: Use of Well: Monitoring; MW-913

☐ X _____ +/- _____ ft. or m

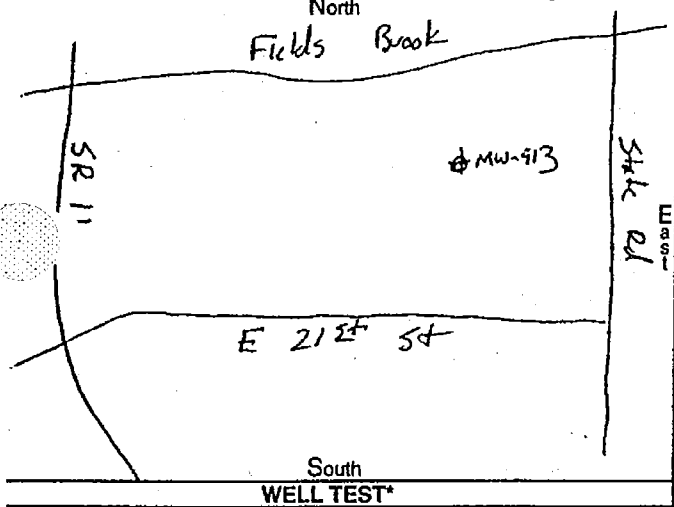
☐ Y _____ +/- _____ ft. or m

Elevation of Well _____ +/- _____ ft. or m

Datum Plain: ☐ NAD27 ☐ NAD83 Elevation Source

Source of Coordinates: ☐ GPS ☐ Survey ☐ Other

Sketch a map showing distance well lies from numbered state highways, street intersections, county roads, buildings or other notable landmarks. If latitude and longitude are available please include here: Lat: Long:



WELL TEST*

Pumping Static Level NA ft. Date

Measured from: ☐ Top of Casing ☐ Ground Level ☐ Other

Air ☐ Bailing ☐ Pumping* ☐ Other

Test Rate _____ gpm Duration of Test _____ hrs.

Depth of Drawdown _____ ft. Sustainable Yield _____ gpm

(Attach a copy of the pumping test record, per section 1521.05, ORC)

Copy Attached? ☐ Yes ☐ No Flowing Well? ☐ Yes ☐ No

Quality

PUMP/PITLESS

Type of pump NA Capacity _____ gpm

Pump set at _____ ft. Pitless Type

Pump Installed by

I hereby certify the information given is accurate and correct to the best of my knowledge.

Drilling Firm Sharp and Associates, Inc

982 Crupper Ave

City Columbus OH 43227

Signature Date 11/4/02

Registration Number NA

CONSTRUCTION DETAILS

☐ Rotary ☐ Cable ☒ Augered ☐ Driven ☐ Other

BOREHOLE/CASING (measured from ground surface)

1☒ Borehole Diameter 8 inches Depth 18 ft.
Casing Diameter 2 in. Length 20 ft. Thickness 0.154 in.

2☐ Borehole Diameter _____ inches Depth _____ ft.
Casing Diameter _____ in. Length _____ ft. Thickness _____ in.

Casing Height Above Ground 2 ft.

Type: 1☒ Steel 1☐ Galv. 1☐ PVC 1☐ 2☐ 2☐ 2☐ 2☐ Other

Joints: 1☒ Threaded 1☐ Welded 1☐ Solvent 1☐ 2☐ 2☐ 2☐ 2☐ Other

SCREEN

Diameter 2-in Slot Size 0.010 Screen Length 5 ft.
Type Wire wrapped Material Stainless
Set Between 18 ft. and 13 ft.

GRAVEL PACK (Filter Pack)

Material/Size #4 Silica Volume/Weight Used 150 lbs
Method of Installation Gravity
Depth: Placed FROM 18 ft. TO 12 ft.

GROUT

Material Bentonite Volume/Weight Used 2 ft³
Method of Installation Tremmie pipe
Depth: Placed FROM 10 ft. TO 3.5 ft.

DRILLING LOG*

INDICATE DEPTH(S) AT WHICH WATER IS ENCOUNTERED. Show color, texture, hardness, and formation: sandstone, shale, limestone, gravel, clay, sand, etc.	From	To
Fill - Gravel	0	2
Brown SILT, ltl. clay, ltl. fg Sand	2	6
Brown Silty Clay, ltl fg Sand	6	6.8
Gray Silt, ltl. fg Sand	6.8	9.4
Gray Silty Clay, ltl. fg-cg Sand, ltl. gravel	9.4	18

000031

*(If more space is needed to complete drilling log, use next consecutively numbered form.)

Date of Well Completion 9/25/02 Total Depth of Well 18 ft.

Completion of this form is required by section 1521.05, Ohio Revised Code - file within 30 days after completion of drilling.
ORIGINAL COPY TO - ODNR, DIVISION OF WATER, 1939 FOUNTAIN SQ. DRIVE, COLS., OHIO 43224-9971

MW-914

RMI Phase II

Project Number	9116-15	Drill Rig	CME 45C
Geologist	Kevin Smith	Ground Elevation	Feet
Date Drilled	10/2/02	Total Depth of Borehole	10 Feet
Borehole Diameter	8 Inches	Depth to Water	Feet

Graphic Log	Description	Depth	Sample	PID	Blow Counts	Completion
	Medium stiff brown/gray/orange mottled CLAYEY SILT (CL-ML), trace sand. Contains roots/organic fibers.				3,2,3,3	
	Very stiff brown and gray SILTY CLAY (CL), little f-c sand, little gravel; damp to moist. Low plasticity.				3,9,13,18	
	Very Stiff gray SILTY CLAY (CL), little f-c sand, little gravel; damp. Low plasticity.	5			6,12,12, 14	
	Increasing angular Shale fragments, decreasing moisture content.				5,11,14, 18	
					5,13,18, 50/5"	
	Gray SHALE; dry.	10				
		15				

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Sharp and Associates, Inc.

000032

DNR 7002.98

TYPE OR USE PEN
SELF TRANSCRIBING
PRESS HARD

WELL LOG AND DRILLING REPORT

Ohio Department of Natural Resources
Divison of Water, 1939 Fountain Square Drive
Columbus, Ohio 43224-9971 Voice (614) 265-6739 Fax (614) 447-9503

956789

WELL LOCATION

County: Ashtabula Township: Ashtabula

Owner/Builder (Circle One or Both): RMI Environmental Services (First / Last)

Address of Well Location: 1601 (Number) E 21st St (Street Name)

City: Ashtabula Zip Code +4: 44004

Permit No.: NA Section/Lot No. (Circle One or Both):

Location of Well in State Plane Coordinates, if available: Use of Well: Monitoring; MW-914

☐ X _____ . _____ +/- _____ ft. or m

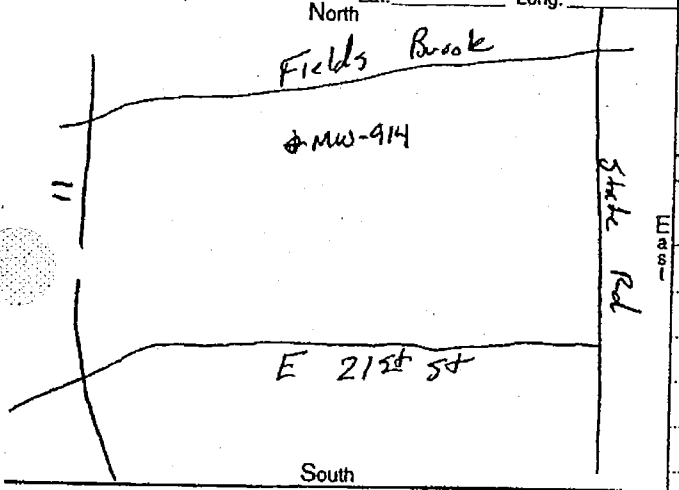
☐ Y _____ . _____ +/- _____ ft. or m

Elevation of Well _____ . _____ +/- _____ ft. or m

Datum Plain: ☐ NAD27 ☐ NAD83 Elevation Source _____

Source of Coordinates: ☐ GPS ☐ Survey ☐ Other _____

Sketch a map showing distance well lies from numbered state highways, street intersections, county roads, buildings or other notable landmarks. If latitude and longitude are available please include here: Lat: _____ Long: _____



WELL TEST*

Pumping Static Level NA ft. Date _____

Measured from: ☐ Top of Casing ☐ Ground Level ☐ Other _____

Air ☐ Bailing ☐ Pumping* ☐ Other _____

Flow Rate _____ gpm Duration of Test _____ hrs.

Depth of Drawdown _____ ft. Sustainable Yield _____ gpm

*(Attach a copy of the pumping test record, per section 1521.05, ORC)

Copy Attached? ☐ Yes ☐ No Flowing Well? ☐ Yes ☐ No

Quality _____

PUMP/PITLESS

Type of pump NA Capacity _____ gpm

Depth set at _____ ft. Pitless Type _____

Pump installed by _____

I hereby certify the information given is accurate and correct to the best of my knowledge.

Drilling Firm: Sharp and Associates, Inc

Address: 982 Crupper Ave
Columbus, OH 43229

Signature: _____ Date: 11/4/02

Certification Number _____

CONSTRUCTION DETAILS

☐ Rotary ☐ Cable ☒ Augered ☐ Driven ☐ Other _____

BOREHOLE/CASING (measured from ground surface)

1☒ Borehole Diameter 8 inches Depth 9.5 ft.
Casing Diameter 2" in. Length 10 ft. Thickness .154 in.

2☐ Borehole Diameter _____ inches Depth _____ ft.
Casing Diameter _____ in. Length _____ ft. Thickness _____ in.

Casing Height Above Ground _____ ft.

Type: 1☐ Steel 1☐ Galv. 1☒ PVC 1☐ 2☐ Other _____

Joints: 1☒ Threaded 1☐ Welded 1☐ Solvent 1☐ 2☐ Other _____

SCREEN

Diameter 2-inch Slot Size .010 Screen Length 2 ft.
Type Machine Slotted Material PVC
Set Between 9.5 ft. and 7.5 ft.

GRAVEL PACK (Filter Pack)

Material/Size #4 Silica Volume/Weight Used 75 lbs
Method of Installation Gravity
Depth: Placed FROM 9.5 ft. TO 6.5 ft.

GROUT

Material Bentonite Volume/Weight Used 0.5 ft³
Method of Installation Tremie Pipe
Depth: Placed FROM 4.5 ft. TO 3.0 ft.

DRILLING LOG*

INDICATE DEPTH(S) AT WHICH WATER IS ENCOUNTERED. Show color, texture, hardness, and formation: sandstone, shale, limestone, gravel, clay, sand, etc.	From	To
Brown/orange/gray Clayey Silt, trace Sand	0	2.3
Brown and gray Silty Clay, ltl. fg-cg Sand, ltl. gravel	2.3	3.7
Gray Silty Clay, ltl. fg-cg. Sand, ltl. gravel	3.7	9.6
Gray Shale	9.6	10

000033

*(If more space is needed to complete drilling log, use next consecutively numbered form.)

Date of Well Completion 10/2/02 Total Depth of Well 9.5 ft.

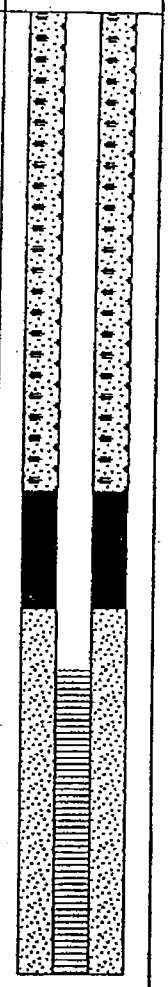
Completion of this form is required by section 1521.05, Ohio Revised Code - file within 30 days after completion of drilling.
ORIGINAL COPY TO - ODNR, DIVISION OF WATER, 1939 FOUNTAIN SQ. DRIVE, COLS., OHIO 43224-9971

MW-915

RMI Phase II

Project Number	9116-15	Drill Rig	CME 45C
Geologist	Kevin Smith	Ground Elevation	Feet
Date Drilled	10/9/02	Total Depth of Borehole	Feet
Borehole Diameter	8 Inches	Depth to Water	Feet

Graphic Log	Description	Depth	Sample	PID	Blow Counts	Completion
	MW-312 Replacement - No Samples Collected	5, 10, 15				



20021116RM-1\WELLLO-1RMI.wl2

Sharp and Associates, Inc.

000034

DNR 7802.96

TYPE OR USE PEN
SELF TRANSCRIBING
PRESS HARD

WELL LOG AND DRILLING REPORT

Ohio Department of Natural Resources
Divison of Water, 1939 Fountain Square Drive
Columbus, Ohio 43224-9971 Voice (614) 265-6739 Fax (614) 447-9503

956790

WELL LOCATION

c Ashtabula Township Ashtabula

wner/Builder (Circle One or Both) RMI Environmental Services (First / Last)

ddress of Well Location ~~[illegible]~~ 1601 E 21st St (Number / Street Name)

ty Ashtabula Zip Code +4 44004

rmit No. NA Section/Lot No. (Circle One or Both)

cation of Well in State Plane ordinates, if available: Use of Well Monitoring; MW-915

☐ X _____ . _____ +/- _____ ft. or m

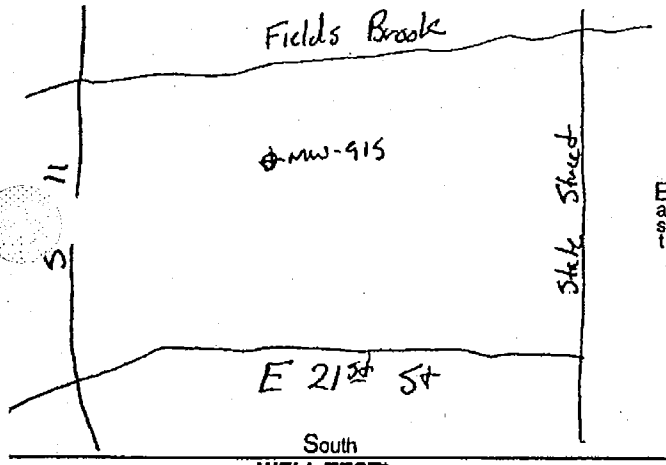
☐ Y _____ . _____ +/- _____ ft. or m

vation of Well _____ . _____ +/- _____ ft. or m

atum Plain: ☐ NAD27 ☐ NAD83 Elevation Source _____

urce of Coordinates: ☐ GPS ☐ Survey ☐ Other _____

ketch a map showing distance well lies from numbered state highways, street tersections, county roads, buildings or other notable landmarks. If latitude and ngitude are available please include here: Lat: _____ Long: _____



WELL TEST*

Pumping Static Level NA ft. Date _____

sured from: ☐ Top of Casing ☐ Ground Level ☐ Other _____

r ☐ Bailing ☐ Pumping* ☐ Other _____

Rate _____ gpm Duration of Test _____ hrs.

of Drawdown _____ ft. Sustainable Yield _____ gpm

ach a copy of the pumping test record, per section 1521.05, ORC)

py Attached? ☐ Yes ☐ No Flowing Well? ☐ Yes ☐ No

lity _____

PUMP/PITLESS

of pump NA Capacity _____ gpm

p set at _____ ft. Pitless Type _____

p installed by _____

ereby certify the information given is accurate and correct to the best of my knowledge.

ng Firm Sharp and Associates, Inc
982 Crupper Ave
Columbus, OH 43227

[signature] Date 11/4/02

ration Number NA

CONSTRUCTION DETAILS

☐ Rotary ☐ Cable ☒ Augered ☐ Driven ☐ Other _____

BOREHOLE/CASING (measured from ground surface)

1☐ Borehole Diameter 8 inches Depth 16 ft.
Casing Diameter -2 in. Length 18 ft. Thickness 0.154 in.

2☐ Borehole Diameter _____ inches Depth _____ ft.
Casing Diameter _____ in. Length _____ ft. Thickness _____ in.

Casing Height Above Ground 2 ft.

Type: 1☒ 2☐ Steel; 1☐ 2☐ Galv.; 1☐ 2☐ PVC; 1☐ 2☐ Other _____

Joints: 1☒ 2☐ Threaded; 1☐ 2☐ Welded; 1☐ 2☐ Solvent; 1☐ 2☐ Other _____

SCREEN

Diameter 2-inch Slot Size 0.010 Screen Length 5 ft.

Type Wire wrapped Material Stainless

Set Between 16 ft. and 11 ft.

GRAVEL PACK (Filter Pack)

Material/Size #4 Silica Volume/Weight Used ~~2 ft~~ 150 lbs

Method of Installation Gravity

Depth: Placed FROM 16 ft. TO 10 ft.

GROUT

Material Bentonite Volume/Weight Used 2 ft 3

Method of Installation Tremmie Pipe

Depth: Placed FROM 8 ft. TO 3.5 ft.

DRILLING LOG*

INDICATE DEPTH(S) AT WHICH WATER IS ENCOUNTERED. Show color, texture, hardness, and formation: sandstone, shale, limestone, gravel, clay, sand, etc.	From	To
Orange / Brown / Gray Silt w/ clay trace sand	0	3.5
Brown SILT w/ clay, trace sand	3.5	7
Gray Clay, little silt, trace sand	7	14
Gray Clay, lt. silt, trace sand fragments of fractured shale	14	16

000035

*(If more space is needed to complete drilling log, use next consecutively numbered form.)

Date of Well Completion 10/9/02 Total Depth of Well 16 ft.

Completion of this form is required by section 1521.05, Ohio Revised Code - file within 30 days after completion of drilling.
ORIGINAL COPY TO - ODNR. DIVISION OF WATER. 1939 FOUNTAIN SQ. DRIVE. COLS., OHIO 43224-9971

Ashtabula Closure Project

FINAL RMI REPORT

PHASE II

SEPETEMBER 2003

Appendix B

DNR 7810.00

WATER WELL SEALING REPORT
OHIO DEPARTMENT OF NATURAL RESOURCES

0144481

Division of Water
1939 Fountain Square Drive
Columbus, Ohio 43224-1385
Voice: (614) 265-6739 Fax: (614) 265-6767

LOCATION

County Ashtabula Township Ashtabula Section/Lot Number (Circle One or Both)

Owner/Builder RMI Environmental Services (Circle One or Both)

Address of Well Location 1601 East 21st Street (Number / Street Name)

City Ashtabula Zip Code +4 44004

0.1 miles East (n, e, s, w) of E. 21st St & SR 11 (nearest intersection)

Property Location Description on the north (n, e, s, w) side of East 21st Street (road name)

Location of Well in State Plane Coordinates, if available N ☐ S ☐ X _____ ft. or m +/- _____ Y _____ ft. or m +/- _____

Elevation of Well _____ ft. or m +/- _____ Datum Plain: ☐ NAD27 ☐ NAD83

Source of Coordinates: ☐ GPS ☐ Survey ☐ Other _____

ORIGINAL WELL ODNR Well Log Number _____ Copy attached? Yes or No (circle one)

MEASURED CONSTRUCTION DETAILS Date of measurements 10/1/02

Well 15 - feet Static Water Level NA

Casing 2-inch Length of casing 15 - feet

Well Condition Surface damage.

SEALING PROCEDURE

Method of Placement Tremmie pipe

Placement:				Sealing Material	Volume
	From 15	To 0		portland cement	5 ft³
	From	To			
	From	To			

Was Casing Removed? Yes or No (circle one)

Condition of Casing Surface damage

Perforations: From 4.5 To 14.5

From To

Date Sealing Performed 10/1/02

Reason(s) for Sealing Surface water infiltration.

CONTRACTOR

Name Sharp and Associates Inc. ODH Registration # N/A

982 Cropper Ave

Zip Columbus, OH 43229

Date _____ Signature _____

I hereby certify the information given is accurate and correct to the best of my knowledge.

000019

Completion of this form is required by section 1521.05 (B) (9), Ohio Revised Code - file within 30 days after completion of sealing.

ORIGINAL COPY TO - ODNR, DIVISION OF WATER, 1939 FOUNTAIN SQ. DRIVE, COLS., OHIO 43224-1385

DNR 7810.00

WATER WELL SEALING REPORT
OHIO DEPARTMENT OF NATURAL RESOURCES
Division of Water
1939 Fountain Square Drive
Columbus, Ohio 43224-1385
Voice: (614) 265-6739 Fax: (614) 265-6767

0144482

LOCATION

County Ashtabula Township Ashtabula Section/Lot Number (Circle One or Both)

Owner/Builder RMI Environmental Services (Circle One or Both)

Address of Well Location 1601 (Number) E 21st St (Street Name)

City Ashtabula, OH Zip Code +4 44004

0.1 miles east (n, e, s, w) of E 21st St + SR 11 (nearest intersection)

Property Location Description on the north (n, e, s, w) side of E 21st St (road name)

Location of Well in State Plane Coordinates, if available N ☐ S ☐ X ____ ft. or m +/- ____ Y ____ ft. or m +/- ____

Elevation of Well 634.__ (ft. or m) +/- 1 Datum Plain: ☐ NAD27 ☐ NAD83

Source of Coordinates: ☐ GPS ☐ Survey ☐ Other ____

ORIGINAL WELL ODNR Well Log Number 883305 Copy attached? (circle one) Yes or No

MEASURED CONSTRUCTION DETAILS Date of measurements 9/25/02

Well 10 - feet Static Water Level NA

Casing 2-inch Length of casing ____

Well Condition Surface damage

SEALING PROCEDURE

Method of Placement Tremmie Pipe

Placement:	From	To	Sealing Material	Volume
	0	10	Portland Cement	3 / 4 ft
	From ____	To ____		
	From ____	To ____		

Was Casing Removed? Yes or No (circle one)

Condition of Casing Surface damage

Perforations: From 5 To 10

From ____ To ____

Date Sealing Performed 9/25/02

Reason(s) for Sealing Surface water infiltration

CONTRACTOR

Name Sharp + Associates, Inc. ODH Registration # NA

Address 982 Cruiser Ave.

City Columbus OH 43229

Signature ____ I hereby certify the information given is accurate and correct to the best of my knowledge.

000001

Completion of this form is required by section 1521.05 (B) (9), Ohio Revised Code - file within 30 days after completion of sealing.

ORIGINAL COPY TO - ODNR, DIVISION OF WATER, 1939 FOUNTAIN SQ. DRIVE, COLS., OHIO 43224-1385

Blue - Customer's copy Pink - Driller's copy Green - Local Health Dept. copy

- TYPE OR USE PEN
SELF TRANSCRIBING
PRESS HARD

WELL LOG AND DRILLING REPORT

Ohio Department of Natural Resources
Divison of Water, 1939 Fountain Square Drive
Columbus, Ohio 43224-9971 Voice (614) 265-6739 Fax (614) 447-9503

883305

WELL LOCATION

County: Ashtabula Township: Ashtabula

Owner/Builder (Circle One or Both): First: BMI Titanium Company Extrusion Plant Last:

Address of Well Location: Number: 1601 Street Name: E. 21 st. Street

City: Ashtabula Zip Code +4: 44005-0575

Permit No.: NA Section/Lot No. (Circle One or Both): NA

Location of Well in State Plane Coordinates, if available: Use of Well: Monitoring (#512)

X E 6429. 183 +/- 1 ft or m

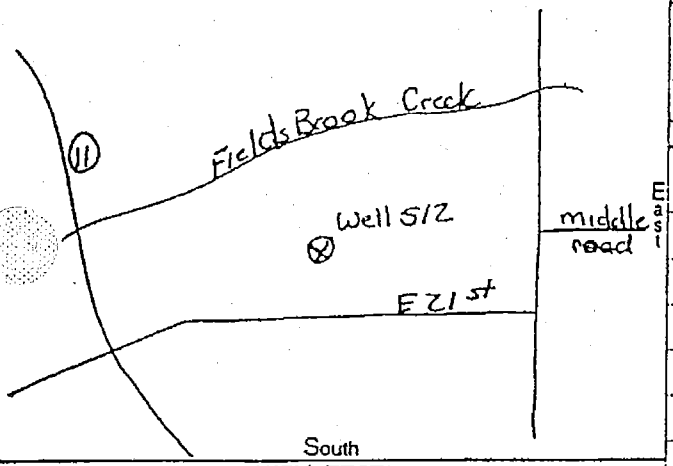
Y N 4964. 983 +/- 1 ft or m

Elevation of Well: 634. +/- 1 ft or m

Datum Plain: ☐ NAD27 ☐ NAD83 Elevation Source: Survey map

Source of Coordinates: ☐ GPS ☒ Survey ☐ Other

Sketch a map showing distance well lies from numbered state highways, street intersections, county roads, buildings or other notable landmarks. If latitude and longitude are available please include here: Lat: Long:



WELL TEST*

Pumping Static Level: NA ft. Date:

Measured from: ☐ Top of Casing ☐ Ground Level ☐ Other

Air: ☐ Bailing ☐ Pumping* ☐ Other

Yield: Rate gpm Duration of Test hrs.

Level of Drawdown ft. Sustainable Yield gpm

(Attach a copy of the pumping test record, per section 1521.05, ORC)

Copy Attached? ☐ Yes ☐ No Flowing Well? ☐ Yes ☐ No

Quality:

PUMP/PITLESS

Type of pump: NA Capacity gpm

Pump set at ft. Pitless Type:

Pump installed by:

I hereby certify the information given is accurate and correct to the best of my knowledge.

Reg. Firm: Consultants Eckenfelder Inc.

Address: 227 French Landing Drive

Zip: Nashville TN 37228

Reg. Christ Date: 11/29/99

Registration Number:

CONSTRUCTION DETAILS

☐ Rotary ☐ Cable ☒ Augered ☐ Driven ☐ Other

BOREHOLE/CASING (measured from ground surface)

1 ☐ Borehole Diameter 6 inches Depth 10 ft.

Casing Diameter 2 in. Length 5.7 ft. Thickness 0.2 in.

2 ☐ Borehole Diameter inches Depth ft.

Casing Diameter in. Length ft. Thickness in.

Casing Height Above Ground 2 ft.

Type: 1 ☐ Steel 1 ☐ Galv. 1 ☐ PVC 1 ☒ 2 ☐ Other stainless steel

Joints: 1 ☐ Threaded 1 ☐ Welded 1 ☐ Solvent 1 ☐ 2 ☐ Other

SCREEN

Diameter 2 Slot Size 10 Screen Length 5 ft.

Type wire wrapped Material Stainless Steel

Set Between 5 ft. and 10 ft.

GRAVEL PACK (Filter Pack)

Material/Size No 1 Marine Volume/Weight Used 3.2 ft³

Method of Installation Gravity Pour

Depth: Placed FROM 4 ft. TO 10 ft.

GROUT

Material Type I Portland +2% Bentonite Volume/Weight Used

Method of Installation Gravity Pour

Depth: Placed FROM 0 ft. TO 2.5 ft.

Bentonite 2.5 to 4

DRILLING LOG*

INDICATE DEPTH(S) AT WHICH WATER IS ENCOUNTERED. Show color, texture, hardness, and formation: sandstone, shale, limestone, gravel, clay, sand, etc.	From	To
Dark Gray Clayey Silt, Lt. fine Sand	0	4
Dark Gray Clayey Silt,	4	5
Tan Silty find Sand, Lt. Clay (wet)	5	10
Gray Clayey Silt, Lt. fine Sand,	10	-14

000002

*(If more space is needed to complete drilling log, use next consecutively numbered form.)

Date of Well Completion 10/13/99 Total Depth of Well 10 ft.

Completion of this form is required by section 1521.05, Ohio Revised Code - file within 30 days after completion of drilling.
ORIGINAL COPY TO - ODNR, DIVISION OF WATER, 1939 FOUNTAIN SQ. DRIVE, COLS., OHIO 43224-9971

DNR 7810.00

WATER WELL SEALING REPORT
OHIO DEPARTMENT OF NATURAL RESOURCES

0144483

Division of Water
1939 Fountain Square Drive
Columbus, Ohio 43224-1385
Voice: (614) 265-6739 Fax: (614) 265-6767

LOCATION

County Ashtabula Township Ashtabula Section/Lot Number (Circle One or Both)

Owner/Builder (Circle One or Both) RMI Environmental Services

Address of Well Location 1601 (Number) East 21st Street (Street Name)

City Ashtabula Zip Code +4 44004

0.1 miles East (n, e, s, w) of E. 21st St + SR 11 (nearest intersection)

Property Location Description: on the north (n, e, s, w) side of East 21st Street (road name)

Location of Well in State Plane coordinates, if available: N ☐ S ☐ X [ ] ft. or m +/- [ ] Y [ ] ft. or m +/- [ ]

Elevation of Well [ ] ft. or m +/- [ ] Datum Plain: ☐ NAD27 ☐ NAD83

Source of Coordinates: ☐ GPS ☐ Survey ☐ Other

ORIGINAL WELL ODNR Well Log Number Copy attached? (circle one) Yes or No

MEASURED CONSTRUCTION DETAILS Date of measurements 10/3/02

of Well 14 - feet Static Water Level NA

f Casing 2 - inch Length of casing 14 - feet

Well Condition Surface damage

SEALING PROCEDURE

Method of Placement tremmie pipe

Placement:	From	To	Sealing Material	Volume
	0	15	portland cement	5 ft 3
	From	To		
	From	To		

Was Casing Removed? (Yes) or No (circle one)

Condition of Casing Surface damage

Perforations: From 4 To 14

From To

Date Sealing Performed 10/3/02

Reason(s) for Sealing Surface water Infiltration

CONTRACTOR

Name Sharp and Associates, Inc ODH Registration # N/A

Address 982 Cropper Ave

City/State/Zip Columbus, OH 43229

Signature

I hereby certify the information given is accurate and correct to the best of my knowledge.

000618

Completion of this form is required by section 1521.05 (B) (9), Ohio Revised Code - file within 30 days after completion of sealing.

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ONR 7810.00

WATER WELL SEALING REPORT
OHIO DEPARTMENT OF NATURAL RESOURCES
Division of Water
1939 Fountain Square Drive
Columbus, Ohio 43224-1385
Voice: (614) 265-6739 Fax: (614) 265-6767

0144484

LOCATION

County Ashtabula Township Ashtabula (Circle One or Both) Section/Lot Number

Owner/Builder RMI Environmental Services
(Circle One or Both)

Address of Well Location 1601 (Number) East 21st Street (Street Name)

City Ashtabula, OH Zip Code +4 44004

0.1 miles north (n, e, s, w) East of E. 21st & SR 11 (nearest intersection)

Property Location Description on the north (n, e, s, w) side of East 21st Street (road name)

Location of Well in State Plane Coordinates, if available N ☐ S ☐ X ____ +/- ____ ft. or m Y ____ +/- ____ ft. or m

Elevation of Well ____ +/- ____ ft. or m Datum Plain: ☐ NAD27 ☐ NAD83

Source of Coordinates: ☐ GPS ☐ Survey ☐ Other

ORIGINAL WELL ODNR Well Log Number ____ Copy attached? Yes or No (circle one)

MEASURED CONSTRUCTION DETAILS Date of measurements 10/11/02

Depth of Well 14.8 - feet Static Water Level NA

Casing 2-inch Length of casing 14.8 - feet

Description Surface damage

SEALING PROCEDURE

Method of Placement tremmie pipe

Placement:				Sealing Material	Volume
	From 0	To 15		portland cement	5 ft 3
	From ____	To ____			
	From ____	To ____			

Was Casing Removed? Yes or No (circle one)

Condition of Casing Surface damage

Perforations: From 4.8' To 14.8'

From ____ To ____

Date Sealing Performed 10/11/02

Reason(s) for Sealing Surface water infiltration

CONTRACTOR

Name Sharp and Associates, Inc. ODH Registration # N/A

Address 982 Cropper Avenue

City Columbus, Ohio 43229

Signature
I hereby certify the information given is accurate and correct to the best of my knowledge.

000017

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DNR 7810.00

WATER WELL SEALING REPORT
OHIO DEPARTMENT OF NATURAL RESOURCES
Division of Water
1939 Fountain Square Drive
Columbus, Ohio 43224-1385
Voice: (614) 265-6739 Fax: (614) 265-6767

0144485

LOCATION

County Ashtabula Township Ashtabula Section/Lot Number (Circle One or Both)

Owner/Builder RMT Environmental Services (Circle One or Both)

Address of Well Location 1601 (Number) East 21st Street (Street Name)

City Ashtabula, OH Zip Code +4 44004

0.1 miles east (n, e, s, w) of E 21st St & SR 11 (nearest intersection)

Property Location Description: on the north (n, e, s, w) side of E 21st St (road name)

Location of Well in State Plane coordinates, if available: N ☐ S ☐ X [ ] ft. or m +/- [ ] Y [ ] ft. or m +/- [ ]

Elevation of Well [ ] ft. or m +/- [ ] Datum Plain: ☐ NAD27 ☐ NAD83

Source of Coordinates: ☐ GPS ☐ Survey ☐ Other

ORIGINAL WELL ODNR Well Log Number [ ] Copy attached? (circle one) Yes or No

MEASURED CONSTRUCTION DETAILS Date of measurements 10/1/02

Depth of Well 15 - feet Static Water Level NA

Casing 2-inch Length of casing 15 - feet

Well Condition Surface damage

SEALING PROCEDURE

Method of Placement tremmie pipe

Placement:	From	To	Sealing Material	Volume
	0	15	portland cement	5 ft 3

Was Casing Removed? Yes or No (circle one)

Condition of Casing Surface damage

Perforations: From 5 To 15

From [ ] To [ ]

Date Sealing Performed 10/1/02

Reason(s) for Sealing Surface water Infiltration

CONTRACTOR

Name Sharp and Associates, Inc ODH Registration # NA

Address 582 Crupper Ave

City/State/Zip Columbus OH 43229

Signature [signature] I hereby certify the information given is accurate and correct to the best of my knowledge.

000016

Completion of this form is required by section 1521.05 (B) (9), Ohio Revised Code - file within 30 days after completion of sealing.

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DNR 7810.00

WATER WELL SEALING REPORT
OHIO DEPARTMENT OF NATURAL RESOURCES
Division of Water
1939 Fountain Square Drive
Columbus, Ohio 43224-1385
Voice: (614) 265-6739 Fax: (614) 265-6767

0144486

LOCATION

County Ashtabula Township Ashtabula (Circle One or Both) Section/Lot Number

Owner/Builder RMT Environmental Services
(Circle One or Both)

Address of Well Location 1601 E. 21st St.
Number Street Name

City Ashtabula, OH Zip Code +4 44004

0.1 miles east of E 21st St + SR 11
n, e, s, w nearest intersection

Property Location Description on the north side of E. 21st St.
n, e, s, w road name

Location of Well in State Plane Coordinates, if available N ☐ S ☐ X _____ +/- _____ ft. or m Y _____ +/- _____ ft. or m

Elevation of Well _____ +/- _____ ft. or m Datum Plain: ☐ NAD27 ☐ NAD83

Source of Coordinates: ☐ GPS ☐ Survey ☐ Other

ORIGINAL WELL ODNR Well Log Number _____ Copy attached? Yes or No
(circle one)

MEASURED CONSTRUCTION DETAILS Date of measurements 10/1/01

Depth of Well 15 - feet Static Water Level NA

Casing 2-inch Length of casing 15'

Well Condition Surface damage

SEALING PROCEDURE

Method of Placement tremmie pipe

				Sealing Material	Volume
Placement:	From 0	To 15		portland cement	5 ft 3
	From	To			
	From	To			

Was Casing Removed? Yes or No (circle one)

Condition of Casing Surface damage

Perforations: From 5 To 15
From To

Date Sealing Performed 10/1/01

Reason(s) for Sealing Surface water infiltration

CONTRACTOR

Name Sharp and Associates ODH Registration # NA

Address 982 Cropper Ave

City Columbus, OH 43229

Signature _____
I hereby certify the information given is accurate and correct to the best of my knowledge.

000015

Completion of this form is required by section 1521.05 (B) (9), Ohio Revised Code - file within 30 days after completion of sealing.
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DNR 7810.00

WATER WELL SEALING REPORT
OHIO DEPARTMENT OF NATURAL RESOURCES

0144487

Division of Water
1939 Fountain Square Drive
Columbus, Ohio 43224-1385
Voice: (614) 265-6739 Fax: (614) 265-6767

LOCATION

County Ashtabula Township Ashtabula Section/Lot Number (Circle One or Both)

Owner/Builder RMI Environmental Services (Circle One or Both)

Address of Well Location 1601 (Number) E. 21st St. (Street Name)

City Ashtabula, OH Zip Code +4 44004

0.1 miles east (n, e, s, w) of E. 21st St + SR 11 (nearest intersection)

Property Location Description: on the north (n, e, s, w) side of E. 21st St. (road name)

Location of Well in State Plane coordinates, if available: N ☐ S ☐ X ____ ft. or m +/- ____ Y ____ ft. or m +/- ____

Elevation of Well ____ ft. or m +/- ____ Datum Plain: ☐ NAD27 ☐ NAD83

Source of Coordinates: ☐ GPS ☐ Survey ☐ Other

ORIGINAL WELL ODNR Well Log Number ____ Copy attached? Yes or No (circle one)

MEASURED CONSTRUCTION DETAILS Date of measurements 10/4/02

of Well 15 - feet Static Water Level NA

of Casing 2-inch Length of casing 15 - feet

Well Condition Surface damage

SEALING PROCEDURE

Method of Placement tremmie Pipe

Placement:	From	To	Sealing Material	Volume
	0	15	portland cement	5 ft 3
	From	To		
	From	To		

Was Casing Removed? Yes or No (circle one)

Condition of Casing Surface Damage

Perforations: From 5 To 15

From ____ To ____

Date Sealing Performed 10/4/02

Reason(s) for Sealing Surface water infiltration

CONTRACTOR

Name Sharp & Associates, Inc. ODH Registration # ____

Address 982 Crupper Ave

City/State/Zip Columbus, OH 43229

Signature [signature] I hereby certify the information given is accurate and correct to the best of my knowledge.

000014

Completion of this form is required by section 1521.05 (B) (9), Ohio Revised Code - file within 30 days after completion of sealing.

ORIGINAL COPY TO - ODNR, DIVISION OF WATER, 1939 FOUNTAIN SQ. DRIVE, COLS., OHIO 43224-1385

ONR 7810.00

WATER WELL SEALING REPORT
OHIO DEPARTMENT OF NATURAL RESOURCES
Division of Water
1939 Fountain Square Drive
Columbus, Ohio 43224-1385
Voice: (614) 265-6739 Fax: (614) 265-6767

0144488

OCATION

County Ashtabula Township Ashtabula Circle One or Both Section/Lot Number

Owner/Builder RMI Environmental Services

Circle One or Both

Address of Well Location 1601 E. 21st St.
Number Street Name

City Ashtabula, OH Zip Code +4 44004

0.1 miles east (n, e, s, w) of E 21st St & SR 11 (nearest intersection)

Property Location Description on the north (n, e, s, w) side of E. 21st St, (road name)

Location of Well in State Plane Coordinates, if available N ☐ S ☐ X [ ] +/- ft. or m Y [ ] +/- ft. or m

Elevation of Well [ ] +/- ft. or m Datum Plain: ☐ NAD27 ☐ NAD83

Source of Coordinates: ☐ GPS ☐ Survey ☐ Other

ORIGINAL WELL ODNR Well Log Number Copy attached? (circle one) Yes or No

MEASURED CONSTRUCTION DETAILS Date of measurements 10/1/02

Well 15-feet Static Water Level NA

Casing 2-inch Length of casing 15'

Well Condition Surface damage

SEALING PROCEDURE

Method of Placement Tremmie Pipe

				Sealing Material	Volume
Placement:	From 0	To 15		portland cement	5 ft 3
	From	To			
	From	To			

Was Casing Removed? (Yes) or No (circle one)

Condition of Casing Surface damage

Perforations: From 5 To 15

From To

Date Sealing Performed 10/1/02

Reason(s) for Sealing Surface water infiltration

CONTRACTOR

Name Sharp + Associates, Inc ODH Registration #

Address 782 Crupper Ave

City Columbus, OH 43227

Signature

I hereby certify the information given is accurate and correct to the best of my knowledge.

000013

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ORIGINAL COPY TO - ODNR, DIVISION OF WATER, 1939 FOUNTAIN SQ. DRIVE, COLS., OHIO 43224-1385

Blue - Customer's copy, Pink - Driller's copy, Green - Local Health Dept. copy

DNR 7810.00

WATER WELL SEALING REPORT
OHIO DEPARTMENT OF NATURAL RESOURCES
Division of Water
1939 Fountain Square Drive
Columbus, Ohio 43224-1385
Voice: (614) 265-6739 Fax: (614) 265-6767

0144489

LOCATION

County Ashtabula Township Ashtabula Section/Lot Number (Circle One or Both)

Owner/Builder RMI Environmental Services

Address of Well Location 1601 (Number) E 21st St. (Street Name)

City Ashtabula, OH Zip Code +4 44004

0.1 miles east (n, e, s, w) of E 21st St & SR 11 (nearest intersection)

Property Location Description: on the north (n, e, s, w) side of E 21st St. (road name)

Location of Well in State Plane coordinates, if available: N ☐ S ☐ X ____ ft. or m +/- ____ Y ____ ft. or m +/- ____

Elevation of Well ____ ft. or m +/- ____ Datum Plain: ☐ NAD27 ☐ NAD83

Source of Coordinates: ☐ GPS ☐ Survey ☐ Other

ORIGINAL WELL ODNR Well Log Number ____ Copy attached? Yes or No (circle one)

MEASURED CONSTRUCTION DETAILS Date of measurements 10/3/02

Depth of Well 26-feet Static Water Level NA

Casing 2-inch Length of casing 26-feet

Well Condition Surface damage

SEALING PROCEDURE

Method of Placement Tremmie Pipe

Placement:			Sealing Material	Volume
From	0	To 26	portland/bentonite grout	9 ft 3
From		To		
From		To		

Was Casing Removed? Yes or No (circle one)

Condition of Casing Surface damage

Perforations: From 4.3 To 26

From To

Date Sealing Performed 10/3/02

Reason(s) for Sealing Poor Construction, surface water Infiltration.

CONTRACTOR

Name Sharp & Associates, Inc. ODH Registration #

Address 982 Crupper Ave

City/Zip Columbus, OH 43229

Signature [signature] I hereby certify the information given is accurate and correct to the best of my knowledge.

000012

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DNR 7810.00

WATER WELL SEALING REPORT
OHIO DEPARTMENT OF NATURAL RESOURCES
Division of Water
1939 Fountain Square Drive
Columbus, Ohio 43224-1385
Voice: (614) 265-6739 Fax: (614) 265-6767

0144490

LOCATION

County Ashtabula Township Ashtabula Circle One or Both Section/Lot Number

Owner/Builder RMI Environmental Services
Circle One or Both

Address of Well Location 1601 (Number) E 21st St (Street Name)

City Ashtabula, OH Zip Code +4 44004

0.1 miles (n, e, s, w) east of E 21st St & SR 11 (nearest intersection)

Property Location Description: on the north (n, e, s, w) side of E 21st St. (road name)

Location of Well in State Plane Coordinates, if available: N ☐ S ☐ X ____ +/- ____ ft. or m Y ____ +/- ____ ft. or m

Elevation of Well ____ +/- ____ ft. or m Datum Plain: ☐ NAD27 ☐ NAD83

Source of Coordinates: ☐ GPS ☐ Survey ☐ Other

ORIGINAL WELL ODNR Well Log Number ____ Copy attached? Yes or No (circle one)

MEASURED CONSTRUCTION DETAILS Date of measurements 10/3/02

Depth of Well 15-feet Static Water Level NA
Casing 2-inch Length of casing 15-feet
Well Condition Surface damage

SEALING PROCEDURE

Method of Placement Tremmie Pipe

			Sealing Material	Volume
Placement:	From 0	To 15	portland Cement	5 ft³
	From	To		
	From	To		

Was Casing Removed? Yes or No (circle one)

Condition of Casing Surface damage

Perforations: From 5 To 15
From To

Date Sealing Performed 10/3/02

Reason(s) for Sealing Surface water Infiltration

CONTRACTOR

Name Sharp & Associates, Inc. ODH Registration #

Address 782 Cropper Ave

Zip Columbus OH 43221

Signature ____ I hereby certify the information given is accurate and correct to the best of my knowledge.

000011

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DNR 7810.00

WATER WELL SEALING REPORT
OHIO DEPARTMENT OF NATURAL RESOURCES
Division of Water
1939 Fountain Square Drive
Columbus, Ohio 43224-1385
Voice: (614) 265-6739 Fax: (614) 265-6767

0144491

LOCATION

County Ashtabula Township Ashtabula Circle One or Both Section/Lot Number

Owner/Builder Rail Environmental Services
Circle One or Both

Address of Well Location 1601 E 21st St.
Number Street Name

City Ashtabula, OH Zip Code +4 44004

0.1 miles N cost of E 21st St & SR 11
n, e, s, w nearest intersection

Property Location Description on the North side of E 21st St.
n, e, s, w road name

Location of Well in State Plane Coordinates, if available N ☐ S ☐ X [ ] ft. or m +/- Y [ ] ft. or m +/-

Elevation of Well [ ] ft. or m +/- Datum Plain: ☐ NAD27 ☐ NAD83

Source of Coordinates: ☐ GPS ☐ Survey ☐ Other

ORIGINAL WELL ODNR Well Log Number Copy attached? (circle one) Yes or No

MEASURED CONSTRUCTION DETAILS Date of measurements 10/14/02

Depth of Well 32-feet Static Water Level NA
Diameter Casing 2-inch Length of casing 32-feet
Casing Condition Surface damage

SEALING PROCEDURE

Method of Placement Tremmie Pipe

			Sealing Material	Volume
Cement:	From 0	To 32	portland cement	11 ft³
	From	To		
	From	To		

Was Casing Removed? (Yes) or No (circle one)

Condition of Casing Surface damage

Perforations: From 27 To 32
From To

Date Sealing Performed 10/14/02

Reason(s) for Sealing Subsurface water infiltration

CONTRACTOR

Name Sharp and Associates, Inc ODH Registration #

Address 982 Cropper Ave

City/State/Zip Columbus OH 43229

Signature [signature] I hereby certify the information given is accurate and correct to the best of my knowledge.

000010

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NR 7810.00

WATER WELL SEALING REPORT
OHIO DEPARTMENT OF NATURAL RESOURCES
Division of Water
1939 Fountain Square Drive
Columbus, Ohio 43224-1385
Voice: (614) 265-6739 Fax: (614) 265-6767

0144492

..ATION

ounty Ashtabula Township Ashtabula Circle One or Both Section/Lot Number

wner/Builder RML Environmental Services

cle One or Both

ddress of Well Location 1601 E 21st St.
Number Street Name

ty Ashtabula, OH Zip Code +4 44004

0.1 miles east of E 21st St & SR 11
n, e, s, w nearest intersection

operty Location
scription on the _____ side of _____
n, e, s, w road name

cation of Well in State Plane N ☐ S ☐ X _____ +/- ft. or m Y _____ +/- ft. or m
ordinates, if available

vation of Well _____ +/- ft. or m Datum Plain: ☐ NAD27 ☐ NAD83

urce of Coordinates: ☐ GPS ☐ Survey ☐ Other _____

IIGINAL WELL ODNR Well Log Number _____ Copy attached? Yes or No (circle one)

ASURED CONSTRUCTION DETAILS Date of measurements 10/15/02

Well 33.5-feet Static Water Level NA
sing 2-inch Length of casing 33.5-feet
Condition Surface damage

ALING PROCEDURE
hod of Placement Tremmie Pipe

				Sealing Material	Volume
cement:	From 0	To 32.5		portland cement	11 ft3
	From	To			
	From	To			

Casing Removed? Yes or No (circle one)

dition of Casing Surface damage
orations: From 28.5 To 33.5
From To

Sealing Performed 10/15/02
son(s) for Sealing Surface water Infiltration

ITRACTOR
e Sharp and Associates, Inc. ODH Registration # NA
ss 982 Crupper Ave
p Columbus, OH 43229

e [signature]
I hereby certify the information given is accurate and correct to the best of my knowledge.

000009

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DNR 7810.00

WATER WELL SEALING REPORT
OHIO DEPARTMENT OF NATURAL RESOURCES

0144493

Division of Water
1939 Fountain Square Drive
Columbus, Ohio 43224-1385
Voice: (614) 265-6739 Fax: (614) 265-6767

LOCATION

County Ashtabula Township Ashtabula Section/Lot Number (Circle One or Both)

Owner/Builder RMI Environmental Services (Circle One or Both)

Address of Well Location 1601 (Number) E 21st St (Street Name)

City Ashtabula, OH Zip Code +4 44004

0.1 miles (n, e, s, w) East of E 21st St & SR 11 (nearest intersection)

Property Location Description: on the ____ (n, e, s, w) side of ____ (road name)

Location of Well in State Plane Coordinates, if available: N ☐ S ☐ X ____ (ft. or m) +/- ____ Y ____ (ft. or m) +/- ____

Elevation of Well ____ (ft. or m) +/- ____ Datum Plain: ☐ NAD27 ☐ NAD83

Source of Coordinates: ☐ GPS ☐ Survey ☐ Other ____

ORIGINAL WELL ODNR Well Log Number ____ Copy attached? Yes or No (circle one)

MEASURED CONSTRUCTION DETAILS Date of measurements 10/15/02

Depth of Well 34- feet Static Water Level NA

Casing 2-inch Length of casing 34-feet

Well Condition Surface damage

SEALING PROCEDURE

Method of Placement Tremmie pipe

Placement:				Sealing Material	Volume
	From 0	To 34		portland cement	12 ft 3
	From ____	To ____		____	____
	From ____	To ____		____	____

Was Casing Removed? Yes or No (circle one)

Condition of Casing Surface damage

Perforations: From 29 To 34

From ____ To ____

Date Sealing Performed 10/15/02

Reason(s) for Sealing Surface water infiltration.

CONTRACTOR

Name Sharp and Associates, Inc ODH Registration # NA

Address 982 Cypress Ave

City/State/Zip Columbus, OH 43229

Signature [signature] I hereby certify the information given is accurate and correct to the best of my knowledge.

000008

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DNR 7810.00

WATER WELL SEALING REPORT
OHIO DEPARTMENT OF NATURAL RESOURCES
Division of Water
1939 Fountain Square Drive
Columbus, Ohio 43224-1385
Voice: (614) 265-6739 Fax: (614) 265-6767

0144494

LOCATION

County Ashtabula Township Ashtabula Circle One or Both Section/Lot Number

Owner/Builder RMI Environmental Services
Circle One or Both

Address of Well Location 1601 E 21st St
Number Street Name

City Ashtabula, OH Zip Code +4 44004

0.1 miles east of E 21st St + SR 11
n, e, s, w nearest intersection

Property Location Description on the north side of E 21st St
n, e, s, w road name

Location of Well in State Plane coordinates, if available N ☐ S ☐ X ____ +/- ft. or m Y ____ +/- ft. or m

Elevation of Well ____ +/- ft. or m Datum Plain: ☐ NAD27 ☐ NAD83

Source of Coordinates: ☐ GPS ☐ Survey ☐ Other

ORIGINAL WELL ODNR Well Log Number Copy attached? Yes or No (circle one)

MEASURED CONSTRUCTION DETAILS Date of measurements 10/9/02

Depth of Well 24-feet Static Water Level NA
Casing 2-inch Length of casing 24-feet
Well Condition Surface damage

SEALING PROCEDURE
Method of Placement Tremmie Pipe

			Sealing Material	Volume
Placement:	From 0	To 24	portland cement	8 ft³
	From	To		
	From	To		

Was Casing Removed? Yes or No (circle one)

Condition of Casing Surface damage
Perforations: From 19 To 24
From To

Date Sealing Performed 10/9/02
Reason(s) for Sealing Surface water Infiltration

CONTRACTOR
Name Sharp and Associates, Inc ODH Registration #
Address 982 Crupper Ave
Zip Columbus

Signature [signature]
I hereby certify the information given is accurate and correct to the best of my knowledge.

000007

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DNR 7810.00

WATER WELL SEALING REPORT
OHIO DEPARTMENT OF NATURAL RESOURCES
Division of Water
1939 Fountain Square Drive
Columbus, Ohio 43224-1385
Voice: (614) 265-6739 Fax: (614) 265-6767

0144495

LOCATION

County Ashtabula Township Ashtabula Circle One or Both Section/Lot Number

Owner/Builder RMI Environmental Services
Circle One or Both

Address of Well Location 1601 E 21st St
Number Street Name

City Ashtabula, OH Zip Code +4 44004

0.1 miles east of E 21st St + SR 11
n, e, s, w nearest intersection

Property Location Description on the north side of E 21st St
n, e, s, w road name

Location of Well in State Plane Coordinates, if available N ☐ S ☐ X [ ] ft. or m +/- [ ] Y [ ] ft. or m +/- [ ]

Elevation of Well 634.10 ft. or m +/- [ ] Datum Plain: ☐ NAD27 ☐ NAD83

Source of Coordinates: ☐ GPS ☒ Survey ☐ Other

ORIGINAL WELL ODNR Well Log Number 883302 Copy attached? (circle one) Yes or No

MEASURED CONSTRUCTION DETAILS Date of measurements 10/9/02

Depth of Well 15-feet Static Water Level NA
Casing 2-inch Length of casing 15-feet
Well Condition Surface damage

SEALING PROCEDURE
Method of Placement Tremmie Pipe

Placement:				Sealing Material	Volume
	From 0	To 15		portland Cement	5 ft 3
	From	To			
	From	To			

Was Casing Removed? Yes or No (Circle one)

Condition of Casing Surface damage
Perforations: From 5 To 15
From To

Date Sealing Performed 10/9/02
Reason(s) for Sealing Surface water infiltration

CONTRACTOR
Name Sharp + Associates, Inc. ODH Registration #
Address 982 Cropper Ave
Zip Columbus OH 43229

Signature [signature] I hereby certify the information given is accurate and correct to the best of my knowledge.

000005

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SELF TRANSCRIBING
PRESS HARD

Division of Water, 1939 Fountain Square Drive
Columbus, Ohio 43224-8971 Voice (614) 265-6739 Fax (614) 447-9503

883302

WELL LOCATION

County Ashtabula Township Ashtabula

Owner RMI Titanium Company Extrusion Plant
(Last Name or Business) (First)

Address of Well Location 1601 E. 21 Street
(Number) (Street Name)

City Ashtabula Zip Code +4 44004

Permit No. N/A Section/Lot No. N/A (Circle One or Both)

Location of Well in State Plane Coordinates, if available: Use of Well Monitoring; #500

N ☐ X _____ +/- _____ ft. or m

S ☐ Y _____ +/- _____ ft. or m

Elevation of Well 634 +/- 1 (ft.) or m

Datum Plain: ☐ NAD27 ☐ NAD83 Elevation Source Survey

Source of Coordinates: GPS ☒ Survey ☐ Other

Sketch a map showing distance well lies from numbered state highways, street intersections, county roads, buildings or other notable landmarks. If latitude and longitude are available please include here: Lat: 41°53.84N Long: 84°46.75W

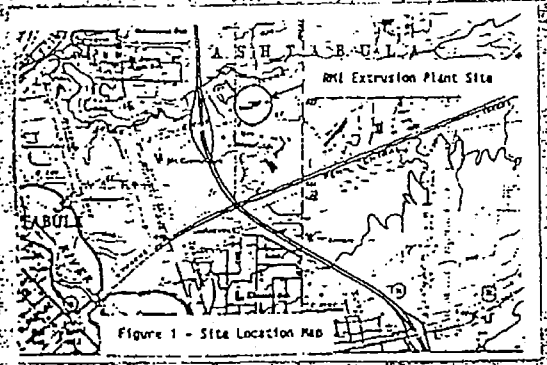

Figure 1 - Site Location Map

WELL TEST N/A

Pre-Pumping Static Level _____ ft. Date _____

Measured from: ☐ Top of Casing ☒ Ground Level ☐ Other

Air ☒ Bailing ☐ Pumping ☐ Other

Test Rate _____ gpm Duration of Test _____ hrs.

Level of Drawdown _____ ft. Sustainable Yield _____ gpm

Attach a copy of the pumping test record, per section 1521.05, ORC)

Copy Attached? ☐ Yes ☐ No Flowing Well? ☐ Yes ☐ No

Quality _____

PUMP/PITLESS N/A

Type of pump _____ Capacity _____ gpm

Pump set at _____ ft. Pitless Type _____

Pump installed by _____

I hereby certify the information given is accurate and correct to the best of my knowledge.

Drilling Firm Lahti Drilling

Address 8936 State Road

City, State, Zip Kinsman, OH 44428

Signature _____ Date 10/12/98

Registration Number N/A

CONSTRUCTION DETAILS

☐ Rotary ☒ Cable ☐ Augered ☐ Driven ☐ Other

BOREHOLE/CASING (measured from ground surface)

1 ☒ Borehole Diameter 6 inches Depth 15

Casing Diameter 2 in. Length 17 ft. Thickness 0.10 in.

2 ☐ Borehole Diameter _____ inches Depth _____ ft.

Casing Diameter _____ in. Length _____ ft. Thickness _____ in.

Casing Height Above Ground 2 ft.

Type 1 ☐ Steel 1 ☐ Galv. 1 ☐ PVC 1 ☒ 2 ☐ Other stainless steel

Joints 1 ☒ Threaded 1 ☐ Welded 1 ☐ Solvent 1 ☐ 2 ☐ 2 ☐ 2 ☐ 2 ☐ Other

SCREEN

Diameter 2" Slot Size 0.010" Screen Length 10 ft.

Type Machine Slotted Material Stainless steel

Set Between 5 ft. and 15 ft.

GRAVEL PACK (Filter Pack)

Material/Size #4 sieve Volume/Weight Used 26 cu. ft.

Method of Installation poured

Depth: Placed FROM 4 ft. TO 15 ft.

GROUT

Material Cement/Water/Sand Volume/Weight Used 9.5 cu ft

Method of Installation poured

Depth: Placed FROM 0 ft. TO 4 ft.

DRILLING LOG

INDICATE DEPTH(S) AT WHICH WATER IS ENCOUNTERED. Show color, texture, hardness, and formation: sandstone, shale, limestone, gravel, clay, sand, etc.	From	To
Orange clay w/sand, firm & moist	0'	10'
small stone < 0.75" wide		
Orange & grey clay mix w/sand	14'	15'
Moist - some angular stone < 0.75"		
Disturbed, prior fill site.		

(If more space is needed to complete drilling log, use next consecutively numbered form.)

Date of Well Completion September 15, 1998 Total Depth of Well 15 ft.

Completion of this form is required by section 1521.05, Ohio Revised Code; file within 30 days after completion of drilling.

ORIGINAL COPY TO: ODNR, DIVISION OF WATER, 1939 FOUNTAIN SQ. DRIVE, COLS., OHIO 43224-9971

Blue - Customer's copy Pink - Driller's copy Green - Local Health Dept. copy

900

ODNR 7810.00

WATER WELL SEALING REPORT
OHIO DEPARTMENT OF NATURAL RESOURCES

0144496

Division of Water
1939 Fountain Square Drive
Columbus, Ohio 43224-1385
Voice: (614) 265-6739 Fax: (614) 265-6767

LOCATION

County Ashtabula Township Ashtabula Section/Lot Number (Circle One or Both)
Owner/Builder Rust Environmental Services
Address of Well Location 1601 (Number) E 21st St (Street Name)
City Ashtabula, OH Zip Code +4 44004
0.1 miles (n, e, s, w) east of E 21st St + SR 11 (nearest intersection)
Property Location Description on the north (n, e, s, w) side of E 21st St (road name)
Location of Well in State Plane Coordinates, if available N ☐ S ☐ X _____ +/- _____ ft. or m Y _____ +/- _____ ft. or m
Elevation of Well 634.[ ] +/- 1 (ft. or m) Datum Plain: ☐ NAD27 ☐ NAD83
Source of Coordinates: ☐ GPS ☐ Survey ☐ Other

ORIGINAL WELL ODNR Well Log Number 883304 Copy attached? (circle one) Yes or No

MEASURED CONSTRUCTION DETAILS Date of measurements 10/11/02

Well 11- feet Static Water Level NA
Casing 2-inch Length of casing 11-feet
Well Condition Surface damage

SEALING PROCEDURE
Method of Placement Tremmie Pipe

				Sealing Material	Volume
Placement:	From 0	To 12		Portland Cement	4 ft3
	From	To			
	From	To			

Was Casing Removed? Yes or No (circle one)
Condition of Casing Surface damage
Perforations: From 6 To 11
From To

Date Sealing Performed 10/11/02
Reason(s) for Sealing Surface water infiltration

CONTRACTOR
Name Sharp and Associates, Inc. ODH Registration # NA
Address 982 Cropper Ave
Zip Columbus, OH 43229
Signature _____ I hereby certify the information given is accurate and correct to the best of my knowledge.

000003

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TYPE OR USE PEN
SELF TRANSCRIBING
PRESS HARD

Ohio Department of Natural Resources
Divison of Water, 1939 Fountain Square Drive
Columbus, Ohio 43224-9971 Voice (614) 265-6739 Fax (614) 447-9503

883304

WELL LOCATION

Ashtabula Township Ashtabula

Owner/Builder (If One or Both) RMI titanium Company (First) Extrusion Plant (Last)

Address of Well Location 1601 E. 21st Street (Number / Street Name)

Ashtabula Zip Code +4 44005-0579

Unit No. N/A Section/Lot No. (Circle One or Both) N/A

Location of Well in State Plane Coordinates, if available: Use of Well monitoring (#511)

X E6543 .617 +/- 1 ft. or m

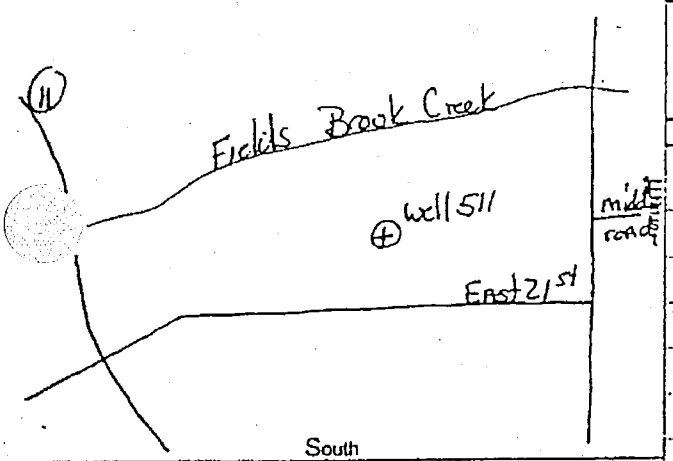
Y N5011 .707 +/- 1 ft. or m

Elevation of Well 629 . +/- 2 ft. or m

Datum Plain: ☐ NAD27 ☐ NAD83 Elevation Source Survey map

Source of Coordinates: ☐ GPS ☒ Survey ☐ Other

Sketch a map showing distance well lies from numbered state highways, street intersections, county roads, buildings or other notable landmarks. If latitude and longitude are available please include here: Lat: Long:



WELL TEST*

Pumping Static Level NA ft. Date

Measured from: ☐ Top of Casing ☐ Ground Level ☐ Other

☐ Bailing ☐ Pumping* ☐ Other

Rate gpm Duration of Test hrs.

Level of Drawdown ft. Sustainable Yield gpm

(Attach a copy of the pumping test record, per section 1521.05, ORC)

Copy Attached? ☐ Yes ☐ No Flowing Well? ☐ Yes ☐ No

Remarks

PUMP/PITLESS

Type of pump NA Capacity gpm

Depth set at ft. Pitless Type

Pump installed by

I hereby certify the information given is accurate and correct to the best of my knowledge.

Firm Consultant Eckenfelder Inc

Address 224 French Landing Dr

City/State/Zip Nashville TN 37228

Signature Gregg A Christian Date 10/29/99

Certification Number

CONSTRUCTION DETAILS

☐ Rotary ☐ Cable ☒ Augered ☐ Driven ☐ Other

BOREHOLE/CASING (measured from ground surface)

1 ☐ Borehole Diameter 6 inches Depth 11.5 ft.

Casing Diameter 2 in. Length 8.75 ft. Thickness 0.2 in.

2 ☐ Borehole Diameter inches Depth ft.

Casing Diameter in. Length ft. Thickness in.

Casing Height Above Ground 1.5 ft.

Type 1 ☐ Steel 1 ☐ Galv. 1 ☐ PVC 1 ☒ 2 ☐ Other Stainless steel

Joints 1 ☐ Threaded 1 ☐ Welded 1 ☐ Solvent 1 ☐ 2 ☐ Other

SCREEN

Diameter 2in. Slot Size 10 Screen Length 5 ft.

Type wire wrapped Material stainless steel

Set Between 6 ft. and 11 ft.

GRAVEL PACK (Filter Pack)

Material/Size #1 Marine Volume/Weight Used 3.4 ft³

Method of Installation Gravity Pour

Depth: Placed FROM 4 ft. TO 11.5 ft.

GROUT

Material Type I Portland 2% Bentonite Volume/Weight Used 1 Ft³

Method of Installation gravity Pour

Depth: Placed FROM 0 ft. TO 2 ft.

Bentonite 2 to 4

DRILLING LOG*

INDICATE DEPTH(S) AT WHICH WATER IS ENCOUNTERED. Show color, texture, hardness, and formation: sandstone, shale, limestone, gravel, clay, sand, etc.	From	To
Gray mottled Clayey Silt Lt(t) shale Fragments (Fill)	0	5'
Gray mottled Clayey Silt Lt(t) f. Sand, Lt(t) shale Fragments (Fill)	5'	10'
Gray & Clayey Silt, Lt(t) f. Sand	10'	12'

000004

*(If more space is needed to complete drilling log, use next consecutively numbered form.)

Date of Well Completion 10/13/99 Total Depth of Well 11 ft.

Completion of this form is required by section 1521.05, Ohio Revised Code - file within 30 days after completion of drilling.
ORIGINAL COPY TO - ODNR, DIVISION OF WATER, 1939 FOUNTAIN SQ. DRIVE, COLS., OHIO 43224-9971

Ashtabula Closure Project

FINAL RMI REPORT

PHASE II

SEPETEMBER 2003

Appendix C

Project No: 2116-25

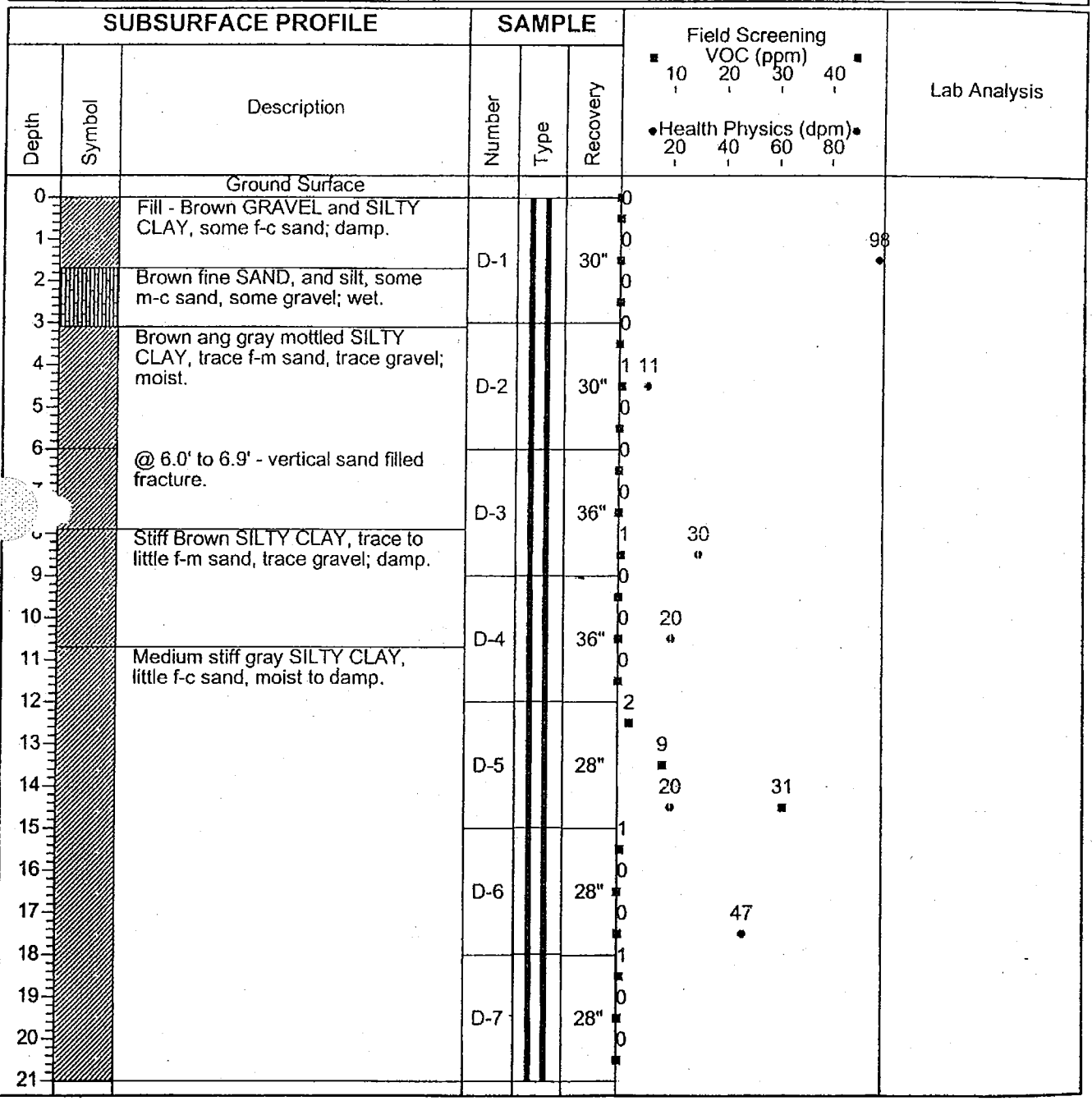
Project: RMIES Geoprobe Investigation

Log of Borehole: BH1A

Client: RMIES

Location: Transect 1

Geologist: K. Smith



SHARP AND ASSOCIATES, INC. Environmental Engineers, Scientists, & Contractors

Drill Method: Geoporobe Piston Rod Datum:

Drill Date: 12-10-02 Checked by:

Hole Size: Sheet: 1 of 1

000001

Project No: 2116-25

Project: RMIES Geoprobe Investigation

Client: RMIES

Location: Transect 1

Log of Borehole: BH1B

Geologist: K. Smith

SUBSURFACE PROFILE			SAMPLE			Field Screening VOC (ppm) 10 20 30 40 / Health Physics (dpm) 20 40 60 80	Lab Analysis
Depth	Symbol	Description	Number	Type	Recovery		
0		Ground Surface				0	
1		Fill - Aggregate base.				3	>100
2		Fill - Brown SILTY CLAY and gravel, some f-c sand; damp. @ 2.3'-2.9' - wet/saturated.	D-1		35/36	0	
3		Native - Brown SILTY CLAY (Topsoil).				0	
4		Brown and gray mottled SILTY CLAY, trace f-m sand; moist, soft.	D-2		23/36	0 10	
5		Brown SILTY CLAY, little f-c sand, trace gravel; damp, stiff.				0	
6						1	
7			D-3		36/36	1 13	
8						0	
9						2	
10		Brown CLAY and SAND, little f-c gravel; damp	D-4		36/36	618	
11		Brown SILTY CLAY, little f-c sand, trace gravel; damp, stiff.				3	
12		Gray SILTY CLAY, little f-c sand, trace gravel, damp, stiff				7	
13		@12.0 to 14.2 - Iron stained fracture w/solvent odor.	D-5		36/36	3 24	
14						8	
15						1	
16			D-6		36/36	1 17	
17						1	
18						1	
19			D-7		36/36	0 21	
20						0	
21							

SHARP AND ASSOCIATES, INC. Environmental Engineers, Scientists, & Contractors

Drill Method: Geoporobe Piston Rod Datum:

Drill Date: 12-10-02 Checked by:

Hole Size: Sheet: 1 of 1

000002

Project No: 2116-25

Project: RMIES Geoprobe Investigation

Client: RMIES

Location: Transect 1

Log of Borehole: BH1C

Geologist: K. Smith

SUBSURFACE PROFILE			SAMPLE			Field Screening VOC (ppm) 10 20 30 40 / Health Physics (dpm) 20 40 60 80	Lab Analysis
Depth	Symbol	Description	Number	Type	Recovery		
		Ground Surface					
0		Fill - Aggregate Base	D-1		31"	0	>100
1						0	
2		Fill - Breown SILTY CLAY and gravel; damp.				0	
3						0	
4		Fill - Brown/black/gray SILTY CLAY, little f-c sand; damp to moist.	D-2		26"	0 18	
5		@ 4.0' to 4.8' - increased moisture - moist to wet.				0	
6						0	
7			D-3		17"	0 12	
9						0	
10			D-4		22"	0 17	
11						0	
12						0	
13		Native - Soft gray SILTY CLAY, little f-c sand, trace gravel; moist. High plasticity.	D-5		30"	0	
14						0 20	
15		Stiff gray SILTY CLAY, little f-c sand, trace gravel; damp.				0	
16			D-6		30"	0	
17						0	
18							
19			D-7		36"		
20							
21							

SHARP AND ASSOCIATES, INC. Environmental Engineers, Scientists, & Contractors

Drill Method: Geoporobe Piston Rod Datum:

Drill Date: 12-9-02 Checked by:

Hole Size: Sheet: 1 of 1

000003

Project No: 2116-25

Project: RMIES Geoprobe Investigation

Client: RMIES

Location: Transect 1

Log of Borehole: BH1D

Geologist: K. Smith

SUBSURFACE PROFILE			SAMPLE			Field Screening VOC (ppm) 10 20 30 40 / Health Physics (dpm) 20 40 60 80	Lab Analysis
Depth	Symbol	Description	Number	Type	Recovery		
0		Ground Surface					
0		Fill - Aggregate base				0	
1		Fill - Brown and black SILTY CLAY; moist. Organic odor.	D-1		33"	0	
2						0	
3						0 8	
4			D-2		31"	0	
5						0	
6		@ 6.0' - Increase in moisture content.				0	
7			D-3		33"	1 10	
8		Native - Brown SILTY CLAY, little f-c sand, little gravel; damp to moist, very stiff. Contains vertical iron stained fractures.				0	
9						0 25	
10			D-4		32"	0	
11						0	
12		Gray SILTY CLAY, little f-c sand, trace gravel; damp.				0	
13			D-5		33"	0 9	
14						0	
15						0 50	
16			D-6		36"	0	
17						0	
18							
19			D-7		36"	20	
20							
21							

SHARP AND ASSOCIATES, INC. Environmental Engineers, Scientists, & Contractors

Drill Method: Geoporobe Piston Rod Datum:

Drill Date: 12-9-02 Checked by:

Hole Size: Sheet: 1 of 1

000004

Project No: 2116-25

Project: RMIES Geoprobe Investigation

Client: RMIES

Location: Transect 1

Log of Borehole: BH1E

Geologist: K. Smith

SUBSURFACE PROFILE			SAMPLE			Field Screening VOC (ppm) 10 20 30 40 / Health Physics (dpm) 20 40 60 80	Lab Analysis
Depth	Symbol	Description	Number	Type	Recovery		
0		Ground Surface				0	
1		Fill - Brown GRAVEL and silty clay, some f-c sand; damp.	D-1		31/36	1	>100
2						0	
3		Native - Dark brown and gray SILTY CLAY (topsoil).				0	
4		Native - Brown and gray mottled SILTY CLAY, trace f-c sand; moist.	D-2		19/36	0 15	
5						0	
6		Brown SILTY CLAY, little f-c sand, trace gravel; medium stiff.				0	
7			D-3			0	
8		@ 8.3' - Iron stained fractures.				0 29	
9						0	
10			D-4			0 18	
11		Gray SILTY CLAY, little f-c sand, little gravel; damp, stiff.				0	
12		End of Borehole at 12 ft					
13							
14							
15							
16							
17							
18							
19							
20							
21							

SHARP AND ASSOCIATES, INC. Environmental Engineers, Scientists, & Contractors

Drill Method: Geoporobe Piston Rod Datum:

Drill Date: 12-9-02 Checked by:

Hole Size: Sheet: 1 of 1

Project No: 2116-25

Project: RMIES Geoprobe Investigation

Client: RMIES

Location: Transect 1

Log of Borehole: BH1F

Geologist: K. Smith

SUBSURFACE PROFILE			SAMPLE				
Depth	Symbol	Description	Number	Type	Recovery	Field Screening VOC (ppm) 10 20 30 40 / Health Physics (dpm) 20 40 60 80	Lab Analysis
0		Ground Surface					
0		Fill - Brown GRAVEL and silty clay, some f-c sand; damp to moist.	D-1		30/36	0	>100
1						0	
2						0	
3						0	>100
4		Native - Dark brown and gray SILTY CLAY (topsoil).	D-2		32/36	0	
5		Brown and gray mottled SILTY CLAY; damp to moist.				0	
6		Brown SILT; wet.				0	
7		Brown and gray mottled SILTY CLAY; damp to moist.	D-3			0	
8		Brown SILTY CLAY, little f-c sand, trace gravel; moist to damp. Contains iron stains/fractures throughout sample.				31	
9		End of Borehole at 9 ft					
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
21							

SHARP AND ASSOCIATES, INC. Environmental Engineers, Scientists, & Contractors

Drill Method: Geoporobe Piston Rod Datum:

Drill Date: 12-12-02 Checked by:

Hole Size: Sheet: 1 of 1

Project No: 2116-25

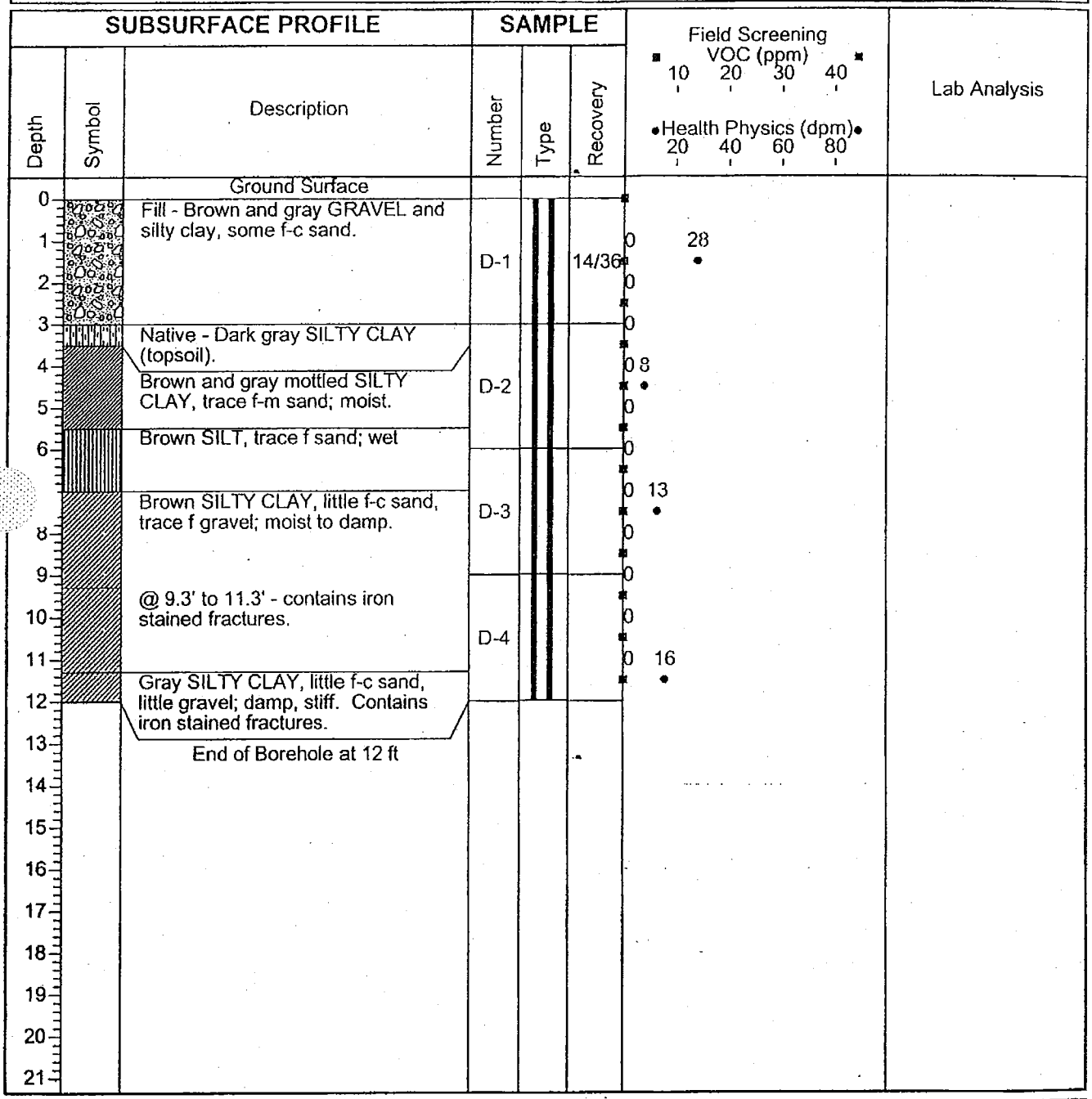
Project: RMIES Geoprobe Investigation

Client: RMIES

Location: Transect 2

Log of Borehole: BH2B

Geologist: K. Smith



SHARP AND ASSOCIATES, INC. Environmental Engineers, Scientists, & Contractors

Drill Method: Geoporobe Piston Rod Datum:

Drill Date: 12-12-02 Checked by:

Hole Size: Sheet: 1 of 1

000007

Project No: 2116-25

Project: RMIES Geoprobe Investigation

Client: RMIES

Location: Transect 2

Log of Borehole: BH2C

Geologist: K. Smith

SUBSURFACE PROFILE			SAMPLE			Field Screening VOC (ppm) 10 20 30 40 / Health Physics (dpm) 20 40 60 80	Lab Analysis
Depth	Symbol	Description	Number	Type	Recovery		
0		Ground Surface					
0		Fill - Aggregate base					
1		Fill - Brown SILTY CLAY, some f-c sand, little gravel; damp to moist.	D-1		36/36	0 70	
2						0	
3						0	
4			D-2		31/36	0 27	
5						0	
6						0	
7		Native - Brown SILTY CLAY, trace f-m sand; damp, medium stiff.	D-3		25/36	0	
8						0 28	
9		Gray SILTY CLAY, little f-c sand, trace gravel; damp, medium stiff to stiff.				06	
10		@ 9.0' to 12.0' - Contains iron stained fractures.	D-4		36/36	0	
11						0	
12		@ 12.0' - Increased moisture content.				0 14	
13			D-5		15/36	0	
14						0	
15						0	
16			D-6			0 19	
17						0	
18		End of Borehole at 18 ft					
19							
20							
21							

SHARP AND ASSOCIATES, INC. Environmental Engineers, Scientists, & Contractors

Drill Method: Geoporobe Piston Rod Datum:

Drill Date: 12-12-02 Checked by:

Hole Size: Sheet: 1 of 1

000008

Project No: 2116-25

Project: RMIES Geoprobe Investigation

Client: RMIES

Location: Transect 2

Log of Borehole: BH2D

Geologist: K. Smith

Depth	Symbol	Description	Sample Number	Sample Type	Recovery	Field Screening VOC (ppm) 10 20 30 40 / Health Physics (dpm) 20 40 60 80	Lab Analysis
0		Ground Surface					
0		Fill - Aggregate base				0	
1		Fill - Brown SILTY CLAY, little f-c sand, trace gravel; stiff.	D-1		31/36	0 34	
2						0	
3		Fill - brown and gray mottled SILTY CLAY, trace f-c sand; moist.				0 28	
4		Native - Dark gray SILTY CLAY (topsoil).	D-2		18/36	0	
5		Light brown SILTY CLAY, little f-c sand; moist.				0	
6						0	
7		@ 7.0' to 7.6' - moist, soft.	D-3		36/36	0	
8						0 22	
9		Gray SILTY CLAY, little f-c sand, little f gravel; damp to moist, stiff.				0	
10		@ 10.0' to 10.8' - Vertical and horizontal iron stained fractures.	D-4		36/36	0 18	
11						0	
12						0 17	
13			D-5		36/36	0	
14						0	
15						0	
16			D-6		36/36	0	
17						0 9	
18		End of Borehole at 18 ft					
19							
20							
21							

Lab Analysis

SHARP AND ASSOCIATES, INC. Environmental Engineers, Scientists, & Contractors

Drill Method: Geoporobe Piston Rod Datum:

Drill Date: 12-12-02 Checked by:

Hole Size: Sheet: 1 of 1

Project No: 2116-25

Project: RMIES Geoprobe Investigation

Log of Borehole: BH3A

Client: RMIES

Location: Transect 3

Geologist: K. Smith

SUBSURFACE PROFILE			SAMPLE			Field Screening VOC (ppm) 10 20 30 40 / Health Physics (dpm) 20 40 60 80	Lab Analysis
Depth	Symbol	Description	Number	Type	Recovery		
0		Ground Surface					
0		Fill - Aggregate base.					
1			D-1		34/36		
2		Native - Dark gray and black SILTY CLAY (topsoil), trace f-m sand. Contains organic material.					
3		Brown and gray mottled SILTY CLAY, trace f-m sand; moist.					
4			D-2		32/36		
5		Brown SILT, little clay; moist to wet.					
6		@ 6.0' - Saturated/wet					
7			D-3		31/36		
8							
9		End of Borehole at 9 ft					
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
21							

SHARP AND ASSOCIATES, INC. Environmental Engineers, Scientists, & Contractors

Drill Method: Geoporobe Piston Rod Datum:

Drill Date: 12-19-02 Checked by:

Hole Size: Sheet: 1 of 1

000010

Project No: 2116-25

Project: RMIES Geoprobe Investigation

Client: RMIES

Location: Transect 3

Log of Borehole: BH3B

Geologist: K. Smith

SUBSURFACE PROFILE			SAMPLE			Field Screening VOC (ppm) 10 20 30 40 / Health Physics (dpm) 20 40 60 80	Lab Analysis
Depth	Symbol	Description	Number	Type	Recovery		
0		Ground Surface				0	
1		Fill - Aggregate base.				0	
2		Fill - Brown SILTY CLAY and f-c sand, some gravel.	D-1		32/36	0 93	
3						0	
4		Native - Brown and gray mottled SILTY CLAY, trace f-m sand; moist.	D-2		30/36	0 12	
5		@ 5.0' - moist to wet.				0	
6		Brown SILT, trace f sand; wet.				0	
8			D-3		28/36	0 13	
9						0	
10		@ 10.0' - gradational change from brown to gray.	D-4		21/36	0 14	
12						0	
13		Gray SILTY CLAY, little f-c sand, trace gravel; damp to moist, stiff.	D-5		32/36	0	
15		End of Borehole at 15 ft					
16							
17							
18							
19							
20							
21							

SHARP AND ASSOCIATES, INC. Environmental Engineers, Scientists, & Contractors

Drill Method: Geoporobe Piston Rod Datum:

Drill Date: 12-13-02 Checked by:

Hole Size: Sheet: 1 of 1

000011

Project No: 2116-25

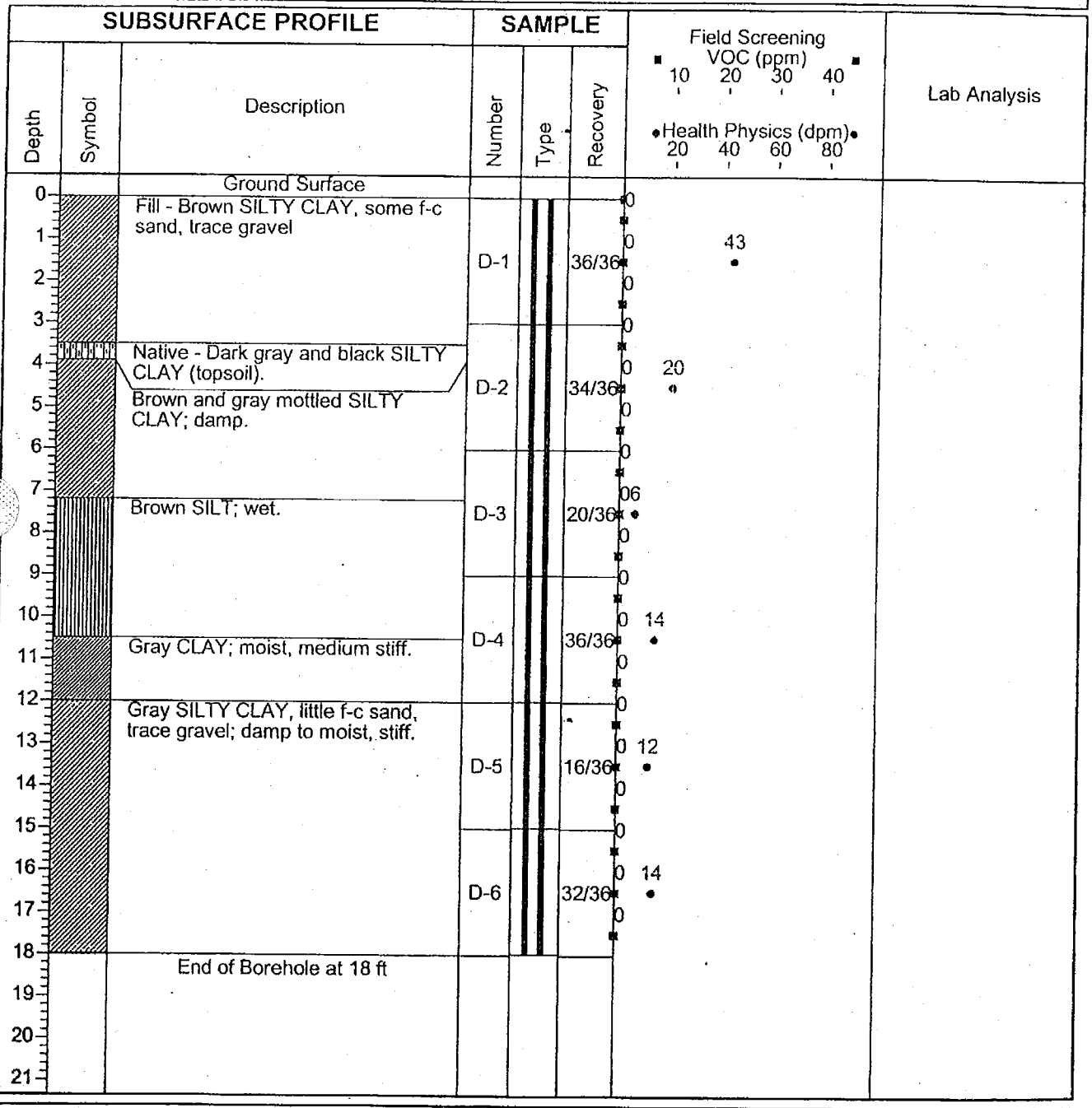
Project: RMIES Geoprobe Investigation

Client: RMIES

Location: Transect 3

Log of Borehole: BH3C

Geologist: K. Smith



SHARP AND ASSOCIATES, INC. Environmental Engineers, Scientists, & Contractors

Drill Method: Geoporobe Piston Rod Datum:

Drill Date: 12-12-02 Checked by:

Hole Size: Sheet: 1 of 1

000012

Project No: 2116-25

Project: RMIES Geoprobe Investigation

Client: RMIES

Location: Transect 3

Log of Borehole: BH3D

Geologist: K. Smith

SUBSURFACE PROFILE			SAMPLE			Field Screening VOC (ppm) 10 20 30 40 / Health Physics (dpm) 20 40 60 80	Lab Analysis
Depth	Symbol	Description	Number	Type	Recovery		
0		Ground Surface					
0		Fill - Brown SILTY CLAY, some f-c sand, some gravel; damp.	D-1		36/36	32	
4		Fill - Gray SILTY CLAY, little f-c sand, trace gravel; moist to wet, soft to very soft.	D-2		34/36	17	
6			D-3		20/36	15	
10		Native - Gray SILTY CLAY, little f-c sand, trace gravel; damp, stiff.	D-4		36/36	28	
13			D-5		16/36	46	
16			D-6		32/36	18	
18		End of Borehole at 18 ft					

SHARP AND ASSOCIATES, INC. Environmental Engineers, Scientists, & Contractors

Drill Method: Geoporobe Piston Rod Datum:

Drill Date: 12-12-02 Checked by:

Hole Size: Sheet: 1 of 1

Project No: 2116-25

Project: RMIES Geoprobe Investigation

Client: RMIES

Location: Transect 3

Log of Borehole: BH3E

Geologist: K. Smith

SUBSURFACE PROFILE			SAMPLE			Field Screening VOC (ppm) 10 20 30 40 / Health Physics (dpm) 20 40 60 80	Lab Analysis
Depth	Symbol	Description	Number	Type	Recovery		
0		Ground Surface					
0–3		Fill - Brown SILTY CLAY, some f-c sand, some gravel; damp to moist.	D-1		36/36	0 0 0 47	
3–6		Native - Brown and gray mottled SILTY CLAY, trace f-c sand. Contains iron stains.	D-2		19/36	0 0 0 53	
6–7		Brown SILT, trace f sand; wet.				0	
7–9		Brown SILTY CLAY, little f-c sand, trace gravel; damp, stiff. Contains iron stained fractures.	D-3		36/36	0 14 0	
9–12		Gray SILTY CLAY, little f-c sand, trace gravel; damp, dense	D-4			0 06 0	
12		End of Borehole at 12 ft					
13–21							

SHARP AND ASSOCIATES, INC. Environmental Engineers, Scientists, & Contractors

Drill Method: Geoporobe Piston Rod Datum:

Drill Date: 12-13-02 Checked by:

Hole Size: Sheet: 1 of 1

Project No: 2116-25

Project: RMIES Geoprobe Investigation

Client: RMIES

Location: Transect 3

Log of Borehole: BH3F

Geologist: K. Smith

SUBSURFACE PROFILE			SAMPLE			Field Screening VOC (ppm) 10 20 30 40 / Health Physics (dpm) 20 40 60 80	Lab Analysis
Depth	Symbol	Description	Number	Type	Recovery		
0		Ground Surface					
0		Fill - Aggregate base					
1		Fill - Brown SILTY CLAY, some f-c sand, little gravel; damp.	D-1		34/36		
2							
3							
4		Native - Brown and gray mottled SILTY CLAY, trace f-c sand, trace gravel; damp.	D-2		32/36		
5							
6		Brown SILT, trace clay, trace f sand; wet.	D-3		31/36		
7		Brown SILTY CLAY, trace f-c sand; dry to damp, dense. Contains iron stained fractures.					
8							
9		End of Borehole at 9 ft					
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
21							

SHARP AND ASSOCIATES, INC. Environmental Engineers, Scientists, & Contractors

Drill Method: Geoporobe Piston Rod Datum:

Drill Date: 12-19-02 Checked by:

Hole Size: Sheet: 1 of 1

Project No: 2116-25

Project: RMIES Geoprobe Investigation

Client: RMIES

Location: Transect 4

Log of Borehole: BH4A

Geologist: K. Smith

SUBSURFACE PROFILE			SAMPLE				
Depth	Symbol	Description	Number	Type	Recovery	Field Screening VOC (ppm) 10 20 30 40 / Health Physics (dpm) 20 40 60 80	Lab Analysis
0		Ground Surface					
1		Fill - Brown and gray GRAVEL, some silty clay; damp.	D-1		32/36		
2		Native - Dark gray and black SILTY CLAY (topsoil), trace f-c sand. Contains organic material.					
3							
4		Brown and gray mottled CLAYEY SILT; moist to wet.	D-2				
5							
6							
7		Brown SILTY CLAY, little f-c sand, trace gravel; moist.	D-3				
8							
9		End of Borehole at 9 ft					
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
21							

SHARP AND ASSOCIATES, INC. Environmental Engineers, Scientists, & Contractors

Drill Method: Geoporobe Piston Rod Datum:

Drill Date: 12-19-02 Checked by:

Hole Size: Sheet: 1 of 1

000016

Project No: 2116-25

Project: RMIES Geoprobe Investigation

Client: RMIES

Location: Transect 4

Log of Borehole: BH4B

Geologist: K. Smith

SUBSURFACE PROFILE			SAMPLE			Field Screening VOC (ppm) 10 20 30 40 / Health Physics (dpm) 20 40 60 80	Lab Analysis
Depth	Symbol	Description	Number	Type	Recovery		
0		Ground Surface					
0		Fill - Brown and gray SAND and GRAVELsome silt, little clay; damp.	D-1		33/36	0 16	
3		Native - Dark gray and black SILTY CLAY(topsoil), trace f-c sand; damp.	D-2		21/36	0 25	
4		Native - Brown and gray mottled SILTY CLAY, trace f-m sand; moist, medium stiff.					
6		Brown and Gray CLAYEY SILT w/ silt lenses; wet, soft.	D-3		36/36	0 8	
9		Brown SILTY CLAY, trace f-c sand; damp, laminated. Contrains iron stained fractures.					
10		Gray SILTY CLAY, little f-c sand, trace gravel; damp, stiff.	D-4		36/36	0 11	
12		End of Borehole at 12 ft					
13							
14							
15							
16							
17							
18							
19							
20							
21							

SHARP AND ASSOCIATES, INC. Environmental Engineers, Scientists, & Contractors

Drill Method: Geoporobe Piston Rod Datum:

Drill Date: 12-16-02 Checked by:

Hole Size: Sheet: 1 of 1

000017

Project No: 2116-25

Project: RMIES Geoprobe Investigation

Client: RMIES

Location: Transect 4

Log of Borehole: BH4C

Geologist: K. Smith

SUBSURFACE PROFILE			SAMPLE			Field Screening: VOC (ppm) 10 20 30 40; Health Physics (dpm) 20 40 60 80	Lab Analysis
Depth	Symbol	Description	Number	Type	Recovery		
		Ground Surface					
0–1		Fill - Aggregate base.					
1–5		FILL - Brown SILTY CLAY and f-c sand, some gravel; damp, stiff.	D-1		36/36	82	
			D-2		33/36		
5–6.5		Fill? - Gray SILTY CLAY, trace f-c sand; moist, soft.					
6.5–7.5		Fill? - Gray and brown f GRAVEL and f-c sand; wet, well sorted.	D-3		27/36		
7.5–8.5		Native - Brown SILTY CLAY, trace f-m sand; damp, stiff.					
8.5–12		Gray SILTY CLAY, little f-m sand; moist. @ 10.0' - 11.5' - iron stained fractures.	D-4		33/36		
12–18		Gray SILTY CLAY, little f-c sand, trace gravel; damp, stiff.	D-5		36/36	53	
			D-6		36/36	37	
18		End of Borehole at 18 ft					

Drill Method: Geoporobe Piston Rod | Datum:

Drill Date: 12-13-02 | Checked by:

Hole Size: | Sheet: 1 of 1

SHARP AND ASSOCIATES, INC. Environmental Engineers, Scientists, & Contractors

Project No: 2116-25

roject: RMIES Geoprobe Investigation

Log of Borehole: BH4D

Client: RMIES

Location: Transect 4

Geologist: K. Smith

SUBSURFACE PROFILE			SAMPLE				
Depth	Symbol	Description	Number	Type	Recovery	Field Screening VOC (ppm) 10 20 30 40 / Health Physics (dpm) 20 40 60 80	Lab Analysis
0		Ground Surface					
0		Fill - Aggregate base.				0	
1			D-1		36/36	0 42	
2		Fill - Dark gray and black SILTY CLAY, little f-c sand, trace gravel.				0	
3						0	
4		Fill - Dark gray SILTY CLAY, little f-c sabd, trace gravel; moist, soft.				0	
5			D-2		24/36	0 15	
6						0	
7						0	
8			D-3		22/36	0 8	
9						0	
10						0	
11			D-4		17/36	05	
12						0	
13						0	
14			D-5		15/36	0 53	
15						0	
16						0	
16		Native - Black SILTY CLAY, little f-c sand, little gravel; moist to wet.	D-6		32/36	0	
17		Native - Gray SILTY CLAY, little f-c sand, little gravel; damp.				0	
18		End of Borehole at 18 ft					
19							
20							
21							

Drill Method: Geoporobe Piston Rod Datum:

Drill Date: 12-13-02 Checked by:

Hole Size: Sheet: 1 of 1

SHARP AND ASSOCIATES, INC. Environmental Engineers, Scientists, & Contractors

000019

Project No: 2116-25

Project: RMIES Geoprobe Investigation

Client: RMIES

Location: Transect 4

Log of Borehole: BH4E

Geologist: K. Smith

SUBSURFACE PROFILE			SAMPLE			Field Screening VOC (ppm) 10 20 30 40 / Health Physics (dpm) 20 40 60 80	Lab Analysis
Depth	Symbol	Description	Number	Type	Recovery		
0		Ground Surface				0	
1		Fill - Aggreegate base.				0	
2		Fill - Brown SILTY CLAY, little f-c sand, little gravel; damp, stiff.	D-1		33/36	0 65	
3						0	
4		Native - Dark gray SILTY CLAY (topsoil), trace f-m sand; damp				0	
5		Brown and gray mottled SILTY CLAY, trace f sand; moist, medium stiff.	D-2		24/36	0 51	
6						0	
7		Brown and gray CLAYEY SILT w/ silt lenses; wet, loose/soft.				0	
8		Brown SILTY CLAY, trace f-c sand, trace gravel.	D-3		34/36	0 9	
9		Gray SILTY CLAY, little f-c sand, little gravel; damp, stiff.				0	
10						0	
11		Gray CLAY; damp, high plasticity.	D-4			0 51	
12		Gray SILTY CLAY, little f-c sand, little gravel; damp, stiff.					
13		End of Borehole at 12 ft					
14							
15							
16							
17							
18							
19							
20							
21							

SHARP AND ASSOCIATES, INC. Environmental Engineers, Scientists, & Contractors

Drill Method: Geoporobe Piston Rod Datum:

Drill Date: 12-16-02 Checked by:

Hole Size: Sheet: 1 of 1

Project No: 2116-25

Project: RMIES Geoprobe Investigation

Client: RMIES

Location: Transect 4

Log of Borehole: BH4F

Geologist: K. Smith

SUBSURFACE PROFILE			SAMPLE			Field Screening VOC (ppm) 10 20 30 40 / Health Physics (dpm) 20 40 60 80	Lab Analysis
Depth	Symbol	Description	Number	Type	Recovery		
0		Ground Surface					
0		Fill - Aggregate base.					
1		Fill - Brown and gray mottled SILTY CLAY, trace f-m sand; damp.	D-1		32/36		
2							
3		Fill - Brown and gray SILTY CLAY; moist, medium stiff. Refusal at 4.5'	D-2		16/36		
4							
5		End of Borehole at 4.5 ft					
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
21							

SHARP AND ASSOCIATES, INC. Environmental Engineers, Scientists, & Contractors

Drill Method: Geoporobe Piston Rod Datum:

Drill Date: 12-19-02 Checked by:

Hole Size: Sheet: 1 of 1

000021

Project No: 2116-25

Project: RMIES Geoprobe Investigation

Client: RMIES

Location: Transect 5

Log of Borehole: BH5A

Geologist: K. Smith

SUBSURFACE PROFILE			SAMPLE			Field Screening VOC (ppm) 10 20 30 40 / Health Physics (dpm) 20 40 60 80	Lab Analysis
Depth	Symbol	Description	Number	Type	Recovery		
0		Ground Surface					
0		Fill - Aggregate base.				0	
1		Possible fill -Brown f-c SAND and GRAVEL.	D-1		30/36	0 15	
2		Brown and gray mottled SILTY CLAY; moist.				0	
3						0 40	
4		Brown SILT, trace clay; wet.	D-2		27/36	0	
5						0	
6		Brown SILTY CLAY, little f-c sand; damp.					
7			D-3				
8		Gray SILTY CLAY, little f-c sand, trace gravel; damp.					
9		End of Borehole at 9 ft					
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
21							

SHARP AND ASSOCIATES, INC. Environmental Engineers, Scientists, & Contractors

Drill Method: Geoporobe Piston Rod Datum:

Drill Date: 12-17-02 Checked by:

Hole Size: Sheet: 1 of 1

Project No: 2116-25

Project: RMIES Geoprobe Investigation

Client: RMIES

Location: Transect 5

Log of Borehole: BH5B

Geologist: K. Smith

SUBSURFACE PROFILE			SAMPLE				
Depth	Symbol	Description	Number	Type	Recovery	Field Screening VOC (ppm) 10 20 30 40 / Health Physics (dpm) 20 40 60 80	Lab Analysis
0		Ground Surface					
0		Fill - Aggregate base.					
1		Possible fill - Brown f-c SAND and GRAVEL.	D-1		29/36	40	
2		Brown and gray mottled SILTY CLAY; moist.					
3							
4		Brown SILT, trace clay; wet.	D-2		30/36		
5		Brown SILTY CLAY, little f-c sand; damp.					
6							
7		Gray SILTY CLAY, little f-c sand, trace gravel; damp.	D-3		36/36		
8							
9							
10			D-4		12/36		
11							
12		End of Borehole at 12 ft					
13							
14							
15							
16							
17							
18							
19							
20							
21							

SHARP AND ASSOCIATES, INC. Environmental Engineers, Scientists, & Contractors

Drill Method: Geoporobe Piston Rod Datum:

Drill Date: 12-17-02 Checked by:

Hole Size: Sheet: 1 of 1

000023

Project No: 2116-25

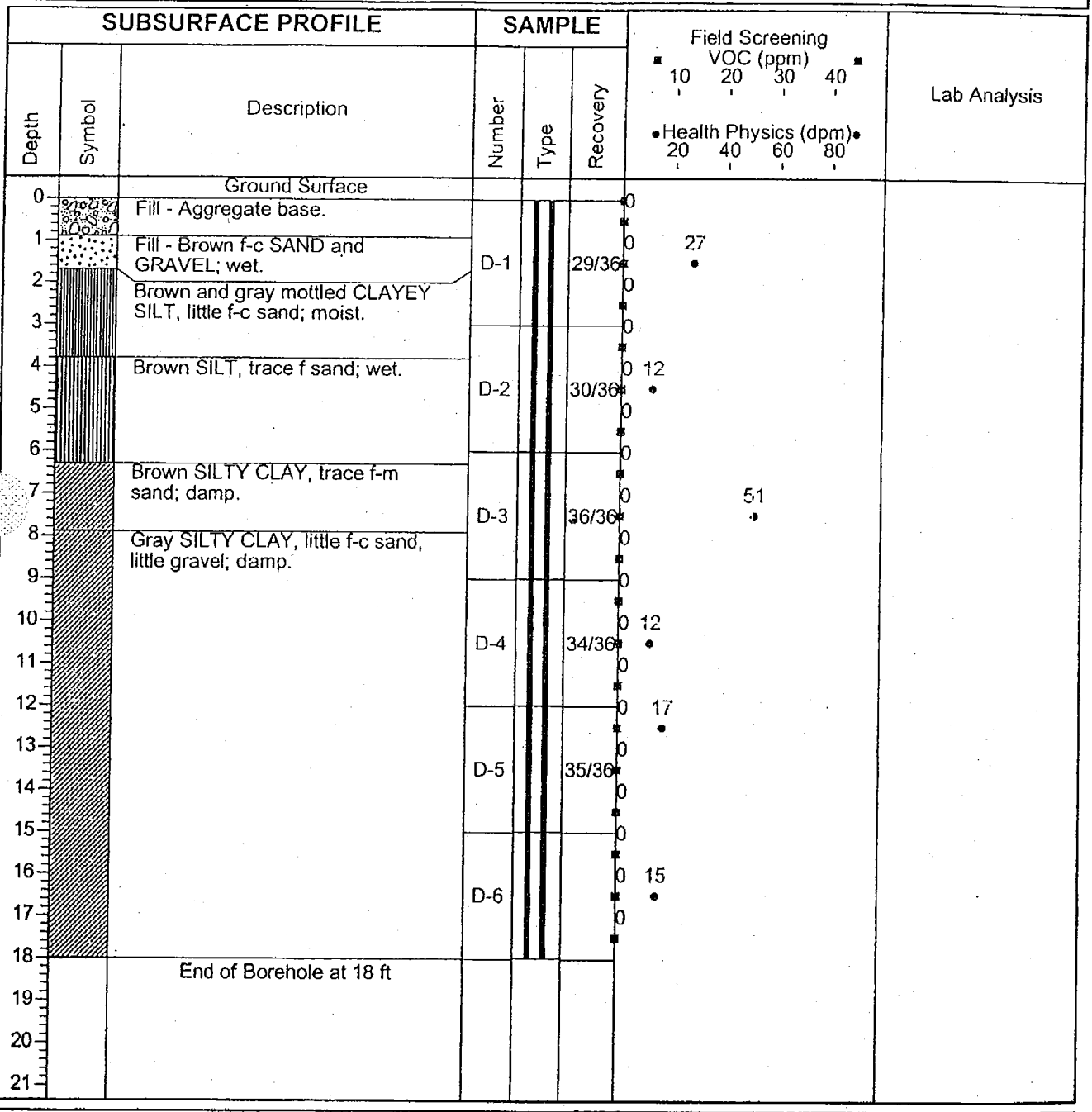
Project: RMIES Geoprobe Investigation

Client: RMIES

Location: Transect 5

Log of Borehole: BH5C

Geologist: K. Smith



SHARP AND ASSOCIATES, INC. Environmental Engineers, Scientists, & Contractors

Drill Method: Geoporobe Piston Rod Datum:

Drill Date: 12-16-02 Checked by:

Hole Size: Sheet: 1 of 1

Project No: 2116-25

Project: RMIES Geoprobe Investigation

Client: RMIES

Location: Transect 5

Log of Borehole: BH5D

Geologist: K. Smith

Depth	Symbol	Description	Number	Type	Recovery	Field Screening VOC (ppm) / Health Physics (dpm)	Lab Analysis
		Ground Surface					
0		Fill - Aggregate base.				0	
1		Fill - Brown SILTY CLAY and f-c sand, some gravel.	D-1		36/36	0	>100
2						0	
3		Brown and gray mottled CLAYEY SILT, little f-c sand; damp.				0	
4		contains organic material.	D-2		29/36	0	
5		Brown SILT w/ clay lenses; wet.				0 35	
6						0	
7		Brown CLAY.	D-3		28/36	0	
8		Brown SILT; wet.				0 60	
9		Gray SILTY CLAY, little f-c sand, little gravel; damp, stiff.				0	
10						0	
11			D-4		35/36	0 15	
12						0	
13			D-5		36/36	0	
14						0 11	
15						0	
16			D-6		33/36	0 12	
17						0	
18		End of Borehole at 18 ft					
19							
20							
21							

SHARP AND ASSOCIATES, INC. Environmental Engineers, Scientists, & Contractors

Drill Method: Geoporobe Piston Rod Datum:

Drill Date: 12-17-02 Checked by:

Hole Size: Sheet: 1 of 1

CC0025

Project No: 2116-25

Project: RMIES Geoprobe Investigation

Client: RMIES

Location: Transect 5

Log of Borehole: BH5E

Geologist: K. Smith

SUBSURFACE PROFILE			SAMPLE			Field Screening VOC (ppm) 10 20 30 40 / Health Physics (dpm) 20 40 60 80	Lab Analysis
Depth	Symbol	Description	Number	Type	Recovery		
0		Ground Surface					
0		Fill - Aggregate base.					
1		Fill - Brpwn SILTY CLAY and f-c sand, trace gravel.	D-1		34/36	>100	
2							
3		Possible fill - Dark gray SILTY CLAY (topsoil).					
4		Brown f-c SAND and GRAVEL.	D-2		25/36	44	
5		Brown SILT, trace f sand; wet.					
6							
7		Brown and gray CLAY.					
8		Gray SILTY CLAY, little f-c sand, little gravel; damp. Contains iron stained fractures from 7.5' to 10.2'.	D-3			15	
9							
10			D-4				
11						12	
12		End of Borehole at 12 ft					
13							
14							
15							
16							
17							
18							
19							
20							
21							

VOC readings: 0 at each interval from 0 to 11 ft.

SHARP AND ASSOCIATES, INC.
Environmental Engineers, Scientists, & Contractors

Drill Method: Geoporobe Piston Rod
Datum:
Drill Date: 12-17-02
Checked by:
Hole Size:
Sheet: 1 of 1

000026

Project No: 2116-25

roject: RMIES Geoprobe Investigation

Client: RMIES

Location: Transect 5

Log of Borehole: BH5F

Geologist: K. Smith

SUBSURFACE PROFILE			SAMPLE			Field Screening VOC (ppm) 10 20 30 40 / Health Physics (dpm) 20 40 60 80	Lab Analysis
Depth	Symbol	Description	Number	Type	Recovery		
		Ground Surface					
0		Fill - Brown f-c SAND, some silt, trace gravel.				0	
1		Fill - Brown SILTY CLAY, little f-c sand, trace gravel; moist. Contains wood.	D-1		32/36	0 78	
2						0	
3		Native - Brown SILTY CLAY; moist to wet.				0	
4		Brown f-c SAND and f GRAVEL: wet.	D-2		24/36	0 24	
5		Brown SILT, trace clay; wet.				0	
6		Brown CLAY; highly plastic.				0	
		Brown SILTY CLAY, trace f-c sand; damp.	D-3		29/36	0 10	
8		Gray SILTY CLAY, little f-c sand, trace gravel; damp. Contains iron stained fractures.				0	
9		End of Borehole at 9 ft					
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
21							

SHARP AND ASSOCIATES, INC. Environmental Engineers, Scientists, & Contractors

Drill Method: Geoporobe Piston Rod Datum:

Drill Date: 12-17-02 Checked by:

Hole Size: Sheet: 1 of 1

000027

Project No: 2116-25

Project: RMIES Geoprobe Investigation

Client: RMIES

Location: Transect 6

Log of Borehole: BH6A

Geologist: K. Smith

SUBSURFACE PROFILE			SAMPLE					
Depth	Symbol	Description	Number	Type	Recovery	Field Screening VOC (ppm) 10 20 30 40 / Health Physics (dpm) 20 40 60 80		Lab Analysis
0		Ground Surface						
1		Fill - Light brown and gray SILTY CLAY, trace f-c sand; damp.	D-1		36/36	0 0	23	
2						0		
3		Fill - Brown and gray SILTY CLAY; moist.				0		
4			D-2		30/36	0	27	
5						0		
6		Fill - Brown and gray SILTY CLAY, trace f-c sand, trace gravel; moist, soft.				0		
7			D-3		26/36	0	24	
8						0		
9		@ 9.0' to 10.9' - increased moisture content.				0		
10			D-4		23/36	0		
11		Native - Brown and gray SILTY CLAY.				1 9		
12						0		
13			D-5		31/36	1	26	
14		Gray SILTY CLAY, little f-c sand, trace gravel; damp, stiff.				1		
15		End of Borehole at 15 ft						
16								
17								
18								
19								
20								
21								

SHARP AND ASSOCIATES, INC. Environmental Engineers, Scientists, & Contractors

Drill Method: Geoporobe Piston Rod Datum:

Drill Date: 12-5-02 Checked by:

Hole Size: Sheet: 1 of 1

000028

Project No: 2116-25

Project: RMIES Geoprobe Investigation

Client: RMIES

Location: Transect 6

Log of Borehole: BH6B

Geologist: K. Smith

SUBSURFACE PROFILE			SAMPLE			Field Screening VOC (ppm) 10 20 30 40 / Health Physics (dpm) 20 40 60 80	Lab Analysis
Depth	Symbol	Description	Number	Type	Recovery		
0		Ground Surface					
0		Fill - Brown and gray SILTY CLAY, little f-c sand, trace f gravel; moist.	D-1		32/36	0 22	
1						0	
2						0	
3			D-2		30/36	0 14	
4						0	
5						0	
6		@ 5.8' - Contains organic material.	D-3		32/36	0	
–		Possible fill - Gray SILTY CLAY, trace f-c sand; moist to wet. Increasing moisture with depth.				0 28	
9						1	
10		Native - Gray SILTY CLAY, little f-c sand, trace gravel; damp, stiff. Confining layer at 9.6'.	D-4		36/36	1 19	
11						0	
12						0	
13			D-5		36/36	0 19	
14						0	
15						0	
16							
17							
18		End of Borehole at 18 ft					
19							
20							
21							

SHARP AND ASSOCIATES, INC. Environmental Engineers, Scientists, & Contractors

Drill Method: Geoporobe Piston Rod Datum:

Drill Date: 12-5-02 Checked by:

Hole Size: Sheet: 1 of 1

000029

Project No: 2116-25

Project: RMIES Geoprobe Investigation

Client: RMIES

Location: Transect 6

Log of Borehole: BH6C

Geologist: K. Smith

SUBSURFACE PROFILE			SAMPLE				
Depth	Symbol	Description	Number	Type	Recovery	Field Screening VOC (ppm) 10 20 30 40 / Health Physics (dpm) 20 40 60 80	Lab Analysis
0		Ground Surface					
0-4.5		Fill - Brown and gray SILTY CLAY, little f-c sand, trace gravel; damp to moist.	D-1		36/36	0 0 0 26	
4.5-7		@ 4.5' - contains wood	D-2		31/36	0 0 8 0	
7-9		@ 7.0 to 7.1 and 7.6' to 8.5' - Increased moisture content/seepage, moist to wet.	D-3		36/36	0 0 0 18 0	
9-15		Native - Gray SILTY CLAY, little f-c sand, trace gravel; damp, stiff.	D-4		36/36	0 0 1 1 0	
			D-5		36/36	0 0 16 0	
15		End of Borehole at 15 ft					
16							
17							
18							
19							
20							
21							

SHARP AND ASSOCIATES, INC. Environmental Engineers, Scientists, & Contractors

Drill Method: Geoporobe Piston Rod Datum:

Drill Date: 12-5-02 Checked by:

Hole Size: Sheet: 1 of 1

Project No: 2116-25

Project: RMIES Geoprobe Investigation

Client: RMIES

Location: Transect 6

Log of Borehole: BH6D

Geologist: K. Smith

SUBSURFACE PROFILE			SAMPLE			Field Screening VOC (ppm) 10 20 30 40 / Health Physics (dpm) 20 40 60 80	Lab Analysis
Depth	Symbol	Description	Number	Type	Recovery		
		Ground Surface					
0		Fill - Brown and gray SILTY CLAY, trace to little f-c sand, trace gravel; moist.	D-1		36/36	0 19	
1						0 19	
2						0 19	
3			D-2		33/36	0 18	
4						0 18	
5						0 18	
6			D-3		36/36	0 19	
7						0 19	
8		@ 8.0' and 9.0' to 10.5' - increased moisture content/seepage, moist to wet.				1 19	
9						0 20	
10			D-4		36/36	1 20	
11		Native - Gray SILTY CLAY, little f-c sand, trace gravel; damp, stiff.				1 20	
12						1 17	
13			D-5		36/36	1 17	
14						1 17	
15			D-6			1 37	
16						0 37	
17						0 37	
18		End of Borehole at 18 ft				0 37	
19							
20							
21							

SHARP AND ASSOCIATES, INC. Environmental Engineers, Scientists, & Contractors

Drill Method: Geoporobe Piston Rod Datum:

Drill Date: 12-5-02 Checked by:

Hole Size: Sheet: 1 of 1

Project No: 2116-25

Project: RMIES Geoprobe Investigation

Client: RMIES

Location: Transect 7

Log of Borehole: BH7A

Geologist: K. Smith

SUBSURFACE PROFILE			SAMPLE			Field Screening VOC (ppm) 10 20 30 40 / Health Physics (dpm) 20 40 60 80	Lab Analysis
Depth	Symbol	Description	Number	Type	Recovery		
0		Ground Surface					
		Concrete				0	
1		Possible fill - Dark gray SILTY CLAY, trace f-c sand, trace gravel; moist to wet. Contains roots and organic material.	D-1		16/36	0	
2						0	
3		Native - Brown and gray mottled SILTY CLAY, trace f sand; moist.				0	
4		Brown CLAYEY SILT; moist.	D-2		30/36	0	
5						0	
6		Brown CLAY, trace silt, trace f-m sand; damp, highly plastic.				0	
7			D-3		33/36	0	
8		Brownish gray SILTY CLAY, little f-c sand, trace gravel; damp. Contains iron stained fractures.				0	
9		End of Borehole at 9 ft					
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
21							

SHARP AND ASSOCIATES, INC. Environmental Engineers, Scientists, & Contractors

Drill Method: Geoporobe Piston Rod Datum:

Drill Date: 12-19-02 Checked by:

Hole Size: Sheet: 1 of 1

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Project No: 2116-25

Project: RMIES Geoprobe Investigation

Client: RMIES

Location: Transect 7

Log of Borehole: BH7B

Geologist: K. Smith

SUBSURFACE PROFILE			SAMPLE				
Depth	Symbol	Description	Number	Type	Recovery	Field Screening VOC (ppm) 10 20 30 40 / Health Physics (dpm) 20 40 60 80	Lab Analysis
		Ground Surface					
0		Concrete.				0	
1		Possible fill - Dark gray SILTY CLAY. Contains roots and organic material.	D-1		26/36	0	
2		Native - Brown and gray mottled SILTY CLAY; moist.				0	
3						0	
4		Brown SILT, little clay, little f sand; wet.	D-2		36/36	0	
5						0	
6		Brown and gray mottled CLAY; damp; highly polastic. Confining layer.				0	
7		Brown SILTY CLAY, little f-m sand; damp.	D-3		36/36	0	
8						0	
9		Gray SILTY CLAY, little f-c sand, trace gravel; damp to moist.				0	
10			D-4		36/36	0	
11						0	
12		End of Borehole at 12 ft					
13							
14							
15							
16							
17							
18							
19							
20							
21							

SHARP AND ASSOCIATES, INC. Environmental Engineers, Scientists, & Contractors

Drill Method: Geoporobe Piston Rod Datum:

Drill Date: 12-19-02 Checked by:

Hole Size: Sheet: 1 of 1

Project No: 2116-25

Project: RMIES Geoprobe Investigation

Client: RMIES

Location: Transect 7

Log of Borehole: BH7C

Geologist: K. Smith

SUBSURFACE PROFILE			SAMPLE			Field Screening VOC (ppm) 10 20 30 40 / Health Physics (dpm) 20 40 60 80	Lab Analysis
Depth	Symbol	Description	Number	Type	Recovery		
0		Ground Surface				0	
0		Concrete				0	
1		Fill - Brown, gray and red mottled SILTY CLAY, some f-c sand; moist.	D-1		20/36	0	
2		Fill - Brown f-c SAND; wet.				0	
3						0	
4		Fill - Black and gray SILTY CLAY; moist to wet. Contains roots and orgamic material.	D-2		21/36	0	
5						0	
6		Fill - Brown, black and gray SILTY CLAY, some f-c sand; moist to wet; soft.				0	
7			D-3		25/36	0	
8						0	
9						0	
10		Native - Gray CLAY; moist to wet; medium stiff.	D-4		28/36	0	
11						0	
12		Gray SILTY CLAT, little f-c sand, trace gravel; damp.				0	
13			D-5		30/36	0	
14						0	
15						0	
16			D-6		36/36	0	
17						0	
18		End of Borehole at 18 ft					
19							
20							
21							

SHARP AND ASSOCIATES, INC. Environmental Engineers, Scientists, & Contractors

Drill Method: Geoporobe Piston Rod Datum:

Drill Date: 12-18-02 Checked by:

Hole Size: Sheet: 1 of 1

Project No: 2116-25

Project: RMIES Geoprobe Investigation

Client: RMIES

Location: Transect 7

Log of Borehole: BH7D

Geologist: K. Smith

SUBSURFACE PROFILE			SAMPLE			Field Screening VOC (ppm) 10 20 30 40 / Health Physics (dpm) 20 40 60 80	Lab Analysis
Depth	Symbol	Description	Number	Type	Recovery		
0		Ground Surface				0	
		Concrete				0	
1		Fill - Brown SILTY CLay and gravel; moist.	D-1		20/36	0	
2		Fill - Brown, gray and orange SILTY CLAY; moist to wet. Contains organic material.				0	
3						0	
4		Fill - Brown f-c SAND; wet.	D-2		17/36	0	
5						0	
6		Fill - Brown, black and gray SILTY CLAY, little f-c sand; moist to wet.				0	
7			D-3		19/36	0	
8						0	
9		Native - Gray SILTY CLAY, trace f-c sand; moist. Decreasing moisture content with depth.				0	
10			D-4		28/36	0	
11						0	
12		Gray SILTY CLAY, little f-c sand, trace gravel; damp.				0	
13			D-5		36/36	0	
14						0	
15						0	
16			D-6		36/36	0	
17						0	
18		End of Borehole at 18 ft				0	
19							
20							
21							

SHARP AND ASSOCIATES, INC. Environmental Engineers, Scientists, & Contractors

Drill Method: Geoporobe Piston Rod Datum:

Drill Date: 12-18-02 Checked by:

Hole Size: Sheet: 1 of 1

Project No: 2116-25

Project: RMIES Geoprobe Investigation

Client: RMIES

Location: Transect 7

Log of Borehole: BH7E

Geologist: K. Smith

Depth	Symbol	Description	Sample Number	Sample Type	Recovery	Field Screening VOC (ppm) / Health Physics (dpm)	Lab Analysis
0		Ground Surface				0	
0		Concrete				0	
1		Fill - Brown SILTY CLAY, little f-c sand, trace gravel; moist to wet.	D-1		11/36	0	
2						0	
3						0	
4		Native - Brown and gray mottled SILTY CLAY, trace f-c sand.	D-2		30/36	0	
5		Brown SILT, little clay, little f sand; wet.				0	
6		Brown SILTY CLAY, little f-c sand; moist. Confining layer.	D-3		36/36	0	
7						0	
8		Gray SILTY CLAY, little f-c sand, trace gravel; damp.				0	
9							
10			D-4		36/36		
11							
12		End of Borehole at 12 ft					
13							
14							
15							
16							
17							
18							
19							
20							
21							

Field Screening VOC (ppm): 10 20 30 40

Health Physics (dpm): 20 40 60 80

SHARP AND ASSOCIATES, INC. Environmental Engineers, Scientists, & Contractors

Drill Method: Geoporobe Piston Rod Datum:

Drill Date: 12-19-02 Checked by:

Hole Size: Sheet: 1 of 1

Project No: 2116-25

Project: RMIES Geoprobe Investigation

Client: RMIES

Location: Transect 7

Log of Borehole: BH7F

Geologist: K. Smith

SUBSURFACE PROFILE			SAMPLE			Field Screening VOC (ppm) 10 20 30 40 / Health Physics (dpm) 20 40 60 80	Lab Analysis
Depth	Symbol	Description	Number	Type	Recovery		
0		Ground Surface					
0		Concrete				0	
1		Fill - Gray SILTY CLAY, trace f-m sand.	D-1		6/36	0	
2						0	
3		Native - Brown and gray mottled SILTY CLAY; moist.				0	
4		Brown CLAYEY SILT; wet.	D-2		30/36	0	
5						0	
6		Brown CLAY, trace silt, trace f-m sand; damp. Highly plastic.				0	
		Brownish gray SILTY CLAY, little f-c sand, trace gravel. Contains iron stained fractures.	D-3		33/36	0	
8						0	
9		End of Borehole at 9 ft					
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
21							

SHARP AND ASSOCIATES, INC. Environmental Engineers, Scientists, & Contractors

Drill Method: Geoporobe Piston Rod Datum:

Drill Date: 12-19-02 Checked by:

Hole Size: Sheet: 1 of 1

Project No: 2116-25

Project: RMIES Geoprobe Investigation

Client: RMIES

Location: Transect 8

Log of Borehole: BH8A

Geologist: K. Smith

SUBSURFACE PROFILE			SAMPLE			Field Screening VOC (ppm) 10 20 30 40 / Health Physics (dpm) 20 40 60 80	Lab Analysis
Depth	Symbol	Description	Number	Type	Recovery		
0		Ground Surface					
0		Fill - Black aggregate base.	D-1		29/36	0	
1		Native - Dark gray and black SILTY CLAY (topsoil).				0	
2		Brown and gray mottled SILTY CLAY.				0	
3						0	
4		Brown and gray SILT; moist to wet.	D-2		36/36	0	
5		Brown SILTY CLAY, little f-c sand, trace gravel; damp, stiff.				0	
6		Brown CLAYEY SILT; wet.	D-3		36/36	0	
7		Brown SILTY CLAY, little f-c sand, trace gravel; damp, stiff.				0	
8		Gray SILTY CLAY, little f-c sand, trace gravel; damp, stiff.				0	
9		End of Borehole at 9 ft					
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
21							

SHARP AND ASSOCIATES, INC. Environmental Engineers, Scientists, & Contractors

Drill Method: Geoporobe Piston Rod Datum:

Drill Date: 12-19-02 Checked by:

Hole Size: Sheet: 1 of 1

Project No: 2116-25

Project: RMIES Geoprobe Investigation

Client: RMIES

Location: Transect 8

Log of Borehole: BH8B

Geologist: K. Smith

SUBSURFACE PROFILE			SAMPLE				
Depth	Symbol	Description	Number	Type	Recovery	Field Screening VOC (ppm) 10 20 30 40 / Health Physics (dpm) 20 40 60 80	Lab Analysis
0		Ground Surface					
0		Fill - Black aggregate base.				0	
1		Fill - Gray GRAVEL and f-c sand.				0	
2		Native - Dark gray and black SILTY CLAY (topsoil).	D-1		36/36	0 41	
3		Dark gray CLAYEY SILT; moist to wet.				0	
4			D-2			0	
5		Brown, orange and gray mottled SILTY CLAY, trace f-c sand; damp.				0 28	
6		Brown and gray f-c SAND, little gravel; wet.				0	
7		Brownish gray SILTY CLAY, little f-c sand; damp to moist. Contains laminated highly plastic clay lenses.	D-3			0	
8						0 21	
9						0	
10		Gray SILTY CLAY, little f-c sand, trace gravel; damp.	D-4			0	
11						0 17	
12		End of Borehole at 12 ft					
13							
14							
15							
16							
17							
18							
19							
20							
21							

SHARP AND ASSOCIATES, INC. Environmental Engineers, Scientists, & Contractors

Drill Method: Geoporobe Piston Rod Datum:

Drill Date: 12-18-02 Checked by:

Hole Size: Sheet: 1 of 1

Project No: 2116-25

Project: RMIES Geoprobe Investigation

Client: RMIES

Location: Transect 8

Log of Borehole: BH8C

Geologist: K. Smith

SUBSURFACE PROFILE			SAMPLE				
Depth	Symbol	Description	Number	Type	Recovery	Field Screening VOC (ppm) 10 20 30 40 / Health Physics (dpm) 20 40 60 80	Lab Analysis
0		Ground Surface					
0		Fill - Aggregate base.				0	
1		Native - Dark gray and black SILTY CLAY (topsoil).	D-1		30/36	0	
2		Native - Brown, gray and green mottled SILTY CLAY; moist to wet, soft.				0	
3						0	
4			D-2		31/36	0 13	
5		Brown SILTY CLAY, little f-c sand, trace gravel; damp, stiff. Contains iron stained fractures.				0	
6						0	
7			D-3		34/36	0 15	
8		Gray SILTY CLAY, little f-c sand, little gravel; damp.				0	
9						0	
10		@ 7.8' to 9.8' - Contains iron stained fractures.	D-4		36/36	0 18	
11						0	
12						0	
13			D-5		36/36	0	
14						0 14	
15						0	
16			D-6		36/36	0	
17						0 18	
18		End of Borehole at 18 ft					
19							
20							
21							

SHARP AND ASSOCIATES, INC. Environmental Engineers, Scientists, & Contractors

Drill Method: Geoporobe Piston Rod Datum:

Drill Date: 12-17-02 Checked by:

Hole Size: Sheet: 1 of 1

Project No: 2116-25

Project: RMIES Geoprobe Investigation

Client: RMIES

Location: Transect 8

Log of Borehole: BH8D

Geologist: K. Smith

Depth	Symbol	Description	Number	Type	Recovery	Field Screening VOC (ppm) 10 20 30 40 / Health Physics (dpm) 20 40 60 80	Lab Analysis
0		Ground Surface					
0		Fill - Black f-c SAND and GRAVEL (Aggregate base).				0	
1						0	
2		Fill - Brown, black and gray SILTY CLAY, little f-c sand; moist to wet.	D-1		31/36	0	
3						0	
4			D-2		21/36	0 31	
5						0	
6						0	
		@ 6.5' - Black organic stains.	D-3		18/36	0 19	
8						0	
9						0	
10			D-4		26/36	0	
11						0 22	
12						0	
13			D-5		25/36	0	
14		Native - Gray SILTY CLAY, little f-c sand, trace gravel; damp to moist.				0 20	
15						0	
16			D-6		36/36	0	
17						0 17	
18		End of Borehole at 18 ft					
19							
20							
21							

SHARP AND ASSOCIATES, INC. Environmental Engineers, Scientists, & Contractors

Drill Method: Geoporobe Piston Rod Datum:

Drill Date: 12-18-02 Checked by:

Hole Size: Sheet: 1 of 1

Project No: 2116-25

Project: RMIES Geoprobe Investigation

Client: RMIES

Location: Transect 8

Log of Borehole: BH8E

Geologist: K. Smith

Depth	Symbol	Description	Sample Number	Sample Type	Recovery	Field Screening VOC (ppm) / Health Physics (dpm)	Lab Analysis
0		Ground Surface					
0		Fill - Black aggregate base.					
1		Fill - Gray aggregate base.					
1–3		Possible fill - Dark gray SILTY CLAY, little f-c sand; moist to wet.	D-1		27/36		
4–5		Native - Brown SILTY CLAY, trace f-m sand; damp to moist. Laminated.	D-2		26/36	23	
6–7		Brown SILTY CLAY, little f-c sand, trace gravel; damp.	D-3		34/36	38	
8–11		Gray SILTY CLAY, little f-c sand, trace gravel; damp. @ 10.0' to 10.9' - moist to wet.	D-4		28/36	33	
12		End of Borehole at 12 ft					

Field Screening VOC (ppm): 10 20 30 40

Health Physics (dpm): 20 40 60 80

SHARP AND ASSOCIATES, INC. Environmental Engineers, Scientists, & Contractors

Drill Method: Geoporobe Piston Rod Datum:

Drill Date: 12-18-02 Checked by:

Hole Size: Sheet: 1 of 1

000042

Project No: 2116-25

Project: RMIES Geoprobe Investigation

Client: RMIES

Location: Transect 8

Log of Borehole: BH8F

Geologist: K. Smith

SUBSURFACE PROFILE			SAMPLE			Field Screening VOC (ppm) ■ 10 20 30 40 ■ •Health Physics (dpm)• 20 40 60 80	Lab Analysis
Depth	Symbol	Description	Number	Type	Recovery		
0		Ground Surface					
0		Fill - Gray and black aggregate base.					
1		Dark gray and black SILT, trace f sand, trace clay; moist.	D-1		31/36		
2		Brown SILTY CLAY, trace f-m sand; damp.					
3		Brown SILT, trace clay, trace f sand; wet. @3.5' to 3.7' - Clay lens, highly plastic.	D-2				
4		Brown SILTY CLAY, trace cf-c sand; damp. Contains iron stained fractures.					
5		Gray SILTY CLAY, little f-c sand; damp, laminated.	D-3				
6		End of Borehole at 9 ft					
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
21							

SHARP AND ASSOCIATES, INC. Environmental Engineers, Scientists, & Contractors

Drill Method: Geoporobe Piston Rod Datum:

Drill Date: 12-19-02 Checked by:

Hole Size: Sheet: 1 of 1

000043

Project No: 2116-25

Project: RMIES Geoprobe Investigation

Client: RMIES

Location: Transect 9

Log of Borehole: BH9A

Geologist: K. Smith

SUBSURFACE PROFILE			SAMPLE			Field Screening VOC (ppm) 10 20 30 40 / Health Physics (dpm) 20 40 60 80	Lab Analysis
Depth	Symbol	Description	Number	Type	Recovery		
0		Ground Surface					
1		Fill - Brown SILTY CLAY and gravel.					
2		Native - Brown CLAYEY SILT; moist.	D-1		30/36		
3		Brown and gray mottled SILTY CLAY; damp.					
4							
5		Brown SILT, trace clay, trace f sand, wet.	D-2		31/36		
6							
7			D-3		36/36		
8		Gray SILTY CLAY, little f-c sand, trace gravel; damp.					
9		End of Borehole at 9 ft					
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
21							

SHARP AND ASSOCIATES, INC. Environmental Engineers, Scientists, & Contractors

Drill Method: Geoporobe Piston Rod Datum:

Drill Date: 12-19-02 Checked by:

Hole Size: Sheet: 1 of 1

Project No: 2116-25

Project: RMIES Geoprobe Investigation

Client: RMIES

Location: Transect 9

Log of Borehole: BH9B

Geologist: K. Smith

SUBSURFACE PROFILE			SAMPLE			Field Screening VOC (ppm) 10 20 30 40 / Health Physics (dpm) 20 40 60 80	Lab Analysis
Depth	Symbol	Description	Number	Type	Recovery		
0		Ground Surface					
0		Fill - Aggregate base.				0	
1		Brown and gray mottled CLAYEY SILT, trace f-c sand; moist.	D-1		25/36	0 30	
2						0	
3						0	
4		Brown SILT, trace clay; wet.	D-2		31/36	0 18	
5						0	
6		Brown CLAY; moist.				0	
7		Brown SILT, little f sand; wet.				0 20	
8		Gray SILTY CLAY, little f-c sand, trace gravel; damp, stiff.	D-3		34/36	0	
9						0	
10			D-4			0 18	
11						0	
12		End of Borehole at 12 ft					
13							
14							
15							
16							
17							
18							
19							
20							
21							

SHARP AND ASSOCIATES, INC. Environmental Engineers, Scientists, & Contractors

Drill Method: Geoporobe Piston Rod Datum:

Drill Date: 12-18-02 Checked by:

Hole Size: Sheet: 1 of 1

000045

Project No: 2116-25

Project: RMIES Geoprobe Investigation

Client: RMIES

Location: Transect 9

Log of Borehole: BH9C

Geologist: K. Smith

Depth	Symbol	Description	Number	Type	Recovery	Field Screening VOC (ppm) / Health Physics (dpm)	Lab Analysis
0		Ground Surface					
0–1		Fill - Aggregate base.	D-1		28/36	0	
1–3		Fill - Dark gray and black SILTY CLAY, little f-c sand, trace gravel. Contains organic materials.				0, 41	
3–6		Fill - Gray SILT and f sand, trace clay moist to wet	D-2		30/36	0, 21	
6		@ 6.0' - saturated/wet.				0	
6–8			D-3		32/36	0, 17	
8–9		Native - Gray SILTY CLAY, little f-c sand, trace gravel; damp, stiff.				0	
9–12			D-4		36/36	0, 27, 38	
12–15			D-5		36/36	0	
15–17			D-6		36/36	0, 15	
17–18						0	
18		End of Borehole at 18 ft					
19–21							

SHARP AND ASSOCIATES, INC. Environmental Engineers, Scientists, & Contractors

Drill Method: Geoporobe Piston Rod Datum:

Drill Date: 12-17-02 Checked by:

Hole Size: Sheet: 1 of 1

000046

Project No: 2116-25

Project: RMIES Geoprobe Investigation

Client: RMIES

Location: Transect 9

Log of Borehole: BH9D

Geologist: K. Smith

SUBSURFACE PROFILE			SAMPLE			Field Screening VOC (ppm) 10 20 30 40 / Health Physics (dpm) 20 40 60 80	Lab Analysis
Depth	Symbol	Description	Number	Type	Recovery		
0		Ground Surface					
0		Fill - Aggregate base.	D-1		24/36	0 0 29 0	
2		Fill - Gray SILTY CLAY, trace f-c sand.					
3		Fill Dark gray CLAYEY SILT; moist to wet, soft.	D-2		30/36	0 0 17 0	
6			D-3		24/36	0 0 21 8	
9			D-4		19/36	0 0 0	
12		Fill - Gray and Black SILTY CLAY, little f-c sand; moist to wet. Contains organic materials/stains.	D-5			0 14 0 0 0	
15		Native -Gray SILTY CLAY, little f-c sand, little gravel; damp.	D-6			0 0 11 0	
18		End of Borehole at 18 ft					
19							
20							
21							

SHARP AND ASSOCIATES, INC. Environmental Engineers, Scientists, & Contractors

Drill Method: Geoporobe Piston Rod Datum:

Drill Date: 12-17-02 Checked by:

Hole Size: Sheet: 1 of 1

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Project No: 2116-25

Project: RMIES Geoprobe Investigation

Client: RMIES

Location: Transect 9

Log of Borehole: BH9E

Geologist: K. Smith

Depth (ft)	Description	Sample Number	Recovery	Field Screening (Health Physics, dpm)	Lab Analysis
0	Ground Surface				
0–1.2	Fill - Aggregate base.	D-1	25/36	16	
1.2–2.3	Fill - Gray SILTY CLAY, little f-c sand.				
2.3–4	Native - Brown, gray and orange mottled SILTY CLAY.				
4–5	Brown CLAYEY SILT; moist to wet.	D-2	28/36	11	
5–7.6	Brown SILTY CLAY, trace f-m sand; damp, laminated.				
7.6–12	Gray SILTY CLAY, little f-c sand; damp.	D-3	36/36	17	
		D-4	36/36		
12	End of Borehole at 12 ft				

Field Screening: VOC (ppm) 10 20 30 40; Health Physics (dpm) 20 40 60 80. VOC readings: 0 at all depths.

SHARP AND ASSOCIATES, INC. Environmental Engineers, Scientists, & Contractors

Drill Method: Geoporobe Piston Rod

Datum:

Drill Date: 12-17-02

Checked by:

Hole Size:

Sheet: 1 of 1

Project No: 2116-25

Project: RMIES Geoprobe Investigation

Client: RMIES

Location: Transect 9

Log of Borehole: BH9F

Geologist: K. Smith

SUBSURFACE PROFILE			SAMPLE			Field Screening VOC (ppm) 10 20 30 40 / Health Physics (dpm) 20 40 60 80	Lab Analysis
Depth	Symbol	Description	Number	Type	Recovery		
0		Ground Surface					
1		Fill - Brown SILTY CLAY and gravel.	D-1		29/36		
2		Native - Dark gray and black SILTY CLAY.					
3		Brown and gray mottled SILTY CLAY; moist.					
4			D-2		32/36		
5		Brown CLAYEY SILT; moist to wet.					
6		Brown SILTY CLAY, little f-c sand, tace gravel.					
8			D-3		36/36		
9		Gray SILTY CLAY, little f-c sand, trace gravel; damp, stiff.					
10		End of Borehole at 9 ft					
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
21							

SHARP AND ASSOCIATES, INC. Environmental Engineers, Scientists, & Contractors

Drill Method: Geoporobe Piston Rod Datum:

Drill Date: 12-19-02 Checked by:

Hole Size: Sheet: 1 of 1

Project No: 2116-25

Project: RMIES Geoprobe Investigation

Client: RMIES

Location: 90' West of MW-901

Log of Borehole: BH11

Geologist: K. Smith

SUBSURFACE PROFILE			SAMPLE			Field Screening VOC (ppm) 10 20 30 40 / Health Physics (dpm) 20 40 60 80	Lab Analysis
Depth	Symbol	Description	Number	Type	Recovery		
0		Ground Surface					
0-3		FILL - Dark Gray Silty Clay, little f-c sand, gravel; damp	D-1		28/36		
3-6		Brown and Gray Mottled Clayey Silt (CL-ML) low to no plasticity, non-cohesive; moist @4.9'-5.1' and 5.3'-5.6' Silt; moist to wet	D-2		36/36		
6-8		Brown Silty Clay, trace f-c sand, iron staining, fractures; damp	D-3		36/36		
8-15		Gray Silty Clay, little f-c sand, gravel; damp, stiff	D-4 D-5		36/36 36/36		
15		End of Borehole at 15 ft					
16-21							

SHARP AND ASSOCIATES, INC. Environmental Engineers, Scientists, & Contractors

Drill Method: Geoporobe Piston Rod Datum:

Drill Date: 1-31-03 Checked by:

Hole Size: Sheet: 1 of 1

Project No: 2116-25

Project: RMIES Geoprobe Investigation

Log of Borehole: BH12

Client: RMIES

Location: 80' West of MW-901

Geologist: K. Smith

SUBSURFACE PROFILE			SAMPLE			Field Screening VOC (ppm) 10 20 30 40 / Health Physics (dpm) 20 40 60 80	Lab Analysis
Depth	Symbol	Description	Number	Type	Recovery		
0		Ground Surface					
1		FILL (possible) Brown and Gray Mottled Clay and Topsoil	D-1		28/36		
2		Brown Gray and Orange Mottled Silty Clay					
3		core loss					
4			D-2		22/36		
5		Brown Clayey Silt (CL-ML); moist to wet					
6		Brown Silty Clay, little f-c sand, trace gravel; damp, stiff					
7		Grownish Gray Clay, little f-c sand, trace gravel, fractures; moist	D-3		31/36		
8		Gray Silty Clay, little f-c sand, trace gravel; damp, stiff					
9							
10		little gravel, angular shale; very stiff	D-4		36/36		
11							
12							
13			D-5		36/36		
14							
15		End of Borehole at 15 ft					
16							
17							
18							
19							
20							
21							

SHARP AND ASSOCIATES, INC. Environmental Engineers, Scientists, & Contractors

Drill Method: Geoporobe Piston Rod Datum:

Drill Date: 1-31-03 Checked by:

Hole Size: Sheet: 1 of 1

Project No: 2116-25

Project: RMIES Geoprobe Investigation

Client: RMIES

Location: 60' West of MW-901

Log of Borehole: BH14

Geologist: K. Smith

SUBSURFACE PROFILE			SAMPLE				
Depth	Symbol	Description	Number	Type	Recovery	Field Screening VOC (ppm) 10 20 30 40 / Health Physics (dpm) 20 40 60 80	Lab Analysis
0		Ground Surface					
1		Dark Gray Topsoil (CL), roots/organics; moist	D-1		31/36		
2		Brown and Gray Mottled Silty Clay					
3							
4			D-2		36/36		
5		Brown Silt (ML), trace clay, fine gravel; wet to moist @5.2'-5.6' Brown Silty Clay; moist					
6							
7		Brown Silty Clay, trace f-c sand, iron staining; damp	D-3		36/36		
8		Gray Clay, little f-c sand, gravel; moist, stiff					
9							
10			D-4		36/36		
11							
12		damp, very stiff					
13			D-5		36/36		
14							
15		End of Borehole at 15 ft					
16							
17							
18							
19							
20							
21							

SHARP AND ASSOCIATES, INC. Environmental Engineers, Scientists, & Contractors

Drill Method: Geoporobe Piston Rod Datum:

Drill Date: 1-31-03 Checked by:

Hole Size: Sheet: 1 of 1

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Project No: 2116-25

Project: RMIES Geoprobe Investigation

Log of Borehole: BH15

Client: RMIES

Location: 51' West of MW-901

Geologist: K. Smith

SUBSURFACE PROFILE			SAMPLE			Field Screening VOC (ppm) 10 20 30 40 / Health Physics (dpm) 20 40 60 80	Lab Analysis
Depth	Symbol	Description	Number	Type	Recovery		
0		Ground Surface					
1		Brown Clay (Topsoil), roots/organics					
2		Light Brown /Clayey Silt (cl-ml), trace f-c sand; moist, very soft	D-1		26/36		
3							
4		Brown Silt, trace fine sand, clay; wet	D-2		29/36		
5							
6		Brown Clay (CH), high plasticity; moist					
		Brown Silt (ML); wet					
8		Brown and Gray Clay (CL) (Till transition zone), little f-c sand, gravel; damp	D-3		36/36		
9		(sharp vertical contact from brown to gray)					
10			D-4		36/36		
11							
12							
13		Gray Clay, little f-c sand, gravel; damp	D-5		36/36		
14							
15		End of Borehole at 15 ft					
16							
17							
18							
19							
20							
21							

SHARP AND ASSOCIATES, INC. Environmental Engineers, Scientists, & Contractors

Drill Method: Geoporobe Piston Rod Datum:

Drill Date: 1-30-03 Checked by:

Hole Size: Sheet: 1 of 1

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Project No: 2116-25

Project: RMIES Geoprobe Investigation

Client: RMIES

Location: 42' West of MW-901

Log of Borehole: BH16

Geologist: K. Smith

SUBSURFACE PROFILE			SAMPLE			Field Screening VOC (ppm) 10 20 30 40 / Health Physics (dpm) 20 40 60 80	Lab Analysis
Depth	Symbol	Description	Number	Type	Recovery		
0		Ground Surface					
0-3		FILL - Brown Silty Clay and Sand and Gravel; wet	D-1		16/36		
3-4.5		Brown Clayey Silt, trace f-c gravel, low to no plasticity, low cohesion; moist to wet	D-2		31/36		
4.5-5		Brown Silt; wet					
5-6		Brown/Gray/Orange Mottled Clay, f-c sand					
6-7.5		Brown Silty Clay, trace f-c sand	D-3		36/36		
7.5-11		Brown and Gray Silty Clay, little f-c sand, trace gravel; damp	D-4		36/36		
11-15		Gray Silty Clay, little f-c sand, trace gravel; damp, stiff to very stiff	D-5		36/36		
15		End of Borehole at 15 ft					
16							
17							
18							
19							
20							
21							

SHARP AND ASSOCIATES, INC. Environmental Engineers, Scientists, & Contractors

Drill Method: Geoporobe Piston Rod Datum:

Drill Date: 1-30-03 Checked by:

Hole Size: Sheet: 1 of 1

000054

Project No: 2116-25

Project: RMIES Geoprobe Investigation

Log of Borehole: BH17

Client: RMIES

Location: 30' West of MW-901

Geologist: K. Smith

SUBSURFACE PROFILE			SAMPLE				
Depth	Symbol	Description	Number	Type	Recovery	Field Screening VOC (ppm) 10 20 30 40 / Health Physics (dpm) 20 40 60 80	Lab Analysis
0		Ground Surface					
0		FILL - Brown Silty Clay; moist to wet, soft	D-1		29/36		
2		Dark Brown Silty Clay, organic/fibers; moist					
3		FILL - Brown Silty Clay, little f-c sand, organics - heterogeneous; wet @ 3.5'	D-2		32/36		
6		Possible FILL - Brown Silty Clay, little f-c sand, gravel; damp	D-3		36/36		
8		Brown Silty Clay, little f-c sand, gravel; damp, stiff					
9		Brown and Gray	D-4		36/36		
12		Gray Silty Clay, little f-c sand, gravel; damp	D-5				
15		End of Borehole at 15 ft					
16							
17							
18							
19							
20							
21							

SHARP AND ASSOCIATES, INC. Environmental Engineers, Scientists, & Contractors

Drill Method: Geoporobe Piston Rod Datum:

Drill Date: 1-30-03 Checked by:

Hole Size: Sheet: 1 of 1

Project No: 2116-25

Project: RMIES Geoprobe Investigation

Client: RMIES

Location: 20' West of MW-901

Log of Borehole: BH18

Geologist: K. Smith

SUBSURFACE PROFILE			SAMPLE				
Depth	Symbol	Description	Number	Type	Recovery	Field Screening VOC (ppm) 10 20 30 40 / Health Physics (dpm) 20 40 60 80	Lab Analysis
0		Ground Surface					
1		FILL - Light Brown Silty Clay, some to and f-c sand, some gravel; damp	D-1		29/36		
2		Gray/Black Silty Clay (Topsoil), roots/organics					
3		Brown and Gray Mottled Silty Clay, trace f-c sand; damp, stiff-very stiff					
4			D-2		36/36		
5							
6		Brown and Gray Silty Clay, Iron Streaks; very stiff to hard					
7			D-3		36/36		
8							
9		Gray Silty Clay, little f-c sand, trace gravel					
10			D-4				
11		11.2' - 13.3' vertical fractures, slight rust staining					
12							
13			D-5				
14							
15		End of Borehole at 15 ft					
16							
17							
18							
19							
20							
21							

SHARP AND ASSOCIATES, INC. Environmental Engineers, Scientists, & Contractors

Drill Method: Geoporobe Piston Rod Datum:

Drill Date: 1-29-03 Checked by:

Hole Size: Sheet: 1 of 1

000056

Project No: 2116-25

Project: RMIES Geoprobe Investigation

Client: RMIES

Location: 10' West of MW-901

Log of Borehole: BH19

Geologist: K. Smith

SUBSURFACE PROFILE			SAMPLE			Field Screening	Lab Analysis
Depth	Symbol	Description	Number	Type	Recovery	VOC (ppm) 10 20 30 40 / Health Physics (dpm) 20 40 60 80	
0		Ground Surface					
1		FILL - Light Brown Silty Clay, roots/organics					
2		Dark Gray/Black Silty Clay (topsoil), organic fibers	D-1		32/36		
3		Brown and Gray Mottled Silty Clay, little f-c sand; moist, medium stiff					
4		Brown Silt, little clay; wet	D-2		36/36		
5		Brown and Gray Mottled Silty Clay, roots; gray vertical fractures					
6		Brown Silty Clay, little f-c sand, trace gravel; damp	D-3		36/36		
9		Brownish Gray Silty Clay, little f-c sand, trace gravel; damp					
10		Gray Silty Clay, little f-c sand, trace gravel; damp	D-4		36/36		
13		@13.1-14.0 Iron Stained fractures; damp	D-5		36/36		
15		End of Borehole at 15 ft					
16							
17							
18							
19							
20							
21							

SHARP AND ASSOCIATES, INC. Environmental Engineers, Scientists, & Contractors

Drill Method: Geoporobe Piston Rod Datum:

Drill Date: 1-29-03 Checked by:

Hole Size: Sheet: 1 of 1

000057

Project No: 2116-25

Project: RMIES Geoprobe Investigation

Client: RMIES

Location: 10' East of MW-901

Log of Borehole: BH20

Geologist: K. Smith

SUBSURFACE PROFILE			SAMPLE				
Depth	Symbol	Description	Number	Type	Recovery	Field Screening VOC (ppm) 10 20 30 40 / Health Physics (dpm) 20 40 60 80	Lab Analysis
0		Ground Surface					
0-1		Fill - Brown SILTY CLAY and gravel.	D-1		30/36		
1-3		Native - Dark gray and black SILTY CLAY (topsoil), little f-c sand.					
3-5		Brown and gray mottled SILTY CLAY, little f-m sand; moist. @ 3.7' to 4.1' - SILT; wet.	D-2		34/36		
5-7		Brown SILTY CLAY, little f-c sand; damp, laminated.	D-3		36/36		
7-13			D-4		36/36		
13-15		Gray SILTY CLAY, little f-c sand, little gravel. Contains vertical iron stain.	D-5		36/36		
15		End of Borehole at 15 ft					
16-21							

SHARP AND ASSOCIATES, INC. Environmental Engineers, Scientists, & Contractors

Drill Method: Geoporobe Piston Rod Datum:

Drill Date: 1-29-03 Checked by:

Hole Size: Sheet: 1 of 1

000058

Ashtabula Closure Project

FINAL RMI REPORT

PHASE II

SEPETEMBER 2003

Appendix D

WSRC-RP-2003-00277

DOE OFFICE OF ENVIRONMENTAL MANAGEMENT
TECHNICAL SOLUTIONS TEAM FOR THE CLOSURE OFFICE

CHARACTERIZATION OF VOC CONTAMINATION ASSOCIATED WITH THE 18-INCH OUTFALL LINES AT THE ASHTABULA ENVIRONMENTAL MANAGEMENT FACILITY USING THE MEMBRANE INTERFACE PROBE: DATA AND SUMMARY REPORT

TECHNICAL ASSISTANCE # *NT031102-006*

FEBRUARY 2003

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EXECUTIVE SUMMARY

In October 2002, technical assistance was requested by Ashtabula Environmental Project (ACP) to address a specific recommendation of the Ohio Closure Sites Technical Solutions team (Recommendation to Address Contaminated Soils, Concrete, and Corrective Action Management Unit/Groundwater Contamination at Ashtabula, OH, Technical Assistance Ohio Closure Sites Final Report, August 2002). ACP needed to better understand the nature of TCE contamination at the ACP. The Technical Solutions had recommended the use of direct push sensor techniques to further delineate TCE-contamination at the site. A Membrane Interface Probe (MIP) and Savannah River Technology Center (STRC) personnel were sent to ACP for two weeks in December to assist with characterization of a 18-inch sewer outfall line.

The MIP was used with a Geoprobe (Model 66DT) to detect locations where TCE might be present along the outfall line. The samples were taken 2 ft on either side of the outfall unless otherwise designated. A total of 23 readings were taken with the MIP. The FEP area (BH10), where the MIP response, was calibrated was the only location where significant contamination was detected. TCE was measured beginning at 4.2 ft and continued to the bottom of the borehole at 16.2 ft and ranged up to 835.8 ppmv. The MIP did not detect VOCs along the sampling transects. This does not exclude contamination along the utility lines, contamination may be present at concentrations lower than the sensitivity of the MIP and PID combination. However the data show that significant levels of VOCs were not present at the push locations.

1.0 INTRODUCTION

The Ashtabula Closure Project (ACP), located in Ashtabula, Ohio, approximately 60 miles east of Cleveland, has sediments and groundwater contaminated with both radiological and hazardous materials resulting from historic manufacturing operations involving the fabrication of nuclear materials for the U.S. Department of Energy (DOE). DOE has initiated a program to provide technical assistance to the Ohio DOE sites including Ashtabula Environmental Management Facility that are scheduled for closure in 2006.

As part of the Ohio Closure Sites Technical Solutions, a technical assistance team visited ACP in June 2002 and provided a general review of environmental activities (Recommendations to Address Contaminated Soils, Concrete, and Corrective Action Management Unit/Groundwater Contamination at Ashtabula, Ohio, Technical Assistance Ohio Closure Sites Final Report, August 2002). A specific recommendation of the team was to investigate the use direct-push technology with a volatile organic contaminant (VOC)-sensor to characterize areas contaminated with VOC's. In Fall 2002, it was determined that dditional characterization information was required along an 18-inch outfall line.

The 18-inch-diameter (ca. 12-16 feet deep) outfall line collected storm water and treated effluent from the wastewater treatment plant. The primary section of line that was investigated is ca. 560 feet long (extending from manhole 11 to manhole 1) and a secondary section that is ca. 150 feet (extending from manhole 2 to manhole 1). Monitoring required by the site's NPDES Permit since 1999, measured concentrations of TCE in the outfall effluent. The Former Evaporation Pond (FEP) Waste Management Unit (WMU), previously referred to as the Corrective Action Management Unit (CAMU), was thought to be the source of the TCE-contamination to the outfall. In August 2002, the outfall lines were plugged (sealed) and bypassed to control migration of TCE through the outfall lines.

The site requested technical assistance in October to better define the nature and extent of TCE contamination associated with the outfall lines (18 inch diameter). A Membrane Interface Probe (MIP) and Savannah River Technology Center (STRC) personnel were sent to ACP for two weeks in December to assist with characteriziation activities designed to determine of the distribution of TCE- contaminated groundwater and sediments associated with the 18-inch outfall lines.

2.0 SAMPLING STRATEGY

A work plan to characterize the sewer line was issued by RMI Environmental Services (Work Plan for the Investigation of Soil and Groundwater Contamination Associated with the Buried 18-inch Outfall Lines, RDP-ENV-013, Rev. 0, 12/3/02). Subsurface field reconnaissance investigations were conducted within two distinct areas. The initial area of investigation included the east-west trending utility conduit that extends between manhole #1 (MH1) and manhole #11 (MH11), and a southwest-northeast trending utility conduit that extends between manhole #2 (MH2) and manhole #1 (MH1) (Figure 1).

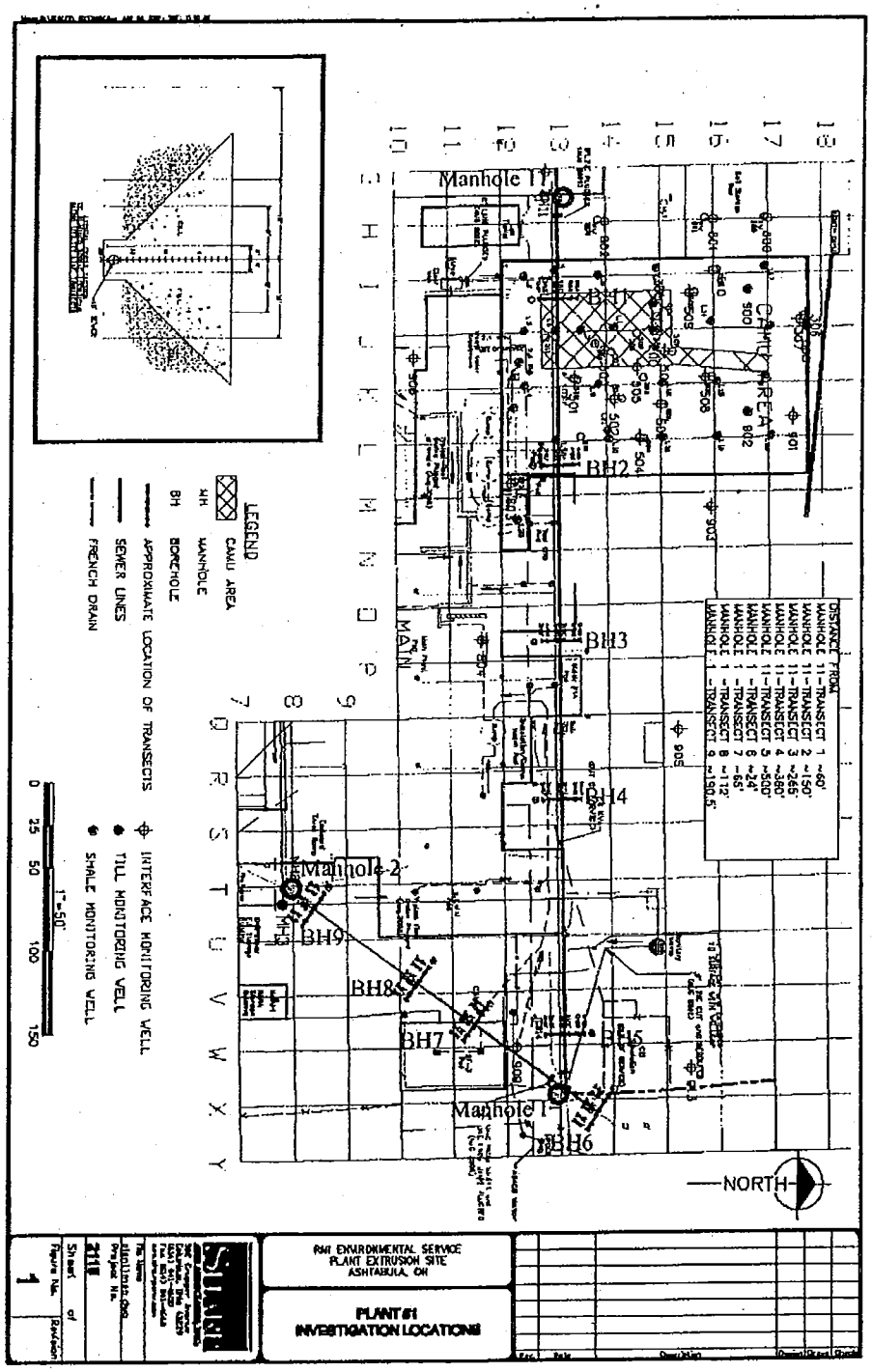


Figure 1. Map of Sampling Traverses

A DOE-owned Geoprobe pneumatic hammer push rig (Model 66DT) and the MIP were used to screen for VOCs followed with soil sampling for lithology and laboratory analysis. The investigation of the areas between MH1 to MH11, and MH2 to MH11, consisted of a series of nine (9) transects oriented perpendicular to the course of the utility pathways and labeled BH1-5 and BH6-9. Six (6) investigative and sampling locations were spaced along each of the 9 transects labeled A-F. Locations A and F, were located 12 ft on each side of the outfall pipe centerline. Locations B and E were located 8 ft on each side of the pipe centerline. Locations C and D were located 2 ft from the pipe centerline (see cross section detail on Figure 1).

The MIP was used at two locations along each transect nearest to the utility line (C and D). The penetration depth was planned to be 21 ft, two feet below the invert elevation of the outfall line estimated to be 18-feet below existing grade (Sharp and Associates, Sampling and Analysis Plan for the Phase II Groundwater Investigation at the RMI Extrusion Plant, 2002).

3.0 METHODS

The MIP is a probe designed to collect *in-situ* samples of VOCs from the subsurface. The MIP is deployed into the subsurface using direct push techniques. The MIP device uses a heated, semi-permeable membrane, installed in the wall of the probe, to collect vapor-phase VOC samples from the subsurface materials adjacent to the probe. The VOC sample is transferred to the surface for chemical analysis through a tube using an inert carrier gas (nitrogen). For the work at Ashtabula, the STRC provided two field based measurement systems. The first system coupled a Geoprobe MIP tip with a Photo Ionization Detector (PID). The PID was sensitive to 0.5 ppmv of VOC's. In addition, SRTC provided a Bruel and Kjaer photoacoustic analyzer (B&K Model 1312) that was used to analyze gas samples in the field. This instrument is slightly more sensitive then the PID but is capable of speciating and quantifying chlorinated compounds in a gaseous mixture.

A Tedlar bag of soil gas was collected from the MIP transfer tube and then analyzed by the B&K instrument to verify the PID results and speciate chlorinated compounds in the sample. The PID is a non-specific detector that will respond to many types of organic compounds such as BTEX, fuels, etc.. Since the MIP equipment was being housed out of an operating minivan, it was important to be able to ensure that ambient gases (e.g., exhaust fumes, humidity) were not affecting the results. Each bag analyzed by the B&K was composed of soil gas from several contiguous depths as a check on the results of the PID. Because the Tedlar bag contained a composite of soil gas from several depths, the B&K results were generally lower than those of the PID (Appendix A).

The MIP controller monitored and maintained the temperature of the membrane on the MIP at 60 degrees Celsius and the flow of nitrogen through the MIP at 70ml/min. The B&K, MIP controller and PID were housed in a vehicle and driven close to the each transect location. The vehicle was moved as the Geoprobe rig progressed to each transect. All measurements were taken in the vehicle to prevent contamination of

equipment and personnel, as well as to provide a barrier from the elements (temperature was below freezing during the field activities). The MIP, PID, and B&K gas analyzer were operated according to manufacturer's operating procedures. Calibration checks were performed prior to and after deployment. One push to a depth of 17 ft was made in the FEP area in a location known to be a hotspot (BH10) to demonstrate the response of the MIP to VOC's in the subsurface. BH10 was located approximately 12 ft west of monitoring well 503. The response of the MIP was checked at the surface, before pushing and after the last borehole, using approximately 5 microliters of liquid TCE applied directly to the membrane.

The initial calibration check established a response time of approximately 35 seconds between the time the probe reached a specific depth and a response by the PID. The lag time was the time it took for the gas to flow up the transfer tube (umbilical) from the MIP membrane and into the PID. This lag time was confirmed in the field at penetration BH10. For each location the probe was pushed one foot at a time, stopping for 35 seconds between one-foot depths. If the PID detected VOC's the probe was not advanced until the PID concentrations reached a maximum. This value was recorded and then the probe was pushed down another foot. This procedure was followed at each location to a depth of 21 ft. If VOC's were detected by the PID at the 2 ft spacings along the transect (i.e. borings C and D), borings would be performed further out along the transect (8 ft, and 12 ft from the sewer line).

The initial four feet of each borehole was pre-pushed using a blank tip (dummy tip) to prevent damage to the MIP from the vibrations caused by pneumatic hammering. The membrane was offset from the Geoprobe tip by 0.8 ft. The data attached to this report were corrected for that offset (Appendix A). Additional gas samples were collected in a Tedlar bag and analyzed in the field using the B&K photoacoustic analyzer for a series of depths at each location.

4.0 RESULTS AND DISCUSSION

The FEP area (BH10) was the only location where significant contamination was detected. PID readings began at 4.2 ft and continued to the bottom of the borehole at 16.2 ft (Table 1). The highest PID reading was 835.8 ppmv at 11 ft. The highest reading of TCE measured by the B&K was for a bag sample containing soil gas from depths between 10.2-12.2 ft (27ppmv). The B&K also detected small amounts of TCE in BH1C, although the PID read 0.0 ppmv. The TCE concentrations measured by the B&K were 0.5 ppmv between 0.8 ft – 12.2 ft and 0.2 ppmv between 13.2 and 20.2 ft. For all other transects BH1-BH9 locations C and D, contamination was not detected by the MIP system (Table 2-9). In addition, no VOC contamination was detected at locations BH1A, BH6A, and BH6B.

Two incidents of equipment failure delayed progress during the initial fieldwork. Equipment failure was due to excessive vibrations damaging the MIP sensor caused by the pneumatic hammer of the Geoprobe 66DT rig. Geoprobe advises against using the 66DT rig to push the MIP probe, however the current literature or manuals do not

document this warning . After several helpful discussions with the staff at Geoprobe a procedure was developed to protect the MIP probe using the 66DT rig. The procedure required a 4-foot prepush using a dummy tip. Followed by removing the rods and attaching the MIP for the rest of the push. Vibrations are damped the further the MIP probe is from the pneumatic hammer (the more steel rods between the MIP and the hammer). Once the operational procedures for using the MIP in the Ashtabula sediments were determined, 16 boreholes were completed in two days.

5.0 CONCLUSION

Although the MIP did not detect VOCs along the sampling transects, the measurements do not preclude contamination along the utility lines. Contamination may be present at concentrations lower than the sensitivity of the MIP and PID combination, however the data show that significant levels of VOCs (0.1 mg/kg (ppm)or greater – approximately twice the detection limit concentration for the MIP system) were not present at the push locations.

The Geoprobe MIP configuration used during this activity shows promise for rapid, cost effective, three-dimensional refinement of the source term in the FEP area or other areas with higher VOC contamination.

Ashtabula Site MIP results			Date: 12/10/02		
Location: BH2C			Membrane offset from tip = 0.8		
Time	Tip Depth	Membrane Depth (ft)	PID (ppm)	Comments	
15:29	3	2.2	0	B&K1	
15:31	4	3.2	0		
15:32	5	4.2	0		
15:34	6	5.2	0		
15:35	7	6.2	0		
15:36	8	7.2	0		
15:37	9	8.2	0		
15:38	10	9.2	0		
15:39	11	10.2	0		
15:40	12	11.2	0		
15:42	13	12.2	0	B&K1 – TCE	0ppmv
15:43	14	13.2	0		
15:44	15	14.2	0		
15:45	16	15.2	0		
15:46	17	16.2	0		
15:47	18	17.2	0		
15:48	19	18.2	0		
15:50	20	19.2	0		
15:53	21	20.2	0	B&K2 – TCE	0ppmv
				Out of hole, no rads, VOCs	

Location: BH2D			Membrane offset from tip = 0.8		
Time	Tip Depth	Membrane Depth (ft)	PID (ppm)	Comments	
14:33	3	2.2	0	B&K1	
14:37	4	3.2	0		
14:38	5	4.2	0		
14:39	6	5.2	0		
14:41	7	6.2	0		
14:42	8	7.2	0		
14:43	9	8.2	0		
14:45	10	9.2	0		
14:46	11	10.2	0		
14:48	12	11.2	0		
14:49	13	12.2	0	B&K1 – TCE	0ppmv
14:51	14	13.2	0		
14:52	15	14.2	0		
14:55	16	15.2	0		
14:56	17	16.2	0		
14:58	18	17.2	0		
15:00	19	18.2	0		
15:07	20	19.2	0		
15:11	21	20.2	0	B&K2 – TCE	0ppmv
				Out of hole, no rads, VOCs	

Ashtabula Site MIP results			Date: 12/10/02		
Location: BH3C			Membrane offset from tip = 0.8		
Time	Tip Depth	Membrane Depth (ft)	PID (ppm)	Comments	
16:12	4	3.2	0	B&K1	
16:13	5	4.2	0		
16:17	6	5.2	0		
16:18	7	6.2	0		
16:19	8	7.2	0		
16:20	9	8.2	0		
16:21	10	9.2	0		
16:22	11	10.2	0		
16:23	12	11.2	0		
16:23	13	12.2	0	B&K1 – TCE	0ppmv
16:25	14	13.2	0		
16:25	15	14.2	0		
16:27	16	15.2	0		
16:28	17	16.2	0		
16:29	18	17.2	0		
16:30	19	18.2	0		
16:31	20	19.2	0		
16:32	21	20.2	0	B&K2 – TCE	0ppmv
				Out of hole, no rads, VOCs.	

Ashtabula Site MIP results			Date: 12/11/02		
Location:	BH3D		Membrane offset from tip = 0.8		
Time	Tip Depth	Membrane Depth (ft)	PID (ppm)	Comments	
7:52	3	2.2	0	B&K1	
7:54	4	3.2	0		
7:55	5	4.2	0		
7:56	6	5.2	0		
7:57	7	6.2	0		
7:58	8	7.2	0		
7:58	9	8.2	0		
7:59	10	9.2	0		
8:00	11	10.2	0		
8:01	12	11.2	0		
8:02	13	12.2	0		
8:03	14	13.2	0		
8:03	15	14.2	0		
8:04	16	15.2	0		
8:05	17	16.2	0		
8:06	18	17.2	0		
8:07	19	18.2	0		
8:08	20	19.2	0		
8:09	21	20.2	0	B&K1 -- TCE	0ppmv
				Out of hole, no rads, VOCs.	

Ashtabula Site MIP results			Date: 12/11/02		
Location:	BH4C		Membrane offset from tip = 0.8		
Time	Tip Depth	Membrane Depth (ft)	PID (ppm)	Comments	
8:29	4	3.2	0	B&K1	
8:30	5	4.2	0		
8:31	6	5.2	0		
8:32	7	6.2	0		
8:33	8	7.2	0		
8:34	9	8.2	0		
8:35	10	9.2	0		
8:35	11	10.2	0		
8:36	12	11.2	0		
8:37	13	12.2	0		
8:38	14	13.2	0		
8:39	15	14.2	0		
8:40	16	15.2	0		
8:41	17	16.2	0		
8:42	18	17.2	0		
8:43	19	18.2	0		
8:44	20	19.2	0		
8:46	21	20.2	0	B&K1 – TCE	0ppmv
				Out of hole, no rads, VOCs	

Location:	BH4D		Membrane offset from tip = 0.8		
Time	Tip Depth	Membrane Depth (ft)	PID (ppm)	Comments	
9:02	4	3.2	0	B&K1	
9:03	5	4.2	0		
9:04	6	5.2	0		
9:05	7	6.2	0		
9:05	8	7.2	0		
9:06	9	8.2	0		
9:07	10	9.2	0		
9:08	11	10.2	0		
9:09	12	11.2	0		
9:10	13	12.2	0		
9:10	14	13.2	0		
9:11	15	14.2	0		
9:12	16	15.2	0		
9:13	17	16.2	0		
9:14	18	17.2	0		
9:15	19	18.2	0		
9:16	20	19.2	0		
9:18	21	20.2	0	B&K1 – TCE	0ppmv
				Out of hole, no rads, VOCs	

Ashtabula Site MIP results			Date: 12/11/02		
Location: BH5C			Membrane offset from tip = 0.8		
Time	Tip Depth	Membrane Depth (ft)	PID (ppm)	Comments	
9:39	4	3.2	0	B&K1	
9:40	5	4.2	0		
9:41	6	5.2	0		
9:41	7	6.2	0		
9:42	8	7.2	0		
9:43	9	8.2	0		
9:44	10	9.2	0		
9:45	11	10.2	0		
9:45	12	11.2	0		
9:46	13	12.2	0		
9:47	14	13.2	0		
9:48	15	14.2	0		
9:49	16	15.2	0		
9:50	17	16.2	0		
9:50	18	17.2	0		
9:51	19	18.2	0		
9:53	20	19.2	0		
9:54	21	20.2	0	B&K1 – TCE	0ppmv
				Out of hole, no rads, VOCs	

Location:	BH5D		Membrane offset from tip =		0.8
Time	Tip Depth	Membrane Depth (ft)	PID (ppm)	Comments	
10:48	4	3.2	0	B&K1	
10:50	5	4.2	0		
10:51	6	5.2	0		
10:52	7	6.2	0		
10:52	8	7.2	0		
10:53	9	8.2	0		
10:54	10	9.2	0		
10:55	11	10.2	0		
10:56	12	11.2	0		
10:56	13	12.2	0		
10:57	14	13.2	0		
10:58	15	14.2	0		
10:59	16	15.2	0		
10:59	17	16.2	0		
11:00	18	17.2	0		
11:02	19	18.2	0		
11:03	20	19.2	0		
11:05	21	20.2	0	B&K1 – TCE	0ppmv
				Out of hole, no rads, VOCs	

Ashtabula Site MIP results			Date:	12/4/02	
Location:	BH6A		Membrane offset from tip = 0.8		
Time	Tip Depth	Membrane Depth (ft)	PID (ppm)	Comments	
13:31	1	0.2	0		
13:32	2	1.2	0		
13:32	3	2.2	0		
13:34	4	3.2	0		
13:35	5	4.2	0		
13:36	6	5.2	0		
13:39	7	6.2	0		
13:40	8	7.2	0		
13:40	9	8.2	0		
13:42	10	9.2	0	Began Tedlar bag sample	
13:43	11	10.2	0		
13:43	12	11.2	0		
13:45	13	12.2	0		
13:46	14	13.2	0		
13:48	15	14.2	0		
13:52	16	15.2	0	Geoprobe hammer not working	
13:59	17	16.2	0	properly – manual operation	
14:03	18	17.2	0	End Tedlar bag sample – pump	
14:06	19	18.2	0	on B&K not working.	
14:15	20	19.2	0		
14:19	20.5	19.7	0	Out of hole, no rads, VOCs.	

Location:	BH6B		Membrane offset from tip = 0.8		
Time	Tip Depth	Membrane Depth (ft)	PID (ppm)	Comments	
14:37	1	0.2	0		
14:38	2	1.2	0		
14:39	3	2.2	0		
14:40	4	3.2	0		
14:41	5	4.2	0		
14:42	6	5.2	0		
14:43	7	6.2	0		
14:44	8	7.2	0		
14:45	9	8.2	0		
14:46	10	9.2	0		
14:47	11	10.2	0		
14:48	12	11.2	0		
14:49	13	12.2	0		
14:50	14	13.2	0		
14:51	15	14.2	0		
14:52	16	15.2	0		
14:53	17	16.2	0		
14:54	18	17.2	0		
14:55	19	18.2	0		
14:56	20	19.2	0		
14:57	21	20.2	0	Out of hole, no rads, VOCs.	

Ashtabula Site MIP results			Date: 12/4/02		
Location: BH6C			Membrane offset from tip = 0.8		
Time	Tip Depth	Membrane Depth (ft)	PID (ppm)	Comments	
15:14	1	0.2	0		
15:15	2	1.2	0		
15:15	3	2.2	0		
15:16	4	3.2	0		
15:17	5	4.2	0		
15:18	6	5.2	0		
15:19	7	6.2	0		
15:20	8	7.2	0		
15:21	9	8.2	0		
15:22	10	9.2	0		
15:23	11	10.2	0		
15:23	12	11.2	0		
15:25	13	12.2	0		
15:26	14	13.2	0		
15:26	15	14.2	0		
15:28	16	15.2	0		
15:33	17	16.2	0		
15:33	18	17.2	0		
15:35	19	18.2	0		
15:36	20	19.2	0		
15:37	21	20.2	0	Out of hole, no rads, VOCs	

Location: BH6D			Membrane offset from tip = 0.8		
Time	Tip Depth	Membrane Depth (ft)	PID (ppm)	Comments	
15:52	1	0.2	0		
15:53	2	1.2	0		
15:54	3	2.2	0		
15:55	4	3.2	0		
15:56	5	4.2	0		
15:56	6	5.2	0		
15:58	7	6.2	0		
15:59	8	7.2	0		
15:59	9	8.2	0		
16:01	10	9.2	0		
16:02	11	10.2	0		
16:02	12	11.2	0		
16:03	13	12.2	0		
16:04	14	13.2	0		
16:05	15	14.2	0		
16:06	16	15.2	0		
16:07	17	16.2	0		
16:08	18	17.2	0		
16:09	19	18.2	0		
16:10	20	19.2	0		
16:11	21	20.2	0	Out of hole, no rads, VOCs	

Ashtabula Site MIP results			Date: 12/11/02		
Location: BH7C			Membrane offset from tip = 0.8		
Time	Tip Depth	Membrane Depth (ft)	PID (ppm)	Comments	
15:29	4	3.2	0	B&K1	
15:30	5	4.2	0		
15:31	6	5.2	0		
15:31	7	6.2	0		
15:32	8	7.2	0		
15:33	9	8.2	0		
15:34	10	9.2	0		
15:34	11	10.2	0		
15:35	12	11.2	0		
15:36	13	12.2	0		
15:37	14	13.2	0		
15:38	15	14.2	0		
15:39	16	15.2	0		
15:40	17	16.2	0		
15:41	18	17.2	0		
15:42	19	18.2	0		
15:44	20	19.2	0		
15:45	21	20.2	0	B&K1 – TCE	0ppmv
				Out of hole, no rads, VOCs	

Location: BH7D			Membrane offset from tip = 0.8		
Time	Tip Depth	Membrane Depth (ft)	PID (ppm)	Comments	
14:57	4	3.2	0	B&K1	
14:59	5	4.2	0		
14:59	6	5.2	0		
15:00	7	6.2	0		
15:01	8	7.2	0		
15:02	9	8.2	0		
15:03	10	9.2	0		
15:03	11	10.2	0		
15:04	12	11.2	0		
15:05	13	12.2	0		
15:06	14	13.2	0		
15:07	15	14.2	0		
15:08	16	15.2	0		
15:09	17	16.2	0		
15:10	18	17.2	0		
15:11	19	18.2	0		
15:14	20	19.2	0		
15:15	21	20.2	0	B&K1 – TCE	0ppmv
				Out of hole, no rads, VOCs	

Ashtabula Site MIP results			Date: 12/11/02		
Location: BH8C			Membrane offset from tip = 0.8		
Time	Tip Depth	Membrane Depth (ft)	PID (ppm)	Comments	
14:24	4	3.2	0	B&K1	
14:25	5	4.2	0		
14:25	6	5.2	0		
14:26	7	6.2	0		
14:27	8	7.2	0		
14:28	9	8.2	0		
14:29	10	9.2	0		
14:30	11	10.2	0		
14:30	12	11.2	0		
14:31	13	12.2	0		
14:32	14	13.2	0		
14:33	15	14.2	0		
14:34	16	15.2	0		
14:35	17	16.2	0		
14:36	18	17.2	0		
14:37	19	18.2	0		
14:39	20	19.2	0		
14:40	21	20.2	0	B&K1 – TCE	0ppmv
				Out of hole, no rads, VOCs	

Location: BH8D			Membrane offset from tip = 0.8		
Time	Tip Depth	Membrane Depth (ft)	PID (ppm)	Comments	
13:50	4	3.2	0	B&K1	
13:51	5	4.2	0		
13:51	6	5.2	0		
13:52	7	6.2	0		
13:53	8	7.2	0		
13:54	9	8.2	0		
13:54	10	9.2	0		
13:55	11	10.2	0		
13:56	12	11.2	0		
13:57	13	12.2	0		
13:58	14	13.2	0		
13:58	15	14.2	0		
13:59	16	15.2	0		
14:00	17	16.2	0		
14:01	18	17.2	0		
14:02	19	18.2	0		
14:05	20	19.2	0	B&K1 – TCE	0ppmv
Refusal				Out of hole, no rads, VOCs	

Ashtabula Site MIP results			Date: 12/11/02		
Location: BH9C			Membrane offset from tip = 0.8		
Time	Tip Depth	Membrane Depth (ft)	PID (ppm)	Comments	
13:07	4	3.2	0	B&K1	
13:08	5	4.2	0		
13:09	6	5.2	0		
13:10	7	6.2	0		
13:10	8	7.2	0		
13:11	9	8.2	0		
13:12	10	9.2	0		
13:13	11	10.2	0		
13:13	12	11.2	0		
13:14	13	12.2	0		
13:15	14	13.2	0		
13:16	15	14.2	0		
13:17	16	15.2	0		
13:18	17	16.2	0		
13:19	18	17.2	0		
13:20	19	18.2	0		
13:21	20	19.2	0		
13:22	21	20.2	0	B&K1 – TCE	0ppmv
				Out of hole, no rads, VOCs	

Location: BH9D			Membrane offset from tip = 0.8		
Time	Tip Depth	Membrane Depth (ft)	PID (ppm)	Comments	
11:30	4	3.2	0	B&K1	
11:31	5	4.2	0		
11:32	6	5.2	0		
11:33	7	6.2	0		
11:34	8	7.2	0		
11:35	9	8.2	0		
11:35	10	9.2	0		
11:36	11	10.2	0		
11:37	12	11.2	0		
11:38	13	12.2	0		
11:39	14	13.2	0		
11:40	15	14.2	0		
11:40	16	15.2	0		
11:41	17	16.2	0		
11:42	18	17.2	0		
11:43	19	18.2	0		
11:45	20	19.2	0		
11:46	21	20.2	0	B&K1 – TCE	0ppmv
				Out of hole, no rads, VOCs	

Ashtabula Site MIP results			Date: 12/9/02		
Location: BH10			Membrane offset from tip = 0.8		
Time	Tip Depth	Membrane Depth (ft)	PID (ppm)	Comments	
8:22	1	0.2	0	B&K1	
8:24	2	1.2	0		
8:25	3	2.2	0		
8:27	4	3.2	0		
8:30	5	4.2	40.5	B&K1 – TCE	1ppmv
8:32	6	5.2	65.4		
8:36	7	6.2	182.1		
8:38	8	7.2	275.4		
8:40	9	8.2	463.2		
8:43	10	9.2	653	B&K2 – TCE	12ppmv
8:46	11	10.2	835.3		
8:48	12	11.2	568.7		
8:50	13	12.2	314.8	B&K3 – TCE	27ppmv
8:52	14	13.2	187		
8:54	15	14.2	189.1		
8:55	16	15.2	112.2		
16:07	17	16.2	70	B&K4 – TCE	11ppmv
				Out of hole, no rads	

Ashtabula Closure Project

FINAL RMI REPORT

PHASE II

SEPETEMBER 2003

Appendix E

APPENDIX E.
Regional Groundwater Use

The RMI Plant site is located in eastern part of the City of Ashtabula, approximately one mile south of Lake Erie and immediately south of Fields Brook. Fields Brook is a westerly flowing tributary to the Ashtabula River, which it joins approximately one mile west of the RMI property. The watershed of the Ashtabula River is a primary surface water source to the central basin area of Lake Erie. Within the watershed, the City of Ashtabula is the only major urban center. The remaining parts are dominantly rural and agricultural. In contrast to this wider scale characterization, the areas adjacent to Fields Brook and parallel to the Ashtabula River through the City towards Lake Erie are largely developed and historically industrialized.

Map 1 locates the RMI site on an enlarged portion of the USGS 7.5 Minute Ashtabula North topographic quadrangle map. The map shows that RMI is established on a southwest-to-northeast trending topographic high. The topography of and adjacent to the RMI property shows several north and northwesterly trending surficial swales, lows and/or drainage patterns. Each of these features leads into the course of Fields Brook.

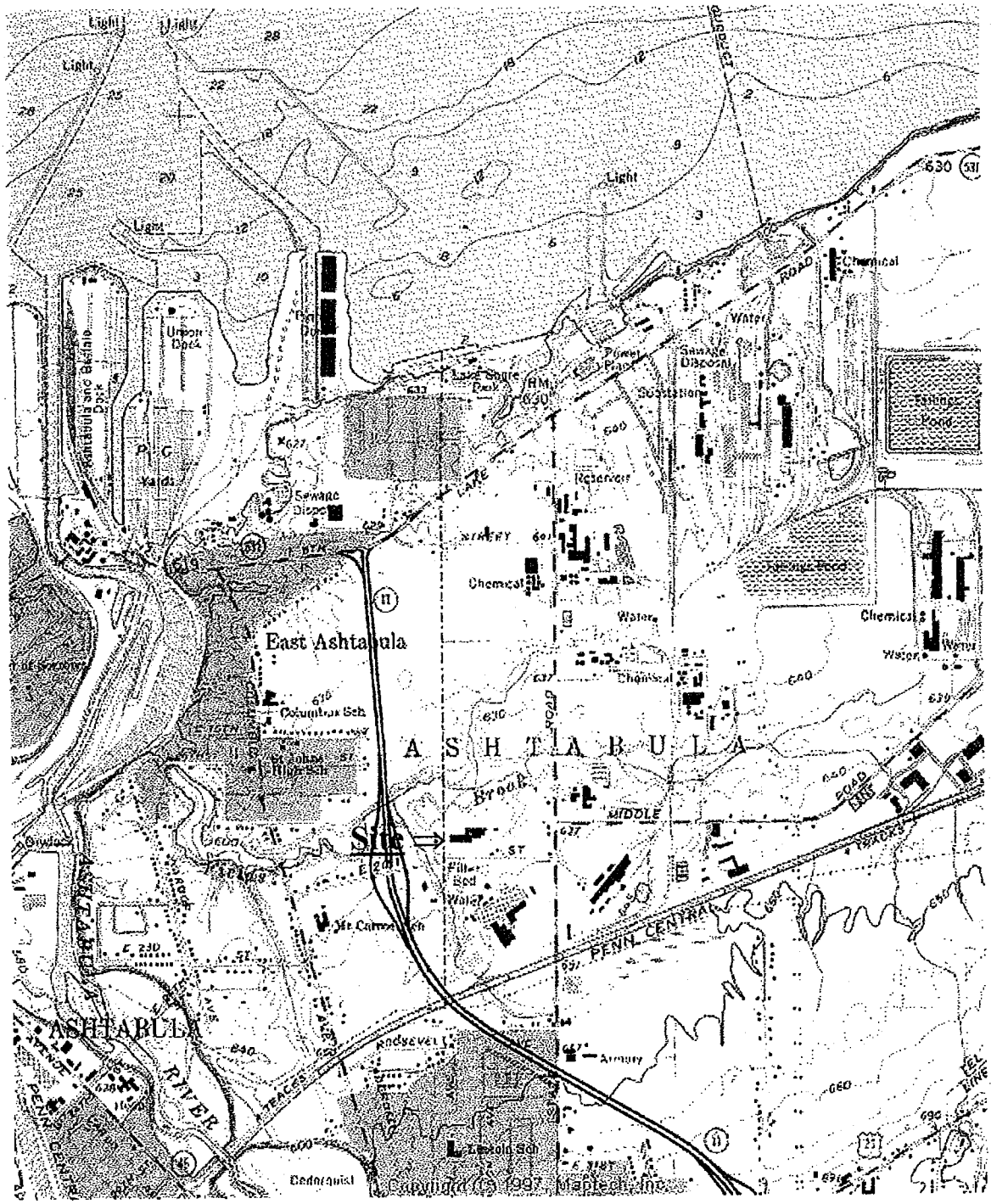
These surface water characteristics are significant as it is surface water that provides the dominant water supply source for the City of Ashtabula, industry and developments in the area. The geology of the region, as discussed in Section 2.1, dominantly consists of very low permeability glacial till(s) that overlie relatively impervious dark shale bedrock. These lithologic and stratigraphic constraints largely prohibit the development of usable groundwater resources. Map 2 is the ODNR Groundwater Resources Map of Ashtabula published by the Division of Water. The map shows that RMI sets within the hydrogeologic area described as being "less than 30 feet of clay and sandy clay overlying shale". Groundwater yields in this area are characteristically < 3 gallons per minute where found along the weathered upper shale bedrock contact with overlying glacial till. This poor groundwater resources area continues throughout all areas downgradient to the RMI site.

To assess the potential for groundwater usage at distance from RMI, the ODNR Division of Water's well files for Ashtabula Township were searched on January 21, 2003 (reference Map 3 and the individual well records contained in Appendix 1). Note that Ashtabula Township includes the City of Ashtabula. In addition to the Division's "located" well records that they post on the base map and highlighted in yellow, they also maintain files of "unlocated" well records. Unlocated wells are those whose address cannot be reliably spotted, or newly drilled wells. SHARP reviewed the "unlocated" well files and tentatively spotted four additional wells onto the Division's map. These tentative wells are posted in blue.

The records for all of the wells posted on Map 3 are included in Appendix 1. These records show that eleven of the twelve "located" wells are completed in shale bedrock and produce at an average rate of 2.4 gallons/minute. This fully agrees with the characterizations presented on the Groundwater Resources Map (Map2). The single located well that is completed in a gravel overlying bedrock is designated #2. This well is located at the far southern border of the township, approximately 3.5 miles from the RMI site.

Summarily:

- the location posting of wells on Map 3 show that there are no reported groundwater wells located within at least a one mile radius of the RMI site,
- the testing and production records for the located wells show that the potential for groundwater usage is low owing to poor production, questionable water quality and discontinuous occurrence of any aquifer, and
- the City of Ashtabula is served by a municipal system that relies on surface water supply from Lake Erie.



SHARP AND ASSOCIATES, INC. 982 CHUPPER AVE COLUMBUS, OHIO 43229 (614) 841-4650 / FAX (614) 841-4660	RMI Extrusion Plant Site USGS 7.5 Minute Topographic Map			Map 1
	PROJECT NUMBER 2116	DATE 2/13/03	FILE NAME Map 1	SCALE Not to Scale

Well Yields

AREAS IN WHICH YIELDS OF LESS THAN 25 GALLONS PER MINUTE CAN BE DEVELOPED

Mississippian sandstone and sandy shale yield 5 to 15 gpm. Wells drilled in the southern part of the county at higher elevations may yield as much as 15 to 20 gpm at depths up to 150 feet while wells drilled in the fringe area are less than 80 feet deep and yield 5 gpm.

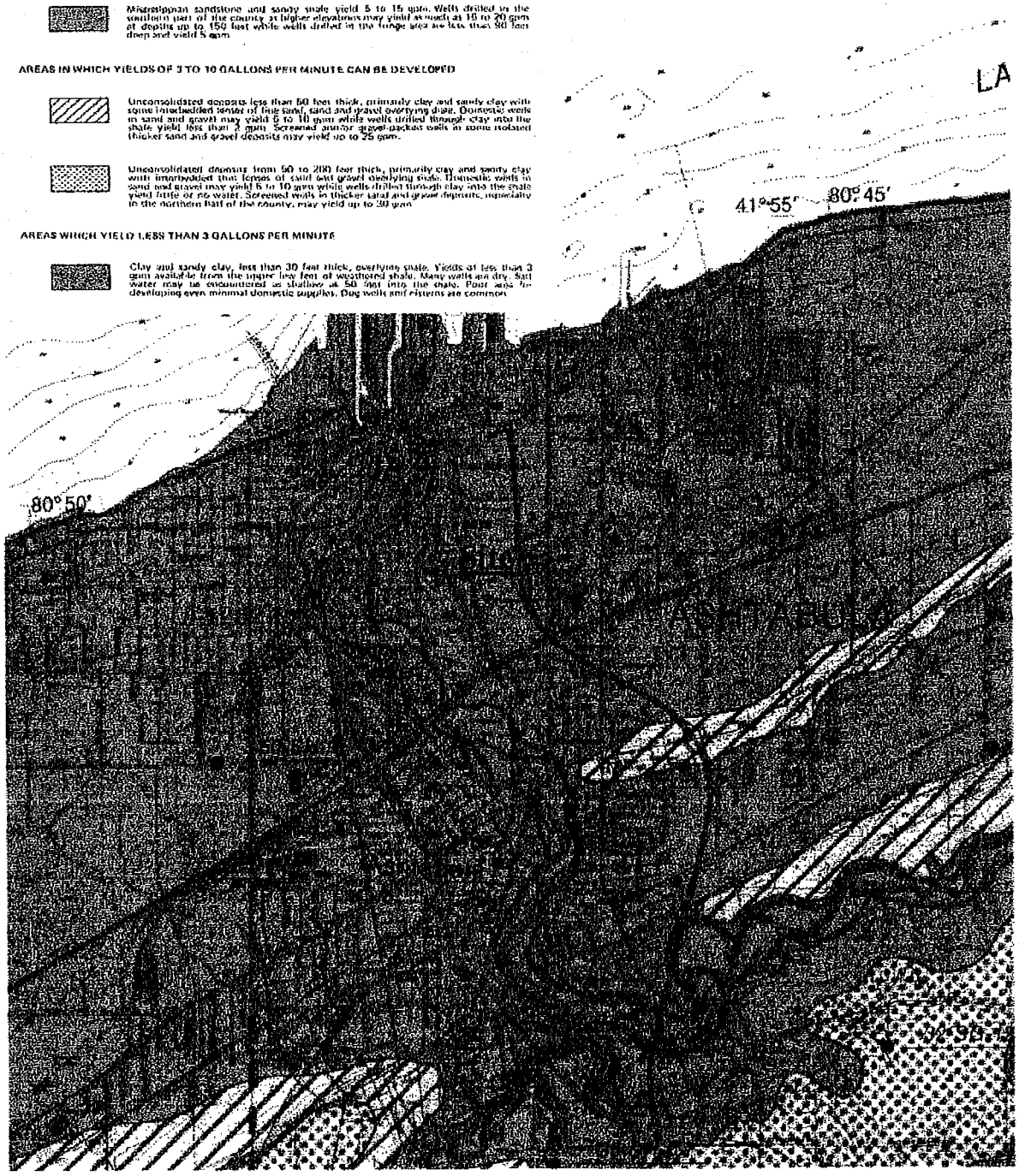
AREAS IN WHICH YIELDS OF 3 TO 10 GALLONS PER MINUTE CAN BE DEVELOPED

Unconsolidated deposits less than 50 feet thick, primarily clay and sandy clay with some interbedded lenses of fine sand, sand and gravel overlying shale. Domestic wells in sand and gravel may yield 6 to 10 gpm while wells drilled through clay into the shale yield little or no water. Screened auger gravel-packed wells in some isolated thicker sand and gravel deposits may yield up to 25 gpm.

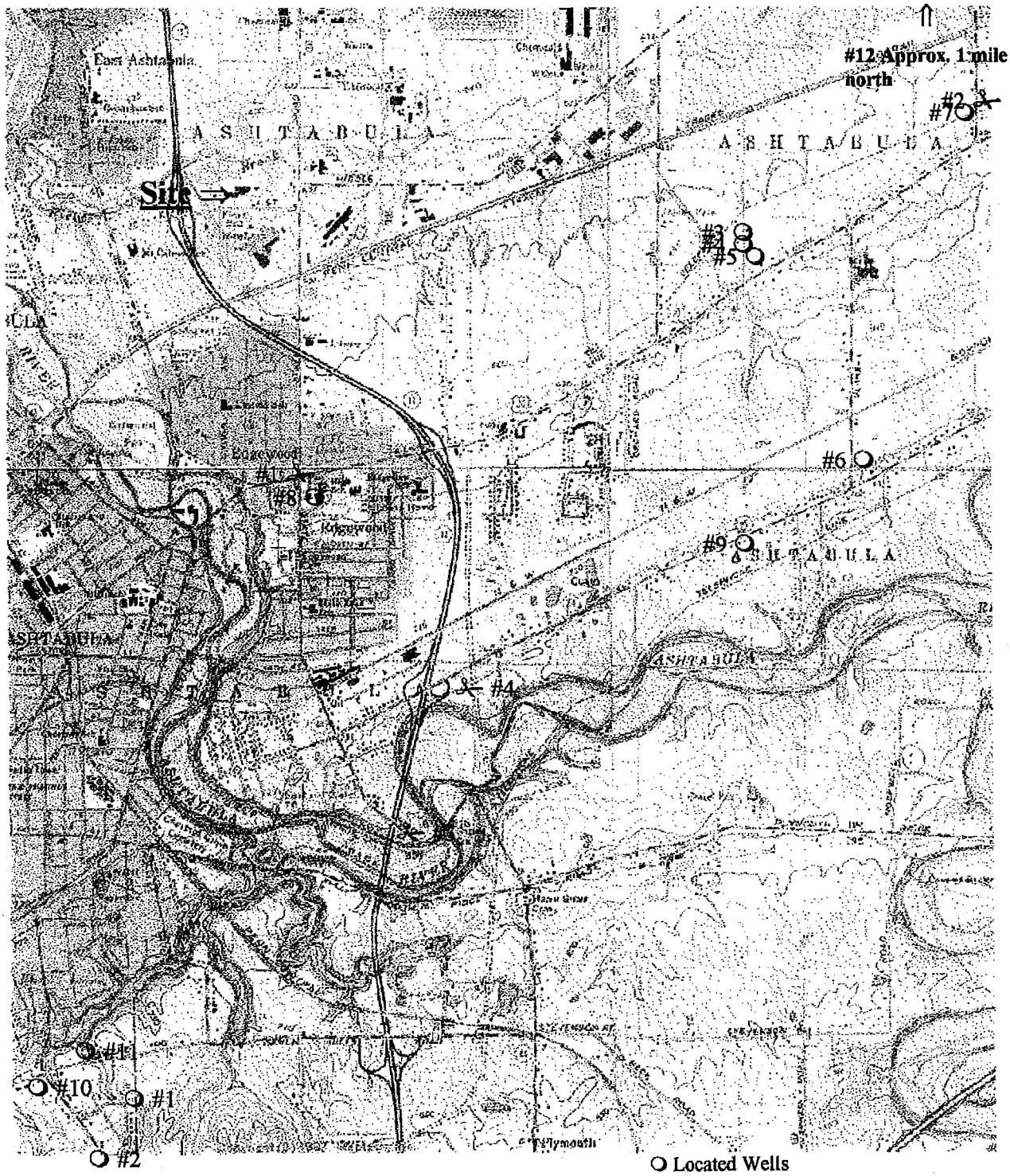
Unconsolidated deposits from 50 to 200 feet thick, primarily clay and sandy clay with interbedded thin lenses of sand and gravel overlying shale. Domestic wells in sand and gravel may yield 6 to 10 gpm while wells drilled through clay into the shale yield little or no water. Screened wells in thicker sand and gravel deposits, especially in the northern half of the county, may yield up to 20 gpm.

AREAS WHICH YIELD LESS THAN 3 GALLONS PER MINUTE

Clay and sandy clay, less than 30 feet thick, overlying shale. Yields of less than 3 gpm available from the upper two feet of weathered shale. Many wells are dry. Salt water may be encountered as shallow as 50 feet into the shale. Poor area for developing even minimal domestic supplies. Dug wells and cisterns are common.



SHARP AND ASSOCIATES, INC. 981 CRUPPER AVE COLUMBUS, OHIO 43229 (614) 841-4600 / FAX (614) 841-4640	RMI Extrusion Plant Site Groundwater Resource Map			Map 2
	PROJECT NUMBER 2116	DATE 2/13/03	FILE NAME Map 2	SCALE Not to Scale



SHARP AND ASSOCIATES, INC. 782 CRUPPER AVE COLUMBUS, OHIO 43229 (614) 841-4630 / FAX (614) 841-4660	RMI Extrusion Plant Site Water Well Locations				Map 3
	PROJECT NUMBER 2116	DATE 2/13/03	FILE NAME Map 3	SCALE Not to Scale	

WELL LOG AND DRILLING REPORT

ORIGINAL

State of Ohio
DEPARTMENT OF NATURAL RESOURCES
Division of Water
1562 W. First Avenue
Columbus, Ohio 43212

LEASE USE PENCIL OR TYPEWRITER
DO NOT USE INK.

№ 363017

County Ashtabula Township Ashtabula Section of Township

Owner Jared Phelps Address 1823 W. 6th Ashtabula O.

Location of property Anderson Allotment, ½ mi. N. of Mineral Springs Rd.

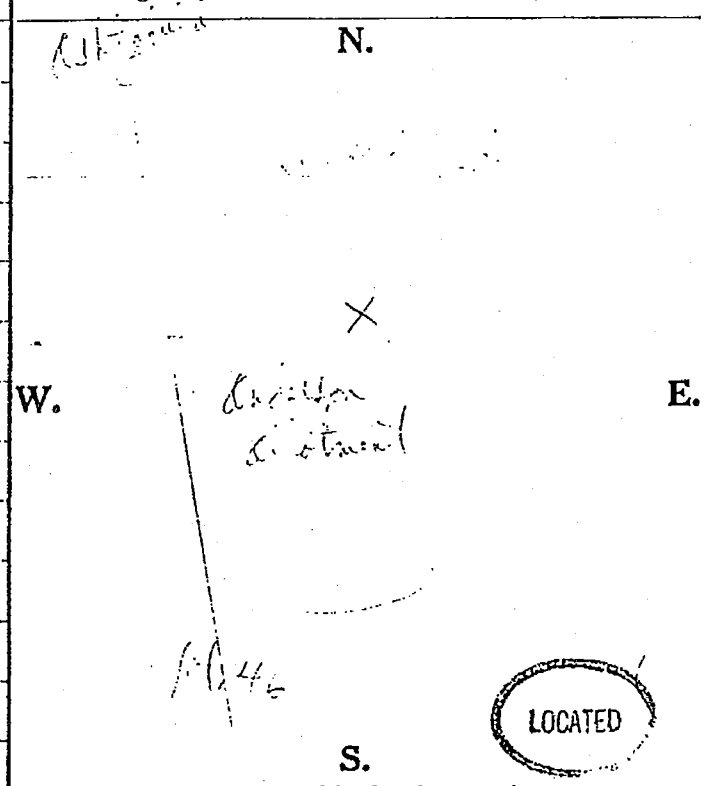
CONSTRUCTION DETAILS	BAILING OR PUMPING TEST
Casing diameter 5¼ ID Length of casing 24'	Pumping Rate 1 G.P.M. Duration of test 3 hrs.
Type of screen Length of screen	Drawdown 68 ft. Date 11-10-66
Type of pump	Static level-depth to water 2 ft.
Capacity of pump	Quality (clear, cloudy, taste, odor) clear, good
Depth of pump setting	
Date of completion 11-10-66	Pump installed by

WELL LOG*

Formations Sandstone, shale, limestone, gravel and clay	From	To
gravel	0 Feet	9 Ft.
clay	5	5
shale	15	70

SKETCH SHOWING LOCATION

Locate in reference to numbered State Highways, St. Intersections, County roads, etc.



See reverse side for instructions

Drilling Firm HAROLD INMAN WELL DRILLING
Address RT. 2-JEFFERSON, OHIO

Date 5-13-67
Signed [illegible]

*If additional space is needed to complete well log, use next consecutive numbered form.

WELL LOG AND DRILLING REPORT

ORIGINAL

PLEASE USE PENCIL OR TYPEWRITER
DO NOT USE INK.

State of Ohio
DEPARTMENT OF NATURAL RESOURCES
Division of Water
1562 W. First Avenue
Columbus, Ohio 43212

No 330813

County Ashtabula Township Ashtabula Section of Township

Owner Eugene Hafer Address 811 W. 45th Ashtabula, O

Location of property Jefferson Rd. (old Rt. 46), 1 mi. S. of Rt. 84, Ashtabula

CONSTRUCTION DETAILS

Casing diameter 6" Length of casing 58'
Type of screen Length of screen
Type of pump
Capacity of pump
Depth of pump setting
Date of completion 12-7-64

BAILING OR PUMPING TEST

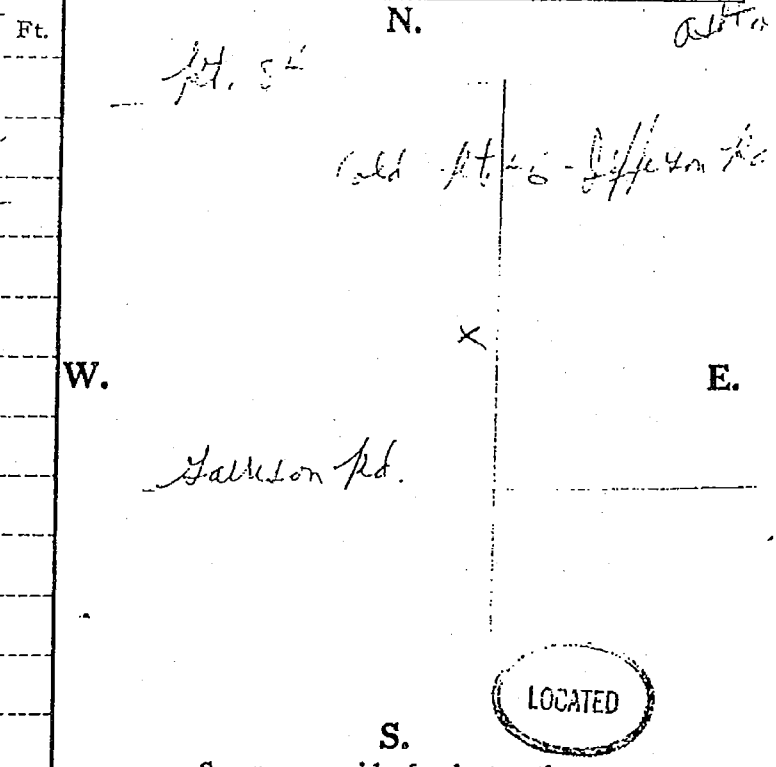
Pumping Rate 3½ G.P.M. Duration of test 5 hrs.
Drawdown 24 ft. Date 12-7-64
Static level-depth to water 31 ft.
Quality (clear, cloudy, taste, odor) clear, slight sulphur odor
Pump installed by

WELL LOG*

Formations Sandstone, shale, limestone, gravel and clay	From	To
clay	0 Feet	48 Ft.
sand	48	51
clay	51	54
slate	54	55

SKETCH SHOWING LOCATION

Locate in reference to numbered State Highways, St. Intersections, County roads, etc.



See reverse side for instructions

Drilling Firm HAROLD INMAN WELL DRILLING
Address RT. 2 JEFFERSON, OHIO
Date 10/28/65
Signed Harold Inman

*If additional space is needed to complete well log, use next consecutive numbered form.

WE' LOG AND DRILLING REP RT

ORIGINA

State of Ohio
DEPARTMENT OF NATURAL RESOURCES
Division of Water
1562 W. First Avenue
Columbus 12, Ohio

PLEASE USE PENCIL
OR TYPEWRITER
DO NOT USE INK.

No 309866

County Ashtabula Township Ashtabula Section of Township

Owner Loyd Weaver Address Tillotson RD.

Location of property ½ mi. Tillotson RD.

CONSTRUCTION DETAILS

Casing diameter 6" Length of casing 14½"

Type of screen Length of screen

Type of pump

Capacity of pump

Depth of pump setting

Date of completion

BAILING OR PUMPING TEST

Pumping Rate 3 G.P.M. Duration of test hrs.

Drawdown ft. Date June 30, 1964

Static level-depth to water ft.

Quality (clear, cloudy, taste, odor)

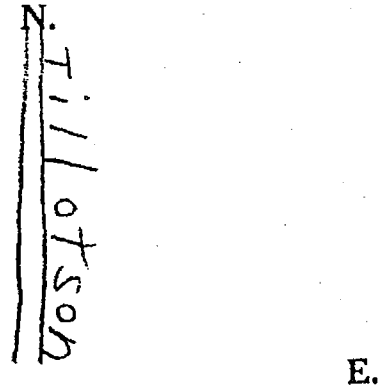
Pump installed by

WELL LOG

Formations Sandstone, shale, limestone, gravel and clay	From	To
	0 Feet	8 Ft.
clay	8	27
shale	27	35

SKETCH SHOWING LOCATION

Locate in reference to numbered State Highways, St. Intersections, County roads, etc.



LOCATED

See reverse side for instructions

Drilling Firm MR Paul McGill Date June 30, 1964

Address Garrisonville Signed Paul McGill

2

WELL LOG AND DRILLING REPORT

ORIGINAL

NO CARBON PAPER NECESSARY— SELF-TRANSCRIBING

State of Ohio
DEPARTMENT OF NATURAL RESOURCES
Division of Water
65 S. Front St., Rm. 815 Phone (614) 469-2646
Columbus, Ohio 43215

No. 420870

County Ashtabula Township Ashtabula Section of Township

Owner Martin Higgins Address Tillotson Rd.

Location of property 1/2 mile on Tillotson Rd in Ashtabula Ohio

CONSTRUCTION DETAILS

Casing diameter 6" Length of casing 40

Type of screen Length of screen

Type of pump

Capacity of pump

Depth of pump setting

Date of completion

BAILING OR PUMPING TEST
(Specify one by circling)

Test Rate 6 G.P.M. Duration of test hrs.

Drawdown ft. Date July 10

Static level-depth to water 5 ft.

Quality (clear, cloudy, taste, odor)

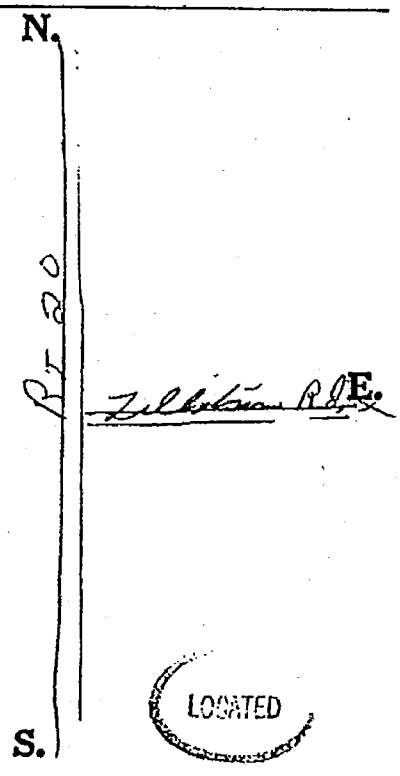
Pump installed by

WELL LOG*

Formations Sandstone, shale, limestone, gravel and clay	From	To
	0 Feet	35 Ft.
Clay	35	5
Shale	5	40
Water at 40 ft		

SKETCH SHOWING LOCATION

Locate in reference to numbered State Highways, St. Intersections, County roads, etc.



Drilling Firm Paul E McGill Date July 10 - 71

Address East Hayesville Rd. Signed Paul E McGill

*If additional space is needed to complete well log, use next consecutive numbered form.

WELL LOG AND DRILLING REPORT

ORIGINAL

State of Ohio
DEPARTMENT OF NATURAL RESOURCES
Division of Water
1562 W. First Avenue
Columbus, Ohio

PLEASE USE PENCIL OR TYPEWRITER. DO NOT USE INK.

No. 274785

County ASHTABULA Township ~~[illegible]~~ Ashtabula Section of Township

Owner DALE C. [illegible] Address TILLOTSON - R2

Location of property [illegible]

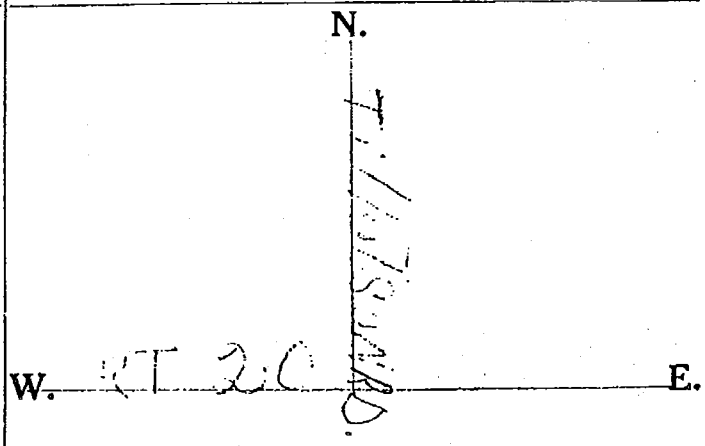
CONSTRUCTION DETAILS	BAILING OR PUMPING TEST
Casing diameter 8" Length of casing	Pumping rate G.P.M. Duration of test hrs.
Type of screen Length of screen	Drawdown ft. Date [illegible] 22 [illegible]
Type of pump	Developed capacity "
Capacity of pump	Static level—depth to water 2½ min ft.
Depth of pump setting	Pump installed by
Date of completion	

WELL LOG

Formations Sandstone, shale, limestone, gravel and clay	From	To
	0 Feet	10 Ft.
CLAY	10	25
SHALE	25	35
WATER AT 35 ft		

SKETCH SHOWING LOCATION

Locate in reference to numbered State Highways, St. Intersections, County roads, etc.



LOCATED

S.

See reverse side for instructions

Drilling Firm [illegible] Date [illegible] 1962

Address Garrison [illegible] Signed [illegible]

5

WELL LOG AND DRILLING REPORT

ORIGINAL

PLEASE USE PENCIL OR TYPEWRITER
DO NOT USE INK.

State of Ohio
DEPARTMENT OF NATURAL RESOURCES
Division of Water
1562 W. First Avenue
Columbus, Ohio 43212

No 374407

County Ashtabula Township Ashtabula Section of Township

Owner Tony Bucci Address Blake Rd, Ashtabula, O.

Location of property Blake Rd. ¼ mile N. of Rt. 84

CONSTRUCTION DETAILS

Casing diameter 8" I.D. Length of casing 19'

Type of screen Length of screen

Type of pump

Capacity of pump

Depth of pump setting

Date of completion 4-17-67

BAILING OR PUMPING TEST

Pumping Rate 4 G.P.M. Duration of test 1 hrs.

Drawdown 43 ft. Date 4-17-67

Static level-depth to water 5 ft.

Quality (clear, cloudy, taste, odor) clear, scant

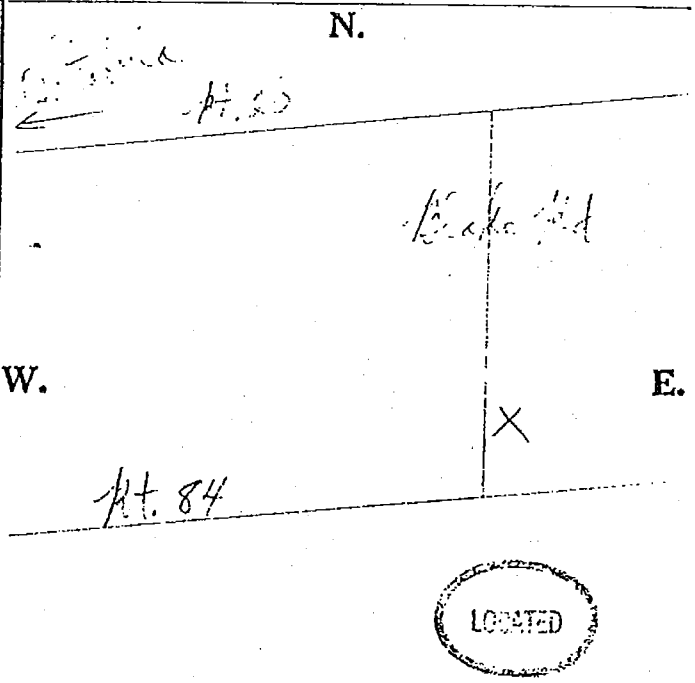
Pump installed by

WELL LOG*

Formations Sandstone, shale, limestone, gravel and clay	From	To
clay	0 Feet	11 Ft.
shale	11	51

SKETCH SHOWING LOCATION

Locate in reference to numbered State Highways, St. Intersections, County roads, etc.



See reverse side for instructions

Drilling Firm HAROLD INMAN WELL DRILLING

Address RT. 2 JEFFERSON, OHIO

Date 12-29-67

Signed Harold Inman

*If additional space is needed to complete well log, use next consecutive numbered form.

WEI' LOG AND DRILLING REPORT

ORIGINA

PLEASE USE PENCIL OR TYPEWRITER
DO NOT USE INK.

State of Ohio
DEPARTMENT OF NATURAL RESOURCES
Division of Water
1562 W. First Avenue.
Columbus 12, Ohio

No 284603

County Ashtabula Township Ashtabula Section of Township

Owner Daniel Samples Address

Location of property on West side of S. 11 Rd

CONSTRUCTION DETAILS

Casing diameter 2" Length of casing 19'4'

Type of screen Length of screen

Type of pump

Capacity of pump

Depth of pump setting

Date of completion

BAILING OR PUMPING TEST

Pumping Rate G.P.M. Duration of test hrs.

Drawdown ft. Date

Static level-depth to water ft.

Quality (clear, cloudy, taste, odor)

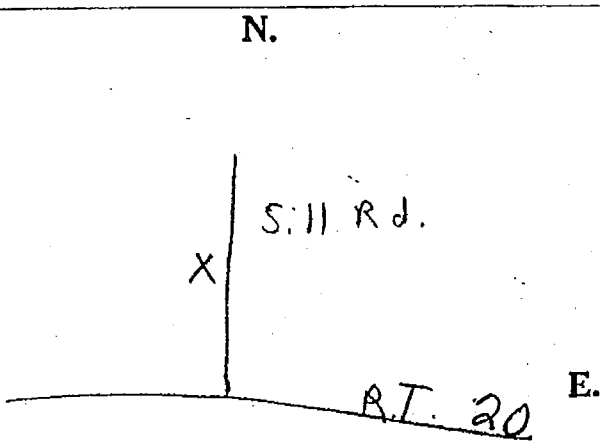
Pump installed by

WELL LOG

Formations Sandstone, shale, limestone, gravel and clay	From	To
Clay	0 Feet	14 Ft.
Shale	14	30
WATER 25 ft		

SKETCH SHOWING LOCATION

Locate in reference to numbered State Highways, St. Intersections, County roads, etc.



LOCATED

See reverse side for instructions

Drilling Firm Paul McGill Date Aug. 20, 1962

Address R.D.#2 Ashtabula, Ohio Signed Paul McGill

WELL LOG AND DRILLING REPORT

ORIGINAL

PLEASE USE PENCIL OR TYPEWRITER. DO NOT USE INK.

State of Ohio
DEPARTMENT OF NATURAL RESOURCES
Division of Water
1562 W. First Avenue
Columbus, Ohio

No. 241682

County Ashtabula Township Ashtabula Section of Township 4

Owner Gale Myers Address Eureka RD.

Location of property ½ mile South on Eureka RD.

CONSTRUCTION DETAILS

Casing diameter 5 ½ Length of casing 17'

Type of screen Length of screen

Type of pump

Capacity of pump

Depth of pump setting

Date of completion

BAILING OR PUMPING TEST

Pumping rate 6.0 G.P.M. Duration of test 7 hrs.

Drawdown ft. Date 8/24/59

Developed capacity

Static level—depth to water ft.

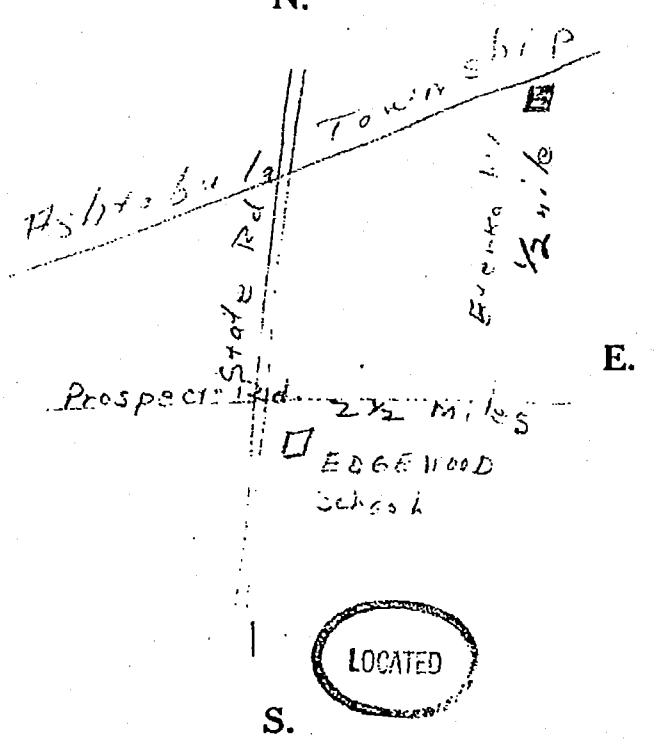
Pump installed by

WELL LOG

Formations Sandstone, shale, limestone, gravel and clay	From	To
BLUE CLAY	0 Feet	15 Ft.
SHALE	15'	53'
WATER AT 53 FEET.		
SALT		

SKETCH SHOWING LOCATION

Locate in reference to numbered State Highways, St. Intersections, County roads, etc.



See reverse side for instructions

Drilling Firm PAUL E McGILL Date 8/24/59

Address R#2 Garrison RD. Ashtabula Signed Paul E McGill

WELL LOG AND DRILLING REPORT

ORIGINAL

PLEASE USE PENCIL OR TYPEWRITER DO NOT USE INK.

State of Ohio
DEPARTMENT OF NATURAL RESOURCES
Division of Water
1562 W. First Avenue
Columbus 12, Ohio

No 295286

County Ashtabula Township Ashtabula Section of Township

Owner Walter Champlin Address 5933 Washington blvd., Astabula Ohio

Location of property Rt. 84, 2 mi. E. of State Rd.

CONSTRUCTION DETAILS

Casing diameter 6 O.D. Length of casing 61

Type of screen Length of screen

Type of pump

Capacity of pump

Depth of pump setting

Date of completion 5-16-63

BAILING OR PUMPING TEST

Pumping Rate 4 G.P.M. Duration of test hrs.

Drawdown 28 ft. Date 5-16-63

Static level-depth to water 47 ft.

Quality (clear, cloudy, taste, odor) good, clear

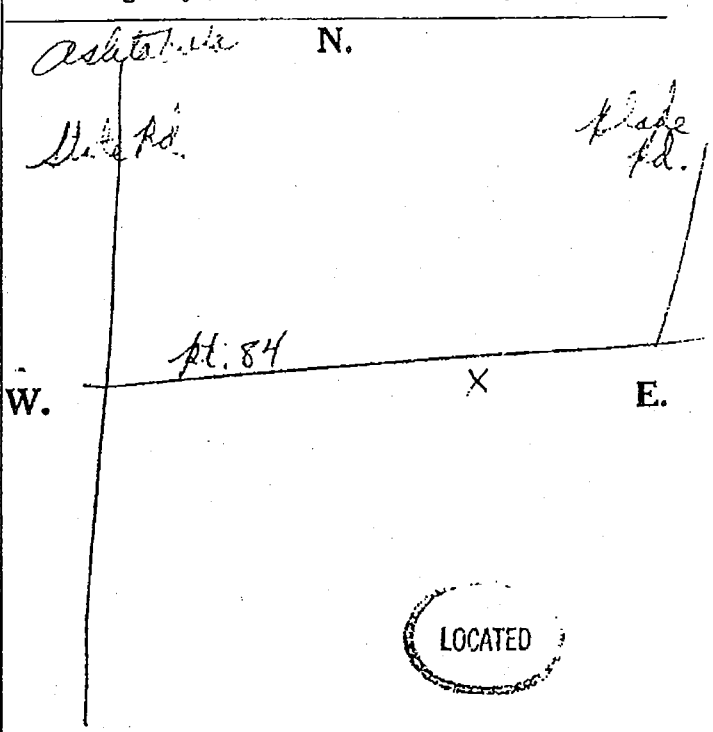
Pump installed by

WELL LOG

Formations Sandstone, shale, limestone, gravel and clay	From	To
clay + sand	0 Feet	49 Ft.
rock	49	52
clay	52	59
shale	59	75

SKETCH SHOWING LOCATION

Locate in reference to numbered State Highways, St. Intersections, County roads, etc.



LOCATED

See reverse side for instructions

Drilling Firm HAROLD INMAN WELL DRILLING

Address RT. 2-JEFFERSON, OHIO

Date 12-11-63

Signed H. Inman

9

WELL LOG REPORT

ORIGINAL

PLEASE USE PENCIL OR TYPEWRITER DO NOT USE INK.

of Ohio
DEPARTMENT OF NATURAL RESOURCES
Division of Water
1562 W. First Avenue
Columbus 12, Ohio

No 292538

County [illegible] Township [illegible] Section of Township

Owner [illegible] Address [illegible]

Location of property [illegible]

CONSTRUCTION DETAILS

Casing diameter 2 Length of casing 19

Type of screen Length of screen

Type of pump

Capacity of pump

Depth of pump setting

Date of completion [illegible]

BAILING OR PUMPING TEST

Pumping Rate 2 G.P.M. Duration of test 1 hrs.

Drawdown 4.1 ft. Date Nov. 15, 62

Static level-depth to water 8½ ft.

Quality (clear, cloudy, taste, odor) clear, good

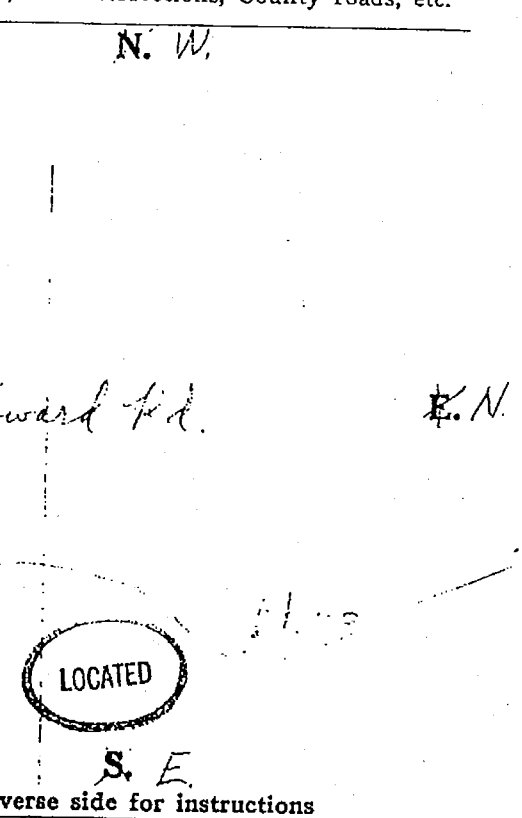
Pump installed by

WELL LOG

Formations Sandstone, shale, limestone, gravel and clay	From	To
[illegible]	0 Feet	30 Ft.

SKETCH SHOWING LOCATION

Locate in reference to numbered State Highways, St. Intersections, County roads, etc.



See reverse side for instructions

Drilling Firm HAROLD INMAN WELL DRILLING

Address RT. 2, JEFFERSON, OHIO

Date 11/13/62

Signed [illegible]

10

WELL LOG AND DRILLING REPORT

ORIGINAL

PLEASE USE PENCIL OR TYPEWRITER DO NOT USE INK.

State of Ohio
DEPARTMENT OF NATURAL RESOURCES
Division of Water
1562 W. First Avenue
Columbus 12, Ohio

No 292523

County [illegible] Township [illegible] Section of Township

Owner [illegible] Address Howard Rd, Galena

Location of property Howard Rd. ½ E of Rt. 46

CONSTRUCTION DETAILS

Casing diameter 6 Length of casing 22

Type of screen Length of screen

Type of pump

Capacity of pump

Depth of pump setting

Date of completion 10-16-62

BAILING OR PUMPING TEST

Pumping Rate ½ G.P.M. Duration of test 1 hrs.

Drawdown 97 ft. Date 10-16-62

Static level-depth to water 69 ft.

Quality (clear, cloudy, taste, odor) clear,

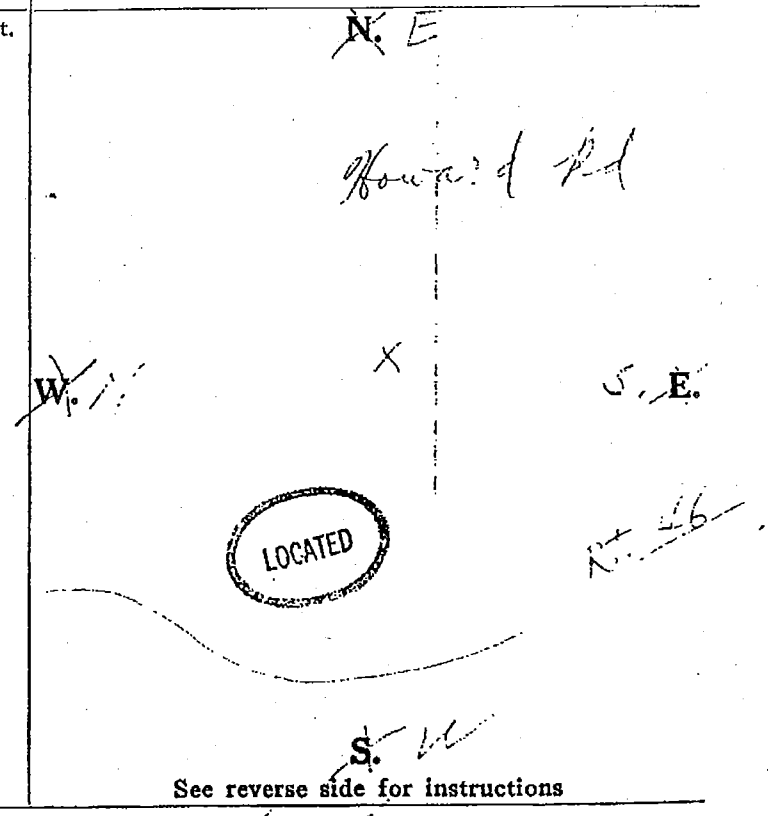
Pump installed by

WELL LOG

Formations Sandstone, shale, limestone, gravel and clay	From	To
[illegible]	0 Feet	[illegible] Ft.
[illegible]	[illegible]	[illegible]
Shale	19	21
[illegible]	21	26

SKETCH SHOWING LOCATION

Locate in reference to numbered State Highways, St. Intersections, County roads, etc.



See reverse side for instructions

Drilling Firm HAROLD INMAN WELL DRILLING

Address RT. 2 JEFFERSON, OHIO

Date 1/24/63

Signed [signature]

11

WELL LOG AND DRILLING REPORT

ORIGINAL

PLEASE USE PENCIL OR TYPEWRITER
DO NOT USE INK.

State of Ohio
DEPARTMENT OF NATURAL RESOURCES
Division of Water
1562 W. First Avenue
Columbus, Ohio 43212

No 347752

County Ashtabula Township Ashtabula Section of Township

Owner Robert Fairburn Address 4815 Lake Rd. East, Ashtabula

Location of property Lake Rd., 2 mi. E. of State Rd.

CONSTRUCTION DETAILS

Casing diameter 6" O.D. Length of casing 65'
Type of screen Length of screen
Type of pump
Capacity of pump
Depth of pump setting
Date of completion 9-17-65

BAILING OR PUMPING TEST

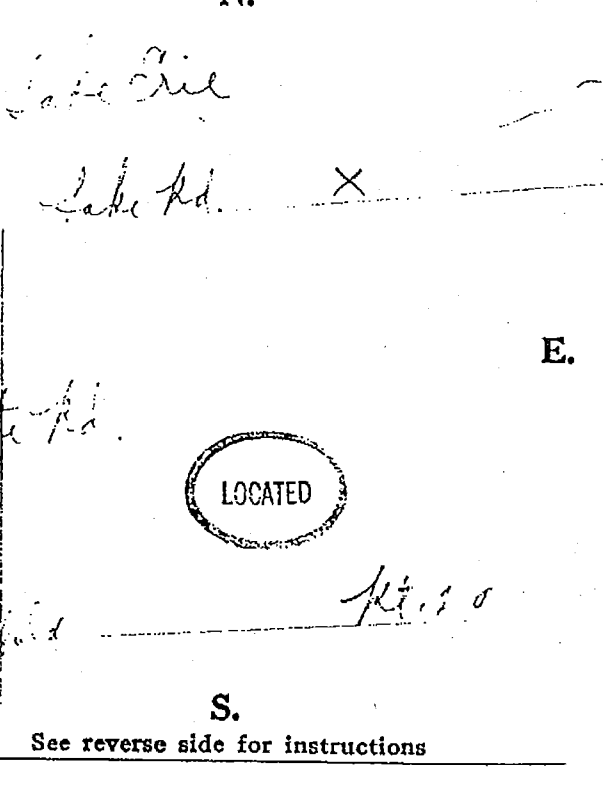
Pumping Rate 10 G.P.M. Duration of test 8 hrs.
Drawdown 170 ft. Date 9-17-65
Static level-depth to water 30 ft.
Quality (clear, cloudy, taste, odor) salty
Pump installed by

WELL LOG*

Formations Sandstone, shale, limestone, gravel and clay	From	To
Clay	0 Feet	60 Ft.
Shale	60	200

SKETCH SHOWING LOCATION

Locate in reference to numbered State Highways, St. Intersections, County roads, etc.



See reverse side for instructions

Drilling Firm HAROLD INMAN WELL DRILLING RT. 2 JEFFERSON, OHIO Date

Address Signed

*If additional space is needed to complete well log, use next consecutive numbered form.

WELL LOG AND DRILLING REPORT

ORIGINAL

433777

NO CARBON PAPER NECESSARY— SELF-TRANSCRIBING

State of Ohio
DEPARTMENT OF NATURAL RESOURCES
Division of Water
65 S. Front St., Rm. 815 Phone (614) 469-2646
Columbus, Ohio 43215

County Ashtabula Township Ashtabula Section of Township

Owner Westlake Address

Location of property ½ mile on Platson Rd in Ashtabula Co

CONSTRUCTION DETAILS

Casing diameter 6 Length of casing 14

Type of screen Length of screen

Type of pump

Capacity of pump

Depth of pump setting

Date of completion

BAILING OR PUMPING TEST
(Specify one by circling)

Test Rate ½ G.P.M. Duration of test hrs

Drawdown ft. Date Aug 28-72

Static level-depth to water 20 ft.

Quality (clear, cloudy, taste, odor)

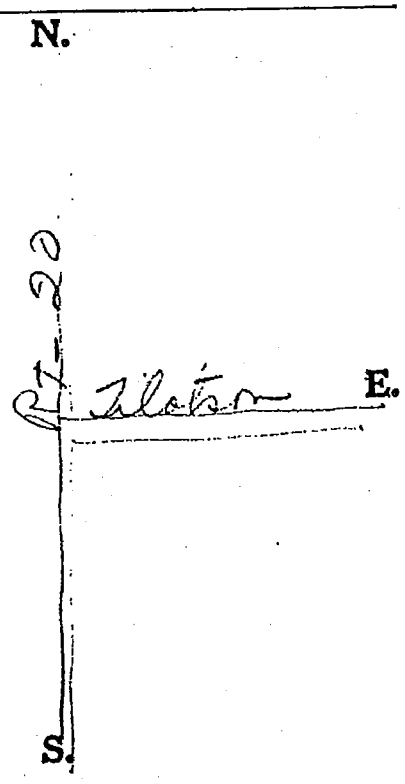
Pump installed by

WELL LOG*

Formations Sandstone, shale, limestone, gravel and clay	From	To
	0 Feet	11 Ft.
Clay	11	29
	29	40
water 40 ft		

SKETCH SHOWING LOCATION

Locate in reference to numbered State Highways, St. Intersections, County roads, etc.



Drilling Firm Paul E McGill Date Aug 28-72

Address East Mayfield Rd. Signed Paul E McGill

*If additional space is needed to complete well log, use next consecutive numbered form.

WELL LOG AND DRILLING REPORT

ORIGINAL

State of Ohio
DEPARTMENT OF NATURAL RESOURCES
Division of Water
1562 W. First Avenue
Columbus, Ohio 43212

PLEASE USE PENCIL OR TYPEWRITER
DO NOT USE INK.

Nº 361533

County Ashtabula Township Ashtabula Section of Township

Owner James Griswold Address 835 W. 48th, Ashtabula O.

Location of property Mannwood Dr., ½ mi. N. of Garrison Rd.

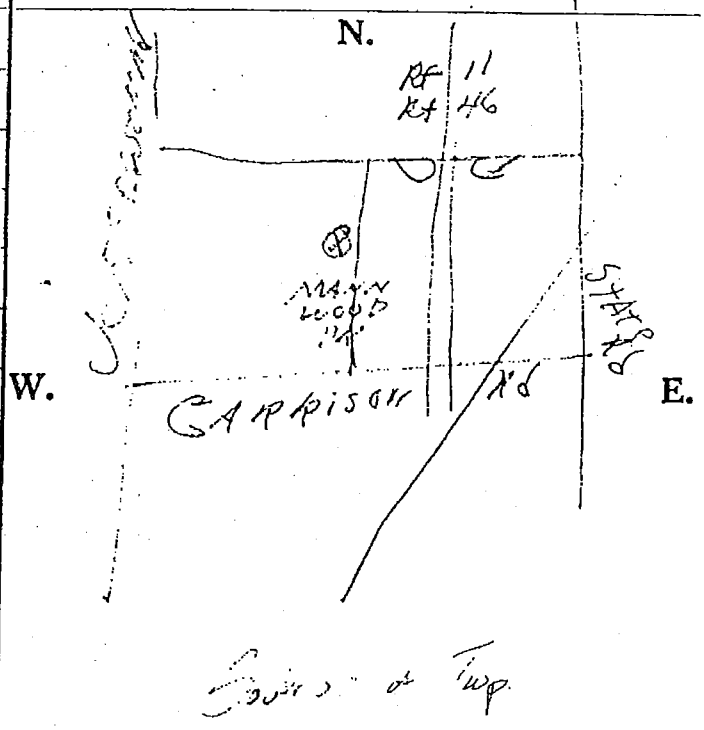
CONSTRUCTION DETAILS	BAILING OR PUMPING TEST
Casing diameter 6" O.D. Length of casing 57'	Pumping Rate 4 G.P.M. Duration of test 1½ hrs.
Type of screen Length of screen	Drawdown 45 ft. Date 9-9-66
Type of pump	Static level-depth to water 35 ft.
Capacity of pump	Quality (clear, cloudy, taste, odor) clear
Depth of pump setting	good
Date of completion 9-9-66	Pump installed by

WELL LOG*

Formations Sandstone, shale, limestone, gravel and clay	From	To
clay	0 Feet	14 Ft.
sand	14	20
clay	20	35
gravel	38	45
clay	45	51
shale	51	80

SKETCH SHOWING LOCATION

Locate in reference to numbered State Highways, St. Intersections, County roads, etc.



See reverse side for instructions

Drilling Firm HAROLD INMAN WELL DRILLING

Address RT. 2-JEFFERSON, OHIO

Date 2-25-67

Signed Harold Inman

*If additional space is needed to complete well log, use next consecutive numbered form.

WELL LOG AND DRILLING REPORT

ORIGINAL

State of Ohio
DEPARTMENT OF NATURAL RESOURCES
Division of Water
1562 W. First Avenue
Columbus, Ohio 43212

PLEASE USE PENCIL OR TYPEWRITER
DO NOT USE INK.

Nº 335022

County [illegible] Township [illegible] Section of Township 5-C1

Owner MR. Ray Cortr[illegible] Address 2[illegible] Rt #1 [illegible]

Location of property [illegible] Rock [illegible] on Cook RD West si

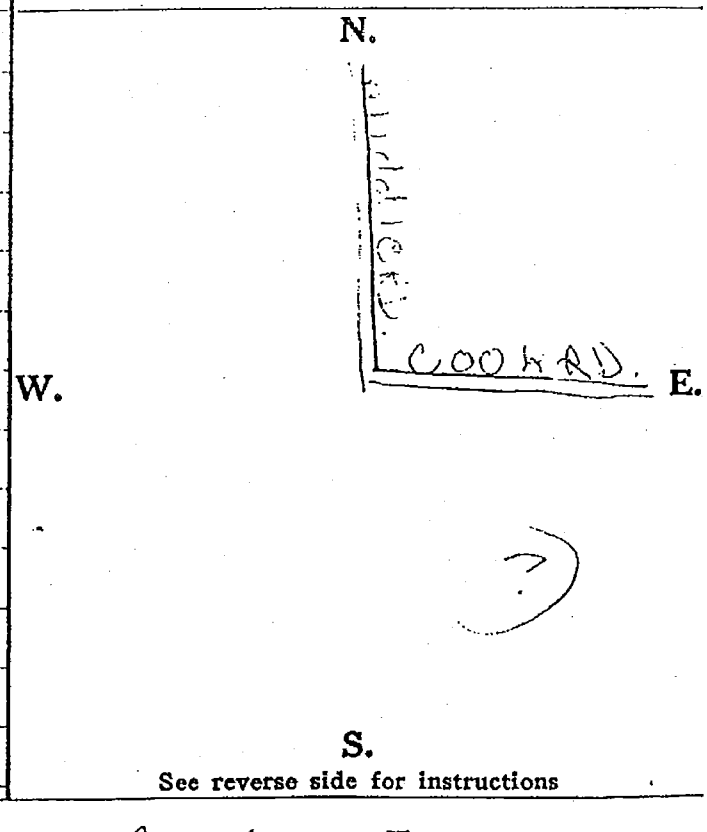
CONSTRUCTION DETAILS	BAILING OR PUMPING TEST
Casing diameter 6" Length of casing 30½'	Pumping Rate 2 G.P.M. Duration of test 1 hrs.
Type of screen none Length of screen	Drawdown ft. Date [illegible]
Type of pump Small well	Static level-depth to water 8 ft.
Capacity of pump	Quality (clear, cloudy, taste, odor)
Depth of pump setting	
Date of completion Aug 10, [illegible]	Pump installed by

WELL LOG*

Formations Sandstone, shale, limestone, gravel and clay	From	To
	0 Feet	28 Ft.
Clay	28	[illegible]
Shale	[illegible]	[illegible]5
Water at		
[illegible]		

SKETCH SHOWING LOCATION

Locate in reference to numbered State Highways, St. Intersections, County roads, etc.



See reverse side for instructions

Drilling Firm [illegible] Date Aug 10, [illegible]

Address [illegible] Signed [illegible]

*If additional space is needed to complete well log, use next consecutive numbered form.

WELL LOG AND DRILLING REPORT

ORIGINAL

NO CARBON PAPER NECESSARY— SELF-TRANSCRIBING

State of Ohio
DEPARTMENT OF NATURAL RESOURCES
Division of Water
65 S. Front St., Rm. 815 Phone (614) 469-2646
Columbus, Ohio 43215

No. 402759

County Ashtabula Township Ashtabula Section of Township

Owner [illegible] Address on 46

Location of property [illegible] East side of [illegible] Ashtabula

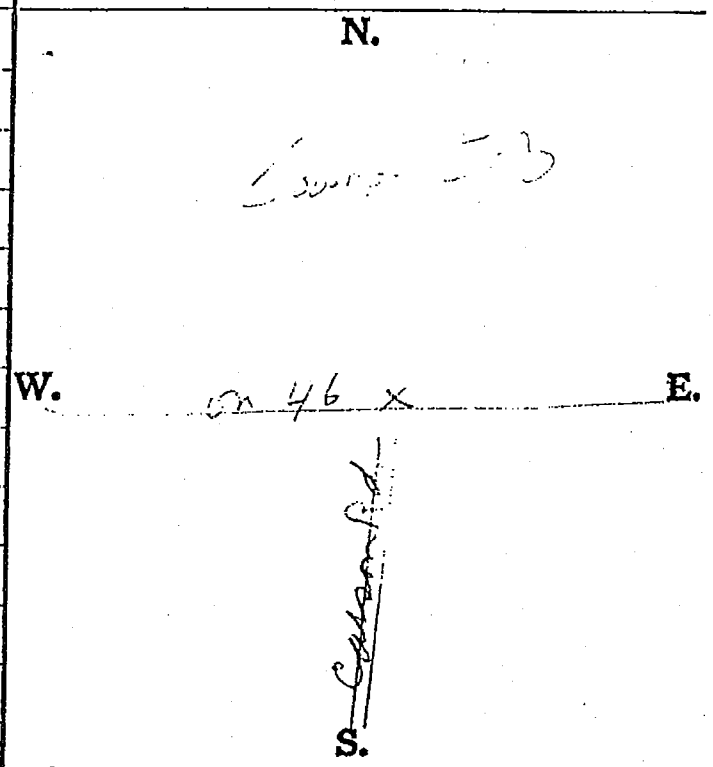
CONSTRUCTION DETAILS	BAILING OR PUMPING TEST (Specify one by circling)
Casing diameter 6 Length of casing 49	Test Rate ? G.P.M. Duration of test ..... hrs.
Type of screen ..... Length of screen	Drawdown ..... ft. Date [illegible] 70
Type of pump	Static level-depth to water 150 ft.
Capacity of pump	Quality (clear, cloudy, taste, odor) .....
Depth of pump setting	
Date of completion [illegible]	Pump installed by .....

WELL LOG*

Formations Sandstone, shale, limestone, gravel and clay	From	To
	0 Feet	46 Ft.
0-46 clay	46	24
46-70 shale	24	70
water		
at 70 ft		

SKETCH SHOWING LOCATION

Locate in reference to numbered State Highways, St. Intersections, County roads, etc.



Drilling Firm Paul E McGill Date May 15-70

Address East Hogeville Rd Signed Paul E McGill

*If additional space is needed to complete well log, use next consecutive numbered form.

WELL LOG AND DRILLING REPORT

ORIGINAL

PLEASE USE PENCIL OR TYPEWRITER. DO NOT USE INK.

State of Ohio
DEPARTMENT OF NATURAL RESOURCES
Division of Water
1562 W. First Avenue
Columbus, Ohio

No. 274774

County ASHTABULA Township ~~Edgewood~~ Ashtabula Section of Township 3-C

Owner Bill Rogers Address PILLITSON Rd

Location of property PILLITSON-Rd & Edgewood North

CONSTRUCTION DETAILS

Casing diameter 6" Length of casing

Type of screen Length of screen

Type of pump

Capacity of pump

Depth of pump setting

Date of completion

BAILING OR PUMPING TEST

Pumping rate G.P.M. Duration of test hrs.

Drawdown ft. Date

Developed capacity

Static level—depth to water 2 Gal a min ft.

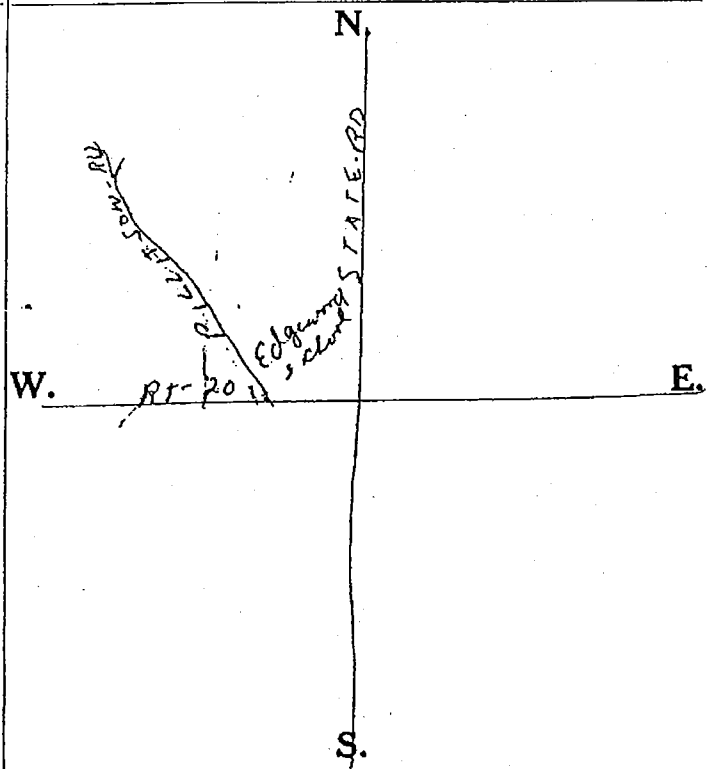
Pump installed by

WELL LOG

Formations Sandstone, shale, limestone, gravel and clay	From	To
	0 Feet	8 Ft.
CLAY	8	16
SHALE	16	35
WATER AT 35 ft		

SKETCH SHOWING LOCATION

Locate in reference to numbered State Highways, St. Intersections, County roads, etc.



See reverse side for instructions

Drilling Firm PAUL E. McGILL Date MAY-26-62

Address R.F.D. 2 ASHTABULA, O Signed Mr. PAUL E McGILL

(1)

WELL LOG AND DRILLING REPORT

ORIGINAL

State of Ohio
DEPARTMENT OF NATURAL RESOURCES
Division of Water
1562 W. First Avenue
Columbus, Ohio 43212

PLEASE USE PENCIL OR TYPEWRITER
DO NOT USE INK.

Nº 347823

County Ashtabula Township Ashtabula Section of Township

Owner Ed Fuller (Bldrs) Address Rt. 3, Austinburg Rd, Ashtabula, O.

Location of property Rt. 84, ½ mi. E. of Rt. 46 (Rt. 11 Interstate)

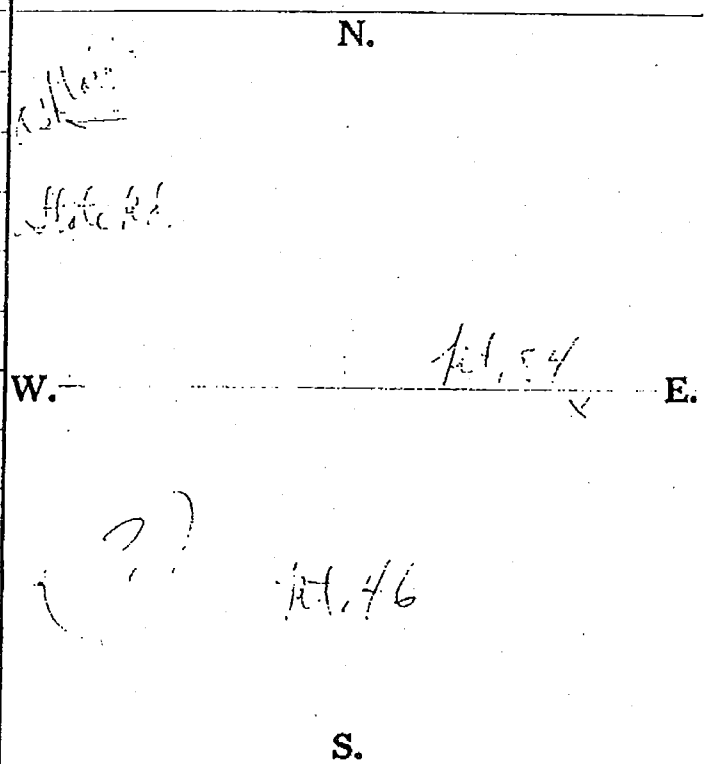
CONSTRUCTION DETAILS	BAILING OR PUMPING TEST
Casing diameter 6" OD Length of casing 48'	Pumping Rate 3 G.P.M. Duration of test 2 hrs.
Type of screen Length of screen	Drawdown 45 ft. Date 5-9-66
Type of pump	Static level-depth to water 45 ft.
Capacity of pump	Quality (clear, cloudy, taste, odor) clear, good
Depth of pump setting	
Date of completion 5-9-66	Pump installed by

WELL LOG*

Formations Sandstone, shale, limestone, gravel and clay	From	To
sand	0 Feet	35 Ft.
gravel	35	38
clay	38	44
shale	44	90

SKETCH SHOWING LOCATION

Locate in reference to numbered State Highways, St. Intersections, County roads, etc.



See reverse side for instructions

Drilling Firm HAROLD INMAN WELL DRILLING

Address RT. 2-JEFFERSON, OHIO

Date 2-4-67

Signed [illegible]

*If additional space is needed to complete well log, use next consecutive numbered form.

WELL LOG AND DRILLING REPORT

ORIGINAL

State of Ohio
DEPARTMENT OF NATURAL RESOURCES
Division of Water
1562 W. First Avenue
Columbus, Ohio 43212

PLEASE USE PENCIL OR TYPEWRITER
DO NOT USE INK.

Nº 335029

County [illegible] Township [illegible] Section of Township [illegible]

Owner [illegible] Kelley Address Austinburg [illegible]

Location of property [illegible]

From where?

CONSTRUCTION DETAILS	BAILING OR PUMPING TEST
Casing diameter [illegible] Length of casing [illegible]	Pumping Rate [illegible] G.P.M. Duration of test 3.00 hrs.
Type of screen [illegible] Length of screen	Drawdown ft. Date [illegible]
Type of pump small well	Static level-depth to water ft.
Capacity of pump	Quality (clear, cloudy, taste, odor)
Depth of pump setting	
Date of completion [illegible]	Pump installed by

WELL LOG*

Formations Sandstone, shale, limestone, gravel and clay	From	To
	0 Feet	5[illegible] Ft.
[illegible]	5[illegible]	2[illegible]
shale	2[illegible]	7[illegible]
water at 7[illegible]		

SKETCH SHOWING LOCATION

Locate in reference to numbered State Highways, St. Intersections, County roads, etc.

N.

W. Austinburg [illegible] E.

S.

See reverse side for instructions

[illegible]ling Firm [illegible] Date Sept [illegible]

[illegible]ddress [illegible] Signed MR [illegible]

[illegible]f additional space is needed to complete well log, use next consecutive numbered form.

WELL LOG AND DRILLING REPORT

ORIGINAL

State of Ohio
DEPARTMENT OF NATURAL RESOURCES
Division of Water
Columbus, Ohio

No 170122

County Asa. Township Asa. Section of Township or Lot Number

Owner Burnice Baker Address Ashtabula RD.

Location of property Rt #6 ½ mile S. of Ashtabula

CONSTRUCTION DETAILS

Casing diameter 6" O.D. Length of casing 58

Type of screen Length of screen

Type of pump

Capacity of pump

Depth of pump setting

PUMPING TEST

Pumping rate G.P.M. Duration of test hrs.

Drawdown ft. Date

Developed capacity 300 GPH

Static level—depth to water 41 ft.

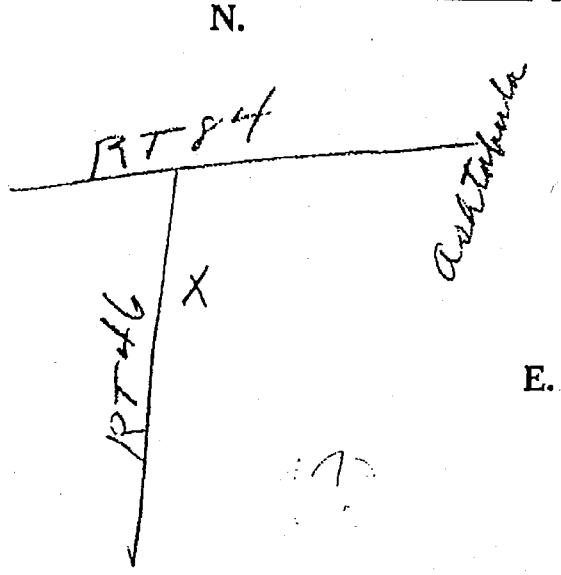
Pump installed by

WELL LOG

Formations Sandstone, shale, limestone, gravel and clay	From	To
clay	0 Feet	40 Ft.
sand	40	50
gravel	50	54
clay	54	56
gravel	56	58

SKETCH SHOWING LOCATION

Locate in reference to numbered State Highways, St. Intersections, County roads, etc.



See reverse side for instructions

Drilling Firm HAROLD INMAN WELL DRILLING

Address RT. 2-JEFFERSON, OHIO

Date 1/16/58

Signed Harold Inman

WELL LOG AND DRILLING REPORT

ORIGINAL

PLEASE USE PENCIL OR TYPEWRITER DO NOT USE INK.

State of Ohio
DEPARTMENT OF NATURAL RESOURCES
Division of Water
1562 W. First Avenue
Columbus 12, Ohio

No 309878

County Ashtabula Township Ashtabula Section of Township Ash T

Owner Bromley Address Jefferson R.D. Box 1

Location of property South of Ashtabula on Jefferson RD. ½ m.

CONSTRUCTION DETAILS

Casing diameter 8" Length of casing 18"

Type of screen ..... Length of screen .....

Type of pump .....

Capacity of pump .....

Depth of pump setting .....

Date of completion .....

BAILING OR PUMPING TEST

Pumping Rate 3 G.P.M. Duration of test ..... hrs.

Drawdown ..... ft. Date July 31, 19 64

Static level-depth to water ..... ft.

Quality (clear, cloudy, taste, odor) .....

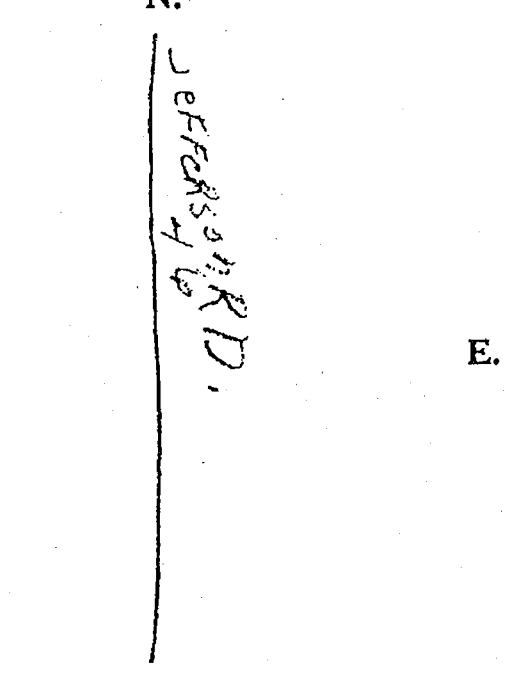
Pump installed by .....

WELL LOG

Formations Sandstone, shale, limestone, gravel and clay	From	To
	0 Feet	..... Ft.
clay	14	21
shale	21	35
Water 35 ft.		

SKETCH SHOWING LOCATION

Locate in reference to numbered State Highways, St. Intersections, County roads, etc.



See reverse side for instructions

Drilling Firm Paul McGill Date July 31, 1964

Address Harrison RD. Signed Paul McGill

WELL LOG AND DRILLING REPORT

ORIGINAL

PLEASE USE PENCIL OR TYPEWRITER DO NOT USE INK.

State of Ohio
DEPARTMENT OF NATURAL RESOURCES
Division of Water
1562 W. First Avenue
Columbus 12, Ohio

No 309856

County Ashtabula Township Ashtabula ? Section of Township ?

Owner James Babe Address Nelson Rd

Location of property Quarter of a mile on the west Side of the ST

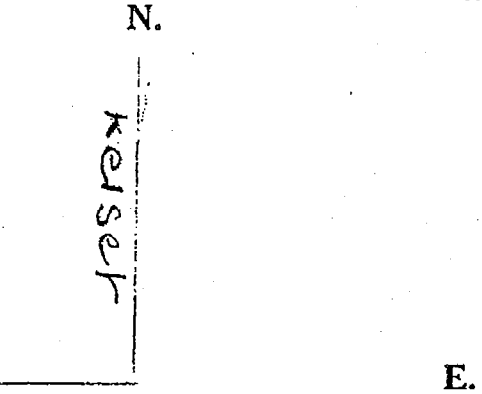
CONSTRUCTION DETAILS	BAILING OR PUMPING TEST
Casing diameter 6" Length of casing 16"	Pumping Rate ..... G.P.M. Duration of test ..... hrs.
Type of screen ..... Length of screen	Drawdown ..... ft. Date .....
Type of pump	Static level-depth to water ..... ft.
Capacity of pump	Quality (clear, cloudy, taste, odor) .....
Depth of pump setting	
Date of completion	Pump installed by .....

WELL LOG

Formations Sandstone, shale, limestone, gravel and clay	From	To
	0 Feet	7 Ft.
Clay	7	30
Rock		
water at 30 ft		

SKETCH SHOWING LOCATION

Locate in reference to numbered State Highways, St. Intersections, County roads, etc.



See reverse side for instructions

Drilling Firm Paul McGee Date apr. 2 1964

Address R. D # 2 Ashtabula Signed Paul E McGee

WELL LOG AND DRILLING REPORT

ORIGINAL

State of Ohio
DEPARTMENT OF NATURAL RESOURCES
Division of Water
1562 W. First Avenue
Columbus 12, Ohio

PLEASE USE PENCIL OR TYPEWRITER DO NOT USE INK.

Nº 284649

County Ashtabula Township ~~Edgewood~~ Ashtabula Section of Township

Owner Homer D Pennington Address North Ridge East

Location of property

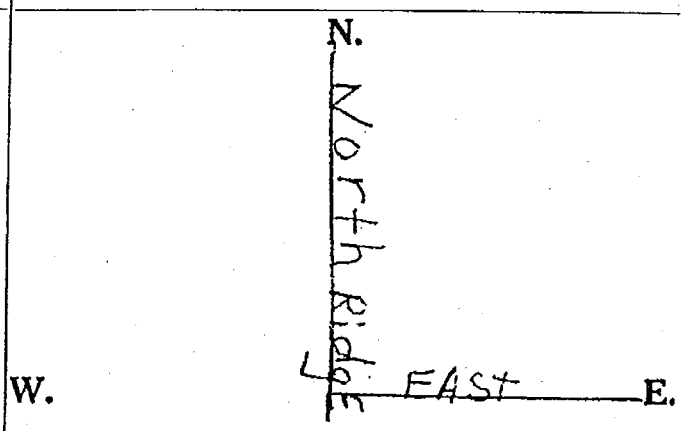
CONSTRUCTION DETAILS	BAILING OR PUMPING TEST
Casing diameter 8" Length of casing 70"	Pumping Rate G.P.M. Duration of test hrs.
Type of screen S Length of screen	Drawdown ft. Date
Type of pump	Static level-depth to water ft.
Capacity of pump	Quality (clear, cloudy, taste, odor)
Depth of pump setting	
Date of completion	Pump installed by

WELL LOG

Formations Sandstone, shale, limestone, gravel and clay	From	To
	0 Feet	Ft.
clay		29
rock	29	36
water at 36 ft		

SKETCH SHOWING LOCATION

Locate in reference to numbered State Highways, St. Intersections, County roads, etc.



See reverse side for instructions

Drilling Firm MR. PAUL McGill Date JULY 8, 1963

Address Garrison Road RFD2 Signed MR. Paul McGill

WELL LOG AND DRILLING REPORT

695236

TYPE OR USE PEN
SELF-TRANSCRIBING
PRESS HARD!

State of Ohio
DEPARTMENT OF NATURAL RESOURCES
Division of Water
1939 Fountain Square Drive
Columbus, Ohio 43224
(614) 265-6739

Permit Number 84-91

COUNTY Ashtabula TOWNSHIP Ashtabula SECTION/LOT NO. (CIRCLE ONE)

OWNER/BUILDER (CIRCLE ONE OR BOTH) Jerry Renaud PROPERTY ADDRESS 932 Zema Drive, Ashtabula (ADDRESS OF WELL LOCATION)

LOCATION OF PROPERTY west side - 1/8 mile W. of Crystal Springs

CONSTRUCTION DETAILS

CASING
Diameter 8 5/8 in. Length 27 ft. Wall Thickness .219 in.
Type: X Steel ☐ Galv. ☐ PVC ☐ Other
Joints: ☐ Threaded X Welded ☐ Solvent ☐ Other

SCREEN
Type (wire wrapped, louvered, etc.) Material
Length ft. Diameter in.
Set between ft. and ft. Slot
☐ Rotary X Cable ☐ Augered ☐ Driven ☐ Dug ☐ Other
Date of completion July 9 1991

GROUT
Material Volume used
Method of installation
Depth: placed from ft. to ft.

GRAVEL PACK
Material Volume used
Method of installation
Depth: placed from ft. to ft.

Pitless Device X Adapter ☐ Preassembled unit
Use of Well Home

PUMP

Type of pump Capacity gpm
Pump set at ft.
Pump installed by

WELL TEST

Bailing X or Pumping ☐
Test rate 9 gpm Duration of test 1 hrs.
Drawdown 17 ft.
Measured from: X top of casing ☐ ground level ☐ Other
Static Level (depth to water) 17 ft. Date: 7-9-91
Quality (clear, cloudy, taste, odor) Cloudy
(Attach a copy of the pumping test record, per 1521.05, ORC)

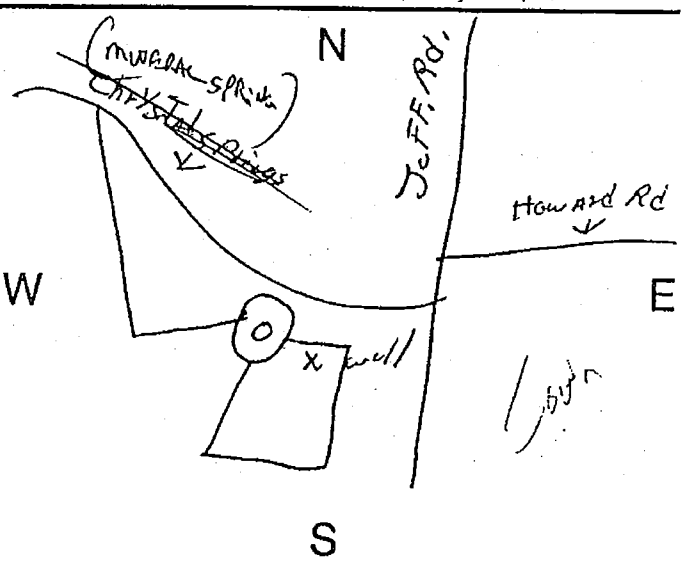
WELL LOG*

ATE DEPTH(S) AT WHICH WATER IS ENCOUNTERED.
color, texture, hardness, and formation:
dstone, shale, limestone, gravel, clay, sand, etc.

From	To	
0 ft.	15 ft.	Brown Clay
15	20	Gray Clay
20	22	Gravel
22	34	Gray Shale
		Water at 22'

SKETCH SHOWING LOCATION

Show distances well lies from numbered state highways, street intersections, county roads, etc.



*tional space is needed to complete well log, use next consecutively numbered form

DNR 780

DRILLING FIRM L L Hall well Drilling
ADDRESS RD #1
STATE, ZIP Sagertown, PA 16433

SIGNED Larry L. Hall
DATE July 9 1991
ODH REGISTRATION NUMBER 1513

Completion of this form is required by 1521.05, Ohio Revised Code - file within 30 days after completion of drilling.

ORIGINAL COPY - ODNR, DIVISION OF WATER, 1939 FOUNTAIN SQ. DRIVE, COLS., OHIO 43224

County Permit No.

NO CARBON PAPER NECESSARY– SELF-TRANSCRIBING

WELL LOG AND DRILLING REPORT

ORIGINAL

State of Ohio
DEPARTMENT OF NATURAL RESOURCES
Division of Water
Fountain Square
Columbus, Ohio 43224

574942

COUNTY Ashtabula TOWNSHIP Ashtabula SECTION OF TOWNSHIP

OWNER John William Morrison ADDRESS 5915 So. Woodmen Ave, Ashtabula

LOCATION OF PROPERTY West side Woodmen Ave – 3/4 mi. South of Rt. 20

CONSTRUCTION DETAILS

Casing diameter 5 5/8" Length of casing 34 ft.

Type of screen — Length of screen —

Type of pump —

Capacity of pump —

Depth of pump setting —

Date of completion

BAILING OR PUMPING TEST
(specify one by circling)

Test rate 3 gpm Duration of test hrs

Drawdown total ft Date June 4, 1981

Static level (depth to water) 8 ft

Quality (clear, cloudy, taste, odor) Clear, no taste or odor

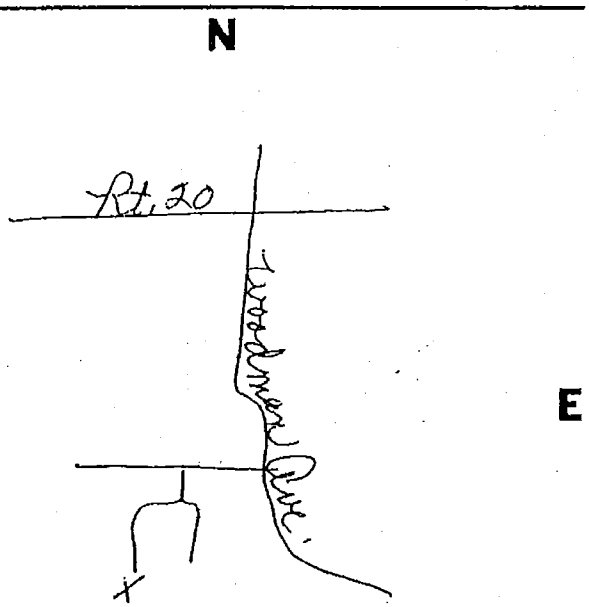
Pump installed by

WELL LOG*

Formations: sandstone, shale, limestone, gravel, clay	From	To
Topsoil	0 ft	1 ft
Yellow Sandy Clay	1	8
Blue Clay	8	21
Blue Clay & Blue Shale	21	31
Blue & Black Shale	31	58

SKETCH SHOWING LOCATION

Locate in reference to numbered state highways, street intersections, county roads, etc.



DRILLING FIRM FREDEBAUGH WELL DRILLING CO
ADDRESS 714 Lake shore Blvd. Grand River, Ohio 44045

DATE June 10, 1981

SIGNED Hewitt Fredebaugh Jr. (RA)

*If additional space is needed to complete well log, use next consecutive numbered form.

WELL LOG AND DRILLING REPORT

NO CARBON PAPER NECESSARY– SELF-TRANSCRIBING

State of Ohio
DEPARTMENT OF NATURAL RESOURCES
Division of Water
Fountain Square
Columbus, Ohio 43224

624665

COUNTY Ashtabula TOWNSHIP Ashtabula SECTION OF TOWNSHIP

OWNER Joe Perry ADDRESS 504 Sill Rd.

LOCATION OF PROPERTY 504 Sill Rd.

CONSTRUCTION DETAILS

Casing diameter 4' Length of casing 16'

Type of screen Length of screen

Type of pump Jet

Capacity of pump 6 gpm

Depth of pump setting 15'

Date of completion 2 Sept 89

BAILING OR PUMPING TEST
(specify one by circling)

Test rate 1 gpm Duration of test 24 hrs

Drawdown ft Date 1 Sept 89

Static level (depth to water) 6' ft

Quality (clear, cloudy, taste, odor) Clear

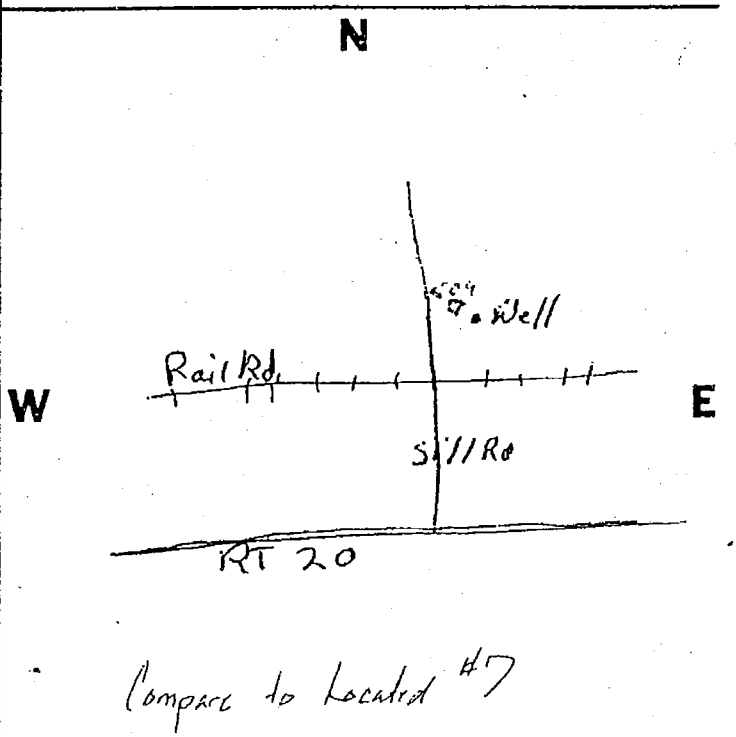
Pump installed by Fred's Water Service

WELL LOG*

Formations: sandstone, shale, limestone, gravel, clay	From	To
Top Soil	0 ft	1 ft
Sub Soil	1'	3'
Fine Sand	3'	5'
Gravel	5'	6'
Blue Clay & Cobbles	6'	9'
Blue Clay	9'	17'

SKETCH SHOWING LOCATION

Locate in reference to numbered state highways, street intersections, county roads, etc.



DRILLING FIRM FRED'S WATER SERVICE DATE 2 SEPT 89

ADDRESS 2638 Townline Rd. Madison SIGNED Fred Schreiber

*If additional space is needed to complete well log, use next consecutive numbered form.

ORIGINAL COPY - OHIO DIVISION OF WATER FOUNTAIN SQ COLS OHIO 43224 (2)

WELL LOG AND DRILLING REPORT

NO CARBON PAPER
NECESSARY-
SELF-TRANSCRIBING

State of Ohio
DEPARTMENT OF NATURAL RESOURCES
Division of Water
Fountain Square
Columbus, Ohio 43224

626858

COUNTY Darke TOWNSHIP _____ SECTION OF TOWNSHIP _____

OWNER _____ ADDRESS _____

LOCATION OF PROPERTY _____

CONSTRUCTION DETAILS

Casing diameter _____ Length of casing _____

Type of screen _____ Length of screen _____

Type of pump _____

Capacity of pump _____

Depth of pump setting _____

Date of completion _____

BAILING OR PUMPING TEST
(specify one by circling)

Test rate _____ gpm Duration of test _____ hrs

Drawdown _____ ft Date _____

Static level (depth to water) _____ ft

Quality (clear, cloudy, taste, odor) _____

Pump installed by _____

WELL LOG*

Formations: sandstone, shale, limestone, gravel, clay	From	To
	0 ft	ft

SKETCH SHOWING LOCATION

Locate in reference to numbered state highways, street intersections, county roads, etc.

N

W E

S

DRILLING FIRM _____ DATE _____

ADDRESS _____ SIGNED _____

*If additional space is needed to complete well log, use next consecutive numbered form.

ORIGINAL COPY - OWNR - DIVISION OF WATER - FOUNTAIN SQ - COLS. OHIO 43224

WELL LOG AND DRILLING REPORT

668198

State of Ohio
DEPARTMENT OF NATURAL RESOURCES
Division of Water
Fountain Square
Columbus, Ohio 43224

NO CARBON PAPER NECESSARY– SELF-TRANSCRIBING

Permit Number _____

COUNTY [illegible] TOWNSHIP [illegible] SECTION OF TOWNSHIP _____

OWNER [illegible] ADDRESS [illegible]

LOCATION OF PROPERTY [illegible]

CONSTRUCTION DETAILS

Casing diameter [illegible] Length of casing [illegible]

Type of screen _____ Length of screen _____

Type of pump _____

Capacity of pump _____

Depth of pump setting _____

Date of completion May 13/88
Rotary ☐ or Cable ☑

BAILING OR PUMPING TEST
(specify one by circling)

Test rate 1 gpm Duration of test _____ hrs

Drawdown 75 ft Date [illegible]

Static level (depth to water) 10 ft

Quality (clear, cloudy, taste, odor) [illegible]

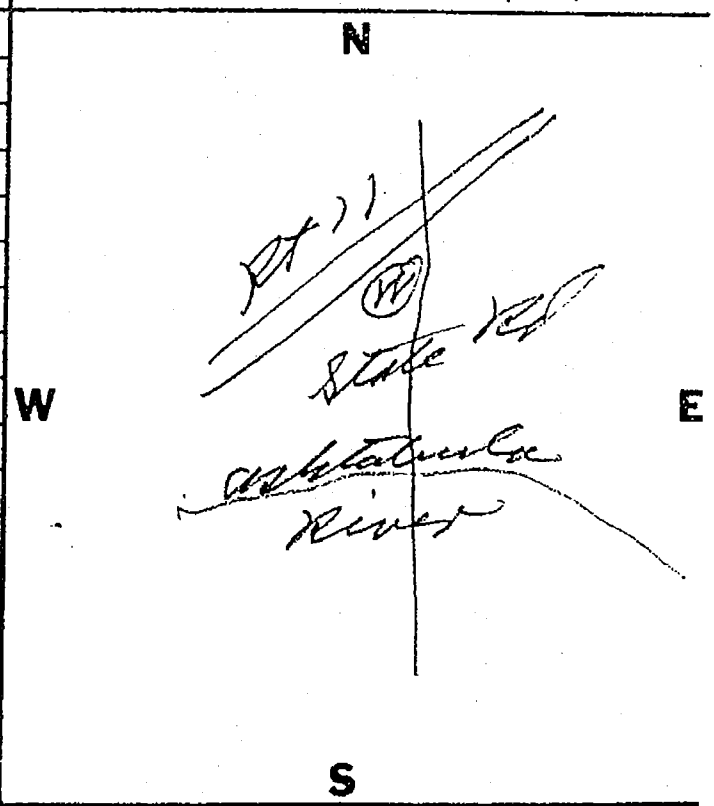
Pump installed by _____

WELL LOG*

Formations: sandstone, shale, limestone, gravel, clay	From	To
Clay	0 ft	22 ft
Shale	22	85

SKETCH SHOWING LOCATION

Locate in reference to numbered state highways, street intersections, county roads, etc.



*additional space is needed to complete well log, use next consecutively numbered form.

DNR 780[illegible]

DRILLING FIRM HAROLD INMAN WELL DRILLING 911 S. R. 307 [illegible] Jefferson, Ohio 44047 REGISTRATION NUMBER 1217 DATE 9/1/88

ADDRESS _____ SIGNED Harold Inman

Completion of this form is required by 1521.05, Ohio Revised Code - file within 30 days after completion.

WHITE ORIGINAL COPY - ODNR, DIVISION OF WATER, FOUNTAIN SQ., COLS., OHIO 43224 / Blue - Customer's Copy / Pink - Driller's Copy / Green - Local Health Dept. Copy

(3)

WELL LOG AND DRILLING REPORT

State of Ohio
DEPARTMENT OF NATURAL RESOURCES
Division of Water
Fountain Square
Columbus, Ohio 43224

NO CARBON PAPER
NECESSARY–
ELF-TRANSCRIBING

635080

COUNTY Ashtabula TOWNSHIP Ashtabula SECTION OF TOWNSHIP

OWNER Bud Hill ADDRESS Rt. 84 Ashtabula

LOCATION OF PROPERTY S. Rt. 84 ½ mile East of Rt. 11

CONSTRUCTION DETAILS

Casing diameter 7¼ Length of casing [illegible]

Type of screen Length of screen

Type of pump

Capacity of pump

Depth of pump setting

Date of completion ✓ Oct 21. 88

BAILING OR PUMPING TEST
(specify one by circling)

Test rate 2 gpm Duration of test 1 hrs

Drawdown ft Date Oct. 21, 1988

Static level (depth to water) 15 ft

Quality (clear, cloudy, taste, odor) good

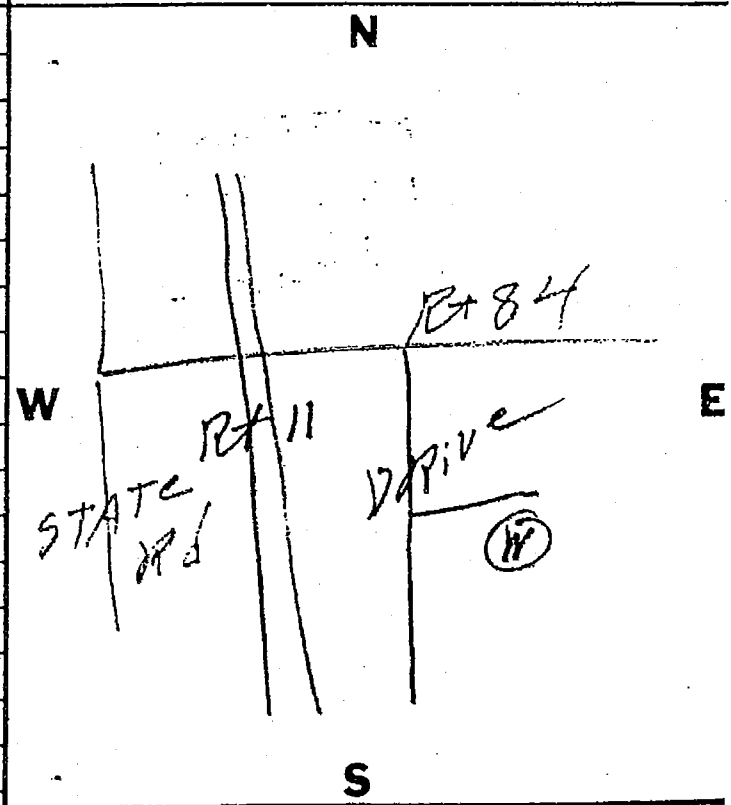
Pump installed by

WELL LOG*

Formations: sandstone, shale, limestone, gravel, clay	From	To
Clay	0 ft	38 ft
sand & gravel	38	41
shale	41	60

SKETCH SHOWING LOCATION

Locate in reference to numbered state highways, street intersections, county roads, etc.



DRILLING FIRM HAROLD INMAN WELL DRILLING
912 S. R. 307 East
ADDRESS Jefferson, Ohio 44047

DATE Nov. 1, 1988

SIGNED Harold Inman

*If additional space is needed to complete well log, use next consecutive numbered form.

0217

(4)

ORIGINAL COPY – ODNR DIVISION OF WATER FOUNTAIN SQ. COLS. OHIO 43224

County Permit No. _____

WELL LOG AND DRILLING REPORT

ORIGINAL

NO CARBON PAPER NECESSARY– SELF-TRANSCRIBING

State of Ohio
DEPARTMENT OF NATURAL RESOURCES
Division of Water
Fountain Square
Columbus, Ohio 43224

547006

COUNTY Ashtabula TOWNSHIP Ashtabula SECTION OF TOWNSHIP _____

OWNER Lyman A Randolph ADDRESS Pinney Rd - 3470

LOCATION OF PROPERTY 1/2 mile on Pinney Rd East side of Rd in Ashtabula

CONSTRUCTION DETAILS

Casing diameter 8" Length of casing 32'

Type of screen _____ Length of screen _____

Type of pump _____

Capacity of pump _____

Depth of pump setting _____

Date of completion _____

BAILING OR PUMPING TEST
(specify one by circling)

Test rate 2 gpm Duration of test _____ hrs

Drawdown _____ ft Date Aug 11-78

Static level (depth to water) 25' ft

Quality (clear, cloudy, taste, odor) _____

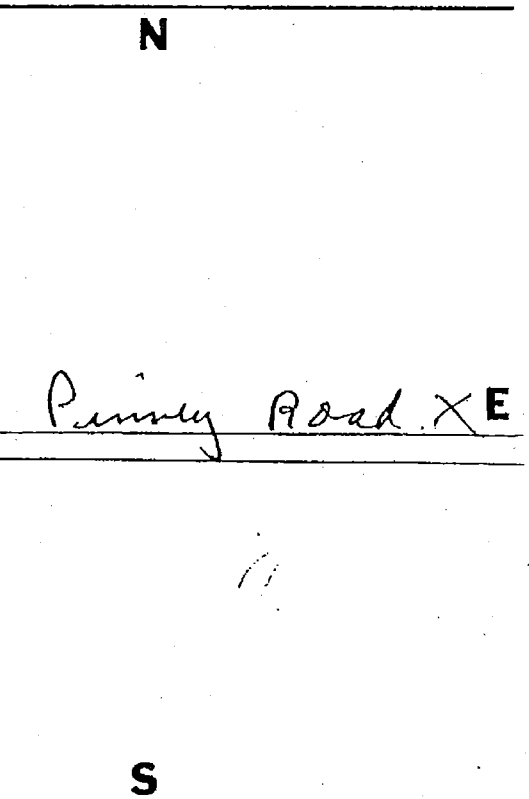
Pump installed by _____

WELL LOG*

Formations: sandstone, shale, limestone, gravel, clay	From	To
	0 ft	26 ft
clay	26	2
gravel	2	14
	14	40
water at 40 ft		

SKETCH SHOWING LOCATION

Locate in reference to numbered state highways, street intersections, county roads, etc.



DRILLING FIRM McGill well Driller DATE Aug 11-78

ADDRESS Monroe Mayaville Rd - SIGNED Paul E McGill

*If additional space is needed to complete well log, use next consecutive numbered form.

WELL LOG AND DRILLING REPORT

ORIGINAL

NO CARBON PAPER NECESSARY— SELF-TRANSCRIBING

State of Ohio
DEPARTMENT OF NATURAL RESOURCES
Division of Water
65 S. Front St., Rm. 815 Phone (614) 469-2646
Columbus, Ohio 43215

465638

County Ashtabula Township Ashta. Section of Township

Owner Helen Fenton Address on RT 46

Location of property 1 mile from 46 in Ashtabula

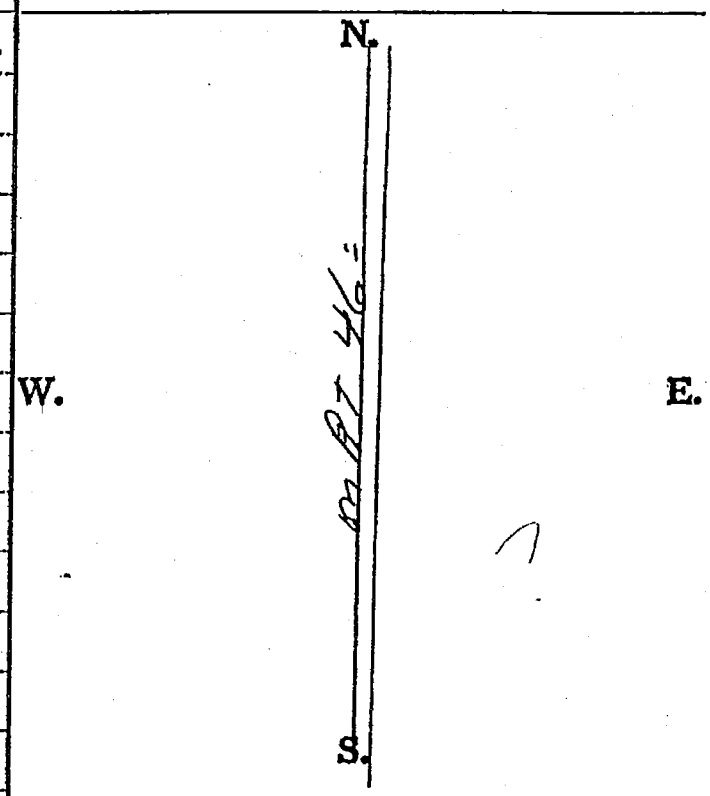
CONSTRUCTION DETAILS	BAILING OR PUMPING TEST (Specify one by circling)
Casing diameter 6" Length of casing 85	Test Rate 5 G.P.M. Duration of test hrs.
Type of screen Length of screen	Drawdown ft. Date Sept 5-74
Type of pump	Static level-depth to water 35 ft ft.
Capacity of pump	Quality (clear, cloudy, taste, odor)
Depth of pump setting	
Date of completion	Pump installed by

WELL LOG*

Formations Sandstone, shale, limestone, gravel and clay	From	To
	0 Feet	55 Ft.
0-55 Clay	55	17
5-72 Quick Sand	17	10
2-82		
Water at		
82 ft		
drilled		
?		

SKETCH SHOWING LOCATION

Locate in reference to numbered State Highways, St. Intersections, County roads, etc.



...ing Firm Paul McGill Date Sept 5 = 74

...ress Monroe Gageville Rd. Signed Paul E McGill

*If additional space is needed to complete well log, use next consecutive numbered form.

WELL LOG AND DRILLING REPORT

ORIGINAL

NO CARBON PAPER NECESSARY— SELF-TRANSCRIBING

State of Ohio
DEPARTMENT OF NATURAL RESOURCES
Division of Water
65 S. Front St., Rm. 815 Phone (614) 469-2646
Columbus, Ohio 43215

No. 389982

County Ashtabula Township Ashtabula Section of Township

Owner Andy Carlson Address on Jefferson Rd Rt-46

Location of property 1 mile on Rt 46 on North side of Rd Ashtabula

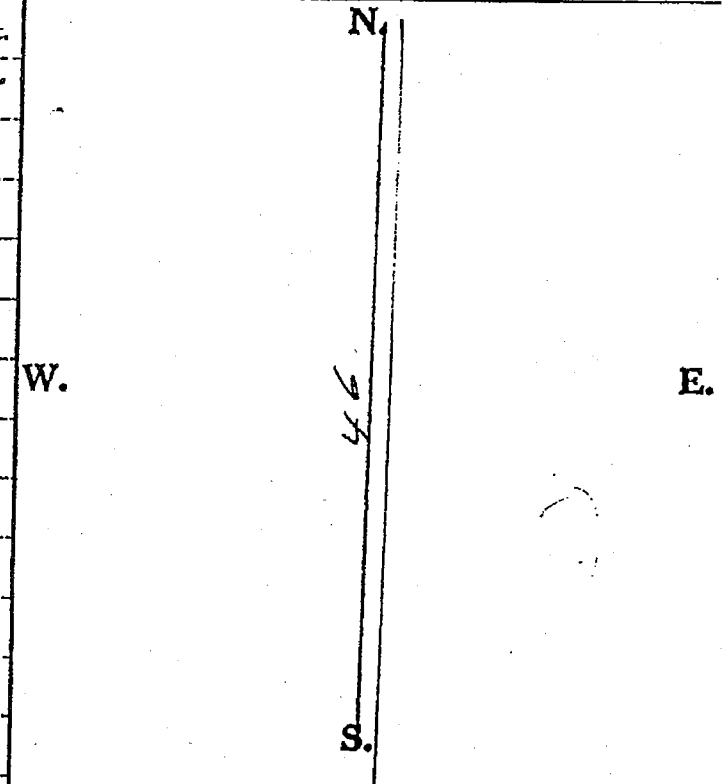
CONSTRUCTION DETAILS	BAILING OR PUMPING TEST (Specify one by circling)
Casing diameter 8" Length of casing 54	Test Rate 30 gals an hr. G.P.M. Duration of test ..... hrs.
Type of screen ..... Length of screen	Drawdown ..... ft. Date Sept 13-69
Type of pump	Static level-depth to water 10 ft.
Capacity of pump	Quality (clear, cloudy, taste, odor) .....
Depth of pump setting	
Date of completion Oct 1-69	Pump installed by .....

WELL LOG*

Formations Sandstone, shale, limestone, gravel and clay	From	To
	0 Feet	52 Ft.
Clay	52	28
Shale Rock	28	80
Water at 80 ft		

SKETCH SHOWING LOCATION

Locate in reference to numbered State Highways, St. Intersections, County roads, etc.



Drilling Firm Paul E McGill Date Sept 13-69

Address East Gageville Rd Signed Paul E McGill

*If additional space is needed to complete well log, use next consecutive numbered form.

Ashtabula Closure Project

FINAL RMI REPORT

PHASE II

SEPETEMBER 2003

Appendix F

SHARP AND ASSOCIATES, INC. Environmental Engineers, Scientists, & Constructors

982 Crupper Avenue
Columbus, Ohio 43229

614 841 4650
614 841 4660 (fax)
www.sharpenv.com

TO: Al Lambacher, RMI Environmental Services Inc, (RMIES)
Eric Marsh, RMIES
FROM: Todd Struttmann, Sharp & Associates, Inc. (SHARP)
Steven Roach, SHARP
SUBJECT: Review of Site Groundwater Investigation Laboratory Data
RMI Facility in Ashtabula, Ohio
DATE: May 12, 2003 (Revised *May 21, 2003*)

There have been a number of discussions on the qualified data collected as part of the Groundwater Remedial Investigation at the RMI facility. RMIES contracted with the outside laboratory, General Engineering Laboratories (GEL) for analysis of radionuclides (U and Tc-99) as well as Volatile Organic Compounds (VOCs). SHARP's role was to provide an independent review of the analytical data. SHARP began discussions with Don Sebest (of RMIES) in January, when the first sets of data were received, regarding certain concerns on data analysis and hold times that would require qualification or rejection of much of the data collected during the investigation. Don has been working with GEL to resolve the analysis protocol and hold time concerns.

SHARP, RMIES and GEL had a conference call on May 2, 2003, to discuss the interpretation of hold times and the revised Encore preservation methods, and confirmed that GEL's Standard Operating Procedures (SOP) are the same as the interpretation expressed by SHARP and RMIES. On May 9, 2003, GEL provided a draft written response to the questions raised. The response did not change the interpretation of hold times and does not provide sufficient documentation to change the data qualifications. Table 1 provides a split of accepted vs. rejected samples.

Table 1. Summary of Off-site Laboratory Analyses

Analysis	Number of Analyses	Number Accepted/ Qualified	Number rejected
Uranium (soil)	123	123	0
Tc-99 (soil)	123	123	0
VOCs (soil)	108	68	40 (37%)
VOCs (water)	14	14	0
Total	368 (100%)	328 (90%)	40 (10%)

Table 1 shows that 37% of the soils analyzed for VOCs were rejected. This rejection is due to GEL missing hold times for a large number of the samples. Table 2, below, provides further breakdown of the soils analyzed for VOCs. There were three shipments of samples that did not arrive at the laboratory in a timely manner: one set due to a snowstorm which delayed Federal

Express (Memphis airport was shutdown); one was misplaced by Federal Express; and one not received for Saturday delivery.

Table 2. Breakdown of Soil VOC Analyses

Description	Total	Rejected	Qualified	Accepted
VOC sample - Shipping delay at Fed Ex (a)	27	21	6	0
VOC Samples received at lab in timely manner (b)	81	19	23	39
Total	108 (100%)	40 (37%)	29 (27%)	39 (36%)

(a) There were three shipments that went through Federal Express that did not allow the laboratory sufficient time to analyze the samples (1 shipment arrived after the hold time expired, 4 days, and two shipments did not leave sufficient time for preparation and analysis (3 days)].
(b) These shipments were received at the laboratory within 2 days of collection.

Rejection of 37% of the VOC analyses for the soil samples is not an acceptable failure rate for a typical laboratory. Even if one considers the 81 samples delivered on time, 17 rejected represent a 21% rejection rate. The next step is to determine the effect of these data rejections on the conclusions that can be made in the Groundwater Remedial Investigation report.

Cc: D. Sebest, RMIES

SHARP AND ASSOCIATES, INC. Environmental Engineers, Scientists, & Contractors

May 20, 2003

To: Steven Roach
From: Sara Crenshaw

Subject: Data Review Report for the RMI Extrusion Plant SI, Sampled December 2002 through January 2003.

The data review followed quality assurance procedures outlined in the U.S. Environmental Protection Agency (USEPA) documents *Test Methods for Solid and Hazardous Waste - Third Edition - Update III (SW-846)* and the other U.S. EPA methods used in these analyses.

1.0 GENERAL COMMENTS

General Engineering Laboratories in Charleston, SC performed all the analyses for the samples in the sample delivery groups. Samples were analyzed for Volatile Organic Compounds (VOCs), by SW-5035/8260B, and Technicium-99 and Total Uranium by DOE EML HASL Methods RAD A-005 and RAD A-013. The data reports received from RMI Environmental Services (RMI) contained the sample results with a quality control summary containing: method blanks, laboratory control samples/laboratory control sample duplicate (LCS/LCSD), matrix spike/matrix spike duplicates (MS/MSD), laboratory duplicates, volatile hold blanks for VOCs, and surrogate recoveries for VOCs.

The review of these data, while not a full validation was based on a technical review of the essential elements that could be determined from the summary data packages. The data were reviewed in accordance of the quality control requirement given in the methodology used. The items which were reviewed are as follows:

- Completeness
- Chain of Custody Records (COC)
- Holding Times
- Blank Contamination
- Laboratory Control Samples
- Matrix Spike/Matrix Spike Duplicate
- Surrogate Recoveries for VOCs

The quality control data for some Technitium-99 and Total Uranium analyses did not correlate with spike recoveries and relative percent differences for duplicate analyses could not be reproduced by the reviewer based on the reports submitted. Because of this, these data could not be evaluated based on the information contained in the laboratory data reports.

The dates used to calculate and evaluate holding times for the soil VOC samples is as follows. The date of collection was noted on the Chain of Custody records. The logbook entries for date preserved (placed in water and frozen) was supplied by the laboratory at the request of the reviewer. The date the sample was removed from the freezer was the "date prepared" listed on the laboratory sample report form. The date of analysis is also listed on the laboratory sample report form.

The following review criteria were used in assessing the VOC sample results. The method required that not more than 48 hours elapse from sample collection to sample analysis. (The sample must be placed in water and frozen within 48 hours of the collection date.) The hold time can then be "suspended" for up to 14 days while the sample remains frozen, however, once removed from the freezer, the sample must be analyzed within the time remaining to reach the total of a 48 hour hold time. If the sample is placed in water and frozen between 48 hours and 96 hours and analyzed upon removal from the freezer, the sample results are qualified as estimated (J). If the samples are collected, placed in water, frozen, removed from the freezer and analyzed within a the total time (minus the time frozen) of greater than 96 hours (greater than two times the holding time criteria), the sample results are qualified as unusable (R).

Of the 108 soil samples collected for VOC analyses, 40 (37%) were qualified as unusable (R) and 29 (27%) of the soil VOC samples were qualified as estimated (J) due to evaluation based on the holding time criteria listed above. Twenty-seven of the affected samples were in three shipments that were late on the arrival time at the laboratory due to weather and Federal Express delays. This affected samples were collected on December 12 and 13, 2002. Of these 27 samples 21 were qualified as unusable (R) and 6 were qualified as estimated (J).

These violations of holding time criteria far over shadowed any other quality control deficiency in the reviewer's consideration of laboratory quality control criteria. The hold time exceedences yield a low reliability of the quantitation data. For compounds that are reported as non-detect, the presence or absence of the compound cannot be determined. For the compounds with detected concentrations, the concentration reported is very highly in question due to the nature of volatile compounds preservation method selected by the laboratory. There is no way of determining the impact the hold-time exceedances have on the data for the detected parameters. Because the compounds were held for so long without preservation and not in a sealed container, it is hard to know how much cross-contamination from the storage with other samples or from laboratory contaminants may be present. If these data are used, they should be considered to be of screening quality and should not used for closure verification or for use in risk assessment.

Thirty eight percent of the soil boring VOC data were collected and analyzed within the hold time criterion (48 hours from collection to analysis). Groundwater data for VOCs were collected and analyzed within the holding time criterion. Some compounds were qualified as estimated due to laboratory or field blank contamination. These data were considered to be reliable and can be used without additional qualification.

A quick reference for the samples VOC data rejected or qualified can be found in Table 1: Overview of Samples Collected in the RMI Groundwater Report.

The following sections detail the validation notes for each of the analyses in these data sets. Any actions (i.e., qualification or rejection of data) required based on the data review are highlighted in bold within the section detailing the Quality Assurance/Quality Control (QA/QC) exceedance. Any necessary data qualifiers have also been added to the data summary pages found in RMI Phase II Groundwater Investigation Report for the RMI Extrusion Plant Site, Appendix H, hereafter referred to the RMI Groundwater Report.

2.0 Completeness

The data were reported for all samples listed on the chain of custody records submitted between December 5, 2002 and January 31, 2003. The electronic data files submitted with the samples did not contain data for the following water samples:

Sample ID	Date Collected	Lab ID
Trip Blank	12/12/2002	S21212201
Equipment Blank	12/11/2002	S21211202
Equipment Blank (PUMP)	12/13/2002	S21212239
Trip Blank	12/13/2002	S21213201
Sample Pump	12/13/2002	S21213202

3.0 Chain of Custody (COC)

The COC records indicated that three samples from differing depth intervals were collected from the soil boring at location BH4C on 2/16/02, however, these samples were actually collected from soil boring at location BH5C (per Kevin Smith, SHARP field geologist on site during collection). These sample identifications have been corrected in the project database and hand corrected in the hard copy deliverables. No further actions are required, as this did not impact the quality of the data.

4.0 Holding Time

4.1 VOCs

Many of the VOC results for soil analyses were qualified as unusable (R) due to the exceedence of holding time criteria given in the method for samples collected for VOCs using ENCORE® samplers. According to the Method 5035 from SW-846 samples collected using the ENCORE® samplers should be placed in an acid solution preservative within 48 hours of collection. The sample can then be held at 4°C for up to 14 days prior to analysis. However, the laboratory placed the sample in water and froze the extract until analysis. Extracting with water and freezing the samples is an option mentioned in Update 4 to SW-846, however, it is not promulgated at this time. The method states that the recovery of analytes from the matrix using this method has not been determined. It also does not give any direct guidance regarding the alloted time between thawing the sample and analysis. Due to the nature of the constituents analyzed in a VOC sample, headspace within the vial and the lack of preservative in the matrix, this time period should be kept as short as possible.

4.2 Technicium-99

No qualifcation of the data was required with regard to holding time criteria for technicium-99.

4.3 Total Uranium

No qualification of the data was required with regard to holding time criteria for total uranium.

5.0 Blank Contamination

5.1 VOCs

The trip blank, field blank, and equipment blank samples were only used to qualify the water samples due to matrix and analytical methodology differences between soil and groundwater samples.

The following qualifications were made due to method blank contamination in the water matrix:

Sample	Lab ID	Collection Date	Compound	Qualified Value
Equipment Blank	S21211202	12/11/02	Acetone	6.41 U ug/L
Trip Blank	S21212201	12/12/02	Acetone	19.1 U ug/L
Trip Blank	S21213201	12/13/02	Acetone	19.8 U ug/L
Sample Pump	S21213202	12/13/02	Acetone	20.9 U ug/L
Equipment Blank	S21212239	12/12/02	Acetone	19.5 U ug/L
BH3C Piz (6'-11')	S21216221	12/16/02	Acetone	6.77 U ug/L
BH4B Piz (7'-12')	S21216224	12/16/02	Acetone	5.00 U ug/L
Trip Blank	S21218202	12/18/02	Acetone	9.71 U ug/L
BH5D (5'-11')	S21217232	12/17/02	Acetone	5.00 U ug/L
Trip Blank	S21220201	12/19/02	Acetone	14.2 U ug/L
BH2B Piz (4'-9')	S21219219	12/19/02	Acetone	5.00 U ug/L
BH7B Piz (6'-11')	S21219217	12/19/02	Acetone	7.48 U ug/L
BH2B Piz (4'-9')	S21219219	12/19/02	Toluene	1.42 U ug/L

None of the method blank contamination noted in the soil matrix was detected in the associated soil samples. No qualification was required in soil samples due to method blank contamination.

5.2 Technicium-99

All method blank results were non-detect for technicium-99 and no qualification of the data was necessary.

5.3 Total Uranium

All method blank results were non-detect for total uranium and no qualification of the data was necessary.

6.0 Laboratory Control Samples (LCS)

6.1 VOCs

All VOC LCS results reported were within the laboratory established control limits for both soil and water matrices. A LCS was analyzed with each batch of samples. No qualification of the data was required based on the LCS recovery and LCS/LCSD relative percent difference (RPD) results reported in association with the RMI Groundwater Site Investigation samples.

6.2 Technicium-99

The LCS results for Technicium-99 were within the laboratory control limits. No qualification of the data was required based on the LCS recovery and LCS/LCSD RPD results reported in association with the RMI Groundwater Site Investigation samples.

6.3 Total Uranium

The LCS results for Total Uranium could not be recalculated by the reviewer. SHARP cannot evaluate the data with regard to the LCS results for Total Uranium.

7.0 Matrix Spike/Matrix Spike Duplicate Samples

7.1 VOC

Very few soil samples were reported for VOC MS/MSD analysis considering that the one hundred and eight soil samples were submitted for VOC analysis. The MS/MSDs reported did meet the laboratory established criteria and no qualification was necessary.

The MS/MSD for water matrices included spikes on equipment and field blanks as well as site-related samples. The MS/MSD results for the water matrices did meet the laboratory established criteria and no qualification of the data was necessary.

7.2 Technicium-99

The MS/MSD results for Technicium-99 were within the laboratory established control limit. No qualification of the data was required based on the sample accuracy evaluation.

7.3 Total Uranium

The MS/MSD results for total uranium were unable to be recalculated by the reviewer. SHARP cannot evaluate the total uranium data with regard to matrix effect on the sample analysis.

8.0 Surrogate Recoveries for VOCs

The surrogate recoveries for all samples were within acceptance criteria with the exception of the following:

Sample	Surrogate	% Recovery	Qualification
BH6D (10.5')	Bromofluoromethane	High	J all positive results
BH6C (8.5')	Bromofluoromethane	High	J all positive results
BH6B (9')	Bromofluoromethane	High	J all positive results
	Toluene-d_8	High	
BH6A (12.5')	Bromofluoromethane	High	J all positive results
BH6A (12.5')V-1	Bromofluoromethane	High	J all positive results
BH3E (12')	Bromofluoromethane	High	J all positive results
BH4C (15')	Bromofluoromethane	High	J all positive results
BH3D (9')	Bromofluoromethane	High	J all positive results
BH3D (16')	Bromofluoromethane	High	J all positive results
BH3C (18')	Bromofluoromethane	High	J all positive results
BH8D (6.5')	Bromofluoromethane	High	J all positive results
BH9C (16')	Bromofluoromethane	High	J all positive results

9.0 Other

The problems with the holding time criteria for the soil samples for VOCs overshadowed any qualifications due to surrogates and the data was reported as unusable (R).

The concentration of some site-related constituents required the sample to be reanalyzed. These samples were reported at a a dilution. The laboratory took the three ENCORE® soil samples received and preserved one with water for freezing, one in methanol for high concentration analysis if needed, and the third was used for moisture. The amount of sample remaining after the moisture aliquot was taken was also placed in water for freezing. This is how some samples were reanalyzed at an "apparent" dilution. For samples that were diluted due to compounds that exceeded the calibration range in original anlysis, the diluted value was reported for only that compound. If a compound in the diluted analysis was detected at a significantly different concentration and above the reporting limit, the diluted result was reported. The compounds that were detected and selected for reporting in all samples that were diluted are given in the attached Tables 1-13.

For several samples, toluene was reported in the diluted analysis with a detected concentration, but was reported as non-detect in the original analysis. In these cases, the detected concentration for toluene was selected for use in the site evaluation.

It has been noted in several places that the quality control data reported for total uranium could not be calculated by the reviewer. Since SHARP cannot evaluate the data, no qualification can be made.

10.0 Summary and Conclusion

The data reported by General Engineering Laboratories for the RMI Groundwater Site was evaluated using the guidelines presented in the analytical method or the USEPA's National Functional Guidelines for Data Review.

The quality control data for Technitium-99 and Total Uranium did not correlate with spike recoveries and relative percent differences for duplicate analyses could not be reproduced by the reviewer based on the report submitted. Because of this, the data were not qualified based on the information submitted in the laboratory data reports.

Samples collected from both soils and groundwater at the site were qualified based on blank contamination in field and laboratory blank samples. Site-related samples with detected concentrations of constituents within 5 times the concentration detected in the associated blank sample were qualified as non-detect ("U" qualifier added) based on likely laboratory or field artifacts. Site-related samples with detected concentrations of constituents greater than 5 times the concentration detected in the associated blank sample were qualified as estimated ("J" qualifier added) based on likely laboratory or field contamination.

37% of the VOC data in soils has been qualified as unusable ("R" qualifier added) due to exceedance of more than two-time the holding time criteria (96 hours) from sample collection to analysis required when using ENCORE® samplers minus the time the sample was frozen. These data should be considered to be of screening quality; results reported as non-detected should not be used to assess the presence or absence of constituents at the site; results with detected concentrations should be considered to be bias low.

27% of the VOC data in soils has been qualified as estimated in both positive and non-detect results ("J" qualifier added) due to severely missed hold-time exceedances that did not reach the criterion used for data rejection (i.e., the samples were preserved and analyzed within the 96 hours from collection).

36% of the VOC data in soils were preserved within the acceptable hold time criteria of 48 hours from time of collection. These results were reported without further qualification.

Table 1
Original Sample vs. Diluted Sample Detected Results Comparison for BH1A at a Depth of 6.5 ft.

Borehole	Depth (ft.)	Lab Number	Date	Chemical	Value	Flag1	Diluted Value	Flag1	Units
BH1A	6.5	S21210215	12/10/02	Toluene	< 4.95	U	156		UG/KG
BH1A	6.5	S21210215	12/10/02	Xylenes (total)	3.66	U	< 124	U	UG/KG
BH1A	6.5	S21210215	12/10/02	1,1-Dichloroethylene	34.4		< 124	U	UG/KG
BH1A	6.5	S21210215	12/10/02	1,1,2-Trichloroethane	4.84	U	< 124	U	UG/KG
BH1A	6.5	S21210215	12/10/02	Trichloroethylene	5550	E	4200		UG/KG

Highlighted results were reported.
J - Estimated value
E - Sample results exceed calibration range
R - Rejected data

project/2002/2116/data/attachTable1-13.xls

Table 2
Original Sample vs. Diluted Sample Detected Results Comparison for BH1B at a Depth of 3.1 ft.

Borehole	Depth (ft.)	Lab Number	Date	Chemical	Value	Flag1	Diluted Value	Flag1	Units
BH1B	3.1	S21210203	12/10/02	Toluene	0.644	J	< 6.17	J	UG/KG
BH1B	3.1	S21210203	12/10/02	Xylenes (total)	1.26	J	10.7	J	UG/KG
BH1B	3.1	S21210203	12/10/02	1,2-Dichloroethylene (total)	9.51	J	6.86	J	UG/KG
BH1B	3.1	S21210203	12/10/02	Acetone	226	J	318	J	UG/KG
BH1B	3.1	S21210203	12/10/02	Vinyl chloride	1.23	J	< 6.17	J	UG/KG
BH1B	3.1	S21210203	12/10/02	1,1-Dichloroethylene	0.842	J	3.50	J	UG/KG
BH1B	3.1	S21210203	12/10/02	2-Butanone	615	EJ	610	J	UG/KG
BH1B	3.1	S21210203	12/10/02	Trichloroethylene	27.2	J	20.5	J	UG/KG

Highlighted results were reported.
J - Estimated value
E - Sample results exceed calibration range
R - Rejected data

project/2002/2116/data/attachTable1-13.xls

Table 3
Original Sample vs. Diluted Sample Detected Results Comparison for BH1B at a Depth of 7.5 ft.

Borehole	Depth (ft.)	Lab Number	Date	Chemical	Value	Flag1	Diluted Value	Flag1	Units
BH1B	7.5	S21210205	12/10/02	Xylenes (total)	< 1.01	J	4.53	J	UG/KG
BH1B	7.5	S21210205	12/10/02	1,2-Dichloroethylene (total)	0.964	J	< 6.08	J	UG/KG
BH1B	7.5	S21210205	12/10/02	Acetone	145	J	213	J	UG/KG
BH1B	7.5	S21210205	12/10/02	Carbon disulfide	3.48	J	< 30.4	J	UG/KG
BH1B	7.5	S21210205	12/10/02	1,1-Dichloroethylene	< 1.01	J	8.59	J	UG/KG
BH1B	7.5	S21210205	12/10/02	2-Butanone	1920	EJ	2960	J	UG/KG
BH1B	7.5	S21210205	12/10/02	1,1,2-Trichloroethane	1.12	J	< 6.08	J	UG/KG
BH1B	7.5	S21210205	12/10/02	Trichloroethylene	252	EJ	438	J	UG/KG

Highlighted results were reported.
J - Estimated value
E - Sample results exceed calibration range
R - Rejected data

Table 4
Original Sample vs. Diluted Sample Detected Results Comparison for BH1B at a Depth of 10.3 ft.

Borehole	Depth (ft.)	Lab Number	Date	Chemical	Value	Flag1	Diluted Value	Flag1	Units
BH1B	10.3	S21210207	12/10/02	Xylenes (total)	< 0.866	J	4.72	J	UG/KG
BH1B	10.3	S21210207	12/10/02	Acetone	141	J	143	J	UG/KG
BH1B	10.3	S21210207	12/10/02	Carbon disulfide	10.1	J	31.7	J	UG/KG
BH1B	10.3	S21210207	12/10/02	1,1-Dichloroethylene	0.964	J	5.43	J	UG/KG
BH1B	10.3	S21210207	12/10/02	2-Butanone	1710	EJ	1770	J	UG/KG

Highlighted results were reported.
J - Estimated value
E - Sample results exceed calibration range
R - Rejected data

Table 5
Original Sample vs. Diluted Sample Result Comparison for BH2B Pizeometer

Borehole	Depth (ft.)	Lab Number	Date	Chemical	Value	Flag1	Diluted Value	Diluted Flag1	Units
BH2B	PIZ 4-9	S21219219	12/19/02	Toluene	1.42		1.63	J	UG/L
BH2B	PIZ 4-9	S21219219	12/19/02	cis-1,2-Dichloroethylene	1.39		1.64	J	UG/L
BH2B	PIZ 4-9	S21219219	12/19/02	1,2-Dichloroethylene (total)	1.39		1.64	J	UG/L
BH2B	PIZ 4-9	S21219219	12/19/02	Acetone	< 5.00		< 10.00		UG/L
BH2B	PIZ 4-9	S21219219	12/19/02	1,1,2-Trichloroethane	1.17		1.13	J	UG/L
BH2B	PIZ 4-9	S21219219	12/19/02	Trichloroethylene	128	E	130		UG/L

Highlighted results were reported.
J - Estimated value
E - Sample results exceed calibration range
R - Rejected data

project/2002/2116/data/attachTable1-13.xls

Table 6
Original Sample vs. Diluted Sample Detected Results Comparison for BH2B at a Depth of 6.5 ft.

Borehole	Depth (ft.)	Lab Number	Date	Chemical	Value	Flag1	Diluted Value	Flag1	Units
BH2B	6.5	S21212223	12/12/02	Tetrachloroethylene	95.7	R	119	R	UG/KG
BH2B	6.5	S21212223	12/12/02	1,2-Dichloroethylene (total)	3.76	R	2.98	R	UG/KG
BH2B	6.5	S21212223	12/12/02	Methylene chloride	< 6.93	R	7.56	R	UG/KG
BH2B	6.5	S21212223	12/12/02	1,1-Dichloroethylene	1.08	R	14.3	R	UG/KG
BH2B	6.5	S21212223	12/12/02	1,1,2-Trichloroethane	0.885	R	< 5.27	R	UG/KG
BH2B	6.5	S21212223	12/12/02	Trichloroethylene	239	ER	212	R	UG/KG

Highlighted results were reported.
J - Estimated value
E - Sample results exceed calibration range
R - Rejected data

Table 7
Original Sample vs. Diluted Sample Result Comparison for BH5D at a Depth of 7.0 ft.

Borehole	Depth (ft.)	Lab Number	Date	Chemical	Value	Flag1	Diluted Value	Flag1	Units
BH5D	7	S21217204	12/17/02	Toluene	< 1.26	J	154	J	UG/KG
BH5D	7	S21217204	12/17/02	Tetrachloroethylene	540	EJ	840	J	UG/KG
BH5D	7	S21217204	12/17/02	1,2-Dichloroethylene (total)	6.22	J	< 140	J	UG/KG
BH5D	7	S21217204	12/17/02	1,1,1-Trichloroethane	2.41	J	< 140	J	UG/KG
BH5D	7	S21217204	12/17/02	Methylene chloride	5.67	J	< 700	J	UG/KG
BH5D	7	S21217204	12/17/02	1,1-Dichloroethylene	3.22	J	< 140	J	UG/KG
BH5D	7	S21217204	12/17/02	Trichloroethylene	56.9	J	< 140	J	UG/KG

Highlighted results were reported.
J - Estimated value
E - Sample results exceed calibration range
R - Rejected data

Table 8
Original Sample vs. Diluted Sample Detected Results Comparison for BH5E at a Depth of 7.5 ft.

Borehole	Depth (ft.)	Lab Number	Date	Chemical	Value	Flag1	Diluted Value	Flag1	Units
BH5E	7.5	S21217213	12/17/02	Toluene	< 0.995	J	129	J	UG/KG
BH5E	7.5	S21217213	12/17/02	1,2-Dichloroethylene (total)	18.0	J	< 116	J	UG/KG
BH5E	7.5	S21217213	12/17/02	Vinyl chloride	1.19	J	< 116	J	UG/KG
BH5E	7.5	S21217213	12/17/02	Methylene chloride	2.70	J	< 582	J	UG/KG
BH5E	7.5	S21217213	12/17/02	1,1-Dichloroethane	0.542	J	< 116	J	UG/KG
BH5E	7.5	S21217213	12/17/02	1,1-Dichloroethylene	2.01	J	< 116	J	UG/KG
BH5E	7.5	S21217213	12/17/02	Trichloroethylene	340	EJ	739	J	UG/KG

Highlighted results were reported.
J - Estimated value
E - Sample results exceed calibration range
R - Rejected data

Table 9
Original Sample vs. Diluted Sample Detected Results Comparison for BH5F at a Depth of 6.0 ft.

Borehole	Depth (ft.)	Lab Number	Date	Chemical	Value	Flag1	Diluted Value	Flag1	Units
BH5F	6	S21217217	12/17/02	Toluene	< 1.21	J	201	J	UG/KG
BH5F	6	S21217217	12/17/02	Tetrachloroethylene	330	EJ	376	J	UG/KG
BH5F	6	S21217217	12/17/02	1,2-Dichloroethylene (total)	34.3	J	< 143	J	UG/KG
BH5F	6	S21217217	12/17/02	Acetone	9.38	J	551	J	UG/KG
BH5F	6	S21217217	12/17/02	1,1,1-Trichloroethane	1.33	J	< 143	J	UG/KG
BH5F	6	S21217217	12/17/02	Vinyl chloride	4.23	J	< 143	J	UG/KG
BH5F	6	S21217217	12/17/02	Methylene chloride	4.27	J	< 713	J	UG/KG
BH5F	6	S21217217	12/17/02	1,1-Dichloroethylene	1.25	J	< 143	J	UG/KG
BH5F	6	S21217217	12/17/02	Trichloroethylene	210	EJ	170	J	UG/KG

Highlighted results were reported.
J - Estimated value
E - Sample results exceed calibration range
R - Rejected data

Table 10
Original Sample vs. Diluted Sample Detected Results Comparison for BH7D at a Depth of 7.5 ft.

Borehole	Depth (ft.)	Lab Number	Date	Chemical	Value	Flag1	Diluted Value	Flag1	Units
BH7D	7.5	S21218233	12/18/02	Xylenes (total)	0.884	R	4.37	R	UG/KG
BH7D	7.5	S21218233	12/18/02	1,2-Dichloroethylene (total)	30.9	R	< 6.00	R	UG/KG
BH7D	7.5	S21218233	12/18/02	Acetone	33.7	R	47.0	R	UG/KG
BH7D	7.5	S21218233	12/18/02	Methylene chloride	3.36	R	18.8	R	UG/KG
BH7D	7.5	S21218233	12/18/02	1,1-Dichloroethylene	8.76	R	11.6	R	UG/KG
BH7D	7.5	S21218233	12/18/02	2-Butanone	4.97	R	< 30.0	R	UG/KG
BH7D	7.5	S21218233	12/18/02	Trichloroethylene	1.18	R	< 6.00	R	UG/KG

Highlighted results were reported.
J - Estimated value
E - Sample results exceed calibration range
R - Rejected data

Table 11
Original Sample vs. Diluted Sample Detected Results Comparison for BH8B at a Depth of 2.0 ft.

Borehole	Depth (ft.)	Lab Number	Date	Chemical	Value	Flag1	Diluted Value	Flag1	Units
BH8B	2	S21218219	12/18/02	Toluene	0.377	J	< 5.91		UG/KG
BH8B	2	S21218219	12/18/02	Acetone	33.8		94.2		UG/KG
BH8B	2	S21218219	12/18/02	Methylene chloride	2.53	J	17.7	J	UG/KG
BH8B	2	S21218219	12/18/02	1,1-Dichloroethylene	8.28		6.13		UG/KG
BH8B	2	S21218219	12/18/02	2-Butanone	6.51		27.3		UG/KG

Highlighted results were reported.
J - Estimated value
E - Sample results exceed calibration range
R - Rejected data

Table 12
Original Sample vs. Diluted Sample Detected Results Comparison for BH8D at a Depth of 6.5 ft.

Borehole	Depth (ft.)	Lab Number	Date	Chemical	Value	Flag1	Diluted Value	Flag1	Units
BH8D	6.5	S21218214	12/18/02	Acetone	8.10		19.8	J	UG/KG
BH8D	6.5	S21218214	12/18/02	Methylene chloride	2.24	J	17.7	J	UG/KG
BH8D	6.5	S21218214	12/18/02	1,1-Dichloroethylene	1.05		4.65	J	UG/KG

Highlighted results were reported.
J - Estimated value
E - Sample results exceed calibration range
R - Rejected data

Table 13
Origianal Sample vs. Diluted Sample Detected Results Comparison for BH9C at a Depth of 16.0 ft.

Borehole	Depth (ft.)	Lab Number	Date	Chemical	Value	Flag1	Diluted Value	Flag1	Units
BH9C	16	S21217230	12/17/02	Toluene	0.297	J	< 5.14	J	UG/KG
BH9C	16	S21217230	12/17/02	Xylenes (total)	1.08	J	4.06	J	UG/KG
BH9C	16	S21217230	12/17/02	Acetone	9.23	J	< 25.7	J	UG/KG
BH9C	16	S21217230	12/17/02	Methylene chloride	3.06	J	16.0	J	UG/KG
BH9C	16	S21217230	12/17/02	1,1-Dichloroethylene	1.92	J	4.70	J	UG/KG

Highlighted results were reported.
J - Estimated value
E - Sample results exceed calibration range
R - Rejected data

project/2002/2116/data/attachTable1-13.xls

Ashtabula Closure Project

FINAL RMI REPORT

PHASE II

SEPETEMBER 2003

Appendix G

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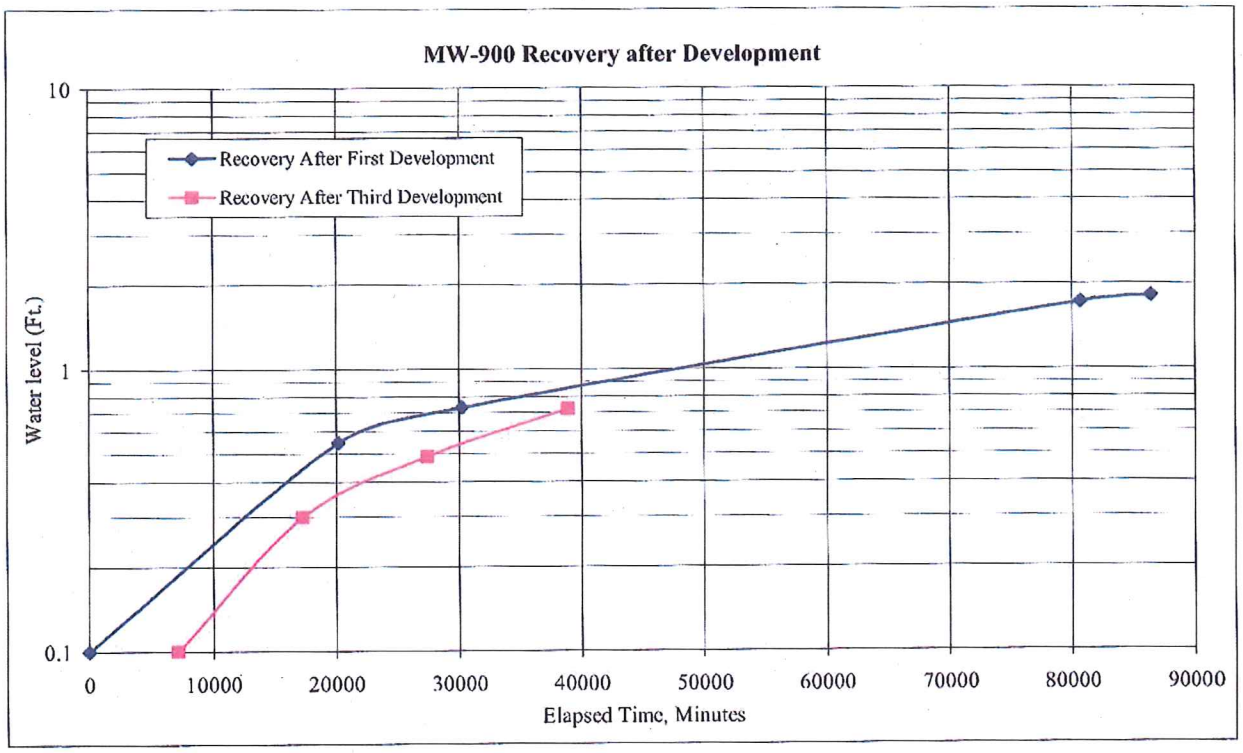
Ashtabula Closure Project

FINAL RMI REPORT

PHASE II

SEPETEMBER 2003

Appendix H



Bouwer and Rice(1976) Calculations

Well: MW-900

Case For Lw=H, Water Level above Screened interval

Determined Variables:

H = equal to Lw	feet	saturated aquifer thickness
Lw = 9.0	feet	height of water column in well
Le = 5	feet	effective screen length
C = 1.25		well geometry factor
rc = 0.08	feet	radius of the well casing
rw = 0.33	feet	centerline radial distance to undisturbed portion of aquifer
Yo = 0.72	feet	water level displacement at start time vs end time
t = 38880	min	recovery time from recovery vs time plot
Yt = 0.1	feet	water level displacement end time (recovery) = t

Definition Of Variables:

Calculate: (1/t)*ln(Yo/Yt)

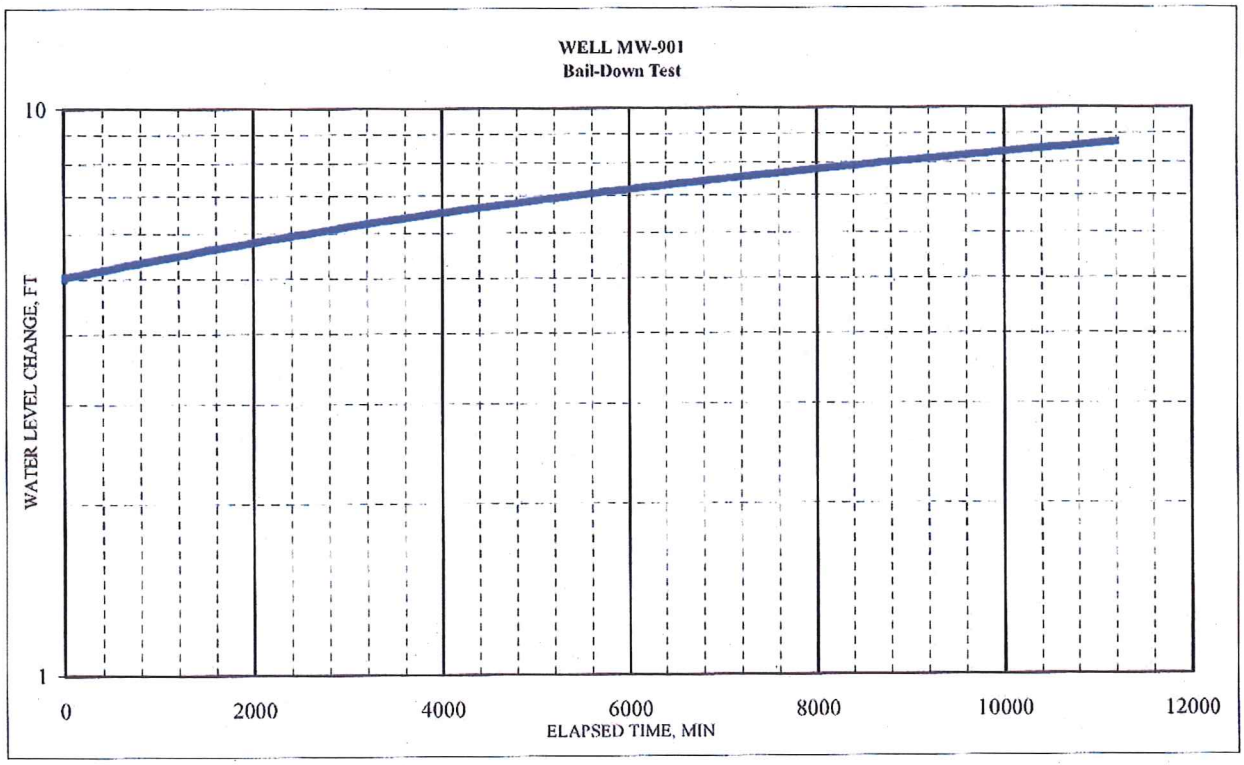
= 5.07737E-05

Calculate: ln(Re/rw) = 1/[1.1/ln(Lw/rw)+C/(Le/rw)]

= 2.408247426

Calculate: K = rc^2*ln(Re/rw)*(1/t)*ln(Yo/Yt))/(2Le)

= < 7.8E-08	feet/minute
= < 1.1E-04	feet/day
= < 4.0E-08	cm/second



Bouwer and Rice(1976) Calculations

Well: MW-901

Case For Lw=H, Water Level above Screened interval

Determined Variables:

			Definition Of Variables:
H =	equal to Lw	feet	saturated aquifer thickness
Lw =	14	feet	height of water column in well
Le =	5	feet	effective screen length
C =	1.25		well geometry factor
rc =	0.08	feet	radius of the well casing
rw =	0.33	feet	centerline radial distance to undisturbed portion of aquifer
Yo =	3.68	feet	water level displacement at start time vs end time
t =	11058	min	recovery time from recovery vs time plot
Yt =	0.04	feet	water level displacement end time (recovery) = t

Calculate: (1/t)*ln(Yo/Yt)

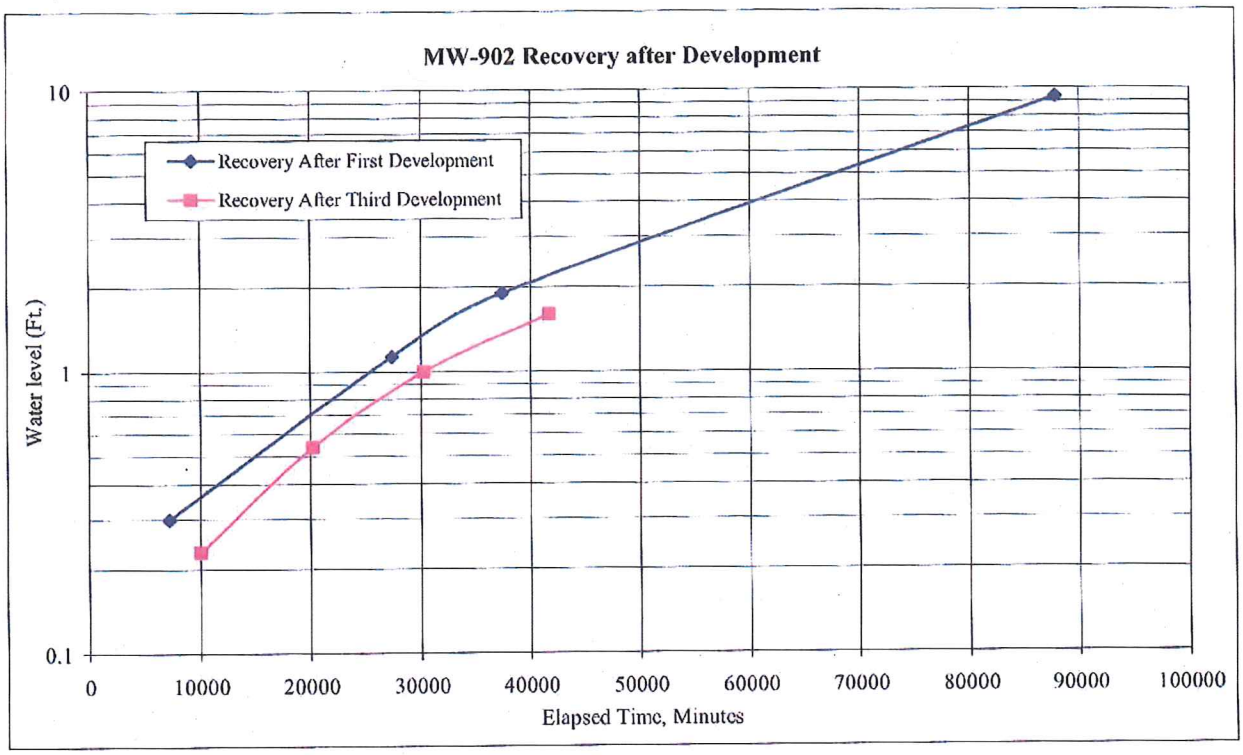
= 0.000415956

Calculate: ln(Re/rw) = 1/[1.1/ln(Lw/rw)+C/(Le/rw)]

= 2.659491061

Calculate: K = rc^2*ln(Re/rw)*(1/t)*ln(Yo/Yt))/(2Le)

=	7.1E-07	feet/minute
=	1.0E-03	feet/day
=	3.6E-07	cm/second



Bouwer and Rice(1976) Calculations

Well: MW-902

Case For Lw=H, Water Level above Screened interval

Determined Variables:

H = equal to Lw	feet	saturated aquifer thickness
Lw = 9.4	feet	height of water column in well
Le = 5	feet	effective screen length
C = 1.25		well geometry factor
rc = 0.08	feet	radius of the well casing
rw = 0.33	feet	centerline radial distance to undisturbed portion of aquifer
Yo = 9.36	feet	water level displacement at start time vs end time
t = 87840	min	recovery time from recovery vs time plot
Yt = 0.3	feet	water level displacement end time (recovery) = t

Definition Of Variables:

Calculate: (1/t)*ln(Yo/Yt)

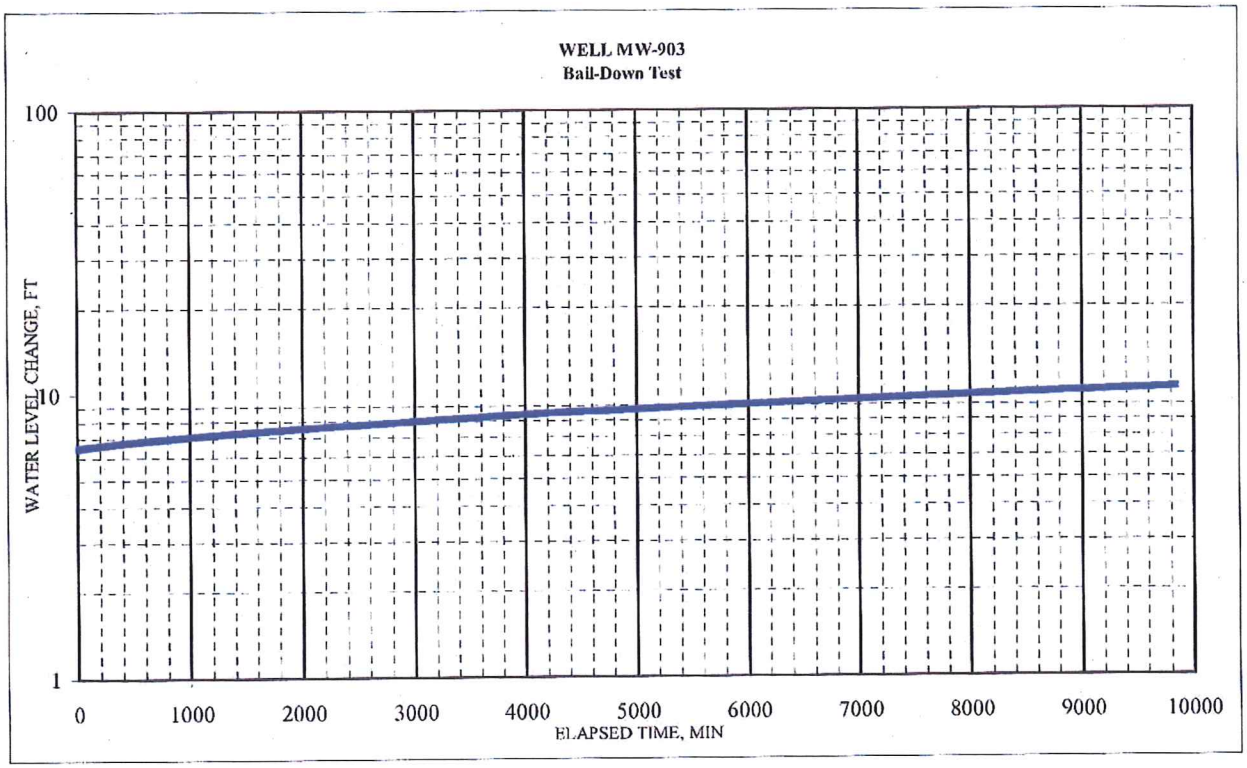
= 3.91669E-05

Calculate: ln(Re/rw) = 1/[1.1/ln(Lw/rw)+C/(Le/rw)]

= 2.433565223

Calculate: K = rc^2*ln(Re/rw)*(1/t)*ln(Yo/Yt))/(2Le)

=< 6.1E-08	feet/minute
=< 8.8E-05	feet/day
=< 3.1E-08	cm/second



Bouwer and Rice(1976) Calculations

Well: MW-903

Case For Lw=H, Water Level above Screened interval

Determined Variables:

		Definition Of Variables:
H = equal to Lw	feet	saturated aquifer thickness
Lw = 14.5	feet	height of water column in well
Le = 5	feet	effective screen length
C = 1.25		well geometry factor
rc = 0.08	feet	radius of the well casing
rw = 0.33	feet	centerline radial distance to undisturbed portion of aquifer
Yo = 3.92	feet	water level displacement at start time vs end time
t = 9578	min	recovery time from recovery vs time plot
Yt = 0.1	feet	water level displacement end time (recovery) = t

Calculate: (1/t)*ln(Yo/Yt)

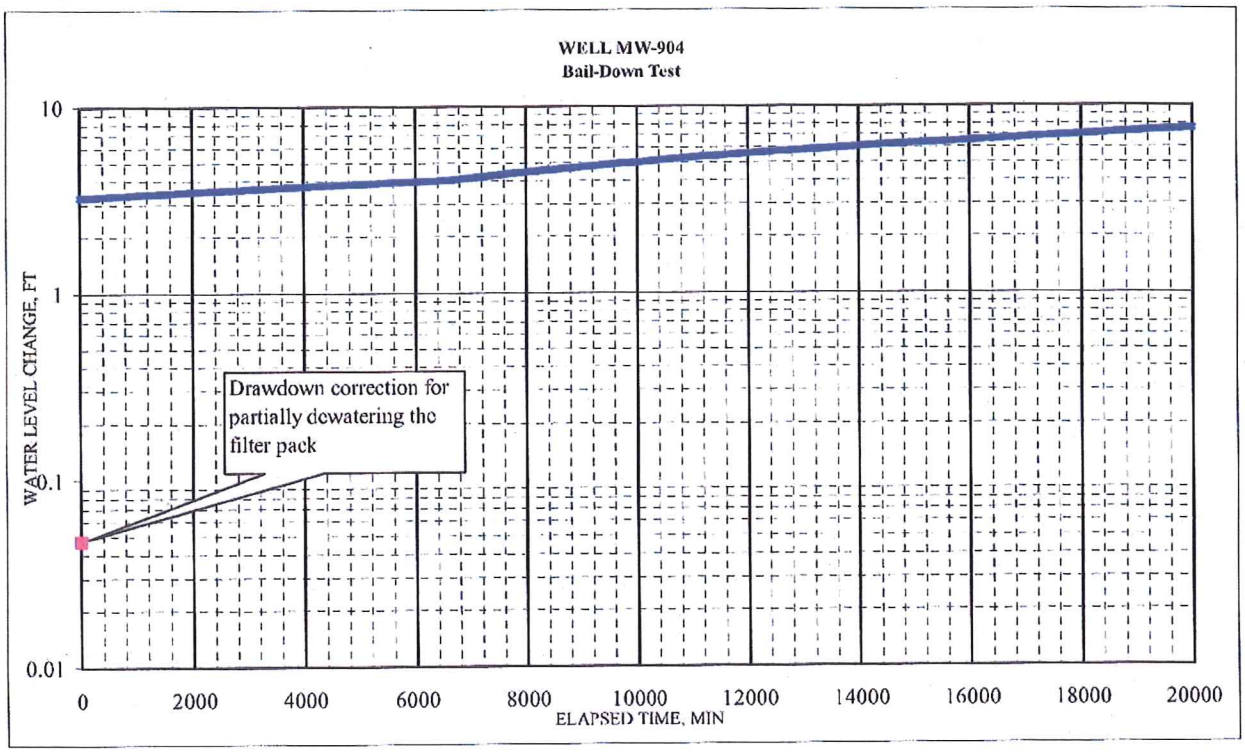
= 0.000408934

Calculate: ln(Re/rw) = 1/[1.1/ln(Lw/rw)+C/(Le/rw)]

= 2.678889371

Calculate: K = rc^2*ln(Re/rw)*(1/t)*ln(Yo/Yt))/(2Le)

= 7.0E-07	feet/minute
= 1.0E-03	feet/day
= 3.6E-07	cm/second



Bouwer and Rice(1976) Calculations

Well: MW-904

Case For Lw=H, Water Level above Screened interval

Determined Variables:

		Definition Of Variables:
H = equal to Lw	feet	saturated aquifer thickness
Lw = 14.5	feet	height of water column in well
Le = 5	feet	effective screen length
C = 1.25		well geometry factor
rc = 0.08	feet	radius of the well casing
rw = 0.33	feet	centerline radial distance to undisturbed portion of aquifer
Yo = 6.74	feet	water level displacement at start time vs end time (corrected)
t = 19918	min	recovery time from recovery vs time plot
Yt = 0.03	feet	water level displacement end time (recovery) = t

Calculate: (1/t)*ln(Yo/Yt)

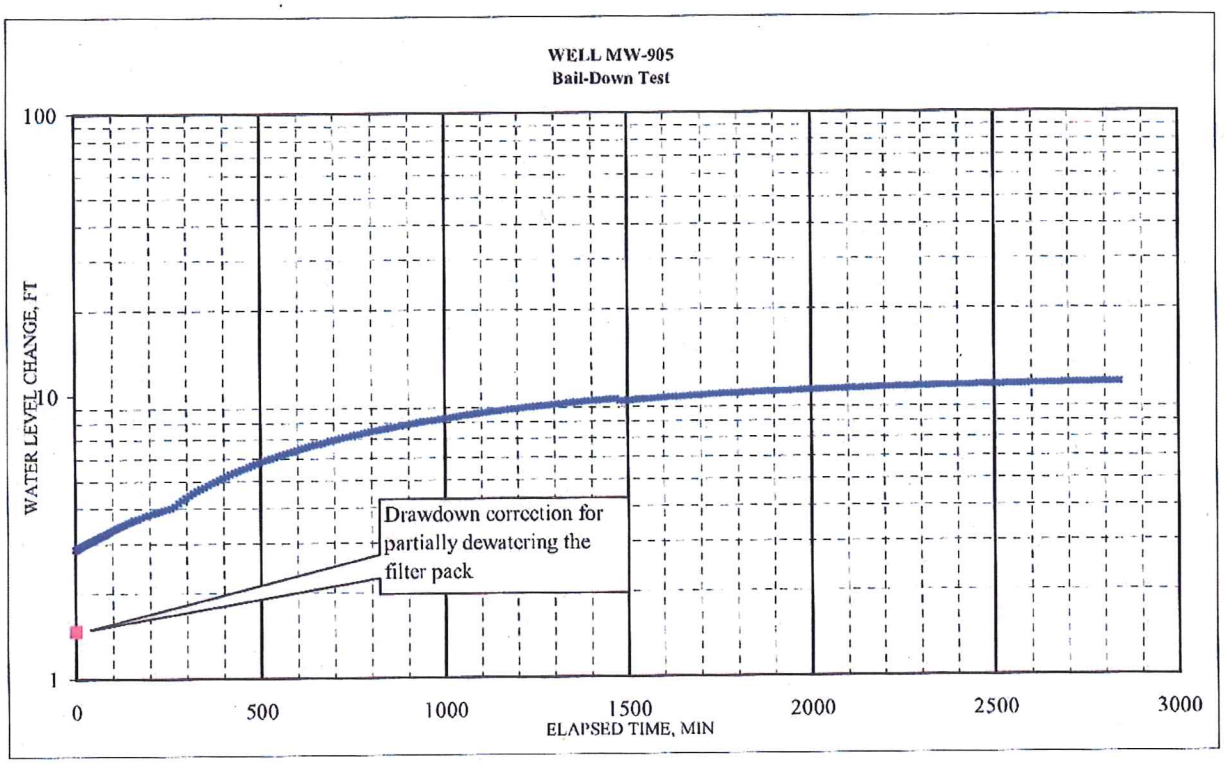
= 0.000268607

Calculate: ln(Re/rw) = 1/[1.1/ln(Lw/rw)+C/(Le/rw)]

= 2.678889371

Calculate: K = rc^2*ln(Re/rw)*(1/t)*ln(Yo/Yt))/(2Le)

= 4.6E-07	feet/minute
= 6.6E-04	feet/day
= 2.3E-07	cm/second



Bouwer and Rice(1976) Calculations

Well: MW-905

Case For Lw=H, Water Level above Screened interval

Determined Variables:

		Definition Of Variables:
H = equal to Lw	feet	saturated aquifer thickness
Lw = 15	feet	height of water column in well
Le = 5	feet	effective screen length
C = 1.25		well geometry factor
rc = 0.08	feet	radius of the well casing
rw = 0.33	feet	centerline radial distance to undisturbed portion of aquifer
Yo = 8.23	feet	water level displacement at start time vs end time (corrected)
t = 1200	min	recovery time from recovery vs time plot
Yt = 1.317	feet	water level displacement end time (recovery) = t

Calculate: (1/t)*ln(Yo/Yt)

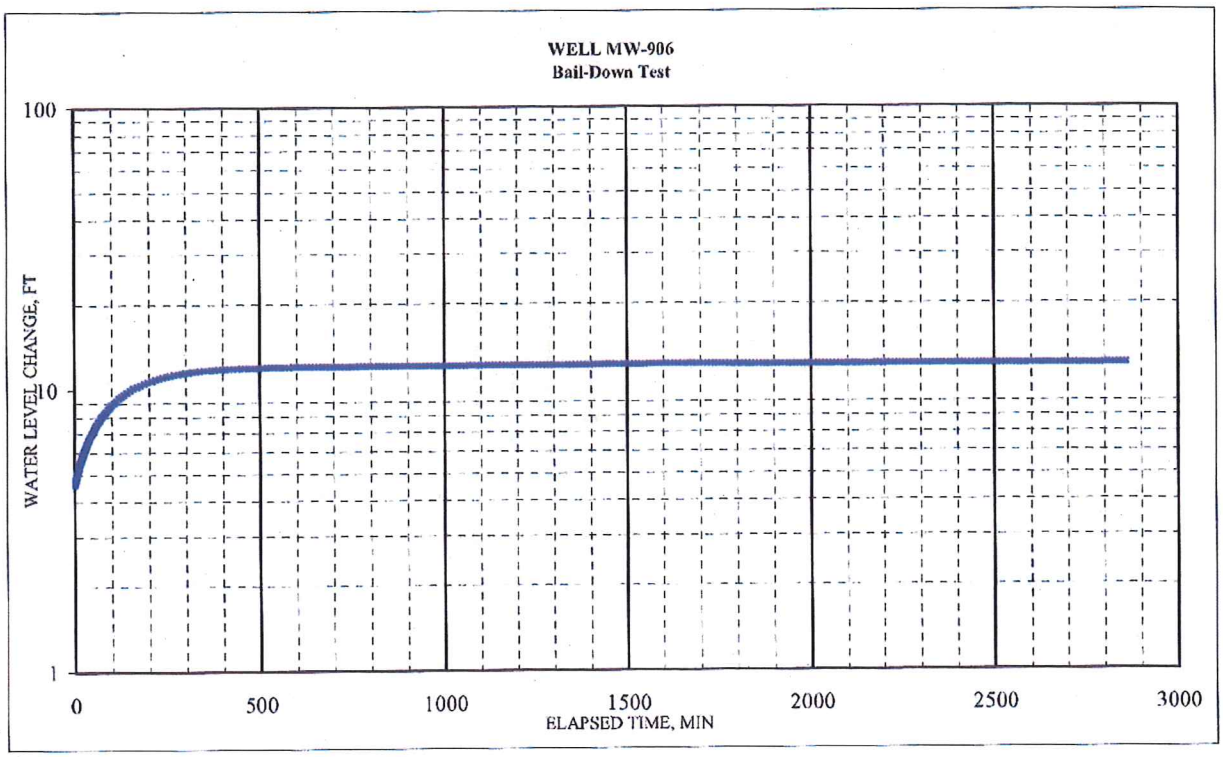
= 0.001526863

Calculate: ln(Re/rw) = 1/[1.1/ln(Lw/rw)+C/(Le/rw)]

= 2.697554592

Calculate: K = rc^2*ln(Re/rw)*(1/t)*ln(Yo/Yt))/(2Le)

= 2.6E-06	feet/minute
= 3.8E-03	feet/day
= 1.3E-06	cm/second



Bouwer and Rice(1976) Calculations

Well: MW-906

Case For Lw=H, Water Level above Screened interval

Determined Variables:

			Definition Of Variables:
H =	equal to Lw	feet	saturated aquifer thickness
Lw =	13.65	feet	height of water column in well
Le =	5	feet	effective screen length
C =	1.25		well geometry factor
rc =	0.08	feet	radius of the well casing
rw =	0.33	feet	centerline radial distance to undisturbed portion of aquifer
Yo =	7.68	feet	water level displacement at start time vs end time
t =	438	min	recovery time from recovery vs time plot
Yt =	0.399	feet	water level displacement end time (recovery) = t

Calculate: (1/t)*ln(Yo/Yt)

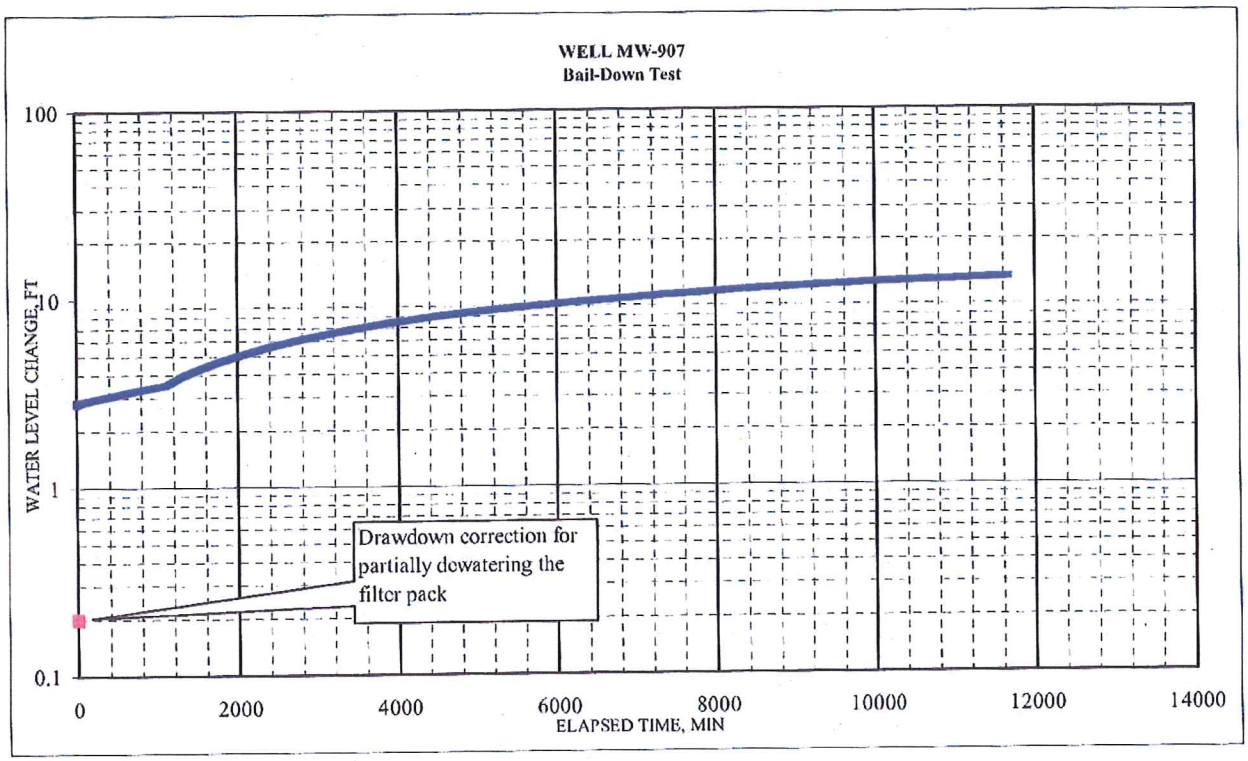
= 0.006750896

Calculate: ln(Re/rw) = 1/[1.1/ln(Lw/rw)+C/(Le/rw)]

= 2.64544593

Calculate: K = rc^2*ln(Re/rw)*(1/t)*ln(Yo/Yt))/(2Le)

= 1.1E-05	feet/minute
= 1.6E-02	feet/day
= 5.8E-06	cm/second



Bouwer and Rice(1976) Calculations

Well: MW-907

Case For Lw=H, Water Level above Screened interval

Determined Variables:

H = equal to Lw	feet	saturated aquifer thickness
Lw = 13	feet	height of water column in well
Le = 5	feet	effective screen length
C = 1.25		well geometry factor
rc = 0.08	feet	radius of the well casing
rw = 0.33	feet	centerline radial distance to undisturbed portion of aquifer
Yo = 11.6	feet	water level displacement at start time vs end time
t = 10390	min	recovery time from recovery vs time plot
Yt = 0.1	feet	water level displacement end time (recovery) = t

Definition Of Variables:

Calculate: (1/t)*ln(Yo/Yt)

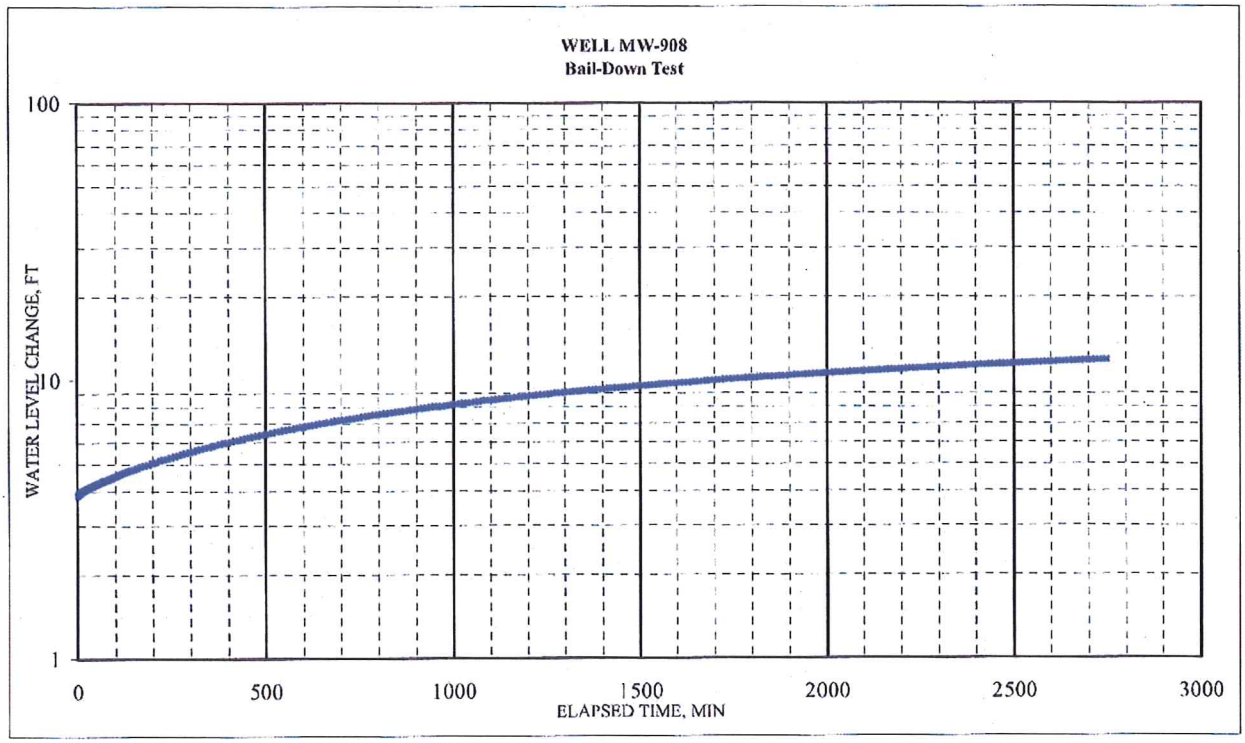
= 0.000515188

Calculate: ln(Re/rw) = 1/[1.1/ln(Lw/rw)+C/(Le/rw)]

= 2.618261496

Calculate: K = rc^2*ln(Re/rw)*(1/t)*ln(Yo/Yt))/(2Le)

= 8.6E-07	feet/minute
= 1.2E-03	feet/day
= 4.4E-07	cm/second



Bouwer and Rice(1976) Calculations

Well: MW-908

Case For Lw=H, Water Level above Screened interval

Determined Variables:

			Definition Of Variables:
H =	equal to Lw	feet	saturated aquifer thickness
Lw =	12	feet	height of water column in well
Le =	5	feet	effective screen length
C =	1.25		well geometry factor
rc =	0.08	feet	radius of the well casing
rw =	0.33	feet	centerline radial distance to undisturbed portion of aquifer
Yo =	8.018	feet	water level displacement at start time vs end time
t =	2748	min	recovery time from recovery vs time plot
Yt =	0.40	feet	water level displacement end time (recovery) = t

Calculate: (1/t)*ln(Yo/Yt)

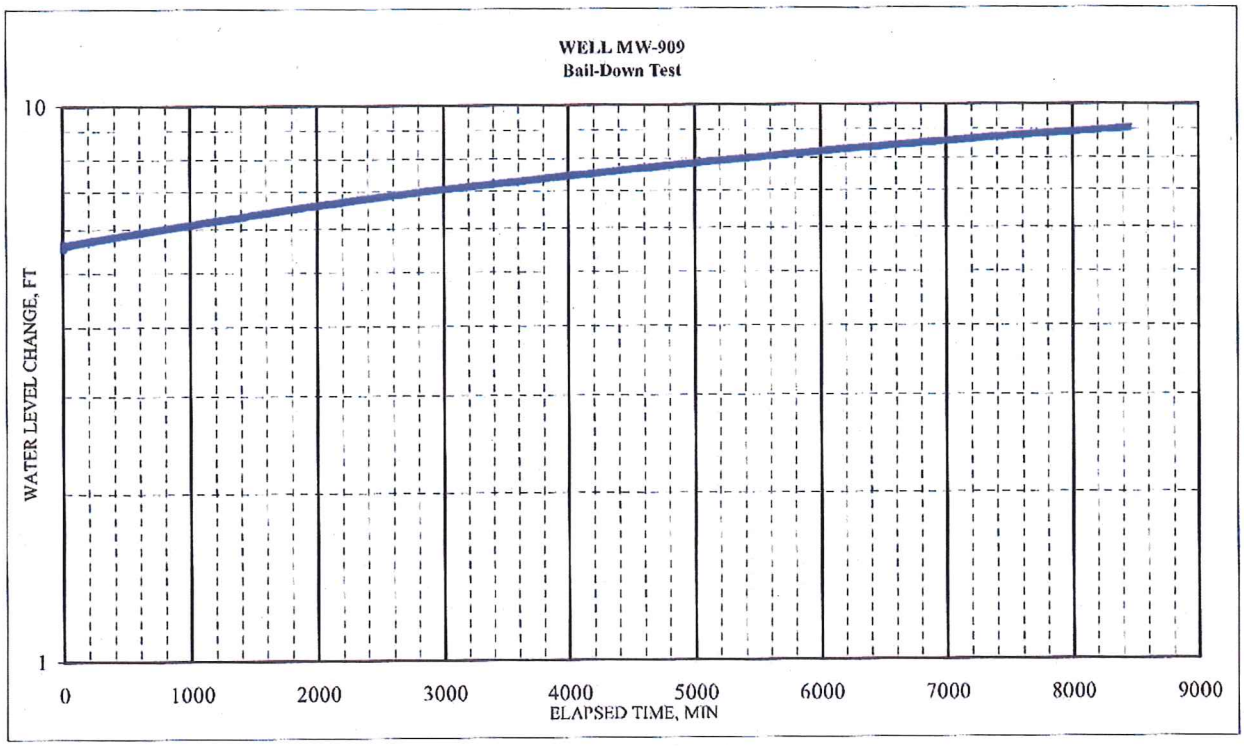
= 0.001087238

Calculate: ln(Re/rw) = 1/[1.1/ln(Lw/rw)+C/(Le/rw)]

= 2.573324633

Calculate: K = rc^2*ln(Re/rw)*(1/t)*ln(Yo/Yt))/(2Le)

=	1.8E-06	feet/minute
=	2.6E-03	feet/day
=	9.1E-07	cm/second



Bouwer and Rice(1976) Calculations

Well: MW-909

Case For Lw=H, Water Level above Screened interval

Determined Variables:

		Definition Of Variables:
H = equal to Lw	feet	saturated aquifer thickness
Lw = 11.6	feet	height of water column in well
Le = 5	feet	effective screen length
C = 1.25		well geometry factor
rc = 0.08	feet	radius of the well casing
rw = 0.33	feet	centerline radial distance to undisturbed portion of aquifer
Yo = 3.56	feet	water level displacement at start time vs end time
t = 8308	min	recovery time from recovery vs time plot
Yt = 0.07	feet	water level displacement end time (recovery) = t

Calculate: (1/t)*ln(Yo/Yt)

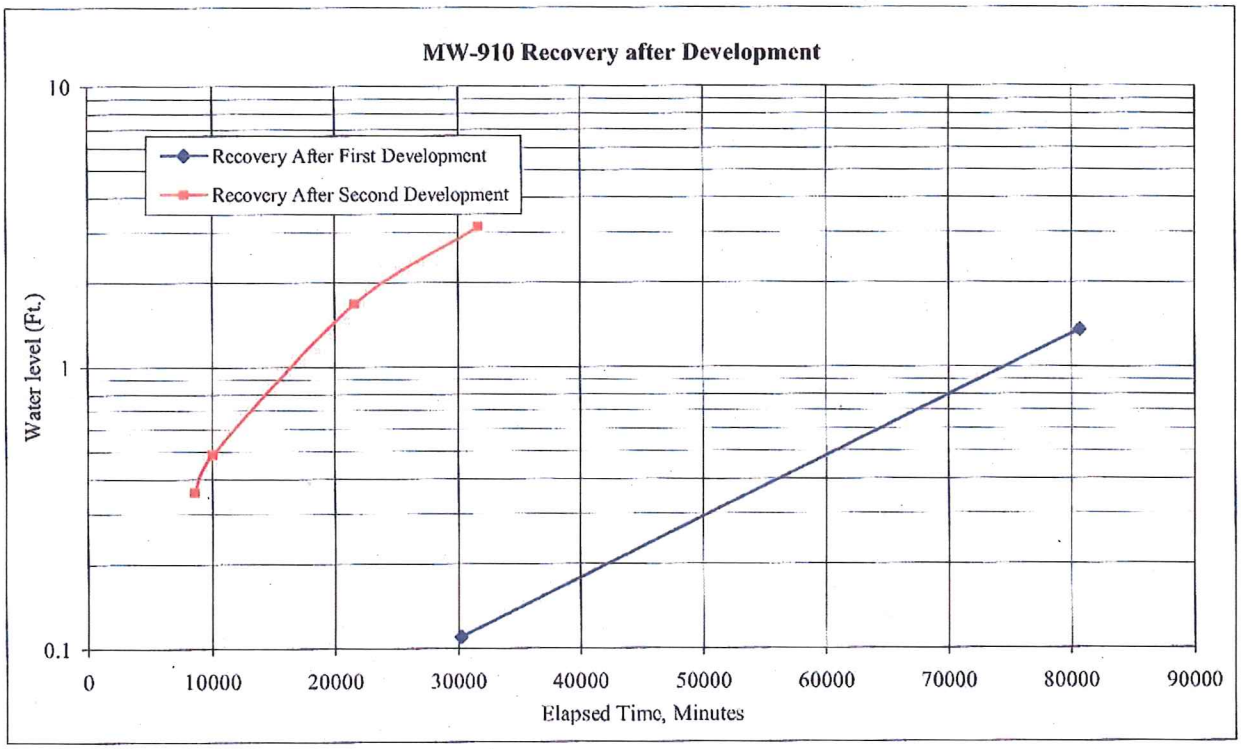
= 0.000480088

Calculate: ln(Re/rw) = 1/[1.1/ln(Lw/rw)+C/(Le/rw)]

= 2.55416355

Calculate: K = rc^2*ln(Re/rw)*(1/t)*ln(Yo/Yt))/(2Le)

= 7.8E-07	feet/minute
= 1.1E-03	feet/day
= 4.0E-07	cm/second



Bouwer and Rice(1976) Calculations

Well: MW-910

Case For Lw=H, Water Level above Screened interval

Determined Variables:

H = equal to Lw	feet	saturated aquifer thickness
Lw = 9.4	feet	height of water column in well
Le = 5	feet	effective screen length
C = 1.25		well geometry factor
rc = 0.08	feet	radius of the well casing
rw = 0.33	feet	centerline radial distance to undisturbed portion of aquifer
Yo = 3.15	feet	water level displacement at start time vs end time
t = 31680	min	recovery time from recovery vs time plot
Yt = 0.36	feet	water level displacement end time (recovery) = t

Definition Of Variables:

Calculate: (1/t)*ln(Yo/Yt)

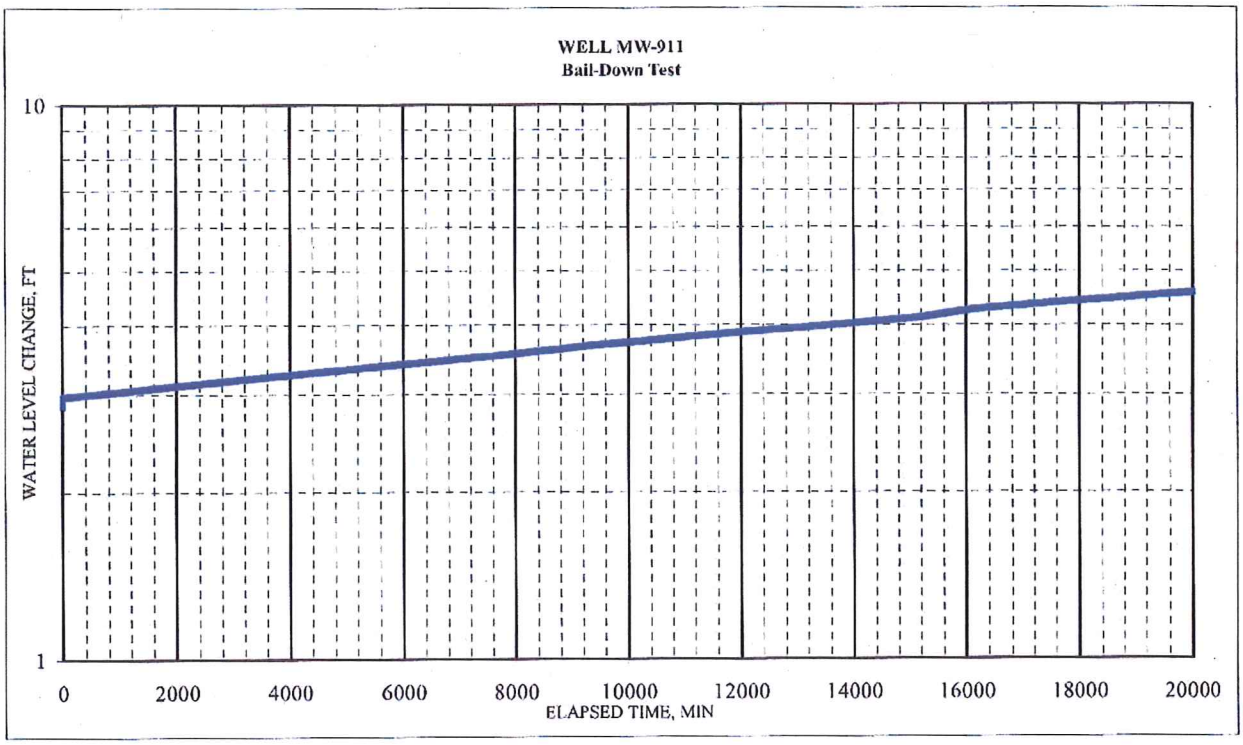
= 6.84676E-05

Calculate: ln(Re/rw) = 1/[1.1/ln(Lw/rw)+C/(Le/rw)]

= 2.433565223

Calculate: K = rc^2*ln(Re/rw)*(1/t)*ln(Yo/Yt))/(2Le)

=< 1.1E-07	feet/minute
=< 1.5E-04	feet/day
=< 5.4E-08	cm/second



Bouwer and Rice(1976) Calculations

Well: MW-911

Case For Lw=H, Water Level above Screened interval

Determined Variables:

			Definition Of Variables:
H	= equal to Lw	feet	saturated aquifer thickness
Lw	= 9.3	feet	height of water column in well
Le	= 5	feet	effective screen length
C	= 1.25		well geometry factor
rc	= 0.08	feet	radius of the well casing
rw	= 0.33	feet	centerline radial distance to undisturbed portion of aquifer
Yo	= 1.72	feet	water level displacement at start time vs end time
t	= 19788	min	recovery time from recovery vs time plot
Yt	= 0.02	feet	water level displacement end time (recovery) = t

Calculate: (1/t)*ln(Yo/Yt)

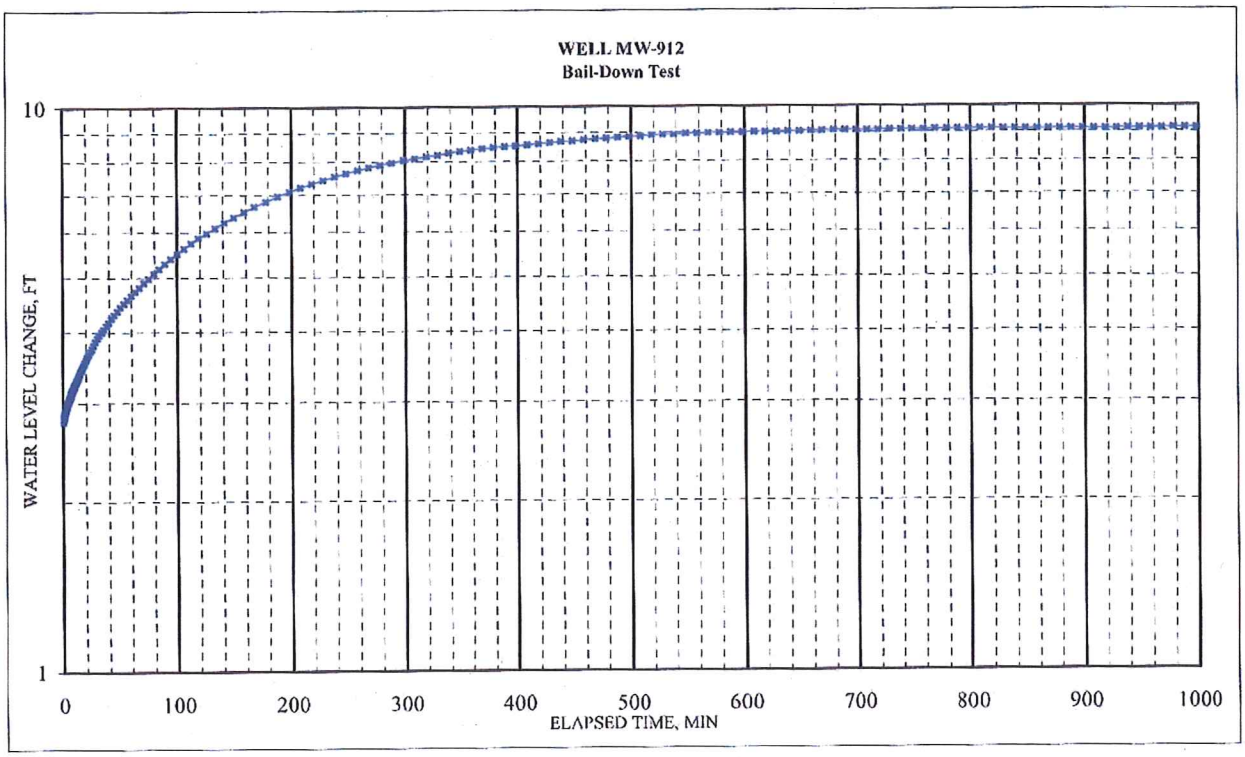
= 0.0002251

Calculate: ln(Re/rw) = 1/[1.1/ln(Lw/rw)+C/(Le/rw)]

= 2.428599401

Calculate: K = rc^2*ln(Re/rw)*(1/t)*ln(Yo/Yt))/(2Le)

= 3.5E-07	feet/minute
= 5.0E-04	feet/day
= 1.8E-07	cm/second



Bouwer and Rice(1976) Calculations

Well: MW-912

Case For Lw=H, Water Level above Screened interval

Determined Variables:

H = equal to Lw	feet	saturated aquifer thickness
Lw = 7	feet	height of water column in well
Le = 2	feet	effective screen length
C = 1		well geometry factor
rc = 0.08	feet	radius of the well casing
rw = 0.33	feet	centerline radial distance to undisturbed portion of aquifer
Yo = 6.38	feet	water level displacement at start time vs end time
t = 498	min	recovery time from recovery vs time plot
Yt = 0.31	feet	water level displacement end time (recovery) = t

Definition Of Variables:

Calculate: (1/t)*ln(Yo/Yt)

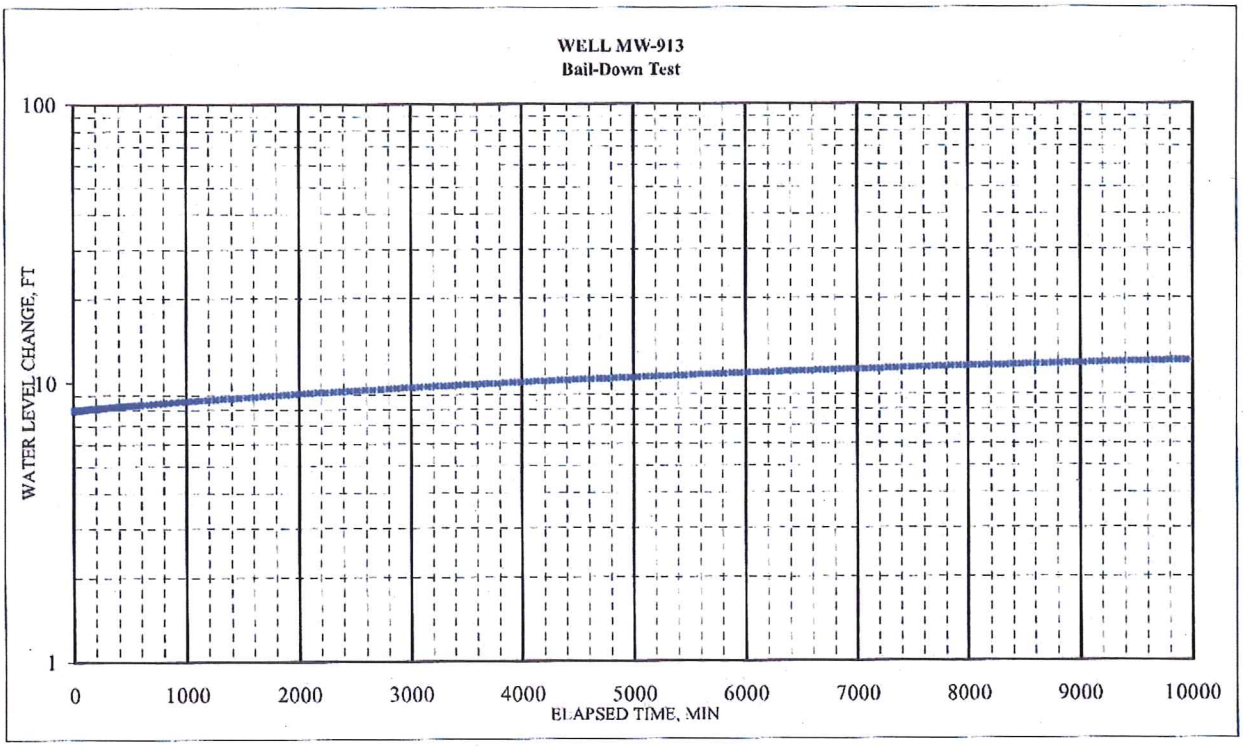
= 0.00606839

Calculate: ln(Re/rw) = 1/[1.1/ln(Lw/rw)+C/(Le/rw)]

= 1.904341764

Calculate: K = rc^2*ln(Re/rw)*(1/t)*ln(Yo/Yt))/(2Le)

= 1.8E-05	feet/minute
= 2.7E-02	feet/day
= 9.4E-06	cm/second



Bouwer and Rice(1976) Calculations

Well: MW-913

Case For Lw=H, Water Level above Screened interval

Determined Variables:

H = equal to Lw	feet	saturated aquifer thickness
Lw = 13	feet	height of water column in well
Le = 5	feet	effective screen length
C = 1.25		well geometry factor
rc = 0.08	feet	radius of the well casing
rw = 0.33	feet	centerline radial distance to undisturbed portion of aquifer
Yo = 4.04	feet	water level displacement at start time vs end time
t = 9309	min	recovery time from recovery vs time plot
Yt = 0.18	feet	water level displacement end time (recovery) = t

Definition Of Variables:

Calculate: (1/t)*ln(Yo/Yt)

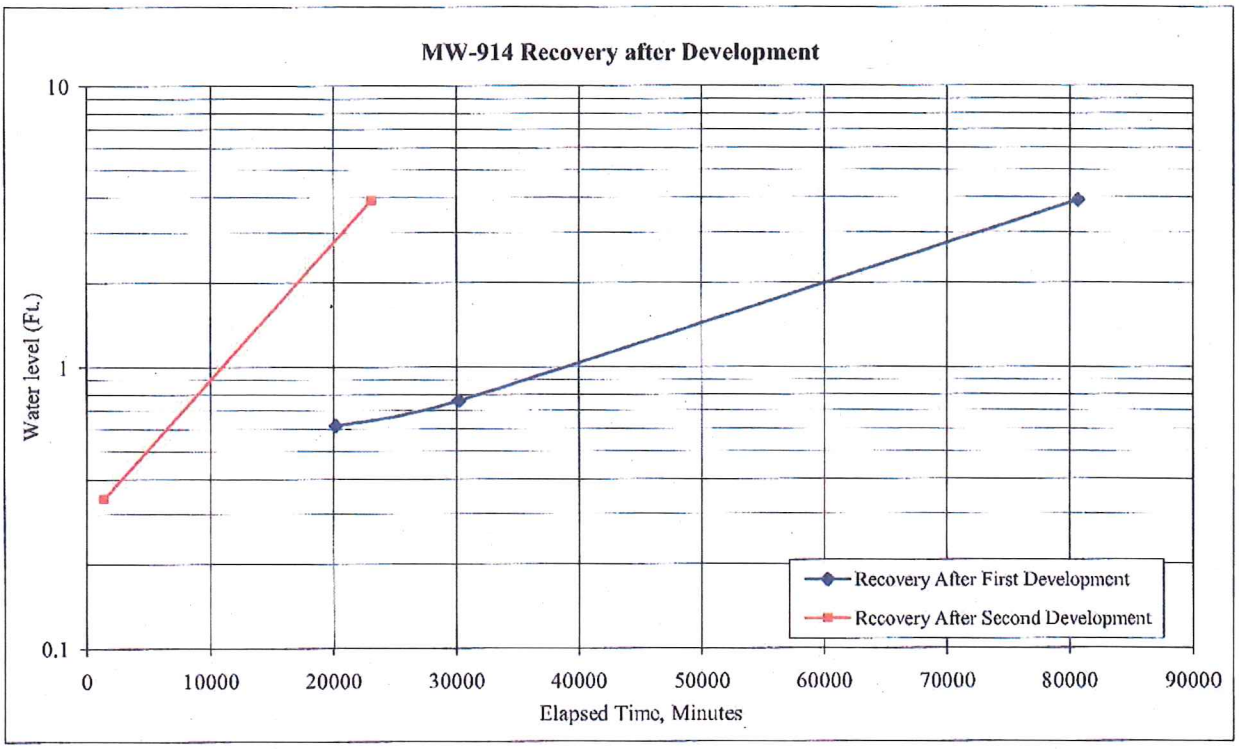
= 0.000332375

Calculate: ln(Re/rw) = 1/[1.1/ln(Lw/rw)+C/(Le/rw)]

= 2.618261496

Calculate: K = rc^2*ln(Re/rw)*(1/t)*ln(Yo/Yt))/(2Le)

= 5.6E-07	feet/minute
= 8.0E-04	feet/day
= 2.8E-07	cm/second



Bouwer and Rice(1976) Calculations

Well: MW-914 Case For Lw=H, Water Level above Screened interval

Determined Variables:

			Definition Of Variables:
H =	equal to Lw	feet	saturated aquifer thickness
Lw =	14.2	feet	height of water column in well
Le =	5	feet	effective screen length
C =	1.25		well geometry factor
rc =	0.08	feet	radius of the well casing
rw =	0.33	feet	centerline radial distance to undisturbed portion of aquifer
Yo =	3.91	feet	water level displacement at start time vs end time
t =	23040	min	recovery time from recovery vs time plot
Yt =	0.62	feet	water level displacement end time (recovery) = t

Calculate: (1/t)*ln(Yo/Yt)

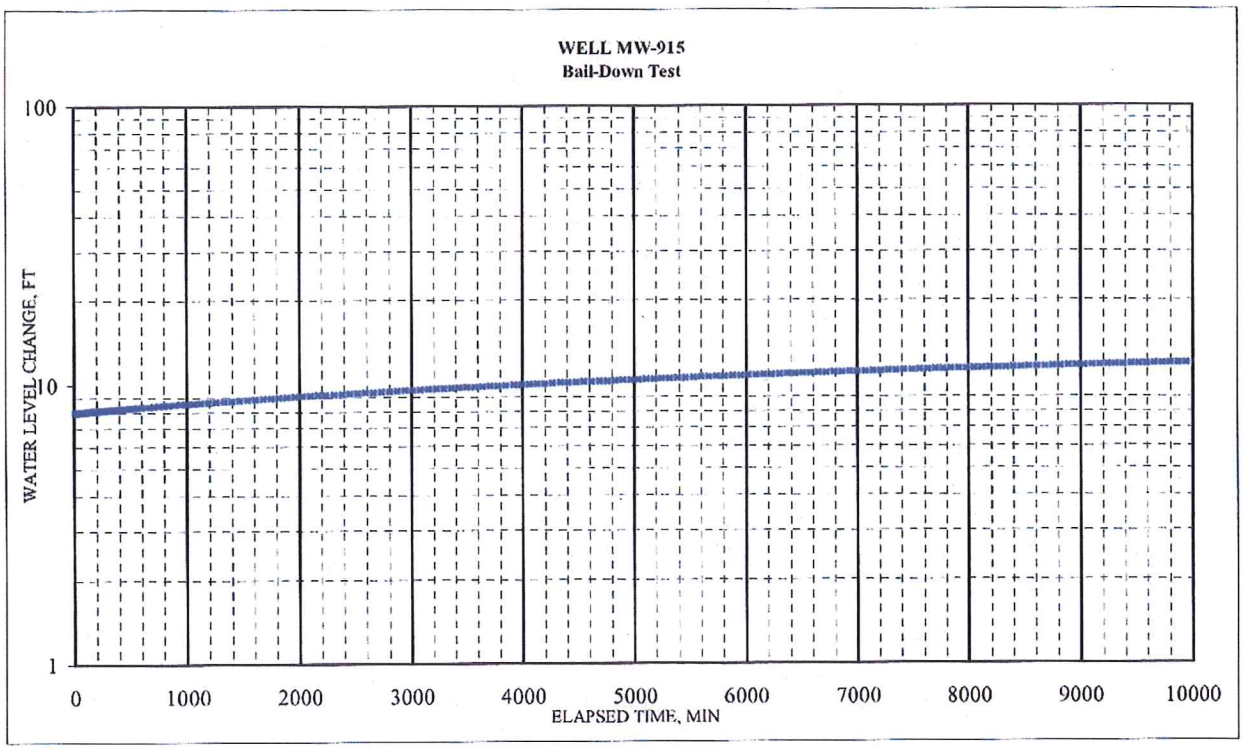
= 7.99294E-05

Calculate: ln(Re/rw) = 1/[1.1/ln(Lw/rw)+C/(Le/rw)]

= 2.665390784

Calculate: K = rc^2*ln(Re/rw)*(1/t)*ln(Yo/Yt))/(2Le)

= < 1.4E-07	feet/minute
= < 2.0E-04	feet/day
= < 6.9E-08	cm/second



Bouwer and Rice(1976) Calculations

Well: MW-915

Case For Lw=H, Water Level above Screened interval

Determined Variables:

		Definition Of Variables:
H = equal to Lw	feet	saturated aquifer thickness
Lw = 9.3	feet	height of water column in well
Le = 5	feet	effective screen length
C = 1.25		well geometry factor
rc = 0.08	feet	radius of the well casing
rw = 0.33	feet	centerline radial distance to undisturbed portion of aquifer
Yo = 4.04	feet	water level displacement at start time vs end time
t = 9309	min	recovery time from recovery vs time plot
Yt = 0.18	feet	water level displacement end time (recovery) = t

Calculate: (1/t)*ln(Yo/Yt)

= 0.000332375

Calculate: ln(Re/rw) = 1/[1.1/ln(Lw/rw)+C/(Le/rw)]

= 2.425471459

Calculate: K = rc^2*ln(Re/rw)*(1/t)*ln(Yo/Yt))/(2Le)

= 5.2E-07	feet/minute
= 7.4E-04	feet/day
= 2.6E-07	cm/second

Ashtabula Closure Project

FINAL RMI REPORT

PHASE II

SEPETEMBER 2003

Appendix I

SHARP AND ASSOCIATES, INC.
Environmental Engineers, Scientists, & Constructors

982 Crupper Avenue
Columbus, Ohio 43229

614 841 4650
614 841 4660 (fax)
www.sharpenv.com

TO: John Hughes, Project Manager, RMI Environmental Services (RMIES)

FROM: Todd Struttmann, Sharp and Associates, inc. (SHARP)
Dave Lawton, SHARP
Kevin Smith, SHARP

SUBJECT: Correlation of Geology with Contamination within the Former Evaporation Pond Waste Management Unit (FEP WMU) at the RMIES Main Extrusion Plant Site (Site) in Ashtabula, Ohio.

DATE: July 7, 2003 (Revised July 25, 2003)

Sharp and Associates, Inc. (SHARP) is pleased to provide Figures 1 through 30, correlating the geological units defined in the report of the Phase III Groundwater Investigation at the RMI Extrusion Plant Site with contaminant concentrations that exceed cleanup criteria in the FEP WMU. These figures have been prepared at the request of John Hughes to support his determination of the correlation between geologic sub layers and contamination. The goal of this effort is to determine whether there is a field indicator that will help in the segregation of soils during the excavation of the FEP WMU. The Cross Sections, Structure Maps and Isoconcentration Maps confirm that the majority of the contaminants that exceed the current cleanup standards are located above the gray till unit in the FEP WMU. Based on the analytical data provided by RMIES, Total Uranium and TCE exceed the cleanup criteria primarily in the surface fill materials, near surface silt lenses, and in the brown till that extends to a maximum depth of less than twelve feet. Below the brown till, TCE and Total Uranium only exceed cleanup criteria in relatively small area in the vicinity of the wick drain system. Tc-99 only exceeds the cleanup criteria in an isolated area of near surface fill.

Scope of Work

The scope of work for this evaluation of the correlation between contamination and geologic sub layers included the following:

- modify up to 7 of the existing cross sections adding the chemical data (Uranium, Tc-99 and TCE) to show visually the correlation between the contamination and geologic subunits units;
- provide 2-d surface of the top of the unoxidized till, base of silt, base of fill;
- provide a 2-dimensional surface of the gross silt isopach , gross fill isopach;
- provide isoconcentration maps of TCE, U and Tc-99 for all data, Fill only, Silt only and data without silt and fill in the brown and gray till units;
- participate in 2 conference calls with RMIES project manager for the soils excavation, Argonne Laboratories representative, and the RMIES project manger for the groundwater investigation; and
- provide a letter accompanying the figures that describes the results.

This scope of work did not include determination of volumes of contamination. This volume determination was in a separate proposal.

Geologic Cross Sections

Figures F-1 through F-10 were generated using existing boring logs and monitoring well logs in the vicinity and within the FEP WMU. The elevations of the distinct geologic units including fill materials, brown and gray mottled silty clay, silt, brown silty clay, gray silty clay, and bedrock were identified and posted on the cross section using 2002/2003 survey data. Total Uranium (U), Tc-99, and TCE concentrations from samples collected at the time the borings were installed are posted on the completed cross sections. The results of samples that exceed the cleanup criteria are outlined in red. Figure F-1 shows the location of the nine cross sections (Figures F-2 through F-10).

Discussion of Data

Figure F-2 – Geologic Cross-Section E-E'

- Total Uranium exceeds cleanup criteria (30 pCi/g) primarily in the surface fill unit.
- Total Uranium exceeds cleanup criteria in the brown silty clay unit in only three borings (L-22, BH2B and BH2C).
- Tc-99 exceeds cleanup criteria (65 pCi/g) in only one sample collected from fill material from boring L-22.
- Total Uranium, Tc-99, and TCE (criterion of 23 ug/g) do not exceed the cleanup criteria in any samples collected from the gray silty clay unit except at location T-1 where the sample taken at the top of the unit exceeded the criteria for TCE This boring was placed in the area of the vertical wick drains.

Figure F-3 – Geologic Cross-Section F-F'

- Tc-99 exceeds the cleanup criteria in samples collected from borings L-1, T-3, and MW-309 in this cross section. All of these borings are in the area of the wick drains.
- TCE exceeds the cleanup criteria only in borings collected within the footprint of the wick drain.

- Total Uranium slightly exceeds cleanup criteria in samples collected in the gray silty clay in only one boring in this transect (L-6).

Figure F-4 – Geologic Cross-Section G-G'

- Total Uranium only exceeds cleanup criteria in the fill material in borings L-19 and BH-17.
- TCE and Tc-99 do not exceed cleanup criteria in any samples collected from borings included in this cross section.

Figure F-5 – Geologic Cross-Section H-H'

- TCE and Tc-99 do not exceed cleanup criteria in any samples collected from borings included in this cross section.
- Total Uranium exceeds cleanup criteria in three samples collected in saturated silt from borings T-4, L-8 and L-11.
- Total Uranium exceeds cleanup criteria in three samples collected in fill material in borings L-5 and L-11.
- Total Uranium, Tc-99, and TCE is not present above cleanup criteria in any samples collected from the brown or gray silty clay from borings included in this cross section.

Figure F-6 – Geologic Cross-Section I-I'

- Tc-99 do not exceed cleanup criteria in any samples collected from borings included in this cross section.
- TCE exceeds the cleanup criteria in the original boring for monitoring well MW-309.
- Total Uranium exceeds cleanup criteria in two samples collected from borings L-11 and L-12 within the fill material.
- Total Uranium slightly exceeds cleanup criteria in a saturated silt lens in boring L-11.
- Total Uranium, Tc-99, and TCE is not present above cleanup criteria in any samples collected from the brown or gray silty clay from borings included in this cross section.

Figure F-7 – Geologic Cross-Section J-J'

- Total Uranium exceeds cleanup criteria in only one sample collected from the brown and gray mottled silty clay in boring L-16.
- Total Uranium, Tc-99, and TCE is not present above cleanup criteria in any samples collected below the fill material in any borings included in this cross section.

Figure F-8 – Geologic Cross-Section K-K'

- Tc-99 and TCE only exceed cleanup criteria from samples collected from borings within the footprint of the wick drain.

- Total Uranium exceeded cleanup criteria in only one sample collected outside of the footprint of the wick drain. This sample was collected from a saturated silt lens in boring L-8.
- Total Uranium exceeds cleanup criteria in the gray silty clay in one boring included in this cross section (L-9). This boring is located within the footprint of the wick drain system.

Figure F-9 – Geologic Cross-Section L-L'

- TCE and Tc-99 do not exceed cleanup criteria in any samples collected from borings included in this cross section.
- Total Uranium exceeds cleanup standards in six samples collected from within the fill material from borings included in this cross section.
- Boring L-25 had one sample collected from the gray silty clay that exceeded the cleanup criteria. This sample may not be representative based on results of samples collect above and below this sample interval due to poor sample recovery reported on the original boring log. From discussions with John Hughes, this result may be from another source of Total Uranium.
- Total Uranium did not exceed the cleanup criteria in any other samples collected from the silt, brown silty clay or gray silty clay in borings included in this cross section.

Figure F-10 – North FEP WMU Transect

- Total Uranium exceeded cleanup criteria in three samples collected from buried topsoil in borings BH-17, BH-18, BH-19, and BH-20.
- Total Uranium, Tc-99, and TCE did not exceed cleanup criteria in any other samples collected from borings included in this cross section.

Description of Structural maps

Figure 11 is a structure map portraying the top of the unoxidized gray till. This map is the same contouring as previously presented, with coverage limited to the area within and immediately around the FEP WMU. All of the subsequent geologic and isoconcentration maps are shallower in the section than this surface.

Figure 12 is a structure map that portrays the base of the silt units within the brown weathered till. It is based on the lowest occurrence of silt in any boring or well where it was identified as distinct from the surrounding till.

Figure 13 portrays the base of the topsoil/fill. It is recognized that there are compositional differences within this section because of site activities that have included grading and fill with different materials at different times, however those compositional differences are undifferentiated with regard to the base of the unit shown here.

Figure 14 is a gross isopach of the silt units within the brown weathered till. By definition the "gross" isopach map portrays the cumulative thickness of all silt units encountered within the brown weathered till section of each boring.

The thicknesses shown are based upon all available information in the area. Where silt was identified with a well or boring without defining the thickness, a default thickness of 1 foot was used for each silt interval that was described. Where the silt thickness was defined in more detail, that was used.

Figure 15 is a gross isopach of the topsoil/fill and portrays the cumulative thickness of the unit, undifferentiated with regard to the lithology variation within the unit.

Description of Isoconcentration maps

TCE

Figures 16 through 20 are the TCE isoconcentration maps for all data, fill only, silt only, brown till, and gray unweathered till, respectively. Observations of the data are as follows:

- The maximum concentration of TCE is in borings in or immediately adjacent to the Wick Drain area.
- There are three exceedances of TCE in the fill, from borings HRCc-4, HRCa-2, and boring MW-501. These exceedances ae in or adjacent the wick drain area.
- The major exceedances are in the Silt lenses (Figure 18). This is significant as the silt lenses have a higher hydraulic conductivity and are presumed to be the source of transport of TCE within the soil.
- There are exceedances within or immediately adjacent to the Wick Drains that extend to 20 feet below ground surface into the gray till (Figure 20). The TCE exceedance in L7 extends to the same depth as the wick drains (15 feet). The TCE exceedance in L1 extends to the 18-20 foot sample. The other exceedances are within 5 feet of the top of the interface between the brown and gray till.
- On all maps, the 23,000 ug/kg contour opens to the east of the FEP WMU area. This is an artifact of the way the kriging algorithm grids the concentration gradient and of the lack of data points to the east of the FEP WMU.

Total Uranium

Figures 21-25 provide a 2-D display of the Total Uranium concentrations. Figures 21, 22, 23, 24, and 25 includes all data, Fill only, silt only, brown till, and gray unweathered till, respectively. A dominant feature is the high concentration in boring L-25 in the fill. Based on discussions with John Hughes, this is believed to not be related to the FEP WMU, but potentially a secondary source adjacent to a building doorway. The data from L-25 is honored in these figures, but skews the overall impression of the data. The observations of the data are as follows:

- The Total Uranium has the highest concentrations in the Fill.
- The Total Uranium above 43 mg/kg within the silt layer is in the southern and western half of the Wick Drain area and south of the wick drains near the original settling pond.
- The Total Uranium above 43 mg/kg in the brown till is predominantly within or adjacent to the Wick Drain area, but also extends to the south near the original settling pond.

- The only Total Uranium found above 43 mg/kg in the gray till is from boring L-25, discussed above as an area outside of the FEP WMU.

Tc-99

Figures 26-30 present Tc-99 isoconcentrations for all data, fill only, silt only, brown till, and gray unweathered till, respectively. There is very limited data that exceed the 65 pCi/g cleanup standard. This is limited to borings in the southwest corner of the FEP WMU, and borings HRCc-1 (immediately north of the wick drain area), and L-22, to the southeast of the wick drain area.

The exceedances shown on Figure 29 (Brown Till) are all found within the top section of the brown till, and may be related to the base of the topsoil/fill section. However the descriptions from these borings are limited with regard to this interval. and so the results in the brown till may be skewed. Tc-99 is not a significant driver for the cleanup of the section deeper than the top of the brown till.

Correlation Between Contaminants and Geologic Subunits

The objective of this scope was to determine whether there is a correlation between the presence of contaminants of concern and the geologic subunits at the sites. The observations from the data collected are listed below.

- Fill. TCE is present in the fill above standards in 2 borings, HRCc-4 and HRCa-2. Tc-99 is present above standards only in borings L-21, L-22 and HRC-a-3 (172 pCi/g). Boring L-9 is less than 5 feet from that boring and had a reported value of 64 pCi/g from the same section, indicating that there can be a large variation of Tc-99 values within a small area. Uranium has more exceedances in the fill than any other part of the section.. Fill is generally a Uranium issue only.
- Silts. – Elevated TCE concentrations are primarily located within the silt layers, although within the wick area it appears that TCE has migrated deeper into the section. Uranium appears to be mostly attenuated within the fill, and Tc-99 has not been detected above standards within the silts.
- Wick Drain Area – The vertical permeability has been greatly altered by installation of the wick drains. The presence of U is attenuated at the depth of the initial installation of wick drains (i.e, 15 feet bgs). TCE appears to have migrated downward in limited areas in or adjacent to the wick drain area.
- Brown till – TCE concentrations in this unit are confined to those borings within or immediately adjacent to the wick drains. The wick drains provide a vertical conduit for transport, thus it is not surprising to find the presence of TCE in this area. Total Uranium and Tc-99 are limited to the uppermost section of the brown till under the fill/topsoil section.
- Gray Till – TCE exceedances in this unit are confined to an isolated area within the Wick Drain Area. There are two borings grouped together adjacent to the east side of the wick drain area (HRCa-2 and MW-504) that also has TCE values above standards.

Conclusions and Recommendations

- There is a correlation between the geologic subunit and the contamination. The implication is that a field screening method based on geologic sub layers could be useful to help direct the excavation.
- The fill primarily a Uranium only issue.
- The wick drain area is a mixed waste issue (TCE and U).
- The TCE within silts is predominantly within the wick drain area but extends outside that area due to transport through the higher permeable silts.
- The Gray till is absent of TCE or U with the exception of an area directly below or immediately adjacent to the Wick Drains.

Recommendations

The next step is to take these correlations and generate volumes for soil removal based on the understanding of the geologic units and contaminants. The volumes should be in a format which can later be used to prepare engineering plan sheets for bidding the excavation work.

Cc: A. Lambacher, RMIES
M. Al-Quraishi, RMIES
R. Johnson, Argonne Labs

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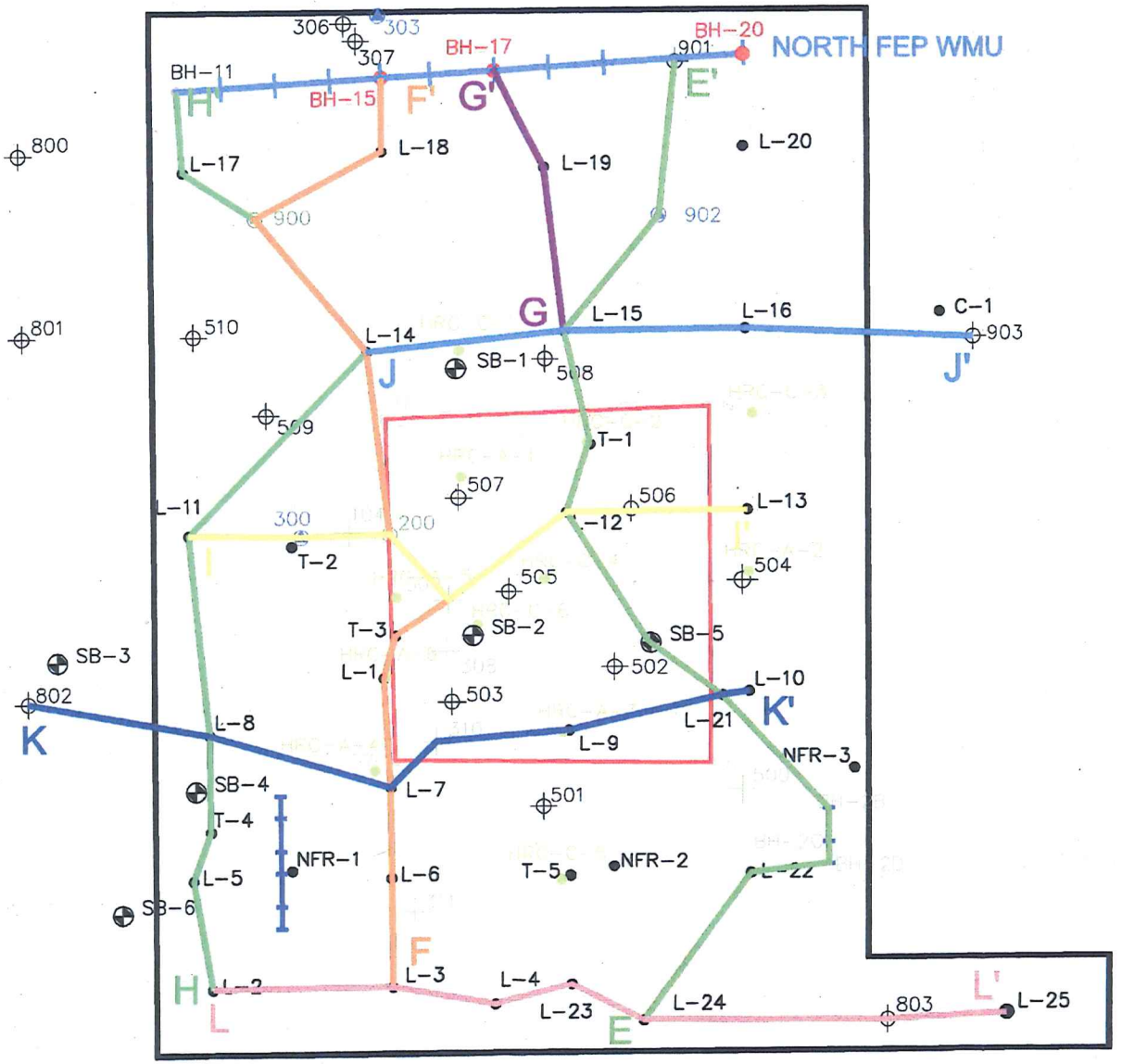

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CROSS-SECTION LOCATION MAP

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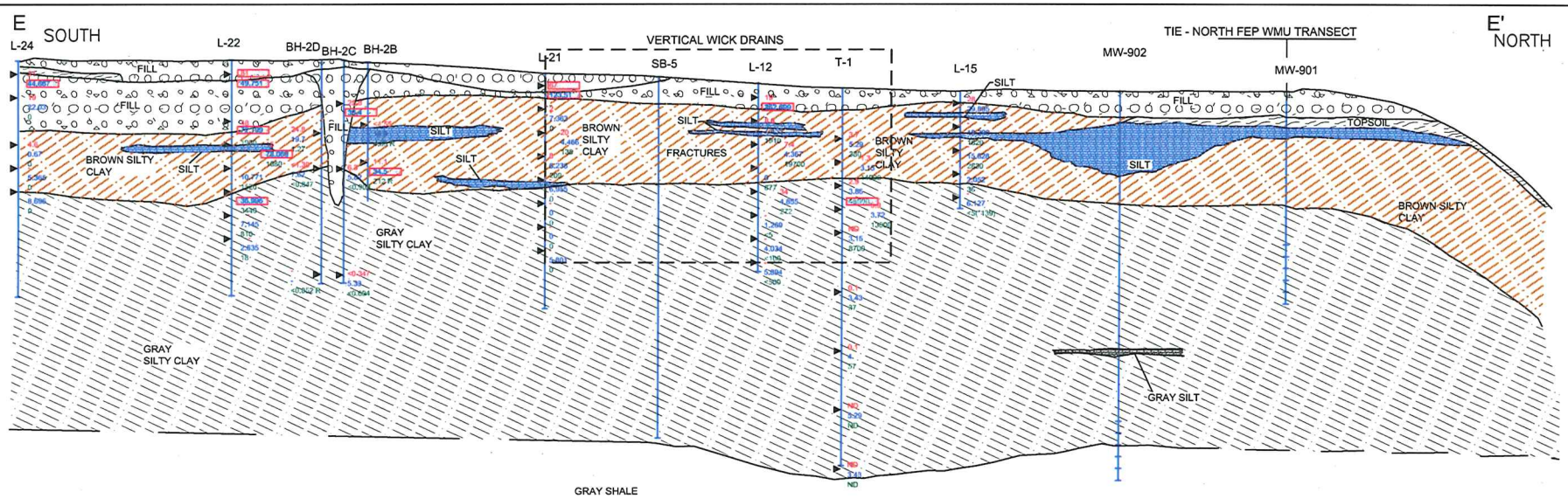

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XXX = TOTAL U IN SOILS, ug/g
XXX = TCE IN SOILS, ug/kg
▶ = AVERAGE SAMPLE DEPTH

TRENCH FILL MATERIALS
SURFACE FILL MATERIALS
BROWN AND GRAY MOTTLED SILTY CLAY
GRAY SILTY CLAY
BROWN SILTY CLAY
SAND
SILT
TOPSOIL-(SILTY CLAY)
CLAYEY SILT
CLAY
GRAY SILTY CLAY WITH IRON

(*) Duplicate result; unable to verify concentration.

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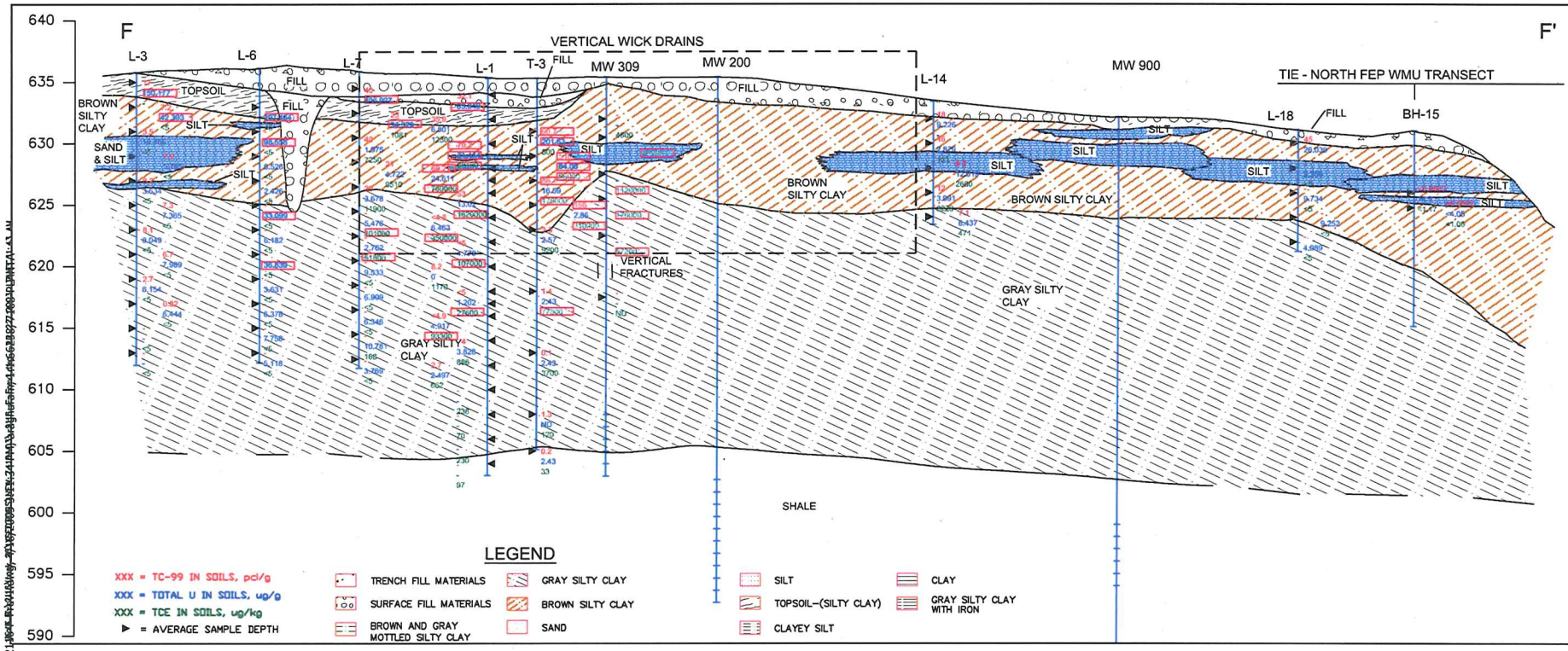

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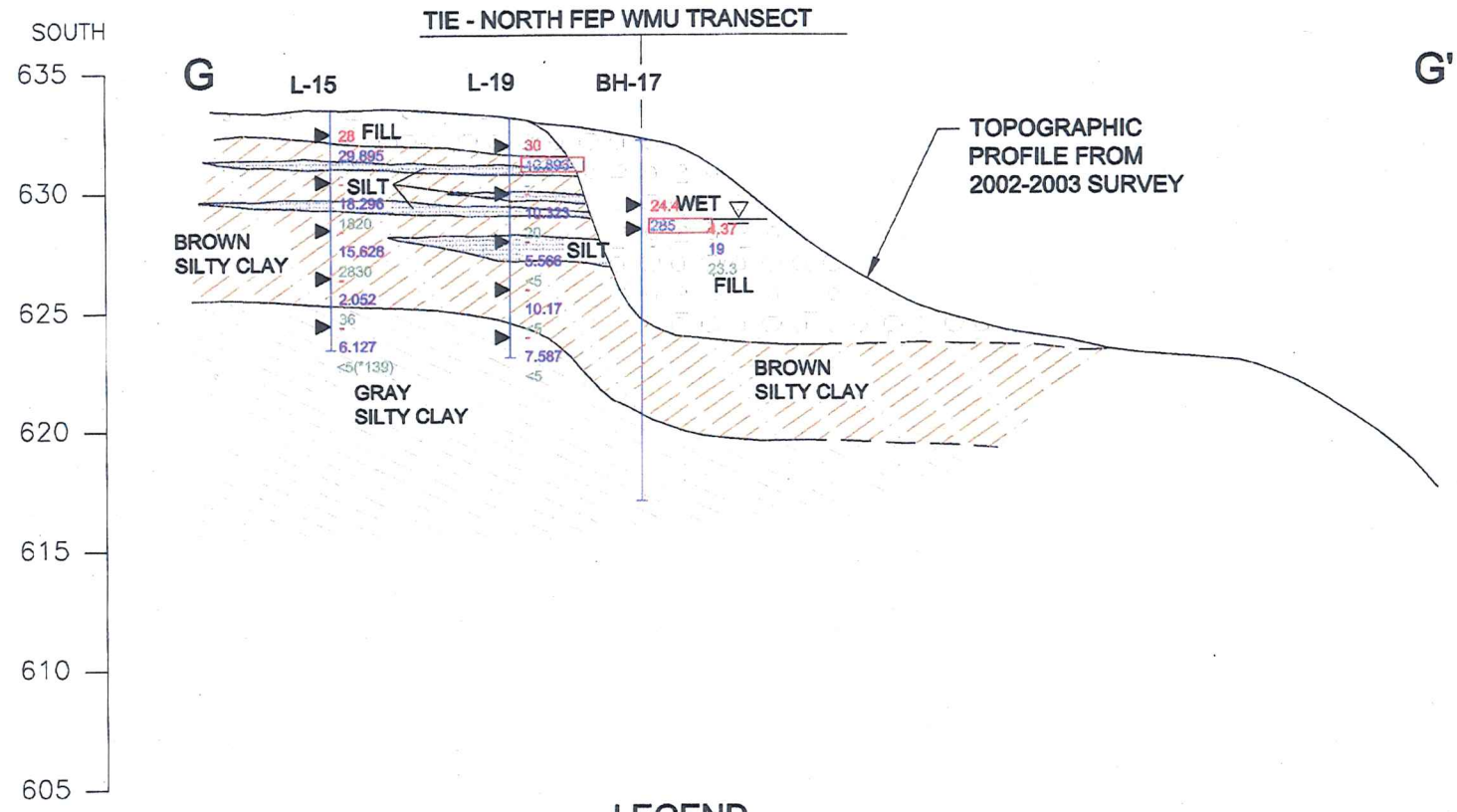

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XXX = TOTAL U IN SOILS, ug/g

XXX = TCE IN SOILS, ug/kg

▶ = AVERAGE SAMPLE DEPTH

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- SURFACE FILL MATERIALS
- BROWN AND GRAY MOTTLED SILTY CLAY
- GRAY SILTY CLAY
- BROWN SILTY CLAY
- SAND
- SILT
- TOPSOIL-(SILTY CLAY)
- CLAYEY SILT
- CLAY
- GRAY SILTY CLAY WITH IRON

(*) Duplicate Result; Unable to verify concentration

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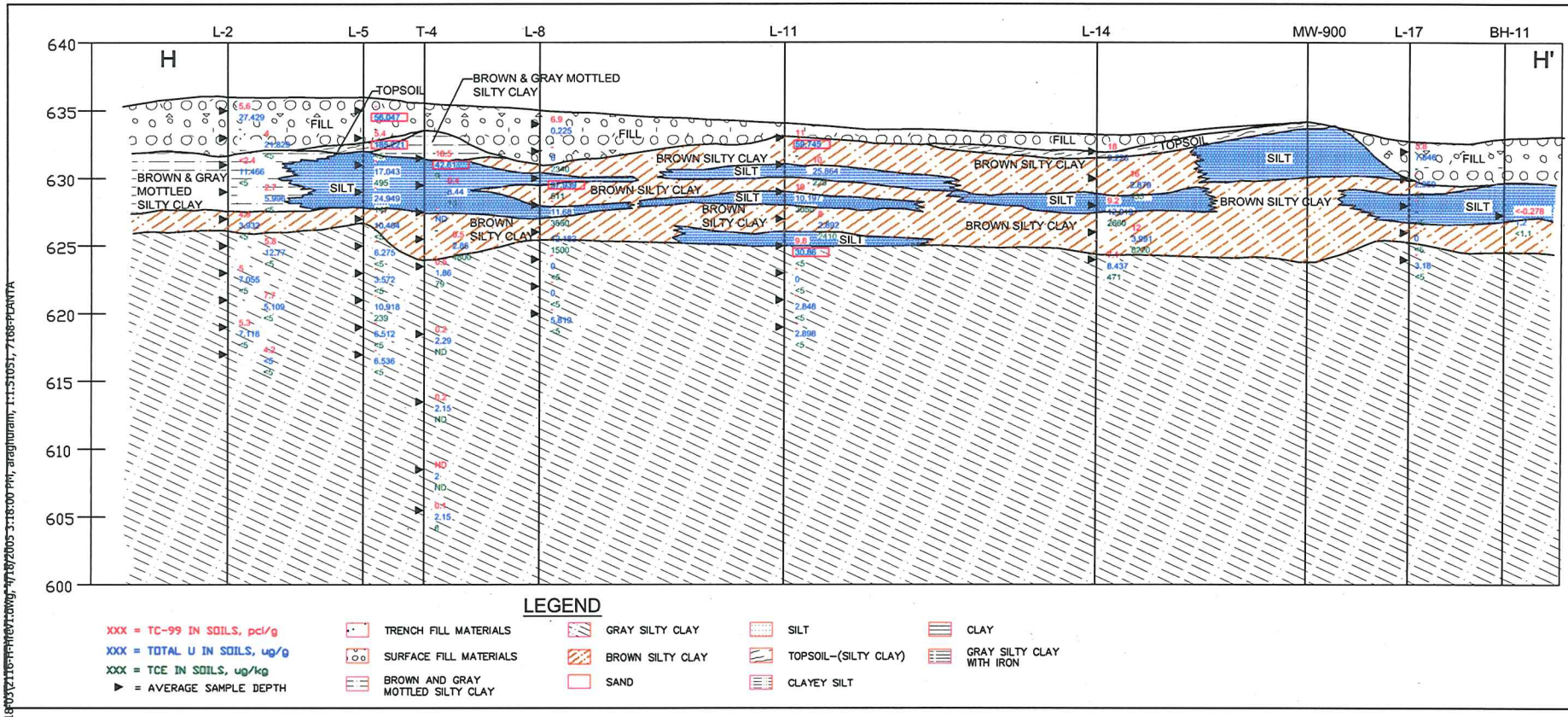

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CROSS SECTION H-H'

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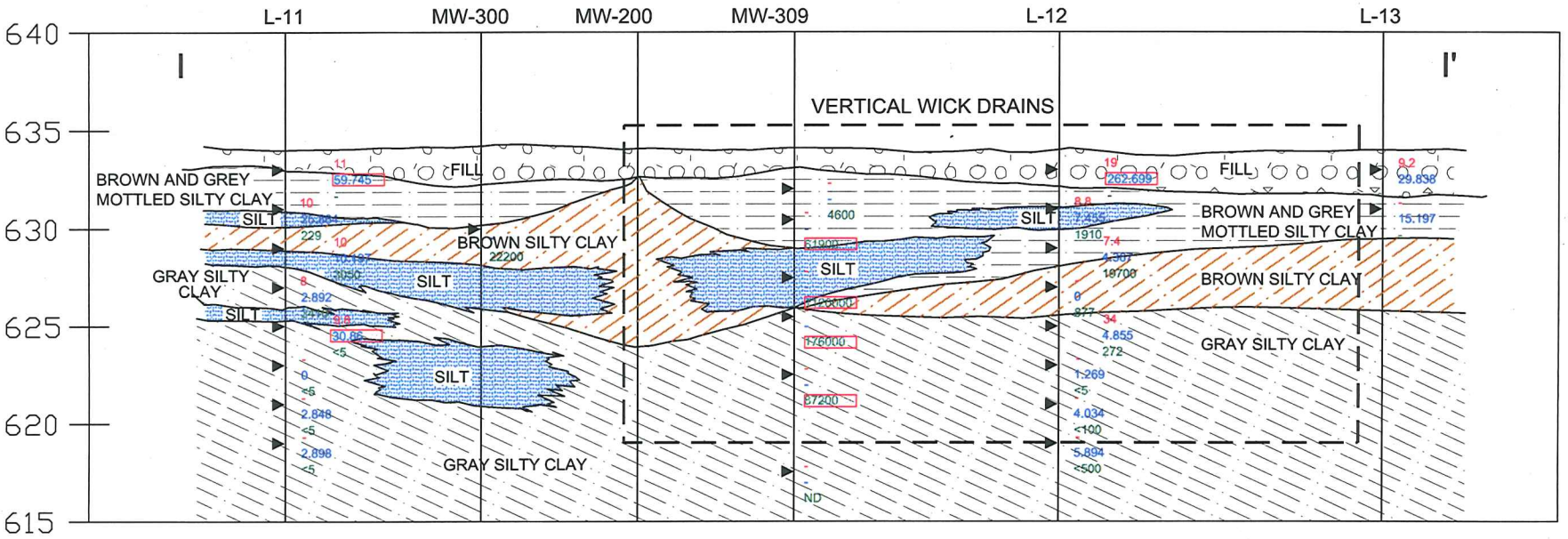

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XXX = TOTAL U IN SOILS, ug/g

XXX = TCE IN SOILS, ug/kg

▶ = AVERAGE SAMPLE DEPTH

- TRENCH FILL MATERIALS
- SURFACE FILL MATERIALS
- BROWN AND GRAY MOTTLED SILTY CLAY
- GRAY SILTY CLAY
- BROWN SILTY CLAY
- SAND
- SILT
- TOPSOIL-(SILTY CLAY)
- CLAYEY SILT
- CLAY
- GRAY SILTY CLAY WITH IRON
- AGGREGATE BASE
- SURFACE FILL MATERIALS
- TRENCH FILL MATERIALS

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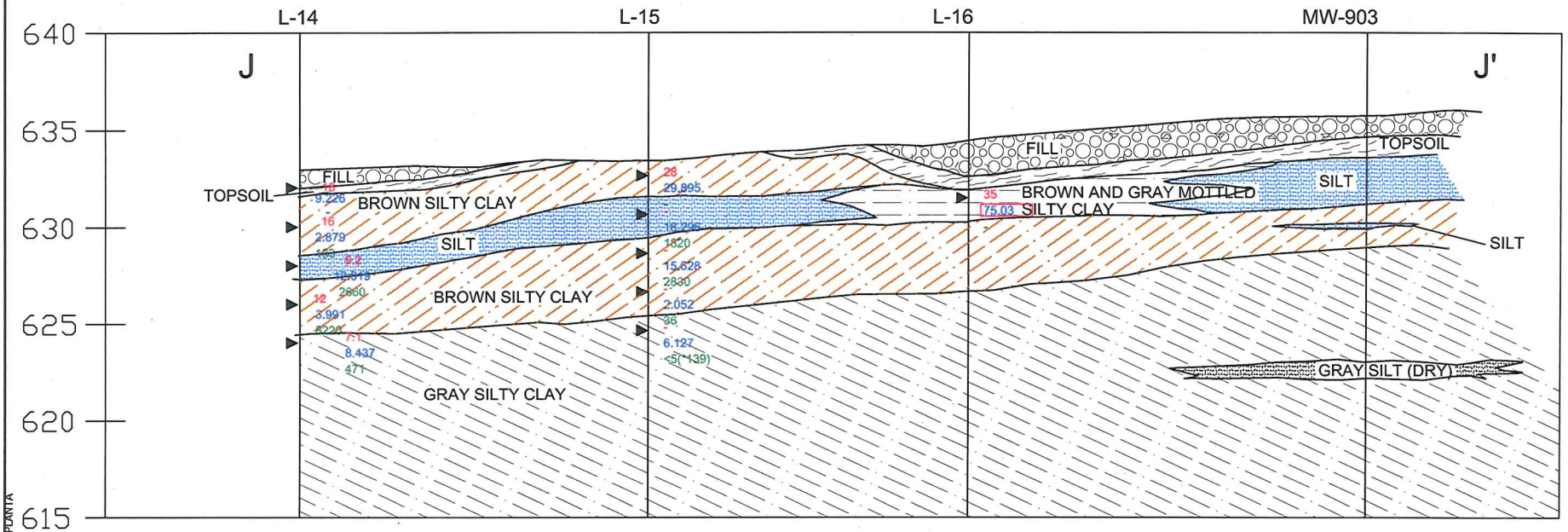

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XXX = TCE IN SOILS, ug/kg

▶ = AVERAGE SAMPLE DEPTH

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- SURFACE FILL MATERIALS
- BROWN AND GRAY MOTTLED SILTY CLAY
- GRAY SILTY CLAY
- BROWN SILTY CLAY
- SAND
- SILT
- TOPSOIL–(SILTY CLAY)
- CLAYEY SILT
- CLAY
- GRAY SILTY CLAY WITH IRON
- AGGREGATE BASE
- SURFACE FILL MATERIALS
- TRENCH FILL MATERIALS

(*) DUPLICATE RESULT; UNABLE TO VERIFY CONCENTRATION

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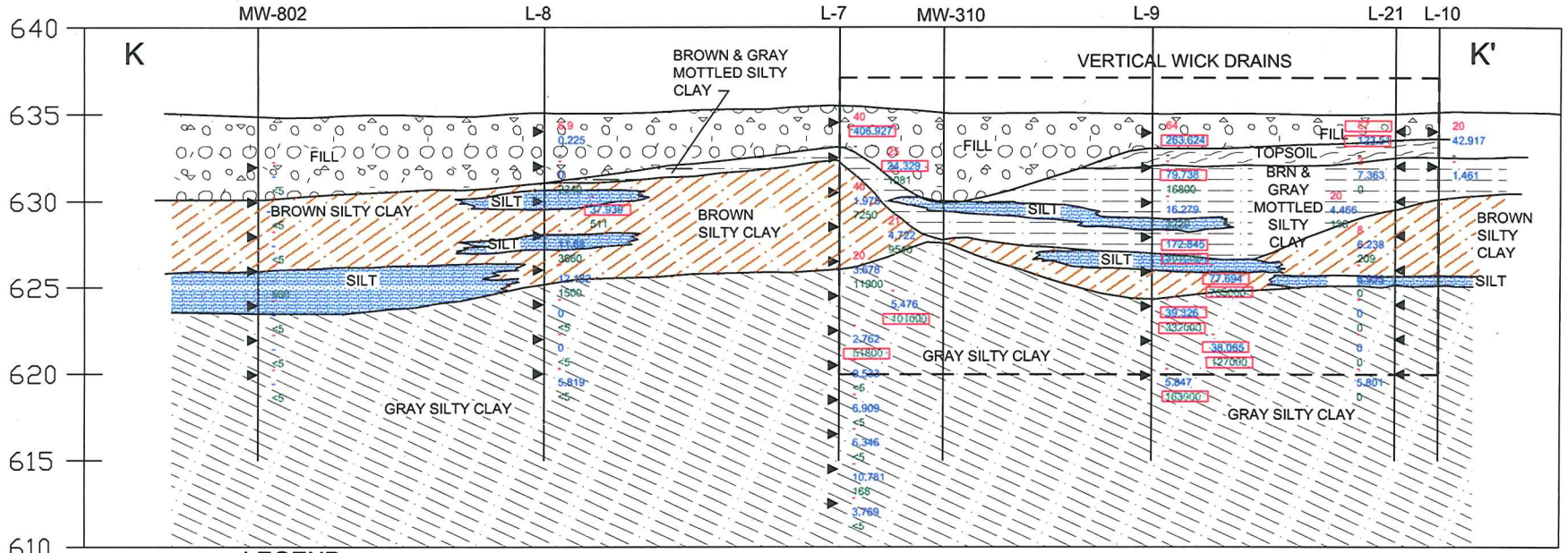

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XXX = TCE IN SOILS, ug/kg
▶ = AVERAGE SAMPLE DEPTH

SURFACE FILL MATERIALS
TRENCH FILL MATERIALS
SURFACE FILL MATERIALS
BROWN AND GRAY MOTTLED SILTY CLAY
GRAY SILTY CLAY
BROWN SILTY CLAY
SAND
SILT
TOPSOIL-(SILTY CLAY)
CLAYEY SILT
CLAY
GRAY SILTY CLAY WITH IRON

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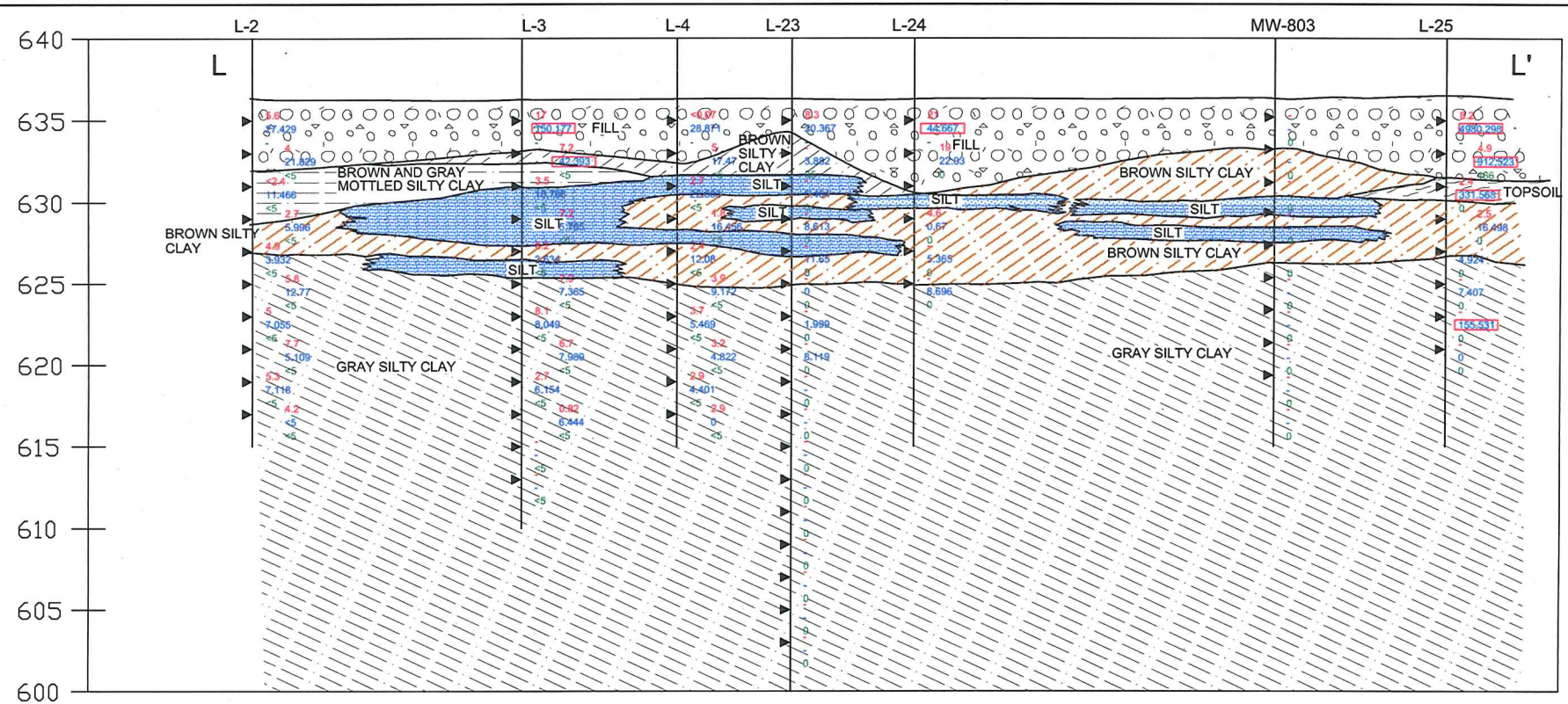

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XXX = TCE IN SOILS, ug/kg
▶ = AVERAGE SAMPLE DEPTH

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- SURFACE FILL MATERIALS
- BROWN AND GRAY MOTTLED SILTY CLAY
- GRAY SILTY CLAY
- BROWN SILTY CLAY
- SAND
- SILT
- TOPSOIL–(SILTY CLAY)
- CLAYEY SILT
- CLAY
- GRAY SILTY CLAY WITH IRON
- AGGREGATE BASE
- SURFACE FILL MATERIALS
- TRENCH FILL MATERIALS

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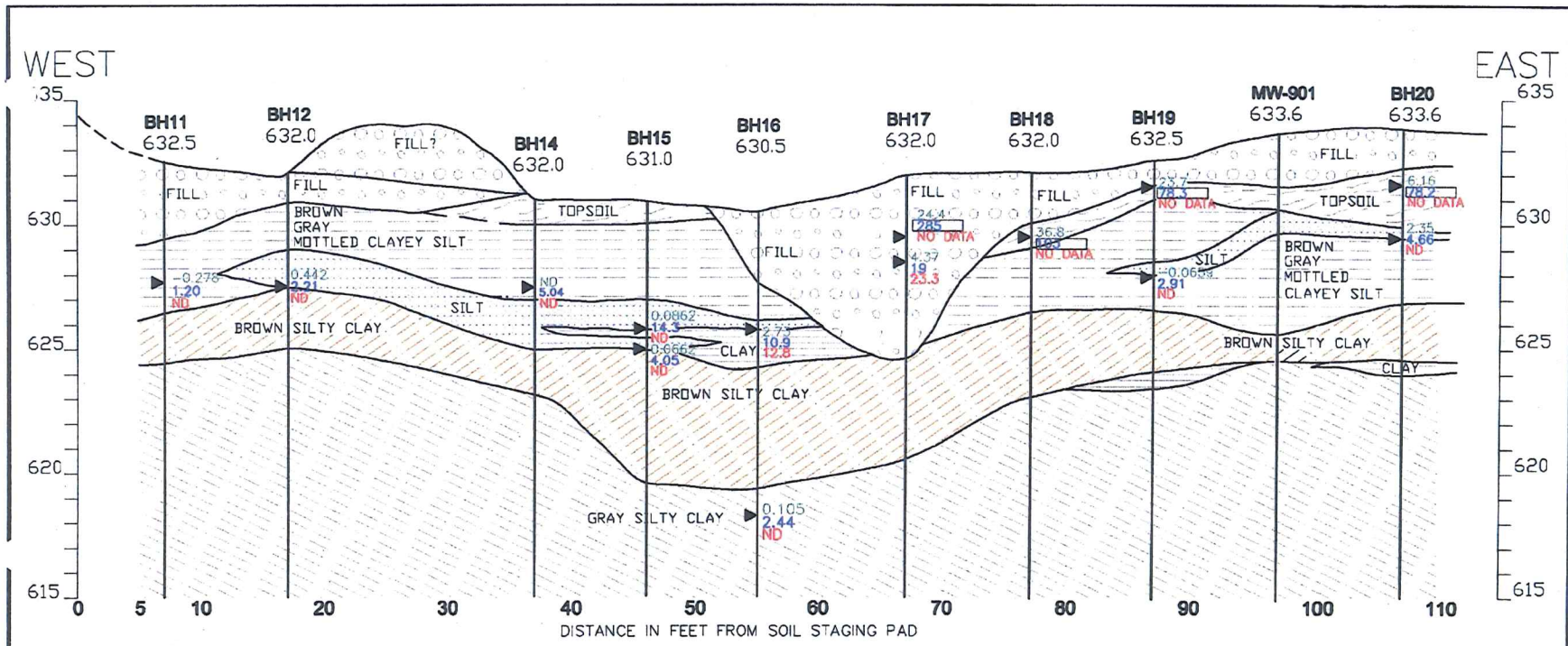

LEGEND

- FILL
- BROWN AND GRAY MOTTLED SILTY CLAY
- GRAY SILTY CLAY
- BROWN SILTY CLAY
- SAND
- SILT
- TOPSOIL–(SILTY CLAY)
- CLAYEY SILT
- CLAY
- GRAY SILTY CLAY WITH IRON
- ▶ AVERAGE SAMPLE DEPTH

ND = NON DETECT
XXX = TC-99 IN SOILS, pci/g
XXX = TOTAL U IN SOILS, ug/g
XXX = TCE IN SOILS, ug/kg

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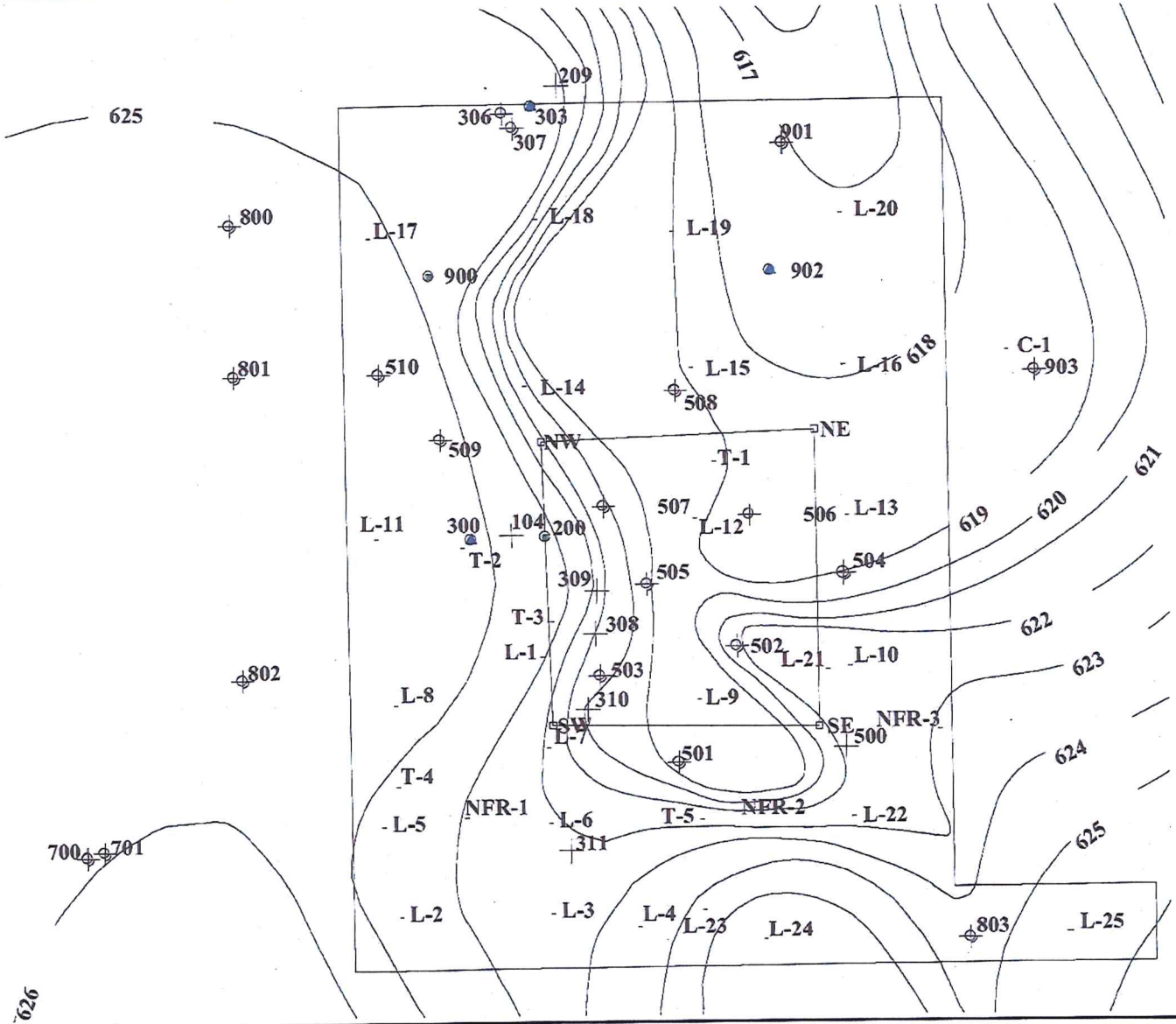
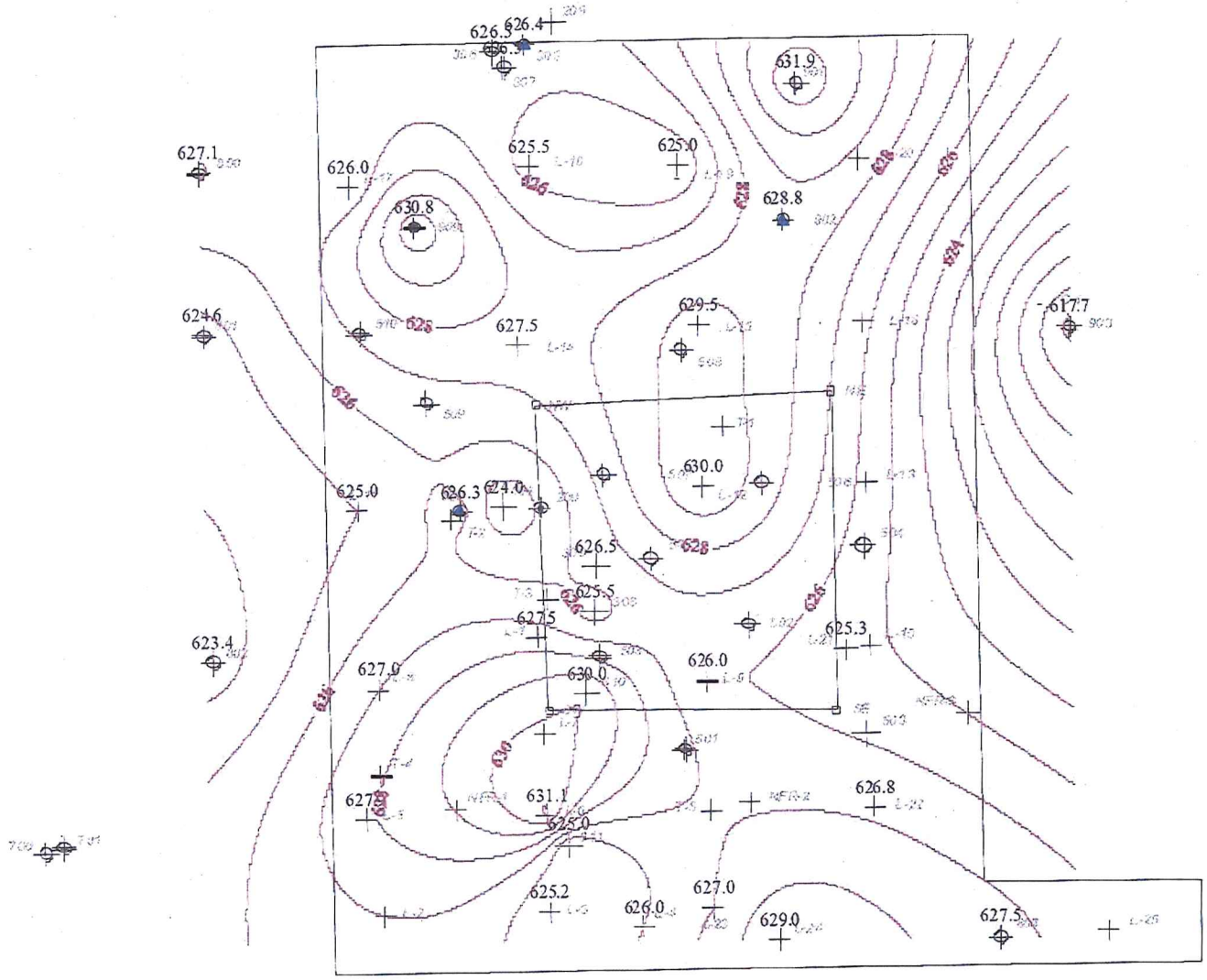
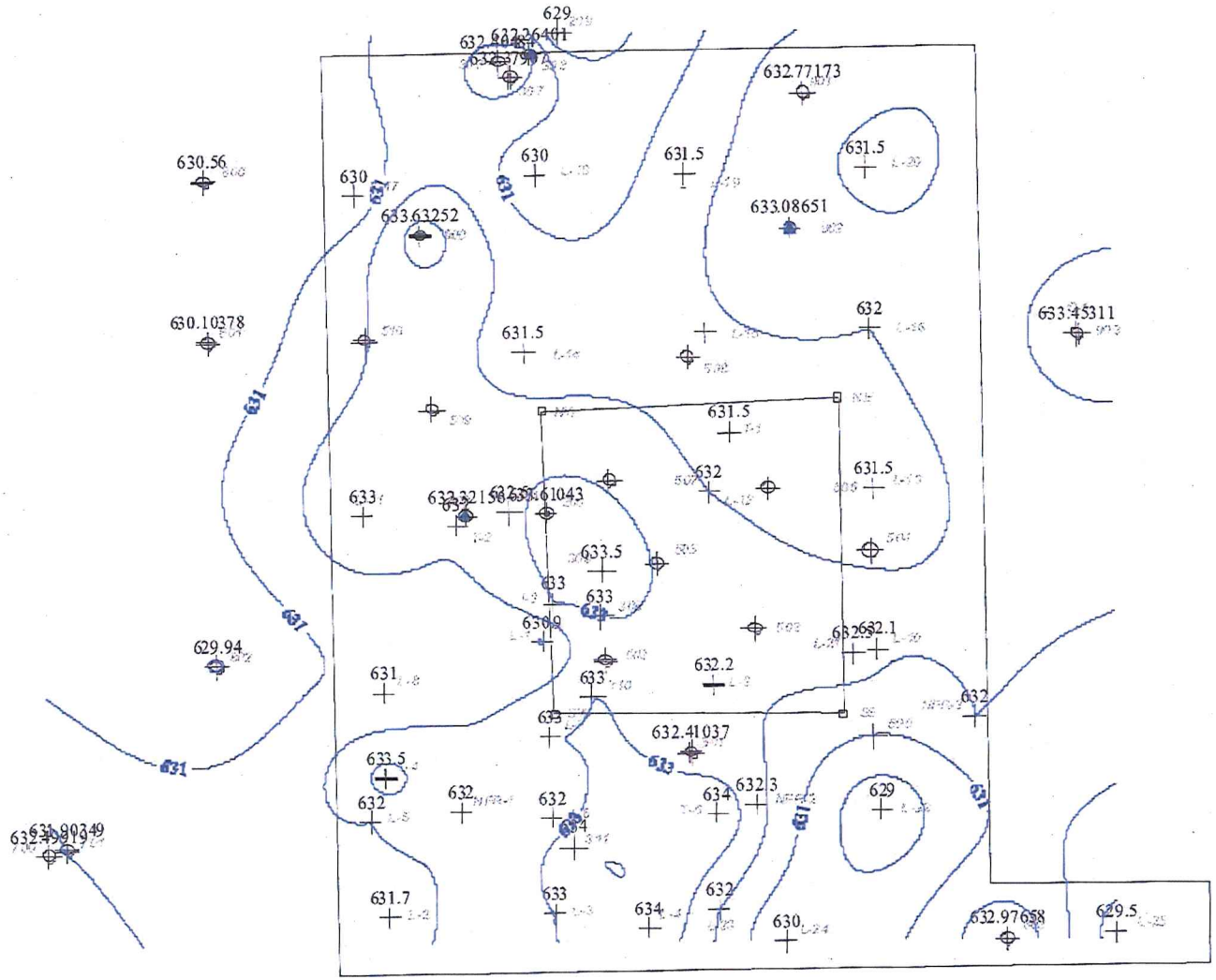
Drawing No.: F-10
Revision: 0



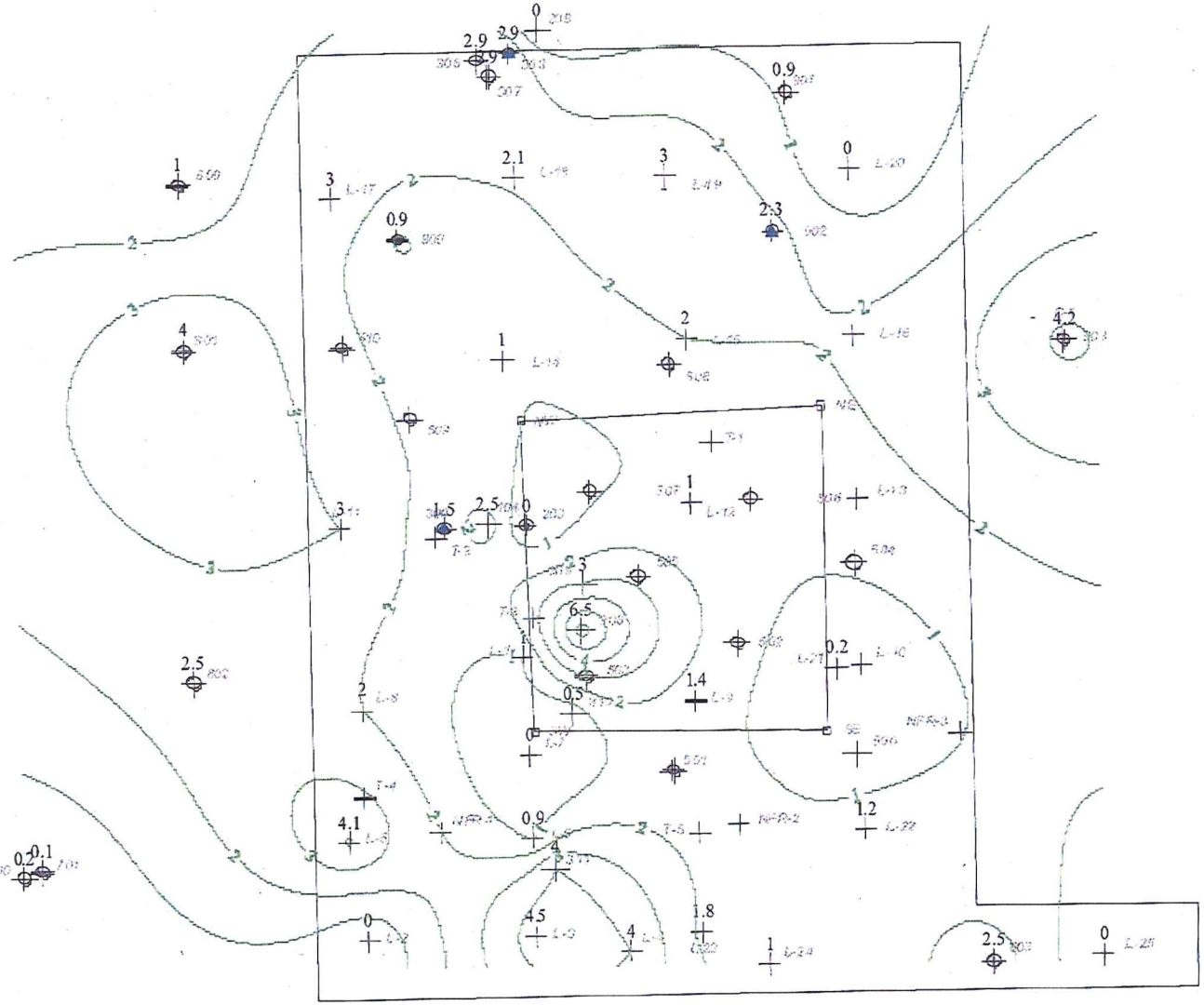
SHARP and Associates, Inc. Environmental Engineers and Scientists 982 Crupper Ave. • Columbus, OH 43229	DATE: 6/20/2003 SCALE: Approx. Contour Interval: 1 Foot PROJECT: 2116	**Structure Map** Top of the Gray Unoxidized Till, Feet above Mean Sea Level	**Figure 11**



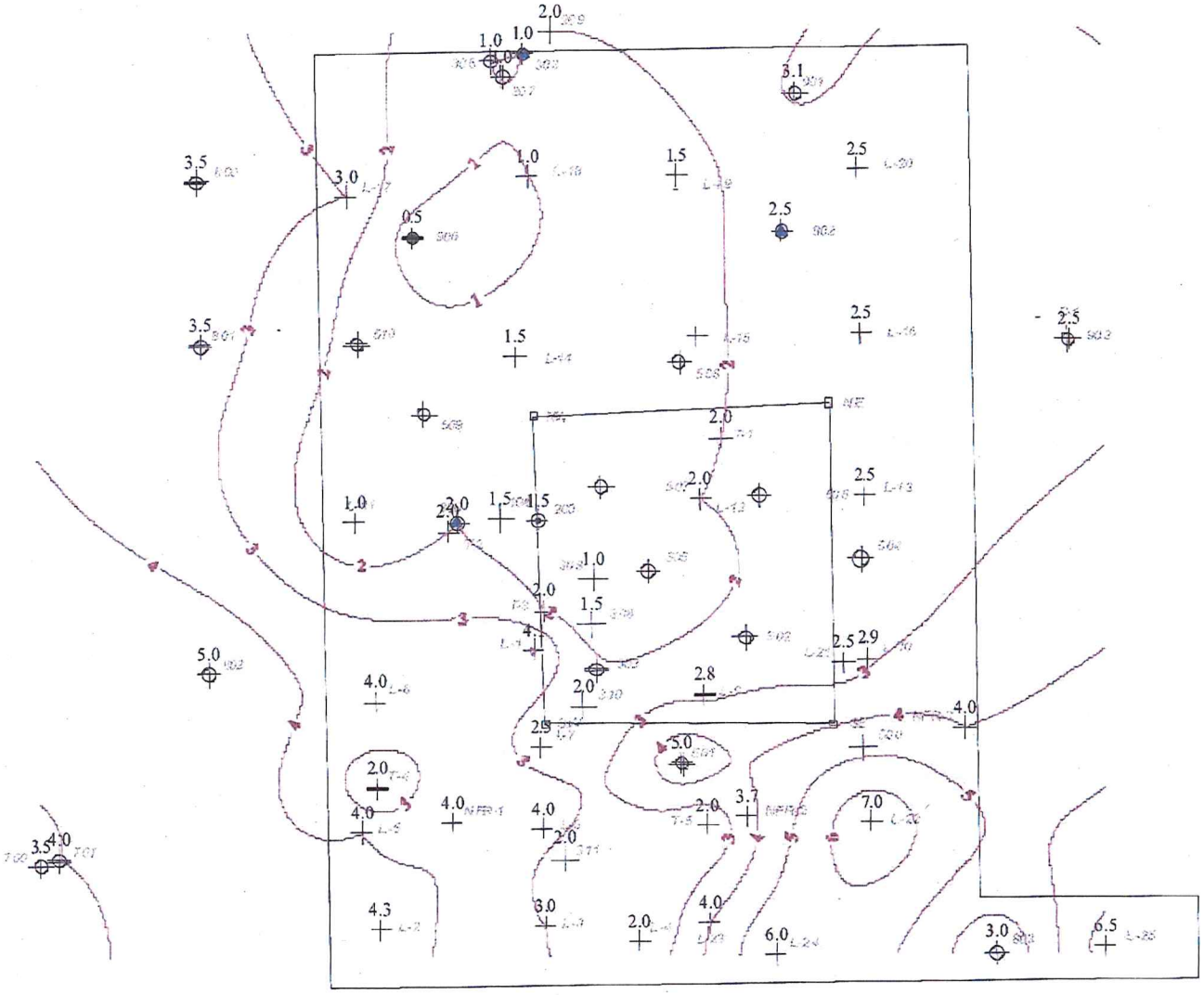
SHARP and Associates, Inc. Environmental Engineers and Scientists 982 Crupper Ave. • Columbus, OH 43229	DATE: SCALE: Approx. Contour Interval: 1 Foot PROJECT: 2116	**Structure Map** Base of the Silt, Feet above Mean Sea Level	**Figure 12**



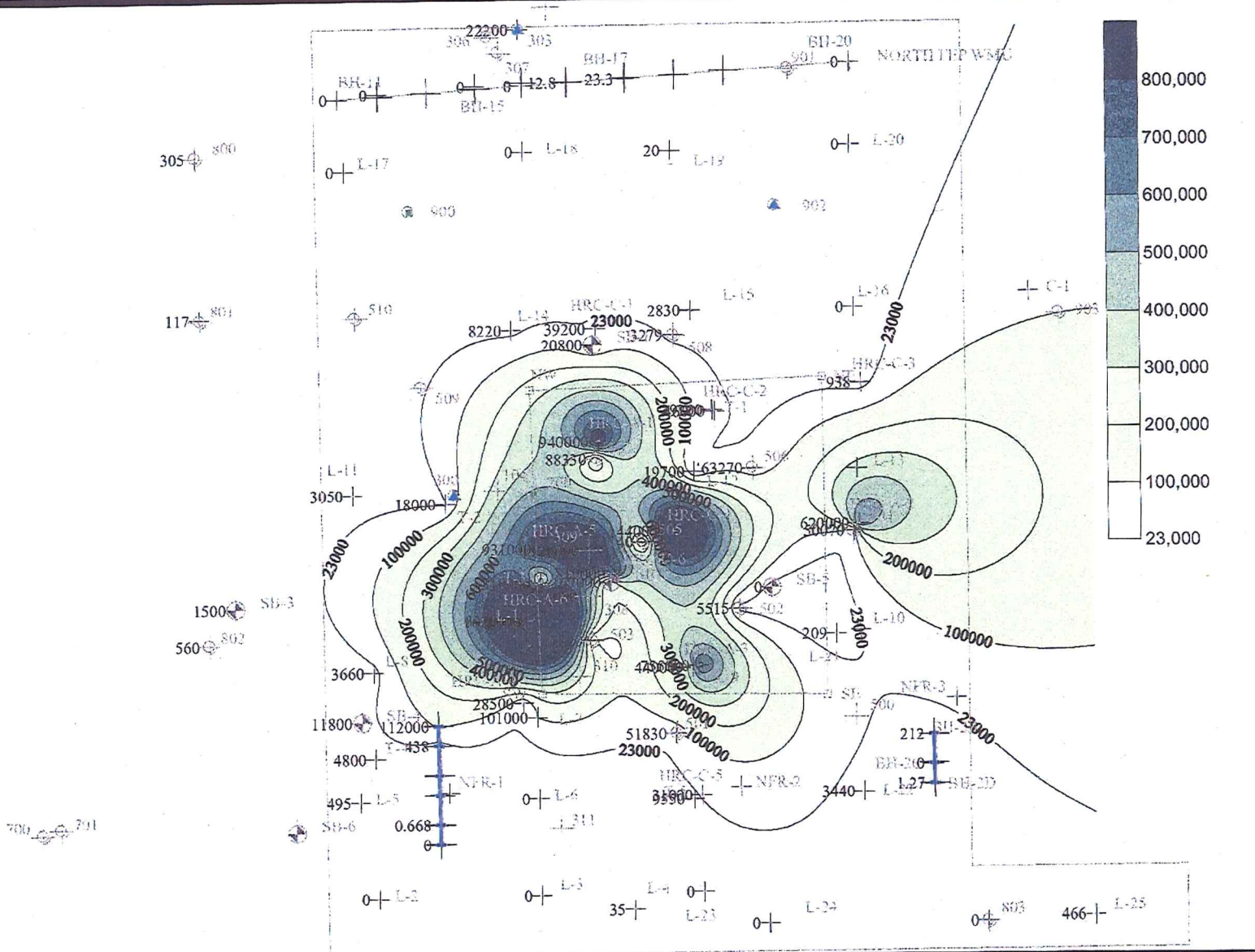
SHARP and Associates, Inc. Environmental Engineers and Scientists 982 Crupper Ave. • Columbus, OH 43229	DATE: 6/20/2003 SCALE: Approx. Contour Interval: 1 Foot PROJECT: 2116	**Structure Map** Base of the Topsoil/Fill Feet above Mean Sea level	**Figure 13**



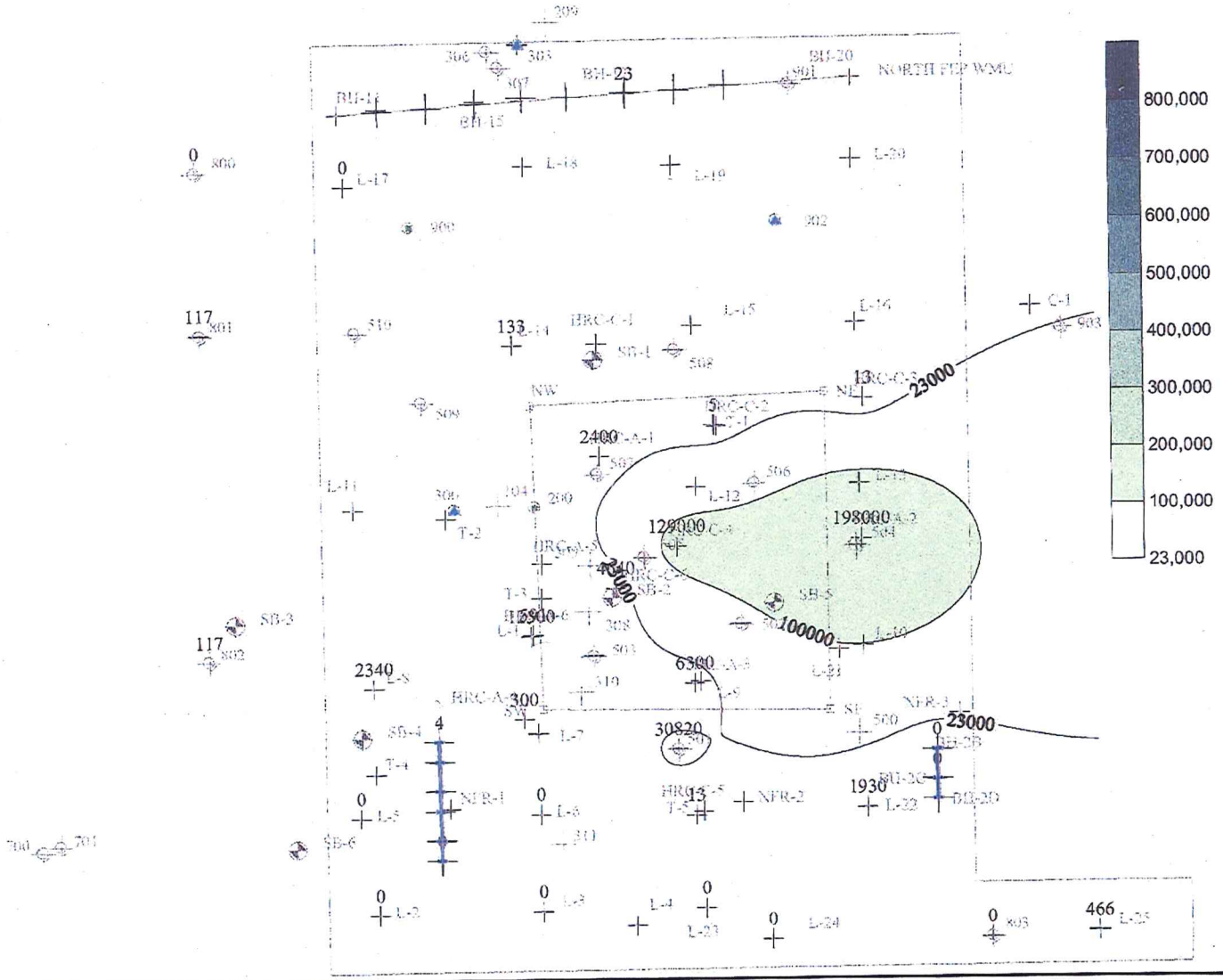
SHARP and Associates, Inc. Environmental Engineers and Scientists 982 Crupper Ave. • Columbus, OH 43229	**DATE:** 6/2/2003 **SCALE:** (Approx.) **Isopach Interval:** 1 Foot **PROJECT:** 2116	**Gross Isopach** Feet of Silt Within the Brown Till	**Figure 14**



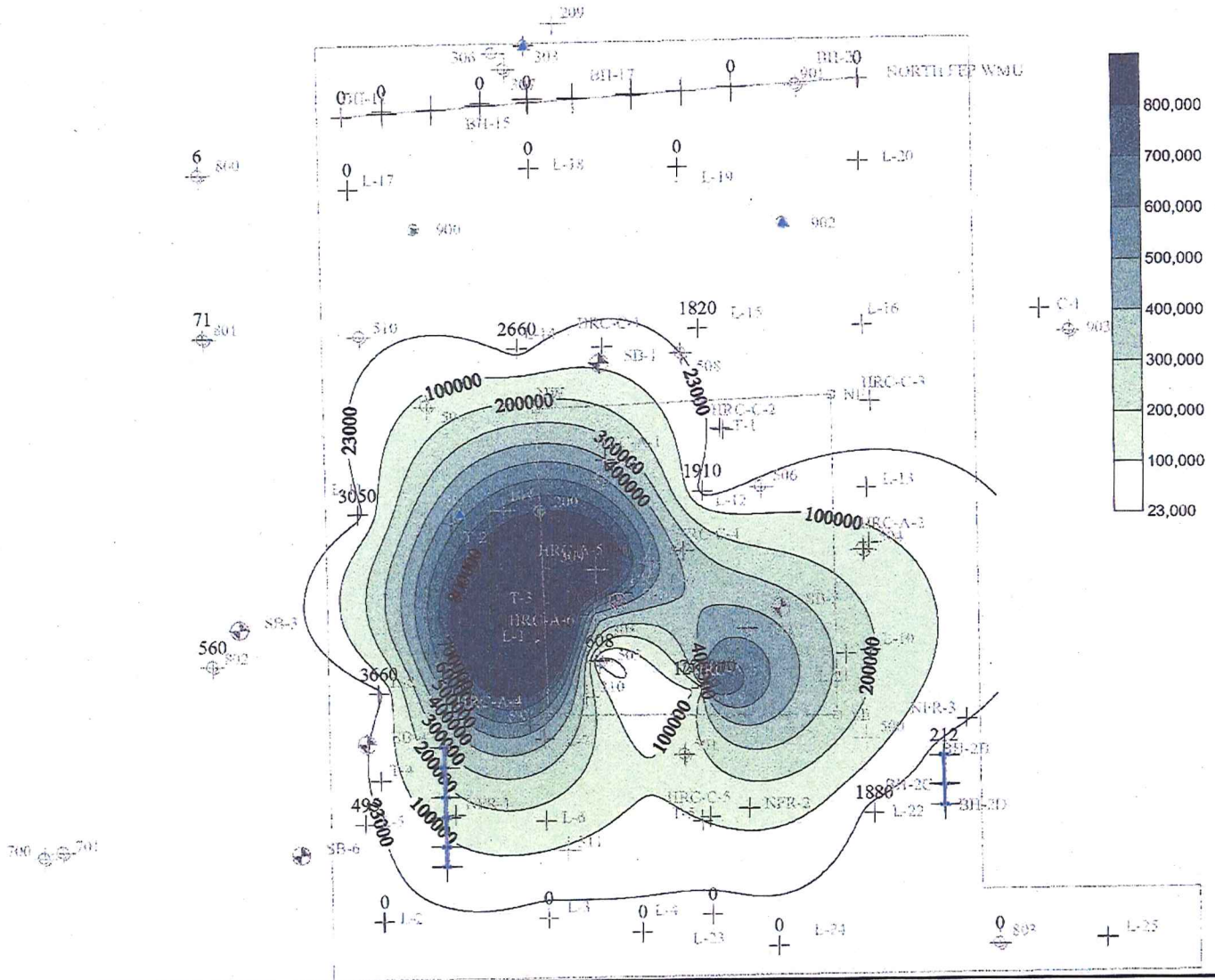
SHARP and Associates, Inc. Environmental Engineers and Scientists 982 Crupper Ave. • Columbus, OH 43229	DATE: 6/2/2003 SCALE: (Approx.) Contour Interval 1 Foot PROJECT: 2116	**Gross Isopach** Feet of Topsoil/Fill	**Figure 15**



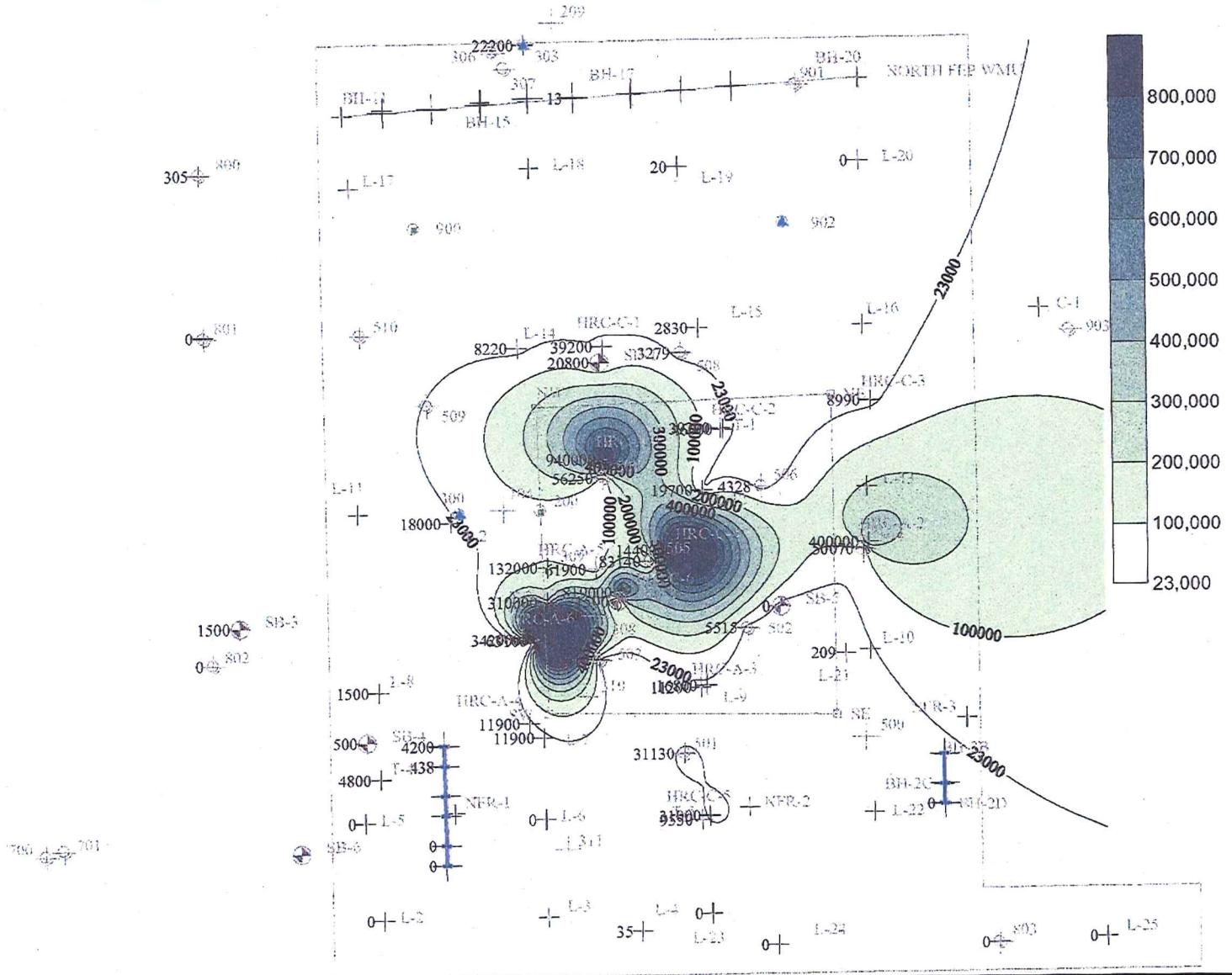
SHARP and Associates, Inc. Environmental Engineers and Scientists 982 Crupper Ave. • Columbus, OH 43229	DATE: 6/2/2003 SCALE: (Approx.) PROJECT: 2116	**Isoconcentration Map** Maximum Concentration of TCE All Data Concentration in µg/kg	**Figure 16**



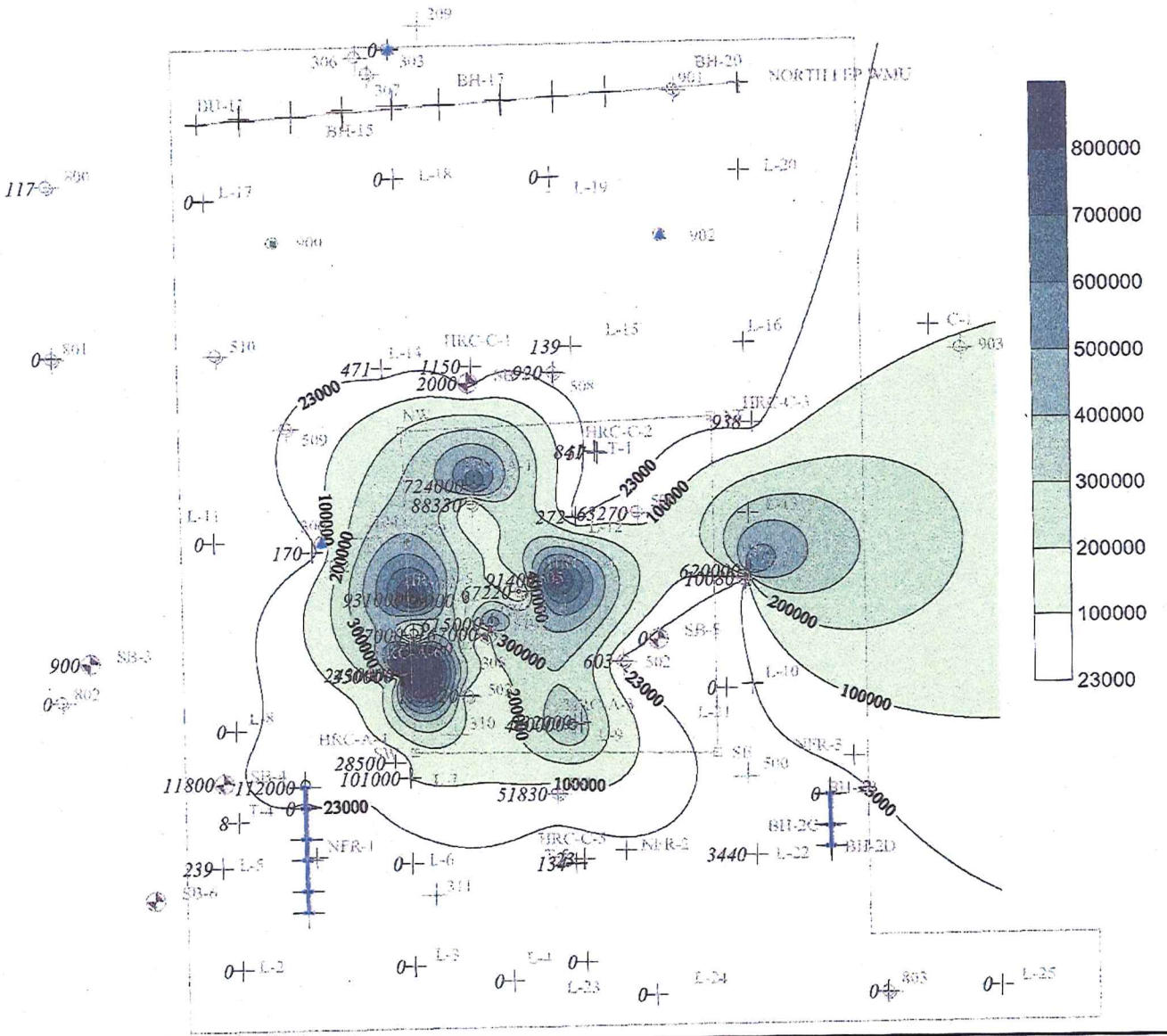
SHARP and Associates, Inc. Environmental Engineers and Scientists 982 Crupper Ave. • Columbus, OH 43229	DATE: 6/2/2003 SCALE: (Approx.) PROJECT: 2116	**Isoconcentration Map** Maximum Concentration of TCE Within The Fill Concentration in µg/kg	**Figure 17**



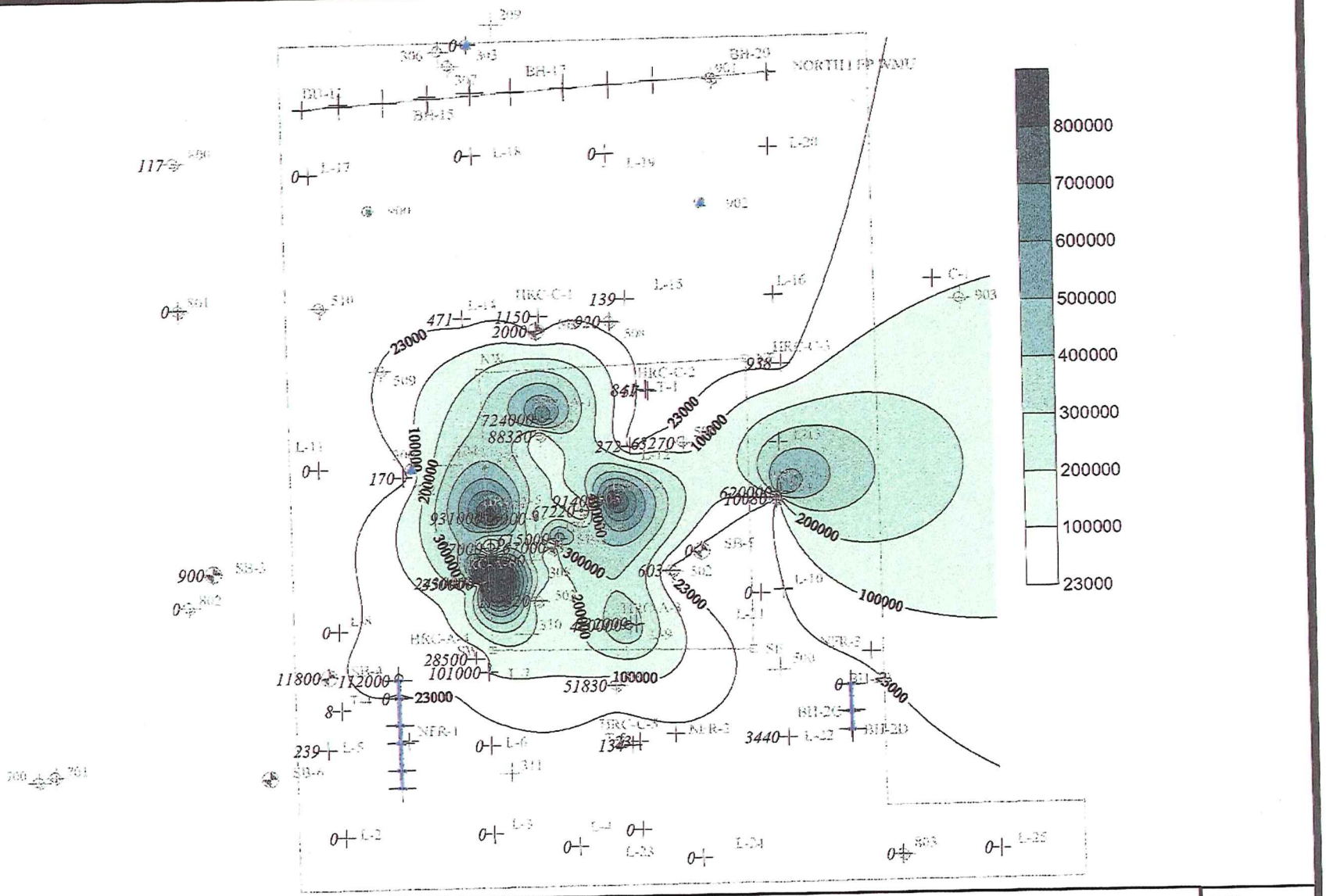
SHARP and Associates, Inc. Environmental Engineers and Scientists 982 Crupper Ave. • Columbus, OH 43229	DATE: 6/2/2003 SCALE: (Approx.) PROJECT: 2116	**Isoconcentration Map** Maximum Concentration of TCE Within The Silt Concentration in µg/kg	**Figure 18**



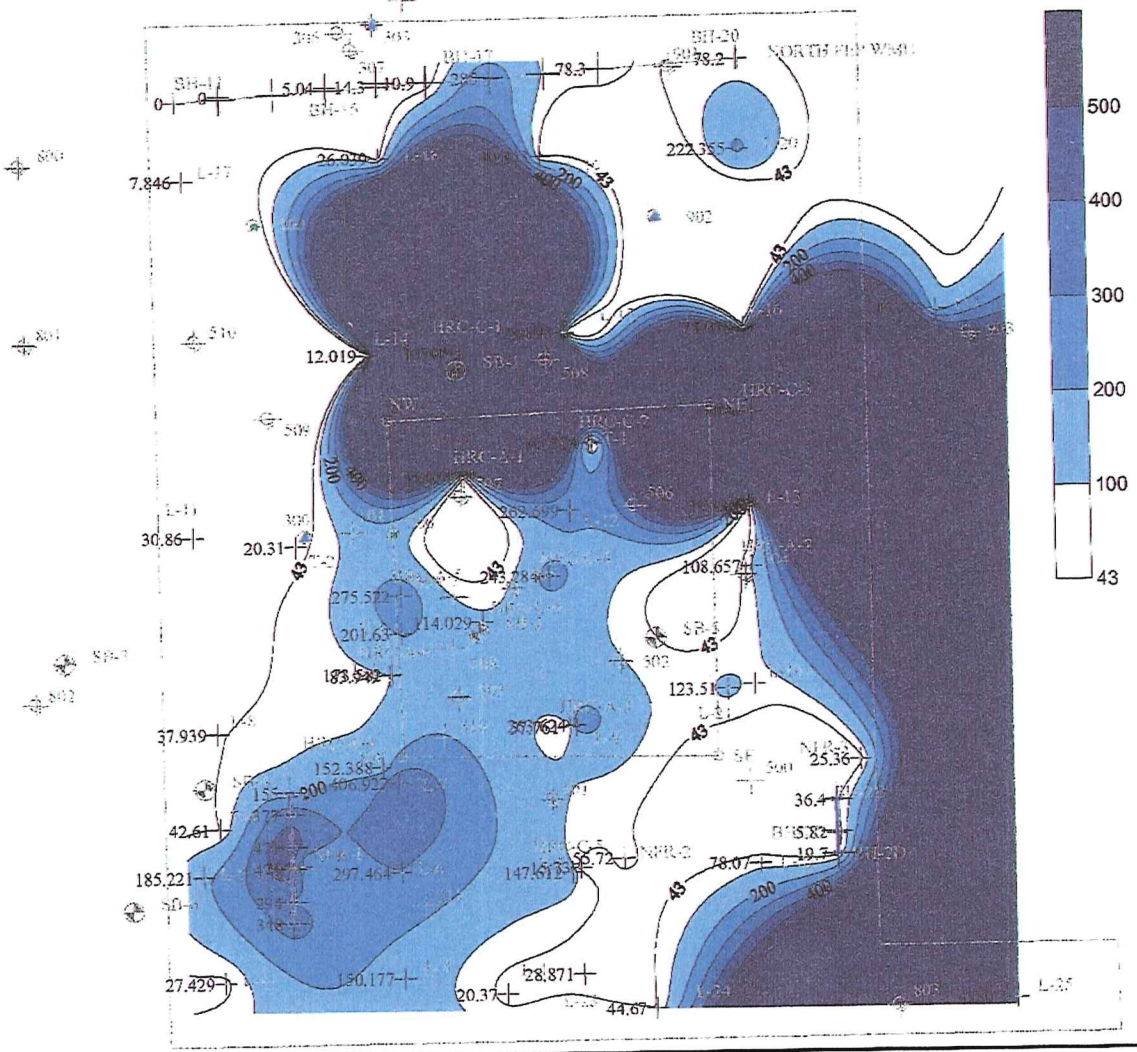
SHARP and Associates, Inc. Environmental Engineers and Scientists 982 Crupper Ave. • Columbus, OH 43229	DATE: 6/2/2003 SCALE: (Approx.) PROJECT: 2116	**Isoconcentration Map** Maximum Concentration of TCE Within The Brown Till Concentration in µg/kg	**Figure 19**



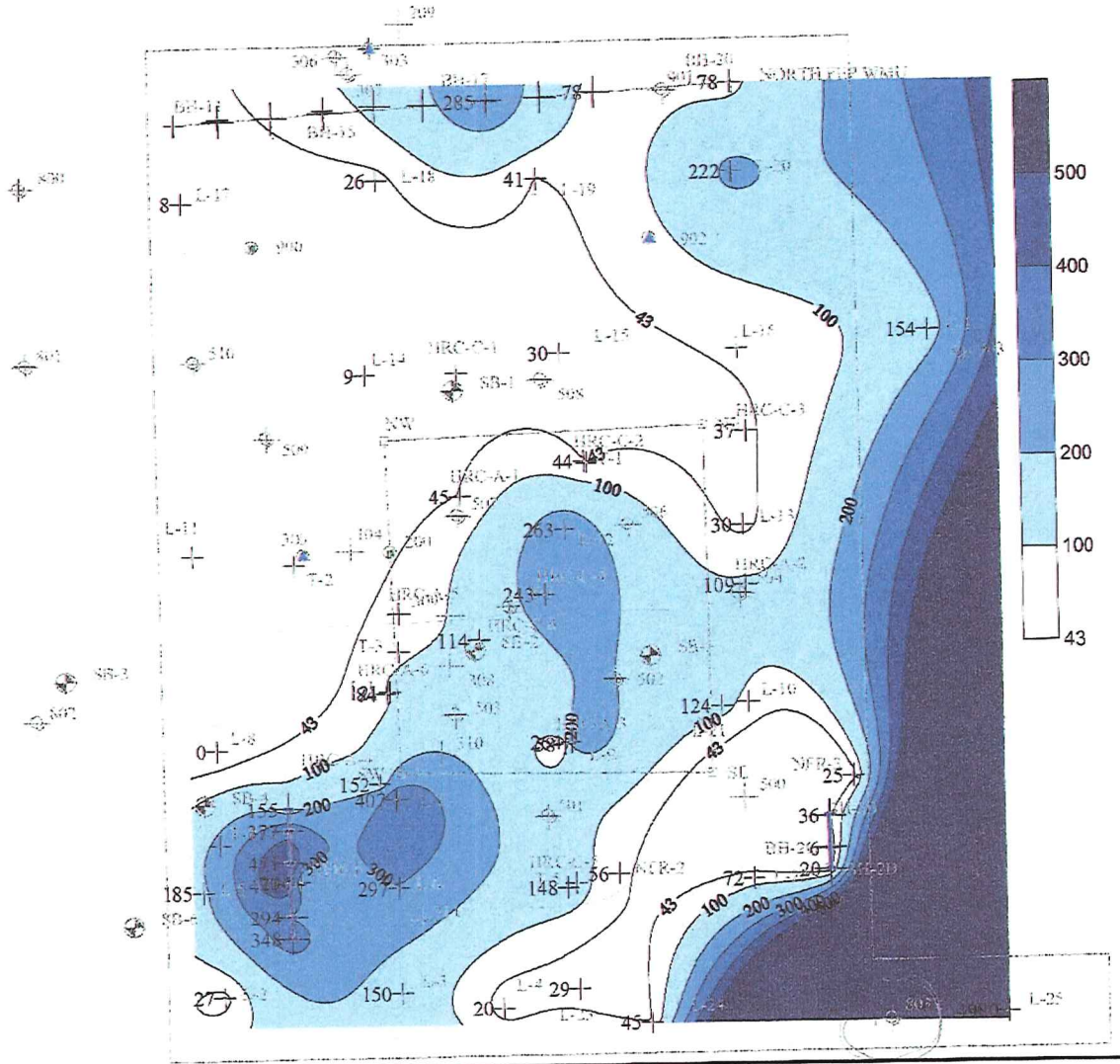
SHARP and Associates, Inc. Environmental Engineers and Scientists 982 Crupper Ave. • Columbus, OH 43229	DATE: 6/2/2003 SCALE: (Approx.) PROJECT: 2116	**Isoconcentration Map** Maximum Concentration of TCE Within The Gray Till Concentration in µg/kg	**Figure 20**



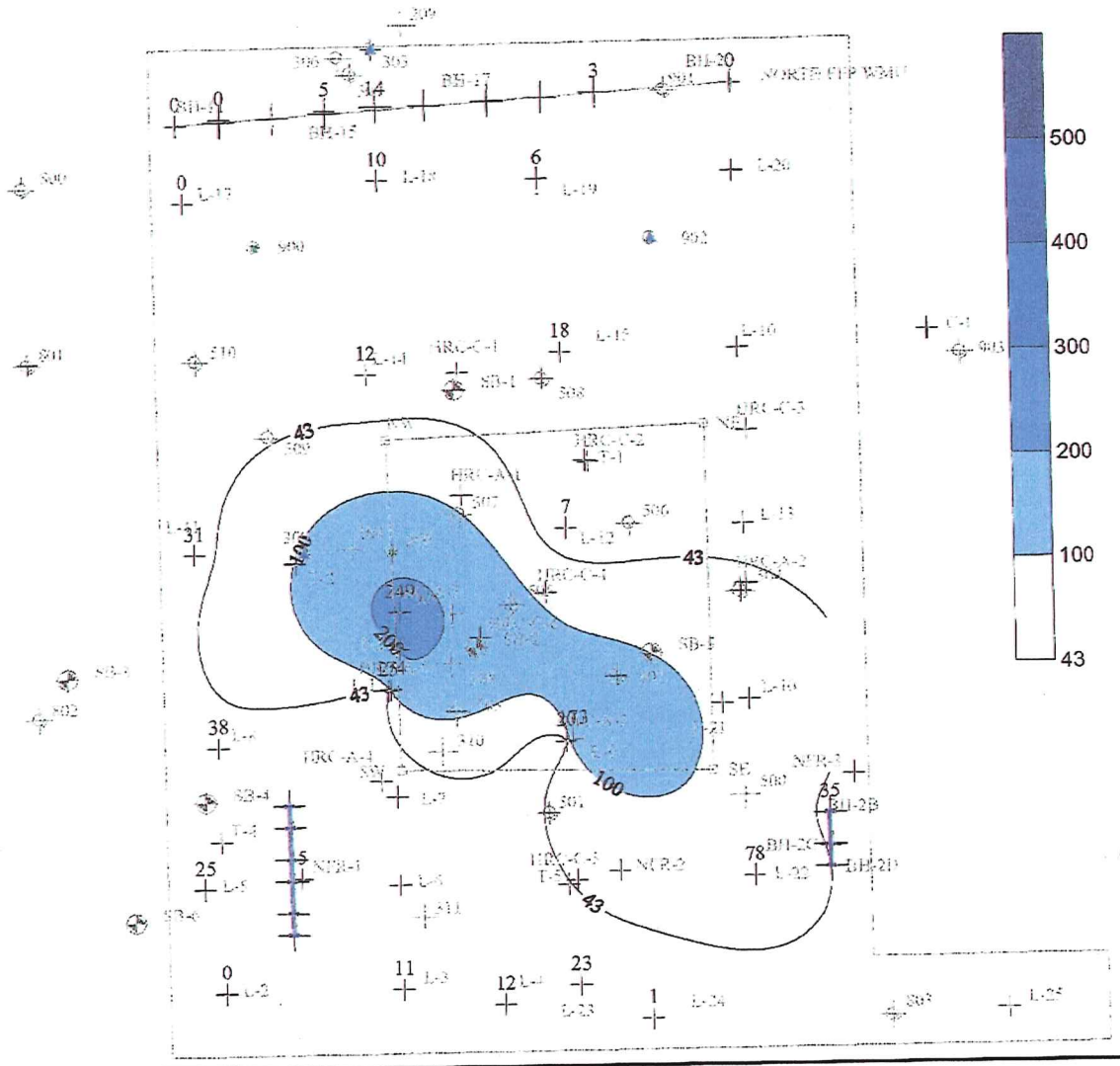
SHARP and Associates, Inc. Environmental Engineers and Scientists 982 Crupper Ave. • Columbus, OH 43229	DATE: 6/2/2003 SCALE: (Approx.) PROJECT: 2116	**Isoconcentration Map** Maximum Concentration of TCE Within The Gray Till Concentration in µg/kg	**Figure 20**



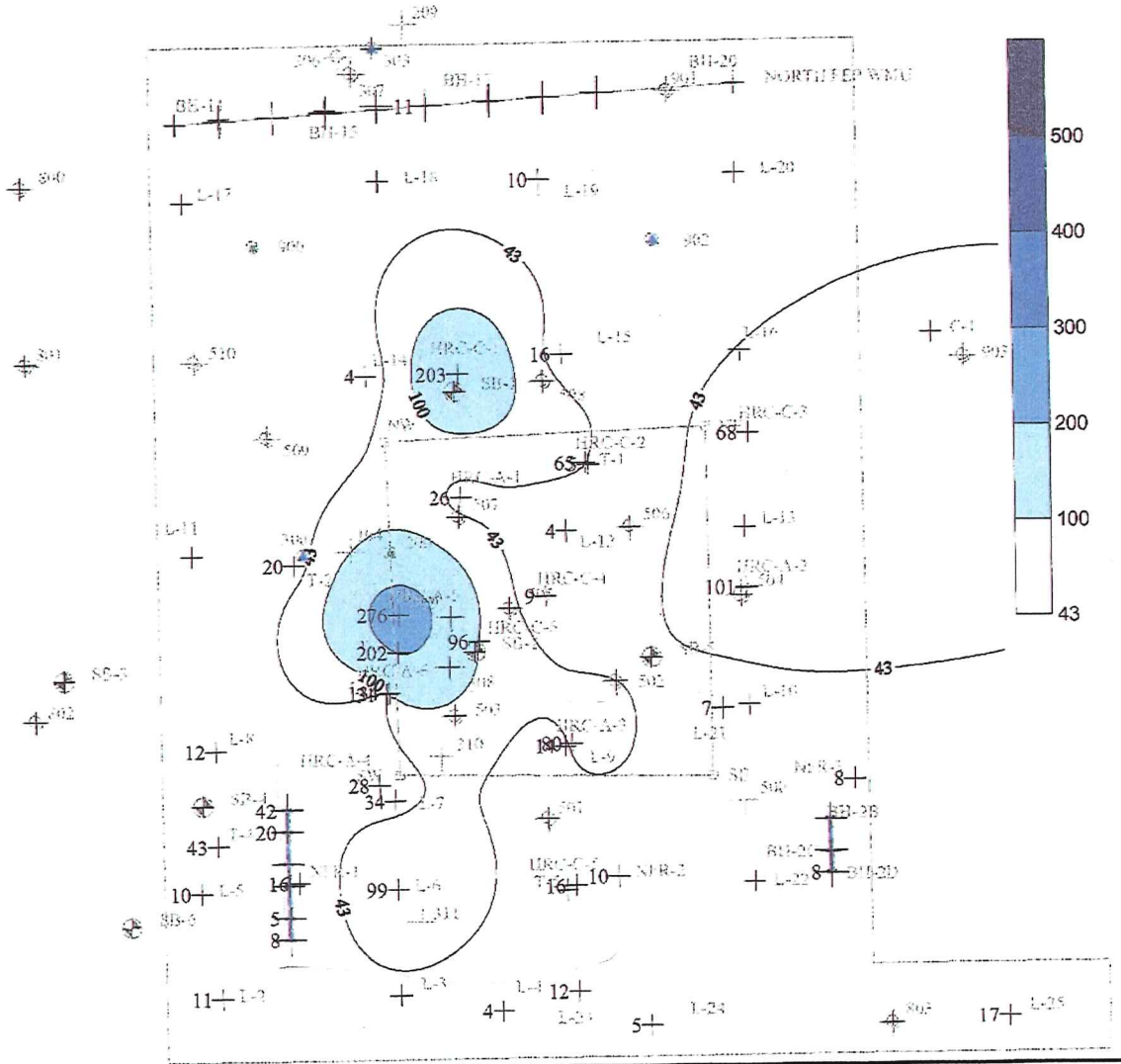
SHARP and Associates, Inc. Environmental Engineers and Scientists 982 Crupper Ave. • Columbus, OH 43229	DATE: 6/2/2003 SCALE: (Approx.) PROJECT: 2116	**Isoconcentration Map** Maximum Concentration of Total Uranium All Data Concentration in mg/kg	**Figure 21**



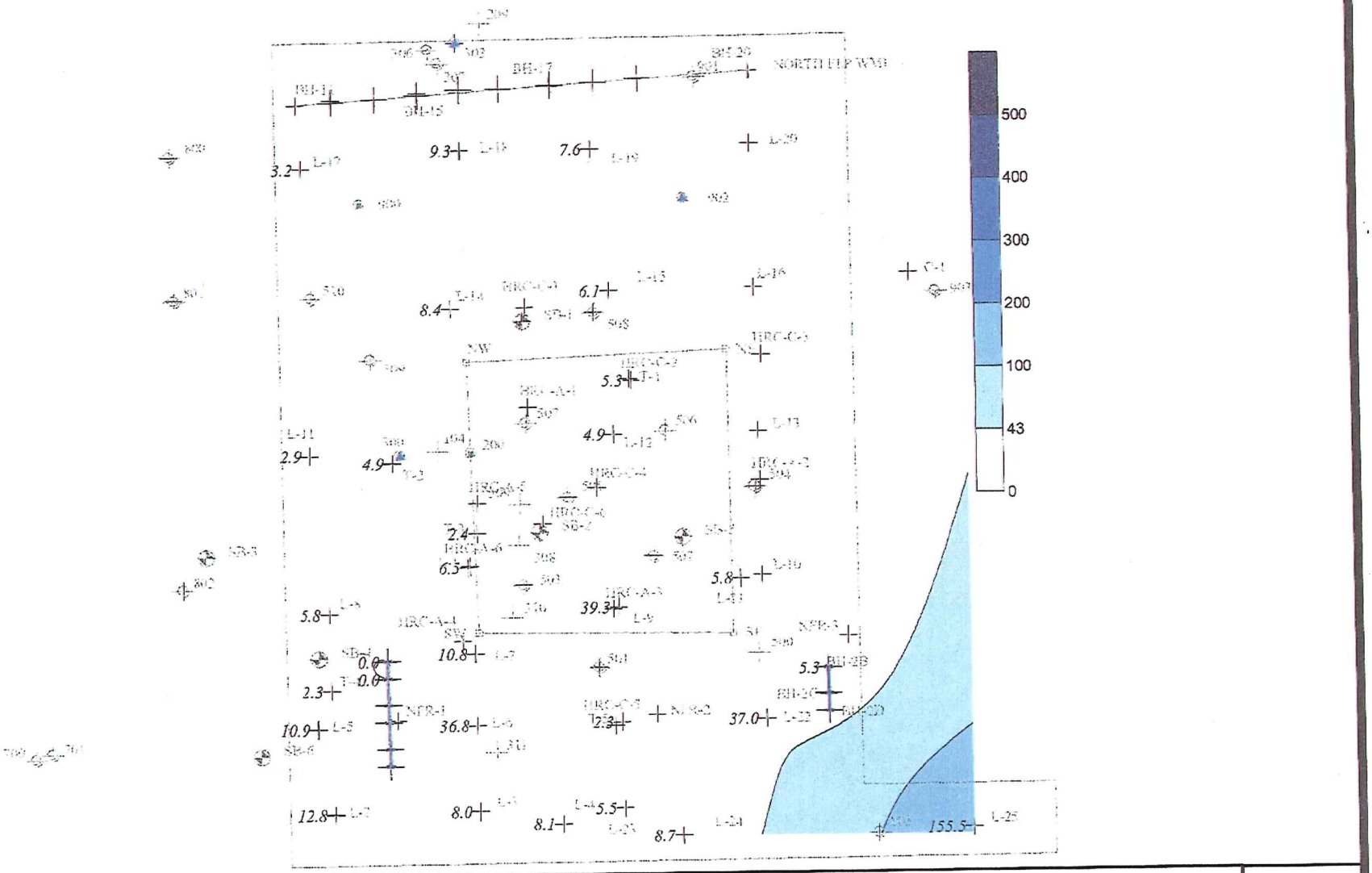
SHARP and Associates, Inc. Environmental Engineers and Scientists 982 Crupper Ave. • Columbus, OH 43229	DATE: 6/2/2003 SCALE: (Approx.) PROJECT: 2116	**Isoconcentration Map** Maximum Concentration of Total Uranium Within The Fill Concentration in mg/kg	**Figure 22**



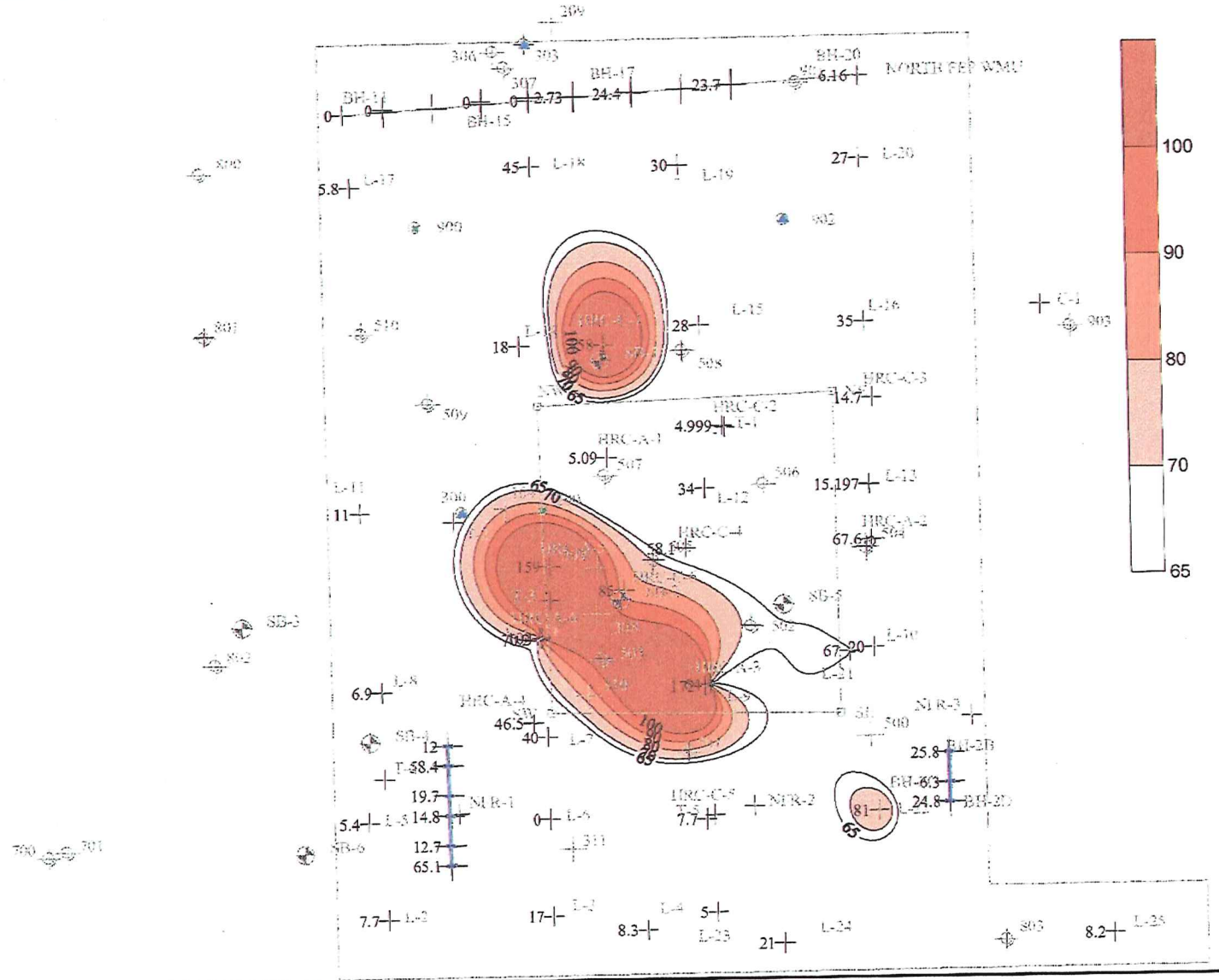
SHARP and Associates, Inc. Environmental Engineers and Scientists 982 Crupper Ave. • Columbus, OH 43229	DATE: 6/2/2003 SCALE: (Approx.) PROJECT: 2116	**Isoconcentration Map** Maximum Concentration of Total Uranium Within The Silt Concentration in mg/kg	**Figure 23**



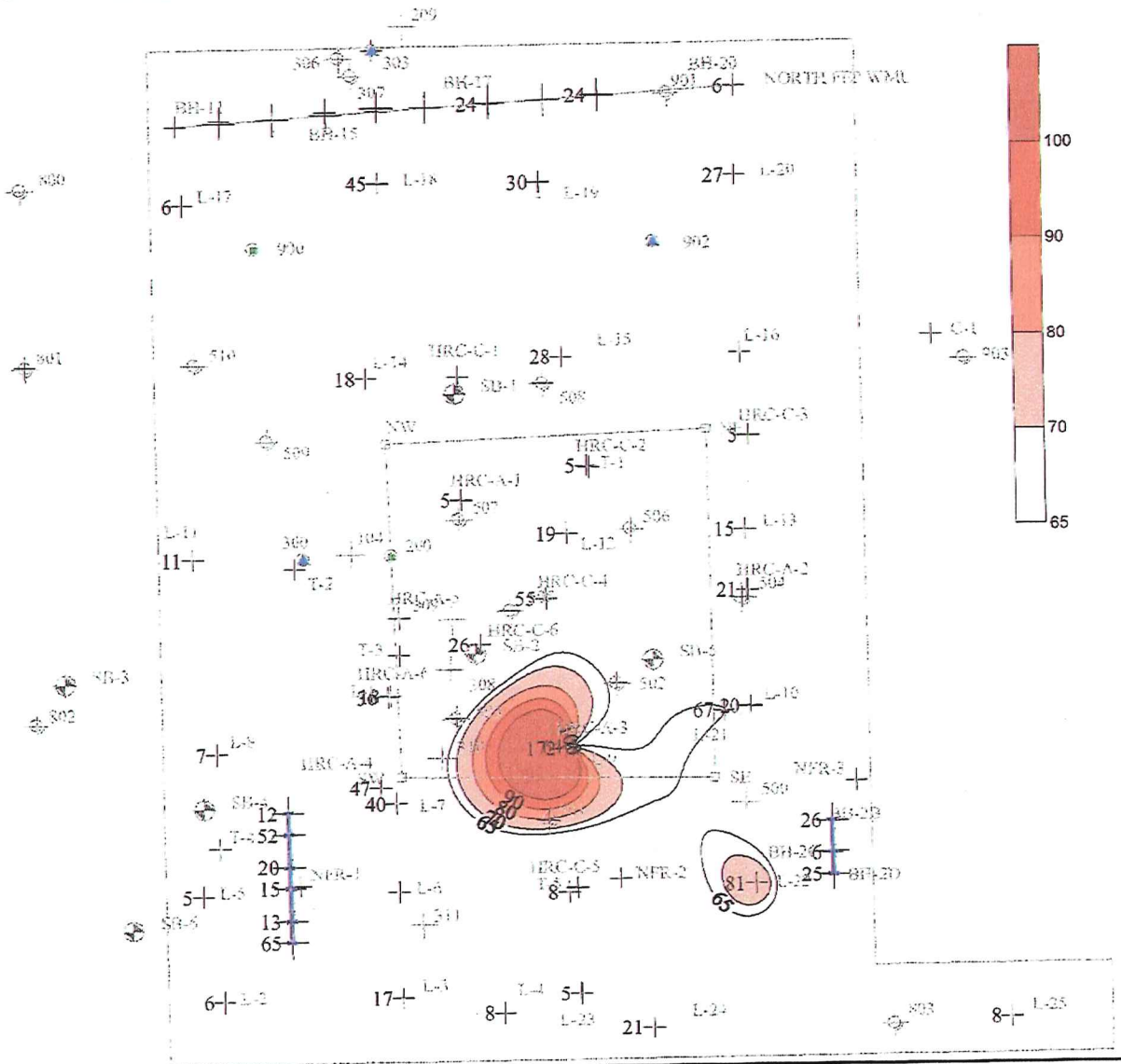
SHARP and Associates, Inc. Environmental Engineers and Scientists 982 Crupper Ave. • Columbus, OH 43229	DATE: 6/2/2003 SCALE: (Approx.) PROJECT: 2116	**Isoconcentration Map** Maximum Concentration of Total Uranium Within The Brown Till, Concentration in mg/kg	**Figure 24**



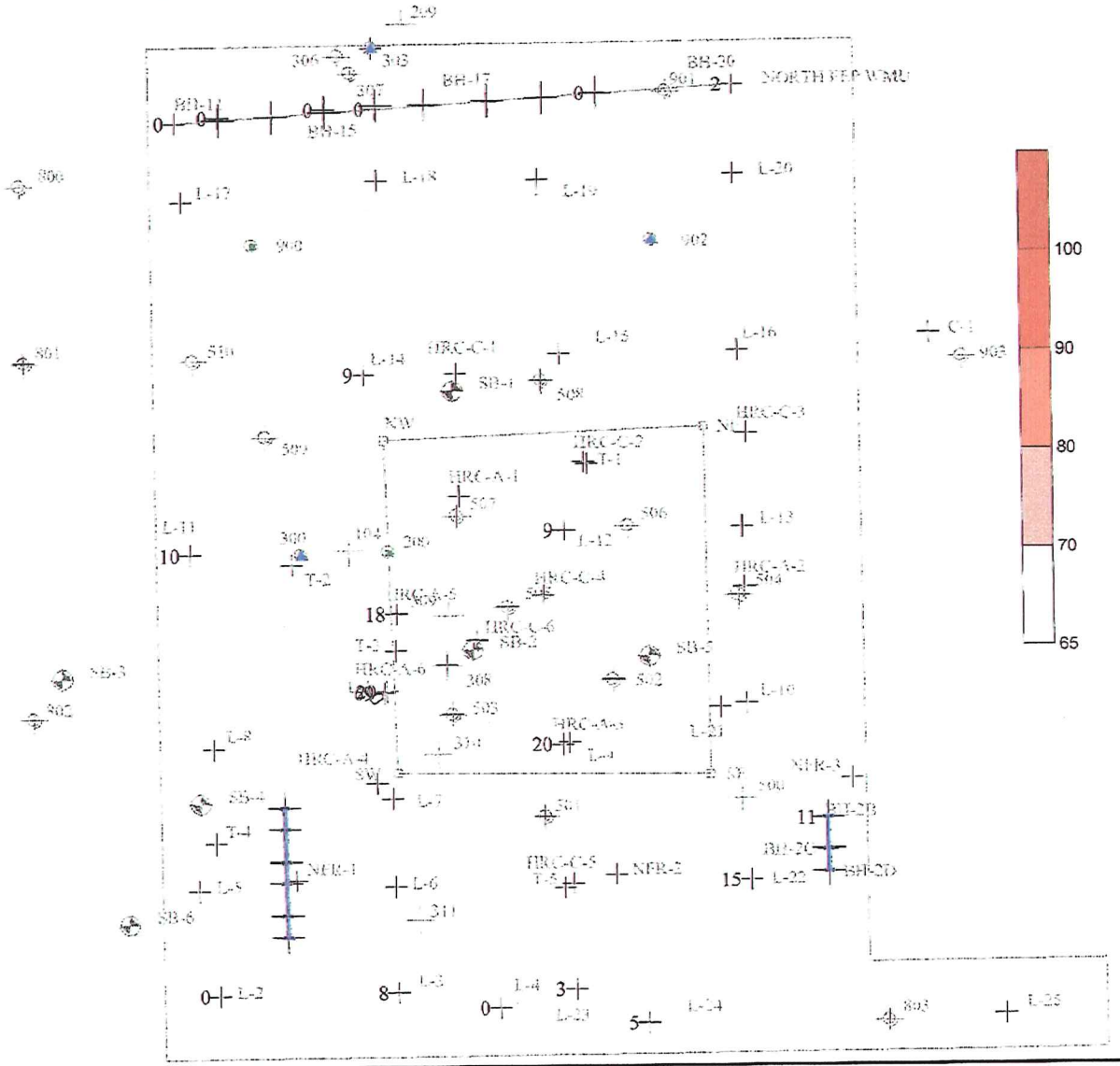
SHARP and Associates, Inc. Environmental Engineers and Scientists 982 Crupper Ave. • Columbus, OH 43229	DATE: 6/2/2003 SCALE: (Approx.) PROJECT: 2116	**Isoconcentration Map** Maximum Concentration of Total Uranium Within The Gray Till, Concentration in mg/kg	**Figure 25**



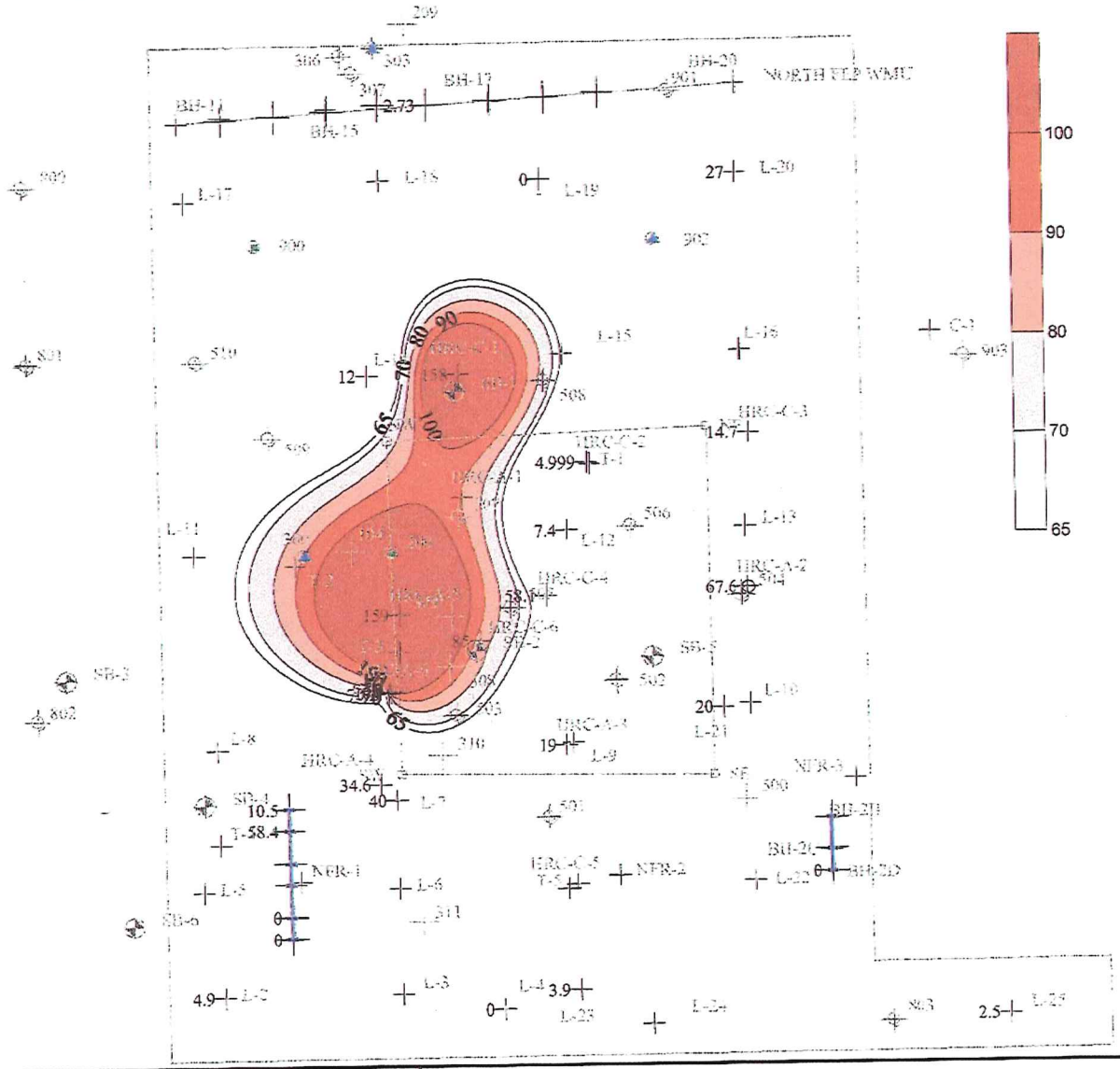
SHARP and Associates, Inc. Environmental Engineers and Scientists 982 Crupper Ave. • Columbus, OH 43229	**DATE:** 6/2/2003 **SCALE:** (Approx.) **PROJECT:** 2116	**Isoconcentration Map** Maximum Concentration of Technecium-99 All Data Concentration in pCi/g	**Figure 26**



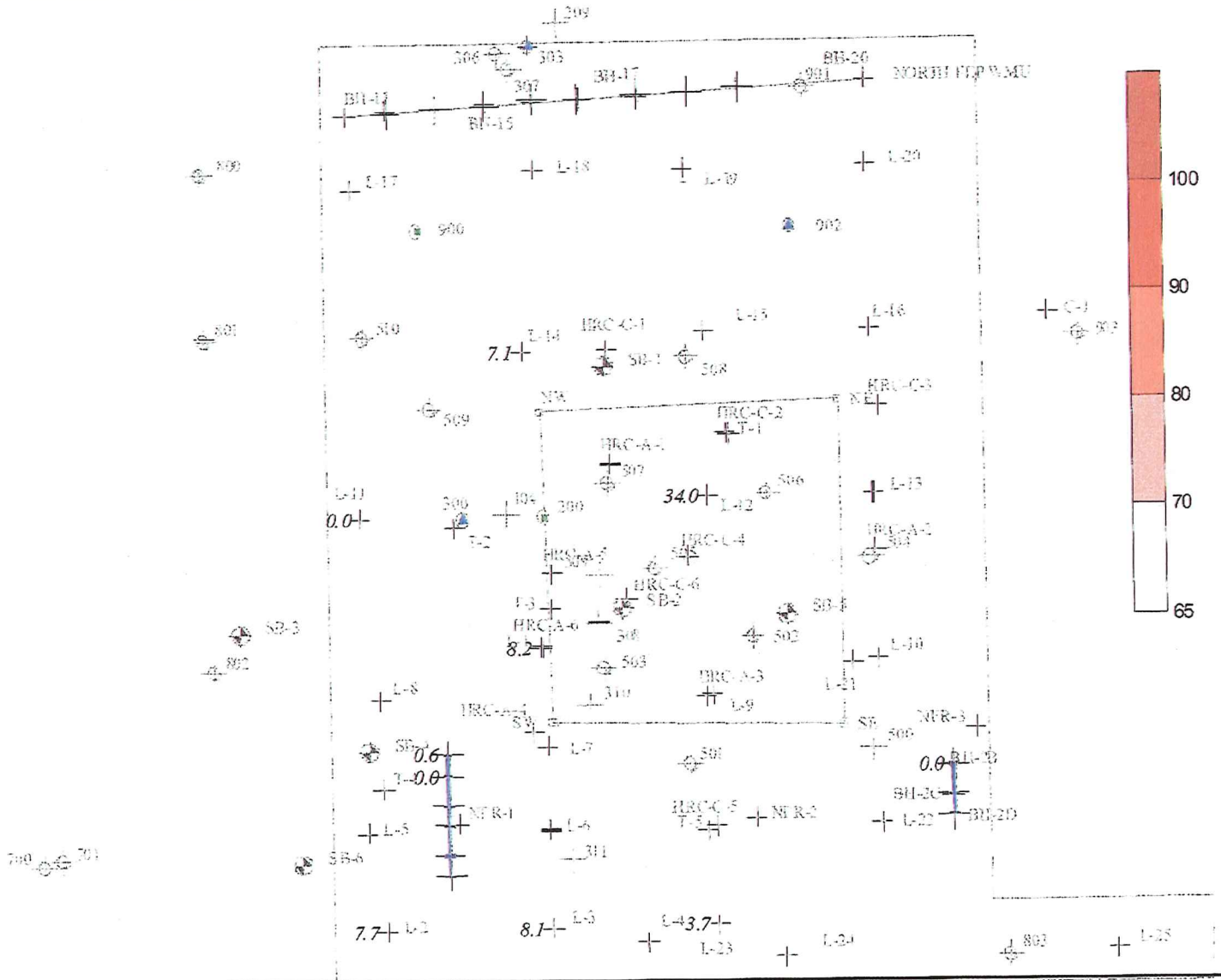
SHARP and Associates, Inc. Environmental Engineers and Scientists 982 Crupper Ave. • Columbus, OH 43229	DATE: 6/2/2003 SCALE: (Approx.) PROJECT: 2116	**Isoconcentration Map** Maximum Concentration of Technicium-99 Within The Fill Concentration in pCi/g	**Figure 27**



SHARP and Associates, Inc. Environmental Engineers and Scientists 982 Crupper Ave. • Columbus, OH 43229	DATE: 6/2/2003 SCALE: (Approx.) PROJECT: 2116	**Isoconcentration Map** Maximum Concentration of Technicium-99 Within The Silt Concentration in pCi/g	**Figure 28**



SHARP and Associates, Inc. Environmental Engineers and Scientists 982 Crupper Ave. • Columbus, OH 43229	DATE: 6/2/2003 SCALE: (Approx.) PROJECT: 2116	**Isoconcentration Map** Maximum Concentration of Technicium-99 Within The Brown Till, Concentration in pCi/g	**Figure 29**



SHARP and Associates, Inc. Environmental Engineers and Scientists 982 Crupper Ave. • Columbus, OH 43229	DATE: 6/2/2003 SCALE: (Approx.) PROJECT: 2116	**Isoconcentration Map** Maximum Concentration of Technicium-99 Within The Gray Till, Concentration in pCi/g	**Figure 30**