U.S. Army Corps of Engineers
New England District

FINAL
2005 ANNUAL REPORT
AREAS OF CONTAMINATION 32 AND 43A
LONG-TERM GROUNDWATER MONITORING

DEVENS, MASSACHUSETTS

CONTRACT GS-10F-0157K
DELIVERY ORDER NO. W912WJ-05-F-0036

Prepared for:

U.S. Army Corps of Engineers
New England District
Concord, Massachusetts

Prepared by:

MACTEC Engineering and Consulting, Inc.
Portland, Maine

MARCH 2007

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March 19, 2007

Mr. Randy Godfrey
U.S. Army Corps of Engineers
New England District
696 Virginia Road
Concord, MA 01742-2751

SUBJECT: **Final 2005 Annual Report**
Areas of Contamination 32 and 43A
Long-Term Groundwater Monitoring
Devens, Massachusetts

Dear Mr. Godfrey:

MACTEC Engineering and Consulting, Inc. is pleased to provide you with 2 copies of the subject document for your files and reference. Also enclosed is a CD-ROM containing a consolidated PDF file. The document has been reviewed for completeness; elimination of conflicts, errors, and omissions; and the overall professional and technical accuracy of the submission. Review comments have been addressed consistent with your direction. A copy of the Response to Comment memo for comments on the Draft 2005 Annual Report is included as Appendix J of the document.

We have forwarded copies of the subject document under copy of this letter as follows:

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Stanley W. Reed, P.E.
Principal Engineer

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Senior Scientist

by SWR with permission

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EXECUTIVE SUMMARY

This annual report documents the results of long-term monitoring activities performed in 2005 at Areas of Contamination (AOCs) 32 and 43A at Devens, Massachusetts (the former Fort Devens). Fort Devens was identified for cessation of operations and closure under Public Law 101-510, the Defense Base Closure and Realignment Act of 1990 (BRAC Act, or BRAC), and was officially closed in September 1996. AOCs 32 and 43A are located in Transfer Lot 10, an area transferred to MassDevelopment and redeveloped as a warehouse in 2001.

AOCs 32 and 43A are historically contaminated locations in the northeast portion of what was the Main Post at the former Fort Devens, near the intersection of Cook and Market Streets and just south of Shepley's Hill Landfill. AOC 32 comprises the former Defense Reutilization and Marketing Office (DRMO) West Yard, East Yard, Tire Recycling Yard, office, and warehouse. The DRMO East Yard and office are now covered by the northern third of the current warehouse. The primary contaminants at AOC 32 are detected in groundwater in the vicinity of the former location of waste oil underground storage tank (UST) No. 13 and consist of chlorobenzene, dichlorobenzenes, trichloroethene (TCE), and volatile petroleum hydrocarbons. The former location of UST No. 13 lies above the eastern portion of a north-south trending bedrock ridge beneath the warehouse. UST No. 13 was installed just above shallow bedrock. There is no overburden aquifer at the former location of UST No.13, and contamination extends into bedrock.

AOC 43A, the former Petroleum, Oil, and Lubricants (POL) Storage Area, is located adjacent to AOC 32. AOC 43A is mostly covered by the western third of the warehouse and paved areas west of the warehouse. Contaminants historically detected at the POL area include total petroleum hydrocarbons, TCE, benzene, toluene, ethylbenzene, and xylene. Arsenic and manganese have also been detected above cleanup goals and may be attributed to reducing conditions caused by the contaminants. AOC 43A lies to the west of the bedrock ridge. Bedrock is deeper at AOC 43A than at AOC 32, and the water table at AOC 43A lies within overburden materials.

The U.S. Army Corps of Engineers – New England District collected groundwater elevation data in June and October 2005 at a total of 27 monitoring wells at AOCs 32 and 43A to aid in assessing groundwater flow and contaminant migration. Analytical samples were collected at nine AOC 32 and nine AOC 43A monitoring wells. Interpretive groundwater elevation contours based on 2005 data indicate contaminant migration potential is to the east in the vicinity of UST No. 13 before turning north to northeast with regional flow. At AOC 43A, contaminant migration potential is interpreted to be southerly near the northwest corner of the warehouse before turning to the southwest and west across the southern end of Shepley's Hill and along a westward trending bedrock trough. Bedrock groundwater flow at AOC 43A is interpreted to be to the southwest. It should be noted however, that actual bedrock groundwater flow directions at both AOCs are determined by both hydraulic gradients and fracture orientation. These interpretations are consistent with the conceptual site model for the sites.

Analytical samples collected at AOC 32 monitoring wells showed persistent exceedances of cleanup goals at monitoring well 32M-01-18XBR, located immediately south of the UST No. 13 tank grave, although dichlorobenzene concentrations were lower in October 2005 than in several previous sampling events. This decrease in contaminant concentrations is encouraging; however, continued sampling is necessary to determine whether this is part of a trend or, alternately, reflective of groundwater and sampling/analysis variability. The only other AOC 32 exceedances were for arsenic, lead, and manganese in well pair 32M-01-14XOB/-14XBR approximately 180 feet northeast of the UST No. 13 tank grave. Arsenic, lead, and manganese have not been shown to be associated with UST 13, and their source has not been identified.

High arsenic and manganese concentrations could be associated with reducing conditions created by degrading organic material. No contaminant exceedances were noted in other AOC 32 monitoring wells, several of which are located in the vicinity of 32M-01-18XBR and the former location of UST No. 13. These wells show no evidence of the migration of contaminants away from the UST No. 13 area at levels of concern.

Because analytical samples collected at AOC 43A in June, similar to samples collected in 2003, and 2004, did not show any cleanup goal exceedances, AOC 43A samples were not collected in October 2005, in accordance with the recommendation of the 2004 annual report.

Groundwater flow directions interpreted from 2005 data appear consistent with historical interpretations in spite of recent construction at Transfer Lot 10 and use of a different array of monitoring wells from which to collect data.

In addition to the monitoring well inspection performed during sampling activities, AOC 32 and 43A monitoring wells were inspected in detail in December 2005 and January 2006 to identify maintenance needs and priorities. The inspection identified the need for several new road boxes and other maintenance items. Maintenance activities were performed in January 2006 and included replacing or resetting the road boxes and/or surface seal for 12 wells. In addition, the internal riser of one well was repaired, and three wells were redeveloped.

Recommendations for 2006 sampling consist of the following:

- Discontinue sampling for chemical analysis at SHL-15 and 32M-92-01X, but retain for groundwater elevation measurements.
- With the exception of SHL-15 and 32M-92-01X, continue monitoring contaminant trends, seasonal effects, and geochemical trends (dissolved oxygen, oxidation-reduction potential) in the same wells monitored in October 2005.
- With the exception of SHL-15 and 32M-92-01X, continue semiannual sampling frequency in the same wells monitored in October 2005.
- Complete preparation of an updated Long-term Monitoring Plan for the combined sites to reflect the warehouse post-construction conditions.
- Measure groundwater elevations at all AOC 32 and 43A wells for use in plotting groundwater contours and evaluating flow directions.

1.0 INTRODUCTION

This annual report documents the results of long-term monitoring activities performed in 2005 at Areas of Contamination (AOCs) 32 and 43A, Devens, Massachusetts. Long-term monitoring activities were completed by the U.S. Army Corps of Engineers (USACE) - New England District in accordance with the Record of Decision (ROD) (Horne, 1998), and the approved Long-Term Monitoring Plans (LTMPs) (SWETS, 2001a, 2001b). MACTEC Engineering and Consulting, Inc. (MACTEC) prepared this annual report as a component of Contract GS-10F-0157K, Delivery Order W912WJ-05-F-0036, under the direction of the USACE - New England District. This annual report covers June and October 2005 sampling events.

Fort Devens was identified for cessation of operations and closure under Public Law 101-510, the Defense Base Closure and Realignment Act of 1990 (BRAC Act, or BRAC), and was officially closed in September 1996. Portions of the property formerly occupied by Fort Devens were retained by the Army and renamed the Devens Reserve Forces Training Area (RFTA). Areas not retained as part of the Devens RFTA were, or are in the process of being transferred to new owners for reuse and redevelopment. AOCs 32 and 43A are located in Transfer Lot 10, an area transferred to MassDevelopment and redeveloped as a warehouse in 2001. Because residual groundwater contamination remains at AOC 32, the Army continues to perform long-term monitoring at the AOCs.

AOCs 32 and 43A are historically contaminated locations in the northeast portion of what was the Main Post at the former Fort Devens (Figure 1-1). AOC 32 comprises the former Defense Reutilization and Marketing Office (DRMO) West Yard, East Yard, Tire Recycling Yard, office, and warehouse located near the former intersection of Cook and Market Streets (Figure 1-2). The DRMO East Yard and office are now covered by the northern third of the current warehouse (Figure 1-3). AOC 43A, the former Petroleum, Oil, and Lubricants (POL) Storage Area, is located east of Cook Street and between the former locations of Market Street to the north and Antietam Street to the south (Figure 1-2). An extensive bedrock outcrop existed just outside the fence defining the eastern edge of AOC 43A. AOC 43A is now mostly covered by the western third of the warehouse and paved areas west of the warehouse (Figure 1-3).

The land surfaces at AOCs 32 and 43A were modified by the construction of a large warehouse that was completed in 2001 (Figures 1-2 and 1-3). Bedrock outcrops east of the DRMO East Yard and east of the POL Storage Area were removed to make room for construction of the warehouse, and the warehouse and pavements cover major portions of both AOCs, altering local recharge patterns to overburden and bedrock and potentially altering the site hydrology. Most existing monitoring wells were destroyed in the process. New replacement monitoring wells were installed at locations to monitor groundwater flow patterns and contamination around former release points.

A Site Investigation (SI), Remedial Investigation (RI), and a Feasibility Study (FS) were completed for each AOC, but the sites were combined administratively under one ROD and are combined in one section of the Five-Year Site Review (HLA, 2000, Nobis, 2005). There are separate Monitored Natural Attenuation (MNA) Reports (SWETS, 2000b and 2000c) and current LTMPs are appendices to them (SWETS, 2001a and 2001b).

1.1 AOC 32 BACKGROUND

AOC 32 was an active materials storage facility from at least 1964 to 1995. It consisted of three fenced areas where various materials were processed and stored. The former location of 5,000-gallon waste oil underground storage tank (UST) No.13, located northeast of the DRMO office (Building T-204), is also included in AOC 32. The DRMO Yard on the west side of Cook Street (West Yard) contained used equipment, including lead-acid batteries, telecommunications equipment, and administrative equipment. The yard on the east side of Cook Street (East Yard) was used for disassembling vehicles and contained scrap metal, tires, stored items ready for sale, and used photographic solutions. The Tire Recycling Yard bordered the north edge of the East Yard.

Upon excavation and removal in 1992, UST No.13 was found to be in good condition with no holes, perforations, or severe corrosion (ATEC, 1994). Associated piping appeared to be in good condition; however, soil located at the south end of the tank in the vicinity of the fill port appeared contaminated. In addition, soil within the excavation along the bottom and at the south end was contaminated and had a petroleum odor. Approximately 227 cubic yards (369 tons) of waste-oil contaminated soil was removed and disposed of off-site as part of the tank excavation. Bedrock was encountered at between five and nine feet below grade. Figure 1-3 shows the footprint of the new warehouse overlying former AOC 32 features.

1.2 AOC 43A BACKGROUND

AOC 43A consisted of a fenced lot that served as the central distribution point for all gasoline stations at Fort Devens during the 1940s and 1950s, and was subsequently used to store fuels for various purposes. Early configurations of the distribution facility consisted of a main gasoline station (T-401) and a pump house associated with two 12,000-gallon aboveground storage tanks (ASTs) and two 8,000-gallon ASTs, and a second gasoline pump house (T-186) which was associated with four 12,000-gallon USTs and one 10,000-gallon UST (Figure 1-2). Gasoline was delivered by rail car and transferred to tanks (Horne, 1998).

Between 1965 and 1972, four ASTs located in pit behind T-401 were removed, and in 1989 and 1990, three USTs and 800 cubic yards of soil were removed from beneath the pump house (Ecology and Environment [E&E], 1994; Horne, 1998). Also in 1989 and 1990, five USTs located near the pump house and listed as storage tanks for fuel oil were excavated. By 1990 all the historical USTs and ASTs had been removed and replaced with 5 double-wall fiberglass 20,000-gallon USTs that were used to store fuel for military vehicles. These 20,000 gallon tanks were removed in 1998 are not known to have been a source of contamination (Dames & Moore, 1998a, b, c, d, and e). Figure 1-3 shows the footprint of the new warehouse overlying former AOC 43A features.

1.3 RECORD OF DECISION FOR AOC 32 AND AOC 43A

A ROD for the combined sites was signed in February 1998 (Horne, 1998). The selected remedy for the AOC 32 Soils Operable Unit was Alternative 6: Excavation and Off-site Disposal. The key components of this alternative consisted of the following:

- Excavation of 1,300 cubic yards of contaminated soil and asphalt from the central portion of the East Yard
- Disposal of excavated material at an off-site location
- Backfill and revegetation
- Monitoring groundwater after five years

The selected remedy for the AOC 32 UST 13 Groundwater Operable Unit and the AOCs 32 and 43A Groundwater Operable Unit was MNA (with long-term monitoring). The key components of this alternative consisted of the following:

- Establishing institutional controls to prevent intrusion into or installation of wells into the known areas of bedrock contamination;
- Allowing for MNA by naturally occurring microorganisms in the groundwater;
- Installing additional groundwater monitoring wells;
- Collecting and incorporating additional field data into groundwater flow and contaminant transport models;
- Performing long-term monitoring and reporting annually on groundwater quality;
- Reviewing field data, modeling predictions, and compliance with applicable or relevant and appropriate requirements at five-year intervals; and
- Reviewing the need for continued monitoring and additional action at the site every five years for 30 years or until contamination is reduced to acceptable concentrations.

The evaluation of contaminants and potential receptors at AOCs 32 and 43A considered that the sites would remain in an area restricted by deed to include limited development and a ban on the installation of wells for drinking water. The current combination of parking lot development and a warehouse (industrial use) is compatible with that intention, and no zoning changes are anticipated.

Groundwater is not to be available for human consumption. There is limited surface water and no identified aquatic habitat (an infiltration basin at the south-west corner of the warehouse is normally dry, with the water table estimated to be at least 10 feet below the bottom elevation of the basin).

If the MNA results indicate that the groundwater contamination plume cannot be remediated within 30 years, appropriate additional cleanup actions are to be evaluated and implemented. If there is an indication that contaminants are migrating into the currently established Zone II boundary or an area sufficiently inside that boundary according to criteria in the ROD (that at a minimum will meet drinking water standards), then the Army will implement an additional remedial action which will be protective of human health and the environment.

Because the selected remedies may result in hazardous substances remaining on-site in soil and ground water above certain health-based exposure levels, five-year reviews will be performed to ensure that the remedy at each AOC continues to provide adequate protection of human health and the environment.

1.4 SUMMARY OF MONITORED NATURAL ATTENUATION ASSESSMENT REPORTS

Quarterly groundwater sampling completed between January and October 1999 at AOCs 32 and 43A demonstrated that the contaminant plume did not appear to be migrating further, and semi-annual sampling rounds were recommended to monitor the downward trend of concentrations over time (SWETS, 2000b and 2000c). It was concluded that additional sampling was needed to determine whether the future warehouse would have an effect on the migration of contaminants or groundwater contours. Subsequently, a separate LTMP for each AOC was issued in April 2001 as Volume II, Appendix E to each report (SWETS, 2001a and 2001b).

1.4.1 AOC 32 Monitored Natural Attenuation Results

Additional piezometers and monitoring wells were installed in 1999 for a total of thirteen sampling points. Geochemical parameters were measured and the Mann-Kendall test was used to assess the statistical trend for wells where contaminants exceeded a cleanup goal, such as individual carbon range fractions comprising extractable petroleum hydrocarbons (EPH) or volatile petroleum hydrocarbons (VPH). Four data points were developed and trends for organics were downward, except for C_9-C_{10} aromatics, which did not have a definable trend. Inorganics were not evaluated. Predominant metals exceeding clean-up goals were arsenic, lead, and manganese.

There was no significant change required to the remedies specified in the ROD.

1.4.2 AOC 43A Monitored Natural Attenuation Results

Ten monitoring wells and four small-diameter microwells were available in 1999 for quarterly groundwater sampling. Natural attenuation parameters were measured as for AOC 32. The Mann-Kendall test was used to assess a statistical loss in contaminant concentrations. Four EPH and VPH data points were developed, and only trichloroethene (TCE) showed a downward trend. The other results were qualified. The Mann-Kendall tests were still calculated for inorganics. Most metals showed downward trends.

There was no significant change required to the remedies specified in the ROD.

1.5 SUMMARY OF LONG-TERM MONITORING PLANS

A LTMP for each AOC was prepared as Appendix E to each MNA Report (SWETS, 2001a and 2001b). The new warehouse was in its planning stage when the LTMPs were prepared, and the LTMPs described future groundwater sampling locations, frequency, and analyses. They also described components specified in the ROD to assess/report remedial progress, and establish specific performance standards for assessment. However, because each plan has some component that is specific to its AOC, a brief summary is provided.

1.5.1 AOC 32 Long-Term Monitoring Plan

The 2001 LTMP for AOC 32 is based on the interpretation that a north-south trending bedrock ridge lies under the former location of the DRMO Office and forms a groundwater divide. Groundwater east of the bedrock ridge was interpreted to flow generally to the east, while groundwater west of the ridge was interpreted to flow generally to the southwest. The UST No.13 area is near the centerline of the divide; however, groundwater was interpreted to flow to the east, which was considered when placing monitoring wells and borings. At the time of LTMP preparation, AOCs 32 and 43A were undergoing modification with the construction of a warehouse, and most existing monitoring wells were destroyed. The LTMP included the following items:

- Installing sixteen monitoring wells and piezometers to replace wells destroyed/abandoned during warehouse construction.
- Sampling designated monitoring wells for VPH, EPH, volatile organic compounds (VOCs), polychlorinated biphenyls (PCBs), manganese, arsenic, and lead.
- Monitoring groundwater levels quarterly at new and existing (32M-92-01X, 32Z-99-02X, and 32M-92-03X) monitoring wells on a quarterly basis for one year to observe the influence of the new building. Once the groundwater contours had stabilized, additional sentry wells would be installed, as necessary, based on flow direction.
- Installing additional wells, if needed, to identify flow directions.

Contaminant migration assessment had the following components:

- Natural attenuation would continue to be considered effective if the plume with concentrations exceeding cleanup goals did not increase in size and migrate from Lot 10.
- No additional wells would be installed if the contaminants of concern showed a reduction in concentration, demonstrating that MNA is working. Additional field actions might be implemented if cleanup goal exceedances were detected. Recommendations would be made in the Annual Report.
- NA would continue to be considered effective if contaminants of concern are being reduced to levels within the duration criteria in the ROD. The Mann-Kendall test would be used to assess for statistical loss in contaminant concentrations. Ideally, four to ten data points would be needed. Mann-Kendall statistics were provided only for those wells where contaminants exceeded a clean-up goal, such as the individual carbon range fractions that comprise VPH or EPH.
- The need for additional assessment/remedial action would be evaluated if contaminants of concern were not being reduced in the source wells. Trend analyses would be conducted every five years, to coincide with the Five-year Review, on source area wells with contaminants of concern exceeding cleanup concentrations.

1.5.2 AOC 43A Long-Term Monitoring Plan

The 2001 LTMP for AOC 43A is based on the interpretation that the AOC lies west of the north-south trending bedrock ridge and that groundwater beneath AOC 43A flows generally to the southwest. At the time of LTMP preparation, AOCs 32 and 43A were undergoing modification with the construction of a warehouse, and most existing monitoring wells were destroyed. The LTMP included the following items:

- Installing six monitoring wells to replace wells destroyed/abandoned during warehouse construction.
- Sampling designated monitoring wells semiannually for VPH, EPH, VOCs, PCBs, manganese, arsenic, and lead.
- Monitoring groundwater levels quarterly at new and existing (43M-93-05X and Campanelli property wells 63BD9901 through 63BD9904) monitoring wells on a quarterly basis for one year to observe the influence of the new building. Once the groundwater contours had stabilized, additional sentry wells would be installed, as necessary, based on flow direction.
- Installing additional wells, if needed, to identify flow directions.

Contaminant migration assessment had the following components:

- Natural attenuation would continue to be considered effective if the plume with concentrations exceeding cleanup goals did not increase in size and migrate from Army property.
- No additional wells to be installed if reduced chemical of concern concentrations demonstrate that MNA is working. New field actions possible if uncharacteristic cleanup goal exceedances were detected. Recommendations to be made in the Annual Report.
- NA would continue to be considered effective if contaminants of concern are being reduced to levels within the duration criteria specified in the ROD. The Mann-Kendall non-parametric rank correlation trend analysis method was proposed to be used to assess statistical trends in contaminant concentrations. Mann-Kendall statistics would be provided only for those wells where contaminants exceeded a clean-up goal, such as the individual carbon range fractions that comprise VPH or EPH.
- The need for additional assessment/remedial action would be evaluated if contaminants of concern were not being reduced in the source wells. Regression analyses would be conducted every five years, to coincide with the Five-year Review, on source area wells with contaminant of concern that exceed cleanup concentrations.

New monitoring wells would be placed to determine groundwater contours first, and then to conduct monitoring according to the following guidance:

- As quarterly groundwater sampling conducted in 1999 demonstrated that the plume did not appear to be migrating further, semi-annual rounds would determine the downward trend of concentration over time.

- Additional sampling would be needed to determine if the warehouse and its associated pavements were found to be affecting the migration of contaminants or groundwater contours. Six wells were installed in 2001 to help with this assessment.

1.5.3 Post-Construction Replacement Wells and Piezometers

Wells replacing those destroyed during the warehouse construction were installed during December 2001 and January 2002 following discussion of the number and locations of the wells by USACE and regulators. Factors that determined locations were historic release areas, known bedrock locations, needed hydraulic gradient monitoring points, and spatial distributions. The resulting set of wells was considered adequate to define any plume migration from the former source areas, as envisioned in the ROD.

As a result of the installation of additional wells, four pre-existing and 14 replacement monitoring wells became available for groundwater chemical sampling. Twenty-six monitoring wells and piezometers became available for measuring water levels to evaluate groundwater flow direction around the warehouse. The spatial distribution of the wells relative to bedrock topography is discussed below.

The former AOC 32 UST site is situated beneath pavement along the outside edge of the warehouse over the eastern portion of an apparent rock ridge, which creates a hydraulic gradient and interpreted contaminant migration potential to the east. The monitoring wells and piezometers are distributed as follows:

- Three bedrock source area wells (32M-01-13XBR, 32M-01-15XBR, and 32M-01-18XBR) surround and are hydraulically downgradient of the former UST No. 13 site;

- Two bedrock wells (32M-01-16XBR, 32M-01-17XBR), one overburden/bedrock well pair (32M-01-14XOB/-14XBR), and well SHL-25 are sentry wells;

- Bedrock piezometer 32Z-01-10XBR and bedrock piezometer/well 32M-01-04XBR are on the flanks of the southern rock mound and are interpreted to be hydraulically cross gradient, but along strike south of the former location of UST No. 13.

- Bedrock piezometer 32Z-01-06XBR is interpreted to be hydraulically cross gradient, but along strike north of the former location of UST No. 13.

- Piezometer 32Z-99-02X provides water table control southeast of the UST No. 13 area.

Monitoring wells and piezometers 32M-01-01X, 32Z-01-07XOB, 32Z-01-08XOB, 32Z-01-11XBR, and 32Z-01-12XBR are southwest of a northwest-southeast trending groundwater divide north of the warehouse and provide hydraulically upgradient information for AOC 43A. Monitoring well SHL-15 is located northeast of the divide and helps confirm its presence.

The overburden/bedrock well pairs 43M-01-17XOB/-17XBR are considered to be AOC 43A source area wells; and well pairs 43M-01-16XOB/-16XBR and 43M-01-20XOB/-20XBR are

considered sentry well pairs. Existing well 32M-92-03X appears to be hydraulically cross-gradient to the POL source area, but is used as a sentry well. The two overburden piezometers 32Z-01-05XOB and 32Z-01-09XOB provide additional points to help determine groundwater flow directions on the west side of the warehouse.

1.5.4 Changes to Long-Term Monitoring Plans and Activities

Table 1-2 summarizes changes to LTMP that have been implemented since 2001.

No additional monitoring wells have been constructed as a result of any findings at the AOCs.

2.0 CONCEPTUAL SITE MODEL

This conceptual site model (CSM) has been prepared to summarize information on contaminant source areas, geology and hydrogeology, contaminant migration pathways, and potential receptors at AOCs 32 and 43A. It takes into account the changes to bedrock topography and potential changes to the local groundwater flow systems from decreased infiltration due to the warehouse and paved areas. The CSM will be updated, as appropriate, as more information about AOCs 32 and 43A becomes available.

2.1 CONTAMINANT SOURCE AREAS

There are two primary historical contaminant source areas at the Site, the former location of waste oil UST No.13 at AOC 32 and the former POL Area UST and AST locations at AOC 43A (Figures 1-2 and 1-3). Contaminants detected in the vicinity of UST No. 13 consist of chlorobenzene, dichlorobenzenes, TCE, and VPH. Inspection of the tank upon removal in 1992 showed that the tank was dented, but there were no holes or severe corrosion (ATEC, 1994). Contaminants are believed to have been released via surface spills or leaks in associated piping or appurtenances. Arsenic and manganese have also been detected above cleanup goals and may be attributed to reducing conditions caused by biodegradation of organic contaminants. Contaminated soils associated with the tank were excavated to a depth of approximately 9 feet and disposed offsite. Confirmatory samples collected during the UST No. 13 removal indicate that the bulk of the soil contamination was removed during the tank removal. Limited residual contaminants may remain, however, at the bedrock/overburden interface located approximately 8 to 10 feet below ground surface (bgs) at this location. Secondary releases of contaminants may have occurred during warehouse construction when bedrock blasting and excavation may have mobilized residual contamination. The primary concern for this historical source area is contaminants in groundwater.

Contaminants historically detected at the POL area USTs and ASTs include total petroleum hydrocarbons, TCE, and benzene, toluene, ethylbenzene, and xylene. Arsenic and manganese have also been detected above cleanup goals and may be attributed to reducing conditions caused by the biodegradation of organic contaminants. There has been no exceedance of site cleanup goals for VOCs or other fuel-related compounds since 2002.

Approximately 800 cubic yards of petroleum-contaminated soil were removed during the 1998/1999 tank removals at AOC 43A (E&E, 1994). The RI report states that the releases from the AST area occurred near the ground surface whereas the releases at the UST area occurred below the surface. More detailed documentation on the pre-1990 AOC 43A tank removals could not be located during preparation of this document. Residual fuel-related contamination, if present in soils, may serve as a secondary groundwater contaminant source; however, groundwater monitoring does not show evidence of this. The primary concern for this source area is contaminants in groundwater.

2.2 GEOLOGY AND HYDROGEOLOGY

Prior to 2000, two bedrock outcrop areas existed in the area now occupied the Lot 10 warehouse (Figure 2-1). These outcrops were flattened during bedrock excavation for the warehouse. Figure 2-2 shows interpreted subsurface bedrock topography following bedrock excavation and warehouse construction, based on historical geotechnical and boring log information. As shown on the figure, two localized bedrock highs remain, one beneath the northeast corner of the warehouse, and one

beneath the southeast corner, and a roughly north-south ridge runs beneath the eastern edge of the warehouse building. The finish floor of the warehouse is at El. 263.6 feet (Ostrowski, 2006), and, therefore, rock probably had to be removed to at least El. 260 feet. Bedrock outcrops remain north-northeast of the warehouse and on Shepley's Hill (which has extensive bedrock outcrops) northwest of the site.

Examination of the bedrock outcrop northeast of the warehouse shows a joint structure trending roughly north-south. Bedrock beneath the site consists of the Ayer granite and the Berwick quartzite. Both rock types show the largest amount of fracturing near the top (5 to 10 feet), and become more competent with depth, consistent with a glacial erosion contact. Impacts to the bedrock competency as a result of blasting and excavation are unknown. Removal of the upper fractured zone may have decreased overall fracture permeability while mechanical fracturing due to blasting may have increased the local permeability.

AOC 32 Hydrogeology

There is no apparent overburden aquifer in the immediate vicinity of the former waste oil UST No.13. Overburden groundwater appears to be present; however, approximately 100 feet to the east and 300 feet to the west of the former UST location. East of UST No. 13, overburden groundwater flow has been interpreted to be to generally to the east with some variation between the northeast and southeast in the RI report (E & E, 1994) and the Monitored Natural Attenuation Report (SWETS, 2000b), both of which pre-date construction of the warehouse. West of the bedrock ridge, overburden groundwater flow is to the south and southwest.

Interpretation of the bedrock potentiometric surface also shows a groundwater divide bisecting Lot 10 in a north-northwest to south-southeast direction. It should be noted that this interpretation is based solely on groundwater elevation data which give an indication of the potential for flow in a certain direction. Actual bedrock groundwater flow directions are determined by both hydraulic gradients and fracture orientation. Historical water level data are interpreted to show that the potential for bedrock groundwater flow in the vicinity of the AOC 32 waste oil UST is to the east.

A second groundwater divide, which trends roughly west to east, exists northwest of the warehouse in the vicinity of 32M-92-01X. Groundwater north of this divide (i.e., in the vicinity of SHL-15 flows to the northeast, while groundwater south of this divide flows to the south. The exact location of this divide relative to monitoring well 32M-92-01X is uncertain, and groundwater flow at 32M-92-01X may change direction seasonally and in response to precipitation events.

Evaluation of vertical hydraulic gradients between the overburden and bedrock aquifers for the one monitoring well pair at AOC 32, 32M-01-14XOB/-14XBR, shows consistent upward gradients.

AOC 43A Hydrogeology

The RI report (E & E, 1994) and the Monitored Natural Attenuation Report (SWETS, 2000c), both of which pre-date construction of the warehouse, have historically interpreted overburden groundwater flow in the vicinity of the AOC 43A to be to the southwest. The mapped distribution of total petroleum hydrocarbons in soil shown in Figure 5-1 of Volume III of the RI report (E & E, 1994) (see Figure 1-2 of this report) and is interpreted in the RI report to be indicative of the southwest groundwater flow direction.

Bedrock groundwater flow potential is interpreted to be to the southwest. It should be noted that this interpretation is based solely on groundwater elevation data which give an indication of the potential for flow in a certain direction. Actual bedrock groundwater flow directions are determined by both hydraulic gradients and fracture orientation.

Evaluation of data shows vertical hydraulic gradients between the overburden and bedrock aquifers for the monitoring well pairs 43M-01-16XOB/-16XBR and 43M-01-17XOB/-17XBR have historically been upward or neutral. Vertical hydraulic gradients at 43M-01-20XOB/-20XBR, located approximately 300 feet to the southwest of the AOC 43A source area USTs, have been primarily upward or neutral, but with occasional downward gradients across the bedrock/overburden interface. An examination of the data shows no relationship to seasonality in general; however, vertical gradients may be influenced by larger scale precipitation events.

2.3 CONTAMINANT NATURE AND DISTRIBUTION

The following contaminant migration pathway discussions are based on the geology and hydrogeology interpretations and the above contaminant distributions.

AOC 32 Contaminant Migration Pathways
Potential contaminant migration pathways from release to projected distribution for AOC 32 are as follows:

- Contaminants released via surficial spills/releases or leaks in piping to surface or subsurface soils.
- Vertical migration via gravity flow and infiltration of recharge water to bedrock overburden interface.
- Further vertical migration in fractures to bedrock aquifer.
- Based on historic contaminant distributions in bedrock wells, the shallow fracture network does not have a high degree of connectivity – the actual amount of fracture connectivity is unknown.
- Horizontal hydraulic gradients in the bedrock aquifer indicate potential for dissolved contaminant flow to the east-northeast.
- Upward hydraulic gradients measured across the bedrock/overburden interface suggest dissolved contaminants would tend to migrate from bedrock to overburden aquifers at areas where overburden aquifer is present.
- Overburden groundwater flow paths are to the east-northeast toward Shepley's Hill Landfill.

AOC 43A Contaminant Migration Pathways
Potential contaminant migration pathways from release to projected distribution for AOC 43A are as follows:

- Contaminants released via surficial spills/releases or leaks in tanks or piping to surface and subsurface soils.
- Vertical migration of fuel and related contaminants via gravity flow and infiltration of recharge water through unsaturated overburden to overburden groundwater.

- Dissolved phase transport of contaminants in groundwater via advective flow to the southwest.

- The lack of detected contaminants to the southwest suggests that the bulk of contamination was removed during tank excavations or has attenuated. Remaining contaminants are likely sorbed to overburden soils.

2.4 POTENTIAL RECEPTOR ANALYSIS

The following items provide a potential receptor analysis for AOCs 32 and 43A.

AOC 32

- There is no groundwater use or exposure to site groundwater as Devens is served by Devens Commerce Commission water supplies.

- The closest delineated Zone II is 1,800 feet to the west of the site (McPherson Well Zone II); however, the lateral continuity of the aquifer over this distance is unknown.

- There is no use of or exposure to contaminated surface water at the site.

- Groundwater modeling for Shepley's Hill Landfill suggests that AOC 32 groundwater will not discharge to Plow Shop Pond.

- There is no current exposure to soil. Exposure potential is limited by the presence of the warehouse and associated paved parking lot.

- The lack of an overburden aquifer beneath much of the warehouse limits the potential for contaminant migration to indoor air. The estimated depth to the water table is 20 feet or greater, limiting the potential for vapor intrusion. Inspection of the building floor showed that it is well maintained, with no observed cracks or penetrations.

AOC 43A

- There is no groundwater use or exposure to site groundwater as Devens is served by Devens Commerce Commission water supplies.

- The closest delineated Zone II is 1,800 feet to the west of the site (McPherson Well Zone II).

- There is no use of or exposure to contaminated surface water at the site.

- There is no current exposure to soil. Exposure potential is limited by the presence of the warehouse and associated paved parking lot.

- The depth of the overburden aquifer beneath much of the warehouse limits the potential for contaminant migration to indoor air. The estimated depth to the water table is 20 feet or greater.

3.0 LONG-TERM MONITORING ACTIVITIES IN 2005

During 2005 USACE performed the following activities at AOCs 32 and 43A:

- Collected groundwater elevation data at 27 monitoring wells in June and 25 in December
- Collected groundwater samples for analysis from 18 monitoring wells and 9 in October
- Performed a monitoring well inspection to identify well maintenance needs and priorities in May, October, and December

Table 3-1 lists the monitoring wells used for groundwater elevation monitoring and sampling.

Appendix I contains well construction information, boring logs, and construction diagrams.

4.0 LONG-TERM MONITORING RESULTS AND DISCUSSION

4.1 GROUNDWATER ELEVATION MONITORING

The ROD requires groundwater modeling and monitoring to demonstrate that MNA is working. Modeling consists of plotting and contouring groundwater elevations and contaminant concentrations.

USACE measured water levels in 27 monitoring wells in June 2005 and in 25 monitoring wells in October 2005 when 32Z-01-04XBR could not be located and 43M-01-20XOB could not be opened. Interpretations of groundwater flow directions are based on the latest revised bedrock contours.

Weather records for the Fitchburg airport show indicate total precipitation of 9.89 inches during the 2-month period (April 13 – June 12) preceding the June sampling event. 2.03 inches fell during the period of June 6 through June 12, with the majority of that (1.57 inches) occurring on June 8, 2005. Precipitation totaled 15.07 inches during the 2-month period (September 3 – November 2) preceding the November sampling event, with 13.46 inches of that during October. Only 0.02 inches was recorded during the period from October 26 through November 2, 2005.

4.1.1 Groundwater Flow In Overburden

Figures 4-1 and 4-2 show interpreted overburden groundwater elevation contours at AOCs 32 and 43A based on data collected in 2005. These data, along with data from previous years, are contained in Table 4-1. The figures indicate that overburden groundwater is absent above the bedrock ridge that extends north-south beneath the eastern portion of the warehouse. Bedrock elevation decreases east and west of the bedrock ridge, thereby permitting an overburden aquifer. Overburden groundwater east of the bedrock ridge and the warehouse is interpreted to flow to the east and northeast before merging with the north to northeast regional flow.

The warehouse and associated pavement limit recharge above and immediately west of the bedrock ridge. Recharge west of the ridge occurs from runoff from Shepley's Hill to the northwest, infiltration in the area between the warehouse and the Shepley's Hill, and two infiltration basins located along Cook Street which receive runoff from the warehouse area. Groundwater flow is interpreted to be southerly near the northwest corner of the warehouse before turning to the southwest and west along a westward trending bedrock trough. Groundwater flow in the vicinity of the historical source area ASTs and USTs at AOC 43A is to the southwest. These interpretations are consistent with the CSM.

Groundwater flow patterns and the locations of monitoring wells SHL-15 and 32M-92-01X are such that SHL-15 and 32M-92-01X are unlikely to be influenced by contamination at either AOC 32 or 43A.

4.1.2 Groundwater Flow Through Bedrock

Figures 4-3 and 4-4 show interpreted bedrock groundwater elevation contours at AOCs 32 and 43A based on data collected in 2005. These data, along with groundwater elevation data from previous years, are contained in Table 4-1. Bedrock groundwater in the vicinity of UST No. 13 is interpreted to flow east to northeast June and east or slightly south of east in October. Overall, bedrock groundwater flow east of the bedrock ridge and warehouse is interpreted to be to the east

and northeast. Bedrock groundwater flow west of the bedrock ridge is interpreted to be to the southwest. These interpretations are consistent with the CSM.

It should be noted that actual bedrock groundwater flow directions are determined by both hydraulic gradients and fracture orientation. The warehouse and associated pavement limit recharge to the bedrock ridge and the rate of flow through the rock is expected to be low.

4.1.3 Vertical Hydraulic Gradients

There are four monitoring well pairs (32M-01-14XOB/-14XBR, 43M-01-16XOB/-16XBR, 43M-01-17XOB/-17XBR, and 43A-01-20XOB/-20XBR) at AOCs 32 and 43A available for assessing vertical hydraulic gradients between bedrock and overburden. As shown in the following table, vertical gradients were generally upward or neutral at all well pairs for which data were available. Well pair 43M-01-16XOB/-16XBR showed a neutral (possibly upward gradient) in June.

Assessment of Vertical Hydraulic Gradients

Monitoring Well	Elevation June 2005	Gradient	Elevation October 2005	Gradient
32M-01-14XOB	234.49	upward	231.53	upward
32M-01-14XBR	236.18		232.56	
43M-01-16XOB	235.20	neutral	231.77	upward
43M-01-16XBR	235.29		231.92	
43M-01-17XOB	234.95	upward	231.81	upward
43M-01-17XBR	235.55		231.92	
43M-01-20XOB	234.29	upward	Not collected	Not calculated
43M-01-20XBR	234.42		231.43	

Notes:
Elevations in feet
Elevation differences less than 0.1 feet are considered to represent neutral gradients.

This pattern is consistent with historical data which show upward or neutral vertical hydraulic gradients at well pairs 32M-01-14XOB/-14XBR, 43M-01-16XOB/-16XBR, and 43M-01-17XOB/-17XBR. Although monitoring well pair 43A-01-20XOB/-20XBR has shown upward or neutral gradients on nine of 12 occasions, it has shown downward gradients on three occasions. The historical distribution of upward, downward, and neutral hydraulic gradients does not show a seasonal influence. Figures 4-5, 4-6, 4-7, and 4-8 show plots of water levels in these wells.

These upward, neutral, and vertical hydraulic gradients will tend to keep dissolved phase contaminants from migrating from overburden into bedrock and to wash any dissolved phase contaminants already in bedrock out into overburden.

4.2 GROUNDWATER SAMPLING

Groundwater at AOCs 32 and 43A was sampled in June and October 2005 by USACE using low-flow groundwater sampling procedures as detailed in Appendix A. Table 3-1 lists the monitoring

wells included in 2005 sampling, and Figure 4-1 shows the location of the monitoring wells. Samples were analyzed by Severn Trent Laboratories (STL) in Colchester, VT. AMRO Environmental Laboratories Corporation (AMRO) of Merrimack, New Hampshire analyzed the quality assurance (QA) split samples. Groundwater sampling log sheets are contained in Appendices B and C. A USACE chemist performed the data evaluation and data evaluation reports and Quality Assurance comparison reports are contained in Appendices D, E, and F.

4.2.1 Analytical Methods

Water samples were analyzed for VOCs, VPH, EPH, PCBs, dissolved gases, alkalinity, nitrate, nitrite, sulfate, sulfide, ammonia, chemical oxygen demand (COD), total organic carbon (TOC), total phosphate, and total arsenic, lead, and manganese. VOCs were analyzed using EPA Methods 8260B. EPH and VPH were analyzed by the MADEP method, and PCBs were analyzed by EPA Method 8082.

Tables 4-2 and 4-3 present groundwater analytical data obtained in 2005. The tables compare contaminant concentrations to applicable cleanup goals and Massachusetts Contingency Plan (MCP) standards for the parameters agreed to for monitoring and listed in Table 4-4. (It should be noted that the list of parameters in Table 4-4 differs from the list of cleanup goals in the ROD.) The MCP Method 1 GW-1 concentration is listed in the tables for compounds with no ROD established cleanup goal. Exceedances of cleanup goals are shaded in the tables, and exceedances of MCP criteria are shown in bold.

4.2.2 Results – AOC 32 Wells East of Warehouse

Review of the 2005 data for 32M-01-14XOB shows total arsenic (88.7 micrograms per liter [µg/L]) and total manganese (6,010 µg/L) concentrations exceeded cleanup goals in June, and arsenic in (41.9 µg/L) exceeded the revised Maximum Contaminant Level (MCL) and GW-1 standard in October. Monitoring well 32M-01-14XOB also exceeded the manganese cleanup goal in 2003 and 2004, and has exceeded the revised arsenic MCL, but not the arsenic cleanup goal in the past. Arsenic (89.1 µg/L) and lead (21.7 µg/L) exceeded cleanup goals in 32M-01-14XBR in October. The 2005 data show the first cleanup goal exceedances at 32M-01-14XBR since 2002; however, total arsenic has exceeded the revised MCL in the past. The high historical total arsenic concentrations appear strongly associated with particulate matter, as concentrations in filtered samples were less than 10 µg/L.

Arsenic, lead, and manganese have not been shown to be associated with UST No. 13. The reason(s) for their presence in 32M-01-14XOB/-14XBR are not clear, although arsenic and manganese are believed to represent naturally present material. High arsenic and manganese concentrations are often associated with reducing conditions created by degrading organic material, although field measurement of oxidation-reduction potential and dissolved oxygen do not indicate reducing conditions at 32M-01-14XOB/-14XBR. Comparison of historical total and dissolved arsenic data suggests a strong correlation with entrained solids in the samples. Continued sampling is recommended to see if the high concentrations persist or decline. Table 4-5 summarizes contaminant exceedances in all wells for the period from 2002 through 2005.

The data also show that exceedances of VOCs, VPH, and manganese persist in bedrock source well 32M-01-18XBR. The following VOCs were detected above their respective cleanup goals at well 32M-01-18XBR in June 2005: 1,2-dichlorobenzene (4,500 µg/L vs. 375 µg/L goal), and 1,4-dichlorobenzene (370 µg/L vs.75 µg/L goal). Aromatic hydrocarbons in the C9-C10 range exceeded their cleanup goal (260 vs. 200 µg/L goal) and manganese exceeded its cleanup goal

(16,700 vs. 3,500 µg/L goal). Total arsenic at 24.4 µg/L did not exceed the established cleanup goal of 50 µg/L, but did exceed the revised MCL and GW-1 standard of 10 µg/L. The previous maximum detected concentration of arsenic was 11 µg/L in May 2004. Chlorobenzene at 410 µg/L exceeded the GW1 standard of 100 µg/L.

In October, the following contaminants exceeded cleanup goals at 32M-01-18XBR: 1,2-dichlorobenzene (1,450 vs. 600 µg/L goal), 1,4-dichlorobenzene (120 vs. 75 µg/L goal), C_9-C_{10} aromatic hydrocarbons (1,150 vs. 200 µg/L goal), and manganese (11,600 vs. 3,500 µg/L goal). 1,3-dichlorobenzene exceeded the GW-1 standard (209 vs. 40 µg/L goal), but not its cleanup goal of 600 µg/L. It is noteworthy that dichlorobenzene concentrations appear to be declining. Table 4-6 summarizes exceedances of cleanup goals at 32M-01-18XBR for the period 2002 through 2005.

There were no other exceedances of cleanup goals in AOC 32 monitoring wells north and east of the warehouse in 2005. Figure 4-9 shows the locations of cleanup goal exceedances in 2005.

Figures 4-10 through 17 show plots of contaminant trends over time for the following parameters at 32M-01-18XBR: TCE; 1,2-dichlorobenzene; 1,3-dichlorobenzene; 1,4-dichlorobenzene; chlorobenzene; C_9-C_{10} aromatic hydrocarbons; C_9-C_{12} aliphatic hydrocarbons; and C_9-C_{18} aliphatic hydrocarbons. It should be noted that contaminant concentrations in October 2005 tended to be lower than in the past, particularly for the chlorinated benzenes and C_9-C_{10} aromatics. Concentrations of TCE have decreased to less than 1 µg/L. Manganese concentrations at 32M-01-18XBR remain well above the cleanup goal, although some decrease occurred in October 2005.

The decrease in contaminant concentrations at 32M-01-18XBR in October is encouraging; however, continued sampling is necessary to determine whether this is part of a trend or, alternately, reflective of groundwater and sampling/analysis variability. Although samples from 32M-01-18XBR show relatively low oxidation-reduction potential readings and high manganese concentrations, both of which are indicative of the reducing conditions necessary for reductive dechlorination, dissolved oxygen was too high in October to support reductive dechlorination processes. The 2004 Annual Report concluded that conditions at 32M-01-18XBR were not conducive to microbial reductive dechlorination of chlorinated compounds.

The Mann-Kendall test for trend (Kendall, 1975) was applied to the data for organic contaminants at 32M-01-18XBR with cleanup goal exceedances listed in Table 4-6.

A minimum of four data points is required for conducting a Mann-Kendall test for trend and be statistically significant at the 95-percent confidence level. For each set of data ordered in time, the Mann-Kendall statistic (S) is calculated by comparing each data value to subsequent data values. Starting with the first data point, each subsequent data point is compared to the baseline value, and each comparison is assigned a value of 1 (greater than the baseline point), 0 (equal to the baseline point), or 1 (less than the baseline data point), whereby a set of values is calculated for each individual data point. This evaluation is completed for each data point in turn, with the maximum possible contribution to the total S value consequently decreasing with each subsequent comparison. All calculated values are then summed, and the resulting value is the S value. The S value is either negative, positive, or possibly zero, and indicates the potential for a decreasing trend (negative S value) or increasing trend (positive S value). The Mann-Kendall test probability (p) is then obtained from published tables for the number of data points and the calculated S value. This p-value is the probability that the S value was calculated in the absence of a true trend (the null hypothesis of the test is no trend). For the S-statistic to indicate a statistically significant trend, some level of confidence must be selected, and the value of S must be sufficiently high that the null hypothesis of no trend is rejected.

For purposes of this evaluation, a confidence level of 90 percent or greater (p-value <0.1) is considered indicative of a high confidence level for trend. The probability of no trend, p, has been determined for the available data. Results of the statistical trend analysis do not result in rejection of the null hypothesis of no statistically significant trend for five of the six evaluated parameters (see Appendix G). That is to say, a significant trend, increasing or decreasing, was not identified for five of the six evaluated parameters.

Three dates had elevated detection limits for TCE, and analyses for these dates were reported as below detection limit. The Mann-Kendall test was performed on the five reported values (including one estimated value). TCE showed a significant downward trend.

4.2.3 Results - Monitoring Wells West and North of Warehouse

Monitoring wells SHL-15, 32M-92-01X, 32M-92-03X, 43M-01-16XOB/-16XBR, 43M-01-17XBR/-17XOB, and 43M-01-20XOB/-20XBR located west and northwest of the warehouse were sampled in June 2005, and 32M-92-01X was sampled in October 2005. Analytical results for VOCs, VPH, EPH, and PCBs were generally below reporting limits for organic analytes. There were no exceedances of cleanup goals for organic compounds.

The revised MCL for arsenic was exceeded in SHL-15 in June 2005 (14.4 vs. 10 µg/L goal), but not in October (9.9 vs. 10 µg/L goal). Arsenic concentrations in samples from SHL-15 have exceeded 10 µg/L in 11 of 12 samples since January 1999, with values as great as 327 µg/L in October 1999. The two lowest values were in 2005. A seasonal pattern is not evident, although a precipitation/infiltration influence is possible. Manganese exceeded its cleanup goal in SHL-15 in October 1999 (6,200 vs. 3,500 µg/L goal) and April 2002 (4,100 vs. 3,500 µg/L goal). Monitoring well SHL-15 is interpreted to be in a separate flow regime (i.e., hydraulically upgradient/crossgradient) from AOCs 32 and 43A and may be influenced by Shepley's Hill Landfill.

There were no other cleanup goal exceedances for inorganic analytes in monitoring wells north and west of the warehouse.

Groundwater flow patterns and the location of monitoring wells SHL-15 and 32M-92-01X are such that SHL-15 and 32M-92-01X are unlikely to be influenced by contamination at either AOC 32 or 43A.

4.3 MONITORING WELL INSPECTION

In addition to the monitoring well inspection performed during sample collection, USACE personnel inspected AOC 32 and 43A monitoring wells in December 2005 and January 2006 to identify maintenance needs and priorities. The inspection involved assessing well conditions more closely than typically done during monitoring activities. The inspection identified the need for several new road boxes and other maintenance items. Maintenance activities were performed in January 2006 and included replacing or resetting the road boxes and surface seal for 12 wells. In addition, the internal riser of one well was repaired and three wells were redeveloped. Assessment and repair activities are listed in Appendix H.

5.0 QUALITY CONTROL

Quality assurance/quality control (QA/QC) samples were collected to monitor the sample collection, transportation, and analysis procedures. USACE collected the samples and performed the data evaluation for both of the sampling events in 2005.

5.1 JUNE 2005 QA/QC AND DATA VALIDATION

STL of Colchester, VT analyzed eighteen groundwater samples including the appropriate quality control (QC) samples (i.e., duplicate, matrix spike/matrix spike duplicate). A duplicate QA sample was collected from the most contaminated well, 32M-01-18XBR. USACE's Chemical Data Evaluation examines acceptability of the primary lab's data (Appendix D). In addition, the QA laboratory, AMRO of Merrimack, NH, analyzed the groundwater duplicate sample. The Chemical Quality Assurance Report compares AMRO's results and STL's QA results (Appendix E).

5.1.1 Data Evaluation Summary

Eighteen groundwater samples collected from AOCs 32 and 43A on June 13, 15, and 17, 2005, were analyzed for VOCs, VPH, dissolved gases, EPH, PCB, alkalinity, nitrate, nitrite, sulfate, sulfide, ammonia, COD, TOC, total phosphate, and total and dissolved arsenic, lead and manganese. In addition, the laboratory analyzed one field duplicate (32M-01-DUP, a duplicate of sample 32M-01-18XBR), one matrix spike/matrix spike duplicate set (MS/MSD) (32M-01-17XBR-MS and 32M-01-17XBR-MSD), three trip blanks (dated 6/13/05, 6/15/05, and 6/17/05), and one rinsate blank (32-43A-EQB, dated 6/16/05).

The results were evaluated (Appendix E) for acceptability in accordance with the laboratory's defined acceptance limits, standard EPA SW846 guidance, guidelines provided in the "Interim Chemical Data Quality Management (CDQM) Policy for USACE Hazardous, Toxic and Radioactive Waste (HTRW) Projects", dated 23 November 1998, and/or EM 200-1-10 (DRAFT/Final), "Guidance for Evaluating Performance Based Chemical Data Packages".

All sample coolers were packed with sufficient quantities of ice in the field and were appropriately preserved. There were no shipment or receipt anomalies. All samples were appropriately preserved as stated in the two Tables 1 of Appendix D. Samples were extracted and analyzed in accordance with the methods and holding time requirements. Exceptions are noted in Appendix D. Based on the data evaluation elements reviewed (including holding times, blank sample results, surrogate recoveries, duplicate samples and MS/MSD recoveries), all data may be reported without qualification, except as summarized below.

Volatile Organic Compound Analysis

- A peristaltic pump was used to collect the samples from wells 32Z-99-02X and 43M-01-20XBR. It was necessary to use the peristaltic pump instead of the submersible pump due to the small diameter of the well casing at 32Z-99-02X and the slow recharge rate at 43M-01-20XBR. The wells were identified on the data tables as being sampled with the peristaltic pump.

- As a result of equipment blank contamination, results for 1,2-dichlorobenzene in samples 32M-01-14XBR, 32M-01-15XBR, 32M-01-16XBR, and 32M-01-17XBR are qualified as tentatively not detected (UJ) at the reported concentration.

- Due to low matrix spike recovery, hexachlorobutadiene, bromobenzene, 2-chlorotoluene, and 4-chlorotoluene reporting limits were qualified as estimated (UJ) in sample 17XBR.

- All 2-chloroethyl-vinyl ether results were rejected (R) due to the inability to recover the compound from the MS and MSD samples.

Target Analyte List Metals Analysis

- Laboratory spike sample: Sample 32M-01-14XBR was spiked – the percent recoveries were acceptable for lead and manganese. The arsenic percent recovery was slightly high; outside QC limits 127 percent (limits 80 to 120 percent). Therefore the arsenic result for that sample was qualified as (J+), possibly biased high as a result of the high spike recovery.

General Analyses

- Phosphorous results for all samples was qualified as tentatively not detected at the reported concentration (UJ) due to the contamination found in the equipment blank sample.

- The reporting limit for TOC in sample 43M-01-20XOB was estimated (UJ) due to the low matrix spike recovery.

- COD and TOC results for sample 32M-01-17XBR were qualified as potentially biased low (J-) due to the low recovery of the matrix spike from that sample.

5.1.2 Laboratory Quality Assurance Summary

There were no sample shipping and chain-of-custody deficiencies. Data comparisons showed overall agreement for 111 of 119 analytical tests in total, and quantitative agreement in 29 of the 37 results for which the analyte was detected by at least one of the labs.

The complete report, including copies of the chain-of-custody documents and sample receipt checklists are in Appendix E.

5.2 OCTOBER 2005 DATA VALIDATION

STL analyzed nine groundwater samples including the appropriate QC (duplicate, matrix spike/matrix spike duplicate) samples. A duplicate QA sample was collected from the most contaminated well, 32M-01-18XBR. USACE's Chemical Data Evaluation examines acceptability of the primary lab's data (Appendix F). In addition, the QA laboratory, AMRO, analyzed the groundwater duplicate sample. The Chemical Quality Assurance Report compares AMRO's results and STL's QA results (Appendix F).

5.2.1 Data Evaluation Summary

Nine groundwater samples collected from AOCs 32 and 43A on October 3, 4, and 5, 2005 were analyzed for VOCs, VPH, EPH, and total arsenic, lead, and manganese. In addition, the laboratory analyzed one field duplicate (of sample 32M-01-18XBR), four trip blanks (dated 10/3/05, 10/4/05 (2), and 10/5/05), and one rinsate blank, 32-43A-EQB, dated 10/4/05).
The results were evaluated for acceptability in accordance with the laboratory's defined acceptance limits, with standard EPA SW846 guidance, guidelines provided in the "Interim Chemical Data Quality Management (CDQM) Policy for USACE Hazardous, Toxic and Radioactive Waste (HTRW) Projects", dated 23 November 1998, and/or EM 200-1-10 (DRAFT/Final), "Guidance for Evaluating Performance Based Chemical Data Packages".

All sample coolers were packed with sufficient quantities of ice in the field and were appropriately preserved. There were no shipment or receipt anomalies. Samples were extracted and analyzed in accordance with the methods and holding time requirements. Exceptions are noted in Appendix D. Based on the data evaluation elements reviewed (including holding times, blank sample results, surrogate recoveries, duplicate samples and MS/MSD recoveries), all data may be reported without qualification, except as summarized below. More complete details are in Appendix D.

Volatile Organic Compound Analysis

- The laboratory spiked sample 32M-01-13XBR in addition to the sample designated for matrix spike. 1,2,3-trichlorobenzene was under-recovered from this spike, consequently, the result for this compound in sample 32M-01-13XBR is qualified (UJ), tentatively not detected at the reporting limit value.

Extractable Petroleum Hydrocarbons Analysis

- Naphthalene was detected in the method blank associated with samples SHL-15, 32M-92-01X, 32M-01-18XBR, AND 32M-01-18XBR-DUP. As a result, naphthalene results in these samples are qualified (UJ).

- The results of the EPH analysis for sample 32M-01-18XBR and its duplicate sample showed greater than 25 percent relative percent difference for C_9-C_{18} aliphatic hydrocarbon range. As a result, both results are qualified as (J) estimated.

- Target Analyte List Metals Analysis.

- Laboratory spike sample: Sample 32M-01-13XBR was spiked – the percent recoveries were acceptable for arsenic and lead. The manganese percent recovery was low; outside QC limits 44 percent (limits 75 to 125 percent). Therefore, the manganese result for that sample was qualified as (J-), possibly biased low as a result of the low spike recovery.

5.2.2 Laboratory Quality Assurance Summary

There were no sample shipping and chain-of-custody deficiencies. Data comparisons showed overall agreement for 92 of 97 analytical tests in total, and quantitative agreement in 11 of the 16 results for which the analyte was detected by at least one of the labs.

The complete report, including copies of the chain-of-custody documents and sample receipt checklists are in Appendix F.

6.0 CONCLUSIONS AND RECOMMENDATIONS

6.1 CONCLUSIONS

- There were no exceedances of cleanup goals among AOC 43A monitoring wells sampled in June 2005. Further, there were no exceedances among these well in 2003 or 2004.

- Cleanup goal exceedances occurred at three (32M-01-14XOB, 32M-01-14XBR, 32M-01-18XBR) AOC 32 monitoring wells. No contaminant exceedances were noted in other AOC 32 monitoring wells.

- The AOC 32 monitoring well pair 32M-01-14XOB showed exceedances of arsenic and manganese and 32M-01-14XBR showed exceedances of arsenic and lead in 2005. Although 32M-01-14XOB has shown manganese exceedances in the past, this was the first exceedance for arsenic. These were the first exceedances at 32-01-14XBR since 2002. The reasons for these exceedances have not been identified.

- Monitoring well 32M-01-18XBR continues to show exceedances of VOCs (1,2-dichlorobenzene, 1,3-dichlorobenzene, 1,4-dichlorobenzene, and chlorobenzene), VPH (C_9-C_{10} aromatic hydrocarbons), and manganese, although dichlorobenzene concentrations were generally lower in October 2005 than in several previous sampling rounds.

- With the exception of TCE, the Mann-Kendall test for trend does not identify significant decreasing trends in contaminant concentrations at 32M-01-18XBR.

- Several of wells (i.e., 32M-01-13XBR, 32M-01-14XOB/-14XBR, 32M-01-15XBR, 32M-01-16XBR, and 32M-01-17XBR) are located in the vicinity of 32M-01-18XBR and the former location of UST 13. These wells show no evidence of the migration of contaminants away from the UST 13 area at levels of concern.

- Neutral and upward vertical hydraulic gradients between bedrock and overburden tend to prevent migration of dissolved phase contaminants from overburden into bedrock and to wash any dissolved phase contaminants already in bedrock out into overburden.

- Arsenic in monitoring well SHL-15 exceeded the revised MCL in June 2005, as it has historically. A seasonal pattern is not evident, although a precipitation/infiltration influence is possible. Monitoring well SHL-15 is interpreted to be a separate flow regime (i.e., hydraulically upgradient/crossgradient) from AOCs 32 and 43A and may be influenced by Shepley's Hill Landfill.

- Groundwater flow patterns and the location of monitoring wells SHL-15 and 32M-92-01X are such that SHL-15 and 32M-92-01X are unlikely to be influenced by contamination at either AOC 32 or 43A.

- Groundwater flow directions interpreted from 2005 data appear consistent with historical interpretations in spite of recent construction at Transfer Lot 10 and use of a different array of monitoring wells from which to collect data.

- In the event that any wells are destroyed during construction at Lot 11, new wells could be installed, if necessary, on Lot 10 property to maintain coverage along the eastern side of the site.

6.2 RECOMMENDATIONS

- Discontinue sampling for chemical analysis at SHL-15 and 32M-92-01X, but retain for groundwater elevation measurements.

- With the exception of SHL-15 and 32M-92-01X, continue monitoring contaminant trends, seasonal effects, and geochemical trends (dissolved oxygen, oxidation-reduction potential) in the same wells monitored in October 2005.

- With the exception of SHL-15 and 32M-92-01X, continue semiannual sampling frequency in the same wells monitored in October 2005.

- Complete preparation of an updated LTMP for the combined sites to reflect the warehouse post-construction conditions.

- Measure groundwater elevations at all AOC 32 and 43A wells for use in plotting groundwater contours and evaluating flow directions.

ABBREVIATIONS

AOC	Areas of Contamination
AMRO	AMRO Environmental Laboratories
AST	aboveground storage tank
bgs	below ground surface
BRAC	Base Closure and Realignment ACT
COD	chemical oxygen demand
CSM	conceptual site model
DRMO	Defense Reutilization and Marketing Office
E & E	Ecology and Environment, Inc.
EPH	extractable petroleum hydrocarbons
FS	feasibility study
HLA	Harding Lawson Associates, Inc.
Horne	Horne Engineering Services, Inc.
LTMP	Long-term Monitoring Plan
MACTEC	MACTEC Engineering and Consulting, Inc.
MCL	maximum contaminant level
MCP	Massachusetts Contingency Plan
MNA	monitored natural attenuation
MS/MSD	matrix spike/matrix spike duplicate
µg/L	micrograms per liter
PCB	polychlorinated biphenyl
POL	petroleum, oil, and lubricants
QA	quality assurance
QC	quality control
QA/QC	quality assurance/quality control
RFTA	Reserve Forces Training Area
RI	remedial investigation
ROD	Record of Decision
SI	site investigation
STL	Severn Trent Laboratories
SWETS	Stone and Webster Environmental Technology and Services
TCE	trichloroethene
TOC	total organic carbon

ABBREVIATIONS, continued

USACE	U.S. Army Corps of Engineers
UST	underground storage tank
VOC	volatile organic compound
VPH	volatile petroleum hydrocarbons

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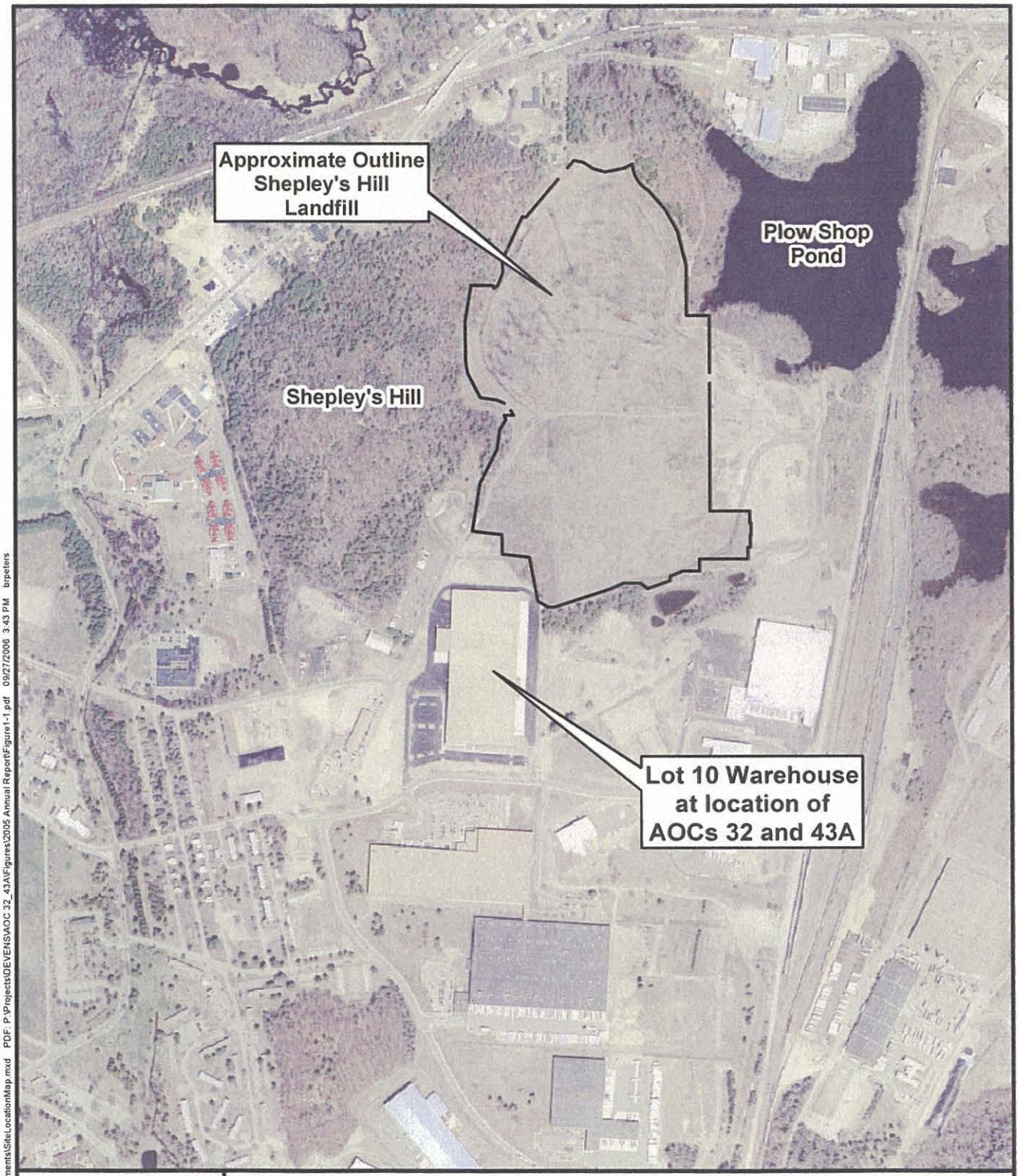
FIGURES



April 2001 color orthophoto obtained from Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs at http://www.mass.gov/mgis/massgis.htm

0 400 800 Feet

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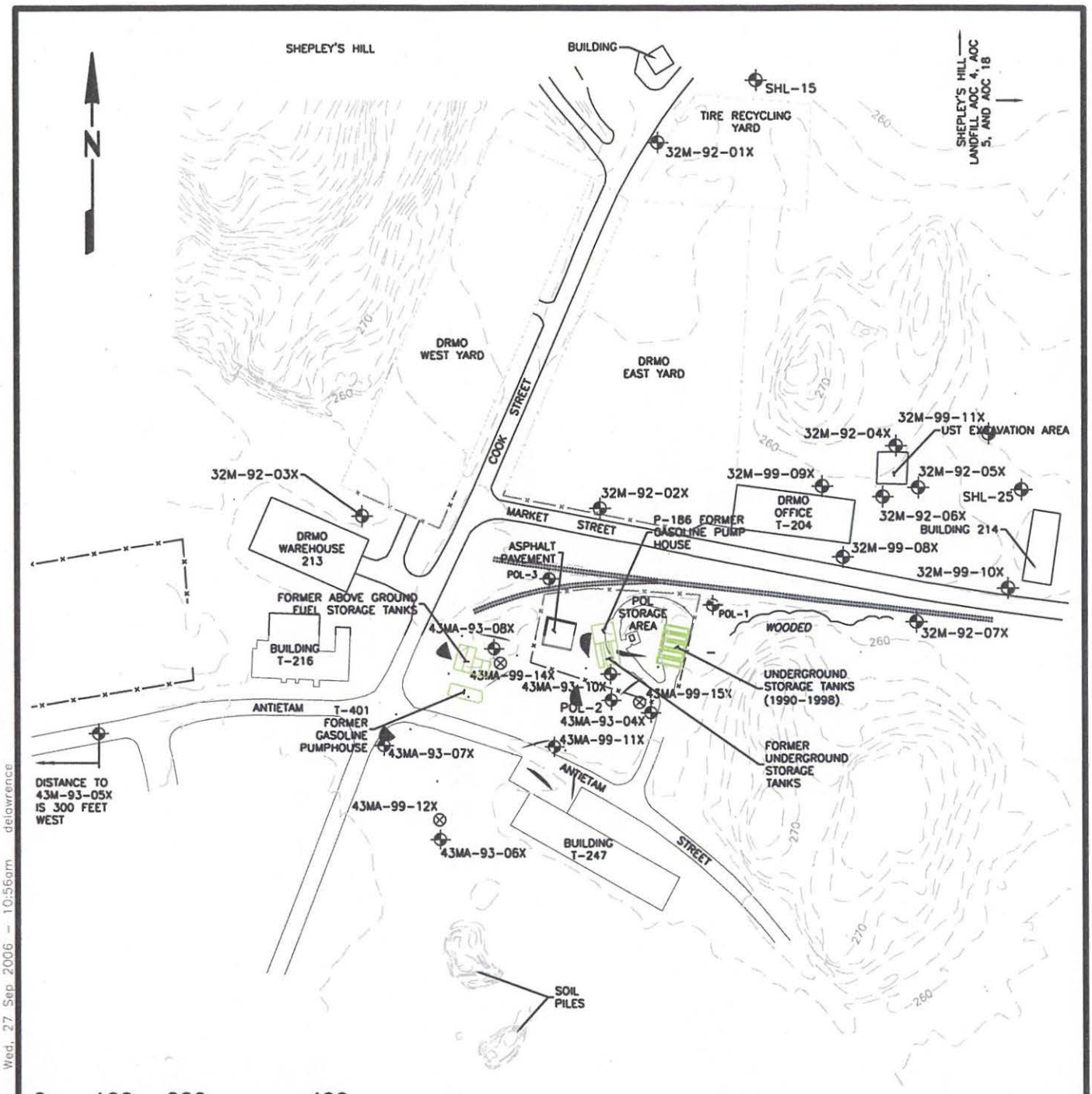
Prepared by BRP | Checked by SWR

BRP SWR

Figure 1-1
Site Location Map

2005 Annual Report
AOCs 32 and 43A
Devens, MA
MACTEC, Inc.



NOTES:
HISTORICAL TANK AND PUMPHOUSE LOCATIONS AND TPHC CONTOURS BASED ON FIGURE 5-1 IN THE REMEDIAL INVESTIGATION REPORT FUNCTIONAL AREA II, VOLUME III OF IV AREA OF CONTAMINATION 43A (E&E, 1994).

THIS MAP IS DERIVED FROM THE AUTOCAD FILE (10-10-00) FROM CUBELLIS SAIVETZ ASSOCIATES AND SHAW ENVIRONMENTAL INC. STOUGHTON, MASSACHUSETTS. ELEVATIONS REFERENCED TO NGVD 1929.

Prepared/Date: DEL / 09-27-06
Checked/Date: SWR / 09-27-06

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AOC 32 and 43A Devens, Massachusetts	MACTEC	Historical Site Features AOCs 32 and 43A 2005 Annual Report Figure 1-2

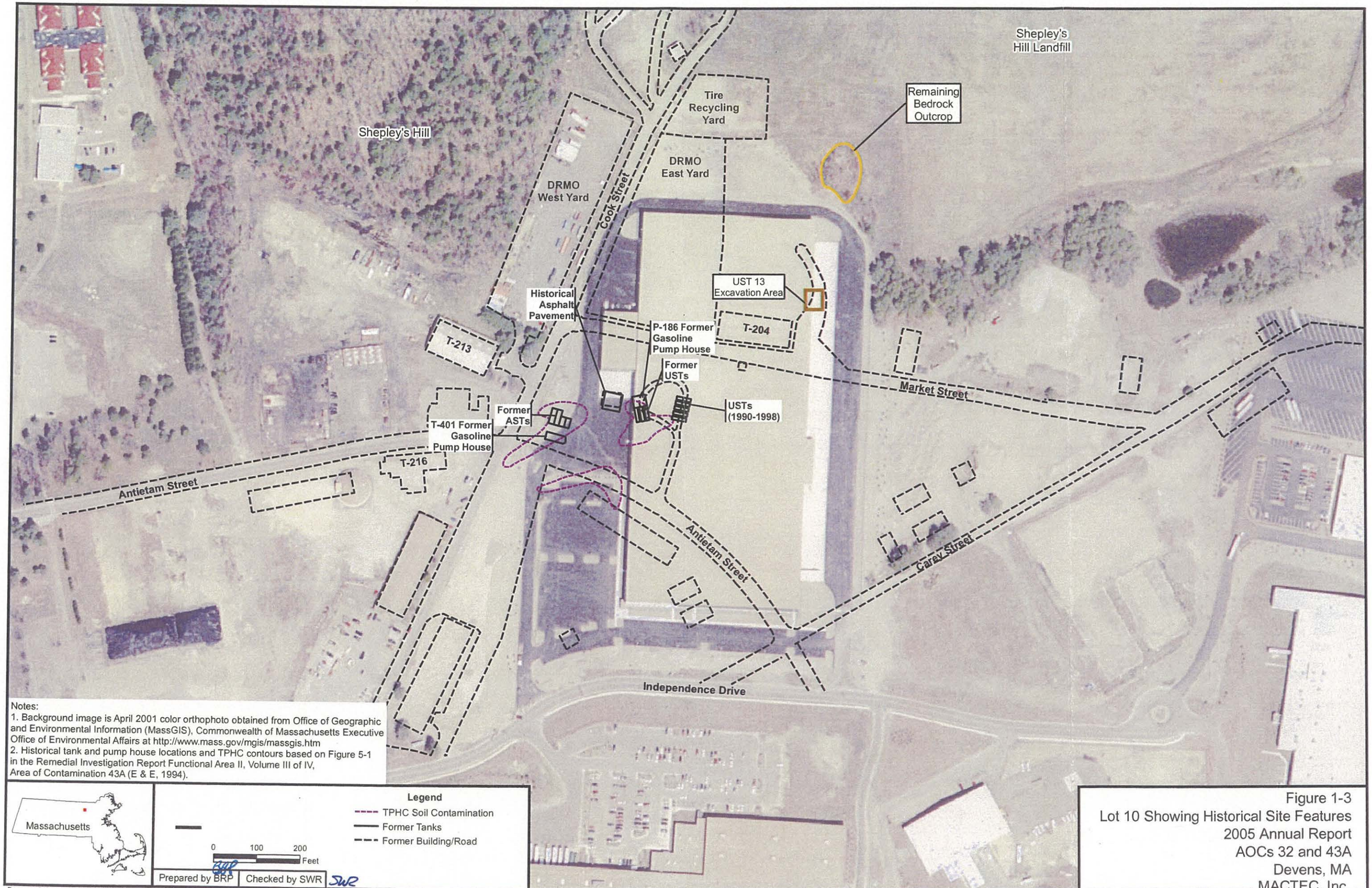

Figure 1-3
Lot 10 Showing Historical Site Features
2005 Annual Report
AOCs 32 and 43A
Devens, MA
MACTEC, Inc.

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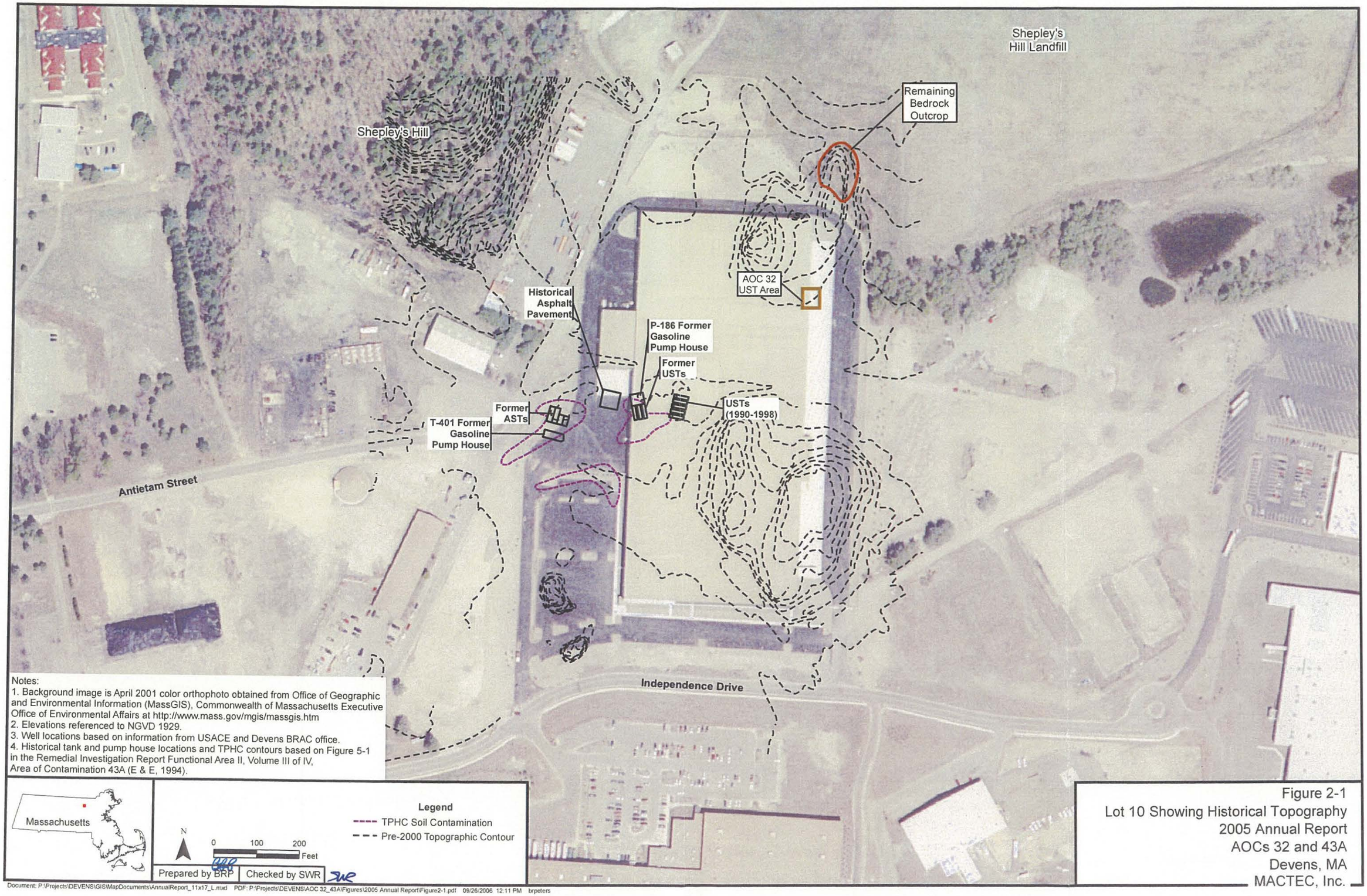

Figure 2-1
Lot 10 Showing Historical Topography
2005 Annual Report
AOCs 32 and 43A
Devens, MA
MACTEC, Inc.

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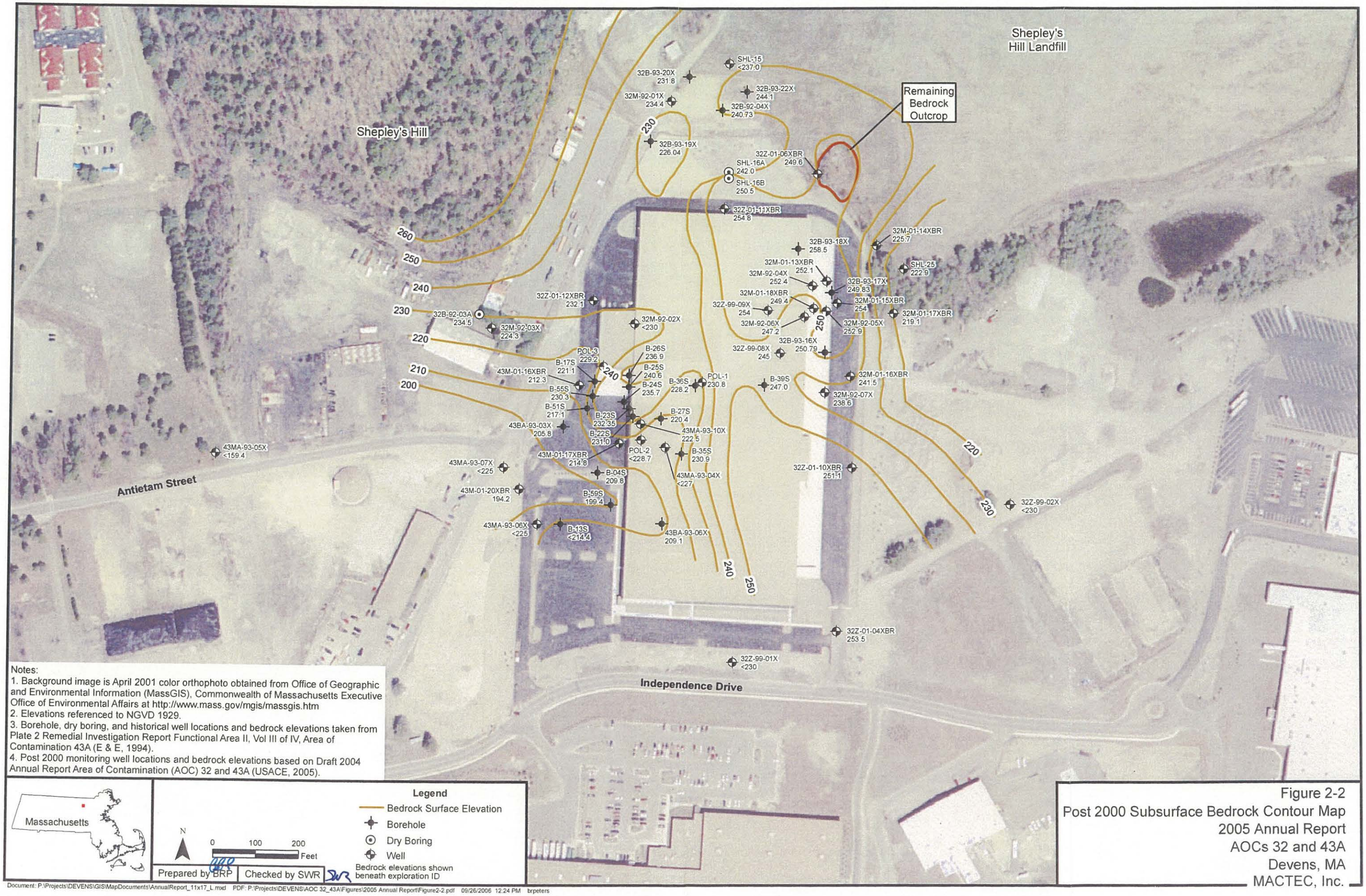

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1. Background image is April 2001 color orthophoto obtained from Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs at http://www.mass.gov/mgis/massgis.htm
2. Elevations referenced to NGVD 1929.
3. Borehole, dry boring, and historical well locations and bedrock elevations taken from Plate 2 Remedial Investigation Report Functional Area II, Vol III of IV, Area of Contamination 43A (E & E, 1994).
4. Post 2000 monitoring well locations and bedrock elevations based on Draft 2004 Annual Report Area of Contamination (AOC) 32 and 43A (USACE, 2005).

N
0 100 200 Feet

Legend
- Bedrock Surface Elevation
- Borehole
- Dry Boring
- Well

Bedrock elevations shown beneath exploration ID

Prepared by BRP | Checked by SWR

Figure 2-2
Post 2000 Subsurface Bedrock Contour Map
2005 Annual Report
AOCs 32 and 43A
Devens, MA
MACTEC, Inc.

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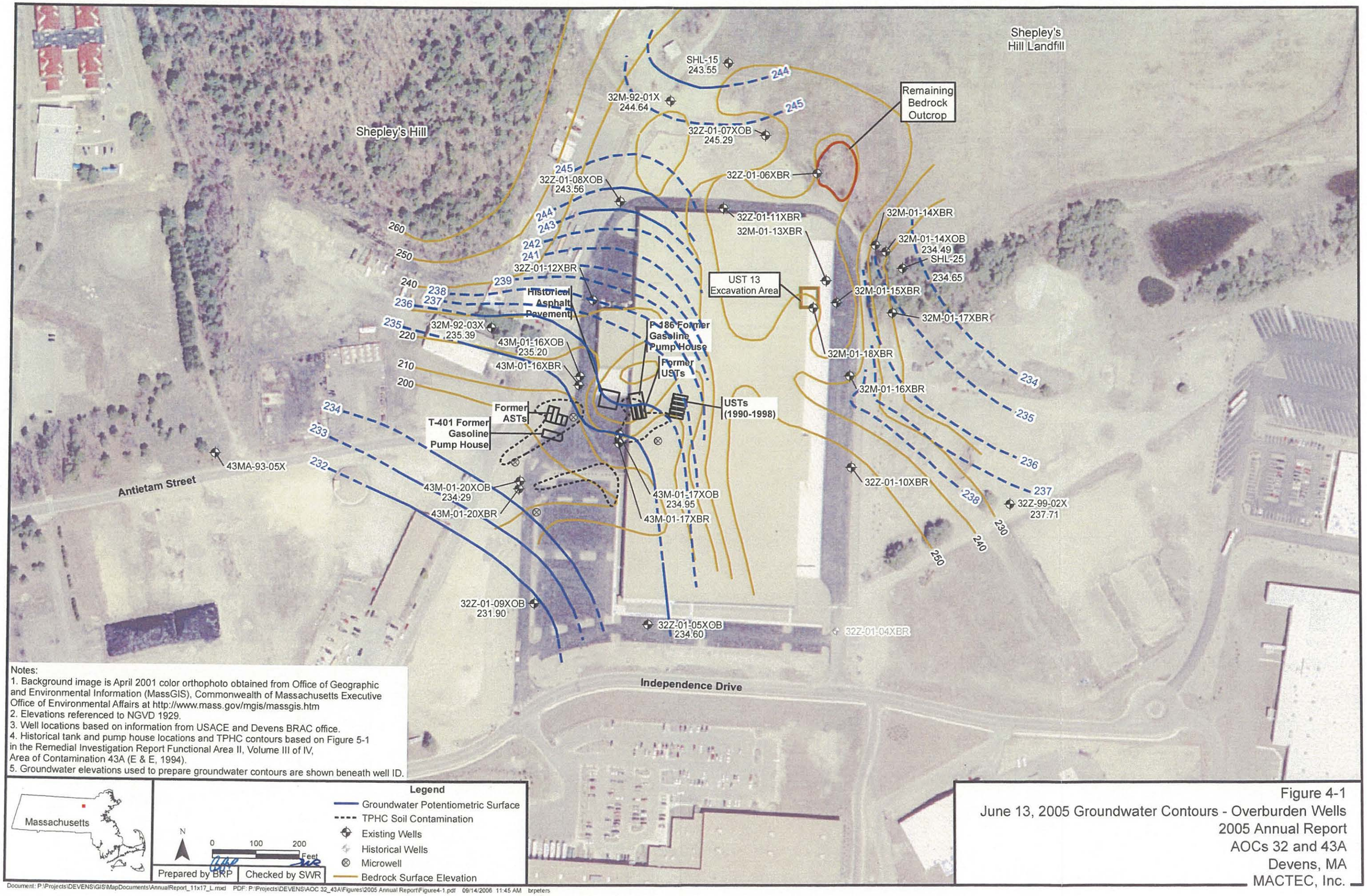

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1. Background image is April 2001 color orthophoto obtained from Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs at http://www.mass.gov/mgis/massgis.htm
2. Elevations referenced to NGVD 1929.
3. Well locations based on information from USACE and Devens BRAC office.
4. Historical tank and pump house locations and TPHC contours based on Figure 5-1 in the Remedial Investigation Report Functional Area II, Volume III of IV, Area of Contamination 43A (E & E, 1994).
5. Groundwater elevations used to prepare groundwater contours are shown beneath well ID.

Figure 4-1
June 13, 2005 Groundwater Contours - Overburden Wells
2005 Annual Report
AOCs 32 and 43A
Devens, MA
MACTEC, Inc.

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Shepley's Hill Landfill

Shepley's Hill

SHL-15
240.31

32M-92-01X
241.02

32Z-01-07XOB
241.32

Remaining Bedrock Outcrop

32Z-01-06XBR

32Z-01-08XOB
241.02

32Z-01-11XBR

32M-01-13XBR

32M-01-14XBR

32M-01-14XOB
231.53

SHL-25
231.38

32Z-01-12XBR

UST 13 Excavation Area

32M-01-15XBR

32M-01-17XBR

Historical Asphalt Pavement

P-186 Former Gasoline Pump House

32M-92-03X
231.99

43M-01-16XOB
231.77

43M-01-16XBR

Former USTs

32M-01-18XBR

32M-01-16XBR

USTs (1990-1998)

Former ASTs

T-401 Former Gasoline Pump House

43MA-93-05X

Antietam Street

43M-01-20XOB

43M-01-20XBR

43M-01-17XOB
231.81

43M-01-17XBR

32Z-01-10XBR

32Z-99-02X
234.24

32Z-01-09XOB
231.46

32Z-01-05XOB
231.89

32Z-01-04XBR

Independence Drive

260 250 241 240 239 238 237 236 235 234 233 232 220 210 200 234 233 232 230 240 250

Notes:
1. Background image is April 2001 color orthophoto obtained from Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs at http://www.mass.gov/mgis/massgis.htm
2. Elevations referenced to NGVD 1929.
3. Well locations based on information from USACE and Devens BRAC office.
4. Historical tank and pump house locations and TPHC contours based on Figure 5-1 in the Remedial Investigation Report Functional Area II, Volume III of IV, Area of Contamination 43A (E & E, 1994).
5. Groundwater elevations used to prepare groundwater contours are shown beneath well ID.

Massachusetts

N

0 100 200 Feet

Prepared by BRP | Checked by SWR

Legend
- Groundwater Potentiometric Surface
- TPHC Soil Contamination
- Existing Wells
- Historical Wells
- Microwell
- Bedrock Surface Elevation

Figure 4-2
October 3, 2005 Groundwater Contours - Overburden Wells
2005 Annual Report
AOCs 32 and 43A
Devens, MA
MACTEC, Inc.

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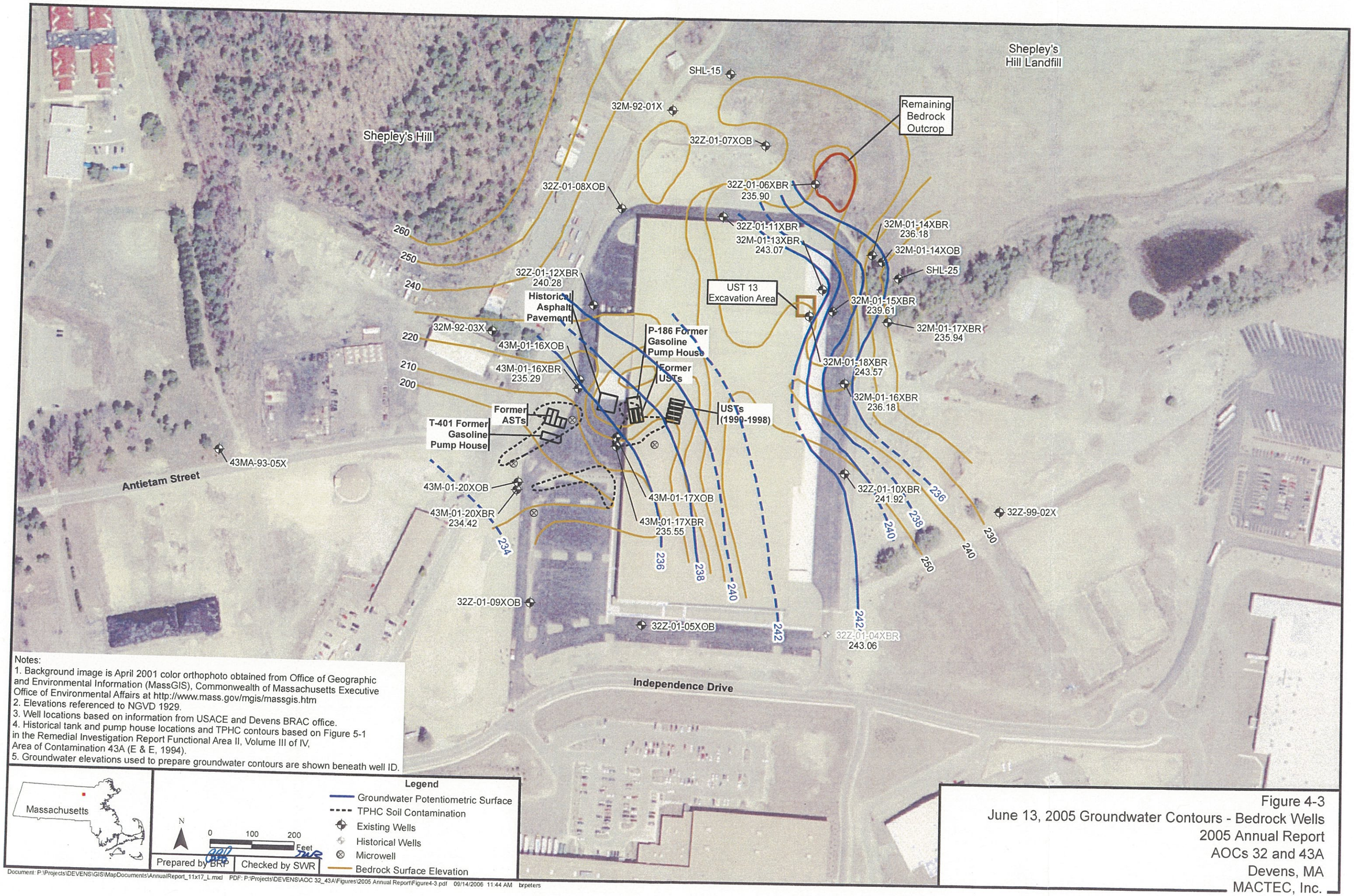

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3. Well locations based on information from USACE and Devens BRAC office.
4. Historical tank and pump house locations and TPHC contours based on Figure 5-1 in the Remedial Investigation Report Functional Area II, Volume III of IV, Area of Contamination 43A (E & E, 1994).
5. Groundwater elevations used to prepare groundwater contours are shown beneath well ID.

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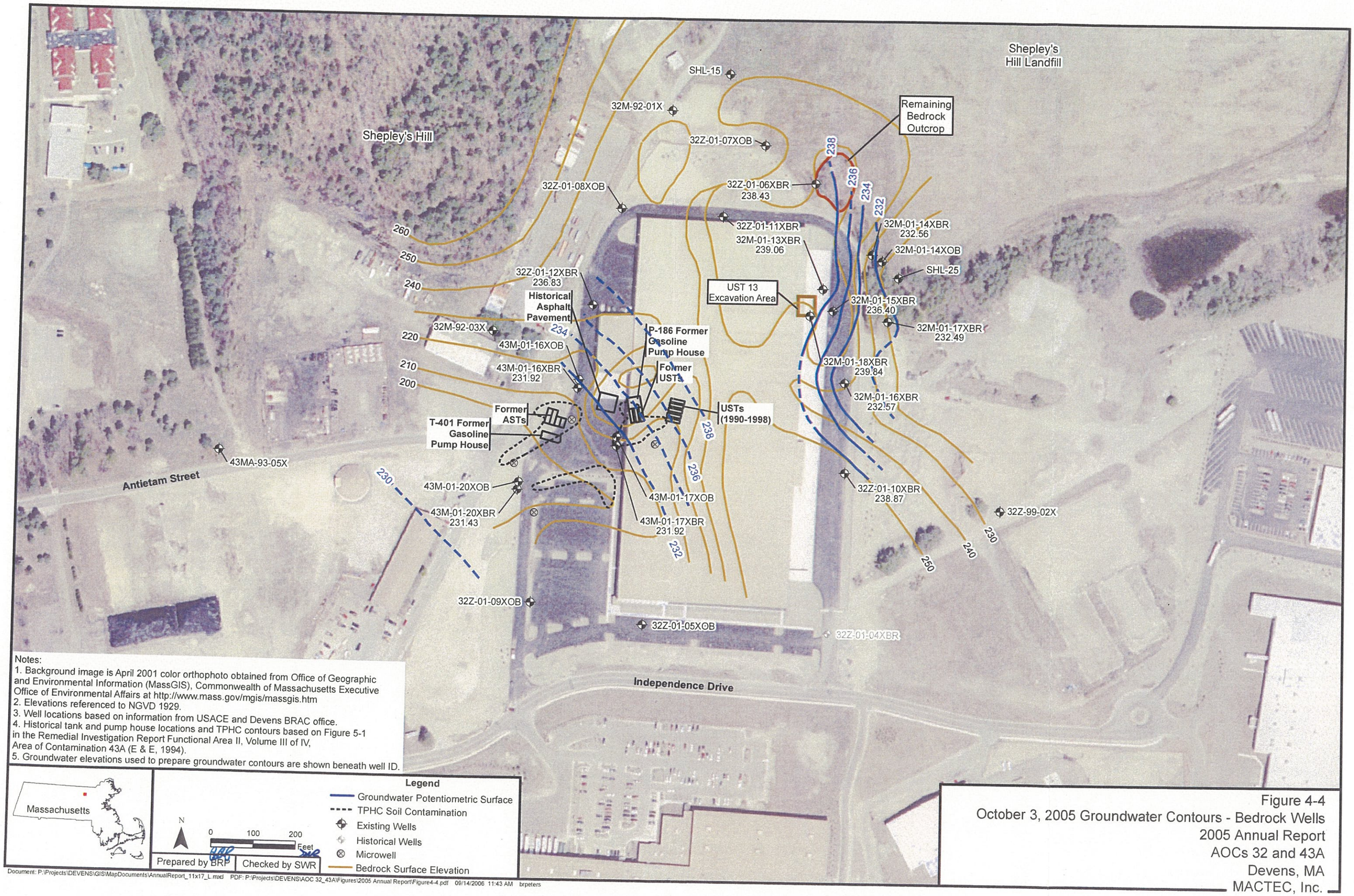
Figure 4-3
June 13, 2005 Groundwater Contours - Bedrock Wells
2005 Annual Report
AOCs 32 and 43A
Devens, MA
MACTEC, Inc.



Notes:
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5. Groundwater elevations used to prepare groundwater contours are shown beneath well ID.

Prepared by BRP | Checked by SWR

Legend
- Groundwater Potentiometric Surface
- TPHC Soil Contamination
- Existing Wells
- Historical Wells
- Microwell
- Bedrock Surface Elevation

Figure 4-4
October 3, 2005 Groundwater Contours - Bedrock Wells
2005 Annual Report
AOCs 32 and 43A
Devens, MA
MACTEC, Inc.

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Figure 4-5: Water Levels in Well Pair 32M-01-14XOB/XBR

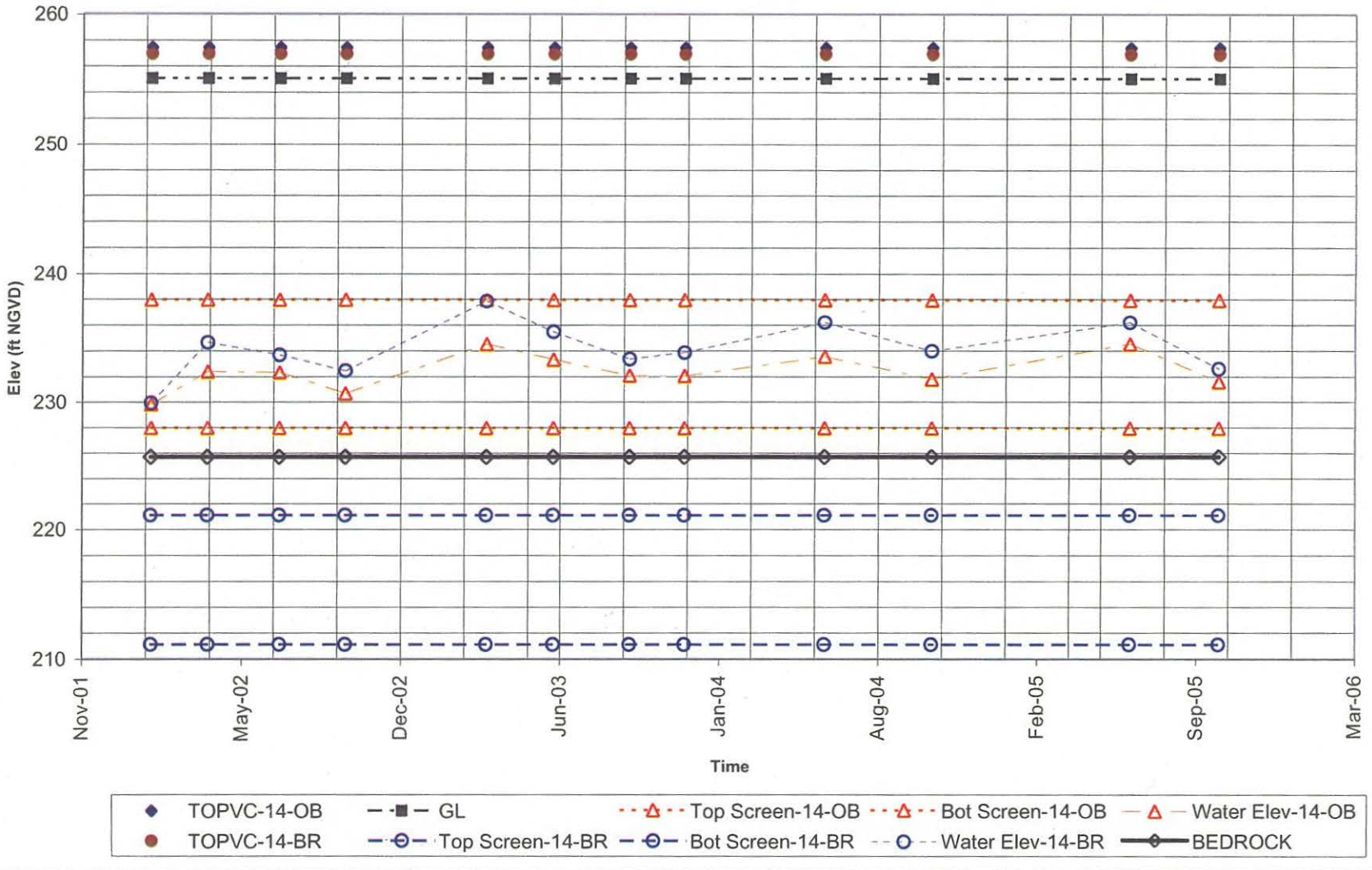


Figure 4-6: Water Levels in Well-Pair 43M-01-16XOB/XBR

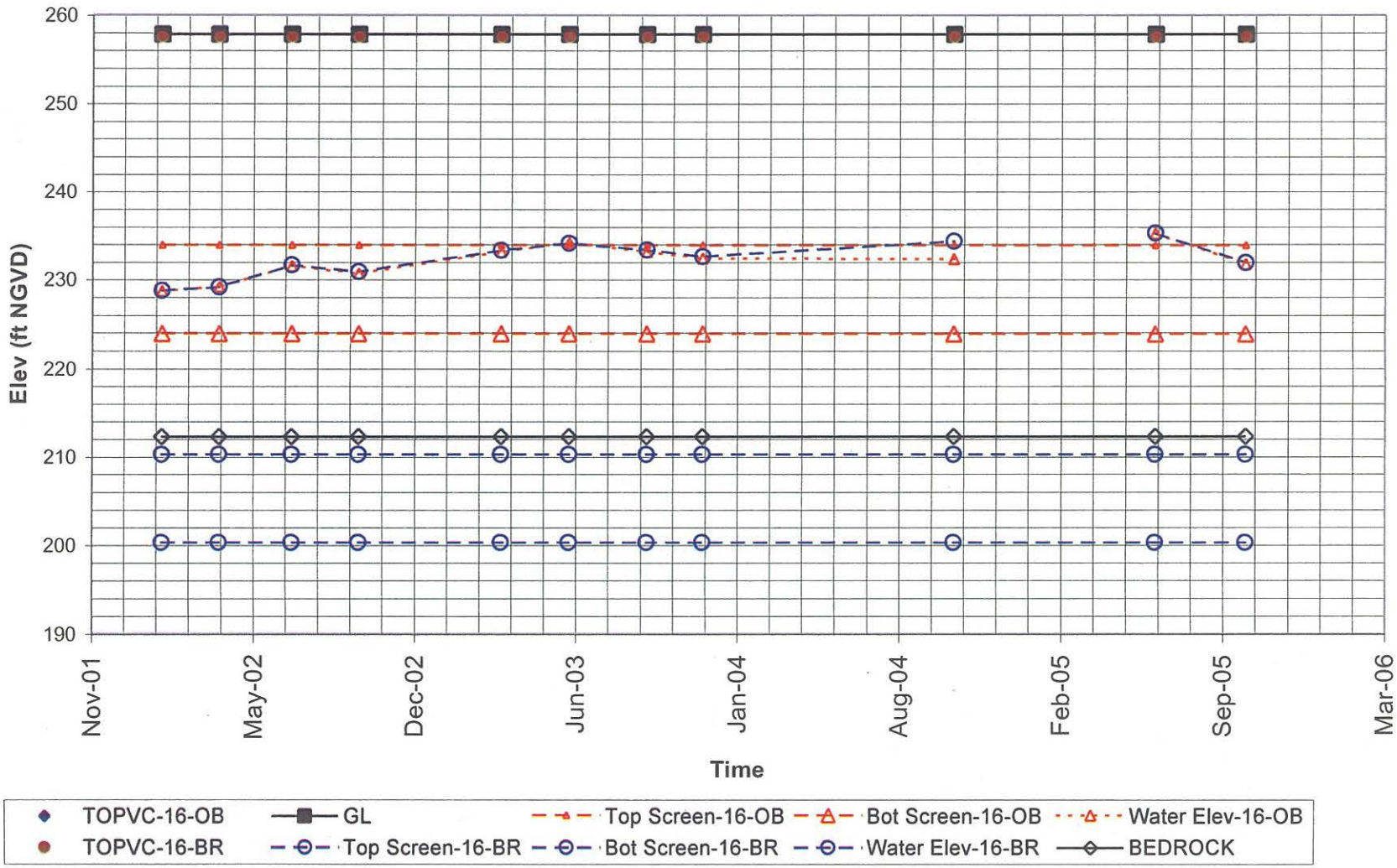


Figure 4-7 Water Levels in Well Pair 43M-01-17XOB/XBR

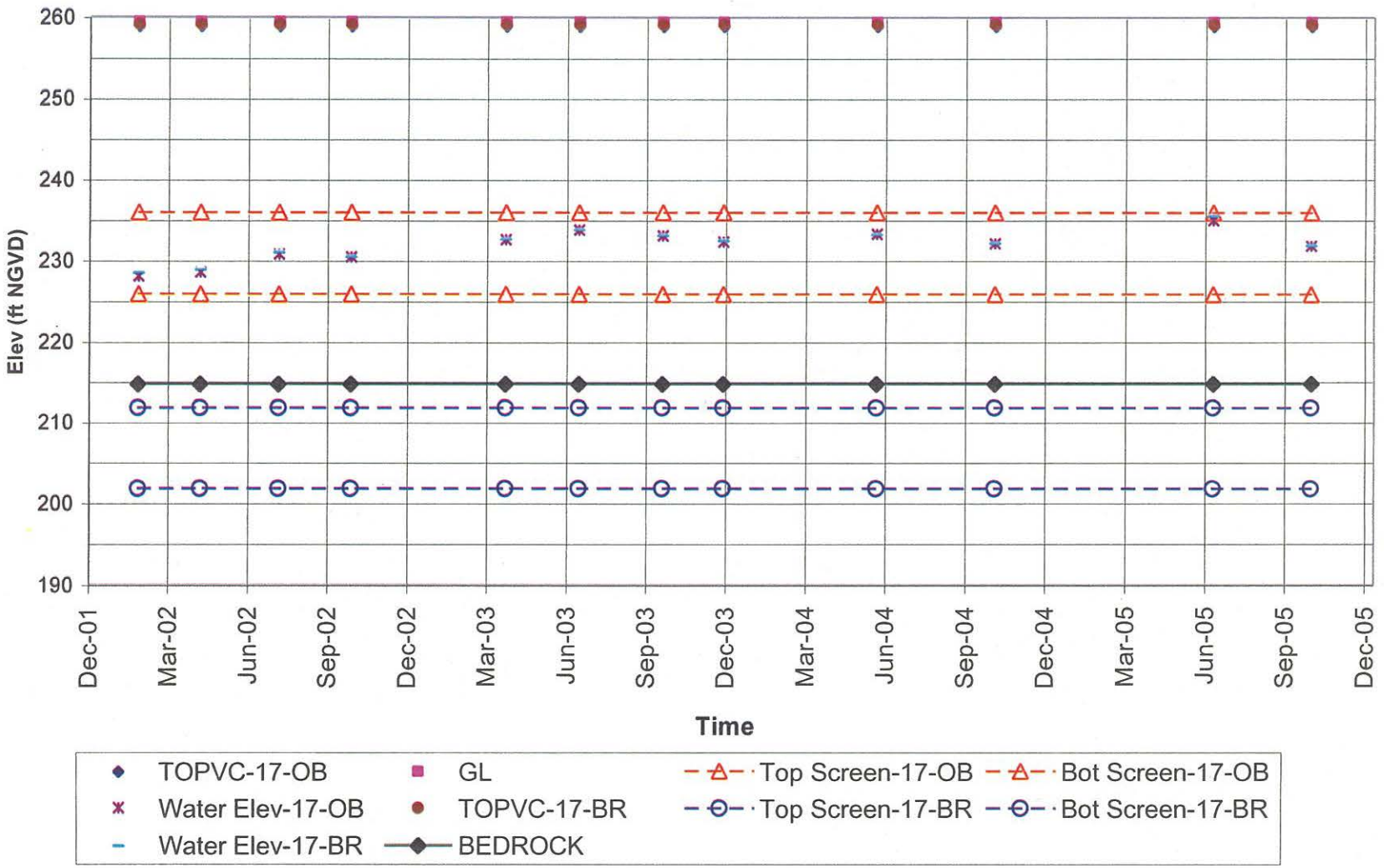
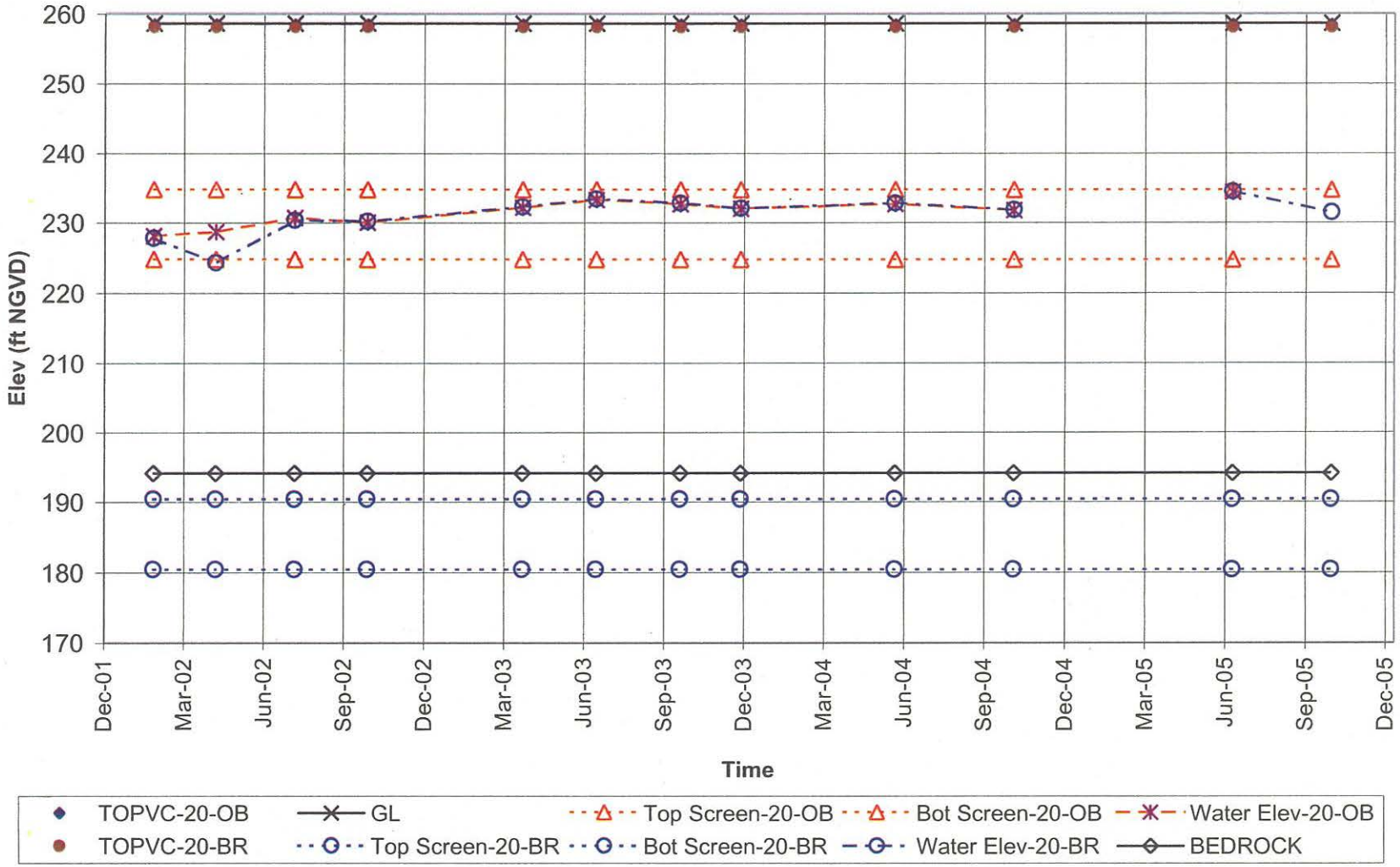


Figure 4-8 Water Levels in Well Pair 43M-01-20XOB/XBR



SHL-15	Cleanup Goal	Jun-05	Oct-05
Arsenic, µg/L	10	14.4	--

Arsenic cleanup goal is 50 µg/L, revised MCL is 10 µg/L
-- = concentration does not exceed cleanup goal

32M-01-14XBR	Cleanup Goal	Jun-05	Oct-05
Arsenic, µg/L	10	--	89.1
Lead, µg/L	15	--	21.7

Arsenic cleanup goal is 50 µg/L, revised MCL is 10 µg/L
-- = concentration does not exceed cleanup goal

32M-01-14XOB	Cleanup Goal	Jun-05	Oct-05
Arsenic, µg/L	10	88	41.9
Manganese, µg/L	3,500	6,010	--

Arsenic cleanup goal is 50 µg/L, revised MCL is 10 µg/L
-- = concentration does not exceed cleanup goal

32M-01-18XBR	Cleanup Goal	Jun-05	Oct-05
Chlorobenzene, µg/L	100	410 / 400	--
1,2-Dichlorobenzene, µg/L	600	4,500 / 4,600	1,450 / 1,630
1,4-Dichlorobenzene, µg/L	75	370 / 370	120 / 142
Hexachlorobutadiene, µg/L	0.6	47J / 160U	--
C9-C10 Aromatics, µg/L	200	260 / 290	--
Arsenic, µg/L	10	24.4 / 23.6	--
Manganese, µg/L	3,500	16,700 / 16,200	11,600 / 10,300

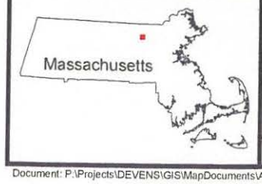
Arsenic cleanup goal is 50 µg/L, revised MCL is 10 µg/L
--= concentration does not exceed cleanup goal
/ = results of analysis for primary / duplicate samples

Shepley's Hill Landfill

Bedrock Outcrop

SHL-15
32M-92-01X
32Z-01-07XOB
32Z-01-06XBR
32Z-01-08XOB
32Z-01-11XBR
32M-01-13XBR
32M-01-14XBR
32M-01-14XOB
SHL-25
UST 13 Excavation Area
32M-01-15XBR
32M-01-17XBR
32Z-01-12XBR
Asphalt Pavement
32M-92-03X
P-186 Former Gasoline Pump House
43M-01-16XOB
43M-01-16XBR
Former USTs
USTs (1990-1998)
32M-01-18XBR
32M-01-16XBR
Former ASTs
T-401 Former Gasoline Pump House
43MA-93-05X
43M-01-20XOB
43M-01-20XBR
43M-01-17XOB
43M-01-17XBR
32Z-01-10XBR
32Z-99-02X
32Z-01-09XOB
32Z-01-05XOB
32M-01-04XBR

Notes:
1. Background image is April 2001 color orthophoto obtained from Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs at http://www.mass.gov/mgis/massgis.htm
2. Well locations based on information from USACE and Devens BRAC office.
3. Historical tank and pump house locations and TPHC contours based on Figure 5-1 in the Remedial Investigation Report Functional Area II, Volume III of IV, Area of Contamination 43A (E & E, 1994).



Legend
TPHC Soil Contamination
Existing Wells

N
0 100 200
Feet

Prepared by BRP | Checked by SWR

Figure 4-9
Exceedances of Cleanup Goals
2005 Annual Report
AOCs 32 and 43A
Devens, MA
MACTEC, Inc.

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Figure 4-10: Trichloroethene Over Time at 32M-01-18XBR

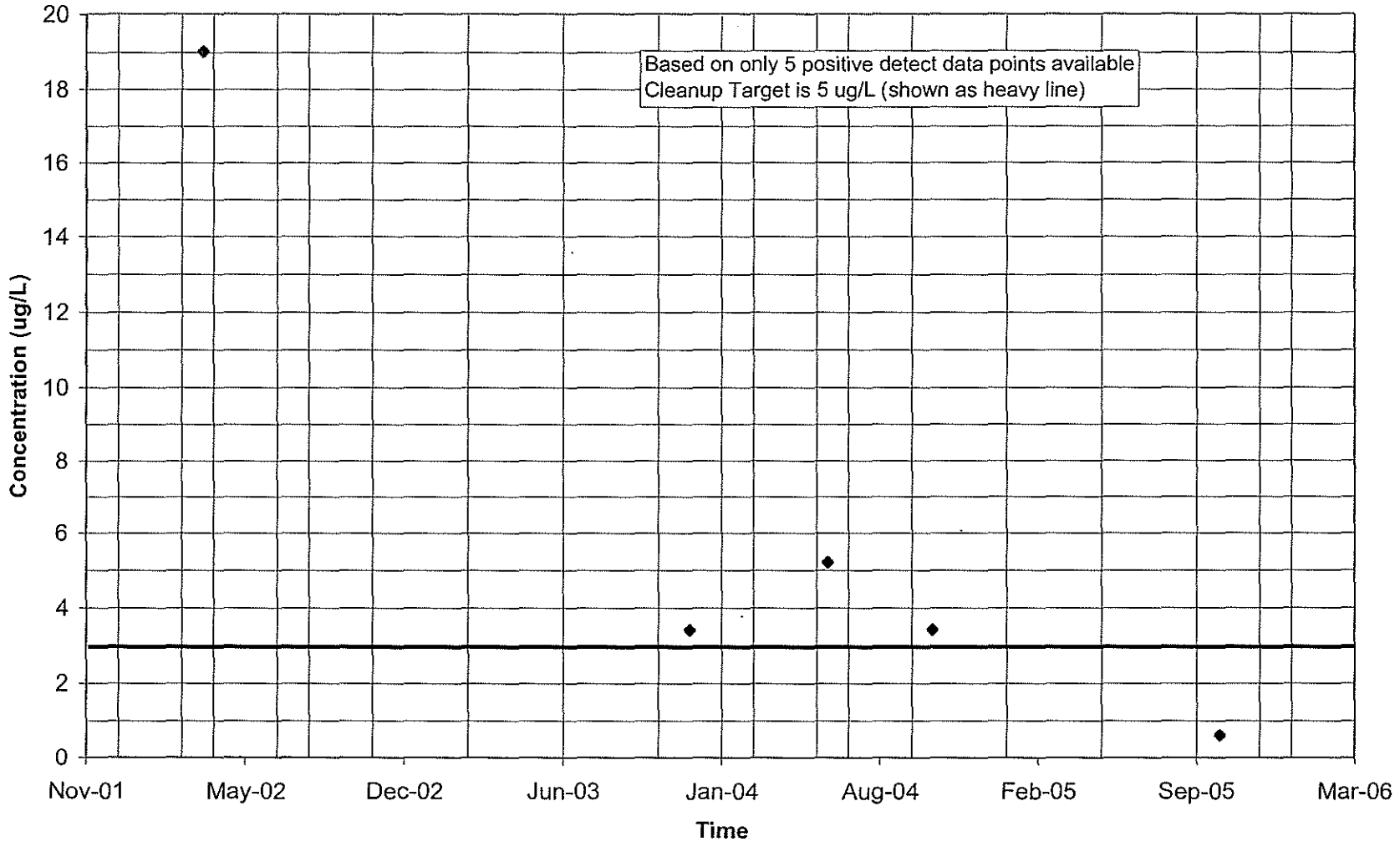


Figure 4-11: 1,2-dichlorobenzene Over Time at 32M-01-18XBR

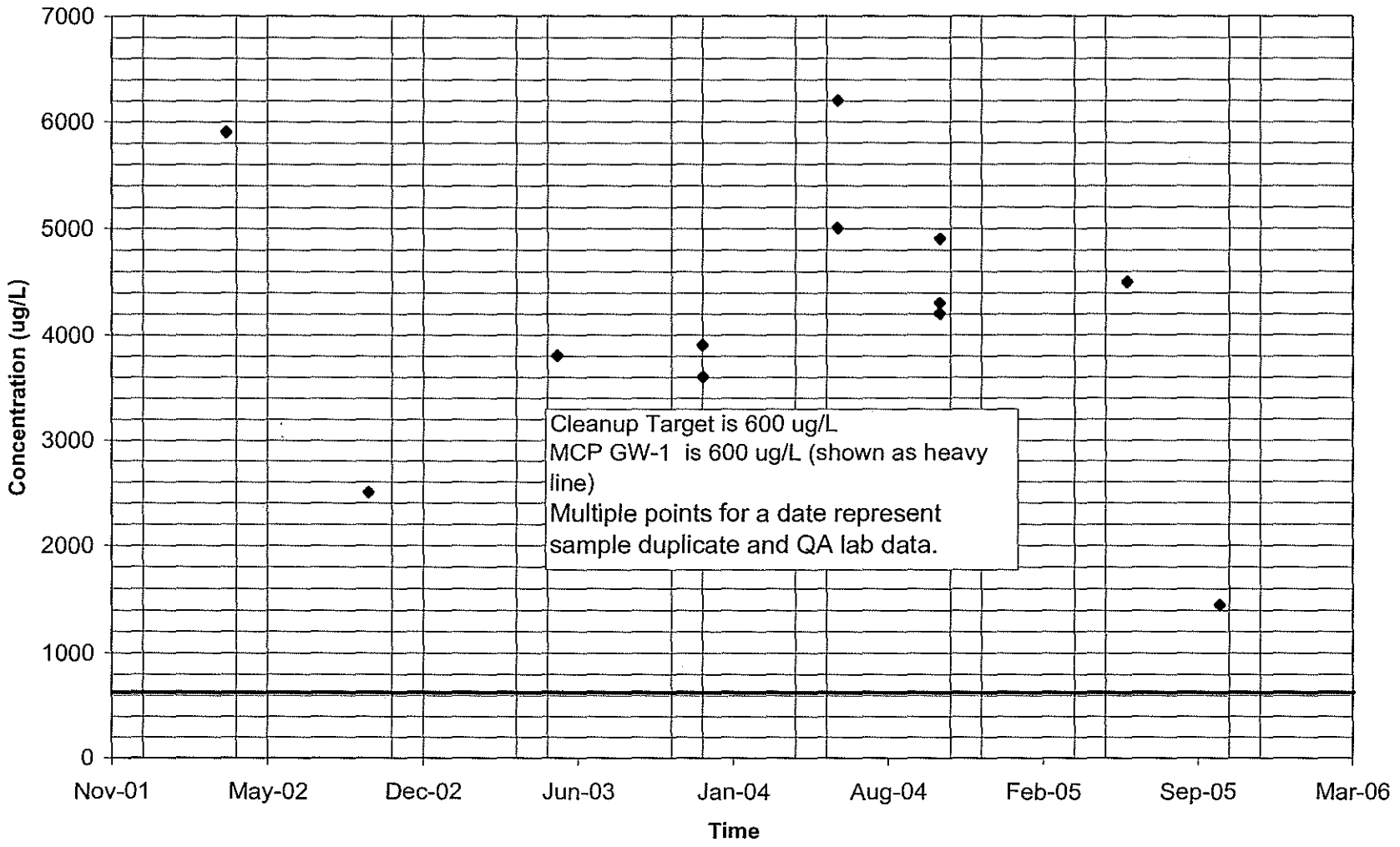


Figure 4-12: 1,3-dichlorobenzene Over Time at 32M-01-18XBR

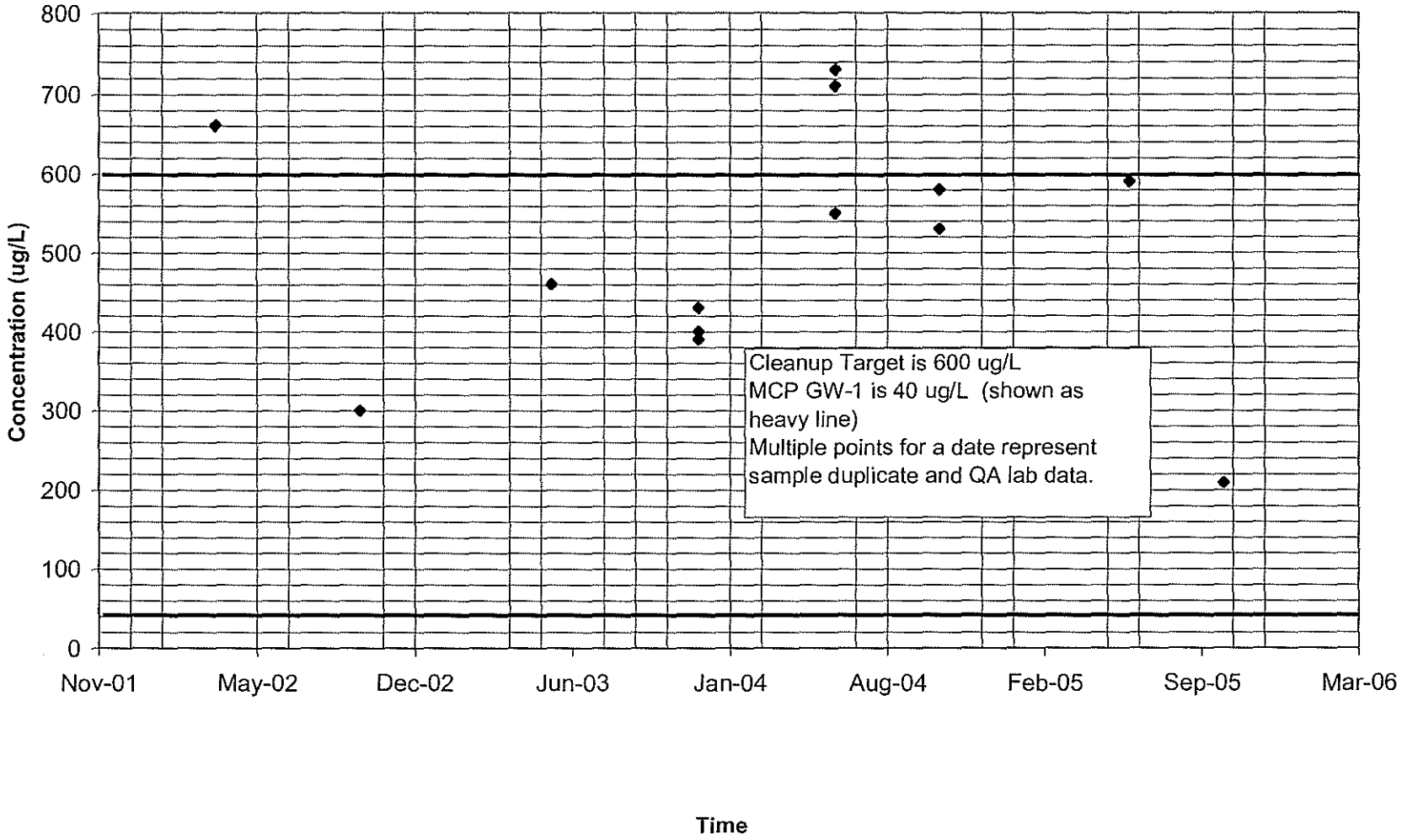


Figure 4-13: 1,4-dichlorobenzene Over Time at 32M-01-18XBR

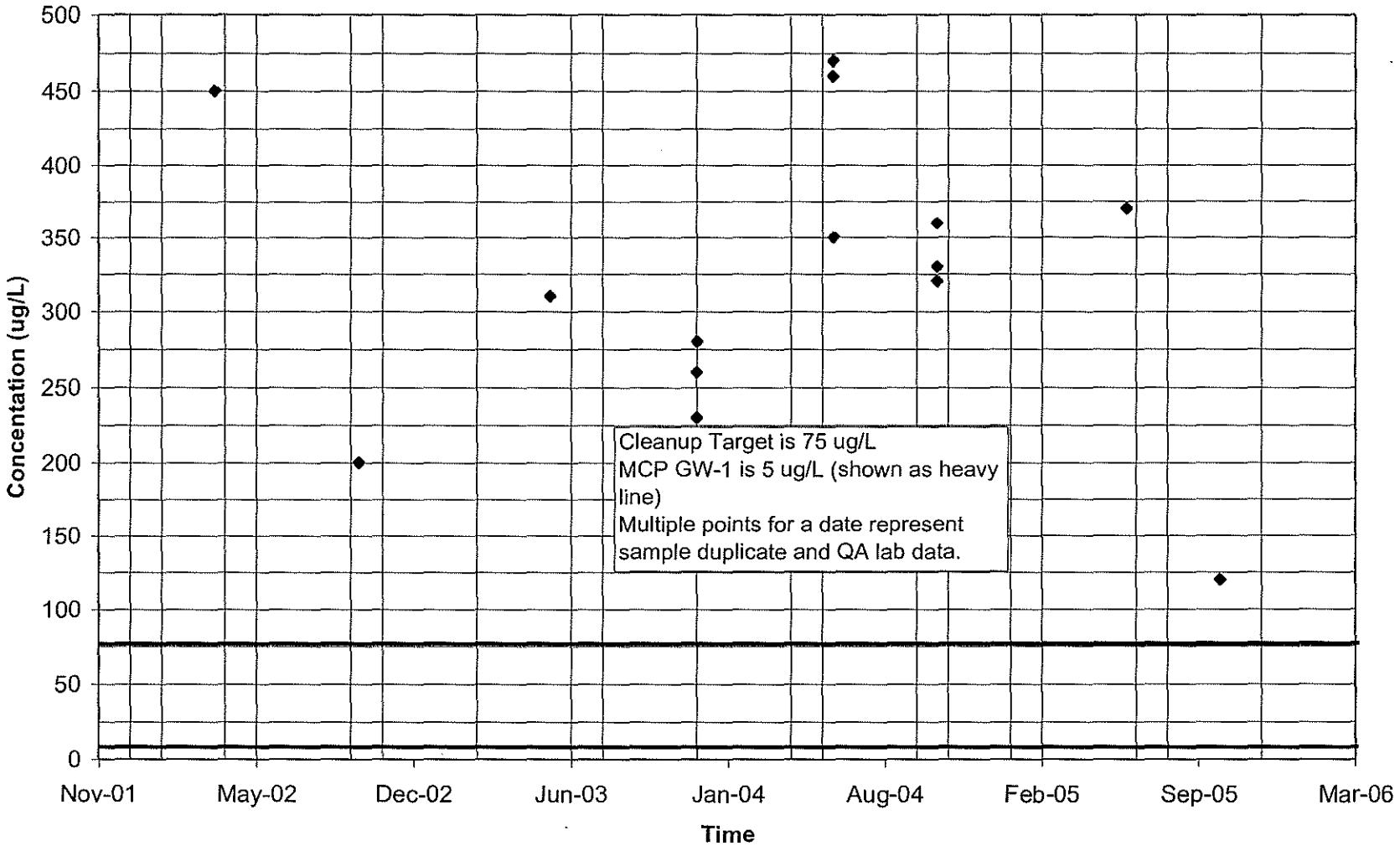


Figure 4-14: Chlorobenzene Over Time at 32M-01-18XBR

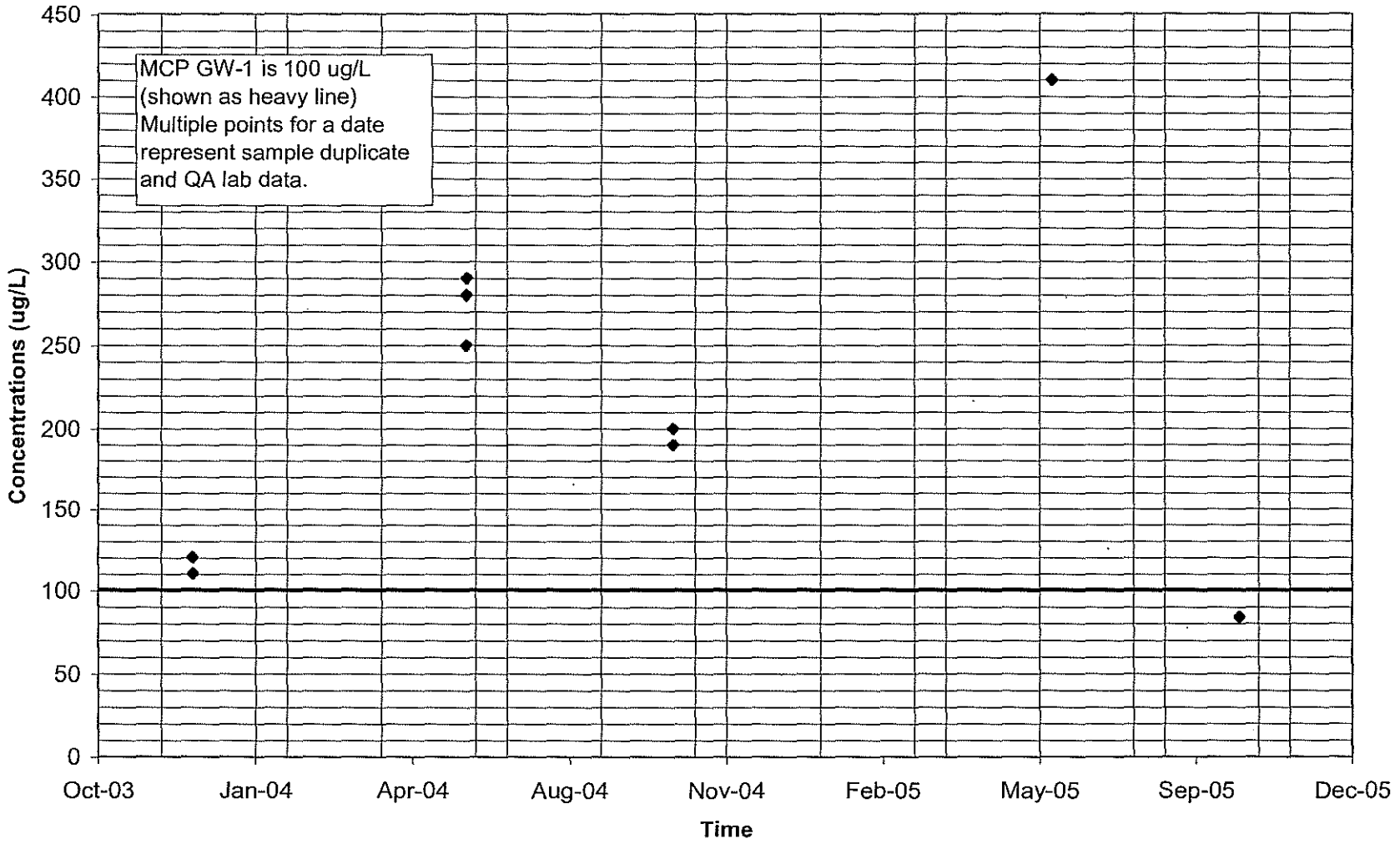


Figure 4-15: C9-C10 Aromatics Over Time in 32M-01-18XBR

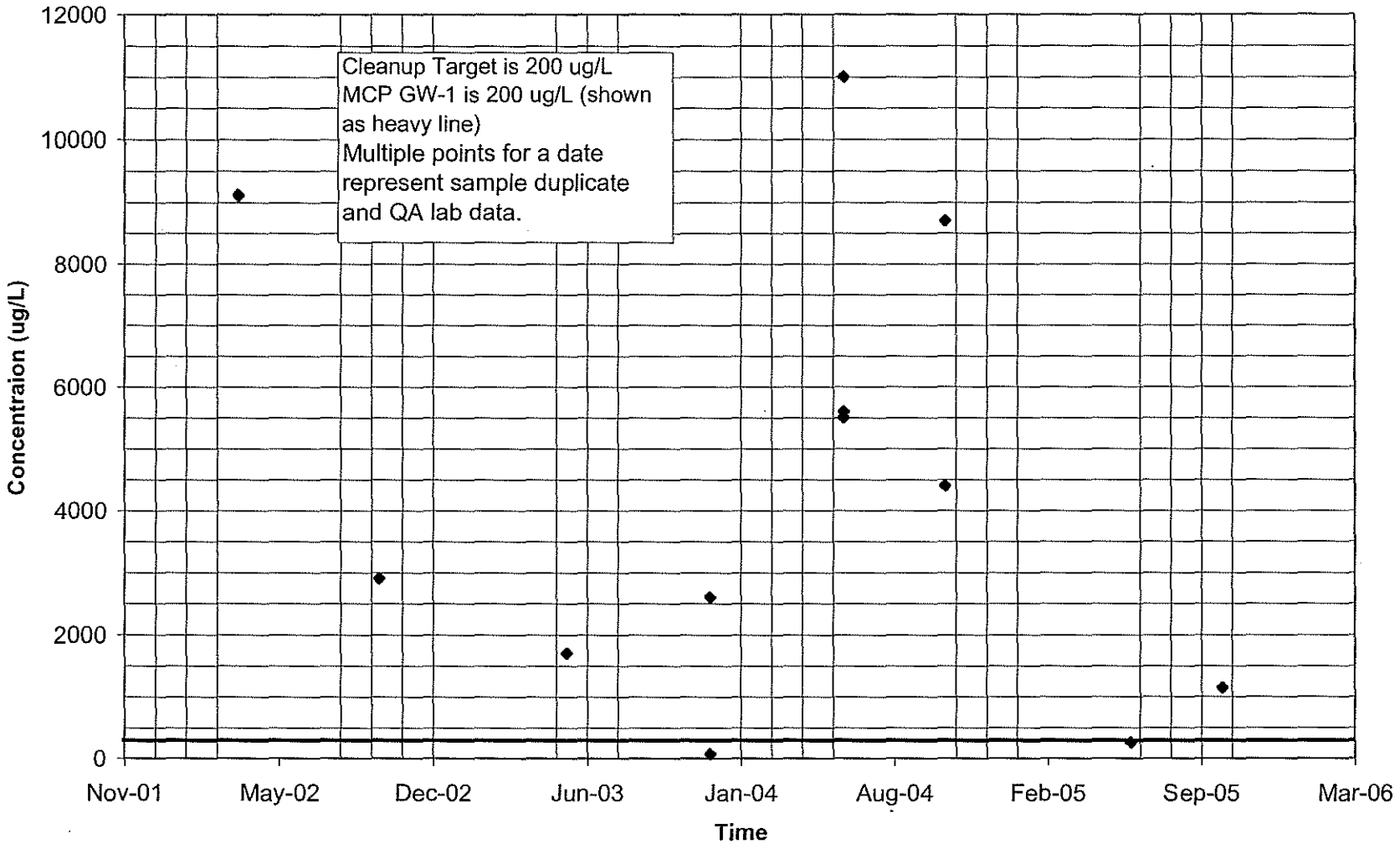


Figure 4-16: C9-C12 Aliphatics in 32M-01-18XBR

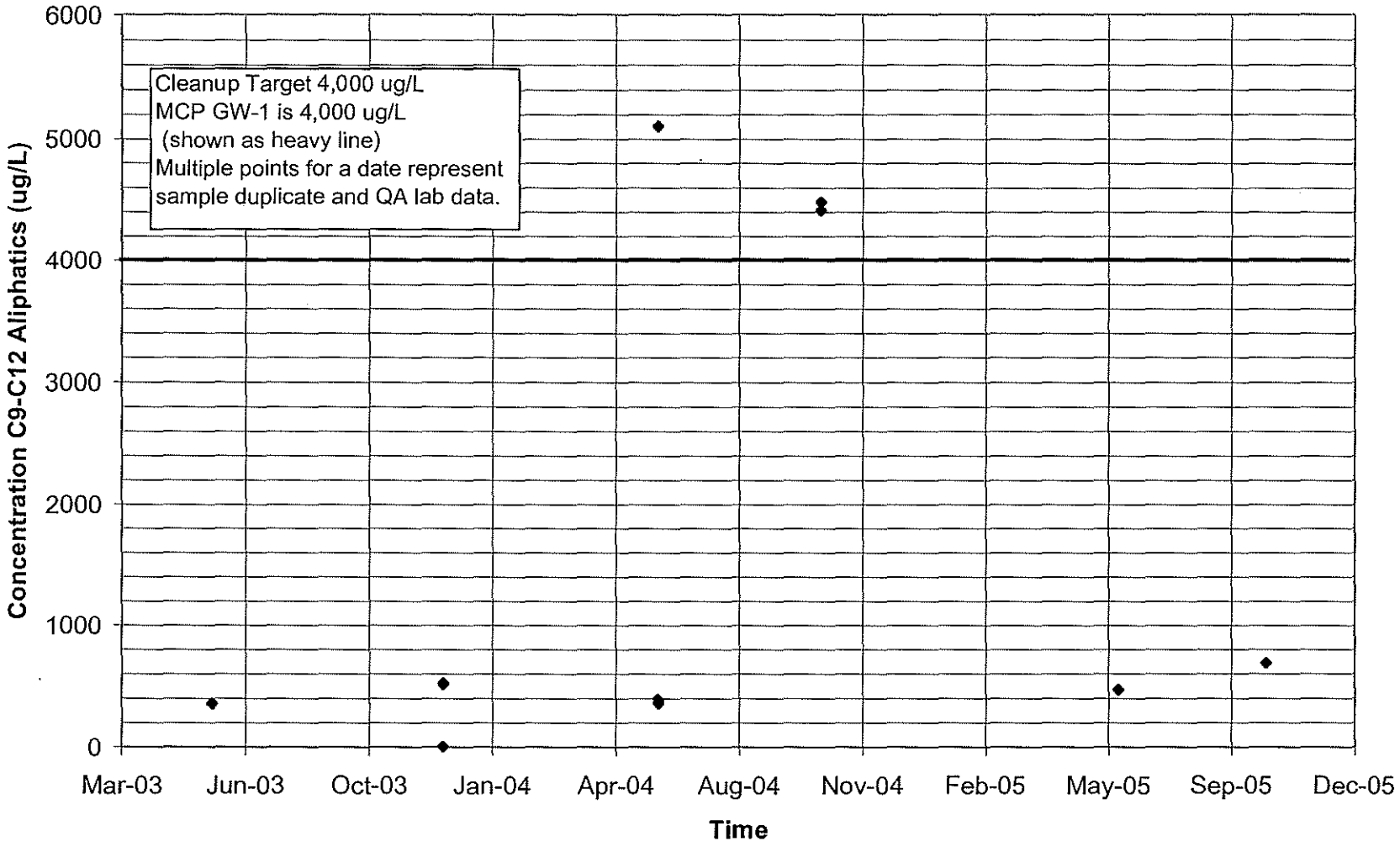
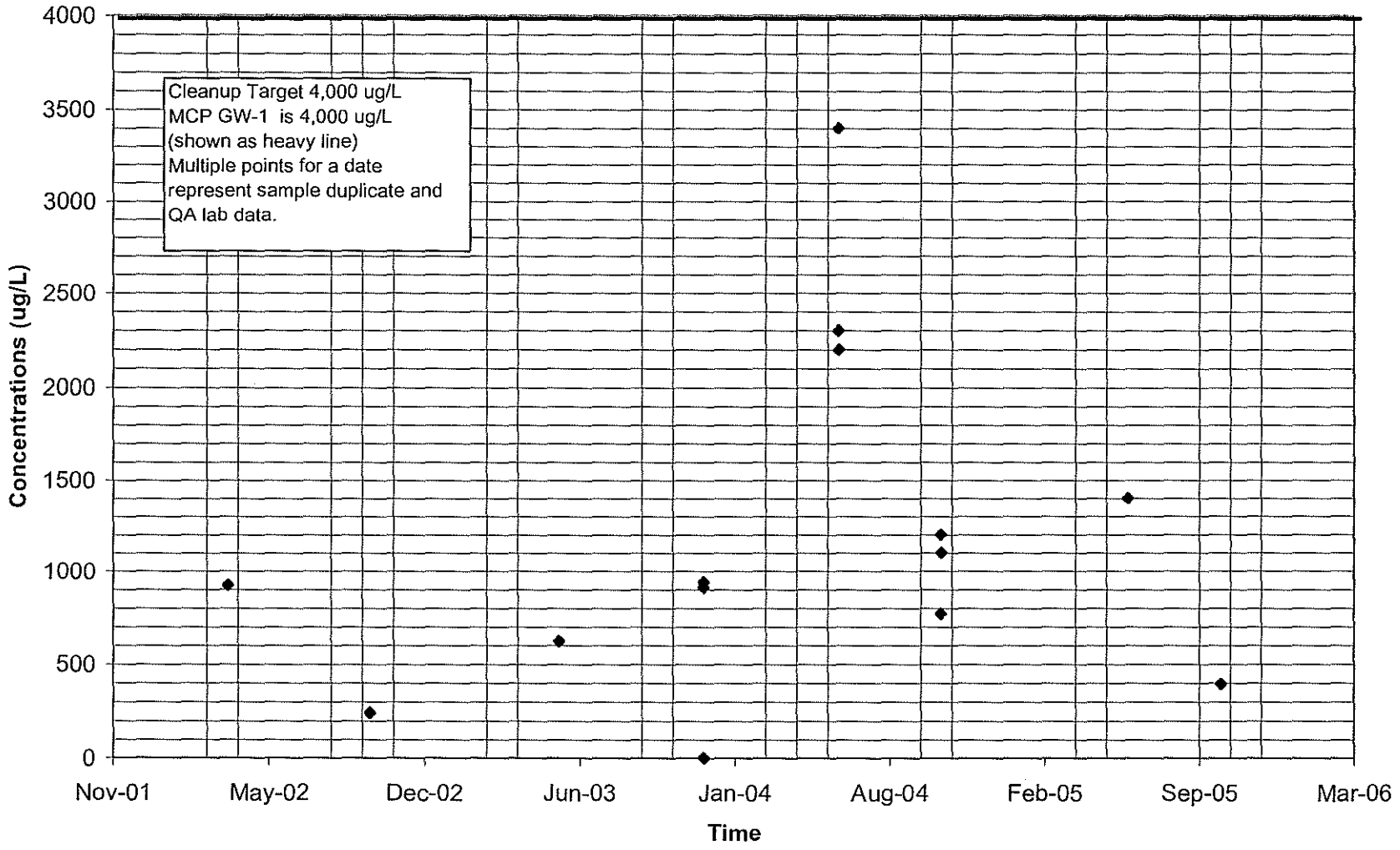


Figure 4-17: C9-C18 Aliphatics Over Time at 32M-01-18XBR



TABLES

TABLE 1-1
SUMMARY OF MODIFICATIONS TO LONG-TERM MONITORING ACTIVITIES

2005 ANNUAL REPORT
AOCS 32 AND 43A
DEVENS, MASSACHUSETTS

Date	Modification	Rationale
June 2005	Discontinued analysis for dissolved metals.	Analysis no longer necessary based on conclusion that only limited potential exists for bio-remediation/attenuation to occur at UST No. 13.
October 2005	Discontinued sampling at 43M-01-16XOB, -16XBR, -17XOB, -17XBR, -20XOB, and -20XBR.	No chemical of concern exceedances in these wells in 2003, 2004, June 2005.
	Discontinued sampling at 32M-01-04XBR	Absence of chemical of concern exceedances.
	Discontinued analysis for COD, TOC, NH3, dissolved gases, alkalinity, and anions.	Analysis no longer necessary based on conclusion that only limited potential exists for bio-remediation/attenuation to occur at UST No. 13.
	Discontinued analysis for PCBs.	No exceedances of cleanup goal.

TABLE 3-1
SUMMARY OF 2005 GROUNDWATER ELEVATION MONITORING AND SAMPLING PROGRAM

2005 ANNUAL REPORT
AOCS 32 AND 43A
DEVENS, MASSACHUSETTS

Monitoring Well	Well Description [1,2]	Elevation Monitoring	Sample Collection June	Sample Collection October
SHL-15	OB	✓	✓	✓
SHL-25	OB, sentry	✓		
32M-92-01X	OB	✓	✓	✓
32M-92-03X	OB	✓	✓	
32Z-99-02X	OB	✓	✓	
32M-01-04XBR	BR	✓	✓	
32Z-01-05XOB	OB	✓		
32Z-01-06XBR	BR	✓		
32Z-01-07XOB	OB	✓		
32Z-01-08XOB	OB	✓		
32Z-01-09XOB	OB	✓		
32Z-01-10XBR	BR	✓		
32Z-01-11XBR	BR	✓		
32Z-01-12XBR	BR	✓		
32M-01-13XBR	BR, source area	✓	✓	✓
32M-01-14XOB	OB, sentry	✓	✓	✓
32M-01-14XBR	BR, sentry	✓	✓	✓
32M-01-15XBR	BR, source area	✓	✓	✓
32M-01-16XBR	BR, sentry	✓	✓	✓
32M-01-17XBR	BR, sentry	✓	✓	✓
32M-01-18XBR	BR, source area	✓	✓	✓
43M-01-16XOB	OB, source area	✓	✓	
43M-01-16XBR	BR, source area	✓	✓	
43M-01-17XOB	OB, source area	✓	✓	
43M-01-17XBR	BR, source area	✓	✓	
43M-01-20XOB	OB, sentry	✓	✓	
43M-01-20XBR	BR, sentry	✓	✓	

Notes:

[1] OB = overburden

[2] BR = bedrock

TABLE 4-2
GROUNDWATER ANALYTICAL RESULTS - JUNE 13-16, 2005 SAMPLING EVENT

2005 ANNUAL REPORT
AOCS 32 AND 43A
DEVENS, MASSACHUSETTS

PARAMETER (METHOD)	MCP GW-1	Site-Specific Cleanup Goals	Reporting Limit	SHL-15	32M-92-01X	32Z-99-02X	32M-92-03X	32M-01-04XBR	32M-01-13XBR	32M-01-14XOB	32M-01-14XBR	32M-01-15XBR	32M-01-16XBR	32M-01-17XBR	32M-01-18XBR	32M-01-18XBR-DUP	32M-01-18XBR QA	43M-01-16XOB	43M-01-16XBR	43M-01-17XBR	43M-01-17XOB	43M-01-20XOB	43M-01-20XBR
	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
VOC (8260)																							
Volatile Organic Compounds																							
Vinyl chloride (chloroethene)	2	2	1.0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	160 U	160 U	2.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
trans-1,2-Dichloroethene	100	55	1.0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	160 U	160 U	2.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
cis-1,2-Dichloroethene	70	55	1.0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	160 U	160 U	2.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1,1-Trichloroethane	200	5	1.0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.25 J	1.0 U	1.0 U	160 U	160 U	11	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Trichloroethene	5	5	1.0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	160 U	160 U	2.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,3-Dichlorobenzene	40	600	1.0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.41 J	160 U	160 U	2.0 J	1.0 U	0.38 J	0.27 J	1.0 U	1.0 U	0.34 J
1,4-Dichlorobenzene	5	75	1.0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.34 J	1.1	1.0 U	0.40 J	**590**	**580**	**580**	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2-Dichlorobenzene	600	600	1.0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.31 J	1.0 U	1.0 U	1.0 U	**370**	**370**	**400**	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Dichlorodifluoromethane (Freon 12)	-	-	1.0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.46 J	0.83 J	0.40 J	0.34 J	**4500**	**4,600**	**5300 J+**	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Chloromethane	-	-	1.0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	160 U	160 U	2.7 J	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Bromomethane	10	-	1.0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	160 U	160 U	5.0 UJ	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Chloroethane	-	-	1.0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	160 U	160 U	2.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Trichlorofluoromethane (Freon 11)	-	-	1.0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	160 U	160 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Acrolein	-	-	5.0	5.0 U	5.0 U	5.0 U	0.46 J	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	160 U	160 U	2.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Freon TF	-	-	1.0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	160 U	160 U	2.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1-Dichloroethene	7	-	1.0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	160 U	160 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Acetone	3,000	-	5.0	10	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	16	5.0 U	5.0 U	5.0 U	5.0 U	800 U	800 U	10 U	5.0 U	3.1 J	5.0 U	5.0 U	5.0 U	5.0 U
Methyl iodide	-	-	1.0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	160 U	160 U	NR	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Carbon disulfide	-	-	1.0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	160 U	160 U	2.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Allyl chloride	-	-	1.0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	160 U	160 U	NR	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Methylene chloride	5	-	1.0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	160 U	160 U	NR	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Acrylonitrile	-	-	1.0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	160 U	160 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2-Dichloroethene (total)	-	-	1.0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	160 U	160 U	NR	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Methyl-t-butyl ether	70	-	1.0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.26 J	0.36 J	160 U	160 U	NR	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1-Dichloroethane	70	-	1.0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	160 U	160 U	2.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Vinyl acetate	-	-	1.0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	160 U	160 U	2.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Chloroprene	-	-	1.0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	160 U	160 U	NR	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
2-Butanone	350	-	5.0	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	800 U	800 U	10 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Propionitrile	-	-	4.0	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	640 U	640 U	NR	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U
Methacrylonitrile	-	-	1.0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	160 U	160 U	NR	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Bromochloromethane	-	-	1.0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	160 U	160 U	2.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Tetrahydrofuran	-	-	14	14 U	14 U	14 U	14 U	14 U	14 U	14 U	14 U	14 U	14 U	14 U	2200 U	2200 U	10 U	14 U	14 U	14 U	14 U	14 U	14 U
Chloroform	5	-	1.0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	160 U	160 U	2.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Carbon tetrachloride	5	-	1.0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	160 U	160 U	2.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Isobutyl alcohol (butanol)	-	-	50	50 U	50 U	5.0 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	8000 U	8000 U	2.0 U	50 U	50 U	50 U	50 U	50 U	50 U
Benzene	5	-	1.0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	160 U	160 U	0.86 J	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2-Dichloroethane	5	-	1.0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	160 U	160 U	2.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2-Dichloropropane	5	-	1.0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	160 U	160 U	2.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Methyl Methacrylate	-	-	1.0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	160 U	160 U	2.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Dibromomethane	-	-	1.0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	160 U	160 U	NR	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,4-Dioxane	-	-	50	50 U	50 U	5.0 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	8000 U	8000 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U
Bromodichloromethane	3	-	1.0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	160 U	160 U	2.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
2-Chloroethyl Vinyl Ether	-	-	1.0	1.0 U R	1.0 U R	1.0 U R	1.0 U R	1.0 U R	1.0 U R	1.0 U R	1.0 U R	1.0 U R	1.0 U R	1.0 U R	160 U R	160 U R	NR	1.0 U R	1.0 U R	1.0 U R	1.0 U R	1.0 U R	1.0 U R
cis-1,3-Dichloropropene	0.5 *	-	1.0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	160 U	160 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
4-methyl-2-pentanone	350	-	5.0	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	800 U	800 U	10 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Toluene	1,000	-	1.0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	160 U	160 U	2.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
trans-1,3-Dichloropropene	0.5 *	-	1.0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	160 U	160 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Ethyl methacrylate	-	-	1.0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	160 U	160 U	2.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1,2-Trichloroethane	5	-	1.0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	160 U	160 U	NR	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Tetrachloroethene	5	-	1.0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	160 U	160 U	2.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
2-Hexanone	-	-	5.0	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	0.41 J	160 U	160 U	0.53 J	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Dibromochloromethane	2	-	1.0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	800 U	800 U	10 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Chlorobenzene	100	-	1.0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	160 U	160 U	2.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1,1,2-Tetrachloroethane	5	-	1.0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.2	1.0 U	1.0 U	1.0 U	**410**	**400**	**400**	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Ethylbenzene	700	-	1.0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	160 U	160 U	2.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
m-Xylene & p-Xylene	10000 *	-	1.0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	160 U	160 U	1.1 J	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Xylene (total)	10000 *	-	1.0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	160 U	160 U	1.2 J	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
o-Xylene	10000 *	-	1.0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	160 U	160 U	NR	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Styrene	100	-	1.0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	160 U	160 U	0.76 J	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Bromoform	4	-	1.0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	160 U	160 U	2.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Isopropylbenzene	-	-	1.0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	160 U	160 U	2.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
cis-1,4-Dichloro-2-butene	-	-	1.0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	160 U	160 U	3.0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1,2,2-Tetrachloroethane	2	-	1.0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	160 U	160 U	NR	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2,3-Trichloropropane	-	-	1.0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	160 U	160 U	2.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
trans-1,4-Dichloro-2-butene	-	-	1.0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	160 U	160 U	2.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2-Dibromo-3-chloropropane (DBCP)	-	-	1.0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	160 U	160 U	NR	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2,4-Trichlorobenzene	70	-	1.0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	160 U	160 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Hexachlorobutadiene	0.6	-	1.0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	49 J	160 U	4.1	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Naphthalene	140	-	1.0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 UJ	**47 J**	160 U	2.0 UJ	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
2,2-Dichloropropane	-	-	1.0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	79 J	160 U	2.6 J	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1-Dichloropropene	-	-	1.0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	160 U	160 U	2.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,3-Dichloropropane	-	-	1.0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	160 U	160 U	2.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Bromobenzene	-	-	1.0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	160 U	160 U	2.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
n-Propylbenzene	-	-	1.0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 UJ	160 U	160 U	1.5 J	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
2-Chlorotoluene	-	-	1.0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	160 U	160 U	1.9 J	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
4-Chlorotoluene	-	-	1.0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 UJ	160 U	160 U	2.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,3,5-Trimethylbenzene	-	-	1.0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 UJ	160 U	160 U	2.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
tert-Butylbenzene	-	-	1.0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	160 U	160 U	0.51 J	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2,4-Trimethylbenzene	-	-	1.0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	160 U	160 U	2.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
sec-Butylbenzene	-	-	1.0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	160 U	160 U	1.9 J	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
p-Isopropyltoluene	-	-	1.0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	160 U	160 U	1.2 J	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
n-Butylbenzene	-	-	1.0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	160 U	160 U	2.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2,3-Trichlorobenzene	-	-	1.0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	65 J	160 U	2.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U

Notes:

Bold numbers indicate exceedance of MCP GW-1 standard

Numbers in shaded areas indicate exceedance of site-specific cleanup goals

NR = Compound not reported by the QA laboratory

* Regulatory standard is for total 1,3-dichloropropene and total xylenes

U = Compound not detected at a concentration above the reporting limit.

UJ = Compound tentatively not detected at reported concentration due to blank contamination or reporting limit is estimated.

J = Estimated value less than the reporting limit or an estimated value resulting from data evaluation

J+ = Value may be biased high based on data evaluation of laboratory results.

R = Reult was rejected based on inability to recover compound (0% recovery) from the matrix spike and matrix spike duplicate.

Note: A peristaltic pump was used to collect a sample from wells 32Z-99-02X and 43M-01-20XBR. It was necessary to use the peristaltic pump instead of the submersible pump due to the small diameter of the well casing at 32Z-99-02X and a history of blockages at 43M-01-20XBR.
QA lab results provided for VOCs since the primary laboratory reported elevated reporting limits for some compounds. A full QA data comparison will accompany the spring report.

TABLE 4-1
GROUNDWATER ELEVATION DATA SUMMARY YEARS 2002 THROUGH 2005

2005 ANNUAL REPORT
AOCS 32 AND 43A
DEVENS, MASSACHUSETTS

	2002 Water Levels				2003 Water Levels				2004 Water Levels		2005 Water Levels	
WELL DESIGNATION	GROUNDWATER ELEVATIONS	GROUNDWATER ELEVATIONS	GROUNDWATER ELEVATIONS	GROUNDWATER ELEVATIONS	GROUNDWATER ELEVATIONS	GROUNDWATER ELEVATIONS	GROUNDWATER ELEVATIONS	GROUNDWATER ELEVATIONS	GROUNDWATER ELEVATIONS	GROUNDWATER ELEVATIONS	GROUNDWATER ELEVATIONS	GROUNDWATER ELEVATIONS
Measuring Dates	1/30/2002	4/11/2002	7/10/2002	10/1/2002	3/27/2003	6/19/2003	9/23/2003	12/1/2003	5/25/2004	10/7/2004	6/13/2005	10/3/2005
32M-92-01X	240.29	243.98	243.35	241.33	245.89	244.14	241.89	242.05	244.47	242.83	244.64	241.02
32M-92-03X	NM	231.77	231.64	231.05	234.11	234.43	233.08	232.42	233.88	232.79	235.39	231.99
32Z-99-02X	232.77	235.42	235.6	233.70	237.59	230.63	234.97	235.40	236.79	234.69	237.71	234.24
SHL-15	239.71	242.45	242.52	240.20	NA	242.15	240.90	241.11	244.11	242.25	243.55	240.31
SHL-25	NM*	230.55	232.74	230.38	232.88	233.38	231.97	231.68	#N/A	231.42	234.65	231.38
32Z-01-04XBR	240.86	244.15	241.05	243.37	247.09	242.60	244.28	240.65	241.28	244.23	243.06	not located
32Z-01-05XOB	231.36	228.73	230.64	230.20	232.21	233.42	232.97	232.32	#N/A	232.00	234.60	231.89
32Z-01-06XBR	241.66	245.65	244.18	240.54	249.60	245.99	240.94	243.37	#N/A	244.15	235.90	238.43
32Z-01-07XOB	241.49	244.51	244.05	241.49	247.37	245.02	242.38	242.94	#N/A	243.65	245.29	241.32
32Z-01-08XOB	239.89	244.33	242.98	241.35	245.07	243.78	241.77	241.93	#N/A	242.51	243.56	241.02
32Z-01-09XOB	227.95	228.64	230.47	230.03	232.10	233.24	232.71	232.05	#N/A	231.73	231.90	231.46
32Z-01-10XBR	240.27	242.91	241.33	242.10	246.11	241.32	241.48	239.73	#N/A	241.54	241.92	238.87
32Z-01-11XBR	NO WATER	NO WATER	245.92	NO WATER	245.45	DRY	DRY	DRY	#N/A	below 245.84	below 245.84	below 245.84
32Z-01-12XBR	234.55	236.84	238.87	236.82	239.98	239.77	238.10	237.63	#N/A	237.73	240.28	236.83
32M-01-13XBR	238.74	240.8	240.79	241.87	247.87	243.58	241.63	240.89	242.01	242.24	243.07	239.06
32M-01-14XOB	229.75	232.3	232.24	230.62	234.47	233.26	232.01	232.00	233.49	231.74	234.49	231.53
32M-01-14XBR	229.89	234.6	233.62	232.41	237.84	235.44	233.31	233.82	236.17	233.94	236.18	232.56
32M-01-15XBR	235.86	238.05	237.66	237.61	242.46	239.18	237.58	237.17	238.36	237.97	239.61	236.40
32M-01-16XBR	231.47	234.36	234.7	232.87	237.34	235.10	233.89	233.59	234.87	233.64	236.16	232.57
32M-01-17XBR	231.08	233.33	230.04	232.64	236.37	234.80	233.62	233.36	234.69	233.39	235.94	232.49
32M-01-18XBR	238.99	241.14	241.63	241.08	246.72	243.61	241.65	241.13	242.52	242.14	243.57	239.84
43M-01-16XOB	228.71	229.13	231.53	230.67	233.17	234.20	233.15	232.42	233.75	232.34	235.20	231.77
43M-01-16XBR	228.77	229.15	231.65	230.89	233.29	234.15	233.37	232.62	#N/A	234.37	235.29	231.92
43M-01-17XOB	228.08	228.57	230.8	230.47	232.62	233.81	233.09	232.37	233.27	232.18	234.95	231.81
43M-01-17XBR	228.56	228.97	231.07	230.54	232.69	233.84	233.16	232.50	233.25	232.24	235.55	231.92
43M-01-20XOB	228.06	228.61	230.62	229.98	232.12	233.20	232.63	231.97	232.61	231.71	234.29	#N/A
43M-01-20XBR	227.73	224.25	230.33	230.18	232.26	233.34	232.72	232.04	232.72	231.83	234.42	231.43

NOTES:
Reference point for 2002 and 2003 elevations is ground surface.
Reference point for 2004 and 2005 elevations is top of PVC.
Groundwater elevations were collected on dates indicated.
Elevation datum is National Geodetic Vertical Datum NGVD, 1929 in feet.
NM* = Not measured, could not open

2004 Notes
For SHL-15 and SHL-25, the reference point for water level calculations is taken as the top of the metal casing.
#N/A: NO READING TAKEN.
#N/A for Well 43M-01-16XBR May 2004: Actual depth reading was 47.4 feet. Reading seems systematically offset (unlike previous events.)

2005 Notes:
Well 43M-01-20XOB could not be opened in October 2005
Well 32M-01-04XBR could not be located in October 2005. (Possibly covered by new pavement, electric gate, or landscaping).

TABLE 4-2
GROUNDWATER ANALYTICAL RESULTS - JUNE 13-16, 2005 SAMPLING EVENT

2005 ANNUAL REPORT
AOCS 32 AND 43A
DEVENS, MASSACHUSETTS

PARAMETER (METHOD)	MCP GW-1	Site-Specific Cleanup Goals	Reporting Limit	SHL-15	32M-92-01X	32Z-99-02X	32M-92-03X	32M-01-04XBR	32M-01-13XBR	32M-01-14XOB	32M-01-14XBR	32M-01-15XBR	32M-01-16XBR	32M-01-17XBR	32M-01-18XBR	32M-01-18XBR-DUP	43M-01-16XOB	43M-01-16XBR	43M-01-17XBR	43M-01-17XOB	43M-01-20XOB	43M-01-20XBR
	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
VOLATILES PETROLEUM HYDROCARBONS (MA DEP) Ranges																						
C5-C8 Aliphatic Hydrocarbons	400	400	3.00	3.0 U	3.0 U	3.0 U	3.0 U	3.0 U	3.0 U	3.0 U	3.0 U	3.0 U	3.0 U	3.0 U	4.6	5.4	3.0 U	3.0 U	3.0 U	3.0 U	3.0 U	3.0 U
C9-C12 Aliphatic Hydrocarbons	4,000	4,000	2.00	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	470	550	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
C9-C10 Aromatic Hydrocarbons	200	200	1.0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	**260**	**290**	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
VPH (MA DEP) Target VPH Analytes																						
Methyl tert-butyl ether	70	-	1.0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Benzene	5	5	1.0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Toluene	1,000	-	1.0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Ethylbenzene	700	500	1.0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	40	45	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
m,p-Xylene *	10,000	-	2.0	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
o-Xylene *	10,000	-	1.0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Naphthalene	140	-	1.0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Extractable Petroleum Hydrocarbon Ranges																						
C9 - C18 Aliphatic Hydrocarbons	4,000	4,000	60	61 U	62 U	62 U	61 U	61 U	61 U	61 U	62 U	61 U	62 U	61 U	1400	1100	62 U	61 U	61 U	61 U	61 U	61 U
C19 - C36 Aliphatic Hydrocarbons	5,000	5,000	80	82 U	82 U	82 U	82 U	81 U	82 U	82 U	82 U	82 U	82 U	82 U	42 U	400 U	83 U	82 U	82 U	81 U	81 U	81 U
C11-C22 Aromatic Hydrocarbons	200	200	170	170 U	180 U	180 U	170 U	170 U	170 U	170 U	170 U	170 U	170 U	180 U	170 U	180 U	170 U	180 U	170 U	170 U	170 U	170 U
Target PAH Analytes																						
Naphthalene	140	-	10	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
2-Methylnaphthalene	10	-	10	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Acenaphthylene	300	-	10	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Acenaphthene	20	-	10	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Fluorene	300	-	10	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Phenanthrene	300	-	10	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Anthracene	2000	-	10	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Fluoranthene	90	-	10	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Pyrene	80	-	10	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Benzo(a)anthracene	1	-	10	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Chrysene	2	-	10	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Benzo(b)fluoranthene	1	-	10	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Benzo(k)fluoranthene	1	-	10	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Benzo(a)pyrene	0.2	-	10	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Indeno(1,2,3-cd)pyrene	0.5	-	10	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Dibenzo(a,h)anthracene	0.5	-	10	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Benzo(g,h,i)perylene	300	-	10	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
TOTAL DISSOLVED GASES (method RSK175)																						
Methane	-	-	2.0	9.0	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	110	2.0 U	2.0 U	2.0 U	2.0 U	32	29	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Ethane	-	-	4.0	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U
Ethene	-	-	3.0	3.0 U	3.0 U	3.0 U	3.0 U	3.0 U	3.0 U	3.0 U	3.0 U	3.0 U	3.0 U	3.0 U	3.0 U	3.0 U	3.0 U	3.0 U	3.0 U	3.0 U	3.0 U	3.0 U
PCBs by EPA8082																						
Aroclor 1016	0.5	0.5	0.50	0.51 U	0.52 U	0.54 U	0.53 U	0.51 U	0.53 U	0.52 U	0.51 U	0.51 U	0.51 U	0.53 U	0.52 U	0.52 U	0.52 U	0.51 U	0.51 U	0.51 U	0.50 U	0.53 U
Aroclor 1221	0.5	0.5	0.50	0.51 U	0.52 U	0.54 U	0.53 U	0.51 U	0.53 U	0.52 U	0.51 U	0.51 U	0.51 U	0.53 U	0.52 U	0.52 U	0.52 U	0.51 U	0.51 U	0.51 U	0.50 U	0.53 U
Aroclor 1232	0.5	0.5	0.50	0.51 U	0.52 U	0.54 U	0.53 U	0.51 U	0.53 U	0.52 U	0.51 U	0.51 U	0.51 U	0.53 U	0.52 U	0.52 U	0.52 U	0.51 U	0.51 U	0.51 U	0.50 U	0.53 U
Aroclor 1242	0.5	0.5	0.50	0.51 U	0.52 U	0.54 U	0.53 U	0.51 U	0.53 U	0.52 U	0.51 U	0.51 U	0.51 U	0.53 U	0.52 U	0.52 U	0.52 U	0.51 U	0.51 U	0.51 U	0.50 U	0.53 U
Aroclor 1248	0.5	0.5	0.50	0.51 U	0.52 U	0.54 U	0.53 U	0.51 U	0.53 U	0.52 U	0.51 U	0.51 U	0.51 U	0.53 U	0.52 U	0.52 U	0.52 U	0.51 U	0.51 U	0.51 U	0.50 U	0.53 U
Aroclor 1254	0.5	0.5	0.50	0.51 U	0.52 U	0.54 U	0.53 U	0.51 U	0.53 U	0.52 U	0.51 U	0.51 U	0.51 U	0.53 U	0.52 U	0.52 U	0.52 U	0.51 U	0.51 U	0.51 U	0.50 U	0.53 U
Aroclor 1260	0.5	0.5	0.50	0.51 U	0.52 U	0.54 U	0.53 U	0.51 U	0.53 U	0.52 U	0.51 U	0.51 U	0.51 U	0.53 U	0.52 U	0.52 U	0.52 U	0.51 U	0.51 U	0.51 U	0.50 U	0.53 U
ICP METALS 3010/6010B (Total metals)																						
Arsenic	10	50	4.5	**14.4**	4.5 U	4.5 U	4.5 U	4.5 U	4.5 U	**88.7**	5.0 J+	4.5 U	4.5 U	4.5 U	**24.4**	**23.6**	4.5 U	4.5 U	4.5 U	7.1 J	4.5 U	4.5 U
Lead	15	15	2.7	2.7 U	2.7 U	3.6	2.7 U	2.7 U	3.4	3.2	5.7	2.7 J	2.9 U	2.7 U	6.6	2.9	2.7 U	3.4	2.7 U	2.7 U	2.7 U	2.9 U
Manganese	-	3,500	0.7	90.5	26.1	9.1 J	22.5	17.0	51.8	6,010	143	124	64.8	15.1	16,700	16,200	5.0 J	40.9	20.7	266	1.0 J	985
UNIT CHANGE			mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
TOC by SW846:9060																						
Total Organic Carbon	-	-	1.0	2.5	1.9	1.0 U	1.0 U	1.6	2.1	3.1	2.1	1.6	2.7	1.6 J-	4.6	5.2	1.0 U	1.2	1.0 U	1.6	1.0 UJ	1.0 U
AMMONIA (350.1)																						
Ammonia as N	-	-	0.024	0.16	0.024 U	0.024 U	0.024 U	0.024 U	0.024 U	0.33	0.024 U	0.024 U	0.024 U	0.024 U	0.038	0.060	0.024 U	0.082	0.024 U	0.024 U	0.024 U	0.024 U
ALKALINITY, TOTAL																						
as CaCO3	-	-	1.0	50.3	52.9	27.5	8.1	132	91.5	119	362	241	96.1	186	199	197	18.7	44.4	26.3	117	1,690	84.9
ANIONS (300)																						
Nitrate/nitrite (as N) by 353.2	-	-	0.010	0.49	0.80	2.2	0.20	1.3	4.1	0.42	0.11	2.4	3.6	2.9	2.9	2.7	1.5	0.77	0.96	1.3	2.0	0.14
Nitrite (as N) by 354.1			0.0050	0.0061	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.027	0.0050 U	0.012	0.0050 U	0.011	0.036	0.036	0.0050 U	0.0050 U	0.017	0.0050 U	0.0050 U	0.0050 U
Phosphorus (as P) by 365.2	-	-	0.010	0.072 UJ	0.026 UJ	0.054 UJ	0.053 UJ	0.05 UJ	0.056 UJ	0.18 UJ	0.24 UJ	0.13 UJ	0.066 UJ	0.048 UJ	0.089 UJ	0.09 UJ	0.045 UJ	0.1 UJ	0.061 UJ	0.037 UJ	0.043 UJ	0.063 UJ
Sulfate by 375.4	-	-	5.0	14.2	20.2	73.5	13.9	30.0	19.0	6.3	10.8	24.6	29.3	37.5	25.1	23.0	33.4	14.4 -	25.3	28.9	84.5	15.1
Sulfide by 376.2	-	-	0.020	0.19	0.020 U	0.0020 U	0.020 U	0.020 U	0.020 U	0.052	0.064	0.029	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U	0.023	0.020 U	0.020	0.020 U	0.056
Nitrate (as N) by calc	-	-	0.010	0.48	0.80	2.2	0.20	1.3	4.1	0.39	0.11	2.4	3.6	2.8	2.8	2.7	1.5	0.77	0.95	1.3	2.0	0.14
COD (410.4)																						
Chemical Oxygen Demand	-	-	20.0	20.0 U	20.0 U	36.9	20.0 U	20.0 U	20.0 U	38.8	40.8	20.0 U	20.0 U	25.1 J-	34.9	36.9	20.0 U	20.0 U	32.9	20.0 U	20.0 U	20.0 U
FIELD PARAMETERS																						
Temperature(deg C) initial	-	-	-	10.69	10.13	11.76	9.24	12.18	14.63	10.77	10.91	14.63	13.14	12.49	13.66	13.66	16.2	18.3	17.53	16.63	15.86	14.11
Temperature (deg C) final	-	-	-	12.66	11.15	11.44	12.80	14.99	19.19	11.73	14.72	15.14	16.10	15.30	14.43	14.43	14.45	17.88	18.62	17.32	17.65	14.01
ORP/Eh (mV)	-	-	-	64.2	397.3	518.0	319.8	203.2	323.7	-50.3	109.3	85.0	142.2	130.8	24.7	24.7	220.5	179.2	553.9	249.6	544.0	15.70
pH (std units)	-	-	-	5.75	6.02	4.54	5.11	6.19	6.03	6.35	6.67	7.04	6.03	6.78	6.29	6.29	5.40	6.51	4.55	5.28	3.95	6.74
Specific Conductance	-	-	-	149	175	212	68	262	295	519	645	596	358	492	481	481	136	76	357	103	153	2227.00
Dissolved Oxygen	-	-	-	0.61	5.36	9.62	9.90	5.11	3.97	2.49	2.92	5.15	3.54	1.53	0.50	0.50	6.99	5.53	1.60	5.26	8.85	0.33
Turbidity				0.96	4.24	2.26	0.11	0.15	1.64	31.9	2.73	22.3	4.42	0.25	0.51	0.51	3.5	5.12	2.35	1.17	0.78	3.42

Notes:
Bold numbers indicate exceedance of MCP GW-1 standard
Numbers in shaded areas indicate exceedance of site-specific cleanup goals. In the case of arsenic, the revised MCL and MCP standard of 10 ug/L has been used for comparison in lieu of the established cleanup goal of 50 ug/L.
U = Compound not detected at a concentration above the reporting limit.
UJ = Compound tentatively not detected at reported concentration due to blank contamination or detection limit estimated due to low spike recoveries
J = Estimated value less than the reporting limit or an estimated value resulting from data evaluation
J+ = Value may be biased high based on data evaluation of laboratory results.

TABLE 4-3
GROUNDWATER ANALYTICAL RESULTS - OCTOBER 3-5, 2005 SAMPLING EVENT

2005 ANNUAL REPORT
AOCS 32 AND 43A
DEVENS, MASSACHUSETTS

PARAMETER (METHOD)	MCP GW-1	Site-Specific Cleanup Goals	SHL-15	32M-92-01X	32M-01-13XBR	32M-01-14XOB	32M-01-14XBR	32M-01-15XBR	32M-01-16XBR	32M-01-17XBR	32M-01-18XBR	32M-01-18XBR-DUP
	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
Volatile Organic Compounds												
1,1,1,2-Tetrachloroethane	2	-	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1,1-Trichloroethane	200	5	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1,2,2-Tetrachloroethane	2	-	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1,2-Trichloro-1,2,2-trifluoroethane	-	-	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.3	1.4
1,1,2-Trichloroethane	5	-	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1-Dichloroethane	70	-	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1-Dichloroethene	7	-	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1-Dichloropropene	-	-	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
1,2,3-Trichlorobenzene	-	-	1.0 U	1.0 U	1.0 UJ	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2,3-Trichloropropane	-	-	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2,4-Trichlorobenzene	70	-	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.2	1.2
1,2,4-Trimethylbenzene	-	-	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.6 J	0.7 J
1,2-Dibromo-3-chloropropane	-	-	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
1,2-Dibromoethane	0.02	-	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2-Dichlorobenzene	600	600	1.0 U	1.0 U	2.2	1.0 U	0.7 J	19.3	1.0 U	2.3	**1450**	**1630**
1,2-Dichloroethane	5	-	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2-Dichloropropane	5	-	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,3,5-Trimethylbenzene	-	-	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,3-Dichlorobenzene	40	600	1.0 U	1.0 U	0.9 J	1.0 U	0.5 J	3.8	1.0 U	3.8	**209**	**232**
1,3-Dichloropropane	-	-	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,4-Dichlorobenzene	5	75	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.6	1.0 U	0.5 J	**120**	**142**
1-Chlorohexane	-	-	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
2,2-Dichloropropane	-	-	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
2-Butanone	350	-	25.0 U	25.0 U	25.0 U	25.0 U	25.0 U	25.0 U	25.0 U	25.0 U	25.0 U	25.0 U
2-Chlorotoluene	-	-	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
2-Hexanone	-	-	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U
4-Chlorotoluene	-	-	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
4-Isopropyltoluene	-	-	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.7 J	0.7 J
4-methyl-2-pentanone	350	-	25.0 U	25.0 U	25.0 U	25.0 U	25.0 U	25.0 U	25.0 U	25.0 U	25.0 U	25.0 U
Acetone	3,000	-	25.0 U	25.0 U	25.0 U	25.0 U	25.0 U	25.0 U	25.0 U	25.0 U	25.0 U	25.0 U
Benzene	5	-	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Bromobenzene	-	-	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Bromochloromethane	-	-	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Bromodichloromethane	3	-	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Bromoform	4	-	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Bromomethane	10	-	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Carbon disulfide	-	-	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Carbon tetrachloride	5	-	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Chlorobenzene	100	-	1.0 U	1.0 U	1.0 U	1.0 U	1.5	1.8	1.0 U	1.0 U	83.9	82.1
Chloroethane	-	-	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Chloroform	5	-	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Chloromethane	-	-	1.0 U	1.0 U	2.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
cis-1,2-Dichloroethene	70	55	0.5 U	0.5 U	1.0 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	2.2
cis-1,3-Dichloropropene	0.5 *	-	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Cyclohexane	-	-	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.9	1.9
Dibromochloromethane	2	-	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Dibromomethane	-	-	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Dichlorodifluoromethane (Freon 12)	-	-	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Ethylbenzene	700	-	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Hexachlorobutadiene	0.6	-	0.6 U	0.6 U	0.6 U	0.6 U	0.6 U	0.6 U	0.6 U	0.6 U	0.6 U	0.6 U
Isopropylbenzene	-	-	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0	1.0
Methyl acetate	-	-	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Methyl tert-butyl ether	70	-	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	10 U	10 U
Methylcyclohexane	-	-	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.2	1.1
Methylene chloride	5	-	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Naphthalene	140	-	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
n-Butylbenzene	-	-	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
n-Propylbenzene	-	-	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.8 J	0.7 J
sec-Butylbenzene	-	-	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.5 J	0.5 J
Styrene	100	-	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
tert-Butylbenzene	-	-	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Tetrachloroethene	5	-	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Tetrahydrofuran	-	-	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Toluene	1,000	-	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
trans-1,2-Dichloroethene	100	55	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
trans-1,3-Dichloropropene	0.5 *	-	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Trichloroethene	5	5	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.6 J	0.6 J
Trichlorofluoromethane (Freon 11)	-	-	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Vinyl acetate	-	-	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Vinyl chloride	2	-	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Xylene M,P	10000 *	-	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Xylene O	10000 *	-	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U

TABLE 4-3
GROUNDWATER ANALYTICAL RESULTS - OCTOBER 3-5, 2005 SAMPLING EVENT

2005 ANNUAL REPORT
AOCS 32 AND 43A
DEVENS, MASSACHUSETTS

PARAMETER (METHOD)	MCP GW-1	Site-Specific Cleanup Goals	SHL-15	32M-92-01X	32M-01-13XBR	32M-01-14XOB	32M-01-14XBR	32M-01-15XBR	32M-01-16XBR	32M-01-17XBR	32M-01-18XBR	32M-01-18XBR-DUP
	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
VOLATILES PETROLEUM HYDROCARBONS (MA DEP) Ranges												
C5-C8 Aliphatic Hydrocarbons	400	400	162 U	162 U	162 U	162 U	162 U	162 U	162 U	162 U	162 U	162 U
C9-C12 Aliphatic Hydrocarbons	4,000	4,000	220 U	220 U	220 U	220 U	220 U	220 U	220 U	220 U	686	633
C9-C10 Aromatic Hydrocarbons	200	200	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	**1,150**	**1,090**
VPH (MA DEP) Target VPH Analytes												
Methyl tert-butyl ether	70	-	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U
Benzene	5	5	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Toluene	1,000	-	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Ethylbenzene	700	500	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	114	107
m,p-Xylene *	10,000	-	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U
o-Xylene *	10,000	-	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Naphthalene	140	-	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Extractable Petroleum Hydrocarbon Ranges												
C9 - C18 Aliphatic Hydrocarbons	4,000	4,000	200 U	200 U	200 U	200 U	200 U	222 U	200 U	200 U	228 J	395 J
C19 - C36 Aliphatic Hydrocarbons	5,000	5,000	200 U	200 U	200 U	200 U	200 U	222 U	200 U	200 U	200 U	200 U
C11-C22 unadj Aromatics 1	200	200	150 U	150 U	150 U	150 U	150 U	167 U	150 U	150 U	150 U	150 U
C11-C22 Aromatics 1,2	200	200	154 U	154 U	154 U	154 U	154 U	171 U	154 U	154 U	154 U	154 U
Target PAH Analytes												
Naphthalene	140	-	0.2 UJ	0.3 UJ	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.6 UJ	0.4 UJ
2-Methylnaphthalene	10	-	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.5	0.4
Acenaphthylene	300	-	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Acenaphthene	20	-	0.2 U	0.3	0.3	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Fluorene	300	-	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2	0.2 U
Phenanthrene	300	-	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.4	0.4 U
Anthracene	2000	-	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Fluoranthene	90	-	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2	0.2
Pyrene	80	-	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Benzo(a)anthracene	1	-	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Chrysene	2	-	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Benzo(b)fluoranthene	1	-	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Benzo(k)fluoranthene	1	-	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
Benzo(a)pyrene	0.2	-	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Indeno(1,2,3-cd)pyrene	0.5	-	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
Dibenzo(a,h)anthracene	0.5	-	0.2 U	0.2	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Benzo(g,h,i)perylene	300	-	0.2 U	0.2	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
ICP METALS 3010/6010B (Total metals)												
Arsenic	10	50	9.9	2.5 U	2.5 U	**41.9**	**89.1**	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
Lead	15	15	2.5 U	2.5 U	3.7	2.5 U	**21.7**	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
Manganese	-	3,500	82	34	2410 J-	3,070	694	139	170.0	10 U	11,600	10,300
FIELD PARAMETERS												
Temperature(deg C) initial	-	-	15.65	15.38	17.17	20.44	12.68	19.77	14.93	15.09	17.63	17.63
Temperature (deg C) final	-	-	15.65	16.62	17.47	16.36	13.94	20.22	18.93	15.64	22.49	22.49
ORP/Eh (mV)	-	-	540	589.5	-26.9	102	316.3	348.6	16	627.3	35.4	35.4
pH (std units)	-	-	3.09	4.42	6.24	5.97	6.26	6.94	5.81	3.87	5.77	5.77
Specific Conductance	-	-	182	186	535	321	697	613	482	558	653	653
Dissolved Oxygen	-	-	0.97	2.75	4.80	3.97	7.52	5.03	4.58	1.45	4.32	4.32
Turbidity				4.9	2.10	23.1	266	18.3	0.75	0.33	0.68	0.68

Notes:

Bold numbers indicate exceedance of MCP GW-1 standard

Numbers in shaded areas indicate exceedance of site-specific cleanup goals. In the case of arsenic, the revised MCL and MCP standard of 10 ug/L has been used for comparison in lieu of the established cleanup goal of 50 ug/L.

U = Compound not detected at a concentration above the reporting limit.

UJ = Compound tentatively not detected at reported concentration due to blank contamination or detection limit estimated due to low spike recoveries

J = Estimated value less than the reporting limit or an estimated value resulting from data evaluation

J+ = Value may be biased high based on evaluation of data.

J- = Value may be biased high based on evaluation of data.

NR = Compound not reported by the QA laboratory

* Regulatory standard is for total 1,3-dichloropropene and total xylenes

Note: No sample was obtained from well 32Z-99-02X in October 2005 because the water in the well was too deep for a peristaltic pump and the well was too narrow for a Grundfos pump.

TABLE 4-4
CLEAN UP GOALS AND REGULATORY STANDARDS
FOR MONITORED GROUNDWATER PARAMETERS

2005 ANNUAL REPORT
AOCS 32 AND 43A
DEVENS, MASSACHUSETTS

Parameter	Cleanup Goal or Standard (µg/L)
VOCs	
Benzene *	5
Vinyl chloride	2
1,2-dichloroethene (trans)**	55
1,2-dichloroethene (cis)**	55
1,1,1-trichloroethane	5
Trichloroethene *	5
1,1,2-trichloroethane	5
1,2-dichlorobenzene *	600
1,3-dichlorobenzene *	600
1,4-dichlorobenzene *	75
VPH	
Ethylbenzene	500
m-, p-xylene	--
o-xylene	--
Toluene	--
C5-C8 Aliphatics	400
C9-C12 Aliphatics	4,000
C9-C10 Aromatics	200
EPH	
C9-C18 Aliphatics	4,000
C19-C36 Aliphatics	5,000
C11-C22 Aromatics	200
PCBs	
PCB-1016	0.5
PCB-1221	0.5
PCB-1232	0.5
PCB-1242	0.5
PCB-1248	0.5
PCB-1254	0.5
PCB-1260 *	0.5
INORGANICS	
Arsenic – Total *	50
Lead - Total	15
Manganese - Total *	3,500
Arsenic - Dissolved	50
Lead - Dissolved	15
Manganese - Dissolved	3,500

Notes: *Cleanup goal established in the Record of Decision (Horne, 1998).
**The Record of Decision lists a cleanup goal of 55 µg/L for total 1,2-dichloroethene.
Other parameters added to list as part of long-term monitoring program development.

Prepared by: JW, 10/5/06
Checked by: SWR, 10/5/06

TABLE 4-5
HISTORY OF CLEANUP GOAL EXCEEDANCES - 2002 to 2005

2005 ANNUAL REPORT
AOCS 32 AND 43A
DEVENS, MASSACHUSETTS

Well	April 2002	October 2002	June 2003	December 2003	May 2004	October 2004	June 2005	October 2005
AOC 32 WELLS - EXCEEDANCES								
32M-01-18XBR (Source well)	VOCs and Manganese	VOCs and Manganese	VOCs and Manganese	VOCs and Manganese	VOCs, VPH*, Manganese	VOCs, VPH*, Manganese	VOCs, VPH*, Manganese, Arsenic**	VOCs, VPH*, Manganese
32M-01-14XBR (Sentry well)	No exceedances	Arsenic and Lead	No exceedances	No exceedances	No exceedances	No exceedances	No exceedances	Arsenic** and Lead*
32M-01-14XOB (Sentry well)	No exceedances	No exceedances	Manganese	Manganese	No exceedances	Manganese	Arsenic** and Manganese	Arsenic** and Lead*
32Z-99-02X (Distant sentry well)	Not sampled	Lead	No exceedances	No exceedances	No exceedances	No exceedances	No exceedances	Not Sampled
SHL-15	Arsenic, manganese	No exceedances	No exceedances	Arsenic	No exceedances	Arsenic	Arsenic	No exceedances
AOC 43A - EXCEEDANCES								
43M-01-17XOB (Source well)	VOCs and Arsenic	Arsenic	No exceedances	No exceedances	No exceedances	No exceedances	No exceedances	Not Sampled
43M-01-20XBR (Sentry well)	Manganese	Manganese	No exceedances	No exceedances	No exceedances	No exceedances	No exceedances	Not Sampled

Notes:

* Cleanup goals were not established for VPH fractions or lead in the Record of Decision. VPH is compared to Massachusetts Contingency Plan GW-1 Standards. Lead is compared to drinking water action level.

** The Record of Decision established a cleanup goal of 50 ug/L for arsenic based on the then current MCL of 50 ug/L. A revised MCL of 10 ug/L became effective in January 2006. This table uses the 50 ug/L standard for evaluation of 2002 through 2004 data and the 10 ug/L standard for subsequent data.

TABLE 4-6
SUMMARY OF CLEANUP GOAL AND REGULATORY STANDARD EXCEEDANCES AT WELL 32M-01-18XBR

2005 ANNUAL REPORT
AOCS 32 AND 43A
DEVENS, MASSACHUSETTS

Parameter	Cleanup Goal	April 2002	October 2002	June 2003	December 2003	May 2004	October 2004	June 2005	October 2005
Trichloroethene (ug/L)	5	19 J	20U	50 U	3.4 QA	5.2 QA	3.4 QA	160 U	0.6J
1,3-dichlorobenzene (ug/L)	600	660 J	300 J	460	430	730	530	590	209
1,4-dichlorobenzene (ug/L)	75	450 J	200	310	280	470	320	370	120
1,2-dichlorobenzene (ug/L)	600	5,900 J	2,500	3,800	3,900	6,200	4,200	4,500	1,450
C9-C12 Aliphatics (ug/L) *	4,000	5000 UJ	200 U	350 J	511 EJ	5,100 QA	4,480	470	686
C9-C10 Aromatics (ug/L) *	200	9,100 J	2,900	1,700 J	2,600 EJ	11,000	4,400	260	1150
Manganese, Total (ug/L)	3,500	7,730	9,260	14,100	11,000	17,400	13,400	16,700	11,600
Manganese, Diss. (ug/L)	3,500	7,500	8,960	14,200	13,900	18,100	12,500	ND	ND

Notes:

* Cleanup goals were not established for EPH fractions in the Record of Decision. Listed values are Massachusetts Contingency Plan GW-1 Standards.

U = Compound not detected at concentration above the reporting limit.

J = Estimated value based on data evaluation of laboratory results.

R = Results were rejected based on zero percent recovery in the MS/MSD.

E = Compound concentration exceeds the upper limit of the calibration range of the instrument for specific analysis.

QA= Result is reported from the QA lab analysis. The primary lab result has an elevated reporting limit due to the dilution of the sample or the primary lab result was outside the calibration range.

ug/L = micrograms per liter

ND = No Data

Appendix A

Groundwater Sampling Procedure and IDW

Devens
AOCs 32 and 43A
Groundwater Sampling Procedure and IDW

1. Groundwater Sampling

USACE collected groundwater samples at AOCs 32 and 43A on June 13, 15, and 16, and October 3, 4, and 5, 2005, as part of the semiannual long-term groundwater monitoring program. The following is a summary of USACE sampling procedures.

1.1 Preparation for Sampling

Sampling activities were coordinated with the Devens BRAC office and the laboratories. The contract laboratory prepared and delivered sampling bottles, quality assurance bottles and coolers to USACE approximately 1 week prior to the sampling event. Sample bottles were checked to ensure that they complied with the requirements of the sampling program. Sampling equipment (including the YSI water quality meters, generators, and the Teflon-lined polyethylene tubing) was rented/purchased from U.S. Environmental in Waltham, MA. USACE used its own Grundfos Rediflow II pumps and controllers, and DRT-15CE turbidity meters. All equipment was inventoried and tested prior to sampling. The well logs were reviewed to verify tubing requirements and copies were brought to the site for reference.

1.2 Sampling

Monitoring wells were purged and sampled in accordance with U. S. EPA's Low Stress (low flow) Purging and Sampling Procedure for the Collection of Groundwater Samples from Monitoring Wells (July 1996, revision 2) using an adjustable rate, low flow submersible pump. Teflon-lined polyethylene tubing was used for sample collection and was disposed of after each well was sampled. Before sampling activities commenced, groundwater elevations were measured at each well location to be sampled. YSI water quality meters, turbidity meters, and the PID were calibrated at the beginning of each day of use and a calibration check was performed on the equipment at the end of each day. During sampling, the generator used to power the pumps was located upwind, at least 30 feet away from the well being sampled, in order to minimize potential contamination from the exhaust. The submersible pump was then lowered to the middle of the well screen intake of each well to be sampled when possible. When the water level was below the top of the screen, the pump was positioned to a depth between the top of the water level and the bottom of the screen.

Before each well was sampled, water quality parameters, including temperature (o Celsius), specific conductance, pH, oxidation-reduction potential (ORP), turbidity, and dissolved oxygen (DO) were collected every 3 to 5 minutes until the readings stabilized to ensure proper purging of the wells before each well was sampled. The field results for AOCs 32 and 43A are listed in Appendix C. All water quality parameters, except turbidity, were monitored using a flow-through cell and a YSI 600 XL water quality meter. Turbidity samples were not collected from the flow-through cell due to the silt buildup, which can occur in the base of the cell and give erroneous readings. A Y-connector with a shutoff valve was set up before the flow-through cell to take the turbidity readings. Sampling was conducted when parameters became stabilized for three consecutive readings. The sample tubing was disconnected from the flow-through cell and samples were collected directly from the discharge tubing. In cases where the water level was lower than

the top of the screen, the pumps were lowered to the approximate midpoint between the water level and the bottom of the screen. This procedure occurred at several wells during each event.

1.3 Equipment Decontamination

All non-disposable sampling and testing equipment that came in contact with the sampling medium was decontaminated to prevent cross contamination between sampling points. The submersible pump was decontaminated using the following procedure:

- Upon removal of the pump from the well, it was submersed in a 4-inch diameter PVC pipe containing potable water and detergent (Alconox) solution. At least 1 to 2 gallons of the detergent solution was pumped through, starting at a low flow rate, as in sampling, and increasing to a higher speed.

- The pump was removed and sprayed with potable water to minimize the transfer of soap to the rinse water and then submersed in a PVC pipe filled with potable water with at least 1 to 2 gallons pumped through.

- Then it was submersed in a PVC pipe filled with deionized water and at least 1 to 2 gallons were pumped through.

- It was then sprayed with isopropyl alcohol (reagent grade) using a hand held spray bottle, over a tub and submersed in a final deionized water rinse with at least 1 to 2 gallons pumped through.

- Finally, the pump was air dried and wrapped in clean aluminum foil.

Appendix B

Groundwater Sampling Log Sheets June 2005

C M well #: **SHL-15**

SCREENED INTERVAL DEPTH: 15.0 to 25.0 ft below top of PVC

H20 LEVEL: PRE-PUMP INSERTION 16.75'

POST-PUMP INSERTION 16.79'

DATE: 6/15/05 TIME: 10.4 SAMPLE DEPTH 20'

SAMPLED BY: AG SIGNATURE:

RECORDED BY: AG SIGNATURE:

US Army Corps of Engineers
Groundwater Sampling Log Sheet

Project Name: **Devens Areas 32/43A**

SAMPLE METHOD: EPA LOW STRESS METHOD

PCBs: 2 x 1 L amber, ice	Ammonia: 1 liter hdpe, H_2SO_4
EPH: 2 x 1 L glass amber, HCl	COD: 250 ml hdpe, H_2SO_4
VOC: 3x40ml vial HCl	Total Metals: 1 x 500 ml hdpe HNO_3
VPH: 3x40ml vial HCl	*Sulfate, Alkalinity*:500ml hdpe, ice
TOC: 2 x 40 ml vial, H2SO4	Sulfide: 1L hdpe, zinc acetate/NaOH
Dislvd Gas: 3 x 40 ml vial, HCl (15 glass)	NO_2,NO_3, T. Phos: 1 liter hdpe, H_2SO_4 (6 hdpe)

Time (24 hr)	Wtr Dpth below MP feet	Pump Setting (Hz)	Purge Rate (ml/min)	Cumulative Volume Purged	Water Temp (Celsius)	Specific Conductance	pH	ORP/Eh (mV)	D.O. mg/L	Turbidity NTUs	COMMENTS
1046	16.85	93.2	550		10.69	150	5.74	215.7	1.10	1.05	
1049	16.89	92.8	500		11.22	147	5.71	212.3	0.74	1.00	
1052	16.89	92.8	500	2 liter	11.72	147	5.72	205.2	0.68	0.79	
1055	16.87	92.8	500		12.12	148	5.73	146.4	0.66	0.72	
1058	16.88	92.8	500	2 liter	12.24	148	5.73	122.0	0.64	0.70	
1101	16.88	92.8	500		12.40	148	5.73	106.3	0.64	0.63	
1104	16.88	92.8	500		12.51	148	5.72	96.2	0.64	0.69	
1107	16.89	92.8	500	3 liter	12.54	149	5.71	88.8	0.63	0.74	
1110	16.89	92.8	500		12.50	149	5.72	80.6	0.62	0.72	
1113	16.89	92.8	500		12.56	149	5.73	76.2	0.62	0.68	
1116	16.85	92.8	500	4 liter	12.59	149	5.74	70.2	0.61	0.75	
1119	16.89	92.8	500		12.65	149	5.75	67.5	0.61	0.98	
1122	16.89	92.8	500		12.66	149	5.75	64.2	0.61	0.96	

SAMPLE TAKEN AT: 1125

+/- 3%	+/- 3%	+/- 0.1 unit	+/- 10 mV	+/-10%	+/-10%

YSI #: 98605O8 TURBIDITY #: 39576 PUMP – Grundfos Rediflow II

NOTES: - LENGTH OF TUBING FOUND LEFT IN WELL; LOCK WAS NOT FASTENED

SAMPLER: ALEX GARNEAU

G M well #: 32M-92-01X

SCREENED INTERVAL DEPTH: 13.7 - 23.7 ft below top of PVC

H20 LEVEL: PRE-PUMP INSERTION 16.29 ft Top of PVC

POST-PUMP INSERTION 16.26

DATE: 6/15/2005 TIME: 10:03 AM SAMPLE DEPTH 21' Top of PVC

SAMPLED BY: SW/PB SIGNATURE:

RECORDED BY: SW SIGNATURE:

US Army Corps of Engineers
Groundwater Sampling Log Sheet

Project Name: **Devens Areas 32/43A**

SAMPLE METHOD: EPA LOW STRESS METHOD

PCBs: 2 x 1 L amber, ice
EPH: 2 x 1 L glass amber, HCl
VOC: 3x40ml vial HCl
VPH: 3x40ml vial HCl
TOC: 2 x 40 ml vial, H2SO4
Dislvd Gas: 3 x 40ml vial, HCl
(15 glass)

Ammonia: 1 liter hdpe, H_2SO_4
COD: 250 ml hdpe, H_2SO_4
Total Metals: 1 x 500 ml hdpe HNO_3
Sulfate, Alkalinity:500ml hdpe, ice
Sulfide: 1L hdpe, zinc acetate/NaOH
NO_2,NO_3, T. Phos: 1 liter hdpe, H_2SO_4
(6 hdpe)

Time (24 hr)	Wtr Dpth below MP feet	Pump Setting (Hz)	Purge Rate (ml/min)	Cumulative Volume Purged gal	Water Temp (Celsius)	Specific Conductance mS/cm	pH	ORP/Eh (mV)	D.O. mg/L	Turbidity NTUs	COMMENTS
1100	17.16	92.5	1000	~1 g	10.13	172	6.12	363.6	7.35	0.91	
1103	17.62	92.5	1100	~2g	10.57	172	6.06	376.6	6.67	2.40	
1107	17.65	91.3	600	~2.5 g	11.31	173	6.01	386.9	5.71	2.50	
1110	17.65	91.3	600	~3 g	11.18	175	6.02	392.3	5.57	3.4	
1113	17.65	91.3	~650	~3.5g	11.15	175	6.02	397.3	5.36	4.24	
1130	SAMPLE	TIME									

SAMPLE TAKEN AT: 1130

+/- 3% +/- 3% +/- 0.1 unit +/- 10 mV +/-10% +/-10%

YSI #: 01J08S1 - AC TURBIDITY #: 910290 PUMP – Grundfos Rediflow II

NOTES:

SAMPLERS: SEAN WALSH
PATRICK BLUMERS

C M well #: 32Z-99-02X PIEZOMETER

SCREENED INTERVAL DEPTH: 14.5-29.5 ft below top of PVC

H20 LEVEL: PRE-PUMP INSERTION 23.08'

POST-PUMP INSERTION 23.08'

DATE: 6/13/05 TIME: 1325 SAMPLE DEPTH 28'

SAMPLED BY: PG SIGNATURE: Paul Young

RECORDED BY: PG SIGNATURE: Paul Young

US Army Corps of Engineers
Groundwater Sampling Log Sheet

Project Name: Devens Areas 32/43A

1 well is the furthest east in the A32/43A study

SAMPLE METHOD: EPA LOW STRESS METHOD

PCBs: 2 x 1 L amber, ice
EPH: 2 x 1 L glass amber, HCl
VOC: 3x40ml vial HCl
VPH: 3x40ml vial HCl
TOC: 2 x 40 ml vial, H2SO4
Dislvd Gas: 3 x 40ml vial, HCl (15 glass)

Ammonia: 1 liter hdpe, H_2SO_4
COD: 250 ml hdpe, H_2SO_4
Total Metals: 1 x 500 ml hdpe HNO_3
Sulfate, Alkalinity:500ml hdpe, ice
Sulfide: 1L hdpe, zinc acetate/NaOH
NO_2,NO_3, T. Phos: 1 liter hdpe, H_2SO_4 (6 hdpe)

Time (24 hr)	Wtr Dpth below MP feet	Pump Setting (Hz)	Purge Rate (ml/min)	Cumulative Volume Purged	Water Temp (Celsius)	Specific Conductance	pH	ORP/Eh (mV)	D.O. mg/L	Turbidity NTUs	COMMENTS
1355	24.41	peristaltic pump used	400		11.76	152	5.12	350.0	6.77	46.6	slightly cloudy
1400	24.22		300	1.5 gal	11.75	169	4.71	419.0	9.14	8.79	
1405	24.19		350		11.71	177	4.57	447.1	10.03	6.44	
1410	24.29		350	2 gal	11.58	185	4.50	468.8	10.04	4.28	
1415	24.20		350		11.66	193	4.47	472.3	9.97	3.66	
1420	24.17		350	3 gal	11.78	197	4.33	498.1	9.82	4.31	
1425	24.18		350		11.70	200	4.37	501.1	9.82	3.40	
1430	24.25		350	4 gal	11.69	203	4.40	506.8	9.74	3.61	
1435	24.25		350		11.40	211	4.51	511.9	9.69	3.28	
1440	24.25		350		11.38	212	4.51	514.3	9.66	2.83	
1445	24.26		350		11.44	212	4.54	518.0	9.62	2.26	
SAMPLE TAKEN AT: 1450					+/- 3%	+/- 3%	+/- 0.1 unit	+/- 10 mV	+/-10%	+/-10%	

YSI #: 00D0698 TURBIDITY #: 410290 PUMP – PERISTALTIC GeoTech Model II

NOTES: (RENTAL UNIT) SAMPLER: PAUL YOUNG

EXCESSIVE HUMIDITY CAUSING MOISTURE BUILDUP ON TURBIDITY UNIT, DIFFICULT TO KEEP CLEAN.

G M well #: 32M-92-03X
SCREENED INTERVAL DEPTH: 23.0-33.0 ft below top of PVC

H20 LEVEL: PRE-PUMP INSERTION 25.60

POST-PUMP INSERTION 25.59

DATE: 6-15-05 TIME: 1120 SAMPLE DEPTH 30.0 ft

SAMPLED BY: TJM SIGNATURE: Thomas J. Marcotte

RECORDED BY: TJM SIGNATURE: Thomas J. Marcotte

US Army Corps of Engineers
Groundwater Sampling Log Sheet

Project Name: Devens Areas 32/43A

SAMPLE METHOD: EPA LOW STRESS METHOD

PCBs: 2 x 1 L amber, ice
EPH: 2 x 1 L glass amber, HCl
VOC: 3x40ml vial HCl
VPH: 3x40ml vial HCl
TOC: 2 x 40 ml vial, H2SO4
Dislvd Gas: 3 x 40ml vial, HCl
(15 glass)

Ammonia: 1 liter hdpe, H_2SO_4
COD: 250 ml hdpe, H_2SO_4
Total Metals: 1 x 500 ml hdpe HNO_3
Sulfate, Alkalinity:500ml hdpe, ice
Sulfide: 1L hdpe, zinc acetate/NaOH
NO_2,NO_3, T. Phos: 1 liter hdpe, H_2SO_4
(6 hdpe)

Time (24 hr)	Wtr Dpth below MP feet	Pump Setting (Hz)	Purge Rate (ml/min)	Cumulative Volume Purged	Water Temp (Celsius)	Specific Conductance	pH	ORP/Eh (mV)	D.O. mg/L	Turbidity NTUs	COMMENTS
1040	25.62	109	600		9.24	67	5.17	211.9	10.43	0.40	
1044	25.62	109	440	1 liter	10.94	67	4.97	253.1	10.02	0.42	
1048	25.62	109	480	3 L	11.93	69	4.95	274.5	10.00	0.14	
1052	25.62	109	480	5	12.54	68	5.11	284.3	9.98	0.11	
1056	25.62	109	500	7	12.34	64	5.11	292.8	10.03	0.10	
1100	25.62	109	520	9	12.77	68	5.12	301.9	9.97	0.11	
1104	25.62	109	520	11	12.67	67	5.11	305.0	9.98	0.12	
1108	25.62	109	520	13	12.84	67	5.11	312.9	9.94	0.10	
1112	25.62	109	520	15	12.60	67	5.11	316.9	9.92	0.09	
1116	25.62	109	520	17	12.80	68	5.11	319.8	9.90	0.11	

SAMPLE TAKEN AT: 1120

+/- 3% ±0.37	+/- 3% ±1.9	+/- 0.1 unit	+/- 10 mV	+/-10% ±1.0	+/-10% 45

YSI #: 00D0698 AA TURBIDITY #: 608146 PUMP – Grundfos Rediflow II

NOTES:

SAMPLER: TOM MARCOTTE

C[illegible]M well #: **32M-01-04XBR**

SCREENED INTERVAL DEPTH: 25.0 – 35.0 ft below top of PVC

H20 LEVEL: PRE-PUMP INSERTION 17.97

POST-PUMP INSERTION 17.94

DATE: 6/15/2005 TIME: 1400 SAMPLE DEPTH 30

SAMPLED BY: SW SIGNATURE: [signature]

RECORDED BY: SW SIGNATURE: [signature]

US Army Corps of Engineers

Groundwater Sampling Log Sheet

Project Name: **Devens Areas 32/43A**

SAMPLE METHOD: EPA LOW STRESS METHOD

PCBs: 2 x 1 L amber, ice	Ammonia: 1 liter hdpe, H_2SO_4
EPH: 2 x 1 L glass amber, HCl	COD: 250 ml hdpe, H_2SO_4
VOC: 3x40ml vial HCl	Total Metals: 1 x 500 ml hdpe HNO_3
VPH: 3x40ml vial HCl	Sulfate, Alkalinity:500ml hdpe, ice
TOC: 2 x 40 ml vial, H2SO4	Sulfide: 1L hdpe, zinc acetate/NaOH
Dislvd Gas: 3 x 40ml vial, HCl (15 glass)	NO_2,NO_3, T. Phos: 1 liter hdpe, H_2SO_4 (6 hdpe)

Time (24 hr)	Wtr Dpth below MP feet	Pump Setting (Hz)	Purge Rate (ml/min)	Cumulative Volume Purged	Water Temp (Celsius)	Specific Conductance	pH	ORP/Eh (mV)	D.O. mg/L	Turbidity NTUs	COMMENTS
1410	19.65	101	800	~0.5g	12.18	366	6.10	216.5	5.95	1.94	
1413	19.89	101	800	~1g	14.00	363	6.26	206.6	4.68	0.55	
1416	19.95	101	800	~1.5g	14.79	364	6.24	202.6	5.02	0.35	
1419	19.99	101	800	~2.25g	14.91	363	6.21	202.3	5.03	0.2	
1422	19.99	101	~750	~3g	14.99	262	6.19	203.2	5.11	0.15	

SAMPLE TAKEN AT: 1430 +/- 3% +/- 3% +/- 0.1 unit +/- 10 mV +/-10% +/-10%

YSI #: TURBIDITY #: PUMP – Grundfos Rediflow II

NOTES:

SAMPLER: SEAN WALSH

C vl well #: 32M-01-13XBR
SCREENED INTERVAL DEPTH: 13.7 – 23.7 ft below top of PVC

H20 LEVEL: PRE-PUMP INSERTION 15.58

POST-PUMP INSERTION 15.34

DATE: 6/16/05 TIME: 1100 SAMPLE DEPTH 22'

SAMPLED BY: AG SIGNATURE: _____

RECORDED BY: AG SIGNATURE: _____

US Army Corps of Engineers
Groundwater Sampling Log Sheet

Project Name: Devens Areas 32/43A

SAMPLE METHOD: EPA LOW STRESS METHOD

well is located between trailer bays 33 and 34.

PCBs: 2 x 1 L amber, ice
EPH: 2 x 1 L glass amber, HCl
VOC: 3x40ml vial HCl
VPH: 3x40ml vial HCl
TOC: 2 x 40 ml vial, H2SO4
Dislvd Gas: 3 x 40ml vial, HCl (15 glass)

Ammonia: 1 liter hdpe, H_2SO_4
COD: 250 ml hdpe, H_2SO_4
Total Metals: 1 x 500 ml hdpe HNO_3
Sulfate, Alkalinity:500ml hdpe, ice
Sulfide: 1L hdpe, zinc acetate/NaOH
NO_2,NO_3, T. Phos: 1 liter hdpe, H_2SO_4 (6 hdpe)

Time (24-hr)	Wtr Dpth below MP feet	Pump Setting (Hz)	Purge Rate (ml/min)	Cumulative Volume Purged	Water Temp (Celsius)	Specific Conductance	pH	ORP/Eh (mV)	D.O. mg/L	Turbidity NTUs	COMMENTS
Well has a history of poor recharge. It may be practical to draw the well down to remove stagnant water column and then sample "fresh" water the next day.											
1322	21.25	146.2	VERY LOW		14.63	304	6.07	281.1	4.71	1.39	
1325	21.50	146.2	VERY LOW		14.70	304	6.05	298.2	4.23	2.00	LOST FLOW
1329	~~21.16~~	151.7	VERY LOW		14.91	304	6.04	318.6	3.97	1.69	
1332	21.22	148.0	" "	MINIMAL	14.89	295	6.03	323.7	7.51		PUMP CAVITATING & YSI SEAL BLOWN
SAMPLE TAKEN AT: 1223					+/- 3%	+/- 3%	+/- 0.1 unit	+/- 10 mV	+/-10%	+/-10%	

YSI #: 01J0851 TURBIDITY #: 375 76 PUMP – Grundfos Rediflow II

NOTES: WELL DRAWN DOWN 1 BUCKET

SAMPLER: ALEX GARNEAU

G M well #: 32M-01-14XBR
SCREENED INTERVAL DEPTH: 34.0 – 44.0 ft below top of PVC

H20 LEVEL: PRE-PUMP INSERTION 20.73

POST-PUMP INSERTION 19.50

DATE: 6/15/05 TIME: 12:20 SAMPLE DEPTH 40'

SAMPLED BY: AL SIGNATURE:

RECORDED BY: AL SIGNATURE:

US Army Corps of Engineers
Groundwater Sampling Log Sheet

Project Name: Devens Areas 32/43A

1 well is located outside the facility fence

SAMPLE METHOD: EPA LOW STRESS METHOD

PCBs: 2 x 1 L amber, ice	Ammonia: 1 liter hdpe, H_2SO_4
EPH: 2 x 1 L glass amber, HCl	COD: 250 ml hdpe, H_2SO_4
VOC: 3x40ml vial HCl	Total Metals: 1 x 500 ml hdpe HNO_3
VPH: 3x40ml vial HCl	Sulfate, Alkalinity:500ml hdpe, ice
TOC: 2 x 40 ml vial, H2SO4	Sulfide: 1L hdpe, zinc acetate/NaOH
Dislvd Gas: 3 x 40ml vial, HCl (15 glass)	NO_2,NO_3, T. Phos: 1 liter hdpe, H_2SO_4 (6 hdpe)

Expect to draw the well down about 10 ft and wait for recharge.

Time (24 hr)	Wtr Dpth below MP feet	Pump Setting (Hz)	Purge Rate (ml/min)	Cumulative Volume Purged	Water Temp (Celsius)	Specific Conductance	pH	ORP/Eh (mV)	D.O. mg/L	Turbidity NTUs	COMMENTS
14:11	23.20	106.0	MINIMAL		10.91	637	6.67	160.2	5.45	6.77	-LOST FLOW
14.14	25.42	109.3	MINIMAL		11.02	641	6.62	152.1	3.52	4.04	LOST FLOW
1418	25.91	112.0	220~	≈1GAL	12.32	637	6.65	136.3	3.36	3.76	" "
1421	28.67	116.4	≈200		12.98	642	6.65	129.6	3.51	2.64	" "
1424	30.15	119.8	≈200		13.16	646	6.67	126.8	3.14	5.10	" "
1427	31.95	123.2			13.58	646	6.67	112.5	3.01	4.68	" "
1430	32.28										" "
1433	33.90	129.5	≈150	≈2.5GAL	13.99	641	6.67	105.8	2.94	3.61	" "
1436	37.50	132.6			14.12	645	6.67	109.3	2.92	2.73	
				2GAL							

SAMPLE TAKEN AT: 1440

+/- 3% +/- 3% +/- 0.1 unit +/- 10 mV +/-10% +/-10%

YSI #: 00D0698 TURBIDITY #: 39576 PUMP – Grundfos Rediflow II

NOTES:

SAMPLER: ALEX GARNEAU

C M well #: 32M-01-14XOB
SCREENED INTERVAL DEPTH: 19 – 29 ft below top of PVC

H20 LEVEL: PRE-PUMP INSERTION 22.93

POST-PUMP INSERTION 22.69

DATE: 6/15/05 TIME: 12:20 SAMPLE DEPTH 28'

SAMPLED BY: _____ SIGNATURE: _____

RECORDED BY: TJM SIGNATURE: _____

US Army Corps of Engineers
Groundwater Sampling Log Sheet

Project Name: **Devens Areas 32/43A**

well is located outside the facility fence

SAMPLE METHOD: EPA LOW STRESS METHOD

PCBs: 2 x 1 L amber, ice	Ammonia: 1 liter hdpe, H_2SO_4
EPH: 2 x 1 L glass amber, HCl	COD: 250 ml hdpe, H_2SO_4
VOC: 3x40ml vial HCl	Total Metals: 1 x 500 ml hdpe HNO_3
VPH: 3x40ml vial HCl	Sulfate, Alkalinity:500ml hdpe, ice
TOC: 2 x 40 ml vial, H2SO4	Sulfide: 1L hdpe, zinc acetate/NaOH
Dislvd Gas: 3 x 40ml vial, HCl (15 glass)	NO_2,NO_3, T. Phos: 1 liter hdpe, H_2SO_4 (6 hdpe)

Expect to draw the well down about 5 ft and wait for recharge.

Time (24 hr)	Wtr Dpth below MP feet	Pump Setting (Hz)	Purge Rate (ml/min)	Cumulative Volume Purged	Water Temp (Celsius)	Specific Conductance	pH	ORP/Eh (mV)	D.O. mg/L	Turbidity NTUs	COMMENTS
1410	24.07	106.3	200		16.77	518	6.24	31.0	4.10	31.8	
1414	24.38	118.1	NA - flow stopped		10.74	520	6.33	-42.0	2.60	—	
1418	24.65	149.8	160		11.73	519	6.35	-50.3	2.49	31.9	
1422	No	reading									Flow-stopped, increasing pump ineffective
	- Pumped 1/3 5-gal bucket out; well dried up										
	- Prior to start, pumped 2/3 5-gallon bucket out										
											- DRAWDOWN
											WELL TO SAMPLE
											TOMORROW
SAMPLE TAKEN AT: 0845 6/16/05					+/- 3%	+/- 3%	+/- 0.1 unit	+/- 10 mV	+/-10%	+/-10%	

YSI #: 01J08511 AC TURBIDITY #: 608146 PUMP – Grundfos Rediflow II

NOTES: 6/16/05 - WATER AT APPROX 23' PRE SAMPLE

SAMPLER: TOM MARCOTTE

G ..M well #: 32M-01-15XBR

SCREENED INTERVAL DEPTH: 34.5 – 44.5 ft below top of PVC

H20 LEVEL: PRE-PUMP INSERTION 16.75

POST-PUMP INSERTION 17.57

DATE: 16 June 05 TIME: 1055 SAMPLE DEPTH 42.5

SAMPLED BY: TJM SIGNATURE: Thomas J Marcotte

RECORDED BY: _____ SIGNATURE: _____

US Army Corps of Engineers
Groundwater Sampling Log Sheet

Project Name: Devens Areas 32/43A

T ..well is located opposite Bay #30

SAMPLE METHOD: EPA LOW STRESS METHOD

PCBs: 2 x 1 L amber, ice	Ammonia: 1 liter hdpe, H_2SO_4
EPH: 2 x 1 L glass amber, HCl	COD: 250 ml hdpe, H_2SO_4
VOC: 3x40ml vial HCl	Total Metals: 1 x 500 ml hdpe HNO_3
VPH: 3x40ml vial HCl	Sulfate, Alkalinity:500ml hdpe, ice
TOC: 2 x 40 ml vial, H2SO4	Sulfide: 1L hdpe, zinc acetate/NaOH
Dislvd Gas: 3 x 40ml vial, HCl (15 glass)	NO_2,NO_3, T. Phos: 1 liter hdpe, H_2SO_4 (6 hdpe)

Well has history of poor recharge. Therefore: reasonable to draw down to ~ 40 ft below TOPVC during sampling.

Time (24 hr)	Wtr Dpth below MP feet	Pump Setting (Hz)	Purge Rate (ml/min)	Cumulative Volume Purged	Water Temp (Celsius)	Specific Conductance	pH	ORP/Eh (mV)	D.O. mg/L	Turbidity NTUs	COMMENTS
1325	39.70	139.1	200		14.63	599	6.76	182.1	5.98	17.25	
1328	40.60	139.3	200		14.69	595	6.80	123.3	4.95	25.2	
1331	40.82	142.3	80		15.03	595	6.84	83.3	5.09	24.1	
1334	40.90	190.0	100	0.50 gal	15.14	596	7.04	85.0	5.15	22.3	Flow stopped after 1334 reading
SAMPLE TAKEN AT: 1215					+/- 3%	+/- 3%	+/- 0.1 unit	+/- 10 mV	+/-10%	+/-10%	

YSI #: 00D0698 AH TURBIDITY #: 608146 PUMP – Grundfos Rediflow II

NOTES: Pumped well dry; pump settings 110 to 150; silty water withdrawn; 38.8 ft final water level - pump unable to remove water below this level
at 5 gallon buckets: 1 + 1 gallon = 6 gallons.
* Well re-charged to 36.00 by 12.15

SAMPLER: TOM MARCOTTE

GWM well #: 32M-01-16XBR
SCREENED INTERVAL DEPTH: 21.0 – 31.0 ft below top of PVC
H20 LEVEL: PRE-PUMP INSERTION 22.13'
POST-PUMP INSERTION 22.12'
DATE: 6/16/05 TIME: 1413 SAMPLE DEPTH 30'
SAMPLED BY: AB SIGNATURE:
RECORDED BY: AB SIGNATURE:

US Army Corps of Engineers
Groundwater Sampling Log Sheet

Project Name: Devens Areas 32/43A

T well is located opposite Bay #20

SAMPLE METHOD: EPA LOW STRESS METHOD

PCBs: 2 x 1 L amber, ice
EPH: 2 x I L glass amber, HCl
VOC: 3x40ml vial HCl
VPH: 3x40ml vial HCl
TOC: 2 x 40 ml vial, H2SO4
Dislvd Gas: 3 x 40ml vial, HCl (15 glass)

Ammonia: 1 liter hdpe, H_2SO_4
COD: 250 ml hdpe, H_2SO_4
Total Metals: 1 x 500 ml hdpe HNO_3
Sulfate, Alkalinity:500ml hdpe. ice
Sulfide: 1L hdpe, zinc acetate/NaOH
NO_2,NO_3, T. Phos: 1 liter hdpe, H_2SO_4 (6 hdpe)

Time (24 hr)	Wtr Dpth below MP feet	Pump Setting (Hz)	Purge Rate (ml/min)	Cumulative Volume Purged	Water Temp (Celsius)	Specific Conductance	pH	ORP/Eh (mV)	D.O. mg/L	Turbidity NTUs	COMMENTS
1430	22.22	105.6	400		13.14	109	6.48	99.0	1.36	70.1	
1433	22.23	105.6	400		13.65	171	6.07	117.2	1.75	24.7	
1436	22.23	105.6	400		14.87	235	6.04	130.5	2.56	15.4	
1439	22.23	105.6	400	2/GAL	15.64	297	6.04	136.1	2.95	11.08	
1442	22.23	105.6	400		15.97	324	6.04	139.7	3.12	7.65	
1445	22.23	105.6	400		16.06	346	6.04	140.8	3.32	4.71	
1448	22.23	105.6	400		16.06	350	6.04	138.8	3.38	4.73	
1451	22.24	105.6	400	22.5GAL	16.06	355	6.03	137.9	3.47	4.18	
1454	22.24	105.6	400		16.10	358	6.03	142.2	3.54	4.42	
SAMPLE TAKEN AT: 1454					+/- 3%	+/- 3%	+/- 0.1 unit	+/- 10 mV	+/-10%	+/-10%	

YSI #: 00D0698 TURBIDITY #: 608146 PUMP – Grundfos Rediflow II
NOTES:

SAMPLER: ALEX GARNEAU

GWM well #: 32M-01-17XBR
SCREENED INTERVAL DEPTH: 41.4 - 51.4 ft below top of PVC
H20 LEVEL: PRE-PUMP INSERTION 23.55 @ 1115 hrs
POST-PUMP INSERTION 23.55 @ 1125
DATE: 6/16/05 TIME: _____ SAMPLE DEPTH 45 feet
SAMPLED BY: P. BLUMERIS SIGNATURE: P. Blumeris
RECORDED BY: P.B. SIGNATURE: P. Blumeris

US Army Corps of Engineers
Groundwater Sampling Log Sheet

Project Name: Devens Areas 32/43A

V ...s located inside the facility fence, near SHL-25.

SAMPLE METHOD: EPA LOW STRESS METHOD

PCBs: 2 x 1 L amber, ice
EPH: 2 x 1 L glass amber, HCl
VOC: 3x40ml vial HCl
VPH: 3x40ml vial HCl
TOC: 2 x 40 ml vial, H2SO4
Dislvd Gas: 3 x 40ml vial, HCl (15 glass)

Ammonia: 1 liter hdpe, H_2SO_4
COD: 250 ml hdpe, H_2SO_4
Total Metals: 1 x 500 ml hdpe HNO_3
Sulfate, Alkalinity:500ml hdpe, ice
Sulfide: 1L hdpe, zinc acetate/NaOH
NO_2,NO_3, T. Phos: 1 liter hdpe, H_2SO_4 (6 hdpe)

Time (24 hr)	Wtr Dpth below MP feet	Pump Setting (Hz)	Purge Rate (ml/min)	Cumulative Volume Purged	Water Temp (Celsius)	Specific Conductance	pH	ORP/Eh (mV)	D.O. mg/L	Turbidity NTUs	COMMENTS
1302	24.45	120	2000								Adjusting rate
1305	-	110	1080		12.49	447	7.15	162.2	0.73	8.5	
1308	23.95	110	1040	~12 L	13.68	447	7.18	164.5	0.53	3.6	
1314	24.10	113	1400	18+ 4L	13.52	452	7.09	161.6	0.55	2.3	
1317	23.85	107	680	18+ 8	13.41	453	7.02	162.0	0.63	0.61	
1320	23.82	108	660	18+ 11	14.61	465	6.96	156.1	0.81	0.33	
1325	23.82	107	640	18+12	14.85	467	6.92	147.4	0.95	0.65	
1329	23.82	108	480	18+16	14.93	471	6.89	144.1	1.13	0.47	
1339	23.78	107	520	36+2	15.19	483	6.82	139.1	1.41	0.20	
1343	23.78	108	500	36+5	15.28	489	6.80	134.4	1.47	0.20	
1347	23.78	107	500	36+6	15.30	492	6.78	130.8	1.53	0.25	
1415	SAMPLE TIME FOR SAMPLE WITH EXTRA VOLUME FOR MS/MSD										
(1450	FINISHED FILLING BOTTLES FOR THIS LOCATION)										
SAMPLE TAKEN AT: 1415.					+/- 3%	+/- 3%	+/- 0.1 unit	+/- 10 mV	+/-10%	+/-10%	

YSI #: 98G0508 AA TURBIDITY #: 910290 PUMP – Grundfos Rediflow II
NOTES:

SAMPLER: PATRICK BLUMERIS

GwM well #: **32M-01-18XBR**
SCREENED INTERVAL DEPTH: 14.0 – 23.0 ft below top of PVC

H20 LEVEL: PRE-PUMP INSERTION 15.57'

POST-PUMP INSERTION 15.43'

DATE: 6/16/05 TIME: 0910 SAMPLE DEPTH 22'

SAMPLED BY: PY SIGNATURE: Paul Young

RECORDED BY: PY SIGNATURE: Paul Young

US Army Corps of Engineers
Groundwater Sampling Log Sheet

Project Name: **Devens Areas 32/43A**

SAMPLE METHOD: EPA LOW STRESS METHOD

Located at Trailer Bay #29; Ground is incorrectly marked "18XOB"

PCBs: 2 x 1 L amber, ice	Ammonia: 1 liter hdpe, H_2SO_4
EPH: 2 x 1 L glass amber, HCl	COD: 250 ml hdpe, H_2SO_4
VOC: 3x40ml vial HCl	Total Metals: 1 x 500 ml hdpe HNO_3
VPH: 3x40ml vial HCl	Sulfate, Alkalinity:500ml hdpe, ice
TOC: 2 x 40 ml vial, H2SO4	Sulfide: 1L hdpe, zinc acetate/NaOH
Dislvd Gas: 3 x 40ml vial, HCl	NO_3,NO_3, T. Phos: 1 liter hdpe, H_2SO_4
(45 glass) = sample+dup+QA	(18 hdpe) = sample+dup+QA

Well recharge is poor. Suggest drawdown then wait for recovery (several hours). CRUCIAL that the parameters below are obtained.

Time (24 hr)	Wtr Dpth below MP feet	Pump Setting (Hz)	Purge Rate (ml/min)	Cumulative Volume Purged	Water Temp (Celsius)	Specific Conductance	pH	ORP/Eh (mV)	D.O. mg/L	Turbidity NTUs	COMMENTS
0920	15.43			~4gal							slight chlorinated odor
0925	22.3										WATER IS CLEAR TO EYE
0938	16.18			~4gal							
0942	22.3										
1045	15.63										
1140	17.85	96.2	NOT TAKEN	0	13.66	465	6.34	98.9	2.95	0.98	slight chlorinated odor
1145	17.55	96.2			14.01	469	6.30	53.2	1.01	0.28	
1148	17.48	96.2			14.35	478	6.30	33.7	0.86	0.85	
1151	17.48	96.2			14.39	479	6.30	30.6	0.75	0.56	
1154	17.48	96.2			14.40	480	6.30	27.9	0.61	0.59	
1157	17.48	96.2			14.41	480	6.30	26.7	0.82	0.58	
1200	17.48	96.2			14.43	481	6.30	25.3	0.61	0.60	
1203	17.48	96.2		~2gal	14.43	481	6.29	24.7	0.50	0.51	
SAMPLE TAKEN AT: 1045					+/- 3%	+/- 3%	+/- 0.1 unit	+/- 10 mV	+/-10%	+/-10%	

YSI #: 98600508 TURBIDITY #: 910290 (ROUTH UNIT) PUMP – Grundfos Rediflow II

NOTES: SAMPLER: PAUL YOUNG

G A well #: 43M-01-16XBR

SCREENED INTERVAL DEPTH: 47.5 – 57.5 ft below top of PVC

H20 LEVEL: PRE-PUMP INSERTION 22.28 @ 10:25

POST-PUMP INSERTION (PB) 20.69'

DATE: 6/13/2005 TIME: _____ SAMPLE DEPTH 52 feet

SAMPLED BY: P.B. SIGNATURE: P.Blum

RECORDED BY: P.B. SIGNATURE: P.Blum

US Army Corps of Engineers

Groundwater Sampling Log Sheet

Project Name: Devens Areas 32/43A

SAMPLE METHOD: EPA LOW STRESS METHOD

Located opposite 3 yellow poles at Door B5

PCBs: 2 x 1 L amber, ice	Ammonia:500 ml hdpe, H2SO4
EPH: 2 x 1 L glass amber, HCl	COD:500 ml hdpe, H2SO4
VOC: 3x40ml vial HCl	Total Metals: 1 x 500 ml hdpe HNO3
VPH: 3x40ml vial HCl	Sulfate, Alkalinity:500ml hdpe. ice
TOC: 2 x 40 ml vial, H2SO4	Sulfide: 1L hdpe, zinc acetate/NaOH
Dislvd Gas: 3 x 40ml vial, HCl (15 glass)	NO2,NO3, T. Phos: 500 ml hdpe, H2SO4 (6 hdpe)

Well was drawn down from 26.1 to 35.7 ft below TOPVC in Dec 2003; and from 23.2 to 44.3 ft in Oct 2004. Therefore expect at least 10 ft drawdown during stabilization.

Time (24 hr)	Wtr Dpth below MP feet	Pump Setting (Hz)	Purge Rate (ml/min)	Cumulative Volume Purged	Water Temp (Celsius)	Specific Conductance	pH	ORP/Eh (mV)	D.O. mg/L	Turbidity NTUs	COMMENTS
11:23	22.30	106.7	80	-	18.3	70	6.59	196.1	5.52	40	Seems clear.
11:26	24.80	111.6	100	~ 2l	16.07	406	7.34	171.7	2.64	25	Flow rate needs const. tweaking
11:31	26.95	118.2	480	~ 3½l	16.57	275	7.26	176.2	4.28	14	" " " "
11:36	27.60	129.0	1200	~ 6l	16.3	124	6.82	182.0	5.49	12.5	" " " "
11:41	32.50	126.6	600	~ 7l	16.77	81	6.54	185.1	5.75	6.1	" " " "
11:46	34.85	133.7	400	~ 9l	16.70	68	6.43	185.0	5.60	9.5	" " " "
11:51	36.80	133.9	560	~ 10l	18.42	75	6.56	180.2	5.60	6.6	" " " "
11:55	38.58	137.9	200	~ 11l	17.83	76	6.51	179.2	5.53	5.12	" " " "
12:15	SAMPLE	TIME									
SAMPLE TAKEN AT: 1215					+/- 3%	+/- 3%	+/- 0.1 unit	+/- 10 mV	+/-10%	+/-10%	

YSI #: 650 MDS, SN = 063644 TURBIDITY #: 608146 PUMP – Grundfos Rediflow II

NOTES: YSI MDS does not measure conductivity initially - until well!!! Y measured 0.0 until water was flowing) PB

SAMPLER: PATRICK BLUMERS

G _ A well #: 43M-01-16XOB

SCREENED INTERVAL DEPTH: 24.0 – 34.0 ft below top of PVC

H20 LEVEL: PRE-PUMP INSERTION 22.45 @ 10:28

POST-PUMP INSERTION (30 A. 22.40 PB)

DATE: 6/13/05 TIME: _____ SAMPLE DEPTH 30 feet.

SAMPLED BY: PB SIGNATURE: P. Blumeris

RECORDED BY: P. BLUMERIS SIGNATURE: P. Blumeris

US Army Corps of Engineers
Groundwater Sampling Log Sheet

Located opposite 3 yellow poles at Door B5

Project Name: Devens Areas 32/43A

SAMPLE METHOD: EPA LOW STRESS METHOD

PCBs: 2 x 1 L amber, ice
EPH: 2 x 1 L glass amber, HCl
VOC: 3x40ml vial HCl
VPH: 3x40ml vial HCl
TOC: 2 x 40 ml vial, H2SO4
Dislvd Gas: 3 x 40ml vial, HCl
(15 glass)

Ammonia:500 ml hdpe, H2SO4
COD:500 ml hdpe, H2SO4
Total Metals: 1 x 500 ml hdpe HNO3
Sulfate, Alkalinity:500ml hdpe, ice
Sulfide: 1L hdpe, zinc acetate/NaOH
NO2,NO3, T. Phos: 500 ml hdpe, H2SO4
(6 hdpe)

Time (24 hr)	Wtr Dpth below MP feet	Pump Setting (Hz)	Purge Rate (ml/min)	Cumulative Volume Purged	Water Temp (Celsius)	Specific Conductance	pH	ORP/Eh (mV)	D.O. mg/L	Turbidity NTUs	COMMENTS
1324	22.70	109.7	880	—	16.2	138	5.50	148.8	7.50	50.5	
1329	22.70	109.7	880	~8 L	14.91	137	5.40	185.0	7.10	16.2	
1334	22.70	109.7	880	~10 L	14.61	137	5.40	193.1	7.08	8.0	
1337	22.70	109.7	880	? ~~14~~ 16 L	14.47	137	5.40	198.9	7.06	6.2	
1340	22.70	109.7	880	17 L	14.47	137	5.40	207.4	7.03	5.0	SEMPTY BUCKET
1343	22.70	109.3	900	18 + 2L	14.47	136	5.40	214.4	7.01	4.0	
1347	22.70	109.7	900	18+4 = 22	14.47	136	5.40	218.0	6.99	3.2	
1350	22.70	109.7	900	18+7 = 25L	14.45	136	5.40	220.5	6.99	3.5	
1400	SAMPLE	TIME									
SAMPLE TAKEN AT: 1400					+/- 3%	+/- 3%	+/- 0.1 unit	+/- 10 mV	+/-10%	+/-10%	

YSI #: 650 MDS, SN = 063644 TURBIDITY #: 608146 PUMP – Grundfos Rediflow II

NOTES:

Sunny day may explain initial high temp (chamber still hot from before the water entered it)

SAMPLER: PATRICK BLUMERIS

C_vl well #: **43M-01-17XOB**
SCREENED INTERVAL DEPTH: 23.5 – 33.5 ft below top of PVC

H20 LEVEL: PRE-PUMP INSERTION 23.92'

POST-PUMP INSERTION 23.93'

DATE: 6/13/05 TIME: 1500 SAMPLE DEPTH 30'

SAMPLED BY: AG SIGNATURE:

RECORDED BY: AG SIGNATURE:

US Army Corps of Engineers
Groundwater Sampling Log Sheet

Project Name: *Devens Areas 32/43A*

1 Door B4; about 6 paces from bottom step

SAMPLE METHOD: EPA LOW STRESS METHOD

PCBs: 2 x 1 L amber, ice	Ammonia: 1 liter hdpe, H_2SO_4
EPH: 2 x 1 L glass amber, HCl	COD: 250 ml hdpe, H_2SO_4
VOC: 3x40ml vial HCl	Total Metals: 1 x 500 ml hdpe HNO_3
VPH: 3x40ml vial HCl	Sulfate, Alkalinity:500ml hdpe, ice
TOC: 2 x 40 ml vial, H2SO4	Sulfide: 1L hdpe, zinc acetate/NaOH
Dislvd Gas: 3 x 40ml vial, HCl (15 glass)	NO_2,NO_3, T. Phos: 1 liter hdpe, H_2SO_4 (6 hdpe)

Time (24 hr)	Wtr Dpth below MP feet	Pump Setting (Hz)	Purge Rate (ml/min)	Cumulative Volume Purged	Water Temp (Celsius)	Specific Conductance	pH	ORP/Eh (mV)	D.O. mg/L	Turbidity NTUs	COMMENTS
1518	23.97	114.2	1320		16.63	71(?)	4.9	282.0	8.58	12.7	
1522	23.97	110.4	400	5L	15.27	97	5.14	261.3	6.79	3.83	
1525	23.97	110.4	400		15.97	100	5.22	259.4	6.19	2.26	
1528	23.97	110.4	400		16.74	103	5.26	257.9	6.07	1.57	
1531	23.97	110.5	400	≈8L	16.90	104	5.26	256.0	5.80	1.40	
1534	23.96	110.5	400		17.13	100	5.28	253.8	5.55	1.23	
1537	23.96	110.5	400	≈12L	17.20	103	5.29	252.3	5.41	1.15	
1540	23.96	110.5	400		17.32	103	5.28	249.6	5.26	1.17	
SAMPLE TAKEN AT: 1543					+/- 3%	+/- 3%	+/- 0.1 unit	+/- 10 mV	+/-10%	+/-10%	

YSI #: 05E2392 TURBIDITY #: 608146 PUMP – Grundfos Rediflow II

NOTES:

SAMPLER: ALEX GARNEAU

C_ M well #: **43M-01-17XBR**

SCREENED INTERVAL DEPTH: 47.5 – 57.5 ft below top of PVC

H20 LEVEL: PRE-PUMP INSERTION 24.06

POST-PUMP INSERTION 22.73

DATE: 6/13/05 TIME: 1440 SAMPLE DEPTH 52'

SAMPLED BY: TJM SIGNATURE: Thomas J Marcotte

RECORDED BY: TJM SIGNATURE: Thomas J Marcotte

US Army Corps of Engineers
Groundwater Sampling Log Sheet

Door B4; about 6 paces from bottom step

Project Name: **Devens Areas 32/43A**

SAMPLE METHOD: EPA LOW STRESS METHOD

PCBs: 2 x 1 L amber, ice
EPH: 2 x 1 L glass amber, HCl
VOC: 3x40ml vial HCl
VPH: 3x40ml vial HCl
TOC: 2 x 40 ml vial, H2SO4
Dislvd Gas: 3 x 40ml vial, HCl (15 glass)

Ammonia: 1 liter hdpe, H_2SO_4
COD: 250 ml hdpe, H_2SO_4
Total Metals: 1 x 500 ml hdpe HNO_3
Sulfate, Alkalinity:500ml hdpe, ice
Sulfide: 1L hdpe, zinc acetate/NaOH
NO_2,NO_3, T. Phos: 1 liter hdpe, H_2SO_4 (6 hdpe)

Time (24 hr)	Wtr Dpth below MP feet	Pump Setting (Hz)	Purge Rate (ml/min)	Cumulative Volume Purged	Water Temp (Celsius)	Specific Conductance	pH	ORP/Eh (mV)	D.O. mg/L	Turbidity NTUs	COMMENTS
1347	25.25	111.9	.160		12.53	226	5.56	259.5	5.65	9.43	
1351	25.55	112.0	160		17.17	271	5.00	325.2	2.90	13.2	
1355	25.85	113.6	300	0.25 gal	16.30	344	4.42	392.1	2.17	10.05	
1359	26.55	115.7	400		15.69	347	4.20	424.8	1.93	8.79	
1403	27.35	115.7	300	0.75 gal	17.44	319	4.36	461.6	1.93	5.89	
1407	27.40	115.7	250		19.21	312	4.98	480.7	1.95	4.80	
1411	27.40	115.7	240	1.25 gal	18.99	318	4.74	498.5	1.88	4.05	
1415	27.40	115.7	240		18.66	325	4.58	510.6	1.81	3.55	
1419	27.40	115.7	240	1.50 gal	18.42	336	4.42	530.0	1.65	2.65	
1423	27.40	115.7	240		18.55	339	4.38	540.6	1.60	2.25	
1427	27.40	115.7	240	1.75 gal	18.66	346	4.41	551.9	1.58	2.33	
1431	27.40	115.7	240		18.55	354	4.50	557.1	1.59	2.30	
1435	27.40	115.7	240	2.00 gal	18.62	357	4.55	553.9	1.60	2.35	
SAMPLE TAKEN AT: 1440					+/- 3% ± 0.6	+/- 3% ± 10	+/- 0.1 unit	+/- 10 mV	+/-10% 5.15	+/-10%	

YSI #: 96 & 0508 AA TURBIDITY #: 39576 PUMP – Grundfos Rediflow II

NOTES:

SAMPLER: TOM MARCOTTE

C M well #: 43M-01-20XBR
SCREENED INTERVAL DEPTH: 68.3 – 78.3 ft below top of PVC

H20 LEVEL: PRE-PUMP INSERTION 23.69'

POST-PUMP INSERTION 23.68'

DATE: 6/13/05 TIME: 0850 SAMPLE DEPTH 73'

SAMPLED BY: PG SIGNATURE: Paul Young

RECORDED BY: PG SIGNATURE: Paul Young

US Army Corps of Engineers
Groundwater Sampling Log Sheet

Project Name: *Devens Areas 32/43A*

SAMPLE METHOD: EPA LOW STRESS METHOD

PCBs: 2 x 1 L amber, ice	Ammonia: 1 liter hdpe, H_2SO_4
EPH: 2 x 1 L glass amber, HCl	COD: 250 ml hdpe, H_2SO_4
VOC: 3x40ml vial HCl	Total Metals: 1 x 500 ml hdpe HNO_3
VPH: 3x40ml vial HCl	Sulfate, Alkalinity:500ml hdpe, ice
TOC: 2 x 40 ml vial, H2SO4	Sulfide: 1L hdpe, zinc acetate/NaOH
Dislvd Gas: 3 x 40ml vial, HCl (15 glass)	NO_2,NO_3, T. Phos: 1 liter hdpe, H_2SO_4 (6 hdpe)

Obstructed (bent?) at ~12 ft depth in Dec2003; used peristaltic pump in May 2004 and October 2004

Time (24 hr)	Wtr Dpth below MP feet	Pump Setting (Hz)	Purge Rate (ml/min)	Cumulative Volume Purged	Water Temp (Celsius)	Specific Conductance	pH	ORP/Eh (mV)	D.O. mg/L	Turbidity NTUs	COMMENTS
1006	25.00	peristaltic pump used	300		14.11	2907	6.95	-36.6	0.76	7.32	
1013	25.42		250	1 gal	13.99	2874	6.86	-13.4	0.47	4.83	
1018	25.42		250		13.99	2873	6.84	-7.5	0.38	4.82	
1023	25.49		250		13.79	2845	6.79	4.0	0.33	3.85	
1028	25.46		250	2 gal	14.13	2849	6.83	6.1	0.41	3.97	
1033	25.46		250		13.91	2827	6.83	11.6	0.31	3.40	
1038	25.46		250		13.92	2806	6.82	12.4	0.30	2.54	
1043	25.49		250	3 gal	13.94	2752	6.81	16.2	0.29	2.49	
1048	25.54		250		13.83	2626	6.83	5.6	0.28	3.46	
1053	25.51		250		14.02	2436	6.82	3.9	0.29	2.67	
1058	25.49		250	4 gal	14.02	2306	6.76	10.8	0.31	3.04	
1103	25.49		250		14.01	2227	6.74	15.7	0.33	3.47	

SAMPLE TAKEN AT: LLID

+/- 3%	+/- 3%	+/- 0.1 unit	+/- 10 mV	+/-10%	+/-10%

YSI #: 00D0698 TURBIDITY #: 910 290 (RENTAL UNIT) PUMP – Grundfos Rediflow II

NOTES:

SAMPLER: PAUL YOUNG

High humidity causing excessive moisture buildup on Turbidity unit, difficult to keep clean

C M well #: 43M-01-20XOB

SCREENED INTERVAL DEPTH: 24.0 – 34.0 ft below top of PVC

H20 LEVEL: PRE-PUMP INSERTION 24.17'

POST-PUMP INSERTION 24.15'

DATE: 6/13/05 TIME: 0850 SAMPLE DEPTH 30'

SAMPLED BY: AGL SIGNATURE:

RECORDED BY: AGL SIGNATURE:

US Army Corps of Engineers
Groundwater Sampling Log Sheet

Project Name: Devens Areas 32/43A

SAMPLE METHOD: EPA LOW STRESS METHOD

PCBs: 2 x 1 L amber, ice
EPH: 2 x 1 L glass amber, HCl
VOC: 3x40ml vial HCl
VPH: 3x40ml vial HCl
TOC: 2 x 40 ml vial, H2SO4
Dislvd Gas: 3 x 40ml vial, HCl (15 glass)

Ammonia: 1 liter hdpe, H_2SO_4
COD: 250 ml hdpe, H_2SO_4
Total Metals: 1 x 500 ml hdpe HNO_3
Sulfate, Alkalinity:500ml hdpe, ice
Sulfide: 1L hdpe, zinc acetate/NaOH
NO_2,NO_3, T. Phos: 1 liter hdpe, H_2SO_4 (6 hdpe)

Time (24 hr)	Wtr Dpth below MP feet	Pump Setting (Hz)	Purge Rate (ml/min)	Cumulative Volume Purged	Water Temp (Celsius)	Specific Conductance	pH	ORP/Eh (mV)	D.O. mg/L	Turbidity NTUs	COMMENTS
0954	24.18	111.2	MINIMAL		15.86	157	5.37	193.9	10.01	6.27	LOST FLOW
1002	24.18	155.4	12		20.02	156	4.81	312.0	8.69	5.14	BACKFLUSHED
1009	24.15	110.5	300		20.27	156	4.64	374.2	8.59	2.14	
1012	24.15	110.5		2 GAL	20.08	154	4.55	395.8	8.38	1.00	FLOW INCREASED
1019	24.15	110.5	300		17.16	153	3.74	457.1	8.56	2.12	
1022	24.15	110.5	300		17.98	152	3.90	466.7	8.44	0.94	
1025	24.15										LOST FLOW REDUCED FLOW
1037	24.15	112.3	800		17.10	153	4.05	511.3	9.33	1.18	
1040	24.15	112.3	800	2 GAL	16.73	154	3.83	522.9	9.35	0.91	
1043	24.15	112.3	900		16.42	154	3.77	532.8	9.29	0.77	
1046	24.16	112.3	900		16.49	154	3.78	537.9	9.20	0.97	
1049	24.16	112.3	600		17.10	153	3.89	542.0	9.03	0.61	
1052	24.16	112.3	2450		17.65	153	3.95	544.0	8.85	0.78	
to											

SAMPLE TAKEN AT: 1053

+/- 3% +/- 3% +/- 0.1 unit +/- 10 mV +/-10% +/-10%

YSI #: 00 D0698 · TURBIDITY #: 39576 PUMP – Grundfos Rediflow II

NOTES:

SAMPLER: ALEX GARNEAU

U.S.ARMY CORPS of ENGINEERS	YSI 600XL MULTIPARAMETER METER CALIBRATION LOG

SERIAL NO. 06D0698

SITE NAME: Devens AOC 32/43A

MODEL NO. 600XLM

DATE: 13 June 2005

DECAL NO.

	calibration standard value	pre-calibration reading	post calbration reading	PM Check	calibration standard lot # and exp	initials	remarks
DO ~~mg/L~~ %	na	99.4	99.6	100.4	saturated sponge	TAK	bar. press. 29.8" = 756.9mm
pH	7.00	6.97	7.00	6.97	lot # 4597 exp 7.28.06		PM = 29.7"
pH	4.00	4.07	4.00	3.93	lot # 4098 exp 8.18.05		
COND uS/cm	1000	1006	1000	995	lot # 4885 exp 4.16.06		
REDOX mV	227.7 @	224.8	227.5	215.5 @	lot # 04C4958 exp 4.06		
TEMP °C	27.5	na	na	33.1			

SERIAL NO. 06D0698

SITE NAME: DEVENS AOC 32/43A

MODEL NO. 600XLM

DATE: 15 JUNE 2005

DECAL NO.

	calibration standard value	pre-calibration reading	post calbration reading	PM Check	calibration standard lot # and exp	initials	remarks
DO ~~mg/L~~ %	na	98.7	98.9	99.7	saturated sponge	PY	bar. press. 29.6" = 751.84mm Hg
pH	7.00	7.08	7.01	7.01	lot # 4597 exp 7.28.06		DO O-RING POPPED OFF PRIOR TO PM BACKCAL.
pH	4.00	4.07	4.00	3.88	lot # 4098 exp 8.18.05		
COND uS/cm	1000	978	1000	1017	lot # 4885 exp 4.16.06		PM = 29.6" = 751.84mm
REDOX mV	239.84	244.0	240.0	217.9 @	lot # 04C4958 exp 4.06		
TEMP °C	18.2	na	na	13.2	239.84		

U.S.ARMY CORPS of ENGINEERS	YSI 600XL MULTIPARAMETER METER CALIBRATION LOG

SERIAL NO. 98G0508
SITE NAME: Devens AOC 32/43A MODEL NO. 600XLM
DATE: 13 June 2005 DECAL NO.

	calibration standard value	pre-calibration reading	post calbration reading	PM Check	calibration standard lot # and exp	initials	remarks
DO ~~mg/L~~ %	na	101.9	99.6	98.1	saturated sponge	TAK	bar. press. 29.8" = 756.9mm
pH	7.00	7.04	7.00	6.95	lot # 4597 exp 7-28-06		PM = 29.7"
pH	4.00	4.08	4.00	3.99	lot # 4098 exp 8-18-05		
COND uS/cm	1000	993	999	1019	lot # 4885 exp 4-16-06		
REDOX mV	227.7 @	231.8	227.9	235.5 @	lot # 04C4958 exp 4-06		
TEMP °C	27.5	na	na	34.2			

SERIAL NO. 98G0508
SITE NAME: DEVENS AOC 32/43A MODEL NO. 600 XLM
DATE: 15 JUNE 2005 DECAL NO.

	calibration standard value	pre-calibration reading	post calbration reading	PM Check	calibration standard lot # and exp	initials	remarks
DO ~~mg/L~~ %	na	102.6	98.9	104.3	saturated sponge	PH	bar. press. 29.6" = 751.84mm
pH	7.00	7.28	7.00	7.02	lot # 4597 exp 7-28-06		PM = 29.6" = 751.84 mm
pH	4.00	3.94	4.00	3.96	lot # 4098 exp 8-18-05		
COND uS/cm	1000	1016	999	1002	lot # 4885 exp 4-16-06		
REDOX mV	239.1 @	245.6	239.9	241.4	lot # 04C4958 exp 4-06		
TEMP °C	18.2	na	na	13.2	239.1 @		

U.S.ARMY CORPS of ENGINEERS	YSI ~~600XL~~ MULTIPARAMETER METER CALIBRATION LOG

SERIAL NO. 05E2392
SITE NAME: Devens AOC 32/43A MODEL NO. 600R
DATE: 13 June 2005 DECAL NO.

	calibration standard value	pre-calibration reading	post calibration reading	PM Check	calibration standard lot # and exp	initials	remarks
DO ~~mg/L~~ %	na	~~95.2~~ 95.2	99.6	93.9	saturated sponge	TJK	bar. press. 29.8" = 756.9mm
pH	7.00	7.16	6.99	6.89	lot # 4597 exp 7-28-06		PM = 29.7"
pH	4.00	4.13	4.00	3.95	lot # 4098 exp 8-18-05		
~~COND uS/cm~~	No Conductivity Probe Present			1273	lot # —— exp ——		- CONDUCTIVITY INLET NOT NOTICED IN AM.
REDOX mV	229.7	229.7	227.7	217.1 @	lot # 04C4958 exp 4.06		
TEMP °C	27.5	na	na	33.6			

SERIAL NO. 01J0851
SITE NAME: DEVENS AOC 32/43A MODEL NO. 600 XLM
DATE: ~~AM~~ PM 15 JUNE 2005 DECAL NO.

	calibration standard value	pre-calibration reading	post calibration reading	PM Check	calibration standard lot # and exp	initials	remarks
DO ~~mg/L~~ %	na	97.1	98.9	98.1	saturated sponge	PY	bar. press. 29.6 = 751.84mm
pH	7.00	7.10	7.00	7.15	lot # 4597 exp 7-28-06		PM = 29.6" = 751.84 mm
pH	4.00	4.13	4.00	4.03	lot # 4098 exp 8-18-05		
COND uS/cm	1000	940	1000	1013	lot # 4385 exp 9-16-06		
REDOX mV	239.84	231.0	239.2	295.4	lot # 04C4958 exp 4.06		
TEMP °C	18.2	na	na	13.2	239.84		

U.S.ARMY CORPS of ENGINEERS	YSI 600XL MULTIPARAMETER METER CALIBRATION LOG

SITE NAME: Devens 32/43A ~~South Post Impact Area~~ SERIAL NO. 01J0851

MODEL NO. 600XLM

DATE: ~~20-Oct-03~~ 16 June 2005 DECAL NO.

	calibration standard value	pre-calibration reading	post calbration reading	PM Check	calibration standard lot # and exp	initials	remarks
D O ~~mg/L~~ %	na	101.1	98.9	97.0	saturated sponge		bar. press. ~~756.92 mm Hg~~
pH	7.00	7.02	7.00	7.02	lot # 4597 exp 7.28.06		= 29.6" = 751.8mm
pH	4.00	3.99	4.00	3.95	lot # 4098 exp 8.18.05		PM = 29.6" = 751.8mm
COND uS/cm	1000	1012	1000	1056	lot # 4885 exp 4.16.06		
REDOX mV	246.6@	321.0	240.6	297.5@	lot # 04C4958 exp 4.06		
TEMP °C	13.0	na	na	14.9			

SERIAL NO. 98B0508

MODEL NO. 600XLM

SITE NAME: ~~South Post Impact Area~~

DATE: ~~30-Oct-03~~ 16 June 2005 DECAL NO.

	calibration standard value	pre-calibration reading	post calbration reading	PM Check	calibration standard lot # and exp	initials	remarks
D O ~~mg/L~~ %	na	102.2	98.9	99.9	saturated sponge		bar. press. = 29.6" = 751.8mm
pH	7.00	6.92	7.00	6.95	lot # Same exp		PM = 29.6" = 751.8mm
pH	4.00	3.97	4.00	3.90	lot # Same exp		
COND uS/cm	1000	1021	1000	1033	lot # Same exp		
REDOX mV	246.6@	241.5	246.7	251.6@	lot # Same exp		
TEMP °C	13.0	na	na	15.0			

16 June 2005

	101.0	98.9	98.7
	6.97	7.00	6.97
	3.94	4.00	3.92
1000	1132	1000	995
246.6@	247.8	246.6	241.7@ 14.9°

00P0698
600XLM

Same as above

bar press. = 29.6" = 751.8 mm
PM. 29.6" = 751.8 mm

U. S. Army Corps of Engineers

FIELD INSTRUMENT CALIBRATION LOG

INSTRUMENT NAME: HF Scientific DRT-15CE MODEL NO.: _____

SERIAL NO.: 608146 DECAL NO.: _____ Devens AOC 32/43A

CALIBRATION DATE	INITIAL READING	PROCEDURE	FINAL READING	SIGNATURE	COMMENTS
6/13	0.16	0.02 STD	0.02	ARL	0.03 Backcalibration (PB)
6/13	10.02	10.00 STD	10.00	ARL	9.88 backcalibration (PB)
6/15	0.13	0.02 STD	0.02	ARL	-0.04 BACKCALIBRATION (AG)
6/15	10.67	10.00 STD	10.00	ARL	10.03 BACKCALIBRATION (AG)
6/16	-0.00	10.00 STD Lot 41005	10.00	P.Bl	0.04 BACKCAL (AL) - MISSING CALIBRATION? NOT DONE?
					10.10 BACKCAL (AG)

U. S. Army Corps of Engineers

FIELD INSTRUMENT CALIBRATION LOG

INSTRUMENT NAME: ~~D~~ HF Scientific DRT-15CE MODEL NO.: _____

SERIAL NO.: 39576 DECAL NO.: _____ Dexters AOC 32/43A

CALIBRATION DATE	INITIAL READING	PROCEDURE	FINAL READING	SIGNATURE	COMMENTS
6/13	-0.25	0.02 STD.	0.02	[illegible]	Backcal -0.06 (and 11.0 PB)
6/13	10.46	10.00 STD.	10.00	[illegible]	Backcal 11.0 PB
6/15	0.04	0.02 STD	0.02	[illegible]	0.03 BACKCALIBRATION (AC)
6/15	10.20	10.00 STD	10.00	[illegible]	9.88 BACKCALIBRATION (AC)
6/16	-0.04	0.02 STD Lot 41008	0.02	P. Blumer	0.10 BACKCAL (AC)
6/16	10.14	10.00 STD Lot 41008	10.01	P. Blumer	9.97 BACKCAL (AC)

U. S. Army Corps of Engineers	FIELD INSTRUMENT CALIBRATION LOG

INSTRUMENT NAME: HF Scientific DRT-15CE MODEL NO.: _____

SERIAL NO.: 910290 DECAL NO.: _____ Devens AOC 32/43A

CALIBRATION DATE	INITIAL READING	PROCEDURE	FINAL READING	SIGNATURE	COMMENTS
6/13	-0.02	0.02 STD	0.02	AEL	0.04 Backcalib. (PB)
6/13	10.18	10.00 STD	10.00	AEL 11.8	11.8 Backcal (PB)
6/15	0.07	0.02 STD	0.02	AEL	0.02 BACKCALIBRATION (AE)
6/15	10.06	10.00 STD	10.00	AEL	10.13 BACKCALIBRATION (AE)
6/16	-0.06	0.02 STD 41008	10.01	P.Bl	0.07 BACKCAL (AE)
6/16	10.30 ~~10.0~~ PB	10.00 STD 41005 10.01 (PB)	10.01	P.Bl	10.06 BACKCAL (AE)

- NOTE - SUPPLIED BOTTLE IS DIRTY - USING A USACE SPARE BOTTLE.

Appendix C

Groundwater Sampling Log Sheets October 2005

GWM well #: **SHL-15** Page 1 of 2

SCREENED INTERVAL DEPTH: 15.0 to 25.0 ft below top of PVC

H20 LEVEL: PRE-PUMP INSERTION 20 ft TOC

POST-PUMP INSERTION ~~22~~ 19.98 TOC

DATE: 10/5/2005 TIME: 12:00 pm SAMPLE DEPTH 22 ½

SAMPLED BY: SW SIGNATURE:

RECORDED BY: SW SIGNATURE:

US Army Corps of Engineers
Groundwater Sampling Log Sheet

Project Name: **Devens Area 32**

SAMPLE METHOD: EPA LOW STRESS METHOD

Total Metals: 1 x 500 ml hdpe, HNO_3
EPH: 2 x 1 L glass amber, HCl
VOC: 3 x 40 ml vial, HCl
VPH: 3 x 40 ml vial, HCl

SAMPLER: SEAN WALSH

Time (24 hr)	Wtr Dpth below MP (feet)	Pump Setting (Hz)	Purge Rate (ml/min)	Cumulative Volume Purged	Water Temp (Celsius)	Specific Conductance (µS/cm)	pH	ORP/Eh (mV)	D.O. (mg/L)	Turbidity (NTUs)	COMMENTS
1215	20.05	98.5	280		15.65	185	3.88	344	1.8	4.59	
1218	20.05	98.5	~~250~~ 250		16.08	185	3.60	324	1.24	4.12	
1221	20.05	98.5	280		16.37	183	3.62	298.4	1.1	3.95	
1224	20.04	98.5	280		16.49	183	3.61	284.5	1.04	~~4~~ 4.20	
1227	20.05	98.5	280		16.52	183	3.61	260.1	0.97	4.19	
1230	20.05	98.5	280		16.52	183	3.61	251.6	0.95	4.17	
1233	20.05	98.5	280		16.47	184	3.57	241.8	0.88	4.3	
1236	20.05	98.5	280		16.52	184	3.60	236.1	0.86	4.28	
1239	20.05	98.5	280		16.56	184	3.62	239.5	0.85	4.5	
1241	20.05	98.5	280		16.7	184	3.65	248.7	0.86	4	
1244	20.05	98.5	280		16.91	184	3.72	259.6	0.87	3.45	
1247	20.03	98.5	200		17.38	183	3.78	284.9	0.92	3.05	
1250	20.02	98.5	200		17.82	185	3.81	310.4	0.86	2.79	
1253	20.11	103	900		16.00	183	3.53	344.9	0.87	2.72	
1256	20.16	103	1200		13.91	183	3.01	356.9	0.99	2	
1259	20.09	98.5	400	4 gal	13.94	182	2.89	371.4	0.99	1.75	
1302	20.08	98.5	400		14.92	182	2.99	399.4	1.02	1.52	
1305	20.08	98.5	400		15.69	182	3.34	385.9	1	1.43	
1308	20.06	98.5	400		15.96	182	3.55	391.5	0.95	1.52	

SAMPLE TAKEN AT: _____ +/- 3% +/- 3% +/- 0.1 unit +/- 10 mV +/-10% +/-10%

YSI #: 600 XL -BM TURBIDITY #: DRT-15CE PUMP – Grundfos Rediflow II

NOTES:

GWM well #: SHL-15 Page 2 of 2

SCREENED INTERVAL DEPTH: ft below top of PVC

H20 LEVEL: PRE-PUMP INSERTION _____

POST-PUMP INSERTION _____

DATE: _____ TIME: _____ SAMPLE DEPTH _____

SAMPLED BY: SW SIGNATURE:

RECORDED BY: SW SIGNATURE:

US Army Corps of Engineers
Groundwater Sampling Log Sheet

Project Name: **Devens Area 32**

SAMPLE METHOD: EPA LOW STRESS METHOD

Total Metals: 1 x 500 ml hdpe, HNO_3
EPH: 2 x 1 L glass amber, HCl
VOC: 3 x 40 ml vial, HCl
VPH: 3 x 40 ml vial, HCl

SAMPLER: SEAN WALSH

Time (24 hr)	Wtr Dpth below MP (feet)	Pump Setting (Hz)	Purge Rate (ml/min)	Cumulative Volume Purged	Water Temp (Celsius)	Specific Conductance (µS/cm)	pH	ORP/Eh (mV)	D.O. (mg/L)	Turbidity (NTUs)	COMMENTS
1312	20.06	98.5	400		15.99	182	3.64	418.6	0.93	1.35	
1315	20.06	98.5	400		15.95	182	3.5	437.6	0.92	1.24	
1318	20.06	98.5	400		15.93	182	3.34	460.3	0.94	1.22	
1321	20.06	98.5	400		15.93	182	3.27	471.3	0.94	1.12	
1324	20.07	98.5	400		15.96	182	3.12	498.4	0.95	1.16	
1327	20.07	98.5	375		15.94	182	3.10	509.	0.94	0.95	
1330	20.07	98.5	375		15.92	182	3.21	516.9	0.95	1.2	
1333	20.07	98.8	375		15.64	181	3.15	531.4	0.96	0.8	
1336	20.07	98.8	375	4.5 gal	15.65	182	3.09	540	0.97	0.75	

SAMPLE TAKEN AT: 1340

+/- 3% +/- 3% +/- 0.1 unit +/- 10 mV +/-10% +/-10%

YSI #: TURBIDITY #: PUMP – Grundfos Rediflow II

NOTES:

GWM well #: 32M-92-01X

SCREENED INTERVAL DEPTH: 13.7 - 23.7 ft below top of PVC

H20 LEVEL: PRE-PUMP INSERTION 19.91 ft to TOC

POST-PUMP INSERTION 19.81 ft 25.86' to Bottom of well

DATE: 30 Oct '05 TIME: 0955 SAMPLE DEPTH 22.0 ft

SAMPLED BY: RBL SIGNATURE: R. Lloyd/B. Loyd

RECORDED BY: RBL SIGNATURE: R. Lloyd/B. Loyd

US Army Corps of Engineers
Groundwater Sampling Log Sheet

Project Name: Devens Area 32

SAMPLE METHOD: EPA LOW STRESS METHOD

Total Metals: 1 x 500 ml hdpe, HNO_3
EPH: 2 x 1 L glass amber, HCl
VOC: 3 x 40 ml vial, HCl
VPH: 3 x 40 ml vial, HCl

SAMPLER: BEN LOYD

Time (24 hr)	Wtr Dpth below MP (feet)	Pump Setting (Hz)	Purge Rate (ml/min)	Cumulative Volume Purged	Water Temp (Celsius)	Specific Conductance (µS/cm)	pH	ORP/Eh (mV)	D.O. (mg/L)	Turbidity (NTUs)	COMMENTS
1038	20.31	98.1	400		15.38	150	4.83	419.7	7.14	5.0	
1041	20.55	98.1	320		15.96	15.1	4.71	446.7	6.89	5.0	
1045	20.61	98.1	320	~1 gal	16.13	150	4.68	473.6	6.47	5.0	
1048	20.66	98.1	320		16.17	150	4.72	491.5	6.03	6.0	
1051	20.66	98.1	320	~2 gal	16.29	154	4.73	505.7	5.50	6.9	
1054	20.66	98.1	320		16.26	156	4.67	517.6	5.08	6.9	
1057	20.66	98.1	320		16.31	161	4.64	528.1	4.44	6.9	
1100	20.66	98.1	320	~3 gal	16.33	166	4.59	536.4	4.14	7.0	
1103	20.66	98.1	320		16.55	169	4.49	547.3	3.79	7.0	
1106	20.66	98.1	320		16.42	173	4.43	556.4	3.47	6.0	
1109	20.66	98.1	320	~4 gal	16.42	180	4.45	568.7	3.12	5.6	
1112	20.66	98.1	320		16.47	181	4.39	574.5	3.03	5.7	
1115	20.66	98.1	320		16.49	181	4.37	579.7	2.90	5.8	
1118	20.66	98.1	320		16.59	187	4.43	585.4	2.77	5.0	
1121	20.66	98.1	320	~5 gal	16.62	186	4.42	589.5	2.75	4.9	

SAMPLE TAKEN AT: _____ +/- 3% +/- 3% +/- 0.1 unit +/- 10 mV +/-10% +/-10%

YSI #: TURBIDITY #: PUMP – Grundfos Rediflow II

NOTES:

GWM well #: 32Z-99-02X *(PIEZOMETER)*
SCREENED INTERVAL DEPTH: 14.5-29.5 ft below top of PVC

H20 LEVEL: PRE-PUMP INSERTION 26.60 ft

POST-~~PUMP~~ TUBING INSERTION _____

DATE: 5 Oct '05 TIME: _____ SAMPLE DEPTH _____

SAMPLED BY: _____ SIGNATURE: _____

RECORDED BY: _____ SIGNATURE: _____

US Army Corps of Engineers
Groundwater Sampling Log Sheet

Project Name: **Devens Area 32**

SAMPLE METHOD: EPA LOW STRESS METHOD

Total Metals: 1 x 500 ml hdpe, HNO_3
EPH: 2 x 1 L glass amber, HCl
VOC: 3 x 40 ml vial, HCl
VPH: 3 x 40 ml vial, HCl

Time (24 hr)	Wtr Dpth below MP (feet)	Pump Setting (Hz)	Purge Rate (ml/min)	Cumulative Volume Purged	Water Temp (Celsius)	Specific Conductance (µS/cm)	pH	ORP/Eh (mV)	D.O. (mg/L)	Turbidity (NTUs)	COMMENTS
Attempted to sample with a peristaltic pump (well is 1" diam). Could not											
draw any flow. Water level is low - peristaltic not capable of pumping											
>20' of head.											
NO SAMPLE - JAR											
Pump USED — ISCO 150 (US Environmental Rental #200C01202)											

SAMPLE TAKEN AT: _____ +/- 3% +/- 3% +/- 0.1 unit +/- 10 mV +/-10% +/-10%

YSI #: 065862 (S.N.) 99C0323 AA (S.N.) TURBIDITY #: 608146 PUMP – PERISTALTIC GeoTech Model II
NOTES:

GWM well #: **32M-01-13XBR**
SCREENED INTERVAL DEPTH: 13.7 – 23.7 ft below top of PVC

H20 LEVEL: PRE-PUMP INSERTION 19.60'

POST-PUMP INSERTION 19.33'

DATE: 4 Oct '05 TIME: _____ SAMPLE DEPTH 22.0'

SAMPLED BY: _____ SIGNATURE: _____

RECORDED BY: _____ SIGNATURE: _____

US Army Corps of Engineers
Groundwater Sampling Log Sheet

Project Name: **Devens Area 32**

SAMPLE METHOD: EPA LOW STRESS METHOD

Total Metals: 1 x 500 ml hdpe, HNO_3
EPH: 2 x 1 L glass amber, HCl
VOC: 3 x 40 ml vial, HCl
VPH: 3 x 40 ml vial, HCl

Time (24 hr)	Wtr Dpth below MP (feet)	Pump Setting (Hz)	Purge Rate (ml/min)	Cumulative Volume Purged	Water Temp (Celsius)	Specific Conductance (µS/cm)	pH	ORP/Eh (mV)	D.O. (mg/L)	Turbidity (NTUs)	COMMENTS
1500	20.21	100.5	160		17.17	490	6.66	191.4	3.70		
1503	20.32	100.5	160		17.18	488	6.59	207.1	3.63		
1506	20.35	101.5	80	~1/2 gallon	17.55	485	6.55	226.0	3.65	24.4	
1509	20.38	101.8	~40		18.42	483	6.55	244.5	3.67	20.6	
1512	20.43	112.7	~30		19.16	484	6.56	257.2	3.53	17.1	
1515	20.42	112.7	~20		19.95	483	6.57	266.2	3.50	13.5	
1518	20.59	145.0	200		20.41	481	6.58	275.5	3.32	12.9	
1525 (7 min)	21.27	~~104.6~~ 101.6	120		24.96	499	6.66	281.8	4.24	8.1	
1530	21.35	145.3	~20	~1 gallon	24.25	499	6.65	285.7	3.96		
10/5/05											
1095	21,50	110.5	~100		17.20	537	6.27	-27.6	4.97	2.10	
1051	22.00	112.3	+320		17.47	535	6.24	-26.9	4.80	-	Well purged before 7 hrs
	~~YSI: 065864~~ (10/5)										

SAMPLE TAKEN AT: 1000

+/- 3% +/- 3% +/- 0.1 unit +/- 10 mV +/-10% +/-10%

YSI #: 065864 (I.N.) TURBIDITY #: 39576 PUMP – Grundfos Rediflow II

NOTES: Backflush @ 1520 - flow had stopped * 10/5/05 - H20 level 19.66', Post Pump H20 level = 19.98
let well recharge to 19.7'

GWM well #: **32M-01-14XBR**
SCREENED INTERVAL DEPTH: 34.0 – 44.0 ft below top of PVC

H20 LEVEL: PRE-PUMP INSERTION 24.35 from top of PVC

POST-PUMP INSERTION 23.39 44.50 to bottom of well

DATE: 3 Oct 05 TIME: 0925 SAMPLE DEPTH 39.0'

SAMPLED BY: _____ SIGNATURE: _____

RECORDED BY: _____ SIGNATURE: _____

US Army Corps of Engineers
Groundwater Sampling Log Sheet

Project Name: **Devens Area 32**

SAMPLE METHOD: EPA LOW STRESS METHOD

Total Metals: 1 x 500 ml hdpe, HNO_3
EPH: 2 x 1 L glass amber, HCl
VOC: 3 x 40 ml vial, HCl
VPH: 3 x 40 ml vial, HCl

Time (24 hr)	Wtr Dpth below MP (feet)	Pump Setting (Hz)	Purge Rate (ml/min)	Cumulative Volume Purged	Water Temp (Celsius)	Specific Conductance (µS/cm)	pH	ORP/Eh (mV)	D.O. (mg/L)	Turbidity (NTUs)	COMMENTS
10/4 1028	42.13	138.5	320		12.68	692	6.13	302.5	7.17	412	
1031	42.45	140.1	320		13.00	688	6.22	306.9	7.41	380	
1034	42.56	140.1	200		13.94	697	6.26	316.3	7.52	286	

SAMPLE TAKEN AT: _____ +/- 3% +/- 3% +/- 0.1 unit +/- 10 mV +/-10% +/-10%

YSI #: TURBIDITY #: PUMP – Grundfos Rediflow II

NOTES:

- Set pump @ 44.0 ft, Pump water down to 43.5 ft
- Water @ 23.5 when starting pumping, Pump reset @ 39.0 ft for sampling
- 10/4 [illegible] had to drop to middle

GWM well #: 32M-01-14XOB

SCREENED INTERVAL DEPTH: 19 – 29 ft below top of PVC

H20 LEVEL: PRE-PUMP INSERTION 25.89 (to top of PVC)

POST-PUMP INSERTION 25.70 29.80 to Bottom

DATE: 3 Oct '05 TIME: 0935 SAMPLE DEPTH 28.0 ft

SAMPLED BY: _____ SIGNATURE: _____

RECORDED BY: _____ SIGNATURE: _____

US Army Corps of Engineers
Groundwater Sampling Log Sheet

Project Name: **Devens Area 32**

SAMPLE METHOD: EPA LOW STRESS METHOD

Total Metals: 1 x 500 ml hdpe, HNO_3
EPH: 2 x 1 L glass amber, HCl
VOC: 3 x 40 ml vial, HCl
VPH: 3 x 40 ml vial, HCl

Time (24 hr)	Wtr Dpth below MP (feet)	Pump Setting (Hz)	Purge Rate (ml/min)	Cumulative Volume Purged	Water Temp (Celsius)	Specific Conductance (µS/cm)	pH	ORP/Eh (mV)	D.O. (mg/L)	Turbidity (NTUs)	COMMENTS
10/4 0931	25.85	114.10	200		20.49	2	5.48	314.6	8.79	9.2	looking T-Value
0934	27.05	114.10	320		19.76	2	5.46	310.8	8.75	8.09	Sensors not completely
0937	28.00	160.20	320		18.95	2	2.4	760			saturated
1013	27.06	190.30			16.36	321	5.97	102	397	23.1	- fixed T value, sensors saturated, well hard to pump

SAMPLE TAKEN AT: _____ +/- 3% +/- 3% +/- 0.1 unit +/- 10 mV +/-10% +/-10%

YSI #: TURBIDITY #: PUMP – Grundfos Rediflow II

NOTES:

- Well pumped at ~ 29.5' until dry. Left water level at 26.62
  Pumped ~ 1 gallon
- 10/4 Water level = 25.88' Samples taken w/ pump setting at 113.8. lowered pump to 28.7' YGT

GWM well #: 32M-01-15XBR Sheet 1 of 1
SCREENED INTERVAL DEPTH: 34.5 – 44.5 ft below top of PVC

H20 LEVEL: PRE-PUMP INSERTION 22.6ft

POST-PUMP INSERTION _____

DATE: 10/4/05 TIME: 1030 SAMPLE DEPTH 40ft

SAMPLED BY: FK SIGNATURE: _____

RECORDED BY: _____ SIGNATURE: _____

US Army Corps of Engineers
Groundwater Sampling Log Sheet

Project Name: **Devens Area 32**

SAMPLE METHOD: EPA LOW STRESS METHOD

Total Metals: 1 x 500 ml hdpe, HNO_3
EPH: 2 x 1 L glass amber, HCl
VOC: 3 x 40 ml vial, HCl
VPH: 3 x 40 ml vial, HCl

SAMPLER: FORREST KNOWLES

Time (24 hr)	Wtr Dpth below MP (feet)	Pump Setting (Hz)	Purge Rate (ml/min)	Cumulative Volume Purged	Water Temp (Celsius)	Specific Conductance (µS/cm)	pH	ORP/Eh (mV)	D.O. (mg/L)	Turbidity (NTUs)	COMMENTS
1038	PUMP	INSERTED									
1044	21.60										
1050	21.75	Start pump									
1053	22.40										Black debris flowing
1055	22.65	106.7									
1100	23.03	109.6	250		19.77	642	6.18	282.9	6.56	14.3	
1105	23.25	109.3	500		20.50	633	6.93	295.2	5.96	11.2	Lost Flow, had to adjust pump
1117	23.52	152.5			21.92	643	7.00	314.4	5.76	9.0	
1122	23.62				21.87	641	6.98	322.5	5.69	7.6	
1130	23.78				22.51	636	6.89	331	5.44	8.4	
1135	24.05	166			20.65	631	6.87	327.5	5.66	7.4	Keep pump flow adjusting
1138	24.38	166			19.27	620	6.91	326.3	5.60	6.5	
1141	24.60				18.85	617	6.90	327.9	5.51	7.5	Turbidity in Sch
1145	24.77				19.37	616	6.91	330.3	5.36	16.69	
1150	25.30				19.31	613	6.94	342.1	5.26	17.4	
1155	25.58				19.35	614	6.91	346.9	5.18	18.1	
1200	25.70				20.27	613	6.94	348.6	5.03	18.3	

SAMPLE TAKEN AT: 1205 +/- 3% +/- 3% +/- 0.1 unit +/- 10 mV +/-10% +/-10%

YSI #: TURBIDITY #: PUMP – Grundfos Rediflow II

NOTES:

Pump is cavitating had to surge pump vertically to get flow Cavitating due to air in packer

GWM well #: **32M-01-16XBR**
SCREENED INTERVAL DEPTH: 21.0 – 31.0 ft below top of PVC
H20 LEVEL: PRE-PUMP INSERTION 25.72 ft
POST-PUMP INSERTION 30.00 ft
DATE: 10/4/05 TIME: ~~2425~~ 1505 SAMPLE DEPTH 30.00
SAMPLED BY: Jeff TD SIGNATURE: [signature]
RECORDED BY: Jeff SIGNATURE: [signature]

US Army Corps of Engineers
Groundwater Sampling Log Sheet

Project Name: **Devens Area 32**
SAMPLE METHOD: EPA LOW STRESS METHOD

Total Metals: 1 x 500 ml hdpe, HNO_3
EPH: 2 x 1 L glass amber, HCl
VOC: 3 x 40 ml vial, HCl
VPH: 3 x 40 ml vial, HCl

SAMPLER: FOREST KNOWLES

Time (24 hr)	Wtr Dpth below MP (feet)	Pump Setting (Hz)	Purge Rate (ml/min)	Cumulative Volume Purged	Water Temp (Celsius)	Specific Conductance (µS/cm)	pH	ORP/Eh (mV)	D.O. (mg/L)	Turbidity (NTUs)	COMMENTS
~~1455~~	25.72	114.0	400		14.93	386	6.29	45.8	7.51		Starting pump
2000	27.90	114.0	400		"			"	"	5.84	
205	26.05	114.0	400		17.34	415	5.27	29.0	7.24	3.00	
210	26.07	114.0	400	3 gal	17.39	426	5.84	4.0	7.14	2.90	
215	26.07	114.0	400	3½ gal	18.18	433	5.83	20	6.82	2.94	
220	26.15	114.0	400	4.5	18.29	435	5.81	20	6.53	2.80	
225		Stopped pump Cleaned Cells restarted									
230	26.14	115.0	400	5.0	19.49	428	5.75	230	3.70	3.20	
233	26.16	115.0	350		17.25	462	5.86	230	3.99	2.50	
243	26.15	113.8	350		18.75	472	5.81	8.8	4.35	1.58	
247	26.15	113.8	350		18.93	476	5.94	2.3	4.38	1.40	
255	26.14	113.8	350	7.100	18.82	479	5.88	2.9	4.42	0.85	
300	26.14	113.8	350	8 gals	18.93	482	5.91	16	4.58	0.75	

Last

SAMPLE TAKEN AT: Readings for pH, and ORP are very variable

+/- 3%	+/- 3%	+/- 0.1 unit	+/- 10 mV	+/-10%	+/-10%

YSI #: 608142 TURBIDITY #: PUMP – Grundfos Rediflow II
NOTES: 3.1

GWM well #: 32M-01-17XBR

SCREENED INTERVAL DEPTH: 41.4 - 51.4 ft below top of PVC

H20 LEVEL: PRE-PUMP INSERTION 27.35' bottom=51.15'

POST-PUMP INSERTION ~~45.00'~~ 27.16'

DATE: 10/4/05 TIME: 1316 SAMPLE DEPTH 45.0'

SAMPLED BY: RBL SIGNATURE:

RECORDED BY: RBL SIGNATURE:

US Army Corps of Engineers
Groundwater Sampling Log Sheet

Project Name: Devens Area 32

SAMPLE METHOD: EPA LOW STRESS METHOD

Total Metals: 1 x 500 ml hdpe, HNO_3
EPH: 2 x 1 L glass amber, HCl
VOC: 3 x 40 ml vial, HCl
VPH: 3 x 40 ml vial, HCl

SAMPLER: BEN LOYD

Time (24 hr)	Wtr Dpth below MP (feet)	Pump Setting (Hz)	Purge Rate (ml/min)	Cumulative Volume Purged	Water Temp (Celsius)	Specific Conductance (µS/cm)	pH	ORP/Eh (mV)	D.O. (mg/L)	Turbidity (NTUs)	COMMENTS
1521	27.17	114.0	260		15.09	518	5.09	396.7	3.55	3.6	
1524	27.17	114.5	260		15.07	524	5.24	421.3	2.86	1.7	
1527	27.17	114.5	260		15.46	529	5.36	450.9	1.85	1.38	
1530	27.17	114.5	260	~1 gal	15.63	530	5.41	462.8	1.17	0.65	
1533	27.17	114.5	260		15.56	530	5.42	481.9	1.58	0.40	
1536	27.17	114.5	260		15.65	530	5.40	494.7	1.51	0.39	
1539	27.17	114.5	260	~2 gal	15.62	531	5.39	502.3	1.44	0.37	
1542	27.17	114.5	260		15.72	532	5.34	515.9	1.42	0.34	
1545	27.17	114.5	260		15.75	535	5.03	534.7	1.42	0.36	
1548	27.17	114.5	260		15.84	536	4.72	549.9	1.44	0.35	
1551	27.17	114.5	260	~3 gal	15.82	538	4.43	565.1	1.42	0.34	
1554	27.17	114.5	260		15.81	541	4.17	580.3	1.45	0.35	
1557	27.17	114.5	260		15.77	544	3.97	594.8	1.49	0.33	
1600	27.17	114.5	260	~4 gal	15.70	548	3.90	608.3	1.45	0.35	
1603	27.17	114.5	260		15.66	554	3.86	616.9	1.39	0.34	
1606	27.17	114.5	260		15.74	556	3.84	623.1	1.42	0.35	
1609	27.17	114.5	260	~5 gal	15.69	558	3.87	627.3	1.45	0.33	

SAMPLE TAKEN AT: 1410

+/- 3% +/- 3% +/- 0.1 unit +/- 10 mV +/-10% +/-10%

YSI #: TURBIDITY #: PUMP – Grundfos Rediflow II

NOTES:

GWM well #: 32M-01-18XBR
SCREENED INTERVAL DEPTH: 14.0 – 23.0 ft below top of PVC

H20 LEVEL: PRE-PUMP INSERTION 19.33'

POST-PUMP INSERTION 19.26'

DATE: 4 Oct '05 TIME: 1047 SAMPLE DEPTH 22.00 ft

SAMPLED BY: TJM SIGNATURE: Thomas J Marcotte

RECORDED BY: TJM SIGNATURE: Thomas J Marcotte

US Army Corps of Engineers
Groundwater Sampling Log Sheet

Project Name: **Devens Area 32**

SAMPLE METHOD: EPA LOW STRESS METHOD

Total Metals: 1 x 500 ml hdpe, HNO_3
EPH: 2 x 1 L glass amber, HCl
VOC: 3 x 40 ml vial, HCl
VPH: 3 x 40 ml vial, HCl

SAMPLER: TOM MARCOTTE

Time (24 hr)	Wtr Dpth below MP (feet)	Pump Setting (Hz)	Purge Rate (ml/min)	Cumulative Volume Purged	Water Temp (Celsius)	Specific Conductance (µS/cm)	pH	ORP/Eh (mV)	D.O. (mg/L)	Turbidity (NTUs)	COMMENTS
1050	19.61	102.9	200		17.63	702	5.41	57.8	2.56	4.93	
~~1055~~	~~19.45~~										
1100	19.48	143.8	40		20.43	709	5.87	31.1	2.54	–	
~~1104~~											
1105	19.71	166.7	240		20.49	694	5.88	29.1	2.66	–	
1108	19.65	150.8	80								
~~1111~~	~~19.20~~	~~150.0~~									
1120	19.80	163.8	400	~1.0 gal	23.20	672	5.91	23.5	2.69		
1123	20.10	148.8	160		22.64	677	5.92	21.3	2.97		
1126	19.78	164.1	200		22.66	685	5.88	21.9	2.58	4.82	
1129	19.83	163.1	120		22.13	663	5.97	23.2	3.25		
1132	19.98	157.0	80	~2.0 gal	22.06	662	5.76	26.6	3.60		
1135	20.02	164.3	200		22.08	661	5.76	27.7	3.55		
1138	19.95	156.9	100		22.31	658	5.75	28.9	3.55	1.45	
1141	20.05	162.1	300		21.45	655	5.72	31.5	3.65	0.78	
1145	19.94	161.6	120	~3.0 gal	22.35	651	5.74	33.6	3.86	0.93	
1148	19.95	163.5	200		22.23	652	5.75	33.0	3.72	1.09	
1151	20.09	160.6 TJM	280		22.52	651	5.76	33.8	4.29	0.50	
SAMPLE TAKEN AT: ~~1150~~ 1150					+/- 3%	+/- 3%	+/- 0.1 unit	+/- 10 mV	+/-10%	+/-10%	

YSI #: 065862 (S.N.) TURBIDITY #: 39576 PUMP – Grundfos Rediflow II

NOTES:

Sample time of 1150 was approximate, actually began closer to 1200. TJM

TJM

EXAMPLE (Minimum uirements)
Well PURGING-FIELD WATER QUALITY MEASUREMENTS FORM

Location (Site/Facility Name) Devens Area 32
Well Number 32M-01-18XBR Date 4 Oct 05
Field Personnel
Sampling Organization
Identify MP

Depth to ____ / ____ of screen
(below MP) top bottom
Pump Intake at (ft. below MP) ____
Purging Device; (pump type) ____

Clock Time 24 HR	Water Depth below MP ft	Pump Dial[1]	Purge Rate ml/min	Cum. Volume Purged liters	Temp. °C	Spec. Cond.[2] µS/cm	pH	ORP/ Eh[3] mv	DO mg/L	Turb-idity NTU	Comments
1154	20.00	162.0	120	~3.5 gal	22.49	653	5.77	35.4	4.32	0.68	

1. Pump dial setting (for example: hertz, cycles/min, etc).
2. µSiemens per cm (same as µmhos/cm) at 25 °C.
3. Oxidation reduction potential (stand in for Eh).

U. S. Army Corps of Engineers	FIELD INSTRUMENT CALIBRATION LOG

INSTRUMENT NAME: HF Scientific DRT 15CE MODEL NO.: _____

SERIAL NO.: _____ DECAL NO.: _____

CALIBRATION DATE	INITIAL READING	PROCEDURE	FINAL READING	SIGNATURE	COMMENTS PM CAL CHECK	
03 Oct 2005	0.11	0.02 Std (Lot 41008 Exp 4/06)	0.02	[signature]	Turbidimeter SN# 608146	
	10.02	10.00 Std (Lot 41005 Exp 4/06)	9.99		↓	
	0.03	0.02 Std (see above)	0.02		Turbidimeter SN# 608142	
↓	9.94	10.00 Std (see above)	10.00	↓	↓	
04 Oct. 2005	-0.02	0.02 STD. (SEE ABOVE)	0.02	T. [signature]	SN# 39576 USGS	0.02
	9.92	10.00 STD. (SEE ABOVE)	10.00		↓	10.01
	-0.03	0.02 STD (SEE ABOVE)	0.02		SN# 608142	0.13
	10.00	10.00 STD	10.00		↓	10.10
	-0.05	0.02 STD.	0.02		SN# 608146	0.20
↓	10.03	10.00 STD	10.00		↓	10.10
05 Oct 05	0.02	0.02 Std (See above)	0.02	[signature]	SN# 608146	0.18
↓	10.14	10.00 Std (See above)	10.01	↓	↓	10.17

U.S.ARMY CORPS of ENGINEERS	YSI 600XL MULTIPARAMETER METER CALIBRATION LOG

SITE NAME: Davis Area 32
DATE: 10/4/05
SERIAL NO. 01C0979 AA
MODEL NO. 600XL-B-0A
DECAL NO.

	calibration standard value	pre-calibration reading	post calbration reading	PM Check	calibration standard lot # and exp Done on 10/3/05	initials	remarks
D O %	na	106.7	101.5	96.3	saturated sponge		bar. press. 30.4" = 772.2 mm
pH	7.00	7.13	7.01	5.93	lot # exp		
pH	4.00	3.95	4.00	3.31	lot # exp		
COND uS/cm	1000	997	1000	998	lot # exp		
REDOX mV	238.4	236.7	238.2	251.1	lot # exp		
TEMP °C	19.2	na	na	24.62			

SITE NAME: Davis Area 32
DATE: 10/4/05
SERIAL NO. 99C0323 AA
MODEL NO. 600XL-B-0
DECAL NO.

	calibration standard value	pre-calibration reading	post calbration reading	PM Check	calibration standard lot # and exp Done on 10/3/05	initials	remarks
D O %	na	102.7	101.6	99.1	saturated sponge		bar. press. 30.4" = 772.2 mm
pH	7.00	7.21	6.96	6.75	lot # exp		
pH	4.00	4.02	4.01	4.00	lot # exp		
COND uS/cm	1009	1024	1000	967	lot # exp		
REDOX mV	239.0	236.2	239.0	228.9	lot # exp		
TEMP °C	19.4	na	na	24.36			

U.S.ARMY CORPS of ENGINEERS	YSI 600XL MULTIPARAMETER METER CALIBRATION LOG

SITE NAME: DEVENS AREA 32
DATE: 10/4/05

SERIAL NO. 32.0055 AC
MODEL NO. 600XL-B-M
DECAL NO.

	calibration standard value	pre-calibration reading	post calbration reading	PM Check	calibration standard lot # and exp Same as 10/3/05	initials	remarks
D O %	na	102.4	101.6	94.1	saturated sponge	JRL	bar. press. 30.4" = 772.2mm
pH	7.00	6.54	7.01	7.20	lot # exp		
pH	4.00	4.44	4.00	4.08	lot # exp		
COND uS/cm	1000	1077	1000	899	lot # exp		
REDOX mV	238.41	238.3	238.4	228.2	lot # exp		
TEMP °C	19.3	na	na	24.21			

SITE NAME: Devens Area 32
DATE: 10/5/05

SERIAL NO. 99C0323AA
MODEL NO. 600XL
DECAL NO.

only one YSI used on 10/5/05

	calibration standard value	pre-calibration reading	post calbration reading	PM Check	calibration standard lot # and exp Same as 10/3/05	initials	remarks
D O %	na	108.4	101.6	103.7	saturated sponge	JRL	bar. press. 30.4" = 772.2mm
pH	7.00	6.98	7.00	6.77	lot # exp		
pH	4.00	4.15	4.00	3.77	lot # exp		
COND uS/cm	1000	961	1000	1020	lot # exp		
REDOX mV	238.54	238.1	238.6	227.8	lot # exp		
TEMP °C	19.2	na	na	29.45			

Appendix D

Groundwater Analytical Results Data Evaluation June 2005
&
Groundwater Analytical Results Data Evaluation October 2005

APPENDIX D - Part 1: June 2005

Data Evaluation Report
For
Devens Areas 32/43A (DRMO/POL Yard)
Long Term Monitoring Groundwater Samples
Collected June 2005

Introduction

Eighteen groundwater samples were collected from the AOC 32/43A site, Devens, MA on June 13, 15 and 16, 2005. The samples were analyzed at Severn Trent Laboratories in Colchester, VT for volatile organic compounds (VOCs), volatile petroleum hydrocarbons (VPH), dissolved gases, extractable petroleum hydrocarbons (EPH), polychlorinated biphenyls (PCB), alkalinity, nitrate, nitrite, sulfate, sulfide, ammonia, chemical oxygen demand (COD), total organic carbon (TOC), total phosphorus, and total and dissolved arsenic, lead and manganese. See Annual Report Table 4-2 for analytical results.

The results were evaluated for acceptability in accordance with the laboratory's defined acceptance limits, with standard EPA SW846 guidance, guidelines provided in Appendix I "Shell for Analytical Chemistry Requirements" in EM200-1-3, dated February 2001 and/or EM 200-1-10 "Guidance for Evaluating Performance Based Chemical Data Packages".

Sample Shipment and Receipt

All sample coolers were packed with sufficient quantities of ice in the field. The laboratory received sample shipments on June 14, 16 and 17, 2005. All samples were appropriately preserved as stated in Table 1.

Holding Times

Samples were extracted and analyzed in accordance with the methods and holding time requirements cited in Table 1.

Volatile Organic Compound (VOC) Analysis

Eighteen groundwater samples were analyzed for VOCs using SW846 Method 8260B. In addition, the laboratory analyzed, one field duplicate (32M-01-DUP, a duplicate of sample 32M-01-18XBR), three trip blanks (dated 6/13/05, 6/15/05 and 6/16/05), and one equipment blank sample (32-43A-EQB, dated 6/16/05).

A peristaltic pump was used to collect the samples from wells 32Z-99-02X and 43M-01-20XBR. It was necessary to use the peristaltic pump instead of the submersible pump due to the small diameter of the well casing at 32Z-99-02X and the slow recharge rate at 43M-01-20XBR. The wells were identified on the data tables as being sampled with the peristaltic pump.

Laboratory Method Blank, Trip Blank and Equipment Blank Results: Target analytes were undetected at levels above the practical quantitation limit (PQL) for method blank, and trip blank samples. The equipment blank sample had detections of chloroform and methylene chloride above

the PQL. There were no detections of either compound in the samples; therefore no data qualification was made due to the equipment blank contamination. The results for 1,2-dichlorobenzene that were within five times the result in the equipment blank sample were qualified as tentatively not detected (UJ) at the reported concentration as a result of the blank contamination. Methylene chloride and chloroform were not detected in any samples other than the equipment blank sample.

Field Duplicate Sample Results: The results of the VOCs for sample 32M-01-18XBR, and its duplicate sample, showed less than 20% relative percent difference (RPD) for all detected compounds.

Surrogate Results: All VOC sample surrogate recoveries were within the laboratory's stated quality control (QC) limits.

Matrix Spike/Matrix Spike Duplicate (MS/MSD) Results: One set of MS/MSD samples was analyzed for this project. In both the MS and MSD samples, there was no recovery of the compound 2-chloroethyl vinyl ether. The laboratory report stated that the acid preservative added to the sample might have degraded the compound. Since they are not acid preserved, the acceptable percent of recovery of 2-chloroethyl vinyl ether from the LCS and LCSD further supported this theory. Since all of the samples were preserved with acid in the field and all of the sample results for 2-chloroethyl vinyl ether were less than the PQL, the results were rejected (R) due to the inability to determine if the compound existed in the samples. 2-chloroethyl vinyl ether is not a primary contaminant of concern at the site.

Chloroprene and tetrahydrafuran were both high in the MS and MSD.
1,3-Dichlorobenzene was marginally low in the MS
4-methyl-2-pentanone was marginally high in the MSD, but ok in the MS
Hexachlorobutadiene, Bromobenzene and 4-chlorotoluene were all low in the MS and MSD, 2-chlorotoluene was low in the MS, but OK in the MSD.

Chloroprene, tetrahydrafuran and 4-methyl-2-pentanone were not detected in any of the field samples, therefore no data was qualified due to the high matrix spike recovery percentages. 1,3-dichlorobenzene was only marginally low in the MS and within QC limits for the MSD, therefore the data was not qualified. Hexachlorobutadiene, bromobenzene, 2-chlorotoluene and 4-chlorotoluene reporting limit was qualified as estimated (UJ) in sample 17XBR since the matrix spike recovery for those compounds was low in the MS/MSD sample (17XBR).

All MS/MSD RPDs were within the laboratory's acceptance limits for VOC analysis.

LCS/LCSD VOC results are acceptable.

Volatile Petroleum Hydrocarbon (VPH) Analysis

Eighteen groundwater samples were analyzed for VPH using the MADEP method. In addition, the laboratory analyzed, one field duplicate (32M-01-DUP, a duplicate of sample 32M-01-18XBR), three trip blanks (dated 6/13/05, 6/15/05 and 6/16/05), and one equipment blank sample (32-43A-EQB, dated 6/16/05).

Laboratory Method Blank, Trip Blank and Equipment Blank Results: Target analytes were undetected at levels above the PQL for method blank and trip blank samples.

Field Duplicate Sample Results: The RPD between positive VPH results for sample 32M-01-18XBR and its duplicate were within 20%. The duplicate sample results were acceptable.

Surrogate Results: All VPH sample surrogate recoveries, for aliphatics and aromatics, were within the laboratory's stated acceptance limits except for 2,5-dibromotoluene in one LCS (E4LCS). The recovery was slightly high, 132% (70-130). The data was not qualified since none of the associated samples had VPH detected.

Matrix Spike/Matrix Spike Duplicate (MS/MSD) Results: One set of MS/MSD samples was analyzed for this project. All MS/MSD recoveries and RPD values were within the laboratory's QC limits.

LCS/LCSD – All LCS and LCSD recoveries were within QC limits except Methyl tert-Butyl Ether was slightly high in one LCS/LCSD pair. The associated samples were trip blank samples (no VPH detected), therefore the data was unaffected.

Dissolved Gas Analysis (Methane, Ethane, Ethene)

Eighteen groundwater samples were analyzed for methane, ethane and ethene using the EPA 3810 RSK-175 method. In addition, the laboratory analyzed one field duplicate (32M-01-DUP, a duplicate of sample 32M-01-18XBR), and one equipment blank sample (32-43A-EQB, dated 6/16/05).

Laboratory Method Blank, Trip Blank and Equipment Blank Results: Target analytes were undetected at levels above the laboratory's reporting limit for method and equipment blank samples.

Field Duplicate Sample Results: The results of the dissolved gas analysis for sample 32M-01-18XBR and its duplicate sample had an acceptable RPD value of 9.8 for methane. Ethane and ethene were not detected in the sample or the duplicate sample. The field duplicate results are acceptable.

Matrix Spike/Matrix Spike Duplicate (MS/MSD) Results: One set of MS/MSD samples was analyzed for this project. The matrix spike recoveries and RPDs were within QC limits.

Laboratory Control Sample/ Laboratory Control Sample Duplicate (LCS/LCSD) Results: All LCS/LCSD recoveries and RPDs were within the laboratory's acceptance limits for the dissolved gas analysis.

Extractable Petroleum Hydrocarbon (EPH) Analysis

Eighteen groundwater samples were analyzed for EPH using the MADEP method. In addition, the laboratory analyzed one field duplicate (32M-01-DUP, a duplicate of sample 32M-01-18XBR), and one equipment blank sample (32-43A-EQB, dated 6/16/05).

Laboratory Method Blank and Equipment Blank Results: No polycyclic aromatic hydrocarbons (PAH) target analytes or aliphatic and aromatic hydrocarbon ranges were detected at levels above the laboratory's reporting limit for the method blank and the equipment blank samples.

Field Duplicate Sample Results: The results of the EPH analysis for sample 32M-01-18XBR and its duplicate sample showed less than 25 % RPD for C_9-C_{18} aliphatic hydrocarbon range. No other hydrocarbon range or PAH analyte was detected. The field duplicate sample therefore showed acceptable comparative results.

Surrogate Results: All EPH surrogate spike recoveries were within the laboratory's QC acceptance limits for both the aliphatic and aromatic fractions.

Matrix Spike/Matrix Spike Duplicate (MS/MSD) Results: One set of MS/MSD samples was analyzed for this project. All MS/MSD recoveries and RPD values were within the laboratory's acceptance limits for EPH analysis.

Polychlorinated Biphenyl (PCB) Analysis

Eighteen groundwater samples were analyzed for seven PCB aroclors using EPA SW846 method 8082. In addition, the laboratory analyzed one field duplicate (32M-01-DUP, a duplicate of sample 32M-01-18XBR), and one equipment blank sample (32-43A-EQB, dated 6/16/05).

Laboratory Method Blank, Trip Blank and Equipment Blank Results: Target PCB aroclors were undetected at levels above the laboratory's reporting limit for all method blank samples and the equipment blank sample.

Field Duplicate Sample Results: Sample results for 32M-01-18XBR and its duplicate showed acceptable comparative results in that no PCB aroclors were detected in either sample.

Surrogate Results: All PCB sample surrogate recoveries were within the laboratory's QC acceptance limits.

Matrix Spike/Matrix Spike Duplicate (MS/MSD) Results: One set of MS/MSD samples was analyzed for this project. All MS/MSD recoveries and RPDs were within the laboratory's acceptance limits for PCB analysis.

Target Analyte List (TAL) Metals Analysis

Eighteen groundwater samples were analyzed for total TAL metals using SW846 method 6010B. In addition, the laboratory analyzed one field duplicate (32M-01-DUP, a duplicate of sample 32M-01-18XBR), one laboratory duplicate (32M-01-17X Duplicate), and one equipment blank sample (32-43A-EQB, dated 6/16/05).

Laboratory Preparation Blank and Equipment Blank Results: Target analytes were undetected at levels above the Contract Required Detection Limit (CRDL) for preparation blank samples and the equipment blank sample. All results were acceptable.

Field Duplicate Sample Results: The metal results for sample 32M-01-18XBR and its duplicate showed less than 20 % RPD for all metals detected above the CRDL. The field duplicate results were acceptable.

Laboratory spike sample: Sample 32M-01-14XBR was spiked – the % recoveries were acceptable for lead and manganese. The arsenic percent recovery was slightly high, outside QC limits 127% (limits 80-120%). Therefore the arsenic result for that sample was qualified as J+ - possibly biased high as a result of the high spike recovery.

Sample spike for 32M-01-17XBR had acceptable spike recoveries for arsenic, lead, and manganese.

Matrix Spike (MS) and Laboratory Duplicate Results: A matrix spike sample and a duplicate sample were analyzed for total and dissolved metals. All MS recoveries were within QC limits. The RPD values were also acceptable. (Two samples were run as spikes and duplicates – 32M-01-17XBR and32M-01-14SBR.)

General Analyses

Eighteen groundwater samples were analyzed for general inorganic and organic analyses, including alkalinity, nitrate/nitrite, nitrite, nitrate by calculation, sulfate, sulfide, total phosphorus, ammonia, COD and TOC. Refer to Table 1 for methods of analysis. In addition, the laboratory analyzed one field duplicate (32M-01-DUP, a duplicate of sample 32M-01-18XBR), and one equipment blank sample (32-43A-EQB, dated 6/16/05).

Laboratory Preparation Blank and Equipment Blank Results: All target analytes were undetected at levels above the laboratory's reporting limit for the preparation blank samples. The equipment blank sample had a phosphorous concentration above the reporting limit. Phosphorous was reported at 0.055 mg/L, which exceeded the reporting limits of 0.010 mg/L. All of the samples had phosphorous results less than five times the concentration found in the equipment blanks sample. Therefore the phosphorous results for every sample was qualified as tentatively not detected at the reported concentration (UJ) due to the contamination found in the equipment blank sample.

Results for all other general analyses parameters were reported without qualification based on the blank sample results.

Field Duplicate Sample Results: The results of the general analyses for sample 32M-01-18XBR, and its duplicate, showed less than 20% RPD for all detected analytes, except ammonia. The sample and sample duplicate results for these ammonia were close to the reporting limit (within 5 times the RL), which could account for the higher RPD. The data was reported without qualification.

Laboratory Duplicate Sample Results: Sample 43M-01-20XOB was analyzed in duplicate for phosphorous and TOC. The phosphorous results of 0.043 mg/L and 0.026 mg/L had an RPD of 49 (limit 20%) The TOC results of 1.0 U mg/L and 1.9 mg/L had an RPD of 200. Laboratory duplicate sample of 32M-01-17XBR were run for alkalinity, ammonia, nitrate/nitrite, nitrite, phosphorous, sulfate, COD, TOC and nitrate (as N) by calculation. All RPDs were acceptable except for the TOC where the sample result of 1.6 mg/L was above the reporting limit and the sample duplicate result was less than the reporting limit, 1.0 U. The RPD cannot be calculated when one result is a detect and one is a non-detect. Since the sample result is within five times the concentration of the reporting limit, the duplicate data was acceptable.

Sample 32M-01-16XBR was run in duplicate for sulfide. The RPD was zero since sulfide was undetected in both the sample and the duplicate. .

Laboratory Control Sample (LCS)Results: All LCS recoveries were within the laboratory's QC limits for accuracy and precision.

Matrix Spike (MS) and Laboratory Duplicate Results: A matrix spike sample was run for 43M-01-20XOB for phosphorous and TOC. The phosphorous recovery of 95% was acceptable. The TOC recover was 68%, outside of the control limit of 75-125%. The reporting limit for TOC in sample 43M-01-20XOB was estimated (UJ) due to the low matrix spike recovery. Note: A matrix spike was not requested for sample 43M-01-20XOB.

A matrix spike sample was also run for 32M-01-17XBR for alkalinity, ammonia, nitrate/nitrite, nitrite, phosphorous, sulfate, COD and TOC. The recovery for sulfate was high (177%) The sulfate data was not qualified because the spike added was not high enough (10.0) relative to the native concentration in the sample (55.2). The COD recovery was low (59%) limit (75-125%). The TOC recovery was low (34%). The COD and TOC results for sample 32M-01-17XBR were qualified as potentially biased low (J-) due to the low recovery of the matrix spike from that sample.

An MS was run for sulfide in sample 32M-01-16XBR. The recovery was acceptable.

Conclusion

Laboratory reports were reviewed for adherence to acceptable laboratory practices. Based on the data evaluation elements reviewed (including holding times, blank sample results, surrogate recoveries, duplicate samples and MS/MSD recoveries), all data may be reported without qualification, except as summarized below.

Volatile Organic Compound (VOC) Analysis

- As a result of equipment blank contamination, results for 1,2-dichlorobenzene in samples 32M-01-14XBR, 32M-01-15XBR, 32M-01-16XBR, and 32M-01-17XBR are qualified as tentatively not detected (UJ) at the reported concentration.

- Due to low matrix spike recovery, hexachlorobutadiene, bromobenzene, 2-chlorotoluene and 4-chlorotoluene reporting limits were qualified as estimated (UJ) in sample 17XBR.

- All 2-chloroethyl-vinyl ether results were rejected (R) due to the inability to recover the compound from the MS and MSD samples.

Target Analyte List (TAL) Metals Analysis

- Laboratory spike sample: Sample 32M-01-14XBR was spiked – the % recoveries were acceptable for lead and manganese. The arsenic percent recovery was slightly high; outside QC limits 127% (limits 80-120%). Therefore the arsenic result for that sample was qualified as (J+), possibly biased high as a result of the high spike recovery.

General Analyses

- Phosphorous results for all samples was qualified as tentatively not detected at the reported concentration (UJ) due to the contamination found in the equipment blank sample.

- The reporting limit for TOC in sample 43M-01-20XOB was estimated (UJ) due to the low matrix spike recovery.

- COD and TOC results for sample 32M-01-17XBR were qualified as potentially biased low (J-) due to the low recovery of the matrix spike from that sample.

TABLE 1
Sample Preparation and Analysis Methods, Containers, Holding Times, and Preservatives

Parameter	Preparation Method[1]	Analysis Method[1]	Sample Container[2]	Preservative	Holding Time (VTS)[3]
VOCs	5030B	EPA SW846 Method 8260B	3 X 40 mL vials with Teflon septa screw caps[4]	HCl to pH less than 2 (No Headspace) 4°C ± 2°C	14 days
VPH	MADEP	MADEP	3 X 40 mL vials with Teflon septa screw caps[4]	HCl to pH less than 2 (No Headspace) 4°C ± 2°C	14 days
Dissolved Gas	EPA Method 3810 RSK-175	EPA Method 3810 RSK-175	3 X 40 mL vials with Teflon septa screw caps[4]	4°C ± 2°C	14 days
EPH	MADEP	MADEP	1-Liter amber glass bottle with Teflon-lined screw cap	HCl to pH less than 2 4°C ± 2°C	14 days
PCB	3510	EPA SW846 8082	1-Liter amber glass bottle with Teflon-lined screw cap	4°C ± 2°C	7 days
Metals [5]	3010A	EPA SW846 Method 6010B	1-Liter HDPE	HNO_3 to pH less than 2	180 days
Alkalinity	NA	EPA Method 310.1	500-mL HDPE	4°C ± 2°C	14 days
Nitrate Nitrite	NA	EPA Method 353.2	500-mL HDPE	4°C ± 2°C	48 hours
Sulfate	NA	EPA Method 375.4	500-mL HDPE	4°C ± 2°C	48 hours
Sulfide	NA	EPA Method 376.1	500-mL HDPE	4°C ± 2°C Add zinc acetate/NaOH	7 days
Total Phosphate	NA	EPA Method 365.2	250-mL HDPE	H_2SO_4 to pH less than 2, 4 ± 2°C	28 days
Ammonia	NA	EPA Method 350.2	250-mL HDPE	H_2SO_4 to pH less than 2, 4 ± 2°C	28 days
COD	NA	EPA Method 410.1	250-mL HDPE	H_2SO_4 to pH less than 2, 4 ± 2°C	28 days
TOC	NA	EPA SW846 Method 9060	250-mL Amber glass	H_2SO_4 to pH less than 2, 4 ± 2°C	28 days

1. "Methods for Chemical Analysis of Water and Wastes", Cincinnati, OH, March 1979, EPA 600-4-79-020.
   "Test Methods for Evaluating Solid Waste, Physical and Chemical Methods", U.S. EPA SW-846, 3rd Edition.
   "Characterizing Risks Posed by Petroleum Contaminated Sites: Implementation of the MADEP VPH/EPH Approach", MADEP, Boston, MA, October 31, 2002.
2. Additional sample containers/volume is required for matrix quality control samples.
3. VTS - Verified Time when the sample was collected.
4. Three vials will be shipped to the laboratory; one will be measured for pH in the field to verify that the sample has been preserved correctly (i.e. pH less than 2).
5. Select metals include Total and Dissolved Arsenic, Lead and Manganese.
   NA = Not Applicable

APPENDIX D Section 2: October 2005

Data Evaluation Report
For
Devens Areas 32/43A (DRMO/POL Yard)
Long Term Monitoring Groundwater Samples
Collected October 2005

Introduction

Nine groundwater samples were collected from the AOC 32/43A site, Devens, MA on October 3, 4 and 5, 2005. The samples were analyzed at ESS Laboratory, Cranston, Rhode Island for volatile organic compounds (VOCs), volatile petroleum hydrocarbons (VPH), extractable petroleum hydrocarbons (EPH), and total arsenic, lead and manganese. See Table 2 for analytical results.

The results were evaluated for acceptability in accordance with the laboratory's defined acceptance limits, with standard EPA SW846 guidance, guidelines provided in Appendix I "Shell for Analytical Chemistry Requirements" in EM200-1-3, dated February 2001 and/or EM 200-1-10 "Guidance for Evaluating Performance Based Chemical Data Packages".

Sample Shipment and Receipt

All sample coolers were packed with sufficient quantities of ice in the field. The laboratory received sample shipments on October 4, 6, and 7, 2005. All samples were appropriately preserved as stated in Table 1.

Holding Times

Samples were extracted and analyzed in accordance with the methods and holding time requirements cited in Table 1.

Volatile Organic Compound (VOC) Analysis

Nine groundwater samples were analyzed for VOCs using SW846 Method 8260B. In addition, the laboratory analyzed, one field duplicate (32M-01-DUP, a duplicate of sample 32M-01-18XBR), three trip blanks (dated 10/3/05, 10/4/05 and 10/5/05), and one equipment blank sample (32-43A-EQB, dated 10/4/05).

Laboratory Method Blank, Trip Blank and Equipment Blank Results: Target analytes were undetected at levels above the practical quantitation limit (PQL) for method blank. The equipment blank sample and one trip blank had detections of chloroform and methylene chloride above the PQL. There were no detections of either compound in the samples; therefore no data qualification was made due to the contamination.

Field Duplicate Sample Results: The results of the VOCs for sample 32M-01-18XBR, and its duplicate sample, showed less than 20% relative percent difference (RPD) for all detected compounds.

Surrogate Results: All VOC sample surrogate recoveries were within the laboratory's stated quality control (QC) limits.

Matrix Spike/Matrix Spike Duplicate (MS/MSD) Results: One set of MS/MSD samples was analyzed for this project. All recoveries were within the acceptance range and precision between MS and MSD was acceptable. The laboratory spiked sample 32M-01-13XBR in addition to the sample designated for matrix spike. 1,2,3-trichlorobenzene was under recovered from this spike, consequently, the result for this compound in sample 32M-01-13XBR is qualified (UJ), tentatively not detected at the reporting limit value.

Laboratory Control Sample/Laboratory Control Sample Duplicate (LCS/LCSD): VOC results are acceptable.

Volatile Petroleum Hydrocarbon (VPH) Analysis

Nine groundwater samples were analyzed for VPH using the MADEP. In addition, the laboratory analyzed, one field duplicate (32M-01-DUP, a duplicate of sample 32M-01-18XBR), three trip blanks (dated 10/3/05, 10/4/05 and 10/5/05), and one equipment blank sample (32-43A-EQB, dated 10/4/05).

Laboratory Method Blank, Trip Blank and Equipment Blank Results: Target analytes were undetected at levels above the PQL for method blank and trip blank samples.

Field Duplicate Sample Results: The RPD between positive VPH results for sample 32M-01-18XBR and its duplicate were within 20%. The duplicate sample results were acceptable.

Surrogate Results: All VPH sample aliphatic and aromatic surrogate recoveries were within the laboratory's stated acceptance limits.

Matrix Spike/Matrix Spike Duplicate (MS/MSD) Results: One set of MS/MSD samples was analyzed for this project. All MS/MSD recoveries and RPD values were within the laboratory's QC limits.

Laboratory Control Sample/Laboratory Control Sample Duplicate (LCS/LCSD): All LCS and LCSD recoveries were within QC limits.

Extractable Petroleum Hydrocarbon (EPH) Analysis

Nine groundwater samples were analyzed for EPH using the MADEP method. In addition, the laboratory analyzed one field duplicate (32M-01-DUP, a duplicate of sample 32M-01-18XBR), and one equipment blank sample (32-43A-EQB, dated 10/4/05).

Laboratory Method Blank and Equipment Blank Results: Naphthalene was detected in the method blank associated with samples SHL-15, 32M-92-01X, 32M-01-18XBR, AND 32M-01-18XBR-DUP. As a result, naphthalene results in these samples are qualified (UJ). No other polycyclic aromatic hydrocarbons (PAH) target analytes or hydrocarbon ranges were detected at levels above the laboratory's reporting limit for the method blank and the equipment blank samples.

Field Duplicate Sample Results: The results of the EPH analysis for sample 32M-01-18XBR and its duplicate sample showed greater than 25 % RPD for C_9-C_{18} aliphatic hydrocarbon range. As a result, both results are qualified as (J) estimated.

No other hydrocarbon range or PAH analyte was detected. The field duplicate sample, except for C_9-C_{18} aliphatic hydrocarbon range, therefore, showed acceptable comparative results.

Surrogate Results: All EPH surrogate spike recoveries were within the laboratory's QC acceptance limits

Matrix Spike/Matrix Spike Duplicate (MS/MSD) Results: One set of MS/MSD samples was analyzed for this project. All MS/MSD recoveries and RPD values were within the laboratory's acceptance limits for EPH analysis.

Target Analyte List (TAL) Metals Analysis

Nine groundwater samples were analyzed for total TAL metals using SW846 method 6010B. In addition, the laboratory analyzed one field duplicate (32M-01-DUP, a duplicate of sample 32M-01-18XBR), one laboratory duplicate (32M-01-17X Duplicate), and one equipment blank sample (32-43A-EQB, dated 10/4/05).

Laboratory Preparation Blank and Equipment Blank Results: Target analytes were undetected at levels above the Contract Required Detection Limit (CRDL) for preparation blank samples and the equipment blank sample. All results were acceptable.

Field Duplicate Sample Results: The metal results for sample 32M-01-18XBR and its duplicate showed less than 20 % RPD for all metals detected above the CRDL. The field duplicate results were acceptable.

Laboratory spike sample: Sample 32M-01-13XBR was spiked – the % recoveries were acceptable for arsenic and lead. The manganese percent recovery was low; outside QC limits 44% (limits 75-125%). Therefore, the manganese result for that sample was qualified as (J-) , possibly biased low as a result of the low spike recovery.

Matrix Spike (MS) and Laboratory Duplicate Results: A matrix spike sample and a duplicate sample were analyzed for total and dissolved metals. All MS recoveries were within QC limits. The RPD values were also acceptable.

Conclusion

Laboratory reports were reviewed for adherence to acceptable laboratory practices. Based on the data evaluation elements reviewed (including holding times, blank sample results, surrogate recoveries, duplicate samples and MS/MSD recoveries), all data may be reported without qualification, except as summarized below.

Volatile Organic Compound (VOC) Analysis

- The laboratory spiked sample 32M-01-13XBR in addition to the sample designated for matrix spike. 1,2,3-trichlorobenzene was under recovered from this spike, consequently, the result for this compound in sample 32M-01-13XBR is qualified (UJ), tentatively not detected at the reporting limit value.

Extractable Petroleum Hydrocarbons (EPH) Analyses

- Naphthalene was detected in the method blank associated with samples SHL-15, 32M-92-01X, 32M-01-18XBR, AND 32M-01-18XBR-DUP. As a result, naphthalene results in these samples are qualified (UJ).

- The results of the EPH analysis for sample 32M-01-18XBR and its duplicate sample showed greater than 25 % RPD for C_9-C_{18} aliphatic hydrocarbon range. As a result, both results are qualified as (J) estimated.

Target Analyte List (TAL) Metals Analysis

- Laboratory spike sample: Sample 32M-01-13XBR was spiked – the % recoveries were acceptable for arsenic and lead. The manganese percent recovery was low; outside QC limits 44% (limits 75-125%). Therefore, the manganese result for that sample was qualified as (J-), possibly biased low as a result of the low spike recovery.

TABLE 1
Sample Preparation and Analysis Methods, Containers, Holding Times, and Preservatives

Parameter	Preparation Method[1]	Analysis Method[1]	Sample Container[2]	Preservative	Holding Time (VTS)[3]
VOCs	5030B	EPA SW846 Method 8260B	3 X 40-mL vials with Teflon septa screw caps[4]	HCl to pH less than 2 (No Headspace) 4°C +/- 2°C	14 days
VPH	MADEP	MADEP	3 X 40-mL vials with Teflon septa screw caps[4]	HCl to pH less than 2 (No Headspace) 4°C +/- 2°C	14 days
EPH	MADEP	MADEP	1-Liter amber glass bottle with Teflon-lined screw cap	HCl to pH less than 2 4°C +/- 2°C	14 days
Metals [5]	3010A	EPA SW846 Method 6010B	1-Liter HDPE	HNO_3 to pH less than 2	180 days
Alkalinity	NA	EPA Method 310.1	500-mL HDPE	4°C +/- 2°C	14 days

1. "Methods for Chemical Analysis of Water and Wastes", Cincinnati, OH, March 1979, EPA 600-4-79-020.
   "Test Methods for Evaluating Solid Waste, Physical and Chemical Methods", U.S. EPA SW-846, 3rd Edition.
   "Characterizing Risks Posed by Petroleum Contaminated Sites: Implementation of the MADEP VPH/EPH Approach", MADEP, Boston, MA, October 31, 2002.
2. Additional sample containers/volume is required for matrix quality control samples.
3. VTS - Verified Time when the Sample was collected.
4. Three vials will be shipped to the laboratory; one will be measured for pH in the field to verify that the sample has been preserved correctly (i.e. pH less than 2).
5. Select metals include Total and Dissolved Arsenic, Lead and Manganese.
   NA = Not Applicable

Appendix E

Chemical Quality Assurance Report

For

Sampling Event

June 2005

CHEMICAL QUALITY ASSURANCE REPORT

LONG TERM GROUNDWATER MONITORING AT AOC's 32/43A (DRMO/POL Yard) DEVENS, MASSACHUSETTS JUNE 2005 SAMPLING ROUND

PREPARED BY
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NEW ENGLAND DISTRICT, CORPS OF ENGINEERS
CONCORD, MASSACHUSETTS

March 16, 2006

CHEMICAL QUALITY ASSURANCE REPORT

LONG TERM GROUNDWATER MONITORING AT AOC's 32/43A (DRMO/POL Yard) DEVENS, MASSACHUSETTS JUNE 2005 SAMPLING ROUND

One groundwater QA sample from Devens areas 32/43A Long Term Monitoring, Devens, Massachusetts project was analyzed by the QA laboratory, resulting in a total of 119 target determinations. In 37 of these determinations analytes were detected by one or both laboratories. Results from the analysis of QA samples were compared with results from analysis of the corresponding primary samples.

All primary lab analyses were performed by Severn Trent Laboratories, Inc., Colchester, Vermont. Analyses performed were volatile organics, MADEP-VPH, PCBs; metals, arsenic, lead, manganese, TOC, ammonia, nitrate/nitrite, nitrite, sulfate, sulfide, alkalinity, total phosphorus, nitrate by calculation, and chemical oxygen demand (COD). QA laboratory analyses were performed by AMRO Environmental Laboratories, Merrimack, New Hampshire.

Comparability and agreement were evaluated and expressed in terms of relative percent difference (RPD). For all analyses, RPD values greater than or equal to 75% RPD constituted a data discrepancy.

The primary and QA samples agreed overall in 111 (93%) of the comparisons. Primary and QA samples agreed quantitatively in 29 out of 37 (78%) of the comparisons. Refer to Table 1 for a QA split sample data comparison summary. Quantitative agreement represents only those determinations where an analyte was detected by at least one laboratory.

Primary laboratory QC was evaluated and reported in the data evaluation report. See that report for findings. QA laboratory data was evaluated for custody, holding times, and laboratory QC compliance and found to be within criteria except as noted: the Laboratory Control Sample (LCS) recovery for dichlorodifluoromethane, chloromethane, bromomethane, and trichlorofluoromethane were outside acceptance limits. Since these are primarily marginal outliers, the data remains unaffected. A matrix spike of the sample exhibited a high out of range recovery for 1,2-dichlorobenzene. The positive result for this compound has be qualified as (J+) for possible high bias. The EPH surrogate 1-chlorooctadecane was recovered below the control limits. All other surrogates were within acceptance limits, therefore the data is unaffected. None of the above noted QC issues significantly impact the usability of the QA data. All QA data is acceptable for its intended use except for results C5-C8 aliphatics and C9-C12 aliphatics. Due to dilution, the resulting elevated reporting limits for these two ranges are not usable to compare to MCP groundwater standards. Data comparison between laboratories exhibits mostly good agreement, except for metals, total dissolved gases, and VPH.

Quality Assurance Split Sample
Data Comparison Summary
June 2005 Sampling Round

Project: Devens Areas 32/43A (DRMO/POL Yard, Devens, Massachusetts

	Overall Agreement (1)		Quantitative Agreement (2)	
Test Parameter	**Number**	**Percent**	**Number**	**Percent**
VOCs	64/66	97	19/21	90
VPH (targets)	5/7	71	0/2	0
VPH (carbon ranges)	2/3	67	0/1	0
EPH (targets)	17/17	100	N/A	N/A
EPH (carbon ranges)	3/3	100	1/1	100
Total Dissolved	2/3	67	0/1	0
PCBs	7/7	100	N/A	N/A
Trace Metals	1/3	33	1/3	33
TOC	1/1	100	1/1	100
Ammonia	1/1	100	1/1	100
Nitrate/nitrite	1/1	100	1/1	100
Sulfate	1/1	100	1/1	100
Alkalinity	1/1	100	1/1	100
Nitrite	1/1	100	1/1	100
Total phosphorus	1/1	100	N/A	N/A
COD	1/1	100	1/1	100
Nitrate (by calc.)	1/1	100	1/1	100
Sulfide	1/1	100	N/A	N/A
Total	111/119	93	29/37	78

NOTES:

(1) Represents the number and percentage agreement of all determinations including analytes not detected by either laboratory.

(2) Represents the number and percentage agreement of only those determinations where an analyte was detected by at least one laboratory.

ATTACHMENT A

DATA COMPARISON TABLES

Table 1
Groundwater Analytical Results - June 13-16, 2005 Sampling Event
Devens Areas 32/43A (DRMO/POL Yard)
(SHEET 1 of 2)

PARAMETER (METHOD)	Well No. MCP GW-1	Site-Specific Cleanup Goals	Reporting Limit µg/L	32M-01-18XBR µg/L	32M-01-18XBR QA µg/L	RPD
VOC (8260)	µg/L	µg/L				
Volatile Organic Compounds						
Vinyl chloride (chloroethene)	2	2	1.0	160 U	2.0 U	NC
trans-1,2-Dichloroethene	100	55	1.0	160 U	2.0 U	NC
cis-1,2-Dichloroethene	70	55	1.0	160 U	11	NC
1,1,1-Trichloroethane	200	5	1.0	160 U	2.0 U	NC
Trichloroethene	5	5	1.0	160 U	2.0 J	NC
1,3-Dichlorobenzene	40	600	1.0	590	580	NC
1,4-Dichlorobenzene	5	75	1.0	370	400	8
1,2-Dichlorobenzene	600	600	1.0	4500	5300 J+	16
Dichlorodifluoromethane (Freon 12)	-	-	1.0	160 U	2.7 J	NC
Chloromethane	-	-	1.0	160 U	5.0 UJ	NC
Bromomethane	10	-	1.0	160 U	2.0 U	NC
Chloroethane	-	-	1.0	160 U	5.0 U	NC
Trichlorofluoromethane (Freon 11)	-	-	1.0	160 U	2.0 U	NC
Acrolein	-	-	5.0	800 U	NR	NC
Freon TF	-	-	1.0	160 U	2.0 U	NC
1,1-Dichloroethene	7	-	1.0	160 U	1.0 U	NC
Acetone	3,000	-	5.0	800 U	10 U	NC
Methyl Iodide	-	-	1.0	160 U	NR	NC
Carbon disulfide	-	-	1.0	160 U	2.0 U	NC
Allyl chloride	-	-	1.0	160 U	NR	NC
Methylene chloride	5	-	1.0	160 U	5.0 U	NC
Acrylonitrile	-	-	1.0	160 U	NR	NC
1,2-Dichloroethene (total)	-	-	1.0	160 U	NR	NC
Methyl-t-butyl ether	70	-	1.0	160 U	2.0 U	NC
1,1-Dichloroethane	70	-	1.0	160 U	2.0 U	NC
Vinyl acetate	-	-	1.0	160 U	NR	NC
Chloroprene	-	-	1.0	160 U	NR	NC
2-Butanone	350	-	5.0	800 U	10 U	NC
Propionitrile	-	-	4.0	640 U	NR	NC
Methacrylonitrile	-	-	1.0	160 U	NR	NC
Bromochloromethane	-	-	1.0	160 U	2.0 U	NC
Tetrahydrofuran	-	-	14	2200 U	10 U	NC
Chloroform	5	-	1.0	160 U	2.0 U	NC
Carbon tetrachloride	5	-	1.0	160 U	2.0 U	NC
Isobutyl alcohol (butanol)	-	-	50	8000 U	2.0 U	NC
Benzene	5	-	1.0	160 U	0.86 J	NC
1,2-Dichloroethane	5	-	1.0	160 U	2.0 U	NC
1,2-Dichloropropane	5	-	1.0	160 U	2.0 U	NC
Methyl Methacrylate	-	-	1.0	160 U	NR	NC
Dibromomethane	-	-	1.0	160 U	2.0 U	NC
1,4-Dioxane	-	-	50	8000 U	50 U	NC
Bromodichloromethane	3	-	1.0	160 U	2.0 U	NC
2-Chloroethyl Vinyl Ether	-	-	1.0	160 U R	NR	NC
cis-1,3-Dichloropropene	0.5 *	-	1.0	160 U	1.0 U	NC
4-methyl-2-pentanone	-	-	5.0	800 U	10 U	NC
Toluene	1,000	-	1.0	160 U	2.0 U	NC
trans-1,3-Dichloropropene	0.5 *	-	1.0	160 U	1.0 U	NC
Ethyl methacrylate	-	-	1.0	160 U	NR	NC
1,1,2-Trichloroethane	5	-	1.0	160 U	2.0 U	NC
Tetrachloroethene	5	-	1.0	160 U	0.53 J	NC
2-Hexanone	-	-	5.0	800 U	10 U	NC
Dibromochloromethane	2	-	1.0	160 U	2.0 U	NC
Chlorobenzene	100	-	1.0	410	400	2
1,1,1,2-Tetrachloroethane	5	-	1.0	160 U	2.0 U	NC
Ethylbenzene	700	-	1.0	160 U	1.1 J	NC
m-Xylene & p-Xylene	10000 *	-	1.0	160 U	1.2 J	NC
Xylene (total)	10000 *	-	1.0	160 U	NR	NC
o-Xylene	10000 *	-	1.0	160 U	0.76 J	NC
Styrene	100	-	1.0	160 U	2.0 U	NC
Bromoform	4	-	1.0	160 U	2.0 U	NC
Isopropylbenzene	-	-	1.0	160 U	3.0	NC
cis-1,4-Dichloro-2-butene	-	-	1.0	160 U	NR	NC
1,1,2,2-Tetrachloroethane	2	-	1.0	160 U	2.0 U	NC
1,2,3-Trichloropropane	-	-	1.0	160 U	2.0 U	NC
trans-1,4-Dichloro-2-butene	-	-	1.0	160 U	NR	NC
1,2-Dibromo-3-chloropropane (DBCP)	-	-	1.0	160 U	5.0 U	
1,2,4-Trichlorobenzene	70	-	1.0	49 J	4.1	169
Hexachlorobutadiene	1	-	1.0	47 J	2.0 U	NC
Naphthalene	140	-	1.0	79 J	2.6 J	187
2,2-Dichloropropane	-	-	1.0	160 U	2.0 U	NC
1,1-Dichloropropene	-	-	1.0	160 U	2.0 U	NC
1,3-Dichloropropane	-	-	1.0	160 U	2.0 U	NC
Bromobenzene	-	-	1.0	160 U	1.5 J	NC
n-Propylbenzene	-	-	1.0	160 U	1.9 J	NC
2-Chlorotoluene	-	-	1.0	160 U	2.0 U	NC
4-Chlorotoluene		-	1.0	160 U	2.0 U	NC
1,3,5-Trimethylbenzene	-	-	1.0	160 U	0.51 J	NC
tert-Butylbenzene	-	-	1.0	160 U	2.0 U	NC
1,2,4-Trimethylbenzene	-	-	1.0	160 U	1.9 J	NC
sec-Butylbenzene	-	-	1.0	160 U	1.2 J	NC
p-Isopropyltoluene	-	-	1.0	160 U	2.0 U	NC
n-Butylbenzene	-	-	1.0	160 U	2.0 U	NC
1,2,3-Trichlorobenzene	-	-	1.0	65 J	2.0 U	NC

Bold numbers indicate exceedance of MCP GW-1 standard
Numbers in shaded areas indicate exceedance of site-specific cleanup goals
NR = Compound not reported by the QA laboratory
* Regulatory standard is for total 1,3-dichloropropene and total xylenes
U = Compound not detected at a concentration above the reporting limit.
UJ = Compound tentatively not detected at reported concentration due to blank contamination or reporting limit is estimated.
J = Estimated value less than the reporting limit or an estimated value resulting from data evaluation
J+ = Value may be biased high based on data evaluation of laboratory results.
R = Result was rejected based on inability to recover compound (0% recovery) from the matrix spike and matrix spike duplicate.
NC = Not calculated

Table 1
Groundwater Analytical Results - June 13-16, 2005 Sampling Event
Devens Areas 32/43A (DRMO/POL Yard)
(SHEET 2 of 2)

	Well No.		Reporting Limit	32M-01-16XBR	32M-01-16XBR-QA	RPD
PARAMETERS	**MCP GW-1**	**Site-Specific Cleanup Goals**	µg/L	µg/L	µg/L	
	µg/L	µg/L				
VOLATILES PETROLEUM HYDROCARBONS (MA DEP) Ranges						
C5-C8 Aliphatic Hydrocarbons	400	400	3.00	4.6	1000 U	NC
C9-C12 Aliphatic Hydrocarbons	4000	4,000	2.00	470	1000 U	NC
C9-C10 Aromatic Hydrocarbons	200	200	1.0	**260**	**7,800**	187
VPH (MA DEP) Target VPH Analytes						
Methyl tert-butyl ether	70	-	1.0	1.0 U	10 U	NC
Benzene	5	5	1.0	1.0 U	10 U	NC
Toluene	1000	-	1.0	1.0 U	10 U	NC
Ethylbenzene	700	500	1.0	40	10 U	NC
m,p-Xylene *	10000	-	2.0	2.0 U	10 U	NC
o-Xylene *	10000	-	1.0	1.0 U	10 U	NC
Naphthalene	140	-	1.0	1.0 U	5.4 J	NC
Extractable Petroleum Hydrocarbon Ranges						
C9 - C18 Aliphatic Hydrocarbons	4000	4,000	50	1400	1300	7
C19 - C36 Aliphatic Hydrocarbons	5000	5,000	80	42 U	100 U	NC
C11-C22 Aromatic Hydrocarbons	200	200	170	180 U	100 U	NC
Target PAH Analytes						NC
Naphthalene	140	-	10	10 U	2.0 U	NC
2-Methylnaphthalene	10	-	10	10 U	2.0 U	NC
Acenaphthylene	300	-	10	10 U	2.0 U	NC
Acenaphthene	20	-	10	10 U	2.0 U	NC
Fluorene	300	-	10	10 U	2.0 U	NC
Phenanthrene	300	-	10	10 U	2.0 U	NC
Anthracene	2000	-	10	10 U	2.0 U	NC
Fluoranthene	90	-	10	10 U	2.0 U	NC
Pyrene	80	-	10	10 U	2.0 U	NC
Benzo(a)anthracene	1	-	10	10 U	2.0 U	NC
Chrysene	2	-	10	10 U	2.0 U	NC
Benzo(b)fluoranthene	1	-	10	10 U	2.0 U	NC
Benzo(k)fluoranthene	1	-	10	10 U	2.0 U	NC
Benzo(a)pyrene	0.2	-	10	10 U	2.0 U	NC
Indeno(1,2,3-cd)pyrene	0.5	-	10	10 U	2.0 U	NC
Dibenzo(a,h)anthracene	0.5	-	10	10 U	2.0 U	NC
Benzo(g,h,i)perylene	300	-	10	10 U	2.0 U	NC
TOTAL DISSOLVED GASES (method RSK175)						
Methane	1000	-	2.0	32	103	105
Ethane	1000	-	4.0	4.0 U	2 U	NC
Ethene	100	-	3.0	3.0 U	2 U	NC
PCBs by EPA8082						NC
Aroclor 1016	0.5	0.5	0.50	0.52 U	0.22 U	NC
Aroclor 1221	0.5	0.5	0.50	0.52 U	0.22 U	NC
Aroclor 1232	0.5	0.5	0.50	0.52 U	0.22 U	NC
Aroclor 1242	0.5	0.5	0.50	0.52 U	0.22 U	NC
Aroclor 1248	0.5	0.5	0.50	0.52 U	0.22 U	NC
Aroclor 1254	0.5	0.5	0.50	0.52 U	0.22 U	NC
Aroclor 1260	0.5	0.5	0.50	0.52 U	0.22 U	NC
ICP METALS 3010/6010B (Total metals)						
Arsenic	10	50	4.5	**24.4**	**54.7**	77
Lead	15	15	2.7	6.6	1.0 J	147
Manganese	-	3,500	0.7	**16,700**	**16,600**	1
UNIT CHANGE			**mg/L**	**mg/L**	**mg/L**	mg/L
TOC by SW846:9060						NC
Total Organic Carbon	-	-	1.0	4.6	5.5	18
AMMONIA (350.1)						NC
Ammonia as N	-	-	0.024	0.038	1.0 U	NC
ALKALINITY, TOTAL						NC
as CaCO3	-	-	1.0	199	190	5
ANIONS (300)						NC
Nitrate/nitrite (as N) by 353.2	-	-	0.010	2.9	2.2	27
Nitrite (as N) by 354.1			0.0050	0.036	0.010 U	NC
Phosphorus (as P) by 365.2	-	-	0.010	0.089 UJ	0.044	NC
Sulfate by 375.4	-	-	5.0	25.1	27.0	7
Sulfide by 376.2	-	-	0.020	0.020 U	1.0 U	NC
Nitrate (as N) by calc	-	-	0.010	2.8	2.2	24
COD (410.4)						NC
Chemical Oxygen Demand	-	-	20.0	34.9	25 J	33

Bold numbers indicate exceedance of MCP GW-1 standard

Numbers in shaded areas indicate exceedance of site-specific cleanup goals

U = Compound not detected at a concentration above the reporting limit.

UJ = Compound tentatively not detected at reported concentration due to blank contamination or detection limit estimated due to low spike recoveries

J = Estimated value less than the reporting limit or an estimated value resulting from data evaluation

J+ = Value may be biased high based on data evaluation of laboratory results.

NC = not calculated

FedEx. US Airbill Express

FedEx Tracking Number 8488 6471 6659

SPH21 0215

Sender's Copy

Date 6/16/2005 Sender's FedEx Account Number 1010-0608-5

Sender's Name PATRICK BLUMERIS Phone (978) 318-8440

Company US ARMY CORP OF ENGINEERS

Address 696 VIRGINIA RD

City CONCORD State MA ZIP 01742

Your Internal Billing Reference DEVENS 32/43A

To

Recipient's Name ROBERT KENNEDY Phone (603) 424 2022

Company AMRO ENVIRONMENTAL LABS CORP

Recipient's Address 111 HERRICK STREET

Address

City MERRIMACK State NH ZIP 03054

4a Express Package Service — Packages up to 150 lbs.

- [X] FedEx Priority Overnight — Next business morning*
- [ ] FedEx Standard Overnight — Next business afternoon*
- [ ] FedEx First Overnight — Earliest next business morning delivery to select locations*
- [ ] FedEx 2Day — Second business day*
- [ ] FedEx Express Saver — Third business day*

FedEx Envelopes not available. Minimum charge. One-pound rate.

4b Express Freight Service — Packages over 150 lbs.

- [ ] FedEx 1Day Freight* — Next business day**
- [ ] FedEx 2Day Freight — Second business day**
- [ ] FedEx 3Day Freight — Third business day**

* Call for Confirmation:

5 Packaging

- [ ] FedEx Envelope*
- [ ] FedEx Pak* — Includes FedEx Small Pak, FedEx Large Pak, and FedEx Sturdy Pak
- [ ] FedEx Box
- [ ] FedEx Tube
- [X] Other

6 Special Handling — Include FedEx address in Section 2.

- [ ] SATURDAY Delivery — Available ONLY for FedEx Priority Overnight, FedEx 2Day, FedEx 1Day Freight, and FedEx 2Day Freight to select ZIP codes
- [ ] HOLD Weekday at FedEx Location — NOT Available for FedEx First Overnight
- [ ] HOLD Saturday at FedEx Location — Available ONLY for FedEx Priority Overnight and FedEx 2Day to select locations

Does this shipment contain dangerous goods? One box must be checked.

- [X] No
- [ ] Yes — As per attached Shipper's Declaration
- [ ] Yes — Shipper's Declaration not required
- [ ] Dry Ice — Dry Ice, 9, UN 1845 ____ x ____ kg
- [ ] Cargo Aircraft Only

Dangerous goods (including Dry Ice) cannot be shipped in FedEx packaging.

7 Payment Bill to: Enter FedEx Acct. No. or Credit Card No. below.

- [X] Sender — Acct. No. in Section 1 will be billed
- [ ] Recipient
- [ ] Third Party
- [ ] Credit Card
- [ ] Cash/Check

FedEx Acct. No. / Credit Card No. Exp. Date

Total Packages	Total Weight	Total Declared Value†
1	45	$ .00

†Our liability is limited to $100 unless you declare a higher value. See back for details. FedEx Use Only

8 Sign to Authorize Delivery Without a Signature

By signing you authorize us to deliver this shipment without obtaining a signature and agree to indemnify and hold us harmless from any resulting claims.

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By using this Airbill you agree to the service conditions on the back of this Airbill and in our current Service Guide, including terms that limit our liability.

Questions? Visit our Web site at fedex.com or call 1.800.GoFedEx 1.800.463.3339.

0285969061

SPH21 0215

Sender's Copy

FedEx. US Airbill Express

FedEx Tracking Number 8488 6471 6648

Date 6/16/2005 Sender's FedEx Account Number 1010-0608-5

Sender's Name PATRICK BLUMERIS Phone (978) 318-8440

Company US ARMY CORP OF ENGINEERS

Address 696 VIRGINIA RD

City CONCORD State MA ZIP 01742

Your Internal Billing Reference DEVENS 32/43A

To

Recipient's Name RON PENTKOWSKI Phone (802) 655 1203

Company STL Severn Trent Labs

Recipient's Address 208 SOUTH PARK DRIVE (SUITE 1)

Address

City COLCHESTER State VT ZIP 05446

4a Express Package Service — Packages up to 150 lbs.

- [X] FedEx Priority Overnight — Next business morning*
- [ ] FedEx Standard Overnight — Next business afternoon*
- [ ] FedEx First Overnight — Earliest next business morning delivery to select locations*
- [ ] FedEx 2Day — Second business day*
- [ ] FedEx Express Saver — Third business day*

FedEx Envelopes not available. Minimum charge. One-pound rate.

4b Express Freight Service — Packages over 150 lbs.

- [ ] FedEx 1Day Freight* — Next business day**
- [ ] FedEx 2Day Freight — Second business day**
- [ ] FedEx 3Day Freight — Third business day**

* Call for Confirmation:

5 Packaging

- [ ] FedEx Envelope*
- [ ] FedEx Pak* — Includes FedEx Small Pak, FedEx Large Pak, and FedEx Sturdy Pak
- [ ] FedEx Box
- [ ] FedEx Tube
- [X] Other

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- [ ] HOLD Saturday at FedEx Location — Available ONLY for FedEx Priority Overnight and FedEx 2Day to select locations

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- [ ] Yes — Shipper's Declaration not required
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- [ ] Cargo Aircraft Only

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7 Payment Bill to: Enter FedEx Acct. No. or Credit Card No. below.

- [X] Sender — Acct. No. in Section 1 will be billed
- [ ] Recipient
- [ ] Third Party
- [ ] Credit Card
- [ ] Cash/Check

FedEx Acct. No. / Credit Card No. Exp. Date

Total Packages	Total Weight	Total Declared Value†
1	38	$ .00

†Our liability is limited to $100 unless you declare a higher value. See back for details. FedEx Use Only

8 Sign to Authorize Delivery Without a Signature

By signing you authorize us to deliver this shipment without obtaining a signature and agree to indemnify and hold us harmless from any resulting claims.

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Questions? Visit our Web site at fedex.com or call 1.800.GoFedEx 1.800.463.3339.

0285969061

FedEx Express — USA Airbill

FedEx Tracking Number: 845866120497

0200 — Sender's Copy

1 From
Date: 6/13/2005 Sender's FedEx Account Number: 1010-0608-5
Sender's Name: PATRICK BLUMERIS Phone: 978 318 8094
Company: US Army Corps of Engineers
Address: 696 VIRGINIA RD
Dept./Floor/Suite/Room
City: CONCORD State: MA ZIP: 01742

2 Your Internal Billing Reference (First 24 characters will appear on invoice.): DEVENS 32/43A

3 To
Recipient's Name: STL: Ron Pentkowski Phone: (802) 655 1203
Company: STL: Severn Trent Lab. Services
Address: 208 South Park Drive Suite 1
To "HOLD" at FedEx location, print FedEx address. We cannot deliver to P.O. boxes or P.O. ZIP codes.
Address:
Dept./Floor/Suite/Room
City: Colchester State: VT ZIP: 05446

Try online shipping at fedex.com

By using this Airbill you agree to the service conditions on the back of this Airbill and to our current Service Guide, including terms that limit our liability.

Questions? Visit our Web site at fedex.com or call 1.800.Go.FedEx® 800.463.3339.

4a Express Package Service — Packages up to 150 lbs. (Delivery commitments may be later in some areas.)
- [X] FedEx Priority Overnight — Next business morning
- [ ] FedEx Standard Overnight — Next business afternoon
- [ ] FedEx First Overnight — Earliest next business morning delivery to select locations
- [ ] FedEx 2Day — Second business day
- [ ] FedEx Express Saver — Third business day
FedEx Envelope rate not available. Minimum charge: One-pound rate

4b Express Freight Service — Packages over 150 lbs. (Delivery commitment may be later in some areas.)
- [ ] FedEx 1Day Freight* — Next business day
- [ ] FedEx 2Day Freight — Second business day
- [ ] FedEx 3Day Freight — Third business day
* Call for Confirmation.

5 Packaging — * Declared value limit $500
- [ ] FedEx Envelope*
- [ ] FedEx Pak* — Includes FedEx Small Pak, FedEx Large Pak, and FedEx Sturdy Pak
- [X] Other

6 Special Handling — Include FedEx address in Section 3.
- [ ] SATURDAY Delivery — Available ONLY for FedEx Priority Overnight, FedEx 2Day, FedEx 1Day Freight, and FedEx 2Day Freight to select ZIP codes
- [ ] HOLD Weekday at FedEx Location — NOT Available for FedEx First Overnight
- [ ] HOLD Saturday at FedEx Location — Available ONLY for FedEx Priority Overnight and FedEx 2Day to select locations

Does this shipment contain dangerous goods? One box must be checked.
- [X] No
- [ ] Yes — As per attached Shipper's Declaration
- [ ] Yes — Shipper's Declaration not required
- [ ] Dry Ice — Dry Ice, 9, UN 1845 ____ x ____ kg
Dangerous Goods (including Dry Ice) cannot be shipped in FedEx packaging.
- [ ] Cargo Aircraft Only

7 Payment — Bill to:
- [X] Sender — Acct. No. in Section 1 will be billed.
- [ ] Recipient
- [ ] Third Party
- [ ] Credit Card
- [ ] Cash/Check
Enter FedEx Acct. No. or Credit Card No. below.
FedEx Acct. No. / Credit Card No. Exp. Date

Total Packages: ____ Total Weight: ____ Total Declared Value*: $ ____.00
*Our liability is limited to $100 unless you declare a higher value. See back for details. FedEx Use Only

8 Release Signature — Sign to authorize delivery without obtaining signature.
By signing you authorize us to deliver this shipment without obtaining a signature and agree to indemnify and hold us harmless from any resulting claims.

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Rev. Date 10/01 • Part #157912 • ©1994-2001 FedEx • PRINTED IN U.S.A. MVN/BC

FedEx Express — US Airbill

FedEx Tracking Number: 8488 6471 6681

0215 — Sender's Copy

4a Express Package Service — Packages up to 150 lbs.
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- [ ] FedEx Standard Overnight — Next business afternoon*
- [ ] FedEx First Overnight — Earliest next business morning delivery to select locations*
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FedEx Envelope rate not available. Minimum charge: One-pound rate

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* Call for Confirmation.

5 Packaging — * Declared value limit $500
- [ ] FedEx Envelope*
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- [ ] FedEx Box
- [ ] FedEx Tube
- [X] Other

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- [ ] Cargo Aircraft Only

7 Payment — Bill to:
- [X] Sender — Acct. No. in Section 1 will be billed.
- [ ] Recipient
- [ ] Third Party
- [ ] Credit Card
- [ ] Cash/Check
Enter FedEx Acct. No. or Credit Card No. below.
FedEx Acct. No. / Credit Card No. Exp. Date

Total Packages: 4 Total Weight: 240 Total Declared Value*: $ .00
*Our liability is limited to $100 unless you declare a higher value. See back for details. FedEx Use Only

8 Sign to Authorize Delivery Without a Signature

1 From
Date: 6/15/2005 Sender's FedEx Account Number: 1010-0608-5
Sender's Name: PATRICK BLUMERIS Phone: (978) 318-8440
Company: US ARMY CORP OF ENGINEERS
Address: 696 VIRGINIA RD
Dept./Floor/Suite/Room
City: CONCORD State: MA ZIP: 01742

2 Your Internal Billing Reference (First 24 characters will appear on invoice.): DEVENS 32/43A

3 To
Recipient's Name: RON PENTKOWSKI Phone: (802) 655 1203
Company: STL SEVERN TRENT LAB SVCS
Recipient's Address: 208 SOUTH PARK DRIVE SUITE 1
We cannot deliver to P.O. boxes or P.O. ZIP codes. Dept./Floor/Suite/Room
Address:
To request a package be held at a specific FedEx location, print FedEx address here.
City: COLCHESTER State: VT ZIP: 05446

Try online shipping at fedex.com

By using this Airbill you agree to the service conditions on the back of this Airbill and to our current Service Guide, including terms that limit our liability.

By signing you authorize us to deliver this shipment without obtaining a signature and agree to indemnify and hold us harmless from any resulting claims.

466

SEVERN TRENT STL

SEVERN TRENT LABORATORIES, INC.

STL Burlington
208 South Park Drive, Suite 1
Colchester, VT 05446 Tel 802 655 1203

1 of 1

CHAIN OF CUSTODY RECORD

Report to:	Invoice to:
Company: USACE	Company: USACE
Address: 696 VIRGINIA RD CONCORD MA	Address: 696 VIRGINIA RD CONCORD MA
Contact: KATHY MILLER	Contact: KATHY BUCCIARELLI
Phone: 978 318 8791	Phone: 978 318 8602
Fax:	Fax:
Contract/ Quote:	

Sampler's Name: Paul Young, Patricia Blumeris, Tom Marotte, Thomas J. Marotte, Alex Gonzalez

Sampler's Signature: Paul Young, Patricia Blumeris, Thomas J. Marotte

Proj. No.:

Project Name: DEVENS 32/43A

No/Type of Containers²

ANALYSIS REQUESTED

Lab Use Only
Due Date:

Temp. of coolers when received (C°): 1 | 2 | 3 | 4 | 5

Custody Seal N / Y
Intact N / Y

Screened For Radioactivity ☐

Matrix¹	Date	Time	Comp	Grab	Identifying Marks of Sample(s)	VOA	A/G 1 Lt.	250 ml	P/O	TOC Preserved with H_2SO_4	Dissolved Gases Pres: HCl	VOC Pres: HCl	MASS DEP VPH Pres: HCl	PCB's Pres: 4°C	MASS DEP EPH Pres: HCl	Sulfide Pres: NaOH, Nitrate 353.1/Alkalinity Pres: 4°C	Ammonia Pres: ZnAc+NaOH	COD Pres: H_2SO_4	Nitrate/Nitrite 353.2, TPHOS Pres: H_2SO_4	Total (As, Pb) Metals Pres: HNO_3	Lab/Sample ID (Lab Use Only)
W	June 11th 2007	0845		X	32M-01-14XOB	10	4	1	5	2	2	3	3	2	2	1	1	1	1	1	1
W		1215		X	32M-01-15XBR	11	4	1	5	2	3	3	3	2	2	1	1	1	1	1	1
W		1225		X	32M-01-13XBR	11	4	1	5	2	3	3	3	2	2	1	1	1	1	1	1
W		1415		X	32M-01-17XBR	11	4	1	5	2	3	3	3	2	2	1	1	1	1	1	1
W		1415		X	32M-01-17XBR-MS	11	4	1	4	2	3	3	3	2	2	1	—	1	1	1	1
W		1415		X	32M-01-17XBR-MSD	11	4	—	4	—	3	3	3	2	2	1	—	1	—	1	1
W		1045		X	32M-01-18XBR	11	4	1	5	2	3	3	3	2	2	1	1	1	1	1	1
W		1045		X	32M-01-DUP	11	4	1	5	2	3	3	3	2	2	1	1	1	1	1	1
W		1459		X	32M-01-16XBR	11	4	1	5	2	3	3	3	2	2	1	1	1	1	1	1
W		1400		X	32-43A-EQB	11	4	1	5	2	3	3	3	2	2	1	1	1	1	1	1
W	↓	—		X	Trip Blank	2	—	—	—	—	—	1	1	—	—	—	—	—	—	—	—

Relinquished by: (Signature)	Date	Time	Received by: (Signature FEDEX AIRBILL 8488 6471 6648	Date	Time
Relinquished by: (Signature)	Date	Time	Received by: (Signature	Date	Time
Relinquished by: (Signature)	Date	Time	Received by: (Signature	Date	Time

Remarks: 7 coolers shipped

Client's delivery of samples constitutes acceptance of Severn Trent Laboratories terms and conditions contained in the Price Schedule.

¹Matrix: WW - Wastewater, W - Water, S - Soil, L - Liquid, A - Air bag, C - Charcoal Tube, SL - Sludge, O - Oil

²Container: VOA - 40 ml vial, A/G - Amber / Or Glass 1 Liter, 250 ml - Glass wide mouth, P/O - Plastic or other _____

STL cannot accept verbal changes. Please Fax written changes to (802) 655-1248

STL8234-200 (12/02)

SEVERN TRENT LABORATORIES, INC.
208 South Park Drive, Suite 1
Colchester, VT 05446 Tel 802 655 1203

CHAIN OF CUSTODY RECORD

Report to:	Invoice to:
Company: USACE	Company: USACE
Address: 696 VIRGINIA RD CONCORD MA	Address: 696 VIRGINIA RD CONCORD MA
Contact: KATHY MILLER	Contact: KATHY BUCCIARELLI
Phone: 978 318 8791	Phone: 978 318 8602
Fax:	Fax:
Contract/Quote:	

Lab Use Only
Due Date:
Temp. of coolers when received (C°): 1 | 2 | 3 | 4 | 5
Custody Seal N / Y
Intact N / Y
Screened For Radioactivity ☐

Sampler's Name: Alex Garnerd, Tom Marcotte, Sean Walsh, P. Blumers
Sampler's Signature: [signature]; P. Blumers for SW; Thomas Marcotte

Proj. No.:
Project Name: DEVENS 32/43A

Analysis Requested:
TOC (Preserved with H_2SO_4); Dissolved Gases (Pres HCl); VOC (Pres HCl); VPH (DEP MASS) (Pres HCl); PCB's (Pres: 4°C); EPH (DEP MASS) (Pres: HCl); Silicate/Nitrate 353.1/Alkalinity (Pres: 4°C); Sulfide (Pres: ZnAc + NaOH); Ammonia (Pres: H_2SO_4); COD (Pres: H_2SO_4); Nitrate/Nitrite 353.2, T. Phos (Pres: H_2SO_4); Total As Pb Mn Fe metals (Pres HNO_3)

Matrix	Date 2005	Time	Comp	Grab	Identifying Marks of Sample(s)	VOA	A/G 1 Lt.	250 ml	P/O	TOC	Dissolved Gases	VOC	VPH	PCB's	EPH	Silicate/Nitrate/Alkalinity	Sulfide	Ammonia	COD	Nitrate/Nitrite, T. Phos	Total As Pb Mn Fe metals	Lab/Sample ID (Lab Use Only)
W	June 15	1130		X	32M-92-01X	11	4	1	5	2	3	3	3	2	2	1	1	1	1	1	1	
W	↓	1120		X	32M-92-03X	11	4	1	5	2	3	3	3	2	2	1	1	1	1	1	1	
W	↓	1125		X	SHL-15	11	4	1	5	2	3	3	3	2	2	1	1	1	1	1	1	
W	↓	1430		X	32M-01-04XBR	11	4	1	5	2	3	3	3	2	2	1	1	1	1	1	1	
W	↓	1440		X	32M-01-14XBR	11	2	1	5	2	3	3	3	1	1	1	1	1	1	1	1	TPhos sample is full-see Ammonia sample for add'l vol.
W	↓	—		X	Trip Blank	2	—	—	—	—	—	1	1	—	—	—	—	—	—	—	—	
~~W~~	~~↓~~	~~—~~		~~X~~	~~Trip Blank~~ JAK	~~2~~ JAK	~~—~~	~~—~~	~~—~~	~~—~~	~~—~~	~~1~~	~~1~~	~~—~~	~~—~~	~~—~~	~~—~~	~~—~~	~~—~~	~~—~~	~~—~~	

[signature] 15 June 2005

Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time
[signature]	15 Jun 05	1800	FedEx Air Bill 8488 6471 6681		

Remarks: 4 coolers shipped

Client's delivery of samples constitutes acceptance of Severn Trent Laboratories terms and conditions contained in the Price Schedule.

Matrix: WW - Wastewater W - Water S - Soil L - Liquid A - Air bag C - Charcoal Tube SL - Sludge O - Oil
Container: - 40 ml vial A/G - Amber / Or Glass 1 Liter 250 ml - Glass wide mouth P/O Plastic or other ____

STL cannot accept verbal changes. Please Fax written chang (802) 655-1248

SEVERN TRENT **STL**

SEVERN TRENT LABORATORIES, INC.

STL Burlington
208 South Park Drive, Suite 1
Colchester, VT 05446 Tel 802 655 1203

CHAIN OF CUSTODY RECORD

Report to:	Invoice to:
Company: USACE	Company: USACE
Address: 696 VIRGINIA RD, CONCORD MA	Address: 696 VIRGINIA RD, CONCORD MA
Contact: KATHY MILLER	Contact: KATHY BUCCIARELLI
Phone: 978-318-8791	Phone: 978-318-8602
Fax:	Fax:
Contract/Quote:	

Lab Use Only
Due Date:

Temp. of coolers when received (C°): 1 | 2 | 3 | 4 | 5

Custody Seal N / Y
Intact N / Y

Screened For Radioactivity ☐

Sampler's Name: Paul Young, Tom Marcotte, Alex Gardeau, Patrick Blumeris

Sampler's Signature: Paul Young, Alex [illegible], Thomas J Marcotte, PBL

Proj. No.:

Project Name: DEVENS 32/43A

ANALYSIS REQUESTED (analysis / preservation):

1. TOC — Preserved with H_2SO_4
2. Dissolved Gases — Pres HCl
3. VOC — Pres HCl
4. VPH — Pres HCl
5. PCB's — Pres 4°C
6. EPH — Pres HCl
7. Sulfate/Alkalinity 353.1/Alkalinity — Pres 4°C
8. Sulfide — Pres ZnAc + NaOH
9. Ammonia — Pres H_2SO_4
10. COD — Pres H_2SO_4
11. Nitrate/Nitrite 353.2/TPHOS — Pres H_2SO_4
12. Total (As Pb Mn) / Diss As Pb Mn — Pres HNO_3

Matrix[1]	Date 2005	Time	Comp	Grab	Identifying Marks of Sample(s)	VOA	A/G 1 Lt.	250 ml	P/O	TOC	Dissolved Gases	VOC	VPH	PCB's	EPH	Sulfate/Alkalinity	Sulfide	Ammonia	COD	Nitrate/Nitrite/TPHOS	Total/Diss As Pb Mn	Lab/Sample ID (Lab Use Only)
W	June 13	1055		X	43M-01-20XOB	11	4	1	5	2	3	3	3	2	2	1	1	1	1	1	1	
W	↓	1215		X	43M-01-16XBR	11	4	1	5	2	3	3	3	2	2	1	1	1	1	1	1	
W	↓	1400		X	43M-01-16XOB	11	4	1	5	2	3	3	3	2	2	1	1	1	1	1	1	
W	↓	1110		X	43M-01-20XBR	11	4	1	5	2	3	3	3	2	2	1	1	1	1	1	1	
W	↓	1450		X	32Z-99-02X	11	4	1	5	2	3	3	3	2	2	1	1	1	1	1	1	
W	↓	1440		X	43M-01-17XBR	11	4	1	5	2	3	3	3	2	2	1	1	1	1	1	1	
W	↓	1543		X	43M-01-17XOB	11	4	1	5	2	3	3	3	2	2	1	1	1	1	1	1	
W	↓	—		X	Trip Blank	2	—	—	—	—	—	1	1	—	—	—	—	—	—	—	—	

[signature] 13 June 2005

Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time
[signature]	13 June 05	1800	FedEx Airbill 845866170477		
Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time
Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time

Remarks: 5 coolers shipped

Client's delivery of samples constitutes acceptance of *Severn Trent Laboratories* terms and conditions contained in the Price Schedule.

[1]Matrix WW - Wastewater W - Water S - Soil L - Liquid A - Air bag C - Charcoal Tube SL - Sludge O - Oil

[2]Container - 40 ml vial A/G - Amber / Or Glass 1 Liter 250 ml - Glass wide mouth P - Plastic or other ______

STL cannot accept verbal changes. Please Fax written changes (802) 655-1248

STL8234-209 (12/02)

SEVERN TRENT LABORATORIES, INC. 208 South Park Drive, Suite 1 Colchester, VT 05446 Tel 802 655 1203

1 of 1

CHAIN OF CUSTODY RECORD

Report to:	Invoice to:
Company: USACE	Company: USACE
Address: 696 VIRGINIA RD CONCORD MA	Address: 696 VIRGINIA RD CONCORD MA
Contact: KATHY MILLER	Contact: KATHY BUCCIARELLI
Phone: 978 318 8791	Phone: 978 318 8602
Fax:	Fax:
Contract/ Quote:	

Sampler's Name: Paul Young

Sampler's Signature: Paul Young

Proj. No.

Project Name: DEVENS 32/43A

No/Type of Containers²

Matrix¹	Date	Time	Comp	Grab	Identifying Marks of Sample(s)	VOA	A/G 1 LL	250 ml	P/O
W	June 16	1045		X	32M-01-18XBR	11	4	1	5
W	↓	—		X	Trip Blank	2	—	—	—

ANALYSIS REQUESTED

TOC preserved with H_2SO_4	Dissolved Gases Pres: HCl	VOC Pres: HCl	VPH (MassDEP) Pres: HCl	PCB's Pres: 4°C	EPH (MassDEP) Sulfate/Nitrate 35 ml/Alkalinity Pres: 4°C	Sulfide Pres: HCl	Ammonia Pres: $ZnAc + NaOH$	COD Pres: H_2SO_4	Nitrate/Nitrite 353.2 Pres: H_2SO_4	Total metals 7 prior 8 RCRA Pres: HNO_3
2	3	3	3	2	2	1	1	1	1	1
—	—	1	1	1	1	1	—	—	1	1

Lab Use Only
Due Date:

Temp. of coolers when received (C°):

1	2	3	4	5

Custody Seal N / Y

Intact N / Y

Screened For Radioactivity ☐

Lab/Sample ID (Lab Use Only)

Relinquished by: (Signature)	Date	Time	Received by: (Signature FEDEX AIRBILL 8488 6471 6659	Date	Time
Relinquished by: (Signature)	Date	Time	Received by: (Signature	Date	Time
Relinquished by: (Signature)	Date	Time	Received by: (Signature	Date	Time

Remarks: 1 cooler shipped

Client's delivery of samples constitutes acceptance of Severn Trent Laboratories terms and conditions contained in the Price Schedule.

¹Matrix WW - Wastewater W - Water S - Soil L - Liquid A - Air bag C - Charcoal Tube SL - Sludge O - Oil

²Container - 40 ml vial A/G - Amber / Or Glass 1 Liter 250 ml - Glass wide mouth Plastic or other _____

STL cannot accept verbal changes. Please Fax written chang (802) 655-1248

STL8234-200 (12/02)

Appendix F

Chemical Quality Assurance Report

For

Sampling Event

October 2005

CHEMICAL QUALITY ASSURANCE REPORT

LONG TERM GROUNDWATER MONITORING AT AOC's 32/43A (DRMO/POL Yard) DEVENS, MASSACHUSETTS OCTOBER 2005 SAMPLING ROUND

PREPARED BY
DAVID LUBIANEZ
OF THE
GEOLOGY & CHEMISTRY SECTION
ENGINEERING/PLANNING DIVISION

DEPARTMENT OF THE ARMY
NEW ENGLAND DISTRICT, CORPS OF ENGINEERS
CONCORD, MASSACHUSETTS

March 20, 2006

CHEMICAL QUALITY ASSURANCE REPORT

LONG TERM GROUNDWATER MONITORING AT AOC's 32/43A (DRMO/POL Yard) DEVENS, MASSACHUSETTS OCTOBER 2005 SAMPLING ROUND

One groundwater QA sample from Devens areas 32/43A Long Term Monitoring, Devens, Massachusetts project was analyzed by the QA laboratory, resulting in a total of 97 target determinations. In 16 of these determinations analytes were detected by one or both laboratories. Results from the analysis of QA samples were compared with results from analysis of the corresponding primary samples.

All primary lab analyses were performed by ESS Laboratory, Cranston, Rhode Island. Analyses performed were volatile organics, MADEP-VPH, MADEP-EPH; metals, arsenic, lead, manganese, QA laboratory analyses were performed by AMRO Environmental Laboratories, Merrimack, New Hampshire.

Comparability and agreement were evaluated and expressed in terms of relative percent difference (RPD). For all analyses, RPD values greater than or equal to 75% RPD constituted a data discrepancy.

The primary and QA samples agreed overall in 92 (95%) of the comparisons. Primary and QA samples agreed quantitatively in 11 out of 16 (69%) of the comparisons. Refer to Table 1 for a QA split sample data comparison summary. Quantitative agreement represents only those determinations where an analyte was detected by at least one laboratory. See Attachment A for Primary and QA laboratory data.

Primary laboratory QC was evaluated and reported in the data evaluation report. See that report for findings. QA laboratory data was evaluated for custody, holding times, and laboratory QC compliance and found to be within criteria except as noted: the Laboratory Control Sample (LCS) recovery for, dichlorodifluoromethane (low), chloroethane (low), naphthalene (high), acetone (low), 2-butanone (low), trichloroethene (high), 4-methyl-2-pentanone (low), 2-hexanone (low), and 1,2-dibromo-3-chloropropane (marginally low) were outside acceptance limits. Analytes with low LCS recoveries are qualified (UJ). Dichlorodifuoromethane is qualifed (J-) for possible low bias. Since recovery of 2-dibromo-3-chloropropane is a marginal outlier, the data remains unaffected. None of the above noted QC issues significantly impact the usability of the QA data. All QA data is acceptable for its intended use. Data comparison between laboratories exhibits mostly good agreement except for VPH targets, VPH carbon ranges, and EPH carbon ranges.

Table 1

Quality Assurance Split Sample
Data Comparison Summary
October 2005 Sampling Round

Project: Devens Areas 32/43A (DRMO/POL Yard, Devens, Massachusetts

	Overall Agreement (1)		Quantitative Agreement (2)	
Test Parameter	**Number**	**Percent**	**Number**	**Percent**
VOCs	62/64	97	9/11	82
VPH (targets)	6/7	86	1/2	50
VPH (carbon	2/3	67	0/1	0
EPH (targets)	17/17	100	N/A	N/A
EPH (carbon ranges)	2/3	67	0/1	0
Trace Metals	3/3	100	1/1	100
Total	92/97	95	11/16	69

NOTES:

(1) Represents the number and percentage agreement of all determinations including analytes not detected by either laboratory.

(2) Represents the number and percentage agreement of only those determinations where an analyte was detected by at least one laboratory.

ATTACHMENT A

DATA COMPARISON TABLES

Table 1
Groundwater Analytical Results - October 3-5, 2005 Sampling Event
Devens Areas 32/43A (DRMO/POL Yard)
(SHEET 1 of 2)

	Well No.		Reporting Limit	32M-01-18XBR	32M-01-18XBR QA	RPD
PARAMETER (METHOD)	MCP GW-1	Site-Specific Cleanup Goals	µg/L	µg/L	µg/L	
VOC (8260)	µg/L	µg/L				
Volatile Organic Compounds						
Vinyl chloride (chloroethene)	2	2	1.0	1.0 U	2.0 U	NC
trans-1,2-Dichloroethene	100	55	1.0	1.0 U	2.0 U	NC
cis-1,2-Dichloroethene	70	55	1.0	0.5 U	2.1	NC
1,1,1-Trichloroethane	200	5	1.0	1.0 U	2.0 U	NC
Trichloroethene	5	5	1.0	0.6 U	2.0 U	NC
1,3-Dichlorobenzene	40	600	1.0	**209**	**190**	10
1,4-Dichlorobenzene	5	75	1.0	**120**	**100**	8
1,2-Dichlorobenzene	600	600	1.0	**1450**	**1,500**	16
Dichlorodifluoromethane (Freon 12)	-	-	1.0	2.0 U	2.2 J-	NC
Chloromethane	-	-	1.0	1.0 U	5.0 U	NC
Bromomethane	10	-	1.0	1.0 U	2.0 U	NC
Chloroethane	-	-	1.0	2.0 U	5.0 UJ	NC
Trichlorofluoromethane (Freon 11)	-	-	1.0	2.0 U	2.0 U	NC
1,1-Dichloroethene	7	-	1.0	1.0 U	1.0 U	NC
Acetone	3,000	-	5.0	25.0 U	10 UJ	NC
Carbon disulfide	-	-	1.0	1.0 U	2.0 U	NC
Methylene chloride	5	-	1.0	5.0 U	5.0 U	NC
Methyl-t-butyl ether	70	-	1.0	10 U	2.0 U	NC
1,1-Dichloroethane	70	-	1.0	1.0 U	2.0 U	NC
Vinyl acetate	-	-	1.0	5.0 U	NR	NC
2-Butanone	350	-	5.0	25.0 U	10 UJ	NC
Bromochloromethane	-	-	1.0	1.0 U	2.0 U	NC
Tetrahydrofuran	-	-	14	5.0 U	10 U	NC
Chloroform	5	-	1.0	1.0 U	2.0 U	NC
Carbon tetrachloride	5	-	1.0	1.0 U	2.0 U	NC
Benzene	5	-	1.0	1.0 U	1.0 U	NC
1,2-Dichloroethane	5	-	1.0	1.0 U	2.0 U	NC
1,2-Dichloropropane	5	-	1.0	1.0 U	2.0 U	NC
Dibromomethane	-	-	1.0	1.0 U	2.0 U	NC
Bromodichloromethane	3	-	1.0	1.0 U	2.0 U	NC
cis-1,3-Dichloropropene	0.5 *	-	1.0	0.5 U	1.0 U	NC
4-methyl-2-pentanone	350	-	5.0	25.0 U	10 UJ	NC
Toluene	1,000	-	1.0	1.0 U	2.0 U	NC
trans-1,3-Dichloropropene	0.5 *	-	1.0	0.5 U	1.0 U	NC
1,1,2-Trichloroethane	5	-	1.0	1.0 U	2.0 U	NC
Tetrachloroethene	5	-	1.0	1.0 U	2.0 U	NC
2-Hexanone	-	-	5.0	10.0 U	10 UJ	NC
Dibromochloromethane	2	-	1.0	1.0 U	2.0 U	NC
Chlorobenzene	100	-	1.0	83.9	87	2
1,1,1,2-Tetrachloroethane	5	-	1.0	1.0 U	2.0 U	NC
Ethylbenzene	700	-	1.0	1.0 U	2.0 U	NC
m-Xylene & p-Xylene	10000 *	-	1.0	2.0 U	2.0 U	NC
o-Xylene	10000 *	-	1.0	1.0 U	2.0 U	NC
Styrene	100	-	1.0	1.0 U	2.0 U	NC
Bromoform	4	-	1.0	1.0U	2.0 U	NC
1,1,2,2-Tetrachloroethane	2	-	1.0	0.5 U	2.0 U	NC
1,2,3-Trichloropropane	-	-	1.0	1.0 U	2.0 U	NC
1,2-Dibromo-3-chloropropane (DBCP)	-	-	1.0	5.0 U	5.0 UJ	NC
1,2,4-Trichlorobenzene	70	-	1.0	1.2	1.1 J	9
Hexachlorobutadiene	1	-	1.0	0.6 U	2.0 U	NC
Naphthalene	140	-	1.0	1.0 U	5.0 U	NC
2,2-Dichloropropane	-	-	1.0	2.0 U	2.0 U	NC

Table 1
Groundwater Analytical Results - October 3-5, 2005 Sampling Event
Devens Areas 32/43A (DRMO/POL Yard)
(SHEET 1 of 2)

	Well No.		Reporting Limit	32M-01-18XBR	32M-01-18XBR QA	RPD
PARAMETER (METHOD)	MCP GW-1	Site-Specific Cleanup Goals	µg/L	µg/L	µg/L	
1,1-Dichloropropene	-	-	1.0	2.0 U	2.0 U	NC
1,3-Dichloropropane	-	-	1.0	1.0 U	2.0 U	NC
Bromobenzene	-	-	1.0	2.0 U	2.0 U	NC
n-Propylbenzene	-	-	1.0	0.8 J	2.0 U	NC
2-Chlorotoluene	-	-	1.0	1.0 U	2.0 U	NC
4-Chlorotoluene		-	1.0	1.0 U	2.0 U	NC
1,3,5-Trimethylbenzene	-	-	1.0	1.0 U	2.0 U	NC
tert-Butylbenzene	-	-	1.0	1.0 U	2.0 U	NC
1,2,4-Trimethylbenzene	-	-	1.0	0.6 J	2.0 U	NC
sec-Butylbenzene	-	-	1.0	0.5 J	2.0 U	NC
p-Isopropyltoluene	-	-	1.0	0.7 J	2.0 U	NC
n-Butylbenzene	-	-	1.0	1.0 U	2.0 U	NC
1,2,3-Trichlorobenzene	-	-	1.0	1.0 U	2.0 U	NC

Bold numbers indicate exceedance of MCP GW-1 standard
Numbers in shaded areas indicate exceedance of site-specific cleanup goals
NR = Compound not reported by the QA laboratory
* Regulatory standard is for total 1,3-dichloropropene and total xylenes
U = Compound not detected at a concentration above the reporting limit.
UJ = Compound tentatively not detected at reported concentration due to blank contamination or reporting limit is estimated.
J = Estimated value less than the reporting limit or an estimated value resulting from data evaluation
J+ = Value may be biased high based on data evaluation of laboratory results.
R = Result was rejected based on inability to recover compound (0% recovery) from the matrix spike and matrix spike duplicate.
NC = Not calculated

Table 1
Groundwater Analytical Results - October 3-5, 2005 Sampling Event
Devens Areas 32/43A (DRMO/POL Yard)
(SHEET 2 of 2)

PARAMETERS	Well No. MCP GW-1	Site-Specific Cleanup Goals	Reporting Limit	32M-01-18XBR	32M-01-18XBR-QA	RPD
	µg/L	µg/L	µg/L	µg/L	µg/L	
VOLATILES PETROLEUM HYDROCARBONS (MA DEP) Ranges						
C5-C8 Aliphatic Hydrocarbons	400	400	3.00	162 U	100 U	NC
C9-C12 Aliphatic Hydrocarbons	4000	4,000	2.00	686	1000 U	NC
C9-C10 Aromatic Hydrocarbons	200	200	1.0	**1,150**	**3,800**	107
VPH (MA DEP) Target VPH Analytes						
Methyl tert-butyl ether	70	-	1.0	1.5 U	1.0 U	NC
Benzene	5	5	1.0	5.0 U	1.0 U	NC
Toluene	1000	-	1.0	5.0 U	1.0 U	NC
Ethylbenzene	700	500	1.0	114	1.0 U	NC
m,p-Xylene *	10000	-	2.0	10.0 U	1.0 U	NC
o-Xylene *	10000	-	1.0	5.0 U	1.0 U	NC
Naphthalene	140	-	1.0	5.0 U	1.2 J	NC
Extractable Petroleum Hydrocarbon Ranges						
C9 - C18 Aliphatic Hydrocarbons	4000	4,000	60	228 J	920	121
C19 - C36 Aliphatic Hydrocarbons	5000	5,000	80	200 U	100 U	NC
C11-C22 Aromatic Hydrocarbons	200	200	170	150 U	100 U	NC
Target PAH Analytes						NC
Naphthalene	140	-	10	0.6 UJ	2.0 U	NC
2-Methylnaphthalene	10	-	10	0.5	2.0 U	NC
Acenaphthylene	300	-	10	0.2 U	2.0 U	NC
Acenaphthene	20	-	10	0.2 U	2.0 U	NC
Fluorene	300	-	10	0.2	2.0 U	NC
Phenanthrene	300	-	10	0.4	2.0 U	NC
Anthracene	2000	-	10	0.2 U	2.0 U	NC
Fluoranthene	90	-	10	0.2	2.0 U	NC
Pyrene	80	-	10	0.2 U	2.0 U	NC
Benzo(a)anthracene	1	-	10	0.2 U	2.0 U	NC
Chrysene	2	-	10	0.2 U	2.0 U	NC
Benzo(b)fluoranthene	1	-	10	0.2 U	2.0 U	NC
Benzo(k)fluoranthene	1	-	10	0.2 U	2.0 U	NC
Benzo(a)pyrene	0.2	-	10	0.2 U	2.0 U	NC
Indeno(1,2,3-cd)pyrene	0.5	-	10	0.2 U	2.0 U	NC
Dibenzo(a,h)anthracene	0.5	-	10	0.2 U	2.0 U	NC
Benzo(g,h,I)perylene	300	-	10	0.2 U	2.0 U	NC
ICP METALS 3010/6010B (Total metals)						
Arsenic	10	50	4.5	2.5 U	5.0 U	NC
Lead	15	15	2.7	2.5 U	5.0 U	NC
Manganese	-	3,500	0.7	**11,600**	**12,000**	3

Bold numbers indicate exceedance of MCP GW-1 standard

Numbers in shaded areas indicate exceedance of site-specific cleanup goals

U = Compound not detected at a concentration above the reporting limit.

UJ = Compound tentatively not detected at reported concentration due to blank contamination or detection limit estimated due to low spike recoveries

J = Estimated value less than the reporting limit or an estimated value resulting from data evaluation

J+ = Value may be biased high based on data evaluation of laboratory results.

NC = not calculated

ATTACHMENT B

CUSTODY DOCUMENTATION

FedEx Express — US Airbill

FedEx Tracking Number: 849202857550

Form ID No. 0200 — Recipient Copy

From (Please print and press hard.)

Date: 04 Oct 05 — Sender's FedEx Account Number: 1010-0608-5

Sender's Name: Jack Keenan — Phone: 9781318 8310

Company: US Army Corps of Engineers

Address: 696 Virginia Road — CENAE-EP-EW (Dept./Floor/Suite/Room)

City: Concord — State: MA — ZIP: 01742

Your Internal Billing Reference (first 24 characters will appear on invoice) — OPTIONAL

To

Recipient's Name: Deanna Bechtel — Phone: (401) 461 7181

Company: ESS Laboratory

Recipient's Address: 185 Frances Avenue (cannot deliver to P.O. boxes or P.O. ZIP codes.) — Dept./Floor/Suite/Room

Address (required if package to be held at a specific FedEx location, print FedEx address here.)

City: Cranston — State: RI — ZIP: 02910-2211

4a Express Package Service (Packages up to 150 lbs. * To most locations)

- [X] FedEx Priority Overnight* — Next business morning*
- [ ] FedEx Standard Overnight* — Next business afternoon*
- [ ] FedEx First Overnight* — Earliest next business morning delivery to select locations*
- [ ] FedEx 2Day* — Second business day*
- [ ] FedEx Express Saver* — Third business day*

FedEx Envelope rate not available. Minimum charge: One-pound rate

4b Express Freight Service (Packages over 150 lbs. ** To most locations)

- [ ] FedEx 1Day Freight* — Next business day**
- [ ] FedEx 2Day Freight* — Second business day**
- [ ] FedEx 3Day Freight* — Third business day**

* Call for Confirmation:

5 Packaging (* Declared value limit $500)

- [ ] FedEx Envelope*
- [ ] FedEx Pak* — Includes FedEx Small Pak, FedEx Large Pak, and FedEx Sturdy Pak
- [ ] FedEx Box
- [ ] FedEx Tube
- [X] Other

6 Special Handling (Include FedEx address in Section 3.)

- [ ] SATURDAY Delivery — Available ONLY for FedEx Priority Overnight, FedEx 2Day, FedEx 1Day Freight, and FedEx 2Day Freight to select ZIP codes
- [ ] HOLD Weekday at FedEx Location — NOT Available for FedEx First Overnight
- [ ] HOLD Saturday at FedEx Location — Available ONLY for FedEx Priority Overnight and FedEx 2Day to select locations

Does this shipment contain dangerous goods? (One box must be checked.)

- [X] No
- [ ] Yes — As per attached Shipper's Declaration
- [ ] Yes — Shipper's Declaration not required
- [ ] Dry Ice — Dry Ice, 9, UN 1845 ____ x ____ kg

Dangerous goods (including Dry Ice) cannot be shipped in FedEx packaging.

- [ ] Cargo Aircraft Only

7 Payment Bill to: (Enter FedEx Acct. No. or Credit Card No. below.)

- [X] Sender — Acct. No. in Section 1 will be billed.
- [ ] Recipient
- [ ] Third Party
- [ ] Credit Card
- [ ] Cash/Check

FedEx Acct. No. / Credit Card No. — Exp. Date

Total Packages: 2 — Total Weight: — Total Declared Value†: $ .00 — FedEx Use Only

†Our liability is limited to $100 unless you declare a higher value. See back for details.

8 Sign to Authorize Delivery Without a Signature

By signing you authorize us to deliver this shipment without obtaining a signature and agree to indemnify and hold us harmless from any resulting claims.

467

Rev. Date 11/04 Part #150200-151564-2005 FedEx PRINTED IN U.S.A. MMA 04

Try online shipping at fedex.com

By using this Airbill you agree to the service conditions on the back of this Airbill and in our current Service Guide, including terms that limit our liability.

Questions? Visit our Web site at fedex.com or call 1.800.GoFedEx 1.800.463.3339.

FedEx Express — US Airbill

FedEx Tracking Number: 849202857539

Form ID No. 0200 — Recipient Copy

From (Please print and press hard.)

Date: 05 Oct 05 — Sender's FedEx Account Number: 1010-0608-5

Sender's Name: Jack Keenan — Phone: 9781318 8310

Company: US Army Corps of Engineers

Address: 696 Virginia Road — CENAE-EP-EW (Dept./Floor/Suite/Room)

City: Concord — State: MA — ZIP: 01742

Your Internal Billing Reference (first 24 characters will appear on invoice) — OPTIONAL

To

Recipient's Name: Deanna Bechtel — Phone: (401) 461 7181

Company: ESS Laboratory

Recipient's Address: 185 Frances Avenue (cannot deliver to P.O. boxes or P.O. ZIP codes.) — Dept./Floor/Suite/Room

Address (required if package to be held at a specific FedEx location, print FedEx address here.)

City: Cranston — State: RI — ZIP: 02910-2211

4a Express Package Service (Packages up to 150 lbs. * To most locations)

- [X] FedEx Priority Overnight* — Next business morning*
- [ ] FedEx Standard Overnight* — Next business afternoon*
- [ ] FedEx First Overnight* — Earliest next business morning delivery to select locations*
- [ ] FedEx 2Day* — Second business day*
- [ ] FedEx Express Saver* — Third business day*

FedEx Envelope rate not available. Minimum charge: One-pound rate

4b Express Freight Service (Packages over 150 lbs. ** To most locations)

- [ ] FedEx 1Day Freight* — Next business day**
- [ ] FedEx 2Day Freight* — Second business day**
- [ ] FedEx 3Day Freight* — Third business day**

* Call for Confirmation:

5 Packaging (* Declared value limit $500)

- [ ] FedEx Envelope*
- [ ] FedEx Pak* — Includes FedEx Small Pak, FedEx Large Pak, and FedEx Sturdy Pak
- [ ] FedEx Box
- [ ] FedEx Tube
- [X] Other

6 Special Handling (Include FedEx address in Section 3.)

- [ ] SATURDAY Delivery — Available ONLY for FedEx Priority Overnight, FedEx 2Day, FedEx 1Day Freight, and FedEx 2Day Freight to select ZIP codes
- [ ] HOLD Weekday at FedEx Location — NOT Available for FedEx First Overnight
- [ ] HOLD Saturday at FedEx Location — Available ONLY for FedEx Priority Overnight and FedEx 2Day to select locations

Does this shipment contain dangerous goods? (One box must be checked.)

- [X] No
- [ ] Yes — As per attached Shipper's Declaration
- [ ] Yes — Shipper's Declaration not required
- [ ] Dry Ice — Dry Ice, 9, UN 1845 ____ x ____ kg

Dangerous goods (including Dry Ice) cannot be shipped in FedEx packaging.

- [ ] Cargo Aircraft Only

7 Payment Bill to: (Enter FedEx Acct. No. or Credit Card No. below.)

- [X] Sender — Acct. No. in Section 1 will be billed.
- [ ] Recipient
- [ ] Third Party
- [ ] Credit Card
- [ ] Cash/Check

FedEx Acct. No. / Credit Card No. — Exp. Date

Total Packages: 1 — Total Weight: 54 — Total Declared Value†: $ .00 — FedEx Use Only

†Our liability is limited to $100 unless you declare a higher value. See back for details.

8 Sign to Authorize Delivery Without a Signature

By signing you authorize us to deliver this shipment without obtaining a signature and agree to indemnify and hold us harmless from any resulting claims.

467

Try online shipping at fedex.com

By using this Airbill you agree to the service conditions on the back of this Airbill and in our current Service Guide, including terms that limit our liability.

Questions? Visit our Web site at fedex.com or call 1.800.GoFedEx 1.800.463.3339.

AMRO Environmental Laboratories Corporation
111 Herrick Street
Merrimack, NH 03054

CHAIN-OF-CUSTODY RECORD

MC 52284

Office: (603) 424-2022
Fax: (603) 429-8496
web: www.amrolabs.com

Project No.:	Project Name: LSAFE Devens Area 32	Project State: MA	Project Manager: Kathy Miller	Samplers (Signature): Thomas J. Marcotte	AMRO Project No.:
P.O.#:	Results Needed by:				
QUOTE #:	Seal Intact? Yes No N/A				

Sample ID.:	Date/Time Sampled	Matrix	Total # of Cont. & Size	Comp.	Grab	8260B VOC	VPH - MADEP	EPH - MADEP	2 or 7 Metals: As Pb Mn	Remarks
Trip Blank	—	W	2V		X	1	1	1	1	
32M-01-18XBR	4/04/05/1150	GW	6x2glp		X	3	3	2	1	
Preservative: Cl-HCl, MeOH, N-HN03, S-H2SO4, Na-NaOH, O- Other						C1	C1	C1	N	

Send Results To: Katherine M. Miller
US Army Corps of Engineers
696 Virginia Road
Concord MA 01742
PHONE #: 978 318 8791 FAX #: 978 318 8614
E-mail:

PRIORITY TURNAROUND TIME AUTHORIZATION
Before submitting samples for expedited TAT, you must *have a coded AUTHORIZATION NUMBER*
AUTHORIZATION No.: BY:

METALS 8 RCRA ☐ 13 PP ☐ 23 TAL ☐ 14 MCP ☐
Method: 6010 ☐ 200.7 ☒ Other Metals: As Pb Mn only
Dissolved Metals Field Filtered? NA YES ☐ NO ☐

MCP Presumptive Certainty Required? YES ☐ NO ☐
MCP Methods Needed: YES ☐ NO ☐

Required Reporting Limits:
S-1 ☐ GW-1 ☒
S-2 ☐ GW-2 ☐
S-3 ☐ GW-3 ☐
Other:

Relinquished By:	Date/Time	Received By

AMRO report package level needed:
EDD required:

Please print clearly, legibly and completely. Samples can not be logged in and the turnaround time clock will not start until any ambiguities are resolved.

Samples arriving after 12:00 noon will be tracked and billed as received on the following day.

AMRO policy requires notification in writing to the laboratory in cases where the samples were collected from highly contaminated sites.

KNOWN SITE CONTAMINATION: VPH Mn chlorobenzene

White: Lab Copy Yellow: Accompanies Report Pink: Client Copy SHEET 1 OF 1 AMROCOC2004, Rev.3 08/18/04

Lab Comments
Relinquished

ESS Laboratory

Division of Thielsch Engineering, Inc.
185 Frances Avenue, Cranston, RI 02910-2211
Tel. (401) 461-7181 Fax (401) 461-4486
www.esslaboratory.com

CHAIN OF CUSTODY

Page 1 of 1

Turn Time: [X] Standard Other ____
If faster than 5 days, prior approval by laboratory is required # ____
State where samples were collected from: (MA) RI CT NH NJ NY ME Other ____
Is this project for any of the following? MA-MCP Navy (USACE) Other ____

Reporting Limits: Standard
ESS LAB PROJECT ID:
Electronic Deliverable: [X] Yes [ ] No
Format: Excel ___ Access ___ PDF ___ Other See Sup.

Co. Name	Project #	Project Name (20 Char. or less)
US Army Corps of Engineers		Devens Area 32

Contact Person	Address
Kathy Miller	696 Virginia Road

City	State	Zip	PO#
Concord	MA	01742	

Telephone #	Fax #	Email Address
978 318 8791	978 318 8614	

Circle and/or Write Required Analysis

ESS LAB Sample#	Date	Collection Time	COMP	GRAB	MATRIX	Sample Identification (20 Char. or less)	Pres Code	Number of Containers	Type of Containers	8260 B VOA	524.2	624	VPH w/target MA DEP	8015 GRO	8021 MTBE/BTEX	8015 DRO	8100 TPH	EPH w/o PAHs	EPH w/PAHs MA DEP	8081 Pesticides	8082 PCB	608 Pesticides	608 PCB	8270 SVOA	PAH 8270	625	RCRA 5	RCRA8 PP13 TAL23	TCLP-RCRA8	NBC7	MCP-METALS (13)	MCP-METALS (13) w/Hg	Metals 200.7 (As Pb)				
	05Oct05	—		X	W	Trip Blank		2		1					1				1														1				
	↓	1000		X	GW	32M-01-13XBR		9		3					3				2															1				

Container Type: P-Poly G-Glass S-Sterile V-VOA | Matrix: S-Soil SD-Solid D-Sludge WW-Waste Water GW-Ground Water SW-Surface Water DW-Drinking Water O-Oil W-Wipes F-Filters

Cooler Present ___ Yes ___ No Internal Use Only
Seals Intact ___ Yes ___ No NA: ___ [ ] Pickup
Cooler Temp: ___ [ ] Technicians ___

Preservation Code: 1- NP, 2- HCl, 3- H_2SO_4, 4- HNO_3, 5- NaOH, 6- MeOH, 7- Asorbic Acid, 8- ZnAct, 9- ___

Sampled by: Thomas J. Marcotte
Comments:

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Date/Time	Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Date/Time
[signature]	050ct05 1600	Fedex Airbill 849202857539					
Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Date/Time	Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Date/Time

*By circling MA-MCP, client acknowledges samples were collected in accordance with MADEP CAM VII A

Please fax all changes to Chain of Custody in writing.

1 (White) Lab Copy 2 (Yellow) Client Receipt

10/29/04 R

ESS Laboratory

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Tel. (401) 461-7181 Fax (401) 461-4486
www.esslaboratory.com

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Turn Time: (X) Standard ( ) Other ____
If faster than 5 days, prior approval by laboratory is required #____
State where samples were collected from: (MA) RI CT NH NJ NY ME Other ____
Is this project for any of the following: MA-MCP Navy (USACE) Other ____

Reporting Limits: Standard
ESS LAB PROJECT ID:
Electronic Deliverable: (X) Yes ( ) No
Format: Excel ( ) Access ( ) PDF ( ) Other See Scope

Co. Name	Project #	Project Name (20 Char. or less)
US Army Corps of Engineers		Devens Area 32

Contact Person	Address
Kathy Miller	696 Virginia Road

City	State	Zip	PO#
Concord	MA	01742	

Telephone #	Fax #	Email Address
978 318 8791		

Circle and/or Write Required Analysis

ESS LAB Sample#	Date	Collection Time	COMP	GRAB	MATRIX	Sample Identification (20 Char. or less)	Pres Code	Number of Containers	Type of Containers	8260 B VOA	624	8021 MTBE/BTEX	8100 TPH	8015 GRO	8015 DRO	EPH w/o PAHs	EPH with PAHs & Target Analytes	8082 PCB	8081 Pesticides	608 PCB	608 Pesticides	8270 SVOA	625	PAH 8270	RCRA 5	RCRA 8	PP13 TAL 23	TCLP-RCRA	MCP-METALS (13)	MCP-METALS (13) w/Hg	As Pb	Metals 7 only (MA)
	04 Oct 05	—		X	W	Trip Blank		2			1	1				1															1
		0831		X	GW	32M-01-14X0B		9			3	3				2																1
		1040		X	GW	32M-01-14XBR		4			3	3				2																1

Container Type: P-Poly G-Glass S-Sterile V-VOA | Matrix: S-Soil SD-Solid D-Sludge WW-Waste Water GW-Ground Water SW-Surface Water DW-Drinking Water O-Oil W-Wipes F-Filters

Cooler Present ___ Yes ___ No — Internal Use Only
Seals Intact ___ Yes ___ No NA: ___ [ ] Pickup
Cooler Temp: ___ [ ] Technicians ___

Preservation Code: 1- NP, 2- HCl, 3- H_2SO_4, 4- HNO_3, 5- NaOH, 6- MeOH, 7- Asorbic Acid, 8- ZnAct, 9- ___

Sampled by: Richard E. Leck

Comments: 1 cooler picked up

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Date/Time	Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Date/Time
R Leck	4/5		10/4/05 1535				
Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Date/Time	Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Date/Time

*By circling MA-MCP, client acknowledges samples were collected in accordance with MADEP CAM VII A

Please fax all changes to Chain of Custody in writing.

1 (White) Lab Copy 2 (Yellow) Client Receipt

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Tel. (401) 461-7181 Fax (401) 461-4486
www.esslaboratory.com

CHAIN OF CUSTODY

Page 1 of 1

Turn Time: X Standard Other ____
If faster than 5 days, prior approval by laboratory is required #____
State where samples were collected from: (MA) RI CT NH NJ NY ME Other ____
Is this project for any of the following: MA-MCP Navy (USACE) Other ____

Reporting Limits: Standard
ESS LAB PROJECT ID:
Electronic Deliverable: X Yes ___ No
Format: Excel ___ Access ___ PDF ___ Other See Scope

Co. Name	Project #	Project Name (20 Char. or less)
US Army Corps of Engineers		Devens Area 32

Contact Person	Address
Kathy Miller	696 Virginia Road

City	State	Zip	PO#
Concord	MA	01742	

Telephone #	Fax #	Email Address
978 318 8791		

Circle and/or Write Required Analysis

ESS LAB Sample#	Date	Collection Time	COMP	GRAB	MATRIX	Sample Identification (20 Char. or less)	Pres Code	Number of Containers	Type of Containers	8260B VOA 524.2	624 8015 DRO	8021 MTBE/BTEX VPH (w/target list)	8100 TPH 8015 DRO	EPH w/FAHs EPH MA (w/FAHs list + Diesel)	8081 Pesticides 8082 PCB 608 Pesticides 608 PCB	8270 SVOA 625 PAH 8270	RCRA5 RCRA8 TPH TAL23	TCLP-RCRA8 NHC7	MCP-METALS (13) w/Hg MCP-METALS (13)	Metals 200.7 (As, Pb)				
	04 Oct 05	—		X	W	Trip Blank		2		1	1			1						1				
		1150		X	GW	32M-01-18XBR		9		3	3			2						1				
		1410		X		32M-01-17XBR		9		3	3			2						1				
		1150		X		32M-DUP		9		3	3			2						1				
		1410		X		32M-01-17XBR-MS		9		3	3			2						1				
		1410		X		32M-01-17XBR-MSD		9		3	3			2						1				
		1205		X		32M-01-15XBR		8		3	2			2						1				
		1505		X		32M-01-16XBR		9		3	3			2						1				
	↓	1630		X	↓	32M-EQB		7		2	2			2						1				
Jason K						04 Oct 2005																		

Container Type: P-Poly G-Glass S-Sterile V-VOA | Matrix: S-Soil SD-Solid D-Sludge WW-Waste Water GW-Ground Water SW-Surface Water DW-Drinking Water O-Oil W-Wipes F-Filters

Cooler Present ___ Yes ___ No — Internal Use Only
Seals Intact ___ Yes ___ No NA: ___ [ ] Pickup
Cooler Temp: ___ [ ] Technicians ___

Preservation Code: 1- NP, 2- HCl, 3- H_2SO_4, 4- HNO_3, 5- NaOH, 6- MeOH, 7- Asorbic Acid, 8- ZnAct, 9- ___

Sampled by: Jason Knowles
Comments:

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Date/Time	Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Date/Time
Jason K	04 Oct 05 1930	Fed Ex Airbill # 849220255 7550					
Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Date/Time	Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Date/Time

*By circling MA-MCP, client acknowledges samples were collected in accordance with MADEP CAM VII A

Please fax all changes to Chain of Custody in writing.

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10/26/04 B

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Page 1 of 1

Turn Time: X Standard Other ____
If faster than 5 days, prior approval by laboratory is required #____
State where samples were collected from: (MA) RI CT NH NJ NY ME Other ____
Is this project for any of the following: MA-MCP Navy (USACE) Other ____

Reporting Limits: Standard
ESS LAB PROJECT ID:
Electronic Deliverable: X Yes ___ No
Format: Excel ___ Access ___ PDF ___ Other See scope

Co. Name	Project #	Project Name (20 Char. or less)
US Army Corps of Engineers		Devens Area 32

Contact Person	Address
Kathy Miller	696 Virginia Road

City	State	Zip	PO#
Concord	MA	01742	

Telephone #	Fax #	Email Address
978 318 8791		

ESS LAB Sample#	Date	Collection Time	COMP	GRAB	MATRIX	Sample Identification (20 Char. or less)	Pres Code	Number of Containers	Type of Containers	Circle and/or Write Required Analysis
	03 Oct 05	—		X	W	Trip Blank		2		1 1 1 1
	↓	1128		X	GW	32M-92-01X		9		3 3 2 1
	↓	1340		X	GW	SHL-15		9		3 3 2 1

Container Type: P-Poly G-Glass S-Sterile V-VOA | Matrix: S-Soil SD-Solid D-Sludge WW-Waste Water GW-Ground Water SW-Surface Water DW-Drinking Water O-Oil W-Wipes F-Filters

Cooler Present ___ Yes ___ No Internal Use Only
Seals Intact ___ Yes ___ No NA: ___ [ ] Pickup
Cooler Temp: ___ [ ] Technicians ___

Preservation Code: 1- NP, 2- HCl, 3- H_2SO_4, 4- HNO_3, 5- NaOH, 6- MeOH, 7- Asorbic Acid, 8- ZnAct, 9- ___

Sampled by:
Comments: 1 cooler picked up

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Date/Time	Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Date/Time
	03 Oct 05 1420						
Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Date/Time	Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Date/Time

*By circling MA-MCP, client acknowledges samples were collected in accordance with MADEP CAM VII A

Please fax all changes to Chain of Custody in writing.

1 (White) Lab Copy 2 (Yellow) Client Receipt

APPENDIX G

Mann-Kendall statistics

Mann-Kendall Test on Selected Parameters from 32M-01-18XBR

Trichloroethene - 32M-01-18XBR

	1	2	3	4	5
	Apr-02	Dec-03	May-04	Oct-04	Dec-05
	-1	1	-1	-1	
	-1	0	-1		
	-1	-1			
	-1				
SUM:	**-4**	**0**	**-2**	**-1**	

Total: S= -7 n= 5 p= 0.< 0.1 (interpreted)

Conclusion: Significant decrease at 90%

1,3-dichlorobenzene - 32M-01-18XBR

	1	2	3	4	5	6	7	8
	Apr-02	Oct-02	Jun-03	Dec-03	May-04	Oct-04	Jun-05	Dec-05
	-1	1	-1	1	-1	1	-1	
	-1	1	1	1	-1	-1		
	-1	1	1	1	-1			
	1	1	1	-1				
	-1	1	-1					
	-1	-1						
	-1							
SUM:	**-5**	**4**	**1**	**2**	**-3**	**0**	**-1**	

S= -2 n= 8 p= 0.452

Conclusion: Not significant at 90%

1,4-dichlorobenzene - 32M-01-18XBR

	1	2	3	4	5	6	7	8
	Apr-02	Oct-02	Jun-03	Dec-03	May-04	Oct-04	Jun-05	Dec-05
	-1	1	-1	1	-1	1	-1	
	-1	1	1	1	-1	-1		
	-1	1	1	1	-1			
	1	1	1	-1				
	-1	1	-1					
	-1	-1						
	-1							
SUM:	**-5**	**4**	**1**	**2**	**-3**	**0**	**-1**	

S= -2 n= 8 p= 0.452

Conclusion: Not significant at 90%

Mann-Kendall Test on Selected Parameters from 32M-01-18XBR

1,2-dichlorobenzne - 32M-01-18XBR								
	1	2	3	4	5	6	7	8
	Apr-02	Oct-02	Jun-03	Dec-03	May-04	Oct-04	Jun-05	Dec-05
	-1	1	1	1	-1	1	-1	
	-1	1	1	1	-1	-1		
	-1	1	1	1	-1			
	1	1	1	-1				
	-1	1	-1					
	-1	-1						
	-1							
SUM:	**-5**	**4**	**3**	**2**	**-3**	**0**	**-1**	
	S= 0		**n= 8**			**p= 0.548**		

Conclusion: Not significant at 90%

C9-C12 Aliphatics - 32M-01-18XBR								
	1	2	3	4	5	6	7	8
	Apr-02	Oct-02	Jun-03	Dec-03	May-04	Oct-04	Jun-05	Dec-05
	-	-	1	1	-1	-1	1	
	-	-	1	1	-1	-1		
	-	-	1	-1	-1			
	-	-	1	1				
	-	-	1					
	-	-						
	-							
SUM:	**0**	**0**	**5**	**2**	**-3**	**-2**	**1**	
	S= 3		**n= 6**			**p= 0.36**		

Conclusion: Not significant at 90%

C9-C10 Aromatics - 32M-01-18XBR								
	1	2	3	4	5	6	7	8
	Apr-02	Oct-02	Jun-03	Dec-03	May-04	Oct-04	Jun-05	Dec-05
	-1	-1	1	1	-1	-1	1	
	-1	-1	1	1	-1	-1		
	-1	1	1	-1	-1			
	1	1	-1	-1				
	-1	-1	-1					
	-1	-1						
	-1							
SUM:	**-5**	**-2**	**1**	**0**	**-3**	**-2**	**1**	
	S= -10		**n= 8**			**p= 0.138**		

Conclusion: Not significant at 90%

Prepared by: K. Winship, 07/06/06
Checked by: S. Reed, 07/10/06

APPENDIX H

Monitoring Well Inspection and Maintenance Record

Monitoring Well Inspection and Maintenance Record
Devens AOC 32/43A LTM
October 3, 2005

Well ID	Total Depth (Feet below top of PVC)	Problems Noted	Recommendations	Repairs made in January 2006
32M-01-04XBR	?	Unable to locate well. Poss. covered by new pavement and new electric gate or landscaping.	Determine if well was properly abandoned.	none.
32M-01-08XOB	24.3	No Label; Old sample tubing dropped inside well	Replace well ID; remove old tubing & discard.	none.
32M-01-13XBR	23.3	No Lock; Abundant salt deposition inside road box	Replace lock, clean out salt deposits and make sure lid securely closed.	Road box and surface seal replaced. Road box set slightly below grade.
32M-01-14XOB	29.8	No issues noted	None.	none.
32M-01-14XBR	46.22	No issues noted	None.	none.
32M-01-15XBR	44.1	Surface seal cracked & degraded. Abundant salt deposition within road box.	Replace surface seal/road box	Road box and surface seal replaced. Road box set slightly below grade.
32M-01-16XBR	30.93	Surface seal heavily cracked and degraded; compression cap shattered? Abundant black sediment/debris within annulus and well riser; some silt on bottom.	Replace road box/surface seal; Redevelop well; Replace compression cap.	Road box and surface seal replaced. Well redeveloped using a whale-pump to surge and pump. Initial purge water included sand sized material and off scale turbidity. Final turbidity 16 NTU's at 1.25 GPM, approx. 25 gallon purged.
32M-01-17XBR	54.05	Some sign of siltation.	Check amount of siltation and poss. need to redevelop.	none.
32M-01-18XBR	23.88	No Lock	Add padlock.	none.
32M-92-01X	26.15	slight siltation. No major issues noted.	Check amount of siltation.	none.
32-M-92-03X	35.55	Missing well ID; Slightly silty on bottom	Replace well ID; Check total depth to check amount of silt in screen.	none.
32Z-01-05XOB	35.21	No lock; No ID; No surface seal remaining.	Replace road box and seal. Add lock & ID.	Road box and surface seal replaced. Road box set slightly below grade.
32Z-01-06XBR	28.7	No Label; Old sample tubing dropped inside well	Relabel; Remove old tubing & discard.	none.
32Z-01-07XOB	24.94	Faded ID.	Relabel.	none.
32Z-01-09XOB	33.2	Minor snow plow damage, but seal and road-box intact; No lock or ID./ Snow plow sheared off 1/2 of lid and damaged road-box frame. Interior annulus filled with road sand	Replace missing lock & ID.	Road box and surface seal replaced. Road box set slightly below grade.
32Z-01-10XBR	22.26	No lock; Surface seal heavily cracked & degraded. Heavy salt deposition inside road box	replace road box/ surface seal; Replace lock.	Road box and surface seal replaced. Road box set slightly below grade.
32Z-01-11XBR	17.11	No Lock; No ID; Material in annulus to same height as well riser & running inside well; Surface seal cracked and loose	Replace road box/surface seal; redevelop well; replace lock & ID.	Road box and surface seal replaced. Road box set slightly below grade.
32Z-01-12XBR	37.6	Missing well ID; No lock on compression cap; old sample tubing dropped inside well; compression cap does not seal well due to jagged top end.	Add well ID; use internal PVC cutter to cut flush end; adjust PVC elev. based on amount of PVC removed or resurvey elevation; remove old unused tubing	none.

Monitoring Well Inspection and Maintenance Record
Devens AOC 32/43A LTM
October 3, 2005

Well ID	Total Depth (Feet below top of PVC)	Problems Noted	Recommendations	Repairs made in January 2006
32Z-99-02	31.15	No cap on riser; slight siltation.	Replace riser cap; Check siltation amount.	none.
43M-01-16XOB	33.74	Road box damaged; incorrectly labeled; No lock; surface seal broken up; slight evidence of debris inside well riser .	Replace road box and seal; redevelop well; replace lock & ID correctly.	Road box and surface seal replaced. Road box set slightly below grade. Well redeveloped using a whale-pump to surge and pump. Initial purge water opaque & off scale turbidity. Final turbidity= 8 NTU's at 1.25 GPM, approx. 35 gallons purged. Final total well depth = 33.80 feet below top of PVC (0.3' sand and silt removed).
43M-01-16XBR	56.92	No Lock; slight siltation noted	Replace lock; Check amount of siltation and consider redevelopment.	none.
43M-01-17XBR	57.25	No lock; Surface seal broken up.	Replace surface seal and add padlock.	Replaced damaged surface seal and reset road-box slightly below grade.
43M-01-17XOB	32.98	No lock; Surface seal broken & degraded.	Replace surface seal and add padlock.	Replaced damaged surface seal and reset road-box slightly below grade.
43M-01-20XOB	33.23	Road-box & lid are broken and jammed shut. Unable to open to measure water level or assess well condition. Find -20XOB totally missing road box and top end of PVC riser. Road sand/salt and slush flowing down well from melting snow. There is a jagged vertical crack running down PVC.	Replace road box and assess well condition once open.	Driller used internal PVC cutter to trim off top 0.33 feet of PVC and installed new compression cap. Replace surface seal and road box. Use whale pump to redevelop. Remove approx. 20 gallons of turbid water. Pumped dry numerous times and let recover. Final turbidity down to 11 NTU's. Final total depth - 33.23 feet below top of PVC.
43M-01-20XBR	77.8	No lock or compression cap; Surface seal broken and road-box damaged; some silt on bottom.	Replace road box; Check total depth to check amount of siltation; replace missing compression cap and padlock.	Road box and surface seal replaced. Road box set slightly below grade.
SHL-15	26.49	Found well unlocked (had been cut off?); found old tubing hanging inside well.	Replace lock, investigate who cut off old lock?; remove old tubing	none.
SHL-25	37.2	Old tubing hanging inside well.	Remove old tubing & discard.	none.
63BO9901	?	Unable to locate well. Poss. covered by new pavement and or landscaping.	Determine if well was properly abandoned.	none.
63BO9902	?	Unable to locate well. Poss. covered by new pavement and or landscaping.	Determine if well was properly abandoned.	none.
63BO9903	?	Unable to locate well. Poss. covered by new pavement and or landscaping.	Determine if well was properly abandoned.	none.
63BO9904	?	Unable to locate well. Poss. covered by new pavement and or landscaping.	Determine if well was properly abandoned.	none.

Black text = generated from October 3, 2005 assessment.
Red Text = Generated from December 2005/January 2006 assessment and repair activities.

APPENDIX I

Well Construction Information

Boring Logs and Construction Diagrams

BORING LOG GENERAL DATA Page: 3 of 3 Sent to USATHAMA: ____ Xerox: ____
Borehole Number: 32M-92-01X Signature: ____ Date Sent: ____

Project: Ft Devens DRMO | Boring: 32M-92-01X | Page: 3 of 3

Depth/ Elevation (FL)	USCS Symbol/ Core Sketch	Soil/Rock Description	Sample Number & Depth	Blow Count & Recovery	Drilling Data
20		S#5 20-22 Silty-sand w/ granite up to 2.5" Silt 30% Sand 40% granite 30% Wet 20-21 Hnu = 0 ppm in auger	R=1.0 S#5 13:00	6 46 36 32	Note 20': 1) Drove 2X 20-22 2) Drove 2X 22-24 3) Augered ahead to 24.' Refusal. 4) Will attempt to set well at 23.5'
22		S#6 22-22.8 Silty-sand w/ granite fragments up to 2" Silt 30% Sand 40% Granite 30% Wet	Hnu = 0 R=.8' S#6 13:37	60 for 1" 120	5) Getting running sands into augers 6) Place bottom of screen at 23.5' top 7) Top of sand pack a 9.0'
24		Bottom of auger hole = 24	Hnu = 0		8) Top of bentonite seal 4.0 9) Place initial grout. Use ~2.5 sacker = 24 lb = 40 gallons Type I portland 10) Place protective casing on well w/ padlock. END 10/17/92

usagndal.pm4

WELL CONSTRUCTION LOG

Site ID: Ft. Devens DRMO
Well Number: 32M-92-01X
Job Number: VC 4043
Today's Date: 10/17/92
Well Start/Completion Dates: 10/17/92 / 10/17/92

Installation Difficulties: Some running sands at T.D.

Remarks: Well set at desired depth

Check as appropriate, record depths as below ground surface (BGS)

Screen:

Manufacturer: Buffalo Well Supplies
Schedule: 40
Type: Continuous Slot
Perforated
Louvre
Other: Slotted ¼" apart

Materials: Stainless Steel
PVC: X
Other

Length: 10'
Screened Interval: 13.9-23.9
Diameter: (ID) 4" (OD) ID 4.05 BP 4.05 4.5"
Thickness: ¼"
Slot: Size (inches): 0.010" ¼" spaced Configuration: Horizontal
Open Area per Foot of Screen:

Casing

Manufacturer: Buffalo Well Supplies
Schedule: 40
Material: Stainless Steel
PVC: X
Other
Length:
Diameter: (ID) 4" (OD) 4.05
Thickness: ¼"
Joint(s): Design ASTM - F480 Thread
Composition
Depth(s)

Centralizer: Design —
Composition
Depth(s)

Solvent, Glues, Cleaners: Manufacturer —
Use(s)

Protective Casing: Material Low Carbon Steel
Inner Diameter 6"

Sent to USATHAMA: ... Date Sent:
Page 1 of 3 Signature: Approx:
WELL CONSTRUCTION LOG Well Number: 32M-92-01X
74

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BORING LOG GENERAL DATA

Project: Ft Devens DRMO Boring: 32M-92-01X Page: 1 of 3

Driller & Company: Brad Brock TDS, Inc.

Geologist/Logger & Company: JOHN BECK Signature: J. Beck

Date Boring Started: 10/17/92 Completed: 10/17/92

Water Levels (from Ground Surface) Drilling Rig: ACKER AD-II

First Encountered: ~~N/A~~ 18.2' Date: 10/17/92

While Drilling: 19.4' Date: 10/17/92

At Boring Completion: 16.1' Date: 10/18/92 (08:50)

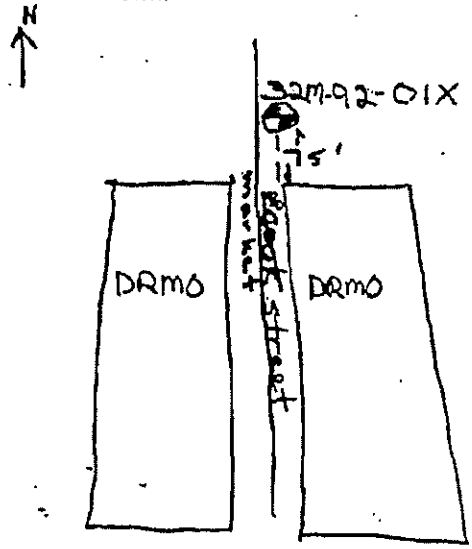
Drilling Shifts:

Date	Time		Depth of Drilling Per Shift		Date	Time		Depth of Drilling Per Shift	
	Start	End	Start	End		Start	End	Start	End
10/17/92	11:15	16:15	0'	24'					

Abbreviations:

Abbr.	Meaning
2X	2" X 2' Split spoon
R	Recovery
HSA	Hollow Stem Augers
I.D.	Inside Diameter
HNU	HNU Model PI-101 photoionization (ppm) detector
S	Sample
S.S.	Split spoon

Location Sketch:



BORING LOG GENERAL DATA Borehole Number: 32M-92-01X Page: 1 of Signature: Xerox: Sent to USATHAMA: Date Sent:

58

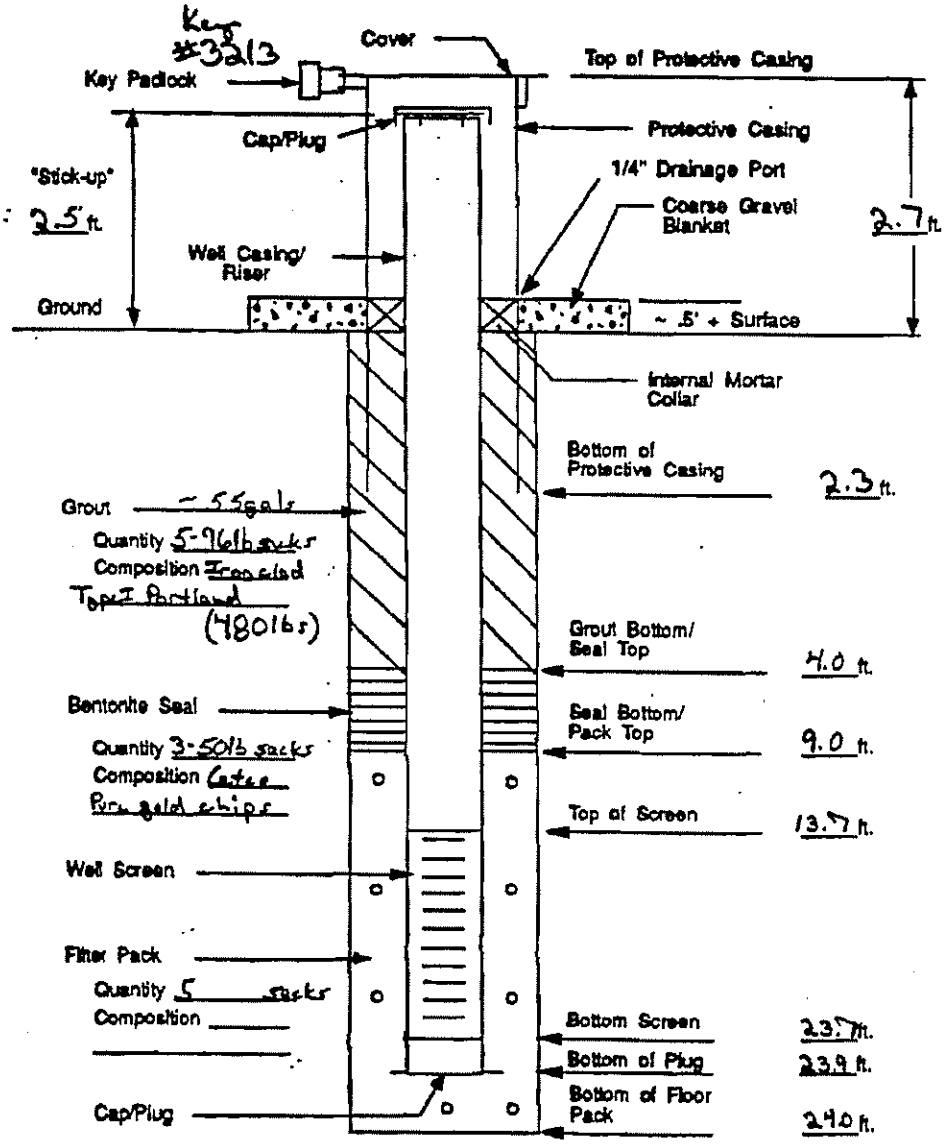
BORING LOG GENERAL DATA
Borehole Number: 32M-92-01X
Page: 2 of
Signature:
Xerox:
Sent to USATHAMA:
Date Sent:

Project: Ft Devens DRMO
Boring: 32M-92-01X
Page: 2 of 3

Depth/ Elevation (Ft.)	USCS Symbol/ Core Sketch	Soil/Rock Description	Sample Number & Depth	Blow Count & Recovery	Drilling Data
0		GROUND SURFACE			11:23
		S#1 : Brown sandy loam 0-2' w/ gravel up to 1". 0-.4' Brown w/ 40% gravel .4-1' Yellow of quartz 1-1.1 White clean sand 1.1-1.3 same as .4-1' with phyllite + quartz	A= 1.3 S#1	7	Note: 1) All samples driven w/ 140 lb hammer w/30" Free Fall
			11:25	12	2) Depth & R in Feet
				10	3) Depth measured infeet below surface
			Hnu=0	10	4) Augered w/ 6¼" I.D. H.S.A.
5		S#2 5-7' 5-5.8' Poorly sorted gravelly sand w/ pieces up to 1". 5.7-6 Fine-grained sand w/ Few pieces up to ½" quartz	R=1.0 S#2	5	
			11:34	11	
			Hnu=0	20	Note 0': Drove 2X 0-2'
7				8 BP	Drove 2X 5-7'
10		S#3 10-12 Sand 100% no gravel Percolation banding at 10.4, 11.0 + 11.5. Loose & Dry 10YR 7/2	R=1.7	3 BP	3) Drove 2X 10-12' 4) Drove 2X 15-17'
			12:50	6 BP	
				9 BP 10	
12			Hnu=0	10	
				4 BP 4T	
15		S#4 15-17 silt 15.0-15.5 BP sand 50% w/ granite pieces up to 2". Dry + Loose 15.5-15.8 silt 70% w/ granite up to 2". 30% Damp 10YR 4/4 Dk yellowish brown slightly cohesive	R=.8	41 BP 22	
			12:41	32 BP 15	
				15 BP 19	
17			Hnu=0	19	

Well Construction Log: _____
Site ID Number: _____
Well Number: 32M-92-01X
Today's Date: 10/12/92

WELL CONSTRUCTION



WELL CONSTRUCTION LOG
Well Number: 32M-92-01X
Page 2 3
Signature:
Xerox: A.R.L.
Sent to USATHAMA:
Date Sent:

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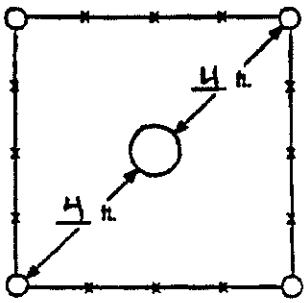
Well Construction Log: _____

Site ID Number: _____

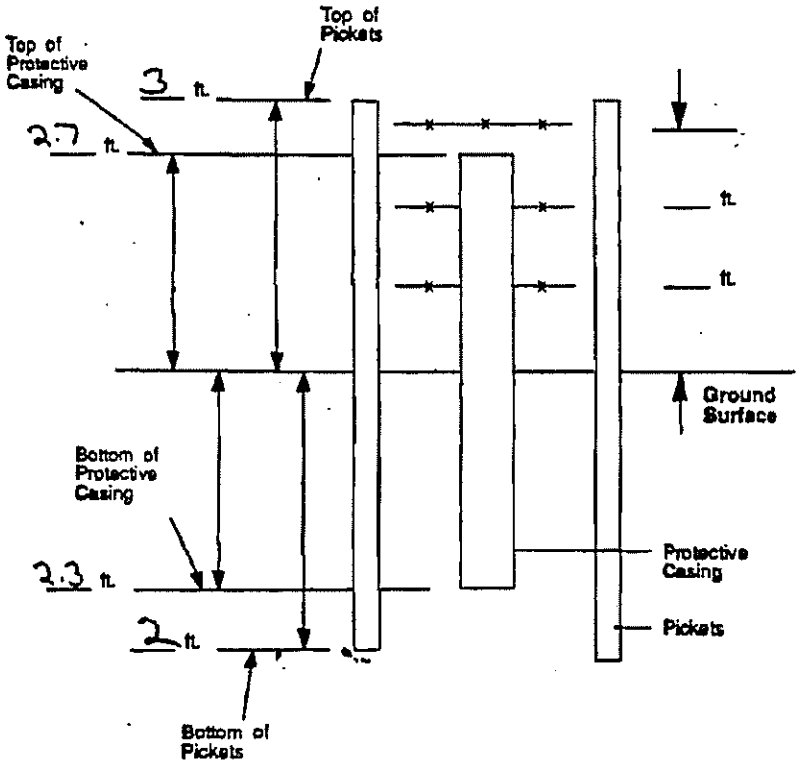
Well Number: 32M-92-01X

Today's Date: 10/30/92

WELL PROTECTION DIAGRAM



PLAN



PROFILE

WELL CONSTRUCTION LOG
Well Number: 32M-92-01X
Page 3 of 3
Signature: Alex
Xerox:
Sent to USATHAMA:
Date Sent:
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Stone & Webster Engineering Corporation	BORING LOG	Boring 32Z-99-02X J.O. 0500032 Sheet 1 of 1

Site: AOC 43A & 32, Devens, Ma
Client: Army Corps of Engineers
Coordinates:
Groundwater Depth: 23.1 ft on 04/01/99
Contractor: Stone & Webster

Logged by: Joseph Coyne
Date Start - Finish: 03/31/99 - 03/31/99
Ground Elevation: ft
Depth to Bedrock: NA ft
Total Depth Drilled: 29.5 ft
Driller: NH Boring
Rig Type:

Methods:
Drilling Soil: Hollow stemmed augers
Sampling Soil:
Drilling Rock:

Casing Used: 2.25

Comments:

Elev (ft)	Depth (ft)	Sample Type	Sample No.	Blows or Recovery / RQD	SPT N Value	USC Symbol	Sample Description
0.0	0						Light brown medium, well sorted sand. PID = 0.0 ppm
-5	5						Light brown medium sand. PID = 0.0 ppm.
-10	10						Light brown medium sand. PID = 0.0 ppm.
-15	15						Light brown medium sand. PID = 0.0 ppm.
-20	20						Light brown medium sand. PID = 0.0 ppm.
-25	25						Light brown medium sand. PID = 0.0 ppm
-30	30						
-35	35						
-40	40						

Legend/Notes

- Datum is
- Sample Type:
- ▽ indicates groundwater level.
- ▌ indicates location of samples.
- Blows = number of blows required to drive 2" O.D. sample spoon 6" or distance shown using 140 pound hammer falling 30".
- ( ) = inches of sample recovery.
- Recovery = % rock core recovery.
- RQD = Rock Quality Designation.
- SPT N = Standard Penetration Test resistance to driving, blows/ft.
- USC = Unified Soil Classification system.
- * indicates use of 300 pound hammer.

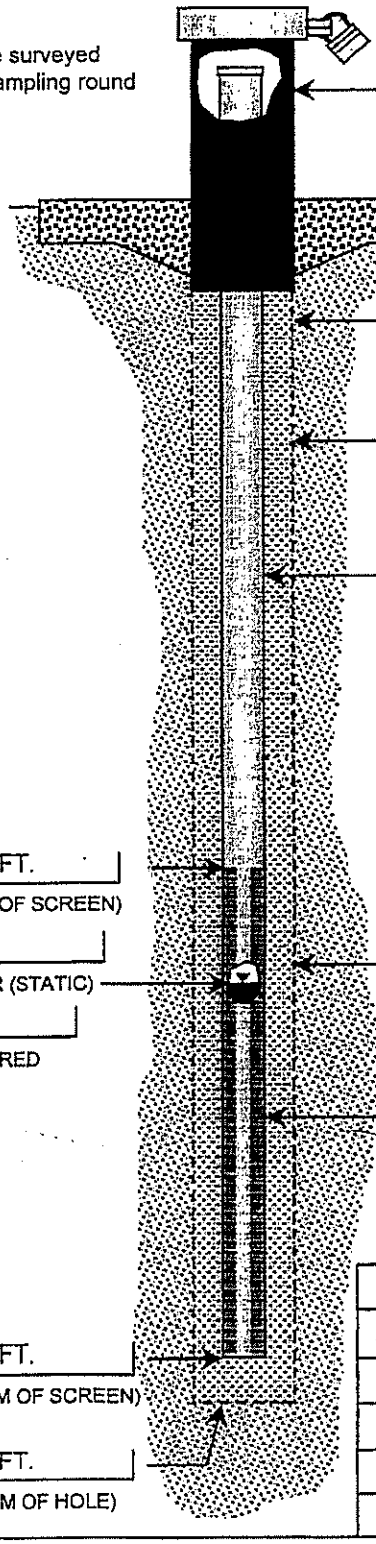
Approved	Date
	06/21/99

NOTES:
1. ALL DEPTHS MEASURED AS BGS. UNLESS OTHERWISE NOTED.
2. DRAWING NOT TO SCALE.

MONITORING WELL LOG
AOC 32 32Z-99-02X

STONE & WEBSTER ENVIRONMENTAL TECHNOLOGIES AND SERVICES

Note: Wells will be surveyed prior to the next sampling round



GUARD PIPE WITH LOCKING COVER

CONCRETE APRON

2.25 IN.
BOREHOLE DIAMETER

NATURAL SOIL
BACKFILL

PVC | 40
CASING TYPE | SCHEDULE

1.0 IN. ID. | 17.0 FT.
DIAMETER | LENGTH

14.5 FT.
DEPTH (TOP OF SCREEN)

23.1
DEPTH TO WATER (STATIC)

4/1/99
DATE MEASURED

NATURAL SOIL
FILTER PACK

PVC | 40 | 15 FT.
SCREEN TYPE | SCHEDULE | LENGTH

1.0 IN. ID. | 0.010
DIAMETER | SLOT

29.5 FT.
DEPTH (BOTTOM OF SCREEN)

29.5 FT.
DEPTH (BOTTOM OF HOLE)

PROJECT: AOC 32 & 43A Devens, Ma
J.O.: 0500032 CLIENT: USACE
CONTRACTOR: Stone & Webster
DRILLER: New Hampshire Boring
RIG TYPE / METHOD: Hollow Stem Auger
STARTED: 3/31/99 COMPLETED: 3/31/99

BORING LOG GENERAL DATA

Project: FT. DEVENS / DRMO Boring: 32M-92-03X Page: 1 of 2

Driller & Company: PETE NEWSHAM / TECHNICAL DRILLING SERVICES

Geologist/Logger & Company: LISA HELTON / ECOLOGY & ENVIRONMENT Signature:

Date Boring Started: 10-18-92 Completed: 10-19-92

Water Levels (from Ground Surface) Drilling Rig: ACKER AD 2

First Encountered: 28.3 Date: 10-18-92

While Drilling: 28.2 Date: 10-19-92

At Boring Completion: Date:

Drilling Shifts:

Date	Time		Depth of Drilling Per Shift		Date	Time		Depth of Drilling Per Shift	
	Start	End	Start	End		Start	End	Start	End
10-18-92	0815	1330	0	24' (6¼" HSA) 2.9' (2¼" SS)					
10-19-92	0814	0828	29'	34' (6¼" HSA)					

Abbreviations:

Abbr.	Meaning
F	FINE GRAINED
M	MEDIUM GRAINED
C	COARSE GRAINED
HSA	HOLLOW STEM AUGER
SS	SPLIT SPOON SAMPLER
2X	2' SPLITSPOON, 2" ID
R	RECOVERY
T.D.	TOTAL DEPTH

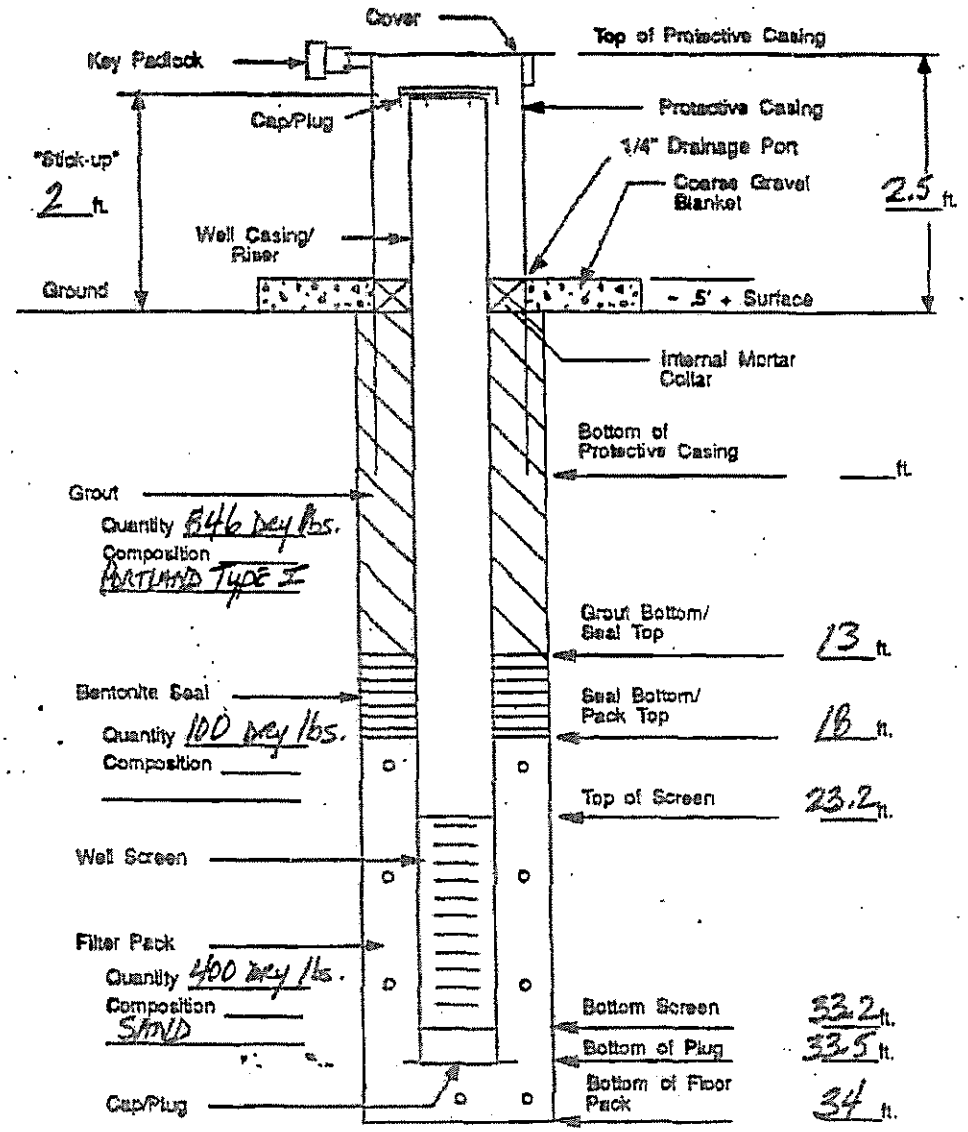
Location Sketch:

Page: 1 of 1

Well Construction Log:
Site ID Number: DRMO (32)
Well Number: 32M-92-03X
Today's Date: 10-19-92

WELL CONSTRUCTION LOG
Well Number: 32M-92-03X
Page 1 of 1
Signature: [signature]
Sent to USATHAMA: Date Sent: 10-26-92

WELL CONSTRUCTION



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Project: FT. DEVENS / DRMO | Boring: 32M-92-03X | Page: 1 of 2

Depth/ Elevation (Ft.)	USCS Symbol/ Core Sketch	Soil/Rock Description	Sample Number & Depth	Blow Count & Recovery	Drilling Data
0		0'-1'. SANDY LOAM - DUSKY YELLOWISH-BRN. (10YR 2/2), DRY, NON-PLASTIC	00:15	NA	NOTES: ① ALL SAMPLES BELOW BY HOW. UNLESS W/ 140# PENFALL
5		1'-5' GRAVELLY SAND - PALE YELL-BRN (10YR 6/2), DRY, M-C (30% F, 70% C), 20% GRAVEL UP TO 1" DIA.	NA	NA	② ALL DEPTH REFERENCES IN FT. BELOW GROUND SURFACE.
10		5'-9'- SAND, PALE YEL.-BRN, M-C (30% F, 70% C), 20% GRAVEL UP TO 1" DIA.	05:15 NR	NA	③ HOLE DRILLED WITH BOTH 4¼" ID AND 6¼" ID HSAs
		9'-15'- GRAV. SAND, M-C (30% F, 70% C), 20% GRAVEL UP TO 1" DIA.			
15		10'-15' GRAV. SAND AS ABOVE EXCEPT MORE GRAVEL (~30%).	08:26 NA	NA	NOTE 05': ① HSA TO 5'
		15'-20' GRAV. SAND AS ABOVE	08:24 NA	NA	NOTE 10': ① HSA TO 10'
20		20'-25' GRAV. SAND AS ABOVE EXCEPT MODERATELY MOIST.	16:25 NA	NA	NOTE 15': ① HSA TO 15'.
25		25'-25.5'- GRAV. SAND AS ABOVE	08:27 NA	NA	NOTE 20': ① HSA TO 20'
	LAB	ESTIMATED 25.5'-29'- GRAV. SAND AS ABOVE	10:17 NA	NA	NOTE 25': ① HSA TO 25'. AUGERING WAS ROUGH AT ~24.5'.
30		29'-31'- GRAV. SAND AS ABOVE WITH HIGHLY WEATHERED BEDROCK, WET	SS-1	14,14,10,12 R=1.1'	NOTE 25': ① HSA TO 30'. REFUSAL AT ~25.5'. ② INSTALLATION OF 4" ID CASING ③ TRI-CONE ROLLER BIT FROM 25.5'-30' = SMOOTH RUN, NOT INDICATIVE OF DRILLING THROUGH ROCK.
35		31'-34'- HIGHLY WEATHERED BEDROCK, WET	SS-2	100/0.5' R=0.5'	NOTE 25.5': ① HSA TO 29'. AUGERING BECAME ROUGH NEAR BOTTOM TO REFUSAL (29'). ② DROVE 2X 28'-31'. COLLECTED SAMPLE ③ LAB W.L. AT 28.3' AND 10 MINUTES LATER IT WAS THE SAME.
					NOTE 29': ① HSA TO 34' AUGERING WAS ROUGH NEAR BOTTOM TO REFUSAL AT ~34'. ② DROVE 2X 34'-34.5'. REFUSAL AT ~34.5'. COLLECTED SAMPLE FOR LAB GEOTECH ANALYSES. ③ W.L. AT 28.4' ④ REAM WITH 6¼" ID HSA TO 29'
					END 10-18-92
					NOTE 29': ① REAM USING 6¼" ID HSAs TO 34'. ② W.L. AT 28.2' ③ SET PVC WELL MATERIAL, SANDPACK, BENTONITE, AND GROUT.
					END 10-19-92
					T.D. = 34.5'

usegmda1.pm4

Sent to USATHAMA: Date Sent: 10-26-92 (Hand)

Page 1 of 1 Signature: [signature]

WELL CONSTRUCTION LOG as Well Number: 32M-92-03X

WELL CONSTRUCTION LOG

Site ID: DRMO (32)
Well Number: 32M-92-03X
Job Number: IAC4040
Today's Date: 10-19-92
Well Start/Completion Dates: 10-18-92 / 10-19-92

Page: 1 of 1

Installation Difficulties:

Remarks:

Check as appropriate, record depths as below ground surface (BGS)

Screen:

Manufacturer: BUFFALO WELL SUPPLIES
Schedule: 40
Type: Continuous Slot
Perforated
Louvre
Other
Materials: Stainless Steel
PVC X
Other
Length: 10'
Screened Interval: 33.2' - 23.2'
Diameter: (ID) 4" (OD) 4.05"
Thickness: 1/4"
Slot: Size (inches): 0.010 Configuration:
Open Area per Foot of Screen:

Casing

Manufacturer: BUFFALO WELL SUPPLIES
Schedule: 40
Material: Stainless Steel
PVC X
Other
Length: 25.2
Diameter: (ID) 4" (OD) 4.05"
Thickness: 1/4"
Joint(s): Design ASTM - F 480 THREAD
Composition
Depth(s)

Centralizer: Design
Composition
Depth(s)

Solvent, Glues, Cleaners: Manufacturer
Use(s)

Protective Casing: Material LOW CARBON STEEL
Inner Diameter 6"

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HALEY & ALDRICH

TEST BORING REPORT

Boring No.32Z-01-04XBR

Project MONITORING WELL INSTALLATION AOC 32/43A DEVENS, MA
Client MASSDEVELOPMENT/DEVENS COMMERCE CENTER
Contractor EARTH EXPLORATION SERVICES, WRENTHAM, MA

File No. 10884-056
Sheet No. 1 of 2
Start December 26, 2001
Finish December 28, 2001
Driller J.Galvin
H&A Rep. D. Velozzi
Elevation 261.5
Datum NGVD (1929)
Location See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	SW	S	HQ	Rig Make & Model: Mobile B-57 Truck
Inside Diameter (in.)	6.0	1 3/8	2.5	Bit Type: Roller Bit
Hammer Weight (lb.)	300	140	-	Drill Mud: None
Hammer Fall (in.)	24	30	-	Casing: driven
				Hoist/Hammer: Winch Doughnut Hammer

Depth (ft.)	SPT*	Sample No. & Rec. (in.)	Sample Depth (ft.)	Well Diagram	Elev./Depth (ft.)	USCS Symbol	Visual-Manual Identification and Description (Density/consistency, color, GROUP NAME, max. particle size**, structure, odor, moisture, optional descriptions, geologic interpretation)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0					261.2	SM	Black silty SAND (SM)										
	2 8 65 25	S1 12	0.3 2.0		0.3	GM	-TOPSOIL- Very dense brown silty GRAVEL with sand (GM), mps 1.0 in., no odor, dry, trace fill	25	10		10	15	40				
	31 32 35 4	S2 17	2.0 4.0			GM	-FILL- Same as above	5	10		5	30	50				
	91 89 69 59	S3 18	4.0 6.0		257.0 4.5	SP-SM	Very dense brown poorly graded SAND with silt (SP-SM), mps 1.0 in., no odor, dry	5	5	15	25	40	10				
5					255.5		-GLACIOFLUVIAL DEPOSITS-										
	24 37 126 150	S4 15	6.0 8.0		6.0	SP	-GLACIOFLUVIAL DEPOSITS- Very dense light brown poorly graded SAND (SP), mps 2.0 mm, no odor, moist			10	25	60	5				
							TOP OF BEDROCK AT 8.0 FT										
							SEE CORE BORING REPORT FOR ROCK DETAILS										
10																	
15																	
20																	

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft.) to: Bottom of Casing	Bottom of Hole	Water
12/27/01	0700	16	11.0	21.3	20.0
1/11/02	0730	14 Days	-	35.0	23.8

Sample Identification

O Open End Rod
T Thin Wall Tube
U Undisturbed Sample
S Split Spoon
G Geoprobe

Well Diagram

Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary

Overburden (lin. ft.) 11.3
Rock Cored (lin. ft.) 25.0
Samples S4, C5

Boring No. 32Z-01-04XBR

Field Tests: Dilatancy: R-Rapid, S-Slow, N-None
Toughness: L-Low, M-Medium, H-High
Plasticity: N-Nonplastic, L-Low, M-Medium, H-High
Dry Strength: N-None, L-Low, M-Medium, H-High, V-Very High

*SPT – Sampler blows per 6 in. **Maximum particle size (mm) is determined by direct observation within the limitations of sampler size (in millimeters)

G:\10884\056\LOGS.GPJ Mar 28, 02
USGS.LIB3.GLB U/
S_TB3

HALEY & ALDRICH

CORE BORING REPORT

Boring No. 32Z-01-04XBR
File No. 10884-056
Sheet No. 2 of 2

Depth (ft)	Drilling Rate Min./ft	Run No.	Depth (ft)	Recovery/RQD in.	Recovery/RQD %	Weathering	Well Diagram	Elev./ Depth (ft)	Visual Description and Remarks
									SEE TEST BORING REPORT FOR OVERBURDEN DETAILS
								253.5 8.0	TOP OF BEDROCK AT 8.0 FT Note: Advanced borehole with roller bit to 11.3 ft.
10									
	5	C1	11.3 16.3	57 37	95 62	Fresh to Slight			C1: Very hard, slightly weathered to fresh, mottled white-gray fine to very coarse grained granitic GNEISS. Gneissic foliation extremely thin at high angles. Primary joint set at moderately to high angles, extremely close to moderate, smooth to rough, planar to stepped, oxidized, tight to open. Secondary joints set at low angle, extremely close to moderate, smooth to rough, planar to stepped, oxidized, tight to open.
	4								
	5								
15	5								Note: 3.0 in. inclusion of Quartzite in top of the run.
	4								
	7	C2	16.3 21.3	57 34	95 57	Fresh to Slight			C2: Same as above, except joints very close to moderate.
	8								
	7								-BEDROCK- (Possible Ayer Granite)
20	8								
	8							240.2 21.3	
	15	C3	21.3 26.3	53 31	88 52	Fresh to Slight			C3: Very hard, fresh to slightly weathered, gray, aphanitic to fine grained QUARTZITE. Foliation extremely thin at high angle. Joints high angle, close to moderate, smooth to rough, planar to stepped, discolored, partly oxidized, tight to open.
	16								
	18								
25	18								
	16								
	8	C4	26.3 31.3	53 33	88 55	Fresh to Slight			C4: Same as above.
	7								Note: Sand infilling at approximately 27.0 to 27.3 ft.
	6								
30	6								-BEDROCK- (Possible Vaughn Hills Formation)
	8								
	8	C5	31.3 36.3	39 17	65 28	Fresh to Slight			C5: Same as above, except secondary joints set at low angle, very close to moderate, smooth to rough, stepped to planar, oxidized, tight to open.
	7								Note: Oxidized zone from 32.6 to 33.3 ft.
	6								
35	6								-BEDROCK-
	8							225.2 36.3	BOTTOM OF EXPLORATION 36.3 FT INSTALLED PIEZOMETER AT 35.0 FT

CORE+WELL3 USCSLIB3 TCSTBC2.GDT Q:\10884\056\LOGS.GPJ Mar 26, 02

HALEY & ALDRICH

PIEZOMETER INSTALLATION REPORT

Project	MONITORING WELL INSTALLATION AOC32/43A	Piezometer	32Z-01-04XBR
City/State	DEVENS, MA	Test Boring	32Z-01-04XBR
Client	MASSDEVELOPMENT/ DEVENS COMMERCE CENTER	Installation Date	28-Dec-01
Contractor	EARTH EXPLORATION SERVICES, WRENTHAM, MA	Location	See Plan
Driller	J. GALVIN	H&A File No.	10884-056
		H&A Rep.	D. Velozzi

Ground El. 261.5
El. Datum NGVD (1929)

SOIL/ROCK CONDITIONS | BOREHOLE BACKFILL
(Numbers refer to elevation/depth from ground surface in feet)
(not to scale)

-TOPSOIL- 0.3
-CONCRETE- 0.7
-FILTER SAND- 3.0
-FILL- 4.5
-GLACIOFLUVIAL DEPOSITS- 8.0
-BENTONITE- 23.0
-BEDROCK-
-FILTER SAND- 36.3

Bottom of Exploration 36.3

Type of protective cover/lock: Bolted Cover
Depth of top of roadway box below ground surface: 0.0 ft
Depth of top of riser pipe below ground surface: 0.4 ft
Type of protective casing: Roadway Box
Length: 0.8 ft
Inside diameter: 6.0 in
Depth of bottom of roadway box: 0.8 ft

Seals:

Type	Depth to top (ft)	Thickness (ft)
Concrete	0.0	0.7
Bentonite	3.0	20.0

Type of riser pipe: Sch 40 PVC Solid
Inside diameter of riser pipe: 2.0 in
Type of backfill around riser: Seal
Diameter of borehole: 6.0 in
Depth of top of well screen: 25.0 ft
Type of screen or manufacturer: Machine Slotted PVC
Screen gauge or size of openings: 0.010 in
Diameter of well screen: 2.0 in
Type of backfill around screen: Filter Sand
Depth of bottom of well screen: 35.0 ft
Depth of bottom of silt trap
Depth of bottom of borehole: 36.3 ft

(Depths refer to ground surface)

Remarks: Installed wide concrete pad around roadway box.

HALEY & ALDRICH

TEST BORING REPORT

Boring No.32Z-01-05XOB

Project MONITORING WELL INSTALLATION AOC 32/43A DEVENS, MA
Client MASSDEVELOPMENT/DEVENS COMMERCE CENTER
Contractor EARTH EXPLORATION SERVICES, WRENTHAM, MA

File No. 10884-056
Sheet No. 1 of 2
Start December 20, 2001
Finish December 21, 2001
Driller R. Eastwood
H&A Rep. W. Rubik
Elevation 261.8
Datum NGVD (1929)
Location See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	SW	S	-	Rig Make & Model: Mobile B-57 Truck
Inside Diameter (in.)	6.0	1 3/8	-	Bit Type: Roller Bit
Hammer Weight (lb.)	300	140	-	Drill Mud: None
Hammer Fall (in.)	30	30	-	Casing: driven
				Hoist/Hammer: Winch Doughnut Hammer

Depth (ft.)	SPT*	Sample No. & Rec. (in.)	Sample Depth (ft.)	Well Diagram	Elev./Depth (ft.)	USCS Symbol	Visual-Manual Identification and Description (Density/consistency, color, GROUP NAME, max. particle size**, structure, odor, moisture, optional descriptions, geologic interpretation)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0					261.3		-Black ASPHALT-										
	63 124 31	S1 5	0.5 2.0		0.5	GM	Very dense brown silty GRAVEL with sand (GM), mps 2.0 in., no odor, dry	25	25	5	5	25	15				
	28 64 71 43	S2 11	2.0 4.0		257.9	GM	Same as above -FILL-	25	30	5	5	20	15				
5	24 26 26 19	S3 13	4.0 6.0		3.9 255.8	SP-SM	Very dense brown poorly graded SAND with silt (SP-SM), mps 1.0 in., no odor, moist -GLACIOFLUVIAL DEPOSITS-	5	5	15	25	40	10				
	13 14 17 15	S4 9	6.0 8.0		6.0 253.8	SP	Dense poorly graded SAND (SP), mps 3.0 mm, stratified, no odor, dry -GLACIOFLUVIAL DEPOSITS-				25	70	5				
	16 13 11 11	S5 9	8.0 10.0		8.0 251.8	SP	Medium dense brown poorly graded SAND (SP), mps 0.8 in., stratified, no odor, wet -GLACIOFLUVIAL DEPOSITS-	5	5	20	20	45	5				
10	13 18 19 22	S6 13	10.0 12.0		10.0	SP	Dense light gray poorly graded SAND (SP), mps 1.0 in., stratified, no odor, moist -GLACIOFLUVIAL DEPOSITS-	5	5	20	35	35					
	13 18 21 27	S7 14	12.0 14.0			SP	Same as above	5	5	20	35	35					
	12 15 18 22	S8 12	14.0 16.0			SP	Same as above	5	5	15	35	40					
15	19 27 43 58	S9 14	16.0 18.0		245.8 16.0	SP	Very dense light gray poorly graded SAND with gravel (SP), mps 1.0 in., stratified, no odor, moist -GLACIOFLUVIAL DEPOSITS-	5	10	30	40	15					
	29 46 63 68	S10 10	18.0 20.0			SP	Same as above	10	10	30	40	10					
20																	

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft.) to: Bottom of Casing	Bottom of Hole	Water
12/21/01	1145	1.5	34.0	36.0	31.6*
1/12/02	1325	22 Days	-	35.5	32.8
		*Pumped out.			

Sample Identification

O Open End Rod
T Thin Wall Tube
U Undisturbed Sample
S Split Spoon
G Geoprobe

Well Diagram

Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary

Overburden (lin. ft.) 36.0
Rock Cored (lin. ft.) -
Samples S18

Boring No. 32Z-01-05XOB

Field Tests: Dilatancy: R-Rapid, S-Slow, N-None
Toughness: L-Low, M-Medium, H-High
Plasticity: N-Nonplastic, L-Low, M-Medium, H-High
Dry Strength: N-None, L-Low, M-Medium, H-High, V-Very High

*SPT = Sampler blows per 6 in. **Maximum particle size (mm) is determined by direct observation within the limitations of sampler size (in millimeters).

HALEY & ALDRICH

TEST BORING REPORT

Boring No. 32Z-01-05XOB
File No. 10884-056

Depth (ft)	SPT*	Sample No. & Rec. (in.)	Sample Depth (ft.)	Well Diagram	Elev./Depth (ft.)	USCS Symbol	Visual-Manual Identification and Description (Density/consistency, color, GROUP NAME, max. particle size**, structure, odor, moisture, optional descriptions, geologic interpretation)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
20	54 66 58 58	S11 13	20.0 22.0			SP	Same as above, except gray-brown -GLACIOFLUVIAL DEPOSITS-	10	15	25	35	15					
	53 59 62 78	S12 3	22.0 24.0		237.8	SP	Same as above. Poor recovery.										
25	19 14 19 30	S13 11	24.0 26.0		24.0	SP-SM	Dense light brown poorly graded SAND with silt (SP-SM), mps 2.0 mm, in partings, no odor, moist -GLACIOFLUVIAL DEPOSITS-			10	30	50	10				
	19 23 27 24	S14 15	26.0 28.0		233.8	SP-SM	Same as above		5	15	40	30	10				
	47 69 51 52	S15 16	28.0 30.0		28.0	SW	Very dense brown-gray well graded SAND with gravel (SW), mps 1.0 in., stratified, no odor, moist to wet	5	15	30	20	15	5				
30	55 67 42 45	S16 14	30.0 32.0			SW	Very dense brown-gray well graded SAND with gravel (SW), mps 1.0 in., stratified, no odor, moist to wet -GLACIOFLUVIAL DEPOSITS-	10	20	30	25	15					
	40 27 19 30	S17 17	32.0 34.0			SW	Same as above, except dense, wet										
35	67 16 13 23	S18 6	34.0 36.0		227.3 34.5	SP	Dense gray poorly graded SAND (SP), mps 1.0 in., no odor, wet -GLACIOFLUVIAL DEPOSITS-	5		10	45	40					
					225.8 36.0		BOTTOM OF EXPLORATION 36.0 FT INSTALLED PIEZOMETER AT 35.5 FT										

*SPT = Sampler blows per 6 in. **Maximum particle size (mm) is determined by direct observation within the limitations of sampler

HALEY & ALDRICH

PIEZOMETER INSTALLATION REPORT

Project	MONITORING WELL INSTALLATION AOC32/43A	Piezometer	32Z-01-05XOB
City/State	DEVENS, MA	Test Boring	32Z-01-05XOB
Client	MASSDEVELOPMENT/ DEVENS COMMERCE CENTER	Installation Date	21-Dec-01
Contractor	EARTH EXPLORATION SERVICES, WRENTHAM, MA	Location	See Plan
Driller	R. EASTWOOD	H&A File No.	10884-056
		H&A Rep.	W. Rubik

Ground El. 261.8
El. Datum NGVD (1929)

SOIL/ROCK CONDITIONS
(Numbers refer to elevation/depth from ground surface in feet)
(not to scale)

BOREHOLE BACKFILL

-ASPHALT- 0.5
-CONCRETE- 0.7
-FILTER SAND- 3.0
-FILL- 3.9
-BENTONITE- 23.5
-GLACIOFLUVIAL DEPOSITS-
-FILTER SAND- 36.0

Bottom of Exploration

Type of protective cover/lock: Bolted Cover
Depth of top of roadway box below ground surface: 0.0 ft
Depth of top of riser pipe below ground surface: 0.4 ft
Type of protective casing: Roadway Box
Length: 0.8 ft
Inside diameter: 6.0 in
Depth of bottom of casing: 0.8 ft

Seals:

Type	Depth to top (ft)	Thickness (ft)
Concrete	0.0	0.7
Bentonite	3.0	20.5

Type of riser pipe: Sch 40 PVC Solid
Inside diameter of riser pipe: 2.0 in
Type of backfill around riser: Seal
Diameter of borehole: 6.5 in
Depth of top of well screen: 25.5 ft
Type of screen or manufacturer: Machine Slotted PVC
Screen gauge or size of openings: 0.010 in
Diameter of well screen: 2.0 in
Type of backfill around screen: Filter Sand
Depth of bottom of well screen: 35.5 ft
Depth of bottom of silt trap
Depth of bottom of borehole: 36.0 ft

(Depths refer to ground surface)

Remarks:

HALEY & ALDRICH

TEST BORING REPORT

Boring No.32Z-01-06XBR

Project MONITORING WELL INSTALLATION AOC 32/43A DEVENS, MA
Client MASSDEVELOPMENT/DEVENS COMMERCE CENTER
Contractor EARTH EXPLORATION SERVICES, WRENTHAM, MA

File No. 10884-056
Sheet No. 1 of 2
Start November 13, 2001
Finish November 15, 2001
Driller J.Galvin
H&A Rep. A. Nichols
Elevation 260.8
Datum NGVD (1929)
Location See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	SW	S	HQ	Rig Make & Model: Mobile B-57 ATV
Inside Diameter (in.)	6.0	1 3/8	2.5	Bit Type: Roller Bit
Hammer Weight (lb.)	300	140	-	Drill Mud: None
Hammer Fall (in.)	30	30	-	Casing: driven
				Hoist/Hammer: Winch Doughnut Hammer

Depth (ft.)	SPT*	Sample No. & Rec. (in.)	Sample Depth (ft.)	Well Diagram	Elev./Depth (ft.)	USCS Symbol	Visual-Manual Identification and Description (Density/consistency, color, GROUP NAME, max. particle size**, structure, odor, moisture, optional descriptions, geologic interpretation)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0	2	S1	0.0		260.6	SM	Medium dense dark brown silty SAND (SM), mps 10.0 mm, no			5	10	70	15				
	7	3	0.2		0.2	SP	structure, faint grassy odor, moist, trace moss										
	6	S1A	0.2				-TOPSOIL-										
	7	13	2.0														
	7	S2	2.0			SP	Medium dense light brown poorly graded SAND (SP), mps 5.0 mm,										
	7	13	4.0				faint stratification, no odor, dry										
	11						-GLACIOFLUVIAL DEPOSITS-										
	31						Same as above										
	15	S3	4.0		256.3	SP	Same as above										
5	46	4	4.5		4.5	SP	Very dense light brown poorly graded SAND (SP), mps 5.0 mm, faint										
	49	S3A	4.5				stratification, no odor, wet										
	37	6	6.0				-GLACIOFLUVIAL DEPOSITS-										
	36	S4	6.0			SP	Very dense light brown poorly graded SAND (SP), mps 5.0 mm, faint										
	146	4	6.5		253.8		stratification, no odor										
		S4A	6.5		7.0	SM	Very dense brown silty SAND with gravel (SM), mps 40.0 mm, well	10	10	10	15	40	15				
		4	7.0		252.8		bonded, no odor, moist										
	72	S5	8.0		8.0		-GLACIAL TILL-										
	67	11	9.5			SP	Very dense yellow-brown poorly graded SAND with gravel (SP), mps										
	152						20.0 mm, well bonded, no odor, moist										
	100/0.5						-GLACIOFLUVIAL DEPOSITS-										
10	22	S6	10.0			SP	Same as above	15	10	10	30	30	5				
	137	8	11.2														
	132/3"						TOP OF BEDROCK AT 11.2 FT										
							SEE CORE BORING REPORT FOR ROCK DETAILS										
15																	
20																	

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft.) to: Bottom of Casing	Bottom of Hole	Water
11/15/01	0740	13	11.5	-	21.7
11/16/01	1300	1.5	11.5	-	24.1
11/19/01	0710	60	11.5	-	22.2

Sample Identification

O Open End Rod
T Thin Wall Tube
U Undisturbed Sample
S Split Spoon
G Geoprobe

Well Diagram

Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary

Overburden (lin. ft.) 11.5
Rock Cored (lin. ft.) 16.0
Samples S6, C4

Boring No. 32Z-01-06XBR

Field Tests: Dilatancy: R-Rapid, S-Slow, N-None
Toughness: L-Low, M-Medium, H-High
Plasticity: N-Nonplastic, L-Low, M-Medium, H-High
Dry Strength: N-None, L-Low, M-Medium, H-High, V-Very High

*SPT = Sampler blows per 6 in.
**Maximum particle size (mm) is determined by direct observation within the limitations of sampler size (in millimeters).

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CORE BORING REPORT

Boring No. 32Z-01-06XBR
File No. 10884-056
Sheet No. 2 of 2

Depth (ft)	Drilling Rate Min./ft	Run No.	Depth (ft)	Recovery/RQD in.	Recovery/RQD %	Weathering	Well Diagram	Elev./ Depth (ft)	Visual Description and Remarks
									SEE TEST BORING REPORT FOR OVERBURDEN DETAILS
								249.6	TOP OF BEDROCK AT 11.2 FT
	11	C1	11.5	57	95	Fresh		11.2	C1: Very hard, fresh, mottled white-gray fine to coarse grained granitic GNEISS. Gneissic foliation extremely thin to massive, at high angles. Joints at horizontal to low angles, close to moderate, smooth to rough, planar to stepped, oxidized, open.
	7		16.5	45	75				
	6								-BEDROCK-
15	7								(Possible Ayer Granite)
	7								
	6	C2	16.5	60	100	Fresh			C2: Same as above, except joints widely to moderately spaced.
	6		21.5	60	100				
	8								
20	10								
	11								
	6	C3	21.5	44	92	Fresh to Slight			C3 to 22.5 ft: Same as above.
	6		25.5	35	73			238.3	
	6							22.5	C3 from 22.5 ft: Very hard, fresh to slightly weathered, gray, aphanitic to medium grained QUARTZITE, with gneissic zone from 23.8 to 25.1 ft. Foliation extremely thin at high angle. Joints extremely close to moderate, smooth, planar, oxidized, open.
25	10								
	30	C4	25.5	23	96	Fresh to Slight			-BEDROCK-
	20		27.5	8	33				C4: Same as above, except observed single vertical joint, smooth, planar, oxidized.
								233.3	
								27.5	BOTTOM OF EXPLORATION 27.5 FT
									INSTALLED PIEZOMETER AT 26.7 FT

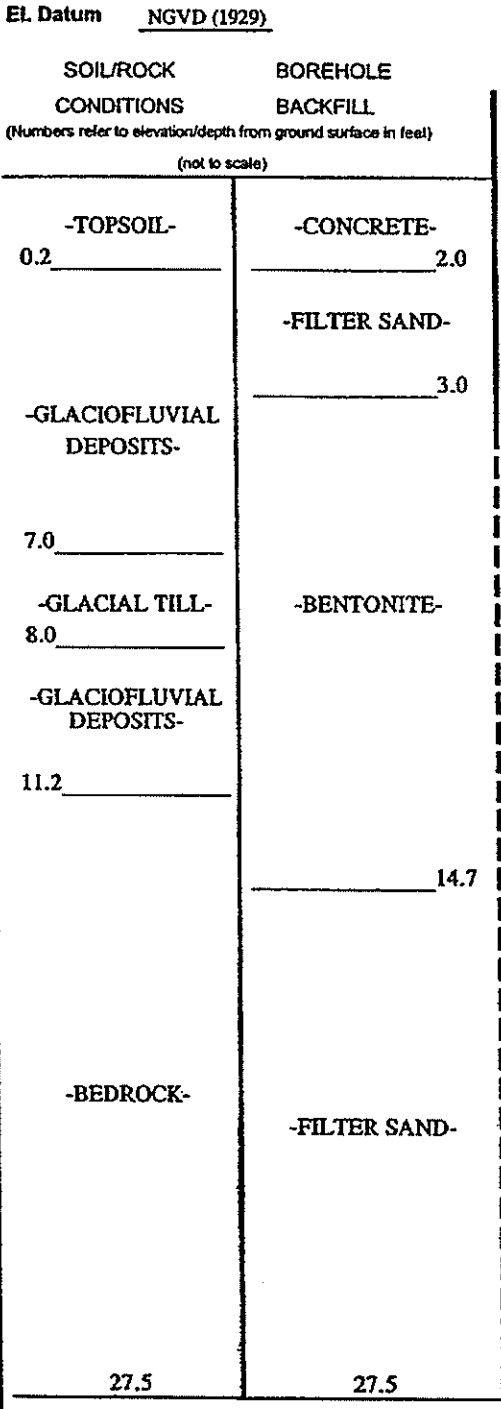
HALEY & ALDRICH

PIEZOMETER INSTALLATION REPORT

Observation Well	32Z-01-06XBR		
Test Boring	32Z-01-06XBR		
Project	MONITORING WELL INSTALLATION AOC32/43A	Installation Date	15-Nov-01
City/State	DEVENS, MA	Location	See Plan
Client	MASSDEVELOPMENT/DEVENS COMMERCE CENTER		
Contractor	EARTH EXPLORATION SERVICES, WRENTHAM, MA	H&A File No.	10884-056
Driller	J. GALVIN	H&A Rep.	A. Nichols

Ground El. 260.8

El. Datum NGVD (1929)



Type of protective cover/lock: Cover/Padlock

Height of top of casing above ground surface: 2.1 ft

Height of top of riser pipe above ground surface: 1.9 ft

Type of protective casing: Guard Pipe

Length: 5.0 ft

Inside diameter: 6.0 in

Depth of bottom of casing: 2.5 ft

Seals:

Type	Depth to top (ft)	Thickness (ft)
Concrete	0.0	2.0
Bentonite Seal	3.0	11.7

Type of riser pipe: Sch 40 PVC Solid

Inside diameter of riser pipe: 2.0 in

Type of backfill around riser: Bentonite

Diameter of borehole: 6.0 in

Depth of top of well screen: 16.7 ft

Type of screen or manufacturer: Machine Slotted PVC

Screen gauge or size of openings: 0.010 in

Diameter of well screen: 2.0 in

Type of backfill around screen: Filter Sand

Depth of bottom of well screen: 26.7 ft

Depth of bottom of silt trap

Depth of bottom of borehole: 27.5 ft

(Depths refer to ground surface)

Remarks:

HALEY & ALDRICH

TEST BORING REPORT

Boring No. 32Z-01-07XOB

Project MONITORING WELL INSTALLATION AOC 32/43A DEVENS, MA
Client MASSDEVELOPMENT/DEVENS COMMERCE CENTER
Contractor EARTH EXPLORATION SERVICES, WRENTHAM, MA

File No. 10884-056
Sheet No. 1 of 2
Start November 16, 2001
Finish November 21, 2001
Driller J.Galvin/T.Martinelli
H&A Rep. A. Nichols
Elevation 258.0
Datum NGVD (1929)
Location See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	SW	S	-	Rig Make & Model: Mobile B-57 ATV
Inside Diameter (in.)	6.0	1 3/8	-	Bit Type: Roller Bit
Hammer Weight (lb.)	300	140	-	Drill Mud: None
Hammer Fall (in.)	30	30	-	Casing: driven
				Hoist/Hammer: Winch Doughnut Hammer

Depth (ft.)	SPT*	Sample No. & Rec. (in.)	Sample Depth (ft.)	Well Diagram	Elev./Depth (ft.)	USCS Symbol	Visual-Manual Identification and Description (Density/consistency, color, GROUP NAME, max. particle size**, structure, odor, moisture, optional descriptions, geologic interpretation)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test: Dilatancy	Field Test: Toughness	Field Test: Plasticity	Field Test: Strength
0	3 6	S1 7	0.0 1.0		257.0	SM	Loose dark brown silty SAND with gravel (SM), mps 20.0 mm, organic odor, dry	10	10				15				
					1.0		-FILL-										
	8 16	S1A 8	1.0 2.0		256.0	SW	Medium dense yellow-brown well graded SAND (SW), mps 0.25 in., no odor, dry		10	30	30	25	5				
	10 13	S2 3	2.0 3.0		2.0 255.0	SM	-FILL- Medium dense gray-brown silty SAND with gravel (SM), mps 1.0 in.,	10	10	10	10	40	20				
	18 23	S2A 7	3.0 4.0		3.0	SP	organic odor, moist -TOPSOIL-	5	5	15	25	45	5				
5	12 19 22 26	S3 10	4.0 6.0			SP	Dense brown poorly graded SAND (SP), mps 5.0 in., no odor, moist -GLACIOFLUVIAL DEPOSITS- Same as above										
					252.0												
	45 25	S4 15	6.0 8.0		6.0 250.5	SW	Very dense brown well graded SAND with gravel (SW), mps 1.0 in., no odor, dry -GLACIOFLUVIAL DEPOSITS-	10	20	20	15	30	5				
					7.5												
	16 13	S5 9	8.0 10.0			ML	Medium dense yellow SILT with sand (ML), mps 2.0 mm, in partings, no odor, dry -GLACIOLACUSTRINE DEPOSITS-					20	80				
10	9	S6 21	10.0 12.0			ML	Same as above, except mps 1.0 in.	5	5			15	75				
					246.0												
	100 68 72 115	S7 16	12.0 14.0		12.0	ML	Very dense yellow-brown sandy SILT with gravel (SM), mps 1.0 in., well bonded, no odor, moist -GLACIAL TILL-	5	10	5	10	20	50			N	
	~~197/4"~~	~~S8~~ 3	~~14.0~~ 14.3			ML	Same as above									N	
15							Note: Drilled through a boulder from 14.3 to 18.0 ft.										
					240.0												
	20 27 27 115/5"	S9 7	18.0 19.9		18.0	SM	Very dense yellow silty SAND with gravel (SM), mps 1.0 in., no odor, wet -GLACIAL TILL-	10	10	15	15	25	25				
20																	

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft.) to: Bottom of Casing	Bottom of Hole	Water
11/21/01	745	43	14.7	20.2	17.7
1/14/02	1345	54 Days	-	22.5	18.0

Sample Identification

O Open End Rod
T Thin Wall Tube
U Undisturbed Sample
S Split Spoon
G Geoprobe

Well Diagram

Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary

Overburden (lin. ft.) 25.2
Rock Cored (lin. ft.) -
Samples S10

Boring No. 32Z-01-07XOB

Field Tests: Dilatancy: R-Rapid, S-Slow, N-None
Toughness: L-Low, M-Medium, H-High
Plasticity: N-Nonplastic, L-Low, M-Medium, H-High
Dry Strength: N-None, L-Low, M-Medium, H-High, V-Very High

*SPT = Sampler blows per 6 in. **Maximum particle size (mm) is determined by direct observation within the limitations of sampler size (in millimeters).

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

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HALEY & ALDRICH

TEST BORING REPORT

Boring No. 32Z-01-07XOB
File No. 10884-056
Sheet No. 2 of 2

Depth (ft.)	SPT*	Sample No. & Rec. (in.)	Sample Depth (ft.)	Well Diagram	Elev./Depth (ft.)	USCS Symbol	Visual-Manual Identification and Description (Density/consistency, color, GROUP NAME, max. particle size**, structure, odor, moisture, optional descriptions, geologic interpretation)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
20							Note: Boulder from 19.5 to 23.7 ft.										
							-GLACIAL TILL-										
	94	S10	24.0		233.5	SM	Same as above										
	85	2	24.5		24.5	ML	Very dense yellow SILT (ML), mps 0.1 mm, in partings, no odor, wet						100			N	
25	120/3"	S10A	24.5		232.8		-GLACIOLACUSTRINE DEPOSITS-										
		9	25.2		25.2		REFUSAL AT 25.2 FT										
							INSTALLED PIEZOMETER AT 22.7 FT										

*SPT = Sampler blows per 6 in. **Maximum particle size (mm) is determined by direct observation within the limitations of sampler

HALEY & ALDRICH

TEST BORING REPORT

Boring No.32Z-01-08XOB

Project MONITORING WELL INSTALLATION AOC 32/43A DEVENS, MA
Client MASSDEVELOPMENT/DEVENS COMMERCE CENTER
Contractor EARTH EXPLORATION SERVICES, WRENTHAM, MA

File No. 10884-056
Sheet No. 1 of 2
Start December 10, 2001
Finish December 10, 2001
Driller R. Eastwood
H&A Rep. W. Rubik
Elevation 258.8
Datum NGVD (1929)
Location See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	SW	S	-	Rig Make & Model: Mobile B-57 Truck
Inside Diameter (in.)	6.0	1 3/8	-	Bit Type: Roller Bit
Hammer Weight (lb.)	300	140	-	Drill Mud: None
Hammer Fall (in.)	30	30	-	Casing: driven
				Hoist/Hammer: Winch Doughnut Hammer

Depth (ft.)	SPT*	Sample No. & Rec. (in.)	Sample Depth (ft.)	Well Diagram	Elev./Depth (ft.)	USCS Symbol	Visual-Manual Identification and Description (Density/consistency, color, GROUP NAME, max. particle size**, structure, odor, moisture, optional descriptions, geologic interpretation)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0	22	S1	0.0			ML	Very dense mottled gray-brown sandy SILT with gravel (ML), mps 1.0 in., disturbed, no odor, dry	5	10	5	10	20	50				
	37	14	2.0				-FILL-										
	38																
	42																
	19	S2	2.0			ML	Same as above										
	23	5	3.0		255.8												
	27	S2A	3.0		3.0	OL/	Black ORGANIC SOIL (OL/OH)				10	10	80				
	14	12	4.0		255.5	OH	-FORMER TOPSOIL-			5	5	20	70				
	7	S3	4.0		3.3	ML	Dense yellow-brown sandy SILT (ML), mps 3.0 mm, in partings, no				5	65	30				
	12	12	5.0		254.8	SM	odor, dry										
5					4.0		-LOESS-										
	23	S3A	5.0		253.8	SP-	Medium dense yellow silty SAND (SM), mps 2.0 mm, in partings, no	10	10	10	20	40	10				
	40	4	6.0		5.0	SM	odor, dry										
	21	S4	6.0			SP-		5	10	10	25	40	10				
	36	11	8.0			SM	-LOESS-										
	41						Very dense gray-brown poorly graded SAND with silt and gravel										
	56						(SP-SM), mps 1.0 in., stratified, no odor, dry										
					250.8												
	32	S5	8.0		8.0	SP	Same as above	5	10	20	50	10	5				
	28	9	10.0				-GLACIOFLUVIAL DEPOSITS-										
	40																
	48						Very dense gray-brown poorly graded SAND with gravel (SP), mps 1.0										
					248.8		in., no odor, wet										
10	22	S6	10.0		10.0	SP			5	25	60	10					
	16	14	12.0				-GLACIOFLUVIAL DEPOSITS-										
	21						Dense gray-brown poorly graded SAND (SP), mps 0.75 in., stratified,										
	23						no odor, moist										
	15	S7	12.0			SP	Same as above	5	5	25	55	10					
	21	12	14.0														
	29						-GLACIOFLUVIAL DEPOSITS-										
	32																
					244.8												
	27	S8	14.0		14.0	SP	Dense gray-brown poorly graded SAND with gravel (SP), mps 1.0 in.,	5	20	35	30	10					
	27	14	16.0				stratified, no odor, wet										
15	19																
	22						-GLACIOFLUVIAL DEPOSITS-										
	53	S9	16.0			SP	Same as above, except very dense	10	15	30	30	10	5				
	125	11	17.0		241.8												
					17.0	ML	Note: Boulder from 17.0 to 20.2 ft.										
							-GLACIAL TILL-										
20																	

Water Level Data					
Date	Time	Elapsed Time (hr.)	Depth (ft.) to: Bottom of Casing	Bottom of Hole	Water
1/14/02	1300	35 Days	-	21.7	19.0

Sample Identification		Well Diagram	
O	Open End Rod		Riser Pipe
T	Thin Wall Tube		Screen
U	Undisturbed Sample		Filter Sand
S	Split Spoon		Cuttings
G	Geoprobe		Grout
			Concrete
			Bentonite Seal

Summary	
Overburden (lin. ft.)	22.5
Rock Cored (lin. ft.)	-
Samples	S10

Boring No. 32Z-01-08XOB

Field Tests: Dilatancy: R-Rapid, S-Slow, N-None Plasticity: N-Nonplastic, L-Low, M-Medium, H-High
Toughness: L-Low, M-Medium, H-High Dry Strength: N-None, L-Low, M-Medium, H-High, V-Very High

*SPT = Sampler blows per 6 in. **Maximum particle size (mm) is determined by direct observation within the limitations of sampler size (in millimeters).

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TEST BORING REPORT

Boring No. 32Z-01-08XOB
File No. 10884-056
Sheet No. 2 of 2

Depth (...)	SPT*	Sample No. & Rec. (in.)	Sample Depth (ft.)	Well Diagram	Elev./Depth (ft.)	USCS Symbol	Visual-Manual Identification and Description (Density/consistency, color, GROUP NAME, max. particle size**, structure, odor, moisture, optional descriptions, geologic interpretation)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
20																	
	49 60 30 30	S10 11	20.5 22.5		236.3	ML	Very dense yellow-brown sandy SILT with gravel (ML), mps 3.2 ft, well bonded, no odor, wet -GLACIAL TILL-										
					22.5		BOTTOM OF EXPLORATION 22.5 FT INSTALLED PIEZOMETER AT 22.0 FT										

*SPT = Sampler blows per 6 in. **Maximum particle size (mm) is determined by direct observation within the limitations of sampler

PIEZOMETER INSTALLATION REPORT

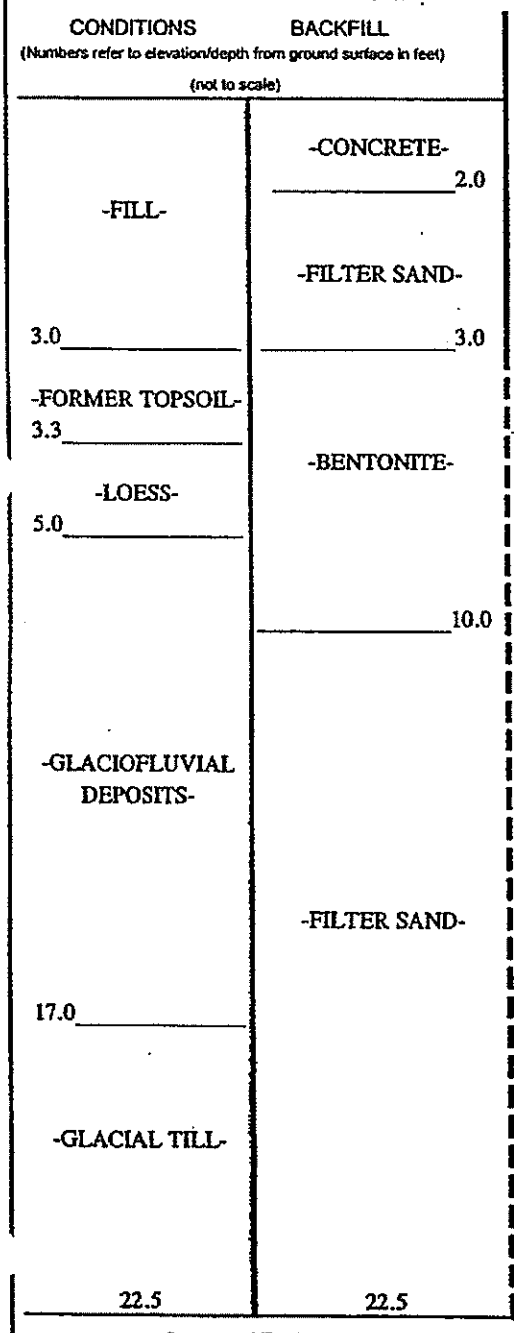
HALEY & ALDRICH

Project	MONITORING WELL INSTALLATION AOC32/43A
City/State	DEVENS, MA
Client	MASSDEVELOPMENT/ DEVENS COMMERCE CENTER
Contractor	EARTH EXPLORATION SERVICES, WRENTHAM, MA
Driller	R. EASTWOOD

Piezometer	32Z-01-08XOB
Test Boring	32Z-01-08XOB
Installation Date	10-Dec-01
Location	See Plan
H&A File No.	10884-056
H&A Rep.	W. Rubik

Ground El. 258.8

El. Datum NGVD (1929)



Type of protective cover/lock: Cover/Padlock

Height of top of casing above ground surface: 2.9 ft

Height of top of riser pipe above ground surface: 2.5 ft

Type of protective casing: Guard Pipe

Length: 5.0 ft

Inside diameter: 6.0 in

Depth of bottom of roadway box: 2.0 ft

Seals:

Type	Depth to top (ft)	Thickness (ft)
Concrete	0.0	2.0
Bentonite Seal	3.0	7.0

Type of riser pipe: Sch 40 PVC Solid

Inside diameter of riser pipe: 2.0 in

Type of backfill around riser: Seal

Diameter of borehole: 6.5 in

Depth of top of well screen: 12.0 ft

Type of screen or manufacturer: Machine Slotted PVC

Screen gauge or size of openings: 0.010 in

Diameter of well screen: 2.0 in

Type of backfill around screen: Filter Sand

Depth of bottom of well screen: 22.0 ft

Depth of bottom of silt trap

Depth of bottom of borehole: 22.5 ft

(Depths refer to ground surface)

Remarks: Ground El. reflects estimated ground surface at time of drilling, prior to gravel pad placement.

HALEY & ALDRICH

TEST BORING REPORT

Boring No.32Z-01-09XOB

Project MONITORING WELL INSTALLATION AOC 32/43A DEVENS, MA
Client MASSDEVELOPMENT/DEVENS COMMERCE CENTER
Contractor EARTH EXPLORATION SERVICES, WRENTHAM, MA

File No. 10884-056
Sheet No. 1 of 2
Start November 19, 2001
Finish November 19, 2001
Driller R. Eastwood
H&A Rep. W. Rubik
Elevation 258.6
Datum NGVD (1929)
Location See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	-/SW	S	-	Rig Make & Model: Mobile B-57 Truck
Inside Diameter (in.)	8.0/6.0	1 3/8	-	Bit Type: Roller Bit
Hammer Weight (lb.)	300	140	-	Drill Mud: None
Hammer Fall (in.)	24	30	-	Casing: 8" Casing to 34.0 ft.
				Hoist/Hammer: Winch Doughnut Hammer

Depth (ft.)	SPT*	Sample No. & Rec. (in.)	Sample Depth (ft.)	Well Diagram	Elev./Depth (ft.)	USCS Symbol	Visual-Manual Identification and Description (Density/consistency, color, GROUP NAME, max. particle size**, structure, odor, moisture, optional descriptions, geologic interpretation)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0					258.1		-Black ASPHALT-										
	31 37 46	S1 15	0.5 2.0		0.5	SM	Very dense mottled brown-gray silty SAND with gravel (SM), trace asphalt specks, mps 1.5 in., no odor, moist to wet	10	10	10	20	30	20				
	25 17 11 12	S2 19	2.0 4.0		255.6	SM	Same as above, except dense										
					3.0		-FILL-										
	8 13 11 14	S3 10	4.0 6.0			SP	Medium dense brown to light gray poorly-graded SAND (SP), mps 0.25 mm., stratified, no odor, dry		5	10	20	60	5				
5						SP	Same as above PID = -GLACIOFLUVIAL DEPOSITS- ppm										
					252.6												
	17 24 16 15	S4 12	6.0 8.0		6.0	SP	-GLACIOFLUVIAL DEPOSITS- Dense light gray poorly-graded SAND with gravel (SP), mps 2.0 in., stratified, no odor, dry	10	10	15	20	40	5				
					250.6		-GLACIOFLUVIAL DEPOSITS-										
	10 11 17 17	S5 10	8.0 10.0		8.0	SP	Medium dense light gray to brown poorly-graded SAND (SP), mps 0.25 in., stratified, no odor, wet		5	15	30	45	5				
					248.6		-GLACIOFLUVIAL DEPOSITS-										
10	17 20 14 18	S6 11	10.0 12.0		10.0	SW	Dense light brown well-graded SAND with gravel (SW), mps 1.5 in., stratified, no odor, wet	10	15	20	25	25	5				
	17 14 19 24	S7 18	12.0 14.0			SW	Same as above										
					244.6		-GLACIOFLUVIAL DEPOSITS-										
	13 15 18 19	S8 13	14.0 16.0		14.0	SP	Dense light brown poorly-graded SAND (SP), mps 3.0 mm., in partings, no odor, moist				45	50	5				
15					242.6		-GLACIOFLUVIAL DEPOSITS-										
	23 35 77 120	S9 17	16.0 18.0		16.0	SP	Very dense brown poorly-graded SAND with gravel (SP), mps 2.0 in., stratified, no odor, moist	10	15	15	25	30	5				
					240.6		-GLACIOFLUVIAL DEPOSITS-										
	57 27 19 27	S10 11	18.0 20.0		18.0	SP	Dense light brown poorly-graded SAND (SP), mps 0.25 in., stratified, no odor, wet		10	5	40	40	5				
20							-GLACIOFLUVIAL DEPOSITS-										

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft.) to: Bottom of Casing	Bottom of Hole	Water
11/20/01	0740	16	16.0	18.0	dry
11/28/01	0730	in well	-	-	28.9
1/12/02	1300	55 Days	-	33.5	30.0

Sample Identification

O Open End Rod
T Thin Wall Tube
U Undisturbed Sample
S Split Spoon
G Geoprobe

Well Diagram

Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary

Overburden (lin. ft.) 34.0
Rock Cored (lin. ft.) -
Samples S17

Boring No. 32Z-01-09XOB

Field Tests: Dilatancy: R-Rapid, S-Slow, N-None Plasticity: N-Nonplastic, L-Low, M-Medium, H-High
Toughness: L-Low, M-Medium, H-High Dry Strength: N-None, L-Low, M-Medium, H-High, V-Very High

*SPT = Sampler blows per 6 in. **Maximum particle size (mm) is determined by direct observation within the limitations of sampler size (in millimeters).

HALEY & ALDRICH

TEST BORING REPORT

Boring No. 32Z-01-09XOB
File No. 10884-056
Sheet No. 2 of 2

Depth (ft.)	SPT*	Sample No. & Rec. (in.)	Sample Depth (ft.)	Well Diagram	Elev./Depth (ft.)	USCS Symbol	Visual-Manual Identification and Description (Density/consistency, color, GROUP NAME, max. particle size**, structure, odor, moisture, optional descriptions, geologic interpretation)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
20	23 25 19 18	S11 10	20.0 22.0			SP	Same as above -GLACIOFLUVIAL DEPOSITS-										
	22 24 27 42	S12 13	22.0 24.0			SP	Same as above, except very dense, moist		5	5	45	40	5				
	34 23 45 56	S13 15	24.0 26.0		234.1 24.5	SW	Very dense light brown well-graded SAND with gravel (SW), mps 1.0 in., stratified, no odor, moist to wet	10	20	20	25	20	5				
25	29 43 35 43	S14 13	26.0 28.0			SW	Same as above -GLACIOFLUVIAL DEPOSITS-										
	40 19 13 17	S15 7	28.0 30.0		230.6 28.0	GP	Dense brown poorly-graded GRAVEL with sand (GP), mps 3.0 in., no odor, wet -GLACIOFLUVIAL DEPOSITS-	30	25	25	15	5					
30	13 13 14 10	S16 0	30.0 32.0				No recovery. Pushing gravel.										
	21 19 22 33	S17 14	32.0 34.0		226.6 32.0	SP	Dense light brown poorly-graded SAND (SP), mps 0.5 in., stratified, no odor, wet -GLACIOFLUVIAL DEPOSITS-		5	25	40	25	5				
					224.6 34.0		BOTTOM OF EXPLORATION 34.0 FT. INSTALLED PIEZOMETER AT 33.5 FT.										

*SPT = Sampler blows per 6 in. **Maximum particle size (mm) is determined by direct observation within the limitations of sampler

HALEY & ALDRICH

PIEZOMETER INSTALLATION REPORT

Project	MONITORING WELL INSTALLATION AOC32/43A	Piezometer	32Z-01-09XOB
City/State	DEVENS, MA	Test Boring	32Z-01-09XOB
Client	MASSDEVELOPMENT/ DEVENS COMMERCE CENTER	Installation Date	20-Nov-01
Contractor	EARTH EXPLORATION SERVICES, WRENTHAM, MA	Location	See Plan
Driller	R. EASTWOOD	H&A File No.	10884-056
		H&A Rep.	W. Rubik

Ground El. 258.6

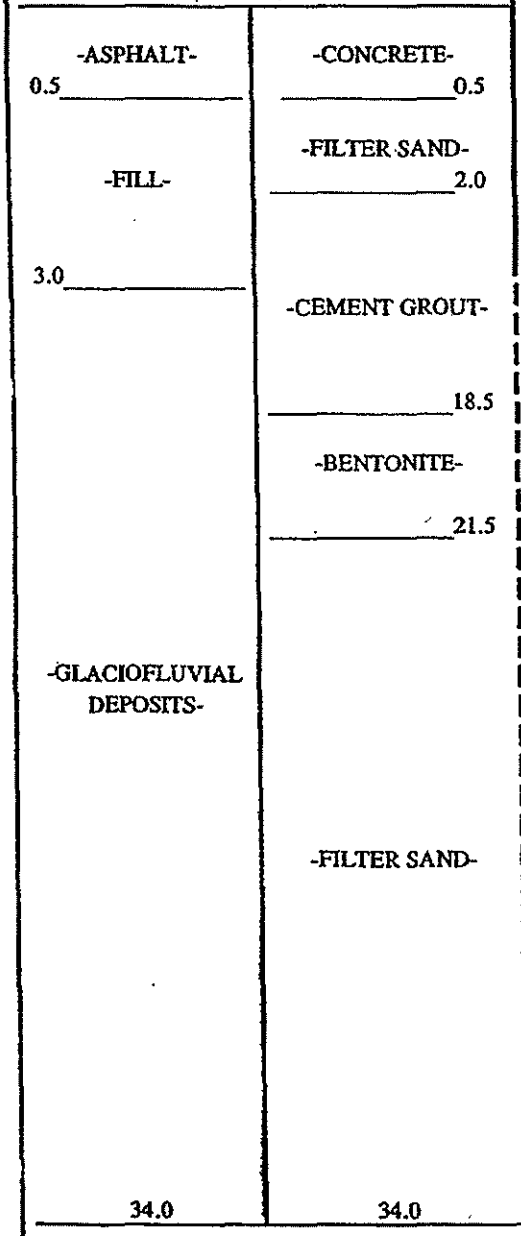
El. Datum NGVD (1929)

SOIL/ROCK CONDITIONS

BOREHOLE BACKFILL

(Numbers refer to elevation/depth from ground surface in feet)

(not to scale)



Type of protective cover/lock: Bolted Cover

Depth of top of roadway box below ground surface: 0.0 ft

Depth of top of riser pipe below ground surface: 0.4 ft

Type of protective casing: Roadway Box

Length: 0.8 ft

Inside diameter: 6.0 in

Depth of bottom of casing: 0.8 ft

Seals:

Type	Depth to top (ft)	Thickness (ft)
Concrete	0.0	0.5
Cement Grout	2.0	16.5
Bentonite	18.5	3.0

Type of riser pipe: Sch 40 PVC Solid

Inside diameter of riser pipe: 2.0 in

Type of backfill around riser: Seal

Diameter of borehole: 9.0 in

Depth of top of well screen: 23.5 ft

Type of screen or manufacturer: Machine Slotted PVC

Screen gauge or size of openings: 0.010 in

Diameter of well screen: 2.0 in

Type of backfill around screen: Filter Sand

Depth of bottom of well screen: 33.5 ft

Depth of bottom of silt trap

Depth of bottom of borehole: 34.0 ft

(Depths refer to ground surface)

Remarks:

HALEY & ALDRICH

TEST BORING REPORT

Boring No.32Z-01-10XBR

Project MONITORING WELL INSTALLATION AOC 32/43A DEVENS, MA
Client MASSDEVELOPMENT/DEVENS COMMERCE CENTER
Contractor EARTH EXPLORATION SERVICES, WRENTHAM, MA

File No. 10884-056
Sheet No. 1 of 2
Start December 31, 2001
Finish January 2, 2002
Driller J.Galvin
H&A Rep. D. Velozzi
Elevation 258.6
Datum NGVD (1929)
Location See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	SW	S	HQ	Rig Make & Model: Mobile B-57 ATV
Inside Diameter (in.)	6.0	1 3/8	2.5	Bit Type: Roller Bit
Hammer Weight (lb.)	300	140	-	Drill Mud: None
Hammer Fall (in.)	24	30	-	Casing: SW to 9.0 ft.
				Hoist/Hammer: Winch Doughnut Hammer

Depth (ft.)	SPT*	Sample No. & Rec. (in.)	Sample Depth (ft.)	Well Diagram	Elev./Depth (ft.)	USCS Symbol	Visual-Manual Identification and Description (Density/consistency, color, GROUP NAME, max. particle size**, structure, odor, moisture, optional descriptions, geologic interpretation)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0					258.0		-Black ASPHALT-										
	110 93 90	S1 15	0.6 2.0		0.6	SM	Very dense dark brown silty SAND with gravel (SM), mps 6.0 mm, no structure, no odor, moist	10	10		15	25	40				
	10 25 20 15	S2 12	2.0 4.0			SM	-FILL- Medium dense dark brown silty SAND with gravel (SM), mps 1.0 in., no structure, no odor, wet	10	25	15	30	15	20				
					254.6												
5	32 28 70 50	S3 6	4.0 6.0		4.0	GP	Very dense dark brown poorly graded GRAVEL with sand (GP), mps 3.0 in., no structure, no odor, wet -FILL-	30	30	20	20						
	32 80 120	S4 4	6.0 7.5			SP	Same as above	40	30	15	15						
							TOP OF BEDROCK AT 7.5 FT										
							SEE CORE BORING REPORT FOR ROCK DETAILS										
10																	
15																	
20																	

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft.) to: Bottom of Casing	Bottom of Hole	Water
1/03/02	0700	16	9.0	27.0	21.0
1/11/02	0855	9 Days	-	22.5	21.8

Sample Identification

O Open End Rod
T Thin Wall Tube
U Undisturbed Sample
S Split Spoon
G Geoprobe

Well Diagram

Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary

Overburden (lin. ft.) 10.0
Rock Cored (lin. ft.) 17.0
Samples S4, C4

Boring No. 32Z-01-10XBR

Field Tests: Dilatancy: R-Rapid, S-Slow, N-None Plasticity: N-Nonplastic, L-Low, M-Medium, H-High
Toughness: L-Low, M-Medium, H-High Dry Strength: N-None, L-Low, M-Medium, H-High, V-Very High

*SPT = Sampler blows per 6 in. **Maximum particle size (mm) is determined by direct observation within the limitations of sampler size (in millimeters)

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CORE BORING REPORT

Boring No. 32Z-01-10XBR
File No. 10884-056
Sheet No. 2 of 2

Depth (ft)	Drilling Rate Min./ft	Run No.	Depth (ft)	Recovery/RQD in.	Recovery/RQD %	Weathering	Well Diagram	Elev./ Depth (ft)	Visual Description and Remarks
									SEE TEST BORING REPORT FOR OVERBURDEN DETAILS
								251.1 7.5	TOP OF BEDROCK AT 7.5 FT
									Note: Advanced roller bit to 10.0 ft.
10	3	C1	10.0 14.0	45 4	93 8	Fresh to Slight			-BEDROCK- C1 to 12.0 ft: Very hard, fresh to slightly weathered, gray white aphanitic to fine grained QUARTZITE. Foliation extremely thin at high angle. Joints at moderate to high angle, extremely close to close, rough, stepped to planar, oxidized, tight to open
	3							246.6 12.0	
	4					Fresh to Moderate			C1 from 12.0 ft: Very hard, fresh to moderately weathered, gray white, fine to coarse grained QUARTZITE. Foliation extremely thin at high angle. Joint sets at high angle, close to open, rough, stepped to planar, oxidized, tight to open
	4							244.6 14.0	
	4	C2	14.0 19.0	59 23	98 38	Fresh to Slight			-BEDROCK- Note: Cavities 1.0 to 4.0 in., vugs, highly weathered quartz veins. C2 from 14.0 ft: Very hard, fresh to slightly weathered, aphanitic to fine grained QUARTZITE. Foliation extremely thin at high angle. Joints at high angle, extremely close to moderate, smooth to rough, planar to stepped, oxidized, tight to open
15	5								
	3								
	4								
	5								-BEDROCK- (Possible Vaughn Hills Formation)
	4	C3	19.0 22.0	29 13	81 36	Fresh to Slight			C3: Same as above, except oxidized from 21.0 to 22.0 ft
20	5								
	5								
	5	C4	22.0 27.0	52 30	87 50	Fresh to Slight			C4: Very hard, fresh to slightly weathered, gray white, aphanitic to fine grained QUARTZITE. Foliation extremely thin at high angle. Primary joint set extremely thin at high angle, extremely close to close, rough, stepped to planar, oxidized, tight to open. Secondary joint set at low angle, moderate, rough, planar, oxidized, tight to open
	5								
25	4								
	5								
	4							231.6 27.0	BOTTOM OF EXPLORATION 27.0 FT
									INSTALLED PIEZOMETER AT 22.5 FT

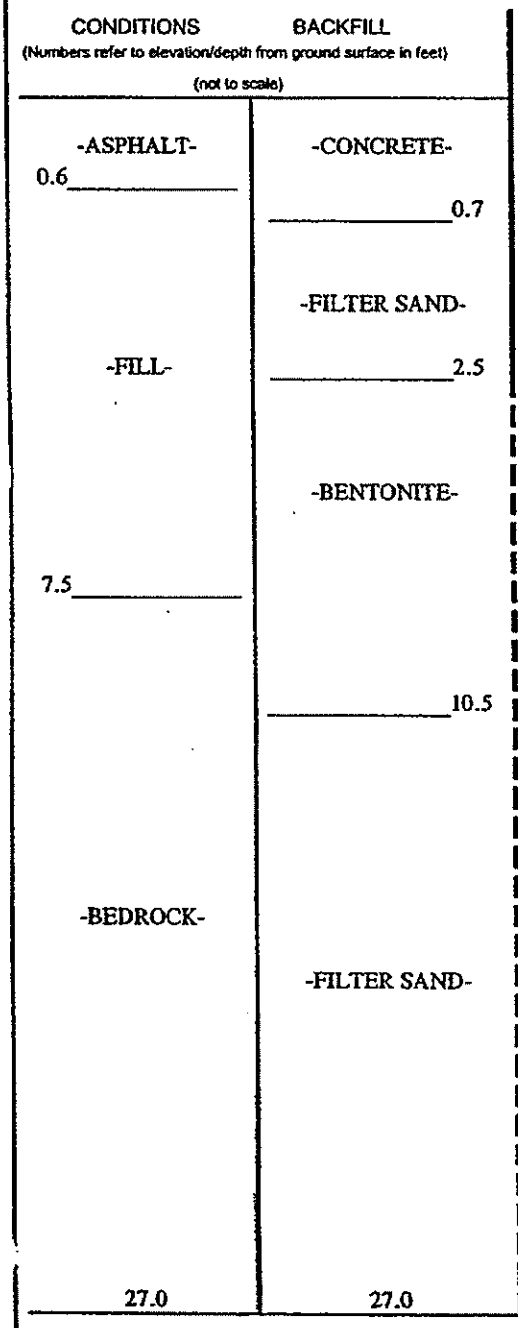
HALEY & ALDRICH

PIEZOMETER INSTALLATION REPORT

Project	MONITORING WELL INSTALLATION AOC32/43A	Observation Well	32Z-01-10XBR
City/State	DEVENS, MA	Test Boring	32Z-01-10XBR
Client	MASSDEVELOPMENT/DEVENS COMMERCE CENTER	Installation Date	2-Jan-02
Contractor	EARTH EXPLORATION SERVICES, WRENTHAM, MA	Location	See Plan
Driller	J. GALVIN	H&A File No.	10884-056
		H&A Rep.	D. Velozzi

Ground El. 258.6

El. Datum NGVD (1929)



Type of protective cover: Bolted Cover

Depth of top of roadway box below ground surface: 0.0 ft

Depth of top of riser pipe below ground surface: 0.4 ft

Type of protective casing: Roadway Box

Length: 0.8 ft

Inside diameter: 6.0 in

Depth of bottom of roadway box: 0.8 ft

Seals:

Type	Depth to top (ft)	Thickness (ft)
Concrete	0.0	0.7
Bentonite Seal	2.5	8.0

Type of riser pipe: Sch 40 PVC Solid

Inside diameter of riser pipe: 2.0 in

Type of backfill around riser: Seal

Diameter of borehole: 6.0 in

Depth of top of well screen: 12.5 ft

Type of screen or manufacturer: Machine Slotted PVC

Screen gauge or size of openings: 0.010 in

Diameter of well screen: 2.0 in

Type of backfill around screen: Filter Sand

Depth of bottom of well screen: 22.5 ft

Depth of bottom of silt trap

Depth of bottom of borehole: 27.0 ft

(Depths refer to ground surface)

Remarks:

HALEY & ALDRICH

TEST BORING REPORT

Boring No.32Z-01-11XBR

Project MONITORING WELL INSTALLATION AOC 32/43A DEVENS, MA
Client MASSDEVELOPMENT/DEVENS COMMERCE CENTER
Contractor EARTH EXPLORATION SERVICES, WRENTHAM, MA

File No. 10884-056
Sheet No. 1 of 2
Start November 13, 2001
Finish November 13, 2001
Driller R. Eastwood
H&A Rep. J. Morey
Elevation 262.8
Datum NGVD (1929)
Location See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	SW	S	HQ	Rig Make & Model: Mobile B-57 Truck
Inside Diameter (in.)	6.0	1 3/8	2.5	Bit Type: Roller Bit
Hammer Weight (lb.)	300	140	-	Drill Mud: None
Hammer Fall (in.)	30	30	-	Casing: driven
				Hoist/Hammer: Winch Doughnut Hammer

Depth (ft.)	SPT*	Sample No. & Rec. (in.)	Sample Depth (ft.)	Well Diagram	Elev./Depth (ft.)	USCS Symbol	Visual-Manual Identification and Description (Density/consistency, color, GROUP NAME, max. particle size**, structure, odor, moisture, optional descriptions, geologic interpretation)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0					262.5		-Black ASPHALT-										
	100/2"	S1	0.3		0.3	SP-SM	Very dense dark brown to black SAND with silt and gravel (SP-SM), mps 1.25 in., no structure, no odor, dry, particles and fragments of brick	5	10	20	30	20	10				
	33	12	1.5				PID = 0.0/0.0 ppm										
	15																
	44	S2	2.0			SP-SM	Same as above										
	39	14	4.0				PID = 0.0/0.0 ppm										
	66																
	52				258.8		-FILL-										
	24	S3	4.0		4.0	SP	Note: 6.0 in. cobble at 3.5 ft.		20	30	40	10					
5	29	10	6.0				Very dense brown to tan poorly-graded SAND with gravel (SP), mps 0.5 in., homogeneous, no odor, wet										
	35						PID = 0.0/0.0 ppm										
	25																
	10	S4	6.0			SP			10	30	50	10					
	14	18	8.0				-GLACIOFLUVIAL DEPOSITS-										
	16						Dense to very dense light brown poorly-graded SAND with gravel (SP), mps 0.5 in., homogeneous, no odor, wet										
	49						PID = 0.0/0.0 ppm										
							TOP OF BEDROCK AT 8.0 FT.										
10							SEE CORE BORING REPORT FOR ROCK DETAILS										
15																	
20																	

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft.) to: Bottom of Casing	Bottom of Hole	Water
11/14/01	1130	-	21.0	21.0	10.75
1/11/02	1200	59 Days	-	17.85	17.65

Sample Identification

O Open End Rod
T Thin Wall Tube
U Undisturbed Sample
S Split Spoon
G Geoprobe

Well Diagram

Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary

Overburden (lin. ft.) 11.0
Rock Cored (lin. ft.) 10.0
Samples S4, C2

Boring No. 32Z-01-11XBR

Field Tests: Dilatancy: R-Rapid, S-Slow, N-None
Toughness: L-Low, M-Medium, H-High
Plasticity: N-Nonplastic, L-Low, M-Medium, H-High
Dry Strength: N-None, L-Low, M-Medium, H-High, V-Very High

*SPT = Sampler blows per 6 in. **Maximum particle size (mm) is determined by direct observation within the limitations of sampler size (in millimeters)

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CORE BORING REPORT

Boring No. 32Z-01-11XBR
File No. 10884-056
Sheet No. 2 of 2

Depth (ft)	Drilling Rate Min./ft	Run No.	Depth (ft)	Recovery/RQD in.	Recovery/RQD %	Weathering	Well Diagram	Elev./ Depth (ft)	Visual Description and Remarks
									SEE TEST BORING REPORT FOR OVERBURDEN DETAILS
								254.8 8.0	TOP OF BEDROCK AT 8.0 FT.
10									
	8	C1	11.0 16.0	57 54	95 90	Fresh to Slight			C1: Very hard fresh to slightly weathered, gray with black streaks, medium- to coarse-grained granitic GNEISS, few joints, horizontal to low angle, close spacing, rough, undulating, fresh, open, minor garnet growth.
	6								
	6								-BEDROCK- (Possible Ayer Granite)
	5								
15	5								
	6	C2	16.0 21.0	58 58	97 97	Fresh to Slight			C2: Similar to C1.
	5								
	7								
	7								
20	6								
								241.8 21.0	BOTTOM OF EXPLORATION 21.0 FT.
									INSTALLED PIEZOMETER AT 19.0 FT.

HALEY & ALDRICH

PIEZOMETER INSTALLATION REPORT

Observation Well	32Z-01-11XBR		
Test Boring	32Z-01-11XBR		
Project	MONITORING WELL INSTALLATION AOC32/43A	Installation Date	14-Nov-01
City/State	DEVENS, MA	Location	See Plan
Client	MASSDEVELOPMENT/DEVENS COMMERCE CENTER		
Contractor	EARTH EXPLORATION SERVICES, WRENTHAM, MA	H&A File No.	10884-056
Driller	R. EASTWOOD	H&A Rep.	J. Morey

Ground El. 262.8

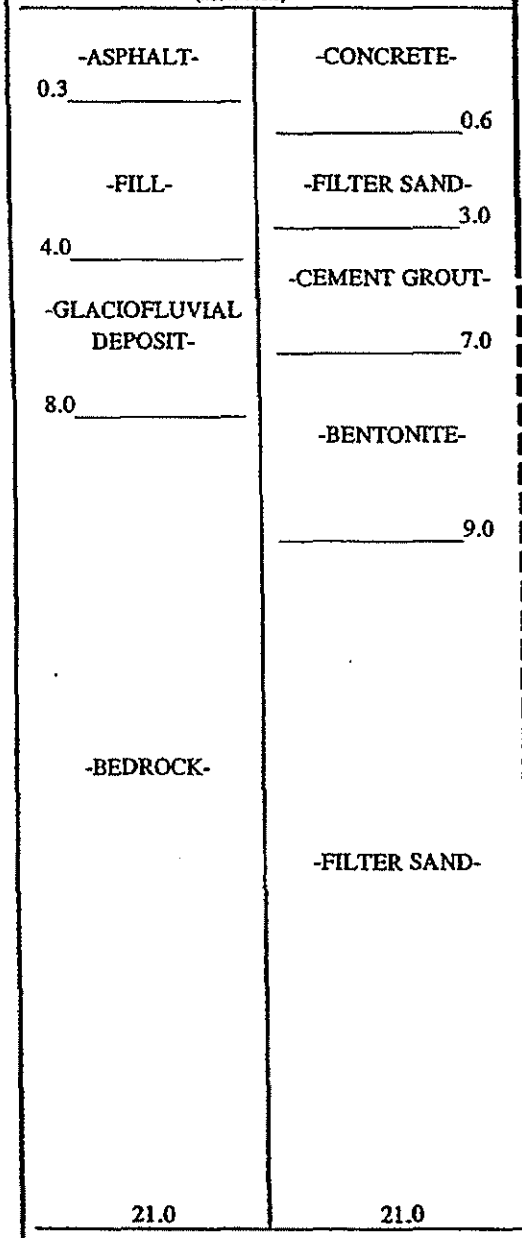
El. Datum NGVD (1929)

SOIL/ROCK CONDITIONS

BOREHOLE BACKFILL

(Numbers refer to elevation/depth from ground surface in feet)

(not to scale)



Type of protective cover/lock: Bolted Cover

Depth of top of roadway box below ground surface: 0.0 ft

Depth of top of riser pipe below ground surface: 0.6 ft

Type of protective casing: Roadway Box

Length: 0.8 ft

Inside diameter: 6.0 in

Depth of bottom of casing: 0.8 ft

Seals:

Type	Depth to top (ft)	Thickness (ft)
Concrete	0.0	0.6
Cement Grout	3.0	4.0
Bentonite Seal	7.0	2.0

Type of riser pipe: Sch 40 PVC Solid

Inside diameter of riser pipe: 2.0 in

Type of backfill around riser: Seal

Diameter of borehole: 6.0 in

Depth of top of well screen: 9.0 ft

Type of screen or manufacturer: Machine Slotted PVC

Screen gauge or size of openings: 0.010 in

Diameter of well screen: 2.0 in

Type of backfill around screen: Filter Sand

Depth of bottom of well screen: 19.0 ft

Depth of bottom of silt trap

Depth of bottom of borehole: 21.0 ft

(Depths refer to ground surface)

Remarks:

HALEY & ALDRICH

TEST BORING REPORT

Boring No.32Z-01-12XBR

Project MONITORING WELL INSTALLATION AOC 32/43A DEVENS, MA
Client MASSDEVELOPMENT/DEVENS COMMERCE CENTER
Contractor EARTH EXPLORATION SERVICES, WRENTHAM, MA

File No. 10884-056
Sheet No. 1 of 3
Start November 15, 2001
Finish November 15, 2001
Driller R. Eastwood
H&A Rep. J.Morey/W.Rubik
Elevation 259.1
Datum NGVD (1929)
Location See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	SW	S	HQ	Rig Make & Model: Mobile B-57 Truck
Inside Diameter (in.)	6.0	1 3/8	2.5	Bit Type: Roller Bit
Hammer Weight (lb.)	300	140	-	Drill Mud: None
Hammer Fall (in.)	24	30	-	Casing: driven
				Hoist/Hammer: Winch Doughnut Hammer

Depth (ft.)	SPT*	Sample No. & Rec. (in.)	Sample Depth (ft.)	Well Diagram	Elev./Depth (ft.)	USCS Symbol	Visual-Manual Identification and Description (Density/consistency, color, GROUP NAME, max. particle size**, structure, odor, moisture, optional descriptions, geologic interpretation)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0					258.7		-ASPHALT-										
	39 35 25	S1 12	0.4 2.0		0.4	SP-SM	Very dense dark brown to black SAND with silt and gravel (SP-SM), mps 1.0 in., no structure, no odor, moist PID = 0.3/0.3 ppm	5	15	20	30	20	10				
	14 13 10 6	S2 3	2.0 4.0			SP	Medium dense dark brown to black SAND with gravel (SP), mps 5.0 mm., no structure, no odor, moist PID = 0.3/0.3 ppm		10	15	40	30	5				
					255.1		-FILL-										
	6 8 13 17	S3 6	4.0 6.0		4.0	SP	Medium dense brown to tan SAND with gravel (SP), mps 4.0 mm., no structure, no odor, dry PID = 0.1/0.1 ppm		10	10	50	30					
5	18 19 22 24	S4 20	6.0 8.0			SP	-GLACIOFLUVIAL DEPOSITS- Dense light brown to tan SAND with gravel (SP), mps 4.0 mm., no structure, no odor, dry PID = 0.1/0.1 ppm		10	20	40	30					
	14 18 23 40	S5 3	8.0 10.0			SP	Dense light brown SAND with gravel (SP), mps 5.0 mm., no structure, no odor, wet, cobble stuck in head of spoon PID = 0.1/0.1 ppm		15	20	40	20	5				
10	13 18 27 26	S6 6	10.0 12.0			SP	Similar to above PID = 0.1/0.1 ppm		15	20	40	20	5				
					247.1												
	33 24 100/1"	S7 12	12.0 13.1		12.0	SP	Very dense light brown to tan SAND with gravel (SP), mps 1.0 in., bonded, no odor, wet, sand-gravel mix PID = 0.1/0.3 ppm	10	15	30	30	10	5				
							-GLACIOFLUVIAL DEPOSITS-										
15	17 21 49 50	S8 10	14.0 16.0			SP	Very dense light brown SAND with gravel (SP), mps 5.0 mm., bonded, no odor, wet, sand-gravel mix PID = 0.1/0.1 ppm	10	5	30	30	10	5				
	57 100/6"	S9 6	16.0 17.0		242.1		Similar to above PID = 0.1/0.1 ppm	10	15	30	30	10	5				
					17.0		-GLACIAL TILL-										
20							Note: Gravel from 17.0 to 19.0 ft. Start to core 1.5 ft. 3.5 ft. boulders.										

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft.) to: Bottom of Casing	Bottom of Hole	Water
11/15/01	0730	40	-	39.5	23.3
12/17/01	0650	32 Days	-	38.2	24.0
1/14/02	1030	60 Days	-	38.0	34.2

Sample Identification

O Open End Rod
T Thin Wall Tube
U Undisturbed Sample
S Split Spoon
G Geoprobe

Well Diagram

Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary

Overburden (lin. ft.) 29.5
Rock Cored (lin. ft.) 10.0
Samples S12, C2

Boring No. 32Z-01-12XBR

Field Tests: Dilatancy: R-Rapid, S-Slow, N-None Plasticity: N-Nonplastic, L-Low, M-Medium, H-High
Toughness: L-Low, M-Medium, H-High Dry Strength: N-None, L-Low, M-Medium, H-High, V-Very High

*SPT = Sampler blows per 6 in. **Maximum particle size (mm) is determined by direct observation within the limitations of sampler size (in millimeters)

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TEST BORING REPORT

Boring No. 32Z-01-12XBR
File No. 10884-056
Sheet No. 2 of 3

Depth (ft.)	SPT*	Sample No. & Rec. (in.)	Sample Depth (ft.)	Well Diagram	Elev./Depth (ft.)	USCS Symbol	Visual-Manual Identification and Description (Density/consistency, color, GROUP NAME, max. particle size**, structure, odor, moisture, optional descriptions, geologic interpretation)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
20																	
	29 57 70 38	S10 6	21.0 23.0			SM	Very dense brown silty SAND with gravel (SM), mps 1.0 in., well-bonded, no odor, wet PID = 0.0/0.0 ppm	5	10	20	20	30	15				
							-GLACIAL TILL-										
							Note: Casing stopped at 17.0 ft. on 11/15/01.										
	19 22 26 24	S11 20	24.0 26.0			SM	Note: Removed 6" casing and replaced with 8" on 11/16/01. Dense brown silty SAND with gravel (SM), mps 5.0 mm., well-bonded, no odor, wet		15	15	20	35	15				
25																	
	57 116	S12 6	26.0 27.0			SM	PID = 0.0/0.0 ppm Very dense brown silty SAND with gravel (SM), mps 5.0 mm., bonded, no odor, wet PID = 0.0/0.0 ppm		10	5	5	60	20				
							TOP OF BEDROCK AT 27.0 FT.										
							SEE CORE BORING REPORT FOR ROCK DETAILS										
30																	
35																	

*SPT = Sampler blown per 6 in. **Maximum particle size (mm) is determined by direct observation within the limitations of sampler

HALEY & ALDRICH

CORE BORING REPORT

Boring No. 32Z-01-12XBR
File No. 10884-056
Sheet No. 3 of 3

Depth (ft)	Drilling Rate Min./ft	Run No.	Depth (ft)	Recovery/RQD in.	Recovery/RQD %	Weathering	Well Diagram	Elev./ Depth (ft)	Visual Description and Remarks
									SEE TEST BORING REPORT FOR OVERBURDEN DETAILS
								232.1 27.0	TOP OF BEDROCK AT 27.0 FT
									Note: Advance borehole with roller bit to 29.5.
30	7 4 3 3 3	C1	29.5 34.5	50 26	83 43	Slight to Fresh			C1: Hard to very hard, slightly weathered to fresh, mottled light gray to rusty-brown, aphanitic to fine-grained QUARTZITE. Foliation extremely thin at high angles, joints at low to high angles, extremely close to moderate, smooth to rough, planar, oxidized, open, some with sandy silt in-filling. -BEDROCK-
35	3 2 2 3 2	C2	34.5 39.5	57 27	95 45	Slight to Fresh		220.4 38.7 219.6 39.5	C2 to 38.7 ft.: Same as above, with thin oxidized shale layer. Note: Losing water while drilling, joints producing sandy silt. C2 from 38.7 ft.: Contact zone with possible CONGLOMERATE. -BEDROCK- BOTTOM OF EXPLORATION 39.5 FT. INSTALLED PIEZOMETER AT 38.2 FT.

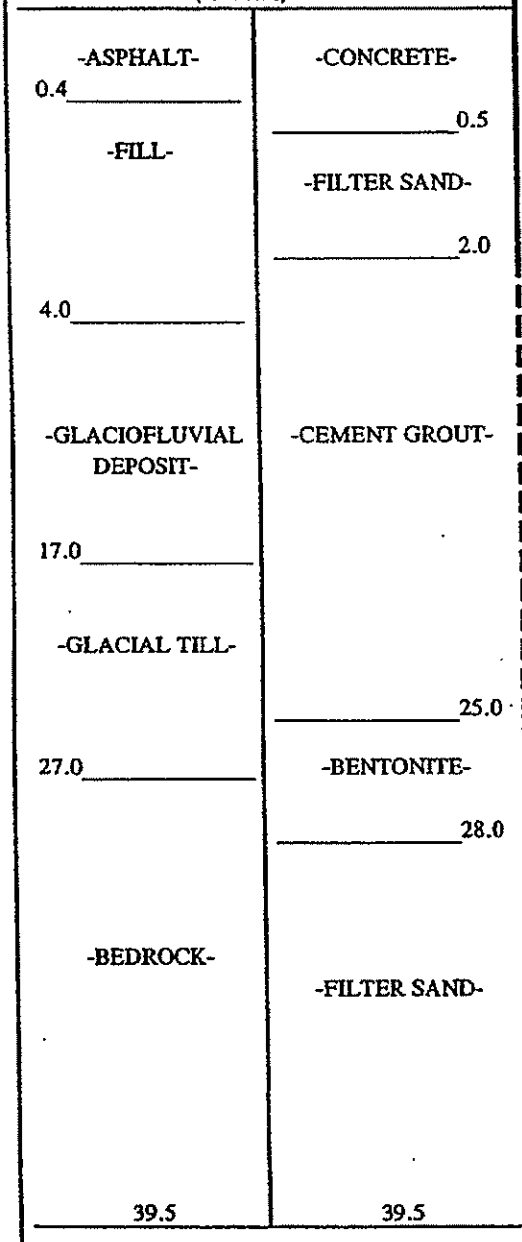
HALEY & ALDRICH

PIEZOMETER INSTALLATION REPORT

Project	MONITORING WELL INSTALLATION AOC32/43A	Observation Well	32Z-01-12XBR
City/State	DEVENS, MA	Test Boring	32Z-01-12XBR
Client	MASSDEVELOPMENT/DEVENS COMMERCE CENTER	Installation Date	19-Nov-01
Contractor	EARTH EXPLORATION SERVICES, WRENTHAM, MA	Location	See Plan
Driller	R. EASTWOOD	H&A File No.	10884-056
		H&A Rep.	W. Rubik

Ground El. 259.1
El. Datum NGVD (1929)

SOIL/ROCK CONDITIONS
BOREHOLE BACKFILL
(Numbers refer to elevation/depth from ground surface in feet)
(not to scale)



Bottom of Exploration

Type of protective cover/lock: Bolted Cover

Depth of top of roadway box below ground surface: 0.0 ft

Depth of top of riser pipe below ground surface: 0.4 ft

Type of protective casing: Roadway Box

Length: 0.8 ft

Inside diameter: 6.0 in

Depth of bottom of casing: 0.8 ft

Seals:

Type	Depth to top (ft)	Thickness (ft)
Concrete	0.0	0.5
Cement Grout	2.0	23.0
Bentonite	25.0	3.0

Type of riser pipe: Sch 40 PVC Solid

Inside diameter of riser pipe: 2.0 in

Type of backfill around riser: Seal

Diameter of borehole: 6.0 in

Depth of top of well screen: 28.2 ft

Type of screen or manufacturer: Machine Slotted PVC

Screen gauge or size of openings: 0.010 in

Diameter of well screen: 2.0 in

Type of backfill around screen: Filter Sand

Depth of bottom of well screen: 38.2 ft

Depth of bottom of silt trap

Depth of bottom of borehole: 39.5 ft

(Depths refer to ground surface)

Remarks:

TEST BORING REPORT

Boring No32M-01-13XBR

Project MONITORING WELL INSTALLATION AOC 32/43A DEVENS, MA
Client MASSDEVELOPMENT/DEVENS COMMERCE CENTER
Contractor EARTH EXPLORATION SERVICES, WRENTHAM, MA

File No. 10884-056
Sheet No. 1 of 2
Start December 26, 2001
Finish December 26, 2001
Driller R. Eastwood
H&A Rep. W. Rubik
Elevation 259.1
Datum NGVD (1929)
Location See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	SW	S	HQ	Rig Make & Model: Mobile B-57 Truck
Inside Diameter (in.)	6.0	1 3/8	2.5	Bit Type: Roller Bit
Hammer Weight (lb.)	300	140	-	Drill Mud: None
Hammer Fall (in.)	24	30	-	Casing: driven
				Hoist/Hammer: Winch Doughnut Hammer

Depth (ft.)	SPT*	Sample No. & Rec. (in.)	Sample Depth (ft.)	Well Diagram	Elev./Depth (ft.)	USCS Symbol	Visual-Manual Identification and Description (Density/consistency, color, GROUP NAME, max. particle size**, structure, odor, moisture, optional descriptions, geologic interpretation)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0					258.3		-CONCRETE-										
	38 38 38 45	S1 16	1.0 3.0		0.8 256.1	SP	Very dense yellow poorly graded SAND (SP), mps 3.0 mm, no odor, dry -FILL-			5	50	40	5				
	17 23 31 48	S2 18	3.0 5.0		3.0 254.6	SP	Very dense gray brown poorly graded SAND (SP), mps 0.25 in., no odor, wet		5	20	50	20	5				
5					4.5		-FILL-										
	28 47 40 52	S3 18	5.0 7.0		252.1	ML	Very dense yellow sandy SILT (ML), mps 0.25 in., well bonded, no odor, moist -GLACIAL TILL-		5	5	5	25	60				
	100/2"	S4 0	7.0 7.1		7.0		No recovery. TOP OF BEDROCK AT 7.0 FT										
							SEE CORE BORING REPORT FOR ROCK DETAILS										
10																	
15																	
20																	

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft.) to: Bottom of Casing	Bottom of Hole	Water
12/27/01	0700	16	7.0	25.5	20.0
1/4/02	0755	9 Days	-	-	20.6
1/14/02	1220	19 Days	-	23.5	21.1

Sample Identification

O Open End Rod
T Thin Wall Tube
U Undisturbed Sample
S Split Spoon
G Geoprobe

Well Diagram

Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary

Overburden (lin. ft.) 10.5
Rock Cored (lin. ft.) 15.0
Samples S4, C3

Boring No. 32M-01-13XBR

Field Tests: Dilatancy: R-Rapid, S-Slow, N-None
Toughness: L-Low, M-Medium, H-High
Plasticity: N-Nonplastic, L-Low, M-Medium, H-High
Dry Strength: N-None, L-Low, M-Medium, H-High, V-Very High

*SPT = Sampler blows per 6 in. **Maximum particle size (mm) is determined by direct observation within the limitations of sampler size (in millimeters)

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

HALEY & ALDRICH

CORE BORING REPORT

Boring No. 32M-01-13XBR
File No. 10884-056
Sheet No. 2 of 2

Depth (ft)	Drilling Rate Min./ft	Run No.	Depth (ft)	Recovery/RQD in.	Recovery/RQD %	Weathering	Well Diagram	Elev./ Depth (ft)	Visual Description and Remarks
									SEE TEST BORING REPORT FOR OVERBURDEN DETAILS
									TOP OF BEDROCK AT 7.0 FT
									Note: Advanced borehole with roller bit to 10.5 ft.
10									
	7	C1	10.5 15.5	54 33	90 55	Slight			C1: Very hard, slightly weathered, gray, aphanitic to fine grained QUARTZITE. Foliation extremely thin at high angle, undulating, microfaulted. Primary joints set at high angle, extremely close to moderate, smooth to rough, planar to stepped, oxidized to disintegrated, tight to open. Observed single horizontal joint, smooth, planar, oxidized, tight.
	7								
	7								
	7								
15	7								-BEDROCK- (Possible Vaughn Hills Formation)
	7	C2	15.5 20.5	57 15	95 25	Slight			C2 to 17.5 ft: Same as above.
	7							241.6	
	7					Slight		17.5	C2 from 17.5: Very hard, slightly weathered, interbedded layers of gray aphanitic QUARTZITE and gray white, aphanitic to coarse grained GNEISS. Foliation extremely thin to thin at high angles. Primary joints set at moderate to high angle, extremely close to close, smooth to rough, planar to stepped, oxidized, tight to open.
	7								
20	7							238.6	
	7	C3	20.5 25.5	54 9	90 15	Fresh to Slight		20.5	-BEDROCK- C3: Very hard, fresh to slightly weathered, mottled gray white, fine to coarse grained GNEISS. Gneissic foliation extremely thin at high angles. Joints at high angle, extremely close to close, smooth to rough, planar, oxidized, tight to open.
	7								
	7								-BEDROCK-
25	7								
								233.6	
								25.5	BOTTOM OF EXPLORATION 25.5 FT
									INSTALLED OBSERVATION WELL AT 23.7 FT

HALEY & ALDRICH

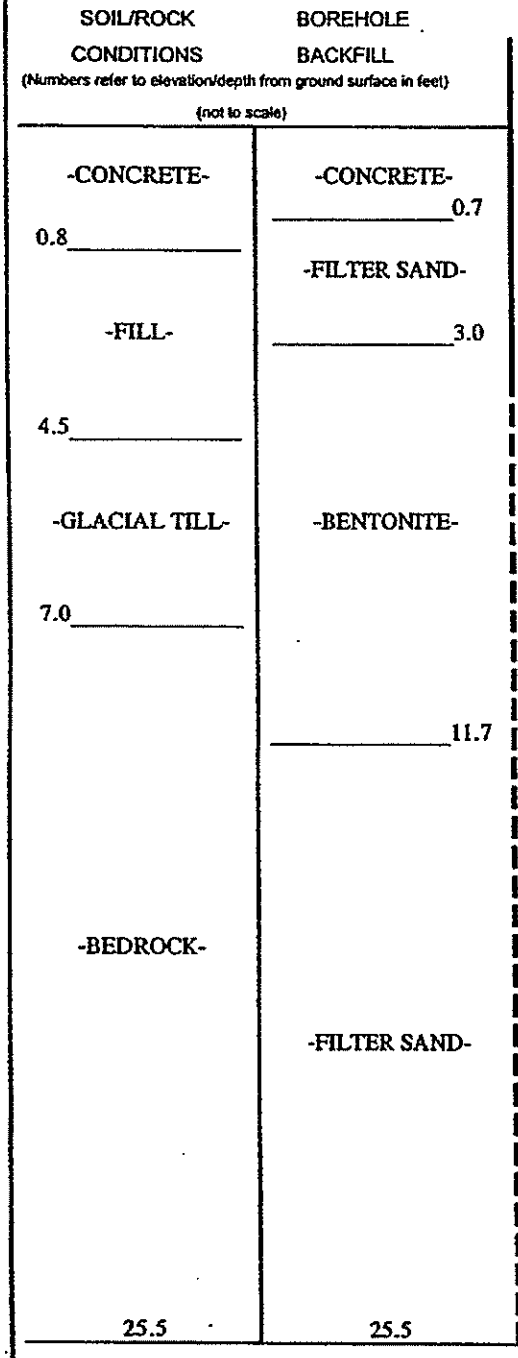
OBSERVATION WELL INSTALLATION REPORT

Project	MONITORING WELL INSTALLATION AOC32/43A
City/State	DEVENS, MA
Client	MASSDEVELOPMENT/DEVENS COMMERCE CENTER
Contractor	EARTH EXPLORATION SERVICES, WRENTHAM, MA
Driller	R. EASTWOOD

Observation Well	32M-01-13XBR
Test Boring	32M-01-13XBR
Installation Date	27-Dec-01
Location	See Plan
H&A File No.	10884-056
H&A Rep.	W. Rubik

Ground El. 259.1

El. Datum NGVD (1929)



Type of protective cover/lock: Bolted Cover

Depth of top of roadway box below ground surface: 0.0 ft

Depth of top of riser pipe below ground surface: 0.4 ft

Type of protective casing: Roadway Box

Length: 0.8 ft

Inside diameter: 6.0 in

Depth of bottom of roadway box: 0.8 ft

Seals:

Type	Depth to top (ft)	Thickness (ft)
Concrete	0.0	0.7
Bentonite Seal	3.0	8.7

Type of riser pipe: Sch 40 PVC Solid

Inside diameter of riser pipe: 2.0 in

Type of backfill around riser: Seal

Diameter of borehole: 6.0 in

Depth of top of well screen: 13.7 ft

Type of screen or manufacturer: Machine Slotted PVC

Screen gauge or size of openings: 0.010 in

Diameter of well screen: 2.0 in

Type of backfill around screen: Filter Sand

Depth of bottom of well screen: 23.7 ft

Depth of bottom of silt trap

Depth of bottom of borehole: 25.5 ft

(Depths refer to ground surface)

Remarks:

HALEY & ALDRICH

TEST BORING REPORT

Boring No32M-01-14XOB

Project MONITORING WELL INSTALLATION AOC 32/43A DEVENS, MA
Client MASSDEVELOPMENT/DEVENS COMMERCE CENTER
Contractor EARTH EXPLORATION SERVICES, WRENTHAM, MA

File No. 10884-056
Sheet No. 1 of 2
Start November 26, 2001
Finish November 29, 2001
Driller T. Martinelli
H&A Rep. A. Nichols
Elevation 255.2
Datum NGVD (1929)
Location See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	SW	S	-	Rig Make & Model: Mobile B-57 ATV
Inside Diameter (in.)	6.0	1 3/8	-	Bit Type: Roller Bit
Hammer Weight (lb.)	300	140	-	Drill Mud: None
Hammer Fall (in.)	30	30	-	Casing: driven
				Hoist/Hammer: Cat-Head Safety Hammer

Depth (ft.)	SPT*	Sample No. & Rec. (in.)	Sample Depth (ft.)	Well Diagram	Elev./Depth (ft.)	USCS Symbol	Visual-Manual Identification and Description (Density/consistency, color, GROUP NAME, max. particle size**, structure, odor, moisture, optional descriptions, geologic interpretation)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0	2	S1	0.0		254.7	SM	Very loose brown TOPSOIL with roots										
	2	14	2.0		0.5	SM	-TOPSOIL FILL-	5		5	10	60	20				
	3						Loose brown silty SAND (SM), mps 1.0 in., no odor, dry										
	15				253.2		-FILL-										
	15	S2	2.0		2.0	SM	Medium dense black silty SAND (SM), little roots, mps 0.25 in.,		5				30				
	14	4	2.5		252.7	ML	organic odor, dry				10	30	60				
	14	S2A	2.5		2.5		-FORMER TOPSOIL-										
	14	13	4.0				Medium dense brown sandy SILT (ML), mps 2.0 mm, no odor, dry										
					251.2		-LOESS-										
	10	S3	4.0		4.0	SP	Medium dense brown poorly graded SAND (SP), mps 1.0 in., no odor,	5	5	10	30	50					
5	12	4	6.0				moist										
	17																
	17																
	14	S4	6.0			SP	Same as above, except dense	5	5	10	30	50					
	15	10	8.0														
	16						-GLACIOFLUVIAL DEPOSITS-										
	15																
	8	S5	8.0			SP	Same as above, except medium dense										
	16	5	9.0		246.2												
	20	S5A	9.0		9.0	SP	Dense gray-brown poorly graded SAND with gravel (SP), mps 2.0 in.,	20	25			15	5				
	14	4	10.0				no odor, moist										
10	21	S6	10.0			SP	Same as above	20	20			15	5				
	16	11	12.0														
	15						-GLACIOFLUVIAL DEPOSITS-										
	12																
	15	S7	12.0			SP	Same as above, except medium dense	10	20			15	5				
	15	5	13.0		242.2												
	12	S7A	13.0		13.0	SM	Medium dense yellow-brown silty SAND (SM), mps 2.0 mm, in				5	80	15				
	12	7	14.0				partings, no odor, moist										
	7	S8	14.0			SM	Same as above				5	80	15				
15	11	13	16.0														
	13						-GLACIOFLUVIAL DEPOSITS-										
	11																
	11	S9	16.0			SM	Same as above										
	11	5	17.0		238.2												
	11	S9A	17.0		17.0	SP	Medium dense gray-brown poorly graded SAND with gravel (SP), mps	5	10	25	30	25	5				
	15	5	18.0		237.2		1.0 in., no odor, moist										
	9	S10	18.0		18.0	ML	-GLACIOFLUVIAL DEPOSITS-				5	30	65			N	
	9	12	20.0				Medium dense yellow-brown sandy SILT (ML), mps 1.0 mm, in										
	10						partings, no odor, moist										
	14						-GLACIOLACUSTRINE DEPOSITS-										
20																	

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft.) to: Bottom of Casing	Bottom of Hole	Water
11/26/01	1225	0.5	19.0	21.0	18.0
11/26/01	1426	0.3	19.0	25.5	21.5
1/12/02	1345	44 Days	-	27.6	24.9

Sample Identification

O Open End Rod
T Thin Wall Tube
U Undisturbed Sample
S Split Spoon
G Geoprobe

Well Diagram

Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary

Overburden (lin. ft.) 28.4
Rock Cored (lin. ft.) -
Samples S14

Boring No. 32M-01-14XOB

Field Tests: Dilatancy: R-Rapid, S-Slow, N-None Plasticity: N-Nonplastic, L-Low, M-Medium, H-High
Toughness: L-Low, M-Medium, H-High Dry Strength: N-None, L-Low, M-Medium, H-High, V-Very High

*SPT = Sampler blows per 6 in **Maximum particle size (mm) is determined by direct observation within the limitations of sampler size (in millimeters)

HALEY & ALDRICH

TEST BORING REPORT

Boring No. 32M-01-14XOB
File No. 10884-056
Sheet No. 2 of 2

Depth (ft.)	SPT*	Sample No. & Rec. (in.)	Sample Depth (ft.)	Well Diagram	Elev./Depth (ft.)	USCS Symbol	Visual-Manual Identification and Description (Density/consistency, color, GROUP NAME, max. particle size**, structure, odor, moisture, optional descriptions, geologic interpretation)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
20					235.2 20.0		Note: Boulder from 20.0 to 22.0 ft. -GLACIOLACUSTRINE DEPOSITS-										
	19 16 23	S11 9	22.0 23.5			ML	Dense yellow-brown SILT with sand (ML), mps 0.25 in., in partings, no odor, moist		5	5	5	10	75				
					231.7												
	25	S11A	23.5		23.5	GM	Dense yellow-brown silty GRAVEL with sand (GM), mps 2.0 in., well	15	35	5	10	15	20				
	25	3	24.0			GM	bonded, no odor, wet	15	30	5	10	20	20				
	21	S12	24.0				Same as above										
25	24	11	26.0														
	25						-GLACIAL TILL-										
	32 16 15 53	S13 11	26.0 28.0			GM	Same as above										
	12	S14	28.0			GM	Same as above										
	100/5"	5	28.9		226.3												
					28.9		BOTTOM OF EXPLORATION 28.9 FT INSTALLED OBSERVATION WELL AT 27.3 FT										

*SPT = Sampler blows per 6 in. **Maximum particle size (mm) is determined by direct observation within the limitations of sampler

HALEY & ALDRICH

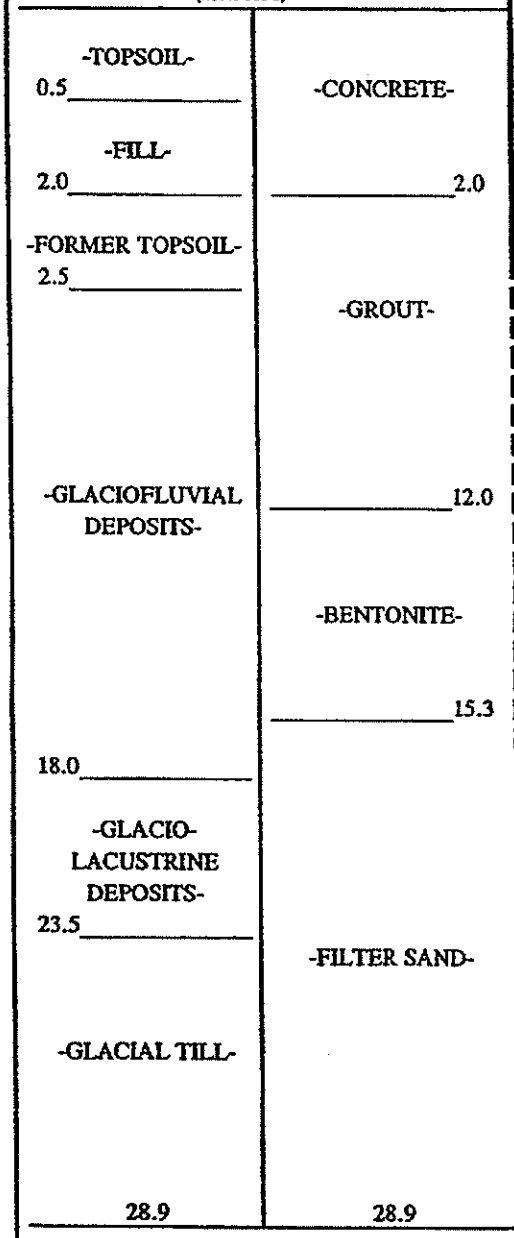
OBSERVATION WELL INSTALLATION REPORT

Project	MONITORING WELL INSTALLATION AOC32/43A
City/State	DEVENS, MA
Client	MASSDEVELOPMENT/DEVENS COMMERCE CENTER
Contractor	EARTH EXPLORATION SERVICES, WRENTHAM, MA
Driller	T. MARTINELLI

Observation Well	32M-01-14XOB
Test Boring	32M-01-14XOB
Installation Date	27-Nov-01
Location	See Plan
H&A File No.	10884-056
H&A Rep.	A. Nichols

Ground El. 255.2
El. Datum NGVD (1929)

SOIL/ROCK CONDITIONS
BOREHOLE BACKFILL
(Numbers refer to elevation/depth from ground surface in feet)
(not to scale)



Bottom of Exploration

Type of protective cover/lock: Cover/Padlock
Height of top of casing above ground surface: 2.5 ft
Height of top of riser pipe above ground surface: 2.2 ft
Type of protective casing: Guard Pipe
Length: 5.0 ft
Inside diameter: 6.0 in
Depth of bottom of roadway box: 2.0 ft

Seals:

Type	Depth to top (ft)	Thickness (ft)
Concrete	0.0	2.0
Bentonite Seal	12.0	3.3
Grout	2.0	10.0

Type of riser pipe: Sch 40 PVC Solid
Inside diameter of riser pipe: 2.0 in
Type of backfill around riser: Grout
Diameter of borehole: 6.5 in
Depth of top of well screen: 17.3 ft
Type of screen or manufacturer: Machine Slotted PVC
Screen gauge or size of openings: 0.010 in
Diameter of well screen: 2.0 in
Type of backfill around screen: Filter Sand
Depth of bottom of well screen: 27.3 ft
Depth of bottom of silt trap
Depth of bottom of borehole: 28.9 ft

(Depths refer to ground surface)

Remarks: Ground El. reflects estimated ground surface at time of drilling, prior to gravel pad placement.

TEST BORING REPORT

Boring No 32M-01-14XBR

Project MONITORING WELL INSTALLATION AOC 32/43A DEVENS, MA
Client MASSDEVELOPMENT/DEVENS COMMERCE CENTER
Contractor EARTH EXPLORATION SERVICES, WRENTHAM, MA

File No. 10884-056
Sheet No. 1 of 3
Start November 27, 2001
Finish November 29, 2001
Driller T. Martinelli
H&A Rep. J.Morey/A.Nichols
Elevation 255.1
Datum NGVD (1929)
Location See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	SW	S	HQ	Rig Make & Model: Mobile B-57 ATV
Inside Diameter (in.)	6.0	1 3/8	2.5	Bit Type: Roller Bit
Hammer Weight (lb.)	300	140	-	Drill Mud: None
Hammer Fall (in.)	30	30	-	Casing: driven
				Hoist/Hammer: Winch Doughnut Hammer

Depth (ft.)	SPT*	Sample No. & Rec. (in.)	Sample Depth (ft.)	Well Diagram	Elev./Depth (ft.)	USCS Symbol	Visual-Manual Identification and Description (Density/consistency, color, GROUP NAME, max. particle size**, structure, odor, moisture, optional descriptions, geologic interpretation)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0					254.6		-TOPSOIL-										
					0.5												
					253.1		Note: Cluster well with Boring 32M-01-14XOB. No sampling required in overburden soils.										
					2.0		-FILL-										
5																	
10																	
15							-GLACIOFLUVIAL DEPOSITS-										
20																	

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft.) to: Bottom of Casing	Bottom of Hole	Water
12/17/01	0745	18 Days	-	-	24.4
1/12/02	1400	46 Days	-	42.5	24.1

Sample Identification

O Open End Rod
T Thin Wall Tube
U Undisturbed Sample
S Split Spoon
G Geoprobe

Well Diagram

Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary

Overburden (lin. ft.) 30.4
Rock Cored (lin. ft.) 15
Samples C3

Boring No. 32M-01-14XBR

Field Tests: Dilatancy: R-Rapid, S-Slow, N-None Plasticity: N-Nonplastic, L-Low, M-Medium, H-High
Toughness: L-Low, M-Medium, H-High Dry Strength: N-None, L-Low, M-Medium, H-High, V-Very High

*SPT = Sampler blows per 6 in **Maximum particle size (mm) is determined by direct observation within the limitations of sampler size (in millimeters)

HALEY & ALDRICH

TEST BORING REPORT

Boring No. 32M-01-14XBR
File No. 10884-056
Sheet No. 2 of 3

Depth (ft.)	SPT*	Sample No. & Rec. (in.)	Sample Depth (ft.)	Well Diagram	Elev./Depth (ft.)	USCS Symbol	Visual-Manual Identification and Description (Density/consistency, color, GROUP NAME, max. particle size**, structure, odor, moisture, optional descriptions, geologic interpretation)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
20							-GLACIOFLUVIAL DEPOSITS-										
25																	
							TOP OF BEDROCK 29.4 FT										
30							SEE CORE BORING REPORT FOR ROCK DETAILS										
35																	
40																	
45																	

*SPT = Sampler blows per 6 in. **Maximum particle size (mm) is determined by direct observation within the limitations of sampler

HALEY & ALDRICH

CORE BORING REPORT

Boring No. 32M-01-14XBF
File No. 10884-056
Sheet No. 3 of 3

Depth (ft)	Drilling Rate Min./ft	Run No.	Depth (ft)	Recovery/RQD in.	Recovery/RQD %	Weathering	Well Diagram	Elev./ Depth (ft)	Visual Description and Remarks
									SEE TEST BORING REPORT FOR OVERBURDEN DETAILS
								225.7	TOP OF BEDROCK 29.4 FT
30								29.4	
	7	C1	30.4	56	93	Fresh			C1 to 33.3 ft: Very hard, fresh, gray, aphanitic QUARTZITE. Foliation extremely thin at high angle. Joints at low angle, close to wide, smooth, planar, fresh, tight.
	5		35.4	48	80				
	5								-BEDROCK-
	5							221.8	
	4					Slight to Moder-		33.3	C1 33.3 to 35.4 ft: Hard, slightly to moderately weathered, brown, aphanitic QUARTZITE. Foliation extremely thin, highly disturbed, microfaulted. Joints at low to high angle, extremely close to close, rough, stepped, oxidized to disintegrated, open.
35	5					ate		219.7	
	5	C2	35.4	59	98	Fresh		35.4	-BEDROCK-
	4		40.4	58	97				C2: Very hard, fresh, gray, aphanitic to medium grained QUARTZITE. Foliation extremely thin at high angle. Joints at horizontal to low angle, close to moderate, smooth, planar, oxidized, tight to open.
	5								-BEDROCK- (Possible Vaughn Hills Formation)
40	6							214.7	
	5	C3	40.4	55	92	Fresh		40.4	C3: Very hard, fresh, light gray to white, aphanitic to medium grained QUARTZITE. Gneissic foliation extremely thin, moderately dipping. Joints at horizontal to moderate angle, very close to moderate, smooth, planar, fresh to oxidized, tight to open.
	6		45.4	46	76				
	7								-BEDROCK-
	4								
45	4							209.7	
								45.4	BOTTOM OF EXPLORATION 45.4 FT
									INSTALLED OBSERVATION WELL AT 44.0 FT

OBSERVATION WELL INSTALLATION REPORT

HALEY & ALDRICH

Project	MONITORING WELL INSTALLATION AOC32/43A	Observation Well	32M-01-14XBR
City/State	DEVENS, MA	Test Boring	32M-01-14XBR
Client	MASSDEVELOPMENT/DEVENS COMMERCE CENTER	Installation Date	29-Nov-01
Contractor	EARTH EXPLORATION SERVICES, WRENTHAM, MA	Location	See Plan
Driller	T. MARTINELLI	H&A File No.	10884-056
		H&A Rep.	A. Nichols

Ground El. 255.1
El. Datum NGVD (1929)

SOIL/ROCK CONDITIONS
BOREHOLE BACKFILL
(Numbers refer to elevation/depth from ground surface in feet)
(not to scale)

-TOPSOIL- 0.5
-FILL- 2.0
-TOPSOIL- 2.5
-LOESS- 4.0
-GLACIOFLUVIAL DEPOSITS- 18.0
-GLACIO-LACUSTRINE DEPOSITS- 23.5
-GLACIAL TILL- 29.4
-BEDROCK-

-CONCRETE- 2.0
-CEMENT GROUT- 28.7
-BENTONITE- 32.0
-FILTER SAND- 45.4

45.4 Bottom of Exploration

Type of protective cover/lock: Cover/Padlock
Height of top of casing above ground surface: 2.5 ft
Height of top of riser pipe above ground surface: 1.8 ft
Type of protective casing: Guard Pipe
Length: 5.0 ft
Inside diameter: 6.0 in
Depth of bottom of roadway box: 2.0 ft

Seals:

Type	Depth to top (ft)	Thickness (ft)
Concrete	0.0	2.0
Grout	3.0	25.7
Bentonite Seal	28.7	3.3

Type of riser pipe: Sch 40 PVC Solid
Inside diameter of riser pipe: 2.0 in
Type of backfill around riser: Seal
Diameter of borehole: 6.0 in
Depth of top of well screen: 34.0 ft
Type of screen or manufacturer: Machine Slotted PVC
Screen gauge or size of openings: 0.010 in
Diameter of well screen: 2.0 in
Type of backfill around screen: Filter Sand
Depth of bottom of well screen: 44.0 ft
Depth of bottom of silt trap:
Depth of bottom of borehole: 45.4 ft

(Depths refer to ground surface)

Remarks: Soil conditions based on adjacent Cluster Boring 32M-01-14XOB. Ground El. Reflects estimated ground surface at time of drilling.

TEST BORING REPORT

Boring No32M-01-15XBR

Project MONITORING WELL INSTALLATION AOC 32/43A DEVENS, MA
Client MASSDEVELOPMENT/DEVENS COMMERCE CENTER
Contractor EARTH EXPLORATION SERVICES, WRENTHAM, MA

File No. 10884-056
Sheet No. 1 of 3
Start December 27, 2001
Finish December 31, 2001
Driller R. Eastwood
H&A Rep. W. Rubik
Elevation 258.7
Datum NGVD (1929)
Location See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	SW	S	HQ	Rig Make & Model: Mobile B-57 Truck
Inside Diameter (in.)	6.0	1 3/8	2.5	Bit Type: Roller Bit
Hammer Weight (lb.)	300	140	-	Drill Mud: None
Hammer Fall (in.)	24	30	-	Casing: driven
				Hoist/Hammer: Winch Doughnut Hammer

Depth (ft.)	SPT*	Sample No. & Rec. (in.)	Sample Depth (ft.)	Well Diagram	Elev./Depth (ft.)	USCS Symbol	Visual-Manual Identification and Description (Density/consistency, color, GROUP NAME, max. particle size**, structure, odor, moisture, optional descriptions, geologic interpretation)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0					258.2		-Black ASPHALT-										
	29 49 80	S1 17	0.5 2.0		0.5 256.7	SM	Very dense dark brown silty SAND with gravel (SM), mps 1.0 in., no odor, dry -FILL-	10	10	10	10	40	30				
	26 37 28 33	S2 9	2.0 4.0		2.0 254.7	SM	Very dense mottled yellow brown silty SAND (SM), mps 0.25 in., layered, no odor, dry. Trace roots -FILL-		5	5	5	65	20				
	34 100/3"	S3 8	4.0 4.7		4.0	SP	Very dense yellow brown poorly graded SAND (SP), mps 4.0 mm, in partings, no odor, wet -GLACIOFLUVIAL DEPOSITS- TOP OF BEDROCK AT 4.7 FT										
5							SEE CORE BORING REPORT FOR ROCK DETAILS										
10																	
15																	
20																	

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft.) to: Bottom of Casing	Bottom of Hole	Water
1/4/02	0750	4 Days	-	-	23.7
1/11/02	1035	11 Days	-	44.5	24.3

Sample Identification

O Open End Rod
T Thin Wall Tube
U Undisturbed Sample
S Split Spoon
G Geoprobe

Well Diagram

Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary

Overburden (lin. ft.) 9.5
Rock Cored (lin. ft.) 35.5
Samples S3, C8

Boring No. 32M-01-15XBR

Field Tests: Dilatancy: R-Rapid, S-Slow, N-None
Toughness: L-Low, M-Medium, H-High
Plasticity: N-Nonplastic, L-Low, M-Medium, H-High
Dry Strength: N-None, L-Low, M-Medium, H-High, V-Very High

*SPT = Sampler blows per 6 in. **Maximum particle size (mm) is determined by direct observation within the limitations of sampler size (in millimeters)

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

USCS_T83 USCS1183.GLB USCSTBC3.GDT G:\10884\056\LOGS.GPJ Mar 28, 02

HALEY & ALDRICH

CORE BORING REPORT

Boring No. 32M-01-15XBR
File No. 10884-056
Sheet No. 2 of 3

Depth (ft)	Drilling Rate Min./ft	Run No.	Depth (ft)	Recovery/RQD in.	Recovery/RQD %	Weathering	Well Diagram	Elev./ Depth (ft)	Visual Description and Remarks
									SEE TEST BORING REPORT FOR OVERBURDEN DETAILS
5								254.0 4.7	TOP OF BEDROCK AT 4.7 FT Note: Advance borehole with roller bit to 9.5 ft. -BEDROCK-
10	8	C1	9.5 13.0	30 0	71 0	Fresh			C1 to 11.0 ft: Very hard, fresh, mottled gray white, fine to very coarse grained GNEISS. Gneissic foliation extremely thin moderately dipping. Joints moderately dipping, extremely close to close, smooth, planar, oxidized, tight to open.
	8							247.7	
	8					Slight		11.0	C1 from 11.0 ft: Very hard, slightly weathered, gray aphanitic to fine grained QUARTZITE. Foliation extremely thin at high angle. Joints at moderate to high angle, extremely close to close, smooth to rough, planar to stepped, oxidized, open.
	15							245.7	
	7	C2	13.0 18.0	60 15	100 25	Slight to Moderate		13.0	-BEDROCK-
15	8								C2: Very hard to hard, slightly to moderately weathered, gray brown, aphanitic to medium grained QUARTZITE. Foliation extremely thin, moderately dipping. Primary joints set at low angle, extremely close to moderate, smooth, planar, oxidized, open. Secondary joints set at vertical angle, close to moderate, smooth, planar to stepped, oxidized, tight to open.
	8								
	7								
	7								-BEDROCK- (Possible Berwick Formation)
	7	C3	18.0 23.0	30 24	50 40	Fresh*			C3 to 20 ft*: Same as above, except fresh, joints not described due to overcoring and poor recovery.
	7							238.7	
20	7					Fresh*		20.0	C3 from 20.0 ft*, depth estimated: Very hard, fresh, mottled gray white fine to coarse grained GNEISS. Gneissic foliation evident. Joints not described due to overcoring and poor recovery.
	7								
	7								-BEDROCK-
	7	C4	23.0 27.5	54 24	100 44	Fresh to Slight			C4: Very hard, fresh to slightly weathered, mottled gray white, aphanitic to very coarse grained GNEISS. Gneissic foliation extremely thin at high angles. Primary joints set at low angles, extremely close to close, rough, planar, oxidized, open to tight. Secondary joints set at high to vertical angle, close to moderate, smooth, planar, oxidized, tight.
	7								
25	7								
	15								
								231.4	
	7	C5	27.5 32.5	54 24	90 40	Fresh		27.3	C5 to 31.5 ft: Very hard, fresh, gray, aphanitic to fine grained hornfelsed GNEISS. Foliation extremely thin at high angles. Joints at high angles, very close to moderate, smooth, planar, oxidized, tight to open.
	7								
	7								-BEDROCK-
30	7								-BEDROCK-
	7							227.2	
	8					Slight		31.5 226.2	C5 from 31.5 ft: Same as above, except slightly weathered, extremely fractured.
	7	C6	32.5 37.5	60 45	100 75	Fresh		32.5	
	7								-BEDROCK-
35	7								C6: Very hard, fresh, gray, aphanitic to fine grained GNEISS. Foliation extremely thin at high angles. Primary joints set at high angles, close to moderate, rough, planar, oxidized, tight to open. Secondary joints set at low angles, smooth to rough, planar, oxidized, tight to open.
	7								
	7								-BEDROCK- (Possible Berwick Formation)
	6	C7	37.5 42.5	48 41	80 68	Fresh			C7: Same as above.
	6								

HALEY & ALDRICH

CORE BORING REPORT

Boring No. 32M-01-15XBR
File No. 10884-056
Sheet No. 3 of 3

Depth (ft)	Drilling Rate Min./ft	Run No.	Depth (ft)	Recovery/RQD in.	Recovery/RQD %	Weathering	Well Diagram	Elev./ Depth (ft)	Visual Description and Remarks
40	6								
	6								
	6								
	5	C8	42.5 45.0	0 0	0 0				C8: No recovery. Rock pulled out from the core barrel.
	6								
45	3							213.7 45.0	BOTTOM OF EXPLORATION 45.0 FT INSTALLED OBSERVATION WELL AT 44.5 FT

HALEY & ALDRICH

TEST BORING REPORT

Boring No32M-01-16XBR

Project MONITORING WELL INSTALLATION AOC 32/43A DEVENS, MA
Client MASSDEVELOPMENT/DEVENS COMMERCE CENTER
Contractor EARTH EXPLORATION SERVICES, WRENTHAM, MA

File No. 10884-056
Sheet No. 1 of 2
Start January 3, 2002
Finish January 4, 2002
Driller R. Eastwood
H&A Rep. W.Rubik/D.Velozz
Elevation 258.5
Datum NGVD (1929)
Location See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	SW	S	HQ	Rig Make & Model: Mobile B-57 Truck
Inside Diameter (in.)	6.0	1 3/8	2.5	Bit Type: Roller Bit
Hammer Weight (lb.)	300	140	-	Drill Mud: None
Hammer Fall (in.)	24	30	-	Casing: driven
				Hoist/Hammer: Winch Doughnut Hammer

Depth (ft.)	SPT*	Sample No. & Rec. (in.)	Sample Depth (ft.)	Well Diagram	Elev./Depth (ft.)	USCS Symbol	Visual-Manual Identification and Description (Density/consistency, color, GROUP NAME, max. particle size**, structure, odor, moisture, optional descriptions, geologic interpretation)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0					258.0		-Black bituminous ASPHALT-										
	100/5"	S1	0.5		0.5	SM	Very dense brown silty SAND with gravel (SM), mps 3.0 in., no odor, wet	10	10	10	15	30	25				
		4	0.9				-FILL-										
					256.5												
	7	S2	2.0		2.0	SP-SM	Medium dense mottled yellow-brown poorly graded SAND with silt (SP-SM), mps 3.0 mm, in partings, no odor, dry			5	25	60	10				
	6	12	4.0				-GLACIOFLUVIAL DEPOSITS-										
	5																
	5				254.5												
	22	S3	4.0		4.0	SW	Dense brown well graded SAND with gravel (SW), mps 1.0 in., stratified, no odor, wet	5	20	25	30	20					
5	20	11	6.0				-GLACIOFLUVIAL DEPOSITS-										
	20																
	22																
	42	S4	6.0			SW	Same as above, except very dense	10	15	25	30	20					
	29	14	8.0														
	38																
	36				250.5												
	22	S5	8.0		8.0	SP	Dense light brown poorly graded SAND (SP), mps 2.0 mm, in partings, no odor, moist				50	50					
	16	10	10.0				-GLACIOFLUVIAL DEPOSITS-										
	20																
10	22																
	10	S6	10.0			SP	Same as above, except medium dense		15	55	30						
	13	11	12.0		247.5												
	34				11.0		Poor recovery of GRAVEL										
	41						-GLACIOFLUVIAL DEPOSITS-										
	33	S7	12.0			GP	Very dense brown poorly graded GRAVEL with sand (GP), mps 0.25 in., stratified, no odor, dry		50	20	15	10	5				
	49	10	13.0														
	100/0"																
	39	S8	14.0			SP	Same as above, except mps 1.0 in.	15	40	15	15	10	5				
15	44	10	15.8														
	65																
	100/3"				242.7												
					15.8		-GLACIAL TILL-										
					241.5												
	100/2"	S9	17.0		17.0		No recovery. TOP OF BEDROCK AT 17.0 FT										
		0	17.1														
20							SEE CORE BORING REPORT FOR ROCK DETAILS										

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft.) to: Bottom of Casing	Bottom of Hole	Water
1/4/02	0700	16	18.5	31.0	27.4
1/11/02	0935	7 Days	-	31.0	27.6

Sample Identification

O Open End Rod
T Thin Wall Tube
U Undisturbed Sample
S Split Spoon
G Geoprobe

Well Diagram

Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary

Overburden (lin. ft.) 21.0
Rock Cored (lin. ft.) 10.0
Samples S9, C2

Boring No. 32M-01-16XBR

Field Tests: Dilatancy: R-Rapid, S-Slow, N-None
Toughness: L-Low, M-Medium, H-High
Plasticity: N-Nonplastic, L-Low, M-Medium, H-High
Dry Strength: N-None, L-Low, M-Medium, H-High, V-Very High

*SPT = Sampler blows per 6 in. **Maximum particle size (mm) is determined by direct observation within the limitations of sampler size (in millimeters).

HALEY & ALDRICH

CORE BORING REPORT

Boring No. 32M-01-16XBR
File No. 10884-056
Sheet No. 2 of 2

Depth (ft)	Drilling Rate Min./ft	Run No.	Depth (ft)	Recovery/RQD in.	Recovery/RQD %	Weathering	Well Diagram	Elev./ Depth (ft)	Visual Description and Remarks
									SEE TEST BORING REPORT FOR OVERBURDEN DETAILS
									TOP OF BEDROCK AT 17.0 FT
									Note: Advanced borehole with roller bit to 21.0 ft.
									-BEDROCK-
20									
	10	C1	21.0 26.0	56 20	93 33	Fresh		236.5 22.0	C1 to 22.0 ft: Very hard, fresh, gray, aphanitic to fine grained QUARTZITE. Foliation extremely thin at high angle. Joints at moderate to low angle, close, rough, stepped, tight to open.
	6					Slight to Moderate			C1 from 22.0 ft: Very hard to hard, slight to moderate weathering, mottled gray-white, fine to coarse grained QUARTZITE. Gneissic foliation extremely thin at high angle. Primary joint sets at high angle, extremely close to close, smooth to rough, planar to stepped, oxidized, open to closed. Secondary joint set at moderate to low angle, extremely close to close, rough, planar to stepped, oxidized, tight to open.
	6								
	5								
25	5								
	6	C2	26.0 31.0	57 18	95 30	Slight to Moderate			-BEDROCK- (Possible Vaughn Hills Formation) C2: Same as above.
	7								
	6								
	5								
30	7							227.5 31.0	BOTTOM OF EXPLORATION 31.0 FT
									INSTALLED OBSERVATION WELL AT 31.0 FT

HALEY & ALDRICH

OBSERVATION WELL INSTALLATION REPORT

Project	MONITORING WELL INSTALLATION AOC32/43A
City/State	DEVENS, MA
Client	MASSDEVELOPMENT/DEVENS COMMERCE CENTER
Contractor	EARTH EXPLORATION SERVICES, WRENTHAM, MA
Driller	R. EASTWOOD

Observation Well	32M-01-16XBR
Test Boring	32M-01-16XBR
Installation Date	4-Jan-02
Location	See Plan
H&A File No.	10884-056
H&A Rep.	W. Rubik

Ground El. 258.5

El. Datum NGVD (1929)

SOIL/ROCK CONDITIONS (Numbers refer to elevation/depth from ground surface in feet) (not to scale)

BOREHOLE BACKFILL

-ASPHALT- 0.5

-CONCRETE- 0.7

-FILL- 2.0

-FILTER SAND- 3.0

-GLACIOFLUVIAL DEPOSITS- 15.8

-BENTONITE-

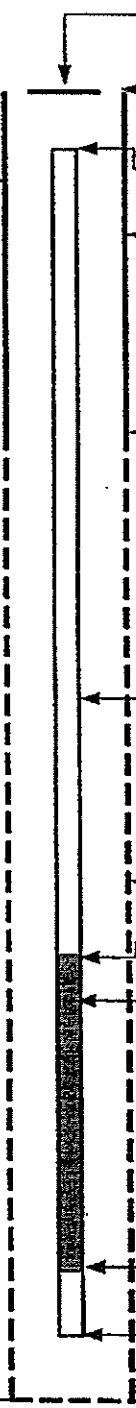
-GLACIAL TILL- 17.0

19.0

-BEDROCK-

-FILTER SAND- 31.0

31.0 Bottom of Exploration



Type of protective cover: Bolted Cover

Depth of top of roadway box below ground surface: 0.0 ft

Depth of top of riser pipe below ground surface: 0.2 ft

Type of protective casing: Roadway Box

Length: 0.8 ft

Inside diameter: 6.0 in

Depth of bottom of roadway box: 0.8 ft

Seals:

Type	Depth to top (ft)	Thickness (ft)
Concrete	0.0	0.7
Bentonite Seal	3.0	16.0

Type of riser pipe: Sch 40 PVC Solid

Inside diameter of riser pipe: 2.0 in

Type of backfill around riser: Seal

Diameter of borehole: 6.0 in

Depth of top of well screen: 21.0 ft

Type of screen or manufacturer: Machine Slotted PVC

Screen gauge or size of openings: 0.010 in

Diameter of well screen: 2.0 in

Type of backfill around screen: Filter Sand

Depth of bottom of well screen: 31.0 ft

Depth of bottom of silt trap

Depth of bottom of borehole: 31.0 ft

(Depths refer to ground surface)

Remarks:

TEST BORING REPORT

Boring No. 32M-01-17XBR

Project MONITORING WELL INSTALLATION AOC 32/43A DEVENS, MA
Client MASSDEVELOPMENT/DEVENS COMMERCE CENTER
Contractor EARTH EXPLORATION SERVICES, WRENTHAM, MA

File No. 10884-056
Sheet No. 1 of 3
Start November 29, 2001
Finish December 5, 2001
Driller T. Martinelli
H&A Rep. A. Nichols
Elevation 257.1
Datum NGVD (1929)
Location See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	SW	S	HQ	Rig Make & Model: Track
Inside Diameter (in.)	6.0	1 3/8	2.5	Bit Type: Roller Bit
Hammer Weight (lb.)	300	140	-	Drill Mud: None
Hammer Fall (in.)	24	30	-	Casing: driven
				Hoist/Hammer: Cat-Head Safety Hammer

Depth (ft.)	SPT*	Sample No. & Rec. (in.)	Sample Depth (ft.)	Well Diagram	Elev./Depth (ft.)	USCS Symbol	Visual-Manual Identification and Description (Density/consistency, color, GROUP NAME, max. particle size**, structure, odor, moisture, optional descriptions, geologic interpretation)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0	6	S1	0.0			SM	Medium dense gray-brown silty SAND (SM), 10% roots, mps 1.0 in., slight organic odor, dry		5	5	5	40	35				
	8	4	1.0		256.1		-TOPSOIL-										
	10	S1A	1.0		1.0	SM	Medium dense yellow-brown silty SAND (SM), mps 0.2 in., stratified, no odor, dry			5	15	55	15				
	8	7	2.0			SM	Same as above, except dense	5	5	5	10	60	15				
	4	S2	2.0														
	16	22	4.0														
	30																
	19																
	17	S3	4.0			SM	Same as above		5	5	15	60	15				
5	27	12	6.0				-GLACIOFLUVIAL DEPOSITS-										
	20																
	20				251.1												
	11	S4	6.0		6.0	SP-SM	Medium dense yellow-brown poorly graded SAND with silty (SP-SM), mps 0.25 in., stratified, no odor, dry		5	5	15	65	10				
	11	24	8.0				-GLACIOFLUVIAL DEPOSITS-										
	9																
	9																
	6	S5	8.0			SP-SM	Same as above		5	5	15	65	10				
	7	11	9.0		248.1												
	8	S5A	9.0		9.0	ML	Medium dense yellow SILT with sand (ML), mps 2.0 mm, in partings, no odor, dry				5	10	85	R	M	N	
10	10	10	10.0			ML	Same as above				5	10	85	R	M	N	
	12	S6	10.0				-GLACIOLACUSTRINE DEPOSITS-										
	15	12	12.0														
	14																
	20				245.1												
	7	S7	12.0		12.0	SM	Medium dense brown silty SAND with gravel (SM), mps 1.0 in., no odor, wet	5	10	20	35	15	15				
	10	4	13.0		244.1												
	15	S7A	13.0		13.0	ML	-GLACIOFLUVIAL DEPOSITS-				5	10	85	S	M	N	
	20	7	14.0			ML	Dense yellow SILT with sand (ML), mps 2.0 mm, in partings, no odor, dry				5	10	85	S	M	N	
	12	S8	14.0														
15	16	16	16.0				-GLACIOLACUSTRINE DEPOSITS-										
	14																
	15						Same as above										
	15	S9	16.0		241.1	SW	Dense brown well graded SAND with gravel (SW), mps 1.0 in., no odor, wet	10	10	30	25	20	5				
	19	8	17.0		16.0												
	20	S9A	17.0		240.1		-GLACIOFLUVIAL DEPOSITS-										
	22	6	18.0		17.0	SP-SM	Dense yellow-brown poorly graded SAND with silt (SP-SM), mps 3.0 mm, stratified, no odor, moist				5	10	75	10			
	21	S10	18.0			SP-SM	Same as above				5	10	75	10			
	20	10	20.0				-GLACIOFLUVIAL DEPOSITS-										
	24																
20	21																

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft.) to: Bottom of Casing	Bottom of Hole	Water
12/04/01	0710	88	32.0	34.0	26.7
1/12/02	1430	38 Days	-	51.3	26.3

Sample Identification

O Open End Rod
T Thin Wall Tube
U Undisturbed Sample
S Split Spoon
G Geoprobe

Well Diagram

Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary

Overburden (lin. ft.) 41.5
Rock Cored (lin. ft.) 10.0
Samples S20, C2

Boring No. 32M-01-17XBR

Field Tests: Dilatancy: R-Rapid, S-Slow, N-None
Toughness: L-Low, M-Medium, H-High
Plasticity: N-Nonplastic, L-Low, M-Medium, H-High
Dry Strength: N-None, L-Low, M-Medium, H-High, V-Very High

*SPT = Sampler blows per 6 in. **Maximum particle size (mm) is determined by direct observation within the limitations of sampler size (in millimeters).

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

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HALEY & ALDRICH

TEST BORING REPORT

Boring No. 32M-01-17XBR
File No. 10884-056
Sheet No. 2 of 3

Depth	SPT*	Sample No. & Rec. (in.)	Sample Depth (ft.)	Well Diagram	Elev./Depth (ft.)	USCS Symbol	Visual-Manual Identification and Description (Density/consistency, color, GROUP NAME, max. particle size**, structure, odor, moisture, optional descriptions, geologic interpretation)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
20	10 19	S11 6	20.0 21.0		236.1	SP- SM	Same as above, except medium dense -GLACIOFLUVIAL DEPOSITS-			5	15	70	10				
	19 20	S11A 10	21.0 22.0		21.0 235.1	SW	Dense brown well graded SAND (SW), mps 0.5 in., no odor, wet	5	5	40	30	20					
	15 13 21 24	S12 14	22.0 24.0		22.0	SM	-GLACIOFLUVIAL DEPOSITS- Dense yellow-brown silty SAND (SM), mps 1.0 mm, in partings, no odor, wet			5	5	75	15				
25	23 23 18 26	S13 17	24.0 26.0		231.1	SM	-GLACIOFLUVIAL DEPOSITS- Same as above, except with a single layer of well graded sand			5	5	75	15				
	10 11 25 15	S14 10	26.0 28.0		26.0 229.1	ML	Dense red-brown SILT with sand (ML), mps 1.0 mm, in partings, no odor, wet -GLACIOLACUSTRINE DEPOSITS-					20	80	S	M	N	
	21 33 32 30	S15 15	28.0 30.0		28.0 227.1	SP	Very dense red-brown poorly graded SAND (SP), mps 0.25 in., no odor, wet -GLACIOFLUVIAL DEPOSITS-		5	45	35	15	5				
30	12 10 17 17	S16 18	30.0 32.0		30.0	ML	Medium dense red-brown SILT (ML), mps 0.1 mm, in partings, no odor, wet -GLACIOLACUSTRINE DEPOSITS-					5	95	S	M	N-L	
	15 14 21 30	S17 25	32.0 34.0		223.1	ML	Same as above, except dense					10	90	S	M	N	
	15 20 21 34	S18 12	34.0 36.0		34.0	SM	Dense yellow-brown silty SAND with gravel (SM), mps 1.0 in., moderately bonded, no odor, wet -GLACIAL TILL-	5	10	10	20	25	30				
35	23 22 19 22	S19 16	36.0 38.0		219.1	SM	Same as above	5	10	10	20	30	25				
	100/0"	S20 0	38.0		38.0		TOP OF BEDROCK AT 38.0 FT SEE CORE BORING REPORT FOR ROCK DETAILS										
40																	
45																	

*SPT = Sampler blows per 6 in. **Maximum particle size (mm) is determined by direct observation within the limitations of sampler

HALEY & ALDRICH

CORE BORING REPORT

Boring No. 32M-01-17XBR
File No. 10884-056
Sheet No. 3 of 3

Depth (ft)	Drilling Rate Min./ft	Run No.	Depth (ft)	Recovery/RQD in.	Recovery/RQD %	Weathering	Well Diagram	Elev./ Depth (ft)	Visual Description and Remarks
									SEE TEST BORING REPORT FOR OVERBURDEN DETAILS
								219.1	
								38.0	TOP OF BEDROCK AT 38.0 FT
									Note: Water loss noted below 38.0 ft. Advanced with roller bit to 41.5 ft.
40									-BEDROCK-
	5	C1	41.5	56	93	Fresh			C1: Very hard, fresh to slighlty weathered, gray, aphanitic to fine grained QUARTZITE. Foliation extremely thin, at high angle, disturbed, occasionally microfaulted. Primary joint set at low angle, extremely close to wide, smooth to rough, stepped, oxidized, tight to open. Secondary joint set at high angle, close to wide, smooth, planar, oxidized, tight to open
	4		46.5	42	70	to Slight			
	5								
45	4								-BEDROCK- (Possible Vaughn Hills Formation)
	5								
	5	C2	46.5	58	97	Fresh			C2: Same as above, except fresh
	4		51.5	46	77				
	5								
50	4								Note: Water loss in Bedrock during drilling is approximately 2800 gallons.
	5							205.6	
								51.5	BOTTOM OF EXPLORATION 51.5 FT
									INSTALLED OBSERVATION WELL AT 51.4 FT

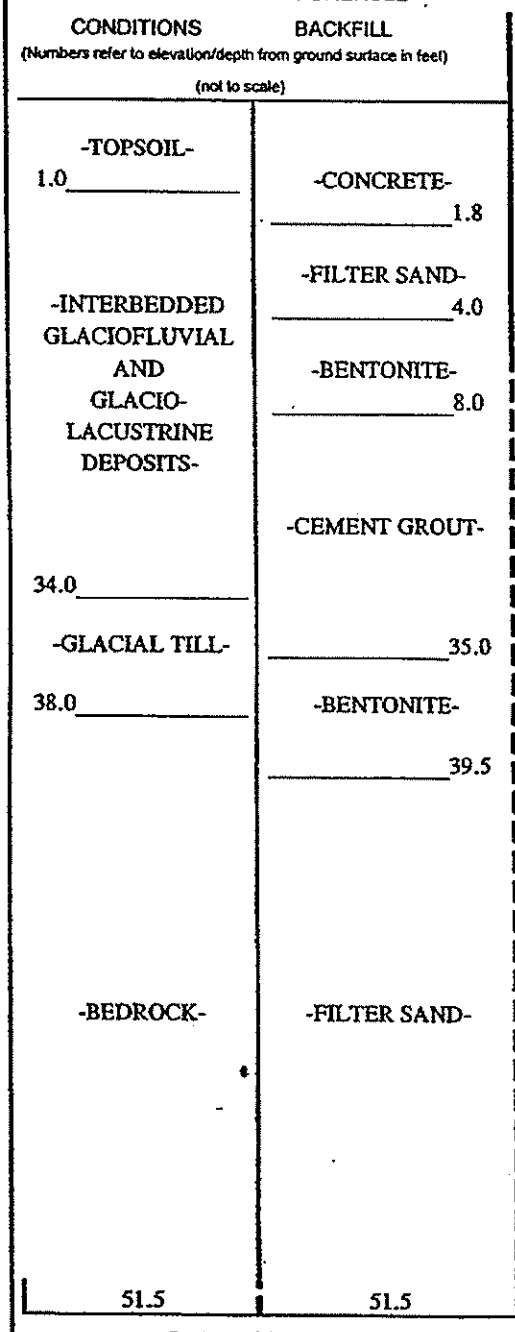
HALEY & ALDRICH

OBSERVATION WELL INSTALLATION REPORT

Project	MONITORING WELL INSTALLATION AOC32/43A
City/State	DEVENS, MA
Client	MASSDEVELOPMENT/DEVENS COMMERCE CENTER
Contractor	EARTH EXPLORATION SERVICES, WRENTHAM, MA
Driller	T. MARTINELLI

Observation Well	32M-01-17XBR
Test Boring	32M-01-17XBR
Installation Date	5-Dec-01
Location	See Plan
H&A File No.	10884-056
H&A Rep.	A. Nichols

Ground El. 257.1
El. Datum NGVD (1929)



Type of protective cover/lock: Cover/Padlock

Height of top of casing above ground surface: 2.9 ft

Height of top of riser pipe above ground surface: 2.4 ft

Type of protective casing: Guard Pipe

Length: 5.0 ft

Inside diameter: 6.0 in

Depth of bottom of casing: 2.0 ft

Seals:

Type	Depth to top (ft)	Thickness (ft)
Concrete	0.0	1.8
Bentonite Seal	4.0	4.0
Cement Grout	8.0	27.0
Bentonite	35.0	4.5

Type of riser pipe: Sch 40 PVC Solid

Inside diameter of riser pipe: 2.0 in

Type of backfill around riser: Seal

Diameter of borehole: 6.0 in

Depth of top of well screen: 41.4 ft

Type of screen or manufacturer: Machine Slotted PVC

Screen gauge or size of openings: 0.010 in

Diameter of well screen: 2.0 in

Type of backfill around screen: Filter Sand

Depth of bottom of well screen: 51.4 ft

Depth of bottom of silt trap

Depth of bottom of borehole: 51.5 ft

(Depths refer to ground surface)

Remarks: Ground El. reflects estimated ground surface at time of drilling, prior to placement of gravel pad.

HALEY & ALDRICH

TEST BORING REPORT

Boring No32M-01-18XBR

Project MONITORING WELL INSTALLATION AOC 32/43A DEVENS, MA
Client MASSDEVELOPMENT/DEVENS COMMERCE CENTER
Contractor EARTH EXPLORATION SERVICES, WRENTHAM, MA

File No. 10884-056
Sheet No. 1 of 2
Start January 2, 2002
Finish January 2, 2002
Driller R. Eastwood
H&A Rep. W. Rubik
Elevation 259.4
Datum NGVD (1929)
Location See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	SW	S	HQ	Rig Make & Model: Mobile B-57 Truck
Inside Diameter (in.)	6.0	1 3/8	2.5	Bit Type: Roller Bit
Hammer Weight (lb.)	300	140	-	Drill Mud: None
Hammer Fall (in.)	24	30	-	Casing: SW to 10.0 ft.
				Hoist/Hammer: Winch Doughnut Hammer

Depth (ft.)	SPT*	Sample No. & Rec. (in.)	Sample Depth (ft.)	Well Diagram	Elev./Depth (ft.)	USCS Symbol	Visual-Manual Identification and Description (Density/consistency, color, GROUP NAME, max. particle size**, structure, odor, moisture, optional descriptions, geologic interpretation)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0					258.5		-Gray CONCRETE SLAB-										
	31 40 46 53	S1 17	1.0 3.0		0.9	SM	Very dense brown silty SAND with gravel (SM), mps 1.5 in., no odor, dry -FILL-	20	20	15	15	15	15				
	46 57 100	S2 9	3.0 4.5			SM	Same as above Note: Frequent cobbles from 4.5 ft.										
5																	
	141 110 100/1"	S3 9	5.5 6.6			SM	Same as above, except wet Note: Most of material appears to be blasted/crushed Bedrock.										
					250.9												
	26 37 100/2"	S4 9	9.0 10.1		8.5	ML	Very dense yellow sandy SILT with gravel (ML), mps 1.0 in., well bonded, no odor, moist -GLACIAL TILL- TOP OF BEDROCK AT 10.0 FT	10	10	5	10	15	50				
10							SEE CORE BORING REPORT FOR ROCK DETAILS										
15																	
20																	

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft.) to: Bottom of Casing	Bottom of Hole	Water
1/11/02	1100	9 Days	-	24.0	21.6

Sample Identification

O Open End Rod
T Thin Wall Tube
U Undisturbed Sample
S Split Spoon
G Geoprobe

Well Diagram

Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary

Overburden (lin. ft.) 14.0
Rock Cored (lin. ft.) 10.0
Samples S4, C2

Boring No. 32M-01-18XBR

Field Tests: Dilatancy: R-Rapid, S-Slow, N-None
Toughness: L-Low, M-Medium, H-High
Plasticity: N-Nonplastic, L-Low, M-Medium, H-High
Dry Strength: N-None, L-Low, M-Medium, H-High, V-Very High

*SPT = Sampler blows per 6 in
**Maximum particle size (mm) is determined by direct observation within the limitations of sampler size (in millimeters)

HALEY & ALDRICH

CORE BORING REPORT

Boring No. 32M-01-18XBR
File No. 10884-056
Sheet No. 2 of 2

Depth (ft)	Drilling Rate Min./ft	Run No.	Depth (ft)	Recovery/RQD in.	Recovery/RQD %	Weathering	Well Diagram	Elev./ Depth (ft)	Visual Description and Remarks
									SEE TEST BORING REPORT FOR OVERBURDEN DETAILS
10								249.4 10.0	TOP OF BEDROCK AT 10.0 FT Note: Advanced borehole with roller bit to 14.0 ft.
	7	C1	14.0 19.0	39 16	55 27	Fresh to Slight			C1: Very hard, fresh to slightly weathered, gray, aphanitic to fine grained QUARTZITE. Foliation extremely thin at high angle, disturbed. Joints at high angle, extremely close to close, smooth, planar, oxidized, tight to open.
15	7								-BEDROCK- (Possible Berwick or Vaughn Hills Formation)
	7								
	7								
	7	C2	19.0 24.0	57 57	95 95	Fresh			C2: Same as above, except fresh. Joints close to wide.
20	7								
	7								
	7								
	7							235.4 24.0	BOTTOM OF EXPLORATION 24.0 FT INSTALLED OBSERVATION WELL AT 24.0 FT

CORE+WELL3 USGSLIB3.GDT G:\10884\2004\LOGS.GPJ Mar 27, 02

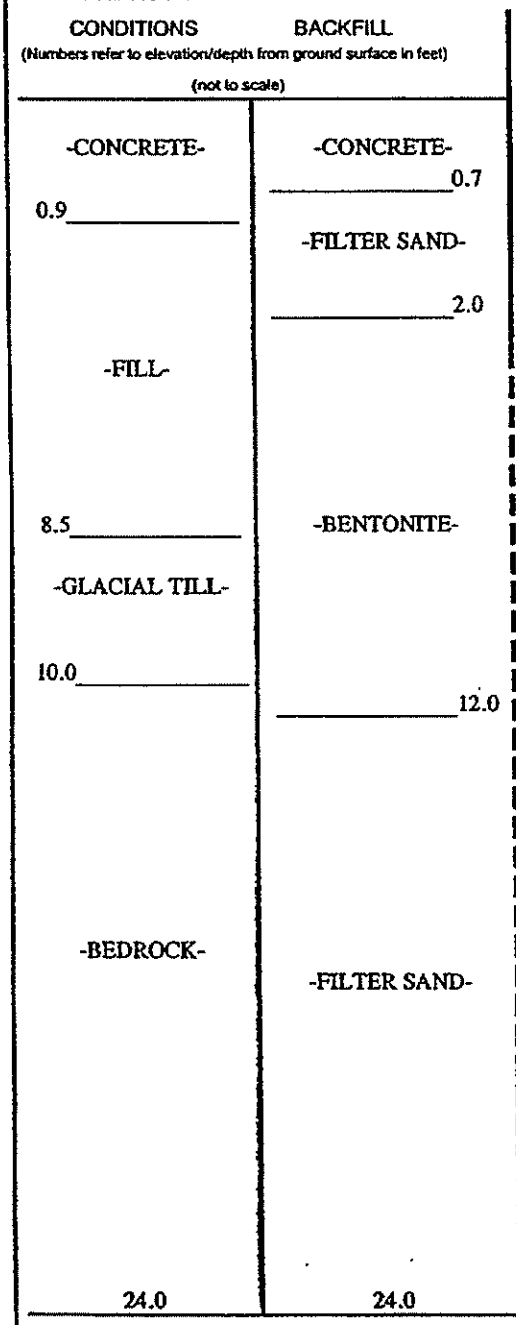
HALEY & ALDRICH

OBSERVATION WELL INSTALLATION REPORT

Project	MONITORING WELL INSTALLATION AOC32/43A	Observation Well	32M-01-18XBR
City/State	DEVENS, MA	Test Boring	32M-01-18XBR
Client	MASSDEVELOPMENT/DEVENS COMMERCE CENTER	Installation Date	2-Jan-02
Contractor	EARTH EXPLORATION SERVICES, WRENTHAM, MA	Location	See Plan
Driller	R. EASTWOOD	H&A File No.	10884-056
		H&A Rep.	W. Rubik

Ground El. 259.4

El. Datum NGVD (1929)



Type of protective cover: Bolted Cover

Depth of top of roadway box below ground surface: 0.0 ft

Depth of top of riser pipe below ground surface: 0.3 ft

Type of protective casing: Roadway Box

Length: 0.8 ft

Inside diameter: 6.0 in

Depth of bottom of roadway box: 0.8 ft

Seals:

Type	Depth to top (ft)	Thickness (ft)
Concrete	0.0	0.7
Bentonite Seal	2.0	10.0

Type of riser pipe: Sch 40 PVC Solid

Inside diameter of riser pipe: 2.0 in

Type of backfill around riser: Seal

Diameter of borehole: 6.0 in

Depth of top of well screen: 14.0 ft

Type of screen or manufacturer: Machine Slotted PVC

Screen gauge or size of openings: 0.010 in

Diameter of well screen: 2.0 in

Type of backfill around screen: Filter Sand

Depth of bottom of well screen: 24.0 ft

Depth of bottom of silt trap

Depth of bottom of borehole: 24.0 ft

(Depths refer to ground surface)

Remarks:

HALEY & ALDRICH

TEST BORING REPORT

Boring No. 43M-01-16XOB

Project MONITORING WELL INSTALLATION AOC 32/43A DEVENS, MA
Client MASSDEVELOPMENT/DEVENS COMMERCE CENTER
Contractor EARTH EXPLORATION SERVICES, WRENTHAM, MA

File No. 10884-056
Sheet No. 1 of 2
Start December 11, 2001
Finish December 14, 2001
Driller R. Eastwood
H&A Rep. W. Rubik
Elevation 257.9
Datum NGVD (1929)
Location See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	SW	S	-	Rig Make & Model: Mobile B-57 Truck
Inside Diameter (in.)	6.0	1 3/8	-	Bit Type: Roller Bit
Hammer Weight (lb.)	300	140	-	Drill Mud: None
Hammer Fall (in.)	24	30	-	Casing: driven
				Hoist/Hammer: Winch Doughnut Hammer

Depth (ft.)	SPT*	Sample No. & Rec. (in.)	Sample Depth (ft.)	Well Diagram	Elev./Depth (ft.)	USCS Symbol	Visual-Manual Identification and Description (Density/consistency, color, GROUP NAME, max. particle size**, structure, odor, moisture, optional descriptions, geologic interpretation)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test: Dilatancy	Field Test: Toughness	Field Test: Plasticity	Field Test: Strength
0					257.4		-Black bituminous ASPHALT-										
	8 12 20	S1 14	0.2 1.7		0.5	SM	Dense black-brown silty SAND with gravel (SM), trace asphalt specks, mps 1.0 in., no odor, wet	10	15	10	20	25	25				
							-FILL-										
	9 14 14 14	S2 16	2.0 4.0		255.4 2.5 255.2	OL/ OH	Black ORGANIC SOIL (OL/OH) -FORMER TOPSOIL-		5	5	15	45	30				
					2.7	SM	Medium dense red-brown silty SAND (SM), mps 0.25 in., no odor, dry										
	8 22 42 31	S3 17	4.0 6.0		253.9 4.0	SP	-LOESS- Very dense yellow poorly graded SAND with gravel (SP), mps 2.0 in., no odor, dry	10	15	15	40	15	5				
5	39 38 32 30	S4 15	6.0 8.0			SP	Same as above, except yellow-brown	10	15	20	40	15					
							-GLACIOFLUVIAL DEPOSITS-										
	20 22 34 34	S5 9	8.0 10.0			SP	Same as above, except gray-brown	15	20	15	40	10					
10	11 19 22 31	S6 14	10.0 12.0			SP	Same as above, except dense										
	12 16 18 26	S7 17	12.0 14.0			SP	Same as above										
					243.9												
	9 14 17 20	S8 11	14.0 16.0		14.0	SP	Dense gray poorly graded SAND with gravel (SP), mps 1.0 in., stratified, no odor, wet		5	40	40	15					
15	17 23 29 36	S9 11	16.0 18.0			SP	Same as above, except very dense		10	40	40	10					
							-GLACIOFLUVIAL DEPOSITS-										
	22 22 20 23	S10 10	18.0 20.0			SP	Same as above, except dense		10	40	10	10					
20																	

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft.) to: Bottom of Casing	Bottom of Hole	Water
12/13/01	0830	-	in cluster hole		28.5
1/12/02	1705	29 Days	-	33.8	28.9

Sample Identification

O Open End Rod
T Thin Wall Tube
U Undisturbed Sample
S Split Spoon
G Geoprobe

Well Diagram

Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary

Overburden (lin. ft.) 35.0
Rock Cored (lin. ft.) -
Samples S15

Boring No. 43M-01-16XOB

Field Tests: Dilatancy: R-Rapid, S-Slow, N-None Plasticity: N-Nonplastic, L-Low, M-Medium, H-High
Toughness: L-Low, M-Medium, H-High Dry Strength: N-None, L-Low, M-Medium, H-High, V-Very High

*SPT = Sampler blows per 6 in **Maximum particle size (mm) is determined by direct observation within the limitations of sampler size (in millimeters)

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HALEY & ALDRICH

TEST BORING REPORT

Boring No. 43M-01-16XOB
File No. 10884-056
Sheet No. 2 of 2

Depth (ft.)	SPT*	Sample No. & Rec. (in.)	Sample Depth (ft.)	Well Diagram	Elev./Depth (ft.)	USCS Symbol	Visual-Manual Identification and Description (Density/consistency, color, GROUP NAME, max. particle size**, structure, odor, moisture, optional descriptions, geologic interpretation)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
20	26 19 21 37	S11 8	20.0 22.0		237.9 20.0	SP	Dense gray poorly graded SAND with gravel (SP), mps 1.0 in., stratified, no odor, wet	5	10	30	40	10	5				
	12 18 18 12	S12 8	22.0 24.0			SP	-GLACIOFLUVIAL DEPOSITS- Same as above	10	10	35	35	10					
25	30 20 20 20	S13 0	24.0 26.0				No recovery. Attempted twice.										
	12 18 20 23	S14 11	26.0 28.0			SP	Dense gray poorly graded SAND (SP), mps 5.0 mm, stratified, no odor, wet		5	15	65	15					
	19 24 23 23	S15 0	28.0 30.0				No recovery										
30					227.9 30.0		Note: See Boring Log 43M-01-16XBR for soil description below 30.0 ft.										
					225.9 32.0		-GLACIOLACUSTRINE DEPOSITS- -GLACIAL TILL-										
35					222.9 35.0		BOTTOM OF EXPLORATION 35.0 FT INSTALLED OBSERVATION WELL AT 34.0 FT.										

*SPT = Sampler blows per 6 in. **Maximum particle size (mm) is determined by direct observation within the limitations of sampler

HALEY & ALDRICH

TEST BORING REPORT

Boring No. 43M-01-16XBR

Project MONITORING WELL INSTALLATION AOC 32/43A DEVENS, MA
Client MASSDEVELOPMENT/DEVENS COMMERCE CENTER
Contractor EARTH EXPLORATION SERVICES, WRENTHAM, MA

File No. 10884-056
Sheet No. 1 of 3
Start December 12, 2001
Finish December 13, 2001
Driller R. Eastwood
H&A Rep. W. Rubik
Elevation 257.8
Datum NGVD (1929)
Location See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	SW	S	HQ	Rig Make & Model: Mobile B-57 Truck
Inside Diameter (in.)	6.0	1 3/8	2.5	Bit Type: Roller Bit
Hammer Weight (lb.)	300	140	-	Drill Mud: None
Hammer Fall (in.)	24	30	-	Casing: driven
				Hoist/Hammer: Winch Doughnut Hammer

Depth (ft.)	SPT*	Sample No. & Rec. (in.)	Sample Depth (ft.)	Well Diagram	Elev./Depth (ft.)	USCS Symbol	Visual-Manual Identification and Description (Density/consistency, color, GROUP NAME, max. particle size**, structure, odor, moisture, optional descriptions, geologic interpretation)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0					255.3		Note: No sampling required to 30.0 ft. See Boring Log 43M-01-16XOB for soil descriptions from 0.0 to 30.0 ft depth.										
					2.5		-FILL-										
					255.1		-FORMER TOPSOIL-										
					2.7		-LOESS-										
					253.8												
5					4.0												
10							-GLACIOFLUVIAL DEPOSITS-										
15																	
20																	

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft.) to: Bottom of Casing	Bottom of Hole	Water
12/13/01	0815	17.5	34.0	38.0	28.5
1/13/02	0900	31 Days	-	57.2	28.8

Sample Identification

O Open End Rod
T Thin Wall Tube
U Undisturbed Sample
S Split Spoon
G Geoprobe

Well Diagram

Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary

Overburden (lin. ft.) 48.3
Rock Cored (lin. ft.) 10.0
Samples S4, C2

Boring No. 43M-01-16XBR

Field Tests:
Dilatancy: R-Rapid, S-Slow, N-None
Toughness: L-Low, M-Medium, H-High
Plasticity: N-Nonplastic, L-Low, M-Medium, H-High, V-Very High
Dry Strength: N-None, L-Low, M-Medium, H-High, V-Very High

*SPT = Sampler blows per 6 in.
**Maximum particle size (mm) is determined by direct observation within the limitations of sampler size (in millimeters)

HALEY & ALDRICH

TEST BORING REPORT

Boring No. 43M-01-16XBR
File No. 10884-056
Sheet No. 2 of 3

Depth	SPT*	Sample No. & Rec. (in.)	Sample Depth (ft.)	Well Diagram	Elev./Depth (ft.)	USCS Symbol	Visual-Manual Identification and Description (Density/consistency, color, GROUP NAME, max. particle size**, structure, odor, moisture, optional descriptions, geologic interpretation)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
20																	
25							-GLACIOFLUVIAL DEPOSITS-										
30					227.8												
	45 44 62 90	S1 17	30.0 32.0		30.0	SM	Very dense light brown silty SAND (SM), mps 3.0 mm, in partings, no odor, moist			5	5	65	25				
					225.8		-GLACIOLACUSTRINE DEPOSITS-										
					32.0		Note: Boulder 32.0 to 33.5 ft.										
	~~24/4"~~ 100/0"	~~S2~~ 2	~~33.5~~ 33.8				Poor recovery of GRAVEL lodged in tip of the samples Note: Numerous cobbles and boulders from 33.8 to 39.0 ft. Unable to obtain sample.										
35							-GLACIAL TILL-										
	93 30 29 63	S3 16	39.0 41.0			SM	Very dense yellow-brown silty SAND with gravel (SM), mps 1.0 ft, well bonded, no odor, moist	5	10	10	10	40	25	N	H	N	
40					216.8												
	82 91 ~~100/3"~~	S4 10	41.0 42.2		41.0	SM/ML	Very dense yellow-brown layered silty SAND (SM) and SILT (ML), mps 0.5 in., no odor, wet Note: Boulder from 42.2 to 45.4 ft.		5	5	10	60	25	N	H	N	
45							-GLACIAL TILL-										
							TOP OF BEDROCK AT 45.5 FT SEE CORE BORING REPORT FOR ROCK DETAILS										

*SPT = Sampler blows per 6 in. **Maximum particle size (mm) is determined by direct observation within the limitations of sampler

HALEY & ALDRICH

CORE BORING REPORT

Boring No. 43M-01-16XBR
File No. 10884-056
Sheet No. 3 of 3

Depth (ft)	Drilling Rate Min./ft	Run No.	Depth (ft)	Recovery/RQD in.	Recovery/RQD %	Weathering	Well Diagram	Elev./ Depth (ft)	Visual Description and Remarks
									SEE TEST BORING REPORT FOR OVERBURDEN DETAILS
								212.3 45.5	TOP OF BEDROCK AT 45.5 FT
									Note: Advanced borehole with roller bit to 48.3 ft.
	7	C1	48.3 53.3	55 45	92 75	Fresh			C1: Very hard fresh gray aphanitic to fine grained QUARTZITE. Foliation extremely thin at high angles. Joints at high angles, parallel to foliation, extremely close to moderate, smooth to rough, planar, fresh to oxidized, tight to open. Observed numerous calcite veins parallel to foliation.
50	6								
	7								-BEDROCK- (Possible Berwick Formation)
	7								
	7								
	7	C2	53.3 58.3	59 45	98 75	Fresh			C2: Same as above
55	7								
	7								
	7								
	7								
								199.5 58.3	BOTTOM OF EXPLORATION 58.3 FT
									INSTALLED OBSERVATION WELL AT 57.5 FT

HALEY & ALDRICH

OBSERVATION WELL INSTALLATION REPORT

Project	MONITORING WELL INSTALLATION AOC32/43A	Observation Well	43M-01-16XBR
City/State	DEVENS, MA	Test Boring	43M-01-16XBR
Client	MASSDEVELOPMENT/DEVENS COMMERCE CENTER	Installation Date	14-Dec-01
Contractor	EARTH EXPLORATION SERVICES, WRENTHAM, MA	Location	See Plan
Driller	R. EASTWOOD	H&A File No.	10884-056
		H&A Rep.	W. Rubik

Ground El. 257.8

El. Datum NGVD (1929)

SOIL/ROCK CONDITIONS (Numbers refer to elevation/depth from ground surface in feet) (not to scale)

-ASPHALT- 0.5

-FILL- 2.5

-FORMER TOPSOIL- 2.7

-LOESS- 4.0

-GLACIOFLUVIAL DEPOSITS- 30.0

-GLACIO-LACUSTRINE-DEPOSITS- 32.0

-GLACIAL TILL- 45.5

-BEDROCK- 58.3

Bottom of Exploration

BOREHOLE BACKFILL

-CONCRETE- 0.6

-FILTER SAND- 2.0

-CEMENT GROUT- 41.5

-BENTONITE- 45.5

-FILTER SAND- 58.3

Type of protective cover/lock: Bolted Cover

Depth of top of roadway box below ground surface: 0.0 ft

Depth of top of riser pipe below ground surface: 0.3 ft

Type of protective casing: Roadway Box

Length: 0.8 ft

Inside diameter: 6.0 in

Depth of bottom of casing: 0.8 ft

Seals:

Type	Depth to top (ft)	Thickness (ft)
Concrete	0.0	0.6
Cement Grout	2.0	39.5
Bentonite Seal	41.5	4.0

Type of riser pipe: Sch 40 PVC Solid

Inside diameter of riser pipe: 2.0 in

Type of backfill around riser: Seal

Diameter of borehole: 6.0 in

Depth of top of well screen: 47.5 ft

Type of screen or manufacturer: Machine Slotted PVC

Screen gauge or size of openings: 0.010 in

Diameter of well screen: 2.0 in

Type of backfill around screen: Filter Sand

Depth of bottom of well screen: 57.5 ft

Depth of bottom of silt trap

Depth of bottom of borehole: 58.3 ft

(Depths refer to ground surface)

Remarks: Soil conditions from 0.0 to 30.0 ft based on adjacent Cluster Boring 43M-01-16XOB.

TEST BORING REPORT

Boring No43M-01-17XOB

Project MONITORING WELL INSTALLATION AOC 32/43A DEVENS, MA
Client MASSDEVELOPMENT/DEVENS COMMERCE CENTER
Contractor EARTH EXPLORATION SERVICES, WRENTHAM, MA

File No. 10884-056
Sheet No. 1 of 2
Start December 20, 2001
Finish December 20, 2001
Driller R. Eastwood
H&A Rep. W. Rubik
Elevation 259.4
Datum NGVD (1929)
Location See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	SW	S	-	Rig Make & Model: Mobile B-57 Truck
Inside Diameter (in.)	6.0	1 3/8	-	Bit Type: Roller Bit
Hammer Weight (lb.)	300	140	-	Drill Mud: None
Hammer Fall (in.)	24	30	-	Casing: driven
				Hoist/Hammer: Cat-Head Doughnut Hammer

Depth (ft.)	SPT*	Sample No. & Rec. (in.)	Sample Depth (ft.)	Well Diagram	Elev./Depth (ft.)	USCS Symbol	Visual-Manual Identification and Description (Density/consistency, color, GROUP NAME, max. particle size**, structure, odor, moisture, optional descriptions, geologic interpretation)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0					258.9		-Black ASPHALT-										
					0.5		Note: No sampling required. See Boring Log 43M-01-17XBR for soil descriptions. -FILL-										
5					253.4												
					6.0		-GLACIOFLUVIAL DEPOSITS-										
10																	
15																	
					241.5												
					17.9		-GLACIOLACUSTRINE DEPOSITS-										
20																	

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft.) to: Bottom of Casing	Bottom of Hole	Water
1/04/02	0848	15 Days	-	-	30.0
1/14/02	1105	25 Days	-	33.5	30.5

Sample Identification

O Open End Rod
T Thin Wall Tube
U Undisturbed Sample
S Split Spoon
G Geoprobe

Well Diagram

Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary

Overburden (lin. ft.) 34.0
Rock Cored (lin. ft.) -
Samples -

Boring No. 43M-01-17XOB

Field Tests: Dilatancy: R-Rapid, S-Slow, N-None
Toughness: L-Low, M-Medium, H-High
Plasticity: N-Nonplastic, L-Low, M-Medium, H-High
Dry Strength: N-None, L-Low, M-Medium, H-High, V-Very High

*SPT = Samoler blows per 6 in **Maximum particle size (mm) is determined by direct observation within the limitations of sampler size (in millimeters)

HALEY & ALDRICH

TEST BORING REPORT

Boring No. 43M-01-17XOB
File No. 10884-056
Sheet No. 2 of 2

Depth (ft)	SPT*	Sample No. & Rec. (in.)	Sample Depth (ft.)	Well Diagram	Elev./Depth (ft.)	USCS Symbol	Visual-Manual Identification and Description (Density/consistency, color, GROUP NAME, max. particle size**, structure, odor, moisture, optional descriptions, geologic interpretation)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
20							-GLACIOLACUSTRINE DEPOSITS-										
25																	
					231.4												
					28.0		-GLACIOFLUVIAL DEPOSITS-										
30																	
					225.4												
					34.0		BOTTOM OF EXPLORATION 34.0 FT										
							INSTALLED OBSERVATION WELL AT 33.5 FT										

*SPT = Sampler blows per 6 in. **Maximum particle size (mm) is determined by direct observation within the limitations of sampler

HALEY & ALDRICH

OBSERVATION WELL INSTALLATION REPORT

Project	MONITORING WELL INSTALLATION AOC32/43A
City/State	DEVENS, MA
Client	MASSDEVELOPMENT/DEVENS COMMERCE CENTER
Contractor	EARTH EXPLORATION SERVICES, WRENTHAM, MA
Driller	R. EASTWOOD

Observation Well	43M-01-17XOB
Test Boring	43M-01-17XOB
Installation Date	20-Dec-01
Location	See Plan
H&A File No.	10884-056
H&A Rep.	W. Rubik

Ground El. 259.4

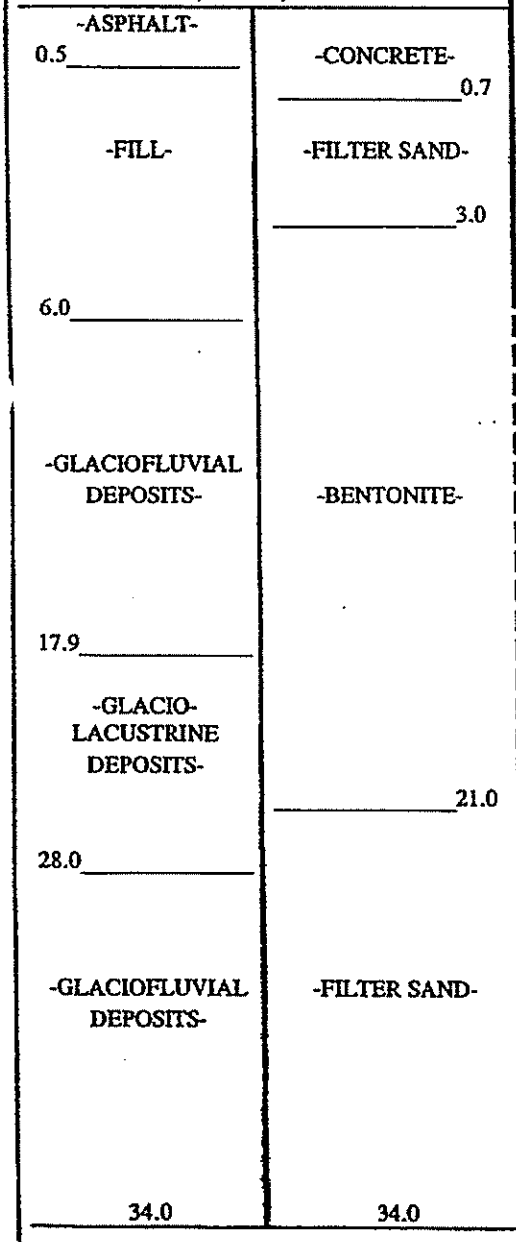
El. Datum NGVD (1929)

SOIL/ROCK CONDITIONS

BOREHOLE BACKFILL

(Numbers refer to elevation/depth from ground surface in feet)

(not to scale)



Bottom of Exploration

Type of protective cover/lock: Bolted Cover

Depth of top of roadway box below ground surface: 0.0 ft

Depth of top of riser pipe below ground surface: 0.5 ft

Type of protective casing: Roadway Box

Length: 0.8 ft

Inside diameter: 6.0 in

Depth of bottom of roadway box: 0.8 ft

Seals:

Type	Depth to top (ft)	Thickness (ft)
Concrete	0.0	0.7
Bentonite Seal	3.0	18.0

Type of riser pipe: Sch 40 PVC Solid

Inside diameter of riser pipe: 2.0 in

Type of backfill around riser: Seal

Diameter of borehole: 6.5 in

Depth of top of well screen: 23.5 ft

Type of screen or manufacturer: Machine Slotted PVC

Screen gauge or size of openings: 0.010 in

Diameter of well screen: 2.0 in

Type of backfill around screen: Filter Sand

Depth of bottom of well screen: 33.5 ft

Depth of bottom of silt trap

Depth of bottom of borehole: 34.0 ft

(Depths refer to ground surface)

Remarks: Soil conditions based on adjacent Cluster Boring 43M-01-17XBR.

HALEY & ALDRICH

TEST BORING REPORT

Boring No. 43M-01-17XBR

Project MONITORING WELL INSTALLATION AOC 32/43A DEVENS, MA
Client MASSDEVELOPMENT/DEVENS COMMERCE CENTER
Contractor EARTH EXPLORATION SERVICES, WRENTHAM, MA

File No. 10884-056
Sheet No. 1 of 3
Start December 17, 2001
Finish December 19, 2001
Driller R. Eastwood
H&A Rep. W. Rubik
Elevation 259.3
Datum NGVD (1929)
Location See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	SW	S	HQ	Rig Make & Model: Mobile B-57 Truck
Inside Diameter (in.)	6.0	1 3/8	2.5	Bit Type: Roller Bit
Hammer Weight (lb.)	300	140	-	Drill Mud: None
Hammer Fall (in.)	24	30	-	Casing: driven
				Hoist/Hammer: Winch Doughnut Hammer

Depth (ft.)	SPT*	Sample No. & Rec. (in.)	Sample Depth (ft.)	Well Diagram	Elev./Depth (ft.)	USCS Symbol	Visual-Manual Identification and Description (Density/consistency, color, GROUP NAME, max. particle size**, structure, odor, moisture, optional descriptions, geologic interpretation)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test: Dilatancy	Field Test: Toughness	Field Test: Plasticity	Field Test: Strength
0					258.8		-Black ASPHALT-										
	19 27 38	S1 14	0.5 1.7		0.5	SM	Very dense gray-brown silty SAND with gravel (SM), mps 1.0 in., no odor, moist to dry	5	10	15	25	30	15				
	10 14 19 16	S2 10	2.0 4.0			SM	Same as above, except dense	5	10	15	25	30	15				
							-FILL-										
	7 6 9 11	S3 3	4.0 6.0			SM	Same as above, except medium dense, wet										
5					253.3												
	12 12 13 12	S4 17	6.0 8.0		6.0	SP	Medium dense light brown poorly graded SAND (SP), mps 2.0 in., stratified, no odor, moist			5	30	60	5				
							-GLACIOFLUVIAL DEPOSITS-										
	26 21 27 24	S5 13	8.0 10.0			SP	Same as above, except dense, mps 5.0 mm		5	5	30	55	5				
10	20 20 22 26	S6 10	10.0 12.0				Same as above										
					247.3												
	17 27 38 29	S7 16	12.0 14.0		12.0	SW	Very dense light gray well graded SAND with gravel (SW), mps 1.0 in., stratified, no odor, moist	10	10	25	25	25	5				
							-GLACIOFLUVIAL DEPOSITS-										
	25 32 28 24	S8 9	14.0 16.0			SW	Same as above, except gray-brown	10	10	30	30	20					
15																	
	34 32 28 24	S9 16	16.0 18.0			SW	Same as above	10	10	25	30	20	5				
					242.3												
					17.0 241.4	SP	Very dense gray-brown poorly graded SAND (SP), mps 2.0 mm, stratified, no odor, moist				30	65	5				
							-GLACIOFLUVIAL DEPOSITS-										
	20 14 21 26	S10 9	18.0 20.0		17.9	SM	Medium dense light gray silty SAND (SM), mps 1.0 mm, in partings, no odor, moist					80	20				
20							-GLACIOLACUSTRINE DEPOSITS-										

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft.) to: Bottom of Casing	Bottom of Hole	Water
12/19/01	0700	16	44.0	45.0	29.8
1/4/02	0855	16 Days	-	-	29.4
1/14/02	1100	26 Days	-	57.5	26.8

Sample Identification

O Open End Rod
T Thin Wall Tube
U Undisturbed Sample
S Split Spoon
G Geoprobe

Well Diagram

Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary

Overburden (lin. ft.) 48.0
Rock Cored (lin. ft.) 10.0
Samples S22, C2

Boring No. 43M-01-17XBR

Field Tests: Dilatancy: R-Rapid, S-Slow, N-None Plasticity: N-Nonplastic, L-Low, M-Medium, H-High
Toughness: L-Low, M-Medium, H-High Dry Strength: N-None, L-Low, M-Medium, H-High, V-Very High

*SPT = Sampler blows per 6 in **Maximum particle size (mm) is determined by direct observation within the limitations of sampler size (i.e. drilling spoon)

HALEY & ALDRICH

TEST BORING REPORT

Boring No. 43M-01-17XBR
File No. 10884-056
Sheet No. 2 of 3

Depth (ft.)	SPT*	Sample No. & Rec. (in.)	Sample Depth (ft.)	Well Diagram	Elev./Depth (ft.)	USCS Symbol	Visual-Manual Identification and Description (Density/consistency, color, GROUP NAME, max. particle size**, structure, odor, moisture, optional descriptions, geologic interpretation)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
20	21	S11	20.0			SM	Same as above, except dense					80	20				
	22	15	22.0														
	23																
	31																
	30	S12	22.0			SM	Same as above, except light gray-brown, very dense					80	20				
	30	13	24.0														
	30																
	29				235.3												
	30	S13	24.0		24.0	ML	Very dense tan sandy SILT (ML), mps 1.0 mm, in partings, no odor, dry to moist					30	70	S	H	N	
25	32	9	26.0														
	30						-GLACIOLACUSTRINE DEPOSITS-										
	31																
	29	S14	26.0														
	31	0	28.0														
	33																
	30				231.3												
	30	S15	28.0		28.0	SW	Very dense brown well graded SAND (SW), mps 1.0 in, stratified, no odor, moist	5	5	30	30	30					
	31	13	30.0														
	22						-GLACIOFLUVIAL DEPOSITS-										
	27																
30	10	S16	30.0			SW	Same as above	5	5	30	30	30					
	14	10	32.0														
	21																
	26				227.3												
	13	S17	32.0		32.0	SP	Dense tan poorly graded SAND (SP), mps 1.0 in., no odor, wet	5	5	10	30	50					
	19	11	34.0														
	22						-GLACIOFLUVIAL DEPOSITS-										
	27																
	26	S18	34.0			SP	Same as above, except very dense	5	5	20	30	40					
35	29	15	36.0														
	25																
	34				223.3												
	28	S19	36.0		36.0	SP	Very dense tant poorly graded SAND (SP), mps 0.25 in., in partings, no odor, wet		5	10	15	70					
	30	14	38.0														
	36						-GLACIOFLUVIAL DEPOSITS-										
	45				221.3												
	24	S20	38.0		38.0	SP	Very dense tan poorly graded SAND with gravel (SP), mps 3.0 in., in partings, no odor, wet	20				80					
	38	9	40.0														
	104						-GLACIOFLUVIAL DEPOSITS-										
	39				219.3												
40	57	S21	40.0		40.0	SM	Very dense yellow-brown silty SAND with gravel (SM), mps 2.0 in., well bonded, no odor, wet	10	10	15	20	20	25				
	125	3	41.0														
							-GLACIAL TILL-										
							Note: Boulder from 41.0 to 43.4 ft.										
	195	S22	44.0			SM	Same as above										
		4	44.5				TOP OF BEDROCK AT 44.5 FT										
45							SEE CORE BORING REPORT FOR ROCK DETAILS										

*SPT = Sampler blows per 6 in. **Maximum particle size (mm) is determined by direct observation within the limitations of sampler

NOTE: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

HALEY & ALDRICH

CORE BORING REPORT

Boring No. 43M-01-17XBR
File No. 10884-008
Sheet No. 3 of 3

Depth (ft)	Drilling Rate Min./ft	Run No.	Depth (ft)	Recovery/RQD in.	Recovery/RQD %	Weathering	Well Diagram	Elev./ Depth (ft)	Visual Description and Remarks
									SEE TEST BORING REPORT FOR OVERBURDEN DETAILS
45								214.8 44.5	TOP OF BEDROCK AT 44.5 FT Note: Advanced borehole with roller bit from 44.5 to 48.0 ft in bedrock.
	10	C1	48.0 53.0	60 60	100 100	Fresh			C1: Very hard, fresh, gray, aphanitic to fine grained QUARTZITE. Foliation extremely thin at high angles, disturbed along joint axes. Single joint at high angle, moderately close to wide, smooth, planar, oxidized, tight. Observed possible vugs above joints, possibly separation on a healed joint.
	9								
50	9								
	10								-BEDROCK- (Possible Berwick Formation)
	9								
	8	C2	53.0 58.0	57 54	95 90	Fresh			C2: Same as above, except joints at low angles, close to wide, smooth, planar to stepped, oxidized, tight to open.
	9								
55	9								
	9								
	9							201.3 58.0	BOTTOM OF EXPLORATION 58.0 FT INSTALLED OBSERVATION WELL AT 57.5 FT

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OBSERVATION WELL INSTALLATION REPORT

Observation Well	43M-01-17XBR
Test Boring	43M-01-17XBR
Installation Date	19-Dec-01
Location	See Plan
H&A File No.	10884-056
H&A Rep.	W. Rubik

Project	MONITORING WELL INSTALLATION AOC32/43A
City/State	DEVENS, MA
Client	MASSDEVELOPMENT/DEVENS COMMERCE CENTER
Contractor	EARTH EXPLORATION SERVICES, WRENTHAM, MA
Driller	R. EASTWOOD

Ground El. 259.3
El. Datum NGVD (1929)

SOIL/ROCK CONDITIONS (Numbers refer to elevation/depth from ground surface in feet) (not to scale)

BOREHOLE BACKFILL

-ASPHALT- 0.5
-CONCRETE- 0.7
-FILTER SAND- 2.0
-FILL-
-BENTONITE- 4.0
6.0
-GLACIOFLUVIAL DEPOSITS-
17.9
-CEMENT GROUT-
-GLACIO-LACUSTRINE DEPOSITS-
28.0
-GLACIOFLUVIAL DEPOSITS-
40.0
41.5
-GLACIAL TILL-
44.5
-BENTONITE-
45.5
-BEDROCK-
-FILTER SAND-
58.0 58.0
Bottom of Exploration

Type of protective cover/lock: Bolted Cover
Depth of top of roadway box below ground surface: 0.0 ft
Depth of top of riser pipe below ground surface: 0.3 ft
Type of protective casing: Roadway Box
Length: 0.8 ft
Inside diameter: 6.0 in
Depth of bottom of roadway box: 0.8 ft

Seals:

Type	Depth to top (ft)	Thickness (ft)
Concrete	0.0	0.7
Bentonite Seal	2.0	2.0
Cement Grout	4.0	37.5
Bentonite Seal	41.5	4.0

Type of riser pipe: Sch 40 PVC Solid
Inside diameter of riser pipe: 2.0 in
Type of backfill around riser: Seal
Diameter of borehole: 6.0 in
Depth of top of well screen: 47.5 ft
Type of screen or manufacturer: Machine Slotted PVC
Screen gauge or size of openings: 0.010 in
Diameter of well screen: 2.0 in
Type of backfill around screen: Filter Sand
Depth of bottom of well screen: 57.5 ft
Depth of bottom of silt trap
Depth of bottom of borehole: 58.0 ft
(Depths refer to ground surface)

Remarks:

HALEY & ALDRICH

TEST BORING REPORT

Boring No. 43M-01-20XOB

Project MONITORING WELL INSTALLATION AOC 32/43A DEVENS, MA
Client MASSDEVELOPMENT/DEVENS COMMERCE CENTER
Contractor EARTH EXPLORATION SERVICES, WRENTHAM, MA

File No. 10884-056
Sheet No. 1 of 2
Start November 21, 2001
Finish November 26, 2001
Driller R. Eastwood
H&A Rep. L. Baerga
Elevation 258.7
Datum NGVD (1929)
Location See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	SW	S	-	Rig Make & Model: Mobile B-57 Truck
Inside Diameter (in.)	6.0	1 3/8	-	Bit Type: Roller Bit
Hammer Weight (lb.)	300	140	-	Drill Mud: None
Hammer Fall (in.)	24	30	-	Casing: driven
				Hoist/Hammer: Winch Doughnut Hammer

Depth (ft.)	SPT*	Sample No. & Rec. (in.)	Sample Depth (ft.)	Well Diagram	Elev./Depth (ft.)	USCS Symbol	Visual-Manual Identification and Description (Density/consistency, color, GROUP NAME, max. particle size**, structure, odor, moisture, optional descriptions, geologic interpretation)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test: Dilatancy	Field Test: Toughness	Field Test: Plasticity	Field Test: Strength
0					258.6		-ASPHALT-										
	27 33 14	S1 13	0.5 2.0		0.1	SP	Very dense light brown poorly-graded SAND (SP), mps 30.0 mm., no odor, dry	5	5	10	20	60					
	10 7 11 7	S2 16	2.0 4.0			SP-SM	Medium dense red-brown poorly-graded SAND with silt (SP-SM), mps 13.0 mm., no odor, dry		5	5	40	40	10				
					254.7		-FILL-										
5	15 29 10 11	S3 16	4.0 6.0		4.0	SP	Dense tan poorly-graded SAND (SP), mps 21.0 mm., faint partings, no odor, dry	4	6	2	3	80					
							-GLACIOFLUVIAL DEPOSITS-										
	15 16 20 24	S4 18	6.0 8.0			SP	Dense tan poorly-graded SAND (SP), mps 22.0 mm., no odor, dry	2	3	5	5	85					
					250.7												
	16 17 21 19	S5 10	8.0 10.0		8.0	SW	Dense light brown well-graded SAND (SW), mps 16.0 mm., no odor, dry		5	30	35	30					
					248.7		-GLACIOFLUVIAL DEPOSITS-										
10	6 13 19 20	S6 12	10.0 12.0		10.0	SP	Dense light brown poorly-graded SAND with gravel (SW), mps 20.0 mm., no structure, no odor, dry	10	10	10	35	35					
							-GLACIOFLUVIAL DEPOSITS-										
	19 17 19 24	S4 14	12.0 14.0														
					244.7												
	22 24 32 28	S8 11	14.0 16.0		14.0	SW	Very dense light brown well-graded SAND with gravel (SW), mps 21.0 mm., no structure, no odor, dry		15	30	30	25					
15							-GLACIOFLUVIAL DEPOSITS-										
	30 19 21 26	S9 14	16.0 18.0			SW	Dense light brown well-graded SAND with gravel (SW), mps 20.0 mm., no structure, no odor, dry		15	25	30	30					
					240.7												
	14 17 20 24	S10 10	18.0 20.0		18.0	SP	Dense light brown poorly-graded SAND (SP), mps 8.0 mm., no structure, no odor, dry			10	45	45					
20							-GLACIOFLUVIAL DEPOSITS-										

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft.) to: Bottom of Casing	Bottom of Hole	Water
11/21/01	1400	-	24.0	24.0	19.9
11/26/01	1500	121	well screen	34.0	29.5
1/11/02	1250	46 Days	-	34.0	30.2

Sample Identification

O Open End Rod
T Thin Wall Tube
U Undisturbed Sample
S Split Spoon
G Geoprobe

Well Diagram

Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary

Overburden (lin. ft.) 34.0
Rock Cored (lin. ft.) -
Samples S17

Boring No. 43M-01-20XOB

Field Tests: Dilatancy: R-Rapid, S-Slow, N-None
Toughness: L-Low, M-Medium, H-High
Plasticity: N-Nonplastic, L-Low, M-Medium, H-High
Dry Strength: N-None, L-Low, M-Medium, H-High, V-Very High

*SPT = Sampler blows per 6 in
**Maximum particle size (mm) is determined by direct observation within the limitations of sampler size (in millimeters)

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TEST BORING REPORT

Boring No. 43M-01-20XOB
File No. 10884-056
Sheet No. 2 of 2

SPT*	Sample No. & Rec. (in.)	Sample Depth (ft.)	Well Diagram	Elev./Depth (ft.)	USCS Symbol	Visual-Manual Identification and Description (Density/consistency, color, GROUP NAME, max. particle size**, structure, odor, moisture, optional descriptions, geologic interpretation)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
20 28 34 39	S11 14	20.0 22.0			SW	Very dense light brown well-graded SAND (SW), mps 18.0 mm., no structure, no odor, dry		10	30	30	30					
						-GLACIOFLUVIAL DEPOSITS-										
26 31 40 36	S12 12	22.0 24.0			SW	Very dense light brown well-graded SAND with gravel (SW), mps 42.0 mm., no structure, no odor, dry	25	15	15	20	20	5				
35 26 22 20	S13 18	24.0 26.0		232.7	SW	Dense light brown well-graded SAND with gravel (SW), mps 25.0 mm., frequent partings, sweet odor, dry	10	10	25	25	25	5				
66 33 23 34	S14 15	26.0 28.0		26.0	SP	Very dense light brown poorly-graded SAND (SP), mps 21.0 mm., frequent partings, faint sweet odor, dry		5	15	40	40					
27 17 10 13	S15 6	28.0 30.0			SP	Medium dense light brown poorly-graded SAND (SP), mps 5.0 mm., no structure, faint sweet odor, wet			15	35	50					
				228.7		-GLACIOFLUVIAL DEPOSITS-										
17 18 24 34	S16 10	30.0 32.0		30.0	SW	Dense brown well-graded SAND with gravel (SW), mps 20.0 mm., no structure, no odor, wet	10	30	30	20	10					
44 23 15 16	S17 7	32.0 34.0			SW	Dense light brown well-graded SAND with gravel (SW), mps 30.0 mm., no structure, no odor, wet	20	25	30	20	5					
				224.7		-GLACIOFLUVIAL DEPOSITS-										
				34.0		BOTTOM OF EXPLORATION 34.0 FT.										
						INSTALLED OBSERVATION WELL AT 34.0 FT.										

*SPT = Sampler blows per 6 in. **Maximum particle size (mm) is determined by direct observation within the limitations of sampler

NOTE: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

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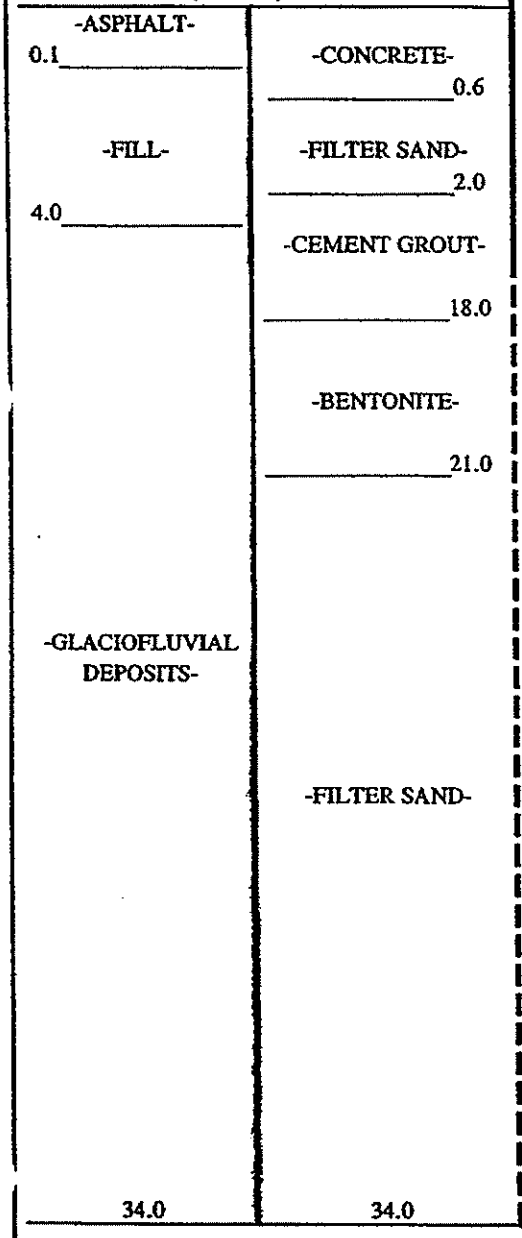
OBSERVATION WELL INSTALLATION REPORT

Project	MONITORING WELL INSTALLATION AOC32/43A	Observation Well	43M-01-20XOB
City/State	DEVENS, MA	Test Boring	43M-01-20XOB
Client	MASSDEVELOPMENT/DEVENS COMMERCE CENTER	Installation Date	26-Nov-01
Contractor	EARTH EXPLORATION SERVICES, WRENTHAM, MA	Location	See Plan
Driller	R. EASTWOOD	H&A File No.	10884-056
		H&A Rep.	L. Baerga

Ground El. 258.7
El. Datum NGVD (1929)

SOIL/ROCK CONDITIONS
BOREHOLE BACKFILL
(Numbers refer to elevation/depth from ground surface in feet)
(not to scale)



Bottom of Exploration

Type of protective cover/lock: Bolted Cover

Depth of top of casing below ground surface: 0.0 ft

Depth of top of riser pipe below ground surface: 0.2 ft

Type of protective casing: Roadway Box

Length: 0.8 ft

Inside diameter: 6.0 in

Depth of bottom of casing: 0.8 ft

Seals:

Type	Depth to top (ft)	Thickness (ft)
Concrete	0.0	0.6
Cement Grout	2.0	16.0
Bentonite	18.0	3.0

Type of riser pipe: Sch 40 PVC Solid

Inside diameter of riser pipe: 2.0 in

Type of backfill around riser: Bentonite/Grout/Cement

Diameter of borehole: 6.5 in

Depth of top of well screen: 24.0 ft

Type of screen or manufacturer: Machine Slotted PVC

Screen gauge or size of openings: 0.010 in

Diameter of well screen: 2.0 in

Type of backfill around screen: Filter Sand

Depth of bottom of well screen: 34.0 ft

Depth of bottom of silt trap:

Depth of bottom of borehole: 34.0 ft

(Depths refer to ground surface)

Remarks:

HALEY & ALDRICH

TEST BORING REPORT

Boring No 43M-01-20XBR

Project MONITORING WELL INSTALLATION AOC 32/43A DEVENS, MA
Client MASSDEVELOPMENT/DEVENS COMMERCE CENTER
Contractor EARTH EXPLORATION SERVICES, WRENTHAM, MA

File No. 10884-056
Sheet No. 1 of 4
Start November 26, 2001
Finish December 5, 2001
Driller R. Eastwood
H&A Rep. L.Baerga/W.Rubik
Elevation 258.7
Datum NGVD (1929)
Location See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	SW	S	HQ	Rig Make & Model: Mobile B-57 Truck
Inside Diameter (in.)	6.0	1 3/8	2.5	Bit Type: Roller Bit
Hammer Weight (lb.)	300	140	-	Drill Mud: None
Hammer Fall (in.)	24	30	-	Casing: driven
				Hoist/Hammer: Winch Doughnut Hammer

Depth (ft.)	SPT*	Sample I.d. & Rec. (in.)	Sample Depth (ft.)	Well Diagram	Elev./Depth (ft.)	USCS Symbol	Visual-Manual Identification and Description (Density/consistency, color, GROUP NAME, max. particle size**, structure, odor, moisture, optional descriptions, geologic interpretation)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0							Note: Cluster well with 43M-01-20XOB. No sampling required to 34.0 ft.										
							See Boring Log 43M-01-20XOB for soil descriptions.										
					254.7												
					4.0		-FILL-										
5							-GLACIOFLUVIAL DEPOSITS-										
10																	
15																	
20																	

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft.) to: Bottom of Casing	Bottom of Hole	Water
12/6/01	0700	160	64.0	68.3	15.4
12/7/01	-	-	64.0	78.3	28.5±
1/11/02	1245	37 Days	-	78.3	30.0

Sample Identification

O Open End Rod
T Thin Wall Tube
U Undisturbed Sample
S Split Spoon
G Geoprobe

Well Diagram

Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary

Overburden (lin. ft.) 64.5
Rock Cored (lin. ft.) 13.8
Samples S14, C2

Boring No. 43M-01-20XBR

Field Tests: Dilatancy: R-Rapid, S-Slow, N-None
Toughness: L-Low, M-Medium, H-High
Plasticity: N-Nonplastic, L-Low, M-Medium, H-High
Dry Strength: N-None, L-Low, M-Medium, H-High, V-Very High

*SPT = Sampler blows per 6 in. **Maximum particle size (mm) is determined by direct observation within the limitations of sampler size (in millimeters).

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

HALEY & ALDRICH

TEST BORING REPORT

Boring No. 43M-01-20XBR
File No. 10884-056
Sheet No. 2 of 4

Depth (ft.)	SPT*	Sample No. & Rec. (in.)	Sample Depth (ft.)	Well Diagram	Elev./Depth (ft.)	USCS Symbol	Visual-Manual Identification and Description (Density/consistency, color, GROUP NAME, max. particle size**, structure, odor, moisture, optional descriptions, geologic interpretation)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
20							-GLACIOFLUVIAL DEPOSITS-										
							Note: Cluster Well with 43M-01-20XOB. No sampling required to 34.0 ft.										
25																	
30																	
	25 14 10 15	S1 0	34.0 36.0				No recovery. Drilling action indicates cobbles from 34.0 to 36.0 ft.										
35	27 15 20 29	S2 6	36.0 38.0			GW	Dense brown well graded GRAVEL with sand (GW), mps 2.0 in., no odor, wet	30	30	20	10	10					
							Note: Drilling action indicates cobble from 37.0 to 38.0 ft.										
	20 34 15 15	S3 5	38.0 40.0			GW	Same as above	35	35	15	10	5					
							-GLACIOFLUVIAL DEPOSITS-										
40					218.7 40.0												
	20 23 19 20	S4 11	40.0 42.0			SP	Dense light brown poorly graded SAND (SP), mps 2.0 mm, faint and frequent partings, no odor, wet					10	90				
							-GLACIOFLUVIAL DEPOSITS-										
	16 20 25 21	S5 12	42.0 44.0			SP	Same as above					10	90				
					214.7 44.0												
	12 12 13 16	S6 14	44.0 46.0			SP	Medium dense light brown poorly graded SAND (SP), mps 2.0 mm, frequent partings, no odor, wet					5	95				
45	10 9 14 15	S4 14	46.0 48.0			SP	Same as above						100				
							-GLACIOFLUVIAL DEPOSITS-										
	13 11 13	S8 15	48.0 50.0			SP	Same as above						100				

*SPT = Sampler blows per 6 in. **Maximum particle size (mm) is determined by direct observation within the limitations of sampler

NOTE: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

HALEY & ALDRICH

TEST BORING REPORT

Boring No. 43M-01-20XBR
File No. 10884-056
Sheet No. 3 of 4

Depth (ft.)	SPT*	Sample No. & Rec. (in.)	Sample Depth (ft.)	Well Diagram	Elev./Depth (ft.)	USCS Symbol	Visual-Manual Identification and Description (Density/consistency, color, GROUP NAME, max. particle size**, structure, odor, moisture, optional descriptions, geologic interpretation)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
	17				208.7												
50	15 17 22 27	S9 10	50.0 52.0		50.0	SP	Dense light brown poorly graded SAND (SP), mps 1.0 in., frequent faint partings, no odor, wet -GLACIOFLUVIAL DEPOSITS-		10	10	20	60					
	10 12 38 29	S10 10	52.0 54.0		204.7	SP	Same as above, except very dense		5	10	30	55					
55	50 69 100/3"	S11 6	54.0 55.3		54.0	GM	Very dense yellow-brown silty GRAVEL with sand (GM), mps 1.5 in., well bonded, no odor, moist -GLACIAL TILL- Note: Boulder from 55.3 to 58.0 ft.	40	30	5	5	5	5				
	32 93 70 87	S12 18	58.0 60.0		200.7 58.0	SM	Very dense yellow silty SAND with gravel (SM), mps 2.0 in., no odor, moist -GLACIAL TILL-	10	20	10	15	20	25				
60	52 38 35 44	S13 16	60.0 62.0			SM	Same as above Note: Boulder from 62.0 to 63.5 ft.	10	15	5	20	25	15				
	100/3"	S14	64.0			SM	Very dense yellow silty SAND with gravel (SM), mps 1.0 in., no odor, dry	5	10	10	15	30	30				
	*50/3"	6	64.5				TOP OF BEDROCK AT 64.5 FT SEE CORE BORING REPORT FOR ROCK DETAILS										
65																	
70																	
75																	

*SPT = Sampler blows per 6 in. **Maximum particle size (mm) is determined by direct observation within the limitations of sampler size.

NOTE: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

HALEY & ALDRICH

CORE BORING REPORT

Boring No. 43M-01-20XBR
File No. 10884-056
Sheet No. 4 of 4

Depth (ft)	Drilling Rate Min./ft	Run No.	Depth (ft)	Recovery/RQD in.	Recovery/RQD %	Weathering	Well Diagram	Elev./ Depth (ft)	Visual Description and Remarks
									SEE TEST BORING REPORT FOR OVERBURDEN DETAILS
65								194.2 64.5	TOP OF BEDROCK AT 64.5 FT Note: Advanced borehole with roller bit to 68.3 ft prior to coring.
	4	C1	68.3 73.3	39 16	65 27	Fresh			C1 to 69.6 ft: Very hard, fresh, light gray, aphanitic to very coarse grained CONGLOMERATE. Bedding or gneissic foliation extremely thin at high angle, disturbed. Joints at low angle, extremely close to close, smooth, planar, oxidized with clayey coating, tight to open
	4							189.1 69.6	
70	3					Slight to High			-BEDROCK-
	3								C1 from 69.6 to 72.7 ft: Same as above, except very hard to hard, slightly to highly weathered, rusty brown, extremely fractured with joints at various orientations, oxidized, disintegrated to decomposed, some with up to 1.0 in. thick clayey infillings, open. Loss of core recovery.
	6							186.0 72.7	
		C2	73.3 78.3	58 29	97 48	Slight to Fresh			-BEDROCK-
75	6								C1 from 72.7 and C2: Very hard, slightly weathered to fresh, gray, aphanitic to coarse grained CONGLOMERATE. Bedding or gneissic foliation extremely thin at high angle, disturbed, sometimes microfaulted. Primary joints set at low angle, extremely close to moderate, smooth to rough, planar to stepped, oxidized, tight to open
	5								
	6								
	7								-BEDROCK-
	8							180.4 78.3	Note: Total water loss approximately 1200 gallons. BOTTOM OF EXPLORATION 78.3 FT
									INSTALLED OBSERVATION WELL AT 78.3 FT

HALEY & ALDRICH

OBSERVATION WELL INSTALLATION REPORT

Project	MONITORING WELL INSTALLATION AOC32/43A	Observation Well	43M-01-20XBR
City/State	DEVENS, MA	Test Boring	43M-01-20XBR
Client	MASSDEVELOPMENT/DEVENS COMMERCE CENTER	Installation Date	7-Dec-01
Contractor	EARTH EXPLORATION SERVICES, WRENTHAM, MA	Location	See Plan
Driller	R. EASTWOOD	H&A File No.	10884-056
		H&A Rep.	L.Baerga/W.Rubik

Ground El. 258.7

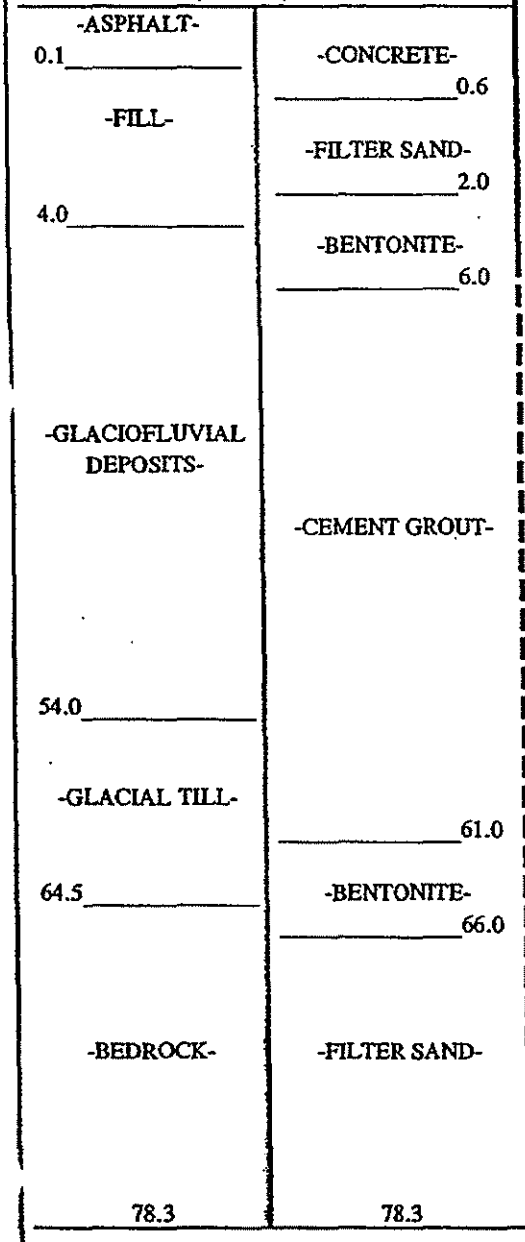
El. Datum NGVD (1929)

SOIL/ROCK CONDITIONS

BOREHOLE BACKFILL

(Numbers refer to elevation/depth from ground surface in feet)

(not to scale)



Bottom of Exploration

Type of protective cover/lock: Bolted Cover

Depth of top of casing below ground surface: 0.0 ft

Depth of top of riser pipe below ground surface: 0.6 ft

Type of protective casing: Roadway Box

Length: 0.8 ft

Inside diameter: 6.0 in

Depth of bottom of roadway box: 0.8 ft

Seals:

Type	Depth to top (ft)	Thickness (ft)
Concrete	0.0	0.6
Bentonite Seal	2.0	4.0
Cement Grout	6.0	55.0
Bentonite	61.0	5.0

Type of riser pipe: Sch 40 PVC Solid

Inside diameter of riser pipe: 2.0 in

Type of backfill around riser: Seal

Diameter of borehole: 6.0 in

Depth of top of well screen: 68.3 ft

Type of screen or manufacturer: Machine Slotted PVC

Screen gauge or size of openings: 0.010 in

Diameter of well screen: 2.0 in

Type of backfill around screen: Filter Sand

Depth of bottom of well screen: 78.3 ft

Depth of bottom of silt trap

Depth of bottom of borehole: 78.3 ft

(Depths refer to ground surface)

Remarks: Soil conditions from 0.0 to 34.0 ft based on adjacent Cluster Boring 43M-01-20XOB.

APPENDIX J

Response to Comments on Draft Report

RESPONSE TO COMMENTS ON
DRAFT 2005 ANNUAL REPORT
AREAS OF CONTAMINATION 32 AND 43A

DEVENS, MASSACHUSETTS

MARCH, 2007

RESPONSE TO COMMENTS ON
DRAFT 2005 ANNUAL REPORT
AREAS OF CONTAMINATION 32 AND 43A

DEVENS, MASSACHUSETTS

Massachusetts DEP Comments Dated November 9, 2006
(Note: The following comments are excerpted from the text of MassDEP's letter.)

DEP Comment No. 1. The 2006 Annual Report for AOC 32 and 43A highlights maintenance activities performed on monitoring wells, repair of road boxes, replacing one riser, and redeveloping three wells that attended to earlier concerns raised by EPA and MassDEP. However, the recommendations listed in this Annual Report on page ES-2 and Section 6, do not address other key points made in the EPA Technical Memorandum and a MassDEP comment letter dated January 12, 2006.

Response: The Army provided responses to MassDEP's January 12, 2006, comments on the 2004 Annual Report in February 2006. In addition, comments on USEPA's Technical Memorandum were provided in September 2006, and the CSM was updated in the updated LTMP for the site (HGL, 2006). All three of these documents have considered and responded to MassDEP's comments.

DEP Comment No. 2. The recommendations in this AR are to continue with the sampling plan, whereas both EPA and MassDEP have emphasized the need to monitor groundwater closer to the source areas and to expand the network of monitoring wells. MassDEP recommend including areas abutting the property and improve the capacity to track contaminant load in bedrock (letter Jan 12th, 2006).

Response: The adequacy of the existing monitoring well network was assessed during the preparation of comments on the USEPA's Technical Memorandum and development of the updated CSM in the LTMP for this site; however, it was concluded that additional monitoring wells were not needed.

DEP Comment No. 3. Construction of the Webvan building has changed groundwater level and flow at AOC 32 and 43A. Blasting, filling, paving parking lots, storm-water detention and drainage alterations, have altered (generally raised) groundwater elevations. Shifted groundwater flow paths due to building construction mean that wells are no longer in the primary flow paths and that adjustments need to be made. With the exception of well 32Z-09XOB there is a lack of monitoring points located along primary flow lines.

Response: Although the earthwork and regrading at AOCs 32 and 43A were thought to have the potential to affect groundwater flow patterns, comparison of groundwater elevation contours plotted and presented in the Remedial Investigation Report Functional Area II, (E&E, 1994), the Monitored Natural Attenuation Assessment Report, AOC 43A POL (Stone & Webster, 2000), and in the 2003 and 2004 Annual Reports show consistent groundwater flow potential. At the UST 13 location, groundwater flow potential is to the east with slight variations to the northeast and southeast. Near the AOC 43A source area, groundwater flow potential is to the southwest with slight variations to the north and south of southwest. This southwest trend is consistent with the distribution of TPH contamination in soil as mapped in the RI. The TPH would have

migrated downgradient along the water table, and mapped TPH contamination provides confirmation of historical groundwater flow patterns.

Figures prepared as part of the Army's comments on USEPA's Technical Memorandum show overburden and bedrock aquifer groundwater contours based on April 1999, July 1999, June 2005, October 2005, and July 2006 which support the conclusion that there have not been significant changes in groundwater flow directions as a result of redevelopment activities. The figures do not show significant changes in flow paths. Based on these figures, monitoring well 32Z-09XOB appears to be cross-gradient to historical sources at AOC 43A.

DEP Comment No. 4. In addition to well location issues, there is also the concern of well performance. As stated in the EPA Technical Memorandum May 2006 "none of the wells in close proximity to the former source area are screened across the top of the water table." Water tables are periodically above the top of the screens at wells 32M-01-13XBR and 32M-01-18XBR, and 32M-01-15XBR is screened below the water table. Under these conditions and given the chemical nature of the contaminants, groundwater contamination may go undetected.

Response: Comparison of screened interval elevations for 32M-01-13XBR (235.4 to 245.4 feet) and 32M-01-18XBR (235.4 to 245.4 feet) to tabulated water level data shows that the water table was within the screened interval at each well for 12 of 13 measuring events spanning January 2002 through June 2006, indicating that these two wells are screened to monitor the water table. In March 2003 groundwater elevations were slightly above the screened intervals for these wells.

The screened interval for monitoring well 32M-01-15XBR (214.2 to 224.2 feet) is screened approximately 14 to 24 feet beneath the water table. This well monitors bedrock groundwater east of the UST area.

DEP Comment No. 5. The overall LTMP for AOC 32 and 43A must incorporate new locations for monitoring wells. Please refer to locations for proposed new monitoring wells in Figure 25 of the EPA Technical Memorandum, Analysis of Bedrock Structure, Implications to LTM Optimization for AOC 32-43A, May 2006.

Response: Please refer to the response to MassDEP Comment No. 2.

DEP Comment No. 6. On page 2-2 of the CSM section in this AR, it is stated that "Impacts to the bedrock competency as a result of blasting and excavation are unknown" and "mechanical fracturing due to blasting may have increased the local permeability." The 4th recommendation in this AR, pages ES-2 and 6-2, is to prepare an updated LTM Plan for the combined sites to reflect post-warehouse conditions. This should involve an updated Conceptual Site Model that addresses warehouse construction site alterations as described in Section 2 of this report.

Response: The updated LTMP contains an updated CSM for this site.

DEP Comment No. 7. Earlier recommendations for AOC 32 and 43A made by EPA and MassDEP include removing obsolete wells, installing monitoring wells in both source areas and along abutting property, and analyzing for perchlorate; a potential residual contaminant the result of blasting and the redevelopment of this parcel. However, perchorate sampling is still not included in the list of recommendations made in this report. Likewise, the recommendation to discontinue sampling for chemical analysis at SHL-15 and 32M-92-01X needs to be discussed with the BCT.

Response: The Army agrees that wells that do not provide useful data should not be sampled, and the updated LTMP contained recommendations to streamline the LTM program. Wells that are no longer considered useful for monitoring groundwater elevations and/or characteristics will ultimately be removed from the LTM program. The adequacy of the existing monitoring well network was assessed during the development of the CSM in the LTMP for this site; however, it was concluded that additional monitoring wells were not needed.

As stated in response to MassDEP comments on the 2004 Annual Report,

> "...the Army is aware of the potential perchlorate and related constituents issue related to blasting agents, this activity postdates the DOD related activity that is being monitored by the LTM activities and is not the DOD's responsibility. The Army is authorized to sample for perchlorate only under specific circumstances, which are not met at this site."

Monitoring well 32M-92-01X is located approximately 600+ feet upgradient of the historical source areas at AOC 43A and 500+ feet cross-gradient of the UST 13 excavation and is unlikely to be influenced by either of these historical source areas. In addition, LTM data do not indicate groundwater contamination at this well. SHL-15 was installed as part of the Shepley's Hill Landfill RI and is located in a separate flow regime at greater distances from AOCs 32 and 43A than 32M-92-01X. It is unlikely to be influenced by either of these historical source areas. Elevated concentrations of arsenic and manganese in samples from this well are attributed the influence of Shepley's Hill Landfill and not to AOCs 32 and 43A. These wells seem to fit the description of "obsolete wells" mentioned in the comment, and the Army sees no reason to continue chemical monitoring at these wells as part of the LTMP for AOCs 32 and 43A.

The recommendations to discontinue monitoring will continue to be discussed with the BCT.

DEP Comment No. 8 Many questions remain concerning the adequacy of the monitoring well network, gaps and coverage, and well integrity.

Response: The Army continues to monitor groundwater and assess conditions at AOCs 32 and 43A. This assessment will continue as new data become available (e.g., data from small-diameter points installed by USEPA).