REMEDIAL ACTION WORK PLAN

LANDFILL M-3

MAIN POST
FORT MONMOUTH, NEW JERSEY

JULY 2000

PROJECT NO.: 02711.00002
CONTRACT NO.: DACA51-96-D-0018

VOLUME 1 OF 5

REPORT, FIGURES, TABLES,
APPENDIX A, APPENDIX B

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PREPARED FOR:

UNITED STATES ARMY, FORT MONMOUTH, NEW JERSEY
DIRECTORATE OF PUBLIC WORKS
BUILDING 167
FORT MONMOUTH, NJ 07703

PREPARED BY:

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CERTIFICATION

For: Remedial Action Work Plan, Landfill M-3 Site, Fort Monmouth, New Jersey

"I certify under penalty of law that the information provided in this document is true, accurate, and complete to the best of my knowledge. I am aware that there are significant civil penalties for knowingly submitting false, inaccurate or incomplete information and that I am committing a crime of the fourth degree if I make a written false statement which I do not believe to be true. I am also aware that if I knowingly direct or authorize the violation of any statute, I am personally liable for the penalties."

Joseph Fallon Environmental Protection Specialist Name, Title	Joseph Fallon Signature	8/21/00 Date

"I certify under penalty of law that I have personally examined and am familiar with the information submitted herein and all attached documents, and that based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate and complete to the best of my knowledge. I am aware that there are significant civil penalties for knowingly submitting false, inaccurate or incomplete information and that I am committing a crime of the fourth degree if I make a written false statement which I do not believe to be true. I am also aware that if I knowingly direct or authorize the violation of any statute, I am personally liable for the penalties."

Stephen N. Wood, LTC, MI Name, Title	Signature	8/24/00 Date

This Remedial Action Work Plan has been reviewed and approved.

Ian Curtis Case Manager NJDEP, Bureau of Case Management Name, Title	Signature	Date

CLASSIFICATION EXCEPTION AREA/WELL RESTRICTION AREA FACT SHEET

Site Name: Fort Monmouth Landfill M-3 **Date:** July 2000
Location: (Include Address Municipality and County) U.S. Army, Fort Monmouth, Monmouth County, New Jersey, 07703
Block(s):
Lot(s):
See Figure 1 (Site Location Map)

Site Contact Person: Joseph Fallon
Address: U.S. Army, Fort Monmouth, New Jersey, Directorate of Public Works, Building 167, Fort Monmouth, NJ 07703
Phone Number: (732) 532-6223

DEP Lead Program 609-633-1455
DEP Remedial Action Workplan Approval Document Dated

Description of CEA:

Pursuant to N.J.A.C. 7:9-6.5, this area is presently designated as Class II-A. The primary designated use for Class II-A ground water is potable water; secondary uses include agricultural and industrial water. Any proposed ground water use within the CEA will require Department review for feasibility of well installation and modifications that would be protective of any impacts from these contaminants for the duration of the CEA.

This CEA/WRA applies only to the contaminants listed in the table below. The ground water criteria/primary drinking water standards for these contaminants are listed in parts per billion (ppb). All constituent standards (N.J.A.C. 7:9-6) apply at the designated boundary.

Contaminant	Ground Water Quality Criteria (ppb)
Chlorobenzene	5

CEA boundaries:

Horizontal Boundaries: See Figure 17 (CEA/WRA Location Map)

Projected term of CEA: Five Years

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EXECUTIVE SUMMARY

Based on recommendations specified in the December 1995 *Site Investigation Report* (SIR) by Roy F. Weston, Inc. of West Chester, Pennsylvania (Weston), the Fort Monmouth Directorate of Public Works (DPW) performed, between May 1997 and March 2000, a Remedial Investigation of Landfill M-3 at Fort Monmouth – Main Post. The results of the Weston investigation at Landfill M-3 indicated that low chlorobenzene concentrations were detected in the shallow groundwater in excess of the New Jersey Department of Environmental Protection (NJDEP) February 1994 Groundwater Quality Criteria (GWQC). The purpose of DPW investigation was to evaluate groundwater and surface water quality at and in the vicinity of the Landfill M-3, and to prepare a Remedial Action Work Plan (RAWP) to address the need for remediation of these mediums, if necessary. In general, the Remedial Investigation activities were conducted by the DPW. ATC Associates, Inc. (ATC) was contracted by the DPW to evaluate the data, and to prepare this RAWP for Landfill M-3.

This Remedial Investigation involved performing twelve rounds of sampling at three existing groundwater monitoring wells, installing five new monitoring wells and performing seven rounds of sampling at these wells, and performing monthly sampling events from October 1996 through April 1997 and quarterly rounds of sampling events starting with July 1997 through March 2000, at five surface water sampling points located throughout Fort Monmouth – Main Post. A total of seventeen rounds of surface water data for one point of collection and eighteen rounds of surface water data for the other four point of collection are included in this report. The results of this investigation indicate that the shallow groundwater contains volatile organic compounds (VOCs), particularly chlorobenzene and benzene, in excess of the New Jersey Department of Environmental Protection (NJDEP) Groundwater Quality Criteria (GWQC).

The concentrations and distribution of VOC contamination in the groundwater at Landfill M-3 suggest that this location is suitable for a Natural Remediation program. In general, chlorobenzene concentrations are expected to come into compliance with the New Jersey Department of Environmental Protection's (NJDEP) Class II Groundwater Quality Criteria (GWQC) within an approximately 3.3 year period, and chlorobenzene is expected to migrate approximately 74 feet during this time frame. While Lafetra Creek lies within this 74-foot distance, impacted groundwater concentrations for chlorobenzene are not so elevated as to result in an adverse impact to surface water quality.

1.0 REMEDIAL INVESTIGATION REPORT

This document is a Remedial Action Work Plan (RAWP) for the shallow groundwater at Landfill M-3, located on the Main Post of Fort Monmouth, New Jersey (Figures 1 and 2). It has been prepared by ATC Associates, Inc. (ATC), on behalf of the Fort Monmouth Directorate of Public Works (DPW), and is based on the data presented in the December 1995 *Site Investigation Report* (SIR), by Roy F. Weston, Inc. (Weston), as well as groundwater and surface water sampling data collected by the DPW between October 1996 and March 2000. This RAWP has been prepared in accordance with the New Jersey Department of Environmental Protection's (NJDEP) July 1993 *Technical Requirements for Site Remediation - NJAC 7:26E* (Technical Requirements).

1.1 Historical Information

According to the Weston SIR, Landfill M-3 was in use as a landfill between 1959 and 1964, and was used for general purpose disposal of domestic and industrial wastes. Materials generally found in Main Post landfills include unwashed pesticide/herbicide cans, batteries, fluorescent tubes, electronic components, garbage, asbestos wrappings from pipes, soot and boiler scale, sludge from sanitary treatment plants (STPs), small quantities of outdated drugs, outdated photographic chemicals in glass bottles, building rubble, incinerator ash, sand from oil spill cleanups, and other debris. Landfill M-3 also was reportedly used for the disposal of wood and coal ash from furnaces and boilers.

1.2 Physical Setting

1.2.1 Site Description

Landfill M-3 is located on the western portion of the Main Post, between North Drive and Lafetra Creek. The actual boundaries of the landfill have been approximated in Figure 2. The approximate area of Landfill M-3 is 257,890 ft^2 (5.9 acres). As mentioned in Weston SIR, the 1969 aerial photographs showed that Landfill M-3 was covered with vegetation. At present, the site is covered with grass.

1.2.2 Regional Geology

Fort Monmouth is located within the New Jersey Section of the Atlantic Coastal Plain physiographic province. In general, New Jersey Coastal Plain formations consist of northeast striking deposits of unconsolidated clay, silt, and gravel. These sediments, predominantly derived from deltaic, shallow marine, and continental shelf environments, date from the Cretaceous through the Quaternary Periods. The mineralogy ranges from quartz to glauconite.

Over 20 regional geologic units are present within the sediments of the New Jersey Coastal Plain. Regressive, upward coarsening deposits are usually aquifers (e.g., Englishtown and Kirkwood Formations, and the Cohansey Sand), while the transgressive deposits act as confining units (e.g.,

the Merchantville, Marshalltown, and Navesink Formations). The individual thickness for these units vary greatly (i.e., from several feet to several hundred feet).

1.2.3 Local Geology

Based on the regional geologic map (Jablonski, 1968), the Cretaceous age Red Bank and Tinton Sands outcrop at the Main Post area. The Red Bank sand conformably overlies the Navesink Formation and dips to the southeast at 35 feet per mile. The upper member (Shrewsbury) of the Red Bank Sand is a yellowish-gray to reddish brown clayey, medium- to coarse-grained sand that contains abundant rock fragments, minor mica, and glauconite (Jablonski). The lower member (Sandy Hook) is a dark gray to black, medium- to fine-grained sand with abundant clay, mica, and glauconite.

The Tinton sand conformably overlies the Red Bank Sand and ranges from a clayey medium- to very coarse-grained feldspathic quartz and glauconite sand to a glauconitic coarse sand. The color varies from dark yellowish orange or light brown to moderate brown and from light olive to grayish olive. Glauconite may constitute 60 to 80 percent of the sand fraction in the upper part of the unit (Minard, 1969). The upper part of the Tinton is often highly oxidized and iron oxide encrusted (Minard).

The boring logs from the monitoring wells M3MW-4, M3MW-5 and M3MW-6 installed during December 1994 indicate that the soils at Landfill M-3 consist of a thin soil cover of brown sandy silt (approximately one foot thick) underlain by approximately seven feet of olive/brown poorly graded sand with silt. Fill material is also encountered at these depths, with glass fragments, paper debris and plastic cuttings visible. This is in turn underlain by 4-foot layer (8- to 12-feet below grade) of green/brown sandy silt. A dark green silty sand extends from 12- to at least 16-feet below grade. The soil boring from the monitoring wells M3MW-7, M3MW-8, M3MW-9, M3MW-10, and M3MW-11 installed during August and September 1998, close to and along Lafetra Creek, indicate that a brown silty sand extends to approximately 10 feet. From 10 to approximately 13 feet a peat layer was encountered and from 13 feet to the bottom of the borings (approximately 15 feet) a green clay layer was encountered.

In order to better characterize the geology in the M3 and M5 area, and in order to determine the vertical extent of soil contamination, three soil borings were drilled at M5 area at depths between approximately 42 feet and approximately 60 feet. A comparison of the boring logs from these soil borings versus the soil borings drilled at landfill M3 confirmed that between surface to approximately 15 feet below surface the same layers were encountered in both M3 and M5 areas. It is assumed that the dry and dark green dense to very dense silty sand/clayey sand, with clay contents increasing with depth, which extends from 16- to at least 60-feet below grade or the depth of the borings in M5 area will be encountered also in M3 area.

Soil boring and monitoring well logs and construction details, soil boring permits, monitoring well permits, monitoring well records and groundwater monitoring well certification – Form B – Location Certifications are attached in Appendix A.

Over the last 80 years, the natural topography of Fort Monmouth has been altered by excavation and filling activities by the military. Topographic elevations for Landfill M-3 range from approximately 6 feet above mean sea level (MSL) to 15 feet above MSL.

1.2.4 Hydrogeology

The water table aquifer in the Main Post area is identified as part of the "composite confining units", or minor aquifers. The minor aquifers include the Navesink formation, Red Bank Sand, Tinton Sand, Hornerstown Sand, Vincentown Formation, Manasquan Formation, Shark River Formation, Piney Point Formation, and the basal clay of the Kirkwood Formation.

Based on records of wells drilled in the Main Post area, water is typically encountered at depths of 2 to 15 feet below ground surface (bgs). According to the boring logs for M3MW-4, M3MW-5, and M3MW-6, groundwater was encountered on-site at approximately 3.12 to 14.51 feet bgs. According to boring logs for M3MW-7, M3MW-8, M3MW-9, M3MW-10, and M3MW-11, groundwater was encountered at approximately 5.03 to 11.37 feet bgs. According to Jablonski, wells drilled in the Red Bank and Tinton Sands may produce 2 to 25 gallons per minute (gpm). According to the boring logs, M3MW-4 produced approximately 2 gpm, M3MW-5 produced approximately 5 gpm, M3MW-6 produced less than 0.5 gpm, M3MW-7, M3MW-8, M3MW-9, and M3MW-10 produced approximately 2 gpm, and M3MW-11 produced approximately 0.75 gpm.

Due to the proximity of the Atlantic Ocean to Fort Monmouth, shallow groundwater may be tidally influenced and may flow toward creeks and brooks as the tide goes out, and away from creeks and brooks as the tide comes in. According to the Weston SIR, and based on groundwater measurements recorded at on-site monitoring wells during quarterly monitoring/sampling events the site-specific groundwater flow direction is estimated to be north – northeast, towards Lafetra Creek.

1.3 Technical Overview

1.3.1 Reliability of Laboratory Data

All data was collected in accordance with the NJDEP's May 1992 *Field Sampling Procedures Manual* and the Technical Requirements. All groundwater samples were analyzed within the requisite holding times by Fort Monmouth Environmental Testing Laboratory, a New Jersey Certified laboratory (Laboratory Certification Number 13461).

1.3.2 Summary of Contamination

The sampling program conducted at Landfill M-3 revealed the presence of ten volatile organic compounds (VOCs), 12 semivolatile organic compounds (SVOCs), three pesticide/PCBs, and 22 priority pollutant metals (PPMs). Of these detected compounds, four VOCs, three pesticides, and ten PPMs were detected at concentrations exceeding their respective NJDEP Class II Ground Water Quality Criteria (GWQC).

A detailed description of the groundwater and surface water impacts in the Landfill M-3 area is presented in Section 1.5 of this document.

1.4 Remedial Investigation Methodology

1.4.1 Piezometer Wells Installation

In order to verify and confirm that groundwater contamination is not exceeding NJDEP GWQC at the boundaries of Landfill M-3, and in an attempt to delineate the groundwater contamination in the direction of Lafetra Creek, the potential receptor, five monitoring wells were drilled and installed between August 27, 1999 and September 1, 1999. Monitoring wells M3MW-7, M3MW-8, M3MW-9, and M3MW-10 were installed on August 27, 1998, and monitoring well M3MW-11 was installed on September 1, 1998 at the locations shown on Figure 2. A hollow stem auger drill rig was used to advance the boring at each well location. The wells were constructed of 2-inch diameter schedule 40 PVC screen and casing, and were installed at depths of approximately 15 feet below ground surface (bgs). The screen interval in each well extends from approximately 5 feet bgs to the bottom of the well. The annular space surrounding the screen was filled with #2 grade sand to a level between at least one foot to two foot above the top of the screen in each well. The remainder of the annular space surrounding each well was filled with cement/bentonite grout. Each monitoring well was finished with approximately 2.5 feet PVC casing above ground level, which is protected by a 6-inch steel casing. Upon completion, the monitoring wells were developed using a submersible pump until the ground water was visibly free of sediments. The wells were installed and developed by Groundwater and Environmental Services, Inc., a licensed New Jersey drilling company. The monitoring wells were installed in accordance with standard NJDEP procedures for the installation of wells in unconsolidated materials. Monitoring well logs and construction details, monitoring well permits, monitoring well records and groundwater monitoring well certification – Form B – Location Certifications are attached in Appendix A.

1.4.2 Survey of the Piezometer Wells

The newly installed piezometer wells M3MW-7, M3MW-8, M3MW-9, M3MW10, and M3MW-11 were surveyed relative to NJGCS Monument Number 9235, with an elevation of 56.69 feet, by Frederick W. Kocen Jr., Professional Land Surveyor (License # 34008). Copies of the Ground Water Monitoring Well Certification - Form B - Location Certification are attached in Appendix A.

1.4.3 Groundwater Monitoring and Sampling

On May 1, 1997, August 7, 1997, October 16, 1997, February 17, 1998, May 5, 1998, July 7, 1998, October 27, 1998, March 1, 1999, June 11, 1999, July 27, 1999, October 26, 1999, and March 2, 2000, groundwater samples were collected from monitoring wells M3MW-4, M3MW-5, and M3MW-6, in accordance with the NJDEP's May 1992 *Field Sampling Procedures Manual* and the DPW - Standard Operation Procedure (SOP). For groundwater sampling procedures and methodology please refer to Appendix B. Samples were handled and analyzed in accordance with the quality assurance/quality control (QA/QC) protocols, given in the Technical Requirements. Groundwater monitoring and sampling field notes are included in Appendices C through N. The

water samples collected on above mentioned dates were preserved, chilled to 4°C, and delivered under chain of custody to Fort Monmouth Environmental Testing Laboratory, Fort Monmouth, New Jersey, where the samples were analyzed for volatile organic compounds (VOC+15), including xylenes, according to EPA Method 624, Base/Neutral and Acid Extractable using EPA Method 625, Pesticide and Polychlorinated Biphenyls (PCB) using EPA Method 608, and Target Analyte List Metals using standard methods [Atomic Absorption/Inductively Coupled Argon Plasma (AA/ICP)]. The results of quarterly groundwater sampling are presented in Section 1.5 of this document. Laboratory reports are attached in Appendices C through N. Monitoring well elevation data and groundwater contour maps are presented on Figures 3 through 14. Historical groundwater sample analytical results are summarized in Figure 15.

One round of groundwater sampling was conducted on October 7, 1998 for piezometer wells M3MW-7, M3MW-9, and M3MW-11 and October 20, 1998 for piezometer wells M3MW-8 and M3MW-10. Groundwater monitoring and sampling field notes are included as Appendix O. A confirmatory round of groundwater sampling was performed on October 23, 1998 (M3MW-7, M3MW-9, and M3MW-11) and November 2, 1998 (M3MW-8 and M3MW-10). Groundwater monitoring and sampling field notes are included as Appendix P. Starting with March 1, 1999 all five piezometer wells were included in the Landfill M-3 monitoring well sampling program. Groundwater monitoring and sampling field notes for March 1, 1999, June 11, 1999, July 27, 1999, October 26, 1999, and March 2, 2000, events are included as Appendix J, Appendix K, Appendix L, Appendix M, and Appendix N, respectively. Groundwater samples were collected from piezometer wells in accordance with the NJDEP's May 1992 *Field Sampling Procedures Manual* and the DPW - Standard Operation Procedure (SOP). For groundwater sampling procedures and methodology please refer to Appendix B. Samples were handled and analyzed in accordance with the quality assurance/quality control (QA/QC) protocols, given in the *Technical Requirements for Site Remediation*. The water samples collected on above mentioned dates were preserved, chilled to 4°C, and delivered under chain of custody to Fort Monmouth Environmental Testing Laboratory, Fort Monmouth, New Jersey, where the samples were analyzed for VOC+15, including xylenes, according to EPA Method 624, Base/Neutral and Acid Extractables using EPA Method 625, Pesticide and PCB using EPA Method 608, and TAL Metals using standard methods AA/ICP. Due to laboratory breakage, on October 26, 1998, one groundwater sample was collected from M3MW-11 and analyzed for Pesticide and PCB. The results of these groundwater sampling are presented in Section 1.5.1 of this document.

1.4.4 Surface Water Sample Collection

The objective of the surface water investigation was to obtain an indication of the quality of Lafetra Creek's and Mill Creek's surface water. Lafetra Creek is located adjacent and to the north (downgradient) of Landfill M-3. Mill Creek is located adjacent and to the east (site-gradient) of Landfill M-3. The surface water sampling locations are shown on Figure 15. Due to salinity concentrations greater than 3.5 parts per thousand at mean high tide, the surface water of these creeks are classified as SC - coastal saline waters and SE - saline waters of estuaries. Surface water SS4 is located to the northeast and downgradient of Landfill M-3. Surface water sample SS-5 is located to the east of Landfill M-3, near the confluence of Mill Creek and Lafetra Creek. Surface water sample SS-17 is located to the northeast and downgradient of Landfill M-3,

along Lafetra Creek. Sampling points SS-15 and SS-14 are located upstream from Landfill M-3, along Lafetra Creek and Mill Creek, respectively. Between October 1996 and March 2, 2000, periodic rounds of samples were collected from these surface water sampling points along these water bodies.

Surface water samples were handled and analyzed in accordance with the quality assurance/quality control (QA/QC) protocols, given in the Technical Requirements. The surface water samples collected on above mentioned dates were preserved, chilled to 4°C, and delivered under chain of custody to Fort Monmouth Environmental Testing Laboratory, Fort Monmouth, New Jersey, where the samples were analyzed for VOC+15, including xylenes, according to EPA Method 624. The results of these surface water samples are presented in Section 1.5.2 of this document. Surface water monitoring and sampling field notes are included as Appendix N.

1.5 Remedial Investigation Results

1.5.1 Groundwater Quality

Twelve rounds of groundwater sampling events were conducted between May 1, 1997 and March 2, 2000 at monitoring wells M3MW-4, M3MW-5, and M3MW-6. Seven rounds of groundwater sampling were conducted between October 7, 1998 and March 2, 2000 at the five piezometric wells M3MW-7, M3MW-8, M3MW-9, M3MW-10 and M3MW-11. Historically, separate phase hydrocarbons were not reported in any of these eight wells. The compounds detected above their respective method detection limits at monitoring wells M3MW-4, M3MW-5, and M3MW-6 are summarized in Tables 1, 2, and 3, respectively. The compounds detected above their respective method detection limits at monitoring wells M3MW-7, M3MW-8, M3MW-9, M3MW-10 and M3MW-11 are summarized in Tables 4, 5, 6, 7, and 8, respectively. Ten VOCs, 12 semi-volatile organic compounds (SVOCs), three pesticides, and 22 priority pollutant metals (PPMs) were detected above their respective method detection limits in at least one sampling round apiece. Of these, four VOCs, three pesticides, and ten PPMs were detected at concentrations exceeding their respective NJDEP-GWQC.

The four VOCs detected at concentrations exceeding their respective NJDEP-GWQC were benzene, 2-butanone, vinyl chloride, and chlorobenzene. Historical concentrations of these four VOCs are mapped on Figure 15. Vinyl Chloride and 2-Butanone exceedances were detected only in monitoring well M3MW-7 on October 23, 1998 and October 7, 1998 sampling events, respectively, followed by at least five consecutive rounds of results in which these two compounds were not detected above their method detection limit or if detected were below the NJDEP-GWQC for each compound. Based on the above discussion, no further action is warranted at this time. These compounds will, however, continue to be monitored as part of a proposed quarterly groundwater quality monitoring program (see Section 10.0).

Benzene exceedances were detected in M3MW-5, M3MW-6, and M3MW-9. In groundwater samples collected from M3MW-5, where the highest benzene concentration of 1.44 µg/L was reported on May 5, 1998, the benzene concentrations decreased to ND for the next six consecutive rounds of sampling events. In groundwater samples collected from M3MW-6, where the highest benzene concentration of 5.35 µg/L was reported on May 1, 1997, the benzene concentrations decreased to 3.10 ug/L on July 7, 1998, followed by six consecutive rounds of results in which benzene was not detected above its method detection limit. In groundwater samples collected from M3MW-9, where the highest benzene concentration of 1.33 µg/L was reported on October 23, 1998, the benzene concentrations decreased to ND for the next three sampling events, increased to 1.25 ug/L on October 26, 1999, and decreased to ND on March 2, 2000 sampling event. Based on the above discussion, benzene concentrations have either decreased to below the NJDEP-GWQC, or exhibit seasonal fluctuations to concentrations only marginally above the NJDEP-GWQC. These minor exceedances do not appear to pose an environmental concern , and do not warrant any specific action at this time. Benzene will, however, continue to be monitored as part of a proposed quarterly groundwater quality monitoring program (see Section 10.0).

The primary contaminant of concern at Landfill M-3 is chlorobenzene, which has been detected at levels exceeding its GWQC of 4 ug/L at five of the eight onsite monitoring wells. Historically, a decrease in chlorobenzene concentrations has been noted only in monitoring wells M3MW-5 and M3MW-6. In M3MW-5, chlorobenzene concentrations decreased from 7.28 ug/L on August 7, 1997 to 4.09 ug/L on March 2, 2000. In M3MW-6, chlorobenzene concentrations decreased from 4.41 ug/L on October 16, 1997 to ND on March 2, 2000. In M3MW-11, chlorobenzene concentrations historically have fluctuated from 5.03 μg/L to 2.66 μg/L, with an overall slightly increasing trend. In M3MW-9, chlorobenzene concentrations historically have fluctuated, increasing from 16.36 ug/L on October 7, 1999 to 17.33 ug/L on October 23, 1998, decreasing to 10.22 μg/L on June 11, 99 μg/L, and increasing to 15.64 ug/L on March 2, 2000. In M3MW-10, chlorobenzene concentrations historically have fluctuated between 20.08 ug/L, the highest concentration reported on March 1, 1999, to 15.34 ug/L reported on March 2, 2000.

It is important to note that, while chlorobenzene concentrations in these wells exceed its GWQC, even the highest concentration detected in any of the wells is below New Jersey's Safe Drinking Water Act Maximum Contaminant Level of 50 ug/L and below the Maximum Contaminant Level of 100 ug/L defined in the National Primary and Secondary Drinking Water Regulations.

The pesticides detected at concentrations exceeding their respective GWQC were 4,4'-DDE, 4,4-DDD, and 4,4'-DDT. These three analytes had noted exceedances at only one monitoring well, M3MW-9. Over seven rounds of groundwater sampling, the concentrations of these three pesticides have all shown decreases. In the last six rounds of sampling 4,4' – DDE and 4,4' – DDT concentrations were both ND or below their GWQC. The 4,4' – DDD concentrations decreased from 0.713 ug/L on October 7, 1998 to 0.057 ug/L on June 11, 1999, increased to 0.108 ug/L on July 27, 1999, decreased to ND on October 26, 1999 and increased to 0.134 ug/L on March 2, 2000. Based on the above discussion, no further action is warranted at this time. These compounds will, however, continue to be monitored as part of a proposed quarterly groundwater quality monitoring program (see Section 4.2).

The ten PPMs detected at concentrations exceeding their respective GWQC were aluminum, arsenic, cadmium, iron, lead, manganese, mercury, nickel, silver, and sodium. However, five of the metals detected (aluminum, manganese, sodium, iron, and zinc) were found in concentrations below those determined for site-specific and Monmouth County maximum background levels. As mentioned in the Weston SIR, several natural and anthropogenic factors contribute to the wide range in concentrations of metals in soils. Soils derived from the glauconitic sands contain abundant iron, aluminum, calcium, magnesium, manganese, and potassium. Anthropogenic influences on the background metal concentrations include deposition of airborne dust, and historical applications of fertilizers, pesticides, and herbicides can account for the elevated levels of mercury, lead, cadmium, and arsenic.

Mercury was detected at a concentration of 2.7 ug/L, above the GWQC of 2.0 ug/L, only in M3MW-9 on October 7, 1998. For the next six consecutive rounds mercury was ND or if detected was below the GWQC. Lead was detected at concentration above GWQC of 10 ug/L in M3MW-4, M3MW-5, M3MW-7, M3MW-8, M3MW-9, for one or two sampling events. For

the next nine consecutive rounds in M3MW-4 and M3MW-5, four consecutive rounds in M3MW-7, five consecutive rounds in M3MW-8, and three consecutive rounds in M3MW-9, lead was ND or if detected was below the GWQC. In M3MW-11, lead concentrations historically have fluctuated between 22.3 ug/L to ND, with the last two consecutive rounds reporting concentrations below GWQC and ND. Cadmium was reported in M3MW-5 on June 11, 1999, at a concentration of 4.38 ug/L, slightly above the GWQC of 4 ug/L, followed by four consecutive rounds with concentrations reported below the GWQC or ND. In M3MW-7 cadmium concentrations increased from ND on October 7 and 23, 1998 to 7.55 ug/L on October 26, 1999 and decreased to 2.58 ug/L, below NJDEP criteria on March 2, 2000. In M3MW-11 cadmium concentrations historically have fluctuated increasing from ND on October 23, 1998 to 47.3 ug/L on June 11, 1999, decreasing to 14.6 ug/L on July 27, 1999, decreasing to 7.61 ug/L on October 26, 1999 and increasing to 15 ug/L on March 2, 2000. Silver was noted in several testing rounds at elevated levels; however, this analyte was also detected at elevated levels in associated method blanks.

Based on the above discussion, with the exception of cadmium in M3MW-11, the concentrations of metals in groundwater are either at background levels or are slightly above the NJDEP-GWQC. Since cadmium and the other metals will continue to be monitored as part of the proposed quarterly groundwater quality monitoring program (see Section 4.2), no specific additional action is warranted at this time.

The laboratory reports are included in Appendices C through M.

1.5.2 Aquifer Characteristics

An aquifer testing program was conducted on June 14, 1999 at Landfill M5, adjacent to Landfill M3, to evaluate the hydraulic conductivity of the shallow aquifer in this area. In-situ hydraulic conductivity of the shallow, saturated, unconsolidated materials underlying the site was determined by means of a constant discharge aquifer test. Based on the results of the constant rate aquifer tests, summarized in the Remedial Action Workplan for Landfill M5, an average hydraulic conductivity of 0.996 ft/day was assumed to be representative for the shallow unconfined aquifer at M3 and M5.

1.5.3 Surface Water Quality

Lafetra Creek and Mill Creek, which are the two surface water bodies in the immediate vicinity of Landfill M-3, are designated as saline coastal/saline estuarine surface water environments.

Laboratory analysis results from the 17 rounds of surface water samples collected from SS-17 and 18 rounds of surface samples collected from SS-4, SS-5, SS-14 and SS-15, performed between October 1996 and March 2000 are summarized on Table 9. The exceedances are mapped on Figure 15, and Laboratory Packages presented in Appendix R. VOC analysis revealed that acetone, carbon disulfide, cis-1,2-dichloroethene, chlorobenzene, bromomethane, methylene chloride, TCE, and PCE were present in concentrations above their respective method detection limits. Of these, only PCE was detected at concentrations exceeding its NJDEP Surface Water Quality Standard (SWQS) of 4.29 µg/L (as per N.J.A.C. 7:9-6 2, September 1997).

PCE concentrations ranging from 1.24 μg/L to 10.38 μg/L were detected. Referring to Figure 15, the latest stream sampling data (from March 1, 2000) shows that PCE concentrations at SS-15 (6.95 μg/L) were reported at higher concentrations than surface water collected from SS-17 (ND), SS-4 (6,18 μg/L) and SS-5 (6.62 μg/L). Since SS-15 is located close to where the stream enters Fort Monmouth, and since SS-14 and SS-15 are located upstream of Landfill M-3, it suggests that surface water is impacted with PCE prior to flowing into Fort Monmouth property. This conclusion is further supported by the fact that monitoring wells located at Landfill M-3 historically have never shown any PCE contamination.

As mentioned in Section 1.5.1, the primary contaminant of concern at Landfill M-3 is chlorobenzene which has been detected at levels exceeding its NJDEP-GWQC at five of the eight monitoring wells located at Landfill M-3. Referring to Figure 15, chlorobenzene was detected in surface water only on February 10, 1998 at SS-17, at a concentration below its NJDEP-SWQS of 21,000 ug/L. This suggests that the chlorobenzene concentrations in groundwater are not likely to cause surface water quality to exceed its NJDEP-SWQS.

1.6 Sensitive Receptor Survey

1.6.1 Well Search Data

All available DPW records and files were reviewed for information concerning wells within Fort Monmouth. Also, two Well Search reports prepared by Roy F. Weston, dated November 1993 and February 1994, were reviewed for information concerning wells within a one mile radius surrounding the center point of Landfill M-3. The well locations were plotted on a scaled map, included as Figure 16 and a well search summary is presented as Table 10.

The results of the well search indicate the following:

Monitoring Wells: 127 monitoring wells were identified within one mile of the site. These wells were completed at depths between ten and 28 feet, with open or screened intervals ranging between one and 28 feet.

Domestic Wells: Five domestic wells identified within one mile of the site. The depths of these wells ranged between 15 and 323 feet, with open or screened intervals ranging between 40 and 323 feet.

Irrigation Wells: Eight lawn irrigation wells were identified within one mile of the site. The depths of these wells ranged between 45 and 250 feet, with open or screened intervals ranging between 35 and 250 feet.

Public Supply Wells: No public supply wells were identified within one mile of the site.

1.6.2 Receptor Evaluation

Typically, groundwater and surface water impacts may give rise to concern about human and ecological receptors. However, in the case of Landfill M-3, based on the following, no receptors are expected to be adversely impacted:

1. Lafetra and Mill Creeks are tidal, and the groundwater in the vicinity of Landfill M-3 is subject to salt-water intrusion. This makes the groundwater unusable as a potable water source, and it is unlikely that wells for human consumption of groundwater would be installed in the impacted aquifer.
2. There are no domestic, irrigation or public supply wells immediately downgradient of Landfill M-3, or within the boundary of the CEA, and since impacted groundwater is expected to naturally attenuate in a very short distance (see Section 1.7), no concerns exist with respect to human exposure to impacted groundwater.
3. As stated previously, the concentrations of cholorobenzene in groundwater are well below the State and Federal MCLs for drinking water, and therefore do not pose a human health risk.
4. Lafetra Creek and Mill Creek represent potential ecological receptors, since the monitoring wells near them have been shown to exhibit chlorobenzene at levels exceeding the NJDEP GWQC. However, even the maximum concentration detected historically in these wells (20.08 ug/L) is not high enough to cause the saline coastal/estuarine surface water quality in these streams to exceed its NJDEP-SWQS of 21,000 ug/L.

1.7 Classification Exception Area

A Classification Exception Area (CEA) is a mechanism that has been established by the NJDEP to temporarily except a defined area where groundwater does not meet the GWQC. As required by the *Groundwater Quality Standards* (N.J.A.C 7:9-6 et seq.), a CEA must be established whenever constituent standards applicable to a groundwater classification area are not, or will not be met for the term of the remediation program. According to the NJDEP's *Final Guidance on Designation of Classification Exception Areas* (April 17, 1995), a CEA is defined by both physical boundaries, and the amount of time that will be required for the groundwater contaminant(s) to achieve compliance with the GWQC. This section provides the information required for establishment of a CEA.

As discussed in Section 1.5, Subsection 1.5.1, benzene, 2-butanone, vinyl chloride, and chlorobenzene were detected at concentrations exceeding their respective NJDEP-GWQC. Vinyl Chloride and 2-Butanone exceedances were detected only in one monitoring well during one sampling event followed by at least five consecutive rounds of results in which these two compounds were not detected above their method detection limit or if detected were below the NJDEP-GWQC for each compound. Benzene exceedances were detected in three monitoring wells, M3MW-5, M3MW-6, and M3MW-9. In groundwater samples collected from M3MW-5, where the highest benzene concentration of 1.44 μg/L was reported on May 5, 1998, the benzene concentrations decreased to ND for the next five consecutive rounds of sampling events. In groundwater samples collected from M3MW-6, where the highest benzene concentration of 5.35 μg/L was reported on May 1, 1997, the benzene concentrations decreased to 3.10 ug/L on July 7,

1998, followed by six consecutive rounds of results in which benzene was not detected above its method detection limit. In groundwater samples collected from M3MW-9, benzene concentrations fluctuated between 1.33 µg/L to ND. For the last five sampling events, only on October 26, 1999 benzene was reported at 1.25 ug/L, slightly above the GWQC of 1 ug/L, and ND reported on the remaining sampling events, including March 2, 2000 sampling event.

The Fort Monmouth DPW proposes that the CEA apply to chlorobenzene, which is the only contaminant of concern at Landfill M-3. A CEA is appropriate for this site since all sources of contamination have been addressed and groundwater contamination remains above standards at a level where the residual contaminant plume will not migrate beyond the designated boundary set forth below.

The classification exception area was determined using the analytical solution model option. Darcy's law was used as the model and was used to predict the duration of the CEA and the distance the contaminant will migrate before groundwater quality standards are achieved.

Determination of the Duration of the CEA

A first order decay equation shown below, was used to calculate the duration of the CEA, since the degradation of the petroleum-based compounds has been shown to be logarithmic.

$$C = C_o * e^{-kt} \qquad \textbf{--Eq. 1}$$

where,

C = Final concentration of the contaminant
C_o = Initial concentration of the contaminant
k = Reaction rate constant
t = Time in days

The reaction rate constant k can be determined by the following equation:

$$k = \frac{0.693}{t^{1/2}} \qquad \textbf{--Eq. 2}$$

where,

$t^{1/2}$ = the half life of the corresponding contaminant in days

Data from monitoring well M3MW-9 was used to define the CEA due to its proximity to the source area, and since the latest analytical data from monitoring well M3MW-9 (from the March 1, 2000 sampling event) indicated the presence of chlorobenzene at a concentration of 15.64 µg/L (C_o). The final concentration of the contaminant will be 4 µg/L (C) as per the NJDEP's Class II GWQC. As reported in *The Handbook of Environmental Degradation Rates* (Howard, et al., 1991) the aqueous anaerobic low and high half life of chlorobenzene in ground water are

estimated at 272 days and 600 days, respectively. The high half life of 600 days for chlorobenzene was used in the following calculations. Substituting the above values, the reaction rate constant k is calculated as 0.001155 days $^{-1}$.

Rearranging **Equation 1**, the time duration of the CEA can be determined as follows:

$$t = \frac{\ln\left(\frac{C}{C_o}\right)}{-k} \qquad \text{-- Eq. 3}$$

Substituting the values of C, C_o and k in **Equation 3**, the duration of the CEA is calculated as follows:

$$t = \frac{\ln\left(\frac{4}{15.64}\right)}{-0.001155}$$

t = 1,181 days (approximately 3.3 years)

Calculation of the CEA Boundary

The boundary of the CEA is determined by calculating the distance of travel of the contaminant. Distance of travel is calculated from the pollutant transport rate. Seepage velocity (V_s) and Retardation factor (R_d) must be calculated for this purpose. The seepage velocity was calculated using the following equation:

$$V_s = \frac{(K * i)}{n_o} \qquad \text{--Eq. 4}$$

where,

K= Hydraulic conductivity of the affected aquifer, (ft/day)
i = Hydraulic gradient (ft/ft)
n_o= Effective porosity

The average hydraulic conductivity of 0.996 ft/day, determined from the pumping test performed at landfill M5, adjacent to landfill M3, was used. The effective porosity of the formation (dense mixed grained sand) is taken as 30%. The hydraulic gradient at the site is calculated as 0.019 ft/ft. Substituting these values in **Equation 4**:

$$V_s = \frac{(0.996 * 0.019)}{0.3}$$

V_s= 0.063 ft/day

The retardation factor was calculated using the equation:

$$R_d = 1 + \frac{(K_d * \sigma_b)}{n_o} \qquad \text{-- Eq. 5}$$

where,

ρ_b = bulk density of the formation
K_d = Distribution co-efficient
n_e = Effective porosity

The distribution co-efficient is calculated from the relation:

$$K_d = 0.63 * K_{ow} * f_{oc} \qquad \text{-- Eq. 6}$$

where,

K_{ow} = n-octonol/water partition coefficient
f_{oc} = fraction of the organic carbon in the matrix

Since Landfill M-3 is adjacent to Landfill M-5, and a comparison of soil boring logs drilled at these two landfill reveled the same lithology beneath the sites, the results of the Total Organic Carbon (TOC) content in soil samples collected from Landfill M-5 were used. It was estimated that TOC at the site is present at an average level of 5 mg/kg. From this the fraction of TOC in the soil matrix, f_{oc} was determined to be 0.000005. According to the *Superfund Public Health Evaluation Manual* (United States Environmental Protection Agency, Office of Emergency and Remedial Response, 1986), the value of K_{ow} is 130. Substituting these values,

$$K_d = 0.63 * 130 * 0.000005$$

$$K_d = 0.00041$$

The bulk density of the formation was estimated as 1.5 g/cm^3. Substituting the value of K_d, ρ_b and n_e into **Equation 5**, the retardation factor R_d is calculated as follows:

$$R_d = 1 + \frac{(0.00041 * 1.5)}{0.3}$$

$$R_d = 1.002$$

From the above parameters, the pollutant transport rate (V_{pt}) is determined by dividing the seepage velocity (V_s) by the retardation factor (R_d):

$$V_{pt} = \frac{V_s}{R_d} \qquad \text{-- Eq. 7}$$

$$V_{pt} = \frac{0.063}{1.002}$$

V_{pt} = 0.0628 ft/day

The distance traveled by the contaminant is calculated by the relationship, Distance = Transport Rate * Time:

$d = V_{pt} * t$ -- **Eq. 8**

d = 0.0628 ft/day * 1,181 days

d = 74.16 ft

From the calculations, it appears that the migration of contaminants from monitoring well M3MW-9 is very minimal (approximately 74 feet), and chlorobenzene concentrations can be expected to naturally attenuate in approximately 3.2 years. Monitoring wells M3MW-7, M3MW-8, M3MW-10 and M3MW-11 are proposed as sentinel wells. The latitude and longitude (taken from the NJDEP Monitoring Well Location Certification forms) of the monitoring wells that mark the area of the CEA are as follows:

Well No.	Latitude	Longitude
M3MW-7	40°18'49.0"	74°03'05.7"
M3MW-8	40°18'48.5"	74°03'08.5"
M3MW-9	40°18'47.3"	74°03'11.0"
M3MW-10	40°18'46.5"	74°03'15.1"
M3MW-11	40°18'46.1"	74°03'16.8"

Figure 17 presents the proposed CEA boundary map compatible with the NJDEP's Geographic Information System. Based upon the well search data (Section 1.6.1) domestic, irrigation, industrial or supply wells do not exist within the proposed boundaries of the CEA and there is reasonable expectation that they will be not installed in the future. Since no groundwater use within proposed CEA boundaries is occurring or is anticipated to occur, the aquifer beneath the Landfill M-3 is not considered a ground water use area.

Based on the CEA calculations and based on the analytical results of quarterly sampling events, the DPW proposes a maximum CEA duration of five years for chlorobenzene to degrade to its GWQC of 4 μg/L, assuming natural degradation rates.

1.8 Conclusions and Recommendations

Based on the investigation conducted to date the DPW concludes the following:

- In the Main Post area, groundwater is typically encountered at depths of approximately 2.0 to 12.00 feet below ground surface. Ground water flow was calculated to be toward the north-northeast, toward Lafetra Creek and Mill Creek, consistent with previous data.
- Historically, separate phase hydrocarbons were not reported in any of the monitoring wells.
- Groundwater analytical results from the permanent monitoring and piezometric wells identified chlorobenzene as the only significant contaminant of concern across Landfill M-3, with exceedances of the NJDEP GWQC noted in six of eight monitoring wells.
- Historically, a decrease in chlorobenzene concentrations was noted in all monitoring wells, except M3MW-9 and M3MW-10, as discussed in Section 1.5.1.
- Groundwater chlorobenzene contamination is limited in extent and can be expected to naturally degrade overtime without significant migration.
- Chlorobenzene concentrations do not pose a human health risk, as discussed in Section 1.6.2.
- The duration of the CEA for chlorobenzene was calculated to be 1,181 days (approximately 3.2 years). The DPW proposes a maximum CEA duration of five years for chlorobenzene to degrade to its GWQC of 4 μg/L, assuming natural degradation rates.
- The surface water samples collected from five locations along Lafetra Creek and Mill Creek, showed that the Landfill M-3 site is not a contributor to the VOC contamination of these creeks, and that chlorobenzene impacted groundwater concentrations are not expected to adversely affect surface water quality.

Based on the above conclusions, the DPW proposes to implement a natural remediation program.

2.0 STATEMENT OF INTENT TO COMPLETE N.J.A.C. 7:26E

It is the DPW's intention that adherence to the remediation program outlined in this RAWP will result in compliance with the criteria set forth in N.J.A.C. 7-26E (7/93).

3.0 APPLICABLE REMEDIATION STANDARDS

The remediation standards for the groundwater at Landfill M-3 will be the NJDEP Ground Water Quality Criteria (GWQC) defined in N.J.A.C. 7:9-6. In the event the GWQC for a particular compound is numerically lower than the practical quantitation limit (PQL) for that compound, the PQL will be applied as the groundwater cleanup level. According to the most recent documentation from the NJDEP, the GWQC for chlorobenzene is 4.0 μg/L.

4.0 REMEDIAL ACTION ALTERNATIVES

4.1 Considered Remedial Actions

There are several technologies proven to be effective for remediating groundwater contaminated with volatile organic compounds (VOCs). However, the applicability of these technologies is dependent on site-specific data, including the nature and extent of the contamination, and the geologic and hydrologic conditions. The following are brief descriptions of possible remedial alternatives based predominantly on their potential for treating VOCs. Site-specific conditions were fully considered during the selection of the best remedial alternative for Landfill M-3.

Two-Phase Vacuum Extraction - Two-Phase Vacuum Extraction (TPVE) consists of extracting contaminated ground water and soil vapors simultaneously using an array of extraction wells, separating the water and vapor phases, and passing each through a surface treatment system. The vapor phase is subsequently discharged to the atmosphere and the water phase is discharged to either the ground water, surface water, or a sanitary sewer. This technology addresses both soil and ground water contamination, and its benefits are most cost-effective when soil and groundwater concentrations are relatively high. In addition, TPVE often requires a follow-up remedial technology to further reduce contaminant concentrations to within NJDEP's regulatory limits. A pilot study must be performed to evaluate effectiveness prior to full-scale implementation.

Since chlorobenzene concentrations are relatively low at Landfill M-3, TPVE is not suitable for this site.

In-Situ Aeration (Air Sparging) - Air sparging treats contaminated groundwater by volatilizing organic compounds. Clean air is injected into the contaminated aquifer through vertical and/or horizontal wells. The air volatilizes the dissolved phase VOCs and transfers the contaminated vapors from the saturated zone into the unsaturated zone. The organic vapors are then extracted from the unsaturated zone through a Soil Vapor Extraction (SVE) system and treated at a surface unit. A pilot study must be performed to evaluate effectiveness prior to full-scale implementation.

As mentioned in Section 1.2.4, ground water is typically encountered at depths of 2 to 9 feet bgs. Due to minimal thickness of the unsaturated zone, an SVE system likely could not be successfully operated. Also, the air injection into the aquifer should be performed under a rigorous control in order to prevent migration of the contamination toward the creeks. Based on these factors, an air-sparging system is not suitable for Landfill M-3.

Pump and Treat - Contaminated ground water is extracted out of the ground with a system of pumping wells and is treated with an air stripper, carbon adsorption unit, or other pertinent treatment unit. Remediated water is then discharged to a ground water recharge zone, a stream, or a sanitary sewer. A pilot study must be performed to evaluate effectiveness prior to full-scale implementation. This is the most commonly used groundwater remediation technology.

As mentioned in Section 1.5.1, a decrease in chlorobenzene concentrations was noticed in all monitoring wells, except wells M3MW-5 and M3MW-10. Based on this fact and based on the aquifer pump test results performed at the landfills adjacent to Landfill M-3, which shows that during the pumping test drawdown recorded in the observation wells did not exceed 0.01 feet, this remedial alternative method is not suitable for Landfill M-3.

Anaerobic Bioremediation - Biodegradation reduces contaminant mass by introducing contaminant-degrading microorganisms, or enhancing indigenous microbial activity within the contaminated area. The microorganisms convert the organic compounds to carbon dioxide, inorganic salts, and water. Bioremediation can be used in either in situ or ex situ environments. Bioremediation is a developed technology, and a variety of bioremediation systems have been used at remediation sites.

Since chlorobenzene concentrations are relatively low at Landfill M-3, anaerobic biremediation is not recommended for this site.

Natural Remediation - Natural remediation is a method of groundwater remediation where contaminant concentrations will decrease to applicable groundwater quality standards via degradation, retardation, or dispersion under present site conditions. This alternative method is discussed in detail in Section 4.2 below.

4.2 Proposed Remedial Action

The DPW proposes a natural remediation program to be implemented at the Landfill M-3. A conditional no further action under a CEA designation is requested for the groundwater portion of this investigation. The following NJDEP requirements were factors that indicate that natural remediation is a viable course of action for this site:

- Groundwater contamination does not appear to be resulting from a specific soil source;
- Groundwater contamination at the site has been delineated;
- As mentioned in Section 1.5.1, a decrease in chlorobenzene concentrations was noticed in all monitoring wells, except wells M3MW-9 and M3MW-10.
- Based upon the CEA calculation, the chlorobenzene contaminant plume will not migrate more than approximately 74 feet over a period of approximately 3.2 years.
- Lafetra Creek and Mill Creek, which are potential ecological receptors, are not contaminated with chlorobenzene at levels exceeding the applicable NJDEP GWQS, and are not expected to be adversely impacted over the duration of the CEA.

5.0 QUALITY ASSURANCE PROJECT PLAN

In order to maintain quality assurance, the DPW's SOP for Sample Handling will be followed during all sampling activities. This SOP is presented as Appendix A.

6.0 REQUIRED PERMITS

No permits are necessary during the natural remediation program.

7.0 EROSION, DUST, AND ODOR CONTROL

Erosion, dust, and odor control measures are not necessary during the implementation of the natural remediation program.

8.0 HEALTH AND SAFETY PLAN

The Department of Public Works (DPW) will be responsible for preparation of a site-specific Health and Safety Plan (HASP) encompassing monitoring and groundwater sampling program.

9.0 SITE RESTORATION

No site restoration will be necessary during the implementation of the natural remediation program.

10.0 POST-REMEDIAL ACTION SAMPLING

The DPW proposes to continue its quarterly groundwater sampling program at Landfill M-3, for the duration of the CEA (5 years). The monitoring wells M3MW-4, M3MW-5, M3MW-6, and the piezometeric wells M3MW-7, M3MW-8, M3MW-9, M3MW-10, and M3MW-11 will be sampled and analyzed for VOCs, semi-volatile, pesticide/PCBs, and priority pollutant metals to monitor the effectiveness of natural remediation. In addition, to more closely monitor surface water quality in Lafetra Creek, two additional surface water sampling points – one downgradient from M3MW-9 and one downgradient from M3MW-10 – will be installed and sampled as part of the DPW's quarterly monitoring program. Figure 17 presents approximate locations of additional surface water sampling points.

If the chlorobenzene concentrations remain below their respective NJDEP-GWQC and NJDEP-SWQS for eight consecutive rounds of sampling, the DPW will apply to the NJDEP for No Further Action (NFA) status. Upon issuance of NFA status, the DPW will seal these monitoring wells.

11.0 ESTIMATED COST OF RAWP IMPLEMENTATION

The anticipated costs for implementing the proposed remedial action are summarized below:

REMEDIATION COSTS

- Costs for groundwater sampling and laboratory (5 years) =$150,000
- Costs for well abandonment =$20,000
- Costs for quarterly progress reports (20 reports) =$55,000

TOTAL REMEDIAL ACTION COSTS =$225,000

12.0 PROPOSED SCHEDULE

Identification of Project Tasks:

- RAWP submittal and NJDEP approval
- Quarterly groundwater sampling events
- Preparation and submittal of quarterly progress reports (5 years)
- Quarterly post-remedial sampling
- NJDEP approval of No Further Action

A schedule for the proposed remedial programs shown in Figure 18. If it becomes necessary to modify the schedule, the Department of Public Works (DPW) will submit a revised schedule to the New Jersey Department of Environmental Protection.

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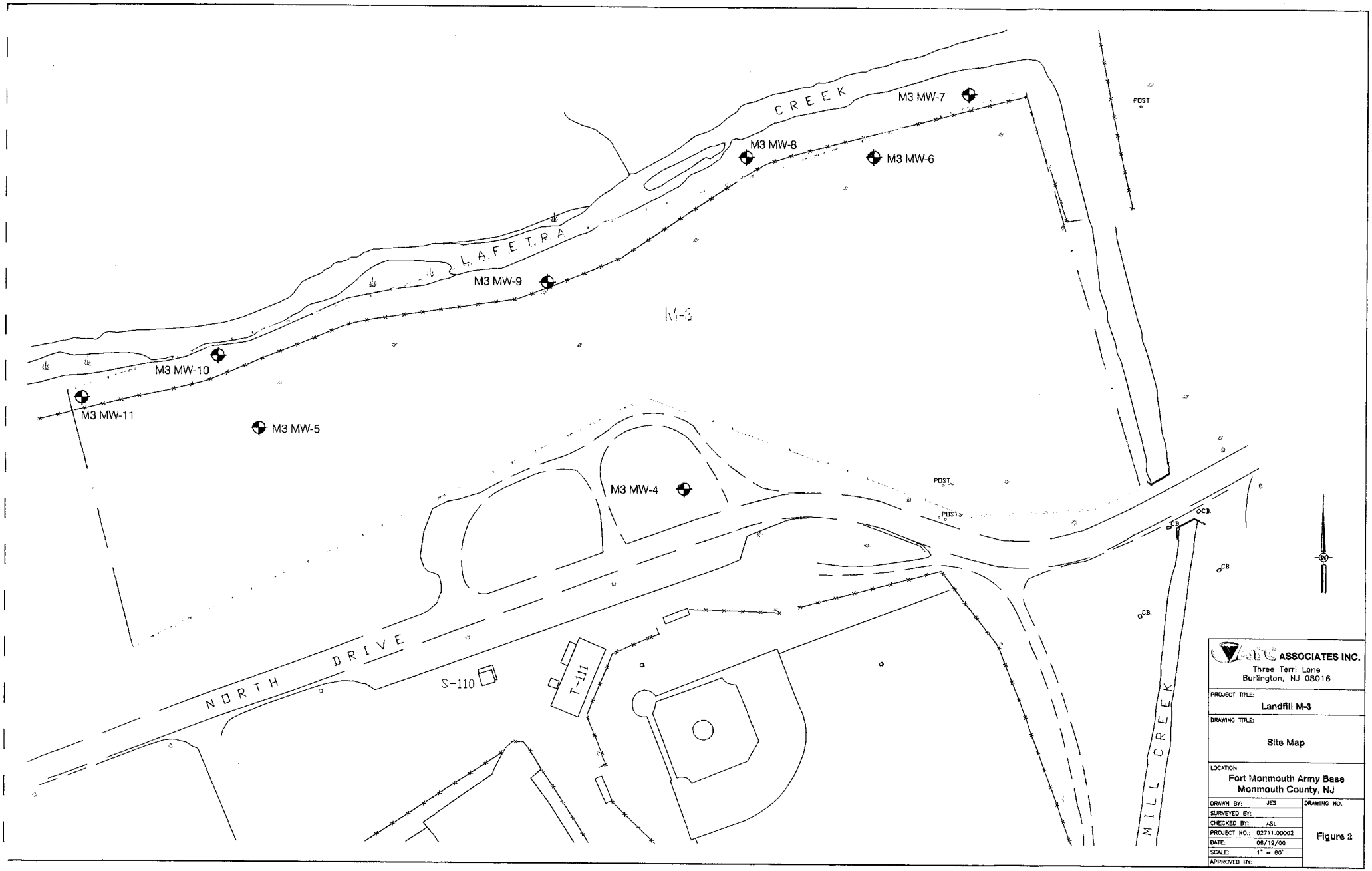
LAFETRA CREEK
M3 MW-7
M3 MW-8
M3 MW-6
M3 MW-9
M3 MW-10
M3 MW-11
M3 MW-5
M3 MW-4
M-3
POST
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POST
CB.
CB.
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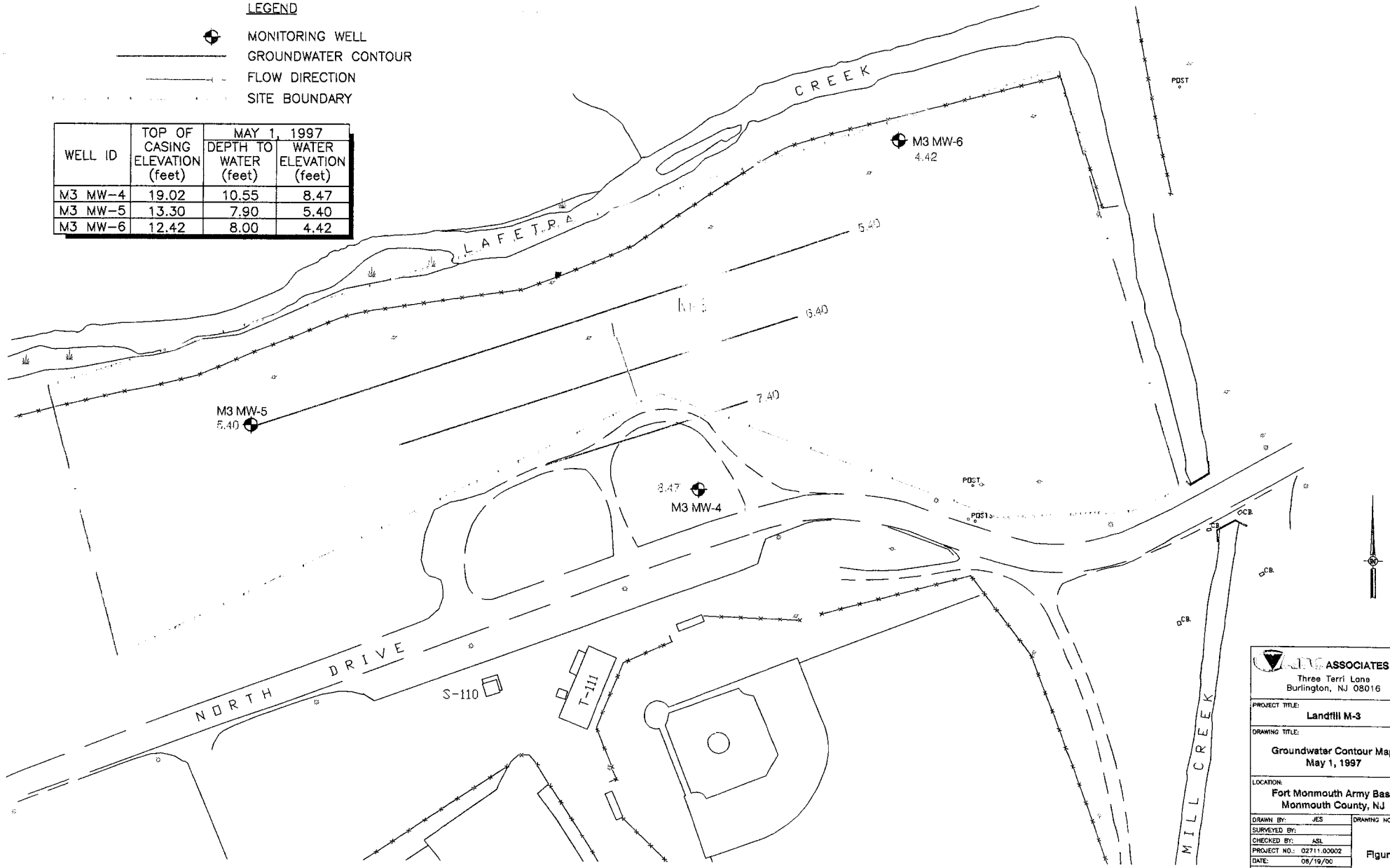
CB.
NORTH DRIVE
S-110
T-111
MILL CREEK
ARC ASSOCIATES INC.
Three Terri Lane
Burlington, NJ 08016
PROJECT TITLE:
Landfill M-3
DRAWING TITLE:
Site Map
LOCATION:
Fort Monmouth Army Base
Monmouth County, NJ
DRAWN BY: JES
SURVEYED BY:
CHECKED BY: ASL
PROJECT NO.: 02711.00002
DATE: 06/19/00
SCALE: 1" = 80'
APPROVED BY:
DRAWING NO.
Figure 2

LEGEND

- MONITORING WELL
- GROUNDWATER CONTOUR
- FLOW DIRECTION
- SITE BOUNDARY

WELL ID	TOP OF CASING ELEVATION (feet)	MAY 1, 1997	
		DEPTH TO WATER (feet)	WATER ELEVATION (feet)
M3 MW-4	19.02	10.55	8.47
M3 MW-5	13.30	7.90	5.40
M3 MW-6	12.42	8.00	4.42



ASSOCIATES INC.
Three Terri Lane
Burlington, NJ 08016

PROJECT TITLE: Landfill M-3

DRAWING TITLE: Groundwater Contour Map May 1, 1997

LOCATION: Fort Monmouth Army Base Monmouth County, NJ

DRAWN BY:	JES	DRAWING NO.
SURVEYED BY:		
CHECKED BY:	ASL	
PROJECT NO.:	02711.00002	Figure 3
DATE:	08/19/00	
SCALE:	1" = 80'	
APPROVED BY:		

LEGEND

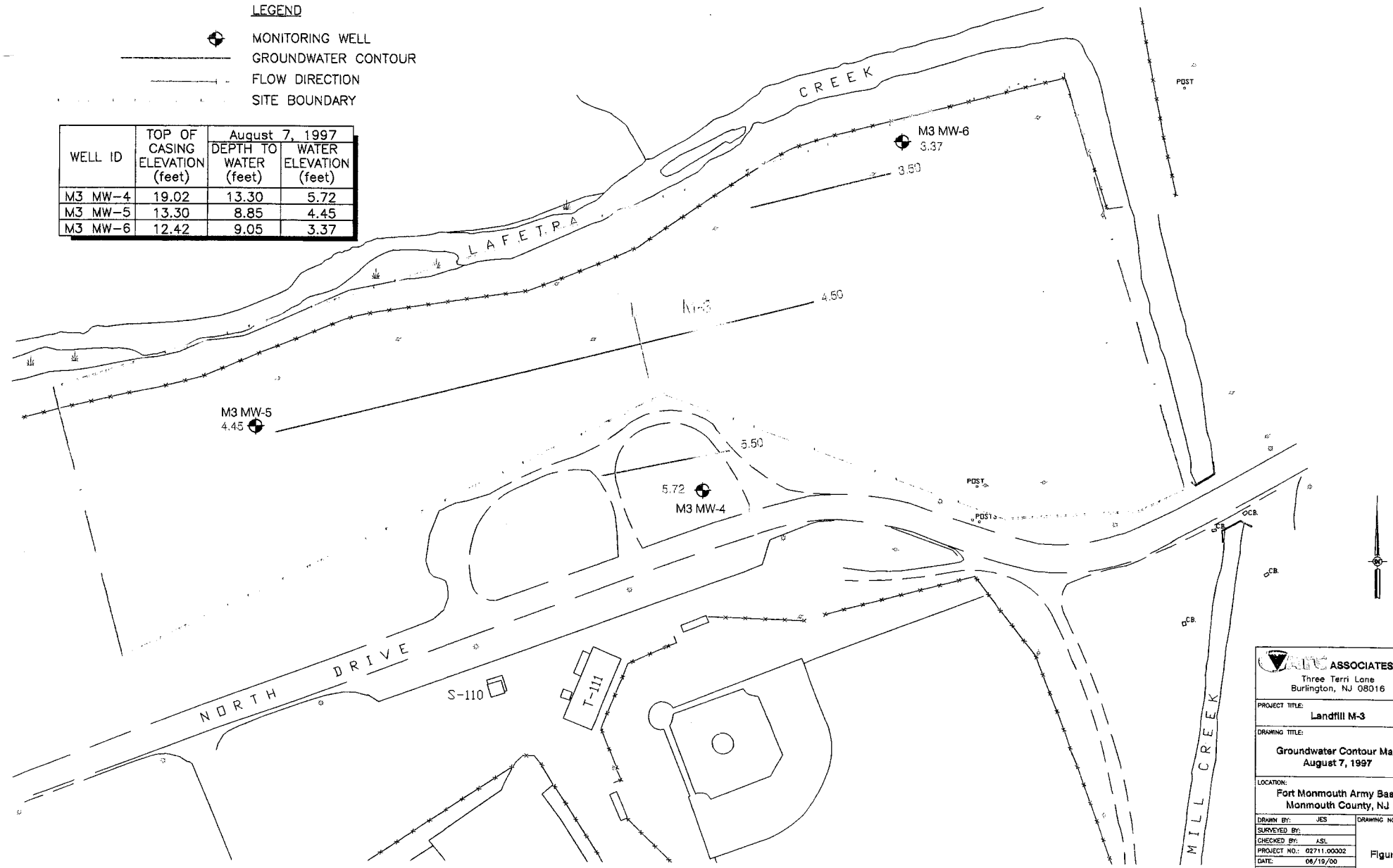
MONITORING WELL

GROUNDWATER CONTOUR

FLOW DIRECTION

SITE BOUNDARY

WELL ID	TOP OF CASING ELEVATION (feet)	August 7, 1997	
		DEPTH TO WATER (feet)	WATER ELEVATION (feet)
M3 MW-4	19.02	13.30	5.72
M3 MW-5	13.30	8.85	4.45
M3 MW-6	12.42	9.05	3.37



ARCADIS ASSOCIATES INC.
Three Terri Lane
Burlington, NJ 08016

PROJECT TITLE: Landfill M-3

DRAWING TITLE: Groundwater Contour Map August 7, 1997

LOCATION: Fort Monmouth Army Base Monmouth County, NJ

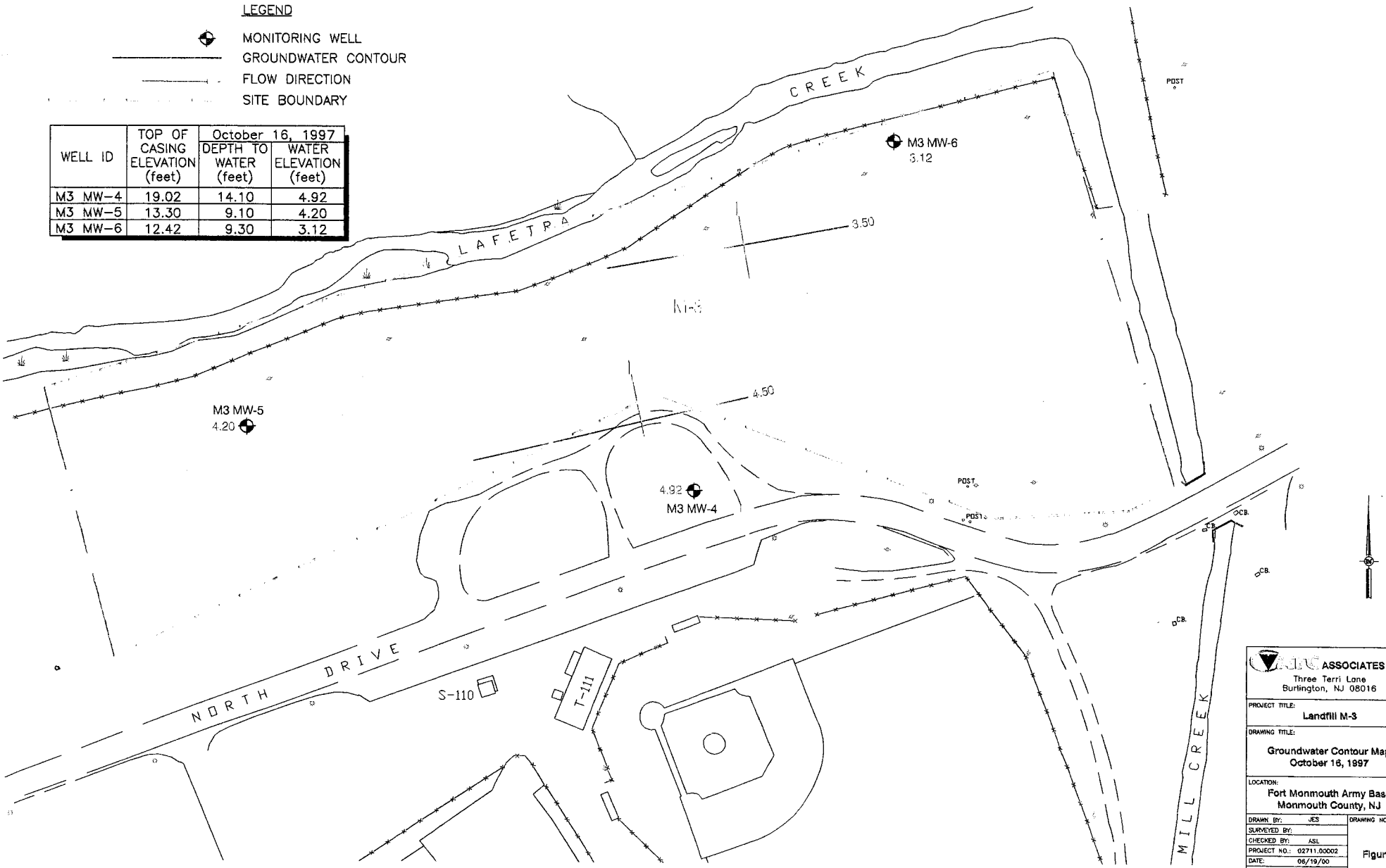
DRAWN BY:	JES
SURVEYED BY:	
CHECKED BY:	ASL
PROJECT NO.:	02711.00002
DATE:	06/19/00
SCALE:	1" = 80'
APPROVED BY:	

DRAWING NO. Figure 4

LEGEND

- MONITORING WELL
- GROUNDWATER CONTOUR
- FLOW DIRECTION
- SITE BOUNDARY

WELL ID	TOP OF CASING ELEVATION (feet)	October 16, 1997	
		DEPTH TO WATER (feet)	WATER ELEVATION (feet)
M3 MW-4	19.02	14.10	4.92
M3 MW-5	13.30	9.10	4.20
M3 MW-6	12.42	9.30	3.12



ASSOCIATES INC.
Three Terri Lane
Burlington, NJ 08016

PROJECT TITLE: Landfill M-3

DRAWING TITLE: Groundwater Contour Map October 16, 1997

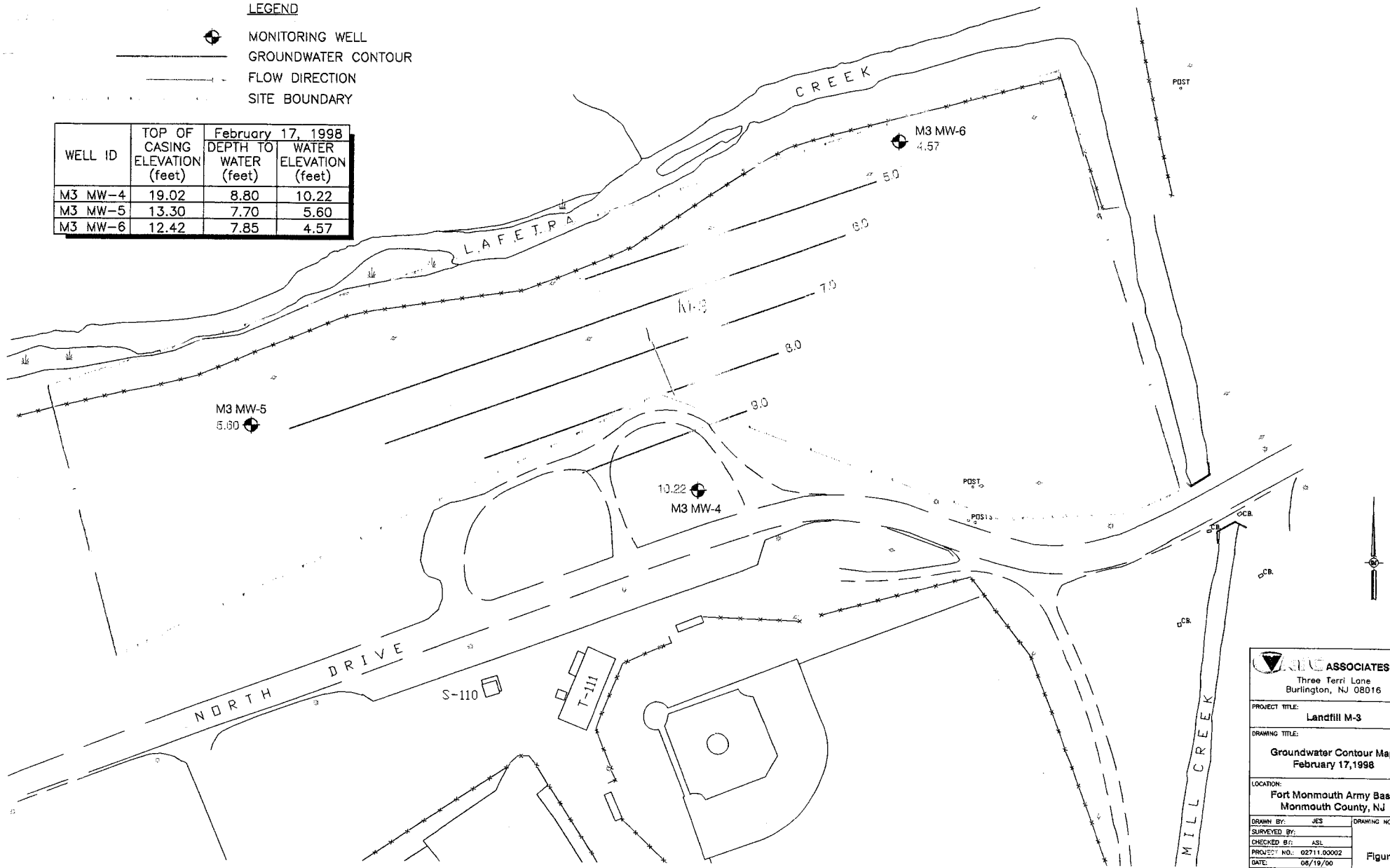
LOCATION: Fort Monmouth Army Base Monmouth County, NJ

DRAWN BY: JES	DRAWING NO.
SURVEYED BY:	
CHECKED BY: ASL	
PROJECT NO.: 02711.00002	Figure 5
DATE: 06/19/00	
SCALE: 1" = 80'	
APPROVED BY:	

LEGEND

- MONITORING WELL
- GROUNDWATER CONTOUR
- FLOW DIRECTION
- SITE BOUNDARY

WELL ID	TOP OF CASING ELEVATION (feet)	February 17, 1998 DEPTH TO WATER (feet)	WATER ELEVATION (feet)
M3 MW-4	19.02	8.80	10.22
M3 MW-5	13.30	7.70	5.60
M3 MW-6	12.42	7.85	4.57



ASSOCIATES INC.
Three Terri Lane
Burlington, NJ 08016

PROJECT TITLE: Landfill M-3

DRAWING TITLE: Groundwater Contour Map February 17,1998

LOCATION: Fort Monmouth Army Base Monmouth County, NJ

DRAWN BY:	JES	DRAWING NO.
SURVEYED BY:		
CHECKED BY:	ASL	
PROJECT NO.:	02711.00002	Figure 6
DATE:	06/19/00	
SCALE:	1" = 80'	
APPROVED BY:		

LEGEND

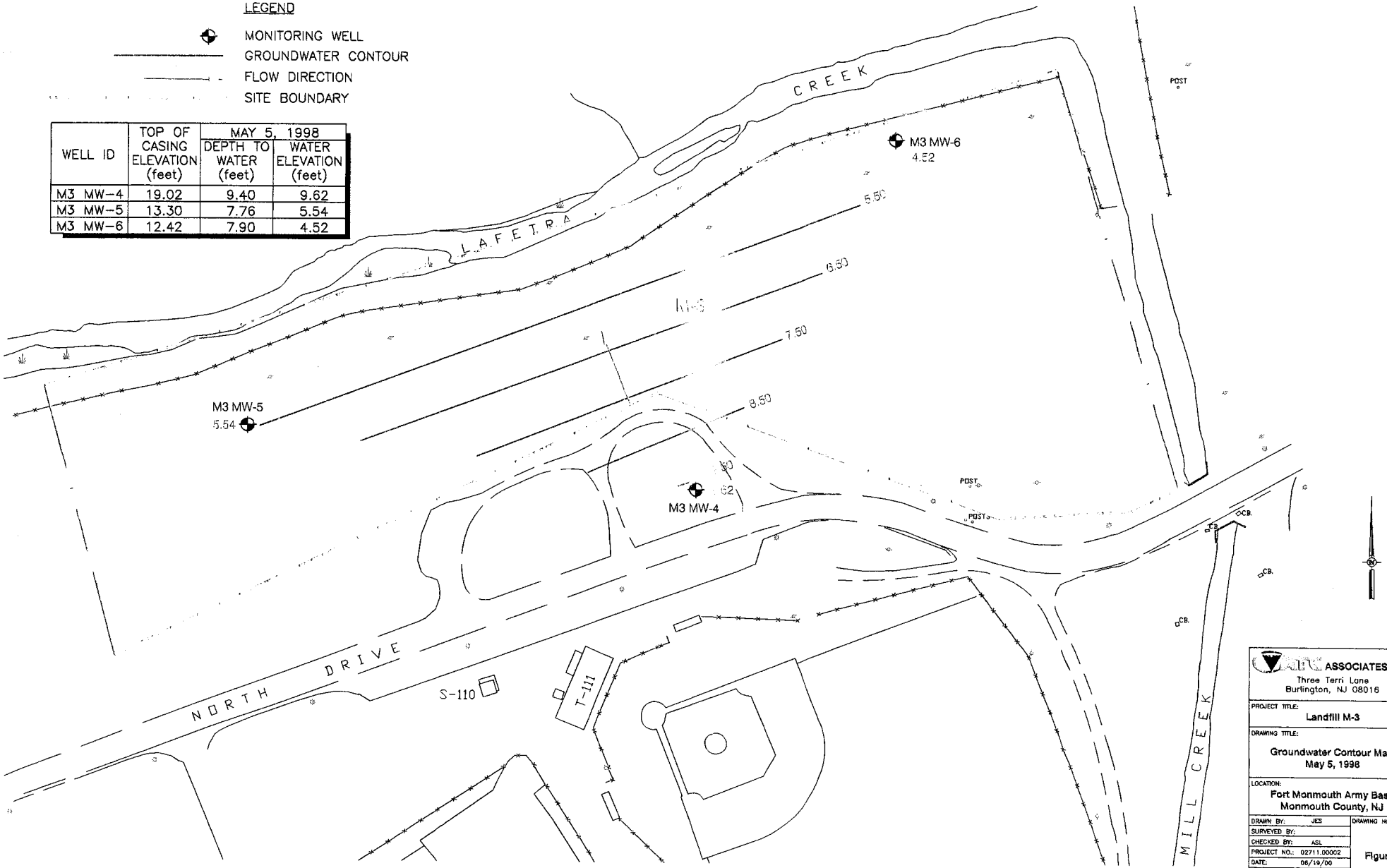
MONITORING WELL

GROUNDWATER CONTOUR

FLOW DIRECTION

SITE BOUNDARY

WELL ID	TOP OF CASING ELEVATION (feet)	MAY 5, 1998	
		DEPTH TO WATER (feet)	WATER ELEVATION (feet)
M3 MW-4	19.02	9.40	9.62
M3 MW-5	13.30	7.76	5.54
M3 MW-6	12.42	7.90	4.52



ARC ASSOCIATES INC.
Three Terri Lane
Burlington, NJ 08016

PROJECT TITLE: Landfill M-3

DRAWING TITLE: Groundwater Contour Map May 5, 1998

LOCATION: Fort Monmouth Army Base Monmouth County, NJ

DRAWN BY:	JES	DRAWING NO.
SURVEYED BY:		Figure 7
CHECKED BY:	ASL	
PROJECT NO.:	02711.00002	
DATE:	06/19/00	
SCALE:	1" = 80'	
APPROVED BY:		

LEGEND

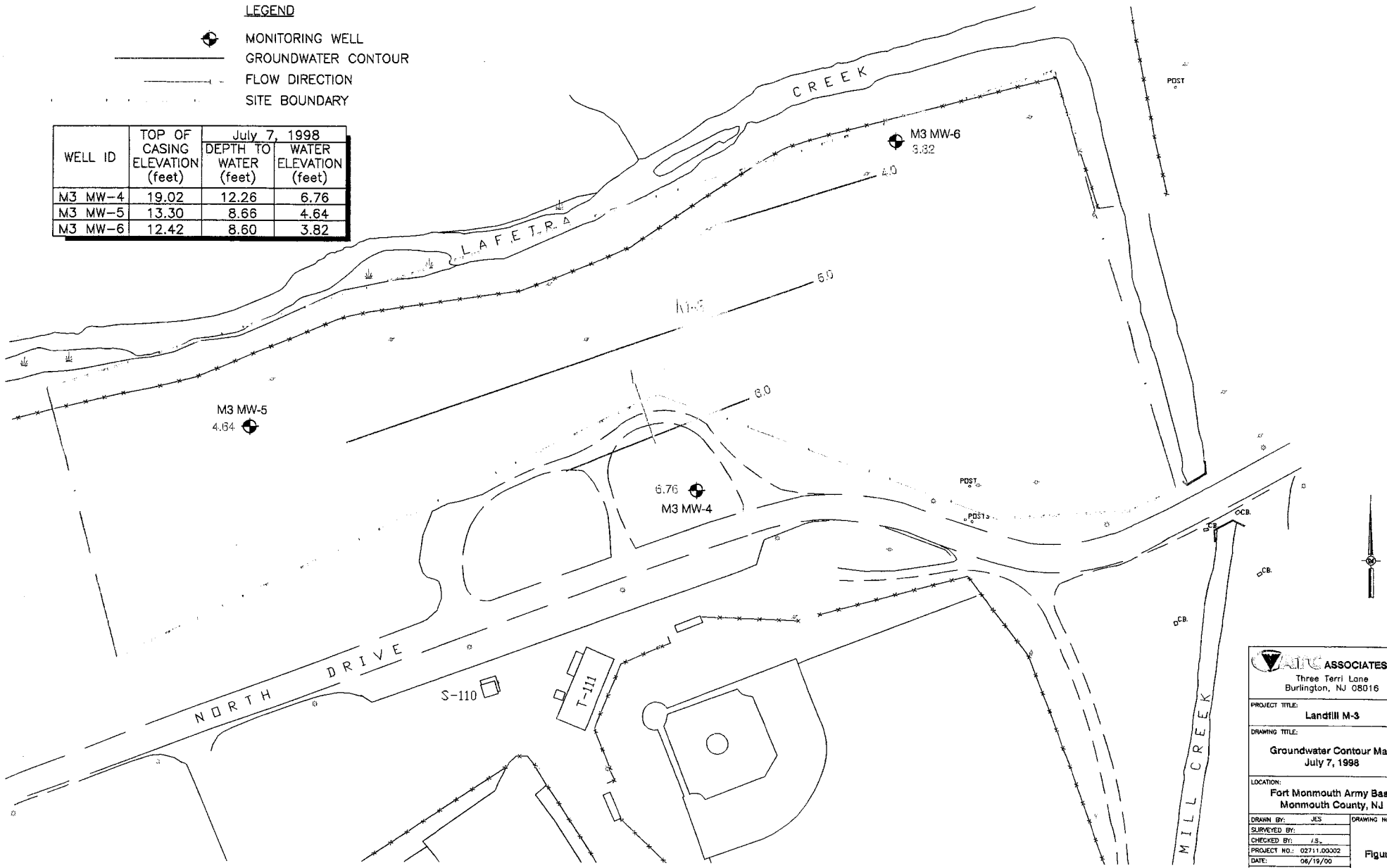
MONITORING WELL

GROUNDWATER CONTOUR

FLOW DIRECTION

SITE BOUNDARY

WELL ID	TOP OF CASING ELEVATION (feet)	July 7, 1998	
		DEPTH TO WATER (feet)	WATER ELEVATION (feet)
M3 MW-4	19.02	12.26	6.76
M3 MW-5	13.30	8.66	4.64
M3 MW-6	12.42	8.60	3.82



ARC ASSOCIATES INC.
Three Terri Lane
Burlington, NJ 08016

PROJECT TITLE: Landfill M-3

DRAWING TITLE: Groundwater Contour Map July 7, 1998

LOCATION: Fort Monmouth Army Base Monmouth County, NJ

DRAWN BY:	JES
SURVEYED BY:	
CHECKED BY:	J.S.
PROJECT NO.:	02711.00302
DATE:	08/19/00
SCALE:	1" = 80'
APPROVED BY:	

DRAWING NO. Figure 8

LEGEND

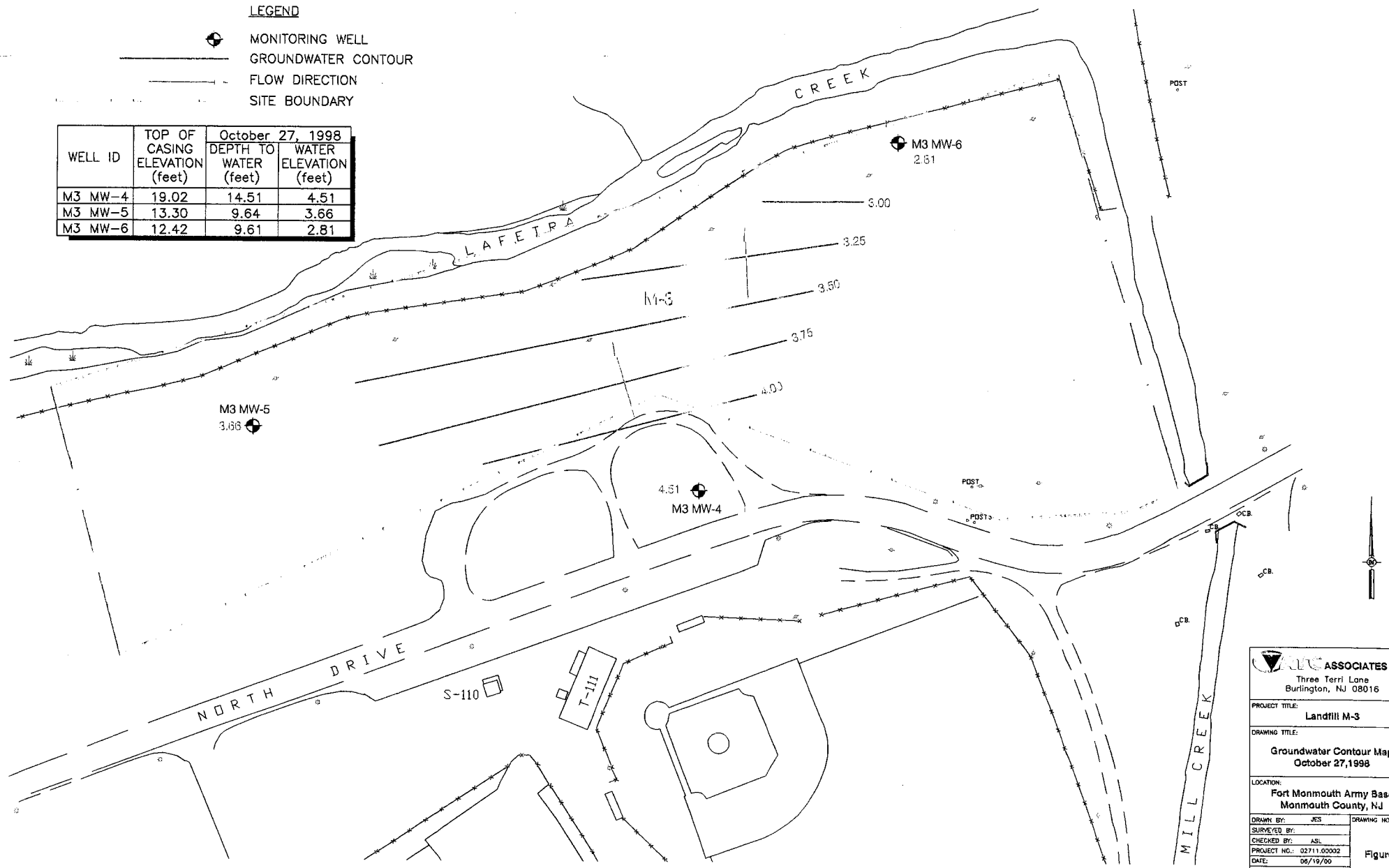
MONITORING WELL

GROUNDWATER CONTOUR

FLOW DIRECTION

SITE BOUNDARY

WELL ID	TOP OF CASING ELEVATION (feet)	October 27, 1998	
		DEPTH TO WATER (feet)	WATER ELEVATION (feet)
M3 MW-4	19.02	14.51	4.51
M3 MW-5	13.30	9.64	3.66
M3 MW-6	12.42	9.61	2.81



ARCADIS ASSOCIATES INC.
Three Terri Lane
Burlington, NJ 08016

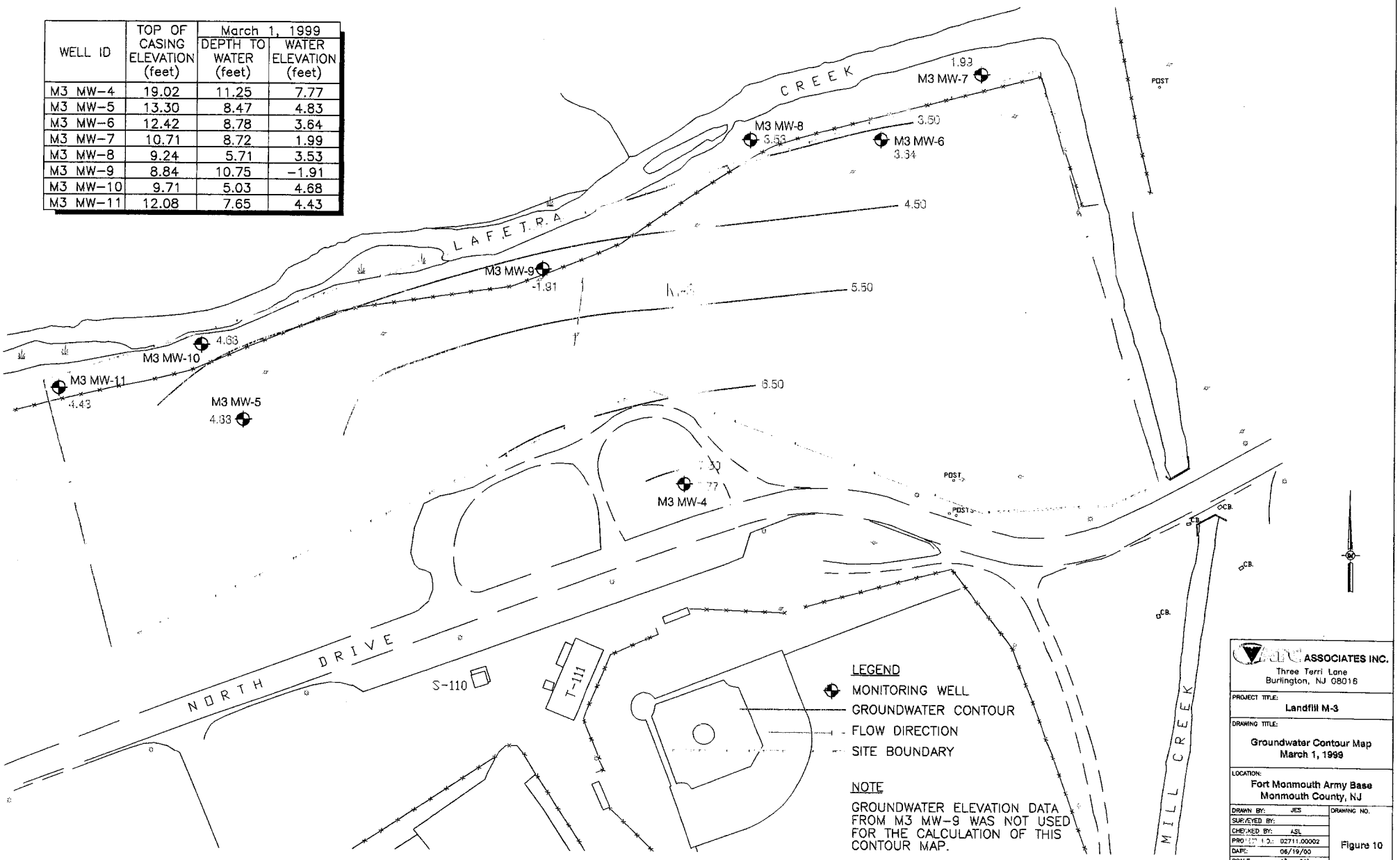
PROJECT TITLE: Landfill M-3

DRAWING TITLE: Groundwater Contour Map October 27,1998

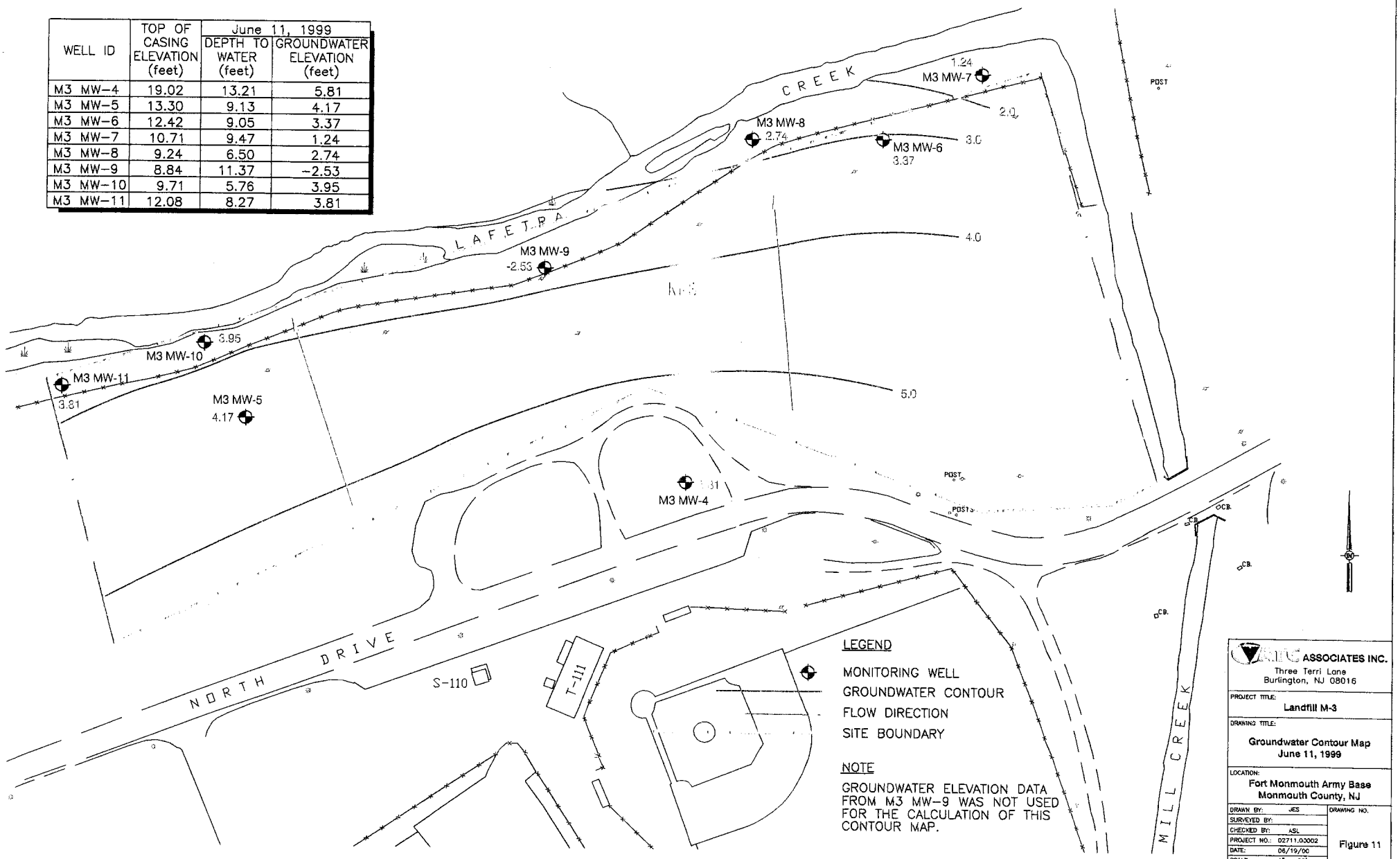
LOCATION: Fort Monmouth Army Base Monmouth County, NJ

DRAWN BY:	JES	DRAWING NO.
SURVEYED BY:		Figure 9
CHECKED BY:	ASL	
PROJECT NO.:	02711.00002	
DATE:	06/19/00	
SCALE:	1" = 80'	
APPROVED BY:		

WELL ID	TOP OF CASING ELEVATION (feet)	March 1, 1999	
		DEPTH TO WATER (feet)	WATER ELEVATION (feet)
M3 MW-4	19.02	11.25	7.77
M3 MW-5	13.30	8.47	4.83
M3 MW-6	12.42	8.78	3.64
M3 MW-7	10.71	8.72	1.99
M3 MW-8	9.24	5.71	3.53
M3 MW-9	8.84	10.75	-1.91
M3 MW-10	9.71	5.03	4.68
M3 MW-11	12.08	7.65	4.43



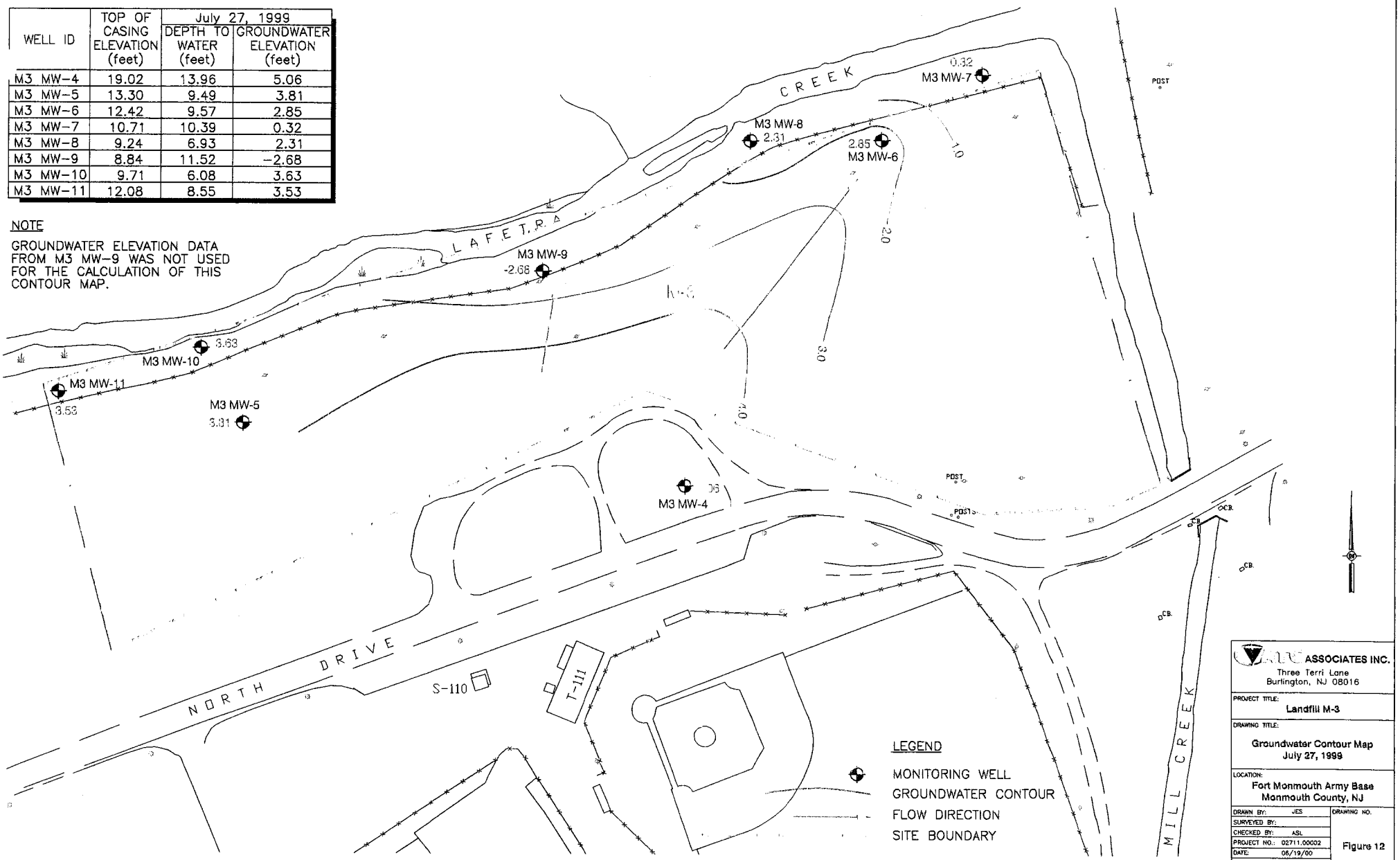
WELL ID	TOP OF CASING ELEVATION (feet)	June 11, 1999	
		DEPTH TO WATER (feet)	GROUNDWATER ELEVATION (feet)
M3 MW-4	19.02	13.21	5.81
M3 MW-5	13.30	9.13	4.17
M3 MW-6	12.42	9.05	3.37
M3 MW-7	10.71	9.47	1.24
M3 MW-8	9.24	6.50	2.74
M3 MW-9	8.84	11.37	-2.53
M3 MW-10	9.71	5.76	3.95
M3 MW-11	12.08	8.27	3.81



WELL ID	TOP OF CASING ELEVATION (feet)	July 27, 1999	
		DEPTH TO WATER (feet)	GROUNDWATER ELEVATION (feet)
M3 MW-4	19.02	13.96	5.06
M3 MW-5	13.30	9.49	3.81
M3 MW-6	12.42	9.57	2.85
M3 MW-7	10.71	10.39	0.32
M3 MW-8	9.24	6.93	2.31
M3 MW-9	8.84	11.52	-2.68
M3 MW-10	9.71	6.08	3.63
M3 MW-11	12.08	8.55	3.53

NOTE

GROUNDWATER ELEVATION DATA FROM M3 MW-9 WAS NOT USED FOR THE CALCULATION OF THIS CONTOUR MAP.



ASSOCIATES INC.
Three Terri Lane
Burlington, NJ 08016

PROJECT TITLE: Landfill M-3

DRAWING TITLE: Groundwater Contour Map July 27, 1999

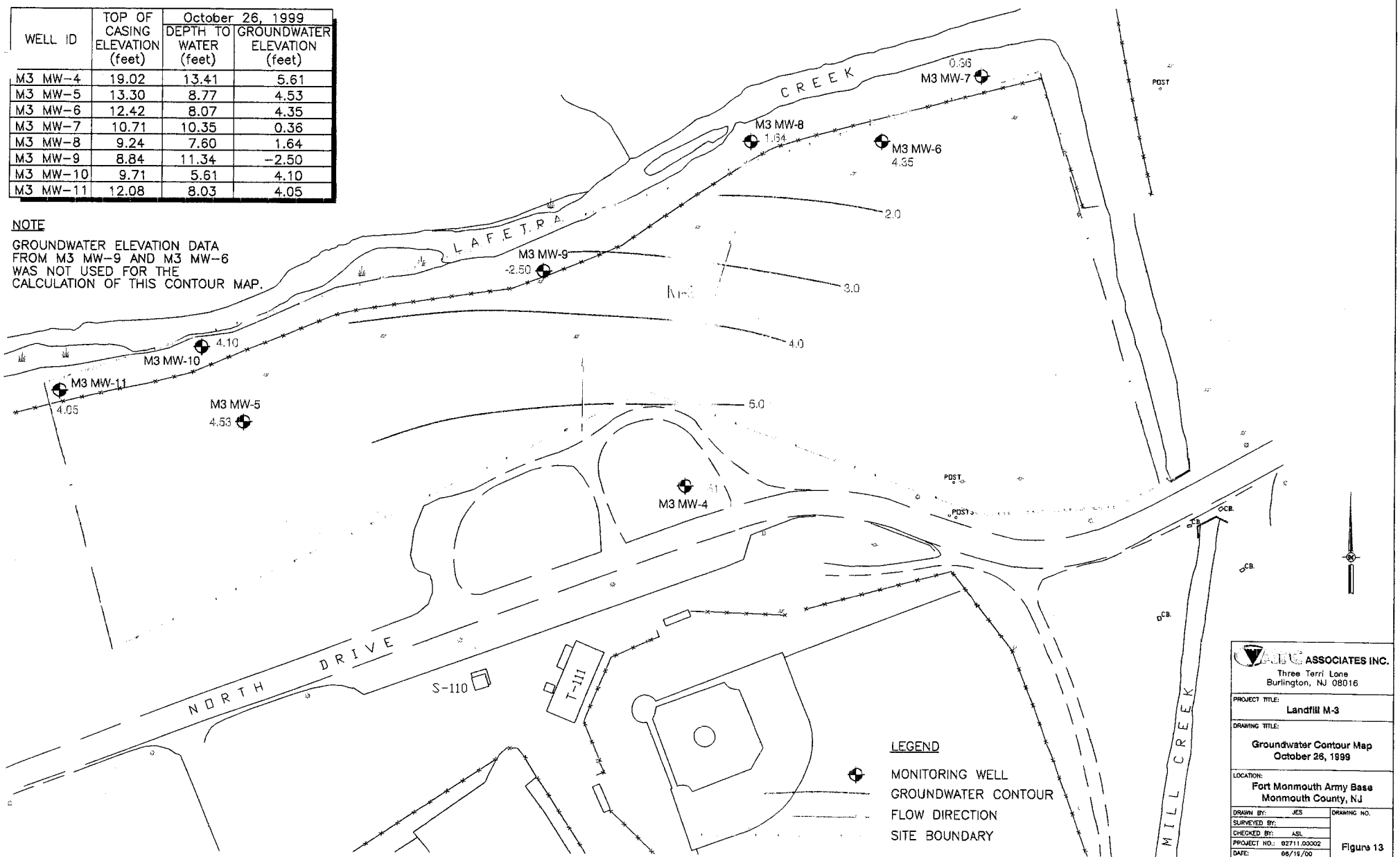
LOCATION: Fort Monmouth Army Base Monmouth County, NJ

DRAWN BY:	JES	DRAWING NO.
SURVEYED BY:		Figure 12
CHECKED BY:	ASL	
PROJECT NO.:	02711.00002	
DATE:	06/19/00	
SCALE:	1" = 80'	
APPROVED BY:	PMN	

WELL ID	TOP OF CASING ELEVATION (feet)	October 26, 1999	
		DEPTH TO WATER (feet)	GROUNDWATER ELEVATION (feet)
M3 MW-4	19.02	13.41	5.61
M3 MW-5	13.30	8.77	4.53
M3 MW-6	12.42	8.07	4.35
M3 MW-7	10.71	10.35	0.36
M3 MW-8	9.24	7.60	1.64
M3 MW-9	8.84	11.34	-2.50
M3 MW-10	9.71	5.61	4.10
M3 MW-11	12.08	8.03	4.05

NOTE

GROUNDWATER ELEVATION DATA FROM M3 MW-9 AND M3 MW-6 WAS NOT USED FOR THE CALCULATION OF THIS CONTOUR MAP.



ARC ASSOCIATES INC.
Three Terri Lane
Burlington, NJ 08016

PROJECT TITLE: Landfill M-3

DRAWING TITLE: Groundwater Contour Map October 26, 1999

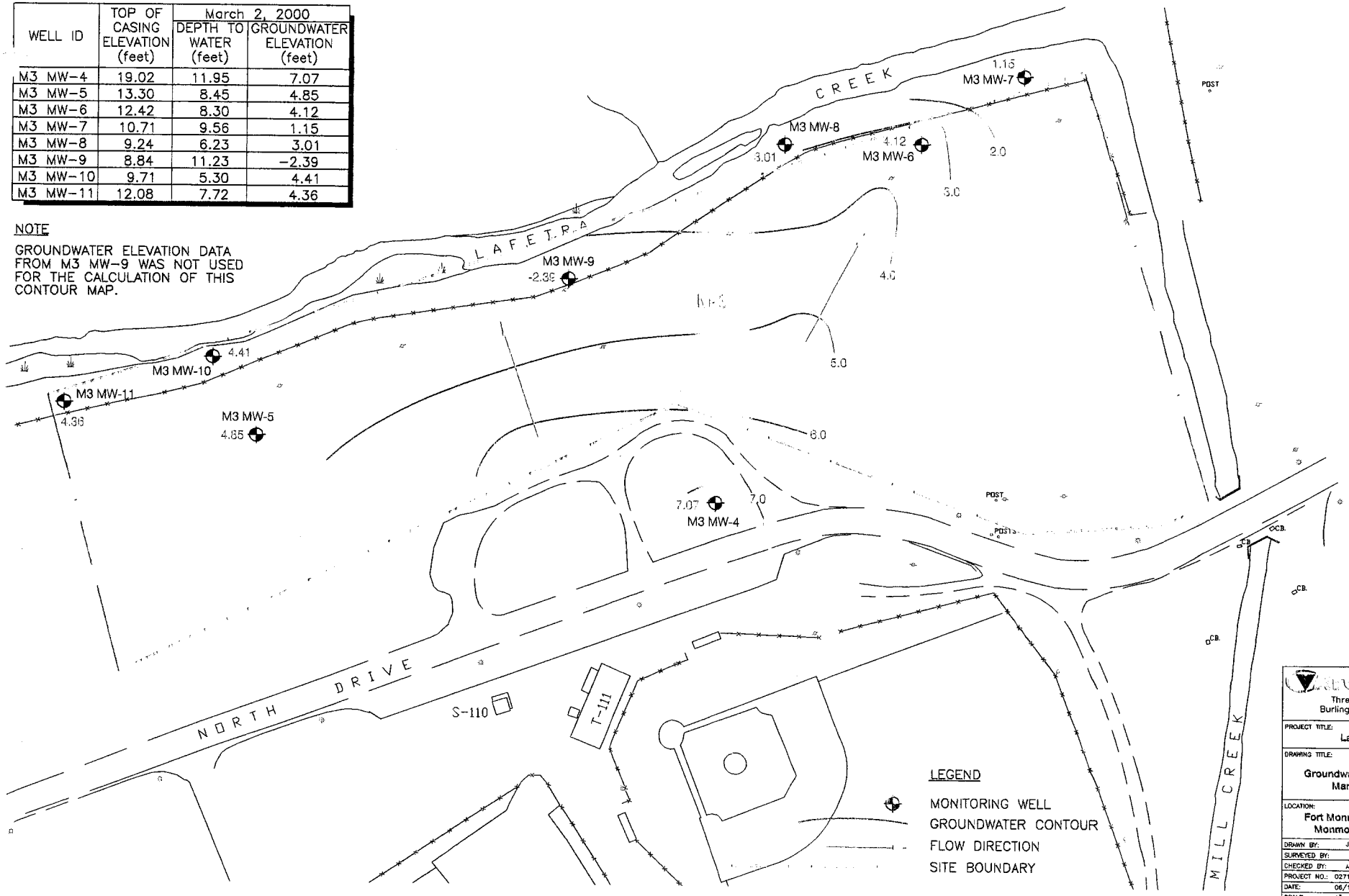
LOCATION: Fort Monmouth Army Base Monmouth County, NJ

DRAWN BY: JES	DRAWING NO.
SURVEYED BY:	
CHECKED BY: ASL	
PROJECT NO.: 02711.00002	Figure 13
DATE: 06/15/00	
SCALE: 1" = 80'	
APPROVED BY: PMN	

WELL ID	TOP OF CASING ELEVATION (feet)	March 2, 2000	
		DEPTH TO WATER (feet)	GROUNDWATER ELEVATION (feet)
M3 MW-4	19.02	11.95	7.07
M3 MW-5	13.30	8.45	4.85
M3 MW-6	12.42	8.30	4.12
M3 MW-7	10.71	9.56	1.15
M3 MW-8	9.24	6.23	3.01
M3 MW-9	8.84	11.23	-2.39
M3 MW-10	9.71	5.30	4.41
M3 MW-11	12.08	7.72	4.36

NOTE

GROUNDWATER ELEVATION DATA FROM M3 MW-9 WAS NOT USED FOR THE CALCULATION OF THIS CONTOUR MAP.



ASSOCIATES INC.
Three Terri Lane
Burlington, NJ 08016

PROJECT TITLE: Landfill M-3

DRAWING TITLE: Groundwater Contour Map March 02, 2000

LOCATION: Fort Monmouth Army Base Monmouth County, NJ

DRAWN BY:	JES
SURVEYED BY:	
CHECKED BY:	ASL
PROJECT NO.:	02711.00002
DATE:	06/19/00
SCALE:	1" = 80'
APPROVED BY:	PMN

DRAWING NO. Figure 14

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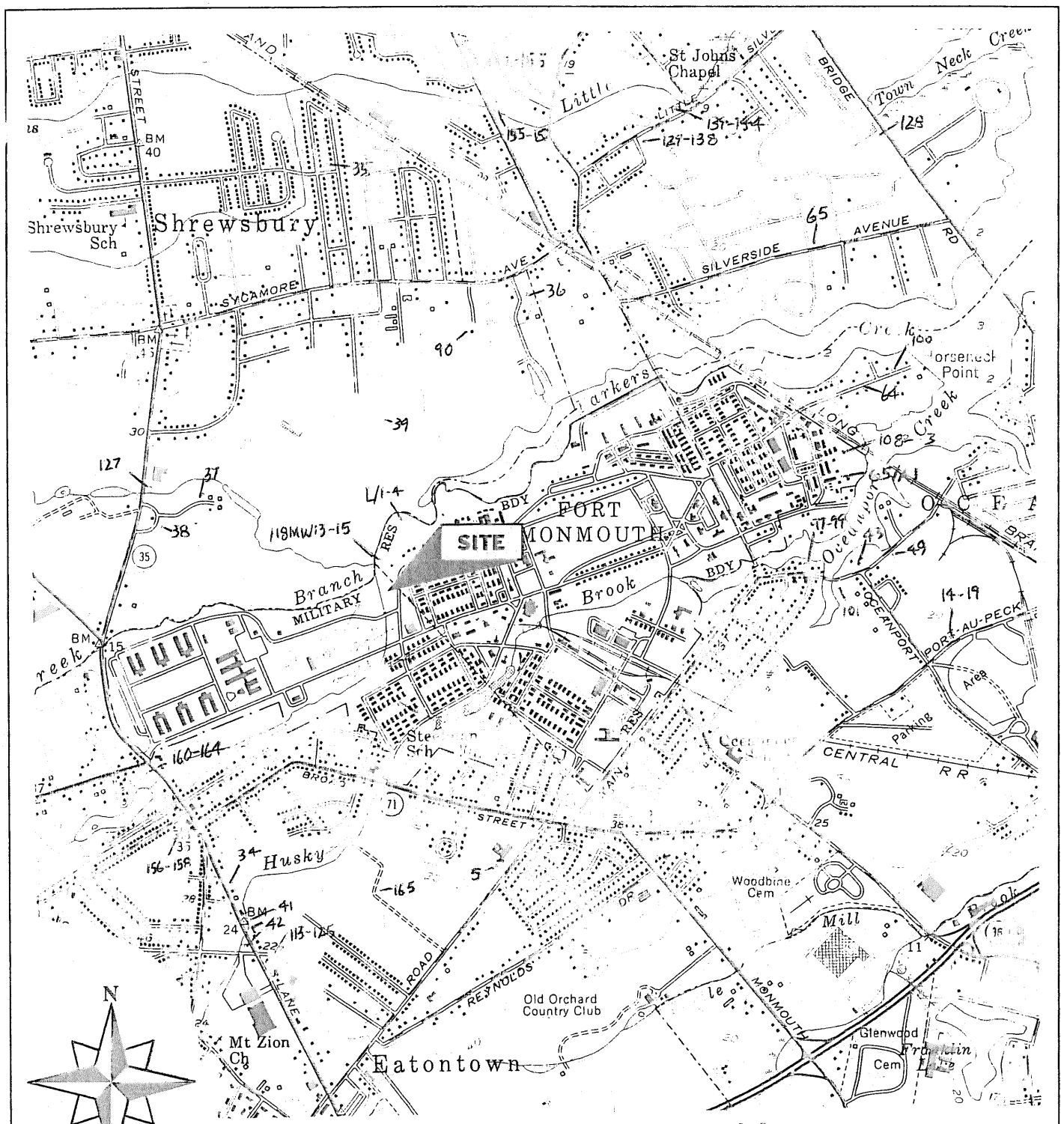

Figure 16 – Well Search Map

Client: U. S. Army Fort Monmouth	ASSOCIATES INC. Three Terri Lane, Burlington, New Jersey 08016
Site Address: Fort Monmouth Main Post, Landfill M5 Fort Monmouth, New Jersey	
Project Number: 02711.00002	**Scale:** 1: 24,000

Copied From: United States Geological Survey Topographic Map 7.5 Minute Series, Long Branch, New Jersey Quadrangle (1954, photorevised 1970).

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Figure 18
Project Schedule Landfill M3
Fort Monmouth Main Post, Fort Monmouth, New Jersey

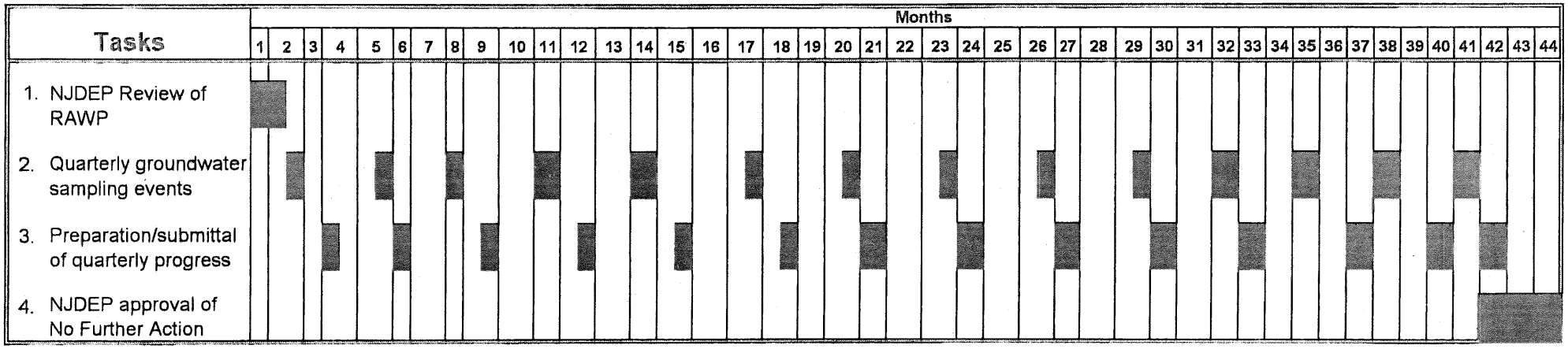


Table 1
Quarterly Groundwater Sampling Results
Fort Monmouth Main Post, Fort Monmouth, New Jersey
Monitoring Well M3MW-4
May 1997 - March 2000

Lab Sample ID Sample Date	2498.03 01-May-97	2882.03 07-Aug-97	3073.05 16-Oct-97	3344.03 17-Feb-98	3546.03 05-May-98	3701.03 07-Jul-98	4010.05 27-Oct-98	4308.03 01-Mar-99	4545.03 11-Jun-99	4653.04 27-Jul-99	4887.04 26-Oct-99	5217.04 Mar-2-00	NJDEP GWQC (ug/L)
Volatiles													
no analytes detected													
Semi-Volatiles													
Naphthalene	0.28	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NLE
Diethylphthalate	ND	ND	1.51	ND	ND	ND	ND	ND	ND	ND	ND	ND	5000
Di - n - butylphthalate	83.45	1.95	ND	13.61	ND	ND	ND	ND	ND	ND	ND	ND	900
Butylbenzylphthalate	2.77	ND	ND	1.18	ND	ND	ND	ND	ND	ND	ND	ND	100
Bis (2-ethlyhexyl)phthalate	ND	ND	ND	1.93	ND	ND	ND	ND	ND	ND	ND	ND	30
Pesticides/PCBs													
4,4' - DDT	ND	ND	ND	ND	ND	0.002	ND	ND	ND	ND	ND	ND	0.10
Metals													
Aluminum	**334.2**	139.3	146.0	**430**	**461**	**877**	121	**815**	**244**	137	111	**219**	200
Antimony	ND	ND	ND	ND	9.0	5.24	8.54	3.95	ND	2.41	ND	ND	20
Arsenic	2.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	8
Barium	120.8	150.0	94.5	84.5	38	131	126	91.0	150	159	112	137	2000
Beryllium	0.2	0.12	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	20
Cadmium	ND	ND	2.8	2.2	0.6	2.41	3.78	1.91	3.34	4.70	2.23	3.10	4
Calcium	31700.0	54730.0	48790.0	26330	7004	44100	42500	27800	58600	66400	36900	46500	NLE
Chromium	0.9	27.0	3.8	ND	ND	ND	1.31	8.17	3.07	3.69	3.95	ND	100
Cobalt	ND	ND	3.5	7.8	5.1	10.8	8.55	8.14	11.2	6.37	4.70	15.5	NLE
Copper	20.0	ND	13.0	10	ND	3.84	10.5	ND	ND	10.7	20.9	ND	1000
Iron	270.0	140.0	**2556.0**	206	**433**	**4990**	**1260**	**2390**	**1030**	**515**	**2270**	**1390**	300
Lead	0.9	0.6	**15.0**	ND	ND	ND	ND	2.28	ND	ND	ND	ND	10
Magnesium	9710.0	ND	6590.0	8530	7252	8620	6710	8940	9670	9170	5680	11600	NLE
Manganese	39.0	**62.0**	**64.2**	**56**	6.6	39.4	41.8	27.2	**55.7**	**72.6**	44.4	40.8	50
Mercury	ND	ND	ND	ND	ND	ND	ND	0.31	ND	0.5	ND	ND	2
Nickel	18.0	ND	25.3	36	19.9	46	41.6	34.1	48.9	38.8	28.2	66.5	100
Potassium	5600.0	8210.0	8040.0	5700	3590	11000	10500	5920	9210	9770	6850	6880	NLE
Selenium	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	4.05	ND	50
Silver	**21.0**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	20
Sodium	22170.0	21870.0	18650.0	16740	13730	19200	16200	21400	27300	23100	21400	29600	50000
Vanadium	ND	ND	ND	ND	ND	2.94	ND	2.26	ND	ND	ND	ND	NLE
Zinc	116.0	44.0	124.0	88	89.8	129	46.0	106	60.5	56.7	27.6	173	5000

All concentrations are given in micrograms per liter (ug/L), equivalent to parts per billion (ppb).
ND: Analyte not detected in sample.
NJDEP GWQC: New Jersey Department of Environmental Protection Groundwater Quality Criteria.
NLE: No GWQC exists for this analyte.
Exceedances of the NJDEP GWQC are printed in bold type and highlighted.

Table 2
Quarterly Groundwater Sampling Results
Fort Monmouth Main Post, Fort Monmouth, New Jersey
Monitoring Well M3MW-5
May 1997 - March 2000

Lab Sample ID Sample Date	2498.04 01-May-97	2882.04 07-Aug-97	3073.03 16-Oct-97	3344.04 17-Feb-98	3546.04 05-May-98	3701.04 07-Jul-98	4010.06 27-Oct-98	4308.04 01-Mar-99	4545.04 11-Jun-99	4653.05 27-Jul-99	4887.05 26-Oct-99	5217.05 02-Mar-00	NJDEP GWQC (ug/L)
Volatiles													
Acetone	ND	ND	ND	ND	3.83	ND	6.85	ND	ND	ND	ND	ND	700
2-Butanone	ND	ND	ND	ND	ND	ND	2.09	ND	ND	ND	ND	ND	300
Benzene	ND	ND	ND	ND	**1.44**	**1.33**	ND	ND	ND	ND	ND	ND	1
Chlorobenzene	3.82	**7.28**	**6.70**	**4.66**	**7.33**	**9.23**	**5.05**	**5.19**	**5.60**	**5.21**	**5.39**	**4.09**	4
1,4-Dichlorobenzene	ND	ND	ND	ND	ND	ND	1.12	ND	ND	1.1	1.02	ND	75
Semi-Volatiles													
2 - Methylnaphthalene	1.64	1.82	2.08	1.33	1.39	1.80	ND	1.57	ND	1.49	2.00	1.29	NLE
Acenaphthene	1.31	1.31	1.70	1.78	1.27	1.52	ND	2.44	1.04	1.47	2.2	1.74	400
Diethylphthalate	ND	ND	1.16	ND	ND	ND	ND	ND	ND	ND	ND	ND	5000
Fluorene	1.03	ND	1.13	1.13	ND	1.06	ND	ND	ND	ND	1.65	1.29	300
Phenanthrene	1.35	1.08	1.57	1.40	ND	1.01	1.91	2.27	1.13	ND	2.14	1.45	NLE
Di - n - butylphthalate	122.97	2.28	ND	43.64	ND	ND	ND	ND	ND	ND	ND	ND	900
Bis (2-ethlyhexyl)phthal	ND	ND	ND	2.10	2.13	2.24	2.32	4.07	1.93	2.02	ND	4.03	30
Pesticides/PCBs													
no analytes detected													
Metals													
Aluminum	27.3	182.3	56.0	149	ND	22.3	ND	13.4	ND	15.0	31.0	16.3	200
Antimony	ND	ND	ND	ND	4.3	4.26	7.83	2.40	ND	ND	ND	ND	20
Arsenic	2.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	8
Barium	702.1	1360.0	627.3	664	637	555	636	638	566	655	625	647	2000
Beryllium	ND	0.06	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	20
Cadmium	ND	ND	ND	ND	ND	1.20	ND	ND	**4.38**	1.21	ND	ND	4
Calcium	68040.0	82810.0	90160.0	96030	89180	90100	88000	97800	89600	90500	85700	95000	NLE
Chromium	0.7	59.0	1.3	ND	ND	ND	ND	5.89	127	1.99	2.76	ND	100
Cobalt	ND	ND	ND	ND	ND	ND	ND	1.41	5.35	1.39	1.59	ND	NLE
Copper	16.0	13.0	6.0	57.0	ND	ND	ND	8.61	ND	3.91	14.0	ND	1000
Iron	**72950.0**	**187600.0**	**64730.0**	**70470**	**84560**	**65400**	**67300**	**75500**	**70000**	**76500**	**66500**	**74000**	300
Lead	2.0	**20.5**	**11.0**	6.0	ND	4.54	ND	3.15	ND	ND	ND	ND	10
Magnesium	15310.0	16790.0	14600.0	15840	14300	13800	14000	15800	14700	15000	13900	15700	NLE
Manganese	**443.0**	**503.0**	**381.0**	**425**	**409**	**399**	**421**	**409**	**440**	**501**	**395**	**417**	50
Mercury	ND	0.3	0.3	ND	ND	ND	ND	0.34	ND	0.2	ND	ND	2
Nickel	ND	ND	1.1	5.7	1.4	ND	0.870	1.69	**11000**	2.15	1.00	0.912	100
Potassium	10300.0	10650.0	12350.0	13960	15490	15100	14100	11400	10800	10900	10800	10800	NLE
Selenium	ND	6.0	ND	ND	ND	ND	ND	8.01	5.52	ND	ND	ND	50
Silver	**21.0**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	20
Sodium	17270.0	16820.0	17370.0	16070	16640	9510	11800	17300	16800	18000	15800	15500	50000
Vanadium	ND	ND	ND	ND	ND	1.72	ND	ND	2.91	1.43	1.53	ND	NLE
Zinc	28.0	146.0	44.0	ND	2.2	18.8	ND	3.68	ND	13.7	5.69	17	5000

All concentrations are given in micrograms per liter (ug/L), equivalent to parts per billion (ppb).
ND: Analyte not detected in sample.
NJDEP GWQC: New Jersey Department of Environmental Protection Groundwater Quality Criteria.
NLE: No GWQC exists for this analyte.
Exceedances of the NJDEP GWQC are printed in bold type and highlighted.

Table 3
Quarterly Groundwater Sampling Results
Fort Monmouth Main Post, Fort Monmouth, New Jersey
Monitoring Well M3MW-6
May 1997 - March 2000

Lab Sample ID Sample Date	2498.05 01-May-97	2882.05 07-Aug-97	3073.04 16-Oct-97	3344.05 17-Feb-98	3546.05 05-May-98	3701.05 07-Jul-98	4010.07 27-Oct-98	4308.05 01-Mar-99	4545.05 11-Jun-99	4653.06 27-Jul-99	4887.05 26-Oct-99	5217.06 02-Mar-00	NJDEP GWQC (ug/L)
Volatiles													
Acetone	ND	ND	ND	ND	ND	8.90	7.53	ND	ND	ND	ND	ND	700
Benzene	**5.35**	ND	ND	ND	0.94	**3.10**	ND	ND	ND	ND	ND	ND	1
Chlorobenzene	ND	2.65	**4.41**	ND	ND	2.65	**5.34**	1.93	ND	**4.59**	2.16	1.9	4
1,3-Dichlorobenzene	ND	ND	ND	ND	ND	ND	1.74	ND	ND	ND	ND	ND	600
1,4-Dichlorobenzene	ND	ND	ND	ND	ND	ND	1.69	ND	ND	1.3	ND	ND	75
Semi-Volatiles													
Diethylphthalate	ND	ND	1.40	ND	ND	ND	ND	ND	ND	ND	ND	ND	5000
Di - n - butylphthalate	59.68	ND	ND	35.80 B	ND	ND	ND	ND	ND	ND	ND	ND	900
Pesticides/PCBs													
4,4 - DDD	ND	ND	ND	ND	0.003	0.005	ND	ND	ND	ND	ND	ND	0.10
Metals													
Aluminum	70.1	61.4	142.0	113	49	92.2	166	182	15.9	**1480**	37.9	ND	200
Antimony	ND	ND	ND	4.0	5.4	2.9	5.31	4.80	ND	ND	2.30	ND	20
Arsenic	2.0	2.0	ND	ND	ND	ND	ND	2.25	ND	2.73	ND	ND	8
Barium	50.4	ND	57.2	66	40	73.6	29.7	149	114	76.2	138	133	2000
Cadmium	ND	ND	ND	ND	0.7	ND	ND	0.630	1.87	1.84	0.866	ND	4
Calcium	62410.0	57010.0	69170.0	94830	74040	126000	38600	159000	119000	63900	165000	184000	NLE
Chromium	1.1	67.0	4.0	1.3	ND	ND	3.65	10.6	7.44	22.1	8.96	6.35	100
Cobalt	ND	ND	1.0	2.9	1.5	ND	1.25	3.00	1.40	2.08	1.14	ND	NLE
Copper	30.0	11.0	11.0	12	5.2	8.84	ND	50.0	ND	6.43	28.9	ND	1000
Iron	**10510.0**	**31020.0**	**37580.0**	**10740**	**6992**	**20900**	**26800**	**35500**	**23500**	**43900**	**12900**	**20800**	300
Lead	ND	1.4	8.0	ND	ND	ND	ND	4.01	ND	3.08	ND	ND	10
Magnesium	16350.0	24860.0	19300.0	22740	16680	29200	12200	33300	28300	19000	34300	36700	NLE
Manganese	**322.0**	**565.0**	**623.7**	**639**	**362**	**555**	**449**	**1010**	**687**	**785**	**711**	**903**	50
Mercury	ND	ND	0.2	ND	ND	ND	ND	0.34	ND	0.1	ND	ND	2
Nickel	ND	ND	2.3	18	10.0	0.579	3.80	18.9	3.55	6.40	27.5	10.4	100
Potassium	6620.0	7240.0	8720.0	10450	9163	12600	8430	10800	10700	9810	11900	10300	NLE
Selenium	ND	ND	ND	ND	ND	ND	ND	8.58	4.77	ND	9.42	5.60	50
Silver	14.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	20
Sodium	21420.0	26990.0	ND	40910	25680	15100	18200	26200	21500	25600	37400	17600	50000
Vanadium	ND	ND	ND	ND	1.4	1.48	1.56	1.54	1.68	6.95	ND	ND	NLE
Zinc	67.0	58.0	68.0	302	150	40.5	80.0	467	44.9	164	416	177	5000

All concentrations are given in micrograms per liter (ug/L), equivalent to parts per billion (ppb).
ND: Analyte not detected in sample.
NJDEP GWQC: New Jersey Department of Environmental Protection Groundwater Quality Criteria
NLE: No GWQC exists for this analyte.
Exceedances of the NJDEP GWQC are printed in bold type and highlighted.

Table 4
Quarterly Groundwater Sampling Results
Fort Monmouth Main Post, Fort Monmouth, New Jersey
Monitoring Well M3MW-7
October 1998 - March 2000

Lab Sample ID Sample Date	3967.07 07-Oct-98	4001.05 23-Oct-98	4308.06 01-Mar-99	4545.06 11-Jun-99	4653.07 27-Jul-99	4887.07 26-Oct-99	5217.07 02-Mar-00	NJDEP GWQC
Volatiles								
Vinyl Chloride	ND	**8.93**	2.76	ND	4.22	ND	ND	5
2 - Butanone	**399.25**	ND	ND	ND	ND	ND	ND	300
Cis1,2Dichloroethene	ND	3.58	4.05	ND	2.61	ND	ND	10
Semi-Volatiles								
bis(2-Ethylhexyl)phthala	ND	ND	ND	ND	ND	3.27	2.22	30
Pesticides/PCBs								
no analytes detected								
Metals								
Aluminum	**4810**	**1820**	**2350**	**2990**	**1480**	**2490**	**3400**	200
Antimony	ND	ND	3.96	ND	ND	2.51	ND	20
Arsenic	10	4.43	3.49	ND	ND	ND	3.72	8
Barium	126	235	516	372	492	807	580	2000
Beryllium	0.6	ND	2.02	ND	ND	ND	0.710	20
Cadmium	ND	ND	2	**4.25**	**4.99**	**7.55**	2.58	4
Calcium	106000	204000	251000	252000	292000	398000	271000	NLE
Chromium	46.4	21	18.5	21.9	24.5	27.3	42.2	100
Cobalt	2.3	ND	2.9	2.35	1.87	2.07	1.31	NLE
Copper	9	ND	46.4	22.8	12.5	42.2	31.8	1000
Iron	**41900**	**56700**	**78400**	**34500**	**36900**	**35100**	**36600**	300
Lead	**23**	6.23	**13.7**	8.33	5.66	7.59	8.94	10
Magnesium	91100	165000	113000	101000	156000	261000	136000	NLE
Manganese	**710**	**1200**	**1080**	**823**	**998**	**1060**	**817**	50
Mercury	0.3	ND	0.34	ND	0.2	0.2	0.1	2
Nickel	5.7	1.32	5.98	2.36	4.74	4.06	8.92	100
Potassium	40900	64200	36400	33900	48500	99900	57000	NLE
Selenium	ND	ND	8.01	7.82	ND	15.2	5.20	50
Sodium	**579000**	**1300000**	**858000**	**709000**	**1050000**	**1800000**	**1070000**	50000
Vanadium	27	9.53	3.68	9.88	6.12	7.79	11.5	NLE
Zinc	125	28.1	1090	571	273	723	817	5000

All concentrations are given in micrograms per liter (ug/L), equivalent to parts per billion (ppb).
ND: Analyte not detected in sample.
NJDEP GWQC: New Jersey Department of Environmental Protection Groundwater Quality Criteria.
NLE: No GWQC exists for this analyte.

Table 5
Quarterly Groundwater Sampling Results
Fort Monmouth Main Post, Fort Monmouth, New Jersey
Monitoring Well M3MW-8
October 1998 - March 2000

Lab Sample ID Sample Date	3990.03 20-Oct-98	4023.01 02-Nov-98	4308.07 01-Mar-99	4545.07 11-Jun-99	4653.08 27-Jul-99	4887.08 26-Oct-99	5217.08 02-Mar-00	NJDEP GWQC (ug/L)
Volatiles								
Acetone	ND	8.50	ND	ND	ND	ND	ND	700
2 - Butanone	6.34	5.43	ND	ND	2.45	ND	ND	300
Chlorobenzene	1.01	1.37	1.55	ND	1.59	1.66	1.44	4
1,4-Dichlorobenzene	ND	ND	ND	ND	1.02	ND	ND	75
Semi-Volatiles								
Bis (2-ethlyhexyl)phthalate	ND	ND	ND	1.26	ND	2.2	2.31	30
Pesticides/PCBs								
4,4-DDE	ND	ND	ND	ND	0.008	ND	ND	0.10
4,4 - DDD	ND	ND	ND	0.021	0.018	ND	ND	0.10
Metals								
Aluminum	**235**	**7030**	**852**	**747**	**1530**	**347**	**395**	200
Antimony	4.61	6.41	4.68	ND	ND	3.26	ND	20
Arsenic	ND	**11**	ND	ND	ND	ND	ND	8
Barium	429	749	271	249	404	559	274	2000
Beryllium	ND	0.996	ND	ND	ND	ND	ND	20
Cadmium	ND	ND	ND	1.28	0.950	0.897	ND	4
Calcium	132000	115000	105000	88600	122000	214000	87400	NLE
Chromium	3.28	66.4	11	7.19	10.9	12.5	7.47	100
Cobalt	2.55	2.81	1.44	1.17	1.01	ND	ND	NLE
Copper	ND	ND	9.23	ND	5.74	38.5	6.72	1000
Iron	**55500**	**88700**	**54700**	**36600**	**44200**	**39400**	**37100**	300
Lead	5.12	**19.7**	9.22	2.53	4.49	2.63	ND	10
Magnesium	37600	19000	24700	16900	29000	81000	27400	NLE
Manganese	**1100**	**511**	**768**	**645**	**855**	**1210**	**527**	50
Mercury	ND	0.19	ND	ND	0.2	ND	ND	2
Nickel	8.49	6.98	2.98	ND	2.90	2.25	5.30	100
Potassium	25900	24400	8910	7740	11500	22400	9300	NLE
Selenium	ND	ND	3.68	3.42	ND	3.75	ND	50
Sodium	**168000**	12100	**118000**	**60100**	**149000**	**593000**	**174000**	50000
Vanadium	2.11	40.6	3.87	4.87	5.24	2.37	1.60	NLE
Zinc	220	107	143	61.6	91.8	30.3	54.7	5000

All concentrations are given in micrograms per liter (ug/L), equivalent to parts per billion (ppb).
ND: Analyte not detected in sample.
NJDEP GWQC: New Jersey Department of Environmental Protection Groundwater Quality Criteria.
NLE: No GWQC exists for this analyte.

Table 6
Quarterly Groundwater Sampling Results
Fort Monmouth Main Post, Fort Monmouth, New Jersey
Monitoring Well M3MW-9
October 1998 - March 2000

Lab Sample ID Sample Date	3967.08 07-Oct-98	4001.06 23-Oct-98	4308.08 01-Mar-99	4545.08 11-Jun-99	4653.09 27-Jul-99	4887.09 26-Oct-99	5217.09 02-Mar-00	NJDEP GWQC (ug/L)
Volatiles								
Acetone	4.66	ND	ND	ND	ND	ND	ND	700
2 - Butanone	6.53	ND	ND	ND	ND	ND	ND	300
Benzene	**1.18**	**1.33**	ND	ND	ND	**1.25**	ND	1
Chlorobenzene	**16.36**	**17.33**	**14.25**	**10.22**	**11.69**	**17.37**	**15.64**	4
1,4 - Dichlorobenzene	2.73	2.61	ND	ND	2	2.48	2.27	75
1,2 - Dichlorobenzene	1.07	1.05	ND	ND	ND	ND	ND	600
Semi-Volatiles								
1,4-Dichlorobenzene	ND	ND	ND	1.22	1.56	2.17	1.77	75
4-Methylphenol	ND	ND	ND	ND	ND	2.6	ND	NLE
Bis(2-ethyhexyl)phthalate	ND	ND	ND	1.84	2.26	4.44	2.93	30
Pesticides/PCBs								
4,4' - DDE	**0.104**	0.020	0.026	ND	ND	ND	0.021	0.1
4,4 - DDD	**0.713**	**0.132**	**0.167**	0.057	**0.108**	ND	**0.134**	0.1
4,4' - DDT	**0.432**	0.038	0.023	ND	0.041	ND	0.062	0.1
Metals								
Aluminum	**1040**	**1380**	**337**	**741**	ND	**832**	**603**	200
Antimony	ND	3.70	4.91	ND	ND	ND	ND	20
Arsenic	ND	4.60	2.50	ND	ND	ND	ND	8
Barium	73	371	430	332	ND	401	412	2000
Cadmium	ND	ND	1.26	1.85	ND	3.58	ND	4
Calcium	31200	62600	82400	65400	244	66700	72700	NLE
Chromium	ND	14.5	11.1	7.78	ND	9.05	8.98	100
Cobalt	ND	0.697	8.22	2.13	ND	1.92	ND	NLE
Copper	4	ND	ND	ND	ND	42.3	ND	1000
Iron	**17400**	**73900**	**60400**	**64100**	31.1	**82100**	**69800**	300
Lead	ND	**32.7**	8.46	**10.6**	ND	9.02	2.32	10
Magnesium	2520	12900	19800	13300	54.5	14000	16100	NLE
Manganese	**90.9**	**476**	**1740**	**595**	2.12	**534**	**772**	50
Mercury	**2.7**	0.26	ND	ND	0.2	0.2	ND	2
Nickel	ND	3.14	22.9	ND	1.15	8.89	1.17	100
Potassium	9390	13100	13600	9910	292	10900	9870	NLE
Selenium	ND	ND	4.90	6.08	ND	7.59	ND	50
Sodium	2720	12100	46900	16300	575	27500	17300	50000
Vanadium	ND	8.73	1.61	6.62	ND	4.97	2.68	NLE
Zinc	25	60.6	1150	109	7.07	212	84.6	5000

All concentrations are given in micrograms per liter (ug/L), equivalent to parts per billion (ppb).
ND: Analyte not detected in sample.

Table 7
Quarterly Groundwater Sampling Results
Fort Monmouth Main Post, Fort Monmouth, New Jersey
Monitoring Well M3MW-10
October 1998 - March 2000

Lab Sample ID Sample Date	3990.04 20-Oct-98	4023.02 02-Nov-98	4308.09 01-Mar-99	4545.09 11-Jun-99	4653.10 27-Jul-99	4887.10 26-Oct-99	5217.10 02-Mar-00	NJDEP GWQC (ug/L)
Volatiles								
Acetone	7.87	6.94	ND	ND	3.59	ND	ND	700
2 - Butanone	5.16	ND	ND	14.14	4.57	ND	ND	300
Toluene	ND	ND	ND	2.73	3.74	ND	ND	1,000
Chlorobenzene	**17.07**	**19.19**	**20.08**	**16.27**	**15.9**	**19.56**	**15.34**	4
1,4 - Dichlorobenzene	1.78	2.05	1.79	ND	1.99	2.13	1.89	75
Semi-Volatiles								
Acenaphthene	ND	ND	2.55	1.25	1.23	1.78	1.18	400
Bis(2-ethyhexyl)phthalate	ND	ND	1.77	ND	ND	ND	2.06	30
Fluorene	ND	ND	ND	ND	ND	1.33	1.04	300
n-Nitrosodiphenylamine	ND	ND	ND	ND	ND	1.1	ND	20
Pesticides/PCBs								
none detected								
Metals								
Aluminum	**1960**	**1570**	**1540**	**1180**	**317**	**268**	**2330**	200
Antimony	ND	4.67	2.79	ND	ND	ND	ND	20
Arsenic	ND	3.75	2.55	ND	ND	ND	ND	8
Barium	561	513	947	592	345	635	760	2000
Cadmium	ND	ND	ND	ND	1.58	ND	ND	4
Calcium	91700	139000	119000	108000	66200	110000	95500	NLE
Chromium	19.3	13.9	17.6	11.3	4.95	6.21	17.2	100
Cobalt	1.57	1.23	1.14	2.01	1.75	1.69	1.46	NLE
Copper	ND	ND	20.5	9.01	34	12.5	ND	1000
Iron	**57400**	**61300**	**103000**	**66100**	**67700**	**62300**	**91200**	300
Lead	9.95	9.20	9.86	2.58	7.30	ND	ND	10
Magnesium	14100	37100	19700	17300	13900	17900	16200	NLE
Manganese	**405**	**993**	**761**	**708**	**866**	**662**	**682**	50
Mercury	ND	0.12	ND	ND	0.2	ND	ND	2
Nickel	1.59	4.62	28	ND	5.49	ND	1.62	100
Potassium	15000	20600	13500	12800	11900	12500	10400	NLE
Selenium	ND	ND	8.99	8.13	ND	10.6	ND	50
Sodium	15500	**154000**	16500	17300	24900	25600	14400	50000
Vanadium	12.9	9.02	9.88	8.70	2.59	3.79	10.3	NLE
Zinc	35.2	229	144	28.8	91.5	8.12	83.8	5000

All concentrations are given in micrograms per liter (ug/L), equivalent to parts per billion (ppb).
ND: Analyte not detected in sample.
NJDEP GWQC: New Jersey Department of Environmental Protection Groundwater Quality Criteria.
NLE: No GWQC exists for this analyte.

Table 8
Quarterly Groundwater Sampling Results
Fort Monmouth Main Post, Fort Monmouth, New Jersey
Monitoring Well M3MW-11
October 1998 - March 2000

Lab Sample ID Sample Date	3967.09 07-Oct-98	4001.07* 23-Oct-98*	4308.10 01-Mar-99	4545.10 11-Jun-99	4653.11 27-Jul-99	4887.11 26-Oct-99	5217.11 02-Mar--0	NJDEP GWQC (ug/L)
Volatiles								
Acetone	8.14	ND	ND	ND	ND	ND	ND	700
2 - Butanone	24.47	4.23	ND	ND	ND	ND	ND	300
Chlorobenzene	**5.03**	**5.56**	2.66	**5.44**	**5.6**	**6.28**	3.26	4
1,4 - Dichlorobenzene	2.46	2.60	ND	ND	2.99	3.44	1.40	75
Semi-Volatiles								
1,4 - Dichlorobenzene	ND	ND	ND	1.57	1.58	1.65	ND	75
Acenaphthene	ND	ND	ND	1.14	1.21	1.84	ND	400
Fluorene	ND	ND	ND	1.18	1.19	1.84	ND	300
4-Methylphenol	ND	ND	ND	ND	ND	3.71	ND	NLE
n-Nitrosodiphenylamine	ND	ND	ND	ND	ND	1.29	ND	20
Bis (2-ethlyhexyl)phthal	ND	ND	ND	1.05	ND	ND	ND	30
Pesticides/PCBs								
4,4 - DDD	0.040	0.027	ND	0.079	0.044	ND	ND	0.10
4,4-DDE	ND	ND	ND	ND	0.012	ND	ND	0.10
4,4' - DDT	ND	0.028	ND	ND	ND	ND	ND	0.10
Metals								
Aluminum	**3480**	**500**	**6840**	**7620**	**7580**	**2750**	**1330**	200
Antimony	ND	2.52	4.45	ND	ND	ND	ND	20
Arsenic	**8.0**	ND	**8.19**	4.71	7.35	ND	ND	8
Barium	393	341	279	529	472	468	287	2000
Beryllium	ND	ND	0.804	0.819	0.655	ND	ND	20
Cadmium	1.2	ND	**12.3**	**47.3**	**14.6**	**7.61**	**15**	4
Calcium	116000	108000	185000	108000	117000	112000	151000	NLE
Chromium	23.3	3.23	21.7	30.8	42.4	15.2	7.59	100
Cobalt	1.8	ND	12.5	5.05	8.69	2.16	3.95	NLE
Copper	39	ND	88.7	149	71.2	69.5	60.2	1000
Iron	**62200**	**49900**	**73200**	**82400**	**77800**	**65800**	**47300**	300
Lead	**11**	3.83	**11.2**	**15.2**	**22.3**	7.95	ND	10
Magnesium	10300	9020	14500	10200	11400	9970	13000	NLE
Manganese	**588**	**549**	**1780**	**956**	**897**	**822**	**1020**	50
Mercury	0.5	ND	0.61	ND	0.8	0.4	ND	2
Nickel	29	6.20	**263**	79.8	**157**	24.2	**359**	100
Potassium	12100	8620	8110	8430	9960	8450	7320	NLE
Selenium	ND	ND	8.30	6.90	ND	6.62	3.42	50
Silver	ND	ND	ND	ND	ND	ND	1.74	20
Sodium	13600	7180	14800	10700	10900	11100	13200	50000
Vanadium	17	3.79	7.91	23.5	28.4	9.83	3.95	NLE
Zinc	435	98.2	3350	1850	2320	330	**6050**	5000

* M3MW-11 was resampled on October 26, 1998 (Sample #4005.01), because the original pesticide/PCB sample was broken.
All concentrations are given in micrograms per liter (ug/L), equivalent to parts per billion (ppb).
ND: Analyte not detected in sample.
NJDEP GWQC: New Jersey Department of Environmental Protection Groundwater Quality Criteria.
NLE: No GWQC exists for this analyte.

Table 9
Periodic Stream Sampling Analytical Results
Fort Monmouth Main Post, Fort Monmouth, New Jersey

Stream Sampling Location SS-17
November 1996 - March 2000

Lab Sample ID Sample Date	2223.13 25-Nov-96	2246.13 12-Dec-96	2298.13 29-Jan-97	2361.14 26-Feb-97	2375.14 10-Mar-97	2439.14 08-Apr-97	2810.14 17-Jul-97	3121.14 30-Oct-97	3331.14 10-Feb-98	3499.14 21-Apr-98	3816.14 19-Aug-98	4069.07 18-Nov-98	4300.14 25-Feb-99	4579.16 25-Jun-99	4806.07 22-Sep-99	4997.13 08-Dec-99	5211.12 01-Mar-00	NJDEP SWQS (ug/L)
Acetone	NA	NA	25.62	ND	ND	1.97	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NLE
Carbon disulfide	NA	NA	ND	1.30	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NLE
cis - 1,2 - Dichloroethene	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	4.43	ND	ND	1.09	ND	ND	NLE
Chlorobenzene	NA	NA	ND	ND	ND	ND	ND	ND	1.59	ND	ND	ND	ND	ND	ND	ND	ND	21,000
Methylene chloride	2.94	4.14	2.79	ND	3.43	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1600
Trichloroethene (TCE)	0.67	0.27	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.12	ND	ND	ND	ND	ND	81
Tetrachloroethene (PCE)	2.77	1.25	ND	ND	ND	ND	ND	ND	ND	ND	ND	**5.09**	ND	ND	ND	ND	ND	4.29

Stream Sampling Location SS-5
October 1996 - March 2000

Lab Sample ID Sample Date	2178.5 08-Oct-96	2223.14 25-Nov-96	2246.14 Dec-12-96	2298.14 29-Jan-97	2361.13 26-Feb-97	2375.13 Mar-10-98	2439.13 08-Apr-97	2810.13 17-Jul-97	3121.13 30-Oct-97	3331.13 10-Feb-98	3499.13 21-Apr-98	3816.11 19-Aug-98	4060.10 17-Nov-98	4300.13 25-Feb-99	4579.15 29-Jun-99	4806.06 22-Sep-99	4997.11 08-Dec-99	5211.11 01-Mar-00	NJDEP SWQS (ug/L)
cis - 1,2 - Dichloroethene	NA	NA	NA	1.19	ND	ND	1.80	3.66	1.83	ND	ND	2.28	1.67	ND	2.74	1.96	1.6	1.27	NLE
Methyl-tert-Butyl ether	NA	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.34	NLE
Methylene chloride	3.52	3.08	3.47	3.41	ND	ND	1.96	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1600
Trichloroethene (TCE)	0.81	1.86	0.71	1.04	ND	ND	ND	ND	ND	ND	ND	1.27	ND	ND	1.74	ND	ND	1.36	81
Tetrachloroethene (PCE)	2.76	**7.53**	2.98	4.76	**5.32**	2.42	2.28	3.54	1.70	**6.34**	**4.48**	3.39	2.17	**5.45**	**6.04**	1.82	3.82	**6.82**	4.29

Stream Sampling Location SS-4
October 1996 - March 2000

Lab Sample ID Sample Date	2178.4 08-Oct-96	2223.12 25-Nov-96	2246.12 Dec-12-97	2298.12 29-Jan-97	2361.12 26-Feb-97	2375.12 Mar-10-97	2439.12 08-Apr-97	2810.12 17-Jul-97	3121.12 30-Oct-97	3331.12 10-Feb-98	3499.12 21-Apr-98	3816.12 19-Aug-98	4060.09 17-Nov-98	4300.12 25-Feb-99	4579.14 29-Jun-99	4806.05 22-Sep-99	4997.10 08-Dec-99	5211.10 01-Mar-00	NJDEP SWQS (ug/L)
Acetone	NA	NA	NA	30.91	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NLE
cis - 1,2 - Dichloroethene	NA	NA	NA	1.16	1.14	ND	2.18	1.63	ND	ND	ND	1.92	1.19	ND	2.41	2.02	ND	1.23	NLE
Methyl-tert-Butyl ether	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.18	NLE
Methylene chloride	3.75	3.03	3.62	2.50	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1600
Trichloroethene (TCE)	0.64	1.60	0.75	ND	ND	ND	ND	ND	ND	ND	ND	1.10	ND	ND	1.56	ND	ND	1.26	81
Tetrachloroethene (PCE)	2.35	**6.28**	2.28	**4.42**	**6.37**	2.33	ND	1.61	1.24	**6.81**	ND	2.85	1.62	**5.61**	**5.27**	1.85	ND	**6.18**	4.29

Only detected compounds are listed.
All concentrations are given in micrograms per liter (ug/L), equivalent to parts per billion (ppb).
NA: Sample not analyzed for this parameter / Not Applicable.
ND: Parameter not detected in this sample.
NLE: No regulatory limit has been established for this parameter.
NJDEP SWQS: Higher of the New Jersey Department of Environmental Protection Surface Water Quality Standards for SE and SC classified streams.
Exceedances of the NJDEP SWQS are printed in bold type and highlighted.

Table 9, continued
Periodic Stream Sampling Analytical Results
Fort Monmouth Main Post, Fort Monmouth, New Jersey

Stream Sampling Location SS-14
October 1996 - March 2000

Lab Sample ID Date	2178.14 08-Oct-96	2223.16 25-Nov-96	2246.16 12-Dec-96	2298.16 29-Jan-97	2361.16 26-Feb-97	2375.16 10-Mar-97	2439.16 08-Apr-97	2810.16 17-Jul-97	3121.16 30-Oct-97	3331.16 10-Feb-98	3499.16 21-Apr-98	3816.16 19-Aug-98	4069.10 18-Nov-98	4300.16 25-Feb-99	4579.16 29-Jun-99	4806.09 Sp-22-99	4997.15 Dec-8-99	5211.15 Mar-1-00	NJDEP SWQS (ug/L)
Acetone	NA	NA	NA	8.06	ND	ND	3.94	ND	ND	ND	ND	ND	3.32	ND	ND	ND	ND	ND	NLE
Bromomethane	ND	ND	ND	2.46	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NLE
cis - 1,2 - Dichloroethene	NA	NA	NA	ND	ND	ND	ND	ND	1.59	ND	ND	ND	ND	ND	ND	ND	11.26	ND	NLE
Methylene chloride	3.65	3.81	ND	4.22	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1600
Trichloroethene (TCE)	ND	ND	ND	ND	ND	ND	ND	ND	1.75	ND	ND	ND	ND	ND	ND	ND	ND	ND	81
Tetrachloroethene (PCE)	0.01	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	4.29

Stream Sampling Location SS-15
October 1996 - March 2000

Lab Sample ID Date	2178.15 08-Oct-96	2223.09 25-Nov-96	2246.09 12-Dec-96	2298.09 29-Jan-97	2361.09 26-Feb-97	2375.09 10-Mar-97	2439.09 08-Apr-97	2810.09 17-Jul-97	3121.09 30-Oct-97	3331.09 10-Feb-98	3499.09 21-Apr-98	3816.09 19-Aug-98	4069.08 18-Nov-98	4300.09 25-Feb-99	4579.11 29-Jun-99	4802.11 Sp-21-99	4997.17 Dec-8-99	5211.17 Mar-1-00	NJDEP SWQS (ug/L)
Acetone	NA	NA	NA	4.22	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NLE
cis - 1,2 - Dichloroethene	NA	NA	NA	1.57	1.46	ND	2.69	5.53	2.57	ND	1.22	3.69	ND	ND	4.17	3.59	ND	1.39	NLE
Methyl-tert-Butyl ether	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.38	NLE
Methylene chloride	3.85	2.98	5.51	2.68	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1600
Trichloroethene (TCE)	2.58	2.54	1.31	1.33	ND	ND	1.60	2.50	ND	1.03	1.21	2.06	ND	ND	2.40	1.37	ND	1.39	81
Tetrachloroethene (PCE)	**8.41**	**10.38**	**5.63**	**5.68**	**7.84**	3.39	**6.00**	**7.12**	2.72	**6.90**	**5.72**	**5.39**	ND	**7.33**	**7.86**	2.61	4.08	**6.85**	4.29

Only detected compounds are listed.
All concentrations are given in micrograms per liter (ug/L), equivalent to parts per billion (ppb).
NA: Sample not analyzed for this parameter./ Not Applicable.
ND: Parameter not detected in this sample.
NLE: No regulatory limit has been established for this parameter.
NJDEP SWQS: Higher of the New Jersey Department of Environmental Protection Surface Water Quality Standards for SE and SC classified streams.
Exceedances of the NJDEP SWQS are printed in bold type and highlighted.

Table 10
Well Search Summary
Fort Monmouth Main Post
Fort Monmouth, New Jersey

Well ID Number	Well Owner	Well Address	Total Depth (feet bgs)	Casing Length (feet)	Static Water Elevation (feet bgs)	Use Code	NJDEP Permit Number
5	Eatontown Senior Housing	55 Wyckoff Rd., Eatontown	192	177	25	G	29-15006
14	Shell Oil Company	Block 100, Lot 25, Oceanport	12	2	4	M	29-24953
15	Shell Oil Company	Block 100, Lot 25, Oceanport	12	2	3	M	29-24953
16	Shell Oil Company	Block 100, Lot 25, Oceanport	12	2	3	M	29-24953
17	Shell Oil Company	Block 100, Lot 25, Oceanport	11	2	3	M	29-24953
34	Boro of Eatontown	Block 14, Lot 17, Eatontown	20	10	12.1	M	29-28236
35	Dennis Bertweiler	Orchard St. Block 73, Lot 36,	67	52	16	D	29-23690
36	Walter and Patricia Zinn	92 Sunnybrook Dr., Shrewsbury Boro	50	50	5	G	29-22571
37	V. J. Russo Realty	170 Ave. of Commons, Shrewsbury Boro	250	245	4	G	29-27756
38	Price Communications Corp.	1 Register Plaza, Shrewsbury Boro	28	15	8	M	29-26185
39	A. Khristiansen	Trafalger Pl., Block 69.04, Lot 4, Shrewsbury Boro	50	50	5	G	29-22571
40	H. Kodama	83 Sunnybrook Dr., Shrewsbury Bro	250	210	8	D	29-26704
41	Boro of Eatontown	Block 14, Lot 17, Eatontown	20	10	11.7	M	29-29158
42	Boro of Eatontown	Block 14, Lot 17, Eatontown	18	8	10.1	M	29-29159
43	Bill Rudolph	Relwof Ave., Block 98, Lot 1 and 2, Oceanport	45	35	2	G	29-21780
44	Kleiner Bros.	Allenhurst and Myrtle Aves.,	50	40	5	D	29-6499
64	Travis Thomas	112 Orchid St., Oceanport	323	317	16	D, G	29-14244
65	N. J. Transit	Silverside and Fairview Ave.,	*	*	*	M	29-13825
97	Shell Oil Company	1 Main St., Oceanport	10	2	2.5	M/S	29-12553
98	Shell Oil Company	1 Main St., Oceanport	9	1	2	M/S	29-12554
99	Shell Oil Company	1 Main St., Oceanport	9	1	2	M/S	29-12555
100	Anthony S. Camara	121 Horseneck Point Rd., Oceanport	15	12	5	D	29-5084
101	Bridgewater Townhouse	57 Bridgewater Dr., Oceanport	180	155	12	G	29-22549
113	Shell Oil Company	Rte. 35 and South St., Eatontown	12	2	4.38	M	29-14180
114	Shell Oil Company	Rte. 35 and South St., Eatontown	12	2	5.1	M	29-14181

Table 10
Well Search Summary
Fort Monmouth Main Post
Fort Monmouth, New Jersey

Well ID Number	Well Owner	Well Address	Total Depth (feet bgs)	Casing Length (feet)	Static Water Elevation (feet bgs)	Use Code	NJDEP Permit Number
115	Shell Oil Company	Rte. 35 and South St., Eatontown	12	2	4.47	M	29-14182
116	Shell Oil Company	Rte. 35 and South St., Eatontown	12	2	4.39	M	29-14183
117	Shell Oil Company	Rte. 35 and South St., Eatontown	12	2	4.75	M	29-14184
118	Shell Oil Company	Rte. 35 and South St., Eatontown	12	2	4.10	M	29-14185
119	Shell Oil Company	Rte. 35 and South St., Eatontown	12	2	4.82	M	29-14186
120	Shell Oil Company	Rte. 35 and South St., Eatontown	12	2	4.30	M	29-14187
121	Shell Oil Company	Rte. 35 and South St., Eatontown	12	2	4.54	M	29-14188
122	Shell Oil Company	Rte. 35 and South St., Eatontown	12	2	4.34	M	29-14189
123	Shell Oil Company	Rte. 35 and South St., Eatontown	12	2	4.22	M	29-14190
124	Shell Oil Company	Rte. 35 and South St., Eatontown	12	2	3.9	M	29-14191
125	Shell Oil Company	Rte. 35 and South St., Eatontown	14.83	4	4	E	29-14192
127	Vincent J. Russo, builder	Block 70.1, Lot 90, Shrewsbury	184	165	5	G	29-14168
128	William Godspeed	30 Alwin Terrace, Little Silver	173	158	6	G	29-22526
129	Exxon Company, USA	Branch & Sycamore Ave., Little Silver	15	5	*	M	29-23732
130	Exxon Company, USA	Branch & Sycamore Ave., Little Silver	15	5	*	M	29-23733
131	Exxon Company, USA	Branch & Sycamore Ave., Little Silver	15	5	*	M	29-23734
132	Exxon Company, USA	Branch & Sycamore Ave., Little Silver	15	5	*	M	29-23735
133	Exxon Company, USA	Branch & Sycamore Ave., Little Silver	15	5	*	M	29-23738
134	Exxon Company, USA	Branch & Sycamore Ave., Little Silver	15	4	*	M	29-23739
135	Exxon Company, USA	Branch & Sycamore Ave., Little Silver	15	5	*	M	29-23740
136	Exxon Company, USA	Branch & Sycamore Ave., Little Silver	15	5	*	M	29-23741
137	Exxon Company, USA	Branch & Sycamore Ave., Little Silver	20	5	7	M	29-27072

Table 10
Well Search Summary
Fort Monmouth Main Post
Fort Monmouth, New Jersey

Well ID Number	Well Owner	Well Address	Total Depth (feet bgs)	Casing Length (feet)	Static Water Elevation (feet bgs)	Use Code	NJDEP Permit Number
138	Exxon Company, USA	Branch & Sycamore Ave., Little Silver	16	3	6	M	29-29208
139	Hunter's Superior Service	333 Willow Dr., Little Silver	10	1	6.36	M	29-12793
140	Hunter's Superior Service	333 Willow Dr., Little Silver	10	1	7.08	M	29-12794
141	Hunter's Superior Service	333 Willow Dr., Little Silver	10	1	6.34	M	29-12795
142	Hunter's Superior Service	333 Willow Dr., Little Silver	10	1	7.59	M	29-12796
143	Hunter's Superior Service	333 Willow Dr., Little Silver	10	1	6.63	M	29-12797
144	Hunter's Superior Service	333 Willow Dr., Little Silver	10	1	6.07	M	29-12798
145	Citgo Oil Co.	700 Branch Ave., Little Silver	9	1	*	M	29-12785
146	Citgo Oil Co.	700 Branch Ave., Little Silver	9	1	*	M	29-12786
147	Citgo Oil Co.	700 Branch Ave., Little Silver	9	1	*	M	29-12787
148	Citgo Oil Co.	700 Branch Ave., Little Silver	10	1	*	M	29-12788
149	Citgo Oil Co.	700 Branch Ave., Little Silver	9	1	*	M	29-12789
150	Citgo Oil Co.	700 Branch Ave., Little Silver	9	1	*	M	29-12790
151	Citgo Oil Co.	700 Branch Ave., Little Silver	9	1	*	M	29-12792
152	Citgo Oil Co.	700 Branch Ave., Little Silver	10	1	*	M	29-12793
153	Mobil Oil Corporation	700 Branch Ave., Little Silver	11	1	*	M	29-12794
154	Mobil Oil Corporation	700 Branch Ave., Little Silver	11	1	*	M	29-12795
155	Mobil Oil Corporation	700 Branch Ave., Little Silver	15	5	7	M	29-25317
156	Mobil Oil Corporation	Hwy. 35 and Tinton Ave., Eatontown	15	2	7	M	29-25316
157	Mobil Oil Corporation	Hwy. 35 and Tinton Ave., Eatontown	15	5	7	M	29-25318
158	Mobil Oil Corporation	Hwy. 35 and Tinton Ave., Eatontown	15	5	7	M	29-25319
159	Mobil Oil Corporation	Hwy. 35 and Tinton Ave., Eatontown	15	5	7	M	29-25320

Table 10
Well Search Summary
Fort Monmouth Main Post
Fort Monmouth, New Jersey

Well ID Number	Well Owner	Well Address	Total Depth (feet bgs)	Casing Length (feet)	Static Water Elevation (feet bgs)	Use Code	NJDEP Permit Number
160	Exxon Oil Company	Hwy. 35 and Tinton Ave., Eatontown	16	3	4.7	M	29-26806
161	Exxon Oil Company	Hwy. 35 and Tinton Ave., Eatontown	17	2	6	M	29-26807
162	Exxon Oil Company	Hwy. 35 and Tinton Ave., Eatontown	15	3	8.2	M	29-26808
163	Exxon Oil Company	Hwy. 35 and Tinton Ave., Eatontown	15	3	5.8	M	29-26809
164	Exxon Oil Company	Hwy. 35 and Tinton Ave., Eatontown	12	2	2.35	M	29-28143
165	Allied Signal, Inc.	118 Rte. 35, Eatontown	*	*	*	M	*
814/1	U.S Army, Ft. Monmouth	Main Post, Bldg. 814, Ft. Monmouth	14	4	4	M	29-26939
750/1	U.S Army, Ft. Monmouth	Main Post, Bldg. 750, Ft. Monmouth	15	5	7.5	M	29-28992
750/2	U.S Army, Ft. Monmouth	Main Post, Bldg. 750, Ft. Monmouth	15	5	7.5	M	29-28993
751/3	U.S Army, Ft. Monmouth	Main Post, Bldg. 750, Ft. Monmouth	15	5	7.5	M	29-28994
751/4	U.S Army, Ft. Monmouth	Main Post, Bldg. 750, Ft. Monmouth	15	5	7.5	M	29-28995
699/1	U.S Army, Ft. Monmouth	Main Post, Bldg. 699, Ft. Monmouth	15	2	4	M	29-23677-1
699/2	U.S Army, Ft. Monmouth	Main Post, Bldg. 699, Ft. Monmouth	17	1.5	5	M	29-23678-9
699/3	U.S Army, Ft. Monmouth	Main Post, Bldg. 699, Ft. Monmouth	15	2	4	M	29-23679-1
699/4	U.S Army, Ft. Monmouth	Main Post, Bldg. 699, Ft. Monmouth	20	2	3	M	29-23680-7
699/5	U.S Army, Ft. Monmouth	Main Post, Bldg. 699, Ft. Monmouth	15	3	5	M	29-23808-1
699/6	U.S Army, Ft. Monmouth	Main Post, Bldg. 699, Ft. Monmouth	15	1	4.5	M	29-23809-9
699/7	U.S Army, Ft. Monmouth	Main Post, Bldg. 699, Ft. Monmouth	15	3	3	M	29-23810-2
699/8	U.S Army, Ft. Monmouth	Main Post, Bldg. 699, Ft. Monmouth	15	2	4	M	29-23811-1
699/9	U.S Army, Ft. Monmouth	Main Post, Bldg. 699, Ft. Monmouth	15	2	3	M	29-24639
699/10	U.S Army, Ft. Monmouth	Main Post, Bldg. 699, Ft. Monmouth	14	1	3	M	29-24640
699/11	U.S Army, Ft. Monmouth	Main Post, Bldg. 699, Ft. Monmouth	15	*	*	R	29-28031
699/12	U.S Army, Ft. Monmouth	Main Post, Bldg. 699, Ft. Monmouth	15	5	7.1	M	29-28907

Table 10
Well Search Summary
Fort Monmouth Main Post
Fort Monmouth, New Jersey

Well ID Number	Well Owner	Well Address	Total Depth (feet bgs)	Casing Length (feet)	Static Water Elevation (feet bgs)	Use Code	NJDEP Permit Number
699/13	U.S Army, Ft. Monmouth	Main Post, Bldg. 699, Ft. Monmouth	5	*	*	M	**
699/14	U.S Army, Ft. Monmouth	Main Post, Bldg. 699, Ft. Monmouth	5.7	*	*	M	**
1076/1	U.S Army, Ft. Monmouth	Main Post, Bldg. 1076, Ft. Monmouth	15	3	5.5	M	29-26940
1076/2	U.S Army, Ft. Monmouth	Main Post, Bldg. 1076, Ft. Monmouth	14	4	5	M	29-26941
1076/3	U.S Army, Ft. Monmouth	Main Post, Bldg. 1076, Ft. Monmouth	15	5	6	M	29-26942
65A/1	U.S Army, Ft. Monmouth	Main Post, Bldg. 65A, Ft. Monmouth	12	2	4	M	29-26938
L/1	U.S Army, Ft. Monmouth	Main Post, Landfill, Ft. Monmouth	9.85	3.05	5.08	M	49-000551
L/2	U.S Army, Ft. Monmouth	Main Post, Landfill, Ft. Monmouth	16.99	1.30	*	M	49-000552
L/3	U.S Army, Ft. Monmouth	Main Post, Landfill, Ft. Monmouth	16.43	1.62	10.83	M	49-000553
L/4	U.S Army, Ft. Monmouth	Main Post, Landfill, Ft. Monmouth	10.25	1.90	*	M	49-000554
108/1	U.S Army, Ft. Monmouth	Main Post, Bldg. 108, Ft. Monmouth	13	3	4	M	29-29739
108/2	U.S Army, Ft. Monmouth	Main Post, Bldg. 108, Ft. Monmouth	13	3	4	M	29-29740
108/3	U.S Army, Ft. Monmouth	Main Post, Bldg. 108, Ft. Monmouth	13	3	4	M	29-29741
M2MW1	U.S Army, Ft. Monmouth	Main Post, Landfill M2, Ft. Monmouth	18	17	*	M	29-32584
M2MW2	U.S Army, Ft. Monmouth	Main Post, Landfill M2, Ft. Monmouth	18	17	*	M	29-32585
M2MW3	U.S Army, Ft. Monmouth	Main Post, Landfill M2, Ft. Monmouth	16	15.14	*	M	29-32586
M5MW12	U.S Army, Ft. Monmouth	Main Post, Landfill M5, Ft. Monmouth	15	10	*	M	29-39179
M5MW13	U.S Army, Ft. Monmouth	Main Post, Landfill M5, Ft. Monmouth	20	15	*	M	29-39178
M5MW14	U.S Army, Ft. Monmouth	Main Post, Landfill M5, Ft. Monmouth	20	15	*	M	29-39177
M5MW15	U.S Army, Ft. Monmouth	Main Post, Landfill M5, Ft. Monmouth	20	15	*	M	29-40120
M5MW16	U.S Army, Ft. Monmouth	Main Post, Landfill M5, Ft. Monmouth	16	13	*	M	29-40121
M5MW18	U.S Army, Ft. Monmouth	Main Post, Landfill M5, Ft. Monmouth	18	15	*	M	29-40123

Table 10
Well Search Summary
Fort Monmouth Main Post
Fort Monmouth, New Jersey

Well ID Number	Well Owner	Well Address	Total Depth (feet bgs)	Casing Length (feet)	Static Water Elevation (feet bgs)	Use Code	NJDEP Permit Number
M5MW19	U.S Army, Ft. Monmouth	Main Post, Landfill M5, Ft. Monmouth	18	15	*	M	29-40124
M5MW20	U.S Army, Ft. Monmouth	Main Post, Landfill M5, Ft. Monmouth	14	10	*	M	29-40122
M5MW23	U.S Army, Ft. Monmouth	Main Post, Landfill M5, Ft. Monmouth	18	15	*	M	29-40125
M4MW7	U.S Army, Ft. Monmouth	Main Post, Landfill M4, Ft. Monmouth	16.01	15.55	*	M	29-32571
M4MW8	U.S Army, Ft. Monmouth	Main Post, Landfill M4, Ft. Monmouth	18.64	18.18	*	M	29-32572
M4MW9	U.S Army, Ft. Monmouth	Main Post, Landfill M4, Ft. Monmouth	22.23	22.69	*	M	29-32573
M5MW10	U.S Army, Ft. Monmouth	Main Post, Landfill M5, Ft. Monmouth	15.00	14.54	*	M	29-32574
M5MW11	U.S Army, Ft. Monmouth	Main Post, Landfill M5, Ft. Monmouth	15.00	14.85	*	M	29-32575
M5 MW25	U.S Army, Ft. Monmouth	Main Post, Landfill M5, Ft. Monmouth	25.00	15	*	M	29-40126
M8MW23	U.S Army, Ft. Monmouth	Main Post, Landfill M5, Ft. Monmouth	15.00	12	*	M	29-40128
M8MW24	U.S Army, Ft. Monmouth	Main Post, Landfill M5, Ft. Monmouth	18.00	15	*	M	29-40127
M8MW12	U.S Army, Ft. Monmouth	Main Post, Landfill M8, Ft. Monmouth	15.00	14.54	*	M	29-32560
M8MW13	U.S Army, Ft. Monmouth	Main Post, Landfill M8, Ft. Monmouth	15.00	14.54	*	M	29-32561
M8MW14	U.S Army, Ft. Monmouth	Main Post, Landfill M8, Ft. Monmouth	15.00	14.54	*	M	29-32562
M8MW15	U.S Army, Ft. Monmouth	Main Post, Landfill M8, Ft. Monmouth	15.00	14.54	*	M	29-32563
M12MW16	U.S Army, Ft. Monmouth	Main Post, Landfill M12, Ft. Monmouth	14.50	14.01	*	M	29-32576
M12MW17	U.S Army, Ft. Monmouth	Main Post, Landfill M12, Ft. Monmouth	14.50	14.35	*	M	29-32577
M12MW18	U.S Army, Ft. Monmouth	Main Post, Landfill M12, Ft. Monmouth	14.50	14.04	*	M	29-32578
M14MW19	U.S Army, Ft. Monmouth	Main Post, Landfill M14, Ft. Monmouth	15.00	14.54	*	M	29-32579
M14MW20	U.S Army, Ft. Monmouth	Main Post, Landfill M14, Ft. Monmouth	14.50	14.05	*	M	29-32580
M14MW21	U.S Army, Ft. Monmouth	Main Post, Landfill M14, Ft. Monmouth	16.00	15.54	*	M	29-32581
M16MW22	U.S Army, Ft. Monmouth	Main Post, Landfill M16, Ft. Monmouth	14.50	14.04	*	M	29-32582

Table 10
Well Search Summary
Fort Monmouth Main Post
Fort Monmouth, New Jersey

Well ID Number	Well Owner	Well Address	Total Depth (feet bgs)	Casing Length (feet)	Static Water Elevation (feet bgs)	Use Code	NJDEP Permit Number
M18MW24	U.S Army, Ft. Monmouth	Main Post, Landfill M18, Ft. Monmouth	15.00	14.54	*	M	29-32565
M18MW25	U.S Army, Ft. Monmouth	Main Post, Landfill M18, Ft. Monmouth	15.00	14.54	*	M	29-32566
B1-MW1B	U.S Army, Ft. Monmouth	Main Post, Ft. Monmouth	14.00	13.54	*	M	29-32587
B2-MW2B	U.S Army, Ft. Monmouth	Main Post, Ft. Monmouth	20.00	19.54	*	M	29-32588
B3-MW3B	U.S Army, Ft. Monmouth	Main Post, Ft. Monmouth	26.00	25.54	*	M	29-32589
B4-MW4B	U.S Army, Ft. Monmouth	Main Post, Ft. Monmouth	15.00	14.54	*	M	29-32567
B5-MW5B	U.S Army, Ft. Monmouth	Main Post, Ft. Monmouth	14.50	14.04	*	M	29-32583

* Information Not Applicable
D: Domestic well
E: Recovery/ Decontamination Pollution Control/ Leachate with Pump Capacity
G: Irrigation well
M: Monitoring well
R: Replacement well
S: Sealed well

APPENDIX A

MONITORING WELL LOGS, MONITORING WELL PERMITS
GROUNDWATER MONITORING WELL CERTIFICATION
FORM B – LOCATION CERTIFICATION

BOREHOLE ID : MP3-MW4 *PROJECT NAME:* FT. MONMOUTH
BEGIN DATE : 01/05/95 *END DATE :* 01/05/95

LOGGER/COMPANY :

BOREHOLE COMPLETED IN (<O>verburden <B>edrock) : O

TOTAL DEPTH : 23.00 *DEPTH TO BEDROCK :* 0.00

BOREHOLE DIAMETER #1: 12.25
INTERVAL: 0.00 ft. to 23.00 ft. BGS
METHOD : HSA *FLUID :* WATER
BOREHOLE DIAMETER #2:
INTERVAL:
METHOD : *FLUID :*
BOREHOLE DIAMETER #3:
INTERVAL:
METHOD : *FLUID :*

DRILLING COMPANY : J.C. ANDERSON
DRILLER : STEVE BURGER
DRILL RIG TYPE : MOBILE B-57

	ESTIMATED	*SURVEYED*
SURFACE ELEVATION :	0.000	17.340
N. COORDINATE :	0.0000	
E. COORDINATE :	0.0000	

WELL PERMIT.....(Y)es (N)o: N *PERMIT # :* 29 32568

HOLE ABANDONED...(Y)es (N)o: N
WELL INSTALLED...(Y)es (N)o: Y
WELL CLUSTER.....(Y)es (N)o: N *No. OF WELLS :* 0
WELL NEST.....(Y)es (N)o: N *No. OF WELLS :* 0
PUMPS INSTALLED..(Y)es (N)o: N *TYPE* *DEPTH*
PURGE : 0.00
SAMPLE : 0.00

BOREHOLE TESTING
BOREHOLE GEOPHYSICS.....(Y)es (N)o: N
SLUG TESTS.....(Y)es (N)o: N
PACKER TESTS.....(Y)es (N)o: N
PUMPING TESTS.....(Y)es (N)o: N

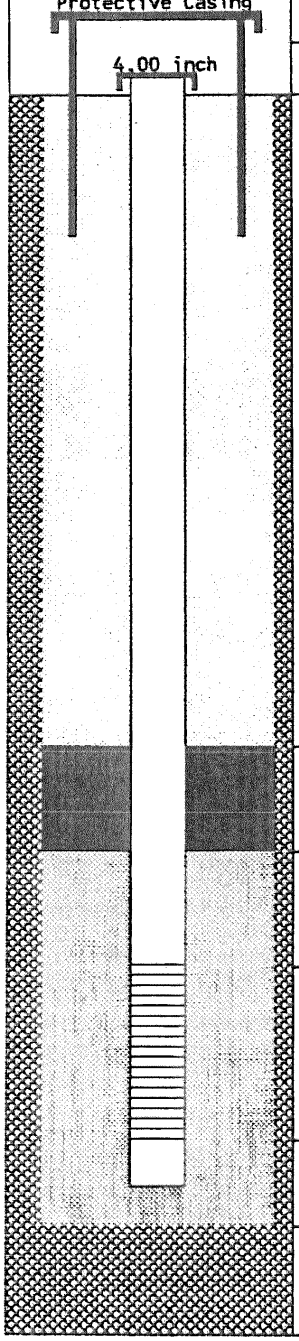
COMMENTS :
Latitude-North: 40 deg 18' 45.2"
Longitude-West: 74 deg 03' 09.3"

Well Completion Summary *Roy F. WESTON, Inc.*

CLIENT	FT. MONMOUTH	*DRILLING FIRM*	J.C. ANDERSON
SITE NAME	MAIN POST 3	*INSPECTOR*	P. THOMAS

WELL ID	MP3-MW4
START DATE	01/05/95
COMPLETION DATE	01/05/95

WATER LEVELS



DEPTH		*ELEV.*
1.68	*TC*	19.02
0.00	*GS*	17.34
3.72	*BN*	13.62
6.72	*SP*	10.62
8.72	*SC*	8.62
23.26	*BS*	-5.92
23.00	*TD*	-5.66

DRILLING SUMMARY

Driller WELLINGTON REEVE
Drilling Fluid WATER
Well Type SINGLE CASED SCREENED

WELL DESIGN CONSTRUCTION

Casing #1 Diameter: 4.00 *inch* *Interval:* 0.00 to 8.00 *ft.*
Type : PVC SCH 40

Stick Up Inner Casing: 1.68 *ft.* *Protective Casing:* 2.36 *ft.*

Casing Grout: CEMT/BENT *Interval:* 0.00 to 3.72 *ft.*

Seal Type: BENTONITE SLURRY *Interval:* 3.72 to 6.72 *ft.*

Sand Pack Type : NO. 1 SAND MORIE *Interval:* 6.72 to 23.72 *ft.*
Grain Size : UNIFORM *Median Diameter:*
Screen Diameter: 4.00 *Interval:* 8.72 to 23.26 *ft.*
Type : PVC *Slots:* 0.010 *inches*

Silt Trap Interval: 23.26 to 23.72 *ft.*
Backfill Type : *Interval:* 0.00 to 0.00 *ft.*

WELL DEVELOPMENT

Date 01/12/95
Method Bailing/overpumping
Yield ~2 gpm *Purged Volume* 154 gal

COMMENTS

TC = Top of Casing
GS = Ground Surface
BN = Top Seal
SP = Top Sand Pack
SC = Top Screen
BS = Bottom Screen
TD = Total Depth

= Grout
= Seal
= Sand Pack
= Formation

Additional Comments:
Depths are measured below ground surface.

NOTE: Well Diagram not to Scale *Elevations are feet above mean sea level*

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Borehole Log

Roy F. WESTON, Inc.

PROJECT	: FT. MONMOUTH	TOTAL DEPTH	: 23.00
SITE NAME	: MAIN POST 3	LOGGER	:
BORING ID	: MP3-MW4	DRILLING COMPANY	: J.C. ANDERSON
NORTHING	: 0.0000 estimated	DRILLING RIG	: MOBILE B-57
EASTING	: 0.0000 estimated	DATE STARTED	: 01/05/95
ELEVATION	: 17.340 surveyed	DATE COMPLETED	: 01/05/95

ELEVATION	DEPTH	MATERIAL	% RECOVERY	CLASSIFICATION	COLOR	STRENGTH	MOISTURE	BLOW COUNT	FIELD INSTRUMENT READING	COMMENTS
				Silty sand, SM	OLIVE GREEN	SFT	MST		OVM 0.0	0-0.2' bgs topsoil - grass and plant fragments
16	1			No Sample Recovered						
15	2		80	Silty sand, SM	OLIVE GREEN	SFT	MST		OVM 0.0	Coarsens downward.
14	3									
				No Sample Recovered						
13	4		60	Silty sand, SM	OLIVE GREEN	FRM	MST	16 19 38 31	OVM 0.0	Trace clay/gravel fragments.
12	5									
				No Sample Recovered						
11	6		75	Silty sand, SM	OLIVE GREEN	FRM	MST	5 12 14 15	OVM 0.0	
10	7									
				No Sample Recovered						
9	8		85	Silty sand, SM	OLIVE GREEN	FRM	MST	10 11 12 15	OVM 0.0	Trace gravel.
8	9			Silty sand, SM	BROWN/OLIVE GRN	SFT	MST		OVM 0.0	Slightly more clayey and moister than above. Dk olive green w/lt Fe color sediments.
				No Sample Recovered						
7	10		75	Silty sand, SM	DK OLIVE GREEN	SFT	WET	11 13 17 20	OVM 0.0	Sand w/clay matrix (similar to soils, found at M5 locations)

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PROJECT	: FT MONMOUTH	TOTAL DEPTH	: 23.00
SITE NAME	: MAIN POST 3	LOGGER	:
BORING ID	: MP3-MW4	DRILLING COMPANY	: J.C. ANDERSON
NORTHING	: 0.0000 estimated	DRILLING RIG	: MOBILE B-57
EASTING	: 0.0000 estimated	DATE STARTED	: 01/05/95
ELEVATION	: 17.340 surveyed	DATE COMPLETED	: 01/05/95

ELEVATION	DEPTH	MATERIAL	% RECOVERY	CLASSIFICATION	COLOR	STRENGTH	MOISTURE	BLOW COUNT	FIELD INSTRUMENT READING	COMMENTS
				Silty sand, SM	DK OLIVE GREEN	SFT	WET		OVM 0.0	Sand w/clay matrix (similar to soils, found at M5 locations)
6	11									
				No Sample Recovered						
5	12		80	Silty sand, SM	DK OLIVE GREEN	LSE	WET	12 15 18 14	OVM 0.0	Sand w/clay matrix, slightly more sandy.
4	13									
				No Sample Recovered						
3	14		65	Silty sand, SM	DK OLIVE GREEN	LSE	WET	11 16 19 22	OVM 0.0	Water is apparant, but soil is not permeable. Sand in silt/clay matrix.
2	15									
				No Sample Recovered						
1	16		85	Silty sand, SM	DK OLIVE GREEN	LSE	SAT	9 10 15 20	OVM 0.0	Sat 16' bgs. Interval above is wet during low tide.
0	17									
				No Sample Recovered						
-1	18		95	Silty sand, SM	DK OLIVE GREEN	LSE	SAT	11 22 26 30	OVM 0.0	
-2	19									
-3	20			No Sample Recovered						

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Borehole Log

Roy F. WESTON, Inc.

PROJECT	: FT. MONMOUTH	TOTAL DEPTH	: 23.00
SITE NAME	: MAIN POST 3	LOGGER	:
BORING ID	: MP3-MW4	DRILLING COMPANY	: J.C. ANDERSON
NORTHING	: 0.0000 estimated	DRILLING RIG	: MOBILE B-57
EASTING	: 0.0000 estimated	DATE STARTED	: 01/05/95
ELEVATION	: 17.340 surveyed	DATE COMPLETED	: 01/05/95

ELEVATION	DEPTH	MATERIAL	% RECOVERY	CLASSIFICATION	COLOR	STRENGTH	MOISTURE	BLOW COUNT	FIELD INSTRUMENT READING	COMMENTS
			95	Silty sand, SM	DK OLIVE GREEN	LSE	SAT	12 19 29 31	OVM 0.0	
-3	21									
-4	22			No Sample Recovered Interval Not Sampled						Augered interval. Set well at 23' bgs.
-5	23									
-6	24									
-7	25									
-8	26									
-9	27									
-10	28									
-11	29									
-12	30									

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BOREHOLE /WELL ID	SMP NUM	LTH NUM	LITHOLOGY INT. (FT BGS)		SAMPLING METHOD	SIZE GRAVEL	GRAVEL PCT.	SIZE SAND	SAND PCT	SILT PCT	CLAY PCT	ORGANIC PCT	ROCK TYPE	PLAST	SORT	STRENGTH	MOISTURE	STRAT UNIT
MP3-MW4	1	1	0.00	1.00	SPS		0	FM	50	40	5	5		NON	MOD	SFT	MST	
MP3-MW4	1	2	1.00	2.00	SPS		0		0	0	0	0						
MP3-MW4	2	1	2.00	3.60	SPS		0	MF	70	25	5	0		NON	MOD	SFT	MST	
MP3-MW4	2	2	3.60	4.00	SPS		0		0	0	0	0						
MP3-MW4	3	1	4.00	5.20	SPS		0	FM	70	25	5	0		NON	MOD	FRM	MST	
MP3-MW4	3	2	5.20	6.00	SPS		0		0	0	0	0						
MP3-MW4	4	1	6.00	7.50	SPS		0	FM	70	25	5	0		NON	MOD	FRM	MST	
MP3-MW4	4	2	7.50	8.00	SPS		0		0	0	0	0						
MP3-MW4	5	1	8.00	8.60	SPS		0	FM	70	25	5	0		NON	MOD	FRM	MST	
MP3-MW4	5	2	8.60	9.70	SPS		0	MF	55	40	5	0		NON	MOD	SFT	MST	
MP3-MW4	5	3	9.70	10.00	SPS		0		0	0	0	0						
MP3-MW4	6	1	10.00	11.50	SPS		0	MF	55	35	10	0		NON	MOD	SFT	WET	
MP3-MW4	6	2	11.50	12.00	SPS		0		0	0	0	0						
MP3-MW4	7	1	12.00	13.60	SPS		0	M	60	30	10	0		NON	MOD	LSE	WET	
MP3-MW4	7	2	13.60	14.00	SPS		0		0	0	0	0						
MP3-MW4	8	1	14.00	15.30	SPS		0	M	60	30	10	0		NON	MOD	LSE	WET	
MP3-MW4	8	2	15.30	16.00	SPS		0		0	0	0	0						
MP3-MW4	9	1	16.00	17.70	SPS		0	MF	60	30	10	0		NON	MOD	LSE	SAT	
MP3-MW4	9	2	17.70	18.00	SPS		0		0	0	0	0						
MP3-MW4	10	1	18.00	19.90	SPS		0	MF	60	30	10	0		NON	MOD	LSE	SAT	
MP3-MW4	10	2	19.90	20.00	SPS		0		0	0	0	0						
MP3-MW4	11	1	20.00	21.90	SPS		0		60	30	10	0		NON	MOD	LSE	SAT	
MP3-MW4	11	2	21.90	22.00	SPS		0		0	0	0	0						
MP3-MW4	12	1	22.00	23.00	NS		0		0	0	0	0						

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BOREHOLE ID : MP3-MW5 *PROJECT NAME:* FT. MONMOUTH
BEGIN DATE : 01/09/95 *END DATE :* 01/09/95

LOGGER/COMPANY : K. VALENTI

BOREHOLE COMPLETED IN (<O>verburden <B>edrock) : O

TOTAL DEPTH : 16.43 *DEPTH TO BEDROCK :* 0.00

BOREHOLE DIAMETER #1: 12.00
INTERVAL: 0.00 ft. to 16.43 ft. BGS
METHOD : HSA *FLUID :* WATER
BOREHOLE DIAMETER #2:
INTERVAL:
METHOD : *FLUID :*
BOREHOLE DIAMETER #3:
INTERVAL:
METHOD : *FLUID :*

DRILLING COMPANY : J.C. ANDERSON
DRILLER : WELLS REEVE
DRILL RIG TYPE : CME-55

	ESTIMATED	*SURVEYED*
SURFACE ELEVATION :	0.000	11.280
N. COORDINATE :	0.0000	
E. COORDINATE :	0.0000	

WELL PERMIT.....(Y)es (N)o: N *PERMIT # :* 2932569

HOLE ABANDONED...(Y)es (N)o: N
WELL INSTALLED...(Y)es (N)o: Y
WELL CLUSTER.....(Y)es (N)o: N *No. OF WELLS :* 0
WELL NEST.....(Y)es (N)o: N *No. OF WELLS :* 0
PUMPS INSTALLED..(Y)es (N)o: N

	TYPE	*DEPTH*
PURGE :		0.00
SAMPLE :		0.00

BOREHOLE TESTING
BOREHOLE GEOPHYSICS.....(Y)es (N)o: N
SLUG TESTS.....(Y)es (N)o: N
PACKER TESTS.....(Y)es (N)o: N
PUMPING TESTS.....(Y)es (N)o: N

COMMENTS :
Moved location due to high tension subsurface lines directly beneath original location. Latitude-North: 40 deg 18' 45.8"/Longitude-West: 74 deg 03' 14.6"

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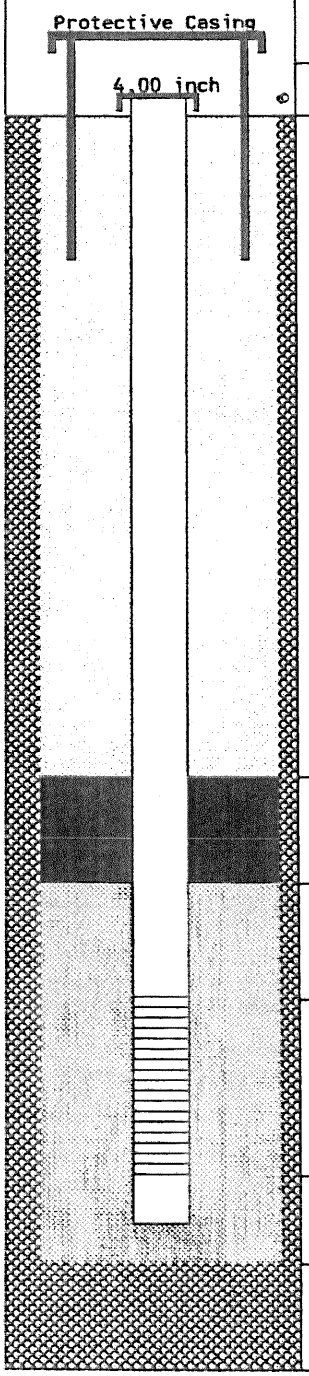
CLIENT	FT. MONMOUTH	*DRILLING FIRM*	J.C. ANDERSON
SITE NAME	MAIN POST 3	*INSPECTOR*	K. VALENTI

WELL ID	MP3-MW5
START DATE	01/09/95
COMPLETION DATE	01/09/95

WATER LEVELS



DEPTH		ELEV.
2.02	TC	13.30
0.00	GS	11.28
2.43	BN	8.85
4.43	SP	6.85
6.43	SC	4.85
15.97	BS	-4.69
16.00	TD	-4.72

DRILLING SUMMARY

Driller WELLINGTON REEVES
Drilling Fluid WATER
Well Type SINGLE CASED SCREENED

WELL DESIGN CONSTRUCTION

Casing #1 Diameter: 4.00 *inch* *Interval:* 0.00 to 16.00 *ft.*
Type : PVC SCH 40

Stick Up Inner Casing: 2.02 *ft.* *Protective Casing:* 2.14 *ft.*

Casing Grout: PORTLAND CEMENT *Interval:* 0.00 to 2.43 *ft.*

Seal Type: BENTONITE *Interval:* 2.43 to 4.43 *ft.*

Sand Pack Type : #1 MORIE *Interval:* 4.43 to 16.43 *ft.*
Grain Size : UNIFORM *Median Diameter:*
Screen Diameter: 4.00 *Interval:* 6.43 to 15.97 *ft.*
Type : PVC *Slots:* 0.010 *inches*

Silt Trap Interval: 15.97 to 16.43 *ft.*
Backfill Type : *Interval:* 0.00 to 0.00 *ft.*

WELL DEVELOPMENT

Date 01/12/95
Method Bailing/overpumping
Yield ~5 gpm *Purged Volume* 70 gal

COMMENTS

TC = Top of Casing
GS = Ground Surface
BN = Top Seal
SP = Top Sand Pack
SC = Top Screen
BS = Bottom Screen
TD = Total Depth

= Grout
= Seal
= Sand Pack
= Formation

Additional Comments:

NOTE: Well Diagram not to Scale *Elevations are feet above mean sea level*

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Borehole Log

Roy F. WESTON, Inc.

PROJECT	: FT. MONMOUTH	TOTAL DEPTH	: 16.43
SITE NAME	: MAIN POST 3	LOGGER	: K. VALENTI
BORING ID	: MP3-MW5	DRILLING COMPANY	: J.C. ANDERSON
NORTHING	: 0.0000 estimated	DRILLING RIG	: CME-55
EASTING	: 0.0000 estimated	DATE STARTED	: 01/09/95
ELEVATION	: 11.280 surveyed	DATE COMPLETED	: 01/09/95

ELEVATION	DEPTH	MATERIAL	% RECOVERY	CLASSIFICATION	COLOR	STRENGTH	MOISTURE	BLOW COUNT	FIELD INSTRUMENT READING	COMMENTS
			50	Silty sand, SM	BROWN	SFT	MST	3 6 14 14	HNU 0.0	Top 4" bgs=topsoil. Cuttings @1.5' bgs black with v. slight petroleum odor (fill?).
10	1			No Sample Recovered						
9	2		50	Silty sand with gravel, SM	BLACK	LSE	MST	9 11 13 8	HNU 0.0	Uncertain/Fill? Black soil - very light petroleum product odor.
8	3			No Sample Recovered						
7	4			No Sample Recovered				9 2 1 2	HNU 0.0	Spoon was wet upon removal from borehole.
6	5									
5	6			No Sample Recovered				3 4 4 3		Spoon was wet. Cuttings wet at ~7' bgs. Fill consisted of film (for camera).
4	7									
3	8		20	Silty sand with gravel, SM	BLACK	LSE	SAT	4 3 2 3	HNU 0.0	Fill, Film coming up as cuttings. Very slight odor of petroleum products.
				No Sample Recovered						
2	9									
1	10			No Sample Recovered				2 2 2 2	HNU 0.0	

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Borehole Log

Roy F. WESTON, Inc.

PROJECT	: FT. MONMOUTH	TOTAL DEPTH	: 16.43
SITE NAME	: MAIN POST 3	LOGGER	: K. VALENTI
BORING ID	: MP3-MW5	DRILLING COMPANY	: J.C. ANDERSON
NORTHING	: 0.0000 estimated	DRILLING RIG	: CME-55
EASTING	: 0.0000 estimated	DATE STARTED	: 01/09/95
ELEVATION	: 11.280 surveyed	DATE COMPLETED	: 01/09/95

ELEVATION	DEPTH	MATERIAL	% RECOVERY	CLASSIFICATION	COLOR	STRENGTH	MOISTURE	BLOW COUNT	FIELD INSTRUMENT READING	COMMENTS
				No Sample Recovered					HNU 0.0	
0	11									
-1	12		15	Silty sand with gravel, SM	BLACK	LSE	SAT	5 4 6 8	HNU 0.0	Used 3" SPS. Same lith. as interval from 8-8.4' bgs.
				No Sample Recovered						
-2	13									
-3	14		15	Elastic silt, MH	BLACK	FRM	SAT	4 4 4 4	HNU 0.0	Used 3" sps. Set well at 16.43' bgs.
				No Sample Recovered						
-4	15									
-5	16			Interval Not Sampled						Augered interval, TD of borehole 16.43'.
-6	17									
-7	18									
-8	19									
-9	20									

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BOREHOLE /WELL ID	SMP NUM	LTH NUM	LITHOLOGY INT. (FT BGS)		SAMPLING METHOD	SIZE GRAVEL	GRAVEL PCT.	SIZE SAND	SAND PCT	SILT PCT	CLAY PCT	ORGANIC PCT	ROCK TYPE	PLAST	SORT	STRENGTH	MOISTURE	STRAT UNIT
MP3-MW5	1	1	0.00	1.00	SPS		0		50	40	10	0		LOW	POR	SFT	MST	
MP3-MW5	1	2	1.00	2.00	SPS		0		0	0	0	0						
MP3-MW5	2	1	2.00	3.00	SPS		15		45	40	0	0		NON	POR	LSE	MST	
MP3-MW5	2	2	3.00	4.00	SPS		0		0	0	0	0						
MP3-MW5	3	1	4.00	6.00	SPS		0		0	0	0	0						
MP3-MW5	4	1	6.00	8.00	SPS		0		0	0	0	0						
MP3-MW5	5	1	8.00	8.40	SPS		20		50	30	0	0		NON	POR	LSE	SAT	
MP3-MW5	5	2	8.40	10.00	SPS		0		0	0	0	0						
MP3-MW5	6	1	10.00	12.00	SPS		0		0	0	0	0						
MP3-MW5	7	1	12.00	12.30	SPS		25		40	30	5	0		LOW	POR	LSE	SAT	
MP3-MW5	7	2	12.30	14.00	SPS		0		0	0	0	0						
MP3-MW5	8	1	14.00	14.30	SPS		0		0	65	35	0		HGH	WEL	FRM	SAT	
MP3-MW5	8	2	14.30	16.00	SPS		0		0	0	0	0						
MP3-MW5	9	1	16.00	16.43	NS		0		0	0	0	0						

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BOREHOLE ID : MP3-MW6 *PROJECT NAME:* FT. MONMOUTH
BEGIN DATE : 01/11/95 *END DATE :* 01/11/95

LOGGER/COMPANY : K. VALENTI

BOREHOLE COMPLETED IN (<O>verburden <B>edrock) : O

TOTAL DEPTH : 15.00 *DEPTH TO BEDROCK :* 0.00

BOREHOLE DIAMETER #1: 12.00
INTERVAL: 0.00 ft. to 15.00 ft. BGS
METHOD : HSA *FLUID :* WATER
BOREHOLE DIAMETER #2:
INTERVAL:
METHOD : *FLUID :*
BOREHOLE DIAMETER #3:
INTERVAL:
METHOD : *FLUID :*

DRILLING COMPANY : J.C. ANDERSON
DRILLER : WELLS REEVE
DRILL RIG TYPE : CME

	ESTIMATED	*SURVEYED*
SURFACE ELEVATION :	0.000	10.250
N. COORDINATE :	0.0000	
E. COORDINATE :	0.0000	

WELL PERMIT.....(Y)es (N)o: N *PERMIT # :* NJ 29 32570

HOLE ABANDONED...(Y)es (N)o: N
WELL INSTALLED...(Y)es (N)o: Y
WELL CLUSTER.....(Y)es (N)o: N *No. OF WELLS :* 0
WELL NEST.....(Y)es (N)o: N *No. OF WELLS :* 0
PUMPS INSTALLED..(Y)es (N)o: N

	TYPE	*DEPTH*
PURGE :		0.00
SAMPLE :		0.00

BOREHOLE TESTING
BOREHOLE GEOPHYSICS.....(Y)es (N)o: N
SLUG TESTS.....(Y)es (N)o: N
PACKER TESTS.....(Y)es (N)o: N
PUMPING TESTS.....(Y)es (N)o: N

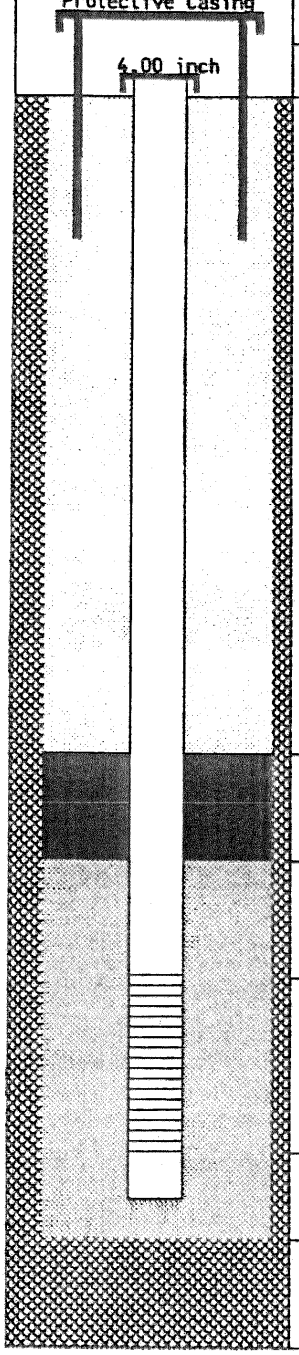
COMMENTS :
No sampling, only installed well. Latitude-North: 40 deg 18' 48.4"/Longitude-West: 74 deg 03' 06.9".

GEOLIS Copyright (c) 1990, Roy F. WESTON, Inc.

Well Completion Summary *Roy F. WESTON, Inc.*

CLIENT	FT. MONMOUTH	*DRILLING FIRM*	J.C. ANDERSON
SITE NAME	MAIN POST 3	*INSPECTOR*	K. VALENTI

WELL ID	MP3-MW6	*WATER LEVELS*
START DATE	01/11/95	
COMPLETION DATE	01/11/95	



DEPTH		ELEV.
2.17	TC	12.42
0.00	GS	10.25
1.33	BN	8.92
3.33	SP	6.92
5.33	SC	4.92
14.87	BS	-4.62
15.00	TD	-4.75

DRILLING SUMMARY

Driller WELLS REEVE
Drilling Fluid WATER
Well Type SINGLE CASED SCREENED

WELL DESIGN CONSTRUCTION

Casing #1 Diameter: 4.00 *inch* *Interval:* 0.00 to 15.00 *ft.*
Type :

Stick Up Inner Casing: 2.17 *ft.* *Protective Casing:* 2.36 *ft.*

Casing Grout: PORTLAND CEMENT *Interval:* 0.00 to 1.33 *ft.*

Seal Type: BENTONITE *Interval:* 1.33 to 3.33 *ft.*

Sand Pack Type : #1 MORIE *Interval:* 3.33 to 15.33 *ft.*
Grain Size : UNIFORM *Median Diameter:*
Screen Diameter: 4.00 *Interval:* 5.33 to 14.87 *ft.*
Type : PVC *Slots:* 0.010 *inches*

Silt Trap Interval: 14.87 to 15.33 *ft.*
Backfill Type : *Interval:* 0.00 to 0.00 *ft.*

WELL DEVELOPMENT

Date 01/18/95
Method Surge blocking/overpump
Yield <.5 gpm *Purged Volume* 45 gal

COMMENTS

TC = Top of Casing
GS = Ground Surface
BN = Top Seal
SP = Top Sand Pack
SC = Top Screen
BS = Bottom Screen
TD = Total Depth

= Grout
= Seal
= Sand Pack
= Formation

Additional Comments:

NOTE: Well Diagram not to Scale *Elevations are feet above mean sea level*

GEOLIS Copyright (c) 1990, Roy F. WESTON, Inc. 06/20/95

Borehole Log

Roy F. WESTON, Inc.

PROJECT	: FT. MONMOUTH	TOTAL DEPTH	: 15.00
SITE NAME	: MAIN POST 3	LOGGER	: K. VALENTI
BORING ID	: MP3-MW6	DRILLING COMPANY	: J.C. ANDERSON
NORTHING	: 0.0000 estimated	DRILLING RIG	: CME
EASTING	: 0.0000 estimated	DATE STARTED	: 01/11/95
ELEVATION	: 10.250 surveyed	DATE COMPLETED	: 01/11/95

ELEVATION	DEPTH	MATERIAL	% RECOVERY	CLASSIFICATION	COLOR	STRENGTH	MOISTURE	BLOW COUNT	FIELD INSTRUMENT READING	COMMENTS
			20	Not Classified - Incomplete Data	BLACK	LSE	NA	8 6 5 5	HNU 0.0	Top 3" bgs consists of topsoil, organics and landfill materials.
				No Sample Recovered						
9	1									
8	2			No Sample Recovered				2 2 2 3	HNU 0.0	
7	3									
6	4			No Sample Recovered				2 2 3 2	HNU 0.0	Switching to 3" dia. sps. Wood in SPS heal & spoon shoe. Cutting consists of wet blk gravelly sand -6'
5	5									
4	6		50	Silty sand, SM	BROWN TO BLACK	FRM	WET	6 8 9 7	HNU 1.0	Fill 3" SPS used. Some orange (lt) Fe staining Water level at 6'4" bgs.
3	7			No Sample Recovered						
2	8		100	Silty sand, SM	GREEN	SFT	SAT	2 4 2 3	HNU 0.0	Fill.
1	9									
0	10		30	Silty sand, SM	GREEN	LSE	WET	1 1 2 3	HNU 0.0	Fill. Saturated sand & silt with fill material.

GEOLIS Copyright (c) 1990, Roy F. WESTON, Inc.

Borehole Log

Roy F. WESTON, Inc.

PROJECT	: FT. MONMOUTH	TOTAL DEPTH	: 15.00
SITE NAME	: MAIN POST 3	LOGGER	: K. VALENTI
BORING ID	: MP3-MW6	DRILLING COMPANY	: J.C. ANDERSON
NORTHING	: 0.0000 estimated	DRILLING RIG	: CME
EASTING	: 0.0000 estimated	DATE STARTED	: 01/11/95
ELEVATION	: 10.250 surveyed	DATE COMPLETED	: 01/11/95

ELEVATION	DEPTH	MATERIAL	% RECOVERY	CLASSIFICATION	COLOR	STRENGTH	MOISTURE	BLOW COUNT	FIELD INSTRUMENT READING	COMMENTS
				Silty sand, SM	GREEN	LSE	WET		HNU 0.0	Fill. Saturated sand & silt with fill material.
				No Sample Recovered						
-1	11									
-2	12		50	Silty sand, SM	GREEN	FRM	WET	11 11 HW 15	HNU 0.0	Auger to 15' set well.
-3	13			No Sample Recovered						
-4	14			Interval Not Sampled						Augered interval.
-5	15									
-6	16									
-7	17									
-8	18									
-9	19									
-10	20									

GEOLIS Copyright (c) 1990, Roy F. WESTON, Inc.

BOREHOLE /WELL ID	SMP NUM	LTH NUM	LITHOLOGY INT. (FT BGS)		SAMPLING METHOD	SIZE GRAVEL	GRAVEL PCT.	SIZE SAND	SAND PCT	SILT PCT	CLAY PCT	ORGANIC PCT	ROCK TYPE	PLAST	SORT	STRENGTH	MOISTURE	STRAT UNIT
MP3-MW6	1	1	0.00	0.40	SPS		90		10	0	0	0		NA	NA	LSE	NA	
MP3-MW6	1	2	0.40	2.00	SPS		0		0	0	0	0						
MP3-MW6	2	1	2.00	4.00	SPS		0		0	0	0	0						
MP3-MW6	3	1	4.00	6.00	SPS		0		0	0	0	0						
MP3-MW6	4	1	6.00	7.00	SPS		10		50	40	0	0		NON	POR	FRM	WET	
MP3-MW6	4	2	7.00	8.00	SPS		0		0	0	0	0						
MP3-MW6	5	1	8.00	10.00	SPS		0		50	35	15	0		LOW	MOD	SFT	SAT	
MP3-MW6	6	1	10.00	10.60	SPS		0		50	50	0	0		LOW	MOD	LSE	WET	
MP3-MW6	6	2	10.60	12.00	SPS		0		0	0	0	0						
MP3-MW6	7	1	12.00	13.00	SPS		0	MF	75	25	0	0		LOW	MOD	FRM	WET	
MP3-MW6	7	2	13.00	14.00	SPS		0		0	0	0	0						
MP3-MW6	8	1	14.00	15.00	NS		0		0	0	0	0						

GEOLIS Copyright (c) 1990, Roy F. WESTON, Inc.

THIS FORM MUST BE COMPLETED BY THE PERMITTEE OR HIS OR HER AGENT

GROUND WATER MONITORING WELL CERTIFICATION - FORM B - LOCATION CERTIFICATION

Name of Permittee: UNITED STATES ARMY
Name of Facility: FORT MONMOUTH
Location: Eatontown Borough, Monmouth County, NJ

NJPDES Permit No: NJ

LAND SURVEYOR'S CERTIFICATION

Well Permit Number (As assigned by NJDEPE's Water Allocation Section, 609-292-2957): This number must be permanently affixed to the well casing.		29-39173
Longitude (one tenth of a second):	West	74 ° 03 ' 05 7 "
Latitude (one tenth of a second):	North	40 ° 18 ' 49 0 "
Elevation of Top of Casing (cap off)		12.29
Distance from Top of Casing (cap off) to ground		3.05'
Owner's Well Number (As shown in the application or Plans):		M-3
		MW7

Benchmark: NJGCS Monument No. 9235
Elevation = 56.69

AUTHENTICATION:

I declare under penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe the submitted information is true, accurate and complete. I am aware that there are significant penalties for submitting false information including the possibility of fine and imprisonment.

Frederick W. Kocen Jr.
Professional Land Surveyor's Signature

Frederick W. Kocen Jr.
Professional Land Surveyor's Name

SEAL

N.J. Lic. #34008
Professional Land Surveyor's License #

The Department reserves the right in cases of violation of permit specified ground water limits or Ground Water Quality Standards (NJAC 7:9-6.1 et seq.) to require that wells be resurveyed to an accuracy of one-hundredth of a second latitude and longitude. This shall not be considered to require a major modification of the NJPDES permit.

SERIAL # 003317

DWR 133M (10/96)

11

29J9173 thru 29J9176

STATE OF NEW JERSEY
DEPARTMENT OF ENVIRONMENTAL PROTECTION
TRENTON, NJ

Permit No. 29J9176

Mail to

NJDEP
Bureau Water Allocation
126
ton, NJ 08625-0426

MONITORING WELL PERMIT

VALID ONLY AFTER APPROVAL BY THE D.E.P.

COORD #: 29 65 564

Owner: U.S. ARMY, FT. MONMOUTH DIRECTOR OF PUBLIC WORKS

Address: BLDG. 173, ATTN: SECFM-7W-EW FT. MONMOUTH, N.J.

Name of Facility: SITE - M-3

Address: NORTH DR. EATONTOWN, FT. MONMOUTH N.J.

Driller: Groundwater & Environmental Services, In

Address: 1340 Campus Parkway - PO Box 1750 Wall, NJ 07719

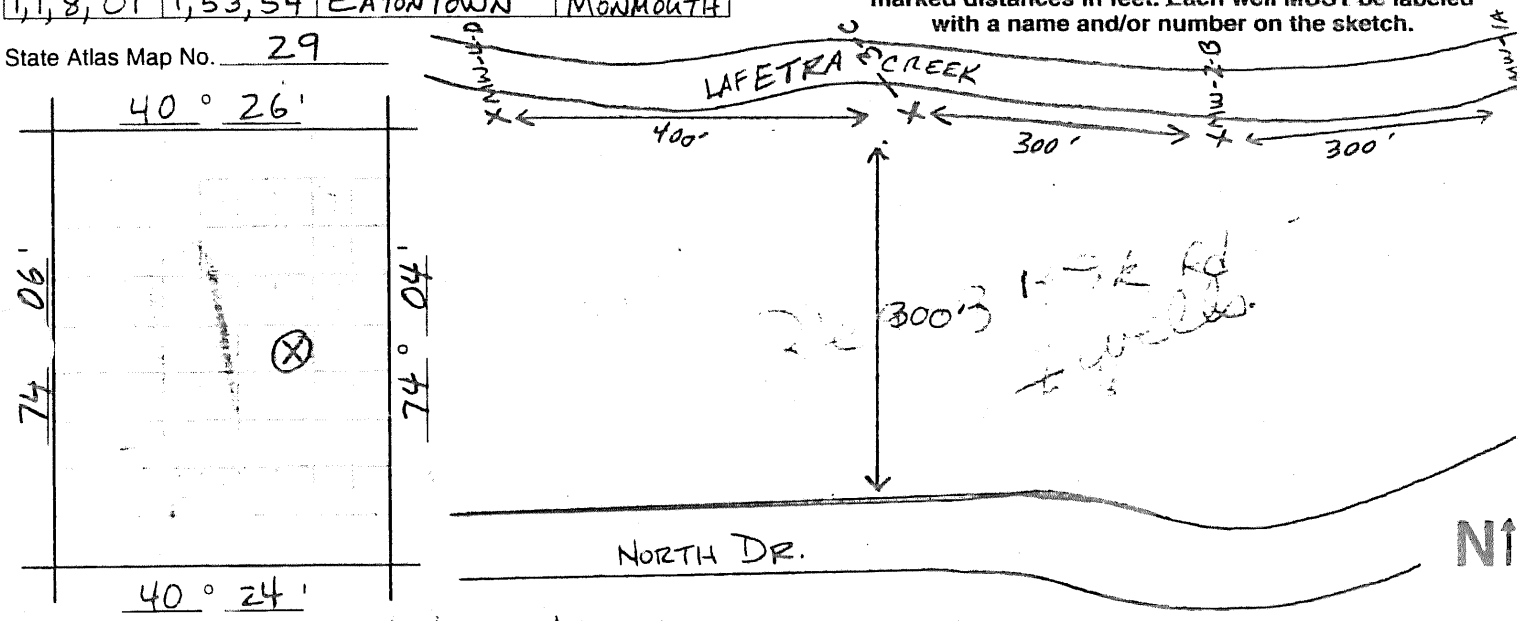
Diameter of Well(s)	2 Inches	Proposed Depth of Well(s)	20 Fee
# of Wells Applied for (max. 10)	4	Will pumping equipment be installed?	YES ☐ NO ☑
Type of Well (see reverse)	MONITOR	If Yes, give pump capacity	N/A cumulative GP

LOCATION OF WELL(S)

Lot #	Block #	Municipality	County
1,1,8,01	1,53,54	EATONTOWN	MONMOUTH

State Atlas Map No. 29

Draw sketch of well(s) nearest roads, buildings, etc. with marked distances in feet. Each well MUST be labeled with a name and/or number on the sketch.



FOR MONITORING WELLS, RECOVERY WELLS, OR PIEZOMETERS, THE FOLLOWING MUST BE COMPLETED BY THE APPLICANT. PLEASE INDICATE WHY THE WELLS ARE BEING INSTALLED:

- ☐ Spill Site
- ☐ ISRA Site
- ☐ CERCLA (Superfund) Site
- ☐ RCRA Site
- ☐ Underground Storage Tank Site
- ☐ Operational Ground Water Permit Site
- ☐ Pretreatment and Residuals Site
- ☐ Water and Hazardous Waste Enforcement Case
- ☐ Water Supply Aquifer Test Observation Well
- ☑ Other (explain) SANITARY LANDFILL

CASE I.D. Number

This Space for Approval Stamp

WELL PERMIT APPROVED
N.J.D.E.P.
AUG 24 1998
BUREAU OF WATER ALLOCATION

FOR D.E.P. USE
- ☐ Issuance of this permit is subject to the conditions attached. (see next page)
- ☑ For monitoring purposes only
- ☐
- ☑ The well(s) may not be completed with more than 25 feet of total screen or uncased borehole.

REVERSE SIDE FOR IMPORTANT PROVISIONS AND REGULATIONS PERTAINING TO THIS PERMIT.

In compliance with N.J.S.A. 58:4A-14, application is made for a permit to drill a well as described above.

Date 7-24-98 Signature of Driller [signature] Registration No. SP-616

Signature of Owner Joseph M. Fallon

COPIES: Water Allocation — White Health Dept. — Yellow Owner — Blue Driller — White

DWR-138 M
11/96

New Jersey Department of Environmental Protection
Bureau of Water Allocation

MONITORING WELL RECORD

Well Permit No. 39 39173

Atlas Sheet Coordinates 29 : 03 564

OWNER IDENTIFICATION - Owner US ARMY, FT MONMOUTH
Address BLDG 173 ATTN SBCFM-7W-EW
City FT MONMOUTH State NJ Zip Code

WELL LOCATION - If not the same as owner please give address. Owner's Well No. ~~MW-1A~~ 00M3MW07
County MONMOUTH Municipality EATONTOWN BORO Lot No. 1.1.8.01 Block No. 1,53,54
Address NORTH DR

DATE WELL STARTED 08 / 27 / 98
DATE WELL COMPETED 08 / 27 / 98

TYPE OF WELL (as per Well Permit Categories) MONITORING
Regulatory Program Requiring Well _____ Case I.D.# _____

CONSULTING FIRM/FIELD SUPERVISOR (if applicable) _____ Tele. # _____

WELL CONSTRUCTION

Total depth drilled 15 ft.
Well finished to 15 ft.

Borehole diameter:
Top 8 in.
Bottom 8 in.

Well was finished: [X] above grade
[ ] flush mounted

If finished above grade, casing height (stick up) above land surface 2.5 ft.

Is steel protective casing installed?
[X] Yes [ ] No

Static water level after drilling 6 ft.

Water level was measured using tape

Well was developed for 1 hours
at 2 gpm

Note: Measure all depths from land surface	Depth to Top (ft.)	Depth to Bottom (ft.)	Diameter (inches)	Material	Wgt./Rating (lbs/sch no.)
Single/Inner Casing	+2.5	5	2	PVC	sch 40
Middle Casing (for triple cased wells only)					
Outer Casing (largest diameter)					
Open Hole or Screen (No. Used 1)	5	15	2	PVC	sch 40 slot .01(
Blank Casings (No. Used)					
Tail Piece					
Gravel Pack	3	15	8	#2 sand	500
Grout	0	3	8	Neat Cement Bentonite	50 lbs ___ lbs

Grouting Method gravity
Drilling Method H.S.A.

Method of development air lift

Was permanent pumping equipment installed? [ ] Yes [X] No

Pump capacity _____ gpm

Pump type: _____

Drilling Fluid _____ Type of Rig A.M.S.

Health and Safety Plan submitted? [ ] Yes [ ] No

Level of Protection used on site (circle one) None D C B A

I certify that I have constructed the above referenced well in accordance with all well permit requirements and applicable State rules and regulations.

Drilling Company GROUNDWATER & ENVIRONMENTAL SE

Well Driller (Print) William Lovenberg

Driller's Signature _____

Registration No. [illegible] Date [illegible]

GEOLOGIC LOG

Note each depth where water was encountered in consolidated formations.

0' - 10' brown silty sand
10' - 13' peat
13' - 15' green clay

COPIES: White - DEP Canary - Driller Pink - Owner Goldenrod - Health Dept.

Groundwater & Environmental Services, Inc.
Monitoring Well Log

Project:	Fort Monmouth	Owner:	U.S. Army - Fort Monmouth		
Location:	North Drive, Eatontown Boro, NJ	Permit Number:	29-39173		
Well Number:	00M3MW07	Total Depth:	15.0'	Diameter:	8"
Casing Elev.:	---	Water Level Initial:	NA	Static:	6.0'
Screen Diam.:	2"	Length:	10.0'	Slot Size:	0.01
Casing Diam.:	2"	Length:	7.5'	Type:	PVC
Drilling Method:	Hollow Stem Auger	Sample Method:	NA		

Completion Details: Above grade, casing height 2.5 feet above grade, with locking well cap.

Driller: GES, Inc. Log By: W. Lovenberg Date: 8/27/98

MW07

Depth	Sample I D	Well Const.	PID (units)	Blow Count	Lithology
+2.5					
+2	NA		NA	NA	
+1					
0					0.0-10.0' Brown Silty SAND.
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					10.0-13.0' PEAT.
11					
12					
13					13.0-15.0' Green CLAY.
14					
15					Monitoring well completed to 15.0'.

THIS FORM MUST BE COMPLETED BY THE PERMITTEE OR HIS OR HER AGENT

GROUND WATER MONITORING WELL CERTIFICATION - FORM B - LOCATION CERTIFICATION

Name of Permittee: UNITED STATES ARMY
Name of Facility: FORT MONMOUTH
Location: Eatontown Borough, Monmouth County, NJ

NJPDES Permit No: NJ

LAND SURVEYOR'S CERTIFICATION

Well Permit Number (As assigned by NJDEPE's Water Allocation Section, 609-292-2957): This number must be permanently affixed to the well casing.		29-39174
Longitude (one tenth of a second):	West	74° 03' 08.5"
Latitude (one tenth of a second):	North	40° 18' 48.4"
Elevation of Top of Casing (cap off)		9.06
Distance from Top of Casing (cap off) to ground		2.87'
Owner's Well Number (As shown in the application or Plans):		M-3
		MW 8

Benchmark: NJGCS Monument No. 9235
Elevation = 56.69

AUTHENTICATION:

I declare under penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe the submitted information is true, accurate and complete. I am aware that there are significant penalties for submitting false information including the possibility of fine and imprisonment.

Frederick W. Kocen Jr.
Professional Land Surveyor's Signature

Frederick W. Kocen Jr.
Professional Land Surveyor's Name

SEAL

N.J. Lic. #34008
Professional Land Surveyor's License #

The Department reserves the right in cases of violation of permit specified ground water limits or Ground Water Quality Standards (NJAC 7:9-6.1 et seq.) to require that wells be resurveyed to an accuracy of one-hundredth of a second latitude and longitude. This shall not be considered to require a major modification of the NJPDES permit.

SERIAL # 003317

DWR-133M (10/96)

Mail to

NJDEP
Bureau Water Allocation
P.O. Box 426
Trenton, NJ 08625-0426

STATE OF NEW JERSEY
DEPARTMENT OF ENVIRONMENTAL PROTECTION
TRENTON, NJ

MONITORING WELL PERMIT

VALID ONLY AFTER APPROVAL BY THE D.E.P.

Permit No. 29J9171 thru 29J9171

COORD #: 29 L5 .564

Owner: U.S. ARMY, FT. MONMOUTH DIRECTOR OF PUBLIC WORKS

Address: BLDG. 173, ATTN: SECFM-7W-EW FT. MONMOUTH, N.J.

Name of Facility: SITE - M-3

Address: NORTH DR. EATONTOWN, FT. MONMOUTH N.J.

Driller: Groundwater & Environmental Services, I

Address: 1340 Campus Parkway - PO Box 1750 Wall, NJ 07719

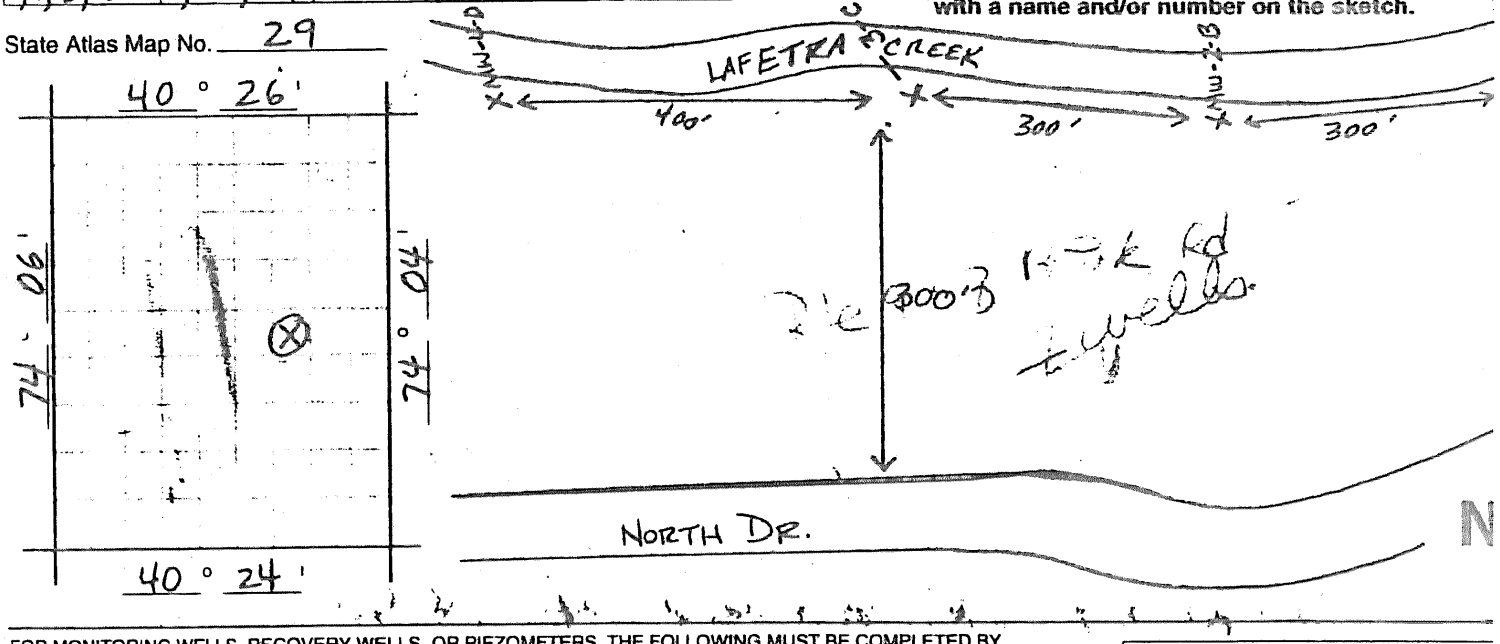
Diameter of Well(s)	2 Inches	Proposed Depth of Well(s)	20
# of Wells Applied for (max. 10)	4	Will pumping equipment be installed?	YES ☐ NO ☑
Type of Well (see reverse)	MONITOR	If Yes, give pump capacity	N/A cumulative G

LOCATION OF WELL(S)

Lot #	Block #	Municipality	County
1,1,8,01	1,53,54	EATONTOWN	MONMOUTH

State Atlas Map No. 29

Draw sketch of well(s) nearest roads, buildings, etc. with marked distances in feet. Each well MUST be labeled with a name and/or number on the sketch.



FOR MONITORING WELLS, RECOVERY WELLS, OR PIEZOMETERS, THE FOLLOWING MUST BE COMPLETED BY THE APPLICANT. PLEASE INDICATE WHY THE WELLS ARE BEING INSTALLED:

- ☐ Spill Site
- ☐ ISRA Site
- ☐ CERCLA (Superfund) Site
- ☐ RCRA Site
- ☐ Underground Storage Tank Site
- ☐ Operational Ground Water Permit Site
- ☐ Pretreatment and Residuals Site
- ☐ Water and Hazardous Waste Enforcement Case
- ☐ Water Supply Aquifer Test Observation Well
- ☑ Other (explain) SANITARY LANDFILL

CASE I.D. Number

This Space for Approval Stamp

WELL PERMIT APPROVED
N.J.D.E.P.
AUG 24 1998
BUREAU OF WATER ALLOCATIO

FOR D.E.P. USE
- ☐ Issuance of this permit is subject to the conditions attached. (see next page)
- ☒ For monitoring purposes only
- ☐
- ☒ The well(s) may not be completed with more than 25 feet of total scre or uncased borehole.

SEE REVERSE SIDE FOR IMPORTANT PROVISIONS AND REGULATIONS PERTAINING TO THIS PERMIT.

In compliance with N.J.S.A. 58:4A-14, application is made for a permit to drill a well as described above.

Date 7-24-98 Signature of Driller [signature] Registration No. SP:1610

Signature of Owner Joseph M. Fallon

DWR-138 M
11/96

New Jersey Department of Environmental Protection
Bureau of Water Allocation

MONITORING WELL RECORD

Well Permit No. 30 39174

Atlas Sheet Coordinates 29 : 03 584

OWNER IDENTIFICATION - Owner US ARMY. FT MONMOUTH
Address BLDG 173 ATTN SEOFM-TW-EW
City FT MONMOUTH State NJ Zip Code

WELL LOCATION - If not the same as owner please give address. Owner's Well No. ~~MW-2-B~~ COM3MW08
County MONMOUTH Municipality EATONTOWN BORO Lot No. 1,1,8.01 Block No. 1,53,54
Address NORTH DR

DATE WELL STARTED 08 / 27 / 98
DATE WELL COMPETED 08 / 27 / 98

TYPE OF WELL (as per Well Permit Categories) MONITORING
Regulatory Program Requiring Well Case I.D.#

CONSULTING FIRM/FIELD SUPERVISOR (if applicable) Tele. #

WELL CONSTRUCTION

Total depth drilled 15 ft.
Well finished to 15 ft.

Borehole diameter:
Top 8 in.
Bottom 8 in.

Well was finished: [X] above grade
[ ] flush mounted

If finished above grade, casing height (stick up) above land surface 2.5 ft.

Is steel protective casing installed?
[X] Yes [ ] No

Static water level after drilling 6 ft.

Water level was measured using tape

Well was developed for 1 hours
at 2 gpm

Note: Measure all depths from land surface	Depth to Top (ft.)	Depth to Bottom (ft.)	Diameter (inches)	Material	Wgt./Rating (lbs/sch no.)
Single/Inner Casing	+2.5	5	2	PVC	sch 40
Middle Casing (for triple cased wells only)					
Outer Casing (largest diameter)					
Open Hole or Screen (No. Used 1)	5	15	2	PVC	sch 40 slot .010
Blank Casings (No. Used)					
Tail Piece					
Gravel Pack	3	15	8	#2 sand	500
Grout	0	3	8	Neat Cement Bentonite	50 lbs. lbs.

Grouting Method gravity
Drilling Method H.S.A.

Method of development air lift

Was permanent pumping equipment installed? [ ] Yes [X] No

Pump capacity gpm

Pump type:

Drilling Fluid Type of Rig A.M.S.

Health and Safety Plan submitted? [ ] Yes [ ] No

Level of Protection used on site (circle one) None (D) C B A

I certify that I have constructed the above referenced well in accordance with all well permit requirements and applicable State rules and regulations.

Drilling Company GROUNDWATER & ENVIRONMENTAL SE

Well Driller (Print) William Lovenberg

Driller's Signature

Registration No. 1610 Date 1 / 3 / 98

GEOLOGIC LOG

Note each depth where water was encountered in consolidated formations.

0' - 10' brown silty sand
10' - 13' peat
13' - 15' green clay

COPIES: White - DEP Canary - Driller Pink - Owner Goldenrod - Health Dept.

Groundwater & Environmental Services, Inc.
Monitoring Well Log

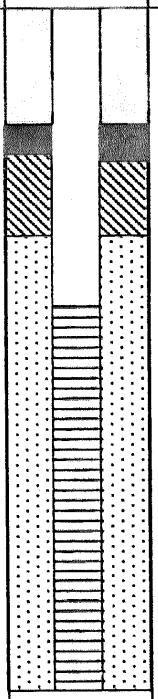
Project:	Fort Monmouth	Owner:	U.S. Army - Fort Monmouth		
Location:	North Drive, Eatontown Boro, NJ	Permit Number:	29-39174		
Well Number:	00M3MW08	Total Depth:	15.0'	Diameter:	8"
Casing Elev.:	---	Water Level Initial:	NA	Static:	6.0'
Screen Diam.:	2"	Length:	10.0'	Slot Size:	0.01
Casing Diam.:	2"	Length:	7.5'	Type:	PVC
Drilling Method:	Hollow Stem Auger	Sample Method:	NA		

Completion Details: Above grade, casing height 2.5 feet above grade, with locking well cap.

Driller: GES, Inc. Log By: W. Lovenberg Date: 8/27/98

MW08

Depth	Sample I D	Well Const.	PID (units)	Blow Count	Lithology
+2.5					
+2	NA		NA	NA	
+1					
0					0.0-10.0' Brown Silty SAND.
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					10.0-13.0' PEAT.
11					
12					
13					13.0-15.0' Green CLAY.
14					
15					Monitoring well completed to 15.0'.



THIS FORM MUST BE COMPLETED BY THE PERMITTEE OR HIS OR HER AGENT

GROUND WATER MONITORING WELL CERTIFICATION - FORM B - LOCATION CERTIFICATION

Name of Permittee: UNITED STATES ARMY
Name of Facility: FORT MONMOUTH
Location: Eatontown Borough, Monmouth County, NJ

NJPDES Permit No: NJ

LAND SURVEYOR'S CERTIFICATION

Well Permit Number (As assigned by NJDEPE's Water Allocation Section, 609-292-2957): This number must be permanently affixed to the well casing.		29-39175
Longitude (one tenth of a second):	West	74° 03' 11.0"
Latitude (one tenth of a second):	North	40° 18' 47.3"
Elevation of Top of Casing (cap off)		13.83
Distance from Top of Casing (cap off) to ground		2.44'
Owner's Well Number (As shown in the application or Plans):		M-3
		MW 9

Benchmark: NJGCS Monument No. 9235
Elevation = 56.69

AUTHENTICATION:

I declare under penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe the submitted information is true, accurate and complete. I am aware that there are significant penalties for submitting false information including the possibility of fine and imprisonment.

Frederick W. Kocen Jr.
Professional Land Surveyor's Signature

Frederick W. Kocen Jr.
Professional Land Surveyor's Name

SEAL

N.J. Lic. #34008
Professional Land Surveyor's License #

The Department reserves the right in cases of violation of permit specified ground water limits or Ground Water Quality Standards (NJAC 7:9-6.1 et seq.) to require that wells be resurveyed to an accuracy of one-hundredth of a second latitude and longitude. This shall not be considered to require a major modification of the NJPDES permit.

SERIAL # 003311

DWR-133M (10/96)

Mail to

NJDEP
Bureau Water Allocation
N 426
Trenton, NJ 08625-0426

STATE OF NEW JERSEY
DEPARTMENT OF ENVIRONMENTAL PROTECTION
TRENTON, NJ

MONITORING WELL PERMIT

VALID ONLY AFTER APPROVAL BY THE D.E.P.

Permit No. 297911 thru 297917

COORD #: 2965.564

Owner: U.S. ARMY, FT. MONMOUTH DIRECTOR OF PUBLIC WORKS

Address: BLDG. 173, ATTN: SECFM-7W-EW FT. MONMOUTH, N.J.

Name of Facility: SITE - M - 3

Address: NORTH DR. EATONTOWN, FT. MONMOUTH N.J.

Driller: Groundwater & Environmental Services,

Address: 1340 Campus Parkway - PO Box 1750 Wall, NJ 07719

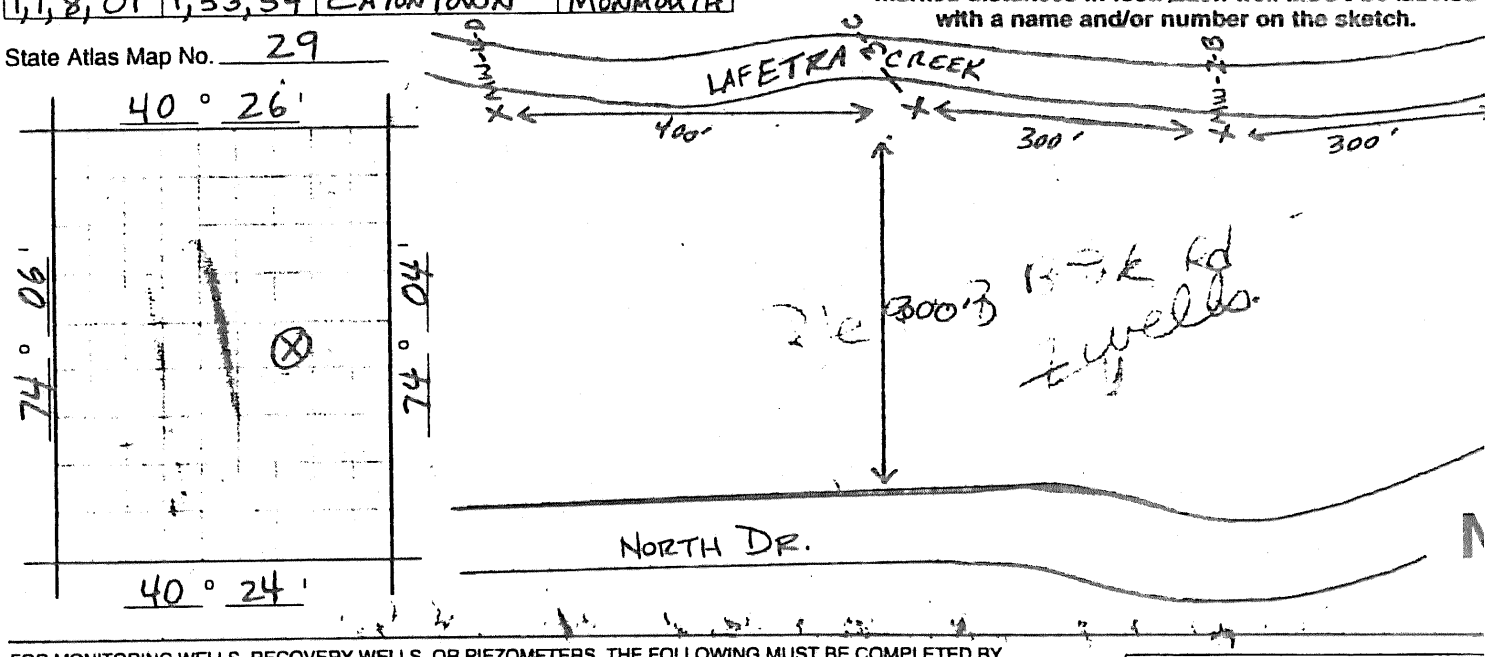
Diameter of Well(s)	2 Inches	Proposed Depth of Well(s)	20
# of Wells Applied for (max. 10)	4	Will pumping equipment be installed?	YES ☐ NO ☑
Type of Well (see reverse)	MONITOR	If Yes, give pump capacity	N/A cumulative

LOCATION OF WELL(S)

Lot #	Block #	Municipality	County
1,1,8,01	1,53,54	EATONTOWN	MONMOUTH

State Atlas Map No. 29

Draw sketch of well(s) nearest roads, buildings, etc. with marked distances in feet. Each well MUST be labeled with a name and/or number on the sketch.



FOR MONITORING WELLS, RECOVERY WELLS, OR PIEZOMETERS, THE FOLLOWING MUST BE COMPLETED BY THE APPLICANT. PLEASE INDICATE WHY THE WELLS ARE BEING INSTALLED:

- ☐ Spill Site
- ☐ ISRA Site
- ☐ CERCLA (Superfund) Site
- ☐ RCRA Site
- ☐ Underground Storage Tank Site
- ☐ Operational Ground Water Permit Site
- ☐ Pretreatment and Residuals Site
- ☐ Water and Hazardous Waste Enforcement Case
- ☐ Water Supply Aquifer Test Observation Well
- ☑ Other (explain) SANITARY LANDFILL

CASE I.D. Number

This Space for Approval Stamp

WELL PERMIT APPROVED
N.J.D.E.P.
AUG 24 1998
BUREAU OF WATER ALLOCATION

FOR D.E.P. USE
- ☐ Issuance of this permit is subject to the conditions attached. (see next page)
- ☒ For monitoring purposes only
- ☐
- ☒ The well(s) may not be completed with more than 25 feet of total scr or uncased borehole.

SEE REVERSE SIDE FOR IMPORTANT PROVISIONS AND REGULATIONS PERTAINING TO THIS PERMIT.

In compliance with N.J.S.A. 58:4A-14, application is made for a permit to drill a well as described above.

Date 7-24-98 Signature of Driller [signature] Registration No. SP-1610

Signature of Owner Joseph M. Fallon

DWR-138 M
11/96

New Jersey Department of Environmental Protection
Bureau of Water Allocation

MONITORING WELL RECORD

Well Permit No. 29 39175

Atlas Sheet Coordinates 29 003 584

OWNER IDENTIFICATION - Owner US ARMY, FT MONMOUTH
Address BLDG 173 ATTN SECOM-TW-RW
City FT MONMOUTH State NJ Zip Code

WELL LOCATION - If not the same as owner please give address. Owner's Well No. ~~MW-3-C~~ 00M3MW09
County MONMOUTH Municipality EATONTOWN BORO Lot No. 1.1.8.01 Block No. 1.53.54
Address NORTH DR

DATE WELL STARTED 08 / 27 / 98
DATE WELL COMPETED 08 / 27 / 98

TYPE OF WELL (as per Well Permit Categories) MONITORING
Regulatory Program Requiring Well Case I.D.#

CONSULTING FIRM/FIELD SUPERVISOR (if applicable) Tele. #

WELL CONSTRUCTION

Total depth drilled 15 ft.
Well finished to 15 ft.

Borehole diameter:
Top 8 in.
Bottom 8 in.

Well was finished: ☒ above grade
☐ flush mounted

If finished above grade, casing height (stick up) above land surface 2.5 ft.

Is steel protective casing installed? ☒ Yes ☐ No

Static water level after drilling 6 ft.

Water level was measured using tape

Well was developed for 1 hours at 2 gpm

Note: Measure all depths from land surface	Depth to Top (ft.)	Depth to Bottom (ft.)	Diameter (inches)	Material	Wgt./Rating (lbs/sch no.)
Single/Inner Casing	+2.5	5	2	PVC	sch 40
Middle Casing (for triple cased wells only)					
Outer Casing (largest diameter)					
Open Hole or Screen (No. Used 1)	5	15	2	PVC	sch 40 slot .010
Blank Casings (No. Used)					
Tail Piece					
Gravel Pack	3	15	8	#2 sand	500
Grout	0	3	8	Neat Cement Bentonite	50 lbs. ___ lbs.

Grouting Method gravity
Drilling Method H.S.A.

Method of development air lift

Was permanent pumping equipment installed? ☐ Yes ☒ No

Pump capacity gpm

Pump type:

Drilling Fluid Type of Rig A.M.S.

Health and Safety Plan submitted? ☐ Yes ☐ No

Level of Protection used on site (circle one) None (D) C B A

I certify that I have constructed the above referenced well in accordance with all well permit requirements and applicable State rules and regulations.

Drilling Company GROUNDWATER & ENVIRONMENTAL SE

Well Driller (Print) William Lovenberg

Driller's Signature

Registration No. Date 1/23/98

GEOLOGIC LOG

Note each depth where water was encountered in consolidated formations.

0' - 10' brown silty sand
10' - 13' peat
13' - 15' green clay

COPIES: White - DEP Canary - Driller Pink - Owner Goldenrod - Health Dept.

Groundwater & Environmental Services, Inc.
Monitoring Well Log

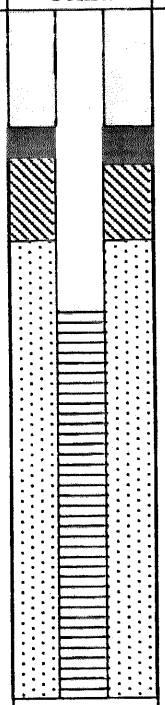
Project:	Fort Monmouth	Owner:	U.S. Army - Fort Monmouth		
Location:	North Drive, Eatontown Boro, NJ	Permit Number:	29-39175		
Well Number:	00M3MW09	Total Depth:	15.0'	Diameter:	8"
Casing Elev.:	---	Water Level Initial:	NA	Static:	6.0'
Screen Diam.:	2"	Length:	10.0'	Slot Size:	0.01
Casing Diam.:	2"	Length:	7.5'	Type:	PVC
Drilling Method:	Hollow Stem Auger	Sample Method:	NA		

Completion Details: Above grade, casing height 2.5 feet above grade, with locking well cap.

Driller: GES, Inc. Log By: W. Lovenberg Date: 8/27/98

MW09

Depth	Sample I D	Well Const.	PID (units)	Blow Count	Lithology
+2.5					
+2	NA		NA	NA	
+1					
0					0.0-10.0' Brown Silty SAND.
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					10.0-13.0' PEAT.
11					
12					
13					13.0-15.0' Green CLAY.
14					
15					Monitoring well completed to 15.0'.



THIS FORM MUST BE COMPLETED BY THE PERMITTEE OR HIS OR HER AGENT

GROUND WATER MONITORING WELL CERTIFICATION - FORM B - LOCATION CERTIFICATION

Name of Permittee: UNITED STATES ARMY
Name of Facility: FORT MONMOUTH
Location: Eatontown Borough, Monmouth County, NJ

NJPDES Permit No: NJ

LAND SURVEYOR'S CERTIFICATION

Well Permit Number (As assigned by NJDEPE's Water Allocation Section, 609-292-2957): This number must be permanently affixed to the well casing.		29-39176
Longitude (one tenth of a second):	West	74 ° 03 ' 15 .1 "
Latitude (one tenth of a second):	North	40 ° 18 ' 46 .5 "
Elevation of Top of Casing (cap off)		9.19
Distance from Top of Casing (cap off) to ground		2.35'
Owner's Well Number (As shown in the application or Plans):		M-3
		MW 10

Benchmark: NJGCS Monument No. 9235
Elevation = 56.69

AUTHENTICATION:

I declare under penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe the submitted information is true, accurate and complete. I am aware that there are significant penalties for submitting false information including the possibility of fine and imprisonment.

Frederick W. Kocen Jr.
Professional Land Surveyor's Signature

Frederick W. Kocen Jr.
Professional Land Surveyor's Name

SEAL

N.J. Lic. #34008
Professional Land Surveyor's License #

The Department reserves the right in cases of violation of permit specified ground water limits or Ground Water Quality Standards (NJAC 7:9-6.1 et seq.) to require that wells be resurveyed to an accuracy of one-hundredth of a second latitude and longitude. This shall not be considered to require a major modification of the NJPDES permit.

SERIAL # 003317

DWP-133M (10/96)

11

2939173 thru 2939176

Mail to

NJDEP
Bureau Water Allocation
426
Trenton, NJ 08625-0426

STATE OF NEW JERSEY
DEPARTMENT OF ENVIRONMENTAL PROTECTION
TRENTON, NJ

Permit No. 2939176

MONITORING WELL PERMIT

VALID ONLY AFTER APPROVAL BY THE D.E.P.

COORD #: 2965.564

Owner: U.S. ARMY, FT. MONMOUTH DIRECTOR OF PUBLIC WORKS

Address: BLDG. 173, ATTN: SECFM-7W-EW FT. MONMOUTH, N.J.

Name of Facility: SITE - M-3

Address: NORTH DR. EATONTOWN, FT. MONMOUTH N.J.

Driller: Groundwater & Environmental Services, In

Address: 1340 Campus Parkway - PO Box 1750 Wall, NJ 07719

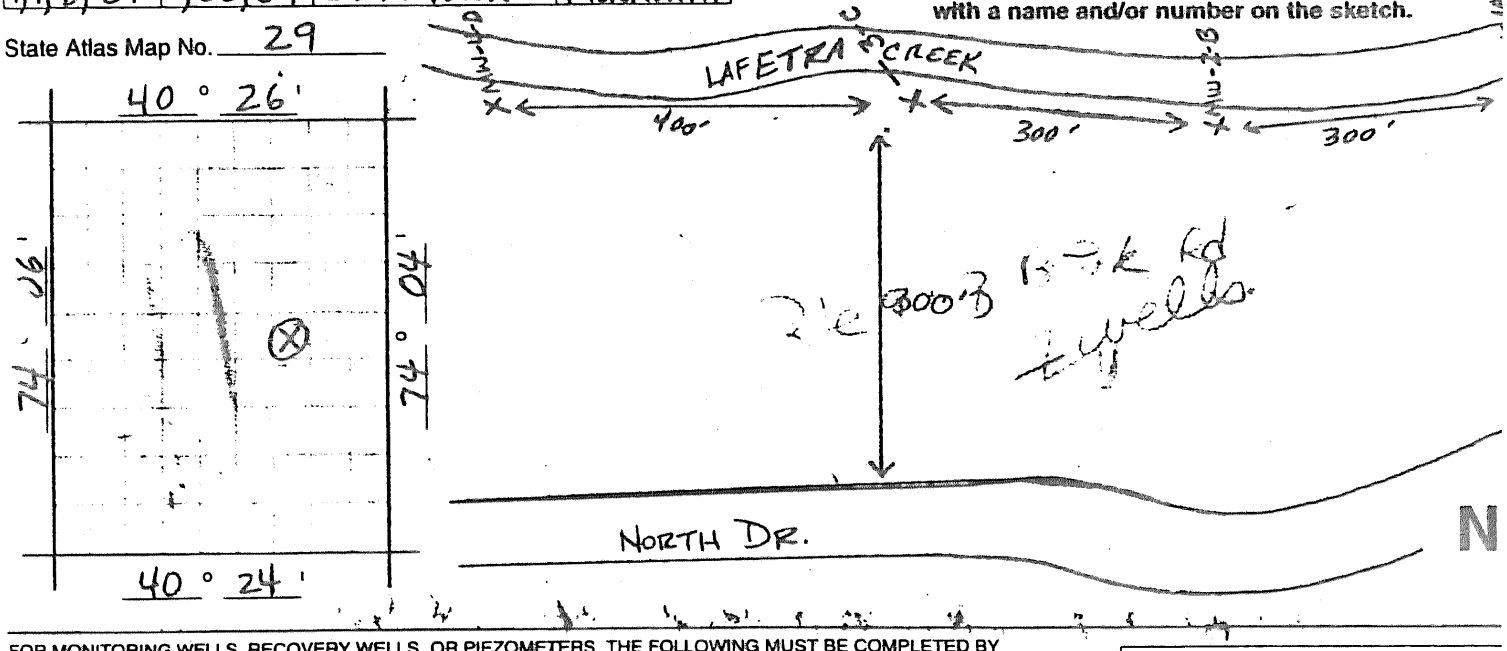
Diameter of Well(s)	2 Inches	Proposed Depth of Well(s)	20 Fe
# of Wells Applied for (max. 10)	4	Will pumping equipment be installed?	YES ☐ NO ☑
Type of Well (see reverse)	MONITOR	If Yes, give pump capacity	N/A cumulative GP

LOCATION OF WELL(S)

Lot #	Block #	Municipality	County
1,1,8,01	1,53,54	EATONTOWN	MONMOUTH

State Atlas Map No. 29

Draw sketch of well(s) nearest roads, buildings, etc. with marked distances in feet. Each well MUST be labeled with a name and/or number on the sketch.



FOR MONITORING WELLS, RECOVERY WELLS, OR PIEZOMETERS, THE FOLLOWING MUST BE COMPLETED BY THE APPLICANT. PLEASE INDICATE WHY THE WELLS ARE BEING INSTALLED:

- ☐ Spill Site
- ☐ ISRA Site
- ☐ CERCLA (Superfund) Site
- ☐ RCRA Site
- ☐ Underground Storage Tank Site
- ☐ Operational Ground Water Permit Site
- ☐ Pretreatment and Residuals Site
- ☐ Water and Hazardous Waste Enforcement Case
- ☐ Water Supply Aquifer Test Observation Well
- ☑ Other (explain) SANITARY LANDFILL

CASE I.D. Number

This Space for Approval Stamp

WELL PERMIT APPROVED
N.J.D.E.P.
AUG 24 1998
BUREAU OF WATER ALLOCATION

FOR D.E.P. USE
- ☐ Issuance of this permit is subject to the conditions attached. (see next page)
- ☒ For monitoring purposes only
- ☐
- ☒ The well(s) may not be completed with more than 25 feet of total screen or uncased borehole.

SEE REVERSE SIDE FOR IMPORTANT PROVISIONS AND REGULATIONS PERTAINING TO THIS PERMIT.

In compliance with N.J.S.A. 58:4A-14, application is made for a permit to drill a well as described above.

Date 7-24-98 Signature of Driller [signature] Registration No. SP-1610

Signature of Owner Joseph M. Fallon

DWR-138 M
11/96

New Jersey Department of Environmental Protection
Bureau of Water Allocation

MONITORING WELL RECORD

Well Permit No. [illegible] 39176

Atlas Sheet Coordinates 29 03 56d

OWNER IDENTIFICATION - Owner US ARMY, FT MONMOUTH
Address BLDG 173 ATTN SEGEM-7W-EW
City FT MONMOUTH State NJ Zip Code

WELL LOCATION - If not the same as owner please give address. Owner's Well No. ~~[illegible]~~ 00M3MW10
County MONMOUTH Municipality EATONTOWN BORO Lot No. 1.1.8.01 Block No. 1.53.54
Address NORTH DR

DATE WELL STARTED 08 / 27 / 98
DATE WELL COMPETED 08 / 27 / 98

TYPE OF WELL (as per Well Permit Categories) MONITORING
Regulatory Program Requiring Well Case I.D.#

CONSULTING FIRM/FIELD SUPERVISOR (if applicable) Tele. #

WELL CONSTRUCTION

Total depth drilled 15 ft.
Well finished to 15 ft.

Borehole diameter:
Top 8 in.
Bottom 8 in.

Well was finished: ☒ above grade
☐ flush mounted

If finished above grade, casing height (stick-up) above land surface 2.5 ft.

steel protective casing installed?
☒ Yes ☐ No

Static water level after drilling 6 ft.

Water level was measured using tape

Well was developed for 1 hours
at 2 gpm

Method of development air lift

Was permanent pumping equipment installed? ☐ Yes ☒ No

Pump capacity gpm

Pump type:

Drilling Fluid Type of Rig A.M.S.

Health and Safety Plan submitted? ☐ Yes ☐ No

Level of Protection used on site (circle one) None (D) C B A

Note: Measure all depths from land surface	Depth to Top (ft.)	Depth to Bottom (ft.)	Diameter (inches)	Material	Wgt./Rating (lbs/sch no.)
Single/Inner Casing	+2.5	5	2	PVC	sch 40
Middle Casing (for triple cased wells only)					
Outer Casing (largest diameter)					
Open Hole or Screen (No. Used 1)	5	15	2	PVC	SCH 40 slot .010
Blank Casings (No. Used)					
Tail Piece					
Gravel Pack	3	15	8	#2 sand	500
Grout	0	3	8	Neat Cement Bentonite	30 lbs. lbs.

Grouting Method gravity
Drilling Method H.S.A.

GEOLOGIC LOG

Note each depth where water was encountered in consolidated formations.

0' - 10' brown silty sand
10' - 13' peat
13' - 15' green clay

I certify that I have constructed the above referenced well in accordance with all well permit requirements and applicable State rules and regulations.

Drilling Company GROUNDWATER & ENVIRONMENTAL SE

Well Driller (Print) William Lovenbegg

ler's Signature

Registration No. Date / /98

COPIES: White - DEP Canary - Driller Pink - Owner Goldenrod - Health Dept.

Groundwater & Environmental Services, Inc.
Monitoring Well Log

Project:	Fort Monmouth	Owner:	U.S. Army - Fort Monmouth		
Location:	North Drive, Eatontown Boro, NJ	Permit Number:	29-39176		
Well Number:	00M3MW10	Total Depth:	15.0'	Diameter:	8"
Casing Elev.:	---	Water Level Initial:	NA	Static:	6.0'
Screen Diam.:	2"	Length:	10.0'	Slot Size:	0.01
Casing Diam.:	2"	Length:	7.5'	Type:	PVC
Drilling Method:	Hollow Stem Auger	Sample Method:	NA		

Completion Details: Above grade, casing height 2.5 feet above grade, with locking well cap.

Driller: GES, Inc. Log By: W. Lovenberg Date: 8/27/98

MW10

Depth	Sample I D	Well Const.	PID (units)	Blow Count	Lithology
+2.5					
+2	NA		NA	NA	
+1					
0					0.0-10.0' Brown Silty SAND.
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					10.0-13.0' PEAT.
11					
12					
13					13.0-15.0' Green CLAY.
14					
15					Monitoring well completed to 15.0'.

THIS FORM MUST BE COMPLETED BY THE PERMITTEE OR HIS OR HER AGENT

GROUND WATER MONITORING WELL CERTIFICATION - FORM B - LOCATION CERTIFICATION

Name of Permittee: UNITED STATES ARMY
Name of Facility: FORT MONMOUTH
Location: Eatontown Borough, Monmouth County, NJ

NJPDES Permit No: NJ

LAND SURVEYOR'S CERTIFICATION

Well Permit Number (As assigned by NJDEPE's Water Allocation Section, 609-292-2957): This number must be permanently affixed to the well casing.		29-39145
Longitude (one tenth of a second):	West	74 ° 03 ' 16 . 8 "
Latitude (one tenth of a second):	North	40 ° 18 ' 46 . 1 "
Elevation of Top of Casing (cap off)		12.02
Distance from Top of Casing (cap off) to ground		2.73
Owner's Well Number (As shown in the application or Plans):		M-3
		MW 11

Benchmark: NJGCS Monument No. 9235
Elevation = 56.69

AUTHENTICATION:

I declare under penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe the submitted information is true, accurate and complete. I am aware that there are significant penalties for submitting false information including the possibility of fine and imprisonment.

Frederick W. Kocen Jr.
Professional Land Surveyor's Signature

Frederick W. Kocen Jr.
Professional Land Surveyor's Name

SEAL

N.J. Lic. #34008
Professional Land Surveyor's License #

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SERIAL # 003317

DWR-133M (10/96)

Mail to

NJDEP
Bureau Water Allocation
426
Trenton, NJ 08625-0426

STATE OF NEW JERSEY
DEPARTMENT OF ENVIRONMENTAL PROTECTION
TRENTON, NJ

MONITORING WELL PERMIT

VALID ONLY AFTER APPROVAL BY THE D.E.P.

11

29J9173 thru 29J9176

Permit No. 29J9176

COORD #: 29 65 .564

Owner U.S. ARMY, FT. MONMOUTH DIRECTOR OF PUBLIC WORKS

Address BLDG. 173, ATTN: SECFM-7W-EW FT. MONMOUTH, N.J.

Name of Facility SITE - M-3

Address NORTH DR. EATONTOWN, FT. MONMOUTH N.J.

Driller Groundwater & Environmental Services, In

Address 1340 Campus Parkway - PO Box 1750 Wall, NJ 07719

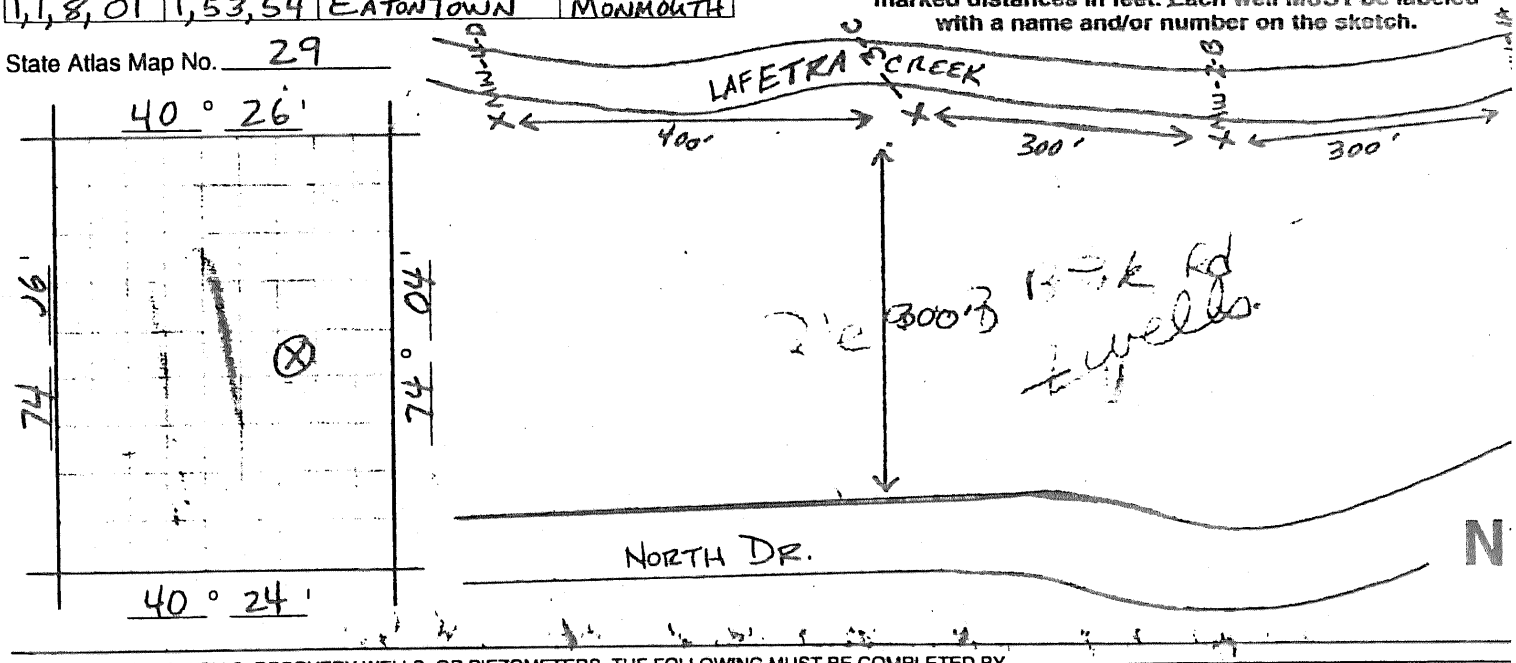
Diameter of Well(s)	2 Inches	Proposed Depth of Well(s)	20 Fe
# of Wells Applied for (max. 10)	4	Will pumping equipment be installed?	YES ☐ NO ☑
Type of Well (see reverse)	MONITOR	If Yes, give pump capacity	N/A cumulative GP

LOCATION OF WELL(S)

Lot #	Block #	Municipality	County
1,1,8,01	1,53,54	EATONTOWN	MONMOUTH

State Atlas Map No. 29

Draw sketch of well(s) nearest roads, buildings, etc. with marked distances in feet. Each well MUST be labeled with a name and/or number on the sketch.



FOR MONITORING WELLS, RECOVERY WELLS, OR PIEZOMETERS, THE FOLLOWING MUST BE COMPLETED BY THE APPLICANT. PLEASE INDICATE WHY THE WELLS ARE BEING INSTALLED:

- ☐ Spill Site
- ☐ ISRA Site
- ☐ CERCLA (Superfund) Site
- ☐ RCRA Site
- ☐ Underground Storage Tank Site
- ☐ Operational Ground Water Permit Site
- ☐ Pretreatment and Residuals Site
- ☐ Water and Hazardous Waste Enforcement Case
- ☐ Water Supply Aquifer Test Observation Well
- ☑ Other (explain) SANITARY LANDFILL

CASE I.D. Number

This Space for Approval Stamp

WELL PERMIT APPROVED
N.J.D.E.P.
AUG 24 1998
BUREAU OF WATER ALLOCATION

FOR D.E.P. USE
☐ Issuance of this permit is subject to the conditions attached. (see next page)
☒ For monitoring purposes only
☐
☒ The well(s) may not be completed with more than 25 feet of total screen or uncased borehole.

SEE REVERSE SIDE FOR IMPORTANT PROVISIONS AND REGULATIONS PERTAINING TO THIS PERMIT.

In compliance with N.J.S.A. 58:4A-14, application is made for a permit to drill a well as described above.

Date 7-24-98 Signature of Driller [signature] Registration No. SP:1610

Signature of Owner Joseph M. Fallon

DWR-138 M
11/96

New Jersey Department of Environmental Protection
Bureau of Water Allocation

MONITORING WELL RECORD

Well Permit No. [illegible] - 39145

Atlas Sheet Coordinates 29 : 03 564

OWNER IDENTIFICATION - Owner U.S. ARMY FT. MONMOUTH
Address BLDG. 173, ATTN:SECFM-TW-EV
City FORT MONMOUTH State NJ Zip Code

WELL LOCATION - If not the same as owner please give address. Owner's Well No. ~~SE~~ OOM3MW11
County MONMOUTH Municipality EATONTOWN BORO Lot No. 1.1.8.01 Block No. 1.53.54
Address SHERRILL AVE.

DATE WELL STARTED 09 / 01 / 98
DATE WELL COMPETED 09 / 01 / 98

TYPE OF WELL (as per Well Permit Categories) MONITORING
Regulatory Program Requiring Well Case I.D.#

CONSULTING FIRM/FIELD SUPERVISOR (if applicable) Tele. #

WELL CONSTRUCTION

Total depth drilled 15 ft.
Well finished to 15 ft.

Borehole diameter:
Top 8 in.
Bottom 8 in.

Well was finished: [X] above grade
[ ] flush mounted

If finished above grade, casing height (stick up) above land surface 2.5 ft.

Is steel protective casing installed? [X] Yes [ ] No

Static water level after drilling 6 ft.

Water level was measured using tape

Well was developed for 1 hours at .75 gpm

Note: Measure all depths from land surface	Depth to Top (ft.)	Depth to Bottom (ft.)	Diameter (inches)	Material	Wgt./Rating (lbs/sch no.)
Single/Inner Casing	+2.5	2	2	PVC	sch 40
Middle Casing (for triple cased wells only)					
Outer Casing (largest diameter)					
Open Hole or Screen (No. Used 1)	2	15	2	PVC	sch 40 .010 slot
Blank Casings (No. Used)					
Tail Piece					
Gravel Pack	4	15	8	#2 sand	500
Grout	0	4.0	8	Neat Cement Bentonite	94 lbs. lbs.

Grouting Method gravity
Drilling Method HSA

Method of development centrifugal pump

Was permanent pumping equipment installed? [ ] Yes [X] No

Pump capacity gpm

Pump type:

Drilling Fluid Type of Rig AMS

Health and Safety Plan submitted? [ ] Yes [ ] No

Level of Protection used on site (circle one) None (D) C B A

I certify that I have constructed the above referenced well in accordance with all well permit requirements and applicable State rules and regulations.

Drilling Company GROUNDWATER & ENVIRONMENTAL SE

Well Driller (Print) William Lovenberg

Driller's Signature

Registration No. [illegible] Date [illegible]/23/98

GEOLOGIC LOG

Note each depth where water was encountered in consolidated formations.

0' - 2' fill material, organic matter
2' - 10' blk m to f sandy clay
10' - 15' gray & green clay sand w s sil

COPIES: *White - DEP* *Canary - Driller* *Pink - Owner* *Goldenrod - Health Dept.*

Groundwater & Environmental Services, Inc.
Monitoring Well Log

Project:	Fort Monmouth	Owner:	U.S. Army - Fort Monmouth		
Location:	Sherrill Ave., Eatontown Boro, NJ	Permit Number:	29-39145		
Well Number:	00M3MW11	Total Depth:	15.0'	Diameter:	8"
Casing Elev.:	---	Water Level Initial:	NA	Static:	6.0'
Screen Diam.:	2"	Length:	13.0'	Slot Size:	0.01
Casing Diam.:	2"	Length:	4.5'	Type:	PVC
Drilling Method:	Hollow Stem Auger	Sample Method:	NA		
Completion Details:	Above grade, casing height 2.5 feet above grade, with locking well cap.				
Driller: GES, Inc.		Log By:	W. Lovenberg	Date:	9/1/98

MW11

Depth	Sample I D	Well Const.	PID (units)	Blow Count	Lithology
+2.5					
+2	NA		NA	NA	
+1					
0					0.0-2.0' Fill Material, Organic Matter.
1					
2					2.0-10.0' Black medium to fine Sandy CLAY.
3					
4					
5					
6					
7					
8					
9					
10					10.0-15.0' Gray-green Clayey SAND, some Silt.
11					
12					
13					
14					
15					Monitoring well completed to 15.0'.

APPENDIX B

DEPARTMENT OF PUBLIC WORKS
STANDARD OPERATING PROCEDURES

CATEGORY: Sample Handling
TITLE: Sample Containers, Preservation and Holding Times

1 PURPOSE: To document the sample containers, preservation and holding times requirements.

2 RESPONSIBILITY: Quality Assurance shall be responsible for maintaining and updating the sample containers, preservation and holding times SOP. These updates will occur annually at a minimum or as the methods' requirements change.

3 REFERENCES: Field Sampling Procedures Manual, May 1992. New Jersey Department of Environmental Protection.

4 SUMMARY: The following table is a summary of the sample containers, method required preservation and holding times of various analytical parameters. The summary will provide information to field sampling personnel and laboratory analysts. Additionally, this summary will aid individuals involved with data validation, quality assurance and sample receiving.

Table 1

Parameter	Container	Preservation	Holding Time*	Method
VOA AQ	2-40 ml septum, G Teflon lined cap	HCL, to pH <2 Cool, 4°C	14 days	624 (4), 8260 (2)
VOA Non-AQ	2 oz wide, G Teflon lined cap	Methanol, Cool, 4°C	14 days	8260 (2)
BNA AQ	1 L amber, G Teflon lined cap	Cool, 4°C	Extraction. 7 days Analysis 40 days	625 (4), 8270 (2)
BNA Non-AQ	4 oz wide, G Teflon lined cap	Cool, 4°C	Extraction. 14 days Analysis 40 days	8270 (2)

Prepared By Jackie Hemer Date 7-15-98

Approved By _____ Date 7-15-98
QA Manager / Laboratory Director

CATEGORY: Sample Handling
TITLE: Sample Containers, Preservation and Holding Times

Parameter	Container	Preservation	Holding Time*	Method
Pest/PCB AQ	1 L amber, G Teflon lined cap	Cool, 4°C	Extraction. 7 days Analysis 40 days	608 (4), 8080 8081/8082 (2)
Pest/PCB Non-AQ	4 oz wide, G Teflon lined cap	Cool, 4°C	Extraction. 7 days Analysis 40 days	8081/8082 (2)
Herbicides AQ	1 L amber, G Teflon lined cap	Cool, 4°C	Extraction. 7 days Analysis 40 days	8151 (2)
TPHC AQ	1 L amber, G Teflon lined cap	Cool, 4°C	Extraction. 7 days Analysis 40 days	OQA-QAM-25
TPHC Non-AQ	4 oz wide, G Teflon lined cap	Cool, 4°C	Extraction. 14 days Analysis 40 days	OQA-QAM-25
Metals AQ Minus Hg, Cr^{+6}	500ml Plastic	HNO_3 to pH <2	6 Months	600 Series(4), SW846 (2)
Metals Non-AQ Minus Hg, Cr^{+6}	4 oz wide, G Teflon lined cap	None	6 Months	SW846 (2)
Hg AQ	500ml Plastic	HNO_3 to pH <2	28 Days	600 Series(4), SW846 (2)
Hg Non-AQ	4 oz wide, G Teflon lined cap	None	28 Days	SW846 (2)
TSS AQ	100 ml Plastic	Cool, 4°C	7 Days	160.2 (1)
TS AQ	100 ml Plastic	Cool, 4°C	7 Days	160.3 (1)
DO AQ	300 ml BOD bottle	Fix on Site Store in Dark	8 Hours	405.1 (1)
COD AQ	100 ml Plastic	Cool, 4°C H_2SO_4 to pH <2	28 Days	410.4 (1)
BOD_5 AQ	1 L Plastic	Cool, 4°C	48 Hours	5210B (5)
pH AQ	25 ml Plastic or Glass	None	Immediately	9040 (2) 150.1 (1)
pH Non-AQ	4 oz wide, G Teflon lined cap	None	Immediately	9045 (2)

*Holding time begins at time of sample collection.

CATEGORY: Sample Handling
TITLE: Sample Containers, Preservation and Holding Times

Parameter	Container	Preservation	Holding Time*	Method
Total Organic Carbon (TOC) AQ	Glass Teflon lined cap	Cool, 4°C H_2SO_4 to pH <2	28 Days	415.1 (1)
Total Organic Carbon (TOC) Non AQ	4 oz Glass Teflon lined cap	Cool, 4°C	28 Days	9060 (2)
Ammonia AQ	1 L Plastic	Cool, 4°C H_2SO_4 to pH <2	28 Days	350.3 (1)
Chemical Oxygen Demand (COD) AQ	1 L Glass	Cool, 4°C H_2SO_4 to pH <2	28 Days	410.2 (1)
Cyanide, Total AQ	1 L Plastic	Cool, 4°C NaOH to pH>12	14 Days	335.2 (1)
Cyanide, Total Non-AQ	4 oz Glass Teflon lined cap	Cool, 4°C	14 Days	9010 (2)
Hardness as $CaCO_3$ AQ	100 ml Plastic	HNO_3 to pH<2	6 Months	130.2 (1)
Kjeldahl, Total AQ	1 //l Plastic	Cool, 4°C H_2SO_4 to pH <2	28 Days	351.3 (1)
Nitrate/Nitrite AQ	100 ml Plastic	Cool, 4°C H_2SO_4 to pH <2	28 Days	353.3 (1)
Nitrate AQ	100 ml Plastic	Cool, 4°C	48 Hours	352.1 (1)
Nitrite AQ	100 ml Plastic	Cool, 4°C	48 Hours	354.1 (1)
Phenolics AQ	1 L Amber	Cool, 4°C H_2SO_4 to pH <2	28 Days	420.1 (1)
Phosphorus, Total AQ	100 ml Plastic	Cool, 4°C H_2SO_4 to pH <2	28 Days	365.2 (1)
Sulfate AQ	100 ml Plastic	Cool, 4°C	28 Days	375.4 (1)
Specific Conductivity AQ	100 ml Plastic	Cool, 4°C	28 Days	120.1 (1)
Turbidity AQ	500 ml Plastic	Cool, 4°C	48 Hours	180.1 (1)
Surfactants, MBAS AQ	500 ml Plastic	Cool, 4°C	48 Hours	425.1 (1)

*Holding time begins at time of sample collection.

CATEGORY: Sample Handling
TITLE: Sample Containers, Preservation and Holding Times

Parameter	Container	Preservation	Holding Time*	Method
Ignitability	P, G	None	NA	1010 (2)
Reactivity - (HCN)	P, G	Cool, 4°C	14 Days	7.3.3 (2)
Reactivity- (H_2S)	P, G	Cool, 4°C	7 Days	7.3.4 (2)
Paint Filter Test	P, G	None	NA	9095 (2)

*Holding time begins at time of sample collection.

(1)-"Methods of Chemical Analysis of Water and Wastes", Environmental Monitoring and Support Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, March 1983, EPA-600 4-79-020.

(2)-"Test Methods for Evaluating Solid Waste", Physical/Chemical Methods, SW-846, 3rd Edition.

(3)-Code of Federal Regulations, Title 40, Part 136.

(4)-"Methods for the Determination of Organic Compounds in Drinking Water", EPA-600/4-88/039, EMSL, USEPA, Cincinnati, OH 45268.

(5)-"Standard Methods for Water and Wastewater", 16th Edition.

CATEGORY: Sample Handling
TITLE: Sample Receiving, Log-In and Disposal

1 PURPOSE: To document the procedure for the handling of coolers, logging in samples and disposal within the laboratory.

2 RESPONSIBILITY: Designated laboratory or administrative personnel who have been properly instructed and trained in the log-in procedure shall be responsible for checking in samples.

3 REFERENCE: Standard Methods for the Examination of Water and Wastewater, 18th Ed., 1989.

4 SUMMARY:

4.1 Using the Master Logbook, assign the next consecutive number as the FMETL project number for the samples.

4.1.1 Open the cooler and immediately check and record the cooler temperature by measuring the temperature of the cooler blank (bottle of water transported with samples).

4.1.2 Record the cooler temperature on the SAMPLE RECEIPT FORM, (Attachment 1).

4.1.3 Inspect the cooler contents by completing the top section of the SAMPLE RECEIPT FORM - Preliminary Examination Phase.

4.1.3.1 Remove samples and verify against the chain of custody to insure documentation accuracy and completeness.

4.1.3.2 Verify field identification numbers against the CHAIN OF CUSTODY FORM, (Attachment 2).

4.1.3.3 Assign each individual sample an FMETL ID # which is designated by the project number with a hyphenated suffix beginning with -1, and increasing consecutively for each sample in the project.

4.2 Inspect the samples for breakage, preservation, and overall condition by completing the center portion of the SAMPLE RECEIPT FORM - Log-In Phase.

Prepared By Jackie Heimer Date 8/4/98

Approved By [signature] Date 8/4/98
QA Manager / Laboratory Director

4.2.1 Any individual sample that requires acidic or basic preservation methods, determine its pH using pH paper.
4.2.2 Record the sample ID# and pH on the SAMPLE RECEIPT FORM.

4.3 In the event of any discrepancies with either the coolers or the samples, complete the laboratory corrective action memo in the lower section of the SAMPLE RECEIPT FORM.
4.3.1 Reference any discrepancies and document the corrective action taken (e.g. pH adjustment or re-attaching loose label).
4.3.2 Where corrective action requires notifying appropriate persons of the problem (e.g. for incorrect sample volumes or broken bottles that would require resampling), contact client or appropriate person immediately to resolve any discrepancies. Record the time and date of the notification on the lower section of the SAMPLE RECEIPT FORM and initiate a Corrective Action Report.

4.4 Record the required information on the CHAIN OF CUSTODY FORM:
4.4.1 Lab Sample ID#.
4.4.2 Date received and time received.
4.4.3 Project information (e.g. number of samples received, type of analyses).

4.5 Information on all samples received will then be entered into a bound logbook. This logbook will be of ledger type with columns and numbered pages. Each sample logbook will be sequentially numbered and on the outside cover, the starting date and sample numbers will be indicated. All entries will be made using a ballpoint pen with permanent ink. All errors will be crossed out with a single line and initialed. The following will be entered into the logbook:
4.5.1 Sample ID#
4.5.2 Location
4.5.3 Sample Date/Time
4.5.4 Matrix
4.5.5 Sampler
4.5.6 Analysis
4.5.7 Comments

4.6 A job folder will then be created. The job folder will be kept, sequentially, in a designated filing cabinet. The folder will contain the original chain of custody, sample receipt form and any field notes or maps. Data will be inserted into the folder, as it becomes available.

4.7 Deliver the logged-in samples to the proper storage areas (designated refrigerators). Proper storage of all samples prior to preparation and analysis is critical to the determination of accurate and high quality analytical results. Samples that are not properly stored may suffer degradation, volatilization, or reaction.

Refrigerator #	Samples
1	Volatiles
2	Semivolatiles
3	Extractions
4	Sample Receipt
5	Extracts
6	Metals/Wet Chemistry

4.8 Store samples that may easily be contaminated by other samples (such as drinking water samples) in a refrigerator separate from one where more highly contaminated samples are stored.

4.8.1 Monitor the temperatures of storage refrigerators daily to ensure sample integrity (see OQC-0303).

4.9 Deliver a copy of the CHAIN OF CUSTODY FORM to the various departments to notify analysts of the presence of the samples.

4.10 Each analysis has specified limits on Holding Times (see SAM-0200).

4.10.1 For samples received within 72 hours of sampling or before one-half of the holding time period is expired (whichever is less), the analyst will initiate sample preparation and/or analysis within the prescribed holding times.

4.10.2 For samples arriving after this, the client will immediately be informed of the status of the sample and told whether preparation and/or analysis can still be performed within established holding times. If preparation or analysis within the designated holding times is impossible, the client will be contacted for further instructions.

4.11 Due to limited refrigerator space, samples will be removed after a 90-day period or when analysis is complete.

4.11.1 Soil samples are emptied and returned to the site location.

4.11.2 Unpreserved aqueous samples are returned to their effluent discharge.

4.11.3 Preserved aqueous samples are disposed of into a 55-gallon acid/aqueous drum.

4.12 All waste materials classified as hazardous are managed in accordance with the Fort Monmouth Hazardous Waste Management Plan.

CATEGORY: Sample Handling
TITLE: Sample Receiving, Log-In and Disposal

Attachment 1

SAMPLE RECEIPT FORM

Date Received: _____ Lab Project ID#: _____

Site/Project Name: _____ Cooler Temp (d. C): _____

Received By: _____ Sign: _____
(print name)

Circle the appropriate answer

1. Did the samples come in a cooler? yes no
2. Were the chain of custody papers filled out correctly and legibly? yes no
3. Did you sign the chain of custody in the appropriate place? yes no
4. Did all the labels agree with the chain of custody and in good condition? yes no
5. Were the correct containers and/or preservatives used for the tests indicated? yes no
6. Was a sufficient amount of sample sent for the tests indicated? yes no
7. Were bubbles absent from aqueous VOC sample containers? yes no

Fill out the following table for each sample bottle

Sample ID	pH	Preservative	Sample ID	pH	Preservative

Comments: _____

CATEGORY: Sample Handling
TITLE: Sample Receiving, Log-In and Disposal

Attachment 2

CHAIN OF CUSTODY FORM

Fort Monmouth Environmental Testing Laboratory

Bldg. 173, SELFM-PW-EV, Fort Monmouth, NJ 07703
Tel (732)532-4359 Fax (732)532-3484 EMail:appleby@doim6.monmouth.army.mil
NJDEP Certification #13461

Chain of Custody Record

Customer:	Project No:	Analysis Parameters	**Comments:**
Phone #:	Location:		
( )DERA ( )OMA ( )Other:_____			

Samplers Name / Company :

Lab Sample I.D.	Sample Location	Date	Time	Sample Type	# bottles									Remarks / Preservation Method

Relinquished by (signature):	Date/Time:	Received by (signature):	Relinquished by (signature):	Date/Time:	Received by (signature):
Relinquished by (signature):	Date/Time:	Received by (signature):	Relinquished by (signature):	Date/Time:	Received by (signature):

Report Type: ()Full, ()Reduced, ()Standard, ()Screen / non-certified
Turnaround time: ()Standard 4 wks, ()Rush ____ Days, ()ASAP Verbal ____ Hrs.

Remarks:

STANDARD OPERATING PROCEDURE

CATEGORY: Sample Handling
TITLE: Field Sampling

1 PURPOSE: To document the current procedures for sample collection.

2 RESPONSIBILITY: Designated field samplers who have been properly instructed and trained in field sampling protocol and techniques.

3 REFERENCES: Field Sampling Procedures Manual, May 1992. New Jersey Department of Environmental Protection.

4 SUMMARY: This SOP represents all general field sampling requirements as required by the NJDEP. It specifically addresses the proper use of protective equipment, collection of QA/QC samples, field decontamination procedures, proper documentation of all field activities, collection of samples into proper containers with the proper preservation and the techniques for collecting each type of sample.

4.1 Employees must use personal protective equipment (PPE) for adequate protection and to limit the level of exposure on site. The equipment selected must be appropriate to protect against all known and potential hazards. All field personnel are required to be familiar with the potential hazards that may be encountered on site prior to entry.

4.2 As a minimum, all field personnel are required to have work boots (steel toe construction), safety glasses or goggles, hard hat and gloves available for all sampling activities). Standard latex surgical gloves will be worn at all times when samples are collected or handled.

4.3 Proper documentation of all site activities is crucial. Documentation must be maintained to trace the possession and handling of samples from the time of collection, through analysis and disposal.

4.4 Every field sampler (team) is required to maintain a bound field-sampling logbook with permanently numbered pages. All field activities and notes will be documented in this book. Notations should be made in logbook fashion, noting the time and date of all entries. Information recorded in the logbook will include: name and location of site investigation, date and time of arrival and departure, persons contacted, weather conditions, samples taken, method and time of collection and depths if required.

Prepared By	Jackie Hemes	Date	7-2-98
Approved By	QA Manager / Laboratory Director	Date	7-15-98

Field instrument calibrations are kept in separate books.

4.5 Sample containers should be pre-labeled before sample collection. Sample labels should include the following: well or sample number, parameters, preservatives, date and time of sample collection, sampler's initials and site name/location.

4.6 A chain of custody (COC) form must be completed in the field and accompany each set of samples collected. The COC is a legal record of possession of the samples and of request for analysis. It bears the name of the person assuming responsibility of the sample. A copy of a chain of custody is enclosed for reference (Appendix 1).

4.7 Due to the variety of sampling techniques, it is impractical to summarize then in this document. It is therefore required that each field technician read and review the May 1992 NJDEP Field Sampling Guidebook for the required techniques.

4.8 The QA/QC samples are intended to provide control over the collection of environmental measurements and subsequent validation, review and interpretation of generated analytical data.

4.8.1 The trip blank is used exclusively for volatile organic analysis, (aqueous sampling only) and its purpose is to measure possible cross contamination of samples during shipping to and from the site. The trip blank is never opened and travels to the site with the empty sample bottles and back from the site with the collected samples. Contaminated trip blanks may also indicate bottle cleaning or blank water of questionable quality. Trip blanks must be included at the rate of one per sample shipment (not to exceed two consecutive field days).

4.8.2 The purpose of a field blank is to place a mechanism of control on sample equipment handling, preparation, storage and shipment. The field blank travels and is stored with the sample bottles. It is a representative of bottle shipment effects on sample quality. Field blanks are collected in the following manner. Two identical sets of bottles are prepared. One set is filled with laboratory demonstrated analyte free water (same water used for trip and method blanks). All of the filled bottles are shipped with the other empty sample containers. At the field location, in an area where contamination is suspected, the water is passed from the full set of like-bottles through the dedicated or field decontaminated sampling device and into the empty set of like-bottles. Field blanks are to be preserved identically to samples receiving the same analyses. Field blanks are collected and analyzed for all of the same parameters as the samples collected that day.

4.8.3 Duplicate samples may be required on a contract or site specific basis. For aqueous samples, duplicates are taken by alternating filling containers from the same sampling device for each of the required parameters. For non-aqueous matrices, obtaining duplicates requires homogenization of the

sample aliquot prior to filling sample containers. Regardless, volatile organic samples must always be taken from discrete locations or intervals without compositing or mixing.

4.9 Samples shall be properly preserved and the correct size, shape and color containers shall be used at all times. Guidelines for sample containers and preservation can be found in SOP SAM-0200.

4.10 Decontamination Procedures for Field Sampling Equipment

4.10.1 Aqueous Sampling

4.10.1.1 Detergent plus tap water wash
4.10.1.2 Generous tap water rinse
4.10.1.3 DI water rinse
4.10.1.4 Nitric acid rinse (if sampling for metals)
4.10.1.5 DI water rinse
4.10.1.6 Acetone rinse (if sampling for organic parameters)
4.10.1.7 Total air dry
4.10.1.8 DI water rinse

4.10.2 Non-Aqueous sampling

4.10.2.1 Detergent plus tap water wash
4.10.2.2 Generous tap water rinse
4.10.2.3 DI water rinse

CATEGORY: Sample Handling
TITLE: Field Sampling

Attachment 1

CHAIN OF CUSTODY

Fort Monmouth Environmental Testing Laboratory

Bldg. 173, SELFM-PW-EV, Fort Monmouth, NJ 07703
Tel (732)532-4359 Fax (732)532-3484 EMail:appleby@doim6.monmouth.army.mil
NJDEP Certification #13461

Chain of Custody Recor

Customer:	Project No:	Analysis Parameters	Comments:
Phone #:	Location:		
( )DERA ( )OMA ( )Other:_____			

Samplers Name / Company :

Lab Sample I.D.	Sample Location	Date	Time	Sample Type	# bottles									Remarks / Preservation Metho

Relinquished by (signature):	Date/Time:	Received by (signature):	Relinquished by (signature):	Date/Time:	Received by (signature):
Relinquished by (signature):	Date/Time:	Received by (signature):	Relinquished by (signature):	Date/Time:	Received by (signature):

Report Type: ( )Full, ( )Reduced, ( )Standard, ( )Screen / non-certified
Turnaround time: ( )Standard 4 wks, ( )Rush ____ Days, ( )ASAP Verbal ____ Hrs.

Remarks:

STANDARD OPERATING PROCEDURE

SOP No.: SAM-0205
Revision No.: 1
Date Revised: 8/9/99

CATEGORY: Sample Handling
TITLE: Monitor Well Sampling for IRP Sites at Fort Monmouth

1 PURPOSE:

To document current procedures for monitoring well sampling.

2 RESPONSIBILITY:

Designated field samplers who have been properly trained and instructed in NJDEP field sampling procedures and protocol.

3 REFERENCES:

3.1 Field Sampling Procedures Manual, May 1992 (most current). New Jersey Department of Environmental Protection and Energy.

3.2 Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities developed by NIOSH, OSHA, USCG, EPA. Oct. 1985

3.3 NJDEP Field Analysis Manual, July 1994.

3.4 On the World Wide Web: www.state.nj.us/dep or www.state.nj.us/dep/srp.

3.5 Lab SOP: SAM-0200, SAM-0202, OQC-0302

4 SUMMARY:

The procedures, materials, and equipment describe the recommended methods for sampling monitoring wells. Necessary equipment, calibrations, calculations and appropriate QA/QC procedures are also included. These procedures are to be followed by all personnel involved with the sampling and purging of wells at Fort Monmouth. Persons following this SOP are recommended to also refer to the NJDEP Field Sampling Procedures Manual.

Prepared By R. Wright Date 8-11-99

Approved By Jackie Herman Date 8/11/99
QA Manager / Laboratory Director

5 EQUIPMENT AND MATERIALS:

5.1 Equipment

5.1.1 Dissolved oxygen meter
5.1.2 HNU photo ionizer
5.1.3 Conductivity/pH/temp meter
5.1.4 Peristaltic well pumps
5.1.5 Pump heads and power cables
5.1.6 Water level meter
5.1.7 Oil/water interface probe
5.1.8 Submersible well pumps
5.1.9 Various batteries
5.1.10 Buckets
5.1.11 Miscellaneous tools, i.e. screwdriver, well wrench, etc.

5.2 Materials:

5.2.1 Thick wall silicone tubing ¼ inch diameter,
5.2.2 Polyethylene (food grade) tubing ¼ inch diameter,
5.2.3 12 inch single sample 1 check stop teflon disposable bailers,
5.2.4 Mason string.

6 STANDARDS/REAGENTS:

6.1 Buffer solutions, calibration gases, decontamination materials, and acids for preservation.

6.1.1 Buffer solutions:

6.1.1.1 7.00 standard buffer solution
6.1.1.2 10.00 standard buffer solution
6.1.1.3 4.00 standard buffer solution
6.1.1.4 Distilled and deionized water
6.1.1.5 Alconox
6.1.1.6 10 % nitric acid rinse (trace metal or higher grade HNO3 diluted with distilled/deionized (ATSM Type II) H2O)
6.1.1.7 Acetone (pesticide grade)
6.1.1.8 Pure nitrogen 100 ppm Isobutylene cal gas.

6.1.2 Acids/materials used in preserving samples:

6.1.2.1 Nitric acid 69, 0-70.0%
6.1.2.2 Sulfuric acid 50% (w/w) solution
6.1.2.3 Hydrochloric acid (trace metal grade)
6.1.2.4 Ice for keeping samples at <4 degrees celcius.

Refer to NJDEP Field Sampling Procedure Manual Table 2-1 Aqueous Sampling Equipment Decontamination (Lab and Field).

7 CALIBRATION:

All instruments used for field readings are calibrated before each day of use. The use of pH meters must start out with a calibration using buffer solution standards to check or calibrate accuracy. HNU's are calibrated with a known calibration gas. Dissolved oxygen meters are checked against a winkler method test weekly. All calibrations for a given day's use are recorded in the log provided for each instrument. Refer to equipment directions for calibration instruction. Likewise, specific conductivity meters are checked against standards regularly. Cooler thermometers are calibrated against an NIST traceable thermometer annually.

8 PROCEDURE:

The following articles document the procedures for sampling monitor wells. They are to be used as a guide, by trained personnel, in conjunction with the NJDEP Field Sampling Procedures Manual.

8.1.1 Preparation: It should be noted that before going out into the field, certain preparations must be made. This includes the selection of PPE, safety plans, proper bottle acquisition for analytes being tested, site entry, map information, and equipment.

8.1.2 Selection of PPE: For adequate protection and prevention of contaminant exposure to workers at hazardous waste sites in all phases of work, PPE is properly used and supplied. Determination of PPE will be outlined in a Health and Safety Plan, and also by preliminary site investigations. Refer to NJDEP Field Sampling Procedures Manual, and the Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities.

8.1.3 Health and Safety Plans: These plans are developed to encompass all the aspects of site operations. Plans are available to personnel associated with site sampling and a copy is kept on file at the site (in this case, the laboratory). At a minimum, the plan includes all portions of Site Remediation Program's (SRP) Site Safety and Health Standard Operating Procedures deemed appropriate for site, detailed site description, emergency phone numbers, a map and directions to nearest hospital identified on the map, and all PPE needed.

8.1.4 Proper bottle selection: Please refer to QA/QC section 10.1.

8.1.5 Equipment: Please refer to Equipment section 5.

8.1.6 Before purge activities: Certain instruments and meters are calibrated before use. Also, certain measurements and calculations are obtained before any purge activities take place. The following is a list of information/data/steps required prior to the commencement of purge activities. Pertinent information is recorded in log books or on well sheets.

8.1.7 Date, time and weather conditions: Date and time are needed for holding time purposes and general record keeping. Weather conditions may affect ambient conditions at a particular site, therefore said information is recorded. Tidal influences may also be included here, if wells are in a tidal area.

8.1.8 Well number and permit number: These are prominently displayed on the outside of each well in accordance with NJDEP regulations for well construction.

8.1.9 Meter and instrument calibrations: Meters utilized in the course of site sampling activities are calibrated at this time, and the findings recorded in the appropriate logbook. Refer to section 7 for instrument/meter calibration directions.

8.1.10 PID or FID, HNU reading: This is taken from the well inner casing immediately after the cap is removed, findings are recorded.

8.1.11 Free product check: Using ORS meter for interfaces, the presence or absence of free product is determined. Thickness is measured and recorded.

8.1.11.1 Light Non-Aqueous Phase Liquids (LNAPLs) and Dense Non-Aqueous Phase Liquids (DNAPLs): Measurement of thickness for DNAPLs and LNAPLs are performed prior to well purging. An interface probe is used (ORS meter) for this task. If present, LNAPLs are sampled and analyzed for chemical and physical parameters. Sampling is conducted by using a bottom filling bailer which is lowered into the LNAPL layer. DNAPLs are sampled using a dual check valve bailer. If present, DNAPLs are also tested for chemical and physical properties.

8.1.12 Dissolved oxygen, pH, temperature, and specific conductivity: Readings are obtained and recorded on well sheets.

8.1.13 Total depth of well and depth to water: These readings are taken using a depth meter. Total depth of well, depth to water, and depth to screen are measured from the top of the inner casing or surveyors mark. All data is recorded on well sheet.

8.1.14 Calculations: Calculations are made as stated in section 9.

8.2 Purging: When pre-purge activities are complete, the purging of a well can begin. This includes pre-entry to the well and pump setup.

8.2.1 Pre-entry to well: Before tubing (refer to materials section) is inserted into a well, it is wiped down and rinsed with DI water. The tubing is then inserted into the well to a maximum depth of six feet below the water table. During purge activities, the depth of the tubing may be adjusted to prevent the static water level from dropping below the end of the tubing.

8.2.2 Pump setup: Once the battery powered peristaltic pump is set up, purging can begin. Evacuation rates never exceed that of well development, and total volume purged never exceeds 5 times the amount of standing water. Purge water management practices are described in section 10.1.8.

8.3 After Purge: When purging is complete, the pump is removed and tubing is disposed of properly. Data referenced in section 8.3.2 is then taken and recorded.

8.3.1 Pump removal: Tubing is removed from the bottom end while the pump is still running. Tubing is then disposed of. The pump is shut down and decontaminated for its next application.

8.3.2 The following data is recorded on the well sheet: Start and end time of purge, purge method, purge rate, total volume purged, dissolved oxygen, pH, temperature, and specific conductivity readings.

8.4 Field Blank Sample: At this time the field blank sample is collected. A new bailer is opened from its sealed package and field blank water is run over the bailer or sample equipment and collected into the proper sample containers.

8.5 Ground water sampling: Following well evacuation procedures, ground water sampling can begin. In most cases, sampling takes place immediately following purge activities. However, due to certain field conditions, well sampling may be postponed for a period not to exceed 2 hours following completion of purge activities. When multiple wells are being sampled, the least contaminated well is sampled first. Subsequent wells are sampled in order of ascending contamination. Sampling is conducted by using a bottom filling teflon bailer, dedicated to each particular monitoring well. The bailer is lowered slowly into water column until submerged, and then slowly retrieved. The sample is then carefully transferred to the appropriate sample containers. Ground water collected in the first bailing sequence is always used for sampling purposes, it is never discarded.

8.6 Sample order: Samples are collected in the following order:

- 8.6.1 volatile organics (VOA)
- 8.6.2 purgeable organic carbons (POC)
- 8.6.3 purgeable organic halogens (POX)
- 8.6.4 total organic halogens (TOX)
- 8.6.5 total organic carbon (TOC)
- 8.6.6 base neutrals/acid extractables
- 8.6.7 TPHC/oil and grease
- 8.6.8 PCB's/pesticides
- 8.6.9 total metals
- 8.6.10 dissolved metals
- 8.6.11 phenols, cyanide
- 8.6.12 sulfate and chloride
- 8.6.13 turbidity
- 8.6.14 nitrate and ammonia,
- 8.6.15 preserved inorganics
- 8.6.16 radionuclides
- 8.6.17 non-preserved inorganics
- 8.6.18 bacteria

8.7 Dupes and matrix spikes/matrix spike duplicates: These samples are taken in same order at same time. Refer to section 10.2.1.2.

8.8 After sampling: The following data is recorded on well sheets: Start and end time of sampling, dissolved oxygen, pH, temperature, specific conductivity, and sampling method.

9 CALCULATIONS:

Four calculations are made while in the field. The calculations are as follows: linear feet of water (height of water), the volume to be purged, the volume purged not to be exceeded, and purge rate.

9.1 Linear feet of water: This is calculated by knowing the total depth of a well and subtracting the depth to water as measured by a depth meter. These two numbers are measured to within .01 feet. Through this calculation, the linear feet of water is determined.

Equation: (Total well depth – Depth to water = linear feet of water)

9.2 Volume to be purged and volume not to be exceeded: The second calculation is to determine the minimum volume to be purged from a well before sampling. Utilizing the linear feet of water and then multiplying it by the volume per foot for the proper diameter casing (see Figure 1 below) equals the amount of water in casing. Multiplying the amount of water within a casing by 3 equals the minimum volume to be purged. It should be noted that the amount purged should not exceed 5x the amount of standing water in a well.

Equation:
linear feet of water x volume per ft for well diameter = amount of water in casing)
then,
(amount of water in casing x 3 = minimum volume to be purged)

Equation:
(amount of water in casing x 5 = total volume not to be exceeded)

Figure 1: Capacity of Common Casing Diameters
(Pp. 170 in NJDEP FSPM)

Casing Diameter (ft.)	Gallons/linear foot
2 inch (0.1667)	0.1632
4 inch (0.3333)	0.6528
6 inch (0.5000)	1.4688
8 inch (0.6667)	2.6112
10 inch (0.8333)	4.0800
12 inch (1.0000)	5.8752

9.3 Purge rate: The purge rate is determined by calculating the length of time it takes for a pump to fill a 1 gallon bucket with water. The time is then multiplied by the minimum volume to be purged. The gallons being purged is then divided by this number (which also happens to be the length of time the purge will take in minutes) which equals the gallons per minute or purge rate.

Equation:
(time x minimum volume to be purged = length of purge in minutes)
then,
(minimum volume to be purged / length of purge in minutes = gallons per minute or the purge rate)

10 QUALITY CONTROL:

The following QA/QC requirements are established in order to maintain sample integrity. The prime objective is to prevent sample contamination from other sources and ensure potential contaminant concentrations remain stable from sample collection to complete analysis. Refer to the NJDEP Field Sampling Procedures Manual Appendix 2-1 Analytical Methodology Reference Charts, Pp. 24-74. Also refer to SAM-0200 Sample Containers, Preservation and Holding Times.

10.1 Sample Containers: Before sample collection can begin consideration must be given as to what type container will be used to transport and store samples. The lab provides containers based upon requested methodologies. Selection is based on the matrix, potential contaminants, analytical methods, and the laboratory's internal QA/QC requirements. They are selected upon review of the following:

10.1.1 Reactivity of container material with sample. Glass is recommended for hazardous material samples since it is chemically inert to most substances. Plastics may be used when analytes of interest or sample characteristics dictate use instead of glass.

10.1.2 Volume of the container. The volume of sample needed is dictated by the analytical method and the sample matrix. The laboratory supplies bottles that allow for sufficient volumes of sample matrix to be collected.

10.1.3 Color of container. Whenever possible, amber glass is used to prevent photodegradation. If not available, samples are protected from light. One exception is the use of 40 ml clear glass vials which are used for VOA/aqueous analysis.

10.1.4 Container closures. All containers utilized have a leak-proof seal and are constructed out of inert material with respect to sampled materials. The closure may also be separated by a closure liner that is inert to sample material.

10.1.5 Decontamination of containers and chain of custody. Sample containers are laboratory cleaned or purchased as lab cleaned. Bottles being shipped are accompanied by a chain of custody in a cooler with a custody seal. Custody always accompanies containers to the field, during collection, back to lab, and during analysis. This helps to assure no tampering or contamination from outside sources occurs.

10.1.6 Storage and transport. Care is taken to avoid contamination. Clean transport and storage environments are observed. Sample or bottle storage is never near solvents, gasoline, or other equipment that is a potential source of contamination. Samples and chain of custody are secured in coolers or transport, with said chain of custody in with bottles or in the possession of authorized personnel. Also, a temperature blank is included in each cooler to measure temperature of samples on ice (ideally a constant 4 degrees Celsius).

10.1.7 Tubing decontamination: ASTM drinking water grade polyethylene tubing is used and discarded after each use. Care is taken to prevent the pump and tubing from coming into contact with the ground surface. Prior to well purging, all tubing is rinsed/wiped with distilled and deionized water to remove any possible residual materials which may be present.

10.1.8 Disposal of development, purge, pump test, and decon waters: To determine whether waste waters are contaminated, field instrument readings and previous analytical data is used to characterize it. Water not considered contaminated is re-applied directly to ground surface and permitted to percolate back to the water table. Care is taken to avoid nuisance situations where a discharge may cause undue concern. When water is considered contaminated, the water generated is reapplied only if the following conditions are met: ground water is not permitted to migrate offsite, no potential exists for contaminating a previously uncontaminated aquifer, discharge will not cause an increase to ground surface soil contamination. If these conditions are met, the water is re-applied to the ground surface. If these conditions aren't met, than water

is collected, containerized and secured in a single locale. Subsequently, the water is properly characterized and processed for offsite disposal.

10.2 QA/QC samples: These samples are intended to provide control over the collection of environmental measurements and subsequent validation, review, and interpretation of analytical data. Trip blanks are used exclusively for volatile organic analysis, (aqueous sampling only) and their purpose is to measure possible cross contamination of samples during shipment to and from a site. Trip blanks are never opened and travel to a site with the empty sample bottles and back from a site with the collected samples. Contaminated trip blanks may indicate bottle cleaning or blank water of questionable quality. Trip blanks are collected at the rate of one per day. Likewise, the purpose of a field blank is to place a mechanism of control on sample equipment handling, preparation, storage and shipment. Field blanks travel and are stored with the sample bottles. Field blanks are collected in the following manner. Two identical sets of bottles are prepared. One set is filled with laboratory demonstrated analyte free water (same water used for trip and method blanks). All of the filled bottles are shipped with the other empty sample containers. At the field location, in an area where contamination is suspected, the water is passed from the full set of like-bottles through the dedicated or field decontaminated sampling device and into the empty set of like-bottles. Field blanks are preserved identically to samples receiving the same analyses. Field blanks are collected and analyzed for all of the same parameters as the samples collected that day.

10.2.1 Additional QA/QC samples:

10.2.1.1 Duplicate samples: Collection of a dupe provides for evaluation of laboratory performance by comparing the analytical data of two samples from the same location. They are included 1 for every 20 samples (5% or 1 a day/site) and submitted as blind samples. They are obtained by alternately filling sample bottles from the same source/device for each parameter. VOA samples are same bailer and first set filled.

10.2.1.2 Matrix spike/Matrix spike duplicate analyses or MS/MSDS sample: The laboratory is supplied with triple volume in order to perform matrix spike and matrix spike dupes. This does not include trips or field blanks. Additional sample volume for MS/MSDS is taken within every set of 20 field samples.

Install and Survey Monitoring Wells

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Install and Survey Monitoring Wells

STATEMENT OF WORK

1. SCOPE OF WORK. The work to be performed under this contract is to establish terms upon which the contractor shall install and survey environmental monitoring wells as well as complete NJDEP and Directorate of Public Works requirements as specified in this document.

2. LOCATION OF WORK. The work is located at various facilities throughout Fort Monmouth and its outlying Sub-Posts. Fort Monmouth is located in Monmouth County, New Jersey.

3. The Government will consider and evaluate all bids based on the "Best Value" concept: Technical, Management, and Costs. A Matrix evaluation system will be used by the contracting officer and a technical representative from the Directorate of Public Works (DPW) to award this contract. All bids shall include a proposal which will be used for this purpose. The contractor shall provide costs for FY99 as well as option year costs for FY00.

4. The Government reserves the right to cancel any day of scheduled activity by notifying the contractor prior to noon the prior work day. The contractor shall provide the Government with the name and phone number of the person to be contacted for cancellation otherwise the company will be called at the general phone number.

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SECTION 01100

GENERAL REQUIREMENTS

1. GENERAL.

1.1 The following specification is for the installation and surveying of monitoring wells on Fort Monmouth, NJ and its sub posts.

1.1.1 All work shall be accomplished by mechanics skilled in the trades involved. Existing work which is damaged or disturbed by the Contractor's operations, shall be restored to its original condition by the Contractor at no extra cost to the Government.

1.2 The work to be performed includes but is not limited to the following:

1.2.1 Installing 4 inch diameter monitoring wells in accordance with NJDEP requirements. The wells may be flush mounted or stick-up. Flush mounted monitoring wells will only be permitted in areas paved or concreted and the Contracting Officer approves of the flush mounted system. In all other cases, the wells will be stick-up.

1.2.2 Wells will be surveyed by a New Jersey licensed surveyor.

1.3 The Contractor's on site employees shall provide proof that they each have had a minimum of 40 hours training (as per 29 CFR 1910-120) for each worker and 8 hours of additional supervisory training for each site supervisor as mandated by the Occupational Safety & Health Administration (OSHA) 29 CFR 1910-120. Evidence of such training shall be provided to the Contracting Officer's Representative after award of the contract and before work commences on contract start date. The contractor will prepare a Site Specific Health and Safety Plan (HSP) as described in (OSHA) 29 CFR 1910-120, for each work. All pertinent information shall be available on site with the HSP once work commences. In the event of change in contractor personnel or updating existing documentation, the information shall be submitted to the COR within 2 weeks of any regulated activity by the affected contractor personnel.

1.4 During the period of this contract, other contractors may be working on, or adjacent to the site of work under this contract. Members of the US Armed Forces may be performing work or occupying facilities on or adjacent to the area. Also the Contractor shall arrange, schedule, and perform this work so as to effectively cooperate with all other contractors and Government agencies.

1.5 Coordination Between Contractors. It shall be the responsibility of the prime contractor to be fully informed of the extent of the limits of work to be performed by the other prime contractors. Should there be any conflict between these limits, it shall be brought to the attention of the Contracting Officer and the Contracting Officer's decision shall be final.

1.6 A Pre-Construction Conference shall be conducted. Prior to commencing work, the Contractor shall meet with the Contracting Officer or his designated representative, and the DPW Facilities Management Specialist (FMS) to discuss and develop mutual understandings relative to scheduling and administration of work.

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1.6.1 Items to be covered at the Pre-Construction Conference shall include but are not limited to the following:

(1) Providing advance information to and coordinating schedules with officials of tenant agencies before setting the time and date for work to be performed.

(2) Assigning parking, if available, for the contractor's vehicles.

(3) Making storage space available for contractor's equipment, materials, and supplies.

(4) Providing any other assistance to make sure that work is accomplished on time.

(5) Ensuring the security of Government property.

(6) Making arrangements to monitor the contractor's activities, if necessary.

(7) Arranging necessary security clearances.

(8) Mutual understandings relative to administration of the safety program shall be discussed. The Contractor shall provide sufficient barriers, warning signs, and covers to protect all work and personnel as required or directed. Barriers shall be of good quality, constructed, and maintained to prevent access to the work site IAW existing OSHA and Army Corps Safety Regulation, 1992.

(9) Arranging for Mark-outs of the utilities.

1.7 Prior to commencement of the work the Contractor shall meet with representatives of the Contracting Officer's Representative (COR) to develop mutual understandings relative to compliance with this provision and administration of the environmental pollution control program.

1.8 The Contracting Officer will notify the Contractor in writing of any non-compliance with the foregoing provisions and the action to be taken. The Contractor shall, after receipt of such notice, immediately take corrective action. Such notice, when delivered to the Contractor or his authorized representative, shall be deemed sufficient for the purpose. If the Contractor fails or refuses to comply promptly, the Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No part of the time lost due to any such stop orders shall be made the subject of a claim for extension of time or for excess costs or damages by the Contractor unless it was later determined that the Contractor was in compliance.

1.9 Protection of and Damage to Government Property.

1.9.1 Contractor shall provide all labor, materials, and equipment necessary for protection of personnel, furnishing, equipment, and building structure.

Install and Survey Monitoring Wells

1.9.2 All work shall be performed in a manner acceptable to the Contracting Officer or his representative. If the Contractor fails to respond and initiate repairs or replacement within 10 days of verbal or written direction from the Contracting Officer or his representative, the Government may cause said repairs or replacement to be undertaken and the cost thereof charged to the Contractor. Existing utility lines indicated on drawings are approximate. It is the Contractor's responsibility to survey and scope areas to determine exact location so damage to these utilities may be avoided. Any cost resulting from damage to existing utilities shall be the responsibility of the Contractor.

1.9.3 All damages or contamination caused by the Contractor during the activities conducted under this specification shall be corrected at the contractors expense.

1.10 Compliance with the provisions of this specification by subcontractors shall be the responsibility of the Contractor.

1.11 Omissions from the specifications or the misdescription of details of work which are manifestly necessary to carry out the intent of the specifications, or which are customarily performed, shall not relieve the contractor from performing such omitted or misdescribed details of the work but they shall be performed as if fully and correctly set forth and described in the specification.

1.12 A joint pre-drilling site visit/inspection shall be made to determine pre-existing conditions. The Contracting Officer's Representatives, a representative from the Contract Management Division, Directorate of Public Works(DPW), and the contractor shall be present at this time.

1.13 Existing Work

1.13.1 Existing work shall be cut, drilled, altered, removed, or temporarily removed and replaced as necessary for performance of work under this contract. Work that is replaced shall match similar existing work, except if otherwise directed by the Contracting Officer's Representative. Work remaining in place which is damaged or defaced during performance of work shall be restored to the condition existing at time of placement of delivery order, by the contractor.

1.13.2 Work out of alignment when exposed by removal of existing work shall be called to the Contracting Officer Representative's attention.

1.14 Use of Building Facilities: While performing required work, utility services and toilet facilities of the building may not be used, unless otherwise directed by the Facility Management Specialist.

1.15 Use of Water: While performing required work, water may be obtained from a DPW designated hydrant. A backflow preventer must be utilized. The contractor will notify the DPW one hour prior to using the hydrant. No other hydrants will be used by the contractor.

1.16 Existing utilities will be marked out IAW the attached SOP prior to the pre-drilling site visit. The contractor shall expect utilities to be within the area (4 feet to either side of the mark-out) and the contractor shall identify the exact utility location prior to drilling when drilling activities may disturb the utility.

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1.17 Submittals

1.17.1 Submission shall be made to the designated Contracting Officer's Representative.

1.17.2 Within 5 calendar days after the project award date all items shall be submitted for approval. In the event of change, addition or replacement of previously submitted items, the Contractor shall work IAW previously submitted items until new modifications are approved by the COR.

1.17.3 Contractor shall submit samples or shop drawings (including Contractor/sub Contractor regulatory compliance documentation, OSHA Compliance Documentation, etc.) for items not listed herein, upon request by the Contracting Officer's Representative.

1.18 The premises will be occupied during the performance of the work.

2.0 SCHEDULING OF WORK.

2.1 Working Hours: Unless otherwise specified, the Contractor shall be permitted to work under this contract five days of the week, Monday through Friday, during the hours of 0730 hours until 1630 hours inclusive, excluding Federal holidays. Exceptions to this rule must be requested, in writing to the Contracting Officer's Representative or the Facilities Management Specialist, three days in advance. No well drilling will be conducted during adverse weather conditions including rain. The instruments (FID/OVA) must work without fail due to environmental variations (high humidity, cold etc...). The Facilities Management Representative will notify the contractor if site conditions are unsuitable and therefor the contractor will be additionally prohibited from drilling.

2.2 Scheduling and Determination on Progress:

2.2.1 The Contractor shall submit to the Contracting Officer's Representative or Facilities Management Specialist, in writing, a five and fourteen day work schedule for accomplishment at each work site to include all work phases. The five day schedule shall be received the Thursday prior to work commencing. The fourteen day tentative work schedule will be for the following two week period.

2.2.2 The submitted schedule is subject to the approval of the Contracting Officer's Representative. Any deviation from the approved schedule must be approved by the Contracting Officer's Representative or Facilities Management Specialist prior to change.

2.2.3 Delivery of materials and equipment shall be made with a minimum of interference to Government operations and personnel.

2.2.4 The work shall, so far as practicable, be done in definite sections or divisions and confined to limited areas which shall be completed before work in other sections or divisions is begun. The drilling will be requested as needed. The requests will be for a minimum of three wells each. Work will begin within 1 week of each request. Each well will be a minimum of 15 feet deep. Most wells will be approximately 20 feet deep with the exception of Charles Wood Area which will be approximately 30 feet deep.

2.2.5 All temporary outages of any utility services required for the performance of work shall be approved and scheduled by the Contracting Officer Representative no less than 48 hours in advance of outages.

3.0 GOVERNMENT FURNISHED PROPERTY. There is no Government Furnished Property provided in conjunction with the work requirements of this contract.

4.0 CONTRACTOR FURNISHED PROPERTY.

4.1 The Contractor shall furnish the necessary equipment, tools, materials, supplies, and personnel certified in their professional designated fields to perform the work contained in this contract.

5.0 SECURITY CLEARANCES. It shall be the Contractor's responsibility, through the Contracting Officer's Representative or Facilities Management Specialist, to obtain access and arrange for escorts in secured buildings and restricted or non-restricted areas.

6.0 SAFETY AND ACCIDENT REPORTING.

6.1 All work shall be conducted in a safe manner and shall comply with all safety requirements.

6.2 The Contractor shall comply with all current Federal, State and Local environmental protection laws until the completion of all work as defined in this specification.

6.3 The Contractor shall also provide and enforce the use of all Personal Protective Equipment (PPE). The contractor shall have Level C PPE equipment on site and available for inspection at all times. If PPE is not on site or is in poor condition (eg. respirators not clean and in sealed bags, tyvek suites not new and of correct size etc....) the Facility Management Specialist will escort the contractor off site.

6.4 If the Contractor fails or refuses to promptly comply with safety requirements, the Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No part of the time lost due to any such stop order shall be made the subject of claim for extension of time or for excess costs or damages to the Contractor.

6.5 In all instances where Government property and/or equipment are damaged by Contractor's employees, a full written report of the facts and extent of such damage shall be submitted to the Contracting Officer within 24 hours of occurrence.

6.6 The Contractor shall comply with OSHA and other regulatory agency requirements for record keeping and reporting of all accidents resulting in death, trauma, occupational disease, or environmental insult. The Contractor shall notify the Contracting Officer of all well installation related accidents on the Installation within 24 hours.

6.7 The Contractor shall familiarize himself / herself and require their employees to become familiar with the method of turning in a FIRE ALARM. The Contractor and their employees shall be cognizant of, and observe all requirements for handling and storage of combustible supplies, materials, and daily disposal of combustible waste and trash.

Install and Survey Monitoring Wells

6.8 Accident Reports. The contractor shall comply with accident reporting requirements as outlined in CECOMR 385-4 which will be furnished to the successful bidder by the Contracting Officer. All accident reports will be submitted directly to the Contracting Officer.

6.9 Hazardous Spills: The Contractor shall familiarize himself and require his employees to become familiar with the storage of hazardous materials and be familiar with the Fort Monmouth Spill Plan Contingency Countermeasures (SPCC). The Contractor and his employees shall be cognizant of and observe all requirements for handling and storage of hazardous wastes and materials.

6.10 Special Notifications. The contractor shall immediately report to the Facility Management Specialist, via telephone or other means, any observations or results which may indicate an imminent health risk. Following this telephone notification, a written notice shall be prepared and delivered within (3) days. This notification shall include supporting documentation.

7.15 Clean Up and Environmental Protection

7.15.1 The contractor shall provide daily broom-sweep cleanup and removal of all debris and trash from the area of work so as to leave the area in a neat, clean condition after each work shift. The contractor shall perform the necessary tasks to ensure that the Governments day-to-day business proceeds without interruption and shall provide the safety precautions necessary to protect the public's interest.

7.15.2 It shall be the responsibility of the Contractor to provide for trash, debris, and rubbish removal.

7.15.3 Final cleanup after completion of work and before final payment is authorized; the contractor shall broom sweep work area and all adjacent areas. The contractor shall remove all unused or partially used construction materials, equipment, debris, rubbish and garbage from the building.

7.15.4 Burning, of any kind shall not be permitted on the site.

7.15.5 All trucks leaving the site with loose debris shall be loaded in a manner that will prevent dropping of materials on streets and shall have suitable tarpaulin fastened over the load before they enter surrounding paved streets.

7.15.6 The contractor shall conform to all local regulations regarding load limits.

7.15.7 All supplies and equipment on project site shall be stored in such a manner as to preclude mechanical and climatic damage. Site shall be maintained in a neat and orderly manner as to further minimize hazards to personnel, supplies, and equipment.

Install and Survey Monitoring Wells

8.0 PROJECTED WORKLOAD. The estimated quantity of services to be ordered are 340 linear feet of installed monitoring wells, 100 linear feet of additional (in addition to the split spoon sampling included in the well drilling bid item) split spoon sampling, logging, etc..., and 6 well surveys. Additional monitoring well installations and surveys may be requested as areas of concern are discovered and as required by law. Any additional (new) work to this contract shall be presented in writing, by the government technical staff in the form of a modification and at that time the contractor shall provide a new and/or revised price schedule which shall be approved and accepted in writing by the Contracting Officer.

9.0 PERFORMANCE REQUIREMENTS. The Contractor shall perform the tasks specified in this Specification IAW the applicable documents herein.

10.0 RECORDS AND REPORTS.

10.1 Reporting of Inspection by Regulatory Agencies: The Contractor shall notify the Contracting Officer's Representative or Facilities Management Specialist immediately by telephone of any inspection visit by an agent, agents, or any regulatory agency (other than OSHA) at any time, occurring on the installation. The Contracting Officer's Representative or Facilities Management Specialist will issue instructions on how to proceed in cooperating with the inspector.

10.2 The Contractor shall provide the Contracting Officer's Representative and the Directorate of Engineering & Housing Facilities Management Specialist with a written report of each visit/inspection of each work site by representatives of Federal, state, and local environmental protection agencies within five working days of each visit/inspection. Such reports shall include names of visitors, agencies, times, dates of visits/inspections, findings, and recommendations.

11.0 INSPECTION. Each phase of the services rendered is subject to Government inspection during the Contractor's operations and/or after the completion of the task. Any defect or unaccomplished work shall be immediately brought to the attention of the Contractor. The Contractor shall meet with the Contracting Officer's Representative or Facilities Management Specialist to discuss the work in question without delay. Work determined unsatisfactory after the discussion or the Contractor's failure to discuss the work in question shall be cause for adjustment in contract price based on the Government estimate of work not performed. The Government may inspect the Contractor's equipment and materials any time. When inspection reveals any inadequacy, the Contractor shall correct the problem within 24 hours (Sundays and holidays excepted) after receiving notice from the Contracting Officer or his representative and at no additional charge to the Government, correct all deficiencies to the satisfaction of the Government.

Install and Survey Monitoring Wells

SPECIFIC FUNCTIONS AND/OR TASKS.

Section 01200

12.0 Monitoring Wells:

12.1 Not Used.

12.2 The well installation will be done by a licensed New Jersey Journeyman Well Driller pursuant to N.J.S.A. 58:4A-4.1 et seq.. Decisions on well locations, well depths, screened intervals and all details of the well installation, and data collection activities shall be made collectively by the Facility Management Specialist and the contractor's field supervisor.

12.3 All well drilling, development and purging, sample collection, and other activities pursuant to this effort shall be conducted in strict accordance with all applicable laws, ordinances, rules, and regulations (guidelines) of Federal, State, and all authorities with jurisdiction over such activities. This includes but is not limited to the NJDEP Field Sampling Procedures Manual in effect as of the date the wells are installed. The contractor shall complete permits, applications, other documents, and proficiency tests required by the regulatory agencies, and provide them with a detailed cover letter to the Facility Management Specialist prior to the commencement of work activity. This includes but is not limited to drilling permits obtained pursuant to N.J.S.A. 58:4A et seq..

12.4 All waste materials generated from well installation and decontamination will be containerized. The contractor shall label and stage all waste containers IAW all applicable regulations. The contractor is not responsible for off-site transport and disposal of the material but is responsible for providing approved (DOT) new drums / containers, not recycled. At a minimum loose soils will be stored at the well site on plastic and covered by plastic by the end of each work day.

12.5 Each well will have split spoon samples collected using American Society of Testing Materials (ASTM) Method D1586-84A. Split spoon samples will be collected continuously ahead of the hollow stem auger at each well. The driller will complete NJDEP well completion log forms for each well. The contractor shall conduct additional split spoon sampling, logging. etc... as requested by the Facility Management Specialist.

12.6 Not Used.

12.7 The core shall provided to the on-site geologist.

12.8 Monitoring wells will be constructed IAW the NJDEP monitoring well specification diagram for unconsolidated formations and of 4-inch Schedule 40 flushjoint threaded PVC casing and well screen. Threads will be ASTM-F-480. PVC pipe and screen will be composed of 100% virgin PVC and will not contain fillers. These materials will be packaged individually in hermetically sealed 6mm plastic bags. These products will be as manufactured by Bedrock Enterprises, Forked River, NJ or equivalent.

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12.9 A silica sand filter gravel will be placed around each well screen. The gravel will be of appropriate size as dictated by the slot size screen and surrounding formation as deemed appropriate by the site supervisor. The gravel will be packaged in 100-pound plastic bags which are sealed at the gravel manufacturers plant. The gravel will be a Morie filter gravel, Millville, NJ or equivalent.

12.10 Flushmount manholes will be 9-inch ID, constructed of cast iron, the skirt will be a minimum 9-inches in length. The manhole cover will have a "NO FILL MONITORING WELL no fill monitoring well logo cast into the lid completed by the Journeyman Driller. A length of protective steel casing with a locking cap must be securely set in cement around the well casing. Flush mount monitoring wells are acceptable provided they have manholes, locking caps, and seals to prevent leakage of surface water into the well. The driller shall consult the Contracting Officer's Representative for the type of casing protector best suited for each well.

12.11 Wells must be developed to yield a non-turbid discharge where possible as determined by the site supervisor. It shall be expected that well development will be completed within two hours after beginning.

12.12 All waste soils determined to be non-regulated shall be securely covered each work day. The contractor will not be permitted to continue work at an additional site unless the previous site is completed (less survey and well development).

Install and Survey Monitoring Wells

SECTION 1300

13.0 Well Survey

13.1 The Contractor shall provide all labor, material and equipment to survey monitoring wells.

13.2 All surveys shall be performed by a New Jersey licensed surveyor as follows:

13.2.1 The inner well casing must be surveyed to the nearest hundredth (0.01) foot above mean sea level in relation to the New Jersey Geodetic Control survey datum and horizontally by an accuracy of one-tenth of a second latitude and longitude.

13.2.2 A permanent water level measurement mark (a stainless steel pin) shall be attached onto the top inner well casing to allow for accurate reproducible water measurement over time.

13.2.3 Complete Form B for each well. Completed Form Bs shall be submitted to the Facility Management Specialist no later than five weeks after well installation.

SECTION 1400

14. STANDARD METHODS OF MEASUREMENT

14.1 Determination of Quantities: Actual quantities shall be determined jointly by the Contractor and the Contracting Officer's Representative or Facilities Management Specialist. Payment shall be based upon the extension of the quantities and the associated unit price as shown in the bid schedule provided by the successful bidder.

14.2 Contractor Guidance: The Government must receive the quantity and quality of work for which it has contracted. In the initial phases of a new contract, it is advisable to provide guidance to the contractor. General guidance shall be provided during the pre-construction conference. When more detailed guidance is required, it may be provided through meetings, or in special meetings, with the Contracting Officer in attendance (if possible). Minutes of these meetings or discussions shall become a part of the contract file. The Contracting Officer is to be notified of any serious omissions or deficiencies on the part of the contractor that would impair the contractor's ability to perform. Government personnel dealing with contractors must be reasonable and fair in their demands and must be open-minded in resolving disputes. At the same time, they must be firm in enforcing contract requirements to make sure the interests of the Government are protected. Unless an action is justified (e.g., safety and health violations, improper materials, inadequate workmanship, etc.) Government personnel must avoid taking any action that will impede the Contractor's progress. Supervision and inspection of the work performed is the responsibility of the contractor, and guidance or inspection by the Government does not relieve the contractor of the responsibilities.

Install and Survey Monitoring Wells

SECTION 1500

UNIT PRICE SCHEDULE

1. General:

This section lists the estimated quantities of monitoring wells to be installed at Fort Monmouth and its sub-Posts. The work to be performed under this contract is to establish terms upon which the contractor shall install and survey environmental monitoring wells as well as complete NJDEP and Directorate of Public Works requirements as specified in this document.

2. Index Unit Quantities:

DESCRIPTION	SECTION	PAGE(S)
Monitoring well installation	01200	11 - 12
Site Survey	01300	13

Install and Survey Monitoring Wells

UNIT PRICE QUANTITIES:

01100-1 Monitoring Well Installation:

Provide all labor, material and equipment necessary to install monitoring wells in accordance with local, Federal and New Jersey State laws and regulations and the requirements of this specification. The Government's Contracting Officer's Representative will determine the depth of each well (all well depth verifications will be performed by the Facility Management Specialist at the well and measured from the ground surface to the well end cap). All contaminated materials shall be transported in accordance with local, state and federal laws and regulations.

FY99 pricing:

ITEM NO.	ITEMS OF WORK	UNIT	UNIT PRICE	ESTIMATED QUANTITIES	TOTAL PRICE
01200-1.1	Install monitoring well	Foot		340	
01200-1.2	Supply, fill 55 gal containers with the materials determined to be hazardous waste by the Government. Remove containers to the designated storage location within the Installation	*BL			
01200-1.3	Additional split spoon sampling	Foot		100	

FY00 Option year pricing:

ITEM NO.	ITEMS OF WORK	UNIT	UNIT PRICE	ESTIMATED QUANTITIES	TOTAL PRICE
01200-1.1	Install monitoring well	Foot		200	
01200-1.2	Supply, fill 55 gal containers with the materials determined to be hazardous waste by the Government. Remove containers to the designated storage location within the Installation	*BL			
01200-1.3	Additional split spoon sampling	Foot		50	

* price will be prorated if not a 55 gal. container (eg. 35 gal. container will be paid at 35/55 (64%) of the price of the 55 gal. drum.

Install and Survey Monitoring Wells

1300-1 Site Survey:

Provide all labor, material and equipment to survey monitoring wells. All surveys shall be performed by a New Jersey licensed surveyor as follows:

-The inner well casing must be surveyed to the nearest hundredth (o.01) foot above mean sea level in relation to the New Jersey Geodetic Control survey datum and horizontally by an accuracy of one-tenth of a second latitude and longitude.

-A permanent water level measurement mark (a stainless steel pin) shall be attached onto the top inner well casing to allow for accurate reproducible water measurement over time.

-Complete all other activities as specified in section 01300 of this specification.

FY99 pricing:

ITEM NO.	ITEMS OF WORK	UNIT	UNIT PRICE	ESTIMATED QUANTITIES	TOTAL PRICE
01300-1.1	Survey Monitoring Wells (Form B)	Each		15	

FY00 Option year pricing:

ITEM NO.	ITEMS OF WORK	UNIT	UNIT PRICE	ESTIMATED QUANTITIES	TOTAL PRICE
01300-1.1	Survey Monitoring Wells (Form B)	Each		6	