



DEPARTMENT OF THE ARMY

OFFICE OF ASSISTANT CHIEF OF STAFF FOR INSTALLATION MANAGEMENT
U.S. ARMY FORT MONMOUTH
P.O. 148
OCEANPORT, NEW JERSEY 07757

January 11, 2017

Ms. Linda Range
New Jersey Department of Environmental Protection
Case Manager
Bureau of Southern Field Operations
401 East State Street, 5th Floor
PO Box 407
Trenton, NJ 08625

**Re: Summary Remedial Investigation Addendum Report for FTMM-56 Petroleum Release, Building 80, Fort Monmouth, NJ
PI G000000032**

Attachments:

- A. Previous FTMM-56 Correspondence (see list below)
- B. Figures (Site Layout and 2015 Concentrations in Groundwater)
- C. Previous Reports (see list below)
- D. Concentrations of Pesticides and Metals in Groundwater at FTMM-56 Compared to NJDEP GWQS

Previous Correspondence (provided in Attachment A):

- 1. NJDEP letter to the Army dated August 29, 2000, re: *UST Closure Approval/NFA, Fort Monmouth Main Post, Monmouth County*
- 2. NJDEP email to the Army dated November 12, 2004, re: *Groundwater Analyses Reduction* and Army letter to NJDEP dated November 10, 2004, re: *Reduction of Groundwater Sampling Analyses-Main Post & Charles Woods Restoration Sites throughout Fort Monmouth, New Jersey*
- 3. NJDEP letter to the Army dated April 29, 2008, re: *Remedial Investigation Report and CEA Information, Site 80/166 – Main Post, Fort Monmouth, NJ*
- 4. NJDEP letter to the Army dated July 3, 2014, re: *Final Baseline Groundwater Sampling Report (August 2013), Remedial Investigation/Feasibility Study/Decision Documents, Fort Monmouth, Oceanport, Monmouth County, PI G000000032*
- 5. NJDEP letter to the Army dated February 5, 2015, re: *November 26, 2014 Response to Comments on the Final Baseline Ground Water Sampling Report (August 2013), Fort Monmouth, Monmouth County, PI# G000000032, Activity Number RPC000001*
- 6. NJDEP letter to the Army dated November 14, 2016, re: *Annual (Fourth Quarter) 2015 Groundwater Sampling Report dated September 2016, Fort Monmouth, Oceanport, Monmouth County, PI G000000032*

Previous Reports (provided in Attachment C):

- 1. Parts of *Final Remedial Investigation Report, Site 80/166 - Main Post, U.S. Army Garrison Fort Monmouth, Fort Monmouth, New Jersey*. Versar, January 4, 2005.

Dear Ms. Range:

The U.S. Army Fort Monmouth (FTMM) has reviewed and summarized relevant information concerning environmental investigations for the Installation Restoration Program (IRP) Site FTMM-56 (Petroleum Release, Building 80). Correspondence 1 (**Attachment A**) from the New Jersey Department of Environmental Protection (NJDEP) documents the regulatory approval of No Further Action (NFA) for the two underground storage tanks (USTs) associated with FTMM-56. Correspondence 3 (**Attachment A**) confirms that NFA was approved for FTMM-56 soils, and in Correspondence 6 (**Attachment A**), the NJDEP states that NFA was necessary for FTMM-56 groundwater.

This Summary Remedial Investigation Addendum Report (RIAR) augments previous investigation reports and provides an overview of information for this site including documentation of NJDEP's previous NFA approval for various aspects of FTMM-56 (UST 80, UST 166, soil, and groundwater). The FTMM team requests NJDEP's review and approval of a NFA determination and concurrence that all identified environmental issues have been adequately addressed for FTMM-56.

1.0 SITE DESCRIPTION

The layout of FTMM-56 is presented on Figure 1 in **Attachment B**. IRP Site FTMM-56 is generally considered to be the former fuel oil tanks UST 166 and UST 80, and the associated groundwater monitoring wells (166MW01, 80MW01, 80MW02, 80MW03, 80MW04, and 80MW05). FTMM-56 is in the eastern portion of the Main Post (MP) approximately 500 feet northwest of Oceanport Creek. The site is located north of Riverside Avenue and south of Building 166, and was also known as Site 80/166 because of the association with the former fuel oil USTs for Building T-80 (which has been demolished) and existing Building 166.

Two FTMM-56 USTs were removed in 1994 during an FTMM program to upgrade heating oil tanks with natural gas. Due to the possibility of contaminated soil near the shallow water table, two monitoring wells (166MW01 and 80MW01) were initially installed in 1994. Four additional monitoring wells were then installed in 2000 to evaluate impacts to groundwater in the vicinity of FTMM-56. The site is currently used as a maintenance yard. The FTMM Reuse and Redevelopment Plan indicates that the anticipated future land use at FTMM-56 is open space (EDAW, Inc. 2008).

Additional information concerning the FTMM-56 background and environmental setting is provided in a previous Remedial Investigation (RI) Report prepared for Site 80/166 (Versar, 2005, provided in **Attachment C**).

2.0 UNDERGROUND STORAGE TANKS

Following are the USTs that were previously removed from the FTMM-56 area in 1994 (and are shown in **Attachment B**):

- UST 80: 1,000-gallon, steel, No. 2 fuel oil tank (NJDEP Registration No. 90010-06, Discharge Investigation and Corrective Action Report [DICAR] 94-06-16-1127-25).
- UST 166: 4,000-gallon, fiberglass, No. 2 fuel oil tank (NJDEP Registration No. 90010-17, DICAR 94-06-16-1545-09).

The two FTMM-56 USTs were removed in 1994 during an FTMM program to upgrade heating oil tanks with natural gas. One tank (UST 80) located near former Building T-80 had two holes in the ends of the tank noted during closure. The other tank (UST 166) located near Building 166 did not have any visible holes. However, stained soils were observed at both UST excavation locations and potentially contaminated soil was removed from both UST sites. Confirmation soil samples were collected at both UST locations during tank closure. The tanks were approved for NFA by NJDEP in a letter dated August 29, 2000 (Correspondence 1 of **Attachment A**) based on the submittal of two UST closure reports (ATC Associates, 1998 and 2000; presented in Appendices A and B of Versar, 2005 in **Attachment C**). FTMM-56 soils were approved for NFA by NJDEP in a letter dated April 29, 2008 (Correspondence 3 **Attachment A**) based on the submittal of a Remedial Investigation Report (Versar, 2005).

3.0 GEOLOGY AND HYDROGEOLOGY

The geology encountered from 0 to 13 feet below ground surface (bgs) at FTMM-56 during the previous RI (Versar, 2005) consists of fine sand, silt, and clay with a few thin layers of rounded quartz gravel. Fill material may also be locally present at FTMM-56 due to the construction of buildings, underground utilities, and paved areas.

The depth to groundwater at the MP typically ranges from 2 to 9 feet bgs. Groundwater is comparatively shallower at FTMM-56, where the groundwater depth ranged from 0.5 to 4 feet bgs (Versar, 2005 in **Attachment C**). Although the hydraulic gradient is generally flat, the inferred shallow groundwater flow direction is predominately to the southeast towards Oceanport Creek (see Figure 1 in **Attachment B**).

4.0 GROUNDWATER QUALITY

4.1 HISTORICAL GROUNDWATER MONITORING RESULTS

Following removal of the fuel oil tanks, two groundwater monitoring wells (166MW01 and 80MW01) were installed and two rounds of sampling for volatile organic compounds (VOCs) and semi-volatile organic compounds (SVOCs) were performed in 1995. Well 166MW01 did not have any detections exceeding the NJDEP GWQS. Benzene was the only analyte detected in well 80MW01 at concentrations exceeding the NJDEP GWQS. In July 2000 four additional groundwater monitoring wells (80MW02, 80MW03, 80MW04, and 80MW05) were installed (Versar, 2005).

From April 1997 through January 2001, 19 rounds of groundwater samples were collected from FTMM-56 monitoring wells (17 quarterly rounds conducted at 80MW01 and 166MW01; four quarterly rounds at 80MW02, 80MW03, 80MW04, and 80MW05; and two additional rounds of low-flow samples conducted at all wells). Wells were sampled for VOCs, SVOCs, pesticides, polychlorinated biphenyls (PCBs), and metals. Benzene was detected above the NJDEP GWQS in one monitoring well (80MW01) four times from April 1997 through May 1999, but was not detected from May 2000 through January 2001; therefore, benzene was not identified as a contaminant of concern (COC) (Versar, 2005). No other VOCs or SVOCs exceeded their GWQS from April 1997 through January 2001. However, the pesticides alpha-chlordane and gamma-chlordane and the metals arsenic and lead were identified as COCs based on exceedances of NJDEP GWQS (Versar, 2005). a-Chlordane was detected above the NJDEP GWQS in

monitoring well 80MW02 during two of five quarterly sampling rounds and in monitoring well 166MW01 during one low-flow sampling round. g-Chlordane was detected above the NJDEP GWQS in well 80MW02 in two of five samples collected (including one during a low-flow sampling round). Arsenic was detected above the NJDEP GWQS in monitoring well 80MW01 in 14 of the 17 quarterly sampling rounds and both of the low-flow sampling rounds. Lead was detected above the NJDEP GWQS in monitoring wells 80MW01, 80MW04, 80MW05, and 166MW01 in multiple sampling rounds, including low-flow sampling.

From November 2004 to August 2011, the six wells were sampled quarterly for pesticides and metals only, since the NJDEP agreed via an e-mail dated November 12, 2004 (see Correspondence 2 of **Attachment A**) to reduce the sampling program and discontinue the analysis of VOCs and SVOCs at FTMM-56 based on the previous sampling results.

Historical quarterly sampling results from March 2011 and August 2011 have been compiled together with more recent (2013 and 2015; discussed below) groundwater monitoring results in **Attachment D** to represent recent groundwater conditions. In 2011 the metals antimony, arsenic, beryllium, cadmium, chromium, and lead were detected at concentrations greater than their respective NJDEP GWQS (Parsons, 2014). With the exception of lead, these metals are considered background concentrations and not related to releases from the former fuel oil tanks. The pesticides chlordane, alpha-chlordane, and gamma-chlordane were detected in one well (80MW02) above the NJDEP GWQS in 2011.

4.2 2013 BASELINE GROUNDWATER MONITORING RESULTS

Following the temporary suspension of groundwater sampling in late 2011, groundwater monitoring at FTMM-56 resumed in August 2013 to re-establish baseline groundwater conditions for constituents of potential concern. Groundwater samples were collected from the six FTMM-56 monitoring wells during the August 2013 baseline sampling event and analyzed for lead only. Lead was not detected above the NJDEP GWQS of 5 µg/L in the groundwater samples (**Attachment D**).

Based on the recommendations in the Final August 2013 Baseline Groundwater Sampling Report (Parsons, 2014), which were approved by NJDEP (see Correspondence 5 of **Attachment A**), four of the six monitoring wells (166MW01, 80MW01, 80MW03 and 80MW04) were removed from further long-term monitoring. NJDEP requested one additional round of groundwater monitoring at 80MW02 for pesticides, and at 80MW05 for arsenic, cadmium, and lead (see Correspondence 4 of **Attachment A**). These samples were inadvertently not collected in 2014; therefore the additional round of sampling took place in 2015.

4.3 2015 GROUNDWATER MONITORING RESULTS

As agreed with the NJDEP, wells 80MW02 (pesticides) and 80MW05 (arsenic, cadmium, and lead) were sampled during the 2015 groundwater sampling event to determine if the long term monitoring of the groundwater at FTMM-56 could be discontinued. The most current (2015) exceedance of a NJDEP GWQS is shown on **Figure 2 in Attachment B**. Arsenic was the only analyte detected above the NJDEP GWQS in groundwater at FTMM-56 in 2015. Arsenic was detected in November 2015 at an estimated concentration of 3.7 µg/L at 80MW05, which is slightly above the NJDEP GWQS of 3 µg/L. Background arsenic concentrations in excess of the

GWQS have been noted in groundwater at the MP (e.g., FTMM, 2011), and in glauconitic soils present within the New Jersey Coastal Plain physiographic province (Dooley, 2001; United States Geological Survey, 1984); therefore the arsenic in 80MW05 groundwater is likely due to naturally occurring background conditions since arsenic is not expected to be associated with the former fuel oil USTs. For example arsenic concentrations ranging up to 8.77 µg/L were detected in shallow groundwater at the MP that is associated with glauconitic soils (FTMM, 2011). Lead and cadmium were not detected above their respective NJDEP GWQS in the November 2015 sample collected from monitoring well 80MW05.

Pesticides were detected below their respective NJDEP GWQS in the November 2015 sample collected from monitoring well 80MW02.

The Annual (Fourth Quarter) 2015 Groundwater Sampling Report (Parsons, 2016), submitted to the NJDEP in September 2016, recommended discontinuation of groundwater sampling at FTMM-56. Based on the recommendations from this report, NJDEP agreed that the single exceedance of the GWQS for arsenic was representative of background conditions, and approved NFA for groundwater in a letter dated November 14, 2016 (Correspondence 6 of **Attachment A**).

5.0 SUMMARY

The 2015 groundwater monitoring results continue to demonstrate that lead, cadmium, and pesticide concentrations are below their respective NJDEP GWQS. Although arsenic (at 3.7 µg/L) was detected slightly above the NJDEP GWQS of 3 µg/L at 80MW05, it is attributed to naturally occurring background conditions due to glauconitic soils present at FTMM, and not to the former fuel oil USTs. Correspondence 1 (**Attachment A**) from the NJDEP documents the regulatory approval of NFA for the two USTs associated with FTMM-56. Correspondence 3 (**Attachment A**) confirms that NFA was approved for FTMM-56 soils, and in Correspondence 6 (**Attachment A**), the NJDEP states that NFA was necessary for FTMM-56 groundwater. Therefore, the FTMM team requests NJDEP's concurrence that a comprehensive NFA determination for all affected media is warranted for FTMM-56.

The technical Point of Contact (POC) for this matter is Kent Friesen at (732) 383-7201 or by email at kent.friesen@parsons.com. Should you have any questions or require additional information, please contact me by phone at (732) 380-7064 or by email at william.r.colvin18.civ@mail.mil.

Sincerely,



William R. Colvin, PMP, CHMM, PG
BRAC Environmental Coordinator

cc: Linda Range (3 hard copies)
Delight Balducci, HQDA ACSIM (CD)
Joseph Pearson, Calibre (CD)
James Moore, USACE (CD)
James Kelly, USACE (CD)
Cris Grill, Parsons (CD)

REFERENCES CITED:

- ATC Associates, BCM Engineers Division, 1998. *Underground Storage Tank Closure and Site Investigation Report, Former Building T-80, Main Post, UST No. 90010-06*. Prepared for United States Army, Fort Monmouth, New Jersey. July.
- ATC Associates, 2000. *Underground Storage Tank Closure and Site Investigation Report, Former Building T-166, Main Post, UST No. 90017-17*. Prepared for United States Army, Fort Monmouth, New Jersey. May.
- Dooley, J.H., 2001. *Baseline Concentrations of Arsenic, Beryllium, and Associated Elements in Glauconite and Glauconite Soils in the New Jersey Coastal Plain*. New Jersey Geological Survey, Trenton, New Jersey.
- EDAW, Inc., 2008. *Fort Monmouth Reuse and Redevelopment Plan, Final Plan*. Prepared for Fort Monmouth Economic Revitalization Planning Authority. August 22.
- Fort Monmouth, 2011. *Base-Wide Glauconitic Soil Sampling Report*. Directorate of Public Works. Fort Monmouth, New Jersey.
- Parsons, 2014. *August 2013 Baseline Groundwater Sampling Report, Fort Monmouth, Oceanport, Monmouth County, New Jersey*.
- Parsons, 2016. *Annual (Fourth Quarter) 2015 Groundwater Sampling Report, Fort Monmouth, Oceanport, Monmouth County, New Jersey*. September.
- U.S. Geological Survey (USGS), 1984. *Element Concentrations in Soils and Other Surficial Materials of the Conterminous United States, Professional Paper No. 270*.
- Versar, 2004. *Final Classification Exception Area Information for Various Sites, M-12 Landfill Site, M-18 Landfill Site, Site 80/166, Site 108, Site 283, Site 812, Site 1122 and Site 2567, U.S. Army Installation Fort Monmouth, Fort Monmouth, New Jersey*. July 12.
- Versar, 2005. *Remedial Investigation Report Site 80/166 – Main Post*. U.S. Army Garrison Fort Monmouth. Fort Monmouth, New Jersey. January 04.



New Jersey Department of Environmental Protection
Site Remediation Program

Report Certifications for RCRA GPRA 2020, CERCLA, and Federal Facility Sites

These certifications are to be used for reports submitted for RCRA GPRA 2020, CERCLA, and Federal Facility Sites. The Department has developed guidance for report certifications for RCRA GPRA 2020, CERCLA, and Federal Facility Sites under traditional oversight. The "Person Responsible for Conducting the Remediation Information and Certification" is required to be submitted with each report. For those sites that are required or opt to use a Licensed Site Remediation Professional (LSRP) the report must also be certified by the LSRP using the "Licensed Site Remediation Professional Information and Statement". For additional guidance regarding the requirement for LSRPs at RCRA GPRA 2020, CERCLA and Federal Facility Sites see http://www.nj.gov/dep/srp/srra/training/matrix/quick_ref/rcra_cercla_fed_facility_sites.pdf.

Document: "Summary Remedial Investigation Addendum Report for FTMM-56 Petroleum Release, Building 80"

PERSON RESPONSIBLE FOR CONDUCTING THE REMEDIATION INFORMATION AND CERTIFICATION

Full Legal Name of the Person Responsible for Conducting the Remediation: William R. Colvin

Representative First Name: William Representative Last Name: Colvin

Title: BRAC Environmental Coordinator

Phone Number: (732) 380-7064

Ext: _____

Fax: _____

Mailing Address: P.O. Box 148

City/Town: Oceanport

State: NJ

Zip Code: 07757

Email Address: william.r.colvin18.civ@mail.mil

This certification shall be signed by the person responsible for conducting the remediation who is submitting this notification in accordance with Administrative Requirements for the Remediation of Contaminated Sites rule at N.J.A.C. 7:26C-1.5(a).

I certify under penalty of law that I have personally examined and am familiar with the information submitted herein, including all attached documents, and that based on my inquiry of those individuals immediately responsible for obtaining the information, to the best of my knowledge, I believe that the submitted information is true, accurate and complete. 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.

Signature: _____

Date: 11 January 2017

Name/Title: William R. Colvin / BRAC Environmental Coordinator

ATTACHMENT A

Previous FTMM-56 Correspondence

1. NJDEP letter to the Army dated August 29, 2000, re: *UST Closure Approval/NFA, Fort Monmouth Main Post, Monmouth County*
2. NJDEP email to the Army dated November 12, 2004, re: *Groundwater Analyses Reduction* and Army letter to NJDEP dated November 10, 2004, re: *Reduction of Groundwater Sampling Analyses-Main Post & Charles Woods Restoration Sites throughout Fort Monmouth, New Jersey*
3. NJDEP letter to the Army dated April 29, 2008, re: *Remedial Investigation Report and CEA Information, Site 80/166 – Main Post, Fort Monmouth, NJ*
4. NJDEP letter to the Army dated July 3, 2014, re: *Final Baseline Groundwater Sampling Report (August 2013), Remedial Investigation/Feasibility Study/Decision Documents, Fort Monmouth, Oceanport, Monmouth County, PI G000000032*
5. NJDEP letter to the Army dated February 5, 2015, re: *November 26, 2014 Response to Comments on the Final Baseline Ground Water Sampling Report (August 2013), Fort Monmouth, Monmouth County, PI# G000000032, Activity Number RPC000001*
6. NJDEP letter to the Army dated November 14, 2016, re: *Annual (Fourth Quarter) 2015 Groundwater Sampling Report dated September 2016, Fort Monmouth, Oceanport, Monmouth County, PI G000000032*



State of New Jersey

Christine Todd Whitman
Governor

Department of Environmental Protection

Robert C. Shinn, Jr.
Commissioner

Mr. Dinkerrai Desai
DEPARTMENT OF THE ARMY
HEADQUARTERS, U.S. ARMY COMMUNICATIONS-ELECTRONIC COMMAND
FORT MONMOUTH, NJ 07703-5000

AUG 29 2000

Re: UST Closure Approval/NFA
Fort Monmouth Main Post
Monmouth County

Dear Mr. Desai:

The NJDEP is in receipt of seventeen (17) UST closure reports dated June 1, 2000. The Army has requested to receive No Further Action approval letters for each of these reports. This letter approves the NFA requests for the following 17 UST located on the Main Post of the Fort Monmouth site:

NJDEP Req. #	Bldg. #	NJDEP Req. #	Bldg. #
0090010-06	80	0081533-226	707
0090010-17	166	0081533-119	745
0081533-5	207A	0081533-160	1076
0081533-211	207B	0081533-161	1076
0081533-57	282	0081533-168	1108
0081533-64	290	00192486-1	2000
0081533-68	295	0081515-62	2700.4
0081533-108	689A	00192486-30	3050
0081533-109	689B		

The NJDEP has determined that the Army has performed the remedial actions in a manner consistent or in excess of the regulatory requirements, specifically the Technical Requirements For Site Remediation (N.J.A.C. 7:26E et seq.). Soils with contamination in excess of the NJDEP residential cleanup criteria have been excavated and the Army has taken great care to provide documentation which assures us that all sources of contamination have been remediated.

The NJDEP has one comment in that we request that future reports provide ground water flow direction indications on the well location maps.

If you should have any questions or comments, please do not hesitate to contact me at (609) 633-7232 or via E-mail.

Sincerely,


Ian R. Curtis, Case Manager
Bureau of Case Management
ICURTIS@DEP.STATE.NJ.US

Guenther, Douglas C MONMOUTH USAG

From: Greg Zalaskus [Greg.Zalaskus@dep.state.nj.us]
Sent: Friday, November 12, 2004 2:03 PM
To: Douglas.Guenther@mail1.monmouth.army.mil
Cc: John Prendergast; Ken Petrone; Joseph.Fallon@mail1.monmouth.army.mil
Subject: Re: GROUNDWATER ANALYSES REDUCTION

Doug: The Department has completed a review of your November 10, 04 letter request to reduce the groundwater sampling analysis for the seven site listed in the November 10, 04 letter. The Department hereby approves your request as submitted. Additionally, the updated "Restoration Program Site Report Status Table" you e-mailed is most appreciated. If you have any questions please contact me.

Sincerely, greg

Gregory Zalaskus, Case Manager
NJDEP/DRMR/BCM
Greg.Zalaskus@dep.state.nj.us
609-984-2065 (direct)
609-633-1439 (fax)
609-633-1455 (main)

>>> "Guenther, Douglas C MONMOUTH USAG"
<Douglas.Guenther@mail1.monmouth.army.mil> 11/10/04 01:28PM >>> Greg,

As discussed, attached is the letter identifying analyses reduction at restoration sites and a summary of submitted site reports pending NJDEP review. A hard copy is on the way. Any questions let me know.

Sincerely,

Douglas C. Guenther
Environmental Protection Specialist
U.S. Army, Directorate of Public Works
Attn: SELFM-PW-EV, Bldg. 173
Fort Monmouth, NJ 07703
Phone: 732-532-0986; Fax: 732-532-6263; DSN: 992-0986
E-mail: Douglas.Guenther@Mail1.Monmouth.Army.mil



DEPARTMENT OF THE ARMY
HEADQUARTERS, U.S. ARMY GARRISON FORT MONMOUTH
FORT MONMOUTH, NEW JERSEY 07703-5101



REPLY TO
ATTENTION OF

Directorate of Public Works

November 10, 2004

ATTN: Mr. Greg Zalaskus
State of New Jersey
Department of Environmental Protection
Division of Responsible Party Site Remediation
Bureau of Case Management
401 East State Street, 5th Fl., West Wing
PO Box 028
Trenton, New Jersey 08625-0028

RE: **REDUCTION OF GROUNDWATER SAMPLING ANALYSES--
MAIN POST&CHARLES WOODS**
Restoration Sites throughout Fort Monmouth, New Jersey

Dear Mr. Zalaskus:

As discussed during our telephone conversation on November 9, 2004, this letter summarizes groundwater sampling revisions at seven active restoration sites on Fort Monmouth property. The Directorate of Public Works (DPW) and TECOM-Vinnell Services (TVS) personnel currently conduct quarterly groundwater monitoring at each of these sites.

The DPW has submitted Remedial Investigation Reports (RIRs), prepared by VERSAR, Inc., requesting no further action (NFA) at four sites including Landfill M-12 (FTMM-12), Landfill M-18/290/296 (FTMM-18/55/54), Landfill M-3 (FTMM-03), and Site 108 (FTMM-57). Two RIRs requesting NFA are pending submittal including Site 80/166 (FTMM-56) and Landfill CW3A (FTMM-25), and one Remedial Action Report for Site 886 (FTMM-66) recommending natural attenuation is also pending submittal.

Initial groundwater sampling at each site consisted of a comprehensive analytical program including volatile organic compounds (VOCs); semi-volatile organic compounds (SVOCs); pesticides/polychlorinated biphenyls (PCBs); and TAL metals. Analytical results were then examined to establish potential contaminants of concern (COCs). Each site report presents the identified potential COCs based on the comparison of groundwater analytical results to the higher of the Practical Quantitation Limits (PQLs) and the NJDEP Groundwater Quality Criteria (GWQC) for Class II-A aquifers (NJAC 7:9-6, Table 1). Further evaluation of the potential COCs was then performed to assess contaminant occurrence/magnitude, transport (modeling), and risk to receptors, the environment and human health to determine if remedial action was warranted.

Based on report conclusions, Fort Monmouth DPW proposes the following revisions to the current groundwater sampling program at these sites to maintain a compliant and cost effective program. As discussed, proposed changes will be implemented immediately unless otherwise directed by the NJDEP.

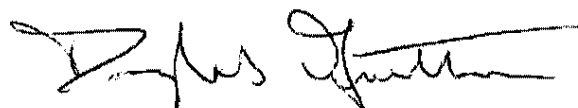
The following table summarizes the revised sampling program at these sites:

Submitted No Further Action Requests			
Site	Was Analyzed:	Revised Analysis:	Potential Contaminants of Concern
Landfill M-12 (FTMM-12)	Quarterly for VOCs, SVOCs, pesticides/PCBs, Metals	Quarterly for TAL Metals.	Arsenic and lead
Landfill M-18/290/296 (FTMM-18/55/54)	Quarterly for VOCs, SVOCs, pesticides/PCBs, Metals	Quarterly for VOCs and TAL Metals.	Benzene, arsenic, cadmium, chromium and lead
Landfill M-3 (FTMM-03)	Quarterly for VOCs, SVOCs, pesticides/PCBs, Metals	Quarterly for VOCs.	Chlorobenzene
Site 108 (FTMM-57)	Quarterly for VOCs, SVOCs, pesticides/PCBs, Metals	Quarterly for TAL Metals.	Arsenic
No Further Action Requests - Submittal Pending			
Site 80/166 (FTMM-56)	Quarterly for VOCs, SVOCs, pesticides/PCBs, Metals	Quarterly for Pesticides and TAL Metals.	a-chlordane, g-chlordane, arsenic and lead
Landfill CW3A (FTMM-25)	Quarterly for VOCs, SVOCs, pesticides/PCBs, Metals	Quarterly for TAL Metals.	Non-Native Metals
Natural Attenuation Request - Submittal Pending			
Site 886 (FTMM-66)	Quarterly for VOCs, SVOCs, pesticides/PCBs, Metals	Quarterly for VOCs and SVOCs	Benzene and 2-butanone

Groundwater sampling and monitoring will continue at these sites as indicated above, in accordance with NJDEP *Technical Requirements for Site Remediation* (July 1999), NJAC 7:26E, et seq. and *Fort Monmouth Standard Sampling Operating Procedure* (1997), pending NJDEP review of these site documents. I have attached an updated summary table of site reports previously submitted to NJDEP which are pending review.

If you should have any questions or comments, please contact me at (732) 532-0986.

Sincerely,



Douglas C. Guenther
Environmental Protection Specialist
Directorate of Public Works

Attachment: Restoration Program Report Status Table
cc: File



State of New Jersey - Tics

DEPARTMENT OF ENVIRONMENTAL PROTECTION
PUBLICLY FUNDED REMEDIATION ELEMENT
P.O. BOX 413
TRENTON, NJ 08625-0413

JON S. CORZINE
Governor

LISA P. JACKSON
Commissioner

April 29, 2008

Mr. Joseph Fallon, CHMM
Directorate of Public Works
ATTN: IMNE-MON-PWE
167 Riverside Ave.
Fort Monmouth, NJ 07703

RE: Remedial Investigation Report and CEA Information
Site 80/166 - Main Post
Fort Monmouth, NJ

Dear Mr. Fallon:

The NJDEP Division of Remediation Management & Response (DRMR) has completed its review of the report titled "Remedial Investigation Report, Site 80/166", dated January 4, 2005, by Versar Inc. We have also reviewed the Classification Exception Area (CEA) Information for Site 80/166 that is included in the report titled "Classification Exception Area Information for Various Sites", dated July 12, 2004 by Versar. Our comments are attached.

You or your staff may contact me at 609-633-0766 with any questions on the enclosed comments, or any other site remediation matters at Fort Monmouth.

Sincerely,

Larry Quinn, P.E., CHMM, Site Manager
Bureau of Design and Construction

Attachment

NJDEP COMMENTS ON
RI REPORT and CEA INFORMATION for SITE 80/166
FORT MONMOUTH, NJ

RI Report

1. Soil. Based upon the information provided in the RIR, no further investigation of soil is required at Site 80/166.
2. Section 5.3: The statement the benzene is not a ground water contaminant of concern (COC) is not acceptable to the NJDEP. Benzene was detected above the New Jersey Ground Water Quality Criteria (GWQC) of 1.0 ug/l in ground water samples from one well and two geoprobe borings near the Building 80 tank excavation. Therefore, benzene must be a COC in the RIR. The fate and transport of benzene as a ground water contaminant must be determined. Benzene must also be included on all Figures as appropriate, including Figure 5.1.
3. Section 7.0. This section recommends no further action (NFA) for pesticides and metals in ground water. The Department acknowledges the results of the fate and transport modeling of those COCs. However, an NFA determination is not acceptable. The Army needs to request approval for a natural ground water remediation remedy, together with the proposed Classification Exception Area (CEA), as detailed in 7:26E-6.3(d) and (e). Also, based on comment #1, benzene must be included in the remedial proposal.
4. VOC TICs: The NJDEP Ground Water Quality Criteria for Volatile Organic Tentatively Identified Compounds (TICs) are as follows: 100 ppb for individual TICs, and 500 ppb for total TICs. Geoprobe boring #4 registered a slight exceedance of the Criteria with a reported 110 ppb of 2,3-Dihydro-1-methylindene. NJDEP isn't requiring any action, based upon downgradient geoprobe sample TICs, but this exceedance should be noted in the report and shown on Figure 5-2.
5. Section 3.0 (Site Activities): The report states that sampling and decontamination procedures were conducted in accordance with the December 1997 Fort Monmouth Standard Sampling Operating Procedure. All future sampling procedures and equipment decontamination must be conducted pursuant to the most recent version of the NJDEP Field Sampling Procedures Manual per the requirements of N.J.A.C. 7:26E-4.4(d).

NJDEP COMMENTS ON
RI REPORT and CEA INFORMATION for SITE 80/166
FORT MONMOUTH, NJ (continued)

6. Section 3.2 (Ground water Sample Collection Activities): The report is deficient pursuant to N.J.A.C. 7:26E-4.8(c)7. Information regarding the purging and sampling of the monitoring wells was not provided in the report. At a minimum, the purging and sampling information for the last 4 quarters of sampling must be submitted to NJDEP. The information should be submitted for all sampling events if available on compact disc.
7. Ground Water Contour Maps: For future reference, the Contour Map Reporting Form found in Appendix G of the Technical Requirements must be completed and submitted for each ground water contour map included in reports.
8. Figure 2-4. The scale on this figure (1"= 10') is incorrect.

CEA Information Report

1. Benzene. Benzene must be included in the CEA Proposal as a COC, and its fate and transport must be determined.
2. The current and projected use of ground water in the proposed CEA must be addressed.

Bc:

K. Petrone, BIDC

J. Prendergast, BEERA

D. Clark, BGWPA

B. Verner, BIDC

S. Maybury, BCM

K. Koschek, Environmental Regulation



State of New Jersey

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BOB MARTIN
Commissioner

July 3, 2014

Wanda Green
BRAC Environmental Coordinator
OACSIM – U.S. Army Fort Monmouth
PO Box 148
Oceanport, NJ 07757

Re: Final Baseline Groundwater Sampling Report (August 2013)
Remedial Investigation/Feasibility Study/Decision Documents
Fort Monmouth
Oceanport, Monmouth County
PI G000000032

Dear Ms. Green:

The New Jersey Department of Environmental Protection (Department) has completed review of the referenced report, dated March 2014, received on April 7, 2014. The report was prepared by Parsons Government Services Inc. (Parsons), in support of the Remedial Investigation (RI), Feasibility Study (FS), and Decision Documents project at Fort Monmouth.

A baseline ground water sampling event was conducted at 21 "sites" at the Fort Monmouth property in August 2013. The purpose of the sampling event was to re-establish baseline conditions following suspension of ground water sampling in late 2011, as well as to evaluate Fort Monmouth's long-term ground water sampling program, and the current analytical conditions of the ground water at each site. Sampling methodologies used included low-flow and passive diffusion bag samplers (PDBS). At four sites (FTMM-14, 18, 59, 68), only PDBS sampling was conducted. At three sites (FTMM-05, 22, 58) both low-flow and PDBS samples were obtained for comparison purposes. Fourteen (14) sites were only sampled using low-flow. The report states that PDBS concentrations were consistently biased somewhat low compared to the low-flow concentrations. The report concludes, however, that the PDBS results were still similar to the low-flow results and are considered representative of ground water conditions at the sites. Based on this conclusion, the report states that for future ground water sampling, PDBS will be used for all sites where volatile organic compounds (VOCs) are the sole contaminants of concern. Comments are presented below.

Section 3.1; Table 6; Appendices & associated Tables - *The "background concentrations" submitted in the 1995 Weston report were not accepted by the Department as representative of background conditions for Fort Monmouth. The study was not performed in accordance with Departmental protocol and is not a consideration in our evaluations/determinations. As indicated in Section 3.1, background concentrations are evaluated on a site by site basis.*

FTMM-02 Landfill

Historic sampling at this parcel indicated levels of VOCs above the Ground Water Quality Standard (GWQS); metals were previously determined to be reflective of naturally occurring conditions. The August 2013 sampling of wells using low-flow confirmed the continued exceedance of the GWQS for VOCs. The report recommends VOC sampling of wells M2MW03, M2MW11, M2MW21, M2MW22 and M2MW24 for two additional rounds using PDBS. Well M2MW10 will be monitored as a downgradient sentinel well. Although the proposal is acceptable, for wells in which the saturated screen length exceeds 10 feet, the deployment of multiple PDBS will be required. At any point where a decision is made to terminate ground water sampling at this site, confirmatory sampling using low-flow due to PDBS biasing low as compared to low-flow results at the Fort Monmouth site will be required.

FTMM-03 Landfill

Historic sampling at this parcel revealed GWQS exceedances of vinyl chloride and metals. The August 2013 sampling of wells using low-flow confirmed the continued exceedance of the GWQS for vinyl chloride in well 3MW07. Well 3MW02 was not sampled due to low water column and silty conditions, however, Table 4 of Appendix B recommends sampling of 3MW02 for VOCs and metals. The report attributes the presence of vinyl chloride to leaching of PVC piping from well 3MW07. A temporary well point investigation was conducted in 2009 to delineate the vinyl chloride, the results were non-detect, and abandonment of 3MW07 is recommended. The recommendations are acceptable. However, a figure presenting the locations and sampling results from the 2009 temporary well point investigation must be provided to the Department.

FTMM-04 Landfill

Historic sampling at this parcel revealed GWQS exceedances of various metals. The August 2013 sampling of wells using low-flow confirmed the continued exceedance of the GWQS for metals. The metals are attributed to background conditions, and cessation of ground water sampling is recommended. The recommendation is acceptable. Monitoring wells at this parcel shall be properly abandoned if they are no longer subject to sampling or gaging for water elevation data.

FTMM-05 Landfill

Historic sampling at this parcel revealed GWQS exceedances of PCE, TCE and vinyl chloride, which the August 2013 sampling, using low-flow and PDBS, confirmed. The report recommends annual VOC sampling of wells M5MW11, M5MW16, M5MW20 and M5MW23 using PDBS. The Department finds the proposal to be acceptable. At any point where a decision is made to terminate ground water sampling at this parcel, the Department will require confirmatory sampling using low-flow due to PDBS results at this parcel biased low compared to the low-flow results.

FTMM-08 Landfill

Historic sampling at this parcel revealed GWQS exceedances of pesticides, benzene, PCE and lead. The August 2013 sampling of wells using low-flow confirmed the exceedance of the GWQS for PCE and lead. The well with historic pesticide exceedances (697MW01) could not be located and was not sampled. The report recommends annual ground water sampling of well M8MW11 for VOCs and lead, M8MW12, 15, 16 and 24 for VOCs and M8MW17 and 21 for lead only. Monitoring well 697MW01 will be located and sampled for pesticides, lead and VOCs. The recommendation is acceptable.

FTMM-12 Landfill

Historic sampling at this parcel revealed GWQS exceedances of various metals, including arsenic and lead. Historic exceedances of metals except for lead are attributed to background quality. The August 2013 sampling was conducted for lead analysis only. Lead was not detected. The report recommends discontinuing ground water sampling at this parcel. The Department finds the recommendation to be acceptable. Monitoring wells at this parcel shall be properly abandoned if they are no longer subject to sampling or gaging for water elevation data.

FTMM-14 Landfill

Historic sampling at this parcel revealed no GWQS exceedances of VOCs. The August 2013 sampling of wells using PDBS confirmed that there was no exceedance of the GWQS. The report recommends discontinuing ground water sampling at this parcel. The Department finds the recommendation to be acceptable. Monitoring wells at this parcel shall be properly abandoned if they are no longer subject to sampling or gaging for water elevation data. The Department also notes that on Table 1, well M14MW19 is listed as having 10 feet of total screen length. However, the table also lists the saturated screen length as 13.35 feet. This discrepancy should be clarified.

FTMM-18 Landfill

Historic sampling at this parcel revealed GWQS exceedances of benzene and 1,2-DCA. The August 2013 sampling results of wells using PDBS showed the exceedance of the GWQS for 1,2-DCA in well M18MW22. Well M18MW23 could not be located and was not sampled. The report recommends annual ground water sampling using PDBS for M18MW22 and M18MW23 if it can be located. Every reasonable effort, such as reviewing the NJ State Plane Coordinates of the well, must be made to locate M18MW23. The use of M18MW22 as the sole monitoring well at this parcel will not be acceptable due to the vast difference in historical concentrations between M18MW22 and M18MW23. Historic 2011 benzene concentrations for M18MW23 were 775 ppb and 664 ppb while 2011 concentrations for M18MW22 were 1.81 ppb and 1.65 ppb. The Department cannot approve the use of PDBS sampling only for this parcel. Once M18MW23 is located, the Department can approve the use of both PDBS and low-flow sampling for comparison purposes.

FTMM-22 Former Wastewater Treatment Lime Pit

Historic sampling at this parcel revealed GWQS exceedances of TCE. The August 2013 sampling of wells using low-flow and PDBS confirmed the continued exceedance of the GWQS for TCE in ground water. The report recommends quarterly VOC sampling of wells CW1MW27, CW1MW29, CW1MW31 and CW1MW281 using PDBS. The Department finds the proposal to be acceptable. At any point where a decision is made to terminate ground water sampling at this parcel, the Department will require confirmatory sampling using low-flow due to PDBS results biasing low compared to low-flow results at the Fort Monmouth site.

FTMM-25 Landfill

Historic sampling at this parcel revealed GWQS exceedances of various metals. The August 2013 sampling of wells using low-flow confirmed the continued exceedance of the GWQS for metals. The metals are attributed to background conditions. The report recommends discontinuing ground water sampling at this parcel. The Department finds the recommendation to be acceptable. Monitoring wells at this parcel shall be properly abandoned if they are no longer subject to sampling or gaging for water elevation data.

FTMM-53 Building 699

Historic sampling at this parcel revealed GWQS exceedances of benzene, PCE, TCE, TBA, VOC TICs and lead. The August 2013 sampling of wells using low-flow showed the exceedance of the GWQS for benzene, xylenes, PCE, 1,2,4-Trimethylbenzene, 1,3,5-Trimethylbenzene and VOC TICs. The report recommends quarterly VOC sampling of wells 699MW01, 699MW04, 699MW06, 699MW09, 699MW16, 699RW03, 699RW05 and 699RW11 using PDBS. The Department finds the proposal to be acceptable. For wells in which the saturated screen length exceeds 10 feet, the deployment of multiple PDBS will be required. At any point where a

decision is made to terminate ground water sampling at this parcel, the Department will require confirmatory sampling using low-flow due to PDBS biasing low compared to low-flow at the Fort Monmouth site.

FTMM-54 Building 296

Historic sampling at this parcel revealed GWQS exceedances of benzene, lead and arsenic. The metals are attributed to background conditions. The August 2013 sampling of wells using low-flow showed an exceedance of the GWQS for benzene. The report recommends annual VOC sampling of wells 269MW04 and 296MW06 using PDBS. The Department finds the proposal to be acceptable. For wells in which the saturated screen length exceeds 10 feet, the deployment of multiple PDBS will be required. At any point where a decision is made to terminate ground water sampling at this parcel, the Department will require confirmatory sampling using low-flow due to PDBS biasing low compared to low-flow at the Fort Monmouth site.

FTMM-55 Building 290

Historic sampling at this parcel revealed GWQS exceedances of arsenic and lead. The August 2013 sampling of wells using low-flow confirmed the continued exceedance of the GWQS for lead. The metals are attributed to background conditions. The report recommends discontinuing ground water sampling at this parcel. The Department finds the recommendation to be acceptable. Monitoring wells at this parcel shall be properly abandoned if they are no longer subject to sampling or gaging for water elevation data.

FTMM-56 Building 80

Historic sampling at this parcel revealed GWQS exceedances of chlordane, arsenic, lead and cadmium. The August 2013 sampling of wells was conducted for lead only using low-flow. There were no exceedances of lead. The report recommends one additional sampling round of well 80MW02 for chlordane and 80MW05 for lead. The Department finds the recommendation for well 80MW02 to be acceptable. The Department disagrees with the recommendation to sample well 80MW05 for lead only. The last low-flow sampling event in August 2011 had lead, arsenic and cadmium exceeding both the GWQS and background concentrations. Well 80MW05 shall be sampled during the next round for TAL metals.

FTMM-57 Building 108

Historic sampling at this parcel revealed GWQS exceedances of lead. In the August 2013 sampling event, there were no exceedances of lead in ground water. The report recommends two additional sampling rounds of well 108MW04 for lead. The Department finds the recommendation acceptable.

FTMM-58 Building 2567

Historic sampling at this parcel revealed GWQS exceedances of TBA in wells 2567MW01 and 2567MW03. The August 2013 sampling results using low-flow and PDBS were below the GWQS for TBA. The report recommends two annual sampling events for TBA analyses of wells 2567MW01 and 2567MW03 using low-flow. The Department finds the proposal to be acceptable.

FTMM-59 Building 1122

Historic sampling at this parcel revealed no GWQS exceedances for VOCs. The August 2013 sampling results of wells using PDBS showed no exceedance of VOCs. The text of the report recommends VOC sampling of well 1122MW07 for one additional sampling round to confirm the 2013 results because August 2013 was the first time this well was sampled. The Department finds the proposal to be acceptable. The Department also notes that there is a discrepancy between the recommendation in the text and the recommendation in Table 7. Table 7 recommends that sampling at this parcel be discontinued. Table 7 shall be amended to indicate well 1122MW07 will be sampled for VOCs using PDBS methodology.

FTMM-61 Building 283

Historic sampling at this parcel revealed GWQS exceedances of metals, benzene and VOC TICs in 283MW02. The August 2013 sampling of wells using low-flow for VOCs and lead showed no exceedances. The report recommends VOC sampling of well 283MW02 for one additional sampling round using PDBS methodology to confirm the 2013 results. The Department finds the proposal to be conditionally acceptable. If the saturated screen length exceeds 10 feet, the deployment of multiple PDBS will be required. If a decision is made to terminate ground water sampling at this parcel based on PDBS results, the Department will require confirmatory sampling using low-flow due to PDBS biasing low compared to low-flow at the Fort Monmouth site.

FTMM-64 Building 812

Historic sampling at this parcel revealed GWQS exceedances of benzene, vinyl chloride and metals. The August 2013 sampling of wells using low-flow for VOCs and lead showed no exceedances. The report recommends VOC sampling of well 812MW04 for one additional sampling round using PDBS methodology to confirm the 2013 results (however Section 5.0 recommends sampling be continued on an annual basis). The Department finds the proposal to be conditionally acceptable. If the saturated screen length exceeds 10 feet, the deployment of multiple PDBS will be required. If a decision is made to terminate ground water sampling at this

parcel based on PDBS results, the Department will require confirmatory sampling using low-flow due to PDBS biasing low compared to low-flow at the Fort Monmouth site.

FTMM-66 Building 886

Historic sampling at this parcel revealed GWQS exceedances of benzene, VOC TICs, arsenic and lead. The August 2013 sampling results from wells using low-flow showed the exceedance of the GWQS for SVOC TICs. The report recommends that sampling at this parcel be discontinued. The Department finds the recommendation unacceptable. Total SVOC TICs exceeded the GWQS of 500 ppb in wells 886RW01 and 886RW06. Ground water monitoring of wells 886RW01, 886RW06 and 886RW08 shall continue for SVOC+TICs using low-flow methodology.

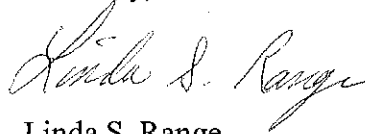
FTMM-68 Building 700

There are no historic sampling results for this parcel. The August 2013 sampling results of wells using PDBS showed the exceedance of the GWQS for PCE, TCE, cis-1,2-DCE and vinyl chloride in wells 565MW01 and 565MW01D. The report recommends quarterly ground water sampling for VOC+TICs using PDBS for these 2 wells. The Department agrees with the recommendation of quarterly sampling, however, has concerns regarding the use of PDBS for long-term monitoring at this parcel. Unlike the other Fort Monmouth parcels, there are no historical ground water sampling data for comparison with the PDBS results. The DEP's Field Sampling Procedures Manual states that "the intended application of Passive Diffusion Bag Samplers (PDBS) is for long-term monitoring of volatile organic compounds (VOCs) in ground water at well-characterized sites." The Department would find long-term sampling of the wells using PDBS acceptable if low-flow sampling is conducted concurrently once or twice for comparison.

Finally, each of the above comments speak only to the ground water findings and recommendations included in the referenced submittal, rather than to the ground water at the entire site.

Please contact this office if you have any questions.

Sincerely,



Linda S. Range

C: Joe Pearson, Calibre
Rick Harrison, FMERA
Julie Carver, Matrix
Frank Barricelli
Daryl Clark, BGWPA



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KIM GUADAGNO
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BOB MARTIN
Commissioner

February 5, 2015

Wanda Green
BRAC Environmental Coordinator
OACSIM – U.S. Army Fort Monmouth
PO Box 148
Oceanport, NJ 07757

Approval

Re: *November 26, 2014 Response to Comments –on the Final Baseline Ground Water Sampling Report (August 2013)*
Fort Monmouth
Monmouth County
PI # G000000032
Activity Number: RPC000001

Dear Ms. Green:

The New Jersey Department of Environmental Protection (Department) has completed a review of the referenced Response to Comments dated November 26, 2014, submitted in response to the Department's comment letter dated July 3, 2014 regarding the Final Baseline Ground Water Sampling Report.

The *Response to Comments* agrees with or acknowledges the Department's comments for areas FTMM-03, FTMM-04, FTMM-05, FTMM-08, FTMM-12, FTMM-14, FTMM-22, FTMM-25, FTMM-53, FTMM-54, FTMM-55, FTMM-56, FTMM-57, FTMM-58, FTMM-59, FTMM-61, FTMM-64, and FTMM-66.

FTMM-18

The Department had indicated low-flow sampling must also be performed if Passive Diffusion Bag Sampling (PDBS) is conducted, for comparison purposes. The *Response to Comments* submittal contends as low-flow sampling has been historically conducted at this area, PDBS sampling only is appropriate. Based upon this reasoning, the Department agrees the performance via PDBS only is acceptable for the ensuing round of ground water sampling. The PDBS results are to be compared to the previous low-flow sampling results and presented in the forthcoming sampling report.

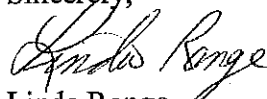
FTMM-68

The Department had expressed concern regarding the use of PDBS for long-term monitoring. FTMM-68 has not been fully characterized, and the use of PDBS for longer term monitoring is acceptable only for well characterized sites, as per the DEP's Field Sampling Procedures

Manual. As per information provided in the *Response to Comments* submittal, a Remedial Investigation to fully characterize the area is to be conducted in the near future using low-flow sampling methodology, and request approval for the use of PDBS to characterize contaminant concentrations in the interim. This is acceptable based on the stipulation that a full remedial investigation is to be performed. The November '14 *Response to Comments* (Section V), however, indicated the Remedial Investigation Workplan for FTMM-68 was awaiting DEP approval. Although some clarification was requested, the proposed remedial activities, soil and ground water, were approved for the FTMM-68 area via letter dated *January 8, 2014*, which addressed the RI/FS Workplan for FTMM-22, FTMM-53, FTMM-59 & FTMM-68.

If you have any questions, please contact me at (609)984-6606, or via email at Linda.Range@dep.nj.gov.

Sincerely,



Linda Range
Bureau of Case Management

cc: Joe Pearson, Calibre
Rick Harrison, FMERA
Joe Fallon, FMERA
Frank Barricelli, RAB



State of New Jersey

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BOB MARTIN
Commissioner

KIM GUADAGNO
Lt. Governor

November 14, 2016

William R. Colvin
BRAC Environmental Coordinator
OACSIM – U.S. Army Fort Monmouth
PO Box 148
Oceanport, NJ 07757

Re: *Annual (Fourth Quarter) 2015 Groundwater Sampling Report dated September 2016*
Fort Monmouth
Oceanport, Monmouth County
PI G000000032

Dear Mr. Colvin:

The New Jersey Department of Environmental Protection (NJDEP) has completed review of the referenced report, received September 29, 2016, prepared by Parsons to support the Remedial Investigation (RI), Feasibility Study (FS), and Decision Documents project at Fort Monmouth. An annual ground water sampling event was conducted at twelve (12) FTMM sites between September 30, 2015 and December 15, 2015. Sampling methodologies used included low-flow purging and sampling (LFPS) and passive diffusion bag samplers (PDBS). Comments on each FTMM site are as follows:

FTMM-02 Landfill

Historic sampling results at FTMM-02 have exhibited exceedances of the Ground Water Quality Standard (GWQS) for VOCs. Results from the 2015 annual sampling event exceeded the GWQS for MTBE and TBA in M2MW22. The report recommends biennial sampling of M2MW03, M2MW10 and M2MW22 as part of the biennial sampling requirements for the existing CEA for this site. The existing CEA will also be revised to include TBA and MTBE. The recommendation is acceptable. At any point where a decision is made to terminate ground water sampling at this parcel, confirmatory sampling using low-flow methodology is required.

FTMM-05 Landfill

Historic sampling results at FTMM-05 have exhibited exceedances of the GWQS for PCE, TCE and vinyl chloride. Results from the 2015 annual sampling event exceeded GWQS for PCE in wells M5MW11, M5MW16, M5MW20 and M5MW23. The report recommends the

establishment of a CEA, with biennial ground water sampling of wells M5MW11, M5MW16, M5MW20 and M5MW23 for VOCs as the "preferred remedy". Although an essential component of certain ground water remedies, a CEA is an institutional control rather than a remedy. A remedial action proposal, e.g. Monitored Natural Attenuation (MNA), in accordance with the applicable requirements of N.J.A.C. 7:26E-5.1, must be submitted to address the ground water contaminants. At such time as the formal proposal for a CEA is to be submitted, the proposal must be accompanied by a CEA/WRA Fact Sheet Form; the form and form instructions may be obtained from the Site Remediation website at www.nj.gov/dep/srp/srra/forms/. Submittal of a draft CEA/WRA Fact Sheet Form is recommended to allow for DEP confirmation of the CEA components and boundaries.

FTMM-08 Landfill

Historic sampling results at FTMM-08 exhibited exceedances of the GWQS for pesticides, benzene, PCE and lead. Results from the 2015 annual sampling event exceeded the GWQS for PCE, lead and pesticides. The 2016 RIR for FTMM-08, however, indicated manganese is also a contaminant of concern which requires monitoring. The submittal recommends the establishment of a CEA, with biennial ground water sampling for the contaminants of concern from selected wells. As above, although an essential component of certain ground water remedies, a CEA is an institutional control rather than a remedy. A remedial action proposal, e.g. Monitored Natural Attenuation (MNA), in accordance with the applicable requirements of N.J.A.C. 7:26E-5.1, must be submitted to address the ground water contaminants. At such time as the formal proposal for a CEA is to be submitted, the proposal must be accompanied by a CEA/WRA Fact Sheet Form; the form and form instructions may be obtained from the Site Remediation website at www.nj.gov/dep/srp/srra/forms/. Submittal of a draft CEA/WRA Fact Sheet Form is recommended to allow for DEP confirmation of the CEA components and boundaries.

FTMM-18 Landfill

Historic sampling results at FTMM-18 exhibited exceedances of the GWQS for benzene and 1,2-DCA. Results from the annual 2015 sampling event exceed the GWQS for benzene in well 296MW06. In the October 2015 RIR for FTMM-18, it was indicated that manganese is also a contaminant of concern, which requires monitoring. The report recommends the establishment of a CEA as the preferred remedy, with biennial ground water sampling for the contaminants of concern from selected wells. As above, although an essential component of certain ground water remedies, a CEA is an institutional control rather than a remedy. A remedial action proposal, e.g. Monitored Natural Attenuation (MNA), in accordance with the applicable requirements of N.J.A.C. 7:26E-5.1 and guidance documents, must be submitted to address the ground water contaminants. At such time as the formal proposal for a CEA is to be submitted, the proposal must be accompanied by a CEA/WRA Fact Sheet Form; the form and form instructions may be obtained from the Site Remediation website at www.nj.gov/dep/srp/srra/forms/. Submittal of a draft CEA/WRA Fact Sheet Form is recommended to allow for DEP confirmation of the CEA components and boundaries.

FTMM-22 - Former Wastewater Treatment Lime Pit

Historic sampling results at FTMM-22 exhibited exceedances of the GWQS for TCE and vinyl chloride. Results from the annual 2015 sampling event also exceeded the GWQS for TCE and vinyl chloride. Long-term ground water monitoring has been suspended while the remedial investigation/feasibility study (RI/FS) is being conducted. Upon completion of the RI/FS, a revised monitoring program will be proposed. The recommendation is acceptable.

FTMM-53 - Former Gas Station at Building 699

Historic sampling results at FTMM-53 exhibited exceedances of the GWQS for benzene, PCE, TCE, TBA, VOC TICs and lead. Results from the 2015 annual sampling event exceeded the GWQS for benzene, PCE, 1,2,4-trimethylbenzene, and VOC TICs. Long-term ground water monitoring has been suspended while the RI/FS is being conducted. Upon completion of the RI/FS, a revised monitoring program will be proposed. The recommendation is acceptable.

FTMM-56 – Building 80 Petroleum Release

Historic sampling results at FTMM-56 exhibited exceedances of the GWQS for pesticides and metals. Recently, one additional round of sampling from two wells was required; results from the 2015 annual sampling event found a single exceedance of the GWQS, of arsenic, however, the arsenic concentration is determined to be representative of background conditions, and no further action for ground water is necessary.

FTMM-57 - Building 108 UST Gasoline Release

Historic sampling results at FTMM-57 exhibited an exceedance of the GWQS for lead. Results from the 2015 annual sampling event were below the GWQS for lead; no further action for ground water is acceptable.

FTMM-58 - Building 2567 UST Gasoline

Historic sampling results at FTMM-58 exhibited exceedances of the GWQS for TBA. Results from the 2015 annual sampling event continue to exceed the GWQS for TBA. The submittal recommends continued sampling of well 2567MW01 and the addition of downgradient well 2567MW05 for TBA. One additional round of sampling is recommended for monitoring of 2567MW03 for TBA to confirm compliance for same. The recommendations are acceptable.

Evaluations regarding potential benzene exceedances relative to FTMM-58 continue under separate investigative efforts.

FTMM-64 - Building 812 UST Gasoline

Historic sampling results at FTMM-64 exhibited exceedances of the GWQS for benzene, vinyl chloride and metals. Although results from the 2015 annual sampling event were below the GWQS for contaminants of concern, due to previous analytical results, the submittal recommends continued annual sampling of well 812MWS04 for VOCs. The recommendation is acceptable. If a decision is made to terminate ground water sampling at FTMM-64, confirmatory sampling using the low-flow methodology will be required.

FTMM-66 - Building 886 Former AST

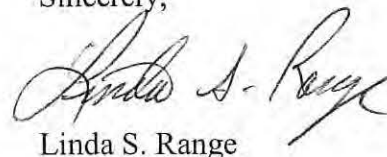
Historic sampling results from wells at FTMM-66 exhibited exceedances of the GWQS for SVOC TICs; results from the 2015 annual sampling event did not exceed the GWQS for SVOC TICs. The submittal recommends the ground water sampling at FTMM-66 be discontinued. The recommendation is acceptable; no further action for ground water is necessary.

FTMM-68 - Building 700 Former Dry Cleaners

Historic sampling results have shown exceedances of the GWQS for PCE, TCE, cis-1,2-DCE and vinyl chloride in ground water. Results from the 2015 annual sampling event confirmed these chlorinated VOCs continue to exceed GSQS in ground water. Long-term ground water monitoring has been suspended until such time as the RI/FS is completed. Upon completion of the RI/FS, a revised monitoring program will be proposed. The recommendation is acceptable.

Please contact this office if you have any questions.

Sincerely,



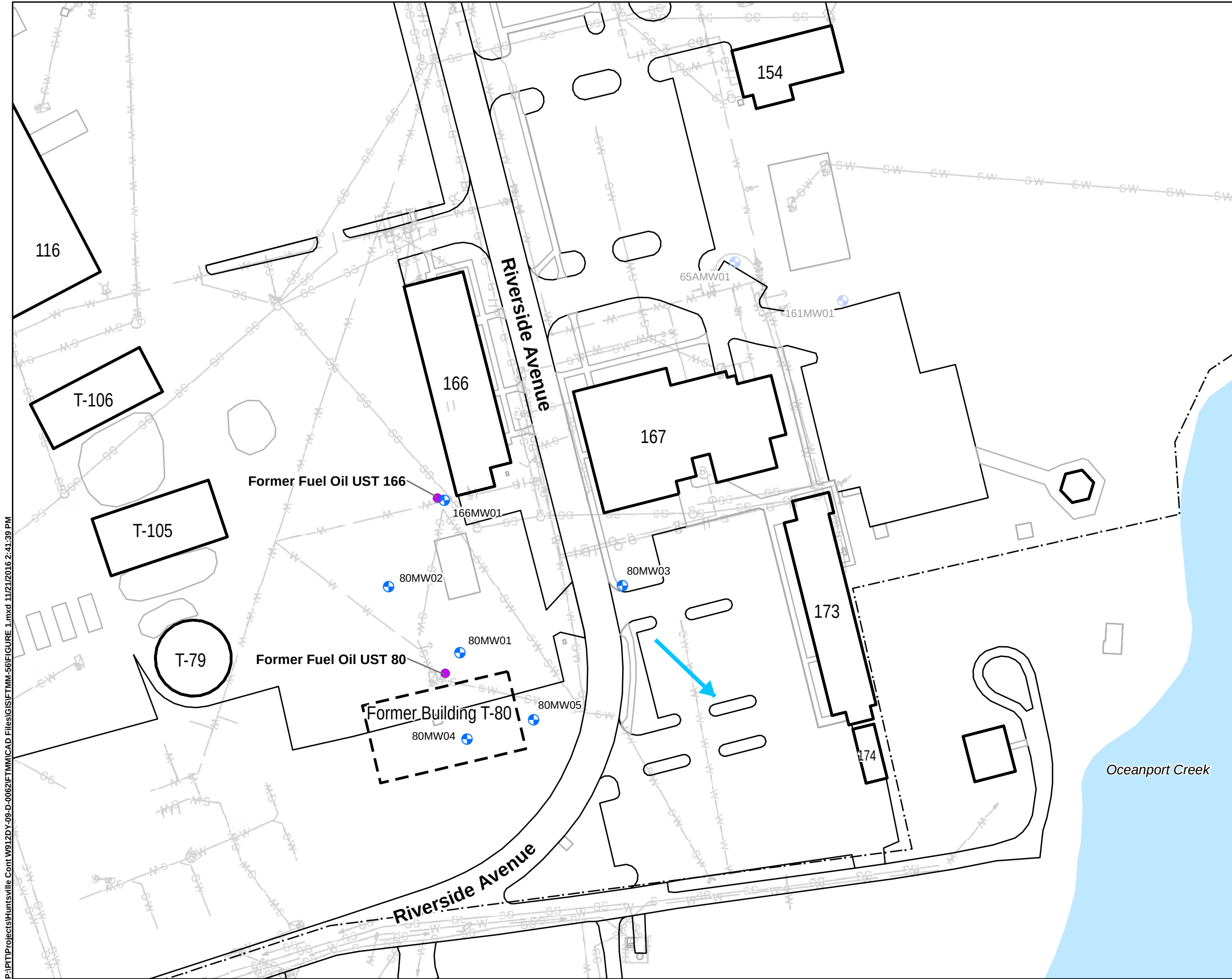
Linda S. Range

C: James Moore, USACE
Cris Grill, Parsons
Joe Pearson, Calibre
Rick Harrison, FMERA
Joe Fallon, FMERA
Daryl Clark, BGWPA

ATTACHMENT B

Figure 1 – Layout of FTMM-56

**Figure 2 – 2015 Concentrations in Groundwater Exceeding NJDEP GWQS at
FTMM-56**



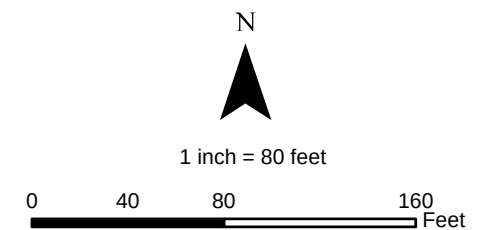
LEGEND:

- FTMM-56 Shallow Monitoring Well
- Shallow Monitoring Well not Associated with FTMM-56
- Former UST Location
- Installation Boundary
- W Water Line
- S Sanitary Sewer Line
- SW Storm Sewer Line
- G Gas Line
- Estimated Groundwater Flow Direction
- Former Building T-80 (demolished in 1994)

NOTE:

FTMM-56 is generally considered to be the UST 80 and UST 166 locations and associated monitoring wells.

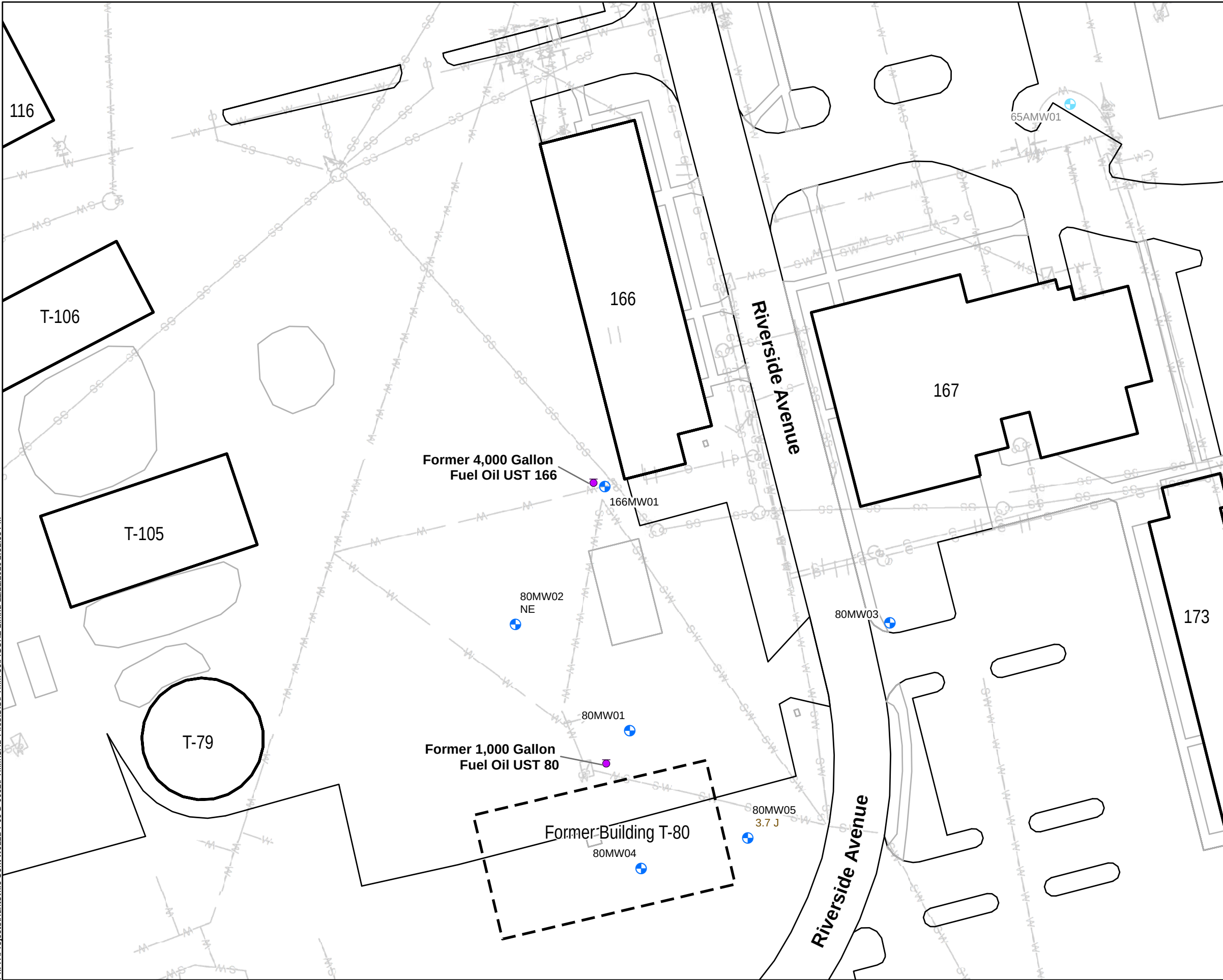
DRAFT



Source: FTMM Supplied CAD, 2013.

PARSONS 401 Diamond Drive NW, Huntsville AL	Fort Monmouth New Jersey
LAYOUT OF FTMM-56 BUILDING 80 PETROLEUM RELEASE	
CREATED BY: RR	REVIEWED BY: ME
DATE: NOV. 2016	FIGURE NUMBER: FIGURE 1
PROJECT NUMBER: 748810-01000	FILE: FIGURE 1.mxd

P:\PTP\Projects\Huntsville Cont W912DY-09-D-0062\FTMM\CAD Files\GIS\FTMM-56\FIGURE 2.mxd 11/21/2016 2:51:53 PM



LEGEND:

- FTMM-56 Shallow Monitoring Well
- Shallow Monitoring Well not Associated with FTMM-56
- Former UST Location
- W Water Line
- S Sanitary Sewer Line
- SW Storm Sewer Line
- G Gas Line

NOTE:

- All concentrations are in µg/L.
- Only those analytes with concentrations that exceed the NJDEP Groundwater Quality Standards (GWQS) are shown on the figure.
- 166MW01, 80MW01, 80MW03, and 80MW04 were not sampled during the 2015 Annual Sampling Event. 80MW02 was analyzed for pesticides and 80MW05 was analyzed for arsenic, cadmium, and lead.

EXPLANATION:

80MW05 — Sample ID
3.7J — Arsenic Concentration

J - Estimated Value
NE - No analyte exceeded the NJ GWQS this sampling period

Compound	NJDEP GWQS
Arsenic	3

DRAFT

N

1 inch = 50 feet

0 25 50 100 Feet

Source: FTMM Supplied CAD, 2013.

PARSONS 401 Diamond Drive NW, Huntsville AL	Fort Monmouth New Jersey
2015 CONCENTRATIONS IN GROUNDWATER EXCEEDING NJDEP GWQS AT FTMM-56	
CREATED BY: RR	REVIEWED BY: CL
DATE: NOV. 2016	FIGURE NUMBER: FIGURE 2
PROJECT NUMBER: 748810-02140	FILE: FIGURE 2.mxd

ATTACHMENT C

Summary Reports

1. Parts of *Final Remedial Investigation Report, Site 80/166 - Main Post, U.S. Army Garrison Fort Monmouth, Fort Monmouth, New Jersey*. Versar, January 4, 2005.

U.S. Army, Directorate of Public Works
Planning & Environmental Branch
Attn: IMNE-MON-PWE, 173 Riverside Ave.
Fort Monmouth, NJ 07703

TRANSMITTAL

TO:

Gregory Zalaskus,
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DATE:

May 10, 2005

☐ URGENT ☒ FOR REVIEW ☐ PLEASE COMMENT ☐ PLEASE REPLY ☐ PLEASE RECYCLE

SUBJECT:

Document Submittal

Enclosed Please Find:

- (1) One copy of the *Remedial Action Progress Report, April 2002 through September 2004, Building 699, Main Post Gas Station*, April 2005 prepared by Handex, Inc.
 - (2) Two copies of the *Remedial Investigation Report, Building 80/166-Main Post*, January 2005, prepared by Versar, Inc.
 - (3) Two copies of the *Remedial Investigation Report, M-4 Landfill Site*, January 2005, prepared by Versar, Inc.
 - (4) Two copies of the *Remedial Investigation Report, CW-3A Landfill Site*, January 2005, prepared by Versar, Inc.
-
-

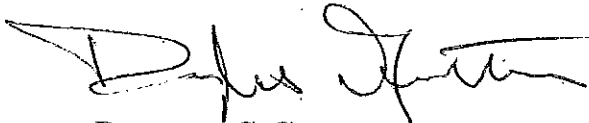
- (5) Two copies of the *Remedial Investigation Report, CW-6 Former Pesticide Storage Building*, January 2005, prepared by Versar, Inc.

Greg,

For Bldg. 699 RAPR - This is a standard RAPR indicating effective contaminant recovery at this site and the need for continued system operation and ground water monitoring.

Remaining four RIRs – These are no further action requests. We can prioritize these to discuss at future meetings. Additional copies are for John Prendergast.

Any questions let me know.



DOUGLAS C. GUENTHER

Environmental Protection Specialist

FINAL

Remedial Investigation Report Site 80/166 – Main Post

**U. S. Army Garrison Fort Monmouth
Fort Monmouth, New Jersey**



Directorate of Public Works



January 4, 2005

***Versar* INC.**

**201 Gibraltar Road, Suite 100
Horsham, Pennsylvania 19044**

**Contract No. DACA 51-00-D-004
Delivery Order No. 19**

United States Army
Fort Monmouth, New Jersey

Remedial Investigation Report
Site 80/166 – Main Post

Fort Monmouth, New Jersey

January 4, 2005

PREPARED BY:



**201 GIBRALTAR ROAD, SUITE 100
HORSHAM, PA 19044**

January 4, 2005

VERSAR PROJECT NO. 4936.119

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EXECUTIVE SUMMARY

VERSAR, Inc. (Versar) has been contracted by the United States (U.S.) Army Garrison, Fort Monmouth (Fort Monmouth), Directorate of Public Works (DPW), Fort Monmouth, New Jersey to prepare a Remedial Investigation Report (RIR) to document groundwater and surface water conditions at Site 80/166 located in the Main Post Area of Fort Monmouth, New Jersey. This report addresses the remedial investigation activities performed at this site to investigate groundwater conditions from April 1997 through August 2001.

Site 80/166 is located in the eastern part of the Main Post at Fort Monmouth, north of Riverside Avenue and south of Building 166. Site 80/166 is located approximately 500 feet northwest of Oceanport Creek. Two Underground Storage Tank (UST) closures have been performed at Site 80/166 as part of the DPW's UST management program. The groundwater monitoring program associated with the DPW's UST management program includes six monitoring wells at Site 80/166 that were installed in September 1994 and July 2000.

The *UST Closure and Site Investigation Report for Former Building T-80, NJDEP Registration No. 090010-06*, prepared by ATC Associates, BCM Division (ATC) for the DPW, July 1998, documents the removal of one single-walled, steel UST located immediately north of former Building T-80. This UST was cleaned, excavated and disposed of in accordance with New Jersey Department of Environmental Protection (NJDEP) requirements. In addition to the UST removal, approximately 56 cubic yards of potentially contaminated soil was removed and disposed offsite. Six post-excavation samples were collected and analyzed for Total Petroleum Hydrocarbons (TPHC). All samples contained either non-detectable concentrations of contaminants or detections at concentrations below NJDEP cleanup criteria.

In response to the observation of potentially contaminated soil near the shallow water table, one shallow monitoring well was installed at the former Building T-80 area. On May 19, 1995 and June 13, 1995, monitoring well 80-MW1 was sampled and analyzed for volatile organic compounds (VOCs) plus 10 Tentatively Identified Compounds (TICs) and semi-volatile organic compounds (SVOCs) plus 15 TICs. One VOC, benzene, was detected in both rounds at concentrations exceeding the NJDEP Groundwater Quality Criteria (GWQC). No other VOCs or SVOCs were detected in these two groundwater samples at concentrations exceeding the NJDEP GWQC. No product or sheen was observed in well 80-MW1 during either of the sampling rounds.

The *UST Closure and Site Investigation Report, Building 166, UST No. 90017-17*, prepared by ATC, May 2000, documents the removal of one UST located under the pavement approximately 20 feet west of the southwest corner of Building 80/166. The DPW closed UST No. 90017-17. Stained soils were observed in the excavation and organic vapors were detected with an organic vapor analyzer (OVA). Soil screening was also conducted along the former UST piping. No contamination was observed anywhere

along the piping length. Based on visual observations, approximately 24 cubic yards of potentially contaminated soil was excavated and disposed offsite during the UST closure. Nine post-excavation soil samples were collected from nine locations along the sidewalls of the UST excavation. Following removal of the fuel lines (on the same date of the tank closure), one additional post-excavation sample was collected along the former piping length, which was approximately 10 feet long. These ten post-excavation soil samples were analyzed for TPHC. TPHC was detected in each of the ten samples below the NJDEP cleanup criteria.

In response to the observation of potentially contaminated soil near the shallow water table, one shallow monitoring well was installed southwest of Building 166. Monitoring well 166-MW1 was sampled in two sampling rounds, and the samples were analyzed for VOCs plus 10 TICs and SVOCs plus 15 TICs. No VOCs or SVOCs were detected in these two groundwater samples at concentrations exceeding the NJDEP GWQC. No product or sheen was observed in well 166-MW1 during either of the sampling rounds.

Roy F. Weston, Inc. (Weston) conducted soil sampling, monitoring well installation and sampling and geophysical surveying as part of an SI of the Fort Monmouth military installation. Weston established background concentrations for soil and groundwater for the Fort Monmouth installation, as reported in the Weston SI Report (1995).

As presented in the Weston SI Report, several natural and anthropogenic factors contribute to the wide range in concentrations of metals in soils, which further impact the concentration of metals in groundwater. A low-flow sampling methodology was proposed for use by the DPW and accepted by the NJDEP to assess the impact of entrained sediments on the dissolved phase metals concentrations at Fort Monmouth.

Fort Monmouth DPW has conducted a Remedial Investigation (RI), including a groundwater sampling program, to define the areal extent of potential pollutants and evaluate impacts to groundwater in the vicinity of Site 80/166. Remedial investigation activities were performed from April 1997 and continued through August 2001.

A total of six monitoring wells comprise the quarterly groundwater monitoring program conducted by the DPW. Two of the six wells were installed in September 1994 during UST closures and site investigations. The remaining four wells were installed by the DPW on July 24, 2000. The locations of these four wells were strategically selected by the DPW to monitor possible contaminants released into the groundwater due to the former USTs located at Site 80/166.

Monitoring wells 80-MW1, 80-MW2, 80-MW3, 80-MW4, 80-MW5 and 166-MW1 were sampled during 17 quarterly groundwater sampling rounds and two low-flow rounds. The groundwater samples were analyzed for VOCs plus 15 TICs, SVOCs plus 15 TICs, pesticides, polychlorinated biphenyls (PCBs) and Target Analyte List (TAL) metals. During 19 quarterly sampling events, one VOC, four pesticides and eight TAL metals were detected in groundwater samples at concentrations above their respective NJDEP GWQC.

Geoprobe[®] soil and groundwater samples were collected in March and May 2000 at Site 80/166. A total of 18 subsurface soil samples and 18 groundwater samples were collected from 18 distinct Geoprobe[®] borings. The soil samples were analyzed for VOCs plus 15 TICs and percent solids. A total of three VOCs were detected below their respective NJDEP Residential Direct Contact Soil Cleanup Criteria (RDCSCC) and the NJDEP Impact to Groundwater Soil Cleanup Criteria (IGWSCC).

The 18 Geoprobe[®] groundwater samples were also analyzed for VOCs plus 15 TICs. A total of eight VOCs were detected in the Geoprobe[®] groundwater samples. Two VOCs were detected at concentrations that exceeded their respective GWQC.

Based on the magnitude of the exceedances, the frequency of occurrences, and the wide-ranging results, two pesticides (a-chlordane and g-chlordane) and two metals (arsenic and lead) are identified as potential COCs at Site 80/166 and are given further consideration with regard to contaminant migration potential in this RIR.

The RI also included the collection of groundwater depth measurements, the performance of slug tests, evaluation of the aquifer classification, and the completion of a sensitive receptor survey. The results of the field and laboratory investigations were used to develop a conceptual site model to provide a basis for the development of a three-dimensional computer model. The conceptual site model considers the site-specific topography, groundwater recharge, groundwater flow conditions and the geologic formations present at the site. The MODFLOW computer model was used to simulate groundwater flow and contaminant transport beneath the site. The purpose of developing a groundwater model for Site 80/166 was to predict the migration of the identified COCs in site groundwater.

Due to the low concentrations of COCs at the site and the slow migration rates for the COCs in the groundwater, there is little potential for significant COC impact by migration into Oceanport Creek. The Wenonah Mount Laurel aquifer, which is approximately 125 feet bgs, is too deep to be affected by the COCs near the ground surface. The sensitive receptor survey indicates that there are no domestic or irrigation wells close enough to Site 80/166 to be adversely impacted by COC migration.

No Further Action (NFA) is recommended with regard to pesticides and metals contamination in groundwater at Site 80/166.

1.0 INTRODUCTION

Versar has been contracted by the U.S. Army Garrison, Fort Monmouth, DPW, Fort Monmouth, New Jersey to prepare an RIR to document groundwater and surface water conditions at Site 80/166 located in the Main Post area of Fort Monmouth, New Jersey. This report addresses the remedial investigation activities performed at this site to investigate groundwater conditions from April 1997 through January 2001.

1.1 Objectives

The objectives of this RIR are to define aquifer chemical and physical characteristics and to determine the requirement for further remedial activities at Site 80/166. The remedial investigation was conducted in accordance with NJDEP *Technical Requirements for Site Remediation* (July 1999), NJAC 7:26E, et seq.

The remedial investigation and subsequent preparation of the RIR encompassed the following:

- Characterization of groundwater quality at Site 80/166 through quarterly groundwater sampling events conducted from April 1997 through January 2001.
- Characterization of the Site 80/166 groundwater quality during two low-flow sampling events in September and October 2000.
- Characterization of Site 80/166 subsurface soil and groundwater conditions through Geoprobe® borings conducted in March and May 2000.
- Comparison of the groundwater sample results with the NJDEP GWQC and subsurface soil sample results with NJDEP Residential Direct Contact Soil Cleanup Criteria (RDCSCC).
- Investigation and evaluation of the designated aquifer uses, the associated aquifer classification, and the appropriate groundwater quality criteria for groundwater resources beneath Site 80/166. The NJDEP Ground Water Quality Standards (GWQS) specify the quality criteria and designated uses for groundwater and also contain technical and general policies to ensure that the designated uses can be adequately protected.
- Performance of slug tests at Site 80/166 during August 2001 to characterize the hydraulic conductivity and groundwater flow regime.
- Development of a groundwater flow and transport model for Site 80/166 based on the hydrogeologic data, field investigation programs and technical research to evaluate the migration of potential contaminants of concern (COC) beneath Site 80/166.
- Formulation of recommendations for future remedial investigation or remedial action alternatives for Site 80/166.

1.2 Report Organization

This report is organized to minimize repetition. **Section 2.0** provides background information and a general description of Site 80/166 located in the Main Post Area of Fort Monmouth. **Section 3.0** describes and summarizes the field activities conducted at Site 80/166 including groundwater sampling from monitoring wells, groundwater and soil sampling from Geoprobe[®] borings, and aquifer testing. **Section 4.0** presents the physical characterization of Site 80/166 including lithology and groundwater conditions. The chemical characterization of Site 80/166 is presented in **Section 5.0**, which includes groundwater and soil sample results and the determination of potential COCs. **Section 6.0** discusses the potential for contaminant migration in the vicinity of Site 80/166 and presents groundwater modeling involving the COCs. Conclusions and recommendations for Site 80/166 are presented in **Section 7.0**. References used to prepare this report are listed in **Section 8.0**.

2.0 SITE BACKGROUND AND ENVIRONMENTAL SETTING

The following sections describe Site 80/166 background and the environmental setting of the area surrounding Fort Monmouth and Site 80/166. Included is a description of the location, background, current conditions and environmental setting of Site 80/166.

2.1 Site Location and Description

Fort Monmouth is located in the central-eastern portion of New Jersey in Monmouth County, approximately 45 miles south of New York City and 70 miles northeast of Philadelphia (**Figure 2-1**). In addition to the Main Post, the installation includes two subposts, the Charles Wood Area and the Evans Area. The Main Post encompasses approximately 630 acres and is bounded by State Highway 35, Parkers Creek, Lafetra Brook, the New Jersey Transit Railroad and a residential area to the south. The post was established in 1918 during World War I (WWI) as an Army Signal Corps training center. The Main Post currently provides administrative, training, and housing support functions, as well as providing many of the community facilities for Fort Monmouth. The primary mission of Fort Monmouth is to provide command, administrative, and logistical support for Headquarters, U.S. Army Communications and Electronics Command (CECOM). CECOM is a major subordinate command of the U.S. Army Materiel Command (AMC) and is the host tenant at Fort Monmouth.

Site 80/166 is located in the eastern part of the Main Post Area of Fort Monmouth, north of Riverside Avenue and south of Building 166 (**Figure 2-2**). Site 80/166 is located approximately 500 feet northwest of Oceanport Creek.

2.2 Site Background

In the early 1990s, the DPW developed a UST program for managing approximately 506 USTs located throughout the Fort Monmouth installation (Main Post, Charles Wood and Camp Evans areas). This program was created to work toward replacing the use of heating oil as a major energy source and to convert to natural gas. The DPW's approach involved installing new gas lines, new boilers that could be gas fed, and removing the non-regulated (residential) USTs. Since 1990, approximately 97 percent of the aforementioned USTs at Fort Monmouth have been removed.

As part of the DPW's UST management program, two UST closure reports (dated July 1998 and May 2000) have been submitted to the NJDEP regarding USTs in the immediate vicinity of Site 80/166. These two reports are presented in **Appendices A and B** and are discussed below in **Sections 2.2.1 and 2.2.2**, respectively.

In 1995, the DPW submitted a Site Investigation (SI) report for the Main Post and Charles Wood areas. This site investigation report is discussed below in **Section 2.2.3**, and incorporated into the discussion of contaminants of concern at Site 80/166 (**Section 5.3**).

The groundwater monitoring program presented in this report includes two wells (80-MW1 and 166-MW1) originally installed in September 1994 as part of UST closures. The locations of these two monitoring wells and four additional wells installed in July 2000 are shown in **Figure 2-3**. A well construction summary is provided in **Table 2-1**. The monitoring well records for these wells are provided in **Appendix C**.

2.2.1 UST Closure and SI Report for Former Building T-80 (BCM, 1998)

According to the *UST Closure and Site Investigation Report for Former Building T-80*, NJDEP Registration No. 090010-06, prepared by ATC for the DPW, July 1998 (**Appendix A**), there was one single-wall steel UST (UST No. 090010-06) located immediately north of former Building T-80 (**Figure 2-4**). UST No. 090010-06 was a 1,000-gallon No. 2 fuel oil UST. On June 16, 1994, following the removal of this UST, a spill was reported to the NJDEP “Hot Line” for UST number 090010-06 and Case Number 94-6-16-1127-25 was assigned by the NJDEP. On July 16, 1994, UST No. 090010-06 was cleaned, excavated and disposed of in accordance with NJDEP requirements. In addition to the UST removal, approximately 56 cubic yards of potentially contaminated soil was removed and disposed offsite. One hole was observed on each of the end seams of the tank during the inspection by the subsurface evaluator.

Following the soil excavation and removal of UST No. 090010-06, six post-excavation samples were collected and analyzed for TPHC using USEPA Method 418.1. All samples contained either non-detectable concentrations of contaminants or concentrations below 1,000 mg/kg (the NJDEP cleanup criteria for TPHC is 10,000 mg/kg).

In response to the observation of potentially contaminated soil near the shallow water table, one shallow monitoring well (80-MW1) was installed at the former Building T-80 area on September 15, 1994. Well 80-MW1 was constructed to a maximum finished depth of 13 feet. This well was screened from a depth of 3.0 feet below ground surface (bgs) to 13 feet bgs with 4-inch diameter 20-slot PVC.

On May 19, 1995 and June 13, 1995, monitoring well 80-MW1 was sampled and analyzed for VOCs plus 10 TICs and SVOCs plus 15 TICs. One VOC, benzene, was detected at concentrations exceeding the NJDEP GWQC at concentrations of 1.7 ug/L and 1.4 ug/L, respectively. No other VOCs or SVOCs were detected in these two groundwater samples at concentrations exceeding the NJDEP GWQC. No product or sheen was observed in well 80-MW1 during either of the sampling rounds.

2.2.2 UST Closure and SI Report for Building 166 (ATC, 2000)

According to the *UST Closure and Site Investigation Report, Building 166*, UST No. 90017-17, prepared by ATC, May 2000, (**Appendix B**), there was one UST (No. 90017-17) located under the pavement approximately 20 feet west of the southwest corner of Building 80/166 (**Figure 2-4**). UST No. 90017-17 was a 4,000-gallon fiberglass tank that contained No. 2 fuel oil.

On June 16, 1994, the DPW closed UST No. 90017-17. Stained soils were observed in the UST excavation and organic vapors were detected with an OVA. Based on these observations, a spill was reported to the NJDEP Hotline and this spill was assigned as Case No. 94-6-16-1545-09 by the NJDEP. The subsurface evaluator did not observe any holes or punctures in UST No. 90017-17 after the UST was removed and drained. Soil screening was also conducted along the former UST piping run. No contamination was observed anywhere along the piping length. Based on visual observations, approximately 24 cubic yards of potentially contaminated soil was excavated and disposed offsite during the UST closure.

On June 16, 1994, following the removal of UST No. 90017-17 and soil excavation, nine post-excavation soil samples were collected from eight locations along the sidewalls of the UST excavation. Following the removal of the UST fuel lines (on the same date of the tank closure), one additional post-excavation sample was collected along the former piping length, which was approximately 10 feet long. These ten post-excavation soil samples were analyzed for TPHC using USEPA Method 418.1. TPHC was detected in each of these ten samples below 1,000 mg/kg.

In response to the observation of potentially contaminated soil near the shallow water table, one shallow monitoring well (166-MW1) was installed southwest of Building 166 (**Figure 2-3**) on September 14, 1994. Monitoring well 166-MW1 was constructed to a maximum finished depth of 10 feet. This well was screened from a depth of 0.5 feet bgs to 10 feet bgs with 4-inch diameter 20-slot PVC.

Monitoring well 166-MW1 was sampled in two sampling rounds (May 18, 1995 and June 13, 1995). The two groundwater samples collected in these two rounds were analyzed for VOCs plus 10 TICs and SVOCs plus 15 TICs. No VOCs or SVOCs were detected in these two groundwater samples at concentrations exceeding the NJDEP GWQC. No product or sheen was observed in well 166-MW1 during either of the sampling rounds.

2.2.3 SI Report for Main Post and Charles Wood Areas (Weston, 1995)

As part of an SI of the Fort Monmouth military installation, Weston conducted soil sampling, monitoring well installation and sampling and geophysical surveying. In addition to sampling soil and groundwater at sites throughout the Main Post and Charles Wood areas of Fort Monmouth, Weston established background concentrations for soil and groundwater for the Fort Monmouth installation, as reported in the Weston SI (1995) (**Appendix D**). These background concentrations have been used by the DPW for comparing sample results for native constituents of soil and groundwater (see **Section 5.3**).

As presented in the Weston SI Report, several natural and anthropogenic factors contribute to the wide range in concentrations of metals in soils, which further impact the concentration of metals in groundwater. Soils derived from the glauconitic sands contain abundant aluminum, calcium, potassium, iron, magnesium and manganese (among others), which are likely to be present at elevated concentrations in the groundwater,

particularly when sediments are entrained in the collected groundwater samples. A low-flow sampling methodology was proposed for use by the DPW and accepted by the NJDEP to assess the impact of entrained sediments on the dissolved phase metals concentrations at the Main Post and Charles Wood areas of Fort Monmouth. Using a low-flow sampling methodology to reduce the presence of entrained sediment has generally yielded substantial reductions in the dissolved phase concentrations of metals, such as arsenic, antimony, beryllium, cadmium, chromium, cobalt, lead, mercury, selenium, silver, thallium and vanadium at Fort Monmouth sites. Significant decreases in the concentrations of metals characteristic of glauconitic sand also were observed. These included aluminum, barium, calcium, copper, iron, magnesium, manganese, nickel, potassium, sodium and zinc.

2.3 Current Conditions

Versar conducted a site walkthrough on June 20, 2001 to assess current conditions at Site 80/166. The site currently consists of Building 166, which is used by the DPW as office space and equipment storage, a parking area used for storage of construction and army vehicles, and grassy areas along Riverside Drive. Underground utilities at Site 80/166 are shown in **Figure 2-5**. Site photographs were taken during the Site 80/166 walkthrough and are included in **Appendix E**.

2.4 Environmental Setting

The following is a description of the geological/hydrogeological setting of the area surrounding Site 80/166. Included is a description of the regional geology of the area surrounding Fort Monmouth, as well as descriptions of the local geology and hydrogeology of the Main Post.

2.4.1 Regional and Local Geology

Monmouth County lies within the New Jersey Section of the Atlantic Coastal Plain physiographic province. Site 80/166 is located in what may be referred to as the Outer Coastal Plain subprovince, or the Outer Lowlands. The geologic map of New Jersey is provided as **Figure 2-6**.

In general, New Jersey Coastal Plain formations consist of a seaward-dipping wedge of unconsolidated deposits of clay, silt, sand and gravel. These formations typically strike northeast-southwest with a dip ranging from 10 to 60 feet per mile and were deposited on Precambrian and lower Paleozoic rocks (Zapeczka, 1989). These sediments, predominantly derived from deltaic, shallow marine and continental shelf environments, date from Cretaceous through the Quaternary Periods. The mineralogy ranges from quartz to glauconite.

The formations record several major transgressive/regressive cycles and contain units, which are generally thicker to the southeast and reflect a deeper water environment. More than 20 regional geologic units are present within the sediments of the 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 varies greatly (e.g., from several feet to several hundred feet). The Coastal Plain deposits thicken to the southeast from the Fall Line (e.g., a boundary zone between older, resistant rocks and younger, softer plain sediments) to greater than 6,500 feet in Cape May County (Brown and Zapecza, 1990).

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. The upper part of the Tinton is often highly oxidized and iron oxide encrusted (Minard, 1969). Groundwater occurs beneath the site at a depth of approximately 2 to 12 feet bgs.

The Kirkwood Formation (part of the Kirkwood-Cohansey system) crops out southeast of the Main Post and dips to the southeast at a slope of 20 feet per mile (Jablonski, 1968). The Kirkwood Formation consists of alternating layers of sand and clay. The upper unit is a light gray to yellowish-brown, fine-grained quartz sand with quartz nodules and small pebbles. The lower unit is a brown silt in Monmouth County (Jablonski, 1968).

As presented in the *Site Investigation Report - Main Post and Charles Wood Areas, Fort Monmouth, New Jersey*, prepared by Weston, Inc, December 1995 (Weston SI), several natural and anthropogenic factors contribute to the wide range in concentrations of metals in soils, which further impact the concentration of metals in groundwater. Soils derived from the glauconitic sands contain abundant aluminum, calcium, potassium, iron, magnesium and manganese (among others), which are likely to be present at elevated concentrations in the groundwater, particularly when sediments are entrained in the collected groundwater samples.

As presented in **Appendix C**, the lithologic logs from monitoring well installations at Site 80/166 indicate that the lithology consists of brown, green and black clay, silt and fine sand and brown sand with sub-rounded quartz pebbles. Water-level elevation data collected during the investigation presented in this report indicates groundwater flow was toward Oceanport Creek. Further discussion of the subsurface conditions is presented in **Section 4.0**.

2.4.2 Hydrogeology

Fort Monmouth lies in the Atlantic and Eastern Gulf Coastal Plain groundwater region (Meisler et al., 1988). This groundwater region is underlain by undeformed, unconsolidated to semi-consolidated sedimentary deposits. The chemistry of the water near the surface is variable with low dissolved solids and high iron concentrations. The water chemistry in areas underlain by glauconitic sediments (such as Red Bank, Tinton and Hornerstown Sands) is dominated by calcium, magnesium, manganese, aluminum and iron. The sediments in the area of Fort Monmouth were deposited in fluvial-deltaic to near shore environments.

The water table aquifer in the Main Post area is identified as part of the “Navesink-Hornerstown 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. These geologic formations comprise a “Composite Confining Bed” for the Wenonah Mount Laurel Aquifer (Zapeczka, 1984).

Wells installed in the Red Bank and Tinton Sands produce 2 to 25 gallons per minute (gpm) (Jablonski, 1968). Groundwater is typically encountered at the Main Post and in the surrounding areas at shallow depths below ground surface (2 to 9 feet bgs). Water in the surficial aquifer generally flows east toward the Atlantic Ocean.

As presented in **Figure 2-7**, Fort Monmouth is located within the outcrop area of the “Navesink-Hornerstown Confining Unit” (Martin, 1998), which also includes the Red Bank Sand, Tinton Sand, Vincentown Formation, Manasquan Formation, Shark River Formation, Piney Point Formation and the basal clay of the Kirkwood Formation. The Navesink-Hornerstown Confining Unit is approximately 125 feet thick at Site 80/166.

Based on a review of the NJDEP GWQS (NJAC 7:9-6), January 7, 1993, Versar has determined that the site is underlain by a Class III-A aquifer. A formal presentation of this finding was made to the NJDEP in November 2003. The primary designated use for Class III-A groundwater is the release or transmittal of groundwater to adjacent classification areas and surface water, as relevant. Secondary designated uses in Class III-A include any reasonable use. Further discussion of the Class III-A aquifer designation is presented in **Section 6.3**.

Shallow groundwater may be locally influenced within the Main Post area by the following factors:

- Tidal influence (based on proximity to the Atlantic Ocean, rivers, and tributaries)
- Topography
- Nature of the fill material within the Main Post area
- Presence of clay and silt lenses in the natural overburden deposits
- Local groundwater recharge areas (i.e., streams, lakes)

- Roadways, utility conduits, and stormwater culverts

Due to the fluvial nature of the overburden deposits (e.g., sand and clay lenses), shallow groundwater flow direction is best determined on a case-by-case basis. The groundwater in the vicinity of Site 80/166 appears to be flowing in a southeast direction toward Oceanport Creek.

2.4.3 Soils

According to the U.S. Department of Agriculture (USDA), Soil Conservation Service, Monmouth County Soil Survey (April 1989), the majority of the Main Post is covered by urban land (**Figure 2-8**). The soil survey describes urban land as areas where concrete, asphalt, buildings, shopping centers, airports or other impervious surfaces cover 80 percent or more of the surface. In addition, the survey indicated that the natural subsurface soils have largely been replaced with artificial or foreign fill materials (developed land with disturbed soils).

The following soil series and classification units are mapped in the Main Post area:

- DoB Downer sandy loam (with 2 to 5 percent slopes)
- FrB Freehold sandy loam (with 2 to 5 percent slopes)
- FUB Freehold sandy loam/urban land complex (with 0 to 10 percent slopes)
- HV Humaquepts, frequently flooded
- KvA Kresson loam (with 0 to 5 percent slopes)
- UA Udorthents, smoothed
- UD Udorthents – urban land complex (with 0 to 3 percent slopes).

The Downer series soils are well-drained soils that are found on uplands and terraces. The soils are formed in acid, silty coastal plain sediments. The Freehold soils are also well drained and are formed in acid, loamy, coastal plain sediments that, by volume, are 1 to 10 percent glauconite and are found on uplands. The Humaquepts soils are somewhat poorly- to very poorly- drained soils that are formed in stratified, sandy, or loamy sediments of fluvial origins. The Humaquepts soils are located on the floodplain and are subject to flooding several times each year. The Kresson loam is a nearly level to gently sloping soil and is somewhat poorly drained. The soil is found on low divides and in depressions.

The Udorthents soils have been altered by excavation or filling activities. In filled areas, these soils consist of loamy material that is more than 20 inches thick. The filled areas include floodplain, tidal marshes and areas with moderately, well drained to very poorly drained soils. Some Udorthent soils contain concrete, asphalt, metal and glass. The soils in the vicinity of Site 80/166 are classified as UD – Udorthents – urban land complex, with 0 to 3 percent slopes (**Figure 2-8**).

2.4.4 Topography and Surface Drainage

Over the last 80 years, the natural topography of Fort Monmouth has been altered by excavation and filling activities conducted by the military. The land surface at the Main Post is relatively flat and ranges in elevation from approximately 4 feet above mean sea level (amsl) in the east at Oceanport Creek to 32 feet amsl at the western end of the post, near Highway 35. The eastern half of the post is generally 10 feet amsl in elevation.

Surface water runoff from the western part of the Main Post flows into the Lafetra Creek to the north or into Mill Creek to the south. The USGS topographic map (**Figure 2-1**) shows the Lafetra Creek as Parkers Creek Branch and Mill Creek as Wampum. Both Mill Creek and Lafetra Creek originate off-post. Mill Creek is channelized and flows along the southern boundary of the Main Post, turning north just past the Auto Craft Shop. Lafetra Creek forms the northern boundary of the Main Post and joins Mill Creek to form Parkers Creek. Parkers Creek flows eastward along the northern boundary and joins Oceanport Creek east of the post. Most of Parkers Creek, Lafetra Creek and Mill Creek are tidally influenced.

The U.S. Fish and Wildlife Service (FWS) National Wetland Inventory Long Branch quadrangle maps indicate the presence of wetlands at the Main Post. Parkers Creek and Oceanport Creek are classified as estuarine intertidal aquatic beds. The area of Parkers Creek and the part of Oceanport Creek/Husky Brook are classified as estuarine intertidal emergent wetlands. Lafetra Creek and Mill Creek are classified as riverine lower perennial open water/unknown bottom.

Site 80/166 is located approximately 500 feet northwest of Oceanport Creek, which empties to the east into Shrewsbury River. The USGS topographic map (**Figure 2-1**) shows that the land surface of the site is relatively flat at an elevation of less than 20 feet amsl. Surface water runoff at Site 80/166 drains into catch basins and flows southeast into Oceanport Creek.

3.0 SITE ACTIVITIES

Fort Monmouth DPW has conducted remedial investigation activities, including a groundwater sampling program, to define the areal extent of potential pollutants and evaluate impacts to groundwater in the vicinity of Site 80/166. Remedial investigation activities were performed from April 1997 and continued through August 2001. These activities were managed by the Fort Monmouth DPW and performed by TECOM-Vinnell Services (TVS) and Versar. The details of remedial investigation activities that occurred at Site 80/166 are described in the following sections.

3.1 Well Installation

A total of six monitoring wells (80-MW1, 80-MW2, 80-MW3, 80-MW4, 80-MW5 and 166-MW1) comprise the quarterly groundwater monitoring program conducted by the DPW. As discussed in **Section 2.2**, two of the six wells (80-MW1 and 166-MW1) were installed in September 1994 during UST closures and site investigations (at former Building T-80 and Building 166, respectively). The remaining four wells (80-MW2 through 80-MW5) were installed by the DPW on July 24, 2000.

Each of these four additional wells were installed to a total depth of 10 feet and screened with 10-slot PVC from 2 to 10 feet bgs. The locations of these wells (**Figure 2-3**) were strategically selected by the DPW to monitor possible contaminants released into the groundwater due to the former USTs located at Site 80/166. Monitoring well construction details are summarized in **Table 2-1**. Well boring logs and monitoring well records are provided in **Appendix C**.

3.2 Sample Collection Activities

As part of the remedial investigation of Site 80/166, quarterly groundwater monitoring was conducted from April 1997 through January 2001 and a Geoprobe® investigation was conducted in March and May 2000. Sampling activities were performed in accordance with the *Fort Monmouth Standard Sampling Operating Procedure* (December 1997). Laboratory analyses of the samples collected at Site 80/166 were conducted by the Fort Monmouth Environmental Testing Laboratory (FMETL), a New Jersey certified laboratory (Certification No. 13461).

3.2.1 Groundwater Sampling Collection Activities

Two monitoring wells (80-MW1 and 166-MW1) were sampled during 16 quarterly sampling rounds (#1 through #14, #16 and #17) from April 1997 through January 2001. Monitoring wells 80-MW2, 80-MW3, 80-MW4 and 80-MW5 were incorporated later into the quarterly monitoring program and sampled from August 2000 through January 2001 during four quarterly rounds (#14, #15, #16 and #17). Monitoring wells 80-MW1 and 166-MW1 were not sampled during quarterly round #15, which occurred one month after round #14.

During the 17 rounds of quarterly groundwater sampling, a total of 89 groundwater samples, including 11 duplicate samples, 15 field blanks and 15 trip blanks for quality assurance/quality control (QA/QC) purposes, were collected from the six monitoring wells at Site 80/166. The quarterly groundwater samples were analyzed as follows:

- During the first quarterly sampling round, groundwater samples were analyzed for VOCs plus 15 TICs using USEPA method 624, and lead using USEPA Method 3113B.
- During quarterly sampling round #2, VOCs plus 15 TICs were analyzed using USEPA Method 624, SVOCs plus 25 TICs were analyzed using USEPA Method 625, pesticides and PCBs were analyzed using USEPA Method 608, and TAL metals were analyzed using USEPA Methods 3111D, 3111B, 3112B, 3113B and 3120B.
- During quarterly sampling rounds #3 through #17, VOCs plus 15 TICs were analyzed using USEPA Method 624, SVOCs plus 25 TICs were analyzed using USEPA Method 625, pesticides and PCBs were analyzed using USEPA Method 608, and TAL metals were analyzed using USEPA Methods 3112B and 3120B.

A summary of the groundwater sampling activities, including rounds, well IDs, sample IDs, sample locations, collection/analysis date, analytical parameters and analysis method, is provided in **Table 3-1**. Copies of the groundwater sampling chain-of-custody forms and laboratory data sheets are presented in **Appendix F**. The results of the quarterly groundwater monitoring program for Site 80/166 are discussed in **Section 5.1**.

In consideration of the potential benefits of the low-flow sampling procedure (see **Section 2.2.3**), two additional rounds of low-flow sampling were conducted on September 6 - 7, 2000 (Low Flow #1), and October 11 - 12, 2000 (Low Flow #2) using a low-flow groundwater sampling technique. A total of 20 samples, including four duplicate samples and four field blanks for QA/QC purposes, were collected and analyzed for TAL metals to determine whether metal concentrations observed in the groundwater samples at Site 80/166 are due to entrained soil particles (e.g., high turbidity), rather than dissolved phased groundwater constituents. During the two low-flow sampling rounds at Site 80/166, groundwater samples were also analyzed for pesticides and PCBs in order to determine if detections of pesticides and PCBs were affected by turbidity during quarterly sampling rounds. The samples were analyzed by the FMETL for pesticides and PCBs using USEPA Method 608 and TAL metals utilizing USEPA Methods 3120B and 3112B. A summary of the groundwater sampling activities, including rounds, well IDs, sample IDs, sample locations, collection/analysis date, analytical parameters and analysis method, is provided in **Table 3-1**. Copies of the groundwater sampling chain-of-custody forms and laboratory data sheets are presented in **Appendix F**. The results of the low-flow sampling rounds for Site 80/166 are discussed in **Sections 5.1**.

Sampling equipment was thoroughly decontaminated before and after each use in accordance with the *Fort Monmouth Standard Sampling Operating Procedure* (1997). Following collection, the groundwater samples were immediately placed in laboratory-

supplied bottleware. The sample containers were labeled, sealed, packed in ice and transported to the FMETL under proper chain-of-custody procedures.

During each of the monitoring well sampling rounds, aquifer chemical characteristics including pH, temperature, conductivity and dissolved oxygen (DO) were recorded prior to sampling. These chemical characteristics are included in the laboratory data packages. The aquifer pH and DO data are presented in **Section 5.4** and discussed in **Section 6.1**.

3.2.2 Geoprobe[®] Investigation

Geoprobe[®] soil and groundwater samples were collected in March and May 2000 at Site 80/166. A total of 18 subsurface soil samples and 18 groundwater samples were collected from 18 distinct Geoprobe[®] borings. The soil samples were collected from each Geoprobe[®] boring at depth intervals ranging from 3 to 4 feet bgs. The Geoprobe[®] groundwater samples were collected from depth intervals approximately 3 to 7 feet bgs. The locations of the Geoprobe[®] samples are shown in **Figure 3-1**.

Sampling equipment was thoroughly decontaminated before and after each use, in accordance with the *Fort Monmouth Standard Sampling Operating Procedure* (1997). The soil samples were collected and immediately placed in laboratory-supplied bottleware. The sample containers were labeled, sealed, packed in ice and transported to the FMETL under proper chain-of-custody procedures. A summary of the Geoprobe[®] soil and groundwater sampling activities, including rounds, sample IDs, collection/analysis dates, analytical parameters and analysis method is provided in **Table 3-2**. Copies of the Geoprobe[®] soil and groundwater sampling chain-of-custody forms for the laboratory analyses are presented in **Appendix G**. The Geoprobe[®] soil and groundwater samples were analyzed by the FMETL for VOCs plus 15 TICs and percent solids using USEPA Method 624. The Geoprobe[®] soil and groundwater sample results are discussed in **Section 5.2**.

3.3 Groundwater Depth Measurements

During each of the groundwater monitoring rounds conducted at Site 80/166 (including the 17 quarterly monitoring rounds and two low-flow rounds), measurements of the depth to water were recorded with an accuracy of 0.01 feet. These depth to groundwater measurements, recorded from 1997 through 2001, are presented in **Table 3-3**. The groundwater elevation at each well was calculated by subtracting the measured depth to groundwater from the elevation of the top of the well casing. Groundwater elevations are discussed in **Section 4.2**.

3.4 Slug Testing Procedures

Versar conducted slug testing at the six monitoring wells located at Site 80/166 on August 15, 2001. Slug testing was performed to estimate hydrogeologic properties of the shallow soils at this site, such as groundwater velocity, to be used for contaminant

transport modeling. The equipment used to perform the slug testing included a Hermit Environmental Data Logger (Model 1000C), a 10-psi pressure transducer, and a 4-foot long, 3.5-inch diameter PVC slug.

Slug testing was performed by first recording the depth to top of groundwater, then placing the slug and the transducer into the well and allowing the water to equilibrate to a level close to the original water level. The new water level was set as the reference water level for the data logger during the slug test. The slug was then removed and the data logger recorded the changing water level with time. The collected data were then transferred to a personal computer for later review and reduction. The raw data are presented in **Appendix H**. The results are discussed in **Section 4.2**.

3.5 Sensitive Receptors/Well Search

Searches were conducted using various databases and historical information to identify receptors and groundwater wells that may be potentially affected by Site 80/166. An Offsite Receptor Report (dated October 24, 2001) was prepared surrounding a central point of the Main Post (less than one-mile from Site 80/166) by Environmental Data Resources, Inc. (EDR).

In addition, a search of the comprehensive well database maintained by the NJDEP Well Permitting and Regulations Section of the Bureau of Water Allocation was performed to identify groundwater wells that may potentially be affected by Site 80/166. The search was performed for a one-mile radius surrounding the central point of Site 80/166.

A copy of the sensitive receptor survey is provided in **Appendix I** and a copy of the well search summary is provided in **Appendix J**. The results of the sensitive receptor survey and well search are discussed in **Section 6.2**.

4.0 SITE PHYSICAL CHARACTERISTICS

The following sections represent the findings of the geologic and hydrogeologic characterization program for Site 80/166. The following sections represent the findings of Site 80/166 geologic and hydrogeologic characterization program for Site 80/166. These sections include a detailed discussion of the physical properties of the unconsolidated soil, bedrock and groundwater underlying the study area. Groundwater elevation data collected by the DPW from April 1997 through January 2001 are presented in this section.

4.1 Lithology

The lithology encountered at Site 80/166 consists of fine sand, silt and clay with a few thin layers of rounded quartz gravel. Two geologic cross sections (A-A' and A'-A'') were prepared for monitoring wells in the study area. Geologic cross section A-A' depicts the profiles for monitoring wells 166-MW1, 80-MW1, 80-MW2 and 80-MW4. Geologic cross section A'-A'' depicts the profiles for monitoring wells 80-MW3, 80-MW4 and 80-MW5. The cross section location map is included as **Figure 4-1**. The data used to construct the cross sections are presented in **Table 4-1** (cross section A-A') and **Table 4-2** (cross section A'-A''). The geologic cross section A-A' is presented in **Figure 4-2** and the geologic cross section A'-A'' is presented in **Figure 4-3**. The boring logs used to create the cross section data tables are contained in **Appendix C**.

Subsurface material encountered in the well borings at Site 80/166 consisted of brown, green and black clay, silt and fine sand (Units 2, 3, 4, 5, 6 and 8) and brown sand with sub-rounded quartz pebbles (Unit 7). The lithology of this material is consistent with the Tinton Sand formation (Minard, 1969). As noted on the geologic cross sections in **Figures 4-2** and **4-3**, some of the lithology presented in cross section A-A' as native soil may be fill. The boring logs for the wells at Site 80/166 (**Appendix C**) do not specify that fill was encountered; however, due to the construction of buildings, underground utilities, and paved areas at Site 80/166, the presence of fill is assumed.

The following underground utilities are shown in geologic cross sections A-A' and A'-A'':

- One 6-inch diameter gas line is shown in geologic cross section A-A'.
- One 6-inch diameter gas line and two 10-inch diameter gas lines are shown in geologic cross section A'-A''.

4.2 Groundwater Flow

During the groundwater sampling program at Site 80/166 (17 quarterly rounds and two low-flow rounds), groundwater was encountered in monitoring wells at Site 80/166 at depths ranging from 0.47 to 4.04 feet bgs (**Table 3-3**) with a slight gradient toward the southeast. Groundwater velocity and flow directions were predicted based on the

4.2.1 Groundwater Flow Direction

In accordance with NJAC 7:26E-3.13(d)2iv, three groundwater contour maps were generated based on groundwater depth measurements collected on August 16, 2000 (**Figure 4-4a**), October 27, 2000 (**Figure 4-4b**), and January 24, 2001 (**Figure 4-4c**) from the six monitoring wells. The groundwater underlying Site 80/166 consistently flows to the southeast towards Oceanport Creek. No significant variations in groundwater flow conditions were observed in these three groundwater contour maps. Groundwater elevation data are presented in **Table 3-3**.

4.2.2 Hydrogeologic Properties

As discussed in **Section 3.4**, Versar conducted slug testing of the six monitoring wells located at Site 80/166 on August 15, 2001. Versar utilized the computer software *Aquifer Test* by Waterloo Hydrogeologic, Inc. (version 3.01, 2001) to reduce the slug testing data using Bouwer-Rice methodologies. Data plots generated by *Aquifer Test* are presented in **Appendix H**. A summary of the calculated conductivity values is presented in **Table 4-3**.

The calculated conductivity values range from 2.0 feet/day at monitoring well 80-MW1 to 6.4 feet/day at well 80-MW5, with a calculated geometric mean of 3.8 feet/day. The variability in the range of hydraulic conductivities is associated with the shallow depth of the monitoring wells, partial penetration into the aquifer, and the heterogeneous nature of the fill material at Site 80/166. The geometric mean is used instead of the average due to the commonly high range of variability in hydraulic conductivity measurements.

The groundwater flow gradient for Site 80/166 was estimated using the groundwater elevation data discussed above. The groundwater flow gradient (i) is calculated by measuring the distance (L) between two equipotential lines h_1 and h_2 using the following equation:

$$i = \frac{h_1 - h_2}{L}$$

The groundwater flow gradient for Site 80/166, based on water level measurements collected on January 24, 2001, was estimated at approximately 0.015 feet per foot.

Groundwater flow velocity (v) in the vicinity of Site 80/166 was then estimated using the groundwater flow gradient (i), an estimated hydraulic conductivity (K) for the surrounding soils based on the slug test results, and an assumed porosity (α) in the following equation:

$$v = \frac{Ki}{\alpha}$$

The hydraulic conductivity (K) used in the calculation, 3.8 feet/day, is the geometric mean based on the results of slug testing performed by Versar (**Table 4-3**). The porosity (α) was estimated at 40% using average values for silt and sands (Heath, USGS, 1989). The groundwater velocity for Site 80/166 was calculated to be approximately 0.14 feet per day (equal to 52 feet per year) based on the January 24, 2001 water-level measurements.

5.0 SITE CHEMICAL CHARACTERIZATION

This section includes a discussion of the chemical characterization of Site 80/166 based on the various samples collected and analyzed from 19 rounds of monitoring well sampling. DPW personnel were responsible for the collection of samples during this remedial investigation. Sample analyses were performed by the FMETL.

5.1 Groundwater Sampling Results

This section presents a discussion of the results of laboratory analyses performed for the 19 rounds of groundwater samples collected from April 1997 through June 2001 from the six monitoring wells (80-MW1 through 80-MW5 and 166-MW1) at Site 80/166. These 19 rounds are a combination of 17 quarterly rounds conducted at wells 80-MW1 and 166-MW1, four quarterly rounds at wells 80-MW2 through 80-MW5, and two additional low-flow rounds conducted at each of the wells (**Table 3-1**). The groundwater samples were collected and analyzed for VOCs plus 15 TICs, SVOCs plus 25 TICs, pesticides, PCBs and TAL metals.

The two low-flow sampling rounds were conducted on September 6 - 7, 2000 (Low Flow #1), and October 11 - 12, 2000 (Low Flow #2) using a low-flow groundwater sampling technique for pesticides, PCBs and TAL metals. As discussed in **Section 2.2.3**, a low-flow sampling methodology was proposed for use by the DPW and accepted by the NJDEP to assess the impact of suspended sediments on the dissolved phase metals, pesticides and PCB concentrations at Site 80/166.

As discussed in **Section 2.4.2**, Fort Monmouth is underlain by a Class III-A aquifer. The appropriate groundwater quality criteria for Class III-A are the criteria for the most stringent classification for vertically or horizontally adjacent ground waters that are not Class III-A (NJAC 7:9-6.7e). The NJDEP criteria used for comparison of groundwater analytical results were the higher of the Practical Quantitation Limits (PQLs) and the NJDEP GWQC for Class II-A aquifers (NJAC 7:9-6, Table 1).

During the 19 rounds of sampling, a total of six VOCs were detected in site groundwater. One VOC was detected at concentrations that exceeded its respective GWQC in at least one sample, while the remaining five VOCs were detected below their respective GWQC or Interim GWQC. A total of ten SVOCs were detected in site groundwater below their respective GWQC. A total of four pesticides were detected in site groundwater above their respective GWQC. No PCBs were detected in site groundwater. A total of 23 metals were detected in site groundwater. Eight metals were detected at concentrations that exceed their respective GWQC in at least one sample, while the remaining 15 metals were detected below their respective GWQC.

The detections of analytes in groundwater samples are presented in four subsections: VOCs (**Section 5.1.1**), SVOCs (**Section 5.1.2**), Pesticides and PCBs (**Section 5.1.3**) and Metals (**Section 5.1.4**). Analytes detected in groundwater samples at Site 80/166 at

concentrations above the NJDEP criteria are bold and highlighted in **Table 5-1**. The chain-of-custody forms for groundwater samples and laboratory data sheets are provided in **Appendix F**. **Figure 5-1** shows the contaminant distribution for groundwater within the area of Site 80/166.

5.1.1 VOCs

During 19 rounds of groundwater sampling, one VOC was detected in site groundwater at concentrations that exceeded its respective GWQC in at least one sample.

Benzene was detected at concentrations exceeding the GWQC of 1.0 ug/L in four rounds of sampling collected at one monitoring well location. Concentrations ranged from 1.26 ug/L (sampling round #8) to 1.71 ug/L (sampling round #5) in 80-MW1.

5.1.2 SVOCs

No SVOCs were detected above the appropriate GWQC at the site.

5.1.3 Pesticides and PCBs

During 19 rounds of groundwater sampling, four pesticides were detected in site groundwater at concentrations that exceeded their respective GWQC in at least one sample.

a-Chlordane was detected at concentrations exceeding the GWQC of 0.5 ug/L in three rounds of sampling collected at two monitoring well locations. Concentrations ranged from 0.779 ug/L (sampling round #15) to 1.625 ug/L (sampling round #17) in 80-MW2.

g-Chlordane was detected at concentrations exceeding the GWQC of 0.5 ug/L in two rounds of sampling collected at one monitoring well location. Concentrations ranged from 0.979 ug/L (Low Flow #2) to 2.719 ug/L (sampling round #17) in 80-MW2.

4,4'-DDD was detected at concentrations exceeding the GWQC of 0.1 ug/L in three rounds of sampling collected at two monitoring well locations. Concentrations ranged from 0.148 ug/L (sampling round #9) in 80-MW1 to 0.453 ug/L (sampling round #14) in 80-MW2.

Endosulfan Sulfate was detected at concentrations exceeding the GWQC of 0.4 ug/L in one round of sampling collected at one monitoring well location at a concentration of 0.485 ug/L in 80-MW2.

5.1.4 Metals

During 19 rounds of groundwater sampling, eight metals were detected in site groundwater at concentrations that exceeded their respective GWQC in at least one sample.

Aluminum was detected at concentrations exceeding the GWQC of 200 ug/L in 18 rounds of sampling collected at six monitoring well locations. Concentrations ranged from 215 ug/L (sampling round #16) in 80-MW1 to 97,500 ug/L (sampling round #15) in 80-MW5.

Arsenic was detected at concentrations exceeding the GWQC of 8.0 ug/L in 17 rounds of sampling collected at four monitoring well locations. Concentrations ranged from 8.49 ug/L (sampling round #8) in 80-MW1 to 71.6 ug/L (sampling round #15) in 80-MW5.

Cadmium was detected at concentrations exceeding the GWQC of 4.0 ug/L in eight rounds of sampling collected at four monitoring well locations. Concentrations ranged from 4.15 ug/L (sampling round #17) in 166-MW1 to 24.6 ug/L (sampling round #8) in 80-MW1.

Chromium was detected at concentrations exceeding the GWQC of 100 ug/L in one rounds of sampling collected at two monitoring well locations. Concentrations ranged from 121 ug/L (sampling round #2) in 166-MW1 to 148 ug/L (sampling round #2) in 80-MW1.

Iron was detected at concentrations exceeding the GWQC of 300 ug/L in 18 rounds of sampling collected at six monitoring well locations. Concentrations ranged from 578 ug/L (sampling round #2) in 80-MW2 to 571,000 ug/L (sampling round #2) in 80-MW5.

Lead was detected at concentrations exceeding the GWQC of 10 ug/L in ten rounds of sampling collected at four monitoring well locations. Concentrations ranged from 10.4 ug/L (sampling round #6) in 80-MW1 to 84.1 ug/L (sampling round #15) in 80-MW5.

Manganese was detected at concentrations exceeding the GWQC of 50 ug/L in 18 rounds of sampling collected at six monitoring well locations. Concentrations ranged from 51.5 ug/L (sampling round #17) in 80-MW3 to 17,250 ug/L (sampling round #2) in 166-MW1.

Sodium was detected at concentrations exceeding the GWQC of 50,000 ug/L in 18 rounds of sampling collected at six monitoring well locations. Concentrations ranged from 58,200 ug/L (sampling round #6) in 166-MW1 to 11,700,000 ug/L (sampling round #15) in 80-MW5.

5.2 Geoprobe® Investigation Results

The DPW installed 18 Geoprobe® borings at Site 80/166 and collected subsurface soil and groundwater samples at each of these borings. **Figure 3-1** shows the locations of the Geoprobe® borings at Site 80/166. The Geoprobe® sampling results are discussed below and are summarized in **Figure 5-2**, **Table 5-2** (soils), **Table 5-3** (groundwater).

5.2.1 Geoprobe® Soil Sampling Results

The 18 soil samples were collected at each Geoprobe® boring at Site 80/166 at depth intervals ranging from 3 to 4 feet bgs. The soil samples were analyzed by the FMETL for VOCs plus 15 TICs and percent solids using USEPA Method 624. A summary of the subsurface soil sample analytical results is provided in **Table 5-2**. The soil sample results were compared to the NJDEP Residential Direct Contact Soil Cleanup Criteria (RDCSCC) and the NJDEP Impact to Groundwater Soil Cleanup Criteria (IGWSCC).

A total of three VOCs were detected in at least one soil sample below their respective RDCSCC and IGWSCC.

5.2.2 Geoprobe® Groundwater Sampling Results

The 18 Geoprobe® groundwater samples were collected at depth intervals of approximately 3 to 7 feet bgs. The groundwater samples were analyzed by the FMETL for VOCs plus 15 TICs using USEPA Method 624. The analytical results for the groundwater samples collected are provided in **Table 5-3**.

A total of eight VOCs were detected in the Geoprobe® groundwater samples. Two VOCs were detected at concentrations that exceeded their respective GWQC in at least one sample, while the remaining five VOCs were detected below their respective GWQC.

Benzene was detected at concentrations exceeding the GWQC of 1.0 ug/L in two groundwater samples collected at two Geoprobe® boring locations. Concentrations ranged from 1.13 ug/L in boring location #2 to 6.84 ug/L in boring location #3.

Bromodichloromethane was detected at concentrations exceeding the GWQC of 1.0 ug/L in one groundwater sample collected at one Geoprobe® boring location (#18) at a concentration of 2.06 ug/L.

5.3 Contaminants of Concern

In order to determine the potential COCs at Site 80/166, the first step was to identify exceedances of the NJDEP GWQC in monitoring well and Geoprobe® groundwater samples collected at Site 80/166. These exceedances are presented in **Sections 5.1** and

5.2 above and in **Tables 5-1** and **5-3**. There were no exceedances of applicable NJDEP cleanup criteria in soil samples collected from Geoprobe® samples at Site 80/166 (**Table 5-2**). There were four groundwater constituents identified as COCs in groundwater (a-chlordane, g-chlordane, arsenic and lead) at Site 80/166 as discussed in this section.

There were several factors that were used to eliminate or identify analytes as COCs. These factors include the magnitude and frequency of the exceedances, comparisons to low-flow sample results (for metals and pesticides only) and comparisons to established background concentrations (see **Section 2.2.1**). **Table 5-4** summarizes the process used to identify COCs in groundwater at Site 80/166.

There were two VOCs (benzene and bromodichloromethane) that were detected in groundwater at Site 80/166 at concentrations exceeding the NJDEP GWQC during the 19 groundwater sampling events and the Geoprobe® groundwater study. However, neither of these VOCs is considered to be a COC at Site 80/166, as discussed below:

- Benzene was detected in four of 16 rounds in monitoring well 80-MW1 at concentrations exceeding the GWQC. Benzene was also detected at concentrations exceeding the GWQC in two of the 18 Geoprobe® boring groundwater samples in March 2000 (boring locations #2 and #3) near well 80-MW1. Benzene was not detected in each of the four most recent monitoring well sampling rounds (May 2000 to January 2001). Benzene is not considered a COC at the 80/166 due to the infrequency and magnitude of the exceedances in groundwater samples.
- Bromodichloromethane exceeded the GWQC in only one groundwater sample collected at Site 80/166 and is therefore not considered to be a COC.

There were no SVOCs detected at concentrations exceeding the GWQC. Therefore, no SVOCs are considered COCs at Site 80/166.

There were four pesticides (4,4'-DDD, a-chlordane, g-chlordane and endosulfan sulfate) that were detected in groundwater at concentrations exceeding the NJDEP GWQC. Out of these four pesticides, two are identified as COCs (a-chlordane and g-chlordane), as discussed below:

- 4,4-DDD was detected at concentrations exceeding the NJDEP GWQC during two of 17 quarterly sampling rounds in monitoring well 80-MW1 and during one of five rounds in well 80-MW2. There were no exceedances for 4,4-DDD during the two low-flow sampling rounds. 4,4-DDD is not considered a COC at Site 80/166 due to the infrequency and magnitude of the exceedances in groundwater samples.
- a-Chlordane was detected above the NJDEP GWQC in well 80-MW2 during two of five quarterly sampling rounds. a-Chlordane was also detected above the NJDEP GWQC in monitoring well 166-MW during the first low-flow sampling round. The maximum detected concentration of a-chlordane was 1.625 ug/L. Therefore, a-chlordane is identified as a potential COC.

- g-Chlordane was detected above the NJDEP GWQC in well 80-MW2 in two of five samples collected (including one during the first low-flow sampling round). The maximum detected concentration of g-chlordane was 2.719 ug/L. Therefore, g-chlordane is identified as a potential COC.
- Endosulfan sulfate exceeded the NJDEP GWQC in only one groundwater sample (low flow) collected at Site 80/166 and is therefore not considered to be a COC.

There were eight metals that were detected in site groundwater at concentrations exceeding the NJDEP GWQC (aluminum, arsenic, cadmium, chromium, iron, lead, manganese and sodium). The specific exceedances and the identification of each of these metals as a potential COC are discussed below.

As discussed in **Section 2.2.3**, a low-flow sampling methodology was proposed for use by the DPW and accepted by the NJDEP to assess the impact of suspended sediments on the dissolved phase metals concentrations at Site 80/166. The eight different metals that were detected in Site 80/166 groundwater at concentrations exceeding the NJDEP GWQC are distinguished below into background and non-native metals. The indigenous metals are compared to the Main Post Maximum Background Concentrations (MBC) identified in the Weston SI (1995), which are presented in **Tables 5-1** and **5-4**. The non-native metals are discussed in relation to the NJDEP GWQC only.

Of the eight metals detected in Site 80/166 groundwater that exceed the GWQC, four metals (aluminum, iron, manganese and sodium) are common background constituents in Monmouth County soils. The water chemistry in areas underlain by glauconitic sediments (such as Red Bank, Tinton and Hornerstown Sands) is dominated by calcium, magnesium, manganese, aluminum and iron. Elevated concentrations of these metals are routinely observed in groundwater samples collected at Fort Monmouth. In consideration of these facts, the groundwater analytical results for these eight metals were compared to their respective MBCs of 121,000 ug/L (aluminum), 431,000 ug/L (iron), 331 ug/L (manganese), and 21,500 ug/L (sodium), as follows:

- Aluminum is not considered to be a COC because aluminum was not detected at concentrations exceeding the MBC.
- Iron and manganese are not considered COCs because these metals are native constituents of soils at Site 80/166.
- Sodium is not considered to be a COC due to the proximity of Site 80/166 to sea water.

There were four non-native metals that exceeded the NJDEP GWQC (arsenic, cadmium, chromium and lead). Of these four non-native metals, chromium is not considered a COC because chromium exceeded the NJDEP GWQC in only two samples collected at Site 80/166. Both of the chromium exceedances occurred in August 1997 when chromium was also detected in the laboratory blank sample. The remaining three non-native metals (arsenic, cadmium and lead) were compared to sample results collected during the low-flow sampling rounds.

Two separate rounds of sampling (September 6 - 7, 2000 and October 11 - 12, 2000) were performed during the quarterly groundwater sampling program using the low-flow groundwater sampling technique as discussed in **Section 3.2.1**. This technique was used to determine if the detected metal concentrations observed in the groundwater samples are a function of entrained sediments suspended in the groundwater during the course of well purging and sampling activities, or an accurate representation of dissolved phase aquifer/groundwater conditions. These comparisons provided the following results:

- Arsenic concentrations exceeded the NJDEP GWQC in samples collected during both of the low-flow sampling rounds. Arsenic was also detected at concentrations exceeding the GWQC in 14 of 17 quarterly sampling rounds at monitoring well 80-MW1. Based on these results, arsenic is considered to be a potential COC at Site 80/166.
- Cadmium was not detected during the two low-flow sampling rounds (September and October 2000) and is therefore not considered a COC.
- Lead was detected above the NJDEP GWQC during both of the low-flow sampling rounds (September and October 2000). Lead was also detected in multiple rounds in monitoring wells 80-MW1, 80-MW4, 80-MW5 and 166-MW1. Based on these results, lead is considered to be a potential COC at Site 80/166.

Based on the magnitude of the exceedances, the frequency of occurrences, and the wide-ranging results, two pesticides (a-chlordane and g-chlordane) and two metals (arsenic and lead) are identified as potential COCs at Site 80/166 and are given further consideration with regard to contaminant migration potential in **Section 6.0** of this RIR. No other potential contaminants of concern were identified at Site 80/166. The concentrations of these COCs at Site 80/166 are summarized on **Figure 5-1** and in **Table 5-5**.

The method detection limits (MDLs) for each of the sample results in which there was a non-detect (ND) result are included in **Table 5-5**. The MDL for each analysis is included in the laboratory data packages. These MDLs were used in the groundwater model as discussed in **Section 6.1.3**.

5.4 Aquifer pH and DO

During each of the monitoring well sampling rounds, the pH and DO of the groundwater were recorded prior to sampling. The average pH ranged from 5.06 in well 80-MW5 to 6.85 in well 166-MW1. The average DO ranged from 3.10 in well 80-MW3 to 4.10 in well 80-MW4. The aquifer pH and DO measurements are shown in **Table 5-6**. The pH and DO data is included in the laboratory data packages. The aquifer pH and DO is discussed in more detail in **Section 6.1**.

6.0 CONTAMINANT MIGRATION AND GROUNDWATER USE DESIGNATION

The purpose of developing a groundwater model for Site 80/166 was to predict the migration of the identified COCs (a-chlordane, g-chlordane, arsenic and lead) in site groundwater. For the model, areas at the site were assigned initial concentrations of these COCs, and predictions of the migration and change in COC concentration over time were made. The initial COC concentrations, as well as future predictions (results) of the COC concentrations, are presented graphically. The time required to achieve compliance with the NJDEP GWQC was estimated for each COC.

6.1 Groundwater Model Development

A conceptual site model was developed for Site 80/166 to provide a basis for the computer model development. The conceptual site model includes the topography, groundwater recharge, groundwater flow conditions and the geologic formations in the ground. The parameters used in the groundwater flow model were based on Fort Monmouth survey data, published literature on the hydrogeology of the region, as well as field measurements of groundwater elevation at the site (discussed in **Section 4.2**).

For a-chlordane and g-chlordane, a degradation spreadsheet model was used to predict the decay and contaminant transport. The degradation model was applied to g-chlordane only, because g-chlordane concentrations in Site 80/166 groundwater samples have been higher than concentrations of a-chlordane (**Section 5.1.3, Table 5-1**), and these two pesticides are addressed as one compound in Howard (1991). The degradation model incorporates the effects of horizontal groundwater flow, biodegradation and retardation.

The United States Geologic Survey (USGS) Modular Three-Dimensional Groundwater Flow Model, MODFLOW, was chosen for additional groundwater modeling for g-chlordane in order to incorporate the effects of dispersion and 3-dimensional groundwater flow. MODFLOW was also used to simulate groundwater migration for the COCs that are metals (arsenic and lead), which do not degrade. The MODFLOW simulation includes the effect of dispersion, which accounts for the dilution of the groundwater due to mixing, 3-dimensional groundwater flow, degradation (applied to g-chlordane only) and retardation due to sorption.

6.1.1 Conceptual Site Model

Land surface at the Main Post is relatively flat and ranges in elevation from 4 feet amsl in the east at Oceanport Creek to 32 feet amsl at the western end of the post, near Highway 35. The eastern half of the post is generally 10 feet amsl in elevation. Site 80/166 is located approximately 500 feet northwest of Oceanport Creek. The USGS topographic map (**Figure 2-1**) shows that the land surface of the site is relatively flat at an elevation

of less than 20 feet amsl. Surface water runoff from Site 80/166 is likely to flow through stormdrains into Oceanport Creek (**Figure 2-5**).

According to Jablonski (1968), the average precipitation for Monmouth County is 44.67 inches per year. After precipitation reaches the ground, the water cycle begins and the water is lost to the atmosphere through evapotranspiration, discharged to receiving waters as surface runoff, or percolates into the soil as groundwater recharge. Groundwater is then separated into water utilization and groundwater flow (“base flow”). The average groundwater recharge for Site 80/166 was calculated from Jablonski (1968) to be approximately 13.28 inches per year, which is the sum of the base flow (11.56 inches per year), utilization from groundwater (0.84 inches per year), and the utilization from surface water (0.88 inches per year). As an approximation to natural conditions, the recharge of 13.28 inches was applied to the entire MODFLOW model area as an approximation (as discussed below in **Section 6.1.4**).

As discussed in **Section 2.4.1**, the geologic formations that outcrop at the Fort Monmouth Army Base include the Tinton and Red Bank Sands, as well as the Hornerstown Formation. These formations, along with the Navesink Formation, are part of the Navesink-Hornerstown Confining Unit that overlies the Wenonah-Mount Laurel Aquifer (Zapeczka, 1990). A cross section of the New Jersey Coastal plain that shows these formations is presented in **Figure 6-1**.

As discussed in **Section 4.1**, the lithology encountered during drilling of the monitoring wells at Site 80/166 consists of material that is consistent with the Tinton Sand formation as described in Minard (1969). The subsurface material encountered in the well borings at Site 80/166 consisted of brown, green, and black clay, silt and fine sand (Units 2, 3, 4, 5, 6 and 8) and brown sand with sub-rounded quartz pebbles (Unit 7). Some of the subsurface lithology is likely to be fill, as noted on geologic cross sections A-A' and A'-A" (**Figures 4-2 and 4-3**). Underground utilities (discussed in **Section 2.2 and 4.1** and shown on **Figure 2-5**) were not included as part of the groundwater migration models.

Groundwater was encountered in both the fill and native soils in each monitoring well at depths ranging from 0.47 to 4.04 feet bgs (**Table 3-3**) with a hydraulic gradient indicating flow southeast toward Oceanport Creek (**Figure 4-4a, 4-4b, and 4-4c**). The groundwater flow gradient for Site 80/166 was estimated to be 0.015 feet per foot. The calculated conductivity values range from 2.00 feet/day at monitoring well 80-MW1 to 6.41 feet/day at 80-MW5, with a calculated geometric mean of 3.8 feet/day. The groundwater velocity for Site 80/166 was calculated to be approximately 0.14 feet per day (equal to 52 feet per year).

6.1.2 Chlordane Biodegradation Model

A *Microsoft Excel* spreadsheet was used to predict the biodegradation and migration of g-chlordane in groundwater at Site 80/166. The biodegradation model incorporates the effects of horizontal groundwater flow, first-order biodegradation and retardation.

As discussed in **Section 5.1** and shown in **Figure 5-1**, a-Chlordane was detected above the NJDEP GWQC of 0.5 ug/L in two of five samples collected from well 80-MW2 with a maximum concentration of 1.625 ug/L. g-Chlordane was detected at concentrations above the NJDEP GWQC of 0.5 ug/L in two of five samples collected from well 80-MW2 with a maximum concentration of 2.719 ug/L. There was only one exceedance of the NJDEP GWQC for either a-chlordane or g-chlordane in well 166-MW1 (0.84 ug/L for a-chlordane in March 2000). Both a-chlordane and g-chlordane were not detected in groundwater samples collected from any other wells at Site 80/166. The biodegradation model predicts the future concentrations of g-chlordane with time, starting with an initial concentration of 2.719 ug/L in well 80-MW2 in January 2001.

Due to the lack of a decreasing trend in the chlordane detections, a site-specific decay rate for chlordane was not calculated. The half-life of 7.6 years was obtained from published results (Howard, 1991) and used in the model. This half-life corresponds to a degradation rate constant (k) of 0.00025 (1/day). The chlordane biodegradation model parameters and results for well 80-MW2 is presented in **Table 6-1**. Predicted chlordane concentrations at well 80-MW2 is presented in **Figure 6-2**.

At monitoring well 80-MW2, the initial g-chlordane concentration of 2.719 ug/L led to a predicted time of 19.0 years for compliance with the NJDEP criteria (1.0 ug/L). The migration distance to achieve compliance at well 80-MW2 is predicted to be 0.66 feet. This prediction was made using the biodegradation half-life of 7.6 years for chlordane (Howard, 1991) and does not include the effects of dilution due to dispersion, which was simulated using MODFLOW. Aerobic biodegradation is discussed in more detail below.

6.1.3 Dissolved Oxygen

The aerobic biodegradation of chlordane is justified based on analysis of the DO observed during monitoring well sampling at Site 80/166. As discussed in **Section 5.4**, during each sampling event, at each well, DO was recorded while the wells were being purged. **Table 5-6** shows the DO measurements for the monitoring wells at Site 80/166 during sampling events between April 1997 and January 2001.

Aerobic respiration is the first reaction in an aerobic environment that contains microorganisms capable of biodegradation (Wiedemeir, 1999). Once the available DO is depleted and anaerobic conditions dominate the interior regions of the organic contaminant plume, anaerobic microorganisms can utilize other electron acceptors in the following order of preference: nitrate, manganese, iron (III), sulfate, and finally carbon dioxide. As each electron acceptor being utilized for biodegradation becomes depleted, the next most preferable electron acceptor is utilized. Each successive redox couple provides less energy to the microorganism.

Aerobic degradation requires the presence of DO. If the subsurface environment becomes devoid of oxygen, the rate of aerobic biodegradation will typically be limited by

oxygen supply rather than by nutrient concentration. For anaerobic biodegradation the microbial competition ultimately will determine the dominant process, but the dominant process can vary both temporally and spatially. Therefore, iron (III) reduction, sulfate reduction or methanogenesis may dominate, depending on seasonal variations in concentrations of DO and sulfate.

Using stoichiometry, a utilization factor can be developed showing the ratio of the oxygen consumed to the mass of DO consumed in the biodegradation reactions. Similarly, utilization factors can be developed to show the ratio of the mass of metabolic by-products (such as ferrous iron) that are generated to the mass of dissolved organic degraded in the biodegradation reactions. When the available electron acceptor/by-product concentrations are divided by the appropriate utilization factor, an estimate of the biodegradation capacity of the groundwater flowing through the source zone and plume can be developed as follows:

Biodegradation Capacity (mg/L) =

{(Average Upgradient Electron Acceptor Concentration) -
(Minimum Plume Zone Electron Acceptor Concentration)} / Utilization Factor

The upgradient well used in the calculation of Biodegradation Capacity is well 166-MW1. The plume zone is assumed to be located in the vicinity of well 80-MW2. The following utilization factors and site biodegradation capacity based on the degradation of a-chlordane and g-chlordane are calculated for the site:

Electron Acceptor	Average Upgradient Electron Acceptor Concentration	Minimum Plume Zone Electron Acceptor Concentration	Aerobic Biodegradation of Chlordane: $4C_6H_5O + 29O_2 \rightarrow 2Cl_2 + 24CO_2 + 10H_2O$	
	166-MW1 (mg/L)	80-MW2 (mg/L)	Utilization Factor (mg/mg)	Site Biodegradation Capacity (mg/L)
Oxygen	3.90	3.41	2.063	0.238

The most recent chlordane detection at well 80-MW2 (in January 2001) was 2.917 ug/L (0.002917 mg/L) for g-chlordane. Based on the calculations presented in the preceding table and on site observations, groundwater has enough biodegradation capacity to degrade dissolved-phase chlordane, if aerobic reactions are occurring at the site.

6.1.4 MODFLOW Input Parameters

Visual MODFLOW Version 2.8.2 (Waterloo Hydrogeologic, Inc.) was used to simulate the groundwater flow at Site 80/166, and *MT3D 1999* (1999, Papadopolos & Associates, Inc.) was used to simulate the movement of the contaminants over time at Site 80/166. *Surfer for Windows Version 7* (Golden Software, Inc.) was used to create the map of the

ground surface that was used in the simulation, and the maps of initial arsenic and lead concentrations. The input parameters for the MODFLOW model for Site 80/166 are presented in **Table 6-2**.

Physical Boundaries and Grid

The model grid for Site 80/166 is presented in **Figure 6-3** with topographic contours shown as brown lines, Oceanport Creek highlighted as solid brown (groundwater constant head boundary condition of 0 feet amsl), and the Fort Monmouth Base Map shown in black. The Fort Monmouth Base Map was used to determine the location of Oceanport Creek.

The model area for Site 80/166 was 2,400 feet (West to East) by 2,400 feet (South to North). This area was divided into a grid with 124 columns and 124 rows. The grid cells are 20 by 20 feet in the majority of the model area and 10 feet by 10 feet in the vicinity of the Site 80/166 monitoring wells. Ground surface elevation points were obtained from the Fort Monmouth topographic survey map, and the surface water at the site was assumed to be at an elevation of 0 feet amsl. The ground surface was obtained for each of the MODFLOW grid cells by importing topographic data into *Visual MODFLOW*, which uses the “kriging” method to estimate topographic elevations in each model grid-values from a set of topographic measurements.

The groundwater recharge for Site 80/166 was estimated to be 13.28 inches, as discussed in **Section 6.1.1**. The recharge of 13.28 inches was applied to the entire MODFLOW model area as an approximation. Surface water drainage through storm sewers was not addressed in the MODFLOW model. The grid cells that are located within Oceanport Creek were designated the boundary condition of 0 feet amsl for the groundwater head.

The porosity and specific yield of 0.4 and 0.2, respectively, were taken from Heath (USGS, 1989). The bulk density of 46.7 kg/feet³ was derived from the porosity (0.4), and a typical soil particle density of 2.65 g/ml (Brady and Weil 1996).

Groundwater Flow Parameters

The model area for Site 80/166 was divided into seven layers, which relate to three published hydrogeologic units and one five-foot layer of surficial layer of fill. As noted in **Section 4.1**, boring logs for Site 80/166 monitoring wells do not specify that fill was encountered. However, some of the lithology presented in geologic cross sections A-A' (**Figure 4-2**) and A'-A'' (**Figure 4-3**) can be assumed to be fill. **Figure 6-4** presents a cross section of the model area showing these layers. Each color on this figure represents a different hydrogeologic unit and a different hydraulic conductivity. Four hydrogeologic units (surficial fill, the Navesink-Hornerstown Confining Unit, the Mount Laurel Aquifer and the Marshalltown-Wenonah Confining Unit) were used in the MODFLOW simulation for Site 80/166. Conductivity values for the lower three hydrogeologic units were taken to be the geometric mean of published conductivity values (Martin, 1998). The thicknesses of these lower four layers correspond to the published thicknesses of

geologic formations (as presented in Zapecza, 1990, plates 16, 17 and 18). The seven model layers are discussed below:

- The top layer, identified as Layer 1, is 5 feet thick, and corresponds to fill material. The fill thickness of 5 feet was assigned to the entire model area as a simplification. This assumed thickness approximates the observations of fill in soil borings at Fort Monmouth. Layer 1 was assigned a hydraulic conductivity of 3.8 feet per day, which is the geometric mean of the conductivity values obtained from slug tests (described in **Sections 3.4 and 4.2.2**).
- Layers 2 (approximately 12.5 feet thick), 3 (12.5 feet thick), 4 (55 feet thick), and 5 (55 feet thick) correspond to the Navesink-Hornerstown Confining Unit. This confining unit was divided into four layers to identify potential contamination within 20 feet of the ground surface and to accurately predict the effects of dispersion in the model. Layers 2, 3, 4 and 5 were assigned a hydraulic conductivity of 0.12 feet per day. The thickness of the Navesink-Hornerstown Confining Unit is 125 feet at Site 80/166 (**Figure 2-7**).
- Layer 6, which corresponds to the Wenonah-Mount Laurel Aquifer, was assigned a thickness of 75 feet and a hydraulic conductivity of 15.96 feet per day.
- The bottom layer, Layer 7, corresponds to the Marshalltown-Wenonah Confining Unit and was assigned the thickness of 10 feet. The hydraulic conductivity of 0.00018 feet per day was assigned to this lowermost layer.

Contaminant Transport Inputs: Initial Concentrations

The physical and chemical parameters that effect contaminant transport were set up for three groundwater constituents at Site 80/166, g-chlordane, arsenic and lead. The contaminant transport parameters include initial concentrations of the COCs, dispersivity, bulk density, sorption type and sorption coefficients. In addition, biodegradation parameters were used for the MODFLOW simulation of g-chlordane. The initial concentrations of these COCs in each well is discussed in **Section 5.0** and summarized in **Table 5-5**. The initial concentration maps used in MODFLOW are portrayed in **Figures 6-5a, 6-5b and 6-5c**.

The initial concentration map for g-chlordane (**Figure 6-5a**) was created by assigning a 40 foot by 40 foot area surrounding well 80-MW2 with the initial concentration of 2.719 (the most recent detection of g-chlordane, in January 2001). The remainder of the map was assigned the initial concentration of 0.014 ug/L, which corresponds to half the MDL for g-chlordane during the groundwater sampling program (see **Table 5-5**).

The initial concentration maps for arsenic (**Figure 6-5b**) and lead (**Figure 6-5c**) were derived for each of the MODFLOW grid cells by entering average groundwater concentrations into *Visual MODFLOW*. The average concentrations were derived from the groundwater sampling results obtained between April 1997 and January 2001 (**Table 5-1**). Points outside of the Site 80/166 monitoring wells were entered into MODFLOW as half the respective MDLs for arsenic and lead.

Contaminant Transport Inputs: Aquifer Characteristics

The contaminant transport simulation for Site 80/166 incorporated the sorption of the COCs to the solid soil particles. The sorption coefficient, K_d , represents the fraction of a particular substance that is “sorbed” to the soil (absorption and/or adsorption) versus that fraction dissolved in the groundwater. The linear isotherm portrayed in the following equation describes the simplest relationship involving sorption:

$$S = K_d C$$

where S represents the sorbed fraction and C represents the dissolved concentration, and the sorption coefficient, K_d , is a constant that does not vary with the dissolved concentration. The ratio of the groundwater velocity to the velocity of a dissolved substance is called the “retardation factor,” or R_d . The retardation factor can be calculated using the following equation:

$$R_d = 1 + (\rho_d / \alpha) * (K_d)$$

where R_d is the retardation factor, ρ_d is the bulk density of the soil, α is the porosity, and K_d is the sorption coefficient (Domenico and Schwartz, 1998). For g-chlordane, K_d was calculated using the relationship:

$$K_d = f_{oc} * K_{oc}$$

where f_{oc} is the fraction of organic carbon and K_{oc} is the organic carbon partition coefficient. The contaminant transport simulation was conducted using a linear isotherm and K_d values from the USEPA (1996). As shown in **Table 6-2**, the retardation factors for g-chlordane, arsenic and lead at Site 80/166 are 900, 73 and 2,204, respectively.

Dispersion was incorporated in the model to predict the effects of dilution of the COCs at Site 80/166. The longitudinal dispersivity of 3.48 feet was used in the model, which was calculated using the method published by the USEPA (2001). The longitudinal dispersivity is a function of the plume size of 40 feet.

6.1.5 MODFLOW Calibration

The model was first run to simulate the groundwater conditions at Site 80/166 without the contaminant transport simulation. **Figure 6-6** shows the flow directions and groundwater elevation contours that were predicted during model calibration. These conditions represent steady-state, which was achieved by running the model until the head change variation was less than 0.01 feet between iterations. **Figure 6-7** presents a comparison of the groundwater elevations simulated in the model (“Calculated Heads”) and field measurements (“Observed Heads”) conducted on January 24, 2001 at Site 80/166 (see **Table 3-3** for groundwater elevation data). The model calibration results shown in **Figure 6-7** provide evidence that the model accurately predicts groundwater flow

conditions at Site 80/166 and that the output (predictions) of the model match closely with field measurements.

6.1.6 MODFLOW Results

The migration of the COCs in groundwater at Site 80/166 was simulated in MODFLOW using the grid setup and input parameters discussed above. The MODFLOW simulation was run for a simulated time of 20 years (7,300 days) for each COC. The MODFLOW results are presented in **Figures 6-8a and 6-8b** (g-chlordane), **Figures 6-9a and 6-9b** (arsenic), and **Figures 6-10a and 6-10b** (lead). The estimated times for COCs at Site 80/166 to achieve compliance with NJDEP groundwater standards are presented in **Table 6-3**.

For g-chlordane, the estimated time of compliance at Site 80/166 is approximately 20 years, which is the same as predicted using the biodegradation spreadsheet in **Table 6-1**. This result indicates that the additional components of 3-dimensional flow and dispersion did not change the estimated time of compliance. This lack of change is due to the strong retardation of chlordane in soil.

The result for g-chlordane was derived from groundwater concentrations at a single location (80-MW2). Additional soil and groundwater sampling would be needed in order to determine the extent of the chlordane contamination in soils and/or groundwater at Site 80/166 and the surrounding area. The soil and groundwater samples collected during the Geoprobe[®] investigation in March and May 2000 were not analyzed for pesticides/PCBs.

For each of the metal COCs at Site 80/166 (arsenic and lead), the predicted concentrations at 20 years exceeded their respective NJDEP groundwater criteria. The MODFLOW results for arsenic and lead are shown in **Figures 6-9a and 6-9b** (arsenic), and **6-10a and 6-10b** (lead). The estimated times for compliance with the NJDEP criteria is 600 years for arsenic and greater than 1,000 years for lead. The results of the groundwater modeling indicate that COC migration will be minimal due to low hydraulic conductivity and strong retardation by the soils.

6.2 Sensitive Receptor Survey Results

The sensitive receptor survey was completed by performing two tasks: an Offsite Receptor Report and an NJDEP well record search.

Offsite Receptor Report

An Offsite Receptor Report (dated October 24, 2001) was prepared for Site 80/166 by EDR of Southport, Connecticut. A copy of the Offsite Receptor Report, identifying sensitive receptors in the area, is provided in **Appendix I**.

The Offsite Receptor Report indicates that there are three schools (Steelman School, Wolf Hill Elementary School and Meadowbrook Elementary School) located less than one-mile from Site 80/166. These three schools are located between one-half and one-mile from Site 80/166.

Well Record Search

A search of the comprehensive well database maintained by the NJDEP Well Permitting and Regulations Section of the Bureau of Water Allocation was performed by Versar to identify groundwater wells that may be potentially affected by COCs at Site 80/166. The search was performed for a one-mile radius surrounding the central point of Site 80/166.

The well records obtained during the well search are provided in **Appendix J** and are summarized in **Table 6-4**. The wells designated for domestic or irrigation uses are presented in **Figure 6-11**. There was one domestic well identified by records within 1,000 feet of Site 80/166 with the following information (though actual water use and physical presence were not verified):

- NJDEP Permit #2904513
- Original Owner: Rumson Country Club
- Permit Date: 10/16/64
- Location: N40°19'06" W74°01'33"
- Depth of well: 350 feet
- Approximate distance from Site 80/166: 850 feet (east, across Oceanport Creek)

Due to the significant distance of Site 80/166 from this one sensitive receptor, as well as the ongoing monitoring of Oceanport Creek adjacent to the impacted area, the concern for sensitive receptors is minimal. The probability that any well in the vicinity of the site is being used for consumptive purposes is low, thus minimizing health-based risks associated with ingestion. Furthermore, based on the MODFLOW model predictions, the COCs will not migrate beyond the boundaries of Site 80/166, and would seep into Oceanport Creek before reaching the one identified receptor. Therefore, no sensitive receptors are likely to be impacted by the presence of COCs in the groundwater beneath Site 80/166.

6.3 Aquifer Classification

Upon review of the NJDEP Groundwater Quality Standards (NJAC 7:9-6), January 7, 1993, Site 80/166 is found to be underlain by a Class III-A aquifer. The primary designated use for Class III-A groundwater is the release or transmittal of groundwater to adjacent classification areas and surface water, as relevant. Secondary designated uses in Class III-A include any reasonable uses. For an area to be classified as a Class III-A aquifer, groundwater must meet the following characteristics:

- Class III-A groundwater includes portions of the saturated zones (that meet the criteria below) of the Woodbury Formation, Merchantville Formation, Marshalltown Formation, Navesink Formation, Hornerstown Formation, aquitard formations of the Potomac-Raritan-Magothy aquifer system and the Kirkwood aquifer system, portions of the glacial moraine and glacial lake deposits and other geologic units having the characteristics of an aquitard. Class III-A areas have the following characteristics (NJAC 7:9-6.5):
 - The average thickness of a Class III-A aquifer must be at least 50 feet;
 - Typical hydraulic conductivity of a Class III-A aquifer is approximately 0.1 feet/day or less; and
 - The aerial extent defined as Class III-A must be at least 100 acres.

The shallow aquifer at Fort Monmouth meets each of the four criteria listed above. These criteria are discussed below:

- As presented in **Figure 2-7**, Fort Monmouth is located within the outcrop area of the “Navesink-Hornerstown Confining Unit” (Martin, 1998), which also includes the Red Bank Sand, Tinton Sand, Vincentown Formation, Manasquan Formation, Shark River Formation, Piney Point Formation and the basal clay of the Kirkwood Formation (see **Section 2.4.2**). **Figure 2-7** illustrates that the thickness of the Hornerstown-Navesink Confining Unit, which in the vicinity of Fort Monmouth, is approximately 125 feet.
- Published hydraulic conductivities (Martin, 1998) for the Navesink-Hornerstown Confining Unit (shown in **Table 6-2**) yield a geometric mean of 0.12 feet per day, which was the conductivity used in the MODFLOW Model (**Section 6.1.2**) and which is consistent with an aquitard.
- The area of Fort Monmouth is greater than 100 acres.

6.4 Contaminant Migration Summary

At Site 80/166, a-chlordane, g-chlordane, arsenic and lead were identified as COCs in groundwater using the NJDEP GWQC for Class II-A aquifers. The Class II-A criteria were used for comparison with site-specific data obtained from the various sampling rounds because the GWQS (NJAC 7:9-6.7e) state that the groundwater quality criteria to be used for Class III-A aquifers are the most stringent criteria associated with vertically or horizontally adjacent ground waters that are not Class III-A.

Groundwater modeling and a sensitive receptor survey were conducted to determine whether groundwater from Site 80/166 could impact surface water, off-site domestic wells, and subsurface groundwater aquifers. Groundwater modeling shows the impact of COC migration in groundwater at Site 80/166 will be minimal due to low hydraulic conductivity and sorption of the COCs to the soil (retardation). The results of the groundwater modeling and sensitive receptor survey are summarized below:

- Using published biodegradation rates for chlordane, the biodegradation model predicts that g-chlordane will degrade in well 80-MW2 within approximately 20 years. a-Chlordane was detected at lower concentrations than g-chlordane and will therefore degrade within a shorter period of time.
- Due to the low concentrations of the a-chlordane and g-chlordane at Site 80/166, and the very slow migration rates for these pesticides in groundwater, there is little potential for significant impact by migration (seepage) into Oceanport Creek. The 20 year prediction for compliance with NJDEP GWQC is not affected by the inclusion of 3-dimensional groundwater flow and dispersion in MODFLOW.
- Due to the low concentrations of the identified metal COCs (arsenic and lead) at Site 80/166, and the very slow migration rates for these metals in the groundwater, there is little potential for significant impact by migration (seepage) into Oceanport Creek.
- The closest aquifer, the Wenonah-Mount Laurel Aquifer, is located approximately 125 feet bgs. The results of the groundwater modeling indicate that this aquifer is too deep to be affected by the COCs near the ground surface at Site 80/166 and that the vertical exchange of groundwater between the aquifers (leakage) is minimal.
- The sensitive receptor survey indicates that the closest downstream domestic well is approximately 850 feet from Site 80/166 across Oceanport Creek, which is too far to be impacted by COC migration. The potential migration of the COCs from Site 80/166 to this well in any reasonable time period is not possible.

7.0 CONCLUSIONS AND RECOMMENDATIONS

Geologic publications show that Site 80/166 is located within an aquitard (the Navesink-Hornerstown Confining Unit). The low hydraulic conductivity of the aquitard and the thickness of the aquitard at the site conform to the requirements of a Class III-A aquifer, as specified in the NJDEP GWQS (NJAC 7:9-6, January 7, 1993).

The analytical results for the groundwater samples collected between April 1997 and January 2001 indicate that a-chlordane, g-chlordane, arsenic and lead exceed the GWQC at Site 80/166 and are considered COCs. The Class II-A criteria were used for comparison with site-specific data obtained from the various sampling rounds because the GWQS (NJAC 7:9-6.7e) state that the groundwater quality criteria to be used for Class III-A aquifers are the most stringent criteria associated with vertically or horizontally adjacent ground waters that are not Class III-A.

Due to the low concentrations of COCs at the site and the slow migration rates for the COCs in the groundwater, there is little potential for significant COC impact by migration into Oceanport Creek. The Wenonah Mount Laurel aquifer, which is approximately 125 feet bgs, is too deep to be affected by the COCs near the ground surface. The sensitive receptor survey indicates that there are no domestic or irrigation wells close enough to Site 80/166 to be adversely impacted by COC migration.

NFA is recommended with regard to pesticides and metals contamination in groundwater at Site 80/166.

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TABLES

Table 2-1
Well Construction Summary
Site 80/166 - Main Post
Fort Monmouth, New Jersey

Well ID	NJDEP Permit Number	Northing	Easting	Elevation of Inner Casing Survey Mark	Elevation of Ground Surface	Hole Diameter	Total Depth of Well	Depth to Top of Screen	Screen Length	Screen Material	Date of Construction
Units	--	ft	ft	ft (amsl) ⁽¹⁾	ft (amsl) ⁽¹⁾	in	ft (bgs) ⁽²⁾	ft (bgs) ⁽²⁾	ft	--	--
80-MW1	29-31774	540841.109	623562.057	6.84 ⁽³⁾	7.65 ⁽³⁾	8	13.0	3.0	10.0	20 Slot PVC	9/15/1994
80-MW2	29-43199	540895.438	623503.5	7.68	8.01	10	12.0	2.0	10.0	10 Slot PVC	7/24/2000
80-MW3	29-43201	540896.111	623695.234	7.63	7.86	10	12.0	2.0	10.0	10 Slot PVC	7/24/2000
80-MW4	29-43200	540770.626	623567.858	7.46	7.76	10	12.0	2.0	10.0	10 Slot PVC	7/24/2000
80-MW5	29-43202	540786.22	623622.45	7.14	7.36	10	12.0	2.0	10.0	10 Slot PVC	7/24/2000
166-MW1	29-31733	540965.787	623549.32	6.91	7.29	8	10.0	0.5	9.5	20 Slot PVC	9/14/1994

Notes:

Where a difference in reported data exists between a monitoring well permit and the corresponding boring log, data from the permit was used.

⁽¹⁾amsl = above mean sea level

⁽²⁾bgs = below ground surface

⁽³⁾Most recent Form B survey data used

NA = Not available

Well locations were recorded using Trimble GPS equipment in August 2001.

Table 3-1
Groundwater Sample Collection Summary
Site 80/166 - Main Post
Fort Monmouth, New Jersey

Round #	Sample ID	Monitoring Well ID	Date Collected	Date Analysis Started	Matrix	Sample Type	Analytical Parameters	Analysis Method
1	2457.01	Trip Blank	04/16/97	04/25/97	aqueous	Blank	VOCs+15	Method 624
	2457.02	Field Blank	04/16/97	04/22/97	aqueous	Blank	VOCs+15; Lead	Method 624; Method 3113B
	2457.03	80-MW1	04/16/97	04/22/97	aqueous	GW	VOCs+15; Lead	Method 624; Method 3113B
	2458.01	166-MW1	04/16/97	04/22/97	aqueous	GW	VOCs+15; Lead	Method 624; Method 3113B
2	2917.01	Trip Blank	08/20/97	08/26/97	aqueous	Blank	VOCs +15	Method 624
	2917.02	Field Blank	08/20/97	08/26/97	aqueous	Blank	VOCs+15; SVOCs +25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3111D, 3111B, 3112B, 3113B, 3120B
	2917.03	166-MW1	08/20/97	08/26/97	aqueous	GW	VOCs+15; SVOCs +25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3111D, 3111B, 3112B, 3113B, 3120B
	2918.01	80-MW1	08/20/97	08/26/97	aqueous	GW	VOCs+15; SVOCs +25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3111D, 3111B, 3112B, 3113B, 3120B
3	3174.01	Trip Blank	11/24/97	12/02/97	aqueous	Blank	VOCs +15	Method 624
	3174.02	Field Blank	11/24/97	12/02/97	aqueous	Blank	VOCs+15; SVOCs +25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	3174.03	80-MW1	11/24/97	12/02/97	aqueous	GW	VOCs+15; SVOCs +25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	3175.01	166-MW1	11/24/97	12/02/97	aqueous	GW	VOCs+15; SVOCs +25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
4	3373.01	Trip Blank	02/27/98	03/03/98	aqueous	Blank	VOCs +15	Method 624
	3373.02	Field Blank	02/27/98	03/03/98	aqueous	Blank	VOCs+15; SVOCs +25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	3373.06	Duplicate	02/27/98	03/03/98	aqueous	GW	VOCs+15; SVOCs +25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	3375.01	166-MW1	02/27/98	03/03/98	aqueous	GW	VOCs+15; SVOCs +25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	3376.01	80-MW1	02/27/98	03/03/98	aqueous	GW	VOCs+15; SVOCs +25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
5	3610.01	Trip Blank	06/02/98	06/09/98	aqueous	Blank	VOCs +15	Method 624
	3610.02	Field Blank	06/02/98	06/10/98	aqueous	Blank	VOCs+15; SVOCs +25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	3614.01	80-MW1	06/02/98	06/11/98	aqueous	GW	VOCs+15; SVOCs +25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	3614.02	166-MW1	06/02/98	06/11/98	aqueous	GW	VOCs+15; SVOCs +25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
6	3823.01	Duplicate	08/24/98	08/28/98	aqueous	GW	VOCs+15; SVOCs +25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	3823.02	Trip Blank	08/24/98	08/28/98	aqueous	Blank	VOCs +15	Method 624
	3823.03	Field Blank	08/24/98	08/28/98	aqueous	Blank	VOCs+15; SVOCs +25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	3823.04	80-MW1	08/24/98	08/28/98	aqueous	GW	VOCs+15; SVOCs +25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	3823.05	166-MW1	08/24/98	08/28/98	aqueous	GW	VOCs+15; SVOCs +25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
7	4076.01	Trip Blank	11/20/98	11/24/98	aqueous	Blank	VOCs +15	Method 624
	4076.02	Field Blank	11/20/98	11/24/98	aqueous	Blank	VOCs+15; SVOCs +25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	4076.03	80-MW1	11/20/98	11/24/98	aqueous	GW	VOCs+15; SVOCs +25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	4076.04	166-MW1	11/20/98	11/24/98	aqueous	GW	VOCs+15; SVOCs +25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	4076.05	Duplicate	11/20/98	11/24/98	aqueous	GW	VOCs+15; SVOCs +25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
8	4262.01	Trip Blank	02/09/99	02/17/99	aqueous	Blank	VOCs +15	Method 624
	4262.02	Field Blank	02/09/99	02/16/99	aqueous	Blank	VOCs+15; SVOCs +25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	4262.03	80-MW1	02/09/99	02/16/99	aqueous	GW	VOCs+15; SVOCs +25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	4262.04	166-MW1	02/09/99	02/16/99	aqueous	GW	VOCs+15; SVOCs +25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	4262.05	Duplicate	02/09/99	02/16/99	aqueous	GW	VOCs+15; SVOCs +25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
9	4514.01	Trip Blank	05/26/99	05/28/99	aqueous	Blank	VOCs +15	Method 624
	4514.02	Field Blank	05/26/99	05/28/99	aqueous	Blank	VOCs+15; SVOCs +25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	4514.03	80-MW1	05/26/99	05/28/99	aqueous	GW	VOCs+15; SVOCs +25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	4514.04	166-MW1	05/26/99	05/28/99	aqueous	GW	VOCs+15; SVOCs +25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	4514.05	Duplicate	05/26/99	05/28/99	aqueous	GW	VOCs+15; SVOCs +25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
10	4808.01	80-MW1	09/22/99	09/25/99	aqueous	GW	VOCs+15; SVOCs +25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	4808.02	166-MW1	09/22/99	09/25/99	aqueous	GW	VOCs+15; SVOCs +25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	4808.03	Trip Blank	09/22/99	09/25/99	aqueous	Blank	VOCs +15	Method 624
	4808.04	Field Blank	09/22/99	09/25/99	aqueous	Blank	VOCs+15; SVOCs +25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	4808.05	Duplicate	09/22/99	09/25/99	aqueous	GW	VOCs+15; SVOCs +25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B

Table 3-1
Groundwater Sample Collection Summary
Site 80/166 - Main Post
Fort Monmouth, New Jersey

Round #	Sample ID	Monitoring Well ID	Date Collected	Date Analysis Started	Matrix	Sample Type	Analytical Parameters	Analysis Method
11	5021.01	80-MW1	12/17/99	12/22/99	aqueous	GW	VOCs+15; SVOCs +25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	5021.02	166-MW1	12/17/99	12/22/99	aqueous	GW	VOCs+15; SVOCs +25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
12	5223.01	Trip Blank	03/06/00	03/08/00	aqueous	Blank	VOCs+15; SVOCs +25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	5223.02	Field Blank	03/06/00	03/08/00	aqueous	Blank	VOCs+15; SVOCs +25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	5223.03	Duplicate	03/06/00	03/08/00	aqueous	GW	VOCs+15; SVOCs +25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	5223.04	80-MW1	03/06/00	03/08/00	aqueous	GW	VOCs+15; SVOCs +25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	5223.05	166-MW1	03/06/00	03/08/00	aqueous	GW	VOCs+15; SVOCs +25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
13	5406.01	80-MW1	05/09/00	05/10/00	aqueous	GW	VOCs+15; SVOCs +25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	5406.02	166-MW1	05/09/00	05/10/00	aqueous	GW	VOCs+15; SVOCs +25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
14	5635.01	80-MW1	08/16/00	08/17/00	aqueous	GW	VOCs+15; SVOCs +25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	5635.02	166-MW1	08/16/00	08/17/00	aqueous	GW	VOCs+15; SVOCs +25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	5636.01	Trip Blank	08/16/00	08/24/00	aqueous	Blank	VOCs +15	Method 624; Method 625; Method 608; Methods 3112B and 3120B Method 624
	5636.02	Field Blank	08/16/00	08/18/00	aqueous	Blank	VOCs+15; SVOCs +25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	5636.03	Duplicate	08/16/00	08/18/00	aqueous	GW	VOCs+15; SVOCs +25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	5636.04	80-MW2	08/16/00	08/18/00	aqueous	GW	VOCs+15; SVOCs +25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	5636.05	80-MW3	08/16/00	08/18/00	aqueous	GW	VOCs+15; SVOCs +25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	5636.06	80-MW4	08/16/00	08/18/00	aqueous	GW	VOCs+15; SVOCs +25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
15	5636.07	80-MW5	08/16/00	08/18/00	aqueous	GW	VOCs+15; SVOCs +25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	5675.01	Trip Blank	08/30/00	09/09/00	aqueous	Blank	VOCs +15	Method 624
	5675.02	Field Blank	08/30/00	09/05/00	aqueous	Blank	VOCs+15; SVOCs +25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	5675.03	Duplicate	08/30/00	09/05/00	aqueous	GW	VOCs+15; SVOCs +25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	5675.04	80-MW2	08/30/00	09/05/00	aqueous	GW	VOCs+15; SVOCs +25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	5675.05	80-MW3	08/30/00	09/05/00	aqueous	GW	VOCs+15; SVOCs +25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	5675.06	80-MW4	08/30/00	09/05/00	aqueous	GW	VOCs+15; SVOCs +25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
low flow 1	5675.07	80-MW5	08/30/00	09/05/00	aqueous	GW	VOCs+15; SVOCs +25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	5691.01	Field Blank	09/06/00	09/19/00	aqueous	Blank	Pesticides/PCBs; TAL metals	Method 608; Method 3112B, 3120B
	5691.02*	Duplicate	09/06/00	09/19/00	aqueous	GW	Pesticides/PCBs; TAL metals	Method 608; Method 3112B, 3120B
	5691.03*	80-MW4	09/06/00	09/19/00	aqueous	GW	Pesticides/PCBs; TAL metals	Method 608; Method 3112B, 3120B
	5691.04*	80-MW5	09/06/00	09/19/00	aqueous	GW	Pesticides/PCBs; TAL metals	Method 608; Method 3112B, 3120B
	5691.05*	80-MW3	09/06/00	09/19/00	aqueous	GW	Pesticides/PCBs; TAL metals	Method 608; Method 3112B, 3120B
	5694.01	Field Blank	09/07/00	09/19/00	aqueous	Blank	Pesticides/PCBs; TAL metals	Method 608; Method 3112B, 3120B
	5694.02*	Duplicate	09/07/00	09/19/00	aqueous	GW	Pesticides/PCBs; TAL metals	Method 608; Method 3112B, 3120B
low flow 2	5694.03*	80-MW2	09/07/00	09/19/00	aqueous	GW	Pesticides/PCBs; TAL metals	Method 608; Method 3112B, 3120B
	5694.04*	80-MW1	09/07/00	09/19/00	aqueous	GW	Pesticides/PCBs; TAL metals	Method 608; Method 3112B, 3120B
	5694.05*	166-MW1	09/07/00	09/19/00	aqueous	GW	Pesticides/PCBs; TAL metals	Method 608; Method 3112B, 3120B
	5780.01*	Duplicate	10/11/00	10/18/00	aqueous	GW	Pesticides/PCBs; TAL metals	Method 608; Method 3112B, 3120B
	5780.02	Field Blank	10/11/00	10/18/00	aqueous	Blank	Pesticides/PCBs; TAL metals	Method 608; Method 3112B, 3120B
	5780.03*	80-MW4	10/11/00	10/18/00	aqueous	GW	Pesticides/PCBs; TAL metals	Method 608; Method 3112B, 3120B
	5780.04*	80-MW5	10/11/00	10/18/00	aqueous	GW	Pesticides/PCBs; TAL metals	Method 608; Method 3112B, 3120B
	5780.05*	80-MW3	10/11/00	10/18/00	aqueous	GW	Pesticides/PCBs; TAL metals	Method 608; Method 3112B, 3120B
low flow 2	5782.01*	Duplicate	10/12/00	10/18/00	aqueous	GW	Pesticides/PCBs; TAL metals	Method 608; Method 3112B, 3120B
	5782.01	Field Blank	10/12/00	10/18/00	aqueous	Blank	Pesticides/PCBs; TAL metals	Method 608; Method 3112B, 3120B
	5782.03*	80-MW1	10/12/00	10/18/00	aqueous	GW	Pesticides/PCBs; TAL metals	Method 608; Method 3112B, 3120B
	5782.04*	80-MW2	10/12/00	10/18/00	aqueous	GW	Pesticides/PCBs; TAL metals	Method 608; Method 3112B, 3120B
	5782.05*	166-MW1	10/12/00	10/18/00	aqueous	GW	Pesticides/PCBs; TAL metals	Method 608; Method 3112B, 3120B

Table 3-1
Groundwater Sample Collection Summary
Site 80/166 - Main Post
Fort Monmouth, New Jersey

Round #	Sample ID	Monitoring Well ID	Date Collected	Date Analysis Started	Matrix	Sample Type	Analytical Parameters	Analysis Method
16	5818.01	Trip Blank	10/27/00	11/02/00	aqueous	Blank	VOCs +15	Method 624
	5818.02	Field Blank	10/27/00	11/02/00	aqueous	Blank	VOCs+15; SVOCs +25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	5818.03	Duplicate	10/27/00	11/02/00	aqueous	GW	VOCs+15; SVOCs +25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	5818.04	80-MW1	10/27/00	11/02/00	aqueous	GW	VOCs+15; SVOCs +25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	5818.05	80-MW2	10/27/00	11/02/00	aqueous	GW	VOCs+15; SVOCs +25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	5818.06	80-MW3	10/27/00	11/02/00	aqueous	GW	VOCs+15; SVOCs +25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	5818.07	80-MW4	10/27/00	11/02/00	aqueous	GW	VOCs+15; SVOCs +25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	5818.08	80-MW5	10/27/00	11/02/00	aqueous	GW	VOCs+15; SVOCs +25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	5818.09	166-MW1	10/27/00	11/02/00	aqueous	GW	VOCs+15; SVOCs +25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
17	342	Trip Blank	01/24/01	01/31/01	aqueous	Blank	VOCs +15	Method 624
	343	Field Blank	01/24/01	01/31/01	aqueous	Blank	VOCs+15; SVOCs +25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	344	Duplicate	01/24/01	01/31/01	aqueous	GW	VOCs+15; SVOCs +25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	345	166-MW1	01/24/01	01/31/01	aqueous	GW	VOCs+15; SVOCs +25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	346	80-MW1	01/24/01	01/31/01	aqueous	GW	VOCs+15; SVOCs +25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	347	80-MW2	01/24/01	01/31/01	aqueous	GW	VOCs+15; SVOCs +25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	348	80-MW3	01/24/01	01/31/01	aqueous	GW	VOCs+15; SVOCs +25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	349	80-MW4	01/24/01	01/31/01	aqueous	GW	VOCs+15; SVOCs +25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B
	350	80-MW5	01/24/01	01/31/01	aqueous	GW	VOCs+15; SVOCs +25; Pesticides/PCBs; TAL metals;	Method 624; Method 625; Method 608; Methods 3112B and 3120B

Notes:

GW : Groundwater

TAL metals : Target Analyte List metals

VOCs+15: Volatile Organic Compounds plus 15 tentatively identified compounds (TICs)

SVOCs+15: Semi-Volatile Organic Compounds plus 15 TICs

*Low Flow Sampling Method was used to collect sample

Table 3-2
Geoprobe Investigation Sample Collection Summary
Site 80/166 - Main Post
Fort Monmouth, New Jersey

Sample ID	Sample Location	Sample Depth	Date Collected	Date Analysis Started	Matrix	Sample Type	Analytical Parameters	Analysis Method
5241.01	Trip Blank	-	3/13/2000	3/16/2000	methanol	Blank	VOCs+15	Method 624
5241.02	Field Blank	-	3/13/2000	3/14/2000	aqueous	Blank	VOCs+15	Method 624
5241.03	1	48"	3/13/2000	3/16/2000	Soil	S	VOCs+15, Percent Solids	Method 624
5241.04	1	3-7'	3/13/2000	3/16/2000	aqueous	GW	VOCs+15	Method 624
5241.05	2	48"	3/13/2000	3/16/2000	Soil	S	VOCs+15, Percent Solids	Method 624
5241.06	2	3-7'	3/13/2000	3/16/2000	aqueous	GW	VOCs+15	Method 624
5241.07	3	48"	3/13/2000	3/16/2000	Soil	S	VOCs+15, Percent Solids	Method 624
5241.08	3	3-7'	3/13/2000	3/16/2000	aqueous	GW	VOCs+15	Method 624
5241.09	4	48"	3/13/2000	3/16/2000	Soil	S	VOCs+15, Percent Solids	Method 624
5241.10	4	3-7'	3/13/2000	3/16/2000	aqueous	GW	VOCs+15	Method 624
5246.01	Trip Blank	-	3/14/2000	3/18/2000	methanol	Blank	VOCs+15	Method 624
5246.02	Field Blank	-	3/14/2000	3/18/2000	aqueous	Blank	VOCs+15	Method 624
5246.03	5	42"	3/14/2000	3/18/2000	Soil	S	VOCs+15, Percent Solids	Method 624
5246.04	5	3-7'	3/14/2000	3/18/2000	aqueous	GW	VOCs+15	Method 624
5246.05	6	42"	3/14/2000	3/18/2000	Soil	S	VOCs+15, Percent Solids	Method 624
5246.06	6	3-7'	3/14/2000	3/18/2000	aqueous	GW	VOCs+15	Method 624
5246.07	7	42"	3/14/2000	3/18/2000	Soil	S	VOCs+15, Percent Solids	Method 624
5246.08	7	3-7'	3/14/2000	3/18/2000	aqueous	GW	VOCs+15	Method 624
5246.09	8	42"	3/14/2000	3/18/2000	Soil	S	VOCs+15, Percent Solids	Method 624
5246.10	8	3-7'	3/14/2000	3/18/2000	aqueous	GW	VOCs+15	Method 624
5246.11	9	48"	3/14/2000	3/18/2000	Soil	S	VOCs+15, Percent Solids	Method 624
5246.12	9	3-7'	3/14/2000	3/18/2000	aqueous	GW	VOCs+15	Method 624
5246.13	10	48"	3/14/2000	3/18/2000	Soil	S	VOCs+15, Percent Solids	Method 624
5246.14	10	3-7'	3/14/2000	3/18/2000	aqueous	GW	VOCs+15	Method 624
5248.01	Trip Blank	-	3/15/2000	3/19/2000	methanol	Blank	VOCs+15	Method 624
5248.02	Field Blank	-	3/15/2000	3/19/2000	aqueous	Blank	VOCs+15	Method 624
5248.03	11	48"	3/15/2000	3/19/2000	Soil	S	VOCs+15, Percent Solids	Method 624
5248.04	11	3-7'	3/15/2000	3/19/2000	aqueous	GW	VOCs+15	Method 624
5248.05	12	48"	3/15/2000	3/19/2000	Soil	S	VOCs+15, Percent Solids	Method 624
5248.06	12	3-7'	3/15/2000	3/19/2000	aqueous	GW	VOCs+15	Method 624

Table 3-2
Geoprobe Investigation Sample Collection Summary
Site 80/166 - Main Post
Fort Monmouth, New Jersey

Sample ID	Sample Location	Sample Depth	Date Collected	Date Analysis Started	Matrix	Sample Type	Analytical Parameters	Analysis Method
5248.07	13	48"	3/15/2000	3/19/2000	Soil	S	VOCs+15, Percent Solids	Method 624
5248.08	13	3-7'	3/15/2000	3/19/2000	aqueous	GW	VOCs+15	Method 624
5248.09	14	48"	3/15/2000	3/19/2000	Soil	S	VOCs+15, Percent Solids	Method 624
5256.01	14	3-7'	3/17/2000	3/19/2000	aqueous	GW	VOCs+15	Method 624
5248.11	15	48"	3/15/2000	3/19/2000	Soil	S	VOCs+15, Percent Solids	Method 624
5248.12	15	3-7'	3/15/2000	3/19/2000	aqueous	GW	VOCs+15	Method 624
5248.13	FD	48"	3/15/2000	3/19/2000	soil	S	VOCs+15	Method 624
5256.02	FD	3-7'	3/17/2000	3/19/2000	aqueous	GW	VOCs+15	Method 624
5416.01	Trip Blank	-	5/15/2000	5/16/2000	methanol	Blank	VOCs+15	Method 624
5416.02	Field Blank	-	5/15/2000	5/16/2000	aqueous	Blank	VOCs+15	Method 624
5416.03	16	36"	5/15/2000	5/16/2000	Soil	S	VOCs+15, Percent Solids	Method 624
5416.04	16	3.4-8'	5/15/2000	5/16/2000	aqueous	GW	VOCs+15	Method 624
5416.05	17	36"	5/15/2000	5/16/2000	Soil	S	VOCs+15, Percent Solids	Method 624
5416.06	17	3-8'	5/15/2000	5/16/2000	aqueous	GW	VOCs+15	Method 624
5416.07	18	36"	5/15/2000	5/16/2000	Soil	S	VOCs+15, Percent Solids	Method 624
5416.09	18	3-8'	5/15/2000	5/16/2000	aqueous	GW	VOCs+15	Method 624

Notes:

FD: Field Duplicate

GW:Groundater

NA: Data not available.

S: Soil Boring

VOCs+15: Volatile Organic Compounds plus 15 tentatively identified compounds (TICs)

Table 3-3
Groundwater Elevation Summary
Site 80/166 - Main Post
Fort Monmouth, New Jersey

Well ID	Elev. of Inner Casing Survey Mark	Date	Depth to Water	Ground-water Elev.	Date	Depth to Water	Ground-water Elev.	Date	Depth to Water	Ground-water Elev.	Date	Depth to Water	Ground-water Elev.
80-MW1	6.91	04/16/97	2.60	4.31	08/20/97	3.2	3.71	11/24/97	2.40	4.51	02/27/98	1.40	5.51
80-MW2	7.68	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
80-MW3	7.63	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
80-MW4	7.46	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
80-MW5	6.91	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
166-MW1	6.96	04/16/97	2.51	4.45	08/20/97	3.20	3.76	11/24/97	2.25	4.71	02/27/98	1.00	5.96

Notes:

- 1) Elev.: Elevation in feet above mean sea level.
- 2) Depth to water: depth in feet from the inner casing survey mark.
- 3) NS: Not Sampled

Table 3-3
Groundwater Elevation Summary
Site 80/166 - Main Post
Fort Monmouth, New Jersey

Well ID	Elev. of Inner Casing Survey Mark	Date	Depth to Water	Ground-water Elev.	Date	Depth to Water	Ground-water Elev.	Date	Depth to Water	Ground-water Elev.	Date	Depth to Water	Ground-water Elev.
80-MW1	6.91	06/02/98	2.09	4.82	08/24/98	3.43	3.48	11/20/98	4.04	2.87	02/09/99	3.84	3.07
80-MW2	7.68	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
80-MW3	7.63	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
80-MW4	7.46	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
80-MW5	6.91	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
166-MW1	6.96	06/02/98	1.97	4.99	08/24/98	3.42	3.54	11/20/98	3.99	2.97	02/09/99	2.73	4.23

Notes:

- 1) Elev.: Elevation in feet above mean sea level.
- 2) Depth to water: depth in feet from the inner casing survey mark.
- 3) NS: Not Sampled

Table 3-3
Groundwater Elevation Summary
Site 80/166 - Main Post
Fort Monmouth, New Jersey

Well ID	Elev. of Inner Casing Survey Mark	Date	Depth to Water	Ground-water Elev.	Date	Depth to Water	Ground-water Elev.	Date	Depth to Water	Ground-water Elev.	Date	Depth to Water	Ground-water Elev.
80-MW1	6.91	05/26/99	2.61	4.3	09/22/99	2.73	4.18	12/17/99	2.52	4.39	03/06/00	2.76	4.15
80-MW2	7.68	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
80-MW3	7.63	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
80-MW4	7.46	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
80-MW5	6.91	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
166-MW1	6.96	05/26/99	2.90	4.06	09/22/99	2.71	4.25	12/17/99	2.57	4.39	03/06/00	2.61	4.35

Notes:

- 1) Elev.: Elevation in feet above mean sea level.
- 2) Depth to water: depth in feet from the inner casing survey mark.
- 3) NS: Not Sampled

Table 3-3
Groundwater Elevation Summary
Site 80/166 - Main Post
Fort Monmouth, New Jersey

Well ID	Elev. of Inner Casing Survey Mark	Date	Depth to Water	Ground-water Elev.	Date	Depth to Water	Ground-water Elev.	Date	Depth to Water	Ground-water Elev.	Date	Depth to Water	Ground-water Elev.
80-MW1	6.91	05/09/00	2.36	4.55	08/16/00	1.80	5.11	NS	NS	NS	09/07/00	3.15	3.76
80-MW2	7.68	NS	NS	NS	08/16/00	2.44	5.24	08/30/00	3.22	4.46	09/07/00	2.25	5.43
80-MW3	7.63	NS	NS	NS	08/16/00	2.81	4.82	08/30/00	3.37	4.26	09/06/00	3.25	4.38
80-MW4	7.46	NS	NS	NS	08/16/00	2.76	4.7	08/30/00	3.18	4.28	09/06/00	2.9	4.56
80-MW5	6.91	NS	NS	NS	08/16/00	2.26	4.65	08/30/00	3.05	3.86	09/06/00	3.34	3.57
166-MW1	6.96	05/09/00	2.31	4.65	08/16/00	1.54	5.42	NS	NS	NS	09/07/00	2.1	4.86

Notes:

- 1) Elev.: Elevation in feet above mean sea level.
- 2) Depth to water: depth in feet from the inner casing survey mark.
- 3) NS: Not Sampled

Table 3-3
Groundwater Elevation Summary
Site 80/166 - Main Post
Fort Monmouth, New Jersey

Well ID	Elev. of Inner Casing Survey Mark	Date	Depth to Water	Ground-water Elev.	Date	Depth to Water	Ground-water Elev.	Date	Depth to Water	Ground-water Elev.
80-MW1	6.91	10/12/00	2.9	4.01	10/27/00	2.98	3.93	01/24/01	2.09	4.82
80-MW2	7.68	10/12/00	3.5	4.18	10/27/00	3.77	3.91	01/24/01	2.87	4.81
80-MW3	7.63	10/11/00	3.6	4.03	10/27/00	3.83	3.8	01/24/01	2.57	5.06
80-MW4	7.46	10/11/00	3.5	3.96	10/27/00	3.67	3.79	01/24/01	3.1	4.36
80-MW5	6.91	10/11/00	3.2	3.71	10/27/00	3.58	3.33	01/24/01	2.4	4.51
166-MW1	6.96	10/12/00	2.55	4.41	10/27/00	2.95	4.01	01/24/01	1.99	4.97

Notes:

- 1) Elev.: Elevation in feet above mean sea level.
- 2) Depth to water: depth in feet from the inner casing survey mark.
- 3) NS: Not Sampled

Min. Depth to Water	Max. Depth to Water	Min. Ground-water Elev.	Max. Ground-water Elev.	Average Groundwater Elev.
1.40	4.04	2.87	5.51	4.23
2.25	3.77	3.91	5.43	4.67
2.57	3.83	3.80	5.06	4.39
2.76	3.67	3.79	4.70	4.28
2.26	3.58	3.33	4.65	3.94
0.47	3.46	3.50	6.49	4.97
0.47	4.04	2.87	6.49	

Table 4-1
Data for Geologic Cross-Section A-A'
Site 80/166 - Main Post
Fort Monmouth, New Jersey

Well ID	Units	166-MW1	80-MW2	80-MW1	80-MW4
Elevation of Top of Casing	ft (amsl)	6.91	7.68	6.84	7.46
Elevation of Ground Surface	ft (amsl)	7.29	8.01	7.65	7.76
Elevation of Top of Screen	ft (amsl)	6.79	6.01	4.65	5.76
Elevation of Groundwater (1/24/01)	ft (amsl)	4.97	4.81	4.82	4.36
Elevation of Top of Unit 2	ft (amsl)	6.29	7.34	7.05	7.76
Elevation of Top of Unit 3	ft (amsl)	3.29	7.01	4.65	5.76
Elevation of Top of Unit 4	ft (amsl)	2.29	2.01	NA	0.76
Elevation of Top of Unit 5	ft (amsl)	NA	NA	NA	NA
Elevation of Top of Unit 6	ft (amsl)	NA	-2.99	-2.35	-3.24
Elevation of Bottom of Well	ft (amsl)	-2.71	-3.99	-5.35	-4.24

Explanation of Units (see Minard, 1969):

Surface Materials:

Unit 1 (not in table) = asphalt and base stone

Tinton Sand Formation / Fill

Unit 2 = brown to black fine-medium sand and silt (fill?)

Unit 3 = olive green to gray clay, fine sand and silt

Unit 4 = light brown and orange clay with fine sand and silt

Unit 5 = yellowish orange fine medium sand

Unit 6 = fine sand with small-large subrounded to rounded quartz gravel

Notes:

All measurements in feet.

amsl: above mean sea level

NA: Not Applicable

Table 4-2
Data for Geologic Cross-Section A'-A''
Site 80/166 - Main Post
Fort Monmouth, New Jersey

Well ID	Units	80-MW4	80-MW5	80-MW3
Elevation of Top of Casing	ft (amsl)	7.46	7.14	7.63
Elevation of Ground Surface	ft (amsl)	7.76	7.36	7.86
Elevation of Top of Screen	ft (amsl)	5.76	5.36	5.86
Elevation of Groundwater (1/24/01)	ft (amsl)	4.36	4.51	5.06
Elevation of Top of Unit 2	ft (amsl)	7.76	0	0
Elevation of Top of Unit 3	ft (amsl)	5.76	6.86	5.76
Elevation of Top of Unit 4	ft (amsl)	0.76	-2.64	-0.97
Elevation of Top of Unit 5	ft (amsl)	NA	NA	NA
Elevation of Top of Unit 6	ft (amsl)	-3.24	NA	NA
Elevation of Top of Unit 7	ft (amsl)	NA	NA	6.86
Elevation of Top of Unit 8	ft (amsl)	NA	NA	-0.39
Elevation of Bottom of Well	ft (amsl)	-4.24	-4.64	-4.14

Explanation of Units (see Minard, 1969):

Surface Materials:

Unit 1 (not in table) = asphalt and base stone

Tinton Sand Formation:

Unit 2 = brown to black fine-medium sand and silt

Unit 3 = olive green to gray clay, fine sand and silt

Unit 4 = light brown and orange clay with fine sand and silt

Unit 5 = yellowish orange fine medium sand

Unit 6 = fine sand with small-large subrounded to rounded quartz gravel

Unit 7 = brown fine-course sand with small-medium subrounded quarts gravel

Unit 8 = gray clay interbedded with orange fine-medium sand

Notes:

All measurements in feet.

amsl: above mean sea level

NA: Not Applicable

Table 4-3
Slug Testing Results Summary
Site 80/166 - Main Post
Fort Monmouth, New Jersey

Well ID	Date	Depth to Static Water Level	DTW at t=0	b	DTW Adjustment	Hydraulic Conductivity (feet/day)
80-MW1	8/15/2001	3.13	6.136	6.864	1.899	2.00
80-MW2	8/15/2001	3.91	6.184	5.816	1.944	4.85
80-MW3	8/15/2001	4.31	7.556	4.444	0.929	6.30
80-MW4	8/15/2001	4.15	6.309	5.691	1.380	6.41
80-MW5	8/15/2001	3.65	5.762	6.238	0.478	2.08
166-MW1	8/15/2001	3.05	5.204	4.796	0.056	NA*

Geometric Mean of Hydraulic Conductivity (feet/day):

3.8

Notes:

DTW = Depth To Water

Depth to Static Water Level was estimated by subtracting 0.3 ft. from the measured DTW at the end of each test.

b = height of water in well at the beginning of the test.

DTW Adjustment = factor by which raw data was adjusted so final hermit data point equals final measured DTW.

*Not Available: Not enough water in well to perform slug test. When slug test was performed, observed sediment inside the well. Data for 166MW01 was discarded from Geometric Mean of Hydraulic Conductivity calculation

Table 5-1
Groundwater Sampling Results
Site 80/166 - Main Post
Fort Monmouth, New Jersey

Well ID			80-MW1	80-MW1	80-MW1	80-MW1	80-MW1	80-MW1	80-MW1	80-MW1	80-MW1	80-MW1	80-MW1	80-MW1	80-MW1	80-MW1	80-MW1	80-MW1	80-MW1
Lab Sample ID	NJDEP	Site Specific	2457.03	2918.01	3174.03	3376.01	3614.01	3823.04	4076.03	4262.03	4514.03	4808.01	5021.01	5223.04	5406.01	5635.01	5818.04	346	5694.04
Sample Date	Criteria	MBC ⁽¹⁾	04/16/97	08/20/97	11/24/97	02/27/98	06/02/98	08/24/98	11/20/98	02/09/99	05/26/99	09/22/99	12/17/99	03/06/00	05/09/00	08/16/00	10/27/00	01/24/01	09/07/00
Round No.			1	2	3	4	5	6	7	8	9	10	11	12	13	14	16	17	low flow 1
Volatiles																			
Acetone	700	N/A	ND	ND	ND	ND	ND	10.27	ND	ND	2.28	ND	ND	ND	ND	ND	ND	ND	NS
Benzene	1	N/A	1.38	ND	ND	ND	1.71	ND	ND	1.26	1.31	ND	ND	ND	ND	ND	ND	ND	NS
2-Butanone	300	N/A	ND	ND	ND	ND	ND	3.32	ND	ND	ND	ND	ND	ND	ND	ND	ND	4.87	NS
Carbon Disulfide ⁽³⁾	100	N/A	2.31	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS
Chlorobenzene ⁽³⁾	50	N/A	2.61	ND	2.26	3.26	5.14	5.2	4.88	5.71	5.58	ND	1.95	3.83	4.49	5.9	2.23	7.34	NS
Methylene Chloride ⁽³⁾	3	N/A	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS
Semi-Volatiles																			
Acenaphthene	400	N/A	ND	1.12	1.1	1.39	2.28	ND	ND	ND	1.29	1.29	ND	1.1	1.75	1.54	ND	1.17	NS
Dibenzofuran ⁽³⁾	100	N/A	ND	ND	ND	ND	2.03	ND	ND	ND	ND	ND	ND	ND	1.24	1.19	ND	ND	NS
1,2-Dichlorobenzene	600	N/A	ND	ND	1.79	1.05	1.2	ND	ND	2	1.97	ND	ND	1.25	ND	1.81	ND	1.62	NS
2,4-Dichlorophenol	20	N/A	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS
Di-n-butylphthalate	900	N/A	ND	ND	2.54	ND	3.94	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS
Fluorene	300	N/A	ND	1.62	1.27	1.56	3.44	ND	ND	ND	ND	1.69	ND	1.01	2.12	1.98	ND	ND	NS
2-Methylnaphthalene ⁽³⁾	100	N/A	ND	7.25	3	8.85	ND	ND	ND	3.95	ND	1.73	2.67	ND	ND	2.91	ND	1.5	NS
Naphthalene ⁽³⁾	100	N/A	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS
Phenanthrene ⁽³⁾	100	N/A	ND	0.52	ND	ND	2.56	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bis(2-Ethylhexyl)phthalate	30	N/A	ND	1.40	1.17	1.07	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Pesticides/PCBs																			
4,4'-DDD	0.1	N/A	ND	ND	ND	ND	0.099	0.059	0.093	0.09	0.148	ND	0.04	ND	0.176	ND	ND	0.084	NS
a-Chlordane	0.5	N/A	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS
g-Chlordane	0.5	N/A	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS
Endosulfan Sulfate	0.4	N/A	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS
Metals																			
Aluminum	200	121000	NS	329.5	121	306	195	545	422	975	553	542	121	2070	750	267	215	28.2	368
Antimony	20	N/A	NS	2.8	ND	ND	ND	3.95	ND	ND	ND	ND	ND	ND	ND	5.85	ND	ND	ND
Arsenic	8	N/A	NS	9	ND	24	11.9	41.5	34.3	8.49	24	11.8	6.56	17.9	11.3	28.8	16.8	32.4	55.2
Barium	2000	699	NS	70	24.5	86.2	40.2	108	86.1	81.2	89.7	47.7	56.5	97	118	75.1	97.6	77.6	89.7
Beryllium	20	N/A	NS	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.849
Cadmium	4	N/A	NS	8	ND	8	3.9	4.49	1.96	24.6	3.64	3.31	6.69	0.585	4.44	ND	ND	5.66	ND
Calcium	NLE	45400	NS	28750	81220	51010	39700	75000	58600	86000	65000	28400	50200	71100	79400	49800	84400	53300	51900
Chromium	100	N/A	NS	148 (3)	1.2	1.3	ND	3.12	9.77	8	5.7	4.65	2.82	15.6	11	4.05	5.21	5.43	5.93
Cobalt	NLE	N/A	NS	50	ND	2	ND	2.05	2.81	0.704	2.9	ND	1.84	0.783	ND	1.86	0.682	1.95	1.9
Copper	1000	65.6	NS	15	17	16	6.6	17.5	ND	8.75	13.9	12.6	6.13	ND	197	ND	62.4	12.6	8.58
Iron	300	431000	NS	7490	9062	70680	8409	67400	68800	17600	56700	10500	28500	52900	22200	48600	26200	69800	109000
Lead	10	N/A	2.5	4	14	6	3.3	10.4	2.86	ND	5.34	5.15	ND	3.67	26.7	2.63	3.16	1.87	ND
Magnesium	NLE	62700	NS	136	18780	16030	4236	18700	16900	10100	15300	3820	10600	13500	10000	ND	11100	14000	18200
Manganese	50	331	NS	4260	552.7	456.2	117	605	647	407	564	228	424	529	318	444	396	579	788
Mercury	2	N/A	NS	ND	0.3	ND	ND	0.21	0.38	0.17	ND	ND	ND	ND	ND	ND	ND	0.2	ND
Nickel	100	187	NS	ND	2.3	2.7	2.4	ND	2.23	4.85	1.72	2	ND	4.9	2.3	9.42	1.85	ND	ND
Potassium	NLE	137000	NS	3920	6010	8470	8833	17400	5340	5080	5730	4660	6360	6520	7570	4590	6530	4140	5130
Selenium	50	N/A	NS	ND	ND	ND	ND	ND	8.2	7.53	5.22	ND	ND	3.46	ND	ND	5.92	ND	ND
Silver	NLE	N/A	NS	8	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Sodium	50000	21500	NS	110750	97380	279400	147200	533000	530000	306000	457000	181000	359000	315000	648000	331000	431000	574000	664000
Thallium	10	N/A	NS	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Vanadium	NLE	N/A	NS	200	ND	ND	3.1	4.11	3.18	3.15	6.41	3.18	1.21	11	3.55	2.56	2.34	2.85	ND
Zinc	5000	233	NS	92	60	117	65	72.9	44.2	214	80.3	59.5	23.2	42.1	103	29	38.2	76.9	31.6

Notes

All concentrations in micrograms per liter (ug/L), equivalent to
 NJDEP Criteria: Higher of Practical Quantitation Limits (PQLs)
 & Groundwater Quality Criteria (GWQC) per NJAC 7:9-6

Exceedences of NJDEP GWQS are shaded and **bold**

ND: Analyte not detected in sample

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NLE: No cleanup standard exists for this analyte

⁽¹⁾Fort Monmouth Site-specific Groundwater Maximum
 Background Concentrations (MBCs), background (native) metals
 only (Weston SI Report Dated 1995)

⁽²⁾Low Flow Sampling Method used to collect sample

⁽³⁾Interim Criteria used as NJDEP criteria

⁽⁴⁾Laboratory blank greater than Method Detection Limit

Table 5-1
Groundwater Sampling Results
Site 80/166 - Main Post
Fort Monmouth, New Jersey

Well ID			80-MW2	80-MW2	80-MW2	80-MW2	80-MW2	80-MW2
Lab Sample ID	NJDEP	Site Specific	5636.04	5675.04	5818.05	347	5694.03	5782.04
Sample Date	Criteria	MBC ⁽¹⁾	08/16/00	08/30/00	10/27/00	01/24/01	09/07/00	10/12/00
Round No.			14	15	16	17	low flow 1	low flow 2
Volatiles								
Acetone	700	N/A	ND	ND	ND	ND	NS	NS
Benzene	1	N/A	ND	ND	ND	ND	NS	NS
2-Butanone	300	N/A	ND	ND	ND	ND	NS	NS
Carbon Disulfide ⁽³⁾	100	N/A	ND	ND	ND	ND	NS	NS
Chlorobenzene ⁽³⁾	50	N/A	ND	ND	ND	ND	NS	NS
Methylene Chloride ⁽³⁾	3	N/A	ND	ND	ND	ND	NS	NS
Semi-Volatiles								
Acenaphthene	400	N/A	ND	ND	ND	ND	NS	NS
Dibenzofuran ⁽³⁾	100	N/A	ND	ND	ND	ND	NS	NS
1,2-Dichlorobenzene	600	N/A	ND	ND	ND	ND	NS	NS
2,4-Dichlorophenol	20	N/A	ND	ND	ND	ND	NS	NS
Di-n-butylphthalate	900	N/A	ND	ND	ND	ND	ND	ND
Fluorene	300	N/A	ND	ND	ND	ND	NS	NS
2-Methylnaphthalene ⁽³⁾	100	N/A	ND	ND	ND	ND	NS	NS
Naphthalene ⁽³⁾	100	N/A	ND	ND	ND	ND	NS	NS
Phenanthrene ⁽³⁾	100	N/A	ND	ND	ND	ND	ND	ND
Bis(2-Ethylhexyl)phthalate	30	N/A	ND	ND	ND	ND	ND	ND
Pesticides/PCBs								
4,4'-DDD	0.1	N/A	0.453	ND	ND	ND	0.025	ND
a-Chlordane	0.5	N/A	0.197	0.779	ND	1.625	ND	ND
g-Chlordane	0.5	N/A	ND	0.303	ND	2.719	ND	0.979
Endosulfan Sulfate	0.4	N/A	ND	ND	ND	ND	ND	0.485
Metals								
Aluminum	200	121000	1770	544	1400	256	102	743
Antimony	20	N/A	5.6	ND	ND	ND	ND	ND
Arsenic	8	N/A	ND	ND	ND	2.69	46.6	ND
Barium	2000	699	82.2	59.6	61.7	43.6	76.9	62.1
Beryllium	20	N/A	0.726	0.733	0.73	ND	ND	0.784
Cadmium	4	N/A	ND	ND	ND	5.36	ND	ND
Calcium	NLE	45400	18100	13800	12500	12700	51100	12200
Chromium	100	N/A	6.56	ND	5.8	1.01	ND	3.04
Cobalt	NLE	N/A	13.1	11.4	10.3	10.4	3.18	11.3
Copper	1000	65.6	ND	ND	17.4	3.38	ND	58.5
Iron	300	431000	3420	578	1320	729	89700	942
Lead	10	N/A	2.64	1.55	1.7	ND	ND	9.12
Magnesium	NLE	62700	8390	6640	6040	6250	16500	6240
Manganese	50	331	479	421	419	412	697	407
Mercury	2	N/A	0.1	0.1	ND	0.3	ND	ND
Nickel	100	187	6.66	ND	7.24	3.7	ND	8.1
Potassium	NLE	137000	3240	2440	2670	2020	4210	2640
Selenium	50	N/A	ND	ND	5.79	ND	ND	ND
Silver	NLE	N/A	ND	ND	ND	ND	ND	ND
Sodium	50000	21500	116000	178000	170000	164000	638000	126000
Thallium	10	N/A	ND	ND	ND	ND	ND	ND
Vanadium	NLE	N/A	5.87	ND	4.7	ND	ND	ND
Zinc	5000	233	80.7	70.2	42.2	40.3	22.8	114

Notes

All concentrations in micrograms per liter (ug/L), equivalent to
 NJDEP Criteria: Higher of Practical Quantitation Limits (PQLs)
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⁽²⁾Low Flow Sampling Method used to collect sample

⁽³⁾Interim Criteria used as NJDEP criteria

⁽⁴⁾Laboratory blank greater than Method Detection Limit

Table 5-1
Groundwater Sampling Results
Site 80/166 - Main Post
Fort Monmouth, New Jersey

Well ID			80-MW3	80-MW3	80-MW3	80-MW3	80-MW3	80-MW3
Lab Sample ID	NJDEP	Site Specific	5636.05	5675.05	5818.06	348	5691.05	5780.05
Sample Date	Criteria	MBC ⁽¹⁾	08/16/00	08/30/00	10/27/00	01/24/01	09/06/00	10/11/00
Round No.			14	15	16	17	low flow 1	low flow 2
Volatiles								
Acetone	700	N/A	ND	16.1	5.12	ND	NS	NS
Benzene	1	N/A	ND	ND	ND	ND	NS	NS
2-Butanone	300	N/A	ND	8.15	3.3	ND	NS	NS
Carbon Disulfide ⁽³⁾	100	N/A	ND	ND	ND	ND	NS	NS
Chlorobenzene ⁽³⁾	50	N/A	ND	ND	ND	ND	NS	NS
Methylene Chloride ⁽³⁾	3	N/A	ND	ND	ND	ND	NS	NS
Semi-Volatiles								
Acenaphthene	400	N/A	3.44	19.59	13.2	ND	NS	NS
Dibenzofuran ⁽³⁾	100	N/A	1.09	20.05	3.32	ND	NS	NS
1,2-Dichlorobenzene	600	N/A	ND	ND	ND	ND	NS	NS
2,4-Dichlorophenol	20	N/A	ND	13.95	ND	ND	NS	NS
Di-n-butylphthalate	900	N/A	3.9	ND	ND	ND	ND	ND
Fluorene	300	N/A	1.04	20.95	ND	ND	NS	NS
2-Methylnaphthalene ⁽³⁾	100	N/A	ND	ND	ND	ND	NS	NS
Naphthalene ⁽³⁾	100	N/A	4.34	14.37	ND	ND	NS	NS
Phenanthrene ⁽³⁾	100	N/A	ND	ND	ND	ND	ND	ND
Bis(2-Ethylhexyl)phthalate	30	N/A	ND	ND	ND	ND	ND	ND
Pesticides/PCBs								
4,4'-DDD	0.1	N/A	ND	ND	ND	ND	ND	ND
α-Chlordane	0.5	N/A	ND	ND	ND	ND	ND	ND
γ-Chlordane	0.5	N/A	ND	ND	ND	ND	ND	ND
Endosulfan Sulfate	0.4	N/A	ND	ND	ND	ND	ND	ND
Metals								
Aluminum	200	121000	292	217	1370	97.9	650	237
Antimony	20	N/A	4.86	ND	ND	ND	ND	ND
Arsenic	8	N/A	3.36	7.06	7.27	2.28	ND	ND
Barium	2000	699	27.2	22.3	29.4	53	34.7	23.9
Beryllium	20	N/A	ND	ND	ND	ND	ND	ND
Cadmium	4	N/A	ND	ND	ND	3.89	ND	ND
Calcium	NLE	45400	39200	27600	22800	79800	33800	28000
Chromium	100	N/A	2.59	ND	13.2	4.17	ND	2.55
Cobalt	NLE	N/A	0.704	0.969	1.14	0.747	1.67	ND
Copper	1000	65.6	ND	ND	5.92	4.31	ND	ND
Iron	300	431000	2890	12800	21400	5710	14600	8170
Lead	10	N/A	1.7	ND	1.52	ND	ND	ND
Magnesium	NLE	62700	8870	7240	8140	18600	11100	7420
Manganese	50	331	87.8	93.1	144	51.5	121	61.3
Mercury	2	N/A	ND	0.1	ND	ND	0.2	ND
Nickel	100	187	ND	ND	2.02	ND	ND	ND
Potassium	NLE	137000	9660	5010	4950	10700	6110	7000
Selenium	50	N/A	5.71	ND	3.72	ND	ND	ND
Silver	NLE	N/A	ND	ND	ND	ND	ND	ND
Sodium	50000	21500	27100	35000	40200	71500	132000	40200
Thallium	10	N/A	ND	ND	ND	ND	ND	ND
Vanadium	NLE	N/A	2.18	ND	8.02	1.28	ND	2.33
Zinc	5000	233	17.2	37.9	27.5	27.9	25.3	14.8

Notes

All concentrations in micrograms per liter (ug/L), equivalent to
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 only (Weston SI Report Dated 1995)

⁽²⁾Low Flow Sampling Method used to collect sample

⁽³⁾Interim Criteria used as NJDEP criteria

⁽⁴⁾Laboratory blank greater than Method Detection Limit

Table 5-1
Groundwater Sampling Results
Site 80/166 - Main Post
Fort Monmouth, New Jersey

Well ID			80-MW4	80-MW4	80-MW4	80-MW4	80-MW4	80-MW4
Lab Sample ID	NJDEP	Site Specific	5636.06	5675.06	5818.07	349	5691.03	5780.03
Sample Date	Criteria	MBC ⁽¹⁾	08/16/00	08/30/00	10/27/00	01/24/01	09/06/00	10/11/00
Round No.			14	15	16	17	low flow 1	low flow 2
Volatiles								
Acetone	700	N/A	ND	ND	ND	ND	NS	NS
Benzene	1	N/A	ND	ND	ND	ND	NS	NS
2-Butanone	300	N/A	ND	ND	ND	ND	NS	NS
Carbon Disulfide ⁽³⁾	100	N/A	ND	ND	ND	ND	NS	NS
Chlorobenzene ⁽³⁾	50	N/A	ND	ND	ND	ND	NS	NS
Methylene Chloride ⁽³⁾	3	N/A	ND	ND	ND	ND	NS	NS
Semi-Volatiles								
Acenaphthene	400	N/A	ND	ND	ND	ND	NS	NS
Dibenzofuran ⁽³⁾	100	N/A	ND	ND	ND	ND	NS	NS
1,2-Dichlorobenzene	600	N/A	ND	ND	ND	ND	NS	NS
2,4-Dichlorophenol	20	N/A	ND	ND	ND	ND	NS	NS
Di-n-butylphthalate	900	N/A	3.31	ND	ND	ND	ND	ND
Fluorene	300	N/A	ND	ND	ND	ND	NS	NS
2-Methylnaphthalene ⁽³⁾	100	N/A	ND	ND	ND	ND	NS	NS
Naphthalene ⁽³⁾	100	N/A	ND	ND	ND	ND	NS	NS
Phenanthrene ⁽³⁾	100	N/A	ND	ND	ND	ND	ND	ND
Bis(2-Ethylhexyl)phthalate	30	N/A	ND	ND	ND	ND	ND	ND
Pesticides/PCBs								
4,4'-DDD	0.1	N/A	ND	ND	ND	ND	ND	ND
α-Chlordane	0.5	N/A	ND	ND	ND	ND	ND	ND
γ-Chlordane	0.5	N/A	ND	ND	ND	ND	ND	ND
Endosulfan Sulfate	0.4	N/A	ND	ND	ND	ND	ND	ND
Metals								
Aluminum	200	121000	4020	1240	3850	1260	1130	1420
Antimony	20	N/A	4.04	ND	ND	ND	ND	ND
Arsenic	8	N/A	6.28	5.04	5.3	4.18	4.93	6
Barium	2000	699	269	186	204	162	273	672
Beryllium	20	N/A	ND	ND	0.726	ND	ND	0.679
Cadmium	4	N/A	ND	ND	ND	0.945	ND	ND
Calcium	NLE	45400	213000	226000	198000	209000	230000	241000
Chromium	100	N/A	25.2	14.2	22.2	18.6	10.5	20.7
Cobalt	NLE	N/A	34.6	14	18	9.68	12.6	ND
Copper	1000	65.6	359	ND	ND	180	ND	ND
Iron	300	431000	256000	297000	211000	264000	306000	448000
Lead	10	N/A	70.4	ND	2.03	20	ND	ND
Magnesium	NLE	62700	129000	132000	118000	125000	139000	163000
Manganese	50	331	2320	2130	2220	2070	1980	2080
Mercury	2	N/A	0.3	0.1	ND	0.2	0.2	ND
Nickel	100	187	54.6	3.61	30.6	16.3	2.67	ND
Potassium	NLE	137000	10600	8450	9190	8450	10700	17700
Selenium	50	N/A	ND	ND	5.16	ND	ND	ND
Silver	NLE	N/A	ND	2.35	ND	ND	ND	ND
Sodium	50000	21500	1500000	1820000	1190000	1360000	1920000	1920000
Thallium	10	N/A	ND	ND	ND	ND	ND	7.55
Vanadium	NLE	N/A	5.13	0.727	0.633	ND	3.11	ND
Zinc	5000	233	666	90.6	271	485	71.7	42.4

Notes

All concentrations in micrograms per liter (ug/L), equivalent to
 NJDEP Criteria: Higher of Practical Quantitation Limits (PQLs)
 & Groundwater Quality Criteria (GWQC) per NJAC 7:9-6

Exceedences of NJDEP GWQS are shaded and **bold**

ND: Analyte not detected in sample

N/A: Not Applicable NS: Not Sampled

NLE: No cleanup standard exists for this analyte

⁽¹⁾Fort Monmouth Site-specific Groundwater Maximum
 Background Concentrations (MBCs), background (native) metals
 only (Weston SI Report Dated 1995)

⁽²⁾Low Flow Sampling Method used to collect sample

⁽³⁾Interim Criteria used as NJDEP criteria

⁽⁴⁾Laboratory blank greater than Method Detection Limit

Table 5-1
Groundwater Sampling Results
Site 80/166 - Main Post
Fort Monmouth, New Jersey

Well ID			80-MW5	80-MW5	80-MW5	80-MW5	80-MW5	80-MW5
Lab Sample ID	NJDEP	Site Specific	5636.07	5675.07	5818.08	350	5691.04	5780.04
Sample Date	Criteria	MBC ⁽¹⁾	08/16/00	08/30/00	10/27/00	01/24/01	09/06/00	10/11/00
Round No.			14	15	16	17	low flow 1	low flow 2
Volatiles								
Acetone	700	N/A	ND	ND	ND	ND	NS	NS
Benzene	1	N/A	ND	ND	ND	ND	NS	NS
2-Butanone	300	N/A	ND	ND	ND	ND	NS	NS
Carbon Disulfide ⁽³⁾	100	N/A	ND	ND	ND	ND	NS	NS
Chlorobenzene ⁽³⁾	50	N/A	ND	ND	ND	ND	NS	NS
Methylene Chloride ⁽³⁾	3	N/A	ND	ND	ND	ND	NS	NS
Semi-Volatiles								
Acenaphthene	400	N/A	ND	ND	ND	ND	NS	NS
Dibenzofuran ⁽³⁾	100	N/A	ND	ND	ND	ND	NS	NS
1,2-Dichlorobenzene	600	N/A	ND	ND	ND	ND	NS	NS
2,4-Dichlorophenol	20	N/A	ND	ND	ND	ND	NS	NS
Di-n-butylphthalate	900	N/A	ND	ND	ND	ND	ND	ND
Fluorene	300	N/A	ND	ND	ND	ND	NS	NS
2-Methylnaphthalene ⁽³⁾	100	N/A	ND	ND	ND	ND	NS	NS
Naphthalene ⁽³⁾	100	N/A	ND	ND	ND	ND	NS	NS
Phenanthrene ⁽³⁾	100	N/A	ND	ND	ND	ND	ND	ND
Bis(2-Ethylhexyl)phthalate	30	N/A	ND	ND	ND	ND	ND	ND
Pesticides/PCBs								
4,4'-DDD	0.1	N/A	ND	ND	ND	ND	ND	ND
α-Chlordane	0.5	N/A	ND	ND	ND	ND	ND	ND
γ-Chlordane	0.5	N/A	ND	ND	ND	ND	ND	ND
Endosulfan Sulfate	0.4	N/A	ND	ND	ND	ND	ND	ND
Metals								
Aluminum	200	121000	5580	97500	2750	2500	48000	3420
Antimony	20	N/A	7.72	ND	ND	ND	ND	ND
Arsenic	8	N/A	11.2	71.6	4.42	5.85	32.7	7.86
Barium	2000	699	257	1220	149	54.5	865	367
Beryllium	20	N/A	ND	14.3	ND	ND	8.35	1.25
Cadmium	4	N/A	ND	ND	ND	11.1	ND	ND
Calcium	NLE	45400	239000	978000	144000	87500	699000	417000
Chromium	100	N/A	36.5	75.7	82.6	22.1	29.5	20.4
Cobalt	NLE	N/A	15	41.9	6	5.37	30.3	7.85
Copper	1000	65.6	ND	ND	6.13	11.6	ND	17.3
Iron	300	431000	82600	571000	30100	10700	353000	162000
Lead	10	N/A	11.1	84.1	ND	ND	79.5	15.2
Magnesium	NLE	62700	61300	386000	34000	18200	241000	103000
Manganese	50	331	1020	2980	673	491	2300	1280
Mercury	2	N/A	0.2	0.1	ND	ND	0.2	ND
Nickel	100	187	25.9	73.3	35.7	4.16	45.5	13
Potassium	NLE	137000	27700	119000	35500	35700	69700	45800
Selenium	50	N/A	ND	ND	10.2	ND	ND	3.45
Silver	NLE	N/A	ND	ND	ND	ND	ND	ND
Sodium	50000	21500	3830000	11700000	2590000	1810000	7830000	5670000
Thallium	10	N/A	ND	ND	ND	ND	ND	ND
Vanadium	NLE	N/A	19.9	84	12.6	12.9	7.3	0.724
Zinc	5000	233	137	378	267	325	248	307

Notes

All concentrations in micrograms per liter (ug/L), equivalent to
 NJDEP Criteria: Higher of Practical Quantitation Limits (PQLs)
 & Groundwater Quality Criteria (GWQC) per NJAC 7:9-6

Exceedences of NJDEP GWQS are shaded and **bold**

ND: Analyte not detected in sample

N/A: Not Applicable NS: Not Sampled

NLE: No cleanup standard exists for this analyte

⁽¹⁾Fort Monmouth Site-specific Groundwater Maximum
 Background Concentrations (MBCs), background (native) metals
 only (Weston SI Report Dated 1995)

⁽²⁾Low Flow Sampling Method used to collect sample

⁽³⁾Interim Criteria used as NJDEP criteria

⁽⁴⁾Laboratory blank greater than Method Detection Limit

Table 5-1
Groundwater Sampling Results
Site 80/166 - Main Post
Fort Monmouth, New Jersey

Well ID			166-MW1	166-MW1	166-MW1	166-MW1	166-MW1	166-MW1	166-MW1	166-MW1	166-MW1	166-MW1	166-MW1	166-MW1	166-MW1	166-MW1	166-MW1	166-MW1	166-MW1	166-MW1
Lab Sample ID	NJDEP Criteria	Site Specific MBC ⁽¹⁾	2458.01 04/16/97	2917.03 08/20/97	3175.01 11/24/97	3375.01 02/27/98	3614.02 06/02/98	3823.05 08/24/98	4076.04 11/20/98	4262.04 02/09/99	4514.04 05/26/99	4808.02 09/22/99	5021.02 12/17/99	5223.05 03/06/00	5406.02 05/09/00	5635.02 08/16/00	5818.09 10/27/00	345 01/24/01	5694.05 09/07/00	5782.05 10/12/00
Round No.			1	2	3	4	5	6	7	8	9	10	11	12	13	14	16	17	low flow 1	low flow 2
Volatiles																				
Acetone	700	N/A	ND	ND	ND	ND	ND	13.03	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NS
Benzene	1	N/A	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NS
2-Butanone	300	N/A	ND	ND	ND	ND	ND	3.19	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NS
Carbon Disulfide ⁽³⁾	100	N/A	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NS
Chlorobenzene ⁽³⁾	50	N/A	ND	ND	ND	ND	ND	ND	1.88	ND	ND	ND	ND	1.28	1.68	ND	ND	1.1	ND	NS
Methylene Chloride ⁽³⁾	3	N/A	2.4	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NS
Semi-Volatiles																				
Acenaphthene	400	N/A	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NS
Dibenzofuran ⁽³⁾	100	N/A	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NS
1,2-Dichlorobenzene	600	N/A	ND	ND	ND	ND	ND	ND	ND	2	ND	ND	ND	ND	ND	ND	ND	ND	NS	NS
2,4-Dichlorophenol	20	N/A	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NS
Di-n-butylphthalate	900	N/A	ND	ND	16.28	ND	3.96	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Fluorene	300	N/A	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NS
2-Methylnaphthalene ⁽³⁾	100	N/A	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NS
Naphthalene ⁽³⁾	100	N/A	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NS
Phenanthrene ⁽³⁾	100	N/A	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bis(2-Ethylhexyl)phthalate	30	N/A	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Pesticides/PCBs																				
4,4'-DDD	0.1	N/A	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
a-Chlordane	0.5	N/A	ND	ND	ND	ND	0.027	0.052	ND	ND	ND	0.048	ND	ND	ND	ND	ND	0.028	0.84	ND
g-Chlordane	0.5	N/A	ND	ND	ND	ND	0.022	0.05	ND	ND	ND	0.049	ND	ND	ND	ND	ND	0.024	0.46	ND
Endosulfan Sulfate	0.4	N/A	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Metals																				
Aluminum	200	121000	NS	15.1	408	291	266	1620	662	687	945	97.5	362	274	422	272	3800	43.1	39.9	154
Antimony	20	N/A	NS	ND	ND	ND	ND	3.7	ND	ND	ND	ND	2.75	ND	ND	3.91	ND	ND	ND	ND
Arsenic	8	N/A	NS	4	23	ND	2.3	3.21	ND	ND	4.57	ND	ND	2.83	ND	ND	5.67	4.83	ND	3.13
Barium	2000	699	NS	100	65.5	16	14.6	23	28.3	36.2	31.7	24.5	25.7	36.8	32.2	19.1	42.2	34.5	23.5	27.4
Beryllium	20	N/A	NS	0.26	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Cadmium	4	N/A	NS	5	1.6	1.4	1.4	4.35	2.31	3.51	3.04	2.44	2.95	1.25	2.79	1.21	4.58	4.15	ND	ND
Calcium	NLE	45400	NS	72390	46940	46400	52700	69600	79700	98300	61200	70100	69600	95200	93600	49200	86100	101000	71200	79400
Chromium	100	N/A	NS	121 (3)	3	1.5	ND	9.58	9.49	8.3	9.16	4.56	4.75	6.79	11.3	3.11	23.7	7.28	ND	4.69
Cobalt	NLE	N/A	NS	30	ND	1	ND	0.782	ND	1.27	1.23	1.29	1.01	ND	0.71	0.796	1.39	ND	0.603	ND
Copper	1000	65.6	NS	14	14	15	8	22.2	ND	179	47.1	66	5.31	13.8	98.4	ND	59.3	9.15	ND	146
Iron	300	431000	NS	4750	31700	5976	6776	11500	13300	6510	9880	2310	10300	18300	9300	6260	20100	9140	8360	11300
Lead	10	N/A	2.4	1.6	15	ND	2.3	12.4	4.23	ND	11.4	7.95	ND	4.21	17.3	5.12	16.4	ND	1.73	22.7
Magnesium	NLE	62700	NS	336	9730	13030	14350	17000	19800	22800	15200	15400	16500	23100	25500	13000	23000	24800	18400	20200
Manganese	50	331	NS	17250	286.6	245.6	235	397	669	413	368	214	377	603	239	204	587	360	452	606
Mercury	2	N/A	NS	ND	ND	0.3	ND	0.12	0.29	0.16	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Nickel	100	187	NS	ND	4.5	1.7	2.6	1.5	2.06	7.09	3.85	8.48	1.13	7.07	4.93	3.72	5.4	1.72	ND	6.5
Potassium	NLE	137000	NS	6350	6850	4610	7118	10000	4800	4890	4410	6130	4670	4690	6460	5000	6040	5100	4590	4570
Selenium	50	N/A	NS	ND	ND	ND	ND	3.87	4.09	7.58	3.39	ND	ND	ND	ND	ND	5.13	ND	ND	ND
Silver	NLE	N/A	NS	26	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Sodium	50000	21500	NS	83750	200200	29310	27800	58200	114000	108000	72900	46500	60300	66500	62300	33600	121000	154000	83300	94600
Thallium	10	N/A	NS	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	4.13	ND	ND
Vanadium	NLE	N/A	NS	800	ND	ND	4.2	7.9	3.87	3.07	7.01	1.53	2.42	3.63	3.56	1.74	18.1	2.66	ND	ND
Zinc	5000	233	NS	289	147	144	104	285	99.6	328	160	261	54.4	126	289	161	318	301	28.4	237

Notes

All concentrations in micrograms per liter (ug/L), equivalent to
NJDEP Criteria: Higher of Practical Quantitation Limits (PQLs)
& Groundwater Quality Criteria (GWQC) per NJAC 7:9-6

Exceedences of NJDEP GWQS are shaded and **bold**

ND: Analyte not detected in sample

N/A: Not Applicable NS: Not Sampled

NLE: No cleanup standard exists for this analyte

⁽¹⁾Fort Monmouth Site-specific Groundwater Maximum
Background Concentrations (MBCs), background (native) metals
only (Weston SI Report Dated 1995)

⁽²⁾Low Flow Sampling Method used to collect sample

⁽³⁾Interim Criteria used as NJDEP criteria

⁽⁴⁾Laboratory blank greater than Method Detection Limit

Table 5-2
Soil Sampling Results from Geoprobe® Investigation
Site 80/166 - Main Post
Fort Monmouth, New Jersey

Lab Sample ID	NJDEP RDCSCC ⁽¹⁾ (mg/Kg)	NJDEP IGWSCC ⁽²⁾ (mg/Kg)	5241.03	5241.05	5241.07	5241.09	5246.03	5246.05	5246.07	5246.09	5246.11
Sample Location			1	2	3	4	5	6	7	8	9
Sample Depth			48"	48"	48"	48"	42"	42"	42"	42"	48"
Sample Date			03/13/00	03/13/00	03/13/00	03/13/00	03/14/00	03/14/00	03/14/00	03/14/00	03/14/00
2-Butanone	1000	50	1.3	ND	ND	ND	1.7	1.6	1.5	ND	ND
Chloroform	19	1	ND	ND	ND	ND	ND	ND	ND	ND	ND
Methylene Chloride	49	1	ND	ND	ND	ND	ND	ND	ND	ND	ND

Lab Sample ID	NJDEP RDCSCC ⁽¹⁾ (mg/Kg)	NJDEP IGWSCC ⁽²⁾ (mg/Kg)	5246.13	5248.03	5248.05	5248.07	5248.09	5248.11	5416.03	5416.05	5416.07
Sample Location			10	11	12	13	14	15	16	17	18
Sample Depth			42"	48"	48"	48"	48"	48"	36"	36"	36"
Sample Date			03/14/00	03/15/00	03/15/00	03/15/00	03/15/00	03/15/00	05/15/00	05/15/00	05/15/00
2-Butanone	1000	50	ND	ND	ND	ND	ND	ND	2.8	ND	3
Chloroform	19	1	ND	ND	ND	ND	ND	ND	0.42	ND	0.44
Methylene Chloride	49	1	ND	ND	ND	ND	ND	ND	0.96	0.71	ND

NOTES:

⁽¹⁾New Jersey Department of Environmental Protection (NJDEP) Residential Direct Contact Soil Cleanup Criteria (RDCSCC) per NJAC 7:26D.

⁽²⁾New Jersey Department of Environmental Protection (NJDEP) Impact to Groundwater Soil Cleanup Criteria (IGWSCC).

All concentrations are reported in milligrams per kilogram (mg/kg) or parts per million (ppm) per NJAC 7:26D.

Exceedances of the RDCSCC and IGWSCC are highlighted and printed in **bold-faced** type.

ND: Analyte not detected in sample.

Table 5-3
Groundwater Sampling Results from Geoprobe® Investigation
Site 80/166 - Main Post
Fort Monmouth, New Jersey

Lab Sample ID	NJDEP	5241.04	5241.06	5241.08	5241.10	5246.04	5246.06	5246.08	5246.10	5246.12	5246.14
Sample Location	Groundwater	1	2	3	4	5	6	7	8	9	10
Sample Depth	Criteria	3-7'	3-7'	3-7'	3-7'	3-7'	3-7'	3-7'	3-7'	3-7'	3-7'
Sample Date	(ug/L) ⁽¹⁾	03/13/00	03/13/00	03/13/00	03/13/00	03/14/00	03/14/00	03/14/00	03/14/00	03/14/00	03/14/00
Volatiles											
Acetone	700	7.4	12.99	ND	9.38	ND	8.32	9.81	7.95	16.85	16.37
Benzene	1	ND	1.13	6.84	ND	ND	ND	ND	ND	ND	ND
Bromodichloromethane	1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Carbon Disulfide*	100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chlorobenzene*	50	ND	5.01	2.06	ND	ND	3.69	3.78	ND	ND	ND
Chloroform	6	ND	ND	ND	ND	1.77	1.32	ND	1.82	1.41	ND
Ethylbenzene	700	ND	ND	2.69	ND	ND	ND	ND	ND	ND	ND
MTBE*	70	ND	4.16	5.89	ND	ND	ND	ND	ND	ND	ND

NOTES:

All concentrations are reported in micrograms per liter (ug/L) or parts per billion (ppb).

NJDEP Criteria: Higher of Practical Quantitation Limits (PQLs) & Groundwater Quality Criteria (GWQC) per NJAC 7:9-6.

Exceedances of the NJDEP criteria are highlighted and printed in **bold-faced** type.

ND: Analyte not detected in sample.

*Interim Criteria used as NJDEP criteria.

Table 5-3
Groundwater Sampling Results from Geoprobe® Investigation
Site 80/166 - Main Post
Fort Monmouth, New Jersey

Lab Sample ID	NJDEP	5248.04	5248.06	5248.08	5256.01	5248.12	5416.04	5416.06	5416.09
Sample Location	Groundwater	11	12	13	14	15	16	17	18
Sample Depth	Criteria	3-7'	3-7'	3-7'	3-7'	3-7'	3.4-8'	3-8'	3-8'
Sample Date	(ug/L) ⁽¹⁾	03/15/00	03/15/00	03/15/00	03/17/00	03/15/00	05/15/00	05/15/00	05/15/00
Volatiles									
Acetone	700	13.4	5.62	36.64	ND	ND	ND	17.99	ND
Benzene	1	ND	ND	ND	ND	ND	ND	ND	ND
Bromodichloromethane	1	ND	ND	ND	ND	ND	ND	ND	2.06
Carbon Disulfide*	100	ND	ND	3.17	ND	ND	ND	ND	ND
Chlorobenzene*	50	ND	6.54	ND	1.48	2.7	ND	5.31	ND
Chloroform	6	ND	ND	ND	ND	ND	ND	ND	5.6
Ethylbenzene	700	ND	ND	ND	ND	ND	ND	ND	ND
MTBE*	70	ND	ND	ND	ND	ND	ND	ND	ND

NOTES:

All concentrations are reported in micrograms per liter (ug/L) or parts per billion (ppb).

NJDEP Criteria: Higher of Practical Quantitation Limits (PQLs) & Groundwater Quality Criteria (GWQC) per NJAC 7:9-6.

Exceedances of the NJDEP criteria are highlighted and printed in **bold-faced** type.

ND: Analyte not detected in sample.

*Interim Criteria used as NJDEP criteria.

Table 5-4
Determination of Contaminants of Concern
Site 80/166 - Main Post
Fort Monmouth, New Jersey

Analyte	NJDEP Criteria ⁽¹⁾	Site Specific Groundwater MBC ⁽²⁾	Maximum Result	No. of Exceedences in Monitoring Well Samples	No. of Exceedences in Geoprobe Groundwater Samples	No. of Site Maximum Background Exceedences	Comments
Volatiles							
Acetone	700	N/A	16.1	0	0	N/A	No exceedance of NJDEP criteria
Benzene	1	N/A	1.71	4	2	N/A	Not a COC. Benzene was detected in 4 of 16 rounds in monitoring well 80-MW1 at concentrations exceeding the NJDEP criteria. Benzene was also detected at concentrations exceeding the NJDEP criteria in 2 of the 18 Geoprobe borings in March 2000 (boring locations 2 and 3) near well 80-MW1. Benzene was not detected in each of the four most recent sampling rounds (May 2000 to January 2001).
Bromodichloromethane	1	N/A	2.06	1	0	N/A	Not a COC. There were no exceedances of NJDEP criteria in monitoring well samples. There was only one exceedance in Geoprobe groundwater samples.
2-Butanone	300	N/A	8.15	0	0	N/A	No exceedance of NJDEP criteria
Carbon Disulfide ⁽³⁾	100	N/A	2.31	0	0	N/A	No exceedance of NJDEP criteria
Chlorobenzene ⁽³⁾	50	N/A	7.34	0	0	N/A	Not a COC. There were no exceedances of NJDEP criteria in monitoring well samples or Geoprobe groundwater samples.
Methylene Chloride ⁽³⁾	3	N/A	2.4	1	0	N/A	Not a COC; no exceedences of NJDEP Cleanup Criteria.
Semi-Volatiles							
Acenaphthene	400	N/A	19.59	0	N/A	N/A	No exceedance of NJDEP criteria
Dibenzofuran ⁽³⁾	100	N/A	20.05	0	N/A	N/A	No exceedance of NJDEP criteria
1,2-Dichlorobenzene	600	N/A	2	0	N/A	N/A	No exceedance of NJDEP criteria
2,4-Dichlorophenol	20	N/A	13.95	0	N/A	N/A	No exceedance of NJDEP criteria
Di-n-butylphthalate	900	N/A	16.28	0	N/A	N/A	No exceedance of NJDEP criteria
Fluorene	300	N/A	20.95	0	N/A	N/A	No exceedance of NJDEP criteria
2-Methylnaphthalene ⁽³⁾	100	N/A	8.85	0	N/A	N/A	No exceedance of NJDEP criteria
Naphthalene ⁽³⁾	100	N/A	14.37	0	N/A	N/A	No exceedance of NJDEP criteria
Phenanthrene ⁽³⁾	100	N/A	2.56	0	N/A	N/A	No exceedance of NJDEP criteria

Table 5-4
Determination of Contaminants of Concern
Site 80/166 - Main Post
Fort Monmouth, New Jersey

Analyte	NJDEP Criteria ⁽¹⁾	Site Specific Groundwater MBC ⁽²⁾	Maximum Result	No. of Exceedences in Monitoring Well Samples	No. of Exceedences in Geoprobe Groundwater Samples	No. of Site Maximum Background Exceedences	Comments
Bis(2-Ethylhexyl)phthalate	30	N/A	1.4	0	N/A	N/A	No exceedance of NJDEP criteria
Pesticides/PCBs							
4,4'-DDD	0.1	N/A	0.453	3	N/A	N/A	Not a COC. 4,4-DDD concentrations exceeded the NJDEP criteria during 2 of 18 rounds in monitoring well 80-MW1 and 1 of 5 rounds in well 80-MW2.
a-Chlordane	0.5	N/A	1.625	3	N/A	N/A	COC: a-Chlordane was detected above the NJDEP criteria in 2 of 5 samples collected from well 80-MW2.
g-Chlordane	0.5	N/A	2.719	2	N/A	N/A	COC: g-Chlordane was detected above the NJDEP criteria in 2 of 5 samples collected from well 80-MW2.
Endosulfan Sulfate	0.4	N/A	0.485	1	N/A	N/A	Not a COC: only one exceedence of NJDEP Cleanup Criteria.
Metals							
Aluminum	200	121000	97500	46	N/A	0	Not a COC: no exceedance of the Site Specific MBC.
Antimony	20	N/A	7.72	0	N/A	N/A	No exceedance of NJDEP criteria
Arsenic	8	N/A	71.6	19	N/A	N/A	COC. Arsenic was detected at concentrations exceeding the NJDEP criteria in 15 rounds at monitoring well 80-MW1.
Barium	2000	699	1220	0	N/A	2	No exceedance of NJDEP criteria
Beryllium	20	N/A	14.3	0	N/A	N/A	No exceedance of NJDEP criteria
Cadmium	4	N/A	24.6	13	N/A	N/A	Not a COC: cadmium was not detected during Low-Flow sampling (September and October 2000).
Calcium	NLE	45400	978000	N/A	N/A	44	No NJDEP Groundwater Criteria
Chromium	100	N/A	148	2	N/A	N/A	Not a COC: there were 2 exceedences in August 1997. However, chromium was detected in laboratory blank samples during this sampling round.

Table 5-4
Determination of Contaminants of Concern
Site 80/166 - Main Post
Fort Monmouth, New Jersey

Analyte	NJDEP Criteria ⁽¹⁾	Site Specific Groundwater MBC ⁽²⁾	Maximum Result	No. of Exceedences in Monitoring Well Samples	No. of Exceedences in Geoprobe Groundwater Samples	No. of Site Maximum Background Exceedences	Comments
Cobalt	NLE	N/A	50	N/A	N/A	N/A	No NJDEP Groundwater Criteria
Copper	1000	65.6	359	0	N/A	7	No exceedance of NJDEP criteria
Iron	300	431000	571000	58	N/A	19	Not a COC: iron is a background metal.
Lead	10	N/A	84.1	15	N/A	N/A	COC. Lead was detected in multiple rounds in monitoring wells 80-MW1, 80-MW4, 80-MW5, and 166-MW1. Lead was detected above the NJDEP criteria during Low Flow sampling rounds (September and October 2000).
Magnesium	NLE	62700	386000	N/A	N/A	9	No NJDEP Groundwater Criteria
Manganese	50	331	17250	58	N/A	43	Not a COC: manganese is a background metal.
Mercury	2	N/A	0.38	0	N/A	N/A	No exceedance of NJDEP criteria
Nickel	100	187	73.3	0	N/A	0	No exceedance of NJDEP criteria
Potassium	NLE	137000	119000	N/A	N/A	0	No NJDEP Groundwater Criteria
Selenium	50	N/A	10.2	0	N/A	N/A	No exceedance of NJDEP criteria
Silver	NLE	N/A	26	N/A	N/A	N/A	No NJDEP Groundwater Criteria
Sodium	50000	21500	11700000	50	N/A	58	Not a COC: sodium is not of concern due to proximity of site to seawater.
Thallium	10	N/A	7.55	0	N/A	N/A	No exceedance of NJDEP criteria
Vanadium	NLE	N/A	800	N/A	N/A	N/A	No NJDEP Groundwater Criteria
Zinc	5000	233	666	0	N/A	16	No exceedance of NJDEP criteria

Notes:

All concentrations in micrograms per liter (ug/L), equivalent to parts per billion (ppb).

COC: Contaminant of Concern.

N/A = Not Applicable

Exceeds NJDEP GWQC =

ND: Analyte not detected in sample

NLE: No limit established for this analyte

⁽¹⁾Higher of Practical Quantitation Limits (PQLs) and Groundwater Quality Criteria (GWQC) per N.J.A.C. 7:9-6

⁽²⁾Fort Monmouth Summary of Site-Specific Groundwater Maximum Background Concentrations (MBC) (Weston SI Report Dated 1995);

MBCs are shown for background (native) metals only.

⁽³⁾Interim Criteria used as NJDEP criteria

Table 5-5
Groundwater Sampling Results for Contaminants of Concern
Site 80/166 - Main Post
Fort Monmouth, New Jersey

Well ID		80-MW1	80-MW1	80-MW1	80-MW1	80-MW1	80-MW1	80-MW1	80-MW1	80-MW1	80-MW1	80-MW1	80-MW1	80-MW1	80-MW1	80-MW1	80-MW1	80-MW1	80-MW1
Lab Sample ID	NJDEP	2457.03	2918.01	3174.03	3376.01	3614.01	3823.04	4076.03	4262.03	4514.03	4808.01	5021.01	5223.04	5406.01	5635.01	5818.04	346	5694.04	5782.03
Sample Date	Criteria	04/16/97	08/20/97	11/24/97	02/27/98	06/02/98	08/24/98	11/20/98	02/09/99	05/26/99	09/22/99	12/17/99	03/06/00	05/09/00	08/16/00	10/27/00	01/24/01	09/07/00	10/12/00
Round No.		1	2	3	4	5	6	7	8	9	10	11	12	13	14	16	17	low flow 1	low flow 2
Pesticides/PCBs																			
a-Chlordane	0.5	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	NS	NS
MDL		0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014		
g-Chlordane	0.5	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	NS	NS
MDL		0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014		
Metals																			
Arsenic	8	NS	9	0.5	24	11.9	41.5	34.3	8.49	24	11.8	6.56	17.9	11.3	28.8	16.8	32.4	0.5	55.2
MDL				1														1	
Lead	10	2.5	4	14	6	3.3	10.4	2.86	0.25	5.34	5.15	0.25	3.67	26.7	2.63	3.16	1.87	0.25	0.25
MDL									0.5			0.5						0.5	0.5

Well ID		80-MW2	80-MW2	80-MW2	80-MW2	80-MW2	80-MW2
Lab Sample ID	NJDEP	5636.04	5675.04	5818.05	347	5694.03	5782.04
Sample Date	Criteria	08/16/00	08/30/00	10/27/00	01/24/01	09/06/00	10/12/00
Round No.		14	15	16	17	low flow 1	low flow 2
Pesticides/PCBs							
a-Chlordane	0.5	0.197	0.779	0.007	1.625	0.007	0.007
MDL				0.014		0.014	0.014
g-Chlordane	0.5	0.007	0.007	0.007	2.719	0.007	0.979
MDL		0.014	0.014	0.014		0.014	
Metals							
Arsenic	8	0.5	0.5	0.5	2.69	46.6	0.5
MDL		1	1	1			1
Lead	10	2.64	1.55	1.7	0.25	0.25	9.12
MDL					0.5	0.5	

Well ID		80-MW3	80-MW3	80-MW3	80-MW3	80-MW3	80-MW3
Lab Sample ID	NJDEP	5636.05	5675.05	5818.06	348	5691.05	5780.05
Sample Date	Criteria	08/16/00	08/30/00	10/27/00	01/24/01	09/06/00	10/11/00
Round No.		14	15	16	17	low flow 1	low flow 2
Pesticides/PCBs							
a-Chlordane	0.5	0.007	0.007	0.007	0.007	0.007	0.007
MDL		0.014	0.014	0.014	0.014	0.014	0.014
g-Chlordane	0.5	0.007	0.007	0.007	0.007	0.007	0.007
MDL		0.014	0.014	0.014	0.014	0.014	0.014
Metals							
Arsenic	8	3.36	7.06	7.27	2.28	0.5	0.5
MDL						1	1
Lead	10	1.7	0.25	1.52	0.25	0.25	0.25
MDL			0.5		0.5	0.5	0.5

Table 5-5
Groundwater Sampling Results for Contaminants of Concern
Site 80/166 - Main Post
Fort Monmouth, New Jersey

Well ID		80-MW4	80-MW4	80-MW4	80-MW4	80-MW4	80-MW4
Lab Sample ID	NJDEP	5636.06	5675.06	5818.07	349	5691.03	5780.03
Sample Date	Criteria	08/16/00	08/30/00	10/27/00	01/24/01	09/06/00	10/11/00
Round No.		14	15	16	17	low flow 1	low flow 2
Pesticides/PCBs							
a-Chlordane	0.5	0.007	0.007	0.007	0.007	0.007	0.007
MDL		0.014	0.014	0.014	0.014	0.014	0.014
g-Chlordane	0.5	0.007	0.007	0.007	0.007	0.007	0.007
MDL		0.014	0.014	0.014	0.014	0.014	0.014
Metals							
Arsenic	8	6.28	5.04	5.3	4.18	4.93	6
MDL							
Lead	10	70.4	0.25	2.03	20	0.25	0.25
MDL			0.5			0.5	0.5

Well ID		80-MW5	80-MW5	80-MW5	80-MW5	80-MW5	80-MW5
Lab Sample ID	NJDEP	5636.07	5675.07	5818.08	350	5691.04	5780.04
Sample Date	Criteria	08/16/00	08/30/00	10/27/00	01/24/01	09/06/00	10/11/00
Round No.		14	15	16	17	low flow 1	low flow 2
Pesticides/PCBs							
a-Chlordane	0.5	0.007	0.007	0.007	0.007	0.007	0.007
MDL		0.014	0.014	0.014	0.014	0.014	0.014
g-Chlordane	0.5	0.007	0.007	0.007	0.007	0.007	0.007
MDL		0.014	0.014	0.014	0.014	0.014	0.014
Metals							
Arsenic	8	11.2	71.6	4.42	5.85	32.7	7.86
MDL							
Lead	10	11.1	84.1	0.25	0.25	79.5	15.2
MDL				0.5	0.5		

Well ID		166-MW1	166-MW1	166-MW1	166-MW1	166-MW1	166-MW1	166-MW1	166-MW1	166-MW1	166-MW1	166-MW1	166-MW1	166-MW1	166-MW1	166-MW1	166-MW1	166-MW1	166-MW1
Lab Sample ID	NJDEP	2458.01	2917.03	3175.01	3375.01	3614.02	3823.05	4076.04	4262.04	4514.04	4808.02	5021.02	5223.05	5406.02	5635.02	5818.09	345	5694.05	5782.05
Sample Date	Criteria	04/16/97	08/20/97	11/24/97	02/27/98	06/02/98	08/24/98	11/20/98	02/09/99	05/26/99	09/22/99	12/17/99	03/06/00	05/09/00	08/16/00	10/27/00	01/24/01	09/07/00	10/12/00
Round No.		1	2	3	4	5	6	7	8	9	10	11	12	13	14	16	17	low flow 1	low flow 2
Pesticides/PCBs																			
a-Chlordane	0.5	0.007	0.007	0.007	0.007	0.027	0.052	0.007	0.007	0.007	0.048	0.007	0.007	0.007	0.007	0.007	0.028	0.84	0.007
MDL		0.014	0.014	0.014	0.014			0.014	0.014	0.014		0.014	0.014	0.014	0.014	0.014	0.014		0.014
g-Chlordane	0.5	0.007	0.007	0.007	0.007	0.022	0.05	0.007	0.007	0.007	0.049	0.007	0.007	0.007	0.007	0.007	0.024	0.46	0.007
MDL		0.014	0.014	0.014	0.014			0.014	0.014	0.014		0.014	0.014	0.014	0.014	0.014			0.014
Metals																			
Arsenic	8	NS	4	23	0.5	2.3	3.21	0.5	0.5	4.57	0.5	0.5	2.83	0.5	0.5	5.67	4.83	0.5	3.13
MDL					1			1	1		1	1		1	1			1	
Lead	10	2.4	1.6	15	0.25	2.3	12.4	4.23	0.25	11.4	7.95	0.25	4.21	17.3	5.12	16.4	0.25	1.73	22.7
MDL					0.5				0.5			0.5					0.5		

Notes:

NJDEP Criteria: Higher of Practical Quantitation Limits (PQLs) and Groundwater Quality Criteria (GWQC) per NJAC 7:9-6.

Exceedences of NJDEP GWQS are shaded and **bold**.

MDL: Method Detection Limit. The MDL is shown for samples for which the analyte was not detected (ND).

One half the MDL was used in calculating the average concentration (See Table 6-2).

Table 5-6
Aquifer pH and Dissolved Oxygen
Site 80/166 - Main Post
Fort Monmouth, New Jersey

80-MW1		
Sample Date	pH	DO (mg/L)
04/16/97	6.43	2.2
08/20/97	7.15	1.8
11/24/97	6.84	1.4
02/27/98	7.18	3.1
06/02/98	5.85	1.2
08/24/98	6.10	4.16
11/20/98	6.37	5.74
02/09/99	6.28	5.91
05/26/99	5.44	NA
09/22/99	6.16	4.17
12/17/99	6.12	5.3
03/06/00	6.21	5.3
05/09/00	6.33	5.04
08/16/00	5.99	3.77
09/07/00	4.65	NA
10/12/00	5.20	NA
10/27/00	6.62	4.11
01/24/01	6.74	5.2
Min:	4.65	1.2
Max:	7.18	5.91
Average:	6.20	3.89

80-MW2		
Sample Date	pH	DO (mg/L)
08/16/00	4.90	3.71
08/30/00	5.19	3.41
09/07/00	5.77	NA
10/12/00	3.98	NA
10/27/00	6.32	3.47
01/24/01	6.33	4.5
Min:	3.98	3.41
Max:	6.33	4.5
Average:	5.42	3.77

80-MW3		
Sample Date	pH	DO (mg/L)
08/16/00	5.98	3.21
08/30/00	5.97	3.09
09/06/00	5.75	0.08
10/11/00	5.75	NA
10/27/00	6.6	4.07
01/24/01	6.7	5.07
Min:	5.75	0.08
Max:	6.70	5.07
Average:	6.13	3.10

80-MW4		
Sample Date	pH	DO (mg/L)
08/16/00	5.41	3.76
08/30/00	5.57	3.17
09/06/00	5.31	NA
10/11/00	5.26	NA
10/27/00	6.24	4.13
01/24/01	6.38	4.99
Min:	5.26	3.17
Max:	6.38	4.99
Average:	5.70	4.01

80-MW5		
Sample Date	pH	DO (mg/L)
08/16/00	5.31	3.41
08/30/00	3.79	3.21
09/06/00	4.05	NA
10/11/00	4.70	NA
10/27/00	6.17	4
01/24/01	6.32	5
Min:	3.79	3.21
Max:	5.31	5
Average:	5.06	3.91

166-MW1		
Sample Date	pH	DO (mg/L)
04/16/97	6.35	2.3
08/20/97	7.98	2
11/24/97	7.15	1.8
02/27/98	7.02	3.7
06/02/98	6.91	1.5
08/24/98	6.73	3.71
11/20/98	7.11	7.09
02/09/99	6.75	4.71
05/26/99	7.18	NA
09/22/99	6.80	4.2
12/17/99	6.77	5.19
03/06/00	6.77	5.1
05/09/00	6.84	5.07
08/16/00	6.18	3.97
09/07/00	6.35	NA
10/12/00	5.89	NA
10/27/00	7.09	3.41
01/24/01	7.37	4.7
Min:	5.89	1.5
Max:	7.98	7.09
Average:	6.85	3.90

Notes:

- 1.) DO: Dissolved Oxygen
- 2.) NA: Not Available / Not Applicable
- 3.) Measurements shown for pH and DO were recorded following the purging of wells prior to groundwater sampling.

Table 6-1
g-Chlordane Biodegradation Model at Monitoring Well 80-MW2
Site 80/166 - Main Post
Fort Monmouth, New Jersey

Duration of Chlordane Degradation Based on Published Biodegradation Rate		
Input		
Parameters	Units	Constituent: g-Chlordane
Δt	days	365
$T_{1/2}$	days	2,774
$k^{(1)}$	days ⁻¹	0.00025
Initial Concentration, $C_0^{(2)}$	$\mu\text{g/L}$	2.719
January 24, 2001		
Calculation and Results		
Time (days)	Date	Predicted Concentrations, C (ug/L)
0	January 24, 2001	2.719
365	January 24, 2002	2.482
730	January 24, 2003	2.266
1095	January 24, 2004	2.068
1460	January 23, 2005	1.888
1825	January 23, 2006	1.723
2190	January 23, 2007	1.573
2555	January 23, 2008	1.436
2920	January 22, 2009	1.311
3285	January 22, 2010	1.197
3650	January 22, 2011	1.092
4015	January 22, 2012	0.997
4380	January 21, 2013	0.910
4745	January 21, 2014	0.831
5110	January 21, 2015	0.758
5475	January 21, 2016	0.692
5840	January 20, 2017	0.632
6205	January 20, 2018	0.577
6570	January 20, 2019	0.527
6935	January 20, 2020	0.481
Time until NJDEP criteria is reached:		
6,935	January 20, 2020	0.481
New Jersey Criteria	$\mu\text{g/L}$	0.5
Notes: NJ Criteria = Interim Groundwater Quality Criteria Constituent Predicted Concentration: $C_p(t) = C_p(t-1) * e^{-k\Delta t}$ Time to reach NJ Criteria = TNJC Reaction Rate Constant = $k = -\ln(0.5)/t_{1/2}$		
Length of Impacted Area Based on Available Published Biodegradation Rates		
Input Data		
Hydraulic Conductivity ⁽³⁾ (K)	ft/day	3.8
Hydraulic Gradient ⁽⁴⁾ (i):	ft/ft	0.015
Effective Porosity ⁽⁵⁾ (n_e):	---	0.4
Bulk Density of Formation ⁽⁵⁾ (ρ_b)	kg/L	1.65
n-Octanol/Carbon Partition ⁽⁶⁾ (K_{oc}):	L/kg	1.21E+05
Fraction of Organic Carbon ⁽⁷⁾ (f_{oc})	---	0.003
Sorption Coefficient (K_d)	L/kg	363.000
Calculation and Results		
Seepage Velocity (ft/day)	$vs = K*i/ne =$	0.143
Retardation Factor	$Rd = 1 + (Kd * \rho_b / ne) =$	1498.38
Pollutant Transport Rate (ft/day)	$vpt = vs/Rd =$	0.00010
or (ft/year)		0.035
TNJC (days)	Determined above	6,935
TNJC (years)		19.0
Length (ft)	$vpt * TNJC =$	0.66
Notes: (1) Half-Life for aerobic biodegradation in groundwater, upper limit: Howard, P.H. et. al. 1991. <i>Handbook of Environmental Degradation Rates</i> . Lewis Publishers. (2) Initial concentration (Co) is the most recent concentration that was detected during the groundwater monitoring program. (3) Hydraulic conductivity of surficial fill, K = 25.9 ft/day (Geometric mean of slug tests performed by Versar in August 2001) (4) Hydraulic gradient (i) derived from ground water elevation contours (August 2000) (5) Effective porosity, n = 0.4, and bulk density, ρ_b = 1.65 g/mL (consistent with the type of soil - clayey sands, at the Site). (6) K_{oc} data reference: USEPA Soil Screening Guidance 1996. (7) f_{oc} = 0.003 (the geometric mean of the minimum and maximum range of f_{oc}). <i>USEPA 1996</i> .		

Table 6-2
MODFLOW Input Parameters
Site 80/166 - Main Post
Fort Monmouth, New Jersey

Software used for Modeling			
Waterloo Hydrogeologic <i>Visual Modflow Version 2.8</i>			
Golden Software, Inc. <i>Surfer for Windows Version 7</i>			
Papadopoulos & Associates, Inc. <i>MT3D99</i>			

Grid			
Model Area:	Min	Max	Range
X (Easting, NJ Nad 83):	622100	624500	2400
Y (Northing, NJ Nad 83):	539800	542200	2400
Number of Columns:	124		
Number of Rows:	124		
Default Grid Size:	20' x 20'		
Grid size near well 80-MW2	10' x 10'		

Units used in model	
Length	feet
Time	day
Hydraulic Conductivity	Feet per day (ft/day)
Recharge	Inches per year (in./year)
Concentration	Micrograms per Liter (ug/L), equivalent to Parts Per Billion (ppb)
Mass	kg
Volume	ft ³

Ground Surface	
The ground surface elevations were obtained from the Fort Monmouth Nad83 topographic survey.	
The river was assigned to elevation of zero (0) ft.	
The ground surface used in the model was interpolated from elevation points using Golden Software Surfer.	

Table 6-2
MODFLOW Input Parameters
Site 80/166 - Main Post
Fort Monmouth, New Jersey

Layer properties			
Number of Layers:	5		
<u>Layer Number</u>	<u>Formation</u>	<u>Thickness</u>	<u>Porosity*</u>
Layer 1	Fill	5 ft	0.40
Layer 2	Navesink-Hornerstown Confining Unit	7.5 ft	0.40
Layer 3	Navesink-Hornerstown Confining Unit	7.5 ft	0.40
Layer 4	Navesink-Hornerstown Confining Unit	55 ft	0.40
Layer 5	Navesink-Hornerstown Confining Unit	55 ft	0.40
Layer 6	Wenonah-Mount Laurel Aquifer	75 ft	0.40
Layer 7	Marshalltown-Wenonah Confining Unit	10 ft	0.40
<i>*Porosity estimated from Dominico and Schwarts (1998), Table 2.1.</i>			

Recharge	
Majority of Area:	13.28 in. / year
Selected Area:	0 in./year in paved area south of M-18 site
Recharge applied to:	Highest Active Cells
Source:	Jablonski, 1968, Ground-Water Resources of Monmouth County, New Jersey, USGS Special Report No. 23. <i>The recharge used for the model was taken to be the sum of the groundwater base flow and water utilization.</i>

Constant Head Boundary	
Location:	Oceanport Creek
Constant Head	0 ft (applied to all layers)

Table 6-2
MODFLOW Input Parameters
Site 80/166 - Main Post
Fort Monmouth, New Jersey

Hydraulic Conductivity (K)		
The geometric means were used for the layers specified below:		
Fill:	<i>From Slug tests conducted February 6-7, 2001.</i>	
(Layer 1)	<u>Well</u>	<u>K</u>
	80-MW1	2
	80-MW2	4.85
	80-MW3	6.3
	80-MW4	6.41
	80-MW5	2.08
	166-MW1	[Not Available]
Geometric Mean:		3.8
Navesink-Hornerstown	<i>From Martin (1998)</i>	
Confining Unit:	2	
(Layers 2, 3, 4 and 5)	5.00E-04	
	1.30E-01	
	9	
	3.00E-03	
	2.00E-02	
	8.00E-02	
	6.70E-01	
	4	
	5.60E-02	
Geometric Mean:		0.12

Hydraulic Conductivity (K) (Continued)	
Wenonah Formation:	From Martin (1998)
(Layer 6)	17
	13
	19
	13
	19
Geometric Mean:	15.9649869
Marshalltown Wenonah	From Martin (1998)
Confining Unit:	2.60E-04
(Layer 7)	1.30E-01
	4.90E-04
	5.70E-06
	2.40E-05
	1.50E-05
Geometric Mean:	0.00017998
Source:	Martin, Mary, 1998, Groundwater Flow in the New Jersey Coastal Plain, USGS Professional Paper 1404-H.

Table 6-2
MODFLOW Input Parameters
Site 80/166 - Main Post
Fort Monmouth, New Jersey

Contaminant Transport Inputs

Dispersivity: Longitudinal: 3.48 ft Lattitudinal = $0.1 * \text{Longitudinal} = 0.348 \text{ ft.}$

Source for dispersivity: USEPA Office of Research and Development, Feb. 2001,

<http://www.epa.gov/athens/learn2model/part-two/onsite/longdisp.htm>

Dispersivity calculated based on a plume length of 40 feet.

Bulk Density:	46.7 kg/ft3
---------------	-------------

Sorption type: Linear Isotherm

Sorption Constants Used in Model (K_d):

					Calculated
Source	COC	Kd (ml/g)	Kd (L/ug)	Kd (ft3/kg)	Rd
(1)	g-Chlordane	363	3.63E-07	1.28E+01	900
(2)	Arsenic	2.90E+01	2.90E-08	1.02E+00	73
(3)	Lead	890	8.90E-07	3.14E+01	2,204

Notes:

Kd for g-chlordane was found from the relationship: $K_d = f_{oc} * K_{oc}$.

from MIDEQ (2001): $K_{oc} = 1.21E+5 \text{ ml/g} = 4321 \text{ ft}^3/\text{Kg}$. $f_{oc} = 0.003$

Benzene was also modelled separately using biodegradation only, see Table 6-2.

Sources:

(1) Michigan Department of Environmental Quality (MIDEQ)

<http://www.deq.state.mi.us/erd/opmemos/opmemo18/om18bt.html>

(2) United States Environmental Protection Agency (USEPA). 1996.

Soil Screening Guidance: Technical Background Document.

Office of Solid Waste and Emergency Response. Washington, D.C. EPA/540/R-95/128.

Note: Kd for arsenic used for aquifer pH of 6.8.

(3) Pennsylvania Department of Environmental Protection (PADEP)

Manual Appendix A Table 5B, <http://www.dep.state.pa.us/dep/subject/eqb/2000/jun20/Table5b.pdf>

Table 6-2
MODFLOW Input Parameters
Site 80/166 - Main Post
Fort Monmouth, New Jersey

Contaminant Transport Inputs (Continued):

Method for Determining Initial Concentrations for each Contaminant of Concern:

Contaminant of Concern	NJDEP Cleanup Criteria ⁽¹⁾	Wells with Number of Exceedances	Method for Determining Initial Concentrations
g-CHLORDANE	0.5	80-MW2 [2]	Initial concentration "plume" surrounding well 80-MW2 with initial concentration of 2.719 (the most recent detection of g-chlordane).
ARSENIC	8	80-MW1 [14] 80-MW2 [2] 80-MW5 [3] 166-MW1 [1]	Initial concentration map derived from average concentrations.
LEAD	10	80-MW1 [3] 80-MW4 [2] 80-MW5 [4] 166-MW1 [5]	Initial concentration map derived from average concentrations.

Notes:

ND: Not Detected in any groundwater sampling round at the 80/166 site.

⁽¹⁾Higher of Practical Quantitation Limits (PQLs) and Groundwater Quality Criteria (GWQC) per N.J.A.C. 7:9-6

All concentrations in micrograms per liter (ug/L), equivalent to parts per billion (ppb).

Table 6-2
MODFLOW Input Parameters
Site 80/166 - Main Post
Fort Monmouth, New Jersey

Contaminant Transport Inputs (Continued):

Average Concentrations for arsenic and lead

Contaminant of Concern	NJDEP Cleanup Criteria ⁽¹⁾	80-MW1 Average Concentration	80-MW2 Average Concentration	80-MW3 Average Concentration	80-MW4 Average Concentration	80-MW5 Average Concentration	166-MW1 Average Concentration
ARSENIC	8	19.703	8.548	3.495	5.288	22.272	3.385
LEAD	10	5.143	2.585	0.703	15.530	31.733	6.986

Notes:

⁽¹⁾Higher of Practical Quantitation Limits (PQLs) and Groundwater Quality Criteria (GWQC) per N.J.A.C. 7:9-6

All concentrations in micrograms per liter (ug/L), equivalent to parts per billion (ppb).

MDL: Minimum Detection Limit.

Bold with Shading: average concentration exceeds the NJDEP Criteria.

Samples with a Non-Detect result (ND) were assigned the concentration of 0.5 * MDL for the calculation of average concentrations.

Biodegradation Rate:

COC	Half-life (years)	k (1/day)
g-Chlordane	7.60E+00	2.50E-04

Source:

(1) Howard, P.H. et. al. 1991. *Handbook of Environmental Degradation Rates*. Lewis Publishers.

Half-Life for aerobic biodegradation in groundwater, upper limit.

Table 6-3
MODFLOW Results
Site 80/166 - Main Post
Fort Monmouth, New Jersey

Contaminant of Concern	NJDEP Criteria (ug/L) ⁽¹⁾	Well used for Calculation	Initial Concentration (ug/L)	Approximate Change of Concentration (ug/L per year)	Estimated Time for Compliance (Years)
g-Chlordane	0.5	80-MW2	2.917	0.121	20
Arsenic	8	80-MW1	16.93	0.015	>600
Lead	10	80-MW5	24.87	0.010	>1,000

Notes:

⁽¹⁾Higher of Practical Quantitation Limits (PQLs) and Groundwater Quality Criteria (GWQC) per NJAC 7:9-6

Table 6-4
Well Search Summary
Site 80/166 - Main Post
Fort Monmouth, New Jersey

NJDEP Permit Number	Depth (feet)	Use*	Permit Date	Latitude	Longitude
2900961	50	D	10/27/1953	401920	740106
2901016	150	D	12/24/1953	401839	740240
2901400	54	D	4/19/1955	401920	740040
2902505	100	D	10/10/1957	401906	740226
2902774	124	D	9/22/1958	401933	740226
2903015	60	G	8/20/1959	401906	740119
2903369	100	D	8/8/1960	401933	740213
2904271	60	D	2/13/1964	401933	740213
2904513	350	D	10/16/1964	401906	740133
2904519	60	D	10/15/1964	401933	740053
2904782	50	D	8/5/1965	401839	740240
2904815	50	D	9/10/1965	401906	740053
2904817	50	D	9/10/1965	401853	740040
2904855	50	D	10/15/1965	401853	740040
2905009	70	D	3/21/1966	401853	740119
2905084	50	D	5/31/1966	401933	740133
2905673	100	D	1/22/1969	401839	740226
2906131	70	D	12/18/1970	401906	740040
2906460	50	D	4/25/1972	401906	740106
2906499	50	D	5/22/1972	401920	740106
2906510	50	D	6/7/1972	401839	740200
2906958	85	D	4/18/1973	401933	740106
2907172	85	D	9/5/1973	401933	740106
2907264	50	D	10/18/1973	401933	740106
2908438	60	D	8/3/1976	401853	740200
2908810	50	D	5/12/1977	401839	740146
2910282	80	D	9/11/1979	401920	740053
2911063	25	M	3/31/1981	401906	740213
2911064	25	M	3/31/1981	401906	740213
2911065	25	M	3/31/1981	401906	740213
2911066	25	M	3/31/1981	401906	740213
2911067	25	M	3/31/1981	401906	740213
2911068	25	M	3/31/1981	401906	740213
2911772	100	H	12/22/1981	401906	740240
2911855	175	I	2/17/1982	401920	740053
2912553	25	M	1/21/1983	401846	740152
2912554	25	M	1/21/1983	401846	740152
2912555	25	M	1/21/1983	401846	740152
2912598	80	R	2/1/1983	401832	740126
2912785	10	M	6/2/1983	401939	740219
2912786	10	M	6/2/1983	401939	740219
2912787	10	M	6/2/1983	401939	740219
2912788	10	M	6/2/1983	401939	740219
2912789	10	M	6/2/1983	401939	740219
2912790	10	M	6/2/1983	401939	740219
2912792	10	M	6/2/1983	401939	740219
2912793	10	M	6/2/1983	401939	740219
2912794	10	M	6/2/1983	401939	740219
2912795	10	M	6/2/1983	401939	740219
2912796	10	M	6/2/1983	401939	740219
2912797	10	M	6/2/1983	401939	740219
2912798	10	M	6/2/1983	401939	740219
2913696	10	M	8/5/1984	401939	740219
2913697	10	M	8/5/1984	401939	740219
2913698	25	M	8/5/1984	401939	740219
2913825	35	M	6/20/1985	401819	740152
2913978	35	M	6/20/1985	401920	740040
2914157	60	D	9/15/1984	401846	740139
2914244	120	D	10/5/1984	401819	740219

NJDEP Permit Number	Depth (feet)	Use*	Permit Date	Latitude	Longitude
2914980	200	R	5/5/1985	401912	740246
2915005	80	D	7/18/1985	401846	740059
2915421	100	D	9/20/1985	401859	740046
2916628	12	M	6/11/1986	401939	740232
2916629	12	M	6/11/1986	401939	740232
2916630	12	M	6/11/1986	401939	740232
2919474	200	D	10/26/1987	401920	740133
2919537	60	D	11/9/1987	401920	740053
2919952	80	D	2/16/1988	401920	740040
2920242	80	R	4/12/1988	401839	740106
2920243	15	Z	4/12/1988	401839	740106
2920244	15	Z	4/12/1988	401839	740106
2920245	60	Z	4/12/1988	401839	740106
2920246	15	Z	4/12/1988	401839	740106
2920248	15	Z	4/12/1988	401839	740106
2921780	190	G	11/10/1988	401853	740133
2922063	100	R	2/10/1989	401920	740053
2922181	150	G	2/9/1989	401933	740133
2922236	60	D	2/28/1989	401920	740053
2922526	190	G	4/7/1989	401933	740133
2922549	180	G	4/12/1989	401839	740133
2923608	200	D	10/18/1989	401933	740226
2923677	30	M	11/3/1989	401906	740226
2923678	30	M	11/3/1989	401906	740226
2923679	30	M	11/3/1989	401906	740226
2923680	30	M	11/3/1989	401906	740226
2924557	60	D	4/10/1990	401920	740053
2924639	30	M	4/27/1990	401906	740226
2924640	30	M	4/27/1990	401906	740226
2924953	10	M	6/27/1990	401853	740200
2924954	10	M	6/27/1990	401853	740200
2924955	10	M	6/27/1990	401853	740200
2924956	10	M	6/27/1990	401853	740200
2925357	20	M	10/12/1990	401839	740213
2925453	15	M	11/7/1990	401906	740119
2925454	15	M	11/7/1990	401906	740119
2925455	15	M	11/7/1990	401906	740119
2925456	15	M	11/7/1990	401906	740119
2925457	15	M	11/7/1990	401906	740119
2925506	70	I	11/20/1990	401906	740040
2926778	40	M	8/29/1991	401946	740200
2926925	20	M	9/24/1991	401906	740200
2926926	20	M	9/24/1991	401906	740200
2926927	20	M	9/24/1991	401906	740200
2926928	20	M	9/24/1991	401906	740200
2926929	20	M	9/24/1991	401906	740200
2926930	20	M	9/24/1991	401906	740200
2926931	20	M	9/24/1991	401906	740200
2926938	20	M	9/25/1991	401920	740200
2926939	20	M	9/25/1991	401920	740200
2926940	20	M	9/25/1991	401906	740200
2926941	20	M	9/25/1991	401906	740200
2926942	20	M	9/25/1991	401906	740200
2928031	20	E	5/14/1992	401906	740200
2928907	20	M	10/13/1992	401906	740200
2928992	20	M	10/27/1992	401920	740200
2928993	20	M	10/27/1992	401920	740200
2928994	20	M	10/27/1992	401920	740200
2928995	20	M	10/27/1992	401920	740200

Table 6-4
Well Search Summary
Site 80/166 - Main Post
Fort Monmouth, New Jersey

NJDEP Permit Number	Depth (feet)	Use*	Permit Date	Latitude	Longitude
2929739	20	M	6/3/1993	401920	740146
2929740	20	M	6/3/1993	401920	740146
2929741	20	M	6/3/1993	401920	740146
2930322	100	I	10/12/1993	401906	740040
2930957	15	M	4/5/1994	401906	740200
2930961	15	M	4/5/1994	401853	740240
2930962	15	M	4/5/1994	401906	740200
2930963	15	M	4/5/1994	401906	740200
2930964	15	M	4/5/1994	401906	740200
2930973	15	M	4/5/1994	401906	740240
2930974	15	M	4/5/1994	401906	740240
2930975	15	M	4/5/1994	401920	740240
2930976	15	M	4/5/1994	401920	740240
2930980	15	M	4/5/1994	401906	740240
2931158	25	M	5/4/1994	401853	740200
2931159	25	M	5/4/1994	401853	740200
2931440	200	G	6/9/1994	401933	740106
2931552	30	G	6/30/1994	401853	740133
2931772	15	M	8/3/1994	401906	740240
2931773	15	M	8/3/1994	401906	740240
2931774	15	M	8/3/1994	401906	740240
2931775	15	M	8/3/1994	401906	740240
2932576	25	M	11/29/1994	401853	740226
2932577	25	M	11/29/1994	401853	740226
2932578	25	M	11/29/1994	401853	740226
2932579	25	M	11/29/1994	401853	740226
2932580	25	M	11/29/1994	401853	740226
2932581	25	M	11/29/1994	401853	740226
2932582	25	M	11/29/1994	401853	740226
2932583	25	M	11/29/1994	401853	740226
2933754	20	M	7/19/1995	401906	740200
2933755	20	M	7/19/1995	401906	740200
2933989	20	M	8/18/1995	401920	740240
2934702	40	B	12/15/1995	401920	740146
2934857	50	B	2/8/1996	401920	740146
2935504	70	D	6/5/1996	401906	740040
2935731	25	M	7/17/1996	401826	740119
2935732	25	M	7/17/1996	401826	740119
2935833	15	M	8/2/1996	401920	740106
2936864	175	D	4/23/1997	401920	740119
2936995	40	B	5/27/1997	401826	740119
2937878	120	G	11/14/1997	401853	740200
2938172	30	M	2/11/1998	401826	740226
2938340	100	G	3/18/1998	401920	740053
2938652	60	G	5/14/1998	401920	740119
2938811	60	G	6/15/1998	401906	740106
2939550	300	H	10/21/1998	401826	740226

Notes:

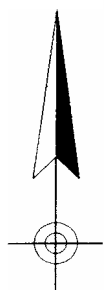
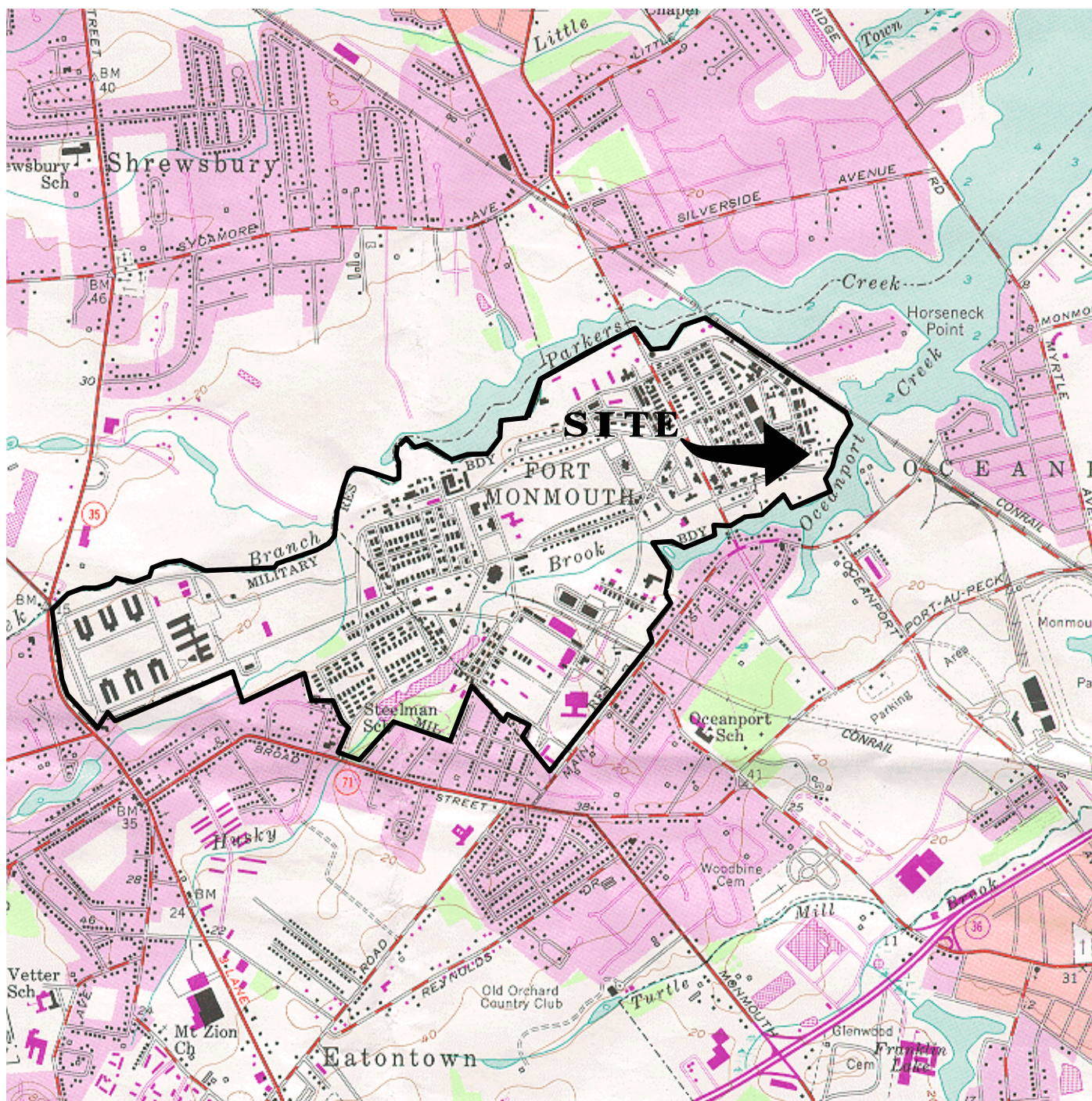
Source: State of New Jersey Department of Environmental Protection - Well Permitting and Regulations Section of the Bureau of Water Allocation, Trenton, NJ.
Search date: 6 August 2001.
Well search was performed for a 1-mile radius surrounding the center point of Site 80/166, U.S. Army Garrison Fort Monmouth, Fort Monmouth, New Jersey.

80/166 Location: latitude = North 40° 19' 03",
longitude = West 74° 01' 43".

***Well Use Codes**

A - Unknown/Well Record Use Only
B - Boring
C - Commercial
D - Domestic (Potable)
E - Recovery/Decontamination Pollution Control/Leachate with Pump Capacity
F - Fire
G - Irrigation
H - Heat Pump/Geothermal (Return Well)
I - Industrial
J - Injection
K - Inclinator
L - Livestock
M - Monitoring Well (Observation)
N - Public Non Community
O - Oil/Gas Exploration
P - Public Supply
Q - Recharge
R - Replacement (Replacement Codes: 1 - Domestic; 2 - Public Community, 5 - Irrigation)
S - Closed Loop
T - Test
U - Non Public (Supply)
V - Gas Vent
W - Dewatering
X - Agricultural/Horticultural/Irrigation Wells
Y - Cathodic Protection
Z - Piezometer

FIGURES



LONG BRANCH, N. J.

40073-C8-TF-024

1954

PHOTOREVISED 1981

DMA 6164 I SE-SERIES V822



QUADRANGLE LOCATION

Figure 2-1
Site Location Map
Site 80/166

Fort Monmouth, New Jersey

Versar INC.

201 Gibraltar Road, Suite 100
Horsham, PA 19044
(215) 957-0955

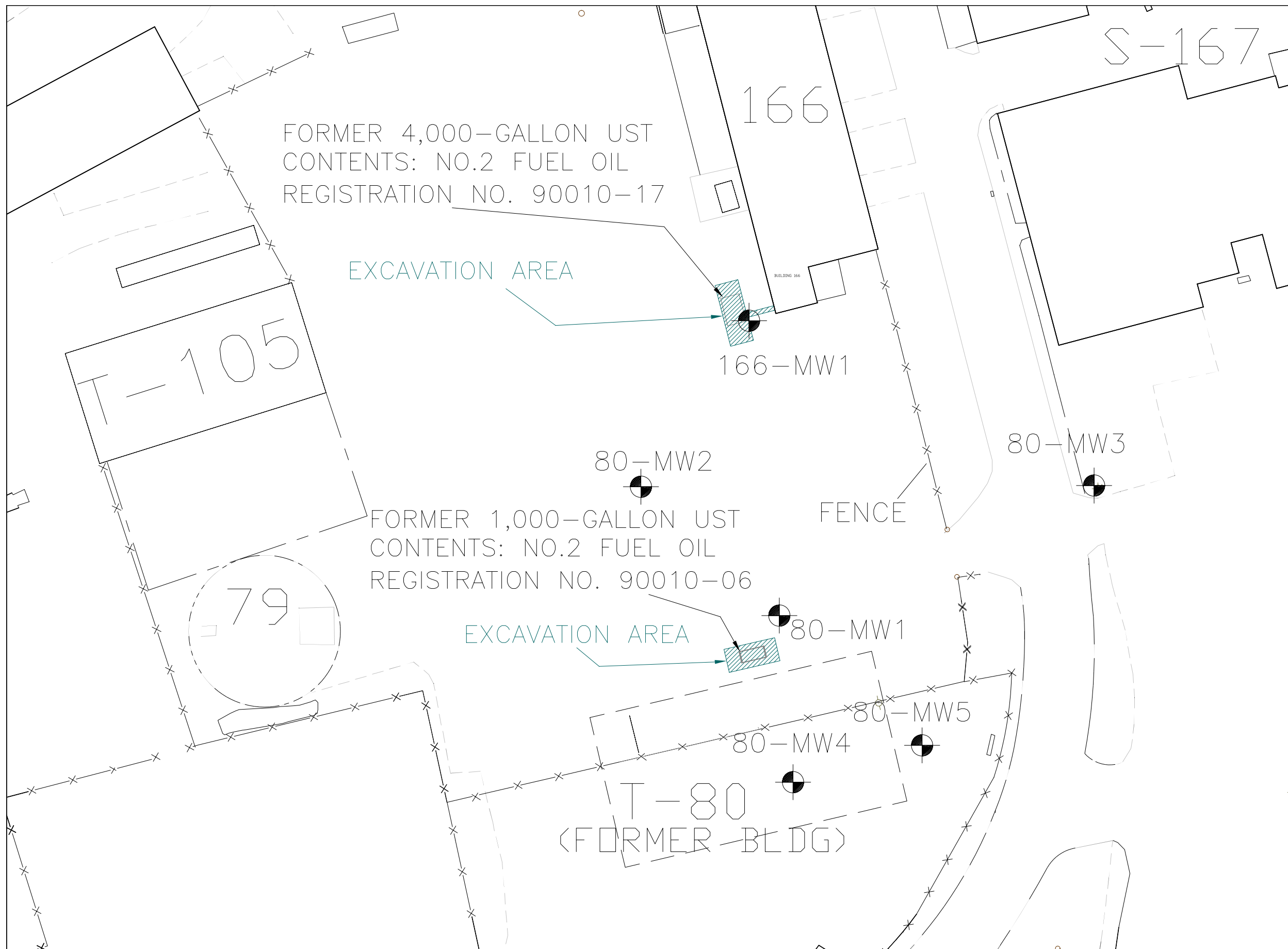


ROAD (PAVED)	ROAD/TRAILS (UNPAVED)	FENCE	BUILDING	APPROXIMATE BOUNDARY	BASE BOUNDARY	WOODED AREA	TREE/BUSH	LIGHT POLE	UTILITY POLE	BROOK/CREEK	MARSHY AREA

NOTES:

REV.	REVISIONS	APPROVED	DATE	DRAWN BY
TITLE: FIGURE 2-2 SITE LAYOUT SITE 80/166 - MAIN POST FORT MONMOUTH, NEW JERSEY				
DRAWN BY: PS		DATE DRAWN: 01 AUG 01		
CHECKED BY:		DATE CHECKED:		
APPROVED BY:		DATE APPROVED:		
DRAWING No.: FIG 2-2		FILE No.: FIG 2-2		
2558 PEARL BUCK ROAD, SUITE 1 BRISTOL, PA 19007 (215) 788-7844		SCALE: 1" = 60'		
SHEET		OF		REV.: A



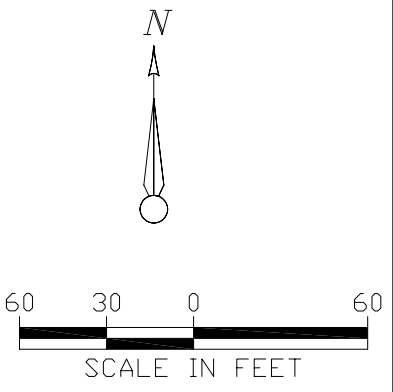
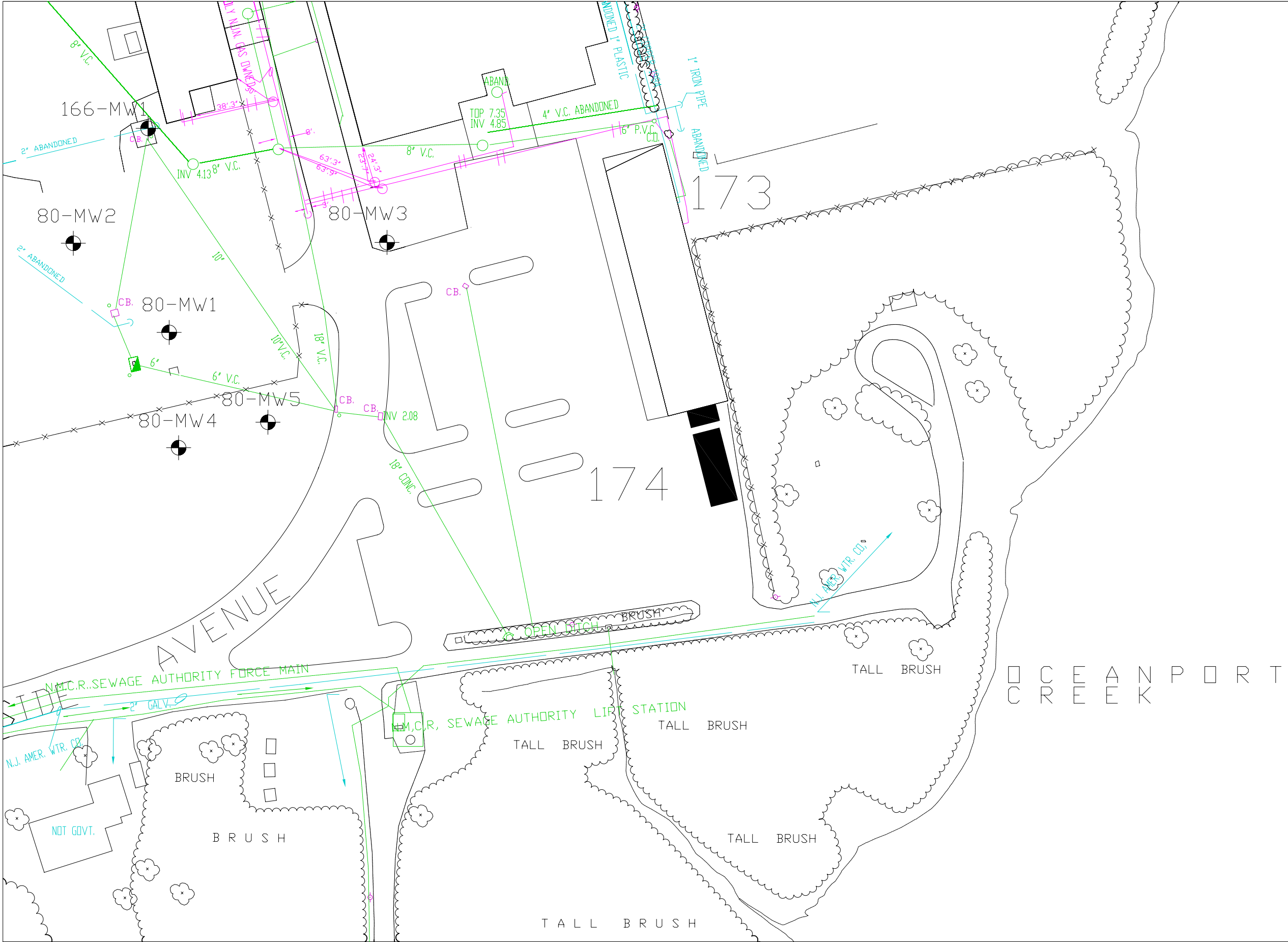


NOTES:

 = MONITORING WELL LOCATION



REV	REVISIONS	APPROVED	DATE	DRAWN BY
TITLE:				
FIGURE 2-4 FORMER UST LOCATION MAP SITE 80/166 - MAIN POST FORT MONMOUTH, NEW JERSEY				
DRAWN BY: TJK		DATE DRAWN: 29 AUG 01		
CHECKED BY:		DATE CHECKED:		
APPROVED BY:		DATE APPROVED:		
 2558 PEARL BUCK ROAD, SUITE 1 BRISTOL, PA 19007 (215) 788-7844		DRAWING No.: FIGURE 2-4		
		FILE No.: 80/166 FIGURE 2-4		
		SCALE: 1" = 10'		
SHEET 1 OF 1				REV.: A



- NOTES:
- BUILDING
 - ROAD/CURB
 - FENCE
 - MONITORING WELL
 - TREES/VEGETATION
 - SEWER
 - INVERT ELEVATION (FEET ABOVE MEAN SEA LEVEL)
 - VALVE
 - C.B. CATCH BASIN
 - GAS
 - WATER

REV.	REVISIONS	APPROVED	DATE	DRAWN BY
TITLE: FIGURE 2-5 UNDERGROUND UTILITY LOCATION MAP SITE 80/166 - MAIN POST FORT MONMOUTH, NEW JERSEY				
DRAWN BY: TJK		DATE DRAWN: 11 DEC 01		
CHECKED BY:		DATE CHECKED:		
APPROVED BY:		DATE APPROVED:		
DRAWING No: FIGURE 2-5		FILE No: 80-166 FIGURE 2-5		
2558 PEARL BUICK ROAD, SUITE 1 BRISTOL, PA 19007 (215) 788-7844		SCALE: 1" = 60'		
SHEET 1 OF 1		REV: A		

Geologic Map of New Jersey

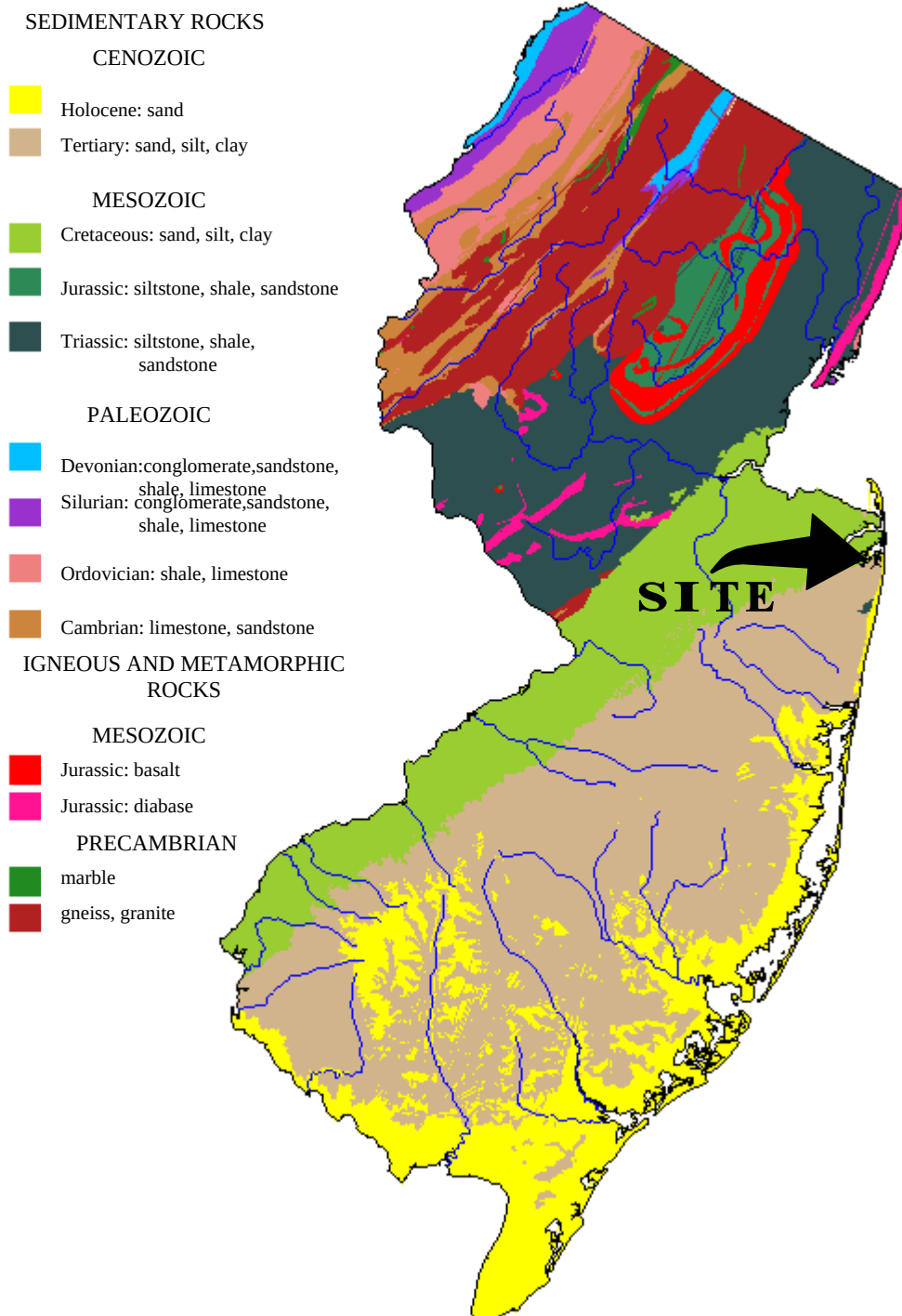


FIGURE 2-6
Geologic Map of New Jersey
Site 80/166
Fort Monmouth, New Jersey

Versar INC.

2558 Pearl Buck Road, Suite 1
Bristol, Pennsylvania, 19007
(215)-788-7844

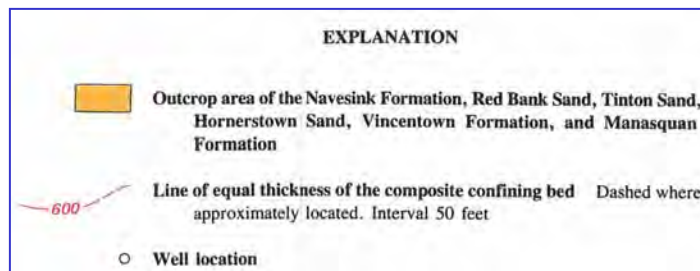
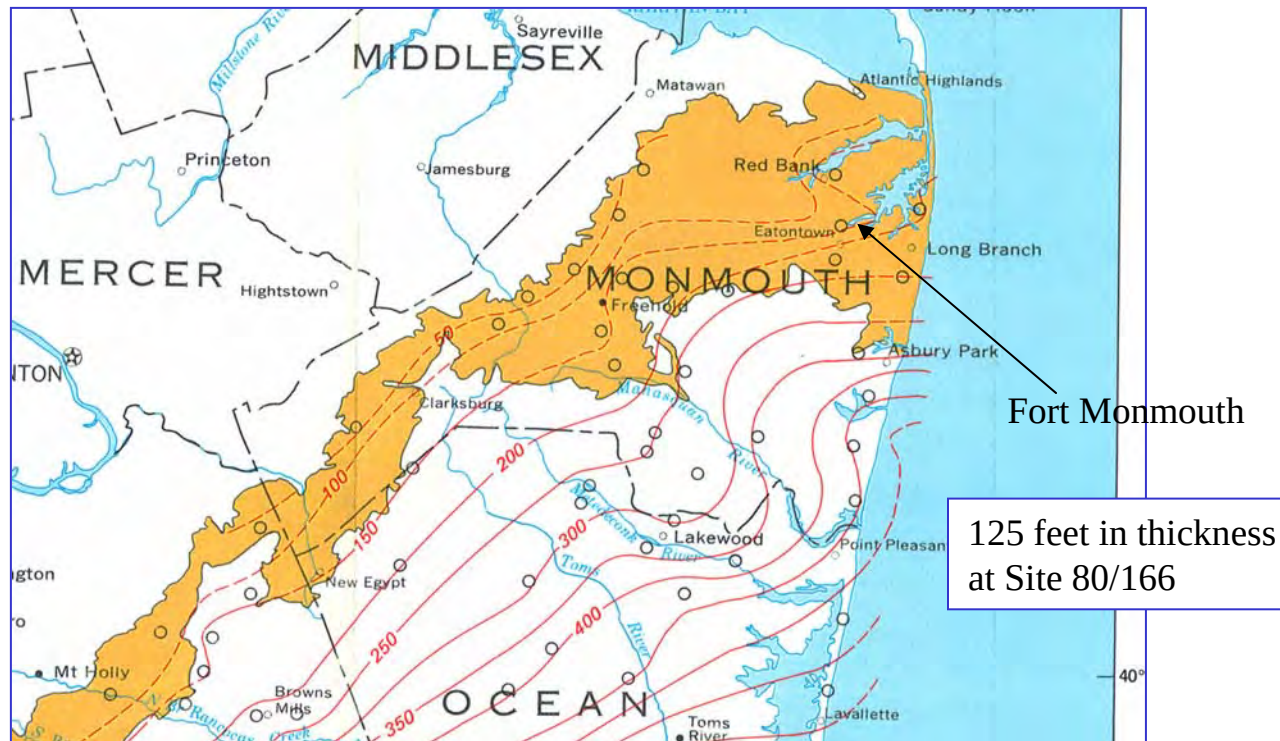


FIGURE 2-7

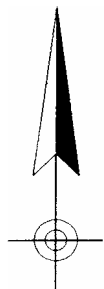
**Outcrop and Thickness of
Composite Confining Unit
Site 80/166**

Fort Monmouth, New Jersey

Versar INC.

2558 Pearl Buck Road, Suite 1
Bristol, PA 19007
(215) 788-7844

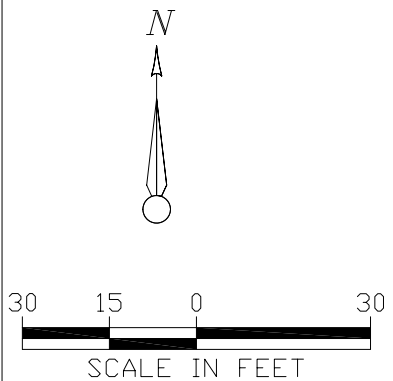
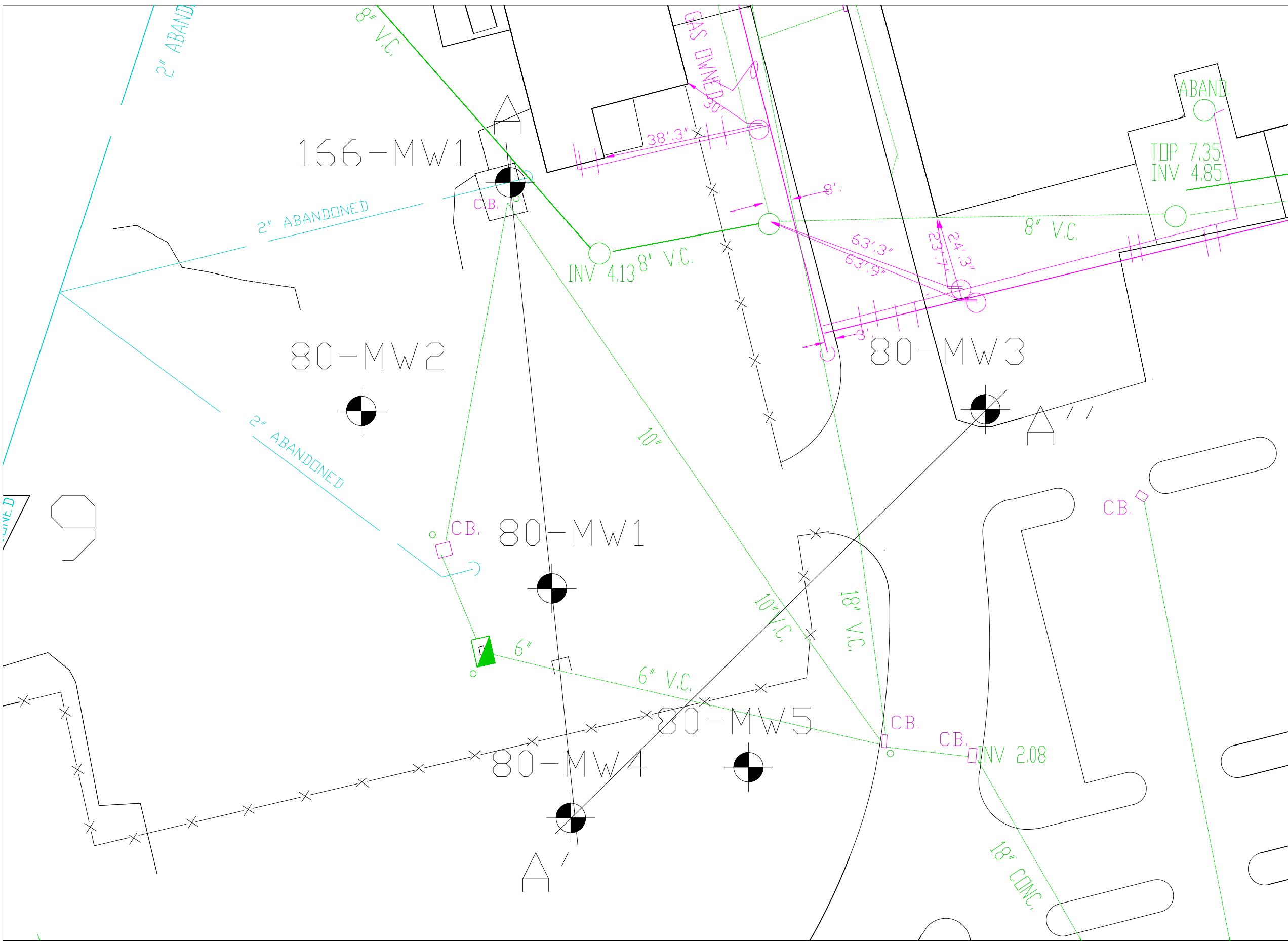
Source: Zapecza, O. 1989. *Hydrogeologic Framework of the New Jersey Coastal Plain*.
USGS Professional Paper 1404-B. U.S. Government Printing Office, Washington, DC.



US Department of Agriculture
Soil Conservation Service
Soil Survey of Monmouth County, NJ
April 1989

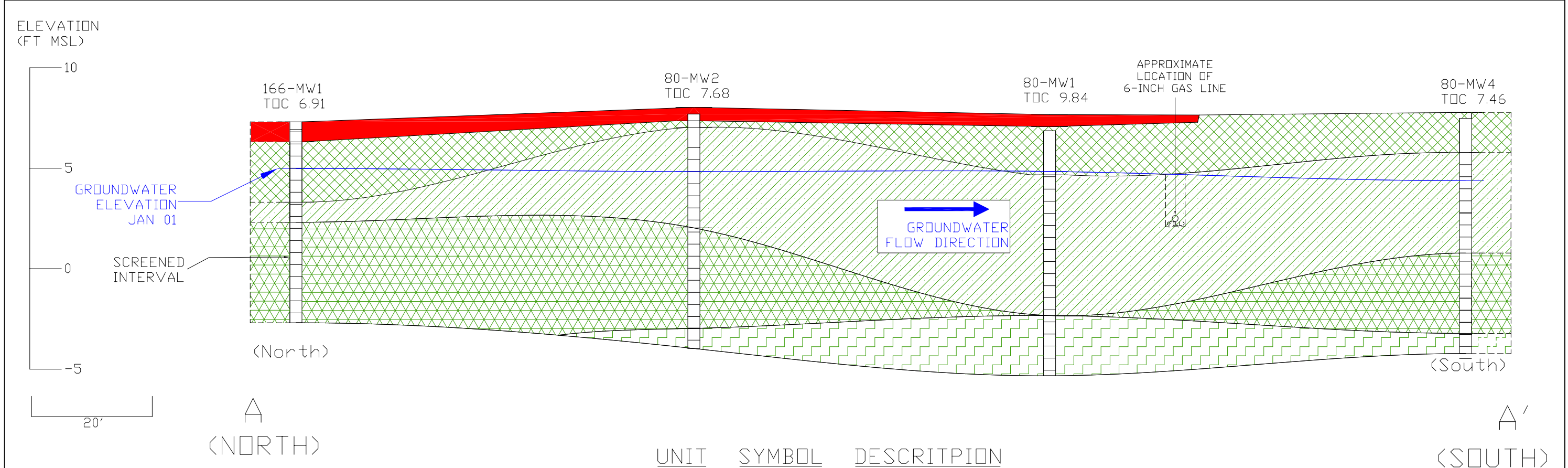
Figure 2-8
Soil Map of Monmouth County
Site 80/166
Fort Monmouth, New Jersey

Versar INC. 201 Gibraltar Road, Suite 100
Horsham, PA 19044
(215) 957-0955



- NOTES:
- BUILDING
 - ROAD/CURB
 - FENCE
 - MONITORING WELL
 - TREES/VEGETATION
 - SEWER
 - INVERT ELEVATION
(FEET ABOVE MEAN SEA LEVEL)
 - VALVE
 - CATCH BASIN
 - GAS
 - WATER

REV.	REVISIONS	APPROVED	DATE	DRAWN BY
TITLE: FIGURE 4-1 GEOLOGIC CROSS SECTION LOCATION MAP SITE 80/166 - MAIN POST FORT MONMOUTH, NEW JERSEY				
DRAWN BY: TJK		DATE DRAWN: 11 DEC 01		
CHECKED BY:		DATE CHECKED:		
APPROVED BY:		DATE APPROVED:		
DRAWING No: FIGURE 4-1		FILE No: 80-166 FIGURE 4-1		
2558 PEARL BUCK ROAD, SUITE 1 BRISTOL, PA 19007 (215) 788-7844		SCALE: 1" = 30'		
SHEET 1 OF 1		REV: A		



NOTES:

1) CROSS SECTION LINE (A TO A') IS SHOWN ON FIGURE 4-1.

2) VERTICAL SCALE: 1" = 6'.
HORIZONTAL SCALE: 1" = 20'.
VERTICAL EXAGGERATION = 3.33.

3) ELEV. = ELEVATION OF INNER WELL CASING SURVEY MARK (FEET ABOVE MEANSEA LEVEL).

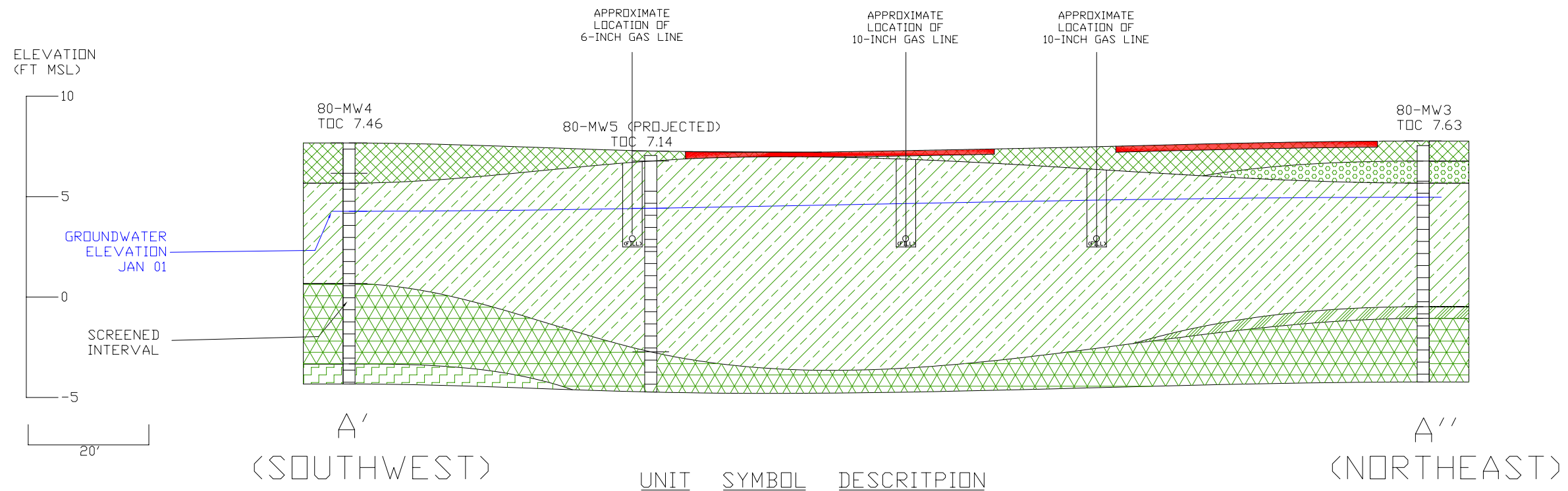
4) EACH OF THE WELLS HAS A DIAMETER OF 4 INCHES, WHICH IS ENLARGED ON THIS DRAWING FOR PRESENTATION.

5) BOUNDARIES ARE DASHED WHERE INFERRED.

UNIT	SYMBOL	DESCRITPION
(1)		ASPHALT AND BASE STONE
TINTON SAND FORMATION / FILL		
(2)		BROWN TO BLACK FINE-MEDIUM SAND AND SILT (FILL?)
(3)		OLIVE GREEN TO GRAY CLAY, FINE SAND AND SILT
(4)		LIGHT BROWN AND ORANGE CLAY WITH FINE SAND AND SILT
(5)		YELLOWISH ORANGE FINE MEDIUM SAND
(6)		FINE SAND WITH SMALL-LARGE SUBROUNDED TO ROUNDED QUARTZ GRAVEL
(7)		BROWN FINE-COARSE SAND WITH SMALL-MEDIUM SUBROUNDED QUARTZ GRAVEL
(8)		GRAY CLAY INTERBEDDED WITH ORANGE FINE-MEDIUM SAND

REV.	REVISIONS	APPROVED	DRAWN BY
TITLE: FIGURE 4-2 GEOLOGIC CROSS SECTION A-A' SITE 80/166 - MAIN POST FORT MONMOUTH, NEW JERSEY			
DRAWN BY: JRA		DATE DRAWN: 27 NOV 01	
CHECKED BY:		DATE CHECKED:	
APPROVED BY:		DATE APPROVED:	
 2558 PEARL BUCK ROAD, SUITE 1 BRISTOL, PA 19007 (215) 788-7844		DRAWING No: FIGURE 4-2	
		FILE No: 80-166 FIG. 4-2	
		SCALE: 1" = 20' (VERT: 1"=6')	
		SHEET 1 OF 1	
		REV:	A

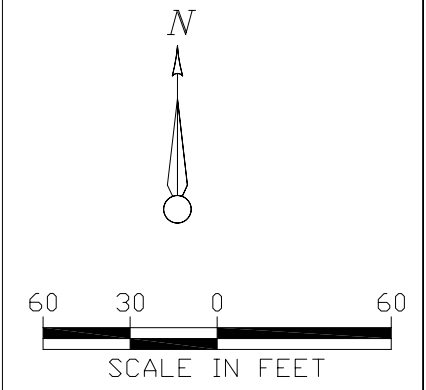
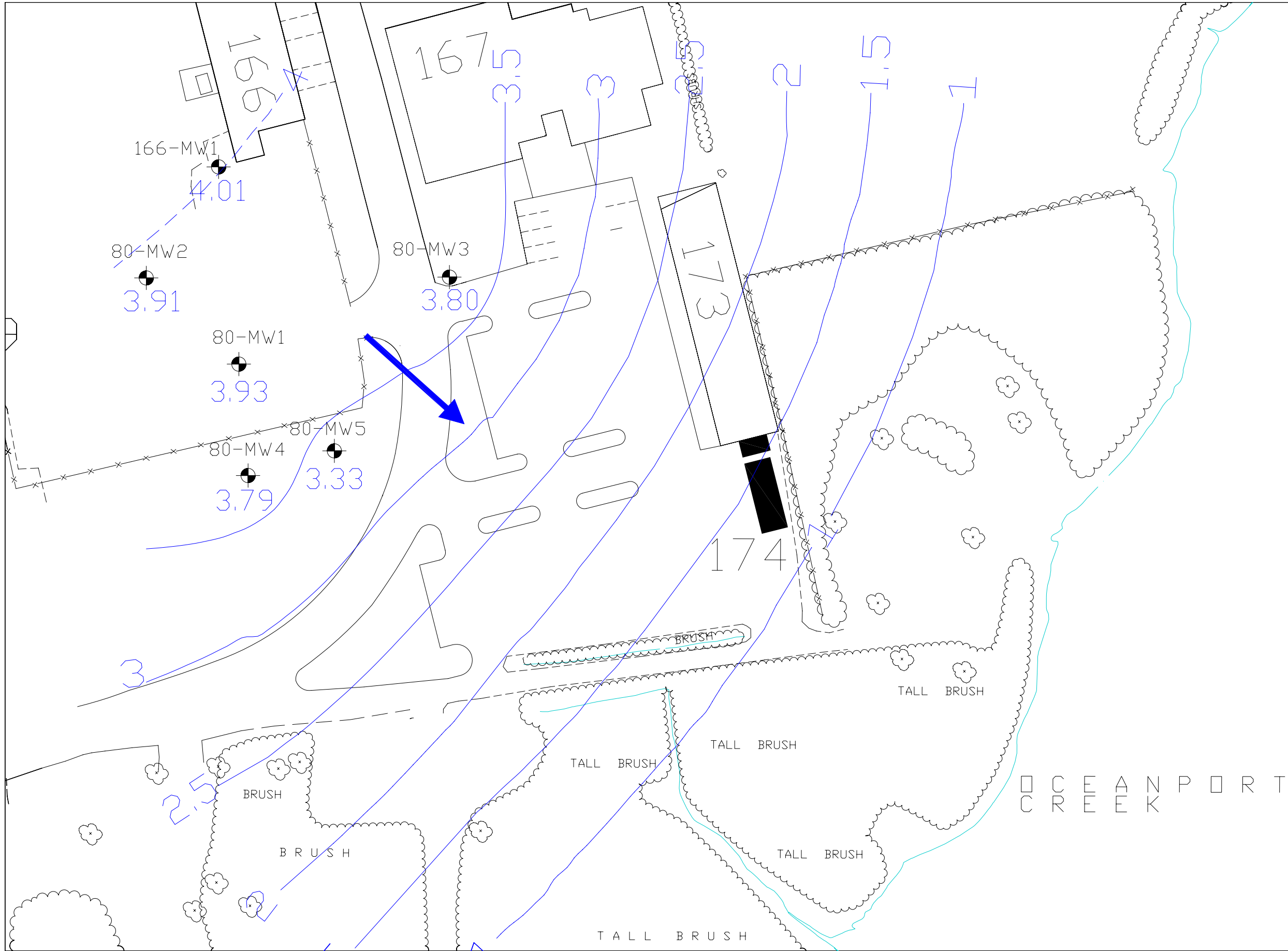
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BRISTOL, PA 19007
(215) 788-7844



NOTES:

- CROSS SECTION LINE (A' TO A'') IS SHOWN ON FIGURE 4-1.
- VERTICAL SCALE: 1" = 6'.
HORIZONTAL SCALE: 1" = 20'.
VERTICAL EXAGGERATION = 3.33.
- ELEV. = ELEVATION OF INNER WELL CASING SURVEY MARK (FEET ABOVE MEANSEA LEVEL).
- EACH OF THE WELLS HAS A DIAMETER OF 4 INCHES, WHICH IS ENLARGED ON THIS DRAWING FOR PRESENTATION.
- BOUNDARIES ARE DASHED WHERE INFERRED.

REV.	REVISIONS	APPROVED	DRAWN BY
TITLE:			
FIGURE 4-3 GEOLOGIC CROSS SECTION A'-A'' SITE 80/166 - MAIN POST FORT MONMOUTH, NEW JERSEY			
DRAWN BY: JRA		DATE DRAWN: 10 AUG 01	
CHECKED BY:		DATE CHECKED:	
APPROVED BY:		DATE APPROVED:	
DRAWING No: FIGURE 4-3		FILE No: 80-166 FIG. 4-3	
2558 PEARL BUCK ROAD, SUITE 1 BRISTOL, PA 19007 (215) 788-7844		SCALE: 1" = 20' (VERT:1"=6')	
SHEET 1 OF 1		REV: A	



- NOTES:
- BUILDING
 - ROAD/CURB
 - RAILROAD
 - BROOK/CREEK
 - MARSHY AREA
 - WOODED AREA
 - MONITORING WELL
 - GROUNDWATER ELEVATION IN FEET ABOVE MEAN SEA LEVEL
 - GROUNDWATER ELEVATION CONTOUR (DASHED WHERE INFERRED)
 - APPROXIMATE GROUNDWATER FLOW DIRECTION
- ELEVATION OF OCEANPORT CREEK IS ZERO FEET ABOVE MEAN SEA LEVEL

REV.	REVISIONS	APPROVED	DATE	DRAWN BY
TITLE: FIGURE 4-4b GROUNDWATER COUNTOUR MAP (27 OCT 00) SITE 80/166 - MAIN POST FORT MONMOUTH, NEW JERSEY				
DRAWN BY: TJK		DATE DRAWN: 29 AUG 01		
CHECKED BY:		DATE CHECKED:		
APPROVED BY:		DATE APPROVED:		
Versar inc. 2558 PEARL BUCK ROAD, SUITE 1 BRISTOL, PA 19007 (215) 788-7844		DRAWING No.: FIGURE 4-4b		
		FILE No.: 108 FIGURE 4-4b		
		SCALE: 1" = 60'		
SHEET 1 OF 1				REV: A



CONTAMINANT OF CONCERN	NJDEP CRITERIA (ug/L)	8/16/00	8/30/00	10/27/00	1/24/01	9/6/00	10/12/00
a- Chlordane	0.5	0.197	0.025	ND	0.025	ND	ND
g- Chlordane	0.5	ND	0.083	ND	2.919	ND	2.919
Arsenic	8	ND	ND	ND	2.64	0.04	ND
Lead	1.0	ND	ND	ND	ND	ND	11.2

CONTAMINANT OF CONCERN	NJDEP CRITERIA (ug/L)	4/16/97	8/28/97	11/24/97	2/27/98	6/2/98	8/24/98	11/28/98	2/9/99	5/26/99	9/22/99	12/17/99	3/6/00	5/9/00	8/16/00	10/27/00	1/24/01	9/7/00	10/12/00
a- Chlordane	0.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NS
g- Chlordane	0.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NS
Arsenic	8	NS	5	ND	24	11.1	41.5	34.1	8.4	24	13.0	6.56	17.9	17.3	28.0	16.8	32.4	ND	NS
Lead	1.0	1.0	7.0	1	8	3.3	2.8	ND	5.31	11.1	ND	3.57	ND	3.63	11.6	1.87	ND	ND	ND

CONTAMINANT OF CONCERN	NJDEP CRITERIA (ug/L)	8/16/00	8/30/00	10/27/00	1/24/01	9/6/00	10/12/00
a- Chlordane	0.5	ND	ND	ND	ND	ND	ND
g- Chlordane	0.5	ND	ND	ND	ND	ND	ND
Arsenic	8	6.28	5.84	5.3	4.18	4.93	8
Lead	1.0	ND	ND	ND	ND	ND	ND

CONTAMINANT OF CONCERN	NJDEP CRITERIA (ug/L)	8/16/00	8/30/00	10/27/00	1/24/01	9/6/00	10/12/00
a- Chlordane	0.5	ND	ND	ND	ND	ND	ND
g- Chlordane	0.5	ND	ND	ND	ND	ND	ND
Arsenic	8	11.3	71.6	4.42	5.85	10.7	7.86
Lead	1.0	ND	ND	ND	ND	ND	ND

CONTAMINANT OF CONCERN	NJDEP CRITERIA (ug/L)	8/16/00	8/30/00	10/27/00	1/24/01	9/6/00	10/12/00
a- Chlordane	0.5	ND	ND	ND	ND	ND	ND
g- Chlordane	0.5	ND	ND	ND	ND	ND	ND
Arsenic	8	3.38	7.86	7.27	2.28	ND	ND
Lead	1.0	ND	ND	ND	ND	ND	ND

CONTAMINANT OF CONCERN	NJDEP CRITERIA (ug/L)	4/16/97	8/28/97	11/24/97	2/27/98	6/2/98	8/24/98	11/28/98	2/9/99	5/26/99	9/22/99	12/17/99	3/6/00	5/9/00	8/16/00	10/27/00	1/24/01	9/7/00	10/12/00
a- Chlordane	0.5	ND	ND	ND	ND	0.027	0.052	ND	ND	ND	0.048	ND	ND	ND	ND	0.038	0.05	ND	ND
g- Chlordane	0.5	ND	ND	ND	ND	0.022	0.05	ND	ND	ND	0.049	ND	ND	ND	ND	0.024	0.06	ND	ND
Arsenic	8	NS	4	23	ND	2.3	3.21	ND	ND	4.57	ND	ND	2.83	ND	ND	5.67	4.83	ND	31.9
Lead	1.0	1.0	1.4	ND	ND	ND	4.73	ND	ND	7.35	ND	1.01	ND	ND	5.13	ND	1.73	ND	ND

ROAD (PAVED)	=====	WOODED AREA	=====
ROAD/TRAILS (UNPAVED)	-----	TREE/BUSH	=====
FENCE	-----	LIGHT POLE	=====
BUILDING	=====	UTILITY POLE	=====
APPROXIMATE BOUNDARY	=====	BROOK/CREEK	=====
BASE BOUNDARY	=====	MARSHY AREA	=====

NOTES:

1.) ALL CONCENTRATIONS ARE GIVEN IN MICROGRAMS PER LITER (ug/L), EQUIVALENT TO PARTS PER BILLION (PPB).

2.) NJDEP CLEANUP CRITERIA: HIGHER OF PRACTICAL QUANTITION LIMITS (PQLs) AND GROUNDWATER QUALITY STANDARDS (GWQS) PER NJAC 7:9-6.

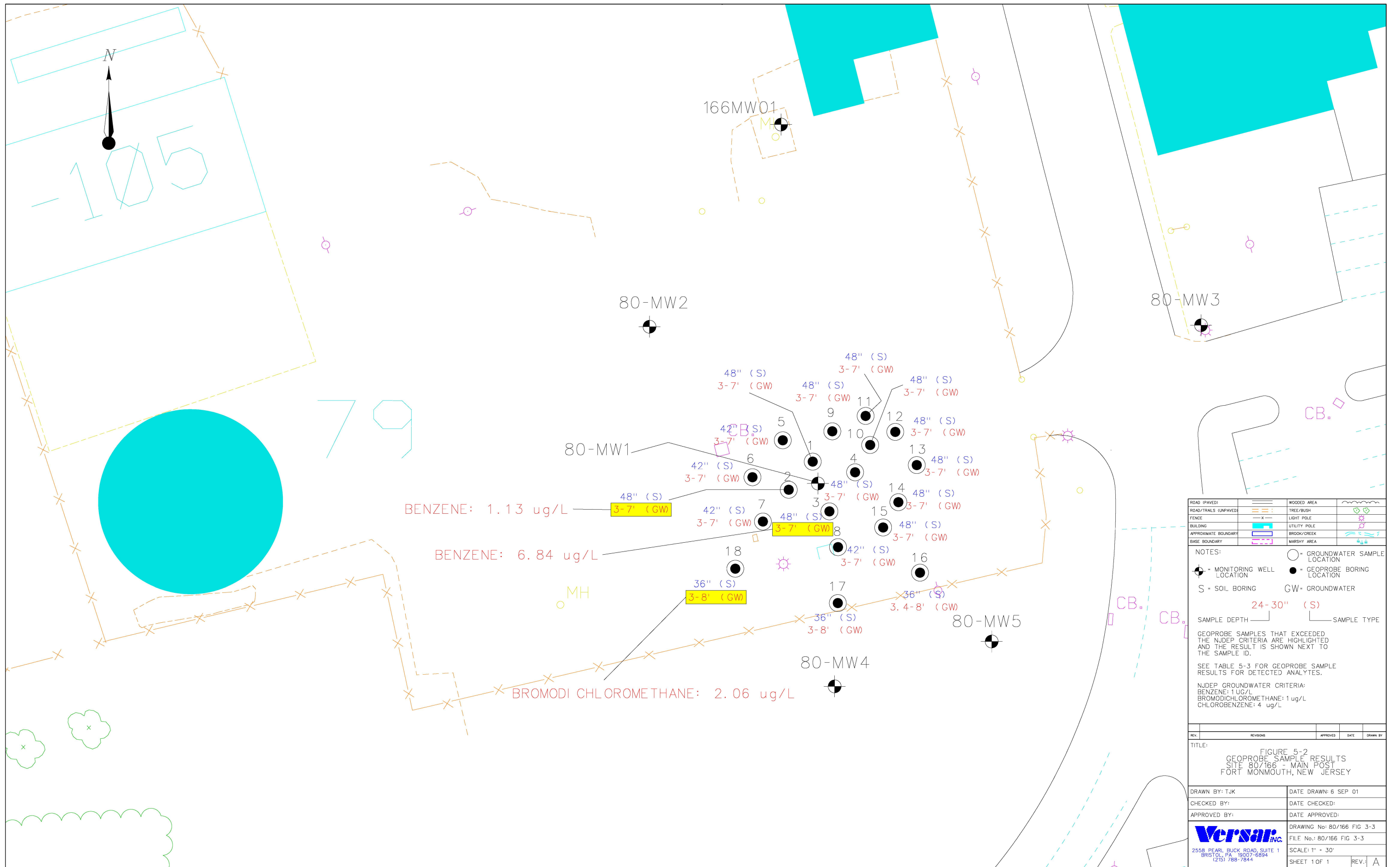
3.) EXCEEDANCES OF THE NJDEP CLEANUP CRITERIA ARE HIGHLIGHTED AND PRINTED IN BOLD-FACED TYPE.

4.) ND: ANALYTE NOT DETECTED IN SAMPLE.

5.) SAMPLES COLLECTED USING LOW-FLOW SAMPLING ARE SHOWN IN GREEN TYPEFACE.

6.) NS: NOT SAMPLED.

REV.	REVISIONS	APPROVED	DATE	DRAWN BY
TITLE: FIGURE 5-1 GROUNDWATER CONTAMINANT DISTRIBUTION SITE 80/166 - MAIN POST FORT MONMOUTH, NEW JERSEY				
DRAWN BY: JMM		DATE DRAWN: 25 AUG 01		
CHECKED BY: TJK		DATE CHECKED: 27 AUG 01		
APPROVED BY:		DATE APPROVED:		
DRAWING No.: 80-166 FIG 5-1		FILE No.: 80-166 FIG 5-1		
201 GIBRALTAR ROAD, SUITE 100 HORSHAM, PA 19044 (215) 987-8155		SCALE: 1" = 20'		
SHEET		OF	REV.	A



Fort Monmouth

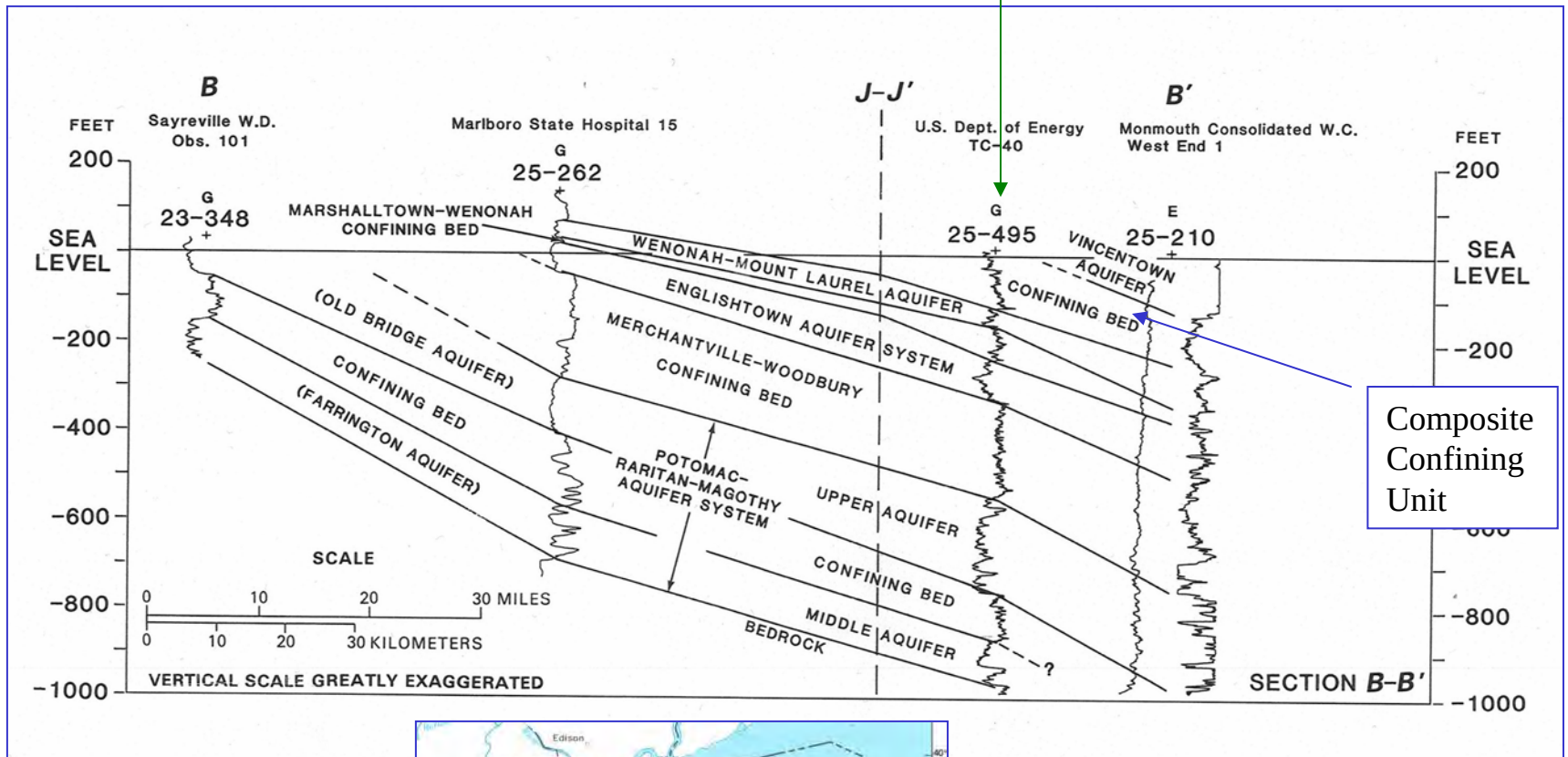


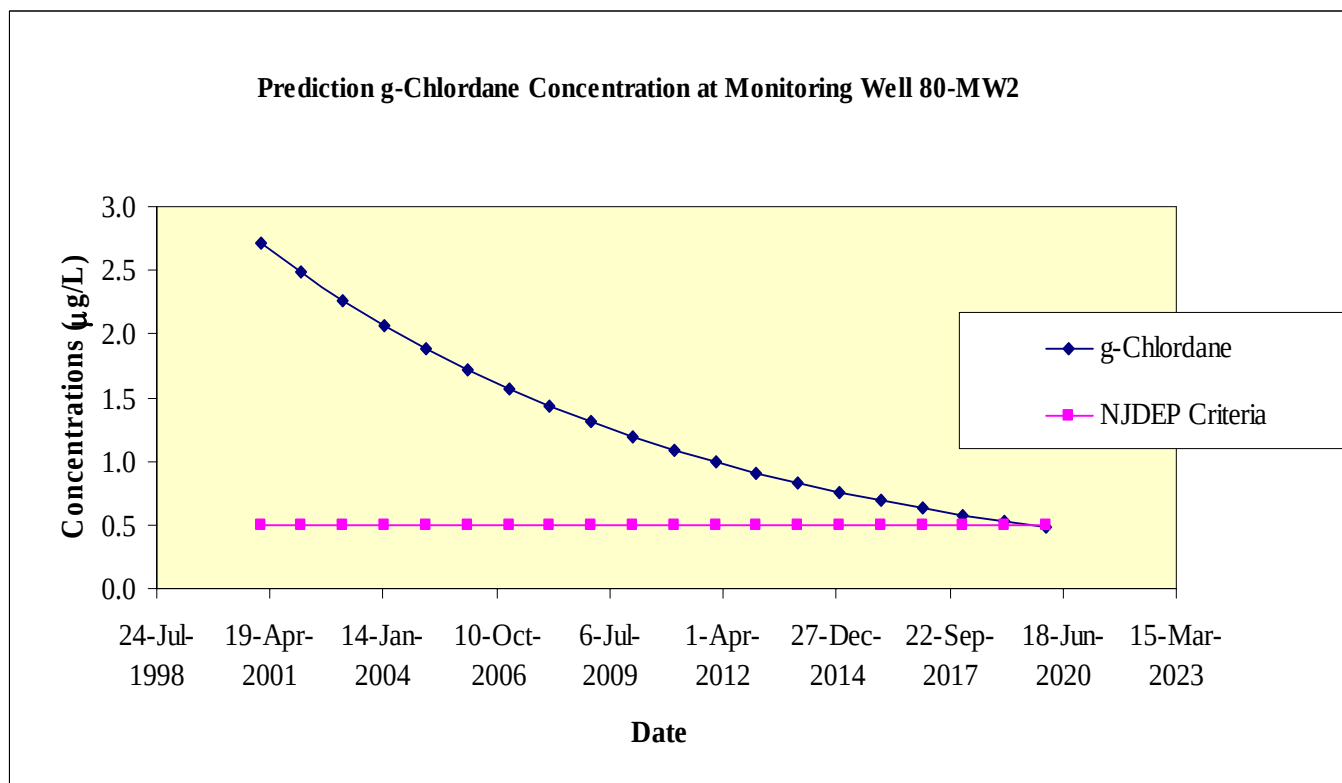
FIGURE 6-1

Geologic Cross-Section B-B'
Site 80/166 – Main Post
Fort Monmouth, New Jersey

Source: Zapecza, O. 1989. *Hydrogeologic Framework of the New Jersey Coastal Plain*.
 USGS Professional Paper 1404-B. U.S. Government Printing Office, Washington, DC.

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Notes:

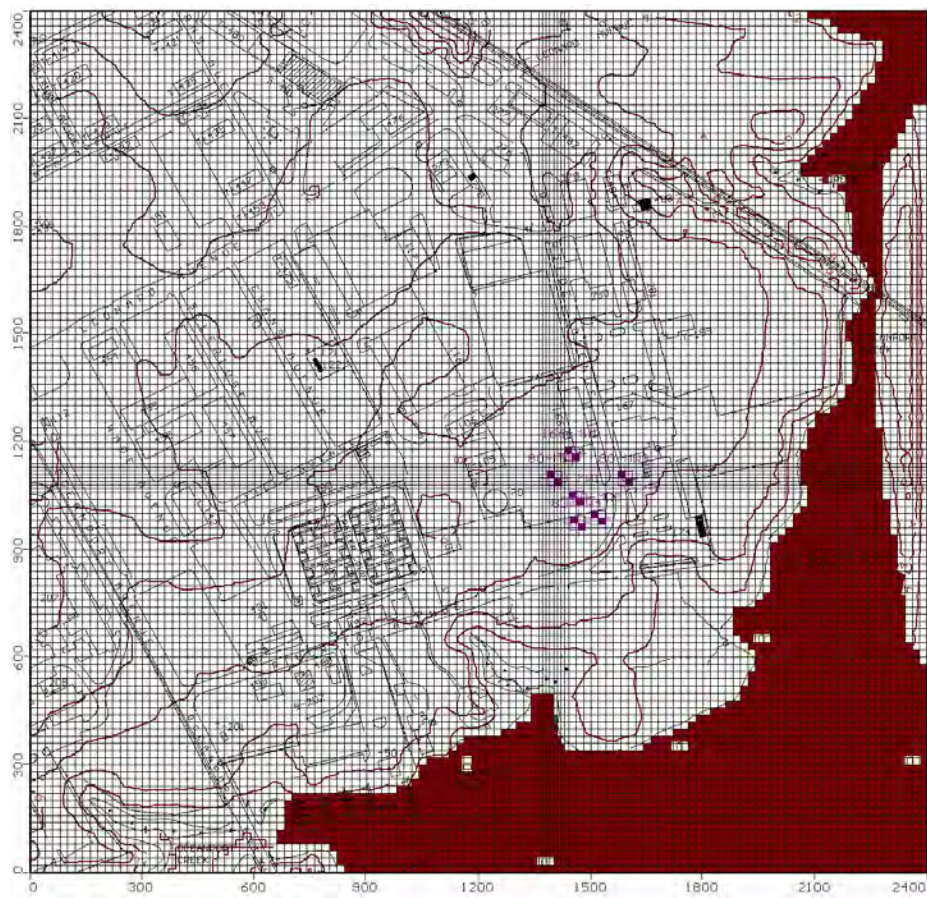
- 1) Concentration is shown in micrograms per liter (ug/L), equivalent to parts per billion
- 2) Initial g-chlordane concentration at well 80-MW2 was considered to be 2.719 ug/L on January 24, 2001.
- 3) Estimated time for NJDEP compliance with the NJDEP groundwater quality criteria of 0.5 ug/L is 19 years.
- 4) Prediction was made using the biodegradation half-life of 7.6 years for chlordane (Howard, 1991). This prediction does not include the effects of dilution due to dispersion, which was simulated using MODFLOW.

FIGURE 6-2

**Predicted g-Chlordane
Concentration at 80-MW2
Site 80/166 – Main Post
Fort Monmouth, New Jersey**

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Notes:

- 1) Grid size is 20' by 20' in most of model area, 10' x 10' in vicinity of Site 80/166.
- 2) Monitoring wells at Site 80/166 are shown in purple.
- 3) Topographic contours for the ground surface are shown as brown lines. The contour interval is 1 foot.
- 3) Oceanport Creek shown in solid brown, represents river boundary with constant head of zero feet (mean sea level).
- 4) Coordinates shown represent NAD-83 survey feet.

FIGURE 6-3

**MODFLOW Boundaries and Grid
Site 80/166 – Main Post
Fort Monmouth, New Jersey**

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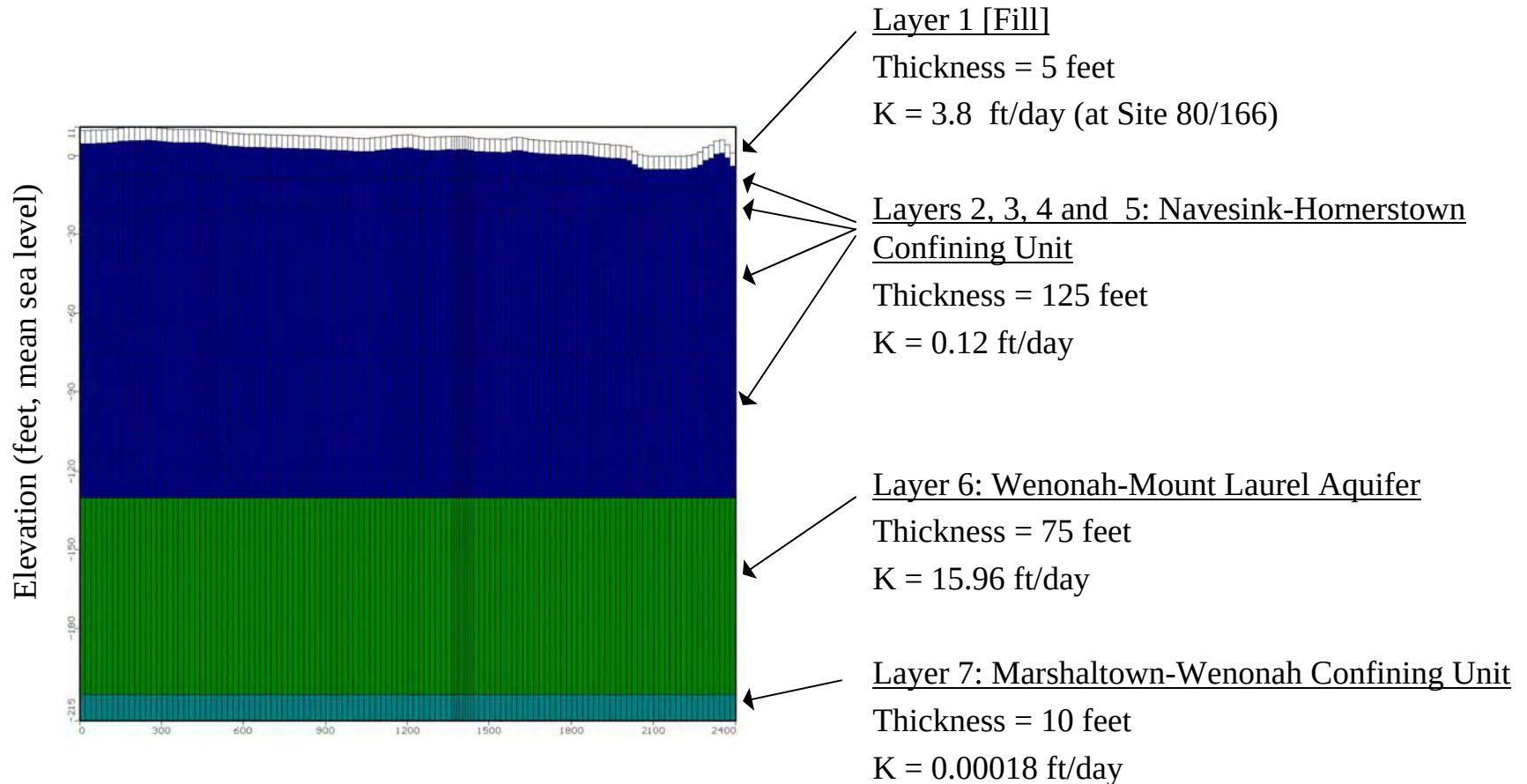
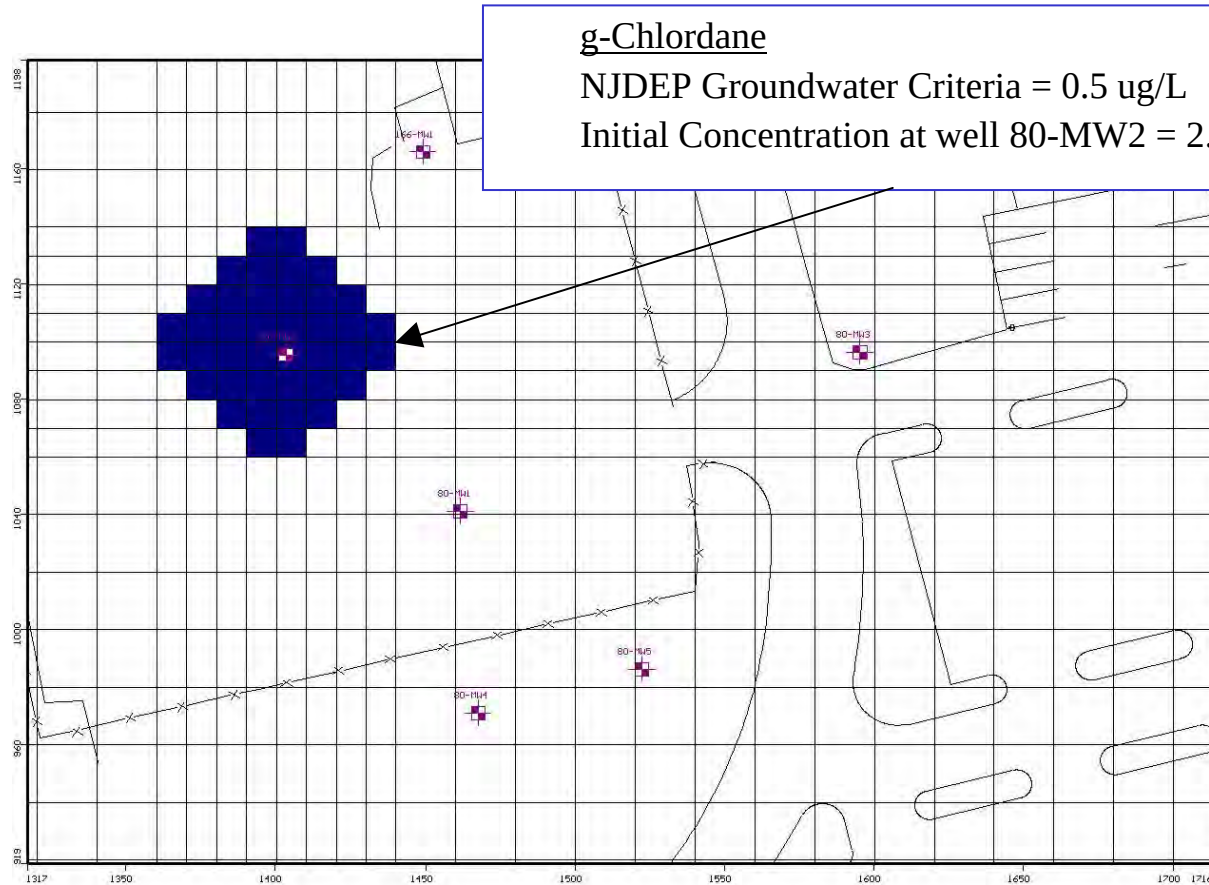


FIGURE 6-4

**Cross Section of MODFLOW Area
 Site 80/166 – Main Post
 Fort Monmouth, New Jersey**

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Notes:

- 1) Initial Concentrations based on most recent g-chlordane detection in well 80-MW2
 See Table 5-1 for groundwater sampling results for Site 80/166.
- 2) The NJDEP groundwater quality criteria for g-chlordane is 0.5 ug/L.
- 3) Monitoring wells for Site 80/166 are shown in purple.
- 4) Coordinates shown represent NAD-83 survey feet.

FIGURE 6-5a

Initial MODFLOW Concentration
g-Chlordane
Site 80/166 – Main Post
Fort Monmouth, New Jersey

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Notes:

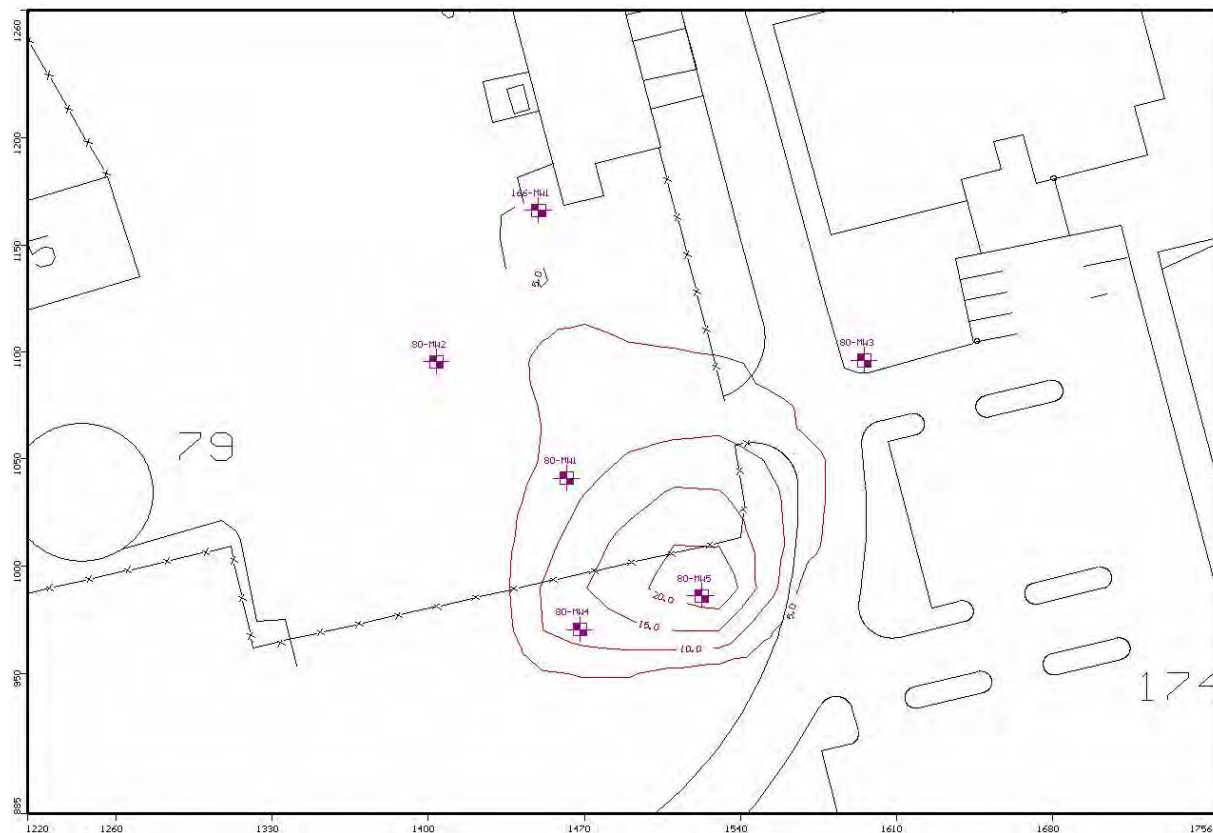
- 1) Isoconcentration lines represent initial concentrations of arsenic in groundwater as used in the MODFLOW simulation. Contour Interval = 2 ug/L.
- 2) The NJDEP groundwater quality criteria for arsenic is 8 ug/L.
- 3) Monitoring wells for Site 80/166 are shown in purple.
- 4) Initial Concentrations based on averaged concentrations from groundwater sampling program. See Table 6-2 for averaged groundwater sampling results.
- 5) Coordinates shown represent NAD-83 survey feet.

FIGURE 6-5b

**Initial Concentration of Arsenic
In MODFLOW Simulation
Site 80/166 – Main Post
Fort Monmouth, New Jersey**

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Notes:

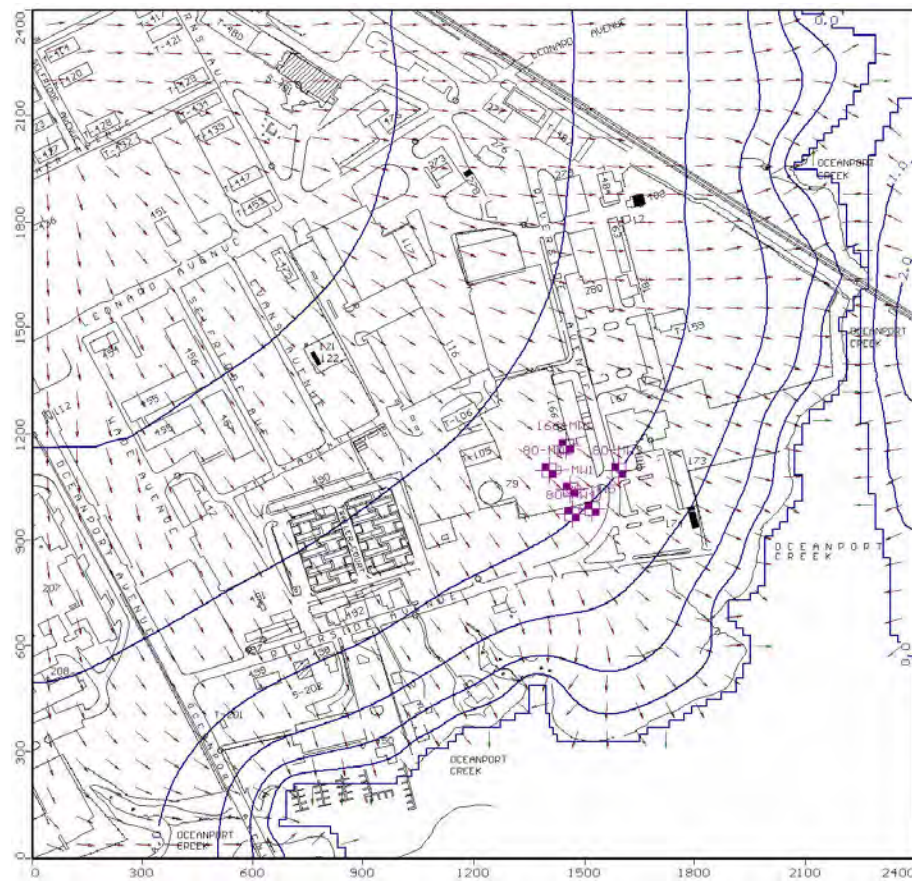
- 1) Isoconcentration lines represent initial concentrations of lead in groundwater as used in the MODFLOW simulation. Contour Interval = 5 ug/L.
- 2) The NJDEP groundwater quality criteria for lead is 10 ug/L.
- 3) Monitoring wells for Site 80/166 are shown in purple.
- 4) Initial Concentrations based on averaged concentrations from groundwater sampling program. See Table 6-2 for averaged groundwater sampling results.
- 5) Coordinates shown represent NAD-83 survey feet.

FIGURE 6-5c

**Initial Concentration of Lead
In MODFLOW Simulation
Site 80/166 – Main Post
Fort Monmouth, New Jersey**

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Notes:

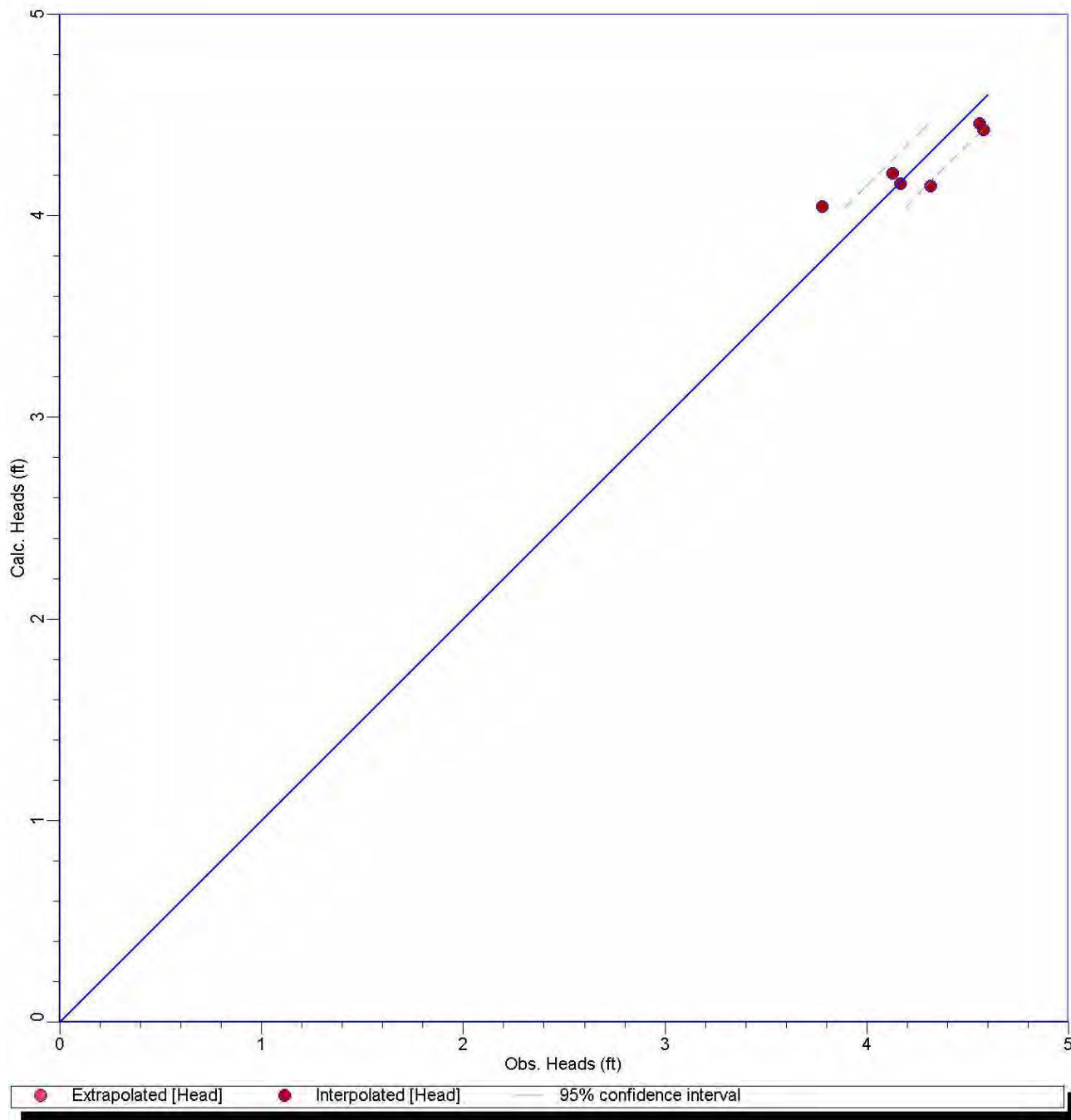
- 1) Arrows indicate groundwater flow direction.
- 2) Monitoring wells for Site 80/166 are shown in purple.
- 3) Contour Lines indicate groundwater elevation contours. Contour Interval = 1 ft.
- 4) Coordinates shown represent NAD-83 survey feet.
- 5) Modeling Software: *Visual MODFLOW Version 2.8.2*, Waterloo Hydrogeologic, Inc., 2000

FIGURE 6-6

Flow Directions and Groundwater Elevation Contours Site 80/166 – Main Post Fort Monmouth, New Jersey

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Notes:

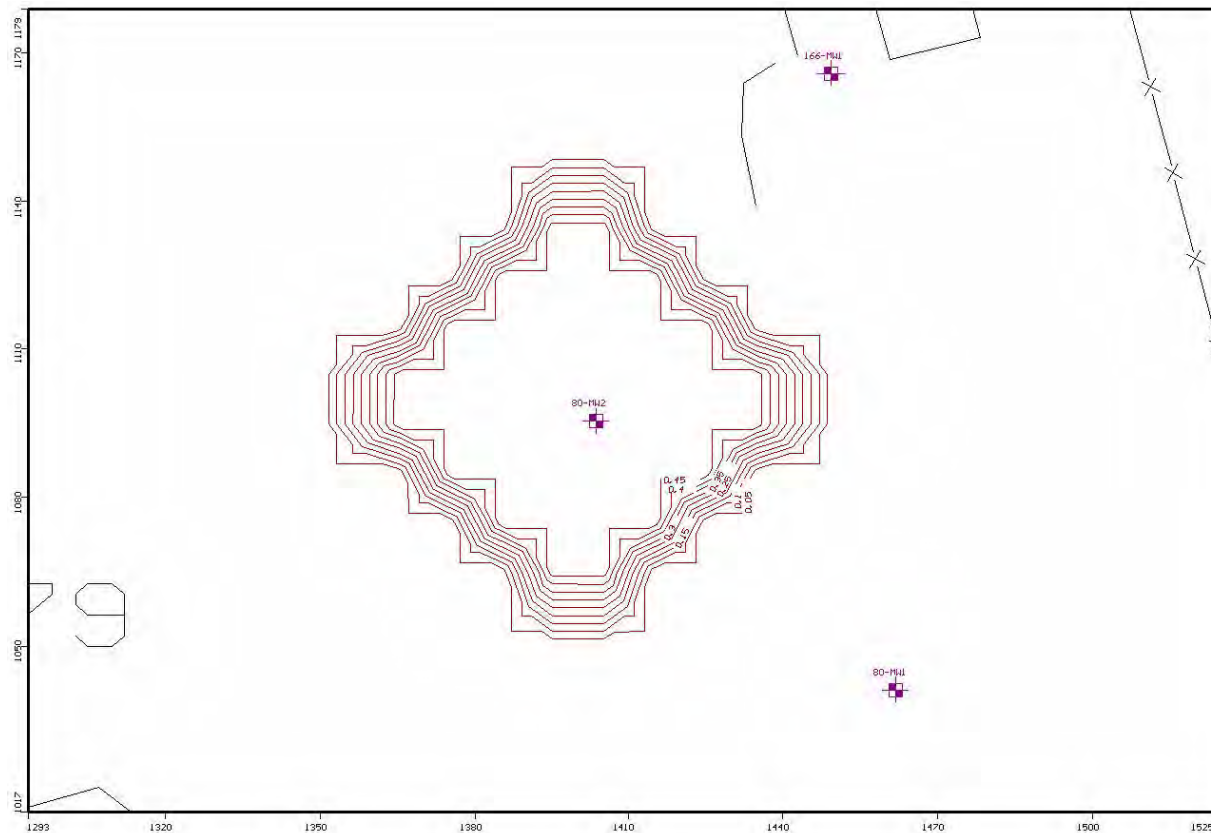
- 1) This graph represents a comparison between heads calculated in the model with heads observed in monitoring wells at Site 80/166 on January 24, 2001.
- 2) Modeling Software: *Visual MODFLOW Version 2.7.2*, Waterloo Hydrogeologic, Inc., 2000.

FIGURE 6-7

**MODFLOW Calibration:
Calculated Versus Observed Head
Site 80/166 – Main Post
Fort Monmouth, New Jersey**

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Notes:

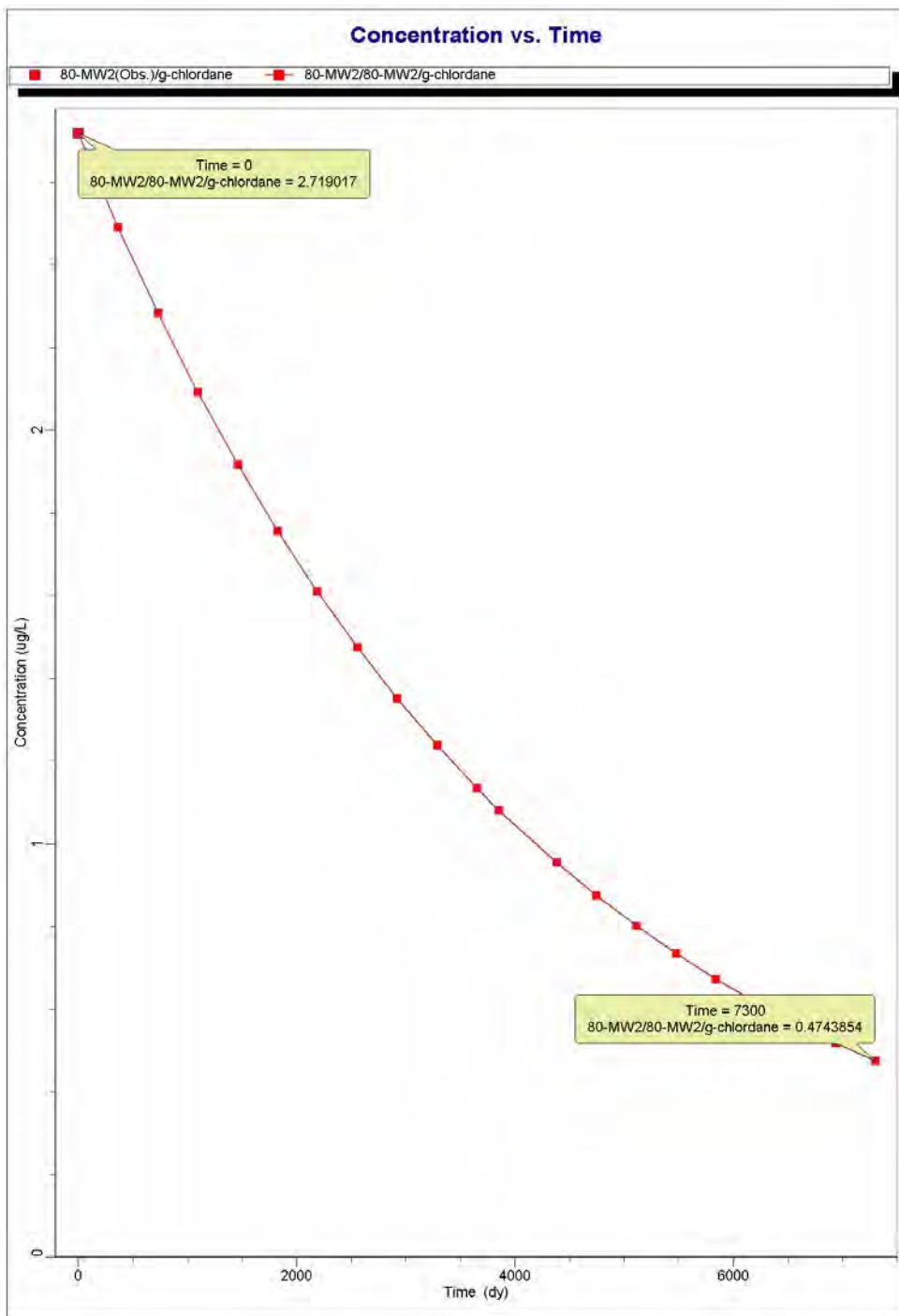
- 1) Isoconcentration contours represent predicted g-chlordane concentrations at 20 years.
Contour Interval = 0.05 ug/L
- 2) The NJDEP groundwater quality criteria for g-chlordane is 0.5 ug/L.
- 3) Monitoring wells for Site 80/166 are shown in purple.
- 4) Coordinates shown represent NAD-83 survey feet.
- 5) Modeling Software: *Visual MODFLOW Version 2.8.2*, Waterloo Hydrogeologic, Inc., 2000

FIGURE 6-8a

**Predicted g-Chlordane Concentration
20 Years
Site 80/166 – Main Post
Fort Monmouth, New Jersey**

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Notes:

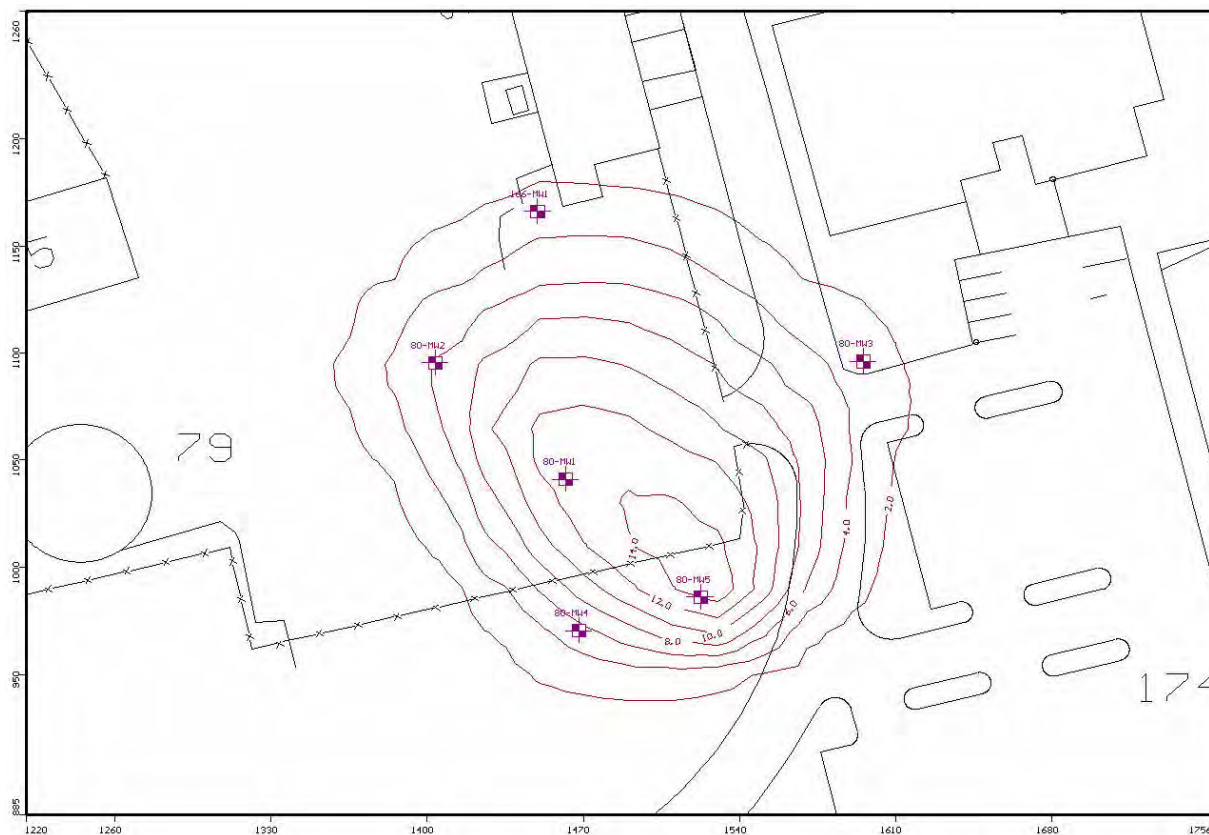
- 1) NJDEP groundwater criteria for g-chlordane is 0.5 ug/L.
- 2) Time for compliance is estimated from this graph to be approximately 20 years.
- 3) Modeling Software: *Visual MODFLOW Version 2.8.2*, Waterloo Hydrogeologic, Inc., 2000.

FIGURE 6-8b

**Predicted g-Chlordane
Concentration Versus Time
Site 80/166 – Main Post
Fort Monmouth, New Jersey**

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Notes:

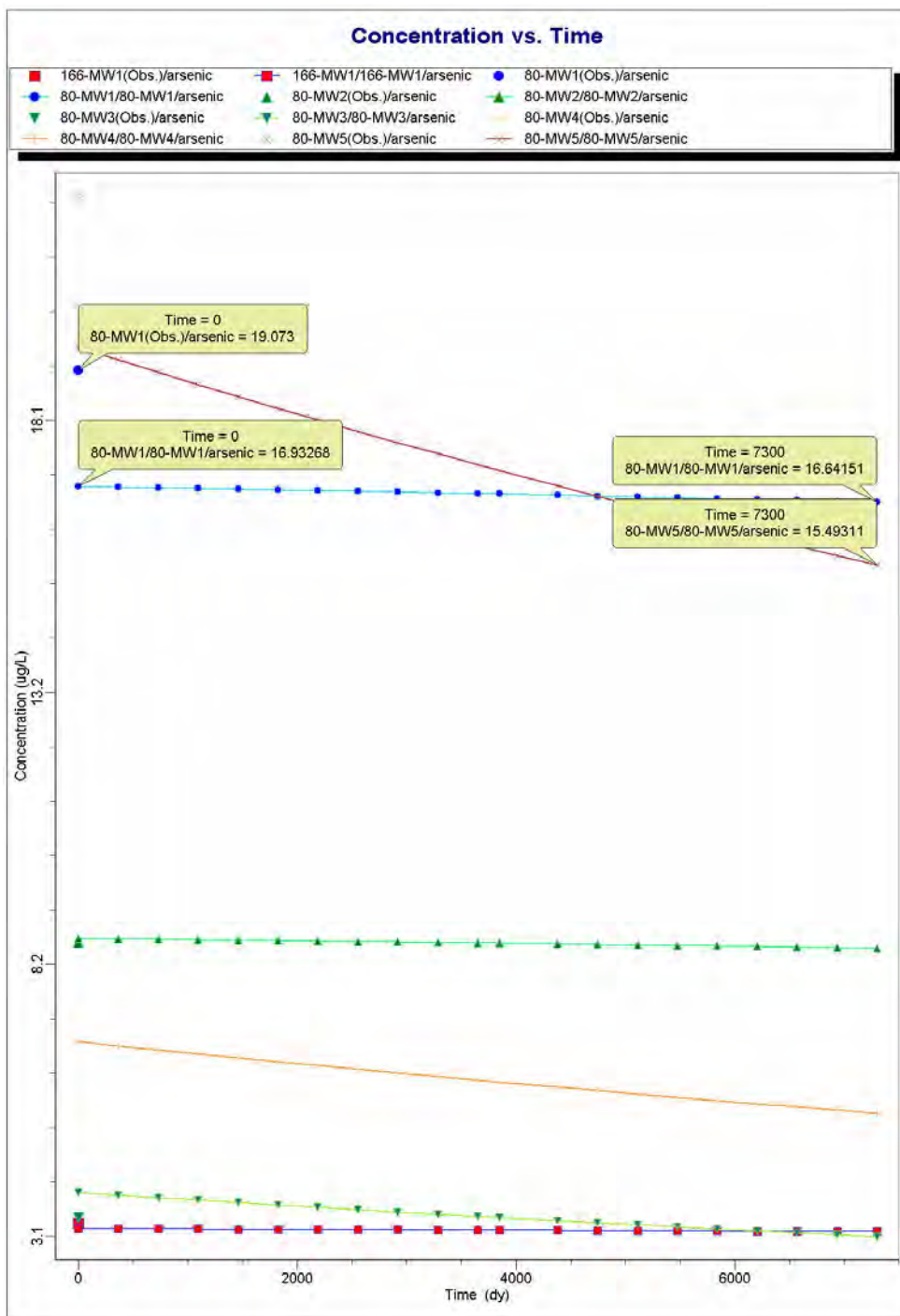
- 1) Isoconcentration contours represent predicted arsenic concentrations at 20 years.
Contour Interval = 2 ug/L.
- 2) The NJDEP groundwater quality criteria for arsenic is 8 ug/L.
- 3) Monitoring wells for Site 80/166 are shown in purple.
- 4) Coordinates shown represent NAD-83 survey feet.
- 5) Modeling Software: *Visual MODFLOW Version 2.8.2*, Waterloo Hydrogeologic, Inc., 2000

FIGURE 6-9a

**Predicted Arsenic Concentration
20 Years
Site 80/166 – Main Post
Fort Monmouth, New Jersey**

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Notes:

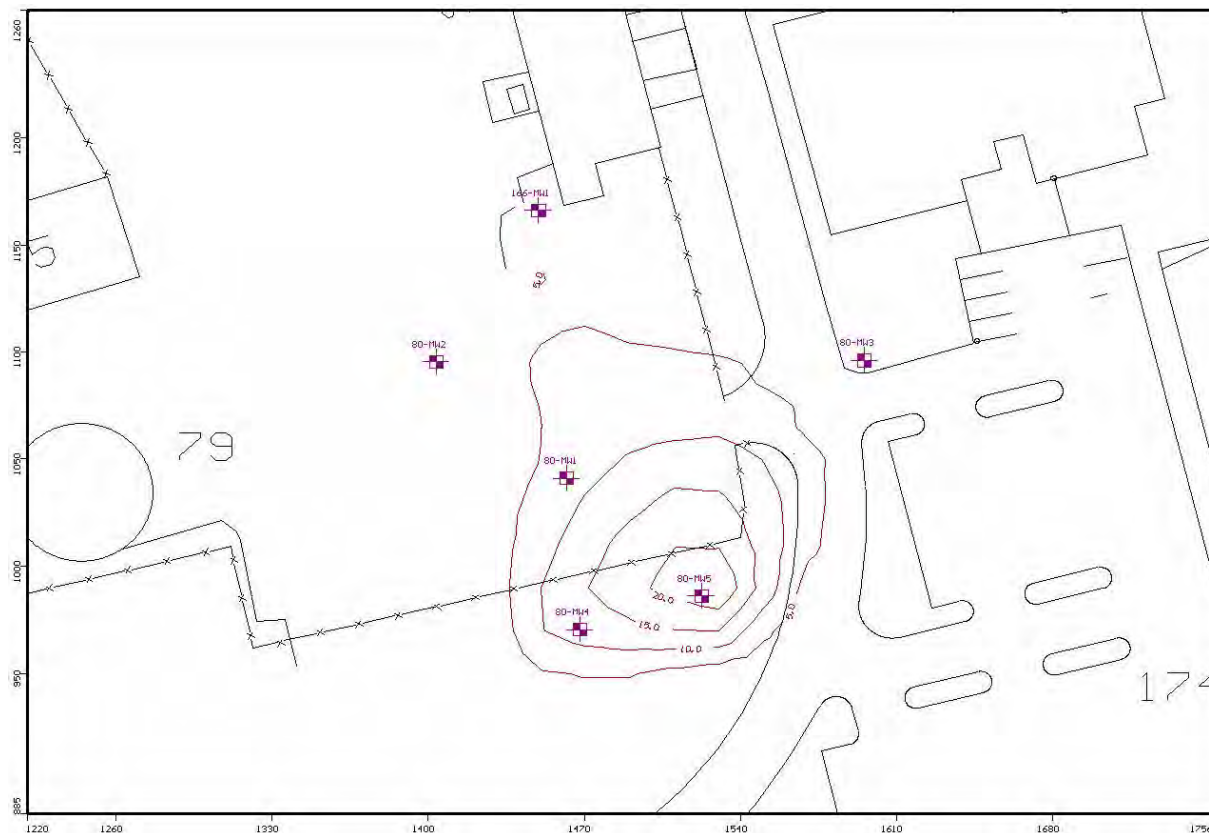
- 1) NJDEP groundwater criteria for arsenic is 8 ug/L.
- 2) Time for compliance is estimated from this graph to be greater than 1,000 years.
- 3) Modeling Software: *Visual MODFLOW Version 2.8.2*, Waterloo Hydrogeologic, Inc., 2000.

FIGURE 6-9b

**Predicted Arsenic Concentration
Versus Time
Site 80/166 – Main Post
Fort Monmouth, New Jersey**

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Notes:

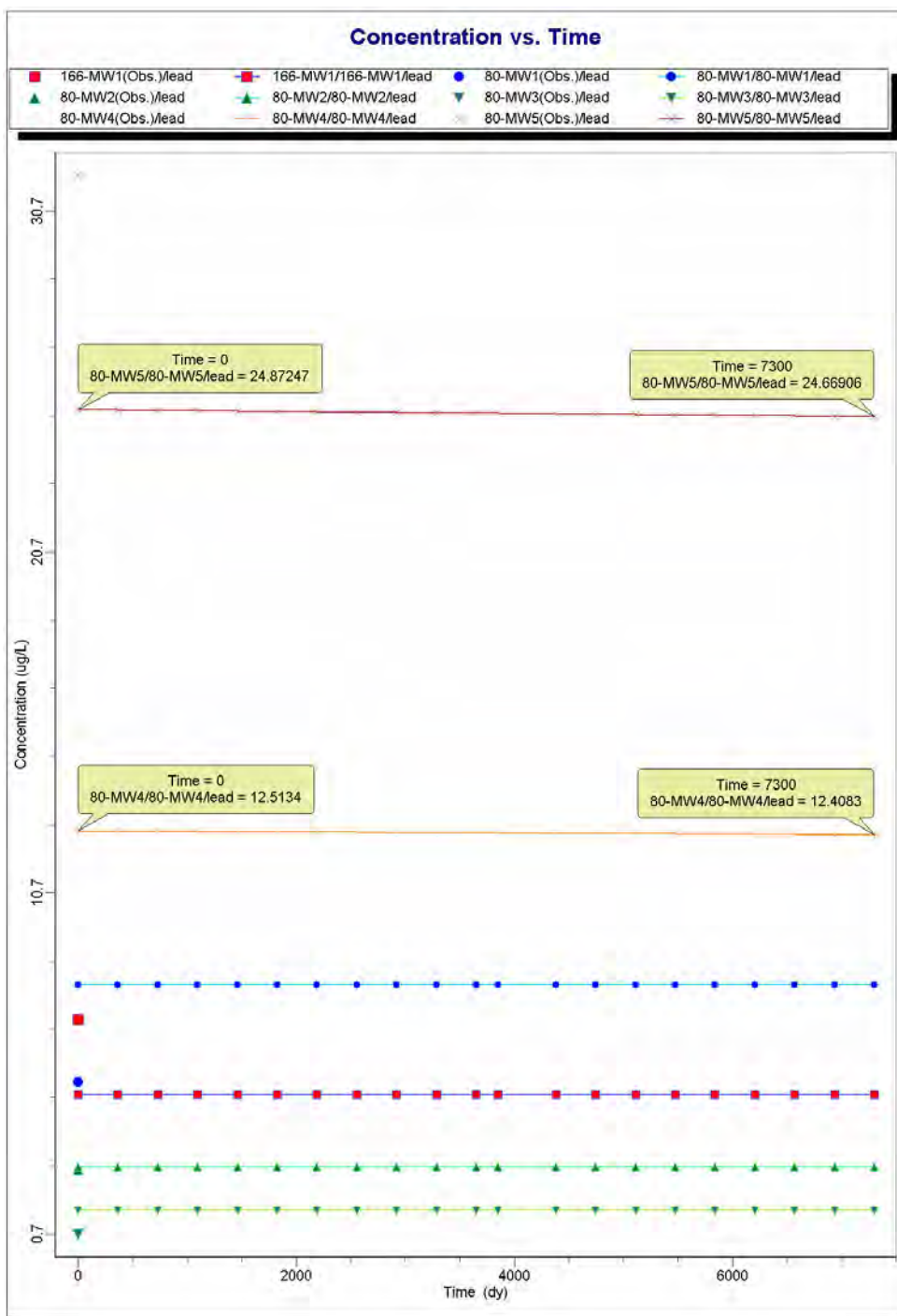
- 1) Isoconcentration contours represent predicted lead concentrations at 20 years.
Contour Interval = 5 ug/L.
- 2) The NJDEP groundwater quality criteria for arsenic is 10 ug/L.
- 3) Monitoring wells for Site 80/166 are shown in purple.
- 4) Coordinates shown represent NAD-83 survey feet.
- 5) Modeling Software: *Visual MODFLOW Version 2.8.2*, Waterloo Hydrogeologic, Inc., 2000

FIGURE 6-10a

**Predicted Lead Concentration
20 Years
Site 80/166 – Main Post
Fort Monmouth, New Jersey**

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Notes:

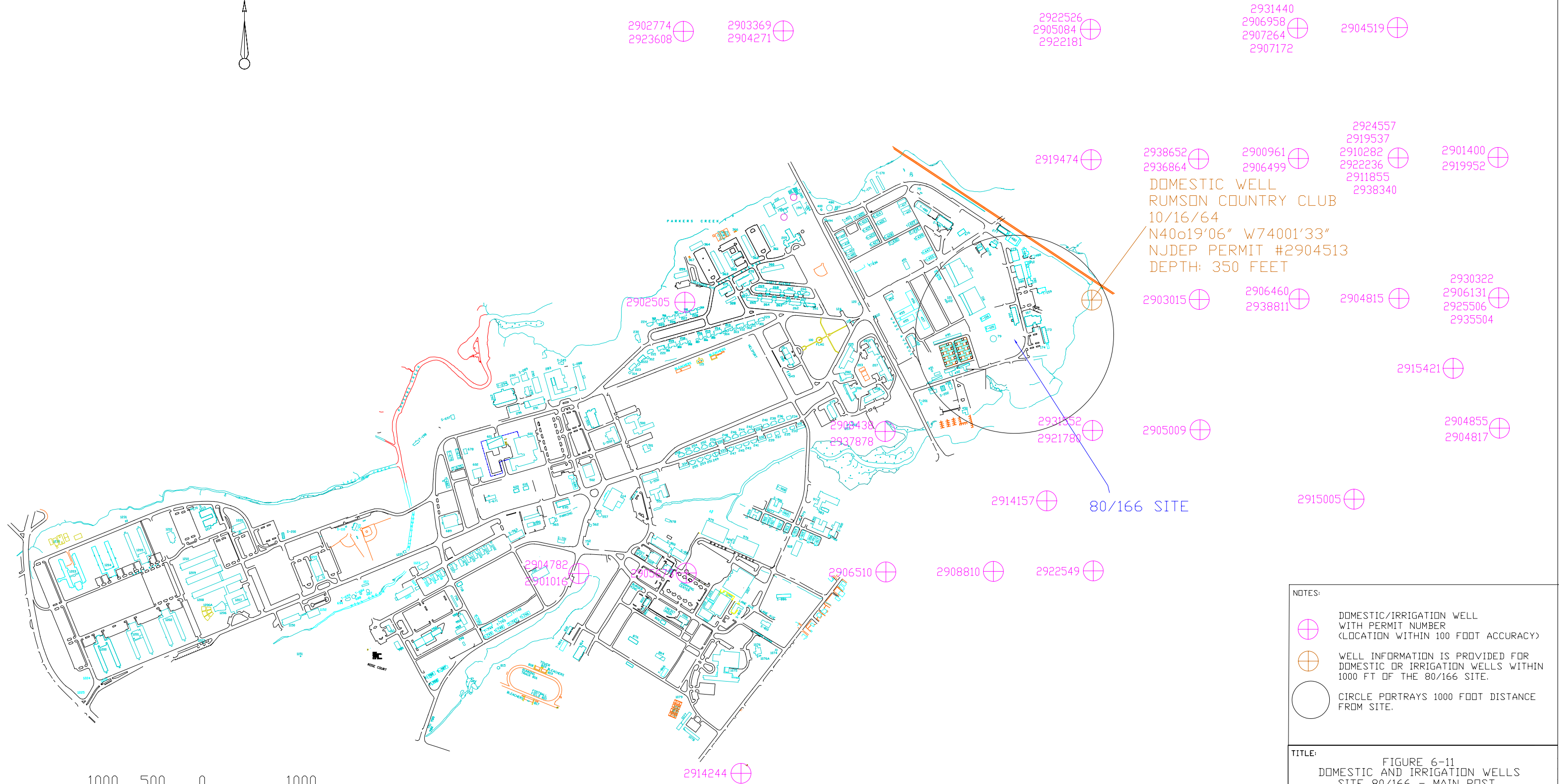
- 1) NJDEP groundwater criteria for lead is 10 ug/L.
- 2) Time for compliance is estimated from this graph to be greater than 1,000 years.
- 3) Modeling Software: *Visual MODFLOW Version 2.8.2*, Waterloo Hydrogeologic, Inc., 2000.

FIGURE 6-10b

**Predicted Lead
Concentration Versus Time
Site 80/166 – Main Post
Fort Monmouth, New Jersey**

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NOTES:

- DOMESTIC/IRRIGATION WELL WITH PERMIT NUMBER (LOCATION WITHIN 100 FOOT ACCURACY)
- WELL INFORMATION IS PROVIDED FOR DOMESTIC OR IRRIGATION WELLS WITHIN 1000 FT OF THE 80/166 SITE.
- CIRCLE PORTRAYS 1000 FOOT DISTANCE FROM SITE.

TITLE: FIGURE 6-11
DOMESTIC AND IRRIGATION WELLS
SITE 80/166 - MAIN POST
FORT MONMOUTH, NEW JERSEY

DRAWN BY: TJK/PS	DATE DRAWN: 30 AUGUST 01	
CHECKED BY:	DATE CHECKED:	
APPROVED BY:	DATE APPROVED:	
 2558 PEARL BUCK ROAD SUITE 1 BRISTOL, PA 19007 (215) 788-7844	DRAWING No.: FIG. 6-11	
	FILE No.: 80-166 FIG. 6-11	
	SCALE: 1" = 1000'	
SHEET	OF	REV.: A

APPENDICES

Appendix A

UST Closure and Site Investigation Report for Former Building T-80
(UST No. 90010-06), ATC Associates, Inc., BCM Engineers Division, July 1998

United States Army

Fort Monmouth, New Jersey

Underground Storage Tank Closure and Site Investigation Report

***Former Building T-80
Main Post***

**NJDEP UST Registration No. 090010-06
NJDEP Closure Approval No. C-93-4297
NJDEP Case No. 94-6-16-1127-25**

July 1998

**UNDERGROUND STORAGE TANK
CLOSURE AND SITE INVESTIGATION REPORT**

FORMER BUILDING T-80

MAIN POST

**NJDEP UST REGISTRATION NO. 090010-06
NJDEP CLOSURE APPROVAL NO. C-93-4297
NJDEP CASE NO. 94-6-16-1127-25**

JULY 1998

**PROJECT NO.: 09-5004-12
CONTRACT NO.: DACA51-94-D-0014**

PREPARED FOR:

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

PREPARED BY:

**BCM ENGINEERS
A DIVISION OF ATC
BROMLEY CORPORATE CENTER
THREE TERRI LANE
BURLINGTON, NEW JERSEY 08016**

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EXECUTIVE SUMMARY

On June 16, 1994, a steel underground storage tank (UST) was closed by removal in accordance with the New Jersey Department of Environmental Protection (NJDEP) Closure Approval No. C-93-4297 at U.S. Army Fort Monmouth, Fort Monmouth, New Jersey. The UST, NJDEP Registration No. 090010-06, was located immediately adjacent to Former Building T-80 in the Main Post area of U.S. Army, Fort Monmouth. UST No. 090010-06 was a 1,000-gallon No. 2 fuel oil UST. The UST fill port was located directly above the tank. The tank closure was performed by Cleaning Up The Environment Inc. (CUTE).

The site assessment was performed by U.S. Army personnel in accordance with the NJDEP *Technical Requirements for Site Remediation* (N.J.A.C. 7:26E) and the NJDEP *Field Sampling Procedures Manual*. Soils surrounding the tank were screened visually and with air monitoring equipment for evidence of contamination. Following removal, the UST was inspected for corrosion holes. One corrosion hole was observed on each of the end seams of the UST, and evidence of potentially contaminated soils was observed surrounding the tank. Based on the inspection of the UST, Directorate of Public Works (DPW) concluded that a discharge was associated with this UST. On June, 1994 a spill was reported to the NJDEP "Hot Line" for UST number 090010-06 and Case Number 94-6-16-1127-25 was assigned. On July 16, 1994, following the removal of the UST, approximately 56 cubic yards of potentially contaminated soil were removed from the excavation. Groundwater was present in the excavation at approximately 6.0 feet below ground surface. No product lines were found during the excavation of the UST.

All post-excavation soil samples collected from the UST excavation at Former Building T-80 contained TPHC concentrations below the NJDEP residential direct contact total organic contaminants soil cleanup criteria of 10,000 milligrams per kilogram (mg/kg) (N.J.A.C. 7:26D and revisions dated February 3, 1994). The soil samples contained TPHC concentrations ranging from non-detectable to 440.0 mg/kg. Following receipt of all post-excavation soil sampling results, the excavation was backfilled to grade with a combination of uncontaminated excavated soil and certified clean fill. The excavation site was then restored to its original condition.

In response to the observation of potentially contaminated soil near the shallow water table, one shallow overburden monitoring well (MW-1) was installed at the Former Building T-80 area on September 15, 1994. On May 19, 1995, and June 13, 1995, MW-1 was sampled for volatile organic compounds calibrated for xylene plus 15 tentatively identified compounds (VOCs), and semivolatile organic compounds plus 15 tentatively identified compounds (SVOCs). All groundwater analytical results were either below the detection limit or in compliance with the New Jersey Ground Water Quality Criteria (GWQC) with the exception to the volatile compound benzene. This compound was detected at a concentration of 1.4 ug/l, above the GWQC of 1.0 ug/l, in monitoring well MW-1 during both sampling events. No product or sheen was observed in MW-1 on either of the sampling dates.

Based on the analytical results of the groundwater samples collected on May 18, 1995 and June 13, 1995, groundwater quality at the Former Building T-80 UST closure site exceeds the New Jersey Groundwater Quality Standard for benzene. Collection of the samples on a quarterly basis from MW-1 for BTEX is recommended. The BTEX analysis will determine if the low levels of benzene detected previously are declining. The need for any additional actions to address groundwater quality should be evaluated following receipt of the additional groundwater data.

1.0 UNDERGROUND STORAGE TANK DECOMMISSIONING ACTIVITIES

1.1 OVERVIEW

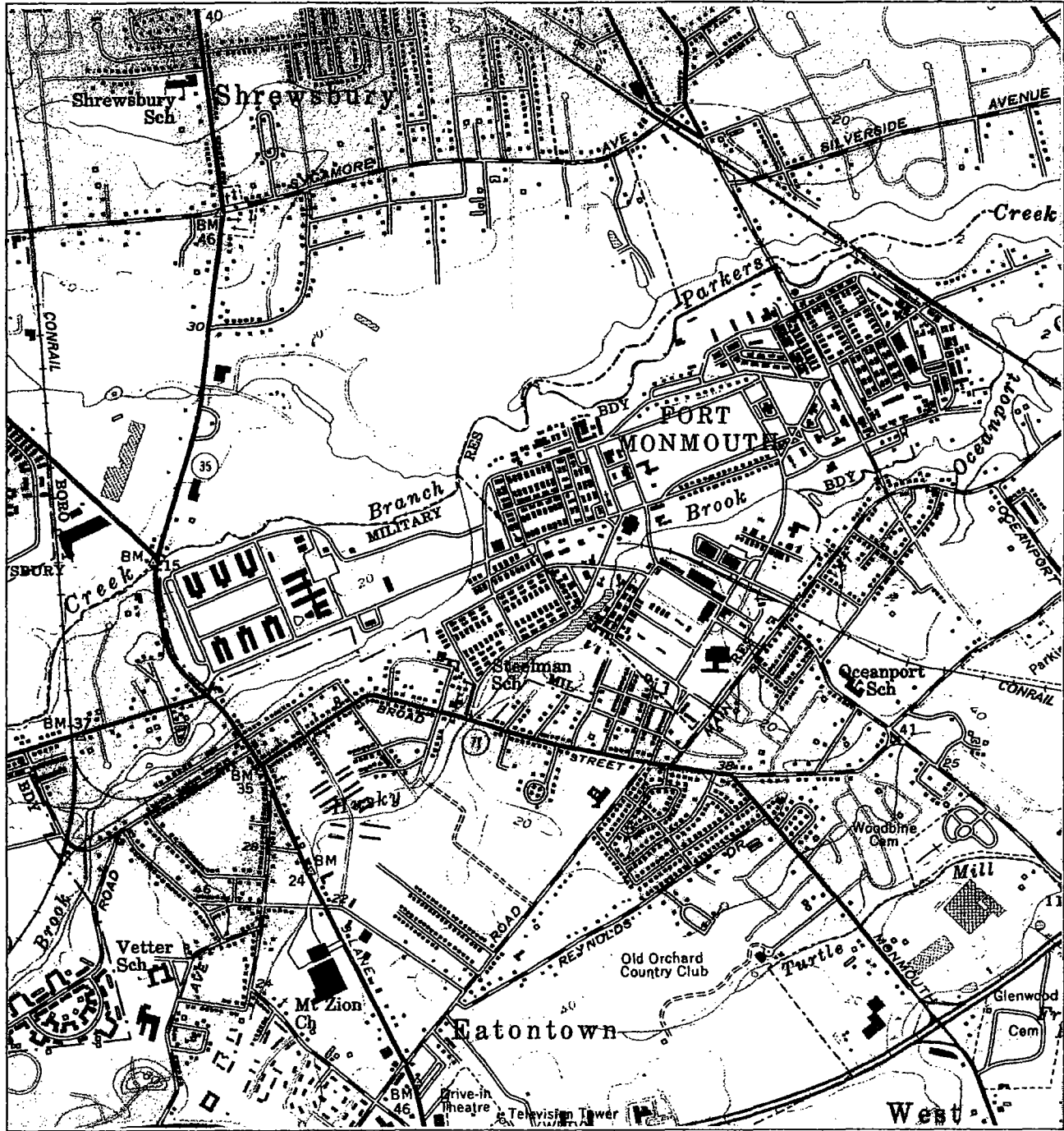
One underground storage tank (UST), New Jersey Department of Environmental Protection (NJDEP) Registration No. 090010-06, was closed at Former Building T-80 at U.S. Army Fort Monmouth, Fort Monmouth, New Jersey on June 16, 1994. Refer to site location map on Figure 1. This report presents the results of the DPW's implementation of the UST Decommissioning/Closure Plan submitted to the NJDEP on August 5, 1993. The plan was approved on December 7, 1993 and assigned TMS No. C-93-4297. The UST was a steel 1,000-gallon tank containing No. 2 fuel oil.

Decommissioning activities for UST No. 090010-06 complied with all applicable Federal, State and Local laws and ordinances in effect at the date of decommissioning. These laws included but were not limited to: N.J.A.C. 7:14B-1 et seq., N.J.A.C. 5:23-1 et seq., and Occupational Safety and Health Administration (OSHA) 1910.146 & 1910.120. All permits including but not limited to the NJDEP-approved Decommissioning/Closure Plan were posted on site for inspection. CUTE, the contractor that conducted the decommissioning activities, is registered and certified by the NJDEP for performing UST closure activities. Closure of UST No. 090010-06 proceeded under the approval of the NJDEP Bureau of Underground Storage Tanks (NJDEP-BUST). The NJDEP-BUST closure approval and signed certifications for UST No. 090010-06 are included in Appendices A and B, respectively.

This UST Closure and Site Investigation Report has been prepared by Smith Technology Corporation, to assist the United States Army Directorate of Public Works (DPW) in complying with the NJDEP Bureau of Underground Storage Tanks (NJDEP-BUST) regulations. The applicable NJDEP-BUST regulations at the date of closure were the *Interim Closure Requirements for Underground Storage Tank Systems* (N.J.A.C. 7:14B-1 et seq. September 1990 and revisions dated November 1, 1991).

This report was prepared using information required at the time of closure. Section 1 of this UST Closure and Site Investigation Report provides a summary of the UST decommissioning activities. Section 2 of this report describes the site investigation activities. Conclusions and recommendations, including the results of the soil sampling investigation, are presented in the final section of this report.

Source: Long Branch, New Jersey Quadrangle



SCALE
0 2000 FT.

NEW JERSEY



QUADRANGLE LOCATION

1.2 SITE DESCRIPTION

Former Building T-80 was located in the eastern portion of the Main Post area of Fort Monmouth, as shown on Figure 1. UST No. 090010-06, located north of the Former Building T-80, was exposed during excavation activities performed to demolish Building T-80. No product lines (piping) were found during the excavation of the UST or Building T-80. The fill port area was located directly above the tank. A site map is provided on Figure 2.

1.2.1 Geological/Hydrogeological Setting

The following is a description of the geological/hydrogeological setting of the area surrounding Former Building T-80. Included is a description of the regional geology of the area surrounding Fort Monmouth as well as descriptions of the local geology and hydrogeology of the Main Post area.

Regional Geology

Monmouth County lies within the New Jersey Section of the Atlantic Coastal Plain physiographic province. The Main Post, Charles Wood, and the Evans areas are located in what may be referred to as the Outer Coastal Plain subprovince, or the Outer Lowlands.

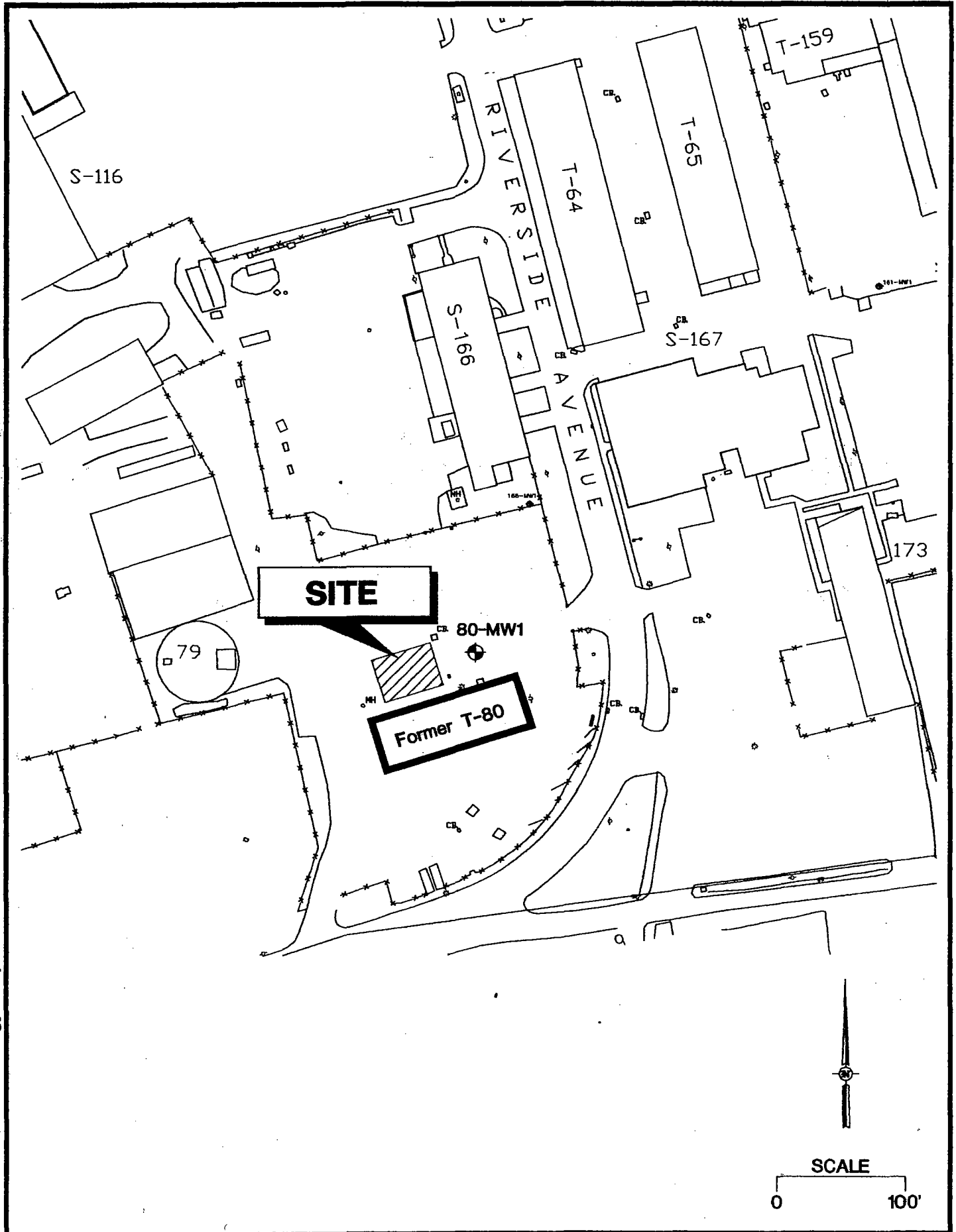
In general, New Jersey Coastal Plain formations consist of a seaward-dipping wedge of unconsolidated deposits of clay, silt, and gravel. These formations typically strike northeast-southwest with a dip ranging from 10 to 60 feet per mile and were deposited on Precambrian and lower Paleozoic rocks (Zapeczka, 1989). These sediments, predominantly derived from deltaic, shallow marine, and continental shelf environments, date from Cretaceous through the Quaternary Periods. The mineralogy ranges from quartz to glauconite.

The formations record several major transgressive/regressive cycles and contain units which are generally thicker to the southeast and reflect a deeper water environment. Over 20 regional geologic units are present within the sediments of the 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 thicknesses for these units vary greatly (i.e., from several feet to several hundred feet). The Coastal Plain deposits thicken to the southeast from the Fall Line to greater than 6,500 feet in Cape May County (Brown and Zapeczka, 1990).

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-

Source: Smith Technology Corporation (157)



Project No. 09-5004-12

Figure 2
**Former Building T-80
Site Map**

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).

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 9 feet below ground surface (bgs). According to Jablonski, wells drilled in the Red Bank and Tinton Sands may produce 2 to 25 gallons per minute (gpm). Some well owners have reported acidic water that requires treatment to remove iron.

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. However, an abundance of clay lenses and sand deposits were noted in borings installed throughout Fort Monmouth. Therefore the direction of shallow groundwater should be determined on a case by case basis.

1.3 HEALTH AND SAFETY

Before, during, and after all decommissioning activities, hazards at the work site which may have posed a threat to the Health and Safety of all personnel who were involved with, or were affected by, the decommissioning of the UST system were minimized. All areas which posed, or may have been suspected to pose a vapor hazard were monitored by a qualified individual utilizing an organic vapor analyzer (OVA). The individual ascertained if the area was properly vented to render the area safe, as defined by OSHA.

1.4 REMOVAL OF UNDERGROUND STORAGE TANK

1.4.1 General Procedures

- All underground obstructions (utilities, etc.) were marked out by the contractor performing the closure prior to excavation activities.
- All activities were carried out with the greatest regard to safety and health and the safeguarding of the environment.
- All excavated soils were visually examined and screened with an OVA for evidence of contamination. Potentially contaminated soils were identified and logged during closure activities.
- Surface materials (i.e., asphalt, concrete, etc.) were excavated and staged separately from all soil and recycled in accordance with all applicable regulations and laws.
- A Sub-Surface Evaluator from the DPW was present during all site assessment activities.

1.4.2 Underground Storage Tank Excavation and Cleaning

Prior to UST decommissioning activities, surficial soil was removed to expose the UST. No product lines (piping) were found during the excavation of the UST. The UST was purged to remove vapors prior to cutting. A manway was made in the UST to allow for proper cleaning. The UST was completely emptied of all liquids prior to removal from the ground. Approximately 1,024 gallons of liquid were transported by Freehold Cartage Inc. to Lionetti Oil Recovery Co. Inc., a NJDEP-approved petroleum recycling and disposal company located in Old Bridge, New Jersey. Refer to Appendix C for the waste manifests (NJA-1603186 and NJA-1603243).

The UST was cleaned prior to removal from the excavation in accordance with the NJDEP-BUST regulations. After the UST was removed from the excavation, it was staged on polyethylene sheeting and examined for holes. One hole was observed on each of the end seams of the tank during the inspection by the Sub-Surface Evaluator. Soil surrounding the UST were screened visually and with an OVA for evidence of contamination. Evidence of potential contamination was observed.

1.5 UNDERGROUND STORAGE TANK TRANSPORTATION AND DISPOSAL

The tank was transported by CUTE to Mazza and Sons Inc. for disposal in compliance with all applicable regulations and laws. See Appendix D for UST Disposal Certificate.

The removal contractor labeled the UST prior to transport with the following information:

- site of origin
- contact person
- NJDEP UST Facility ID number
- name of transporter/contact person
- destination site/contact person

1.6 MANAGEMENT OF EXCAVATED SOILS

Based on visual observations, approximately 56 cubic yards of potentially contaminated soils were excavated from the UST excavation. Potentially contaminated soils were stockpiled separately from other excavated material and were placed on and covered with polyethylene sheets. Potentially contaminated soils were stored on-site prior to ultimate disposal at Soil Remediation of Philadelphia. Soils that did not exhibit signs of contamination were used as backfill following removal of the UST.

2.0 SITE INVESTIGATION ACTIVITIES

2.1 OVERVIEW

The Site Investigation was managed and carried out by U.S. Army DPW personnel. All analyses were performed and reported by U.S. Army Fort Monmouth Environmental Laboratory, a NJDEP-certified testing laboratory. All sampling was performed under the direct supervision of a NJDEP Certified Sub-Surface Evaluator according to the methods described in the NJDEP *Field Sampling Procedures Manual* (1992). Sampling frequency and parameters analyzed complied with the NJDEP-BUST document *Interim Closure Requirements for Underground Storage Tank Systems* (September 1990 and revisions dated November 1, 1991) which was the applicable regulation at the date of the closure. All records of the Site Investigation activities are maintained by the Fort Monmouth DPW Environmental Office.

The following Parties participated in Closure and Site Investigation Activities.

- Closure Contractor: Cleaning Up The Environment Inc. (CUTE)
Closure Supervisor: John Lonergan
Phone Number: (201)427-2881
NJDEP Company Certification No.: 0200128
NJDEP -UST Closure Certification No.: 3248
- Subsurface Evaluator: Dinkerrai M. Desai
Employer: U.S. Army, Fort Monmouth
Phone Number: (908) 532-1475
NJDEP Certification No.: E0002266
- Analytical Laboratory: U.S. Army Fort Monmouth Environmental Laboratory
Contact Person: Brian K. McKee
Phone Number: (908)532-4359
NJDEP Certification No.: 13461
- Hazardous Waste Hauler: Freehold Cartage Inc.
Contact Person: Barry Olsen
Phone Number: (908)721-0900
NJDEP Hazardous Waste Hauler No.: 2265

2.2 FIELD SCREENING/MONITORING

Field screening was performed by a NJDEP Certified Sub-Surface Evaluator using an OVA and visual observations to identify potentially contaminated material. Additional soils were removed from the excavation surrounding UST No. 090010-06 until no evidence of contamination remained.

2.3 SOIL SAMPLING

On July 16, 1994, post-excavation soil samples A, B, C, D, E, F, G, and H were collected from a total of eight (8) locations along the sidewalls of the UST excavation, at a depth of 5.5 feet below ground surface (bgs). No product lines (piping) were found during the excavation of the UST or excavations performed to demolish Building T-80. The soil samples were analyzed for TPHC.

The site assessment was performed by U.S. Army personnel in accordance with the NJDEP *Technical Requirements* and the NJDEP *Field Sampling Procedures Manual*. A summary of sampling activities including parameters analyzed is provided in Table 1. The post-excavation soil samples were collected using polystyrene scoops. Actual soil TPHC values may be higher than reported, due to sample utensil absorbency. If absorbency resulted in reducing the actual soil TPHC concentration by 50 %, the highest soil contaminant would have been 880.0 mg/kg, still below the applicable NJDEP soil cleanup standard for total organic contaminants of 10,000 mg/kg. Following soil sampling activities, the samples were chilled and delivered to U.S. Army Fort Monmouth Environmental Laboratory located in Fort Monmouth, New Jersey, for analysis.

2.4 GROUNDWATER SAMPLING

2.4.1 Monitoring Well Installation

In response to the observation of potentially contaminated soil near the shallow water table, one shallow monitoring well (MW-1) was installed at the Former Building T-80 area on September 15, 1994. It was installed approximately 30 feet east of the former UST excavation. The monitoring well was screened in the 3.0 to 13.0 foot interval, across the water table, which is approximately 3.0 feet below grade surface.

The well was constructed in accordance with the NJDEP's well construction protocols outlined in its May 1992 *Field Sampling Procedures Manual*. The NJDEP well drilling permit and a well construction log is presented in Appendix E.

The well was constructed with 4-inch (ID) PVC riser and 0.020 slotted PVC well screen. A silica sand pack was installed in the annulus between the borehole wall and the screen. The sand

TABLE 1
SUMMARY OF SAMPLING ACTIVITIES
BUILDING 80, MAIN POST
FORT MONMOUTH, NEW JERSEY

Sample ID	Date of Collection	Matrix	Sample Type	Analytical Parameters (and USEPA Methods) *	Sampling Method
A	6/16/94	Soil	Post-Excavation	TPHC	Polystyrene Scoop
B	6/16/94	Soil	Post-Excavation	TPHC	Polystyrene Scoop
DUP B	6/16/94	Soil	Post-Excavation	TPHC	Polystyrene Scoop
C	6/16/94	Soil	Post-Excavation	TPHC	Polystyrene Scoop
D	6/16/94	Soil	Post-Excavation	TPHC	Polystyrene Scoop
DUP D	6/16/94	Soil	Post-Excavation	TPHC	Polystyrene Scoop
E	6/16/94	Soil	Post-Excavation	TPHC	Polystyrene Scoop
F	6/16/94	Soil	Post-Excavation	TPHC	Polystyrene Scoop
MW-1	5/18/95	Aqueous	Groundwater	VOCs, SVOCs	Teflon Bottom Fill Bailer
MW-1	6/3/95	Aqueous	Groundwater	VOCs, SVOCs	Teflon Bottom Fill Bailer

* NOTES:

TPHC: Total Petroleum Hydrocarbons (Method 418.1 / soil and aqueous)
VOCs: Volatile Organic Compounds plus 15 tentatively identified compounds (Method 624 / soil and aqueous)
SVOCs: Semivolatile organic compounds plus 15 tentatively identified compounds (Method 625 / aqueous)
Pb: Lead (Method SW-846 / soil and aqueous)

Source: Smith Technology Corporation (Smith Project No. 09-5004-12)

80TBL.XLS

pack was extended approximately 2 feet above the top of the screen. The sand pack above the well screen was graded down to a fine sand to minimize grout intrusion.

The borehole was tremie-grouted with bentonite-cement grout from the top of the sand pack to 0.5 inches bgs. The well was secured with a water-tight, flush-mounted locking road box. The road box was set in place with concrete, which was placed in the remaining open borehole. The elevation of the well riser was surveyed to the nearest 0.01 feet by a New Jersey-licensed surveyor. The well permit number was marked on the well casing as required.

The monitoring well was developed using a peristaltic surface pump. The well was pumped for 1 hour or until silt free. All residual soils and liquids generated during monitoring well installation and development program were collected in New Jersey Department of Transportation-approved 55-gallon drums. The drums were placed in a designated secure location for waste characterization and offsite disposal.

2.4.2 Monitoring Well Sampling

On May 18, 1995 and June 13, 1995, MW-1 was sampled for volatile organic compounds calibrated for xylene plus 15 tentatively identified compounds (VOCs), and semivolatile organic compounds plus 15 tentatively identified compounds (SVOCs). Sampling and analysis were performed in accordance with the NJDEP *Field Sampling Procedures Manual* and the *Technical Requirements For Site Remediation*.

Prior to sampling, the water level was measured to the nearest 0.01 feet, and the distance to the bottom of the well was to be measured to the nearest 0.1 feet. The well was checked for floating product (light non-aqueous phase liquids). The well was purged of three to five well volumes of standing water. Sample volume was then collected using a dedicated decontaminated Teflon bottom-filled bailer attached to PTFE (Teflon)-coated stainless steel cable.

3.0 CONCLUSIONS AND RECOMMENDATIONS

3.1 SOIL SAMPLING RESULTS

To evaluate soil conditions following removal of the UST, post-excavation soil samples were collected from a total of eight (8) locations on July 16, 1994. No product lines (piping) were found during the excavation activities. All samples were analyzed for TPHC. The post-excavation sampling results were compared to the NJDEP residential direct contact total organic contaminants soil cleanup criteria of 10,000 mg/kg (N.J.A.C. 7:26D and revisions dated February 3, 1994). A summary of the analytical results and comparison to the NJDEP soil cleanup criteria is provided in Table 2 and the soil sampling results are shown on Figure 3. The analytical data package is provided in Appendix E.

All post-excavation soil samples contained concentrations of TPHC below the NJDEP soil cleanup criteria. Post-excavation soil samples C, E, F, and H contained TPHC concentrations ranging from 11.7 mg/kg to 440.0 mg/kg. All other samples contained non-detectable concentrations of TPHC.

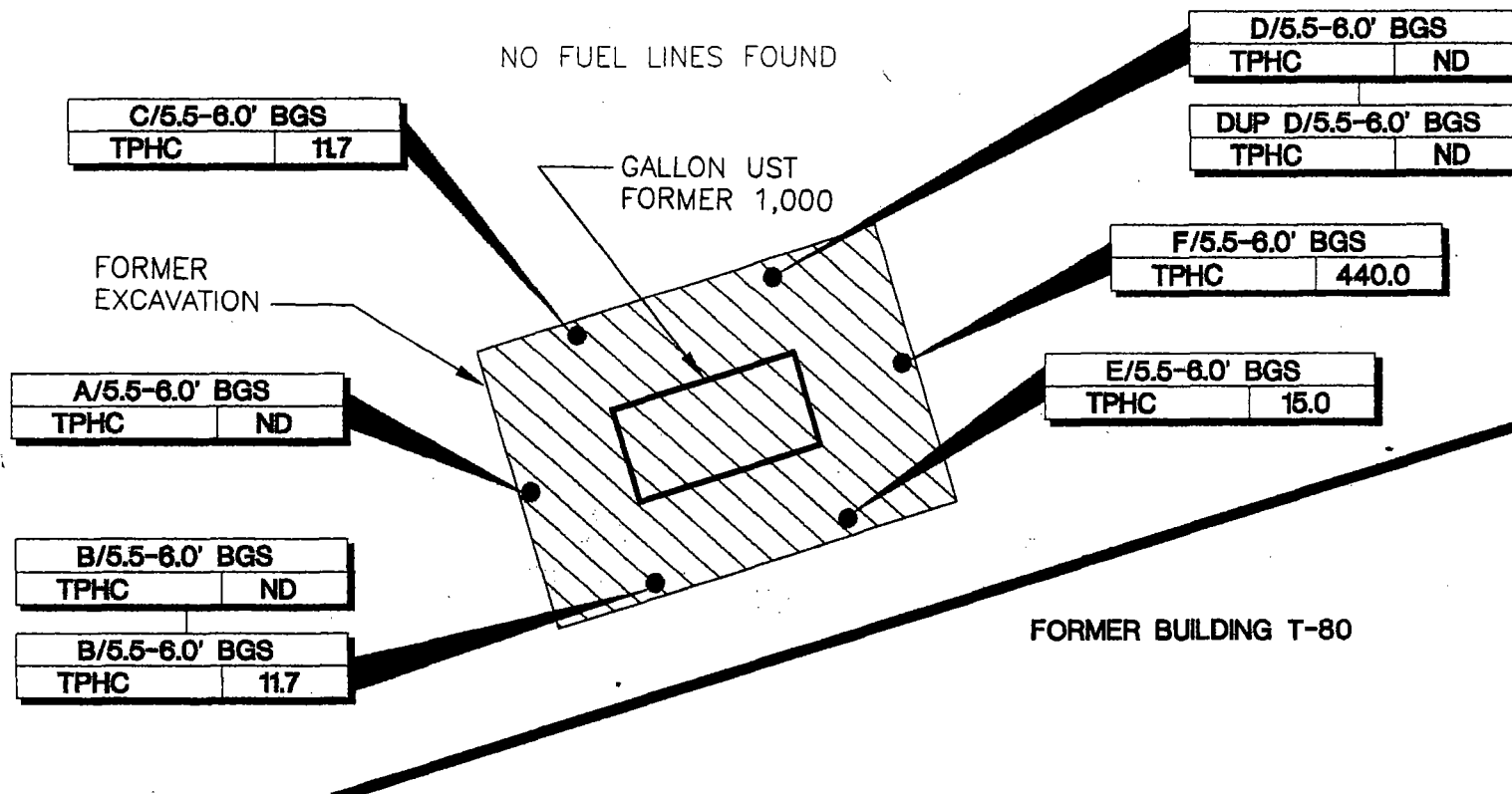
3.2 GROUNDWATER SAMPLING RESULTS

The sample collected from MW-1 on May 18, 1995, contained methylene chloride at 1.4 ug/l, benzene at 1.7 ug/l, chlorobenzene at 3.6 ug/l, sec-butylbenzene at 1.6 ug/l, 1,4-dichlorobenzene at 0.9 ug/l, 1,2-dichlorobenzene at 2.3 ug/l, naphthalene at 2.0 ug/l, and di-n-butylphthalate at 70.0 ug/l. No other compounds were detected. The benzene concentration exceeded the GWQS of 1.0 ug/l. Methylene chloride and di-n-butylphthalate were detected in the field blank at concentrations of 5.1 ug/l and 55 ug/l, respectively. No other compounds were detected in the field blank.

The sample collected from MW-1 on June 13, 1995, contained methylene chloride at 1.3 ug/l, benzene at 1.4 ug/l, chlorobenzene at 3.4 ug/l, isopropylbenzene at 1.4 ug/l, sec-butylbenzene at 1.6 ug/l, 1,4-dichlorobenzene at 1.0 ug/l, 1,2-dichlorobenzene at 2.3 ug/l, and n-butylbenzene at 1.0 ug/l. No other compounds were detected. The benzene concentration exceeded the GWQS of 1.0 ug/l. Methylene chloride was detected in the field blank at a concentration of 2.1 ug/l. No other compounds were detected in the field blank.

No product or sheen was observed in MW-1 on either of the sampling dates. The depth to the water table was 2.96 feet below grade surface on May 18, 1995 and 3.24 feet below grade surface on June 13, 1995.

All groundwater analytical results are presented in Table 3 and shown on Figure 4. The groundwater analytical data package is provided in Appendix F. The full data package, including quality control, is on file at U.S. Army Fort Monmouth, DPW.

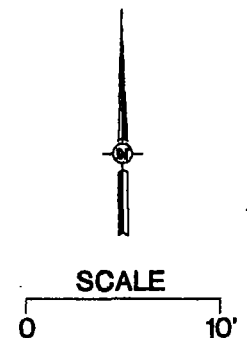


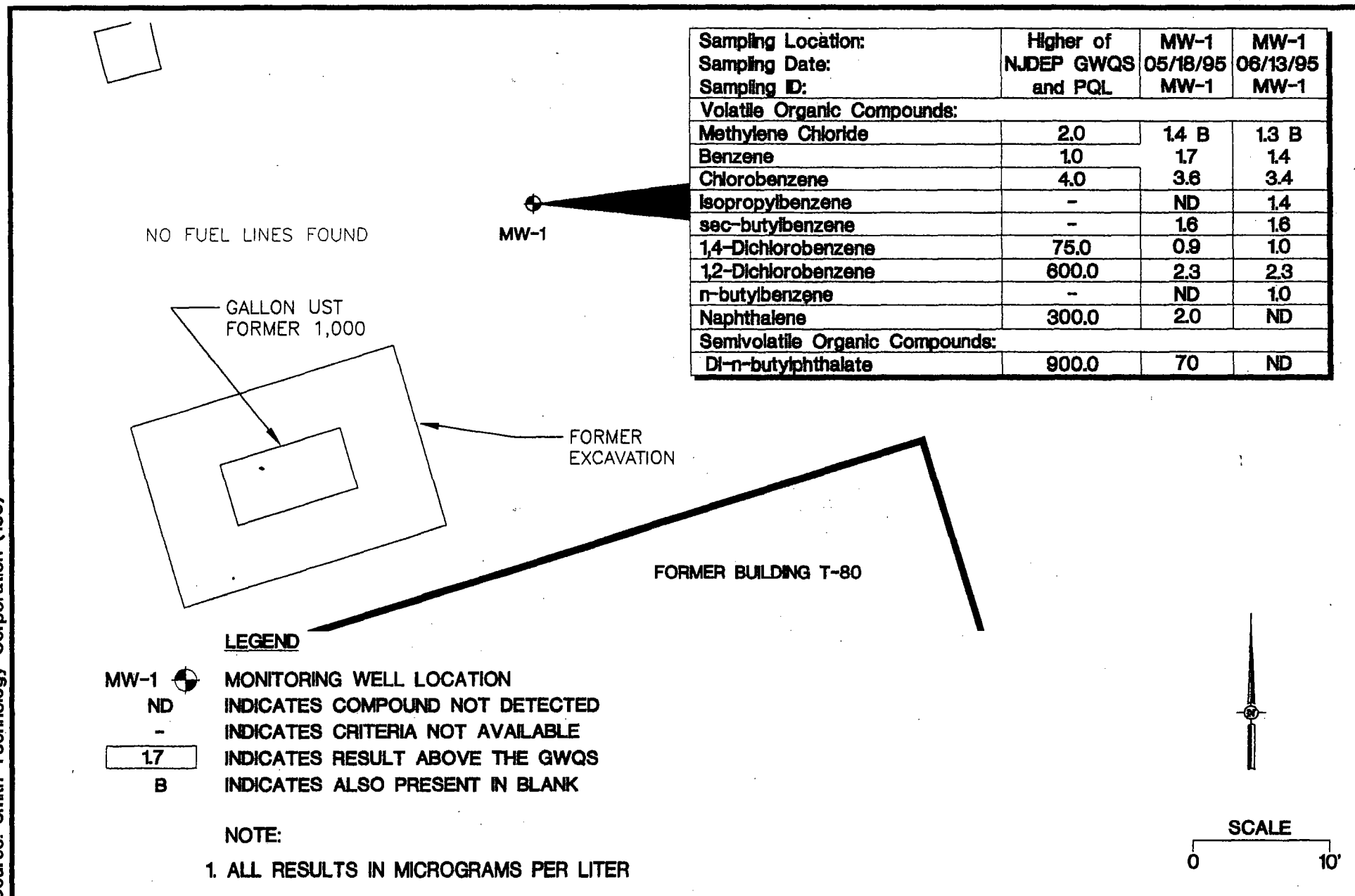
LEGEND

● SOIL SAMPLE LOCATION
(JUNE 16, 1994)

▨ LIMIT OF EXCAVATION
(JUNE 16, 1994)

- NOTES: 1. ALL RESULTS IN MILLIGRAMS PER KILOGRAM (DRY WEIGHT)
2. SEE TABLE 2 FOR NJDEP SOIL CLEANUP CRITERIA
3. BGS = BELOW GROUND SURFACE





3.3 CONCLUSIONS AND RECOMMENDATIONS

The analytical results for all post-excavation soil samples collected from the UST closure excavation at Former Building T-80 were below the NJDEP soil cleanup criteria for total organic contaminants.

Based on the post-excavation sampling results, soils with TPHC concentrations exceeding the NJDEP soil cleanup criteria for total organic contaminants of 10,000 mg/kg, do not exist in the former location of the UST or associated piping.

Based on the analytical results of the groundwater samples collected on May 18, 1995 and June 13, 1995, groundwater quality at the Former Building T-80 UST closure site exceeded the New Jersey Groundwater Quality Criteria (GWQC) for benzene. Based on the groundwater analytical results, the collection and analysis of two additional sets of samples from MW-1 for BTEX is recommended. The BTEX analysis will determine if the low levels of benzene detected previously are declining. The need for any additional actions to address groundwater quality should be evaluated following receipt of the additional groundwater data.

Appendix B

UST Closure and Site Investigation Report, Building 166 (UST No. 90017-17),
ATC Associates, Inc., May 2000

United States Army

Fort Monmouth, New Jersey

**Underground Storage Tank
Closure and Site Investigation
Report**

***Building 166
Main Post***

**NJDEP UST Registration No. 090017-17
NJDEP Closure Approval Letter
Dated June 7, 1994**

May 2000

**UNDERGROUND STORAGE TANK
CLOSURE AND SITE INVESTIGATION REPORT**

BUILDING 166

**MAIN POST
NJDEP UST REGISTRATION NO. 090017-17
NJDEP CLOSURE APPROVAL LETTER
DATED JUNE 7, 1994**

MAY 2000

**PROJECT NO.: 09-5004-12
CONTRACT NO.: DACA51-94-D-0014**

PREPARED FOR:

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

PREPARED BY:

**BCM ENGINEERS
A DIVISION OF ATC
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Appendix G	Groundwater Analytical Data Package

EXECUTIVE SUMMARY

On June 16, 1994, a fiberglass underground storage tank (UST) was closed by removal in accordance with the New Jersey Department of Environmental Protection (NJDEP) Closure Approval letter dated June 7, 1994, at U.S. Army Fort Monmouth, Fort Monmouth, New Jersey. The UST, NJDEP Registration No. 090017-17, was located immediately adjacent to Building 166 in the Main Post area of U.S. Army, Fort Monmouth. UST No. 090017-17 was a 4,000-gallon No. 2 fuel oil UST. The UST fill port was located directly above the tank. The tank closure was performed by Cleaning Up the Environment Inc. (CUTE Inc.).

The site assessment was performed by U.S. Army personnel in accordance with the NJDEP *Technical Requirements for Site Remediation* (N.J.A.C. 7:26E) and the NJDEP *Field Sampling Procedures Manual*. Soils surrounding the tank were screened visually and with air monitoring equipment for evidence of contamination. Following removal, the UST was inspected for corrosion holes. No holes were noted in the UST, however, evidence of potentially contaminated soils was observed surrounding the tank. Based on an inspection of the UST, and field screening of subsurface soils, the Directorate of Public Works (DPW) concluded that an historical discharge was associated with the UST. On June 16, 1994, a spill was reported to the NJDEP "Hotline" for UST No. 090017-17 and was assigned Spill Case No. 94-6-16-1545-09.

On June 16, 1994, following the removal of the UST, approximately 24 cubic yards of potentially contaminated soil were removed from the excavation. All post-excavation soil samples collected, on June 16, 1994, from the UST excavation and from below piping associated with the former UST at Building 166 contained total petroleum hydrocarbons (TPHC) concentrations below the NJDEP residential direct contact total organic contaminants soil cleanup criteria of 10,000 milligrams per kilogram (mg/kg) (N.J.A.C. 7:26D and revisions dated February 3, 1994). The samples contained TPHC concentrations ranging from non-detectable to 786.0 mg/kg. Following receipt of all post-excavation soil sampling results, the excavation was backfilled to grade with a combination of uncontaminated excavated soil and certified clean fill.

In response to the observation of potentially contaminated soil near the shallow water table, one shallow overburden monitoring well (MW-1) was installed at the Building 166 area on September 14, 1994. On May 18, 1995 and June 13, 1995, MW-1 was sampled for volatile organic compounds calibrated for xylene plus 15 tentatively identifies compounds (VOCs), and semivolatile organic compounds plus 15 tentatively identified compounds (SVOCs). Groundwater analytical results were either below the detection limit or in compliance with the New Jersey Groundwater Criteria (GWQC). No product or sheen was observed in MW-1 on either of the sampling dates.

No further action is proposed in regard to the closure and site assessment of UST No. 090017-17 at Building 166.

1.0 UNDERGROUND STORAGE TANK DECOMMISSIONING ACTIVITIES

1.1 OVERVIEW

One underground storage tank (UST), New Jersey Department of Environmental Protection (NJDEP) Registration No. 090017-17, was closed at Building 166 at U.S. Army Fort Monmouth, Fort Monmouth, New Jersey on June 16, 1994. Refer to site location map on Figure 1. This report presents the results of the DPW's implementation of the UST Decommissioning/Closure Plan submitted to the NJDEP on May 25, 1994, and approved on June 7, 1994. The UST was a fiberglass 4,000-gallon tank containing No. 2 fuel oil.

Decommissioning activities for UST No. 090017-17 complied with all applicable Federal, State and Local laws and ordinances in effect at the date of decommissioning. These laws included but were not limited to: N.J.A.C. 7:14B-1 et seq., N.J.A.C. 5:23-1 et seq., and Occupational Safety and Health Administration (OSHA) 1910.146 & 1910.120. All permits including but not limited to the NJDEP-approved Decommissioning/Closure Plan were posted on site for inspection. CUTE, Inc., the contractor that conducted the decommissioning activities, is registered and certified by the NJDEP for performing UST closure activities. Closure of UST No. 090017-17 proceeded under the approval of the NJDEP Bureau of Underground Storage Tanks (NJDEP-BUST). The NJDEP-BUST closure approval and signed certifications for UST No. 090017-17 are included in Appendices A and B, respectively.

Based on an inspection of the UST, field screening of subsurface soils and analytical results of collected soil samples, the DPW has concluded that a significant historical discharge was associated with this UST or more probable with a former UST. On June 16, 1994, a spill was reported to the NJDEP "Hotline" for UST No. 090017-17 and was assigned Spill Case No. 94-6-16-1545-09.

This UST Closure and Site Investigation Report has been prepared by Smith Technology Corporation, to assist the United States Army Directorate of Public Works (DPW) in complying with the NJDEP Bureau of Underground Storage Tanks (NJDEP-BUST) regulations. The applicable NJDEP-BUST regulations at the date of closure were the *Interim Closure Requirements for Underground Storage Tank Systems* (N.J.A.C. 7:14B-1 et seq. September 1990 and revisions dated November 1, 1991).

This report was prepared using information required at the time of closure. Section 1 of this UST Closure and Site Investigation Report provides a summary of the UST decommissioning activities. Section 2 of this report describes the site investigation activities. Conclusions and recommendations, including the results of the soil sampling investigation, are presented in the final section of this report.

1.2 SITE DESCRIPTION

Building 166 is located in the northeastern portion of the Main Post area of Fort Monmouth, as shown on Figure 1. UST No. 090017-17 was located west of Building 166 and appurtenant piping ran less than 10 feet east from the excavation to Building 166. The fill port area was located directly above the tank. A site map is provided on Figure 2.

1.2.1 Geological/Hydrogeological Setting

The following is a description of the geological/hydrogeological setting of the area surrounding Building 166. Included is a description of the regional geology of the area surrounding Fort Monmouth as well as descriptions of the local geology and hydrogeology of the Main Post area.

Regional Geology

Monmouth County lies within the New Jersey Section of the Atlantic Coastal Plain physiographic province. The Main Post, Charles Wood, and the Evans areas are located in what may be referred to as the Outer Coastal Plain subprovince, or the Outer Lowlands.

In general, New Jersey Coastal Plain formations consist of a seaward-dipping wedge of unconsolidated deposits of clay, silt, and gravel. These formations typically strike northeast-southwest with a dip ranging from 10 to 60 feet per mile and were deposited on Precambrian and lower Paleozoic rocks (Zapeczka, 1989). These sediments, predominantly derived from deltaic, shallow marine, and continental shelf environments, date from Cretaceous through the Quaternary Periods. The mineralogy ranges from quartz to glauconite.

The formations record several major transgressive/regressive cycles and contain units which are generally thicker to the southeast and reflect a deeper water environment. Over 20 regional geologic units are present within the sediments of the 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 thicknesses for these units vary greatly (i.e., from several feet to several hundred feet). The Coastal Plain deposits thicken to the southeast from the Fall Line to greater than 6,500 feet in Cape May County (Brown and Zapeczka, 1990).

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).

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 9 feet below ground surface (bgs). According to Jablonski, wells drilled in the Red Bank and Tinton Sands may produce 2 to 25 gallons per minute (gpm). Some well owners have reported acidic water that requires treatment to remove iron.

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. However, an abundance of clay lenses and sand deposits were noted in borings installed throughout Fort Monmouth. Therefore the direction of shallow groundwater should be determined on a case by case basis.

1.3 HEALTH AND SAFETY

Before, during, and after all decommissioning activities, hazards at the work site which may have posed a threat to the Health and Safety of all personnel who were involve with, or were affected by, the decommissioning of the UST system were minimized. All areas which posed, or may have been suspected to pose a vapor hazard were monitored by a qualified individual utilizing an organic vapor analyzer (OVA). The individual ascertained if the area was properly vented to render the area safe, as defined by OSHA.

1.4 REMOVAL OF UNDERGROUND STORAGE TANK

1.4.1 General Procedures

- All underground obstructions (utilities, etc.) were marked out by the contractor performing the closure prior to excavation activities.
- All activities were carried out with the greatest regard to safety and health and the safeguarding of the environment.
- All excavated soils were visually examined and screened with an OVA for evidence of contamination. Potentially contaminated soils were identified and logged during closure activities.
- Surface materials (i.e., asphalt, concrete, etc.) were excavated and staged separately from all soil and recycled in accordance with all applicable regulations and laws.
- A Sub-Surface Evaluator from the DPW was present during all site assessment activities.

1.4.2 Underground Storage Tank Excavation and Cleaning

Prior to UST decommissioning activities, surficial soil was removed to expose the UST and associated piping. All free product present in the piping was drained into the UST and all associated piping were removed. Approximately 3,348 gallons of liquid were removed from the UST prior to removal from the ground, and approximately 1,738 gallons were removed from the UST four days after the UST was removed from the excavation. A total of 5,086 gallons of liquid were transported by Freehold Cartage Inc. to Lionetti Oil Recovery Co. Inc., a NJDEP-approved petroleum recycling and disposal company located in Old Bridge, New Jersey. Refer to Appendix C for the waste manifests (NJ-1603243 and NJ-1603186).

The UST was cleaned prior to removal from the excavation in accordance with the NJDEP-BUST regulations. After the UST was removed from the excavation, it was staged on polyethylene sheeting and examined for holes. No holes or punctures were observed during the inspection by the Sub-Surface Evaluator. Soils surrounding the UST were screened visually and with an OVA for evidence of contamination. Evidence of contamination was observed.

Soil screening was also performed along the piping associated with the UST. No contamination was noted anywhere along the piping length.

1.5 UNDERGROUND STORAGE TANK TRANSPORTATION AND DISPOSAL

The fiberglass tank was transported by CUTE, Inc. to Fort Monmouth Reclamation Center for disposal in compliance with all applicable regulations and laws. See Appendix D for UST Disposal Certificate.

The removal contractor labeled the UST prior to transport with the following information:

- site of origin
- contact person
- NJDEP UST Facility ID number
- name of transporter/contact person
- destination site/contact person

1.6 MANAGEMENT OF EXCAVATED SOILS

Based on visual observations, approximately 24 cubic yards of potentially contaminated soils were excavated from the UST excavation. Potentially contaminated soils were stockpiled separately from other excavated material and were placed on and covered with polyethylene sheets. Potentially contaminated soils were transported to a designated site on Main Post for storage prior to ultimate disposal at Soil Remediation of Philadelphia. Soils that did not exhibit signs of contamination were used as backfill following removal of the UST.

2.0 SITE INVESTIGATION ACTIVITIES

2.1 OVERVIEW

The Site Investigation was managed and carried out by U.S. Army DPW personnel. All analyses were performed and reported by U.S. Army Fort Monmouth Environmental Laboratory, a NJDEP-certified testing laboratory. All sampling was performed under the direct supervision of a NJDEP Certified Sub-Surface Evaluator according to the methods described in the NJDEP *Field Sampling Procedures Manual* (1992). Sampling frequency and parameters analyzed complied with the NJDEP-BUST document *Interim Closure Requirements for Underground Storage Tank Systems* (September 1990 and revisions dated November 1, 1991) which was the applicable regulation at the date of the closure. All records of the Site Investigation activities are maintained by the Fort Monmouth DPW Environmental Office.

The following Parties participated in Closure and Site Investigation Activities.

- Closure Contractor: Cleaning Up the Environment Inc. (CUTE)
Closure Supervisor: John Lonergan
Phone Number: (201)427-2881
NJDEP Company Certification No. 200128
NJDEP UST Closure Certification No.: 3248
- Subsurface Evaluator: Dinkerrai M. Desai
Employer: U.S. Army, Fort Monmouth
Phone Number: (908) 532-1475
NJDEP Certification No.: E0002266
- Analytical Laboratory: U.S. Army Fort Monmouth Environmental Laboratory
Contact Person: Brian K. McKee
Phone Number: (908)532-4359
NJDEP Certification No.: 13461
- Hazardous Waste Hauler: Freehold Cartage Inc.
Contact Person: Barry Olsen
Phone Number: (908)721-0900
NJDEP Hazardous Waste Hauler No.: 2265

2.2 FIELD SCREENING/MONITORING

Field screening was performed by a NJDEP Certified Sub-Surface Evaluator using an OVA and visual observations to identify potentially contaminated material. Additional soils were removed

from the excavation surrounding UST No. 090017-17 until no evidence of contamination remained.

2.3 SOIL SAMPLING

On June 16, 1994, post-excavation soil samples A, DUP A, B, C, D, E, F, G, and H were collected from a total of eight (8) locations along the sidewalls of the excavation, immediately above groundwater. The samples were collected at a depth of 7.5 feet below ground surface (bgs). Groundwater was present at approximately 8.0 feet bgs.

Following removal of the UST fuel lines, sample J was collected along the former piping length of the excavation, which ran less than 10 feet in length. The piping sample was collected at a depth of at 2.0 feet bgs. All soil samples were analyzed for total petroleum hydrocarbons (TPHC).

The site assessment was performed by U.S. Army personnel in accordance with the NJDEP *Technical Requirements* and the NJDEP *Field Sampling Procedures Manual*. A summary of sampling activities including parameters analyzed is provided in Table 1. The post-excavation soil samples were collected using polystyrene scoops. Actual soil TPHC values may be higher than reported, due to sample utensil absorbency. If absorbency resulted in reducing the actual soil TPHC concentration by 50 %, the highest soil contaminant would have been 1,472.0 mg/kg, still below the applicable NJDEP soil cleanup standard for total organic contaminants of 10,000 mg/kg. Following soil sampling activities, the samples were chilled and delivered to U.S. Army Fort Monmouth Environmental Laboratory located in Fort Monmouth, New Jersey, for analysis.

2.4 GROUNDWATER SAMPLING

2.4.1 Monitoring Well Installation

In response to the observation of potentially contaminated soil near the shallow water table, one shallow monitoring well (MW-1) was installed at the Building 166 area on September 14, 1994. It was installed approximately 12 feet southwest of Building 166 in the downgradient direction. It was screened in the 2 to 10 feet depth interval, across the water table, which is approximately 3.0 feet below ground surface.

The well was constructed in accordance with the NJDEP's well construction protocols outlined in its May 1992 *Field Sampling Procedures Manual*. The NJDEP well drilling permit and a well construction log is presented in Appendix F.

The well was constructed with 4-inch (ID) PVC riser and 0.020 slotted PVC well screen. A silica sand pack was installed in the annulus between the borehole wall and the screen. The

sandpack was extended approximately one foot above the top of the screen. The sand pack above the well screen was graded down to a fine sand to minimize grout intrusion.

The borehole was tremie-grouted with bentonite-cement grout from the top of the sand pack to 0.5 inches bgs. The well was secured with a water-tight, flush-mounted locking road box. The road box was set in place with concrete, which was placed in the remaining open borehole. The elevation of the well riser was surveyed to the nearest 0.01 feet by a New Jersey-licensed surveyor. The well permit number was marked on the well casing as required.

The monitoring well was developed using a peristaltic surface pump. The well was pumped for 1 hour or until silt free. All residual soils and liquids generated during monitoring well installation and development program were collected in New Jersey Department of Transportation-approved 55-gallon drums. The drums were placed in a designated secure location for waste characterization and off-site disposal.

2.4.2 Monitoring Well Sampling

On May 18, 1995 and June 13, 1995, MW-1 was sampled for VOCs and SVOCs. Sampling and analysis were performed in accordance with the NJDEP *Field Sampling Procedures Manual* and the *Technical Requirements for Site Remediation*.

Prior to sampling, the water level was measured to the nearest 0.01 feet, and the distance to the bottom of the well was to be measured to the nearest 0.1 feet. The well was checked for floating product (light non-aqueous phase liquids). The well was purged of three to five well volumes of standing water. Sample volume was then collected using a dedicated decontaminated Teflon bottom-filled bailer attached to PTFE (Teflon)-coated stainless steel cable.

3.0 CONCLUSIONS AND RECOMMENDATIONS

3.1 SOIL SAMPLING RESULTS

To evaluate soil conditions following removal of the UST and associated piping, post-excavation soil samples were collected from a total of nine (9) locations on June 16, 1994. All samples were analyzed for TPHC. The post-excavation soil sampling results were compared to the NJDEP residential direct contact total organic contaminants soil cleanup criteria of 10,000 mg/kg (N.J.A.C. 7:26D and revisions dated February 3, 1994). A summary of the analytical results and comparison to the NJDEP soil cleanup criteria is provided in Table 2 and the soil sampling results are shown on Figure 3. The analytical data package is provided in Appendix E.

All post-excavation soil samples collected on June 16, 1994 from the UST excavation and from below piping associated with the UST, contained concentrations of TPHC below the NJDEP soil cleanup criteria. Post-excavation soil samples A, DUP A, B, C, D, E, F, H, and J, contained TPHC concentrations ranging from 13.1 mg/kg to 786.0 mg/kg. Sample G contained a non-detectable concentration of TPHC.

3.2 GROUNDWATER SAMPLING RESULTS

All VOC and SVOC results were either below the detection limit or in compliance with the New Jersey Groundwater Quality Criteria (GWQC).

The sample collected on May 18, 1995 from MW-1 contained methylene chloride at a concentration of 1.8 ug/l, and di-n-butylphthalate at 64 ug/l. No other compounds were detected. The trip blank contained methylene chloride at 5.1 ug/l. The field blank contained di-n-butylphthalate at 55 ug/l, and methylene chloride at 5.1 ug/l.

The sample collected on June 13, 1995 from MW-1 contained methylene chloride at 1.5 ug/l, and chloroform at 0.7 ug/l. No other compounds were detected. The trip blank contained methylene chloride at 2.3 ug/l. The field blank contained methylene chloride at 2.1 ug/l.

No product or sheen was observed in MW-1 on either of the sampling dates. The depth to the water table was 3.02 feet below ground surface on May 18, 1995 and 3.34 feet below ground surface on June 13, 1995.

All groundwater analytical results are presented in Table 3 and shown on Figure 4. The groundwater analytical data package is provided in Appendix F. The full data package, including quality control, is on file at U.S. Army Fort Monmouth, DPW.

3.3 CONCLUSIONS AND RECOMMENDATIONS

The analytical results for all post-excavation soil samples collected from the UST closure excavation at Building 166 were below the NJDEP soil cleanup criteria for total organic contaminants.

Based on the post-excavation sampling results, soils with TPHC concentrations exceeding the NJDEP soil cleanup criteria for total organic contaminants of 10,000 mg/kg, do not exist in the former location of the UST or associated piping.

Based on the analytical results of the groundwater samples collected on May 18, 1995 and June 13, 1995, groundwater quality at the Building 166 closure site complies with the New Jersey Groundwater Quality Standard for VOCs and SVOCs. The trace concentrations of methylene chloride detected during both sampling rounds is attributed to sampling and/or analytical interference, based on the detection of methylene chloride, a common source of laboratory interference, in the sampling blanks.

No further action is proposed in regard to the closure and site assessment of UST No. 090017-17 at Building 166.

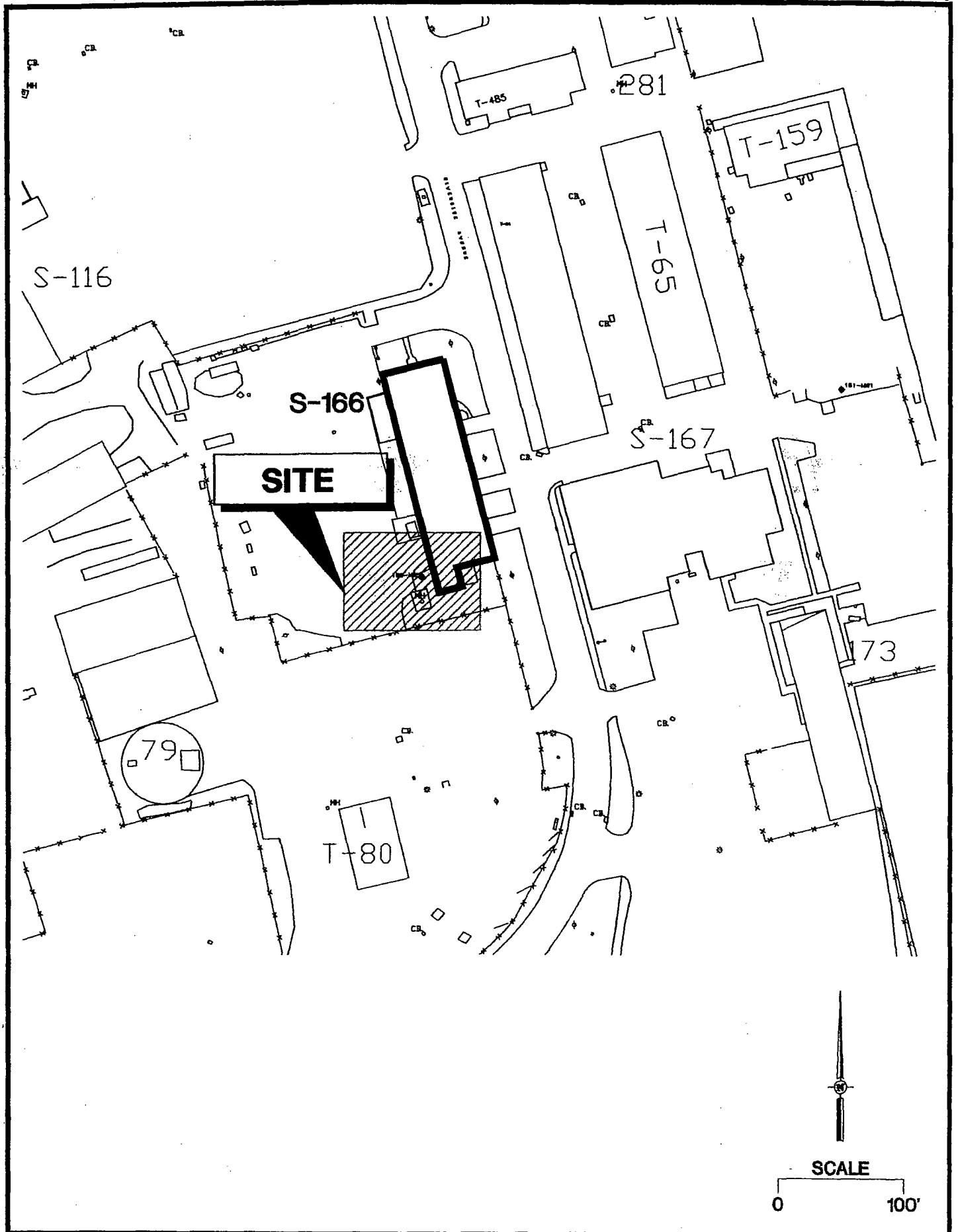


TABLE 1
SUMMARY OF SAMPLING ACTIVITIES
BUILDING 166, MAIN POST
FORT MONMOUTH, NEW JERSEY

Sample ID	Date of Collection	Matrix	Sample Type	Analytical Parameters (and USEPA Methods) *	Sampling Method
A	6/16/1994	Soil	Post-Excavation	TPHC	Polystyrene Scoop
B	6/16/1994	Soil	Post-Excavation	TPHC	Polystyrene Scoop
C	6/16/1994	Soil	Post-Excavation	TPHC	Polystyrene Scoop
D	6/16/1994	Soil	Post-Excavation	TPHC	Polystyrene Scoop
E	6/16/1994	Soil	Post-Excavation	TPHC	Polystyrene Scoop
F	6/16/1994	Soil	Post-Excavation	TPHC	Polystyrene Scoop
G	6/16/1994	Soil	Post-Excavation	TPHC	Polystyrene Scoop
H	6/16/1994	Soil	Post-Excavation	TPHC	Polystyrene Scoop
DUP A	6/16/1994	Soil	Post-Excavation	TPHC	Polystyrene Scoop
J	6/16/1994	Soil	Post-Excavation	TPHC	Polystyrene Scoop
MW-1	5/18/1995	Aqueous	Groundwater	VOCs, SVOCs	Teflon Bottom Fill Bailer
MW-1	6/13/1995	Aqueous	Groundwater	VOCs, SVOCs	Teflon Bottom Fill Bailer

*Note:

TPHC: Total Petroleum Hydrocarbons (Method 418.1 / soil and aqueous)
VOCs: Volatile Organic Compounds calibrated for xylene plus 10 tentativley identified compounds (Method 524.2 / aqueous)
SVOCs: Semivolatile Organic Compounds plus 15 tentatively identified compounds (Method 625 / aqueous)

Source: Smith Technology Corporation (Smith Project No. 09-5004-12)

GWT166.XLS

TABLE 2
POST-EXCAVATION SOIL SAMPLING RESULTS
BUILDING 166, MAIN POST
FORT MONMOUTH, NEW JERSEY

Sample ID/Depth	Sample Laboratory ID	Sample Date	Analysis Date	Compound Name	Sample Quantitation Limit (mg/kg)	Compound of Concern	Result (mg/kg)	NJDEP Soil Cleanup Criteria *	Exceeds Cleanup Criteria
A/7.5-8.0'	1529.1	6/16/1994	6/17/1994	Total % Solid	--	--	86%	--	--
				TPHC	6.6	yes	42.9	10,000	--
B/7.5-8.0'	1529.2	6/16/1994	6/17/1994	Total % Solid	--	--	87%	--	--
				TPHC	6.6	yes	103	10,000	--
C/7.5-8.0'	1529.3	6/16/1994	6/17/1994	Total % Solid	--	--	85%	--	--
				TPHC	6.6	yes	13.1	10,000	--
D/7.5-8.0'	1529.4	6/16/1994	6/17/1994	Total % Solid	--	--	78%	--	--
				TPHC	6.6	yes	224	10,000	--
E/7.5-8.0'	1529.5	6/16/1994	6/17/1994	Total % Solid	--	--	86%	--	--
				TPHC	6.6	yes	70.6	10,000	--
F/7.5-8.0'	1529.6	6/16/1994	6/17/1994	Total % Solid	--	--	85%	--	--
				TPHC	6.6	yes	786	10,000	--
G/7.5-8.0'	1529.7	6/16/1994	6/17/1994	Total % Solid	--	--	86%	--	--
				TPHC	6.6	yes	ND	10,000	--
H/7.5-8.0'	1529.8	6/16/1994	6/17/1994	Total % Solid	--	--	83%	--	--
				TPHC	6.6	yes	63.6	10,000	--
DUP A/7.5-8.0'	1529.9	6/16/1994	6/17/1994	Total % Solid	--	--	88%	--	--
				TPHC	6.6	yes	21.0	10,000	--
J/2.0-2.5'	1529.10	6/16/1994	6/17/1994	Total % Solid	--	--	93%	--	--
				TPHC	6.6	yes	28.4	10,000	--

--: Not applicable / does not exceed criteria

*: Cleanup criteria for total organics

ND: Indicates compound not detected

Actual soil TPHC values may be higher than reported due to absorbancy by polystyrene scoops. If absorbancy resulted in reducing the actual soil TPHC concentration by 50%, the highest soil contaminant would be 1,572 mg/kg.

Source: Smith Technology Corporation (Smith Project No. 09-5004-12)

GWT166.XLS

TABLE 3

GROUNDWATER SAMPLING RESULTS
 BUILDING 166, MAIN POST, MW-1
 FORT MONMOUTH, NEW JERSEY
 SEMIVOLATILES

Sample ID	Sample Date	Analysis Date	Compound Name	Sample Quantitation Limit (ug/l)	Compound of Concern	Result (ug/l)	GWQS (ug/l)	Exceeds Criteria
MW-1	5/18/1995	6/2/1995	N-nitrosodimethylamine	2	--	ND	20	--
			bis(2-Chloroethyl)Ether	1	--	ND	10	--
			1,3-Dichlorobenzene	2	--	ND	600	--
			1,4-Dichlorobenzene	1	--	ND	75	--
			1,2-Dichlorobenzene	2	--	ND	600	--
			bis(2-chloroisopropyl)ether	5	--	ND	300	--
			N-Nitroso-Di-N-propylamine	2	--	ND	20	--
			Hexachloroethane	1	--	ND	10	--
			Nitrobenzene	2	--	ND	10	--
			Isophorone	1	--	ND	100	--
			bis(2-Chloroethoxy)methane	3	--	ND	--	--
			1,2,4-Trichlorobenzene	2	--	ND	9	--
			Naphthalene	2	--	ND	300	--
			Hexachlorobutadiene	2	--	ND	1	--
			Hexachlorocyclopentadiene	12	--	ND	50	--
			2-Chloronaphthalate	1	--	ND	--	--
			Dimethylphthalate	1	--	ND	--	--
			Acenaphthylene	5	--	ND	NA	--
			2,6-Dinitrotoluene	2	--	ND	NA	--
			Acenaphthene	3	--	ND	400	--
			2,4-Dinitrotoluene	3	--	ND	10	--
			Diethylphthalate	1	--	ND	5,000	--
			Fluorene	3	--	ND	300	--
			4-Chlorophenyl-phenylether	3	--	ND	--	--
			n-Nitrosodiphenylamine	6	--	ND	20	--
			1,2-Diphenylhydrazine(as azo)	6	--	ND	0.04	--
			4-Bromophenyl-phenylether	2	--	ND	--	--
			Hexachlorobenzene	2	--	ND	10	--
			Phenanthrene	2	--	ND	NA	--
			Anthracene	2	--	ND	2,000	--
			Di-n-butylphthalate	64	--	64	900	--
			Fluoranthene	1	--	ND	300	--

TABLE 3
GROUNDWATER SAMPLING RESULTS
BUILDING 166, MAIN POST, MW-1
FORT MONMOUTH, NEW JERSEY
SEMIVOLATILES (continued)

Sample ID	Sample Date	Analysis Date	Compound Name	Sample Quantitation Limit (ug/l)	Compound of Concern	Result (ug/l)	GWQS (ug/l)	Exceeds Criteria
MW-1	5/18/1995	6/2/1995	Benizidine	1	--	ND	50	--
			Pyrene	2	--	ND	200	--
			Butylbenzylphthalate	9	--	ND	100	--
			Benzo(a)anthracene	2	--	ND	0.05	--
			3,3'-Dichlorobenzidine	15	--	ND	60	--
			Chrysene	2	--	ND	5	--
			bis(2-Ethylhexyl)phthalate	4	--	ND	30	--
			Di-n-octylphthalate	2	--	ND	100	--
			Benzo(b)fluoranthene	1	--	ND	0.05	--
			Benzo(k)fluoranthene	2	--	ND	0.5	--
			Benzo(a)pyrene	2	--	ND	0.005	--
			Indeno(1,2,3-cd)pyrene	2	--	ND	0.05	--
			Dibenz(a,h)anthracene	3	--	ND	0.005	--
			Benzo(g,h,i)perylene	2	--	ND	NA	--
			SEMIVOLATILE TICS:					
			Unknown Hydrocarbon	--	--	5 J	--	--
			Undecane,3,6-dimethyl-	--	--	6 J	--	--
			Heptadecane,2,6,10,14-tetra	--	--	13 J	--	--
			Dodecane,2,7,10-trimethyl-	--	--	9 J	--	--
			Unknown	--	--	6 J	--	--
			TOTAL TICS:	--	--	39	--	--

TABLE 3
GROUNDWATER SAMPLING RESULTS
BUILDING 166, MAIN POST, MW-1
FORT MONMOUTH, NEW JERSEY
VOLATILES

Sample ID	Sample Date	Analysis Date	Compound Name	Sample Quantitation Limit (ug/l)	Compound of Concern	Result (ug/l)	GWQS (ug/l)	Exceeds Criteria
MW-1	5/18/1995	6/2/1995	Dichlorodifluoromethane	0.5	--	ND	1,000	--
			Chloromethane	0.5	--	ND	30	--
			Bromomethane	0.5	--	ND	10	--
			Vinyl Chloride	0.5	--	ND	5	--
			Chloroethane	0.5	--	ND	--	--
			Trichlorofluoromethane	0.5	--	ND	--	--
			Methylene Chloride	1.8	--	1.8 B	2	--
			trans-1,2-Dichloroethene	0.5	--	ND	100	--
			1,1-Dichloroethene	0.5	--	ND	2	--
			1,1-Dichloroethane	0.5	--	ND	70	--
			2,2-Dichloropropane	0.5	--	ND	--	--
			Bromochloromethane	0.5	--	ND	--	--
			cis-1,2-Dichloroethene	0.5	--	ND	10	--
			Chloroform	0.5	--	ND	6	--
			1,1-Dichloropropene	0.5	--	ND	--	--
			1,2-Dichloroethane	0.5	--	ND	2	--
			1,1,1-Trichloroethane	0.5	--	ND	30	--
			Dibromomethane	0.5	--	ND	--	--
			Carbon Tetrachloride	0.5	--	ND	2	--
			Bromodichloromethane	0.5	--	ND	1	--
			1,2-Dichloropropane	0.5	--	ND	1	--
			cis-1,3-Dichloropropene	0.5	--	ND	NA	--
			1,3-Dichloropropane	0.5	--	ND	--	--
			Trichloroethene	0.5	--	ND	1	--
			Dibromochloromethane	0.5	--	ND	10	--
			1,1,2-Trichloroethane	0.5	--	ND	3	--
			Benzene	0.5	--	ND	1	--
			trans-1,3-Dichloropropene	0.5	--	ND	NA	--
			Bromoform	0.5	--	ND	4	--
			1,1,1,2-Tetrachloroethane	0.5	--	ND	10	--
			Tetrachloroethene	0.5	--	ND	1	--
			1,1,2,2-Tetrachloroethane	0.5	--	ND	2	--

TABLE 3
GROUNDWATER SAMPLING RESULTS
BUILDING 166, MAIN POST, MW-1
FORT MONMOUTH, NEW JERSEY
VOLATILES (continued)

Sample ID	Sample Date	Analysis Date	Compound Name	Sample Quantitation Limit (ug/l)	Compound of Concern	Result (ug/l)	GWQS (ug/l)	Exceeds Criteria
MW-1	5/18/1995	6/2/1995	Toluene	0.5	--	ND	1,000	--
			1,2-Dibromoethane	0.5	--	ND	--	--
			Chlorobenzene	0.5	--	ND	4	--
			Ethylbenzene	0.5	--	ND	700	--
			Xylene (total)	0.5	--	ND	40	--
			Styrene	0.5	--	ND	100	--
			Isopropylbenzene	0.5	--	ND	--	--
			Bromobenzene	0.5	--	ND	--	--
			1,2,3-Trichloropropane	0.5	--	ND	40	--
			n-Propylbenzene	0.5	--	ND	--	--
			2-Chlorotoluene	0.5	--	ND	--	--
			4-Chlorotoluene	0.5	--	ND	--	--
			1,3,5-Trimethylbenzene	0.5	--	ND	--	--
			tert-Butylbenzene	0.5	--	ND	--	--
			1,2,4-Trimethylbenzene	0.5	--	ND	--	--
			sec-Butylbenzene	0.5	--	ND	--	--
			1,3-Dichlorobenzene	0.5	--	ND	600	--
			1,4-Dichlorobenzene	0.5	--	ND	75	--
			4-Isopropyltoluene	0.5	--	ND	--	--
			1,2-Dichlorobenzene	0.5	--	ND	600	--
			n-Butylbenzene	0.5	--	ND	--	--
			1,2-Dibromo-3-chloropropane	0.5	--	ND	NA	--
			1,2,4-Trichlorobenzene	0.5	--	ND	9	--
			Hexachlorobutadiene	0.5	--	ND	1	--
			Naphthalene	0.5	--	ND	300	--
			1,2,3-Trichlorobenzene	0.5	--	ND	--	--

TABLE 3
GROUNDWATER SAMPLING RESULTS
BUILDING 166, MAIN POST, MW-1
FORT MONMOUTH, NEW JERSEY
VOLATILE TICS

Sample ID	Sample Date	Analysis Date	Compound Name	Sample Quantitation Limit (ug/l)	Compound of Concern	Result (ug/l)	GWQS (ug/l)	Exceeds Criteria
MW-1	5/18/1995	6/2/1995	Unknown	--	--	1 J	--	--
			Naphthalene, decahydro-2-met	--	--	2 J	--	--
			Unknown	--	--	2 J	--	--
			Unknown	--	--	1 J	--	--
			Unknown	--	--	2 J	--	--
			Unknown	--	--	2 J	--	--
			Unknown Hydrocarbon	--	--	1 J	--	--
			Unknown	--	--	3 J	--	--
			Unknown	--	--	3 J	--	--
			Unknown	--	--	3 J	--	--
			Unknown	--	--	2 J	--	--
			Unknown	--	--	1 J	--	--
			Unknown	--	--	2 J	--	--
			Unknown	--	--	1 J	--	--
			Unknown	--	--	1 J	--	--
			TOTAL TICS:	--	--	27	--	--

TABLE 3
GROUNDWATER SAMPLING RESULTS
BUILDING 166, MAIN POST, TRIP BLANK
FORT MONMOUTH, NEW JERSEY
VOLATILES

Sample ID	Sample Date	Analysis Date	Compound Name	Sample Quantitation Limit (ug/l)	Compound of Concern	Result (ug/l)	GWQS (ug/l)	Exceeds Criteria
TRIP BLANK	5/18/1995	6/1/1995	Dichlorodifluoromethane	0.5	--	ND	1,000	--
			Chloromethane	0.5	--	ND	30	--
			Bromomethane	0.5	--	ND	10	--
			Vinyl Chloride	0.5	--	ND	5	--
			Chloroethane	0.5	--	ND	--	--
			Trichlorofluoromethane	0.5	--	ND	--	--
			Methylene Chloride	5.1	--	5.1 B	2	yes
			trans-1,2-Dichloroethene	0.5	--	ND	100	--
			1,1-Dichloroethene	0.5	--	ND	2	--
			1,1-Dichloroethane	0.5	--	ND	70	--
			2,2-Dichloropropane	0.5	--	ND	--	--
			Bromochloromethane	0.5	--	ND	--	--
			cis-1,2-Dichloroethene	0.5	--	ND	10	--
			Chloroform	0.5	--	ND	6	--
			1,1-Dichloropropene	0.5	--	ND	--	--
			1,2-Dichloroethane	0.5	--	ND	2	--
			1,1,1-Trichloroethane	0.5	--	ND	30	--
			Dibromomethane	0.5	--	ND	--	--
			Carbon Tetrachloride	0.5	--	ND	2	--
			Bromodichloromethane	0.5	--	ND	1	--
			1,2-Dichloropropane	0.5	--	ND	1	--
			cis-1,3-Dichloropropene	0.5	--	ND	NA	--
			1,3-Dichloropropane	0.5	--	ND	--	--
			Trichloroethene	0.5	--	ND	1	--
			Dibromochloromethane	0.5	--	ND	10	--
			1,1,2-Trichloroethane	0.5	--	ND	3	--
			Benzene	0.5	--	ND	1	--
			trans-1,3-Dichloropropene	0.5	--	ND	NA	--
			Bromoform	0.5	--	ND	4	--
			1,1,1,2-Tetrachloroethane	0.5	--	ND	10	--
			Tetrachloroethene	0.5	--	ND	1	--
			1,1,2,2-Tetrachloroethane	0.5	--	ND	2	--

TABLE 3
GROUNDWATER SAMPLING RESULTS
BUILDING 166, MAIN POST, TRIP BLANK
FORT MONMOUTH, NEW JERSEY
VOLATILES (continued)

Sample ID	Sample Date	Analysis Date	Compound Name	Sample Quantitation Limit (ug/l)	Compound of Concern	Result (ug/l)	GWQS (ug/l)	Exceeds Criteria
TRIP BLANK	5/18/1995	6/1/1995	Toluene	0.5	--	ND	1,000	--
			1,2-Dibromoethane	0.5	--	ND	--	--
			Chlorobenzene	0.5	--	ND	4	--
			Ethylbenzene	0.5	--	ND	700	--
			Xylene (total)	0.5	--	ND	40	--
			Styrene	0.5	--	ND	100	--
			Isopropylbenzene	0.5	--	ND	--	--
			Bromobenzene	0.5	--	ND	--	--
			1,2,3-Trichloropropane	0.5	--	ND	40	--
			n-Propylbenzene	0.5	--	ND	--	--
			2-Chlorotoluene	0.5	--	ND	--	--
			4-Chlorotoluene	0.5	--	ND	--	--
			1,3,5-Trimethylbenzene	0.5	--	ND	--	--
			tert-Butylbenzene	0.5	--	ND	--	--
			1,2,4-Trimethylbenzene	0.5	--	ND	--	--
			sec-Butylbenzene	0.5	--	ND	--	--
			1,3-Dichlorobenzene	0.5	--	ND	600	--
			1,4-Dichlorobenzene	0.5	--	ND	75	--
			4-Isopropyltoluene	0.5	--	ND	--	--
			1,2-Dichlorobenzene	0.5	--	ND	600	--
			n-Butylbenzene	0.5	--	ND	--	--
			1,2-Dibromo-3-chloropropane	0.5	--	ND	NA	--
			1,2,4-Trichlorobenzene	0.5	--	ND	9	--
			Hexachlorobutadiene	0.5	--	ND	1	--
			Naphthalene	0.5	--	ND	300	--
			1,2,3-Trichlorobenzene	0.5	--	ND	--	--
			VOLATILE TICS:					
			NONE FOUND	--	--	--	--	--

TABLE 3
GROUNDWATER SAMPLING RESULTS
BUILDING 166, MAIN POST, FIELD BLANK
FORT MONMOUTH, NEW JERSEY
SEMIVOLATILES

Sample ID	Sample Date	Analysis Date	Compound Name	Sample Quantitation Limit (ug/l)	Compound of Concern	Result (ug/l)	GWQS (ug/l)	Exceeds Criteria
FIELD BLANK	5/18/1995	6/2/1995	N-nitrosodimethylamine	2	--	ND	20	--
			bis(2-Chloroethyl)Ether	1	--	ND	10	--
			1,3-Dichlorobenzene	2	--	ND	600	--
			1,4-Dichlorobenzene	1	--	ND	75	--
			1,2-Dichlorobenzene	2	--	ND	600	--
			bis(2-chloroisopropyl)ether	5	--	ND	300	--
			N-Nitroso-Di-N-propylamine	2	--	ND	20	--
			Hexachloroethane	1	--	ND	10	--
			Nitrobenzene	2	--	ND	10	--
			Isophorone	1	--	ND	100	--
			bis(2-Chloroethoxy)methane	3	--	ND	--	--
			1,2,4-Trichlorobenzene	2	--	ND	9	--
			Naphthalene	2	--	ND	300	--
			Hexachlorobutadiene	2	--	ND	1	--
			Hexachlorocyclopentadiene	12	--	ND	50	--
			2-Chloronaphthalate	1	--	ND	--	--
			Dimethylphthalate	1	--	ND	--	--
			Acenaphthylene	5	--	ND	NA	--
			2,6-Dinitrotoluene	2	--	ND	NA	--
			Acenaphthene	3	--	ND	400	--
			2,4-Dinitrotoluene	3	--	ND	10	--
			Diethylphthalate	1	--	ND	5,000	--
			Fluorene	3	--	ND	300	--
			4-Chlorophenyl-phenylether	3	--	ND	--	--
			n-Nitrosodiphenylamine	6	--	ND	20	--
			1,2-Diphenylhydrazine(as azo)	6	--	ND	0.04	--
			4-Bromophenyl-phenylether	2	--	ND	--	--
			Hexachlorobenzene	2	--	ND	10	--
			Phenanthrene	2	--	ND	NA	--
			Anthracene	2	--	ND	2,000	--
			Di-n-butylphthalate	55	--	55	900	--
			Fluoranthene	1	--	ND	300	--

TABLE 3
GROUNDWATER SAMPLING RESULTS
BUILDING 166, MAIN POST, FIELD BLANK
FORT MONMOUTH, NEW JERSEY
SEMIVOLATILES (continued)

Sample ID	Sample Date	Analysis Date	Compound Name	Sample Quantitation Limit (ug/l)	Compound of Concern	Result (ug/l)	GWQS (ug/l)	Exceeds Criteria
FIELD BLANK	5/18/1995	6/2/1995	Benizidine	1	--	ND	50	--
			Pyrene	2	--	ND	200	--
			Butylbenzylphthalate	9	--	ND	100	--
			Benzo(a)anthracene	2	--	ND	0.05	--
			3,3'-Dichlorobenzidine	15	--	ND	60	--
			Chrysene	2	--	ND	5	--
			bis(2-Ethylhexyl)phthalate	4	--	ND	30	--
			Di-n-octylphthalate	2	--	ND	100	--
			Benzo(b)fluoranthene	1	--	ND	0.05	--
			Benzo(k)fluoranthene	2	--	ND	0.5	--
			Benzo(a)pyrene	2	--	ND	0.005	--
			Indeno(1,2,3-cd)pyrene	2	--	ND	0.05	--
			Dibenz(a,h)anthracene	3	--	ND	0.005	--
			Benzo(g,h,i)perylene	2	--	ND	NA	--
			SEMIVOLATILE TICS:					
			Unknown	--	--	14 J	--	--
			TOTAL TICS:	--	--	14	--	--

TABLE 3
GROUNDWATER SAMPLING RESULTS
BUILDING 166, MAIN POST, FIELD BLANK
FORT MONMOUTH, NEW JERSEY
VOLATILES

Sample ID	Sample Date	Analysis Date	Compound Name	Sample Quantitation Limit (ug/l)	Compound of Concern	Result (ug/l)	GWQS (ug/l)	Exceeds Criteria
FIELD BLANK	5/18/1995	6/1/1995	Dichlorodifluoromethane	0.5	--	ND	1,000	--
			Chloromethane	0.5	--	ND	30	--
			Bromomethane	0.5	--	ND	10	--
			Vinyl Chloride	0.5	--	ND	5	--
			Chloroethane	0.5	--	ND	--	--
			Trichlorofluoromethane	0.5	--	ND	--	--
			Methylene Chloride	5.1	--	5.1 B	2	yes
			trans-1,2-Dichloroethene	0.5	--	ND	100	--
			1,1-Dichloroethene	0.5	--	ND	2	--
			1,1-Dichloroethane	0.5	--	ND	70	--
			2,2-Dichloropropane	0.5	--	ND	--	--
			Bromochloromethane	0.5	--	ND	--	--
			cis-1,2-Dichloroethene	0.5	--	ND	10	--
			Chloroform	0.5	--	ND	6	--
			1,1-Dichloropropene	0.5	--	ND	--	--
			1,2-Dichloroethane	0.5	--	ND	2	--
			1,1,1-Trichloroethane	0.5	--	ND	30	--
			Dibromomethane	0.5	--	ND	--	--
			Carbon Tetrachloride	0.5	--	ND	2	--
			Bromodichloromethane	0.5	--	ND	1	--
			1,2-Dichloropropane	0.5	--	ND	1	--
			cis-1,3-Dichloropropene	0.5	--	ND	NA	--
			1,3-Dichloropropane	0.5	--	ND	--	--
			Trichloroethene	0.5	--	ND	1	--
			Dibromochloromethane	0.5	--	ND	10	--
			1,1,2-Trichloroethane	0.5	--	ND	3	--
			Benzene	0.5	--	ND	1	--
			trans-1,3-Dichloropropene	0.5	--	ND	NA	--
			Bromoform	0.5	--	ND	4	--
			1,1,1,2-Tetrachloroethane	0.5	--	ND	10	--
			Tetrachloroethene	0.5	--	ND	1	--
			1,1,2,2-Tetrachloroethane	0.5	--	ND	2	--

TABLE 3
GROUNDWATER SAMPLING RESULTS
BUILDING 166, MAIN POST, FIELD BLANK
FORT MONMOUTH, NEW JERSEY
VOLATILES (continued)

Sample ID	Sample Date	Analysis Date	Compound Name	Sample Quantitation Limit (ug/l)	Compound of Concern	Result (ug/l)	GWQS (ug/l)	Exceeds Criteria
FIELD BLANK	5/18/1995	6/1/1995	Toluene	0.5	--	ND	1,000	--
			1,2-Dibromoethane	0.5	--	ND	--	--
			Chlorobenzene	0.5	--	ND	4	--
			Ethylbenzene	0.5	--	ND	700	--
			Xylene (total)	0.5	--	ND	40	--
			Styrene	0.5	--	ND	100	--
			Isopropylbenzene	0.5	--	ND	--	--
			Bromobenzene	0.5	--	ND	--	--
			1,2,3-Trichloropropane	0.5	--	ND	40	--
			n-Propylbenzene	0.5	--	ND	--	--
			2-Chlorotoluene	0.5	--	ND	--	--
			4-Chlorotoluene	0.5	--	ND	--	--
			1,3,5-Trimethylbenzene	0.5	--	ND	--	--
			tert-Butylbenzene	0.5	--	ND	--	--
			1,2,4-Trimethylbenzene	0.5	--	ND	--	--
			sec-Butylbenzene	0.5	--	ND	--	--
			1,3-Dichlorobenzene	0.5	--	ND	600	--
			1,4-Dichlorobenzene	0.5	--	ND	75	--
			4-Isopropyltoluene	0.5	--	ND	--	--
			1,2-Dichlorobenzene	0.5	--	ND	600	--
			n-Butylbenzene	0.5	--	ND	--	--
			1,2-Dibromo-3-chloropropane	0.5	--	ND	NA	--
			1,2,4-Trichlorobenzene	0.5	--	ND	9	--
			Hexachlorobutadiene	0.5	--	ND	1	--
			Naphthalene	0.5	--	ND	300	--
			1,2,3-Trichlorobenzene	0.5	--	ND	--	--
			VOLATILE TICS:					
			NONE FOUND	--	--	--	--	--

TABLE 3
GROUNDWATER SAMPLING RESULTS
BUILDING 166, MAIN POST, MW-1
FORT MONMOUTH, NEW JERSEY
SEMIVOLATILES

Sample ID	Sample Date	Analysis Date	Compound Name	Sample Quantitation Limit (ug/l)	Compound of Concern	Result (ug/l)	GWQS (ug/l)	Exceeds Criteria
MW-1	6/13/1995	6/22/1995	N-nitrosodimethylamine	2	--	ND	20	--
			bis(2-Chloroethyl)Ether	1	--	ND	10	--
			1,3-Dichlorobenzene	2	--	ND	600	--
			1,4-Dichlorobenzene	1	--	ND	75	--
			1,2-Dichlorobenzene	2	--	ND	600	--
			bis(2-chloroisopropyl)ether	5	--	ND	300	--
			N-Nitroso-Di-N-propylamine	2	--	ND	20	--
			Hexachloroethane	1	--	ND	10	--
			Nitrobenzene	2	--	ND	10	--
			Isophorone	1	--	ND	100	--
			bis(2-Chloroethoxy)methane	3	--	ND	--	--
			1,2,4-Trichlorobenzene	2	--	ND	9	--
			Naphthalene	2	--	ND	300	--
			Hexachlorobutadiene	2	--	ND	1	--
			Hexachlorocyclopentadiene	12	--	ND	50	--
			2-Chloronaphthalate	1	--	ND	--	--
			Dimethylphthalate	1	--	ND	--	--
			Acenaphthylene	5	--	ND	NA	--
			2,6-Dinitrotoluene	2	--	ND	NA	--
			Acenaphthene	3	--	ND	400	--
			2,4-Dinitrotoluene	3	--	ND	10	--
			Diethylphthalate	1	--	ND	5,000	--
			Fluorene	3	--	ND	300	--
			4-Chlorophenyl-phenylether	3	--	ND	--	--
			n-Nitrosodiphenylamine	6	--	ND	20	--
			1,2-Diphenylhydrazine(as azo)	6	--	ND	0.04	--
			4-Bromophenyl-phenylether	2	--	ND	--	--
			Hexachlorobenzene	2	--	ND	10	--
			Phenanthrene	2	--	ND	NA	--
			Anthracene	2	--	ND	2,000	--
			Di-n-butylphthalate	5	--	ND	900	--
			Fluoranthene	1	--	ND	300	--

TABLE 3
GROUNDWATER SAMPLING RESULTS
BUILDING 166, MAIN POST, MW-1
FORT MONMOUTH, NEW JERSEY
SEMIVOLATILES (continued)

Sample ID	Sample Date	Analysis Date	Compound Name	Sample Quantitation Limit (ug/l)	Compound of Concern	Result (ug/l)	GWQS (ug/l)	Exceeds Criteria
MW-1	6/13/1995	6/22/1995	Benzidine	1	--	ND	50	--
			Pyrene	2	--	ND	200	--
			Butylbenzylphthalate	9	--	ND	100	--
			Benzo(a)anthracene	2	--	ND	0.05	--
			3,3'-Dichlorobenzidine	15	--	ND	60	--
			Chrysene	2	--	ND	5	--
			bis(2-Ethylhexyl)phthalate	4	--	ND	30	--
			Di-n-octylphthalate	2	--	ND	100	--
			Benzo(b)fluoranthene	1	--	ND	0.05	--
			Benzo(k)fluoranthene	2	--	ND	0.5	--
			Benzo(a)pyrene	2	--	ND	0.005	--
			Indeno(1,2,3-cd)pyrene	2	--	ND	0.05	--
			Dibenz(a,h)anthracene	3	--	ND	0.005	--
			Benzo(g,h,i)perylene	2	--	ND	NA	--

TABLE 3
GROUNDWATER SAMPLING RESULTS
BUILDING 166, MAIN POST, MW-1
FORT MONMOUTH, NEW JERSEY
SEMIVOLATILE TICS:

Sample ID	Sample Date	Analysis Date	Compound Name	Sample Quantitation Limit (ug/L)	Compound of Concern	Result (ug/L)	GWQS (ug/L)	Exceeds Criteria
MW-1	6/13/1995	6/22/1995	Undecane,2,6-dimethyl-	--	--	5 J	--	--
			Cyclohexane,2-butyl-1,1,3-t	--	--	6 J	--	--
			Octane,3-ethyl-	--	--	13 J	--	--
			Unknown Hydrocarbon	--	--	5 J	--	--
			Unknown Hydrocarbon	--	--	4 J	--	--
			Dodecane,2,7,10-trimethyl	--	--	7 J	--	--
			Decahydro-4,4,8,9,10-pentame	--	--	12 J	--	--
			Naphthalene,2,3-dimethyl-	--	--	5 J	--	--
			Unknown Hydrocarbon	--	--	5 J	--	--
			Undecane,4,6-dimethyl-	--	--	21 J	--	--
			Unknown Hydrocarbon	--	--	10 J	--	--
			Unknown	--	--	5 J	--	--
			1,1'-Biphenyl,4-methyl-	--	--	12 J	--	--
			Undecane,3,6-dimethyl-	--	--	23 J	--	--
			3-Tetradecene,(E)-	--	--	5 J	--	--
			Azulene,7-ethyl-1,4-dimethy	--	--	4 J	--	--
			Heptadecane,2-6-dimethyl-	--	--	53 J	--	--
			Tridecane,6-propyl-	--	--	30 J	--	--
			Unknown Hydrocarbon	--	--	4 J	--	--
			TOTAL TICS:	--	--	229	--	--

TABLE 3
GROUNDWATER SAMPLING RESULTS
BUILDING 166, MAIN POST, MW-1
FORT MONMOUTH, NEW JERSEY
VOLATILES

Sample ID	Sample Date	Analysis Date	Compound Name	Sample Quantitation Limit (ug/l)	Compound of Concern	Result (ug/l)	GWQS (ug/l)	Exceeds Criteria
MW-1	6/13/1995	6/27/1995	Dichlorodifluoromethane	0.5	--	ND	1,000	--
			Chloromethane	0.5	--	ND	30	--
			Bromomethane	0.5	--	ND	10	--
			Vinyl Chloride	0.5	--	ND	5	--
			Chloroethane	0.5	--	ND	--	--
			Trichlorofluoromethane	0.5	--	ND	--	--
			Methylene Chloride	1.5	--	1.5 B	2	--
			trans-1,2-Dichloroethene	0.5	--	ND	100	--
			1,1-Dichloroethene	0.5	--	ND	2	--
			1,1-Dichloroethane	0.5	--	ND	70	--
			2,2-Dichloropropane	0.5	--	ND	--	--
			Bromochloromethane	0.5	--	ND	--	--
			cis-1,2-Dichloroethene	0.5	--	ND	10	--
			Chloroform	0.7	--	0.7	6	--
			1,1-Dichloropropene	0.5	--	ND	--	--
			1,2-Dichloroethane	0.5	--	ND	2	--
			1,1,1-Trichloroethane	0.5	--	ND	30	--
			Dibromomethane	0.5	--	ND	--	--
			Carbon Tetrachloride	0.5	--	ND	2	--
			Bromodichloromethane	0.5	--	ND	1	--
			1,2-Dichloropropane	0.5	--	ND	1	--
			cis-1,3-Dichloropropene	0.5	--	ND	NA	--
			1,3-Dichloropropane	0.5	--	ND	--	--
			Trichloroethene	0.5	--	ND	1	--
			Dibromochloromethane	0.5	--	ND	10	--
			1,1,2-Trichloroethane	0.5	--	ND	3	--
			Benzene	0.5	--	ND	1	--
			trans-1,3-Dichloropropene	0.5	--	ND	NA	--
			Bromoform	0.5	--	ND	4	--
			1,1,1,2-Tetrachloroethane	0.5	--	ND	10	--
			Tetrachloroethene	0.5	--	ND	1	--
			1,1,2,2-Tetrachloroethane	0.5	--	ND	2	--

TABLE 3
GROUNDWATER SAMPLING RESULTS
BUILDING 166, MAIN POST, MW-1
FORT MONMOUTH, NEW JERSEY
VOLATILES (continued)

Sample ID	Sample Date	Analysis Date	Compound Name	Sample Quantitation Limit (ug/l)	Compound of Concern	Result (ug/l)	GWQS (ug/l)	Exceeds Criteria
MW-1	6/13/1995	6/27/1995	Toluene	0.5	--	ND	1,000	--
			1,2-Dibromoethane	0.5	--	ND	--	--
			Chlorobenzene	0.5	--	ND	4	--
			Ethylbenzene	0.5	--	ND	700	--
			Xylene (total)	0.5	--	ND	40	--
			Styrene	0.5	--	ND	100	--
			Isopropylbenzene	0.5	--	ND	--	--
			Bromobenzene	0.5	--	ND	--	--
			1,2,3-Trichloropropane	0.5	--	ND	40	--
			n-Propylbenzene	0.5	--	ND	--	--
			2-Chlorotoluene	0.5	--	ND	--	--
			4-Chlorotoluene	0.5	--	ND	--	--
			1,3,5-Trimethylbenzene	0.5	--	ND	--	--
			tert-Butylbenzene	0.5	--	ND	--	--
			1,2,4-Trimethylbenzene	0.5	--	ND	--	--
			sec-Butylbenzene	0.5	--	ND	--	--
			1,3-Dichlorobenzene	0.5	--	ND	600	--
			1,4-Dichlorobenzene	0.5	--	ND	75	--
			4-Isopropyltoluene	0.5	--	ND	--	--
			1,2-Dichlorobenzene	0.5	--	ND	600	--
			n-Butylbenzene	0.5	--	ND	--	--
			1,2-Dibromo-3-chloropropane	0.5	--	ND	NA	--
			1,2,4-Trichlorobenzene	0.5	--	ND	9	--
			Hexachlorobutadiene	0.5	--	ND	1	--
			Naphthalene	0.5	--	ND	300	--
			1,2,3-Trichlorobenzene	0.5	--	ND	--	--

TABLE 3
GROUNDWATER SAMPLING RESULTS
BUILDING 166, MAIN POST, MW-1
FORT MONMOUTH, NEW JERSEY
VOLATILE TICS:

Sample ID	Sample Date	Analysis Date	Compound Name	Sample Quantitation Limit (ug/l)	Compound of Concern	Result (ug/l)	GWQS (ug/l)	Exceeds Criteria
MW-1	6/13/1995	6/27/1995	Unknown Hydrocarbon	--	--	2 J	--	--
			Unknown Hydrocarbon	--	--	3 J	--	--
			Unknown Hydrocarbon	--	--	2 J	--	--
			Unknown	--	--	2 J	--	--
			Unknown	--	--	2 J	--	--
			Unknown	--	--	2 J	--	--
			Unknown	--	--	4 J	--	--
			Unknown	--	--	3 J	--	--
			Unknown	--	--	2 J	--	--
			Unknown	--	--	2 J	--	--
			Unknown	--	--	2 J	--	--
			Naphthalene, decahydro-2-met	--	--	5 J	--	--
			Unknown	--	--	3 J	--	--
			Unknown	--	--	11 J	--	--
			Unknown	--	--	3 J	--	--
			TOTAL TICS:	--	--	48	--	--

TABLE 3

GROUNDWATER SAMPLING RESULTS
BUILDING 166, MAIN POST, TRIP BLANK
FORT MONMOUTH, NEW JERSEY
VOLATILES

Sample ID	Sample Date	Analysis Date	Compound Name	Sample Quantitation Limit (ug/l)	Compound of Concern	Result (ug/l)	GWQS (ug/l)	Exceeds Criteria
TRIP BLANK	6/13/1995	6/21/1995	Dichlorodifluoromethane	0.5	--	ND	1,000	--
			Chloromethane	0.5	--	ND	30	--
			Bromomethane	0.5	--	ND	10	--
			Vinyl Chloride	0.5	--	ND	5	--
			Chloroethane	0.5	--	ND	--	--
			Trichlorofluoromethane	0.5	--	ND	--	--
			Methylene Chloride	2.3	--	2.3 B	2	yes
			trans-1,2-Dichloroethene	0.5	--	ND	100	--
			1,1-Dichloroethene	0.5	--	ND	2	--
			1,1-Dichloroethane	0.5	--	ND	70	--
			2,2-Dichloropropane	0.5	--	ND	--	--
			Bromochloromethane	0.5	--	ND	--	--
			cis-1,2-Dichloroethene	0.5	--	ND	10	--
			Chloroform	0.5	--	ND	6	--
			1,1-Dichloropropene	0.5	--	ND	--	--
			1,2-Dichloroethane	0.5	--	ND	2	--
			1,1,1-Trichloroethane	0.5	--	ND	30	--
			Dibromomethane	0.5	--	ND	--	--
			Carbon Tetrachloride	0.5	--	ND	2	--
			Bromodichloromethane	0.5	--	ND	1	--
			1,2-Dichloropropane	0.5	--	ND	1	--
			cis-1,3-Dichloropropene	0.5	--	ND	NA	--
			1,3-Dichloropropane	0.5	--	ND	--	--
			Trichloroethene	0.5	--	ND	1	--
			Dibromochloromethane	0.5	--	ND	10	--
			1,1,2-Trichloroethane	0.5	--	ND	3	--
			Benzene	0.5	--	ND	1	--
			trans-1,3-Dichloropropene	0.5	--	ND	NA	--
			Bromoform	0.5	--	ND	4	--
			1,1,1,2-Tetrachloroethane	0.5	--	ND	10	--
			Tetrachloroethene	0.5	--	ND	1	--
			1,1,2,2-Tetrachloroethane	0.5	--	ND	2	--

TABLE 3
GROUNDWATER SAMPLING RESULTS
BUILDING 166, MAIN POST, TRIP BLANK
FORT MONMOUTH, NEW JERSEY
VOLATILES (continued)

Sample ID	Sample Date	Analysis Date	Compound Name	Sample Quantitation Limit (ug/L)	Compound of Concern	Result (ug/L)	GWQS (ug/L)	Exceeds Criteria
TRIP BLANK	6/13/1995	6/21/1995	Toluene	0.5	--	ND	1,000	--
			1,2-Dibromoethane	0.5	--	ND	--	--
			Chlorobenzene	0.5	--	ND	4	--
			Ethylbenzene	0.5	--	ND	700	--
			Xylene (total)	0.5	--	ND	40	--
			Styrene	0.5	--	ND	100	--
			Isopropylbenzene	0.5	--	ND	--	--
			Bromobenzene	0.5	--	ND	--	--
			1,2,3-Trichloropropane	0.5	--	ND	40	--
			n-Propylbenzene	0.5	--	ND	--	--
			2-Chlorotoluene	0.5	--	ND	--	--
			4-Chlorotoluene	0.5	--	ND	--	--
			1,3,5-Trimethylbenzene	0.5	--	ND	--	--
			tert-Butylbenzene	0.5	--	ND	--	--
			1,2,4-Trimethylbenzene	0.5	--	ND	--	--
			sec-Butylbenzene	0.5	--	ND	--	--
			1,3-Dichlorobenzene	0.5	--	ND	600	--
			1,4-Dichlorobenzene	0.5	--	ND	75	--
			4-Isopropyltoluene	0.5	--	ND	--	--
			1,2-Dichlorobenzene	0.5	--	ND	600	--
			n-Butylbenzene	0.5	--	ND	--	--
			1,2-Dibromo-3-chloropropane	0.5	--	ND	NA	--
			1,2,4-Trichlorobenzene	0.5	--	ND	9	--
			Hexachlorobutadiene	0.5	--	ND	1	--
			Naphthalene	0.5	--	ND	300	--
			1,2,3-Trichlorobenzene	0.5	--	ND	--	--
			VOLATILE TICS:					
			NONE FOUND	--	--	--	--	--

TABLE 3
GROUNDWATER SAMPLING RESULTS
BUILDING 166, MAIN POST, FIELD BLANK
FORT MONMOUTH, NEW JERSEY
SEMIVOLATILES

Sample ID	Sample Date	Analysis Date	Compound Name	Sample Quantitation Limit (ug/L)	Compound of Concern	Result (ug/L)	GWQS (ug/L)	Exceeds Criteria
FIELD BLANK	6/13/1995	6/26/1995	N-nitrosodimethylamine	2	--	ND	20	--
			bis(2-Chloroethyl)Ether	1	--	ND	10	--
			1,3-Dichlorobenzene	2	--	ND	600	--
			1,4-Dichlorobenzene	1	--	ND	75	--
			1,2-Dichlorobenzene	2	--	ND	600	--
			bis(2-chloroisopropyl)ether	5	--	ND	300	--
			N-Nitroso-Di-N-propylamine	2	--	ND	20	--
			Hexachloroethane	1	--	ND	10	--
			Nitrobenzene	2	--	ND	10	--
			Isophorone	1	--	ND	100	--
			bis(2-Chloroethoxy)methane	3	--	ND	--	--
			1,2,4-Trichlorobenzene	2	--	ND	9	--
			Naphthalene	2	--	ND	300	--
			Hexachlorobutadiene	2	--	ND	1	--
			Hexachlorocyclopentadiene	12	--	ND	50	--
			2-Chloronaphthalate	1	--	ND	--	--
			Dimethylphthalate	1	--	ND	--	--
			Acenaphthylene	5	--	ND	NA	--
			2,6-Dinitrotoluene	2	--	ND	NA	--
			Acenaphthene	3	--	ND	400	--
			2,4-Dinitrotoluene	3	--	ND	10	--
			Diethylphthalate	1	--	ND	5,000	--
			Fluorene	3	--	ND	300	--
			4-Chlorophenyl-phenylether	3	--	ND	--	--
			n-Nitrosodiphenylamine	6	--	ND	20	--
			1,2-Diphenylhydrazine(as azo)	6	--	ND	0.04	--
			4-Bromophenyl-phenylether	2	--	ND	--	--
			Hexachlorobenzene	2	--	ND	10	--
			Phenanthrene	2	--	ND	NA	--
			Anthracene	2	--	ND	2,000	--
			Di-n-butylphthalate	5	--	ND	900	--
			Fluoranthene	1	--	ND	300	--

TABLE 3
GROUNDWATER SAMPLING RESULTS
BUILDING 166, MAIN POST, FIELD BLANK
FORT MONMOUTH, NEW JERSEY
SEMIVOLATILES (continued)

Sample ID	Sample Date	Analysis Date	Compound Name	Sample Quantitation Limit (ug/l)	Compound of Concern	Result (ug/l)	GWQS (ug/l)	Exceeds Criteria
FIELD BLANK	6/13/1995	6/26/1995	Benzidine	1	--	ND	50	--
			Pyrene	2	--	ND	200	--
			Butylbenzylphthalate	9	--	ND	100	--
			Benzo(a)anthracene	2	--	ND	NA	--
			3,3'-Dichlorobenzidine	15	--	ND	60	--
			Chrysene	2	--	ND	5	--
			bis(2-Ethylhexyl)phthalate	4	--	ND	30	--
			Di-n-octylphthalate	2	--	ND	100	--
			Benzo(b)fluoranthene	1	--	ND	0.05	--
			Benzo(k)fluoranthene	2	--	ND	0.5	--
			Benzo(a)pyrene	2	--	ND	0.005	--
			Indeno(1,2,3-cd)pyrene	2	--	ND	0.05	--
			Dibenz(a,h)anthracene	3	--	ND	0.005	--
			Benzo(g,h,i)perylene	2	--	ND	NA	--
			SEMIVOLATILE TICS:					
			NONE FOUND	--	--	--	--	--

TABLE 3
GROUNDWATER SAMPLING RESULTS
BUILDING 166, MAIN POST, FIELD BLANK
FORT MONMOUTH, NEW JERSEY
VOLATILES

Sample ID	Sample Date	Analysis Date	Compound Name	Sample Quantitation Limit (ug/l)	Compound of Concern	Result (ug/l)	GWQS (ug/l)	Exceeds Criteria
FIELD BLANK	6/13/1995	6/21/1995	Dichlorodifluoromethane	0.5	--	ND	1,000	--
			Chloromethane	0.5	--	ND	30	--
			Bromomethane	0.5	--	ND	10	--
			Vinyl Chloride	0.5	--	ND	5	--
			Chloroethane	0.5	--	ND	--	--
			Trichlorofluoromethane	0.5	--	ND	--	--
			Methylene Chloride	2.1	--	2.1 B	2	yes
			trans-1,2-Dichloroethene	0.5	--	ND	100	--
			1,1-Dichloroethene	0.5	--	ND	2	--
			1,1-Dichloroethane	0.5	--	ND	70	--
			2,2-Dichloropropane	0.5	--	ND	--	--
			Bromochloromethane	0.5	--	ND	--	--
			cis-1,2-Dichloroethene	0.5	--	ND	10	--
			Chloroform	0.5	--	ND	6	--
			1,1-Dichloropropene	0.5	--	ND	--	--
			1,2-Dichloroethane	0.5	--	ND	2	--
			1,1,1-Trichloroethane	0.5	--	ND	30	--
			Dibromomethane	0.5	--	ND	--	--
			Carbon Tetrachloride	0.5	--	ND	2	--
			Bromodichloromethane	0.5	--	ND	1	--
			1,2-Dichloropropane	0.5	--	ND	1	--
			cis-1,3-Dichloropropene	0.5	--	ND	NA	--
			1,3-Dichloropropane	0.5	--	ND	--	--
			Trichloroethene	0.5	--	ND	1	--
			Dibromochloromethane	0.5	--	ND	10	--
			1,1,2-Trichloroethane	0.5	--	ND	3	--
			Benzene	0.5	--	ND	1	--
			trans-1,3-Dichloropropene	0.5	--	ND	NA	--
			Bromoform	0.5	--	ND	4	--
			1,1,1,2-Tetrachloroethane	0.5	--	ND	10	--
			Tetrachloroethene	0.5	--	ND	1	--
			1,1,2,2-Tetrachloroethane	0.5	--	ND	2	--

TABLE 3
GROUNDWATER SAMPLING RESULTS
BUILDING 166, MAIN POST, FIELD BLANK
FORT MONMOUTH, NEW JERSEY
VOLATILES (continued)

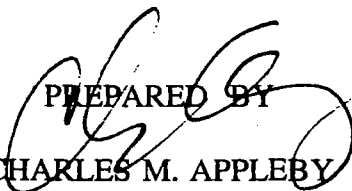
Sample ID	Sample Date	Analysis Date	Compound Name	Sample Quantitation Limit (ug/l)	Compound of Concern	Result (ug/l)	GWQS (ug/l)	Exceeds Criteria
FIELD BLANK	6/13/1995	6/21/1995	Toluene	0.5	--	ND	1,000	--
			1,2-Dibromoethane	0.5	--	ND	--	--
			Chlorobenzene	0.5	--	ND	4	--
			Ethylbenzene	0.5	--	ND	700	--
			Xylene (total)	0.5	--	ND	40	--
			Styrene	0.5	--	ND	100	--
			Isopropylbenzene	0.5	--	ND	--	--
			Bromobenzene	0.5	--	ND	--	--
			1,2,3-Trichloropropane	0.5	--	ND	40	--
			n-Propylbenzene	0.5	--	ND	--	--
			2-Chlorotoluene	0.5	--	ND	--	--
			4-Chlorotoluene	0.5	--	ND	--	--
			1,3,5-Trimethylbenzene	0.5	--	ND	--	--
			tert-Butylbenzene	0.5	--	ND	--	--
			1,2,4-Trimethylbenzene	0.5	--	ND	--	--
			sec-Butylbenzene	0.5	--	ND	--	--
			1,3-Dichlorobenzene	0.5	--	ND	600	--
			1,4-Dichlorobenzene	0.5	--	ND	75	--
			4-Isopropyltoluene	0.5	--	ND	--	--
			1,2-Dichlorobenzene	0.5	--	ND	600	--
			n-Butylbenzene	0.5	--	ND	--	--
			1,2-Dibromo-3-chloropropane	0.5	--	ND	NA	--
			1,2,4-Trichlorobenzene	0.5	--	ND	9	--
			Hexachlorobutadiene	0.5	--	ND	1	--
			Naphthalene	0.5	--	ND	300	--
			1,2,3-Trichlorobenzene	0.5	--	ND	--	--
			VOLATILE TICS:					
			NONE FOUND	--	--	--	--	--

**US ARMY
FORT MONMOUTH NJ**

**DIRECTORATE OF
ENGINEERING AND HOUSING
ENVIRONMENTAL OFFICE**

**UNDERGROUND STORAGE TANK
CLOSURE PLAN**

**BUILDING 166
NJDEPE UST NO.0090010 - 17**


PREPARED BY

CHARLES M. APPLEBY

**ENVIRONMENTAL PROTECTION SPECIALIST
NJDEPE UST SUBSURFACE CERTIFICATION # 002056**

MAY 25, 1994

U.S. Army
DEH Bldg. 167
SELFM-PW-EV
Fort Monmouth, NJ 07703

Date: 25 MAY 1994
Building No.: 166
NJDEPE UST Reg. No.: 0090010 - 17

UNDERGROUND STORAGE TANK (UST) DECOMMISSIONING / CLOSURE PLAN

A. General Requirements:

All activities associated with the decommissioning of any underground storage tank (UST) shall comply with all applicable Federal, State and Local laws and ordinances. These laws include but are not limited to: NJAC 7:14B et seq., 5:23 et seq. and OSHA 1910.146, 1910.120. All permits including but not limited to this document, the NJDEP Closure Plan Approval Package, etc..., shall be posted on site for inspection. The Contractor conducting the decommissioning activities shall be registered and certified by the NJDEP for performing said activities.

B. Safety and Health:

Before, during, and after all activities, the work site shall be made free of all hazards which may pose a threat to the health and safety of all personnel who are involved with, or are affected by, the decommissioning of the UST. All areas which pose, or may be suspected of posing, a vapor hazard shall be monitored by a qualified individual utilizing approved equipment. This individual will ascertain if the area is properly vented to render the area safe, as defined by OSHA.

C. UST Excavation:

1. All underground obstructions (utilities,... etc.) shall be marked out by the contractor performing the excavation.
2. All activities shall be carried out with the greatest regard to safety and health and the safeguarding of the environment.
3. All excavated soils will be evaluated as to the possibility of contamination. Soils suspected to be contaminated with product shall be staged on poly-sheeting separate from soils not suspected to be contaminated (see Section E - Excavated Soils Management).
4. Surface materials (ie. asphalt, concrete, etc...) shall be excavated and staged separate from all soils.

U.S. Army
DEH Bldg. 167
SELFM-PW-EV
Fort Monmouth, NJ 07703

Date: 25 MAY 1994
Building No.: 166
NJDEPE UST Reg. No.: 0090010 - 17

5. Soil will be excavated to expose the UST and associated piping. The piping shall not be removed/disturbed until all free product is drained into the UST. The UST will be rendered vapor free by purging or addition of dry ice prior to any cutting or access. After the removal of the associated piping, a manway will be made in the UST to allow for the proper cleaning of the UST. The UST will be completely emptied of all liquids prior to removal of the UST from the ground. All of the openings in the tank will be plugged except for one vent hole.

6. After the UST is removed from the ground, it will be staged on poly-sheeting and examined for corrosion holes. The presence or absence of corrosion holes will be documented by the Sub-Surface Evaluator. If corrosion holes are observed, or if upon inspection of the excavation site evidence of a discharge to the environment exists, the NJDEPE hotline shall be notified at (609) 292-7172.

7. In the event of a discharge to the environment, additional soils will be excavated as needed. Site assessment activities under the direct supervision of the Sub-Surface Evaluator will determine to what extent the contractor will excavate.

8. After completion of the Site Assessment activities, the excavation will be backfilled to grade with noncontaminated soils from the site and additional certified clean fill provided by the contractor.

D. UST Transport/Disposal:

1. The tank will be transported and disposed/recycled in compliance with all applicable regulations and laws.

2. The contractor shall label the tank with the following information:

- a. site of origin
- b. generator/contact person
- c. NJDEPE UST ID number
- d. product previously stored
- e. name of transporter/contract person
- f. destination site/contact person
- g. other information as required

U.S. Army
DEH Bldg. 167
SELFM-PW-EV
Fort Monmouth, NJ 07703

Date: 25 MAY 1994
Building No.: 166
NJDEPE UST Reg. No.: 0090010 - 17

3. The contractor shall provide Fort Monmouth with sufficient documentation certifying that transport/disposal (recycling) of the tank was completed according to all applicable Federal and State regulations.

E. Excavated Soils Management:

1. All excavated soils suspected to be contaminated will be transported, by the contractor, to a designated staging area within Fort Monmouth. The designated area will contain the soils and direct all stormwater runoff away from any contact with the soil.
2. All soils stored in the designated staging areas will be maintained in piles no larger than 100 cubic yards each. Each pile will be lined and covered with poly-sheeting and weighted to ensure proper containment.
3. Each soil pile will be sampled and analyzed for waste classification as outlined in the NJDEPE document titled "Management of Excavated Soils" dated August 17, 1990.
4. All soils categorized as Hazardous waste or nonhazardous waste will be managed as such, in accordance with N.J.A.C. 7:26-1 et seq..
5. All soils that contain levels of contaminants below the Category 3 soil limits will be used in accordance with Federal and State requirements.

F. Changes/Authorizations:

All deviations in activities related to the closure of a UST as outlined in this document shall require prior authorization from the NJDEPE-DWR-BUST.

U.S. Army
DEH Bldg. 167
SELF-M-PW-EV
Fort Monmouth, NJ 07703

Date: 25 MAY 1994
Building No.: 166
NJDEPE UST Reg. No.: 0090010 - 17

UNDERGROUND STORAGE TANK (UST) SITE ASSESSMENT PLAN

General:

This site specific assessment plan will be managed and carried out by U.S. Army DEH and Serv-Air Inc. personnel. All analyses will be performed and reported by NJDEPE certified testing laboratories. All sampling will be performed under the direct supervision of a NJDEPE Certified Sub-Surface Evaluator and according to the methods described in the 1992 NJDEP Field Sampling Procedures Manual. All records of the Site Assessment will be maintained by DEH and submitted to the NJDEPE-DWR-Bust in accordance with NJAC 7:14B-9.2 and 9.3.

PHASE I UST DECOMMISSIONING

A. Initial Soil Excavation:

1. Soil will be excavated from the UST site and screened utilizing a Photo Ionization Detector (PID) and/or a Flame Ionization Detector (FID).
2. All soils suspected to be contaminated will be treated in accordance with the UST Decommissioning Plan.

B. Continued Excavation:

1. Excavation of suspect contaminated soil will continue until one of the following situations is encountered:
 - a. groundwater
 - b. excavated soils no longer exhibit characteristics of contamination determined in the field by the Sub-Surface Evaluator
 - c. excavation equipment can no longer remove soils due to the depth of the excavation or other restrictive cause.

U.S. Army
DEH Bldg. 167
SELFM-PW-EV
Fort Monmouth, NJ 07703

Date: 25 MAY 1994
Building No.: 166
NJDEPE UST Reg. No.: 0090010 - 17

PHASE II
Site Survey

A. Vapor Screening:

1. An individual under the direct supervision of a NJDEPE Sub-Surface Evaluator and trained in the operation of a FID and/or PID shall evaluate the sides and pit bottom of the excavation.
2. All observed instrument readings will be documented and included in the Site Assessment Survey report. This documentation will include all factory and daily calibrations of the instrument.

PHASE III
Site Sampling

A. Soil samples will be collected from the UST excavation and analyzed according to the following schedule:

PRODUCT	SIZE (gal.)	# TPHC SAMPLES	VOA+15 (if TPHC >10000)
#2 HEATING OIL	4000	8	8
FIELD BLANKS		1	1
DUPLICATE SAMPLES		1	1
TOTAL # SAMPLES		10	10

U.S. Army
DEH Bldg. 167
SELFM-PW-EV
Fort Monmouth, NJ 07703

Date: 25 MAY 1994
Building No.: 166
NJDEPE UST Reg. No.: 0090010 - 17

B. Soil samples will be collected from the Pipe excavation at the same time as UST pit sampling and analyzed according to the following schedule:

PRODUCT	LENGTH OF PIPING	# TPHC SAMPLES	VOA+15 (if TPHC >10000)
#2 HEATING OIL	15 FEET	1	1
FIELD BLANKS		0	0
DUPLICATE SAMPLES		0	0
TOTAL # SAMPLES		1	1

C. All TPHC samples will be taken in the native soil below the bedding material. The sample locations should be along the mid-lines of the tank outline except for at least two of the samples which should be taken within one foot of each of the two highest field survey readings. All of the soil samples should be discrete samples taken within a 6" vertical interval. All samples will be collected by utilizing laboratory decontaminated stainless steel trowels dedicated to each sample location. All VOA+15 samples will be taken within 24 hours of UST excavation at a depth of 0-6" with the use of a laboratory decontaminated stainless steel core sampler. Each VOA+15 sample will be screened with an FID and/or PID and recorded immediately after collection.

D. The excavations of USTs containing #2 Fuel Oil will remain open until laboratory results determine all TPHC samples are less than 10000 ppm. If levels greater than 10000 ppm are reported, further excavation and resampling may be requested by the Sub-Surface Evaluator for those contaminated areas. If further excavation is not possible, additional VOA+15 analyses on 25% of the TPHC samples with the highest results will be performed and the excavation will be filled to grade with certified clean fill.

U.S. Army
DEH Bldg. 167
SELFM-PW-EV
Fort Monmouth, NJ 07703

Date: 25 MAY 1994
Building No.: 166
NJDEPE UST Reg. No.: 0090010 - 17

**UNDERGROUND STORAGE TANK REMOVAL
IMPLEMENTATION SCHEDULE**

Facility Name: U.S. Army, Fort Monmouth
Facility Location: Building #166
Fort Monmouth, NJ 07703
Owner's Mailing Address: DEH Bldg. #167
Fort Monmouth, NJ 07703
Owner's Name: U.S. Army
Contact Person: Charles Appleby
Phone Number: (908) 532-6224
UST Registration Number: 0090010

TANK ID #	PRODUCT	CAPACITY (gal.)	SITE ASSESS. REQUIRED	MONITORING WELL REQ.
17	#2 FUEL OIL	4000	YES	NO

SCHEDULE

ACTIVITY	START DATE	COMPLETION
TANK REMOVAL	6-14-94	6-14-94
SITE ASSESSMENT	6-14-94	6-14-94
MONITORING WELL INSTALL	n/a	
ANALYTICAL RESULTS		
SITE ASSESSMENT	6-16-94	6-16-94
MONITORING WELL	n/a	
SITE ASSESSMENT SUMMARY	10/16-94	10-16-94



State of New Jersey

DEPARTMENT OF ENVIRONMENTAL PROTECTION AND ENERGY

CHRISTINE TODD WHITMAN
Governor

ROBERT C. SHINN,
Commissioner

Mr. Joseph Fallon
SELFMEH-EV
Department of the Army
Headquarters CECOM Fort Monmouth
Fort Monmouth, NJ 077703-5000

JUN 7 1994

Dear Mr. Fallon:

Re: UST Closures - Fort Monmouth
Fort Monmouth Army Base
Tinton Falls, Monmouth County

The NJDEPE has reviewed the four underground storage tank closure plans for UST number 0081533 tanks 1 and 171 and for UST number 0090010 tanks 17 and 18 submitted on May 31, 1994 for NJDEPE review and approval. The NJDEPE has determined that the closure plans for these tanks are consistent with the Technical Requirements for Site Remediation.

The remedial efforts associated with the closures of these tanks may commence as scheduled in each of the associated closure plans. This letter must be made available to any authorized personnel responsible for review and oversight of UST removals. This approval does not relinquish Fort Monmouth from fulfilling any Federal, County or Municipal requirement associated with the removal of underground storage tanks.

If you should have any questions or require additional information, please do not hesitate to contact me at (609) 633-1455.

Sincerely,

Ian R. Curtis, Case Manager
Bureau of Federal Case Management

RPCE\BFCM\FTMMTH12.IRC



State of New Jersey

Christine Todd Whitman
Governor

Department of Environmental Protection

Robert C. Shinn, Jr.
Commissioner

Mr. Dinkerrai Desai
DEPARTMENT OF THE ARMY
HEADQUARTERS, U.S. ARMY COMMUNICATIONS-ELECTRONIC COMMAND
FORT MONMOUTH, NJ 07703-5000

AUG 29 2000

Re: UST Closure Approval/NFA
Fort Monmouth Main Post
Monmouth County

Dear Mr. Desai:

The NJDEP is in receipt of seventeen (17) UST closure reports dated June 1, 2000. The Army has requested to receive No Further Action approval letters for each of these reports. This letter approves the NFA requests for the following 17 UST located on the Main Post of the Fort Monmouth site:

NJDEP Req. #	Bldg. #	NJDEP Req. #	Bldg. #
0090010-06	80	0081533-226	707
0090010-17	166	0081533-119	745
0081533-5	207A	0081533-160	1076
0081533-211	207B	0081533-161	1076
0081533-57	282	0081533-168	1108
0081533-64	290	00192486-1	2000
0081533-68	295	0081515-62	2700.4
0081533-108	689A	00192486-30	3050
0081533-109	689B		

The NJDEP has determined that the Army has performed the remedial actions in a manner consistent or in excess of the regulatory requirements, specifically the Technical Requirements For Site Remediation (N.J.A.C. 7:26E et seq.). Soils with contamination in excess of the NJDEP residential cleanup criteria have been excavated and the Army has taken great care to provide documentation which assures us that all sources of contamination have been remediated.

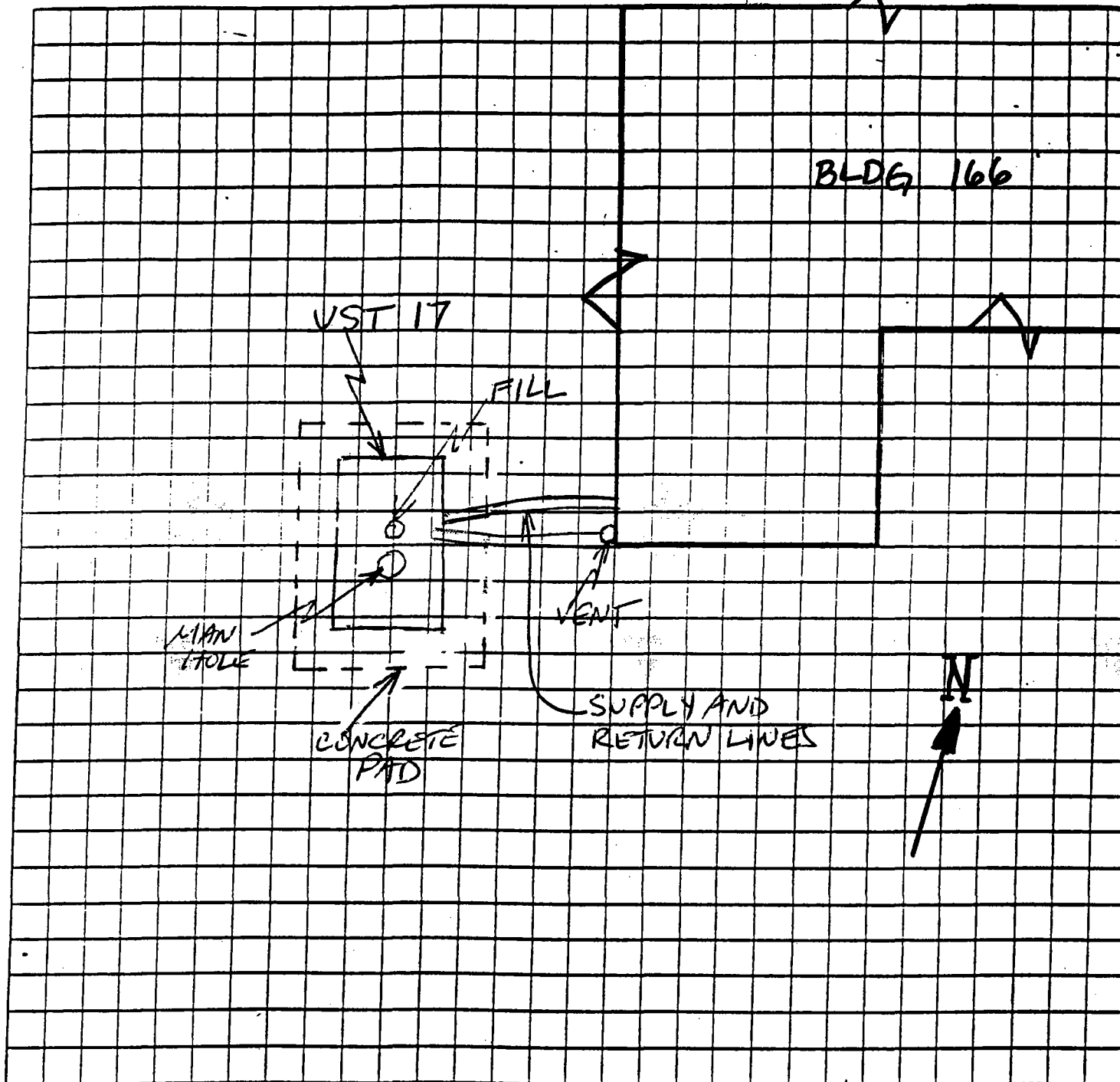
The NJDEP has one comment in that we request that future reports provide ground water flow direction indications on the well location maps.

If you should have any questions or comments, please do not hesitate to contact me at (609) 633-7232 or via E-mail.

Sincerely,


Ian R. Curtis, Case Manager
Bureau of Case Management
ICURTIS@DEP.STATE.NJ.US

PROPOSED SITE PLAN:



NOTE: Indicate scale and compass direction.

SCALE: 1" = 10'

REMARKS

TANK LOCATION

BLDG# 166

TANK # 0090010-17

TANK SIZE 4000 GALS

TANK CONTENTS #2 FUEL OIL

Appendix C

Boring Logs and Monitoring Well Construction Records



U.S. ARMY
FORT MONMOUTH
SELF PM PW KV

LOG OF BORING T-80-MW1

(Page 1 of 1)

Mainpost Well Logs

Project Name : BLDG. T-80
NJDEP CASE # : 94-6-16-1127-25
Logged By : TYREE INC.
start date : 09/15/94

Completion Date : 09/15/94
NORTHING : N 541120.967
EASTING : E 2177811.318
Driller : M. BECK

Depth in Feet	29-31774 ELEV: 6.91	DESCRIPTION	GRAPHIC	USCS	Samples	Blows/Ft	Well Construction Information
0		Asphalt/subbase		14			WELL CONSTRUCTION Date Compl. : 9/15/94 Hole Diameter : 8 in Drill. Method : HSA Company Rep. : M. BECK WELL CASING Material : PVC Diameter : 4 in. Joints : threaded WELL SCREEN Material : PVC Diameter : 4 in. Joints : threaded Opening : 20 slot SAND PACK : #2 MORIE SAND ANNULUS SEAL : Bentonite/Portland : TREMMIE WELL SCREEN Material : PVC Diameter : 4 in. Cap : NOTES Well #1 is T-80 MW1 Flushmount Water depth is 3' .92 adjustment for elevation
.6		Black fine sand		SW			
		Black silts and fine sands					
2				SM			
2.5							
3		Olive gray silts and fine sands		SM			
4		Olive gray soft clay and black soft clay					
	09/94			CL			
6							
8		Olive gray soft clay with pebbles		CL			
10		Yellowish organge, fine medium sand					
				SW			
12							
13							



PROJECT	Fort Monmouth	DATE STARTED	07/24/2000
LOCATION	Building 167	DATE FINISHED	07/24/2000
PROJECT NO.		ELEVATION & DATUM	
RIG TYPE	Canterra 80	COMPLETION DEPTH	12'
DRILLING METHOD	HSA	ROCK DEPTH	NA
BIT DIAMETER	12"	NO. OF SAMPLES	0
		WATER LEVEL	Approx. 4'
SAMPLER		DRILLING CO.	Lutz
HAMMER/FALL		LICENSED DRILLER	Tim Westover
		INSPECTOR	Brian Finnegan

DEPTH SCALE (ft.)	Rec (in.)	Blow Count	Sample ID	PID (ppm)	STRATIGRAPHY	REMARKS
1					0-8" Asphalt	Hand clear 0-5'
2					8"-1' Brown Silt with fine Sand, dry	USGS symbol ML
3					Olive green Clay and Silt with trace fine Sand moist at approximately 4'	USGS symbol ML-CL
4						
5						
6					Same as above, moist-wet	
7					Light brown and tan Silt and Clay with trace/ little fine Sand, wet	USGS symbol ML-CL
8						
9						
10					Red brown Silt with Clay and trace fine Sand wet	USGS symbol ML-CL
11					fine-coarse Sand with some small subangular-subrounded quartz gravel, wet	USGS symbol SP
12						
13					End of boring at 12'	
14					Note: no Sand sample collected for laboratory analysis. Stratigraphy descriptions based on drill cuttings	
15						
16						
17						
18						
19						
20						



PROJECT	Fort Monmouth	DATE STARTED	07/24/2000
LOCATION	Building 167	DATE FINISHED	07/24/2000
PROJECT NO.		ELEVATION & DATUM	
RIG TYPE	Canterra 80	COMPLETION DEPTH	12'
DRILLING METHOD	HSA	ROCK DEPTH	NA
BIT DIAMETER	12"	NO. OF SAMPLES	3
		WATER LEVEL	approx. 4'
SAMPLER	140 lbs.	DRILLING CO.	Lutz
HAMMER/FALL	30"	LICENSED DRILLER	Tim Westover
		INSPECTOR	Brian Finnegan

DEPTH SCALE (ft.)	Rec (in.)	Blow Count	Sample ID	PID (ppm)	STRATIGRAPHY	REMARKS
1				0	Brown and black fine-medium Sand with trace Silt, dry, no odor, no stain	Hand clear 0-5' USGS symbol SM
2				0	Brown fine-coarse Sand with small-medium subrounded quartz gravel, slightly moist	USGS symbol SP
3						
4					Olive green and gray Silt and Clay with trace fine-medium Sand, slightly moist, slight odor	USGS symbol CL-ML slight marsh smell
5	12"	2	S1	0	Light gray Silt with some fine sand and Clay, wet	USGS symbol ML
6		3	(5'-7')	0	0-7" Olive green fine-medium Sand and Silt with trace/some Clay, wet. 7"-12" Orange and reddish brown fine-medium Sand and Silt, wet, no odor, no stain	USGS symbol SM
7	24"	3	S2	0	0-15" Orange and gray fine-medium Sand with Silt, wet, no odor. 15"-22" Gray Clay, moist-wet, no odor. 22"-24" Orange fine-medium Sand with trace Silt, no odor	USGS symbol SM USGS symbol CL USGS symbol SM
8		4	(7'-9')	0	0-12" Light tan and orange fine-medium Sand with trace Silt, no odor. 12"-20" Orange Silt with fine Sand and trace Clay, wet. 20"-24" Light gray Silt and Clay with some fine Sand, wet	USGS symbol ML USGS symbol ML-CL
9	24"	5	S3	0		
10		2	(9'-11)	0		
11		3		0		
12		5		0		
13					End of boring at 12'	
14						
15						
16						
17						
18						
19						
20						



PROJECT	Fort Monmouth		DATE STARTED	07/24/2000	
LOCATION	Building 167		DATE FINISHED	07/24/2000	
PROJECT NO.			ELEVATION & DATUM		
RIG TYPE	Canterra 80		COMPLETION DEPTH	12'	
DRILLING METHOD	HSA		ROCK DEPTH	NA	
BIT DIAMETER	10"		NO. OF SAMPLES	0	
			WATER LEVEL	Approx. 3.5-4'	
SAMPLER			DRILLING CO.	Lutz	
HAMMER/FALL			LICENSED DRILLER	Tim Westover	
			INSPECTOR	Brian Finnegan	

DEPTH SCALE (ft.)	Rec (in.)	Blow Count	Sample ID	PID (ppm)	STRATIGRAPHY	REMARKS
1				0	Brown fine-medium Sand and Silt, dry, no odor	0-5' Hand clear USGS symbol SM
2						
3				0	Olive green and gray Silt with fine-medium Sand, moist at 3.5'-4'	USGS symbol ML
4						
5						
6				0	Same as above with Clay, wet, no odor	USGS symbol ML
7						
8						
9				0	Light brown soft Clay with trace fine Sand, wet, no odor	USGS symbol CL
10						
11					11'-11.5' Same as above with small-large subrounded to rounded quartz Gravel	USGS symbol CL
12						
13					End of boring at 12'	
14					Note: no Sand sample collected for laboratory analysis. Stratigraphy descriptions based on drill cuttings	
15						
16						
17						
18						
19						
20						



PROJECT	Fort Monmouth		DATE STARTED	07/24/2000	
LOCATION	Building 167		DATE FINISHED	07/24/2000	
PROJECT NO.			ELEVATION & DATUM		
RIG TYPE	Canterra 80		COMPLETION DEPTH	12'	
DRILLING METHOD	HSA		ROCK DEPTH	NA	
BIT DIAMETER	12"		NO. OF SAMPLES	0	
			WATER LEVEL	approx. 4'	
SAMPLER	none		DRILLING CO.	Lutz	
HAMMER/FALL	none		LICENSED DRILLER	Tim Westover	
			INSPECTOR	Brian Finnegan	

DEPTH SCALE (ft.)	Rec (in.)	Blow Count	Sample ID	PID (ppm)	STRATIGRAPHY	REMARKS
1				0	Dark brown Silt with fine Sand, dry, topsoil	Hand clear 0-5' USGS symbol ML-CL
2					Olive green Silt and Clay with trace fine Sand, dry, no odor	
3						
4					Olive green fine-medium Sand with Silt and trace Clay, moist, wet	USGS symbol SM
5				0	Dark gray Clay and Silt, moist, slight odor	Marsh like odor USGS symbol CL-ML
6						
7				0	Same as above, wet	
8						
9				0	Greenish gray Silt and Clay with fine-medium Sand, wet	USGS symbol CL-ML
10						
11				0	Light brown Silt and Clay with trace fine Sand, wet	USGS symbol CL-ML
12						
13					End of boring at 12'	
14					Note: no Sand sample collected for laboratory analysis. Stratigraphy descriptions based on drill cuttings	
15						
16						
17						
18						
19						
20						

SERIAL # 41183

DWR-193M (10/93)

STATE OF NEW JERSEY
DEPARTMENT OF ENVIRONMENTAL PROTECTION AND ENERGY
TRENTON, NJ

Mail to

NJDEPE
Bureau Water Allocation
126
Trenton, NJ 08625

MONITORING WELL PERMIT

Permit No. 2931774

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

Owner US Army Fort Monmouth
Address SELF M DW EV
Fort Monmouth NJ 07703
Name of Facility T-80
Address Main Post
Fort Monmouth NJ

Driller Three Organization, Ltd
Address 1350 US Hwy 130
Burlington NJ 08016

Diameter of Well(s) <u>4</u>	Proposed Depth of Well(s) <u>15</u>	Feet
Will pumping equipment be installed? YES ☒ NO ☒		
Type of Well (See reverse) <u>Monitoring</u>	If Yes, give pump capacity <u>N/A</u>	GPM

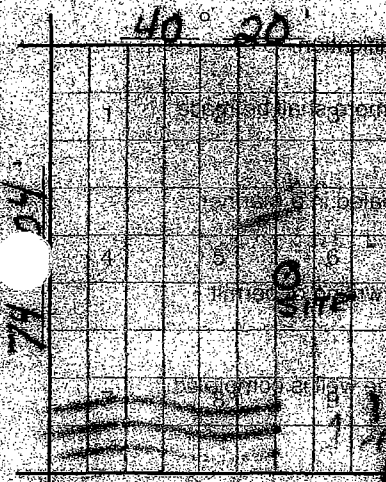
LOCATION OF WELL(S)

Lot #	Block #	Municipality	County
		Fort Monmouth	Monmouth

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.

State Atlas Map No. 29

S166



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)

CASE I.D. Number

N/A
94-6-16-1127-25
(Site Bldg. T-80)

This Space for Approval Stamp

WELL PERMIT APPROVED
NJDEP
AUG 3 1994
BUREAU OF WATER ALLOCATION

FOR D.E.P.E. 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 7-25-94

Signature of Driller [Signature]

License # 1921

Signature of Owner [Signature]

SELF M-PW-EV

COPIES:

Water Allocation — White and Pink

Health Dept — Yellow

Owner — Blue

Driller — White

SERIAL # **41182**

DWB-133M (10/93)

STATE OF NEW JERSEY
DEPARTMENT OF ENVIRONMENTAL PROTECTION AND ENERGY
TRENTON, NJ

Mail to

NJDEP
Bureau Water Allocation
1426
Trenton, NJ 08625

MONITORING WELL PERMIT

Permit No. **293177**
29364

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

Owner **US Army Fort Monmouth**
Address **SELF M-PW-EV**
Fort Monmouth, NJ 07703
Name of Facility **Bldg 166**
Address **Main Post**
Fort Monmouth, NJ

Driller **Tyree Organization, Ltd**
Address **7300 US Hwy 130**
Burlington NJ 08016

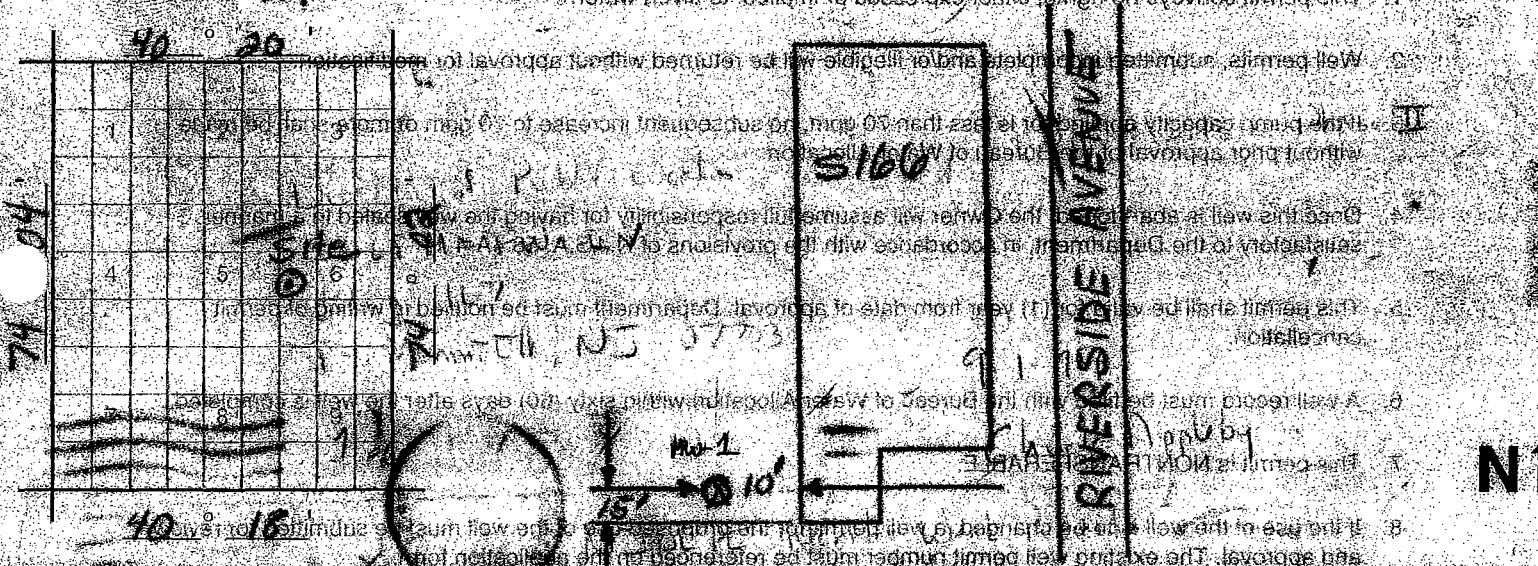
Diameter of Well(s) 4	Proposed Depth of Well(s) 15
Will pumping equipment be installed? YES ☒ NO ☒	If Yes, give pump capacity N/A
Type of Well (see reverse) Monitoring	

LOCATION OF WELL(S)

Lot # **Fort Monmouth**
Block # **Monmouth**
Municipality **Monmouth**
County **Monmouth**

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.

State Atlas Map No. **29 Oceanport**



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)

CASE I.D. Number

94-6-16-1545-09
(Six Bldg. 166)

This Space for Approval Stamp

WELL PERMIT APPROVED
N.J.D.E.P.

AUG 3 1994

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 **7-25-94**

Signature of Driller

License # **1421**

Signature of Owner

SELF M-PW-EV

COPIES:

Water Allocation — White and Pink

Health Dept. — Yellow

Owner — Blue

Driller — White

SERIAL # **016986**

DWR-133M (10/95)

STATE OF NEW JERSEY
DEPARTMENT OF ENVIRONMENTAL PROTECTION
TRENTON, NJ

Mail to

NJDEP
Bureau Water Allocation
426
Trenton, NJ 08625-0426

MONITORING WELL PERMIT

Permit No.

2943171
2943207
294320
294320

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

Owner U.S. Army
Address 173 RIVERSIDE AVE.
FT. MONMOUTH, N.J. 07703
Name of Facility Bldg. 166 (former Bldg. 80)
Address 166 RIVERSIDE AVE.
FT. MONMOUTH, N.J. 07703

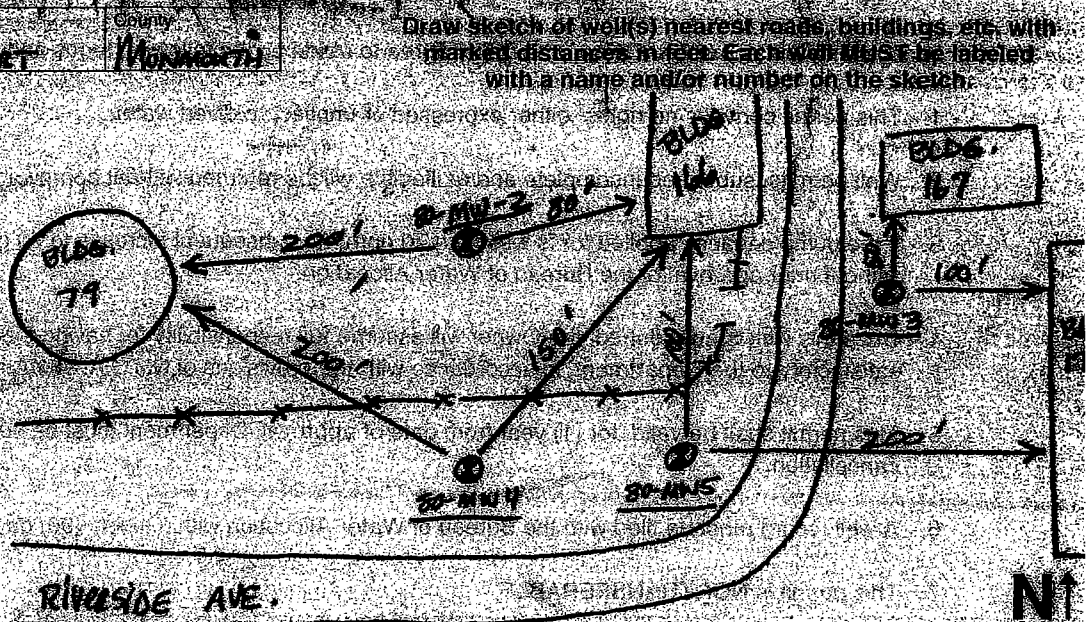
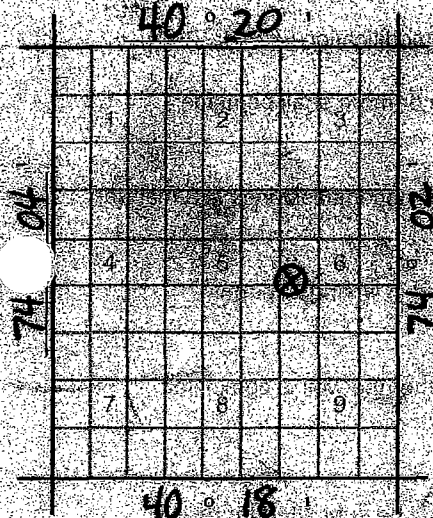
Driller Lutz Environmental Co., Inc.
Address P.O. Box 1247, 2020 Clinton St.
Linden, NJ 07036

Diameter of Well(s)	4	Proposed Depth of Well(s)	20
Will pumping equipment be installed?	YES ☒ NO ☐	Will pumping equipment be installed?	YES ☐ NO ☒
Type of Well (see reverse)	MONITOR	It is a give pump capacity	N/A cumulative GPM

LOCATION OF WELL(S)

Lot #	Block #	Municipality	County
N/A	N/A	Oceanport	Monmouth

State Atlas Map No. 29



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) OWNER INVESTIGATION

CASE I.D. Number

This Space for Approval Stamp

WELL PERMIT APPROVED
NJDEP

JUN 19 2000

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.

VERSE SIDE FOR IMPORTANT PROVISIONS AND REGULATIONS PERTAINING TO THIS PERMIT

In compliance with N.J.S.A. 60.4A-13, application is made for a permit to drill a well as described above.

Date 6-9-00

Signature of Driller

Registration No.

Signature of Owner

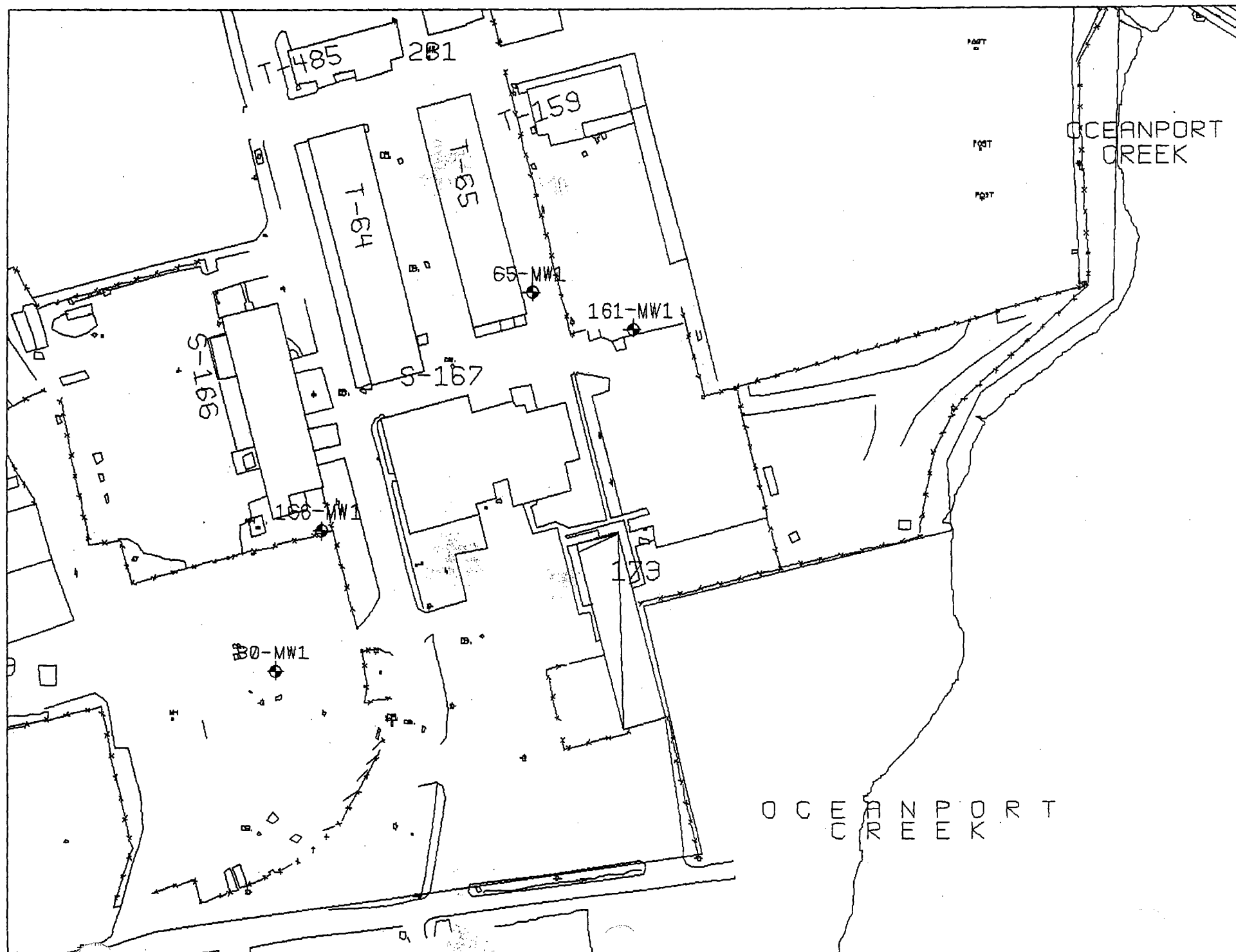
COPIES:

Water Allocation — White

Health Dept. — Yellow

Owner — Blue

Driller — White



FIELD LOG OF BORING

SHEET 1 OF 2

LOCATION OF BORING:

PROJECT: US Army
Fort Monmouth

BORING NO: MW-1

TOTAL DEPTH: 13'

JOB NO:

LOGGED BY: E. Pyle

PROJ. MGR.: Capritti

EDITED BY:

DRILLING CONTRACTOR: Tyre

DRILL RIG TYPE: B 80

DRILLERS NAME: M. Beck

SAMPLING METHODS: ~~SS~~ 55

HAMMER WT.: 120 lbs.

DROP:

STARTED, TIME: 8:30

DATE:

COMPLETED, TIME: 9:20

DATE:

BORING DEPTH (ft): 13

CASING DEPTH (ft): 3

WATER DEPTH (ft): 3' 2"

TIME:

DATE: 9/13/94

BACKFILLED, TIME: 9:25 DATE: 9/15/94 BY: Tyre

SURFACE ELEV:

DATUM:

CONDITIONS:

Asphalt / Subbase

SP Black fine sand with granular asphalt

Black silts + fine sands; wet
at $\approx 3'$. Sample collected at
the 2-4' interval. Strong waste
oil, heating oil odors.

SM Olive gray silts + fine sands

Olive gray soft clay w/ black
soft clay; soil discoloration;
Strong waste oil, heating oil
odors.

CL

CL

CL

CL

CL

CL

CL

CL

CL

CL

SP Yellowish-orange, fine-medium sand; w/

pebbles

SP

SP

SP

80
FIELD LOG OF BORING (CONTINUED)

SHEET 2 OF 2

DEPTH	TYPE	BLOWS	DRIVEN	REC'D	COND.	D. RATE	PID	ODOR	GR. WELL	DEPTH	GRAPHIC LOG	PROJECT:	NO:	BORING NO:
												Bldg. #80		
									Screen sand	11				
										12				
										13				
										14				
										5				
										6				
										7				
										8				
										9				
										0				
										1				
										2				
										3				
										4				
										5				
										6				
										7				
										8				

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): 29-31774
This number must be permanently affixed to the well casing.
Longitude (one tenth of a second): West 74° 01' 44.1"
Latitude (one tenth of a second): North 40° 19' 02.1"
Elevation of Top of Casing (cap off) 6.84
Distance from Top of Casing (cap off) to ground 0.81
Owner's Well Number (As shown in the application or Plans): 80-MW-1
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.

MONITORING WELL CERTIFICATION-FORM B-LOCATION CERTIFICATION

Name of Permittee: U.S. ARMY
Name of Facility: FORT MONMOUTH
Location: MONMOUTH COUNTY, NJ
~~NJPDOS~~ Number: 94-6-16-1127-25
Draw

LAND SURVEYOR'S CERTIFICATION

Well Permit Number:
This number must be permanently affixed to
the well casing.

29-31774-

Longitude (to nearest second):

West 74° 01' 44.54"

Latitude (to nearest second):

North 40° 19' 01.84"

Elevation of Top of Inner Casing (cap off)
(one-hundredth of a foot):

6.91

Elevation of ground level (1/100th ft.)

7.83

Source of elevation datum (benchmark, nail,
etc.) and year. (If an alternate datum has
been approved by the Department, identify
here, assume datum of 100', and give
approximated actual elevation.)

Source: MON. FM-6

☒ 1927 ☐ 1983

Elev.:

Owners Well Number (As shown on
application or plans):

BLOG-T-80 MW-1

Elevations are to be determined by double run, three wire leveling
methods using balanced sights, commencing from a well marked and
described point. This beginning point shall either be derived from
Federal or State benchmarks if not more than 1000 feet from the site
or from an alternate datum approved by the Department. Tolerances
should meet third order standards, which are 0.05 ft x (miles)^{1/2}. For
sections less than 0.1 mile, let miles = 0.1.

AUTHENTICATION

I certify 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.

Wayne W. Burgett
PROFESSIONAL LAND SURVEYOR'S SIGNATURE

WAYNE W. BURGESS
PROFESSIONAL LAND SURVEYOR'S NAME
(Please print or type)

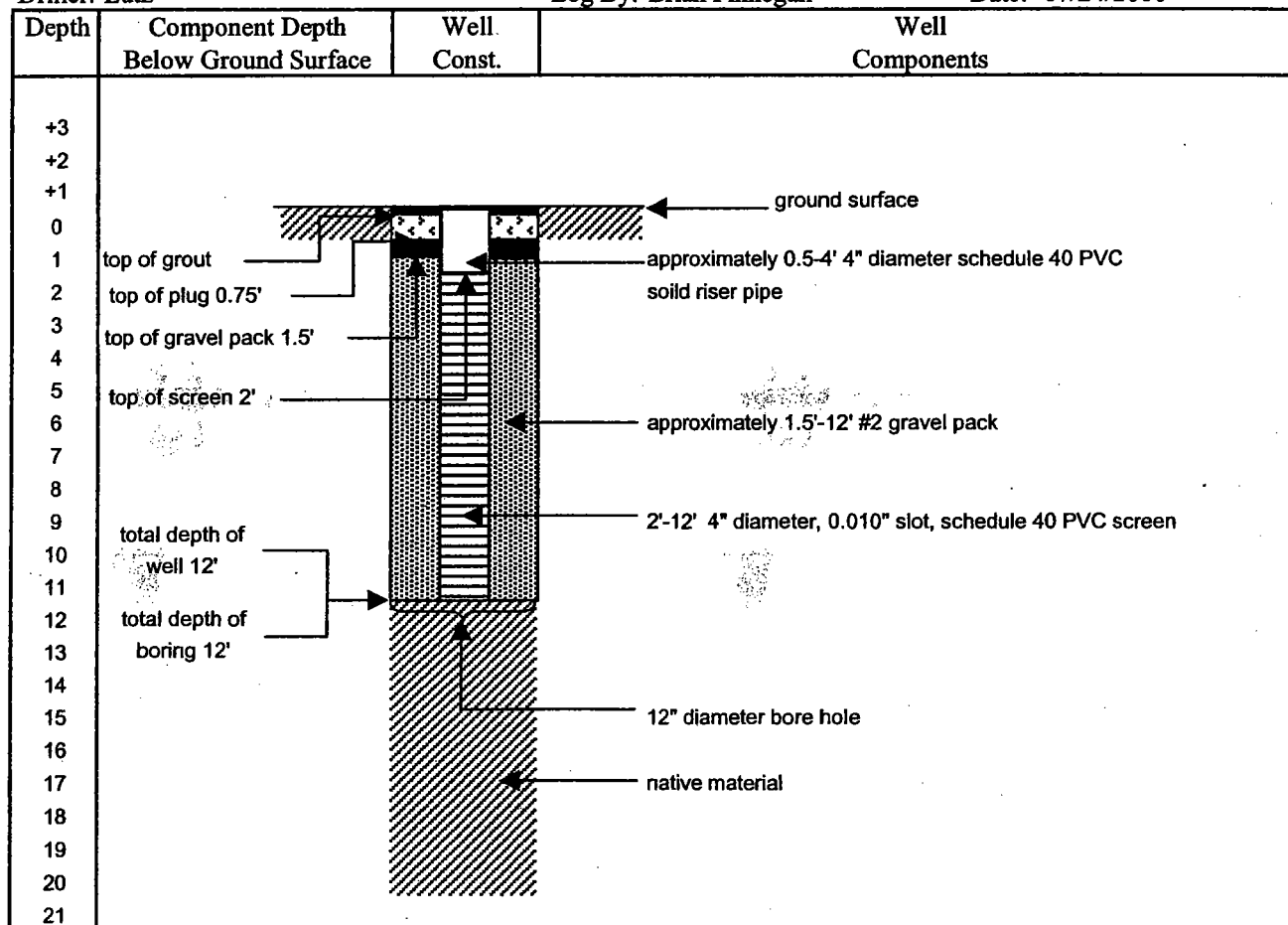
SEAL

31654
PROFESSIONAL LAND SURVEYOR'S LICENSE #

Monitoring Well Construction Sheet



Project:	<u>Fort Monmouth</u>	Owner:	<u>U.S. Army</u>
Location:	<u>Building 167</u>	Permit Number:	<u> </u>
Well Number:	<u>MW-2</u>	Total Depth:	<u>12'</u>
Casing Elev.:	<u> </u>	Water Level Initial:	<u>approx. 4'</u>
Screen Diam.:	<u>4 inches</u>	Length:	<u>10'</u> Slot Size: <u>0.010"</u>
Casing Diam.:	<u>4 inches</u>	Length:	<u>2'</u> Type: <u>PVC</u>
Drilling Method:	<u>Hollow Stem Auger</u>	Sample Method:	<u>2 inch Split Spoon</u>
Driller:	<u>Lutz</u>	Log By:	<u>Brian Finnegan</u> Date: <u>07/24/2000</u>



LUTZ ENVIRONMENTAL CO., INC.

2020 CLINTON STREET • LINDEN, NEW JERSEY 07036 • (908)862-8888

BORING LOG:

WELL NO. 80-MW-2 COORDINATE NO. 29-13-664 PERMIT NO. 29-43199
 DATE DRILLED 7-24-2000 COUNTY MONMOUTH USE MONITOR
 LOCATION Bldg. 166 (Formerly Bldg 80) 166 RIVERSIDE AVE FT. MONMOUTH NJ 07707
 OWNER U.S. ARMY ADDRESS 173 RIVERSIDE AVE FT. MONMOUTH NJ 07707
 DRILLING METHOD Auger SAMPLING METHOD SPoon / Composite
 HOLE DIA. 10" TOTAL DEPTH 12'
 CASING:
 TYPE MONOFLEX FLUSH MOUNT SLOT — DIA. 4" LENGTH 2'
 SCREEN:
 TYPE MONOFLEX FLUSH MOUNT SLOT .010 DIA. 4" LENGTH 10'
 GRAVEL PACK SIZE #1 WELL GRAVEL CASING SEAL CEMENT
 STATIC WATER LEVEL APPROX. 6' GEOLOGIC FORMATION UNCONSOLIDATED

DEPTH BELOW SURFACE	SAMPLE NUMBER	BLOWS PER 6" ON SAMPLER	WELL DESIGN	12" STEEL MANHOLE with 2x2 CONCRETE PAD	IDENTIFICATION OF SOILS/REMARKS
		S P O O N S	CEMENT BENT #1 SOLID CASING		0" - 12' → GREEN / GRAY clayey SILTS AND SANDS
		W O T	#1 WELL GRAVEL		
		R E C O R D E D			
		B Y D R I L L E R			

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):

29-43199

This number must be permanently affixed to the well casing.

Longitude (one tenth of a second):

West

Latitude (one tenth of a second):

North

Elevation of Top of Casing (cap off)

Distance from Top of Casing (cap off) to ground Owner's Well Number (As shown in the application or Plans):

Benchmark: NJGCS Monument No. 9235
Elevation = 56.69

74° 01' 44.9"
40° 19' 02.6"
7.68
0.33
80-MW-2

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

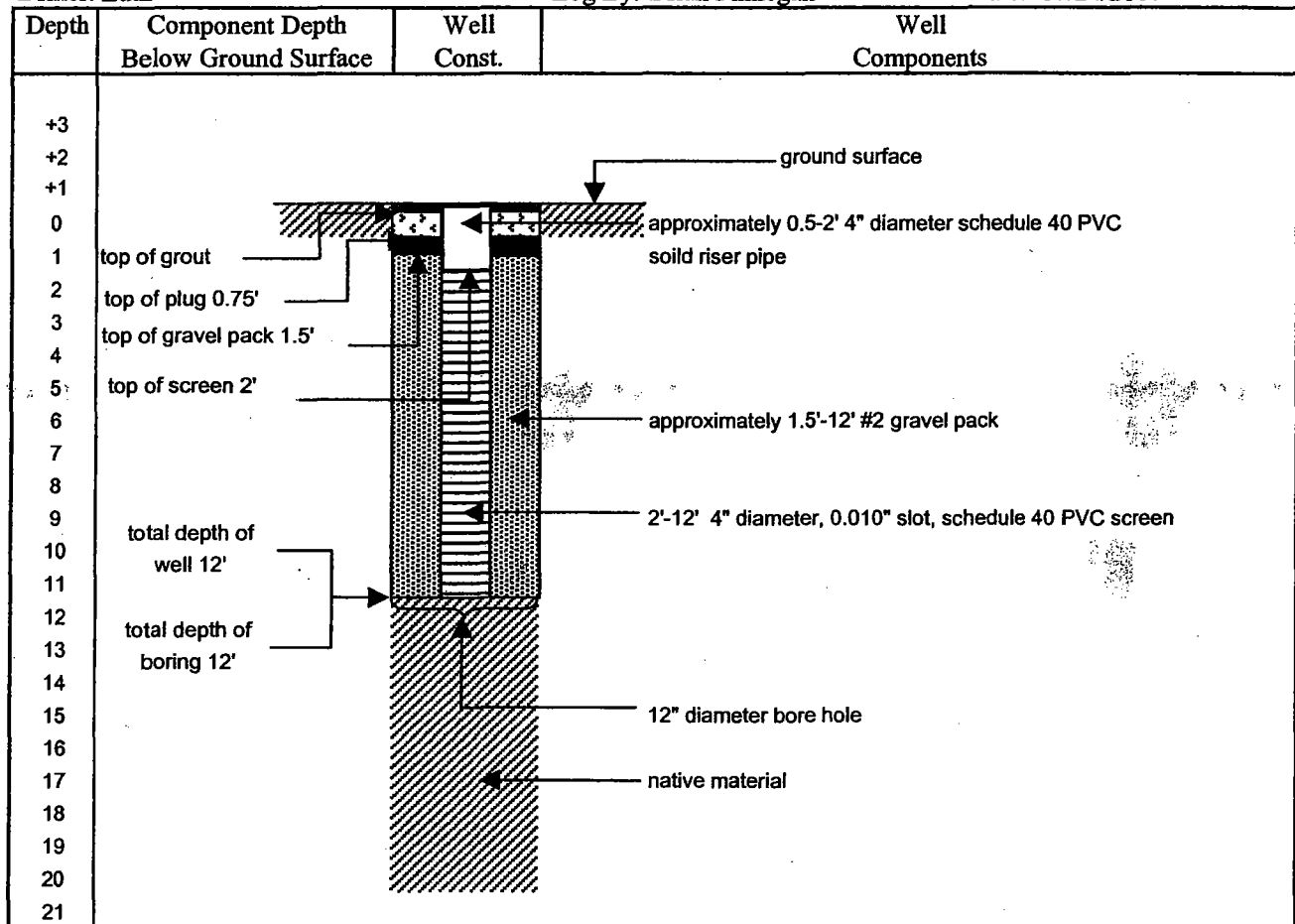
N.J. Lic. #34008
Professional Land Surveyor's License #

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.

Monitoring Well Construction Sheet



Project:	Fort Monmouth	Owner:	U.S. Army
Location:	Building 167	Permit Number:	
Well Number:	MW-3	Total Depth:	12'
Casing Elev.:		Water Level Initial:	approx. 4'
Screen Diam.:	4 inches	Length:	10'
Casing Diam.:	4 inches	Length:	2'
Drilling Method:	Hollow Stem Auger	Sample Method:	2 inch Split Spoon
Driller:	Lutz	Log By:	Brian Finnegan
		Date:	07/24/2000



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WELL NO. 80-MW-3 COORDINATE NO. 29-13-664 PERMIT NO. 29-43201
DATE DRILLED 7-24-2000 COUNTY MONMOUTH USE MONITOR
LOCATION Bldg. 166 (Formerly Bldg 80) 166 RIVERSIDE AVE FT. MONMOUTH NJ 0
OWNER U.S. ARMY ADDRESS 173 RIVERSIDE AVE FT. MONMOUTH NJ 0
DRILLING METHOD AUGER SAMPLING METHOD SPOON / COMPOSITE
HOLE DIA. 10" TOTAL DEPTH 12'
CASING:
TYPE MONOFLEX FLUSH MOUNT SLOT — DIA. 4" LENGTH 2'
SCREEN:
TYPE MONOFLEX FLUSH MOUNT SLOT O/D DIA. 4" LENGTH 10'
GRAVEL PACK SIZE #1 WELL GRAVEL CASING SEAL CEMENT
STATIC WATER LEVEL APPROX. 6' GEOLOGIC FORMATION UNCONSOLIDATED

DEPTH BELOW SURFACE	SAMPLE NUMBER	BLOWS PER 6" ON SAMPLER	WELL DESIGN	IDENTIFICATION OF SOILS/REMARKS
				12" STEEL MANHOLE WITH ONE CONCRETE PAD
		SPONS	CEMENT BENT	0' - 12' → ORANGE/TAN, clayey SILTS AND SANDS
		NOT	#1 SOLID CASING	
		R	10' - .010 SLOT SCREEN	
		E	#1 WELL GRAVEL	
		CORDED		
		D		
		E		
		D		
		B		
		Y		
		D		
		R		
		L		
		L		
		E		
		R		

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):

29-43202

This number must be permanently affixed to the
well casing.

Longitude (one tenth of a second):

West

74° 01' 42.4"

Latitude (one tenth of a second):

North

40° 19' 02.7"

Elevation of Top of Casing (cap off)

7.63

Distance from Top of Casing (cap off) to ground

0.23

Owner's Well Number (As shown in the application
or Plans):

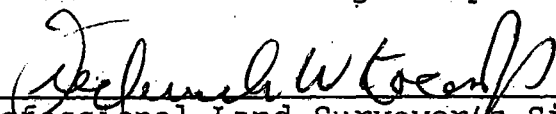
80-MW-3

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.


Professional Land Surveyor's Signature

Frederick W. Kocen Jr.

Professional Land Surveyor's Name

SEAL

N.J. Lic. # 34008

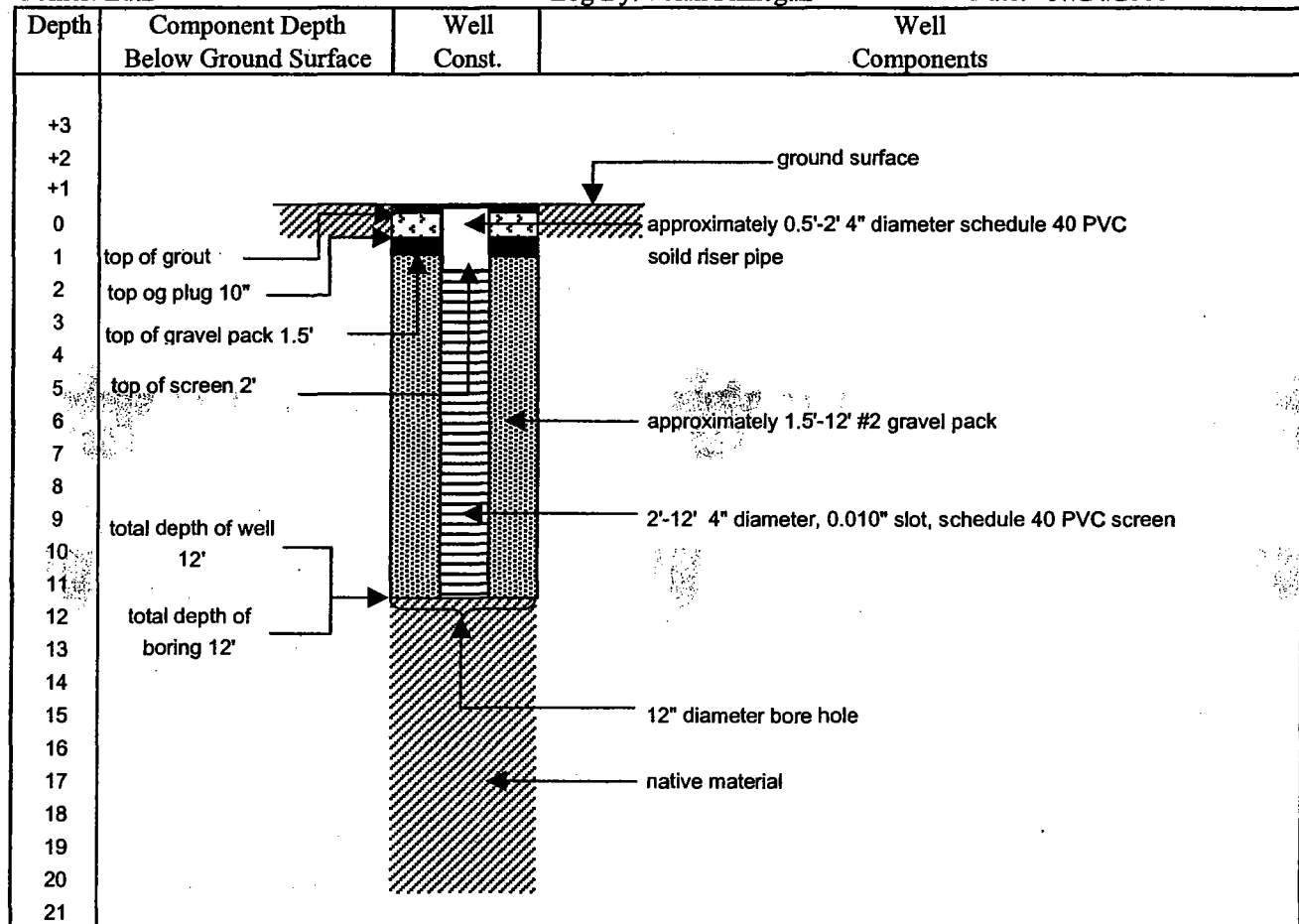
Professional Land Surveyor's License #

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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.

Monitoring Well Construction Sheet



Project:	Fort Monmouth	Owner:	U.S. Army	
Location:	Building 167	Permit Number:		
Well Number:	MW-4	Total Depth:	12'	
Casing Elev.:		Water Level Initial:	approx. 4'	
Screen Diam.:	4 inches	Length:	10'	Slot Size: 0.010"
Casing Diam.:	4 inches	Length:	2'	Type: PVC
Drilling Method:	Hollow Stem Auger	Sample Method:	2 inch Split Spoon	
Driller:	Lutz	Log By:	Brian Finnegan	
		Date:	07/24/2000	



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WELL NO. 80-MW-4 COORDINATE NO. 29-13-664 PERMIT NO. 29-43200
DATE DRILLED 7-24-2000 COUNTY MONMOUTH USE MONITOR
LOCATION Bldg 166 (Formerly Bldg 80) 166 RIVERSIDE AVE FT. MONMOUTH NJ 07720
OWNER U. S. ARMY ADDRESS 173 RIVERSIDE AVE FT. MONMOUTH NJ 07720
DRILLING METHOD AUGER SAMPLING METHOD SPOON / COMPOSITE
HOLE DIA. 10" TOTAL DEPTH 12'
CASING:
TYPE MONOFLEX FLUSH MOUNT SLOT — DIA. 4" LENGTH 2'
SCREEN:
TYPE MONOFLEX FLUSH MOUNT SLOT 0.0 DIA. 4" LENGTH 10'
GRAVEL PACK SIZE #1 WELL GRAVEL CASING SEAL CEMENT
STATIC WATER LEVEL APPROX. -6' GEOLOGIC FORMATION UNCONSOLIDATED

[illegible]

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
NJDES Permit No: NJ

LAND SURVEYOR'S CERTIFICATION

Well Permit Number (As assigned by NJDEPE's Water Allocation Section, 609-292-2957):

29-43200

This number must be permanently affixed to the well casing.

Longitude (one tenth of a second):

West

Latitude (one tenth of a second):

North

Elevation of Top of Casing (cap off)

Distance from Top of Casing (cap off) to ground

Owner's Well Number (As shown in the application or Plans):

Benchmark: NJGCS Monument No. 9235

Elevation = 56.69

74° 01' 44.0"
40° 19' 01.4"
7.46
0.30
80-MW-4

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

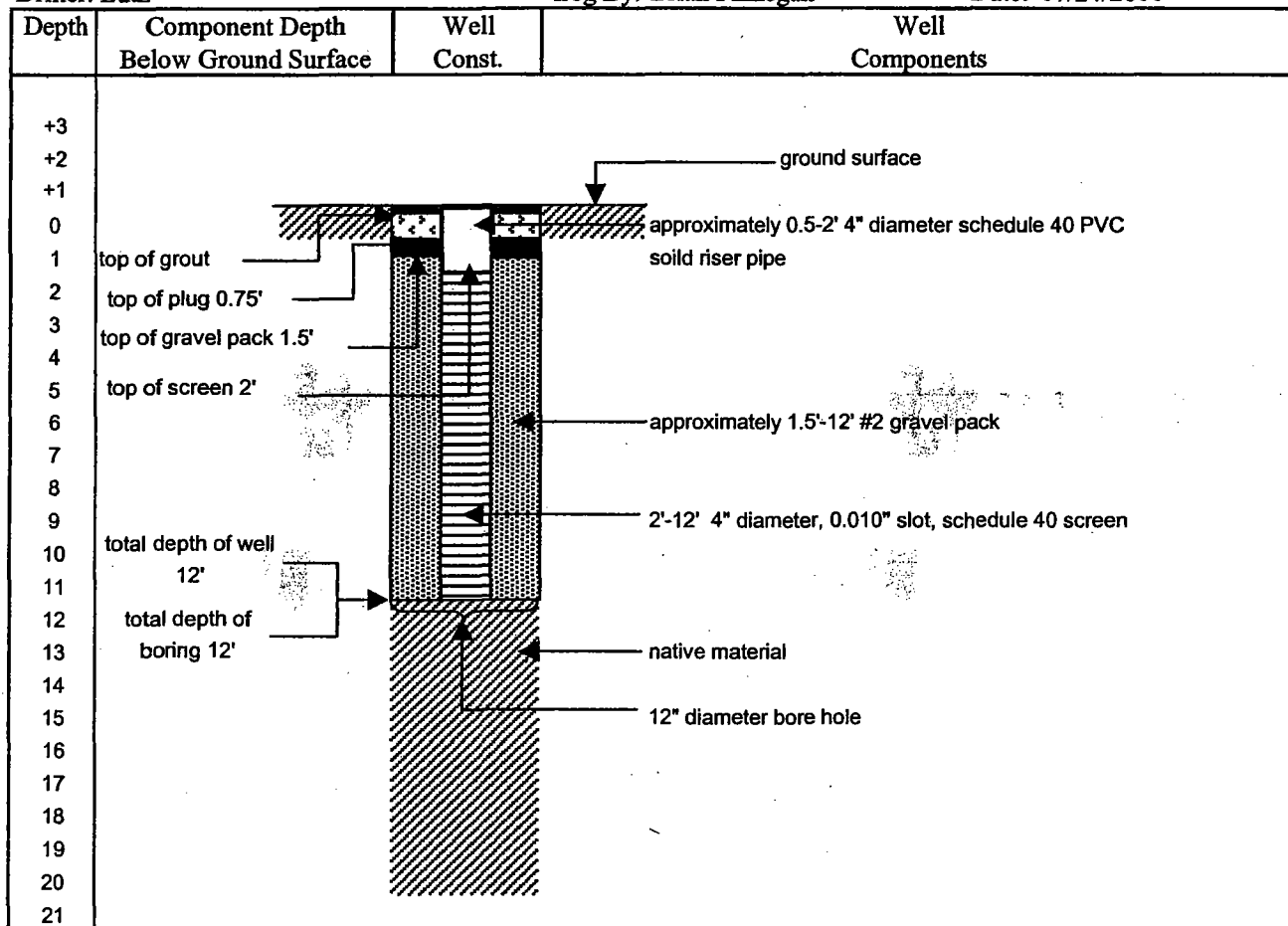
Professional Land Surveyor's License #

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Monitoring Well Construction Sheet



Project:	<u>Fort Monmouth</u>	Owner:	<u>U.S. Army</u>
Location:	<u>Building 167</u>	Permit Number:	<u> </u>
Well Number:	<u>MW-5</u>	Total Depth:	<u>12'</u>
Casing Elev.:	<u> </u>	Water Level Initial:	<u>approx. 4'</u>
Screen Diam.:	<u>4 inches</u>	Length:	<u>10'</u> Slot Size: <u>0.010"</u>
Casing Diam.:	<u>4 inches</u>	Length:	<u>2'</u> Type: <u>PVC</u>
Drilling Method:	<u>Hollow Stem Auger</u>	Sample Method:	<u>2 inch Split Spoon</u>
Driller: <u>Lutz</u>	Log By: <u>Brian Finnegan</u>	Date: <u>07/24/2000</u>	



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WELL NO. 80-MW-5 COORDINATE NO. 29-13-664 PERMIT NO. 29-43202
DATE DRILLED 7-24-2000 COUNTY MONMOUTH USE MONITOR
LOCATION Bldg. 166 (Formerly Bldg 80) 166 RIVERSIDE AVE FT. Monmouth NJ 0
OWNER U. S. Army ADDRESS 173 RIVERSIDE AVE FT. Monmouth NJ 0
DRILLING METHOD Auger SAMPLING METHOD Spoon / Composite
HOLE DIA. 10" TOTAL DEPTH 12'
CASING:
TYPE MONOFLEX FLUSH MOUNT SLOT — DIA. 4" LENGTH 2'
SCREEN:
TYPE MONOFLEX FLUSH MOUNT SLOT O/D DIA. 4" LENGTH 10'
GRAVEL PACK SIZE #1 WELL GRAVEL CASING SEAL CEMENT
STATIC WATER LEVEL APPROX. 6' GEOLOGIC FORMATION UNCONSOLIDATED

[illegible]

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

GROUND WATER MONITORING WELL CERTIFICATION - FORM B - LOCATION CERTIFICATION

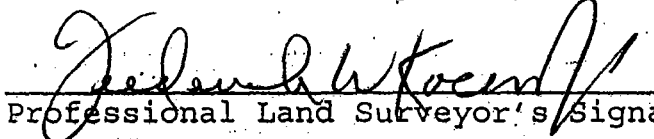
Name of Permittee: UNITED STATES ARMY
Name of Facility: FORT MONMOUTH
Location: Eatontown Borough, Monmouth county, NJ
NJDES Permit No: NJ

LAND SURVEYOR'S CERTIFICATION

Well Permit Number (As assigned by NJDEPE's Water Allocation Section, 609-292-2957): 29-43202
This number must be permanently affixed to the well casing.
Longitude (one tenth of a second): West 74° 01' 43.3"
Latitude (one tenth of a second): North 40° 19' 01.6"
Elevation of Top of Casing (cap off): 7.14
Distance from Top of Casing (cap off) to ground: 0.28
Owner's Well Number (As shown in the application or Plans): 80-MW-5
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.


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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U.S. ARMY
FORT MONMOUTH
SELF-PM PW EV

LOG OF BORING 166-MW1

(Page 1 of 1)

Mainpost Well Logs

Project Name : BLDG. 166
NJDEP CASE # : 94-6-16-1545-09
Logged By : TYREE INC.
start date : 08/03/94

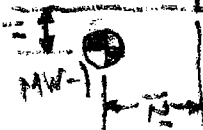
Completion Date : 08/03/94
NORTHING : N 541238.652
EASTING : E 2177852.302
Driller : M. BECK

Depth in Feet	29-31777 ELEV: 6.96	DESCRIPTION	GRAPHIC	USCS	Samples	Blows/Ft	% Recovery	Well Construction Information
0		Asphalt subbase		14				WELL CONSTRUCTION Date Compl. : 10/05/94 Hole Diameter : 8 in. Drill. Method : HSA Company Rep. : M. BECK WELL CASING Material : PVC Diameter : 4 in. Joints : threaded WELL SCREEN Material : PVC Diameter : 4 in. Joints : threaded Opening : 20 slot SAND PACK : #2 MORIE SAND ANNULUS SEAL : Bentonite/Portland : TREMMIE WELL SCREEN Material : PVC Diameter : 4 in. Cap : NOTES Well #1 is 166 MW1 Flushmount Water depth 3.5'
1.		Black fine sand with asphalt		SP				
2.		Medium brown silts and fine sand with few pebbles		SM				
		Medium brown, fine/medium sand wet at 3ft with black fines		SP	1	12	100	
4.		Greenish grey soft clay with light brown, fine sand + silts		CL				
		Dark brown silts with light brown soft clay, moist at approx. 6'		CL	2	10	100	
6.		Brown soft clay with black fines; wet at approx. 11'						
8.								
10.								
12.								
13.								
14.								

FIELD LOG OF BORING

SHEET 1 OF 2

LOCATION OF BORING:

Building
#166PROJECT: US Army
Fort Monmouth

BORING NO: MW-1

TOTAL DEPTH: 10'

JOB NO:

LOGGED BY: E. Pyle

PROJ. MGR.: Capritti

EDITED BY:

DRILLING CONTRACTOR: Tyree

DRILL RIG TYPE: B 80

DRILLERS NAME: M. Beck

SAMPLING METHODS: SS

HAMMER WT.: 20 lbs

DROP:

STARTED, TIME: 12:00

DATE:

COMPLETED, TIME: 1:00

DATE:

BORING DEPTH (ft): 10'

CASING DEPTH (ft): —

WATER DEPTH (ft): 3' 1"

TIME:

DATE: 10/3/94

BACKFILLED, TIME: 1:05 DATE: 9/14/94 BY: Tyree

SURFACE ELEV:

DATUM:

CONDITIONS:

Asphalt / Subbase

SP Black fine sand with crumbly top
Medium brown, silts + fine sand
w/ few pebbles

SM

Med. brown, fine-medium sand;
wet at $\approx 3'$

SP

SP Medium brown, fine-medium sand w/ 12

SAMPLE DEPTH	SAMPLER TYPE	BLOWS / 6 IN.	INCHES DRIVEN	INCHES RECOVERED	SAMPLE CONDITION	DRILLING RATE (min./ft.)	PID READING (ppm)	ODOR (Y / N ?)	GRAPHIC WELL CONST.	DEPTH IN FEET	GRAPHIC LOG
2-4'	SS	3	6	18			21	N		1	SP
		3	6							2	SM
		5	6							3	
		6	6					N		4	
										5	
										6	SP
										7	
										8	
										9	
										10	SP

166)
FIELD LOG OF BORING (CONTINUED)

SHEET 2 OF 2

DEPTH	TYPE	BLOWS	DRIVEN	REC'D	COND.	D. RATE	PID	ODOR	GR. WELL	DEPTH	GRAPHIC LOG	PROJECT:	NO:	BORING NO: MW-1
							5	Y		11	Per gravel; rounded GP Notes: No sample was collected. However, per gravel at approx. 11'-13' had a strong waste oil, heating oil odor. HNU reading was approx. 5 ppm.			
										12				
										13				
										14				
										5				
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										4				
										5				
										6				
										7				
										8				

MONITORING HZ. CERTIFICATION-FORM B-LOCAT 1 CERTIFICATION

Name of Permittee: U.S. ARMY
Name of Facility: FORT MONMOUTH
Location: MONMOUTH COUNTY, NJ
NJPDIS-Number: 94-6-16-1545-09

DICAR

LAND SURVEYOR'S CERTIFICATION

Well Permit Number:
This number must be permanently affixed to the well casing.

29-31773-

Longitude (to nearest second):

West 74°01'44.69"

Latitude (to nearest second):

North 40°19'03.08"

Elevation of Top of Inner Casing (cap off)
(one-hundredth of a foot):

6.96

Elevation of ground level (1/100th ft.)

7.49

Source of elevation datum (benchmark, nail, etc.) and year. (If an alternate datum has been approved by the Department, identify here, assume datum of 100', and give approximated actual elevation.)

Source: MON. FM-6

☒ 1927 ☐ 1983

Elev.:

Owners Well Number (As shown on application or plans):

BLDG. 166 MW-46

Elevations are to be determined by double run, three wire leveling methods using balanced sights, commencing from a well marked and described point. This beginning point shall either be derived from Federal or State benchmarks if not more than 1000 feet from the site or from an alternate datum approved by the Department. Tolerances should meet third order standards, which are 0.05 ft x (mile)^{1/2}. For sections less than 0.1 mile, let miles = 0.1.

AUTHENTICATION

I certify 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.

Wayne W. Burgett
PROFESSIONAL LAND SURVEYOR'S SIGNATURE

WAYNE W. BURGETT
PROFESSIONAL LAND SURVEYOR'S NAME
(Please print or type)

SEAL

31654
PROFESSIONAL LAND SURVEYOR'S LICENSE #

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):

29-31773

This number must be permanently affixed to the well casing.

Longitude (one tenth of a second):

West

74° 01' 44.3"

Latitude (one tenth of a second):

North

40° 19' 03.3"

Elevation of Top of Casing (cap off)

6.91

Distance from Top of Casing (cap off) to ground

0.88

Owner's Well Number (As shown in the application or Plans):

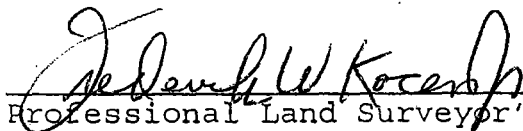
166-MW-1

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.



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.

Appendix D

Site Investigation Report – Main Post and Charles Wood Areas, Fort Monmouth, New Jersey, Roy F. Weston, Inc., December 1995

Appendix E

Current Conditions Site Photographs

**SITE 80/166 – MAIN POST
FORT MONMOUTH, NEW JERSEY
JUNE 20, 2001**



**BACKGROUND: BUILDING 166
FOREGROUND: MONITORING WELL 80-MW2**



**BACKGROUND: BUILDING 173
FOREGROUND: MONITORING WELL 80-MW1**

Appendix F

Laboratory Data Sheets for Monitoring Well Samples

Appendix G

Laboratory Data Sheets for Geoprobe[®] Soil and Groundwater Samples

Appendix H

Slug Test Analyses and Raw Data

Appendix I

Sensitive Receptor Survey

Appendix J

Well Survey and Well Search Summary

ATTACHMENT D
2015 Concentrations in Groundwater
Compared To NJDEP GWQS at FTMM-56

Comparison of Recent FTMM-56 Groundwater Sampling Results (2011-2015) with NJDEP
Standards

Attachment D
Comparison of Recent FTMM-56 Groundwater Sampling
Results (2011 - 2015) with NJDEP Standards
Fort Monmouth, New Jersey

Well ID	Unit	NJ Ground Water Quality Standards ⁽¹⁾	166MW01			80MW01			80MW02		
Sample ID			FTMM56-GW-166MW01-7	FTMM56-GW-166MW01-8	FTMM-56-GW-166MW01	FTMM56-GW-80MW01-7	FTMM56-GW-80MW01-8	FTMM-56-GW-80MW01	FTMM56-GW-80MW02-7	FTMM56-GW-80MW02-8	FTMM-56-GW-80MW02
Sample Date			3/18/2011	8/12/2011	8/16/2011	3/18/2011	8/12/2011	8/16/2011	3/18/2011	8/12/2011	8/16/2013
Sample Type			SA	SA	SA	SA	SA	SA	SA	SA	SA
Pesticides											
4,4'-DDD	µg/L	0.1	0.02 U	0.01 U	NA	0.022	0.074	NA	0.02 U	0.01 U	NA
4,4'-DDE	µg/L	0.1	0.02 U	0.01 U	NA	0.02 U	0.01 U	NA	0.02 U	0.01 U	NA
4,4'-DDT	µg/L	0.1	0.02 U	0.01 U	NA	0.02 U	0.01 U	NA	0.02 U	0.026	NA
Aldrin	µg/L	0.04	NA	NA	NA	NA	NA	NA	NA	NA	NA
Alpha-BHC	µg/L	0.02	NA	NA	NA	NA	NA	NA	NA	NA	NA
Alpha-Chlordane	µg/L	0.5	0.02 U	0.042	NA	0.02 U	0.01 U	NA	0.44	1.2	NA
Beta-BHC	µg/L	0.04	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chlordane	µg/L	0.5	0.5 U	0.01 U	NA	0.5 U	0.01 U	NA	7.87	0.01 U	NA
Delta-BHC	µg/L	100	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dieldrin	µg/L	0.03	NA	NA	NA	NA	NA	NA	NA	NA	NA
Endosulfan I	µg/L	40	0.02 U	0.01 U	NA	0.02 U	0.01 U	NA	0.02 U	0.01 U	NA
Endosulfan II	µg/L	40	NA	NA	NA	NA	NA	NA	NA	NA	NA
Endosulfan sulfate	µg/L	40	NA	NA	NA	NA	NA	NA	NA	NA	NA
Endrin	µg/L	2	NA	NA	NA	NA	NA	NA	NA	NA	NA
Endrin aldehyde	µg/L	100	NA	NA	NA	NA	NA	NA	NA	NA	NA
Endrin ketone	µg/L	100	NA	NA	NA	NA	NA	NA	NA	NA	NA
Gamma-BHC/Lindane	µg/L	0.03	NA	NA	NA	NA	NA	NA	NA	NA	NA
Gamma-Chlordane	µg/L	0.5	0.02 U	0.01 U	NA	0.02 U	0.01 U	NA	0.45	1	NA
Heptachlor	µg/L	0.05	0.02 U	0.01 U	NA	0.02 U	0.01 U	NA	0.02 U	0.01 U	NA
Heptachlor epoxide	µg/L	0.2	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methoxychlor	µg/L	40	0.02 U	0.02 U	NA	0.02 U	0.02 U	NA	0.02 U	0.02 U	NA
Toxaphene	µg/L	2	NA	NA	NA	NA	NA	NA	NA	NA	NA
Metals											
Aluminum	µg/L	200	0 U-ND	965	NA	264	247	NA	613	1,250	NA
Antimony	µg/L	6	6 U	6 U	NA	6 U	6 U	NA	6 U	6 U	NA
Arsenic	µg/L	3	3 U	3 U	NA	3 U	43.2	NA	3 U	3 U	NA
Barium	µg/L	6,000	200 U	200 U	NA	200 U	200 U	NA	200 U	200 U	NA
Beryllium	µg/L	1	1 U	1 U	NA	1 U	1 U	NA	1.5	2.2	NA
Cadmium	µg/L	4	3 U	3 U	NA	8.1	3 U	NA	3 U	3 U	NA
Calcium	µg/L		95,800	50,200	NA	30,400	91,600	NA	44,500	39,400	NA
Chromium	µg/L	70	10 U	10 U	NA	10 U	10 U	NA	10 U	10 U	NA
Cobalt	µg/L	100	0 U-ND	0 U-ND	NA	0 U-ND	0 U-ND	NA	0 U-ND	0 U-ND	NA
Copper	µg/L	1,300	10 U	24.2	NA	59.6	10 U	NA	10 U	10 U	NA
Iron	µg/L	300	3,240	7,950	NA	545	79,800	NA	437	3,270	NA
Lead	µg/L	5	3 U	6.4	2 U	3 U	3 U	2 U	3 U	3 U	2 U
Magnesium	µg/L		18,200	8,200	NA	0 U-ND	18,400	NA	11,700	11,700	NA
Manganese	µg/L	50	451	242	NA	107	829	NA	784	878	NA
Mercury	µg/L	2	0.2 U	0.2 U	NA	0.2 U	0.2 U	NA	0.2 U	0.2 U	NA
Nickel	µg/L	100	10 U	10 U	NA	37.2	10 U	NA	10.9	13	NA
Potassium	µg/L		0 U-ND	0 U-ND	NA	0 U-ND	0 U-ND	NA	0 U-ND	0 U-ND	NA
Selenium	µg/L	40	10 U	10 U	NA	10 U	10 U	NA	10 U	10 U	NA
Silver	µg/L	40	0 U-ND	0 U-ND	NA	0 U-ND	0 U-ND	NA	0 U-ND	0 U-ND	NA
Sodium	µg/L	50,000	570,000	186,000	NA	20,100	570,000	NA	503,000	340,000	NA
Thallium	µg/L	2	2 U	2 U	NA	2 U	2 U	NA	2 U	2 U	NA
Vanadium	µg/L		0 U-ND	0 U-ND	NA	0 U-ND	0 U-ND	NA	0 U-ND	0 U-ND	NA
Zinc	µg/L	2,000	207	127	NA	720	62.8	NA	41.8	67.9	NA

Notes:
(1) New Jersey Department of Environmental Protection Ground Water
Quality Standards, Specific Ground Water Quality Criteria - Class IIA
and Practical Quantitation Levels.
(http://www.state.nj.us/dep/wms/bwqsa/Appendix_Table_1.htm)

B = Compound detected in the sample at a concentration less than or
equal to 5 times (10 times for common lab contaminants) the blank
concentration.
DU = Duplicate sample.
Dup = Duplicate sample collected.
J - Estimated concentration exceeds the method detection limit (MDL)
and is less than the reporting limit (RL).
NA - Not analyzed.
ND - Not detected.
SA = Primary sample.
U = Non-detect, i.e. not detected at or above this value.
U-ND = Analyte not detected in sample, but no detection or reporting
limit provided.
µg/L = micrograms per liter.

Detections are bolded.
Shaded cells = Concentration exceeds NJDEP GWQS.

Attachment D
Comparison of Recent FTMM-56 Groundwater Sampling
Results (2011 - 2015) with NJDEP Standards
Fort Monmouth, New Jersey

Well ID	Unit	NJ Ground Water Quality Standards ⁽¹⁾	80MW02		80MW03				80MW04			
Sample ID			FTMM-56-GW-80MW02-7.5_4Q2015	FTMM-56-GW-80MW102-7.5_4Q2015	FTMM56-GW-80MW03-7	FTMM56-GW-80MW03-7-Dup	FTMM56-GW-80MW03-8	FTMM56-GW-80MW03-8-Dup	FTMM-56-GW-80MW03	FTMM56-GW-80MW04-7	FTMM56-GW-80MW04-8	
Sample Date			11/20/2015	11/20/2015	3/17/2011	3/17/2011	8/12/2011	8/12/2011	8/16/2013	3/18/2011	8/12/2011	
Sample Type			SA	DU	SA	DU	SA	DU	SA	SA	SA	
Pesticides												
4,4'-DDD	µg/L	0.1	0.025 U	0.025 U	0.02 U	0.02 U	0.01 U	0.01 U	NA	0.02 U	0.01 U	
4,4'-DDE	µg/L	0.1	0.025 U	0.025 U	0.02 U	0.02 U	0.01 U	0.01 U	NA	0.02 U	0.01 U	
4,4'-DDT	µg/L	0.1	0.027 U	0.027 U	0.02 U	0.02 U	0.01 U	0.01 U	NA	0.02 U	0.01 U	
Aldrin	µg/L	0.04	0.025 U	0.025 U	NA	NA	NA	NA	NA	NA	NA	
Alpha-BHC	µg/L	0.02	0.025 U	0.025 U	NA	NA	NA	NA	NA	NA	NA	
Alpha-Chlordane	µg/L	0.5	0.28 J	0.28 J	0.02 U	0.02 U	0.01 U	0.01 U	NA	0.02 U	0.01 U	
Beta-BHC	µg/L	0.04	0.028 U	0.028 U	NA	NA	NA	NA	NA	NA	NA	
Chlordane	µg/L	0.5	NA	NA	0.5 U	0.5 U	0.01 U	0.01 U	NA	0.5 U	0.01 U	
Delta-BHC	µg/L	100	0.048 U	0.048 U	NA	NA	NA	NA	NA	NA	NA	
Dieldrin	µg/L	0.03	0.025 U	0.025 U	NA	NA	NA	NA	NA	NA	NA	
Endosulfan I	µg/L	40	0.025 U	0.025 U	0.02 U	0.02 U	0.01 U	0.01 U	NA	0.02 U	0.01 U	
Endosulfan II	µg/L	40	0.025 U	0.025 U	NA	NA	NA	NA	NA	NA	NA	
Endosulfan sulfate	µg/L	40	0.025 U	0.025 U	NA	NA	NA	NA	NA	NA	NA	
Endrin	µg/L	2	0.025 U	0.025 U	NA	NA	NA	NA	NA	NA	NA	
Endrin aldehyde	µg/L	100	0.025 U	0.025 U	NA	NA	NA	NA	NA	NA	NA	
Endrin ketone	µg/L	100	0.025 U	0.025 U	NA	NA	NA	NA	NA	NA	NA	
Gamma-BHC/Lindane	µg/L	0.03	0.025 U	0.025 U	NA	NA	NA	NA	NA	NA	NA	
Gamma-Chlordane	µg/L	0.5	0.29	0.29	0.02 U	0.02 U	0.01 U	0.01 U	NA	0.02 U	0.01 U	
Heptachlor	µg/L	0.05	0.025 U	0.025 U	0.02 U	0.02 U	0.01 U	0.01 U	NA	0.02 U	0.01 U	
Heptachlor epoxide	µg/L	0.2	0.055	0.055	NA	NA	NA	NA	NA	NA	NA	
Methoxychlor	µg/L	40	0.025 U	0.025 U	0.02 U	0.02 U	0.02 U	0.02 U	NA	0.02 U	0.02 U	
Toxaphene	µg/L	2	0.5 U	0.5 U	NA	NA	NA	NA	NA	NA	NA	
Metals												
Aluminum	µg/L	200	NA	NA	1,750	2,400	10,700	10,900	NA	0 U-ND	28,900	
Antimony	µg/L	6	NA	NA	6 U	6 U	6 U	6 U	NA	6 U	6 U	
Arsenic	µg/L	3	NA	NA	8.4	8.2	24.3	24.6	NA	3 U	20	
Barium	µg/L	6,000	NA	NA	200 U	200 U	200 U	200 U	NA	200 U	200 U	
Beryllium	µg/L	1	NA	NA	1 U	1 U	1 U	1 U	NA	1 U	2.3	
Cadmium	µg/L	4	NA	NA	3 U	3 U	3 U	3 U	NA	3 U	3 U	
Calcium	µg/L		NA	NA	30,700	31,700	37,400	37,100	NA	42,600	40,900	
Chromium	µg/L	70	NA	NA	10 U	10 U	76.5	79.8	NA	10 U	60.9	
Cobalt	µg/L	100	NA	NA	0 U-ND	0 U-ND	0 U-ND	0 U-ND	NA	0 U-ND	0 U-ND	
Copper	µg/L	1,300	NA	NA	53.3	51	49.9	52.8	NA	10 U	29.9	
Iron	µg/L	300	NA	NA	3,790	4,130	33,500	34,400	NA	123	31,600	
Lead	µg/L	5	NA	NA	7.8	6.9	20.5	21.2	1.7 J	3 U	22.8	
Magnesium	µg/L		NA	NA	5,650	5,880	8,950	8,920	NA	10,200	12,100	
Manganese	µg/L	50	NA	NA	0 U-ND	0 U-ND	74.3	77.6	NA	0 U-ND	137	
Mercury	µg/L	2	NA	NA	0.2 U	0.2 U	0.2 U	0.2 U	NA	0.2 U	0.2 U	
Nickel	µg/L	100	NA	NA	10 U	10 U	10 U	10.8	NA	10	38.5	
Potassium	µg/L		NA	NA	0 U-ND	0 U-ND	11,300	11,300	NA	0 U-ND	10,300	
Selenium	µg/L	40	NA	NA	10 U	10 U	10 U	10 U	NA	10 U	10 U	
Silver	µg/L	40	NA	NA	0 U-ND	0 U-ND	0 U-ND	0 U-ND	NA	0 U-ND	0 U-ND	
Sodium	µg/L	50,000	NA	NA	131,000	132,000	142,000	141,000	NA	111,000	95,100	
Thallium	µg/L	2	NA	NA	2 U	2 U	2 U	2 U	NA	2 U	2 U	
Vanadium	µg/L		NA	NA	0 U-ND	0 U-ND	0 U-ND	50.9	NA	0 U-ND	83.8	
Zinc	µg/L	2,000	NA	NA	166	171	380	398	NA	80.2	210	

Notes:
(1) New Jersey Department of Environmental Protection Ground Water
Quality Standards, Specific Ground Water Quality Criteria - Class IIA
and Practical Quantitation Levels.
(http://www.state.nj.us/dep/wms/bwqsa/Appendix_Table_1.htm)

B = Compound detected in the sample at a concentration less than or
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µg/L = micrograms per liter.

Detections are bolded.
Shaded cells = Concentration exceeds NJDEP GWQS.

Attachment D
Comparison of Recent FTMM-56 Groundwater Sampling
Results (2011 - 2015) with NJDEP Standards
Fort Monmouth, New Jersey

Well ID	Unit	NJ Ground Water Quality Standards ⁽¹⁾	80MW04	80MW05			
Sample ID			FTMM-56-GW-80MW04	FTMM56-GW-80MW05-7	FTMM56-GW-80MW05-8	FTMM-56-GW-80MW05	FTMM-56-GW-80MW05-7.0_4Q2015
Sample Date			8/16/2013	3/17/2011	8/12/2013	8/16/2013	11/20/2015
Sample Type			SA	SA	SA	SA	SA
Pesticides							
4,4'-DDD	µg/L	0.1	NA	0.02 U	0.01 U	NA	NA
4,4'-DDE	µg/L	0.1	NA	0.02 U	0.01 U	NA	NA
4,4'-DDT	µg/L	0.1	NA	0.02 U	0.01 U	NA	NA
Aldrin	µg/L	0.04	NA	NA	NA	NA	NA
Alpha-BHC	µg/L	0.02	NA	NA	NA	NA	NA
Alpha-Chlordane	µg/L	0.5	NA	0.02 U	0.01 U	NA	NA
Beta-BHC	µg/L	0.04	NA	NA	NA	NA	NA
Chlordane	µg/L	0.5	NA	0.5 U	0.01 U	NA	NA
Delta-BHC	µg/L	100	NA	NA	NA	NA	NA
Dieldrin	µg/L	0.03	NA	NA	NA	NA	NA
Endosulfan I	µg/L	40	NA	0.02 U	0.01 U	NA	NA
Endosulfan II	µg/L	40	NA	NA	NA	NA	NA
Endosulfan sulfate	µg/L	40	NA	NA	NA	NA	NA
Endrin	µg/L	2	NA	NA	NA	NA	NA
Endrin aldehyde	µg/L	100	NA	NA	NA	NA	NA
Endrin ketone	µg/L	100	NA	NA	NA	NA	NA
Gamma-BHC/Lindane	µg/L	0.03	NA	NA	NA	NA	NA
Gamma-Chlordane	µg/L	0.5	NA	0.02 U	0.01 U	NA	NA
Heptachlor	µg/L	0.05	NA	0.02 U	0.01 U	NA	NA
Heptachlor epoxide	µg/L	0.2	NA	NA	NA	NA	NA
Methoxychlor	µg/L	40	NA	0.02 U	0.02 U	NA	NA
Toxaphene	µg/L	2	NA	NA	NA	NA	NA
Metals							
Aluminum	µg/L	200	NA	0 U-ND	67,300	NA	NA
Antimony	µg/L	6	NA	6 U	14.6	NA	NA
Arsenic	µg/L	3	NA	8.5	108	NA	3.7 J
Barium	µg/L	6,000	NA	200 U	400 U	NA	NA
Beryllium	µg/L	1	NA	1 U	5	NA	NA
Cadmium	µg/L	4	NA	3 U	134	NA	0.42 B
Calcium	µg/L		NA	201,000	110,000	NA	NA
Chromium	µg/L	70	NA	10 U	454	NA	NA
Cobalt	µg/L	100	NA	0 U-ND	0 U-ND	NA	NA
Copper	µg/L	1,300	NA	10 U	102	NA	NA
Iron	µg/L	300	NA	7,840	185,000	NA	NA
Lead	µg/L	5	2 U	3 U	122	2.4 J	2 J
Magnesium	µg/L		NA	31,100	34,100	NA	NA
Manganese	µg/L	50	NA	489	324	NA	NA
Mercury	µg/L	2	NA	0.2 U	0.4 U	NA	NA
Nickel	µg/L	100	NA	10 U	61	NA	NA
Potassium	µg/L		NA	27,700	40,900	NA	NA
Selenium	µg/L	40	NA	10 U	20 U	NA	NA
Silver	µg/L	40	NA	0 U-ND	0 U-ND	NA	NA
Sodium	µg/L	50,000	NA	1,170,000	976,000	NA	NA
Thallium	µg/L	2	NA	2 U	8 U	NA	NA
Vanadium	µg/L		NA	0 U-ND	326	NA	NA
Zinc	µg/L	2,000	NA	28.2	3,010	NA	NA

Notes:
(1) New Jersey Department of Environmental Protection Ground Water
Quality Standards, Specific Ground Water Quality Criteria - Class IIA
and Practical Quantitation Levels.
(http://www.state.nj.us/dep/wms/bwqsa/Appendix_Table_1.htm)

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limit provided.

µg/L = micrograms per liter.

Detections are bolded.

Shaded cells = Concentration exceeds NJDEP GWQS.