REMEDIAL INVESTIGATION REPORT ADDENDUM FOR BUILDING 1104 FORT MONMOUTH, NEW JERSEY

PREPARED FOR:

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BUILDING 167
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ACRONYMS

Accutest	Accutest Laboratories
AMC	Army Materiel Command
amsl	Above mean sea level
bgs	Below ground surface
Brinkerhoff	Brinkerhoff Environmental Services, Inc.
CECOM	Communications and Electronic Command
COC	Contaminant of concern
DPW	Directorate of Public Works
FMETL	Fort Monmouth Environmental Testing Laboratory
FTMM	Fort Monmouth
FWS	Fish and Wildlife Service
GWQS	Ground Water Quality Standards
GWQS	Ground Water Quality Standard
LNAPL	Light non-aqueous phase liquid
mg/kg	Milligrams per kilogram
NFA	No Further Action
NJAC	*New Jersey Administrative Code*
NJDEP	New Jersey Department of Environmental Protection
OVA	Organic Vapor Analyzer
PQL	Practical Quantitation Limit
PVC	Polyvinyl chloride
RI	Remedial Investigation
RIR	Remedial Investigation Report
SI	Site Investigation
SOP	Standard Operating Procedure
SVOC	Semivolatile organic compound
Tetra Tech	Tetra Tech EM, Inc.
TIC	Tentatively Identified Compound
TPH	Total petroleum hydrocarbons
TVS	TECOM-Vinnell Services
U.S.	United States
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
UST	Underground storage tank
Versar	Versar, Inc.
VOC	Volatile organic compound
WWI	World War I

Further ground water monitoring and remedial investigation activities at Building 1104 are not required. No further action (NFA) is recommended concerning ground water at Building 1104.

1.2 REPORT ORGANIZATION

This report is organized to minimize repetition. **Section 2.0** provides background information and a general description of Building 1104 located in the Main Post Area of FTMM. **Section 3.0** describes and summarizes the field activities conducted at Building 1104 including ground water sampling from soil borings and monitoring wells. **Section 4.0** presents the physical characterization of Building 1104 including lithology and ground water conditions. The chemical characterization of Building 1104 is presented in **Section 5.0**, which includes ground water results and the determination of potential COCs. Conclusions and recommendations for Building 1104 are presented in **Section 6.0**. References used in this RIR are provided in **Section 7.0**.

2.2.1 2001 Underground Storage Tank Closure and SI Report

According to the *Underground Storage Tank Closure and Site Investigation* (SI) *Report for Building 1104, Main Post-West Area, NJDEP UST Registration No. 81533-164,* prepared by Versar, Inc., (Versar) for the DPW, dated May 2001 (**Appendix A**), one UST (UST No. 0081533-164) was located northeast of building 1104 (**Figure 2-4**). UST No. 0081533-164 was a 1,000-gallon No. 2 fuel oil UST. No product lines were found during the excavation of the UST.

On August 23, 2000, UST No. 0081533-164 was closed by removal in accordance with NJDEP closure procedures. After the UST had been removed from the excavation, it was staged on polyethylene sheeting and examined for holes. Numerous holes were noted in the UST. Soils at the location of the holes were dark in color and appeared to be impacted. Ground water was encountered at 8.5 feet below ground surface (bgs), and no sheen was observed on the ground water.

Approximately 30 cubic yards of potentially contaminated soil were removed from the excavation area from August 23, 2000 to February 27, 2001. A total of 16 soil samples were collected from the floor and sidewalls of the excavation area and analyzed for total petroleum hydrocarbons (TPH) and total solids. The initial post-excavation soil samples contained TPH concentrations in excess of the regulatory limit (NJDEP residential direct contact total organic contaminations soil cleanup criteria) of 10,000 milligrams per kilogram (mg/kg). Soils were removed from the excavation until no evidence of contamination remained. The TPH concentrations of the final post-excavation samples ranged from non-detect to 281 mg/kg—less than the regulatory limit.

An Order of Magnitude Compliance Review of the UST closure soil results was conducted in accordance with the NJDEP Order of Magnitude Guidance Document. The available soil data were compared to the newly adopted remediation standards that are an order of magnitude or more lower than the previous soil cleanup criteria. No COCs were identified based on the order of magnitude analysis.

Based on organic vapor analysis (OVA) air monitoring and results of the analysis of the post-excavation soil samples for TPH, approximately 20 cubic yards of the 30 cubic yards of soil removed from the excavation area were identified as potentially contaminated soil. Soils that did not exhibit signs of contamination (via visual observation, field screening, or TPH analysis) were used as backfill (along with certified clean fill) following removal of the UST.

In response to the observation of potentially contaminated soil near the water table, three ground water grab samples were collected in the vicinity of Building 1104 on, October 4, 2000; January 18, 2001; and April 21, 2001 respectively,. The ground water grab samples were analyzed for volatile organic compounds (VOC) plus 15 tentatively identified compounds (TIC) and semivolatile organic compounds (SVOC) plus 15 TICs. Compounds detected at concentrations greater than the appropriate NJDEP GWQS included benzene, bis(2-ethylhexyl)phthalate, and n-nitrosodiphenylamine.

2.2.4 Public Notification

In accordance with the Notification and Public Outreach Rule of the NJDEP Technical Requirements for Site Remediation (TRSR) (N.J.A.C. 7:26E-1.4), Fort Monmouth established a Restoration Advisory Board (RAB) in 2006 with representatives from the local municipalities who represent a variety of interests and viewpoints. The RAB acts as a focal point to exchange information between Fort Monmouth and the local communities regarding environmental and restoration activities and meets on a quarterly basis to review and comment on on-going environmental work. The meetings are open to the public and are advertised in local newspapers. All environmental projects subject to the NJDEP TRSR are presented at the RAB.

Although the Public Notification requirements were amended in 2009 with the implementation of signs or periodic letters to inform the public of on-going environmental work, on June 17, 2010, Fort Monmouth requested that the NJDEP grant approval of an alternate notification and public outreach plan utilizing the existing RAB and document repository of Fort Monmouth environmental reports, which is accessible to the public. The NJDEP response indicated that the alternative plan provided adequate public notice and complied with the intent of 7:26E-1.4; NJDEP approved the request on June 24, 2010.

Public notification documentation is presented in **Appendix G**.

2.2.5 Baseline Ecological Evaluation

Shaw Environmental, Inc. was contracted by the Army to conduct a BEE for Fort Monmouth's Main Post and Charles Wood Areas. Sampling of multiple media was conducted in 2010, the results of which are not available for discussion herein. The final BEE will be submitted to the NJDEP under separate cover in June 2011.

2.3 SITE CONDITIONS

Tetra Tech conducted a site walk on October 21, 2010, to assess current conditions at the Building 1104. The site consisted of one building (S-1104). The former UST area was vegetated and well-maintained. A stick-up monitoring well was observed to the west of Building 1104. General utilities servicing Building 1104 are depicted on **Figure 2-4.**

2.4 ENVIRONMENTAL SETTING

The following is a description of the geological/hydrogeological setting of the area surrounding Building 1104. Included is a description of the regional geology of the area surrounding FTMM, as well as descriptions of the local geology and hydrogeology of the Main Post.

As presented in **Appendix B**, the lithologic logs from the monitoring well installation at Building 1104 indicate that the lithology in this area consists of fill and native material. The fill encountered in the Building 1104 monitoring well boring is composed of brown sand, silt, cobbles, and trace cinders. The native material encountered at Building 1104 consists of brown sand and silt, and dark green clay with some silt and sand. The lithology of the native material is consistent with the upper member of the Red Bank Sand (Shrewsbury Formation), as described in Minard (1969). Further discussion of the subsurface conditions at Building 1104 is presented in **Section 4.0**.

A Basewide Glauconitic Investigation Report was completed by DPW in March 2011 and a Background Metals Evaluation was prepared by Brinkerhoff for DPW in May 2011. Both documents indicate the potential for soil particles present in groundwater samples which are potentially affecting the metals analysis results in groundwater samples collected from the overall FTMM site. Additional groundwater sampling including the comparison of filtered and unfiltered samples results has been proposed to determine the potential affect of soil particles on metals analysis results. Results and conclusions from these future sampling events will be provided to NJDEP under separate cover.

The Basewide Glauconitic Investigation Report and the Background Metals Evaluation Report are provided in **Appendix H.**

2.4.2 Hydrogeology

FTMM lies in the Atlantic and Eastern Gulf Coastal Plain ground water region (Meisler and others 1988). This ground water 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 the Red Bank, Tinton, and Hornerstown Sands) is dominated by calcium, magnesium, manganese, aluminum, and iron. The sediments in the area of FTMM were deposited in fluvial-deltaic to near shore environments.

Based on a review of the NJDEP Ground Water Quality Standards (GWQS) (NJAC 7:9-6), dated 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 on November 21, 2003. The primary designated use for Class III-A ground water is the release or transmittal of ground water to adjacent classification areas and surface water, as relevant. Secondary designated uses in Class III-A include any reasonable use.

MODFLOW Ground water Modeling, US Army, Fort Monmouth Main Post and Charles Wood Areas (Ground water Modeling Summary Report), dated June 10, 2010, was prepared by Brinkerhoff Environmental Services, Inc., (Brinkerhoff 2010) and is included as **Appendix E**. Brinkerhoff developed and refined site-wide ground water models for both the Main Post and the Charles Wood area.

According to the Ground water Modeling Summary Report, the water table aquifer in the Main Post area is identified as part of the "composite confining units" or minor aquifers. The minor

downgradient direction, and vertical contaminant migration would typically be heavily retarded by the fine-grained aquifer materials present at depth.

2.4.3 Soils

According to the U.S. Department of Agriculture (USDA), Soil Conservation Service, Monmouth County Soil Survey (USDA 1989), most 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 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 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. This 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 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 Building 1104 are classified as UD – Udorthents – urban land complex, with 0 to 3 percent slopes (**Figure 2-8**).

3.0 SITE ACTIVITIES

FTMM DPW has conducted RI activities to evaluate impacts to ground water in the vicinity of Building 1104. RI activities were performed from May 2001 through August 2001. These activities were managed by the FTMM DPW and performed by TECOM-Vinnell Services (TVS). The details of RI activities that occurred at Building 1104 are described in the following sections.

3.1 WELL INSTALLATION

One monitoring well (1104MW01) was installed in July 2010 by the DPW. The well was constructed with 4-inch-diameter 10 Slot polyvinyl chloride (PVC) to a depth of 20 feet bgs. The monitoring well is screened from 5 to 20 feet bgs. Monitoring well construction details are summarized in **Table 2-1**. The well boring log and monitoring well record are provided in **Appendix B**. The well inspection checklist is provided as Appendix K.

3.2 SAMPLE COLLECTION ACTIVITIES

As part of the RI of Building 1104, ground water sampling was conducted in May 2010 and August 2010. Sampling activities were performed in accordance with the *Fort Monmouth Standard Sampling Operating Procedures* (FTMM DPW 1997) (**Appendix I**). Laboratory analyses of the samples collected at Building 1104 were conducted at the FTMM Environmental Testing Laboratory (FMETL), a New Jersey-certified laboratory (Certification No. 13461), and at Accutest Laboratories (Accutest), a New Jersey-certified laboratory (Certification No. 12129).

On May 19, 2010, a Geoprobe® was advanced in order to collect a ground water grab sample for screening purposes. Ground water was encountered at approximately 11 feet bgs. A layer of an oil-like substance was observed on the top of the ground water. A ground water grab sample, field blank, and trip blank were collected and analyzed for VOCs plus 10 TICs by United States Environmental Protection Agency (USEPA) Method 624, and for SVOCs plus 15 TICs by USEPA Method 625. The waste types generated by the remedial activities included three-gallon polyethylene pails, polyethylene tubing, Teflon® bailers, mason string, and personal protective equipment (PPE). The pails were recycled, and the other materials were disposed of in accordance with the *Fort Monmouth Solid Waste Management Plan.*

As discussed in **Section 3.1**, a permanent monitoring well, 1104MW01, was installed in July 2010 downgradient of the former UST location (**Figure 2-3**). The well is located northwest of the former UST location but still within the limits of the soil excavation. Ground water samples (along with trip and field blanks) were collected from this monitoring well on August 12 and August 27, 2010, and analyzed for VOCs plus 15 TICs by USEPA Method 624, and for SVOCs plus 15 TICs by SW-846 Method 8270C.

A summary of the ground water sampling activities, including well IDs, sample IDs, sample type, collection/analysis dates, analytical parameters, and analytical methods, is provided in

4.0 SITE PHYSICAL CHARACTERISTICS

The following sections represent the findings of the Building 1104 geologic and hydrogeologic characterization program. These sections include a detailed discussion of the physical properties of the unconsolidated soil, bedrock, and ground water underlying the study area.

4.1 LITHOLOGY

The lithology encountered at Building 1104 consists of silty gravels, gravel-sand-silt mixtures, fine sand, and clay or silt. A boring log for 1104MW01 is included in **Appendix B**. Ground water was encountered at a depth of 8 feet bgs during drilling activities.

4.2 GROUND WATER FLOW

A ground water contour plot (**Figure 2-7**) was generated based on the 2010 ground water modeling effort by Brinkerhoff (**Appendix E**). The ground water underlying the site appears to be flowing towards the northwest.

4.2.1 Ground Water Flow Direction

Ground water contour maps were generated based on ground water depth measurements from quarters one through three of 2010 ground water sampling rounds (**Figures 2-7a to 2-7c**). The ground water underlying the site appears to be flowing towards the northwest towards Mill Creek. Ground water elevation data for 1104MW01 are listed in **Table 3-2**.

4.2.2 Hydrogeologic Properties

As discussed in **Section 2.4.2** and **Section 4.2.1**, Brinkerhoff developed and refined post-wide ground water models for both the Main Post and the Charles Wood Area in 2010. The ground water flow model simulation was performed under steady state conditions using the WHS Solver for Visual MODFLOW, a proprietary solver developed by Waterloo Hydrogeologic Inc., of Ontario, Canada. The Ground water Modeling Summary Report is included as **Appendix E**. The following is a description of the ground water flow conditions summary from the Ground water Modeling Summary Report.

> "The suggested ground water flow directions indicated by the ground water flow model are generally consistent with that seen in previous ground water investigations, and are also favorable when compared to ground water contour maps prepared using field depth to water measurements collected on January 28, 2010.
>
> In general, ground water flow is from areas of relatively high topographic elevations toward lower topographic elevations where the site's surface water features are located. The simulation shows that the central portion of the Main Post is a relative high (ground water divide) being that this portion of the Fort is

5.0 SITE CHEMICAL CHARACTERIZATION

This section includes a discussion of the chemical analytical characterization of the site based on the various samples collected from the site and analyzed in 2010, including one ground water grab sample and two rounds of ground water monitoring well samples. DPW personnel were responsible for collection of samples during this site investigation. Sample analyses were performed by the FMETL, a New Jersey-certified laboratory (Certification No. 13461).

5.1 GROUND WATER SAMPLE RESULTS

This section discusses results of laboratory analyses of the ground water grab sample collected in May 2010 and the two ground water samples collected in August 2010 from monitoring well 1104MW01 at Building 1104. The ground water samples were collected and analyzed for VOCs plus 15 TICs (10 TICs for the grab sample) and for SVOCs plus 15 TICs.

As discussed in **Section 2.4.2**, FTMM is underlain by a Class III-A aquifer. The Ground Water Quality Standards for Class III-A are considered the criteria for the most stringent classification for vertically or horizontally adjacent ground waters that are not Class III-A (N.J.A.C. 7:9C-1.5). The NJDEP criteria used for comparison of ground water analytical results were the higher of the Practical Quantitation Limits (PQL) and the NJDEP GWQS for Class II-A aquifers (*New Jersey Administrative Code* [NJAC] 7:9C, Appendix Table 1).

During the three sampling events, one VOC, carbon disulfide, was detected in site ground water at concentrations less than its GWQS. Three SVOCs (2-methylnaphthalene, phenanthrene, and pyrene) were detected in site ground water at concentrations less than their respective GWQS. No exceedances of GWQS were found in any of the three ground water samples collected in 2010 (**Table 5-1**).

No Tentatively Identified Compounds (TICs) were detected at concentrations greater than the appropriate NJDEP GWQS at the site (500 µg/L for VOCs and 100 µg/L for an individual compound) in any of the three ground water samples collected in 2010 (**Appendix J**).

The chain-of-custody forms for ground water samples and laboratory data sheets are provided in **Appendix J**.

5.2 CONTAMINANTS OF CONCERN

In order to determine the potential COCs in ground water at Building 1104, the first step was to identify exceedances of the NJDEP GWQS in monitoring well samples collected at Building 1104. These exceedances are listed in **Table 5-1** (2010 samples).

During the UST Closure SI, three ground water grab samples were collected and analyzed for VOCs and SVOCs. Exceedances of GWQS (current in 2001) were found for benzene, xylenes, and n-nitrosodiphenylamine. Comparison of those results from 2001 to the most recent GWQS (July 2007) indicates exceedances of benzene, bis(2-ethylhexyl)phthalate, and

6.0 CONCLUSIONS AND RECOMMENDATIONS

Geologic publications show that Building 1104 is located within an aquitard (the Navesink-Hornerstown Confining Unit). The low hydraulic conductivity of the aquitard and the thickness of the aquitard at Building 1104 conform to the requirements of a Class III-A aquifer, as specified in the NJDEP GWQS (NJAC 7:9C, July 22, 2010).

The Class II-A criteria were used for comparison with site-specific data obtained from the various sampling rounds because the GWQS (NJAC 7:9C-1.5) state that the ground Water Quality Standards to be used for Class III-A aquifers are to be the most stringent criteria associated with vertically or horizontally adjacent ground waters that are not Class III-A.

Compounds detected in ground water grab samples in 2000 and 2001 greater than the appropriate GWQS were not detected in the ground water samples collected in 2010. No compounds detected in ground water samples collected in 2010 exceeded the appropriate current GWQS. Therefore, no COCs were identified for Building 1104.

A layer of light non-aqueous phase liquid (LNAPL) was observed on the top of the ground water grab sample collected in May 2010. Monitoring well 1104MW01 was installed in the same location as this ground water grab sample. No free product was observed during installation of the monitoring well. Moreover, no free product was observed during the two sampling events at 1104MW01. The DPW will collect a ground water sample using low-flow methodology to try to draw any material present into the monitoring well. The DPW believes that the oil-like substance observed in the ground water grab sample was an isolated pocket, as no other free product has been observed during other activities at the site.

Further ground water monitoring and RI activities at Building 1104 are not required. NFA is recommended concerning ground water at Building 1104.

TABLES

APPENDICES

APPENDIX B

Boring Logs and Monitoring Well Construction Records

APPENDIX D

Sensitive Receptor Report and Survey

APPENDIX F

Aerial Photographs/Survey Review

APPENDIX H

Basewide Glauconitic Investigation Report and Background Metals Evaluation Report

APPENDIX J

Laboratory Data Packages