# PROPOSED PLAN FOR FORT MONMOUTH SITE 68 (FTMM-68)
# FORMER DRY CLEANER'S UNDERGROUND STORAGE TANK
# FORT MONMOUTH, NEW JERSEY
# January 2023

## INTRODUCTION AND PURPOSE

This Proposed Plan provides information necessary to allow the public to participate with the United States Department of the Army (Army) at Fort Monmouth (FTMM), the Lead Agency, in selecting a response action for contaminated groundwater at FTMM Site 68 (FTMM-68). This response action is being taken according to authorities granted under the Defense Environmental Restoration Program (DERP, 10 U.S.C. §2701 et seq), in compliance with the **Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA,** 42 U.S.C. §9601 et seq**)** and Executive Order 12580. New Jersey Department of Environmental Protection (NJDEP) is the state support agency under the **National Oil and Hazardous Substances Pollution Contingency Plan (NCP**, 40 CFR Part 300**)** for FTMM. The Army, in consultation with NJDEP, shall make the final selection of the response action for site FTMM-68.

A list of acronyms and abbreviations and a glossary of the terms written in bold type are provided at the end of this Proposed Plan to further define the terminology used.

**Remedial Investigations (RIs)** were conducted at FTMM-68 in 2011 and 2015 through 2020 to delineate contamination in soil and groundwater. Following the discovery of contaminant exceedances in soil of the United States Environmental Protection Agency (USEPA) residential **regional screening levels (RSLs)** for tetrachloroethene (PCE) and trichloroethene (TCE), soil removal actions were conducted between April and May 2011 and in February 2019 (Parsons 2020).

The **human health risk assessment (HHRA)** prepared as part of the RI/**Feasibility Study** (**FS**; Parsons 2020a) concluded that following the above removal actions, no unacceptable risks to human health from exposure to contaminants remain in soil at FTMM-68.

Additionally, the HHRA concluded that there is no unacceptable risk from exposure to groundwater under industrial exposure scenarios. However, there is an unacceptable risk to hypothetical receptors in an **unrestricted use/unlimited exposure (UU/UE)** scenario due to exposure to **chlorinated volatile organic compound (CVOC)**-contaminated groundwater under potable use.

This Proposed Plan summarizes information provided in more detail in the RI/FS Report (Parsons 2020a) and the Feasibility Study Addendum (FSA; Arcadis U.S., Inc. [Arcadis] 2021), which are available for review as part of the **Administrative Record** file for FTMM-68.

### IMPORTANT DATES AND LOCATIONS

**Public Comment Period:**
**February 1, 2023 to March 3, 2023**
The Army will accept written comments on the Proposed Plan during the public comment period. Written comments may be postmarked or emailed by **March 3, 2023** and sent to:

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Environmental, InterAgency &
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**Public Meeting: February 15, 2023**
The Army will hold a virtual public meeting to explain the Proposed Plan and all response actions presented in the FS and FSA. Oral and written comments will also be accepted at the meeting. The virtual public meeting will be held at 6:30pm via Webex.

To attend the meeting (audio/visual), please use the following link:
**https://usace1.webex.com/usace1/j.php?MTID=m73b582b19ef4d69c422e1fc6c870eb4b.**

Alternatively, the audio portion of the meeting can be accessed by dialing the following toll-free number: **1-844-800-2712**. Enter the meeting number and pound sign when prompted: **2763 828 3009#.**

The Proposed Plan can be found at **HTTPS://FORTMONMOUTHRECORDS.COM/SITE-RECORDS/** or the Fort Monmouth Environmental Restoration Public Information Repository (the Administrative Record) at the following location:

Monmouth County Library, Eastern Branch
1001 Route 35, Shrewsbury, NJ 07702-4398
Phone: (732) 683-8980
Hours: Mon-Thurs, 9am-9pm;
Fri-Sat, 9am-5pm, and Sun, 1pm-5pm

This Proposed Plan highlights the preferred response actions for remediation of groundwater at FTMM-68 and outlines all alternatives evaluated in the FS and FSA. In addition to Alternatives 1 through 8 presented



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in the RI/FS, this Proposed Plan also presents an additional remedial alternative identified within the FSA. The additional alternative is titled Alternative 9 – Source Removal via Direct Excavation and Backfill, Downgradient **Zero Valent Iron (ZVI) Permeable Reactive Barrier (PRB)**, **Monitored Natural Attenuation (MNA)**, with Alternative 2 – **Land Use Controls (LUCs)**. This alternative combines components of Alternative 3 – Downgradient ZVI PRB, MNA, with Alternative 2 and components of Alternative 8 – Source Removal via Direct Excavation and Backfill, MNA, with Alternative 2, which were evaluated in the RI/FS (Parsons 2020a).

LUCs will be implemented at FTMM-68 through a **LUC Implementation Plan (LUCIP)** to document institutional controls and identify procedural responsibilities including site inspections, monitoring and reporting, and long-term management requirements. In addition to the LUCs incorporated into a LUCIP and included in deed transfers, as an additional layering of controls at the site, the NJDEP has agreed to implement and enforce a Classification Exception Area (CEA) for the groundwater at the site. The CEA restricts the use of groundwater and will remain in effect until the remedial action objectives (RAOs) are achieved. The CEA will be established to restrict groundwater use because of the presence of volatile organic compound (VOC) concentrations above the NJDEP groundwater quality standards (GWQS). **Contaminants of concern (COCs)** in groundwater at FTMM-68 include PCE, TCE, cis-1,2-dichloroethene (DCE), and vinyl chloride (VC).

The Army will finalize and present the selected response actions for the FTMM-68 in a **Record of Decision**. The final selection will not take place until after the public comment period to provide for the possibility of new information or concerns that may surface during the public comment period.

## PUBLIC INVOLVEMENT PROCESS

As the lead agency for implementing the environmental response program at FTMM, the Army, with support from NJDEP, has prepared this Proposed Plan in accordance with Section 117(a) of the CERCLA and the **NCP** Section 300.430(f)(2) to continue its community awareness efforts and to encourage public participation. The Army and NJDEP encourage the public to review all of the documents relevant to environmental response activities conducted at FTMM-68 to assist in the selection of an appropriate response action for the site. After the public has the opportunity to review and comment on this Proposed Plan, the Army will summarize and respond to the comments received during the public comment period and accept oral and written comments at a public meeting. The Proposed Plan will also be presented at the public meeting, and comments and questions will be accepted and responded to at the meeting. Information on the times and places for public comment and the public meeting are shown in the box on Page 1.

Local community members and other interested parties are encouraged to review this Proposed Plan and submit comments. The Army will carefully consider all comments received from the public and provide responses, which will be compiled into a **Responsiveness Summary**. The decision on which response action is appropriate for FTMM-68 groundwater will be detailed in a Record of Decision, which will include the Responsiveness Summary.

This Proposed Plan summarizes information that can be found in greater detail in the RI/FS for FTMM-68 (Parsons 2020a) and other documents contained in the Administrative Record file for FTMM and on the website listed in the box on Page 1. The Army encourages the public to review these documents to gain a more comprehensive understanding of the site and all associated activities. Relevant documents used in the preparation of this Proposed Plan are listed in the References Section found at the end of this document.

The preferred response actions presented in this Proposed Plan meet the CERCLA threshold criteria including protection of human health and the environment, and to provide the best combination of balancing criteria when evaluated against the CERCLA requirements.

## FTMM BACKGROUND

FTMM is located in the central-eastern portion of New Jersey in Monmouth County, approximately 45 miles south of New York City, New York; 70 miles northeast of Philadelphia, Pennsylvania; and 40 miles east of Trenton, New Jersey. The Atlantic Ocean is approximately 3 miles to the east. FTMM consisted of three areas: the Main Post (MP), the Charles Wood Area (CWA), and the Evans Area (Figure 1; figures are located at the end of this document). The areas of the MP and CWA are 637 acres and 489 acres, respectively. FTMM's MP and CWA were selected for closure by the Base Realignment and Closure (BRAC) Commission in 2005 and officially closed on September 15, 2011. The Evans Area (not shown on Figure 1) was closed under BRAC in 1998 and has since been transferred from FTMM. FTMM falls within the Boroughs of Eatontown, Oceanport, and Tinton Falls. The MP is in the Eatontown and Oceanport Boroughs. FTMM-68 is located in the central portion of the MP (Figure 2) and encompasses the area of former Building 700 (Figure 3).

FTMM-68 is immediately east of FTMM-53, the former gasoline station at Building 699, which included a groundwater and **soil vapor extraction**

**(SVE)** remediation system that operated from 2001 until 2013 (Parsons 2018). Building 114 (former Base fitness center) is located to the east of FTMM-68.

## FTMM-68 SITE BACKGROUND

FTMM-68 is located on the MP and was the site of a former dry-cleaning facility (former Building 565) built in 1965 that used PCE as the cleaning solvent contained in an underground storage tank (UST). Building 565 was demolished, and former Building 700 was built in its footprint and used for office space in connection with Army recruitment. Building 700 was demolished in July 2018 as part of the ongoing remediation activities at FTMM-68.

## SITE CHARACTERISTICS

### Physical Characteristics

Major vegetation zones at FTMM consist of landscaped areas, wetlands, riparian areas, upland forests, and old field habitats. Much of the upland areas of the MP consist of extensive areas of regularly mowed lawns and landscaped areas and commercial/industrial buildings. Detailed vegetation information can be found in the Baseline Ecological Evaluation Report (Shaw 2012).

The ground surface topography of FTMM-68 is relatively flat but slopes gently toward Husky Brook to the southeast. Much of the ground surface of the site is unmaintained grass.

### Surface Water Hydrology

The closest surface water body is Husky Brook Lake, which is approximately 700 feet (ft) south of the former dry-cleaning facility. Husky Brook Lake flows into Husky Brook, which flows through a culvert for approximately 1,800 ft before it daylights approximately 300 ft southeast of Building 114. Husky Brook drains into Oceanport Creek (Figure 2), adjacent to the eastern edge of the MP, and ultimately into the Shrewsbury Bay. Water in Oceanport Creek is tidally influenced and is brackish to saline. Water in the tributary streams to Shrewsbury Bay is also tidally influenced and is fresh to brackish at low tide and brackish to saline at high tide. Stormwater at FTMM drains to municipal drainage systems via overland flow. Surface water runoff from FTMM-68 eventually enters Husky Brook Lake or Husky Brook.

### Geology and Hydrogeology

FTMM-68 is underlain by the Cape May Formation Unit 2, which consists predominately of brown, fine to medium sand with trace to some silt and trace clay. The Cape May Formation Unit 2 extends from ground surface to approximately 10 to 22 ft below ground surface (bgs). Underlying the Cape May Formation Unit 2 is the Hornerstown Formation, which is characterized by interlayered sand, silt, and clay, and is divided into two subunits. The uppermost subunit of the Hornerstown Formation is present across FTMM-68 and is transitional in composition between the overlying sandy Cape May Formation and the underlying clayey subunit. This subunit is characterized by interlayered fine to medium sand, silt, and clay that is typically gray to black in color and ranges in thickness from 3 to 13 ft. The lower subunit of the Hornerstown Formation is denser and finer-grained than the upper subunit and consists of dark gray to green clay with glauconite and minor sand. This subunit has a maximum thickness of 33 ft and extends to a maximum depth of 50 ft bgs.

The Tinton Formation underlies the Hornerstown Formation and is characterized as olive brown, dense, fine sand with trace to some silt, glauconite, and clay. The Red Bank Formation, Shrewsbury Member, underlies the Tinton Formation and consists of brown, mostly fine sand with trace to little silt that contains evidence of burrows. The Shrewsbury Member is approximately 65 ft thick at FTMM based on information presented by Stanford and Sugarman (2010). The deepest monitoring wells were installed in this formation to a maximum depth of 109 ft bgs.

The depth to groundwater at FTMM-68 is approximately 3 to 12 ft bgs and can rapidly fluctuate in response to precipitation events and the tidal action in area creeks (AECOM 2013). The Hornerstown Formation clay unit likely functions as an aquitard between the overlying Cape May Formation and the underlying Tinton Formation; however, data collected during the RI indicated that groundwater and dissolved contaminants can migrate through the Hornerstown Formation both laterally and vertically, indicating the presence of more permeable zones and/or water-transmitting fractures (Parsons 2020a). Groundwater flow in the Cape May, Hornerstown, and Tinton Formations at the site is primarily west to east, toward where Husky Brook emerges from the culvert. NJDEP GWQS classify groundwater for FTMM as Class II-A: potable water with secondary uses including agricultural and industrial (NJDEP 2010).

## CURRENT AND FUTURE USE OF FTMM-68

The FTMM-68 area is currently mostly undeveloped. FTMM-68 is accessed by Saltzman Avenue to the north, and has no perimeter fencing. The anticipated future land use for FTMM-68 is offices and research and development, with additional civic/institutional buildings (Fort Monmouth Economic Revitalization Authority [FMERA 2019]). Groundwater at FTMM-68 is not currently used as a potable water source because municipal water supplies are available. It is anticipated that groundwater use will be restricted following property transfer and municipal water supplies will continue to be used at FTMM-68.

## IDENTIFICATION OF ENVIRONMENTAL CONTAMINATION

To determine the nature and extent of contamination in groundwater and soil at FTMM-68, chemical concentrations measured during the RI were compared to the following federal (USEPA) and state (NJDEP) residential and non-residential standards, and impact to groundwater (IGW) screening criteria:

- USEPA Regional Screening Levels (RSLs) (target risk = 1 x $10^{-6}$ and target hazard quotient = 0.1) for residential and industrial soil and protection of groundwater;
- NJDEP residential direct contact soil remediation standards (RDCSRS), non-residential direct contact soil remediation standards (NRDCSRS), and **IGW soil screening levels (SSLs)** for soils; and
- NJDEP GWQS for groundwater.

USEPA RSLs for soil and groundwater were used for comparison purposes because the Army is required to complete a CERCLA-compliant RI (including an HHRA). Therefore, RSLs were used to identify those chemicals that are **constituents of potential concern (COPCs)**. COPCs were then evaluated in an HHRA. Four COPCs were determined to be **constituents of concern (COCs)** in groundwater at FTMM-68, including PCE, TCE, cis-1,2-DCE, and VC. No COCs were identified in soil.

The following subsections describe site characterization activities for soil and groundwater for FTMM-68. The results of the HHRA are presented in the Summary of Site Risks Section following site characterization.

### <u>Extent of Contamination in Soil</u>

Impacts in soil were first identified during removal of a 500-gallon solvent UST at the southwestern corner of Building 700 in April 2011. Soil sampling was conducted at FTMM-68 from April 2011 through February 2019 and is summarized below. Results of the investigations are presented in the RI/FS Report (Parsons 2020a):

- Soil samples were collected in April 2011 following the excavation of the solvent UST and surrounding soil at the southwest corner of Building 700 for initial evaluation of a potential release (Army 2011). Seven soil samples were collected from the excavation floor, sidewalls, and piping in April 2011 and analyzed for VOCs and 15 tentatively identified compounds (TICs). PCE, TCE, and cis-1,2-DCE were detected in the samples. PCE and TCE were each detected above NJDEP and USEPA residential and non-residential direct contact criteria in two samples collected at the water table and at the base of excavation, approximately 7.5 ft bgs. Maximum PCE concentrations in the samples was 17,418 milligrams per kilogram (mg/kg) (duplicate) to 23,889 mg/kg (parent).
- Additional soil excavation was performed in May 2011, and two confirmation samples were collected from the north and south ends of the excavation area at approximately 9 ft bgs. Both samples collected below the water table had PCE detections but were below the NJDEP RDCSRS. The maximum concentration of PCE was 1.58 mg/kg.
- An additional investigation was conducted in 2015 to further assess the magnitude of CVOCs in soil in the source area outside of the May 2011 UST excavation. A total of nine soil samples were collected from three soil borings and analyzed for VOCs and TICs. Samples were collected from the shallow subsurface (1.5 to 2 ft bgs), just above the water table, just above the top of the shallowest aquitard (Hornerstown Formation) that would inhibit downward migration of CVOCs, from the base of the shallow water-bearing zone, and at depths exhibiting elevated photoionization detector readings between 1.5 to 24.5 ft bgs. Based on the soil sampling results, it was concluded that the lateral and vertical extents of soil contamination exceeding the NJDEP RDCSRS area outside of the May 2011 UST excavation were adequately delineated.
- In January 2017, 46 soil samples were collected and analyzed for VOCs and TICs for the further refinement of the magnitude and vertical/lateral extent of soil contamination in and near the source area at FTMM-68. There were no exceedances of the NJDEP RDCSRS or the USEPA residential RSL for any of the targeted analytes. Concentrations of PCE, 1,2-dichloroethane, TCE, and VC exceeded their respective NJDEP IGW SSLs in multiple samples, with depths ranging from 2 to 42.5 ft bgs. However, only one of the samples collected above the water table exceeded the IGW SSL for PCE. IGW exceedances below the water table are not applicable in water-saturated soils.
- In February 2019, a time-critical removal action was performed to excavate CVOC-contaminated soil in the vicinity of the former building adjacent to the former solvent UST location (Figure 3). The excavation was approximately 8 ft wide by 14 ft long, and approximately 10 ft deep. A total of approximately 37.5 tons of impacted soil was excavated and disposed offsite. Ten post-excavation samples were collected and there were no exceedances of NJDEP RDCSRS or USEPA residential or non-residential RSLs, but there were exceedances of the USEPA RSL for

protection of groundwater for cis-1,2-DCE, methylene chloride, TCE, and PCE.

Following the above investigations, it was concluded that PCE detections in soil extend an estimated 160 ft east and 40 ft north of the former UST and up to 10 ft into the clay of the Hornerstown Formation. Distribution of PCE in the saturated zone may have been influenced by operation of the former groundwater extraction system at adjacent site FTMM-53, which drew the PCE-contaminated groundwater to the north of FTMM-68.

**Extent of Contamination in Groundwater**

Groundwater investigations were conducted at FTMM-68 from August 2013 through May 2020 and are summarized below. Results of the investigations are presented in the RI/FS Report (Parsons 2020a):

- Sampling of the original two source area monitoring wells (565MW01 and 565MW01D) was conducted starting in August 2013 and continued quarterly through 2015.
- Thirteen groundwater grab samples were collected in September 2015 with a Geoprobe® to determine the direction of migration from the source area and lateral extent of the CVOC plume.
- Five additional monitoring wells were installed and sampled in November 2015 to expand the groundwater monitoring network based on the results from the September 2015 groundwater grab sampling.
- Two additional wells were installed and sampled in October 2016 to expand the groundwater monitoring well network.
- Fifteen additional wells were installed, and 24 wells were sampled from March to April 2017 to evaluate the nature, extent, and natural attenuation of CVOCs.
- Three rounds of sampling at six wells were performed from August 2018 to June 2019 for performance monitoring of the in-situ chemical oxidation pilot test.
- Thirteen additional wells were installed and 41 wells were sampled in July 2019 to complete the characterization of the lateral and vertical extents of PCE exceeding the 1 microgram per liter (µg/L) NJDEP GWQS.
- Five additional wells were installed, and 48 wells were sampled from February to March 2020 to provide a second round of groundwater data that characterizes the lateral and vertical extents of PCE, and the lateral extent of tertiary butyl alcohol (TBA) exceeding the 100 µg/L NJDEP GWQS.
- Five wells were sampled in May 2020 to provide a second round of groundwater data that characterizes the downgradient extent of the TBA plume.

During the sampling events discussed above, 15 VOCs exceeded NJDEP GWQS or USEPA tapwater RSLs in at least one sample. PCE is the dominant CVOC throughout the plume and the highest concentrations of biodegradation products (TCE, cis-1,2-DCE, and VC) are present in the source area near the adjacent former gasoline/service station (FTMM-53). Downgradient (east) of the source area, concentrations of biodegradation products are relatively low to non-detect.

Groundwater sample results for TBA exceeded the NJDEP GWQS at multiple locations downgradient of the PCE plume (east of Nicodemus Avenue). The TBA plume extends farther east than the PCE plume, but has not migrated to the housing area east of Buildings 550 and 551. TBA is a known biodegradation breakdown product of methyl tert-butyl ether, and both TBA and methyl tert-butyl ether are oxygenated chemical compounds used as additives to gasoline. Based on the proximity to FTMM-53 and the distribution of TBA in groundwater, the source of the TBA plume is likely the FTMM-53 former gasoline station, which is adjacent to FTMM-68, rather than FTMM-68. TBA has migrated farther downgradient than the PCE plume because it is soluble in water.

## SCOPE AND ROLE OF THE RESPONSE ACTION

The response actions included in this Proposed Plan were evaluated to address VOCs in groundwater at FTMM-68. Soil removal actions were previously conducted between April and May 2011 and in February 2019 (Parsons 2020) for PCE- and TCE-contaminated soil. The remaining contaminants at FTMM-68 do not constitute principal threat wastes, but it is the lead agency's judgement that the Preferred Alternative identified in this Proposed Plan, or one of the other active measures considered in the Proposed Plan, is necessary to protect public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment. Further authority to select an active treatment is found in 42 U.S.C. §9621(d)(2)(A), which requires the remedial action shall require a level or standard of control which at least attains Maximum Contaminant Level Goals established under the Safe Drinking Water At (42 U.S.C. 300F et seq.).

## SUMMARY OF THE SITE RISKS

An HHRA evaluation of the potential risk from exposure to contaminants in soil and groundwater was conducted as part of the RI at FTMM-68. The HHRA evaluated the exposure of future hypothetical

**WHAT IS RISK AND HOW IS IT CALCULATED?**

A baseline HHRA is an analysis of the potential adverse health effects caused by hazardous substance releases from a site in the absence of any actions to control or mitigate these under current and future land uses. A four-step process is used for assessing site-related human health risks for reasonable maximum exposure scenarios.

*Hazard Identification:* In this step, the COCs at the site in various media (i.e., soil, groundwater, surface water, and air) are identified based on such factors as toxicity, frequency of occurrence, and fate and transport of the contaminants in the environment, concentrations of the contaminants in specific media, mobility, persistence, and bioaccumulation.

*Exposure Assessment:* In this step, the different exposure pathways through which people might be exposed to the contaminants identified in the previous step are evaluated. Examples of exposure pathways include incidental ingestion of and dermal contact with contaminated soil. Factors relating to the exposure assessment include, but are not limited to, the concentrations that people might be exposed to and the potential frequency and duration of exposure. Using these factors, a reasonable maximum exposure scenario, which portrays the highest level of human exposure that could reasonably be expected to occur, is calculated.

*Toxicity Assessment:* In this step, the types of adverse health effects associated with chemical exposures, and the relationship between magnitude of exposure (dose) and severity of adverse effects (response) are determined. Potential health effects are chemical-specific and may include the risk of developing cancer over a lifetime or other non-cancer health effects, such as changes in the normal functions of organs within the body (e.g., changes in the effectiveness of the immune system). Some chemicals are capable of causing both cancer and non-cancer health effects.

*Risk Characterization:* This step summarizes and combines exposure information and toxicity assessments to provide a quantitative assessment of site risks. Exposures are evaluated based on the potential risk of developing cancer and the potential for non-cancer health hazards. The likelihood of an individual developing cancer is expressed as a probability. For example, a $10^{-4}$ cancer risk means a one-in-ten-thousand excess cancer risk; or one additional cancer may be seen in a population of 10,000 people as a result of exposure to site contaminants under the conditions explained in the Exposure Assessment. Current Superfund guidelines for acceptable exposures are an individual lifetime excess cancer risk in the range of $10^{-4}$ to $10^{-6}$ (corresponding to a one-in-ten-thousand to a one-in-a-million excess cancer risk). For non-cancer health effects, a hazard index (HI) is calculated. An HI represents the sum of the individual exposure levels compared to their corresponding reference doses. The key concept for a non-cancer HI is that a threshold level (measured as an HI of less than 1) exists below which non-cancer health effects are not expected.

receptors representing a UU/UE scenario (the scenario protective of residential users), outdoor workers, utility workers, and recreational users to COPCs in soil through dermal contact, incidental ingestion, and inhalation of VOCs and particulates. Assessment of the UU/UE scenario is done to satisfy requirements found in the Defense Environmental Restoration Manual (DoDM 4615.20) and represents an unrealistic future scenario for FTMM-68 because the future land use of FTMM-68 is proposed to be offices and research and development, with additional civic/institutional buildings (FMERA 2019).

The HHRA was completed prior to the availability of groundwater data collected in March and May 2020 and, therefore, does not include these data. However, qualitative evaluation of the data indicates that the observed groundwater concentrations are consistent with those evaluated in the HHRA. Thus, the conclusions of the risk assessment remain valid for this round of groundwater sampling.

FTMM-68 groundwater is not used as a potable water source because municipal water is provided for use. Therefore, there are no current exposures to groundwater except to potential workers that may be exposed to groundwater during subsurface maintenance activities.

The HHRA concluded that there are no unacceptable risks to human health from exposure to contaminants in soil. Additionally, there is no unacceptable risk to utility workers from exposure to contaminants in groundwater.

However, there is an unacceptable risk to hypothetical receptors representing a UU/UE scenario from exposure to site groundwater if site groundwater were to be extracted for potable use and from vapor intrusion (in the vicinity of monitoring well 565MW01 only). Because there is an unacceptable risk to human health in a UU/UE scenario, an FS was performed.

## REMEDIAL ACTION OBJECTIVES

This Proposed Plan recommends actions to address groundwater contamination at FTMM-68 that poses an unacceptable risk to human health and the environment. The remedial action objectives (RAOs) are as follows:

- Protect public health by preventing exposure (inhalation, dermal contact, and ingestion) to groundwater containing VOCs (cis-1,2-DCE, PCE, TCE, and VC) at concentrations in excess of cleanup levels.
- Protect public health by preventing exposure by inhalation of indoor air potentially impacted by vapor intrusion from VOC-impacted groundwater (PCE, TCE, and VC) at concentrations in excess of cleanup levels.

COCs at FTMM-68 and their cleanup levels are presented in Table 1.

**Table 1 – Cleanup Levels for COCs in Groundwater at FTMM-68**

| COC | Remediation Level[a] (µg/L) |
|---|---|
| cis-1,2-DCE | 70 |
| PCE | 1 |
| TCE | 1 |
| VC | 1 |

[a] Remediation levels are based on the NJDEP GWQS New Jersey Administrative Code (N.J.A.C) 7:9C.

## SUMMARY OF REMEDIAL ALTERNATIVES

Based on the RI/FS (Parsons 2020a), remedial action is required for groundwater at FTMM-68. In the eight alternatives for remediation of groundwater at FTMM-68 were developed and evaluated:

- Alternative 1 – No Action
- Alternative 2 – LUCs
- Alternative 3 – Downgradient ZVI PRB, MNA, with Alternative 2
- Alternative 4 – Source Area Treatment via **Electrical Resistance Heating (ERH)**, MNA, with Alternative 2
- Alternative 5 – Source/Plume Core Area Treatment via ERH, MNA, with Alternative 2
- Alternative 6 – Source/Plume Core Area Treatment via ERH, Downgradient **Enhanced Anaerobic Bioremediation (EAB)** PRBs, MNA, with Alternative 2
- Alternative 7 – Source/Plume Core Area PRBs, MNA, with Alternative 2
  - Alternative 7A – Source/Plume Core Area ZVI PRBs
  - Alternative 7B – Source/Plume Core Area EAB PRBs
- Alternative 8 – Source Removal via Direct Excavation and Backfill, MNA, with Alternative 2

In addition to Alternatives 1 through 8 presented in the RI/FS Report (Parsons 2020a), this Proposed Plan also presents an additional remedial alternative, as described in FSA (Arcadis 2021). The additional alternative is as follows:

- Alternative 9 – Source Removal via Direct Excavation and Backfill, Downgradient ZVI PRBs, MNA, with Alternative 2

A summary of each alternative is provided below. An analysis of the various alternative's strengths and weaknesses is described further in the Evaluation of Alternatives Section. Additional detail regarding the development and evaluation of remedial alternatives is provided in the RI/FS Report (Parsons 2020a).

### Alternative 1: No Action

*Estimated **Present Worth Cost:** $113,000*

*Estimated Time to Achieve RAOs: Not applicable*

Section 300.430(e)(6) of the NCP requires that the No Action alternative be developed and examined as a potential remedial action for all sites. The alternative includes no remedial action for treatment, control, or monitoring of site groundwater. This alternative would be readily implementable. The No Action alternative is required by the NCP as a baseline with which to compare other remedial action alternatives. The No Action alternative evaluated for FTMM-68 would involve the abandonment of 42 existing site monitoring wells in the first year.

### Alternative 2: LUCs

*Estimated Present Worth Cost: $2,990,000*

*Estimated Time to Achieve RAOs: Indefinitely*

LUCs will be used to prevent uncontrolled exposure of potential receptors to contaminated site media. A groundwater use restriction will be established and will include sampling every year. The Army will prepare a LUCIP to document the institutional controls and identify procedural responsibilities including inspections, monitoring and reporting, and long-term management responsibilities. The LUCIP would be subject to periodic (5-year) reviews to assess the protectiveness of the remedy and effectiveness of meeting the RAOs. It is expected that the LUCs will take the form of a deed notice. As an additional layering of controls at the site, the NJDEP has agreed to implement and enforce a CEA for the groundwater at the site. The CEA restricts the use of groundwater and will remain in effect for as long as the CERCLA remedy is in place. Although not anticipated, activity use restrictions requiring the prevention of soil vapors from entering structures (such as the installation of a vapor barrier or subslab vapor removal system) would be established in the event of building construction. When the property is transferred to private ownership, the LUCs will be transferred in the deeds and the new owner would be responsible for complying with the LUCs. Although the Army may later transfer its procedural responsibilities to another party by contract, property transfer agreement, or through other means, the Army would retain ultimate responsibility for remedy integrity.

Because groundwater poses a risk in the future use scenario, the site does not meet the standards for UU/UE. Groundwater monitoring wells may require periodic maintenance such as pad replacement, redevelopment, or lock replacement. For cost estimating purposes, as typical for FS standards, a 30-year time period was used for estimating costs. The actual remedial timeframe would extend indefinitely beyond 30 years for this alternative.

**Alternative 3: Downgradient ZVI PRB, MNA, with Alternative 2**

*Estimated Present Worth Cost: $4,905,000*

*Estimated Time to Achieve RAOs: Indefinitely*

Alternative 3 consists of MNA of groundwater and installation and operation of a downgradient PRB using in-situ reactive metals for contaminant reduction. MNA would be implemented for groundwater restoration in the source area, plume core, and dilute plume fringes. Additionally, the LUCs described for Alternative 2 would be established to protect site users from impacts until achievement of RAOs. LTM would be used to document the decline of CVOC concentration through MNA processes. Groundwater sampling and analysis would be conducted to document the natural degradation and reduction of PCE, TCE, and VC concentrations over time through MNA processes until NJDEP GWQS (Table 1) are met. The PRB would be installed at a downgradient location and configured in a line perpendicular to groundwater flow to intercept groundwater flow across the plume core west of Nicodemus Avenue (Figure 4). The PRB would destroy contaminant mass as the plume flows through the PRB with natural groundwater flow, thereby reducing plume front migration and plume expansion. A Remedial Action Work Plan (RAWP) would be prepared that would include all the elements of design, implementation, and monitoring.

For cost estimating purposes and conceptual design, it is assumed that the FTMM-68 downgradient ZVI PRB would be maintained and monitored for a period of 30 years after installation for long-term performance monitoring. Costing assumes installation with a one-pass trenching system (e.g., DeWind One-Pass Trenching) and PRB backfill with a 50/50 mix of pea stone and granular ZVI. Due to low concentrations of VOCs at this location, no refreshment of the ZVI was assumed for the 30-year period. Replacement or refresh of the ZVI would eventually be needed at some point beyond the 30-year period. The actual remedial timeframe would be much longer than the 30-year costing window and would likely extend indefinitely beyond 30 years for this alternative due to the continued need to treat the PCE plume located upgradient of the PRB.

**Alternative 4: Source Area Treatment via ERH, MNA, with Alternative 2**

*Estimated Present Worth Cost: 6,368,000*

*Estimated Time to Achieve RAOs: Indefinitely*

Alternative 4 consists of source area treatment via the in-situ thermal remediation technology ERH and MNA of downgradient groundwater. The LUCs described in Alternative 2 along with MNA would also be implemented to ensure protection of human health until achievement of RAOs.

ERH is an intensive in-situ thermal remediation technology that uses the flow of alternating current electricity to heat soil and groundwater and volatilize contaminants. Electric current is passed through a targeted soil volume between subsurface electrode elements. The resistance to electrical flow that exists in the soil causes the formation of heat, resulting in an increase in temperature until the boiling point of water at depth is reached. After reaching this temperature, further energy input causes a phase change, forming steam and removing volatile contaminants. Volatilized contaminants are captured by a surface or subsurface vapor recovery system. Vapor recovery wells are typically installed horizontally in a thin vadose zone (e.g., only 4 ft) as is present at FTMM-68. Vapors would be conveyed to the surface along with recovered air and steam. Similar to SVE, the air, steam and volatilized contaminants are then treated at the surface to separate water, air, and the contaminants. Figure 5 shows the conceptual design of Alternative 4.

Downgradient of the source area, LTM would be used to document the decline of CVOC concentrations through MNA processes. Groundwater sampling and analysis would be conducted to document the natural degradation and reduction of PCE, TCE, and VC concentrations over time through MNA processes until NJDEP GWQS (Table 1) are met.

The estimated project duration for Alternative 4 is 18 months to complete: design and permitting 3 months; drilling and construction 3 to 6 months; operation 3 to 7 months; and demobilization 1 to 2 months. MNA and LUCs would be implemented after ERH is complete and for a duration of 30 years for cost estimating purposes. However, the actual remedial timeframe would likely extend indefinitely beyond 30 years for this alternative due to the continued migration of the PCE plume located downgradient of the treated source area.

**Alternative 5: Source/Plume Core Area Treatment via ERH, MNA, with Alternative 2**

*Estimated Present Worth Cost: $7,604,000*

*Estimated Time to Achieve RAOs: >30 years*

Alternative 5 has the same components as Alternative 4, but the soil mass and area to be treated by in-situ thermal remediation via ERH (see Figure 6) would be expanded to include both the source area (near the former UST) and plume core (extending approximately 120 ft east of the source area). The

LUCs described in Alternative 2 would also need to be implemented with this alternative to ensure protection of human health until achievement of RAOs.

Downgradient of the source area, LTM would be used to document the decline of CVOC concentrations through MNA processes. Groundwater sampling and analysis would be conducted to document the natural degradation and reduction of PCE, TCE, and VC concentrations over time through MNA processes until NJDEP GWQS (Table 1) are met.

The estimated project duration for the Alternative 5 system is 22 months to complete: design and permitting 3 months; drilling and construction 3 to 8 months; operation 3 to 9 months; and demobilization 1 to 2 months. MNA and LUCs would be implemented for a duration of 30 years for cost estimating purposes. The actual remedial timeframe would likely extend beyond 30 years for this alternative, but not indefinitely, due to the continued migration and attenuation of the PCE plume located downgradient of the treated source and plume core area.

**Alternative 6: Source/Plume Core Area Treatment via ERH, Downgradient EAB PRBs, MNA, with Alternative 2**

*Estimated Present Worth Cost: $11,938,000*

*Estimated Time to Achieve RAOs: 30 years*

Alternative 6 has the same components as Alternative 5, but also includes downgradient EAB PRBs (Figure 7). The LUCs described in Alternative 2 would also need to be implemented with this alternative to ensure protection of human health until achievement of RAOs. LTM would be used to document the decline of CVOC concentrations through MNA processes.

Two downgradient vertical PRBs would be installed perpendicular to groundwater flow to intercept plume migration and to treat contaminant mass by EAB. Installation of the PRBs would be similar to Alternative 3, using the one-pass trenching technology. The PRBs would be installed as follows:

- Mid-plume: 70 ft long, 45 ft deep, 1 ft wide
- Downgradient: 100 ft long, 40 ft deep, 1 ft wide

The two vertical PRBs would be composed of a 50/50 mixture of bark mulch and gravel. Emulsified vegetable oil will be added to the bark mulch as it is mixed with the gravel. The PRBs would require organic substrate loading refresh approximately every 5 to 7 years through the expected remedy life cycle. For cost estimating purposes 30 years has been assumed for Alternative 6 and LUCs, and MNA would be implemented for the duration. Although the actual remedial timeframe may extend beyond 30 years for this alternative, the addition of EAB is expected to result in more rapid attenuation of the downgradient PCE plume than thermal treatment alone.

**Alternative 7A: Source/Plume Core Area ZVI PRBs, MNA, with Alternative 2**

*Estimated Present Worth Cost: $6,923,000*

*Estimated Time to Achieve RAOs: Indefinitely*

Alternative 7A consists of source area and plume core treatment using ZVI PRBs, MNA of downgradient groundwater, and the LUCs as described for Alternative 2. Source containment and mass flux reduction would be achieved via the installation of the following:

- A vertical PRB along the downgradient source area edge;
- A horizontal PRB blanket atop impacted clay of the Hornerstown formation that defines the plume core (as determined by previous membrane interface probe investigations at the site); and
- A second vertical PRB along the downgradient edge of the blanket to treat contaminant mass migrating laterally through the impacted clay.

Figure 8 presents the conceptual design for Alternative 7A. The vertical PRBs would degrade dissolved phase contaminant mass as impacted groundwater flows laterally from the source and plume core areas. The horizontal PRB blanket would prevent back-diffusion of VOCs from the contaminated Hornerstown Formation clay (Zone B) into the overlying shallow groundwater.

Downgradient of the source area, LTM would be used to document the decline of CVOC concentrations through MNA processes. Groundwater sampling and analysis would be conducted to document the natural degradation and reduction of PCE, TCE, and VC concentrations over time through MNA processes until NJDEP GWQS (Table 1) are met.

The Alternative 7A ZVI would require refresh approximately every 20 years due to the VOC concentrations in the source area through the expected remedy life cycle; for cost estimating purposes 30 years has been assumed. The actual remedial timeframe would be much longer than the 30-year costing window and would likely extend indefinitely beyond 30 years for this alternative.

**Alternative 7B: Source/Plume Core Area EAB PRBs, MNA, with Alternative 2**

*Estimated Present Worth Cost: $9,814,000*

*Estimated Time to Achieve RAOs: Indefinitely*

Alternative 7B is designed similarly to Alternative 7A, except Alternative 7B uses EAB PRBs for contaminant reduction in the source and plume core areas. Alternative 7B would also include implementation of the LUCs discussed previously for Alternative 2. Downgradient of the source area, LTM would be used to document the decline of CVOC concentrations through MNA processes.

The Alternative 7B EAB option would require refresh approximately every 5 to 7 years through the expected remedy life cycle; for cost estimating purposes 30 years has been assumed. The actual remedial timeframe would be much longer than the 30-year costing window and would likely extend indefinitely beyond 30 years for this alternative.

**Alternative 8: Source Removal via Direct Excavation and Backfill, MNA, with Alternative 2**

*Estimated Present Worth Cost: $9,244,000*

*Estimated Time to Achieve RAOs: >30 years*

Alternative 8 addresses source area and plume core removal through direct excavation, backfill, and off-site disposal of contaminated subsurface soils. This alternative would result in removal of contaminant mass to allow impacted groundwater over time (through MNA) to meet the RAOs. Alternative 8 would also include implementation of the LUCs discussed previously for Alternative 2.

An estimated soil excavation area of 140 by 85 ft and 30 ft deep was assumed under this alternative for removal of the VOC source area and plume core (Figure 9). Before excavation, topsoil would be removed and stockpiled separately to a depth of approximately 0.5 ft bgs for subsequent re-use in site restoration. Removal of clean overburden soil (that is, soil with VOC concentrations less than the cleanup criteria determined in the RAWP) would be completed, and this clean soil would be stockpiled separately for re-use during backfilling. As stated above, the total depth of excavation is estimated to be 30 ft bgs; therefore, most of the contaminated soil would be located below the water table, and construction dewatering would be required. Sheet piling would be installed around the perimeter of the excavation to reduce the soil volume required for sloped sidewalls, as well as to minimize the amount of groundwater from surrounding soils draining into the open excavation, especially through the sandy Cape May Formation Unit 2 (Zone A). Temporary sump areas would be used as the excavation advances to accumulate groundwater for removal by pumping. The removed groundwater would be staged at the ground surface either in temporary aboveground tanks or lined ponds, and sediment would be removed from the water by a combination of settlement and filtration. The water would then be characterized for proper waste classification for disposal and disposed accordingly.

Conventional heavy earthmoving equipment, such as a track-mounted excavator and track or wheeled loaders, would be used to excavate the soil. After excavation has been completed, placement of backfill and compaction would be initiated. The excavation would be backfilled to the original surface contours and revegetated with grass to restore to pre-excavation conditions. The excavated material would be segregated, stockpiled, sampled, and characterized based on the sample results. For the purpose of cost estimating, the excavated soil is assumed to be classified as non-hazardous waste. Excavated soil requiring disposal would be hauled to a permitted off-site landfill for disposal. This alternative would achieve mass reduction and reduce long-term **operation and maintenance (O&M)** by reducing the time required for the plume to meet RAOs through MNA. However, direct excavation under this alternative would only achieve the RAOs throughout FTMM-68 over time; therefore, it would need to be combined with LUCs (Alternative 2) and MNA until achievement of RAOs. For the purposes of cost estimating, an additional 30 years of LUCs and MNA would be required for the downgradient plume to be protective of human health and the environment through contaminant dispersion.

**Alternative 9: Source Removal via Direct Excavation and Backfill, Downgradient ZVI PRBs, MNA, with Alternative 2**

*Estimated Present Worth Cost: $9,156,000*

*Estimated Time to Achieve RAOs: 30 years*

Alternative 9 would consist of source area removal through direct excavation, backfill, and off-site disposal of contaminated subsurface soils, and downgradient treatment of groundwater using ZVI PRBs. Alternative 9 would also contain the LUCs as discussed previously for Alternative 2. An estimated soil excavation area of 45 by 45 ft and 50 ft deep was assumed under this alternative for removal of the VOC source area. The source removal component of Alternative 9 would consist of source area removal through direct excavation, backfill, and off-site disposal of contaminated subsurface soils as discussed in Alternative 8. A focused investigation would be implemented during remedy implementation to further refine the volume of soil requiring excavation. Approximately 20% of the volume of soil to be excavated is assumed to be clean overburden soil that would be usable for backfilling. Contaminated groundwater and soil removed during the excavation would be disposed offsite. Following the excavation, the site would be restored to original vegetation.

Groundwater downgradient of the source area would be treated with ZVI PRBs. Three ZVI PRBs would be installed at a downgradient location and configured in a line perpendicular to groundwater flow to intercept groundwater flow across the plume core west of Nicodemus Avenue (Figure 10). The PRBs would destroy contaminant mass as the plume flows through the PRBs with natural groundwater flow, thereby reducing plume front migration and plume expansion. A RAWP would be prepared that would include all the elements of design, implementation, and monitoring. Groundwater downgradient of the PRBs would be routinely monitored to assess the efficacy of the remedy. Groundwater sampling and analysis would be conducted to document the natural degradation and reduction of PCE, TCE, and VC concentrations over time through MNA processes until NJDEP GWQS (Table 1) are met.

For cost estimating purposes and conceptual design, it is assumed that the FTMM-68 downgradient ZVI PRBs would be maintained and monitored for a period of 30 years after installation for long-term performance monitoring. Costing assumes installation with a one-pass trenching system (e.g., DeWind One-Pass Trenching) and PRB backfill with a 50/50 mix of pea stone and granular ZVI. Due to concentrations of VOCs at this location, no refreshment of the ZVI was assumed for the 30-year period. As this alternative combines source area removal with downgradient treatment of the CVOC plume, the timeline for this alternative to achieve RAOs is approximately 30 years; however, if RAOs are not achieved within 30 years, the ZVI PRBs will be replaced or refreshed as needed. Following the installation of the PRBs, the site would be fully restored to original vegetation.

## EVALUATION OF ALTERNATIVES

Each of the alternatives presented above were evaluated in the FS following the CERCLA guidance and consistent with the NCP. Nine criteria are used to evaluate the different response actions individually and against one another to select a remedy (40 Code of Federal Regulations [CFR] 300.430(e)(9)(iii)). These criteria are as follows:

<u>Threshold Criteria</u> – Must be met for the response action to be eligible for selection as a remedial option.

1. Overall Protectiveness of Human Health and the Environment – Determines whether a response action eliminates, reduces, or controls threats to public health and the environment through institutional controls, engineering controls, or treatment.
2. Compliance with **Applicable or Relevant and Appropriate Requirements (ARARs)** – Evaluates whether the response action meets federal and state environmental statutes, regulations, and other requirements that pertain to the site, or whether a waiver is justified. Identification of ARARs is dependent on the hazardous substances present at the site, site characteristics, the site location, and the actions recommended to remediate the site. Thus, requirements may be chemical-, location-, or action-specific. Please refer to Section 8.3 of the RI/FS (Parsons 2020a) for a more detailed discussion of ARARs. Table 2 presents the ARARs for FTMM-68.

<u>Primary Balancing Criteria</u> – Used to weigh major tradeoffs among response actions.

3. Long-term Effectiveness and Permanence – Considers the ability of a response action to maintain protection of human health and the environment over time.
4. Reduction of Toxicity, Mobility, or Volume of Contaminants through Treatment – Evaluates a response action's use of treatment to reduce the harmful effects of principal contaminants, their ability to move in the environment, and the amount of contamination present.
5. Short-term Effectiveness – Considers the length of time needed to implement a response action and the risks the response action poses to workers, residents, and the environment during implementation.
6. Implementability – Considers the technical and administrative feasibility of implementing the response action, including factors such as the relative availability of goods and services.
7. Cost – Includes estimated **capital costs** and annual O&M costs, as well as present worth cost. Present worth cost is the total cost of a response action over time in terms of today's dollar value. Cost estimates are expected to be accurate within a range of –30 to +50 percent.

<u>Modifying Criteria</u> – May be considered to the extent that information is available during the FS, but can be fully considered only after public comment is received on this Proposed Plan.

8. State/Support Agency Acceptance – Considers whether the state agrees with the Army's analysis and recommendations, as described in the RI/FS (Parsons 2020a) and Proposed Plan.
9. Community Acceptance – Considers whether the local community agrees with the Army's analysis and preferred response action. Comments received on the Proposed Plan

are an important indicator of community acceptance.

A detailed evaluation of the alternatives compared to threshold and primary balancing criteria is presented in the RI/FS Report (Parsons 2020a). Note that the evaluation has been updated for this PP in consideration of Alternative 9, which was added as part of the FSA (Arcadis 2021).

## COMPARATIVE ANALYSIS OF ALTERNATIVES

This section summarizes the comparative analysis of alternatives for FTMM-68 groundwater that is presented in the RI/FS Report (Parsons 2020a) and FSA (Arcadis 2021) for the CVOC plume. Table 3 presents a comprehensive comparison of all alternatives against the nine criteria listed above.

### Protection of Human Health and the Environment

Alternative 1 does not satisfy this threshold criterion of overall protection of human health and the environment, as it would provide no treatment and no control of exposure pathways. Therefore, Alternative 1 does not satisfy the RAOs. Alternatives 2 through 9 all satisfy the threshold criterion of overall protection of human health and the environment. Alternative 2 protects human health and the environment by restricting future use of the impacted groundwater and potential vapor intrusion exposure, effectively eliminating the exposure pathway and, therefore, would achieve the RAOs. An LTM program is required to support the CEA and will provide for periodic assessment of the groundwater quality improvement, facilitate plume tracking, and permit a periodic evaluation of additional actions, if necessary. Alternatives 3 through 9 combine LUCs and LTM with active treatment measures designed to destroy contaminant mass in-situ (Alternatives 3 through 9) or remove the source area and/or plume core (Alternatives 8 and 9). Alternatives 6 and 9 provide the most protection overall because they combine source area and downgradient in-situ treatment via EAB PRBs (Alternative 6) or source area removal with downgradient treatment via a ZVI PRB to destroy the chemical mass present in the downgradient groundwater via reductive dehalogenation (Alternative 9). These alternatives would destroy contaminant mass as it flows through the PRB with natural groundwater flow, thereby reducing plume front migration and plume expansion. MNA would demonstrate that contaminant risk reduction is achieved over time in the portion of the PCE plume downgradient of the PRB. This treatment would need to be conducted in a carefully controlled manner to ensure that deleterious intermediate products are not produced at unacceptable concentrations.

### Compliance with ARARs

ARARs are not identified for the no-action alternative (Alternative 1). All other alternatives comply with the identified ARARs.

### Long-term Effectiveness

Alternative 1 would not provide any actions or controls to reduce the existing contaminant levels or risks to human health and the environment. Although contaminant levels would eventually reach RAOs through natural attenuation and dispersion processes, no measures are provided to monitor its effectiveness or to control exposure.

Alternatives 2, 3, 7A, and 7B all provide a moderate degree of long-term effectiveness and permanence as they all implement LUCs and LTM to reduce the risks to human health and the environment. Alternatives 3, 7A, and 7B also provide contaminant destruction and plume containment via EAB or ZVI PRBs; however, the timeframe for these alternatives to meet cleanup criteria is uncertain.

Alternatives 4, 5, and 8 provide a moderate to high degree of long-term effectiveness and permanence because they provide permanent destruction or removal of the source and plume core area via ERH (Alternatives 4 and 5) or removal via excavation and dewatering (Alternative 8).

Alternatives 6 and 9 provide a high degree of long-term effectiveness and permanence because they provide source and plume core treatment (Alternative 6) or removal of the source area (Alternative 9) combined with downgradient treatment via PRBs (EAB for Alternative 6 and ZVI for Alternative 9). This combination of source area and downgradient contaminant removal provides the highest level of protectiveness in the long term.

### Reduction in Toxicity, Mobility, or Volume through Treatment

All of the alternatives except Alternatives 1 and 2 provide reduction of COC toxicity, mobility, and volume through treatment or removal. Alternative 2 implements an LTM program to monitor natural attenuation processes occurring within the aquifer, but does not implement any active measures for COC reduction. Alternatives 6 and 9 provide the highest degree of reduction in toxicity, mobility, or volume through treatment because they address both the source area and/or plume core and the downgradient portion of the plume.

### Short-term Effectiveness

Alternative 1 is rated high for this balancing criterion because it doesn’t require any remedial actions other than abandoning onsite monitoring wells. Therefore, this alternative presents minimal opportunity for any adverse impacts to workers or the community during implementation. Alternatives 2 through 9 are rated moderate to moderate to low as they all require implementation for at least 30 years, in which groundwater sampling would need to be conducted to monitor the effectiveness of the remedies. Initial implementation of the active remedies (Alternatives 3 through 9) would require trenching and/or excavation, which could result in adverse impacts to workers or the community. Alternatives 8 and 9 both involve excavation, which presents a direct exposure route to workers with contaminated groundwater and a risk of potential construction hazards associated with heavy equipment around an excavation. Alternatives involving ERH (Alternatives 4, 5, and 6) would include application of high-voltage electricity, evaporation and collection of volatile contaminants, and the potential for migration of contaminant vapors away from the treated source area in possibly unpredictable ways. Field personnel participating in construction and sampling would wear personal protective equipment as specified in a site Health and Safety Plan, and engineering controls such as dust control and sheet piling to maintain slope stability would be implemented during any excavation work (Alternatives 8 and 9) to protect workers and the surrounding community.

**Implementability**

Alternative 1 is not rated under this criterion because no action would be taken to address groundwater contamination under this alternative.

For the remaining alternatives, Alternative 2 is ranked the highest for implementability, as LUCs limiting groundwater access or use is an administrative process that is readily implementable. Additionally, a monitoring well network is already present at the site, and any new wells can be installed quickly and without much risk to workers or the community. Alternative 8 is ranked lowest for this criterion because the excavation area is the largest for Alternative 8, and it is estimated that approximately 2,000 truckloads of contaminated soil would be transported across public roadways for offsite disposal. Due to the large excavation area under Alternative 8, utility location activities would be more extensive, and buried utilities are more likely to be present within the excavation area. This may present logistical challenges during field work.

Alternatives 3, 4, 5, 6, 7A, 7B, and 9 are ranked either moderate or moderate to low under this criterion as the active components (focused excavation, ERH, PRBs) all include logistical challenges for implementation.

**Table 3 Evaluation of Alternatives**

| Criteria | Alternative | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1[a] | 2[b] | 3[c] | 4[d] | 5[e] | 6[f] | 7A[g] | 7B[h] | 8[i] | 9[j] |
| **Threshold Criteria[k]** | | | | | | | | | | |
| Overall Protection of Human Health and the Environment | No | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Compliance with ARARs | N/A | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| **Balancing Criteria[l]** | | | | | | | | | | |
| Long-Term Effectiveness and Permanence | Low | Moderate | Moderate | Moderate to High | Moderate to High | High | Moderate | Moderate | Moderate to High | High |
| Reduction of Toxicity, Mobility, and Volume through Treatment | Low | Low | Moderate | Moderate to High | Moderate to High | High | Moderate | Moderate | Moderate to High | High |
| Short-Term Effectiveness | High | Moderate | Moderate | Moderate to Low | Moderate to Low | Moderate to Low | Moderate | Moderate | Moderate to Low | Moderate to Low |
| Implementability | N/A | High | Moderate | Moderate to Low | Moderate to Low | Moderate to Low | Moderate | Moderate | Low | Moderate to Low |
| Cost (Total Present Value) | $113K | $2.990M | $4.905M | $6.368M | $7.604M | $11.938M | $6.923M | $9.814M | $9.244M | $9.156M |
| **Optional Evaluation Factor** | | | | | | | | | | |
| Remedial Timeframe | N/A | Indefinite | Indefinite | >30 years | Approx. 30 years | Indefinite | Indefinite | Indefinite | >30 years | Approx. 30 years |

**Notes:**

[a] Alternative 1 – No Action
[b] Alternative 2 – LUCs
[c] Alternative 3 – Downgradient ZVI PRB, MNA, with Alternative 2
[d] Alternative 4 – Source Area Treatment via ERH, MNA, with Alternative 2
[e] Alternative 5 – Source/Plume Core Area Treatment via ERH, MNA, with Alternative 2
[f] Alternative 6 – Source/Plume Core Area Treatment via ERH, Downgradient EAB PRBs, MNA, with Alternative 2
[g] Alternative 7A – Source/Plume Core Area ZVI PRBs, MNA, with Alternative 2
[h] Alternative 7B – Source/Plume Core Area EAB PRBs, MNA, with Alternative 2
[i] Alternative 8 – Source Removal via Direct Excavation and Backfill, MNA, with Alternative 2
[j] Alternative 9 – Source Removal via Direct Excavation and Backfill, Downgradient ZVI PRB, MNA, with Alternative 2
[k] For the threshold criteria, "No" means it does not meet the criteria and "Yes" mean it does meet the criteria
[l] For the balancing criteria, the ratings are as follows:

High
Moderate to High
Moderate
Moderate to Low
Low

> = greater than
Approx. = approximately
K = thousand
M = million
N/A = not applicable

**Cost**

Table 3 presents the total present worth costs (including a 20% contingency) for all of the alternatives. Alternative 1 is the least costly alternative, as it only involves abandoning site wells and no remedial action would be taken. Of the remaining alternatives (Alternatives 2 through 9), Alternative 2 is the least costly ($2,990,000) as it does not implement any active remediation measures or removal of the source mass/plume core area. Alternative 6 is the most costly alternative ($11,938,000) and includes the installation of a source area ERH system, downgradient ZVI PRBs, implementation of LUCs, and remedy monitoring for 30 years.

**State Acceptance**

Approval of the preferred response action presented in this Proposed Plan is expected. State concurrence will be further evaluated in the **Record of Decision (ROD)** following the public comment period.

**Community Acceptance**

The USEPA has approved the release of this Proposed Plan to the public. Community acceptance of the preferred response action will be evaluated at the conclusion of the public comment period. Community acceptance will be addressed in the Responsiveness Summary prepared for the ROD.

## SUMMARY OF THE PREFERRED ALTERNATIVE

The preferred alternative was selected based on the best balance among the selection criteria for treatment of contamination at FTMM-68. The preferred alternative for FTMM-68 is Alternative 9: Source Removal via Direct Excavation and Backfill, Downgradient ZVI PRB, with the LUCs described under Alternative 2. An estimated soil excavation area of 45 by 45 ft and 50 ft deep was assumed under this alternative for removal of the VOC source area. Source removal would be conducted to remove the remaining contaminated groundwater in the source area. A RAWP would be prepared and approved before beginning the excavation. All contaminated soil would be disposed offsite, and the excavated area would be backfilled with clean fill and restored to original vegetation. The primary elements of the source removal include the following:

- A focused investigation during remedy implementation to further refine the volume of soil requiring excavation;
- Site preparation including removal and stockpiling of topsoil;
- Construction dewatering, including installation of sheet pile, pumping groundwater from the excavation, and wastewater management and disposal;
- Excavation of soil and placement into separate stockpiles for clean overburden and contaminated soil;
- Waste characterization and transportation of the excavated contaminated soil to an offsite landfill disposal facility;
- Backfilling the excavation with suitable clean overburden and import material; and
- Site restoration.

The downgradient plume component of Alternative 9 would follow a similar rationale as Alternative 3 and would consist of the following primary elements:

- As part of the focused investigation to refine the volume of soil requiring excavation, additional soil borings/investigation efforts would be completed during remedy implementation to further define the downgradient plume extent and aquifer characteristics;
- Installation of three downgradient PRBs using in-situ reactive metals for contaminant reduction, the length of the PRBs would be refined during the focused investigation conducted during the implementation of the remedy;
- Monitoring of groundwater downgradient of the PRBs; and,
- Site restoration.

A RAWP would be prepared that would include all the elements of design, implementation, and monitoring. Groundwater downgradient of the PRBs would be routinely monitored to assess the efficacy of the remedy. Following the installation of the PRBs, the site would be fully restored to previous conditions.

The preferred alternative includes the use of LUCs. The LUC objectives for the FTMM-68 groundwater are to ensure that no contact with groundwater occurs by users that could result in unacceptable risk. These LUC objectives will be met until such time as contaminant levels are sufficiently reduced to allow beneficial use. A groundwater use restriction would be established in the form of a CEA in accordance with NJDEP's Technical Requirements for Site Remediation (N.J.A.C. 7:26E) and Administrative Requirements for the remediation of Contaminated Sites (N.J.A.C. 7:26C). The CEA would remain in place until NJDEP GWQS are achieved.

The Army would prepare a LUCIP to document the institutional controls and identify procedural responsibilities including groundwater monitoring and

MNA reporting, and long-term stewardship responsibilities. Activity use restrictions (such as the installation of a sub-slab vapor removal system) would be required to prevent vapors from entering structures for any future building constructed at FTMM-68 as long as groundwater contaminant concentrations exceed the NJDEP GWQS. When the property is transferred to private ownership out of federal control, the LUCs will be recorded against the property, and the new owner would be responsible for complying with the LUCs. Although the Army may later transfer its procedural responsibilities to another party by contract, property transfer agreement, or through other means, the Army would retain ultimate responsibility for remedy integrity until groundwater contaminant concentrations are in compliance with NJDEP GWQS.

It should be noted that the components of the selected remedy or the remedy recommended can be changed in light of new information or in response to public comment. Public comment will be received through the activities discussed in the next section.

Based on information currently available, the Army believes the preferred alternative meets the threshold criteria and provides the best balance of tradeoffs among the other alternatives with respect to the balancing and modifying criteria. The Army expects the preferred alternative to satisfy the following statutory requirements of CERCLA 121: 1) be protective of human health and the environment; 2) comply with ARARs; 3) be cost-effective; 4) utilize permanent solutions and alternative treatment technologies to the maximum extent practicable; and, 5) satisfy the preference for treatment as a principal element.

## COMMUNITY PARTICIPATION

Public participation is an important component of remedy selection. The Army is soliciting input from the community on the preferred alternative identified for FTMM-68. The comment period includes a public meeting at which the Army will present this Proposed Plan. Written comments will be accepted during the public comment period and both oral and written comments will be accepted at the public meeting. The Army and the NJDEP encourage the public to gain a more comprehensive understanding of the site and remedial activities that have been conducted at FTMM-68. The dates for the public comment period; the date, location, and time of the public meeting; and the locations of the Administrative Record files are provided on the front page of this Proposed Plan.

Comments made at the meeting will be transcribed. A copy of the transcript will be included in the ROD and will be added to the FTMM Administrative Record file and information repositories.

## ACRONYMS AND ABBREVIATIONS

µg/L ................... ……….microgram per liter
ARAR ............................ applicable or relevant and appropriate requirement
Arcadis .......................... Arcadis U.S., Inc.
Army ............................. United Stated Department of the Army
bgs ................................ below ground surface
BRAC ............................ Base Realignment and Closure
CFR .............................. Code of Federal Regulations
CEA .............................. Classification Exception Area
CERCLA ....................... Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CFR .............................. Code of Federal Regulations
COC .............................. constituent of concern
COPC ........................... constituent of potential concern
CVOC ........................... chlorinated volatile organic compound
CWA ............................. Charles Wood Area
DCE .............................. dichloroethene
DERP ............................ Defense Environmental Restoration Program
EAB ............................... enhanced anaerobic bioremediation
ERH .............................. electrical resistance heating
FS ................................. feasibility study
FSA ............................... Feasibility Study Addendum
ft .................................... feet
FTMM ........................... Fort Monmouth
FTMM-68 ...................... Fort Monmouth Site 68
FMERA ......................... Forth Monmouth Economic Revitalization Authority
GWQS .......................... groundwater quality standards
HHRA ............................ human health risk assessment
HI .................................. hazard index
IGW ............................... impact to groundwater
LTM ............................... long-term monitoring
LUC ............................... land use control
LUCIP ........................... Land Use Control Implementation Plan
mg/kg ............................ milligram per kilogram
MNA .............................. monitored natural attenuation
MP ................................. Main Post
N.J.A.C. ........................ New Jersey Administrative Code
NCP .............................. National Contingency Plan
NJDEP .......................... New Jersey Department of Environmental Protection

NRDCSRS .................... non-residential direct contact soil remediation standards
O&M............................. operation and maintenance
PCE .............................. tetrachloroethene
PRB .............................. permeable reactive barrier
RCRA............................ Resource Conservation and Recovery Act
RDCSRS....................... residential direct contact soil remediation standards
RAO .............................. remedial action objective
RAWP ........................... Remedial Action Work Plan
RI ................................. remedial investigation
ROD.............................. Record of Decision
RSL............................... regional screening level
SARA ............................ Superfund Amendments and Reauthorization Act of 1986
SSL ............................... soil screening level
TBA............................... tertiary butyl alcohol
TCE............................... trichloroethene
TIC ................................ tentatively identified compound
UST............................... underground storage tank
USEPA.......................... U.S. Environmental Protection Agency
UU/UE.......................... unrestricted use/unlimited exposure
UST............................... underground storage tank
VC................................. vinyl chloride
VOC .............................. volatile organic compound
ZVI zero valent iron

## GLOSSARY OF TERMS

**Administrative Record:** A collection of documents (including plans, correspondence, and reports) generated during site investigation and remedial activities. Information in the Administrative Record is used to select the preferred alternative and is available for public review.

**Applicable or relevant and appropriate requirements (ARARs):** The federal and state requirements that a selected remedy will attain. These requirements may vary among sites and alternatives.

**Capital costs:** Costs associated with construction, treatment equipment, site preparation, services, transportation, disposal, health and safety, installation and startup, administration, legal support, engineering, and design associated with remedial alternatives.

**Chlorinated volatile organic compound (CVOC):** An organic chemical compound containing chlorine whose composition makes it possible for it to evaporate under normal indoor atmospheric conditions of temperature and pressure.

**Classification Exception Area (CEA):** An NJDEP designation established whenever groundwater standards in a particular area are not met. It ensures the use of the groundwater in that area is restricted until standards are achieved.

**Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA):** A federal law passed in 1980 and commonly referred to as the Superfund Program. It provides for liability, compensation, cleanup, and emergency response in connection with the cleanup of inactive hazardous waste disposal sites that endanger public health and safety or the environment.

**Contaminants of concern (COCs):** Compounds or elements identified through the risk assessment process as driving a human health risk and/or ecological risk.

**Electrical resistance heating (ERH):** An intensive in-situ environmental remediation method that uses the flow of alternating current electricity to heat soil and groundwater to transfer contaminants to the vapor phase so they can be extracted via a soil vapor extraction system or released to the atmosphere.

**Enhanced anaerobic bioremediation (EAB):** An in-situ remediation technology in which a substrate is added to groundwater to provide a carbon source for microbial anaerobic biodegradation.

**Feasibility study:** A CERCLA document that reviews the chemicals of concern at a site and evaluates multiple remedial technologies for use at the site. It identifies the most feasible remedial action alternatives.

**Human Health Risk Assessment (HHRA):** An evaluation of the risk posed to human health from contaminants at a contaminant release site.

**Impact to groundwater soil screening level (IGW SSL):** A NJDEP soil cleanup standard that is applied in soil above the water table that is designed to be protective of groundwater quality.

**Land use controls:** Land-use and access restrictions and institutional controls employed to prevent exposure to contaminants present at the sites at unacceptable levels.

**Land Use Control Implementation Plan (LUCIP):** Documents the LUCs required during and after implementation of the preferred alternative.

**Monitored natural attenuation (MNA):** The reduction of contaminant concentrations in the environment through biological processes (aerobic and anaerobic biodegradation and plant and animal uptake), physical processes (advection, dispersion, dilution, diffusion, volatilization, sorption, and desorption), and chemical reactions (ion exchange, complexation, and abiotic transformation).

**National Contingency Plan (NCP):** The National Oil and Hazardous Substances Pollution Contingency Plan. These CERCLA regulations provide the federal government the organization structure and procedures for responding to discharges of oil and releases of hazardous substances pollutants and contaminants.

**Operation and maintenance (O&M):** Annual post-construction cost necessary to ensure the continued effectiveness of a remedial action.

**Permeable reactive barrier (PRB):** A passive, in-situ treatment technology that intersects groundwater flow and allows the groundwater to flow through the barrier while treating contaminants by either abiotic or biotic processes.

**Present worth costs:** Used to evaluate expenditures that occur over different time periods by discounting all future costs to a common base year. This allows the cost of the remedial alternatives to be compared on the basis of a single figure representing the amount of money that would be sufficient to cover capital and O&M costs associated with each remedial action over its planned life.

**Record of Decision (ROD):** A legal record signed by the Army, NJDEP, and the USEPA. It provides the cleanup action or remedy selected for a site, the basis for selecting that remedy, public comments, responses to comments, and the estimated cost of the remedy.

**Regional screening levels (RSLs):** Risk-based concentrations derived from standardized equations combining information assumptions with USEPA toxicity data. RSLs are considered by the USEPA to be protective for humans over a lifetime.

**Remedial investigation:** An investigation under CERCLA that involves sampling environmental media such as air, soil, and water to determine the nature and extent of contamination and human health and environmental risks that result from the contamination.

**Responsiveness Summary:** A part of the ROD in which the Army documents and responds to written and oral comments received from the public about the Proposed Plan.

**Soil vapor extraction (SVE):** A process in which a vacuum is applied to the soil to induce the controlled flow of air, VOCs, and some semi-volatile organic compounds from the soil.

**Superfund Amendments and Reauthorization Act (SARA):** A congressional act that modified CERCLA. SARA was enacted in 1986 and again in 1990 to authorize additional funding for the Superfund Program.

**Unlimited use and unrestricted exposure (UU/UE):** A term used to describe when contamination at a site has been reduced to levels that are safe for any land use, including residential land uses.

**Zero valent iron:** A reducing agent that is used for abiotic in-situ groundwater remediation of organochloride pollutants.

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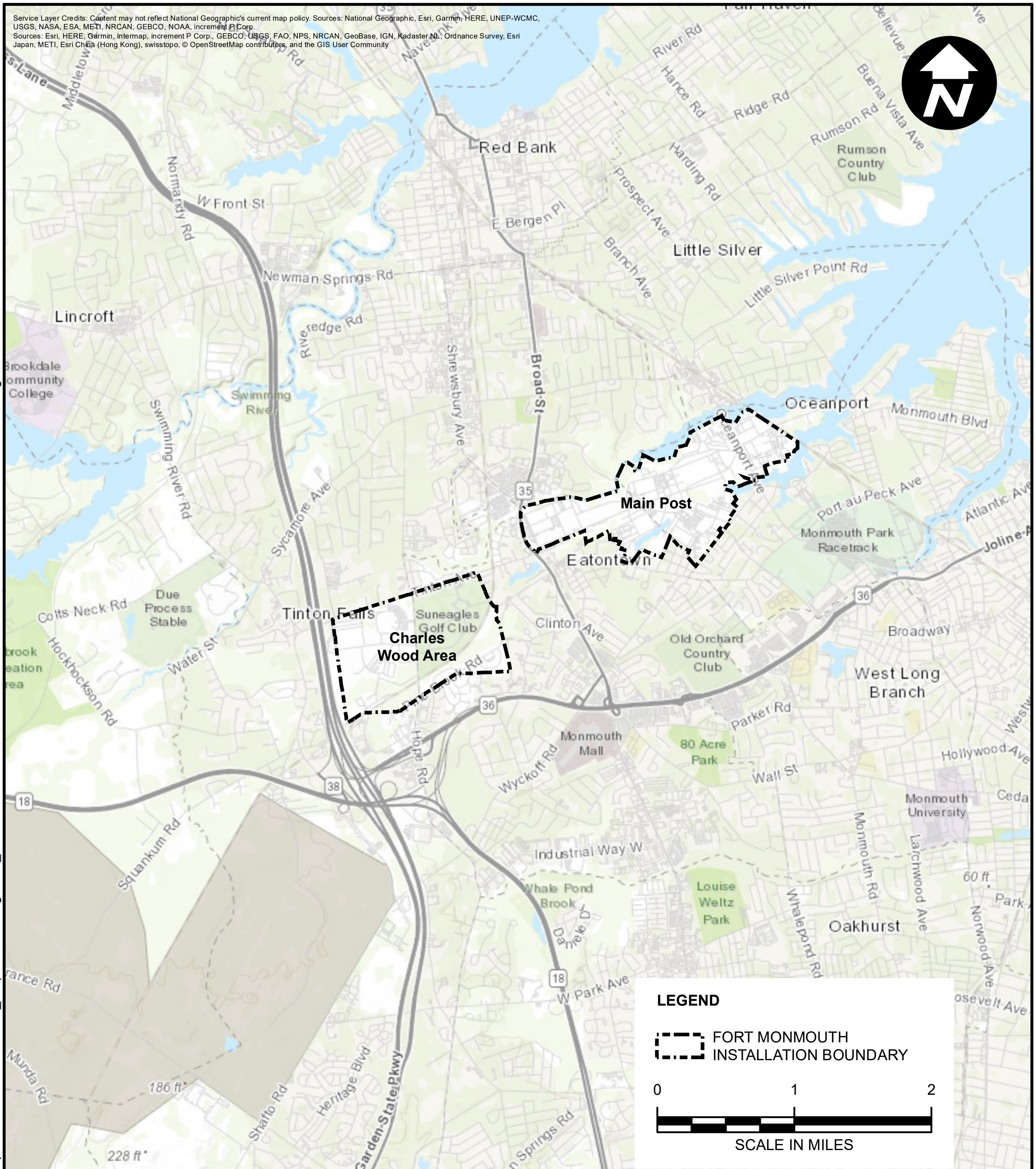



FORT MONMOUTH
OCEANPORT, NEW JERSEY

**FORT MONMOUTH LOCATION**

FIGURE
1

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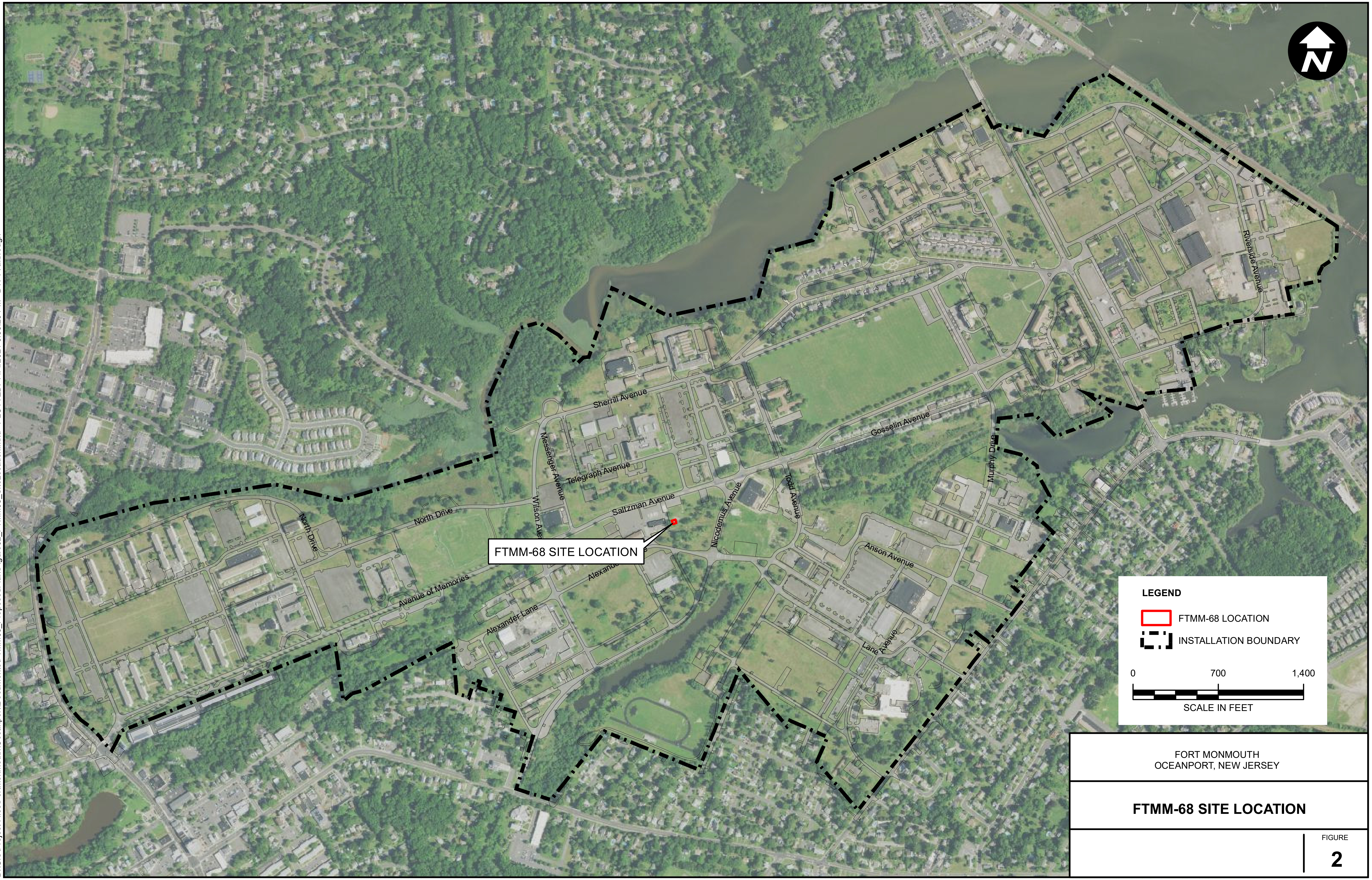


FORT MONMOUTH
OCEANPORT, NEW JERSEY

**FTMM-68 SITE LOCATION**

FIGURE
2

CITY: NOVI, MI DIV: ENV DB: TRY PIC: PM: TM: TR: PROJECT NUMBER: COORDINATE SYSTEM: NAD 1983 StatePlane New Jersey FIPS 2900 Feet
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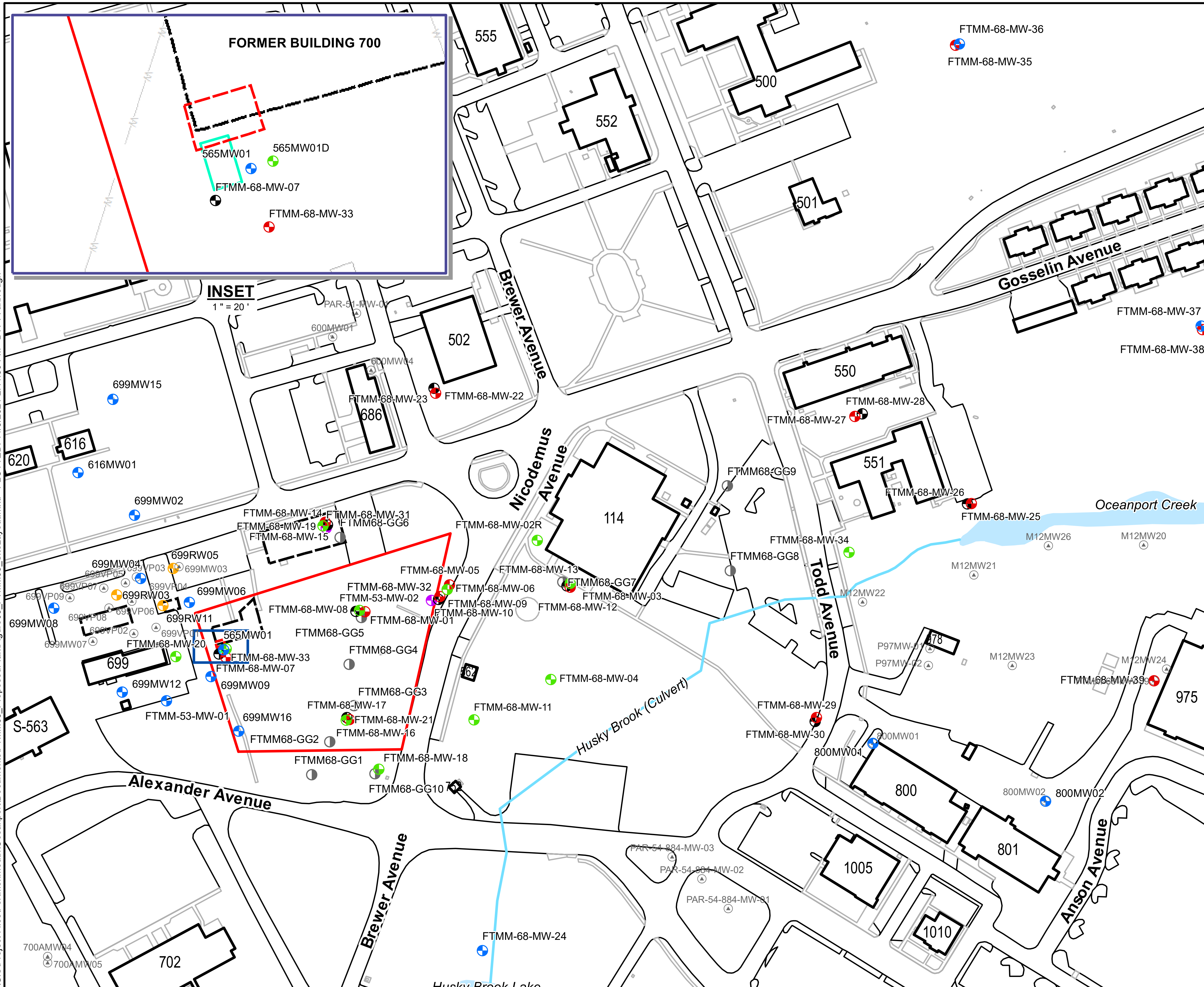


**LEGEND:**

- Monitoring Well Screened in QCM2 (A)
- Monitoring Well Screened across QCM2/Tht Contact (A/B)
- Monitoring Well Screened in Tht (B)
- Monitoring Well Screened in Kt (C)
- Monitoring Well Screened in Krs (D)
- Abandoned Monitoring Well
- Recovery Well
- Phase 1 Groundwater Grab Sample (2015)
- Former Structure
- Geologic Cross-Section Alignment (Figures 3.1, 3.2)
- UST Excavation Footprint (2011)
- Removal Action Excavation Footprint (2019)
- Parcel 96 Environmental Carve-Out

**NOTES:**

A - Cape May Formation Unit (QCM2)
B - Hornestown Formation (Tht)
C - Tinton Formation (Kt)
D - Red Bank Formation (Krs)

Source of Parcel 96 boundary obtained from ALTA/ACSM Land Title Survey, Fort Monmouth Phase Two Parcel Envorinmental Carve-Out Parcels, Drawing VL-102, Langan, August 2016.

Figure Source: Parsons. 2020. Remedial Investigation/Feasibility Study Report for FTMM-68 – Former Building 700 Dry Cleaners. August 2020.

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SCALE IN FEET

FORT MONMOUTH
OCEANPORT, NEW JERSEY

**FTMM-68 SITE LAYOUT**

FIGURE
3

CITY: NOVI, MI DIV: ENV DB: TRY PIC: PM: TM: TR: PROJECT NUMBER: COORDINATE SYSTEM: NAD 1983 StatePlane New Jersey FIPS 2900 Feet PLOTTED: 11/8/2021 2:41:56 PM BY: TYarbrough
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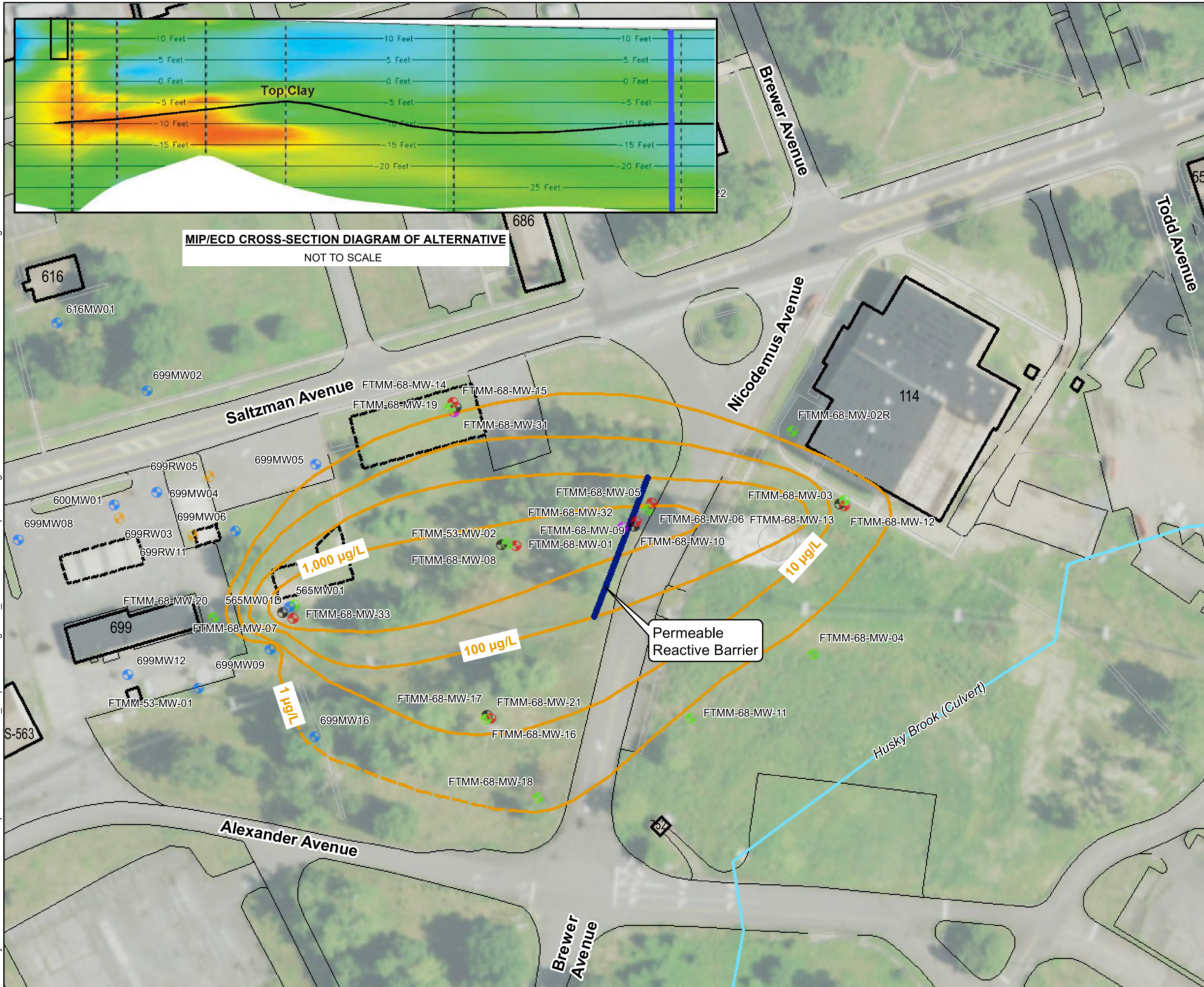


**LEGEND:**

- Monitoring Well Screened in QCM2 (A)
- Monitoring Well Screened across QCM2/Tht Contact (A/B)
- Monitoring Well Screened in Tht (B)
- Monitoring Well Screened in Kt (C)
- Monitoring Well Screened in Krs (D)
- Recovery Well
- Demolished Structure
- 2019 PCE Isoconcentration Contour
- 2019 Inferred PCE Isoconcentration Contour
- Zero Valent Iron Permeable Reactive Barrier

**NOTES:**

A - Cape May Formation Unit (QCM2)
B - Hornestown Formation (Tht)
C - Tinton Formation (Kt)
D - Red Bank Formation (Krs)

ECD = Electron Capture Detector
MIP = Membrane Interface Probe
PCE = Tetrachloroethene

Figure Source: Parsons. 2020. Remedial Investigation/Feasibility Study Report for FTMM-68 – Former Building 700 Dry Cleaners. August 2020.

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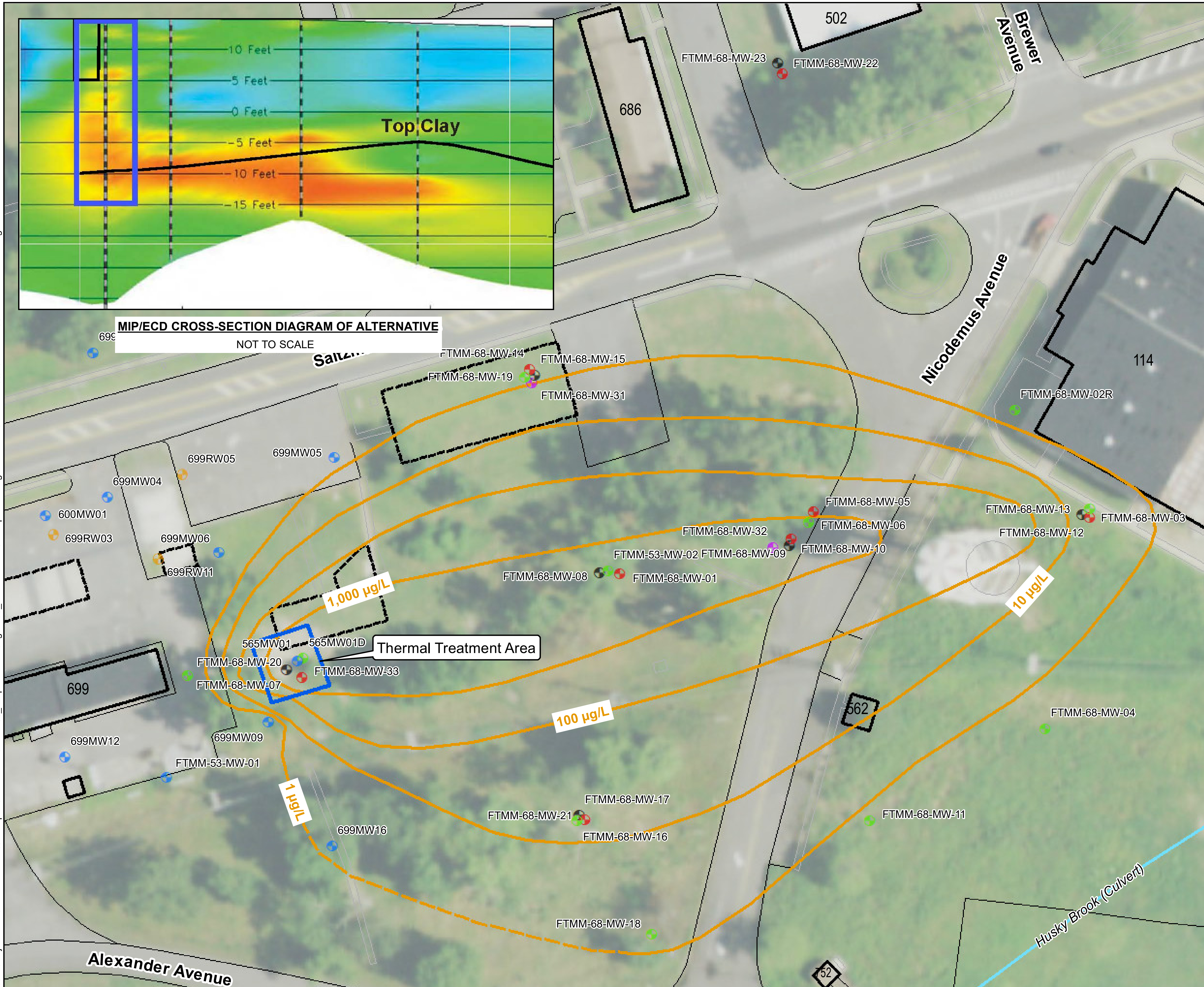
SCALE IN FEET

FORT MONMOUTH
OCEANPORT, NEW JERSEY

**ALTERNATIVE 3 CONCEPTUAL DESIGN**

FIGURE
4




**LEGEND:**

- Monitoring Well Screened in QCM2 (A)
- Monitoring Well Screened across QCM2/Tht Contact (A/B)
- Monitoring Well Screened in Tht (B)
- Monitoring Well Screened in Kt (C)
- Monitoring Well Screened in Krs (D)
- Recovery Well
- Demolished Structure
- 2019 PCE Isoconcentration Contour
- 2019 Inferred PCE Isoconcentration Contour
- Thermal Treatment Area

**NOTES:**

A - Cape May Formation Unit (QCM2)
B - Hornestown Formation (Tht)
C - Tinton Formation (Kt)
D - Red Bank Formation (Krs)

ECD = Electron Capture Detector
ERH = Electrical Resistivity Heating
MIP = Membrane Interface Probe
PCE = Tetrachloroethene

Figure Source: Parsons. 2020. Remedial Investigation/Feasibility Study Report for FTMM-68 – Former Building 700 Dry Cleaners. August 2020.

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SCALE IN FEET

FORT MONMOUTH
OCEANPORT, NEW JERSEY

**ALTERNATIVE 4 CONCEPTUAL DESIGN**

FIGURE
**5**

CITY: NOVI, MI DIV: ENV DB: TRY PIC: PM: TM: TR: PROJECT NUMBER: COORDINATE SYSTEM: NAD 1983 StatePlane New Jersey FIPS 2900 Feet BY: TYarbrough
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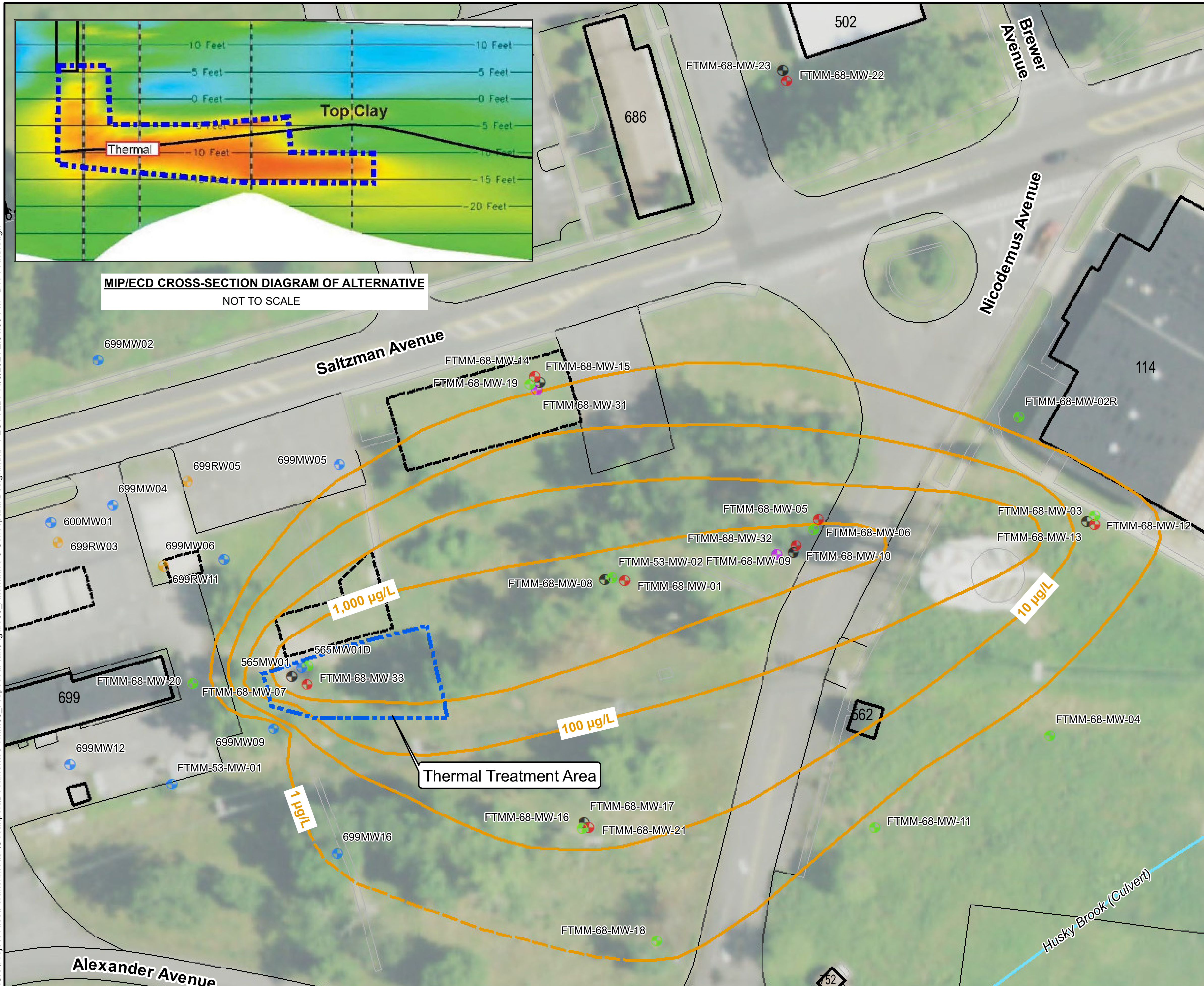


**LEGEND:**

- Monitoring Well Screened in QCM2 (A)
- Monitoring Well Screened across QCM2/Tht Contact (A/B)
- Monitoring Well Screened in Tht (B)
- Monitoring Well Screened in Kt (C)
- Monitoring Well Screened in Krs (D)
- Recovery Well
- Demolished Structure
- 2019 PCE Isoconcentration Contour
- 2019 Inferred PCE Isoconcentration Contour
- Thermal Treatment Area

**NOTES:**

A - Cape May Formation Unit (QCM2)
B - Hornestown Formation (Tht)
C - Tinton Formation (Kt)
D - Red Bank Formation (Krs)

ECD = Electron Capture Detector
ERH = Electrical Resistivity Heating
MIP = Membrane Interface Probe
PCE = Tetrachloroethene

Figure Source: Parsons. 2020. Remedial Investigation/Feasibility Study Report for FTMM-68 – Former Building 700 Dry Cleaners. August 2020.

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SCALE IN FEET

FORT MONMOUTH
OCEANPORT, NEW JERSEY

## ALTERNATIVE 5 CONCEPTUAL DESIGN

FIGURE
6

CITY: NOVI, MI DIV: ENV DB: TRY PIC: PM: TM: TR: PROJECT NUMBER: COORDINATE SYSTEM: NAD 1983 StatePlane New Jersey FIPS 2900 Feet BY: TYarbrough
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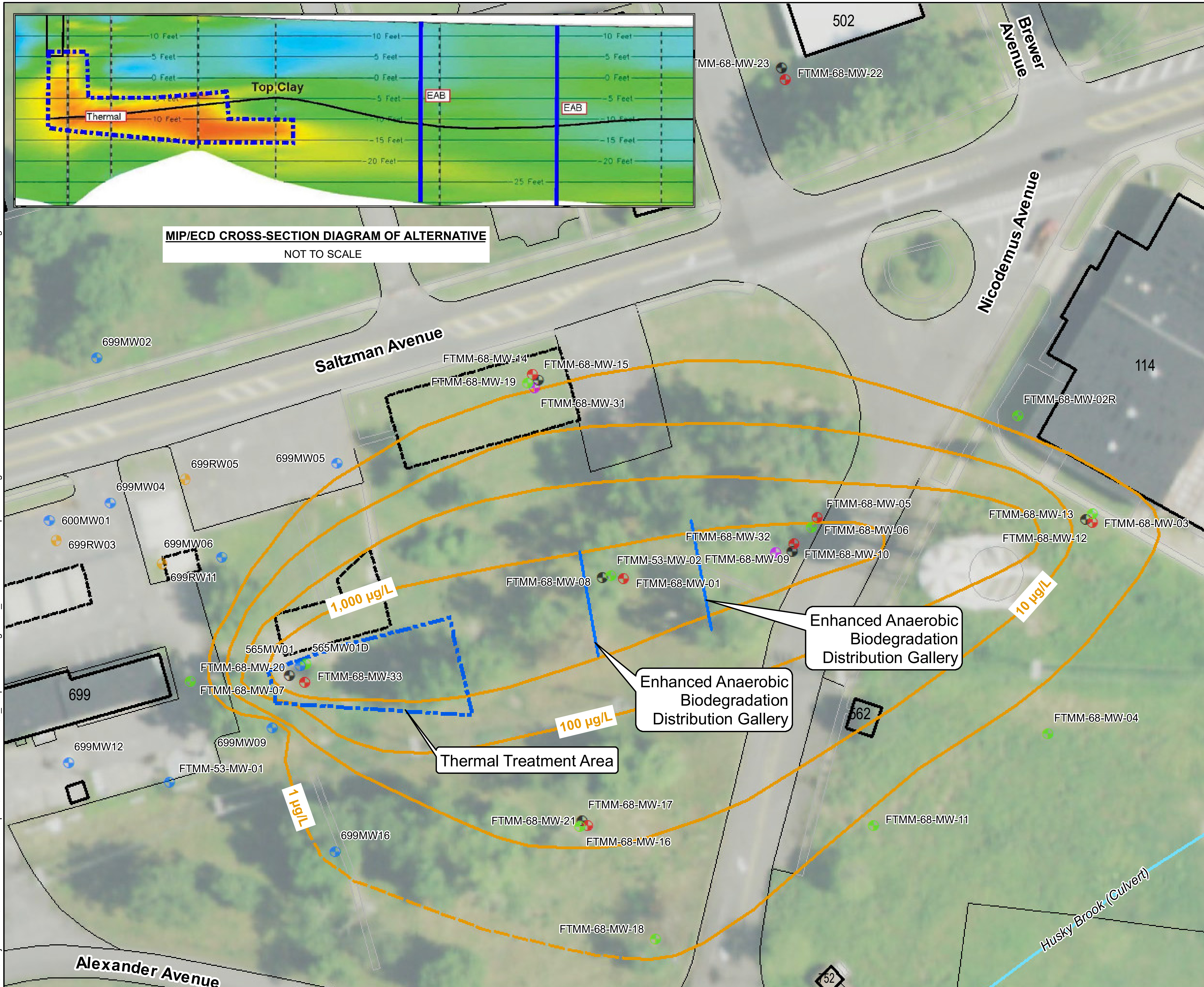


## LEGEND:

- Monitoring Well Screened in QCM2 (A)
- Monitoring Well Screened across QCM2/Tht Contact (A/B)
- Monitoring Well Screened in Tht (B)
- Monitoring Well Screened in Kt (C)
- Monitoring Well Screened in Krs (D)
- Recovery Well
- Demolished Structure
- 2019 PCE Isoconcentration Contour
- 2019 Inferred PCE Isoconcentration Contour
- EAB Permeable Reactive Barriers
- Thermal Treatment Area

## NOTES:

A - Cape May Formation Unit (QCM2)
B - Hornestown Formation (Tht)
C - Tinton Formation (Kt)
D - Red Bank Formation (Krs)

EAB = Enhanced Anaerobic Biodegration
ECD = Electron Capture Detector
ERH = Electrical Resistivity Heating
MIP = Membrane Interface Probe
PCE = Tetrachloroethene

Figure Source: Parsons. 2020. Remedial Investigation/Feasibility Study Report for FTMM-68 – Former Building 700 Dry Cleaners. August 2020.

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SCALE IN FEET

FORT MONMOUTH
OCEANPORT, NEW JERSEY

**ALTERNATIVE 6 CONCEPTUAL DESIGN**

FIGURE
7

CITY: NOVI, MI DIV: ENV DB: TRY PIC: PM: TM: TR: PROJECT NUMBER: COORDINATE SYSTEM: NAD 1983 StatePlane New Jersey FIPS 2900 Feet BY: TYarbrough
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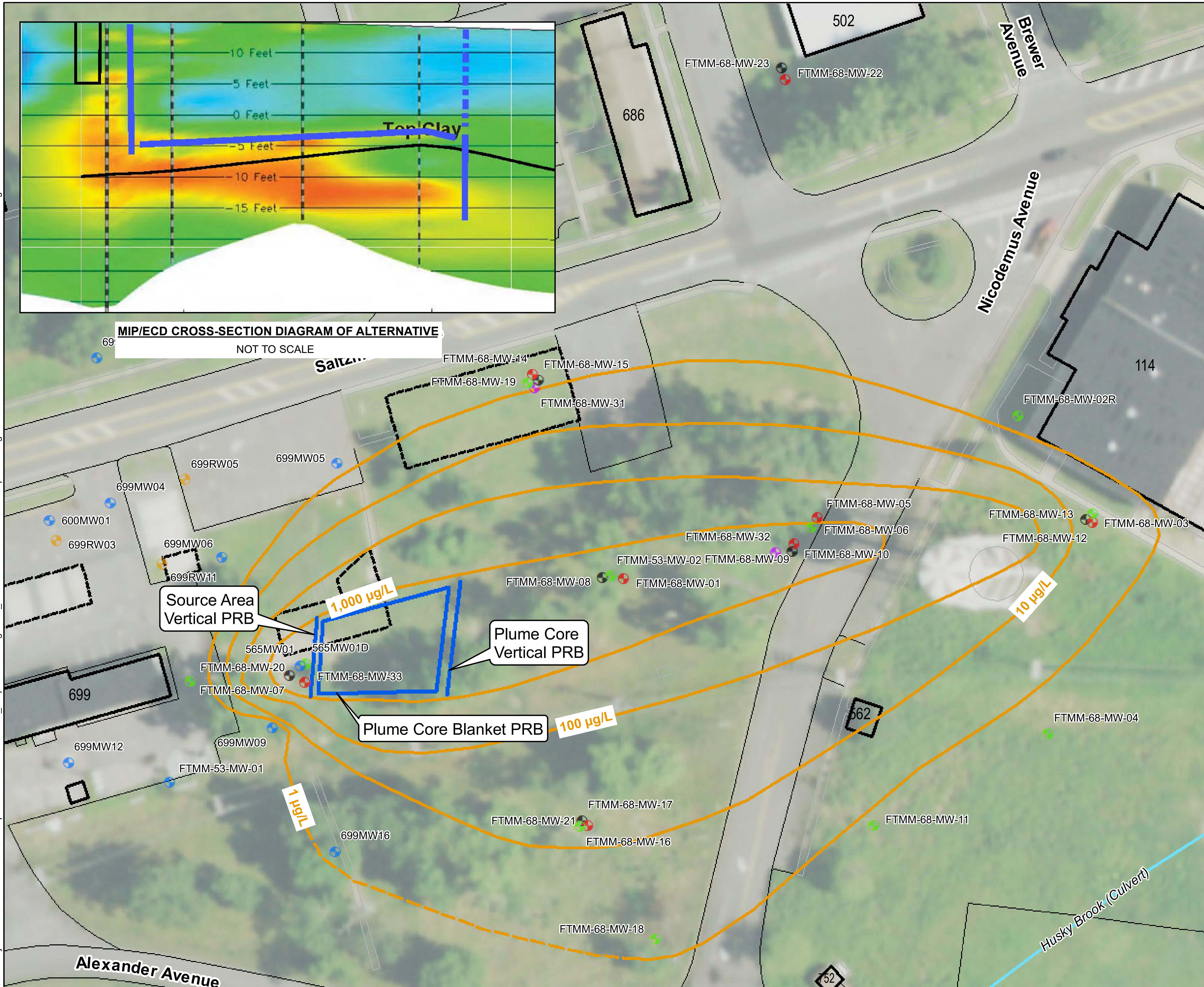


**LEGEND:**

- Monitoring Well Screened in QCM2 (A)
- Monitoring Well Screened across QCM2/Tht Contact (A/B)
- Monitoring Well Screened in Tht (B)
- Monitoring Well Screened in Kt (C)
- Monitoring Well Screened in Krs (D)
- Recovery Well
- Demolished Structure
- 2019 PCE Isoconcentration Contour
- 2019 Inferred PCE Isoconcentration Contour
- Permeable Reactive Barriers

**NOTES:**

A - Cape May Formation Unit (QCM2)
B - Hornestown Formation (Tht)
C - Tinton Formation (Kt)
D - Red Bank Formation (Krs)

ECD = Electron Capture Detector
MIP = Membrane Interface Probe
PCE = Tetrachloroethene

Figure Source: Parsons. 2020. Remedial Investigation/Feasibility Study Report for FTMM-68 – Former Building 700 Dry Cleaners. August 2020.

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SCALE IN FEET

FORT MONMOUTH
OCEANPORT, NEW JERSEY

**ALTERNATIVE 7A AND 7B CONCEPTUAL DESIGN**

FIGURE
8

CITY: NOVI, MI DIV: ENV DB: TRY PIC: PM: TM: TR: PROJECT NUMBER: COORDINATE SYSTEM: NAD 1983 StatePlane New Jersey FIPS 2900 Feet BY: TYarbrough
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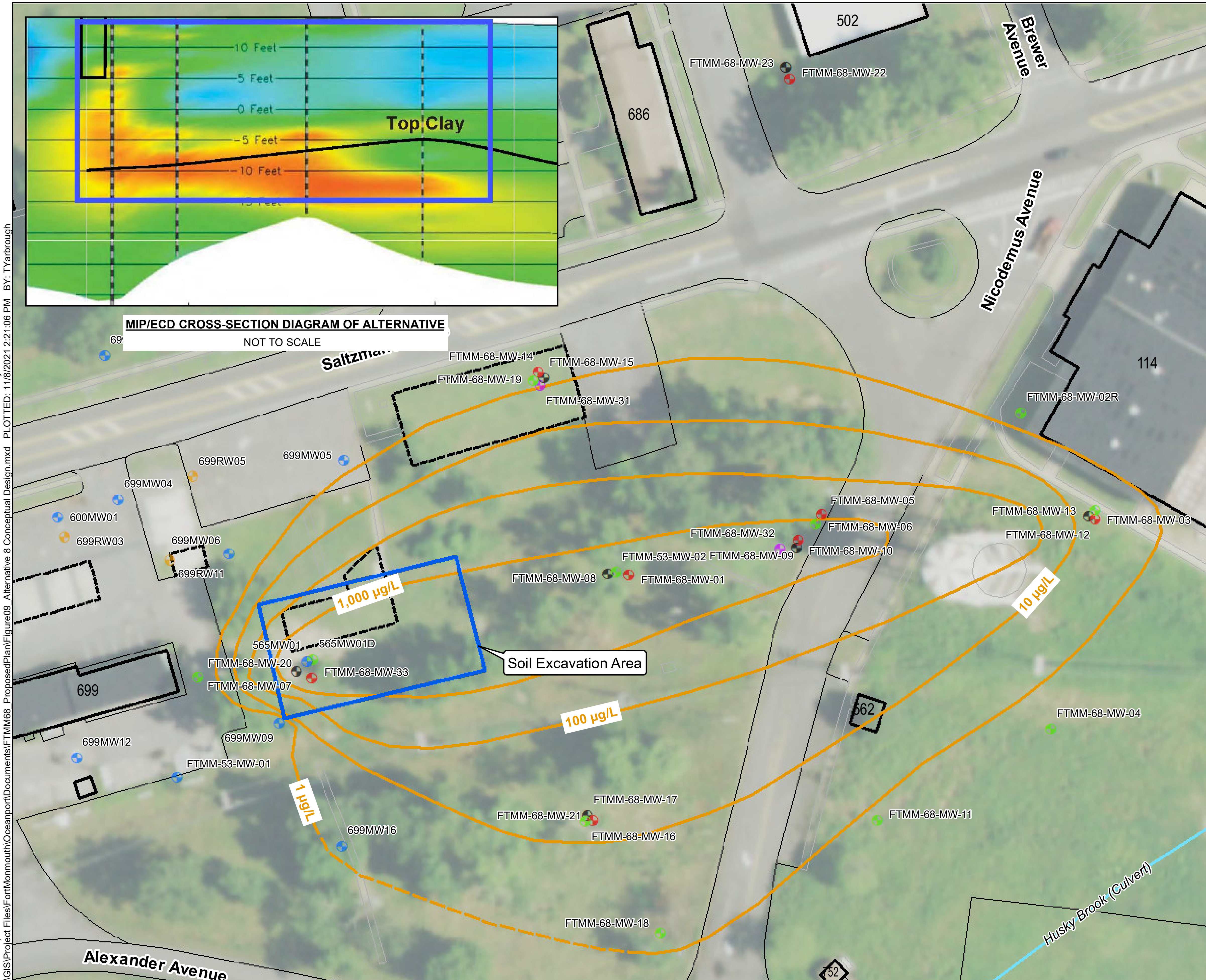


**LEGEND:**

- Monitoring Well Screened in QCM2 (A)
- Monitoring Well Screened across QCM2/Tht Contact (A/B)
- Monitoring Well Screened in Tht (B)
- Monitoring Well Screened in Kt (C)
- Monitoring Well Screened in Krs (D)
- Recovery Well
- Demolished Structure
- 2019 PCE Isoconcentration Contour
- 2019 Inferred PCE Isoconcentration Contour
- Excavation Area

**NOTES:**

A - Cape May Formation Unit (QCM2)
B - Hornestown Formation (Tht)
C - Tinton Formation (Kt)
D - Red Bank Formation (Krs)

ECD = Electron Capture Detector
MIP = Membrane Interface Probe
PCE = Tetrachloroethene

Figure Source: Parsons. 2020. Remedial Investigation/Feasibility Study Report for FTMM-68 – Former Building 700 Dry Cleaners. August 2020.

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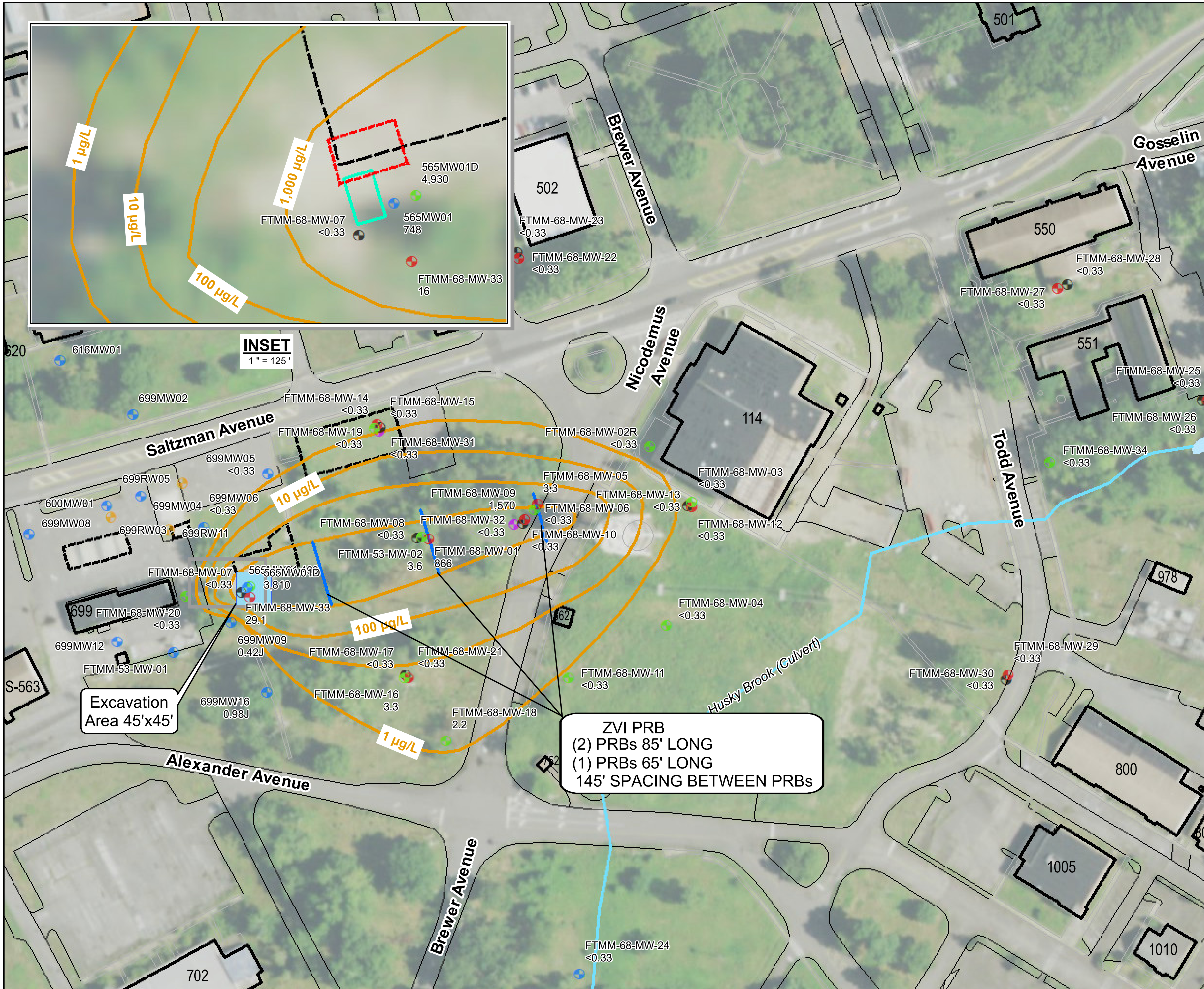
SCALE IN FEET

FORT MONMOUTH
OCEANPORT, NEW JERSEY

**ALTERNATIVE 8 CONCEPTUAL DESIGN**

FIGURE
9




**LEGEND:**

- Monitoring Well Screened in QCM2 (A)
- Monitoring Well Screened across QCM2/Tht Contact (A/B)
- Monitoring Well Screened in Tht (B)
- Monitoring Well Screened in Kt (C)
- Monitoring Well Screened in Krs (D)
- Recovery Well
- UST Excavation Footprint
- Removal Action Excavation Footprint (2019)
- Demolished Structure
- PCE Isoconcentration Contour
- Zero-Valent Iron Permeable Reactive Barriers
- Proposed Excavation Area

**EXPLANATION:**

699MW09 — Well ID
<12.5 — Highest PCE concentration for samples in March 2020 unless otherwise noted (µg/L)
J — Estimated detection

**NOTES:**

A - Cape May Formation Unit (QCM2)
B - Hornestown Formation (Tht)
C - Tinton Formation (Kt)
D - Red Bank Formation (Krs)

1. PCE - Tetrachloroethylene NJDEP GWQS = 1 µg/L

2. Vertical profiling of well screens for each fully saturated five foot interval was performed for wells installed at FTMM-68. If vertical profiling had been performed on a well, it was not repeated.

Figure Source: Parsons. 2020. Remedial Investigation/Feasibility Study Report for FTMM-68 – Former Building 700 Dry Cleaners. August 2020.

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SCALE IN FEET

FORT MONMOUTH
OCEANPORT, NEW JERSEY

**ALTERNATIVE 9 CONCEPTUAL DESIGN**

FIGURE
10