DOCUMENTATION OF ENVIRONMENTAL INDICATOR DETERMINATION

RCRA Corrective Action
Environmental Indicator (EI) RCRIS code (CA750)
Migration of Contaminated Groundwater Under Control

Facility Name: **U.S. Army, Fort Dix**
Facility Address: **5417 Alabama Avenue, Fort Dix, New Jersey 08640**
Facility EPA ID#: **NJ4213720275**

Definition of Environmental Indicators (for the RCRA Corrective Action)

Environmental Indicators (EI) are measures being used by the RCRA Corrective Action program to go beyond programmatic activity measures (e.g., reports received and approved, etc.) to track changes in the quality of the environment. The two EIs developed to-date indicate the quality of the environment in relation to current human exposures to contamination and the migration of contaminated groundwater. An EI for non-human (ecological) receptors is intended to be developed in the future.

Definition of "Migration of Contaminated Groundwater Under Control" EI

A positive "Migration of Contaminated Groundwater Under Control" EI determination ("YE" status code) indicates that the migration of "contaminated" groundwater has stabilized, and that monitoring will be conducted to confirm that contaminated groundwater remains within the original "area of contaminated groundwater" (for all groundwater "contamination" subject to RCRA corrective action at or from the identified facility (i.e., site-wide)).

Relationship of EI to Final Remedies

While final remedies remain the long-term objectives of the RCRA Corrective Action program, the EIs are near-term objectives which are currently being used as Program measures for the Government Performance and Results Act of 1993 (GPRA). The "Migration of Contaminated Groundwater Under Control" EI pertains ONLY to the physical migration (i.e., further spread) of contaminated groundwater and contaminants within groundwater (e.g., non-aqueous phase liquids or NAPLs). Achieving this EI does not substitute for achieving other stabilization or final remedy requirements and expectations associated with sources of contamination and the need to restore, wherever practicable, contaminated groundwater to be suitable for its designated current and future uses.

Duration / Applicability of EI Determinations

EI Determination status codes should remain in the RCRIS national database ONLY as long as they remain true (i.e., RCRIS status codes must be changed when the regulatory authorities become aware of contrary information).

Facility Information

The U.S. Army Training Center and Fort Dix (Fort Dix) is located in Burlington and Ocean Counties in New Jersey, approximately 16 miles southeast of Trenton. The installation is currently comprised of approximately 31,000 acres of land. Fort Dix is located within the New Jersey Pinelands Nature Reserve

(Pine Barrens), and it is bordered to the south by the Brendan T. Byrne State Forest. Fort Dix is divided into a Cantonment Area, a Training Area, and a Range and Impact area. The Fort Dix Cantonment Area is bordered by McGuire Air Force Base (AFB) to the east, forest management and training areas to the west and south, and by agricultural land and low-density residential housing to the north. McGuire AFB is also located north of the Training Area and west of the Range Impact Area, while Lakehurst Naval Air Station is located to the east of the Range Impact Area. The Boeing Michigan Aeronautical Research Center (BOMARC) Missile Facility occupies approximately 218 acres within the Fort Dix range and impact area; however, it falls under the jurisdiction of McGuire AFB, which is located 11 miles west of the BOMARC site. Therefore, the BOMARC site will not be considered in this EI determination.

Fort Dix, initially known as Camp Dix, was developed from farmland and forest on July 18, 1917, and used as a cantonment area and training post for World War I troops. The camp served as a demobilization center after the war, and it was used as a training ground for active Army, Army Reserve, and National Guard Units from 1922 to 1926. Camp Dix was inactive from 1926 to 1933, and it was used as a Civilian Conservation Corps reception, discharge, and replacement center from 1933 to 1939. The camp became a permanent Army installation in 1939 and was renamed Fort Dix. It served as a reception and training center during World War II, and it was used as a separation center following the war. The installation was designated a basic training center in 1947 and was officially named the U.S. Army Training Center and Fort Dix in 1956. The last active duty basic training company graduated from Fort Dix in July 1992. In October 1992, the major command was shifted from the U.S. Army Training and Doctrine Command (TRADOC) to Forces Command (FORSCOM). The primary mission under FORSCOM was to provide command, administration, and support of all U.S. Army units attached to the installation; all tenant and satellite units; and the New York Area Command. In October 1997, the major command was again shifted to U.S. Army Reserve Command (USARC), and the current mission of the installation is to provide training for reserve and national guard units. Fort Dix has the capability to mobilize, train, equip, and deploy forces anywhere in the world.

The Fort Dix Cantonment Area contains approximately 1,800 structures, including offices and administrative buildings; training facilities; housing areas; a dependents' school and child care center; an unoccupied hospital; utility buildings; recreational facilities, including a golf course and several ballparks; and warehouse, maintenance, and supply service areas. The Training Area is primarily used for tactical training and is undeveloped, with overgrown vegetation and large sections of swamplands present. The range and impact areas located east of McGuire AFB are restricted areas that are used for activities including artillery and small firearms practices and tank maneuvers. This area is also overgrown and contains swampland, but paved roads provide access to most range areas. Tenant organizations present at Fort Dix include approximately ten U.S. Army organizations, 12 U.S. Army National Guard organizations, 24 U.S. Army Reserves organizations, and 28 non-Army tenants.

1. Has **all** available relevant/significant information on known and reasonably suspected releases to the groundwater media, subject to RCRA Corrective Action (e.g., from Solid Waste Management Units (SWMU), Regulated Units (RU), and Areas of Concern (AOC)), been **considered** in this EI determination?

   X If yes - check here and continue with #2 below.

   ___ If no - re-evaluate existing data, or

   ___ If data are not available, skip to #8 and enter "IN" (more information needed) status code.

Summary of Areas Requiring Environmental Evaluation (AREEs):

The site characterization and remediation process was initiated at Fort Dix in the 1980s under the Army's Installation Restoration Program (IRP) (Ref. 3). The Fort Dix Sanitary Landfill was closed in 1984 and placed on the National Priorities List (NPL) in 1987; the Record of Decision (ROD) was signed in 1991. A Preliminary Assessment/Site Investigation (PA/SI) was conducted in 1985 and documented in the January 1989 Final PA/SI Report. A Phase I Remedial Investigation (RI) was conducted in 1987, followed by a Phase II RI from 1990-1991; the final RI Report was submitted in 1993. Fort Dix submitted an RI Work Plan to regulators in 1995 and proceeded with RI work as funds became available. RI activities are complete for the majority of sites for which they are required, and many sites have signed Decision Documents (DDs).

An Enhanced PA was completed in March 1992 under the Base Realignment and Closure (BRAC) program. The Enhanced PA identified 42 areas requiring environmental evaluation (AREEs), 19 of which were investigated under the BRAC program (Ref. 2). The remaining 23 sites were either recommended for no further action (NFA) or are being addressed under the ongoing IRP. According to the Fort Dix Environmental Division, the 1992 Enhanced PA was approved by the New Jersey Department of Environmental Protection (NJDEP) (Ref. 5); however, an approval letter could not be located in the site file. An Environmental Investigation was conducted at 12 of these 42 AREEs from 1993-1996. Most AREEs were also assigned individual Fort Dix (FTDX) numbers.

Fort Dix has completed work at many AREEs and has either recommended them for NFA or received a formal NFA determination from NJDEP (Ref. 5). It was also determined that no releases occurred at many sites that were historically included in the list of 42 AREEs and three FTDX sites, and that several of these sites were redundant. Thus, the IRP currently contains 18 active AREEs that were considered in this EI determination; and 24 inactive AREEs plus three inactive FTDX sites that either require NFA, did not have a release, or were considered repetitive of active sites. Table 1 below lists the 24 inactive AREEs and three inactive FTDX sites that were not considered in this EI determination.

Table 1: Inactive AREEs and FTDX Sites Not Considered in this EI Determination

AREE #	FTDX #	Area Name	AREE #	FTDX #	Area Name
11	15	ANC-9 Landfill	37a	N/A	Spills: Bldg xxxx - Petroleum Spill Site
14	21	Area North of Dogwood Lake UST Site	37b		Spills: Bldg xxxx - Petroleum Spill Site
18	28	5700 Area Motor Pool	37c		Spills: Bldg 5881 - Petroleum Spill Site
19		5800 Area Motor Pool	37d		Spills: Bldg 5324/5326 - Petroleum Spill Site
20		5900 Area Motor Pool	37e		Spills: 5800 Area Motor Pool - Petroleum Spill Site
21		8100 Area Motor Pool	37f		Spills: 5900 Area Motor Pool - Petroleum Spill Site
22	05	Boiler Plants: Bldg 5426	37g		Spills: Bldg 5252 - Petroleum Spill Site
		Boiler Plants: Bldg 5252	37h		Spills: Bldg 5426 - Petroleum Spill Site
		Boiler Plants: Bldg 5324	39	N/A	ASTs
		Boiler Plants: Bldg 5881	40	N/A	Asbestos
23	N/A	Building 0690 Service Station	41	34	Transformers
24	14	Pathological Waste Landfill	42	N/A	Radon
27	03	Resource Recovery Facility	N/A	05	Fuel Spills
28	27	Hazardous Waste Storage Area	N/A	20	Old Incinerator
29	29	PCB Transformer Storage Area	N/A	28	Motor Pools
30	30	Magazine 2 Area			
31	02	Old Sewerage Treatment Plant			
	04	Old STP Sludge Drying Beds			
32	31	Bivouac 5 Washracks			
33	32	PBAS 83 Basin			
34	N/A	Midstate Correctional Facility			
35	23	Paint Shop			
36	08	Range Impact Area			

N/A – not applicable

The Agency for Toxic Substances and Disease Registry (ATSDR) prepared a Public Health Assessment (PHA) for Fort Dix on October 18, 1999. Based on two site visits and a review of relevant documents, ATSDR evaluated whether current or past exposures to contamination at Fort Dix could pose a health hazard to receptors. ATSDR compared soil, sediment, surface water, and groundwater data at all Fort Dix IRP sites to several media-specific comparison values. ATSDR concluded that none of the IRP sites with sufficient data posed a public health hazard (PHH) as a result of exposures to contaminated environmental media. At the time of the PHA, data were unavailable for six IRP sites (AREE sites 2, 5, 8, 9, 10, and 12); thus, ATSDR could not make a public health determination on these sites in the PHA (Ref. 3). The CA725 Environmental Indicator Assessment completed in September 2006 concluded that public health risks were also under control at these remaining six IRP sites.

The text in Question 2 and the table in Attachment 1 present a summary of the active AREE/FTDX sites being considered in this EI determination. Note that the EI evaluation has been completed independently for each of the eight FTDX sites included within the scope of AREE No. 38. Also note that former AREE No. 4, FTDX No. 11 was redesignated as AREE No. 38, FTDX No. 19-6 in the Fort Dix Installation Restoration Program, AREE List and Status Spreadsheet dated November 2005 (Ref. 4). Thus, 24 separate areas, encompassing the 18 active AREE/FTDX sites, are identified in the text and tables below. Information provided in Attachment 1 includes: (1) a list of the IRP sites by name and number; (2) a brief summary of each site's history; (3) identification of contaminant classes reported in

groundwater above New Jersey or other relevant standards at each site; and (4) appropriate references for the listed information. Figure 5-2 from the 1992 Enhanced PA provides a map of all AREEs, except AREEs 6, 9, and 10 (Ref. 2); these three AREEs are shown on Figure 1-2 from the Draft RI Report (Ref. 1).

References:

1. Draft Remedial Investigation. Prepared by Dames & Moore. Dated January 1992.
2. Enhanced Preliminary Assessment. Prepared by Roy F. Weston, Inc. Dated March 1992.
3. Public Health Assessment for Fort Dix (Landfill Site). Prepared by U.S. Department of Health and Human Services, Public Health Service, Agency for Toxic Substances and Disease Registry. Dated October 18, 1999.
4. Fort Dix Installation Restoration Program, AREE List and Status Spreadsheet. Prepared by U.S. Army, Fort Dix. Dated November 2005.
5. CA725 Environmental Indicator for Fort Dix, New Jersey. Prepared by Booz Allen. Reviewed and approved by EPA. Dated September 25, 2006.

2. Is **groundwater** known or reasonably suspected to be "**contaminated**"[1] above appropriately protective "levels" (i.e., applicable promulgated standards, as well as other appropriate standards, guidelines, guidance, or criteria) from releases subject to RCRA Corrective Action, anywhere at, or from, the facility?

X If yes - continue after identifying key contaminants, citing appropriate "levels," and referencing supporting documentation.

___ If no - skip to #8 and enter "YE" status code, after citing appropriate "levels," and referencing supporting documentation to demonstrate that groundwater is not "contaminated."

___ If unknown - skip to #8 and enter "IN" status code.

Rationale:

HYDROGEOLOGICAL BACKGROUND

Groundwater beneath Fort Dix exists in two principal aquifer systems: shallow and deep. Shallow groundwater flows through the highly permeable sands of the Cohansey and Kirkwood Formations, comprising the Kirkwood-Cohansey aquifer in the Fort Dix area (Ref. 2). This shallow groundwater system extends to depths between 20 and 75 feet below ground surface (bgs). General groundwater movement in this aquifer system is toward lowland areas where water discharges to the Rancocas Creek, Crosswicks Creek, and minor tributaries.

Moving deeper, lower aquifers in the Fort Dix area include the Mt. Laurel-Wenonah, Englishtown, and Potomac-Raritan-Magothy aquifers, respectively. Deep aquifers in the Fort Dix area are pumped extensively as a public water source for Fort Dix, McGuire Air Force Base, and Wrightstown. Because of the extensive pumping, a downward vertical groundwater gradient has been identified from shallow to deeper water-bearing formations across the confining layer. However, in the site vicinity, the deep aquifers are separated from the shallow aquifer system by a composite confining unit approximately 120- to 230-feet thick (Ref. 2). The vertical hydraulic gradient of this unit is estimated to be approximately 0.0001 feet per day (Ref. 24). Based on its thickness and relative impermeability, this layer serves as a significant barrier to downward flow of groundwater and contamination from the surficial aquifers to deeper water supply aquifers. Thus, groundwater impacts are believed to be limited to the shallow water table aquifer at Fort Dix (Refs. 2 and 3).

SHALLOW GROUNDWATER CONTAMINATION

The water table aquifer has been impacted by surface activities. An overwhelming amount of data has been obtained for groundwater at the 18 active AREE/FTDX sites, and a table of historic contaminant concentrations in groundwater has not been prepared for this EI determination. However, Attachment 1 includes a summary of the major contaminant classes that have been historically detected in groundwater at each IRP site above applicable New Jersey Ground Water Quality Criteria (NJ GWQC) and other pertinent water quality criteria including site-specific background levels (as presented in the Final Background Constituent Concentration Statistical Report for Fort Dix [Ref. 1]), EPA's Maximum

[1] "Contamination" and "contaminated" describes media containing contaminants (in any form, NAPL and/or dissolved, vapors, or solids, that are subject to RCRA) in concentrations in excess of appropriate "levels" (appropriate for the protection of the groundwater resource and its beneficial uses).

Contaminant Levels (MCLs), and laboratory practical quantitation limits (PQLs). The discussion below outlines the status of groundwater investigation and/or monitoring at each AREE/FTDX site, identifies the most recent groundwater quality data for each site, and highlights current NJ GWQC exceedances.

AREE No. 1 / FTDX No. 07 (Magazine 1 Area): This area is being monitored as part of the Basewide Classification Exception Area (CEA) monitoring program. AREE No. 1 was initially included in the CEA based on the presence of two hazardous constituents (i.e., 1, 2-dichloroethylene [DCE] and trichloroethylene [TCE]). Accordingly, the current NJDEP-approved CEA monitoring program for this location requires quarterly volatile organic compound (VOC) sampling and analysis. The most recent available data for AREE No. 1 groundwater was obtained in September 2005 (Ref. 31). The plume well in this location (well MAG-108A) reported the following exceedances during this sampling event:

Constituent	Well Result (micrograms per liter [µg/L])	Criteria (µg/L)	Criteria Source
cis-1,2-DCE	236	70	NJ GWQC
Tetrachloroethylene (PCE)	2.4	1	NJ GWQC
TCE	185	1	NJ GWQC

AREE No. 2 / FTDX No. 13 (Petroleum, Oil, & Lubricants [POL] Area): Groundwater in this location is being monitored on a biannual basis as part of a limited groundwater investigation effort. The most recent sampling event for which data are available was conducted on September 16, 2005 (Ref. 32). Groundwater samples from AREE No. 2 are analyzed for VOCs, semi-volatile organic compounds (SVOCs), target analyte list (TAL) metals, tin, and total suspended solids (TSS). No RCRA hazardous constituents were reported above applicable screening levels in this 2005 sampling round. Consequently, this AREE will not be considered further in this EI determination.

AREE No. 3 / FTDX No. 24 (Fire Training Tanks [FTT] Area): Five monitoring wells in the FTT Area were most recently sampled on December 10, 1996 (Ref. 29). The results of this investigation indicated concentrations of methylene chloride and bis(2-ethylhexyl)phthalate (up to 4.4 and 15 µg/L, respectively) above their respective NJ GWQC (established at 3 µg/L for both constituents). No other exceedances were reported during the December 1996 sampling event. Furthermore, both of the detected constituents are common laboratory artifacts and may not be representative of actual groundwater quality. The results of a human health risk assessment revealed that chemicals in the groundwater at the FTT Area will not pose a risk to human health, and the risk is below the USEPA and NJDEP risk levels. Similarly, the results of an ecological risk assessment revealed no significant risks due to the constituents of potential concern in the groundwater at the FTT Area (Ref. 29). As a result, the 2006 Draft RI Addendum Report recommended NFA for soil and groundwater (Ref. 29). Consequently, this AREE will not be considered further in this EI determination.

AREE No. 5 / FTDX No. 12 (Transportation Motor Pool [TMP]): Investigations conducted between 1985 and 1993 indicated that environmental media at the TMP Area may have been impacted by fuel dispensing activities. Groundwater in this location is being monitored on a biannual basis as part of a limited groundwater, surface water, and sediment investigation effort. The most recent sampling events for which data are available were conducted in April and September 2005 (Ref. 33). Groundwater samples from AREE No. 5 are analyzed for VOCs, SVOCs, TAL metals, tin, and TSS. No RCRA hazardous constituents were reported in groundwater from this location during either of the 2005 sampling events. Consequently, this AREE will not be considered further in this EI determination.

AREE No. 6 / FTDX No. 25 (Armaments Research & Development Center [ARDC] Test Site): The selected groundwater remedy for this AREE included excavation of VOC-impacted soils to the groundwater surface, and long-term monitoring (LTM) to determine the effectiveness of natural attenuation processes (Ref. 13). The soil removal was complete as of November 2005 (Ref. 28). AREE No. 6 groundwater is being evaluated as part of the Basewide CEA monitoring program. Although this AREE was initially included in the CEA based on the presence of several hazardous metal and VOC constituents, the current NJDEP-approved CEA requires monitoring only for VOCs. No explanation was provided in the available file material to explain this winnowing of the analytical suite. Nevertheless, because it has been approved, it appears that RCRA hazardous metals constituents are no longer a concern for groundwater at AREE No. 6, and they will not be considered further in this EI determination. The most recent data for AREE No. 6 groundwater was obtained from the plume well (well ARD-77) during the January/February 2006 sampling round (Ref. 31). No VOCs were reported above applicable NJ GWQC. Consequently, AREE No. 6 will not be considered further in this EI determination.

AREE No. 7 / FTDX No. 10 (NPL Sanitary Landfill): Groundwater monitoring wells were installed around the perimeter of the landfill in 1979 and 1982, and results from downgradient wells indicated the presence of VOCs at up to 14,000 parts per billion (ppb). The landfill was subsequently closed, and remedial actions included placement and long-term maintenance of a cap and cover system. The remedy also required LTM for groundwater, implementation of deed restrictions, and a CEA for the landfill area (Ref. 24). The requirement for a CEA was fulfilled in 2002. Groundwater data were collected from 32 LTM wells within the landfill plume in the Spring and Fall of 2005 (Ref. 27). The LTM samples were analyzed for VOCs, SVOCs, pesticides, polychlorinated biphenyls (PCBs), TAL metals, tin, cyanide, and radionuclides. Maximum concentrations of hazardous constituents reported above applicable groundwater quality criteria during the Fall 2005 sampling event at AREE No. 7 include:

Constituent	Well Reporting Max. Conc.	Max. Well Result (µg/L)	Criteria (µg/L)	Criteria Source
Benzene	LTM-20	12	1	NJ GWQC
Mercury	LTM-28	2.5 J	2	NJ GWQC
Methylene Chloride	LTM-33	73.5	3	NJ GWQC

J: concentration estimated

Fort Dix plans to install additional point of compliance (POC) monitoring wells to serve as sentinel wells for the CEA monitoring program. Proposed POC well locations were sampled by Geoprobe in 2006 (Ref. 36). No hazardous constituents were reported above applicable groundwater quality criteria at the well locations.

AREE No. 8 / FTDX No. 06 (Pesticide Control Storage [PCS] Shop): A Remedial Investigation (RI) conducted at this AREE in December 2003 included collection of eight groundwater samples from temporary well points and three groundwater samples from permanent monitoring wells (Ref. 18). These samples were analyzed for a wide array of contaminant classes including VOCs, polynuclear aromatic hydrocarbons (PAHs), pesticides, herbicides, and metals. No RCRA hazardous constituents were reported in groundwater from this location during the RI, and no subsequent groundwater samples have been collected (Ref. 18). Consequently, this AREE will not be considered further in this EI determination.

AREE No. 9 / FTDX No. 26 (New Egypt Armory [NEA]): Groundwater at this AREE has been sampled on at least seven separate occasions between 1998 and 2003 as part of the RI program (Ref. 17). These samples, covering a total of seven wells, were analyzed for VOCs, SVOCs, total

petroleum hydrocarbons (TPH), PCBs, and metals. The only RCRA hazardous constituents reported above applicable screening criteria during the area-wide sampling event in July 2003 were PCBs in well NEA-61. Because such exceedances had not been previously detected in this well, two rounds of confirmation sampling were performed on August 1 and 12, 2003. PCBs were not reported above detection limits in well NEA-61 during either sampling event. Because no RCRA hazardous constituents were reported and confirmed above groundwater screening criteria during the RI, this AREE will not be considered further in this EI determination.

AREE No. 10 / FTDX No. 16 (Range Landfill): This landfill is a 39-acre site located in the northeastern portion of the Range and Impact Area, just southwest of the BOMARC site. The Range Landfill was reportedly used from approximately 1940 to 1975 for disposing of wastes (including rubble, refuse, old storage tanks, and miscellaneous metals) from the Range and Impact Area (Ref. 4). Four groundwater monitoring wells were installed at this AREE as part of the PA/SI, and six additional wells were installed in 2001 as part of the RI. The wells are shown on Figure 6-4 of the Remedial Investigation for the Range Landfill (Ref. 4). All ten wells were sampled in 2001 and 2002. Total chromium was detected slightly above applicable NJ GWQC (70 µg/L) in wells FDRLF-MW2 and FDRLF-MW3 at 73.8 and 83.1 µg/L, respectively (Ref. 4). There were no exceedances of dissolved chromium. Groundwater flow in the area of FDRLF-MW2 and FDRLF-MW3 is generally to the west, and the distance from each well to the landfill boundary is approximately 275 and 350 feet, respectively.

AREE No. 12 / FTDX No. 18 (ANC-2 Disposal Area): The ten-acre ANC-2 Disposal Area was previously used for waste disposal activity, as evidenced by a pile of mounded material and debris on the site surface (Ref. 12), and also reportedly as a sand and gravel excavation pit that has been backfilled (Ref. 3). More recent disposal practices have reportedly included limited landscaping materials such as grass, leaves, and wood chips. Disposal of materials other than landscaping materials is strictly prohibited, and no recent dumping was observed at the time of the RI activities. Following an initial groundwater screening effort, groundwater well samples were collected from this AREE in September 2001 and April 2002 (Ref. 12). The first round of samples were analyzed for VOCs, SVOCs, radionuclides, and metals. However, results from the September 2001 sampling round eliminated the organic and radiological constituents as constituents of concern for this AREE (Ref. 12). Consequently, the second groundwater sampling round included analysis of only inorganics.

During the April 2002 sampling round, two RCRA hazardous metals (lead and thallium) were reported in AREE No. 12 groundwater at concentrations above their respective NJ GWQCs (5 and 2 µg/L, respectively). The maximum concentration of total lead was reported in MW6 at 18.5 µg/L in April 2002 and at 5.6 µg/L during the September 2001 sampling event. Thallium was reported only in one sample during the April 2002 sampling event, but it was not detected in the duplicate sample or in any sample from the September 2001 sampling event. Although below applicable standards, mercury and vanadium detections were similarly sporadic (Ref. 12). In the RI Report for this AREE, the Army attributes these elevated inorganic concentrations to a combination of the samples' elevated TSS and total dissolved solids concentrations, elevated turbidity, and low pH, which tends to draw inorganics out of natural soil deposits in the area. The report also pointed out that lower inorganic concentrations were found in well FDANC-MW4, where turbidity is decreased and pH is measured at more neutral levels. Consequently, the report concludes that the metals exceedances are naturally occurring and not associated with debris historically disposed in the ANC-2 Disposal Area (Ref. 12). Consequently, no further action is proposed for groundwater, and this AREE will not be considered further in this EI determination.

AREE No. 13 / FTDX No. 22 (Boiler Blowdown Area): According to the Final RI Report for this AREE (Ref. 6), only beryllium was detected at a concentration of 2.75 mg/kg in one surface soil sample (New Jersey Non Residential Direct Contact Soil Cleanup Criterion [NJ NRDCSCC] = 2 mg/kg) in 1998. Given this one minor (less than 1.5 times), isolated surface soil exceedance, it appears unlikely that groundwater has been impacted by historic operations at AREE No. 13. Furthermore, Fort Dix has recommended NFA for the Boiler Blowdown Area (Ref. 6). Consequently, this AREE will not be considered further in this EI determination.

AREE No. 15 / FTDX No. 35 (Golf Course Pesticide Mixing & Storage Area): According to the February 2002 Final Decision Document for this AREE, contaminated groundwater at the golf course is being addressed as part of corrective action for the Golf Course Leaking Underground Storage Tank (UST), otherwise referenced as AREE No. 38, FTDX No. 19-6 (Ref. 9). As a result, this AREE will not be considered further in this EI determination.

AREE No. 16 / FTDX No. 05B (4300 Area Motor Pool): As part of the Phase IV Environmental Investigation in February 1996, two newly installed monitoring wells (wells DIO-13S and DIO-14D) were sampled and analyzed for VOCs. At that time, PCE was reported in the shallow well at 1.6 µg/L, which is above its applicable NJ GWQC of 1.0 µg/L (Ref. 15). Subsequent resampling of well DIO-13S in 1999 indicated that PCE had dropped below the NJ GWQC to a concentration of 0.8 µg/L. No VOCs were reported in deep well DIO-14D. This motor pool area has been grouped with the 4400 Area Motor Pool (AREE No. 17 / FTDX No. 05B) for ongoing remedial actions (Ref. 15). However, based on the lack of contamination of concern originating at the 4300 Area Motor Pool itself, the CEA monitoring effort does not include either of the AREE No. 16 monitoring wells (Ref. 31). For this reason, this AREE will not be considered further in this EI determination.

AREE No. 17 / FTDX No. 05B (4400 Area Motor Pool): Groundwater quality data for this AREE are available from four phases of groundwater investigation conducted as part of the Environmental Investigation between 1993 and 1996. Based on those results, and as shown on Figure 3 from the Remedial Action Decision Document for this area (Ref. 15), three separate PCE source areas were identified at this AREE: a former drum storage area in the 39th Engineering Battalion Motor Pool (west of Building 4400), a former drum storage area in the G-4 Maintenance Motor Pool (east of Building 4433), and an oil/water separator in the 195th Ordnance Battalion Motor Pool (north of Building 4465). Maximum contaminant levels reported above their applicable NJ GWQC in groundwater occurring in the most shallow (Cohansey) and slightly deeper yet still shallow (Kirkwood) aquifers during the October 1999 Alternative Analysis Addendum effort include:

Constituent	PCE (NJ GWQC = 1 µg/L)		TCE (NJ GWQC = 1 µg/L)	
Area of Concern at AREE No. 17	Cohansey GW	Kirkwood GW	Cohansey GW	Kirkwood GW
39th Engineering Battalion Motor Pool	79	NE	ND	ND
G-4 Maintenance Motor Pool	37	NA	ND	NA
195th Ordnance Battalion Motor Pool	13	5	11	2

NA: Not analyzed; ND: not detected; NE: no exceedance.

AREE No. 25 / FTDX No. 17 (EPIC-8 Landfill): This five-acre landfill was used until sometime in the 1950s (i.e., before the Fort Dix Sanitary Landfill opened), and records indicate that no disposal restrictions were in place during its use. A groundwater investigation of AREE No. 25 was conducted as part of the 1989 PA/SI. Additional groundwater investigation was conducted during the

base-wide Environmental Investigation. Four monitoring wells were installed in 1993, and samples collected in 1993 and 1994 were analyzed for VOCs, SVOCs, inorganics, pesticides, and PCBs. Seven wells at AREE No. 25 were sampled in December 1995. Although specific data were not found in the available file material, documentation does indicate that the groundwater data were evaluated in a human health risk assessment using a hypothetical residential use scenario. The only hazardous constituent identified as a potential concern for the risk assessment was chromium. Although the resulting hazard quotient exceeded the acceptable risk level of 1, chromium was not indicated as the primary driver of risk; instead, iron was the key metal of concern. Because iron is not a RCRA hazardous constituent and because iron is found at naturally elevated levels in groundwater in the Fort Dix area (Ref. 11), iron need not be considered in this EI determination. Furthermore, because the risk assessment used groundwater data from 1993, which were consistently higher than those reported in 1995, the current levels of risk are likely to be even less than indicated in the risk assessment (Ref. 11). Based on the results of these investigations, Fort Dix determined that wastes buried in trenches have not resulted in RCRA hazardous constituent impacts to groundwater (Ref. 11). Furthermore, the NJDEP-approved remedy for this AREE does not require groundwater remediation. Thus, this AREE will not be considered further in this EI determination.

AREE No. 26 / FTDX No. 33 (Property Disposal Office [PDO] Landfill): The selected remedy for mercury-impacted groundwater in this location includes implementation of a well use restriction (WUR) to prohibit installation of water supply wells at or downgradient of the AREE and LTM as part of the base-wide CEA. One monitoring well from AREE No. 26 (well PDO-40) is included in the CEA, and samples from this well are analyzed for mercury (the only constituent of concern for purposes of the CEA). The most recent sampling of AREE No. 26 groundwater was conducted in January 2006. During this round, mercury was reported at 0.36 µg/L, which is below its NJ GWQC of 2 µg/L (Ref. 31). Samples obtained in July 2005 also reported mercury (0.94 µg/L) at levels below the standard, and the sample collected in September 2005 was only slightly above the NJ GWQC, at an estimated concentration of 2.5 µg/L (Ref. 31). Because the most recent groundwater data do not exceed NJ GWQC, this AREE will not be considered further in this EI determination.

AREE No. 38 / FTDX No. 19A (UST Taxi Stand Site): Groundwater at this AREE occurs at a depth of approximately 20 feet bgs and is contaminated with benzene, toluene, ethylbenzene, xylene (BTEX) and free product gasoline (Ref. 10). An in-situ chemical oxidation groundwater treatment program is currently underway at this site (Ref. 26), and four monitoring wells (TSG-02, TSG-04, TSG-05, and TSG-06) are currently included in the CEA LTM program (Ref. 31). The NJDEP-approved CEA requires groundwater sampling and analysis only for VOCs at this AREE. The most recent groundwater sampling event for which data are available was conducted in this location on January 5, 2006 (Ref. 31). Only benzene exceeded its NJ GWQC of 1 µg/L, with a detected concentration of 130 µg/L.

AREE No. 38 / FTDX No. 19-1 (UST at Former Building 3379): The selected remedy for groundwater at this AREE involves injection of hydrogen release compounds (HRCs) into the VOC groundwater plume to enhance naturally occurring anaerobic bioremediation and LTM as part of the CEA (Ref. 19). The first round of HRC treatment is reportedly complete at this site (Ref. 34). Three monitoring wells (FD3379-MW1, FD3379-MW2, and FD3379-MW3) are currently included in the LTM program, and the NJDEP-approved CEA requires groundwater sampling and analysis only for VOCs at this AREE. Groundwater in this location was sampled four times between April 2005 and February 2006, and no VOC concentrations were reported above applicable groundwater screening criteria (Ref. 31). Consequently, this AREE will not be considered further in this EI determination.

AREE No. 38 / FTDX No. 19-2 (UST at Building 5390): The contaminants of concern for groundwater in this location are BTEX and methyl tertiary-butyl ether (MTBE) in groundwater. The selected remedial action for groundwater included in-situ bioremediation and LTM as a component of the base-wide CEA (Ref. 19). Two monitoring wells in this location (FD5390-MW3 and FD5390-MW6) are currently included in the CEA program, and samples collected during the 2005 sampling year reported concentrations of benzene and xylene above their respective groundwater quality screening criteria (Ref. 31). However, the most recent groundwater sampling results (subsequent to February 2006) reportedly came back clean, and bioventing was discontinued at this site (Ref. 34). Based on these results and the decision to cease corrective action (as communicated by the Fort Dix environmental project manager), this AREE will not be considered further in this EI determination.

AREE No. 38 / FTDX No. 19-3 (UST at Building 6045): This building formerly functioned as a gasoline station with a gasoline UST of unknown capacity, associated piping, and one 1,000-gallon heating oil UST. Following removal of the gasoline UST and piping, MTBE-contaminated groundwater was identified (Ref. 19). Three groundwater monitoring wells were installed in this location, and each was sampled in April 2000 for VOCs, MTBE, tertiary butyl alcohol (TBA), and lead (Ref. 19). Only MTBE exceeded its NJ GWQC of 70 µg/L, with a reported concentration of 190 µg/L, and in only one of the three wells (well FD6045-MW1). Lower levels of MTBE were also reported in wells FD6045-MW2 and FD6045-MW3 (situated approximately 45 and 50 feet east and southeast of well FD6045-MW1, respectively), but neither of these concentrations exceeded the applicable NJ GWQC (Ref. 19). Sampling of the three wells in 2004, 2006, and 2007 showed MTBE and BTEX at ND or below the applicable NJ GWQC (Ref. 37). Although MTBE concentrations in well FD6045-MW3 appear to be increasing slightly, the highest level reported to date in this well (5.9 µg/L) is significantly below the NJ GWQC of 70 µg/L (Ref. 38). Thus, the extent of MTBE exceedances has been partially delineated at AREE No. 38/FTDX No. 19-3. Three additional wells (FD6045-MW4, FD6045-MW5 and FD6045-MW6) were installed north and west of FD6045-MW1, and groundwater sampling was initiated in 2004 and 2005. Sampling of these additional wells through 2007 showed MTBE at ND or below its NJ GWQC. However, the new wells consistently reported BTEX concentrations above the NJ GWQC of 1 µg/L(Ref. 37). BTEX concentrations detected during the most recent sampling round in February 2007 ranged from 98.4 to 5,710 µg/L and appear to be stabilizing (Ref. 38). Additional delineation will be performed for BTEX in this area in the future (Ref. 39).

AREE No. 38 / FTDX No. 19-4 (UST at Building 6605): This site is located in the 6600 block of the Cantonment Area and was originally constructed as a leaded gasoline fueling station. Four monitoring wells were installed at this AREE in April 2001, and two additional wells were installed in May 2002. Low-level BTEX constituents exceeded applicable groundwater quality standards, but decreasing concentration trends were identified and attributed to ongoing natural attenuation (Ref. 19). Based on these findings, monitored natural attenuation was selected as the official remedy for impacted groundwater at this site (Ref. 19). All six monitoring wells were sampled in March 2003, and only one well reported any VOCs above their respective NJ GWQC: total xylenes in well FD6605-MW1. Furthermore, that detection was considered suspect because the xylenes concentration was estimated, and xylenes were also found in the associated blank samples (Ref. 19). Based on the lack of confirmed VOC contamination in groundwater, the strong evidence for natural attenuation of contamination, and the likelihood that historic contamination has now been reduced to levels below relevant water quality standards, this AREE will not be considered further in this EI determination.

AREE No. 38 / FTDX No. 19-5 (UST at Building 7061): This building is the New Lisbon potable water pumping station and is located off the main Fort Dix site. A 290-gallon UST was removed in 1997

and observed to be in poor condition. The selected remedial action was installation of an additional groundwater monitoring well, injection of oxygen release compounds (ORCs) to treat BTEX-contaminated groundwater, and LTM as part of the base-wide CEA (Ref. 19). Two monitoring wells in this location (FD7061-MW7 and FD7061MW-NEW) are currently included in the CEA program, and none of the samples collected during the 2005 sampling year (the most recent sampling events for which data are available) reported contaminant concentrations above their respective groundwater quality screening criteria (Ref. 31). Consequently, this AREE will not be considered further in this EI determination.

AREE No. 38 / FTDX No. 19-6 (Golf Course Leaking UST): The primary contaminants of concern are petroleum-related compounds that were released from a leaking UST, which has since been removed (Ref. 5). The Draft 2001 Site Investigation Report presented the results of natural attenuation modeling suggesting that benzene in groundwater was undergoing natural bioremediation and recommended monitored natural attenuation combined with LTM as part of the CEA (Ref. 5). Four monitoring wells in this location (wells FDGCC-MW1, FDGCC-MW5, GLF-16, and GLF-73) are currently included in the CEA program, with samples analyzed for BTEX constituents. The most recent groundwater sampling event for which data are available was conducted on January 31 and February 1, 2006 (Ref. 31). Only benzene exceeded its NJ GWQC of 1 µg/L with a detected concentration of 11 µg/L.

AREE No. 38 / FTDX No. 19-7 (UST at Range Road Areas A, B, C): This AREE is associated with a variety of USTs used to store No. 2 heating oil for consumption in the former military barracks. The barracks have been demolished, and the USTs have been removed. Following an initial screening effort, groundwater samples were collected from 21 monitoring wells across Areas A, B, and C in June 2001 and March 2002. Small, localized BTEX plumes were identified in wells FD8100-MW03, FD8200-MW08, FD8200-MW17, and FD8200-MW23. None of the reported SVOC concentrations exceeded relevant criteria. In addition, during the March 2002 sampling event (the most recent available groundwater data for this AREE), only benzene was reported above its NJ GWQC (at a concentration of 2 µg/L, as compared to the screening criterion of 1 µg/L). The suggested remedial action for groundwater at this AREE involves installation of ORC socks at these four monitoring wells to enhance existing microbial activity, monitored natural attenuation, and LTM as part of the Final CEA for Fort Dix (Ref. 14). As of February 2006, this AREE had not yet been added to the base-wide CEA program (Ref. 31). However, based on the isolated and low-level nature of detected contamination, the strong evidence for natural attenuation of contamination, and the likelihood that historic contamination has now been reduced to levels below relevant water quality standards, this AREE will not be considered further in this EI determination.

DEEP GROUNDWATER CONTAMINATION

As stated above, deep groundwater in the Fort Dix area (contained in the Mt. Laurel-Wenonah aquifer and deeper) is not believed to have been impacted by historic or present site operations. Specific data on deep groundwater quality was not found in the available file materials. However, because deep groundwater is withdrawn in the Fort Dix area to supplement potable water supplies, and because routine water quality testing is required for such usage, any impacts to deep groundwater in the area are likely to be quickly identified and appropriate corrective actions would be expeditiously implemented to protect human health.

SUMMARY OF AREE SITES BEING CARRIED FORWARD

Based on the assessments presented above, only the following seven AREE/FTDX sites have been identified as having confirmed, current groundwater contamination and, thus, will be carried forward for further evaluation in this EI determination:

AREE No.	FTDX No.	Site Name
1	07	Magazine 1 Area
7	10	NPL Sanitary Landfill
10	16	Range Landfill
17	05B	4400 Area Motor Pool
38	19A	UST Taxi Stand Site
38	19-3	UST at Building 6045
38	19-6	Golf Course Leaking UST

References:

1. Fort Dix U.S. Army Installation Background Constituent Concentration Statistical Report. Prepared by ABB-ES. Dated 1996.
2. Final Fort Dix Environmental Investigation Report. Prepared by ICF Kaiser Engineers, Inc. Dated May 1997.
3. Public Health Assessment for Fort Dix (Landfill Site). Prepared by U.S. Department of Health and Human Services, Public Health Service, Agency for Toxic Substances and Disease Registry. Dated October 18, 1999.
4. Remedial Investigation for the Range Landfill, Draft Document. Prepared by Shaw Environmental and Infrastructure. Dated September 2002.
5. Draft Site Investigation Report, Golf Course Sites. Prepared by Pacific Western Technologies, Ltd. Dated February 13, 2001.
6. Final Remedial Investigation Report (ELIN A009), Boiler Blowdown Area. Prepared by KEMRON Environmental Services, Inc. Dated May 23, 2001.
7. Final Remedial Investigation Report, Fire Tank Training Area. Prepared by KEMRON Environmental Services, Inc. Dated August 2001.
8. Final Magazine Area 1 Decision Document. Prepared by Harding ESE, Inc. Dated August 2002.
9. Final Decision Document for the Golf Course Pesticide Mixing and Storage Area. Prepared by Pacific Western Technologies, Ltd. Dated February 20, 2002.
10. Decision Document for Remedial Design and Remedial Action, Taxi Stand Underground Storage Tank Site. Prepared by U.S. Army, Fort Dix. Dated May 20, 2002.
11. Final EPIC-8 Landfill Decision Document: Institutional Controls. Prepared by EM Federal Corporation. Dated August 2002.
12. Draft Remedial Investigation for the ANC-2 Landfill RI/FS. Prepared by Shaw Environmental and Infrastructure. Dated November 2002.
13. Draft ARDC Test Facility Decision Document. Prepared by Harding ESE, Inc. Dated February 2003.
14. Site Investigation Report for the Former Group 5 UST Sites (Site 6605 and the Range Road Sites). Prepared by Shaw Environmental and Infrastructure, Inc. Dated March 2003.
15. Final 4300 Area Spill Site, 4400 Area Spill Site Decision Document: Remedial Action. Prepared by EM Federal Corporation. Dated May 2003.
16. Final Property Disposal Office Landfill Decision Document: Remedial Action. Prepared by EM Federal Corporation. Dated November 2003.

17. Draft Final Remedial Investigation Report, New Egypt Armory, Fort Dix, New Jersey. Prepared by Kemron Environmental Services. Dated January 15, 2004.
18. Draft Remedial Investigation of the Former Pesticide Control Shop, Fort Dix, New Jersey. Prepared by Tetrahedron, Inc. Dated March 2004.
19. Final Remedial Action Work Plan, 7 Former UST Sites. Prepared by Shaw Environmental, Inc. Dated May 2004.
20. Final Remedial Investigation Addendum for the Boiler Blowdown and Fire Tank Training Areas and Remedial Action Work Plan for the Armaments Research and Development Center Test Facility and the Golf Course Pesticide Mixing and Storage Area. Prepared by Shaw Environmental, Inc. Dated May 2004.
21. Final Remedial Action Work Plan for the Property Disposal Office Landfill. Prepared by Shaw Environmental, Inc. Dated August 2004.
22. Final Closure Report for the Removal of PCB Contaminated Soils at the New Egypt Armory, Fort Dix, New Jersey. Prepared by Kemron Environmental Services. Dated March 30, 2005.
23. Final Remedial Action Work Plan Addendum for Groundwater, MAG-1 Area. Prepared by Shaw Environmental, Inc. Dated June 2005.
24. Final Five-Year Review Report for U.S. Army Fort Dix (NPL Landfill Site). Prepared by U.S. Army Corps of Engineers. Dated September 2005.
25. Letter from George Pavlou, U.S. EPA Region 2, to R. David McNeil, US Army, re: CERCLA Five-Year Review Fort Dix Sanitary Landfill. Dated September 29, 2005.
26. Fort Dix Installation Restoration Program, AREE List and Status Spreadsheet. Prepared by U.S. Army, Fort Dix. Dated November 2005.
27. Draft 2005 Sampling and Analysis Report for Groundwater, Surface Water, and Sediment for the Fort Dix Sanitary Landfill. Prepared by EA Engineering, Science, and Technology, Inc. Dated December 2005.
28. Draft Final FY2006 Fort Dix Installation Action Plan. Prepared by Fort Dix. Dated December 22, 2005.
29. Draft Remedial Investigation Addendum, Fire Tank Training Area. Prepared by Shaw Environmental, Inc. Dated February 2006.
30. E-mail from Alan Straus, EPA Region 2, to Amy Brezin, Booz Allen Hamilton, re: U.S. Army, Fort Dix. Dated March 10, 2006.
31. Draft 2005 Sampling and Analysis Report for the CEA Comprised of the Cantonment Area, Training Area, and Satellite Sites. Prepared by EA Engineering, Science, and Technology, Inc. Dated May 2006.
32. Sampling and Analysis Report for Groundwater at the Petroleum, Oil, and Lubricants (POL) Site. Prepared by EA Engineering, Science, and Technology, Inc. Dated July 2006.
33. Sampling and Analysis Report for Groundwater, Surface Water, and Sediment at the Transportation Motor Pool. Prepared by EA Engineering, Science, and Technology, Inc. Dated July 2006.
34. Personal communication between Amy Brezin, Booz Allen Hamilton, Bill Lewendoski, U.S. Army, Fort Dix, and Alan Straus, U.S. EPA Region 2. Dated August 11, 2006.
35. Personal communication between Michele Benchouk, Booz Allen Hamilton, and Bill Lewendoski, U.S. Army, Fort Dix. Dated February 9, 2007.
36. Personal communication between Alan Straus, EPA, and Bill Lewendoski, U.S. Army, Fort Dix. Dated March 9, 2007.
37. Personal communication between Alan Straus, EPA, and Bill Lewendoski, U.S. Army, Fort Dix. Dated August 15, 2007.
38. E-mail from Bill Lewendoski, U.S. Army, Fort Dix, to Alan Straus, EPA, re: Map – Site 6045 Monitoring Well Sample Results. Dated August 15, 2007.
39. E-mail from Alan Straus, EPA, to Bill Lewendoski, U.S. Army, Fort Dix, re: Fort Dix Building 6045. Dated August 22, 2007.

3. Has the **migration** of contaminated groundwater **stabilized** (such that contaminated groundwater is expected to remain within "existing area of contaminated groundwater"[2] as defined by the monitoring locations designated at the time of this determination)?

X If yes - continue, after presenting or referencing the physical evidence (e.g., groundwater sampling/measurement/migration barrier data) and rationale why contaminated groundwater is expected to remain within the (horizontal or vertical) dimensions of the "existing area of groundwater contamination"[2].

___ If no (contaminated groundwater is observed or expected to migrate beyond the designated locations defining the "existing area of groundwater contamination"[2]) - skip to #8 and enter "NO" status code, after providing an explanation.

___ If unknown - skip to #8 and enter "IN" status code.

Rationale:

This section includes a review of each AREE carried forward from Question 2 to determine if the migration of contaminated groundwater can be considered stabilized. Stabilization in this response has been established based on both the likelihood that groundwater contamination will remain within the existing area of impact, and decreasing or stabilizing trends in contaminant concentrations.

AREE No. 1 / FTDX No. 07 (Magazine 1 Area): The selected remedy for impacted groundwater in this area includes monitored natural attenuation and source control with hydrogen release compounds (Ref. 3). Groundwater use restrictions are planned to prohibit installation of water supply wells at or downgradient of the AREE. The most recent available data for groundwater at this AREE were obtained in September 2005 as part of the base-wide CEA (Ref. 7). As stated in the response to Question 2, the plume well in this location (well MAG-108A) reported exceedances of cis-1,2-DCE, PCE, and TCE during this sampling event. Contaminant concentrations detected in this well remained fairly stable through the 2005 monitoring year (April 2005 through September 2005 at this AREE). Two point of compliance (POC) wells (wells MAG-102B and MAG-103B) located over 1,000 feet southwest and downgradient of plume well MAG-108A are also included in the CEA LTM program. No VOCs were reported in well MAG-103B, and only low levels of cis- and trans-1,2-DCE were detected in well MAG-102B. With maximum concentrations of 5.2 and 0.82 J µg/L, these constituents are present at levels well below their NJ GWQC (70 and 100 µg/L, respectively). Based on consistent source concentrations and the lack of significant contamination in the POC wells, groundwater impacts in the Magazine 1 Area appear to have stabilized.

AREE No. 7 / FTDX No. 10 (NPL Sanitary Landfill): As stated in the response to Question 2, groundwater samples were collected from 32 LTM wells within the landfill plume in the Spring and Fall of 2005 (Ref. 6). As shown on Figure 4-3 from the Draft 2005 Sampling and Analysis Report (Ref. 6), four NJ GWQC exceedances reported during the Fall 2005 sampling round included: benzene in two wells (LTM-20 and LTM-32 at 12 and 1.9 µg/L, respectively); mercury in one well

[2] "Existing area of contaminated groundwater" is an area (with horizontal and vertical dimensions) that has been verifiably demonstrated to contain all relevant groundwater contamination for this determination, and is defined by designated (monitoring) locations proximate to the outer perimeter of "contamination" that can and will be sampled/tested in the future to physically verify that all "contaminated" groundwater remains within this area, and that the further migration of "contaminated" groundwater is not occurring. Reasonable allowances in the proximity of the monitoring locations are permissible to incorporate formal remedy decisions (i.e., including public participation) allowing a limited area for natural attenuation.

(LTM-28 at an estimated concentration of 2.5 µg/L); and methylene chloride in one well (LTM-33 at 73.5 µg/L). Stabilization of this groundwater contamination is indicated by groundwater trend plots in Reference 6 which show that:

- The concentration of benzene in well LTM-20 has declined from a high of 35 µg/L in 1997, to an average of around 25 µg/L between 1998 and 2000, to current levels averaging around 10 µg/L since the first quarter of 2003.

- The concentration of benzene in well LTM-32 has declined from a high of 13.5 µg/L in 1996 to levels routinely under 5 µg/L since 1998, and under 2 µg/L for both 2005 sampling events.

- Despite slight increases between 1994 and 2003, the level of mercury in well LTM-28 has declined in 2004 and 2005 and are well within the historic range of concentrations.

- The concentration of methylene chloride in well LTM-33 reached a high of 180 µg/L in 2000, averaged around 100 µg/L since 2002, and most recently reported the third lowest detection since 1996.

A wider variety of contaminants were reported above applicable screening levels in a wider range of monitoring wells during the Spring 2005 sampling round (e.g., 1,2-dichloroethane and 1,2-dichloropropane in well LTM-12), but most of these exceedances dropped off by the Fall sampling event. However, the groundwater trend plots referenced above show that these exceedances also remain within or below the historic range of contaminant concentrations. Thus, contaminant concentrations at the Sanitary Landfill appear to have stabilized. Statistically significant increases in groundwater contaminant concentrations at this AREE are not expected based on the length of time since the landfill was closed in 1984, and placement of a cap over the landfill in 1995 to reduce leachability and prevent mass loading to groundwater (Ref. 7). Thus, accounting for natural dispersion and attenuation processes, detected groundwater contamination is expected to remain within the immediate vicinity of the sanitary landfill and will be specifically bounded by four proposed POC wells located to the west, southwest, southeast, and east of the landfill, as shown on Figure 4-19 of the CEA Sampling and Analysis Report (Ref. 7). As stated in the response to Question 2, the proposed POC well locations were sampled by Geoprobe in 2006. No hazardous constituents were reported above applicable groundwater quality criteria at the well locations. Thus, it appears that migration of contaminated groundwater has stabilized at this AREE.

AREE No. 10 / FTDX No. 16 (Range Landfill): As stated in the response to Question 2, ten groundwater monitoring wells were sampled at the Range Landfill in 2001 and 2002. Only total chromium was detected slightly above applicable NJ GWQC in wells FDRLF-MW2 and FDRLF-MW3 (Ref. 2). No exceedances of dissolved chromium were reported. FDRLF-MW2 and FDRLF-MW3 are located in the interior portion of the landfill approximately 275 and 350 feet, respectively, from the downgradient landfill boundary. Due to the slight exceedances of total chromium, no exceedances of dissolved chromium, and the distance from the wells to the landfill boundary, it is unlikely that contaminated groundwater is migrating beyond the landfill area. Therefore, it appears that migration of contaminated groundwater has stabilized at this AREE.

AREE No. 17 / FTDX No. 05B (4400 Area Motor Pool): As stated in the response to Question 2, PCE and TCE are the main contaminants in groundwater at the 4400 Area Motor Pool. According to the 1997 Environmental Investigation Report (Ref. 1), groundwater in this area flows north-northeast, toward and into South Run. Available data on Figures 4 and 5 from the Remedial Action Decision Document show that levels of PCE and TCE in the Kirkwood Formation groundwater decrease to

levels below NJ GWQCs and/or detection limits through natural attenuation and dissipation processes as groundwater flows out of the 195th Ordinance Battalion Motor Pool, through the G-4 Maintenance Motor Pool, and into the 39th Engineering Battalion Motor Pool area (Ref. 4). The figures also show that TCE exceedances reported in shallower Cohansey Formation groundwater in 1999 were isolated to the immediate vicinity of well DIO-33S. Additionally, although the figures show shallow PCE impacts associated with each of the three source areas, concentrations of this VOC were reported below laboratory detection limits in 1999 in all of the most downgradient shallow wells except well DIO-40S (Ref. 4). Thus, the area of impact is largely limited to the AREE boundaries. Available documentation also indicates that impacted groundwater from this AREE is discharging into surface water in South Run. Furthermore, the interpretation of groundwater flow north-northeast in the 4400 Area Motor Pool and southeast in the 4300 Area Motor Pool on the opposite bank of South Run (Ref. 1) suggests that most, if not all, shallow groundwater from the 4400 Area Motor Pool discharges to surface water rather than flowing beneath it. South Run thereby serves as a hydraulic barrier to contaminant migration beyond the current impact area. Thus, it appears that groundwater contaminant migration at AREE No. 17 has stabilized.

AREE No. 38 / FTDX No. 19A (UST Taxi Stand Site): Four monitoring wells at this AREE (TSG-02, TSG-04, TSG-05, and TSG-06) are currently included in the CEA LTM program. As stated in the response to Question 2, the most recent available groundwater data for the UST Taxi Stand Site were obtained on January 5, 2006 (Ref. 7). At that time, only benzene exceeded its NJ GWQC of 1 µg/L; it was detected in plume well TSG-04 at 130 µg/L, down slightly from 164, 172, and 177 µg/L reported in April, July, and September of 2005, respectively. Benzene exceedances were also reported in plume well TSG-02 in July and September 2005 (31.9 and 2.9 µg/L, respectively). Two POC wells (wells TSG-05 and TSG-06) are located approximately 250 feet downgradient of plume well TSG-04. No NJ GWQC exceedances were reported in either POC well during the 2005 CEA monitoring year (Ref. 7). Based on isolated and consistent source concentrations, and the lack of groundwater quality exceedances in downgradient POC wells, groundwater impacts at the UST Taxi Stand Site appear to have stabilized.

AREE No. 38 / FTDX No. 19-3 (UST at Building 6045): As stated in the response to Question 2, MTBE did not exceed its NJ GWQC during the most recent groundwater sampling events. MTBE impacts to groundwater were identified following removal of the gasoline UST piping. Groundwater treatment involving chemical oxidation was conducted to address the identified groundwater impacts (Ref. 9). As stated in the Remedial Action Work Plan for Former UST Sites (Ref. 5), MTBE is capable of being naturally attenuated under aerobic conditions. According to base representatives, this treatment operation has been completed, and LTM is underway on a semi-annual basis (Ref. 10). As stated in the response to Question 2, total BTEX concentrations were reported above the NJ GWQC of 1 µg/L in three wells during the most recent sampling event in February 2007. As shown in Attachment 3, the BIOSCREEN natural attenuation model (version 1.4) was used to estimate how far downgradient the observed BTEX contamination (specifically, the most mobile contaminant, benzene) will migrate before attenuating to concentrations below the NJ GWQC. The model was run using the most current available data on this AREE and conservative default or derived values, and assumes no change in the contamination source (i.e., no further leakage and no source removal). Results of the modeling effort suggest that BTEX concentrations will attenuate by first order decay to levels below the NJ GWQC within approximately 1,200 feet of well FD6045-MW6. Based on this AREE's location roughly 9,000 feet from the nearest downgradient property line, it is unlikely that the observed BTEX contamination in groundwater at Building 6045 will migrate beyond the base boundaries. Thus, groundwater contamination at this AREE appears to have stabilized.

AREE No. 38 / FTDX No. 19-6 (Golf Course Leaking UST): Four monitoring wells are currently included in the CEA program at this AREE (plume wells FDGCC-MW1 and FDGCC-MW5, and POC wells GLF-16 and GLF-73). During the 2005 monitoring year, benzene was repeatedly reported above its NJ GWQC of 1 µg/L in the plume wells – ranging from a high of 121 µg/L to the current low of 11 µg/L in well FDGCC-MW5, and 1.3 to 2.3 µg/L in well FDGCC-MW1 (Ref. 7). Xylene also exceeded its NJ GWQC of 1,000 µg/L in plume well FDGCC-MW5 during the September 2005 monitoring round, but the most recent xylene concentration in this well (178 µg/L) was below the NJ GWQC. No exceedances were reported at any time during the 2005 monitoring year in POC well GLF-73, located approximately 150 feet downgradient of plume well FDGCC-MW5. POC well GLF-16, located approximately 150 feet downgradient of plume well FDGCC-MW1, reported low-level benzene exceedances during the April and July 2005 sampling rounds (6.7 and 1.7 µg/L, respectively), but the most recent February 2006 reading from this well (estimated at 0.68 µg/l) was below the established NJ GWQC (Ref. 7). Consequently, well GLF-16 is more appropriately labeled as a plume fringe well; accordingly, the Draft 2005 CEA Sampling and Analysis Report (Ref. 7) recommended that a new POC well be identified for inclusion in the CEA LTM program. Wells GTG-04 and GTG-05, located approximately 400 feet downgradient of well GLF-16, have been suggested as replacement options. Nevertheless, based on stable and declining contaminant concentrations in the plume wells and plume fringe well GLF-16, groundwater impacts at the Golf Course Leaking UST site appear to have stabilized.

References:

1. Final Fort Dix Environmental Investigation Report. Prepared by ICF Kaiser Engineers, Inc. Dated May 1997.
2. Remedial Investigation for the Range Landfill, Draft Document. Prepared by Shaw Environmental and Infrastructure. Dated September 2002.
3. Final Magazine Area 1 Decision Document. Prepared by Harding ESE, Inc. Dated August 2002.
4. Final 4300 Area Spill Site, 4400 Area Spill Site Decision Document: Remedial Action. Prepared by EM Federal Corporation. Dated May 2003.
5. Final Remedial Action Work Plan, 7 Former UST Sites. Prepared by Shaw Environmental, Inc. Dated May 2004.
6. Draft 2005 Sampling and Analysis Report for Groundwater, Surface Water, and Sediment for the Fort Dix Sanitary Landfill. Prepared by EA Engineering, Science, and Technology, Inc. Dated December 2005.
7. Draft 2005 Sampling and Analysis Report for the CEA Comprised of the Cantonment Area, Training Area, and Satellite Sites. Prepared by EA Engineering, Science, and Technology, Inc. Dated May 2006.
8. Sampling and Analysis Report for Groundwater at the Petroleum, Oil, and Lubricants (POL) Site. Prepared by EA Engineering, Science, and Technology, Inc. Dated July 2006.
9. Personal communication between Amy Brezin, Booz Allen Hamilton, Bill Lewendoski, U.S. Army, Fort Dix, and Alan Straus, U.S. EPA Region 2. Dated August 11, 2006.
10. Personal communication between Michele Benchouk, Booz Allen Hamilton, and Bill Lewendoski, U.S. Army, Fort Dix. Dated February 9, 2007.

4. Does "contaminated" groundwater **discharge** into **surface water** bodies?

X If yes - continue after identifying potentially affected surface water bodies.

___ If no - skip to #7 (and enter a "YE" status code in #8, if #7 = yes) after providing an explanation and/or referencing documentation supporting that groundwater "contamination" does not enter surface water bodies.

___ If unknown - skip to #8 and enter "IN" status code.

Rationale :

Shallow groundwater discharges to the ground surface, creating surface water bodies or seeps. Accordingly, groundwater flow directions are variable and generally point toward lowland areas where water is discharged to Rancocas Creek, Crosswicks Creek, and minor tributaries (Ref. 3). The western and northern portions of Fort Dix are drained by several perennial and intermittent tributaries of Crosswicks Creek, which flows six miles north and west before joining the Delaware River. The eastern and southern portions of the installation drain to the North Branch of Rancocas Creek, which is located immediately south of Fort Dix and flows westward into the Delaware River (Ref. 9). Fort Dix is estimated to contain 54 miles of stream channels (both intermittent and perennial), and it also has several ponds and lakes. Several of the streams are bordered by swamps, indicating relatively shallow depths to groundwater (Ref. 2). Surface water bodies located in the vicinity of the AREE/FTDX sites carried forward from Question 2 are listed in the table below, along with an assessment as to whether contaminated groundwater discharges into that surface water body.

AREE No.	FTDX No.	Site Name	Surface Water Bodies in Direction of Groundwater Flow	Contaminated Groundwater Discharges to Surface Water?	Ref.
1	07	Magazine 1 Area	Unnamed tributary flows westward in a low area across the site and into an adjacent wetland area.	Yes – Groundwater beneath the MAG-1 Area discharges to the unnamed tributary just downgradient of the CEA plume monitoring well MAG-108A.	10
7	10	NPL Sanitary Landfill	Cannon Run is located on the east side of the landfill, and a marshy area is present along Pipeline Road southwest of the landfill.	Yes – Both of the listed surface water bodies are believed to receive discharges of impacted groundwater.	11
10	16	Range Landfill	The Elisha Branch of Success Creek is located approximately 3,000 feet downgradient of assumed landfill limits.	No – Because of the significant distance, it is unlikely that contaminated groundwater discharges to surface water.	4
17	05B	4400 Area Motor Pool	South Run is located along the site's northern border.	Yes – The most recent data (1999) show a PCE concentration above its NJ GWQC in well DIO-40S immediately adjacent to the creek.	7
38	19A	UST Taxi Stand Site	No surface water bodies appear to be located in the immediate vicinity of this AREE.	No – No surface water bodies appear to be located in the immediate vicinity of this AREE.	5, 6
38	19-3	UST at Building 6045	No surface water bodies are present within the boundaries of this site or within the modeled plume extent (approximately 1,200 feet downgradient of well FD6045-MW6).	No – MTBE not detected above GWQC in recent sampling events. BTEX likely to attenuate to below applicable NJ GWQC before reaching the nearest surface water tributaries, approximately 1,500 feet to the east.	8, 13, 14
38	19-6	Golf Course Leaking UST	Two ponds and an intermittent stream are present on the west and south sides of this AREE. The leaking tank associated with this AREE was identified after an oily sheen was observed on the surface of a nearby stream.	Yes – Slightly impacted groundwater moving past POC well GLF-16 may be discharging to surface water in the west pond. Because well GLF-73 did not report any NJ GWQC exceedances, groundwater in the vicinity of this well is not considered contaminated. Thus, contaminated groundwater does not appear to be directly discharging to the south pond.	1

SUMMARY OF AREE SITES BEING CARRIED FORWARD

Based on the assessments presented above, four AREE/FTDX sites have been identified as locations where contaminated groundwater discharges to surface water. Thus, only the following AREE/FTDX sites will be carried forward for further evaluation in this EI determination:

AREE No.	FTDX No.	Site Name
1	07	Magazine 1 Area
7	10	NPL Sanitary Landfill
17	05B	4400 Area Motor Pool
38	19-6	Golf Course Leaking UST

References:

1. Draft Remedial Investigation. Prepared by Dames & Moore. Dated January 1992.
2. Final Fort Dix Environmental Investigation Report. Prepared by ICF Kaiser Engineers, Inc. Dated May 1997.
3. Public Health Assessment for Fort Dix (Landfill Site). Prepared by U.S. Department of Health and Human Services, Public Health Service, Agency for Toxic Substances and Disease Registry. Dated October 18, 1999.
4. Remedial Investigation for the Range Landfill, Draft Document. Prepared by Shaw Environmental and Infrastructure. Dated September 2002.
5. Site Remediation Report, Taxi Stand Site. Prepared by Pacific Western Technologies, Ltd. Dated August 20, 2001.
6. Decision Document for Remedial Design and Remedial Action, Taxi Stand Underground Storage Tank Site. Prepared by U.S. Army, Fort Dix. Dated May 20, 2002.
7. Final 4300 Area Spill Site, 4400 Area Spill Site Decision Document: Remedial Action. Prepared by EM Federal Corporation. Dated May 2003.
8. Final Remedial Action Work Plan, 7 Former UST Sites. Prepared by Shaw Environmental, Inc. Dated May 2004.
9. Environmental Baseline Survey for Housing Privatization at Fort Dix, New Jersey. Prepared by Parsons. Dated August 2004.
10. Final Remedial Action Work Plan Addendum for Groundwater, MAG-1 Area. Prepared by Shaw Environmental, Inc. Dated June 2005.
11. Final Five-Year Review Report for U.S. Army Fort Dix (NPL Landfill Site). Prepared by U.S. Army Corps of Engineers. Dated September 2005.
12. Sampling and Analysis Report for Groundwater at the Petroleum, Oil, and Lubricants (POL) Site. Prepared by EA Engineering, Science, and Technology, Inc. Dated July 2006.
13. Personal communication between Alan Straus, EPA, and Bill Lewendoski, U.S. Army, Fort Dix. Dated August 15, 2007.
14. E-mail from Bill Lewendoski, U.S. Army, Fort Dix, to Alan Straus, EPA, re: Map – Site 6045 Monitoring Well Sample Results. Dated August 15, 2007.

5. Is the **discharge** of "contaminated" groundwater into surface water likely to be **"insignificant"** (i.e., the maximum concentration[3] of each contaminant discharging into surface water is less than 10 times their appropriate groundwater "level," and there are no other conditions (e.g., the nature, and number, of discharging contaminants, or environmental setting), which significantly increase the potential for unacceptable impacts to surface water, sediments, or ecosystems at these concentrations)?

___ If yes - skip to #7 (and enter "YE" status code in #8 if #7 = yes), after documenting: 1) the maximum known or reasonably suspected concentration[3] of key contaminants discharged above their groundwater "level," the value of the appropriate "level(s)," and if there is evidence that the concentrations are increasing; and 2) provide a statement of professional judgment/explanation (or reference documentation) supporting that the discharge of groundwater contaminants into the surface water is not anticipated to have unacceptable impacts to the receiving surface water, sediments, or ecosystem.

_X_ If no - (the discharge of "contaminated" groundwater into surface water is potentially significant) - continue after documenting: 1) the maximum known or reasonably suspected concentration[3] of each contaminant discharged above its groundwater "level," the value of the appropriate "level(s)," and if there is evidence that the concentrations are increasing; and 2) for any contaminants discharging into surface water in concentrations[3] greater than 100 times their appropriate groundwater "levels," the estimated total amount (mass in kg/yr) of each of these contaminants that are being discharged (loaded) into the surface water body (at the time of the determination), and identify if there is evidence that the amount of discharging contaminants is increasing.

___ If unknown - enter "IN" status code in #8.

Rationale :

In determining whether groundwater to surface water discharges are significant for Environmental Indicator purposes, reported contaminant concentrations closest to the point of discharge are compared to site-specific groundwater screening criteria (multiplied by a factor of ten to account for dilution, dispersion, and other mitigating factors). This evaluation is conducted to ensure that surface water quality is acceptable for various activities, which may include human consumption, primary and secondary contact recreation, and industrial or agricultural usage.

The table below provides a comparison between the adjusted groundwater quality criteria and the highest levels of groundwater contamination (defined in the response to Question 2) that could be discharging to surface water. Only the four Fort Dix sites carried forward from the response to Question 4 are evaluated. The wells closest to the point of discharge are identified, and the most recent available data for each AREE has been used.

[3] As measured in groundwater prior to entry to the groundwater-surface water/sediment interaction (e.g., hyporheic) zone.

Well	Contaminant	Concentration (µg/L)	10 x GW Criteria (µg/L)	Discharge of Potential Concern?
Magazine 1 Area – AREE No. 1 / FTDX No. 07 (data from September 2005)				
MAG-108A	cis-1,2-DCE	236	700	No
MAG-108A	PCE	2.4	10	No
MAG-108A	TCE	**219**	10	Yes
NPL Sanitary Landfill – AREE No. 7 / FTDX No. 10 (data from July 2005)				
LTM-32	Benzene	1.9	10	No
LTM-33	Methylene Chloride	**73.5**	30	Yes
4400 Area Motor Pool – AREE No. 17 / FTDX No. 05B (data from October 1999)				
DIO-40S	PCE	2	10	No

* Bolded concentrations exceed the adjusted groundwater screening criteria.

Groundwater flow at AREE No. 1 (Magazine 1 Area) is toward the southwest (Ref. 3). Plume well MAG-108A is located directly upgradient of the unnamed tributary and is most likely to be representative of groundwater quality at the point of discharge to surface water. As shown in the table above, the current concentration of TCE (Ref. 6) discharging to surface water in this area exceeds the groundwater criterion by more than a factor of 10 and, thus, cannot be considered insignificant.

Groundwater flow at AREE No. 7 (NPL Sanitary Landfill) is south and southwest toward Cannon Run and the marsh along Pipeline Road (Ref. 4). As shown on Figures 3-1 and 4-3 from the Draft 2005 Sampling and Analysis Report for the Sanitary Landfill (Ref. 5), groundwater quality at the point of discharge into Cannon Run is most likely to be represented by wells LTM-12 through LTM-15. At present, none of these wells contain detectable levels of RCRA hazardous constituents and, consequently, discharges to Cannon Run are not expected to be of concern. Groundwater quality at the point of discharge into the Pipeline Road marsh is most likely to be reflected in wells LTM-15, LTM-17, LTM-18, LTM-32, and LTM-33 (Ref. 5). As shown in the table above, RCRA hazardous constituents are currently reported only in wells LTM-32 and LTM-33, and only methylene chloride exceeded its groundwater criterion by more than a factor of 10 (Ref. 5). Consequently, current discharges of methylene chloride to the Pipeline Road marsh cannot be considered insignificant.

Groundwater flow at AREE No. 17 (4400 Area Motor Pool) is toward the north-northeast, and South Run Creek is the primary potential discharge location for impacted groundwater from the 4400 Area Motor Pool (Refs. 1 and 2). As shown on Figure 4 from the AREE's Remedial Action Decision Document (Ref. 2), data from shallow wells DIO-11, DIO-12, DIO-15S, and DIO-40S are most likely to be representative of groundwater at the point of discharge into South Run. In October 1999, PCE in well DIO-40S was the only groundwater exceedance identified immediately upgradient of South Run (Ref. 2). However, because the reported PCE concentration is less than the adjusted groundwater quality screening level, discharges from this AREE into South Run are not expected to be of concern.

As stated in the response to Question 4, slightly impacted groundwater moving past POC well GLF-16 at the Golf Course Leaking UST Site (AREE No. 38/FTDX No. 19-6) may be discharging to surface water in the west pond. However, because no groundwater exceedances are currently reported in this well (Ref. 6), groundwater discharges to the west pond are not expected to be of concern.

References:

1. Final Fort Dix Environmental Investigation Report. Prepared by ICF Kaiser Engineers, Inc. Dated May 1997.
2. Final 4300 Area Spill Site, 4400 Area Spill Site Decision Document: Remedial Action. Prepared by EM Federal Corporation. Dated May 2003.
3. Final Remedial Action Work Plan Addendum for Groundwater, MAG-1 Area. Prepared by Shaw Environmental, Inc. Dated June 2005.
4. Final Five-Year Review Report for U.S. Army Fort Dix (NPL Landfill Site). Prepared by U.S. Army Corps of Engineers. Dated September 2005.
5. Draft 2005 Sampling and Analysis Report for Groundwater, Surface Water, and Sediment for the Fort Dix Sanitary Landfill. Prepared by EA Engineering, Science, and Technology, Inc. Dated December 2005.
6. Draft 2005 Sampling and Analysis Report for the CEA Comprised of the Cantonment Area, Training Area, and Satellite Sites. Prepared by EA Engineering, Science, and Technology, Inc. Dated May 2006.

6. Can the **discharge** of "contaminated" groundwater into surface water be shown to be "**currently acceptable**" (i.e., not cause impacts to surface water, sediments or ecosystems that should not be allowed to continue until a final remedy decision can be made and implemented[4])?

X If yes - continue after either: 1) identifying the Final Remedy decision incorporating these conditions, or other site-specific criteria (developed for the protection of the site's surface water, sediments, and ecosystems), and referencing supporting documentation demonstrating that these criteria are not exceeded by the discharging groundwater; OR 2) providing or referencing an interim-assessment[5], appropriate to the potential for impact, that shows the discharge of groundwater contaminants into the surface water is (in the opinion of a trained specialist, including an ecologist) adequately protective of receiving surface water, sediments, and ecosystems, until such time when a full assessment and final remedy decision can be made. Factors which should be considered in the interim-assessment (where appropriate to help identify the impact associated with discharging groundwater) include: surface water body size, flow, use/classification/habitats and contaminant loading limits, other sources of surface water/sediment contamination, surface water and sediment sample results and comparisons to available and appropriate surface water and sediment "levels," as well as any other factors, such as effects on ecological receptors (e.g., via bio-assays/benthic surveys or site-specific ecological Risk Assessments), that the overseeing regulatory agency would deem appropriate for making the EI determination.

___ If no - (the discharge of "contaminated" groundwater can not be shown to be "**currently acceptable**") - skip to #8 and enter "NO" status code, after documenting the currently unacceptable impacts to the surface water body, sediments, and/or ecosystem.

___ If unknown - skip to 8 and enter "IN" status code.

Rationale:

As stated in the response to Question 5, groundwater to surface water impacts are of potential concern due to TCE discharges into the unnamed tributary at AREE No. 1 (Magazine 1 Area) and methylene chloride discharges to the Pipeline Road marsh at AREE No. 7 (NPL Sanitary Landfill).

As stated in the Final Magazine 1 Area Decision Document (Ref. 1), surface water samples collected from the topographic depression and unnamed tributary in and prior to December 1999 contained elevated levels of TCE and 1,2-DCE. These concentrations (up to 200 and 71 µg/L, respectively) were believed to be the direct result of groundwater to surface water discharges. At that time, TCE and 1,2-DCE concentrations in groundwater at the Magazine 1 Area were both as high as 2,000 µg/L. Also according to the Final Decision Document for this area (Ref. 1), human health and ecological risk assessments developed using the December 1999 surface water data identified no unacceptable risks associated with impacted surface water in the topographic depression or unnamed tributary. It is assumed that surface

[4] Note, because areas of inflowing groundwater can be critical habitats (e.g., nurseries or thermal refugia) for many species, an appropriate specialist (e.g., ecologist) should be included in management decisions that could eliminate these areas by significantly altering or reversing groundwater flow pathways near surface water bodies.

[5] The understanding of the impacts of contaminated groundwater discharges into surface water bodies is a rapidly developing field, and reviewers are encouraged to look to the latest guidance for the appropriate methods and scale of demonstration to be reasonably certain that discharges are not causing currently unacceptable impacts to the surface waters, sediments, or ecosystems.

water TCE concentrations have declined over time below the previously reported level of 200 µg/L, as the maximum concentrations of TCE in groundwater have declined to 219 µg/L (Ref. 3). Following this line of reasoning, it is appropriate to assume that surface water continues to pose no unacceptable risks to human health or the environment, and no remedial response objectives have been developed for the area. Consequently, historic and current discharges of groundwater to surface water at AREE No. 1 appear to be acceptable.

To evaluate the significance of methylene chloride contamination discharging from groundwater to surface water in the vicinity of the NPL Sanitary Landfill (AREE No. 7), surface water and sediment samples were collected from the middle of the Pipeline Road marsh (samples SW-8 and SD-8) in the Spring and Fall of 2005. These samples contained no detectable levels of methylene chloride (Ref. 2). Thus, discharges to surface water at AREE No. 7 appear to be currently acceptable.

References:

1. Final Magazine Area 1 Decision Document. Prepared by Harding ESE, Inc. Dated August 2002.
2. Draft 2005 Sampling and Analysis Report for Groundwater, Surface Water, and Sediment for the Fort Dix Sanitary Landfill. Prepared by EA Engineering, Science, and Technology, Inc. Dated December 2005.
3. Draft 2005 Sampling and Analysis Report for the CEA Comprised of the Cantonment Area, Training Area, and Satellite Sites. Prepared by EA Engineering, Science, and Technology, Inc. Dated May 2006.

7. Will groundwater **monitoring**/measurement data (and surface water/sediment/ecological data, as necessary) be collected in the future to verify that contaminated groundwater has remained within the horizontal (or vertical, as necessary) dimensions of the "existing area of contaminated groundwater?"

   X If yes - continue after providing or citing documentation for planned activities or future sampling/measurement events. Specifically identify the well/measurement locations which will be tested in the future to verify the expectation (identified in #3) that groundwater contamination will not be migrating horizontally (or vertically, as necessary) beyond the "existing area of groundwater contamination."

   ___ If no - enter "NO" status code in #8.

   ___ If unknown - enter "IN" status code in #8.

Rationale:

A CEA was proposed for the Fort Dix Cantonment Area in 1999 (Ref. 1), and a separate CEA was established for the Sanitary Landfill (AREE No. 7) in 2002 (Ref. 2). The CEA proposed in 1999 was finalized in 2004 and includes all sites requiring long-term monitoring across the installation as of 2005, not just those in the Cantonment Area (Ref. 4). The base-wide CEA location, in reference to the individual AREE/FTDX sites, is shown on Figure 2-2 of the Draft 2005 Sampling and Analysis Report for the CEA (Ref. 3). In Table 3-1, this document also includes a summary of sampling parameters and specific wells where groundwater is being monitored.

Of the seven sites identified as having contaminated groundwater in the response to Question 2, five are included in the current CEA scope (Ref. 3). These sites include: the Magazine 1 Area, the NPL Sanitary Landfill (although still conducted and reported separately at present), the 4400 Area Motor Pool, the UST Taxi Stand Site, and the Golf Course Leaking UST. The remaining two sites are being monitored independently. The RI/FS for the Range Landfill is expected to be complete in 2007 (Ref. 5), and further delineation of BTEX impacts is planned for the Building 6045 area (Ref. 6). LTM is also underway for the UST at Building 6045 (Ref. 5). Like other recent scope expansions (Ref. 3), any required monitoring will be incorporated into the base-wide CEA.

References:

1. Final Fort Dix Cantonment Area Classification Exception Area. Prepared by ICF Kaiser Engineers. Dated February 1999.
2. Final Classification Exception Area, The Fort Dix Sanitary Landfill. Prepared by EA Engineering, Science, and Technology. Dated March 2002.
3. Draft 2005 Sampling and Analysis Report for the CEA Comprised of the Cantonment Area, Training Area, and Satellite Sites. Prepared by EA Engineering, Science, and Technology, Inc. Dated May 2006.
4. Personal communication between Bill Lewendoski, Fort Dix Environmental Division, and Amy Brezin, Booz Allen Hamilton. Dated September 14, 2006.
5. Personal communication between Michele Benchouk, Booz Allen Hamilton, and Bill Lewendoski, U.S. Army, Fort Dix. Dated February 9, 2007.
6. E-mail from Alan Straus, EPA, to Bill Lewendoski, U.S. Army, Fort Dix, re: Fort Dix Building 6045. Dated August 22, 2007.

8. Check the appropriate RCRIS status codes for the Migration of Contaminated Groundwater Under Control EI (event code CA750), and obtain Supervisor (or appropriate Manager) signature and date on the EI determination below (attach appropriate supporting documentation as well as a map of the facility).

X YE - Yes, "Migration of Contaminated Groundwater Under Control" has been verified. Based on a review of the information contained in this EI determination, it has been determined that the "Migration of Contaminated Groundwater" is "Under Control" at the U.S. Army, Fort Dix site, EPA ID# NJ4213720275, located at 5417 Alabama Avenue in Pemberton Township, Burlington County, New Jersey. Specifically, this determination indicates that the migration of "contaminated" groundwater is under control, and that monitoring will be conducted to confirm that contaminated groundwater remains within the "existing area of contaminated groundwater." This determination will be re-evaluated when the Agency becomes aware of significant changes at the facility and/or additional data become available.

___ NO - Unacceptable migration of contaminated groundwater is observed or expected.

___ IN - More information is needed to make a determination.

Completed by: _____ Date:_____
Michele Benchouk
Environmental Consultant
Booz Allen Hamilton

Reviewed by: _____ Date:_____
Amy Brezin
Environmental Consultant
Booz Allen Hamilton

Also reviewed by: _____ Date:_____
Alan Straus, RPM
RCRA Programs Branch
EPA Region 2

_____ Date:_____
Barry Tornick, New Jersey Section Chief
RCRA Programs Branch
EPA Region 2

Approved by: (signature) _____ Date: September 28, 2007
Adolph Everett, Chief
RCRA Programs Branch
EPA Region 2

Locations where references may be found:

References reviewed to prepare this EI determination are identified after each response. Reference materials are available at U.S. EPA, Region 2.

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Attachments

The following attachment has been provided to support this EI determination.

Attachment 1 - Summary of AREE/FTDX Sites
Attachment 2 - Summary of Media Impacts Table
Attachment 3 – BIOSCREEN Modeling Details

Attachment 1: Summary of AREE/FTDX Sites

U.S. Army, Fort Dix
NJ4213720275

AREE No.	FTDX No.	Site Name, History, and Description	Historic COCs	Refs.*
1	07	**Magazine 1 Area**: This area was used as an ammunition and weapon storage and vapor-degreasing area from 1917 through approximately 1965. TCE was apparently used to remove Cosmoline, a petroleum product used for packing rifles, and drums of Cosmoline-saturated TCE were reportedly poured into the holes of an on-site rubble pile for disposal. A septic tank that drained into an open pit and a fuel oil underground storage tank (UST) were located east of the rubble pile and are no longer in use; the UST was removed in 1997 with no reported contamination (Ref. 8). This site is currently used for sorting and recycling spent ammunition (Ref. 3) and is surrounded by a chain-link fence (Ref. 8). The selected remedies for this area include excavation and off-site treatment in an asphalt batching system for surface soil; monitored natural attenuation and source control with hydrogen release compounds for groundwater; and additional sampling and a five-year review for sediment, as no unacceptable human risks were determined to be present (Ref. 8). The remedy also includes land-use restrictions to limit residential development of the site and groundwater-use restrictions to prohibit the installation of supply wells at or downgradient of the site (Ref. 8). The soil removal has been completed (Ref. 30).	GW: Metals**, SVOCs, VOCs	3, 8, 23, 26, 30
2	13	**Petroleum, Oil, & Lubricants (POL) Area**: This area is located at the intersection of Rancocas Road and Lexington Avenue, in the northwest portion of the Cantonment Area. The POL Area served a warehouse and central supply function for approximately 50 years. In 1988, Fort Dix removed five USTs, two of which were reported to be leaking diesel fuel and Type II dry cleaning solvent (i.e., 100 percent aliphatic naptha) and impacted soil (Ref. 32). The subsurface soil contamination is within the paved and fenced area of the site (Ref. 30). Groundwater at this site was observed from depths of approximately 9.6 to 17.4 feet bgs (Ref. 32).	GW: Metals**, SVOCs	30, 32
3	24	**Fire Training Tanks (FTT)**: This area is located in the northwestern part of the Cantonment Area, southeast of the Fort Dix Fire Station. Two fire training tanks were formerly located in this area, with one removed in 1989 and one removed in 2004. Both tank areas were surrounded by earthen berms with plastic liners, which were removed in 2004. The FTT area was used for fire training exercises from approximately the early 1960s to the early 1980s. During these exercises, the tanks were filled with flammable wastes and set on fire. The waste products were discharged to the ground surface once the fires were extinguished. From the early 1980s until their removal, both tanks were allowed to fill and overflow with rainwater. Dogwood Brook flows along the southeast perimeter of the FTT area. During RI Addendum activities, 65 cubic yards of TPH, VOC, SVOC, and dieldrin-impacted soil were excavated from around the former tank areas and disposed/recycled, and confirmation samples indicated no residual contamination above New Jersey Residential Direct Contact Soil Cleanup Criteria (NJ RDCSCC). Potentially non-contaminated soil from the earthern berms was analyzed, and soil determined to be clean was reused as backfill, along with virgin soil as necessary. The 2006 Draft RI Addendum Report recommended NFA for soil and groundwater (Ref. 29). Fort Dix and NJDEP agreed that additional sediment and surface water sampling would be performed during the planned investigation at the Transportation Motor Pool Area, which is the suspected source of this contamination (Ref. 29).	GW: Metals** SW: Metals**, SVOCs	3, 7, 29
5	12	**Transportation Motor Pool (TMP)**: The TMP Area is located in the north central portion of the Cantonment Area, west of the FTT Area. This area is an active fuel dispensing and vehicle parking facility. The majority of the area is paved, and surface water runoff is collected by the storm sewer system that traverses the southern half of the TMP site and discharges to Dogwood Brook, located southeast of the site. Investigations conducted between 1985 and 1993 indicated that environmental media at the TMP Area may have been impacted by fuel dispensing activities, including TPH in soil. A 2006 groundwater, surface water, and sediment investigation confirmed exceedances of manganese in groundwater and surface water, and several metals and one PAH in sediment. Depth to groundwater at this site has historically ranged from 4 to 12 feet bgs.	GW: Metals** SW: Metals**	33

AREE No.	FTDX No.	Site Name, History, and Description	Historic COCs	Refs.*
6	25	**Armaments Research & Development Center (ARDC) Test Site**: The ARDC Test Site includes buildings 9985 through 9999 and a motor Fuel Storage Area east of Building 9999. It is located in a remote section of the Range and Impact Area and was used for weapons testing and analysis; spills have been documented in this area (Ref. 3). An x-ray photographic processing laboratory was also located at the site. The Fuel Storage Area contains two ASTs for fuel and 55-gallon drums for waste oils. Approximately 25 gallons of diesel fuel was spilled in the Fuel Storage Area in 1984; the top one foot of soil affected by the spill was subsequently removed and backfilled (Ref. 20). The site is occasionally used as a bivouac area for visiting troops. Two locked, chain-linked fences controlled by the Fort Dix Range Control limit site access (Ref. 13). Additionally, the site is inactive and located in a remote area. The selected remedy included excavation of VOC-impacted soils to the groundwater surface and off-site treatment and/or disposal of approximately 130 cubic yards of PCE-contaminated soil; land use restrictions through amendment of the base master plan; sampling and long-term monitoring (LTM) to determine the effectiveness of natural attenuation processes in groundwater, surface water, and sediment; and a Five-Year Review (Ref. 17). The soil removal was complete as of November 2005 (Ref. 28).	GW: Metals**, SVOCs, VOCs SW: Metals**, VOCs	3, 13, 20, 28
7	10	**NPL Sanitary Landfill**: The 130-acre Fort Dix Sanitary Landfill is located south of Browns Mills-Lewistown Road in the southern portion of the Cantonment Area. Wastes were disposed at the landfill from 1950 to 1984. Although landfill disposal records are incomplete, they indicate that the following types of wastes were historically disposed at the landfill: solid wastes; wash rack sludge; and waste paints, solvents, thinners, and pesticides. Groundwater monitoring wells were installed around the perimeter of the landfill in 1979 and 1982, and results from downgradient wells indicated the presence of VOCs at up to 14,000 parts per billion (ppb). The landfill was subsequently closed in 1984 and placed on the NPL in 1987. A ROD was signed for the landfill in 1991, and remedial action was completed in August 1996. Remedial actions included: placement of a cap over 53 acres and maintaining two feet of cover on the remainder; LTM for groundwater, surface water, and sediment; installation of a chain-link fence around the landfill perimeter; long-term operation and maintenance of the cap; implementation of deed restrictions and a classification exception area (CEA) on the landfill area; and regular risk assessments using the data obtained in the monitoring program (Ref. 24). Five-year review reports were completed in 2000 and 2005. The requirement for a CEA was fulfilled in 2002, and four additional monitoring wells will be installed to serve as sentinel wells for the CEA monitoring (Ref. 36). EPA concurred with the human health protectiveness statement in the 2005 Five-Year Review, indicating that the remedy protects human health and should continue to do so as long as the existing site controls are properly operated, monitored, and maintained (Ref. 25).	GW: Metals**, Pesticides, SVOCs, VOCs SW: Metals**, Pesticides, SVOCs, VOCs	3, 24, 25, 27, 28, 36
8	06	**Pesticide Control Storage (PCS) Shop**: Building 5352 is located on the northeastern portion of the Cantonment Area. Building 5352 was formerly used as the installation PCS and is currently used as a self-help shop. It contains home improvement supplies (e.g., paint, caulking) and is used by base residents to obtain supplies or attend training classes. Paved parking areas exist to the north, east, and south of the building. Surface water runoff drains into storm sewers that likely flow south to the outlet channel of Dogwood Lake, or north into an eastward-flowing unnamed brook. Depth to groundwater is approximately 8 to 9 feet bgs. The site is currently either paved or vegetated, so significant exposure to soil contaminants is not expected. A small area of pesticide-contaminated soil (SB-6) is present in the narrow grass strip between the northern parking lot and the building. The RI proposed performing a FS to develop alternatives for remediating the identified contamination at this site.	GW: Metals** SW: Metals**	18

AREE No.	FTDX No.	Site Name, History, and Description	Historic COCs	Refs.*
9	26	**New Egypt Armory (NEA)**: This site is located in the northwest corner of the Range and Impact Area, with the site entrance located along NJ Route 539 on the eastern boundary of Fort Dix. The site was formerly used by the Army and Air Force for radar work. The NEA is currently used for maintenance and storage of National Guard vehicles, tanks, and artillery. Runoff from this site is not expected to reach a small tributary to Jumping Brook, located approximately 1,000 feet downgradient, due to obstacles including a bermed road. The site is completely enclosed by chain link fence with a gate at the entrance. Two 1,000-gallon waste oil USTs were removed in 1997; confirmatory sampling indicated the presence of polychlorinated biphenyls (PCBs) at up to 15.3 milligrams per kilogram (mg/kg). Stockpiled soil from the excavation contained TPH at up to 4.960 mg/kg and PCBs (up to 24.4 mg/kg) above the NJ RDCSCC/NRDCSCC (0.49 mg/kg and 2 mg/kg, respectively). VOC, SVOC, and metal concentrations did not exceed the NJ NRDCSCC. The excavation was lined with polyethylene and filled with clean fill, and the PCB-contaminated soil was sent for off-site disposal. Soil and groundwater were subsequently sampled on multiple occasions through 2003 as part of the RI program. PCBs in soil were delineated to NJDEP standards, and Fort Dix performed an interim removal action (IRA) in late 2004 to remove 6,900 tons of non-hazardous PCB waste and 843.52 tons of hazardous PCB waste (Ref. 34). Confirmatory samples were collected for off-site analysis once soil field screening indicated that PCB samples were equal to or less than 1 mg/kg (Ref. 22), and the sample results confirmed that PCBs were removed above NJ RDCSCC (Ref. 34). Clean fill soil and clean site soil were used to backfill the excavations, which were then graded and subsequently seeded in early spring 2005. Excavated soil was characterized and sent off site for proper recycling and/or disposal. Exposure of site workers to PCB-contaminated surface soil is no longer a potentially complete exposure pathway due to the IRA and subsequent site restoration with clean fill and revegetation. Information on depth to groundwater is not available for this site.	GW: Metals**, PCBs, VOCs	17, 22, 34
10	16	**Range Landfill**: This landfill is a 21-acre site located in the northeastern portion of the Range and Impact Area, just southwest of the BOMARC site. The site is unfenced but is located in a remote area. The Range Landfill was reportedly used from approximately 1940 to 1975 for disposing of wastes (including rubble, refuse, old storage tanks, and miscellaneous metals) from the Range and Impact Area (Ref. 4). One of the debris areas is currently exposed at the surface, although Fort Dix plans to cover it (Ref. 34). This area is currently used as a driver training site on dirt roads between the thick brush and debris piles (Ref. 34). There is no known surface contamination (Ref. 30) and no reason for the drivers to get out of their vehicles within the landfill area (Ref. 34). Although this area is unfenced, it is located in a remote area and surrounded by dense vegetation, including brush and trees. No trespassing has been observed in this area (Ref. 34), and trespassing is considered unlikely. A 2000 Work Plan for the Range Landfill RI/FS outlined additional tasks to be performed, including an aerial survey, geophysical survey, and soil and groundwater screening (Ref. 4). Depth to groundwater ranges from 40 to 50 feet bgs (Ref. 4). The RI/FS is expected to be complete in 2007 (Ref. 35).	GW: Metals**	4, 30, 34, 35
12	18	**ANC-2 Disposal Area**: The ten-acre ANC-2 Disposal Area is located in the northwestern portion of the Cantonment Area, and approximately 7.5 acres are accessible to vehicles. However, a locked gate secures the site's only access road, preventing vehicles from entering the site; densely forested areas surrounding the 10-15 foot high soil berms around the remainder of the site further restrict access. The site was previously used for waste disposal activity, as evidenced by a pile of mounded material and debris on the site surface (Ref. 12), and it was also reportedly used as a sand and gravel excavation pit that has been backfilled (Ref. 3). More recent disposal practices have reportedly included limited landscaping materials such as grass, leaves, and wood chips. Disposal of materials other than landscaping materials is strictly prohibited, and no recent dumping was observed at the time of the RI activities. Most of the existing miscellaneous rubble and construction debris appears to be located in mounds throughout the eastern portion of the site and near the base of the soil berms at the perimeter. Depth to groundwater ranges from 25 to 35 feet bgs across the site (Ref. 12). At this time, Fort Dix has no plans to remove the debris located at this site (Ref. 12).	GW: Metals**	3, 12

AREE No.	FTDX No.	Site Name, History, and Description	Historic COCs	Refs.*
13	22	**Boiler Blowdown Area**: This area is located in the northeast portion of the Cantonment Area, one-third of a mile east of the Boiler Plant Building 5426. The site consists of an unnamed stream and its surrounding channel, which is situated approximately 12-15 feet bgs; the channel banks are very steep and are covered with heavy vegetation. Boiler blowdown was reportedly discharged to the Fort Dix storm sewer until approximately 1979. Since then, boiler blowdown has been discharged to the sanitary sewer system. Beryllium was detected at 2.75 mg/kg in one surface soil sample (NJ NRDCSCC = 2 mg/kg) in 1998 and several metals were detected above either NJ SWQC or EPA federal surface water quality criteria (water and fish ingestion), where a NJ SWQC level was unavailable. Given the one minor (less than 1.5 times), isolated surface soil exceedance, and the fact that human exposures to surface water in this area are not currently occurring (Ref. 6), no potentially complete exposure pathways were identified for this area. Fort Dix recommended NFA for the Boiler Blowdown Area (Ref. 6).	GW: None SW: Metals**	3, 6
15	35	**Golf Course Pesticide Mixing & Storage Area**: This site is located adjacent to the Golf Course Leaking UST Area (AREE 39, FTDX 19-6), within the golf maintenance portion of the Cantonment Area. This area includes Building 3150 (former Pesticide Storage Building), Building 3151 (former Herbicide Storage Building), and the pesticide mixing area located east of Building 3150. Herbicides and pesticides were historically stored and mixed for application to the golf course; pesticide mixing reportedly occurred at the site until 1985 (Ref. 9). Buildings 3150 and 3151 currently serve as maintenance and storage areas for golf course equipment. The golf course is currently in use and open to Army officers, enlisted men, and their families (Ref. 9). The selected remedial action for this area included installation of a security fence around the site perimeter to prevent direct contact with surface soil contamination, installation of signs, and performance of Five-Year Reviews (Ref. 9). The fence construction is complete (Ref. 26).	GW: None	3, 9, 26
16	05 B	**4300 Area Motor Pool**: This area contains the MOTAC refueling center, the HHC 36th Transportation Battalion Motor Pool, and parking facilities. Historical fuel spills occurred in this area (Ref. 3). VOC contamination in groundwater at this site is below applicable standards; however, it was included in the remedial action for the 4400 Area Motor Pool (Ref. 15). See the AREE 17/FTDX 05B entry for a description of the selected remedy.	GW: VOCs	3, 15
17	05 B	**4400 Area Motor Pool**: This area contains the 39th Battalion (Buildings 4439 and 4440), G-4 Maintenance (Buildings 4429 through 4434), and 195th Ordnance Battalion (Buildings 4465 through 4471) Motor Pools. Areas surrounding the associated buildings are primarily gravel or asphalt-covered and a locked, barbed wire fence surrounds each motor pool. These areas are used for storage of military vehicles and a helicopter hangar. Historical fuel spills occurred in this area (Ref. 3). The selected remedy for the 39th Battalion portion of this site includes installation of an air sparging/soil vapor extraction system combined with granular activated carbon to capture organic vapor (Ref. 15). LTM of groundwater and surface water/sediment was proposed for both the 4300/4400 Area Motor Pools, and a CEA/WUR will be implemented through the Base Master Plan to restrict groundwater use in these areas (Ref. 15).	GW: Metals**, VOCs SW: VOCs	3, 15
25	17	**EPIC-8 Landfill**: This five-acre landfill was used until sometime in the 1950s (i.e., before the Fort Dix Sanitary Landfill opened), and records indicate that no disposal restrictions were in place during its use. Material was disposed using the trench excavation method. The site is surrounded by a locked fence (Ref. 11) and is located in a remote location south of the Cantonment Area (Ref. 3). The selected remedy for the EPIC-8 Landfill includes inspection and maintenance of the existing fence at least annually, and land use restriction through the base master plan (Ref. 11). This area will be subject to five-year reviews (Ref. 11).	GW: Metals**	3, 11

AREE No.	FTDX No.	Site Name, History, and Description	Historic COCs	Refs.*
26	33	**Property Disposal Office (PDO) Landfill**: The PDO Landfill is a five-acre site that was used for storage and the unauthorized disposal of materials including domestic waste, demolition material, and miscellaneous trash, until the 1970s. There is also evidence of previous coal storage. Buildings have been removed, and this site is generally located within a remote portion of the Training Area but it is near a residential section (Ref. 3). The site is heavily vegetated with grasses, trees, and vines (Ref. 16). During an inspection of the site in March 2006, EPA observed gates at the road entrances and a fence at the adjacent residential area; the area is generally remote, wooded, and heavily vegetated (Ref. 30). A narrow stream runs through the site approximately 600 feet to the southwest of the landfill in the downgradient direction (Ref. 16). Mercury was detected in surface water and sediment samples in the first 1,400 feet of the stream downgradient of the PDO Landfill, but it was not detected in surface water or sediment approximately two miles downstream (Ref. 16). It should be noted that the maximum detected concentration of mercury in sediment (4.7 mg/kg) does not exceed the NJ RDCSCC of 14 mg/kg. However, for ecological considerations, the selected remedy includes: delineation of mercury-impacted sediments and surface water, hot spot removal along stream/wetlands, stream/wetlands restoration, groundwater monitoring, inclusion in the CEA/WUR, and a five-year review (Ref. 16).	GW: Metals** SW: Metals**, VOCs	3, 16, 21, 30
38	19 A	**UST Taxi Stand Site**: This site is located near industrial portions of the Cantonment Area and previously served as a taxi pickup area. One 1,000-gallon and two 3,000- gallon gasoline USTs, and one 1,000-gallon diesel fuel UST were located at the site; three of these were determined to have holes. The four USTs and associated contaminated soil were removed in 1993-1994. No buildings are present; the site is currently an open grassy area with large, mature trees (Ref. 3). Currently, no surface contamination is present at this site (Ref. 30). Groundwater occurs at a depth of approximately 20 feet bgs and is contaminated with BTEX and free product gasoline (Ref. 10). The selected remedy consists of characterization of non-aqueous phase liquid (NAPL) and saturated soil zones, followed by in-situ chemical oxidation destruction of NAPL and BTEX, and subsequent long-term groundwater monitoring (Ref. 10). The groundwater treatment is currently underway (Ref. 26).	GW: Metals**, SVOCs, VOCs	3, 10, 26, 30
38	19-1	**UST at Former Building 3379**: Building 3379 was formerly located within the 3300 block of the Cantonment Area and was formerly occupied by military barracks/housing. A 20,000-gallon steel UST containing heating oil was removed around 1997; the building was subsequently demolished and is now a grassy field that serves as a training area for the Army Reserve and National Guard Units (Ref. 19). The selected remedial action is delineation of TPH, which is expected to be below the unrestricted use standard of 10,000 mg/kg of total organic carbon (TOC); and injection of hydrogen release compounds (HRCs) into the VOC groundwater plume to enhance naturally occurring anaerobic bioremediation (Ref. 19), combined with groundwater monitoring (Ref. 19). The first round of HRC treatment is reportedly complete at this site (Ref. 34).	GW: VOCs	3, 19, 34
38	19-2	**UST at Building 5390**: This building is located in the Cantonment Area and was formerly a government-owned fuel service station. The removed infrastructure included three 6,000-gallon USTs and one 10,000-gallon UST containing gasoline and related piping and dispenser islands (Ref. 19). The building was subsequently used as a Dough Nut Shop until 2006. The contaminants of concern at this site were BTEX compounds in subsurface soil and MTBE in groundwater. The selected remedial action included bioventing of vadose zone soils and in-situ bioremediation of soil and groundwater, combined with groundwater monitoring (Ref. 19). The most recent groundwater sampling results reportedly came back clean; therefore, the bioventing was discontinued at this site (Ref. 34). Building 5390 had not been re-occupied as of August 11, 2006 (Ref. 34).	GW: VOCs	3, 19, 34

AREE No.	FTDX No.	Site Name, History, and Description	Historic COCs	Refs.*
38	19-3	**UST at Building 6045**: This building formerly functioned as a gasoline station with a gasoline UST of unknown capacity, associated piping, and one 1,000-gallon heating oil UST. Following removal of the gasoline UST and piping, MTBE-contaminated groundwater was identified (Ref. 19). One round of chemical oxidation treatment was completed performed and xylene-impacted soil (below NJ RDCSCC) was reportedly removed from Building 6045 (Refs. 34 and 35). BTEX was reported above the NJ GWQC in groundwater during most recent sampling rounds (Ref. 38). Additional source soil removal actions and delineation of BTEX impacts are planned (Refs. 38, 39). This building is currently used for storage of recreation equipment (Ref. 30). LTM for groundwater is underway (Ref. 35).	GW: VOCs	3, 19, 30, 34, 35, 38, 39
38	19-4	**UST at Building 6605**: This site is located in the 6600 block of the Cantonment Area and was originally constructed as a leaded gasoline fueling station. Three corroded 2,500-gallon USTs were removed in March 1998, but post-excavation samples were below applicable soil criteria (Ref. 19). The building was demolished prior to September 2000. Natural attenuation has occurred at this site and only one well reported VOC concentrations above NJ GWQC in March 2003 (Ref. 19). Monitored natural attenuation was the selected remedy at this site (Ref. 19).	GW: VOCs	3, 19
38	19-5	**UST at Building 7061**: This building is the New Lisbon potable water pumping station and is located off the main Fort Dix site. A 290-gallon UST was removed in 1997 and observed to be in poor condition (Ref. 19). The selected remedial action was installation of an additional groundwater monitoring well, bioventing of soil impacted by xylenes below NJ RDCSCC, injection of oxygen release compounds (ORCs) to treat BTEX-contaminated groundwater, and groundwater monitoring (Ref. 19).	GW: VOCs	3, 19
38***	19-6	**Golf Course Leaking UST**: A 1,000-gallon steel UST dating from 1960 was removed in 1984, after an oily sheen was observed on the surface of a nearby stream. The leaking tank and associated soil were removed and remediated in 1984. The primary contaminants of concern are petroleum-related compounds that were released from the leaking UST (Ref. 5). An actively used golf clubhouse (Building 3152) and parking lot are located just south of the former UST location. In March 1998, excavation performed for a demolition/construction project at the clubhouse uncovered oily soil, which was excavated and disposed. A leaking 1,000-gallon fuel oil UST located upgradient from the impacted soil had been removed in February 1997 (Ref. 5). Subsurface soil and groundwater contamination remain underneath the clubhouse and parking lot (Ref. 30). The Draft 2001 Site Investigation Report presented the results of natural attenuation modeling suggesting that benzene in groundwater was undergoing natural bioremediation and recommended monitored natural attenuation combined with LTM and inclusion in the CEA (Ref. 5). This site has been included in the final Fort Dix CEA and a Five-Year Review is planned (Ref. 5).	GW: Metals**, SVOCs, VOCs	3, 5, 30
38	19-7	**UST at Range Road Areas A, B, C**: The Range Road sites are located in the 8100 and 8200 blocks of Fort Dix in the Training Area and include 24 former heating oil USTs. These sites were formerly military barracks that were demolished prior to the UST removals. The southern half of the 8200 block is currently used as an active motor pool. The suggested remedial action is installation of ORC socks at four monitoring wells to enhance existing microbial activity, monitored natural attenuation, and inclusion of these sites in the Final CEA for Fort Dix (Ref. 14).	GW: SVOCs, VOCs	3, 14

***** Reference numbers listed in this column correspond to the references at the end of the response to Question 2.

** Metals included as constituents of concern during site investigation were not limited to RCRA hazardous constituents as outlined in Appendix VIII to 40 CFR Part 261. However, only hazardous constituents are considered for purposes of EI assessment.

*** AREE 38, FTDX 19-6 was previously designated as AREE 4, FTDX 11 (Ref. 26).

Attachment 2: Summary of Media Impacts Table

U.S. Army, Fort Dix
NJ4213720275

AEC or SWMU	GW	AIR (Indoors)	SURF SOIL	SURF WATER	SED	SUB SURF SOIL	AIR (Outdoors)	CORRECTIVE ACTION MEASURE	KEY CONTAMINANTS
Groundwater	Yes	No	No	Yes	No	No	No	Basewide CEA and independent LTM in place Well use restriction in place to prevent well installation in shallow groundwater within the existing area of impact	VOCs, SVOCs, Inorganics

Attachment 3: BIOSCREEN Modeling Details

U.S. Army, Fort Dix
NJ421372027

BIOSCREEN Natural Attenuation Decision Support System

Air Force Center for Environmental Excellence — *Version 1.4*

Fort Dix, NJ / *Bldg 6045 Area* — *Run Name*

1. HYDROGEOLOGY

Seepage Velocity*	*Vs*	486.7	*(ft/yr)*
or		↑ *or*	
Hydraulic Conductivity	*K*	3.9E-02	*(cm/sec)*
Hydraulic Gradient	*i*	0.003	*(ft/ft)*
Porosity	*n*	0.25	*(-)*

2. DISPERSION

Longitudinal Dispersivity	*alpha x*	26.4	*(ft)*
Transverse Dispersivity*	*alpha y*	2.6	*(ft)*
Vertical Dispersivity*	*alpha z*	0.0	*(ft)*
or		↑ *or*	
Estimated Plume Length	*Lp*	1200	*(ft)*

3. ADSORPTION

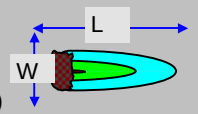
Retardation Factor*	*R*	1.3	*(-)*
or		↑ *or*	
Soil Bulk Density	*rho*	1.7	*(kg/l)*
Partition Coefficient	*Koc*	38	*(L/kg)*
FractionOrganicCarbon	*foc*	1.0E-3	*(-)*

4. BIODEGRADATION

1st Order Decay Coeff*	*lambda*	2.8E+0	*(per yr)*
or		↑ *or*	
Solute Half-Life	*t-half*	0.25	*(year)*
or Instantaneous Reaction Model			
Delta Oxygen*	*DO*	5.8	*(mg/L)*
Delta Nitrate*	*NO3*	6.3	*(mg/L)*
Observed Ferrous Iron*	*Fe2+*	16.6	*(mg/L)*
Delta Sulfate*	*SO4*	24.6	*(mg/L)*
Observed Methane*	*CH4*	7.2	*(mg/L)*

5. GENERAL

Modeled Area Length*	1500	*(ft)*
Modeled Area Width*	0	*(ft)*
Simulation Time*	3	*(yr)*



Data Input Instructions:

115 → *1. Enter value directly....or*

↑ *or*

0.02 → *2. Calculate by filling in grey cells below. (To restore formulas, hit button below).*

Variable* → *Data used directly in model.*

20 → *Value calculated by model. (Don't enter any data).*

6. SOURCE DATA

Source Thickness in Sat.Zone* 10 *(ft)*

Source Zones:

Width* (ft)	Conc. (mg/L)*
60	5.71
0	0
0	0

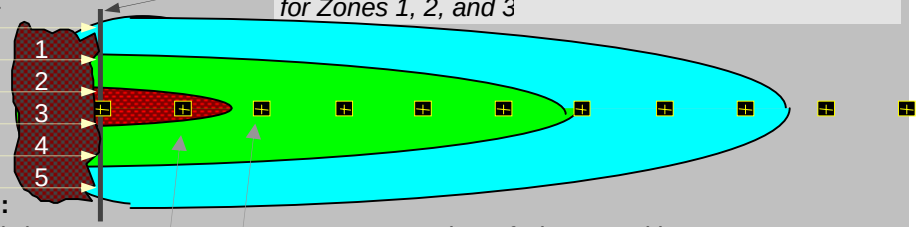
Source Halflife (see Help):

50	200	*(yr)*
Inst. React.	↑ 1st Order	

Soluble Mass 3264 *(Kg)*

In Source NAPL, Soil

Vertical Plane Source: Look at Plume Cross-Section and Input Concentrations & Widths for Zones 1, 2, and 3



View of Plume Looking Down

Observed Centerline Concentrations at Monitoring Wells
If No Data Leave Blank or Enter "0"

7. FIELD DATA FOR COMPARISON

Concentration (mg/L)	5.71										
Dist. from Source (ft)	*0*	*150*	*300*	*450*	*600*	*750*	*900*	*1050*	*1200*	*1350*	*1500*

8. CHOOSE TYPE OF OUTPUT TO SEE:

RUN CENTERLINE — **View Output**

RUN ARRAY — **View Output**

Help | Recalculate This Sheet

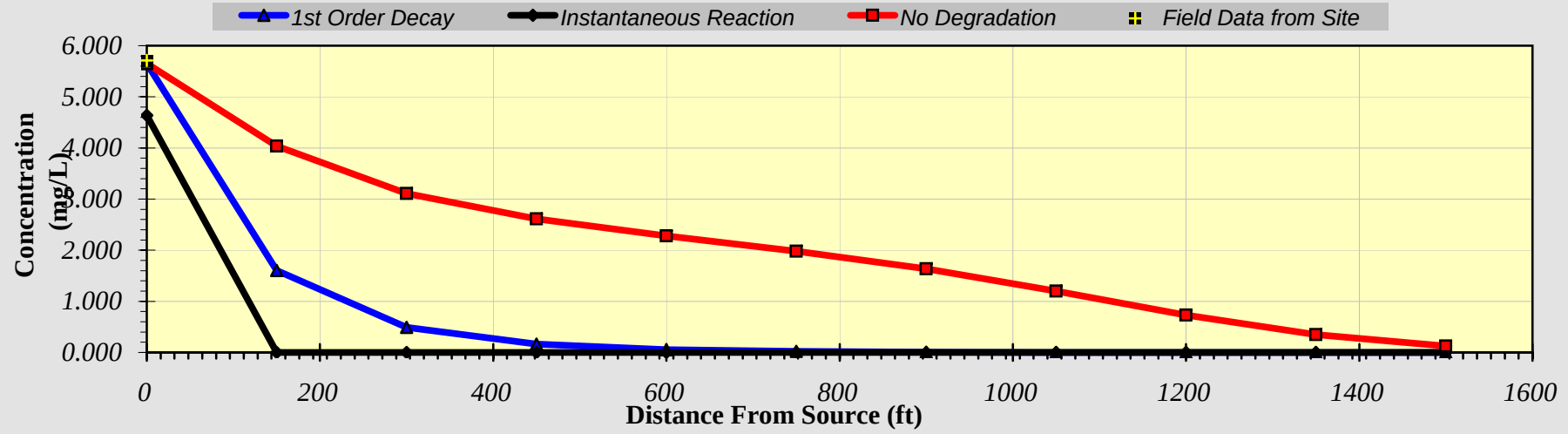
Paste Example Dataset

Restore Formulas for Vs, Dispersivities, R, lambda, other

DISSOLVED HYDROCARBON CONCENTRATION ALONG PLUME CENTERLINE (mg/L at Z=0)

Distance from Source (ft)

TYPE OF MODEL	0	150	300	450	600	750	900	1050	1200	1350	1500
No Degradation	5.648	4.036	3.108	2.613	2.278	1.982	1.636	1.199	0.732	0.351	0.128
1st Order Decay	5.648	1.601	0.489	0.163	0.057	0.020	0.007	0.003	0.001	0.000	0.000
Inst. Reaction	4.635	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Field Data from Site	5.710										



Calculate Animation

Time: 3 Years

Return to Input

Recalculate This Sheet

BIOSCREEN Modeling Inputs and Assumptions

AREE No. 38/FTDX No. 19-3, UST at Building 6045
BTEX Contamination in Groundwater

1. Hydraulic conductivity values were taken from the Fort Dix Regional Groundwater Study, Table 2, for the Cohansey/Kirkwood formation (Ref. 3).

   Horizontal conductivity = 111.01 ft/day ("worst case" arithmetic mean used)
   = 0.0392 cm/sec

2. Hydraulic gradient was determined using March 2007 groundwater elevations on the Site 6045 Monitoring Well Sample Results Through March 2007 map (Ref. 5). Wells FD6045-MW1 and MW2 were used to establish an average gradient. The gradient appears somewhat steeper between wells FD6045-MW1 and MW5, and shallower between wells FD6045-MW4 and MW6.

   Rise in groundwater elevation = 130.06 - 129.92 = 0.14 feet
   Distance between wells = 45 feet

   Gradient = rise/run = 0.014/45 ft/ft = 0.003 ft/ft

3. Effective porosity is based on BIOSCREEN instructions (Ref. 1), which indicate that a commonly used value for silts and sands is 0.25. Section 3.3.3 of the Remedial Action Work Plan (RAWP) for 7 Former UST sites (Ref. 4) described the Building 6045 area geology as "fine to coarse sand with trace amounts of silt and clay."

4. Estimated plume length was determined using Method 2 in the BIOSCREEN instructions (Ref. 1). Selected value is larger (and more conservative) than typical values presented in the BIOSCREEN instructions for benzene, toluene, ethylbenzene, and xylene (BTEX) plumes.

5. Default values were used for soil bulk density (1.7 kg/L), organic carbon partition coefficient (38 L/kg for benzene), fraction organic carbon (0.001), and source thickness (10 feet). Median values were used for instantaneous reaction model input parameters.

6. Commonly used value of 90 days (0.25 year) was used for benzene half life.

7. Modeled area length was selected as the distance to the tributary of concern (i.e., 1500 feet). Modeled area width has no impact on model results, as only the centerline model was run, so a value of 0 was entered. Simulated timeframe (3 years) was selected as the minimum number of years that results in no further plume expansion.

8. Source width (60 feet), concentration (5.71 mg/L), and field data (0 feet from source) were estimated using the March 2007 map (Ref. 5) and following directions in the BIOSCREEN instructions (Ref. 1). Because the exact source area has not been determined, the model was run under the assumption that the source exists around well FD6045-MW6. The detected BTEX concentration of 5,710 µg/L was conservatively assumed to be comprised solely of benzene for the purposes of this modeling effort.

9. Source mass is determined based on an estimate of spilled material. According to the RAWP for 7 Former UST sites (Ref. 4), this area included a gasoline underground storage tank (UST) of unknown capacity, a 1,000-gallon heating oil UST, and approximately 160 feet of associated piping. Assuming a conservative capacity of 10,000 gallons for the gasoline UST and a rough pipe diameter of 12 inches, a total of approximately 12,000 gallons of petroleum product could have been managed in this area. For purposes of this modeling effort, we will conservatively assume that all of the petroleum has been released. One gallon of gasoline is approximately 6 pounds or 2.72 kg. Thus, there is a potential total mass of spilled fuel of 32,640 kg of gasoline. As indicated in the BIOSCREEN instructions (Ref. 1), BTEX represents only 5-15% of the total mass of gasoline. Therefore, a conservative estimate of dissolvable mass is 3,264 kg (10% of total mass).

References

1. BIOSCREEN Natural Attenuation Decision Support System, EPA/600/R-96/087. Prepared by the U.S. Environmental Protection Agency (EPA) Office of Research and Development. Dated August 1996. Available at: http://www.epa.gov/ada/download/models/bioscrn.pdf.

2. BIOSCREEN Model, Version 1.4. Prepared by Air Force Center for Environmental Excellence. Dated July 1997. Available at: http://www.epa.gov/ada/csmos/models/bioscrn.html.

3. Fort Dix Regional Groundwater Study, Volume 1 - Hydrogeologic Conceptualization Report. Dated August 1997.

4. Final Remedial Action Work Plan, 7 Former UST Sites. Prepared by Shaw Environmental, Inc. Dated May 2004.

5. Site 6045 Monitoring Well Sample Results Through March 2007 map. Prepared by Shaw Environmental, Inc. Dated April 2, 2007. (Provided via e-mail from Bill Lewendoski, U.S. Army, Fort Dix, to Alan Straus, EPA, on August 15, 2007.)