Proposed Plan for
BOMARC OT-16 Trichloroethene Groundwater Plume
Joint Base McGuire-Dix-Lakehurst, New Jersey

Department of the Air Force

Air Force Announces Proposed Plan

This Proposed Plan identifies the Preferred Alternative for cleaning up contaminated groundwater at the Boeing Michigan Aeronautical Research Center (BOMARC) OT-16 Trichloroethene (TCE) Groundwater Plume, Joint Base McGuire-Dix-Lakehurst (JB MDL), New Jersey and provides the rationale for this preference. The Preferred Alternative is Alternative 5, Zero Valent Iron (ZVI) Permeable Reactive Barrier (PRB), Institutional Controls and Long Term Monitoring. In addition, this Proposed Plan includes summaries of other cleanup alternatives evaluated for use at this site.

This document is issued by the Department of the Air Force (USAF), the lead agency for site activities, and the New Jersey Department of Environmental Protection (NJDEP), the support agency. The USAF, in consultation with the NJDEP, will select a final remedy for the site after reviewing and considering all information submitted during the 30-day public comment period. The USAF, in consultation with the NJDEP, may modify the Preferred Alternative or select another response action presented in this Plan based on new information or public comments. Therefore, the public is encouraged to review and comment on all the alternatives in this Proposed Plan.

The USAF is issuing this Proposed Plan as part of its public participation responsibilities under Section 117 (a) of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA, 42 USC § 9617(a) and Section 300.430(f)(2) and (f)(3) of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). Because JB MDL is an active federal facility, environmental activities at the base conform to the rules and guidance specific to projects performed under CERCLA and the NCP, per the Voluntary Cleanup Agreement between NJDEP and the Department of Defense including the US Department of the Air Force (August 30, 2000).

This Proposed Plan summarizes information that can be found in greater detail in the remedial investigation (RI) and feasibility study (FS) reports and other documents contained in the Administrative Record file for this site. The USAF and the NJDEP encourage the public to review these documents to gain a more comprehensive understanding of the site and the proposed remedial actions that are planned.

MARK YOUR CALENDARS

PUBLIC COMMENT PERIOD:
February 9, 2012-March 9, 2012
The USAF will accept written comments on the Proposed Plan during the public comment period. Comment letters must be postmarked by March 9, 2012 and should be submitted to:

Curtis A. Frye
Chief, Environmental Restoration Program
87th CES/CEAN
2403 Vandenberg Avenue
Joint Base McGuire-Dix-Lakehurst, NJ 08641

Email: Curtis.Frye@us.af.mil
Fax: (609) 754-2096
To request an extension send a request in writing to Curtis A. Frye by 5:00 PM, March 9, 2012

PUBLIC MEETING:
The USAF will hold a public meeting to explain the Proposed Plan and all of the alternatives presented in the Feasibility Study-BOMARC OT-16 Trichloroethene Groundwater Plume, August 2011. Oral and written comments will also be accepted at the meeting. The meeting will be held:

February 9, 2012 at 6:30PM
Edward Holloway Senior Citizen Community Center
Main Street, Cookstown, NJ 08511
FOR MORE INFORMATION, SEE THE ADMINISTRATIVE RECORD FILE AT THE FOLLOWING LOCATIONS:

Burlington County Library
5 Pioneer Blvd.
Westampton, NJ 08060
[(609) 267-9660]
Hours:
Sun, 1 p.m. – 5 p.m.
Mon, 9 a.m. – 9 p.m.
Tues – Fri, 10 a.m. – 9 p.m.
Sat, 9 a.m. – 5 p.m.

U.S. EPA Region II
Records Center,
290 Broadway, 18th Floor
New York, NY 10007-1866
[(212) 637-3261]
Hours:
Mon – Fri, 9 a.m. – 5 p.m.

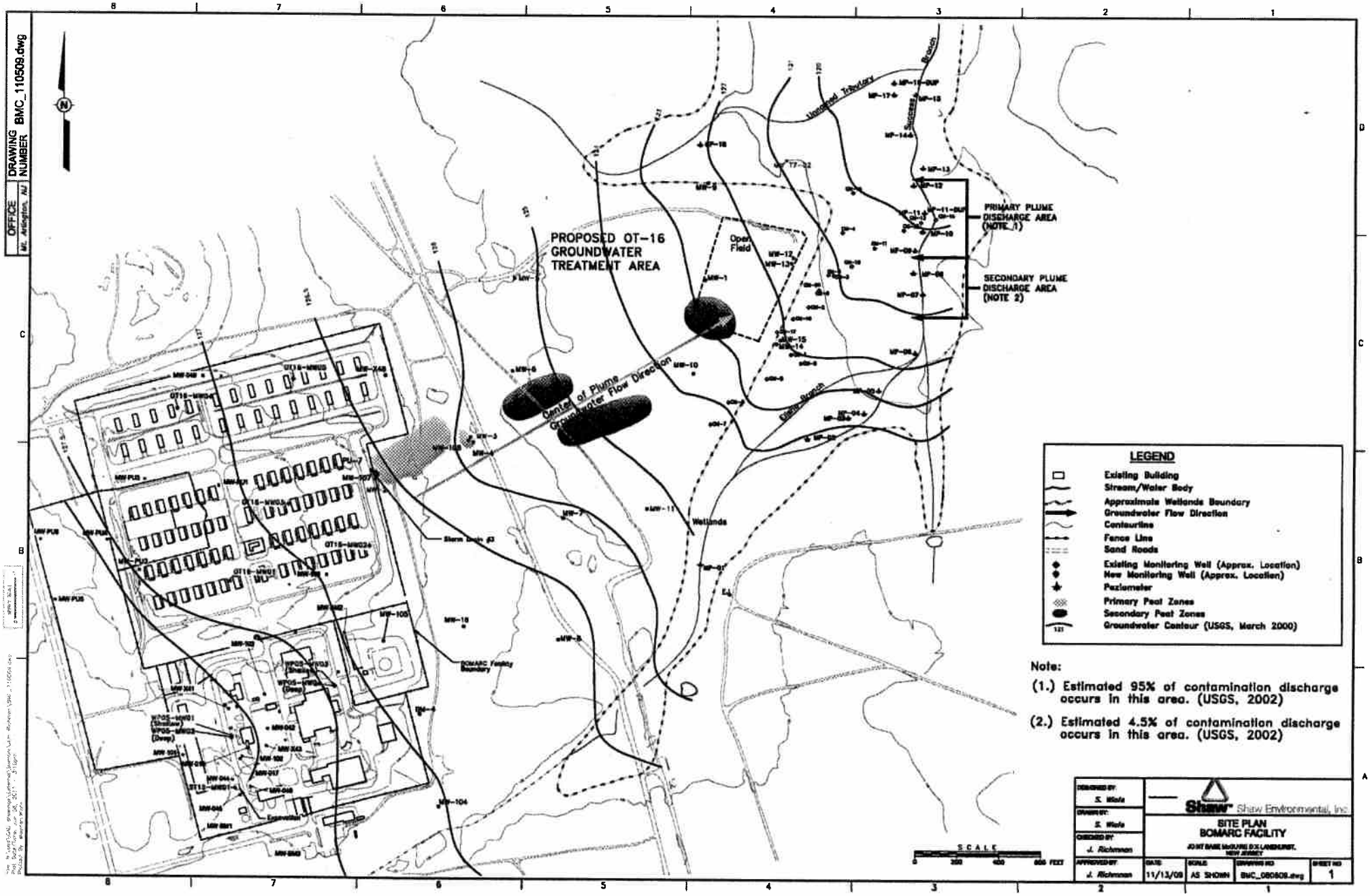
Site History and Background

This Proposed Plan addresses the proposed remediation of the BOMARC TCE plume (referred to as OT-16) at Joint Base McGuire-Dix-Lakehurst (JB MDL) located in south-central New Jersey. BOMARC is an inactive facility situated on 218 acres of rural land that the Air Force leased from Fort Dix. In 2009, with the advent of joint basing, this parcel was permanently transferred to the Air Force. The site is located in the Pinelands National Reserve, approximately 11 miles east of the McGuire portion of JB MDL in Plumsted Township, Ocean County, New Jersey. The BOMARC facility was constructed in the mid-1950s and was deactivated in 1972.

The BOMARC missile facility was established in 1958 and housed 84 surface-to-air missiles (56 liquid-fueled and 28 solid-fueled), each with a nuclear warhead. The facility was one of many similar facilities along the eastern seaboard of the United States, together providing a network of protection against incoming hostile aircraft. In 1960, a fire completely destroyed a missile and warhead. During firefighting operations, several contaminants were released into the subsurface, including plutonium and americium. The facility was closed in 1972. Radioactive material from the 1960 fire has been removed.

The environmental media of concern at the OT-16 site is groundwater and surface water. Currently, TCE impacted groundwater discharges to the surface waters of Success Branch approximately 2,500 ft – 3,000 ft east of the BOMARC facility. TCE and its breakdown product, cis-1,2-dichloroethene (cis-DCE), have been identified in groundwater at concentrations exceeding chemical-specific Applicable or Relevant and Appropriate Requirements (ARARs) for groundwater. These same compounds have been identified in surface water at concentrations exceeding chemical-specific ARARs for surface water.

There is no known documentation of either the usage or disposal of TCE at the site. However, TCE was widely used by general industry as a degreasing agent during the period of facility operation (1958 through 1972). TCE was first identified in groundwater in late 1986/early 1987 after the installation and sampling of several monitoring wells within the BOMARC facility. Since then, several focused environmental investigations have been completed at OT-16 to determine the source of the TCE and the extent of the TCE plume. Previous investigations indicated that the TCE plume originated as a point source near Storm Drain No. 3, located at the BOMARC facility eastern fence line (see **Figure 1**). Various investigations suggest the storm drain, which is approximately 3,000-ft from Success Branch, was the original source of TCE plume. The storm drain no longer serves as the source of TCE contamination to groundwater and surface water. The present sources of TCE are mulitple discontinuous lenses of peat that vary in size and thickness, to a depth of approximately 45 feet below ground surface, and are scattered between the



Note:

(1.) Estimated 95% of contamination discharge occurs in this area. (USGS, 2002)

(2.) Estimated 4.5% of contamination discharge occurs in this area. (USGS, 2002)

OFFICE: Mt. Arlington, NJ
DRAWING NUMBER: BMC_110509.dwg

DESIGNED BY: S. Wells	Shaw Environmental, Inc.			
DRAWN BY: S. Wells	SITE PLAN BOMARC FACILITY			
CHECKED BY: J. Richman	JOINT BASE MCGUIRE-DIX-LAKEHURST, NEW JERSEY			
APPROVED BY: J. Richman	DATE: 11/13/09	SCALE: AS SHOWN	DRAWING NO: BMC_080609.dwg	SHEET NO: 1

facility fence and Success Branch. Peat is a natural organic material that forms as the result of the decomposition of vegetative material over several millennia. It is also the precursor of coal. The peat zones have adsorbed the TCE in groundwater and are currently acting as a persistent continuous source by desorbing the TCE back into groundwater in the dissolved phase.

Eight previous investigations were completed at the BOMARC site that focused on the OT-16 TCE groundwater plume; the reports are summarized as follows:

1. Groundwater Screening Investigation

An investigation was conducted by the Air Force from 1995 to 1997. The investigations included the collection of groundwater and surface water samples from the site and the collection of soil samples within the Storm Drain No. 3 source area. The results are provided in the report *Groundwater Screening Survey Report, Final Engineering Evaluation/Cost Analysis* (TetraTech, 1998). These investigations provided a preliminary delineation of the plume of TCE contamination extending from the BOMARC facility to the discharge point of Success Branch. TCE and cis-DCE were the primary contaminants found in groundwater. The highest concentration of TCE in groundwater was 6,400 parts per billion (ppb) at the source area, which is in the vicinity of Storm Drain No. 3. The report recommended the installation of an array of monitoring wells to further investigate the plume.

2. Draft Engineering Evaluation/Cost Analysis

As a follow-up to the initial groundwater screening evaluation, the Draft Engineering Evaluation/Cost Analysis (EE/CA) (Tetra Tech, 1999) resulted in the collection of additional groundwater samples and the installation of 16 monitoring wells. Groundwater sampling provided additional information on the horizontal and vertical extent of the plume. The highest TCE concentration was detected at a concentration of 420 ppb, approximately 2,000 feet from the eastern fence line.

A screening level risk assessment was conducted as part of the EE/CA. The risk assessment indicated an unacceptable risk via the drinking water exposure route with the primary risk driver being TCE contamination. No unacceptable risks were found for exposure to soil or surface water.

The EE/CA was conducted following CERCLA guidance. The remedial alternatives evaluated as part of the EE/CA included: natural attenuation; institutional controls and monitoring; biostimulation via methane injection; and, in situ chemical oxidation.

The proposed remedial action resulting from the EE/CA was institutional controls and monitoring. The EE/CA concluded that institutional controls already in place for the Pinelands National Reserve prohibit development and preclude the use of the groundwater as a drinking water source, and therefore eliminates the unacceptable human health risk.

3. Natural Attenuation Assessment of Groundwater

The United States Geological Survey (USGS) conducted investigations of natural degradation processes at the site and the results are described in the report *Draft Assessment of Ground-water Quality and Natural Attenuation Potential East of the Former BOMARC Missile Installation in Plumsted Township, New Jersey, November 1999-May 2000* (USGS, 2001).

As part of the investigation the USGS collected groundwater and surface water samples with analysis for Volatile Organic Compounds (VOCs) and a suite of water quality and natural attenuation parameters. USGS determined the presence of cis-DCE in the groundwater provides evidence that reductive dehalogenation of TCE is occurring in the aquifer. Dehalogenation is

the process of removing the chlorine molecules from a contaminant (such as TCE). By removing a chlorine molecule in this "parent" compound, the contaminant is reduced to another compound referred to as the "daughter" compound; thus, the resulting contaminant concentration is decreased for the "parent" compound but is increased for the "daughter" compound. As the process continues of reducing "parent and daughter" compounds, the contaminants are reduced to a non-toxic compound. The results concluded that natural attenuation of chlorinated ethers may be useful as a remediation technique in the wetlands portion of the plume.

4. Surface Water Investigation

The USGS conducted additional surface water investigations and described the results in the report *Investigation of Surface Water Quality and Ground Water Quality Discharging to Streams East of the Former BOMARC Missile Installation, Plumsted Township, New Jersey, July and August 2002* (USGS, 2002).

As part of the investigation, stream flow was measured, which confirmed that the stream in this area was a gaining stream receiving groundwater inflow from the underlying aquifer. The majority of TCE contamination discharge (i.e. 95 percent of the TCE contamination) occurs over a relatively short reach of 375 feet in Success Branch; a minor secondary discharge area (i.e. 4.5 percent of the TCE contamination) occurs immediately upstream of this primary discharge area to a point approximately 50-ft downstream of the Elisha/Success Branch confluence; the remaining 0.5 percent is considered insignificant relative to the primary and secondary discharge areas. The total mass of TCE discharging to the stream was calculated at 16 kilograms per year.

5. Natural Attenuation Assessment of TCE in Groundwater by Wetlands

This investigation, conducted by USGS and Air Force Research Laboratory (ARFL) in 2003, involved an additional detailed investigation of the natural attenuation processes occurring within the wetlands at the site. The investigation methods and results are described in the report *Natural Attenuation of Chlorinated Solvent Ground-Water Plumes Discharging to Wetlands* (USGS and AFRL, 2003).

The purpose of the study was to determine the extent of natural attenuation of chlorinated solvents occurring in wetlands located in different hydrogeologic environments. The BOMARC TCE plume was one of two DoD sites selected for detailed investigation.

As part of the investigation, the USGS installed a number of multi-level groundwater sampling devices to monitor halogenated hydrocarbon degradation occurring in both the non-wetlands portion of the aquifer and the wetlands portion of the aquifer. Several rounds of samples were used to provide data for the study.

The results of the study indicated substantial biodegradation is occurring in the wetlands portion of the aquifer. The USGS concluded that biodegradation beyond cis-DCE was inefficient at the BOMARC site due to the naturally acidic condition of the groundwater and the inability to consistently maintain anaerobic conditions.

6. Remedial Investigation of the BOMARC TCE Plume (Phase 1 RI)

A Remedial Investigation (RI) was conducted between 2001 and 2002 and the results were described in the *Draft Remedial Investigation Report, Delineation of the BOMARC Trichloroethene Groundwater Plume at the Boeing Michigan Aeronautical Research Center* (URS, 2003).

The investigations were conducted in collaboration with the USGS investigations.

The RI included sampling of groundwater, surface water, and soil. The report provides a detailed description of the extent of contamination in these media. TCE and the breakdown product cis-DCE were the only significant constituents identified in groundwater.

The extent of the TCE plume was determined to be bounded by Elisha Branch, Success Branch, and the unnamed tributary. Groundwater sampling on the eastern side of these steams did not indicate the presence of contamination and no evidence of underflow beneath these streams was found. TCE was detected in the surface water of Success Branch approximately 4,000 feet downstream of the core discharge area of the plume. TCE was also detected in stream sediment samples approximately 2,500 ft downstream of the core discharge area; with the highest concentration being 20 ppb.

7. Remedial Investigation of TCE Source Areas (Phase 2 RI)

The Phase I RI was followed by a Phase 2 RI in 2004; the results were reported in the *Draft OT-16 TCE Source Area Remedial Investigation Report* (SAIC and Hayworth Engineering, 2005).

The primary objective of this project was to spatially determine the chlorinated VOC source area suspected to exist within or in close proximity to the BOMARC facility. The secondary objective was to spatially determine the presence of any groundwater plumes originating from the peat source area.

The primary TCE source area was identified in the northeastern portion of the site, just east of the BOMARC facility fence-line. This source area was determined to be confined to a discontinuous peat layer approximately 45 feet below ground surface. The source area accounted for the distribution of dissolved-phase TCE in groundwater observed at the site. The amount of TCE mass present in the primary source area was roughly estimated to be approximately 180 kilograms (kg). The persistence of this source was estimated to be approximately 152 years; actual TCE source area persistence was likely to be longer due to rate-limited desorption phenomena of the TCE from the peat and the presence of additional peat source. The dominance of TCE in the peat layers and groundwater, coupled with the absence of significant reductive de-chlorination daughter products within and surrounding the primary source area, suggested either: (1) oxygen enriched conditions exist in the peat and groundwater plume, or (2) conditions exist that are inhibitory to microbially-induced reductive de-chlorination. Intrinsic bioremediation of TCE within the primary source area is negligible.

8. Remedial Investigation of Additional TCE Source Areas and Groundwater (Phase 3 RI)

The Phase 2 RI was followed by a Phase 3 RI between 2005 and 2007; the results were reported in the *Final Remedial Investigation, Additional TCE Source Areas and TCE-Contaminated Groundwater* (SAIC and Hayworth Engineering, 2008). The Phase 3 RI was conducted to determine if additional peat or residual soil source areas were present at the BOMARC site. The investigation focused on the subsurface peat layers within the aquifer as a possible area of adsorbed contamination, similar to the conditions identified in the Phase 2 RI.

The report concluded that the spatial distribution of TCE in groundwater is a single plume that originally emanated from Storm Drain No. 3. The TCE discharged from this drain, percolated through the subsurface and was adsorbed by the discontinuous peat layers beneath the storm drain (due to the peat's high carbon content and physical affinity to adsorb TCE) or migrated downgradient along the natural groundwater flow. The TCE adsorbed by the primary peat layers slowly desorbs from

the peat and dissolves into the surrounding groundwater, continuing to migrate downgradient along the natural groundwater flow path. The TCE continues to adsorb/desorb within the discontinuous secondary peat layers located between the primary source area and Success Branch, eventually discharging to the surface water of Success Branch. TCE concentrations as high as 3.5 ppm were found in saturated samples of the secondary peat layers.

The investigation delineated three additional peat areas, described as secondary peat sources, that continually act as sources of TCE groundwater contamination via desorption of TCE from the peat. The four peat source areas extend approximately 1,800 feet downgradient from Storm Drain No. 3. The total combined surface area of the primary and secondary peat sources is estimated to be approximately 254,000 square feet or approximately 6 acres.

As part of the Phase 3 RI, a baseline ecological risk assessment (ERA) and supporting macroinvertebrate survey and field ecological surveys for amphibians, fish and plants, were conducted in accordance with USEPA Ecological Risk Assessment Guidance for Superfund and NJDEP guidance. The ecological risk characterization concluded there was no indication of unacceptable ecological risks due to the contamination at the site.

In an August 13, 2009 letter, the NJDEP approved the *Final Remedial Investigation Report, Additional TCE Source Areas and TCE-Contaminated Groundwater, OT-16, McGuire AFB, New Jersey* (SAIC and Hayworth Engineering, 2008).

Site Characteristics

The BOMARC facility is located entirely within the New Jersey Pinelands. The New Jersey Pinelands is a unique ecological region that is designated the Pinelands National Reserve. The Pinelands National Reserve is protected by state and federal regulations due to its unique ecological and hydrologic resources. BOMARC is surrounded by forests, wetlands, wildlife management areas, and other portions of JB MDL. The surrounding forests are typical of the New Jersey Pinelands and are dominated by pitch pine and scrub oak with stands of Atlantic white cedar in wetter areas.

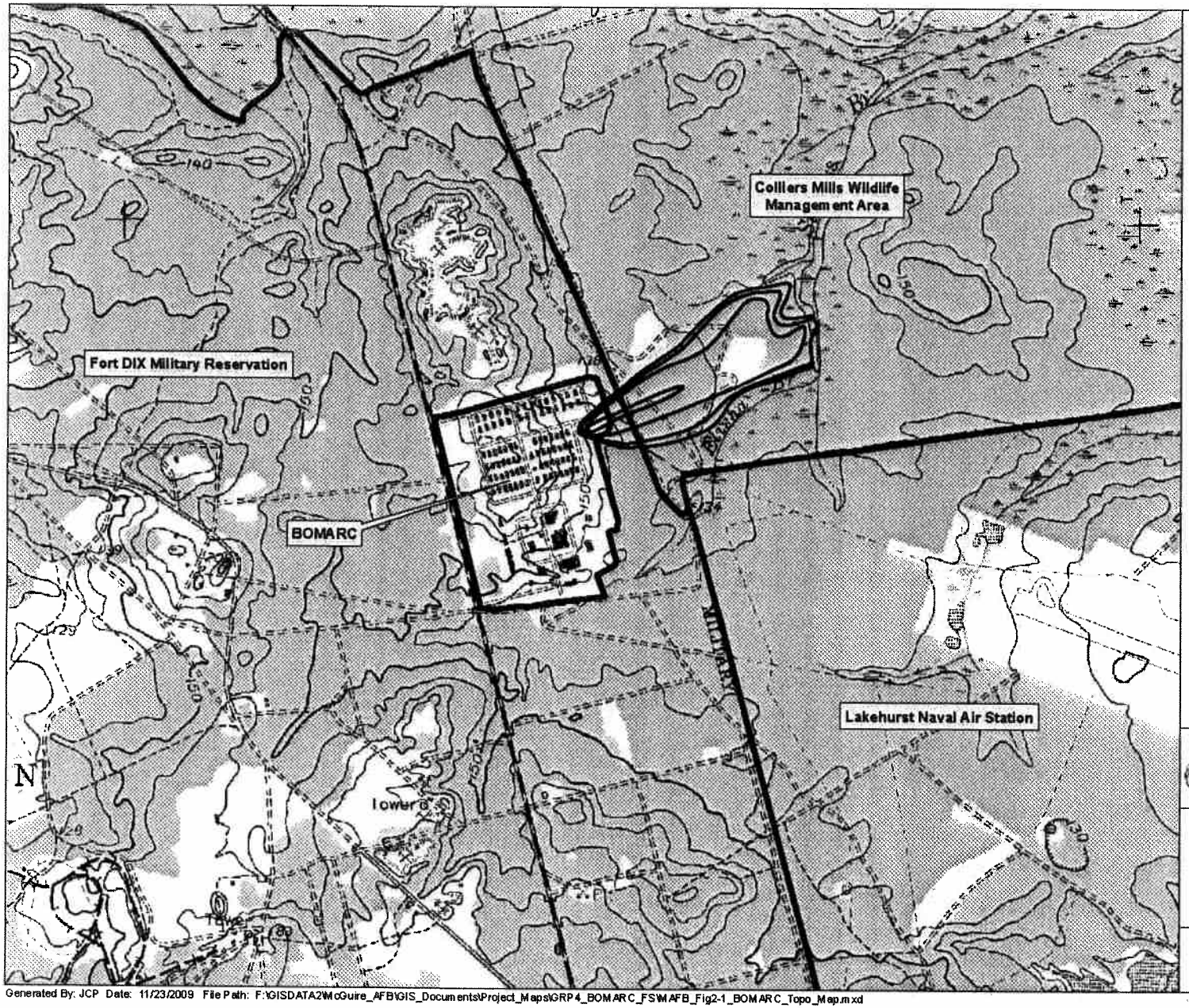
Land use proximate to the site according to the NJDEP Land-use/Land-cover GIS coverage, is dominated by open space and military installations.

The TCE plume originates in the drier pine/oak upland and travels through the cedar forest wetlands before discharging to the surface water of Success Branch. Elisha Branch and an unnamed tributary of Success Branch encompass the TCE plume to the south and north, respectively. However, TCE has not been detected in these streams.

The fenced area of the BOMARC facility is located on the far eastern portion of JB MDL - Dix. East of the BOMARC fence line, Colliers Mills Wildlife Management Area (WMA) adjoins the BOMARC facility to the northeast in Jackson Township, New Jersey. JB MDL - Lakehurst adjoins the BOMARC facility to the southeast. The property boundaries of JB MDL - Dix, JB MDL - Lakehurst and Colliers Mills WMA intersect at the eastern boundary of the BOMARC site. The BOMARC TCE plume is almost entirely located within the Colliers Mills WMA (see **Figure 2**). Success Branch originates in the northwest corner of JB MDL Lakehurst but is not impacted by the OT-16 TCE plume. Success Branch meanders through the WMA.

1. Hydrogeologic Conditions

The site is located within the New Jersey Coastal Plain Providence. The Miocene Cohansey Formation underlies the site except in low lying wetland areas where recent peat deposits are present. The wetland peat deposits rarely exceed a thickness of five feet and are largely composed of vegetative matter in various stages of decomposition. Discontinuous



LEGEND

- TCE in Groundwater Isopleth
- BOMARC Boundary
- Property Boundary

Notes:
1) USGS Topographic Quadrangle (Cossville, NJ) was obtained from the Digital Raster Graphic (DRG) Mosaic of Ocean County, New Jersey (U.S. Department of Agriculture, Natural Resources Conservation Service).

N

Scale:

0 500 1,000 2,000 Feet

AIR FORCE CENTER FOR ENGINEERING AND THE ENVIRONMENT

ENVIRONMENTAL RESTORATION PROGRAM

BOMARC SITE OT-16 TCE PLUME VICINITY MAP

JOINT BASE McGUIRE -DIX-LAKEHURST, NEW JERSEY

Shaw Shaw Environmental, Inc.

FIGURE NO. 2

Generated By: JCP Date: 11/23/2009 File Path: F:\GISDATA2\McGuire_AFB\GIS_Documents\Project_Maps\GRP4_BOMARC_FS\MAFB_Fig2-1_BOMARC_Topo_Map.mxd

Miocene-age peat layers are also present in the Cohansey Formation at the study area. The peat layers are often described as organic silt in boring logs, but may contain recognizable plant material of a fibrous or woody nature. The thickness of the Cohansey Formation within the site ranges between 60 to 90 feet and is underlain by silty fine sand of the Kirkwood Formation. The Kirkwood Formation is approximately 45 feet thick.

Unconfined conditions occur within the Cohansey and Kirkwood Formation. Groundwater flow is more rapid within the Cohansey Formation than the Kirkwood. Groundwater quality investigations indicate the contaminant plume is mostly within the Cohansey Formation.

USGS estimated the groundwater velocity at the site to be 376 feet per year or about one foot per day. Groundwater at the site ranges from approximately 12 to 60 feet below ground surface.

Groundwater flows in a northeast direction and discharges to the wetlands and surface water of Success Branch. Well searches indicate there are no potable water supply wells at the site or within a one mile radius of the site.

2. Nature and Extent of TCE Contamination

As previously mentioned, site investigations determined that the primary source of TCE was from Storm Drain No. 3. The RI concluded that, based on the spatial distribution of TCE in groundwater, a single plume emanated from the primary source. The plume has since migrated hydraulically downgradient and currently discharges to Success Branch. According to the Final RI, subsurface peat zones are acting as secondary source areas due to their high carbon content and their affinity to adsorb TCE. TCE concentrations as high as 3.5 ppm were detected in saturated peat samples. Four peat areas are described as being persistent sources of TCE groundwater contamination. The total combined surface area of the primary and secondary peat source areas is approximately 254,000 square feet or approximately 6 acres.

The maximum width of the TCE plume ranges from approximately 1,000 ft to 1,250 ft with a saturated thickness of approximately 45 ft. Approximately two-thirds of the plume is in the non-wetlands portion of the aquifer and approximately one third is in the wetlands portion of the aquifer. Degradation of the TCE occurs within the wetland portion of the plume but does not sufficiently reduce contaminant concentrations before discharging to the stream. The USGS determined that the TCE discharges to an approximate 375-ft stretch of Success Branch (**Figure 1**). All TCE groundwater from the OT-16 plume discharges to the tributary or streams and does not migrate beyond the limits of Success Branch.

WHAT ARE THE "CONTAMINANTS OF CONCERN"

The USAF and the NJDEP have identified two contaminants that pose the greatest potential risk to human health and the environment at this site.

Trichloroethene (TCE): TCE is a halogenated organic compound historically used as a solvent and degreaser in many industries. Exposure to this compound has been associated with deleterious health effects in humans, including anemia, skin rashes, diabetes, liver conditions, and urinary track disorders. Based on laboratory studies, TCE is considered a probable human carcinogen.

Cis-1,2-dichloroethene (cis-DCE): cis-DCE is a colorless, flammable liquid with a harsh odor. It is used as a chemical intermediate in the production of other chlorinated solvents. It has also been used as a solvent in the extraction of rubber, to remove fats from meat and fish, and to decaffeinate coffee. At high concentrations, cis-DCE, like many other chlorinated compounds, acts as an anesthetic resulting in central nervous system depression. Effects observed in humans include nausea, fatigue, vertigo, and drowsiness. There are no data in humans or animals regarding the carcinogenic potential of cis-DCE. It has been categorized by the EPA as a Group D carcinogen (inadequate evidence to classify).

The Final RI (SAIC and Hayworth Engineering, 2008), identified TCE concentrations in groundwater ranging from 1.3 to 930 ppb and concentrations in surface water ranging from 0.99 to 19 ppb. Concentrations of cis-DCE in groundwater ranged from 0.58 to 7.9 ppb and in surface water concentrations ranged from 0.4 to 1.2 ppb.

The surface water screening criteria used for TCE and cis-DCE is the NJDEP Surface Water Quality Criteria (SWQC) which is 1 ppb for TCE. There is no SWQC for cis-DCE.

The groundwater screening criteria for TCE and cis-DCE is the NJDEP Groundwater Quality Criteria (GWQC) which is 1 ppb and 70 ppb, respectively.

Scope and Role of the Action

This Proposed Plan summarizes the remedial alternatives detailed in the *Final Feasibility Study for BOMARC OT-16 Trichloroethene Groundwater Plume*, dated August 2011 and identifies alternatives for addressing TCE contaminated groundwater and surface water. The preferred alternative is installation of a Zero Valent Iron (ZVI) Permeable Reactive Barrier (PRB), which is a technology that destroys chlorinated VOCs through an abiotic (non-living) chemical process. The ZVI PRB would be installed immediately upgradient of the wetland area. As contaminated groundwater flows through the PRB, contaminants would be reduced to non-toxic molecules prior to discharging to Success Branch. Additionally, the preferred alternative includes long-term groundwater monitoring, land use controls, and CERCLA Five Year Reviews.

It is the USAF's current judgment that the Preferred Alternative identified in this Proposed Plan is necessary to protect public health or welfare or the environment from actual or threatened releases of hazardous substances or pollutants and contaminants into the environment.

Summary of Site Risks

A human health risk assessment has not been completed for the site, but a baseline Ecological Risk Assessment (ERA) was conducted as part of the NJDEP approved Final RI Report for OT-16 (SAIC and Hayworth Engineering, 2008).

The current and foreseen future use of the BOMARC facility is classified as industrial/military. The BOMARC facility, fence line to fence line, had been under permit from Fort Dix to the Air Force since 1950 until the bases were joined as JB MDL in 2009. No active training occurs, or has occurred at the facility since 1972 when the facility was deactivated. Outside the fence line, the immediate surrounding property is JB MDL - Dix, JB MDL - Lakehurst, and Collier Mills WMA.

For there to be a risk, three conditions must be met; if one or more of the conditions are missing, then there is no risk. The conditions are: 1) there must be contaminants present; 2) there must be current and future receptors (human or ecological); and 3) there must be an exposure pathway from the contaminant to the receptor that could result in an exposure concentration to cause an adverse affect.

1. Human Health Risks

A human health risk assessment was not conducted at the BOMARC site because NJDEP is the lead regulatory agency and NJDEP clean-up standards are based on an acceptable human health risk of one person in a million (or $1x10^{-6}$) lifetime cancer risk from site contaminants. The USEPA considers a cancer risk of $1x10^{-6}$ to be acceptable without the need to implement a remedial action. Because NJDEP standards meet the minimal risk requirements by the USEPA, no human health risk assessment is required at this site.

Since Colliers Mills WMA is protected from State and Federal institutional controls, current and future development is prohibited within the WMA and precludes the use of groundwater as a drinking water source in this area.

There are no current human receptors or complete pathways at the BOMARC site or within a one-mile radius of the sites because the site is unoccupied and no drinking water wells are located at the site or within a one-mile radius. Development within the BOMARC facility is currently restricted via the JB MDL General (Master) Plan, thus precluding the current use of groundwater as a drinking water source at the Site. Likewise, there are no future human receptors or complete pathways at the BOMARC site or within a one-mile radius because CERCLA Land Use Controls will be imposed after the ROD is signed by the Air Force to preclude future development and the installation of drinking water wells. Therefore, the future development restrictions of the BOMARC facility and the Collier Mills WMA will restrict groundwater use for the entire TCE groundwater plume. Since there are no human receptors or complete pathways, there is no human health risk

Lastly, a public health assessment conducted by the Agency for Toxic Substances and Disease Registry (ATSDR) concluded that no public health hazards are associated with the VOC-contaminated groundwater plume emanating from the BOMARC site. The assessment additionally concluded that there are no apparent public health hazards to off-site recreational users of the Elisha Branch or Success Branch or the Colliers Mill WMA due to past or current exposures to contaminants in surface water and sediment (ATSDR, 2002).

2. Ecological Risks

The purpose of a baseline ERA is to identify those contaminants present that have the potential to negatively impact wildlife and which may require further evaluation. The ERA was completed as part of the *Final Remedial Investigation Report, Additional TCE Source Areas and TCE-Contaminated Groundwater, OT-16, McGuire AFB, New Jersey* (SAIC, 2008 and Hayworth Engineering). The contaminant of concern evaluated in the ERA was TCE in surface water and sediment; note, there are no ecological risks to contaminated groundwater because this pathway is incomplete to all ecological receptors. However, TCE discharges from groundwater to surface water along a relatively small section of Success Branch. Once TCE is in surface water, it may be adsorbed onto highly organic sediments (similar to peat) and subsequently undergo desorption into surface water and re-adsorption by sediments further downstream.

The Ecological Area of Concern (EAOC) identified in the baseline ERA is the Rancocas Watershed within Colliers Mill WMA of Jackson Township, Ocean County, New Jersey. This EAOC includes Elisha Branch, Success Branch, and the unnamed tributary to Success Branch. These surface water bodies are classified by the NJDEP as Pineland Waters (designated PL). Although these are not considered Category One (FW1) waters, which are afforded the highest state-level protection, they are considered, along with FW1 waters to be "Outstanding Natural Resource Waters of the State".

The baseline ERA concluded that "ecological receptors (amphibians, fish, terrestrial plants, macroinvertebrates) and potential pathways were present, but that the concentrations of TCE observed in surface water and sediment within the groundwater discharge areas of Success Branch did not present a risk to wildlife." Although TCE levels continue to decrease in surface water and sediment, the ERA states that "any deleterious effects are likely to have already occurred" and "cleanup activities should seek to minimize additional TCE loading into surface water that may occur as a result of enhanced TCE

desorption from peat source areas during active remediation".

The ERA also concluded that "Direct remediation of contaminated sediment within Success Branch should be avoided due to potential increased exposures of ecological receptors to elevated TCE concentrations." Surface water is identified as a media of concern. TCE concentrations in sediments will continue to decrease (i.e., indirectly remediated) as surface water TCE concentrations decrease.

Remedial Action Objectives

There are primary and secondary remedial action objectives (RAOs) based on ARARs, receptors and land use. The primary objective is to restore surface water quality within the 375-ft discharge area of Success Branch. Clean-up goals for TCE and related chemicals in surface water will be based on Surface Water Quality Standards designated Pine Lands (PL) including Colliers Mills and Success Branch which are "Outstanding National resource Waters" and selected as ARARS in the FS.

A secondary objective is to restore groundwater in the downgradient portion of the plume between the treatment zone and stream; the wetland area between the treatment zone and stream would continue to act as a "polisher" of groundwater before discharging to surface water. Clean-up goals for TCE and related chemicals in groundwater will be based on Groundwater Quality Standards selected as ARARs in the FS. Additional secondary objectives are to establish land use controls (i.e. an amendment to the JB MDL General Plan (in production) and a Classification Exception Area) for the BOMARC facility and plume area to restrict future development and use of site groundwater as drinking water.

Summary of Remedial Alternatives

Five remedial technologies were identified and screened to ensure that they: are capable of protecting human health and the environment; control potential exposure pathways; reduce the risk to receptors to acceptable levels; and can reduce and/or eliminate the mobility, toxicity or volume of contaminants in media to the appropriate remediation goals.

Following the screening process, five selected remedial alternatives were evaluated in detail against CERCLA and NJDEP criteria. The five remedial alternatives evaluated were as follows:

- Alternative 1: No Action
- Alternative 2: Monitored Natural Attenuation / Institutional Controls / Long Term Monitoring
- Alternative 3: In-Situ Biological Treatment / Institutional Controls / Long Term Monitoring
- Alternative 4: Hydraulic Control and Treatment / Institutional Controls / Long Term Monitoring
- Alternative 5: ZVI Permeable Reactive Barrier / Institutional Controls / Long Term Monitoring

Alternatives 2, 3, 4, and 5 also include the performance of periodic CERCLA Five Year Reviews to ensure the remedy continues to be protective of human health and the environment.

Note, the costs and times estimated for the remedial alternatives were based on a 30-year timeframe, pursuant to CERCLA and NJDEP 20-year Master Plan (N.J.S.A 40:55D) requirements. Currently none of the alternatives are capable of remediating the entire site within 30-years based on the following: 1) the slow dissolution rate of TCE from the peat sources area limits the rate at which the TCE can be treated (i.e. the necessity of the TCE to dissolve into groundwater, migrate and eventually be "captured"); 2) the significant, remaining capacity of the secondary peat source zones downgradient to continue to adsorb TCE and slow the migration of TCE to the treatment area; 3) the potential presence of

unknown peat zones located downgradient of the known primary and secondary peat source areas that would be presumed to interact with the TCE and cis-DCE similar to the known peat areas; 4) the capabilities of the selected technologies are limited to the rate of groundwater flow except for alternative 4 which would enhance groundwater flow rates. Other existing technologies were screened out during the FS because they would require the entire area to be cleared of vegetation to implement, and they were also much more costly to implement.

A determination of the total length of time of the selected remedial action to achieve clean-up goals will be calculated utilizing groundwater modeling during the final design.

The five remedial alternatives evaluated are summarized as follows.

Alternative 1: No Action

(Costs and times are estimated, based on a 30-year timeframe)

Capital Cost:	*$0*
Annual O&M Cost:	*$0*
Present Worth Cost:	*$0*
Construction Timeframe:	*0 MONTHS*
Time to Achieve RAOs:	*Indefinite*

The primary and secondary RAOs would not be achieved. The NCP requires that a "no action" alternative be evaluated to establish a baseline for comparison. Under this alternative, no action would be taken to address groundwater and surface water contamination.

Alternative 2: Monitored Natural Attenuation / Institutional Controls / Long Term Monitoring

(Costs and times are estimated, based on a 30-year timeframe)

Capital Cost:	*$223,000*
Annual O&M Cost:	*$1,019,000*
Present Worth Cost:	*$1,242,000*
Construction Timeframe:	*2 MONTHS*
Time to Achieve RAOs:	*Indefinite*

The primary and secondary RAOs would not be achieved. Natural attenuation refers to the naturally occurring processes in soil and groundwater environments that act without human intervention to reduce the mass, toxicity, mobility, volume or concentration of contaminants in those media. Monitored natural attenuation (MNA) refers to a remedial program established to monitor the natural attenuation processes.

Institutional controls are actions such as administrative and legal controls that help minimize the potential for human exposure to contamination by ensuring appropriate land or resource use. Institutional controls currently in place at the site include the regulations of the Pinelands Comprehensive Management Plan, N.J.A.C. 7:50. These institutional controls prevent development at the site and thereby prevent common exposure scenarios such as direct contact with excavated material, ingestion of groundwater and soil vapor intrusion into occupied buildings.

Institutional controls would include an amendment to the JB MDL General Plan (in production) and an establishment of a Classification Exception Area (CEA) for the portion of the aquifer contaminated above the chemical-specific ARARs. The amendment of the General Plan would restrict future development at the site. The CEA would restrict the use of groundwater at the site as a drinking water source.

Alternative 2 includes semi-annual, long-term monitoring of VOCs and nutrients to document the natural attenuation processes at the site and the reduction of contaminant concentrations. Additional monitoring wells would be installed to provide monitoring points in the centerline and down-gradient limits of the plume.

Note, alternatives 3, 4, and 5 also include the establishment of institutional controls and long-term monitoring of groundwater and surface water.

Alternative 3: In Situ Biological Treatment / Institutional Controls / Long Term Monitoring

(Costs and times are estimated, based on a 30-year timeframe)

Capital Cost:	*$887,000*
Annual O&M Cost:	*$3,134,000*
Present Worth Cost:	*$4,021,000*
Construction Timeframe:	*22 MONTHS*
Time to Achieve RAOs:	*24 MONTHS*

Chlorinated VOCs such as TCE can be anaerobically degraded by specific bacteria. Biodegradation of TCE occurs in three sequential reactions: TCE is converted to cis-DCE, cis-DCE is converted to vinyl chloride, and vinyl chloride is subsequently converted to ethene, a non-toxic organic compound.

In some environments, bacteria completely dechlorinate TCE to ethene, whereas in other cases, partially dechlorinated byproducts such as cis-DCE accumulate. When the environmental conditions become unfavorable to the bacteria (e.g, a change in pH, water chemistry, depletion of nutrients, etc.) reduction of contaminants is limited.

In situ biological treatment includes a combination of biostimulation (the addition of a carbon source and nutrients to stimulate biological growth) and bioaugmentation (the addition of biological cultures to augment naturally occurring bacteria populations).

As determined by the USGS, all groundwater from the OT-16 area discharges to surface water; 95 percent of the contamination discharge occurs within a 375-ft span of Success Branch (Figure 1). Active natural biological degradation is occurring in the wetland area (USGS, 2001 and 2003). Alternative 3 includes the creation of an in situ biological passive treatment barrier located immediately up-gradient of the wetland area. Contaminant concentrations would be degraded below the chemical-specific ARARs before contaminated groundwater discharges to surface water. MNA would continue to occur within the wetland area and would benefit from the anaerobic conditions created by the biological treatment barrier.

The effectiveness of the in-situ biological treatment area would be monitored several times a year as part of the operation and maintenance activities. It is estimated that a reinjection of bio-augmented cultures, nutrients, and buffer would be necessary every three years to maintain effectiveness.

The primary and secondary RAOs would be achieved within two months after the full scale injections and buffering has stabilized.

Alternative 4: Hydraulic Control and Treatment / Institutional Controls / Long Term Monitoring

(Costs and times are estimated, based on a 30-year timeframe)

Capital Cost:	*$2,295,000*
Annual O&M Cost:	*$7,009,000*
Present Worth Cost:	*$9,304,000*
Construction Timeframe:	*24 MONTHS*
Time to Achieve RAOs:	*24 MONTHS*

Hydraulic control of the groundwater plume can be achieved through appropriately spaced extraction wells. Alternative 4 includes pumping from multiple extraction wells to eliminate contaminant migration to surface water, treating the extracted groundwater ex situ, and discharging the treated water to groundwater.

The extracted groundwater would be pumped to an on-site treatment plant, treated and discharged to groundwater via injection wells located along the up-gradient edge of the plume.

Six extraction wells would be installed in a north-south direction to capture the primary

discharge of the contaminant plume. A groundwater treatment plant would need to be built on the BOMARC facility. Six injection wells would be installed in the source area at the head of the plume to return the treated groundwater to the aquifer. MNA outside the extraction area would continue to occur and would act as a "polisher" of groundwater in the wetland area between the treatment zone and the stream.

The effectiveness of the hydraulic treatment controls would be monitored several times a year as part of the operation and maintenance activities.

The primary and secondary RAOs would be achieved immediately after full system startup. Dewatering of the wetlands due to over pumping would be an important consideration with this technology and could limit the effectiveness of meeting the RAOs.

Alternative 5: ZVI Permeable Reactive Barrier / Institutional Controls / Long Term Monitoring

(Costs and times are estimated, based on a 30-year timeframe)

Capital Cost:	*$1,240,000*
Total O&M Cost:	*$1,799,000*
Present Worth Cost:	*$3,039,000*
Construction Timeframe:	*22 MONTHS*
Time to Achieve RAOs:	*24 MONTHS*

A Zero Valent Iron (ZVI) Permeable Reactive Barrier (PRB) is the preferred alternative at OT-16. ZVI is a technology that destroys chlorinated VOCs through an abiotic chemical process. A treatment zone at the downgradient edge of the plume would be created by injecting ZVI powder to create a PRB. Implementation of the technology, through the injection of ZVI powder into the aquifer matrix with nitrogen gas, will reduce chlorinated VOCs such as TCE. ZVI can be injected into the aquifer through Direct Push Technologies (DPT) or injection wells.

Contaminants are carried to the PRB by natural groundwater flow and are destroyed by abiotic reduction (i.e. reduced to non-toxic molecules) as they come in contact with the ZVI.

Contaminant concentrations would be degraded below the chemical-specific ARARs before contaminated groundwater discharges to surface water.

MNA would continue to occur within the wetland area and would benefit from the anaerobic conditions created by the PRB which is necessary to biologically degrade chlorinated contaminants.

This alternative would require the installation of a PRB approximately 500 feet long through the depth of the aquifer in a north-south direction, transecting natural groundwater flow, to capture the primary discharge area of the contaminant plume.

The effectiveness of the ZVI PRB would be monitored several times a year as part of the operation and maintenance activities. It is estimated that a reinjection of the ZVI would be necessary every five years to maintain effectiveness.

The primary and secondary RAOs would be achieved within two months after the full scale injections.

Summary of Remedial Alternatives OT-16 Trichloroethene Groundwater Plume		
Medium	**RI/FS Designation**	**Description**
Surface Water/Groundwater	1	No Action
	2	Monitored Natural Attenuation (MNA) and Institutional Controls
	3	In Situ Biological Treatment Barrier
	4	Hydraulic Control and Treatment
	5	Zero Valent Iron (ZVI) Permeable Reactive Barrier (PRB)

Evaluation Criteria for Superfund Remedial Alternatives
THRESHOLD CRITERIA
Overall Protectiveness of Human Health and the Environment determines whether an alternative eliminates, reduces, or controls threats to public health and the environment through institutional controls, engineering controls, or treatment.
Compliance with ARARs evaluates whether the alternative meets Federal and State environmental statutes, regulations, and other requirements that pertain to the site, or whether a waiver is justified.
PRIMARY BALANCING CRITERIA
Long-term Effectiveness and Permanence considers the ability of an alternative to maintain protection of human health and the environment over time.
Reduction of Toxicity, Mobility, or Volume of Contaminants through Treatment evaluates an alternative's use of treatment to reduce the harmful effects of principal contaminants, their ability to move in the environment, and the amount of contamination present.
Short-term Effectiveness considers the length of time needed to implement an alternative and the risks the alternative poses to workers, residents, and the environment during implementation.
Implementability considers the technical and administrative feasibility of implementing the alternative, including factors such as the relative availability of goods and services.
Cost includes estimated capital and annual operations and maintenance costs, as well as present worth cost. Present worth cost is the total cost of an alternative over time in terms of today's dollar value. Cost estimates are expected to be accurate within a range of +50 to -30 percent.
MODIFYING CRITERIA

State/Support Agency Acceptance considers whether the State agrees with the EPA/NJDEP's analyses and recommendations, as described in the RI/FS and Proposed Plan.
Community Acceptance considers whether the local community agrees with EPA's/NJDEP's analyses and Preferred Alternative. Comments received on the Proposed Plan are an important indicator of community acceptance.

Evaluation of Alternatives

Nine criteria are used to evaluate the different remediation alternatives individually and against each other in order to select a remedy. This section of the Proposed Plan profiles the relative performance of each alternative against the nine criteria, noting how it compares to the other options under consideration.

The nine CERCLA criteria fall into three groups: threshold criteria, primary balancing criteria, and modifying criteria. A description of the purposes of the three groups follows:

- Threshold criteria, which are requirements that each alternative must meet in order to be eligible for selection.
- Primary balancing criteria, which are used to weigh major trade-offs among alternatives.
- Modifying criteria, which may be considered to the extent that information is available during the FS, but can be fully considered only after public comment is received on the Proposed Plan.

In the final balancing of trade-offs between alternatives upon which the final remedy selection is based, modifying criteria are of equal importance to the balancing criteria.

The nine evaluation criteria are discussed below. The "Detailed Analysis of Alternatives" can be found in the Final Feasibility Study for OT-16 Trichloroethene Groundwater Plume (dated August 2011).

1. Overall Protection of Human Health and the Environment

Alternatives 1 (No Action) and 2 (MNA) are the least protective of human health and environment. These alternatives do not meet the primary or secondary RAO. Because these alternatives do not meet the RAOs, they were not considered usable as a stand-alone remedial alternative. Alternatives 1 and 2 were not considered further for the remaining eight criteria.

Alternatives 3, 4, and 5 are protective of human health and the environment because they would treat contaminated groundwater at the downgradient edge of the plume and would eliminate TCE from being discharged to surface water.

2. Compliance with ARARs

Actions taken at any Superfund site must meet all ARARs of federal and state law or provide grounds for invoking a waiver of these requirements. These include chemical-specific, location-specific, and action-specific ARARs.

Alternatives 3, 4, and 5 would comply with all applicable surface water ARARs through the destruction or extraction of TCE and cis-DCE prior to discharging to surface water. Groundwater ARARs upgradient of the treatment area would not be met with Alternatives 3, 4, and 5; however, the amendment to the General Plan and establishment of a CEA would eliminate future development and human receptor pathways.

3. Long-Term Effectiveness and Permanence

Alternative 3, 4, and 5 would be effective at reducing contaminant concentrations to levels below surface water ARARs in the long-term. The length of the remedial action for each alternative would exceed the 30-year timeframe due to the dissolution rate of the TCE from the peat source areas. However, as previously mentioned the amendment to the General Plan and establishment of a CEA would eliminate human receptor pathways.

4. Reduction of Toxicity, Mobility, or Volume of Contaminants through Treatment

Alternatives 3 and 5 would be effective at reducing the toxicity and volume of contaminants downgradient of the treatment area before discharging to Success Branch. Alternative 4 would be effective at reducing the toxicity and volume of contaminants and enhancing the mobility of contaminants toward the extraction wells. Extraction of TCE and cis-DCE would minimize contaminants migrating and discharging to groundwater. Initially, Alternative 4 (Hydraulic Control) may reduce contaminant volumes at a higher rate compared to Alternatives 3 and 5, however the dissolution of TCE from the peat source areas are the limiting factor in each of the evaluated alternatives. The longer Alternative 4 continues to operate, the rate of contaminant removal decreases while the cost to operate the system increases. Thus, the long-term O&M cost for Alternative 4 significantly increases relative to the passive treatment technologies of Alternatives 3 and 5, while each of the Alternative provide the equivalent protection of surface water.

5. Short-term Effectiveness

Surface water ARARs would not be achieved in Alternative 3 and 5 until the full scale installation is complete. Once full scale installation is complete, surface water ARARs would be met within approximately two months.

Alternative 4 (Hydraulic Control and Treatment) is generally considered a long-term operation and compliance with groundwater and surface water ARARs would be expected in the short-term following full-scale implementation.

Alternatives 3, 4, and 5 would be effective at protecting the local community and workers in the short-term because no potable wells are located on-site and a CEA would be established.

6. Implementability

Alternative 3 and 4 can be implemented in a reasonable timeframe after all required pilot tests, system designs, and installation and the "start up" period are completed.

Alternative 5 can be implemented using readily available suppliers. This Alternative requires that a small portion (0.11 acres) of Pineland National Reserve forest be cleared to the south of the treatment zone for installation of the PRB. An additional portion of forest will need to be cleared; however, the size is unknown until the final design of the treatment barrier is completed. Alternative 3 would require a limited area of Pineland National Reserve forest to be cleared to accommodate injection wells and the construction of an access road.

Permit equivalents would be required for Alternative 3, 4, and 5. A permit equivalent may be difficult to achieve for Alternative 4 due to the degree of disturbance required to build the groundwater treatment system. Alternatives 3 and 5 require less ground disturbance than Alternative 4.

7. Cost

The evaluation of costs addresses direct and indirect capital costs and annual operation and maintenance costs. To capture the costs that occur in outlying years, the present worth is calculated to evaluate each alternatives equally as if all the costs occurred in the present year.

The estimated present worth cost of Alternative 3 is $4,021,00. The estimated present worth costs of Alternative 4 and 5 are $9,304,000 and $3,039,000, respectively. These costs assume all remedies would be operated for 30 years.

8. State/Support Agency Acceptance

The NJDEP agrees with the Preferred Alternative (Alternative 5) in this Proposed Plan. Comments from the NJDEP on the Draft Feasibility Study for OT-16 Trichloroethene Groundwater Plume (dated January 2011) were adequately addressed and are included in the Final FS BOMARC OT-16 TCE Groundwater Plume dated August 2011 (Shaw, 2011).

9. Community Acceptance

Community acceptance of the Preferred Alternative will be evaluated after the public comment period ends and will be described in the Record of Decision, the document that formalizes the selection of the remedy for the site.

The JB MDL Environmental Restoration Program (ERP) Restoration Advisory Board (RAB) meetings are intended to keep the public informed about the installation's environmental cleanup efforts, as well as involve the community in the remedial action decision-making process. The board gives community members, particularly those who may be affected by cleanup activities, and government representatives a chance to exchange information and participate in meaningful dialogue.

JB MDL holds quarterly RAB meetings co-chaired by a community individual not involved in the decisions of the environmental program. Advance notice of each RAB meeting is published in the local newspaper and is open to the public pursuant to CERCLA requirements.

The meetings are held in Cookstown, New Jersey. JB MDL provides briefings and a Q&A session to these members and the public. The last meeting was held on November 9, 2011. The next meeting is scheduled for February 9, 2012. In addition, all relevant documents are available as part of the McGuire Administrative Record file located at the Burlington County Library.

The dates for the public comment period, the date, location, and time of the public meeting, and the locations of the Administrative Record files, are provided on the front page of this Proposed Plan.

Summary of Preferred Alternative

The Preferred Alternative for achieving the Primary RAO is Alternative 5 (ZVI PRB). The primary RAO is to restore surface water quality below the ARARs within Success Branch. The two secondary RAOs are to restore groundwater below the ARARs in the downgradient portion of the plume before discharging to Success Branch and to establish land use controls (i.e. an amendment to the JB MDL General Plan (in production) and the establishment of a CEA) for the BOMARC facility and the plume area that restricts future development and would eliminate the human receptor pathway of utilizing groundwater as drinking water. Alternative 5 achieves all of the RAOs.

The Preferred Alternative was selected over the other alternatives because of its ability to meet the RAOs, comply with ARARs for long-term effectiveness, reduce the toxicity and volume of contaminants, its ease of implementability and long-term maintenance, its low costs compared to other alternatives, and it low potential to impact the community and natural resources. NJDEP biennial reviews and CERCLA Five Year reviews of the Preferred Alternative would be required because it would take longer to remediate the site within the specific timeframes.

Based on information currently available, the USAF believes the Preferred Alternative meets the threshold criteria and provides the best balance of tradeoffs among the other alternatives with respect to the

balancing and modifying criteria. The USAF expects the Preferred Alternative to satisfy the following statutory requirements of CERCLA §121(b): (1) be protective of human health and the environment; (2) comply with ARARs; (3) be cost-effective; (4) utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable; and (5) satisfy the preference for treatment as a principal element.

Community Participation

The USAF and NJDEP provide information regarding the cleanup of BOMARC OT-16 Trichloroethene Groundwater Plume to the public through public meetings, the Administrative Record file for the site, and announcements published in the Burlington County Times and Asbury Park Press. The USAF and the NJDEP encourage the public to gain a more comprehensive understanding of the site and the remedial activities that have been conducted at the site.

The dates for the public comment period, the date, location, and time of the public meeting, and the locations of the Administrative Record files, are provided on the front page of this Proposed Plan.

FOR FURTHER INFORMATION ON BOMARC OT-16, PLEASE CONTACT:

Curtis A. Frye
Chief, Environmental Restoration Program
87th CES/CEAN
2403 Vandenberg Avenue
Joint Base McGuire-Dix-Lakehurst, NJ 08641

Deputy Chief of Public Affairs
87th Air Base Wing Public Affairs
2901 Falcon Lane, Suite 235
Joint Base McGuire-Dix-Lakehurst, NJ 08641

Air Force Center for Engineering and the Environment
Building 171; 2261 Hughes Ave., Suite 155
Lackland AFB, TX 78236-9853

Glossary of Terms

Specialized terms used in this Proposed Plan are defined below:

Applicable or Relevant and Appropriate Requirements (ARARs) – The Federal and State environmental cleanup standards and other substantive requirements that a selected remedy will meet. These requirements may vary among sites and alternatives.

Bioaugmentation - The addition of biological cultures to augment naturally occurring bacteria populations.

Biostimulation - The addition of a carbon source and nutrients to stimulate biological growth.

Classification Exception Area (CEA) – CEAs are established by the NJDEP in order to provide notice that the constituent standards for a given aquifer classification are not or will not be met in a localized area due to natural water quality or anthropogenic influences, and that designated aquifer uses are suspended in the affected area for the term of the CEA.

Contaminant plume – A body of contamination with measurable horizontal and vertical dimensions that is suspended in and moves with groundwater.

Ex situ – The removal of a medium (for example, water or soil) from its original place, as through excavation, in order to perform the remedial action.

Groundwater – Underground water that fills pores in soil or openings in rocks to the point of saturation. Groundwater is often used as a source of drinking water via municipal or domestic wells.

In situ – The remediation of a polluted site is performed "in place" as opposed to ex situ where where contaminated material is excavated and cleaned elsewhere, off site.

Institutional controls - Actions such as administrative and legal controls that help minimize the potential for human exposure to contamination by ensuring appropriate land or resource use.

General (Master) Plan – A comprehensive document that is intended to guide the base in its development and strategies over an extended time frame; the Air Force uses a 25-year Master Plan.

Monitoring – Ongoing collection of information about the environment that helps gauge the effectiveness of a clean-up action, e.g., monitor wells, stream and sediment sampling.

Monitored Natural Attenuation (MNA) – A remedial program established to monitor the natural attenuation processes.

Natural attenuation - The naturally occurring processes in soil and groundwater environments that act without human intervention to reduce the mass, toxicity, mobility, volume or concentration of contaminants in those media.

Outstanding National Resource Waters (ONRW) – means high quality waters that constitute an outstanding national resource (for example, waters of National/State Parks and Wildlife Refuges and waters of exceptional recreational or ecological significance). Waters classified as FW1 waters and Pineland waters are Outstanding Natural Resource Waters.

Parts Per Billion (ppb) – A unit of measure used to describe the mass of a contaminant per unit of volume in any media. A contaminant detected at 1 ppb means the volume of mass detected is equal to one-billionth of a pure substance, or 1/1,000,000,000. In terms of groundwater or surface water, contaminant concentrations are expressed in micrograms of contaminant per liter (ug/L) of water, where, 1 ppb = 1 ug/L. These units are frequently interchanged but mean the same.

Parts Per Million (ppm) – A unit of measure used to describe the mass of a contaminant per unit of volume in any media. A contaminant detected at 1 ppm means the volume of mass detected is equal to one-millionth of a pure substance, or 1/1,000,000. In terms of soil or sediment, contaminant concentrations are expressed in milligrams of contaminant per kilogram (mg/kg) of soil, where, 1 ppm = 1 mg/kg. These units are frequently interchanged but mean the same.

Pinelands waters – means all waters within the boundaries of the Pinelands Area, except those waters designated as FW1 in N. J. A. C. 7:9B-1.15(j), as established in the Pinelands Protection Act (N.J.S.A 13:18A-1 et seq) and shown in Plate 1 of the "Comprehensive Management Plan" adopted by the New Jersey Pinelands Commission in November 1980.

PL – means the general surface water classification applied to Pineland Waters

Present Worth Analysis - A method of evaluation of expenditures that occur over different time periods. By discounting all costs to a common base year, the costs for different remedial action alternatives can be compared on the basis of a single figure for each alternative. When calculating present worth cost for Superfund sites, total operations & maintenance costs are to be included.