Record of Decision
for
Site 95 – Building 2101 Paint Booth Sump

Marine Corps Base (MCB)
Quantico, Virginia

Naval Facilities Engineering Command
Washington

August 2008

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ACRONYMS AND ABBREVIATIONS

µg/L	microgram per liter
ARAR	applicable or relevant and appropriate requirement
bgs	below ground surface
CDI	chronic daily intake
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CERCLIS	CERCLA Information System
CFR	Code of Federal Regulations
COC	chemical of concern
COPC	chemical of potential concern
CSF	cancer slope factor
CSM	conceptual site model
DCE	dichloroethene
DO	dissolved oxygen
DON	Department of the Navy
DTA	Desktop Audit
DTAWS	Desktop Audit with Sampling
EE/CA	Engineering Evaluation/Cost Analysis
EPC	exposure point concentration
ESD	Explanation of Significant Differences
FFA	Federal Facilities Agreement
FS	Feasibility Study
GIS	Geographic Information System
HHRA	human health risk assessment
HI	hazard index
HMX-1	Marine Helicopter Squadron One
HQ	hazard quotient
ILCR	Incremental Lifetime cancer risk
IR	Installation Restoration
IRIS	Integrated Risk Information System
iSOC™	in-situ submerged oxygen curtain
LTM	Long-Term Monitoring
LUC	land use control
MCAF	Marine Corps Air Facility
MCB	Marine Corps Base
MCL	Maximum Contaminant Level

MNA	monitored natural attenuation
NA	not applicable/available
NAPL	non-aqueous-phase liquid
NAVFAC	Naval Facilities Engineering Command
NC	no criterion
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
O&M	operation and maintenance
ORC	oxygen release compound
OU	Operable Unit
PRG	preliminary remediation goal
QPMT	Quantico Project Managers Team
RAGS	Risk Assessment Guidance for Superfund
RAO	remedial action objective
RBC	Risk-Based Concentration
RCRA	Resource, Conservation, and Recovery Act
RF&P	Richmond, Fredericksburg, and Potomac
RfD	reference dose
RFA	RCRA Facility Assessment
RI	Remedial Investigation
RME	reasonable maximum exposure
ROD	Record of Decision
SARA	Superfund Amendments and Reauthorization Act
SI	Site Investigation
SSP	Site Screening Process
SVOC	semivolatile organic compound
SWMU	Solid Waste Management Unit
TBC	To Be Considered
TCE	trichloroethene
UCL	upper confidence limit
USEPA	United States Environmental Protection Agency
VAC	Virginia Administrative Code
VC	vinyl chloride
VDEQ	Virginia Department of Environmental Quality
VOC	volatile organic compound

1.0 DECLARATION

1.1 SITE NAME AND LOCATION

Site 95 – Building 2101 Paint Booth Sump
Marine Corps Base
Quantico, Virginia
CERCLIS ID No. VA1170024722

1.2 STATEMENT OF BASIS AND PURPOSE

This decision document presents the Selected Remedy for Site 95 (Building 2101 Paint Booth Sump) at the Marine Corps Base (MCB) Quantico, Virginia. The Selected Remedy was chosen in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA), and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision is based on the Administrative Record for this site.

The Department of the Navy (DON) and United States Environmental Protection Agency (USEPA) jointly selected the remedy, and the Virginia Department of Environmental Quality (VDEQ) concurs with the Selected Remedy.

Six Installation Restoration (IR) Program sites were identified near Building 2101 during the Resource Conservation and Recovery Act (RCRA) Facility Assessment (RFA)[(1)]. Two of the sites [Solid Waste Management Units (SWMUs) D-03 – Building 2101 Dry Paint Booth and T-06 – Building 2101 Trenches] were closed out with no action after a Desktop Audit (DTA)[(2)] was completed. The remaining four sites [Site 30 (SWMU W-06) – Building 2101 Washrack, Site 45 (SWMU CA-22) – Building 2101 Container Accumulation Area No. 2, Site 50 (SWMU CA-21) – Building 2101 Container Accumulation Area No. 1, and Site 95 (SWMU M-27) – Building 2101 Paint Booth Sump] were subsequently evaluated during a Desktop Audit with Sampling (DTAWS) investigation and a Site Screening Process (SSP) investigation. The results of the investigations for these four sites are documented in the SSP Presentation for Buildings 4, 2101, and 2113 Sites[(3)]. Three of the sites (Site 30, Site 45, and Site 50) were closed out with no action after the SSP investigation. Elevated groundwater concentrations [greater than Federal Maximum Contaminant Levels (MCLs)] were attributed to Site 95, the Paint Booth Sump. Subsequent investigations, while focusing on Site 95, included the sampling of monitoring wells that had been installed around the other three sites to determine if contamination in the vicinity of Site 95 was migrating.

The decisions presented in this document address the groundwater in the vicinity of Site 95, the only environmental medium requiring remediation to be protective of human health and the environment.

1.3 ASSESSMENT OF SITE

There has been a release of volatile organic compounds (VOCs) to the groundwater at Site 95. The response action selected in this Record of Decision (ROD) is necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances, pollutants, or contaminants into the environment.

1.4 DESCRIPTION OF SELECTED REMEDY

Site 95 is one of the 226 sites included in the MCB Quantico IR Program. Separate investigations and assessments have been or are being conducted for most of these sites in accordance with CERCLA. This ROD regarding groundwater contamination at Site 95 consists of the final remedial actions to be taken.

Four alternatives were evaluated in the Remedial Investigation (RI)/Feasibility Study (FS)[(4)] and presented in the Proposed Plan[(5)]. The Preferred Alternative, or Selected Remedy, is Alternative 3, Enhanced In-Situ Bioremediation, Oxygen Release Compound (ORC) Treatment. The components of Alternative 3 are as follows:

- Enhanced in-situ bioremediation using an electron acceptor chemical – ORC. ORC is used to provide oxygen, the release of which supports a number of biological oxidation pathways that are expected to result in the complete breakdown of site contaminants to nontoxic byproducts.

- Groundwater use restrictions shall be implemented to ensure that contaminated groundwater is not used as a source of potable water. Construction restrictions shall be implemented to ensure that mitigative measures designed to eliminate unacceptable risks associated with vapor intrusion, if required, are incorporated into new construction (commercial or residential) at the site. Excavation restrictions shall be implemented to ensure that construction workers are not exposed (dermal or inhalation) to groundwater contaminated with unacceptable levels of chemicals of concern (COCs) during construction activities. These restrictions shall remain in place until the concentrations of COCs attain preliminary remediation goals (PRGs).

- Groundwater monitoring will include periodic sampling and analysis of groundwater to determine the effectiveness of bioremediation, to confirm that contaminants are not migrating off site at

unacceptable concentrations, and to confirm that COC concentrations do not increase to levels above PRGs once treatment is discontinued.

- A discretionary 5-year review will be conducted to evaluate the analytical results of the groundwater monitoring samples, assess the site status, review environmental laws and regulations in effect at the time of the review, and provide direction for further action, if deemed necessary. The discretionary 5-year review will be completed to document that the concentrations of COCs have decreased to levels below the PRGs and, as a result, the remedial action objectives (RAOs) have been attained.

Alternative 3 was selected as the recommended alternative, or Selected Remedy, because it is protective of human health and the environment, provides for treatment of contaminated groundwater, anticipated to meet PRGs within 1 year, and estimated to cost less than the other alternatives (except for the no action alternative).

1.5 STATUTORY DETERMINATIONS

The Selected Remedy attains the mandates of CERCLA Section 121 and, to the extent practicable, meets regulatory requirements of the NCP. The Selected Remedy is protective of human health and the environment, complies with federal and state requirements that are applicable or relevant and appropriate to the remedial action, is cost effective, and utilizes permanent solutions and alternative treatment (or resource recovery) technologies to the maximum extent practicable. Alternative 3 also satisfies the statutory preference for treatment as a principal element of the remedy.

The Selected Remedy will not result in hazardous substances, pollutants, or contaminants remaining on site at concentrations greater than levels that allow for unlimited use and unrestricted exposure. Because it may take several years to attain PRGs and RAOs, a discretionary review will be conducted within 5 years after initiation of treatment to ensure that the remedy is, or will be, protective of human health and the environment.

1.6 ROD DATA CERTIFICATION CHECKLIST

The following information is included in the Decision Summary section of this ROD. Specific subsections where each item can be found are shown in parentheses. Additional information can be found in the Administrative Record for this site.

- COCs and their respective concentrations (Section 2.5.4)

- Baseline risk estimates associated with the COCs (Section 2.7)

- How clean-up levels will be established for COCs and the basis for development of these levels (Section 2.8)

- How source materials constituting principal threats are addressed (Section 2.11)

- Current and reasonably anticipated future land use assumptions and current and potential future beneficial uses of groundwater used in the baseline risk assessment and ROD (Sections 2.6 and 2.7)

- Potential land and groundwater use that will be available at the site as a result of the Selected Remedy (Section 2.12.4)

- Estimated capital, annual operation and maintenance (O&M), and total present-worth costs, discount rate, and number of years over which the remedy cost estimates are projected (Section 2.9)

- Key factors that led to selection of the remedy (i.e., how the Selected Remedy provides the best balance of tradeoffs with respect to the balancing and modifying criteria, highlighting criteria key to the decision) (Sections 2.10 and 2.12).

1.7 AUTHORIZING SIGNATURES

Charles h. Dallachie — 14 Sept 08

Charles A. Dallachie
Colonel, U.S. Marine Corps
Commander
Marine Corps Base, Quantico

Date

James J Burke — 9/30/08

James J. Burke, Director
Hazardous Site Cleanup Division
USEPA Region 3

Date

2.0 DECISION SUMMARY

2.1 SITE NAME, LOCATION, DESCRIPTION, AND HISTORY

The MCB is located in Quantico, Virginia, approximately 35 miles south of Washington, D.C. and 75 miles north of Richmond, Virginia (Figure 2-1). The facility covers more than 59,000 acres in southern Prince William County, northern Stafford County, and eastern Fauquier County. The facility is bounded to the north by Cedar Run and Virginia State Route 646; to the east by the Potomac River; to the south by Tank Creek, Aquia Creek, and Virginia State Route 610; and to the west by Dorrells Run and Virginia State Route 612 (Figure 2-2). The facility is divided into two sections, the Mainside east of Interstate 95 and the Guadalcanal Area west of Interstate 95. The USEPA CERCLA Information System (CERCLIS) identification number for MCB Quantico is VA1170024722. The DON [specifically the Naval Facilities Engineering Command (NAVFAC) Washington] is the lead agency for site activities at MCB Quantico. The USEPA is the lead regulatory agency, and VDEQ is the support agency. Clean-up funds are provided by the Department of Defense.

The Marine Corps Air Facility (MCAF) Turner Airfield is located within MCB Quantico. The MCAF began operations in July 1918 and operated from the old airfield (Brown Field) located west of the Richmond, Fredericksburg, and Potomac (RF&P) railroad, which is a subdivision of CSX Transportation. In 1931, construction began on a new airfield east of the railroad tracks. At the onset of World War II, all tactical air squadrons were shifted to the West Coast, and the helicopter became the primary aircraft used at the Base.

Site 95, also known as SWMU M-27, is the paint booth sump associated with Building 2101, the Marine Helicopter Squadron One (HMX-1) hangar. Building 2101 is located within the MCAF on Rowell Street on the Mainside of MCB Quantico (Figure 2-2). The building has been used as an aircraft maintenance building since 1941. A dry paint booth for painting helicopter parts (SWMU D-03) was added to the building in 1984 and is enclosed within a concrete block room located in the northern interior corner of the building. Various organic primers, lacquers, and solvents are used in the paint booth. The 16-foot-wide and 26-foot-long paint booth uses a dry filter system, and the exhaust for the system is vented outside the building via stainless steel ducts on the northern wall and the roof.

A floor drain inside the paint booth discharges through a 6-inch drainpipe to the sump (Site 95). The paint booth sump (Site 95) consists of a below-grade concrete pit covered with a steel grate and was initially equipped with a submersible pump. The sump collects water from floor washing in the dry paint booth after the floor is swept of dry and loose material. After the sump was filled, the pump would be activated to discharge the water to an outside spigot. Initially, a hose was connected to the spigot, and wastewater

was drained to a washrack (Site 30) that was connected to a sanitary sewer drain. A 55-gallon drum was placed on a concrete slab under the spigot outside of Building 2101 in case of accidental discharge from the spigot. In 1999, the integrity of the unit was sound, with no apparent transport pathways out of the building with the exception of the exhaust vent[2]. During a 2001 site visit, the drum was observed to be full. The paint booth sump was replaced in 2001 and linked directly to the sanitary sewer system[3]. Dewatering of the excavation, which resulted from the removal and replacement of the sump, occurred when the sump was replaced.

2.2 PREVIOUS INVESTIGATIONS AND ENFORCEMENT ACTIVITIES

2.2.1 Previous Investigations

The environmental investigations that pertain to Site 95 are listed below and summarized in the remainder of this subsection:

- RFA[1]
- 1999 DTA[2]
- 1999 DTAWS Investigation[3]
- 2001 SSP Investigation[3]
- 2003/2004 Engineering Evaluation/Cost Analysis (EE/CA) Investigation[6]
- 2006 RI[4]

Six IR Program Sites were identified near Building 2101 during the RFA[1] (Figure 2-3). Two of the sites (SWMUs D-03 – Building 2101 Dry Paint Booth and T-06 – Building 2101 Trenches) were closed out with no action after a DTA[2], which included a thorough review of all existing or easily obtainable documentation/information, Base personnel interviews, and site visits.

1999 DTAWS Investigation

A DTAWS investigation was conducted in 1999 at the four remaining IR Program sites at Building 2101 [Site 30 (SWMU W-06) – Building 2101 Washrack, Site 45 (SWMU CA-22) – Building 2101 Container Accumulation Area No. 2, Site 50 (SWMU CA-21) – Building 2101 Container Accumulation Area No. 1, and Site 95 (SWMU M-27) – Building 2101 Paint Booth Sump]. The DTAWS investigation included a site visit and file research to determine whether any releases of hazardous waste had occurred. Based on the site visit, the overall condition of the sump was reported to be excellent; however, the piping leading from the sump was not inspected at the time.

Soil samples were collected from all four Building 2101 sites during the DTAWS investigation. Based on the assumption that the possible source of contamination Site 95 was the spigot located outside Building 2101, subsurface soil samples were collected from beneath the pavement at two locations near the spigot.

Based on the results of the DTAWS investigation, it was determined that releases may have occurred in the area around Building 2101. Reported concentrations of soil contaminants were not considered to be significant with respect to direct contact (i.e., concentrations were less than residential risk-based screening levels). However, one VOC and two semivolatile organic compounds (SVOCs) were detected in subsurface soil samples at concentrations indicating that migration of soil contaminants to groundwater could be considered problematic. Groundwater samples were not collected during the DTAWS investigation. Consequently, the decision was made to further investigate the area via an SSP investigation. A DTAWS Report was not prepared for the site; however, data collected for the DTAWS investigation were included in the SSP presentation[(3)].

2001 SSP Investigation

Groundwater sampling at the four building 2101 sites was conducted in 2001 as part of an SSP investigation. Groundwater samples were collected from shallow monitoring wells installed around the sites, including one installed near the outside spigot at Site 95 (095TW001). VOCs and metals were detected in the groundwater samples collected in 2001. Risk screening results indicated that residential human exposure to the groundwater may pose potential noncancer/cancer risks because of the presence of several VOCs and arsenic. The highest concentrations were detected in the sample collected from the monitoring well installed near Site 95 (095TW001). Vinyl chloride (VC) and cis-1,2-dichloroethene (DCE) were the only contaminants detected at concentrations greater than Federal MCLs. Concentrations greater than the MCLs were only detected in well 095TW001.

There are no unacceptable risks to ecological receptors. The area surrounding Site 95 is a light industrial area without suitable habitat for ecological receptors. Although the general direction of groundwater flow is to the Potomac River, contamination is not expected to reach the river, which contains a significant ecological habitat. The migration of contaminants from the site through the storm sewers to the sediments in nearby watersheds was evaluated via the completion of several watershed-based ecological risk assessments. However, VOCs were not identified as chemicals of concern (COCs) for these assessments, supporting the conclusion that downstream habitats have not been adversely impacted by the release of contaminants from Site 95.

Based on the data collected during the DTAWS and SSP investigations, it was recommended that an EE/CA be conducted at Site 95 to delineate the horizontal and vertical extent of groundwater contamination and evaluate remedial alternatives. The other three sites were closed out with no action.

2003/2004 EE/CA Investigation

As part of the Site 95 EE/CA investigation in 2003, subsurface soil samples were collected from soil boring and monitoring well installations. VOCs were not detected in any of the soil samples. Additional shallow, intermediate, and deep monitoring wells were installed during this investigation to evaluate the vertical and horizontal extent of groundwater contamination.

Groundwater samples were collected in 2003 from existing and newly installed monitoring wells. For the most part, VOCs were detected at low concentrations (less than Federal MCLs) in the groundwater samples. As with the previous sampling, the highest concentrations were detected in the monitoring well closest to the spigot outside Building 2101 (095TW001). Cis-1,2-DCE and VC were detected at concentrations greater than Federal MCLs in well 095TW001. The concentrations detected during this investigation were 4 to 10 times greater than the concentrations detected during the SSP investigation. This occurrence (increase in concentrations) may be the result of dewatering efforts that were conducted during the replacement of the sump (pulling contamination into the area of the sump as groundwater was removed from the excavation). Although most of the same compounds were detected in the groundwater sample collected from well 095MW002 (the deep well paired with well 095TW001), the concentrations were significantly lower than those detected in well 095TW001, indicating that vertical migration of the contamination has not occurred.

Groundwater samples collected in 2004 from five of the existing monitoring wells near Site 95 were used to evaluate concentration trends (time and depth) and the potential for monitored natural attenuation (MNA). As with the previous sampling events, the highest concentrations of VOCs were detected in well 095TW001, and as before, cis-1,2-DCE and VC were detected at concentrations greater than Federal MCLs in well 095TW001. The evaluation of the data indicated that conditions at Site 95 are favorable for natural attenuation.

Based on the data collected during the SSP and EE/CA investigations, it was determined that exposure to groundwater may pose unacceptable noncancer/cancer risks to potential human receptors.

Four alternatives for remediating the groundwater were developed and evaluated in the EE/CA. At the time, MNA was identified as the recommended alternative. Additional sampling, as part of an Expanded Site Investigation (SI), was also recommended to establish baseline groundwater conditions before implementing a groundwater treatment system at the site.

2006 RI

A comprehensive round of groundwater sampling to establish baseline groundwater conditions was conducted in December 2006; this investigation was originally called an Expanded SI. It was subsequently decided that a streamlined RI/FS would be completed so that a ROD could be prepared before implementation of any remedial actions. The RI indicated that the extent of groundwater contamination is limited to a small area around well 095TW001. Concentrations of cis-1,2-DCE and VC in the groundwater from this well have consistently exceeded Federal MCLs by several orders of magnitude. However, groundwater in the downgradient wells and in the deep well associated with well 095TW001 (well 095MW002) does not exhibit such high concentrations.

Based on the data collected during the 2006 RI, it was determined that exposure to groundwater may pose unacceptable noncancer/cancer risks to potential human receptors. These potential risks to human receptors were associated with exposure of personnel working in and around Building 2101 (construction/ excavation worker) and potential future residents to VOCs in the groundwater (primarily cis-1,2-DCE and VC).

Technologies that can be applied to the remediation of Site 95 groundwater were categorized, identified, and evaluated in the 2007 RI/FS Report[4]. After the technologies were evaluated, four treatment alternatives were identified and evaluated.

2.2.2 Enforcement Actions

No CERCLA enforcement actions have occurred at Site 95.

2.3 COMMUNITY PARTICIPATION

The RI/FS Report[4] and Proposed Plan[5] for Site 95 at MCB Quantico, Virginia were made available to the public in February 2008 and March 2008, respectively. These documents can be found in the Administrative Record and the information repositories maintained at the Chinn Park Regional Library in Prince William, Virginia, the John Musante Porter Memorial Library in Stafford, Virginia, and the Natural Resources and Environmental Affairs Branch at MCB Quantico. The notice of availability of these documents was published in the Potomac News and Manassas Journal Messenger on April 20, 2008 and The Free Lance-Star on April 27, 2008. A public comment period was held from April 20 to May 19, 2008. In addition, a public availability session was held on May 7, 2008. At this availability session, representatives of the DON, USEPA, and VDEQ were prepared to answer questions about environmental

concerns at the site and potential remedial alternatives. However, no one from the public attended the meeting, and no verbal or written comments have been received from the public.

To assist the DON in disseminating information to the local community regarding the ongoing investigative and remedial processes at MCB Quantico, the DON prepared a Community Relations Plan in 1995, which was updated in 2004. The Community Relations Plan identifies community concerns about the investigation and restoration of potentially contaminated sites at MCB Quantico and outlines community relations activities to be conducted during the current and anticipated future restoration activities.

2.4 SCOPE AND ROLE OF RESPONSE ACTION

This ROD addresses the final remedial actions to be taken regarding groundwater contamination at Site 95. No other remedial actions have been taken or need to be taken at Site 95. The scope of the proposed action is limited to contamination present within the site boundaries.

Site 95 is one of the 226 IR Program sites that have been or are being addressed under CERCLA at MCB Quantico. In addition to this site, RODs have previously been issued and signed for the following:

- Operable Unit (OU) 1 – Pesticide Burial Area (Site 1), Building 2427 Burn Area (SWMU L-17), Building 2427 Disposal Area (SWMU L-18), and Building 2427 Drum Disposal Area (SWMU M-29)

- OU 2 – Arsenic Burial Area (Site 17)

- OU 3 – Former Rifle Range (Site 20)

- OU 4 – Old Landfill (Site 4), Building 669 (SWMU B-08), and Defense Reutilization and Marketing Office Scrapyard (SWMU L-03)

- OU 6 – Old Batch Plant (Site 5), Building 3218 (SWMU B-07), Old Batch Plant Drop Inlet No. 1 (SWMU M-06), Old Batch Plant Drop Inlet No. 2 (SWMU M-07), and Old Batch Plant Collection Sump (SWMU M-08)

Additionally, RODs are currently being prepared for the following:

- Site 8 - Camp Barrett Disposal Area, Site 9 - Camp Goettege Disposal Area, Site 10 - Camp Upshur Disposal Area, Site 21 - Smith Lake Road Cleared Area, Site 32 - Pesticide Control Building, Site 33 - The Basic School Northwest Training Area, Site 34 - Building 4 Accumulation Area, and Site 98 - Golf Course Maintenance Area
- Site 96 – Old Landfill Southern Wetlands / Site 99 – Quantico Embayment

RODs will be prepared for Site 100 (Chopawamsic Creek) and SWMU M-13 (Building 2113 Underground Tank Loading/Unloading Area) when FS Reports for the sites are finalized.

The DON and regulators have already addressed the other 199 IR Program sites identified in the MCB Quantico Federal Facilities Agreement (FFA)[7]. Site investigations (Desktop Audits, DTAWSs, or SSP investigations) were completed, and closeout documentation was prepared for these sites.

The status of all IR Program sites at MCB Quantico can be found in the current version of the Site Management Plan[8], contained in the Administrative Record file.

The following are the components of the overall site cleanup plan for Site 95:

- Enhanced in-situ bioremediation using an electron acceptor chemical – ORC
- Groundwater use, construction, and excavation restrictions
- Groundwater monitoring
- A discretionary 5-year review

This ROD presents the Selected Remedy that will prevent unacceptable risks from exposure to on-site contaminants.

2.5 SITE CHARACTERISTICS

2.5.1 Physical Setting

The following is a description of the physical characteristics of Site 95 based on both the RI and historical environmental investigations.

Site 95 and the surrounding area is a secured area within the industrialized portion of the airfield at MCB Quantico. The area is primarily comprised of buildings, asphalt and concrete streets, sidewalks, and parking lots. The area is currently used as a helicopter testing and repair hangar. There are small grassy island areas surrounding Building 2101. Directly to the southeast lies the airfield's runways, taxiways, and tarmac. Access to the airfield and associated buildings/hangars is restricted and requires security

clearance to enter the area. Building 2101 and other buildings in the area are slated for demolition once replacement hangars are constructed. Construction of the replacement hangars has started, and the schedule for completion is estimated to be Fiscal Year 2010.

The topography at Site 95 is relatively flat, as is most of the Mainside area of MCB Quantico. The topography rises just slightly to the west where a rail line operated by the RF&P railroad is located.

Surface water runoff from the site drains towards storm grates located near the northern and southern ends of Building 2101. Several additional storm drains are located around the site and along Rowell Road. These storm drains ultimately drain into the Quantico Embayment.

Subsurface geology at Site 95 was interpreted based on boring logs prepared during the installation of soil borings and monitoring wells in 2003. Generally, the site is underlain by unconsolidated materials overlying bedrock. The unconsolidated materials are predominantly made up of silty sands to a depth of approximately 6 to 8 feet below ground surface (bgs) and fine- to medium-grained sands to approximately 30 feet bgs. A sandy clay layer observed in one of the borings between 9.5 feet and 15.5 feet was not seen in other borings.

Hydrogeologic conditions were interpreted from field data collected during the well installation activities performed in December 2006. Groundwater flow direction is southeast (Figure 2-3). The data also indicate that the groundwater flow direction and groundwater elevations are not tidally influenced.

Natural attenuation data were collected during the 2003/2004 EE/CA investigation and the 2006 RI. The data were evaluated to determine if site conditions were favorable for natural attenuation of VOCs, particularly trichloroethene (TCE), 1,2-DCE, and VC. In addition, the data were evaluated to determine whether biological activity could be enhanced to degrade VOCs through reductive anaerobic degradation. The evaluation of the data indicated that conditions at Site 95 are favorable for natural attenuation and that in-situ biological treatment is worthy of further evaluation. A treatability study will be conducted at Site 95 to optimize groundwater treatment at the site. The results of the treatability study will be used to help prepare the Remedial Design for the treatment system at Site 95.

2.5.2 Conceptual Site Model

Figure 2-4 is the conceptual site model (CSM) for Site 95. The CSM graphically integrates information regarding the physical characteristics of the site, exposed populations, sources of contamination, and contaminant mobility (fate and transport) to identify potential exposure routes and receptors evaluated in the human health risk and ecological risk assessments. A well-defined CSM allows for a better understanding of the risks at a site and aids in the identification of the potential need for remediation.

Although the source of groundwater contamination has not been found, it is suspected that activities in and around the paint booth sump contributed to the contamination found in the groundwater.

Human receptors under current and future land use scenarios include occupational workers, construction/ excavation workers, and residents. The only potentially complete exposure pathway under current land use is via vapor intrusion into the building. Construction/excavation workers exposed to groundwater and vapor intrusion while working in a trench were evaluated because of the possibility of future on-site construction/excavation activities (i.e., new hangars are being built at the airfield and existing hangars are slated for demolition in the future). Although residential use of the shallow groundwater as a source of drinking water is not a reasonably anticipated future land use, hypothetical future residential use of the site was evaluated in the human health risk assessment (HHRA) for decision-making purposes [i.e., to determine whether unrestricted land use was appropriate or land use controls (LUCs) would be needed].

Current and potential future land use and resource uses are discussed in Section 2.6. Potential risks to human health receptors are discussed in Section 2.7.

2.5.3 Sampling Strategy

Information about Site 95 media has been gathered from numerous soil and groundwater samples that have been collected at the site since 1999 (Section 2.2.1). The sample results for the COCs are discussed in Section 2.5.4. Additional sample information is presented in the RI/FS Report[(4)] and other historical documents.

2.5.4 Nature and Extent of Contamination

This section contains a discussion of the nature and extent of groundwater contamination at Site 95 based on data collected in 2006 (most representative of current site conditions). Sample locations are depicted on Figure 2-3. In addition, comparisons of 2006 RI data to analytical results from previous investigations are provided in Table 2-1. Although comparisons to Federal drinking water standards and USEPA Risk-Based Concentrations (RBCs) for tap water are also provided in Table 2-1, the groundwater at Site 95 is currently not used, and is not expected to be used in the future as a drinking water source.

Twelve groundwater samples were collected at Site 95 in December 2006 and analyzed for VOCs. Nineteen VOCs were detected during the 2006 RI sampling. The 2006 data are summarized in Table 2-2, and illustrated on Figure 2-3. Results were compared to Federal MCLs[(9)] and Region 3 tap water RBCs[(10)] as summarized in Table 2-1.

Cis-1,2-DCE [2,200 micrograms per liter (µg/L) – approximately 30 times greater than the Federal MCL] and VC (4,300 µg/L – approximately 2,000 times greater than the Federal MCL) were the only VOCs detected at concentrations above their Federal MCLs. These chemicals were only detected at concentrations in excess of Federal MCLs in well 095TW001, which has exhibited elevated concentrations of these chemicals during previous investigations. As in the past, some of the same compounds were detected in the associated deep well, 095MW002, but at much lower concentrations (less than Federal MCLs). Cis-1,2-DCE has been detected at low concentrations (10 times less than the Federal MCL) in all samples from the well. The concentrations of cis-1,2-DCE in well 095MW002 are 400 times less than the concentrations of cis-1,2-DCE in well 095TW001. VC has never been detected in well 095MW002.

VOCs were detected in some of the other wells in the area, but at concentrations orders of magnitude lower than the concentrations detected in monitoring well 095TW001. In addition, the concentrations in the other wells were all below any associated Federal MCLs. VOCs were not detected in well 095MW006 (downgradient deep well) and well 095MW009 (upgradient well). The three VOCs that were detected in 2004 in monitoring well 030TW002 at concentrations above their Federal MCLs (1,1-DCE, tetrachloroethene, and TCE) were again detected in the 2006 groundwater sample collected from that well but at lower concentrations (less than their Federal MCLs).

The 2006 data, along with the previous data, indicate that the extent of groundwater contamination is limited to a small area around monitoring well 095TW001. Concentrations of cis-1,2-DCE and VC in the groundwater from this well have consistently exceeded Federal MCLs by several orders of magnitude. In addition, the concentrations of these two VOCs have increased over the course of the sampling efforts at Site 95. Concentrations of cis-1,2-DCE increased from 150 µg/L in 2001 to 2,200 µg/L in 2006, and the concentrations of VC increased from 380 µg/L in 2001 to 6,100 µg/L in 2004 (the 2006 VC concentration of 4,300 µg/L is slightly lower than the 2004 concentration). This increase in the concentrations may be the result of the dewatering efforts that occurred during the replacement of the sump in 2001 (pulling contamination into the area of the sump as groundwater was removed from the excavation). The decrease in VC concentrations from 2004 to 2006 may be the result of several factors (natural attenuation of the VC, dispersion of the VC, etc.).

Groundwater in the downgradient wells does not exhibit concentrations greater than Federal MCLs, and groundwater in the deep well associated with well 095TW001 (well 095MW002) does not contain concentrations greater than Federal MCLs. In addition, the VOCs detected in some of the downgradient monitoring wells (acetone and chloroform in well 095MW003; bromodichloromethane, chlorodibromomethane, and chloroform in well 095MW004; and chloroform in well 095MW006) differ from

the chlorinated ethenes and ethanes detected in well 095TW001 and are likely attributable to other IR program activities near Building 2101 (Site 30, Site 45, and Site 50), not Site 95.

2.6 CURRENT AND POTENTIAL FUTURE LAND AND RESOURCE USES

This section of the ROD discusses the current and reasonably anticipated future land uses and current and potential beneficial groundwater uses at Site 95. This section forms the basis for reasonable exposure assessment assumptions and risk characterization conclusions.

Site 95 can be characterized as being in an industrialized area mostly overlain by concrete and asphalt. The area surrounding Site 95 is currently used as a helicopter testing and repair hangar located within an industrialized area of the airfield at MCB Quantico. Access to the airfield and associated buildings/hangars is restricted and requires security clearance to enter the area. The area immediately around Site 95 is a secured area primarily comprised of buildings and asphalt and concrete streets, sidewalks, and parking lots. There are small grassy island areas throughout this portion of the MCB. Directly to the southeast lies the airfield's runways, taxiways, and tarmac. Building 2101 and other buildings in the area are slated for demolition once replacement hangars are constructed. Construction of the replacement hangars has started, and the schedule for completion is estimated to be Fiscal Year 2010.

Groundwater beneath Site 95 currently is not used for any purpose. The DON has no plans to use this groundwater in the future.

Although it is not expected that the site area would be developed for residential use in the future, hypothetical residential use was evaluated in the HHRA during the RI.

2.7 SUMMARY OF SITE RISKS

This section includes a summary of the potential human health risks via exposure to groundwater at Site 95 assuming that no additional actions are taken to mitigate risks. Risk assessments provide the basis for taking additional action and identify the contaminants and exposure pathways that need to be addressed by a remedial action.

There are no unacceptable risks to ecological receptors. The area surrounding Site 95 is a light industrial area without suitable habitat for ecological receptors. Although the general direction of groundwater flow is to the Potomac River, contamination is not expected to reach the river, which contains a significant ecological habitat. The migration of contaminants from the site through the storm sewers to the sediments in nearby watersheds was evaluated via the completion of several watershed-based ecological

risk assessments. However, VOCs were not identified as chemicals of concern (COCs) for these assessments, supporting the conclusion that downstream habitats have not been adversely impacted by the release of contaminants from Site 95.

Although the HHRA evaluated all chemicals of potential concern (COPCs) (i.e., those chemicals present at concentrations greater than risk-based screening levels), this section of the ROD places emphasis on those exposure pathways and chemicals that are likely to pose a threat (i.e., COCs). COCs are a subset of the COPCs identified in the risk assessment. No information is provided for chemicals and media that do not pose an unacceptable risk. Specific details of the risk assessment, including all chemicals and media addressed, can be found in the RI/FS Report[4].

Direct exposure to groundwater at Site 95 was evaluated in the baseline HHRA contained in the RI/FS Report[4]. The risk assessment for groundwater was conducted using the 2006 groundwater data only because it is representative of current site conditions.

Identification of Chemicals of Concern

Table 2-3 presents the COCs and exposure point concentrations for each COC at Site 95. VC and 1,2-DCE were selected as COCs for groundwater. These chemicals pose unacceptable risks to potential human receptors.

The exposure point concentration is the concentration that was used to estimate the exposure and risk from each COC. Table 2-3 also includes the concentration range for each COC in groundwater, the frequency of detection, the exposure point concentration, and how the exposure point concentration was derived. The exposure point concentration is the lower of the 95 percent upper confidence limit (UCL) of the arithmetic mean and the maximum detected concentration.

Exposure Assessment

The exposure assessment defines and evaluates the type and magnitude of human exposure to the chemicals present at or migrating from a site. The exposure assessment is designed to depict the physical setting of the site, identify potentially exposed populations, and estimate chemical intakes under the identified exposure scenarios. Actual or potential exposures are based on the most likely pathways of contaminant release and transport, as well as human activity patterns. A complete exposure pathway has three components: a source of chemicals that can be released into the environment, a route of contaminant transport through an environmental medium, and an exposure or contact point for a human receptor.

The compilation of contaminant sources, likely exposure pathways, and receptors at Site 95 is depicted in the CSM, which is presented on Figure 2-4. Potential receptors exposed to groundwater include the following: occupational workers, future construction/excavation workers and hypothetical future residents. Future residential use is not a reasonably anticipated land use but was evaluated to identify whether unrestricted land use could be permitted. Major assumptions about exposure frequency (days/year), exposure duration (years), and other exposure factors (e.g., body surface area for dermal exposure, ingestion rates) included in the HHRA can be found in the RI/FS Report[4].

Toxicity Assessment

Table 2-4 provides toxicity data (carcinogenic and noncarcinogenic) for COCs in groundwater. Carcinogenic toxicity data is only available for VC, which is a known human carcinogen. The remaining COC for groundwater (cis-1,2-DCE) is not classifiable as a human carcinogen, and there is no cancer slope factor (CSF) available for this chemical. However, both COCs have reference doses (RfDs) indicating their potential for adverse noncarcinogenic effects in humans.

Risk Characterization

Methodology

For carcinogens, risks are generally expressed as the incremental probability of an individual developing cancer over a lifetime of exposure to the carcinogen. An incremental lifetime cancer risk (ILCR) is calculated from the following equation:

$$ILCR = CDI \times CSF$$

Where: ILCR = a unitless probability (e.g., 2.5E-05) of an individual developing cancer
CDI = chronic daily intake averaged over 70 years (mg/kg/day)
CSF = cancer slope factor, expressed as $(mg/kg/day)^{-1}$

These risks are probabilities that are usually expressed in scientific notation (e.g., 1E-06). An ILCR of 1E-06 indicates that an individual experiencing the reasonable maximum exposure estimate has a 1 in 1,000,000 chance of developing cancer as a result of site-related exposure. This is referred to as an "increased lifetime cancer risk" because it would be in addition to the risks of cancer individuals face from other causes such as smoking or exposure to too much sun. The chance of an individual developing cancer from all other causes has been estimated to be as high as one in three. The USEPA generally acceptable risk range for site-related exposure is 1E-04 to 1E-06 or an excess lifetime cancer risk of 1 in 10,000 to 1 in 1,000,000.

The potential for noncarcinogenic effects is evaluated by comparing an exposure level over a specified time period (e.g., lifetime) with an RfD derived for a similar exposure period. An RfD represents a level that an individual may be exposed to that is not expected to cause any deleterious effect. The ratio of exposure to toxicity is called a hazard quotient (HQ). An HQ less than 1.0 indicates that a receptor's dose of a single contaminant is less than the RfD and that toxic noncarcinogenic effects from that chemical are unlikely. The hazard index (HI) is generated by adding the HQs for all COCs that affect the same target organ (e.g., liver) or that act through the same mechanisms of action within a medium or across all media to which a given individual may reasonably be exposed. An HI less than 1.0 indicates that, based on the sum of all HQs from different contaminants and exposure routes, toxic noncarcinogenic effects from all contaminants are unlikely. An HI greater than 1.0 indicates that site-related exposures may present a risk to human health.

The HQ is calculated as follows:

$$\text{Noncancer HQ} = \text{CDI}/\text{RfD}$$

Where: CDI = chronic daily intake (mg/kg/day)
RfD = reference dose (mg/kg/day)

CDI and RfD are expressed in the same units and represent the same exposure period (i.e., chronic, subchronic, or short term).

Carcinogenic Risks

If no clean-up action is taken, future construction/excavation workers and hypothetical future residents would have an unacceptable increased probability of developing cancer as a result of direct contact with site-related groundwater contaminated with VC. Table 2-5 summarizes the risk estimates for the occupational worker, future construction/excavation worker, and hypothetical future residential scenarios. As indicated previously, VC is the only carcinogenic COC for groundwater. Total ILCRs associated with direct exposure to groundwater are 5.1E-04 for a future construction/excavation worker, 3.6E-02 for a future child resident, and 3.7E-02 for a future adult resident. For the construction/excavation worker, risks for inhalation (in a trench) pathway are significant (i.e., greater than 1E-04) and for the future hypothetical residents, risks for dermal contact, direct ingestion, and inhalation of indoor air exposure pathways are all significant.

The ILCR for the occupational worker (1.5E-04) is only slightly greater than USEPA's acceptable risk range of 1E-04 to 1E-06. These risks are driven by exposure to VC via inhalation. Because the

noncarcinogenic risks for the occupational workers are less than USEPA benchmarks (next section) and the carcinogenic risks for the occupational worker are only slightly greater than USEPA's acceptable risk range, and because of significant uncertainties associated with the indoor air concentrations predicted by the conservative screening model, current occupational workers are not at risk. However, any new construction at Site 95 may result in less uncertainty associated with indoor air concentrations predicted by the conservative screening model and future occupational workers may be subject to unacceptable risks as a result of vapor intrusion.

Noncarcinogenic Risks

If no clean-up action is taken, future construction/excavation workers and hypothetical future residents may also develop adverse deleterious effects as a result of contact with site-related groundwater contaminated with VC and cis-1,2-DCE. A summary of the noncarcinogenic risks for the occupational worker, future construction/excavation worker, and hypothetical future residential scenarios is provided in Table 2-6. An HI of 80 was calculated for the future construction/excavation worker, an HI of 109 was calculated for the future child resident, the HI for the future adult resident was 90.

The HI for the occupational worker (1.1) was only slightly greater than the USEPA benchmark for noncarcinogenic risks (1.0), but when target organs are considered, the HIs for the occupational worker (0.16 for cis-1,2-DCE and 0.94 for VC) are below the USEPA benchmark. Because the noncarcinogenic risks for the occupational workers are less than USEPA benchmarks and the carcinogenic risks for the occupational worker (previous section) are only slightly greater than USEPA's acceptable risk range, and because of significant uncertainties associated with the indoor air concentrations predicted by the conservative screening model, current occupational workers are not at risk. However, any new construction at Site 95 may result in less uncertainty associated with indoor air concentrations predicted by the conservative screening model and future occupational workers may be subject to unacceptable risks as a result of vapor intrusion.

Uncertainty Analysis

The main sources of uncertainty inherent in the Site 95 HHRA are:

- Residential Land Use – Groundwater at Site 95 is not expected to be used as a drinking water source. The site is currently in an industrial area and the future use of the site is expected to remain the same. It is unlikely that this area would be rezoned residential and developed for residential use because the site is located within the industrial area of the airfield. A hypothetical residential scenario was evaluated only for the purposes of evaluating unrestricted land use.

- Groundwater Exposure Point Concentration – Because the 95 percent UCLs exceeded maximum detected concentrations, the maximum concentration of each COPC was used as the exposure point concentration (EPC) for groundwater. This is an extremely conservative assumption because it assumes that potential receptors are exposed to each COPC at the location of its maximum concentration simultaneously for 30 years. Because of this, the risks calculated for groundwater are likely to be greatly overestimated. There was also uncertainty in assuming that current groundwater concentrations will not change in the future, and this introduces additional uncertainty in the EPCs and risk estimates. Concentrations in groundwater may decrease over time due to natural attenuation processes, source depletion, and dilution.

  In addition, VC, which is the main risk driver for the site, was detected in only 1 of 12 samples collected in 2006. The single VC detection of 4,300 µg/L indicates that a VC "hot spot" is present at the site. The hot spot concentration was used to calculate risk for the entire site, thereby overestimating the cumulative risks calculated for the site.

The response action selected in this ROD is necessary to protect the public health or welfare or the environment from the unacceptable risks associated with dermal contact, direct ingestion, and inhalation of groundwater (indoor air) beneath the site contaminated with VC and cis-1,2-DCE. Future construction/excavation workers may be at risk if exposed to contaminated groundwater during intrusive construction activities in the vicinity of well 095TW001. Hypothetical future residents may be at risk if groundwater in the vicinity of well 095TW001 is used as potable water. Occupants of any buildings (commercial or residential) built in the vicinity of well 095TW001 may be at risk if mitigative measures are not incorporated into new construction to eliminate unacceptable risks associated with vapor intrusion.

Because the ILCR for the occupational worker is only slightly greater than USEPA's acceptable risk range, the noncarcinogenic risks for the occupational workers are less than USEPA benchmarks, and because of significant uncertainties associated with the indoor air concentrations predicted by the conservative screening model, current occupational workers are not at risk. However, any new construction at Site 95 may result in less uncertainty associated with indoor air concentrations predicted by the conservative screening model and future occupational workers may be subject to unacceptable risks as a result of vapor intrusion.

2.8 REMEDIAL ACTION OBJECTIVES

RAOs provide a general description of what the cleanup will accomplish. These goals typically serve as the design basis for many of the remedial alternatives that are discussed in the next section. The RAOs provide a basis for evaluating clean-up options for the site and an understanding of how the risks identified in the previous section will be addressed by the response action. Based on the potential

exposure pathways, receptors of concern, and potential future land use scenarios, the RAOs for Site 95 are as follows:

- Restore shallow groundwater near well 095TW001 to its beneficial use.

- Prevent exposure to shallow groundwater near well 095TW001 until COC concentrations attain PRGs.

- Incorporate mitigative measures into new construction at the site, as necessary, to eliminate unacceptable risks associated with vapor intrusion until COC concentrations attain PRGs.

Based on the identified RAOs for Site 95 groundwater, PRGs were established for the COCs for the protection of human receptors exposed to groundwater. The selected PRGs are the Federal MCLs for each COC.

- Cis-1,2-DCE – 70 µg/L
- VC – 2 µg/L

Although the site is currently used for industrial purposes, and anticipated future use of the site is the same, the PRGs were established for potential future residential receptors (the most conservative scenario).

2.9 DESCRIPTION OF ALTERNATIVES

The Site 95 RI/FS Report[4] presented the results of the detailed analysis of four potential remedial action alternatives. These alternatives were developed to provide a range of remedial actions for the site. This section of the ROD summarizes the alternatives that are described in the RI/FS Report[4].

2.9.1 Description of Remedy Components

This section provides a list of the major components of each alternative as they logically occur in the remediation process. The lists include treatment components and the materials they address, groundwater use, construction, and excavation restrictions, and monitoring requirements.

2.9.1.1 Alternative 1 – No Action

There are no remedy components for the no-action alternative. This alternative is required under CERCLA to establish a basis for comparison with other alternatives. No remedial actions would be

implemented, and the property could be available for unrestricted land use because no institutional controls would be included.

2.9.1.2 Alternative 2 – Monitored Natural Attenuation

Under this alternative, there would be no direct, active remediation of the groundwater; the groundwater would be allowed to naturally attenuate. Monitored natural attenuation refers to inherent processes (biodegradation, dilution from recharge, volatilization, etc.) that affect the rates of migration and the concentrations of contaminants in groundwater. The components of this alternative also include groundwater monitoring to evaluate the effectiveness of natural attenuation; groundwater use restrictions to ensure that contaminated groundwater is not used as a source of potable water; construction restrictions to ensure that mitigative measures designed to eliminate unacceptable risks associated with vapor intrusion, if required, are incorporated into new construction (commercial or residential) at the site; and excavation restrictions to ensure that construction workers are not exposed (dermal or inhalation) to groundwater contaminated with unacceptable levels of COCs during construction activities. These restrictions would be developed, with USEPA and VDEQ concurrence, as part of a Remedial Design for LUCs and would be maintained until COC concentrations attain PRGs. Discretionary 5-year reviews would be conducted to evaluate the analytical results from monitoring samples, assess the site status, and determine whether further action is necessary. These discretionary site reviews would be completed because this alternative would allow contaminants to remain at the site in excess of levels that allow for unlimited use and unrestricted exposure for at least 30 years before PRGs and RAOs are attained.

2.9.1.3 Alternative 3 – Enhanced In-Situ Bioremediation: ORC Treatment

This alternative includes enhanced in-situ bioremediation using an electron acceptor chemical, ORC, monitoring, groundwater use, construction, and excavation restrictions, and a 5-year review. ORC is used to provide oxygen, the release of which supports a number of biological oxidation pathways that are expected to result in the complete breakdown of site contaminants. Under Option A, ORC would be injected at three locations upgradient of well 095TW001. Option B would involve the installation of two wells upgradient of well 095TW001 and the placement in each well of replaceable ORC filter socks. Groundwater monitoring would be implemented to determine the effectiveness of bioremediation, to confirm that contaminants are not migrating off site at unacceptable concentrations, and to confirm that COC concentrations do not increase to levels above PRGs once treatment is discontinued.

Groundwater use restrictions would be implemented to ensure that contaminated groundwater is not used as a source of potable water. Construction restrictions would be implemented to ensure that mitigative measures designed to eliminate unacceptable risks associated with vapor intrusion, if required, are incorporated into new construction (commercial or residential) at the site. Excavation restrictions would

be implemented to ensure that construction workers are not exposed (dermal or inhalation) to groundwater contaminated with unacceptable levels of COCs during construction activities. These restrictions would be developed, with USEPA and VDEQ concurrence, as part of a Remedial Design for LUCs and would be maintained until COC concentrations attain PRGs. A discretionary 5-year review would be conducted to evaluate the analytical results from monitoring samples, assess the site status, and determine whether further action is necessary. The discretionary 5-year review would be completed to document that the concentrations of COCs have decreased to levels below the PRGs and, as a result, the RAOs have been attained.

2.9.1.4 Alternative 4 – Enhanced In-Situ Bioremediation: In-Situ Submerged Oxygen Curtain (iSOC™) Treatment

This alternative includes enhanced in-situ bioremediation using an oxygen delivery technology, iSOC™, monitoring, groundwater use, construction, and excavation restrictions, and a 5-year review. An iSOC™ unit would be installed in an underground vault that holds a control panel and a replaceable oxygen tank. iSOC™ is used to supersaturate the groundwater with dissolved oxygen (DO), the release of which supports a number of biological oxidation pathways that are expected to result in the complete breakdown of the COCs. Groundwater monitoring would be implemented to determine the effectiveness of bioremediation, to confirm that contaminants are not migrating off site at unacceptable concentrations, and to confirm that COC concentrations do not increase to levels above PRGs once treatment is discontinued.

Groundwater use restrictions would be implemented to ensure that contaminated groundwater is not used as a source of potable water. Construction restrictions would be implemented to ensure that mitigative measures designed to eliminate unacceptable risks associated with vapor intrusion, if required, are incorporated into new construction (commercial or residential) at the site. Excavation restrictions would be implemented to ensure that construction workers are not exposed (dermal or inhalation) to groundwater contaminated with unacceptable levels of COCs during construction activities. These restrictions would be developed, with USEPA and VDEQ concurrence, as part of a Remedial Design for LUCs and would be maintained until COC concentrations attain PRGs. A discretionary 5-year review would be conducted to evaluate the analytical results from monitoring samples, assess the site status, and determine whether further action is necessary. The discretionary 5-year review would be completed to document that the concentrations of COCs have decreased to levels below the PRGs and, as a result, the RAOs have been attained.

2.9.2 Common Elements and Distinguishing Features of Each Alternative

This section describes common elements and distinguishing features unique to each response action.

No response actions would be implemented under Alternative 1, the no-action alternative.

Alternatives 2, 3, and 4 include groundwater monitoring, groundwater use restrictions, construction restrictions, excavation restrictions, and discretionary 5-year reviews. Groundwater monitoring would be implemented to determine the effectiveness of the remedial action and to confirm that contaminants are not migrating off site at unacceptable concentrations. For Alternatives 3 and 4, groundwater monitoring would ensure that COC concentrations do not increase to levels above PRGs once treatment is discontinued.

Groundwater use restrictions would be implemented to ensure that contaminated groundwater is not used as a source of potable water. Construction restrictions would be implemented to ensure that mitigative measures designed to eliminate unacceptable risks associated with vapor intrusion, if required, are incorporated into new construction (commercial or residential) at the site. Excavation restrictions would be implemented to ensure that construction workers are not exposed (dermal or inhalation) to groundwater contaminated with unacceptable levels of COCs during construction activities. These restrictions will be developed, with USEPA and VDEQ concurrence, as part of a Remedial Design for LUCs and will be maintained until COC concentrations attain PRGs.

In addition, discretionary 5-year reviews would be completed because these alternatives would result in hazardous substances, pollutants, or contaminants remaining on site above levels that allow for unlimited use and unrestricted exposure, at least until the concentrations of COCs have attained PRGs.

Alternative 2 does not include active treatment of the groundwater, but instead relies on MNA. Alternative 3 includes treatment of the groundwater via enhanced in-situ bioremediation using ORC, whereas, Alternative 4 includes treatment of the groundwater via enhanced in-situ bioremediation using iSOC™.

Alternative 2 and the groundwater use, construction, and excavation restrictions under Alternatives 3 and 4 could be implemented within 1 month. The last two RAOs (prevent exposure to shallow groundwater near well 095TW001 until COC concentrations attain PRGs and incorporate mitigative measures into new construction (commercial or residential) at the site, as necessary, to eliminate unacceptable risks associated with vapor intrusion until COC concentration attain PRGs) would also be achieved within this time frame. The estimated construction durations for Alternatives 3 and 4 are both 3 months (there is no construction under Alternative 2). For Alternatives 3 and 4, it is expected that chemical concentrations would reach PRGs within 1 year (achieving the first RAO of restore shallow groundwater near well 095TW001 to its beneficial use). For Alternative 2, it is expected that chemical concentrations would take

at least 30 years to reach PRGs. Monitoring would be needed to evaluate the effectiveness of treatment with ORC or iSOC™ and natural attenuation, to confirm that the contamination is not migrating, and to confirm that COC concentrations do not increase to levels above PRGs once treatment is discontinued.

The present-worth cost for Alternative 2 is based on a 30-year maintenance life and on a 7 percent annual discount factor. The present-worth cost for Alternatives 3 and 4 are based on a 5-year maintenance life and a 7 percent annual discount factor. The present-worth cost of each alternative is as follows:

- Alternative 1: $0
- Alternative 2: $180,000
- Alternative 3: $140,000 (Option A), $158,000 (Option B)
- Alternative 4: $153,000

2.9.3 Expected Outcomes of Each Alternative

Under Alternative 1 (no action) the site use would be unrestricted. However, this could result in unacceptable risks to human health.

Under Alternatives 2, 3, and 4, groundwater could not be used as a source of potable water as long as it poses an unacceptable risk (until COC concentrations attain PRGs). Construction restrictions are needed to ensure that mitigative measures designed to eliminate unacceptable risks associated with vapor intrusion, if required, are incorporated into new construction (commercial or residential) at the site (until COC concentrations attain PRGs). In addition, excavation would be restricted to ensure that construction workers are not exposed to groundwater contaminated with unacceptable levels of COCs during construction activities (until COC concentrations attain PRGs). The USEPA and VDEQ would be appropriately notified of any proposed development plans prior to construction, so that the potential for unacceptable risks could be evaluated and appropriate actions could be taken.

2.10 SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

This section of the ROD summarizes the comparative analysis of alternatives presented in the detailed analysis section of the RI/FS Report[4]. The major objective is to evaluate the relative performance of the alternatives with respect to the nine evaluation criteria, so that the advantages and disadvantages of each are clearly understood.

Each alternative was developed to address potential risks to human health posed by contaminated groundwater. The NCP requires the remedial alternatives to be evaluated against the nine criteria listed below.

To be considered for remedy selection, an alternative must meet the two following threshold criteria:

- Overall protection of human health and the environment
- Compliance with applicable or relevant and appropriate requirements (ARARs)

The primary balancing criteria are then considered to determine which alternative provides the best combination of attributes. The primary balancing criteria are:

- Long-term effectiveness and permanence
- Reduction in toxicity, mobility, or volume through treatment
- Short-term effectiveness
- Implementability
- Cost

The alternatives are evaluated further against the two modifying criteria:

- Acceptance by the State
- Acceptance by the community

The alternatives proposed for the Site 95 groundwater were evaluated in the Proposed Plan[5] with respect to the first seven criteria. The two additional modifying criteria are evaluated after the public comment period. Table 2-7 contains a summary of the comparative analysis of alternatives.

2.10.1 Threshold Criteria

2.10.1.1 Overall Protection of Human Health and the Environment

This criterion addresses whether each alternative provides adequate protection of human health and the environment and describes how risks posed by each exposure pathway are eliminated, reduced, or controlled through removal, engineering controls, and/or institutional controls.

All of the alternatives, except Alternative 1 (No Action) would provide adequate protection of human health and the environment. Therefore, the no-action alternative (Alternative 1) will not be considered further in this analysis because it does not satisfy this threshold criterion.

Alternative 2 would be protective of human health because groundwater contamination would be allowed to naturally attenuate. Alternative 3 (Enhanced In-Situ Bioremediation using ORC) and Alternative 4 (Enhanced In-Situ Bioremediation using iSOC^{TM}) would protect human health by treating contaminated groundwater in situ. Restrictions on the use of shallow groundwater as a source of potable water, construction restrictions requiring mitigative measures to prevent unacceptable risk associated with vapor intrusion, and excavation restrictions to prevent exposure of construction workers to groundwater during possible excavation activities would be imposed for Alternatives 2, 3, and 4 (to protect human health) until PRGs are attained.

Alternatives 2, 3, and 4 would include groundwater monitoring to determine the effectiveness of natural attenuation or bioremediation and to confirm that contaminants are not migrating off site at unacceptable concentrations. Groundwater monitoring under Alternatives 3 and 4 would also confirm that COC concentrations do not increase to levels above PRGs once treatment is discontinued.

2.10.1.2 Compliance with ARARs

Section 121(d) of CERCLA and the NCP, 40 Code of Federal Regulations (CFR) 300.430(f)(1)(ii)(B), require that remedial actions at CERCLA sites at least attain legally applicable or relevant and appropriate federal and state requirements, standards, criteria, and limitations, unless such ARARs are waived under CERCLA Section 121(d)(4). ARARs are defined in USEPA guidance[(11)].

Applicable requirements are those clean-up standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance found at a CERCLA site. Only those state standards that are identified by a state in a timely manner and that are more stringent than federal requirements may be applicable.

Relevant and appropriate requirements are those clean-up standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that, while not applicable to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well-suited to the particular site. Only those state standards that are identified in a timely manner and are more stringent than federal requirements may be relevant and appropriate.

In addition, the NCP, at 40 CFR Section 300.400(g)(3), invites the lead agency to identify criteria or guidance to be considered (TBC) in deciding upon implementation of a remedial action. TBCs are guidance, advisories, or criteria developed by USEPA, other federal agencies, or states that may be useful in developing a CERCLA remedy; however, TBCs are not promulgated rules or laws.

This criterion addresses whether a remedy will meet all the ARARs of federal and state environmental statutes or provides a basis for invoking a waiver.

Alternatives 2, 3, and 4 would attain their federal and State ARARs.

2.10.2 Primary Balancing Criteria

2.10.2.1 Long-Term Effectiveness and Permanence

This criterion refers to expected residual risk and the ability of a remedy to maintain reliable protection of human health and the environment over time, once clean-up levels have been met. This criterion includes the consideration of residual risk that will remain on site following remediation and the adequacy and reliability of controls.

Because Alternatives 2, 3, and 4 involve some form of active or passive groundwater remediation, they are expected to be effective at decreasing groundwater contaminant levels over the long term. Alternatives 2, 3, and 4 also provide groundwater use, construction, and excavation restrictions, and groundwater monitoring that are all adequate and reliable controls. Groundwater use, construction, and excavation restrictions could be removed after contaminant concentrations have decreased to PRGs. Any private ownership of the land in the future would need to be controlled under a deed restriction until PRGs have been attained.

Groundwater monitoring would be implemented to determine the effectiveness of bioremediation, to confirm that contaminants are not migrating off site at unacceptable concentrations, and to confirm that COC concentrations do not increase to levels above PRGs once COCs have attained PRGs.

Discretionary 5-year reviews of the site would be conducted for Alternatives 2, 3, and 4 as long as groundwater contaminants remain in excess of levels that allow for unlimited use and unrestricted exposure.

The DON will be responsible for implementing, maintaining, reporting on, and enforcing the groundwater use, construction, and excavation restrictions.

2.10.2.2 Reduction of Toxicity, Mobility, or Volume through Treatment

Reduction of toxicity, mobility, or volume through treatment refers to the anticipated performance of the treatment technologies that may be included as part of a remedy.

Alternatives 3 and 4 include in-situ biological treatment to reduce the toxicity of hazardous substances in groundwater.

Alternative 2 does not include active treatment to reduce the toxicity, mobility, or volume of hazardous substances in groundwater.

2.10.2.3 Short-Term Effectiveness

Short-term effectiveness addresses the time needed to implement the remedy and any adverse impacts that may be posed to workers, the community, or the environment during construction and operation of the remedy until clean-up levels are achieved.

Alternative 2 and the groundwater use, construction, and excavation restrictions under Alternatives 3 and 4 could be implemented within 1 month. The last two RAOs (prevent exposure to shallow groundwater near well 095TW001 until COC concentrations attain PRGs and incorporate mitigative measures into new construction (commercial or residential) at the site, as necessary, to eliminate unacceptable risks associated with vapor intrusion until COC concentrations attain PRGs) would also be achieved within this time frame. The estimated construction durations for Alternatives 3 and 4 are both 3 months (there is no construction under Alternative 2). For Alternatives 3 and 4, it is expected that chemical concentrations would reach PRGs within 1 year (achieving the first RAO of restore shallow groundwater near well 095TW001 to its beneficial use). For Alternative 2, it is expected that chemical concentrations would take at least 30 years to reach PRGs. Monitoring would be needed to evaluate the effectiveness of treatment with ORC or iSOC™ and natural attenuation, to confirm that the contamination is not migrating, and to confirm that COC concentrations do not increase to levels above PRGs once COCs have attained PRGs.

No risks to workers, the community, or the environment during construction and operation of Alternatives 2, 3, and 4 are anticipated.

2.10.2.4 Implementability

Implementability addresses the technical and administrative feasibility of a remedy from design through construction and operation. Factors such as availability of services and materials, administrative feasibility, and coordination with other government entities are also considered.

All the alternatives are implementable. There are no significant technical difficulties associated with implementing any of the alternatives. Equipment and services needed to implement the alternatives are available. The groundwater use, construction, and excavation restrictions under Alternatives 2, 3, and 4 can be strictly enforced because the site is located within a military facility.

2.10.2.5 Cost

The estimated present-worth costs for Alternatives 2 through 4 range from approximately $140,000 for Alternative 3 to approximately $180,000 for Alternative 2. Present-worth costs are listed below:

- Alternative 2: $180,000
- Alternative 3: $140,000 (Option A), $158,000 (Option B)
- Alternative 4: $153,000

2.10.3 Modifying Criteria

2.10.3.1 State Acceptance

The VDEQ, on behalf of the state of Virginia, has reviewed the information available for Site 95 groundwater and concurs with the selected remedy (Alternative 3).

2.10.3.2 Community Acceptance

A public availability session was held on May 7, 2008. At this availability session, representatives of the DON, USEPA, and VDEQ were prepared to answer questions about environmental concerns at the site and potential remedial alternatives. However, no one from the public attended the meeting, and no verbal or written comments have been received from the public.

2.11 PRINCIPAL THREAT WASTES

The NCP establishes an expectation that treatment will be used to address the principal threats posed by a site, wherever practicable [40 CFR 300.430(a)(1)(iii)(A)]. Principal threat wastes are those source materials considered to be highly toxic or highly mobile that generally cannot be reliably contained or would present a significant risk to human health or the environment should exposure occur. Contaminated groundwater that does not contain non-aqueous phase liquids (NAPLs) is generally not considered to be a principal threat waste. NAPLs have not been detected at Site 95.

2.12 SELECTED REMEDY

This section identifies the Selected Remedy and expands upon the details provided in the Description of Alternatives section of the ROD.

2.12.1 Summary of the Rationale for the Selected Remedy

This section provides a discussion of the principal factors upon which the remedy selection decision is based.

The Selected Remedy for Site 95 at MCB Quantico is Alternative 3 – Enhanced In-Situ Bioremediation: ORC Treatment. This alternative meets all the RAOs, provides adequate protection of human health and the environment, and attains ARARs in the most cost-effective manner of all the alternatives. Alternative 3 would protect human health by treating the groundwater. In addition, human health would be protected under this alternative by controlling potential exposure of human receptors to the groundwater by implementing groundwater use, construction, and excavation restrictions. Groundwater monitoring would be implemented to determine the effectiveness of bioremediation, to confirm that contaminants are not migrating off site at unacceptable concentrations, and to confirm that COC concentrations do not increase to levels above PRGs once treatment is discontinued.

The present-worth cost of Alternative 3, Option A is lower than the costs for Alternatives 2 and 4. Alternative 3, Option B is slightly more than Alternative 4 but less than Alternative 2. Alternative 1 (no action) is not protective of human health and the environment.

2.12.2 Description of the Selected Remedy

The Selected Remedy, Alternative 3, consists of treating contaminated groundwater by enhanced in-situ bioremediation using an electron acceptor chemical, ORC, groundwater use, construction, and excavation restrictions, monitoring, and a discretionary 5-year review. Groundwater use restrictions will be implemented to ensure that contaminated groundwater is not used as a source of potable water. Construction restrictions will be implemented to ensure that mitigative measures designed to eliminate unacceptable risks associated with vapor intrusion, if required, are incorporated into new construction (commercial or residential) at the site. Excavation restrictions will be implemented to ensure that construction workers are not exposed (dermal or inhalation) to groundwater contaminated with unacceptable levels of COCs during construction activities. These restrictions will be developed, with USEPA and VDEQ concurrence, as part of a Remedial Design for LUCs and will be maintained until COC concentrations attain PRGs. Monitoring will be conducted to confirm the effectiveness of the remedy, to

confirm that contaminant migration is not occurring at unacceptable levels, and to confirm that COC concentrations do not increase to levels above PRGs once treatment is discontinued.

Alternative 3 involves using ORC (an electron acceptor) to treat the area near 095TW001 where cis-1,2-DCE and VC are the COCs. ORC is used to provide oxygen, and the release of DO supports a number of biological oxidation pathways that are expected to result in the complete breakdown of these contaminants. The screening evaluation of natural attenuation data from the site indicated that in-situ biological treatment is worthy of further evaluation; however, the technical protocol used in the evaluation recommended treatability studies before this technology is implemented. The presence of halogenated VOC constituents and their degradation products (e.g., cis-1,2-DCE and VC) indicates that some biodegradation is occurring that could possibly be enhanced. Additional data would be needed to determine the rate and success of complete degradation to non-toxic end products. A treatability study will be conducted at Site 95 to optimize groundwater treatment at the site. The results of the treatability study will be used to help prepare the Remedial Design for the treatment system at Site 95.

Two options were evaluated for Alternative 3. Under Option A, ORC would be injected at three locations upgradient of well 095TW001, which is contaminated with cis-1,2-DCE and VC. The injection points would be spaced approximately 10 feet apart, and ORC would be injected to a depth of 14 feet. Option B involves the installation of two 4-inch wells upgradient of well 095TW001 about 10 feet apart to a depth of 14 feet. Placed in each well would be 10 replaceable ORC filter socks, which would be replaced after 4 and 8 months. The decision as to which option will be implemented will be made during the preparation of the remedial design.

Groundwater use restrictions will be implemented to ensure that contaminated groundwater is not used as a source of potable water. Construction restrictions will be implemented to ensure that mitigative measures designed to eliminate unacceptable risks associated with vapor intrusion, if required, are incorporated into new construction (commercial or residential) at the site. Excavation restrictions will be implemented to ensure that construction workers are not exposed (dermal or inhalation) to groundwater contaminated with unacceptable levels of COCs during construction activities. The groundwater use, construction, and excavation restrictions will be maintained until the concentrations of the COCs are at such levels as to allow for unrestricted use and unlimited exposures (at or below the PRGs). The LUCs or restrictions (for groundwater use, construction, and excavation) identified in this ROD will be effectively enforced as a base-wide order when the ROD is signed by the MCB Commander. Signed RODs are kept at the MCB Quantico Natural Resources and Environmental Affairs (NREA) Branch, as well as in the information repositories. The LUCs will be detailed in the Remedial Design and maintained in the MCB Quantico GIS. Any new development projects are reviewed by NREA for environmental impact and this review includes verification using the MCB Quantico GIS that no site LUCs are violated.

Monitoring of groundwater will be conducted to evaluate the effectiveness of the remedy, to confirm that groundwater contamination migration is not occurring at unacceptable levels, and to confirm that COC concentrations do not increase to levels above PRGs once treatment is discontinued. Samples from four monitoring wells will be collected quarterly for Year 1 and annually for Years 2 through 5. Samples will be analyzed for VOCs and natural attenuation parameters (ferrous iron, TOC, alkalinity, nitrate, nitrite, sulfate, sulfide, chloride, carbon dioxide, methane, ethane, and ethene). A Long-Term Monitoring (LTM) Plan to be implemented as part of the Selected Remedy will be developed with USEPA and VDEQ concurrence and will detail the frequency, media type, analysis, and locations of the LTM samples.

A discretionary 5-year site review will be conducted to evaluate analytical results from monitoring samples, assess the site status (the site's use at that time and plans for future use), review environmental laws and regulations in effect at the time of the review, and provide direction for further action, if deemed necessary. The discretionary 5-year review will be completed to document that the concentrations of COCs have decreased to levels below the PRGs and, as a result, the RAOs have been attained.

The DON will prepare a remedial design for the Selected Remedy. The remedial design will need to be approved by USEPA and VDEQ. The remedial design for the Selected Remedy will include a remedial design that shall contain implementation and maintenance actions for the groundwater use, construction, and excavation restrictions (which will be submitted within 90 days of ROD signature). The DON will implement, maintain, monitor, report on, and enforce the groundwater use, construction, and excavation restrictions.

2.12.3 Summary of the Estimated Remedy Costs

A cost estimate summary for the Selected Remedy, Alternative 3, is provided in Table 2-8 (capital cost), Table 2-9 (annual cost), and Table 2-10 (present-worth analysis). The information in these cost estimate summary tables is based on the best available information regarding the anticipated scope of the remedial alternative. Changes in the cost elements may occur because of new information or data collected during the engineering design of the remedial alternative. Major changes may be documented in the form of a memorandum in the Administrative Record, an Explanation of Significant Differences (ESD), or a ROD amendment. This is an order-of-magnitude cost estimate that is expected to be within -30 to +50 percent of the actual project cost. These estimates are refined as the remedy is designed and implemented. Even after the remedial action is implemented, the total project cost is still reported as an estimate because of the uncertainty associated with annual O&M expenditures.

Expenditures that occur over time are analyzed using present worth, which discounts future costs to a common base year. Present-worth analysis allows the cost of remedial action alternatives to be

compared on the basis of a single figure representing the amount of money that, if invested in the base year and disbursed as needed, would be sufficient to cover all costs throughout the life of the remedial project.

2.12.4 Expected Outcomes of the Selected Remedy

The purpose of the remedial action is to prevent exposure to shallow groundwater near well 095TW001 until COC concentrations attain PRGs, incorporate mitigative measures into new construction (commercial or residential) at the site, as necessary, to eliminate unacceptable risks associated with vapor intrusion until COC concentrations attain PRGs, and to restore shallow groundwater near well 095TW001 to its beneficial use. The results of the HHRA indicate direct exposure to the COCs in groundwater at Site 95 results in unacceptable risks to future construction/excavation workers and hypothetical future residents.

Control of groundwater exposure and reduction in cis-1,2-DCE and VC concentrations are expected to be accomplished as a result of the Selected Remedy. Upon completion of the remedy, (estimated at 1 year), it is anticipated that the groundwater at Site 95 will be restored to beneficial use as a source of potable water (COC concentrations attain PRGs). Monitoring will continue for 5 years to confirm that COC concentrations do not increase to levels above PRGs once treatment is discontinued.

There are no anticipated socio-economic or community revitalization impacts associated with the Selected Remedy.

2.13 STATUTORY DETERMINATIONS

Under CERCLA Section 121 and the NCP, remedies must be protective of human health and the environment, comply with ARARs (unless a statutory waiver is justified), be cost effective, and utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. In addition, CERCLA includes a preference for remedies that employ treatment that permanently and significantly reduces the volume, toxicity, or mobility of hazardous wastes as a principal element and a bias against off-site disposal of untreated wastes. The following sections discuss how the Selected Remedy meets these statutory requirements.

2.13.1 Protection of Human Health and the Environment

The Selected Remedy, Alternative 3, will protect human health and the environment by treating the groundwater using enhanced in-situ bioremediation and ensuring that groundwater use, construction, and

excavation restrictions are enforced to prohibit potential exposure to groundwater contaminants until COC concentrations attain PRGs.

There are no short-term threats associated with the Selected Remedy. In addition, no adverse cross-media impacts are expected from the Selected Remedy. In the future, LTM will be conducted to determine the effectiveness of the bioremediation, confirm that contaminants are not migrating off site at unacceptable concentrations, and provide the data to determine whether actions are necessary to protect human health and the environment.

2.13.2 Compliance with ARARs

The Selected Remedy (Alternative 3 – Enhanced In-Situ Bioremediation: ORC Treatment) will be implemented in compliance with Federal and State requirements that are legally applicable or relevant and appropriate to the remedial action whether chemical-, location-, or action- specific. The ARARs identified for Site 95 are listed in Table 2-11.

2.13.3 Cost-Effectiveness

In the DON's judgment, the Selected Remedy is cost-effective. In making this determination, the following definition was used [40 CFR 300.430(f)(1)(ii)(D)]: " A remedy shall be cost-effective if its costs are proportional to its overall effectiveness." This was accomplished by evaluating the overall protectiveness of those alternatives that satisfied the threshold criteria (i.e., were both protective of human health and the environment and ARAR compliant). Overall effectiveness was evaluated by assessing three of the five balancing criteria (long-term effectiveness and permanence, reduction of toxicity, mobility, or volume through treatment, and short-term effectiveness). The overall effectiveness of all the alternatives was considered and then compared to each of their costs.

The estimated present-worth cost of the Selected Remedy (Alternative 3) is approximately $140,000 (Option A) or $158,000 (Option B). The present-worth costs of Alternative 4 ($153,000) are within this range and the costs of Alternative 2 ($180,000) are approximately 30 percent higher, respectively, but do not provide significantly higher protection of human health and the environment.

2.13.4 Utilization of Permanent Solutions and Alternative Treatment (or Resource Recovery) Technologies to the Maximum Extent Practicable

The DON and USEPA, with state concurrence, have determined that the Selected Remedy represents the maximum extent to which permanent solutions and treatment technologies can be utilized in a practicable manner at the site. The selected remedy employs the treatment technology of enhanced

in-situ bioremediation using ORC to reduce the concentrations of cis-1,2-DCE and VC. ORC is used to provide oxygen, the release of which supports a number of biological oxidation pathways that are expected to result in the complete breakdown of site contaminants. It also satisfies the criteria for long-term effectiveness by reducing COC concentrations permanently.

Of those alternatives that are protective of human health and the environment and comply with ARARs, the DON and USEPA have determined that the Selected Remedy provides the best balance of trade-offs in terms of the five balancing criteria. The DON and USEPA also considered the statutory preference for treatment as a principal element, the bias against off-site treatment and disposal, and state and community acceptance.

No risks to the community would be anticipated from implementation of any of the remedial alternatives, and exposure to workers can be adequately controlled.

All of the remedial alternatives are readily implementable. Alternative 3 has the lowest cost, and Alternative 2 has the highest cost.

Long-term effectiveness and permanence and cost were the most decisive balancing criteria used for the identification of Alternative 3 as the Selected Remedy.

2.13.5 Preference for Treatment as a Principal Element

The Selected Remedy satisfies the statutory preference for treatment as a principal element. Although there are unacceptable risks to human health under a future construction/excavation worker scenario and a hypothetical future residential exposure scenario, there are no principal threat wastes at Site 95 (see Section 2.11).

2.13.6 Five-Year Review Requirement

The Selected Remedy will not result in hazardous substances, pollutants, or contaminants remaining on site at concentrations greater than levels that allow for unlimited use and unrestricted exposure. Because it will take several years to attain PRGs and RAOs, a discretionary review will be conducted within 5 years after initiation of treatment to ensure that the remedy is, or will be, protective of human health and the environment.

2.14 DOCUMENTATION OF SIGNIFICANT CHANGES

The Proposed Plan[5] for Site 95, Building 2101 Paint Booth Sump, at MCB Quantico, Virginia was released for public comment in March 2008. The Proposed Plan[5] identified Alternative 3 – Enhanced In-situ Bioremediation: ORC Treatment as the preferred alternative. No written or verbal comments were submitted during the public comment period. Therefore, no changes to the remedy, as originally identified in the Proposed Plan[5], were necessary or appropriate.

TABLE 2-1

SUMMARY OF POSITIVE RESULTS - 2006 REMEDIAL INVESTIGATION AND HISTORICAL GROUNDWATER DATA
SITE 95 - BUILDING 2101 PAINT BOOTH SUMP
MCB QUANTICO, VIRGINIA

CHEMICAL	FEDERAL MCL	REGION 3 TAP WATER RBC	030TW001			030TW002			
			11/8/2001	4/22/2003	12/13/2006	11/8/2001	4/23/2003	3/10/2004	12/13/2006
Volatile Organics (µg/L)									
1,1,1-TRICHLOROETHANE	200	1700	0.5 J	0.52 J	0.02 U	0.6 J	1 U	0.8 J	0.02 U
1,1,2-TRICHLOROTRIFLUOROETHANE	NC	59000	10 U	0.28 J	0.1 U	4 J	1 U	7 J	19 J
1,1-DICHLOROETHANE	NC	900	2 J	4	3	17	1 U	17 J	8
1,1-DICHLOROETHENE	7	350	1 J	1.7	1	5 J	1 U	**9 J [F]**	4
1,2,3-TRICHLOROBENZENE	NC	NC	NA	NA	1 J	NA	NA	0.5 UJ	0.5 U
1,2,4-TRICHLOROBENZENE	70	61	10 U	1 U	0.7	10 U	1 U	0.5 UJ	0.38 U
1,2-DICHLOROBENZENE	600	270	10 U	1 U	0.2 U	10 U	1 U	1 J	0.2 U
1,2-DICHLOROETHANE	5	0.12	10 U	1 U	0.09 U	10 U	1 U	0.5 UJ	0.09 U
1,2-DICHLOROPROPANE	5	0.16	10 U	1 U	0.02 U	10 U	1 U	0.5 UJ	0.02 U
ACETONE	NC	5500	3 B	2.2 J	0.56 UR	3 B	5 UR	5 UR	0.56 UR
BENZENE	5	0.34	10 U	0.2 J	**0.4 J [R3]**	10 U	1 U	0.5 UJ	0.19 U
BROMODICHLOROMETHANE	80	0.17	10 U	1 U	0.02 U	10 U	1 U	0.5 UJ	0.02 U
CARBON DISULFIDE	NC	1000	10 U	1 U	0.03 U	10 U	1 U	0.5 UJ	0.03 U
CHLORODIBROMOMETHANE	80	0.13	10 U	1 U	0.06 U	10 U	1 U	0.5 UJ	0.06 U
CHLOROFORM	80	0.15	10 U	1 U	0.19 U	10 U	**0.46 J [R3]**	0.5 UJ	0.19 U
CIS-1,2-DICHLOROETHENE	70	61	1 J	1.9	1	5 J	1 U	7 J	3
CYCLOHEXANE	NC	12000	10 U	1 U	0.5 U	10 U	1 U	0.5 UJ	0.5 U
ISOPROPYLBENZENE	NC	660	10 U	1 U	0.6	10 U	1 U	0.5 UJ	0.16 U
METHYL CYCLOHEXANE	NC	6300	10 U	1 U	0.5 U	10 U	1 U	0.5 UJ	0.5 U
METHYL TERT-BUTYL ETHER	NC	2.6	10 U	0.31 J	0.1 U	0.8 J	1 U	0.5 UJ	0.1 U
METHYLENE CHLORIDE	5	4.1	0.5 B	2 U	0.44 U	0.8 B	2 U	0.5 UJ	0.44 U
N-PROPYLBENZENE	NC	NC	NA	NA	0.05 U	NA	NA	NA	0.05 U
NAPHTHALENE	NC	6.5	NA	NA	2 J	NA	NA	NA	0.42 U
SEC-BUTYLBENZENE	NC	NC	NA	NA	0.5	NA	NA	NA	0.04 U
TETRACHLOROETHENE	5	0.1	**1 J [R3]**	**1.9 [R3]**	**1 [R3]**	**4 J [R3]**	1 U	**6 J [F,R3]**	**2 [R3]**
TOLUENE	1000	2300	10 U	1 U	0.02 U	10 U	1 U	0.5 UJ	0.02 U
TOTAL 1,2-DICHLOROETHENE	NC	55	NA	NA	1	NA	NA	7 J	3
TRANS-1,2-DICHLOROETHENE	100	120	10 U	1 U	0.02 U	10 U	1 U	0.5 UJ	0.02 U
TRICHLOROETHENE	5	0.026	**1 J [R3]**	**1.9 [R3]**	**1 [R3]**	**3 J [R3]**	1 U	**6 J [F,R3]**	**2 [R3]**
VINYL CHLORIDE	2	0.015	10 U	**0.26 J [R3]**	0.21 U	**0.9 J [R3]**	1 U	**1 J [R3]**	0.21 U

TABLE 2-1

SUMMARY OF POSITIVE RESULTS - 2006 REMEDIAL INVESTIGATION AND HISTORICAL GROUNDWATER DATA
SITE 95 - BUILDING 2101 PAINT BOOTH SUMP
MCB QUANTICO, VIRGINIA

CHEMICAL	FEDERAL MCL	REGION 3 TAP WATER RBC	030TW003				030TW004		
			11/8/2001		4/23/2003	12/12/2006	11/9/2001	12/13/2006	
			Sample	Duplicate				Sample	Duplicate
Volatile Organics (µg/L)									
1,1,1-TRICHLOROETHANE	200	1700	0.4 J	0.5 J	0.2 J	0.02 U	0.5 J	0.02 U	0.02 U
1,1,2-TRICHLOROTRIFLUOROETHANE	NC	59000	1 J	1 J	0.66 J	0.1 U	0.9 J	0.1 U	0.1 U
1,1-DICHLOROETHANE	NC	900	18	20 J	9.4	6	19	5	5
1,1-DICHLOROETHENE	7	350	3 J	4 J	2.3	2	4 J	2	2
1,2,3-TRICHLOROBENZENE	NC	NC	NA	NA	NA	0.8 J	NA	0.5 U	0.5 U
1,2,4-TRICHLOROBENZENE	70	61	10 U	10 UJ	1 U	0.5	10 U	0.38 U	0.38 U
1,2-DICHLOROBENZENE	600	270	10 U	10 UJ	1 U	0.2 U	10 U	0.2 U	0.2 U
1,2-DICHLOROETHANE	5	0.12	10 U	10 UJ	1 U	0.09 U	10 U	0.09 U	0.09 U
1,2-DICHLOROPROPANE	5	0.16	10 U	10 UJ	1 U	0.02 U	10 U	0.02 U	0.02 U
ACETONE	NC	5500	3 B	3 B	5 UR	0.56 UR	3 B	0.56 UR	0.56 UR
BENZENE	5	0.34	10 U	10 UJ	1 U	0.19 U	10 U	0.19 U	0.19 U
BROMODICHLOROMETHANE	80	0.17	10 U	10 UJ	1 U	0.02 U	10 U	0.02 U	0.02 U
CARBON DISULFIDE	NC	1000	10 U	10 UJ	1 U	0.03 U	10 U	0.03 U	0.03 U
CHLORODIBROMOMETHANE	80	0.13	10 U	10 UJ	1 U	0.06 U	10 U	0.06 U	0.06 U
CHLOROFORM	80	0.15	10 U	10 UJ	1 U	0.19 U	10 U	0.19 U	0.19 U
CIS-1,2-DICHLOROETHENE	70	61	4 J	5 J	2.6	2	5 J	2	2
CYCLOHEXANE	NC	12000	10 U	10 UJ	1 U	0.5 U	10 U	0.5 U	0.5 U
ISOPROPYLBENZENE	NC	660	10 U	10 UJ	1 U	0.16 U	10 U	0.16 U	0.16 U
METHYL CYCLOHEXANE	NC	6300	10 U	10 UJ	1 U	0.5 U	10 U	0.5 U	0.5 U
METHYL TERT-BUTYL ETHER	NC	2.6	0.9 J	0.9 J	0.14 J	0.1 U	1 J	0.1 U	0.1 U
METHYLENE CHLORIDE	5	4.1	0.5 B	0.5 B	2 U	0.44 U	0.5 B	0.44 U	0.44 U
N-PROPYLBENZENE	NC	NC	NA	NA	NA	0.05 U	NA	0.05 U	0.05 U
NAPHTHALENE	NC	6.5	NA	NA	NA	1 J	NA	0.42 U	0.42 U
SEC-BUTYLBENZENE	NC	NC	NA	NA	NA	0.04 U	NA	0.04 U	0.04 U
TETRACHLOROETHENE	5	0.1	**3 J [R3]**	**4 J [R3]**	**2.9 [R3]**	**1 [R3]**	**5 J [R3]**	**2 [R3]**	**2 [R3]**
TOLUENE	1000	2300	10 U	10 UJ	1 U	0.02 U	10 U	0.02 U	0.02 U
TOTAL 1,2-DICHLOROETHENE	NC	55	NA	NA	NA	2	NA	2	2
TRANS-1,2-DICHLOROETHENE	100	120	10 U	10 UJ	1 U	0.02 U	10 U	0.02 U	0.02 U
TRICHLOROETHENE	5	0.026	**3 J [R3]**	**3 J [R3]**	**2 [R3]**	**1 [R3]**	**4 J [R3]**	**2 [R3]**	**2 [R3]**
VINYL CHLORIDE	2	0.015	**1 J [R3]**	**1 J [R3]**	**0.53 J [R3]**	0.21 U	**1 J [R3]**	0.21 U	0.21 U

TABLE 2-1

SUMMARY OF POSITIVE RESULTS - 2006 REMEDIAL INVESTIGATION AND HISTORICAL GROUNDWATER DATA
SITE 95 - BUILDING 2101 PAINT BOOTH SUMP
MCB QUANTICO, VIRGINIA

CHEMICAL	FEDERAL MCL	REGION 3 TAP WATER RBC	095MW002					095MW003		
			4/22/2003		3/9/2004		12/13/2006	4/21/2003	3/10/2004	12/14/2006
			Sample	Duplicate	Sample	Duplicate				
Volatile Organics (µg/L)										
1,1,1-TRICHLOROETHANE	200	1700	0.17 J	0.15 J	0.5 UJ	0.5 U	0.02 U	1 U	0.5 U	0.04 U
1,1,2-TRICHLOROTRIFLUOROETHANE	NC	59000	0.31 J	0.37 J	0.6 J	0.5 U	0.1 U	1 U	0.5 U	0.2 U
1,1-DICHLOROETHANE	NC	900	0.56 J	0.54 J	1 J	0.9	0.5	1 U	0.5 U	0.44 U
1,1-DICHLOROETHENE	7	350	0.3 J	0.35 J	0.5 UJ	0.6	0.06 U	1 U	0.5 U	0.12 U
1,2,3-TRICHLOROBENZENE	NC	NC	NA	NA	0.5 UJ	0.5 U	0.5 U	NA	0.5 U	1 U
1,2,4-TRICHLOROBENZENE	70	61	1 U	1 U	0.5 UJ	0.5 U	0.38 U	1 U	0.5 U	0.76 U
1,2-DICHLOROBENZENE	600	270	1 U	1 U	0.5 UJ	0.5 U	0.2 U	1 U	0.5 U	0.4 U
1,2-DICHLOROETHANE	5	0.12	1 U	1 U	0.5 UJ	0.5 U	0.09 U	1 U	0.5 U	0.18 U
1,2-DICHLOROPROPANE	5	0.16	1 U	1 U	0.5 UJ	0.5 U	0.02 U	1 U	0.5 U	0.04 U
ACETONE	NC	5500	5 UR	2.7 J	5 UR	5 UR	0.56 UR	2.7 J	5 UR	1.12 UR
BENZENE	5	0.34	1 U	1 U	0.5 UJ	0.5 U	0.19 U	1 U	0.5 U	0.38 U
BROMODICHLOROMETHANE	80	0.17	1 U	1 U	0.5 UJ	0.5 U	0.02 U	1 U	0.5 U	0.04 U
CARBON DISULFIDE	NC	1000	1 U	1 U	0.5 UJ	0.5 U	0.03 U	1 U	0.5 U	0.06 U
CHLORODIBROMOMETHANE	80	0.13	1 U	1 U	0.5 UJ	0.5 U	0.06 U	1 U	0.5 U	0.12 U
CHLOROFORM	80	0.15	**0.47 J [R3]**	**0.43 J [R3]**	0.5 UJ	0.5 U	0.19 U	**33 [R3]**	**62 [R3]**	**37 [R3]**
CIS-1,2-DICHLOROETHENE	70	61	1.8	1.8	4 J	4	6	1 U	0.5 U	0.04 U
CYCLOHEXANE	NC	12000	1 U	1 U	0.5 UJ	0.5 U	0.5 U	1 U	0.5 U	1 U
ISOPROPYLBENZENE	NC	660	1 U	1 U	0.5 UJ	0.5 U	0.16 U	1 U	0.5 U	0.32 U
METHYL CYCLOHEXANE	NC	6300	1 U	1 U	0.5 UJ	0.5 U	0.5 U	1 U	0.5 U	1 U
METHYL TERT-BUTYL ETHER	NC	2.6	1 U	1 U	0.5 UJ	0.5 U	0.1 U	1 U	0.5 U	0.2 U
METHYLENE CHLORIDE	5	4.1	2 U	2 U	0.5 UJ	0.5 U	0.44 U	2 U	0.5 U	0.88 U
N-PROPYLBENZENE	NC	NC	NA	NA	NA	NA	0.05 U	NA	NA	0.1 U
NAPHTHALENE	NC	6.5	NA	NA	NA	NA	0.42 U	NA	NA	0.84 U
SEC-BUTYLBENZENE	NC	NC	NA	NA	NA	NA	0.04 U	NA	NA	0.08 U
TETRACHLOROETHENE	5	0.1	**0.47 J [R3]**	**0.45 J [R3]**	**0.8 J [R3]**	**0.8 [R3]**	**0.4 J [R3]**	1 U	0.5 U	0.04 U
TOLUENE	1000	2300	1 U	1 U	0.5 UJ	0.5 U	0.02 U	1 U	0.5 U	0.04 U
TOTAL 1,2-DICHLOROETHENE	NC	55	NA	NA	4 J	4	6	NA	0.5 U	0.08 U
TRANS-1,2-DICHLOROETHENE	100	120	1 U	1 U	0.5 UJ	0.5 U	0.02 U	1 U	0.5 U	0.04 U
TRICHLOROETHENE	5	0.026	**0.46 J [R3]**	**0.48 J [R3]**	**0.6 J [R3]**	**0.6 [R3]**	**0.5 [R3]**	1 U	0.5 U	0.34 U
VINYL CHLORIDE	2	0.015	1 U	1 U	0.5 UJ	0.5 U	0.21 U	1 U	0.5 U	0.42 U

TABLE 2-1

SUMMARY OF POSITIVE RESULTS - 2006 REMEDIAL INVESTIGATION AND HISTORICAL GROUNDWATER DATA
SITE 95 - BUILDING 2101 PAINT BOOTH SUMP
MCB QUANTICO, VIRGINIA

CHEMICAL	FEDERAL MCL	REGION 3 TAP WATER RBC	095MW004		095MW006		095MW007		095MW008	
			4/14/2003	12/14/2006	4/14/2003	12/14/2006	4/14/2003	12/14/2006	4/21/2003	12/14/2006
Volatile Organics (µg/L)										
1,1,1-TRICHLOROETHANE	200	1700	1 U	0.02 U	1 U	0.02 U	1 U	0.02 U	1 U	0.02 U
1,1,2-TRICHLOROTRIFLUOROETHANE	NC	59000	1 U	0.1 U	1 U	0.1 U	1 U	0.1 U	1 U	0.1 U
1,1-DICHLOROETHANE	NC	900	1 U	0.22 U	1 U	0.22 U	1 U	0.22 U	0.27 J	0.22 U
1,1-DICHLOROETHENE	7	350	1 U	0.06 U	1 U	0.06 U	1 U	0.06 U	1 U	0.06 U
1,2,3-TRICHLOROBENZENE	NC	NC	NA	0.5 U	NA	0.5 U	NA	0.5 U	NA	0.5 U
1,2,4-TRICHLOROBENZENE	70	61	1 U	0.38 U	1 U	0.38 U	1 U	0.38 U	1 U	0.38 U
1,2-DICHLOROBENZENE	600	270	1 U	0.2 U	1 U	0.2 U	1 U	0.2 U	1 U	0.2 U
1,2-DICHLOROETHANE	5	0.12	1 U	0.09 U	1 U	0.09 U	1 U	0.09 U	1 U	0.09 U
1,2-DICHLOROPROPANE	5	0.16	1 U	0.02 U	1 U	0.02 U	1 U	0.02 U	1 U	0.02 U
ACETONE	NC	5500	1.6 B	0.56 UR	5 UR	0.56 UR	5 UR	0.56 UR	2 J	0.56 UR
BENZENE	5	0.34	1 U	0.19 U	1 U	0.19 U	1 U	0.19 U	**0.39 J [R3]**	**0.5 [R3]**
BROMODICHLOROMETHANE	80	0.17	**2.9 [R3]**	0.02 U	1 U	0.02 U	**0.47 J [R3]**	0.02 U	1 U	0.02 U
CARBON DISULFIDE	NC	1000	1 U	0.03 U	1 U	0.03 U	1 U	0.03 U	1 U	0.03 U
CHLORODIBROMOMETHANE	80	0.13	0.13 J	0.06 U	1 U	0.06 U	1 U	0.06 U	1 U	0.06 U
CHLOROFORM	80	0.15	**48 [R3]**	**2 [R3]**	**0.4 J [R3]**	0.19 U	**18 [R3]**	**11 [R3]**	1 U	0.19 U
CIS-1,2-DICHLOROETHENE	70	61	1 U	0.02 U	1 U	0.02 U	1 U	0.02 U	0.11 J	0.02 U
CYCLOHEXANE	NC	12000	1 U	0.5 U	1 U	0.5 U	1 U	0.5 U	0.37 J	5
ISOPROPYLBENZENE	NC	660	1 U	0.16 U	1 U	0.16 U	1 U	0.16 U	1 U	0.6
METHYL CYCLOHEXANE	NC	6300	1 U	0.5 U	1 U	0.5 U	1 U	0.5 U	1 U	0.6
METHYL TERT-BUTYL ETHER	NC	2.6	1 U	0.1 U	1 U	0.1 U	1 U	0.1 U	1 U	1
METHYLENE CHLORIDE	5	4.1	2 U	0.44 U	2 U	0.44 U	2 U	0.44 U	2 U	0.44 U
N-PROPYLBENZENE	NC	NC	NA	0.05 U	NA	0.05 U	NA	0.05 U	NA	0.4 J
NAPHTHALENE	NC	6.5	NA	0.42 U	NA	0.42 U	NA	0.42 U	NA	0.42 U
SEC-BUTYLBENZENE	NC	NC	NA	0.04 U	NA	0.04 U	NA	0.04 U	NA	0.04 U
TETRACHLOROETHENE	5	0.1	1 U	0.02 U	1 U	0.02 U	**0.46 J [R3]**	**0.4 J [R3]**	1 U	0.02 U
TOLUENE	1000	2300	1 U	0.02 U	1 U	0.02 U	1 U	0.02 U	1 U	0.02 U
TOTAL 1,2-DICHLOROETHENE	NC	55	NA	0.04 U	NA	0.04 U	NA	0.04 U	NA	0.04 U
TRANS-1,2-DICHLOROETHENE	100	120	1 U	0.02 U	1 U	0.02 U	1 U	0.02 U	1 U	0.02 U
TRICHLOROETHENE	5	0.026	1 U	0.17 U	1 U	0.17 U	1 U	0.17 U	1 U	0.17 U
VINYL CHLORIDE	2	0.015	1 U	0.21 U	1 U	0.21 U	1 U	0.21 U	**0.14 J [R3]**	0.21 U

TABLE 2-1

SUMMARY OF POSITIVE RESULTS - 2006 REMEDIAL INVESTIGATION AND HISTORICAL GROUNDWATER DATA
SITE 95 - BUILDING 2101 PAINT BOOTH SUMP
MCB QUANTICO, VIRGINIA

CHEMICAL	FEDERAL MCL	REGION 3 TAP WATER RBC	095MW009			095TW001				
			4/22/2003	3/9/2004	12/13/2006	11/29/2001 Sample	11/29/2001 Duplicate	4/22/2003	3/9/2004	12/13/2006
Volatile Organics (µg/L)										
1,1,1-TRICHLOROETHANE	200	1700	0.21 J	0.5 UJ	0.02 U	10 U	10 U	50 U	25 U	4 U
1,1,2-TRICHLOROTRIFLUOROETHANE	NC	59000	0.28 J	0.5 UJ	0.1 U	10 U	10 U	440	920	1200 J
1,1-DICHLOROETHANE	NC	900	0.94 J	0.5 UJ	0.22 U	11	10	43 J	68	44 U
1,1-DICHLOROETHENE	7	350	0.48 J	0.5 UJ	0.06 U	1 J	1 J	50 U	25 U	12 U
1,2,3-TRICHLOROBENZENE	NC	NC	NA	0.5 UJ	0.5 U	NA	NA	NA	25 U	100 U
1,2,4-TRICHLOROBENZENE	70	61	1 U	0.5 UJ	0.38 U	0.3 J	2 J	50 U	25 U	76 U
1,2-DICHLOROBENZENE	600	270	1 U	0.5 UJ	0.2 U	10 U	10 U	50 U	25 U	40 U
1,2-DICHLOROETHANE	5	0.12	1 U	0.5 UJ	0.09 U	**1 J [R3]**	**1 J [R3]**	50 U	25 U	18 U
1,2-DICHLOROPROPANE	5	0.16	1 U	0.5 UJ	0.02 U	**0.4 J [R3]**	**0.4 J [R3]**	50 U	25 U	4 U
ACETONE	NC	5500	1.1 J	5 UR	0.56 UR	7 B	7 B	54 J	250 UR	112 UR
BENZENE	5	0.34	1 U	0.5 UJ	0.19 U	**4 J [R3]**	**3 J [R3]**	**24 J [F,R3]**	**33 [F,R3]**	38 U
BROMODICHLOROMETHANE	80	0.17	1 U	0.5 UJ	0.02 U	10 U	10 U	50 U	25 U	4 U
CARBON DISULFIDE	NC	1000	1 U	0.5 UJ	0.03 U	0.4 J	0.4 J	7.6 J	25 U	6 U
CHLORODIBROMOMETHANE	80	0.13	1 U	0.5 UJ	0.06 U	10 U	10 U	50 U	25 U	12 U
CHLOROFORM	80	0.15	**0.32 J [R3]**	0.5 UJ	0.19 U	10 U	10 U	50 U	25 U	38 U
CIS-1,2-DICHLOROETHENE	70	61	0.34 J	0.5 UJ	0.02 U	**120 [F,R3]**	**150 [F,R3]**	**680 [F,R3]**	**1600 J [F,R3]**	**2200 [F,R3]**
CYCLOHEXANE	NC	12000	1 U	0.5 UJ	0.5 U	1 J	1 J	50 U	25 U	100 U
ISOPROPYLBENZENE	NC	660	1 U	0.5 UJ	0.16 U	10 U	10 U	50 U	25 U	32 U
METHYL CYCLOHEXANE	NC	6300	1 U	0.5 UJ	0.5 U	10 U	10 U	50 U	25 U	100 U
METHYL TERT-BUTYL ETHER	NC	2.6	1 U	0.5 UJ	0.1 U	10 U	10 U	50 U	25 U	20 U
METHYLENE CHLORIDE	5	4.1	2 U	0.5 UJ	0.44 U	1 B	0.8 B	**10 J [F,R3]**	120 B	88 U
N-PROPYLBENZENE	NC	NC	NA	NA	0.05 U	NA	NA	NA	NA	10 U
NAPHTHALENE	NC	6.5	NA	NA	0.42 U	NA	NA	NA	NA	84 U
SEC-BUTYLBENZENE	NC	NC	NA	NA	0.04 U	NA	NA	NA	NA	8 U
TETRACHLOROETHENE	5	0.1	**0.49 J [R3]**	0.5 UJ	0.02 U	**2 J [R3]**	**2 J [R3]**	50 U	25 U	4 U
TOLUENE	1000	2300	1 U	0.5 UJ	0.02 U	0.7 J	0.7 J	36 J	61	82 J
TOTAL 1,2-DICHLOROETHENE	NC	55	NA	0.5 UJ	0.04 U	NA	NA	NA	**1600 J [R3]**	**2200 [R3]**
TRANS-1,2-DICHLOROETHENE	100	120	1 U	0.5 UJ	0.02 U	1 J	1 J	50 U	25 U	4 U
TRICHLOROETHENE	5	0.026	**0.56 J [R3]**	0.5 UJ	0.17 U	**9 J [F,R3]**	**8 J [F,R3]**	**5.3 J [F,R3]**	25 U	34 U
VINYL CHLORIDE	2	0.015	1 U	0.5 UJ	0.21 U	**330 [F,R3]**	**380 [F,R3]**	**4400 [F,R3]**	**6100 J [F,R3]**	**4300 [F,R3]**

Notes:
Shaded values indicate that reported concentrations exceed one of the following screening criteria.
[F] indicates exceedance of Federal Maximum Contaminant Level (MCL)[(9)].
[R3] indicates exceedance of Region 3 tap water Risk-Based Concentration (RBC)[(10)].
NA Not analyzed.
NC No criterion.

Data Qualifiers:
B - Positive result is considered to be attributable to laboratory blank contamination.
J - Positive result qualified as estimated.
U - Not detected at associated detection limit.
UR - Non-detect result is considered unreliable and unusable.

TABLE 2-2

SUMMARY OF POSITIVE RESULTS - 2006 REMEDIAL INVESTIGATION DATA
SITE 95 - BUILDING 2101 PAINT BOOTH
MCB QUANTICO, VIRGINIA

CHEMICAL	FREQUENCY OF DETECTION	RANGE OF DETECTED CONCENTRATIONS (µg/L)	LOCATION OF MAXIMUM CONCENTRATION	AVERAGE OF DETECTED CONCENTRATIONS (µg/L)
1,1,2-TRICHLOROTRIFLUOROETHANE	2 / 12	19 J - 1200 J	095TW001	610
1,1-DICHLOROETHANE	5 / 12	0.5 - 8	030TW002	4.5
1,1-DICHLOROETHENE	4 / 12	1 - 4	030TW002	2
1,2,3-TRICHLOROBENZENE	2 / 12	0.8 J - 1 J	030TW001	0.9
1,2,4-TRICHLOROBENZENE	2 / 12	0.5 - 0.7	030TW001	0.6
BENZENE	2 / 12	0.4 J - 0.5	095MW008	0.5
CHLOROFORM	3 / 12	2 - 37	095MW003	17
CIS-1,2-DICHLOROETHENE	6 / 12	1 - 2200	095TW001	369
CYCLOHEXANE	1 / 12	5	095MW008	5
ISOPROPYLBENZENE	2 / 12	0.6	030TW001 095MW008	0.6
METHYL CYCLOHEXANE	1 / 12	0.6	095MW008	0.6
METHYL TERT-BUTYL ETHER	1 / 12	1	095MW008	1
NAPHTHALENE	2 / 12	1 J - 2 J	030TW001	1.5
N-PROPYLBENZENE	1 / 12	0.4 J	095MW008	0.4
SEC-BUTYLBENZENE	1 / 12	0.5	030TW001	0.5
TETRACHLOROETHENE	6 / 12	0.4 J - 2	030TW002 030TW004	1.1
TOLUENE	1 / 12	82	095TW001	82
TRICHLOROETHENE	5 / 12	0.5 - 2	030TW002 030TW004	1.3
VINYL CHLORIDE	1 / 12	4300	095TW001	4300

Data Qualifiers:
J Positive result qualified as estimated during data validation.

TABLE 2-3

SUMMARY OF COCs FOR GROUNDWATER
SITE 95 – BUILDING 2101 PAINT BOOTH SUMP
MCB QUANTICO, VIRGINIA

Exposure Point	Chemical	Range of Detections (µg/L)	Frequency of Detection	Exposure Point Concentration[(1)] (µg/L)	Statistical Measure
Groundwater – ingestion and dermal contact (residential use); inhalation (vapor intrusion)	Cis-1,2-dichloroethene	1 – 2,200	6/12	2,200	Maximum
	Vinyl chloride	4,300	1/12	4,300	Maximum

Abbreviations:
COCs chemicals of concern
UCL upper confidence limit

Notes:
This table presents the exposure point concentrations (i.e., the concentrations used to estimate potential risks) for each of the COCs detected in groundwater.

Footnotes:
1 The exposure point concentration is the lower of the 95 percent UCL of the arithmetic mean and the maximum detected site concentration.

TABLE 2-4

TOXICITY DATA SUMMARY
SITE 95 – BUILDING 2101 PAINT BOOTH SUMP
MCB QUANTICO, VIRGINIA

CANCER TOXICITY

Chemical	Oral CSF	Dermal CSF	Inhalation CSF	Slope Factor Units	Weight of Evidence	Source	Date
Cis-1,2-Dichloroethene	---(1)	---	---	---	---	---	---
Vinyl chloride (child)	1.50E+00	1.50E+00	3.0E-02	$(mg/kg/day)^{-1}$	A	IRIS	May 2007
Vinyl chloride (adult)	7.2E-01	7.2E-01	1.5E-02	$(mg/kg/day)^{-1}$	A	IRIS	May 2007

NONCANCER TOXICITY

Chemical	Chronic/ Subchronic	Oral RfD	Dermal RfD	Inhalation RfD	Units	Target Organ(s)	Combined Uncertainty/ Modifying Factors	Source of RfD; Target Organ	Date of RFD; Target Organ
Cis-1,2-Dichloroethene	Chronic	1.0E-02	1.0E-02	---	mg/kg/day	Blood	---	EPA 3	April 2007
Vinyl chloride	Chronic	3.0E-03	3.0E-03	2.9E-02	mg/kg/day	Liver	30/1	IRIS	May 2007

Notes:
This table provides the carcinogenic and noncarcinogenic risk information for the COCs in groundwater. Both of the COCs have toxicity data indicating their potential for adverse noncarcinogenic risks in humans. At this time, CSFs and RfDs are not available for the dermal route of exposure. The dermal CSF an RfD used in the assessment have been extrapolated from the oral value. An adjustment factor is applied and is dependent upon how well the chemical is absorbed via the oral route. Adjustments are particularly important for chemicals with less than 50 percent absorption via the ingestion route.

Abbreviations:
COC chemical of concern
CSF cancer slope factor
EPA 3 United State Environmental Protection Agency Region 3 Risk-Based Concentration Table
IRIS Integrated Risk Information System
RfD reference dose

Weight of Evidence:
A Human carcinogen

Footnotes:
1 No information is available for this chemical.

TABLE 2-5

RISK CHARACTERIZATION SUMMARY – CARCINOGENS
SITE 95 – BUILDING 2101 PAINT BOOTH SUMP
MCB QUANTICO, VIRGINIA
PAGE 1 OF 2

Receptor	Exposure Medium	Exposure Point	COC	ILCR (unitless)			
				Ingestion	Dermal	Inhalation	Exposure Route Total
Occupational Worker	Groundwater	Inhalation (Indoor Air)	Vinyl Chloride	NA	NA	1.5E-04	1.5E-04
						Total $ILCR_{occupational\ worker}$ =	**1.5E-04**
Future Construction Worker	Groundwater	Inhalation (in a trench) Dermal Contact	Vinyl Chloride	NA	1.8E-05	4.8E-04	5.1E-04
						Total $ILCR_{construction\ worker}$=	**5.1E-04**
Future Child Resident	Groundwater	Tap Water	Vinyl Chloride	3.5E-02	1.0E-03	NA	3.6E-02
						Total $ILCR_{child}$ =	**3.6E-02**
Future Adult Resident	Groundwater	Tap Water	Vinyl Chloride	2.9E-02	1.1E-03	7.1E-03	3.7E-02
						Total $ILCR_{adult}$ =	**3.7E-02**

Notes:

1. This table provides risk estimates for exposure to groundwater. These risk estimates are based on an RME scenario and were developed by taking into account various conservative assumptions about the frequency and duration of exposure to groundwater. The risk estimates are also based on the toxicity of the COC (vinyl chloride). The total risk from direct exposure to groundwater at Site 95 is estimated to be 3.6E-02 for a future child resident and 3.7E-02 for a future adult resident. Vinyl chloride is the only COC contributing to the risk levels. The risk levels indicate that, if no clean-up action is taken, an individual child would have an increased probability of 4 in 100 of developing cancer as a result of site related exposure to vinyl chloride in groundwater, and an individual adult would have an increased probability of 4 in 100 of developing cancer.

2. The ILCR for the occupational worker (1.5E-04) is only slightly greater than USEPA's acceptable risk range of 1E-04 to 1E-06. These risks are driven by exposure to VC via inhalation. Because the noncarcinogenic risks for the occupational workers are less than USEPA benchmarks (Table 2-6) and the carcinogenic risks for the occupational worker are only slightly greater than USEPA's acceptable risk range, and because of significant uncertainties associated with the indoor air concentrations predicted by the conservative screening model, current occupational workers are not at risk. However, any new construction at Site 95 may result in less uncertainty associated with indoor air concentrations predicted by the conservative screening model and future occupational workers may be subject to unacceptable risks as a result of vapor intrusion.

TABLE 2-5

RISK CHARACTERIZATION SUMMARY – CARCINOGENS
SITE 95 – BUILDING 2101 PAINT BOOTH SUMP
MCB QUANTICO, VIRGINIA

Abbreviations:
COC chemical of concern
ILCR incremental lifetime cancer risk
NA not applicable
RME reasonable maximum exposure

TABLE 2-6

RISK CHARACTERIZATION SUMMARY – NONCARCINOGENS
SITE 95 – BUILDING 2101 PAINT BOOTH SUMP
MCB QUANTICO, VIRGINIA
PAGE 1 OF 2

Receptor	Exposure Medium	Exposure Point	COC	Primary Target Organ(s)	HQ (unitless)			
					Ingestion	Dermal	Inhalation	Exposure Route Total
Occupational Workers	Groundwater	Inhalation (Indoor Air)	Cis-1,2-dichloroethene	Blood	NA	NA	1.6E-01	0.16
			Vinyl chloride	Liver	NA	NA	9.4E-01	.94
							Total $HI_{occupational\ worker}$ =	**1.1**
Future Construction/ Excavation Worker	Groundwater	Inhalation (in a trench) Dermal Contact	Cis-1,2-dichloroethene	Blood	NA	1.3E-01	6.5E-02	0.19
			Vinyl chloride	Liver	NA	5.7E-01	7.8E+01	78
							Total $HI_{construction\ worker}$ =	**80**
Future Child Resident	Groundwater	Tap Water	Cis-1,2-dichloroethene	Blood	1.41E+01	6.94E-01	NA	14.8
			Vinyl chloride	Liver	9.16E+01	2.63E+00	NA	94.3
							Total HI_{child} =	**109**
Future Adult Resident	Groundwater	Tap Water	Cis-1,2-dichloroethene	Blood	6.03E+00	4.05E-01	5.17E+00	11.6
			Vinyl chloride	Liver	3.93E+01	1.53E+00	3.77E+01	78.5
							Total HI_{adult} =	**90**

Notes:

1. Thiss table provides HQs for each route of exposure and the HI for all routes of exposure for groundwater. RAGS states that, generally, an HI greater than 1.0 indicates the potential for adverse noncancer effects. Estimated HIs of 109 for the future child resident and 90 for the future adult resident indicate that there is a potential for adverse noncancer health effects from exposure to contaminated groundwater under an RME scenario. The COCs contributing the most to the HIs are cis-1,2-dichloroethene and vinyl chloride in groundwater.

2. The HI for the occupational worker (1.1) was only slightly greater than the USEPA benchmark for noncarcinogenic risks (1.0), but when target organs are considered, the HIs for the occupation worker (0.16 for cis-1,2-DCE and 0.94 for VC) are below the USEPA benchmark. Because

TABLE 2-6

RISK CHARACTERIZATION SUMMARY – NONCARCINOGENS
SITE 95 – BUILDING 2101 PAINT BOOTH SUMP
MCB QUANTICO, VIRGINIA

the noncarcinogenic risks for the occupational workers are less than USEPA benchmarks and the carcinogenic risks for the occupational worker (Table 2-5) are only slightly greater than USEPA's acceptable risk range, and because of significant uncertainties associated with the indoor air concentrations predicted by the conservative screening model, current occupational workers are not at risk. However, any new construction at Site 95 may result in less uncertainty associated with indoor air concentrations predicted by the conservative screening model and future occupational workers may be subject to unacceptable risks as a result of vapor intrusion.

Abbreviations:

COCs	chemicals of concern	HQ	hazard quotient	RAGS	Risk Assessment Guidance for Superfund
HI	hazard index	NA	not applicable	RME	reasonable maximum exposure

TABLE 2-7

SUMMARY OF EVALUATION OF GROUNDWATER ALTERNATIVES
SITE 95 – BUILDING 2101 PAINT BOOTH SUMP
MCB QUANTICO, VIRGINIA
PAGE 1 OF 3

Evaluation Criteria	Alternative 1 – No Action	Alternative 2 – Monitored Natural Attenuation	Alternative 3 – In-Situ Bioremediation: ORC Treatment
Threshold Criteria			
Overall Protection of Human Health and the Environment	No reduction in potential risks.	Reduces risks to human health and the environment.	Reduces risks to human health and the environment.
Compliance with ARARs	Would not comply.	Would comply.	Would comply.
Primary Balancing Criteria			
Long-Term Effectiveness and Permanence	Allows uncontrolled risks to remain.	Reduces risks to human health and provides adequate and reliable controls would be effective over the long-term.	Treatment would be expected to be effective over the long term.
Reduction of Toxicity, Mobility, or Volume through Treatment	No treatment.	No treatment.	In-situ biological treatment would reduce toxicity of hazardous substances in groundwater.
Short-Term Effectiveness	Not applicable.	No impacts to community, workers, or environment.	No impacts to community, workers, or environment.
Implementability	Not applicable.	Implementable.	Implementable.
Cost (Present Worth)	$0	$180,000	$140,000 (Option A) $158,000 (Option B)

TABLE 2-7

SUMMARY OF EVALUATION OF GROUNDWATER ALTERNATIVES
SITE 95 – BUILDING 2101 PAINT BOOTH SUMP
MCB QUANTICO, VIRGINIA
PAGE 2 OF 3

Evaluation Criteria	Alternative 1 – No Action	Alternative 2 – Monitored Natural Attenuation	Alternative 3 – In-Situ Bioremediation: ORC Treatment
Modifying Criteria			
State Acceptance	Not applicable.	VADEQ concurs with the selected remedy (Alternative 3)	VADEQ concurs with the selected remedy (Alternative 3)
Community Acceptance	Not applicable.	A public availability session was held on May 7, 2008. At this availability session, representatives of the DON, USEPA, and VDEQ were prepared to answer questions about environmental concerns at the site and potential remedial alternatives. However, no one from the public attended the meeting, and no verbal or written comments have been received from the public.	A public availability session was held on May 7, 2008. At this availability session, representatives of the DON, USEPA, and VDEQ were prepared to answer questions about environmental concerns at the site and potential remedial alternatives. However, no one from the public attended the meeting, and no verbal or written comments have been received from the public.

TABLE 2-7

SUMMARY OF EVALUATION OF GROUNDWATER ALTERNATIVES
SITE 95 – BUILDING 2101 PAINT BOOTH SUMP
MCB QUANTICO, VIRGINIA
PAGE 3 OF 3

Evaluation Criteria	Alternative 4 – In-Situ Bioremediation: iSOC™ Treatment
Threshold Criteria	
Overall Protection of Human Health and the Environment	Reduces risks to human health and the environment.
Compliance with ARARs	Would comply.
Primary Balancing Criteria	
Long-Term Effectiveness and Permanence	Treatment would be expected to be effective over the long term.
Reduction of Toxicity, Mobility, or Volume through Treatment	In-situ biological treatment would reduce toxicity of hazardous substances in groundwater.
Short-Term Effectiveness	No impacts to community, workers, or environment.
Implementability	Implementable.
Cost (Present worth)	$153,000
Modifying Criteria	
State Acceptance	VADEQ concurs with the selected remedy (Alternative 3)
Community Acceptance	A public availability session was held on May 7, 2008. At this availability session, representatives of the DON, USEPA, and VDEQ were prepared to answer questions about environmental concerns at the site and potential remedial alternatives. However, no one from the public attended the meeting, and no verbal or written comments have been received from the public.

ARARs Applicable or Relevant and Appropriate Requirements
ORC Oxygen Release Compound
iSOC™ In-situ Submerged Oxygen Curtain
VADEQ Virginia Department of Environmental Quality

TABLE 2-8

CAPITAL COST DETAILS FOR SELECTED REMEDY
ALTERNATIVE 3: ENHANCED IN-SITU BIOREMEDIAITON: ORC TREATMENT
SITE 95 - BUILDING 2101 PAINT BOOTH SUMP
MCB QUANTICO, VIRGINIA

Alternative 3A: ORC Treatment (Slurry Injection)

Item	Quantity	Unit	Unit Cost Subcontract	Unit Cost Material	Unit Cost Labor	Unit Cost Equipment	Total Cost Subcontract	Total Cost Material	Total Cost Labor
1 PROJECT PLANNING AND DOCUMENTS									
1.1 Prepare Documents and Plans	150	hr			$30.00		$0	$0	$4,500
1.2 Post Construction Documents	100	hr			$30.00		$0	$0	$3,000
2 ORC INJECTION									
2.1 Driller Mobilization/Demobilization	1	ea	$1,000.00				$1,000	$0	$0
2.2 ORC Injection	3	ea	$325.00				$975	$0	$0
2.3 Collect/Containerize IDW	1	drum	$100.00				$100	$0	$0
2.4 Sample/Transport/Dispose IDW	1	drum	$200.00				$200	$0	$0
2.5 ORC	120	lb	$11.00				$1,320	$0	$0
3 OVERSIGHT AND MONITORING									
3.1 Installation (labor, travel, supplies)	1	ea		$500.00	$2,000.00	$200.00	$0	$500	$2,000
3.2 Sampling (months 3, 6, 9, and 12 - labor, travel, supplies)	4	ea		$500.00	$2,000.00	$200.00	$0	$2,000	$8,000
3.3 Lab Analysis (months 3, 6, 9, and 12, VOCs and misc.)	24	ea	$300.00				$7,200	$0	$0
Subtotal							$10,795	$2,500	$17,500
Local Area Adjustments							100.0%	114.1%	83.6%
							$10,795	$2,853	$14,630
Overhead on Labor Cost @ 30%									$4,389
G & A on Labor Cost @ 10%									$1,463
G & A on Material Cost @ 10%								$285	
G & A on Subcontract Cost @ 10%							$1,080		
Total Direct Cost							$11,875	$3,138	$20,482
Indirects on Total Direct Cost @ 35%									
Profit on Total Direct Cost @ 10%									
Subtotal									
Health & Safety Monitoring @ 3%									
Total Field Cost									
Contingency on Total Field and Subcontractor Costs @ 20%									
Engineering on Total Field and Subcontractor Costs @ 10%									
TOTAL COST									

TABLE 2-8

CAPITAL COST DETAILS FOR SELECTED REMEDY
ALTERNATIVE 3: ENHANCED IN-SITU BIOREMEDIAITON: ORC TREATMENT
SITE 95 - BUILDING 2101 PAINT BOOTH SUMP
MCB QUANTICO, VIRGINIA

Alternative 3B: ORC Treatment (Filter Socks)

Item	Quantity	Unit	Unit Cost				Total Cost		
			Subcontract	Material	Labor	Equipment	Subcontract	Material	Labor
1 PROJECT PLANNING & DOCUMENTS									
1.1 Prepare Documents and Plans	150	hr			$30.00		$0	$0	$4,500
1.2 Post Construction Documents	100	hr			$30.00		$0	$0	$3,000
2 ORC WELLS									
2.1 Driller Mobilization/Demobilization	1	ea	$1,000.00				$1,000	$0	$0
2.2 Install ORC Wells (2 wells)	30	lf	$65.00				$1,950	$0	$0
2.3 Well Development	3	hr	$75.00				$225	$0	$0
2.4 Flush Mount Covers	2	ea	$250.00				$500	$0	$0
2.5 Collect/Containerize IDW	2	drum	$100.00				$200	$0	$0
2.6 Sample/Transport/Dispose IDW	2	drum	$200.00				$400	$0	$0
2.7 ORC Filter Socks (replace at 4 and 8 months)	120	ea	$65.00				$7,800	$0	$0
3 OVERSIGHT AND MONITORING									
3.1 Installation (labor, travel, supplies)	1	ea		$500.00	$2,000.00	$200.00	$0	$500	$2,000
3.2 Sampling (months 3, 6, 9, and 12 - labor, travel, supplies)	4	ea		$500.00	$2,000.00	$200.00	$0	$2,000	$8,000
3.3 Lab Analysis (months 3, 6, 9, and 12, VOCs and misc.)	24	ea	$300.00				$7,200	$0	$0
Subtotal							$19,275	$2,500	$17,500
Local Area Adjustments							100.0%	114.1%	83.6%
							$19,275	$2,853	$14,630
Overhead on Labor Cost @ 30%									$4,389
G & A on Labor Cost @ 10%									$1,463
G & A on Material Cost @ 10%								$285	
G & A on Subcontract Cost @ 10%							$1,928		
Total Direct Cost							$21,203	$3,138	$20,482
Indirects on Total Direct Cost @ 35%									
Profit on Total Direct Cost @ 10%									
Subtotal									
Health & Safety Monitoring @ 3%									
Total Field Cost									
Contingency on Total Field and Subcontractor Costs @ 20%									
Engineering on Total Field and Subcontractor Costs @ 10%									
TOTAL COST									

TABLE 2-9

ANNUAL COST DETAILS FOR SELECTED REMEDY
ALTERNATIVE 3: ENHANCED IN-SITU BIOREMEDIATION: ORC TREATMENT
SITE 95 -BUILDING 2101 PAINT BOOTH SUMP
MCB QUANTICO, VIRGINIA

Alternative 3A: ORC Treatment (Slurry Injection)

Item	Item Cost Year 1	Item Cost Years 2 - 5	Item Cost 5th Year	Notes
Sampling	$20,000	$5,000		Labor, Per Diem, Equipment, Travel
Analysis[1]	$8,000	$2,000		Analyze Groundwater Samples.
Report	$2,000	$2,000		Document sampling events and results
Site Review			$18,000	Perform 5-Year review
TOTALS	$30,000	$9,000	$18,000	

(1) Groundwater to be sampled and analyzed quarterly the first year and then annually thereafter.

TABLE 2-9

ANNUAL COST DETAILS FOR SELECTED REMEDY
ALTERNATIVE 3: ENHANCED IN-SITU BIOREMEDIATION: ORC TREATMENT
SITE 95 -BUILDING 2101 PAINT BOOTH SUMP
MCB QUANTICO, VIRGINIA

Alternative 3B: ORC Treatment (Filter Socks)

Item	Item Cost Year 1	Item Cost Years 2 - 5	Item Cost 5th Year	Notes
Sampling	$20,000	$5,000		Labor, Per Diem, Equipment, Travel
Analysis[1]	$8,000	$2,000		Analyze Groundwater Samples.
Report	$2,000	$2,000		Document sampling events and results
Site Review			$18,000	Perform 5-Year review
TOTALS	$30,000	$9,000	$18,000	

(1) Groundwater to be sampled and analyzed quarterly the first year and then annually thereafter.

TABLE 2-10

PRESENT WORTH DETAILS FOR SELECTED REMEDY
ALTERNATIVE 3: ENHANCED IN-SITU BIOREMEDIATION: ORC TREATMENT
SITE 95 -BUILDING 2101 PAINT BOOTH SUMP
MCB QUANTICO, VIRGINIA

Alternative 3A: ORC Treatment (Slurry Injection)

Year	Capital Cost	Annual Cost	Annual Discount Rate at 7%	Present Worth
0	$70,537		1.000	$70,537
1		$30,000	0.935	$28,050
2		$9,000	0.873	$7,857
3		$9,000	0.816	$7,344
4		$9,000	0.763	$6,867
5		$27,000	0.713	$19,251
6		$0	0.666	$0
7		$0	0.623	$0
8		$0	0.582	$0
9		$0	0.544	$0
10		$0	0.508	$0
11		$0	0.475	$0
12		$0	0.444	$0
13		$0	0.415	$0
14		$0	0.388	$0
15		$0	0.362	$0
16		$0	0.339	$0
17		$0	0.317	$0
18		$0	0.296	$0
19		$0	0.277	$0
20		$0	0.258	$0
21		$0	0.242	$0
22		$0	0.226	$0
23		$0	0.211	$0
24		$0	0.197	$0
25		$0	0.184	$0
26		$0	0.172	$0
27		$0	0.161	$0
28		$0	0.150	$0
29		$0	0.141	$0
30		$0	0.131	$0
			TOTAL PRESENT WORTH	**$139,906**

TABLE 2-10

PRESENT WORTH DETAILS FOR SELECTED REMEDY
ALTERNATIVE 3: ENHANCED IN-SITU BIOREMEDIATION: ORC TREATMENT
SITE 95 -BUILDING 2101 PAINT BOOTH SUMP
MCB QUANTICO, VIRGINIA

Alternative 3B: ORC Treatment (Filter Socks)

Year	Capital Cost	Annual Cost	Annual Discount Rate at 7%	Present Worth
0	$88,648		1.000	$88,648
1		$30,000	0.935	$28,050
2		$9,000	0.873	$7,857
3		$9,000	0.816	$7,344
4		$9,000	0.763	$6,867
5		$27,000	0.713	$19,251
6		$0	0.666	$0
7		$0	0.623	$0
8		$0	0.582	$0
9		$0	0.544	$0
10		$0	0.508	$0
11		$0	0.475	$0
12		$0	0.444	$0
13		$0	0.415	$0
14		$0	0.388	$0
15		$0	0.362	$0
16		$0	0.339	$0
17		$0	0.317	$0
18		$0	0.296	$0
19		$0	0.277	$0
20		$0	0.258	$0
21		$0	0.242	$0
22		$0	0.226	$0
23		$0	0.211	$0
24		$0	0.197	$0
25		$0	0.184	$0
26		$0	0.172	$0
27		$0	0.161	$0
28		$0	0.150	$0
29		$0	0.141	$0
30		$0	0.131	$0
			TOTAL PRESENT WORTH	**$158,017**

TABLE 2-11

ARARs
SITE 95 – BUILDING 2101 PAINT BOOTH SUMP
MCB QUANTICO, VIRGINIA

CHEMICAL SPECIFIC ARARs

Act/Authority	Criteria/Issues	Citation	Brief Description	Status	Consideration in the FS
Federal					
Safe Drinking Water Act	MCLs	40 CFR 141.2, 141.24, 141.27, 141.28, and 141.61	Defines and establishes enforceable standards (MCLs) for public water systems for contaminants that have been determined to adversely affect human health and sets forth related sampling and analytical requirements.	MCLs are relevant and appropriate.	Considered for developing groundwater goals for unrestricted use.

LOCATION-SPECIFIC ARARs

Act/Authority	Criteria/Issues	Citation	Brief Description	Status	Consideration in the FS
State					
Virginia Private Well Regulations	Standards and prohibitions on groundwater wells	12 VAC 5-630 (Sections 10, 220, and 230)	Private wells are prohibited if a source of contamination could adversely affect the well and preventative measures are not available to protect groundwater.	Applicable	Wells would not be permitted at Site 95 until groundwater has been remediated.

TABLE 2-11

ARARs
SITE 95 – BUILDING 2101 PAINT BOOTH SUMP
MCB QUANTICO, VIRGINIA

ACTION-SPECIFIC ARARs

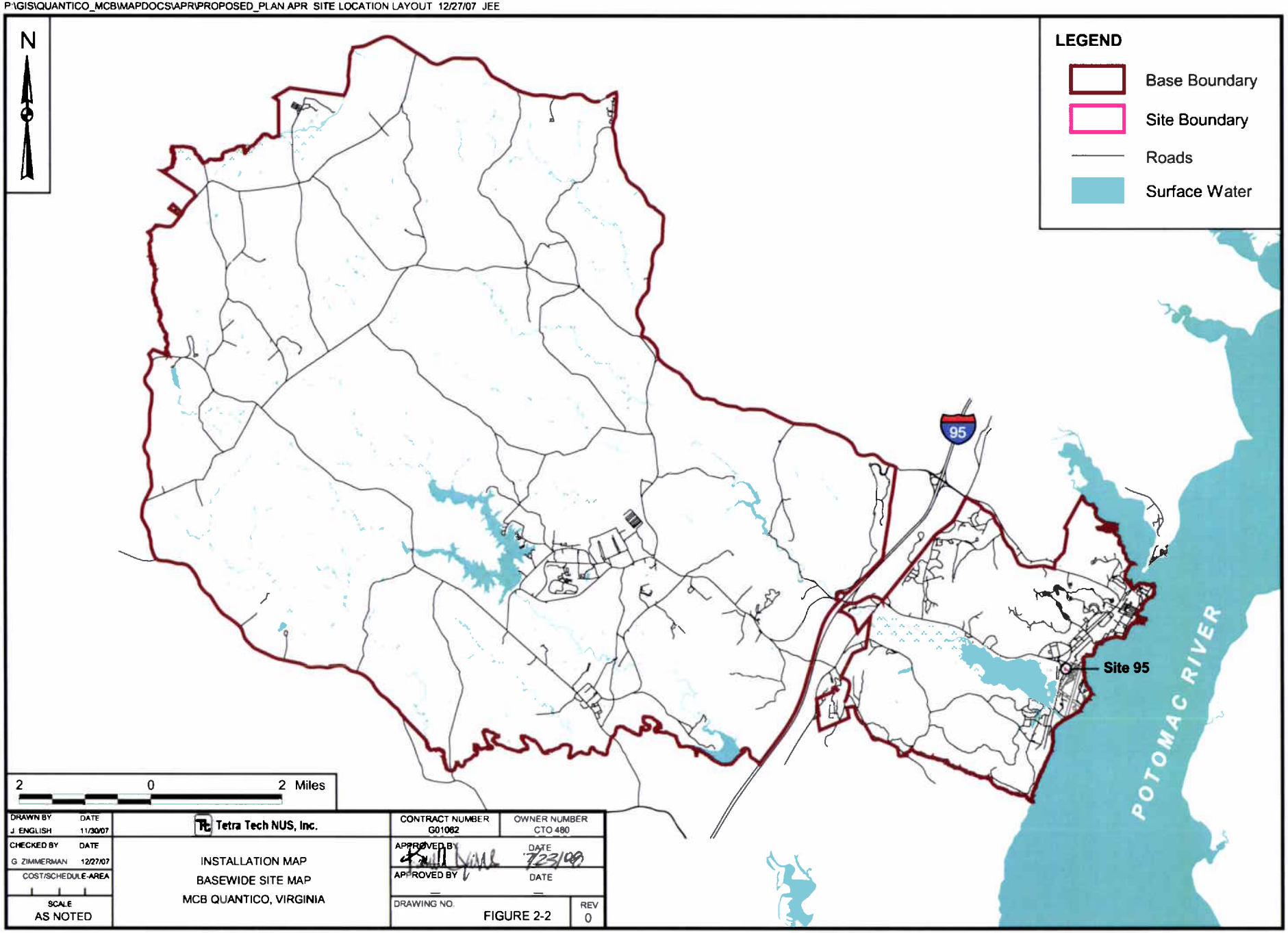
Act/Authority	Criteria/Issues	Citation	Brief Description	Status	Consideration in the FS
Federal					
Safe Drinking Water Act	Underground Injection Control program	40 CFR 144, 144.3, 144.6(e), 144.12(a), 144.24(c), 144.51(d) and (e), 144.80(e), 144.81, 144.82; 40 CFR 146, 146.3, 146.5(e), 146.6, 146.8, 146.10(c); 40 CFR 147, 147.2351	Contains provisions for control and prevention of pollutant injection into groundwater. Since the remediation work will be taking place entirely on-site, the remedial action must comply only with the substantive aspects of the Underground Injection Control regulations, not the corresponding administrative procedures such as administrative reviews, reporting and recordkeeping requirements.	Applicable	These requirements would be applicable for injection of ORC.

Abbreviations:
ARARs Applicable or Relevant and Appropriate Requirements
CFR Code of Federal Regulations
FS Feasibilty Study
MCLs Maximum Contaminant Levels
NA Not available/not applicable
TBC To be considered
USEPA United States Environmental Protection Agency
VAC Virginia Administrative Code

P:\GIS\QUANTICO_MCB\APR\FFR_REV.APR VICINITY MAP 12/27/07 JEE

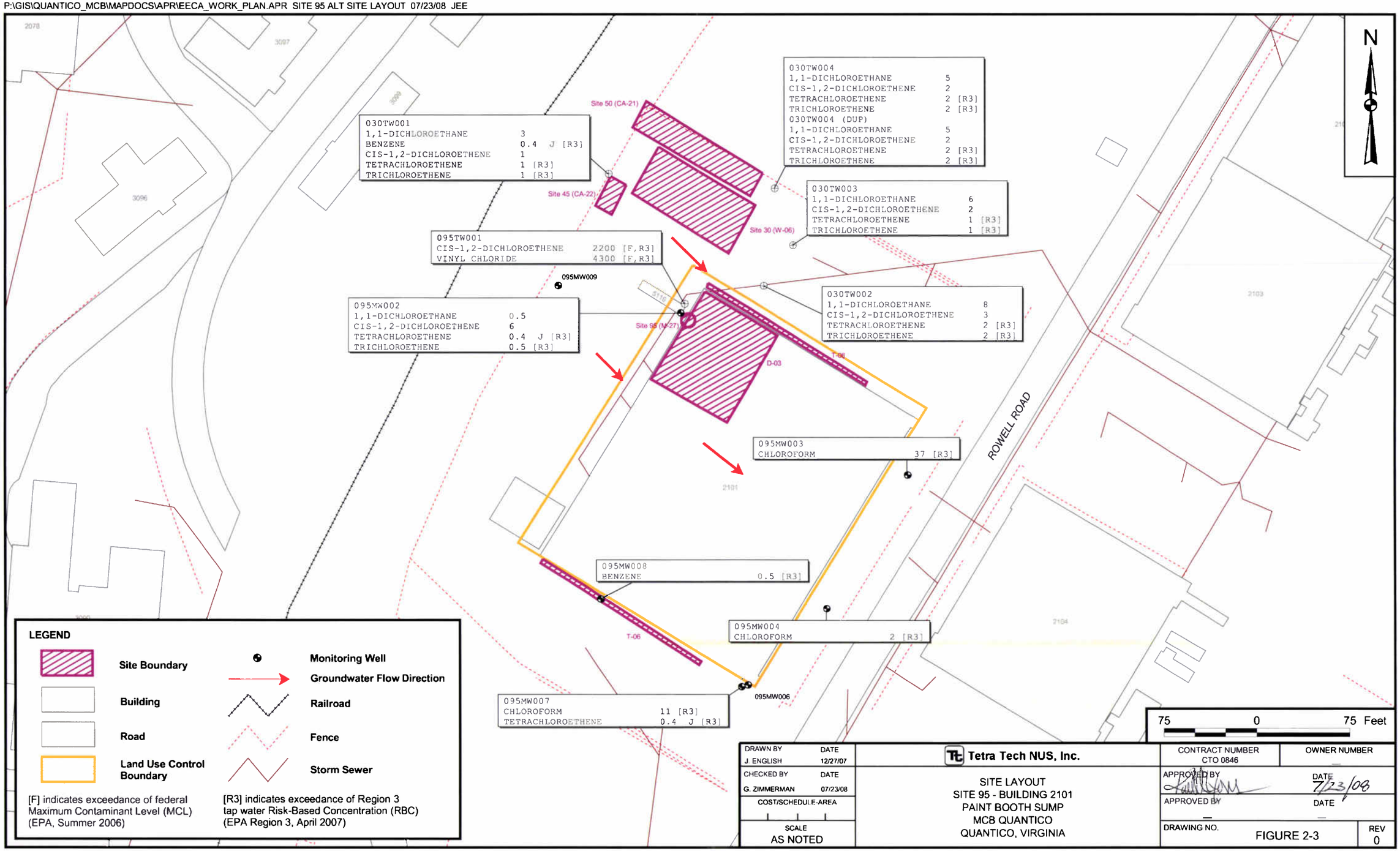
DRAWN BY K. PEILA	DATE 3/26/02	Tetra Tech NUS, Inc.	CONTRACT NUMBER 0018 / OWNER NUMBER 5074
CHECKED BY G. ZIMMERMAN	DATE 12/27/07	VICINITY MAP MCB QUANTICO, VIRGINIA	APPROVED BY K. LYONS / DATE 8/13/07
COST/SCHEDULE-AREA			APPROVED BY — / DATE —
SCALE AS NOTED			DRAWING NO. FIGURE 2-1 / REV 0

P:\GIS\QUANTICO_MCB\MAPDOCS\APR\PROPOSED_PLAN APR SITE LOCATION LAYOUT 12/27/07 JEE

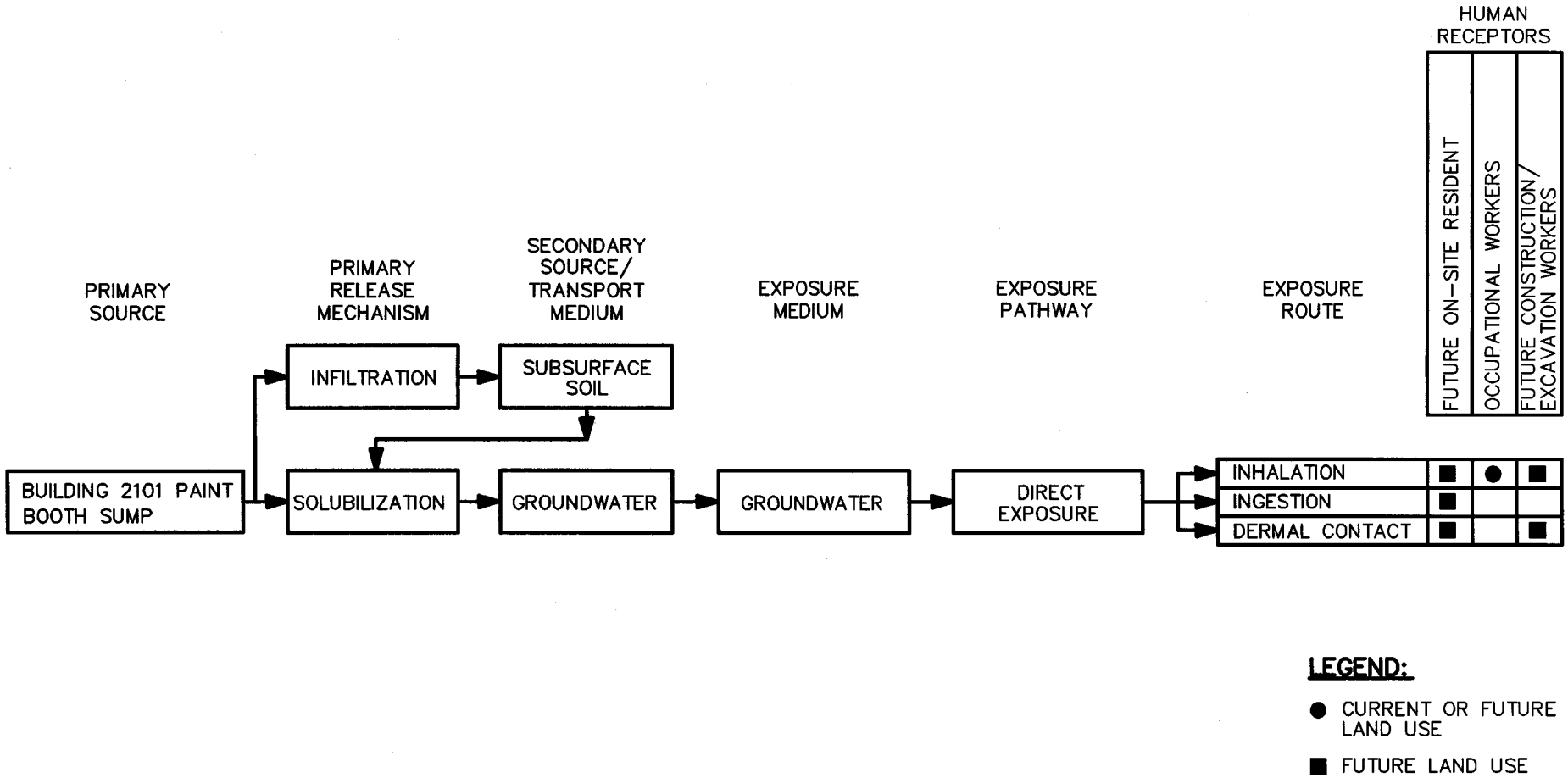


DRAWN BY J. ENGLISH DATE 11/30/07	Tetra Tech NUS, Inc.	CONTRACT NUMBER G01062	OWNER NUMBER CTO 480
CHECKED BY G. ZIMMERMAN DATE 12/27/07	INSTALLATION MAP BASEWIDE SITE MAP MCB QUANTICO, VIRGINIA	APPROVED BY [signature] DATE 1/23/08	
COST/SCHEDULE-AREA		APPROVED BY — DATE —	
SCALE AS NOTED		DRAWING NO. FIGURE 2-2	REV 0

P:\GIS\QUANTICO_MCB\MAPDOCS\APR\EECA_WORK_PLAN.APR SITE 95 ALT SITE LAYOUT 07/23/08 JEE



DRAWN BY J. ENGLISH	DATE 12/27/07	Tetra Tech NUS, Inc.	CONTRACT NUMBER CTO 0846 / OWNER NUMBER —
CHECKED BY G. ZIMMERMAN	DATE 07/23/08	SITE LAYOUT SITE 95 - BUILDING 2101 PAINT BOOTH SUMP MCB QUANTICO QUANTICO, VIRGINIA	APPROVED BY — DATE 7/23/08
COST/SCHEDULE-AREA			APPROVED BY — DATE —
SCALE AS NOTED			DRAWING NO. FIGURE 2-3 / REV 0



DRAWN BY MF	DATE 1/29/08	Tetra Tech NUS, Inc.	CONCEPTUAL SITE MODEL SITE 95 – BUILDING 2101 PAINT BOOTH SUMP MCB QUANTICO, VIRGINIA
CHECKED BY	DATE		
REVISED BY	DATE		
SCALE AS NOTED			

CONTRACT NO. 1062
OWNER NO.
APPROVED BY DATE 7/31/08
DRAWING NO. FIGURE 2-4
REV. 0

3.0 RESPONSIVENESS SUMMARY

The Responsiveness Summary is a concise and complete summary of significant comments received from the public and includes responses to these comments. The Responsiveness Summary was prepared after the public comment period (which ended on May 19, 2008) in accordance with USEPA guidance[12]. The Responsiveness Summary provides the decision maker with information about the views of the community. It also documents how the DON, USEPA, and VDEQ considered public comments during the decision-making process and provides answers to major comments.

3.1 OVERVIEW

The Proposed Plan that was presented to the public identified in-situ bioremediation using ORC, groundwater use, construction, and excavation restrictions, LTM, and 5-year site reviews as the preferred remedial alternative.

The LUCs or restrictions (for groundwater use, construction, and excavation) are identified in this ROD will be effectively enforced as a base-wide order when the ROD is signed by the MCB Commander. Signed RODs are kept at the MCB Quantico Natural Resources and Environmental Affairs (NREA) Branch, as well as in the information repositories. The LUCs are detailed in the Remedial Design and maintained in the MCB Quantico GIS. Any new development projects are reviewed by NREA for environmental impact and this review includes verification using the MCB Quantico GIS that no site LUCs are violated.

LTM of groundwater at Site 95 would be conducted to determine the effectiveness of bioremediation, to confirm that contaminants are not migrating off site at unacceptable concentrations, and to confirm that COC concentrations do not increase to levels above PRGs once treatment is discontinued. A discretionary site review would be performed within 5 years to ensure that the remedy is, or will be, protective of human health and the environment.

3.2 BACKGROUND ON COMMUNITY INVOLVEMENT

The public comment period for the proposed action at Site 95 began on April 20, 2008 and ended on May 19, 2008. A public availability session was held on May 7, 2008 at the Clubs at Quantico, 3017 Russell Road, Quantico, Virginia, to answer questions regarding the proposed action. No written or verbal questions/comments were received.

3.3 SUMMARY OF COMMENTS RECEIVED DURING THE PUBLIC COMMENT PERIOD AND DEPARTMENT OF NAVY RESPONSES

No comments were received during the public comment period or the public availability session.

REFERENCES

(1) A.T. Kearney, March 1989. Phase II RCRA Facility Assessment Report, Marine Corps Development and Education Command. EPA Contract No. 68-01-7038. Alexandria, Virginia.

(2) TtNUS (Tetra Tech NUS, Inc.), February 2000. Desktop Audit Report No. 6, Marine Corps Combat Development Command (MCCDC), Quantico, Virginia. King of Prussia, Pennsylvania.

(3) TtNUS, July 2002. SSP Presentation, Buildings 4, 2101, 2113 Sites. Presented to Quantico Project Managers Team (QPMT) and USEPA Tech Support, July 9. King of Prussia, Pennsylvania.

(4) TtNUS, July 2007. Remedial Investigation/Feasibility Study Report for Site 95 – Building 2101 Paint Booth Sump, Marine Corps Base, Quantico, Virginia. King of Prussia, Pennsylvania.

(5) TtNUS, October 2007. Proposed Plan for Building 2101 Paint Booth Sump (Site 95), Marine Corps Base, Quantico, Virginia. King of Prussia, Pennsylvania.

(6) TtNUS, September 2004. Engineering Evaluation/Cost Analysis Presentation, Site 95 – Building 2101 Paint Booth Sump. Presented to: QPMT, September 30, 2004. King of Prussia, Pennsylvania.

(7) USEPA (United States Environmental Protection Agency)/DON (Department of Navy), December 1998. Federal Facilities Agreement, MCB Quantico. CERCLA Section 120, Administrative Docket Number: III-FCA-CERC-014.

(8) TtNUS (Tetra Tech NUS, Inc.), May 2008. 2008 Site Management Plan, MCB Quantico, Virginia. King of Prussia, Pennsylvania.

(9) USEPA, Summer 2006. 2006 Edition of the Drinking Water Standards and Health Advisories. Office of Water, EPA/822/R/06/013, Washington, D.C.

(10) USEPA Region 3, April 2007. Risk-Based Concentration Table. http://www.epa.gov.reg3hwmd/risk/human/index.htm.

(11) USEPA, October 1988. Interim Final, Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA. EPA 540-G-89-004. Office of Engineering and Remedial Response, Washington, D.C.

(12) USEPA, April 2002. Superfund Community Involvement Handbook. EPA 540-K-01-003, Office of Solid Waste and Emergency Response, Washington, D.C