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Massachusetts Military Reservation

PLUME RESPONSE PROGRAM

Final Record of Decision for Groundwater at Eastern Briarwood, Western Aquafarm, and Storm Drain-5

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Prepared for:
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ACRONYMS AND ABBREVIATIONS

AFCEE	Air Force Center for Environmental Excellence
ANG	Air National Guard
ANGB	Air National Guard Base
ANGI	Air National Guard Instruction
AOC	area of concern
ARAR	applicable or relevant and appropriate requirement
AVGAS	aviation gasoline
CDI	chronic daily intake
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CERCLIS	Comprehensive Environmental Response, Compensation, and Liability Information System
CFR	Code of Federal Regulations
CMR	Code of Massachusetts Regulations
COC	contaminant of concern
COPC	chemical of potential concern
DAD	dermally absorbed dose
DOD	U.S. Department of Defense
DSRP	drainage structure removal program
EB	Eastern Briarwood
EDB	ethylene dibromide (1,2-dibromoethane)
EPA	U.S. Environmental Protection Agency
EPC	exposure point concentration
ETR	extraction, treatment, reinjection
FFA	Federal Facility Agreement

ACRONYMS AND ABBREVIATIONS

FS-#	Fuel Spill-#
ft msl	feet mean sea level
GAC	granular activated carbon
HEAST	Health Effects Assessment Summary Table
HI	hazard index
HQ	hazard quotient
IRIS	Integrated Risk Information System
IROD	Record of Decision for Interim Action
IRP	Installation Restoration Program
LTM	long-term monitoring
LUC	land use control
M	million
MassDEP	Massachusetts Department of Environmental Protection
MCL	maximum contaminant level
mg/kg-day	milligrams per kilogram per day
MMR	Massachusetts Military Reservation
MMCL	Massachusetts maximum contaminant level
MPP	Mashpee Pitted Plain
NCP	National Oil and Hazardous Substances Contingency Plan
NDIL	Non-Destructive Inspection Laboratory
NGB	National Guard Bureau
NPL	National Priorities List
OU	operable unit
PCE	tetrachloroethene
PCT	Plume Cleanup Team

ACRONYMS AND ABBREVIATIONS

PP	Proposed Plan
PRG	preliminary remediation goal
RAO	remedial action objective
RCRA	Resource Conservation and Recovery Act
RfD	reference dose
RI	remedial investigation
RME	reasonable maximum exposure
ROD	Record of Decision
RPM	remedial program manager
SD-5	Storm Drain-5
SERGOU	Southeast Region Groundwater Operable Unit
SF	slope factor
SI	site investigation
SPEIM	system performance and ecological impact monitoring
SRTF	Sandwich Road Treatment Facility
TCE	trichloroethene
UCL_{95}	95 percent upper confidence limit on the mean
USCG	U.S. Coast Guard
UST	underground storage tank
VOC	volatile organic compound
WA	Western Aquafarm
µg/L	micrograms per liter

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1.0 DECLARATION

1.1 SITE NAME AND LOCATION

The Massachusetts Military Reservation (MMR) on Cape Cod Massachusetts lies within the boundaries of the towns of Bourne, Mashpee, and Sandwich, and abuts the town of Falmouth. This site is listed on the National Priority List (NPL) as Otis Air National Guard/Camp Edwards in Falmouth, Massachusetts. This Record of Decision (ROD) addresses the groundwater at Eastern Briarwood (EB), Western Aquafarm (WA), and Storm Drain 5 (SD-5). The Comprehensive Environmental Response, Compensation and Liability Information System (CERCLIS) number for the MMR site is MA2570024487.

1.2 STATEMENT OF BASIS AND PURPOSE

This ROD presents the selected remedies for Eastern Briarwood, Western Aquafarm, and SD-5 groundwater, which were chosen in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended by the Superfund Amendment and Reauthorization Act (CERCLA), and to the extent practicable, the National Oil and Hazardous Substances Contingency Plan (NCP). This decision is based on the administrative record for this site. The EB, WA, and SD-5 source areas have been addressed as separate operable units (OU). This ROD addresses the EB, WA, and SD-5 groundwater operable units.

The United States Department of Defense (DOD) (U.S. Air Force) is the lead agency for CERCLA remedial actions at the MMR. The U.S. Environmental Protection Agency (EPA), the U.S. Air Force, and the National Guard Bureau (NGB) are parties to the Federal Facility Agreement (FFA) (EPA et al. 2002) for this site. They, along with the Commonwealth of Massachusetts Department of Environmental Protection (MassDEP), concur with the selected remedy.

1.3 ASSESSMENT OF THE SITE

The response action selected in this ROD for the SD-5 site will be protective of the public health and welfare and the environment from actual or threatened releases of hazardous substances into the environment. No further action is necessary at the Eastern Briarwood and Western Aquafarm sites to be protective of human health and the environment.

1.4 DESCRIPTION OF SELECTED REMEDY

The EB, WA, and SD-5 source areas have been addressed as separate OUs. This ROD will only address the selected remedies for current EB, WA, and SD-5 groundwater contamination.

Volatile organic compounds (VOCs) were detected in groundwater samples collected from the Eastern Briarwood area. In recent years (2000 to 2004), there has been only one detection of any VOC with a concentration above the respective state and federal drinking water standard. After review of the conservative assumptions used in the risk assessment, the EPA, MassDEP and Air Force Center for Environmental Excellence (AFCEE) concluded that VOC concentrations in Eastern Briarwood groundwater did not pose unacceptable human health risks. Based on the review of the risk assessment for Eastern Briarwood and the spatial and temporal distribution of VOCs in Eastern Briarwood groundwater, the EPA, MassDEP, and AFCEE concluded that no additional action was warranted to be protective of human health and the environment.

VOCs were also detected in groundwater samples collected from the Western Aquafarm area. Even though the concentrations were below the drinking water standard, the risk assessment indicated there was a potential for unacceptable non-cancer health risks to future residents, associated with the VOC concentrations in one monitoring well. VOC concentrations have been decreasing with time in the Western Aquafarm area, which is within a secured portion of the MMR. Because there is no potential for current or future residential exposure to the remaining contamination at Western Aquafarm, the EPA,

MassDEP, and AFCEE agreed that no further action is warranted to be protective of human health and the environment.

The selected remedy for SD-5 groundwater includes the following components:

- Periodic groundwater sampling and analysis for trichloroethene (TCE).
- Periodic review and optimization of the sampling program.
- Monitoring, which will continue for two years beyond the time at which the remedial action objectives have been met.
- [illegible] human exposure to TCE-contaminated groundwater.
- Five-year reviews, which will be performed to determine if the remedy is still appropriate and protective.
- A residual risk assessment to be conducted if deemed necessary.

1.5 STATUTORY DETERMINATIONS

The selected remedy for Eastern Briarwood and Western Aquafarm groundwater is consistent with CERCLA and, to the extent practicable, the NCP; is protective of human health and the environment; and is cost-effective. Because the selected remedy for Eastern Briarwood and Western Aquafarm groundwater is no further action, there are no applicable or relevant and appropriate requirements (ARARs) with which to comply.

The selected SD-5 groundwater remedy is consistent with CERCLA and, to the extent practicable, the NCP; is protective of human health and the environment; complies with federal and Commonwealth of Massachusetts requirements that are ARARs for the remedial action; and is cost-effective. Although groundwater treatment was a principal element of the interim remedy for the SD-5 groundwater contamination, groundwater will not be treated under the final remedy. The remedy does not meet the statutory preference for treatment because there are no immediate health risks from contaminants, and data show that the groundwater contamination is not expanding significantly and will not impact sensitive areas during the time required for natural degradation to achieve cleanup goals. Because contamination above levels that allow for unlimited use and unrestricted

exposure will remain in the aquifer for a few years, five-year reviews will be conducted to ensure that the remedy continues to be protective of human health and the environment.

1.6 DATA CERTIFICATION CHECKLIST

The following information is included in the Decision Summary section (Section 2.0) of this ROD. Additional information can be found in the Administrative Record for this site.

Contaminant of concern (COC) and its respective concentration.	Section 2.5.1
Baseline risk represented by the COC.	Section 2.7
Cleanup level established for the COC and the basis for this level.	Section 2.8
How source materials constituting principal threats will be addressed.	Section 2.2
Current and reasonable anticipated future land use assumptions and current and potential future beneficial use of groundwater used in the baseline risk assessment and the ROD.	Section 2.6
Potential land and groundwater use that will be available at the site as a result of the selected remedy.	Section 2.8
Estimated annual and total present value costs, discount rate, and the number of years over which the remedy cost estimate is projected.	Tables 2-48 and 2-49 Section 2.11.3
Key factor(s) that led to selecting the remedy.	Sections 2.10.2, 2.12.3, 2.12.4

1.7 AUTHORIZING SIGNATURES

The foregoing represents the decision for final remedial action for EB, WA, and SD-5 groundwater by AFCEE and the EPA, with the concurrence of the MassDEP.

Approve and recommend for immediate implementation.

AIR FORCE CENTER FOR ENVIRONMENTAL EXCELLENCE

By: _____ Date: 14 August 2006

Paul A. Parker
Director

U.S. ENVIRONMENTAL PROTECTION AGENCY

By: Susan Studlien Date: 09/28/06

Susan Studlien
Director, Office of Site Remediation and Restoration

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2.0 DECISION SUMMARY

The following sections describe the Eastern Briarwood, Western Aquafarm, and SD-5 settings and potential risks, and the remedial action objectives (RAOs) and alternative evaluation for remediation of the SD-5 groundwater.

2.1 SITE NAME, LOCATION, AND BRIEF DESCRIPTION

The MMR is listed on the NPL as Otis Air National Guard/Camp Edwards in Falmouth, Massachusetts. The CERCLIS number for the MMR site is MA2570024487. In accordance with Executive Order 12580, the DOD is the lead agency for remedial actions at the MMR. The Commonwealth of Massachusetts chose not to be a signatory to the FFA. The MMR was formally added to the NPL in 1989. The FFA for the MMR site was signed in 1991 by the DOD, the EPA, and the U.S. Coast Guard (USCG)/Department of Transportation[1] (EPA et al. 2002). In 1995, the FFA was amended to add the U.S. Air Force as the lead agent for the cleanup at MMR. The FFA, as amended, requires the U.S. Air Force to implement CERCLA requirements at the MMR.

The MMR occupies approximately 22,000 acres on Cape Cod (Figure 2-1) and consists of several operating command units: the Air National Guard, the Army National Guard, the Air Force, the U.S. Coast Guard (USCG), and the Veterans Administration. Military training and maneuvers, military aircraft operations, and maintenance and support activities have resulted in past releases of hazardous materials at the MMR. EB, WA, and SD-5 are located in the southeast corner of the MMR (Figures 2-1 and 2-2).

The MMR OUs being addressed in this ROD are listed as follows in the EPA database:

- OU ID 13, OU01A – SD5 NORTH GROUNDWATER PLUME
- OU ID 20, OU 01G – SD5 SOUTH GROUNDWATER PLUME

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[1] In 2000, the FFA was amended to remove the USCG/U.S. Department of Transportation as a signatory to the FFA.

- OU ID 17, OU 01E – EASTERN BRIARWOOD GROUNDWATER
- OU ID 18, OU 01F – WESTERN AQUAFARM GROUNDWATER.

2.2 SITE HISTORY AND ENFORCEMENT ACTIVITIES

Military use at the MMR began in 1911. The most intense periods of activity occurred from 1940 to 1946 and 1955 to 1970. Sources of contamination resulting from a variety of military operations include former chemical spills, motor pools, landfills, fire training areas and drainage structures such as dry wells and drainage swales.

The MMR history follows a series of complex interactions between various federal agencies and the Commonwealth of Massachusetts. In 1940, the U.S. Army signed a 99-year lease with the Commonwealth of Massachusetts for the use of the MMR. The Army transferred this lease to the Air Force in 1953 for the Otis Air Force Base portion of the military reservation, and the Army maintained a sublease for the 14,000-acre area on the base known as Camp Edwards. In 1974, the Air Force licensed the Massachusetts Air National Guard to use Otis Air Force Base, and in 1975, the U.S. Army licensed the Massachusetts Army National Guard to use and occupy Camp Edwards. On 05 March 2002, a law was enacted that designated the northern 15,000 acres of the MMR as protected conservation land dedicated for the purposes of water supply and wildlife habitat, at the same time allowing military training that is compatible with the environmental protection of the land. In 2003, the Commonwealth of Massachusetts extended the lease with the National Guard until 2052.

Activities resulting in CERCLA actions are summarized below. In 1982, the DOD initiated the Installation Restoration Program (IRP) at the Otis Air National Guard Base (ANGB) area of the MMR. The IRP at the MMR is funded by the Defense Environmental Restoration Account. The NGB was responsible for implementing the IRP at the MMR. In 1986, the IRP was expanded to include all potential hazardous waste releases at MMR resulting only from practices that were discontinued before 1976. In 1989, the MMR was formally added to the NPL. An FFA among the NGB, the EPA, and the USCG was signed in 1991 and has since been amended (EPA et al. 2002). The FFA

provides a framework for EPA oversight and enforcement of the MMR investigations and cleanup activities and identifies a schedule for cleanup activities. A Community Relations Plan is included as an attachment to the FFA. In 1996, the EPA Region I Administrator requested that the DOD provide a new management structure for the MMR IRP. In response to that request, the U.S. Air Force assumed the lead role in the execution of the IRP and assigned AFCEE to manage the program. Under Amendment 2, additional enforceable milestones and the Plume Response Decision Criteria and Schedule were added to the FFA in April 1997. More recently, the USCG has been [illegible] February 2000). Amendment 4, signed in February 2000, added Section 7003 of the Resource Conservation and Recovery Act (RCRA) to the FFA in order to address contamination caused solely by petroleum releases that fall within the scope of the CERCLA "petroleum exclusion" described in the last sentence of CERCLA Section 101(14). Amendment 5 was signed in June 2002 and removed the CS-13 site from the list of Study Areas and Areas of Contamination contained in Section 5.24 of the FFA.

Wide varieties of investigations, removal actions, and remedial actions have been and are currently being conducted at the MMR.

Eastern Briarwood

Early environmental investigations were conducted in this area to evaluate the nature and distribution of contaminants at individual areas of concern, which were potential sources of contamination in the Eastern Briarwood area (i.e., Fuel Spill-25 [FS-25], Chemical Spill-14, Central Heating Plant, Weapons Storage Area, and USCG FS-1). Preliminary assessments began in 1983 and continued through preliminary studies, site inspections, and various remedial and hydrologic investigations into the spring of 1993. The results of these early investigations, as well as other background information, were used to scope the Southeast Region Groundwater Operable Unit (SERGOU) remedial investigation (RI), which was completed in 1994. One subset of the SERGOU was called southeast MMR groundwater, which was later identified as the Eastern Briarwood area (ANG 1994b). The SERGOU RI concluded that the source area for the Eastern Briarwood

groundwater contamination was the industrial area located within the southeastern portion of the MMR. Due to the low concentrations and lack of a pattern, it was determined that the contamination was related to occasional spills from normal operations and not from a sustained source. The power plant and the weapons storage area were identified as potential sources of these small releases. A Record of Decision for Interim Action (IROD) (ANG 1995a) presented the selected interim action (plume containment) for the Eastern Briarwood groundwater.

Initially, an interim response action to contain the Eastern Briarwood plume at the leading edge was developed that conceptually consisted of eight extraction wells and 16 injection wells on the MMR boundary. After review of the conceptual interim response action, it was determined that this remedy could not be implemented without a detrimental impact to the sensitive ecosystems, undesirable alterations in regional groundwater flow paths, and counterproductive spreading of the contamination. In 1996, a data gap investigation indicated contaminant concentrations were low (only TCE exceeded the maximum contaminant level [MCL] of 5.0 micrograms per liter [µg/L] with a maximum concentration of 5.9 µg/L) (ANG 1996). Based on the data gap investigation and potential negative effects of the conceptual remedial action, the approach for Eastern Briarwood was revised to long-term monitoring to ensure that no unacceptable toxicological risks develop from discharge of the groundwater contamination to the Quashnet River (AFCEE 1997).

In 1996, a long-term monitoring (LTM) program for the Eastern Briarwood area was initiated to assess contaminant trends and distributions. Between 1996 and 2005, 29 monitoring well screens at 13 different locations were installed in the Eastern Briarwood area. Sample collection in the Eastern Briarwood area from 1996 through 2004 included over 60 surface water samples, over 20 sediment samples, and over 750 groundwater samples.

In support of reaching a final ROD for Eastern Briarwood, a risk assessment was performed (AFCEE 2005b) using data collected from the LTM program and

supplemented by additional data collected specifically to support the risk assessment. The risk assessment evaluated potential risks from exposure to the groundwater and surface water in the Eastern Briarwood area.

Western Aquafarm

The Western Aquafarm was identified as a potential source of contamination during a 1986 expanded records search (ANG 1986). The Western Aquafarm consisted of six 25,000-gallon underground storage tanks (USTs) that were used in the 1950s and 1960s to store and transfer aviation gasoline (AVGAS) and Jet Propulsion Fuel-4. Fuel was transferred from the tanks by pumping water into the tanks to displace the fuel. To refill the tanks with fuel, the water was displaced and discharged into a 1-acre basin within the Central Drainage Swale (AFCEE 1996).

A site investigation (SI) was conducted in 1988 to further characterize the distribution of soil and groundwater contamination at the Western Aquafarm and other suspected source areas (ANG 1990). Fuel-related compounds (benzene, ethylbenzene, and xylenes) indicating AVGAS contamination were detected in soil and groundwater located downgradient of the Western Aquafarm. Extensive soil contamination was also detected at the Western Aquafarm during the interim and final remedial investigations conducted between 1989 (ANG 1992) and 1993 (AFCEE 1996).

As part of the MMR tank removal program, all six USTs and associated piping at the Western Aquafarm were removed in October 1994 (ANG 1995b). No evidence of leakage was observed in any of the tanks. Evidence of leakage associated with the piping and transfer support system was noted in conjunction with one tank. Approximately 450 cubic yards of contaminated soil were excavated and removed for thermal treatment.

As part of the SERGOU RI completed in 1994, a benzene plume was delineated from the Western Aquafarm to the base boundary. An IROD (ANG 1995a) presented the selected interim action (plume containment) for the Western Aquafarm groundwater.

Initially, an interim response action to contain the Western Aquafarm plume at the leading edge was developed that conceptually consisted of nine extraction wells, treatment of the contaminated water with granular activated carbon (GAC), and 18 injection wells on the MMR boundary. After review of the conceptual interim response action, it was determined that this remedy could not be implemented without a detrimental impact to the sensitive ecosystems, undesirable alterations in regional groundwater flow paths, and counterproductive spreading of the contamination. In 1996, a data gap investigation indicated contaminant concentrations were low. Based on the data gap investigation and potential negative effects of the conceptual remedial action, the approach for Western Aquafarm was revised in the *Strategic Plan* (AFCEE 1997) from the active leading edge remedial system previously presented in the IROD to LTM to ensure that no unacceptable toxicological risks develop in place of the active leading edge remedial system previously presented in the IROD.

In 1996, an LTM program was initiated for the Western Aquafarm area to assess contaminant trends and distributions. The primary contaminants detected in the Western Aquafarm monitoring area are fuel-related compounds: ethylbenzene and total xylenes. Between 1996 and 2005, 12 monitoring well screens at six different locations were installed and over 270 groundwater samples were collected.

In support of reaching a final ROD for Western Aquafarm, a risk assessment was performed (AFCEE 2005b) using data collected from the LTM program and supplemented by additional data collected specifically to support the risk assessment. The risk assessment evaluated potential risks from exposure in the groundwater in the Western Aquafarm area.

SD-5

The SD-5 area of concern (AOC) was first identified as a potentially hazardous site during the Phase I records search for the MMR, which was completed in 1983 (ANG 1983). This study concluded that the Non-Destructive Inspection Laboratory (NDIL) site was a potential source of contamination. Test pits were excavated in the vicinity of the

NDIL during the initial IRP Phase II SI, and total organic halogens and lead were detected in the test pits and sludge from the NDIL leaching well (R.F. Weston 1985).

An expanded records search was conducted in 1986 to identify historical activities that had the potential to cause soil and groundwater contamination. This search identified the Western Aquafarm, Eastern Aquafarm, the Corrosion Control Shop, the Permanent Field Training Site hangar, and the FS-5 spill as possible contamination sources (ANG 1986) (Figure 2-2).

An SI was conducted in 1988 to further characterize the distribution of soil and groundwater at suspected source locations (ANG 1990). This investigation included inspecting stormwater drainpipes, conducting a soil gas survey, excavating test pits, and installing monitoring wells. Inspection of the drainpipes indicated that the top half of the joints in the larger stormwater drainpipes were commonly not grouted, which could have allowed water to pass into and out of the pipes. Chlorinated solvents were detected in shallow soil gas samples obtained in areas adjacent to the NDIL leaching well. Lead, 1,1-dichloroethene, and polycyclic aromatic hydrocarbons were detected in test pits located within the Central Drainage Swale. TCE was detected at concentrations exceeding the MCL in groundwater samples collected from a monitoring well located adjacent to the NDIL, and the NDIL was confirmed as a source of groundwater contamination.

An RI was completed to characterize the nature and extent of contamination in the SD-5 AOC. An interim RI presented data collected between 1989 and 1990 (ANG 1992), and a final RI incorporated supplemental data collected in 1993 (AFCEE 1996). These investigations focused primarily on the characterization of source areas and groundwater contamination in the northern portion of SD-5 (SD-5 North). The former NDIL leaching well was defined as the primary source of a chlorinated solvent groundwater plume that extended past the MMR base boundary. Soil contamination was also detected at the Western Aquafarm, the Corrosion Control Shop, the Eastern Aquafarm, and the Central Drainage Swale.

Several source removal activities occurred in the SD-5 AOC between 1990 and 1996. In November 1990, the Air National Guard (ANG) removed approximately 700 gallons of fluid from the NDIL leaching well, and four drainage structures at SD-5/FS-5 were removed in July 1996 as part of the MMR drainage structure removal program (DSRP). The NDIL leaching well and four other drainage structures associated with AOC SD-5 were removed during the DSRP. Between October 1994 and March 1995, during the MMR tank removal program, a total of 17 USTs, associated piping, and approximately 450 cubic yards of contaminated soil were removed from the Western and Eastern Aquafarms.

The SERGOU RI concluded that the primary potential sources of the SD-5 solvent plume were the NDIL leaching well, the Corrosion Control Shop, and sumps in Hangars 3122 and 3192. An IROD (ANG 1995a) presented the selected interim action (plume containment) for SD-5 groundwater.

The preliminary design for the interim response action for the SD-5 plume included 15 extraction wells, treatment of the contaminated water with GAC, and 30 injection wells. The 15 extraction wells were to be located along Hooppole Road, to contain the SD-5 plume at the leading edge, and the injection wells were to be located along the edge of Johns Pond downgradient of the extraction wells. After review of the conceptual interim response action, it was determined that this remedy could not be implemented without a detrimental impact to the sensitive ecosystems, undesirable alterations in regional groundwater flow paths, and counterproductive spreading of the contamination.

The approach to the revised plume containment strategy (AFCEE 1997) for SD-5 included a phased installation of an extraction well fence at the base boundary for the northern portion of the plume (which included 10 extraction wells, eight injection wells, and a treatment plant) and the development of a plume response strategy to reduce toxicological risks, with minimal ecological impacts in the southern portion of the SD-5 plume between Ashumet and Johns ponds.

In 1996, the SD-5 North remedial system was designed to maintain hydraulic control of the plume upgradient of the MMR boundary, which is defined as 100 percent capture of the groundwater flow within the area where TCE exceeds the MCL. The system consists of 10 closely spaced extraction wells, the Sandwich Road Treatment Facility (SRTF), and eight reinjection wells (Figure 2-2). The SD-5 North extraction, treatment, and reinjection (ETR) system began operation on 04 August 1997.

In December 1997, after evaluation of plume characterization data and conceptual remedial alternatives in the remedial assessment memorandum (RAMM) from AFCEE, the EPA and the MassDEP determined that active groundwater remediation was required to remediate groundwater contamination in the SD-5 South plume. During the pre-design investigation for the SD-5 South plume, a separate plume of TCE was detected adjacent to the southern limit of the SD-5 South plume. Therefore, a phased design and construction approach was selected for the SD-5 South plume. Phase I addressed the axial (core) portion of the SD-5 South plume, and Phase II addressed the southernmost portion of the SD-5 South plume in the vicinity of Hooppole Road and the adjacent TCE plume (now known as the CS-10 Northern Lobe).

The SD-5 South axial system (Phase I) consisted of two recirculating wells, 28RW1101 and 28RW1102 (AFCEE 1999). Water treatment for the recirculating wells consisted of closed-loop air stripping of influent water within the wellhead vault, followed by filtration of the air stream by primary and secondary GAC units. Treatment systems were housed in below-grade vaults installed at each recirculating well location. This system began operation on 17 June 1999.

Phase II of the SD-5 South design addresses the southernmost portion of the SD-5 South plume in the vicinity of Hooppole Road (AFCEE 2000). This Phase II system consists of one extraction well in the SD-5 South plume, 28EW0015. The extracted groundwater was pumped to the SRTF for treatment, and the treated water was reinjected into the aquifer through the SD-5 North reinjection wells. The Phase II Hooppole Road extraction well system began operation on 22 January 2000.

The SD-5 treatment systems were turned off in 2003 (SD-5 South Phase I system and SD-5 North) and in 2004 (SD-5 South Phase II system). In November 2005, the SD-5 North and SD-5 South plume contours were eliminated because detections in SD-5 monitoring wells no longer defined a plume. In the SD-5 North area, the MCL exceedances of TCE were not consistently detected in monitoring wells and the contamination is not contiguous or extensive. In the SD-5 South area, there are MCL exceedances of TCE in two monitoring wells, but the contamination is likely not migrating very far downgradient and will more likely attenuate in place over time (AFCEE 2005a). Currently, an LTM program is being conducted to monitor SD-5 groundwater.

In support of reaching a final ROD for SD-5, a risk assessment was performed (AFCEE 2005b) using data collected from the system performance and ecological impact monitoring (SPEIM) program and the ongoing LTM program to characterize the groundwater contamination and assess potential risks from exposure to the groundwater and surface water in the SD-5 area.

2.3 COMMUNITY PARTICIPATION

The MMR IRP has a very robust community involvement program that provides many opportunities for the public to become involved in the investigation and decision-making process. Public meetings and poster board sessions are held, display ads are placed in newspapers to announce significant events and meetings, news releases are issued, tours of the sites and treatment facilities are conducted, neighborhood notices are distributed to notify people of events impacting their neighborhoods, and public notices of other kinds are issued.

In addition, several citizen teams advise the IRP and the regulatory agencies about the program. They include the Senior Management Board and the Plume Cleanup Team (PCT). These teams are made up of citizen volunteers and government representatives working together to resolve problems and complete the cleanup. All citizen team meetings are open to the public. Certain teams are decision-making teams. They include

the Management Review Group and the RPMs. Assumptions about reasonably anticipated future land use and potential beneficial uses of groundwater and surface water are regularly discussed by these teams.

The public has been kept up-to-date on the progress of the EB, WA, and SD-5 sites through various public and citizen team meetings and public notices. The following updates on the IROD to ROD process for sites addressed in this ROD were presented to the PCT:

11 September 2002: Overview of the *Draft Final Work Plan for the Process Leading to Final Groundwater Decisions for Eastern Briarwood, Western Aquafarm, Storm Drain-5, and Fuel Spill-12* (AFCEE 2002b).

10 September 2003: Overview of the SD-5 Risk Assessment and initial list of SD-5 feasibility study remedial alternatives.

12 November 2003: Revised list of SD-5 feasibility study remedial alternatives.

12 May 2004: Overview of the risk assessments for Eastern Briarwood and Western Aquafarm and the SD-5 feasibility study results.

13 July 2005: Proposed Plan for Eastern Briarwood, Western Aquafarm and SD-5 (AFCEE 2005c).

From 22 July to 20 August 2005, AFCEE held a 30-day comment period to obtain public comments on the remedies presented for the EB, WA, and SD-5 groundwater in a Proposed Plan (PP). A presentation of the EB, WA, SD-5 PP was made to the PCT on 13 July 2005, and AFCEE held a public meeting at the Mashpee Senior Center on 21 July 2005 to present the PP. At these meetings, representatives from AFCEE presented the PP and answered questions from the audience. On 18 August 2005, AFCEE held a public hearing at the Mashpee Senior Center to accept formal public comments on the PP. A transcript of the public hearing is provided in Appendix B. One

individual provided verbal comments at the public hearing. No written comments were received by AFCEE from any community group.

AFCEE published a display ad for the Public Information Meeting, public comment period, and public hearing for the EB, WA, SD-5 PP in the *Falmouth, Mashpee, Bourne,* and *Sandwich Enterprises* and in the *Cape Cod Times* on 15 July 2005. News releases for the Public Information Meeting, public comment period, and public hearing were circulated on 15 July 2005, and an additional news release for the public hearing was circulated on 10 August 2005. The PP was made available for public review at the main public libraries in Bourne, Falmouth, Mashpee, and Sandwich, Massachusetts and on the MMR website. The PP has also been made part of the Administrative Record available for public review at the AFCEE IRP office at the MMR and on the MMR website, http://www.mmr.org. Because the sole comment received during the public comment period simply expressed support for the proposed plan, neither a formal response nor a Responsiveness Summary is necessary.

2.4 SCOPE AND ROLE OF OPERABLE UNIT

The EB, WA, and SD-5 sites were organized into separate groundwater OUs. The source area operable units have been investigated and remediated where necessary for EB, WA, and SD-5; refer to Section 2.2. Soils in non-source areas are not impacted by groundwater contamination and there is no reason to believe that off base soil has been contaminated by base related activities. The OUs in this ROD only address groundwater contamination.

The EB, WA, and SD-5 groundwater OUs are within and downgradient of the southern industrial area of the MMR where, through the IRP, AFCEE is responsible for the cleanup of contamination from past military practices. The NGB is actively investigating and remediating soil and groundwater contamination in the northern portion of the base as part of the Impact Area Groundwater Study Program. The soil and groundwater contamination are attributable to training activities.

2.5 SITE CHARACTERISTICS

As described in Section 2.2, environmental data have been collected from these sites since the 1980s. This overview of the site characteristics will focus on current site conditions.

The EB, WA, and SD-5 sites are all located on a broad, flat, gently southward-sloping glacial outwash plain known as the Mashpee Pitted Plain (MPP) (Figure 2-1). The MPP consists of stratified outwash sand underlain by silty glaciolacustrine sediment, gravel, or [illegible] msl) in the south to 140 ft msl in the north and is pocked with numerous kettle ponds. Moraines bound the MMR to the west and north.

The single groundwater flow system that underlies western Cape Cod, including the MMR, is known as the Sagamore Lens. This sole-source aquifer is primarily unconfined and recharged by infiltration of precipitation. Groundwater flow is generally radial from the recharge area toward the ocean, which forms the lateral boundary of the aquifer on three sides; the Bass River in Yarmouth forms the eastern boundary of the Sagamore Lens. Flow direction within the aquifer is generally horizontal with stronger vertical gradients near surface water bodies. Ponds are generally an expression of the water table and are hydraulically connected with the aquifer. Water table elevations fluctuate from 1 to 4 feet per year. The aquifer thickness varies between 200 and 250 feet thick in the EB, WA, SD-5 area.

The sources of the EB, WA, and SD-5 groundwater contamination have been addressed under separate actions and, therefore, are not described in this section. A summary of source area actions by area is described in Section 2.2.

2.5.1 Conceptual Site Model

Western Aquafarm

The Western Aquafarm area is located in the southern portion of the MMR, generally west and southwest of the Otis ANGB runways (Figure 2-2). The contaminated soils were addressed in a previous source area action and, therefore, are not considered in the groundwater ROD for Western Aquafarm. The medium of concern in the Western Aquafarm area is groundwater. Figure 2-3 illustrates the conceptual site model for Western Aquafarm.

Fuel-related compounds, primarily ethylbenzene and total xylenes are present in the groundwater in the Western Aquafarm area. Historically, fuel contamination (ethylbenzene) was only detected above the MCL in monitoring well, 39MW0002 (Figure 2-2). Ethylbenzene has not been detected above the MCL of 700 μg/L in any monitoring well in this area since June 2001. The maximum ethylbenzene concentration detected in the Western Aquafarm area in 2004 was 550 μg/L (39MW0002) (AFCEE 2005d). Both 39MW0002 and 39MW0005A are located in the Landfill-2 source area (Figure 2-2).

Contamination in the Western Aquafarm area is not defined as a plume since concentrations are below the MCL. The current area of fuel detections extends from monitoring well 39MW0002 to monitoring well 39MW0005A (Figure 2-2). The area of fuel detections is approximately 600 feet long and 250 feet wide. The elevation of the fuel detections ranges from the water table at 39MW0002 (44 ft msl) to a few feet below the water table at 39MW0005A (36 ft msl). The water table is approximately 55 feet below the ground surface.

Concentrations of fuel contamination in the Western Aquafarm have decreased and are expected to continue to decrease because the source of this contamination has been removed. Potential fate and transport processes for fuel contamination include absorption, attenuation, dispersion, and biodegradation. The primary attenuation process

for fuel-related contamination is biodegradation. A zone of low dissolved oxygen concentrations (i.e., less than 1.0 milligram per liter dissolved oxygen), indicative of aerobic biodegradation, is present in the Western Aquafarm monitoring area, and contaminant concentrations are expected to continue to decrease with time. Groundwater flow trajectories indicate that groundwater from the Western Aquafarm area will discharge into the West Pond and bog system. Future impacts to the surface water and sediment in the West Pond and bog system are not expected because upgradient concentrations have decreased, and contamination will continue to degrade and is not expected to migrate.

Eastern Briarwood

The Eastern Briarwood area is located in the southeastern portion of the MMR (Figure 2-2). The sources of contamination were determined to be from occasional spills and not from a sustained source. The media of concern in the Eastern Briarwood area are groundwater, as well as surface water and sediment of the Quashnet River in the area where Eastern Briarwood groundwater is discharging to the river. Figure 2-4 illustrates the conceptual site model for Eastern Briarwood.

The primary contaminants in Eastern Briarwood groundwater are TCE and ethylene dibromide (EDB). Concentrations of TCE and EDB have decreased throughout the Eastern Briarwood area, and currently contamination in the Eastern Briarwood area is not defined as a plume since TCE and EDB concentrations only infrequently exceed the TCE MCL of 5 μg/L or the Massachusetts maximum contaminant level (MMCL) of 0.02 μg/L for EDB. TCE was not detected at concentrations above the MCL from December 2000 until December 2004 when a sample was collected with a concentration of 6.4 μg/L. EDB had not been detected at concentrations above the MMCL since September 2001. Other chlorinated solvents are occasionally detected at low concentrations in Eastern Briarwood groundwater, but have never been detected in the Quashnet River surface water.

Through natural attenuation processes including advection, attenuation, adsorption, dispersion, and biodegradation, TCE and EDB contamination within the Eastern Briarwood area have decreased. Low-level contamination currently present within the Eastern Briarwood area is expected to discharge into the Quashnet River and bog system. VOCs have not been detected in surface water samples collected from the Quashnet River or in groundwater samples collected from shallow drive points located along the Quashnet River (AFCEE 2002e). Therefore, it is anticipated that, upon interaction with the surface water, contamination will continue to be diluted to below detection levels.

The EDB contamination detected within the Eastern Briarwood area is located approximately 50 to 80 feet below the historical TCE plume and is considered to have originated from another source located further upgradient (AFCEE 2002e). Although this contamination is located deeper in the aquifer, groundwater modeling results indicate that the EDB-contaminated groundwater will also discharge into the Quashnet River and bog system. EDB has intermittently been detected in surface water samples collected from the Quashnet River and bog system, but EDB has not been detected in Eastern Briarwood monitoring wells located south of the Quashnet River. EDB concentrations have generally decreased. With no evident continuing source, concentrations are expected to continue to decrease over time through natural attenuation processes including advection, attenuation, dispersion, and biodegradation. EDB contamination will discharge into the Quashnet River and bog system, and concentrations will be diluted upon interaction with the surface water. There is a large flux of groundwater into this surface water system, and even though higher EDB concentrations have historically discharged into the surface water from the adjacent FS-1 plume, EDB has not been detected in the most downgradient surface water sampling locations (AFCEE 2002d).

SD-5

The media of concern associated with the SD-5 groundwater contamination includes groundwater, as well as surface water and sediment of Johns Pond in the area where SD-5 groundwater is discharging into the pond. The contaminated soils were addressed in a previous source area action (drainage removal, soil removal) and a separate ROD and,

therefore, are not considered in the groundwater ROD for SD-5. The COC in the areas of SD-5 North and SD-5 South groundwater contamination is TCE. Figure 2-5 illustrates the conceptual site model for the SD-5 area.

SD-5 North

The SD-5 plume was administratively separated into the SD-5 North plume and the SD-5 South plume when the SD-5 North treatment system was constructed (Figure 2-2). The historical SD-5 North plume has diminished and is no longer characterized as a plume [illegible] groundwater contamination still exist upgradient of the base boundary. TCE is the only chlorinated compound in the SD-5 North area that is detected at concentrations exceeding the MCL of 5 μg/L. In 2005, TCE was only detected above the MCL in two monitoring wells in the SD-5 North area (28MW0004 and 28MW0596, Figure 2-2) with a maximum concentration of 12.4 μg/L (28MW0004). The elevation of the TCE MCL exceedances ranges from the water table at 28MW0004 (approximately 55 ft msl) to approximately 30 feet below the water table at 28MW0596 (approximately 21 ft msl).

Although concentrations that exceed the MCL persist in the SD-5 North source area, transport modeling results indicate that no contamination reaches the SD-5 North extraction well fence at concentrations exceeding the MCL. Based on the history of TCE analytical results at SD-5 North, the source area contamination is degrading in place and any significant transport from its current location in concentrations above the MCL is unlikely (AFCEE 2002c).

SD-5 South

The SD-5 South area groundwater contamination COC is TCE. The source of contamination at SD-5 South has been removed with operation of the SD-5 North treatment system. The historical SD-5 South plume has diminished and is no longer characterized as a plume due to the operation of the SD-5 North and South remedial

systems, but remnants of groundwater contamination still exist in the SD-5 South area (Figure 2-2).

The SD-5 South area groundwater contamination consists of contamination above the TCE MCL identified in two monitoring wells. TCE is the only chlorinated compound in the SD-5 South area that is detected at concentrations exceeding the MCL of 5 µg/L. In 2005, TCE was only detected above the MCL in two monitoring wells in the SD-5 South area (28MW1132B and 28MW0035, Figure 2-2) with a maximum concentration of 39 µg/L (28MW0035B). Both of these monitoring wells are located in a low permeability silty sand layer, and it is expected that TCE concentrations at these locations will be more persistent since groundwater velocities through these units are slower than in the surrounding sandy portions of the aquifer. The groundwater contamination is located approximately 60 feet below the water table along the isthmus between Ashumet and Johns ponds and then rises and discharges into Johns Pond. The depth to the bottom of the pond ranges between 10 and 30 feet within the area where SD-5 groundwater contamination discharges. No plume-related VOCs have been detected above the reporting limit of 1 µg/L in any of the surface water samples collected in the SD-5 discharge area since monitoring of these locations began in 1999. Fourteen sampling rounds were conducted between 1999 and 2004.

Under ambient conditions, groundwater flow in the SD-5 area shifts from mainly south at the MMR boundary to southeast in the vicinity of Johns Pond and then discharges into Johns Pond.

The SD-5 groundwater COC, TCE, has a relatively high solubility and is present in the aquifer in a dissolved phase. Potential fate and transport processes for this contamination include groundwater transport by advection, attenuation, dispersion, and biodegradation. The contamination is migrating through the aquifer with no substantial retardation or volatilization.

The remaining mass discharges into Johns Pond and is diluted upon interaction with the surface water. It is anticipated that TCE concentrations within the SD-5 South area will be below the MCL by 2008 (AFCEE 2004).

2.5.2 Sampling Strategy

Groundwater samples were collected in the Eastern Briarwood and Western Aquafarm areas at prescribed frequencies (minimum of annual frequency) beginning in 1996 as part of an LTM program. Groundwater samples were collected in the SD-5 area at prescribed [illegible] initiated before the operation of the SRTF (1997). Surface water and sediment samples were collected in the Eastern Briarwood and SD-5 areas as part of investigative and LTM activities. All of these sampling programs were initiated as part of the interim remedy for EB, WA, and SD-5 groundwater and, thus, are ongoing until the final ROD is signed.

2.6 CURRENT AND POTENTIAL FUTURE SITE AND RESOURCE USES

This section discusses the current and reasonably anticipated future land uses and current and potential beneficial groundwater uses in the vicinity of EB, WA, and SD-5 contaminated groundwater, and presents the basis for future groundwater use assumptions.

2.6.1 Land Use

On-base, the Western Aquafarm and SD-5 contaminated groundwater are in industrial areas used by the U.S. Air Force (Figure 2-6). The off-base area south of the MMR boundary in the EB, WA, and SD-5 areas is primarily residential. The land surrounding the Quashnet River in the Eastern Briarwood area is conservation land. South of the base boundary in the Western Aquafarm area, there is some conservation land.

It is anticipated that the density of residential development south of the base boundary will not significantly increase over time. The land use for the on-base portion of the Western Aquafarm and SD-5 areas are also unlikely to change in the near future. The on-

base portions of the EB, WA, and SD-5 study areas are owned by the Commonwealth of Massachusetts and leased to the DOD for military use. Legislative approval is needed to designate this land to be used for non-military purposes.

2.6.2 Water Resource Use

There are no current groundwater uses at the EB, WA, and SD-5 areas. All of the residences in the area are connected to the municipal water supply. There are no residences or water supply wells in the Western Aquafarm and SD-5 areas on-base. The aquifer throughout upper Cape Cod, referred to as the Sagamore Lens, is generally highly transmissive and is a productive aquifer. Much of the aquifer within the Sagamore Lens has been designated by the MassDEP as a potentially productive aquifer for drinking water.

Surface water bodies, which are fed by groundwater, provide recreational use. Johns Pond is used for fishing, swimming, and boating. The Quashnet River is used for fishing.

AFCEE has developed a working relationship with the water commissioners of the four surrounding towns to ensure that future development of the groundwater resource is coordinated with groundwater monitoring and remediation at the MMR.

2.7 SUMMARY OF SITE RISKS

The risk assessments estimate the risks posed by the present EB, WA, and SD-5 groundwater contamination. They provide the basis for taking action and identify the contaminants and exposure pathways that need to be addressed. The technical approach of the risk assessments is detailed in the *Final Work Plan for the Process Leading to Final Groundwater Decisions for Eastern Briarwood, Western Aquafarm, Storm Drain-5, and Fuel Spill-12* (AFCEE 2002a). This section of the ROD summarizes the results of the human health risk assessment for Eastern Briarwood, Western Aquafarm, and SD-5, and the ecological baseline risk assessments and COC selection for Eastern Briarwood and SD-5 groundwater contamination; these results are presented in two documents (AFCEE 2005b and 2004). An ecological baseline risk assessment was not conducted for

Western Aquafarm because groundwater contamination associated with Western Aquafarm is not discharging into any surface water bodies; therefore, there is no ecological exposure to Western Aquafarm groundwater contamination. The risk assessments evaluated the human health risks from exposure to contaminated groundwater in the EB, WA, and SD-5 areas. Potential impacts to human health from exposure to surface water and sediment in the Quashnet River in the area of Eastern Briarwood groundwater discharge and exposure to surface water in Johns Pond in the area of SD-5 groundwater discharge were also evaluated. The potential impacts to wildlife from exposure to surface water and sediment were evaluated for the Quashnet River in the area into which Eastern Briarwood groundwater is discharging, and for Johns Pond in the area into which SD-5 groundwater is discharging. The results of these risk assessments form the basis for the selected remedies, which are no further action for Eastern Briarwood and Western Aquafarm and LTM for SD-5.

2.7.1 Summary of the EB, WA, and SD-5 Human Health Risk Assessments

A complete description of the methods and results of the baseline human health risk assessment for Eastern Briarwood and Western Aquafarm is presented in the *Final Risk Assessment for Eastern Briarwood and Western Aquafarm* (AFCEE 2005b). The SD-5 risk assessment is Appendix A of the *Final Storm Drain-5 Groundwater Feasibility Study* (AFCEE 2004).

2.7.1.1 Identification of Chemicals of Potential Concern

The selection of chemicals of potential concern (COPCs) for inclusion in the quantitative human health risk calculations was typically based on three screening criteria:

- Frequency of detection,
- Compound concentration and toxicity, as compared to conservative risk and/or hazard-based concentrations,
- Essential nutrient status.

The concentration-toxicity screen was conducted by comparing site data with a series of federal and Massachusetts risk-based criteria. The maximum detected concentration was used in the concentration-toxicity screen.

For groundwater, the following screening criteria were used:

- EPA Region IX preliminary remedial goals (PRGs) for residential tap water (EPA 1999),
- EPA MCLs,
- Massachusetts drinking water standards and guidelines.

For surface water, the same groundwater screening criteria were used with the addition of the EPA recommended water quality criteria for human health consumption of water and organisms. For sediment, the Region IX PRGs for residential soil were used.

PRGs for non-carcinogens were modified (PRG was multiplied by 0.1) such that the PRGs were based on a non-cancer hazard quotient (HQ) of 0.1 (EPA 1995). PRGs for carcinogens were based on a cancer risk level of 1×10^{-6} and were not modified for the screening. When more than one criterion was available for a chemical (PRGs, MCLs, state standards, and guidelines), the lowest of the available criteria was used in the concentration-toxicity screen.

Subsets of the Eastern Briarwood and SD-5 areas were evaluated separately in the risk assessments, based on different environmental media, different land use, and different contamination sources. The Western Aquafarm area was addressed as a whole. Nine separate areas/media were evaluated for the EB, WA, and SD-5 human health risk assessments. Those nine areas/media and the tables presenting the screening process for identifying COPCs in each area are listed below:

- On-Base Eastern Briarwood Groundwater (Table 2-1)
- Off-Base Eastern Briarwood Groundwater Impacted by Chlorinated Solvents (Table 2-2)

- Off-Base Eastern Briarwood Groundwater Impacted by EDB (Table 2-3)
- Surface Water in the Quashnet River Where Eastern Briarwood Groundwater Discharges (Table 2-4)
- Sediment in the Quashnet River Where Eastern Briarwood Groundwater Discharges (Table 2-5)
- Western Aquafarm Groundwater (Table 2-6)
- On-Base SD-5 Groundwater (Table 2-7)
- Off-Base SD-5 Groundwater (Table 2-8)
- Surface Water in Johns Pond Where the SD-5 Groundwater Discharges (Table 2-9).

Tables 2-1 through 2-9 present the occurrence and distribution of compounds detected in EB, WA, and SD-5 areas. For each detected chemical, these tables include the minimum and maximum detected concentration, the data qualifiers associated with these concentrations, the location of the maximum detected concentration, the frequency of detection, and the range of detection limits. The "J" qualifier indicates an estimated concentration.

2.7.1.2 Exposure Assessment

The exposure assessment identified potential exposure routes for each site and impacted media, the pathways by which humans may be exposed to site contamination. Soil exposure pathways were not considered primarily because the source areas (soils) have been addressed by the IRP program as separate OUs. In addition, soil in non-source areas is not impacted by groundwater contamination. The only contamination at these sites is related to the migration of contaminants from the military base in groundwater and its emergence in surface water.

Currently, there is no exposure to contaminated groundwater in the EB, WA, and SD-5 areas. However, much of the aquifer has been designated by the MassDEP as a potentially productive aquifer for drinking water, and potential future exposure to groundwater in the EB, WA, and SD-5 areas was evaluated since it was assumed that residential use of groundwater could occur in the future. Potential exposure routes for

these individuals are ingestion and dermal contact. VOCs could also be inhaled during household use of water.

Groundwater from Eastern Briarwood discharges to the Quashnet River. Human receptors of concern evaluated for the Quashnet River were recreational waders (adult and child), cranberry workers, and fish consumers. Exposure routes for the recreational wader and cranberry worker included ingestion of surface water and sediment, dermal contact with surface water and sediment, and inhalation of vapors from surface water. Exposure through recreational fishing included ingestion of recreationally caught fish impacted by the bioaccumulation of contaminants from surface water.

Groundwater from SD-5 discharges to Johns Pond. Human receptors of concern for Johns Ponds were recreational swimmers (adult and child) and fish consumers. Exposure routes for the recreational swimmer included ingestion and dermal contact with surface water. Exposure through recreational fishing included ingestion of recreationally caught fish impacted by the bioaccumulation of contaminants from surface water. Since no COPCs were selected for surface water (maximum consistent concentrations were below screening criteria), recreational exposures to surface water in Johns Pond were not qualitatively or quantitatively evaluated.

The human health conceptual exposure models for the WA, EB, and SD-5 sites are illustrated in Figures 2-7, 2-8, and 2-9, respectively. After identifying which human receptors would be evaluated in the risk assessments, the exposure point concentrations (EPCs) for each receptor were determined. A representative EPC was calculated for each COPC.

For groundwater, the reasonable maximum exposure (RME) EPCs were the maximum detected concentrations. For surface water and sediment, the EPCs were the 95 percent upper confidence limit on the mean (UCL_{95}) unless the UCL_{95} exceeded the maximum concentration. When this was the case, the RME EPC was the maximum concentration. For metals that were selected based on both dissolved and total concentrations, the EPCs were selected as the higher of the total or dissolved concentration.

The EPCs for each area/media are presented in the tables listed below:

- On-Base Eastern Briarwood Groundwater (Table 2-10)
- Off-Base Eastern Briarwood Groundwater Impacted by Chlorinated Solvents (Table 2-11)
- Off-Base Eastern Briarwood Groundwater Impacted by EDB (Table 2-12)
- Surface Water in the Quashnet River Where Eastern Briarwood Groundwater Discharges (Table 2-13)
- Sediment in the Quashnet River Where Eastern Briarwood Groundwater Discharges (Table 2-14)
- Western Aquafarm Groundwater (Table 2-15)
- On-Base SD-5 Groundwater (Table 2-16)
- Off-Base SD-5 Groundwater (Table 2-17).

To quantitatively assess the potential carcinogenic risks and health hazards, daily intakes of the COPCs were calculated based on receptor-specific, site-specific, and chemical-specific exposure parameters. These exposure parameters may vary depending on the time frame, exposure medium, exposure point, and receptor population and age. Exposure assumptions and other parameters used in the chronic daily intake or dermal absorbed dose algorithms are presented for each receptor and exposure medium in the tables listed below:

- Future On-Base or Off-Base Adult Resident, Groundwater (Table 2-18)
- Future On-Base or Off-Base Child Resident, Groundwater (Table 2-19)
- Consumer of Fish, Quashnet River Surface Water (Table 2-20)
- Cranberry Bog Worker, Quashnet River Surface Water (Table 2-21)
- Adult Wader, Quashnet River Surface Water (Table 2-22)
- Child Wader, Quashnet River Surface Water (Table 2-23)
- Cranberry Bog Worker, Quashnet River Sediment (Table 2-24)
- Adult Wader, Quashnet River Sediment (Table 2-25)
- Child Wader, Quashnet River Sediment (Table 2-26).

All of the parameters used in the chronic daily intake and daily absorbed dose equations are presented in these tables except for some chemical-specific parameters (e.g., bioaccumulation factors for fish, dermal absorption factors, and other calculated parameters used in the daily absorbed dose calculations), which are presented in the *Final Risk Assessment for Eastern Briarwood and Western Aquafarm* (AFCEE 2005b) and in Appendix A of the *Final Storm Drain-5 Groundwater Feasibility Study* (AFCEE 2004).

2.7.1.3 Toxicity Assessment

At the time each risk assessment was prepared, toxicity values were obtained from EPA's most current versions of the Integrated Risk Information System (IRIS) or the Health Effects Assessment Summary Table (HEAST), which are databases containing toxicity values for use in quantitative risk assessment. Cancer and non-cancer toxicity factors for each of the COPCs evaluated in the risk assessments for EB, WA, and SD-5 are presented in the tables listed below:

- Oral/Dermal Non-Cancer Toxicity Factors (Table 2-27)
- Inhalation Non-Cancer Toxicity Factors (Table 2-28)
- Oral/Dermal Cancer Toxicity Factors (Table 2-29)
- Inhalation Cancer Toxicity Factors (Table 2-30).

2.7.1.4 Risk Characterization

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

$$\text{Risk} = (\text{CDI or DAD}) \times \text{SF}$$

Where

Risk = a unitless probability of an individual developing cancer

CDI = chronic daily intake (milligrams per kilogram per day [mg/kg-day])

DAD = dermally absorbed dose (mg/kg-day)

SF = slope factor $(\text{mg/kg-day})^{-1}$

Carcinogenic risks are probabilities that usually are expressed in scientific notation (e.g., 1E-06). An excess lifetime cancer risk of 1E-06 indicates that an individual experiencing the RME theoretically has a 1 in 1,000,000 chance of developing cancer as a result of site-related exposure. This is referred to as an excess lifetime cancer risk because it would be in addition to the risk of cancer an individual faces from other causes such as exposure to too much solar radiation or radon. In accordance with the NCP, excess lifetime cancer risk estimates at EB, WA, and SD-5 are compared to EPA's target risk range for site-related exposures of E-04 to E-06 (EPA 1991b). For informational purposes, under the Massachusetts Contingency Plan (310 Code of Massachusetts Regulations [CMR] 40), sites where the risk is less than 1E-05 (one in 100,000) are considered to have attained a level of no significant risk.

Separate assumptions were used to calculate doses for adult and child residents, and then cancer risks for the adult and child were combined to represent total risks to off-site residents for a 30-year exposure period.

The potential for noncarcinogenic effects is evaluated by comparing an exposure level over a specified time period (e.g., lifetime) with a reference dose (RfD) derived for a similar exposure period. An RfD represents a level to which an individual may be exposed that is not expected to cause any deleterious effect. The ratio of exposure to toxicity, which is called a hazard quotient (HQ), is calculated as follows:

Non-cancer HQ= (CDI or DAD) / (RfD)

Where

CDI	= chronic daily intake (mg/kg-day)
DAD	= dermally absorbed dose (mg/kg-day)
RfD	= reference dose (mg/kg-day)

The hazard index (HI) is calculated by adding the HQs for all COCs that affect the same target organ (e.g., prostate) within a medium or across all media to which a given individual may reasonably be exposed. An HI less than 1 indicates that, based on all of the different contaminants and exposure routes, toxic noncarcinogenic effects are

unlikely. An HI greater than 1 indicates that site-related exposures may present a hazard to human health.

The tables listed below are the tables from the risk assessments that summarize the cancer and non-cancer risks to each receptor under the RME exposure scenario. Cancer and non-cancer risks that appear in these tables are limited to those for the COPCs that produced cancer or non-cancer risks at or near regulatory thresholds. Risks associated with COPCs that produced excess lifetime cancer risks less than 1E-06 or HQs less than 0.1 do not appear in these tables (EPA 1991b).

- Future Adult Resident, On-Base Eastern Briarwood Groundwater (Table 2-31)
- Future Child Resident, On-Base Eastern Briarwood Groundwater (Table 2-32)
- Future Adult Resident, Off-Base Eastern Briarwood Groundwater Impacted by Chlorinated Solvents (Table 2-33)
- Future Child Resident, Off-Base Eastern Briarwood Groundwater Impacted by Chlorinated Solvents (Table 2-34)
- Future Adult Resident, Off-Base Eastern Briarwood Groundwater Impacted by EDB (Table 2-35)
- Future Child Resident, Off-Base Eastern Briarwood Groundwater Impacted by EDB (Table 2-36)
- Consumer of Fish, Quashnet River (Table 2-37)
- Cranberry Bog Worker, Quashnet River (Table 2-38)
- Adult Wader, Quashnet River (Table 2-39)
- Child Wader, Quashnet River (Table 2-40)
- Future Adult Resident, Western Aquafarm Groundwater (Table 2-41)
- Future Child Resident, Western Aquafarm Groundwater (Table 2-42)
- Future Adult Resident, On-Base SD-5 Groundwater (Table 2-43)
- Future Child Resident, On-Base SD-5 Groundwater (Table 2-44)
- Future Adult Resident, Off-Base SD-5 Groundwater (Table 2-45)
- Future Child Resident, Off-Base SD-5 Groundwater (Table 2-46).

The cancer risk calculations indicated that future residential exposure to Eastern Briarwood groundwater on-base and Eastern Briarwood off-base EDB-impacted

groundwater may present an excess lifetime cancer risk within the acceptable federal range of E-04 to E-06. The potential RME carcinogenic risk levels for the future residential exposure pathways are 9E-05 for Eastern Briarwood groundwater on-base and 6E-05 for Eastern Briarwood off-base EDB-contaminated groundwater. The Eastern Briarwood off-base solvent-impacted groundwater may present an excess lifetime cancer risk greater than the federal target risk range of E-04 to E-06 with a potential RME carcinogenic risk level of 2E-04. The non-cancer hazard calculations indicated that residential exposure to impacted groundwater in the on-base Eastern Briarwood area and the off-base Eastern Briarwood solvent-impacted groundwater area may present an unacceptable non-cancer hazard (Table 2-47).

The cancer risk calculations for the Quashnet River cranberry bog worker exposed to surface water and sediment impacted by Eastern Briarwood groundwater did not exceed the federal risk thresholds. The potential RME carcinogenic risk levels for cranberry bog worker exposure pathways is 2E-07. Cranberry bog work related activities did not present an unacceptable non-cancer hazard (Table 2-38).

Calculations of potential risk due to fish consumption from the area of the Quashnet River impacted by Eastern Briarwood groundwater were within the federal target risk range. The potential RME carcinogenic risk levels for fish consumption is 2E-05. Fish consumption did not present an unacceptable non-cancer hazard (Table 2-37).

Calculations of potential risk due to recreational waders in the area of the Quashnet River impacted by Eastern Briarwood groundwater were at the low end of the federal target risk range. The potential RME carcinogenic risk level for recreational wading exposure pathways is 3E-06. Wading did not present an unacceptable non-cancer hazard (Table 2-39 and 2-40).

The Western Aquafarm groundwater cancer risk calculations indicated that future residential exposure may present an excess lifetime cancer risk that is greater than the federal target risk range with a potential RME carcinogenic risk level of 4E-04. The non-

cancer hazard calculations indicated that future residential exposure to Western Aquafarm groundwater may present an unacceptable non-cancer hazard (Table 2-47).

The cancer risk calculations in the risk assessment indicated that future residential exposure to SD-5 contaminated groundwater may present an excess lifetime cancer risk that is within the federal target risk range of E-04 to E-06 for SD-5 on-base groundwater and above the federal target risk range for SD-5 off-base groundwater. The potential RME carcinogenic risk levels for the future residential exposure pathways are 9E-04 for SD-5 groundwater on-base and 1E-03 for SD-5 groundwater off-base. The non-cancer hazard calculations indicated that future residential exposure to SD-5 on-base and off-base contaminated groundwater may present an unacceptable non-cancer hazard (Table 2-47).

Since maximum concentrations of the detected constituents were below screening criteria, there is no concern for potential risks or hazards associated with recreational exposures to Johns Pond through discharge of SD-5 groundwater.

2.7.1.5 Uncertainty Analysis and Human Health Risk Assessment Conclusions

There are uncertainties involved in the process of quantifying the risk for human receptors, and overall they make the risk assessment very conservative. Exposure assumptions, slope factors, and oral-to-dermal adjustment factors are all very conservative. In the RME groundwater assumptions, the maximum concentrations of contaminants detected in groundwater were conservatively assumed to be present in all groundwater throughout the area for the entire 30-year period (neglecting contaminant degradation or contaminant movement). The assumption was also made that human exposure remains constant over the lifetime of an individual when in fact, lifestyle changes due to age and actual residence time will alter the projected exposure duration. Even the assumption that the groundwater in these areas would be used for household purposes is a conservative assumption. In light of the conservatism that was built into many of the factors used in the risk assessment approach, the results should be considered to be significant overestimates of actual risk.

COPCs for which an RME was calculated to result in an excess lifetime cancer risk greater than one in a million or an HI greater than 1 are presented in Table 2-47. From this list, the COCs were identified based on a range of criteria. Several COPCs were eliminated from inclusion as COCs because they met one or more of the following criteria:

- The detection frequency of the COPC at the site is low.
- The COPC was not detected in more recent sampling rounds at the site. Five rounds of sampling have been conducted at SD-5 since the risk assessment was conducted, two rounds at Western Aquafarm and two rounds at Eastern Briarwood.
- Concentrations of the COPC have decreased with time such that current and future concentrations will not pose unacceptable risks.
- The COPC is present at the site at concentrations similar to background concentrations.
- The COPC is detected in a very limited part of the site and not migrating based on historical results from surrounding monitoring wells.
- The COPC is attributable to sampling or analytical contamination.
- Site-specific exposure assumptions used in the risk assessment were overly conservative considering the predicted persistence of the COPC and reasonably anticipated future land use.
- The COPC has a sporadic distribution and is not present in multiple samples from a similar area, so no contiguous area of groundwater contamination can be defined.
- The COPC is present only at concentrations below state and federal drinking water standards.

In consideration of these criteria, none of the COPCs for Eastern Briarwood and Western Aquafarm were identified as COCs. For SD-5 groundwater, only TCE was identified as a COC. The contaminant-specific evaluations are presented in the risk assessment reports (AFCEE 2005b and 2004). Some of the more significant COPCs associated with potential risk are discussed below.

The human health risk assessment indicated that the Eastern Briarwood groundwater contaminants TCE and tetrachloroethene (PCE) resulted in lifetime cancer risks of 1E-04 and 5E-05, respectively, which are within the acceptable federal range of E-04 to E-06.

The concentrations of PCE and TCE were below the state and federal MCLs, and after reviewing the conservative assumptions in the risk assessment, the EPA, MassDEP, and AFCEE concluded that the concentrations of TCE and PCE in Eastern Briarwood groundwater did not pose unacceptable human health risks. For example, the risk assessment conservatively assumed that future residents would be constantly exposed to the recently measured maximum concentration of TCE and PCE for a period of 30 years. This scenario is unrealistic because monitoring data collected since 1996 demonstrate that TCE and PCE concentrations in this area are decreasing with time and because there currently are no residences in this area and residential development in the near future is unlikely. Based on the review of the risk assessment for Eastern Briarwood and the spatial and temporal distribution of TCE and PCE in Eastern Briarwood groundwater, the EPA, MassDEP, and AFCEE concluded that no further action was warranted to be protective of human health and the environment.

For the Western Aquafarm risk assessment, xylenes were detected at concentrations less than the MCL of 10,000 µg/L, yet resulted in child and adult resident HQs of 54 and 18, respectively. Because the non-cancer HQs calculated for xylenes in 39MW0002 indicated the potential for unacceptable health risks, AFCEE, the EPA, and the MassDEP carefully considered the exposure assumptions used in the risk assessment and carefully evaluated the spatial and temporal distribution of xylenes in the Western Aquafarm area. Analysis of groundwater samples collected since 1996 from monitoring wells in the area indicates decreased concentrations of xylenes in all repeatedly monitored wells over time, and that the only place where problematic concentrations (those that might pose an unacceptable health risk) of xylenes persist is near monitoring well 39MW0002. Additionally, xylenes contamination is biodegrading faster than it is advecting; it is naturally attenuating (decreasing in volume and concentration) in its current position. Lastly, monitoring well 39MW0002 is located on MMR property, within a secure portion of the MMR, within 600 feet of an active runway, and within the AOC of the Landfill-2 source area. Because there is no potential current or future residential exposure to the remaining xylenes contamination at Western Aquafarm, the EPA, MassDEP, and AFCEE

agreed that no further action is warranted to be protective of human health and the environment.

The SD-5 risk assessment identified EDB as a potential health risk based on a concentration of 0.019 µg/L measured in March 2002. Current concentrations of EDB in SD-5 groundwater are below reporting limits. The highest concentrations of TCE and PCE used in the risk assessment calculations were 34 µg/L and 4.2 µg/L, respectively. These concentrations of TCE and PCE equated to excess lifetime cancer risks of 1E-03 and 6E-05, respectively, for the future residents under the RME scenario. Current (August 2005) maximum TCE and PCE concentrations in SD-5 groundwater are 39 and 3.8 µg/L, respectively. Based on the risk assessment and the current distribution of contamination in SD-5 groundwater, PCE and EDB are not COCs because the concentrations of these chemicals have dropped to very low levels. However, TCE is a COC in SD-5 groundwater because the current maximum concentrations exceed the MCL and could conceivably pose unacceptable human health risks to a future resident.

2.7.2 Summary of the Eastern Briarwood and SD-5 Ecological Risk Assessments

The ecological risk assessment is a qualitative and/or quantitative evaluation of the potential impacts that Eastern Briarwood and SD-5 groundwater contaminants may have on wildlife species. An ecological baseline risk assessment was not conducted for Western Aquafarm because groundwater contamination associated with Western Aquafarm is not discharging into any surface water bodies and, therefore, there is no ecological exposure to Western Aquafarm groundwater contamination. The ecological risk assessments are presented in the *Final Risk Assessment for Eastern Briarwood and Western Aquafarm* (AFCEE 2005b) and the *Final Storm Drain-5 Groundwater Feasibility Study* (AFCEE 2004). Both ecological risk assessments evaluated potential impacts to representative aquatic (non-specific fish, amphibian larvae, and aquatic invertebrates) and semi-aquatic organisms (osprey, black-crowned night heron, raccoon, and eastern box turtle) that would use the Quashnet River and Johns Pond (Figures 2-10 and 2-11). Terrestrial organisms were not included in the assessment because the risk

assessments focused on groundwater and surface water bodies that are potentially affected by contaminated groundwater.

The assessment of aquatic and benthic populations in Johns Pond identified several contaminants of potential ecological concern. However, when considering other factors such as laboratory contamination and background concentrations, only carbon disulfide and chloromethane in sediment were identified as a potential concern. The presence of VOCs in sediment may not represent a real risk to benthic organisms due to the strong propensity for VOCs to mix readily in the large volume of pond water and volatize to the atmosphere. In addition, these constituents are not associated with the source of the SD-5 groundwater contamination and are not known to be site-related. Consequently, there is no ecological concern to aquatic and benthic populations in Johns Pond associated with the SD-5 study area. The food web screening assessment identified no chemicals of potential ecological concern posing potential risk to the selected receptor species. No ecological constituents of concern were identified based on aquatic and benthic population assessment endpoints and the food web screening.

There is no ecological concern to aquatic and benthic populations in the Quashnet River associated with the Eastern Briarwood study area. In addition, the food web analysis determined that the selected receptor species are not expected to be at risk. There are no COCs for ecological receptors in the Quashnet River in the Eastern Briarwood study area.

2.8 REMEDIAL ACTION OBJECTIVES FOR SD-5 GROUNDWATER

Results of the human health and ecological risk assessment for SD-5 groundwater were considered in conjunction with expected current and future use of the aquifer to develop RAOs for the SD-5 groundwater OU. No further action is warranted for the Eastern Briarwood and Western Aquafarm groundwater OUs to be protective of human health and the environment; thus, RAOs were not developed for these sites.

There is no risk to ecological receptors. Therefore, the following RAOs for SD-5 groundwater were established to protect human health:

- Prevent or reduce exposure to on-base and off-base SD-5 groundwater with TCE concentrations greater that the MCL of 5 μg/L;
- Return useable groundwater to beneficial uses wherever practicable, within a time frame that is reasonable given the particular circumstances of the site.

For human health concerns, the only media/exposure pathway that presents a cancer risk and/or a non-cancer HI above the target values is the future potential on-base or off-base residential exposure to groundwater. This hypothetical scenario assumes that a drinking water well is installed within the area of SD-5 groundwater contamination. A summary of the human health total non-cancer HIs and cancer risks for the SD-5 study area indicates that TCE increases risk and hazards associated with exposure to groundwater to an unacceptable level for human health. Therefore, in order to achieve the RAOs, the existing on-base and off-base LUCs must be maintained.

2.9 DESCRIPTION OF SD-5 ALTERNATIVES

Three alternatives were considered for the SD-5 groundwater action: (1) No Action, (2) Land Use Controls and Long-Term Monitoring, and (3) Construction, Operation, Maintenance, and Monitoring of a New SD-5 ETR System.

A component common to Alternatives 2 and 3 is LUCs. Several LUCs protect area residents from exposure to SD-5 TCE groundwater contamination. The safety of all public water supplies within Massachusetts is currently regulated by the Commonwealth. Residents and workers on the MMR receive their water from the base water supply system that has well head treatment. Additionally, in 1998 the Mashpee Board of Health adopted a moratorium on groundwater wells, which states that existing and future residential wells located in documented or anticipated areas of MMR groundwater contamination as defined by the Board of Health are restricted from use for any purpose. This moratorium reduces human exposure to TCE groundwater contamination in the SD-5 area.

2.9.1 Alternative 1 – No Action

The no-action alternative is required by the NCP (40 *Code of Federal Regulations* [CFR] 300.430[e][6]) to provide a baseline condition if no remedial action is taken. Under this alternative, no monitoring would be performed to assess the predicted natural attenuation of the SD-5 groundwater contamination. TCE concentrations would eventually reach the cleanup levels through natural attenuation processes, but there would be no monitoring data to demonstrate that this was happening.

2.9.2 Alternative 2 – Land Use Controls Long-Term Monitoring

No active remediation would occur with this alternative. However, unlike Alternative 1, this alternative would provide for continued chemical monitoring of the monitoring wells in the surrounding network (as described below). Because the remedial system components that were installed as part of the interim remedy for the SD-5 plume have all been shut down, this alternative represents the current program (status quo). Continued monitoring and reporting would provide for

- Tracking attenuation of SD-5 groundwater contamination;
- Determining when TCE concentrations have decreased to below the MCL; and
- Supporting ongoing modeling.

Monitoring results would provide data that could be used to update the conceptualization of the groundwater contamination. The data would be valuable for confirming attenuation of groundwater contamination or detecting deviations from predicted behavior. Groundwater monitoring will continue for two years after the TCE cleanup level (5 μg/L) is met to verify that the heterogeneities in the groundwater system are accounted for when determining if the restoration goal has been met. Monitoring results would be periodically reported in technical update meetings and would be reported formally in periodic reports. In addition, CERCLA reviews would be performed every five years, as required. A residual risk assessment would be conducted if deemed necessary.

Monitoring would involve periodic testing of groundwater for VOCs to measure the natural attenuation of the groundwater contamination. Only TCE in groundwater needs be examined under the RAO. This alternative also includes LUCs that would prevent future human exposure to the groundwater contamination in the SD-5 area until cleanup levels are met.

2.9.3 Alternative 3 – Construction, Operation, Maintenance, and Monitoring of a New SD-5 ETR System

This alternative would provide for active treatment of the SD-5 groundwater contamination with the construction and operation of one new extraction well in the area of remaining TCE contamination in SD-5 South. The goal of the active remediation would be to expedite aquifer restoration. The new extraction well would be located between monitoring well 28MW0035B and Johns Pond and would be tied into the existing Hooppole Road pipeline for treatment at the SRTF and reinjection through the Chemical Spill-10 and SD-5 reinjection wells. This alternative would also provide for chemical and hydraulic monitoring as long as active remediation continued. Additional action may be taken if monitoring data indicate the remedial system is not performing as designed.

Groundwater monitoring would continue for two years after the TCE cleanup level is met. Monitoring results would be periodically reported in technical update meetings and would be reported formally in annual reports. In addition, CERCLA reviews would be performed every five years, as required. A residual risk assessment would be conducted if deemed necessary. This alternative also includes LUCs that would prevent future human exposure to the groundwater contamination in the SD-5 area until cleanup levels are met.

2.9.4 Common Elements and Distinguishing Features of the Alternatives

Alternatives 1 and 2 do not actively treat the SD-5 groundwater contamination. Under both Alternatives 1 and 2, cleanup levels of the SD-5 groundwater contamination would be reached through natural attenuation, and groundwater modeling predicts that TCE

concentrations would decrease to below the MCL by approximately 2008. Under Alternatives 2 and 3, TCE concentrations would be routinely measured, allowing for a check on modeling assumptions and verification of natural attenuation. Alternative 3 would actively treat the SD-5 South groundwater contamination by extracting groundwater via a new extraction well, and treating and reinjecting the water through existing facilities. Existing on-base and off-base LUCs would remain under all three alternatives.

ARAR waivers would not be required with any of the SD-5 groundwater alternatives. Refer to the *Final Storm Drain-5 Groundwater Feasibility Study* (AFCEE 2004) for a complete listing of ARARs for each alternative and how individual alternatives would comply with them. ARARs for the selected alternative are discussed in Section 2.12.2 of this document.

Alternatives 2 and 3 rely on techniques and technologies that have been proven and employed at the MMR since 1997. Significant residual risk would not remain with any of the alternatives; however, with Alternative 1 the level of residual risk could not be confirmed.

For Alternative 3, it was assumed that the new extraction well would begin operation in the spring of 2006 and would operate for approximately a year and a half. Based on modeling predictions, contaminant concentrations would be reduced below the cleanup level by approximately 2008 under Alternatives 1 and 2 and by approximately 2007 under Alternative 3. The estimated costs for Alternatives 2 and 3 are presented in Table 2-48.

2.9.5 Expected Outcomes of the Alternatives

Groundwater modeling indicates concentrations will decrease below cleanup levels under Alternatives 1 and 2 by approximately 2008 and under Alternative 3 by approximately 2007. All of the alternatives include LUCs, which will prevent the hypothetical scenario of residential exposure to contaminated groundwater.

2.10 COMPARATIVE ANALYSIS OF SD-5 ALTERNATIVES

The following sections summarize the comparative analysis of SD-5 groundwater Alternatives 1, 2, and 3 presented in the *Final Storm Drain-5 Feasibility Study* (AFCEE 2004).

2.10.1 Criteria for Detailed Analysis of Alternatives

The NCP (40 CFR, Part 300) presents nine criteria for analyzing the acceptability of a given alternative. These nine criteria are categorized as threshold criteria, primary balancing criteria, and modifying criteria.

2.10.1.1 Threshold Criteria

There are two threshold criteria: overall protection of human health and the environment, and compliance with ARARs. Threshold criteria represent the minimum requirements that each alternative must meet to be eligible for selection.

Overall Protection of Human Health and the Environment This criterion assesses the overall effectiveness of an alternative and focuses on whether that alternative achieves adequate protection and risk reduction, elimination, or control. The assessment of overall protection draws on assessments conducted under other evaluation criteria, especially long-term effectiveness and permanence, short-term effectiveness, and compliance with ARARs.

Compliance with ARARs Each alternative is assessed to determine whether it complies with ARARs under federal and state laws. Section 121(d) of CERCLA requires that remedial actions at CERCLA sites 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). Appendix C of the *Final Storm Drain-5 Feasibility Study* (AFCEE 2004) outlines ARARs for all the SD-5 alternatives. Section 2.12.2 discusses ARARs for the selected remedy for the SD-5 groundwater.

2.10.1.2 Primary Balancing Criteria

The five primary balancing criteria are (1) long-term effectiveness and permanence, (2) reduction of toxicity, mobility or volume through treatment, (3) short-term effectiveness, (4) implementability, and (5) cost. Primary balancing criteria form the basis for comparing alternatives in light of site-specific conditions.

Long-Term Effectiveness and Permanence Each alternative is assessed for its long-term effectiveness and the permanence of the solution. This criterion assesses the destruction or removal of contaminants, the magnitude of residual risks remaining at the conclusion of remedial activities, and the adequacy and reliability of controls to be used to manage residual risk.

Reduction of Toxicity, Mobility, or Volume Through Treatment Section 121 (Cleanup Standards) of CERCLA states a preference for remedial actions that employ treatment that permanently and significantly reduces the volume, toxicity, or mobility of contaminants as the primary element of the action. This criterion addresses the capacity of the alternative to reduce the principle risks through destruction of contaminants, reduction in the total mass of contaminants, irreversible reduction in contaminant mobility, or reduction in the total volume of contaminated media.

Short-Term Effectiveness This criterion addresses the effects of the alternative during construction and operational phases until remedial objectives are met. Each alternative is evaluated with respect to its (potentially negative) effects on community health, worker safety, and environmental quality during the course of remedial actions. This criterion also addresses the time required by each alternative until remedial objectives are achieved.

Implementability The implementability criterion is used to assess the technical and administrative feasibility of implementing an alternative. Technical issues include the reliability of the technology under consideration, potential construction difficulties, and the availability of required services, materials, and equipment (preferably from multiple

sources). Administrative issues include permitting and access for construction and monitoring.

Cost Costs associated with carrying out an alternative are based on current (present day) information escalated at a rate of 5 percent until year zero; after year zero, costs are discounted at a rate of 2.1 percent (per OMB Circular A-94 [OMB 2004]). It is assumed that costs are incurred at the beginning of each year and that the expected useful project life is five years, to allow for two additional years of monitoring beyond the estimated date of reaching the TCE MCL in groundwater. Cost estimates included in this document are intended for comparative purposes only. The accuracy of the estimates are between –30 and +50 percent.

2.10.1.3 Modifying Criteria

There are two modifying criteria: state acceptance and community acceptance.

State Acceptance State acceptance evaluates the technical and administrative issues and concerns of the state, specifically the MassDEP.

Community Acceptance Community acceptance evaluates the issues and concerns that the public may have regarding each of the alternatives. A summary of the public comments received during the public comment period on the Proposed Plan for Groundwater at Eastern Briarwood, Western Aquafarm, and Storm Drain-5 (AFCEE 2005c), along with AFCEE's responses, are provided in Section 3.0, Responsiveness Summary, of this ROD.

2.10.2 Comparison of SD-5 Groundwater Alternatives

Alternatives 1, 2, and 3 were evaluated against the nine NCP criteria. The following sections present the evaluation.

2.10.2.1 Overall Protection of Human Health and the Environment

The alternatives that include LUCs (2 and 3) provide additional control of exposure to the contaminated groundwater and reduction in risk to human health beyond that which is already achieved by the existing residential connections to the municipal water supply. Alternatives 2 and 3 also provide monitoring, which allows for confirmation that the alternative meets the RAOs. Based on modeling predictions, contaminant concentrations are predicted to decrease below the cleanup levels by approximately 2008 under Alternative 2 and by approximately 2007 under Alternative 3.

2.10.2.2 Compliance with ARARs

All the alternatives are compliant with ARARs. The point at which chemical-specific ARARs are met would not be known under Alternative 1 since monitoring would not be performed. Construction under Alternative 3 will be designed to meet location-specific ARARs. All treatment and monitoring activities will be performed in accordance with action-specific ARARs.

2.10.2.3 Long-Term Effectiveness and Permanence

All current and potential future risks would remain under all three alternatives. However, with the Mashpee Board of Health moratorium in place, there are no additional exposure controls necessary. Alternatives 2 and 3 provide for long-term management with the monitoring program, which would provide information to confirm the natural attenuation was progressing as predicted. Alternative 3 provides for active removal of the remaining portion of the SD-5 groundwater contamination with proven technology. Modeling indicates that active groundwater treatment (Alternative 3) would reduce the TCE contamination to below the MCL in the SD-5 South area by approximately 2007, compared to approximately 2008 for Alternatives 1 and 2.

2.10.2.4 Reduction of Toxicity, Mobility, or Volume Through Treatment

Alternative 3 satisfies EPA's preference that active treatment be a principle element in site remediation. Contaminants are permanently removed from the aquifer. Regeneration of the carbon used in the SRTF ultimately destroys the contaminants. Approximately 0.058 kilograms (2 ounces) of TCE will be treated.

2.10.2.5 Short-Term Effectiveness

Alternative 1 has the least impact on workers, the community, and the environment since it does not require any monitoring, construction, or maintenance activities. Alternative 3 has the greatest impact since it involves the construction and operation of a new ETR system.

Since monitoring is already being conducted under an LTM program, there would be no new risks posed to the community, the workers, or the environment as a result of this activity under Alternatives 2 and 3. For Alternative 2, it is assumed that no additional monitoring wells are required; however, if changes in the future trajectory of groundwater contamination resulted in a requirement for additional monitoring wells, the risks associated with that work is considered low and would be easily controlled through training, safety procedures and medical monitoring.

Alternative 3 poses environmental impacts in the form of site preparation (clearing and grading) for the extraction and monitoring wells and access road; excavation for the well vault; additional vehicle traffic in the neighborhood and at the site; and increased sound levels associated with operation of the ETR system, as well as increased electrical demand.

2.10.2.6 Implementability

Technical implementability concerns arise for Alternative 3 only. There may be technical feasibility concerns with respect to ideally locating the proposed extraction well

and associated monitoring wells. Additionally, roads would probably be temporarily closed and traffic rerouted during well installation.

Under Alternatives 2 and 3, administrative implementability concerns include coordination with other agencies for technical update meetings, RPM meetings, and active communication on all issues of concern. Long-term access agreements with private landowners and well permits are an administrative implementability concern for Alternative 3 where extraction and monitoring wells are being constructed, and could be a concern with Alternative 2 if new monitoring wells are required in the future.

2.10.2.7 Cost

As expected, estimated costs increase with an increase in the degree of activity. Alternative 1 has no costs associated with it so as to serve as a baseline scenario. Alternative 2 is LTM only and has a present value cost of $0.5 million (M). Alternative 3 adds active treatment to LTM and has a present value cost of $1.9M.

2.10.2.8 State Acceptance

The MassDEP has expressed its support for Alternative 2.

2.10.2.9 Community Acceptance

A Proposed Plan (AFCEE 2005c) was presented to the public in the public meeting held 21 July 2005, and a public hearing was held on 18 August 2005. Appendix B of that document contains the transcript of the public hearing. Because the only comment received during the public comment period (a verbal statement at the public hearing) supported the Proposed Plan, no Responsiveness Summary was necessary.

2.11 SELECTED REMEDY FOR THE SD-5 GROUNDWATER OPERABLE UNIT

Based on the Administrative Record for the SD-5 site and the evaluation of comments received by interested parties during the public comment period, AFCEE has selected Alternative 2 as the remedy for the SD-5 groundwater OU.

2.11.1 Summary of the Rationale for the Selected Remedy

The selected remedy is Alternative 2, which consists of LTM with LUCs. A full description of the preferred remedy is provided below. The selected remedy provides a means of verifying the natural attenuation of the groundwater contamination through monitoring, is protective of human health through implementation of LUCs, does not have any significant implementability concerns, and has minor impacts on worker safety, the community, and the environment. The preferred remedy was selected over the other alternatives because it is expected to achieve the RAOs in a reasonable time frame (three years) and is cost-effective.

2.11.2 Detailed Description of Selected Remedy

AFCEE has developed a monitoring plan for the SD-5 groundwater OU that will include data from a network of monitoring wells. The monitoring wells will be sampled periodically for VOCs. Periodic monitoring results will be reported in a letter report. Periodic evaluation of all analytical results will include tracking the natural attenuation of the SD-5 groundwater contamination. The monitoring plan itself will be reviewed annually for adequate coverage of the area and optimization. Monitoring will continue for two years beyond the time at which TCE concentrations decrease below the MCL. CERCLA five-year reviews will be performed to evaluate remedy appropriateness and site status for as long as hazardous substances remain above unrestricted use levels in the groundwater. A residual risk assessment and/or an evaluation of the technical and economic feasibility of additional remediation to approach or achieve background concentrations would be conducted if deemed necessary.

The SD-5 contaminated groundwater currently poses an unacceptable risk to human health if used for drinking water purposes. The SD-5 contaminated groundwater is located in the central part of the MMR cantonment area, and a portion of the SD-5 contaminated groundwater has migrated past the MMR boundary into the neighboring town of Mashpee. Therefore, administrative and/or legal controls that minimize the potential for human exposure to contamination by limiting land or resource use, known as "land use controls" (LUCs), must be established for this area of concern to avoid the risk of exposure to groundwater from the SD-5 area. These LUCs are needed both on-base and off-base, within the town of Mashpee, until the groundwater from the SD-5 contaminated groundwater no longer poses an unacceptable risk.

The performance objectives of the LUCs are:

- Prevent access to or use of the groundwater from the SD-5 contaminated groundwater until the groundwater no longer poses an unacceptable risk;
- Maintain the integrity of the current or future remedial or monitoring system such as treatment systems and monitoring wells.

The LUCs will encompass the area including the SD-5 contaminated groundwater (Figure 2-12) and surrounding areas to prevent a risk from exposure to contaminated groundwater. The on-base area of concern is controlled and operated by the U.S. Air Force, which leases this land from the Commonwealth of Massachusetts. It is expected that these entities will operate and own, respectively, the area of concern and the surrounding area for the duration of this ROD. As a result, the Air Force will coordinate with the Commonwealth of Massachusetts as the Air Force fulfills its responsibility to establish, monitor, maintain and report on the LUCs for this site.

Each LUC will be maintained until either (1) the concentrations of TCE in the groundwater are at such a level to allow unrestricted use and exposure, or (2) the Air Force, with the prior approval of EPA and MassDEP, modifies or terminates the LUC in question.

The Air Force is responsible for ensuring that the following two LUCs are established, monitored, maintained, and reported on as part of this final remedy to ensure protection of human health and the environment in accordance with CERCLA and the NCP for the duration of the final remedy selected in this ROD. In the event that the Town of Mashpee fails to promptly enforce the first LUC or the Commonwealth of Massachusetts fails to promptly enforce the second LUC, the Air Force will act in accordance with the third to last paragraph in this section. For purposes of the preceding sentence, "promptly enforce" means if the violation or potential violation is imminent or on-going, enforce to prevent or terminate [illegible] Commonwealth) discovery of the violation or potential violation; otherwise, enforce as soon as possible.

(1) To better protect the public health and welfare of its citizens, the Mashpee Board of Health, adopted a moratorium on private drinking water wells on April 23, 1998, amended July 29, 1999, in the town of Mashpee. The moratorium, as amended, applies to existing wells and potential future wells, and restricts any and all uses of groundwater. The areas where well use is excluded are defined by the Mashpee Board of Health, and include documented areas of contamination and anticipated areas of contamination from the SD-5 contaminated groundwater. To assist the Mashpee Board of Health in the implementation of this LUC, the Air Force will meet with the Board of Health on an annual basis, or more frequently if needed, to provide and discuss plume maps that document the current and projected location of the SD-5 contaminated groundwater within the town of Mashpee. While Figure 2-12 shows the current area of LUCs in the town, the Mashpee Board of Health may modify the areas subject to the moratorium, and this LUC will apply to such areas even if they differ from the area shown in Figure 2-12.

(2) In addition to the Board of Health regulation, which generally applies to small water supply wells, existing LUCs also prevent the possible creation of a large potable water supply well. The MassDEP administers a permitting process for any new drinking water supply wells in Massachusetts that propose to service more than 25 customers or exceed a withdrawal rate of 100,000 gallons per day. This permitting process, which serves to regulate the use of the SD-5 contaminated groundwater for any withdrawals of groundwater for drinking water purposes, constitutes an additional LUC for this final remedy. This LUC applies to both on-base and off-base portions of SD-5.

Additionally, the Air Force is responsible for ensuring that the following LUCs are established, monitored, maintained, reported on, and enforced as part of this final remedy to ensure protection of human health and the environment in accordance with CERCLA and the NCP for the duration of this final remedy selected in this ROD.

(1) For the on-base area of concern, a prohibition on new drinking water wells serving 25 or fewer customers has been established and placed on file with the planning and facilities offices for the Massachusetts Air and Army National Guard and United States Coast Guard (major tenants at the Massachusetts Military Reservation). The prohibition will be applied to future land use planning per Air National Guard Instruction (ANGI) 32-1003, Facilities Board, Army National Guard Regulation 210-20, Real Property Development Planning for the Army National Guard, and Commandant Instruction Manual 11010.14, Shore Facility Project Development Manual.

(2) For the on-base area of concern, the Air National Guard has administrative processes and procedures that require approval for all projects involving construction or digging/subsurface soil disturbance, currently set forth in ANGI 32-1001, Operations Management. This procedure is a requirement of the Army National Guard and the United States Coast Guard by the Air National Guard through Installation Support Agreements. The Air National Guard requires a completed AF Form 103, Base Civil Engineer Work Clearance Request (also known as the base digging permit), prior to allowing any construction, digging or subsurface soil disturbance activity. All such permits are forwarded to the Installation Restoration Program for concurrence before issuance. An AF Form 103 will not be processed without a Dig Safe permit number (see next paragraph).

(3) The Dig Safe program implemented in Massachusetts provides an added layer of protection to prevent the installation of water supply wells in the SD-5 area and to protect monitoring wells and the treatment system's infrastructure. This program requires, by law, anyone conducting digging activities (e.g., well drilling) to request clearance through the Dig Safe network. The Air Force at the MMR is a member utility of Dig Safe. The SD-5 contaminated groundwater is encompassed by a geographical area identified by the Air Force as a notification region within the Dig Safe program. Through the Dig Safe process, the Air Force will be electronically notified at least 72 hours prior to any digging within this area. The notification will include the name of the party contemplating, and the nature of, the digging activity. The Air Force will review each notification and if the digging activity is intended to provide a well, which has not been approved via the procedures above, the Air Force will immediately notify the project sponsor (of the well drilling), the EPA, the Mashpee Board of Health and the MassDEP, in order to curtail the digging activity. If the Dig Safe notification indicates proposed work near monitoring wells or treatment system infrastructure, the Air Force will mark its components to prevent damage due to excavation. This LUC applies to both on-base and off-base portions of SD-5. The extent of the Air Force's enforcement of this LUC does not address off-base parties failing to file a dig Safe request nor Dig Safe improperly processing a notification, but if such incidents do occur, the Air Force is responsible for ensuring remedy integrity and, if necessary, repairing damage caused by third parties to the remedial system infrastructure or monitoring wells.

Monitoring of the environmental use restrictions and controls will be conducted annually by the Air Force. The monitoring results will be included in a separate report or as a section of another environmental report, if appropriate, and provided to the EPA and MassDEP for informational purposes. The annual monitoring reports will be used in preparation of the five-year review to evaluate the effectiveness of the final remedy.

The annual monitoring report, submitted to the regulatory agencies by the Air Force, will evaluate the status of the LUCs and how any LUC deficiencies or inconsistent uses have been addressed. The annual evaluation will address (i) whether the use restrictions and controls referenced above were effectively communicated, (ii) whether the operator, owner and state and local agencies were notified of the use restrictions and controls affecting the property, and (iii) whether use of the property has conformed with such restrictions and controls and, in the event of any violations, summarize what actions have been taken to address the violations.

The Air Force shall notify the EPA and MassDEP 45 days in advance of any proposed land use changes that would be inconsistent with the LUC objectives or the final remedy. If the Air Force discovers a proposed or ongoing activity that would be or is inconsistent with the LUC objectives or use restrictions, or any other action (or failure to act) that may interfere with the effectiveness of the LUCs, it will address this activity or action as soon as practicable, but in no case will the process be initiated later than 10 days after the Air Force becomes aware of this breach. The Air Force will notify the EPA and MassDEP as soon as practicable, but no later than 10 days after the discovery of any activity that is inconsistent with the LUC objectives or use restrictions, or any other action that may interfere with the effectiveness of the LUCs. The Air Force will notify the EPA and MassDEP regarding how the Air Force has addressed or will address the breach within 10 days of sending the EPA and MassDEP notification of the breach.

The Air Force will provide notice to the EPA and MassDEP at least six months prior to relinquishing the lease to the SD-5 area so the EPA and MassDEP can be involved in discussions to ensure that appropriate provisions are included in the transfer terms or conveyance documents to maintain effective LUCs. If it is not possible for the Air Force to notify the EPA and MassDEP at least six months prior to any transfer or sale, then the Air Force will notify the EPA and MassDEP as soon as possible, but no later than 60 days prior to the transfer or sale of any property, subject to LUCs.

For the LUCs identified and selected for this ROD, the Air Force shall not modify or terminate LUCs, implementation actions, or modify land use without approval by the EPA and MassDEP. The Air Force, in coordination with other agencies using or controlling the SD-5 area, shall seek prior concurrence before taking any anticipated action that may disrupt the effectiveness of the LUCs or any action that may alter or negate the need for LUCs.

2.11.3 Cost Estimate for the Selected Remedy

The cost estimate for Alternative 2 is provided in Tables 2-48 and 2-49. The information for the cost estimate is based on the best available information regarding the anticipated scope of the remedial alternative. Changes in the cost elements may change based on changes in the SD-5 LTM program. This is an order-of-magnitude engineering cost estimate that is expected to be within +50 percent to –30 percent of the actual project cost.

The cost comes from the LTM program and periodic reporting. It is assumed that existing monitoring wells provide adequate coverage of the subject area; therefore, no capital costs for additional wells are estimated at this time. For cost-estimating purposes, it is assumed that the monitoring program would be similar to the chemical monitoring that already exists under the SPEIM program instituted in 2003, and that hydraulic monitoring, interpretation, and reporting would not be necessary. In addition, only groundwater samples would be analyzed, and analysis would be for VOCs only. Surface

water samples and water level measurements would not be required to monitor the area of groundwater contamination and natural attenuation. It is also assumed that the monitoring program would reduce in effort over time due to stabilization of the system operations and, thus, the reduction in frequency of sample collection. Costs include equipment, personnel, laboratory analyses, investigation-derived materials, maintenance, and data interpretation and reporting. Based on the changes in the magnitude of the SPEIM program in recent years, it is assumed that at two years into the project lifetime, the monitoring program will be reduced by 36 percent; and after four years, the monitoring program will be reduced by 59 percent (from the initial proposed monitoring program). It is assumed that concentrations will decrease to below MCLs by 2008 and monitoring would continue to 2010. The monitoring results are assumed to be reported informally at technical update meetings and formally in technical reports. Other reporting is assumed to be one CERCLA five-year review and one residual risk assessment, which will be performed when concentrations decrease below the MCL.

Capital, annual and periodic costs generated in the cost estimates and used in the present value calculations have been escalated from the time the cost estimate was prepared (December 2003) to the start of the base year (June 2005). This is assumed to be March 2006; thus, an escalation of 1.5 years at a rate of 5 percent has been used. A discount rate of 2.1 percent was used for all present value calculations per EPA guidance (EPA 2000) and Office Management and Budget Circular A-94, revised February 2004 (OMB 2004).

2.11.4 Estimated Outcomes of the Selected Remedy

Alternative 2 provides for protection of human health through implementation of LUCs. The groundwater model indicates that concentrations will decrease below the MCL by 2008, at which time the groundwater will be useable as a source of drinking water.

2.12 STATUTORY DETERMINATIONS

Under CERCLA Section 121, selected remedies must be protective of human health and the environment, comply with ARARs (unless a waiver is justified), be cost-effective,

and use 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. The following sections discuss how the selected remedy meets these statutory requirements.

2.12.1 Protection of Human Health and the Environment

The selected remedy will protect human health and the environment through LUCs and monitoring of the contaminated groundwater to insure contaminant concentrations are dissipating to below the MCL, as predicted by the groundwater model. Monitoring and LUCs will prevent residential exposure to the SD-5 North and South areas. There are no short-term threats associated with the selected remedy that cannot be readily controlled.

2.12.2 Compliance with Applicable or Relevant and Appropriate Requirements

The selected remedy of long-term monitoring of the SD-5 groundwater complies with all chemical-, location-, and action-specific ARARs. Refer to Tables 2-50, 2-51, and 2-52 for a listing of these ARARs.

2.12.3 Cost-Effectiveness

In AFCEE's judgment, the selected remedy for SD-5 groundwater is cost-effective. The overall effectiveness of the selected remedy was determined to be proportional to its costs and, hence, to represent a reasonable value for the money to be spent.

The cost-effectiveness of the SD-5 remedy was evaluated based on the data currently available for the SD-5 groundwater and the following considerations: (1) the contaminated groundwater is naturally attenuating and is predicted to dissipate to less than the MCL by 2008; (2) long-term monitoring is the lowest cost alternative that still maintains protection of human health.

2.12.4 Utilization of Permanent Solutions and Alternative Treatment Technologies to the Maximum Extent Practicable

The selected remedy for SD-5 groundwater provides the best balance of trade-offs among the alternatives considered in the feasibility study. Alternative 2 represents the maximum extent to which permanent solutions and treatment can be practicably utilized at the site because active remediation (Alternative 3) is not cost-effective, would not significantly expedite aquifer restoration or contaminant mobility, and may not be technically implementable. Based on the evaluation criteria and the statutory mandates, AFCEE [illegible] monitoring and controls included in Alternative 2 will demonstrate compliance with ARARs and protectiveness of human health and the environment. Alternative 2 will satisfy the criteria for long-term effectiveness and permanence by allowing natural attenuation to reduce contaminant concentrations to acceptable levels. The selected remedy does not present any significant short-term risks. There are no special implementability issues that make the selected remedy unacceptable.

2.12.5 Preference for Treatment as a Principal Element

The selected remedy does not treat the contamination present in the SD-5 North and South areas. Although the statutory preference is for remedies that employ treatment as a principal element, active treatment was not selected as the remedy because active treatment was predicted to decrease the aquifer restoration by only approximately six months. The costs associated with the active treatment alternative were disproportionately high for the predicted improvement in aquifer restoration time. Additionally, it is anticipated that there would be implementability challenges with building and operating the groundwater extraction system components in Alternative 3, and active remediation would effect no reduction in human or ecological health risks.

2.12.6 Five-Year Review Requirements

Five-year statutory reviews will be performed for the SD-5 groundwater, according to Section 121(c) of CERCLA and NCP Section 300.430(f)(4)(ii), which requires such

reviews in those instances where the remedy results in any hazardous substances, pollutants, or contaminants remaining at the site in excess of levels that allow for unlimited use and unrestricted exposure. The purpose of the five-year reviews is to revisit the appropriateness of the remedy in providing adequate protection of human health and the environment. The five-year review for the SD-5 groundwater OU will be part of the five-year reviews conducted for the CERCLA IRP sites on the MMR.

2.13 DOCUMENTATION OF NO SIGNIFICANT CHANGES

The Proposed Plan for the Groundwater at Eastern Briarwood, Western Aquafarm, and Storm Drain-5 (AFCEE 2005c) was released for public comment in July 2005. The Proposed Plan identified the following alternatives as components of AFCEE's preferred alternative:

- Eastern Briarwood: No further action.
- Western Aquafarm: No further action.
- Storm Drain-5: Land Use Controls and Long-Term Monitoring.

AFCEE, the EPA, and the MassDEP considered the one verbal comment received during the public comment period. Upon review of this comment, it was determined that no significant changes to the remedies, as they were originally identified in the Proposed Plan, were necessary.

3.0 RESPONSIVENESS SUMMARY

Because the only comment received during the public comment period (a verbal statement at the public hearing) supported the Proposed Plan, no Responsiveness Summary was necessary.

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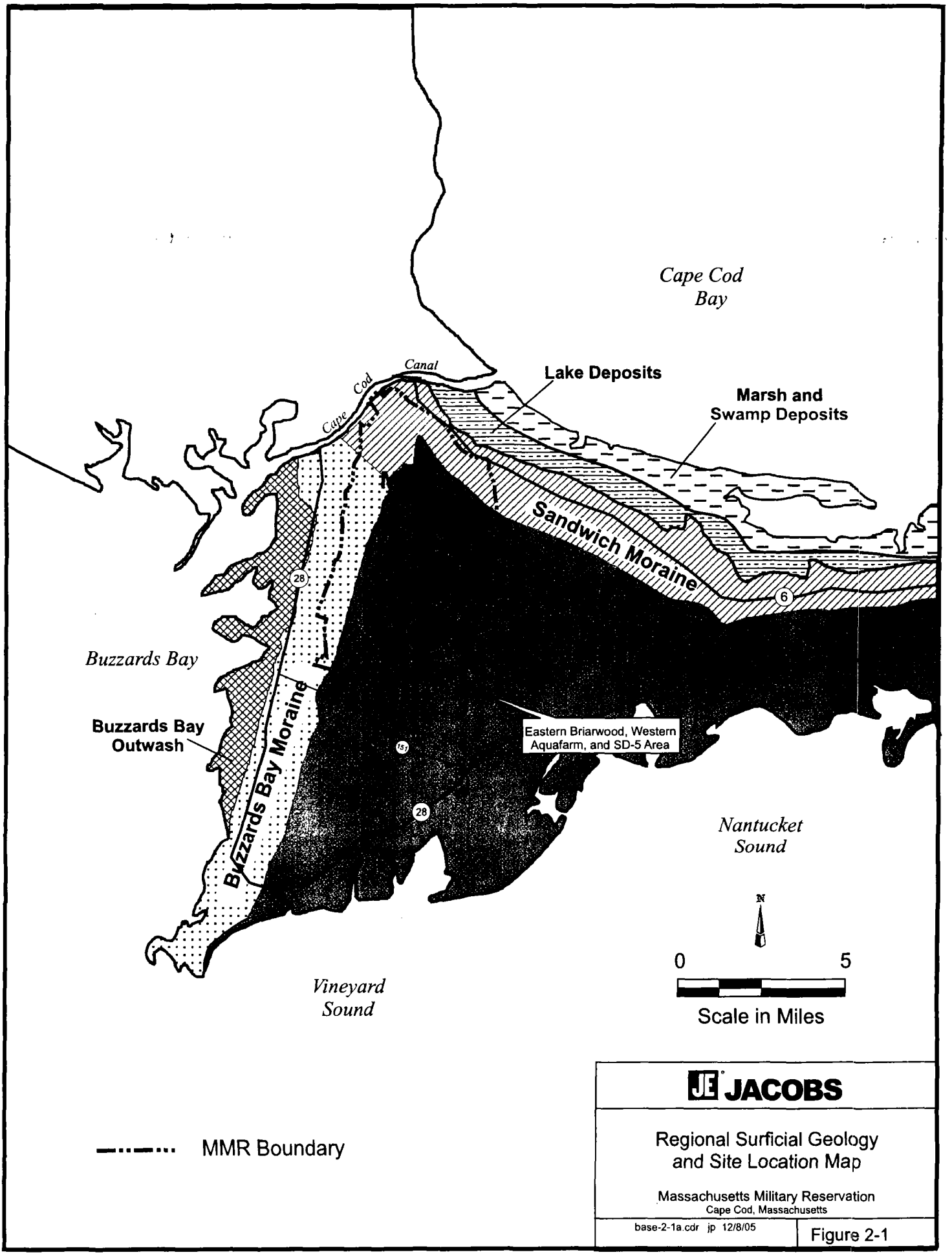
FIGURES



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Regional Surficial Geology and Site Location Map

Massachusetts Military Reservation
Cape Cod, Massachusetts

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Figure 2-1

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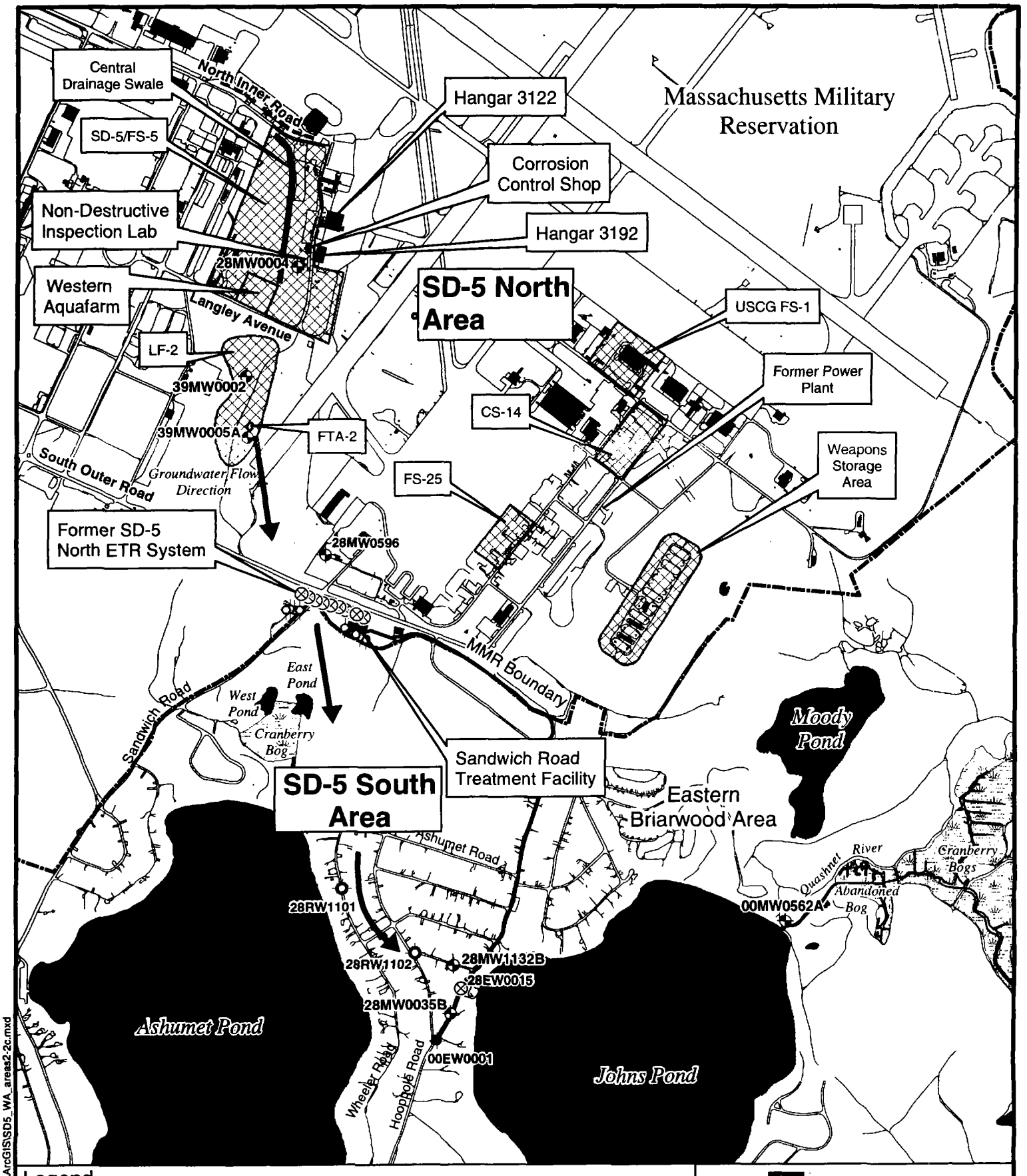

Legend

- Monitoring Well
- Recirculation Well (non-operational)
- Extraction Well (non-operational)
- Reinjection Well
- Extraction Well
- MMR Boundary
- Pipe Line
- Source Area
- Treatment Facility
- Groundwater Flow

N

0 625 1,250 Feet

Scale 1:15,000

JE JACOBS

Eastern Briarwood, Western Aquafarm and SD-5 Site Map

Massachusetts Military Reservation
Cape Cod, Massachusetts

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Figure 2-2

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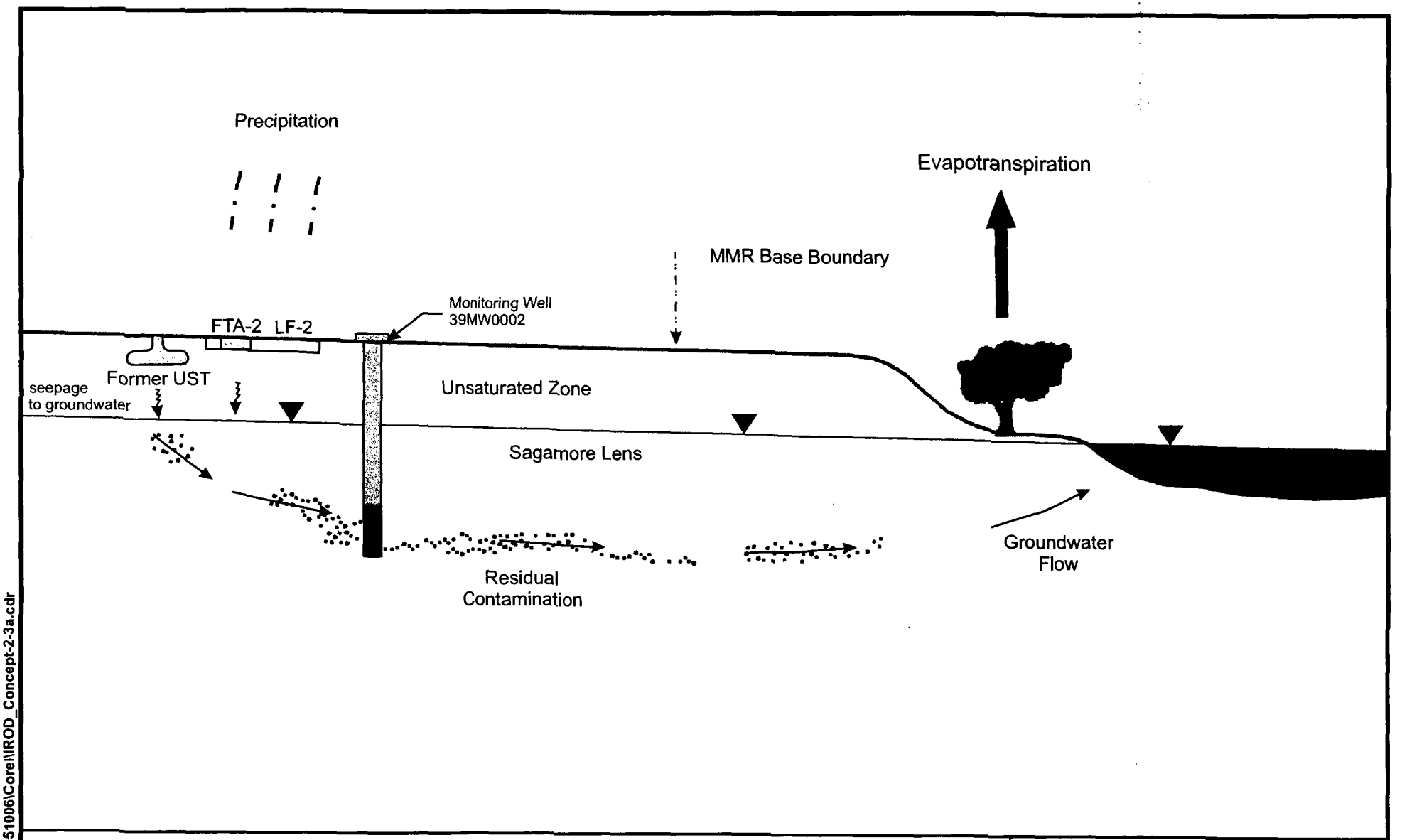

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Not to Scale

Indicates area of fuel-related contamination below MCLs

Water Table

Indicates Groundwater Flow Direction

FTA-2 Fuel Training Area-2

LF-2 Landfill-2

UST Underground Storage Tank

JACOBS

Conceptual Model for
Western Aquafarm Area

Massachusetts Military Reservation
Cape Cod, Massachusetts

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Figure 2-3

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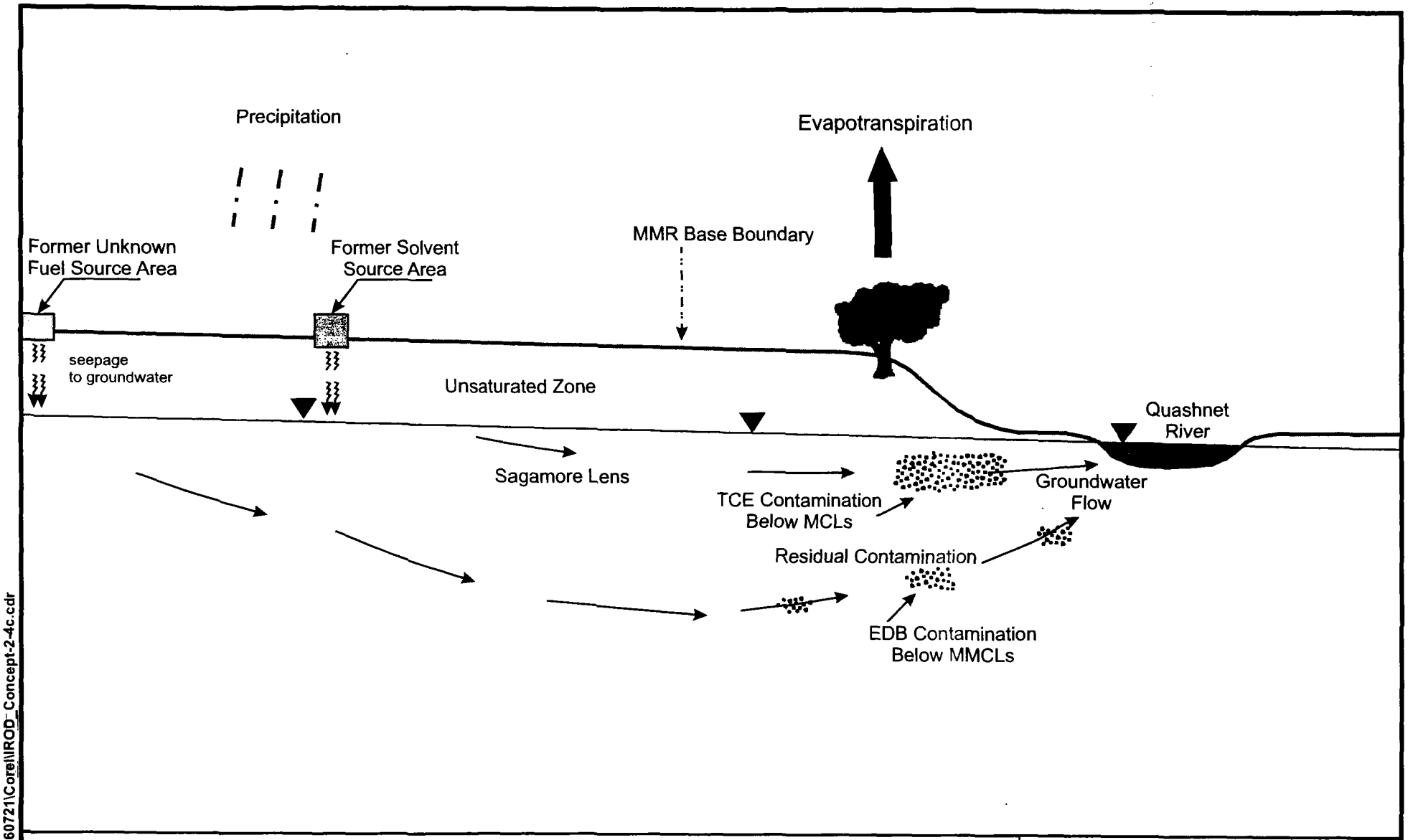

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Water Table

Indicates Groundwater Flow Direction

TCE = trichloroethene
EDB = ethylene dibromide

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Conceptual Model for Eastern Briarwood Area

Massachusetts Military Reservation
Cape Cod, Massachusetts

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Figure 2-4

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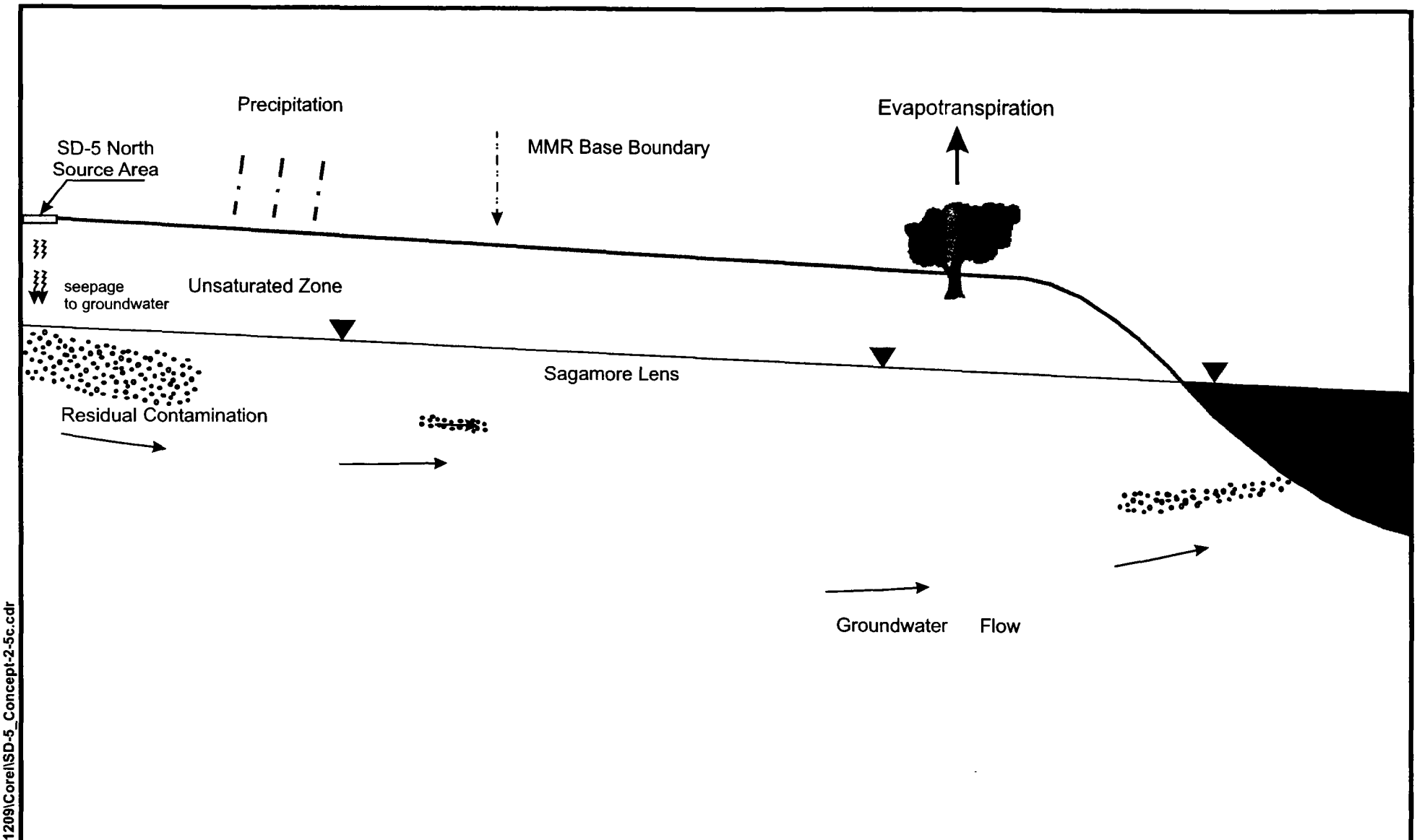

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Not to Scale

▼ Water Table

→ Indicates Groundwater Flow Direction

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Conceptual Model
for SD-5 Area

Massachusetts Military Reservation
Cape Cod, Massachusetts

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Figure 2-5

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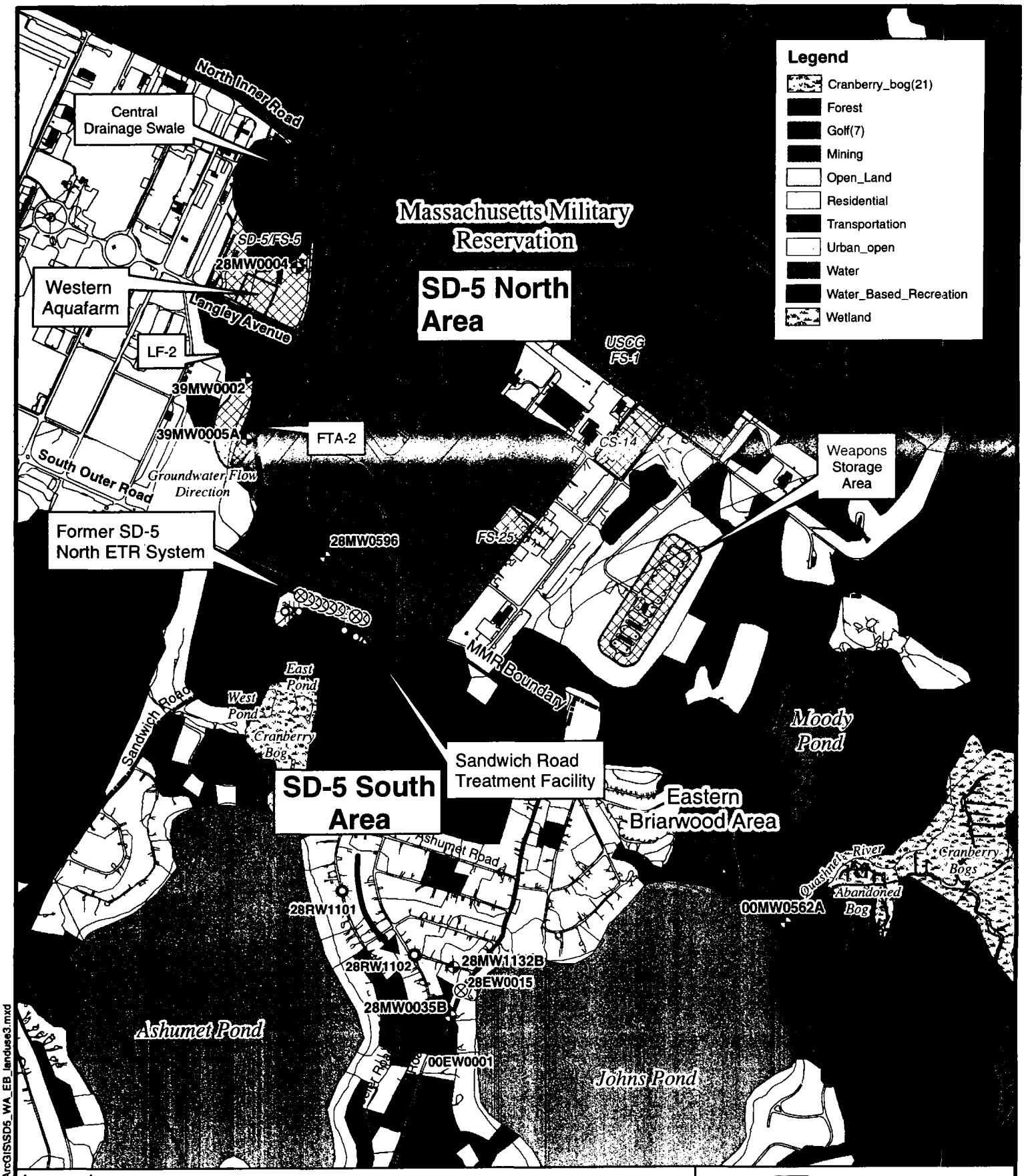

Legend

- Monitoring Well
- Recirculation Well (non-operational)
- Extraction Well (non-operational)
- Reinjection Well
- Extraction Well
- Pipe Line
- Treatment Facility
- MMR Boundary
- Source Area
- Groundwater Flow

Source: Land Use layer provided by MASS GIS 2002

N

0 625 1,250 Feet

Scale 1:15,000

JE JACOBS

Eastern Briarwood, Western Aquafarm and SD-5 Land Use

Massachusetts Military Reservation
Cape Cod, Massachusetts

NAME csroberts DATE 12/4/2005

Figure 2-6

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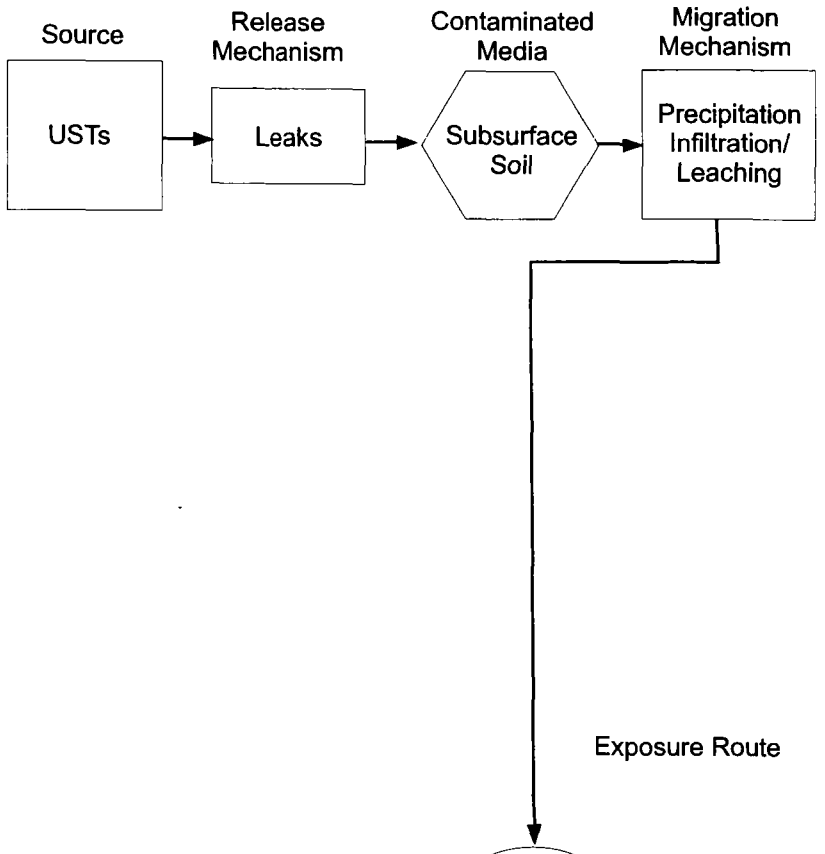
ON-BASE/OFF-BASE



Exposure Route	Receptor: Current Resident	Receptor: Future Resident
Ingestion		X
Dermal Absorption		X
Inhalation of VOCs		X

Legend

Transport Media

Exposure/Transport Media

Source, Release Mechanism, Migration Mechanism

VOC volatile organic compound

NDIL Non-Destructive Inspection Laboratory

JACOBS

Human Health
Conceptual Exposure Model
Western Aquafarm

Massachusetts Military Reservation
Cape Cod, Massachusetts

10/6/05 JP: flow_WA2-7.cdr

Figure 2-7

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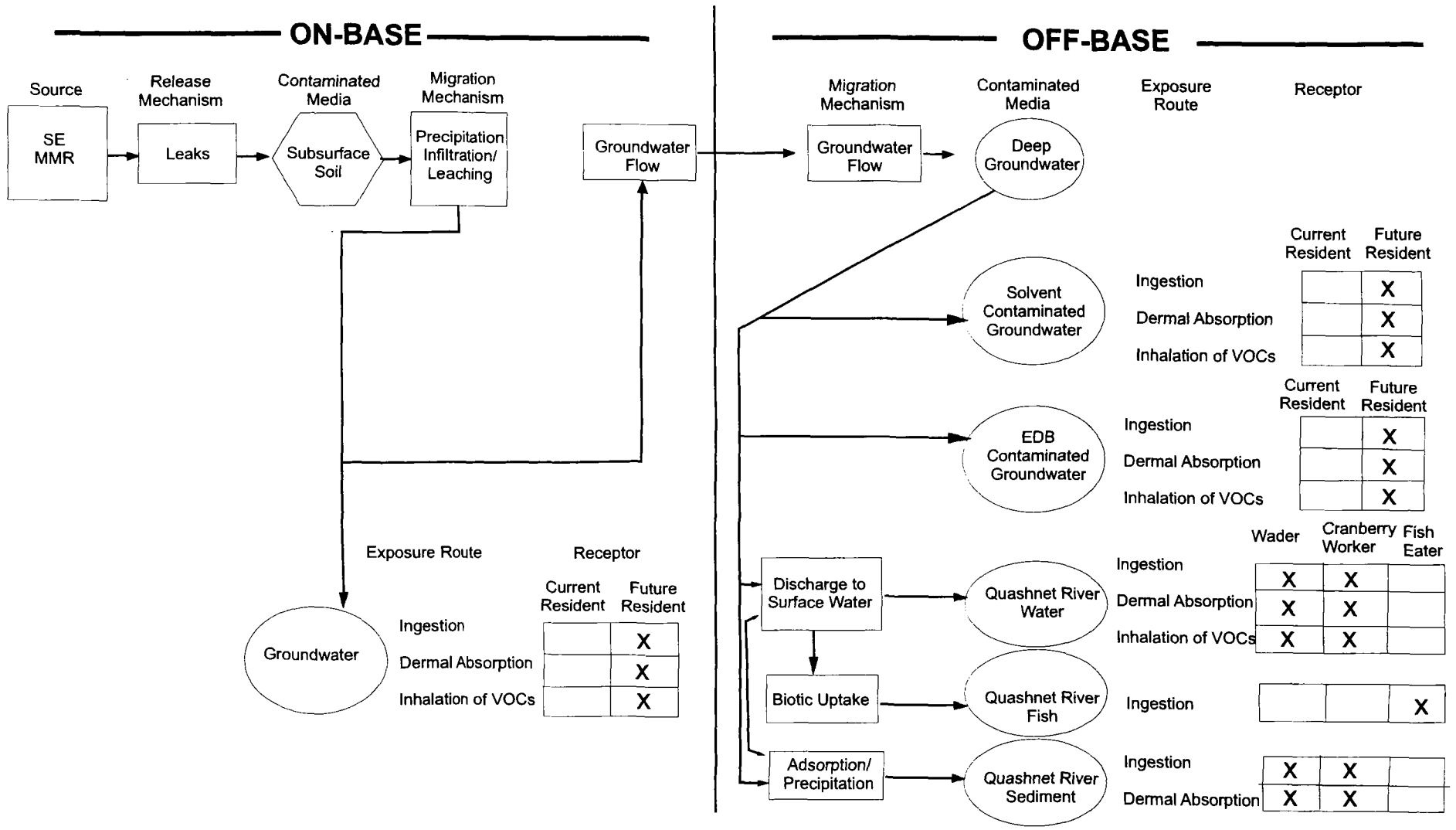

Legend

Transport Media

Exposure/Transport Media

Source, Release Mechanism, Migration Mechanism

EDB ethylene dibromide
VOC volatile organic compound

SE MMR - Southeast Massachusetts Military Reservation

JACOBS

Human Health
Conceptual Exposure Model
Eastern Briarwood

Massachusetts Military Reservation
Cape Cod, Massachusetts

10/6/05 JP: flow_EB2-8.cdr

Figure 2-8

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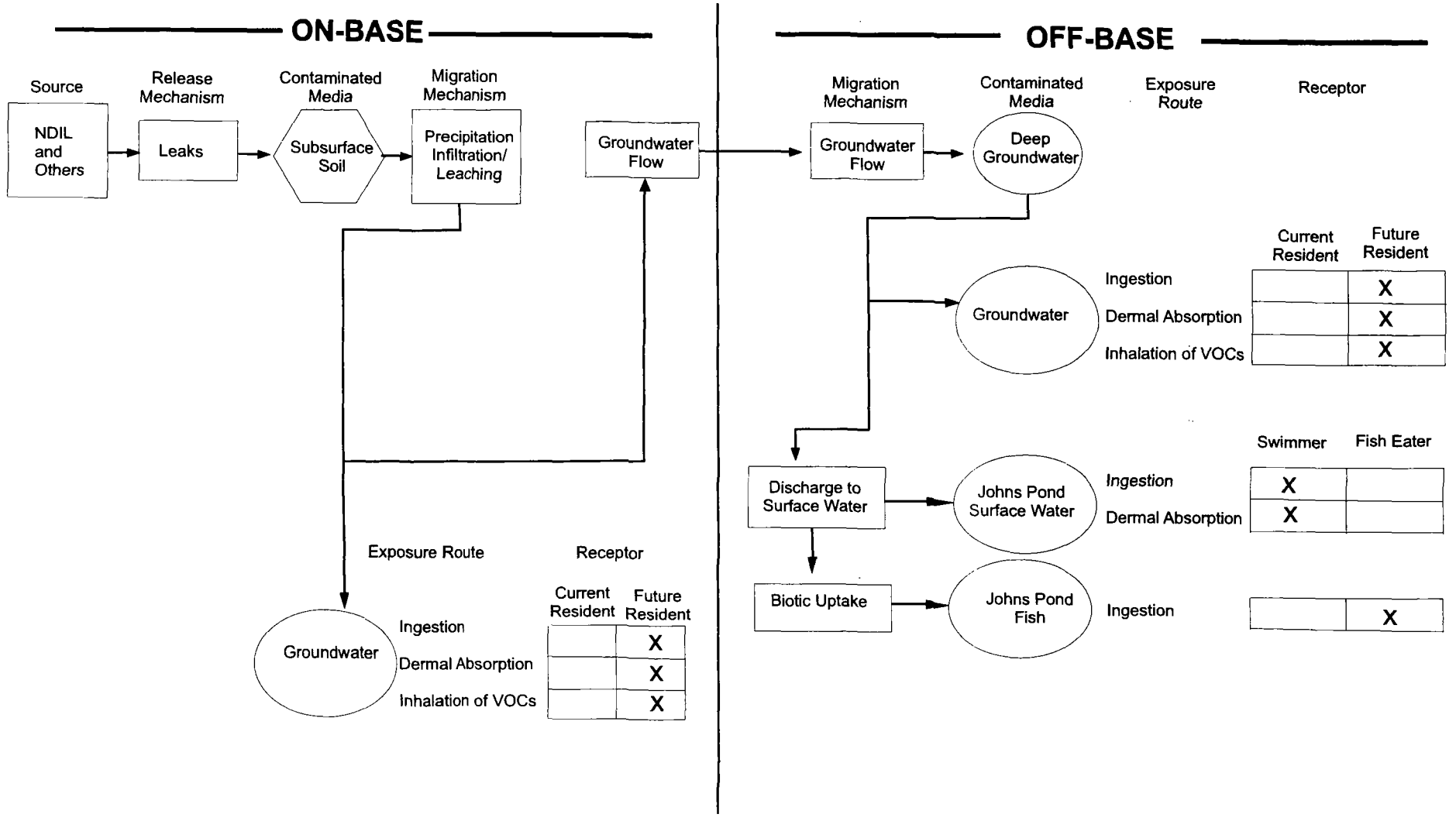

Legend

Transport Media

Exposure/Transport Media

Source, Release Mechanism, Migration Mechanism

VOC volatile organic compound

NDIL Non-Destructive Inspection Laboratory

JACOBS

Human Health
Conceptual Exposure Model
SD-5

Massachusetts Military Reservation
Cape Cod, Massachusetts

10/6/05 JP flow_SD5-2-9.cdr

Figure 2-9

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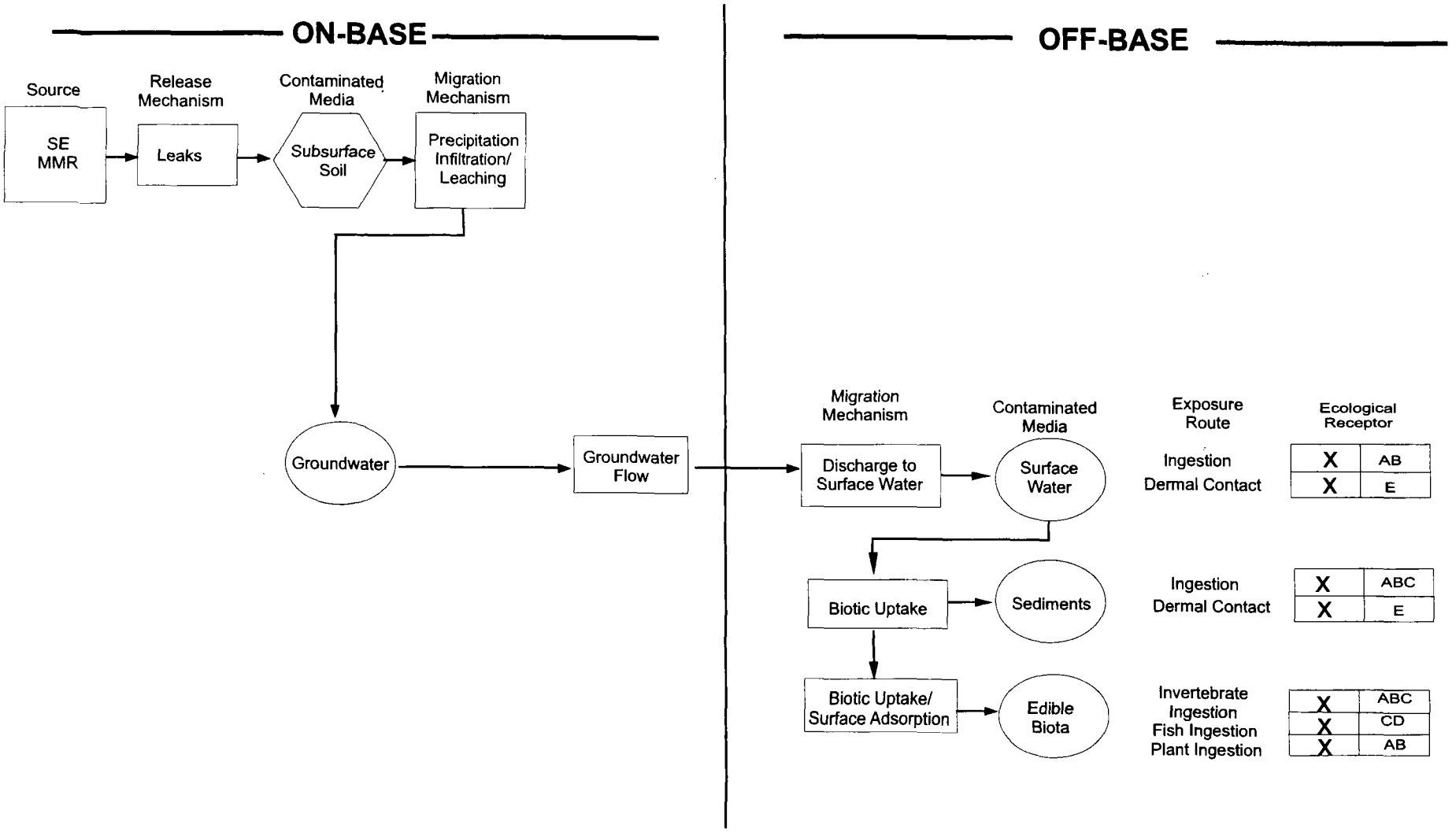

Legend

Transport Media

Exposure/Transport Media

Source, Release Mechanism, Migration Mechanism

RECEPTORS:
A. Eastern Box Turtle B. Racoon C. Blackcrowned Night Heron D. Osprey E. Fish, Invertebrates, Amphibians

JACOBS

Ecological
Conceptual Exposure Model
Eastern Briarwood

Massachusetts Military Reservation
Cape Cod, Massachusetts

10/6/05 JP: flow_EcoEB2-10.cdr

Figure 2-10

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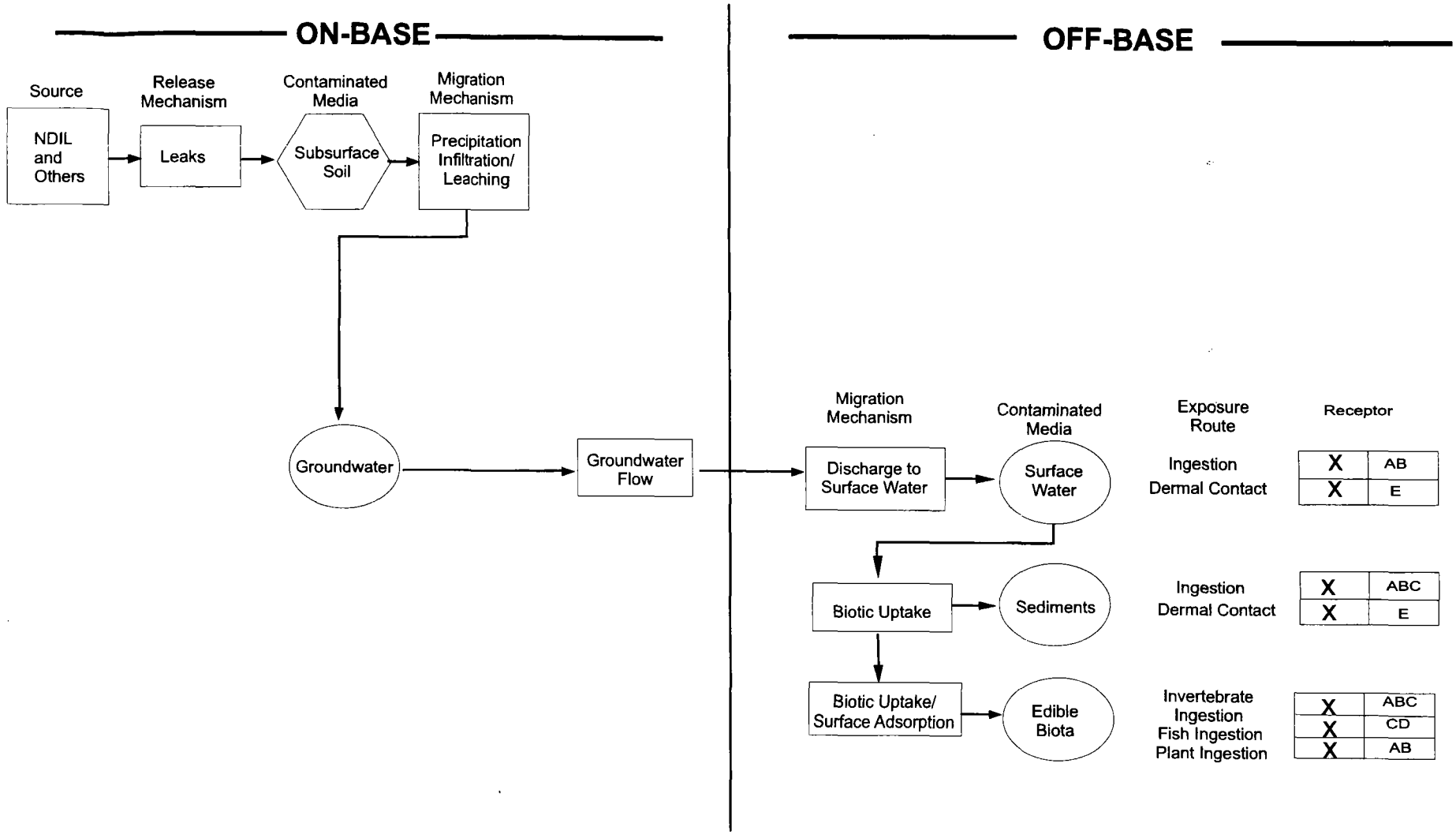

Legend

Transport Media

Exposure/Transport Media

Source, Release Mechanism, Migration Mechanism

RECEPTORS:
A. Eastern Box Turtle B. Racoon C. Blackcrowned Night Heron D. Osprey E. Fish, Invertebrates, Amphibians

JACOBS

Ecological
Conceptual Exposure Model
SD-5

Massachusetts Military Reservation
Cape Cod, Massachusetts

10/6/05 JP flow_EcoSD5-2-11.cdr

Figure 2-11

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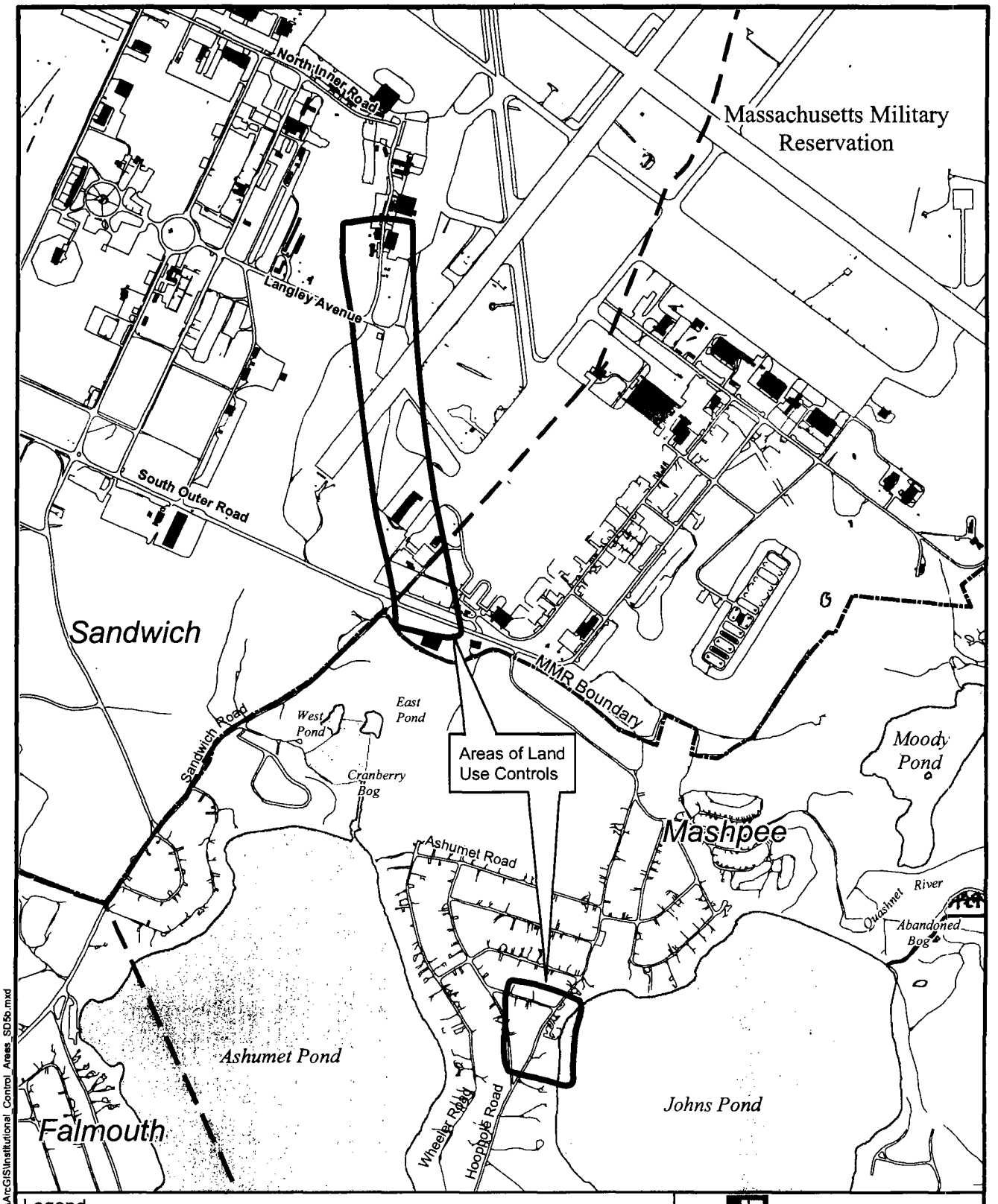

Legend

- Area of Land Use Controls
- MMR Boundary
- Town Property Boundary

N

0 625 1,250 Feet

Scale 1:15,000

JACOBS

Area of Land Use Controls for SD-5

Massachusetts Military Reservation
Cape Cod, Massachusetts

NAME jpcurto DATE 9/12/2006

Figure 2-12

Y:\GIS\projects\35Z048\02\20060912\ArcGIS\Institutional_Control_Areas_SD5b.mxd

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TABLES

Table 2-1
Occurrence, Distribution, and Selection of Chemicals of Potential Concern
Eastern Briarwood On-Base

Scenario Time Frame:	current/ future
Medium:	groundwater
Exposure Medium:	groundwater
Exposure Point:	Eastern Briarwood, On-base

CAS Number	Chemical	Minimum Concentration (1)	Minimum Qualifier	Maximum Concentration (1)	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening	Backgrou Val	Screening Toxicity Value (2)		Potential ARAR/TBC Value (3)	Potential Source	COPC Flag	Rationale for Contaminant Deletion or Selection (4)
67-64-1	Acetone	5.1	J	5.1	J	µg/L	00MW0567	1/2	0.28 - 2.8	5.1		61	N	3000	ORSG	NO	BSL
67-66-3	Chloroform	0.1	J	0.37	J	µg/L	00MW0567	5/25	0.08 - 0.336	0.37		0.62	N/C	80	MCL	NO	BSL
156-59-2	cis-1,2-Dichloroethene	0.25	J	0.25	J	µg/L	00MW0567	1/25	0.08 - 0.347	0.25		6.1	N	70	MCL	NO	BSL, IFD
127-18-4	Tetrachloroethene (PCE)	0.16	J	2.5	-	µg/L	98MW0001	12/25	0.11 - 0.75	2.5		0.66	C	5	MCL	YES	ASL
79-01-6	Trichloroethene (TCE)	0.19	J	1.7	-	µg/L	00MW0567	15/25	0.09 - 0.15	1.7		0.028	C	5	MCL	YES	ASL
7429-90-5	Aluminum (dissolved)	25.8	J	41	J	µg/L	00MW0531	3/4	21.1 - 65.8	41		3600	N	50 to 200	SMCL	NO	BSL
7429-90-5	Aluminum (total)	26.9	J	51.3	J	µg/L	00MW0531	2/10	21.1 - 63.4	51.3		3600	N	50 to 200	SMCL	NO	BSL
7440-39-3	Barium (dissolved)	25.5	-	70.8	-	µg/L	00MW0531	4/4	0.5 - 1.8	70.8		260	N	2000	MCL	NO	BSL
7440-39-3	Barium (total)	12	-	72.3	-	µg/L	00MW0531	10/10	0.3 - 2.5	72.3		260	N	2000	MCL	NO	BSL
7440-42-8	Boron (dissolved)	31.7	J	31.7	J	µg/L	00MW0531	1/1	12 - 12	31.7		730	N	NA	NA	NO	BSL
7440-42-8	Boron (total)	33.1	J	33.1	J	µg/L	00MW0531	1/1	12 - 12	33.1		730	N	NA	NA	NO	BSL
7440-70-2	Calcium (dissolved)	5680	J	10100	-	µg/L	00MW0530	4/4	68.6 - 68.6	10100		NA		NA	NA	NO	NUT, NSL
7440-70-2	Calcium (total)	2520	-	11800	-	µg/L	00MW0530	8/10	28.1 - 100	11800		NA		NA	NA	NO	NUT, NSL
7440-47-3	Chromium (total)	0.78	J	1.4	-	µg/L	98MW0001	3/10	0.67 - 2.5	1.4		11	N	100	MCL	NO	BSL
7440-48-4	Cobalt (dissolved)	4.1	J	4.5	J	µg/L	00MW0567	2/4	1.2 - 2.6	4.5		73	N	NA	NA	NO	BSL
7440-48-4	Cobalt (total)	7.1	-	8.1	-	µg/L	00MW0567	2/10	0.6 - 2.6	8.1		73	N	NA	NA	NO	BSL
7440-50-8	Copper (total)	2	J	2	J	µg/L	98MW0001	1/10	0.8 - 2.5	2		150	N	1000	SMCL	NO	BSL
7439-89-6	Iron (dissolved)	7.9	J	17	J	µg/L	00MW0530	3/4	7.3 - 27.8	17		1100	N	300	SMCL	NO	BSL, NUT
7439-89-6	Iron (total)	21.4	J	49.4	J	µg/L	98MW0002	3/10	7.3 - 38.5	49.4		1100	N	300	SMCL	NO	BSL, NUT
7439-92-1	Lead (total)	4.9	J	4.9	J	µg/L	00MW0567	1/10	1 - 2.5	4.9		NA		15	AL	NO	BAL
7439-95-4	Magnesium (dissolved)	1130	-	1810	-	µg/L	00MW0531	4/4	39.4 - 39.4	1810		NA		NA	NA	NO	NUT, NSL
7439-95-4	Magnesium (total)	588	-	1730	-	µg/L	00MW0531	10/10	21.8 - 100	1730		NA		NA	NA	NO	NUT, NSL
7439-96-5	Manganese (dissolved)	3.9	J	51.2	-	µg/L	00MW0531	4/4	0.3 - 1.3	51.2		88	N	50	SMCL	NO	BSL
7439-96-5	Manganese (total)	1.9	J	47.8	-	µg/L	00MW0531	9/10	0.3 - 1.3	47.8		88	N	50	SMCL	NO	BSL
7440-02-0	Nickel (total)	1.4	J	1.4	J	µg/L	98MW0002	1/10	1 - 5	1.4		73	N	100	ORSG	NO	BSL
7440-09-7	Potassium (dissolved)	1250	-	2190	-	µg/L	00MW0530	4/4	33.7 - 45.7	2190		NA		NA	NA	NO	NUT, NSL
7440-09-7	Potassium (total)	740	J	2250	-	µg/L	00MW0530	10/10	33.7 - 250	2250		NA		NA	NA	NO	NUT, NSL
7782-49-2	Selenium (dissolved)	1	J	1.7	-	µg/L	00MW0531	3/4	1 - 1	1.7		18	N	50	MCL	NO	BSL
7782-49-2	Selenium (total)	1.1	J	1.4	J	µg/L	00MW0531	2/10	1 - 2.7	1.4		18	N	50	MCL	NO	BSL
7440-21-3	Silicon (dissolved)	2910	J	3560	J	µg/L	00MW0567	4/4	7.8 - 7.9	3560		NA		NA	NA	NO	CC, NSL
7440-21-3	Silicon (total)	2860	J	3530	J	µg/L	00MW0567	4/4	7.8 - 7.9	3530		NA		NA	NA	NO	CC, NSL
7440-22-4	Silver (total)	0.81	J	0.81	J	µg/L	98MW0002	1/9	0.8 - 2.1	0.81		18	N	100	SMCL	NO	BSL
7440-23-5	Sodium (dissolved)	4330	-	33600	-	µg/L	00MW0531	4/4	28.4 - 37.8	33600		NA		NA	NA	NO	NUT, NSL
7440-23-5	Sodium (total)	4210	-	47500	-	µg/L	00MW0531	10/10	28.4 - 250	34100		NA		NA	NA	NO	NUT, NSL

Table 2-1
Occurrence, Distribution, and Selection of Chemicals of Potential Concern
Eastern Briarwood On-Base

Scenario Time Frame:	current/ future
Medium:	groundwater
Exposure Medium:	groundwater
Exposure Point:	Eastern Briarwood, On-base

CAS Number	Chemical	Minimum Concentration (1)	Minimum Qualifier	Maximum Concentration (1)	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening	Background Value (2)	Screening Toxicity Value (3)		Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for Contaminant Detection or Selection (4)
7440-28-0	Thallium (total)	5.3	J	5.3	J	µg/L	98MW0002	1/13	1.5 - 2.5	5.3		0.24	N	2	MCL	YES	ASL
7440-62-2	Vanadium (total)	1.1	J	1.1	J	µg/L	98MW0002	1/10	0.8 - 5	1.1		26	N	NA	NA	NO	BSL
7440-66-6	Zinc (dissolved)	5.2	-	26	-	µg/L	00MW0531	2/4	3.8 - 4.8	26		1100	N	5000	SMCL	NO	BSL
7440-66-6	Zinc (total)	7.7	-	8.7	-	µg/L	00MW0530	4/10	1.9 - 15.3	8.7		1100	N	5000	SMCL	NO	BSL

Data Source AFCEE, October 2002 and October 2003, AFCEE-MMR Data Warehouse

(1) Minimum/maximum detected concentration.

(2) N/A - Refer to *Final Risk Assessment for Eastern Briarwood and Western Aquafarm* (AFCEE, July 2005).

(3) N = one-tenth of the EPA Region IX PRG based on non-carcinogenic effects

N/C = one-tenth of the EPA Region IX PRG based on non-carcinogenic effects (also protective of carcinogenic effects)

C = EPA Region IX PRG based on carcinogenic effects (at a risk of 1E-06)

(4) Rationale Codes

Infrequent Detection but Associated Historically (HIST)
Frequent Detection (FD)
Common Cation (CC)
Above Screening Levels (ASL)
No Screening Level (NSL)
Background Levels (BKG)
Below Action Level (BAL)
Essential Nutrient (NUT)
Below Screening Level (BSL)

Definitions

AL = Action Level
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/To Be Considered
C = Carcinogenic
CAS = Chemical Abstracts Service
COPC = Chemical of Potential Concern
EPA = U.S. Environmental Protection Agency
J = Estimated Value
MCL = Federal Maximum Contaminant Level
N = Non-Carcinogenic
N/A = Not Applicable
NA = Not Available
ORSG = Office of Research and Standards Guidelines
PRG = Preliminary Remediation Goal
SMCL = Secondary Maximum Contaminant Level
µg/L = micrograms per liter

Table 2-2
Occurrence, Distribution, and Selection of Chemicals of Potential Concern
Eastern Briarwood Off-Base Solvent-Impacted Groundwater

Scenario Time Frame:	current/future
Medium:	groundwater
Exposure Medium:	groundwater
Exposure Point:	Eastern Briarwood, Off-base solvent affected area

CAS Number	Chemical	Minimum Concentration (1)	Minimum Qualifier	Maximum Concentration (1)	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening	Background Value	Screening Toxicity Value (2)		Potential ARAR/TBC Value	Potential ARAR/TBC Source	Tox Flag	Rationale for Contaminant Selection or Deletion
71-55-6	1,1,1-Trichloroethane	0.44	J	2.9	-	µg/L	00MW0562A	6/59	0.09 - 0.528	2.9		320	N	200	MCL	NO	BSL
75-34-3	1,1-Dichloroethane	0.36	J	0.36	J	µg/L	00MP0571A	1/59	0.07 - 0.156	0.36		81	N	NA	NA	NO	BSL, IFD
75-35-4	1,1-Dichloroethene	0.59	J	1.2	-	µg/L	00MW0562A	5/59	0.09 - 0.227	1.2		34	N	7	MCL	NO	BSL
71-43-2	Benzene	1.9	-	1.9	-	µg/L	00MW0562A	1/59	0.11 - 0.216	1.9		0.34	C	5	MCL	NO	IFD
75-15-0	Carbon Disulfide	0.12	J	0.12	J	µg/L	00MW0562A	1/38	0.08 - 0.11	0.12		100	N	NA	NA	NO	BSL, IFD
67-66-3	Chloroform	0.12	J	4.9	-	µg/L	00MW0544D	28/59	0.08 - 0.336	4.9		0.62	N/C	80	MCL	YES	ASL
156-59-2	cis-1,2-Dichloroethene	0.13	J	1	-	µg/L	00MW0569	8/59	0.08 - 0.347	1		6.1	N	70	MCL	NO	BSL
100-41-4	Ethylbenzene	1.1	-	1.1	-	µg/L	00MW0562A	1/59	0.1 - 0.193	1.1		2.9	C	700	MCL	NO	BSL, IFD
1634-04-4	Methyl (tert-butyl) ether (MTBE)	0.28	J	0.28	J	µg/L	00MP0571A	1/59	0.09 - 0.42	0.28		13	C	NA	NA	NO	BSL, IFD
127-18-4	Tetrachloroethene (PCE)	0.16	J	3.2	-	µg/L	00MW0542C	10/59	0.11 - 0.146	3.2		0.66	C	5	MCL	YES	ASL
108-88-3	Toluene	0.39	J	0.39	J	µg/L	00MW0562A	1/59	0.09 - 0.271	0.39		72	N	1000	MCL	NO	BSL, IFD
79-01-6	Trichloroethene (TCE)	0.15	J	4.5	-	µg/L	00MW0562A	25/59	0.09 - 0.15	4.5		0.028	C	5	MCL	YES	ASL
117-81-7	BEHP [Bis(2-ethylhexyl)phthalate]	2	J	2	J	µg/L	00MW0544A	1/15	1 - 2.73	2		4.8	C	6	MCL	NO	BSL
7429-90-5	Aluminum (dissolved)	27.6	J	568	-	µg/L	00MW0544D	5/8	21 - 23.9	568		3600	N	50 to 200	SMCL	NO	BSL
7429-90-5	Aluminum (total)	23.3	J	296	-	µg/L	00MW0544C	9/14	21.1 - 50	296		3600	N	50 to 200	SMCL	NO	BSL
7440-39-3	Barium (dissolved)	2.1	J	31.3	-	µg/L	00MW0544D	8/8	0.5 - 1.8	31.3		260	N	2000	MCL	NO	BSL
7440-39-3	Barium (total)	2.2	J	49.6	-	µg/L	00MW0539D	12/14	1.8 - 2.5	49.6		260	N	2000	MCL	NO	BSL
7440-43-9	Cadmium (total)	0.777	-	0.777	-	µg/L	00MW0561	1/14	0.2 - 1.3	0.777		1.8	N	5	MCL	NO	BSL
7440-70-2	Calcium (dissolved)	1090	-	5370	-	µg/L	00MW0561	8/8	21.4 - 68.6	5370		NA		NA	NA	NO	NUT, NSL
7440-70-2	Calcium (total)	1220	-	5550	-	µg/L	00MW0561	14/14	21.4 - 100	5550		NA		NA	NA	NO	NUT, NSL
7440-47-3	Chromium (dissolved)	1.4	J	5.1	-	µg/L	00MW0561	4/8	0.6 - 2.4	5.1		11	N	100	MCL	NO	BSL
7440-47-3	Chromium (total)	1.4	J	19.9	-	µg/L	00MW0544C	7/14	1.2 - 2.5	19.9		11	N	100	MCL	YES	ASL
7439-89-6	Iron (dissolved)	39.5	J	411	-	µg/L	00MW0544D	2/8	5.3 - 27.6	411		1100	N	300	SMCL	NO	NUT, BSL
7439-89-6	Iron (total)	21.8	J	664	J	µg/L	00MW0561	8/14	5.3 - 65.9	664		1100	N	300	SMCL	NO	NUT, BSL
7439-95-4	Magnesium (dissolved)	1470	-	5280	-	µg/L	00MW0561	8/8	39.4 - 59.1	5280		NA		NA	NA	NO	NUT, NSL
7439-95-4	Magnesium (total)	1850	-	5450	-	µg/L	00MW0561	14/14	39.4 - 100	5450		NA		NA	NA	NO	NUT, NSL
7439-96-5	Manganese (dissolved)	1.9	J	29.8	-	µg/L	00MW0544D	7/8	0.3 - 1.3	29.8		88	N	50	SMCL	NO	BSL
7439-96-5	Manganese (total)	1.9	J	44.8	-	µg/L	00MW0539D	12/14	1- 1.3	44.8		88	N	50	SMCL	NO	BSL
7439-97-6	Mercury (total)	0.3	J	0.3	J	µg/L	00MW0539B	1/14	0.1 - 0.1	0.3		1.1	N	2	MCL	NO	BSL
7440-02-0	Nickel (dissolved)	1.1	J	1.1	J	µg/L	00MW0544D	1/8	1 - 4.7	1.1		73	N	NA	NA	NO	BSL
7440-02-0	Nickel (total)	6.7	J	13.2	-	µg/L	00MW0544C	3/14	4.7 - 5	6.7		73	N	NA	NA	NO	BSL
7440-09-7	Potassium (dissolved)	583	J	1050	-	µg/L	00MW0561	6/8	33.7 - 494	1050		NA		NA	NA	NO	NUT, NSL
7440-09-7	Potassium (total)	559	J	1080	-	µg/L	00MW0561	14/14	33.7 - 250	1080		NA		NA	NA	NO	NUT, NSL

Table 2-2
Occurrence, Distribution, and Selection of Chemicals of Potential Concern
Eastern Briarwood Off-Base Solvent-Impacted Groundwater

Scenario Time Frame:	current/future
Medium:	groundwater
Exposure Medium:	groundwater
Exposure Point:	Eastern Briarwood, Off-base solvent affected area

CAS Number	Chemical	Minimum Concentration (1)	Minimum Qualifier	Maximum Concentration (1)	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening	Background Value (2)	Screening Toxicity Value (3)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for Contaminant Deletion or Selection (4)
7440-21-3	Silicon (dissolved)	3570	-	5830	-	µg/L	00MW0544A	7/7	7.8 - 7.9	5830		NA	NA	NA	NO	CC, NSL
7440-21-3	Silicon (total)	3650	-	5800	-	µg/L	00MW0544A	6/6	7.9 - 7.9	5800		NA	NA	NA	NO	CC, NSL
7440-23-5	Sodium (dissolved)	4040	J	9260	-	µg/L	00MW0544D	8/8	28.4 - 37.8	9260		NA	NA	NA	NO	NUT, NSL
7440-23-5	Sodium (total)	4060	J	18000	-	µg/L	00MW0539D	14/14	37.8 - 250	18000		NA	NA	NA	NO	NUT, NSL
7440-66-6	Zinc (dissolved)	12.5	J	12.5	-	µg/L	00MW0570A	1/8	3.7 - 4.5	12.5		1100 N	5000	SMCL	NO	BSL
7440-66-6	Zinc (total)	4.1	J	17.8	J	µg/L	00MW0561	3/14	3.8 - 5	17.8		1100 N	5000	SMCL	NO	BSL

Data Source: AFCEE, October 2002 and October 2003, AFCEE-MMR Data Warehouse.

(1) Minimum/maximum detected concentration.

(2) N/A - Refer to *Final Risk Assessment for Eastern Briarwood and Western Aquafarm* (AFCEE, July 2005).

(3) N = one-tenth of the EPA Region IX PRG based on non-carcinogenic effects
N/C = one-tenth of the EPA Region IX PRG based on non-carcinogenic effects (also protective of carcinogenic effects)
C = EPA Region IX PRG based on carcinogenic effects (at a risk of 1E-06)

(4) Rationale Codes:
Toxicity Information Available (TX)
Above Screening Levels (ASL)
Infrequent Detection (IFD)
Common Cation (CC)
No Screening Level (NSL)
Essential Nutrient (NUT)
Below Screening Level (BSL)

Definitions:
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/To Be Considered
C = Carcinogenic
CAS = Chemical Abstracts Service
COPC = Chemical of Potential Concern
EPA = U.S. Environmental Protection Agency
J = Estimated Value
MCL = Federal Maximum Contaminant Level
N = Non-Carcinogenic
N/A = Not Applicable
NA = Not Available
PRG = Preliminary Remediation Goal
SMCL = Secondary Maximum Contaminant Level
µg/L = micrograms per liter

Table 2-3
Occurrence, Distribution, and Selection of Chemicals of Potential Concern
Eastern Briarwood Off-Base EDB-Impacted Groundwater

Scenario Time Frame:	current/future
Medium:	groundwater
Exposure Medium:	groundwater
Exposure Point:	Eastern Briarwood, off-base in area affected by EDB

CAS Number	Chemical	Minimum Concentration (1)	Minimum Qualifier	Maximum Concentration (1)	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening	Background Value	Screening Toxicity Value (3)		Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for Contaminant Deletion or Selection (4)
106-93-4	1,2-Dibromoethane (EDB)	0.005	J	0 042	-	µg/L	MW212M01	40/102	0.0022 - 0.0054	0 042		0.00076	C	0.02	MMCL	YES	ASL
67-66-3	Chloroform	0.11	J	0.12	J	µg/L	00MW0573C	2/22	0.08 - 0.336	0.12		0 62	N/C	80	MCL	NO	BSL
74-87-3	Chloromethane	0.51	J	0 51	J	µg/L	00MW0577A	1/22	0.1 - 0.486	0.51		1 5	C	NA	NA	NO	BSL, IFD
79-01-6	Trichloroethene (TCE)	0.11	J	0.11	J	µg/L	00MW0573C	1/22	0.09 - 0.203	0.11		0.028	C	5	MCL	NO	IFD
7429-90-5	Aluminum (total)	164	-	164	-	µg/L	00MW0579B	1/5	50 - 50	164		3600	N	50 to 200	SMCL	NO	BSL
7440-39-3	Barium (total)	3.1	J	8.3	J	µg/L	00MW0573C	2/5	2.5 - 2.5	8.3		260	N	2000	MCL	NO	BSL
7440-70-2	Calcium (total)	3270	-	5510	-	µg/L	00MW0573B	5/5	100 - 100	5510		NA		NA	NA	NO	NUT, NSL
7440-47-3	Chromium (total)	2.8	J	7.1	J	µg/L	00MW0579B	2/5	2.5 - 2.5	7.1		11	N	100	MCL	NO	BSL
7440-48-4	Cobalt (total)	5.7	J	5.7	J	µg/L	00MW0579B	1/5	2.5 - 2.5	5.7		73	N	NA	NA	NO	BSL
7439-89-6	Iron (total)	195	-	3060	J	µg/L	00MW0579B	2/5	20 - 123	3060		1100	N	300	SMCL	NO	BSL, NUT
7439-95-4	Magnesium (total)	1670	-	3270	-	µg/L	00MW0573C	5/5	100 - 100	3270		NA		NA	NA	NO	NUT, NSL
7439-96-5	Manganese (total)	1.6	J	193	J	µg/L	00MW0579B	5/5	1 - 1	193		88	N	50	SMCL	YES	ASL
7440-09-7	Potassium (total)	735	J	1210	-	µg/L	00MW0573C	5/5	250 - 250	1210		NA		NA	NA	NO	NUT, NSL
7440-23-5	Sodium (total)	6770	-	9900	-	µg/L	00MW0573C	5/5	250 - 250	9900		NA		NA	NA	NO	NUT, NSL
7440-66-6	Zinc (total)	7.5	J	7.5	J	µg/L	00MW0579B	1/5	5 - 5	7.5		1100	N	5000	SMCL	NO	BSL

Data Source: AFCEE, October 2002 and October 2003, AFCEE-MMR Data Warehouse.

(1) Minimum/maximum detected concentration.

(2) N/A - Refer to *Final Risk Assessment for Eastern Briarwood and Western Aquafarm* (AFCEE, July 2005).

(3) C = EPA Region IX PRG based on carcinogenic effects (at a risk of 1E-06)
N/C = one-tenth of the EPA Region IX PRG based on non-carcinogenic effects (also protective of carcinogenic effects)
N = one-tenth of the EPA Region IX PRG based on non-carcinogenic effects

(4) Rationale Codes:
Above Screening Levels (ASL)
Below Screening Level (BSL)
Infrequent Detection (IFD)
No Screening Level (NSL)
Essential Nutrient (NUT)

Definitions:
ARAR/TBC = ' cable or Relevant and Appropriate Requirement/To Be Considered
C = Carcinog
CAS = Chemi Abstracts Service
COPC = Chem l of Potential Concern
EPA = U.S. En onmental Protection Agency
J = Estimated ue
MCL = Federa aximum Contaminant Level
N = Non-Carcin enic
N/A = Not App ble
NA = Not Avail e
PRG = Prelim y Remediation Goal
µg/L = microgr s per liter

Table 2-4
Occurrence, Distribution, and Selection of Chemicals of Potential Concern
Quashnet River Surface Water

Scenario Time Frame:	current/future
Medium:	surface water
Exposure Medium:	surface water
Exposure Point:	Quashnet River

CAS Number	Chemical	Minimum Concentration (1)	Minimum Qualifier	Maximum Concentration (1)	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening	Background Value (2)	Screening Toxicity Value (3)		Potential ARAR/BC Value	Potential ARAR/BC Source	ROC? (Y/N)	Rationale for Contaminant Selection (4)
67-64-1	Acetone	3	J	6	-	µg/L	ECRM104	3/6	3 - 4	6		61	N	3000	ORSG	NO	BSL
106-93-4	1,2-Dibromoethane (EDB)	0.007	J	0.007	J	µg/L	36SW0015	1/45	0.0022-0.0054	0.007		0.00076	C	0.02	MMCL	YES	ASL
75-09-2	Methylene Chloride	0.35	J	0.35	J	µg/L	00QSR0703	1/42	0.08 - 1	0.35		4.3	C	4.7	WQC	NO	BSL, IFD
1634-04-4	Methyl (tert-butyl) ether (MTBE)	0.37	J	2.24	-	µg/L	ECQSR06	9/21	0.09 - 0.42	2.24		13	C	70	ORSG	NO	BSL
108-88-3	Toluene	0.6	J	5	-	µg/L	ECRM103	2/42	0.09 - 0.5	5		72	N	1000	MCL	NO	BSL, IFD
106-44-5	4-methylphenol (p-cresol)	4	J	7	J	µg/L	ECRM103	2/21	1 - 1	7		18	N	NA	NA	NO	BSL
117-81-7	BEHP [Bis(2-ethylhexyl)phthalate]	1	J	4	J	µg/L	ECAB103	2/21	1 - 1	4		1.2	WQC	6	MCL	YES	ASL*
7429-90-5	Aluminum (dissolved)	209	-	4970	-	µg/L	ECRM103	6/25	19.3 - 67.1	4970		3600	N	50 to 200	SMCL	YES	ASL
7429-90-5	Aluminum (total)	54.5	J	22500	-	µg/L	ECRM104	12/49	5.8 - 95.9	22500		3600	N	50 to 200	SMCL	YES	ASL
7440-38-2	Arsenic (dissolved)	13.7	-	13.7	-	µg/L	ECRM104	1/25	1.8 - 2.12	13.7		0.018	WQC	10	MCL	NO	IFD
7440-38-2	Arsenic (total)	2.2	J	22.5	-	µg/L	ECAB104	6/49	1.8 - 4.4	22.5		0.018	WQC	10	MCL	YES	ASL*
7440-39-3	Barium (dissolved)	6.2	-	47.4	-	µg/L	ECRM103	17/25	0.1 - 11.3	47.4		260	N	1000	WQC	NO	BSL
7440-39-3	Barium (total)	4.2	J	204	-	µg/L	ECRM104	44/49	0.1 - 13.1	204		260	N	1000	WQC	NO	BSL
7440-41-7	Beryllium (dissolved)	0.17	J	0.17	J	µg/L	ECRM103	1/25	0.1 - 0.2	0.17		4	MCL	4	MCL	NO	BSL, IFD
7440-41-7	Beryllium (total)	0.47	J	2.6	-	µg/L	ECRM104	4/49	0.081 - 0.61	2.6		4	MCL	4	MCL	NO	BSL
7440-42-8	Boron (dissolved)	52.5	J	56.4	J	µg/L	ECQSR07	2/17	0.6 - 91.2	56.4		730	N	NA	NA	NO	BSL
7440-42-8	Boron (total)	19.9	J	66	J	µg/L	ECQSR06	4/17	0.6 - 53.8	66		730	N	NA	NA	NO	BSL
7440-43-9	Cadmium (dissolved)	0.24	J	0.24	J	µg/L	ECRM103	1/25	0.2 - 1.3	0.24		1.8	N	5	MCL	NO	BSL, IFD
7440-43-9	Cadmium (total)	0.35	J	0.35	J	µg/L	36SW0015	1/49	0.2 - 5.1	0.35		1.8	N	5	MCL	NO	BSL, IFD
7440-70-2	Calcium (dissolved)	505	-	3210	-	µg/L	ECAB102	25/25	8.2 - 68.6	3210		NA		NA	NA	NO	NUT, NSL
7440-70-2	Calcium (total)	470	J	4640	-	µg/L	36SW0015	49/49	8.2 - 71.9	4640		NA		NA	NA	NO	NUT, NSL
7440-47-3	Chromium (dissolved)	0.81	J	2.4	J	µg/L	ECRM103	3/25	0.3 - 1.2	2.4		11	N	100	MCL	NO	BSL
7440-47-3	Chromium (total)	0.37	J	19.5	-	µg/L	ECAB104	8/49	0.29 - 7.9	19.5		11	N	100	MCL	YES	ASL
7440-48-4	Cobalt (dissolved)	1.5	J	1.5	J	µg/L	ECRM103	1/25	0.31 - 2.6	1.5		73	N	NA	NA	NO	BSL, IFD
7440-48-4	Cobalt (total)	2.7	J	3.3	J	µg/L	ECRM104	2/49	0.3 - 12.6	3.3		73	N	NA	NA	NO	BSL
7440-50-8	Copper (dissolved)	0.68	J	9.5	-	µg/L	ECQSR05	5/25	0.6 - 6.5	9.5		150	N	1000	SMCL	NO	BSL
7440-50-8	Copper (total)	3	J	89.4	-	µg/L	ECAB104	8/49	0.6 - 11.3	89.4		150	N	1000	SMCL	NO	BSL
7439-89-6	Iron (dissolved)	8.1	J	3640	J	µg/L	ECRM104	19/25	5.3 - 12.3	3640		300	WQC	300	SMCL	NO	NUT
7439-89-6	Iron (total)	9.8	J	310000	J	µg/L	ECAB104	36/49	5.3 - 137	310000		300	WQC	300	SMCL	NO	NUT
7439-92-1	Lead (dissolved)	1	J	51	-	µg/L	ECRM103	4/25	1 - 5	51		NA		15	AL	YES	AAL
7439-92-1	Lead (total)	1.7	J	157	J	µg/L	ECAB104	9/49	0.08 - 10.2	157		NA		15	AL	YES	AAL
7439-95-4	Magnesium (dissolved)	591	-	2680	-	µg/L	ECAB102	25/25	6.9 - 59.1	2680		NA		NA	NA	NO	NUT, NSL
7439-95-4	Magnesium (total)	606	-	4760	-	µg/L	ECAB104	49/49	5.2 - 72.8	4760		NA		NA	NA	NO	NUT, NSL
7439-96-5	Manganese (dissolved)	1.8	J	91.5	-	µg/L	ECAB105	17/25	0.3 - 5.6	91.5		50	WQC	50	SMCL	YES	ASL*
7439-96-5	Manganese (total)	2.1	J	418	-	µg/L	ECAB104	43/49	0.18 - 17	418		50	WQC	50	SMCL	YES	ASL*
7439-97-6	Mercury (total)	0.23	-	0.23	-	µg/L	ECRM104	1/49	0.012 - 0.5	0.23		0.05	WQC	2	MCL	NO	IFD
7440-02-0	Nickel (dissolved)	0.82	J	3.4	J	µg/L	ECRM103	6/25	0.7 - 4.7	3.4		73	N	610	WQC	NO	BSL

Table 2-4
Occurrence, Distribution, and Selection of Chemicals of Potential Concern
Quashnet River Surface Water

Scenario Time Frame:	current/future
Medium:	surface water
Exposure Medium:	surface water
Exposure Point:	Quashnet River

CAS Number	Chemical	Minimum Concentration (1)	Minimum Qualifier	Maximum Concentration (1)	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening	Background Val	Screening Toxicity Value (2)	(3)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for Contaminant Deletion or Selection (4)
7440-02-0	Nickel (total)	0.72	J	10	-	µg/L	ECRM104	11/49	0.7 - 4.7	10		73	N	610	WQC	NO	BSL
7440-09-7	Potassium (dissolved)	882	-	4000	J	µg/L	ECAB101	12/25	10.1 - 1340	4000		NA		NA	NA	NO	NUT, NSL
7440-09-7	Potassium (total)	687	J	4260	-	µg/L	ECAB101	37/49	10.1 - 1020	4260		NA		NA	NA	NO	NUT, NSL
7782-49-2	Selenium (dissolved)	2.4	J	2.4	J	µg/L	ECAB101	1/25	1 - 2	2.4		18	N	50	MCL	NO	BSL, IFD
7782-49-2	Selenium (total)	1.1	J	9.9	-	µg/L	ECRM104	5/49	1 - 4.1	9.9		18	N	50	MCL	NO	BSL
7440-21-3	Silicon (dissolved)	498	-	4260	-	µg/L	ECRM101	13/13	7.8 - 7.9	4260		NA		NA	NA	NO	CC, NSL
7440-21-3	Silicon (total)	508	-	4760	-	µg/L	ECRM101	13/13	7.8 - 7.9	4760		NA		NA	NA	NO	CC, NSL
7440-23-5	Sodium (dissolved)	3400	-	845000	J	µg/L	ECAB101	25/25	28.4 - 131	845000		NA		NA	NA	NO	NUT, NSL
7440-23-5	Sodium (total)	3920	-	859000	J	µg/L	ECAB101	49/49	28.4 - 597	859000		NA		NA	NA	NO	NUT, NSL
7440-62-2	Vanadium (dissolved)	0.95	J	12	-	µg/L	ECRM103	7/25	0.5 - 4.4	12		26	N	NA	NA	NO	BSL
7440-62-2	Vanadium (total)	0.85	J	76.9	-	µg/L	ECAB104	13/49	0.5 - 4.4	76.9		26	N	NA	NA	YES	ASL
7440-66-6	Zinc (dissolved)	2.9	J	29.2	-	µg/L	ECRM103	8/25	0.2 - 18.2	29.2		1100	N	5000	SMCL	NO	BSL
7440-66-6	Zinc (total)	1.1	J	83.8	J	µg/L	ECAB104	17/49	0.2 - 24.8	83.8		1100	N	5000	SMCL	NO	BSL

Data Source: AFCEE, 04 through 22 October 2002, AFCEE-MMR Data Warehouse.

(1) Minimum/maximum detected concentration.

(2) N/A - Refer to *Final Risk Assessment for Eastern Briarwood and Western Aquafarm* (AFCEE, July 2005).

(3) N = one-tenth of the EPA Region IX PRG based on non-carcinogenic effects
C = EPA Region IX PRG based on carcinogenic effects (at a risk of 1E-06)
WQC = EPA Water Qualtiy Criteria for protection of human health due to ingestion of water and organisms
MCL = EPA Maximum Contaminant Level

(4) Rationale Codes:
- Above Screening Levels (ASL)
- Above Screening Levels (ASL*) where the screening level is the Water Quality Criteria
- Infrequent Detection (IFD)
- Essential Nutrient (NUT)
- Below Screening Level (BSL)
- No Screening Level (NSL)
- Above Action Level (AAL)
- Common Cation (CC)

Definitions:
- ARAR/TBC = Applicable or Relevant and Appropriate Requirement/To Be Considered
- C = Carcinogenic
- CAS = Chemical Abstracts Service
- COPC = Chemical of Potential Concern
- EPA = U.S. Environmental Protection Agency
- J = Estimated Value
- MCL = Federal Maximum Contaminant Level
- MMCL = Massachusetts Maximum Contaminant Level
- N = Non-Carcinogenic
- N/A = Not Applicable
- NA = Not Available
- PRG = Preliminary Remediation Goal
- ORSG = Office of Research and Standards Guidelines
- SMCL = Secondary Maximum Contaminant Level
- WQC = Water Quality Criteria for protection of human health due to ingestion of water and organisms
- µg/L = micrograms per liter

Table 2-5
Occurrence, Distribution and Selection of Chemicals of Potential Concern
Quashnet River Sediment

Scenario Time Frame:	current/future
Medium:	sediment
Exposure Medium:	sediment
Exposure Point:	Quashnet River

CAS Number	Chemical	(1) Minimum Concentration	Minimum Qualifier	(1) Maximum Concentration	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening	(2) Background Value	(3) Screening Toxicity Value		Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	(4) Rationale for Contaminant Deletion or Selection
67-64-1	Acetone	10	J	30	J	µg/kg	ECAB101	5/30	3 - 36	30		160000	N	NA	NA	NO	BSL
78-93-3	Methyl Ethyl Ketone (2-Butanone)	3	J	9	J	µg/kg	ECAB101	4/30	3 - 18	9		730000	N	NA	NA	NO	BSL
75-09-2	Methylene Chloride	1	J	3	J	µg/kg	ECRM101	9/30	0.3 - 18	3		9100	C	NA	NA	NO	BSL
108-88-3	Toluene	1	J	41	-	µg/kg	ECRM103	4/29	0.3 - 18	41		66000	N	NA	NA	NO	BSL
106-44-5	4-methylphenol (p-cresol)	49	J	140	J	µg/kg	ECAB104	2/29	33 - 121	140		31000	N	NA	NA	NO	BSL
117-81-7	BEHP [Bis(2-ethylhexyl)phthalate]	49	J	2800	-	µg/kg	ECAB102	10/29	33 - 123	2800		35000	C	NA	NA	NO	BSL
84-66-2	diethyl phthalate	55	J	55	J	µg/kg	ECAB102	1/29	33 - 79.6	55		4900000	N	NA	NA	NO	BSL, IFD
7429-90-5	Aluminum	156	-	3300	-	mg/kg	ECAB105	29/29	1.14 - 32.1	3300		7600	N	NA	NA	NO	BSL
7440-38-2	Arsenic	1.5	J	4	-	mg/kg	ECAB104	8/29	0.289 - 5.8	4		0.39	C	NA	NA	YES	ASL
7440-39-3	Barium	0.49	J	44.6	-	mg/kg	ECAB105	27/29	0.0161 - 4	44.6		540	N	NA	NA	NO	BSL
7440-41-7	Beryllium	0.06	J	0.8	-	mg/kg	ECAB101	13/29	0.0225 - 0.275	0.8		15	N	NA	NA	NO	BSL
7440-43-9	Cadmium	0.05	J	1.1	J	mg/kg	ECAB105	2/29	0.048 - 3.5	1.1		3.7	N	NA	NA	NO	BSL
7440-70-2	Calcium	22	J	2810	-	mg/kg	ECAB101	25/29	1.88 - 37.3	2810		NA		NA	NA	NO	NUT, NSL
7440-47-3	Chromium	0.32	J	1.1	J	mg/kg	ECRM101	6/29	0.641 - 6.4	1.1		22	N	NA	NA	NO	BSL
7440-48-4	Cobalt	1.2	J	1.5	J	mg/kg	ECQSR05	3/29	0.0482 - 4.6	1.5		140	N	NA	NA	NO	BSL
7440-50-8	Copper	0.244	J	33.5	-	mg/kg	ECAB105	17/29	0.112 - 8.1	33.5		310	N	NA	NA	NO	BSL
7439-89-6	Iron	85.1	-	2430		mg/kg	ECQSR05	29/29	1.03 - 7.1	2430		2300	N	NA	NA	NO	NUT
7439-92-1	Lead	0.88	J	69.3	-	mg/kg	ECAB101	26/29	0.209 - 4.2	69.3		400	N*	NA	NA	NO	BSL
7439-95-4	Magnesium	33.7	J	763		mg/kg	ECAB101	25/29	1.11 - 181	763		NA		NA	NA	NO	NUT, NSL
7439-96-5	Manganese	0.54	J	86.1	-	mg/kg	ECAB105	27/29	0.0643 - 2	86.1		180	N	NA	NA	NO	BSL
7440-02-0	Nickel	0.38	J	0.38	J	mg/kg	ECRM104	1/29	0.112 - 11.6	0.38		160	N	NA	NA	NO	BSL, IFD
7440-09-7	Potassium	209	J	209	J	mg/kg	ECRM101	1/29	7.3 - 702	209		NA		NA	NA	NO	IFD, NUT, NSL
7782-49-2	Selenium	1.6	J	3.6	-	mg/kg	ECAB101	2/29	0.305 - 5.5	3.6		39	N	NA	NA	NO	BSL
7440-21-3	Silicon	77.4	-	1530	-	mg/kg	ECAB105	13/13	22.2 - 40.2	1530		NA		NA	NA	NO	CC, NSL
7440-22-4	Silver	0.4	J	4.3	J	mg/kg	ECAB101	3/29	0.0321 - 2.8	4.3		39	N	NA	NA	NO	BSL
7440-23-5	Sodium	44.8	J	263	J	mg/kg	ECRM101	2/29	21 - 948	263		NA		NA	NA	NO	NUT, NSL
7440-62-2	Vanadium	0.26	J	36.1	-	mg/kg	ECAB101	20/29	0.0859 - 4.8	36.1		55	N	NA	NA	NO	BSL
7440-66-6	Zinc	1.5	J	24.7	J	mg/kg	ECAB102	22/29	0.0321 - 6.8	24.7		2300	N	NA	NA	NO	BSL

Data Source: AFCEE, 07 October 2002, AFCEE-MMR Data Warehouse.

(1) Minimum/maximum detected concentration.

(2) N/A - Refer to *Final Risk Assessment for Eastern Briarwood and Western Aquafarm* (AFCEE, July 2005).

(3) N = one-tenth of EPA Region IX PRG based on non-carcinogenic effects
C = EPA Region IX PRG based on carcinogenic effects (at a risk of 1E-06)
N* = unadjusted EPA Region IX PRG for lead per EPA Region I

(4) Rationale Codes Above Screening Levels (ASL)
Infrequent Detection (IFD)
Essential Nutrient (NUT)
Below Screening Level (BSL)
No Screening Level (NSL)
Common Cation (CC)

Definitions: ARAR/TBC = Applicable or Relevant and Appropriate Requirement/To Be Considered
C = Carcinogenic
CAS = Chemical Abstracts Service
COPC = Chemical of Potential Concern
EPA = U.S. Environmental Protection Agency
J = Estimated Value
mg/kg = milligrams per kilogram
N = Non-Carcinogenic
N/A = Not Applicable
NA = Not Available
PRG = Preliminary Remediation Goal
µg/kg = micrograms per kilogram

Table 2-6
Occurrence, Distribution, and Selection of Chemicals of Potential Concern
Western Aquafarm

Scenario Time Frame	current/future
Medium:	groundwater
Exposure Medium:	groundwater
Exposure Point:	Western Aquafarm

CAS Number	Chemical	(1) Minimum Concentration	Minimum Qualifier	(1) Maximum Concentration	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening	Backg V.	(2) d	(3) Screening Toxicity Value		Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	(4) Rationale for Contaminant Deletion or Selection
71-43-2	Benzene	1.2	J	1.2	J	µg/L	28MW0573	1/36	0.11 - 0.216	1 2			0 34	C	5	MCL	NO	IFD
74-83-9	Bromomethane	0.66	J	7.9	J	µg/L	39MW0002	2/36	0.15 - 15	7 9			0 87	N	10	ORSG	YES	ASL
67-66-3	Chloroform	0 36	J	0 36	J	µg/L	00MW0514C	1/36	0.08 - 8	0.36			0.62	N/C	80	MCL	NO	BSL, IFD
74-87-3	Chloromethane	0.51	J	4.6	J	µg/L	39MW0002	2/36	0.1 - 10	4.6			1 5	C	NA	NA	YES	ASL
100-41-4	Ethylbenzene	0.33	J	820	-	µg/L	39MW0002	7/36	0.1 - 18	820			2.9	C	700	MCL	YES	ASL
	M,P-Xylene (Sum of Isomers)	870	-	1530	-	µg/L	39MW0002	2/13	0.525 - 5.25	1530			21	N	10000	MCL	YES	ASL
95-47-6	O-Xylene (1,2-Dimethylbenzene)	323	-	509	-	µg/L	39MW0002	2/13	0.142 - 1.42	509			21	N	10000	MCL	YES	ASL
127-18-4	Tetrachloroethene (PCE)	0.19	J	0 31	J	µg/L	39MW0002	5/36	0 11 - 11	0.31			0.66	C	5	MCL	NO	BSL
108-88-3	Toluene	0.47	J	51	J	µg/L	39MW0002	7/36	0.09 - 9	51			72	N	1000	MCL	NO	BSL
79-01-6	Trichloroethene (TCE)	0.54	J	0.81	J	µg/L	39MW0004	2/36	0.09 - 9	0.81			0.028	C	5	MCL	YES	ASL
1330-20-7	Xylenes, total	0.45	J	4700	-	µg/L	39MW0002	6/23	0 11 - 47	4700			21	N	10000	MCL	YES	ASL
91-57-6	2-Methylnaphthalene *	13	-	27.5	-	µg/L	39MW0002	2/8	1 - 2.65	27.5			0.62	N	140	ORSG	YES	ASL
117-81-7	BEHP [Bis(2-ethylhexyl)phthalate]	1	J	1	J	µg/L	28MW0575	1/8	1 - 3	1			4.8	C	6	MCL	NO	BSL
91-20-3	Naphthalene	26	-	176	-	µg/L	39MW0002	2/8	1 - 13	176			0.62	N	140	ORSG	YES	ASL
7429-90-5	Aluminum (dissolved)	54.2	J	71.9	J	µg/L	39MW0005A	2/7	21.1 - 53.3	71.9			3600	N	50 to 200	SMCL	NO	BSL
7429-90-5	Aluminum (total)	59.7	J	59.7	J	µg/L	39MW0005A	1/11	21.1 - 50	59.7			3600	N	50 to 200	SMCL	NO	BSL
7440-38-2	Arsenic (dissolved)	3.1	-	8 5	-	µg/L	28MW0575	2/7	1 - 2	8.5			0.045	C	10	MCL	YES	ASL
7440-38-2	Arsenic (total)	2.4	-	14.9	-	µg/L	39MW0002	4/11	1 - 2	14.9			0.045	C	10	MCL	YES	ASL
7440-39-3	Barium (dissolved)	8.8	-	54 8	-	µg/L	28MW0022	7/7	0.1 - 1 8	78.3			260	N	2000	MCL	NO	BSL
7440-39-3	Barium (total)	5.1	-	53.5	-	µg/L	28MW0022	11/11	0 1 - 2.5	75.4			260	N	2000	MCL	NO	BSL
7440-70-2	Calcium (dissolved)	2160	-	56700	-	µg/L	39MW0005A	7/7	8.2 - 68 6	56700			NA		NA	NA	NO	NUT, NSL
7440-70-2	Calcium (total)	1810	-	55400	-	µg/L	39MW0005A	11/11	8.2 - 100	55400			NA		NA	NA	NO	NUT, NSL
7440-47-3	Chromium (dissolved)	0.45	J	10 1	-	µg/L	28MW0022	2/7	0.3 - 1.2	10.1			11	N	100	MCL	NO	BSL
7440-47-3	Chromium (total)	1.11	J	10.4	-	µg/L	28MW0022	2/11	0 3 - 2.5	10.4			11	N	100	MCL	NO	BSL
7440-48-4	Cobalt (dissolved)	6.3	-	6.3	-	µg/L	28MW0575	1/7	0.3 - 2 6	6.3			73	N	NA	NA	NO	BSL
7440-48-4	Cobalt (total)	2.9	J	7 6	-	µg/L	28MW0575	3/11	0.3 - 2.6	7.6			73	N	NA	NA	NO	BSL
7440-50-8	Copper (dissolved)	7.7	-	7.7	-	µg/L	28MW0575	1/7	0.7 - 1.7	7.7			150	N	1000	SMCL	NO	BSL
7440-50-8	Copper (total)	2	J	2	J	µg/L	00MW0527	1/11	0.7 - 3.4	2			150	N	1000	SMCL	NO	BSL
7439-89-6	Iron (dissolved)	20.3	J	26900	-	µg/L	28MW0575	4/7	5.3 - 7.3	26900			1100	N	300	SMCL	NO	NUT
7439-89-6	Iron (total)	41.9	-	39200	-	µg/L	39MW0002	7/11	5.3 - 20	39200			1100	N	300	SMCL	NO	NUT
7439-92-1	Lead (dissolved)	25.3	J	25 3	J	µg/L	28MW0023	1/7	1 - 2	25.3			NA		15	AL	YES	AAL
7439-92-1	Lead (total)	5 2	-	35.4	-	µg/L	28MW0023	3/11	1 - 4	35.4			NA		15	AL	YES	AAL
7439-95-4	Magnesium (dissolved)	1060	-	3760	J	µg/L	00MW0527	7/7	6.9 - 59.1	3760			NA		NA	NA	NO	NUT, NSL
7439-95-4	Magnesium (total)	942	-	4220	-	µg/L	00MW0527	11/11	6 9 - 100	4220			NA		NA	NA	NO	NUT, NSL

Table 2-6
Occurrence, Distribution, and Selection of Chemicals of Potential Concern
Western Aquafarm

Scenario Time Frame:	current/future
Medium:	groundwater
Exposure Medium:	groundwater
Exposure Point:	Western Aquafarm

CAS Number	Chemical	(1) Minimum Concentration	Minimum Qualifier	(1) Maximum Concentration	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening	(2) Background Value	(3) Screening Toxicity Value		Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	(4) Rationale for Contaminant Deletion or Selection
7439-96-5	Manganese (dissolved)	4.8	J	1140	-	µg/L	28MW0575	6/7	1.3 - 6.08	1190		88	N	50	SMCL	YES	ASL
7439-96-5	Manganese (total)	1.5	J	1140	-	µg/L	28MW0575	9/11	1 - 6.01	1140		88	N	50	SMCL	YES	ASL
7440-02-0	Nickel (dissolved)	1.6	J	1.6	J	µg/L	00MW0527	1/7	0.7 - 4.7	1.6		73	N	NA	NA	NO	BSL
7440-02-0	Nickel (total)	0.87	J	0.87	J	µg/L	00MW0527	1/11	0.7 - 5	1.71		73	N	NA	NA	NO	BSL
7440-09-7	Potassium (dissolved)	563	J	2570	-	µg/L	28MW0022	6/7	10.1 - 814	2570		NA		NA	NA	NO	NUT, NSL
7440-09-7	Potassium (total)	466	J	2440	-	µg/L	28MW0022	11/11	10 1 - 250	2360		NA		NA	NA	NO	NUT, NSL
7440-21-3	Silicon (dissolved)	3600	-	4900	J	µg/L	28MW0023	5/5	7.9 - 7 9	4900		NA		NA	NA	NO	CC, NSL
7440-21-3	Silicon (total)	3590	-	5050	J	µg/L	28MW0023	5/5	7.9 - 7.9	5050		NA		NA	NA	NO	CC, NSL
7440-23-5	Sodium (dissolved)	4320	-	7890	-	µg/L	39MW0005A	7/7	37.8 - 131	24600		NA		NA	NA	NO	NUT, NSL
7440-23-5	Sodium (total)	4250	-	7420	-	µg/L	39MW0005A	11/11	37.8 - 131	23400		NA		NA	NA	NO	NUT, NSL
7440-66-6	Zinc (dissolved)	2.58	J	10.5	J	µg/L	00MW0527	3/7	0.2 - 3.8	12.3		1100	N	5000	SMCL	NO	BSL
7440-66-6	Zinc (total)	2.24	J	10.2	J	µg/L	39MW0002	3/11	0.2 - 5	11		1100	N	5000	SMCL	NO	BSL

Data Source. AFCEE, October 2002 and October 2003, AFCEE-MMR Data Warehouse.

* Used naphthalene as a surrogate for 2-methylnaphthalene

(1) Minimum/maximum detected concentration.

(2) N/A - Refer to *Final Risk Assessment for Eastern Briarwood and Western Aquafarm* (AFCEE, July 2005)

(3) N = one-tenth of EPA Region IX PRG based on non-carcinogenic effects
C = EPA Region IX PRG based on carcinogenic effects (at a risk of 1E-06)
N/C = one-tenth of the EPA Region IX PRG based on non-carcinogenic effects (also protective of carcinogenic effects)

(4) Rationale Codes:
Above Screening Levels (ASL)
Infrequent Detection (IFD)
Essential Nutrient (NUT) (Ca, Fe, Mg, K, Na)
Below Screening Level (BSL)
No Screening Level (NSL)
Common Cation (CC)
Above Action Level (AAL)

Definitions:
AL = Action Level
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/To Be Considered
C = Carcinogenic
CAS = Chemical Abstracts Service
COPC = Chemical of Potential Concern
EPA = U.S. Environmental Protection Agency
J = Estimated Value
MCL = Federal Maximum Contaminant Level
N = Non-Carcinogenic
N/A = Not Applicable
NA = Not Available
ORSG = Office of Research and Standards Guidelines
PRG = Preliminary Remediation Goal
SMCL = Secondary Maximum Contaminant Level
µg/L = micrograms per liter

Table 2-7
Occurrence, Distribution, and Selection of Chemicals of Potential Concern
SD-5 On-Base

Scenario Time Frame:	current/ future
Medium:	groundwater
Exposure Medium:	groundwater
Exposure Point:	SD-5, On-base

CAS Number	Chemical	Minimum Concentration (1)	Minimum Qualifier	Maximum Concentration (1)	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening	Backgro Val	(2)	Screening Toxicity Value (3)		Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for Contaminant Deletion or Selection (4)
71-55-6	1,1,1-Trichloroethane	0.2	J	0.2	J	µg/L	28MW1124A	1/63	0.13 - 0.528	0.2			200	MCL	200	MCL	NO	BSL, IFD
107-06-2	1,2-Dichloroethane	1.1	-	1.1	-	µg/L	28MW0606B	1/63	0.12 - 0.382	1.1			0.12	C	5	MCL	NO	IFD
71-43-2	Benzene	0.2	J	0.2	J	µg/L	28MW0596	1/63	0.12 - 0.216	0.2			0.34	C	5	MCL	NO	BSL, IFD
56-23-5	Carbon Tetrachloride	0.13	J	0.13	J	µg/L	28MW0018A	1/63	0.11 - 0.618	0.13			0.17	C	5	MCL	NO	BSL, IFD
67-66-3	Chloroform	0.34	J	0.79	J	µg/L	28MW0018A	5/63	0.11 - 0.336	0.79			0.62	N/C	80	MCL	YES	ASL
74-87-3	Chloromethane	0.48	J	0.48	J	µg/L	28MW0605B	1/62	0.32 - 0.486	0.48			1.5	C	NA	NA	NO	BSL, IFD
156-59-2	cis-1,2-Dichloroethene	0.23	J	1.3	-	µg/L	28MW0605B	7/63	0.14 - 0.347	1.3			6.1	N	70	MCL	NO	BSL
100-41-4	Ethylbenzene	2.4	-	2.4	-	µg/L	28MW0596	1/63	0.178 - 0.18	2.4			2.9	C	700	MCL	NO	BSL, IFD
127-18-4	Tetrachloroethene (PCE)	0.22	J	4.21	-	µg/L	28MW0009	35/63	0.13 - 0.25	4.21			0.66	C	5	MCL	YES	ASL
108-88-3	Toluene	0.15	J	0.77	J	µg/L	28MW0580	3/63	0.12 - 0.185	0.77			72	N	1000	MCL	NO	BSL, IFD
79-01-6	Trichloroethene (TCE)	0.15	J	27.6	-	µg/L	28MW0004	32/63	0.138 - 0.15	27.6			0.028	C	5	MCL	YES	ASL
1330-20-7	Xylenes (total)	0.64	J	2.1	-	µg/L	28MW0596	2/16	0.47 - 0.47	2.1			21	N	10000	MCL	NO	BSL
117-84-0	Di-n-Octylphthalate	1	J	1	J	µg/L	28MW0006	1/3	1 - 1	1			150	N	NA	NA	NO	BSL
7440-39-3	Barium (total)	5.5	J	37.5	J	µg/L	28MW0574	24/24	0.2 - 0.27	37.5			260	N	2000	MCL	NO	BSL
7440-43-9	Cadmium (total)	0.92	J	0.92	J	µg/L	28MW0597B	1/24	0.18 - 0.3	0.92			1.8	N	5	MCL	NO	BSL, IFD
7440-70-2	Calcium (total)	1650	J	8360	-	µg/L	28MW0018A	24/24	7.7 - 46.6	8360			NA		NA	NA	NO	NUT, NSL
7440-47-3	Chromium (total)	0.73	J	2.1	J	µg/L	28MW0018A	4/24	0.55 - 2.5	2.1			11	N	100	MCL	NO	BSL
7440-48-4	Cobalt (total)	0.68	J	5.9	-	µg/L	28MW0018B	7/24	0.53 - 3.2	5.9			73	N	NA	NA	NO	BSL
7440-50-8	Copper (total)	1.9	J	1.9	J	µg/L	28MW0597A	1/24	0.76 - 1	1.9			150	N	1000	SMCL	NO	BSL, IFD
7439-89-6	Iron (total)	27.1	J	27.1	J	µg/L	28MW0018A	1/24	12.7 - 71.5	27.1			1100	N	300	SMCL	NO	NUT
7439-92-1	Lead (total)	1.7	J	2.8	J	µg/L	28MW0580	3/24	1.1 - 1.7	2.8			NA		15	AL	NO	BAL
7439-95-4	Magnesium (total)	257	J	3680	J	µg/L	28MW0018A	24/24	6.5 - 43.7	3680			NA		NA	NA	NO	NUT, NSL
7439-96-5	Manganese (total)	2.9	J	63.5	-	µg/L	28MW0597A	18/24	0.21 - 4.7	63.5			88	N	50	SMCL	NO	BSL
7439-97-6	Mercury (total)	0.051	J	0.073	J	µg/L	28MW0597A	3/24	0.05 - 0.1	0.073			1.1	N	2	MCL	NO	BSL
7440-02-0	Nickel (total)	1.4	J	4.5	J	µg/L	28MW0597A	3/24	1.2 - 1.8	4.5			73	N	100	ORSG	NO	BSL
7440-09-7	Potassium (total)	649	J	1760	J	µg/L	28MW0597C	22/24	26.5 - 763	1760			NA		NA	NA	NO	NUT,NSL
7440-23-5	Sodium (total)	2070	-	9580	-	µg/L	28MW0018A	24/24	115 - 597	9580			NA		NA	NA	NO	NUT,NSL
7440-28-0	Thallium (total)	2.7	J	6.2	J	µg/L	28MW0577B	6/24	1.3 - 4.5	6.2			0.24	N	2	MCL	YES	ASL
7440-66-6	Zinc (total)	3.5	J	3.5	J	µg/L	28MW0598A	1/24	0.33 - 21	3.5			1100	N	5000	SMCL	NO	BSL,IFD

Data Source: AFCEE, 16 through 18 December 2002, AFCEE-MMR Data Warehouse.

Table 2-7
Occurrence, Distribution, and Selection of Chemicals of Potential Concern
SD-5 On-Base

(1) Minimum/maximum detected concentration.

(2) N/A - Refer to *Final Risk Assessment for Eastern Briarwood and Western Aquafarm* (AFCEE, July 2005).

(3) MCL = maximum contaminant level

N = one-tenth of the EPA Region IX PRG based on non-carcinogenic effects

N/C = one-tenth of the EPA Region IX PRG based on non-carcinogenic effects (also protective of carcinogenic effects)

C = EPA Region IX PRG based on carcinogenic effects (at a risk of 1E-06)

(4) Rationale Codes:

Infrequent Detection but Associated Historically (HIST)

Frequent Detection (FD)

Common Cation (CC)

Above Screening Levels (ASL)

No Screening Level (NSL)

Background Levels (BKG)

Below Action Levels (BAL)

Essential Nutrient (NUT)

Below Screening Level (BSL)

Definitions:

AL = Action Level

ARAR/TBC = Applicable or Relevant and Appropriate Requirement/To Be Considered

C = Carcinogenic

CAS = Chemical Abstracts Service

COPC = Chemical of Potential Concern

EPA = U.S. Environmental Protection Agency

J = Estimated Value

MCL = Federal Maximum Contaminant Level

N = Non-Carcinogenic

N/A = Not Applicable

NA = Not Available

ORSG = Office of Research and Standards Guidelines

PRG = Preliminary Remediation Goal

SMCL = Secondary Maximum Contaminant Level

µg/L = micrograms per liter

Table 2-8
Occurrence, Distribution, and Selection of Chemicals of Potential Concern
SD-5 Off-Base

Scenario Time Frame:	current/ future
Medium:	groundwater
Exposure Medium:	groundwater
Exposure Point:	SD-5, Off-base

CAS Number	Chemical	Minimum (1) Concentration	Minimum Qualifier	Maximum (1) Concentration	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening	Background Value	(2) Screening Toxicity Value	(3)	Potential ARAR/TBC Value	Potential Applicable ARAR/TBC	Carcinogen Flag	(4) Rationale for Contaminant Selection
67-64-1	Acetone	3.4	J	3.4	J	µg/L	28MW1132B	1/6	0.71 - 2.8	3.4		61	N	3000	ORSG	NO	BSL
71-43-2	Benzene	0.86	J	0.86	J	µg/L	00MW0590	1/149	0.11 - 0.22	0.86		0.34	C	5	MCL	NO	IFD
75-27-4	Bromodichloromethane	0.27	J	0.27	J	µg/L	00MW0528B	1/149	0.07 - 0.494	0.27		0.18	C	80	MCL	NO	IFD
56-23-5	Carbon Tetrachloride	0.13	J	0.15	J	µg/L	28MW1132B	3/149	0.08 - 0.618	0.15		0.17	C	5	MCL	NO	BSL, IFD
67-66-3	Chloroform	0.11	J	2.29	-	µg/L	00MW0523C	21/149	0.034 - 0.336	2.29		0.62	N/C	80	MCL	YES	ASL
74-87-3	Chloromethane	0.53	J	0.53	J	µg/L	00MW0524A	1/149	0.1 - 0.486	0.53		1.5	C	NA	NA	NO	BSL, IFD
124-48-1	Dibromochloromethane	0.12	J	0.12	J	µg/L	00MW0548B	1/149	0.09 - 0.366	0.12		0.13	C	80	MCL	NO	BSL, IFD
156-59-2	cis-1,2-Dichloroethene	0.1	J	1.6	-	µg/L	28MW0033B	32/149	0.08 - 0.347	1.6		6.1	N	70	MCL	NO	BSL
106-06-2	1,2-Dichloroethane	1	-	1.8	-	µg/L	00MW0524A	4/149	0.09 - 0.382	1.8		0.12	C	5	MCL	NO	IFD
106-93-4	Ethylene Dibromide	0.006	J	0.019	-	µg/L	28MW0037A	12/69	0.002 - 0.005	0.019		0.00076	C	0.02	MMCL	YES	ASL
1634-04-4	Tert-butyl methyl ether	0.22	J	0.45	J	µg/L	00MW0549	5/149	0.09 - 0.42	0.45		13	C	70	ORSG	NO	BSL
127-18-4	Tetrachloroethene (PCE)	0.12	J	3.75	-	µg/L	28MW1132B	57/149	0.11 - 0.22	3.75		0.66	C	5	MCL	YES	ASL
79-01-6	Trichloroethene (TCE)	0.15	J	34	J	µg/L	28MW0035B	81/149	0.09 - 0.75	34		0.028	C	5	MCL	YES	ASL
7429-90-5	Aluminum (dissolved)	21.5	J	188	-	µg/L	28MW0034A	8/32	14.2 - 98	188		3600	N	50 to 200	SMCL	NO	BSL
7429-90-5	Aluminum (total)	20.5	J	421	-	µg/L	00MW0524B	5/32	14.3 - 177	421		3600	N	50 to 200	SMCL	NO	BSL
744-38-2	Arsenic (dissolved)	2.4	J	2.4	J	µg/L	28MW0033C	1/32	1.3 - 2.3	2.4		0.045	C	10	MCL	NO	IFD
744-38-2	Arsenic (total)	1.73	J	1.73	J	µg/L	ECMWEAP01	1/32	1.3 - 1.8	1.73		0.045	C	10	MCL	NO	IFD
7440-39-3	Barium (dissolved)	1.79	J	78.3	J	µg/L	ECMWEAP02	31/32	0.1 - 5.5	78.3		260	N	2000	MCL	NO	BSL
7440-39-3	Barium (total)	1.84	J	75.4	-	µg/L	ECMWEAP02	32/32	0.1 - 3	75.4		260	N	2000	MCL	NO	BSL
7440-42-8	Boron (dissolved)	39.1	J	208	-	µg/L	00MW0524E	7/26	0.7 - 85.2	208		730	N	NA	NA	NO	BSL
7440-42-8	Boron (total)	38.8	J	350	-	µg/L	00MW0524B	17/32	0.7 - 84	350		730	N	NA	NA	NO	BSL
7440-43-9	Cadmium (dissolved)	0.47	J	0.47	J	µg/L	ECMWEAP02	1/32	0.2 - 0.4	0.47		1.8	N	5	MCL	NO	BSL, IFD
7440-43-9	Cadmium (total)	0.21	J	0.21	J	µg/L	00MW0526Z	1/332	0.18 - 0.4	0.21		1.8	N	5	MCL	NO	BSL, IFD
7440-70-2	Calcium (dissolved)	353	J	31900	-	µg/L	28MW0037A	32/32	8.2 - 28.7	31900		NA		NA	NA	NO	NUT, NSL
7440-70-2	Calcium (total)	359	J	39600	-	µg/L	00MW0524A	32/32	8.2 - 28.7	39600		NA		NA	NA	NO	NUT, NSL
7440-47-3	Chromium (dissolved)	0.36	J	1.05	J	µg/L	00MW0526B	6/32	0.3 - 1.8	1.05		11	N	100	MCL	NO	BSL
7440-47-3	Chromium (total)	0.7	J	3.32	J	µg/L	00MW0526B	11/32	0.3 - 1.8	3.32		11	N	100	MCL	NO	BSL
7440-48-4	Cobalt (dissolved)	1	J	8.6	J	µg/L	28MW0032B	10/32	0.3 - 1.7	8.6		73	N	NA	NA	NO	BSL
7440-48-4	Cobalt (total)	0.33	J	2.84	J	µg/L	91MW0522Y	2/32	0.3 - 2.2	2.84		73	N	NA	NA	NO	BSL
7440-50-8	Copper (dissolved)	0.62	J	27	J	µg/L	28MW0032C	3/32	0.5 - 4.5	27		150	N	1000	SMCL	NO	BSL
7439-89-6	Iron (dissolved)	26.4	J	3300	-	µg/L	28MW0033A	19/62	6.4 - 93.4	3300		1100	N	300	SMCL	NO	NUT
7439-89-6	Iron (total)	124	-	1440	-	µg/L	00MW0524D	4/31	10 - 128	1440		1100	N	300	SMCL	NO	NUT
7439-92-1	Lead (dissolved)	1.9	J	8.6	J	µg/L	00MW0526A	4/56	1 - 7.46	8.6		NA		15	AL	NO	BAL
7439-92-1	Lead (total)	104	J	4.51	-	µg/L	00MW0526Z	2/32	0.6 - 1.87	4.51		NA		15	AL	NO	BAL
7439-95-4	Magnesium (dissolved)	455	J	5910	-	µg/L	28MW035B	32/32	6.9 - 28.6	5910		NA		NA	NA	NO	NUT, NSL
7439-95-4	Magnesium (total)	475	J	4630	-	µg/L	00MW0526Z	32/32	6.9 - 28.6	4630		NA		NA	NA	NO	NUT, NSL
7439-96-5	Manganese (dissolved)	1.4	J	1190	-	µg/L	ECMWEAP02	47/61	0.33 - 5.98	1190		88	N	50	SMCL	YES	ASL
7439-96-5	Manganese (total)	0.94	J	1140	-	µg/L	ECMWEAP02	16/32	0.4 - 5.25	1140		88	N	50	SMCL	YES	ASL

Table 2-8
Occurrence, Distribution, and Selection of Chemicals of Potential Concern
SD-5 Off-Base

Scenario Time Frame:	current/ future
Medium:	groundwater
Exposure Medium:	groundwater
Exposure Point:	SD-5, Off-base

CAS Number	Chemical	Minimum Concentration (1)	Minimum Qualifier	Maximum Concentration (1)	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening	Background Value (2)	Screening Toxicity Value (3)		Potential ARAR/TBC Value	Rationale for Selection	COPC Flag	Rationale for Contaminant Deletion (4)
7440-02-0	Nickel (dissolved)	0.8	J	14.1	J	µg/L	28MW0034A	20/32	0.7 - 2.08	14.1		73	N	100	ORSG	NO	BSL
7440-02-0	Nickel (total)	1.01	J	2.8	J	µg/L	00MW0524E	11/32	0.7 - 3.26	2.8		73	N	100	ORSG	NO	BSL
7440-09-7	Potassium (dissolved)	648	J	5920	-	µg/L	28MW0035B	26/32	10.1 - 1650	5920		NA		NA	NA	NO	NUT, NSL
7440-09-7	Potassium (total)	660	J	2410	-	µg/L	00MW0524E	28/32	10.1 - 1910	2410		NA		NA	NA	NO	NUT, NSL
7782-49-2	Selenium (total)	1.41	J	1.41	J	µg/L	ECMWEAP02	1/32	1.4 - 2.1	1.41		18	N	50	MCL	NO	BSL
7440-21-3	Silicon (dissolved)	3380	-	8470	-	µg/L	00MW0524D	5/5	30.8 - 30.8	8470		NA		NA	NA	NO	CC, NSL
7440-23-5	Sodium (dissolved)	3590	-	23300	-	µg/L	ECMWEAP01	32/32	22.9 - 205	23300		NA		NA	NA	NO	NUT, NSL
7440-23-5	Sodium (total)	3230	-	23400	-	µg/L	ECMWEAP01	32/32	23.9 - 296	23400		NA		NA	NA	NO	NUT, NSL
7440-62-2	Vanadium (dissolved)	0.67	J	1.4	J	µg/L	00MW0524A	2/32	0.5 - 10.5	1.4		26	N	NA	NA	NO	BSL
7440-62-2	Vanadium (total)	0.71	J	1.5	J	µg/L	00MW0524B	4/32	0.5 - 2.27	1.5		26	N	NA	NA	NO	BSL
7440-66-6	Zinc (dissolved)	0.97	J	20	-	µg/L	00MW0524A	10/32	0.2 - 34.6	20		1100	N	5000	SMCL	NO	BSL
7440-66-6	Zinc (total)	0.26	J	19.4	-	µg/L	00MW0524A	8/32	0.2 - 0.8	19.4		1100	N	5000	SMCL	NO	BSL

Data Source: AFCEE, 18 December 2002, AFCEE-MMR Data Warehouse.

(1) Minimum/maximum detected concentration.

(2) N/A - Refer to *Final Risk Assessment for Eastern Briarwood and Western Aquafarm* (AFCEE, July 2005).

(3) N = one-tenth of the EPA Region IX PRG based on non-carcinogenic effects
N/C = one-tenth of the EPA Region IX PRG based on non-carcinogenic effects (also protective of carcinogenic effects)
C = EPA Region IX PRG based on carcinogenic effects (at a risk of 1E-06)

(4) Rationale Codes:
Infrequent Detection but Associated Historically (HIST)
Frequent Detection (FD)
Common Cation (CC)
Above Screening Levels (ASL)
No Screening Level (NSL)
Background Levels (BKG)
Below Action Levels (BAL)
Essential Nutrient (NUT)
Below Screening Level (BSL)

Definitions:
AL = Action Level
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/To Be Considered
C = Carcinogenic
CAS = Chemical Abstracts Service
COPC = Chemical of Potential Concern
EPA = U.S. Environmental Protection Agency
J = Estimated Value
MCL = Federal Maximum Contaminant Level
N = Non-Carcinogenic
N/A = Not Applicable
NA = Not Available
ORSG = Office of Research and Standards Guidelines
PRG = Preliminary Remediation Goal
SMCL = Secondary Maximum Contaminant Level
µg/L = micrograms per liter

Table 2-9
Occurrence, Distribution, and Selection of Chemicals of Potential Concern
SD-5 Surface Water

Scenario Time Frame:	current/ future
Medium	surface water
Exposure Medium:	surface water
Exposure Point:	SD-5, surface water Johns Pond

CAS Number	Chemical	Minimum (1) Concentration	Minimum Qualifier	Maximum (1) Concentration	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening	Backgr Valu	(2)	Screening Toxicity Value	(3)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for Contaminant Deletion or Selection (4)
75-15-0	Carbon disulfide	0.34	J	0.34	J	µg/L	28JNP0101	1/10	0.11 - 0.11	0.34			100	N	NA	NA	NO	BSL
1634-04-4	Tert-butyl methyl ether	2.37	-	3.6	-	µg/L	28JNP0102	11/31	0.18 - 0.42	3.6			13	C	70	ORSG	NO	BSL
108-88-3	Toluene	0.13	J	0.58	J	µg/L	28JNP0102	5/31	0.12 - 0.185	0.58			72	N	1000	MCL	NO	BSL
7440-39-3	Barium (dissolved)	8.17	J	10.9	J	µg/L	ECJNP06	5/5	0.1 - 0.3	10.9			260	N	1000	WQC	NO	BSL
7440-39-3	Barium (total)	8.59	J	10.8	J	µg/L	ECJNP06	5/5	0.1 - 0.3	10.8			260	N	1000	WQC	NO	BSL
7440-42-8	Boron (dissolved)	47.2	J	49.1	J	µg/L	ECJNP08	2/5	0.6 - 56.2	49.1			730	N	NA	NA	NO	BSL
7440-42-8	Boron (total)	58.8	-	73.7	-	µg/L	ECJNP08	3/5	0.6 - 43.8	73.7			730	N	NA	NA	NO	BSL
7440-70-2	Calcium (dissolved)	2260	-	2480	J	µg/L	ECJNP06	5/5	8.2 - 28.7	2480			NA		NA	NA	NO	NUT, NSL
7440-70-2	Calcium (total)	2190	-	2490	-	µg/L	ECJNP07	5/5	8.2 - 28.7	2490			NA		NA	NA	NO	NUT, NSL
7439-89-6	Iron (total)	42.7	J	42.7	J	µg/L	ECJNP07	1/5	16.1 - 24.3	42.7			300	WQC	300	SMCL	NO	BSL
7439-95-4	Magnesium (dissolved)	1800	-	1920	J	µg/L	ECJNP06	5/5	6.9 - 28.6	1920			NA		NA	NA	NO	NUT, NSL
7439-95-4	Magnesium (total)	1770	-	1920	-	µg/L	ECJNP07	5/5	6.9 - 28.6	1920			NA		NA	NA	NO	NUT, NSL
7439-96-5	Manganese (dissolved)	2.3	J	7	J	µg/L	ECJNP06	2/5	0.4 - 1.1	7			50	WQC	50	SMCL	NO	BSL
7439-96-5	Manganese (total)	9.86	J	39.5	-	µg/L	ECJNP07	5/5	0.4 - 0.6	39.5			50	WQC	50	SMCL	NO	BSL
7440-09-7	Potassium (dissolved)	959	-	1040	-	µg/L	ECJNP08	5/5	10.1 - 20.6	1040			NA		NA	NA	NO	NUT, NSL
7440-09-7	Potassium (total)	932	-	1060	-	µg/L	ECJNP08	5/5	10.1 - 20.6	1060			NA		NA	NA	NO	NUT, NSL
7440-21-3	Silicon (dissolved)	248	-	248	-	µg/L	ECJNP08	1/1	7.4 - 7.4	248			NA		NA	NA	NO	CC, NSL
7440-23-5	Sodium (dissolved)	8230	-	8730	-	µg/L	ECJNP06	5/5	131 - 205	8730			NA		NA	NA	NO	NUT, NSL
7440-23-5	Sodium (total)	7960	J	8610	-	µg/L	ECJNP07	5/5	131 - 205	8610			NA		NA	NA	NO	NUT, NSL
7440-66-6	Zinc (dissolved)	0.74	J	2.89	J	µg/L	ECJNP08	4/5	0.2 - 0.4	2.89			1100	N	5000	SMCL	NO	BSL
7440-66-6	Zinc (total)	0.45	J	14.6	J	µg/L	ECJNP06	1/5	0.2 - 3.27	14.6			1100	N	5000	SMCL	NO	BSL

Data Source: AFCEE, 12 December 2002, AFCEE-MMR Data Warehouse.

(1) Minimum/maximum detected concentration.

(2) N/A - Refer to *Final Risk Assessment for Eastern Briarwood and Western Aquafarm* (AFCEE, July 2005).

(3) N = one-tenth of the EPA Region IX PRG based on non-carcinogenic effects
C = EPA Region IX PRG based on carcinogenic effects (at a risk of 1E-06)
WQC = EPA Water Qualtiy Criteria for protection of human health due to ingestion of water and organisms

(4) Rationale Codes.
Infrequent Detection but Associated Historically (HIST)
Frequent Detection (FD)
Common Cation (CC)
Above Screening Levels (ASL)
No Screening Level (NSL)
Background Levels (BKG)
Below Action Levels (BAL)
Essential Nutrient (NUT)
Below Screening Level (BSL)

Definitions:
AL = Action l l
ARAR/TBC = plicable or Relevant and Appropriate Requirement/To Be Considered
C = Carcino c
CAS = Chen Abstracts Service
COPC = Chr al of Potential Concern
EPA = U.S. vonmental Protection Service
J = Estimate lue
MCL = Fede laximum Contaminant Level
N = Non-Car genic
N/A = Not A able
NA = Not Av le
ORSG = Off f Research and Standards Guidelines
PRG = Prelir ry Remediation Goal
SMCL = Sec lary Maximum Contaminant Level
µg/L = micro ns per liter

Table 2-10
Exposure Point Concentrations
Eastern Briarwood On-Base Groundwater

Scenario Time Frame: Future
Medium: Groundwater
Exposure Medium: Groundwater
Exposure Point: Eastern Briarwood, on-base

Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL of Data	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Reasonable Maximum Exposure (RME EPC)			Central Tendency (CT EPC)		
							Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale	Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale
Volatile Organic Compounds												
Tetrachloroethene (PCE)	µg/L	0.41	N/A	2.50		µg/L	2.50	Max	Reg Guide (2)	0.41	Mean-N	SW-Test (1)
Trichloroethene (TCE)	µg/L	0.58	N/A	1.70		µg/L	1.70	Max	Reg Guide (2)	0.58	Mean-N	SW-Test (1)
Metals												
Thallium (Total)	µg/L	1.28	N/A	5.30	J	µg/L	5.30	Max	Reg Guide (2)	1.28	Mean-N	SW-Test (1)

Notes:
EPC = exposure point concentration
J = estimated value
N/A = not applicable
UCL = upper confidence limit
µg/L = micrograms per liter

For non-detects, 1/2 sample detection limit was used as a proxy concentration in the calculation of means and UCLs.
Statistics: Maximum Detected Value (Max), arithmetic mean of normally distributed data (Mean-N).

(1) Shapiro-Wilk W test indicates that data are neither normally nor log-normally distributed so arithmetic mean (Mean-N) used by default.
(2) Regulators advise to use maximum value for RME EPC for groundwater.

Table 2-11
Exposure Point Concentrations
Eastern Briarwood Off-Base Solvent-Impacted Groundwate

Scenario Time Frame: Future
Medium: Groundwater
Exposure Medium: Groundwater
Exposure Point: Eastern Briarwood, off-base solvent area

Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL of Data	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Reasonable Maxim (RME E		Exposure	Central Tendency (CTE EPC)		
							Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale	Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale
Volatile Organic Compounds												
Chloroform	µg/L	0.33	N/A	4.90		µg/L	4.90	Max	Reg Guide (3)	0.33	Mean-N	SF-Test (1)
Tetrachloroethene (PCE)	µg/L	0.23	N/A	3.20		µg/L	3.20	Max	Reg Guide (3)	0.23	Mean-N	SF-Test (1)
Trichloroethene (TCE)	µg/L	0.65	N/A	4.50		µg/L	4.50	Max	Reg Guide (3)	0.65	Mean-N	SF-Test (1)
Metals												
Chromium (total)	µg/L	3.94	N/A	20.00		µg/L	20.00	Max	Reg Guide (3)	3.94	Mean-N	SW-Test (2)

Notes:
EPC = exposure point concentration
N/A = not applicable
UCL = upper confidence limit
µg/L = micrograms per liter

For non-detects, 1/2 sample detection limit was used as a proxy concentration in the calculation of means and UCLs.
Statistics: Maximum Detected Value (Max), arithmetic mean of normally distributed data (Mean-N).

(1) Shapiro-Francia test indicates samples are normally distributed.
(2) Shapiro-Wilk W test indicates that data are neither normally nor log-normally distributed so arithmetic mean (Mean-N) used by default.
(3) Regulators advise to use maximum value for RME EPC for groundwater.

Table 2-12
Exposure Point Concentrations
Eastern Briarwood Off-Base EDB-Impacted Groundwater

Scenario Time Frame: Future
Medium: Groundwater
Exposure Medium: Groundwater
Exposure Point: Eastern Briarwood, off-base in EDB cont. area

Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL of Data	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Reasonable Maximum Exposure (RME EPC)			Central Tendency (CT-EPC)		
							Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale	Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale
Volatile Organic Compounds												
1,2-Dibromoethane (EDB)	µg/L	0.0068	N/A	0.0420		µg/L	0.0420	Max	Reg Guide (3)	0.0068	Mean-N	DA-Test (1)
Metals												
Manganese (total)	µg/L	25.48	N/A	104.5	J	µg/L	104.5	Max	Reg Guide (3)	25.48	Mean-N	SW-Test (2)

Notes:
EPC = exposure point concentration
J = estimated value
N/A = not applicable
UCL = upper confidence limit
µg/L = micrograms per liter

For non-detects, 1/2 sample detection limit was used as a proxy concentration in the calculation of means and UCLs.
Statistics: Maximum Detected Value (Max), arithmetic mean of normally distributed data (Mean-N).

(1) D'Agostino's test indicates that the data are neither normally nor log-normally distributed so arithmetic mean (Mean-N) used by default.
(2) Shapiro-Wilk W test indicates that the data are normally distributed.
(3) Regulators advise to use maximum value for RME EPC for groundwater.

Table 2-13
Exposure Point Concentrations
Eastern Briarwood Quashnet River Surface Water

Scenario Time Frame: Current/Future
Medium: Surface Water
Exposure Medium: Surface Water
Exposure Point: Quashnet River

Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL of Data	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Reasonable Maxi m Exposure (RME C)			Central Tendency (CTEC)		
							Medium EPC Value	Medium EPC Statisti	Medium EPC Rationale	Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale
Volatile Organic Compounds												
1,2-Dibromoethane (EDB)	µg/L	0.0022	0.0025	0.0070	J	µg/L	0.0025	95% UCL	SF-Test (1)	0.0025	95% UCL-N	SF-Test (1)
Semivolatile Organic Compounds												
BEHP [Bis(2-ethylhexyl)phthalate]	µg/L	0.96	N/A	4.00	J	µg/L	4.00	Max	SW-Test(2)	0.96	Mean-N	SW-Test(2)
Metals												
Aluminum (Dissolved)	µg/L	420.15	N/A	4970.00		µg/L	4970.00	Max	SW-Test(2)	420.15	Mean-N	SW-Test(2)
Aluminum (Total)	µg/L	1439.42	2517.41	22500.00		µg/L	2517.41	95% UCL	SF-Test (1)	2517.41	95% UCL-N	SF-Test (1)
Arsenic (Total)	µg/L	2.38	3.34	22.50		µg/L	3.34	95% UCL	SF-Test (1)	3.34	95% UCL-N	SF-Test (1)
Chromium (Total)	µg/L	1.35	2.10	19.50		µg/L	2.10	95% UCL	SF-Test (1)	2.10	95% UCL-N	SF-Test (1)
Lead (Dissolved)	µg/L	3.19	N/A	51.00		µg/L	51.00	Max	SW-Test(2)	3.19	Mean-N	SW-Test(2)
Lead (Total)	µg/L	10.48	17.91	157.00	J	µg/L	17.91	95% UCL	SF-Test (1)	17.91	95% UCL-N	SF-Test (1)
Manganese (Dissolved)	µg/L	27.12	N/A	91.50		µg/L	91.50	Max	SW-Test(2)	27.12	Mean-N	SW-Test(2)
Manganese (Total)	µg/L	41.49	59.84	418.00		µg/L	59.84	95% UCL	SF-Test (1)	59.84	95% UCL-N	SF-Test (1)
Vanadium (Total)	µg/L	4.56	7.76	76.90		µg/L	7.76	95% UCL	SF-Test (1)	7.76	95% UCL-N	SF-Test (1)

Notes:
EPC = exposure point concentration
J = estimated value
N/A = not applicable
UCL = upper confidence limit
µg/L = micrograms per liter

For non-detects, 1/2 sample detection limit was used as a proxy concentration in the calculation of means and UCLs.
Statistics: 95% upper confidence limit determined from normally distributed data (95% UCL-N), maximum detected value (Max), arithmetic mean normally distributed data (Mean-N).
(1) Shapiro-Francia test indicates that the data are normally distributed.
(2) Shapiro-Wilk W test indicates that the data are neither normally nor log-normally distributed so regulatory guidance indicates use of max for RME and mean for CT.

Table 2-14
Exposure Point Concentrations
Eastern Briarwood Quashnet River Sediment

Scenario Time Frame: Current/Future
Medium: Sediment
Exposure Medium: Sediment
Exposure Point: Quashnet River

Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL of Data	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Reasonable Maximum Exposure (RME EPC)			Central Tendency (CT EPC)		
							Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale	Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale
Metals												
Arsenic	mg/kg	1.10	1.70	4.00		mg/kg	1.70	95% UCL-T	SW-Test (1)	1.70	95% UCL-T	SW-Test (1)

Notes:
EPC = exposure point concentration
mg/kg = milligrams per kilogram
UCL = upper confidence limit

For non-detects, 1/2 sample detection limit was used as a proxy concentration in the calculation of means and UCLs.
Statistics: 95% upper confidence limit determined from log-transformed data set (95% UCL-T).

(1) Shapiro-Wilk W test indicates that the data are log-normally distributed.

Table 2-15
Exposure Point Concentrations
Western Aquafarm Groundwater

Scenario Time Frame: Future
Medium: Groundwater
Exposure Medium: Groundwater
Exposure Point: Western Aquafarm, on-base and off-base GW

Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL of Data	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Reasonable Maximum Exposure (RME EPC)				Central Tendency (CTE EPC)		
							Medium EPC Value	Medium EPC Statistic		Medium EPC Rationale	Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale
Volatile Organic Compounds													
Bromomethane	µg/L	0.83	NA	7.90	J	µg/L	7.90	Max		g Guide (4)	0.83	Mean-N	SW-Test(2)
Chloromethane	µg/L	0.61	NA	4.60	J	µg/L	4.60	Max		g Guide (4)	0.61	Mean-N	SF-Test(3)
Ethylbenzene	µg/L	71.79	NA	820.00		µg/L	820.00	Max		g Guide (4)	71.79	Mean-N	SF-Test(3)
Trichloroethene (TCE)	µg/L	0.32	NA	0.81	J	µg/L	0.81	Max		g Guide (4)	0.32	Mean-N	SF-Test(3)
Xylenes (Total)	µg/L	389.41	NA	4700.00		µg/L	4700.00	Max		g Guide (4)	389.41	Mean-N	SW-Test(2)
Semivolatile Organic Compounds													
2-Methylnaphthalene	µg/L	5.83	NA	27.50		µg/L	27.50	Max		g Guide (4)	5.83	Mean-N	SW-Test(2)
Naphthalene	µg/L	26.02	NA	176.00		µg/L	176.00	Max		g Guide (4)	26.02	Mean-N	SF-Test(3)
Metals													
Arsenic (Dissolved)	µg/L	1.99	NA	8.50		µg/L	8.50	Max		g Guide (4)	1.99	Mean-N	SW-Test(2)
Arsenic (Total)	µg/L	3.10	NA	14.90		µg/L	14.90	Max		g Guide (4)	3.10	Mean-N	SW-Test(2)
Lead (Dissolved)	µg/L	3.80	NA	21.95	J	µg/L	21.95	Max		g Guide (4)	3.80	Mean-N	SW-Test(2)
Lead (Total)	µg/L	5.06	NA	33.20		µg/L	33.20	Max		g Guide (4)	5.06	Mean-N	SW-Test(2)
Manganese (Dissolved)	µg/L	196.69	NA	1140.00		µg/L	1140.00	Max		g Guide (4)	196.69	Mean-N	SW-Test(1)
Manganese (Total)	µg/L	153.71	NA	1140.00		µg/L	1140.00	Max		g Guide (4)	153.71	Mean-N	SW-Test(1)

Notes:
EPC = exposure point concentration
GW = groundwater
J = estimated value
NA = not available
UCL = upper confidence limit
µg/L = micrograms per liter

For non-detects, 1/2 sample detection limit was used as a proxy concentration in the calculation of means and UCLs.
Statistics: Maximum Detected Value (Max), arithmetic mean of normally-distributed data (Mean-N).

(1) Shapiro-Wilk W test indicates samples are log-normally distributed, but regulatory guidance requires use of arithmetic mean (Mean-N).
(2) Shapiro-Wilk W test indicates that the data are neither normally nor log-normally distributed, arithmetic mean (Mean-N) used as default.
(3) Shapiro-Francia test indicates samples are normally distributed, but regulatory guidance requires use of arithmetic mean (Mean-N).
(4) Regulators advise to use maximum value for RME EPC for groundwater.

Table 2-16
Medium-Specific Exposure Point Concentration Summary
On-Base SD-5 Groundwater

Scenario Time Frame: Future
Medium: Groundwater
Exposure Medium: Groundwater
Exposure Point: On-base SD-5 groundwater

Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL of Data	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Reasonable Maximum Exposure (RME EPC)			Central Tendency (CT EPC)		
							Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale	Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale
Volatile Organic Compounds												
Chloroform	µg/L	0.17	0.20	0.77	J	µg/L	0.77	Max	Reg Guide (2)	0.17	Mean-N	SF-Test (3)
Tetrachloroethene (PCE)	µg/L	0.77	0.98	4.21		µg/L	4.21	Max	Reg Guide (2)	0.77	Mean-N	SF-Test (3)
Trichloroethene (TCE)	µg/L	2.78	3.87	27.00		µg/L	27.00	Max	Reg Guide (2)	2.78	Mean-N	SF-Test (3)
Metals												
Thallium (Total)	µg/L	1.72	NA	6.20	J	µg/L	6.20	Max	Reg Guide (2)	1.72	Mean-N	SW-Test (4)

Notes:
EPC = exposure point concentration
J = estimated value
NA = not available
UCL = upper confidence limit
VOC = volatile organic compound
µg/L = micrograms per liter

For non-detects, 1/2 sample detection limit was used as a proxy concentration in the calculation of means and UCLs.
Statistics: Maximum detected value (Max), arithmetic mean of normally distributed data (Mean-N), mean of log-normally distributed data (Mean-T).

(1) Shapiro-Wilk W test indicates that data are log-normally distributed.
(2) Regulators advise to use maximum value for RME EPC for groundwater.
(3) Shapiro-Francia test indicates samples are normally distributed.
(4) Shapiro-Wilk W test indicates that the data are neither normally nor log-normally distributed, arithmetic mean (Mean-N) used as default.

Table 2-17
Medium-Specific Exposure Point Concentration Summary
Off-Base SD-5 Groundwater

Scenario Time Frame: Future
Medium: Groundwater
Exposure Medium: Groundwater
Exposure Point: Off-base SD-5 groundwater

Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL of Data	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Reasonable Maximu xposure (RME EPC			Central Tendency (CT EPC)		
							Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale	Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale
Volatile Organic Compounds												
Chloroform	µg/L	0.16	NA	2.29		µg/L	2.29	Max	eg Guide (2)	0.16	Mean-N	DA-Test (3)
Ethylene Dibromide (EDB)	µg/L	0.0039	0.0047	0.0190		µg/L	0.0190	Max	eg Guide (2)	0.0039	Mean-N	SF-Test (1)
Tetrachloroethene (PCE)	µg/L	0.54	NA	3.75		µg/L	3.75	Max	eg Guide (2)	0.54	Mean-N	DA-Test (4)
Trichloroethene (TCE)	µg/L	2.51	NA	34.00	J	µg/L	34.00	Max	eg Guide (2)	2.51	Mean-N	DA-Test (3)
Metals												
Manganese (Dissolved) *	µg/L	128.71	187.13	1190.00		µg/L	1190.00	Max	eg Guide (2)	128.71	Mean-N	SF-Test (1)

Notes:
EPC = exposure point concentration
J = estimated value
NA = not available
UCL = upper confidence limit
VOC = volatile organic compound
µg/L = micrograms per liter

* = For manganese, EPCs based on dissolved are higher than EPCs based on total.
For non-detects, 1/2 sample detection limit was used as a proxy concentration in the calculation of means and UCLs.
Statistics: Maximum detected value (Max), arithmetic mean of normally distributed data (Mean-N), mean of log-normally distributed data (Mean-T).

(1) Shapiro-Francia test indicates samples are normally distributed.
(2) Regulators advise to use maximum value for RME EPC for groundwater.
(3) D'Agostino normality test indicates that the data are neither normally nor log-normally distributed, arithmetic mean (Mean-N) used as default.
(4) D'Agostino normality test indicates samples are log-normally distributed, but regulatory guidance requires use of arithmetic mean (Mean-N).

Table 2-18
Values Used for Daily Intake Calculations
Groundwater - Adult

Scenario Time Frame: Future
Medium: Groundwater
Exposure Medium: Groundwater
Exposure Point: Aquifer - Tap Water
Receptor Population: On-Site and Off-Site Resident
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Intake Equation/ Model Name
Ingestion	CW	Chemical Concentration in Water	µg/L	Chem.-specific Maximum	-	Chem.-specific Arithmetic Mean	-	Chronic Daily Intake (CDI) (mg/kg/day) = CW x IRW x EF x ED x CF1 x 1/BW x 1/AT
	IRW	Ingestion Rate of Water	L/day	2	EPA 1995	1.4	EPA 1995	
	EF	Exposure Frequency	days/yr	350	Site-specific	350	Site-specific	
	ED	Exposure Duration	yrs	24	EPA 1989	9	EPA 1995	
	CF1	Conversion Factor	mg/µg	0.001	-	0.001	-	
	BW	Body Weight	kg	70	EPA 1989	70	EPA 1989	
	AT-NC	Averaging Time (noncancer)	days	8,760	EPA 1989	3,285	EPA 1995	
	AT- C	Averaging Time (cancer)	days	25,550	EPA 1989	25,550	EPA 1989	
Dermal	CW	Chemical Concentration in Water	µg/L	Chem.-specific Maximum	-	Chem.-specific Arithmetic Mean	-	Dermal Absorbed Dose (DAD) (mg/kg/day) = DA_{event} x SA x EV x EF x ED x 1/BW x 1/AT
	DA_{event}	Dose absorbed per unit area per event	mg/cm^2-event	Chem.-specific	EPA 2001a	Chem.-specific	EPA 2001a	Where DA_{event} (mg/cm^2-event) is calculated in accordance with EPA Superfund Dermal Risk Guidance (EPA, 2001)
	SA	Skin surface area available for contact	cm^2	18,000	EPA 2001a	18,000	EPA 2001a	
	ET	Exposure Time	hr/day	0.58	EPA 2001a	0.25	EPA 2001a	
	EV	Event	event/day	1	EPA 2001a	1	EPA 2001a	
	EF	Exposure Frequency	days/yr	350	Site-specific	350	Site-specific	
	ED	Exposure Duration	yrs	24	EPA 1989	9	EPA 1995	
	BW	Body Weight	kg	70	EPA 1989	70	EPA 1989	
	AT-NC	Averaging Time (noncancer)	days	8,760	EPA 1989	3,285	EPA 1995	
	AT- C	Averaging Time (cancer)	days	25,550	EPA 1989	25,550	EPA 1989	
Inhalation	CW	Chemical Concentration in Water	µg/L	Chem.-specific Maximum	-	Chem.-specific Arithmetic Mean	-	Chronic Daily Intake (CDI) (mg/kg/day) = CW x IRd x VF x EF x ED x CF1 x 1/BW x 1/AT
	Ird	Inhalation Rate, daily	m^3/day	15	EPA 1991	15	EPA 1991	
	VF	Volatilization Factor*	L/m^3	0.5	EPA 1991	0.5	EPA 1991	
	EF	Exposure Frequency	days/yr	350	Site-specific	350	Site-specific	
	ED	Exposure Duration	yrs	24	EPA 1989	9	EPA 1995	
	CF1	Conversion Factor	mg/µg	0.001	-	0.001	-	
	BW	Body Weight	kg	70	EPA 1989	70	EPA 1989	
	AT-NC	Averaging Time (noncancer)	days	8,760	EPA 1989	3,285	EPA 1989	
	AT- C	Averaging Time (cancer)	days	25,550	EPA 1989	25,550	EPA 1989	

Notes:

Chem. = chemical
cm^2 = square centimeter
CT = central tendency
hr = hour
kg = kilogram
L = liter
mg = milligram
m^3 = cubic meter
RME = reasonable maximum exposure
yr = year
µg = microgram
*Vapor from household use of groundwater.

Table 2-19
Values Used for Daily Intake Calculations
Groundwater - Child

Scenario Time Frame: Future
Medium: Groundwater
Exposure Medium: Groundwater
Exposure Point: Aquifer - Tap Water
Receptor Population: On-Site and Off-Site Resident
Receptor Age: Child (0 - 6 years)

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Ration Refere	Intake Equation/ Model Name
Ingestion	CW	Chemical Concentration in Water	µg/L	Chem.-specific Maximum	-	Chem.-specific Arithmetic Mean	-	Chronic Daily Intake (CDI) (mg/kg/day) = CW x IRW x EF x ED x CF1 x 1/BW x 1/AT
	IRW	Ingestion Rate of Water	L/day	1	EPA 1995	1	EPA 1	
	EF	Exposure Frequency	days/yr	350	Site-specific	350	Site-spe	
	ED	Exposure Duration	yrs	6	EPA 1989	6	EPA 1	
	CF1	Conversion Factor	mg/µg	0.001	-	0.001	-	
	BW	Body Weight	kg	15	EPA 1989	15	EPA 1	
	AT-NC	Averaging Time (noncancer)	days	2,190	EPA 1989	2,190	EPA 1	
	AT- C	Averaging Time (cancer)	days	25,550	EPA 1989	25,550	EPA 1	
Dermal	CW	Chemical Concentration in Water	µg/L	Chem.-specific Maximum	-	Chem.-specific Arithmetic Mean	-	Dermal Absorbed Dose (DAD) (mg/kg/day) = DA_{event} x SA x EV x EF x ED x 1/BW x 1/AT
	DA_{event}	Dose absorbed per unit area per event	mg/cm^2-event	Chem.-specific	EPA 2001a	Chem.-specific	EPA 20	Where DA_{event} (mg/cm^2-event) is calculated in accordance with EPA Superfund Dermal Risk Guidance (EPA, 2001)
	SA	Skin surface area available for contact	cm^2	6,600	EPA 2001a	6,600	EPA 20	
	ET	Exposure Time	hr/day	1	EPA 2001a	0.33	EPA 20	
	EV	Event	event/day	1	EPA 2001a	1	EPA 20	
	EF	Exposure Frequency	days/yr	350	Site-specific	350	Site-spe	
	ED	Exposure Duration	yrs	6	EPA 1989	6	EPA 19	
	BW	Body Weight	kg	15	EPA 1989	15	EPA 19	
	AT-NC	Averaging Time (noncancer)	days	2,190	EPA 1989	2,190	EPA 19	
	AT- C	Averaging Time (cancer)	days	25,550	EPA 1989	25,550	EPA 19	
Inhalation	CW	Chemical Concentration in Water	µg/L	Chem.-specific Maximum	-	Chem.-specific Arithmetic Mean	-	Chronic Daily Intake (CDI) (mg/kg/day) = CW x IRd x VF x EF x ED x CF1 x 1/BW x 1/AT
	Ird	Inhalation Rate, daily	m^3/day	10	EPA 1997a	10	EPA 19	
	VF	Volatilization Factor*	L/m^3	0.5	EPA 1991	0.5	EPA 19	
	EF	Exposure Frequency	days/yr	350	Site-specific	350	Site-spe	
	ED	Exposure Duration	yrs	6	EPA 1989	6	EPA 19	
	CF1	Conversion Factor	mg/µg	0.001	-	0.001	-	
	BW	Body Weight	kg	15	EPA 1989	15	EPA 19	
	AT-NC	Averaging Time (noncancer)	days	2,190	EPA 1989	2,190	EPA 19	
	AT- C	Averaging Time (cancer)	days	25,550	EPA 1989	25,550	EPA 19	

Notes:
Chem. = chemical
cm^2 = square centimeter
CT = central tendency
hr = hour
kg = kilogram
L = liter
m^3 = cubic meter
mg = milligram
RME = reasonable maximum exposure
yr = year
µg = microgram
*Vapor from household use of groundwater.

Table 2-20
Values Used for Daily Intake Calculations
Fish Tissue

Scenario Time Frame: Current/Future
Medium: Surface Water
Exposure Medium: Fish Tissue
Exposure Point: Johns Pond and Quashnet River
Receptor Population: Recreational Fisherman
Receptor Age: Child + Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Intake Equation/ Model Name
Ingestion	Csw	Chemical Concentration in Surface Water	mg/L	Chem.-specific Maximum	-	Chem.-specific Arithmetic Mean	-	Chronic Daily Intake (CDI) (mg/kg/day) = Csw x BAF x IRf x FI x EF x ED x CF1 x 1/BW x 1/AT
	BAF	Bioaccumulation Factor	L/kg	Chem.-specific		Chem.-specific		
	IRf	Ingestion Rate, Fish	g/day	26	EPA 1997a	6.4	EPA 1997a	
	FI	Fraction Ingested	dimensionless	1	Assumption	1	Assumption	
	EF	Exposure Frequency	days/yr	350	Assumption	350	Assumption	
	ED	Exposure Duration	yrs	30	EPA 1989	9	EPA 1989	
	CF1	Conversion Factor	kg/g	0.001	-	0.001	-	
	BW	Body Weight	kg	70	EPA 1989	70	EPA 1989	
	AT-NC	Averaging Time (noncancer)	days	10,950	EPA 1989	3,285	EPA 1989	
	AT- C	Averaging Time (cancer)	days	25,550	EPA 1989	25,550	EPA 1989	

Notes:
Chem. = chemical
CT = central tendency
g = gram
kg = kilogram
L = liter
mg = milligram
RME = reasonable maximum exposure
yr = year

Table 2-21
Values Used for Daily Intake Calculations
Surface Water - Cranberry Worker

Scenario Time Frame: Current/Future
Medium: Surface Water
Exposure Medium: Surface Water and Vapor
Exposure Point: Quashnet River
Receptor Population: Cranberry Worker
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Chronic Equation/ Subchronic Equation
Ingestion	Csw	Chemical Concentration in Surface Water	µg/L	max or 95% UCL of mean	Site-specific	mean or 95% UCL of mean	Site-specific	Chronic Daily Intake (CDI) (mg/kg/day) = Csw x IRsw x EF x ED x CF1 x 1/BW x 1/AT
	IRsw	Ingestion Rate of Surface Water	L/day	0.05	EPA 1998	0.05	EPA 1998	
	EF	Exposure Frequency	days/yr	12	Site-specific	8	Site-specific	
	ED	Exposure Duration	yrs	25	EPA 1991	6.6	EPA 1991a	
	CF1	Conversion Factor	mg/µg	0.001	-	0.001	-	
	BW	Body Weight	kg	70	EPA 1989	70	EPA 1989	
	AT-NC	Averaging Time (noncancer)	days	9,125	EPA 1989	2,409	EPA 1989a	
	AT- C	Averaging Time (cancer)	days	25,550	EPA 1989	25,550	EPA 1989	
Dermal	Csw	Chemical Concentration in Surface Water	µg/L	max or 95% UCL of mean	Site-specific	mean or 95% UCL of mean	Site-specific	Dermal Absorbed Dose (DAD) (mg/kg/day) = DA_{event} x SAw x EV x EF x ED x 1/BW x 1/AT
	DA_{event}	Dose absorbed per unit area per event	mg/cm^2-event	Chem.-specific	EPA 2001a	Chem.-specific	EPA 2001a	Where DA_{event} (mg/cm^2-event) is calculated in accordance with EPA Superfund Dermal Risk Guidance (EPA 2001)
	SAw	Skin surface area available for contact	cm^2	6,600	EPA 1997a	5,700	EPA 1997a	
	ET	Exposure Time	hr/day	8	Site-specific	8	Site-specific	
	EV	Event	event/day	1	EPA 2001a	1	EPA 2001a	
	EF	Exposure Frequency	days/yr	12	Site-specific	8	Site-specific	
	ED	Exposure Duration	yrs	25	EPA 1991	6.6	EPA 1991a	
	BW	Body Weight	kg	70	EPA 1989	70	EPA 1989	
	AT-NC	Averaging Time (noncancer)	days	9,125	EPA 1989	2,409	EPA 1989a	
	AT- C	Averaging Time (cancer)	days	25,550	EPA 1989	25,550	EPA 1989	
Inhalation	Csw	Chemical Concentration in Surface Water	µg/L	max or 95% UCL of mean	Site-specific	mean or 95% UCL of mean	Site-specific	Chronic Daily Intake (CDI) (mg/kg/day) = Csw x IRh x VF x ET x EF x ED x CF1 x 1/BW x 1/AT
	IRh	Inhalation Rate, hourly	m^3/hour	3.3	EPA 1997a	1.3	EPA 1997a	
	VF	Volatilization Factor	L/m^3	Chem.-specific [1]	EPA 1991	Chem.-specific	EPA 1991	
	ET	Exposure Time	hr/day	8.0	Site-specific	8.0	Site-specific	
	EF	Exposure Frequency	days/yr	12	Site-specific	8	Site-specific	
	ED	Exposure Duration	yrs	25	EPA 1991	6.6	EPA 1991a	
	CF1	Conversion Factor	mg/µg	0.001	-	0.001	-	
	BW	Body Weight	kg	70	EPA 1989	70	EPA 1989	
	AT-NC	Averaging Time (noncancer)	days	9,125	EPA 1989	2,409	EPA 1989a	
	AT- C	Averaging Time (cancer)	days	25,550	EPA 1989	25,550	EPA 1989	

Notes:
[1] A chemical-specific volatilization factor for EDB of 0.5 was selected based on EPA 1991a.

Chem. = chemical
cm^2 = square centimeter
CT = central tendency
EDB = ethylene dibromide
hr = hour
kg = kilogram
L = liter
m^3 = cubic meter
mg = milligram
max = maximum
RME = reasonable maximum exposure
UCL = upper confidence level
yr = year
µg = microgram

Table 2-22
Values Used for Daily Intake Calculations
Surface Water - Adult Wader

Scenario Time Frame: Current/Future
Medium: Surface Water
Exposure Medium: Surface Water and Vapor
Exposure Point: Quashnet River
Receptor Population: Wader
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Intake Equation/ Model Name
Ingestion	Csw	Chemical Concentration in Surface Water	µg/L	max or 95% UCL of mean	Site-specific	mean or 95% UCL of mean	Site-specific	Chronic Daily Intake (CDI) (mg/kg/day) = Csw x IRsw x EF x ED x CF1 x 1/BW x 1/AT
	IRsw	Ingestion Rate of Surface Water	L/day	0.05	Levinson 1998	0.05	Levinson 1998	
	EF	Exposure Frequency	days/yr	104	EPA 1998	52	EPA 1998	
	ED	Exposure Duration	yrs	24	EPA 1989	9	EPA 1995	
	CF1	Conversion Factor	mg/µg	0.001	-	0.001	-	
	BW	Body Weight	kg	70	EPA 1989	70	EPA 1989	
	AT-NC	Averaging Time (noncancer)	days	8,760	EPA 1989	3,285	EPA 1995	
	AT- C	Averaging Time (cancer)	days	25,550	EPA 1989	25,550	EPA 1989	
Dermal	Csw	Chemical Concentration in Surface Water	µg/L	max or 95% UCL of mean	Site-specific	mean or 95% UCL of mean	Site-specific	Dermal Absorbed Dose (DAD) (mg/kg/day) = DA_{event} x SAw x EV x EF x ED x 1/BW x 1/AT
	DA_{event}	Dose absorbed per unit area per event	mg/cm^2-event	Chem.-specific	EPA 2001a	Chem.-specific	EPA 2001a	Where DA_{event} (mg/cm^2-event) is calculated in accordance with EPA Superfund Dermal Risk Guidance (EPA 2001)
	SAw	Skin surface area available for contact	cm^2	6,600	EPA 1997a	5,700	EPA 1997a	
	ET	Exposure Time	hr/day	1	ANG 1994b	1	ANG 1994b	
	EV	Event	event/day	1	EPA 2001a	1	EPA 2001a	
	EF	Exposure Frequency	days/yr	104	EPA 1998	52	EPA 1998	
	ED	Exposure Duration	yrs	24	EPA 1989	9	EPA 1995	
	BW	Body Weight	kg	70	EPA 1989	70	EPA 1989	
	AT-NC	Averaging Time (noncancer)	days	8,760	EPA 1989	3,285	EPA 1995	
	AT- C	Averaging Time (cancer)	days	25,550	EPA 1989	25,550	EPA 1989	
Inhalation	Csw	Chemical Concentration in Surface Water	µg/L	max or 95% UCL of mean	Site-specific	mean or 95% UCL of mean	Site-specific	Chronic Daily Intake (CDI) (mg/kg/day) = Csw x IRh x VF x ET x EF x ED x CF1 x 1/BW x 1/AT
	IRh	Inhalation Rate, hourly	m^3/hour	2	EPA 1997a	1	EPA 1997a	
	VF	Volatilization Factor	L/m^3	Chem.-specific [1]	EPA 1991	Chem.-specific	EPA 1991a	
	ET	Exposure Time	hr/day	1.0	Site-specific	1.0	Site-specific	
	EF	Exposure Frequency	days/yr	104	EPA 1998	52	EPA 1998	
	ED	Exposure Duration	yrs	24	EPA 1989	9	EPA 1995	
	CF1	Conversion Factor	mg/µg	0.001	-	0.001	-	
	BW	Body Weight	kg	70	EPA 1989	70	EPA 1989	
	AT-NC	Averaging Time (noncancer)	days	8,760	EPA 1989	3,285	EPA 1995	
	AT- C	Averaging Time (cancer)	days	25,550	EPA 1989	25,550	EPA 1989	

Notes:
[1] A chemical-specific volatilization factor for EDB of 0.5 was selected based on EPA 1991a.

Chem. = chemical
cm^2 = square centimeter
CT = central tendency
EDB = ethylene dibromide
hr = hour
kg = kilogram
L = liter
m^3 = cubic meter
mg = milligram
max = maximum
RME = reasonable maximum exposure
UCL = upper confidence level
yr = year
µg = microgram

Table 2-23
Values Used for Daily Intake Calculations
Surface Water - Child Wader

Scenario Time Frame: Current/Future
Medium: Surface Water
Exposure Medium: Surface Water and Vapor
Exposure Point: Quashnet River
Receptor Population: Wader
Receptor Age: Child (0 - 6 years)

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Intake Equation/ Model Name
Ingestion	Csw	Chemical Concentration in Surface Water	µg/L	max or 95% UCL of mean	Site-specific	mean or 95% UCL of mean	Site-sp ic	Chronic Daily Intake (CDI) (mg/kg/day) = Csw x IRsw x EF x ED x CF1 x 1/BW x 1/AT
	IRsw	Ingestion Rate of Surface Water	L/day	0.05	Levinson 1998	0.05	Levinso 98	
	EF	Exposure Frequency	days/yr	104	EPA 1998	52	EPA	
	ED	Exposure Duration	yrs	6	EPA 1995	6	EPA 1 5	
	CF1	Conversion Factor	mg/µg	0.001	-	0.001	-	
	BW	Body Weight	kg	15	EPA 1995	15	EPA 1 5	
	AT-NC	Averaging Time (noncancer)	days	2,190	EPA 1995	2,190	EPA 1 5	
	AT- C	Averaging Time (cancer)	days	25,550	EPA 1995	25,550	EPA 1 5	
Dermal	Csw	Chemical Concentration in Surface Water	µg/L	max or 95% UCL of mean	Site-specific	mean or 95% UCL of mean	Site-sp ic	Dermal Absorbed Dose (DAD) (mg/kg/day) = DA_{event} x SAw x EV x EF x ED x 1/BW x 1/AT
	DA_{event}	Dose absorbed per unit area per event	mg/cm^2-event	Chem.-specific	EPA 2001a	Chem.-specific	EPA 2 a	Where DA_{event} (mg/cm^2-event) is calculated in accordance
	SAw	Skin surface area available for contact	cm^2	3,400	EPA 1997a	2,900	EPA 19 7a	with EPA Superfund Dermal Risk Guidance (EPA 2001)
	ET	Exposure Time	hr/day	1	ANG 1994b	0.33	ANG 19 b	
	EV	Event	event/day	1	EPA 2001a	1	EPA 2 a	
	EF	Exposure Frequency	days/yr	104	EPA 1998	52	EPA 1	
	ED	Exposure Duration	yrs	6	EPA 1989	6	EPA 1	
	BW	Body Weight	kg	15	EPA 1989	15	EPA 1	
	AT-NC	Averaging Time (noncancer)	days	2,190	EPA 1989	2,190	EPA 1	
	AT- C	Averaging Time (cancer)	days	25,550	EPA 1989	25,550	EPA 1	
Inhalation	Csw	Chemical Concentration in Surface Water	µg/L	max or 95% UCL of mean	Site-specific	mean or 95% UCL of mean	Site-sp ic	Chronic Daily Intake (CDI) (mg/kg/day) = Csw x IRh x VF x ET x EF x ED x CF1 x 1/BW x 1/AT
	IRh	Inhalation Rate, hourly	m^3/hour	1.2	EPA 1997a	1	EPA 19 a	
	VF	Volatilization Factor	L/m^3	Chem.-specific [1]	EPA 1991	Chem.-specific	EPA 1 a	
	ET	Exposure Time	hr/day	1.0	Site-specific	1.0	Site-sp ic	
	EF	Exposure Frequency	days/yr	104	EPA 1998	52	EPA 1	
	ED	Exposure Duration	yrs	6	EPA 1989	6	EPA 1	
	CF1	Conversion Factor	mg/µg	0.001	-	0.001	-	
	BW	Body Weight	kg	15	EPA 1989	15	EPA 1	
	AT-NC	Averaging Time (noncancer)	days	2,190	EPA 1989	2,190	EPA 1 5	
	AT- C	Averaging Time (cancer)	days	25,550	EPA 1989	25,550	EPA 1	

Notes:
[1] A chemical-specific volatilization factor for EDB of 0.5 was selected based on EPA 1991a.

Chem. = chemical
cm^2 = square centimeter
CT = central tendency
EDB = ethylene dibromide
hr = hour
kg = kilogram
L = liter
m^3 = cubic meter
mg = milligram
max = maximum
RME = reasonable maximum exposure
UCL = upper confidence leve
yr = year
µg = microgram

Table 2-24
Values Used for Daily Intake Calculations
Sediment - Cranberry Worker

Scenario Time Frame: Current and Future
Medium: Sediment
Exposure Medium: Sediment
Exposure Point: Quashnet River
Receptor Population: Cranberry Worker
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Intake Equation/ Model Name
Ingestion	CS	Chemical Concentration in Sediment	mg/kg	max or 95% UCL of mean	Site-specific	mean or 95% UCL of mean	Site-specific	Chronic Daily Intake (CDI) (mg/kg/day) = CS x IRs x FI x EF x ED x CF1 x 1/BW x 1/AT
	IRs	Ingestion Rate of sediment	mg/day	200	EPA 1998	100	EPA 1998	
	FI	Fraction Ingested	unitless	1	EPA 1989	1	EPA 1989	
	EF	Exposure Frequency	days/yr	12	Site-specific	8	Site-specific	
	ED	Exposure Duration	yrs	25	EPA 1991	6.6	EPA 1997a	
	CF1	Conversion Factor	kg/mg	1.E-06	-	1.E-06	-	
	BW	Body Weight	kg	70	EPA 1989	70	EPA 1989	
	AT-NC	Averaging Time (noncancer)	days	9,125	EPA 1989	2,409	EPA 1997a	
	AT- C	Averaging Time (cancer)	days	25,550	EPA 1989	25,550	EPA 1989	
Dermal	CS	Chemical Concentration in Sediment	mg/kg	max or 95% UCL of mean	Site-specific	mean or 95% UCL of mean	Site-specific	Chronic Daily Intake (CDI) (mg/kg/day) = CS x SA x AF x ABS x EF x ED x CF1 x 1/BW x 1/AT
	SA	Skin surface area available for contact	cm^2/event	6,600	EPA 1997a	5,700	EPA 1997a	
	AF	Sediment-to-skin adherence factor	mg/cm^2	0.14	EPA 1998	0.14	EPA 1998	
	ABS	Absorption factor	unitless	Chem.-specific	-	Chem.-specific	-	
	EF	Exposure Frequency	events/yr	12	Site-specific	8	Site-specific	
	ED	Exposure Duration	yrs	25	EPA 1991	6.6	EPA 1997a	
	CF1	Conversion Factor	kg/mg	1.E-06	-	1.E-06	-	
	BW	Body Weight	kg	70	EPA 1989	70	EPA 1989	
	AT-NC	Averaging Time (noncancer)	days	9,125	EPA 1989	2,409	EPA 1997a	
	AT- C	Averaging Time (cancer)	days	25,550	EPA 1989	25,550	EPA 1989	

Notes:

Chem. = chemical
cm^2 = square centimeter
CT = central tendency
kg = kilogram
max = maximum
mg = milligram
RME = reasonable maximum exposure
UCL = upper confidence level
yr = year

Table 2-25
Values Used for Daily Intake Calculations
Sediment - Adult Wader

Scenario Time Frame: Current and Future
Medium: Sediment
Exposure Medium: Sediment
Exposure Point: Quashnet River
Receptor Population: Wader
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Intake Equation/ Model Name
Ingestion	CS	Chemical Concentration in Sediment	mg/kg	max or 95% UCL of mean	Site-specific	mean or 95% UCL of mean	Site-sp c	Chronic Daily Intake (CDI) (mg/kg/day) = CS x IR x FI x EF x ED x CF1 x 1/BW x 1/AT
	IRs	Ingestion Rate of sediment	mg/day	100	EPA 1991	50	EPA 19 a	
	FI	Fraction Ingested	unitless	1	EPA 1989	1	EPA 1)	
	EF	Exposure Frequency	days/yr	104	EPA 1998	52	EPA 1 3	
	ED	Exposure Duration	yrs	24	EPA 1989	9	EPA 1	
	CF1	Conversion Factor	kg/mg	1.E-06	-	1.E-06	-	
	BW	Body Weight	kg	70	EPA 1989	70	EPA 19)	
	AT-NC	Averaging Time (noncancer)	days	8,760	EPA 1989	3,285	EPA 19 5	
	AT- C	Averaging Time (cancer)	days	25,550	EPA 1989	25,550	EPA 1)	
Dermal	CS	Chemical Concentration in Sediment	mg/kg	max or 95% UCL of mean	Site-specific	mean or 95% UCL of mean	Site-sp c	Chronic Daily Intake (CDI) (mg/kg/day) = CS x SA x AF x ABS x EF x ED x CF1 x 1/BW x 1/AT
	SA	Skin surface area available for contact	cm^2/event	6,600	EPA 1997a	5,700	EPA 19 a	
	AF	Sediment-to-skin adherence factor	mg/cm^2	0.14	EPA 1998	0.14	EPA 1 3	
	ABS	Absorption factor	unitless	Chem.-specific	-	Chem.-specific	-	
	EF	Exposure Frequency	events/yr	104	EPA 1998	52	EPA 1 3	
	ED	Exposure Duration	yrs	24	EPA 1989	9	EPA 1	
	CF1	Conversion Factor	kg/mg	1.E-06	-	1.E-06	-	
	BW	Body Weight	kg	70	EPA 1989	70	EPA 1)	
	AT-NC	Averaging Time (noncancer)	days	8,760	EPA 1989	3,285	EPA 1 5	
	AT- C	Averaging Time (cancer)	days	25,550	EPA 1989	25,550	EPA 1)	

Notes:

Chem. = chemical
cm^2 = square centimeter
CT = central tendency
kg = kilogram
max = maximum
mg = milligram
RME = reasonable maximum exposure
UCL = upper confidence level
yr = year

Table 2-26
Values Used for Daily Intake Calculations
Sediment - Child Wader

Scenario Time Frame: Current and Future
Medium: Sediment
Exposure Medium: Sediment
Exposure Point: Quashnet River
Receptor Population: Wader
Receptor Age: Child (0 - 6 years)

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Intake Equation/ Model Name
Ingestion	CS	Chemical Concentration in Sediment	mg/kg	max or 95% UCL of mean	Site-specific	mean or 95% UCL of mean	Site-specific	Chronic Daily Intake (CDI) (mg/kg/day) = CS x IR x FI x EF x ED x CF1 x 1/BW x 1/AT
	IRs	Ingestion Rate of sediment	mg/day	200	EPA 1991	100	EPA 1997a	
	FI	Fraction Ingested	unitless	1	EPA 1989	1	EPA 1989	
	EF	Exposure Frequency	days/yr	104	EPA 1998	52	EPA 1998	
	ED	Exposure Duration	yrs	6	EPA 1989	6	EPA 1989	
	CF1	Conversion Factor	kg/mg	1.E-06	-	1.E-06	-	
	BW	Body Weight	kg	15	EPA 1989	15	EPA 1989	
	AT-NC	Averaging Time (noncancer)	days	2,190	EPA 1989	2,190	EPA 1989	
	AT- C	Averaging Time (cancer)	days	25,550	EPA 1989	25,550	EPA 1989	
Dermal	CS	Chemical Concentration in Sediment	mg/kg	max or 95% UCL of mean	Site-specific	mean or 95% UCL of mean	Site-specific	Chronic Daily Intake (CDI) (mg/kg/day) = CS x SA x AF x ABS x EF x ED x CF1 x 1/BW x 1/AT
	SA	Skin surface area available for contact	cm^2/event	3,400	EPA 1997a	2,900	EPA 1997a	
	AF	Sediment-to-skin adherence factor	mg/cm^2	1.00	Levinson 1998	0.3	Levinson 1998	
	ABS	Absorption factor	unitless	Chem.-specific	-	Chem.-specific	-	
	EF	Exposure Frequency	events/yr	104	EPA 1998	52	EPA 1998	
	ED	Exposure Duration	yrs	6	EPA 1989	6	EPA 1989	
	CF1	Conversion Factor	kg/mg	1.E-06	-	1.E-06	-	
	BW	Body Weight	kg	15	EPA 1989	15	EPA 1989	
	AT-NC	Averaging Time (noncancer)	days	2,190	EPA 1989	2,190	EPA 1989	
	AT- C	Averaging Time (cancer)	days	25,550	EPA 1989	25,550	EPA 1989	

Notes:
Chem. = chemical
cm^2 = square centimeter
CT = central tendency
kg = kilogram
max = maximum
mg = milligram
RME = reasonable maximum exposure
UCL = upper confidence level
yr = year

Table 2-27
Non-Cancer Toxicity Data – Oral/Dermal

Chemical of Potential Concern	Chronic/ Subchronic	Oral RfD Value	Oral RfD Units	Oral to Dermal Adjustment Factor (1)	Adjusted Dermal RfD (1)	Units	Primary Target Organ	Combined Uncertainty/Modifying Factors	Sources of RfD: Target Organ	Date of RfD: Target Organ (MM/DD/YY)
Bis(2-ethylhexyl)phthalate (BEHP)	Chronic	2.0E-02	mg/kg/day	none	2.0E-02	mg/kg/day	Liver	1000	IRIS	10/29/03
Bromomethane	Chronic	1.4E-03	mg/kg/day	none	1.4E-03	mg/kg/day	Stomach	1000	IRIS	10/29/03
Chloroform	Chronic	1.0E-02	mg/kg/day	none	1.0E-02	mg/kg/day	Liver	1000	IRIS	10/29/03
Chloromethane	Chronic	NA	mg/kg/day	none	NA	mg/kg/day	NA	NA	IRIS	10/29/03
Ethylbenzene	Chronic	1.0E-01	mg/kg/day	none	1.0E-01	mg/kg/day	Liver/Kidney	1000	IRIS	10/29/03
Ethylene Dibromide (EDB)	Chronic	NA	mg/kg/day	none	NA	mg/kg/day	NA	NA	IRIS	10/29/03
2-Methylnaphthalene	Chronic	9.0E-03	mg/kg/day	none	9.0E-03	mg/kg/day	Lung	1000	EPA 2003c, IRIS	10/29/03
Naphthalene	Chronic	2.0E-02	mg/kg/day	none	2.0E-02	mg/kg/day	Body weight	3000	IRIS	10/29/03
Tetrachloroethene (PCE)	Chronic	1.0E-02	mg/kg/day	none	1.0E-02	mg/kg/day	Liver	1000	IRIS	10/29/03
Trichloroethene (TCE)	Chronic	3.0E-04	mg/kg/day	none	3.0E-04	mg/kg/day	Liver	NA	NCEA	10/01/02
Xylenes (total)	Chronic	2.0E-01	mg/kg/day	none	2.0E-01	mg/kg/day	Body weight	1000	IRIS	10/29/03
Aluminum	Chronic	1.0E+00	mg/kg/day	none	1.0E+00	mg/kg/day	NA	NA	NCEA	10/01/02
Arsenic	Chronic	3.0E-04	mg/kg/day	none	3.0E-04	mg/kg/day	Skin	3	IRIS	10/29/03
Chromium	Chronic	3.0E-03	mg/kg/day	0.025	7.5E-05	mg/kg/day	None	900	IRIS	10/29/03
Lead (and compounds-inorg.)	Chronic	NA	mg/kg/day	NA	NA	mg/kg/day	CNS	NA	IRIS	10/29/03
Manganese	Chronic	1.4E-01 (food)	mg/kg/day	NA	NA	mg/kg/day	CNS	1	IRIS	10/29/03
Manganese	Chronic	7E-02 (soil)	mg/kg/day	0.04	2.8E-03 (soil)	mg/kg/day	CNS	1	EPA Region 1	9/99
Manganese	Chronic	2.4E-2 (water)	mg/kg/day	0.04	9.6E-04 (water)	mg/kg/day	CNS	1	EPA Region 1	11/96
Thallium	Chronic	6.6E-05	mg/kg/day	none	6.6E-05	mg/kg/day	Liver	3000	HEAST	7/97
Vanadium	Chronic	7.00E-03	mg/kg/day	0.026	1.8E-04	mg/kg/day	Unspecified	100	HEAST	7/97

Notes:
(1) EPA 2001a (September). Risk Assessment Guidance for Superfund (RAGS): Volume I: Human Health Evaluation Manual. (Part E, Supplemental Guidance for Dermal Risk Asse ent). Interim Guidance.
EPA 2003c. Toxicological Review of 2-Methylnaphthalene.

CNS = central nervous system
HEAST=Health Effects Assessment Summary Tables, EPA 1997b.
IRIS =Integrated Risk Information System. Online database. Accessed 10/29/03, EPA 2003b.
mg/kg/day = milligrams per kilogram per day
NA = not available
NCEA= National Center For Environmental Assessment.
RfD = reference dose

Table 2-28
Non-Cancer Toxicity Data – Inhalation

Chemical of Potential Concern	Chronic/ Subchronic	Value Inhalation RfC	Units	Adjusted (1) Inhalation RfD	Units	Primary Target Organ	Combined Uncertainty/Modifying Factors	Sources of RfD: Target Organ	Dates (MM/YY)
Bis(2-ethylhexyl)phthalate (BEHP)	Chronic	NA	mg/m^3	NA	mg/kg/day	NA	NA	IRIS	10/29/03
Bromomethane	Chronic	5.00E-03	mg/m^3	1.43E-03	mg/kg/day	Sinus	100	IRIS	10/29/03
Chloroform	Chronic	NA	mg/m^3	8.60E-04	mg/kg/day	NA	NA	NCEA	10/29/03
Chloromethane	Chronic	9.00E-02	mg/m^3	2.57E-02	mg/kg/day	CNS	1000	IRIS	10/29/03
Ethylbenzene	Chronic	1.00E+00	mg/m^3	2.86E-01	mg/kg/day	Developmental	300	IRIS	10/29/03
Ethylene Dibromide (EDB)	Chronic	NA	mg/m^3	5.70E-05	mg/kg/day	Reproductive	NA	HEAST	7/97
2-Methylnaphthalene	Chronic	NA	mg/m^3	NA	mg/kg/day	NA	NA	EPA 2003c, IRIS	10/29/03
Naphthalene	Chronic	3.00E-03	mg/m^3	8.57E-04	mg/kg/day	Respiratory	3000	IRIS	10/29/03
Tetrachloroethene (PCE)	Chronic	NA	mg/m^3	1.70E-01	mg/kg/day	NA	NA	NCEA	10/29/03
Trichloroethene (TCE)	Chronic	4.00E-02	mg/m^3	1.00E-02	mg/kg/day	CNS, Liver, ES	NA	EPA 2001b	2/7/2003
Xylenes (total)	Chronic	1.00E-01	mg/m^3	2.9E-02	mg/kg/day	Motor Coordination	300	IRIS	10/29/03
Aluminum	Chronic	NA	mg/m^3	1.40E-03	mg/kg/day	NA	NA	HEAST	7/97
Arsenic	Chronic	NA	mg/m^3	NA	mg/kg/day	NA	NA	NA	10/29/03
Chromium	Chronic	1.0E-04	mg/m^3	2.86E-05	mg/kg/day	Lung	300	IRIS	10/29/03
Lead	Chronic	NA	mg/m^3	NA	mg/kg/day	NA	NA	NA	10/29/03
Manganese	Chronic	5.0E-05	mg/m^3	1.43E-05	mg/kg/day	CNS	1000	IRIS	10/29/03
Thallium	Chronic	NA	mg/m^3	NA	mg/kg/day	NA	NA	NA	10/29/03
Vanadium	Chronic	NA	mg/m^3	NA	mg/kg/day	NA	NA	NA	10/29/03

Notes:
(1) Adjustment factor applied to inhalation RfC to calculate inhalation RfD = 20 m^3/day x 1/70 kg.
EPA 2001b. Trichloroethylene Risk Assessment: Synthesis and Characterization.
EPA 2003c. Toxicological Review of 2-Methylnaphthalene.

CNS = central nervous system
ES = endocrine system
HEAST = Health Effects Assessment Summary Tables, EPA 1997b.
IRIS =Integrated Risk Information System. Online database. Accessed 10/29/03, EPA 2003b.
mg/kg/day = milligrams per kilogram per day
mg/m^3= milligrams per cubic meter
NA = not available
RfC = reference concentration
RfD = reference dose

Table 2-29
Cancer Toxicity Data - Oral/Dermal

Chemical of Potential Concern	Oral Cancer Slope Factor	Oral to Dermal Adjustment Factor (1)	Adjusted Dermal Cancer Slope Factor (1)	Units	Weight of Evidence/ Cancer Guideline Description	Source	Date
Bis(2-ethylhexyl)phthalate (BEHP)	1.4E-02	none	1.4E-02	$(mg/kg/day)^{-1}$	B2	IRIS	10/29/03
Bromomethane	NA	NA	NA	$(mg/kg/day)^{-1}$	D	IRIS	10/29/03
Chloroform	NA	NA	NA	$(mg/kg/day)^{-1}$	B2	IRIS	10/29/03
Chloromethane	1.3E-02	none	1.3E-02	$(mg/kg/day)^{-1}$	D	HEAST	July 1997
Ethylbenzene	NA	NA	NA	$(mg/kg/day)^{-1}$	D	IRIS	10/29/03
Ethylene Dibromide (EDB)	8.5E+01	none	8.5E+01	$(mg/kg/day)^{-1}$	B2	IRIS	10/29/03
2-Methylnaphthalene	NA	NA	NA	$(mg/kg/day)^{-1}$	(2)	(2)	(2)
Naphthalene	NA	NA	NA	$(mg/kg/day)^{-1}$	C	IRIS	10/29/03
Tetrachloroethene (PCE)	5.4E-01	none	5.4E-01	$(mg/kg/day)^{-1}$	NA	EPA 2003a	6/12/2003
Trichloroethene (TCE)	4.0E-01	none	4.0E-01	$(mg/kg/day)^{-1}$	NA	EPA 2002	10/01/02
Xylenes (total)	NA	NA	NA	$(mg/kg/day)^{-1}$	D	IRIS	10/29/03
Aluminum	NA	NA	NA	$(mg/kg/day)^{-1}$	NA	NA	NA
Arsenic	1.5E+00	none	1.5E+00	$(mg/kg/day)^{-1}$	A	IRIS	10/29/03
Chromium	NA	0.025	NA	$(mg/kg/day)^{-1}$	D	IRIS	10/29/03
Lead (and compounds-inorganic)	NA	NA	NA	$(mg/kg/day)^{-1}$	B2	IRIS	10/29/03
Manganese	NA	0.04	NA	$(mg/kg/day)^{-1}$	D	IRIS	10/29/03
Thallium	NA	NA	NA	$(mg/kg/day)^{-1}$	D	IRIS	10/29/03
Vanadium	NA	0.026	NA	$(mg/kg/day)^{-1}$	D	IRIS	10/29/03

Notes:
HEAST = Toxicity values were obtained from Health Effects Assessment Summary Tables (HEAST) Annual FY-1997. EPA 1997b.
IRIS = Integrated Risk Information System. Online database. Accessed 10/29/03 EPA 2003b.
mg/kg/day = milligrams per kilogram per day
NA = not available
(1) EPA 2001a (September). Risk Assessment Guidance for Superfund (RAGS): Volume I: Human Health Evaluation Manual. (Part E, Supplemental Guidance for Dermal Risk Assessment). Interim Guidance.
(2) Naphthalene was used as a surrogate compound to determine toxicity values for 2-methylnaphthalene.2

EPA 2002. U.S. EPA Region 9 PRGs Table 2002 Update, October 1, 2002
EPA 2003a. Letter from Elizabeth Southerland (Deputy Director, Office of Emergency and Remedial Response) to Region X regarding oral and inhalation carcinogenic slope factors for PCE. OSWER No. 9285.7-75.

EPA Weight of Evidence Classification:
A - Human carcinogen
B1 - Probable human carcinogen - indicates that limited human data are available
B2 - Probable human carcinogen - indicates sufficient evidence in animals and inadequate or no evidence in humans
C - Possible human carcinogen
D - Not classifiable as a human carcinogen

Table 2-30
Cancer Toxicity Data - Inhalation

Chemical of Potential Concern	Unit Risk	Units	Adjustment (1)	Inhalation Cancer Slope Factor (1)	Units	Weight of Evidence Cancer Guideline Description	Source	Date
Bis(2-ethylhexyl)phthalate (BEHP)	NA	$(mg/m^3)^{-1}$	3.5E+00	NA	$(mg/kg/day)^{-1}$	B2	IRIS	10/29/03
Bromomethane	NA	$(mg/m^3)^{-1}$	3.5E+00	NA	$(mg/kg/day)^{-1}$	D	IRIS	10/29/03
Chloroform	2.3E-02	$(mg/m^3)^{-1}$	3.5E+00	8.05E-02	$(mg/kg/day)^{-1}$	B2	IRIS	10/29/03
Chloromethane	1.8E-03	$(mg/m^3)^{-1}$	3.5E+00	6.30E-03	$(mg/kg/day)^{-1}$	D	HEAST	10/29/03
Ethylbenzene	NA	$(mg/m^3)^{-1}$	3.5E+00	NA	$(mg/kg/day)^{-1}$	D	IRIS	10/29/03
Ethylene Dibromide (EDB)	2.2E-01	$(mg/m^3)^{-1}$	3.5E+00	7.70E-01	$(mg/kg/day)^{-1}$	B2	IRIS	10/29/03
2-Methylnaphthalene	NA	$(mg/m^3)^{-1}$	3.5E+00	NA	$(mg/kg/day)^{-1}$	(2)	(2)	(2)
Naphthalene	NA	$(mg/m^3)^{-1}$	3.5E+00	NA	$(mg/kg/day)^{-1}$	C	IRIS	10/29/03
Tetrachloroethene (PCE)	5.9E-03	$(mg/m^3)^{-1}$	3.5E+00	2.07E-02	$(mg/kg/day)^{-1}$	NA	EPA 2003a	6/12/2003
Trichloroethene (TCE)	NA	$(mg/m^3)^{-1}$	3.5E+00	4.00E-01	$(mg/kg/day)^{-1}$	NA	EPA 2002	10/01/02
Xylenes (total)	NA	$(mg/m^3)^{-1}$	3.5E+00	NA	$(mg/kg/day)^{-1}$	D	IRIS	10/29/03
Aluminum	NA	$(mg/m^3)^{-1}$	3.5E+00	NA	$(mg/kg/day)^{-1}$	NA	NA	NA
Arsenic	4.3E+00	$(mg/m^3)^{-1}$	3.5E+00	1.51E+01	$(mg/kg/day)^{-1}$	A	IRIS	10/29/03
Chromium	1.2E+01	$(mg/m^3)^{-1}$	3.5E+00	4.20E+01	$(mg/kg/day)^{-1}$	A	IRIS	10/29/03
Lead (and compounds-inorganic)	NA	$(mg/m^3)^{-1}$	3.5E+00	NA	$(mg/kg/day)^{-1}$	B2	IRIS	10/29/03
Manganese	NA	$(mg/m^3)^{-1}$	3.5E+00	NA	$(mg/kg/day)^{-1}$	D	IRIS	10/29/03
Thallium	NA	$(mg/m^3)^{-1}$	3.5E+00	NA	$(mg/kg/day)^{-1}$	NA	NA	NA
Vanadium	NA	$(mg/m^3)^{-1}$	3.5E+00	NA	$(mg/kg/day)^{-1}$	NA	NA	NA

Notes:
HEAST = Toxicity values were obtained from Health Effects Assessment Summary Tables (HEAST) Annual FY-1997. EPA 1997b.
IRIS =Integrated Risk Information System. Online database. Accessed 10/29/03 EPA 2003b.
mg/kg/day = milligrams per kilogram per day
NA = not available
$\mu g/m^3$ = micrograms per cubic meter
(1) Adjustment factor applied to Unit Risk to calculate Inhalation Slope Factor = 70 kg x 1/20 m^3/day
(2) Naphthalene was used as a surrogate compound to determine toxicity values for 2-methylnaphthalene.

EPA 2002. U.S. EPA Region 9 PRGs Table 2002 Update, October 1, 2002
EPA 2003a. Letter from Elizabeth Southerland (Deputy Director, Office of Emergency and Remedial Response) to Region X regarding oral and inhalati carcinogenic slope factors for PCE. OSWER No. 9285.7-75.

EPA Weight of Evidence Classification:
A - Human carcinogen
B2 - Probable human carcinogen - indicates sufficient evidence in animals and inadequate or no evidence in humans
C - Possible human carcinogen
D - Not classifiable as a human carcinogen

Table 2-31
Risk Assessment Summary
Reasonable Maximum Exposure
Eastern Briarwood Groundwater, On-Base Adult

Scenario Time Frame: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Groundwater	Groundwater	On-Base Eastern Briarwood Groundwater - Tap Water	Tetrachloroethene (PCE)	1E-05	NA	8E-06	2E-05	Thallium (Total)	Liver	2E+00	NA	1E-02	2E+00
			Trichloroethene (TCE)	6E-06	NA	1E-06	8E-06						
			(Total)	2E-05	NA	9E-06	3E-05	(Total)		2E+00	NA	1E-02	2E+00
	Vapor	On-Base Eastern Briarwood Groundwater - Vapor	Tetrachloroethene (PCE)	NA	2E-06	NA	2E-06	None					
			Trichloroethene (TCE)	NA	2E-05	NA	2E-05						
			(Total)	NA	3E-05	NA	3E-05						
				Total Risk Across Groundwater			5E-05	Total Hazard Index Across All Media and All Exposure Routes					2E+00
				Total Adult Risk Across All Media and All Exposure Routes			5E-05						
				Total Child Risk Across All Media and All Exposure Routes			4E-05						
				Total Lifetime Risk Across All Media and All Exposure Routes			9E-05						

Notes:
NA = not available

Table 2-32
Risk Assessment Summary
Reasonable Maximum Exposure
Eastern Briarwood Groundwater, On-Base Child

Scenario Time Frame: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	On-Base Eastern Briarwood Groundwater - Tap Water	Tetrachloroethene (PCE)	7E-06	NA	5E-06	1E-05						
			Trichloroethene (TCE)	4E-06	NA	6E-07	4E-06	Thallium (Total)	Liver	5E+00	NA	3E-02	5E+00
			(Total)	1E-05	NA	5E-06	2E-05			5E+00	NA	3E-02	5E+00
	Vapor	On-Base Eastern Briarwood Groundwater - Vapor	Tetrachloroethene (PCE)	NA	1E-06	NA	1E-06	None					
			Trichloroethene (TCE)	NA	2E-05	NA	2E-05						
			(Total)	NA	2E-05	NA	2E-05						
			Total Risk Across Groundwater				4E-05	Total Hazard Index Across All Media and All Exposure Routes					5E+00
			Total Child Risk Across All Media and All Exposure Routes				4E-05						
			Total Adult Risk Across All Media and All Exposure Routes				5E-05						
			Total Lifetime Risk Across All Media and All Exposure Routes				9E-05						

Notes:
NA = not available

Table 2-33
Risk Assessment Summary
Reasonable Maximum Exposure
Eastern Briarwood Groundwater, Off-Base Solvent-Impacted Area Adult

Scenario Time Frame: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Off-Base Groundwater Contaminated by Solvents - Tap Water	Tetrachloroethene (PCE)	2E-05	NA	1E-05	3E-05	None					
			Trichloroethene (TCE)	2E-05	NA	3E-06	2E-05						
			(Total)	3E-05	NA	1E-05	5E-05						
	Vapor	Off-Base Groundwater Contaminated by Solvents - Vapor	Chloroform	NA	1E-05	NA	1E-05	None					
			Tetrachloroethene (PCE)	NA	2E-06	NA	2E-06						
			Trichloroethene (TCE)	NA	6E-05	NA	6E-05						
			(Total)	NA	8E-05	NA	8E-05						
						Total Risk Across Groundwater	1E-04		Total Hazard Index Across All Media and All Exposure Routes				
						Total Adult Risk Across All Media and All Exposure Routes	1E-04						
						Total Child Risk Across All Media and All Exposure Routes	9E-05						
						Total Lifetime Risk Across All Media and All Exposure Routes	2E-04						

Notes:
NA = not available

Table 2-34
Risk Assessment Summary
Reasonable Maximum Exposure
Eastern Briarwood Groundwater, Off-Base Solvent-Impacted Area Child

Scenario Time Frame: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Off-Base Groundwater Contaminated by Solvents - Tap Water	Tetrachloroethene (PCE)	1E-05	NA	6E-06	2E-05	None					
			Trichloroethene (TCE)	1E-05	NA	2E-06	1E-05						
			(Total)	2E-05	NA	7E-06	3E-05						
	Vapor	Off-Base Groundwater Contaminated by Solvents - Vapor	Chloroform	NA	1E-05	NA	1E-05	Chloroform	NA	NA	2E+00	NA	2E+00
			Tetrachloroethene (PCE)	NA	2E-06	NA	2E-06						
			Trichloroethene (TCE)	NA	5E-05	NA	5E-05						
			(Total)	NA	6E-05	NA	6E-05	otal)		NA	2E+00	NA	2E+00
			Total Risk Across Groundwater				9E-05	Tota	zard Index Across All Media and All Exposure Routes				2E+00
			Total Child Risk Across All Media and All Exposure Routes				9E-05						
			Total Adult Risk Across All Media and All Exposure Routes				1E-04						
			Total Lifetime Risk Across All Media and All Exposure Routes				2E-04						

Notes:
NA = not available

Table 2-35
Risk Assessment Summary
Reasonable Maximum Exposure
Eastern Briarwood Groundwater, Off-Base EDB-Impacted Area Adult

Scenario Time Frame: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Off-Base Groundwater Contaminated by EDB - Tap Water	1,2-Dibromoethane (EDB)	3E-05	NA	2E-06	4E-05	None					
			(Total)	3E-05	NA	2E-06	4E-05						
	Vapor	Off-Base Groundwater Contaminated by EDB - Vapor	1,2-Dibromoethane (EDB)	NA	1E-06	NA	1E-06	None					
			(Total)	NA	1E-06	NA	1E-06						
						Total Risk Across Groundwater	4E-05		Total Hazard Index Across All Media and All Exposure Routes				
						Total Adult Risk Across All Media and All Exposure Routes	4E-05						
						Total Child Risk Across All Media and All Exposure Routes	2E-05						
						Total Lifetime Risk Across All Media and All Exposure Routes	6E-05						

Notes:
NA = not available

Table 2-36
Risk Assessment Summary
Reasonable Maximum Exposure
Eastern Briarwood Groundwater, Off-Base EDB-Impacted Area (ild

Scenario Time Frame: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Off-Base Groundwater Contaminated by EDB - Tap Water	1,2-Dibromoethane (EDB)	2E-05	NA	1E-06	2E-05	None					
			(Total)	2E-05	NA	1E-06	2E-05						
	Vapor	Off-Base Groundwater Contaminated by EDB - Vapor	1,2-Dibromoethane (EDB)	NA	9E-07	NA	9E-07	None					
			(Total)	NA	9E-07	NA	9E-07						
						Total Risk Across Groundwater	2E-05	Tota	izard Index Across All Media and All Exposure Routes				
						Total Child Risk Across All Media and All Exposure Routes	2E-05						
						Total Adult Risk Across All Media and All Exposure Routes	4E-05						
						Total Lifetime Risk Across All Media and All Exposure Routes	6E-05						

Notes:
NA = not available

Table 2-37
Risk Assessment Summary
Reasonable Maximum Exposure
Eastern Briarwood Quashnet River, Fish Consumer

Scenario Time Frame: Future
Receptor Population: Fish Eater
Receptor Age: Child + Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Inhalation	Ingestion	Dermal	Exposure Routes Total
Surface Water	Fish Tissue	Quashnet River - Surface Water	BEHP [Bis(2-ethylhexyl)phthalate]	3.1E-06	NA	NA	3.1E-06	None					
			Arsenic (Total)	1.3E-05	NA	NA	1.3E-05						
			(Total)	1.6E-05	NA	NA	1.6E-05						
			Total Risk Across Surface Water				1.6E-05	Total Hazard Index Across All Media and All Exposure Routes					
			Total Risk Across All Media and All Exposure Routes				1.6E-05						

Notes:

NA = not available

Table 2-38
Risk Assessment Summary
Reasonable Maximum Exposure
Eastern Briarwood Quashnet River, Cranberry Worker

Scenario Time Frame: Future
Receptor Population: Cranberry Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Surface Water	Surface Water	Quashnet River - Surface Water	None					None					
	Vapor	Quashnet River Surface Water - Vapor	None					None					
Sediment	Sediment	Quashnet River - Sediment	None					None					
						Total Risk Across Surface Water			Tota	zard Index Across All Media and All Exposure Routes			
						Total Risk Across All Media and All Exposure Routes							

Notes:
NA = not available

Table 2-39
Risk Assessment Summary
Reasonable Maximum Exposure
Eastern Briarwood Quashnet River, Adult Wader

Scenario Time Frame: Future
Receptor Population: River Wader
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Surface Water	Surface Water	Quashnet River - Surface Water	None					None					
	Vapor	Quashnet River Surface Water - Vapor	None					None					
Sediment	Sediment	Quashnet River - Sediment	Arsenic	4E-07	NA	1E-07	5E-07	None					
			(Total)	4E-07	NA	1E-07	5E-07						

Total Risk Across Surface Water	
Total Risk Across Sediment	5E-07
Total Adult Risk Across All Media and All Exposure Routes	5E-07
Total Child Risk Across All Media and All Exposure Routes	1E-06
Total Lifetime Risk Across All Media and All Exposure Routes	2E-06
Total Hazard Index Across All Media and All Exposure Routes	

Notes:
NA = not available

Table 2-40
Risk Assessment Summary
Reasonable Maximum Exposure
Eastern Briarwood Quashnet River, Child Wader

Scenario Time Frame: Future
Receptor Population: River Wader
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Surface Water	Surface Water	Quashnet River - Surface Water	None					None					
	Vapor	Quashnet River Surface Water - Vapor	None					None					
Sediment	Sediment	Quashnet River - Sediment	Arsenic	8E-07	NA	4E-07	1E-06	None					
			(Total)	8E-07	NA	4E-07	1E-06						

Total Risk Across Surface Water	
Total Risk Across Sediment	1E-06
Total Child Risk Across All Media and All Exposure Routes	1E-06
Total Adult Risk Across All Media and All Exposure Routes	5E-07
Total Lifetime Risk Across All Media and All Exposure Routes	2E-06

Tot... ...zard Index Across All Media and All Exposure Routes

Notes:
NA = not available

Table 2-41
Risk Assessment Summary
Reasonable Maximum Exposure
Western Aquafarm Groundwater, Adult

Scenario Time Frame: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	On/Off-Base Western Aquafarm Groundwater - Tap Water	Arsenic (Total)	2E-04	NA	1E-06	2E-04	none					
			Trichloroethene (TCE)	3E-06	NA	5E-07	4E-06						
			(Total)	2E-04	NA	2E-06	2E-04						
	Vapor	On/Off-Base Western Aquafarm Groundwater - Vapor	Chloromethane	NA	1E-06	NA	1E-06	Xylenes (Total)	Motor Coordination	NA	2E+01	NA	2E+01
			Trichloroethene (TCE)	NA	1E-05	NA	1E-05						
			(Total)	NA	1E-05	NA	1E-05	(Total)		NA	2E+01	NA	2E+01
						Total Risk Across Groundwater	2E-04					Total Hazard Index Across All Media and All Exposure Routes	2E+01
						Total Adult Risk Across All Media and All Exposure Routes	2E-04						
						Total Child Risk Across All Media and All Exposure Routes	1E-04						
						Total Lifetime Risk Across All Media and All Exposure Routes	4E-04						

Notes:
CNS = central nervous system
NA = not available

Table 2-42
Risk Assessment Summary
Reasonable Maximum Exposure
Western Aquafarm Groundwater, Child

Scenario Time Frame: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	On/Off-Base Western Aquafarm Groundwater - Tap Water	Arsenic (Total)	1E-04	NA	8E-07	1E-04	Arsenic (Total)	Skin	3E+00	NA	2E-02	3E+00
								Manganese (Total)	CNS	3E+00	NA	5E-01	4E+00
			Trichloroethene (TCE)	2E-06	NA	3E-07	2E-06	Xylenes (Total)	Body Weight	2E+00	NA	1E+00	3E+00
			(Total)	1E-04	NA	1E-06	1E-04	(To:		8E+00	NA	2E+00	1E+01
	Vapor	On/Off-Base Western Aquafarm Groundwater - Vapor	Chloromethane	NA	8E-07	NA	8E-07	Bromomethane	Respiratory	NA	2E+00	NA	2E+00
			Trichloroethene (TCE)	NA	9E-06	NA	9E-06						
								Xylenes (Total)	Motor Coordination	NA	5E+01	NA	5E+01
			(Total)	NA	1E-05	NA	1E-05	(To!		NA	5E+01	NA	5E+01
						Total Risk Across Groundwater	1E-04	Tc	Hazard Index Across All Media and All Exposure Routes				6E+01
						Total Child Risk Across All Media and All Exposure Routes	1E-04						
						Total Adult Risk Across All Media and All Exposure Routes	2E-04						
						Total Lifetime Risk Across All Media and All Exposure Routes	4E-04						

Notes:
CNS = central nervous system
NA = not available

Table 2-43
Risk Assessment Summary
Reasonable Maximum Exposure
SD-5 Groundwater, On-Base Adult

Scenario Time Frame: Future
Receptor Population: On-Base Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	On-Base Groundwater-Tap Water	Tetrachloroethene (PCE)	2E-05	NA	1E-05	4E-05	Thallium	Liver	3E+00	NA	1E-02	3E+00
			Trichloroethene (TCE)	1E-04	NA	2E-05	1E-04	Trichloroethylene (TCE)	Liver	2E+00	NA	4E-01	3E+00
			(Total)	1E-04	NA	3E-05	2E-04	(Total)		5E+00	NA	4E-01	5E+00
	Vapor	On-Base Groundwater-Vapor	Chloroform	NA	2E-06	NA	2E-06	none					
			Tetrachloroethene (PCE)	NA	3E-06	NA	3E-06						
			Trichloroethene (TCE)	NA	4E-04	NA	4E-04						
			(Total)	NA	4E-04	NA	4E-04	(Total)					
				Total Risk Across Groundwater			5E-04	Total Hazard Index Across All Media and All Exposure Routes					5E+00
			Total Adult Risk Across All Media and All Exposure Routes				5E-04						

Notes:

NA = not available

Table 2-44
Risk Assessment Summary
Reasonable Maximum Exposure
SD-5 Groundwater, On-Base Child

Scenario Time Frame: Future
Receptor Population: On-Base Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	On-Base Groundwater-Tap Water	Tetrachloroethene (PCE)	1E-05	NA	8E-06	2E-05	Thallium	Liver	6E+00	NA	4E-02	6E+00
			Trichloroethene (TCE)	6E-05	NA	1E-05	7E-05	Trichloroethene (T	Liver	6E+00	NA	1E+00	7E+00
			(Total)	7E-05	NA	2E-05	9E-05	tal)		1E+01	NA	1E+00	1E+01
	Vapor	On-Base Groundwater-Vapor	Chloroform	NA	2E-06	NA	2E-06	none					
			Tetrachloroethene (PCE)	NA	2E-06	NA	2E-06						
			Trichloroethene (TCE)	NA	3E-04	NA	3E-04						
			(Total)	NA	3E-04	NA	3E-04	tal)					
				Total Risk Across Groundwater			4E-04	Total H	ard Index Across All Media and All Exposure Routes				1E+01
			Total Child Risk Across All Media and All Exposure Routes				4E-04						

Notes:

NA = not available

Table 2-45
Risk Assessment Summary
Reasonable Maximum Exposure
SD-5 Groundwater, Off-Base Adult

Scenario Time Frame: Future
Receptor Population: Off-Base Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotients				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Off-Base Groundwater-Tap Water	Ethylene Dibromide (EDB)	2E-05	NA	9E-07	2E-05	Manganese	CNS	1E+00	NA	2E-01	2E+00
			Tetrachloroethene (PCE)	2E-05	NA	1E-05	3E-05	Trichloroethene (TCE)	Liver	3E+00	NA	5E-01	4E+00
			Trichloroethene (TCE)	1E-04	NA	2E-05	2E-04						
			(Total)	2E-04	NA	4E-05	2E-04	(Total)		4E+00	NA	7E-01	5E+00
	Vapor	Off-Base Groundwater-Vapor	Chloroform	NA	6E-06	NA	6E-06	none					
			Tetrachloroethene (PCE)	NA	3E-06	NA	3E-06						
			Trichloroethene (TCE)	NA	5E-04	NA	5E-04						
			(Total)	NA	5E-04	NA	5E-04	(Total)					
			Total Risk Across Groundwater				7E-04	Total Hazard Index Across All Media and All Exposure Routes					5E+00
			Total Adult Risk Across All Media and All Exposure Routes				7E-04						

Notes:

CNS = central nervous system

NA = not available

Table 2-46
Risk Assessment Summary
Reasonable Maximum Exposure
SD-5 Groundwater, Off-Base Child

Scenario Time Frame: Future
Receptor Population: Off-Base Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Off-Base Groundwater-Tap Water	Ethylene Dibromide (EDB)	9E-06	NA	5E-07	9E-06	Manganese	CNS	3E+00	NA	5E-01	4E+00
			Tetrachloroethene (PCE)	1E-05	NA	7E-06	2E-05	Trichloroethene (E)	Liver	7E+00	NA	1E+00	8E+00
			Trichloroethene (TCE)	7E-05	NA	1E-05	9E-05						
			(Total)	9E-05	NA	2E-05	1E-04	Total)		1E+01	NA	2E+00	1E+01
	Vapor	Off-Base Groundwater-Vapor	Chloroform	NA	5E-06	NA	5E-06	Trichloroethene (E)	NA	NA	1E+00	NA	1E+00
			Tetrachloroethene (PCE)	NA	2E-06	NA	2E-06						
			Trichloroethene (TCE)	NA	4E-04	NA	4E-04						
			(Total)	NA	4E-04	NA	4E-04	otal)		NA	1E+00	NA	1E+00
				Total Risk Across Groundwater			5E-04	Tot:	izard Index Across All Media and All Exposure Routes				1E+01
			Total Child Risk Across All Media and All Exposure Routes				5E-04						

Notes:

CNS = central nervous system

NA = not available

Table 2-47
Summary of Human Health Risk Drivers
Eastern Briarwood, Western Aquafarm, and SD-5

Receptor/COPC	ELCR (if >1E-5)	HQ Child (if >1)	HQ Adult (if >1)	EPC (µg/L)	(M)MCL (µg/L)	COC
Resident, Eastern Briarwood On-Base Groundwater						
Tetrachloroethene (PCE)	4E-05			2.5	5	No
Trichloroethene (TCE)	5E-05			1.7	5	No
Thallium		5E+00	2E+00	5.3 J	2	No
Total	**9E-05**	**5E+00**	**2E+00**			
Resident, Eastern Briarwood Off-Base EDB-Contaminated Groundwater						
Ethylene Dibromide (EDB)	6E-05			0.042	0.02	No
Total	**6E-05**					
Resident, Eastern Briarwood Off-Base Solvent-Contaminated Groundwater						
Chloroform	2E-05	2E+00		4.9	80	No
Tetrachloroethene (PCE)	5E-05			3.2	5	No
Trichloroethene (TCE)	1E-04			4.5	5	No
Total	2E-04	2E+00				
Quashnet River Fish Consumer						
BEHP [bis(2-ethylhexyl) phthalate]	3E-06			4	NA	No
Arsenic	1E-05			3.34	NA	No
Total	**2E-05**					
Quashnet River Cranberry Worker						
none						
Quashnet River Wader						
Arsenic	2E-06			3.34	NA	No
Total	**2E-06**					
Resident, Western Aquafarm Groundwater						
Bromomethane		2E+00		7.9 J	10	No
Trichloroethene (TCE)	3E-05			0.81 J	5	No
Xylenes (Total)		5E+01	2E+01	4700	10000	No
Arsenic	3E-04	3E+00		14.9	10	No
Manganese		4E+00		1140		No
Total	**4E-04**	**6E+01**	**2E+01**			
Resident, On-Base SD-5 Groundwater						
Chloroform	4E-06			0.77	80	No
Tetrachloroethene (PCE)	6E-05			4.21	5	No
Trichloroethene (TCE)	9E-04	7E+00	7E+00	27	5	Yes
Thallium		6E+00	6E+00	6.2	2	No
Total	**9E-04**	**1E+01**	**1E+01**			
Resident, Off-Base SD-5 Groundwater						
Chloroform	1.2E-05			2.29	80	No
Ethylene Dibromide (EDB)	2.5E-05			0.019	0.02	No
Tetrachloroethene (PCE)	5.4E-05			3.75	5	No
Trichloroethene (TCE)	1.1E-03	3.6E+00	9.6E+00	34	5	Yes
Manganese		1.5E+00	3.7E+00	1190		No
Total	**1E-03**	**5E+00**	**1E+01**			

Notes:
COC = contaminant of concern
COPC = chemical of potential concern
ELCR = excess lifetime cancer risk
EPC = exposure point concentration
HQ = hazard quotient
MCL = maximum contaminant level
MMCL = Massachusetts maximum contaminant level
µg/L = micrograms per liter

Table 2-48
Present Value Calculation for
SD-5 Groundwater Operable Unit Alternatives 2 and 3

Alternative 2			Alternative				
Year	Annual Chemical Monitoring and Periodic Costs	Total Present Value Cost at 2.1%	Year	Treatment System Construction & Start-Up Costs	Ba eline Monit ing, and Ann l O&M, Cr nical Mo oring, Hy aulic Monit ing, and Perio c Costs		Total Present Value Cost at 2.1%
0	$99,846	$99,846	0	$1,252,819		$151,921	$1,404,740
1	$99,846	$97,793	1	$0		$184,896	$181,093
2	$99,846	$95,781	2	$0		$184,896	$177,369
3	$63,902	$60,039	3	$0		$63,902	$60,039
4	$63,902	$58,804	4	$0		$63,902	$58,804
5	$113,110	$101,947	5	$0		$72,173	$65,050
TOTAL	$540,452	$514,210	TOTAL	$1,252,819		$721,691	$1,947,096

Notes:
O&M = operations and maintenance
Using a 2.1% discount factor; Escalation of 5% from 2003
Monitoring for only two years after maximum contaminant levels are met.

Table 2-49
Cost Basis for SD-5 Groundwater Operable Unit Alternative 2

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL	SUBTOTAL	COMMENTS (1)
Monitoring Costs						
ANNUAL COSTS						
Chemical Monitoring and Reporting Years 0-2						
Existing Wellfield Chemical Monitoring	1	YR	$ 92,800	$ 92,800		Based on actual costs with ongoing monitoring under the SPEIM program. Includes equipment, personnel, laboratory analyses, IDM, maintenance, data interpretation, and reporting. Actual costs also include overhead and support.
Escalated-Existing					$ 99,846	Overhead and support costs are included in the actual costs used to derive monitoring costs.
Chemical Monitoring and Reporting Years 3&4						Assume after two years that the monitoring program will be reduced by 36%.
Existing Wellfield Chemical Monitoring	1	YR	$ 59,392	$ 59,392		
Escalated-Existing					$ 63,902	
Chemical Monitoring and Reporting Years 5+						Assume after four years that the monitoring program will be reduced by 59%.
Existing Wellfield Chemical Monitoring	1	YR	$ 38,048	$ 38,048		
Escalated-Existing					$ 40,937	

Table 2-49
Cost Basis for SD-5 Groundwater Operable Unit Alternative

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL	SUBTOTAL	COMMENTS (1)
				PERIODIC COSTS		
CERCLA 5-Year Reporting						Ye r 5 (1 event)
Report Preparation and Submittal	1	EA	$ 2,000	$ 2,000		Re ort is part of a larger review of all sources ar systems at MMR.
OVERHEAD & SUPPORT				$ 580		
TOTAL					$ 2,580	
TOTAL ESCALATED					$ 2,776	
Residual Risk Assessment						Y 5 (1 event)
Report Preparation and Submittal	1	EA	$ 50,000	$ 50,000		
OVERHEAD & SUPPORT				$ 14,500		
TOTAL					$ 64,500	
TOTAL ESCALATED					$ 69,397	

Notes:
CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act
EA = each
IDM = investigation-derived material
MMR = Massachusetts Military Reservation
SD-5 = Storm Drain-5
SPEIM = System Performance and Ecological Impact Monitoring
YR = year

Table 2-50
Chemical-Specific ARARs for
SD-5 Groundwater Operable Unit Remedy Alternative 2

Media	Requirements	Requirement Synopsis	Action to be Taken to Attain Requirements	Status
Groundwater	FEDERAL – SDWA MCLs (40 CFR 141.61-141.63)	MCLs have been promulgated for organic and inorganic contaminants. These levels regulate the concentration of contaminants in public drinking water supplies, but are also considered relevant and appropriate for CERCLA groundwater response actions where the groundwater aquifer is used or classified for use as drinking water.	These standards were used to develop cleanup standards to be met through cleanup of the SD-5 plume. LTM will determine when these cleanup standards are met, unless a more stringent state standard has been promulgated, in which case the more stringent state standard must be met.	Relevant and Appropriate
Groundwater	STATE – MA Drinking Water Standards (310 CMR 22.05-22.09)	These standards establish MCLs for public drinking water systems but are also considered relevant and appropriate for CERCLA groundwater response actions. When state MCLs are more stringent that federal levels, state levels must be used.	These standards were used to develop cleanup standards to be met through cleanup of the SD-5 plume. The MA MCL for TCE is 5 µg/L, the same as the federal MCL. LTM will determine when this cleanup standard is met.	Relevant and Appropriate
Groundwater	STATE – MA Groundwater Quality Standards (314 CMR 6.06)	These standards limit the concentration of certain materials allowed in classified Massachusetts waters. The groundwater beneath MMR has been classified as a Class I water or fresh groundwater found in the saturated zone of unconsolidated deposits and is designated as a source of potable water. The standards for Class I groundwater are the same as the state's MCLs.	LTM will determine when these standards are met, unless a more stringent state standard has been promulgated, in which case the more stringent state standard must be met.	Applicable

ARAR applicable or relevant and appropriate requirement
CERCLA Comprehensive Environmental Response, Compensation, and Liability Act
CFR Code of Federal Regulations
CMR Code of Massachusetts Regulations
LTM long-term monitoring
MA Massachusetts
MCL maximum contaminant level
MMR Massachusetts Military Reservation
SD-5 Storm Drain-5
SDWA Safe Drinking Water Act
TCE trichloroethene
µg/L micrograms per liter

Table 2-51
Location-Specific ARARs for
SD-5 Groundwater Operable Unit Remedy Alternative 2

Resource	Requirements	Requirement Synopsis	Action to I Attain Rec	Taken to irements	Status
Endangered and threatened species and their habitats	STATE – MA Endangered Species Act (321 CMR 10.00 et seq.)	Actions that jeopardize state-listed endangered or threatened species, or species of special concern or their habitats must be avoided, or appropriate mitigation measures must be taken.	The operation and mainten well system, as well as the LTM wells, if needed, will b effects to endangered or th state-listed species have b The Camp Edwards Natura (http://www.eandrc.org/rar search for, identify, and ma on the MMR and provides t Massachusetts Division of	ce of the current LTM onstruction of any new designed to minimize atened species. Several n identified on the MMR. Resource Office ecies.htm) continues to locations of rare species s information to the sheries and Wildlife.	Applicable
Historic, archeological, and Native American artifacts and resources	FEDERAL – NHPA (16 USCA 470 et seq.; 36 CFR 800); AHPA (16 USCA 469a-c); ARPA (16 USC 470aa-ll; 43 CFR 7); NAGPRA (25 USCA 3001-3013; 43 CFR 10)	These statutes and regulations provide for the protection of historic, archaeological, and Native American burial sites, artifacts, and objects that might be lost as a result of a federal construction project. If a discovery is made, all activity in the area must stop and reasonable effort must be made to secure and protect the objects discovered.	After consultation with the and the SHPO, the parties cultural resources survey is identify and identify objects Native American artifacts o Tribes. If LTM wells need t have such resources, all su during a survey or inadvert site remedial activities will as required by law and in a consulting parties' memora	mpanoag Indian Tribes ay determine that a eeded to discover and nd artifacts, particularly he Wampanoag Indian e sited in areas that may resources discovered tly discovered during on- secured and protected ordance with the lum of agreement.	Applicable
Historic, archeological, and Native American artifacts and resources	STATE – MA Historic Preservation Act (MGL Ch. 9 Sections 26-27C; MGL Ch. 7, Section 38A; MGL Ch. 38 Sections 6B-6C; and 950 CMR 70-71)	The MHC is the state historic preservation office and is authorized by Massachusetts law to identify, evaluate and protect the Commonwealth's important historic and archaeological resources. The MHC administers state and federal preservation programs, including planning, review and compliance.	After consultation with the and the SHPO, the parties cultural resources survey is identify and identify objects Native American artifacts of Tribes. If LTM wells need to have such resources, all su during a survey or inadvert site remedial activities will as required by law and in a consulting parties' memora	mpanoag Indian Tribes ay determine that a eeded to discover and nd artifacts, particularly he Wampanoag Indian e sited in areas that may resources discovered tly discovered during on- secured and protected ordance with the lum of agreement.	Applicable

Table 2-51
Location-Specific ARARs for
SD-5 Groundwater Operable Unit Remedy Alternative 2

Resource	Requirements	Requirement Synopsis	Action to be Taken to Attain Requirements	Status
Wetlands	FEDERAL – Protection of Wetlands (EO 11990, 40 CFR 6, Appendix A)	Under this order, federal agencies are required to minimize the destruction, loss, or degradation of wetlands, and preserve beneficial values of wetlands. Appendix A requires that no remedial alternatives adversely affect a wetland if another practicable alternative is available. If no alternative is available, effects from implementing the alternative must be mitigated.	If operation and maintenance of the LTM well system and construction of any new LTM wells (if needed) would adversely affect nearby wetlands, such potential impacts will be minimized to comply with these requirements.	Applicable
Wetlands	FEDERAL – CWA Section 404 (40 CFR 230; 33 CFR Parts 320-323)	No activity that adversely affects a wetland shall be permitted if a practicable alternative with fewer effects is available. If no practicable alternative exists, impacts must be mitigated.	If the construction (if needed), operation and maintenance of the LTM well system may adversely affect nearby wetlands, such potential impacts will be mitigated to comply with CWA 404 requirements.	Applicable
Wetlands	STATE – MassDEP Wetlands Protection Act (MGL Ch. 131, Section 40) and regulations (310 CMR 10.00)	This regulation outlines performance standards that must be met to work within 100 feet of a coastal or inland wetland and within 200 feet of a river. It governs all work involving the filling, dredging, or alteration of wetlands, banks, land under water bodies, waterways, land subject to flooding and riverfront areas.	The construction (if needed), operation, and maintenance of the LTM well system will be designed and implemented to meet the performance standards in 310 CMR 10.21 through 10.60 to minimize adverse effects to any nearby wetlands.	Applicable
Wetlands	FEDERAL – Fish and Wildlife Coordination Act (40 CFR 6.302; 16 USC 661 et seq.)	This act and regulations require federal agencies to take into consideration the effect that water-related projects would have on fish and wildlife, and to consult with the U.S. Fish and Wildlife Service and the state to develop measures to prevent, mitigate, or compensate for project-related losses to fish and wildlife.	LTM actions will be designed to minimize adverse effects to fish and wildlife in any wetland areas. Relevant federal and state agencies will be contacted, if indicated, to help analyze the effects of the LTM system on fish and wildlife in the wetlands in and around the site.	Applicable

Table 2-51
Location-Specific ARARs for
SD-5 Groundwater Operable Unit Remedy Alternative 2

Resource	Requirements	Requirement Synopsis	Action to b Attain Rec	Taken to irements	Status
Floodplains	FEDERAL – Protection of Floodplains (EO 11988, 40 CFR 6, Appendix A)	Requires federal agencies to minimize potential harm to or within floodplains and avoid the long- and short-term adverse impacts with modifications to floodplains. Appendix A requires that no remedial alternatives adversely affect a floodplain if another practicable alternative is available. If no alternative is available, effects from implementing the alternative must be mitigated.	These requirements are AF needed and are sited in floc of any such LTM well is nee will be complied with if the l is within or affecting a flood	Rs only if new wells are plains. If the placement ed, these requirements ation of the new well(s) ain.	Applicable
Floodplains	STATE – MassDEP Wetland Protection Act (MGL Ch. 131, Section 40, and 310 CMR 10.00)	Governs work proposed within land subject to flooding (100-year floodplain) and coastal storm flow. Compensatory flood storage is required for any loss of floodplain area.	These requirements are AF needed and are sited in floc of any such LTM well is nee will be complied with if the l is within or affecting a flood	Rs only if new wells are plains. If the placement ed, these requirements ation of the new well(s) ain.	Applicable

AHPA	Archaeological and Historic Preservation Act
ARAR	applicable or relevant and appropriate requirement
ARPA	Archaeological Resources Protection Act
CFR	Code of Federal Regulations
Ch.	chapter
CMR	Code of Massachusetts Regulations
CWA	Clean Water Act
LTM	long-term monitoring
MA	Massachusetts
MassDEP	Massachusetts Department of Environmental Protection
MGL	Massachusetts Gene Law
MHC	Massachusetts Histor Commission
MMR	Massachusetts Militar Reservation
NAGPRA	Native American Gra Protection and Repatriation Act
NHPA	National Historic Pres vation Act
SD-5	Storm Drain-5
SHPO	State Historic Preserv on Officer
TCE	trichloroethene
USC	United States Code
USCA	United States Code, A notated

Table 2-52
Action-Specific ARARs for
SD-5 Groundwater Operable Unit Remedy Alternative 2

Media	Requirements	Requirement Synopsis	Action to Be Taken to Attain Requirements	Status
Stormwater runoff	FEDERAL – CWA NPDES Stormwater Discharge Requirements (40 CFR 122.26)	Establishes requirements for stormwater discharges associated with construction activities that are in a land disturbance of equal to or greater than one acre of land. The requirements include good construction management techniques; phasing of construction projects; minimal clearing; and sediment, erosion, structural, and vegetative controls to be implemented to mitigate stormwater run-on and runoff.	If new LTM wells need to be sited in areas that would trigger stormwater runoff releases to any nearby surface water body, including wetlands, and the area of disturbance is greater than one acre of land, the runoff will be controlled in accordance with these requirements.	Applicable
Stormwater runoff	STATE – Stormwater Discharge Requirements (314 CMR 3.04 and 314 CMR 3.19)	Requires that stormwater discharges associated with construction activities be managed in accordance with the general permit conditions of 314 CMR 3.19 so as not to cause a violation of Massachusetts surface water quality standards in the receiving surface water body (including wetlands).	If new LTM wells need to be sited in areas that would trigger stormwater runoff releases to any nearby surface water body, including wetlands, and the area of disturbance is greater than one acre of land, the runoff will be controlled in accordance with these requirements.	Applicable
Stormwater runoff	STATE – Stormwater Management Program Policy (November 18, 1996)	Provides policies and guidance on complying with the state's stormwater discharge requirements.	If new LTM wells need to be sited in areas that would trigger stormwater runoff releases to any nearby surface water body, including wetlands, the runoff will be controlled in accordance with these requirements.	TBC
Soil	STATE – MA Erosion and Sediment Control Guidelines for Urban and Suburban Areas (May 2003)	Provides guidance and best management practices regarding erosion and sediment control	Construction of any new LTM wells (if needed) and operation and maintenance of LTM activities will be performed in accordance with this guidance as appropriate.	TBC

Table 2-52
Action-Specific ARARs for
SD-5 Groundwater Operable Unit Remedy Alternative 2

Media	Requirements	Requirement Synopsis	Action to be Ta n to Attain Requirements	Status
Hazardous waste	FEDERAL – Subtitle C Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities (40 CFR 264 et seq.)	These requirements establish minimum national standards that define the acceptable management of hazardous waste.	Because Massac usetts has been authorized to run the RCRA ase program, hazardous materials will be anaged according to the state requiremer listed below.	Applicable
Hazardous waste	FEDERAL – RCRA Subtitle C Standards for Identification and Listing of Hazardous Wastes (40 CFR 261.24)	These requirements identify the maximum concentrations of contaminants at which the waste would be considered characteristically hazardous waste.	Soils generated ring well installations and groundwater san les will be analyzed according to the CLP. If TCLP results exceed the stanc rds in 261.24, the material will be disposed off-site in a RCRA-permitted treatm t, storage, and disposal facility.	Applicable
Hazardous waste	STATE – MA HWMR Requirements for Generators of Hazardous Waste (310 CMR 30.300-30.353)	A person who generates solid waste must determine whether that waste is hazardous using various methods, including the TCLP method, or application of knowledge of hazardous characteristics of the waste. If the waste is determined to be hazardous, it must be managed in accordance with applicable Massachusetts generator requirements, which require management in accordance with 310 CMR 30.000 et seq.	If RCRA-charact stic wastes are generated, they will be man ed in accordance with these requireme s.	Applicable

ARAR applicable or relevant and appropriate requirement
CFR Code of Federal Regulations
CMR Code of Massachusetts Regulations
CWA Clean Water Act
HWMR hazardous waste management regulations
LTM long-term monitoring
MA Massachus s
NPDES National Po tant Discharge Elimination System
RCRA Resource C nservation and Recovery Act
SD-5 Storm Drai
TBC to be consic ed
TCLP Toxicity Cha cteristic Leaching Procedure

APPENDIX A

MassDEP Concurrence Letter

COMMONWEALTH OF MASSACHUSETTS
EXECUTIVE OFFICE OF ENVIRONMENTAL AFFAIRS
DEPARTMENT OF ENVIRONMENTAL PROTECTION
SOUTHEAST REGIONAL OFFICE
20 RIVERSIDE DRIVE, LAKEVILLE, MA 02347 508-946-2700

MITT ROMNEY
Governor

KERRY HEALEY
Lieutenant Governor

ROBERT W. GOLLEDGE, Jr.
Secretary

ARLEEN O'DONNELL
Commissioner

September 26, 2006

Ms. Susan Studlein
Office of Site Remediation and Restoration
U.S. Environmental Protection Agency,
Region 1
One Congress Street, Suite 1100
Boston, MA 02114-2023

RE: BOURNE—BWSC-4-0037
Massachusetts Military Reservation,
Final Record of Decision for Groundwater at Eastern Briarwood, Western Aquafarm, and Storm Drain -5, Concurrence

Dear Ms. Studlein:

The Massachusetts Department of Environmental Protection (the "MassDEP") has reviewed the document entitled **"Final Record of Decision for Groundwater at Eastern Briarwood, Western Aquafarm, and Storm Drain -5"** (the "EB/WA/SD-5 ROD"), dated August 2006. The EB/WA/SD-5 ROD presents the selected remedy for EB/WA/SD-5 groundwater, which was selected by the Air Force Center for Environmental Excellence ("AFCEE") in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). The U.S Air Force is the lead agency for CERCLA remedial actions at the Massachusetts Military Reservation ("MMR"). The EB/WA/SD-5 ROD was prepared for the AFCEE in connection with the MMR situated on Cape Cod in Bourne, Massachusetts. The AFCEE recommends *no further action* for the EB/WA groundwater study areas and *long-term monitoring with land use controls* for the SD-5 groundwater plume. MassDEP concurs with the AFCEE's selected final remedy as identified in the EB/WA/SD-5 ROD.

The AFCEE has implemented interim remedies for the groundwater at Eastern Briarwood, Western Aquafarm, and Storm Drain-5 since 1996. The interim remedy for groundwater at Eastern Briarwood and Western Aquafarm involved periodic sampling and analysis of groundwater monitoring wells. The interim remedy for the Storm Drain-5 groundwater plume involved the cleanup of the groundwater using a combination of recirculating wells (RWs) and groundwater extraction, treatment, and reinjection (ETR) systems.

This information is available in alternate format. Call Donald M. Gomes, ADA Coordinator at 617-556-1057. TDD Service - 1-800-298-2207.

DEP on the World Wide Web: http://www.mass.gov/dep
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Eastern Briarwood Groundwater:

The source of the former Eastern Briarwood plume was the military industrial area located along the southeastern portion of the MMR. The primary contaminants detected in the groundwater were chlorinated solvents, primarily trichloroethene (TCE) and tetrachloroethene (PCE). The contamination was determined to be the result of occasional spills from operations at the former power plant and weapons storage area at the MMR. Contaminated groundwater associated with Eastern Briarwood discharges to Johns Pond and the Quashnet River in Mashpee.

A long-term monitoring program was initiated in 1996 to evaluate contaminant trends and distributions within the Eastern Briarwood plume. Concentrations of TCE, PCE, and ethylene dibromide (EDB) within the plume have decreased substantially and are now below their respective Maximum Contaminant Levels (MCLs). These contaminants are currently detectable in only a few monitoring wells within the Eastern Briarwood plume. A definable plume of groundwater contamination no longer exists at the Eastern Briarwood study area. A risk assessment performed by the AFCEE during the IROD to ROD process concluded that contaminant concentrations in the Eastern Briarwood groundwater did not pose an unacceptable ecological or human health risk. The AFCEE, EPA, and MassDEP agreed that no additional action was necessary at the Eastern Briarwood groundwater area to be protective of human health and the environment.

Western Aquafarm Groundwater:

The Western Aquafarm consisted of six 25,000-gallon underground storage tanks used in the 1950s and 1960s to store aviation gasoline and jet fuel at the MMR. Investigations conducted between 1988 and 1993 detected fuel-related contaminants (i.e., benzene, ethylbenzene, and xylene) in the groundwater downgradient of the Western Aquafarm. A benzene plume was delineated from the Western Aquafarm to the base boundary.

A long-term monitoring program was initiated in 1996 to observe contaminant trends and distributions within the Western Aquafarm groundwater. Over the past ten years, natural attenuation has caused concentrations of contaminants associated with fuel contamination to decrease substantially in the Western Aquafarm groundwater. Concentrations of fuel-related contaminants above the MCL are no longer observed in the Western Aquafarm groundwater.

A risk assessment performed by the AFCEE during the IROD to ROD process concluded that the only unacceptable potential human health risk posed by the Western Aquafarm groundwater stems from concentrations of xylene in a single monitoring well located near an active runway. After evaluating the results of the risk assessment, groundwater contaminant trends, and upon considering the lack of potential current or future exposure to contaminated groundwater, and given the land use restrictions at the MMR, the AFCEE, EPA, and MassDEP agreed that no additional action was necessary at the Western Aquafarm groundwater.

Storm Drain-5 Groundwater:

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A central drainage swale at the SD-5 source area received storm water runoff from approximately 100 acres of runways and ramps starting in the late 1950s. Record searches and field investigations were performed between 1983 and 1988 to characterize source areas and groundwater contamination. The primary sources of the SD-5 plume were determined to be the Non-Destructive Inspection Laboratory, the Corrosion Control Shop, and floor sumps in hangars at the MMR. Shallow contaminated soil in the SD-5 source area was excavated and transported off base to landfills. In 2003, deeper soil contamination was removed using a soil vapor extraction system.

The primary contaminants in the SD-5 groundwater plume are chlorinated solvents (TCE, PCE, and 1,2-dichloroethene) and EDB. It was determined by the AFCEE that the SD-5 plume extended from the on-base source area to its discharge point off base along the northwestern [illegible] water of Johns Pond. A containment fence was installed in 1997 at the base boundary to prevent further off-base migration of the SD-5 plume. This system was designated as the SD-5 North ETR and designed to capture all the SD-5 groundwater contamination located upgradient of the MMR base boundary. The SD-5 South plume was designated as that area of groundwater contamination located downgradient of the base boundary, primarily in the Briarwood neighborhood in Mashpee between Ashumet Pond and Johns Pond.

The SD-5 North ETR operated from August 1997 to August 2003, when it ceased to detect TCE contamination above the MCL in the vicinity of the extraction fence. In 2005, TCE was detected above the MCL (max. concentration = 12.4 ug/L) in only two groundwater wells located on the MMR near the SD-5 source area. Groundwater modeling by the AFCEE indicates that this contamination will not reach the SD-5 north extraction fence at the MMR boundary at concentrations above the MCL.

The AFCEE installed two recirculating wells (RWs) in the Briarwood neighborhood in 1999 to restore the aquifer and to reduce the mass of contamination in the SD-5 South plume flowing into Johns Pond. One of these RWs was turned off in December 2000 due to low TCE concentrations (below the MCL) in the influent. The other RW was turned off in April 2003 for the same reasons. The AFCEE installed an extraction well downgradient of the RWs in 2000 to augment the RWs. The extraction well was turned off in 2004 after TCE concentrations in all of the SD-5 South monitoring wells within the capture zone of the extraction well decreased to sub-MCL concentrations.

TCE concentrations above the MCL are currently detected in only two monitoring wells in the SD-5 South plume. These wells are located in a low permeability silty sand layer, which is difficult to remediate. EDB has not been detected at concentrations above the MMCL in the SD-5 South plume since February 2001. A risk assessment conducted by the AFCEE as part of the IROD to ROD process concluded that SD-5 groundwater contamination does not pose an unacceptable ecological risk, but the maximum concentration of TCE (34 ug/L) remaining in SD-5 groundwater could pose an unacceptable human health risk to a future resident in the Briarwood neighborhood. Accordingly, a feasibility study (FS) was performed to evaluate potential remedial alternatives for the remaining TCE contamination in the SD-5 plume.

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The SD-5 FS evaluated three remedial alternatives, including: 1) No Action, 2) Land Use Controls and Long-Term Monitoring, and 3) Construction, Operation, Maintenance and Monitoring of a New SD-5 ETR System. Alternative 3 was designed to expedite aquifer restoration in the vicinity of the monitoring well where TCE persists at concentrations greater than the MCL. The AFCEE's preferred remedial alternative is Alternative 2. The AFCEE's preference for long-term monitoring with land use controls is based on the fact that the vast majority of the SD-5 plume has already been cleaned up with the existing ETR system and that any potential risks to human health associated with the remaining TCE contamination have been controlled by the Town of Mashpee who has imposed restrictions on the installation of any new drinking water wells within known areas of groundwater contamination associated with the MMR. The AFCEE's preference for Alternative 2, the selected remedy, was also based upon concerns regarding construction impacts to the community from Alternative 3. In addition, AFCEE's groundwater model predicts Alternative 3 would only shorten aquifer restoration by approximately two years over the selected remedy.

The MassDEP concurs with the final remedy proposed in the EB/WA/SD-5 ROD. The MassDEP's concurrence with the EB/WA/SD-5 ROD is based upon representations made to the MassDEP by the AFCEE and assumes that all information provided is substantially complete and accurate. Without limitation, if the MassDEP determines that any material omissions or misstatements exist, if new information becomes available, or if conditions within the Eastern Briarwood, Western Aquafarm, and/or Storm Drain-5 groundwater change, resulting in potential or actual human exposure or threats to the environment, the MassDEP reserves its authority under M.G.L. c. 21E, and the MCP, 310 CMR 40.0000 et seq., and any other applicable law or regulation to require further response actions.

Please incorporate this letter into the Administrative Record for the Eastern Briarwood, Western Aquafarm, and Storm Drain-5 groundwater. If you have any questions regarding this matter, please contact Leonard J. Pinaud, Chief of Federal Facilities Remediation Section, at (508) 946-2871 or Millie Garcia-Surette, Deputy Regional Director of the Bureau of Waste Site Cleanup at (508) 946-2727.

Sincerely,

Edward P. Kunce, DCP

for Arleen O'Donnell
Acting Commissioner
Massachusetts Department of Environmental Protection

AO/P/xx
SD-5 WA EB ROD Concurrence Letter

Cc: DEP - SERO
Attn: Gary S. Moran, Regional Director
Millie Garcia-Surette, Deputy Regional Director
Leonard J. Pinaud, Chief Federal Facilities Remediation Section

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SMB
Plume Cleanup Team (IRP)
Boards of Selectmen
Boards of Health
Mark Begley, Environmental Management Commission

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APPENDIX B

Transcript of Public Hearing

MASSACHUSETTS MILITARY RESERVATION

INSTALLATION RESTORATION PROGRAM

IN RE:
PROPOSED PLAN FOR GROUNDWATER AT
EASTERN BRIARWOOD,
WESTERN AQUAFARM AND
STORM DRAIN 5

Mashpee Senior Center
26 Frank E. Hicks Drive
Mashpee, Massachusetts

HEARING OFFICER: Douglas Karson, AFCEE

Thursday, August 18, 2005
6:30 p.m.

Carol P. Tinkham
Professional Court Reporter
321 Head of the Bay Road
Buzzards Bay, MA 02532
(508) 759-9162
caroltinkham@verizon.net

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A T T E N D E E S:
(Signed in)

Albert Orlando, Mashpee - Citizen

Michael Minior - Air National Guard

Lana Brodziak - Portage Environmental

Paul Marchessault - EPA

Thomas Sims - AFCEE Atlanta

Ellie Grillo - Massachusetts DEP

John Schoolfield - AFCEE

Lauren Goster - Jacobs Engineering

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1 P R O C E E D I N G S

2 HEARING OFFICER KARSON: We are now
3 starting the public hearing portion of the meeting.
4 The official record is now open.
5 Good evening, everyone. Doug Karson, for
6 AFCEE. Thank you for coming to our meeting
7 tonight. Also in attendance here: Michael Minor,
8 who's in the back of the room, obviously, Deputy
9 Program Manager for AFCEE, the cleanup program;
10 representing the federal EPA, Paul Marchessault came
11 out for the meeting today; Tom Sims, who is with
12 AFCEE out of Atlanta; we also have Lauren Goster,
13 with Jacobs Engineering; and John Schoolfield who is
14 with AFCEE; and in the back, Lana Brodziak, on our
15 CI team out at the IRP Office working for Portage;
16 and our stenographer here tonight.
17 The purpose of tonight's meeting is to
18 have an open public hearing on the Eastern
19 Briarwood, Western Aquafarm and Storm Drain 5
20 proposed plan. What I'm going to do is officially
21 open the record at this point and we are now
22 starting the public hearing portion of this meeting
23 and the official record is open.
24 My name, as I said, is Douglas Karson,

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1 community involvement lead for the Installation
2 Restoration Program at the Massachusetts Military
3 Reservation, and I will be the hearing officer here
4 tonight.
5 The purpose of this hearing is to accept
6 oral and written comments on the proposed plan for
7 groundwater at Eastern Briarwood, Western Aquafarm
8 and Storm Drain 5. All oral comments that are
9 received tonight will be transcribed verbatim.
10 Those comments, along with any comments submitted in
11 writing, will become part of the official record on
12 this project. AFCEE and the regulatory agencies
13 will consider all comments prior to making a final
14 decision. Each and every comment will be responded
15 to in a Responsiveness Summary that will be issued
16 at a later date as part of the Record of Decision.
17 All those who comment will receive a copy of that
18 Responsiveness Summary.
19 The Record of Decision will contain the
20 Air Force's final decision for Eastern Briarwood,
21 Western Aquafarm and Storm Drain 5.
22 This hearing is exclusively for listening
23 to and recording your oral comments. You can also
24 provide written comments to me at any time during

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this hearing. Everyone wanting to make an oral comment must state their name and town of residence. Also, please make sure that you sign in for tonight's meeting so that we have your mailing address.

The floor is now open for public comment.

MR. ORLANDO: My name is Albert Orlando. I live in Briarwood, 240 Wheeler Road. I am in agreement with the base as the proposed plan to discontinue monitoring the Eastern Briarwood and the Western Aquafarm. As far as the SD-5 alternative, I am in favor of Alternative 2 - Long-Term Monitoring.

MR. KARSON: Thank you.

Are there any further comments to be offered at this time on the proposed plan?

I would ask again: are there any further comments to be offered on the proposed plan at this time?

If there are no further comments to be made, then I shall now close the formal public hearing for the proposed plan for groundwater at Eastern Briarwood, Western Aquafarm and Storm Drain

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5.

Please note that you can still provide written comments through tomorrow, August 20th, 2005. They must be postmarked by the 20th.

I thank you for coming and have a good evening. The record is now closed.

[Whereupon, this matter ended.]

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C E R T I F I C A T E

COMMONWEALTH OF MASSACHUSETTS
COUNTY OF BARNSTABLE

I, Carol P. Tinkham, a Professional Court Reporter and Notary Public in and for the Commonwealth of Massachusetts, do hereby certify that the foregoing transcript represents a complete, true and accurate transcription of my audiographic recordings

Eastern Briarwood, Western Aquafarm and Storm Drain 5, held at the Mashpee Senior Center on August 18, 2005, to the best of my knowledge, skill and ability.

Carol P. Tinkham
Notary Public
My Commission Expires
May 14, 2010

PLEASE NOTE: THE FOREGOING CERTIFICATION OF THIS TRANSCRIPT DOES NOT APPLY TO ANY REPRODUCTION OF THE SAME BY ANY MEANS UNLESS UNDER THE DIRECT CONTROL AND/OR DIRECTION OF THE CERTIFYING REPORTER.

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APPENDIX C

Town of Mashpee Board of Health
Public Water Supply Requirements

PART XIX: WELL REGULATIONS
SECTION 2.00 WELL WATER ANALYSIS REQUIREMENT

TOWN OF MASHPEE
BOARD OF HEALTH

PUBLIC WATER SUPPLY REQUIREMENTS

Under the authority of the Massachusetts General Laws, Chapter 111, Section 31, the Board of Health has adopted the following regulation in an effort to better protect the public health of the residents of Mashpee:

Whereas, there are known and documented areas of groundwater contamination within the Town of Mashpee and;

Whereas, there may be future areas of groundwater contamination unknown at present;

Therefore, the Board of Health, at its discretion, may require single family, multi-family or commercial structures to connect to a community public water supply.

This regulation is adopted by the Board of Health on September 13, 1990 and shall be come effective upon the date of publication.

Per Order Of,
The Mashpee Board of Health

Stephen J. Greelish, Chairman
John T. Doherty, Co-Chairman
George R. Costa, Clerk

TOWN OF MASHPEE
BOARD OF HEALTH

MORATORIUM ON GROUNDWATER WELLS

Under the authority of Massachusetts General Law [illegible] Board of Health of Mashpee adopts the following regulation in an effort to better protect the public health and welfare of the citizens and visitors in the Town:

REGULATION:

Residential well located in documented or anticipated areas of groundwater contamination as defined by the Board of Health are herewith restricted from use for any purpose, including drinking, any agricultural use (lawn watering, gardening, livestock watering, irrigation of crop land, etc.), washing vehicles, pool filling, etc. This moratorium includes groundwater wells owner by residents currently connected to a public water supply.

A Massachusetts Licensed Well Driller must decommission the affected wells and written evidence thereof must be submitted to the Board of Health.

PURPOSE:

This regulation seeks to prevent any inadvertent exposure to contaminated groundwater, which may present a potential health risk to the residents and visitors of Mashpee. Residential well waters in documented or potentially affected areas of groundwater pollution pose a possibility of exposure pathways to humans. Ingestion, inhalation and dermal exposure are potential pathways. This potential risk necessitates this regulation.

Adopted by the Board of Health on April 23, 1998. This regulation will become effective upon the date of publication in the press.

Per Order Of,
The Mashpee Board of Health

Steven R. Ball, Chairman
John T. Doherty, Co-Chairman
Robert F. Cram, Clerk

TOWN OF MASHPEE
BOARD OF HEALTH

AMENDMENT TO MORATORIUM ON GROUNDWATER WELLS

Under the authority of Massachusetts General Laws, Chapter 111, Section 31, the Board of Health of Mashpee adopts the following regulation in an effort to better protect the public health and welfare of the citizens and visitors in the Town:

REGULATION:

Existing and future residential wells located in documented or anticipated areas of groundwater contamination as defined by the Board of Health are herewith restricted from use for any purpose, including drinking, any agricultural use (lawn watering, gardening, livestock watering, irrigation of crop land, etc.) washing vehicles, pool filling, etc. This moratorium includes groundwater wells owner by the residents currently connected to a public water supply.

A Massachusetts Licensed Well Driller must decommission the affected wells and written evidence thereof must be submitted to the Board of Health.

PURPOSE:

This regulation seeks to prevent any inadvertent exposure to contaminated groundwater, which may present a potential health risk to the residents and visitors of Mashpee. Residential well waters in documented or potentially affected areas of groundwater pollution pose a possibility of exposure pathways to humans. Ingestion, inhalation and dermal exposure are potential pathways. This potential risk necessitates this regulation.

Adopted by the Board of Health on April 23, 1998. This regulation will become effective upon the date of publication in the press.

THE BOARD OF HEALTH

The original intent of the Board of Health was clarified on July 15, 1999, by inserting the words **"Existing and Future"** in the first paragraph of the regulation. The Board of Health approved this amendment to the regulation on July 29, 1999.

Per Order Of,
The Mashpee Board of Health

Steven R. Ball, Chairman
John T. Doherty, Co-Chairman
Robert F. Cram, Clerk