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United States Environmental Protection Agency
Region 1

Decision Document
Demolition Area 1 Groundwater Operable Unit

Camp Edwards
Massachusetts Military Reservation
Cape Cod, Massachusetts

November 1, 2006

TABLE OF CONTENTS

Page

PART I: DECLARATION FOR THE SDWA DECISION DOCUMENT 1

A. SITE NAME 1
B. STATEMENT OF BASIS AND PURPOSE 1
C. ASSESSMENT OF THE SITE 1
D. DESCRIPTION OF COMPREHENSIVE RESPONSE ACTION 1
E. DETERMINATIONS 3
F. SUPPORTING DATA 4
G. AUTHORIZING SIGNATURE 4

PART II: THE DECISION SUMMARY 5

A. DEMO 1 SITE DESCRIPTION 5
B. SITE HISTORY AND ENFORCEMENT ACTIVITIES 5
1 History of Site Activities 5
2 History of Investigations and Response Actions 6
3 History of SDWA Enforcement Activity 6
C. COMMUNITY PARTICIPATION 6
D. SCOPE AND ROLE OF OPERABLE UNIT OR RESPONSE ACTION 8
E. SITE CHARACTERISTICS 9
1 Site Geology 9
2 Site Hydrogeology 9
3 Movement of Contaminants in Groundwater 9
4 Estimate of the Contaminant Volume and Mass 10
5 Current Exposure Pathways 11
6 Potential Exposure Pathways 11
F. CURRENT AND POTENTIAL FUTURE SITE AND RESOURCE USES 11
G. SUMMARY OF SITE RISKS 11
H. REMEDIAL ACTION OBJECTIVES 11
I. DEVELOPMENT AND SCREENING OF ALTERNATIVES 12
J. DESCRIPTION OF ALTERNATIVES 13
K. SUMMARY OF THE COMPARATIVE ANALYSIS OF ALTERNATIVES 15
L. THE SELECTED RESPONSE ACTION 19
1 Groundwater Extraction, Treatment, and Recharge to the Aquifer: 20
2 Cleanup Levels: 21
3 Operations and Maintenance: 21
4 Plume Monitoring: 22
5 Contingency for Additional Remedial Actions: 22
6 System Operation and Shutdown: 23
7 Land Use Controls: 23
8 Modifications: 26
M. DETERMINATIONS 27

TABLE OF CONTENTS

Page

N. DOCUMENTATION OF NO SIGNIFICANT CHANGES 27
O. STATE ROLE 28

PART III: THE RESPONSIVENESS SUMMARY 29

List of Figures

Figure 1: Location of Demo 1 Massachusetts Military Reservation
Figure 2a: Demo 1 Perchlorate Plume and Monitoring Wells
Figure 2b: Demo 1 RDX Plume and Monitoring Wells
Figure 3: Alternative 5 Conceptual Layout (Plan View)
Figure 4: Alternative 5 – Process Flow Diagram – Frank Perkins Road
Figure 5: Alternative 5 – Process Flow Diagram – Pew Road
Figure 6: Demo 1 Former Source Area
Figure 7: Surficial Geology of Western Cape Cod

List of Tables

Table 1: Remediation Goals for COCs for Demo 1 Groundwater Operable Unit
Table 2: Summary of Alternatives
Table 3: Regulatory Considerations

List of Appendices

Appendix A: MassDEP Letter of Concurrence
Appendix B: References
Appendix C: Glossary of Terms and Acronyms
Appendix D: On-base Prohibition on New Drinking Wells

PART I: DECLARATION FOR THE SDWA DECISION DOCUMENT

A. SITE NAME

The subject site is the Demolition Area 1 (Demo 1) Groundwater Operable Unit (OU) within Camp Edwards at the Massachusetts Military Reservation (MMR) (Figure 1). The OU consists of the groundwater impacted by contaminants from the Demo 1 source area.

B. STATEMENT OF BASIS AND PURPOSE

This Decision Document presents the selected response action for the Demo 1 Groundwater OU. This selected response action was chosen in accordance with Section 1431(a) of the Safe Drinking Water Act (SDWA), 42 USC §300i(a), as amended, and with the Administrative Order concerning response actions issued there under, U.S. Environmental Protection Agency Region 1 (EPA) Administrative Order No. SDWA-1-2000-0014 (AO3). The Regional Administrator of EPA Region I has been delegated the authority to select the necessary response action pursuant to EPA Delegation No. 9-17 (1200-TN-350) dated May 11, 1994.

This decision is based on the Administrative Record, which has been developed in accordance with AO3 and with a previous EPA Administrative Order, SDWA 1-97-1019 (AO1), requiring investigation of contamination at the Training Ranges and Impact Area. This Administrative Record is available for review at the Impact Area Groundwater Study Program (IAGWSP) office, 1803 West Outer Road, Camp Edwards, MA. Documents included in the Administrative Record are listed in Appendix B.

C. ASSESSMENT OF THE SITE

On July 13, 1982, EPA determined that the Cape Cod Aquifer is the sole or principal source of drinking water for Cape Cod, Massachusetts, and that the Cape Cod Aquifer, if contaminated, would create a significant hazard to public health (47 Fed. Reg. 30282). Contaminants from the Training Ranges and Impact Area at MMR are present in and may enter and migrate in the Cape Cod Aquifer. The response action selected in this Decision Document is necessary to protect the Cape Cod aquifer, an underground source of drinking water on which the public currently relies and may in the future rely.

D. DESCRIPTION OF COMPREHENSIVE RESPONSE ACTION

This Decision Document sets forth the selected response action for the remediation of a plume of groundwater contamination at and emanating from the Demo 1 site (Figure 2).

In the Demo 1 Feasibility Study (AMEC 2005), seven contaminants of concern (COCs) were identified for groundwater at Demo 1. These included hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX), octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX), 2,4,6-trinitrotoluene (TNT), 2,4-dinitrotoluene (2,4-DNT), (4A-DNT), (2A-DNT), and perchlorate. After the development of the Feasibility Study, the completion of soil remedial actions in the Demo 1 source area, and the

start up of the Rapid Response Action pump and treat system for groundwater, maximum levels of the seven COCs in groundwater decreased within the Demo 1 plume. As of April 2006, only four of the original COCs remain in the aquifer above risk based or regulatory levels. These four are RDX, 2,4-DNT, TNT, and perchlorate (Table 1).

Specific COCs for groundwater at Demo 1 used to develop the comprehensive response action include the explosive compound RDX and the water-soluble salt perchlorate that is used as an oxidizer. Since the other two remaining COCs are limited in extent within the RDX and perchlorate plume, are at much lower concentrations, and are expected to be remediated well within the timeframes for RDX and perchlorate, modeling used for determining the feasibility of remediation alternatives and the selected response action was based on remediation of the RDX and perchlorate plumes. Detections of RDX in the Demo 1 plume have ranged from the detection limit of 0.25 parts per billion (ppb) to 370 ppb. Perchlorate detections have ranged from the detection limit of 0.35 ppb to 500 ppb.

The lifetime federal health advisory (HA) for RDX in drinking water is 2 ppb. There currently is no federal drinking water standard for perchlorate. However, the EPA has established an official reference dose for perchlorate of 0.0007 milligrams per kilogram per day (mg/kg/day). This translates to a Drinking Water Equivalent Level (DWEL) of 24.5 ppb, assuming all of the contaminant comes from drinking water. With a contaminant like perchlorate, individuals may be exposed through other sources such as food or breast milk. EPA previously issued interim guidance suggesting 4-18 ppb perchlorate as a provisional cleanup level (1999 and 2003). In addition, the Massachusetts Department of Environmental Protection (MassDEP) has promulgated a Massachusetts Maximum Contamination Level (MMCL) of 2 ppb.

The Demo 1 Plume will be remediated to restore the aquifer which has been designated a Sole Source Aquifer by the EPA and a Potentially Productive Aquifer by the MassDEP. This groundwater response action will remediate the contaminated groundwater containing RDX at concentrations greater than the 10^{-6} risk-based level, the concentration resulting in an increased lifetime cancer risk of one in a million, which currently is 0.6 ppb, and/or perchlorate greater than 2 ppb , by withdrawing groundwater from several extraction wells and treating that water to remove contaminants before recharging it to the aquifer (Figure 3). The selected response action is the third of three major actions at Demo 1. The first action was conducted as a Rapid Response Action (RRA) to remove contaminated soil from the source area of the Demo 1 plume. Soil was treated on-site by thermal desorption, which uses heat to separate contaminants from the soil and oxidize them. The second major action was a groundwater RRA intended to begin removal of contaminants from the aquifer and limit further migration of the plume while the comprehensive remedy could be selected and implemented. The groundwater RRA began operation during September 2004. The comprehensive remedy will build upon the groundwater RRA.

Groundwater modeling predicts this response action will prevent significant further migration of the plume and restore the impacted portion of the aquifer for use as a public water supply. The major components of this response action are:

- Extraction of 906 gallons of contaminated water per minute from the plume using five extraction wells
- Treatment of the groundwater to remove contaminants to below applicable federal and state drinking water standards and risk-based levels using granular activated carbon (GAC) and ion exchange resin (IX) (Figure 4 and Figure 5)
- Reinjection of the treated water back into the aquifer using four injection wells
- Natural attenuation of the leading edge of the plume to below applicable water-quality standards and risk-based levels over a reasonable period of time.
- Land Use Controls to eliminate the potential for ingestion of contaminated groundwater until the concentrations of Contaminants of Concern in the groundwater are at such a level to allow unrestricted use and exposure.
- Long-term monitoring through a network of approximately 103 groundwater monitoring well screens (Figure 2) to track the extent and movement of the plume during and after operation of the comprehensive remedy.
- A contingency response for additional active measures to be taken to control the plume if plume contaminants above applicable federal and state drinking standards or risk-based levels are found to migrate substantially further than anticipated. This contingency response would most likely include additional extraction and treatment of groundwater near the leading edge of the plume if actual or modeled data at a well transect west of North Pond exceeds applicable federal or state regulatory or risk-based levels for COCs.
- The additional active treatment system will likely consist of an extraction well pumping at 30 to 50 gpm and a portable treatment container, which will use GAC and/or ion exchange filters to clean the groundwater.

E. DETERMINATIONS

The comprehensive groundwater response action selected in this Decision Document will protect the public health from any endangerment which may be presented by the presence or potential entry of COCs into an underground source of drinking water from the Demo 1 source area.

The selected response action meets current applicable federal and state requirements.

As required by AO3, the selected alternative provides a level of protection to the aquifer underlying and downgradient of the Demo 1 source area commensurate with the aquifer's designation as a Sole Source Aquifer and a Potential Productive Aquifer that is protective of human health.

The selected response action includes a periodic review at frequencies not to exceed five years. At each periodic interval, the IAGWSP will provide to EPA and MassDEP sampling data, modeling data, and other relevant data. EPA and MassDEP will review this and any other relevant information to determine if additional measures are necessary for the protection of public health. This will include information acquired after the implementation or five-year period

(such as new regulatory requirements or changes in the environmental conditions of the site). In addition the remedy includes a detailed annual evaluation to determine if the contingency remedy is needed.

F. SUPPORTING DATA

The following information is included in the Decision Summary section of this SDWA Decision Document. Additional information can be found in the Administrative Record for this Site.

- COCs and their respective concentrations;
- Baseline risk represented by the COCs;
- Cleanup levels established for COCs and the basis for the levels;
- Current and future land and groundwater use assumptions used in the baseline risk assessment and Decision Document;
- Land and groundwater use that will be available at the Site as a result of the selected response action;
- Decision factor(s) that led to selecting the comprehensive groundwater response action.

G. AUTHORIZING SIGNATURE

This Decision Document documents the selected response action for remediation of the MMR Demo 1 Groundwater OU. This response action was selected by EPA under the authority of the SDWA. MassDEP concurs in this decision.

U.S. Environmental Protection Agency

By: Robert W. Varney
Robert W. Varney
Regional Administrator
Region 1

Date: 11-1-06

PART II: THE DECISION SUMMARY

A. DEMO 1 SITE DESCRIPTION

Demo 1 is an approximately 7.4-acre site located on Camp Edwards approximately two miles northeast of the Otis Rotary in Bourne. Demo 1 is located north of Pocasset Forestdale Road and south of the Camp Edwards Impact Area, west of Turpentine Road and east of Frank Perkins Road. Demo 1 is located in a natural topographic depression, or kettle hole, that covers approximately one acre at its base, which is 45 feet (ft) below the surrounding grade. The Demo 1 source area exists largely within a perimeter road. However, investigations outside of Perimeter Road have not been completed. Four explosive and propellant compounds (RDX, TNT, 2,4-DNT, and perchlorate) have been detected in groundwater and are identified as the COCs in groundwater for the Demo 1 Groundwater OU. These contaminants are all directly related to past demolition, disposal and/or demolition training activities and have been detected in soil at Demo 1.

A more complete description of the Site can be found in Section 2.0 of the Groundwater Report Addendum (AMEC, 2004).

B. SITE HISTORY AND ENFORCEMENT ACTIVITIES

History of Site Activities

Demo 1 was used from the mid 1970s to the late 1980s for destruction of munitions and other items along with demolition training. These activities included the destruction of various types of ordnance using explosive charges of C4 (90% RDX and 10% inert materials), TNT, and detonation cord. The predominant explosive compounds used in demolition munitions are RDX, followed by TNT.

Perchlorate, a water-soluble salt used as an oxidizer, is a component of some munitions, rocket propellants, and pyrotechnics, and fireworks that were likely destroyed at Demo 1. Perchlorate (ClO_4^-) originates as a contaminant in the environment from the solid salts of ammonium, potassium, or sodium perchlorate.

RDX, TNT, and other explosives, and perchlorate resided on the soil surface at Demo 1 as particulates and residuals (chunks of C4, hand grenades, or flares) from the destruction activities or from the destroyed items. Regrading and filling activities following destruction and training events likely raised the elevation of the ground surface in the Demo 1 depression. Placing fill to create a smoother surface and to cover protruding objects increased the safety of subsequent military training activities. These regrading and/or filling activities resulted in distribution of contaminants to depths of approximately 8 ft below the ground surface prior to any RRA remediation activities.

A more detailed description of the Site history can be found in Section 2.0 of the Demo 1 Groundwater Report Addendum and Site Archive Search Report.

History of Investigations and Response Actions
The history of investigations and response actions conducted at Demo 1 is summarized in Appendix B – References.

History of SDWA Enforcement Activity
In February 1997, EPA Region 1 issued SDWA Administrative Order 1-97-1019 (AO1) requiring investigation of contamination at or emanating from the Training Ranges and Impact Area upon the sole source aquifer.

In May 1997, EPA issued SDWA Administrative Order 1-97-1030 (AO2), which prohibited all live firing of mortars and artillery, firing of lead from small arms, planned detonation of ordnance or explosives at or near the Training Ranges and Impact Area except for UXO activities, and certain other training related activities (Paragraph II.A.1)

In January 2000, EPA issued SDWA Administrative Order 1-2000-0014 (AO3) which required the IAGWSP to implement RRAs and remedial actions to abate the threat to public health presented by the contamination from past and present activities and sources at and emanating from the Training Ranges and Impact Area. The RRAs specifically required by AO3 addressed elevated concentrations of contaminants in soil and have been completed. The comprehensive remedial action component of AO3 requires that a Feasibility Study (FS), Remedial Design (RD) and Remedial Action (RA) be completed for several areas of concern, including the Demo 1 Groundwater OU.

C. COMMUNITY PARTICIPATION

Throughout the Site's history, the IAGWSP and EPA and MassDEP have kept the community and other interested parties apprised of Site activities at the Demo Area 1 site through informational meetings, fact sheets, press releases and public meetings. Below is a brief chronology of public outreach efforts.

The Impact Area Review Team (IART) is a citizen advisory committee that was established in 1997 under AO1. The IART's goal is to serve as a technical advisory resource and to allow the EPA and NGB to hear first hand the concern of the public related to the ongoing investigation and cleanup effort at Camp Edwards. The team meets regularly (usually the fourth Tuesday of each month) to hear updates and provide public input on the IAGWSP investigation and cleanup.

The IAGWSP also regularly briefs the Senior Management Board (SMB), which advises MMR organizations on environmental programs and policies. Members of the SMB include selectmen from the towns of Bourne, Falmouth, Mashpee, and Sandwich and representatives from the EPA, MassDEP, Massachusetts Department of Public Health, Massachusetts National Guard, the U.S. Coast Guard, and a representative from the Wampanoag Tribe.

In October 2001 the IAGWSP, EPA and MassDEP released a Public Involvement Plan outlining activities to address community concerns and to keep citizens informed about and involved in response activities.

From March 8, 2000, through the present, the IAGWSP regularly presented updates on the plan and execution of the Remedial Investigation, RRAs, and FS for Demo 1 Soil and Groundwater at the IART meetings. With respect to this Decision Document, the most important were:

- On April 26, 2005 an informational meeting, in Sandwich, MA, to describe the Supplemental Evaluation to the Revised Draft FS for Demo 1 Groundwater.
- On August 23, 2005 an informational meeting in Falmouth, MA to describe the Remedy Selection Plan (RSP) for Demo 1 Groundwater at which the IAGWSP gave a presentation on the RSP and the EPA presented its proposed remedy and answered questions from the IART. The IAGWSP notified the public of the August 23, 2005 public meeting and announced the public comment period in a display ad placed in the August 19, 2005, editions of *The Cape Cod Times* and *The Enterprise* newspapers, and display ads were placed in the September 9, 2005 editions of these same newspapers to announce the public hearing and as a reminder of the public comment period.
- From August 22, through September 19, 2005 a Public Comment Period on the RSP for Demo 1 Groundwater. The IAGWSP placed copies of the RSP for the Demo 1 Groundwater Plume in the IAGWSP's information repositories at the Bourne, Falmouth, Mashpee, and Sandwich, MA public libraries. The repository contains documents on the Demo 1 investigation and findings supporting selection of the Remedial Action including the FS for Demo 1 Groundwater and other relevant documents upon which EPA relied in selecting the proposed remedy. The RSP also was made available on the IAGWSP Web site, which also contains the supporting documents and which offered a means of submitting public comments on the RSP. In addition, the IAGWSP mailed copies of the RSP to IART members and distributed to individuals in attendance at the public meeting and public hearing.
- On September 13, 2005 a Public Information Session and Public Hearing on the RSP for Demo 1 Groundwater in Bourne, MA. The public information session, along with a presentation on the RSP and EPA's proposed remedy was held prior to the opening of the public hearing. Local residents and officials, news media representatives, representatives from EPA, MassDEP and the IAGWSP interested in site activities and cleanup decisions were invited to attended both meetings. Representatives from EPA, MassDEP and IAGWSP were available to answer questions. The IAGWSP notified the public of the September 13, 2005 information session and public hearing and reminded them about the public comment period in a display ad placed in the September 9, 2005 editions of *The Cape Cod Times* and *The Enterprise* newspapers. Comments received during the Public Comment Period for the RSP for Demo 1 Groundwater were compiled and answered in the Responsiveness Summary included in this document.

All draft and final reports related to the Demo 1 remedial investigation, work plans, RRAs, FS and RSP were made available through the Information Repository at the public libraries in Bourne, Falmouth, Mashpee and Sandwich, MA. These documents also were made available to the public through the IAGWSP Web site: groundwaterprogram.army.mil (formerly www.groundwaterprogram.org.) and the Administrative Record at 1803 West Outer Road, Camp Edwards, MA.

All IART meetings, public meetings, Public Comment Periods and Public Hearings related to the Demo 1 remedial investigation, work plans, RRAs, FS and RSP were advertised in *the Cape Cod Times* and the local edition of *the Enterprise* newspapers.

Media releases on presentations and Public Comment Periods for Demo 1 were distributed to *the Cape Cod Times* and other area media including newspapers, radio and television media. Media releases also were distributed to area reporters on the startup, progress and completion of the Demo 1 RRA work.

Fact sheets were published and distributed on the Demo 1 investigation, the plan for the RRAs, the start of RRA treatment, and the Revised Draft FS. General fact sheets related to the Demo 1 investigation including those on the IAGWSP investigations and findings and on related issues, such as the contaminants of concern, were also published and distributed.

IAGWSP, the EPA, and MassDEP also participated in general information sessions such as open houses, information sessions, and community meetings on the program including Demo 1.

D. SCOPE AND ROLE OF OPERABLE UNIT OR RESPONSE ACTION

The Demo 1 site was split into two operable units in 2000. The Soil OU and the Groundwater OU were established in the FS Work plan (AMEC, 2000). This allowed the two media to be evaluated on separate timelines, thereby expediting the remedy selection process.

Soil OU

The IAGWSP has completed soil and unexploded ordnance (UXO) work as an RRA at Demo 1. Approximately 27,000 tons of contaminated soil was excavated and either treated on-site or sent off-site for disposal. Upon completion of the RRA, no significant residual contamination remained in the soil within the perimeter road. A Completion of Work and Operable Unit Closure Report was issued in December 2005 to document that no further action relating to soil contamination is needed within the perimeter road at this time. However, investigations outside of Perimeter Road have not been completed.

Groundwater OU

Two groundwater extraction/treatment/reinjection (ETR) systems including extraction wells, piping, portable treatment units containing IX resin and GAC filtration media were installed at the Demo 1 Groundwater OU as a RRA measure. One system is located at Frank Perkins Road and the other is located at Pew Road (Figure 2A and 2B). The systems were started in September 2004 and have been removing contaminants and limiting the migration of explosives and perchlorate in Demo 1 groundwater.

A comprehensive response action, as described in this Decision Document, is planned for long-term treatment of Demo 1 groundwater. The selected response action addresses groundwater contamination at and emanating from the Demo 1 source area. The selected response action required by this decision document provides a design that groundwater modeling predicts will achieve a risk-based level of 0.6 ppb for RDX in 11 years while reducing perchlorate concentrations to less than 2 ppb within the same time frame. Background concentrations of

RDX and perchlorate would be reached within 19 years.

E. SITE CHARACTERISTICS

Site Geology

The geology of Western Cape Cod comprises glacial sediments deposited during the retreat of the Wisconsin stage of glaciation. Three extensive sedimentary units dominate the regional geology: the Buzzards Bay Moraine (BBM), the Sandwich Moraine (SM), and the Mashpee Pitted Plain (MPP). These moraines form hummocky ridges. The MPP, which consists of fine- to coarse-grained sands forming a broad outwash plain, lies south and east of the two moraines. Underlying the MPP are fine-grained, glaciolacustrine sediments and basal till at the base of the unconsolidated sediments. The Demo 1 depression is located within the MPP. The Demo 1 plume originates in the MPP, eventually flowing into the BBM (Figure 7).

In the area east of Frank Perkins Road, subsurface lithology is dominated by varying compositions of fine, medium and coarse sand with occasional gravels. Ground surface elevation in the MPP portion of the Demo 1 plume is relatively flat from the western edge of the kettle hole depression to the eastern edge of the moraine. West of Frank Perkins Road, the Demo 1 plume crosses into the BBM. As expected, the BBM is comprised of fine to coarse sand and gravel, with discontinuous and continuous clays and silts.

Site Hydrogeology

A single groundwater flow system underlies Western Cape Cod, including MMR. The Camp Edwards Impact Area lies over the Sagamore Lens, which is part of the Cape Cod aquifer. Groundwater flows radially in all directions from the apex of the Sagamore Lens, which is located to the southeast of the Impact Area. The aquifer system is unconfined (i.e., the water table is in equilibrium with atmospheric pressure and is recharged by infiltration from precipitation). Surface water runoff at MMR is minimal except on extreme slopes, due to the highly permeable nature of the sands and gravels underlying the area.

The ocean bounds the aquifer on three sides, with groundwater discharging into Nantucket Sound on the south, Buzzards Bay on the west, and Cape Cod Bay on the north. The Bass River in Yarmouth forms the eastern lateral aquifer boundary.

Surface water is present at MMR in a few ponds in kettle holes. The kettle hole ponds are land-surface depressions that extend below the water table. Where these kettle holes do not extend down to the water table, they are merely surface depressions, such as the Demo 1 depression. Larger and deeper ponds have greater effect on slope and direction of the regional water table near the pond. While horizontal groundwater flow is dominant in the aquifer system, vertical flow is important in areas near ponds.

Groundwater flow in the Demo 1 area is from north-northeast to south-southwest away from the groundwater mound to the north-northeast and toward the Bourne area to the south-southwest.

Movement of Contaminants in Groundwater
RDX (and other explosives compounds) and perchlorate were present in the soils at Demo 1. These compounds readily leach from soil to the groundwater, with perchlorate more readily dissolving than RDX. The majority of the source of explosives and perchlorate within the perimeter road has been removed through the soil RRA recently completed at Demo 1. No further impact to groundwater is expected after the dissolved contaminants in the partially saturated soil above the groundwater table are washed out.

Movement of RDX is slightly retarded in the soil and the aquifer due to limited sorption to soil particles. Therefore, RDX will generally move at a velocity slightly less than that of normal advective flow, while perchlorate will move generally at the same rate as the advective front. Longitudinal dispersion is a significant transport process for both perchlorate and RDX and a factor in natural attenuation.

The longitudinal and lateral extent of the perchlorate plume is larger than the RDX plume at Demo 1. The combination of higher solubility, higher dissolution rates, and lower sorption rates has allowed perchlorate to travel further in the groundwater regime and impact a larger portion of the aquifer. Based on results through June 2005, the downgradient extent of the RDX plume extends as far as MW-211, approximately 7,300 feet downgradient of the source, whereas the perchlorate plume is 10,000 feet long (Figure 2). [Note: RDX was detected in MW-225M3, which is located approximately 1,300 feet downgradient of MW-211, at concentrations of 0.33 ug/L and 1.6 ug/L in samples obtained in April and August 2005, respectively. Therefore, the RDX plume has advanced considerably downgradient of MW-211.] The widest downgradient width of the RDX plume is approximately 650 ft, whereas the widest extent of the perchlorate plume is approximately 1,000 ft, roughly two times the observed width of the RDX plume.

Estimate of the Contaminant Volume and Mass
The estimated volume and mass of the contaminant plumes for perchlorate RDX and TNT are presented below. The mass of perchlorate in three sections of the plume is broken down and presented relative to RRA treatment system components. The mass of perchlorate upgradient of Frank Perkins Road is 31.8 kilograms (kg); the mass of perchlorate between Frank Perkins Road and Pew Road is 9.7 kg; and the mass of perchlorate downgradient of Pew Road is less than 1 kg.

COC	Estimated Volume		Estimated Mass	
	Liters	Gallons	Kilograms	Pounds
Perchlorate (Total)	5.2 E09	1.4 E09	42.3	93.3
Upgradient of Frank Perkins Road	2.4 E09	6.4 E08	31.8	70.1
Between Frank Perkins Road & Pew Road	2.0 E09	5.2 E08	9.7	21.4
Downgradient of Pew Road	8.7 E08	2.3 E08	0.78	1.7
RDX (Total)	1.5 E09	4.0 E08	21	46.3
TNT (Total)	4.7 E07	1.2 E07	0.06	0.13

Current Exposure Pathways

No one is currently drinking contaminated water at Demo 1.

Potential Exposure Pathways

The development of water supply wells and consumption of groundwater resources in the area downgradient of Demo 1 is a potential future exposure pathway. Camp Edwards, including the Demo 1 OU has been set aside as drinking water supply reserve by the Massachusetts Legislature.

F. CURRENT AND POTENTIAL FUTURE SITE AND RESOURCE USES

The site is currently used for military training and is located in an area designated as a water and wildlife preserve by Chapter 47 of the Acts of 2002 (Effective March 5, 2002 'An Act Relative to the Environmental Protection of the Massachusetts Military Reservation'). The site overlays a sole source aquifer which is a valued water supply to the Cape. The Land Use Controls (described in Section L below) will prevent the installation of on-base water wells that could provide a pathway for ingestion of drinking water that contains COCs in concentrations that exceed applicable drinking water standards. It is anticipated that all land affected by the on-base Land Use Controls described herein will remain under the control and direction of government military agencies and will continue to be used for military training and support purposes.

G. SUMMARY OF SITE RISKS

The baseline risk assessments revealed that there are no presently existing exposure routes for human receptors, and no one is currently drinking groundwater contaminated by Demo 1. However a potential future exposure pathway is through the development and consumption of groundwater resources in the area downgradient of Demo 1. The Demo 1 Plume will be remediated to restore the aquifer which has been designated a Sole Source Aquifer by the EPA and a Potentially Productive Aquifer by the MassDEP. Since groundwater contamination in this area is above a federal health advisory, this contamination may present an unacceptable human health risk to persons exposed to such compounds in the future.

H. REMEDIATION ACTION OBJECTIVES

Based on preliminary information relating to types of contaminants, environmental media of concern, and potential exposure pathways, response action objectives were developed to aid in the development and screening of alternatives. These objectives were developed to mitigate and prevent existing and future risks to human health. The response action objectives for the selected response action for Demo 1 are to restore the useable groundwater to its beneficial use within a reasonable timeframe; to provide a level of protection in the aquifer that takes into account that the Cape Cod aquifer, including the Sagamore Lens, is a sole source aquifer that is susceptible to contamination; and to prevent potential ingestion, inhalation and dermal contact with groundwater containing COCs (RDX, 2,4-DNT, TNT and perchlorate) in excess of federal maximum contaminant levels (MCLs), HAs, drinking water equivalent levels (DWELs), applicable

state standards, and/or an unacceptable excess lifetime cancer risk or non-cancer Hazard Index (Table 1).

In addition, the remedy will also prevent any migration of contaminants above regulatory or risk-based levels beyond the vicinity of the well transect that will include monitoring wells D1P-30, D1P-31 and D1P-32, which are to be installed as close as possible to the western edge of North Pond. The trigger for additional action will be activated if actual or modeled data at the above well transect exceeds federal or state regulatory or risk-based levels for COCs.

I. DEVELOPMENT AND SCREENING OF ALTERNATIVES

Remedial Alternatives were developed that considered the following objectives: provide an appropriate level of protection to the aquifer underlying the Training Ranges and Impact Area; evaluate and address the short-term and long-term potential for human exposure; and consider the potential threat to human health if the remedial alternative proposed were to fail.

The FS developed a range of alternatives that included the following:

- A no action alternative to serve as a baseline for alternative comparisons.
- An alternative that, throughout the entire groundwater plume, reduces the contaminant concentrations to background conditions;
- An alternative that, throughout the entire groundwater plume, reduces the contaminant concentrations to levels that meet or exceed the requirement governing public protection inherent in all MCLs, health advisories, DWELS, other relevant standards, results in a Hazard Index of 1 or less, and a cumulative 10^{-6} excess cancer risk and the non-cancer Hazard Risk of one as rapidly as possible and in less than 10 years.
- A limited number of remedial alternatives that attain site-specific remediation levels within different restoration time periods utilizing one or more different technologies if they offer the potential for comparable or superior performance or implementability; fewer or lesser adverse impacts than others available approached; or lower costs for similar levels of performance than demonstrated treatment technologies.

The FS screened the alternatives based on the short and long term aspects of the following three criteria:

- Effectiveness. This criterion focuses on the degree to which an alternative restores and protects the sole source aquifer underlying the Training Ranges and Impact Area as a future water supply; as well as the degree to which an alternative reduces toxicity, mobility, or volume through treatment; minimizes residual risks and affords long term protection; complies with Regulations, and minimizes short-term impacts. It also focuses on how quickly the alternative

achieves protection with a minimum of short term impact in comparison to how quickly the protection shall be achieved.

- Implementability. This criterion focuses on the technical feasibility and availability of the technologies that each alternative would employ and the administrative feasibility of implementing the alternative.
- Cost. This criterion focuses on the costs of installation and any long-term costs to operate and maintain the alternatives.

Upon completion of this screening, three remedial technologies were retained for further evaluation in the Final FS. They are Fluidized Bed Reactors, IX filtration, and GAC filtration. The Final FS determined that IX filtration for perchlorate removal and GAC filtration for explosives removal best met the three criteria and would be retained for detailed analysis. All 5 alternatives considered in the FS that employed active groundwater treatment used combinations of those technologies as the proposed remedial technologies.

J. DESCRIPTION OF ALTERNATIVES

The FS developed and evaluated five alternatives that attain site-specific remediation levels for RDX and perchlorate within different time frames and a no action alternative (Table 2). The development and evaluation were focused on RDX and perchlorate because all of the other COCs are limited in extent within the RDX plume, are at much lower concentrations, and are expected to be remediated well within the timeframes for RDX. The alternatives analyzed for the Site include:

- Alternative 1 - An alternative with no active remediation.
- Alternative 2 – An alternative based on the existing RRA extraction, treatment and reinjection (ETR) system,
- Alternatives 3 through 6 – ETR systems with different well field configurations and pumping scenarios.

All six alternatives include long-term monitoring and implementation of land use controls, which will remain in effect until the aquifer is restored. The active treatment systems will all use GAC and IX, as appropriate, to remove contaminants.

In order to account for changes in plume geometry since the evaluation in the FS, Alternative 5 and Alternative 6 were selected for re-evaluation under updated plume conditions. The results were reported in the FS Appendix F – Supplemental Evaluations. These alternatives were selected for updating because they represent the average of the range of alternatives with regard to total flow rate, years to achieve remedial goals, and cost. It also provided an opportunity to assess the sensitivity of contaminant migration at the toe of the plume to natural dispersion versus active remediation. The groundwater model was updated and the two alternatives were compared to determine changes in plume migration, years required to achieve remedial goals, and costs.

The six alternatives include:

Alternative 1 Minimal Action
Alternative 1 is a minimal action alternative with no active remediation. This alternative calls for:

- Shut-down of the two RRA ETR systems located at Frank Perkins Road and Pew Road.
- Installation of six additional monitoring wells for long-term monitoring of the groundwater plume.
- Long-term monitoring at 12 monitoring wells.
- The total cost (present worth) for Alternative 1, estimated over 50 years, is $ 2,850,000.

Alternative 2 - Baseline
Alternative 2 provides a baseline alternative that makes use of the RRA systems currently in place as a comprehensive response action. Groundwater modeling predicts that this alternative would restore groundwater to risk-based concentrations for COCs within 36 years and achieve background concentrations within 50 years. This alternative includes:

- Continued operation of the two RRA extraction, treatment and reinjection systems.
- Natural attenuation of the leading edge of the plume downgradient of Pew Road.
- Extraction of groundwater at the total pumping rate of 320 gpm.
- Recharge of the treated groundwater into the aquifer using three injection wells.
- The total cost for Alternative 2 is estimated to be $ 15,000,000.

Alternative 3 – Background
Alternative 3 is predicted by groundwater modeling to achieve risk-based concentrations for COCs in less than 23 years and background concentrations in less than 27 years. Alternative 3 would include:

- Continued operation of the two RRA extraction, treatment and reinjection systems.
- Installation of two additional extraction wells.
- Extraction of groundwater from the four wells at a total pumping rate of 472 gpm.
- Natural attenuation of the leading edge of the plume downgradient of Pew Road.
- Recharge of treated groundwater into the aquifer using a total of four injection wells (three from RRA systems plus one new well).
- The total cost for Alternative 3 is estimated to be $ 21,100,000.

Alternative 4 - 10 Year
Alternative 4 is predicted to achieve risk-based concentrations for COCs within approximately 11 years and background concentrations within 15 years. This alternative calls for:

- Continued operation of the two RRA extraction, treatment and reinjection systems.
- Installation of three additional extraction wells.
- Extraction of groundwater from the five wells at a total pumping rate of 1,417 gpm.
- Natural attenuation of the leading edge of the plume downgradient of Pew Road.

- Recharge of the treated groundwater into the aquifer using a total of four injection wells (three RRA wells plus one new well).
- The total cost for Alternative 4 is estimated to be $ 25,700,000.

Alternative 5 - Additional Alternative A (5-well system)
Alternative 5 provides a design that groundwater modeling predicts would achieve risk-based concentrations for the COCs within approximately 11 years and background concentrations within 19 years. This alternative calls for:

- Continued operation of the two RRA extraction, treatment and reinjection systems.
- Installation of three additional extraction wells.
- Extraction of groundwater from five extraction wells at a total pumping rate of 906 gpm.
- Natural attenuation of the leading edge of the plume downgradient of Pew Road.
- Recharge of the treated groundwater into the aquifer using a total of four injection wells (three RRA wells, plus one new well).
- The total cost for Alternative 5 was estimated in the FS to be $ 21,000,000 and later revised by the Supplemental Evaluations to $18,900,000.

Alternative 6 - Additional Alternative B (6-well system)
Alternative 6 provides a design that groundwater modeling predicts would restore groundwater to risk-based concentrations for the COCs within 11 years and background concentrations in approximately 17 years. This alternative includes:

- Continued operation of the two RRA extraction, treatment and reinjection systems.
- Installation of four additional extraction wells.
- Extraction of groundwater at a total pumping rate of 1,006 gpm.
- Recharge of the treated groundwater into the aquifer using a total of four injection wells (three RRA wells plus one new well).
- A new portable treatment unit near Frederickson Road to house treatment equipment including GAC and potentially IX filters.
- The total cost for Alternative 6 was estimated in the FS to be $ 26,600,000 and later revised by the Supplemental Evaluations to $23,900,000.

For all of the remedial alternatives evaluated (except Alternative 1), it is assumed that the RRA System would operate for the four year timeframe during construction and system startup. For each alternative (except Alternative 1), extraction wells are located throughout the plume to enable the greatest capture of mass possible. A more detailed presentation of each alternative is found in Section 6.0 of the FS.

K. SUMMARY OF THE COMPARATIVE ANALYSIS OF ALTERNATIVES

A detailed analysis was performed on the alternatives using nine evaluation criteria in order to select a comprehensive response action for groundwater at Demo 1. These criteria are divided into threshold, balancing, and modifying criteria and are given different weights accordingly. Although this decision is being made under the SDWA, these criteria provide a useful framework

for evaluating response alternatives. The threshold criteria include the protection of public health and compliance with regulations (Table 3). These criteria must be met by the remedy. The balancing criteria include the long-term effectiveness and permanence, reduction of toxicity, mobility or volume through treatment, short-term effectiveness, implementability, and cost. Modifying criteria include state and community acceptance of the selection of the remedy. These criteria were modeled on those used under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) and the National Contingency Plan (NCP).

In this decision under Section 1431(a) of the SDWA, the agency is using these criteria, not strictly in accordance with CERCLA and the NCP but as a way to evaluate and balance a number of relevant factors. The remedy selected through this process is one determined to be necessary to protect the health of persons from contaminants that are present in or likely to enter an underground source of drinking water and that is otherwise in accordance with law, as reflected in the first two criteria. It also reflects the EPA's determination of the appropriate balance of other environmental concerns as reflected by the other criteria. The following is a summary of the nine evaluation criteria:

- Overall protection of human health and the environment including preservation of the aquifer as a public drinking water supply. This addresses whether or not a response action provides adequate protection and describes how risks posed through each pathway are eliminated, reduced or controlled through treatment, engineering controls, or institutional controls. This includes prevention of the movement of contaminants into and through the aquifer and its preservation as a public drinking water supply.

- Compliance with state and federal requirements addresses whether or not a response action will meet all applicable federal and state requirements.

- Long-term effectiveness and permanence addresses the criteria that are utilized to assess alternatives for the long-term effectiveness and permanence they afford, along with the degree of certainty that they will prove successful.

- Reduction of toxicity, mobility, or volume through treatment addresses the degree to which alternatives employ recycling or treatment that reduces toxicity, mobility, or volume, including how treatment is used to address the principal threats posed by the Site.

- Short-term effectiveness addresses the period of time needed to achieve protection and any adverse impacts on human health and the environment that may be posed during the installation and implementation period, until cleanup goals are achieved.

- Implementability addresses the technical and administrative feasibility of a response action, including the availability of materials and services needed to implement a particular option.

- Cost includes estimated capital and Operation and Maintenance (O&M) costs, as well as present-worth cost analysis.

- State acceptance addresses the State's position and key concerns related to the preferred alternative.

- Community acceptance addresses the public's general response to the proposed remedy.

Below is a comparison of the strength and weakness each alternative presented in the FS with respect to the nine criteria:

Overall Protection of Human Health and the Aquifer
Alternative 1 provides the least protection of human health and the aquifer because the plume is not prevented from further migration by extraction and treatment, and concentrations of explosives and perchlorate will persist in the aquifer for the longest time period. Alternatives 2 through 5 differ in their degrees of protectiveness in that some achieve cleanup levels more quickly. Alternative 6 is the most protective in that it achieves background levels sooner and actively remediates contamination downgradient of Pew Road, halting further migration of the plume. Alternatives 2 through 6 all protect human health by limiting the further migration of the plume and reducing contaminant concentrations although some will achieve this protection in a shorter timeframe. Alternatives 4, 5 and 6 provide protection in similar timeframes that are substantially faster than Alternatives 2 and 3. Alternative 5 achieves similar results through active remediation of the upgradient portions of the plume and natural attenuation of the leading edge of the plume.

Compliance with State and Federal Requirements
If no remedy is implemented, groundwater contamination would attenuate over a lengthy period of time (greater than 50 years) to health based standards but this is not protective of the aquifer. Alternative 1 is such a remedy. Alternatives 2 through 6 achieve federal and state health-based standards and background in differing periods of time. Alternatives 4, 5 and 6 achieve background and health-based levels in a reasonable period of time.

A summary of federal and state regulations that are potentially applicable to the response action is provided in Table 3.

Long-Term Effectiveness and Permanence
Alternative 1 is the least effective alternative in that time to achieve background is longer and results in the most significant degradation of the aquifer. Alternatives 4, 5, and 6 all provide for effective and permanent remediation for the portion of the plume that is captured by extraction wells although some will achieve protective levels in shorter timeframes. Alternatives 4 and 5 include natural attenuation (including dilution and dispersion) of the downgradient portion of the plume while Alternative 6 would actively restore the aquifer downgradient of Pew Road limiting further migration of the plume.

Reduction of Toxicity, Mobility, or Volume through Treatment

Alternative 1 does not reduce the toxicity, mobility, or volume of contaminated groundwater through treatment because it relies on natural processes of dilution. Alternatives 2 through 6 vary in their rate of reduction of the total mass and volume of contamination due to differences in the number of extraction wells, their placement and pumping rates. Alternatives 2 through 5 do not reduce toxicity, mobility or volume through treatment in the portion of the plume where natural attenuation will occur. Alternative 6 reduces toxicity, mobility and volume of the plume the quickest because it includes an extraction well near the leading edge of the plume. Based on modeling, it is estimated that the leading edge would migrate only approximately 250 ft further in Alternative 5 than in Alternative 6.

Short-Term Effectiveness

Alternative 4 would reach risk-based cleanup goals or background concentrations most quickly. Alternatives 5 and 6 also reach the objectives quickly and in similar timeframes but have significantly lower flow rates, less cost, and less stress on the aquifer than Alternative 4. Alternatives 4, 5 and 6 would reach the cleanup goals most quickly, providing the greatest short-term effectiveness. Alternatives 2 and 3 would provide the least short-term effectiveness. Alternatives 2 and 3 would achieve background levels in greater than 50- and 27-year time frames, respectively, providing the least short-term effectiveness. Alternative 1 would not achieve background conditions within the aquifer in the time period used in the analysis. Alternative 6 would have the most construction activities since additional pipelines are required for the leading edge extraction well. Alternatives 4 and 5 with each having five extraction wells and associated piping would have the next greatest impact on natural resources but these impacts are minimized by construction on existing road and power line corridors.

None of the alternatives are expected to have significant short-term impacts on the community since the construction activities, if any, would be restricted to Camp Edwards. Alternative 1 would have the least short-term impact on the community since it involves no further action, except for the long-term groundwater monitoring and institutional controls.

Implementability

All alternatives can be implemented and rely upon proven technologies. Alternatives 1 and 2 are the most easily implemented alternatives because Alternative 2 relies on the existing treatment systems which were installed as part of the RRA, and Alternative 1 relies on existing monitoring wells. Alternatives 3 through 6 can be implemented, and can be effectively operated and monitored. The treatment technologies of groundwater extraction and treatment with GAC and IX in Alternatives 2 through 6 are reliable technologies.

Cost

Alternative 1 has the lowest cost (Table 2) but does not meet other important criteria. Alternative 2 has the lowest total cost (capital cost plus continuing operation costs) of the remaining alternatives (Alternatives 2 through 6). Alternative 5 has the next lowest total cost. Alternatives 4 and 6 have the highest total costs. In general, there is a trade off between cost and time required to achieve the remedial action goals. Alternative 5 seems to be a reasonable trade off between total costs and achieving the remedial goals in a reasonable timeframe.

Typically, to shorten duration, higher flow rates are needed and this increases both capital and yearly operating costs, as well as environmental impact. After a point, the costs of increasing flow rates increase more quickly with less benefit. Alternative 5 provides a system that balances cost and duration while providing flexibility to optimize operations in the future.

State Acceptance
This criterion is continually evaluated as the MassDEP participates in all aspects of the evaluation and selection of a remedy. The MassDEP's official concurrence is set forth in Appendix A

Community Acceptance
Comments were received from three members of the public as part of the public comment period on the RSP. Based on the comments received on the RSP, the public is generally supportive of Enhanced Alternative 5 (see Part III, the Responsiveness Summary).

L. THE SELECTED RESPONSE ACTION

Alternative 5 as presented in the Feasibility Study provides for a groundwater extraction system with five wells (Figure 3) with treatment to risk-based levels. This alternative provides the best balance of the criteria used to evaluate cleanup alternatives. It achieves cleanup goals in a reasonable timeframe. However, to strengthen this alternative, EPA has selected an Enhanced Alternative 5. This Enhanced Alternative 5 includes the groundwater extraction design provided in Alternative 5 and adds a significant feature - a contingency to add additional extraction wells if the plume is found to migrate further than expected as discussed in paragraph three below.

This feature of Enhanced Alternative 5 relates to the capture of the plume downgradient of Pew Road. The IAGWSP has presented information in its Supplemental Evaluation that under Alternative 5 a small section of the plume would migrate an additional 250 ft west and thereafter disperse to background levels. Because this assessment is based on projected conditions from modeling results, it contains uncertainties. So as to be protective of human health and the aquifer, EPA's Enhanced Alternative 5 would create a contingency for additional action.

If EPA determines, based on monitoring data or revised modeling by the IAGWSP or EPA, that plume migration is substantially different than predicted by the modeling conducted in the Feasibility Study, the IAGWSP will conduct a detailed analysis to determine, as accurately as possible, the current and projected future plume location. If groundwater modeling suggests that contamination above applicable federal or state regulatory or risk-based levels for COCs will likely migrate past the well transect that will include wells D1P-30, D1P-31, and D1P-32, (which are to be installed as close as possible to the western edge of North Pond) (Figure 3), an additional active groundwater treatment system will be designed and built within 12 months prior to the plume arrival date, and operated to prevent migration beyond the vicinity of the well transect.

The additional active treatment system will likely consist of an extraction well pumping at 30 to 50 gpm and a portable treatment container, similar to the unit located at Pew Road, which will use GAC and/or ion exchange filters to clean the groundwater.

In the Enhanced Alternative 5, the IAGWSP, as part of its annual monitoring reporting, will conduct a detailed annual assessment of plume migration west of Fredrikson Road.
EPA believes that this Enhanced Alternative 5 is reasonable when compared to Alternative 6 because it provides similar benefits at significantly less cost. Thus, the proposed remedy for the Demo 1 Groundwater Plume is Enhanced Alternative 5, which includes:

- Groundwater extraction at a total flow rate of 906 gpm from five extraction wells, three of which will be new construction;
- Treatment of water at two treatment facilities with construction of a permanent treatment building at Frank Perkins Road;
- Recharge of treated water via four injection wells;
- Monitoring for the entire plume including the leading edge downgradient of Pew Road; and
- Contingency for additional active treatment in the area downgradient of Pew Road.

Groundwater Extraction, Treatment, and Recharge to the Aquifer
The primary cleanup goals for groundwater at Demo 1 are to restore the useable groundwater to its beneficial use within a reasonable timeframe; to provide a level of protection in the aquifer that takes into account that the Cape Cod aquifer, including the Sagamore Lens, is a sole source aquifer that is susceptible to contamination; and to prevent potential ingestion and inhalation of groundwater containing COCs (RDX, 2,4-DNT, TNT, and perchlorate) in excess of federal maximum contaminant levels, Health Advisories, DWELs, applicable State standards or an unacceptable excess lifetime cancer risk or non-cancer Hazard Index.

In addition, the Enhanced Alternative 5 will also prevent any migration of contaminants above regulatory or risk-based levels beyond the vicinity of the well transect that will include monitoring wells D1P-30, D1P-31, and D1P-32, which are to be installed as close as possible to the western edge of North Pond. The trigger for additional action will be activated if actual or modeled data at the above well transect exceeds federal or state regulatory or risk-based levels for COCs.

The proposed remedy is expected to achieve a risk-based level of 0.6 ppb for RDX in 11 years while reducing perchlorate concentrations to less than 2 ppb within the same time frame (Table 2).

Cleanup Levels
The cleanup level for RDX is the 10^{-6} risk-based level, currently 0.6 ppb. The cleanup level for perchlorate is 2 ppb. The cleanup level for TNT is 2 ppb. The cleanup level for 2,4-DNT is 0.25 ppb. Table 1 provides a complete summary of cleanup levels.

Frank Perkins Road
Groundwater extracted from eastern extraction wells (EW-D1-1, EW-D1-501, EW-D1-502, EW-D1-503) would be pumped to a treatment facility at the Frank Perkins Road location (Figure 3). Based on the modeling results, a total of 808 gpm would be conveyed to this treatment facility. Groundwater would be treated by a combination of IX and GAC (Figure 4). Groundwater treated at the Frank Perkins Road system would be recharged to the aquifer via the existing injection wells IW-D1-1 and IW-D1-2. The flow would typically be split equally between the two injection wells, or 404 gpm each.

Pew Road
Groundwater extracted from the extraction well at Pew Road (EW-D1-2) would be conveyed to a treatment facility located on Pew Road (Figure 3). Based on the modeling results a total of 98 gpm of groundwater would be pumped to this location. A treatment container system, like those being used for the RRA, would be used at Pew Road. The treatment system would consist of GAC (Figure 5) with the addition of IX media if necessary. Groundwater treated via the Pew Road system would be recharged to the aquifer via the existing injection well IW-D1-3 and one new injection well IW-D1-4. The flow would typically be split equally between the two injection wells, or 49 gpm each.

Operation and Maintenance
O&M of the extraction, treatment and recharge systems will be routinely conducted to ensure effective operation of the remedy.

Plume Monitoring
During the period that the treatment systems are remediating the aquifer, the IAGWSP will monitor the contaminant plume in accordance with an approved performance monitoring plan.

Contingency for Additional Remedial Actions
The portion of the plume already downgradient of Pew Road is expected to dissipate through natural dispersion. If EPA determines, based on monitoring well data or revised modeling, that plume migration is substantially different than predicted by the modeling conducted in the Supplemental Evaluations (Appendix D of the Final Feasibility Study), the IAGWSP will conduct a detailed analysis to determine, as accurately as possible, the current and projected future plume location.

Two sentinel well fences will be used to monitor the downgradient extent and dissipation of the Demo 1 plume (Figure 2). The first fence consists of existing well clusters MW-352 and MW-353 (upgradient fence). Both of these wells are located northeast of North Pond in the expected trajectory of the plume. Contamination has not yet been detected in these wells, however it is expected that the plume will eventually reach these wells. The second sentinel well fence will include well clusters D1P-30, 31 and 32 (downgradient fence). The elevation of the well screens and the north-south position of the downgradient fence will be based on the detection(s) at the upgradient fence. The wells in the downgradient fence will be placed as close as practical to the western side of North Pond (Figure 2).

All sentinel wells will be sampled and analyzed three times per year for perchlorate through the ongoing system performance monitoring program. The groundwater model will be updated yearly through the system performance monitoring program. The groundwater travel time between the upgradient and downgradient fences is expected to be 1.5 to 3 years. The model will also be used to determine the proper locations of the downgradient fence, both horizontally and vertically.

If groundwater modeling predicts that contamination above applicable federal or state regulatory or risk-based levels for COCs will likely migrate past the well transect that will include wells D1P-30, D1P-31, and D1P-32 an additional active groundwater treatment system will be designed and built within 12 months prior to the plume arrival date, and operated to prevent migration beyond the vicinity of the well transect. The location and elevation of the extraction well screen for this treatment system will be determined based on the location and elevation of COCs detected in the downgradient sentinel well fence. North Pond may have significant influence on the horizontal and vertical trajectory of the plume. Therefore, the proper location of the extraction well can not be determined until the leading edge of the plume is detected in the downgradient fence.

The contingency treatment system will likely consist of an extraction well pumping at 30 to 50 gpm and a portable treatment container, similar to the unit currently located at Pew Road, which will use GAC and/or IX units to clean the groundwater. Treated water will be returned to the aquifer. The objective of this system would be to prevent the migration of COCs above applicable federal and state standards or risk-based levels beyond the vicinity of the downgradient fence.

System Operation and Shutdown

Performance Monitoring

During the period that the treatment systems are remediating the aquifer to applicable drinking water standards or risk-based cleanup levels the IAGWSP will monitor the contaminant plumes in accordance with a system performance monitoring plan approved by EPA in consultation with MassDEP. The performance monitoring program will collect data for evaluating whether the system is performing as designed; the potential for short-term health effects due to exposures during active remediation; and when the selected remedy will attain the remediation goals set forth in this document.

Residual Risk Assessment

Before the treatment system is shut off, the IAGWSP will conduct, pursuant to a workplan approved by EPA in consultation with MassDEP, a residual risk assessment to determine if COCs remaining in the aquifer pose unacceptable human health risks. The IAGWSP will continue to operate the system and will undertake additional measures as necessary to achieve acceptable risks.

Feasibility Analysis

In light of uncertainties and limitations that may exist concerning current capabilities to estimate potential exposures and to quantify potential health risks associated with Demo 1 groundwater contamination, the IAGWSP will evaluate additional quantitative risk reduction elements (e.g. continued groundwater treatment to contaminant levels approaching or achieving background). Once acceptable risk levels have been achieved, the IAGWSP will evaluate, considering the factors set forth in MassDEP guidance, the technical and economic feasibility of conducting additional remediation activities to approach or achieve background concentrations.

Land Use Controls

The contaminated groundwater from the Demo 1 site currently poses an unacceptable risk to human health if used for drinking water purposes. The Demo 1 site is located on base approximately 2 miles east of the boundary with the Town of Bourne. The plume of contaminated groundwater extends approximately 10,000 feet west, is about 1,000 feet wide and covers an area of the aquifer 100 feet deep. No groundwater contamination associated with the plume has or is expected to migrate beyond the Camp Edwards boundary in concentrations that exceed applicable water quality standards or risk-based levels. Therefore, administrative and/or legal controls that minimize the potential for human exposure to groundwater contamination by limiting land or resource use, known as "land use controls" (LUCs), must be established for the on-base area of concern to avoid the risk of human exposure to contaminated groundwater from the Demo 1 site. These LUCs are needed on-base until the groundwater contamination from the Demo 1 site no longer poses an unacceptable risk.

The performance objectives of the LUCs are:

- Prevent access to or use of the Demo 1 site 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 Demo 1 site contaminated groundwater (indicated on Figure 2 in this Decision Document) and surrounding areas to prevent a risk from exposure to contaminated groundwater. The on-base area of concern is controlled and operated by the Massachusetts National Guard (MANG) in conjunction with the United States Army (Army), which leases this land from the Commonwealth of Massachusetts. It is expected that these entities will operate and lease, respectively, the area of concern and the surrounding area for the duration of this Decision Document. As a result, the Army will coordinate with the Commonwealth of Massachusetts as it 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 Contaminants of Concern in the groundwater are at such a level to allow unrestricted use and exposure, or (2) the Army, with the prior approval of EPA, modifies or terminates the LUC in question.

The Army is responsible for ensuring that the following two LUCs are established, monitored, maintained, reported on and enforced as part of this final remedy to ensure protection of human health in accordance with SDWA § 1431(a) for the duration of this final remedy selected in this Decision Document. In the event that the Commonwealth of Massachusetts fails to enforce the first LUC, the Army will act in accordance with the third to last paragraph in this section.

1. Existing LUCs prevent the inadvertent creation of a large potable water supply well. The Massachusetts Department of Environmental Protection (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 Demo 1 site contaminated groundwater for any withdrawals of groundwater for drinking water purposes, constitutes a LUC for this final remedy.

2. The Dig Safe program implemented in Massachusetts provides an added layer of protection to prevent the installation of water supply wells in the Demo 1 site area and to protect monitoring wells and 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 MANG Air National Guard 102nd Fighter Wing at the Otis Air National Guard Base (Air Guard) is a member utility of Dig Safe. The Camp Edwards Training Range and Impact Area, including the area encompassed by the Demo 1 site and plume, falls within the geographical area identified by the Air Guard as a notification region within the Dig Safe program. Through the Dig Safe process, the Air Guard 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. Upon receiving Dig Safe notification of any proposed digging activity on Camp Edwards (which includes the Training Range and Impact Area and the Demo 1 site area), the Air Guard will promptly transmit the Dig Safe notification information to the MANG MMR Environmental & Readiness Center (E&RC). The E&RC will review each notification and, if the digging activity is intended to provide a previously unknown water supply well, the E&RC will immediately notify the project sponsor (of the well drilling), the EPA, 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 E&RC (or its designee) will mark its components to prevent damage due to excavation. The extent of the Air Guard's and E&RC's enforcement of this LUC does not address off-base parties failing to file a Dig Safe request.

Additionally, the Army is responsible for ensuring that the following LUC is established, monitored, maintained, reported on and enforced as part of this final remedy to ensure protection of human health in accordance with SDWA § 1431(a) for the duration of the final remedy selected in this Decision Document.

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 MMR). 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 (See Appendix D).

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).

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

The Army may transfer various operational responsibilities for LUCs (i.e., monitoring) to other parties through agreements. However, the Army acknowledges its ultimate liability under SDWA § 1431(a) for remedy integrity.

The Army shall notify 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 Army 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 ten (10) days after the Army becomes aware of this breach. The Army will notify EPA and MassDEP as soon as practicable but no later than ten (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 Army will notify EPA and MassDEP regarding how the Army has addressed or will address the breach within ten (10) days of sending EPA and MassDEP notification of the breach.

The Army will provide notice to the EPA and MassDEP at least six (6) months prior to relinquishing the lease covering the Demo 1 site so the EPA and MassDEP can be involved in discussion 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 Army to notify the EPA and MassDEP at lease six (6) months prior to any transfer or sale, then the Army 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.

The Army shall not modify or terminate LUCs, implementation actions, or modify land use without approval by the EPA in conjunction with MassDEP. The Army, in coordination with other agencies using or controlling the Demo 1 site, 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.

Modifications

The performance of the system will be continuously evaluated through the system performance monitoring program. This will include evaluation of system parameters and flow rates to insure that the system continues to achieve project goals as efficiently as possible. Optimization changes will be documented in the periodic system performance monitoring reports.

Any significant changes to the response action described in this Decision Document will be documented in a technical memorandum in the Administrative Record for the Site. If EPA, in consultation with the state, believes that fundamental changes to the response action are necessary, EPA will issue a proposed revised decision document and accept public comment on it before issuing a final revised decision document.

Expected Outcomes of the Selected Response

The primary cleanup goals for groundwater at Demo 1 are to restore the useable groundwater to its beneficial use within a reasonable timeframe; to provide a level of protection in the aquifer that takes into account that the Cape Cod aquifer, including the Sagamore Lens, is a sole source aquifer that is susceptible to contamination; and to prevent potential ingestion, dermal contact, and inhalation of groundwater containing COCs in excess of federal maximum contaminant levels, health advisories, DWELs, applicable state standards or an unacceptable excess lifetime cancer risk or non-cancer Hazard Index. The proposed remedy is expected to achieve a risk-based level of 0.6 ppb for RDX in 11 years while reducing perchlorate concentrations to less than 2 ppb within the same time frame (Table 2).

There are currently no federal MCLs for any of the COCs so other federal or state standards or guidelines were used to establish cleanup levels (Table 1). For RDX the DWEL is 100 ppb. The lifetime HA is 2.0 ppb, and the concentration resulting in an increased incremental lifetime cancer risk of one in a million is 0.6 ppb. The cleanup standard for RDX was thus established at

the cancer risk level, currently at 0.6 ppb. For TNT, the DWEL is 20 ppb, the HA is 2.0 and the lifetime cancer risk for one in a million is 2.2 ppb. The cleanup standard for TNT was thus established at 2.0 ppb. For 2,4-DNT, the DWEL is 70 ppb and there is no lifetime HA, the 10^{-6} lifetime cancer risk for one in a million is 0.1 ppb. Due to analytical method limits, the cleanup standard was established at 0.25 ppb. In February 2005, EPA established a reference dose for perchlorate which equates to a DWEL of 24.5 ppb. The DWEL assumes that all of the contaminant comes from drinking water. With a contaminant like perchlorate, individuals may be exposed through other sources, such as food or breast milk. The State has promulgated a Massachusetts Maximum Contamination Level (MCLL) of 2 ppb. The cleanup standard for perchlorate was thus established at 2 ppb.

In addition, the Enhanced Alternative 5 will also prevent migration of COCs above applicable drinking water quality standards or risk-based levels beyond the vicinity of the well transect that will include monitoring wells D1P-30, D1P-31, and D1P-32. The trigger for additional action will be activated if actual groundwater concentrations or concentrations predicted by the model at this well transect exceed applicable federal or state standards or risk-based levels for COCs.

Five-Year Reviews

In addition to continuing evaluation of the treatment system by submission of annual reports on system performance and ecological impact monitoring, the IAGWSP shall review this groundwater remedy every five years. The purpose of the review is to revisit the appropriateness of the remedy in providing adequate protection of human health. The scope of the review shall include, but is not limited to the following questions: is the remedy operating as designed; have any of the cleanup standards changed since finalization of this Decision Document; and is there any new information that would warrant updating the remedy. If appropriate, additional actions may be required as a result of these reviews.

M. DETERMINATIONS

The groundwater response action selected for implementation at Demo 1 is consistent with the SDWA Section 1431(a), 42 USC §300i(a), as amended and with AO3.

The selected response action is protective of human health, will comply with applicable federal and state requirements, standards, MCLs, health advisories, and DWELS. The response action will adequately protect human health and the sole source aquifer which constitutes a current and potential drinking water supply by eliminating, reducing, or controlling exposures to potential human receptors at the site through treatment and institutional controls.

N. DOCUMENTATION OF NO SIGNIFICANT CHANGES

EPA presented a RSP for Enhanced Alternative 5 for the groundwater remedy at Demo 1 on August 22, 2005. The proposed alternative includes groundwater extraction, treatment and recharge. EPA reviewed all written and verbal comments submitted during the public comment period. It was determined that no significant changes to the response action, as originally

identified in the RSP, were necessary.

O. STATE ROLE

The MassDEP has reviewed the various alternatives and has concurred with the selected response action. See Appendix A.

PART III: THE RESPONSIVENESS SUMMARY

On August 22, 2005, the IAGWSP published the RSP for the Demo 1 Groundwater Plume, which included the EPA proposed remedy for the Demo 1 site and announced the public comment period on the proposed remedy. The EPA proposed Enhanced Alternative 5 as the remedy for the Demo 1 plume.

At the August 23, 2005 public meeting of the IART, held in Falmouth, MA, the IAGWSP gave a presentation on the RSP and the EPA presented its proposed remedy and answered questions from the IART.

In addition, the IAGWSP held a public hearing on the RSP on September 12, 2005 in Bourne, MA. A public information session, along with a presentation on the RSP and EPA's proposed remedy were held prior to the opening of the public hearing. Local residents and officials, news media representatives, representatives from EPA, MassDEP and the IAGWSP interested in site activities and cleanup decisions were invited to attended both meetings. Representatives from EPA, MassDEP, and IAGWSP were present. Two members of the public and no news media representatives attended.

The IAGWSP notified the public of the August 23, 2005 public meeting and announced the public comment period in a display ad placed in the August 19, 2005, editions of *The Cape Cod Times* and *The Enterprise* newspapers, and display ads were placed in the September 9, 2005 editions of these same newspapers to announce the public hearing and as a reminder of the public comment period.

The IAGWSP placed copies of the RSP for the Demo 1 Groundwater Plume in the IAGWSP's information repositories at the Bourne, Falmouth, Mashpee and Sandwich, MA public libraries. The repository contains documents on the Demo 1 investigation and findings supporting selection of the RA including the FS for Demo 1 Groundwater and other relevant documents upon which EPA relied in selecting the proposed remedy. The RSP also was made available on the IAGWSP Web site, which also contains the supporting documents and which offered a means of submitting public comments on the RSP. In addition, the IAGWSP mailed copies of the RSP to IART members and distributed to individuals in attendance at the public meeting and public hearing.

The following table provides a summary of issues and concerns raised during the public comment period held on the RSP for the Demo 1 Groundwater Plume from August 22, 2005 through September 19, 2005.

	Name of Comment Originator:	Organization of Comment Originator:	Comment:	Response:
1	David Dow	Sierra Club	In regards to remedy selection for the Demo Area 1 Groundwater Plume, we favor the Enhanced Alternative 5 proposed by the Environmental Protection Agency (EPA) which has 5 extraction wells/4 injection wells with treatment facilities (granulated activated carbon utilization for RDX and exchange resin treatment for perchlorate). We feel that the "adaptive management" approach for the toe of the plume (if it extends beyond the Pew Road Treatment facility) offers the flexibility to treat the leading edge if it migrates beyond the D1P-30-32 monitoring well transect. Since the regulatory agencies (EPA and MassDEP) disagree with the Army National Guard (ANG) on whether the leading edge will move past the Rod & Gun Club North Pond, we feel that an approach that uses monitoring data to revise model predictions should be used in choosing a remedy that adjusts to the facts on the ground. EPA's alternative 5 uses this adaptive management approach.	Preference noted. Both the IAGWSP and the regulators understand that groundwater modeling is an iterative process with inherent uncertainties. That is the reason why an extensive performance monitoring plan is incorporated into the remedy. That will allow actual data to be used to ensure the treatment system is meeting the remediation objectives.
2	David Dow	Sierra Club	In the face of scientific uncertainty regarding the safe drinking water level for perchlorate, we feel that a precautionary approach should be utilized in deriving the cleanup standard for Demo Area 1. The Massachusetts Department of Environmental Protection appears to be closer than EPA in establishing a maximum contaminant level (MCL) for perchlorate. Since the National Academy of Sciences used a no effect concentration from adults receiving perchlorate doses on thyroid hormones, we don't feel that their analysis should provide the basis for the reference dose, since babies and children are the most sensitive population for perchlorate impacts on thyroid function. EPA proposes to use risk-based criteria to establish the perchlorate cleanup standard of 1 ppb (parts per billion). Risk analysis presumes that one understands the cause/effect relationship in order to link dose to response. It is not clear that this is known for humans (since epidemiology studies don't link concentration of contaminants at the tissue level to their biological effects), even though animal studies may provide this information.	Comments noted related to uncertainty of safe drinking water level for perchlorate.

	Name of Comment Originator:	Organization of Comment Originator:	Comment:	Response:
			Different regulatory bodies have arrived at widely different decisions on the safe level of perchlorate in the environment, depending upon what types of data they choose to utilize in the analysis. As an environmental advocacy organization the Sierra Club is not in the position to decide which of these technical arguments are correct, but we feel that the cleanup standard should be 1 ppb or less, based on a precautionary approach. Certainly the Environmental Working Group which has examined this issue from a technical perspective favors lower perchlorate levels than those proposed by the military or state of California. When Assistant Secretary Tad McCall came to Cape Cod during the Clinton Administration, he stated that the Department of Defense was going to make the citizens of Cape Cod whole from the groundwater contamination emanating from the Massachusetts Military Reservation (MMR). The Sierra Club's operational interpretation of this promise is that the cleanup standard would be non-detect, even though the Army National Guard has not even committed to achieving MCL levels when the current rule making process is completed. It is likely that similar uncertainties apply to the safe level of RDX, but it has been out of the public eye unlike perchlorate. Ross Vincent, a Sierra Club activist who is a former chemical engineer, has written eloquently on the fallacies underlying the application of risk assessment and cost/benefit analysis in establishing cleanup standards for hazardous/toxic waste cleanups.	Preference noted for 1 ppb standard or less for perchlorate. Comments noted regarding interpretation of Assistant Secretary Tad McCall statements. The response action goals include "preventing potential ingestion and inhalation of groundwater containing COCs in excess of federal maximum contaminant levels, Health Advisories, DWELs, applicable state standards or an unacceptable excess life-time cancer risk or non-cancer Hazard Index."
3	David Dow	Sierra Club	At the August 23, 2005 Impact Area Review Team (IART) meeting, a citizen member, Peter Schlesinger, recommended that the Impact Area Groundwater Study program (IAGS) erect wind towers at the MMR to provide power for the pump and treatment plants involved in the groundwater cleanup. The Sierra Club supports this recommendation. We gather that the Air Force Center for Environmental Excellence (AFCEE) has done some preliminary analysis of utilizing renewable sources of energy to supplement that drawn from the New England Power Grid. Normally cost/benefit analysis is conducted in order to decide	Comments noted regarding support for a renewable energy source for the pump and treat plants involved in the groundwater cleanup. Comments noted regarding use of competent economists to perform cost/benefit analysis.

	Name of Comment Originator:	Organization of Comment Originator:	Comment:	Response:
			whether to utilize renewable energy to replace a portion of that generated from fossil fuels/nuclear power plants. There are a lot of technical issues, like the assumed discount rate and estimating costs and benefits in comparable units that influence the outcome of cost/benefit approaches. Many of the costs are part of our market economy and can be estimated using traditional natural resource economic approaches. Many of the benefits stem from reducing global warming and providing U.S. energy security. These have to be estimated using either ecological economics approaches or non-market valuation techniques as adjuncts to traditional economics. Thus competent economists should be employed in this analysis to avoid the problems found in the economic analysis utilized to support the Cape Wind Draft Environmental Impact Statement (DEIS). The Sierra Club feels that the federal government should provide the leadership for the wider society in moving towards greater use of renewable energy sources and promotion of greater energy use efficiency. This alone should justify the use of wind power to meet power requirements on AO3 of 10 million kw per yr at a cost of $1.5 million per year (based on AFCEE use described at August 23 IART meeting). Given the rising price of fuel oil and natural gas used in the production of electricity, this switch is likely to be cost effective in the long run and will save the O&M money in the operation of the treatment systems. Placing wind towers on the moraine at the MMR could provide a supplemental electricity source for the entire facility, even if the wind speed is not up to those required for a commercial renewable energy operation like Cape Wind.	The IAGWSP supports the idea of using renewable energy sources to provide power for pump and treat systems where feasible and will explore the possibility of renewable energy sources that do not impact the training mission of Camp Edwards and other existing uses of MMR. Please be aware that Camp Edwards Aviation officials have historically requested that all facilities in the Demo 1 area remain below the tree tops. EPA and DOD support the use of renewable energy and has several programs currently investigating or using renewable energy sources.
4	Peter Schlesinger	Impact Area Review Team (IART)	In general, I haven't any issue with the proposed Enhanced Alternative 5 scheme in the RSP, because it allows for an additional well to capture the toe of the plume as necessary (and there is sufficient room for consideration of an additional well(s) as needed).	Comment noted.

	Name of Comment Originator:	Organization of Comment Originator:	Comment:	Response:
5	Peter Schlesinger	IART	I believe that the draft RSP should be amended to include a section on Energy Requirements for each of the potential Remedies, as well as a Renewable Energy-based solution (wind/solar/other) that would make use of the most efficient means of renewable energy for each suggested remedy. I propose that the regulatory agencies (MassDEP and EPA) require that all subsequent RSPs to be made for IAGWSP remedial solutions be required to include a section on potential Energy Requirements/Renewable Energy-based solutions (wind/solar/other) I propose that the IAGWSP commit to powering all of its remedial groundwater facilities with grid-tied non-fossil fuel based renewable energy solutions (wind/solar/other)	Comment noted. See response to Number 3. Since energy requirements would be the same for the alternatives presented regardless of power to operate the systems being from renewable or conventional sources, a comparison of Operations and Maintenance costs, which was completed in the FS, provides this information. Enhanced Alternative 5 was selected because it provided the best balance between meeting the cleanup goals and operational efficiency. Energy requirements are not required to be part of the Feasibility Study, although it may be added if the IAGWSP and regulatory agencies agree to incorporating this additional analysis in future feasibility studies.
6	Michael E. Minior	Air Force/IRP Representative on the IART and Citizen of Pocasset	First, I would like to express my support for selection of alternative 3 for cleanup of the Demo 1 plume. This is the only alternative that balances the time for cleanup versus cost in consideration of risk and potential for future use of the aquifer. This is also the opinion of my neighbors to whom I have spoken as we are residents of the Pocasset community which is located to the west of the base.	Preference noted.

	Name of Comment Originator:	Organization of Comment Originator:	Comment:	Response:
7	Michael E. Minior	Air Force/IRP Representative on the IART and Citizen of Pocasset	I find it disingenuous that EPA, who selected the preferred remedy, put forth in the RSP, had the cost figures for alternatives 5 and 6 revised based on the latest plume shells and did not do the same for all the active alternatives. I would like an explanation of why only alternatives 5 and 6 were revised and an explanation of how EPA expected the public to be able to knowledgeably compare alternatives that have a different basis of analysis. It is difficult for the public to compare apples and oranges.	Both the original and revised costs were included in the Feasibility Study for comparison purposes. Only Alternatives 5 and 6, which required updated modeling of the toe of the plume were redone in the supplemental evaluation, so updated costs were only available for those alternatives.
8	Michael E. Minior	Air Force/IRP Representative on the IART and Citizen of Pocasset	The map provided in the RSP (August 2005) for public evaluation provides an outline of the RDX and perchlorate plumes. However, there is no reference to the concentration contour depicted. This is an intentional misrepresentation of the actual size of the plume based on current federal or state standards. Why didn't EPA provide an accurate plume depiction for public review in the RSP? Where is the RDX 2ppb Health Advisory concentration contour? Where is the perchlorate 24.5 ppb concentration contour? Or even the 1 ppb contour? How can the public reasonably consider the various alternatives in addition to the recommended alternative without accurate information?	Since new concentrations that would change both the 2 ppb RDX contour and the 1 ppb perchlorate contour were detected in recent sampling rounds it was determined that showing only the outline of the plume and not the inner contours would be most accurate. With respect to your comment about misrepresentation, EPA believes (and has been addressed by the IART) that showing the entire detectable plume is an honest representation. Based on your comments at the public meeting where the RSP was initially

	Name of Comment Originator:	Organization of Comment Originator:	Comment:	Response:
				presented, the figure was revised to show the 2 ppb RDX and 1 ppb perchlorate contours prior to the public hearing.
9	Michael E. Minior	Air Force/IRP Representative on the IART and Citizen of Pocasset	On page 9 in the discussion of cleanup goals there is reference to perchlorate contamination in the aquifer. Perchlorate is an unregulated contaminant for which EPA has established a DWEL of 24.5 ppb (page 2). There is no state standard for perchlorate, only an advice level for sensitive populations. The EPA has stated that they selected "enhanced alternative 5" as the remedy to be implemented. This I perceive is the only way that the EPA could get the Army to support the six well system (alt. 6) that EPA really wants built to remove every trace of contamination. How does the enhanced alternative 5 which is nothing more than a contingent remedy save money? I would like EPA to provide a clear explanation of which authority allows them to order the reduction of perchlorate concentrations to 1 ppb (as it requires a specialized technology for removal unlike the activated carbon that will easily remove the RDX) in the absence of a cleanup or drinking water standard at the 1 ppb level. Perchlorate removal to such low levels drives up the cost of cleanup considerably. How can the decision to build the sixth well, which will be based on perchlorate only, be justified?	The Commonwealth of Massachusetts has promulgated an MMCL for perchlorate since this comment was received. Alternative 5 was found to be the best balance between total (capital and operation) costs and time required to reach the remedial goals. If the contingency is not required, Enhanced Alternative 5 would be significantly less costly than Alternative 6. The decision to build the sixth well will be based on contamination above any federal or state regulatory or risk-based levels for contaminants of concern migrating past the well transect that will include wells D1P-30, D1P-31 and D1P-32. . SDWA does require protection of human health as a priority objective. Cost was considered as one of the factors in

	Name of Comment Originator:	Organization of Comment Originator:	Comment:	Response:
9	Michael E. Minior	Air Force/IRP Representative on the IART and Citizen of Pocasset	The modeling predicts that the concentrations of perchlorate will dissipate (below 24.5 ppb) through natural processes downgradient of Pew Road. The RDX will also be reduced below its Health Advisory of 2ppb long before it reaches the base boundary now that the Demo 1 source area has been cleaned up (since there is no longer any mass of RDX leaching to groundwater to support higher concentrations downgradient).	achieving this objective but SDWA does not require a cost-benefit analysis under Section 1431. You are correct that perchlorate is not likely to migrate beyond the base boundary at concentrations exceeding 24.5 ppb under current conditions. However it is not certain that RDX would not migrate past the base boundary above the 2 ppb health advisory if no remedial systems were in place. In addition, because Camp Edwards is a potential future drinking water supply the plume should be remediated to prevent future exposures and the protect the sole source aquifer.
10	Michael E. Minior	Air Force/IRP Representative on the IART and Citizen of Pocasset	I would like EPA to provide a clear delineation of the productive portion of the aquifer that the recommended remedy is attempting to restore, to include an estimation (year) of when this portion of the aquifer might be needed to support future water supply needs for the Town of Bourne. The IRP's Long Range Water Supply Process Action Team	There is no current estimation as to when the restored portion of the aquifer will be required for water supply use. Your comments concerning

	Name of Comment Originator:	Organization of Comment Originator:	Comment:	Response:
			downgradient of Pew Road; specifically for test well site number 10. The LRWSPAT recommended that site 10 not be pursued, even though the water quality looked good and the formation looked promising for a sustainable yield, because of the potential for adverse ecological impacts to North Pond from development of site 10 as a potable source. How is it reasonable then to push for a quicker cleanup of that portion of the aquifer (than afforded by Alternative 3) if it will never (probability = zero) be used for water supply purposes?	supply wells in the vicinity of North Pond are noted and consistent with findings during development of the Upper Cape Regional Water Supply system. Further, as a sole source aquifer, it should be remediated as quickly as possible.
11	Michael E. Minior	Air Force/IRP Representative on the IART and Citizen of Pocasset	There is no mention of the receptors that are potentially at risk from the Demo 1 groundwater contamination. Is the sole reason for this cleanup to "restore the aquifer" as stated on page 2? Please explain the future use that warrants the expenditure of millions of additional dollars in order to restore this impacted portion of the aquifer in 11 years rather than the 23 years the modeling predicts will be the case for alternative 3. I am not sure of the cost difference (dollars to be saved) because of the EPA's decision not to include alternative 3 in the supplemental evaluation.	Currently there are no users of the aquifer affected by the Demo 1 plume. The objective is to restore the portion of the aquifer impacted by Demo 1 to protect the beneficial uses of the sole source aquifer and to minimize any future health risks and expedite cleanup as much as possible.
12	Michael E. Minior	Air Force/IRP Representative on the IART and Citizen of Pocasset	In conclusion, the remedy preferred by EPA is not reasonable or supported by the facts. The information presented in this Remedy Selection Plan is a biased misrepresentation of (1) the extent of contamination, of (2) the risks associated with contaminants due to the potential for future use of this portion of the aquifer to include the lack of potential receptors and (3) for only revising the capital and life-cycle costs of the two alternatives that ultimately were combined into one enhanced alternative 5 without any cost information provided for public review in the RSP.	Preference for Alternative 2 noted.
			I strongly recommend that EPA revise their recommendation (from enhanced alternative 5) and select alternative 2 as the cleanup remedy to be implemented. Or redo the RSP to present correct, factual information to allow for a through public	EPA disagrees with the statements. The SDWA specifically allows for protection of present and future

Name of Comment Originator:	Organization of Comment Originator:	Comment:	Response:
		review (apples to apples comparison) and schedule another public comment period. The above opinion is submitted for your consideration in final remedy selection. I request a written response to my comments and that I be provided a copy of the entire responsiveness summary that will be appended to the Decision Document for Demo 1 groundwater.	drinking water supplies. A copy of the Responsiveness Summary will be supplied as requested.

Table 1

Remediation Goals for COCs for Demo 1 Groundwater Operable Unit

Contaminant Of Concern	Max. Concentration (2005-2006) (μg/L)	Analytical Reporting Limit (μg/L)	Background Concentration (μg/L)	Oral Risk-Based Concentration, RBC[1] (μg/L)			Other Limits				
				Non-Cancer	Cancer		MCL (μg/L)	MMCL (μg/L)	Lifetime HA (μg/L)	DWEL (μg/L)	Remediation Goal (μg/L)
					10^{-4}	10^{-6}					
RDX	140	0.25	0.25	110	60	0.6	NA	NA	2	105	0.6
Perchlorate	102	1.00	0.35	24.5	NC	NC	NA	2	NA	24.5	2
TNT	5.9	0.25	0.25	18	220	2.2	NA	NA	2	20	2
2,4-DNT	0.37	0.25	0.25	73	10	0.1	NA	NA	NA	100	0.25*

1 – Source of Toxicity Information (RfD and CSF) to derive RBC is IRIS (EPA 2006).

* – The risk based remediation level for 2,4,-DNT (0.1 μg/L) is below the reporting limit of the analytical method, therefore the reporting limit of 0.25 μg/L will be used as the Remediation Goal. This equates to a cancer risk of $2x10^{-6}$.

Background concentrations for RDX, TNT, and 2,4-DNT are equal to the analytical reporting limit, for perchlorate it is the analytical method detection limit.

COC – Contaminant of Concern.

DWEL – Drinking Water Equivalent Level, based on non-carcinogenic effects.

HA – USEPA Health Advisory.

NA – Not Available.

NC – Non-carcinogenic.

MCL – USEPA Maximum Contaminant Level.

MMCL – Massachusetts Maximum Contaminant Level.

RBC - Risk Based Concentration.

TABLE 2
SUMMARY OF ALTERNATIVES

Alt#	Design Details			RDX Remediation			Perchlorate Remediation			Capital Cost	O&M	Total Present Worth***
	Number of Extraction Wells	Total Extraction Rate (gpm)	Number of Injection Wells	Years to Achieve Risk-Based Concentration (0.6 ppb)	Years to Achieve Background (0.25 ppb)	% Mass Removed After 10 years	Years to Achieve Risk-Based Concentration (1.0 ppb)	Years to Achieve Background (0.35 ppb)	% Mass Removed after 10 years			
1	0	0	0		>50	0		>50	0	1,550,000	1,300,000	2,850,000
2	2	320	3	36	50	67.5	36	35/>50*	80.2	3,640,000	11,400,000	15,000,000
3	4	472	4	23	27	92.1	23	23/21*	92.7	6,350,000	14,700,000	21,100,000
4	5	1417	4	11	15	99.7	10	15/15*	98.3	10,200,000	15,500,000	25,700,000
5**	5	906	4	14 (11)	16 (13)	98.8	13 (11/9)*	15/20* (12/19)*	98.3	8,340,000 (8,300,000)	12,700,000 (10,600,000)	21,000,000 (18,900,000)
6**	6	981 (1006)	4 (5)	14 (11)	16 (13)	99.0	14 (11/9)*	15/17* (12/17)*	97.9	9,870,000 (9,900,000)	16,700,000 (14,000,000)	26,600,000 (23,900,000)

TABLE 2
SUMMARY OF ALTERNATIVES

NOTES:

Although the Contaminants of Concern list includes other explosive compounds, this table presents only RDX and perchlorate because those two plume shells contain the other contaminants.

* upgradient/downgradient of Pew Road

All percentages reflect cumulative mass removed including interim actions taken prior to startup of selected cleanup alternative.

gpm = gallons per minute

** Alternatives 5 and 6 were reevaluated in early 2005 to account for revised RDX and perchlorate plume shells. The results of the supplemental evaluation are presented within the parentheses below the results from the Feasibility Study. These results show that Alternatives 5 and 6 perform relatively similar in time to restore the aquifer.

*** In the supplemental evaluation, the estimated time to reach a 1 ppb cleanup for perchlorate is 11 years for both Alternatives 5 and 6 with total present worth cost to achieve 1 ppb for perchlorate of $18.9 million and $22.1 million for Alternative 5 and Alternative 6 respectively. To achieve background for perchlorate, the total present worth costs are $20.3 million and $23.9 million for Alternatives 5 and 6, respectively.

Table 3
Regulatory Considerations
Decision Document
Demo 1 Groundwater Response Action

AUTHORITY/TYPE	PROVISION	SYNOPSIS	RESPONSE
Groundwater			
Federal/Chemical Specific	SDWA Maximum Contaminant Levels (MCLs), 40 CFR 141.61–141.63	EPA has promulgated SDWA MCLs (40 CFR Parts 141-143). MCLs are enforceable standards that regulate the concentration of contaminants in public drinking water supplies. In addition to health considerations, MCLs also take into account cost and feasibility using current technology. At present, EPA has not promulgated MCLs for any of the COCs at Demo 1.	EPA has considered these values in the determination of numerical remediation goals for this response action. Under Alternative 5, the Demo 1 ETR system is designed to treat groundwater to levels at or below relevant MCLs. If EPA promulgates more stringent MCLs, the more stringent standards will apply.
State/Chemical Specific	MA Drinking Water Regulations, 310 CMR 22.05 – 22.09A	These MassDEP regulations establish Massachusetts MCLs for public drinking water systems. At present, the only COC at Demo 1 with a state MCL is perchlorate (2 ppb).	EPA has considered these values in the determination of numerical remediation goals for this response action. Under Alternative 5, the Demo 1 ETR system is designed to treat groundwater to levels at or below relevant Massachusetts MCLs. If the State issues new or revised MCLs relevant to this response action, EPA will evaluate whether the MCLs warrant modification of the response action.

Table 3
Regulatory Considerations
Decision Document
Demo 1 Groundwater Response Action

AUTHORITY/TYPE	PROVISION	SYNOPSIS	RESPONSE
State/Chemical Specific	Massachusetts Method 1 Groundwater Standards, 310 CMR 40.0974(2), Table 1	These standards have been developed by MassDEP considering a defined set of exposures considered to be a conservative estimate of the potential exposures at most sites. The State has classified the groundwater beneath MMR as GW-1. The State has promulgated Method 1 standards for GW-1 groundwater for perchlorate (2 ppb) and 2, 4-DNT (30 ppb).	EPA has considered these values in the determination of numerical remediation goals for this response action. Under Alternative 5, the Demo 1 ETR system is designed to treat groundwater to levels at or below these values.
State/Chemical Specific	Massachusetts Ground Water Quality Standards, 314 CMR 6.06	These MassDEP standards limit the concentration of certain materials allowed in classified Massachusetts waters. Massachusetts has classified the groundwater beneath MMR as a Class I water (fresh groundwater found in the saturated zone of unconsolidated deposits) and is designated as a source of potable water. The standards for Class 1 groundwater are stated in 314 CMR 6.06(1).	EPA has considered the MassDEP groundwater quality standards in the determination of numerical remediation goals for this response action. Under Alternative 5, the Demo 1 ETR system is designed to treat groundwater to levels at or below relevant Massachusetts Class 1 groundwater standards. If EPA promulgates more stringent drinking water or groundwater quality standards, the more stringent standards will apply. If the State issues new or revised drinking water or groundwater quality standards relevant to this response action, EPA will evaluate whether such standards warrant modification of the response action.

Table 3
Regulatory Considerations
Decision Document
Demo 1 Groundwater Response Action

AUTHORITY/TYPE	PROVISION	SYNOPSIS	RESPONSE
Federal/Chemical Specific	Drinking Water Health Advisories, published at http://www.epa.gov/ waterscience/criteria/drinking/	These are exposure concentrations protective of adverse *non*-cancer effects for a given exposure period. The 1-day and 10-day HA are designed to protect a child; the lifetime HA is designed to protect an adult.	EPA has considered Drinking Water Health Advisories in the determination of numerical remediation goals for this response action. Under Alternative 5, the Demo 1 ETR system is designed to treat groundwater to levels at or below the relevant Health Advisory values. If EPA issues new or revised Drinking Water Health Advisories relevant to this response action, EPA will determine whether such Health Advisories warrant modification of the response action.
Federal/Chemical Specific	Drinking Water Equivalent Levels (DWELs), published at http://www.epa.gov/ waterscience/criteria/drinking/	DWELs set forth lifetime exposure concentration values protective of adverse, *non*-cancer health effects, assuming that all of the exposure to a contaminant is from drinking water.	EPA has considered DWEL values in the determination of numerical remediation goals for this response action. Under Alternative 5, the Demo 1 ETR system is designed to treat groundwater to levels at or below the relevant DWEL values. If EPA issues new or revised Drinking Water Equivalent Levels relevant to this response action, EPA will determine whether such Levels warrant modification of the response action.

Table 3
Regulatory Considerations
Decision Document
Demo 1 Groundwater Response Action

AUTHORITY/TYPE	PROVISION	SYNOPSIS	RESPONSE
Federal/Chemical Specific	Human Health Reference Doses (RfDs), Reference Concentrations (RfCs), Cancer Slope Factors (CSFs), and 10^{-6} excess lifetime cancer risk level	These risk-based concentrations are considered together with site-specific exposure information to develop concentrations of residual contamination that will not endanger human health.	These values were considered in the risk assessment and calculation of numerical remediation goals. When the response action's residual risk assessment is performed, the most up-to-date values available will be used.
State/Chemical Specific	Massachusetts Office of Research and Standards ("ORS") Guidelines, as found in *Standards and Guidelines for Chemicals in Massachusetts Drinking Waters* (Spring 2006)	The Massachusetts ORS has identified guidelines, based on health and technical practicality, applicable to drinking water.	EPA has considered these guidelines in the determination of numerical remediation goals for this response action.
Federal/Action Specific	Underground Injection Control Program, 40 CFR Parts 144-148	These regulations outline minimum program and performance standards for underground injection wells, prohibit any injection that may cause a violation of any primary drinking water regulation under 40 CFR 142 in the aquifer or may otherwise adversely affect the health of persons, and restrict injection of hazardous waste. Infiltration galleries fall within the broad definition of Class V wells. The relevant regulations are administered by the State through 310 CMR 27.00.	Under Alternative 5, the Demo 1 ETR system is designed to treat groundwater to levels at or below relevant federal and state drinking water standards (where they exist) to ensure that reinjection of the treated groundwater will not cause a violation of these standards in the aquifer or otherwise adversely affect the health of persons.

Table 3
Regulatory Considerations
Decision Document
Demo 1 Groundwater Response Action

AUTHORITY/TYPE	PROVISION	SYNOPSIS	RESPONSE
State/Action Specific	Underground Injection Control, 310 CMR 27.00	These MassDEP regulations prohibit injection of fluid containing any pollutant into underground sources of drinking water where such pollutant will, or is likely to, cause a violation of any state drinking water standard or may adversely affect the health of persons.	Under Alternative 5, the Demo 1 ETR system is designed to treat groundwater to levels at or below relevant federal and state drinking water standards (where they exist) to ensure that injection of the treated groundwater will not cause a violation of these standards in the aquifer or adversely affect the health of persons.

Table 3
Regulatory Considerations
Decision Document
Demo 1 Groundwater Response Action

AUTHORITY/TYPE	PROVISION	SYNOPSIS	RESPONSE
State/Action Specific	Groundwater Discharge Regulations, 314 CMR 5.00	These MassDEP regulations provide that recharge of effluent from some treatment works requires a permit under Groundwater Discharge Regulations at 314 CMR 5.00 unless the exemption allowing for actions taken in compliance with MGL ch. 21E and 310 CMR 40.0000applies. 314 CMR 5.10 sets forth specific water quality-based effluent limits for groundwater discharge. MassDEP has determined that effluent from the Demo 1 treatment system is "conditionally exempt" from obtaining a groundwater discharge permit provided that the treatment system is built and operated consistent with "the applicable or relevant provisions of the Massachusetts Contingency Plan, and more specifically, the Management Procedures for Remedial Wastewater and Remedial Additives at 310 CMR 40.0040." (see letter from MassDEP to IAGWSP dated 13 February 2004).	Under Alternative 5, the planned approach for operation and maintenance of the Demo 1 ETR system meets the substantive objectives of this regulation or provides adequate alternative protective measures. Treated effluent which is recharged to the aquifer will be at or below applicable Massachusetts groundwater quality standards. The detailed plan for monitoring, inspecting and reporting on the performance of the extraction, treatment and recharge systems will be presented in the system performance monitoring plan, which will be provided to the MassDEP for review.

Table 3
Regulatory Considerations
Decision Document
Demo 1 Groundwater Response Action

AUTHORITY/TYPE	PROVISION	SYNOPSIS	RESPONSE
State/Action Specific	Construction and operation of a groundwater treatment plant, 310 CMR 40.0040	These MassDEP regulations establish management procedures for remedial wastewater as well as the construction, installation, change, operation and maintenance of treatment works for Remedial Wastewater. Treatment works shall be inspected and the inspections documented. Treatment works shall be protected from vandalism and measures shall be taken to prevent system failure, contaminant pass through, interference, by-pass, upset, and other events likely to result in a discharge of oil and/or hazardous material to the environment.	Consistent with the letter from MassDEP to IAGWSP dated 13 February 2004 and the Demo 1 treatment system's conditional exemption from the requirements of 314 CMR 5.00, the Demo 1 ETR system will be operated and maintained in a manner consistent with these provisions.

Table 3
Regulatory Considerations
Decision Document
Demo 1 Groundwater Response Action

AUTHORITY/TYPE	PROVISION	SYNOPSIS	RESPONSE
State/Action Specific, Chemical Specific	Discharge of Groundwater, 310 CMR 40.0045	These MassDEP regulations restrict remedial wastewater discharge to the ground surface or subsurface and/or groundwater. Such a discharge should not erode or impair the functioning of the surficial and subsurface soils, infiltrate underground utilities, building interiors or subsurface structures, result in groundwater mounding within two feet of the ground surface, or result in flooding or breakout to the ground surface. The concentrations of all pollutants discharged must be below the Massachusetts Groundwater Quality Standards established by 314 CMR 6.00. The concentrations must also be below the applicable Reportable Concentrations established by 310 CMR 40.0300 and 40.1600. The regulations provide performance standards for discharges depending on whether they are downgradient or upgradient, contain non-reportable concentrations of oil or hazardous material, or occur during well development or sampling.	EPA has considered these provisions in its review of Alternative 5. Under Alternative 5, the planned approach for operation and maintenance of the Demo 1 ETR system meets the objectives of this regulation. Under Alternative 5, the system Performance Monitoring Plan presents a detailed plan for monitoring, inspecting and reporting on the performance of the Demo 1 ETR system. The Performance Monitoring Plan, will be provided to MassDEP for review.

Table 3
Regulatory Considerations
Decision Document
Demo 1 Groundwater Response Action

AUTHORITY/TYPE	PROVISION	SYNOPSIS	RESPONSE
State/Action Specific, Chemical Specific	Discharge of Groundwater, 310 CMR 40.0300 and 310 CMR 40.1600	The MCP contains special provisions for the discharge of groundwater containing very low levels of oil or hazardous material. Groundwater containing oil and/or hazardous material in concentrations less than the applicable release notification threshold established by 310 CMR 40.0300 and 40.1600, can be discharged to the ground subsurface and/or groundwater only when following appropriate guidelines.	EPA has considered these provisions in its review of Alternative 5. Under Alternative 5, the planned approach for operation and maintenance of the Demo 1 ETR system meets the objectives of this regulation. Under Alternative 5, the system Performance Monitoring Plan presents a detailed plan for monitoring, inspecting and reporting on the performance of the Demo 1 ETR system. The Performance Monitoring Plan will be provided to MassDEP for review.
Federal/Location Specific	Sole Source Aquifer Determination for Cape Cod Aquifer, 47 Fed. Reg. 30,282 (July 13, 1982)	SDWA Section 1424(e) authorizes EPA to determine that an area has an aquifer which is the sole or principal drinking water source for the area and, if contaminated, would create a significant hazard to public health. Once an area is so designated, no Federal financial assistance may be provided for any project that may contaminate the aquifer through a recharge zone so as to create a significant hazard to public health.	EPA has considered the Sole Source Aquifer Determination in its review of Alternative 5. Alternative 5 is designed to remediate groundwater to levels that prevent creation or aggravation of a significant hazard to public health. Specifically, Alternative 5 is designed to remediate groundwater to levels that meet or exceed applicable Federal/State MCLs, MCLGs, DWELs, HAs, and the 10^{-6} excess cancer risk level.

Table 3
Regulatory Considerations
Decision Document
Demo 1 Groundwater Response Action

AUTHORITY/TYPE	PROVISION	SYNOPSIS	RESPONSE
Surface water			
State/Chemical Specific	Massachusetts Surface Water Quality Standards, 314 CMR 4.00	These MassDEP standards prescribe the minimum water quality criteria required to sustain the designated uses of Massachusetts waters. The levels are designed to prevent all adverse health effects from ingestion, inhalation or dermal contact.	EPA has considered these provisions in its review of Alternative 5. Alternative 5 as designed, does not involve routine discharge of effluent into surface waters. However, if dewatering or other activities were to require discharge into a surface water body, the treated effluent from the Demo 1 ETR system would meet or exceed these standards.
State/Action Specific	Prohibitions and Standards for Discharges to POTWs, 314 CMR 12.08	Contains prohibitions and pretreatment standards for discharges to publicly owned treatment works.	EPA has considered these provisions in its review of Alternative 5. Alternative 5 as designed, does not involve routine discharge of effluent into a POTW. However, if dewatering, sludge disposal, or other activities generate wastewater that requires discharge into a POTW, the treated effluent from the Demo 1 ETR system would meet or exceed the relevant standards.

Table 3
Regulatory Considerations
Decision Document
Demo 1 Groundwater Response Action

AUTHORITY/TYPE	PROVISION	SYNOPSIS	RESPONSE
Federal/Chemical Specific	National Recommended Water Quality Criteria, published at http://www.epa.gov/waterscience/criteria/wqcriteria.html	Under Section 304(a)(1) of the Clean Water Act, EPA develops these criteria for surface water quality that accurately reflect the latest scientific knowledge. These criteria are based solely on data and scientific judgments on pollutant concentrations and environmental or human health effects.	EPA has considered these provisions in its review of Alternative 5. Alternative 5 as designed, does not involve routine discharge of effluent into surface waters. However, if dewatering or other activities were to generate wastewater that required discharge into surface waters, the treated effluent from the Demo 1 ETR system would meet or exceed these standards.
Federal/Action Specific	CWA NPDES Stormwater Discharge Requirements, 40 CFR 122.26	Establishes requirements for stormwater discharges associated with construction activities that result 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 mitigate stormwater run-on and runoff.	If stormwater runoff associated with well placement, or from remedy construction, operation, and maintenance activities, or other activities deriving from the remedial action discharges directly or indirectly to a surface water body, including wetlands, the runoff will be controlled in accordance with these provisions.

Table 3
Regulatory Considerations
Decision Document
Demo 1 Groundwater Response Action

AUTHORITY/TYPE	PROVISION	SYNOPSIS	RESPONSE
State/Action Specific	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 stormwater runoff associated with well placement, or from remedy construction, operation, and maintenance activities, or other activities deriving from the remedial action discharges directly or indirectly to a surface water body, including wetlands, the runoff will be controlled in accordance with these provisions.
State/Action Specific	Stormwater Management Program Policy (Nov. 18, 1996)	Provides policies and guidance on complying with the state's stormwater discharge requirements.	If stormwater runoff associated with well placement, or from remedy construction, operation, and maintenance activities, or other activities deriving from the remedial action discharges directly or indirectly to a surface water body, including wetlands, the runoff will be controlled in accordance with these provisions.

Table 3
Regulatory Considerations
Decision Document
Demo 1 Groundwater Response Action

AUTHORITY/TYPE	PROVISION	SYNOPSIS	RESPONSE
Solid Waste			
Federal/Action Specific	Resource Conservation and Recovery Act (RCRA) - Identification and Listing of Hazardous Waste, 40 CFR Part 261	Part 261 establishes requirements for determining whether wastes are hazardous. 40 CFR 261.24 identifies the concentrations of contaminants that make a waste material a RCRA-characteristic hazardous waste for toxicity using the Toxicity Characteristic Leaching Procedure (TCLP) test. At present, the only COC with a listed toxicity threshold is 2,4-DNT (130 ppb). *See* 40 CFR 261.24(b), Table 1.	Spent activated carbon and any other solid waste will be analyzed. If the results exceed the standards in 40 CFR 261.24, or otherwise constitute hazardous wastes, the material will be treated and/or disposed of offsite in a RCRA-permitted treatment, storage, and disposal facility.
Federal/Action Specific	RCRA Generator Requirements; 40 CFR Part 262	RCRA establishes requirements applicable to generators of hazardous waste. Those requirements include provisions addressing hazardous waste determinations, manifesting, pre-transport requirements, and recordkeeping.	Hazardous wastes will be identified at the point of generation, and will be accumulated in accordance with requirements of 40 CFR 262.34(a) on-site for no greater than 90 days without a RCRA permit. If hazardous wastes are accumulated for greater than 90 days, then a RCRA permit will be obtained.
Federal/Action Specific	RCRA Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities, 40 CFR Part 264	These regulations define the acceptable management of hazardous waste, and apply to owners and operators of all facilities which treat, store, or dispose of hazardous waste.	If remedial actions result in the generation or accumulation of hazardous waste, then such wastes will be treated, stored, and disposed of in a manner that meets or exceeds these requirements.

Table 3
Regulatory Considerations
Decision Document
Demo 1 Groundwater Response Action

AUTHORITY/TYPE	PROVISION	SYNOPSIS	RESPONSE
Federal/Action Specific	RCRA Land Disposal Restrictions, 40 CFR Part 268	These regulations restrict the disposal of any treatment wastes classified as hazardous waste.	If any offsite land disposal of hazardous waste occurs, the hazardous waste will be treated before disposal so as to meet or exceed these requirements.
Federal/Action Specific	RCRA Control of Hazardous Waste Injection, RCRA Section 3020; "Applicability of RCRA Section 3020 to In Situ Treatment of Ground Water" (EPA, Dec. 2000); "Applicability of Land Disposal Restrictions to RCRA and CERCLA Ground Water Treatment Reinjection" (EPA, Dec. 1989)	This provision prohibits disposing of hazardous waste by underground injection into or above a formation which contains an underground source of drinking water within one-quarter mile of the injection well. The statute exempts certain cleanup actions conducted under CERCLA and RCRA, but not the SDWA.	All remedial actions will be conducted in accordance with RCRA Section 3020 and EPA's guidance. No hazardous wastes will be injected into the ground. The groundwater that is treated by the remedial system is not expected to be a listed or characteristic hazardous waste. Any hazardous wastes that are disposed of on or below ground must satisfy the Land Disposal Restrictions at 40 CFR Part 268.
Federal/Action Specific	Hazardous Waste Operations and Emergency Response, 29 CFR 1910.120	These regulations describe training, monitoring, planning, and other activities to protect the health of workers performing hazardous waste operations.	These worker protection standards will be followed, where applicable, to protect the health of workers from risks posed by hazardous substances.
State/Action Specific	Massachusetts Solid Waste Management Regulations, 310 CMR 19.00	If a waste is determined to be a solid waste, it must be managed in accordance with the state regulations at 310 CMR 19.00.	Any solid wastes determined to be non-hazardous will be managed and disposed of in accordance with these regulations.

Table 3
Regulatory Considerations
Decision Document
Demo 1 Groundwater Response Action

AUTHORITY/TYPE	PROVISION	SYNOPSIS	RESPONSE
State/Action Specific	Massachusetts Hazardous Waste Regulations, 310 CMR 30.00	These regulations establish requirements for identification, treatment, storage, and disposal of hazardous waste. 310 CMR 30.100-30.162 specifies how to determine whether a solid waste is considered hazardous under these regulations. 310 CMR 30.125 identifies the concentrations of contaminants that make a waste material a characteristic hazardous waste for toxicity using the TCLP test. At present, the only COC with a listed toxicity threshold is 2,4-DNT (130 ppb). *See* 40 CFR 261.24(b), Table 1. Certain dinitrotoluene byproducts are listed in 30 CMR 30.132.	Any solid wastes determined to be hazardous will be managed and disposed of in accordance with these regulations. The guidelines in 310 CMR 30.561, concerning the substances with which perchlorates should not be mixed so as to prevent fire, explosion, or violent reaction, will be followed unless impractical or unsafe.
Air			
State/Chemical Specific	Massachusetts Air Pollution Control Regulations, 310 CMR 7.00	These regulations set emission limits necessary to attain ambient air quality standards for fugitive emissions, dust, odor, particulates, and noise.	Construction or demolition activities may trigger the Massachusetts Air Pollution Control Regulations. Engineering controls, such as dust suppression, will be used as necessary to comply with these regulations for fugitive emissions, dust, odor, particulate, and noise emissions during site construction activities.

Table 3
Regulatory Considerations
Decision Document
Demo 1 Groundwater Response Action

AUTHORITY/TYPE	PROVISION	SYNOPSIS	RESPONSE
State/Action Specific	Massachusetts Remedial Air Emissions Regulations, 310 CMR 40.0049	The Massachusetts rules set forth standards for emissions from remedial activities, including a requirement for 95% control over emissions of oil and hazardous materials from the remedial system.	The remedial system is not expected to emit any oil or hazardous materials to the atmosphere. However, if oil or hazardous materials are emitted, then the remedial system will meet or exceed the substantive requirements of this provision.
Wetlands			
Federal/Location Specific	Clean Water Act § 404, Permits for Dredged or Fill Material; Army Corps of Engineers Regulations, 33 CFR Part 320-330; 40 CFR Part 230	Regulates discharges of dredged or fill material, and associated activities, that may adversely affect wetlands. No such 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.	Some of the area near North Pond is a wetland. If construction of additional monitoring wells, or other activity that might disturb any wetlands becomes necessary, then the activity will be designed to minimize impacts on wetlands.
State/Location Specific	Massachusetts 401 Water Quality Certification for Discharge of Dredged or Fill Material, 314 CMR 9.00	Applies to the discharge of dredged or fill material in waters of the United States within the Commonwealth which require federal permits and which are subject to state water quality certification. With certain exceptions, applicants for such permits must also apply for state certification.	If any remedial activity requires a discharge of dredged or fill material to waters of the United States, a state water quality certification will also be obtained.

Table 3
Regulatory Considerations
Decision Document
Demo 1 Groundwater Response Action

AUTHORITY/TYPE	PROVISION	SYNOPSIS	RESPONSE
Federal/Location Specific	Executive Order 11990, Protection of Wetlands; 40 CFR Part 6, Appendix A	Requires federal agencies to take action to avoid adversely impacting wetlands wherever possible, and to preserve the beneficial values of wetlands.	Some of the area near North Pond is a wetland. If construction of additional wells, or other activity that might disturb any wetlands, becomes necessary, then the activity will be designed to minimize impacts on, and preserve the values of, these wetlands.
Federal/Location Specific	Fish and Wildlife Coordination Act, 16 U.S.C. §§ 661 et seq.	Requires federal agencies to consult with U.S. Fish and Wildlife Service and state wildlife agencies to mitigate losses of fish and/or wildlife habitat that may result from modification of a water body for any purpose.	Some of the area near North Pond is a wetland. If construction of additional wells, or other activity that might disturb any water body becomes necessary, then the wildlife agencies will be consulted and the activity will be designed to minimize and/or compensate for impacts on wildlife resources.
State/Location Specific	Massachusetts Wetlands Protection Act, MGL ch. 131, § 40; 310 CMR 10.00	Imposes requirements and limitations for alteration of land under water bodies and establishes performance standards for projects that affect wetlands.	Some of the area near North Pond is a wetland. If construction of additional wells, or other activity that might disturb any wetlands, becomes necessary, then the activity will be designed to minimize impacts on, and preserve the values of, these wetlands.

Table 3
Regulatory Considerations
Decision Document
Demo 1 Groundwater Response Action

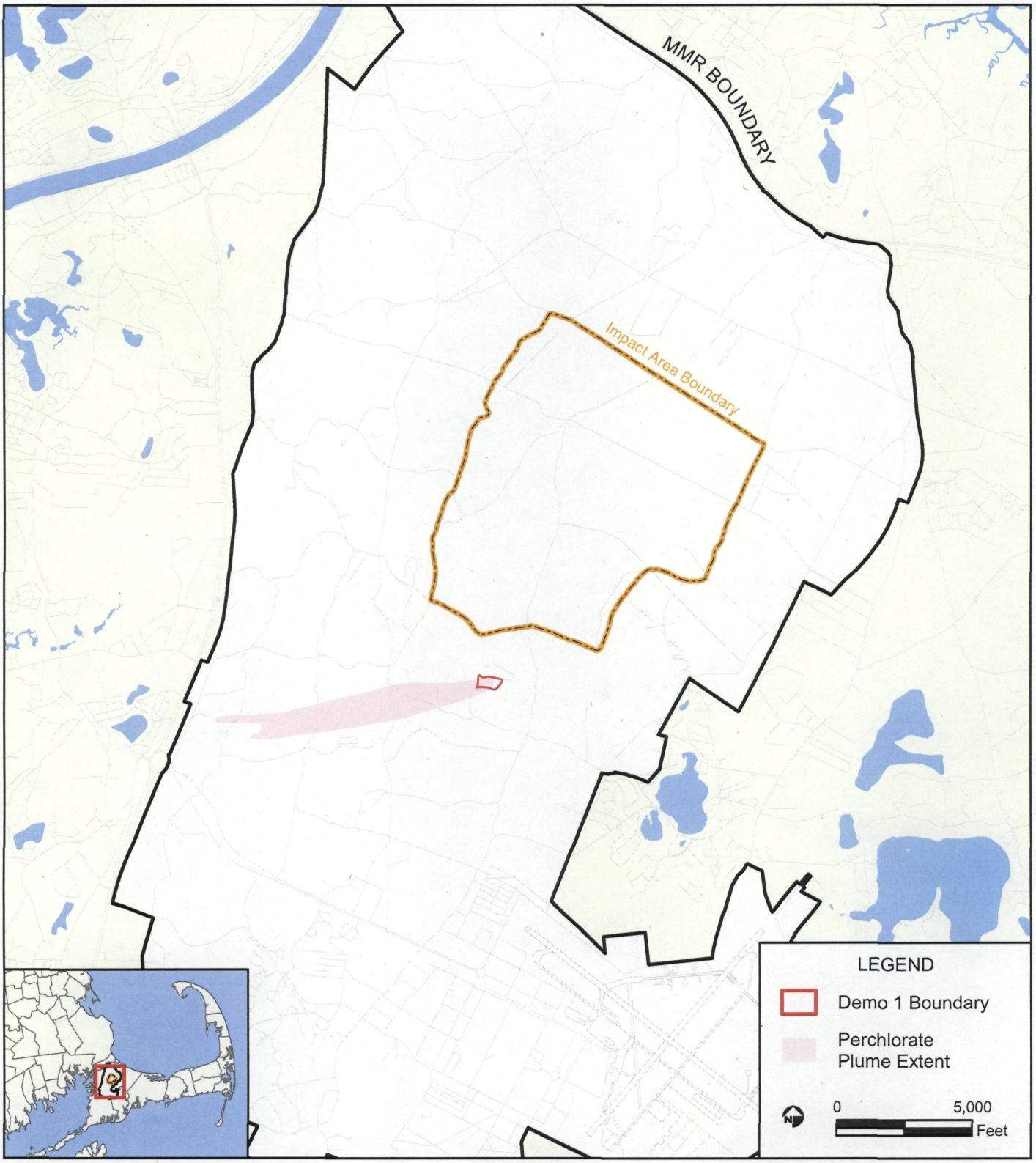
AUTHORITY/TYPE	PROVISION	SYNOPSIS	RESPONSE
Wildlife			
State/Action Specific	Massachusetts Endangered Species Act, MGL ch. 131A; 321 CMR 10.00	Actions that jeopardize state-listed endangered or threatened species, or species of special concern or their habitats must be avoided, or, if that is not possible, minimized and mitigated.	Several state-listed species have been identified on MMR, and some of the area near North Pond is listed as a state Natural Heritage and Endangered Species Program (NHESP) Estimated Habitat of Rare Wildlife in Wetland Areas. Moreover, the Natural Resource Offices at the Massachusetts National Guard Environmental & Readiness Center continues to search for, identify, and map locations of rare species on MMR. Operation and maintenance of the current well system, construction of new wells, and all other activities will be designed to minimize effects to endangered or threatened species and their habitats.

Table 3
Regulatory Considerations
Decision Document
Demo 1 Groundwater Response Action

AUTHORITY/TYPE	PROVISION	SYNOPSIS	RESPONSE
Other			
Federal/Action Specific	Historic Sites, Buildings, Objects, and Antiquities: National Historic Preservation Act, 16 U.S.C. §§ 470 et seq., 36 CFR Part 800; AHPA, 16 U.S.C. §§ 469a-c; Archaeological Resources Protection Act, 16 U.S.C. §§ 470aa-ll, 43 CFR Part 7; Native American Graves Protection and Repatriation Act, 25 U.S.C. §§ 3001-3013, 43 CFR Part 10	These statutes and regulations provide for the protection of historical, 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.	The Wampanoag Indian Tribes and the Massachusetts Historical Commission will be consulted regarding whether a cultural resources survey is needed to discover and identify objects and artifacts, particularly Native American artifacts of the Wampanoag Indian Tribes. If wells will be sited, or any other potentially land-disturbing activities will occur, in areas that may have such resources, all such resources discovered during a survey or inadvertently discovered during on-site remedial activities (for example, siting new wells) will be secured and protected as required by law.

Table 3
Regulatory Considerations
Decision Document
Demo 1 Groundwater Response Action

AUTHORITY/TYPE	PROVISION	SYNOPSIS	RESPONSE
State/Action Specific	Massachusetts Historic Preservation Act, MGL ch. 9 §§ 26-27C; MGL ch. 7, § 38A; MGL ch. 38, §§ 6B-6C; 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.	The Wampanoag Indian Tribes and the Massachusetts Historical Commission will be consulted regarding whether a cultural resources survey is needed to discover and identify objects and artifacts, particularly Native American artifacts of the Wampanoag Indian Tribes. If wells will be sited, or any other potentially land-disturbing activities will occur, in areas that may have such resources, all such resources discovered during a survey or inadvertently discovered during on-site remedial activities (for example, siting new wells) will be secured and protected as required by law.



NOTES & SOURCES:
Basemap data from US Geological Survey 7 1/2 minute Topographic Maps. Source: MassGIS

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AMEC Earth & Environmental, Inc.
Westford, Massachusetts

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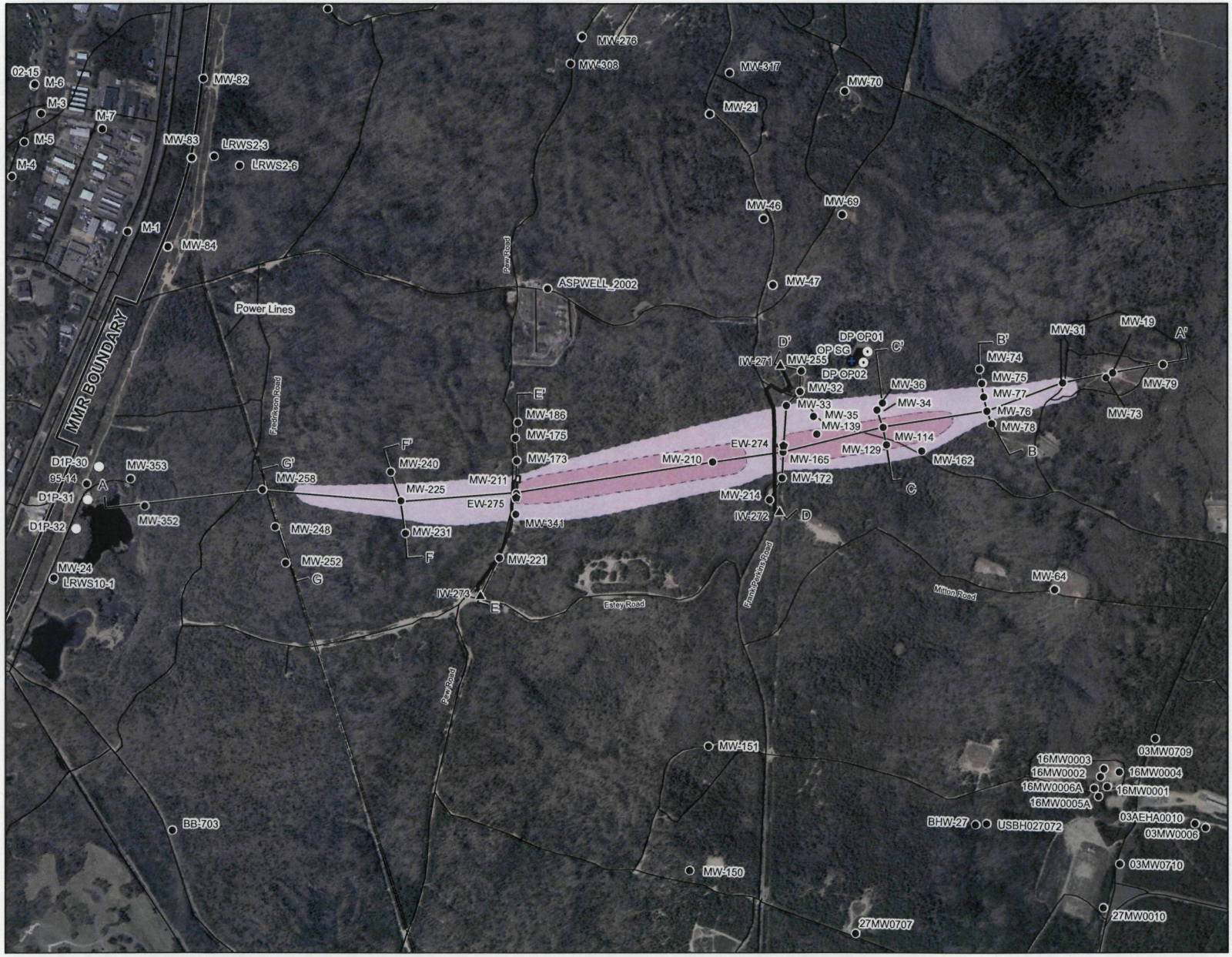
January 12, 2005 DWN: JBB AP CHKD: BK

Impact Area Groundwater Study Program

Location of Demo 1
Massachusetts Military Reservation
Decision Document
Demo 1 Groundwater OU

FIGURE
1



Impact Area Groundwater Study Program

LEGEND

- Existing Monitoring Well
- Proposed Monitoring Well
- Piezometer
- Staff Gauge
- Extraction Well
- Injection Well

Perchlorate in Groundwater

- 2 to 24 ppb
- 24 to 200 ppb
- > 200 ppb

- Treatment System Piping
- A A' Cross Section

Note: Plume shell illustrated is representative of widest observed at each transect cross-section Groundwater data through April 2006. Contour lines dashed where inferred.

LOCATION MAP

NOTES & SOURCES

Basemap data from US Geological Survey 7 1/2 minute Topographic Maps. Source: MassGIS
Aerial Photos: Color Digital Orthophotos:
Date Flown: 2002 Source: EarthData International

TITLE

Perchlorate Distribution in Groundwater
April 2006 Sampling Round
2006 System Performance and
Ecological Impact Monitoring Report
Demo 1 Groundwater Operable Unit

0 1,000 Feet

US Army Corps of Engineers
New England District

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August 4, 2006 DWN: MTW CHKD: MRK SCM

FIGURE 7-1

Impact Area Groundwater Study Program

LEGEND

- Existing Monitoring Well
- Proposed Monitoring Well
- Piezometer
- Staff Gauge
- Extraction Well
- Injection Well

RDX in Groundwater

- 0.6 to 2 ppb
- 2 to 20 ppb
- 20 to 200 ppb
- > 200 ppb

- Treatment System Piping
- A A' Cross Section

Note: Plume shell illustrated is representative of widest observed at each transect cross-section. Groundwater data through April 2006. Contour lines dashed where inferred.

LOCATION MAP

NOTES & SOURCES

Basemap data from US Geological Survey 7 1/2 minute Topographic Maps. Source: MassGIS
Aerial Photos: Color Digital Orthophotos:
Date Flown: 2002 Source: EarthData International

TITLE

RDX Distribution in Groundwater
April 2006 Sampling Round
2006 System Performance and
Ecological Impact Monitoring Report
Demo 1 Groundwater Operable Unit

0 1,000 Feet

US Army Corps of Engineers
New England District

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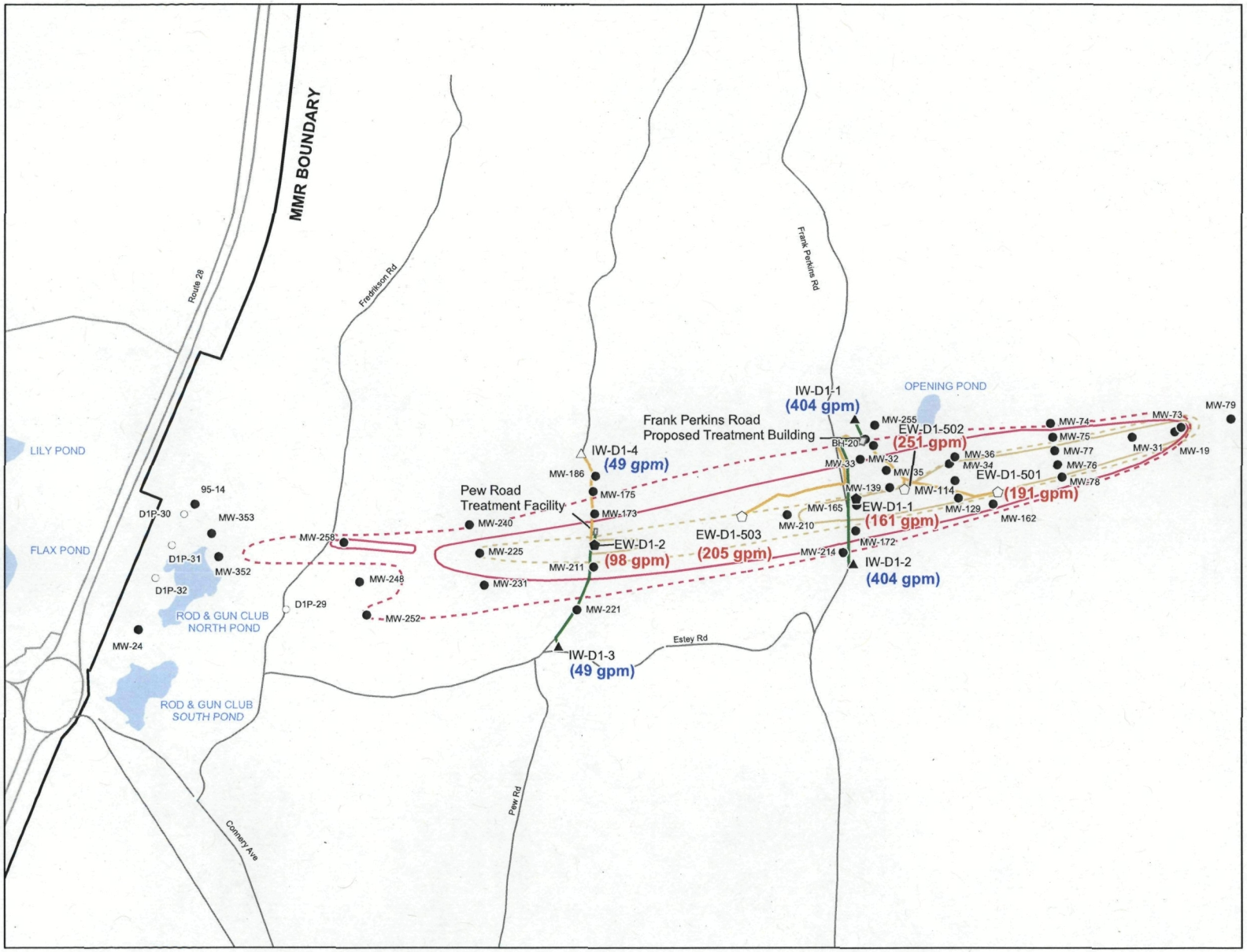
August 21, 2006 DWN: MTW CHKD: MRK SCM

FIGURE 7-7



Impact Area Groundwater Study Program

LEGEND

- Proposed Extraction Wells
- Existing Extraction Wells
- Proposed Injection Well
- Existing Injection Wells
- Proposed Monitoring Wells
- Existing Monitoring Wells
- Extent of Perchlorate Plume (>ND)
- Extent of Perchlorate Plume (>1 ppb)
- Extent of RDX Plume (>ND)
- Extent of RDX Plume (>2 ppb)
- Existing Piping Locations
- Proposed Piping Locations
- Major Roads
- (100) Extraction Rate (gallons per minute)
- (100) Injection Rate (gallons per minute)

Note: Perchlorate and RDX plumes based on detections as of 06/23/05

LOCATION MAP

NOTES & SOURCES

Map Coordinates: NAD 83, UTM, Zone 19N, Meters
Basemap data from US Geological Survey 7 1/2 minute
Topographic Map Source: MassGIS
Color Digital Orthophotos; Date Flown: 2002
Source: EarthData International

TITLE

Alternative 5 Conceptual Layout (Plan View)
Decision Document
Demo 1 Groundwater OU

0 1,000 Feet

AMEC Earth and Environmental, Inc.
Westford, Massachusetts

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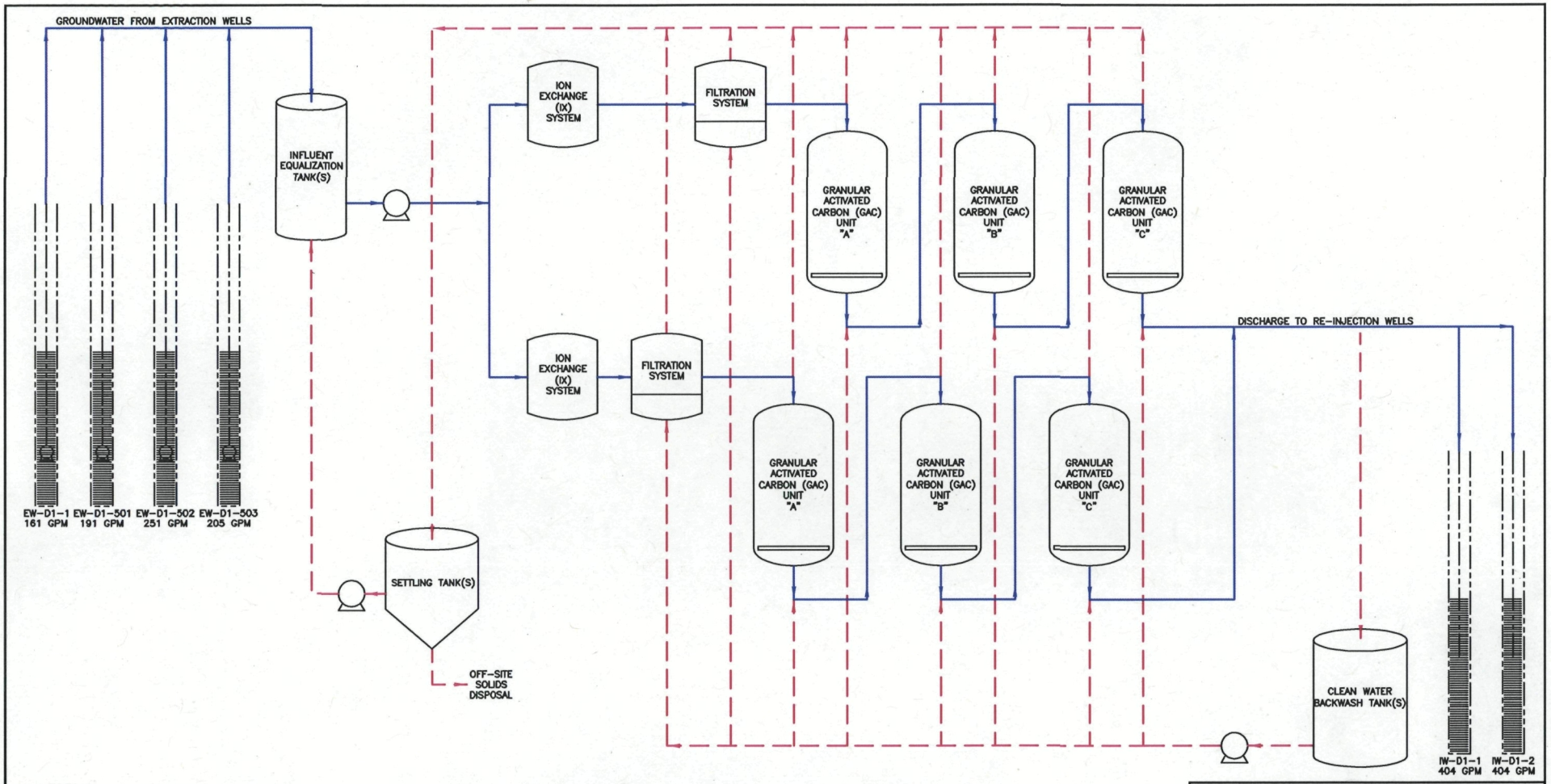
January 12, 2005 DWN: JBB AP CHKD: BK

FIGURE 3



LEGEND:

NORMAL OPERATIONS

BACKWASH OPERATIONS

NOTE:

NON-CRITICAL ASPECTS OF PROCESS FLOW DIAGRAM MAY CHANGE DURING THE CONSTRUCTION PROCESS.

ALTERNATIVE 5 – ADDITIONAL ALTERNATIVE A PROCESS FLOW DIAGRAM FRANK PERKINS ROAD

DECISION DOCUMENT
DEMO 1 GROUNDWATER OPERABLE UNIT

PROJECT MANAGER M. APPLEBEE	DRAWING NUMBER FIG 4.DWG
CHECKED BY J. MUZZIN	PROJECT NUMBER 3-1300-0669
DRAWN BY R. BOWMAN	FIGURE NUMBER 4
DATE DRAWN 1/12/06	

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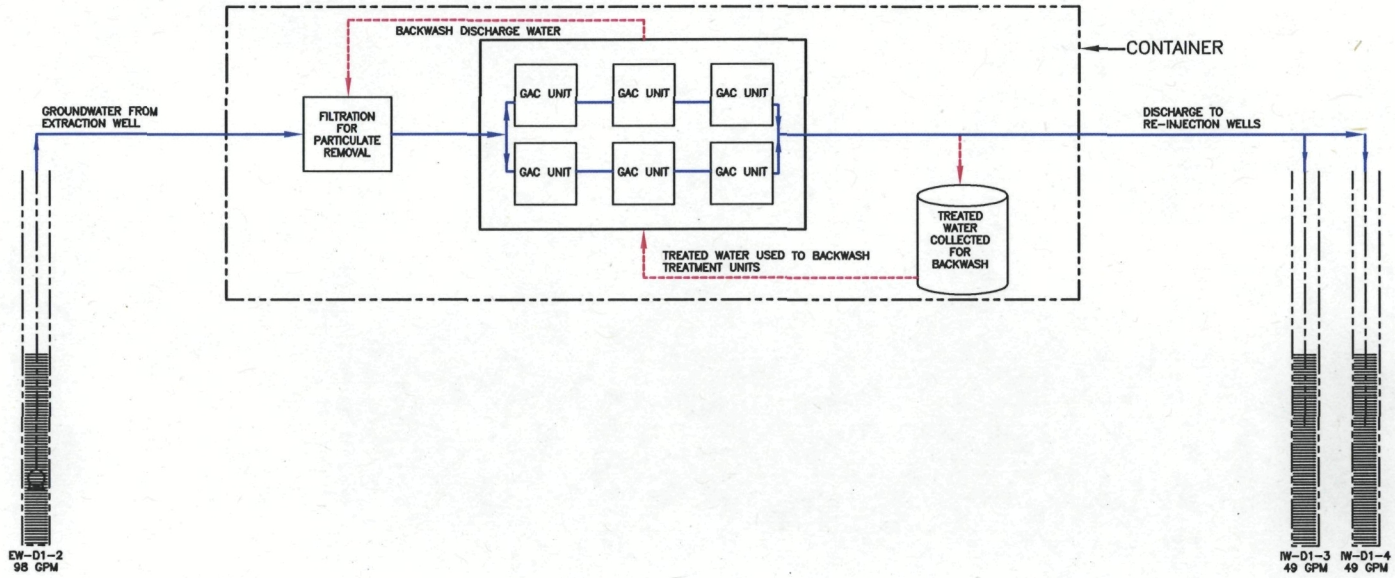
Phone: (978) 692-9090 Fax: (978) 692-6633 www.amec.com

FILE: J:\Demo 1\GW\Decision Document\FIG 4.dwg BY: ron.bowman



LEGEND:

NORMAL OPERATIONS

BACKWASH OPERATIONS

NOTE:

NON-CRITICAL ASPECTS OF PROCESS FLOW DIAGRAM MAY CHANGE DURING THE CONSTRUCTION PROCESS.

ALTERNATIVE 5 – ADDITIONAL ALTERNATIVE A PROCESS FLOW DIAGRAM PEW ROAD

DECISION DOCUMENT
DEMO 1 GROUNDWATER OPERABLE UNIT

PROJECT MANAGER M. APPLEBEE	DRAWING NUMBER FIG 5.DWG
CHECKED BY J. MUZZIN	PROJECT NUMBER 3-1300-0668
DRAWN BY R. BOWMAN	FIGURE NUMBER 5
DATE DRAWN 1/12/06	

amec
Earth & Environmental
239 LITTLETON ROAD
SUITE 1B
WESTFORD, MASSACHUSETTS 01886
Phone: (978) 692-9090 Fax: (978) 692-6633 www.amec.com

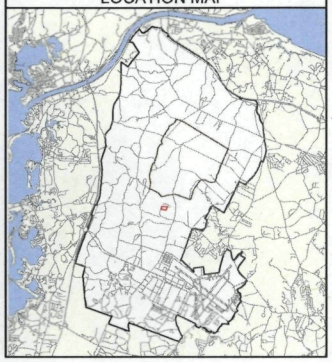
FILE: J:\Demo 1\GW\Decision Document\FIG 5.dwg BY: ron.bowman

Impact Area Groundwater Study Program

LEGEND

- Existing Monitoring Well
- Elevation Contour (Labeled in Feet Above NGVD)
- Demo 1

LOCATION MAP



NOTES & SOURCES

Basemap data from US Geological Survey 7 1/2 minute Topographic Maps. Source: MassGIS
Aerial photos: 1:5000 black & white digital orthophotos
Resolution: 0.5 feet; Date Flown: 1997; Source: Jacobs Eng.

TITLE

Demo 1 Former Source Area Site Plan

Decision Document
Demo 1 Groundwater OU

0 100 Feet

N

DRAFT

AMEC Earth & Environmental, Inc.
Westford, Massachusetts

J:\Demo 1\GW\Decision Document\MMR-9934 Figs. & Tables
RCL Decision Document\D9934_Fig6.pdf
G:\MMR_COE\work2006\D9934\D9934_Fig6.mxd
January 12, 2005 DWN: JBB AP CHKD: BK

FIGURE

6

APPENDIX A
MassDEP Letter of Concurrence

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

RE: BOURNE—BWSC-4-0037
Massachusetts Military Reservation,
Decision Document, Demolition Area 1 Groundwater Operable Unit, Concurrence

Dear Ms. Studlien:

The Massachusetts Department of Environmental Protection (the "MassDEP") has reviewed the document entitled **"Decision Document, Demolition Area 1 Groundwater Operable Unit"** (the "Demo-1 DD"), dated September 14, 2006. The Demo-1 DD presents the response action selected by the U.S. Environmental Protection Agency (USEPA) for the Demolition Area 1 groundwater operable unit, located on Camp Edwards at the Massachusetts Military Reservation (MMR), situated in Bourne, Cape Cod, Massachusetts. The response action was selected by the USEPA in accordance with Section 1431(a) of the Safe Drinking Water Act (SDWA) and USEPA Administrative Order No. SDWA-1-2000-0014 (AO3). In addition, the selected response action includes consideration of the clean up standards set forth under Massachusetts General Laws, M.G.L. c. 21E and 310 CMR 40.0000, the Massachusetts Contingency Plan (MCP). For the following reasons, the MassDEP concurs with the response action proposed in the Demo-1 DD.

Demolition Area-1 Source Area:

The source of the Demo-1 groundwater plume is an approximately 7.4 acre site located at Camp Edwards. This site was used from the mid 1970s to the late 1980s by the military for the destruction of munitions, demolition training and the destruction of various types of military ordnance using explosives. The predominant explosive compound used in munitions at the site is Royal Demolition Explosive (RDX), followed by 2,4,6 trinitrotoluene (TNT). Perchlorate, a water-soluble salt used as an oxidizer, is a component of some munitions, fireworks, rocket propellants, and pyrotechnics that were likely destroyed at Demolition Area 1. In 2005, Army/NGB performed a Rapid Response Action (RRA) to remove contaminated soil from the

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

MassDEP on the World Wide Web: http://www.mass.gov/dep
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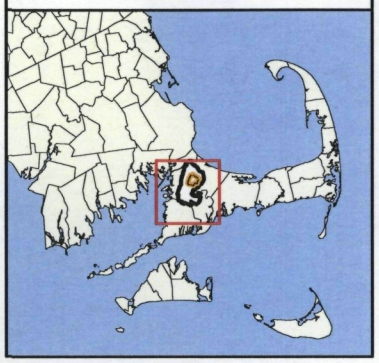
Impact Area Groundwater Study Program

LEGEND

- Perchlorate Plume Extent
- Sand and Gravel Deposits
- Till or Bedrock
- Sandy Till Over Sand
- End Moraines
- Large Sand Deposits
- Fine-Grained Deposits
- Floodplain Alluvium

LOCATION MAP



NOTES & SOURCES

Map Coordinates: NAD 83, UTM, Zone 19N, Meters
Basemap data from US Geological Survey 7 1/2 minute
Topographic Map Source: MassGIS

TITLE

Surficial Geology of Western Cape Cod
Decision Document
Demo 1 Groundwater OU

0 1 Miles

N

DRAFT

AMEC Earth and Environmental, Inc.
Westford, Massachusetts

J:\Demo 1\GW\Decision Document\MMR-9934 Figs. & Tables
RCL Decision Document\D9934_Fig8.pdf
G:\MMR_COE\work2006\D9934\D9934_Fig8.mxd
January 12, 2005 DWN: JBB AP CHKD: BK

FIGURE
8

source area of the Demo 1 groundwater plume. Soil was treated on-site by thermal desorption, which uses heat to separate contaminants from the soil and oxidize them. Approximately 27,000 tons of soil was excavated and treated or disposed of off-site.

Demolition Area-1 Groundwater Operable Unit:

The contaminants of concern (COCs) for the Demolition Area 1 groundwater operable unit include the explosive compounds RDX and TNT, and the propellants 2,4-dinitrotoluene (2,4-DNT), and perchlorate. Detections of RDX in the Demo 1 plume have ranged from the detection limit of 0.25 parts per billion (ppb) to 370 ppb. The lifetime federal health advisory (HA) for RDX in drinking water is 2 ppb. Perchlorate detections have ranged from the detection limit of 0.35 ppb to 500 ppb. The Massachusetts Maximum Contaminant Level (MMCL) and MCP Groundwater 1 (GW-1) standard for perchlorate is 2 ppb.

The Army/NGB performed a groundwater RRA in September of 2004 that was designed to remove contaminants from the aquifer and limit further migration of the plume while the comprehensive remedy could be selected and implemented. The groundwater RRA consists of two groundwater extraction wells, one at Frank Perkins Road and the other at Pew Road. Groundwater is pumped from these wells at 320 gallons per minute (gpm) to modular treatment units. The extracted groundwater is then treated with a combination of granular activated carbon (GAC) and ion exchange resin (IX) and returned to the aquifer via three reinjection wells.

The selected remedy for the Demolition Area 1 groundwater operable unit will be performed by the United States Army/National Guard Bureau (Army/NGB) and builds upon the existing RRA groundwater extraction, treatment, and reinjection (ETR) system. Groundwater modeling performed by the Army/NGB predicts that the proposed remedy will prevent significant further migration of the plume and restore the impacted portion of the aquifer for use as a public water supply, which has been designated a Sole Source Aquifer by the USEPA and a Potentially Productive Aquifer by the MassDEP. The response action will also remediate the contaminated groundwater containing RDX at concentrations greater than the 10^{-6} risk-based level (0.6 ppb) and perchlorate greater than the MMCL/GW-1 of 2 ppb.

As part of the selected remedy, Army/NGB will install three additional extraction wells to the existing RRA treatment system, for a total of five wells that will extract contaminated groundwater at 906 gpm. Groundwater will be treated to remove contaminants to below applicable federal and state drinking water standards and risk-based levels using GAC and IX. The treated water will be re-injected back into the aquifer using four injection wells.

The selected remedy relies on natural attenuation of the leading edge of the plume (located beyond the well furthest downgradient from the source area) to below applicable water-quality standards and risk-based levels. In addition, the Army/NGB will perform long-term monitoring through a network of approximately 103 groundwater monitoring well screens to track the extent and movement of the plume. Groundwater modeling predicts this remedy will prevent significant further migration of the plume and restore the impacted portion of the aquifer for use as a public water supply. However, the selected remedy also includes a contingency remedy for additional active measures to be taken to control migration of the plume if

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contaminants migrate further than predicted by groundwater modeling performed by the Army/NGB. This contingency remedy will most likely include additional groundwater extraction and treatment near the leading edge of the plume if actual or modeled data at a well transect west of North Pond exceeds applicable federal/state regulatory or risk-based levels for COCs.

Furthermore, under the selected remedy, Army/NGB will implement administrative and/or legal controls known as land use controls (LUCs) to prevent access to or use of the groundwater from the Demo-1 plume until the groundwater no longer poses an unacceptable risk to human health. The Army/NGB will also annually monitor the environmental use restrictions and controls.

Based on the foregoing, the MassDEP concurs with the selected response action proposed in the Demo-1 DD. This concurrence is based upon representations made to the MassDEP by the Army/NGB 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 at the Demo-1 groundwater operable unit 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.

In addition, please be advised that the MassDEP reserves all rights against the Army/NGB and all other persons to take any civil, criminal, or administrative enforcement action pursuant to any available legal authority, including the right to seek injunctive relief; the recovery of money expended or to be expended (plus interest); monetary penalties; criminal sanctions; and/or punitive damages regarding any violation of M.G.L. c. 21E and the MCP, or any actual or potential threat to human health, safety, public welfare or the environment, or any release of hazardous substances on, at, in, or near the MMR. Nothing in this letter shall preclude the MassDEP from taking any additional enforcement actions, including the issuance of Orders and/or additional actions, as the MassDEP may deem necessary, or from requiring the Army/NGB in the future to perform additional activities pursuant to any other applicable law.

Please incorporate this letter into the Administrative Record for the Demo-1 groundwater operable unit. 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, DEP

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

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AO/LP/
Demolition Area 1 DD concurrence letter

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

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

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APPENDIX B
REFERENCES

APPENDIX B -- DEMOLITION AREA 1 REFERENCES

Name	Creation Date	Type	Doc ID
Memorandum of Resolution on the 2005 System Performance and Ecological Monitoring (SPEIM) Report Rapid Response Action (RRA) Demo 1 Groundwater Operable Unit	14-Mar-06	Letter	8471
Demolition Area 1 Soil Rapid Response Action and Soil Operable Unit Closeout Report	21-Dec-05	Report	8405
Remedial Design-Demo 1 Groundwater Operable Unit, Frank Perkins Treatment Fac., Concurrence	7-Dec-05	Letter	8433
Final Completion of Work Report Rapid Response Action Systems Demo 1 Groundwater Operable Unit	4-Nov-05	Report	8348
Demo 1 Groundwater Operable Unit, Remedial Design Documents	2-Nov-05	Letter	8440
Draft 2005 System Performance and Ecological Impact Monitoring (SPEIM) Report	28-Oct-05	Report	8345
Memorandum of Resolution, Remedial Design Work Plan, Remedial Action, Demo 1 Groundwater Operable Unit	26-Oct-05	Letter	8337
Draft Completion of Work Report, RRA System, Demo 1 GW Operable Unit, Response to Comments, Concurrence	13-Oct-05	Letter	8401
Remedy Selection Plan for the Demolition Area 1 Groundwater Plume	22-Aug-05	Plan	8288
Final Technical Team Memorandum 01-17 Feasibility Study Demo 1 Groundwater Operable Unit	19-Aug-05	Report	8285
Response to EPA Comments (08/09/05) on the Revised Memorandum of Resolution (07/11/05) to the Revised Draft System Feasibility Study, Technical Memorandum (TM) 01-17, Demo 1 Groundwater Operable Unit	10-Aug-05	Letter	8289
Response to Comments on the Completion of Work Report, Rapid Response Action Systems, Demo 1 Groundwater Operable Unit	3-Aug-05	Letter	8284
Revised Memorandum of Resolution on the Revised Draft Feasibility Study, Technical Memorandum (TM) 01-17 Demo 1 Groundwater Operable Unit	11-Jul-05	Letter	8273
Final System Performance and Ecological Impact Monitoring (SPEIM) Plan Rapid Response Action Systems Demo 1 Groundwater Operable Unit	6-Jan-05	Plan	8095
Remedial Action, Demo 1 Groundwater Operable Unit, approval of RCL	1-Dec-04	Letter	8434
Memorandum of Resolution System Performance and Ecological Impact Monitoring Plan, Rapid Response Action Systems, Demo 1 Groundwter Operable Unit	30-Nov-04	Letter	7969
Final Groundwater Report Addendum to Technical Team Memorandum 01-2 Demo 1 Groundwater Operable Unit	21-Apr-04	Report	5852
MADEP Concurrence with the Memorandum of Resolution for the Draft Groundwater Report Addendum to Technical Memorandum 01-2, Demo 1 Groundwater Operable Unit	7-Apr-04	Letter	6195
Memorandum of Resolution for the Draft Rapid Response Action Plan Demolition Area 1 (Demo 1) Groundwater Operable Unit	2-Apr-04	Letter	7238
Memorandum of Resolution for the Draft Groundwater Report Addendum to Technical Memorandum 01-2, Demo 1 Groundwater Operable Unit	23-Feb-04	Letter	6196
Response to Comment Letter on the Rapid Response Action Plan Demo 1 Groundwater Operable Unit	6-Nov-03	Letter	4723

DEP comments to the Draft appendix E, Sampling and Analysis plan - Demo 1, Response to comments, Concurrence	4-Nov-03	Letter	5382
Bourne-BWSC-4-15031 Massachusetts Military Reservation, Rapid Response Action, Demo-1 Groundwater Operable Unit, Comments/Approval	23-Sep-03	Letter	5475
EPA Conditional Approval with Required Modifications of the Revised Draft Rapid Response Action (RRA) Plan, Demolition Area 1 Groundwater Operable Unit	2-Sep-03	Letter	5476
Adequate delineation at Demo area 1 groundwater operable unit Camp Edwards impact area	6-May-03	Letter	5044
EPA Conditional approval with Required Modifications of the Draft Rapid Response Action/Release Abatement Measure Plan, demolition area 1 Groundwater Operable Unit	11-Feb-03	Letter	5356
Draft Rapid Response Action / Release Abatement Measure (RRA/RAM) Plan, Demo 1 Groundwater Operable Unit	21-Jan-03	Plan	4015
DEP comments on the Draft technical team Memorandum 01-17, Feasibility study report, Demo 1 groundwater operable unit - MOR, Concurrence	7-May-02	Letter	6205
MOR for the Draft Technical Team Memorandum 01-17, Feasibility Study Report, Demo 1 Goundwater Operable Unit	2-May-02	Letter	6043
Response to Comments on the Draft IAGWSP Technical Team Memorandum 01-17, Feasibility Study Report, Demo 1 Groundwater Operable Unit	10-Dec-01	Letter	6063
MADEP Comments on the Draft Technical Team Memorandum 01-17 Feasibility Study Report, Demo 1 Groundwater Operable Unit	20-Nov-01	Letter	6064
USEPA region I Administrative Orders SDWA 1-97-1019 & 1-2000-001 BOURNE -BWSC-4-13683 Camp Edwards impact area groundwater study program Delineation plan, downgradient extent of contamination, demo 1 groundwater operable unit	16-Nov-01	Letter	5046
Draft IAGWSP Technical Team Memorandum 01-17, Feasibility Study Report, Demo 1 Operable Groundwater Unit, Administrative Order SDWA 1-2000-0014	31-Oct-01	Letter	6065
Revision to Transport Modeling Simulations in the Draft IAGWSP Technical Team Memorandum 01-17 Feasibility Study Report Demo 1 Groundwater Operable Unit	26-Oct-01	Letter	6066
Tech Team Memo 01-17 Draft Feasibility Study Report, Demo 1Groundwater Operable Unit	1-Oct-01	Report	828
Memorandum of Resolution for the Draft Contaminant of Concern Identification, Demo Area 1	10-May-01	Letter	5204
Letter with the Final Technical Team Memorandum 01-2, Demo 1 Groundwater Report	19-Apr-01	Letter	6200
IAGWSP Technical Team Memorandum 01-2 Demo 1 Groundwater Report	19-Apr-01	Report	3924
Impact Area Groundwater Study MOR for the Draft IAGWSP Technical Team Memorandum 01-5, Development and initial screening of alternatives report, Demo 1	12-Apr-01	Letter	6154
Memorandum of Resolution for the Draft IAGWSP Technical Team Memorandum 01-2, Demo 1 Groundwater Report	21-Mar-01	Letter	6179
IAGS Technical Team Memorandum 01-5 Development and Initial Screening of Alternatives Report	31-Jan-01	Report	2753
Draft TM 01-2, Demo 1 GW Report	18-Jan-01	Report	666
COC Identification, Demo 1 - Groundwater Operable Unit	5-Dec-00	Report	664
IAGS TECHNICAL TEAM MEMORANDUM 00-2 DEMO 1 RESPONSE PLAN INVESTIGATION	7-Jun-00	Report	7512

APPENDIX C
GLOSSARY OF TERMS AND ACRONYMS

APPENDIX C
GLOSSARY OF TERMS AND ACRONYMS

2A-DNT	2-amino-4,6-dinitrotoluene, a breakdown product of the explosive TNT
4A-DNT	4-amino-2,6-dinitrotoluene, a breakdown product of the explosive TNT
2,4-DNT	2,4-dinitrotoluene, a propellant
AFCEE	U.S. Air Force Center for Environmental Excellence
AO	Administrative Order
AOC	Area of Concern
Background	A background level is the concentration of a hazardous substance that represents the level of the substance in an undisturbed environmental setting at or near the site.
BBM	Buzzards Bay Moraine
CERCLA	Comprehensive Environmental Response Compensation and Liability Act
COC	Contaminant of Concern
DD	Decision Document; summarizes the selected comprehensive remedy
Demo 1	Demolition Area 1
DWEL	Drinking Water Equivalent Level
EPA	United States Environmental Protection Agency
EPS	Environmental Performance Standards
ETR	Extraction/Treatment/Reinjection
EW-D1-X	Extraction Well at Demo 1 where X is replaced by the well number
FS	Feasibility Study
ft	feet
GAC	Granular Activated Carbon; used in the treatment of contaminated water
gpm	gallons per minute; unit of measure for liquid flow per unit time
HA	Health Advisory; EPA guidelines that represent the concentration of a chemical in drinking water that, given a lifetime of exposure, is not expected to cause adverse, non-cancerous, effects.

HMX	Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine, an explosives compound
IAGWSP	Impact Area Groundwater Study Program
IART	Impact Area Review Team
IRP	Installation Restoration Program
IW-D1-X	Injection Well at Demo 1 where X is replaced by the well number
IX	Ion exchange resin; used in the treatment of contaminated Water
kettle hole	a depression that in the ground surface that was formed during the last ice age from the melting of a remnant glacial ice block
kg	kilogram; unit of measure for mass
Lifetime Health Advisory	Guideline established by EPA that represents the concentration of a chemical in drinking water that, given a lifetime of exposure, is not expected to cause adverse, non-cancerous effects
LUC	Land Use Control
lb	pound; unit of measure for weight
MassDEP	Massachusetts Department of Environmental Protection
MANG	Massachusetts National Guard
mg	milligram; unit of measure for mass
mg/kg/day	milligram of substance per kilogram of bodyweight per day of consumption
MCL	Maximum Contaminant Level
MMR	Massachusetts Military Reservation
NCP	National Contingency Plan
NEPA	National Environmental Policy Act
OU	Operable Unit
O&M	Operation and Maintenance
oxidizer	A substance that gives up oxygen easily to stimulate combustion of organic material

perchlorate	A water-soluble salt used as an oxidizer
ppb	parts per billion, a measure of concentration in liquid, e.g. one part of contaminant in one billion parts of water is 1 ppb, or 1 microgram per liter
RDX	Hexahydro-1,3,5-trinitro-1,3,5-triazine / Royal Demolition Explosive, an explosive compound
RRA	Rapid Response Action, an interim cleanup action taken to reduce contamination while the investigation and selection, design and implementation of a comprehensive cleanup plan is completed
RSP	Remedy Selection Plan, the plan outlining the cleanup alternatives and the proposed plan
SDWA	Safe Drinking Water Act
TNT	Trinitrotoluene, an explosives compound
TTU	Thermal Treatment Unit; a system that uses heat to remove contaminants from soil
UXO	Unexploded Ordnance

APPENDIX D
ON-BASE PROHIBITION ON NEW DRINKING WELLS

DEPARTMENT OF THE ARMY
US ARMY ENVIRONMENTAL CENTER
IMPACT AREA GROUNDWATER STUDY PROGRAM OFFICE
1803 WEST OUTER ROAD
CAMP EDWARDS, MA 02542-5003

SFIM-AEC-IA

28 September 2006

MEMORANDUM FOR

COL Steven E. Wujciak, Commander, ARNG Training Site, Bldg. 3468, Camp Edwards, MA 02542

COL Paul G. Worcester, Commander 102d Fighter Wing, Bldg. 158, Otis ANGB, MA 02542

SUBJECT: Land Use Controls for Demolition Area 1

1. The Decision Document for the Demolition Area 1 (Demo 1) groundwater operable unit requires Land Use Controls that prevent or reduce exposure to contaminated groundwater associated with Demo 1 and to protect remediation infrastructure.

2. The Demo 1 contaminated groundwater plume and the related groundwater treatment infrastructure are located on Camp Edwards (see attached map). In order to ensure this groundwater is not used for drinking water purposes, you, and the other component commanders on the MMR, have established a prohibition against any new drinking water wells serving 25 or fewer customers (attached). Drinking water wells that service more than 25 customers are regulated through the Massachusetts Department of Environmental Protection's permitting process. This prohibition has been provided to the Facilities Management Office, Base Civil Engineering and Environmental Management Offices for Camp Edwards and the 102d Fighter Wing as appropriate, where it will be used for facility and land use planning activities 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.

3. Another key element of the Land Use Controls is the continued implementation of the Dig Safe and Dig Permit processes used by MMR components and tenants to ensure that cleanup infrastructure is not damaged. Your staff's continued diligence in using the established program is required to ensure the viability of this Land Use Control.

4. Since these Land Use Controls are a part of the Demo 1 remedy, we request your acknowledgement of this transmittal. Any comments or questions regarding this issue can be directed to me at (508) 968-5107.

Kent R. Gonser

KENT R. GONSER
Program Manager

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Acknowledgement

The Massachusetts Army National Guard acknowledges the Land Use Control requirements as outlined above.

5 OCTOBER 2006

COL Steven E. Wujciak, Commander, Camp Edwards Date

The 102d Fighter Wing acknowledges the Land Use Control requirements as outlined above.

12 October 2006

COL Paul G. Worcester, Commander, 102d Fighter Wing Date

Attachments:
MMR Prohibition on Drinking Water Wells Serving 25 or Fewer Customers (August 2006)
Demo 1 Groundwater Operable Unit Plume Map

cc:
MANG FMO
MANG E&RC
102d BCE
102d EMO

MASSACHUSETTS MILITARY RESERVATION

PROHIBITION ON DRILLING DRINKING WATER WELLS SERVING 25 OR FEWER CUSTOMERS

The 102nd Fighter Wing, Geographically Separated Units, tenants, and other lawful users located on Otis Air National Guard Base under the control of the Commander, 102nd Fighter Wing, Otis Air National Guard Base, will not drill, cause or allow to be drilled any drinking water well serving 25 or fewer customers on land located on Otis Air National Guard Base.

30 AUG 06

COL WORCESTER Date

Camp Edwards, Geographically Separated Units, tenants, and other lawful users located on Camp Edwards under the control of the Commander, Camp Edwards, will not drill, cause or allow to be drilled any new drinking water well serving 25 or fewer customers on land located on Camp Edwards. The existing wells operating at the Ammunition Supply Point and Range Control can continue to be operated, maintained and replaced as required.

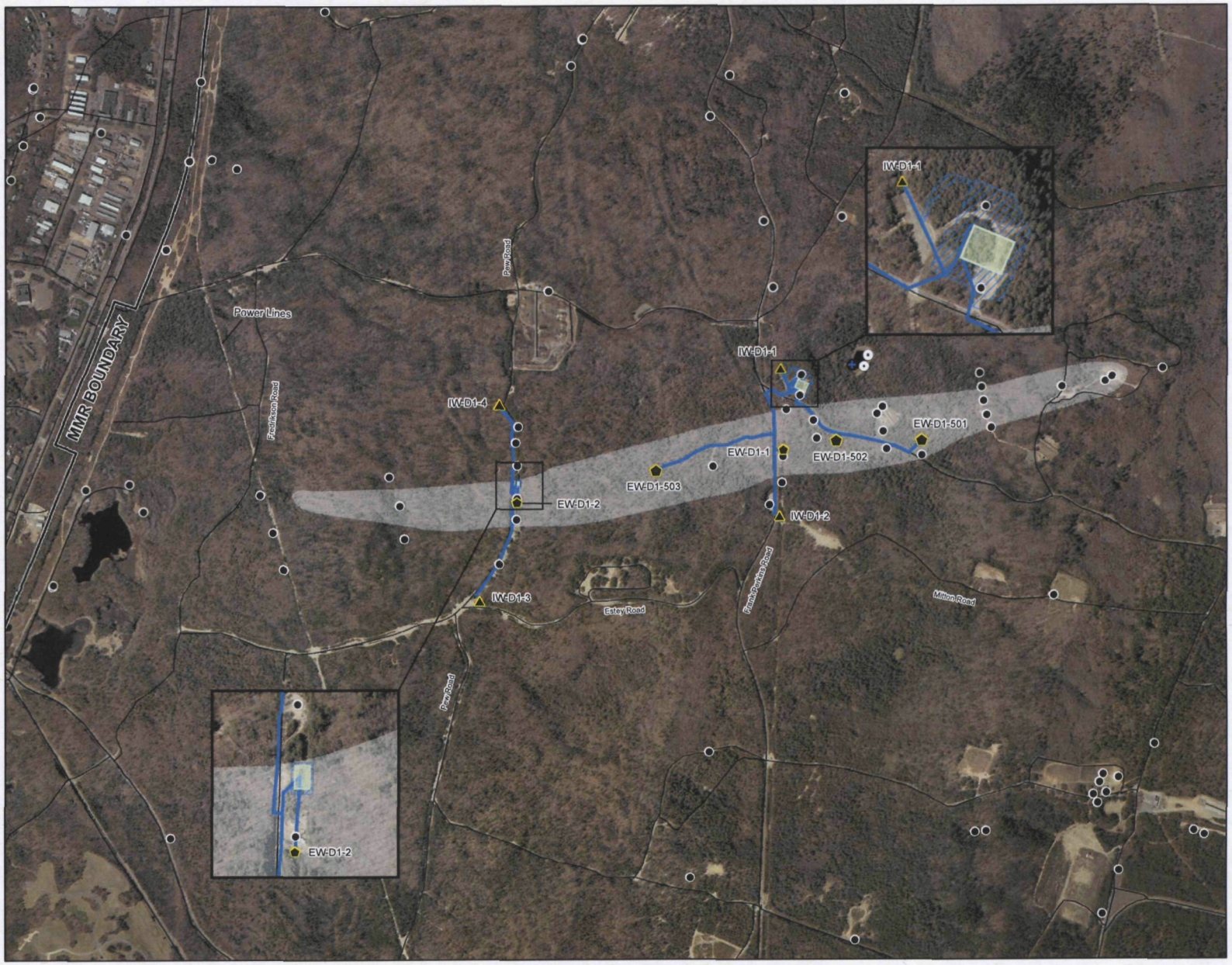
10 Aug 06

COL WUJCIAK Date

Air Station Cape Cod, Geographically Separated Units, tenants, and other lawful users located on Air Station Cape Cod under the control of the Commander, Air Station Cape Cod, will not drill, cause or allow to be drilled any new drinking water well serving 25 or fewer customers on land located on Air Station Cape Cod. The existing well operating at the Communications Station can continue to be operated, maintained and replaced as required.

30 AUG 06

CAPTAIN OSTEBO Date



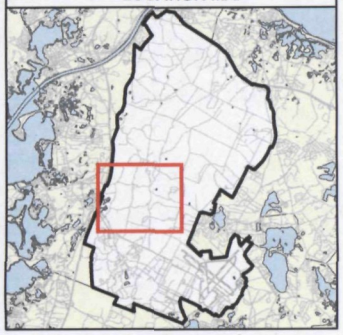
Impact Area Groundwater Study Program

LEGEND

- Existing Monitoring Well
- Piezometer
- Staff Gauge
- Extraction Well
- Injection Well
- Treatment System Piping
- Treatment System
- Treatment System Access
- Extent of Perchlorate and RDX Plumes

Note: Plume shell illustrated is representative of widest observed at each transect cross-section Groundwater data through April 2006. Contour lines dashed where inferred.

LOCATION MAP



NOTES & SOURCES

Basemap data from US Geological Survey 7 1/2 minute Topographic Maps. Source: MassGIS
Aerial Photos: Color Digital Orthophotos:
Date Flown: 2002 Source: EarthData International

TITLE

Demo 1
Groundwater Treatment Infrastructure

0 1,000 Feet

N

US Army Corps of Engineers - New England District

DRAFT

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October 10, 2006 DWN: MTW CHKD: MRK SCN