United States Environmental Protection Agency
Region 1

Decision Document

L Range Operable Unit

Camp Edwards
Massachusetts Military Reservation
Cape Cod, Massachusetts

September 2010

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PART I: DECLARATION FOR THE SAFE DRINKING WATER ACT DECISION DOCUMENT

A. SITE NAME

The subject site is the L Range ("the Site"), which is located at Camp Edwards at the Massachusetts Military Reservation (MMR).

B. STATEMENT OF BASIS AND PURPOSE

This Decision Document presents the selected response actions for the Site. The selected response actions were chosen in accordance with Section 1431(a) of the Safe Drinking Water Act (SDWA), 42 USC § 300i(a), as amended, and the Administrative Order (AO) concerning response actions issued thereunder, U.S. Environmental Protection Agency Region 1 (EPA) Administrative Order No. SDWA-1-2000-0014 (AO3). The authority to select the necessary response action(s) has been delegated to EPA Region 1's Regional Administrator pursuant to EPA Delegation No. 9-17 (1200-TN-350) dated May 11, 1994, and further delegated to EPA Region 1's Director, Office of Site Remediation and Restoration, pursuant to a redelegation of authorities dated April 6, 2010.

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), including consideration of the substantive cleanup standards of the Massachusetts Contingency Plan (MCP) 310 CMR 40.0000. The Index of Key Supporting Documents is available for review at the Impact Area Groundwater Study Program (IAGWSP) office, 1803 West Outer Road, Camp Edwards, MA. Documents included in the Index of Key Supporting Documents 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 aquifer. The response actions selected in this Decision Document are necessary to protect the

Cape Cod Aquifer, an underground source of drinking water on which the public relies.

D. DESCRIPTION OF RESPONSE ACTIONS

This Decision Document sets forth the response actions taken and to be taken, for addressing source area and groundwater contamination at and emanating from the Site. The source area includes both soil and UXO that may be in or on the soil.

Based on recent sampling results presented in the remedial investigation report for the Site, it was determined that no further action was necessary with regards to the source associated with the Site. Soil contamination and most of the UXO at the L Range were adequately removed during a response action in 2009/2010. Post-excavation soil samples collected at the Site revealed no detections of explosives compounds. Geophysical investigations suggest only a few UXO items may remain. Since no further contribution of contaminants from soil or UXO to groundwater is expected, the proposed alternatives did not include any further source-area cleanup or control.

However, based on groundwater sampling results, EPA deemed it necessary to develop and evaluate a range of potential response actions to address contaminants detected in groundwater associated with the Site. The Remedial Investigation / Feasibility Study (RI/FS) for the Site identified Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX) and perchlorate as the contaminants of concern (COCs) for groundwater.

These specific COCs were used to develop and evaluate a range of potential response actions for the Site. Groundwater modeling was used to determine the feasibility of the alternatives and the selected response action was based on the remediation of the RDX and perchlorate plumes. The cleanup objectives for the Site are to restore the useable groundwater to its beneficial use, wherever practicable, within a timeframe that is reasonable given the particular circumstances of the site; 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 the ingestion and inhalation of groundwater containing the COCs (RDX and perchlorate) in excess of federal Maximum Contaminant Levels (MCLs), Health Advisories (HA), Drinking Water Equivalent Levels (DWELs), applicable State standards or unacceptable excess lifetime cancer risk or non-cancer Hazard Index (HI).

There currently is no federal drinking water standard for perchlorate. However, in December 2008, EPA issued an Interim Drinking Water Health Advisory for exposure to perchlorate in water of 15 µg/L. Also, the Massachusetts Department of Environmental Protection (MassDEP) has promulgated a Massachusetts Maximum Contaminant Level (MMCL) for perchlorate of 2 µg/L.

The lifetime federal Health Advisory for RDX in drinking water is 2 µg/L, the Massachusetts Contingency Plan (MCP) GW-1 standard is 1 µg/L, and the 10^{-6} risk-based concentration that results in an increased lifetime cancer risk of one in a million is currently 0.6 µg/L.

The EPA has selected a response action for the Site under which the aquifer, which has been designated a Sole Source Aquifer by the EPA and a Potentially Productive Aquifer by the MassDEP, will be restored. The response action will ensure that the groundwater containing RDX at concentrations greater than the 10^{-6} risk-based level and/or perchlorate greater than 2 µg/L is restored to protective levels.

The EPA selected response action for the L Range groundwater is Monitored Natural Attenuation and Land-Use Controls. This alternative, as presented in the L Range RI/FS, provides the best balance of the criteria used to evaluate cleanup alternatives.

The selected alternative achieves cleanup goals in a reasonable timeframe and protects human health through the use of groundwater monitoring to ensure that groundwater modeling predictions regarding the reduction and migration of contamination at the Site are correct and that any residual contamination remains below risk-based levels. Human health will be further protected through the implementation and verification of land-use controls. These controls will prevent use of contaminated portions of the aquifer at the Site for drinking water purposes until groundwater data confirm that contamination has been reduced to below risk-based levels.

The major components of this response action are:

- Development and implementation of a long-term monitoring program that would be optimized as required, as contamination levels are reduced through natural processes;
- Implementation of land-use controls to prevent access to and use of the contaminated portions of the aquifer for drinking water, and maintain the integrity of any current or future groundwater monitoring systems;
- Monitoring to verify actual versus predicted migration and attenuation (i.e., confirmation that

cleanup levels have been achieved and to demonstrate that the source removal is adequate);

- Site closeout documentation;
- Well abandonment after monitoring is complete.

E. DETERMINATIONS

The response action selected in this Decision Document will protect the public health from any endangerment, which may be presented by the presence or potential migration of COCs from the Site into the underlying Sole Source Aquifer.

As required by AO3, the selected alternative for the Site (Monitored Natural Attenuation and Land-Use Controls for groundwater and no further action for source areas) provides a level of protection to the aquifer underlying and downgradient of the Site commensurate with the aquifer's designation as a Sole Source Aquifer and a Potentially Productive Aquifer and is protective of human health. EPA's determination is related to unacceptable threats to the groundwater aquifer from the Site; however, by this Decision Document EPA is making no determination regarding any remaining public safety risk, ecological risk, dermal contact risk, and/or soil ingestion risk posed by any remaining contamination at the Site.

In addition to annual reports on groundwater monitoring and verification of land-use controls, the selected response actions include periodic reviews at frequencies not to exceed five years. The scope of each review will include, but not be limited to, sampling data, modeling data, and other relevant data. EPA, in consultation with MassDEP, will review this and any other relevant information to determine if additional measures are necessary for the protection of human health. This will include information acquired after the implementation of the selected response actions (such as new regulatory requirements or changes in the environmental conditions of the Site).

F. SUPPORTING DATA

Detailed information on the Site is included in the *Final L Range Remedial Investigation/ Feasibility Study* dated May 6, 2010. In addition, information on the soil response actions is included in the April 2010, Final L Range Interim Source Remediation Report. An overview of

the Site, including decision factor(s) that led to selecting the groundwater response action, is included in the Decision Summary section of this document. The Decision Summary section also includes information on COCs and their respective concentrations, the 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 screening and Decision Document, land and groundwater use that will be available at the Site as a result of the selected response action, and decision factor(s) that led to selecting the remedy. Additional information can be found in the Index of Key Supporting Documents, which is Appendix B to this decision document.

G. AUTHORIZING SIGNATURE

This Decision Document documents the selected response actions for remediation of the L Range within Camp Edwards at the MMR. This response action was selected by EPA under the authority of the SDWA. .

U.S. Environmental Protection Agency

By: _____ Date: 9/30/10

James T. Owens, III
Director, Office of Site Remediation and Restoration
Region 1

PART II: THE DECISION SUMMARY

A. SITE DESCRIPTION

The L Range investigation area is located on Camp Edwards on the Massachusetts Military Reservation on Cape Cod in Massachusetts (Figure 1). It is located southeast of the impact area between the J-1 and J-3 ranges. The L Range Study Area includes the L Range firing points and targets plus three adjacent areas referred to as Area 46, Area 79 and Cleared Area 11. These three areas have been grouped together due to their proximity (Figure 2). Access to L Range is restricted by a continuous chain-link fence around its perimeter.

B. SITE HISTORY AND ENFORCEMENT ACTIVITIES

1. History of Site Activities

The area currently occupied by the L Range was originally developed as an infiltration course in the 1940's, and used as such into the 1950's. In the mid to late 1970's the area was used as a M79 and M203 grenade launcher familiarization range. In the late 1980's to 1994 the L Range was used as an M203 grenade launcher range with its current configuration of eight firing points with multiple targets positioned at varying locations downrange around the northern portion of the range.

2. History of Investigations and Response Actions

Investigations were conducted at the L Range between 1999 and 2009 to identify any contamination in soil and groundwater resulting from past activities. Data collected as part of these investigations were used to characterize the nature and extent of groundwater contamination emanating from the site, any continuing sources of contamination, including soil contamination and potential contamination from UXO, and to provide a basis for the evaluation of risks posed by the site. Investigations included soil sampling, geophysical surveys, groundwater sampling and a robotic technology demonstration. A brief summary of the investigations and response actions performed at the Site is provided below. A more detailed discussion can be found in Sections 3 and 4 of the May 2010 Remedial Investigation/Feasibility Study (RI/FS) Report.

Soil Investigations and Results

During the period from 1999 through 2005, 473 soil samples were collected from 60 locations within the L Range Study Area. In addition, numerous intrusive investigations of geophysical anomalies were conducted at the L Range Study Area. The analytical data collected identified volatile organic compounds (VOC), semi-volatile organic compounds (SVOC), pesticides, herbicides, explosives, and metals at various concentrations in portions of the L Range Study Area.

Area 46 is located south of the L Range across Greenway Road. This area was included in the L Range study area as part of an effort to identify the source of explosives contamination in groundwater collected from a nearby well. Cleared Area 11 is located along Greenway Road to the west of the L Range and Area 79 is located across and to the south of Greenway Road. These areas were identified because they appeared as cleared areas on historic photographs. None of the contaminants detected from these areas were evaluated in the Feasibility Study because either the contaminant was detected infrequently, the contaminant detected is an essential human nutrient, or the contaminant concentrations were generally below relevant screening levels, or less than or similar to background levels.

In 2008, a robotics technology demonstration was conducted at the L Range to evaluate the effectiveness of using remotely operated equipment to safely remove unexploded ordnance (UXO) to facilitate multi-increment soil sampling (Figure 3). The robotics technology demonstration was performed over the entire L Range floor where the former targets were located, and therefore, where there was the greatest probability of finding UXO. A total of 53 potentially high explosive grenades and more than 12,000 pounds of munitions debris were recovered from the range floor. A post-robotics confirmatory geophysical survey and intrusive investigation (excavation of 750 feet of trenches and investigation of 16 select anomalies) in the range floor found no high explosive grenades and only two items with potentially live fuses. Extensive intrusive investigations in the area of the range outside the range floor found no UXO.

After completion of the robotics demonstration, multi-increment soil samples were collected from a total of 23 decision units in the up-range, mid-range, and down-range areas of L Range for explosives and perchlorate analyses (Figure 4). Analytical results indicated elevated levels of RDX, HMX and TNT at 10 of the 15 decision units in the mid-range area. None of the three up-

range or five down-range decision units had any detections of explosives. Additional explosives compounds and perchlorate were detected, but only at levels well below relevant standards. A second round of multi-increment soil samples, collected in May 2009 from the mid-range decision units, confirmed the presence of explosives in this portion of the range.

L Range Source Removal Action

Based on these results, soil from the 10 mid-range decision units with explosives detections was excavated to a depth of six inches below ground surface (Figure 3). Excavation activities were conducted in September 2009 and October 2009.

Approximately 2,000 cubic yards of explosives-contaminated soil was excavated. Post-excavation, 100-point multi-increment soil samples in each of the 10 decision units were collected from 0- to 3-inches below the excavation floor. Results from post-excavation sampling indicated no detections of explosives.

All excavated soils were mechanically screened to one inch to remove any remaining UXO. The excavated soils were treated beginning in November 2009. The soils were treated using alkaline hydrolysis, which involved raising the pH of the soil by blending it with water and hydrolyzed lime to mineralize the explosives compounds to more elemental compounds of inorganic nitrogen and carbon dioxide. After blending, the soils were staged in a lined treatment cell at the L Range. After treatment, the soils were sampled to determine the effectiveness of treatment. No explosives compounds were detected in the samples from the treated soils. This activity is documented in the April 2010 Final L Range Interim Source Remediation Report. The soils were removed from the treatment cell and placed back on the range.

The oversize material removed during the mechanical screening of the excavated soil was inspected by UXO technicians. UXO technicians recovered an additional 16 potentially high explosive grenades and more than 12,000 pounds of munitions debris (thousands of practice grenades). After the soil excavation was completed, a post-excavation anomaly investigation was conducted and resulted in the removal of 2 additional HE grenades. One grid in the mid-range area was not excavated because no explosives were detected from these soils. UXO technicians also performed a UXO clearance of this grid (MR07) to determine the number of UXO in the remainder of the mid-range area. An additional 2 potentially high explosive

grenades were found in this grid. The excavation of soils in the mid-range area as well as post-excavation anomaly removal greatly reduced the possibility that further UXO remain in this portion of the range. The downrange area is less than half the size of the excavated area where 18 high explosive grenades were found, so it is possible that up to 9 high explosive grenades would remain in this area. However, the absence of post-robotics soil contamination in the downrange area suggests that the number of UXO remaining in this area, where no soil excavation was conducted, would be significantly less per unit area than that of the mid-range area. In addition, portions of the up-range and down-range areas were manually cleared. No HE grenades and only two smoke grenades with potential live fuzes were found outside the mid-range area. Intrusive investigations outside the range floor found no UXO.

Historical range records and field observations indicate that the 40mm practice grenade was the predominant munition fired at the L Range (available range records for the years 1980-1987 indicate that in addition to smoke and illumination grenades, greater than 21,000 practice grenades and greater than 12,000 high explosive grenades were fired at the L Range). Records available for the mid-1990s indicate that greater than 54,000 target practice grenades were fired. According to the records review, the use of HE grenades was discontinued at the range in July 1982 and only 40mm practice, smoke and illumination grenades were authorized for use on the range. The vast majority of historical ordnance discoveries at the L Range have been practice grenades.

Groundwater Investigations and Results

More than 70 groundwater monitoring wells were sampled at and downgradient of the L Range. Results of this sampling indicated the presence of small discontinuous groundwater plumes of both perchlorate and RDX (Figure 5). All residences in the area downgradient of the contaminated groundwater are connected to the municipal water supply.

The maximum historic detections in groundwater were 9 ug/L for RDX and 3 ug/L for perchlorate. Based on recent data, perchlorate and RDX concentrations have decreased or remained stable in almost all of the downgradient monitoring wells. Perchlorate is no longer detected above the MMCL in any monitoring well. Groundwater contamination currently consists of two RDX lobes and four areas with low levels of perchlorate. As of February 2010, the maximum detection of RDX was 2.8 ug/L and perchlorate was 0.69 ug/L. Fate and transport

modeling indicates the RDX contamination will migrate south in the direction of the Installation Restoration Programs northernmost Fuel Spill 12 (FS-12) extraction wells. The modeling suggests that perchlorate would not migrate appreciably beyond its current location in the aquifer. It is extremely unlikely that RDX from the L Range will reach the northernmost FS-12 extraction wells. Overall, the most recent data supports the understanding of the L Range groundwater contamination as diffuse areas of perchlorate and RDX contamination that occur as isolated and noncontiguous zones or lobes detached from upgradient source areas.

There have been no significant site-related detections of SVOCs, VOCs, pesticides, polychlorinated biphenyls, herbicides, or inorganic constituents in groundwater; either the contaminant was detected infrequently, the contaminant detected is an essential human nutrient, or the contaminant concentrations were generally below relevant screening levels, or less than or similar to background levels.

Based on the nature and extent of contamination and the risk-screening process, RDX and perchlorate in groundwater were retained as COCs since they are detected in a number of wells at concentrations above risk-based standards indicating the presence of a plume of groundwater contamination.

3. History of Relevant Federal and State Enforcement Activities

In February 1997, EPA Region 1 issued SDWA Administrative Order 1-97-1019 (AO1) requiring the investigation of the impact of contamination at or emanating from the training ranges and impact area upon the Sole Source Aquifer.

In May 1997, EPA issued 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.

In January 2000, EPA issued SDWA Administrative Order 1-2000-0014 (AO3), which required implementation of Rapid Response Actions (RRAs) and Remedial Actions (RAs) to address 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 response action component of AO3 requires that a feasibility study, remedial design and response action be completed for several areas of concern.

C. COMMUNITY PARTICIPATION

Throughout the Site's history, the IAGWSP, EPA and MassDEP have kept the community and other interested parties apprised of response activities at L Range 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) was a citizen advisory committee established in 1997 under AO1. The IART served as a technical advisory resource, allowing the EPA, the Army, and MassDEP to hear first hand the concern of the public related to the ongoing investigation and cleanup effort at Camp Edwards. In 2007, this team was merged with the Plume Cleanup Team, the citizens' advisory team for the Air Force Center for Engineering & Environment's MMR Installation Restoration Program, and renamed the MMR Cleanup Team. The combined team meets regularly throughout the year to hear updates and provide public input on the MMR investigations 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 or their designated representative from the towns of Bourne, Falmouth, Mashpee, and Sandwich and representatives from the EPA, MassDEP, Massachusetts Department of Public Health, Massachusetts National Guard, U.S. Coast Guard, and a representative from the Mashpee Wampanoag Tribe.

All IART, MMR Cleanup Team, and Senior Management Board meetings related to the Site's investigation and response activities were advertised in the *Cape Cod Times* and the local edition of *The Enterprise* newspapers.

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 the time the initial investigations at the Site began, through the present, the IAGWSP regularly presented updates on the investigation and response activities at the Site. With respect to this Decision Document, the most important updates were:

- On May 13, 2009, an informational meeting was held at Camp Edwards, MA, to present the findings of the RI/FS report for the L Range to the MMR Cleanup Team and the public. A display ad regarding the meeting was placed in the May 6, 2009 editions of the *Cape Cod Times* and *The Enterprise* newspapers and a news release regarding the meeting was sent to the local media on May 7, 2009.

- On March 24, 2010, an informational meeting was held at Camp Edwards, MA, to describe the Remedy Selection Plan for the L Range to the MMR Cleanup Team, Senior Management Board and the public. At the meeting, the IAGWSP gave a presentation on the Site, the Remedy Selection Plan and the proposed response and answered questions from the MMR Cleanup Team and Senior Management Board. The IAGWSP notified the public of the meeting in a display ad placed in the March 18, 2010 editions of the *Cape Cod Times* and *The Enterprise* newspapers.

- From May 6, 2010 through June 4, 2010, a Public Comment Period was held on the Remedy Selection Plan for the L Range. The IAGWSP placed copies of the Remedy Selection Plan in the IAGWSP's information repositories at the Bourne, Falmouth, and Sandwich, MA, public libraries. The repository contains documents on the L Range investigations and findings supporting selection of the response action including the RI/FS report for the L Range, along with other relevant documents. The Remedy Selection Plan 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 Remedy Selection Plan. In addition, the IAGWSP provided copies of the Remedy Selection Plan to MMR Cleanup Team members and distributed it to individuals in attendance at the public meeting and public hearing.

- On May 19, 2010, a Public Information Session and Public Hearing were held on the Remedy Selection Plan for the L Range in Sandwich, MA. The public information session, along with a presentation on the Remedy Selection Plan and EPA's proposed response,

was held prior to the opening of the public hearing. Local residents and officials, news media representatives, and members of the public interested in site activities and cleanup decisions were invited to attend both meetings. Representatives from EPA, MassDEP and IAGWSP were available to answer questions. The IAGWSP notified the public of the May 19, 2010 information session and public hearing, and reminded them about the public comment period in a display ad placed in the May 7 and May 14, 2010 editions of the *Cape Cod Times* and *The Enterprise* newspapers. A news release regarding the meeting and the public comment period was sent to the local media on May 6, 2010. Comments received during the Public Comment Period for the Remedy Selection Plan for the L Range were compiled and answered in the Responsiveness Summary included in Part III of this document.

All draft and final reports related to the Site's investigation and response activities were made available through the Information Repository at the public libraries in Bourne, Falmouth, 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.

Media releases on presentations and the Public Comment Period for the Site were distributed to the Cape *Cod Times* and other area media including newspapers, radio and television media.

Fact sheets were published and distributed regarding the Site's investigation and response activities. General fact sheets pertaining to the IAGWSP investigations and findings and on related issues, such as the contaminants of concern, were also published and distributed.

The IAGWSP, EPA, and MassDEP also participated in general information sessions, such as open houses, information sessions, community meetings and annual updates to the local Town Managers, Boards of Selectmen, and Boards of Health on MMR investigation and response activities.

D. SCOPE AND ROLE OF OPERABLE UNIT

The Site consists of source area (i.e., soil and UXO) and groundwater operable units. The source area for L Range was addressed through the removal of UXO during the 2008 Robotics

Technology Demonstration and through the subsequent excavation and removal of contaminated soil. EPA determined that no further action with respect to the source area was necessary at this time based on the removal of the contaminated soils and UXO. Therefore, the analysis of alternatives in the RI/FS was limited to groundwater.

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 and Sandwich Moraines, and the Mashpee Pitted Plain. The Buzzards Bay Moraine and the Sandwich Moraine are visible as hummocky ridges along the western and northern boundaries of Camp Edwards, respectively. The Buzzards Bay Moraine and Sandwich Moraine are composed of ablation till, which is unsorted material ranging from clay to boulder size that was deposited at the leading edge of two lobes of the Wisconsinian glacier at its furthest advance. The Mashpee Pitted Plain is a broad outwash plain that lies between the two moraines and consists of fine to coarse-grained sands and is underlain by fine-grained glaciolacustrine sediments and a basal till layer over bedrock. The L Range lies within the Mashpee Pitted Plain.

Site Hydrogeology

A single groundwater-flow system underlies western Cape Cod including MMR. Camp Edwards lies over the Sagamore Lens, which is part of the larger, Cape Cod Aquifer. The primary source of natural fresh water recharge to this groundwater system is rainfall and snow melt-water that averages approximately 48 inches per year. Additional water is returned to the aquifer as wastewater from domestic septic systems. Municipal sewer systems at the MMR and in parts of Falmouth return treated wastewater to the groundwater flow system through infiltration beds at the sewage treatment facilities. Wastewater return flow accounts for approximately 5 percent of the total groundwater recharge in the MMR region.

The high point of the water table within the western Cape Cod groundwater system occurs as a groundwater mound located beneath the east central portion of MMR. Groundwater flows

radially outward: north to either the Cape Cod Canal or the Cape Cod Bay, east to the Bass River, south and southeast to Nantucket Sound, and west and southwest to Buzzards Bay.

Groundwater from the L Range generally flows south to north. The height of the water table in and around the MMR can fluctuate up to seven feet annually due to seasonal variations in groundwater recharge and pumping demand. Groundwater levels are highest in the spring when recharge rates are high and pumping demand is low; levels are lowest in the late summer/early autumn when rainfall is minimal and pumping demand is at its maximum. The total thickness of the aquifer varies from approximately 80 feet in the south to approximately 350 feet in the north. The variation in thickness is due to the episodes of glacial advance and retreat, the underlying bedrock geology, and the presence of fine-grained materials in the deeper sediments beneath the southern portion of the aquifer. Within the L Range Study Area, the groundwater elevation is typically between 60 and 70 feet national geodetic vertical datum (ngvd) or approximately 100 feet below ground surface (bgs).

Surface water is not significantly retained due to the excessively drained sandy soils of Camp Edwards. No large lakes, rivers, or streams exist on the property, only small, marshy wetlands and ponds. Most of the wetlands and surface waters in the Sandwich and Buzzards Bay Moraines on Camp Edwards are considered to be perched. Surface water is present at MMR in a few ponds in kettle holes. The kettle-hole ponds are land-surface depressions that generally extend below the water table. Where these kettle holes do not extend down to the water table, they are merely surface depressions. 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 and near the top of the groundwater mound for the Sagamore Lens aquifer.

Movement of Contaminants in Groundwater

Groundwater in the L Range study area generally flows horizontally to the south-southeast at approximately one foot/day in an unconfined sandy aquifer comprised of glacial outwash deposits. Groundwater flow is influenced locally by discontinuous fine-grained units, hydraulic gradients, and proximity to the top of the groundwater mound. Snake Pond and the groundwater extraction, treatment and reinjection system for the FS-12 plume also influence groundwater flow.

Two COCs are present in groundwater at the Site: RDX and perchlorate. RDX and perchlorate readily leach from soil to the groundwater, with perchlorate more readily dissolving than RDX. 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 generally will move 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.

Estimate of the Contaminant Volume and Mass

The total volume of the plume at the L Range was estimated to be 24 million gallons as of 2010. The total mass of RDX with concentrations greater than 0.6 µg/L was approximately 0.11 kilograms (Kg), and there were no concentrations of perchlorate greater than 2.0 µg/L.

Current Exposure Pathways

There are no known private or public water supplies located within the L Range groundwater study area and no one is currently believed to be drinking water related to the L Range site, that contains COCs at concentrations that exceed applicable drinking water standards, Health Advisories, and/or risk-based levels.

Potential Exposure Pathways

The development of new water supply wells and consumption of groundwater resources in areas contaminated or predicted to be contaminated by the L Range plumes are potential future exposure pathways. As noted above, the Cape Cod Aquifer is the sole or principal source of drinking water for Cape Cod. Portions of Camp Edwards, including the on-base portions of the Site, have been set aside as a drinking water supply reserve by the Massachusetts legislature.

F. CURRENT AND POTENTIAL FUTURE SITE AND RESOURCE USES

The L Range site is located on the MMR and is designated as an active military training area. It is anticipated that the Site will remain under the control and direction of government agencies and will continue to be used for military training and support purposes until at least 2052. The area also is designated as a water and wildlife preserve by Chapter 47 of the Massachusetts Acts of 2002. The Site overlays portions of a sole source aquifer that is a valued water supply

for the upper portion of Cape Cod. The land-use controls (described in section K) will prevent the installation of new water supply wells, or use of existing water supply wells (if any), that could provide a pathway for ingestion of drinking water that contains COCs in concentrations that exceed applicable drinking water standards, Health Advisories, and/or risk-based levels, and maintain the integrity of any current or future groundwater monitoring systems.

G. SUMMARY OF SITE RISKS

A Risk Screening was conducted for L Range. The objective of the risk screening was to identify any contaminants of concern detected at the L Range that required further evaluation in the Feasibility Study.

Constituents detected in soil samples were evaluated by comparing the maximum concentration of each detected constituent to a series of risk-based criteria. A number of metals, SVOCs and VOCs exceeded one or more of their respective screening levels. However, on further analysis, it was determined that the detections of metals and SVOCs, were below or consistent with background levels or were common laboratory artifacts. VOC detections were sporadic and at low levels, so none of these constituents were carried forward in the feasibility study.

Perchlorate was detected, but only at very low levels, throughout the range and well below screening values. Elevated detections of explosives, including RDX, HMX and TNT, where found in the mid-range area of the L Range. These explosives-contaminated soils were excavated and treated on site. Post-excavation soil sampling results were all non-detect for explosives. As a result of this screening process and the subsequent analysis of the anticipated leaching behavior of the constituents that were highlighted by the screening, none of the analytes detected in soil were found to pose a risk.

Constituents detected in groundwater samples were evaluated by comparing the maximum concentration of each detected constituent to a series of risk-based criteria including Federal Maximum Contaminant Levels (MCLs), Health Advisory Levels (HAs), EPA Regional Screening Levels for Tapwater (RSL), and the MCP GW-1 standards. The maximum detected concentrations for a few of the explosive compounds and perchlorate exceeded at least one of their respective screening levels. However, with the exception of perchlorate and RDX, these explosive compounds were detected infrequently or were detected at concentrations marginally

exceeding the screening values. The results of this screening identified groundwater containing COCs (RDX and perchlorate) in excess of federal MCLs, Health Advisory Levels, Drinking Water Equivalent Levels (DWELs), applicable State standards or unacceptable excess lifetime cancer risk or non-cancer Hazard Index (HI).

There are believed to be no existing exposure routes for human receptors, and no one is currently believed to be drinking groundwater associated with the L Range site that contains COCs above current drinking water standards, Health Advisories, and/or risk-based levels. A potential future exposure pathway exists through development and consumption of groundwater resources in the area downgradient from the Site. Since groundwater contamination has been detected above drinking water regulatory standards, Health Advisories, and/or risk-based levels, unacceptable human health risks could occur if future exposures occur. However, as noted above, land-use controls will prevent the installation of water wells that could provide a pathway for ingestion of drinking water that contains COCs in concentrations that exceed applicable drinking water standards, Health Advisories, and/or risk-based levels, and maintain the integrity of any current or future groundwater monitoring systems.

H. RESPONSE ACTION OBJECTIVES FOR GROUNDWATER

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. The response action objectives for the selected L Range alternative are to restore the useable groundwater to its beneficial use wherever practicable within a timeframe that is reasonable given the particular circumstances of the site; 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 ingestion and inhalation of groundwater containing COCs (RDX and/or perchlorate) in excess of federal maximum contaminant levels, Health Advisories, drinking water equivalent levels (DWELs), applicable State standards and/or an unacceptable excess lifetime cancer risk or non-cancer Hazard Index.

I. DEVELOPMENT AND SCREENING OF ALTERNATIVES FOR GROUNDWATER

Pursuant to the AO3 SOW, the following range of remedial alternatives was developed that consider 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:

- 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 MCLs, Health Advisories, DWELS, other relevant standards, and a cumulative 10^{-6} excess cancer risk. It shall achieve the objective as rapidly as possible and must be completed in less than 10 years and shall require no long-term maintenance.
- 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 other available approaches; or lower costs for similar levels of performance than demonstrated treatment technologies.

A range of alternatives from no action to focused extraction were developed specifically for groundwater in consideration of the response action objectives described in Part II.H above. The range of alternatives did not consider further soil remediation or control since no further contribution from soil to groundwater contamination is expected at any of the source areas investigated. Other alternatives utilizing one or more different technologies were not included because, for the circumstances of this operable unit, they would not provide superior performance or implementability, fewer or less adverse impacts, or lower costs for similar levels of performance, than the alternatives evaluated.

Three alternatives were developed to address the response action objectives discussed in Part II.H above and to meet the requirements set forth in the AO3. Each of the alternatives reduces the contaminant concentrations to background conditions. In addition, each alternative reduces the contaminant concentrations to levels that meet or exceed all regulatory and risk-based standards in 10 years or less.

- Alternative 1 – No Further Action

- Alternative 2 – Monitored Natural Attenuation and Land-Use Controls
- Alternative 3 – Focused Extraction (with Monitored Natural Attenuation and Land-Use Controls)

For the site, at least one alternative included both long-term groundwater monitoring (to confirm model predictions and achievement of cleanup goals) and monitoring of land-use controls (to ensure their effective implementation until the aquifer achieves risk-based levels and is restored to allow for unrestricted use and exposure). Groundwater monitoring will be performed in accordance with an approved, long-term monitoring plan with periodic and annual summaries of available groundwater monitoring data. Monitoring of land-use controls will be conducted annually by the Army and results will be included in a separate report or as a section of another report, if appropriate, and submitted annually to the regulatory agencies. The annual monitoring report will evaluate the status of the land-use controls and how any land-use control deficiencies or inconsistent uses have been addressed. These reports will be used in preparation of the five-year review to evaluate the effectiveness of the remedy in protecting human health and the sole source aquifer.

A detailed analysis was performed on the alternatives using nine evaluation criteria in order to select the appropriate remedy for each site. These criteria are divided into threshold, balancing, and modifying criteria and are given different weights accordingly, and provide a useful framework for evaluating response alternatives. The threshold criteria include the protection of human health and the environment and compliance with regulations. 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 selected 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 determined to be necessary to protect the health of persons from contaminants present in or likely to enter an underground source of drinking water and that it is otherwise in accordance with existing law or

laws. It also reflects the EPA's determination of the appropriate balance of other environmental concerns as reflected by the other criteria. The following are the nine evaluation criteria:

- Overall protection of human health and the environment; this shall include prevention of the movement of contaminants into the aquifer and its preservation as a public drinking water supply.
- Compliance with state and federal regulations.
- Long-term effectiveness and permanence.
- Reduction of toxicity, mobility, or volume through treatment.
- Short-term effectiveness.
- Implementability.
- Cost.
- State acceptance.
- Community acceptance.

J. DESCRIPTION OF ALTERNATIVES, SUMMARY OF COMPARATIVE ANALYSIS AND THE SELECTED RESPONSE ACTION

Description of Alternatives

Alternative 1 – No Further Action: Alternative 1 provides for no further action to address any remaining groundwater contamination at the L Range. Under this alternative:

- No active groundwater treatment would occur.
- Model predictions could not be verified due to discontinued groundwater sampling/analysis and abandonment of existing monitoring wells.
- Land-use controls would not be implemented to ensure against exposure until cleanup is achieved.
- The total cost of Alternative 1 is estimated to be $109,725.
- RDX contamination is expected to drop below the 2 µg/L health advisory by 2013, the 10^{-6} risk-based level of 0.6 µg/L by 2027, and background levels (0.25 ug/L) by 2040.

Alternative 2 – Monitored Natural Attenuation and Land-Use Controls: Alternative 2 would provide long-term monitoring of L Range groundwater until concentrations of contaminants within the plume reach risk-based levels. Under this alternative:

- A long-term groundwater monitoring program would be implemented and optimized yearly as the plume attenuates.
- Land-use controls would be implemented to prevent use of contaminated portions of the aquifer for drinking water, and maintain the integrity of any current or future groundwater monitoring systems.
- Monitoring, reporting and site close-out documentation would be completed.
- The total cost of Alternative 2 is estimated to be $1,873,426.
- RDX contamination is expected to drop below the 2 µg/L health advisory by 2013, the 10^{-6} risk-based level of 0.6 µg/L by 2027, and background levels (0.25 ug/L) by 2040.

Alternative 3 – Focused Extraction with Monitored Natural Attenuation and Land-Use Controls: Alternative 3 provides for extraction and treatment of L Range groundwater. Under this alternative:

- A 50-gallon-per-minute pump and treat system would be installed that would include one extraction well, an infiltration trench, a modular treatment unit using granular activated carbon to remove contaminants, and associated pipeline and power networks.
- A long-term groundwater monitoring program would be implemented and optimized yearly as required.
- Land-use controls would be implemented to prevent use of contaminated portions of the aquifer for drinking water, and maintain the integrity of any current or future groundwater monitoring systems.
- Monitoring, reporting and site close-out documentation would be completed.
- The total cost of Alternative 3 is estimated to be $3,736,526.
- RDX contamination is expected to drop below the 2 µg/L health advisory by 2012, the 10^{-6} risk-based level of 0.6 µg/L by 2016 and background levels (0.25 ug/L) by 2024.

Summary of the Comparative Analysis of Alternatives

The following discussion summarizes the strengths and weaknesses of each response action alternative identified for the L Range with respect to the nine criteria:

Overall Protection of Human Health and the Environment: Alternative 1 provides the least protection of human health and the aquifer because it does not contain any land-use controls to ensure that future exposure (use of aquifer as a drinking water source) does not occur, or groundwater monitoring to confirm that RDX and perchlorate concentrations are or will be below regulatory standards. Alternatives 2 and 3 add provisions for long-term groundwater monitoring to confirm model predictions and land-use controls to prevent exposure to contaminated groundwater above state and federal drinking water standards, Health Advisories and/or, risk-based levels.

Compliance with Regulations: All three alternatives are expected to eventually result in compliance with applicable regulations. Alternatives 1 and 2 would meet chemical-specific regulations when contaminant concentrations decrease below the cleanup standards. Alternative 2 includes monitoring to confirm this occurs; Alternative 1 does not. Alternative 3 includes active treatment to ensure that applicable standards are met. Alternatives 2 and 3 would comply with location- and action-specific regulations. Alternative 1 involves no action, so no location- or action-specific requirements apply.

Long-Term Effectiveness and Permanence: All alternatives are expected to provide long-term effectiveness and permanence however the timeframes differ. The source area has been removed so residual soil contamination is unlikely to compromise the permanence of the remedial alternatives once completed.

Reduction of Toxicity, Mobility, or Volume through Treatment: Alternatives 1 and 2 are not treatment alternatives and, therefore, do not reduce toxicity, mobility, or volume through treatment. However, the toxicity and volume of the contaminated groundwater would be reduced through natural processes. Based on model predictions, Alternative 3 would extract 0.08 Kg of RDX through treatment over the course of approximately one year of operation.

Short-Term Effectiveness: Alternative 1 would have the least short-term impact on the community or workers because construction is minimal. Alternative 3 would have the greatest short-term impact because of the construction involved.

Implementability: None of the alternatives are limited by administrative or technical feasibility. Alternative 1 is the most easily implemented alternative since it requires no further action other

than abandoning groundwater monitoring wells and preparing close-out documentation. Alternative 3 would be the most difficult to implement since it includes the installation of an extraction well, a treatment system as well as new piping/power lines. Property access issues could develop in locating extraction wells and associated piping off-site.

Cost: Alternative 1 is the least expensive alternative with a total estimated cost of $109,725. Alternative 2 is the next least expensive alternative with a total estimated cost of $1,873,426. Alternative 3 is the most expensive alternative with a total estimated cost of $3,736,526.

State Acceptance: This criterion is continually evaluated as the MassDEP participates in all aspects of the evaluation and selection of a remedy.

Community Acceptance: Comments were received from one member of the public as part of the public comment period on the Remedy Selection Plan for the L Range. See "Part III Responsiveness Summary" for more details.

The Selected Response Action

For the reasons set forth herein, EPA has identified Alternative 2 - Monitored Natural Attenuation and Land-Use Controls as the appropriate response action for the L Range site. This alternative, as presented in the feasibility study, provides the best balance of the criteria used to evaluate cleanup alternatives.

This alternative achieves cleanup goals in a reasonable timeframe and protects human health through the use of groundwater monitoring to ensure that groundwater modeling predictions regarding the reduction and migration of contamination at the L Range site are correct and that any residual contamination remains below risk-based levels. The response actions taken to date to address soil and UXO are expected to have removed any unacceptable risks currently to groundwater. However, long-term groundwater monitoring will be conducted to verify the effectiveness of the soil and UXO response. Human health will be further protected through the implementation and verification of land-use controls. These controls will prevent use of contaminated portions of the aquifer at the L Range for drinking water, and maintain the integrity of any current or future groundwater monitoring systems until it is clear that contamination is reduced to below regulatory standards. In addition to continued groundwater monitoring and

use of land-use controls, the Army will review this selected remedy every five years for purposes of evaluating the appropriateness of the remedy in providing adequate protection of human health. The Monitored Natural Attenuation and Land-Use Controls remedy includes:

- A long-term groundwater monitoring program that will be optimized as required as the plume attenuates.
- Land-use controls to prevent use of contaminated portions of the aquifer for drinking water, and maintain the integrity of any current or future groundwater monitoring systems.
- Monitoring, reporting, and site close-out documentation.

K. RESPONSE ACTION IMPLEMENTATION

Plume Monitoring

At L Range, the cleanup goals will be achieved through natural processes. The success of these processes to achieve regulatory standards will be confirmed through the development and implementation of approved, long-term groundwater monitoring plans. The long-term groundwater monitoring plan will also verify that any possible remaining UXO will not pose a threat to groundwater. Optimization of the program will lead to changes that will be documented in the periodic monitoring reports.

Cleanup Levels

The cleanup level for RDX is the 10^{-6} risk-based level that results in an increased lifetime cancer risk of one in a million, currently 0.6 µg/L. The cleanup level for perchlorate is the 2 µg/L MMCL.

Land-Use Controls

Contaminated groundwater at the L Range currently poses an unacceptable risk to human health if used for drinking water purposes. Administrative and/or legal controls that minimize the potential for human exposure to contamination by limiting land or resource use, known as "Land-Use Controls", must be established to avoid the risk of exposure to contaminated groundwater above regulatory standards, Health Advisories, and/or risk-based levels, and maintain the integrity of any current or future groundwater monitoring systems. The land-use

controls are needed until the groundwater contamination no longer poses an unacceptable risk.

The performance objectives of the land-use controls are to:

- Prevent access to or use of the groundwater from the L Range plume areas until the groundwater no longer poses an unacceptable risk; and
- Maintain the integrity of any current or future groundwater monitoring systems.

The land-use controls will be implemented in the areas encompassing the L Range contaminated groundwater plume and surrounding areas to prevent risks from exposure to contaminated groundwater (Figure 6). The on-base areas of concern are controlled and operated by the Massachusetts National Guard in conjunction with the US Army (Army), which leases the land from the Commonwealth of Massachusetts. It is expected that these entities will operate and lease, respectively, the L Range and surrounding areas for the duration of the remedy specified in 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 land-use controls for the Site. Although there are no potential receptors in the path of the L Range plume and all homes in the area have been connected to town water, an additional land-use control will be necessary within the Town of Sandwich for the downgradient portion of the plume.

The land-use controls will be maintained until either (1) the concentrations of RDX and perchlorate in the groundwater are at levels that allow for unrestricted use and unlimited exposure, or (2) the Army, with the prior approval of the EPA, in consultation with MassDEP, modifies or terminates the land-use control in question.

Specific Land-Use Controls

The Army is responsible for ensuring that the following land-use controls 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 the final remedy selected in this Decision Document. The Town of Sandwich has enforcement authority regarding the first land-use control, which is applicable to the off-base portion of the plume. The Commonwealth of Massachusetts has enforcement authority regarding the second land-use control. The Massachusetts Air National Guard and Massachusetts Army National Guard have

enforcement authority regarding the third and fourth land-use controls, which are applicable to the on-base portion of the plume. The Air Force has enforcement authority regarding the fifth land-use control, which is applicable to the on-base portion of the site.

1. The Sandwich Board of Health requires a permit for the installation and use of all wells, including drinking water wells, irrigation wells, and monitoring wells. If a permit to install a drinking water well is approved, the Sandwich Board of Health will not approve the use of that well until its water has been tested and the Board of Health has determined that the water is potable. In addition, the Town of Sandwich has a moratorium on the drilling of new private drinking water and irrigation wells in areas within 200 feet of known groundwater contamination. The town also prohibits the construction of new potable supply wells for new buildings if Sandwich Water District service is available. (Sandwich Water District service is available in areas downgradient from the L Range and homes in that area are connected to town water.) The Sandwich Board of Health Water Well Regulations do not apply to use of existing drinking water wells and irrigation wells. To assist the Town of Sandwich in the implementation of this land-use control, the Army will meet with the Sandwich Board of Health on an annual basis, or more frequently if needed, to provide and discuss plume maps that document the current and projected location of the plume within the town of Sandwich. While Figure 6 shows the current area of land-use controls in the town, the Sandwich Board of Health may modify the areas where the Board of Health may require additional well testing, and this land-use control will apply to such areas even if they differ from the area shown.

2. In addition to the Town of Sandwich Board of Health regulations, which generally apply to small water supply wells, existing land-use controls also prevent the possible creation of a large potable water supply well. The MassDEP administers a permitting process for any new drinking water supply wells in Massachusetts that propose to service more than 25 customers or exceed a withdrawal rate of 100,000 gallons per day. This permitting process, which serves to regulate the use of the L Range contaminated groundwater for any new withdrawals of groundwater for drinking water purposes, constitutes an additional land-use control for these final remedies. This land-use control applies to both

on-post and off-post areas. (Existing public water supply wells will remain subject to permits currently in place.)

3. For on-post areas, 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 Guards (major tenants at the MMR). The prohibition will be applied to future land-use planning per Massachusetts Air National Guard Instruction (ANGI) 32-1003, Facilities Board and Massachusetts Army National Guard Regulation 210-20, Real Property Development Planning for the Army National Guard.

4. For the on-post areas, the Massachusetts 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 Massachusetts Air National Guard Instruction 32-1001, Operations Management. This procedure is a requirement of the Massachusetts Army National Guard, by the Massachusetts Air National Guard, through Installation Support Agreements. The Massachusetts 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 Army for concurrence before issuance. An AF Form 103 will not be processed without a Dig Safe permit number (see next paragraph).

5. The Dig Safe program implemented in Massachusetts provides an added layer of protection to prevent the installation of water supply wells in the L Range groundwater area and to protect monitoring wells. This program requires, by law, anyone conducting digging activities (e.g., well drilling) to request clearance through the Dig Safe network. The Air Force at the MMR is a member utility of Dig Safe. The Camp Edwards Training Range and Impact Area, including L Range, fall within the geographical area identified by the Air Force as a notification region within the Dig Safe program. Through the Dig Safe process, the Air Force will be electronically notified at least 72 hours prior to any digging within this area. The notification will include the name of the party contemplating,

and the nature of, the digging activity. Upon receiving Dig Safe notification of any proposed digging activity on Camp Edwards (which includes the Training Range and Impact Area), the Air Force will promptly transmit the Dig Safe notification information to the Army with a copy to the Massachusetts National Guard MMR Environmental & Readiness Center (E&RC). The Army (or its designee) will promptly review each notification and if the digging activity is intended to provide a previously unknown water supply well, the Army (or its designee) 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, the Army (or its designee) will mark its components to prevent damage due to excavation. The extent of the Army's enforcement of this land-use control does not address off-base parties failing to file a Dig Safe request or the improper processing of a notification; but if incidents do occur, the Army is responsible for ensuring remedy integrity and, if necessary, repairing damage caused by third parties to the monitoring wells.

In the event that the Town of Sandwich fails to promptly enforce the first land-use control, the Commonwealth of Massachusetts fails to promptly enforce the second land-use control, the Massachusetts Air and Army National Guards fail to promptly enforce the third or fourth land-use control, or the Air Force fails to promptly enforce the fifth land-use control, the Army will act in accordance with the third to last paragraph in this section, headed "*Activities Inconsistent With Land-Use Controls.*" Specifically, if the Army discovers that the party responsible for enforcing the identified land-use control has failed to promptly enforce that land-use control, then, as soon as practicable, but no later than 10 days after the Army becomes aware of this failure to promptly enforce the land-use control, the Army will notify the EPA and MassDEP and initiate actions to address such failure. The Army will notify the EPA and MassDEP regarding how the Army has addressed or will address the breach within 10 days of sending the EPA and MassDEP notification of the breach. For purposes of this paragraph, "promptly enforce" means if the violation or potential violation is imminent or on-going, enforce to prevent or terminate the violation within 10 days from the enforcing agency's (i.e., the Town's, Commonwealth's, Massachusetts Air and Army National Guards', or Air Force's) discovery of the violation or potential violation; otherwise, enforce as soon as possible.

Private Wells

The land-use controls are intended to prevent exposure to groundwater impacted by the plume. However, to ensure that the land-use controls achieve the land-use controls performance objectives, the Army will take the following additional action.

Within three years of the signing of this Decision Document, the Army shall:

a. Document all private wells (i.e., non-decommissioned wells, including wells not currently in use) that are above or within the projected path of the L Range plume.

b. Demonstrate and document that the private well is not capable of drawing contaminated groundwater originating from the L Range plume, or test the private well for contamination and demonstrate the private well to be safe for human use. The Army will continue such testing, on an appropriate frequency as determined in coordination with the EPA, until the plume no longer presents a threat to that well as determined in coordination with EPA.

c. If the Army identifies a well containing COCs, the Army shall assess the risk that current and potential future non-drinking uses of such a well pose to human health. The Army shall submit a draft version of any such risk assessment to EPA for review and approval.

d. If neither b nor c is able to confirm that the identified well is safe for human use, the Army will offer the owner decommissioning of the well. If accepted, the Army will document such action with the Sandwich Board of Health. If the decommissioning is not accepted, the Army will take other steps to ensure protectiveness to include, but not be limited to, requesting assistance from the Sandwich Board of Health to issue health warnings to the property owner and any other person with access to the well (such as a lessee or licensee), offering bottled water (if well is used for drinking), or installing treatment systems on affected wells. In each instance, the Army shall submit a schedule subject to EPA concurrence, outlining and including time limitations for the completion of steps sufficient to prevent exposure to concentrations of contaminated groundwater from the L Range plume having COCs in excess of cleanup levels.

Monitoring

Monitoring of the land-use restrictions and controls will be conducted annually by the Army. The monitoring results will be provided annually in a separate report or as a section of another monitoring report, if appropriate, and provided to the EPA and MassDEP. The 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 land-use controls and how any land-use control deficiencies or inconsistent uses have been addressed. The annual evaluation will address (1) whether the use restrictions and controls referenced above were put in place and effectively communicated, (2) whether the operator, owner, and state and local agencies were notified of the use restrictions and controls affecting the property, and (3) 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. In addition, the Annual Monitoring Report will include a discussion of the efforts undertaken during the past year to complete the tasks outlined in "*Private Wells*" above.

Operational Responsibilities and Liability

Upon approval by EPA, after consultation with MassDEP, 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 the SDWA § 1431(a) for remedy integrity.

Activities Inconsistent With Land-Use Controls

For any proposed land-use change(s) that would be inconsistent with the land-use control objectives or the final remedy, the Army shall seek EPA review and concurrence at least 45 days prior to any proposed land-use change(s). In addition, if the Army discovers a proposed or ongoing activity that would be or is inconsistent with the land-use control objectives or use restrictions, or any other action (or failure to act) that may interfere with the effectiveness of the land-use controls, it will address this activity or action as soon as practicable, but in no case will the process be initiated later than 10 days after the Army becomes aware of this breach. The Army will notify the EPA and MassDEP as soon as practicable, but no later than 10 days after the discovery of any activity that is inconsistent with the land-use controls objectives or use

restrictions, or any other action that may interfere with the effectiveness of the land-use controls. The Army will notify the EPA and MassDEP regarding how the Army has addressed or will address the breach within 10 days of sending the EPA and MassDEP notification of the breach.

Ensuring Continued Maintenance of Land-Use Controls

The Army will provide notice to the EPA and MassDEP at least six months prior to relinquishing the lease to the L Range area so the EPA and MassDEP can be involved in discussions to ensure that appropriate provisions are included in the transfer terms or conveyance documents to maintain effective land-use controls. If it is not possible for the Army to notify the EPA and MassDEP at least six 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 land-use controls.

The Army shall not modify or terminate land-use controls or implementation actions, or modify land-use without approval by the EPA, in consultation with MassDEP. The Army, in coordination with other agencies using or controlling the L Range site, shall obtain prior approval before taking any anticipated action that may disrupt the effectiveness of the land-use controls or any action that may alter or negate the need for land-use controls. The Army will provide EPA and MassDEP 30 days' notice of any changes to the internal procedures for maintaining land-use controls which may affect the site.

Expected Outcomes of the Selected Responses

The response action objectives for groundwater associated with the site are to restore the useable groundwater to its beneficial use, wherever practicable, within a timeframe that is reasonable given the particular circumstances of the site; 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 ingestion and inhalation of groundwater containing COCs (perchlorate and RDX) 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 permanent cleanup of COCs in groundwater. Specifically, RDX concentrations in groundwater are expected to drop below the 2 µg/L Health

Advisory by 2013, the 0.6 µg/L 10^{-6} risk-based level by 2027, and the 0.25 ug/L background level by 2040. Perchlorate concentrations in L Range groundwater have been below the 2 µg/L Massachusetts Maximum Contaminant Level since 2003 and are expected to reach background levels (0.35 ug/L) by approximately 2013.

Five-Year Reviews

In addition to annual reports on groundwater monitoring and verification of land-use controls, the groundwater response will be reviewed every five years. The purpose of the review is to revisit the appropriateness of the response in providing adequate protection of human health. The scope of the review will include, but is not limited to the following questions: is the response 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 (including, if necessary, reopening this decision) may be required as a result of these reviews.

Modifications

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

Response Completion

The Massachusetts Military Reservation (MMR) groundwater plumes, including the L Range plume, are located within the Cape Cod sole-source aquifer. Subject to EPA approval, in consultation with MassDEP, the following three-step process will be implemented by the Army to achieve site closure.

(1) The plume will be monitored in accordance with an EPA-approved monitoring plan.
(2) In accordance with applicable EPA guidance, a cumulative, residual risk assessment(s) for all contaminants will be performed to determine if additional measures are necessary to achieve acceptable risk levels.

(3) Once acceptable levels have been achieved, the technical feasibility of additional remediation to approach or achieve background concentrations will be evaluated.

In the event that a dispute arises regarding any of the determinations reached under the process outlined above, such dispute shall be resolved under the dispute resolution procedure of the AOs.

L. DETERMINATIONS

The groundwater response action selected for implementation at the L Range site 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, and 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 groundwater monitoring and institutional controls. In addition, the selected response action includes a periodic review at a frequency not to exceed five years so that relevant data can be provided to EPA for purposes of determining whether additional measures are necessary for the protection of human health.

As required by AO3, the selected alternative for the Site (Monitored Natural Attenuation and Land-Use Controls for groundwater and no further action for source areas) provides a level of protection to the aquifer underlying and downgradient of the Site commensurate with the aquifer's designation as a Sole Source Aquifer and a Potentially Productive Aquifer and is protective of human health. EPA's determination is related to unacceptable threats to the groundwater aquifer from the Site; however, by this Decision Document EPA is making no determination regarding any remaining public safety risk, ecological risk, dermal contact risk, and/or soil ingestion risk posed by any remaining contamination at the Site.

M. DOCUMENTATION OF NO SIGNIFICANT CHANGES

EPA presented a Remedy Selection Plan for the selected alternatives set forth in Part II for the Sites on May 19. EPA reviewed all written and verbal comments submitted during the public

comment period. EPA determined that no significant changes to the response action, as originally identified in the Remedy Selection Plan, were necessary.

N. STATE ROLE

The MassDEP has reviewed the various alternatives and has coordinated with EPA on this decision.

PART III: THE RESPONSIVENESS SUMMARY

On May 6, 2010 EPA published the remedy selection plan for the L Range site, which included the proposed remedies for the site and announced the public comment period on the proposed remedy. The EPA proposed the Monitored Natural Attenuation and Land-Use Controls alternative as the remedy for the site.

At the March 24 public meeting of the MMRCT and the SMB, held in Camp Edwards, MA, the Army gave a presentation on the remedy selection plan and the proposed remedy and answered questions from the teams.

In addition, the Army held a public hearing on the remedy selection plan on May 19, 2010 in Sandwich, MA. A public information session, along with a presentation on the remedy selection plan and EPA's proposed remedies were held prior to the opening of the public hearing. Local residents, officials, and news media representatives interested in site activities and cleanup decisions were invited to attend both meetings. Representatives from EPA, MassDEP, and Army were present.

The Army notified the public of the May 19 public meeting and announced the public comment period in a display ad placed in the May 7, 2010 editions of the *Cape Cod Times* and *Enterprise* newspapers, and display ads were placed in the May 14, 2010 editions of these same newspapers to announce the public hearing and as a reminder of the public comment period.

The Army placed copies of the remedy selection plan for the L Range in the Army's information repositories at the Bourne, Falmouth, and Sandwich, MA public libraries. The repository contains documents on the investigations and findings supporting selection of the response action including the feasibility study for the sites and other relevant documents upon which EPA relied in selecting the proposed remedies. The remedy selection plan also was made available on the Army Web site, which also contains the supporting documents and which offered a means of submitting public comments on the remedy selection plan.

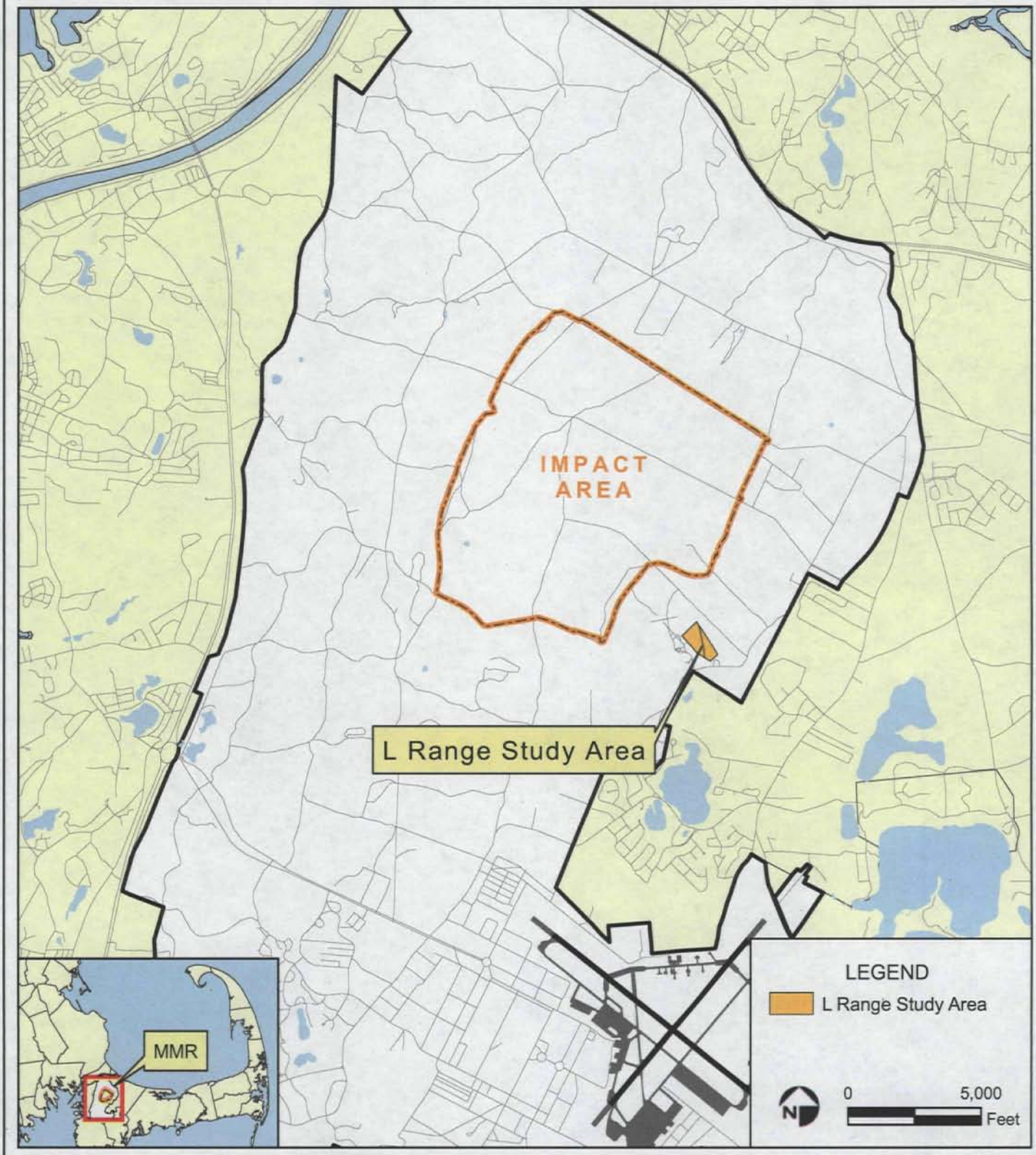
At the May 19, 2010 public meeting of the MMRCT, the team and public were given another opportunity to ask questions or make comments on the proposed remedies.

The following table provides a summary of issues and concerns that were raised during and after the public comment period held on the remedy selection plan for the L Range site from May 6 through June 4, 2010.

Comments:	Responses:
Comments from Ron Reif, P.E., MMRCT Member (RSP) Section: Source Area Response Action. This section should describe the follow-up testing that was conducted to evaluate the effectiveness of the treatment process, i.e., alkaline hydrolysis using hydrated lime. This section should describe what will happen to the treated soil.	A completion of work report detailing all excavation, confirmatory sampling and soil treatment activities will be prepared after soil treatment is complete. This report will be made available to MMRCT members and the public The follow-up testing was conducted in April 2010 and all explosives were below detection limits verifying the effectiveness of the treatment process. The treated soil was returned to the L Range excavation.
Comments from Ron Reif, P.E., MMRCT Member (RSP) Section: L Range Groundwater Alternatives (Alternative 2 - $1,873,426). Considering the relatively low concentrations (as indicated by sampling of more than 70 wells) and that the exposure pathways are incomplete (no residences in vicinity and down gradient residences are on municipal water supply), this remediation cost appears to be very high relative to the small/negligible reduction in risk. Also, this remediation alternative implies that the cleanup limit is 0.25 ug/L rather than 0.6 ug/L. As a tax payer and an environmental engineer, I'm wondering why we need to continue implementing this alternative for another 13 years just to reduce the theoretical RDX concentration from 0.6 to 0.25 ug/L. This seems like a waste of resources at a time when we need to be saving money.	EPA has determined that Alternative 2 (Monitored Natural Attenuation and Land-Use Controls) is preferred over Alternative 1 (No Action) because Alternative 2 includes provisions for plume monitoring to confirm that the plume is actually attenuating below cleanup levels, and land-use controls to prevent exposure until cleanup levels are attained. These added elements provide greater overall protection of human health and will confirm compliance with chemical-specific regulations by verifying that contaminant concentrations in fact decrease below cleanup standards. The cleanup level for the alternative proposed is the 10^{-6} risk-based level of 0.6 ug/L, which will be achieved in 2027.
Comments from James Matthew Callahan, New Haven CT I am writing in regard to a possible (proposed) remedy for groundwater contamination on the Upper Cape (Edward's Air Force) military base; it is my understanding that the Army has recommended "natural attenuation", which is most inadequate. It is my position that every effort possible should be made to utilize the EPA "superfund" to clean up the site as quickly as possible, as you may be aware, the issue of clean and safe drinking water as well as groundwater (sewer) discharge are issues of immense importance on Cape Cod and the luxury of using (wasting) time is simply not an option; the supply of safe and clean drinking water on the Cape cannot be put in jeopardy, any and all contamination must be eliminated as soon as possible and I would be glad to work with the state	The groundwater modeling predicts that the estimated time for restoring the aquifer to risk-based levels via natural attenuation will occur in 2027. EPA believes that this alternative will achieve permanent cleanup of RDX in groundwater economically and in a reasonable timeframe. All homes and businesses in the area are connected to town water and there are no public drinking water supplies downgradient of the plume. Thus, there is believed to be no current exposure to this plume. Moreover, this Decision Document requires the Army to take specific measures to enforce the land-use controls to prevent exposure to any contaminated groundwater associated with the L Range plume.

and Federal government to complete the work immediately. It is or should be understood that every effort possible should be made a preventing contamination in the future but when there is pollution it needs to be cleaned up immediately, with absolutely no time wasted. I would be glad to contact Senator John Kerry (and Senator Joseph Lieberman) about working with people at Yale University and possibly utilizing the endowment fund at Yale to solve the problem in the immediate future as well as making every effort possible to prevent pollution in the future. It is my opinion/position that environmental concerns and a growing economy can be accomplished at the same time in fact future industries will be based on those concerns and I feel so strongly about this subject that I am considering running for Congress from Cape Cod in the near future. In conclusion, I am writing to provide a possible (proposed) remedy for groundwater contamination at the Upper Cape (Edward's Air Force) military base and that remedy to work with Senator John Kerry to utilize the EPA "superfund" and possibly the Yale endowment fund to eliminate any pollution as quickly as possible as well as working to prevent any pollution in the immediate future; it is my position that such a plan will actually be conducive to economic growth on Cape Cod and if I decide to run for Congress environmental concerns will be the basis (platform) of my campaign. Thank you.	Given all of these factors, EPA believes that monitored natural attenuation with land use controls is protective of human health and the environment, complies with regulations, and provides an appropriate balance of the various factors for selecting the appropriate remedy for these plumes. Under the monitored natural attenuation remedy, EPA will continue to evaluate the results of the long-term groundwater monitoring program that will occur over the next several years, both through ongoing review of monitoring results and through the five-year review process. If the conditions change or the plumes are not behaving consistent with current groundwater modeling predictions, EPA can require the Army to re-evaluate and amend the current remedy, if necessary.

FIGURES



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

Impact Area Groundwater Study Program

DRAFT

Location of L Range Study Areas
Massachusetts Military Reservation

FIGURE
1

ECC GIS Server
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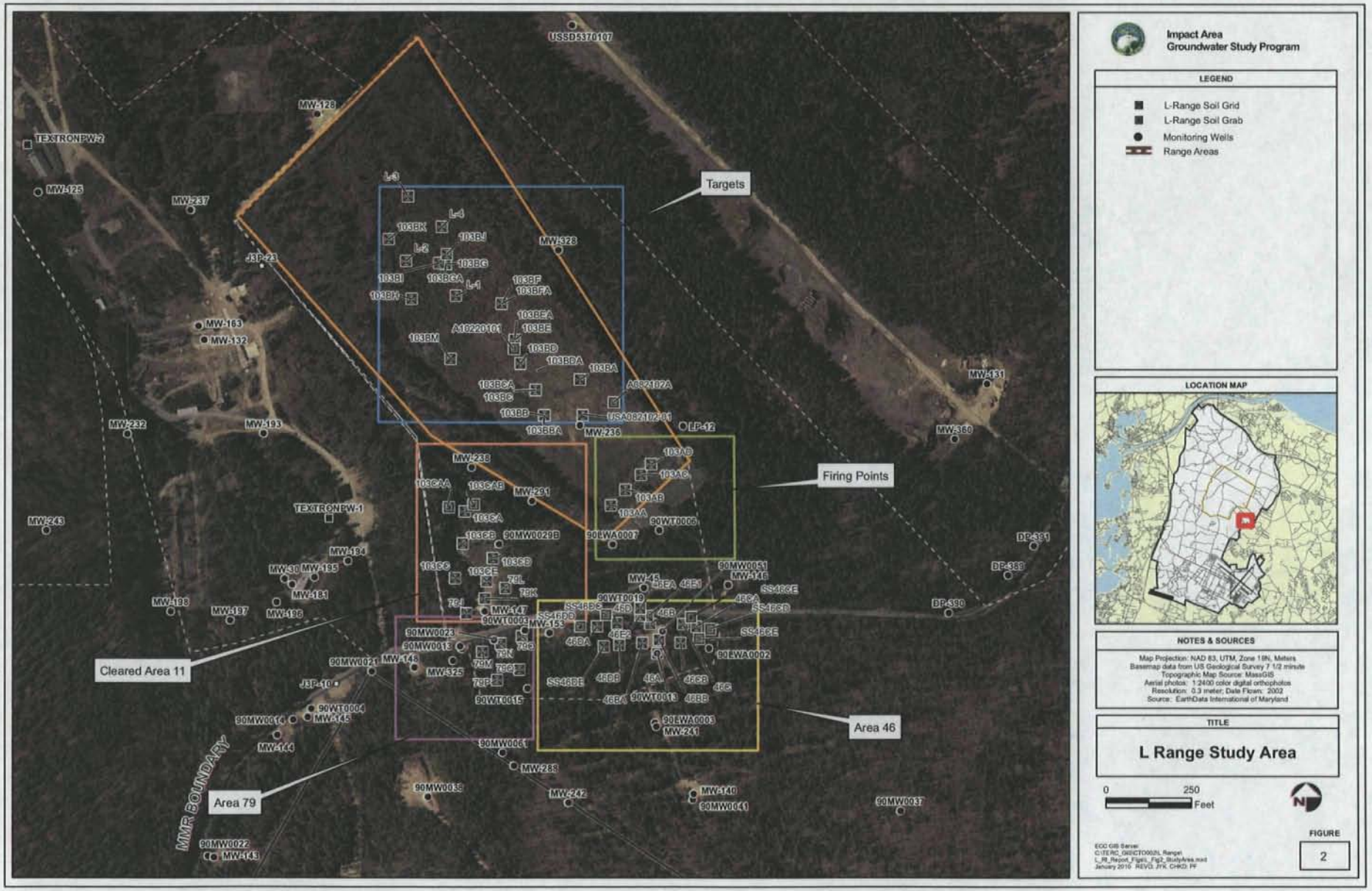
October 2007 REVD: JYK CHKD: PF



Impact Area
Groundwater Study Program

LEGEND

- L-Range Soil Grid
- L-Range Soil Grab
- Monitoring Wells
- Range Areas

LOCATION MAP

NOTES & SOURCES

Map Projection: NAD 83, UTM, Zone 19N, Meters
Basemap data from US Geological Survey 7 1/2 minute Topographic Map Source: MassGIS
Aerial photos: 1:2400 color digital orthophotos
Resolution: 0.3 meter; Date Flown: 2002
Source: EarthData International of Maryland

TITLE

L Range Study Area

0 250 Feet

ECC GIS Server:
C:\TERC_GIS\CTO002\L Range\
L_IR_Report_Figs\L_Fig2_StudyArea.mxd
January 2010 REVD. JYK CHKD: PF

FIGURE 2

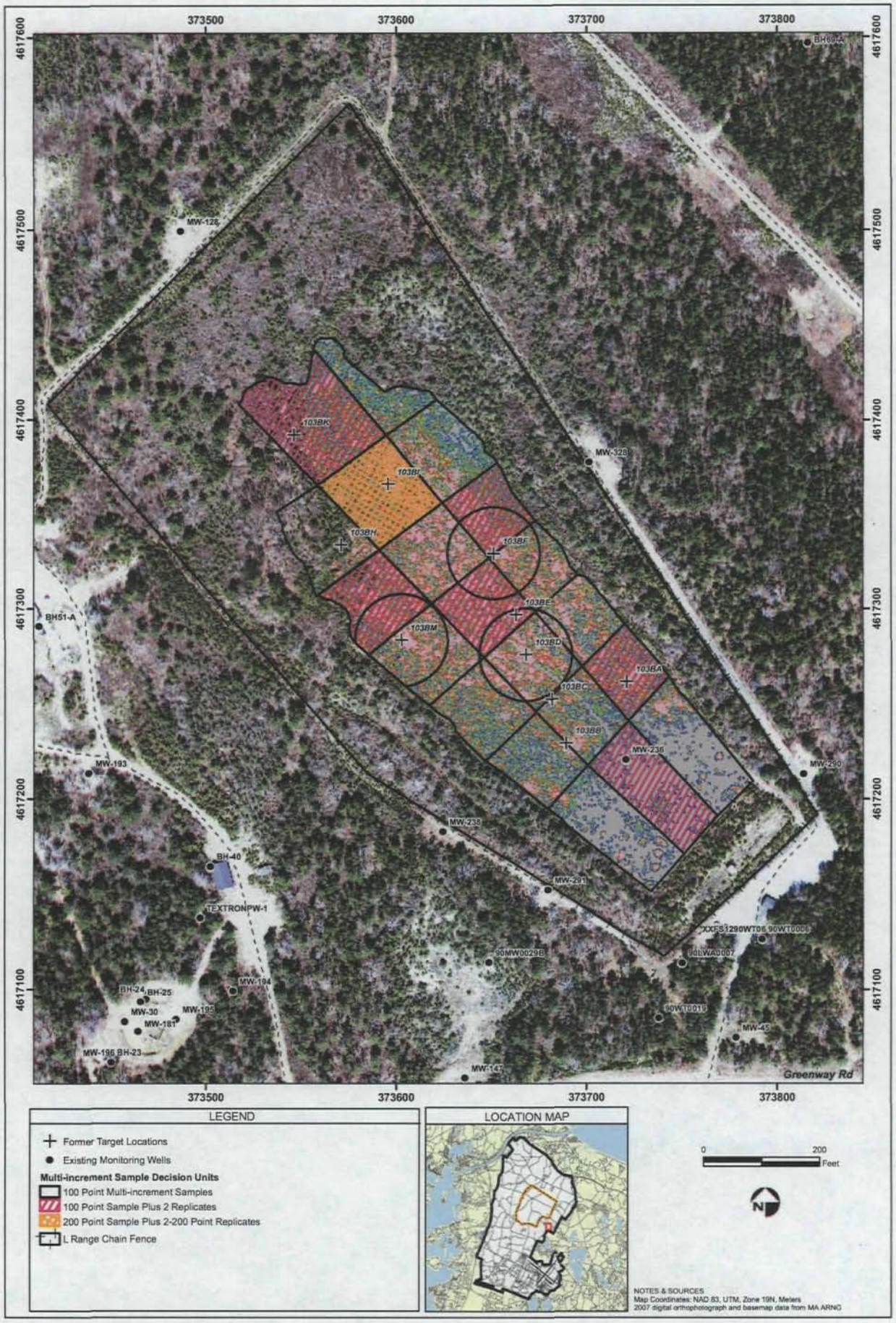
ECC MMR
Cape Cod, Massachusetts

L Range
Limits of Excavation

FIGURE
3

GIS Server
C:\TERC_GIS\CTO002\L Range\L_RI_Report_Figs\
L_Fig3-3_Excavation.mxd
April 2010 DWN BY: JYK CHKD BY: PF

Impact Area
Groundwater Study Program



ECC MMR
Cape Cod, Massachusetts

L Range
Multi-Increment Sample Locations

FIGURE
4

GIS Server
C:\TERC_GIS\CTO002\L Range\L_RI_Report_Figs\L_Fig3-2_MIS_Nov08.mxd
November 2008 DWN BY: JYK CHKD BY: MJG

Impact Area
Groundwater Study Program

Impact Area Groundwater Study Program

LEGEND

MMR Boundary

Range Boundary

RDX Detection

0.6-2 µg/L

2-20 µg/L

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

L Range
Groundwater Contamination 2007

0 500 Feet

Jacobs
Bourne, Massachusetts

Y:\A_TERC\Projects\35AYS302\2010\0630\ArcGIS\L_range_gw_plumes_rl_fs_07_final3.mxd
June 30, 2010 jpiccuito Checked by Kelle Thomas

FIGURE 5

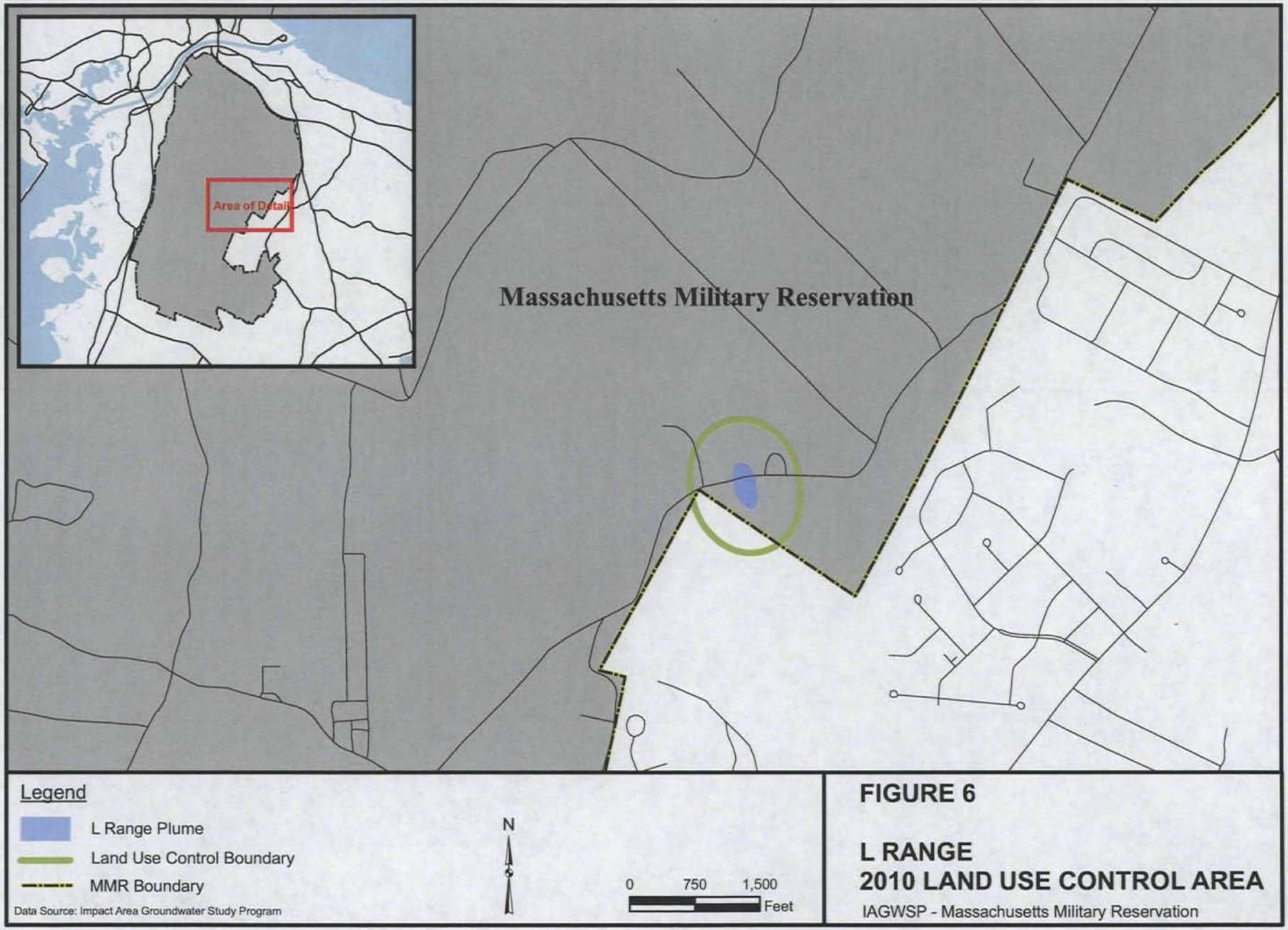


FIGURE 6

L RANGE
2010 LAND USE CONTROL AREA

IAGWSP - Massachusetts Military Reservation

TABLES

TABLE 1
Summary of Alternatives

Alternative	Design Details		Cleanup Timeframes			Cost
	Number of Extraction Wells	Total Extraction Rate (gpm)	Year Concentrations are Below 2 µg/L[1]	Year Concentrations are Below 0.6 µg/L[1]	Year Concentrations are Below Nondetect[1]	Total Cost
1	0	0	2013	2027	2040	$1,600,000
2	0	0	2013	2027	2040	$3,400,000
3	1	50	2012	2016	2024	$5,300,000

NOTES:

[1]Based on review of the animation, the estimated time all concentrations are below the listed level except for mass retained in low-hydraulic-conductivity units.

ug/Kg = microgram/Kilogram
µg/L = micrograms per liter
gpm = gallons per minute
kg = kilograms

Table 2
L Range Remedial Investigation/Feasability Study
Summary of Regulatory Considerations*

AUTHORITY/TYPE	PROVISION	SYNOPSIS
Federal/Chemical Specific	SDWA MCLs, 40 CFR 141.61 – 141.63	The EPA has promulgated SDWA MCLs (40 CFR 141-143) that are enforceable standards for public drinking water supplies. The standards protect drinking water quality by limiting the levels of specific contaminants that can adversely affect public health.
State/Chemical Specific	MA Drinking Water Regulations, 310 CMR 22.00	These standards establish Massachusetts MCLs (MMCLs) for public drinking water systems (310 CMR 22.00 et seq.).
Federal/Action Specific	SDWA 47 FR 30282 Sole Source Aquifer	Pursuant to Section 1424(e) of the Safe Drinking Water Act, the EPA has 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.
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.
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.
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.

Table 2
L Range Remedial Investigation/Feasability Study
Summary of Regulatory Considerations*

AUTHORITY/TYPE	PROVISION	SYNOPSIS
State/Chemical Specific	Massachusetts Contingency Plan, Method 1, GW-1 Groundwater Standards, 310 CMR 40.0974(2) Table 1	These cleanup standards were developed by MassDEP considering a defined set of exposures considered to be a conservative estimate of the potential exposures at most sites. Groundwater at MMR is classified as GW-1.
State/Chemical Specific	Massachusetts Drinking Water Guidelines, in Standards and Guidelines for Chemicals in Massachusetts Drinking Waters (Spring 2009), available at http://www.mass.gov/dep/water/dwstand.pdf.	This document lists both promulgated Massachusetts MCLs and also MassDEP Office of Research and Standards guidelines for chemicals that do not have Massachusetts MCLs. Standards promulgated by EPA but not yet effective may be included on the Guidelines list. These values are derived based on a review and evaluation of all available data for the chemical of interest.
State/Action 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.
Federal/Action Specific	Subtitle C Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities, 40 CFR Part 264	These requirements establish minimum national standards that define the acceptable management of hazardous waste.
State/Action Specific	MA Hazardous Waste Management Regulations (310 CMR 30.0000)	These requirements specify how a generator of solid waste must determine whether that waste is hazardous. If waste is determined to be hazardous, it must be managed in accordance with these requirements.

Table 2
L Range Remedial Investigation/Feasability Study
Summary of Regulatory Considerations*

AUTHORITY/TYPE	PROVISION	SYNOPSIS
Federal/Action Specific	EPA Guidance on "Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites" (9200.4-17P) (Apr. 21, 1999)	This guidance describes EPA's policy regarding the use of monitored natural attenuation (MNA) for the cleanup of contaminated soil and groundwater. It provides guidance regarding necessary site-specific characterization data and analysis, a methodology for determining a reasonable timeframe for remediation, a preference for remediation of sources, appropriate performance monitoring and evaluation, and a preference for contingency remedies.
Federal/Action Specific	Resource Conservation and Recovery Act (RCRA) [40 CFR 261-262]	These regulations govern the identification and listing of hazardous waste under RCRA, and the requirements on generators of hazardous waste.
Federal/Action Specific	RCRA Land Disposal Restrictions [40 CFR 268]	These regulations restrict the disposal of any treatment wastes classified as hazardous waste.
State/Action Specific	Solid Waste Management Regulations (RCRA Subtitle D), 310 CMR 19.000 et seq.	If a waste is determined to be a solid waste, it must be managed in accordance with the state regulations at 310 CMR 19.000 et seq.
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.
Federal/Action Specific	Underground Injection Control Program [40 CFR 114, 144, 146, 147, 148, 1000]	Underground Injection Control Program regulations outline minimum program and performance standards for underground injection wells and prohibit any injection that may cause a violation of any primary drinking water regulation in the aquifer. Infiltration galleries and wells fall within the broad definition of Class V wells. These regulations are administered by the State.

Table 2
L Range Remedial Investigation/Feasability Study
Summary of Regulatory Considerations*

AUTHORITY/TYPE	PROVISION	SYNOPSIS
State/Action Specific	MassDEP Stormwater Management Program Policy (Nov. 18, 1996)	Provides policies and guidance on complying with the state's stormwater discharge requirements.
Federal/Action Specific	National Environmental Policy Act, 42 U.S.C. 4321-4370f	"EPA believes that NGB is not required to follow NEPA procedures, as long as the NGB's actions are conducted in accordance with the administrative order, because of the provision in the CEQ regulations exempting enforcement actions from NEPA." (USEPA, 1 March 01)
Federal/Action Specific	CWA NDPES 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.
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).
State/Chemical Specific	Massachusetts Air Pollution Control Regulations [310 CMR 6.00 – 7.00]	Construction activities could trigger Massachusetts Air Pollution Control Regulations (310 CMR 6.00 – 7.00). These regulations set emission limits necessary to attain ambient air quality standards for fugitive emissions, dust and particulates.

Table 2
L Range Remedial Investigation/Feasability Study
Summary of Regulatory Considerations*

AUTHORITY/TYPE	PROVISION	SYNOPSIS
State/Action Specific, Chemical Specific	310 CMR 40.0040 Construction and operation of a groundwater treatment plant	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.
State/Action Specific, Chemical Specific	Discharge of Groundwater 310 CMR 40.0045	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 6.0. The concentrations must also be below the applicable Reportable Concentrations established by 310 CMR 40.0300 and 40.1600.
State/Action 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.

Table 2
L Range Remedial Investigation/Feasability Study
Summary of Regulatory Considerations*

AUTHORITY/TYPE	PROVISION	SYNOPSIS
State/Action Specific	Groundwater Discharge Regulations [314 CMR 5.00]	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 C. 21E and regulations at 40 CMR 40.00 applies. The effluent discharged must not exceed any Massachusetts Groundwater Quality Standards and effluent limitations in 314 CMR 5.10(3). For previous projects on MMR, the MassDEP has determined that effluent from any constructed treatment system is "conditionally exempt" from obtaining the permit provided that the applicable or relevant provisions of the MCP 310 CMR 40.0000 are complied with.
State/Action Specific	MassDEP Drinking Water Program, Private Well Guidelines (2008), available at http://www.mass.gov/dep/water/laws/prwellgd.pdf	These are guidelines concerning private well location, design, construction, development, water quality testing, operation, maintenance, and decommissioning.
State/Action Specific	Underground Injection Control [310 CMR 27.00]	These 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 adversely affect the health of persons.
State/Action Specific	STATE - MA Erosion and Sediment Control Guidelines for Urban and Suburban Areas (May 2003), available at http://www.mass.gov/dep/water/essec1.pdf	Provides guidance and best management practices regarding erosion and sediment control.

Table 2
L Range Remedial Investigation/Feasability Study
Summary of Regulatory Considerations*

AUTHORITY/TYPE	PROVISION	SYNOPSIS
Federal/Action Specific	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, National Historic Preservation Act, 16 U.S.C. §§ 470 et seq., 36 CFR Part 800; Massachusetts Historic Preservation Act, MGL ch. 9 §§ 26-27C; MGL ch. 7, § 38A; MGL ch. 38, §§ 6B-6C; 950 CMR 70-71.	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.
State/Action Specific	Massachusetts Endangered Species Act.	The Massachusetts Endangered Species Act provides that impacts to state-listed endangered or threatened species, or species of special concern or their habitats from actions are to be avoided, minimized, and/or mitigated.

*Regulations that EPA will either consider or require, as appropriate, in selecting and defining the remedial action as specified in the final decision document.

TABLE 3a
Soil Screening - Organic Analytes

Analyte	Maximum Detected Concentration (mg/kg)	Location of Maximum Concentration	Detection Frequency	MCP S-1/GW-1 Standard	MassDEP Leaching Based Soil Concentration	MMR SSL	EPA Region 3 Risk-Based SSL	Background Value [a]
1,2,4-Trichlorobenzene	2.00E-03	SS103BK-01	1 / 222	2.00E+00	2.24E+00	NA	1.30E-02	NA
1,3-Diethyl-1,3-diphenyl ure	2.00E-02	HC103AD1BAA	1 / 194	NA	NA	NA	NA	NA
2-Methylnaphthalene	3.30E-01	HC46C1AAA	10 / 222	7.00E-01	3.60E-01	**7.23E-02**	9.00E-01	5.00E-01
Acenaphthene	4.80E-01	HC46C1AAA	15 / 222	4.00E+00	3.88E+00	2.71E+00	2.70E+01	5.00E-01
Acenaphthylene	2.50E-01	HC46C1AAA	12 / 222	1.00E+00	1.18E+00	**6.76E-02**	2.70E+01	5.00E-01
Acetone	1.80E+00	HD103BF1BAA	187 / 200	6.00E+00	6.30E+00	**1.07E-01**	4.40E+00	NA
alpha-BHC	1.30E-03	HD103BB3AAD	1 / 237	NA	NA	**6.18E-05**	**7.40E-05**	NA
alpha-Chlordane	1.80E-03	HC46C1CAA	4 / 237	1.00E+00	4.00E-02	**3.84E-04**	3.30E-02	NA
gamma-Chlordane	1.60E-03	HC46D1CAA	1 / 237	1.00E+00	1.20E+00	**3.84E-05**	3.30E-02	NA
Anthracene	4.90E-01	HC46C1AAA	17 / 222	1.00E+03	NA	5.38E+01	4.50E+02	1.00E+00
Benzene	1.20E-02	HC103BB1BAA	6 / 200	2.00E+00	1.50E+00	**1.03E-04**	**2.30E-04**	NA
Benzo(a)anthracene	2.10E+00	HC46C1AAA	46 / 222	7.00E+00	NA	**3.69E-02**	**1.40E-02**	2.00E+00
Benzo(a)pyrene	2.40E+00	HC46C1AAA	46 / 222	**2.00E+00**	NA	**2.03E-01**	**4.60E-03**	2.00E+00
Benzo(b)fluoranthene	2.70E+00	HC46C1AAA	50 / 222	7.00E+00	NA	**1.14E-01**	**4.70E-02**	2.00E+00
Benzo(g,h,i)perylene	8.70E-01	HC46C1AAA	36 / 222	1.00E+03	NA	5.54E+02	**5.60E-04**	1.00E+00
Benzo(k)fluoranthene	3.00E+00	HC46C1AAA	49 / 222	7.00E+01	NA	**1.14E-01**	**4.60E-01**	1.00E+00
Benzoic acid	8.50E-01	HC103BB1AAA	33 / 194	NA	NA	NA	3.30E+01	NA
Benzyl butyl phthalate	3.70E-01	HD103BD7AAA	4 / 222	NA	NA	4.91E+02	6.70E-01	NA
beta-BHC	2.00E-03	HD103BH1AAA	1 / 237	NA	NA	**1.99E-04**	**2.60E-04**	NA
Bis(2-chloroethyl) ether	9.50E-02	HC103BG1AAA	1 / 222	7.00E-01	**2.85E-02**	NA	**2.70E-06**	NA
Bis(2-ethylhexyl) phthalate	8.10E+00	HC103BD1BAA	48 / 222	2.00E+02	NA	7.20E+01	**1.60E+00**	NA
Bromoform	1.00E-03	HD103BGA6DAA	6 / 200	1.00E-01	7.00E-03	2.17E-03	2.30E-03	NA
Bromomethane	1.20E-02	HDA10220101AA	9 / 200	5.00E-01	5.00E-02	**1.82E-03**	**2.20E-03**	NA
Carbazole	6.30E-01	HC46C1AAA	16 / 222	NA	NA	**1.21E-02**	NA	NA
Chlorobenzene	1.00E-03	HC46B1CAA	1 / 200	1.00E+00	1.20E+00	NA	6.80E-02	NA
Chloroform	2.00E-02	HC46D1AAA	11 / 200	4.00E-01	3.50E-01	**3.64E-05**	**5.50E-05**	NA

TABLE 3a
Soil Screening - Organic Analytes

Analyte	Maximum Detected Concentration (mg/kg)	Location of Maximum Concentration	Detection Frequency	MCP S-1/GW-1 Standard	MassDEP Leaching Based Soil Concentration	MMR SSL	EPA Region 3 Risk-Based SSL	Background Value [a]
Chloromethane	1.60E-02	HDA10220101AA	9 / 200	NA	NA	**3.99E-04**	4.90E-02	NA
Chrysene	4.10E+00	HC46C1AAA	65 / 222	7.00E+01	NA	**3.40E+00**	**1.40E+00**	2.00E+00
Dalapon	2.40E+00	HD103BG5CAA	1 / 211	NA	NA	NA	**4.10E-02**	NA
DDD	2.00E-02	HD103BB1CAA	11 / 207	4.00E+00	NA	2.78E-01	8.60E-02	NA
DDE	2.00E-02	HC79J1BAA	17 / 211	3.00E+00	NA	8.84E-01	6.00E-02	NA
DDT	4.40E-02	HC46B1BAA	30 / 211	3.00E+00	NA	5.25E-01	8.70E-02	NA
Dibenz(a,h)anthracene	3.60E-01	HC46C1AAA	18 / 222	7.00E-01	NA	**3.77E-02**	**1.60E-02**	5.00E-01
Dibenzofuran	3.80E-01	HC46C1AAA	13 / 222	NA	NA	**2.62E-01**	NA	NA
Dicamba	6.60E-03	HD103BB1BAA	1 / 211	NA	NA	2.65E-01	2.80E-01	NA
Dieldrin	5.20E+00	46CC-01	61 / 235	**5.00E-02**	NA	**7.99E-04**	**9.00E-05**	NA
Diethyl phthalate	1.90E-02	HC103BB1AAA	1 / 222	1.00E+01	9.98E+00	1.34E+01	1.30E+01	NA
Di-n-butyl phthalate	5.30E-02	HC103BD1CAA	7 / 222	NA	NA	1.51E+02	1.10E+01	NA
Di-n-octylphthalate	1.10E-01	HC103BD1BAA	1 / 222	NA	NA	4.80E-01	NA	NA
Endosulfan sulfate	2.20E-03	HC103BB1BAA	1 / 236	5.00E-01	5.40E-01	2.18E+00	9.70E+00	NA
Endrin aldehyde	1.30E-01	HD103BC3AAD	6 / 236	8.00E+00	NA	1.89E-01	**4.30E-02**	NA
Endrin ketone	3.00E-02	HC46C1AAA	12 / 236	8.00E+00	NA	1.89E-01	4.30E-02	NA
Fluoranthene	7.60E+00	HC46C1AAA	66 / 222	1.00E+03	NA	1.08E+02	2.10E+02	4.00E+00
Fluorene	5.10E-01	HC46C1AAA	17 / 222	1.00E+03	NA	1.39E+01	3.30E+01	1.00E+00
Heptachlor epoxide	2.30E-02	HD103BD1AAA	3 / 237	9.00E-02	NA	**6.10E-03**	**7.90E-05**	NA
Indeno(1,2,3-c,d)pyrene	9.00E-01	HC46C1AAA	35 / 222	7.00E+00	NA	**3.17E-01**	**1.60E-01**	1.00E+00
MCPA	1.40E+01	HC46C1AAA	2 / 209	NA	NA	**1.43E-03**	**4.70E-03**	NA
Methyl ethyl ketone	3.80E-02	SS103BK-02	121 / 200	4.00E+00	4.00E+00	3.35E-01	1.50E+00	NA
Methylene chloride	7.00E-03	HC46C1BAA	6 / 200	1.00E-01	1.00E-02	NA	**1.30E-03**	NA
Naphthalene	3.30E-01	HC46C1AAA	10 / 222	4.00E+00	4.48E+00	**1.36E-02**	**5.60E-04**	5.00E-01
Nitrate/nitrite	1.10E+00	SS103BK-01	143 / 198	NA	NA	NA	NA	NA
Nitroglycerin	4.70E+00	HD46B2AAA	2 / 376	NA	NA	**1.02E-03**	**1.70E-03**	NA

TABLE 3a
Soil Screening - Organic Analytes

Analyte	Maximum Detected Concentration (mg/kg)	Location of Maximum Concentration	Detection Frequency	MCP S-1/GW-1 Standard	MassDEP Leaching Based Soil Concentration	MMR SSL	EPA Region 3 Risk-Based SSL	Background Value [a]
N-nitrosodiphenylamine	7.50E-02	HD103BB3AAA	4 / 222	NA	NA	**7.77E-03**	1.70E-01	NA
Pentachlorophenol	7.00E-02	HD103BB1BAA	6 / 215	3.00E+00	**8.00E-03**	**4.29E-04**	**3.90E-03**	NA
Phenanthrene	8.50E+00	HC46C1AAA	57 / 222	1.00E+01	1.09E+01	4.81E+01	1.50E+02	3.00E+00
Phenol	3.90E-02	HD103BB3CAD	1 / 222	1.00E+00	9.51E-01	7.66E-01	8.10E+00	NA
Phosphorus	6.83E+02	HD103BG5CAA	198 / 198	NA	NA	NA	NA	NA
Picloram	6.80E-03	HC103AA1AAA	1 / 172	NA	NA	8.82E-02	1.20E-01	NA
Pyrene	5.90E+00	HC46C1AAA	67 / 222	1.00E+03	NA	1.90E+01	1.50E+02	4.00E+00
Silvex	8.30E-03	HC46B1BAA	1 / 211	NA	NA	NA	1.80E-02	NA
Styrene	1.00E-03	HD103BF5CAA	1 / 200	3.00E+00	2.90E+00	2.34E+00	1.30E-01	NA
Tetryl	2.10E+00	HD103BI7CAA	1 / 376	NA	NA	**6.37E-02**	**6.50E-01**	NA
Toluene	1.50E-02	HC103AA1BAA	101 / 200	3.00E+01	3.20E+01	2.72E-01	7.60E-01	NA

[a] MassDEP background (MADEP 2002).

Shading indicates that the screening level was exceeded by the maximum detected concentration.

MassDEP Leaching Based Soil Concentrations are not used as a screening criteria, but are included for comparison purposes only.

Table 3b
Soil Screening by Sub-Area - Metals

Analyte	Maximum Detected Concentration (mg/kg)	Location of Maximum Concentration	Detection Frequency	Average Concentration [a]	MCP S-1/GW-1 Standard	MADEP Leaching Based Soil Concentration [c]	MMR SSL	EPA Risk-Based SSL	Background Value [b]
L Range - Firing Points									
Aluminum	9.87E+03	HC103AA1CAA	12 / 12	5.81E+03	NA	NA	5.40E+04	5.50E+04	1.00E+04
Arsenic	3.50E+00	HC103AA1BAA	12 / 12	2.10E+00	2.00E+01	NA	**9.01E-03**	**1.30E-03**	3.90E+00
Barium	1.45E+01	HC103AC1AAA	12 / 12	9.72E+00	1.00E+03	NA	1.20E+02	8.20E+01	1.60E+01
Beryllium	4.00E-01	HC103AA1BAA	12 / 12	2.25E-01	1.00E+02	NA	2.60E+00	3.20E+00	3.30E-01
Cadmium	3.60E-01	HC103AA1CAA	4 / 12	1.15E-01	2.00E+00	NA	4.01E-01	3.80E-01	3.50E-01
Calcium	2.94E+02	HC103AC1AAA	12 / 12	1.22E+02	NA	NA	NA	NA	1.80E+02
Chromium, total	1.17E+01	HC103AA1CAA	12 / 12	7.94E+00	3.00E+01	NA	**7.02E+00**	1.80E+05	1.50E+01
Cobalt	9.30E+00	HC103AA1BAA	12 / 12	2.64E+00	NA	NA	1.32E+02	**5.00E-01**	NA
Copper	1.61E+01	HC103AB1BAA	12 / 12	9.47E+00	NA	NA	4.57E+01	4.60E+01	1.10E+01
Iron	1.16E+04	HC103AA1CAA	12 / 12	7.38E+03	NA	NA	**2.42E+03**	**6.40E+02**	1.20E+04
Lead	1.55E+01	HC103AD1AAA	12 / 12	8.68E+00	3.00E+02	NA	**4.05E+00**	NA	1.90E+01
Magnesium	1.71E+03	HC103AA1CAA	12 / 12	9.84E+02	NA	NA	NA	NA	1.50E+03
Manganese	3.04E+02	HC103AA1BAA	12 / 12	9.33E+01	NA	NA	**4.42E+01**	**5.70E+01**	1.10E+02
Nickel	6.30E+00	HC103AA1CAA	12 / 12	4.14E+00	2.00E+01	NA	2.92E+02	4.80E+01	6.90E+00
Potassium	5.67E+02	HC103AA1CAA	12 / 12	3.97E+02	NA	NA	NA	NA	5.60E+02
Thallium	1.30E+00	HC103AA1CAA	2 / 12	4.48E-01	8.00E+00	NA	3.00E+00	**1.40E-01**	6.00E-01
Vanadium	1.80E+01	HC103AA1CAA	12 / 12	1.12E+01	6.00E+02	NA	2.60E+02	2.60E+02	2.20E+01
Zinc	2.69E+01	HC103AB1AAA	12 / 12	1.77E+01	2.50E+03	NA	2.20E+03	6.80E+02	2.60E+01

Table 3b
Soil Screening by Sub-Area - Metals

Analyte	Maximum Detected Concentration (mg/kg)	Location of Maximum Concentration	Detection Frequency	Average Concentration [a]	MCP S-1/GW-1 Standard	MADEP Leaching Based Soil Concentration [c]	MMR SSL	EPA Risk-Based SSL	Background Value [b]
L Range - Targets									
Aluminum	2.14E+04	HD103BC7CAA	275 / 275	1.20E+04	NA	NA	5.40E+04	5.50E+04	1.00E+04
Antimony	1.60E+00	HD103BF3AAD	115 / 275	6.28E-01	2.00E+01	NA	**2.71E-01**	**2.70E-01**	1.00E+00
Arsenic	1.68E+01	HD103BDA5DAA	261 / 275	4.11E+00	2.00E+01	NA	**9.01E-03**	**1.30E-03**	3.90E+00
Barium	5.82E+01	HDA08210201SS5	275 / 275	1.45E+01	1.00E+03	NA	1.20E+02	8.20E+01	1.60E+01
Beryllium	9.20E-01	HD103BDA5DAA	258 / 275	3.12E-01	1.00E+02	NA	2.60E+00	3.20E+00	3.30E-01
Boron	1.49E+01	HDA08210201SS5	209 / 275	3.28E+00	NA	NA	**9.52E+00**	2.30E+01	1.70E+01
Cadmium	2.30E+00	HC103BA1CAA	181 / 275	1.87E-01	**2.00E+00**	NA	**4.01E-01**	**3.80E-01**	3.50E-01
Calcium	1.45E+03	HD103BFA5AAA	264 / 275	1.27E+02	NA	NA	NA	NA	1.80E+02
Chromium, total	3.95E+01	HDA08210201SS5	275 / 275	1.43E+01	**3.00E+01**	NA	**7.02E+00**	1.80E+05	1.50E+01
Cobalt	1.43E+01	HD103BFA5AAA	275 / 275	4.08E+00	NA	NA	1.32E+02	**5.00E-01**	NA
Copper	1.81E+03	HD103BE3AAD	271 / 275	1.70E+01	NA	NA	**4.57E+01**	**4.60E+01**	1.10E+01
Iron	4.37E+04	HD103BG5CAA	275 / 275	1.33E+04	NA	NA	**2.42E+03**	**6.40E+02**	1.20E+04
Lead	1.26E+02	HC103BF1AAA	275 / 275	1.76E+01	3.00E+02	NA	**4.05E+00**	NA	1.90E+01
Magnesium	8.48E+03	HD103BFA5AAA	275 / 275	1.56E+03	NA	NA	NA	NA	1.50E+03
Manganese	1.67E+03	HD103BG5CAA	275 / 275	9.39E+01	NA	NA	**4.42E+01**	**5.70E+01**	1.10E+02
Mercury	9.00E-02	HD103BDA3CAA	17 / 275	1.51E-02	2.00E+01	NA	**2.04E-02**	**3.00E-02**	1.00E-01
Molybdenum	4.80E+00	HD103BG5CAA	140 / 275	5.07E-01	NA	NA	**1.83E-01**	**3.70E+00**	1.10E+00
Nickel	3.88E+01	HD103BFA5AAA	275 / 275	7.19E+00	**2.00E+01**	NA	2.92E+02	4.80E+01	6.90E+00
Potassium	1.98E+03	HD103BFA5AAA	244 / 275	5.96E+02	NA	NA	NA	NA	5.60E+02
Selenium	1.30E+00	HDA08210201SS2	51 / 275	4.27E-01	4.00E+02	NA	2.76E+00	**2.60E-01**	5.00E-01
Silver	4.70E-01	HC103BJ1BAA	8 / 275	1.64E-01	1.00E+02	NA	1.62E+01	1.60E+00	5.20E-01
Sodium	1.26E+02	SS103BK-01FD	1 / 275	4.15E+01	NA	NA	NA	NA	1.60E+02
Thallium	7.40E-01	SS103BK-01	1 / 275	4.42E-01	8.00E+00	NA	3.00E+00	**1.40E-01**	6.00E-01
Vanadium	5.14E+01	HD103BFA5AAA	275 / 275	2.24E+01	6.00E+02	NA	2.60E+02	2.60E+02	2.20E+01
Zinc	2.96E+02	HD103BD1BAA	275 / 275	3.83E+01	2.50E+03	NA	2.20E+03	6.80E+02	2.60E+01

Table 3b
Soil Screening by Sub-Area - Metals

Analyte	Maximum Detected Concentration (mg/kg)	Location of Maximum Concentration	Detection Frequency	Average Concentration [a]	MCP S-1/GW-1 Standard	MADEP Leaching Based Soil Concentration [c]	MMR SSL	EPA Risk-Based SSL	Background Value [b]
AREA 46									
Aluminum	1.88E+04	HC46C1CAA	12 / 12	9.88E+03	NA	NA	5.40E+04	5.50E+04	1.00E+04
Antimony	1.00E+00	HC46D1AAA	5 / 12	4.70E-01	2.00E+01	NA	**2.71E-01**	**2.70E-01**	1.00E+00
Arsenic	4.60E+00	HC46C1CAA	12 / 12	3.22E+00	2.00E+01	NA	**9.01E-03**	**1.30E-03**	3.90E+00
Barium	1.67E+01	HC46C1CAA	12 / 12	1.32E+01	1.00E+03	NA	1.20E+02	8.20E+01	1.60E+01
Beryllium	3.40E-01	HC46C1CAA	12 / 12	2.10E-01	1.00E+02	NA	2.60E+00	3.20E+00	3.30E-01
Boron	4.10E+00	HC46A1CAA	3 / 12	1.19E+00	NA	NA	9.52E+00	2.30E+01	1.70E+01
Calcium	3.31E+02	HC46A1AAA	12 / 12	2.05E+02	NA	NA	NA	NA	1.80E+02
Chromium, total	1.81E+01	HC46C1CAA	12 / 12	1.08E+01	3.00E+01	NA	**7.02E+00**	1.80E+05	1.50E+01
Cobalt	3.10E+00	HC46A1BAA	12 / 12	2.32E+00	NA	NA	1.32E+02	**5.00E-01**	NA
Copper	1.28E+01	HC46B1BAA	12 / 12	4.46E+00	NA	NA	4.57E+01	4.60E+01	1.10E+01
Iron	1.66E+04	HC46C1CAA	12 / 12	1.07E+04	NA	NA	**2.42E+03**	**6.40E+02**	1.20E+04
Lead	1.64E+01	HC46C1AAA	12 / 12	1.21E+01	3.00E+02	NA	**4.05E+00**	NA	1.90E+01
Magnesium	1.25E+03	HC46C1CAA	12 / 12	1.06E+03	NA	NA	NA	NA	1.50E+03
Manganese	7.29E+01	HC46A1AAA	12 / 12	5.47E+01	NA	NA	**4.42E+01**	**5.70E+01**	1.10E+02
Mercury	1.30E-01	HC46D1AAA	6 / 12	5.84E-02	2.00E+01	NA	**2.04E-02**	**3.00E-02**	1.00E-01
Molybdenum	7.60E-01	HC46D1BAA	10 / 12	5.03E-01	NA	NA	**1.83E-01**	3.70E+00	1.10E+00
Nickel	4.90E+00	HC46A1CAA	12 / 12	2.99E+00	2.00E+01	NA	2.92E+02	4.80E+01	6.90E+00
Potassium	5.53E+02	HC46B1BAA	12 / 12	4.70E+02	NA	NA	NA	NA	5.60E+02
Selenium	6.30E-01	HC46D1BAA	1 / 12	3.32E-01	4.00E+02	NA	2.76E+00	**2.60E-01**	5.00E-01
Silver	4.30E-01	HC46A1CAA	2 / 12	1.36E-01	1.00E+02	NA	1.62E+01	1.60E+00	5.20E-01
Thallium	1.20E+00	HC46D1CAA	6 / 12	6.14E-01	8.00E+00	NA	3.00E+00	**1.40E-01**	6.00E-01
Vanadium	2.87E+01	HC46C1CAA	12 / 12	2.05E+01	6.00E+02	NA	2.60E+02	2.60E+02	2.20E+01
Zinc	1.84E+01	HC46D1CAA	12 / 12	1.44E+01	2.50E+03	NA	2.20E+03	6.80E+02	2.60E+01

Table 3b
Soil Screening by Sub-Area - Metals

Analyte	Maximum Detected Concentration (mg/kg)	Location of Maximum Concentration	Detection Frequency	Average Concentration [a]	MCP S-1/GW-1 Standard	MADEP Leaching Based Soil Concentration [c]	MMR SSL	EPA Risk-Based SSL	Background Value [b]
CLEARED AREA 11									
Aluminum	1.91E+04	103CAA-03	27 / 27	5.74E+03	NA	NA	5.40E+04	5.50E+04	1.00E+04
Antimony	2.60E+00	HC103CA1AAA	9 / 27	7.18E-01	2.00E+01	NA	**2.71E-01**	**2.70E-01**	1.00E+00
Arsenic	6.30E+00	103CAA-03	25 / 27	1.93E+00	2.00E+01	NA	**9.01E-03**	**1.30E-03**	3.90E+00
Barium	1.93E+01	103CAA-03	27 / 27	8.24E+00	1.00E+03	NA	1.20E+02	8.20E+01	1.60E+01
Beryllium	3.90E-01	HC103CE1CAA	13 / 27	1.19E-01	1.00E+02	NA	2.60E+00	3.20E+00	3.30E-01
Boron	1.25E+01	HC103CE1CAA	20 / 27	4.10E+00	NA	NA	**9.52E+00**	2.30E+01	1.70E+01
Calcium	3.30E+02	103CAA-01	19 / 27	8.55E+01	NA	NA	NA	NA	1.80E+02
Chromium, total	3.07E+01	HC103CB1BAA	27 / 27	8.40E+00	**3.00E+01**	NA	**7.02E+00**	1.80E+05	1.50E+01
Cobalt	5.70E+00	HC103CE1CAA	27 / 27	1.69E+00	NA	NA	1.32E+02	**5.00E-01**	NA
Copper	3.43E+01	HC103CA1AAA	26 / 27	7.12E+00	NA	NA	4.57E+01	4.60E+01	1.10E+01
Iron	1.85E+04	103CAA-03	27 / 27	7.16E+03	NA	NA	**2.42E+03**	**6.40E+02**	1.20E+04
Lead	2.92E+02	HC103CA1AAA	27 / 27	3.74E+01	3.00E+02	NA	**4.05E+00**	NA	1.90E+01
Magnesium	4.22E+03	HC103CE1CAA	27 / 27	9.35E+02	NA	NA	NA	NA	1.50E+03
Manganese	9.12E+01	HC103CA1CAA	27 / 27	5.85E+01	NA	NA	**4.42E+01**	**5.70E+01**	1.10E+02
Mercury	6.00E-02	103CAA-01	3 / 27	1.79E-02	2.00E+01	NA	**2.04E-02**	**3.00E-02**	1.00E-01
Molybdenum	1.10E+00	103CAA-02	14 / 27	3.88E-01	NA	NA	**1.83E-01**	3.70E+00	1.10E+00
Nickel	2.13E+01	HC103CB1BAA	25 / 27	4.46E+00	**2.00E+01**	NA	2.92E+02	4.80E+01	6.90E+00
Potassium	6.36E+02	HC103CE1CAA	27 / 27	3.31E+02	NA	NA	NA	NA	5.60E+02
Selenium	1.00E+00	103CAA-02	5 / 27	4.78E-01	4.00E+02	NA	2.76E+00	**2.60E-01**	5.00E-01
Sodium	4.95E+02	103CAA-03	3 / 27	1.06E+02	NA	NA	NA	NA	1.60E+02
Vanadium	3.25E+01	103CAA-02	27 / 27	1.22E+01	6.00E+02	NA	2.60E+02	2.60E+02	2.20E+01
Zinc	2.16E+01	HC103CE1CAA	27 / 27	1.09E+01	2.50E+03	NA	2.20E+03	6.80E+02	2.60E+01

Table 3b
Soil Screening by Sub-Area - Metals

Analyte	Maximum Detected Concentration (mg/kg)	Location of Maximum Concentration	Detection Frequency	Average Concentration [a]	MCP S-1/GW-1 Standard	MADEP Leaching Based Soil Concentration [c]	MMR SSL	EPA Risk-Based SSL	Background Value [b]
AREA 79									
Aluminum	1.35E+04	HC79Q1AAD	10 / 10	8.26E+03	NA	NA	5.40E+04	5.50E+04	1.00E+04
Arsenic	4.40E+00	HC79O1AAA	4 / 10	1.71E+00	2.00E+01	NA	**9.01E-03**	**1.30E-03**	3.90E+00
Barium	1.17E+01	HC79Q1AAD	10 / 10	9.59E+00	1.00E+03	NA	1.20E+02	8.20E+01	1.60E+01
Beryllium	2.20E-01	HC79O1BAA	10 / 10	1.84E-01	1.00E+02	NA	2.60E+00	3.20E+00	3.30E-01
Boron	1.02E+01	HC79Q1AAD	4 / 10	3.34E+00	NA	NA	**9.52E+00**	2.30E+01	1.70E+01
Calcium	1.29E+02	HC79P1BAA	9 / 10	8.77E+01	NA	NA	NA	NA	1.80E+02
Chromium, total	1.32E+01	HC79Q1AAD	10 / 10	8.76E+00	3.00E+01	NA	**7.02E+00**	1.80E+05	1.50E+01
Cobalt	3.30E+00	HC79O1BAA	9 / 10	2.33E+00	NA	NA	1.32E+02	**5.00E-01**	NA
Copper	5.50E+00	HC79Q1BAA	4 / 10	1.77E+00	NA	NA	4.57E+01	4.60E+01	1.10E+01
Iron	1.33E+04	HC79Q1AAD	10 / 10	8.50E+03	NA	NA	**2.42E+03**	**6.40E+02**	1.20E+04
Lead	1.31E+01	HC79Q1AAA	10 / 10	7.57E+00	3.00E+02	NA	**4.05E+00**	NA	1.90E+01
Magnesium	1.57E+03	HC79Q1BAA	10 / 10	1.01E+03	NA	NA	NA	NA	1.50E+03
Manganese	7.38E+01	HC79M1BAA	10 / 10	5.10E+01	NA	NA	**4.42E+01**	**5.70E+01**	1.10E+02
Mercury	8.00E-02	HC79Q1AAD	1 / 10	2.60E-02	2.00E+01	NA	**2.04E-02**	**3.00E-02**	1.00E-01
Nickel	6.20E+00	HC79Q1BAA	4 / 10	2.08E+00	2.00E+01	NA	2.92E+02	4.80E+01	6.90E+00
Potassium	5.41E+02	HC79M1BAA	10 / 10	3.94E+02	NA	NA	NA	NA	5.60E+02
Selenium	4.50E-01	HC79Q1AAA	1 / 10	3.20E-01	4.00E+02	NA	2.76E+00	**2.60E-01**	5.00E-01
Thallium	7.90E-01	HC79Q1BAA	1 / 10	3.67E-01	8.00E+00	NA	3.00E+00	**1.40E-01**	6.00E-01
Vanadium	2.49E+01	HC79Q1AAD	10 / 10	1.57E+01	6.00E+02	NA	2.60E+02	2.60E+02	2.20E+01
Zinc	1.68E+01	HC79O1BAA	10 / 10	1.32E+01	2.50E+03	NA	2.20E+03	6.80E+02	2.60E+01

[a] Non-detects were included at one-half the detection limit.

[b] The lower of the MMR Background value (AMEC 2001a; 2001b) or MADEP background (MADEP 2002).

NA = Not Available.

Shading indicates that the screening level was exceeded by the maximum detected concentration.

MassDEP Leaching Based Soil Concentrations are not used as a screening criteria, but are included for comparison purposes only.

TABLE 4
Groundwater Screening
L Range Related Contaminants

Analyte	Maximum Detected Concentration (µg/L)	Location of Maximum Concentration	Detection Frequency	FOD %	Maximum Contaminant Level (µg/L)	EPA Chronic Health Advisory Level [a] (µg/L)	EPA Regional Screening Level for Tap Water (µg/L)	MCP GW-1 Standard (µg/L)
Acenaphthene	0.23	MW241	1/152	0.66%	NA	NA	2200	20
Acetone	130	MW45	149/330	45.15%	NA	NA	22000	6300
4-Amino-2,6-Dinitrotoluene	0.57	MW147	1/1057	0.09%	NA	NA	73	NA
Alpha Endosulfan	0.0068	MW239	2/85	2.35%	NA	NA	220 [b]	10 [c]
Alpha-BHC	0.0097	90WT0013	1/85	1.18%	NA	NA	0.011	NA
Aroclor 1254	0.12	MW153	1/85	1.18%	0.5	NA	**0.034**	0.5
Benzyl Alcohol	19	MW45	1/147	0.68%	NA	NA	18000	NA
Beta-BHC	0.025	90WT0013	2/84	2.38%	NA	NA	0.037	NA
Bis(2-Ethylhexyl) Phthalate	58	XX90WT0003	36/151	23.84%	**6**	300	**4.8**	**6**
Carbon Disulfide	0.7	MW146	13/483	2.69%	NA	NA	1000	NA
Chloramben	1.2	MW45	2/80	2.50%	NA	100	550	NA
Chloroethane	3	MW140	39/608	6.41%	NA	NA	21000	NA
Chloroform	5	MW148	209/608	34.38%	80 [c]	70	**0.19**	70
Chloromethane	56	90MW0016	49/607	8.07%	NA	**30**	190	NA
Cymene	15	90MW0003	1/1	100%	NA	NA	NA	NA
1,4-Diamino-2,3-Dihydroanthraquinon	0.032	MW241	1/25	4%	NA	NA	NA	NA
2,4-Diamino-6-Nitrotoluene	0.44	90WT0013	5/1060	0.47%	NA	NA	73 [d]	NA
Dibenzofuran	0.5	MW241	4/152	2.63%	NA	NA	NA	NA
1,2-Dibromo-3-Chloropropane	0.029	96SV0004	2/586	0.34%	0.2	NA	**0.00032**	NA
1,2-Dichloroethane	14	90MW0016	3/608	0.49%	**5**	40	**0.15**	**5**
1,2-Dichloropropane	0.6	MW45	1/608	0.16%	5	NA	**0.39**	5
Diethylphthalate	0.43	MW153	2/150	1.33%	NA	NA	29000	2000
2,4-Dimethylphenol	8	90WT0013	4/152	2.63%	NA	NA	730	60
Di-N-Butyl Phthalate	0.46	MW128	3/151	1.99%	NA	NA	3700	NA
2,4-Dinitrotoluene	0.38	90WT0013	1/1065	0.09%	NA	NA	**0.22**	30
2,6-Dinitrotoluene	8.3	MW45	38/1066	3.56%	NA	**5**	37	NA
DNX	0.89	90LWA0007	1/38	2.63%	NA	NA	**0.61** [e]	NA

TABLE 4
Groundwater Screening
L Range Related Contaminants

Analyte	Maximum Detected Concentration (µg/L)	Location of Maximum Concentration	Detection Frequency	FOD %	Maximum Contaminant Level (µg/L)	EPA Chronic Health Advisory Level [a] (µg/L)	EPA Regional Screening Level for Tap Water (µg/L)	MCP GW-1 Standard (µg/L)
Endosulfan Sulfate	0.01	MW146	1/85	1.18%	NA	NA	220 [c]	NA
Fluorene	0.86	MW241	5/152	3.29%	NA	NA	1500	30
Gamma-BHC (Lindane)	0.013	90MW0005	1/85	1.18%	0.2	NA	0.061	0.2
Heptachlor	0.0076	MW45	1/85	1.18%	0.4	NA	0.015	0.4
2-Hexanone	13	MW242	34/462	7.36%	NA	NA	NA	NA
HMX	0.8	MW147	28/1060	2.64%	NA	400	1800	200
Isopropylbenzene	14	90MW0034	3/15	20%	NA	NA	680	NA
Methyl Ethyl Ketone	62	MW45	148/349	42.41%	NA	4000	7100	4000
Methyl Isobutyl Ketone	59	MW45	23/483	4.76%	NA	NA	2000	350
2-Methylphenol	23	MW45	3/152	1.97%	NA	NA	1800	NA
4-Methylphenol	6	MW45	3/152	1.97%	NA	NA	180	NA
Methylene Chloride	14	90WT0013	6/608	0.99%	**5**	500	**4.8**	**5**
MNX	0.39	90WT0013	2/23	8.70%	NA	NA	0.61 [f]	NA
MTBE	4	MW45	12/363	3.31%	NA	NA	12	70
N-Butylbenzene	6.4	90MW0034	1/15	6.67%	NA	NA	NA	NA
Nitrobenzene	0.36	MW290	2/1066	0.19%	NA	NA	**0.12**	NA
N-Propylbenzene	27	90MW0034	3/15	20%	NA	NA	NA	NA
Perchlorate	3	MW128	54/658	8.21%	NA	15	26	**2** [h]
Phenol	2	90MW0003	2/152	1.32%	NA	2000	11000	1000
RDX	9.2	MW153	97/1058	9.17%	NA	**2**	**0.61**	**1**
Sec-Butylbenzene	3	90MW0003	1/15	6.67%	NA	NA	NA	NA
Styrene	22	96SV0004	4/608	0.66%	100	NA	1600	100
2,4,5-T	0.12	MW45	2/95	2.11%	NA	NA	370	NA
Tetrachloroethene	5.6	WL45S	1/608	0.16%	**5**	10	**0.11**	**5**
Tetryl	0.46	MW241	1/1061	0.09%	NA	NA	150	NA
1,2,4-Trichlorobenzene	0.3	MW147	6/674	0.89%	70	70	8.2	70
1,1,2-Trichloroethane	0.23	90DP0007	1/608	0.16%	5	NA	0.24	5

TABLE 4
Groundwater Screening
L Range Related Contaminants

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1,2,4-Trimethylbenzene	96	90WT0013	1/33	3.03%	NA	NA	**15**	NA
1,3,5-Trimethylbenzene	51	90WT0013	3/33	9.09%	NA	NA	**12**	NA
1,3,5-Trinitrobenzene	1.2	MW242	5/1060	0.47%	NA	NA	1100	NA
2,4,6-Trinitrotoluene	0.64	MW290	1/1059	0.09%	NA	2	2.2	NA
Trichloroethene	0.58	90MW0034	2/608	0.33%	5	300	1.7	5
Inorganics (Total)								
Aluminum (Total)	3640	90MW0039	29/134	21.64%	NA	NA	37000	NA
Antimony (Total)	52.3	90MW0003	4/132	3.03%	**6**	**6**	**15**	**6**
Arsenic (Total)	2.8	MW239	2/89	2.25%	10	**2**	**0.045**	10
Barium (Total)	68	MW148	105/135	77.78%	2000	NA	7300	2000
Beryllium (Total)	0.15	MW140	2/135	1.48%	4	NA	73	4
Boron (Total)	49.7	MW45	51/107	47.66%	NA	1000	7300	NA
Bromide (Total)	630	90MW0016	5/6	83.33%	NA	NA	NA	NA
Cadmium (Total)	2.3	MW45	11/135	8.15%	5	5	18	5
Calcium (Total)	10800	MW146	135/135	100%	NA	NA	NA	NA
Chloride (Total)	60700	90WT0015	88/88	100%	NA	NA	NA	NA
Chromium (Total)	11.6	90MW0039	20/141	14.18%	100	NA	110	100
Cobalt (Total)	63.5	MW45	60/135	44.44%	NA	NA	**11**	NA
Copper (Total)	65.6	MW45	38/135	28.15%	1300	NA	1500	NA
Fluoride (Total)	140	90MW0039	2/6	33.33%	4000	NA	NA	NA
Iron (Total)	135000	MW45	77/135	57.04%	NA	NA	**26000**	NA
Lead (Total)	619	MW-45	25/104	24.04%	**15**	NA	NA	**15**
Magnesium (Total)	6920	90WT0013	135/135	100%	NA	NA	NA	NA
Manganese (Total)	856	MW147	84/89	94.38%	NA	**300**	880	NA
Mercury (Total)	0.6	MW45	4/129	3.10%	2	NA	**0.57**	2
Molybdenum (Total)	10.4	MW45	26/106	24.53%	NA	40	180	NA
Nickel (Total)	14.8	XX90WT0003	48/135	35.56%	NA	100	730	100

TABLE 4
Groundwater Screening
L Range Related Contaminants

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Nitrogen, Nitrate-Nitrite	3400	90WT0015	77/89	86.52%	**1000** [f]	NA	58000	NA
Phosphorus (Total)	250	90MW0029B	54/85	63.53%	NA	NA	NA	NA
Potassium (Total)	3230	MW45	111/135	82.22%	NA	NA	NA	NA
Selenium (Total)	6.5	MW45	4/135	2.96%	50	50	180	50
Silicon (Total)	6840	90WT0013	6/6	100%	NA	NA	NA	NA
Silver (Total)	1.8	MW153	4/133	3.01%	NA	100	180	100
Sodium (Total)	34300	90WT0015	135/135	100%	NA	NA	NA	NA
Sulfate (As So4)	42600	MW146	88/88	100%	NA	NA	NA	NA
Thallium (Total)	7.9	90MW0005	10/132	7.58%	**2**	**0.5**	**2.4**	**2**
Vanadium (Total)	15.8	90MW0029	9/135	6.67%	NA	NA	260	30
Zinc (Total)	748	90MW0039	67/135	49.63%	NA	2000	11000	5000
Alpha, Gross g	1.4	MW146	2/49	4.08%	15	15	NA	NA

(a) When applicable, the more conservative of the lifetime or 10^{-4} cancer risk health advisory levels was used.

(b) Endosulfan value used as a surrogate.

(c) Total trihalomethanes value used as a surrogate.

(d) Aminodinitrotoluene value used as a surrogate.

(e) RDX value used as a surrogate.

(f) Nitrite value used as a surrogate.

(g) Units for gross alpha are in picocuries per liter (pCi/L). MCL and Health Advisory Level are based on alpha particles.

(h) The GW-1 standard for perchlorate is also the MMCL

µg/L = Micrograms per liter.

MCL = Maximum contaminant level.

NA = Not available.

Shading indicates that the screening level was exceeded by the maximum detected concentration.

APPENDIX A
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
AFCEE	Air Force Center for Engineering and the Environment
AO	Administrative Order
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.
CERCLA	Comprehensive Environmental Response Compensation and Liability Act
COC	Contaminant of Concern
DWEL	Drinking Water Equivalent Level
EPA	United States Environmental Protection Agency
FS	Feasibility Study
ft	feet
GMP	Gun and Mortar Position
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
kettle hole	a depression in the ground surface that was formed during the last ice age from the melting of a remnant glacial ice block
LUC	Land-Use Control
MassDEP	Massachusetts Department of Environmental Protection
MCL	Maximum Contaminant Level (Federally-promulgated)
mg/Kg	Milligrams per Kilogram
MMCL	Massachusetts Maximum Contaminant Level (State-promulgated)
MMR	Massachusetts Military Reservation
O&M	Operation and Maintenance
OU	Operable Unit
oxidizer	A substance that gives up oxygen easily to stimulate combustion of organic material
perchlorate	A water-soluble salt used as an oxidizer
RDX	Hexahydro-1,3,5-trinitro-1,3,5-triazine / Royal Demolition Explosive, an

	explosive compound
RI/FS	Remedial Investigation/Feasibility Study
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
SVOC	semi-volatile organic compound
TNT	Trinitrotoluene (an explosives compound)
µg/Kg	Micrograms per Kilogram
µg/L	Micrograms per Liter
UXO	Unexploded Ordnance
VOC	volatile organic compound

APPENDIX B
INDEX OF KEY SUPPORTING DOCUMENTS

Appendix B
L Range Decision Document: Index of Key Supporting Documents

-Final J-1, J-3, L Range Interim Data Results Report, #1	3/29/01
-Draft J-1, J-3, L Range Interim Data Results Report, #2	9/01
-Draft J-1, J-3, L Range Additional Delineation Report, No. 1	5/02
-Final L Range Groundwater Characterization Report	11/23/05
-Final L Range Interim Groundwater Monitoring Plan	7/25/06
-Draft L Range AFRL Technology Demonstration Project Note	3/08
-Final L Range Groundwater Human Health Risk Assessment	5/15/08
-Final L Range Post-AFRL MEC Clearance Confirmation Soil Sampling Approach	11/25/08
-Final L Range Interim Groundwater Monitoring Submittal	2/26/09
-L Range Supplemental Confirmation Soil Sampling Approach, Project Note	5/12/09
-Soil Removal Activities Project Note	7/30/09
-Final L Range Interim 2009 Environmental Monitoring Report	10/8/09
-Final Interim L Range Source Remediation Report	4/23/10
-Final L Range RI/FS	5/6/10
-Final L Range Remedy Selection Plan	5/5/10
-Draft L Range Interim Environmental Monitoring Report, September 2009 – March 2010	6/29/10