FINAL
5 - YEAR REVIEW REPORT
(2005 - 2010)

FORMER LORING AIR FORCE BASE
LIMESTONE, MAINE

CONTRACT No. FA8903-04-D-8679
TASK ORDER No. 0051

Prepared for:
Air Force Center for Engineering and the Environment (AFCEE)
Brooks City-Base, TX 78235-5328

Prepared by:

URS Group Inc.
77 Goodell Street
Buffalo, NY 14203

September 2010

G4322GG

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 1
1 CONGRESS STREET, SUITE 1100
BOSTON, MASSACHUSETTS 02114-2023

September 27, 2010

Mr. David E. Strainge
AFCEE/EXC Loring
154 Development Drive, Suite G
Limestone, ME 04750-9743

Re: Five-Year Review Report (2005 to 2010), Loring Air Force Base NPL Site

Dear Mr. Strainge:

This office is in receipt of the Air Force's *Five-Year Review Report (2005 - 2010), Former Loring Air Force Base,* dated September 2010. Upon review of this report, EPA concurs with the findings that all remedies which have been implemented are currently protective of human health and the environment. EPA also concurs that important follow-up actions, such as completing more comprehensive indoor air vapor intrusion studies, are necessary to confirm the long-term protectiveness of some of the Loring remedies. EPA will continue to work closely with the Air Force to ensure that all Loring AFB remedies continue to remain protective as well as provide technical assistance and oversight of current and future Air Force efforts to accelerate the cleanup of Loring.

This third five-year review was triggered by the first remedial action which was documented by EPA to be September 30, 1995. Consistent with Section 121(c) of CERCLA and EPA's *Comprehensive Five-Year Review Guidance* (OSWER *Directive 9355.7-03B-P)*, the next statutorily required five-year review must be finalized by September 30, 2015.

Sincerely,

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

cc: Bryan Olson, EPA-New England
Mary Sanderson, EPA-New England
Mike Daly, EPA-New England
Naji Akladiss, Maine Dept. Of Environmental Protection

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Approved by:

ROBERT M. MOORE **Date**
Director
Air Force Real Property Agency

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ACRONYMS AND ABBREVIATIONS

µg/L	micrograms per liter
µg/kg	micrograms per kilogram
$\mu g/m^3$	micrograms per cubic meter
ABB-ES	ABB Environmental Services, Inc.
AEWs	air extraction wells
AFB	Air Force Base
AFBCA	Air Force Base Conversion Agency
AFCEE	Air Force Center for Engineering and the Environment
AFRPA	Air Force Real Property Agency
AHS	Auto Hobby Shop
AIW	air injection well
ARAR	Applicable or Relevant and Appropriate Requirements
AST	aboveground storage tank
BB/LS	Butterfield Brook/Limestone Stream
BCT	BRAC Cleanup Team
Bechtel	Bechtel Environmental, Inc.
BEHP	bis(2-ethylhexyl)phthalate
bgs	below ground surface
BIA	Bureau of Indian Affairs
BioQPP	Biological Monitoring Quality Program Plan
BL	Base Laundry
BRAC	Base Realignment and Closure
BTEX	benzene, toluene, ethylbenzene, and xylenes
BXSS	Base Exchange Service Station
CAP	Corrective Action Plan
CDM	CDM Federal Programs Corporation
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CERCLIS	Comprehensive Environmental Response, Compensation, and Liability Information System
CFR	Code of Federal Regulations
cis-1,2-DCE	cis-1,2-dichloroethene
CNDA	Central Nose Dock Area
COC	chemical of concern
COPC	chemicals of potential concern
CSS	Contractor's Storage Shed
CSSA	Contractor's Storage Shed Area
cy	cubic yards
DC	Double Cantilever
DHS	Department of Human Services
DO	dissolved oxygen
DRMO	Defense Reutilization and Marketing Office
DRO	Diesel Range Organics

ACRONYMS AND ABBREVIATIONS

EBGB	East Branch Greenlawn Brook
EE/CA	Engineering Evaluation/Cost Analysis
ELCR	excess lifetime cancer risk
EOD	Explosive Ordnance Disposal
EPA	United States Environmental Protection Agency
ERA	ecological risk assessment
ES	Entomology Shop
FFA	Federal Facility Agreement
FJETC	Former Jet Engine Test Cell
FLA	Flightline Area
FLDD	Flightline Drainage Ditch
FS	Feasibility Study
FSF	Flightline Structural Feature
FSSB	Former Solvent Storage Building
ft	foot or feet
ft/sec	ft per second
ft/day	ft per day
FTA	Fire Training Area
FTF	Fuels Tank Farm
FWN	field work notification
gal	gallon
GB	Greenlawn Brook
GMZ	Groundwater Management Zone
gpm	gallons per minute
GRO	Gasoline Range Organics
HAZWRAP	Hazardous Waste Remedial Actions Program
HHRA	human health risk assessment
HI	hazard index
HLA	Harding Lawson Associates, Inc.
IC	institutional control
IRP	Installation Restoration Program
IWQPP	Installation-Wide Quality Program Plan
JEBS	Jet Engine Buildup Shop
JP-4	jet fuel
LA	Limited Action
Langille	J.T. Langille, Inc.
Law	Law Environmental, Inc.
LDA	Loring Development Authority
LF 2	Landfill 2
LF 3	Landfill 3
LMR	Little Madawaska River
LNAPL	light non-aqueous phase liquid
Loring AFB	Loring Air Force Base
LTM	long-term monitoring

ACRONYMS AND ABBREVIATIONS

LTMP	Long-Term Monitoring Plan
LUC	land use control
LUC/IC	Land Use Controls/Institutional Controls
MCL	Maximum Contaminant Level
MEARNG	Maine Army National Guard
MEDEP	Maine Department of Environmental Protection
MEG	Maximum Exposure Guidelines
mg/kg	milligrams/kilogram
MSL	mean sea level
MW	Montgomery Watson
MWH	Montgomery Watson Harza Americas, Inc.
NCP	National Contingency Plan
NFA	No Further Action
NPL	National Priorities List
O&M	Operations and Maintenance
OFR	Outdoor Firing Range
OPS	Operating Properly and Successfully
ORP	oxygen reduction potential
OU	Operable Unit
OWS	oil water separator
PA/SI	Preliminary Assessment/Site Investigation
PAHs	polynuclear aromatic hydrocarbons
PCBs	polychlorinated biphenyls
PCE	tetrachloroethene
PH8210	Pump house 8210
PQL	practical quantitation limit
PVC	polyvinyl chloride
RA	remedial action
RAO	Remedial Action Objectives
RG	Restoration Goals
RI	Remedial Investigation
RI/ASI	Remedial Investigation/Additional Site Assessment
RI/FS	Remedial Investigation/Feasibility Study
RMSA	Refueling Maintenance Shop Area
ROD	Record of Decision
SAIC	Science Applications International Corporation
scfm	standard cubic ft per minute
SI	site inspection
SVE	soil vapor extraction
SVOC	semi-volatile organic compounds
TBC	To Be Considered criteria
TCE	trichloroethene
TI	Technical Impracticability
TPH	total petroleum hydrocarbons

ACRONYMS AND ABBREVIATIONS

TSERAWG	Tri-Service Environmental Risk Assessment Workgroup
URS	URS Group, Inc.
URZ	use restriction zone
USAF	U. S. Air Force
USFWS	U.S. Fish and Wildlife Service
UST	underground storage tank
VMB	Vehicle Maintenance Building
VOC	volatile organic compounds
WB/BB	Wolverton Brook/Brandy Brook
WBGB	West Branch Greenlawn Brook

Five-Year Review Summary Form

SITE IDENTIFICATION

Site name *(from WasteLAN)*: Loring Air Force Base		
EPA ID *(from WasteLAN)*: ME9570024522		
Region: 1	**State:** ME	**City/County:** Limestone/Aroostook County

SITE STATUS

NPL Status: **X** Final Deleted Other (specify)			
Remediation Status (choose all that apply)**:**	Under Construction	**X** Operating	**X** Complete
Multiple OUs? X Yes No	**Construction completion date:** 09/30/2000		
Has Site been put into reuse? X Yes No			

REVIEW STATUS

Lead Agency:	EPA	State	Tribe	**X** Other Federal Agency (United States Air Force)
Author name: Steven Moeller				
Author title: Senior Geologist				**Author affiliation: URS Group, Inc.**
Review Period: 09/30/2005 to 09/30/2010				
Date(s) of inspection: N/A (see report)				
Type of Review: **X** Post-SARA Pre-SARA NPL-Removal Only Non-NPL Remedial Action Site NPL State/Tribe-lead Regional Discretion				
Review number: 1 (first) 2 (second) **X** 3 (third) Other (specify) _____				
Triggering Action: Actual RA Start Actual RA On-Site Construction at OU #6 Actual RA Start at OU# _____ Construction Completion Previous Five-Year Review Report Other (specify) Signing of ROD				
Triggering action date (from WasteLAN): 09/30/2000				
Due date (five years after triggering action date): 09/30/2010				

Five-Year Review Summary Form (continued)

Issues:

- At Operable Unit 10 - Entomology Shop and Jet Engine Buildup Shop (ES/JEBS), the current soil vapor extraction remedial system is unable to address the small area of remaining soil contamination. Investigations are being performed to better characterize the small area of residual soil contamination for residual risk analyses.
- Additional investigation of the VI pathway is also warranted at Operable Unit 10 - ES/JEBS.
- At the Base Laundry (BL), the VI pathway at Building 7330 could result in unacceptable risks to future receptors and requires additional evaluation.
- At Operable Unit 12 - Basewide Groundwater (OU 12), the ongoing evaluation of the VI pathway needs to be completed.
- The *OU 12 ROD* requires that as part of the five-year site reviews, the Air Force conduct a review of new technologies that might be applicable for any portions of OU 12 where TI waiver have been granted (i.e., the ES/JEBS and Quarry plumes).

Recommendations and Follow-up Actions:

- Continue investigations at the ES/JEBS to better characterize the small area of residual soil contamination.
- To fulfill *OU 12 ROD* five-year site review requirements, a separate technologies review document will be prepared for the *OU 12* TI waiver sites (i.e., the ES/JEBS and Quarry plumes).
- Complete the ongoing evaluation of vapor intrusion concerns at EB/JEBS, BL, and 18 additional buildings in OU 12. Additional VI field investigations are planned for Fall-Winter 2010/2011.

Protectiveness Statement:

The remedies for all sites are currently protective of human health and the environment and all immediate threats to human health and the environment have been addressed.

EXECUTIVE SUMMARY

The Air Force Real Property Agency (AFRPA) has initiated a Five-Year Review for the former Loring Air Force (Loring AFB) in Limestone, Maine. The review was conducted under the Air Force Center for Engineering and the Environment (AFCEE) Contract No. FA8903-04-D-8679, Task Order 51. The Air Force is preparing this Five-Year Review pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) §121 and the National Contingency Plan (NCP). A Five-Year Review is required for the former Loring AFB because the implemented remedies have resulted in hazardous substances remaining onsite at concentrations that do not allow unlimited use and unrestricted exposure. This document represents the third Five-Year Review for the former Loring AFB, and encompasses the period 2005 through 2010.

The overall purpose of this Five-Year Review is to determine if selected remedies are functioning as intended and are protective of human health and the environment. Methods, findings, and conclusions are documented in this *Five-Year Review Report*, which also identifies remaining issues and makes recommendations to attain or maintain protectiveness.

Each of the sites included in the Five-Year Review has a remedy in place. Therefore, technical assessments, as required under United States Environmental Protection Agency (EPA) guidance, were performed for each of the sites. These assessments consisted of answering the following questions:

- Question A: Is the remedy functioning as intended by the decision documents?
- Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of the remedy selection still valid?
- Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

Sites included in the Five-Year Review were organized into two categories:

Statutory Review Sites

- Operable Unit 2 and Operable Unit 4 – Landfill 2 and Landfill 3
- Operable Unit 3 – Contractor's Storage Shed
- Operable Unit 3 – Explosive Ordnance Disposal Range and Outdoor Firing Range

Policy Review Sites

- Operable Unit 5 – Former Jet Engine Test Cell
- Operable Unit 8 – Fire Training Area
- Operable Unit 9 – Auto Hobby Shop
- Operable Unit 10 – Entomology Shop and Jet Engine Buildup Shop
- Operable Unit 11 – Base Laundry
- Operable Unit 12 – Basewide Groundwater
- Operable Unit 13 – Basewide Surface Water and Sediment

Based on the review, remedies at all sites were found to be functioning as intended by the decision documents. A change in the standard for arsenic in groundwater was noted in Sections 7.3 and 8.7 of this *Five-Year Review Report*. No additional information was identified that would call into question the protectiveness of any of the individual remedies associated with the sites.

Several issues were identified during the Five-Year Review process. These issues are listed in the table below, on a site-by-site basis. Significant issues requiring more definitive follow-up actions are listed in the subsequent table with party responsible and projected milestone dates.

Category/Zone/Site	Identified Issue	Recommended Action(s)
Statutory Review Sites		
Operable Units 2 and 4: Landfills 2 and 3	None.	None.
Operable Unit 3: Contractor's Storage Shed	None.	None.
Operable Unit 3: Explosive Ordnance Disposal Range, Outdoor Firing Range	None.	None.
Policy Review Sites		
Operable Unit 5: Former Jet Engine Test Cell	None.	None.
Operable Unit 8: Fire Training Area	None.	None.
Operable Unit 9: Auto Hobby Shop	None.	None.
Operable Unit 10: Entomology Shop and Jet Engine Buildup Shop (ES/JEBS)	The current SVE system is unable to address the small area of remaining soil contamination. Additional investigation of the VI pathway is warranted.	Investigations are being performed to better characterize the small area of residual soil contamination. Additional VI investigations of the VI pathway are planned for Fall-Winter 2010/2011.
Operable Unit 11: Base Laundry (BL)	The VI pathway at Building 7330 could result in unacceptable risks to future receptors and requires additional evaluation.	Additional investigations of the VI pathway.
Operable Unit 12: Basewide Groundwater (OU 12)	The *OU 12 ROD* requires that as part of the five-year site reviews, the Air Force conduct a review of new technologies that might be applicable for any portions of OU 12 where TI waiver have been granted (i.e., the ES/JEBS and Quarry plumes). The ongoing evaluation of the VI pathway at Operable Unit 12 needs to be completed.	To fulfill *OU 12 ROD* five-year site review requirements, a separate technologies review document will be prepared for the TI waiver sites (i.e., the ES/JEBS and Quarry plumes). Additional VI investigations of the VI pathway are planned for Fall-Winter 2010/2011.
Operable Unit 13: Basewide Surface Water and Sediment	None.	None.

Recommendations/ Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date	Follow-Up Actions: Affect Protectiveness (Y/N)	
				Current	Future
Continue investigations at the ES/JEBS to better characterize the small area of residual soil contamination.	AFRPA	EPA/ MEDEP	Spring 2011	N	N
To fulfill *OU 12 ROD* five-year site review requirements, a separate technologies review document will be prepared for the *OU 12* TI waiver sites (i.e., the ES/JEBS and Quarry plumes).	AFRPA	EPA/ MEDEP	Spring 2011	N	N
Complete the ongoing evaluation of vapor intrusion concerns at EB/JEBS, BL, and 18 additional buildings in OU 12. Additional VI field investigations are planned for Fall -Winter 2010/2011.	AFRPA	EPA/ MEDEP	Spring 2011	N	N*

* The VI pathway is currently being investigated and if any unacceptable risks are identified, they will be mitigated by the Air Force under the appropriate OU (i.e., soil and/or groundwater).

1.0 STATEMENT OF AUTHORITY AND PURPOSE

The AFRPA has initiated a Five-Year Review for the former Loring AFB in Limestone, Maine. The review was conducted under AFCEE Contract No. FA8903-04-D-8679, Task Order 51. The overall purpose of this Five-Year Review is to determine if selected remedies are functioning as intended and are protective of human health and the environment. Methods, findings, and conclusions are documented in this *Five-Year Review Report*, which also identifies remaining issues and makes recommendations to attain or maintain protectiveness.

The Air Force is preparing this Five-Year Review pursuant to the CERCLA §121 and the NCP. CERCLA §121 states "If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each five years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented. In addition, if upon such review it is the judgment of the President that action is appropriate at such site in accordance with section [104] or [106], the President shall take or require such action. The President shall report to the Congress a list of facilities for which such review is required, the results of all such reviews, and any actions taken as a result of such reviews."

The EPA interpreted this requirement further in the NCP; 40 Code of Federal Regulations (CFR) §300.430(f)(4)(ii) states "If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such action no less often than every five years after the initiation of the selected remedial action."

A Five-Year Review is required for the former Loring AFB because some of the implemented remedies have resulted in hazardous substances remaining onsite at concentrations that do not allow unlimited use and unrestricted exposure, and the remedial actions at additional sites will require greater than five years to complete. This document represents the third Five-Year Review for the former Loring AFB and encompasses the Period 2005 Through 2010. The Comprehensive Environmental Response, Compensation,

and Liability Information System (CERCLIS) trigger for the first Five-Year Review was the substantial beginning of remedial action for Operable Unit (OU) 6 (EPA, 2000). The first review was submitted in September 2000 (Air Force Base Conversion Agency [AFBCA], 2000). The second review was submitted in August 2005 (Montgomery Watson Harza Americas, Inc. [MWH], 2005). This third Five-Year Review is required to be submitted to the EPA five years after the second (September 2010).

1.1 References

AFBCA, 2000. *First Five-Year Review Report, Loring Air Force Base, Limestone, Maine.* September.

MWH, 2005. *Five-Year Review Report (2000-2005), Loring Air Force Base, Limestone, Maine.* August.

EPA, 2000. *Letter of Concurrence on First-Five Year Review Report, Loring Air Force Base, Limestone, Maine.* September.

2.0 REPORT ORGANIZATION

The *Comprehensive Five-Year Review Guidance* (EPA, 2001) indicates that the Five-Year Review Report should generally contain the following information:

- An introduction to the review;
- A site chronology and presentation of general site background information;
- A discussion of remedial actions that have taken place at the site;
- Description of progress since the last Five-Year Review, if applicable;
- A discussion of the Five-Year Review process;
- Technical assessment for each site;
- Identification of any issues arising from the review process;
- Recommendations and follow-up actions;
- Protectiveness statements; and
- Identification of the expected date of the next Five-Year Review.

This *Five-Year Review Report* generally follows the report template found in the 2001 EPA Guidance. However, because of the number of sites involved in the review, certain modifications were made to make the data more accessible to the reader. Certain general information was presented in introductory sections. Tables and Figures are included in separate sections at the end of the document. The contents of each section of the *Five-Year Review Report* are as follows:

Section	Contents
1	Introduction to the *Five-Year Review Report*, stating the authority for, and purpose of, the review
2	Report Organization – Describes the organization of the *Five-Year Review Report.*
3	Methodology – Describes the overall process followed for the Five-Year Review.
4	Community Involvement – Describes the process for public involvement in the Five-Year Review process.

Section	Contents
5	Site Location and Description – Provides general background information for the former Loring AFB.
6	Report Summary – Provides summary maps and a summary table to assist the reader in locating specific site information in the *Five-Year Review Report.*
7	Statutory Review Sites – Provides detailed background information on sites where remedial actions that have been performed allow for hazardous substances, pollutants or contaminants to remain onsite. The review includes descriptions of remedial actions, progress since the last five-year review, technical assessments for individual sites, recommendations, and protectiveness statements.
8	Policy Review Sites – Provides detailed information on sites where remedial actions have been implemented that will allow for unlimited use and unrestricted exposure, but require more than five years to complete. The review includes descriptions of remedial actions, progress since the last five-year review, technical assessments for individual sites, recommendations, and protectiveness statements.

2.1 References

EPA, 2001. *Comprehensive Five-Year Review Guidance*, EPA 540-R-01-007.

3.0 METHODOLOGY

3.1 Applicable Guidance

The *Comprehensive Five-Year Review Guidance* (EPA, 2001) was the primary document used to prepare this third *Five-Year Review Report* for the former Loring AFB. This guidance provides an overview of the review process and describes roles and responsibilities, components of the Five-Year Review process, and procedures for assessing the protectiveness of remedies.

3.2 Site Categorization

The *Comprehensive Five-Year Review Guidance* (EPA, 2001) identifies criteria for determining when remedial activities require a five-year review under CERCLA. The *Guidance* indicates that a five-year review is required by Statute for those sites where the following conditions are true:

- Upon completion of the remedial action, hazardous substances, pollutants, or contaminants will remain on site; and
- The ROD for the site was signed on or after October 17, 1986 (the effective date of Superfund Amendments and Reauthorization Act of 1986) and the remedial action was selected under CERCLA §121.

The *Guidance* also indicates that a five-year review is required by a matter of EPA Policy for those sites where the following conditions are true:

- A remedial action that, upon completion, will not leave hazardous substances, pollutants, or contaminants on site above levels that allow for unlimited use and unrestricted exposure, but requires five years or more to complete;
- A remedial action performed prior to the October 17, 1986 Superfund Amendments and Reauthorization Act of 1986 that leaves hazardous substances, pollutants, or contaminants on site above levels that allow for unlimited use and unrestricted exposure.

Individual sites at the former Loring Air Force Base fall into one of these categories (statutory review or policy review). During the first and second *Five-Year Review Reports*

(AFBCA, 2000 and MWH, 2005, respectively), sites were categorized as either a Statutory Review site or a Policy Review site. For this third *Five-Year Review Report (2005-2010)*, sites will be categorized as they were in the first and second *Five-Year Review Reports*, for purposes of consistency.

3.3 Site Data

Numerous documents were reviewed for each site during the process of the Five-Year Review. These documents are cited as references at the end of individual sections of the report. These documents are maintained in the official Information Repository for the former Loring AFB, located at the AFRPA Office at 154 Development Drive, Suite G, Limestone, Maine.

3.4 Interviews And Site Inspections

Specific site interviews and inspections were not performed for this *Five-Year Review Report*. All sites included in the Five-Year Review are routinely inspected, and subject to ongoing monitoring and maintenance. Inspection logs included in annual reports, contractor and AFRPA personnel responsible for individual sites, and Operations and Maintenance (O&M) personnel were consulted for specific information relative to the performance of individual remedies during preparation of this *Five-Year Review Report*.

3.5 Technical Assessments

Each of the sites included in the Five-Year Review has a remedy in place. Therefore, technical assessments, as required under EPA guidance, were made for each of the sites in the three categories. These assessments consisted of answering the following questions:

- Question A: Is the remedy functioning as intended by the decision documents?
- Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of the remedy selection still valid?
- Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

Section 4 of the Comprehensive Five-Year Review Guidance (EPA, 2001) was used to develop appropriate responses to these questions. In general, the response to Question A was developed based on review of the Remedial Action Objectives (RAOs) set forth in the applicable Records of Decision (RODs), followed by assessment of current remedy performance data and progress toward cleanup goals. Question B was answered through an assessment of significant changes in standards and assumptions that were used at the time of remedy selection. Cleanup goals established based on promulgated standards were assessed for changes in those promulgated standards that have occurred since the last Five-Year Review Report (MWH, 2005) that would have an impact on remedy management. Where risk-based values were established as cleanup goals, the underlying toxicity data were also reviewed. Other information, such as potential changes in land use that could affect the protectiveness of the remedy was considered in responding to Question C.

3.6 References

AFBCA, 2000. *First Five-Year Review Report, Loring Air Force Base, Limestone, Maine.* September.

EPA, 2001. *Comprehensive Five-Year Review Guidance,* EPA 540-R-01-007.

MWH, 2005. *Five-Year Review Report (2000-2005), Loring Air Force Base, Limestone, Maine.* August.

4.0 COMMUNITY INVOLVEMENT

The Information Repository for the former Loring AFB Installation Restoration Program (IRP) is maintained at the AFRPA Office at 154 Development Drive, Suite G, Limestone, Maine. Information can also be found on the Air Force's Administrative Record database via the following web link https://afrpaar.lackland.af.mil/ar/docsearch.aspx. A public notice announcing initiation of this five-year review was published in the Aroostook Republican and News on February 17, 2010 (Appendix A).

The final five-year review report will be placed in the Information Repository and Administrative Record for the former Loring AFB and made available for public review. A second public notice will be published announcing the completion of the five-year review and its availability at the Information Repository. Additional community involvement activities were not conducted as part of this five-year review due to lack of community interest.

5.0 SITE LOCATION AND DESCRIPTION

The former Loring AFB is located in Aroostook County in northern Maine, approximately 3 miles west of the Canadian (New Brunswick) border. As shown in Figure 5-1, the former AFB occupies approximately 9,000 acres and is bordered on the south and east by the Town of Limestone, on the north by the towns of Caswell and Connor, and on the west by the City of Caribou.

Loring AFB was constructed in the late 1940s to support long-range bomber aircraft for the Strategic Air Command. Principal base operations included aircraft maintenance, refueling, munitions storage and maintenance, and flightline operations. Many of these activities required the handling, storage, or disposal of hazardous substances and petroleum products. As a result of these activities, hazardous substances and petroleum products have entered the environment through accidental spills, leaks in supply piping, landfilling operations, burning of liquid wastes during firefighter training exercises, and the cumulative effects of operations conducted at the base's flightline and industrial areas. As part of the Department of Defense's IRP, the Air Force initiated activities to identify, evaluate, and remediate former disposal or spill sites containing hazardous substances and petroleum products.

The Loring AFB was placed on the EPA's National Priorities List (NPL) of sites in 1990. Under Section 120 of CERCLA, a Federal Facility Agreement (FFA) between the EPA Region I, the MEDEP, and the Air Force was signed in January 1991, and amended in 1995 (FFA, 1995). The FFA governs the environmental activities being conducted at Loring AFB. Following the signing of the FFA, LAFB was placed on the United States Congress Base Closure List (1991) and was closed in September 1994.

Pursuant to Section 120 of CERCLA and the FFA, the Air Force is responsible for addressing the hazardous substances at Loring AFB. In 1994, a Bottom Up Program review was conducted as part of the President's five-point fast-track cleanup initiative for closing military bases. Recommendations included performing early actions at sites where risks were well-defined. In accordance with CERCLA, Engineering Evaluation/Cost Analysis (EE/CA) reports were developed for source control removal actions. The purpose of the

source control removal actions was to address soil contamination identified at areas within the OUs during Remedial Investigation (RI) activities.

The FFA established fifteen OUs for Loring AFB according to geographic location, disposal type (e.g., landfill), or affected media, for which separate remedial investigation and feasibility study (RI/FS) reports were prepared. The OUs and the sites included in this five-year review are:

- Operable Unit 2 (OU 2) includes the surface soils and solid waste contained in Landfills 2 and 3.
- Operable Unit 4 (OU 4) includes the groundwater associated with Landfills 2 and 3. Landfills 2 and 3 are located in the southwest portion of the former Loring AFB.
- Operable Unit 3 (OU 3) includes the soil and source control for several debris disposal areas including the Contractors Storage Shed Area, the Explosive Ordnance Disposal Range, and the Outdoor Firing Range.
- Operable Unit 5 (OU 5) includes source control and removal of contamination in soils associated with the Former Jet Engine Test Cell.
- Operable Unit 8 (OU 8) includes recovery of light-non-aqueous phase liquid (LNAPL) from the shallow bedrock to remove a continual source of groundwater contamination.
- Operable Unit 9 (OU 9) includes source control and removal of contamination in soils associated with the Auto Hobby Shop.
- Operable Unit 10 (OU 10) includes source control and removal of contamination in soils associated with the Entomology Shop and Jet Engine Buildup Shop.
- Operable Unit 11 (OU 11) includes source control and removal of contamination in soils associated with the Base Laundry.
- Operable Unit 12 (OU 12) includes the affected groundwater media for the entire base excluding the area of the landfills included in OU 4.
- Operable Unit 13 (OU 13) includes the affected surface water and sediments media for various areas located throughout the base.

The locations of the Operable Units discussed in this Report are shown in Figure 5-2.

The Operable Units and the sites not included in this *Five-Year Review Report* are:

- Operable Unit 1 (OU 1) includes the source of contamination and impacts on media for radioactive waste areas located in the northeast section of the base. Restoration activities at OU 1 have made the site available for unlimited use and unrestricted exposure. Five year site reviews are not required for OU 1.

- Operable Unit 2A (OU 2A) included surface soils and the solid waste contained in Landfill No. 1 and the Coal Ash and Drum Pile at Landfill No. 3 located in the southwest section of the base. The *OU 2A Record of Decision* (HAZWRAP, 1996) documented the remedy of Further CERCLA Action for OU 2A. Five-year site reviews are not required for OU 2A.

- Operable Unit 6 (OU 6) includes the source of contamination in surface and subsurface soils for the Railroad Maintenance Site, East Gate Waste Storage Tanks and Fuel Drop Site. Restoration activities at OU 6 have made the site available for unlimited use and unrestricted exposure. Five year site reviews are not required for OU 6.

- Operable Unit 7 (OU 7) includes the source of contamination in surface and subsurface soils and in sediments and surface water for the Quarry site. A removal action has been completed for source at OU 7 and the site was determined to be available for unlimited use and unrestricted exposure in the *First Five Year Review Report* (AFBCA, 2000). Five year site reviews are not required for OU 7.

- Operable Unit 7A (OU 7A) includes the source of contamination and addresses all media at the Receiver Site. In May 1995, the Receiver Site was removed from the CERCLA program and placed under the State of Maine regulations for underground storage facilities as specified in Code of Maine Rules Chapter 691, *Regulations for Registration Installation, Operation, and Closure of Underground Storage Facilities*.

Remedial Investigation and Feasibility Study (FS) Reports were prepared for each of these Operable Units. The RI/FS reports were utilized to develop RODs for the individual Operable Units. The RODs have become the controlling documents for site cleanup at the former Loring AFB.

5.1 References

AFBCA, 2000. *First-Five Year Review Report, Loring Air Force Base, Limestone, Maine.* September.

FFA, 1995. *Under CERCLA Section 120, The Matter of Loring Air Force Base by the U.S. Environmental Protection Agency Region I, State of Maine, and the U.S. Department of the Air Force*. January 1991, amended December 20, 1993 and January 12, 1995.

HAZWRAP, 1996. *Operable Unit 2A Record of Decision*. Loring Air Force Base. March.

6.0 REPORT SUMMARY

This section is included in this *Five-Year Review Report* to aid the reader in locating information specific to a particular Operable Unit.

6.1 Maps

Two reference figures are included in this section. Figure 5-2 illustrates the Operable Units at the former Loring AFB. Figure 6.1-1 presents the locations of Operable Units, individual IRP sites, and land use parcels identified at the Former Loring AFB.

6.2 Summary Table

Table 6.2-1 is provided as a reference for locating information on specific sites that were included in the Five-Year Review. Table 6.2-1 includes the following information:

Site I.D. – Specifies Operable Unit identifier used in the first and second *Five-Year Reports* (AFBCA, 2000 and MWH, 2005).

Sites Included – Lists individual sites included under the identifier in this *Five-Year Review Report*.

Site Categories – Indicates the category (Statutory or Policy) individual Operable Units were included in this *Five-Year Review Report.*

Location in Report – Indicates the report section where information for specific sites can be located.

6.3 References

AFBCA, 2000. *First-Five Year Review Report, Loring Air Force Base, Limestone, Maine.* September.

MWH, 2005. *Five-Year Review Report (2000-2005), Loring Air Force Base, Limestone, Maine.* August.

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7.0 STATUTORY REVIEW SITES

7.1 MAP

The Statutory Review sites addressed in this Five-Year Review Report include Operable Units 2 and 4 (Landfills 2 and 3) and Operable Unit 3 (Contractor's Storage Shed, Explosive Ordnance Disposal Range and Outdoor Firing Range). The locations of these Operable Units and sites are illustrated in Figure 6.1-1.

7.2 Five-Year Review Of Statutory Review Sites

Individual subsections are provided to document the Five-Year Review process for each of the Statutory Review sites. These subsections are organized by Operable Unit/site identifier used in the previous *Five-Year Review Reports* (AFBCA, 2000 and MWH, 2005) and include the following:

- Background information: site description, initial responses, and basis for taking action;
- Remedial/removal action description: regulatory actions, RAOs, remedy description, and remedy implementation;
- Implementation of recommendations from last five year review;
- Technical assessment: answers to Questions A, B, and C in the *Comprehensive Five-Year Review Guidance* (EPA, 2001);
- Issues;
- Recommendations and follow-up actions;
- Protectiveness statements; and
- References.

7.3 OPERABLE UNITS 2 AND 4, LANDFILLS 2 AND 3

7.3.1 Background

Operable Unit 2 (OU 2) is the management division for investigation and remedy selection for the soils/source component of Landfill 2 (LF 2) and Landfill 3 (LF 3). As shown in Figure 7.3-1, both landfills are located in the western portion of the former air base. OU 2 deals directly with the landfill contents and their effect on human health and the environment. Operable Unit 4 (OU 4) is the groundwater component of LF 2 and LF 3.

7.3.1.1 Site Description

Landfill 2

LF 2 is located approximately one mile from the west gate on Nebraska Road and covers approximately 9 acres (see Figure 7.3-2). The LF 2 area was quarried for gravel during construction of the base. Waste disposal began in 1956 when the gravel supply had been exhausted. Wastes buried or burned at the site included domestic garbage, construction rubble, flightline wastes, and sewage sludge. Flightline wastes disposed in this landfill reportedly included oil, hydraulic fluids, solvents, thinners, and paints. LF 2 received waste from base activities until 1974.

The overburden geology at LF 2 is characterized as glaciofluvial, with associated deposits consisting of ablation till underlain by ice-contact deposits and a discontinuous layer of basal till (ABB-ES, 1995). Bedrock is characterized as a dark gray, weathered, pellitic limestone. Overburden thickness ranges from negligible in the central area of the landfill to about 60 feet (ft) at the northwestern portion of the site, outside the area of landfilled wastes. In most cases, landfilled wastes were placed on ice-contact deposits; however, they were also placed directly on the bedrock surface in some areas.

Based on interpretive bedrock contours, it appears that a northwest to southeast trending bedrock trough exists beneath LF 2 (ABB-ES, 1995). The topographic high of the trough is located near the northwestern end of LF 3. The trough plunges northwest in the vicinity of LF 2 and influences groundwater flow in both the shallow bedrock and overburden soils.

Groundwater flow at LF 2 is to the north-northwest, subparallel to the trend of the bedrock trough (see Figure 7.3-2). Potentiometric head data for two overburden/bedrock well pairs has shown weak overall upward gradients in the area of LF 2 (MWH, 2005a).

Due to the permeable nature of the sand and gravel and the weathered and fractured nature of the bedrock, the discontinuous shallow overburden aquifer and the fractured-bedrock aquifer appear to form one groundwater system throughout the LF 2 area. The water table is located in the overburden soils over the majority of the LF 2 site. Therefore, it is assumed that groundwater comes into contact with some of the waste throughout the year (AFBCA, 2000).

Landfill 3

LF 3 is located approximately one-half mile from the west gate on Sawyer Road and covers approximately 30 acres (see Figure 7.3-2). Similar to LF 2, the site was mined for gravel during base construction activities and used as a landfill thereafter. LF 3 received residential, commercial, and industrial waste from base activities from 1974 to 1991.

LF 3 overburden geology is characterized as a former esker deposit, consisting of ablation till underlain by ice-contact deposits and highly weathered, pellitic limestone (ABB-ES, 1995). Thickness of the soils outside the landfilled material ranges from about 5 ft on the northern side to a maximum of 55 ft southeast of the site in the bedrock trough. Wastes appear to have been placed directly on the ice-contact sand and gravel deposits.

Bedrock in the LF 3 area is a gray pellitic limestone. The northwest-to southeast-trending bedrock trough present beneath LF 2 appears to continue beneath LF 3, narrowing and rising to a saddle in the northwestern area of LF 3, then deepening again to the southeast of the landfill (ABB-ES, 1995). Bedrock is interpreted to be more fractured within the trough axis than on the trough walls.

The water table was typically encountered above the bedrock surface within the perimeter of LF 3 and the cap (ABB-ES, 1995). The uppermost portion of LF 3 waste appeared to be seasonally saturated prior to capping. The groundwater system is bounded to the east and west of LF 3 by the bedrock trough, and data indicate that the water table enters bedrock in

the axis of the trough south of LF 3. A groundwater flow divide is interpreted to exist somewhere in the northwestern portion of LF 3 where the saddle occurs in the bedrock trough (ABB-ES, 1995). To the north of the divide, groundwater flows north-northwest toward LF 2, whereas south of the divide, groundwater flow is interpreted to be southeast (see Figure 7.3-2). Calculated vertical gradients suggest that downward groundwater movement exists on the flanks of the bedrock trough and limited upward groundwater movement exists in the central areas of the bedrock trough (AFBCA, 2000).

7.3.1.2 Initial Response

In 1974, disposal of waste at LF 2 was discontinued and the area was covered with approximately 12 inches of clean cover soil. In 1991, disposal of waste at LF 3 was discontinued and the area was covered with clean native soils similar to LF 2.

7.3.1.3 Basis for Taking Action

Site investigations at LF 2 and LF 3 were conducted beginning in 1985. The Final RI/FS for OU 2 was issued in 1994 (ABB Environmental Services, Inc. [ABB-ES], 1994a). The Final RI for OU 4 was issued in 1995 (ABB-ES, 1995). Results of the RIs are summarized below.

Landfill 2

Volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), pesticides, inorganics above background concentrations, total petroleum hydrocarbons (TPH), and oil and grease were detected in groundwater in and around LF 2. In addition, several miscellaneous parameters, which are typical indicators of a plume of landfill-related groundwater contamination, were detected in groundwater samples collected in 1993 and 1994.

Contaminants detected in overburden wells inside the landfill perimeter include fuel-related VOCs and chlorobenzenes, SVOCs (including bis(2-ethylhexyl)phthalate [BEHP] at concentrations above the MCL), pesticides, and inorganics. Concentrations of contaminants detected in perimeter wells completed in the overburden adjacent to or downgradient from LF 2 were generally lower than concentrations within the limits of the waste.

In bedrock monitoring wells around LF 2, inorganics were detected in all monitored wells at concentrations above background levels. The SVOC BEHP was detected at concentrations above the corresponding MCL. The VOCs vinyl chloride and tetrachlorethene (PCE) were detected at concentrations above their State of Maine Maximum Exposure Guidelines (MEGs), but not in excess of their MCLs.

Landfill 3

VOCs, SVOC, pesticides, and inorganics were detected in groundwater in and around LF 3 at concentrations above background levels. Oil and grease were also detected in groundwater samples collected within the LF 3 boundary during sampling.

Within the LF 3 boundary, VOCs (including benzene, trichloroethene [TCE], PCE, and vinyl chloride), SVOCs (including polynuclear aromatic hydrocarbons [PAHs]), and inorganics (including lead, nickel, and cadmium) were detected at concentrations above MEGs and/or MCLs; the only exceedance for pesticides was heptachlor in a single well. Concentrations of VOCs, SVOCs, and inorganics are generally highest in wells within the southern half of the landfill.

VOCs (i.e., PCE, benzene, and vinyl chloride) were detected at concentrations above the MEGs and/or MCLs in bedrock wells generally south, east, and west of LF 3. SVOCs have been detected in several bedrock monitoring wells, however, only BEHP concentrations were above MCLs or MEGs. No pesticides or polychlorinated biphenyls (PCBs) were detected at concentrations above MEGs and/or MCLs in wells around LF 3. Inorganics above background concentrations have been detected in bedrock wells in the vicinity of LF 3.

7.3.2 Remedial/Removal Actions

The following subsections describe regulatory actions and remedial actions performed at Landfills 2 and 3.

7.3.2.1 Regulatory Actions

Described below are the controlling documents that present the selected remedy.

Operable Unit 2 Record of Decision

The *OU 2 Record of Decision* (ABB-ES, 1994b) outlined the selection of a source control remedy for OU 2.

Operable Unit 4 Record of Decision

The *OU 4 Record of Decision* (ABB-ES, 1996b) outlined the selection of a minimal action remedy for OU 4.

7.3.2.2 Remedial Action Objectives

RAOs were developed to serve as a framework for the identification of remedial action alternatives. According to the Federal and State guidance, RAOs should be designed to protect human health and the environment by identifying chemicals of concern (COCs), receptor groups of greatest concern, exposure routes associated with the highest risk estimates, and a target risk level of the individual contaminants based on site-specific exposure scenarios.

The RAOs for the soils/source component (OU 2) of LF 2 and LF 3 were (ABB-ES, 1994b):

- Soils/Landfill Contents - prevent dermal contact with and ingestion of contaminated landfill contents and soils.
- Air/Dust - prevent the migration and inhalation of fugitive dust and soil particles with adhering contaminants.
- Landfill Gas - prevent inhalation and explosion of landfill gases.
- Surface Water and Sediment - prevent ingestion, adsorption, and bioconcentration of contaminants in surface water and sediment.
- Leachate - minimize formation and migration of leachate to groundwater and surface water.

The RAOs for groundwater (OU 4) at LF 2 and LF 3 were (ABB-ES, 1996b):

- To prevent human exposure to contaminated groundwater.
- To protect downgradient groundwater from contamination.

7.3.2.3 Remedy Description

The OU 2 source control remedy included:

- Site preparation, including consolidation of Loring AFB soils for subgrade and grading to minimize erosion and manage runoff.
- Multi-layer cover system installation which complies with RCRA Subtitle C and Maine hazardous waste requirements, including landfill gas assessment and controls, and assessment of adjacent wetlands.
- Gate and warning sign installations.
- Deed restrictions on land in the vicinity of the landfills.
- Post closure monitoring and maintenance.
- Five-year site reviews.

The OU 4 minimal action remedy included:

- Implementation of institutional controls (ICs).
- Groundwater monitoring.
- Five-year site reviews.
- Contingency action, if necessary.

The *OU 4 Record of Decision* (ABB-ES, 1996b) established Action Levels for groundwater at Landfill 2 and 3. The OU 4 groundwater Action Levels are listed in Table 7.3-1.

7.3.2.4 Remedy Implementation

Cover Systems: The cover systems for LF 2 and LF 3 were designed to meet or exceed applicable Federal and State regulations and in accordance with accepted engineering design practices. Site preparation for the LF 2 cover system began in 1994 and the cover system was constructed in 1996. Construction of the LF 3 cap was initiated in 1999 and completed in 2000 (AFBCA, 2000).

Documentation of project completion, including record drawings, is recorded in the *Final Remedial Action Report, Landfill 2 Cover System* (Bechtel Environmental, Inc. [Bechtel], 1997).

The final cap at LF 3 was built in accordance with the *Construction of Landfill 3, Final Cap, Remedial Action Work Plan, Revision 2,* June (Bechtel, 1999). Documentation of project completion, including record drawings, is recorded in the *Landfill 3 Remedial Action Report,* (Bechtel, 2000).

Gates and Warning Signs: Gates were installed at all entrances (one at LF 3 and two at LF 2) to prevent vehicle access, and signs were installed in the spring of 2000.

Deed restrictions on land in the vicinity of the landfills: The ROD for OU 2 specifies the use of Land Use Controls/Institutional Controls (LUC/ICs) on the land in the vicinity of the landfills to limit subsurface development, use of the property, and excessive vehicular traffic. This includes land currently owned by the U.S. Fish and Wildlife Service (USFWS) and the University of Maine. Both landfills were transferred to USFWS by Transfer Agreement dated September 8, 1998. There is no deed for this Federal-to-Federal agency transfer. This agreement prohibits activities that will affect the OU 2 remedies. As required by the OU 4 ROD, a groundwater use restriction in the form of a Groundwater Management Zone (GMZ) was placed in the Transfer Agreement with the USFWS for all of their property. The transfer agreement strictly prohibits any activity on the refuge that would jeopardize the effectiveness of the remedy. A portion of this GMZ extends beyond the northern edge of LF 2 into property owned by the University of Maine. Groundwater use restrictions have been acquired and recorded for this property.

The LUC/ICs implemented for the landfills are monitored and maintained in accordance with the *LUC/IC Management Plan* (AFRPA, 2004). No violations of the LUC/ICs have been documented. The ongoing use of the property conforms with the restrictions of the use restriction zone (URZ), and this use is not expected to change. The LUC/ICs remain protective; no deficiencies have been identified.

Monitoring and Maintenance: Maintenance activities and results from visual inspections, settlement monitoring, groundwater and landfill gas monitoring, as well as trend analyses have been presented annually in Maintenance and Monitoring Reports. Since the last Five-Year Review, groundwater monitoring has been performed at LF 2 and LF 3 in accordance with the *Post Closure Monitoring and Maintenance Plan (PCMMP), Revision 1* (MWH, 2003). This revision reduced the frequency of groundwater sampling at LF 2 from biannually to annually. LF 2 is sampled in the spring; sampling at LF 3 is performed biannually in the spring and fall. Samples are analyzed for site specific COCs, total petroleum hydrocarbons, and miscellaneous landfill parameters including major and complex ions required by the *MEDEP Solid Waste Management Rules, Chapter 405*. Based upon historical data indicating no detections of cadmium, lead, and zinc above their Action Levels since post-closure monitoring began in 1997, the recommendation to remove these metals from the OU 4 monitoring plan was made in the *2003 Annual Report* (MWH, 2004).

The *PCMMP* also requires that samples from LF 2 compliance boundary wells (LF2MW3, LF2MW4, and MMW0001) and LF 3 compliance boundary wells (MMW0018A and MMW0018B) are analyzed for a full suite of EPA priority pollutants for the CERCLA Five-Year Review process. These samples were collected during the fall 2009 sampling round. No organic or inorganic EPA priority pollutant analytes were detected in the LF 2 and LF 3 compliance boundary wells at concentrations above the Landfill 2 and Landfill 3 Action Levels listed in Table 7.3-1, nor at concentrations above MCLs/MEGs (see Appendix B, Tables B-1 and B-2) (URS Group, Inc. [URS], 2010).

Groundwater and landfill gas monitoring data are presented to EPA and MEDEP in the annual Maintenance and Monitoring Reports subsequent to the end of that year. A summary of groundwater contamination detected at concentrations above ROD action levels at LF 2 and LF 3 from 2005 through 2009 can be found on Figures 7.3-3 and 7.3-4, respectively; all of the action levels exceedances occurred in wells within the LF 2/LF 3 compliance boundary. The 2009 post-closure monitoring groundwater analytical results for LF 2 and LF 3 are provided in Appendix B, Tables B-3 and B-4, respectively; in addition to the compounds shown exceeding ROD action levels in Figures 7.3-3 and 7.3-4, 4-methylphenol, diesel range organics (DRO), gasoline range organics (GRO), arsenic, and sodium

concentrations variously exceeded MEGs and/or MCLs in the same wells that had ROD action level exceedances.

Bis(2-ethylhexyl)phthalate (BEHP) was detected in the spring (1.5 µg/L) and subsequent summer (2.5 µg/L) 2009 samples from a residential well west of LF-2 (location LF2RESD on Figure 7.3-3; see Appendix B, Table B-3); it was not detected in subsequent fall 2009 or spring 2010 samples. BEHP was last detected in this residential well in October 2002 at a concentration of 1.8 µg/L (URS, 2010). While these detections were at concentrations below the corresponding ROD Action Level (10 µg/L), MEG (25 µg/L), and MCL (6 µg/L) for BEHP, the detection of BEHP in this potable water supply well is cause for concern. The well and associated plumbing were inspected and no potential sources for BEHP (i.e., PVC or plastics) were noted in the water supply equipment. BEHP is a historical COC at LF-2, but it has not been detected in any LF-2 monitoring wells since 2007 and has not been detected at concentrations over action levels since 2001 (URS, 2010). Historical detections have occurred at monitoring well locations along the northeastern (Nebraska Road) side of LF-2 that appear to be located hydraulically crossgradient from the residential well. Although the 2009 BEHP detections at LF2RESD are not believed to be attributable to LF-2, it was recommended that this well be sampled for BEHP analysis in spring, summer, and fall 2010 to further evaluate BEHP concentration trends in this well and to ensure the safety of the homeowners; as noted previously, BEHP was not detected in the spring 2010 sample.

Landfill gas monitoring is performed at the LF 2 and LF 3 interior gas vent and perimeter gas probe locations shown in Figures 7.3-5 and 7.3-6, respectively. The gas at all vents and probes is monitored in the field using direct-reading instruments for methane, hydrogen sulfide, and total organic gases. The perimeter landfill gas probe monitoring has not indicated signs of off-landfill lateral gas migration. Based upon the field screening results, ten gas vent locations (five locations at LF-2 and five locations at LF-3) were selected for gas characterization activities that included gas flow rate measurements and collection of Summa canister samples for laboratory EPA method TO 15 VOC analyses. Calculations were then performed to estimate landfill VOC emission rates; the calculated VOC emission rates were always orders of magnitude below the MEDEP threshold values (MWH, 2006; URS, 2007: URS, 2008; and URS 2009a). In 2009, the MEDEP and EPA agreed to the elimination of

laboratory analysis of LF-2 and LF-3 gas vent samples; field screening of the gas vents and probes is still performed annually in the fall.

Five-Year Reviews: The *First Five-Year Review Report* was submitted in 2000 (AFBCA, 2000) and the second *Five-Year Review Report* was submitted in 2005 (MWH, 2005a). As required by the OU 2 and OU 4 ROD, five-year site reviews are intended to evaluate whether the response action continues to protect human health and the environment, assess site conditions, and propose further actions, if necessary. This *Five-Year Review Report* is the third five-year review of the remedial action at Landfills 2 and 3.

Contingency Action: Groundwater monitoring conducted in 1997 and 1998 indicated contaminant concentrations in LF 2 and LF 3 compliance boundary wells in excess of the action levels established in the *OU 4 ROD*. In accordance with the *ROD*, a contingency action was implemented. As described in the *OU 4 and OU12 Explanation of Significant Differences* (AFBCA, 2001), the LF 2/LF 3 compliance boundary was extended to the north and south with the installation of three new compliance boundary wells. Figure 7.3-2 illustrates the updated compliance boundary. No compounds have been detected in excess of Action Levels at the new compliance boundary wells.

7.3.3 Implementation of Recommendations from Last Five-Year Review

The last *Five-Year Review Report* (MWH, 2005a) concluded that the remedies for Landfill 2 and 3 remained protective of human health and the environment. The following recommendations were included in the second *Five-Year Review Report* (MWH, 2005a):

- Routine long-term monitoring (LTM) and reporting of groundwater under the Post-Closure Monitoring and Maintenance program should continue.
- Routine monitoring for OU 4 should also include monitoring of LUC/ICs to document their continued effectiveness.

The Air Force has successfully implemented the components of the remedy. The successful implementation of the remedy has been documented in the following reports:

- *Monitoring and Maintenance of Landfills 2005 Annual Report* (MWH, 2006)
- *Monitoring and Maintenance of Landfills 2006 Annual Report* (URS, 2007)

- *Monitoring and Maintenance of Landfills 2007 Annual Report* (URS, 2008)
- *Monitoring and Maintenance of Landfills 2008 Annual Report* (URS, 2009a)
- *Monitoring and Maintenance of Landfills 2009 Annual Report* (URS, 2010)

7.3.4 Technical Assessment

The technical assessment component of the five-year review consists of evaluating the protectiveness of the remedy. The technical assessment was performed based on guidance provided in Section 4.0 of the *Comprehensive Five-Year Review Guidance* (EPA, 2001).

7.3.4.1 Question A

Question A: Is the remedy functioning as intended by the decision documents?

The source control remedy selected for OU 2 (cover installation and institutional controls) and the minimal action remedy selected for OU 4 (groundwater monitoring, contingency action, and additional institutional controls) remain protective of human health and the environment.

7.3.4.2 Question B

Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of the remedy selection still valid?

Changes in Standards: Groundwater remediation goals in the OU 4 Record of Decision were based on standards promulgated within Applicable or Relevant and Appropriate Requirements (ARARs), except where ARAR based standards were not available. Action levels for landfill related groundwater COCs at the Compliance Boundary are based on Federal Safe Drinking Water Act MCLs, the State of Maine MEGs, laboratory practical quantitation limits (PQLs), or human health based risk calculations.

Of the action levels established for groundwater under the OU 4 long-term monitoring program, ARAR base standards were used for all COCs except bis(2-ethylhexyl)phthalate, 4-methylphenol, iron, lead, manganese, and zinc. The Federal Safe Drinking Water Act MCL for bis(2-ethylhexyl)phthalate (6 µg/l) was below the PQL achievable by the analytical

laboratories, and as such, the then achievable PQL (10 µg/l) served as the action level. At the time of the OU 4 ROD, ARAR base standards did not exist for 4-methylphenol, iron, and manganese; as such, human health risk-based concentrations were established as action levels. Action levels for lead and zinc were also based upon human health risk-based concentrations.

There have been updates to the standards used to derive the action levels in the OU 4 ROD (ABB-ES, 1996b), but most of the OU 4 ROD action levels based on ARAR standards are either still consistent with or more stringent than current standards, with the exception of the COCs shown in the following tables.

Landfill 2			
COC	**ROD Action Level (µg/L) and Rationale**	**Current MEG (µg/L)**	**Current MCL (µg/L)**
Cadmium	5 (MCL)	3.5	5
Lead	80 (Risk-Based)	10	15
Zinc	8,400 (Risk-Based)	2,000	None Available

Landfill 3			
COC	**ROD Action Level (µg/L) and Rationale**	**Current MEG (µg/L)**	**Current MCL (µg/L)**
1,4-Dichlorobenzene	27 (MEG)	21	75
4-Methylphenol	140 (Risk-Based)	3.5	None Available
Manganese	1,300 (Risk-Based)	500	None Available

The current MEGs (MEDEP, 2008a) for cadmium, lead, zinc, 1,4-dichlorobenzene, 4-methylphenol, and manganese are lower than their ROD action levels (ABB-ES, 1996b) (see table above). Cadmium, lead, and zinc detections in groundwater have not been an issue at Landfill 2 (see Figure 7.3-3); recommendations were made in the 2004 and 2005 Annual Reports to discontinue these analyses (MWH, 2005b and 2006). The only well at Landfill 3 to have sporadic 1,4-dichlorobenzene or 4-methylphenol detections is JMW0980, which is located near the center of the landfill (Figure 7.3-4); these compounds are not detected in

wells downgradient of JMW0980. Therefore, the change in the 1,4-dichlorobenzene and 4-methylphenol MEGs should not affect the protectiveness of the remedy.

The only metals detected at concentrations above ROD action levels at Landfill 3 are iron and manganese in 4 wells (Figure 7.3-4). The natural degradation of wastes in the landfill creates a reducing and low pH geochemical environment that increases the mobility of some naturally occurring metals, including iron and manganese.

In the OU 4 ROD (ABB-ES, 1996b), arsenic was determined not to be a COC for groundwater at LF 2 or LF 3; the MCL for arsenic at that time was 50 µg/l. However, LTM groundwater samples have been analyzed for arsenic at the request of MEDEP. On January 22, 2001, EPA adopted a new Federal MCL for arsenic (changed from 50 µg/l to 10 µg/l), which was incorporated into the revised MEG (MEDEP, 2008a). A review of the historical data indicates that detections at concentrations above the new MCL of 10 µg/l at Landfill 3 would be limited to the same 4 wells that have elevated iron and manganese concentrations (Figure 7.3-4). The arsenic detections in groundwater beneath Landfill 3 are not believed to be attributable to arsenic disposal activities at Landfill 3, but more likely are due to the increased mobility of naturally occurring inorganics caused by the reducing and low pH geochemical environment created by the breakdown of constituents disposed there. Arsenic concentrations in groundwater beneath Landfill 2 are below the current arsenic MCL value, probably reflecting the older age and more mature decompositional state of LF 2 as compared to LF 3.

It is expected that the OU 4 remedy will remain protective of human health and the environment with respect to arsenic. Groundwater LTM and groundwater use restrictions protect receptors at the compliance boundaries and restrict the usage of groundwater within the GMZs. Should long-term monitoring of groundwater at the compliance boundary points indicate that elevated arsenic in groundwater is migrating offsite, the remedy for OU 4 would be revisited to assess whether it remains protective of human health and the environment.

Changes in Exposure Pathways: There have been no changes in physical conditions, exposure pathways, and land use that would affect the protectiveness of the remedy.

Changes in Toxicity and Other Contaminant Characteristics: Human health risk-based concentrations were used to establish remediation goals for 4-methylphenol, iron, lead, manganese, and zinc (see Table 7.3-1). Review of toxicity factors showed that the values have not changed since establishment of the remediation goals. MEGs are now available for 4-methylphenol, lead, manganese, and zinc. EPA's current Health Advisory value for manganese is 300 μg/L.

In addition to the constituents for which remediation goals were calculated, several others were identified as chemicals of potential concern (COPCs) in the human health risk assessment. In the time since remediation goals were first calculated, it is possible that changes in toxicity values for some COPCs may result in total estimated risk that exceeds the target risk level. Under that scenario, remediation goals for the additional specific COPCs may need to be developed. Therefore, toxicity factors for all COPCs identified in the risk assessment were evaluated to identify changes in values used in the risk assessment versus values currently available. Table 7.3-2 lists all COPCs identified in groundwater at the Loring Air Force Base for which toxicity factors have changed. Toxicity factors remain unchanged for all other COPCs not listed in Table 7.3-2.

Among the COPCs identified at OU4 (listed in Table 3-2 of the *Operable Unit 4 Feasibility Study* [ABB-ES, 1996a]), toxicity factors have changed for a number of COPCs. For carcinogenic risks, remediation goals were developed for COPCs that contributed to a risk in excess of $1x10^{-6}$ (one in one million), leading to a total risk in exceedance of $1x10^{-4}$ (one in ten thousand) when contribution from all COPCs are considered. Therefore, carcinogenic risks did not exceed $1x10^{-6}$ for COPCs not listed in Table 7.3-2. There are no changes in cancer slope factors that would result in the remedy being non-protective.

Benzene is the only COPC for which the currently available carcinogenic toxicity factor is higher than that used during the risk assessment. Because the benzene toxicity factor is higher by a factor of 2, estimated risk using currently available toxicity data will not significantly add to the total carcinogenic risk.

For noncarcinogenic risks, currently available reference concentrations are lower (therefore, estimated risks will be higher) for beryllium, 2-methylnaphthalene, naphthalene, phenol, and

xylenes. The calculated noncarcinogenic risks for these compounds were checked to determine the impact of currently available values. There are no changes in non-cancer reference doses that would result in the remedy being non-protective

Three compounds currently have toxicity factors available that were not available at the time of the risk assessment. These include Aroclor 1254, 1,2-dibromoethane, and vinyl chloride. Again, estimated non-cancer risks will not be impacted if currently available toxicity factors are used. The remediation goals listed in Table 7.3-1 are conservative and remain protective.

Unlike human health risk assessments, EPA does not recommend specific toxicity reference doses for constituents in ecological risk assessments. The toxicity factors used in the ecological risk assessment are considered protective of the environment.

Changes in Risk Assessment Methods: The original human health risk assessment (HHRA) was conducted following then current EPA and EPA Region 1 guidance. Risk assessments are performed somewhat differently now than they were at the time of the last Five-Year Review and especially since the time of the *OU 4 ROD*. Guidance documents/risk assessment tools that have been issued include:

- Background guidance (2002), which changed the way background comparisons are performed for metals.
- EPA guidance regarding the sources of toxicity values (December 2003) has changed; toxicity values are now generally obtained from EPA Regional Screening Levels tables.
- EPA Risk Assessment Guidance for Superfund (RAGS) Part E (2004), which changed the way dermal risk assessment is performed.
- EPA ProUCL guidance and software (numerous versions of new guidance and software, up through 2008), which changed the way 95% UCLs are calculated.
- EPA RAGS Part F (2009), which changed the way inhalation risk assessment is performed. There are many chemicals with new toxicity values in this document.
- *Guidelines for Carcinogenic Risk Assessment* (EPA, 2005a) and *Supplemental Guidance for Assessing Susceptibility from Early Life Exposure to Carcinogens* (EPA, 2005b), which provide updated guidance for preparation of cancer risk assessments.

- State of Maine documents *Guidance for Human Health Risk Assessments for Hazardous Waste Sites in Maine* (MEDEP and CDC, 2009) and *Maine Remedial Action Guidelines (RAGS) for Soil Contaminated with Hazardous Substances* (MEDEP, 2010).

Changes have been made with regard to toxicity values. In particular, provisional toxicity values are now available that were not available at the time of the original HHRA.

Since the last Five-Year Review, various guidance documents have been issued regarding changes to ecological risk assessments; however, these changes should not significantly impact the protectiveness of the remedies since the action levels were based on ARARs, rather than risk-based numbers.

Expected Progress Toward Meeting RAOs: RAOs associated with the source control remedy and groundwater remedy at LF 2 and LF 3 are currently being achieved.

7.3.4.3 Question C

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

No other information has been identified that would call into question the protectiveness of the remedy.

7.3.4.4 Technical Assessment Summary

As described above, the remedies at OU 2 and OU 4 are functioning as intended by installation of the landfill cover systems, successful establishment of Groundwater Management Zones, groundwater-use restrictions, LTM and maintenance, and five-year site reviews. Additionally, LUC/ICs are in place and performing as expected. No changes in exposure pathways or toxicity and other contaminant characteristics are affecting the protectiveness of the remedy. The remedy is currently progressing toward achievement of RAOs and no other information has come to light that would call into question the protectiveness of the remedy.

7.3.5 Issues

Since the last Five-Year Review, the MEDEP replaced TPH laboratory analyses with DRO and GRO laboratory analyses (MEDEP, 2008b) (i.e., the TPH RG was compared against the sum total of the DRO and GRO analytical results from a particular sample) and more recently with Volatile Petroleum Hydrocarbons/Extractible Hydrocarbons analyses (MEDEP, 2009) for dealing with petroleum contamination. Any implications of these most recent changes in MEDEP guidance have not yet been discussed among the Base Realignment and Closure (BRAC) Cleanup Team (BCT; the Air Force, USEPA, and MEDEP). No issues were identified for OU 2 and OU 4.

7.3.6 Recommendations and Follow-Up Actions

Routine LTM and reporting of groundwater under the Post-Closure Monitoring and Maintenance program should continue. Routine monitoring for OU 4 should also include monitoring of LUC/ICs to document their continued effectiveness. The PCMMP should also be updated to record previously approved changes (MEDEP, 2006 and EPA, 2006) and to reflect the agreements reached during the July 2009 BCT meeting (URS, 2009b).

The BCT should discuss any implications of the new MEDEP guidance document *Remediation Guidelines for Petroleum Contaminated Sites in Maine* (MEDEP, 2009) on sample analytical methodologies for LF 2 and LF 3.

7.3.7 Protectiveness Statement

The remedy selected for the Landfills 2 and 3 (source control and minimal action) remains protective of human health and the environment.

7.3.8 References

ABB Environmental Services, Inc. (ABB-ES), 1994a. *OU 2 Remedial Investigation/ Focused Feasibility Study, Final*. August 1993, revised July 1994.

ABB-ES, 1994b. *Operable Unit 2 (OU 2) Record of Decision.*

ABB-ES, 1995. *Final Operable Unit 4 (OU4) Remedial Investigation Report*. November.

ABB-ES, 1996a. *Operable Unit 4 (OU 4) Feasibility Study*. May.

ABB-ES, 1996b. *Operable Unit 4 (OU 4) Record of Decision.* September.

AFBCA, 2000. *First Five-Year Review Report for Loring Air Force Base, Limestone, Maine.* September.

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Bechtel Environmental, Inc. (Bechtel), 1997. *Final Remedial Action Report, Landfill 2 Cover System*. May.

Bechtel, 1999. *Construction of Landfill 3, Final Cap, Remedial Action Work Plan, Revision 2*. June.

Bechtel, 2000. *Landfill 3 Remedial Action Report, Volume 1, Revision 0*. April.

EPA, 2001. *Comprehensive Five-Year Review Guidance,* EPA 540-R-01-007.

EPA, 2004. *Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment),* EPA-540-R-99-005. July.

EPA, 2005a. *Guidelines for Carcinogenic Risk Assessment,* EPA 630-P-03-001F. March.

EPA, 2005b. *Supplemental Guidance for Assessing Susceptibility from Early Life Exposure to Carcinogens* (EPA, 2005b), EPA 630-R-03-003F. March.

EPA, 2009. *Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part F, Supplemental Guidance for Inhalation Risk Assessment),* EPA-540-R-070-002. January.

Maine Department of Environmental Protection (MEDEP), 2006. Letter from Naji Akladiss, MEDEP Division of Remediation to John Mueller, AFCEE. MEDEP Comments on the *Loring Air Force Base, Limestone, Maine, Monitoring and Maintenance of Landfills, 2005 Annual Report, dated April 2006*. July 6.

MEDEP, 2008a. *Maximum Exposure Guidelines from Maine Department of Human Services Memorandum "Maine CDC Maximum Exposure Guidelines (MEGs) for Drinking Water"*. December 8.

MEDEP, 2008b. *Procedural Guidelines for Establishing and Implementing Action Levels and Remediation Goals for the Remediation of Oil Contaminated Soil and Ground Water in Maine*. December 5.

MEDEP, 2009. *Remediation Guidelines for Petroleum Contaminated Sites in Maine*. December 1.

MEDEP, 2010. *Maine Remedial Action Guidelines (RAGS) for Soil Contaminated with Hazardous Substances*. January 13.

MEDEP and CDC, 2009. *Guidance for Human Health Risk Assessments for Hazardous Substance Sites in Maine*. June.

MWH Americas, Inc. (MWH), 2003. *Post-Closure Monitoring and Maintenance Plan for Landfills, Revision 1*. June.

MWH, 2004. *Monitoring and Maintenance of Landfills 2003 Annual Report, Loring Air Force Base, Limestone, Maine*.

MWH, 2005a. *Five-Year Review Report (2000-2005), Loring Air Force Base, Limestone, Maine.* August.

MWH, 2005b. *Monitoring and Maintenance of Landfills 2004 Annual Report, Loring Air Force Base, Limestone, Maine.* May.

MWH, 2006. *Monitoring and Maintenance of Landfills 2005 Annual Report, Loring Air Force Base, Limestone, Maine.* April.

URS Group, Inc. (URS), 2007. *Monitoring and Maintenance of Landfills 2006 Annual Report*. November

URS, 2008. *Monitoring and Maintenance of Landfills 2007 Annual Report*. May.

URS, 2009a. *Monitoring and Maintenance of Landfills 2008 Annual Report*. May.

URS, 2009b. *Minutes from the July 21-22, 2009 Loring AFB BCT Meeting*. October.

URS, 2010. *Monitoring and Maintenance of Landfills 2009 Annual Report*. April.

7.4 OPERABLE UNIT 3, CONTRACTOR'S STORAGE SHED AREA

7.4.1 Background

Operable Unit 3 (OU 3) includes a number of the former debris disposal areas at the former Loring AFB. OU 3 consists of 17 sites located throughout the former base area; the Contractor's Storage Shed Area is one of these sites.

7.4.1.1 Site Description

The Contractor's Storage Shed Area (CSSA) site is located in the south-central portion of Loring AFB (Figure 7.4-1). The CSSA is located in the northeast quadrant of the intersection of Weinman and Kansas Roads, west of the railroad tracks. A former storage shed (Building 7258) at the site was open on the east side facing the railroad tracks and flightline. The site is now primarily grass covered (Figure 7.4-2) (URS, 2009). A drainage culvert is located on the northeastern side of the site, next to the railroad tracks, but has only intermittent flow following rain events or winter thaw.

The CSSA site historically served as an industrial waste handling area. Prior to demolition of Building 7258, this site was used for storage and staging of electrical transformers, waste oil, and waste chemical drums. After remedial activities had been completed, the site was used for a period as a parking and storage area for grounds-keeping equipment; the site has been vacant for the past several years. The future use of the site is expected to remain industrial and has been classified as airport-support property by the Loring Development Authority (LDA).

The suspected sources of contaminants at the CSSA site are spills which occurred during the handling of electrical transformers, waste oil, and waste chemical drums. Accidental releases in this area were reportedly witnessed by base personnel. Drums with location identifications that included Drum Storage, Stockroom 03B, and Building 7258 contributed to some of the spills. Pesticide mixing at the site was verbally reported, but has not been confirmed by written documentation. These accidental releases impacted surface and subsurface soils, sediments, and groundwater (AFBCA, 2000).

7.4.1.2 Initial Response

No remedial action was performed at CSSA prior to the finalization of the *Operable Unit 3 Record of Decision* (Law Environmental, Inc. [Law], 1996a).

7.4.1.3 Basis for Taking Action

A Preliminary Assessment/Site Investigation (PA/SI) was completed for OU 3 in 1994 to evaluate the risks posed by 17 sites, including the CSSA, to human health and the environment (Law, 1994). The results of the PA/SI indicated that a Remedial Investigation/Additional Site Assessment (RI/ASI) should be performed for the CSSA site. The RI/ASI (Law, 1996b) indicated the presence of fuel related VOCs and SVOCs, PCBs and pesticides in surface and subsurface soils at the CSSA site as well as fuel related VOCs and SVOCs and pesticides in sediment along the railroad tracks at the site. The baseline risk assessment in the RI/ASI indicated an elevated risk to both human and ecological receptors from soils and sediment at the CSSA site (Law, 1996b); the RI/ASI recommended a Feasibility Study (FS) be performed for soil and sediment. The FS and subsequent Proposed Plan recommended excavation and on-base disposal (at LF 3) of the contaminated soils and sediment (Law, 1996c and 1996d).

7.4.2 Remedial/Removal Actions

The following subsections describe remedial actions at the CSSA site.

7.4.2.1 Regulatory Actions

The controlling documents that present the selected remedy are described below.

Operable Unit 3 Record of Decision

The *Operable Unit 3 Record of Decision* (Law, 1996a) documented the selection of a remedy to address the risk to human and ecological receptors presented by soil and sediment at the CSSA site. The remedy included the following components:

- Excavation of soils for which associated contamination exceeds the remediation goals, except chlordane-contaminated soils;

- Confirmation sampling to ensure soils exceeding the remediation goals, except chlordane-contaminated soils, have been excavated;
- On-base disposal of the excavated soils in Landfill 3;
- Placement of a 2-foot (ft) thick clean soil cover over the chlordane-contaminated areas, with proper erosion protection;
- Implementation of institutional controls; and
- Wastewater treatment (if required).

7.4.2.2 Remedial Action Objectives

The excavation, removal and disposal of soils containing contaminants exceeding the remediation goals, and placement of the soil cover over the chlordane-contaminated soils are to protect against human exposure to the contaminated soils and prevent migration of contaminants to groundwater. The application of institutional controls is designed to protect against future human exposure to the chlordane-contaminated soils exceeding the remediation goals (Law, 1996a).

The *Operable Unit 3 Record of Decision* (Law, 1996a) identified the following RAOs for the CSSA site to be protective of human health:

- Reduce soil and sediment levels of systemic toxicants to equal background or a target hazard index of one (1) for individual constituents, with the cumulative target hazard index not to exceed 10 for the most exposed human receptor groups.
- Reduce soil and sediment levels of potential carcinogens to equal background or a target risk of $1x10^{-6}$ for individual constituents, with a cumulative risk of no greater than $1x10^{-5}$ for the total excess carcinogenic risk for the most exposed human receptor groups. The method detection limit is used as a goal when background and risk-based goals are below analytical limits.
- Reduce subsurface soil levels to levels that would be protective of groundwater quality.
- Control the migration of soil and sediment contamination to uncontaminated areas.

The CSSA soil remediation goals (RGs) are summarized in Table 7.4-1.

7.4.2.3 Remedy Description

The selected remedy for the CSSA site involved the excavation, removal, and on-base land disposal of soils contaminated with PAHs, pesticides (except chlordane), and heavy metals at concentrations that exceeded the RGs (Table 7.4-1). Chlordane-contaminated soils were to remain on site and be covered by a minimum of 2 ft of clean soil, with erosion protection, to prevent future exposure. ICs to identify the presence of chlordane at the site and to manage exposure to chlordane were established and are to be modified as necessary to ensure that they remain in place and effective.

7.4.2.4 Remedy Implementation

During 1997, approximately 2,500 cubic yards (cy) of contaminated soil were excavated, loaded into dump trucks, and transported to LF 3 for disposal. 180 cy of chlordane contaminated soils were excavated and placed into adjacent excavations. As required by the ROD, 2 ft of non-chlordane contaminated soil cover was placed over the chlordane contaminated soils. In some instances, chlordane containing soil was placed into excavations to ensure that the final grade over the excavated areas matched the existing grades to avoid future grading and erosion (Bechtel, 1997). Confirmatory sampling was completed and some re-excavation and re-sampling was performed until all test results showed compliance with the remediation goals identified in the *Operable Unit 3 Record of Decision* (Law, 1996a). A total of 72 confirmatory soil samples were collected from the 14 excavation locations and variously analyzed (depending on the primary COCs at each location) for the compounds with ROD soil remediation goals listed in Table 7.4-1. Details of this remedial action implementation and confirmatory sampling locations and analytical results were documented in the *Remedial Action Report for the Contract Storage Shed Area* (Bechtel, 1997).

LUC/ICs are in place for the CSSA site in the form of restrictions in the deed that was executed between the Air Force and the current owner of the property (LDA). As necessary to comply with CERCLA Section 120(h), and the Loring AFB FFA (FFA, 1995), the deed of transfer contains provisions restricting any activities that could jeopardize the protectiveness of the remedial action. Any such actions are prohibited without the prior approval of the Air

Force, EPA, and MEDEP. The Air Force screens and approves proposed activities that are determined to have no impact to the protectiveness of the remedial action.

The deed implemented several LUC/IC measures. These include a URZ prohibiting both residential use and establishment of child care facilities, playgrounds, or elementary/secondary schools. Additional LUC/IC measures include a GMZ (GMZ 1) prohibiting use of groundwater. The deed established GMZ 1 as a URZ requiring concurrence from the Air Force, EPA, and MEDEP for any digging, excavation, or construction within the URZ.

The LUC/ICs implemented for the CSSA are monitored and maintained in accordance with the *LUC/IC Management Plan* (AFRPA, 2004). No violations of the LUC/ICs have been documented. The ongoing use of the property conforms to the restrictions of the URZ, and this use is not expected to change. The LUC/ICs remain protective; no deficiencies have been identified.

7.4.3 Implementation of Recommendations from Last Five-Year Review

The last *Five-Year Review Report (2000-2005)* (MWH, 2005) concluded that the RAOs for the CSSA site have been met and that the remedy selected for the CSSA site remains protective of human health and the environment. The following recommendations were included in the second *Five-Year Review Report (2000-2005)* (MWH, 2005):

- The Contract Storage Shed site does not meet the requirement for unrestricted use and unlimited exposure. Future Five-Year reviews are required to ensure that the remedy remains protective.

The portion of the former Loring AFB in which the CSSA site is located was transferred to the LDA in December 2004 by quitclaim deed. As necessary to comply with CERCLA Section 120(h), and the Loring AFB FFA (FFA, 1995), the deed of transfer contains provisions restricting any activities that could jeopardize the protectiveness of the remedial action. Any such actions are prohibited without the prior approval of the Air Force, EPA, and MEDEP. The Air Force screens and approves proposed activities that are determined to have no impact to the protectiveness of the remedial action.

To reinforce LUC/ICs, the Air Force conducts periodic, informal, reviews of current land use at Loring AFB and interfaces with current landowners/tenants to remind them of the existing LUC/ICs attached to their property.

7.4.4 Technical Assessment

The technical assessment component of the five-year review consists of evaluating the protectiveness of the remedy. The technical assessment was performed based on guidance provided in Section 4.0 of the *Comprehensive Five-Year Review Guidance* (U.S. EPA, 2001).

7.4.4.1 Question A

Question A: Is the remedy functioning as intended by the decision documents?

The remedy for the CSSA site, including excavation and disposal of contaminated soils above 2 ft below ground surface (bgs) and the establishment of LUC/ICs restricting future use of the site, remain protective of human health and the environment.

7.4.4.2 Question B

Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of the remedy selection still valid?

The remediation goals established for the CSSA site were established to reduce hazard indices and carcinogenic risk to benchmark regulatory standards as well as to protect groundwater. Land use at the CSSA site is consistent with the assumptions used during the evaluation of risks during the RAs. The LUC/ICs established in accordance with the *Operable Unit 3 Record of Decision* (Law, 1996) remain functional and have been included in the deed of transfer for the former Loring Air Force Base.

7.4.4.3 Question C

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

No other information has been identified that would call into question the protectiveness of the remedy.

7.4.4.4 Technical Assessment Summary

The remedy at the CSSA site in OU 3 is functioning as intended. Soil containing chlordane at concentrations above the remediation goal remains secured below 2 ft of clean soil at the site. LUC/ICs are in place for the CSSA site in the form of restrictions in the deed that was executed between the Air Force and the current owner of the property (LDA) to further eliminate any potential exposure pathways to the chlordane contaminated soils. No changes in exposure pathways are affecting the protectiveness of the remedy. No other information has come to light that would call into question the protectiveness of the remedy.

7.4.5 Issues

No issues were identified for the CSSA site.

7.4.6 Recommendations and Follow-Up Actions

Chlordane contaminated soil was excavated and placed on the site where it has more than 2 ft of cover to minimize the risk of erosion. While the chlordane identified in the Remedial Investigation did not present a future human health risk, its concentrations were above the risk based screening values developed at Loring AFB. Therefore, the CSSA site does not meet the requirement for unrestricted use and unlimited exposure. Future Five-Year reviews are required to ensure that the remedy remains protective.

7.4.7 Protectiveness Statement

The remedy selected for the CSSA site under OU 3 remains protective of human health and the environment and is expected to be protective in the future, because exposure pathways to soil containing chlordane have been eliminated.

7.4.8 References

AFBCA, 2000. *First-Five Year Review Report, Loring Air Force Base, Limestone, Maine.* September.

AFRPA, 2004. *Land Use Control/Institutional Control Management Plan, Loring Air Force Base, Maine.* October.

Bechtel, 1997. *Remedial Action Report for the Contract Storage Shed Area.* September.

EPA, 2001. *Comprehensive Five-Year Review Guidance,* EPA 540-R-01-007.

FFA, 1995. *Under CERCLA Section 120, The Matter of Loring Air Force Base by the U.S. Environmental Protection Agency Region I, State of Maine, and the U.S. Department of the Air Force*. January 1991, amended December 20, 1993 and January 12, 1995.

Law Environmental, Inc. (Law), 1994. *Operable Unit 3 (OU 3) Debris Disposal Areas PA/SI Technical Report.* March.

Law, 1996a. *Operable Unit 3 (OU 3) Debris Disposal Areas Record of Decision.* September.

Law, 1996b. *Debris Disposal Areas Operable Unit 3 (OU 3) RI/ASI Technical Report.* March.

Law, 1996c. *Debris Disposal Areas Operable Unit 3 (OU 3) Final Feasibility Study Report.* June.

Law, 1996d. *Loring IRP Final Proposed Plan for the Debris Disposal Areas, Operable Unit 3 (OU 3).* June.

MWH, 2005. *Five-Year Review Report (2000-2005), Loring Air Force Base, Limestone, Maine.* August.

URS, 2009. *Operable Unit 12 Long-Term Monitoring Program 2008 Annual Report*. August.

7.5 OPERABLE UNIT 3, EXPLOSIVE ORDNANCE DISPOSAL RANGE AND OUTDOOR FIRING RANGE

7.5.1 Background

Operable Unit 3 (OU 3) includes all of the former debris disposal areas at the former Loring Air Force Base. OU 3 consists of 17 sites located throughout the former base area; the Explosive Ordnance Disposal Range and Outdoor Firing Range are two of these sites.

7.5.1.1 Site Description

Explosive Ordnance Disposal (EOD) Range

The EOD Range consists of two portions that total approximately 65 acres (Figure 7.5-1). The southern portion of the range (approximately 35 acres) is generally grass covered or barren. The remainder of the site, about 30 acres, is peripheral to the north and west of the open grassy area (Figure 7.5-2). This portion of the site is wooded and appeared to be an abandoned EOD Range based on the presence of warning signs and debris consistent with EOD operations, as observed during the site investigations (AFBCA, 2000).

The site was previously used for disposal of ammunition by detonation and burning and for burial of munitions residue, spent cartridges, and construction debris. Ordnance disposal activities began in the southern area in the late 1960s. Activities were interrupted during the mid-1970s and resumed in the early 1980s until closure of the EOD range in 1988. Following closure, the site was used for mostly specialized training until closure of Loring AFB in September 1994. There are no records of use for the northern area of the site and it is believed to be an abandoned EOD range.

Outdoor Firing Range (OFR)

The OFR site is located in the east-central portion of the base (Figure 7.5-1). The range consisted of a small arms firing line, a skeet range, and a grenade range. The firing line faces east and is surrounded on three sides by an earthen berm and backstop. The area between the firing line and backstop is relatively flat and primarily grass covered (Figure 7.5-2).

7.5.1.2 Initial Response

Explosive Ordnance Disposal (EOD) Range

Limited removal actions in the form of ordnance clearing were conducted in 1997 and documented in the *No Further CERCLA Action for Sites Within Operable Units 3, 5, 10, and 11, Record of Decision* (Harding Lawson Associates, Inc. [HLA], 1998).

Outdoor Firing Range (OFR)

In 1995, as part of a base compliance project, approximately 600 cy of soil contaminated with lead bullets were removed from the firing line backstop berm at the OFR site (J. T. Langille, Inc. [Langille], 1995). The soil was stabilized and disposed at an appropriate, permitted, off-base landfill.

7.5.1.3 Basis for Taking Action

Explosive Ordnance Disposal (EOD) Range

A PA/SI was completed for OU 3 in 1994 to evaluate the risk posed by 17 sites, including the EOD Range, to human health and the environment (Law, 1994). The results of the PA/SI indicated that a RI should be performed for the EOD Range. Sampling performed at the EOD Range site during the RI indicated the presence of low concentrations of volatile and semi-volatile organic contaminants as well as metals and other explosive-related compounds in site soil; the RI/ASI Report recommended limited removals and additional investigation at the EOD Range (Law, 1996a). The *Operable Unit 3 Record of Decision* (Law, 1996b) determined that further investigation was necessary at the EOD Range.

Outdoor Firing Range

A PA/SI was completed for OU 3 in 1994 to evaluate the risk posed by 17 sites, including the Firing Line and Skeet Range sections of the Outdoor Firing Range, to human health and the environment. The PA/SI report recommended remedial action for the Firing Line backstop berm due to lead contamination and an ASI for the Skeet Range and Grenade Range sections of the Outdoor Firing Range (Law, 1994). The RI/ASI Report also recommended soil

removal from the backstop berm and further investigation to verify the extent of contamination at the OFR (Law, 1996a). During the isolated Firing Line backstop soil removal performed in 1995, background soil samples were found to contain lead at concentrations above the Site background levels (Langille, 1995). The *Operable Unit 3 Record of Decision* (Law, 1996b) determined that further investigation was necessary at the OFR site.

Supplemental Site Investigations identified lead-contaminated surface soil in front of and behind the small arms firing line. The affected area was determined to be approximately one-third acre in size. A risk assessment indicated that lead concentrations observed in soil do not pose an unacceptable level of risk to future human receptors and the small size of the affected area limits the impact of contamination on ecological receptors to acceptable levels (URS, 1998).

7.5.2 Remedial/Removal Actions

The following subsections describe remedial actions at the EOD Range and the OFR.

7.5.2.1 Regulatory Actions

The controlling documents that present the selected remedy are described below.

Operable Unit 3 Record of Decision

A remedy was not selected for the EOD Range and OFR site in the *Operable Unit 3 Record of Decision* (Law, 1996). The *OU 3 Record of Decision* recommended the completion of further investigation of both sites.

No Further CERCLA Action for Sites Within Operable Units 3, 5, 10, and 11, Record of Decision

Explosive Ordnance Disposal (EOD) Range

The *No Further CERCLA Action for Sites Within Operable Units 3, 5, 10, and 11, Record of Decision* (HLA, 1998) documented a remedy of no further CERCLA action for the EOD Range, based on the assumption that future land use at the site shall be in accordance with the Disposal ROD (i.e., natural resource area) (AFRPA, 1996).

Outdoor Firing Range

The *No Further CERCLA Action for Sites Within Operable Units 3, 5, 10, and 11, Record of Decision* (HLA, 1998) documented a remedy of no further CERCLA action for the OFR, based on the assumption that future land use at the site shall be in accordance with the Disposal ROD (i.e., small arms firing range) (AFRPA, 1996).

7.5.2.2 Remedial Action Objectives

RAOs were not established under CERCLA for the EOD Range or the OFR since no unacceptable risk to human health or the environment was identified in the *No Further CERCLA Action for Sites Within Operable Units 3, 5, 10, and 11, Record of Decision* (HLA, 1998).

7.5.2.3 Remedy Description

A remedy of no further CERCLA action was documented for both the EOD Range and the OFR in the *No Further CERCLA Action for Sites Within Operable Units 3, 5, 10, and 11, Record of Decision* (HLA, 1998).

7.5.2.4 Remedy Implementation

Explosive Ordnance Disposal (EOD) Range

The *Supplemental RI/ASI Technical Report* (URS, 1998) recommended No Further CERCLA Action for soil in the EOD Range site based on the human health and ecological risk

assessments determination of no unacceptable risk. This conclusion was based on the projected future use of the site as a conservation area. To prepare the site for reuse as a conservation area, the Supplemental RI/ASI Technical Report recommended that the range be cleared of any potentially unsafe EOD-related residuals. Clearing of ordnance from this site began in the fall of 1997 and was completed in 1999. Clearance in accordance with Department of Defense Explosive Safety Board procedures was provided in January 2000.

The EOD Range has been transferred to the USFWS and is now part of the Aroostook National Wildlife Refuge. There is no deed for this Federal-to-Federal agency transfer. However, as necessary to comply with CERCLA Section 120(h), and the Loring AFB FFA (FFA, 1995), the transfer agreement contains provisions restricting any activities that could jeopardize the protectiveness of the remedial action. Any such actions are prohibited without the prior approval of the Air Force, EPA, and MEDEP. The Air Force screens and approves proposed activities that are determined to have no impact to the protectiveness of the remedial action.

Several LUC/IC measures have been implemented for the EOD Range including the establishment of a URZ prohibiting land use incompatible with the established use as a wildlife refuge. Residential use and establishment of child care facilities, playground, or elementary/secondary schools is prohibited. The LUC/IC measures require concurrence from the Air Force for any digging, excavation, or construction within the URZ.

The LUC/ICs implemented for the EOD Range are monitored and maintained in accordance with the *LUC/IC Management Plan* (AFRPA, 2004). No violations of the LUC/ICs have been documented. The ongoing use of the property conforms with the restrictions of the URZ, and this use is not expected to change. The LUC/ICs remain protective; no deficiencies have been identified.

Outdoor Firing Range

The *Supplemental RI/ASI Technical Report* (URS, 1998) identified lead-contaminated surface soil in front of and behind the small arms firing line. The affected area was determined to be approximately one-third acre in size. Risk assessments indicated that lead

concentrations observed in soil do not pose an unacceptable level of risk to future human receptors and the small size of the affected area limits the impact of contamination on ecological receptors to acceptable levels (URS, 1998). This conclusion was based on the projected future use of the site continuing as a firing range.

The OFR has been transferred to the Army National Guard (Army) to be used for small arms training. The Maine Army National Guard (MEARNG) is currently using the property as an OFR. The transfer agreement between the Air Force and the Army requires the Army to mitigate environmental contamination requiring response actions that are attributable to that activity.

Several LUC/IC measures have been implemented for the OFR including the establishment of a URZ prohibiting land use incompatible with the established use as an outdoor firing range. The URZ prohibits both residential use and establishment of child care facilities, playgrounds, or elementary/secondary schools. The property is now in the stewardship of the Army and operated as a firing range by the Maine Army National Guard. Prior to any change in land use, the Army would be required to evaluate its condition in accordance with CERCLA and implement appropriate cleanup actions or additional land use restrictions.

The LUC/ICs implemented for the OFR are monitored and maintained in accordance with the *LUC/IC Management Plan* (AFRPA, 2004). No violations of the LUC/ICs have been documented. The ongoing use of the property conforms with the restrictions of the URZ, and this use is not expected to change. The LUC/ICs remain protective; no deficiencies have been identified.

7.5.3 Implementation of Recommendations From Last Five-Year Review

The last *Five-Year Review Report (2000-2005)* (MWH, 2005) concluded that the land use assumptions supporting the No Further CERCLA Action decisions for these sites remained valid and the remedy remains protective of human health and the environment. The following recommendations were included in the second *Five-Year Review Report (2000-2005)* (MWH, 2005):

- Air Force continues to review land use at these sites to assure consistency with assumptions made in the NFA decision.

To reinforce LUC/ICs, the Air Force conducts periodic, informal, reviews of current land use at Loring AFB and interfaces with current landowners/tenants to remind them of the existing LUC/ICs attached to their property.

7.5.4 Technical Assessment

The technical assessment component of the five-year review consists of evaluating the protectiveness of the remedy. The technical assessment was performed based on guidance provided in Section 4.0 of the *Comprehensive Five-Year Review Guidance* (U.S. EPA, 2001).

7.5.4.1 Question A

Question A: Is the remedy functioning as intended by the decision documents?

The No Further CERCLA Action decisions for these sites are based on the assumptions that future use of the EOD Range and OFR will be as a wildlife management area and military training area, respectively. The current land use of these areas remains consistent with these assumptions and the remedy remains protective of human health and the environment.

7.5.4.2 Question B

Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of the remedy selection still valid?

Since No Further CERCLA Action was warranted for the EOD Range and OFR based on projected future uses of the sites, no ARARs were evaluated in the *No Further CERCLA Action for Sites Within Operable Units 3, 5, 10, and 11, Record of Decision* (HLA, 1998). The physical and land use conditions evaluated in the *Supplemental RI/ASI Technical Report* (URS, 1998) remain unchanged.

7.5.4.3 Question C

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

No other information has been identified that would call into question the protectiveness of the remedy.

7.5.4.4 Technical Assessment Summary

The No Further CERCLA Action decisions for these sites are based on the assumptions that future use of the EOD Range and OFR will be as a wildlife management area and military training area, respectively. The current land use of these areas remains consistent with these assumptions and the remedy remains protective of human health and the environment. Based on residual chromium concentrations at the EOD Range and residual lead concentrations at the OFR, these sites are not acceptable for unlimited use and unrestricted exposure.

7.5.5 Issues

No issues were identified for the EOD Range and the OFR site.

7.5.6 Recommendations and Follow-Up Actions

Based on residual chromium concentrations at the EOD Range and residual lead concentrations at the OFR, these sites are not acceptable for unlimited use and unrestricted exposure. Five-year site reviews will be necessary for these sites until the levels of contaminants remaining allow for unlimited use and unrestricted exposure. The Air Force should continue to review land use at these sites to assure consistency with assumptions made in the no further action (NFA) decision document.

7.5.7 Protectiveness Statement

The remedy selected for the EOD Range and the OFR site under OU 3 remains protective of human health and the environment and is expected to be protective in the future.

7.5.8 References

AFBCA, 2000. *First-Five Year Review Report, Loring Air Force Base, Limestone, Maine.* September.

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Law Environmental, Inc. (Law), 1994. *Operable Unit 3 (OU 3) Debris Disposal Areas PA/SI Technical Report.* March.

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Law, 1996b. *Operable Unit 3 (OU 3) Debris Disposal Areas Record of Decision.* September.

MWH, 2005. *Five-Year Review Report (2000-2005), Loring Air Force Base, Limestone, Maine.* August.

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8.0 POLICY REVIEW SITES

8.1 MAP

The Policy Review sites addressed in this *Five-Year Review Report* include OU 5 (Former Jet Engine Test Cell), OU 8 (Fire Training Area), OU 9 (Auto Hobby Shop), OU 10 (Entomology Shop/Jet Engine Buildup Shop), OU 11 (Base Laundry), OU 12 (Basewide Groundwater) and OU 13 (Surface Water, Sediment and Fish Tissue). The locations of these Operable Units and sites are illustrated in Figures 5-2 and 6.1-1.

8.2 FIVE-YEAR REVIEW OF POLICY REVIEW SITES

Individual subsections are provided to document the Five-Year Review process for each of the Policy Review sites. These subsections are organized by Operable Unit/site identifier used in the used in the first and second *Five-Year Reports* (AFBCA, 2000 and MWH, 2005), and include the following:

- Background information: site description, initial responses, and basis for taking action;
- Remedial/removal action description: regulatory actions, RAOs, remedy description, and remedy implementation;
- Implementation of recommendations from last five year review;
- Technical assessment: answers to Questions A, B, and C in the Comprehensive Five-Year Review Guidance (EPA, 2001);
- Issues;
- Recommendations and follow-up actions;
- Protectiveness statements; and
- References.

8.3 OPERABLE UNIT 5, FORMER JET ENGINE TEST CELL

8.3.1 Background

8.3.1.1 Site Description

The former Jet Engine Test Cell (FJETC) facility, Building 8450, was built in 1957 and occupied approximately 1.2 acres on the east side of Oklahoma Road in the north-central portion of LAFB (Figure 8.3-1). All that presently remains at the FJETC site is a 40-foot by 55-foot concrete pad, some asphalt pavement, and remnants of a cobble-lined blast zone trough (Figure 8.3-2).

During the facility's use, jet engines were mounted on reinforced concrete pedestals in Building 8450 and various tests were performed during engine operation. The engine exhaust was directed southward down a blast zone trough located adjacent to the test cell. Jet fuel (JP-4) was stored in a 2,500 gallon (gal) aboveground storage tank (AST) near building 8450. A hydraulic oil tank, a lubrication oil tank, and an air tank (ASTs with unknown volumes) were located inside of Building 8450. Ancillary equipment included underground fuel lines, underground electrical conduits, and at least one floor drain. The Air Force decommissioned the FJETC in 1976 and demolished structures at the site in 1986. All ASTs at the FJETC were removed at this time. All that remains of the original facility is a concrete pad, some asphalt pavement, and the cobble-lined blast zone trough.

Operations at the FJETC generated JP-4 jet fuel, lubrication oils, hydraulic fluids, wash water, and engine coolants as liquid waste streams. Waste fluids, except for wash water, were drummed and sent to the Defense Reutilization and Marketing Office (DRMO) for disposal. The likely sources of contamination at the site include the former AST, spills or releases of waste fluids resulting from past site activities, and the potential leaching of contaminants into the subsurface soils in the blast zone by infiltration of precipitation (AFBCA, 2000).

The geology at the FJETC consists of an unconsolidated glacial till layer that is 32.5 to 45 ft thick underlain by bedrock. The unconsolidated glacial till is made up of varying amounts of sand, gravel, and cobbles with silt. Shallow soils in the immediate area of the concrete slab

and blast zone trough consist of fill. This fill is reworked native till mixed with some sand and gravel. The bedrock beneath the FJETC is argillaceous limestone that is folded, fractured, faulted, and weakly metamorphosed.

A perched groundwater condition exists at the FJETC. The perched groundwater is believed to be a result of groundwater from infiltration within the relatively permeable fill materials overlying the less permeable glacial till deposits. The groundwater flow direction within the overburden is to the west, but flow in the bedrock is to the southeast (MWH, 2004).

8.3.1.2 Initial Response

Because of the potential risks to human health, an EE/CA (URS, 1995a) and a an Action Memorandum (URS, 1995b) were prepared for the FJETC site recommending a bioventing system to treat an approximately 0.5-acre area of soil contaminated with fuel-related compounds and low concentrations of chlorinated solvents (AFBCA, 2000).

In 1995, the bioventing system was installed. Initially, the system was composed of 13 air injection wells (AIW) and seven soil gas monitoring points (Figure 8.3-2). Following installation of the bioventing system, a 30-day testing period was initiated during which the system performance was monitored. As a result of this initial performance testing period, the final inspection of the bioventing system was performed and the system was certified operational and functional in the *Bioventing at OUs 5, 8, 9, 10, and 11 Removal Action Report* (Bechtel, 1996).

Confirmation soil sampling was conducted at the FJETC in 1998 and as a result, the area of known contamination and system was expanded to the west. To address this area, a new AIW (AIW101) was installed in January 1999. The *Biovent Sites Confirmation Sampling Field/Laboratory Results and Recommendations* (Bechtel, 1999) recommended that surface water management practices (e.g., trench excavation with sump or site grading and low-permeability cover) be implemented at the FJETC site in an attempt to lower the perched groundwater levels, which hampered the effectiveness of the system. Dewatering trenches were installed in July 1999.

8.3.1.3 Basis for Taking Action

During Site Investigation (SI) (ABB-ES, 1991a and 1991b; Law, 1994) and RI (CDM Federal Programs Corporation [CDM], 1997) activities conducted at the FJETC site between 1991 and 1994, numerous test pits and soil borings were completed to characterize the nature and distribution of soil contamination at the site. Several monitoring wells were also installed; however, groundwater associated with the site is being addressed in accordance with OU 12, and is not discussed in this section of the *Five-Year Review Report*. The RI identified contaminated soils at the site that contain elevated levels of primarily fuel-related VOCs and SVOCs; however, low concentrations of chlorinated VOCs were also detected (AFBCA, 2000).

Soil contamination at the FJETC was generally located within a 125-foot radius of the test pad. Benzene, toluene, ethylbenzene, and xylene (BTEX) and two SVOCs (naphthalene and 2-methylnaphthalene) were detected throughout an area located within a 50-foot radius of the test pad and within the blast zone. The depth of contamination in this area ranged from ground surface down to bedrock. Concentrations of BTEX in subsurface soils ranged from not detected to 330 milligrams/kilogram (mg/kg). The highest concentrations of BTEX were generally located at a depth of approximately 5 to 8 ft bgs. Concentrations of chlorinated VOCs in subsurface soils ranged from not detected to 36 mg/kg. TPH contamination in subsurface soils was detected at depths ranging from 4 to 30 ft bgs with the highest concentration of 4,400 mg/kg being detected at 10 ft bgs (MWH, 2004).

8.3.2 Remedial/Removal Actions

The following subsections describe remedial actions at FJETC.

8.3.2.1 Regulatory Actions

The controlling documents that present the selected remedy are described below.

Sites Within OUs 5, 8, 9, 10 and 11 Record Of Decision

The *Sites Within OUs 5, 8, 9, 10 and 11 Record of Decision* (HLA, 1999) documented the selection of a remedy that included continued operation of the bioventing system at the FJETC site to continue to address the petroleum- and solvent-contaminated subsurface soils.

8.3.2.2 Remedial Action Objectives

Based on information relating to types of contaminants, environmental media of concern, and potential exposure pathways, remedial objectives were developed in the *Sites Within OUs 5, 8, 9, 10 and 11 ROD* (HLA, 1999). These remedial objectives were developed to mitigate existing and future potential threats to public health and the environment. The general RAOs relevant to the FJETC identified in the *Sites Within OUs 5, 8, 9, 10 and 11 ROD* (HLA, 1999) are stated as follows:

1. Prevent human exposure (i.e., ingestion, inhalation, and dermal contact) to contaminated soil with concentrations in excess of remediation goals.
2. Prevent ecological exposure (i.e., ingestion, inhalation, and biological uptake) to contaminated soil with concentrations in excess of remediation goals.
3. Prevent contaminated soil with concentrations in excess of remediation goals from migrating to groundwater.

8.3.2.3 Remedy Description

The chosen remedy for FJETC as described in the *ROD* included the continued operation, performance monitoring, and data reporting for the bioventing system until the risk-based remediation goals are achieved, allowing for unlimited use of the site and unrestricted exposure.

Contaminants of concern and site-specific remediation goals were developed for FJETC in the EE/CA (URS, 1995a) and were included in the *Sites Within OUs 5, 8, 9, 10 and 11 ROD* (HLA, 1999). In the development of remediation goals for FJETC, human health and ecological risk-based values were calculated and soil leaching model values were calculated.

The site-specific remediation goals for FJETC represent the most stringent of these values. The FJETC remediation goals are listed in Table 8.3-1.

The chosen remedy for FJETC as described in the *ROD* also included performing Five-Year site reviews until the levels of contaminants remaining at the site allow for unlimited use and unrestricted exposure.

8.3.2.4 Remedy Implementation

Based upon the recommendations of the EE/CA (URS, 1995a) and the Action Memorandum (URS, 1995b), the bioventing system was installed at the FJETC site in 1995. The chosen remedy for FJETC documented in the *Sites Within OUs 5, 8, 9, 10 and 11 ROD* (HLA, 1999) was the continued operation of the biovent system. The system was certified operational and functional in the *Bioventing at OUs 5, 8, 9, 10, and 11 Removal Action Report* (Bechtel, 1996).

Recommendations in the *2001 Annual Performance Report* (MWH, 2002) included testing and, if successful, subsequent installation of deep AIWs to better distribute oxygen in the subsurface. A *Field Work Notification (FWN) for Former Jet Engine Test Cell Deep Air Injection Wells* was submitted to EPA and MEDEP in August 2002. Based upon this FWN, a successful test was completed and 8 new AIWs were installed in September 2002: AIW-2D, AIW-3D, AIW-4D, AIW-8D, AIW-9D, AIW-10D, AIW-12D, and AIW-101D (Figure 8.3-2). The 8 new AIWs were installed with 5-foot screens to a depth ranging from 17 to 19 ft. Design airflow rates for these wells were 3 times greater than the shallow wells, or 10 standard cubic ft per minute (scfm).

The FJETC system was determined to be operating as designed in the *Auto Hobby Shop, Jet Engine Build-Up Shop/Entomology Shop, Former Jet Engine Test Cell and Base Laundry Sites Demonstration of a Remedial Action Operating Properly and Successfully* (MWH, 2004). Confirmation soil samples were collected from 2001 through 2005 to monitor remedial progress (Figure 8.3-3). The results of the sampling event in 2005 indicated that while the contamination had shrunk in a few areas of the site, overall, a large volume of contaminated soils remained. The system operated through November 29, 2006, at which

time the system was shut down pending further evaluation and optimization. The system was restarted for operation on September 6, 2007.

In 2008, pneumatic fracturing was successfully performed across the FJETC site to increase the permeability of site soils and thereby enhance the bioventing system influence (Figure 8.3-4). Either 1 or 2 fracturing intervals were conducted at each location, as field conditions allowed. Following the pneumatic fracturing event, 14 of the proposed fracture locations were converted to additional AIWs (Figure 8.3-4). Additional information on the pneumatic fracturing event can be found in *Pneumatic Fracturing at the Former Jet Engine Test Cell (FJETC)* (URS, 2009a).

Numerous soil samples were collected and analyzed for MEDEP TPH field headspace in conjunction with the pneumatic fracturing that was conducted in 2008. The intent of these samples was to provide a snapshot of the pre-pneumatic fracturing soil conditions at the site. Based on the 2008 field headspace samples, the extent of contamination in 2008 appeared to be little changed from that observed in 2005 (URS, 2009b).

While a complete round of confirmation samples was not considered to be warranted, a few soil analytical samples were collected in 2009 for the purpose of providing an interim snapshot of the most highly contaminated areas of the site (Figure 8.3-3). These samples were used to document any progress from the 2005 analytical sampling event and for comparison to future analyses; data from these 2009 sample analyses indicated that significant contamination above the RGs remains at the site (URS, 2010a). Given the magnitude of the remaining contamination as compared to the RGs, further interim soil sampling in 2010 did not appear useful.

A work plan, targeting sample collection in August 2011, will be developed in late 2010 to redefine the limits of soil contamination following approximately three years of bioventing system operation subsequent to the pneumatic fracturing permeability enhancement (fall 2008 through summer 2011). The plan will provide a sampling scheme that is sufficient to achieve site closure, should contamination be reduced below RGs. If closure is not achieved, the data will be used to develop a strategy for completion of the remediation and site closure.

LUC/ICs are in place for FJETC in the form of restrictions in the deed that was executed between the Air Force and the current owner of the property LDA. As necessary to comply with CERCLA Section 120(h), and the Loring AFB FFA (FFA, 1995), the deed of transfer contains provisions restricting any activities that could jeopardize the protectiveness of the remedial action. Any such actions are prohibited without the prior approval of the Air Force, EPA, and MEDEP. The Air Force screens and approves proposed activities that are determined to have no impact to the protectiveness of the remedial action.

The deed implemented several LUC/IC measures. These include general provisions allowing for the Air Force continued operation of the biovent system in the future including right of access to conduct, operate, maintain or undertake any remedial action required under the Loring IRP. Additional LUC/IC measures include a URZ prohibiting both residential use and establishment of child care facilities, playgrounds, or elementary/secondary schools and prohibiting any subsurface excavating, digging, drilling, subsurface construction or other disturbance of the surface without notice to and written approval of the Air Force. The LUC/IC measures also include a GMZ (GMZ 5) prohibiting use of groundwater.

The LUC/ICs implemented for FJETC are monitored maintained in accordance with the *LUC/IC Management Plan* (AFRPA, 2004). No violations of the LUC/ICs have been documented. The ongoing use of the property conforms with the restrictions of the URZ, and this use is not expected to change. The LUC/ICs remain protective; no deficiencies have been identified.

8.3.3 Implementation of Recommendations from Last Five-Year Review

The last *Five-Year Review Report* (MWH, 2005) concluded that the remedies for FJETC remained protective of human health and the environment, and recommended that routine annual system performance reviews and confirmation soil sampling should continue. Routine monitoring for FJETC should also include monitoring of LUC/ICs to document their continued effectiveness.

Annual evaluation of system performance including the collection of confirmation soil samples, progress toward RGs, and optimization efforts were documented in the following:

- *Bioventing and Soil Vapor Extraction at OUs 5, 8, 9, 10, and 11, 2005 Annual Performance Report* (MWH, 2006)
- *Bioventing and Soil Vapor Extraction at OUs 5, 8, 9, 10, and 11, 2006 Annual Performance Report* (URS, 2007)
- *Bioventing and Soil Vapor Extraction at OUs 5, 8, 9, 10, and 11, 2007 Annual Performance Report* (URS, 2008)
- *Bioventing and Soil Vapor Extraction at OUs 5, 8, 9, 10, and 11, 2008 Annual Performance Report* (URS, 2009b)
- *Bioventing and Soil Vapor Extraction at OUs 5, 8, 9, 10, and 11, 2009 Annual Performance Report* (URS, 2010a)

This *Five-Year Review Report* documents the third review for the FJETC site under OU 5 source control.

8.3.4 Technical Assessment

The technical assessment component of the five-year review consists of evaluating the protectiveness of the remedy. The technical assessment was performed based on guidance provided in Section 4.0 of the *Comprehensive Five-Year Review Guidance* (U.S. EPA, 2001).

8.3.4.1 Question A

Question A: Is the remedy functioning as intended by the decision documents?

As documented above, the chosen remedy is protective of human health and the environment and facilitating the attainment of RAOs. However, the soil RGs at the FJETC site have not yet been met. Portions of the remedy at FJETC were modified in 2008 by conducting pneumatic fracturing and converting some of the pneumatic fractures to additional AIWs for the bioventing system. Sampling will be performed in 2011, following approximately three years of bioventing system operation subsequent to the pneumatic fracturing permeability enhancement, to redefine the limits of soil contamination at the site. If closure is not achieved, the data will be used to develop a strategy for completion of the remediation and site closure.

8.3.4.2 Question B

Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of the remedy selection still valid?

Changes in Standards: No federal or state regulations specify concentration limits for contaminants in soil. Site-specific, risk-based remediation goals were developed during the EE/CA (URS, 1995a) and RI (CDM, 1996) considering both current and projected future land use at FJETC. The *Sites Within OUs 5, 8, 9, 10 and 11 Record of Decision* (HLA, 1999) FJETC soil RGs represent the most stringent value of human health and ecological risk-based values as well as soil leaching model results.

Changes in Exposure Pathways: There have been no changes in physical conditions, exposure pathways, and land use that would affect the protectiveness of the remedy.

Changes in Toxicity and Other Contaminant Characteristics: Remediation goals that are protective of human health and the environment were established based on EPA and MEDEP Risk Assessment Guidance and the *LAFB Risk Assessment Methodology* (HAZWRAP, 1994). Human health remediation goals were calculated using a $1x10^{-6}$ risk level for carcinogens and a hazard index (HI) of one for noncarcinogens. Ecological remediation goals were developed by back-calculating the ecological models to obtain soil concentrations that would result in a HQ of one. Soil leaching model results were used to develop soil remediation goals that would result in groundwater at concentrations less than the Federal Safe Drinking Water Act MCLs or the MEGs.

Remediation goals were established for benzene, methylene chloride, TCE, Toluene, xylene, 1,2-dichloroethane, naphthalene, and TPH at the FJETC in the *Sites Within OUs 5, 8, 9, 10 and 11 ROD* (HLA, 1999). Current available human health toxicity factors for benzene, naphthalene, TCE, and xylene are higher than those used in the risk assessment (See Tables 7.3-2 and 8.3-2). However, carcinogenic risks from exposure to these chemicals did not exceed $1x10^{-6}$ (no individual slope factor increased by more than a factor of 10). Remediation goals were selected because of the presence of TPH in soil and potential adverse effect on groundwater quality at FJETC, and were not selected for FJETC based on

results of human health and ecological risk assessments. Therefore, changes in toxicity factors do not affect the remediation goals applied to the FJETC site.

In addition to the constituents for which remediation goals were calculated, several others were identified as COPCs in the human health risk assessment. It is possible that changes in toxicity values for some COPCs since the original calculations may result in total estimated risk that exceeds the target risk level. Therefore, toxicity factors for all COPCs were evaluated during the five-year review process to identify changes in values used in the risk assessment versus values currently available. Tables 7.3-2 and 8.3-2 list all COPCs identified in soil at FJETC for which toxicity factors have changed. Toxicity factors remain unchanged for all other COPCs not listed in Tables 7.3-2 and 8.3-2.

Among the COPCs identified at FJETC, toxicity factors have changed for a number of COPCs. However, estimated risks using currently available toxicity factors will not significantly add to the total risks. In addition, several compounds currently have toxicity factors available, that were not available at the time of the risk assessment. Estimated risks due to exposure to these compounds are not significant if currently available toxicity factors are used.

Unlike human health risk assessments, EPA does not recommend specific toxicity reference doses for constituents in ecological risk assessments. The toxicity factors used in the ecological risk assessment are considered protective of the environment.

Changes in Risk Assessment Methods: The original HHRA was conducted following then current EPA and EPA Region 1 guidance. Risk assessments are performed somewhat differently now than they were at the time of the last Five-Year Review and especially since the time of the *Sites Within OUs 5, 8, 9, 10 and 11 ROD*. Guidance documents/risk assessment tools that have been issued include:

- Background guidance (2002), which changed the way background comparisons are performed for metals.
- EPA guidance regarding the sources of toxicity values (December 2003) has changed; toxicity values are now generally obtained from EPA Regional Screening Levels tables.

- EPA Risk Assessment Guidance for Superfund (RAGS) Part E (2004), which changed the way dermal risk assessment is performed.

- EPA ProUCL guidance and software (numerous versions of new guidance and software, up through 2008), which changed the way 95% UCLs are calculated.

- EPA RAGS Part F (2009), which changed the way inhalation risk assessment is performed. There are many chemicals with new toxicity values in this document.

- *Guidelines for Carcinogenic Risk Assessment* (EPA, 2005a) and *Supplemental Guidance for Assessing Susceptibility from Early Life Exposure to Carcinogens* (EPA, 2005b), which provide updated guidance for preparation of cancer risk assessments.

- State of Maine documents *Guidance for Human Health Risk Assessments for Hazardous Waste Sites in Maine* (MEDEP and CDC, 2009) and *Maine Remedial Action Guidelines (RAGS) for Soil Contaminated with Hazardous Substances* (MEDEP, 2010).

Changes have been made with regard to toxicity values. In particular, provisional toxicity values that EPA previously did not consider valid for use in risk assessments are now considered valid.

Expected Progress Toward Meeting RAOs: Implementation of the remedy for FJETC is meeting each of the general RAOs listed in Section 8.3.2.2. LUC/ICs are preventing human exposure to contaminated soil with concentrations in excess of remediation goals. Ecological exposures to contaminated soil with concentrations in excess of remediation goals are not believed to be occurring. It is also not believed that any contaminated soil with concentrations in excess of remediation goals is migrating to groundwater. Contaminant concentrations in groundwater have decreased since startup of the bioventing system in 1995 and only the detected concentration of TCE in one site overburden monitoring well remains above groundwater remedial goals (URS, 2010b).

8.3.4.3 Question C

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

No other information has been identified that would call into question the protectiveness of the remedy.

8.3.4.4 Technical Assessment Summary

The soil RGs at the FJETC site have not yet been met. Portions of the remedy at FJETC were modified in 2008 by conducting pneumatic fracturing and converting some of the pneumatic fractures to additional AIWs for the bioventing system. Sampling will be performed in 2011, following approximately three years of bioventing system operation subsequent to the pneumatic fracturing permeability enhancement, to redefine the limits of soil contamination at the site. If closure is not achieved, the data will be used to develop a strategy for completion of the remediation and site closure.

The remainder of the remedy is functioning as intended by successful operation, monitoring, and reporting of the bioventing system, as well as conducting five-year site reviews. Additionally, LUC/ICs are in place and performing as expected. No changes in exposure pathways or toxicity and other contaminant characteristics are affecting the protectiveness of the remedy. The remedy is currently progressing toward achievement of RAOs, and no other information has come to light that would call into question the protectiveness of the remedy.

8.3.5 Issues

Since the last Five-Year Review, the MEDEP replaced TPH laboratory analyses with diesel range organic (DRO) and gasoline range organic (GRO) laboratory analyses (MEDEP, 2008) (i.e., the TPH RG was compared against the sum total of the DRO and GRO analytical results from a particular sample) and more recently with Volatile Petroleum Hydrocarbons/Extractible Hydrocarbons analyses (MEDEP, 2009) for dealing with petroleum contamination. The implications of these most recent changes in MEDEP guidance have not yet been discussed among the BCT. No issues were identified for the FJETC site.

8.3.6 Recommendations and Follow-Up Actions

Routine annual system performance reviews should continue. Routine monitoring for FJETC should also include monitoring of LUC/ICs to document their continued effectiveness. A work plan, targeting sample collection in August 2011, will be developed in late 2010 to redefine the limits of soil contamination following approximately three years of bioventing

system operation subsequent to the pneumatic fracturing permeability enhancement (fall 2008 through summer 2011). The plan will provide a sampling scheme that is sufficient to achieve site closure, should contamination be reduced below RGs. If closure is not achieved, the data will be used to develop a strategy for completion of the remediation and site closure.

The BCT should discuss any implications of the new MEDEP guidance document *Remediation Guidelines for Petroleum Contaminated Sites in Maine* (MEDEP, 2009) on future soil sample analytical methodologies.

8.3.7 Protectiveness Statement

The remedial action at FJETC in OU 5 (operation of the biovent system; implementation of LUC/ICs; and five-year site reviews) is protective of human health and the environment and will remain so in the future as soil remediation goals are achieved.

8.3.8 References

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8.4 OPERABLE UNIT 9, AUTO HOBBY SHOP

8.4.1 Background

8.4.1.1 Site Description

OU 9 is located in the south central portion of the former Loring AFB and includes the Auto Hobby Shop (AHS), Building 6570 (Figure 8.4-1). Building 6570 is located northwest of the intersection of Weinman Road and Pennsylvania Road. The AHS site is located along the western side of Building 6570 and occupies approximately 2.2 acres. Figure 8.4-2 shows the prominent features of the AHS site. The eastern third of the AHS site is paved and relatively flat while the central and western portions are covered with grass and slope downward toward the Flightline Drainage Ditch (FLDD), which is about 150 ft to the west.

The AHS, Building 6570, was a garage used by base personnel to perform maintenance of personal vehicles. Activities included routine car maintenance, oil changes, parts cleaning, car painting, and car cleaning. Floor drains within the building were connected to the sanitary sewer system. Two USTs were located in the area of the AHS: a 5,000-gallon UST used to collect waste oil and a 5,000-gallon heating oil UST. The likely sources of contamination at the AHS site include the waste oil and heating oil USTs and potential spills and releases resulting from past site activities (ABB-ES, 1995).

Unconsolidated soils at the AHS consist of fill overlying peat and ablation till. The fill consists of sandy silt, silty sand, and gravel and appears to thin towards the western side of the site near the FLDD and towards the eastern side near Pennsylvania Road. Fill varies in thickness from 5 ft along the western edge of the site to 13.5 ft in areas near the western edge of the AHS building. Underlying the fill is a 3- to 4-foot thick layer of peat consisting of silt and organics. Ablation till underlies the peat and fill and is brown to gray silty sand with gravel. The thickness of the overburden and depth to bedrock ranges from 32.5 to 37 ft bgs.

Groundwater at the AHS occurs in both the unconsolidated overburden and the bedrock. The direction of flow in the overburden and the bedrock is primarily westerly toward the FLDD, under hydraulic gradients of 0.003 ft/ft in the overburden aquifer and 0.002 ft/ft in the

bedrock. Flow in the southern portion of the site, toward Weinman Road, becomes southerly. Groundwater in the overburden aquifer occurs between 10-13 ft bgs (MWH,2004).

8.4.1.2 Initial Response

Both USTs and contaminated soil associated with the heating oil UST were removed in 1992. Additionally, the heating oil UST was replaced with a new 2,000-gallon UST (AFBCA, 2000).

Because of the potential risks to human health, an EE/CA and a Corrective Action Plan (CAP) were prepared for OU 9 (AFBCA, 2000). The CAP for the AHS proposed bioventing to treat the fuel-related soil contamination (ABB-ES, 1996). Site-specific, risk-based RGs, which also considered the potential impacts to groundwater due to leaching of contaminants, were developed for the AHS site and were included in the CAP.

Based on the *Corrective Action Plan for OUs 5 & 9* (ABB-ES, 1996), a bioventing system was installed at the AHS site in 1996. The system includes 19 air injection wells and eight soil gas monitoring points (Figure 8.4-2). Following installation of the bioventing system, a 30-day testing period was initiated during which the system performance was monitored. As a result of this initial performance testing period, the final inspection of the bioventing system was performed and the system was certified operational and functional (Patrick St. Peter & Sons, Inc. [PSP], 1997). Soil samples were collected at the AHS in 1997. The sampling results indicated TPH-contaminated soil outside the northeast portion of the treatment zone of the bioventing system. An additional air injection well was installed in January 1999 to address this area.

8.4.1.3 Basis for Taking Action

During RI activities conducted at the AHS between 1988 and 1994, 14 soil borings were completed to characterize the nature and distribution of soil contamination. Although the soil contamination at the AHS site is fuel-related, the EPA and MEDEP were concerned about the infrequent low level concentrations of chlorinated compounds detected in soils at the site

during the RI. Therefore, the AHS was placed under the CERCLA process until soil confirmation samples verify that these contaminants do not pose a site risk.

Soils west of the AHS building were primarily contaminated with petroleum hydrocarbons from the ground surface to the saturated zone within the overburden. Figure 8.4-2 illustrates the historical extent of TPH contamination at the AHS (URS, 1995). TPH contamination extended west, northwest, and southwest of the building from the ground surface to a maximum depth of 16 ft below ground surface (PSP, 1997). TPH contamination was deepest near the AHS building and associated with former waste oil and fuel oil USTs and was shallower as the thickness of the overburden decreases toward the west. The detected concentrations of TPH during the RI soil investigations ranged from 37 to 39,000 mg/kg and were widely distributed; however, the higher concentrations were measured at depths near the groundwater table (ABB-ES, 1995).

8.4.2 Remedial/Removal Actions

The following subsections describe remedial actions at AHS.

8.4.2.1 Regulatory Actions

The controlling documents that present the selected remedy are described below.

Sites Within OUs 5, 8, 9, 10 and 11 Record Of Decision

The *Sites Within OUs 5, 8, 9, 10 and 11 Record of Decision* (HLA, 1999) documented the selection of a remedy that included continued operation of the bioventing system at the AHS site to continue to address the petroleum- and solvent-contaminated subsurface soils.

8.4.2.2 Remedial Action Objectives

Based on information relating to types of contaminants, environmental media of concern, and potential exposure pathways, remedial objectives were presented in the *Sites Within OUs 5, 8, 9, 10 and 11 ROD* (HLA, 1999). These remedial objectives were developed to mitigate existing and future potential threats to public health and the environment. The general RAOs

relevant to the AHS identified in the *Sites Within OUs 5, 8, 9, 10 and 11 ROD* (HLA, 1999) were stated as follows:

1. Prevent human exposure (i.e., ingestion, inhalation, and dermal contact) to contaminated soil with concentrations in excess of remediation goals.
2. Prevent ecological exposure (i.e., ingestion, inhalation, and biological uptake) to contaminated soil with concentrations in excess of remediation goals.
3. Prevent contaminated soil with concentrations in excess of remediation goals from migrating to groundwater.

8.4.2.3 Remedy Description

The chosen remedy for AHS as described in the *ROD* included the continued operation, performance monitoring, and data reporting for the bioventing system until the risk-based remediation goals are achieved, allowing for unlimited use of the site and unrestricted exposure.

Contaminants of concern and site-specific remediation goals were developed for AHS in the EE/CA and were included in the *Sites Within OUs 5, 8, 9, 10 and 11 ROD* (HLA, 1999). In the development of remediation goals for AHS, human health and ecological risk-based values and soil leaching model values were calculated. The site-specific remediation goals for AHS represent the most stringent of these values. The AHS remediation goals are listed in Table 8.4-1.

The chosen remedy for AHS as described in the *ROD* also included the conductance of Five-Year site reviews until the levels of contaminants remaining at the site allow for unlimited use and unrestricted exposure.

8.4.2.4 Remedy Implementation

Based upon the recommendations of the CAP, the bioventing system was installed at the AHS site in 1996 as an initial response action. Soil samples were collected at the AHS in 1997. The sampling results indicated TPH-contaminated soil outside the northeast portion of the treatment zone of the bioventing system. An additional air injection well was installed in

January 1999 to address this area. The chosen remedy for AHS documented in the *Sites Within OUs 5, 8, 9, 10 and 11 ROD* (HLA, 1999) was the continued operation of the bioventing system. The system was certified operational and functional in the *Bioventing at OUs 5, 8, 9, 10, and 11 Removal Action Report* (Bechtel, 1996).

An increase in biovent air flow of up to 3 times the original design was recommended in the *2002 Annual Performance Report* (MWH, 2003) in an attempt to accelerate remediation by better distributing the oxygen and enhancing biodegradation. The existing blower capacity was not sufficient to accommodate this flow; hence, in late July 2003, a larger blower was moved to the site and connected to the piping network. Although system operation remained biovent, the proposed air flow rates were sufficiently high that some volatilization of the contaminants was possible. If this occurred, most vapors would harmlessly exit through the soil surface; however, the AHS building was located in close enough proximity that the possibility existed for vapors to migrate under the building foundation and up through cracks in the concrete floor.

To eliminate this potential risk to AHS employees, vacuum vapor recovery was in operation on the building's concrete floor gravel subbase and at AEW-16 to capture any vapors that might migrate under the building frost wall. The enhanced system was started on July 22, 2003. The new operational mode significantly increased AIW air injection rates.

The AHS bioventing system was determined to be operating as designed in the *Auto Hobby Shop, Jet Engine Build-Up Shop/Entomology Shop, Former Jet Engine Test Cell and Base Laundry Sites Demonstration of a Remedial Action Operating Properly and Successfully* (MWH, 2004). Annual confirmation soil sampling was performed from 2000 until 2005 to monitor remedial progress at the site; the 2005 data showed that the bioventing system at the AHS site has achieved established RGs (MWH, 2006).

The bioventing system at the AHS site was temporarily shut down on November 29, 2006, based on approval from the MEDEP and EPA. The shut down was contingent upon independent verification of the 2005 confirmatory soil boring results via a soil boring program to be conducted by the MEDEP during the summer of 2007. MEDEP collected and analyzed confirmatory soil samples from the AHS in July 2007. Based on the results of these

samples, MEDEP gave written indication via e-mail in May 2008 that the remedial objectives for the AHS soil source had been achieved and that no further action was necessary for source removal under OU 9 at this site (MEDEP, 2008).

LUC/ICs are in place for AHS in the form of restrictions in the transfer agreement that was executed between the Air Force and the U.S. Department of Labor and in the deed that was executed with the LDA. As necessary to comply with CERCLA Section 120(h) and the Loring AFB FFA (FFA, 1995), the transfer documents contain provisions restricting any activities that could jeopardize the protectiveness of the remedial action. Any such actions are prohibited without the prior approval of the Air Force, EPA, and MEDEP. The Air Force screens and approves proposed activities that are determined to have no impact on the protectiveness of the remedial action.

The deed and transfer agreement implemented several LUC/IC measures. These include general provisions allowing the Air Force to conduct, operate, maintain, or undertake any remedial action required under the Loring IRP. Additional LUC/IC measures include a URZ prohibiting both residential use and establishment of child care facilities, playgrounds, or elementary/secondary schools and prohibiting any subsurface excavating, digging, drilling, subsurface construction or other disturbance of the surface without notice to and written approval of the Air Force. The LUC/IC measures also prohibit use of groundwater.

The LUC/ICs implemented for AHS are monitored and maintained in accordance with the *LUC/IC Management Plan* (AFRPA, 2004). No violations of the LUC/ICs have been documented. The ongoing use of the property conforms with the restrictions of the URZ, and this use is not expected to change. The LUC/ICs remain protective; no deficiencies have been identified.

8.4.3 Implementation of Recommendations from Last Five-Year Review

The last *Five-Year Review Report* (MWH, 2005) concluded that the remedies for AHS remained protective of human health and the environment. The following recommendations were included in the second *Five-Year Review Report* (MWH, 2005):

- Routine annual system performance reviews and confirmation soil sampling should continue. Routine monitoring for AHS should also include monitoring of LUC/ICs to document their continued effectiveness.

Annual evaluation of system performance including the collection of confirmation soil samples, progress toward RGs, and optimization efforts were documented in the following:

- *Bioventing and Soil Vapor Extraction at OUs 5, 8, 9, 10, and 11, 2005 Annual Performance Report* (MWH, 2006)
- *Bioventing and Soil Vapor Extraction at OUs 5, 8, 9, 10, and 11, 2006 Annual Performance Report* (URS, 2007)
- *Bioventing and Soil Vapor Extraction at OUs 5, 8, 9, 10, and 11, 2007 Annual Performance Report* (URS, 2008a)
- *Bioventing and Soil Vapor Extraction at OUs 5, 8, 9, 10, and 11, 2008 Annual Performance Report* (URS, 2009)

This Five-Year Review Report documents the third review for the AHS site under OU 9 source control.

8.4.4 Technical Assessment

The technical assessment component of the five-year review consists of evaluating the protectiveness of the remedy. The technical assessment was performed based on guidance provided in Section 4.0 of the *Comprehensive Five-Year Review Guidance* (U.S. EPA, 2001).

8.4.4.1 Question A

Question A: Is the remedy functioning as intended by the decision documents?

As documented above, the chosen remedy is protective of human health and the environment and facilitated the attainment of RAOs. As shown in Section 8.4.2.4, MEDEP gave written indication via e-mail in May 2008 that the remedial objectives for the AHS soil source had been achieved and that no further action was necessary for source removal under OU 9 for this site (MEDEP, 2008).

8.4.4.2 Question B

Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of the remedy selection still valid?

Changes in Standards: No federal or state regulations specify concentration limits for contaminants in soil. Site-specific, risk-based soil target clean-up levels were developed during the CAP, considering both current and projected future land use at AHS, and were taken into account during *Sites Within OUs 5, 8, 9, 10 and 11 Record of Decision* AHS soil remedial goal selection (HLA, 1999). The *Sites Within OUs 5, 8, 9, 10 and 11 Record of Decision* (HLA, 1999) AHS soil RGs represent the most stringent value of human health and ecological risk-based values as well as soil leaching model results.

Changes in Exposure Pathways: The last five-year review identified several issues requiring follow-up actions, and recommended that the Air Force consider any appropriate guidance to determine if the vapor intrusion (VI) pathway for various groundwater contaminant plumes at Loring AFB, including the Flightline Drainage Ditch North plume beneath the AHS, required additional analysis.

Since 2008, an evaluation of the VI pathway has been ongoing at the AHS as part of a larger study at Loring AFB. Data generated from VI pathway investigations at the AHS were provided in the *Groundwater to Indoor Air Vapor Intrusion Pathway Screening Evaluation Using 2007 Operable Unit 12 Groundwater Analytical Data* report (URS, 2008b), which recommended additional investigation at the AHS, and the *Soil Vapor Intrusion Investigation Report* (URS, 2010), which summarized the EPA Method TO-15 VOC analytical results for 2 sub-slab air, 1 indoor air, and 1 outdoor air samples collected in December 2009 at Building 6570.

The groundwater contaminant TCE was present in sub-slab soil vapor at Building 6570 at a concentration only slightly above its EPA and below its MEDEP guideline values (URS, 2010). PCE has been detected at very low concentrations in groundwater but was detected at a concentration above both EPA and MEDEP guideline levels in sub-slab soil vapor. The groundwater to sub-slab soil vapor pathway appears to be marginally complete at Building 6570. Building 6570 is currently utilized by the Loring Job Corps as an automotive

maintenance instructional facility and numerous solvents and fuel-related compounds were detected in the indoor air sample, consistent with the activities that are performed in the building and the chemicals used. The Air Force does not believe that any health concerns due to vapor intrusion currently exist at the AHS (Building 6570), but the BCT is still evaluating and discussing the VI pathway at the AHS. Additional, more comprehensive VI investigations are being planned for the winter of 2010-2011 at Loring AFB; the AHS sampling data will be reevaluated in the context of the data compiled from this larger investigation.

Changes in Toxicity and Other Contaminant Characteristics: The remedy has met site soil remediation goals and site soils are suitable for unlimited use and unrestricted exposure.

Changes in Risk Assessment Methods: The original HHRA was conducted following then current EPA and EPA Region 1 guidance. Risk assessments are performed somewhat differently now than they were at the time of the last Five-Year Review and especially since the time of the *Sites Within OUs 5, 8, 9, 10 and 11 ROD.* Guidance documents/risk assessment tools that have been issued include:

- Background guidance (2002), which changed the way background comparisons are performed for metals.
- EPA guidance regarding the sources of toxicity values (December 2003) has changed; toxicity values are now generally obtained from EPA Regional Screening Levels tables.
- EPA Risk Assessment Guidance for Superfund (RAGS) Part E (2004), which changed the way dermal risk assessment is performed.
- EPA ProUCL guidance and software (numerous versions of new guidance and software, up through 2008), which changed the way 95% UCLs are calculated.
- EPA RAGS Part F (2008), which changed the way inhalation risk assessment is performed. There are many chemicals with new toxicity values in this document.
- *Guidelines for Carcinogenic Risk Assessment* (EPA, 2005a) and *Supplemental Guidance for Assessing Susceptibility from Early Life Exposure to Carcinogens* (EPA, 2005b), which provide updated guidance for preparation of cancer risk assessments.

- State of Maine documents *Guidance for Human Health Risk Assessments for Hazardous Waste Sites in Maine* (MEDEP and CDC, 2009) and *Maine Remedial Action Guidelines (RAGS) for Soil Contaminated with Hazardous Substances* (MEDEP, 2010).

Changes have been made with regard to toxicity values. In particular, provisional toxicity values that EPA previously did not consider valid for use in risk assessments are now considered valid.

Expected Progress Toward Meeting RAOs: Implementation of the remedy for AHS has met each of the RAOs, based on data generated from the MEDEP's 2007 confirmatory soil sampling event (MEDEP, 2008).

8.4.4.3 Question C

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

The remedy has met site soil remediation goals and site soils are suitable for unlimited use and unrestricted exposure. No new information calls the protectiveness of this soils/source remedy. Ongoing groundwater management is conducted under OU12.

8.4.4.4 Technical Assessment Summary

As described above, the remedy at AHS has functioned and the soil RGs at the AHS site have been met. LUC/ICs are no longer required for the OU9 remedy. However, ground water ICs will continue to be required as part of the OU 12 remedy that includes ground water under the AHS. No other changes in exposure pathways or toxicity and other contaminant characteristics are affecting the protectiveness of the remedy. The remedy has achieved the RAOs, and no other information has come to light that would call into question the protectiveness of the remedy.

8.4.5 Issues

No issues were identified for the AHS site.

8.4.6 Recommendations and Follow-Up Actions

Routine reporting of groundwater conditions at the AHS should continue under the OU 12 Basewide Groundwater LTM program. This Five-Year Review Report should serve as the final review of AHS source remedial activities under OU 9.

8.4.7 Protectiveness Statement

The remedial action at AHS in OU 9 (operation of the biovent system, implementation of LUC/ICs, and five-year site reviews) has achieved soil remediation goals and has been protective of human health and the environment.

8.4.8 References

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8.5 OPERABLE UNIT 10, ENTOMOLOGY SHOP/JET ENGINE BUILDUP SHOP

8.5.1 Background

8.5.1.1 Site Description

The Entomology Shop (ES), Building 8265, consisted of a small two-story building located in the central portion of the Flightline Area (FLA), east of Arizona Road (Figure 8.5-1). The ES and immediate vicinity occupy approximately 1.8 acres. The Jet Engine Buildup Shop (JEBS), Building 8260, is located within the boundaries of IRP OU 10, which lies west of the FLA in the industrial area of the base. The JEBS and immediate vicinity occupy approximately four acres.

The JEBS building is surrounded by many buildings, and varying amounts of bituminous pavement and concrete cover the ground surface on all four sides of the JEBS, controlling the surface water runoff and drainage. The surface water drainage is primarily to the west and south on the southern end of the JEBS. The surface water is collected in a channel southwest of the building, which continues toward the ES. This swale also receives discharge from the drainage features on the east side of the JEBS (Figure 8.5-2).

The ES site was originally used as a treatment facility for wastewater from the JEBS and the Double Cantilever (DC) and Arch Hangars. In the early 1970s, the building was converted for use in mixing and storing pesticides and herbicides for routine application at the base. No spills were recorded at the site. In 1992, operations were moved and the building was left vacant. The likely sources of contamination at the site include the drainlines connected to the ES building and the ES building basement where the former wastewater treatment process occurred (AFBCA, 2000).

Activities associated with the JEBS site included draining, maintenance, repair, teardown, and modification of jet engines. Facilities at the JEBS included a small washrack room in the northwest corner of the building. Wash water was collected in a floor drain, piped to a sand and grease trap and OWS just outside the building, then to the ES for treatment. From 1952 to 1991, the types of waste stored at the JEBS included paint waste, chemical waste and

mixed petroleum waste. Contamination detected in soil at JEBS consists primarily of constituents originating from cleaning agents/solvents, greases, oils, and paints, which were used on a regular basis at the JEBS (AFBCA, 2000).

The overburden in the vicinity of JEBS is believed to be generally unsaturated with respect to groundwater and consists of 15 to 20 feet of fill and glacial till, which overlie limestone bedrock (HLA, 1998; AFBCA, 2000). However, groundwater is often first encountered in the overburden at depths ranging from approximately 9 to 14 ft bgs; this is believed to represent lenses of higher permeability material containing perched groundwater (AFBCA, 2000). When the Base was constructed, an unknown quantity of fill was excavated and placed in the JEBS area for the construction of the flightline. Generally, the fill present in the vicinity of the JEBS building consists of re-worked till which is described as an olive brown sandy silt to silty sand with little to some sub-rounded to sub-angular gravel and is massive in appearance. The contact between fill and till deposits in JEBS area is generally encountered 6 to 8 ft bgs. Undisturbed till encountered at the JEBS appears to be predominantly a basal till comprised of basal drift and lodgement till. The basal till is generally described as an olive brown to olive gray sandy silt and silty sand with trace to little clay.

The bedrock underlying the unconsolidated deposits at JEBS consists of low-grade metamorphic limestone classified as the upper Cary Mills Formation (MWH, 2004). The bedrock surface ranges from approximately 709 ft mean sea level (MSL) to 695 ft MSL across the site. Elevation of the bedrock surface appears to be highest in the vicinity of Building 8261. The bedrock surface is relatively flat immediately north of the JEBS building and gently sloping to the west-southwest across the remainder of the site (i.e. south, east, and west of the building). The water table is believed to occur in bedrock beneath the site, typically at depths ranging from 29 to 47 ft bgs.

8.5.1.2 Initial Response

Due to the potential risks to human health and ecological receptors, an EE/CA was prepared for ES and JEBS recommending a combination of bioventing and excavation of contaminated soil with disposal at LF-3 (URS, 1995a). Preliminary RGs were developed for

the ES site and were included in the EE/CA (URS, 1995a). The ES building walls and foundation were demolished in 1995 and the waste drainline from the JEBS was removed. Contaminated soil was also removed from the area beneath and surrounding the building. Further soil and drainline excavation was completed in 1996. Excavation activities conducted at the ES during the 1995 and 1996 construction seasons resulted in the excavation of approximately 10,207 cy of contaminated soil, which were disposed of at LF 3. Soil confirmation samples collected following drainline excavations indicated that the 1995 preliminary RGs were met for these portions of the ES/JEBS sites (Bechtel, 1996 and 1997).

Based on the *Action Memorandum for OUs 5, 8, 9, 10, and 11* (URS, 1995b), a bioventing system was installed at the ES site in 1996. The system continued to operate to address the fuel-contaminated soil in the vicinity of the building foundation until 1998 when soil confirmation samples were collected. The data indicated that the site-specific, preliminary RGs for the fuel-related contaminants had been achieved; however, TCE and PCE were detected at concentrations in excess of the preliminary RGs (Bechtel, 1999a).

Based on the *Action Memorandum for the JEBS and Building 8710* (Bechtel, 1998), an in-situ soil vapor extraction (SVE) system was installed at the JEBS site in 1998. The system includes 52 air extraction wells, 10 air vents, and 12 soil gas monitoring points (Figure 8.5-2). Following installation of the SVE system, a 30-day testing period was initiated during which the system performance was monitored. As a result of this initial performance testing period, normal operation of the system began in December 1998 (Bechtel, 1999a) and has remained in operation since.

Based on the *Biovent Sites Confirmation Sampling Field/Laboratory Results and Recommendations* (Bechtel, 1999b), three bioventing wells located immediately adjacent to the former ES building foundation were connected to the in-situ SVE system at the JEBS site in 1998 (Bechtel, 1999b). Following conversion of the wells and connection to the SVE system at the JEBS site, a 30-day testing period was initiated during which the system performance was monitored. As a result of this initial performance testing period, normal operation of the system began in December 1998 (Bechtel, 1999b).

8.5.1.3 Basis for Taking Action

During RI activities conducted at the ES between 1988 and 1993, soil borings were completed to characterize the nature and distribution of soil contamination, and sampling and analysis of the drains connected to the ES building and of the sludge and water in the ES building basement were conducted. The RI identified fuel, solvent, and pesticide-related contaminants in soil at the site (ABB-ES, 1994).

During RI activities conducted at JEBS, constituents originating from cleaning agents/solvents, greases, oils, and paints, which were used on a regular basis at the JEBS, were detected in soils. During additional SI activities conducted at the JEBS in 1997, 91 TerraProbe™ explorations and 31 soil borings were completed to characterize the nature and distribution of soil contamination. The SI identified three areas of subsurface soil contamination north, south, and southwest of the JEBS building (HLA, 1998). The likely sources of this contamination include the washrack, floor drains, oil and grease trap, OWS, and spills resulting from past activities at the JEBS site.

8.5.2 Remedial/Removal Actions

The following subsections describe remedial actions at ES/JEBS.

8.5.2.1 Regulatory Actions

Described below are the controlling documents that present the selected remedy.

Sites Within OUs 5, 8, 9, 10 and 11 Record Of Decision

The *Sites Within OUs 5, 8, 9, 10 and 11 Record of Decision* (HLA, 1999a) documented the selection of a remedy that included continued operation of the SVE system at the ES and JEBS sites to continue to address the petroleum and solvent-contaminated subsurface soils.

8.5.2.2 Remedial Action Objectives

Based on information relating to types of contaminants, environmental media of concern, and potential exposure pathways, remedial objectives were presented in the *Sites Within OUs 5,*

8, 9, 10 and 11 ROD (HLA, 1999a). These remedial objectives were developed to mitigate existing and future potential threats to public health and the environment. The general RAOs relevant to the ES/JEBS identified in the *Sites Within OUs 5, 8, 9, 10 and 11 ROD* (HLA, 1999a) are stated as follows:

1. Prevent human exposure (i.e., ingestion, inhalation, and dermal contact) to contaminated soil with concentrations in excess of remediation goals.
2. Prevent ecological exposure (i.e., ingestion, inhalation, and biological uptake) to contaminated soil with concentrations in excess of remediation goals.
3. Prevent contaminated soil with concentrations in excess of remediation goals from migrating to groundwater.

8.5.2.3 Remedy Description

The chosen remedy for ES/JEBS as described in the *ROD* included the continued operation, performance monitoring, and data reporting for the SVE system until the risk-based RGs are achieved, allowing for unlimited use of the site and unrestricted exposure.

Contaminants of concern and site-specific RGs were developed for ES/JEBS in the EE/CA and were included in the *Sites Within OUs 5, 8, 9, 10 and 11 ROD* (HLA, 1999a). In the development of RGs for ES/JEBS, human health and ecological risk-based values were calculated and soil leaching model values were calculated. The site-specific RGs for ES/JEBS represent the most stringent of these values. The ES/JEBS RGs are listed in Table 8.5-1.

The chosen remedy for ES/JEBS as described in the *ROD* also included performing five-year site reviews until the levels of contaminants remaining at the site allow for unlimited use and unrestricted exposure.

8.5.2.4 Remedy Implementation

Based on the *Action Memorandum for the JEBS and Building 8710* (Bechtel, 1998), an in-situ SVE system was installed at the JEBS site in 1998. Based on the *Biovent Sites Confirmation Sampling Field/Laboratory Results and Recommendations* (Bechtel, 1999b),

three bioventing wells located immediately adjacent to the former ES building foundation were connected to the in-situ SVE system at the JEBS site in 1998 (Bechtel, 1999b). The chosen remedy for ES and JEBS documented in the *Sites Within OUs 5, 8, 9, 10 and 11 ROD* (HLA, 1999a) was the continued operation of the SVE system. The ES/JEBS SVE system was determined to be operating as designed in the *Auto Hobby Shop, Jet Engine Build-Up Shop/Entomology Shop, Former Jet Engine Test Cell and Base Laundry Sites Demonstration of a Remedial Action Operating Properly and Successfully* (MWH, 2004). Confirmation soil sampling has been performed to monitor remedial progress at the site and has shown that the SVE system at the JEBS site has reduced the areal extent of soil above the established RGs to a small area just south of Building 8260 (Figure 8.5-3).

Since the last Five-Year Review, the following have occurred with respect to the operation, maintenance, and monitoring of the SVE system at ES and JEBS:

- The system operated until November 24, 2008, when it was shut down for the winter. The system did not operate in 2009 prior to a soil confirmation sampling event conducted in September 2009.
- Wells in the North JEBS area were last operated in 2006. All remaining active air extraction wells are located in the South JEBS area. Only nine of the 52 original extraction wells were operated in 2008, in addition to two of passive air vents (PAV-8 and PAV-9) that had been converted for use as SVE wells. Extraction wells were operated in the small area south of Building 8260 where soil at concentrations above RGs remains.

LUC/ICs are in place for ES/JEBS in the form of restrictions in the deed that was executed between the Air Force and the current owners of the property (LDA). As necessary to comply with CERCLA Section 120(h) and the Loring AFB FFA (FFA, 1995), the deed of transfer contains provisions restricting any activities that could jeopardize the protectiveness of the remedial action. Any such actions are prohibited without the prior approval of the Air Force, EPA, and MEDEP. The Air Force screens and approves proposed activities that are determined to have no impact on the protectiveness of the remedial action.

The deed implemented several LUC/IC measures. These include general provisions allowing for the Air Force continued operation of the SVE system in the future including right of access to conduct, operate, maintain or undertake any remedial action required under the

Loring IRP. Additional LUC/IC measures include a URZ prohibiting any subsurface excavating, digging, drilling, subsurface construction or other disturbance of the surface without notice to and written approval of the Air Force.

The LUC/ICs implemented for ES/JEBS are monitored and maintained in accordance with the *LUC/IC Management Plan* (AFRPA, 2004). No violations of the LUC/ICs have been documented. The ongoing use of the property conforms with the restrictions of the URZ, and this use is not expected to change. The LUC/ICs remain protective; no deficiencies have been identified.

8.5.3 Implementation of Recommendations from Last Five-Year Review

The last *Five-Year Review Report* (MWH, 2005), concluded that the remedies for ES/JEBS remained protective of human health and the environment. The following recommendations were included in the second *Five-Year Review Report* (MWH, 2005):

- Routine annual system performance reviews and confirmation soil sampling should continue.
- Routine monitoring for JEBS/ES should also include monitoring of LUC/ICs to document their continued effectiveness.

LUC/IC compliance and annual evaluation of system performance, including the collection of confirmation soil samples, progress toward RGs, and optimization efforts, were documented in the following:

- *Bioventing and Soil Vapor Extraction at OUs 5, 8, 9, 10, and 11, 2005 Annual Performance Report* (MWH, 2006)
- *Bioventing and Soil Vapor Extraction at OUs 5, 8, 9, 10, and 11, 2006 Annual Performance Report* (URS, 2007)
- *Bioventing and Soil Vapor Extraction at OUs 5, 8, 9, 10, and 11, 2007 Annual Performance Report* (URS, 2008a)
- *Bioventing and Soil Vapor Extraction at OUs 5, 8, 9, 10, and 11, 2008 Annual Performance Report* (URS, 2009)

- *Bioventing and Soil Vapor Extraction at OUs 5, 8, 9, 10, and 11, 2009 Annual Performance Report* (URS, 2010a)

This *Five-Year Review Report* documents the third review for the ES/JEBS site under OU 10 source control.

8.5.4 Technical Assessment

The technical assessment component of the five-year review consists of evaluating the protectiveness of the remedy. The technical assessment was performed based on guidance provided in Section 4.0 of the *Comprehensive Five-Year Review Guidance* (U.S. EPA, 2001).

8.5.4.1 Question A

Question A: Is the remedy functioning as intended by the decision documents?

The chosen remedy is protective of human health and the environment. The system has removed a substantial portion of the vadose zone soil contamination such that only a small area (approximately 80 feet by 80 feet, see Figure 8.5-2 and 8.5-3) in south JEBS remains where TCE concentrations exceed the OU 10 soil remediation goal. This remaining contaminated soil area appears to be largely saturated by perched groundwater for most of the year, rendering SVE ineffective in reducing soil contaminant concentrations further.

Based on the remaining area of soil source contamination (approximately 80 ft by 80 ft [Figure 8.5-2]), the depth of the vadose zone (assumed to be 8 ft bgs), a soil density of 100 pounds per cubic foot (lb/ft^3) and a maximum concentration of 2,300 micrograms per kilogram (µg/kg) in the 5-7 ft interval (2009 sampling event [Figure 8.5-3]), the total mass of contamination remaining in this area is estimated to be approximately 12 pounds. This is less than one-half of one percent (0.5%) of the more than 3,000 lbs of contamination estimated to have been removed by the SVE system as of 2008 (URS, 2009).

Additional investigations are being performed in the area of south JEBS where TCE concentrations in soil remain above the OU 10 soil remediation goals. Two new overburden soil borings/ monitoring wells were installed near boring SB-JEBS-059 on August 24, 2010 to acquire additional hydrogeologic and contaminant distribution information in this area.

Soil and groundwater sampling data from these new wells will be evaluated by the BCT when they are available.

8.5.4.2 Question B

Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of the remedy selection still valid?

Changes in Standards: No federal or state regulations specify concentration limits for contaminants in soil. Site-specific, risk-based remediation goals were developed during the EE/CA considering both current and projected future land use at ES/JEBS. The *Sites Within OUs 5, 8, 9, 10 and 11 Record of Decision* (HLA, 1999) ES/JEBS soil RGs represent the most stringent value of human health and ecological risk-based values as well as soil leaching model results.

Changes in Exposure Pathways: The last five-year review recommended that the Air Force consider any appropriate guidance to determine if the vapor intrusion (VI) pathway for various groundwater contaminant plumes at Loring AFB required additional analysis. Since 2008, an evaluation of the VI pathway has been ongoing at the ES/JEBS as part of a larger study at Loring AFB. Data generated from VI pathway investigations at the ES/JEBS were provided in the *Groundwater to Indoor Air Vapor Intrusion Pathway Screening Evaluation Using 2007 Operable Unit 12 Groundwater Analytical Data* report (URS, 2008b), which recommended additional investigation of Building 8260 (the former Jet Engine Buildup Shop), and the *Soil Vapor Intrusion Investigation Report* (URS, 2010b), which summarized the EPA Method TO-15 VOC analytical results for 3 sub-slab air and 1 indoor air samples collected in December 2009 at Building 8260.

The groundwater contaminant TCE was present in sub-slab soil vapor at Building 8260 at a significant concentration above both MEDEP and EPA guidelines; TCE was also detected in the indoor air sample (URS, 2010b). The groundwater to sub-slab soil vapor pathway may be complete at this building. However, Building 8270 is currently utilized by the Maine Military Authority as a repair facility for military vehicles and the penetrating oil, degreasers, and brake cleaning fluids used in the building contain the chlorinated hydrocarbons detected in groundwater. The Air Force does not believe that any health concerns due to vapor

intrusion currently exist at Building 8260, but the BCT is still evaluating and discussing the VI pathway at the ES/JEBS. Additional, more comprehensive VI investigations are being planned for the winter of 2010-2011 at Loring AFB; additional ES/JEBS sampling data will be collected and all relevant data for the site will be reevaluated in the context of the data compiled from this larger investigation.

Changes in Toxicity and Other Contaminant Characteristics: Remediation goals that are protective of human health and the environment were established based on the EPA and MEDEP Risk Assessment Guidance and the *LAFB Risk Assessment Methodology* (HAZWRAP, 1994). Human health remediation goals were calculated using a $1x10^{-6}$ risk level for carcinogens and a HI of one for noncarcinogens. Ecological remediation goals were developed by back-calculating the ecological models to obtain soil concentrations that would result in a HQ of one. Soil leaching model results were used to develop soil remediation goals that would result in groundwater at concentrations less than the Federal Safe Drinking Water Act MCLs or the MEGs.

Remediation goals were established for TCE and PCE at ES. However, carcinogenic risks from exposure to these chemicals did not exceed $1x10^{-6}$.

Although carcinogenic risks exceeded $1x10^{-4}$ for several receptors, COPCs contributing to the risks were not selected for development of remediation goals in the risk assessment. In addition, noncarcinogenic hazards did exceed HI=1 for construction workers, but remediation goals were not developed for the COPC contributing to the risk. Based on review of the final remediation goals selected under the ROD, the final standards were based on soil leaching model values and potential threats from TPH in soil to groundwater. Therefore, the final remediation goals were not selected on the basis of the human health and ecological risk assessments.

Remediation goals were established for benzo(a)anthracene, benzo(a)pyrene, chrysene, PCE and TCE at the JEBS. Available human health inhalation carcinogenic toxicity factors for benzo(a)anthracene, TCE, and chrysene are lower than those used in the risk assessment, (See Table 8.3-2) resulting in a lower cancer risk. Noncarcinogenic risks to all receptors were less than HI=1. As was the case with remediation goals for the ES, remediation goals

for the JEBS were not developed based on results of human health and ecological risk assessments. Remediation goals were developed because of presence of potential adverse effect on groundwater quality. Therefore, changes in toxicity factors do not affect the remediation goals applied under the ROD.

In addition to the constituents for which remediation goals were calculated, several others were identified as COPCs in the human health risk assessment. It is possible that changes in toxicity values for some COPCs may result in total estimated risk that exceeds target risk level. Therefore, toxicity factors for all COPCs were evaluated to identify changes in values used in the risk assessment versus values currently available. Tables 7.3-2 and 8.3-2 list all COPCs identified in soil at OU 10 at the Loring AFB for which toxicity factors have changed. Toxicity factors remain unchanged for all other COPCs not listed in Tables 7.3-2 and 8.3-2.

Among the COPCs identified at OU 10, toxicity factors have changed for a number of COPCs. For carcinogenic and non-cancer risks, estimated risks using currently available toxicity factors would not significantly add to the total risks.

In addition, several compounds currently have toxicity factors available, that were not available at the time of the risk assessment. Estimated noncarcinogenic risks due to exposure to these compounds will not be significant if currently available toxicity factors are used.

Unlike human health risk assessments, EPA does not recommend specific toxicity reference doses for constituents in ecological risk assessments. The toxicity factors used in the ecological risk assessment are considered protective of the environment.

Changes in Risk Assessment Methods: The original HHRA was conducted following then current EPA and EPA Region 1 guidance. Risk assessments are performed somewhat differently now than they were at the time of the last Five-Year Review and especially since the time of the *Sites Within OUs 5, 8, 9, 10 and 11 ROD.* Guidance documents/risk assessment tools that have been issued include:

- Background guidance (2002), which changed the way background comparisons are performed for metals.

- EPA guidance regarding the sources of toxicity values (December 2003) has changed; toxicity values are now generally obtained from EPA Regional Screening Levels tables.

- EPA Risk Assessment Guidance for Superfund (RAGS) Part E (2004), which changed the way dermal risk assessment is performed.

- EPA ProUCL guidance and software (numerous versions of new guidance and software, up through 2008), which changed the way 95% UCLs are calculated.

- EPA RAGS Part F (2008), which changed the way inhalation risk assessment is performed. There are many chemicals with new toxicity values in this document.

- *Guidelines for Carcinogenic Risk Assessment* (EPA, 2005a) and *Supplemental Guidance for Assessing Susceptibility from Early Life Exposure to Carcinogens* (EPA, 2005b), which provide updated guidance for preparation of cancer risk assessments.

- State of Maine documents *Guidance for Human Health Risk Assessments for Hazardous Waste Sites in Maine* (MEDEP and CDC, 2009) and *Maine Remedial Action Guidelines (RAGS) for Soil Contaminated with Hazardous Substances* (MEDEP, 2010).

Changes have been made with regard to toxicity values. In particular, provisional toxicity values that EPA previously did not consider valid for use in risk assessments are now considered valid.

Expected Progress Toward Meeting RAOs: Implementation of the remedy for ES/JEBS has made substantial progress toward meeting the RAOs, based on observed decreasing contaminant concentration trends of COCs in soil. It is estimated that over 99.5% of the original contaminant mass has been removed. However, the current SVE treatment may be ineffective in achieving further contaminant reductions in the small area of south JEBS where TCE concentrations in soil remain above the OU 10 soil remediation goals.

8.5.4.3 Question C

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

Since 2008, an evaluation of the soil vapor intrusion pathway has been ongoing at ES/JEBS, as part of a larger study at Loring AFB. The Air Force does not believe that any health concerns due to vapor intrusion currently exist at Building 8260, but the BCT is still

evaluating and discussing the VI pathway at the ES/JEBS. Additional, more comprehensive VI investigations are being planned for the winter of 2010-2011 at Loring AFB; additional ES/JEBS sampling data will be collected and all relevant data for the site will be reevaluated in the context of the data compiled from this larger investigation. Any potential impacts of the soil vapor intrusion pathway at ES/JEBS on the protectiveness of the remedy are still being evaluated by the BCT. No other information has been identified that would call into question the protectiveness of the remedy.

8.5.4.4 Technical Assessment Summary

As described above, the SVE treatment at ES/JEBS has reached a point of diminishing returns. While the soil RGs at the ES/JEBS site have not been met across the site, the contamination remaining in the one small area south of Building 8260 contains less than 0.5% of the original contaminant mass. Additional soil and groundwater investigations are being performed in the area of south JEBS where TCE concentrations in soil remain above the OU 10 soil remediation goals; results from these investigations will be evaluated by the BCT as they become available. No changes in exposure pathways or toxicity and other contaminant characteristics are affecting the protectiveness of the remedy.

8.5.5 Issues

It appears that the SVE treatment at ES/JEBS has reached a point of diminishing returns after removing over 99.5% of the original contaminant mass. The small area of remaining soil where TCE concentrations in soil remain above the OU 10 soil remediation goals appears to be saturated for most of the year and largely unaffected by SVE treatment strategies.

Additional investigation of the VI pathway at ES/JEBS site is warranted.

8.5.6 Recommendations and Follow-Up Actions

Additional investigations are being performed in the area of south JEBS where TCE concentrations in soil remain above the OU 10 soil remediation goals. Two new overburden soil borings/ monitoring wells were installed near boring SB-JEBS-059 on August 24, 2010 to acquire additional hydrogeologic and contaminant distribution information in this area.

Soil and groundwater sampling data from these new wells will be evaluated by the BCT when they are available.

Additional, more comprehensive VI investigations are being planned for the winter of 2010-2011 at Loring AFB; additional ES/JEBS sampling data will be collected and all relevant data for the site will be reevaluated in the context of the data compiled from this larger investigation.

8.5.7 Protectiveness Statement

The remedial action at ES and JEBS in OU 10 (operation of the SVE system, implementation of LUC/ICs, and five-year site reviews) is currently protective of human health and the environment.

8.5.8 References

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URS, 1995b. *Action Memorandum for Operable Units 5, 8, 9, 10, and 11*; Final; Environmental Restoration Program; prepared for Air Force Center for Environmental Excellence; Denver, Colorado. May.

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8.6 OPERABLE UNIT 11, BASE LAUNDRY

8.6.1 Background

8.6.1.1 Site Description

OU 11 is located in the south central portion of Loring AFB and includes the former Base Laundry (BL), Building 7330 (Figure 8.6-1). The BL site is located northeast of the intersection of Loring Commerce Road and Pennsylvania Road and is approximately five acres in size (Figure 8.6-2).

Prior to 1970, Building 7330 was used as a bakery; it became operational as the BL in 1971. As part of the laundry operations, dry cleaning was performed in the building. PCE was originally delivered to the laundry in drums, then later by a tank truck that pumped into an AST north of the building. Used PCE was originally containerized in drums and was later sent to a second AST. Spills or releases may have occurred on or surrounding the pavement near the building. Floor drains in the area of dry cleaning operations appeared to empty into the storm sewer, which discharges into an open drainage ditch southwest of the site (MWH, 2004).

The geology at the BL site has been characterized as reworked till (fill) and glacially-derived till overlying limestone bedrock. The fill is composed of silty clay to sandy silt with coarse gravel, and ranges in thickness from 0 to 6 ft. The fill overlies till composed of olive brown to gray, firm to compact, silt and sand with lesser amounts of gravel and cobbles. The thickness of the till at the BL is between 6 and 29 ft. Bedrock is gray to bluish gray, layered, pelitic limestone ranging in depth from approximately 6 to 36 ft bgs across the site. A frost wall is present along the BL building foundation, which extends to a depth of approximately 7 ft bgs (ABB-ES, 1995 and 1996).

8.6.1.2 Initial Response

Because of the potential risks to human health and ecological receptors, an EE/CA and an Action Memorandum were prepared for the site recommending in-situ SVE for the PCE-contaminated soil (URS, 1996a and 1996b). Based on the *Action Memorandum for*

Operable Unit 11 (URS, 1996b), an in-situ SVE system was installed at the BL site in 1996. Following installation of the SVE system, a 30-day testing period was initiated during which the system performance was monitored. As a result of this initial performance testing period, normal operation of the system began in September 1996 (Bechtel, 1997). The SVE system initially consisted of two vertical air extraction wells (AEWs) (Figure 8.6-2). In 1997, a horizontal AEW was installed. Based on 1998 soil sampling results, three additional vertical AEWs were installed (Bechtel, 1999).

8.6.1.3 Basis for Taking Action

During RI activities conducted at the BL between 1988 and 1994, TerraProbe™ explorations and soil borings were completed to characterize the nature and distribution of soil contamination. The RI identified PCE in subsurface soils in the vicinity of the BL (ABB-ES, 1996). PCE is the main contaminant of concern and was present in a number of areas around the BL. The area of highest PCE concentrations in soil was identified at the northeast corner of the building and was associated with steam discharges from a vent pipe (MWH, 2006a and 2006b).

8.6.2 Remedial/Removal Actions

The following subsections describe remedial actions at BL.

8.6.2.1 Regulatory Actions

Described below are the controlling documents that present the selected remedy.

Sites Within OUs 5, 8, 9, 10 and 11 Record Of Decision

The *Sites Within OUs 5, 8, 9, 10 and 11 Record of Decision* (HLA, 1999) documented the selection of a remedy that included continued operation of the SVE system at the BL site to remediate the PCE contaminated subsurface soils.

8.6.2.2 Remedial Action Objectives

Based on information relating to types of contaminants, environmental media of concern, and potential exposure pathways, remedial objectives were presented in the *Sites Within OUs 5, 8, 9, 10 and 11 ROD* (HLA, 1999). These remedial objectives were developed to mitigate existing and future potential threats to public health and the environment. The general RAOs relevant to the BL identified in the *Sites Within OUs 5, 8, 9, 10 and 11 ROD* (HLA, 1999) are stated as follows:

1. Prevent human exposure (i.e., ingestion, inhalation, and dermal contact) to contaminated soil with concentrations in excess of remediation goals.
2. Prevent ecological exposure (i.e., ingestion, inhalation, and biological uptake) to contaminated soil with concentrations in excess of remediation goals.
3. Prevent contaminated soil with concentrations in excess of remediation goals from migrating to groundwater.

8.6.2.3 Remedy Description

The chosen remedy for BL as described in the *ROD* included the continued operation, performance monitoring, and data reporting for the SVE system until the risk-based remediation goals are achieved, allowing for unlimited use of the site and unrestricted exposure.

Contaminants of concern and site-specific remediation goals were developed for BL in the EE/CA and were included in the *Sites Within OUs 5, 8, 9, 10 and 11 ROD* (HLA, 1999). In the development of remediation goals for BL, human health and ecological risk-based values were calculated and soil leaching model values were calculated. The site-specific remediation goal for BL represents the most stringent of these values. The BL remediation goal (5.64 mg/kg for PCE) is listed in Table 8.6-1.

The chosen remedy for BL as described in the *ROD* also included performing five-year site reviews until the levels of contaminants remaining at the site allow for unlimited use and unrestricted exposure.

8.6.2.4 Remedy Implementation

Based on the *Action Memorandum for the BL* (URS, 1996b), an in-situ SVE system was installed at the BL site in 1996. The chosen remedy for BL documented in the *Sites Within OUs 5, 8, 9, 10 and 11 ROD* (HLA, 1999) was the continued operation of the SVE system. The system was certified operational and functional in the *Bioventing at OUs 5, 8, 9, 10, and 11 Removal Action Report* (Bechtel, 1996).

New AEWs were added to the SVE system in 1997 and again in 1998. The newest AEWs were placed in areas of high PCE concentrations adjacent to the BL in order to improve system performance (SAIC, 2001). The SVE system currently consists of five vertical and one horizontal AEW, as shown in Figure 8.6-2. Contaminant mass removal rates were declining, but were still progressing the site toward closure when the SVE system was last operated in August 2002. A chemical oxidation pilot study (potassium permanganate) was completed at this site in late 2002 and 2003, which necessitated the temporary shut down of the SVE system; however, following the analysis of the test results, it was determined that pilot scale in-situ chemical oxidation treatment of BL soils was ineffective and the SVE system was restarted in 2004. The BL was determined to be operating as designed in the *Auto Hobby Shop, Jet Engine Build-Up Shop/Entomology Shop, Former Jet Engine Test Cell and Base Laundry Sites Demonstration of a Remedial Action Operating Properly and Successfully* (MWH, 2004). Based on an agreement made between the Air Force, EPA, and MEDEP, the BL SVE system was shut down on March 24, 2005 (MWH, 2006a).

In January 2005, an assessment of remedial alternatives was completed to address PCE in soil at the BL site. The goal of this alternatives analysis was to optimize the remedy in place at BL and reduce the remedial timeframe. Additional soil delineation performed during the optimization evaluation indicated that the areal extent of PCE in soil underneath the BL building was greater than that determined during the RI. The selected remedial alternative was partial demolition of the BL building, excavation and landfarming of soils containing PCE at concentrations above the 5.64 mg/kg RG, and return of the remediated soils to the site (MWH, 2005a).

This remedial activity was performed between July 20 and October 21, 2005 and documented in a *Remedial Action Completion Report* (MWH, 2006b). During these activities, approximately 1,328 cubic yards of soil containing PCE at concentrations above the RG (5.64 mg/kg) were removed (as confirmed with excavation sidewall sampling), treated to below the RG (as confirmed by landfarm site sampling), and backfilled at the BL building. A small volume of soil containing concentrations of PCE ranging from 5.9 mg/kg to 6.7 mg/kg (estimated at approximately 2 pounds of PCE total) was left in place below the remaining portion of the building; these soils could not be excavated without demolishing the entire BL building. These soils are currently contained under the building and are not exposed to conditions that would lead to leaching of PCE from the soils to the groundwater.

Portions of the former SVE system were within the footprint of the 2005 soil removal excavation and were removed. A 4-inch diameter polyvinyl chloride (PVC) pipe containing two rows of perforations at 5-inch centers at 120 degrees apart was installed in the bottom of the excavation prior to backfilling for possible future use.

LUC/ICs are in place for the BL in the form of restrictions in the deed that was executed between the Air Force and the current owner of the property (LDA). As necessary to comply with CERCLA Section 120(h), and the Loring AFB FFA (FFA, 1995), the deed of transfer contains provisions restricting any activities that could jeopardize the protectiveness of the remedial action. Any such actions are prohibited without the prior approval of the Air Force, EPA, and MEDEP. The Air Force screens and approves proposed activities that are determined to have no impact on the protectiveness of the remedial action.

The deed implemented several LUC/IC measures. These include general provisions allowing for the Air Force continued operation of the SVE system in the future including right of access to conduct, operate, maintain or undertake any remedial action required under the Loring IRP. Additional LUC/IC measures include a URZ prohibiting any subsurface excavating, digging, drilling, subsurface construction or other disturbance of the surface without notice to and written approval of the Air Force.

The LUC/ICs implemented for BL are monitored and maintained in accordance with the *LUC/IC Management Plan* (AFRPA, 2004). No violations of the LUC/ICs have been

documented. The ongoing use of the property conforms with the restrictions of the URZ, and this use is not expected to change.

8.6.3 Implementation of Recommendations from Last Five-Year Review

The last *Five-Year Review Report* (MWH, 2005b), concluded that the remedies for BL remained protective of human health and the environment. The following recommendations were included in the second *Five-Year Review Report* (MWH, 2005b):

- Excavation and landfarming of the BL soils should be conducted in 2005 as described above. The soil will be landfarmed until PCE concentrations are below 5.64 mg/kg and returned to the site. A closure report will then be submitted.

The evaluation of SVE system performance in early 2005 and the completion of the soil remediation activities were documented in the following:

- *Bioventing and Soil Vapor Extraction at OUs 5, 8, 9, 10, and 11, 2005 Annual Performance Report* (MWH, 2006a).
- *Base Laundry Soil Remediation Work Plan* (MWH, 2005a).
- *Base Laundry Soil Remediation Remedial Action Completion Report* (MWH, 2006b).

This *Five-Year Review Report* documents the third review for the BL site under OU 11 source control.

8.6.4 Technical Assessment

The technical assessment component of the five-year review consists of evaluating the protectiveness of the remedy. The technical assessment was performed based on guidance provided in Section 4.0 of the *Comprehensive Five-Year Review Guidance* (U.S. EPA, 2001).

8.6.4.1 Question A

Question A: Is the remedy functioning as intended by the decision documents?

As documented above, the chosen remedies have been protective of human health and the environment and have made progress toward achieving the RAOs. As indicated in Section 8.6.2.4, the SVE system operated from 1996 to 2005, followed by the excavation of approximately 1,328 cubic yards of soil containing PCE levels above the RG that was landfarmed to concentrations below the RG and backfilled at the BL building site, leaving a small volume of soil containing concentrations of PCE just above the RG in place below a portion of the building.

8.6.4.2 Question B

Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of the remedy selection still valid?

Changes in Standards: No federal or state regulations specify concentration limits for contaminants in soil. Site-specific, risk-based remediation goals were developed during the EE/CA considering both current and projected future land use at BL. The *Sites Within OUs 5, 8, 9, 10 and 11 Record of Decision* (HLA, 1999) BL soil RGs represent the most stringent value of human health and ecological risk-based values as well as soil leaching model results.

Changes in Exposure Pathways: The last five-year review identified several issues requiring follow-up actions, and recommended that the Air Force consider any appropriate guidance to determine if the vapor intrusion pathway for various groundwater contaminant plumes at Loring AFB, including the plume beneath BL, required additional analysis.

Since 2008, an evaluation of the VI pathway has been ongoing at the BL as part of a larger study at Loring AFB. Data generated from VI pathway investigations at the BL were provided in the *Groundwater to Indoor Air Vapor Intrusion Pathway Screening Evaluation Using 2007 Operable Unit 12 Groundwater Analytical Data* report (URS, 2008b), which recommended additional investigation of Building 7330 (the former Base Laundry), and the *Soil Vapor Intrusion Investigation Report* (URS, 2010b), which summarized the EPA

Method TO-15 VOC analytical results for 3 sub-slab air, 2 indoor airand 1 outdoor air samples collected in December 2009 at Building 7330.

The groundwater contaminant PCE was present in sub-slab soil vapor at Building 7330 at significant concentrations that are above both MEDEP and USEPA guidelines; this compound was also detected in indoor air at concentrations above MEDEP and USEPA guidelines (URS, 2010). The vapor intrusion pathway appears to be complete at this building. Building 7330 is currently unoccupied (i.e., no receptors) and unused, so no immediate health concerns due to vapor intrusion exist. The BCT is still evaluating and discussing the VI pathway at the Building 7330; it is uncertain if the source of the vapors is soil or groundwater, or a combination of both. Additional investigations would be necessary to determine the source(s) of the vapors. In addition, more comprehensive VI investigations are being planned for the winter of 2010-2011 at Loring AFB; all relevant data for the BL site will be reevaluated in the context of the data compiled from this larger investigation.

Changes in Toxicity and Other Contaminant Characteristics: Based on the anticipated future land use of the BL site for aviation and industrial purposes (AFBCA, 1996), the HHRA determined that a construction worker may be exposed to contaminated subsurface soil by incidental ingestion, dermal absorption, and inhalation of VOCs and dust. The ecological risk assessment (ERA) conducted for the site concluded that there are calculable risks to ecological receptors from exposure to contaminated soil. The RG developed in the EE/CA for PCE at the BL is designed to be protective of groundwater and is based upon the soil leaching model result that would result in groundwater at concentrations less than the Federal Safe Drinking Water Act Maximum Contaminant Levels or the Maine Maximum Exposure Guideline.

A remediation goal was established for PCE at OU 11. Carcinogenic risks from exposure to PCE did not exceed $1x10^{-6}$. The cleanup standards ultimately presented in the ROD were based on the leaching model and potential adverse effects on groundwater. Cleanup standards were not developed based on results of human health and ecological risk assessments. Toxicity factors for PCE have not changed since the risk assessment was conducted.

In addition to PCE, several others were identified as COPC in the human health risk assessment. It is possible that changes in toxicity values for some COPCs may result in total estimated risk that exceeds target risk level. Therefore, toxicity factors for all COPCs were evaluated to identify changes in values used in the risk assessment versus values currently available. Tables 8.6-2 and 8.6-3 list all COPCs identified in soil at OU 11 (ABB-ES, 1996), toxicity factors used in the HHRA (ABB-ES, 1996), and currently available toxicity factors.

Among the COPCs identified at OU 11, toxicity factors have changed for a few COPCs. However, estimated risks using currently available toxicity factors would not significantly add to the total risks. In addition, several compounds currently have toxicity factors available that were not available at the time of the risk assessment. Estimated risks due to exposure to these compounds would not be significant if currently available toxicity factors were used.

Unlike human health risk assessments, EPA does not recommend specific toxicity reference doses for constituents in ecological risk assessments. The toxicity factors used in the ecological risk assessment are considered protective of the environment.

Changes in Risk Assessment Methods: The original HHRA was conducted following then current EPA and EPA Region 1 guidance. Risk assessments are performed somewhat differently now than they were at the time of the last Five-Year Review and especially since the time of the *Sites Within OUs 5, 8, 9, 10 and 11 ROD.* Guidance documents/risk assessment tools that have been issued include:

- Background guidance (2002), which changed the way background comparisons are performed for metals.
- EPA guidance regarding the sources of toxicity values (December 2003) has changed; toxicity values are now generally obtained from EPA Regional Screening Levels tables.
- EPA Risk Assessment Guidance for Superfund (RAGS) Part E (2004), which changed the way dermal risk assessment is performed.
- EPA ProUCL guidance and software (numerous versions of new guidance and software, up through 2008), which changed the way 95% UCLs are calculated.

- EPA RAGS Part F (2008), which changed the way inhalation risk assessment is performed. There are many chemicals with new toxicity values in this document.

- *Guidelines for Carcinogenic Risk Assessment* (EPA, 2005a) and *Supplemental Guidance for Assessing Susceptibility from Early Life Exposure to Carcinogens* (EPA, 2005b), which provide updated guidance for preparation of cancer risk assessments.

- State of Maine documents *Guidance for Human Health Risk Assessments for Hazardous Waste Sites in Maine* (MEDEP and CDC, 2009) and *Maine Remedial Action Guidelines (RAGS) for Soil Contaminated with Hazardous Substances* (MEDEP, 2010).

Changes have been made with regard to toxicity values. In particular, provisional toxicity values that EPA previously did not consider valid for use in risk assessments are now considered valid.

Expected Progress Toward Meeting RAOs: Implementation of the remedies for the BL have generally attained soil source RAOs, with the exception of leaving a small volume of soil containing concentrations of PCE just above the RG in place below a portion of the building.

8.6.4.3 Question C

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

The future protectiveness of the remedy may be potentially impacted by the subsurface to indoor air vapor intrusion pathway.

8.6.4.4 Technical Assessment Summary

PCE contaminated soils have largely been remediated at the BL, with the exception of a small volume of soil containing concentrations of PCE just above the RG that was left in place below a portion of the building. Based on residual PCE concentrations in soil at the BL, the site is not acceptable for unlimited use and unrestricted exposure. Therefore, five-year site reviews will be necessary for the site until the levels of contaminants remaining in soil allow for unlimited use and unrestricted exposure.

The vapor intrusion pathway appears to be complete at this building. Building 7330 is currently unoccupied (i.e., no receptors) and unused, so no immediate health concerns due to vapor intrusion exist. The BCT is still evaluating and discussing the VI pathway at the Building 7330; it is uncertain if the source of the vapors is soil or groundwater, or a combination of both.

8.6.5 Issues

The VI pathway at Building 7330 could result in unacceptable risk to future human receptors and requires additional evaluation. An appropriate remedy should be implemented under the appropriate OU (i.e, soil and/or groundwater)

8.6.6 Recommendations and Follow-Up Actions

Additional investigations would be necessary to determine the source(s) of the vapors intruding into Building 7330. Alternatively, LUC/ICs could be implemented to restrict the reuse of Building 7330. More comprehensive VI investigations are being planned for the winter of 2010-2011 at Loring AFB; all relevant data for the BL site will be reevaluated in the context of the data compiled from this larger investigation.

8.6.7 Protectiveness Statement

The remedial action at BL in OU 11 (SVE system operation, soil excavation/ landfarming/backfilling, implementation of LUC/ICs, and five-year site reviews) is currently protective of human health and the environment.

8.6.8 References

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URS, 1996b. *Action Memorandum for Operable Unit 11*; Final; Environmental Restoration Program; prepared for Air Force Center for Environmental Excellence; Denver, Colorado. May.

URS, 2008. *Groundwater to Indoor Air Vapor Intrusion Pathway Screening Evaluation Using 2007 Operable Unit 12 Groundwater Analytical Data*, Former Loring Air Force Base, Limestone, Maine. November.

URS, 2010. *Soil Vapor Intrusion Investigation Report*, Former Loring Air Force Base, Limestone, Maine. March.

8.7 OPERABLE UNIT 12, BASEWIDE GROUNDWATER

8.7.1 Background

8.7.1.1 Site Description

OU 12 represents the basewide groundwater OU at the former Loring AFB (Figure 8.7-1). The remedy for OU 12 consolidated the groundwater LTM program into Groundwater Management Zones (GMZs) (HLA, 1999a). For organization and management purposes, groundwater plumes with common contaminant source, migration direction, and/or discharge points were grouped together into the six GMZs illustrated on Figure 8.7-2. In general, the plumes are named for the sites considered to be the source of contamination, nearby structures, or geographical location. A summary of groundwater COCs remaining at concentrations above RGs at each of the plumes in 2009 can be found on Figure 8.7-3. A summary of surface water COCs remaining at concentrations above applicable Maine criteria in 2009 can be found on Figure 8.7-4. The following sections provide a description of each of the GMZs.

Groundwater Management Zone 1

GMZ 1 is located in the central portion of Loring AFB and includes groundwater plumes associated with 11 areas described below and illustrated on Figure 8.7-2:

Central Nose Dock Area (CNDA) Plume

The CNDA comprises approximately 300 acres in the central portion of Loring AFB and was used for storage, maintenance, and refueling and defueling of aircraft. CNDA included subsurface fuel lines, pumphouses, USTs, ASTs, and subsurface utilities. Jet engine fuel, diesel, gasoline, hydraulic oil, heating oil, and anhydrous ammonia were stored in the tanks (HLA, 1999a). Since the last Five-Year Review, approximately 30,000 cubic yards of petroleum contaminated NDA soils were excavated, remediated by landspreading, and replaced (URS, 2010a).

Pump house 8210 (PH8210) Plume

PH8210 was located adjacent to the runway, approximately 100 ft west of the Kilo Ramp and 500 ft south of the Crash Fire Station. The pump house was used for the fueling of aircraft. The facility consisted of a reinforced concrete building, as well as several USTs and associated piping (HLA, 1999a).

Former Solvent Storage Building (FSSB) Plume

The FSSB was located near the northeastern corner of the Arch Hangar. The building was used to store paint thinner and solvents for aircraft maintenance. No documented spills or releases have occurred at the site, but small quantities of thinners or solvent may have been released via spillage or cleaning activities at the building (HLA, 1999a).

JEBS North Plume

The JEBS site is described in detail in Section 8.5 of this report.

ES/JEBS South Plume

The ES/JEBS site is described in detail in Section 8.5 of this report.

Contractor Storage Shed (CSS) Plume

The CSS site is described in detail in Section 7.4 of this report.

BL Plume

The BL site is described in detail in Section 8.6 of this report.

Vehicle Maintenance Building (VMB) Plume

The VMB is located southeast of the intersection of Pennsylvania and Loring Commerce Rds. Waste generated at the facility included waste oil, antifreeze, solvents, Speedidry™ absorbent, and battery electrolyte. Floor drains in the buildings lead through a sand and gas trap to an underground storm drain pipe that discharged to a ponded area south of Building 7500 until 1972. At the time, the existing storm drain pipe was sealed and abandoned, and a

new line was installed connecting the sand and gas trap to the sanitary sewer system. An oil/water separator and waste oil UST replaced the sand and gas trap in 1991. Surface drainage from paved areas of the site is into a drainage ditch that runs northeast to southwest across the site (HLA, 1999a).

Refueling Maintenance Shop Area (RMSA) Plume

The RMSA consists of Building 7600 and is located in the southern portion of the base. Building 7600 was constructed in 1955 and was used to perform maintenance on refueling vehicles until base closure in 1994. Building floor drains historically discharged to an oil interceptor on the eastern side of the building. The oil interceptor would conceptually allow only water to exit the structure but was dependent upon the periodic pumping of oil from the structure to function correctly. Interceptor effluent was piped to a dry well consisting of rock fragments and cobbles, constructed directly on top of the bedrock surface. The dry well was replaced with an oil/water separator in the late 1980s. Oil from the separator was piped to a UST located north of the separator. Water from the separator was routed to the drainageway until 1992, when it was piped to the sanitary sewer (HLA, 1999a).

FLDD North Plume and South Plume

The FLDD is located in the central portion of the base west of Development Drive and flows south to the East Branch Greenlawn Brook (EBGB). Much of the groundwater containing the GMZ 1 contaminant plumes discharges to the FLDD area. The northern portion of the FLDD receives groundwater from the GMZ 1 sites CNDA, PH8210, FSSB, JEBS North, and ES/JEBS. The southern portion of the FLDD receives groundwater discharging from the BL, VMB, and RMSA areas prior to the FLDD confluence with the EBGB.

Groundwater Management Zone 2

GMZ 2 is located in the south-central portion of the base, south of the Flightline Area and west of the former East Gate of Loring AFB (Figure 8.7-2). GMZ 2 consists of the Fuels Tank Farm (FTF). The FTF was constructed in the early 1950s for the storage of bulk fuels. Originally, three ASTs were located at the site; however, increased fuel needs prompted the construction of two additional tanks in the late 1950s. Besides storage and transfer of jet

propellant fuel, motor gasoline, and No. 2 fuel oil, tank sandblasting and repainting periodically occurred at the site. Numerous quantified and unquantified fuel spills have occurred at the FTF. Additionally, leaks in underground fuel lines are a potential source of soil and groundwater contamination (HLA, 1999a).

A *Remedial Action Completion Report for GMZ 2* (MWH, 2002a) demonstrated all RAOs had been met for GMZ 2. The United States Air Force (USAF) received approval in January 2003 from the EPA and the MEDEP to close GMZ 2 and eliminate it from the OU12 LTM program.

Groundwater Management Zone 3

GMZ 3 is located in the western central portion of Loring AFB, east of the West Branch Greenlawn Brook (WBGB) and includes groundwater plumes associated with 3 areas described below and illustrated on Figure 8.7-2.

Building 8711 Plume

The Building 8711 groundwater Plume includes Buildings 8710 and 8711. Building 8710 was used for equipment maintenance, weapon loading, and weapon storage. Building 8711 has a former drum storage/engine degreasing area, a former jet/missile engine testing area, and a fuel bowser storage area (HLA, 1999a).

Base Exchange Service Station (BXSS) Plume

The BXSS is located at the intersection of Texas and Cupp Roads. The site includes a single building and a large paved area where leaded and unleaded gasolines were dispensed. Materials handled at the BXSS included fluids associated with vehicle maintenance such as engine oils, coolants, and lubricants. Several USTs were present at the site for storage of the various materials. Various small spills and potential leakage from tanks are the likely sources of contamination at the BXSS (HLA, 1999a).

Groundwater Management Zone 4

GMZ 4 is located in the northwestern portion of Loring AFB (Figure 8.7-2) and includes groundwater plumes associated with the former operation of the Quarry. The Quarry is located near the northwestern boundary of Loring AFB, adjacent to the NDA. Site topography reflects past rock quarrying activities, which reportedly began with construction of Loring AFB in 1947. Quarry operations ceased in 1985. The Quarry consists of two levels, the upper and lower tiers. The lower tier is seasonally flooded and drains through an excavated ditch into the WGBG wetland. The lower tier rises approximately 30 ft to the upper tier, which rises approximately 30 ft toward the CNDA. Historically, waste materials from construction projects, industrial and maintenance shops, and other base activities were stored and disposed of at the Quarry (HLA, 1999a).

Groundwater Management Zone 5

GMZ 5 is located in the north-central portion of Loring AFB and consists of the FJETC Plume (Figure 8.7-2). The FJETC site is described in detail in Section 8.3 of this report.

Groundwater Management Zone 6

GMZ 6 is located in the northeastern portion of Loring AFB, south-southwest of Oklahoma Road and consists of the FTA Plume.

Basewide Geology and Hydrogeology

Overburden Geology

Three distinct overburden units were identified during the basewide drilling program: glaciofluvial deposits, consisting of sands and gravels; till, consisting of ablation and basal till; and fill. Basal tills are finer-grained and less permeable than the sandier, coarser-grained ablation till; however, the basal till deposits do not act as a significant confining layer to the underlying bedrock groundwater system. Except where man-made debris is observed, the fill is difficult to distinguish from the till (ABB-ES, 1997).

Bedrock Geology

The depth to bedrock across the base varies from zero to greater than 60 ft bgs. Generally, depth to bedrock is shallow near the tops of hills and knolls and increases near low-lying streams. Bedrock explorations at Loring AFB have included both cored and air-hammered boreholes.

Most of the cored boreholes were relatively shallow, and typically no deeper than 100 to 125 ft bgs. Air-hammered boreholes were completed to depths up to 500 ft bgs. Retrieved bedrock samples consisted of a low-grade metamorphosed pelitic limestone of the upper Carys Mills Formation. A green chloritic phyllite was encountered within the Carys Mills limestone in some borings. Core samples from boreholes contain fractures and remnant bedding planes that dip at angles ranging from horizontal to near vertical. Fractures both cross-cut and are parallel to bedding. Depending on location and depth, the limestone varies from very competent and lightly-fractured to well-fractured; at some locations, the limestone displays a well-foliated (layered) texture (ABB-ES, 1997).

Hydrogeology

The factors that influence groundwater occurrence and movement in bedrock at Loring AFB are land surface and bedrock surface topography; thickness of saturated overburden; fracture orientation, frequency, and connectiveness; and location and orientation of streams, drainages (potential discharge features), and regional faults. The amount of seasonal water level change in the overburden is location-dependent.

Discharge of groundwater from bedrock to the overburden groundwater system is an important component of the water balance in the shallow bedrock/overburden groundwater system at Loring AFB. Overburden groundwater is typically present in low areas or valleys in the bedrock surface, which often correspond to geologic faults and to stream channels. The flow direction of overburden groundwater (where present) is generally from the source area sites toward nearby surface water bodies (e.g., streams, brooks and small lakes). Where overburden groundwater approaches a stream, the component that does not discharge to the stream flows in the direction of surface water drainage (ABB-ES, 1997).

Evaluation of the bedrock groundwater potentiometric surface indicates that most flow is toward local watershed drainage areas such as the Butterfield and Greenlaw Brook drainage systems and the man-made East Loring Lake, rather than toward the deeper regional groundwater system represented by the Little Madawaska River and the Aroostook River. Comparison of the overburden and bedrock groundwater surface along the major drainage systems indicates that bedrock groundwater discharges to the overburden system, which in turn, discharges to the surface water system. The direction of groundwater flow in bedrock generally coincides with the average strike direction of the principal water-bearing fractures.

A prominent north-south bedrock low is associated with the FLDD, extending from the eastern side of the NDA southward to the East Branch Greenlaw Brook. The bedrock structural zone interpreted to underlie the FLDD has been termed the Flightline Structural Feature (FSF) and exerts an important influence on groundwater in the central portion of the base. Based on topography and hydrogeologic information, the FSF is thought to be a structural zone composed of parallel faults and associated fractures that are highly transmissive compared to the surrounding rock. Interpreted depth of weathering from geophysical logs of water supply well AR-25 suggests that weathering is deeper within this structural zone and may, in part, be responsible for the increased transmissivity within this area. The FSF acts as a capture zone for overburden and bedrock groundwater migrating from six of the ten flow fields. The distribution of upward and downward vertical gradients within deep and shallow bedrock in the central portion of Loring AFB and specific capacities and yields from adjacent former water supply wells (e.g., 520 gallons per minute [gpm] for AR-25 [Roy F. Weston, 1988]) suggest the FSF is capable of accepting and transmitting large quantities of groundwater from the shallow and deeper zones in the bedrock flow system. The FSF is the dominant hydrogeologic feature in the central part of the base.

8.7.1.2 Initial Response

No remedial actions were performed pertaining to OU 12 (basewide groundwater) prior to the finalization of the *Operable Unit 12 Record of Decision* (HLA, 1999a).

8.7.1.3 Basis for Taking Action

In December 1997, the USAF published a *Operable Unit 12 Remedial Investigation Report* (ABB-ES, 1997). The *Operable Unit 12 RI* developed a comprehensive basewide hydrogeologic conceptual model, characterized the basewide distribution and migration of contaminants in groundwater, and identified potential risk to human receptors for each flow field.

Based on the RI recommendations, the Air Force conducted an FS for areas of groundwater contamination that posed as unacceptable risk to potential receptors (HLA, 1999b). The FS developed and evaluated alternatives to remediate the contamination. A Proposed Plan (HLA, 1999c) was then prepared to document the Air Force's preferred remedial alternatives. The findings and conclusions from these site investigations are summarized below.

Groundwater Management Zone 1

The following is a description of the 11 groundwater plumes included in GMZ 1.

CNDA Plume

The CNDA plume consists of chlorinated and fuel-related VOCs in both overburden and bedrock groundwater (HLA, 1999a).

PH8210 Plume

The Pump house 8210 plume consists of fuel-related VOCs, inorganic compounds, and methylene chloride present in both overburden and bedrock groundwater, with the highest concentrations of VOCs in the source area of the bedrock plume (HLA, 1999a).

FSSB Plume

The FSSB plume consists of chlorinated VOCs in groundwater (HLA, 1999a).

JEBS North Plume

The JEBS North plume consists of chlorinated and fuel-related VOCs. Generally, the highest concentrations of chlorinated VOCs are close to the former source areas located in the shallow bedrock zones (HLA, 1999a).

ES/JEBS South Plume

The plume associated with the ES includes contamination from a source area near the southern end of the JEBS. The JEBS South plume consists of chlorinated and fuel-related VOCs, lead, and manganese (HLA, 1999a).

CSS Plume

OU 12 RI activities identified xylenes and chlorinated VOCs in groundwater at this site (HLA, 1999a).

BL Plume

OU 12 RI activities identified PCE and TCE in the bedrock groundwater in the area of the BL. Contaminant distributions show a chlorinated solvent plume extending from the BL to the discharge area at the confluence of the FLDD wetland and the EBGB (HLA, 1999a).

VMB Plume

The groundwater plume associated with the VMB includes chlorinated VOCs in bedrock groundwater. A number of fuel-related VOCs and SVOCs have also been observed in the area downgradient of the former UST at the VMB.

RMSA Plume

The groundwater plume associated with the RMSA includes chlorinated VOCs in bedrock. The RMSA bedrock groundwater plume discharges to the FLDD South Plume (HLA, 1999a).

FLDD North Plume

Many of the GMZ 1 source area plumes discharge to the FLDD area with groundwater gradient as the predominant controlling factor in plume migration. CNDA, PH8210, FSSB, JEBS North, and ES/JEBS South plumes commingle to form the FLDD North Plume. Contaminants detected in these plumes have been detected in the FLDD North plume.

FLDD South Plume

The southern portion of the FLDD receives groundwater discharging from the FLDD North, BL, VMB, and RMSA plumes. Contaminants detected in these plumes have been detected in the FLDD South plume.

Groundwater Management Zone 2

Both chlorinated VOCs and fuel-related compounds have been identified in FTF groundwater. A *Remedial Action Completion Report for GMZ 2* (MWH, 2002a) demonstrated all RAOs had been met for GMZ 2. The USAF received approval in January 2003 from the EPA and the MEDEP to close GMZ 2 and eliminate it from the OU12 LTM program.

Groundwater Management Zone 3

GMZ 3 is located in the western central portion of Loring AFB and includes 4 groundwater plumes.

Building 8711 Plume

OU 12 RI activities identified TCE and PCE in groundwater at concentrations above MCLs in the vicinity of Building 8711. Concentrations of chlorinated VOCs have also been detected in groundwater in the vicinity of Building 8710 (HLA, 1999a).

BXSS Plume and Upgradient BXSS Plume

The groundwater plume associated with the BXSS includes petroleum-related contaminants in overburden groundwater in an area west of the former gasoline UST locations. Fuel-

related contamination is not regulated under CERCLA. However, because CERCLA contaminants (e.g., TCE) are present in groundwater in the vicinity of the BXSS, the BXSS Plume was included in the OU 12 FS. TCE has been identified in bedrock downgradient of the BXSS and is believed to have originated from an upgradient source, specifically Building 8710. This area of contamination is known as the Upgradient BXSS Plume.

Building 8710 was investigated as part of 1997 supplemental investigations. Building 8710 has historically been an accumulation point for hazardous materials and has been used for equipment maintenance, weapon loading, and weapon storage. No definite release point was identified; however, the floor drain inside the northwest corner of the building is suspected to be the source of the chlorinated VOCs in this area (MWH, 2004b).

Single Well Plume JBW7734

Well JBW7734 is located west of the CNDA and northeast of Building 8711, in the northeast portion of GMZ 3. Although the source is unknown, vinyl chloride was identified in bedrock groundwater at this location during RI activities (HLA, 1999a).

The *OU 12 LTM Program 2000 Annual Report* (Montgomery Watson [MW], 2001a) demonstrated single well plume JBW7734 had met the remedial action objectives. Accordingly, monitoring well JBW7734 was eliminated from the OU 12 LTM program as documented in the *OU 12 Long-Term Monitoring Plan (LTMP), Revision 1* (MWH, 2002b).

Groundwater Management Zone 4

GMZ 4 is located in the northwestern portion of Loring AFB and includes two groundwater plumes.

Quarry Plume

Groundwater contamination associated with the Quarry plume consists primarily of chlorinated VOCs; however, some fuel-related VOCs have also been detected (HLA, 1999a).

Single Well Plume JMW0401

JMW0401 is located in the northwestern portion of the CNDA, between the CNDA and the Quarry. Although the source is unknown, chrysene and manganese were identified in bedrock groundwater at this location during RI activities (HLA, 1999a).

The *OU 12 LTM Program 2000 Annual Report* (MW, 2001a) demonstrated single well plume JMW0401 had met the remedial action objectives. Accordingly, monitoring well JMW0401 was eliminated from the OU 12 LTM program as documented in the *OU 12 LTMP, Revision 1* (MWH, 2002b).

Groundwater Management Zone 5

GMZ 5 consists of the FJETC Plume. Contaminants identified in the perched overburden groundwater at the site include primarily fuel-related VOCs and chlorinated VOCs (HLA, 1999a).

Groundwater Management Zone 6

GMZ 6 consists of the FTA Plume which is comprised of fuel-related VOCs and SVOCs detected in both overburden and bedrock groundwater. Chlorinated VOCs have also been detected in bedrock groundwater (HLA, 1999b).

8.7.2 Remedial/Removal Actions

8.7.2.1 Regulatory Actions

The controlling documents that present the selected remedy are described below.

Operable Unit 12 Record of Decision

The *Operable Unit 12 Record of Decision* (HLA, 1999a) documented and detailed the Limited Action (LA) and Groundwater Management Zone alternatives for remediation of groundwater within specific sites at the former Loring AFB. Table 8.7-1 summarizes the remedial alternative and target analyte lists for each of the individual sites within the OU 12 groundwater program.

8.7.2.2 Remedial Action Objectives

The *Operable Unit 12 Record of Decision* (HLA, 1999a) also documented the establishment of RAOs for the OU 12 groundwater program and documented the establishment of groundwater remediation goals for the individual GMZs that comprise the OU 12 program. The specific OU 12 RAOs established in the *Record of Decision* (HLA, 1999a) are as follows:

1) Prevent residential use of groundwater containing COCs in excess of remediation goal concentrations, or a total excess lifetime cancer risk of (ELCR) of $1x10^{-5}$ and a non-cancer hazard index of 1.

2) If feasible, reduce concentrations of COCs in groundwater to remedial goal concentrations, or a total ELCR of $1x10^{-5}$ and a non-cancer hazard index of 1.

3) Prevent COCs in excess of remediation goal concentrations, or a total ELCR of $1x10^{-5}$ and a non-cancer hazard index of 1, from migrating in groundwater past the GMZ – Groundwater Use Restriction Boundaries.

In addition to the RAOs for the OU 12 groundwater program, the *Record of Decision* also documented the completion of a Technical Impracticability (TI) Evaluation for the ES/JEBS plumes (located within GMZ 1) and the Quarry Plume (GMZ 4). The EPA has determined that a "reasonable timeframe" for restoration of groundwater within OU 12 is 100 years (HLA, 1999a). The TI evaluations for ES/JEBS and the Quarry plumes document that the cleanup times for these plumes are above 100 years and indicate that it is technically impracticable from an engineering perspective to attain compliance with the OU 12 remediation goals within these plumes in the timeframe indicated by the EPA.

8.7.2.3 Remedy Description

The USAF's remedial alternatives for OU 12 included both the LA alternative and the GMZ alternative, as presented in the OU 12 FS. The components of these alternatives included:

- Establishment of GMZ;
- Groundwater-use restrictions;
- Provision of an alternate supply of water;

- Long-term groundwater monitoring; and
- Five-year site reviews.

The major difference between the LA and the GMZ alternatives is the number and type of long-term groundwater monitoring parameters. Both alternatives include monitoring the COCs in each plume. The GMZ alternative also includes monitoring of specific natural attenuation parameters. In the future, based on review of the long-term monitoring data collected, natural attenuation parameters may be added to the monitoring program for groundwater plumes for which the LA Alternative is the selected remedy.

The *Operable Unit 12 Record of Decision* (HLA, 1999a) also documented the establishment of RGs for groundwater associated with the various OU 12 contaminant plumes. RGs that are protective of human health have been developed for groundwater. ARARs were considered in the development of RGs. *The Consensus Statement for OU 12 ARARs Resolution – Groundwater Mitigation Zones* (AFBCA, 1997) identified the federal and state chemical-specific ARARs to be used for OU 12. The chemical-specific ARARs include federal and state MCLs and MEGs.

In accordance with the Consensus Statement, two sets of RGs were developed for OU 12. RGs for the Contaminated Groundwater Area (i.e., plumes) are based on MCLs. Remediation goals for the Compliance Boundary are based on MCLs and MEGs. The development of RGs also considered the laboratory analytical method practical quantitation limit (PQL), appropriate background concentration for inorganic COCs, and risk-based concentrations for COCs that do not have an MCL. The remediation goals developed for the GMZs and groundwater plumes were included in the *Operable Unit 12 Record of Decision* (HLA, 1999a) and are summarized in Table 8.7-2. Details regarding the methodology and development of the RGs are presented in the *Operable Unit 12 Feasibility Study* (HLA, 1999b) and the *Operable Unit 12 Record of Decision* (HLA, 1999a).

8.7.2.4 Remedy Implementation

Establishment of Groundwater Management Zones

To protect human receptors from exposure to groundwater contamination within Loring AFB, the remedy includes a groundwater use restriction component for groundwater within the affected areas of OU 12 (HLA, 1999a). The Air Force has implemented groundwater use restrictions that include prohibiting the use of groundwater within the OU 12 GMZs as a water supply currently or in the future and prohibiting any subsurface exploration, excavation, construction, or subsurface discharge of groundwater within the OU 12 GMZs. To administer the groundwater use restriction portion of the remedy, the Air Force has implemented, maintained, and enforced institutional controls. The institutional controls limit those activities indicated above within the OU 12 GMZs without the prior approval of the Air Force, the EPA and the MEDEP.

To assist in the implementation of this component of the remedy, the Air Force has established GMZs for OU 12 to serve as boundaries for application of the use restrictions (Figure 8.7-2). Each GMZ is comprised of an area of groundwater contamination (the plume[s]), a compliance boundary, and a groundwater use restriction boundary (GMZ boundary). The compliance boundaries have been established approximately 100 to 500 ft downgradient and outside of the edges of areas of known groundwater contamination. The GMZ boundaries have been established at approximately 50 to 200 ft outside of the compliance boundaries. These additional areas serve to provide a buffer between groundwater contamination and areas not regulated by the groundwater use restrictions established for OU 12.

The long-term monitoring activities at OU 12 include the routine monitoring of compliance boundaries to ensure that the COCs do not migrate outside the groundwater use restriction zone boundaries. The GMZ remedy indicates that a contingency action may be implemented if groundwater monitoring detects contaminants at concentrations exceeding the RGs at the compliance boundaries. Groundwater monitoring conducted at the Quarry Plume (GMZ 4) in December 1995 indicated the presence of PCE at a compliance boundary monitoring point. The Air Force subsequently implemented a contingency plan consisting of expansion of the

compliance boundary and groundwater use restriction boundaries and installing new compliance boundary monitoring wells. This contingency action is documented in the *Operable Unit 4 (Landfill 2 & 3 Groundwater) & Operable Unit 12 (Quarry Plume) Explanation of Significant Differences* (AFBCA, 2001).

Establishment of an Alternate Water Supply

Because the use of groundwater will be restricted, the Air Force will assure that an alternate supply of water will be available to future transferees of property within the Groundwater-Use Restriction Boundaries until contaminant concentrations are less than the established RGs. The provision of water will be consistent with projected future land uses as identified in the Disposal ROD (AFBCA, 1996). The Air Force will determine a reasonable method for assuring water is available (e.g., the Air Force could negotiate funding support for the water supplier based on water usage, the Air Force could provide wellhead treatment within the Groundwater-Use Restriction Boundaries, the Air Force could provide bottled water or otherwise transport water to users within the Groundwater-Use Restriction Boundaries, or the Air Force could provide hookup to municipal water systems). Such assurance shall not be construed as a commitment by the Air Force to the expansion or increase in capacity of the existing water treatment and distribution system beyond that necessary to mitigate groundwater contamination concerns.

Currently, potable water for the former base and those areas within the use restriction zones is provided by the Little Madawaska River Dam Treatment Plant. This plant is operated by the LDA and is capable of providing approximately 2 million gallons per day. In May 2009 the Air Force and LDA signed a Memorandum of Agreement whereby the Air Force completed certain capital repairs to the water treatment plant and provided immediate funding while the LDA agreed to provide an ongoing water supply.

Long-Term Groundwater Monitoring

An additional component of the chosen remedy for OU 12 is the performance of long-term monitoring (HLA, 1999a). Groundwater monitoring for the OU 12 program is conducted in accordance with the *Operable Unit 12 Long-term Monitoring Plan (LTMP) – Revision 3*

(MWH, 2004b). The objectives of the long-term groundwater monitoring program as presented in the *Operable Unit 12 Record of Decision* (HLA, 1999a) are to evaluate the concentrations of COCs and natural attenuation processes in groundwater to:

- Verify that groundwater containing COCs in excess of the remediation goal concentrations does not migrate past the GMZ Compliance Boundaries;
- For select plumes, assess whether lateral dispersion of contaminants is occurring to the extent which could cause migration beyond characterized lateral plume boundaries;
- Verify reduction in COC concentrations and on-going natural attenuation processes for plumes for which the GMZ alternative has been selected. Assess whether monitored plume attenuation rates are consistent with predicted attenuation rates presented in the Final *OU 12 FS* (HLA, 1999b);
- Monitor surface water quality at selected groundwater discharge areas to confirm that these media are not being impacted by contaminated groundwater;
- Determine if the remedial alternatives are Operating Properly and Successfully (OPS) after the first two years of groundwater monitoring; and
- Determine when groundwater concentrations no longer exceed established remediation goals.

As noted previously, plumes with common origin, migration and/or discharge points have been grouped into GMZs for organization and management purposes (Figure 8.7-2). Long-term groundwater and surface water monitoring is conducted within the individual plumes to further evaluate reduction in contaminant concentrations. Additionally, monitoring is conducted at the Compliance Boundary to ensure that groundwater with contaminant concentrations in excess of remediation goals is not migrating towards potential receptors outside the Groundwater-use Restriction Boundary. The Air Force installed and incorporated into the long-term monitoring program additional compliance boundary monitoring points for GMZ 1 and GMZ 3 to supplement the original monitoring points.

Long-term groundwater monitoring was conducted at OU 12 on a quarterly basis (3 times per year) through 2003 at which time the monitoring frequency was reduced to semi-annually. In 2004, the frequency was reduced again to annually (fall) in accordance with the *Operable Unit 12 LTMP - Revision 3* (MWH, 2004b).

The Air Force implemented a surface water sampling program in 2000 to monitor the impacts of discharging groundwater on surface water quality. The sampling is conducted once per year (August) in accordance with the *Operable Unit 12 Surface Water Sampling Quality Program Plan - Revision 1* (MW, 2001b).

Five-Year Review

Five-year reviews are to be conducted at OU 12, as a component of the remedy, to evaluate the overall effectiveness of the selected remedies at providing protection to human health and the environment (HLA, 1999a). This *Five-Year Review Report* represents the third five year review performed for OU 12.

Remedy Performance

The *Operable Unit 12 Demonstration of a Remedial Action Operating Properly and Successfully* (MWH, 2004a) documented that the remedy for OU 12 is in place and operating as designed. The *OPS Report* also documented the progress towards attainment of the RAOs for the OU 12 long-term monitoring program established in the *ROD*. The RAOs of preventing residential use of groundwater containing COCs in excess of RGs and preventing COC concentrations in excess of RGs concentrations from migrating offsite have been met. While the RAO of reducing concentrations of COCs in excess of RGs has not yet been attained, progress towards meeting this RAO has been documented in numerous reports.

Since the last five-year review, the successful implementation of these components has been documented in several annual reports (Section 8.7.3). As shown in Figure 8.7-3, the only COCs in OU 12 that exceeded RGs in 2009 were PCE, TCE, cis-1,2-dichlorethene (cis-1,2-DCE), vinyl chloride, benzene, ethylbenzene, manganese, and iron. All other detected COCs were at concentrations below RGs. In addition, statistical and qualitative trend analyses performed using 2008 groundwater analytical data show that the concentrations of COCs detected are decreasing over time (URS, 2009). The remedy performance at each OU 12 GMZ is summarized below.

Groundwater Management Zone 1

The presence of the PCE and TCE degradation products cis-1,2-DCE and vinyl chloride detected in wells along with PCE and TCE within GMZ 1 give the most significant evidence that biodegradation of chlorinated VOC contaminants is occurring. Additionally, declines in BTEX compounds and elevated inorganics (iron and manganese) provide evidence of the biodegradation of fuel-related contaminants.

The dissolved oxygen (DO) and oxygen reduction potential (ORP) measurements suggest that a variety of conditions exist across the GMZ. The presence of dissolved iron (ferrous iron), reduced sulfate levels, and elevated methane in wells where the plume contains both dissolved fuel-related contaminants and chlorinated contaminants (CNDA, ES/JEBS, and PH8210) suggest that biodegradation of the fuel contaminants is consuming oxygen within the plume and driving the development of anaerobic conditions that facilitate reductive dechlorination. Contaminant plumes containing lesser amounts of dissolved fuel-related constituents show a less defined correlation of biodegradation parameters, but do contain measurable concentrations of degradation products indicating that some degree of reductive dechlorination is occurring.

The most recent pH measurements collected indicate the pH varies widely across the site, but most often is neutral to slightly acidic, which would promote the significant biological activity occurring in this GMZ.

Overall, monitored natural attenuation parameters and COCs for plumes within GMZ 1 suggest fuel-related and chlorinated compounds are attenuating.

Groundwater Management Zone 3

The GMZ 3 plumes have been relatively stable or have shown slight declines in COC concentrations. Most DO and ORP measurements suggest that GMZ 3 is aerobic, which explains why benzene was detected at concentrations above the PQL in only one well (JMW0701) during 2009 monitoring activities. The aerobic conditions may help to explain why there appears to be little or no downward chlorinated VOC concentration trends in well JMW6105 as well as the lack of the degradation products cis-1,2-DCE and vinyl chloride.

Overall, fuel-related contaminants have attenuated below their applicable RGs. Conditions within GMZ 3 groundwater (i.e., generally aerobic) are not optimal for supporting reductive dechlorination; however, concentrations of chlorinated VOCs currently exceed RGs in only one (1) LTM well (JMW6105).

Data provided in the *Operable Unit 12 Long-Term Monitoring Program 2009 Annual Report* (URS, 2010c) show that the RGs for the Upgradient BXSS Plume in GMZ 3 were attained for the first time in 2009.

Groundwater Management Zone 4

The natural attenuation data (field parameters) collected within the quarry plume suggest mildly anaerobic conditions (i.e., DO readings < 0.5 mg/L) are prevalent. ORP readings are generally > 50 mV, which is generally not conducive to reductive dechlorination; however, reduced nitrate and sulfate concentrations and minor methane production in some in-plume wells suggests anaerobic biodegradation processes are occurring. All of the five (5) wells within GMZ 4 that still contain PCE at concentrations above the RG have some chlorinated VOC daughter products (i.e., TCE, cis-1,2-DCE, or vinyl chloride) indicative of reductive dechlorination. Trend analyses indicate that the concentrations of PCE in some wells are decreasing while the concentrations of some daughter products are increasing (URS, 2009), further evidence of ongoing reductive dechlorination. This suggests that natural attenuation is slowly proceeding within GMZ 4.

Groundwater Management Zone 5

Within the last several years, TCE detections in well FMW3414 have remained the only COC exceeding RGs for the FJETC Plume within GMZ 5. Cis-1,2-DCE (a daughter product of TCE) has also been detected in conjunction with TCE in well FMW3414, indicating that some reductive dechlorination is occurring at the site; trend analyses indicate decreasing concentration trends for both TCE and cis-1,2-DCE in FMW3414 (URS, 2009). However, field DO (> 1 mg/L) and ORP (> 100 mV) measurements indicate that groundwater conditions at the FJETC site are aerobic, likely due to the operation of the bioventing system at the site, which would not be expected to favor the reductive dechlorination pathway for

chlorinated VOC degradation. Other processes such as dispersion, dilution, sorption, volatilization, and cometabolic biodegradation may play larger roles in the natural attenuation of residual contaminants at the site.

Groundwater Management Zone 6

No organic COCs were detected at concentrations above RGs in GMZ 6 during 2009; fuel-related contaminants remain predominantly at one LTM well location (RFW1147). The natural attenuation parameter results at RFW1147 suggest that bioattenuation of the fuel-related contaminants is occurring. Low DO (generally < 1 mg/L) and negative ORP (< -18 mV) readings indicate the presence of generally anaerobic conditions at RFW1147 (URS, 2010c). Additionally, the presence of dissolved iron (ferrous iron), reduced sulfate levels, and elevated methane and inorganic (iron and manganese) concentrations provide evidence of the biodegradation of fuel-related contaminants. The elevated iron and manganese concentrations remaining above RGs in many of the wells in this GMZ are most likely attributable to the reducing conditions created during the bioattenuation of the fuel-related contaminants.

Natural attenuation parameter and target analyte results for the FTA plume within GMZ 6 suggest fuel-related and chlorinated compounds have largely attenuated. Iron and manganese concentrations are generally stable and likely will only decrease when conditions become more aerobic.

Land Use Controls/Institutional Controls

LUC/ICs are in place for OU 12 in the form of restrictions in the deed that was executed between the Air Force and the current owner of the property (LDA) for portions of OU 12 transferred by quitclaim deed (portions of GMZ 1, GMZ 3, GMZ 4, GMZ 5, and GMZ 6). Additionally LUC/ICs are also in place for portions of GMZ 1 and GMZ 6 transferred by Federal-to-Federal agency transfer to the Bureau of Indian Affairs (BIA) and the USFWS (Figure 6.6-1). The Air Force also acquired a groundwater use restriction for a portion of GMZ 4 that extended beyond Air Force property onto property owned by Allagash Timberlands.

As necessary to comply with CERCLA Section 120(h) and the Loring AFB FFA (FFA, 1995), the deed of transfer and transfer agreements contain provisions restricting any activities that could jeopardize the protectiveness of the remedial action. Any such actions are prohibited without the prior approval of the Air Force, EPA, and MEDEP. The Air Force screens and approves proposed activities that are determined to have no impact to the protectiveness of the remedial action.

The deed and property transfer agreements implemented several LUC/IC measures. These include general provisions allowing for the Air Force's continued operation of the long-term monitoring program in the future. Additional LUC/IC measures include several GMZs prohibiting use of groundwater. The LUC/ICs implemented for OU 12 are monitored and maintained in accordance with the *LUC/IC Management Plan* (AFRPA, 2004). No violations of the LUC/ICs have been documented. The LUC/ICs remain protective; no deficiencies have been identified.

8.7.3 Implementation of Recommendations from Last Five-Year Review

The last *Five-Year Review Report* (MWH, 2005) concluded that the remedies for OU 12 remained protective of human health and the environment. The following recommendations were included in the second *Five-Year Review Report* (MWH, 2005):

- Routine long-term monitoring and reporting of basewide groundwater quality under the OU 12 long-term monitoring program should continue. Routine monitoring for OU 12 should also include monitoring of LUC/ICs to document their continued effectiveness

The Air Force has successfully implemented the components of the remedy. The successful implementation of the remedy has been documented in the following reports:

- *Operable Unit 12 2005 Annual Report* (MWH, 2006)
- *Operable Unit 12 Long-Term Monitoring Program 2006 Annual Report* (URS, 2008a)
- *Operable Unit 12 Long-Term Monitoring Program 2007 Annual Report* (URS, 2008b)

- *Operable Unit 12 Long-Term Monitoring Program 2008 Annual Report* (URS, 2009)
- *Operable Unit 12 Long-Term Monitoring Program 2009 Annual Report* (URS, 2010b)

As noted above, LUC/ICs are in place for OU 12 in the form of restrictions in the deed that was executed between the Air Force and the current owner of the property (LDA).

Additionally, as noted above the Compliance Boundary for GMZ 4 was expanded as documented in the *Operable Unit 4 (Landfill 2 & 3 Groundwater) & Operable Unit 12 (Quarry Plume) Explanation of Significant Differences* (AFBCA, 2001). The current version of the IWQPP is the *Final Installation-Wide Quality Program Plan Version 7* (URS, 2007) incorporates the additional GMZ 4 monitoring requirements. An agreement was reached with Allagash Timberlands (formerly Rambler Mines) to institute the groundwater use restriction for GMZ 4 on the property west of the Quarry in 2003. The use restriction for the property incorporates the groundwater and land use restrictions associated with all GMZs for OU 12.

This *Five-Year Review Report* documents the third review for the OU 12 long-term monitoring program.

8.7.4 Technical Assessment

The technical assessment component of the five-year review consists of evaluating the protectiveness of the remedy. The technical assessment was performed based on guidance provided in Section 4.0 of the *Comprehensive Five-Year Review Guidance* (U.S. EPA, 2001).

8.7.4.1 Question A

Question A: Is the remedy functioning as intended by the decision documents?

A review of documents, ARARs, risk assumptions, and the results of annual groundwater monitoring indicates that the remedy is functioning as intended, as described below.

- LUC/ICs are in place, remain protective, and are functioning as intended.

- Natural attenuation of contamination in overburden and bedrock groundwater is occurring and progress is being monitored.
- Monitoring of surface water quality over time is being performed.

No Further CERCLA Action is necessary for groundwater associated with the PH8270 site, the Demineralization Plant site, the FTF, and portions of the NDA sites because CERCLA contaminants are not present at concentrations that pose an unacceptable risk under CERCLA to human health and ecological receptors. The petroleum-related contamination remaining at these source areas is not regulated under CERCLA. This petroleum-related contamination is being addressed in accordance with applicable state requirements (i.e., MEDEP Chapter 691, Rules for Underground Oil Storage Facilities). The No Further CERCLA Action decision for groundwater associated with these source areas does not constitute a finding by the EPA that adequate protection has been achieved at these source areas. However, proper ICs, including the establishment of groundwater use restrictions, have been implemented for the No Further CERCLA Action areas. These ICs are protective of human health and the environment.

8.7.4.2 Question B

Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of the remedy selection still valid?

Changes in Standards: Groundwater remediation goals in the *OU 12 Record of Decision* were based on ARARs, except where ARARs were not available. RGs for the contaminated groundwater areas of OU 12 (i.e., plumes) are based on Federal Safe Drinking Water Act MCLs. RGs for the Compliance Boundaries are based on Federal Safe Drinking Water Act MCLs and the State of Maine MEGs in effect at the time of the ROD. Of the RGs established for groundwater under the OU 12 LTM program, ARAR based standards were used for all COCs except 4-methyl-2-pentanone (aka methyl isobutyl ketone or MIBK), manganese, and lead for which risk-based concentrations were developed. ARAR based standards did not exist at that time for these constituents.

There have been updates to the regulations used to derive the RGs in the *OU 12 ROD* (HLA, 1999a), but most of the *OU 12 ROD* RGs based on ARARs are either still consistent with or more stringent than current standards, with the exception of the constituents shown on the following tables.

Compliance Boundaries			
Constituent	**ROD Risk-Based Restoration Goal (µg/L)**	**Current MEG (µg/L)**	**Current MCL (µg/L)**
1,2-Dichloroethane	5	4	5
Chloroform	100	70	80
Ethylbenzene	700	70	700
Naphthalene	25	14	Not Available
Antimony	6	3	6
Cadmium	5	3.5	5
Lead	15	10	15

Plumes			
Constituent	**ROD Risk-Based Restoration Goal (µg/L)**	**Current MEG (µg/L)**	**Current MCL (µg/L)**
1,2-Dichloroethane	5	4	5
Carbon tetrachloride	5	3	5
Ethylbenzene	700	70	700
Methyl-tert-butyl-ether (MTBE)	50	35	Not Available
Naphthalene	400	14	Not Available
Vinyl chloride	2	0.2	2
Antimony	6	3	6
Cadmium	5	3.5	5
Lead	15	10	15

MEGs (MEDEP, 2008) have been established for constituents in the *OU 12 ROD* (HLA, 1999a) that had risk-based RGs: lead and manganese. The current MEGs (10 µg/L and 500 µg/L, respectively) are relatively consistent with their corresponding risk-based RGs included in the *OU 12 ROD* (see following table).

Constituent	**ROD Risk-Based Restoration Goal (µg/L)**	**Current MEG (µg/L)**	**Current MCL (µg/L)**
Lead	15	10	15
Manganese	396	500	Not Available

Current groundwater concentrations throughout OU 12 meet the new ARARs for lead.

The MCLs effective for OU 12 remain current with the exception of arsenic. Groundwater monitoring during the OU 12 RI process included analysis for arsenic concentrations, and a background value of 2 µg/l was established for groundwater at the former Loring AFB (HLA, 1999c). Detections of arsenic above the former MCL of 50 µg/l were limited and arsenic was determined not to be a COC for groundwater at the former Loring AFB. On January 22, 2001, EPA adopted a new Federal MCL for arsenic (changed from 50 µg/l to 10 µg/l), which was incorporated into the revised MEG (MEDEP, 2008).

A review of the historical data collected during the RI process indicates that detections above the new MCL of 10 µg/l were infrequent and limited to a couple of locations where active biodegradation of VOCs is suspected to have affected groundwater geochemistry such that arsenic has been mobilized. These locations are located within the boundaries of the OU 12 GMZs. Arsenic was not a chemical released to the environment during routine base activities at Loring AFB, but rather it is a byproduct of the processes of natural attenuation of constituents historically released into groundwater.

It is expected that the OU 12 remedy will remain protective of human health and the environment with respect to the new MCL for arsenic. Long-term monitoring of groundwater and groundwater use restrictions protect receptors at the compliance boundaries and restrict the usage of groundwater within the GMZs. Should long-term monitoring of groundwater at the compliance boundary points indicate that constituents released to the environment during Loring AFB activities are moving offsite and that natural attenuation of those constituents could result in elevated arsenic offsite, the potential offsite impacts would be evaluated. No such concern is indicated at this time.

Changes in Exposure Pathways: With the exception of the soil remediation at the BL site discussed in Section 8.6.2.4 of this report, there have been no changes in physical conditions, exposure pathways, or land use that would affect the protectiveness of the remedy.

The last five-year review identified several issues requiring follow-up actions, and recommended that the Air Force consider any appropriate guidance to determine if the vapor

intrusion (VI) pathway for various GMZ 1 and GMZ 3 plumes required additional analysis. Since completion of the last five-year review, additional guidance has been developed to aid in evaluating the potential for human exposure from the VI pathway. The Air Force evaluates potential vapor intrusion risks in accordance with the *DoD Vapor Intrusion Handbook* (TSERAWG, 2009)

In 2008, the Air Force further evaluated the VI pathway by performing a VI Screening Evaluation using 2007 OU 12 groundwater analytical data (URS, 2008c). Seventy-five OU 12 overburden and shallow bedrock LTM wells were assessed during the VI Screening Evaluation. The evaluation summarized the buildings located within 100 ft laterally from wells with VOC concentrations exceeding draft generic screening levels (EPA, 2002). Consideration was also given to the migration of groundwater contaminants from wells with VOC concentrations exceeding draft EPA generic screening levels. The VI Screening Evaluation identified a total of ten (10) occupied buildings that appeared to warrant more detailed investigation including Buildings 6570, 7210, 7220, 7230, 7240, 7500, 7501, and 8260 in GMZ 1 and Buildings 5005 and 8710 in GMZ 3. At the time of the evaluation, these buildings were occupied by commercial/industrial workers (or automotive technician students in the case of Building 6570) on a regular basis.

In order to further characterize conditions, three (3) buildings were selected for sub-slab vapor analyses, including Building 6570 (the former Auto Hobby Shop), Building 8260 (formerly the Jet Engine Build-up Shop), and Building 7330 (formerly the Base Laundry). These sites are described in detail in Sections 8.4 through 8.6 of this report.

A soil vapor intrusion field investigation was conducted from December 15 through 17, 2009. Data from this investigation are presented in the *Soil Vapor Intrusion Investigation Report, Former Loring Air Force Base* (URS, 2010c), which yielded the following results:

- The groundwater contaminant TCE was present in sub-slab soil vapor at *Building 6570 (Auto Hobby Shop)* at a concentration only slightly above its EPA and below its MEDEP guideline. PCE was detected at a very low level in groundwater but was detected above both EPA and MEDEP guideline levels in sub-slab soil vapor.

- The groundwater contaminant TCE was present in sub-slab soil vapor at *Building 8260 (Jet Engine Buildup Shop)* at a significant concentration (12,000

micrograms per cubic meter [$\mu g/m^3$]) that is above both MEDEP and EPA guidelines.

- The groundwater contaminant PCE was present in sub-slab soil vapor at *Building 7330 (Former Base Laundry)* at significant concentrations (5,800 to 26,000 $\mu g/m^3$) that are above both MEDEP and EPA guidelines. This compound was also detected in indoor air above MEDEP and EPA guidelines.

The *Soil Vapor Intrusion Investigation Report* (URS, 2010c) concluded that pathways from groundwater to sub-slab soil vapor appear to be complete at two of the three buildings tested and marginally complete at the third. The report recommended additional sampling to further evaluate the extent of vapor intrusion concerns at the remaining buildings identified during the VI Screening Evaluation. A Work Plan is currently being prepared for EPA and MEDEP review that proposes field investigations/sampling, anticipated to be performed in Fall-Winter 2010/2011, to evaluate possible VI issues at the 18 remaining buildings identified during the VI Screening Evaluation.

Data from supplemental investigations will be summarized during the next five-year review.

Changes in Toxicity and Other Contaminant Characteristics: Groundwater remediation goals in the *OU 12 Record of Decision* were based on ARARs, except where ARAR based standards were not available. Human health risk-based concentrations were used to establish remediation goals for iron, manganese, and 4-methyl-2-pentanone (Table 8.7-2). There have been updates to the regulations used to derive the RGs in the *OU 12 ROD* (HLA, 1999a), but most of the *OU 12 ROD* RGs based on ARARs are either still consistent with or more stringent than current standards.

Changes in Risk Assessment Methods: The original HHRA was conducted following then current EPA and EPA Region 1 guidance. The health protectiveness of the original RGs would not be expected to change because the groundwater RGs were established primarily using ARARs. Also, the risk-based RG for manganese currently has an ARAR (MEG) available.

Risk assessments are performed somewhat differently now than they were at the time of the last Five-Year Review and especially since the time of the *OU 12 ROD*. Guidance documents/risk assessment tools that have been issued include:

- Background guidance (2002), which changed the way background comparisons are performed for metals.
- EPA guidance regarding the sources of toxicity values (December 2003) has changed; toxicity values are now generally obtained from EPA Regional Screening Levels tables.
- EPA Risk Assessment Guidance for Superfund (RAGS) Part E (2004), which changed the way dermal risk assessment is performed.
- EPA ProUCL guidance and software (numerous versions of new guidance and software, up through 2008), which changed the way 95% UCLs are calculated.
- EPA RAGS Part F (2008), which changed the way inhalation risk assessment is performed. There are many chemicals with new toxicity values in this document.
- *Guidelines for Carcinogenic Risk Assessment* (EPA, 2005a) and *Supplemental Guidance for Assessing Susceptibility from Early Life Exposure to Carcinogens* (EPA, 2005b), which provide updated guidance for preparation of cancer risk assessments.
- The State of Maine document *Guidance for Human Health Risk Assessments for Hazardous Waste Sites in Maine* (MEDEP and CDC, 2009).

Changes have been made with regard to toxicity values. In particular, provisional toxicity values that EPA previously did not consider valid for use in risk assessments are now considered valid. Since the last Five-Year Review, various guidance documents have been issued regarding changes to ecological risk assessments; however, these changes should not significantly impact the protectiveness of the remedies since the RGs were based on ARARs, rather than risk-based numbers.

Expected Progress Toward Meeting RAOs: Implementation of the remedy for OU 12 is expected to meet each of the RAOs based on observed indicators that natural attenuation processes are reducing contaminant mass of COCs in groundwater, the successful implementation of LUC/ICs, and the continued performance of long-term monitoring.

8.7.4.3 Question C

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

Evaluation of the VI pathway is ongoing, although investigations to date have not definitively concluded if there is any risk from VI. The ongoing VI investigation could identify soil and/or groundwater as potential VI contaminant sources. Remedies may have to be revised based upon the outcome of these VI studies.

8.7.4.4 Technical Assessment Summary

As described above, the groundwater remedy at OU 12 is functioning as intended by successful establishment of Groundwater Management Zones, groundwater-use restrictions, availability of an alternate supply of water, long-term groundwater monitoring, and five-year site reviews. Additionally, LUC/ICs are in place and performing as expected. Partial and complete pathways from groundwater to sub-slab vapor exist in portions of GMZ 1; the VI pathway is actively being evaluated by the Air Force and additional investigations are planned for the near future. No other changes in exposure pathways or toxicity and other contaminant characteristics are affecting the protectiveness of the remedy. The groundwater remedy is currently progressing toward achievement of RAOs, and no other information has come to light that would call into question the protectiveness of the remedy.

8.7.5 Issues

The Air Force will continue to actively evaluate potential VI pathway issues in OU 12 to determine if any actions are necessary to ensure the future protectiveness of the OU 12 remedy.

The *OU 12 ROD* (HLA, 1999a) requires that as part of the five-year site reviews, the Air Force conduct a review of new technologies that might be applicable for any portions of OU 12 where TI waiver have been granted (i.e., the ES/JEBS and Quarry plumes).

8.7.6 Recommendations and Follow-Up Actions

Routine long-term monitoring and reporting of basewide groundwater quality under the OU 12 long-term monitoring program should continue. Routine data evaluation of groundwater flow conditions and trends in groundwater quality should be performed to assess progress toward the OU 12 RAOs, and to identify opportunities to optimize remedial activities.

Routine monitoring for OU 12 should also include monitoring of LUC/ICs to document their continued effectiveness.

The Air Force is currently in discussion with EPA and MEDEP regarding the data generated during the 2009 vapor intrusion investigation and work plans for future VI investigations to be conducted in Fall-Winter 2010/2011.

A separate technologies review document will be prepared to fulfill the *OU 12 ROD* requirements associated with the five-year reviews of the TI waiver sites.

8.7.7 Protectiveness Statement

Concentrations of organic and inorganic COCs in groundwater have steadily declined across OU 12. The remedial action at OU 12 (establishment of Groundwater Management Zones; groundwater-use restrictions; provision of an alternate supply of water; long-term groundwater monitoring; and five-year site reviews) is currently protective of human health and the environment.

8.7.8 References

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8.8 OPERABLE UNIT 13, BASEWIDE SURFACE WATER, SEDIMENT AND FISH TISSUE

8.8.1 Background

8.8.1.1 Site Description

OU 13 represents the basewide surface water, sediment, and associated biological communities at the former Loring AFB located in Limestone, Maine (Figure 8.8-1). Operable Unit 13 includes brooks, streams, ditches, lakes, ponds, and wetlands in approximately 30 square miles (19,200 acres) of watershed. Because of the size of the area and the number of drainage systems involved, Operable Unit 13 was subdivided into three primary study areas (Woodlot Alternatives [Woodlot], 2004).

The study areas are the three major watersheds that comprise the geographic area in and surrounding the LAFB and include:

- Wolverton Brook/Brandy Brook Study Area
- Greenlaw Study Area
- Butterfield Brook/Limestone Stream Study Area

The study areas are shown on Figure 8.8-2. A brief description of each study area is provided below.

Wolverton Brook/Brandy Brook (WB/BB) Study Area

These brooks receive runoff from the western portion of Loring AFB as well as off-base areas west of the base, and flow southwesterly into Little Madawaska River (LMR). The LMR is a relatively broad but shallow river located approximately 1.5 miles west of the base boundary. The LMR flows south approximately 7 miles and merges with the Aroostook River.

Greenlawn Brook (GB) Study Area

Greenlawn Brook, the principal on-base drainage, consists of the East Branch and West Branch (EBGB and WBGB), which merge and flow southwesterly into the LMR. The

FLDD and the FLDD Wetland constitute a tributary to the EBGB, which receives runoff and storm drain discharge from the primary operations areas of the base. The EBGB originates in a wetland south of the FTF and flows westerly approximately 2,500 ft before merging with the WBGB. The WBGB originates in a wetland north of the Flightline Area, west of the base boundary. The WBGB flows southward onto base property, passing west of the NDA and into Malabeam Lake, a distance of approximately 2 miles. The WBGB flows out of the southern end of Malabeam Lake, continues southward into Chapman Pit, and then flows south to the confluence with the EBGB.

Butterfield Brook/Limestone Stream (BB/LS) study Area:

The headwaters of the BB are north of the base boundary. BB drains approximately the eastern third of the base, flows southeasterly into Durepo Reservoir, and becomes Limestone Stream below the reservoir dam. Limestone Stream flows south approximately 11 miles and merges with the Aroostook River in New Brunswick, Canada.

8.8.1.2 Initial Response

A Fish Advisory was issued by the Maine Department of Human Services (DHS) in May 1996 warning against ingestion of fish from certain water bodies within and around the former Loring AFB. The areas included Chapman Pit, Green Pond, Greenlaw Brook, and the LMR and its tributaries from the Madawaska Dam Reservoir south to the Aroostook River (AFBCA, 2000).

A time-critical removal action was completed in 1996 that included removal of PCB-contaminated sediment from Ditch G12; removal of soil and sediment from Ditch G11; and cleaning of storm drains and catch basins from the Steam Plant to the head of Ditch G12 (located in the south-central portion of the base) (AFBCA, 2000).

8.8.1.3 Basis for Taking Action

Little is known of the specific sources of contamination in OU 13. Much of the contamination was likely due to non-point source releases from base and non-base related activities. The RI process, performed from 1988 to 1996, focused on assessing current conditions and hazards. This section will summarize the detected contaminants and describe

the pre-remedial response activities taken by the Air Force upon evaluation of the nine years of soil, surface water, biological tissue and sediment data documented in the *Operable Unit 13 Remedial Investigation Report* (ABB-ES, 1997a).

Wolverton Brook/Brandy Brook Study Area

The *Operable Unit 13 Remedial Investigation Report* (ABB-ES, 1997a) documented historical contamination detected in the WB/BB Study Area unrelated to base activities, in the form of pesticides and fuel-related contaminants also detected in the WB/BB Study Area at off-site sampling locations upstream of base influences. The likely source of non-base-related pesticide contamination was runoff from local agricultural fields. Runoff from roads and land where farm machinery was used and repaired was the likely source of fuel-related contamination.

Greenlaw Brook Study Area

The primary contaminants detected in the FLDD and FLDD Wetland include PAHs, PCBs, pesticides, TPH, and lead. The primary contaminants in the EBGB include PAHs, PCBs, pesticides, TPH, and lead. PCBs have also been detected in fish tissue in the EBGB. Contaminants detected in the WBGB are predominantly the result of base-related activities; however, some potential exists for non-base-related contaminants to also enter the WBGB. The primary contaminants in the WBGB, specifically in the NDA drainageways that originate on the western side of the NDA, include PAHs and inorganics (ABB-ES, 1997b).

Butterfield Brook/Limestone Stream Study Area

Contaminants detected within the study area are a result of a combination of base- and non-base-related activities. Butterfield Brook and its northern tributaries are believed to be impacted by runoff from agricultural field activity north of the base (ABB-ES, 1997b).

8.8.2 Remedial/Removal Actions

8.8.2.1 Regulatory Actions

The controlling documents that present the selected remedy are described below.

Operable Unit 13 Record of Decision

The *Operable Unit 13 Record Of Decision* (ABB-ES, 1997b) documented the remedy for OU 13 of both Removal and Disposal and No Further CERCLA Action. No Further CERCLA Action was deemed necessary for much of OU 13 because no unacceptable risk to human health or the environment was identified.

8.8.2.2 Remedial Action Objectives

The *Operable Unit 13 Record Of Decision* (ABB-ES, 1997b) documented the establishment of RAOs for the OU 13 program and documented the establishment of sediment and fish tissue remediation goals for the individual study areas that comprise the OU 13 program. The OU 13 RAOs are as follows:

- Prevent or minimize ingestion of and dermal contact with contaminated soil/sediment by human and ecological receptors;
- Prevent human ingestion of contaminated fish;
- Minimize migration of contaminated soil/sediment; and
- Avoid destruction of existing ecological habitat where the risk associated with short-term habitat loss outweighs the reduction in risk potentially realized by site remediation.

The OU 13 RGs are listed in Table 8.8-1.

8.8.2.3 Remedy Description

The Removal Action remedy included disposal for areas within OU 13 exceeding RGs. These areas include:

- FLDD;
- FLDD Wetland;

- EBGB;
- EBGB Wetland
- NDA Drainageways (north and south);
- Ditch G06;
- Underground Transformer Site (UTS) Wetland (northern portion).

The State Fish Advisory, implemented in 1996, will continue to be in force until the fish are determined to be acceptable for consumption. Areas covered by the advisory include Chapman Pit, Green Pond, Greenlaw Brook, and the LMR and its tributaries from the Madawaska Dam Reservoir south to the Aroostook River.

The No Further CERCLA Action alternative was selected for the LMR because there was no unacceptable risk associated with surface soil, sediment, and surface water. The No Further CERCLA Action alternative includes an environmental monitoring program and five-year site reviews to assess whether human health and the environment continue to be adequately protected.

8.8.2.4 Remedy Implementation

Removal and Disposal Action

The Removal and Disposal Actions for OU 13 were initiated in late 1997 and were completed in 1998. The 1997 remedial actions consisted of sediment removals in the FLDD, the FLDD Wetland, Drainage Ditch G12, the EBGB, EBGB Wetland, two drainage ditches west of the NDA, and a wetland south of the former Underground Transformer Site (UTS). Sediment removal in Drainage Ditch G06 was also anticipated; however, pre-design sampling indicated there was no unacceptable risk to receptors, and remediation was unnecessary. OU 13 sediment remedial actions (i.e., EBGB) at Loring AFB were completed during the 1998 construction season. Compensatory mitigation was initiated to restore over 35 acres of wetlands excavated during the removal of contaminated sediments.

Monitoring

Implementation of the OU 13 LTM Program was initiated in 2001. In 2001, the OU 13 LTM sampling and analysis was completed in accordance with the OU 13 Long-Term Monitoring

Plan (HLA, 1998). PCB concentrations were detected in fish tissue above the OU 13 fish tissue monitoring goal; therefore, additional sediment sampling and analysis was performed along the FLDD/EBGB in 2002. Sediment sampling was conducted within the FLDD/EBGB restoration area and downstream of the former LAFB boundary. Based on the 2002 sediment sampling and analysis results, only one sample detected PCBs slightly above the OU 13 remediation goal.

As recommended in the *OU 13 2001 Long-Term Monitoring Report* (Woodlot, 2002) and approved by the EPA and MEDEP, the focus of OU 13 efforts in 2003 was to gather additional information regarding pesticide and PCB concentrations in fish tissue, and sediment at the areas included in the OU 13 LTM Program, at the areas not influenced by Air Force activities (i.e., background locations), and at historically sampled waterbodies that may have been inadequately characterized due to high laboratory detection limits.

Results from the 2003 OU 13 monitoring confirmed PCB concentrations in fish tissue were elevated above the OU 13 monitoring goal and established pesticide and PCB background concentrations in fish tissue. Results of the OU 13 2003 sampling and analysis were presented in the *OU 13 2003 Monitoring Report* (Woodlot, 2004). Based on the results of OU 13 LTM in 2001 through 2003, the AFRPA, EPA, and MEDEP agreed that the OU 13 LTM Plan would be revised to document required revisions to the OU 13 LTM Program. A Draft revised OU 13 LTM Plan was issued to MEDEP and EPA in April 2005; however, Maine Bureau of Health (MBOH) is currently considering revising fish consumption advisory action levels. These revised action levels will be reviewed prior to initiating future OU 13 LTM, which is currently scheduled for 2008.

Subsequent to the OU 13 removal actions in 1997/1998, the wetland mitigation/restoration component of OU 13 was transferred to the Loring Wetlands Management Program. Wetland mitigation monitoring was initiated in 1998. Wetland mitigation monitoring includes monitoring vegetation, wildlife, soil, wetland hydrology, and wetland functions and values. Results from the 2004 wetlands monitoring indicate each area has met or will meet the site specific mitigation goals and objectives.

The data generated during the 2008 LTM event (Stantec, 2009) showed that the sediment and fish tissue results are similar to the 2003 results, significantly below pre-removal action concentrations. However, fish tissue PCB concentrations still exceed MBOH and ROD cleanup goals. All sediment concentrations were below ROD remedial goals in the 2008 event.

8.8.3 Implementation of Recommendations from Last Five-Year Review

The *Second Five-Year Review Report* (MWH, 2005), concluded that the remedies for OU 13 remained protective of human health and the environment. The following recommendations were included in the *Second Five-Year Review Report* (MWH, 2005):

- The *OU 13 Long-term Monitoring Plan* should be revised to reflect the changes to the LTM program agreed upon during the May 2004 BCT meeting.
- A review of the status of the MBOH fish tissue action levels and recommended PCB analysis should be conducted prior to performing the 2008 OU 13 LTM to be conducted in 2008.

In preparation for the 2008 OU 13 LTM program, the *Final Biological Monitoring Quality Program Plan, Operable Unit 13 Long-Term Monitoring* (BioQPP) (URS and Stantec, 2008) was completed and outlined the quality assurance/quality control (QA/QC) methods for the LTM program's collection and analysis of biological samples and was an addendum to the OU 13 LTM Plan (Woodlot, 2005). In addition, the *2008 OU 13 Long-Term Monitoring Report* (Stantec, 2009), compared values against applicable criteria (i.e. 2005 MBOH Dioxin Fish Tissue Cancer Action Levels for Screening Evaluations [MBOH, 2005]).

The environmental monitoring component of the No Further CERCLA Action remedy has been successfully implemented and has been documented in the following reports:

- *2008 OU 13 Long-Term Monitoring Report* (Stantec, 2009).

8.8.4 Technical Assessment

The technical assessment component of the five-year review consists of evaluating the protectiveness of the remedy. The technical assessment was performed based on guidance provided in Section 4.0 of the *Comprehensive Five-Year Review Guidance* (U.S. EPA, 2001).

8.8.4.1 Question A

Question A: Is the remedy functioning as intended by the decision documents?

The Air Force has successfully implemented the components of the remedy. The Removal Actions were completed as noted above. The environmental monitoring component of the No Further CERCLA Action remedy has been successfully implemented and documented in numerous reports, and the chosen remedy is protective of human health and the environment and facilitating the attainment of the RAOs.

8.8.4.2 Question B

Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of the remedy selection still valid?

Changes in Standards: Specific cleanup standards do not exist for sediment and soil within OU 13. Site-specific, risk-based remediation goals were developed to be protective of human health and the environment.

Changes in Exposure Pathways: There have been no changes in physical conditions, exposure pathways, and land use that would affect the protectiveness of the remedy.

Changes in Toxicity and Other Contaminant Characteristics: Risk-based sediment and surface soil remediation goals were established for several compounds including PAHs, DDD, DDE, DDT, endrin, Aroclor-1260, chlordane, lead and zinc. The standards were developed to protect both human health and the environment. Protection of human health was based on the lesser value of a carcinogenic risk based concentration calculated with the cancer risk set at 1×10^{-6} and a noncarcinogenic risk based concentration with the hazard quotient set at one. Remediation goals selected under the ROD represent the lesser of the human health and ecological criteria.

Changes in toxicity values since the time of the ROD could affect the protectiveness of the remediation goals. Review of toxicity factors for this *Five-Year Review Report* showed that the carcinogenic oral toxicity factors for Aroclor-1260 and the PAHs have decreased, while inhalation slope factors are higher. For chlordane, oral and inhalation factors are lower than those used in the risk assessment. Because of these toxicity factor revisions, carcinogenic risk estimates for these constituents are expected to be lower than those reported in the risk assessment. Consequently, the remediation goals continue to be protective for carcinogenic risks.

Changes in noncarcinogenic toxicity values were also reviewed. The noncarcinogenic reference dose for Aroclor-1260 is not currently available, while a value of 2×10^{-5} was used in the risk assessment. Therefore, noncarcinogenic hazard due to Arochlor 1260 would be lower. Noncarcinogenic risk due to exposure to chlordane would increase. However, the remediation goals remain protective overall because human health risk based remediation goals were developed based on carcinogenic risks.

In addition, fish tissue action levels, based on protection of human health, were established for DDD, DDE, DDT, Arochlor 1242, Arochlor 1260, heptachlor, and chlordane. For this exposure pathway involving human consumption of fish, only the oral toxicity factors affect estimated risks. Review of toxicity factors showed that the carcinogenic oral toxicity factors for Aroclor-1260, Aroclor-1242, and chlordane have decreased. Using currently available values, carcinogenic risk estimates for these constituents are expected to be lower than those reported in the risk assessment. Consequently, the remediation goals remain protective.

In addition to the constituents for which remediation goals were calculated, several others were identified as COPCs in the human health risk assessment. Changes in toxicity values for these COPCs could potentially result in total estimated risk that exceeds the target risk level established in the risk assessment. Therefore, toxicity factors for all COPCs were evaluated to identify changes in values used in the risk assessment versus values currently available. Table 7.3-2 lists all COPCs identified in surface soil, sediment, and fish tissue for which oral toxicity factors have changed. Table 8.3-2 lists inhalation toxicity factors that have

changed. Toxicity factors remain unchanged for all other COPCs not listed in Table 7.3-2 or Table 8.3-2.

Among the COPCs identified at OU-13, toxicity factors have changed for a number of COPCs. Since the time of the risk assessment, carcinogenic oral toxicity factors have not increased for any of the COPCs. Inhalation toxicity factors were higher for few COPCs. However, estimated risks using currently available toxicity factors would not significantly add to the total risks. The remediation goals for carcinogenic COPCs remain protective.

For noncarcinogenic risks, currently available toxicity factors are higher for several COPCs. The calculated noncarcinogenic risks for these compounds were checked to determine impact of currently available values. Estimated noncarcinogenic risks would not be impacted if currently available toxicity factors for all these compounds are used.

In addition, several compounds currently have toxicity factors available that were not available at the time of the risk assessment. Estimated noncarcinogenic risks due to exposure to these compounds would not be significant if currently available toxicity factors are used.

Unlike human health risk assessments, EPA does not recommend specific toxicity reference doses for constituents in ecological risk assessments. The toxicity factors used in the ecological risk assessment are considered protective of the environment.

Changes in Risk Assessment Methods: The original HHRA was conducted following then current EPA and EPA Region 1 guidance. Risk assessments are performed somewhat differently now than they were at the time of the last Five-Year Review and especially since the time of the *OU 13 ROD*. Guidance documents/risk assessment tools that have been issued include:

- Background guidance (2002), which changed the way background comparisons are performed for metals.
- EPA guidance regarding the sources of toxicity values (December 2003) has changed; toxicity values are now generally obtained from EPA Regional Screening Levels tables.

- EPA Risk Assessment Guidance for Superfund (RAGS) Part E (2004), which changed the way dermal risk assessment is performed.

- EPA ProUCL guidance and software (numerous versions of new guidance and software, up through 2008), which changed the way 95% UCLs are calculated.

- EPA RAGS Part F (2008), which changed the way inhalation risk assessment is performed. There are many chemicals with new toxicity values in this document.

- *Guidelines for Carcinogenic Risk Assessment* (EPA, 2005a) and *Supplemental Guidance for Assessing Susceptibility from Early Life Exposure to Carcinogens* (EPA, 2005b), which provide updated guidance for preparation of cancer risk assessments.

- The State of Maine document *Guidance for Human Health Risk Assessments for Hazardous Waste Sites in Maine* (MEDEP and CDC, 2009).

Changes have been made with regard to toxicity values. In particular, provisional toxicity values that EPA previously did not consider valid for use in risk assessments are now considered valid.

Expected Progress Toward Meeting RAOs: The RAOs for OU 13 that address contaminated sediment and restoration of wetlands have been met through removal actions and wetland construction. To address the OU 13 RAO for preventing the human ingestion of contaminated fish, the Air Force will continue long-term monitoring of fish tissue contaminant concentrations and continue work with the Maine CDC to implement a fish consumption advisory program.

8.8.4.3 Question C

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

No other information has been identified that would call into question the protectiveness of the remedy.

8.8.4.4 Technical Assessment Summary

As described above, the remedy at OU 13 is functioning as intended by successful removal of contaminated sediment and implementation of long-term environmental monitoring as well

as five-year site reviews to assess whether human health and the environment continue to be adequately protected. The remedy is currently functioning as intended, and no other information has come to light that would call into question the protectiveness of the remedy.

8.8.5 Issues

No issues were identified for OU 13.

8.8.6 Recommendations and Follow-Up Actions

The following recommendations are provided for the future management of the OU 13 LTM Program:

- Prior to the next scheduled OU 13 LTM sampling event, which is currently scheduled to occur in 2013, PCB analytical methods and biological monitoring criteria (i.e., action levels) should be reviewed and modified, if appropriate.
- As recommended in the 2001 and 2003 OU 13 LTM Reports (Woodlot, 2002 and 2004), the Air Force should continue to publish a copy of the MCDC fish consumption advisory each year during the early portion of the open water fishing season (i.e., April or May) in the *Bangor Daily News* and *Aroostook Republican* because of the potential for stolen and vandalized fish advisory signs.

8.8.7 Protectiveness Statement

The remedial action at OU 13 (removal action of contaminated sediment, environmental monitoring and five-year site reviews) is protective of human health and the environment, and will remain so in the future.

8.8.8 References

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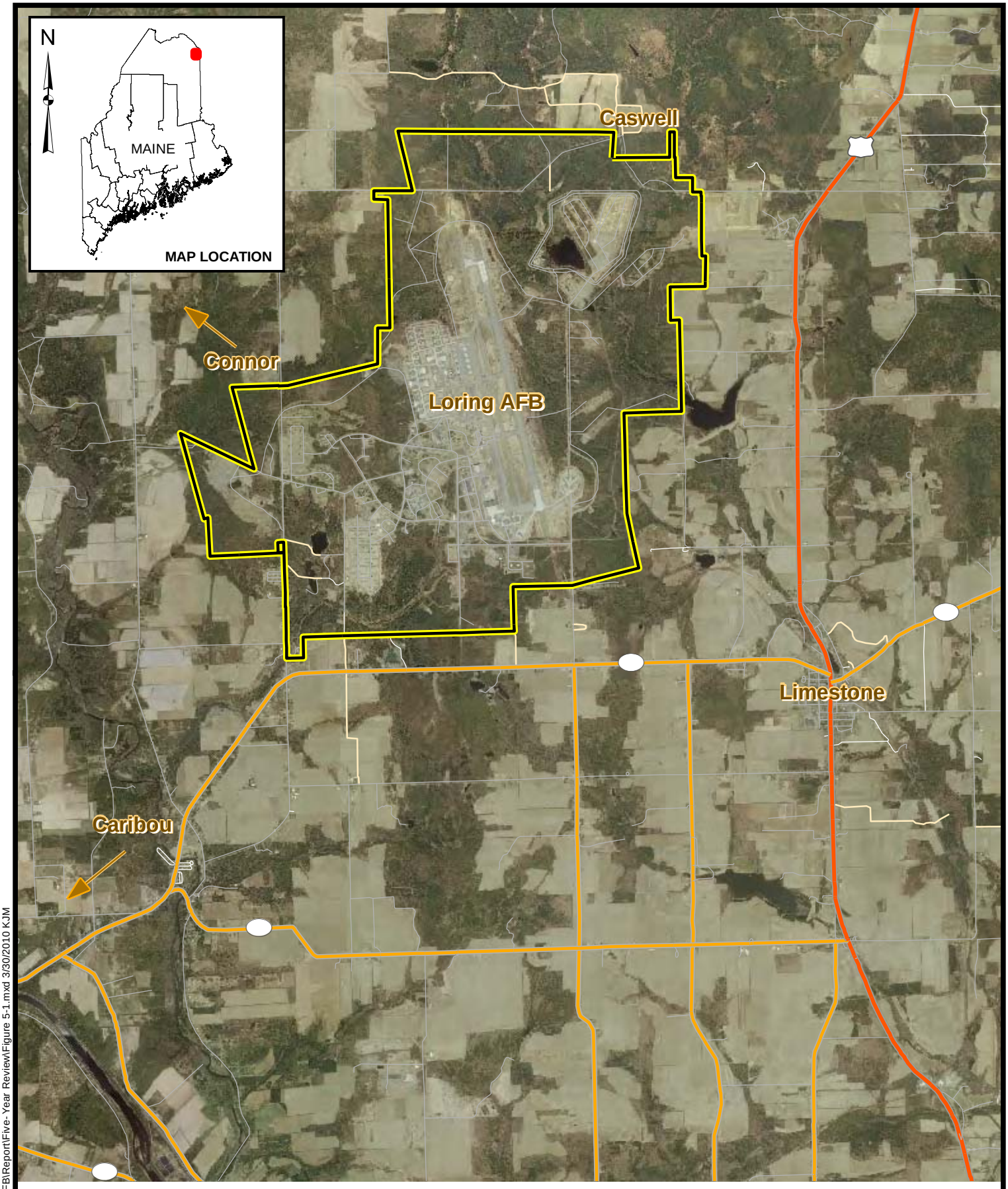
FIGURES



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URS

FIVE-YEAR REVIEW REPORT
FORMER LORING AIR FORCE BASE, LIMESTONE, MAINE
SITE LOCATION MAP

FIGURE 5-1

N

EAST BASE (GMZ 6)

OU8

EAST BASE

FJETC (GMZ 5)

OU5

NOSE DOCK AREA

QUARRY (GMZ 4)

DRMO

LANDFILLS GMZ

NORTH WHERRY

West Branch of Greenlaw Brook

BXSS (GMZ 3)

INDUSTRIAL AREA (GMZ 1)

OU10

ALERT AREA

OU2 & OU4

OU9

SOUTH FLIGHT LINE

OU11

FTF SOUTH (GMZ 2)

SOUTH WHERRY

OU4 & OU2

East Branch of Greenlaw Brook

GROUNDWATER MANAGEMENT ZONE UNDER CERCLA
RESTRICTED FROM GROUNDWATER USE
WITHOUT PERMISSION FROM EPA/MEDEP/AF

AREA REGULATED UNDER MEDEP CMR CHAPTER 691
RESTRICTED FROM GROUNDWATER USE
WITHOUT PERMISSION FROM MEDEP/AF

FORMER AFB PROPERTY BOUNDARY

OPERABLE UNIT (OU)

NOTES:

1. OU 3 - DEBRIS DISPOSAL AREAS ARE LOCATED AT SEVERAL LOCATIONS ACROSS THE BASE.
2. OU 12 - BASEWIDE GROUNDWATER INCLUDES THE RESTORATION OF GROUNDWATER THROUGHOUT THE MAJORITY OF THE BASE.
3. OU 13 - BASEWIDE SURFACE WATER AND SEDIMENT INCLUDES ALL SURFACE DRAINAGE FEATURES OF THE BASE.

2,000 0 2,000 Feet

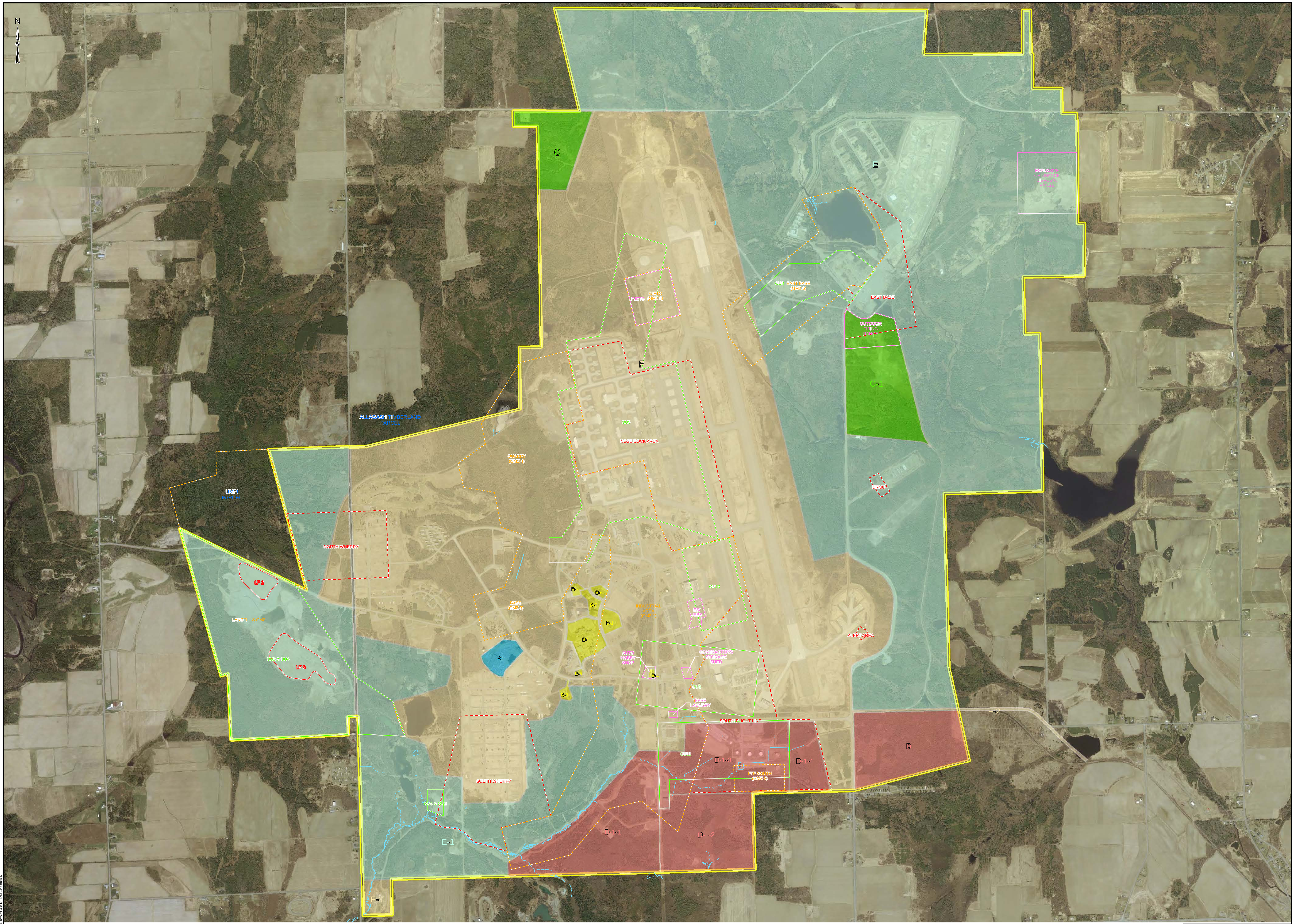
FIVE-YEAR REVIEW REPORT
FORMER LORING AIR FORCE BASE
LIMESTONE, MAINE

OPERABLE UNITS

URS

FIGURE 5-2

J:\LoringPease\DBG\SILoringAFB\Report\Five- Year Review\Figure 5-2.mxd 3/30/2010 KJM



FORMER AFB PROPERTY BOUNDARY

GROUNDWATER MANAGEMENT ZONE (GMZ) UNDER CERCLA
RESTRICTED FROM GROUNDWATER USE WITHOUT PERMISSION FROM EPA/MEDEP/AF

OPERABLE UNITS (OUs)

INSTALLATION RESTORATION PROGRAM (IRP) SITES

AREA REGULATED UNDER MEDEP CMR CHAPTER 691
RESTRICTED FROM GROUNDWATER USE WITHOUT PERMISSION FROM MEDEP/AF

DEFENSE FINANCE AND ACCOUNTING SERVICE (DFAS) PARCEL (A)

JOB CORPS PARCELS (B-1 THROUGH B-7)

MAINE ARMY NATIONAL GUARD (MEARNG) PARCELS (C, C-1)

BUREAU OF INDIAN AFFAIRS (BIA) PARCELS (D, D-1)

US FISH AND WILDLIFE SERVICE (USFWS) PARCELS (E,E-1)

LORING DEVELOPMENT AUTHORITY (LDA) PARCELS (F, F-1, F-2)

NOTES:

1. OU 3 - DEBRIS DISPOSAL AREAS ARE LOCATED AT SEVERAL LOCATIONS ACROSS THE BASE.
2. OU 12 - BASEWIDE GROUNDWATER INCLUDES THE RESTORATION OF GROUNDWATER THROUGHOUT THE MAJORITY OF THE BASE.
3. OU 13 - BASEWIDE SURFACE WATER AND SEDIMENT INCLUDES ALL SURFACE DRAINAGE FEATURES OF THE BASE.

1,000 0 1,000 Feet

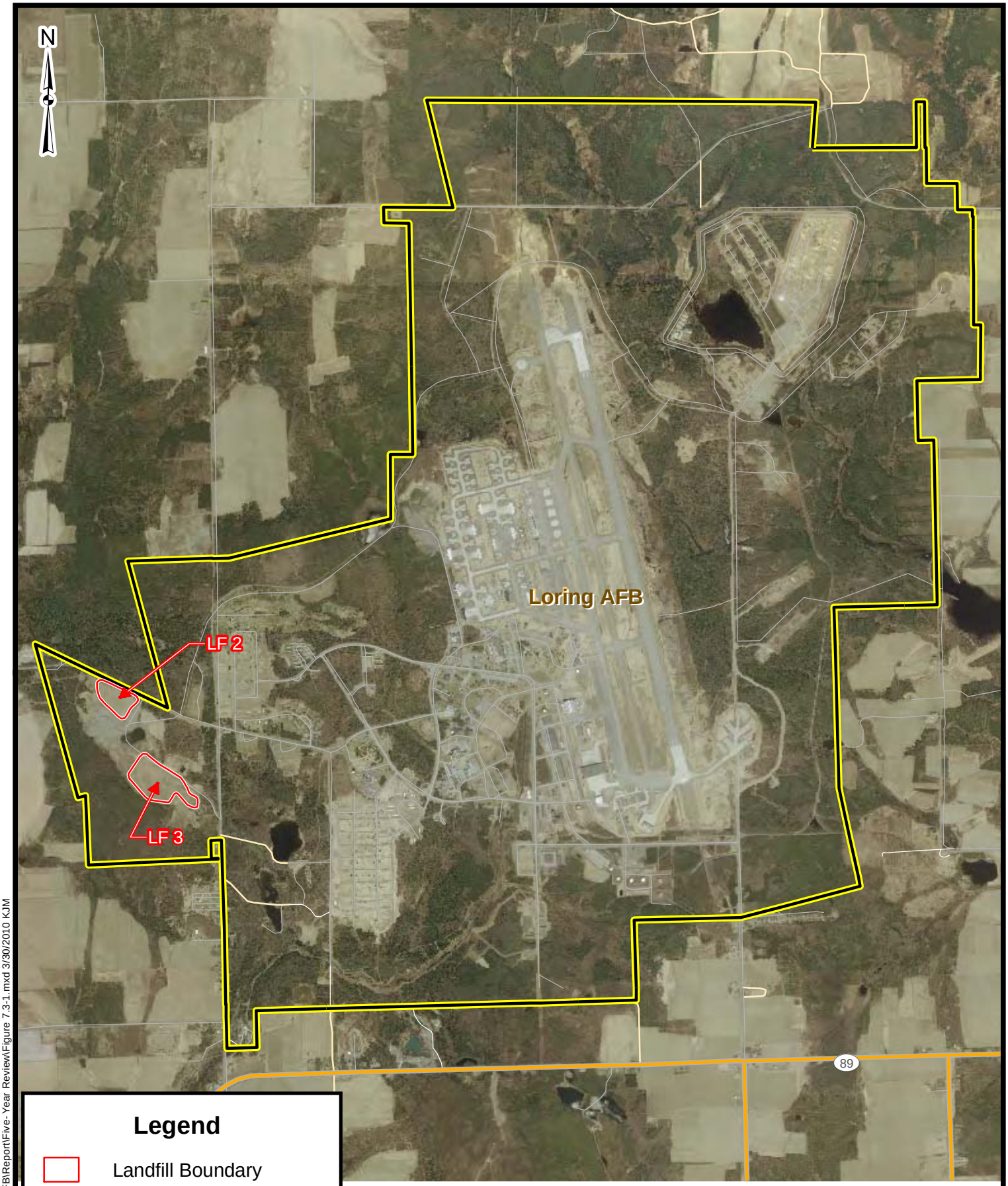
FIVE-YEAR REVIEW REPORT
FORMER LORING AIR FORCE BASE
LIMESTONE, MAINE

OPERABLE UNITS, IRP SITES AND PARCELS

URS

FIGURE 6.1-1

J:\LoringPease\DB\GIS\LoringAFB\Report\Five- Year Review\Figure 6.1-1.mxd 4/20/2010 KJM

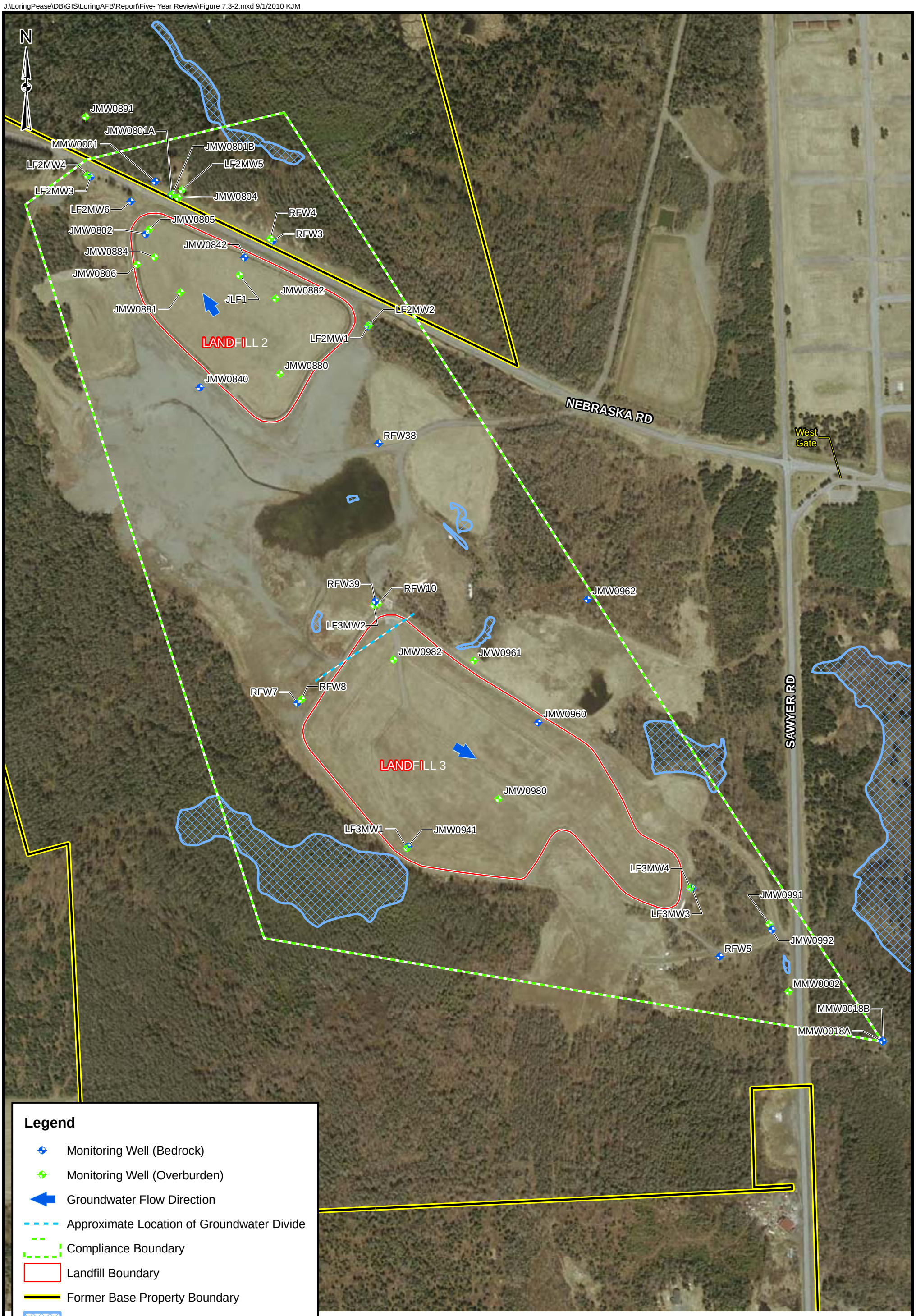


FIVE-YEAR REVIEW REPORT
FORMER LORING AIR FORCE BASE - LIMESTONE, MAINE
LANDFILLS 2 AND 3 SITE LOCATION MAP

FIGURE 7.3-1

J:\LoringPease\DB\GIS\LoringAFB\Report\Five- Year Review\Figure 7.3-1.mxd 3/30/2010 KJM

J:\LoringPease\DB\GIS\LoringAFB\Report\Five- Year Review\Figure 7.3-2.mxd 9/1/2010 KJM



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FIVE-YEAR REVIEW REPORT
FORMER LORING AIR FORCE BASE - LIMESTONE, MAINE
LANDFILLS 2 AND 3

FIGURE 7.3-2

N

LF2RESD

LF2MW3

LF2MW4

MMW0001

LF2MW5

LF2MW6

JMW0801B

JMW0806

JMW0882	ROD	5/05	6/06	5/07	5/08	5/09
Metals:						
Iron	8400	32800	26300	29000	31900	32400

LF2MW1 LF2MW2

Legend

- Landfill Boundary
- Wetland
- Compliance Boundary
- Sampled LTM Monitoring Well

Location ID — Sample Date

JMW0882	ROD	5/09
Metals:		
Iron	8400	32400

Compound — Criteria — Result (UG/L)

Units: µg/L (micrograms per liter)

Criteria: LF-2 Bedrock Groundwater Action Levels from Final Operable Unit 4 Record of Decision (ABB-ES, 1996).

200 0 200 Feet

FIVE-YEAR REVIEW REPORT
FORMER LORING AIR FORCE BASE - LIMESTONE, MAINE

LANDFILL 2 GROUNDWATER TARGET MONITORING PARAMETER EXCEEDANCES 2005 - 2009

URS

FIGURE 7.3-3

J:\Loring\Pease\DB\GIS\LoringAFB\Report\Five- Year Review\Figure 7.3-3.mxd 3/30/2010 KJM

N

RFW39

LF3MW2

JMW0960

JMW0941

LF3MW1

LF3MW3

JMW0992

MMW0002

MMW0018B

MMW0018A

CUTT RD

SAWYER RD

MALABEAM LAKE

CHAPMAN PIT

JMW0961	ROD	5/05	10/05	5/06	10/06	5/07	10/07	5/08	10/08	5/09	10/09
VOCs:											
Vinyl Chloride	0.15	BC	BC	BC	0.17	BC	0.17	BC	BC	BC	BC
Metals:											
Iron	8400	BC	BC	8960	13400	BC	13800	BC	BC	BC	BC
Manganese	1300	1650	2100	3340	3230	1400	2610	2050	2220	1920	2030

JMW0980	ROD	5/05	10/05	5/06	10/06	5/07	10/07	5/08	5/09	10/09
VOCs:										
1,4-Dichlorobenzene	27	NA	BC	BC	BC	BC	BC	BC	28	BC
Benzene	5	11	BC	BC	BC	9.4	BC	BC	5.9	BC
Vinyl Chloride	0.15	0.47	0.34	0.26	0.23	0.4	0.24	0.4	0.5	0.22
Metals:										
Iron	8400	33700	21600	17900	14200	28200	16200	16800	27700	17000

LF3MW4	ROD	5/05	10/05	5/06	10/06	5/07	10/07	5/08	10/08	5/09	10/09
Metals:											
Iron	8400	19700	21800	22700	23000	20000	20300	20000	20500	19500	18000
Manganese	1300	2630	2940	3060	3720	3020	3180	2950	2880	2890	2960

JMW0991	ROD	10/05	5/06	10/06	5/07	10/07	5/08	10/08	5/09	10/09
VOCs:										
Vinyl Chloride	0.15	0.16	0.23	BC	BC	0.19	BC	BC	BC	0.21
Metals:										
Iron	8400	15900	11700	16800	BC	16400	9170	11900	8440	14300
Manganese	1300	2300	1830	2500	1310	2340	1730	1900	1570	2300

Legend

- Landfill Boundary
- Wetland
- Compliance Boundary
- Sampled LTM Monitoring Well

Location ID — Sample Date

LF3MW4	ROD	5/09	10/09
Metals:			
Iron	8400	19500	18000
Manganese	1300	2890	2960

Compound — Criteria — Result (UG/L)

Units: µg/L (micrograms per liter)

BC: Below ROD Criteria

ROD: LF-3 Bedrock and Overburden Groundwater Action Levels from Final Operable Unit 4 Record of Decision (ABB-ES, 1996).

350 0 350 Feet

FIVE-YEAR REVIEW REPORT
FORMER LORING AIR FORCE BASE - LIMESTONE, MAINE

LANDFILL 3 GROUNDWATER TARGET MONITORING PARAMETER EXCEEDANCES 2005 - 2009

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FIGURE 7.3-4

J:\LoringPeaseIDB\GIS\LoringAFB\Report\Five- Year Review\Figure 7.3-4.mxd 3/30/2010 KJM

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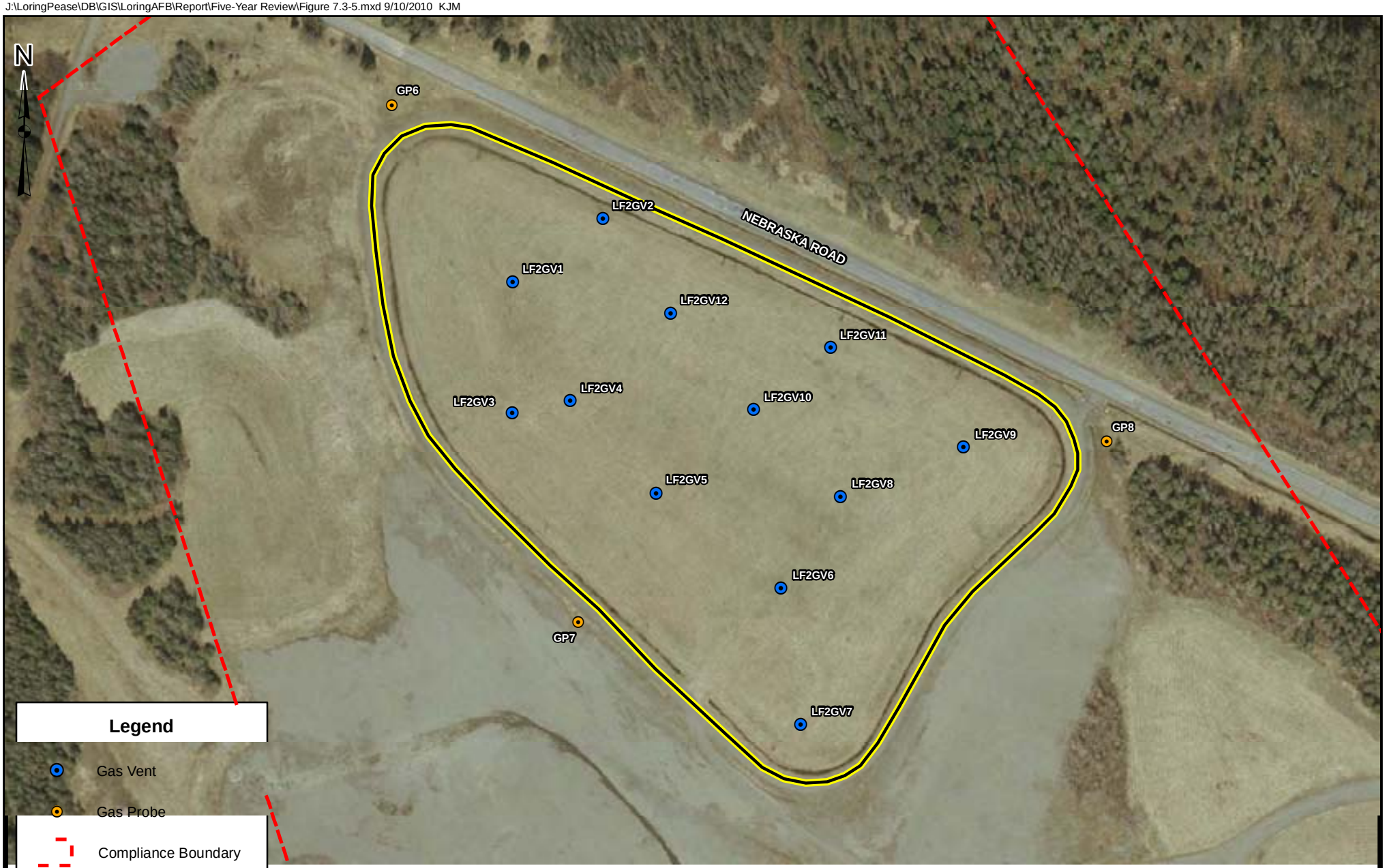

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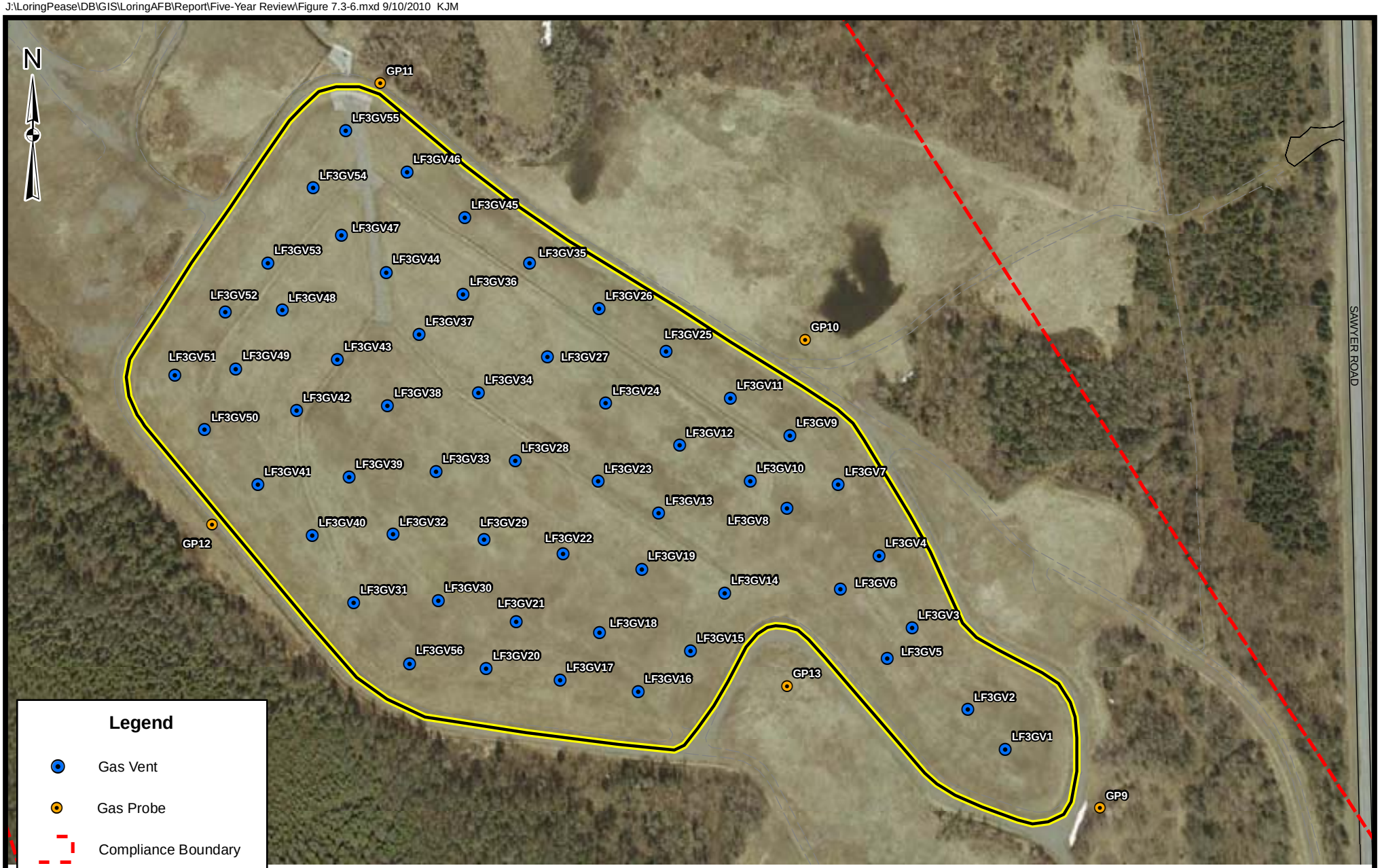
FIVE-YEAR REVIEW REPORT
LORING AIR FORCE BASE - LIMESTONE, MAINE
LOCATION OF GAS VENTS AND PROBES AT LANDFILL 2

FIGURE 7.3-5

J:\LoringPease\DB\GIS\LoringAFB\Report\Five-Year Review\Figure 7.3-6.mxd 9/10/2010 KJM



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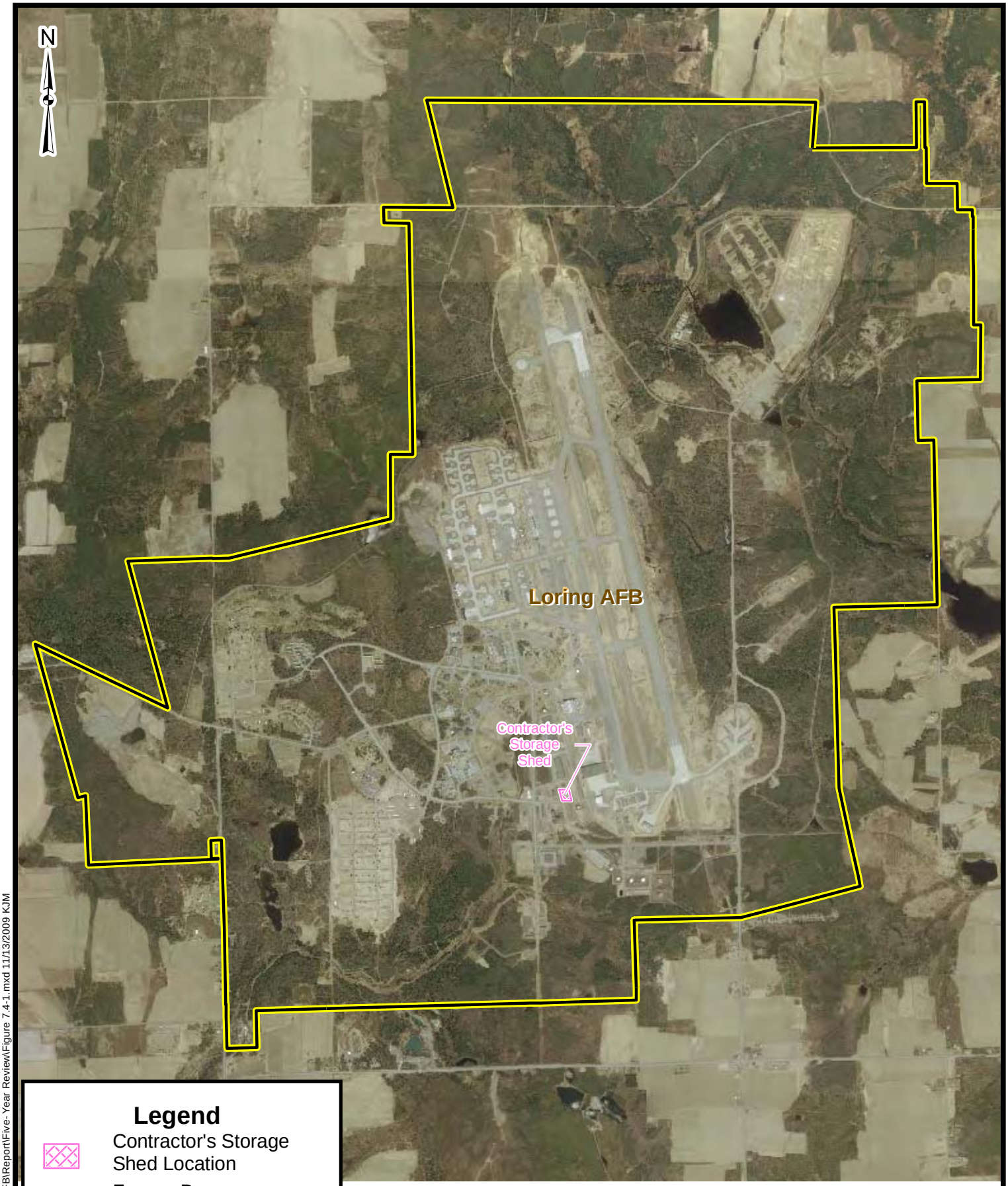
FIVE-YEAR REVIEW REPORT
LORING AIR FORCE BASE - LIMESTONE, MAINE
LOCATION OF GAS VENTS AND PROBES AT LANDFILL 3

FIGURE 7.3-6



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FIVE-YEAR REVIEW REPORT
FORMER LORING AIR FORCE BASE - LIMESTONE, MAINE
CONTRACTOR'S STORAGE SHED SITE LOCATION MAP

FIGURE 7.4-1

J:\LoringPease\DB\GIS\LoringAFB\Report\Five- Year Review\Figure 7.4-1.mxd 11/13/2009 KJM

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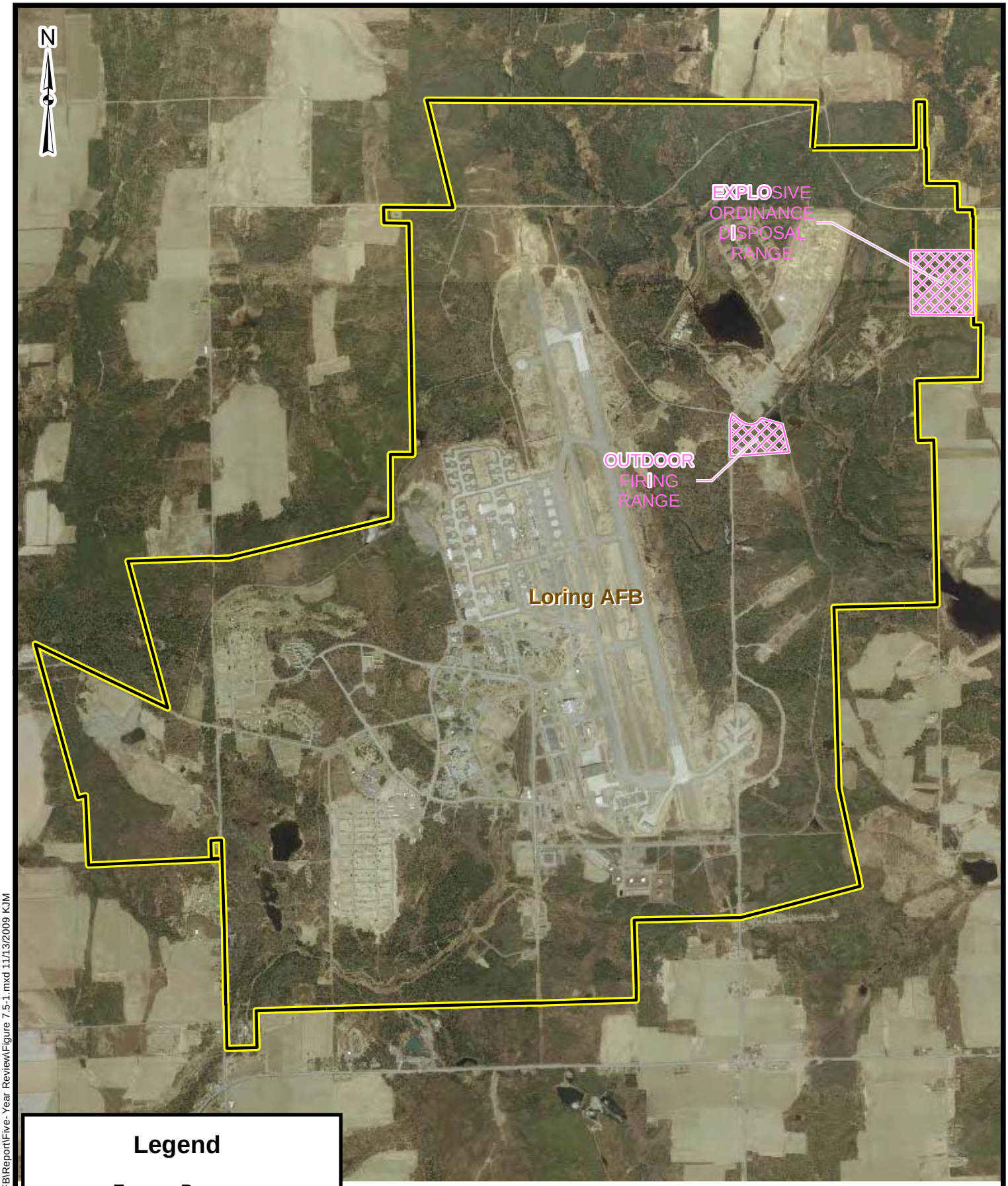
FIVE-YEAR REVIEW REPORT
FORMER LORING AIR FORCE BASE - LIMESTONE, MAINE
SITE PLAN FOR CONTRACTOR'S STORAGE SHED

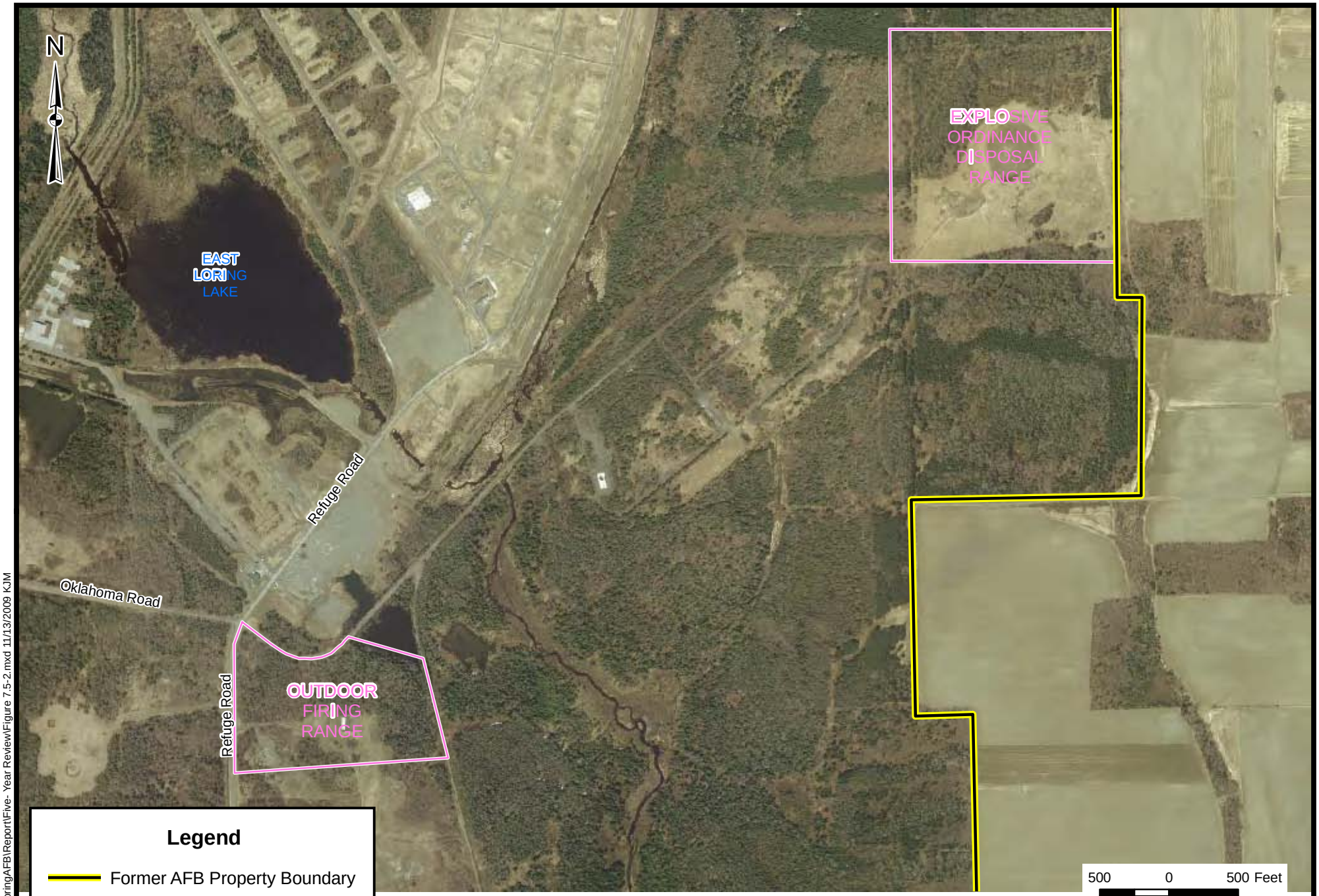
FIGURE 7.4-2



FIVE-YEAR REVIEW REPORT
FORMER LORING AIR FORCE BASE - LIMESTONE, MAINE
EOD RANGE/ OFR SITE LOCATION MAP

FIGURE 7.5-1

J:\LoringPease\DB\GIS\LoringAFB\Report\Five- Year Review\Figure 7.5-1.mxd 11/13/2009 KJM



J:\LoringPease\DB\GIS\LoringAFB\Report\Five- Year Review\Figure 7.5-2.mxd 11/13/2009 KJM

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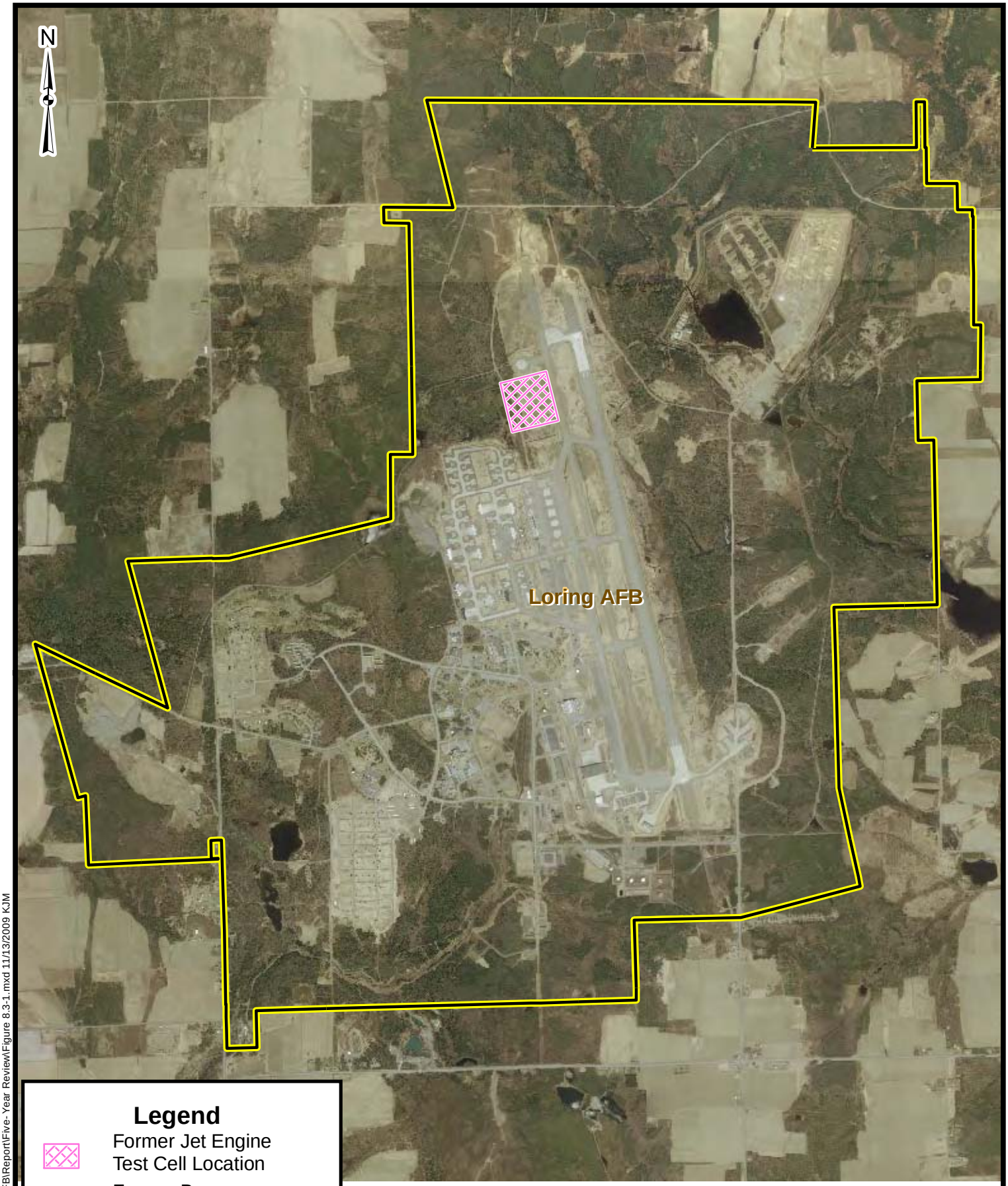
FIVE-YEAR REVIEW REPORT
FORMER LORING AIR FORCE BASE - LIMESTONE, MAINE
SITE PLAN FOR EXPLOSIVE ORDINANCE DISPOSAL RANGE AND OUTDOOR FIRING RANGE

FIGURE 7.5-2



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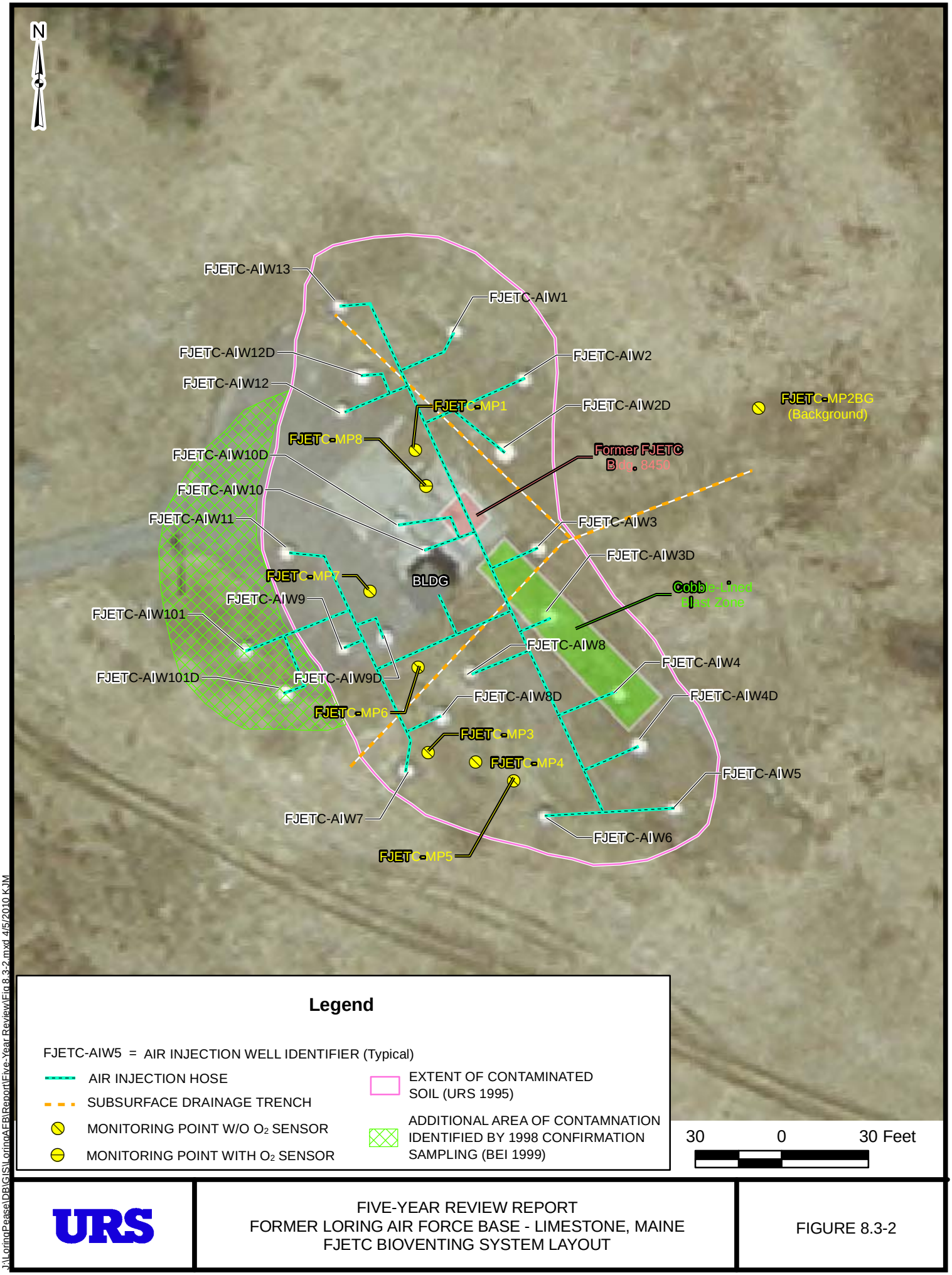
FIVE-YEAR REVIEW REPORT
FORMER LORING AIR FORCE BASE - LIMESTONE, MAINE
FJETC SITE LOCATION MAP

FIGURE 8.3-1



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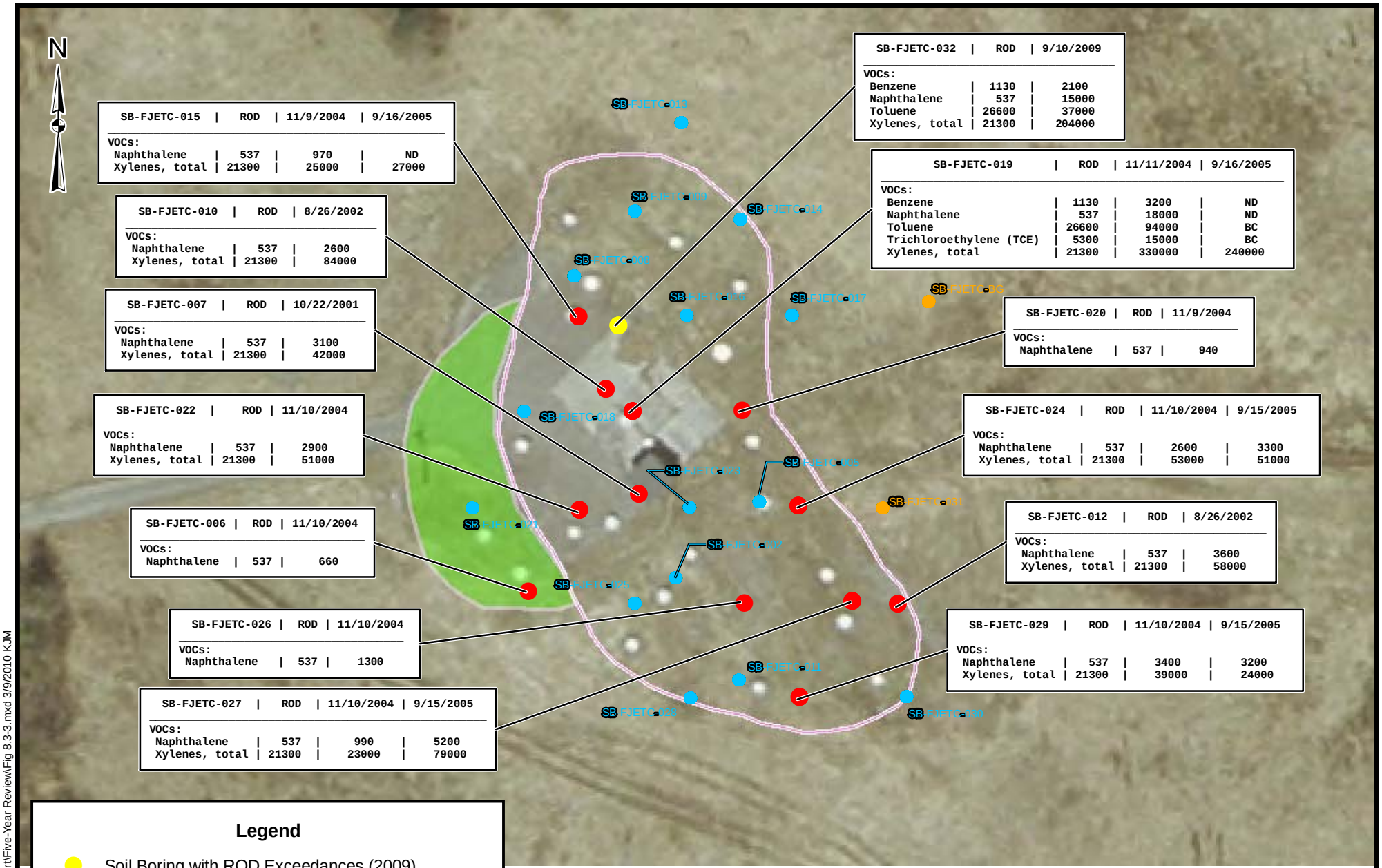
FIVE-YEAR REVIEW REPORT
FORMER LORING AIR FORCE BASE - LIMESTONE, MAINE
FJETC BIOVENTING SYSTEM LAYOUT

FIGURE 8.3-2



FIVE-YEAR REVIEW REPORT
FORMER LORING AIR FORCE BASE - LIMESTONE, MAINE
FJETC SOIL SAMPLING ANALYTICAL SUMMARY (2001-2009)
EXLUDING TPH ANALYSES

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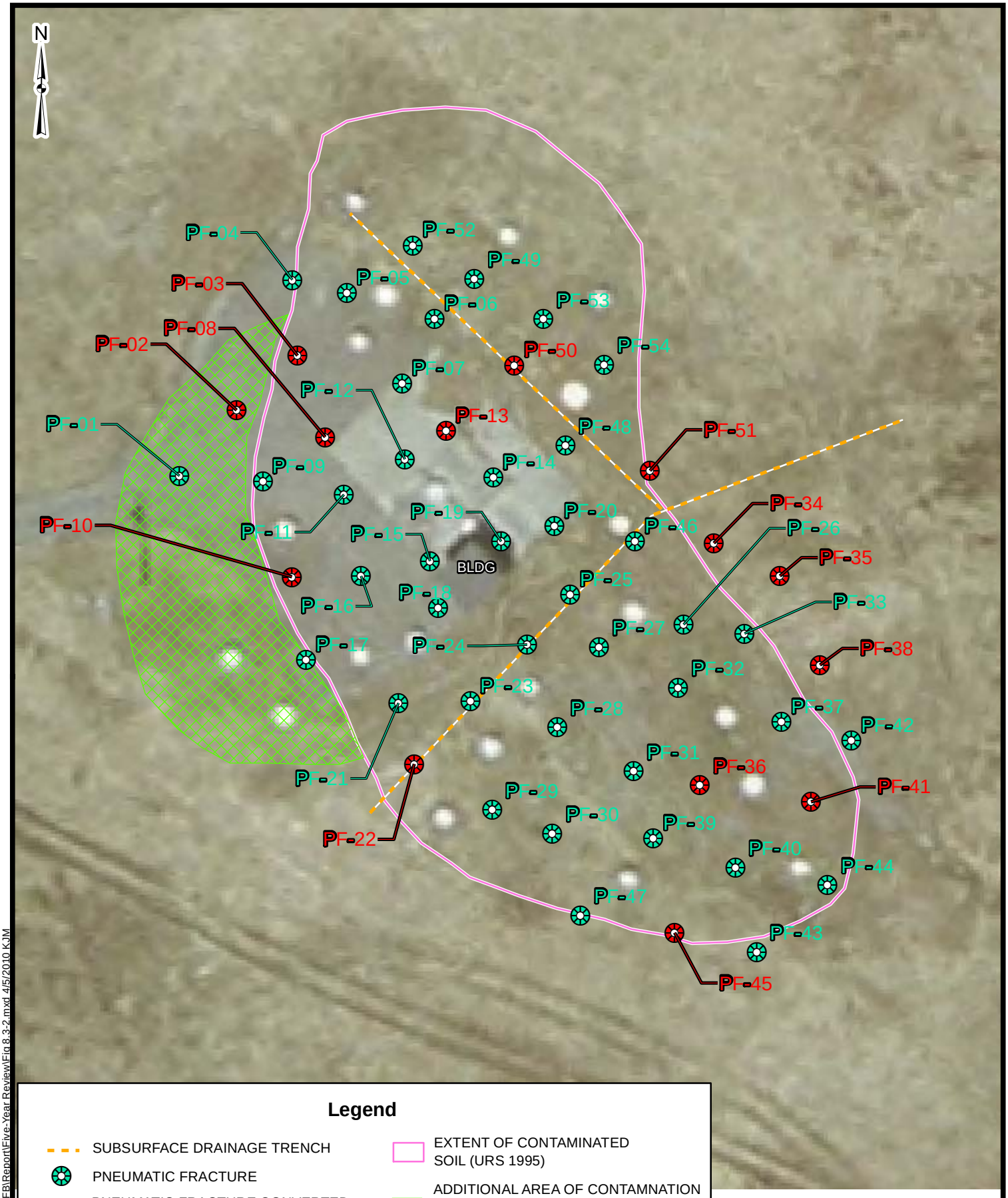
FIGURE 8.3-3

J:\LoringPease\DB\GIS\LoringAFB\Report\Five-Year Review\Fig 8.3-3.mxd 3/9/2010 KJM



J:\LoringPease\DBG\GIS\Loring\AFB\Report\Five-Year Review\Fig 8.3-2.mxd 4/5/2010 KJM

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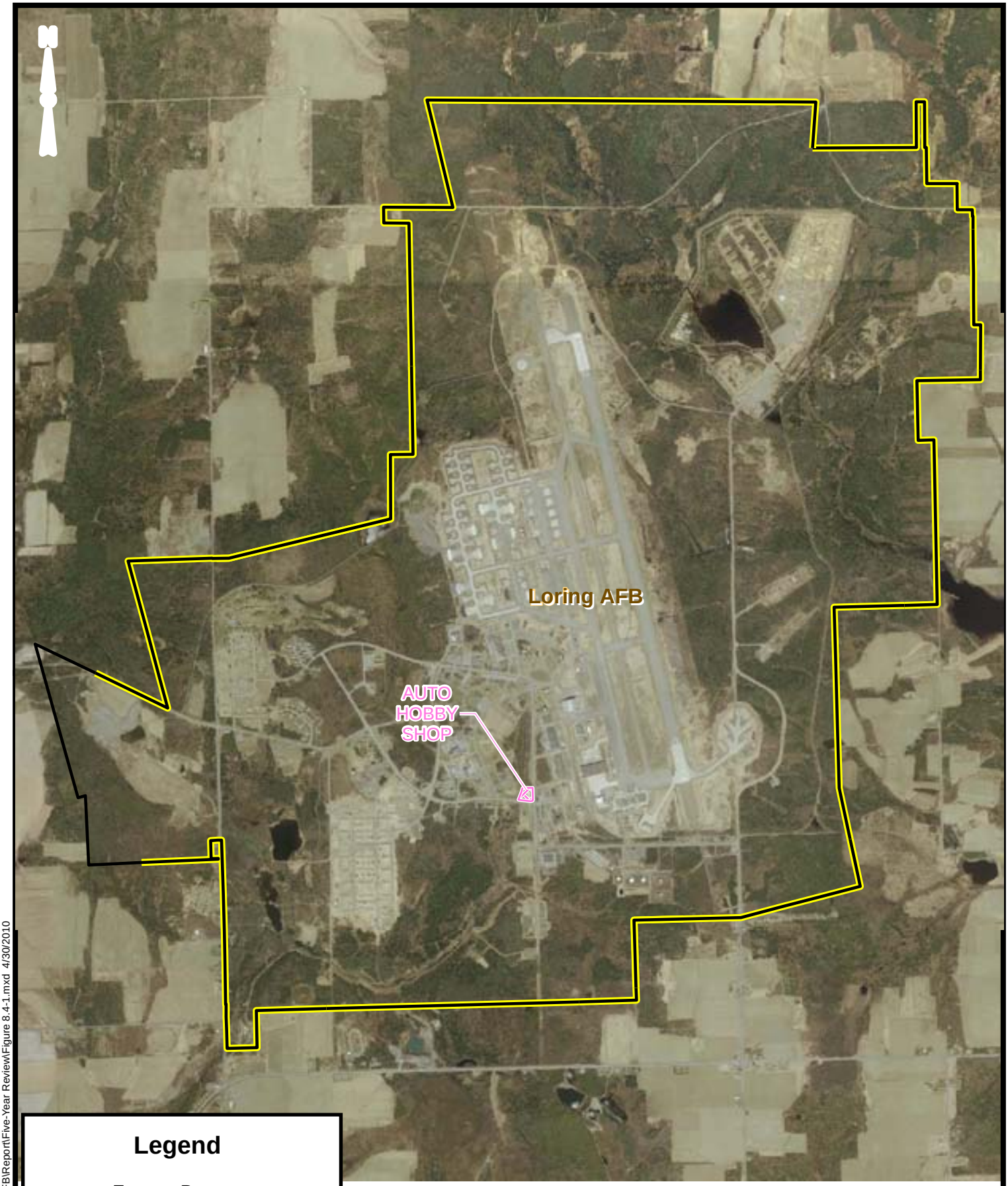
FIVE-YEAR REVIEW REPORT
FORMER LORING AIR FORCE BASE - LIMESTONE, MAINE
PNEUMATIC FRACTURING
AND NEW AIR INJECTION WELL LOCATIONS

FIGURE 8.3-4



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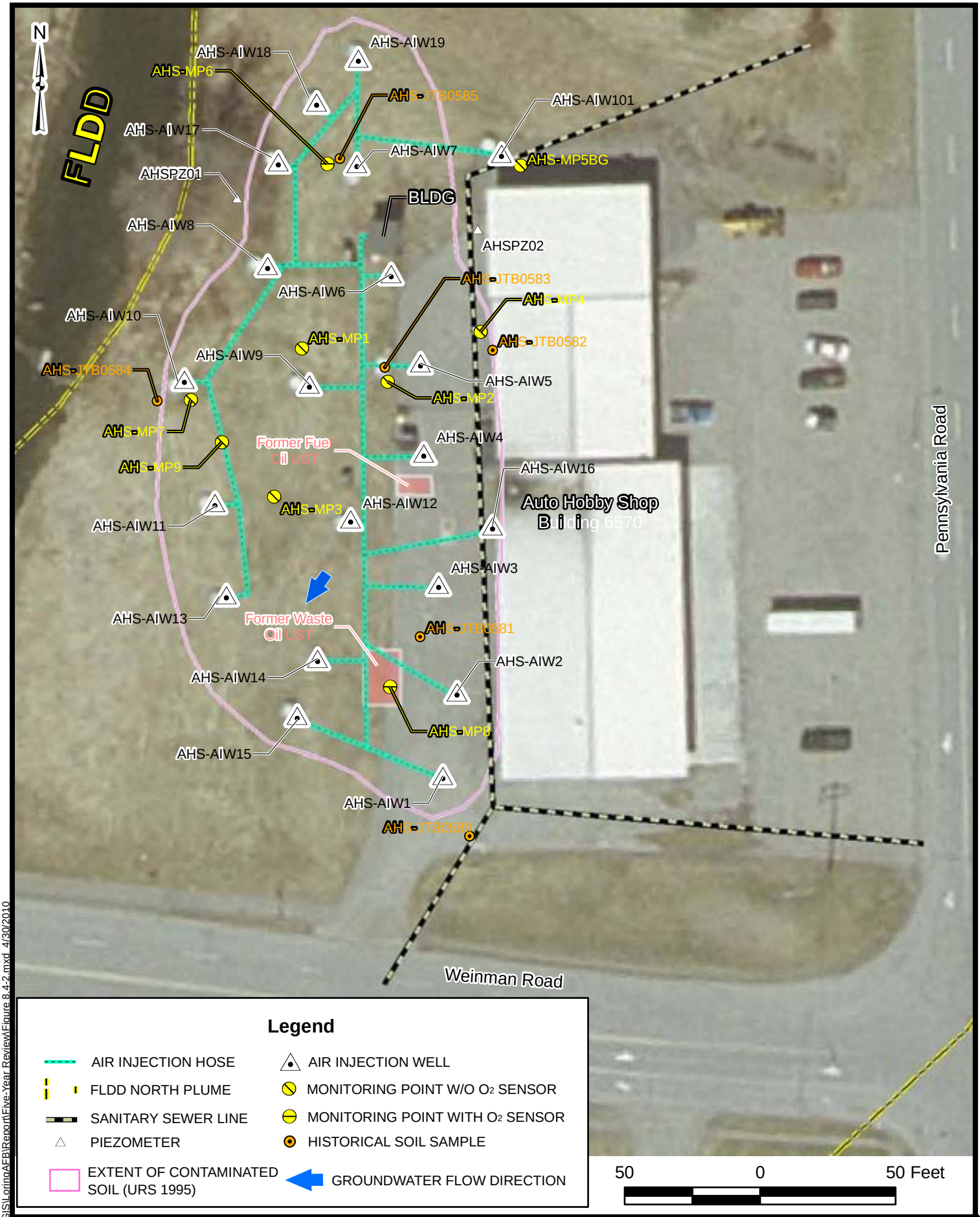
FIVE-YEAR REVIEW REPORT
FORMER LORING AIR FORCE BASE - LIMESTONE, MAINE
AUTO HOBBY SHOP SITE LOCATION MAP

FIGURE 8.4-1



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FIVE-YEAR REVIEW REPORT
FORMER LORING AIR FORCE BASE - LIMESTONE, MAINE
AUTO HOBBY SHOP SITE MAP

FIGURE 8.4-2

FIVE-YEAR REVIEW REPORT
FORMER LORING AIR FORCE BASE - LIMESTONE, MAINE
ES/JEBS SITE LOCATION MAP

FIGURE 8.5-1

J:\LoringPease\DB\GIS\LoringAFB\Report\Five-Year Review\Figure 8.5-1.mxd 4/30/2010

J:\LoringPease\DB\GIS\LoringAFB\Report\Five-Year Review\Figure 8.5-2.mxd 4/30/2010

N

JEBS-PB2
JEBS-PB1
JEBS-AEW1
JEBS-AEW2
JEBS-PAV1
JEBS-PB3
JEBS-AEW5
JEBS-AEW3
JEBS-AEW4
JEBS-MP1
Colorado Road
JEBS-PAV2
JEBS-AEW6
JEBS-AEW7
JEBS-AEW10
JEBS-AEW11
JEBS-PB4
JEBS-AEW16
JEBS-MP2
JEBS-AEW9
JEBS-PAV3
JEBS-AEW17
JEBS-AEW8
JEBS-PAV4
JEBS-AEW21
JEBS-AEW14
JEBS-AEW22
JEBS-AEW12
JEBS-AEW15
JEBS-AEW27
JEBS-AEW20
JEBS-AEW28
JEBS-AEW13
JEBS-PAV6
JEBS-AEW19
JEBS-AEW18
JEBS-PAV5
JEBS-MP3
JEBS-AEW26
JEBS-AEW30
JEBS-AEW23
JEBS-AEW25
JEBS-AEW29
JEBS-AEW24
JEBS-PB5
JET ENGINE BUILDUP SHOP BLDG 8260
BLDG 8262
BLDG 8261
JEBS-AEW34
JEBS-PB10
JEBS-PB9
JEBS-AEW35
JEBS-AEW33
JEBS-AEW32
JEBS-PAV7
JEBS-AEW40
JEBS-AEW31
JEBS-MP4
JEBS-AEW39
JEBS-PAV9
JEBS-AEW38
JEBS-AEW36
JEBS-AEW37
JEBS-AEW51
JEBS-AEW44
JEBS-AEW41
JEBS-PAV8
BLDG 8264
JEBS-AEW43
JEBS-AEW52
JEBS-PB6
JEBS-MP5
JEBS-AEW42
JEBS-AEW45
JEBS-AEW47
JEBS-PAV10
JEBS-PB8
JEBS-MP6
JEBS-AEW46
JEBS-AEW48
JEBS-AEW50
JEBS-PB7
JEBS-AEW49
JEBS-ES1
JEBS-ES2
Arizona Road
FORMER BLDG 8265 (ENTOMOLOGY SHOP)
JEBS-ES3
SVE SYSTEM

Legend

- Air Extraction Well
- Monitoring Point
- Passive Air Vent
- Pre-Startup Perimeter Soil Boring
- Compliance Boundary
- Former Buildings
- Water Main
- Drain Line Excavation
- Sanitary Sewer Line
- Area Where Soils Exceed RGs in 2005-2009 Soil Borings
- JEBS 1997 Contaminant Plume

50 0 50 Feet

URS

FIVE-YEAR REVIEW REPORT
FORMER LORING AIR FORCE BASE - LIMESTONE, MAINE
JEBS SITE MAP

FIGURE 8.5-2

N

SB-JEBS-038, 11/17/2004
Depth (ft): 7 - 7.5
TCE (UG/KG): ND

SB-JEBS-010, 8/23/2002
Depth (ft): 3.5 - 4
TCE (UG/KG): ND

SB-JEBS-011, 8/14/2002
Depth (ft): 3.5 - 4
TCE (UG/KG): ND

SB-JEBS-039, 11/15/2004
Depth (ft): 5 - 5.5
TCE (UG/KG): ND

SB-JEBS-041, 11/15/2004
Depth (ft): 11 - 11.5
TCE (UG/KG): 0.79

SB-JEBS-012, 8/23/2002
Depth (ft): 5.5 - 6
TCE (UG/KG): ND

SB-JEBS-040, 11/17/2004
Depth (ft): 8.5 - 9
TCE (UG/KG): 1.9

SB-JEBS-014, 8/5/2003
Depth (ft): 18.5 - 19
TCE (UG/KG): 250

SB-JEBS-013, 8/23/2002
Depth (ft): 7.5 - 8
TCE (UG/KG): 1.9

SB-JEBS-043, 11/16/2004
Depth (ft): 6.5 - 7
TCE (UG/KG): 2

SB-JEBS-042, 11/17/2004
Depth (ft): 11.5 - 12
TCE (UG/KG): ND

SB-JEBS-017, 8/13/2002
Depth (ft): 7.5 - 8
TCE (UG/KG): 34

SB-JEBS-016, 8/6/2003
Depth (ft): 11.5 - 12
TCE (UG/KG): 160

SB-JEBS-019, 8/14/2002
Depth (ft): 7.5 - 8
TCE (UG/KG): 34

SB-JEBS-015, 8/13/2002
Depth (ft): 7.5 - 8
TCE (UG/KG): 16

SB-JEBS-005, 10/25/2001
Depth (ft): 9.5 - 10
TCE (UG/KG): 380

SB-JEBS-044, 11/18/2004
Depth (ft): 7 - 7.5
TCE (UG/KG): 95

SB-JEBS-044, 11/18/2004
Depth (ft): 14 - 14.5
TCE (UG/KG): 150

SB-JEBS-020, 8/13/2002
Depth (ft): 3.5 - 4
TCE (UG/KG): 71

SB-JEBS-018, 8/13/2002
Depth (ft): 11.5 - 12
TCE (UG/KG): 210

SB-JEBS-050, 11/16/2004
Depth (ft): 5.5 - 6
TCE (UG/KG): 17

SB-JEBS-046, 11/18/2004
Depth (ft): 7.5 - 8
TCE (UG/KG): ND

SB-JEBS-053, 9/14/2005
Depth (ft): 8 - 10
TCE (UG/KG): 59

SB-JEBS-006, 10/25/2001
Depth (ft): 11.5 - 12
TCE (UG/KG): 14

SB-JEBS-049, 11/16/2004
Depth (ft): 12.5 - 13
TCE (UG/KG): 46

SB-JEBS-047, 11/17/2004
Depth (ft): 7.5 - 8
TCE (UG/KG): ND

SB-JEBS-047, 11/17/2004
Depth (ft): 14 - 14.5
TCE (UG/KG): ND

SB-JEBS-052, 11/19/2004
Depth (ft): 9 - 9.5
TCE (UG/KG): 1.1

SB-JEBS-051, 11/18/2004
Depth (ft): 3.5 - 4
TCE (UG/KG): 29

SB-JEBS-021, 8/14/2002
Depth (ft): 7.5 - 8
TCE (UG/KG): 12

SB-JEBS-029, 8/14/2002
Depth (ft): 7.5 - 8
TCE (UG/KG): 850

SB-JEBS-054, 11/17/2004
Depth (ft): 6 - 6.5
TCE (UG/KG): ND

SB-JEBS-054, 11/17/2004
Depth (ft): 13.5 - 14
TCE (UG/KG): ND

SB-JEBS-022, 8/14/2002
Depth (ft): 6.5 - 7
TCE (UG/KG): 4.7

SB-JEBS-057, 9/14/2005
Depth (ft): 6 - 8
TCE (UG/KG): 11

SB-JEBS-045, 11/18/2004
Depth (ft): 3.5 - 4
TCE (UG/KG): 5.9

SB-JEBS-028, 8/14/2002
Depth (ft): 7.5 - 8
TCE (UG/KG): 4.8

SB-JEBS-055, 11/11/2004
Depth (ft): 6 - 6.5
TCE (UG/KG): 15

SB-JEBS-048, 11/18/2004
Depth (ft): 10.5 - 11
TCE (UG/KG): ND

SB-JEBS-069, 9/10/2009
Depth (ft): 8 - 10
TCE (UG/KG): 300

SB-JEBS-069, 9/10/2009
Depth (ft): 11 - 13
TCE (UG/KG): 1900

SB-JEBS-069, 9/10/2009
Depth (ft): 14 - 15
TCE (UG/KG): 1800

SB-JEBS-032, 8/20/2002
Depth (ft): 11.5 - 12
TCE (UG/KG): 13000

SB-JEBS-027, 8/21/2002
Depth (ft): 5.5 - 6
TCE (UG/KG): 16

SB-JEBS-068, 9/10/2009
Depth (ft): 5 - 7
TCE (UG/KG): 2300

SB-JEBS-068, 9/10/2009
Depth (ft): 8 - 10
TCE (UG/KG): 2600

SB-JEBS-068, 9/10/2009
Depth (ft): 11 - 12
TCE (UG/KG): 4400

SB-JEBS-007, 8/6/2003
Depth (ft): 11.5 - 12
TCE (UG/KG): 3600

SB-JEBS-056, 11/11/2004
Depth (ft): 14 - 14.5
TCE (UG/KG): 16

SB-JEBS-058, 11/11/2004
Depth (ft): 16 - 16.5
TCE (UG/KG): 49

SB-JEBS-061, 5/15/2007
Depth (ft): 4 - 6
TCE (UG/KG): 27 *

SB-JEBS-008, 10/25/2001
Depth (ft): 13.5 - 14
TCE (UG/KG): 110

SB-JEBS-030, 8/21/2002
Depth (ft): 9.5 - 10
TCE (UG/KG): ND

SB-JEBS-061, 5/15/2007
Depth (ft): 6 - 8
TCE (UG/KG): 64 *

SB-JEBS-061, 5/15/2007
Depth (ft): 10 - 12
TCE (UG/KG): 110 *

SB-JEBS-031, 8/23/2002
Depth (ft): 3.5 - 4
TCE (UG/KG): 2.6

SB-JEBS-024, 8/23/2002
Depth (ft): 5.5 - 6
TCE (UG/KG): ND

SB-JEBS-059, 9/9/2009
Depth (ft): 5 - 7
TCE (UG/KG): 1500

SB-JEBS-059, 9/9/2009
Depth (ft): 8 - 10
TCE (UG/KG): 1200

SB-JEBS-060, 11/18/2004
Depth (ft): 3 - 3.5
TCE (UG/KG): ND

SB-JEBS-033, 8/20/2002
Depth (ft): 5.5 - 6
TCE (UG/KG): 1400

SB-JEBS-059, 9/9/2009
Depth (ft): 16 - 18
TCE (UG/KG): 4200

SB-JEBS-034, 8/20/2002
Depth (ft): 11.5 - 12
TCE (UG/KG): ND

SB-JEBS-063, 9/15/2005
Depth (ft): 12 - 14
TCE (UG/KG): 250

SB-JEBS-064, 11/18/2004
Depth (ft): 3.5 - 4
TCE (UG/KG): 9.7

SB-JEBS-062, 9/10/2009
Depth (ft): 5 - 7
TCE (UG/KG): 600

SB-JEBS-062, 9/10/2009
Depth (ft): 8 - 10
TCE (UG/KG): 1300

SB-JEBS-036, 8/20/2002
Depth (ft): 5.5 - 6
TCE (UG/KG): ND

SB-JEBS-035, 8/20/2002
Depth (ft): 11.5 - 12
TCE (UG/KG): 560

SB-JEBS-062, 9/10/2009
Depth (ft): 12 - 14
TCE (UG/KG): 1500

SB-JEBS-066, 11/16/2004
Depth (ft): 7.5 - 8
TCE (UG/KG): ND

SB-JEBS-025, 8/26/2002
Depth (ft): 11.5 - 12
TCE (UG/KG): 0.75

SB-JEBS-065, 11/15/2004
Depth (ft): 10 - 10.5
TCE (UG/KG): 2.5

SB-JEBS-009, 11/16/2004
Depth (ft): 7.5 - 8
TCE (UG/KG): ND

SB-JEBS-009, 11/16/2004
Depth (ft): 15 - 15.5
TCE (UG/KG): 350

SB-JEBS-067, 11/15/2004
Depth (ft): 10 - 10.5
TCE (UG/KG): ND

SB-JEBS-026, 11/16/2004
Depth (ft): 7 - 7.5
TCE (UG/KG): 21

SB-JEBS-026, 11/16/2004
Depth (ft): 11.5 - 12
TCE (UG/KG): 57

SB-JEBS-037, 8/20/2002
Depth (ft): 7.5 - 8
TCE (UG/KG): ND

JEBS-AEW1
JEBS-AEW2
JEBS-AEW3
JEBS-PAV1
JEBS-AEW5
JEBS-AEW4
JEBS-MP1
JEBS-AEW6
JEBS-AEW7
JEBS-PAV2
JEBS-AEW10
JEBS-AEW11
JEBS-AEW9
JEBS-AEW8
JEBS-PAV3
JEBS-MP2
JEBS-AEW16
JEBS-AEW14
JEBS-AEW12
JEBS-AEW13
JEBS-AEW15
JEBS-PAV4
JEBS-AEW17
JEBS-AEW21
JEBS-AEW22
JEBS-AEW18
JEBS-AEW19
JEBS-AEW20
JEBS-PAV5
JEBS-MP3
JEBS-AEW27
JEBS-PAV6
JEBS-AEW28
JEBS-AEW24
JEBS-AEW26
JEBS-AEW30
JEBS-AEW23
JEBS-AEW25
JEBS-AEW29
JEBS-AEW33
JEBS-AEW32
JEBS-AEW34
JEBS-AEW35
JEBS-AEW31
JEBS-PAV7
JEBS-AEW39
JEBS-AEW40
JEBS-MP4
JEBS-AEW51
JEBS-AEW38
JEBS-AEW36
JEBS-AEW37
JEBS-AEW52
JEBS-PAV9
JEBS-PAV8
JEBS-AEW44
JEBS-AEW41
JEBS-AEW42
JEBS-AEW43
JEBS-MP5
JEBS-AEW45
JEBS-PAV10
JEBS-AEW47
JEBS-MP6
JEBS-AEW46
JEBS-AEW48
JEBS-AEW50
JEBS-ES1
JEBS-ES2
JEBS-AEW49
JEBS-ES3

NORTH JEBS
SOUTH JEBS
SOUTHWEST JEBS
BUILDING SHOP
BLDG 8262
BLDG 8261
UNE P2
UNE P5
2" PVC (TYP)
3" PVC (TYP)
SVE SYSTEM

Legend

- TCE Meets RG Value
- TCE Exceeds RG Value
- Air Extraction Well
- Passive Air Vent
- Monitoring Point

* These sample results provided by the MEDEP.

1. Results represent only the most recent sampling event at each location.

2. RG for soils is as follows:

North JEBS	PCE	1350 UG/KG
	TCE	950 UG/KG
South JEBS	BENZO (A) ANTHRACENE	170 UG/KG
	BENZO (A) PYRENE	250 UG/KG
	CHRYSENE	450 UG/KG
	PCE	750 UG/KG
	TCE	500 UG/KG
Southwest JEBS	TCE	530 UG/KG
Entomology Shop JEBS	PCE	2330 UG/KG
	TCE	450 UG/KG

75 37.5 0 75
Feet

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URS

FIVE-YEAR REVIEW REPORT
FORMER LORING AIR FORCE BASE - LIMESTONE, MAINE
SUMMARY OF JEBS CONFIRMATION SOIL SAMPLING FOR TCE
RESULTS 2001 TO 2009

FIGURE 8.5-3

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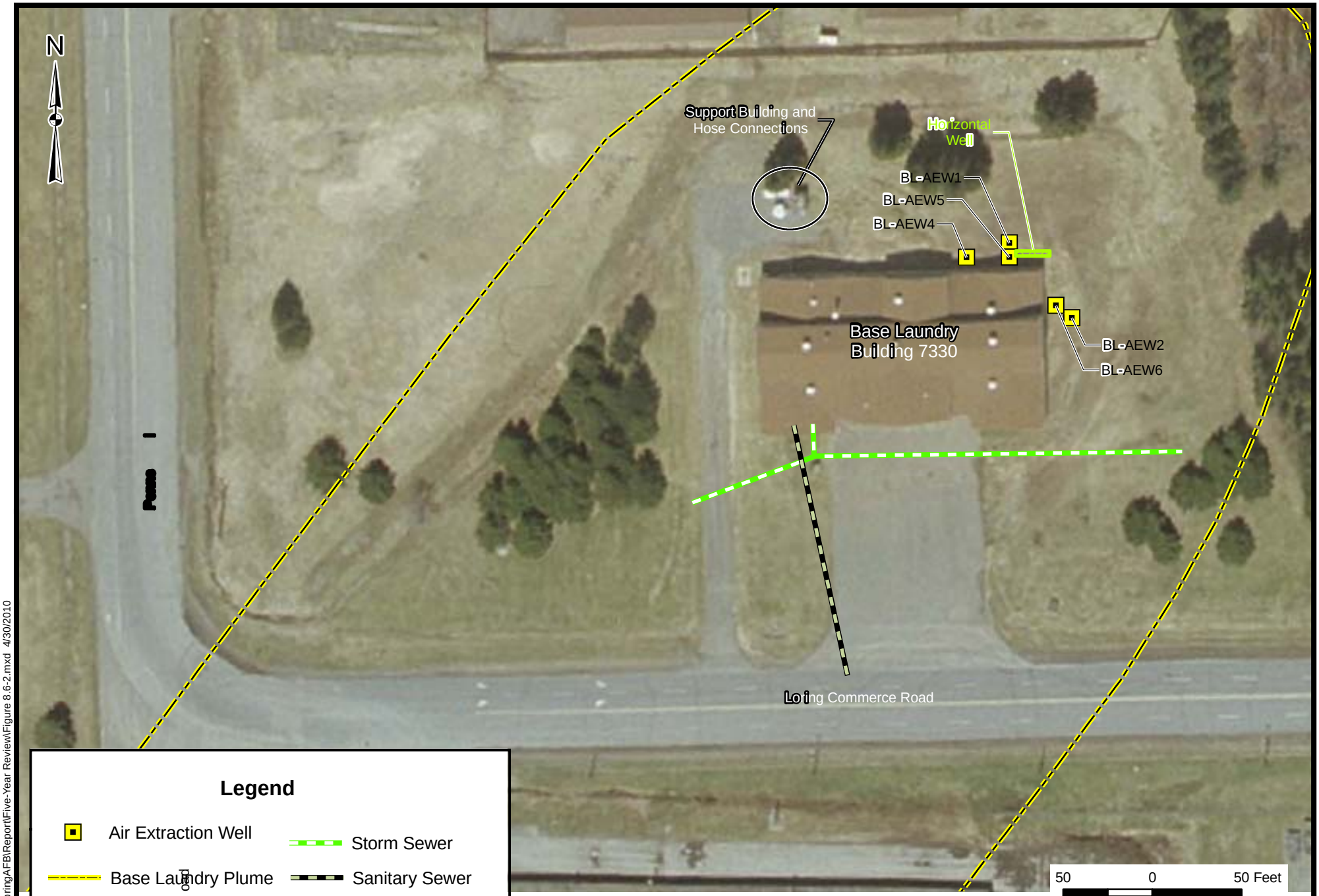
FIVE-YEAR REVIEW REPORT
FORMER LORING AIR FORCE BASE - LIMESTONE, MAINE
BASE LAUNDRY SITE LOCATION MAP

FIGURE 8.6-1



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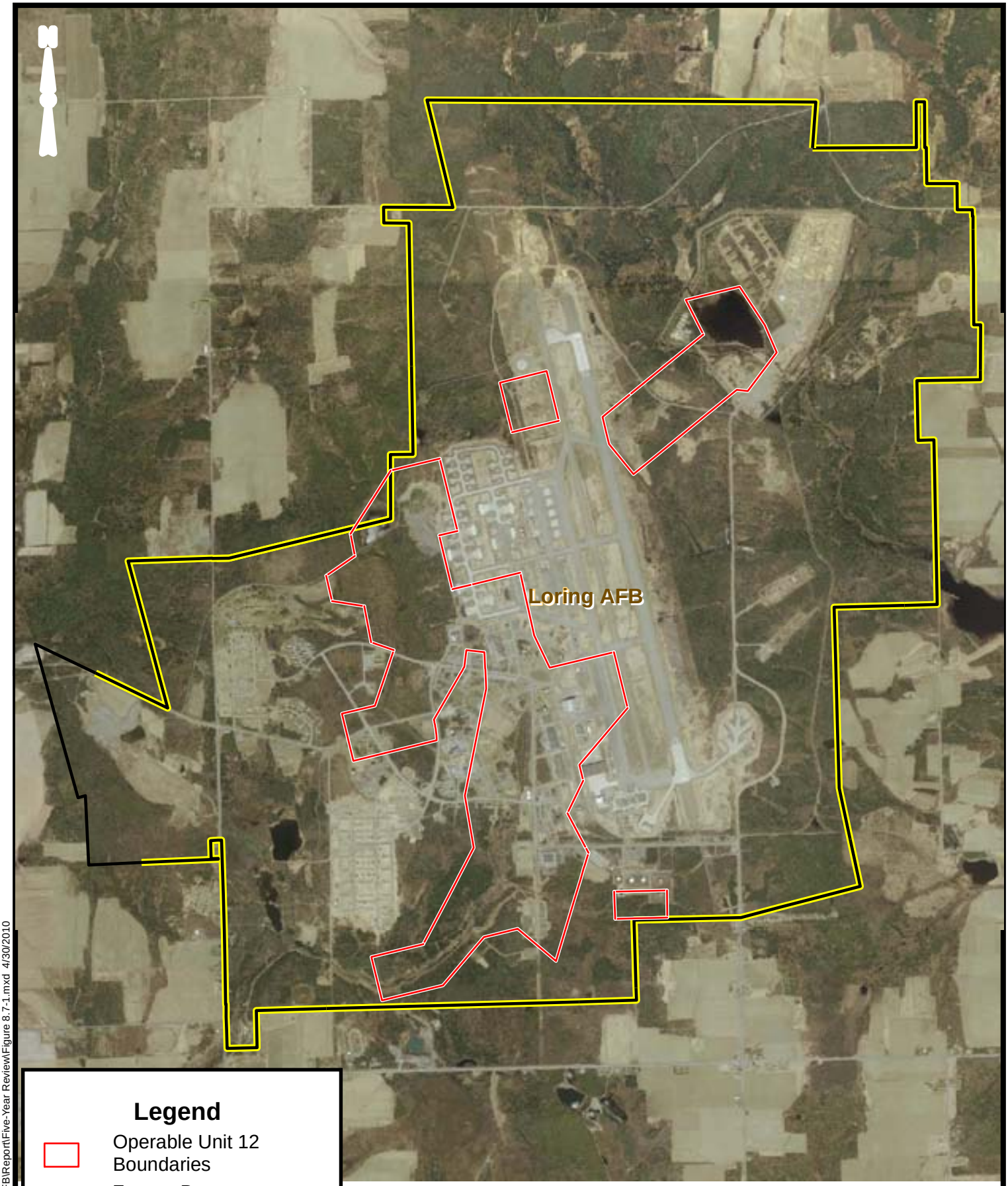
FIVE-YEAR REVIEW REPORT
FORMER LORING AIR FORCE BASE - LIMESTONE, MAINE
BASE LAUNDRY SITE PLAN

FIGURE 8.6-2



J:\LoringPease\DB\GIS\LoringAFB\Report\Five-Year Review\Figure 8.7-1.mxd 4/30/2010

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FIVE-YEAR REVIEW REPORT
FORMER LORING AIR FORCE BASE - LIMESTONE, MAINE
OU 12 SITE LOCATION MAP

FIGURE 8.7-1

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1999 LTMP PLUME DEFINITIONS

VMB CURRENT PLUME DEFINITIONS

BTEX/SVOC OVERBURDEN/BEDROCK GROUNDWATER
ACTION LEVEL EXCEEDENCE LINE

CHLORINATED SOLVENT OVERBURDEN/BEDROCK
GROUNDWATER ACTION LEVEL EXCEEDENCE LINE

AREA REGULATED UNDER MEDEP CMR CHAPTER 691
RESTRICTED FROM GROUNDWATER USE
WITHOUT PERMISSION FROM MEDEP/AF

OVERBURDEN/BEDROCK GROUNDWATER
ACTION LEVEL EXCEEDENCE LINE

1 GROUNDWATER MANAGEMENT ZONE
COMPLIANCE BOUNDARY

FORMER AFB PROPERTY BOUNDARY

AREA NOT REGULATED UNDER CERCLA CONTAINING
CONCENTRATION OF FUEL ABOVE THE SCREENING VALUE

GROUNDWATER MANAGEMENT ZONE UNDER CERCLA
RESTRICTED FROM GROUNDWATER USE
WITHOUT PERMISSION FROM EPA/MEDEP/AF

Bedrock Monitoring Well Location

Hybrid Monitoring Well Location

Overburden Monitoring Well Location

Open Hole Bedrock Monitoring Well Location

Surface Water Sampling Location

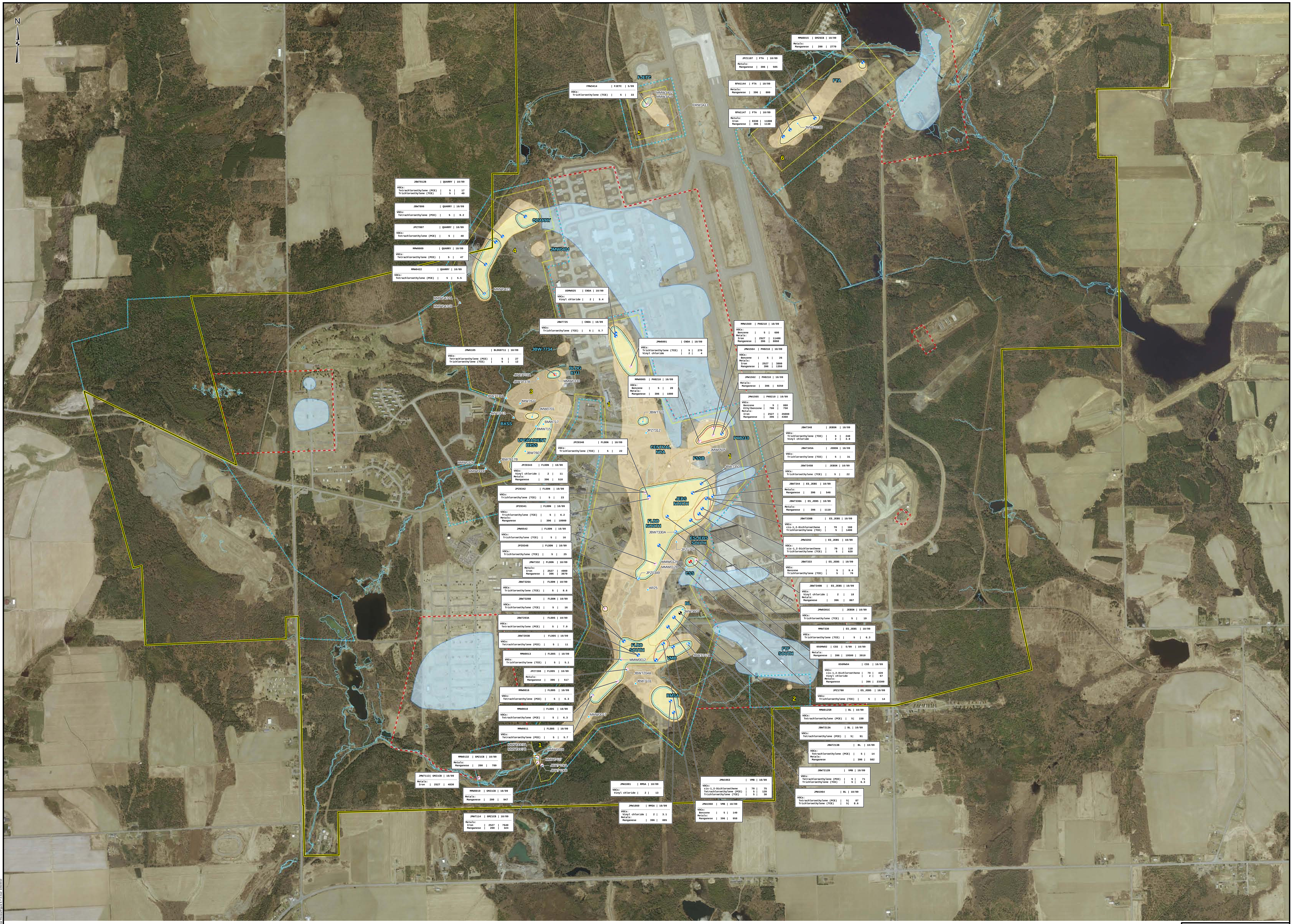
700 0 700 Feet

FIVE-YEAR REVIEW REPORT
FORMER LORING AIR FORCE BASE
LIMESTONE, MAINE

LOCATION OF GROUNDWATER MANAGEMENT ZONES AND PLUMES

URS

FIGURE 8.7-2



1999 LTMP PLUME DEFINITIONS

VMB CURRENT PLUME DEFINITIONS

BTEX/SVOC OVERBURDEN/BEDROCK GROUNDWATER
ACTION LEVEL EXCEEDENCE LINE

CHLORINATED SOLVENT OVERBURDEN/BEDROCK
GROUNDWATER ACTION LEVEL EXCEEDENCE LINE

AREA REGULATED UNDER MEDEP CMR CHAPTER 691
RESTRICTED FROM GROUNDWATER USE WITHOUT PERMISSION FROM MEDEP/AF

OVERBURDEN/BEDROCK GROUNDWATER
ACTION LEVEL EXCEEDENCE LINE

1 GROUNDWATER MANAGEMENT ZONE
COMPLIANCE BOUNDARY

FORMER AFB PROPERTY BOUNDARY

AREA NOT REGULATED UNDER CERCLA CONTAINING
CONCENTRATION OF FUEL ABOVE THE SCREENING VALUE

GROUNDWATER MANAGEMENT ZONE UNDER CERCLA
RESTRICTED FROM GROUNDWATER USE WITHOUT PERMISSION FROM EPA/MEDEP/AF

Location ID — Plume / Criteria — Sample Date

JMW7332	FLDDN	10/09
Metals:		
Iron	2527	4900
Manganese	396	3670

Compound — Criteria: (UG/L) — Result: (UG/L)

Criteria: Remedial Goals from "OU12 Record of Decision" (HLA, 1999)

- Bedrock Monitoring Well Location
- Hybrid Monitoring Well Location
- Overburden Monitoring Well Location
- Open Hole Bedrock Monitoring Well Location
- No detections exceeded criteria

700 0 700 Feet

FIVE-YEAR REVIEW REPORT
FORMER LORING AIR FORCE BASE
LIMESTONE, MAINE

MONITORING WELLS WITH ANALYTE CONCENTRATIONS ABOVE REMEDIAL GOALS (SPRING & FALL 2009)

URS

FIGURE 8.7-3

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1999 LTMP PLUME DEFINITIONS

VMB CURRENT PLUME DEFINITIONS

BTEX/SVOC OVERBURDEN/BEDROCK GROUNDWATER
ACTION LEVEL EXCEEDENCE LINE

CHLORINATED SOLVENT OVERBURDEN/BEDROCK
GROUNDWATER ACTION LEVEL EXCEEDENCE LINE

AREA REGULATED UNDER MEDEP CMR CHAPTER 691
RESTRICTED FROM GROUNDWATER USE
WITHOUT PERMISSION FROM MEDEP/AF

OVERBURDEN/BEDROCK GROUNDWATER
ACTION LEVEL EXCEEDENCE LINE

1 GROUNDWATER MANAGEMENT ZONE
COMPLIANCE BOUNDARY

FORMER AFB PROPERTY BOUNDARY

AREA NOT REGULATED UNDER CERCLA CONTAINING
CONCENTRATION OF FUEL ABOVE THE SCREENING VALUE

GROUNDWATER MANAGEMENT ZONE UNDER CERCLA
RESTRICTED FROM GROUNDWATER USE
WITHOUT PERMISSION FROM EPA/MEDEP/AF

Location ID — Criteria — Sample Date

```
MSW0414   | CRIT | 8/09
Metals:
 Iron      |  961 | 1790
 Manganese | 62.6 |  520
```

Compound — Criteria: (UG/L) — Result: (UG/L)

CRIT: Criteria for Organics - Human Health for Consumption of Water and Organisms, MEDEP Surface Water Quality Criteria (SWQC) for Toxic Pollutants, Ch. 584, Sept. 8, 2005.

Criteria for Fe and Mn based on "Consensus Statement: Background Concentrations in Soils, Surface Water and Sediment", ABB-ES, Feb. 24, 1994.

▲ SURFACE WATER SAMPLE LOCATION - NO DETECTIONS EXCEEDING CRITERIA

▲ SURFACE WATER SAMPLE LOCATION - ANALYTE DETECTED AT CONCENTRATION ABOVE CRITERIA

▲ STREAM GUAGE

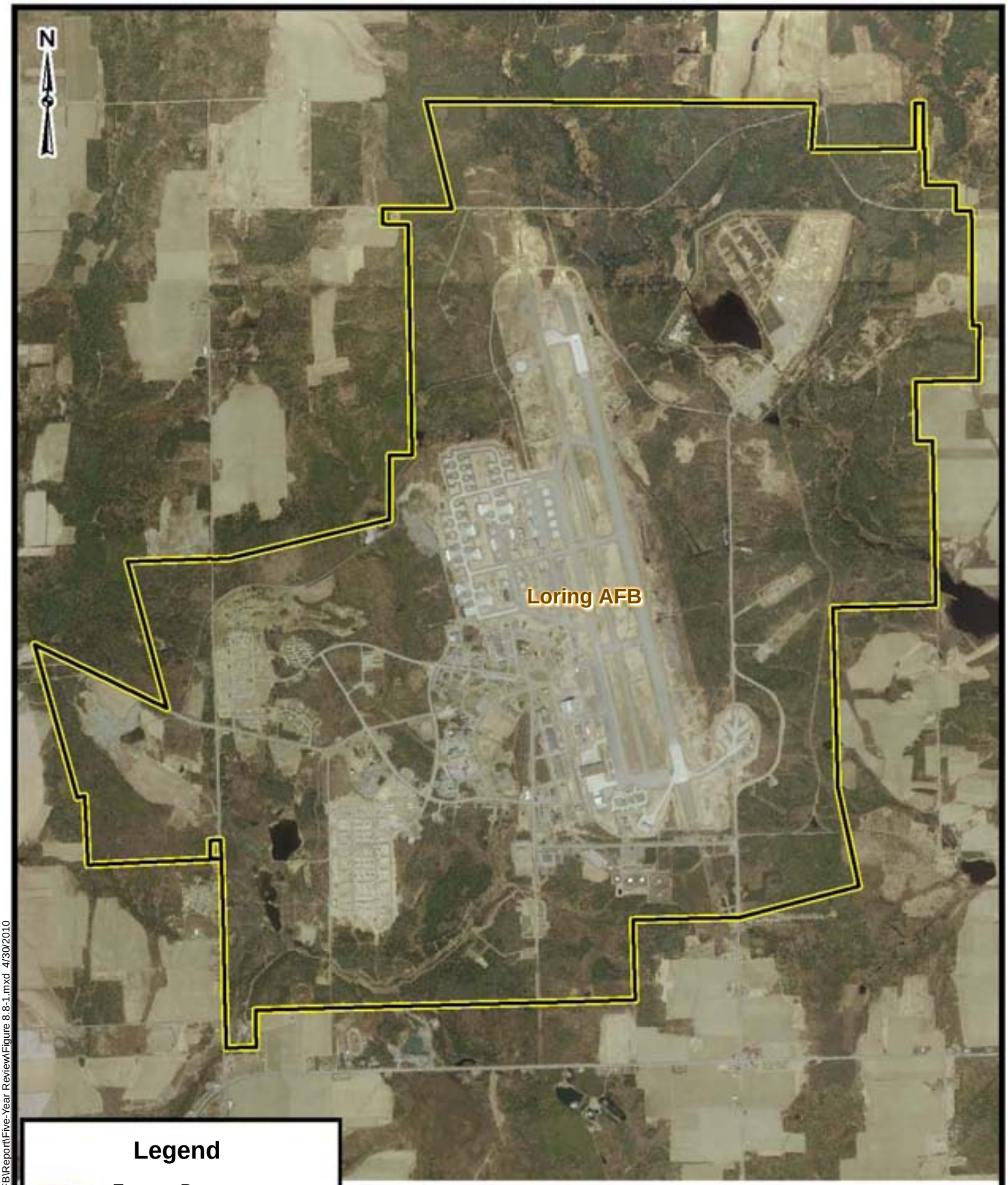
1,000 0 1,000 Feet

FIVE-YEAR REVIEW REPORT
FORMER LORING AIR FORCE BASE
LIMESTONE, MAINE

SURFACE WATER SAMPLING LOCATIONS
WITH ANALYTE CONCENTRATIONS ABOVE
ACTION LEVELS (SUMMER 2009)

URS

FIGURE 8.7-4

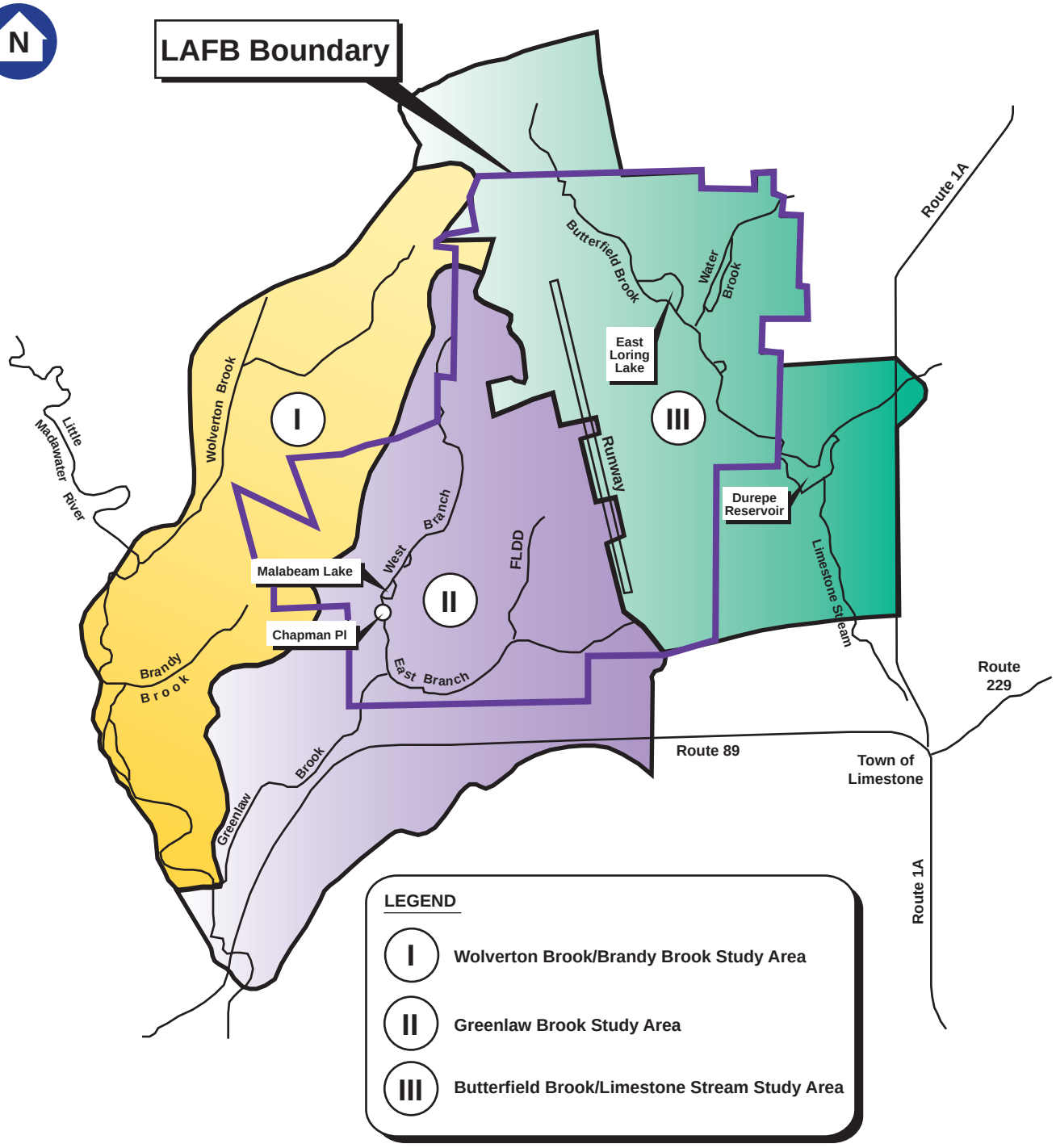


URS

FIVE-YEAR REVIEW REPORT
FORMER LORING AIR FORCE BASE - LIMESTONE, MAINE
OU 13 SITE LOCATION MAP

FIGURE 8.8-1

J:\LoringPease\DB\GIS\LoringAFB\Report\Five-Year Review\Figure 8.8-1.mxd 4/30/2010



MAINE

MAP LOCATION

SCALE IN MILES

0 1 2

Source: ABB Environmental Services, Inc. December 1997, *Operable Unit (OU) 13 Long-Term Monitoring Plan.*

FIVE-YEAR REVIEW REPORT
LORING AIR FORCE BASE
LIMESTONE, MAINE

PRIMARY STUDY AREAS OF OU-13

FIGURE 8.8-2

TABLES

TABLE 6.2-1

Summary of Five Year Review Report (2005-2010)
Former Loring AFB, Limestone, ME

Site ID	Site Names	Statutory Review	Policy Review	Location in Report
Operable Units 2 & 4	Landfills 2 & 3	X		Section 7.3
Operable Unit 3	Contractors Storage Shed	X		Section 7.4
Operable Unit 3	Explosive Ordnance Disposal Range/Outdoor Firing Range	X		Section 7.5
Operable Unit 5	Former Jet Engine Test Cell		X	Section 8.3
Operable Unit 8	Fire Training Area		X	Section 8.4
Operable Unit 9	Auto Hobby Shop		X	Section 8.5
Operable Unit 10	Entomology Shop/Jet Engine Buildup Shop		X	Section 8.6
Operable Unit 11	Base Laundry		X	Section 8.7
Operable Unit 12	Basewide Groundwater		X	Section 8.8
Operable Unit 13	Basewide Surface Water, Sediment and Fish Tissue		X	Section 8.9

TABLE 7.3-1

LANDFILLS 2 AND 3 GROUNDWATER ACTION LEVELS
FIVE-YEAR REVIEW REPORT
FORMER LORING AIR FORCE BASE-LIMESTONE, MAINE

Parameter	Historical Maximum Detected Concentration[1]	Action Level[1,2]	Rationale
LF-2 OB and BR COCs			
Bis(2-ethylhexyl)phthalate	73	10	(2)
Tetrachloroethene	4	3	(2)
Vinyl chloride	1.41	0.15	(2)
Cadmium	32.6	5	(2)
Iron	39,500	8,400	(2)
Lead	495	80	(2)
Zinc	13,000	8,400	(2)
LF-3 BR COCs			
Vinyl chloride	2.46	0.15	(2)
Iron	22,700	8,400	(2)
Manganese	2,780	1,300	(2)
LF-3 OB COCs			
1,4-dichlorobenzene	42	27	(2)
4-methylphenol	2,000	140	(2)
Benzene	11	5	(2)
Tetrachloroethene	4	3	(2)
Trichloroethene	66	5	(2)
Vinyl chloride	0.84	0.15	(2)
Iron	47,000	8,400	(2)
Manganese	4,070	1,300	(2)
Total Petroleum Hydrocarbons			
Gasoline Range Organics	--	--	(3)
Diesel Range Organics	--	--	(3)
Calculated TPH	--	--	(3)
Detection Monitoring Ions			
Arsenic	--	--	(4)
Calcium	--	--	(5)
Magnesium	--	--	(5)
Potassium	--	--	(5)
Sodium	--	--	(5)
Alkalinity	--	--	(5)
Chloride	--	--	(5)
Sulfate	--	--	(5)
Iron	47,000	8,400	(2), (5)
Miscellaneous Landfill Parameters			
Chemical Oxygen Demand	--	--	(6)
Total Kjeldahl Nitrogen	--	--	(6)
Total Organic Carbon	--	--	(6)
Water Quality Parameters			
pH (standard units)	--	--	(7)
Temperature (°C)	--	--	(7)
Specific Conductance (uS/cm)	--	--	(7)
Turbidity (NTU)	--	--	(7)
Dissolved Oxygen (mg/L)	--	--	(7)
Oxidation Reduction Potential (mV)	--	--	(7)

Notes

(1) Units in micrograms per liter for all parameters except water quality parameters. These units are as noted.

(2) Action Levels are from the *Final Operable Unit 4 Record of Decision* (ABB-ES, 1996), Tables 10-1 and 10-2, developed by comparison of maximum detected concentration to PQL, background concentrations, MCLs, MEGs, and risk-based concentrations.

(3) GRO/DRO/TPH is monitored at all LF-3 LTM wells and at LF-2 compliance boundary and residential wells only. Analysis of these parameters may be considered for elimination if determined not to add to the evaluation of required compliance conditions.

(4) Added at the request of MEDEP, not included in the OU4 Record of Decision.

(5) MEDEP Solid Waste Management Rules: Chapter 405 (2)c (2)g.

(6) Miscellaneous Landfill Parameters are indicator parameters and do not have remediation goals. Secondary MCLs may be used for reference. Analysis of these parameters may be considered for elimination if determined not to add to the evaluation of required compliance conditions.

(7) These parameters will be measured in the field at all LF-2 and LF-3 LTM wells.

COC = Chemical of Concern
MCL = Maximum Contaminant Level (USEPA)
MEG = Maximum Exposure Guideline (State of Maine, Department of Human Services)
PQL = Practical Quantitation Limit

Sources: ABB Environmental Services, Inc. (ABB-ES), September 1996, *Final Operable Unit 4 Recvord of Decision.*
Bechtel, April 1997, *Work Plan for Monitoring and Maintenance of Landfills.*
MWH, April 2001, *Monitoring and Maintenance of Landfills 2001 Annual Report.*

TABLE 7.3-2

Comparison of Oral Toxicity Factors
Five-Year Review Report
Former Loring AFB, Limestone, Maine

Compound	Oral Slope Factor (mg/kg/day)$^{-}$		Impact of Current Value on Risk[b]	Oral Reference Dose (mg/kg/day)		Impact of Current Value on Risk[b]
	Value Used in Risk Assessment	Current Value[a]		Value Used in Risk Assessment	Current Value[a]	
Acetone	ND	ND	ND	1.0E-01	9.0E-01	Lower (9)
Aroclor 1254	7.7	2.0[c]	Lower	ND	2.0E-05	Higher
Aroclor 1260	7.7	2.0[c]	Lower	2.0E-05	ND	Lower
Benzene	2.9E-02	5.5E-02	Higher(2)	3.0E-04	4.0E-03	Lower (13)
Benzo(a)anthracene*	7.3	7.3E-01[c]	Lower	ND	ND	NC
Benzo(b)fluoranthene*	7.3	7.3E-01[c]	Lower	ND	ND	NC
Beryllium	ND	ND	NC	5.0E-03	2.0E-03	Higher (2.5)
Chlordane (Alpha and Gamma)	1.3	3.5E-01[c]	Lower	6.0E-05	5.0E-04[c]	Lower (8.3)
Copper	ND	ND	NC	3.7E-02	3.7E-02	Lower(<2)
Chrysene*	7.3	7.3E-03[c]	Lower	ND	ND	NC
1,2-Dibromoethane	8.5E+01	2.0	Lower (42.5)	ND	9.0E-03	Higher
1,1-Dichloroethene	ND	ND	NC	9.0E-03	5.0E-02	Lower (5)
Indeno(1,2,3-cd)pyrene*	7.3	7.3E-01[c]	Lower	ND	ND	NC
Manganese	ND	ND	ND	ND	2.4E-02[c]	Higher
2-Methylnaphthalene	ND	ND	ND	4.0E-02	4.0E-03	Higher (10)
Naphthalene	ND	ND	ND	4.0E-02	2.0E-02	Higher (2)
Phenol	ND	ND	NC	6.0E-01	3.0E-01	Higher (2)
Trichloroethene	1.1E-02	5.9E-03[c]	Lower	6.0E-03	ND	Lower
1,1,1-Trichloroethane	ND	ND	ND	9.0E-02	2.0	Lower (22)
Vinyl Chloride	1.9	1.4	Lower (1.2)	ND	3.0E-03	Higher
Xylenes	ND	ND	ND	2.0	2.0E-01	Higher (10)

Notes: * These values were used only for the OUs listed.
a: Source is USEPA's Integrated Risk Information System (IRIS), unless otherwise mentioned
b: Indicates whether estimated risks will be lower or higher if values currently available were used. Value in parenthesis indicates the factor (sometimes approximate value) by which risks will differ.
c: Source is Regional Screening Level (RSL) Summary Table May 2010 (http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/index.htm).

mg/kg = milligrams per kilogram
ND: No data available or non-carcinogenic
NC: No Change

TABLE 7.4-1

Soil Remediation Goals
Operable Unit 3 Contractor's Storage Shed
Five-Year Review Report
Former Loring AFB, Limestone, Maine

Compound	Remediation Goals (1E+06/1E+05)[a, b] (mg/kg)
Total Metals	
Barium	100/1,000[a]
Cadmium	16/160[a]
Lead	880/8,800[a]
Manganese	1,400
Semi-Volatile Compounds	
Benzo(a)Anthracene	0.470
Benzo(a)pyrene	0.400
Benzo(b)fluoranthene	1.100
Benzo(k)fluoranthene	0.400
Chrysene	3/30[a]
Dibenz(a,h)anthracene	0.400
Indeno(1,2,3-cd)pyrene	0.400
Pyrene	71/710[a]
Pesticides	
Chlordane	0.07/0.7[a]
4,4'-DDD	0.5/4[a]
4,4'-DDE	0.3/3[a]
4,4'-DDT	0.9/3[a]
Aroclor-1260	1
TPH (n-Hexane)	870/8,700

a - Represents Target Carcinogenic risk of 1 in 1 million/ 1 in 100,000

b - Remediation Goals (RGs) documented in the OU3 Debris Disposal Area Record of Decision (Law, 1996)

TABLE 8.3-1

Soil Remediation Goals
Operable Unit 5 Former Jet Engine Test Cell
Five-Year Review Report
Former Loring AFB, Limestone, Maine

Chemical of Concern	Remediation Goal[a] (mg/kg)
CERCLA ROD RG (applicable to soils less then 10 ft bgs[b])	
Benzene	1.13
Methylene Chloride	1.17
TCE	5.3
Toluene	26.6
Xylene	21.3
1,2-DCA	0.133
Naphthalene	0.537
TPH	870

[a]Remediation goal (RG) documented in the *Record of Decision for Sites Within Operable Units (OUs) 5, 8, 9, 10, and 11* (HLA, 1999b).

[b] Based on the Sampling and Analysis Flow Diagram (Bechtel, 1999)

TABLE 8.3-2

Comparison of Inhalation Toxicity Factors
Five-Year Review Report
Former Loring AFB, Limestone, Maine

Compound	Inhalation Slope Factor (mg/kg/day)		Impact of Current Value on Risk[b]	Inhalation Reference Concentration (mg/m^3)[c]		Impact of Current Value on Risk[b]
	Value Used in Risk Assessment	Current Value[a]		Value Used in Risk Assessment	Current Value[a]	
Benzo(a)anthracene*	6.1	ND	Lower	ND	ND	NC
Benzo(a)pyrene*	6.1	ND	Lower	ND	ND	NC
Benzo(b)fluoranthene*	6.1	ND	Lower	ND	ND	NC
Chrysene*	6.1	ND	Lower	ND	ND	NC
Dibenz(a,h)anthracene*	6.1	ND	Lower	ND	ND	NC
1,1-Dichloroethene	1.2	1.2	NC	ND	0.2	Higher
Dieldrin	ND	1.6	Higher	ND	ND	NC
Ethylbenzene	ND	ND	NC	ND	1.0	Higher
Indeno(1,2,3-cd)pyrene*	6.1	ND	Lower	ND	ND	NC
Naphthalene	ND	ND	NC	ND	0.003	Higher
Nitrobenzene	ND	0.14	Higher	ND	0.009	Higher
1,1,1-Trichloroethane	ND	ND	NC	10.15	5.0	Higher (2)
Trichloroethene	0.006	ND	Lower	ND	ND	NC
Xylene	ND	ND	NC	ND	0.1	Higher

Notes: * Values used for the listed OUs only
a: Source is USEPA's Integrated Risk Information System (IRIS), unless otherwise mentioned
b: Indicates whether estimated risks will be lower or higher if values currently available were used. Value in parenthesis indicates the factor (sometimes approximate value) by which risks will differ.
c: Units are mg/kg/day for Inhalation Reference Dose, superseded by Inhalation Reference Concentration (mg/m^3).

ND = No data available or non-carcinogenic
NC = No Change
OU = Operable Unit

TABLE 8.4-1

Soil Remediation Goals
Operable Unit 9 Auto Hobby Shop
Five-Year Review Report
Former Loring AFB, Limestone, Maine

Contaminants of Concern	Remedial Goal[a] (mg/kg)
CERCLA-Based RGs (applicable 0-10 ft bgs)	
Benzo(a)anthracene	2.5
Benzo(a)pyrene	0.25
Benzo(b)fluoranthene	2.5
Chrysene	8.5
Indeno(1,2,3-c,d)pyrene	2.5
TPH	870

Notes:
[a] Remediation goal (RG) documented in the *Record of Decision for Sites Within Operable Units (OUs) 5, 8, 9, 10, and 11* (HLA, 1999).

TABLE 8.5-1

Soil Remediation Goals
Operable Unit 10 Entomology Shop/Jet Engine Buildup Shop
Five-Year Review Report
Former Loring AFB, Limestone, Maine

Area of Site	Chemical of Concern	Remediation Goal[a] (mg/kg)
Entomology Shop	TCE	0.45
	PCE	2.33
North JEBS	PCE	1.35
	TCE	0.95
South JEBS	Benzo(a)anthracene	0.17
	Benzo(a)pyrene	0.25
	Chrysene	0.45
	PCE	0.75
	TCE	0.5
Southwest JEBS	TCE	0.53

[a] Remediation goal (RG) documented in the *Sites Within Operable Units (OUs) 5, 8, 9, 10, and 11 Record of Decision* (HLA, 1999a).

TABLE 8.6-1

Soil Remediation Goals
Operable Unit 11 Base Laundry
Five-Year Review Report
Former Loring AFB, Limestone, Maine

Chemical of Concern	Remediation Goal[a] (mg/kg)
PCE	5.64

[a] Remediation goal (RG) documented in the *Record of Decision for Sites Within Operable Units 5, 8, 9, 10, and 11* (HLA, 1999).

TABLE 8.6-2

Comparison of Oral Toxicity Factors
Five-Year Review Report
Former Loring AFB, Limestone, Maine

Compound	Oral Slope Factor (mg/kg/day)		Impact of Current Value on Risk[b]	Oral Reference Dose (mg/kg/day)		Impact of Current Value on Risk[b]
	Value Used in Risk Assessment	Current Value[a]		Value Used in Risk Assessment	Current Value[a]	
Acenaphthene	ND	ND	ND	6.0E-02	6.0E-02	NC
Anthracene	ND	ND	ND	3.0E-01	3.0E-01	NC
Aroclor 1254	7.7	2.0	Lower	7.0E-05	2.0E-05	Higher (3.5)
Aroclor 1260	7.7	2.0	Lower	7.0E-05	ND	Lower
Barium	ND	ND	ND	7.0E-02	2.0E-01	Lower
Benzo(a)anthracene	7.3E-01	7.3E-01	NC	4.0E-02	ND	NC
Benzo(a)pyrene	7.3	7.3	NC	4.0E-02	ND	Lower
Benzo(b,k)fluoranthene	7.3E-01	7.3E-01	NC	4.0E-02	ND	NC
Benzo(g,h,i)perylene	ND	ND	ND	4.0E-02	ND	Lower
Chrysene	7.3E-03	7.3E-03	NC	4.0E-02	ND	NC
Dibenz(a,h)anthracene	7.3	7.3	NC	4.0E-02	ND	Lower
Fluoranthene	ND	ND	ND	4.0E-02	4.0E-02	NC
Fluorene	ND	ND	ND	4.0E-02	4.0E-02	NC
Indeno(1,2,3-cd)pyrene	7.3E-01	7.3E-01	NC	4.0E-02	ND	NC
Manganese	ND	ND	ND	1.4E-01	2.4E-02	Higher
Mercury	ND	ND	ND	3.0E-04	3.0E-04	NC
2-Methylnaphthalene	ND	ND	ND	4.0E-02	4.0E-03	Higher (10)
Naphthalene	ND	ND	ND	4.0E-02	2.0E-02	Higher (2)
Phenanthrene	ND	ND	ND	4.0E-02	ND	Lower
Pyrene	ND	ND	ND	3.0E-02	3.0E-02	NC
Tetrachloroethene	5.2E-02	5.2E-01	Higher	1.0E-02	1.0E-02	NC

a: Source is Regional Screening Level (RSL) Summary Table May 2010 (http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/index.htm).
b: Indicates whether estimated risks will be lower or higher if values currently available were used. Value in parenthesis indicates the factor (sometimes approximate value) by which risks will differ.

mg/kg = milligrams per kilogram
ND: No data available or non-carcinogenic
NC: No Change

TABLE 8.6-3

Comparison of Inhalation Toxicity Factors
Five-Year Review Report
Former Loring AFB, Limestone, Maine

Compound	Inhalation Slope Factor (mg/kg/day)		Impact of Current Value on Risk[b]	Inhalation Reference Concentration (mg/m^3)[c]		Impact of Current Value on Risk[b]
	Value Used in Risk Assessment	Current Value[a]		Value Used in Risk Assessment	Current Value[a]	
Acenaphthene	ND	ND	NC	ND	ND	NC
Anthracene	ND	ND	NC	ND	ND	NC
Aroclor 1254	ND	ND	NC	ND	ND	NC
Aroclor 1260	ND	ND	NC	ND	ND	NC
Barium	ND	ND	NC	1.4E-04	5.0E-04	Lower
Benzo(a)anthracene	6.1	ND	Lower	ND	ND	NC
Benzo(b)fluoranthene	6.1	ND	Lower	ND	ND	NC
Benzo(g,h,i)perylene	ND	ND	NC	ND	ND	NC
Benzo(a)pyrene	6.1	ND	Lower	ND	ND	NC
Chrysene	6.1	ND	Lower	ND	ND	NC
Dibenz(a,h)anthracene	6.1	ND	Lower	ND	ND	NC
Fluoranthene	ND	ND	NC	ND	ND	NC
Fluorene	ND	ND	NC	ND	ND	NC
Indeno(1,2,3-cd)pyrene	6.1	ND	Lower	ND	ND	NC
Manganese	ND	ND	NC	1.4E-05	5.0E-05	Lower
Mercury	ND	ND	NC	8.6E-05	3.0E-04	Lower
2-Methylnaphthalene	ND	ND	NC	ND	ND	NC
Naphthalene	ND	ND	NC	ND	3.0E-03	Higher
Phenanthrene	ND	ND	NC	ND	ND	NC
Pyrene	ND	ND	NC	ND	ND	NC
Tetrachloroethene	2.0E-03	ND	Lower	ND	2.7E-01	Higher

a: Source is Regional Screening Level (RSL) Summary Table May 2010 (http://www.epa.gov/reg3hwmd/risk/human/rb- concentration_table/Generic_Tables/index.htm).
b: Indicates whether estimated risks will be lower or higher if values currently available were used. Value in parenthesis indicates the factor (sometimes approximate value) by which risks will differ.
c: Units are mg/kg/day for Inhalation Reference Dose, superseded by Inhalation Reference Concentration (mg/m^3).

ND = No data available or non-carcinogenic
NC = No Change
OU = Operable Unit

TABLE 8.7-1

OU 12 Summary Remedial Alternatives and Site Specific Analytes
Five-Year Review Report
Former Loring AFB

Groundwater Monitoring Zone/ Plume	Plume Type	Limited Action Alternative	Analytes to be Monitored	GMZ Alternative	Analytes to be Monitored
GMZ 1					
Central NDA	Mixed			√	PCE, TCE, VC, Ben, Napth, PHC [a]
PH 8210				√	Ben, Xyl, Ethylben, *MeCl, Napth, Fe, Mn, PHC [a]
FSSB	Chlorinated	√	1,1,1-TCA, Pb, Mn		
JEBS North	Mixed			√	TCE, cis-1,2-DCE, VC, Napth, Mn
ES/JEBS South	Mixed			√	TCE, cis-1,2-DCE, VC,Ben, Napth, Pb, Mn, PHC [a]
CSS	Mixed	√	cis-1,2-DCE, 1,2-DCA, VC, MeCl, Xyl, Pb, Mn, PHC[1]		
FLDD North	Mixed			√	TCE, cis-1,2-DCE, VC, 1,1,1-TCA, 1,2-DCA, Ben, Xyl, Tol, Napth, MeCl, Fe, Pb, Mn, Sb, PHC [a]
FLDD South	Mixed			√	TCE, PCE, cis-1,2-DCE, 1,2 DCA, VC, Ben, Xyl, Tol, Napth, Pb, Mn, Sb, PHC [a]
BL	Mixed			√	PCE, TCE, Ben, Mn
VMB	Mixed			√	PCE,TCE, cis-1,2-DCE, 1,2-DCA, VC, Ben, Xyl, Tol, Pb, Mn, PHC [a]
RMSA	Mixed	√	VC, Pb, Mn		
GMZ 2					
FTF South	Chlorinated	√	VC, PCE		
GMZ 3					
Upgradient BXSS	Chlorinated	√	TCE		
Building 8711	Chlorinated	√	TCE, PCE, Aro-1260		
BXSS	Fuel			√	Ben, MTBE, PHC [a]
GMZ 4					
Quarry	Mixed			√	PCE, TCE, cis-1,2-DCE, VC, 1,1-DCE, 1,2-DCA, carbon tet, Ethylben, Napth, Tol, Chloroform, Chlorobenzene, Ben, Mn, PHC [a]

TABLE 8.7-1

OU 12 Summary Remedial Alternatives and Site Specific Analytes
Five-Year Review Report
Former Loring AFB

Groundwater Monitoring Zone/ Plume	Plume Type	Limited Action Alternative	Analytes to be Monitored	GMZ Alternative	Analytes to be Monitored
GMZ 5					
FJETC	Mixed			√	TCE, cis-1,2-DCE, VC, Ben, Xyl, Napth, PHC [a]
GMZ 6					
FTA	Mixed			√	VC, TCE, PCE, Ben, Xyl, Chlorometh, carbon tet, 4-meth-2-pent, Napth, Cd, Fe, Pb, Mn, PHC [a]

Notes:

1,1-DCE=1,1-dichloroethene
1,2-DCA=1,2-dichoroethane
1,1,1-TCA=1,1,1-trichloroethane
1,2-DCP=1,2-dichloropropane
4-meth-2-pent=4-methyl-2-pentanone
Aro-1260=Arochlor 1260
Ben=benzene
carbon tet=carbon tetrachloride
cis-1,2-DCE=cis-1,2-dichloroethene
Chlorometh=chloromethane
Cd=cadmium
Ethylben=ethylbenzene
Fe=Iron
Mn = manganese
MeCl=methylene chloride
MTBE = methyl-tert-butyl-ether
Napth=naphthalene
Pb=lead
PCE=tetrachloroethylene
PHC = petroleum hydrocarbons
Sb=antimony
TCE=trichloroethylene
Tol=toluene
VC=vinyl chloride
Xyl=xlyenes

SWP=Single Well Plume
C-SMP=compound-specific monitoring point
Mixed= a plume consisting of both chlorinated and petroleum-related compounds

NDA= Nose Dock Area
PH = pumphouse
JEBS=Jet Engine Buildup Shop
ES=Enotmology Shop
CSS=Contractors Storage Shed
FLDD=Flightline Drainage Ditch
BL=Base Laundry
VMB= Vehicle Maintainence Building
RMSA=Refueling Maintainence Shop
BXSS=Base Exchange Service Station
FJETC=Former Jet Engine Test Cell
FTA=Fire Training Area
FTF=Fuels Tank Farm

[a] = PHCs may be present at concentrations above the risk-based screening value but will only be monitored at the Compliance Boundary of the GMZ.

*= this compound will only be monitoried at JMW-1565 in this plume.

TABLE 8.7-2

Summary of Groundwater Remedial Goals
OU 12 Long-Term Monitoring Program
Five-Year Review Report
Former Loring Air Force Base - Limestone, Maine

	Contaminated Groundwater Area RGs by Plume [1]											
	GMZ 1											
Chemical of Concern [2]	**CNDA**	**PH 8210**	**FSSB**	**JEBS North**	**ES/JEBS South**	**CSS**	**FLDD North**	**FLDD South**	**BL**	**VMB**	**RMSA**	**Compliance Boundary RGs**
Volatile Organics												
1,1,1-Trichloroethane			200				200					200
1,2-Dichoroethane						5	5	5		5		5
Benzene	5	5			5		5	5	5	5		5
cis-1,2-Dichloroethene				70	70	70	70	70		70		70
Ethylbenzene		700										700
Methylene Chloride		5				5	5					
Naphthalene	480	480		480	480		480	480				25
Tetrachloroethene	5							5	5	5		3
Toluene							1000	1000		1000		1000
Trichloroethene	5			5	5		5	5	5	5		5
Vinyl Chloride	2			2	2	2	2	2		2	2	0.15
Xylene												600
Inorganics												
Antimony							6	6				6
Iron (overburden only)		2527					2527					2527
Lead			15		15	15	15	15		15	15	15
Manganese		396	396	396	396	396	396	396	396	396	396	200

NOTES:

[1] Source of RGs is *OU 12 Record of Decision* (HLA, 1999d)

[2] All concentrations are in micrograms per liter (µg/L)

Shaded cells indicate the COC has met the RG for at least three consecutive sampling rounds within the specific plume.

BL = Base Laundry
CNDA = Central Nose Dock Area
CSS = Contractor Storage Shed
ES = Entomology Shop
FLDD = Flightline Drainage Ditch
FSSB = Former Solvent Storage Building
GMZ = Groundwater Management Zone
JEBS = Jet Engine Buildup Shop
PH = Pumphouse
RG = Remediation Goal
RMSA = Refueling Maintenance Shop Area
VMB = Vehicle Maintenance Building

TABLE 8.7-2

Summary of Groundwater Remedial Goals
OU 12 Long-Term Monitoring Program
Five-Year Review Report
Former Loring Air Force Base - Limestone, Maine

	Contaminated Groundwater Area RGs by Plume [1]													
	GMZ 2		GMZ 3				GMZ 4		GMZ 5			GMZ 6		
Chemical of Concern [2]	**FTF**	**Compliance Boundary**	**Upgradient BXSS**	**Building 8711**	**BXSS**	**Compliance Boundary**	**Quarry**	**Compliance Boundary**	**FJETC**	**Compliance Boundary**		**FTA**	**Compliance Boundary**	
Volatile Organics														
4-Methyl-2-pentanone												530	530	
1,1-Dichloroethene							7	7						
1,2-Dichoroethane							5	5						
Benzene					5	5	5	5	5	5		5	5	
Carbon Tetrachloride							5	2.7				5	2.7	
Chloroform								100						
Chloromethane												2.2	3	
cis-1,2-Dichloroethene							70	70	70	70				
Ethylbenzene							700	700						
Methyl-Tert-butyl ether					3080	50								
Naphthalene							480	25	480	25		480	25	
Tetrachloroethene	5	3		5		3	5	3				5	3	
Toluene							1000	1000						
Trichloroethene			5	5		5	5	5	5	5		5	5	
Vinyl Chloride	2	0.15					2	0.15	2	0.15		2	0.15	
Xylene										600			600	
PCBs				0.5		0.1								
Inorganics														
Cadmium												5	5	
Iron (Bedrock only)												8330	8330	
Lead												15	15	
Manganese (Bedrock only)												396	200	
PHCs [3]						NRG		NRG		NRG			NRG	

NOTES:

[1] Source of RGs is *OU 12 Record of Decision* (HLA, 1999d)

[2] All concentrations are in micrograms per liter (µg/L)

[3] There is no Contaminated Groundwater Area Remediation Goal for PHCs; however, there is a risk-based screening value for monitoring PHCs at the GMZ Compliance Boundary.

Shaded cells indicate the COC has met the RG for at least three consecutive sampling rounds within the specific plume.

BXSS = Base Exchange Service Station
FJETC = Former Jet Engine Test Cell
FTF = Fuels Tank Farm
GMZ = Groundwater Management Zone
PCBs = polychlorinated biphenyls
PHC = petroleum hydrocarbons
RG = Remediation Goal
NRG = No Remedial Goal

TABLE 8.7-3

Comparison of Estimated Clean-Up Times for OU 12 Plumes
OU 12 Long-Term Monitoring Program
Five-Year Review Report
Former Loring Air Force Base - Limestone, Maine

Plume Name	Basewide Groundwater Operable Unit (OU 12) Feasibility Study Report (HLA, 1999a)[1] Limited Action/Groundwater Management Zone	1988 - 2008 Data (URS, 2009)[3]
Groundwater Management Zone 1		
BL Plume	2049[2]	2069.1
Central NDA Plume	2059[2]	2009.2
CSS Plume	2063	2021.7
ES/JEBS Plume	2319[2]	2044.1
FLDD Plume North	2046	2038.0
FLDD Plume South	2049	2013.2
FSSB Plume	2002	Clean-Up Achieved
JEBS North Plume	2319[2]	2027.6
PH 8210 Plume	2096[2]	2047.0
RMSA Plume	2048	2021.4
VMB Plume	2039[2]	Est. Year to Clean-Up Cannot be Calculated
Groundwater Management Zone 2		
FTF South Plume	2002	Clean-Up Achieved
Groundwater Management Zone 3		
Building 8711 Plume/ JBW-7734	2027	Est. Year to Clean-Up Cannot be Calculated
BXSS Plume	2009	Clean-Up Achieved
Upgradient BXSS Plume	2025	2015.0
Groundwater Management Zone 4		
Quarry	2167-3151[4]	Est. Year to Clean-Up Cannot be Calculated
Groundwater Management Zone 5		
FJETC Plume	2011	2018.5
Groundwater Management Zone 6		
FTA Plume	2085[2]	Est. Year to Clean-Up Cannot be Calculated

Notes:

BL = Base Laundry
CNDA = Central Nose Dock Area
CSS = Contractor Storage Shed
ES = Entomology Shop
FLDD = Flightline Drainage Ditch
FSSB = Former Solvent Storage Building
JEBS = Jet Engine Buildup Shop
PH = Pumphouse
RMSA = Refueling Maintenance Shop Area
VMB = Vehicle Maintenance Building
BXSS = Base Exchange Service Station
FJETC = Former Jet Engine Test Cell
FTF = Fuels Tank Farm
NA = Not Applicable

[1] Values listed below are the sum of the years listed in Table 6-3 of the FS and year of FS publication (1999).

[2] Estimated year that clean-up will be achieved was based on numerical, groundwater-contaminant fate and transport modeling.

[3] Analysis of Loring Air Force Base OU12 Data (1988 - 2008), Regression Estimation of Trend and Cleanup Time. Value is latest cleanup time calculated for that plume.

[4] Source = (HLA, 1999b) *OU12 Record of Decision*; Installation Restoration Program; Loring Air Force Base; prepared for HAZWRAP; Portland, Maine. September.

(HLA, 1999a) *Basewide Groundwater OU12 Feasibility Study Report*; Installation Restoration Program; Loring Air Force Base; prepared for HAZWRAP; Portland, Maine. May.
(URS, 2009) *Operable Unit 12 Long-Term Monitoring Program 2008 Annual Report*. August.

TABLE 8.8-1

Sediment and Surface Soil Remediation Goals[1]
Five-Year Review Report
Former Loring AFB, Limestone, Maine

NDA Drainageways							
Contaminant of Concern[2]	**Maximum Detected Concentration[3] (mg/kg)**		**Protection of Human Health[4] (mg/kg)**	**Protection of Ecological Receptors[5] (mg/kg)**		**Remediation Goal[6] (mg/kg)**	
	Sediment	**Soil**	**Sediment/Soil**	**Sediment**	**Soil**	**Sediment**	**Soil**
Total PAHs	270	NS	**	35/87	2,900	35/87* (ECO)	2,900 (ECO)
Lead	427	NS	690	218	320	218 (ECO)	320 (ECO)
Zinc	952	NS	>1,000,000	410	900	410 (ECO)	900 (ECO)

Notes:

1. Ditch sediment remediation goals are based on human and ecological exposure to sediment within the boundaries of the existing ditch channel plus soil in the overbank areas out to 20 feet from the existing ditch banks. Surface-soil remediation goals are based on human and ecological exposure to soil in the overbank areas more than 20 feet from the existing ditch banks.

2. Ecological risk-based concentrations were derived for the primary risk contributors only (i.e., those accounting for >90% of the overall hazard index).

3. Maximum concentration is only for the sample locations in the area proposed for remediation and includes 1993 and later analytical data. Maximum concentrations of total PAHs are the sum of the maximum concentrations of the individual compounds.

4. The lesser value of a carcinogenic risk-based concentration calculated with the cancer risk set at 1x10-6 and a noncarcinogenic risk-based concentration with the hazard quotient set at 1. Development of human health risk-based concentrations is documented in Appendix A.1 of the OU 13 FS (ABB-ES, 1997).

5. Development of ecological risk-based concentrations is documented in Appendix A.2 of the OU 13 FS (ABB-ES, 1997).

6. Remediation goals represent the lower of the human health and ecological criteria.

ECO - Remediation goal is ecological risk-based concentration.
mg/kg - milligrams per kilogram
NS - No samples were collected for this medium in this habitat.
PAHs - polynuclear aromatic hydrocarbons
* - 35/87 represents the RG for upper ditch areas/RG for lower wetland areas.
** - Development of human health risk-based concentrations for total PAHs is unnecessary; no noncarcinogenic risk on site was attributed to noncarcinogenic effects from PAHs.

TABLE 8.8-1

Sediment and Surface Soil Remediation Goals[1]
Five-Year Review Report
Former Loring AFB, Limestone, Maine

East Branch Greenlawn Brook								
Contaminant of Concern[2]	**Maximum Detected Concentration[3] (mg/kg)**		**Protection of Human Health[4] (mg/kg)**		**Protection of Ecological Receptors[5] (mg/kg)**		**Remediation Goal[6] (mg/kg)**	
	Stream	**Palustrine**	**Stream**	**Palustrine**	**Stream**	**Palustrine**	**Stream**	**Palustrine**
Total PAHs	54	NS	**	**	35	230	35 (ECO)	230 (ECO)
Total 4,4'-DDT/DDD/DDE	0.372	NS	77	125	0.28	0.37	0.280 (ECO)	0.370 (ECO)
Aroclor-1260	10	NS	2.5	5.5	1	14	1 (ECO)	5* (HH)
Total Chlordanes	0.11	NS	18	29	0.48	0.32	0.480 (ECO)	0.320 (ECO)
Lead	126	NS	690	690	218	155	218 (ECO)	155 (ECO)

Notes:

1. Stream sediment remediation goals are based on human and ecological exposure to sediment within the boundaries of the existing stream channel plus sediment in the overbank areas out to 20 feet from the existing stream banks. Palustrine sediment remediation goals are based on human and ecological exposure to sediment in the overbank areas more than 20 feet from the existing stream channel.

2. Ecological risk-based concentrations were derived for the primary risk contributors only (i.e., those accounting for >90% of the overall hazard index).

3. Maximum concentration is only for the sample locations in the area proposed for remediation and includes 1993 and later analytical data. Maximum concentrations of total PAHs, total 4,4'-DDT/DDD/DDE, and total chlordanes are the sum of the maximum concentrations of the individual compounds.

4. The lesser value of a carcinogenic risk-based concentration calculated with the cancer risk set at 1x10-6 and a noncarcinogenic risk-based concentration with the hazard quotient set at 1. Development of human health risk-based concentrations is documented in Appendix A.1 of the OU 13 FS (ABB-ES, 1997).

5. Development of ecological risk-based concentrations is documented in Appendix A.2 of the OU 13 FS (ABB-ES, 1997).

6. Remediation goals represent the lower of the human health and ecological criteria.

DDD - dichlorodiphenyldichloroethane

DDE - dichlorodiphenyldichloroethylene

DDT - dichlorodiphenyltrichloroethylene

ECO - Remediation goal is ecological risk-based concentration.

HH - Remediation goal is human health risk-based concentration.

mg/kg - milligrams per kilogram

NS - No samples were collected for this medium in this habitat.

PAHs - polynuclear aromatic hydrocarbons

* - Operationally, 5 mg/kg is used rather than the risk-based value of 5.5 mg/kg.

** - Development of human health risk-based concentrations for total PAHs is unnecessary; no noncarcinogenic risk on site was attributed to noncarcinogenic effects from PAHs.

TABLE 8.8-1

Sediment and Surface Soil Remediation Goals[1]
Five-Year Review Report
Former Loring AFB, Limestone, Maine

Flightline Drainage Ditch							
	Maximum Detected Concentration[3] (mg/kg)		Protection of Human Health[4] (mg/kg)	Protection of Ecological Receptors[5] (mg/kg)		Remediation Goal[6] (mg/kg)	
Contaminant of Concern[2]	**Stream**	**Floodplain**	**Stream/Floodplain**	**Stream**	**Floodplain**	**Stream**	**Floodplain**
Benzo(a)pyrene	11	13	5.14	--	--	5.14 (HH)	5.14 (HH)
Benzo(a)anthracene	11	17	51.4	--	--	51.4 (HH)	51.4 (HH)
Benzo(b)fluoranthene	12	30	51.4	--	--	51.4 (HH)	51.4 (HH)
Benzo(k)fluoranthene	12	30	514	--	--	514 (HH)	514 (HH)
Chrysene	12	15	5,140	--	--	5,140 (HH)	5,140 (HH)
Dibenzo(a,h)anthracene	3.1	2.4	5.14	--	--	5.14 (HH)	5.14 (HH)
Indeno(1,2,3-c,d)pyrene	8.1	7.7	51.4	--	--	51.4 (HH)	51.4 (HH)
Total PAHs	168	225	**	35	597	35 (ECO)	597 (ECO)
Total 4,4'-DDT/DDD/DDE	0.345	0.499	125	0.49	0.372	0.490 (ECO)	0.372 (ECO)
Aroclor-1260	6.4	5.9	5.5	1	14	1 (ECO)	5* (HH)
Total Chlordanes	0.64	0.12	29	0.6	0.315	0.600 (ECO)	0.315 (ECO)
Lead	332	474	690	218	155	218	155 (ECO)

Notes:

1. Stream sediment remediation goals are based on human and ecological exposure to sediment within the boundaries of the existing stream channel plus sediment in the overbank areas out to 10 feet from the existing stream banks. Floodplain sediment remediation goals are based on human and ecological exposure to sediment in the overbank areas more than 10 feet from the existing stream channel.

2. Ecological risk-based concentrations were derived for the primary risk contributors only (i.e., those accounting for >90% of the overall hazard index).

3. Maximum concentration is only for the sample locations in the area proposed for remediation and includes 1993 and later analytical data. Maximum concentrations of total PAHs, total 4,4'-DDT/DDD/DDE, and total chlordanes are the sum of the maximum concentrations of the individual compounds.

4. The lesser value of a carcinogenic risk-based concentration calculated with the cancer risk set at 1x10-6 and a noncarcinogenic risk-based concentration with the hazard quotient set at 1. Development of human health risk-based concentrations is documented in Appendix A.1 of the OU 13 FS (ABB-ES, 1997).

5. Development of ecological risk-based concentrations is documented in Appendix A.2 of the OU 13 FS (ABB-ES, 1997).

6. Remediation goals represent the lower of the human health and ecological criteria.

DDD - dichlorodiphenyldichloroethane
DDE - dichlorodiphenyldichloroethylene
DDT - dichlorodiphenyltrichloroethylene
ECO - Remediation goal is ecological risk-based concentration.
HH - Remediation goal is human health risk-based concentration
mg/kg - milligrams per kilogram
samples
PAHs - polynuclear aromatic hydrocarbons

-- Development of ecological risk-based concentrations for carcinogenic PAHs is unnecessary; ecological criteria listed for total PAHs is considered
* - Operationally, 5 mg/kg is used rather than the risk-based value of 5.5 mg/kg.
** - Development of human health risk-based concentrations for total PAHs is unnecessary; no noncarcinogenic risk on site was attributed to

TABLE 8.8-1

Sediment and Surface Soil Remediation Goals[1]
Five-Year Review Report
Former Loring AFB, Limestone, Maine

	Flightline Drainage Ditch Wetland						
	Maximum Detected Concentration[3] (mg/kg)		Protection of Human Health[4] (mg/kg)	Protection of Ecological Receptors[5] (mg/kg)		Remediation Goal[6] (mg/kg)	
Contaminant of Concern[2]	Stream	Floodplain	Stream/Floodplain	Stream	Floodplain	Stream	Floodplain
Benzo(a)pyrene	5.1	4.6	5.14	--	--	5.14 (HH)	5.14 (HH)
Benzo(a)anthracene	6.2	4.5	51.4	--	--	51.4 (HH)	51.4 (HH)
Benzo(b)fluoranthene	9.8	6.9	51.4	--	--	51.4 (HH)	51.4 (HH)
Benzo(k)fluoranthene	9.8	8.9	514	--	--	514 (HH)	514 (HH)
Chrysene	6	5	5,140	--	--	5,140 (HH)	5,140 (HH)
Dibenzo(a,h)anthracene	0.92	0.99	5.14	--	--	5.14 (HH)	5.14 (HH)
Indeno(1,2,3-c,d)pyrene	2.6	4.4	51.4	--	--	51.4 (HH)	51.4 (HH)
Total PAHs	94	70	**	87	597	87 (ECO)	597 (ECO)
Total 4,4'-DDT/DDD/DDE	96.7	2.68	125	0.35	0.372	0.350 (ECO)	0.372 (ECO)
Aroclor-1260	140	19	5.5	1	14	1 (ECO)	5* (HH)
Total Chlordanes	50	2.4	29	0.6	0.315	0.600 (ECO)	0.315 (ECO)
Lead	454	313	690	218	155	218 (ECO)	155 (ECO)

Notes:

1. Stream sediment remediation goals are based on human and ecological exposure to sediment within the boundaries of the existing stream channel plus sediment in the overbank areas out to 20 feet from the existing stream banks. Floodplain sediment remediation goals are based on human and ecological exposure to sediment in the overbank areas more than 20 feet from the existing stream channel.

2. Ecological risk-based concentrations were derived for the primary risk contributors only (i.e., those accounting for >90% of the overall hazard index).

3. Maximum concentration is only for the sample locations in the area proposed for remediation and includes 1993 and later analytical data. Maximum concentrations of total PAHs, total 4,4'-DDT/DDD/DDE, and total chlordanes are the sum of the maximum concentrations of the individual compounds.

4. The lesser value of a carcinogenic risk-based concentration calculated with the cancer risk set at 1x10-6 and a noncarcinogenic risk-based concentration with the hazard quotient set at 1. Development of human health risk-based concentrations is documented in Appendix A.1 of the OU 13 FS (ABB-ES, 1997).

5. Development of ecological risk-based concentrations is documented in Appendix A.2 of the OU 13 FS (ABB-ES, 1997).

6. Remediation goals represent the lower of the human health and ecological criteria.

DDD - dichlorodiphenyldichloroethane
DDE - dichlorodiphenyldichloroethylene
DDT - dichlorodiphenyltrichloroethylene
ECO - Remediation goal is ecological risk-based concentration.
HH - Remediation goal is human health risk-based concentration.
mg/kg - milligrams per kilogram
PAHs - polynuclear aromatic hydrocarbons

-- Development of ecological risk-based concentrations for carcinogenic PAHs is unnecessary; ecological criteria listed for total PAHs is considered adequate protection from carcinogenic and noncarcinogenic PAHs.

* - Operationally, 5 mg/kg is used rather than the risk-based value of 5.5 mg/kg.

** - Development of human health risk-based concentrations for total PAHs is unnecessary; no noncarcinogenic risk on site was attributed to noncarcinogenic effects

TABLE 8.8-1

Sediment and Surface Soil Remediation Goals[1]
Five-Year Review Report
Former Loring AFB, Limestone, Maine

Ditch G06							
Contaminant of Concern[2]	**Maximum Detected Concentration[3] (mg/kg)**		**Protection of Human Health[4] (mg/kg)**	**Protection of Ecological Receptors[5] (mg/kg)**		**Remediation Goal[6] (mg/kg)**	
	Sediment	**Soil**	**Sediment/Soil**	**Sediment**	**Soil**	**Sediment**	**Soil**
Total PAHs	103	71	**	35	597	35 (ECO)	597 (ECO)

Notes:

1. Ditch sediment remediation goals are based on human and ecological exposure to sediment within the boundaries of the existing ditch channel plus soil in the overbank areas out to 10 feet from the existing ditch banks. Surface-soil remediation goals are based on human and ecological exposure to soil in the overbank areas more than 10 feet from the existing ditch channel.

2. Ecological risk-based concentrations were derived for the primary risk contributors only (i.e., those accounting for >90% of the overall hazard index).

3. Maximum concentration is only for the sample locations in the area proposed for remediation and includes 1993 and later analytical data. Maximum concentrations of total PAHs are the sum of the maximum concentrations of the individual compounds.

4. The lesser value of a carcinogenic risk-based concentration calculated with the cancer risk set at 1x10-6 and a noncarcinogenic risk-based concentration with the hazard quotient set at 1. Development of human health risk-based concentrations is documented in Appendix A.1 of the OU 13 FS (ABB-ES, 1997).

5. Development of ecological risk-based concentrations is documented in Appendix A.2 of the OU 13 FS (ABB-ES, 1997).

6. Remediation goals represent the lower of the human health and ecological criteria.

ECO - Remediation goal is ecological risk-based concentration.

mg/kg - milligrams per kilogram

PAHs - polynuclear aromatic hydrocarbons

** - Development of human health risk-based concentrations for total PAHs is unnecessary; no noncarcinogenic risk on site was attributed to noncarcinogenic effects from PAHs.

TABLE 8.8-1

Sediment and Surface Soil Remediation Goals[1]
Five-Year Review Report
Former Loring AFB, Limestone, Maine

UTS Wetland							
	Maximum Detected Concentration[3] (mg/kg)		Protection of Human Health[4] (mg/kg)	Protection of Ecological Receptors[5] (mg/kg)		Remediation Goal[6] (mg/kg)	
Contaminant of Concern[2]	Sediment	Soil	Sediment/Soil	Sediment	Soil	Sediment	Soil
Total 4,4'-DDT/DDD/DDE	0.184	NS	125	0.012	0.012	0.012 (ECO)	0.012 (ECO)
Aroclor-1260	ND	NS	5.5	1	14	1 (ECO)	5* (HH)
Total Chlordanes	1.32	NS	29	0.32	0.32	0.320 (ECO)	0.320 (ECO)
Endrin	0.012	NS	1,768	0.21	0.21	0.21 (ECO)	0.21 (ECO)
Lead	201	NS	690	155	155	155 (ECO)	155 (ECO)
Zinc	302	NS	1,800,000	370	370	370 (ECO)	370 (ECO)

Notes:

1. Sediment remediation goals are based on human and ecological exposure to sediment within the area identified as aquatic habitat. Surface-soil remediation goals are based on human and ecological exposure to soil outside the area identified as aquatic habitat.
2. Ecological risk-based concentrations were derived for the primary risk contributors only (i.e., those accounting for >90% of the overall hazard index).
3. Maximum concentration is only for the sample locations in the area proposed for remediation and includes 1993 and later analytical data. Maximum concentrations of total PAHs are the sum of the maximum concentrations of the individual compounds.
4. The lesser value of a carcinogenic risk-based concentration calculated with the cancer risk set at 1x10-6 and a noncarcinogenic risk-based concentration with the hazard quotient set at 1. Development of human health risk-based concentrations is documented in Appendix A.1 of the OU 13 FS (ABB-ES, 1997).
5. Development of ecological risk-based concentrations is documented in Appendix A.2 of the OU 13 FS (ABB-ES, 1997).
6. Remediation goals represent the lower of the human health and ecological criteria.

DDD - dichlorodiphenyldichloroethane
DDE - dichlorodiphenyldichloroethylene
DDT - dichlorodiphenyltrichloroethylene
ECO - Remediation goal is ecological risk-based concentration.
HH - Remediation goal is human health risk-based concentration.
mg/kg - milligrams per kilogram
ND - Non detect
NS - No samples were collected for this medium in this habitat.
* - Operationally, 5 mg/kg is used rather than the risk-based value of 5.5 mg/kg.

TABLE 8.8-1

Fish Tissue Remediation Goals
Five-Year Review Report
Former Loring AFB, Limestone, Maine

Fish Tissue		
Contaminant of Concern[1]	**Maximum Detected Concentration[2] (mg/kg)**	**Remediation Goal[3] (mg/kg)**
4,4'-DDD	0.076	0.018
4,4'-DDE	0.044	0.013
4,4'-DDT	0.14	0.013
Aroclor-1242	0.074	0.0022
Aroclor-1260	2.1	0.0022
Heptachlor	0.0031	0.00098
Chlordane, Alpha	0.042	0.0034
Chlordane, Gamma	0.014	0.0034

Notes:

1. Contaminants of concern identified in fish tissue at one or more of the affected areas.
2. Maximum detected concentration out of all the affected areas.
3. Protection of Human Health Remediation Goal, Table 10-5, OU 13 Record of Decision (ABB-ES, 1997b).

DDD - dichlorodiphenyldichloroethane
DDE - dichlorodiphenyldichloroethylene
DDT - dichlorodiphenyltrichloroethylene
mg/kg - milligrams per kilogram
NA - Not Applicable

APPENDIX A

PUBLIC NOTICE

Fun in the Snow Day takes hold in Limestone

By Natalie Bazinet
Staff Writer

LIMESTONE — Well received by the community, the first Limestone Rotary Club-sponsored Fun in the Snow Day took place on Feb. 13 and is certainly an event that will continue through the upcoming years.

Aroostook Republican photo/Natalie Bazinet

Kobe West, 6 of Limestone was all smiles during his sled ride on Feb. 13.

An estimated 75 to 100 community members turned out for Fun in the Snow Day on the sun-soaked winter day, taking advantage of the ski trails, snow shoeing and sliding with full access to the recreation center and their choice of longtime Limestone restaurateur Carol Kelley's famed chicken stew, fire roasted hot dogs and marshmallows.

Some ambitious skiers took the trails all the way out to the Bog Road, while other energetic sliders hit the hill, pausing long enough to reenergize themselves with some hot stew and hotdogs before continuing to sled the afternoon away.

"I think what happened here today was the start of a jump-off point for future years," said Fun in the Snow Day Co-Chair and Rotarian David King. "To me, the most important aspect of the day was the activity — getting people together and providing a reason for families to play and have a good time together skiing and sliding."

King's co-chair, Limestone Rotary Club President Dottie Martin, agreed that Fun in the Snow Day has found a niche in the community.

"When we all get together, we can really do something, and that's exactly what we wanted to do," Martin said, mentioning the tremendous community support that went into the success of the event, including participation from the Fire Department, Recreation Department, Limestone Ski Club, and the Limestone Snow Hawks. The Maine Winter Sports Center even pitched it, bringing out their ski equipment trailer to help potential skiers get on their way.

Aroostook Republican photo/Natalie Bazinet

Stephen Leavitt and his 8-year-old daughter Grace of Limestone roasted hotdogs during a the sunny winter afternoon during Fun in the Snow Day.

Room 208 at CHS filled with 2,442 red, white carnations

By Barbara Scott
Staff Writer

National Honor Society members at Caribou High School completed their annual Carnation Sale Feb. 11 with a record-breaking total of 2,442 flowers sold. This total beat last year's total by more than 100.

On Feb. 12, the NHS members delivered the red, pink and white carnations to homerooms at CHS for distribution to anxiously awaiting students. Each of the carnations was purchased for $1 by students and staff, designating them to be delivered to friends and teachers during class times on Feb. 12. This is the only major fund-raiser for the CHS National Honor Society.

The annual carnation sale was co-chaired by Elizabeth Barbosa, Nicholas Willey and Emily Anderson. Each member of the NHS was given a quota of $40 and every member successfully met their target. Two teams were created to foster a healthy bit of competition between the juniors and senior NHS members with the juniors carrying the day.

The junior NHS students sold $1,381 in carnations and the seniors, though very successful, came in second with a total of $1,056. Leading the way in sales for the winning junior team were Adam Chartier who sold $135 worth of the long-stemmed carnations and Elizabeth Keaton who accumulated $101 in sales. Topping the senior carnation sales effort were Christine Kashian with $56 and Ethan McDuffie with $54.

According to Kenneth Atcheson, adviser to the National Honor Society, "A great deal of trading went on among the teams to guarantee that all members made their sales quotas. The New York Stock Exchange would be impressed with trades that went on during a certain science class here at CHS." The victorious juniors will be treated to a meal at the Jade Palace Restaurant in March but the "bragging rights" appeared to be the bigger prize.

Junior and seniors who acted as team captains for the event, collecting all carnation orders and accounting for the funds were Christine Kashian, Finn Bondeson, Travis Hallett, Dayna Michaud, Kyle McEwen and Hannah Saucier. NHS alumnus Kayla Schurman, home during her Christmas vacation, generously stamped out 1,100 of the 1,700 pink heart tags and NSH members Brittany Doak and Danielle MacDonald completed this task. Special thank yous went to the faculty and staff at Teague Park Elementary School for allowing the NHS students to use their stamp machine.

All proceeds from this sale will be used for various NHS projects throughout the school year. The National Honor Society members offers their thanks to everyone who worked so hard to make this fund-raiser a success.

A pizza party rounded out the day's work, on the afternoon of Feb.11, following the completion of attaching the ribbons and pink heart tags to the 2,442 carnations and arranging them in order for quick and efficient delivery Friday morning.

Aroostook Republican photo/Barb Scott

Ben Willey, a CHS National Honor Society student carries one of numerous buckets of carnations the organization was preparing for delivery at the school on Feb. 12. CHS students were able to purchase the flower and have it delivered as a surprise to someone during classtime. The event is one of the biggest fund-raisers the NHS holds.

PUBLIC NOTICE
THE AIR FORCE REAL PROPERTY AGENCY IS CONDUCTING A CERCLA FIVE-YEAR REVIEW AT THE FORMER LORING AIR FORCE BASE, ME

The United States Air Force, United States Environmental Protection Agency, and Maine Department of Environmental Protection Agency (MEDEP) have begun conducting the third Five-Year review of the selected remedies being implemented to address environmental contamination at the former Loring Air Force Base (AFB), Maine. The purpose of the five-year review is to ensure that the selected remedies are continuing to effectively protect public health and the environment as intended.

To ensure the continued protection of human health and the environment, the Superfund Program requires the review every five years of sites where the remedial actions left wastes at levels which limit site uses. These reviews occur until a site is deemed suitable for unrestricted use or unlimited access. The third Five-Year Review will focus on the progress of ongoing cleanups for groundwater, landfills, and surface water sites at the former Loring AFB. The Air Force plans to complete this review by September 30, 2010. A subsequent public notice will announce the completion and briefly summarize the findings of the five-year review. The completed Five-Year Review Report will be placed in the Loring AFB Information Repository located at the Air Force Real Property Agency Office, 154 Development Drive, Suite G, Limestone, Maine. Additional information can be found on the Air Force's Administrative Record database via the following web link: *https://afrpaar.lackland.af.mil/ar/docsearch.aspx*

Public participation in the Five-Year Review process is encouraged and welcomed. If you are interested in participating in the review process, have questions, or would like more information on the sites under review, please contact:

Mr. David Strainge
BRAC Environmental Coordinator, AFCEE/EXC
154 Development Drive, Suite G
Limestone, Maine 04750
Phone: 207-328-7109

APPENDIX B

LANDFILL 2 & LANDFILL 3 GROUNDWATER ANALYTICAL DATA

TABLE B-1
LANDFILL 2 COMPLIANCE BOUNDARY WELLS - 2009 EPA PRIORITY POLLUTANT GROUNDWATER ANALYTICAL RESULTS
FIVE-YEAR REVIEW REPORT
FORMER LORING AIR FORCE BASE - LIMESTONE, MAINE

Location ID					LF2MW3	LF2MW4	MMW0001	MMW0001	
Sample ID					LF2MW3	LF2MW4	MMW0001	MMW9006	
Matrix					Groundwater	Groundwater	Groundwater	Groundwater	
Depth Interval (ft)					-	-	-	-	
Date Sampled					10/12/09	10/09/09	10/09/09	10/09/09	
Parameter	**Units**	**ROD (1)**	**MEG (2)**	**MCL (3)**				Field Duplicate (1-1)	
Volatile Organic Compounds (Non-Detect = PQL)									
1,1,1-Trichloroethane	UG/L	-	200	200	1.0 U	1.0 U	1.0 U	1.0 U	
1,1,2,2-Tetrachloroethane	UG/L	-	1.8	-	1.0 U	1.0 U	1.0 U	1.0 U	
1,1,2-Trichloroethane	UG/L	-	6	5	1.0 U	1.0 U	1.0 U	1.0 U	
1,1-Dichloroethane	UG/L	-	70	-	1.0 U	1.0 U	1.0 U	1.0 U	
1,1-Dichloroethene	UG/L	-	0.6	7	1.0 U	1.0 U	1.0 U	1.0 U	
1,2-Dichloroethane	UG/L	-	4	5	1.0 U	1.0 U	1.0 U	1.0 U	
1,2-Dichloropropane	UG/L	-	5	5	1.0 U	1.0 U	1.0 U	1.0 U	
1,4-Dichlorobenzene	UG/L	-	21	75	1.0 U	1.0 U	1.0 U	1.0 U	
2-Chloroethyl vinyl ether	UG/L	-	-	-	R	R	R	R	
Acrolein	UG/L	-	-	-	R	R	R	R	
Acrylonitrile	UG/L	-	0.6	-	10 U	10 U	10 U	10 U	
Benzene	UG/L	-	6	5	1.0 U	1.0 U	1.0 U	1.0 U	
Bromodichloromethane	UG/L	-	6	-	1.0 U	1.0 U	1.0 U	1.0 U	
Bromoform	UG/L	-	44	-	1.0 U	1.0 U	1.0 U	1.0 U	
Bromomethane	UG/L	-	10	-	1.0 U	1.0 U	1.0 U	1.0 U	
Carbon tetrachloride	UG/L	-	3	5	1.0 U	1.0 U	1.0 U	1.0 U	
Chlorobenzene	UG/L	-	140	-	1.0 U	1.0 U	1.0 U	1.0 U	
Chloroethane	UG/L	-	-	-	1.0 U	1.0 U	1.0 U	1.0 U	

ROD (1)- LF-2 Bedrock Groundwater Action Levels from Final Operable Unit 4 Record of Decision (ABB-ES, 1996).

MEG (2)- Maximum Exposure Guidelines from Maine Department of Human Services Memorandum "Maine CDC Maximum Exposure Guidelines (MEGs) for Drinking Water", December 5, 2008.

MCL (3)- Environmental Protection Agency MCL Value.

Flags assigned during chemistry validation are shown.

Concentration Exceeds ROD (1)

Concentration Exceeds MEG (2)

Border Concentration Exceeds MCL (3)

U - Not detected above the reported quantitation limit; J - The reported concentration is an estimated value.
D - Result reported from a secondary dilution analysis.; R - The data is rejected.; NA - Not Analyzed
B - The reported concentration is above the method detection limit but below the quantitation limit.
PQL - Practical quantitation limit. MDL - Method detection limit.

Detection Limits shown are PQL

Advanced Selection: LF Tab B-1 2009
J:\LoringPease\DB\Program_LoringAFB\EDMS_Dev.mdb
Printed: 9/10/2010 2:55:19 PM
[LOGDATE] BETWEEN #09/21/09# AND #12/21/09# AND ([MATRIX] = 'WG' OR [MATRIX] = 'WP') AND ([SACODE] = 'FD' OR [SACODE] = 'N' OR [SACODE] = 'FD') AND [SITEID] = '8' AND [PRCCODE] <> 'STD' AND [PRCCODE] <> 'HC' AND [PARNAME] <> 'Alkalinity, bicarbonate (as CaCO3)' AND [PARNAME] <> 'Alkalinity, carbonate (as CaCO3)' AND [PARNAME] <> 'Alkalinity,

TABLE B-1
LANDFILL 2 COMPLIANCE BOUNDARY WELLS - 2009 EPA PRIORITY POLLUTANT GROUNDWATER ANALYTICAL RESULTS
FIVE-YEAR REVIEW REPORT
FORMER LORING AIR FORCE BASE - LIMESTONE, MAINE

Location ID					LF2MW3	LF2MW4	MMW0001	MMW0001
Sample ID					LF2MW3	LF2MW4	MMW0001	MMW9006
Matrix					Groundwater	Groundwater	Groundwater	Groundwater
Depth Interval (ft)					-	-	-	-
Date Sampled					10/12/09	10/09/09	10/09/09	10/09/09
Parameter	**Units**	**ROD (1)**	**MEG (2)**	**MCL (3)**				Field Duplicate (1-1)
Volatile Organic Compounds (Non-Detect = PQL)								
Chloroform	UG/L	-	70	80	1.0 U	1.0 U	1.0 U	1.0 U
Chloromethane	UG/L	-	3	-	1.0 U	1.0 UJ	1.0 UJ	1.0 U
cis-1,2-Dichloroethene	UG/L	-	70	70	1.0 U	1.0 U	1.0 U	1.0 U
cis-1,3-Dichloropropene	UG/L	-	-	-	1.0 U	1.0 U	1.0 U	1.0 U
Dibromochloromethane	UG/L	-	4	-	1.0 U	1.0 U	1.0 U	1.0 U
Ethylbenzene	UG/L	-	70	700	1.0 U	1.0 U	1.0 U	1.0 U
Methylene chloride	UG/L	-	47	5	1.0 U	1.0 U	1.0 U	1.0 U
Tetrachloroethylene (PCE)	UG/L	3	7	5	1.0 U	1.0 U	1.0 U	1.0 U
Toluene	UG/L	-	1400	1000	1.0 U	1.0 U	1.0 U	1.0 U
trans-1,2-Dichloroethene	UG/L	-	140	100	1.0 U	1.0 U	1.0 U	1.0 U
trans-1,3-Dichloropropene	UG/L	-	-	-	1.0 U	1.0 U	1.0 U	1.0 U
Trichloroethylene (TCE)	UG/L	-	32	5	1.0 U	1.0 U	1.0 U	1.0 U
Trichlorofluoromethane	UG/L	-	2100	-	1.0 U	1.0 U	1.0 U	1.0 U
Vinyl chloride	UG/L	0.15	0.2	2	1.0 U	1.0 U	1.0 U	1.0 U
Selected Ion Monitoring (Non-Detect = PQL)								
Vinyl chloride	UG/L	0.15	0.2	2	0.10 U	0.10 U	0.10 U	0.10 U
Semivolatile Organic Compounds (Non-Detect = PQL)								
1,2,4-Trichlorobenzene	UG/L	-	-	70	9.4 U	9.5 U	9.4 U	9.4 U

ROD (1)- LF-2 Bedrock Groundwater Action Levels from Final Operable Unit 4 Record of Decision (ABB-ES, 1996).

MEG (2)- Maximum Exposure Guidelines from Maine Department of Human Services Memorandum "Maine CDC Maximum Exposure Guidelines (MEGs) for Drinking Water", December 5, 2008.

MCL (3)- Environmental Protection Agency MCL Value.

Flags assigned during chemistry validation are shown.

Concentration Exceeds ROD (1)

Concentration Exceeds MEG (2)

Border Concentration Exceeds MCL (3)

U - Not detected above the reported quantitation limit; J - The reported concentration is an estimated value.
D - Result reported from a secondary dilution analysis.; R - The data is rejected.; NA - Not Analyzed
B - The reported concentration is above the method detection limit but below the quantitation limit.
PQL - Practical quantitation limit. MDL - Method detection limit.

Detection Limits shown are PQL

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TABLE B-1
LANDFILL 2 COMPLIANCE BOUNDARY WELLS - 2009 EPA PRIORITY POLLUTANT GROUNDWATER ANALYTICAL RESULTS
FIVE-YEAR REVIEW REPORT
FORMER LORING AIR FORCE BASE - LIMESTONE, MAINE

Location ID					LF2MW3	LF2MW4	MMW0001	MMW0001	
Sample ID					LF2MW3	LF2MW4	MMW0001	MMW9006	
Matrix					Groundwater	Groundwater	Groundwater	Groundwater	
Depth Interval (ft)					-	-	-	-	
Date Sampled					10/12/09	10/09/09	10/09/09	10/09/09	
Parameter	**Units**	**ROD (1)**	**MEG (2)**	**MCL (3)**				Field Duplicate (1-1)	
Semivolatile Organic Compounds (Non-Detect = PQL)									
1,2-Dichlorobenzene	UG/L	-	63	600	9.4 U	9.5 U	9.4 U	9.4 U	
1,3-Dichlorobenzene	UG/L	-	60	-	9.4 U	9.5 U	9.4 U	9.4 U	
1,4-Dichlorobenzene	UG/L	-	21	-	9.4 U	9.5 U	9.4 U	9.4 U	
1,4-Dioxane	UG/L	-	32	-	0.19 U	0.20 U	0.19 U	0.19 U	
2,2'-oxybis(1-Chloropropane)	UG/L	-	-	-	9.4 U	9.5 U	9.4 U	9.4 U	
2,4,5-Trichlorophenol	UG/L	-	-	-	9.4 U	9.5 U	9.4 U	9.4 U	
2,4,6-Trichlorophenol	UG/L	-	32	-	9.4 U	9.5 U	9.4 U	9.4 U	
2,4-Dichlorophenol	UG/L	-	21	-	9.4 U	9.5 U	9.4 U	9.4 U	
2,4-Dimethylphenol	UG/L	-	-	-	9.4 U	9.5 U	9.4 U	9.4 U	
2,4-Dinitrophenol	UG/L	-	14	-	47 U	48 U	47 U	47 U	
2,4-Dinitrotoluene	UG/L	-	0.5	-	9.4 U	9.5 U	9.4 U	9.4 U	
2,6-Dinitrotoluene	UG/L	-	0.5	-	9.4 U	9.5 U	9.4 U	9.4 U	
2-Chloronaphthalene	UG/L	-	-	-	9.4 U	9.5 U	9.4 U	9.4 U	
2-Chlorophenol	UG/L	-	35	-	9.4 U	9.5 U	9.4 U	9.4 U	
2-Methylnaphthalene	UG/L	-	-	-	9.4 U	9.5 U	9.4 U	9.4 U	
2-Methylphenol (o-cresol)	UG/L	-	-	-	9.4 U	9.5 U	9.4 U	9.4 U	
2-Nitroaniline	UG/L	-	-	-	47 U	48 U	47 U	47 U	
2-Nitrophenol	UG/L	-	-	-	9.4 U	9.5 U	9.4 U	9.4 U	

ROD (1)- LF-2 Bedrock Groundwater Action Levels from Final Operable Unit 4 Record of Decision (ABB-ES, 1996).

MEG (2)- Maximum Exposure Guidelines from Maine Department of Human Services Memorandum "Maine CDC Maximum Exposure Guidelines (MEGs) for Drinking Water", December 5, 2008.

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Concentration Exceeds ROD (1)

Concentration Exceeds MEG (2)

Border Concentration Exceeds MCL (3)

U - Not detected above the reported quantitation limit; J - The reported concentration is an estimated value.
D - Result reported from a secondary dilution analysis.; R - The data is rejected.; NA - Not Analyzed
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PQL - Practical quantitation limit. MDL - Method detection limit.

Detection Limits shown are PQL

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FIVE-YEAR REVIEW REPORT
FORMER LORING AIR FORCE BASE - LIMESTONE, MAINE

Location ID					LF2MW3	LF2MW4	MMW0001	MMW0001	
Sample ID					LF2MW3	LF2MW4	MMW0001	MMW9006	
Matrix					Groundwater	Groundwater	Groundwater	Groundwater	
Depth Interval (ft)					-	-	-	-	
Date Sampled					10/12/09	10/09/09	10/09/09	10/09/09	
Parameter	**Units**	**ROD (1)**	**MEG (2)**	**MCL (3)**				Field Duplicate (1-1)	
Semivolatile Organic Compounds (Non-Detect = PQL)									
3,3'-Dichlorobenzidine	UG/L	-	-	-	9.4 U	9.5 U	9.4 U	9.4 U	
3-Nitroaniline	UG/L	-	-	-	47 U	48 U	47 U	47 U	
3&4-Methylphenol (m&p-cresol)	UG/L	-	3.5	-	9.4 U	9.5 U	9.4 U	9.4 U	
4,6-Dinitro-2-methylphenol	UG/L	-	-	-	47 U	48 U	47 U	47 U	
4-Bromophenyl phenyl ether	UG/L	-	-	-	9.4 U	9.5 U	9.4 U	9.4 U	
4-Chloro-3-methylphenol	UG/L	-	-	-	9.4 U	9.5 U	9.4 U	9.4 U	
4-Chloroaniline	UG/L	-	-	-	9.4 U	9.5 U	9.4 U	9.4 U	
4-Chlorophenyl phenyl ether	UG/L	-	-	-	9.4 U	9.5 U	9.4 U	9.4 U	
4-Nitroaniline	UG/L	-	-	-	47 U	48 U	47 U	47 U	
4-Nitrophenol	UG/L	-	60	-	47 UJ	48 U	47 U	47 U	
Acenaphthene	UG/L	-	-	-	9.4 U	9.5 U	9.4 U	9.4 U	
Acenaphthylene	UG/L	-	-	-	9.4 U	9.5 U	9.4 U	9.4 U	
Anthracene	UG/L	-	-	-	9.4 U	9.5 U	9.4 U	9.4 U	
Benzo(a)anthracene	UG/L	-	-	-	9.4 U	9.5 U	9.4 U	9.4 U	
Benzo(a)pyrene	UG/L	-	0.05	0.2	9.4 U	9.5 U	9.4 U	9.4 U	
Benzo(b)fluoranthene	UG/L	-	-	-	9.4 U	9.5 U	9.4 U	9.4 U	
Benzo(g,h,i)perylene	UG/L	-	-	-	9.4 U	9.5 U	9.4 U	9.4 U	

ROD (1)- LF-2 Bedrock Groundwater Action Levels from Final Operable Unit 4 Record of Decision (ABB-ES, 1996).

MEG (2)- Maximum Exposure Guidelines from Maine Department of Human Services Memorandum "Maine CDC Maximum Exposure Guidelines (MEGs) for Drinking Water", December 5, 2008.

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Concentration Exceeds MEG (2)

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FIVE-YEAR REVIEW REPORT
FORMER LORING AIR FORCE BASE - LIMESTONE, MAINE

Location ID					LF2MW3	LF2MW4	MMW0001	MMW0001
Sample ID					LF2MW3	LF2MW4	MMW0001	MMW9006
Matrix					Groundwater	Groundwater	Groundwater	Groundwater
Depth Interval (ft)					-	-	-	-
Date Sampled					10/12/09	10/09/09	10/09/09	10/09/09
Parameter	**Units**	**ROD (1)**	**MEG (2)**	**MCL (3)**				Field Duplicate (1-1)
Semivolatile Organic Compounds (Non-Detect = PQL)								
Benzo(k)fluoranthene	UG/L	-	-	-	9.4 U	9.5 U	9.4 U	9.4 U
Benzyl alcohol	UG/L	-	-	-	9.4 U	9.5 U	9.4 U	9.4 U
Benzyl butyl phthalate	UG/L	-	-	-	9.4 U	9.5 U	9.4 U	9.4 U
bis(2-Chloroethoxy) methane	UG/L	-	-	-	9.4 U	9.5 U	9.4 U	9.4 U
bis(2-Chloroethyl) ether	UG/L	-	0.3	-	9.4 U	9.5 U	9.4 U	9.4 U
bis(2-Ethylhexyl) phthalate	UG/L	10	25	6	9.4 U	9.5 U	9.4 U	9.4 U
Carbazole	UG/L	-	-	-	9.4 U	9.5 U	9.4 U	9.4 U
Chrysene	UG/L	-	-	-	9.4 U	9.5 U	9.4 U	9.4 U
Dibenz(a,h)anthracene	UG/L	-	-	-	9.4 U	9.5 U	9.4 U	9.4 U
Dibenzofuran	UG/L	-	-	-	9.4 U	9.5 U	9.4 U	9.4 U
Diethyl phthalate	UG/L	-	5000	-	9.4 U	9.5 U	9.4 U	9.4 U
Dimethyl phthalate	UG/L	-	-	-	9.4 U	9.5 U	9.4 U	9.4 U
Di-n-butyl phthalate	UG/L	-	700	-	9.4 U	9.5 U	9.4 U	9.4 U
Di-n-octylphthalate	UG/L	-	-	-	9.4 U	9.5 U	9.4 U	9.4 U
Fluoranthene	UG/L	-	-	-	9.4 U	9.5 U	9.4 U	9.4 U
Fluorene	UG/L	-	-	-	9.4 U	9.5 U	9.4 U	9.4 U
Hexachlorobenzene	UG/L	-	0.2	1	9.4 U	9.5 U	9.4 U	9.4 U
Hexachlorobutadiene	UG/L	-	4	-	9.4 U	9.5 U	9.4 U	9.4 U

ROD (1)- LF-2 Bedrock Groundwater Action Levels from Final Operable Unit 4 Record of Decision (ABB-ES, 1996).

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Concentration Exceeds MEG (2)

Border Concentration Exceeds MCL (3)

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Detection Limits shown are PQL

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FIVE-YEAR REVIEW REPORT
FORMER LORING AIR FORCE BASE - LIMESTONE, MAINE

Location ID					LF2MW3	LF2MW4	MMW0001	MMW0001
Sample ID					LF2MW3	LF2MW4	MMW0001	MMW9006
Matrix					Groundwater	Groundwater	Groundwater	Groundwater
Depth Interval (ft)					-	-	-	-
Date Sampled					10/12/09	10/09/09	10/09/09	10/09/09
Parameter	**Units**	**ROD (1)**	**MEG (2)**	**MCL (3)**				Field Duplicate (1-1)
Semivolatile Organic Compounds (Non-Detect = PQL)								
Hexachlorocyclopentadiene	UG/L	-	42	50	9.4 U	9.5 U	9.4 U	9.4 U
Hexachloroethane	UG/L	-	7	-	9.4 U	9.5 U	9.4 U	9.4 U
Indeno(1,2,3-c,d)pyrene	UG/L	-	-	-	9.4 U	9.5 U	9.4 U	9.4 U
Isophorone	UG/L	-	370	-	9.4 U	9.5 U	9.4 U	9.4 U
Naphthalene	UG/L	-	14	-	9.4 U	9.5 U	9.4 U	9.4 U
Nitrobenzene	UG/L	-	3.5	-	9.4 U	9.5 U	9.4 U	9.4 U
n-Nitrosodimethylamine	UG/L	-	-	-	9.4 U	9.5 U	9.4 U	9.4 U
n-Nitrosodi-n-propylamine	UG/L	-	-	-	9.4 U	9.5 U	9.4 U	9.4 U
n-Nitrosodiphenylamine	UG/L	-	-	-	9.4 U	9.5 U	9.4 U	9.4 U
Pentachlorophenol	UG/L	-	3	1	47 U	48 U	47 U	47 U
Phenanthrene	UG/L	-	-	-	9.4 U	9.5 U	9.4 U	9.4 U
Phenol	UG/L	-	2100	-	9.4 U	9.5 U	9.4 U	14 U
Pyrene	UG/L	-	-	-	9.4 U	9.5 U	9.4 U	9.4 U
Organochlorine Pesticides (Non-Detect = PQL)								
4,4'-DDD	UG/L	-	-	-	0.094 U	0.095 U	0.094 U	0.094 U
4,4'-DDE	UG/L	-	-	-	0.094 U	0.095 U	0.094 U	0.094 U
4,4'-DDT	UG/L	-	1	-	0.094 U	0.095 U	0.094 U	0.094 U
Aldrin	UG/L	-	0.02	-	0.047 U	0.048 U	0.047 U	0.047 U

ROD (1)- LF-2 Bedrock Groundwater Action Levels from Final Operable Unit 4 Record of Decision (ABB-ES, 1996).

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Concentration Exceeds ROD (1)

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FIVE-YEAR REVIEW REPORT
FORMER LORING AIR FORCE BASE - LIMESTONE, MAINE

Location ID					LF2MW3	LF2MW4	MMW0001	MMW0001	
Sample ID					LF2MW3	LF2MW4	MMW0001	MMW9006	
Matrix					Groundwater	Groundwater	Groundwater	Groundwater	
Depth Interval (ft)					-	-	-	-	
Date Sampled					10/12/09	10/09/09	10/09/09	10/09/09	
Parameter	**Units**	**ROD (1)**	**MEG (2)**	**MCL (3)**				Field Duplicate (1-1)	
Organochlorine Pesticides (Non-Detect = PQL)									
alpha-BHC	UG/L	-	-	-	0.047 U	0.048 U	0.047 U	0.047 U	
alpha-Chlordane	UG/L	-	-	-	0.047 U	0.048 U	0.047 U	0.047 U	
beta-BHC	UG/L	-	-	-	0.047 U	0.048 U	0.047 U	0.047 U	
delta-BHC	UG/L	-	-	-	0.047 U	0.048 U	0.047 U	0.047 U	
Dieldrin	UG/L	-	0.02	-	0.094 U	0.095 U	0.094 U	0.094 U	
Endosulfan I	UG/L	-	42	-	0.047 U	0.048 U	0.047 U	0.047 U	
Endosulfan II	UG/L	-	42	-	0.094 U	0.095 U	0.094 U	0.094 U	
Endosulfan sulfate	UG/L	-	-	-	0.094 U	0.095 U	0.094 U	0.094 U	
Endrin	UG/L	-	2	2	0.094 U	0.095 U	0.094 U	0.094 U	
Endrin aldehyde	UG/L	-	-	-	0.094 U	0.095 U	0.094 U	0.094 U	
Endrin Ketone	UG/L	-	-	-	0.094 U	0.095 U	0.094 U	0.094 U	
gamma-BHC (Lindane)	UG/L	-	0.2	0.2	0.047 U	0.048 U	0.047 U	0.047 U	
gamma-Chlordane	UG/L	-	-	-	0.047 U	0.048 U	0.047 U	0.047 U	
Heptachlor	UG/L	-	0.08	0.4	0.047 U	0.048 U	0.047 U	0.047 U	
Heptachlor epoxide	UG/L	-	0.04	0.2	0.047 U	0.048 U	0.047 U	0.047 U	
Methoxychlor	UG/L	-	35	-	0.47 U	0.48 U	0.47 U	0.47 U	
Toxaphene	UG/L	-	0.3	3	0.94 U	0.95 U	0.94 U	0.94 U	

ROD (1)- LF-2 Bedrock Groundwater Action Levels from Final Operable Unit 4 Record of Decision (ABB-ES, 1996).

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FIVE-YEAR REVIEW REPORT
FORMER LORING AIR FORCE BASE - LIMESTONE, MAINE

Location ID					LF2MW3	LF2MW4	MMW0001	MMW0001
Sample ID					LF2MW3	LF2MW4	MMW0001	MMW9006
Matrix					Groundwater	Groundwater	Groundwater	Groundwater
Depth Interval (ft)					-	-	-	-
Date Sampled					10/12/09	10/09/09	10/09/09	10/09/09
Parameter	**Units**	**ROD (1)**	**MEG (2)**	**MCL (3)**				Field Duplicate (1-1)
Polychlorinated Biphenyl Mixtures (Aroclors) (Non-Detect = PQL)								
PCB-1016 (Aroclor 1016)	UG/L	-	0.5	-	0.94 U	0.95 U	0.94 U	0.94 U
PCB-1221 (Aroclor 1221)	UG/L	-	0.5	-	1.9 U	1.9 U	1.9 U	1.9 U
PCB-1232 (Aroclor 1232)	UG/L	-	0.5	-	0.94 U	0.95 U	0.94 U	0.94 U
PCB-1242 (Aroclor 1242)	UG/L	-	0.5	-	0.94 U	0.95 U	0.94 U	0.94 U
PCB-1248 (Aroclor 1248)	UG/L	-	0.5	-	0.94 U	0.95 U	0.94 U	0.94 U
PCB-1254 (Aroclor 1254)	UG/L	-	0.5	-	0.94 U	0.95 U	0.94 U	0.94 U
PCB-1260 (Aroclor 1260)	UG/L	-	0.5	-	0.94 U	0.95 U	0.94 U	0.94 U
Metals (Non-Detect = MDL)								
Antimony	UG/L	-	3	6	3.9 U	3.9 U	3.9 U	3.9 U
Arsenic	UG/L	-	10	10	3.2 U	3.2 U	3.2 U	3.2 U
Beryllium	UG/L	-	-	-	0.119 U	0.119 U	0.119 U	0.119 U
Cadmium	UG/L	5	3.5	5	0.202 U	0.119 U	0.119 U	0.119 U
Calcium	UG/L	-	-	-	73,000	83,600	92,200	91,100
Chromium, total	UG/L	-	40	100	0.909 J	0.475 U	0.517 J	0.589 J
Copper	UG/L	-	1300	1300	2.3 J	3.7 J	1.6 U	1.6 U
Iron	UG/L	8400	-	-	39.3 J	31.7 U	47.3 J	31.7 U
Lead	UG/L	80	10	15	0.886 U	0.886 U	0.886 U	0.886 U
Magnesium	UG/L	-	-	-	8,530	8,140	10,200	10,100

ROD (1)- LF-2 Bedrock Groundwater Action Levels from Final Operable Unit 4 Record of Decision (ABB-ES, 1996).

MEG (2)- Maximum Exposure Guidelines from Maine Department of Human Services Memorandum "Maine CDC Maximum Exposure Guidelines (MEGs) for Drinking Water", December 5, 2008.

MCL (3)- Environmental Protection Agency MCL Value.

Flags assigned during chemistry validation are shown.

Concentration Exceeds ROD (1)

Concentration Exceeds MEG (2)

Border Concentration Exceeds MCL (3)

U - Not detected above the reported quantitation limit; J - The reported concentration is an estimated value.
D - Result reported from a secondary dilution analysis.; R - The data is rejected.; NA - Not Analyzed
B - The reported concentration is above the method detection limit but below the quantitation limit.
PQL - Practical quantitation limit. MDL - Method detection limit.

Detection Limits shown are PQL

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[LOGDATE] BETWEEN #09/21/09# AND #12/21/09# AND ([MATRIX] = 'WG' OR [MATRIX] = 'WP') AND ([SACODE] = 'FD' OR [SACODE] = 'N' OR [SACODE] = 'FD') AND [SITEID] = '8' AND [PRCCODE] <> 'STD' AND [PRCCODE] <> 'HC' AND [PARNAME] <> 'Alkalinity, bicarbonate (as CaCO3)' AND [PARNAME] <> 'Alkalinity, carbonate (as CaCO3)' AND [PARNAME] <> 'Alkalinity,

TABLE B-1
LANDFILL 2 COMPLIANCE BOUNDARY WELLS - 2009 EPA PRIORITY POLLUTANT GROUNDWATER ANALYTICAL RESULTS
FIVE-YEAR REVIEW REPORT
FORMER LORING AIR FORCE BASE - LIMESTONE, MAINE

Location ID					LF2MW3	LF2MW4	MMW0001	MMW0001
Sample ID					LF2MW3	LF2MW4	MMW0001	MMW9006
Matrix					Groundwater	Groundwater	Groundwater	Groundwater
Depth Interval (ft)					-	-	-	-
Date Sampled					10/12/09	10/09/09	10/09/09	10/09/09
Parameter	**Units**	**ROD (1)**	**MEG (2)**	**MCL (3)**				Field Duplicate (1-1)
Metals (Non-Detect = MDL)								
Manganese	UG/L	-	500	-	0.463 U	0.247 U	0.690 U	0.247 U
Mercury	UG/L	-	2	2	0.019 U	0.019 U	0.019 U	0.019 U
Nickel	UG/L	-	140	-	1.1 U	1.1 U	1.1 U	1.1 U
Potassium	UG/L	-	-	-	644 J	466 J	836 J	649 J
Selenium	UG/L	-	35	50	6.7 U	4.8 U	5.3 J	4.8 U
Silver	UG/L	-	35	-	0.829 U	0.829 U	0.829 U	0.829 U
Sodium	UG/L	-	20000	-	1,760	1,980	3,690	3,240
Thallium	UG/L	-	0.5	2	2.5 U	2.5 U	2.5 U	2.5 U
Zinc	UG/L	8400	2000	-	4.6 J	3.7 J	3.0 J	2.6 U
Miscellaneous Parameters (Non-Detect = PQL)								
Cyanide	MG/L	-	-	-	0.010 U	0.010 U	0.010 U	0.010 U
Field Parameters (Non-Detect = PQL)								
Dissolved Oxygen	MG/L	-	-	-	6.02	5.10	1.40	NA
Oxidation Reduction Potential	MILLIVOLTS	-	-	-	194	51	152	NA
pH	PH UNITS	-	-	-	6.95	7.13	7.06	NA
Specific Conductance	US/CM	-	-	-	413.8	444.2	484.3	NA
Temperature	DEG C	-	-	-	6.70	8.27	7.75	NA
Turbidity	NTU	-	-	-	0.98	0.42	0.57	NA

ROD (1)- LF-2 Bedrock Groundwater Action Levels from Final Operable Unit 4 Record of Decision (ABB-ES, 1996).

MEG (2)- Maximum Exposure Guidelines from Maine Department of Human Services Memorandum "Maine CDC Maximum Exposure Guidelines (MEGs) for Drinking Water", December 5, 2008.

MCL (3)- Environmental Protection Agency MCL Value.

Flags assigned during chemistry validation are shown.

Concentration Exceeds ROD (1)

Concentration Exceeds MEG (2)

Border Concentration Exceeds MCL (3)

U - Not detected above the reported quantitation limit; J - The reported concentration is an estimated value.
D - Result reported from a secondary dilution analysis.; R - The data is rejected.; NA - Not Analyzed
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TABLE B-1
LANDFILL 2 COMPLIANCE BOUNDARY WELLS - 2009 EPA PRIORITY POLLUTANT GROUNDWATER ANALYTICAL RESULTS
FIVE-YEAR REVIEW REPORT
FORMER LORING AIR FORCE BASE - LIMESTONE, MAINE

Location ID					LF2MW3	LF2MW4	MMW0001	MMW0001
Sample ID					LF2MW3	LF2MW4	MMW0001	MMW9006
Matrix					Groundwater	Groundwater	Groundwater	Groundwater
Depth Interval (ft)					-	-	-	-
Date Sampled					10/12/09	10/09/09	10/09/09	10/09/09
Parameter	**Units**	**ROD (1)**	**MEG (2)**	**MCL (3)**				Field Duplicate (1-1)
Dioxins & Furans (Non-Detect = PQL)								
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	PG/L	-	-	-	8.33 U	8.77 U	8.77 U	8.93 U

ROD (1)- LF-2 Bedrock Groundwater Action Levels from Final Operable Unit 4 Record of Decision (ABB-ES, 1996).

MEG (2)- Maximum Exposure Guidelines from Maine Department of Human Services Memorandum "Maine CDC Maximum Exposure Guidelines (MEGs) for Drinking Water", December 5, 2008.

MCL (3)- Environmental Protection Agency MCL Value.

Flags assigned during chemistry validation are shown.

Concentration Exceeds ROD (1)

Concentration Exceeds MEG (2)

Border Concentration Exceeds MCL (3)

U - Not detected above the reported quantitation limit; J - The reported concentration is an estimated value.
D - Result reported from a secondary dilution analysis.; R - The data is rejected.; NA - Not Analyzed
B - The reported concentration is above the method detection limit but below the quantitation limit.
PQL - Practical quantitation limit. MDL - Method detection limit.

Detection Limits shown are PQL

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TABLE B-2
LANDFILL 3 COMPLIANCE BOUNDARY WELLS - 2009 EPA PRIORITY POLLUTANT GROUNDWATER ANALYTICAL RESULTS
FIVE-YEAR REVIEW REPORT
FORMER LORING AIR FORCE BASE - LIMESTONE, MAINE

Location ID					MMW0018A	MMW0018A	MMW0018B		
Sample ID					MMW0018A	MMW9005	MMW0018B		
Matrix					Groundwater	Groundwater	Groundwater		
Depth Interval (ft)					-	-	-		
Date Sampled					10/09/09	10/09/09	10/09/09		
Parameter	**Units**	**ROD (1)**	**MEG (2)**	**MCL (3)**		Field Duplicate (1-1)			
Volatile Organic Compounds (Non-Detect = PQL)									
1,1,1-Trichloroethane	UG/L	-	200	200	1.0 U	1.0 U	1.0 U		
1,1,2,2-Tetrachloroethane	UG/L	-	1.8	-	1.0 U	1.0 U	1.0 U		
1,1,2-Trichloroethane	UG/L	-	6	5	1.0 U	1.0 U	1.0 U		
1,1-Dichloroethane	UG/L	-	70	-	1.0 U	1.0 U	1.0 U		
1,1-Dichloroethene	UG/L	-	0.6	7	1.0 U	1.0 U	1.0 U		
1,2-Dichloroethane	UG/L	-	4	5	1.0 U	1.0 U	1.0 U		
1,2-Dichloropropane	UG/L	-	5	5	1.0 U	1.0 U	1.0 U		
1,4-Dichlorobenzene	UG/L	27	21	75	1.0 U	1.0 U	1.0 U		
2-Chloroethyl vinyl ether	UG/L	-	-	-	R	R	R		
Acrolein	UG/L	-	-	-	R	R	R		
Acrylonitrile	UG/L	-	0.6	-	10 U	10 U	10 U		
Benzene	UG/L	5	6	5	1.0 U	1.0 U	1.0 U		
Bromodichloromethane	UG/L	-	6	-	1.0 U	1.0 U	1.0 U		
Bromoform	UG/L	-	44	-	1.0 U	1.0 U	1.0 U		
Bromomethane	UG/L	-	10	-	1.0 U	1.0 U	1.0 U		
Carbon tetrachloride	UG/L	-	3	5	1.0 U	1.0 U	1.0 U		
Chlorobenzene	UG/L	-	140	-	1.0 U	1.0 U	1.0 U		
Chloroethane	UG/L	-	-	-	1.0 U	1.0 U	1.0 U		

ROD (1)- LF-3 Bedrock and Overburden Groundwater Action Levels from Final Operable Unit 4 Record of Decision (ABB-ES, 1996).

MEG (2)- Maximum Exposure Guidelines from Maine Department of Human Services Memorandum "Maine CDC Maximum Exposure Guidelines (MEGs) for Drinking Water", December 5, 2008.

MCL (3)- Environmental Protection Agency MCL Value.

Flags assigned during chemistry validation are shown.

Concentration Exceeds ROD (1)

Concentration Exceeds MEG (2)

Border Concentration Exceeds MCL (3)

U - Not detected above the reported quantitation limit; J - The reported concentration is an estimated value.
D - Result reported from a secondary dilution analysis.; R - The data is rejected.; NA - Not Analyzed
B - The reported concentration is above the method detection limit but below the quantitation limit.
PQL - Practical quantitation limit. MDL - Method detection limit.

Detection Limits shown are PQL

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TABLE B-2
LANDFILL 3 COMPLIANCE BOUNDARY WELLS - 2009 EPA PRIORITY POLLUTANT GROUNDWATER ANALYTICAL RESULTS
FIVE-YEAR REVIEW REPORT
FORMER LORING AIR FORCE BASE - LIMESTONE, MAINE

Location ID					MMW0018A	MMW0018A	MMW0018B		
Sample ID					MMW0018A	MMW9005	MMW0018B		
Matrix					Groundwater	Groundwater	Groundwater		
Depth Interval (ft)					-	-	-		
Date Sampled					10/09/09	10/09/09	10/09/09		
Parameter	**Units**	**ROD (1)**	**MEG (2)**	**MCL (3)**		Field Duplicate (1-1)			
Volatile Organic Compounds (Non-Detect = PQL)									
Chloroform	UG/L	-	70	80	1.0 U	1.0 U	1.0 U		
Chloromethane	UG/L	-	3	-	1.0 U	1.0 U	1.0 U		
cis-1,2-Dichloroethene	UG/L	-	70	70	1.0 U	1.0 U	1.0 U		
cis-1,3-Dichloropropene	UG/L	-	-	-	1.0 U	1.0 U	1.0 U		
Dibromochloromethane	UG/L	-	4	-	1.0 U	1.0 U	1.0 U		
Ethylbenzene	UG/L	-	70	700	1.0 U	1.0 U	1.0 U		
Methylene chloride	UG/L	-	47	5	1.0 U	1.0 U	1.0 U		
Tetrachloroethylene (PCE)	UG/L	3	7	5	1.0 U	1.0 U	1.0 U		
Toluene	UG/L	-	1400	1000	1.0 U	1.0 U	1.0 U		
trans-1,2-Dichloroethene	UG/L	-	140	100	1.0 U	1.0 U	1.0 U		
trans-1,3-Dichloropropene	UG/L	-	-	-	1.0 U	1.0 U	1.0 U		
Trichloroethylene (TCE)	UG/L	5	32	5	1.0 U	1.0 U	1.0 U		
Trichlorofluoromethane	UG/L	-	2100	-	1.0 U	1.0 U	1.0 U		
Vinyl chloride	UG/L	0.15	0.2	2	1.0 U	1.0 U	1.0 U		
Selected Ion Monitoring (Non-Detect = PQL)									
Vinyl chloride	UG/L	0.15	0.2	2	0.10 U	0.10 U	0.10 U		
Semivolatile Organic Compounds (Non-Detect = PQL)									
1,2,4-Trichlorobenzene	UG/L	-	-	70	9.4 U	9.4 U	9.4 U		

ROD (1)- LF-3 Bedrock and Overburden Groundwater Action Levels from Final Operable Unit 4 Record of Decision (ABB-ES, 1996).

MEG (2)- Maximum Exposure Guidelines from Maine Department of Human Services Memorandum "Maine CDC Maximum Exposure Guidelines (MEGs) for Drinking Water", December 5, 2008.

MCL (3)- Environmental Protection Agency MCL Value.

Flags assigned during chemistry validation are shown.

Concentration Exceeds ROD (1)

Concentration Exceeds MEG (2)

Border Concentration Exceeds MCL (3)

U - Not detected above the reported quantitation limit; J - The reported concentration is an estimated value.
D - Result reported from a secondary dilution analysis.; R - The data is rejected.; NA - Not Analyzed
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TABLE B-2
LANDFILL 3 COMPLIANCE BOUNDARY WELLS - 2009 EPA PRIORITY POLLUTANT GROUNDWATER ANALYTICAL RESULTS
FIVE-YEAR REVIEW REPORT
FORMER LORING AIR FORCE BASE - LIMESTONE, MAINE

Location ID					MMW0018A	MMW0018A	MMW0018B		
Sample ID					MMW0018A	MMW9005	MMW0018B		
Matrix					Groundwater	Groundwater	Groundwater		
Depth Interval (ft)					-	-	-		
Date Sampled					10/09/09	10/09/09	10/09/09		
Parameter	**Units**	**ROD (1)**	**MEG (2)**	**MCL (3)**		Field Duplicate (1-1)			
Semivolatile Organic Compounds (Non-Detect = PQL)									
1,2-Dichlorobenzene	UG/L	-	63	600	9.4 U	9.4 U	9.4 U		
1,3-Dichlorobenzene	UG/L	-	60	-	9.4 U	9.4 U	9.4 U		
1,4-Dichlorobenzene	UG/L	27	21	-	9.4 U	9.4 U	9.4 U		
1,4-Dioxane	UG/L	-	32	-	0.19 U	0.19 U	0.19 U		
2,2'-oxybis(1-Chloropropane)	UG/L	-	-	-	9.4 U	9.4 U	9.4 U		
2,4,5-Trichlorophenol	UG/L	-	-	-	9.4 U	9.4 U	9.4 U		
2,4,6-Trichlorophenol	UG/L	-	32	-	9.4 U	9.4 U	9.4 U		
2,4-Dichlorophenol	UG/L	-	21	-	9.4 U	9.4 U	9.4 U		
2,4-Dimethylphenol	UG/L	-	-	-	9.4 U	9.4 U	9.4 U		
2,4-Dinitrophenol	UG/L	-	14	-	47 U	47 U	47 U		
2,4-Dinitrotoluene	UG/L	-	0.5	-	9.4 U	9.4 U	9.4 U		
2,6-Dinitrotoluene	UG/L	-	0.5	-	9.4 U	9.4 U	9.4 U		
2-Chloronaphthalene	UG/L	-	-	-	9.4 U	9.4 U	9.4 U		
2-Chlorophenol	UG/L	-	35	-	9.4 U	9.4 U	9.4 U		
2-Methylnaphthalene	UG/L	-	-	-	9.4 U	9.4 U	9.4 U		
2-Methylphenol (o-cresol)	UG/L	-	-	-	9.4 U	9.4 U	9.4 U		
2-Nitroaniline	UG/L	-	-	-	47 U	47 U	47 U		
2-Nitrophenol	UG/L	-	-	-	9.4 U	9.4 U	9.4 U		

ROD (1)- LF-3 Bedrock and Overburden Groundwater Action Levels from Final Operable Unit 4 Record of Decision (ABB-ES, 1996).

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Concentration Exceeds ROD (1)

Concentration Exceeds MEG (2)

Border Concentration Exceeds MCL (3)

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D - Result reported from a secondary dilution analysis.; R - The data is rejected.; NA - Not Analyzed
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TABLE B-2
LANDFILL 3 COMPLIANCE BOUNDARY WELLS - 2009 EPA PRIORITY POLLUTANT GROUNDWATER ANALYTICAL RESULTS
FIVE-YEAR REVIEW REPORT
FORMER LORING AIR FORCE BASE - LIMESTONE, MAINE

Location ID					MMW0018A	MMW0018A	MMW0018B		
Sample ID					MMW0018A	MMW9005	MMW0018B		
Matrix					Groundwater	Groundwater	Groundwater		
Depth Interval (ft)					-	-	-		
Date Sampled					10/09/09	10/09/09	10/09/09		
Parameter	**Units**	**ROD (1)**	**MEG (2)**	**MCL (3)**		Field Duplicate (1-1)			
Semivolatile Organic Compounds (Non-Detect = PQL)									
3,3'-Dichlorobenzidine	UG/L	-	-	-	9.4 U	9.4 U	9.4 U		
3-Nitroaniline	UG/L	-	-	-	47 U	47 U	47 U		
3&4-Methylphenol (m&p-cresol)	UG/L	140	3.5	-	9.4 U	9.4 U	9.4 U		
4,6-Dinitro-2-methylphenol	UG/L	-	-	-	47 U	47 U	47 U		
4-Bromophenyl phenyl ether	UG/L	-	-	-	9.4 U	9.4 U	9.4 U		
4-Chloro-3-methylphenol	UG/L	-	-	-	9.4 U	9.4 U	9.4 U		
4-Chloroaniline	UG/L	-	-	-	9.4 U	9.4 U	9.4 U		
4-Chlorophenyl phenyl ether	UG/L	-	-	-	9.4 U	9.4 U	9.4 U		
4-Nitroaniline	UG/L	-	-	-	47 U	47 U	47 U		
4-Nitrophenol	UG/L	-	60	-	47 U	47 U	47 U		
Acenaphthene	UG/L	-	-	-	9.4 U	9.4 U	9.4 U		
Acenaphthylene	UG/L	-	-	-	9.4 U	9.4 U	9.4 U		
Anthracene	UG/L	-	-	-	9.4 U	9.4 U	9.4 U		
Benzo(a)anthracene	UG/L	-	-	-	9.4 U	9.4 U	9.4 U		
Benzo(a)pyrene	UG/L	-	0.05	0.2	9.4 U	9.4 U	9.4 U		
Benzo(b)fluoranthene	UG/L	-	-	-	9.4 U	9.4 U	9.4 U		
Benzo(g,h,i)perylene	UG/L	-	-	-	9.4 U	9.4 U	9.4 U		

ROD (1)- LF-3 Bedrock and Overburden Groundwater Action Levels from Final Operable Unit 4 Record of Decision (ABB-ES, 1996).

MEG (2)- Maximum Exposure Guidelines from Maine Department of Human Services Memorandum "Maine CDC Maximum Exposure Guidelines (MEGs) for Drinking Water", December 5, 2008.

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Concentration Exceeds ROD (1)

Concentration Exceeds MEG (2)

Border Concentration Exceeds MCL (3)

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D - Result reported from a secondary dilution analysis.; R - The data is rejected.; NA - Not Analyzed
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TABLE B-2
LANDFILL 3 COMPLIANCE BOUNDARY WELLS - 2009 EPA PRIORITY POLLUTANT GROUNDWATER ANALYTICAL RESULTS
FIVE-YEAR REVIEW REPORT
FORMER LORING AIR FORCE BASE - LIMESTONE, MAINE

Location ID					MMW0018A	MMW0018A	MMW0018B		
Sample ID					MMW0018A	MMW9005	MMW0018B		
Matrix					Groundwater	Groundwater	Groundwater		
Depth Interval (ft)					-	-	-		
Date Sampled					10/09/09	10/09/09	10/09/09		
Parameter	**Units**	**ROD (1)**	**MEG (2)**	**MCL (3)**		Field Duplicate (1-1)			
Semivolatile Organic Compounds (Non-Detect = PQL)									
Benzo(k)fluoranthene	UG/L	-	-	-	9.4 U	9.4 U	9.4 U		
Benzyl alcohol	UG/L	-	-	-	9.4 U	9.4 U	9.4 U		
Benzyl butyl phthalate	UG/L	-	-	-	9.4 U	9.4 U	9.4 U		
bis(2-Chloroethoxy) methane	UG/L	-	-	-	9.4 U	9.4 U	9.4 U		
bis(2-Chloroethyl) ether	UG/L	-	0.3	-	9.4 U	9.4 U	9.4 U		
bis(2-Ethylhexyl) phthalate	UG/L	10	25	6	9.4 U	9.4 U	9.4 U		
Carbazole	UG/L	-	-	-	9.4 U	9.4 U	9.4 U		
Chrysene	UG/L	-	-	-	9.4 U	9.4 U	9.4 U		
Dibenz(a,h)anthracene	UG/L	-	-	-	9.4 U	9.4 U	9.4 U		
Dibenzofuran	UG/L	-	-	-	9.4 U	9.4 U	9.4 U		
Diethyl phthalate	UG/L	-	5000	-	9.4 U	9.4 U	9.4 U		
Dimethyl phthalate	UG/L	-	-	-	9.4 U	9.4 U	9.4 U		
Di-n-butyl phthalate	UG/L	-	700	-	9.4 U	9.4 U	9.4 U		
Di-n-octylphthalate	UG/L	-	-	-	9.4 U	9.4 U	9.4 U		
Fluoranthene	UG/L	-	-	-	9.4 U	9.4 U	9.4 U		
Fluorene	UG/L	-	-	-	9.4 U	9.4 U	9.4 U		
Hexachlorobenzene	UG/L	-	0.2	1	9.4 U	9.4 U	9.4 U		
Hexachlorobutadiene	UG/L	-	4	-	9.4 U	9.4 U	9.4 U		

ROD (1)- LF-3 Bedrock and Overburden Groundwater Action Levels from Final Operable Unit 4 Record of Decision (ABB-ES, 1996).

MEG (2)- Maximum Exposure Guidelines from Maine Department of Human Services Memorandum "Maine CDC Maximum Exposure Guidelines (MEGs) for Drinking Water", December 5, 2008.

MCL (3)- Environmental Protection Agency MCL Value.

Flags assigned during chemistry validation are shown.

Concentration Exceeds ROD (1)

Concentration Exceeds MEG (2)

Border Concentration Exceeds MCL (3)

U - Not detected above the reported quantitation limit; J - The reported concentration is an estimated value.
D - Result reported from a secondary dilution analysis.; R - The data is rejected.; NA - Not Analyzed
B - The reported concentration is above the method detection limit but below the quantitation limit.
PQL - Practical quantitation limit. MDL - Method detection limit.

Detection Limits shown are PQL

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[LOGDATE] BETWEEN #09/21/09# AND #12/21/09# AND [MATRIX] = 'WG' AND ([SACODE] = 'FD' OR [SACODE] = 'N') AND [PRCCODE] <> 'STD' AND ([LOCID] = 'MMW0018A' OR [LOCID] = 'MMW0018B') AND [PRCCODE] <> 'HC' AND [PARNAME] <> 'Alkalinity, bicarbonate (as CaCO3)' AND [PARNAME] <> 'Alkalinity, carbonate (as CaCO3)' AND [PARNAME] <> 'Alkalinity, hydroxide (as

TABLE B-2
LANDFILL 3 COMPLIANCE BOUNDARY WELLS - 2009 EPA PRIORITY POLLUTANT GROUNDWATER ANALYTICAL RESULTS
FIVE-YEAR REVIEW REPORT
FORMER LORING AIR FORCE BASE - LIMESTONE, MAINE

Location ID					MMW0018A	MMW0018A	MMW0018B		
Sample ID					MMW0018A	MMW9005	MMW0018B		
Matrix					Groundwater	Groundwater	Groundwater		
Depth Interval (ft)					-	-	-		
Date Sampled					10/09/09	10/09/09	10/09/09		
Parameter	**Units**	**ROD (1)**	**MEG (2)**	**MCL (3)**		Field Duplicate (1-1)			
Semivolatile Organic Compounds (Non-Detect = PQL)									
Hexachlorocyclopentadiene	UG/L	-	42	50	9.4 U	9.4 U	9.4 U		
Hexachloroethane	UG/L	-	7	-	9.4 U	9.4 U	9.4 U		
Indeno(1,2,3-c,d)pyrene	UG/L	-	-	-	9.4 U	9.4 U	9.4 U		
Isophorone	UG/L	-	370	-	9.4 U	9.4 U	9.4 U		
Naphthalene	UG/L	-	14	-	9.4 U	9.4 U	9.4 U		
Nitrobenzene	UG/L	-	3.5	-	9.4 U	9.4 U	9.4 U		
n-Nitrosodimethylamine	UG/L	-	-	-	9.4 U	9.4 U	9.4 U		
n-Nitrosodi-n-propylamine	UG/L	-	-	-	9.4 U	9.4 U	9.4 U		
n-Nitrosodiphenylamine	UG/L	-	-	-	9.4 U	9.4 U	9.4 U		
Pentachlorophenol	UG/L	-	3	1	47 U	47 U	47 U		
Phenanthrene	UG/L	-	-	-	9.4 U	9.4 U	9.4 U		
Phenol	UG/L	-	2100	-	9.4 U	9.4 U	9.4 U		
Pyrene	UG/L	-	-	-	9.4 U	9.4 U	9.4 U		
Organochlorine Pesticides (Non-Detect = PQL)									
4,4'-DDD	UG/L	-	-	-	0.094 U	0.094 U	0.094 U		
4,4'-DDE	UG/L	-	-	-	0.094 U	0.094 U	0.094 U		
4,4'-DDT	UG/L	-	1	-	0.094 U	0.094 U	0.094 U		
Aldrin	UG/L	-	0.02	-	0.047 U	0.047 U	0.047 U		

ROD (1)- LF-3 Bedrock and Overburden Groundwater Action Levels from Final Operable Unit 4 Record of Decision (ABB-ES, 1996).

MEG (2)- Maximum Exposure Guidelines from Maine Department of Human Services Memorandum "Maine CDC Maximum Exposure Guidelines (MEGs) for Drinking Water", December 5, 2008.

MCL (3)- Environmental Protection Agency MCL Value.

Flags assigned during chemistry validation are shown.

Concentration Exceeds ROD (1)

Concentration Exceeds MEG (2)

Border Concentration Exceeds MCL (3)

U - Not detected above the reported quantitation limit; J - The reported concentration is an estimated value.
D - Result reported from a secondary dilution analysis.; R - The data is rejected.; NA - Not Analyzed
B - The reported concentration is above the method detection limit but below the quantitation limit.
PQL - Practical quantitation limit. MDL - Method detection limit.

Detection Limits shown are PQL

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[LOGDATE] BETWEEN #09/21/09# AND #12/21/09# AND [MATRIX] = 'WG' AND ([SACODE] = 'FD' OR [SACODE] = 'N') AND [PRCCODE] <> 'STD' AND ([LOCID] = 'MMW0018A' OR [LOCID] = 'MMW0018B') AND [PRCCODE] <> 'HC' AND [PARNAME] <> 'Alkalinity, bicarbonate (as CaCO3)' AND [PARNAME] <> 'Alkalinity, carbonate (as CaCO3)' AND [PARNAME] <> 'Alkalinity, hydroxide (as

TABLE B-2
LANDFILL 3 COMPLIANCE BOUNDARY WELLS - 2009 EPA PRIORITY POLLUTANT GROUNDWATER ANALYTICAL RESULTS
FIVE-YEAR REVIEW REPORT
FORMER LORING AIR FORCE BASE - LIMESTONE, MAINE

Location ID					MMW0018A	MMW0018A	MMW0018B		
Sample ID					MMW0018A	MMW9005	MMW0018B		
Matrix					Groundwater	Groundwater	Groundwater		
Depth Interval (ft)					-	-	-		
Date Sampled					10/09/09	10/09/09	10/09/09		
Parameter	**Units**	**ROD (1)**	**MEG (2)**	**MCL (3)**		Field Duplicate (1-1)			
Organochlorine Pesticides (Non-Detect = PQL)									
alpha-BHC	UG/L	-	-	-	0.047 U	0.047 U	0.047 U		
alpha-Chlordane	UG/L	-	-	-	0.047 U	0.047 U	0.047 U		
beta-BHC	UG/L	-	-	-	0.047 U	0.047 U	0.047 U		
delta-BHC	UG/L	-	-	-	0.047 U	0.047 U	0.047 U		
Dieldrin	UG/L	-	0.02	-	0.094 U	0.094 U	0.094 U		
Endosulfan I	UG/L	-	42	-	0.047 U	0.047 U	0.047 U		
Endosulfan II	UG/L	-	42	-	0.094 U	0.094 U	0.094 U		
Endosulfan sulfate	UG/L	-	-	-	0.094 U	0.094 U	0.094 U		
Endrin	UG/L	-	2	2	0.094 U	0.094 U	0.094 U		
Endrin aldehyde	UG/L	-	-	-	0.094 U	0.094 U	0.094 U		
Endrin Ketone	UG/L	-	-	-	0.094 U	0.094 U	0.094 U		
gamma-BHC (Lindane)	UG/L	-	0.2	0.2	0.047 U	0.047 U	0.047 U		
gamma-Chlordane	UG/L	-	-	-	0.047 U	0.047 U	0.047 U		
Heptachlor	UG/L	-	0.08	0.4	0.047 U	0.047 U	0.047 U		
Heptachlor epoxide	UG/L	-	0.04	0.2	0.047 U	0.047 U	0.047 U		
Methoxychlor	UG/L	-	35	-	0.47 U	0.47 U	0.47 U		
Toxaphene	UG/L	-	0.3	3	0.94 U	0.94 U	0.94 U		

ROD (1)- LF-3 Bedrock and Overburden Groundwater Action Levels from Final Operable Unit 4 Record of Decision (ABB-ES, 1996).

MEG (2)- Maximum Exposure Guidelines from Maine Department of Human Services Memorandum "Maine CDC Maximum Exposure Guidelines (MEGs) for Drinking Water", December 5, 2008.

MCL (3)- Environmental Protection Agency MCL Value.

Flags assigned during chemistry validation are shown.

Concentration Exceeds ROD (1)

Concentration Exceeds MEG (2)

Border Concentration Exceeds MCL (3)

U - Not detected above the reported quantitation limit; J - The reported concentration is an estimated value.
D - Result reported from a secondary dilution analysis.; R - The data is rejected.; NA - Not Analyzed
B - The reported concentration is above the method detection limit but below the quantitation limit.
PQL - Practical quantitation limit. MDL - Method detection limit.

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TABLE B-2
LANDFILL 3 COMPLIANCE BOUNDARY WELLS - 2009 EPA PRIORITY POLLUTANT GROUNDWATER ANALYTICAL RESULTS
FIVE-YEAR REVIEW REPORT
FORMER LORING AIR FORCE BASE - LIMESTONE, MAINE

Location ID					MMW0018A	MMW0018A	MMW0018B		
Sample ID					MMW0018A	MMW9005	MMW0018B		
Matrix					Groundwater	Groundwater	Groundwater		
Depth Interval (ft)					-	-	-		
Date Sampled					10/09/09	10/09/09	10/09/09		
Parameter	**Units**	**ROD (1)**	**MEG (2)**	**MCL (3)**		Field Duplicate (1-1)			
Polychlorinated Biphenyl Mixtures (Aroclors) (Non-Detect = PQL)									
PCB-1016 (Aroclor 1016)	UG/L	-	0.5	-	0.94 U	0.94 U	0.94 U		
PCB-1221 (Aroclor 1221)	UG/L	-	0.5	-	1.9 U	1.9 U	1.9 U		
PCB-1232 (Aroclor 1232)	UG/L	-	0.5	-	0.94 U	0.94 U	0.94 U		
PCB-1242 (Aroclor 1242)	UG/L	-	0.5	-	0.94 U	0.94 U	0.94 U		
PCB-1248 (Aroclor 1248)	UG/L	-	0.5	-	0.94 U	0.94 U	0.94 U		
PCB-1254 (Aroclor 1254)	UG/L	-	0.5	-	0.94 U	0.94 U	0.94 U		
PCB-1260 (Aroclor 1260)	UG/L	-	0.5	-	0.94 U	0.94 U	0.94 U		
Metals (Non-Detect = MDL)									
Antimony	UG/L	-	3	6	3.9 U	3.9 U	3.9 U		
Arsenic	UG/L	-	10	10	3.2 U	3.2 U	3.2 U		
Beryllium	UG/L	-	-	-	0.119 U	0.119 U	0.119 U		
Cadmium	UG/L	5	3.5	5	0.119 U	0.119 U	0.119 U		
Calcium	UG/L	-	-	-	85,900	87,300	85,000		
Chromium, total	UG/L	-	40	100	0.475 U	0.475 U	0.815 J		
Copper	UG/L	-	1300	1300	1.6 U	1.6 U	1.6 U		
Iron	UG/L	8400	-	-	31.7 U	31.7 U	68.0 J		
Lead	UG/L	80	10	15	0.886 U	0.886 U	0.886 U		
Magnesium	UG/L	-	-	-	9,610	9,710	11,700		

ROD (1)- LF-3 Bedrock and Overburden Groundwater Action Levels from Final Operable Unit 4 Record of Decision (ABB-ES, 1996).

MEG (2)- Maximum Exposure Guidelines from Maine Department of Human Services Memorandum "Maine CDC Maximum Exposure Guidelines (MEGs) for Drinking Water", December 5, 2008.

MCL (3)- Environmental Protection Agency MCL Value.

Flags assigned during chemistry validation are shown.

Concentration Exceeds ROD (1)

Concentration Exceeds MEG (2)

Border Concentration Exceeds MCL (3)

U - Not detected above the reported quantitation limit; J - The reported concentration is an estimated value.
D - Result reported from a secondary dilution analysis.; R - The data is rejected.; NA - Not Analyzed
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TABLE B-2
LANDFILL 3 COMPLIANCE BOUNDARY WELLS - 2009 EPA PRIORITY POLLUTANT GROUNDWATER ANALYTICAL RESULTS
FIVE-YEAR REVIEW REPORT
FORMER LORING AIR FORCE BASE - LIMESTONE, MAINE

Location ID					MMW0018A	MMW0018A	MMW0018B		
Sample ID					MMW0018A	MMW9005	MMW0018B		
Matrix					Groundwater	Groundwater	Groundwater		
Depth Interval (ft)					-	-	-		
Date Sampled					10/09/09	10/09/09	10/09/09		
Parameter	**Units**	**ROD (1)**	**MEG (2)**	**MCL (3)**		Field Duplicate (1-1)			
Metals (Non-Detect = MDL)									
Manganese	UG/L	1300	500	-	0.247 U	0.247 U	1.8 U		
Mercury	UG/L	-	2	2	0.019 U	0.019 U	0.019 U		
Nickel	UG/L	-	140	-	1.1 U	1.1 U	1.1 U		
Potassium	UG/L	-	-	-	899 J	919 J	821 J		
Selenium	UG/L	-	35	50	4.8 U	4.8 U	4.8 U		
Silver	UG/L	-	35	-	0.829 U	0.829 U	0.829 U		
Sodium	UG/L	-	20000	-	2,510	2,620	3,220		
Thallium	UG/L	-	0.5	2	2.5 U	2.5 U	2.5 U		
Zinc	UG/L	8400	2000	-	2.6 U	2.6 U	4.8 J		
Miscellaneous Parameters (Non-Detect = PQL)									
Cyanide	MG/L	-	-	-	0.010 U	0.010 U	0.010 U		
Field Parameters (Non-Detect = PQL)									
Dissolved Oxygen	MG/L	-	-	-	6.28	NA	6.47		
Oxidation Reduction Potential	MILLIVOLTS	-	-	-	115	NA	119		
pH	PH UNITS	-	-	-	6.79	NA	6.96		
Specific Conductance	US/CM	-	-	-	452.2	NA	481.6		
Temperature	DEG C	-	-	-	6.58	NA	6.71		
Turbidity	NTU	-	-	-	1.58	NA	2.51		

ROD (1)- LF-3 Bedrock and Overburden Groundwater Action Levels from Final Operable Unit 4 Record of Decision (ABB-ES, 1996).

MEG (2)- Maximum Exposure Guidelines from Maine Department of Human Services Memorandum "Maine CDC Maximum Exposure Guidelines (MEGs) for Drinking Water", December 5, 2008.

MCL (3)- Environmental Protection Agency MCL Value.

Flags assigned during chemistry validation are shown.

Concentration Exceeds ROD (1)

Concentration Exceeds MEG (2)

Border Concentration Exceeds MCL (3)

U - Not detected above the reported quantitation limit; J - The reported concentration is an estimated value.
D - Result reported from a secondary dilution analysis.; R - The data is rejected.; NA - Not Analyzed
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[LOGDATE] BETWEEN #09/21/09# AND #12/21/09# AND [MATRIX] = 'WG' AND ([SACODE] = 'FD' OR [SACODE] = 'N') AND [PRCCODE] <> 'STD' AND ([LOCID] = 'MMW0018A' OR [LOCID] = 'MMW0018B') AND [PRCCODE] <> 'HC' AND [PARNAME] <> 'Alkalinity, bicarbonate (as CaCO3)' AND [PARNAME] <> 'Alkalinity, carbonate (as CaCO3)' AND [PARNAME] <> 'Alkalinity, hydroxide (as

TABLE B-2
LANDFILL 3 COMPLIANCE BOUNDARY WELLS - 2009 EPA PRIORITY POLLUTANT GROUNDWATER ANALYTICAL RESULTS
FIVE-YEAR REVIEW REPORT
FORMER LORING AIR FORCE BASE - LIMESTONE, MAINE

Location ID					MMW0018A	MMW0018A	MMW0018B		
Sample ID					MMW0018A	MMW9005	MMW0018B		
Matrix					Groundwater	Groundwater	Groundwater		
Depth Interval (ft)					-	-	-		
Date Sampled					10/09/09	10/09/09	10/09/09		
Parameter	**Units**	**ROD (1)**	**MEG (2)**	**MCL (3)**		Field Duplicate (1-1)			
Dioxins & Furans (Non-Detect = PQL)									
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	PG/L	-	-	-	9.09 U	10.1 U	9.62 U		

ROD (1)- LF-3 Bedrock and Overburden Groundwater Action Levels from Final Operable Unit 4 Record of Decision (ABB-ES, 1996).

MEG (2)- Maximum Exposure Guidelines from Maine Department of Human Services Memorandum "Maine CDC Maximum Exposure Guidelines (MEGs) for Drinking Water", December 5, 2008.

MCL (3)- Environmental Protection Agency MCL Value.

Flags assigned during chemistry validation are shown.

Concentration Exceeds ROD (1)

Concentration Exceeds MEG (2)

Border Concentration Exceeds MCL (3)

U - Not detected above the reported quantitation limit; J - The reported concentration is an estimated value.
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[LOGDATE] BETWEEN #09/21/09# AND #12/21/09# AND [MATRIX] = 'WG' AND ([SACODE] = 'FD' OR [SACODE] = 'N') AND [PRCCODE] <> 'STD' AND ([LOCID] = 'MMW0018A' OR [LOCID] = 'MMW0018B') AND [PRCCODE] <> 'HC' AND [PARNAME] <> 'Alkalinity, bicarbonate (as CaCO3)' AND [PARNAME] <> 'Alkalinity, carbonate (as CaCO3)' AND [PARNAME] <> 'Alkalinity, hydroxide (as

TABLE B-3
LANDFILL 2 - 2009 POST-CLOSURE MONITORING GROUNDWATER ANALYTICAL RESULTS
FIVE-YEAR REVIEW REPORT
FORMER LORING AIR FORCE BASE - LIMESTONE, MAINE

Location ID					JMW0801B	JMW0806	JMW0882	LF2MW1	LF2MW2
Sample ID					JMW0801B	JMW0806	JMW0882	LF2MW1	LF29005
Matrix					Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Depth Interval (ft)					-	-	-	-	-
Date Sampled					05/13/09	05/14/09	05/14/09	05/14/09	05/14/09
Parameter	**Units**	**ROD (1)**	**MEG (2)**	**MCL (3)**					Field Duplicate (1-1)
Volatile Organic Compounds (Non-Detect = PQL)									
Tetrachloroethylene (PCE)	UG/L	3	7	5	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Vinyl chloride	UG/L	0.15	0.2	2	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Selected Ion Monitoring (Non-Detect = PQL)									
Vinyl chloride	UG/L	0.15	0.2	2	0.090 J	0.10 U	0.10	0.10 U	0.10 U
Semivolatile Organic Compounds (Non-Detect = PQL)									
bis(2-Ethylhexyl) phthalate	UG/L	10	25	6	10 U	9.8 U	9.4 U	9.6 U	9.5 U
Petroleum Hydrocarbon Mixtures (Non-Detect = PQL)									
Diesel Range Organics	UG/L	-	50	-	NA	NA	NA	NA	NA
Gasoline Range Organics	UG/L	-	50	-	NA	NA	NA	NA	NA
Metals (Non-Detect = MDL)									
Arsenic	UG/L	-	10	10	3.2 U	3.2 U	3.2 U	3.2 U	3.2 U
Cadmium	UG/L	5	3.5	5	0.12 U	0.12 U	0.12 U	0.12 U	0.12 U
Calcium	UG/L	-	-	-	81,600	92,000	156,000	86,700	130,000
Iron	UG/L	8400	-	-	77.4 J	7.7 U	32,400	7.7 U	7.7 U
Lead	UG/L	80	10	15	0.89 U	0.89 U	0.89 U	0.89 U	0.89 U
Magnesium	UG/L	-	-	-	19,800	7,690	20,100	13,300	12,800
Potassium	UG/L	-	-	-	1,130 J	564 J	8,000	1,330 J	1,350 J
Sodium	UG/L	-	20000	-	6,360	1,880	13,400	5,680	7,070

ROD (1)- LF-2 Bedrock Groundwater Action Levels from Final Operable Unit 4 Record of Decision (ABB-ES, 1996).

MEG (2)- Maximum Exposure Guidelines from Maine Department of Human Services Memorandum "Maine CDC Maximum Exposure Guidelines (MEGs) for Drinking Water", December 5, 2008.

MCL (3)- Environmental Protection Agency MCL Value.

Flags assigned during chemistry validation are shown.

Concentration Exceeds ROD (1)

Concentration Exceeds MEG (2)

Border Concentration Exceeds MCL (3)

U - Not detected above the reported quantitation limit; J - The reported concentration is an estimated value.
D - Result reported from a secondary dilution analysis.; R - The data is rejected.; NA - Not Analyzed
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Detection Limits shown are PQL

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[LOGDATE] BETWEEN #03/21/09# AND #8/01/09# AND ([MATRIX] = 'WG' OR [MATRIX] = 'WP') AND ([SACODE] = 'FD' OR [SACODE] = 'N' OR [SACODE] = 'FD') AND [SITEID] = '8' AND [PRCCODE] <> 'STD'

TABLE B-3
LANDFILL 2 - 2009 POST-CLOSURE MONITORING GROUNDWATER ANALYTICAL RESULTS
FIVE-YEAR REVIEW REPORT
FORMER LORING AIR FORCE BASE - LIMESTONE, MAINE

Location ID					JMW0801B	JMW0806	JMW0882	LF2MW1	LF2MW2
Sample ID					JMW0801B	JMW0806	JMW0882	LF2MW1	LF29005
Matrix					Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Depth Interval (ft)					-	-	-	-	-
Date Sampled					05/13/09	05/14/09	05/14/09	05/14/09	05/14/09
Parameter	**Units**	**ROD (1)**	**MEG (2)**	**MCL (3)**					Field Duplicate (1-1)
Metals (Non-Detect = MDL)									
Zinc	UG/L	8400	2000	-	18.2 J	3.3 J	8.0 J	3.0 J	1.9 U
Miscellaneous Parameters (Non-Detect = PQL)									
Alkalinity, bicarbonate (as CaCO3)	MG/L	-	-	-	252	272	536	289	348
Alkalinity, carbonate (as CaCO3)	MG/L	-	-	-	20 U	20 U	40 U	20 U	20 U
Alkalinity, hydroxide (as CaCO3)	MG/L	-	-	-	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Alkalinity, total (as CaCO3)	MG/L	-	-	-	252	272	536	289	348
Chloride (as Cl)	MG/L	-	-	-	39.9	2.0 U	7.9	4.5	16.8
Sulfate (as SO4)	MG/L	-	-	-	12.7	14.8	2.0 U	16.2	46.7
Field Parameters (Non-Detect = PQL)									
Dissolved Oxygen	MG/L	-	-	-	1.98	1.38	2.39	3.30	NA
Oxidation Reduction Potential	MILLIVOLTS	-	-	-	28	167	-83	90	NA
pH	PH UNITS	-	-	-	7.16	6.87	6.46	6.95	NA
Specific Conductance	US/CM	-	-	-	593.9	527.7	1,073	572.6	NA
Temperature	DEG C	-	-	-	14.20	9.95	8.93	9.04	NA
Turbidity	NTU	-	-	-	1.64	0.22	0.86	0.39	NA

ROD (1)- LF-2 Bedrock Groundwater Action Levels from Final Operable Unit 4 Record of Decision (ABB-ES, 1996).

MEG (2)- Maximum Exposure Guidelines from Maine Department of Human Services Memorandum "Maine CDC Maximum Exposure Guidelines (MEGs) for Drinking Water", December 5, 2008.

MCL (3)- Environmental Protection Agency MCL Value.

Flags assigned during chemistry validation are shown.

Concentration Exceeds ROD (1)

Concentration Exceeds MEG (2)

Border Concentration Exceeds MCL (3)

U - Not detected above the reported quantitation limit; J - The reported concentration is an estimated value.
D - Result reported from a secondary dilution analysis.; R - The data is rejected.; NA - Not Analyzed
B - The reported concentration is above the method detection limit but below the quantitation limit.
PQL - Practical quantitation limit. MDL - Method detection limit.

Detection Limits shown are PQL

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[LOGDATE] BETWEEN #03/21/09# AND #8/01/09# AND ([MATRIX] = 'WG' OR [MATRIX] = 'WP') AND ([SACODE] = 'FD' OR [SACODE] = 'N' OR [SACODE] = 'FD') AND [SITEID] = '8' AND [PRCCODE] <> 'STD'

TABLE B-3
LANDFILL 2 - 2009 POST-CLOSURE MONITORING GROUNDWATER ANALYTICAL RESULTS
FIVE-YEAR REVIEW REPORT
FORMER LORING AIR FORCE BASE - LIMESTONE, MAINE

Location ID					LF2MW2	LF2MW3	LF2MW3	LF2MW4	LF2MW5
Sample ID					LF2MW2	LF2MW3	LF2MW3	LF2MW4	LF2MW5
Matrix					Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Depth Interval (ft)					-	-	-	-	-
Date Sampled					05/14/09	05/13/09	05/29/09	05/13/09	05/13/09
Parameter	**Units**	**ROD (1)**	**MEG (2)**	**MCL (3)**					
Volatile Organic Compounds (Non-Detect = PQL)									
Tetrachloroethylene (PCE)	UG/L	3	7	5	1.0 U	1.0 U	NA	1.0 U	1.0 U
Vinyl chloride	UG/L	0.15	0.2	2	1.0 U	1.0 U	NA	1.0 U	1.0 U
Selected Ion Monitoring (Non-Detect = PQL)									
Vinyl chloride	UG/L	0.15	0.2	2	0.10 U	0.10 U	NA	0.10 U	0.10 U
Semivolatile Organic Compounds (Non-Detect = PQL)									
bis(2-Ethylhexyl) phthalate	UG/L	10	25	6	9.5 U	10 U	NA	9.4 U	9.9 U
Petroleum Hydrocarbon Mixtures (Non-Detect = PQL)									
Diesel Range Organics	UG/L	-	50	-	NA	NA	50 U	50 U	NA
Gasoline Range Organics	UG/L	-	50	-	NA	36	NA	25 U	NA
Metals (Non-Detect = MDL)									
Arsenic	UG/L	-	10	10	3.2 U	3.2 U	NA	3.2 U	3.2 U
Cadmium	UG/L	5	3.5	5	0.12 U	0.12 U	NA	0.12 U	0.12 U
Calcium	UG/L	-	-	-	132,000	57,300	NA	83,100	87,000
Iron	UG/L	8400	-	-	7.7 U	63.6 J	NA	7.7 U	19.2 J
Lead	UG/L	80	10	15	0.89 U	0.89 U	NA	0.89 U	0.89 U
Magnesium	UG/L	-	-	-	13,100	5,340	NA	8,000	3,940
Potassium	UG/L	-	-	-	1,360 J	531 J	NA	484 J	1,190 J
Sodium	UG/L	-	20000	-	7,210	1,330	NA	2,100	36,900

ROD (1)- LF-2 Bedrock Groundwater Action Levels from Final Operable Unit 4 Record of Decision (ABB-ES, 1996).

MEG (2)- Maximum Exposure Guidelines from Maine Department of Human Services Memorandum "Maine CDC Maximum Exposure Guidelines (MEGs) for Drinking Water", December 5, 2008.

MCL (3)- Environmental Protection Agency MCL Value.

Flags assigned during chemistry validation are shown.

Concentration Exceeds ROD (1)

Concentration Exceeds MEG (2)

Border Concentration Exceeds MCL (3)

U - Not detected above the reported quantitation limit; J - The reported concentration is an estimated value.
D - Result reported from a secondary dilution analysis.; R - The data is rejected.; NA - Not Analyzed
B - The reported concentration is above the method detection limit but below the quantitation limit.
PQL - Practical quantitation limit. MDL - Method detection limit.

Detection Limits shown are PQL

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[LOGDATE] BETWEEN #03/21/09# AND #8/01/09# AND ([MATRIX] = 'WG' OR [MATRIX] = 'WP') AND ([SACODE] = 'FD' OR [SACODE] = 'N' OR [SACODE] = 'FD') AND [SITEID] = '8' AND [PRCCODE] <> 'STD'

TABLE B-3
LANDFILL 2 - 2009 POST-CLOSURE MONITORING GROUNDWATER ANALYTICAL RESULTS
FIVE-YEAR REVIEW REPORT
FORMER LORING AIR FORCE BASE - LIMESTONE, MAINE

Location ID					LF2MW2	LF2MW3	LF2MW3	LF2MW4	LF2MW5
Sample ID					LF2MW2	LF2MW3	LF2MW3	LF2MW4	LF2MW5
Matrix					Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Depth Interval (ft)					-	-	-	-	-
Date Sampled					05/14/09	05/13/09	05/29/09	05/13/09	05/13/09
Parameter	**Units**	**ROD (1)**	**MEG (2)**	**MCL (3)**					
Metals (Non-Detect = MDL)									
Zinc	UG/L	8400	2000	-	3.7 J	4.4 J	NA	2.2 J	28.2 J
Miscellaneous Parameters (Non-Detect = PQL)									
Alkalinity, bicarbonate (as CaCO3)	MG/L	-	-	-	349	164	NA	244	165
Alkalinity, carbonate (as CaCO3)	MG/L	-	-	-	20 U	10 U	NA	10 U	8.0 U
Alkalinity, hydroxide (as CaCO3)	MG/L	-	-	-	2.0 U	2.0 U	NA	2.0 U	2.0 U
Alkalinity, total (as CaCO3)	MG/L	-	-	-	349	164	NA	244	165
Chloride (as Cl)	MG/L	-	-	-	16.6	2.0 U	NA	2.0 U	124
Sulfate (as SO4)	MG/L	-	-	-	46.1	7.2	NA	9.6	11.7
Field Parameters (Non-Detect = PQL)									
Dissolved Oxygen	MG/L	-	-	-	3.76	NA	9.45	8.80	8.64
Oxidation Reduction Potential	MILLIVOLTS	-	-	-	121	NA	209	14	97
pH	PH UNITS	-	-	-	6.74	NA	7.12	8.88	7.29
Specific Conductance	US/CM	-	-	-	754.4	NA	361.9	474.1	713.0
Temperature	DEG C	-	-	-	8.15	NA	7.30	9.61	11.83
Turbidity	NTU	-	-	-	0.30	NA	0.47	0.57	0.85

ROD (1)- LF-2 Bedrock Groundwater Action Levels from Final Operable Unit 4 Record of Decision (ABB-ES, 1996).

MEG (2)- Maximum Exposure Guidelines from Maine Department of Human Services Memorandum "Maine CDC Maximum Exposure Guidelines (MEGs) for Drinking Water", December 5, 2008.

MCL (3)- Environmental Protection Agency MCL Value.

Flags assigned during chemistry validation are shown.

Concentration Exceeds ROD (1)

Concentration Exceeds MEG (2)

Border Concentration Exceeds MCL (3)

U - Not detected above the reported quantitation limit; J - The reported concentration is an estimated value.
D - Result reported from a secondary dilution analysis.; R - The data is rejected.; NA - Not Analyzed
B - The reported concentration is above the method detection limit but below the quantitation limit.
PQL - Practical quantitation limit. MDL - Method detection limit.

Detection Limits shown are PQL

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[LOGDATE] BETWEEN #03/21/09# AND #8/01/09# AND ([MATRIX] = 'WG' OR [MATRIX] = 'WP') AND ([SACODE] = 'FD' OR [SACODE] = 'N' OR [SACODE] = 'FD') AND [SITEID] = '8' AND [PRCCODE] <> 'STD'

TABLE B-3
LANDFILL 2 - 2009 POST-CLOSURE MONITORING GROUNDWATER ANALYTICAL RESULTS
FIVE-YEAR REVIEW REPORT
FORMER LORING AIR FORCE BASE - LIMESTONE, MAINE

Location ID					LF2MW6	LF2RESD	LF2RESD	MMW0001	MMW0001
Sample ID					LF2MW6	LF2RESD	LF2RESD	MMW0001	MMW9006
Matrix					Groundwater	Drinking Water	Drinking Water	Groundwater	Groundwater
Depth Interval (ft)					-	-	-	-	-
Date Sampled					05/14/09	05/13/09	07/22/09	05/13/09	05/13/09
Parameter	**Units**	**ROD (1)**	**MEG (2)**	**MCL (3)**					Field Duplicate (1-1)
Volatile Organic Compounds (Non-Detect = PQL)									
Tetrachloroethylene (PCE)	UG/L	3	7	5	1.0 U	1.0 U	NA	1.0 U	1.0 U
Vinyl chloride	UG/L	0.15	0.2	2	1.0 U	1.0 U	NA	1.0 U	1.0 U
Selected Ion Monitoring (Non-Detect = PQL)									
Vinyl chloride	UG/L	0.15	0.2	2	0.10 U	0.10 U	NA	0.10 U	0.10 U
Semivolatile Organic Compounds (Non-Detect = PQL)									
bis(2-Ethylhexyl) phthalate	UG/L	10	25	6	9.7 UJ	1.5 J	2.5 J	9.6 U	9.5 U
Petroleum Hydrocarbon Mixtures (Non-Detect = PQL)									
Diesel Range Organics	UG/L	-	50	-	NA	50 U	NA	50 U	50 U
Gasoline Range Organics	UG/L	-	50	-	NA	25 U	NA	25 U	25 U
Metals (Non-Detect = MDL)									
Arsenic	UG/L	-	10	10	3.4 J	3.2 U	NA	3.2 U	3.2 U
Cadmium	UG/L	5	3.5	5	0.12 U	0.12 U	NA	0.12 U	0.12 U
Calcium	UG/L	-	-	-	68,200	79,700	NA	83,000	80,900
Iron	UG/L	8400	-	-	907	75.6 J	NA	13.7 J	12.2 J
Lead	UG/L	80	10	15	0.89 U	0.89 U	NA	0.89 U	0.89 U
Magnesium	UG/L	-	-	-	28,300	7,440	NA	9,270	9,040
Potassium	UG/L	-	-	-	730 J	908 J	NA	539 J	558 J
Sodium	UG/L	-	20000	-	14,100	2,600	NA	2,450	2,410

ROD (1)- LF-2 Bedrock Groundwater Action Levels from Final Operable Unit 4 Record of Decision (ABB-ES, 1996).

MEG (2)- Maximum Exposure Guidelines from Maine Department of Human Services Memorandum "Maine CDC Maximum Exposure Guidelines (MEGs) for Drinking Water", December 5, 2008.

MCL (3)- Environmental Protection Agency MCL Value.

Flags assigned during chemistry validation are shown.

Concentration Exceeds ROD (1)

Concentration Exceeds MEG (2)

Border Concentration Exceeds MCL (3)

U - Not detected above the reported quantitation limit; J - The reported concentration is an estimated value.
D - Result reported from a secondary dilution analysis.; R - The data is rejected.; NA - Not Analyzed
B - The reported concentration is above the method detection limit but below the quantitation limit.
PQL - Practical quantitation limit. MDL - Method detection limit.

Detection Limits shown are PQL

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[LOGDATE] BETWEEN #03/21/09# AND #8/01/09# AND ([MATRIX] = 'WG' OR [MATRIX] = 'WP') AND ([SACODE] = 'FD' OR [SACODE] = 'N' OR [SACODE] = 'FD') AND [SITEID] = '8' AND [PRCCODE] <> 'STD'

TABLE B-3
LANDFILL 2 - 2009 POST-CLOSURE MONITORING GROUNDWATER ANALYTICAL RESULTS
FIVE-YEAR REVIEW REPORT
FORMER LORING AIR FORCE BASE - LIMESTONE, MAINE

Location ID					LF2MW6	LF2RESD	LF2RESD	MMW0001	MMW0001
Sample ID					LF2MW6	LF2RESD	LF2RESD	MMW0001	MMW9006
Matrix					Groundwater	Drinking Water	Drinking Water	Groundwater	Groundwater
Depth Interval (ft)					-	-	-	-	-
Date Sampled					05/14/09	05/13/09	07/22/09	05/13/09	05/13/09
Parameter	**Units**	**ROD (1)**	**MEG (2)**	**MCL (3)**					Field Duplicate (1-1)
Metals (Non-Detect = MDL)									
Zinc	UG/L	8400	2000	-	9.5 J	4.3 J	NA	3.3 J	16.4 J
Miscellaneous Parameters (Non-Detect = PQL)									
Alkalinity, bicarbonate (as CaCO3)	MG/L	-	-	-	258	223	NA	240	240
Alkalinity, carbonate (as CaCO3)	MG/L	-	-	-	20 U	20 U	NA	20 U	20 U
Alkalinity, hydroxide (as CaCO3)	MG/L	-	-	-	2.0 U	2.0 U	NA	2.0 U	2.0 U
Alkalinity, total (as CaCO3)	MG/L	-	-	-	258	223	NA	240	240
Chloride (as Cl)	MG/L	-	-	-	5.4	4.9	NA	2.7	2.7
Sulfate (as SO4)	MG/L	-	-	-	57.8	10.5	NA	14.5	14.3
Field Parameters (Non-Detect = PQL)									
Dissolved Oxygen	MG/L	-	-	-	1.38	7.18	5.19	5.10	NA
Oxidation Reduction Potential	MILLIVOLTS	-	-	-	39	73	95	126	NA
pH	PH UNITS	-	-	-	7.17	7.08	6.69	7.07	NA
Specific Conductance	US/CM	-	-	-	592.4	440.4	576.2	470.1	NA
Temperature	DEG C	-	-	-	11.07	9.01	11.32	8.47	NA
Turbidity	NTU	-	-	-	5.61	1.50	0.80	0.30	NA

ROD (1)- LF-2 Bedrock Groundwater Action Levels from Final Operable Unit 4 Record of Decision (ABB-ES, 1996).

MEG (2)- Maximum Exposure Guidelines from Maine Department of Human Services Memorandum "Maine CDC Maximum Exposure Guidelines (MEGs) for Drinking Water", December 5, 2008.

MCL (3)- Environmental Protection Agency MCL Value.

Flags assigned during chemistry validation are shown.

Concentration Exceeds ROD (1)

Concentration Exceeds MEG (2)

Border Concentration Exceeds MCL (3)

U - Not detected above the reported quantitation limit; J - The reported concentration is an estimated value.
D - Result reported from a secondary dilution analysis.; R - The data is rejected.; NA - Not Analyzed
B - The reported concentration is above the method detection limit but below the quantitation limit.
PQL - Practical quantitation limit. MDL - Method detection limit.

Detection Limits shown are PQL

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[LOGDATE] BETWEEN #03/21/09# AND #8/01/09# AND ([MATRIX] = 'WG' OR [MATRIX] = 'WP') AND ([SACODE] = 'FD' OR [SACODE] = 'N' OR [SACODE] = 'FD') AND [SITEID] = '8' AND [PRCCODE] <> 'STD'

TABLE B-3
LANDFILL 2 - 2009 POST-CLOSURE MONITORING GROUNDWATER ANALYTICAL RESULTS
FIVE-YEAR REVIEW REPORT
FORMER LORING AIR FORCE BASE - LIMESTONE, MAINE

Location ID					LF2RESD				
Sample ID					LF2RESD				
Matrix					Drinking Water				
Depth Interval (ft)					-				
Date Sampled					10/09/09				
Parameter	**Units**	**ROD (1)**	**MEG (2)**	**MCL (3)**					
Semivolatile Organic Compounds (Non-Detect = PQL)									
bis(2-Ethylhexyl) phthalate	UG/L	10	25	6	9.5 U				
Field Parameters (Non-Detect = PQL)									
Dissolved Oxygen	MG/L	-	-	-	0.91				
Oxidation Reduction Potential	MILLIVOLTS	-	-	-	34				
pH	PH UNITS	-	-	-	7.07				
Specific Conductance	US/CM	-	-	-	522.1				
Temperature	DEG C	-	-	-	9.36				
Turbidity	NTU	-	-	-	13.0				

ROD (1)- LF-2 Bedrock Groundwater Action Levels from Final Operable Unit 4 Record of Decision (ABB-ES, 1996).

MEG (2)- Maximum Exposure Guidelines from Maine Department of Human Services Memorandum "Maine CDC Maximum Exposure Guidelines (MEGs) for Drinking Water", December 5, 2008.

MCL (3)- Environmental Protection Agency MCL Value.

Flags assigned during chemistry validation are shown.

Concentration Exceeds ROD (1)

Concentration Exceeds MEG (2)

Border Concentration Exceeds MCL (3)

U - Not detected above the reported quantitation limit; J - The reported concentration is an estimated value.
D - Result reported from a secondary dilution analysis.; R - The data is rejected.; NA - Not Analyzed
B - The reported concentration is above the method detection limit but below the quantitation limit.
PQL - Practical quantitation limit. MDL - Method detection limit.

Detection Limits shown are PQL

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[LOGDATE] BETWEEN #10/01/09# AND #10/10/09# AND ([MATRIX] = 'WG' OR [MATRIX] = 'WP') AND ([SACODE] = 'FD' OR [SACODE] = 'N' OR [SACODE] = 'FD') AND [LOCID] = 'LF2RESD' AND [PRCCODE] <> 'STD'

TABLE B-4
LANDFILL 3 - 2009 POST-CLOSURE MONITORING GROUNDWATER ANALYTICAL RESULTS
FIVE-YEAR REVIEW REPORT
FORMER LORING AIR FORCE BASE - LIMESTONE, MAINE

Location ID					JMW0941	JMW0960	JMW0961	JMW0980	JMW0980
Sample ID					JMW0941	JMW0960	JMW0961	JMW0980	JMW9008
Matrix					Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Depth Interval (ft)					-	-	-	-	-
Date Sampled					05/13/09	05/13/09	05/12/09	05/12/09	05/12/09
Parameter	**Units**	**ROD (1)**	**MEG (2)**	**MCL (3)**					Field Duplicate (1-1)
Volatile Organic Compounds (Non-Detect = PQL)									
1,4-Dichlorobenzene	UG/L	27	21	75	NA	NA	1.0 U	28	27
Benzene	UG/L	5	6	5	NA	NA	0.91 J	5.9	5.6
Tetrachloroethylene (PCE)	UG/L	3	7	5	NA	NA	1.0 U	1.0 U	1.0 U
Trichloroethylene (TCE)	UG/L	5	32	5	NA	NA	1.0 U	1.0 U	1.0 U
Vinyl chloride	UG/L	0.15	0.2	2	NA	NA	1.0 U	1.0 U	1.0 U
Selected Ion Monitoring (Non-Detect = PQL)									
Vinyl chloride	UG/L	0.15	0.2	2	0.10 U	0.10 U	0.12	0.50	0.46
Semivolatile Organic Compounds (Non-Detect = PQL)									
4-Methylphenol (p-cresol)	UG/L	140	3.5	-	NA	NA	9.4 U	11	11
Petroleum Hydrocarbon Mixtures (Non-Detect = PQL)									
Diesel Range Organics	UG/L	-	50	-	50 U	50 U	50 U	NA	NA
Gasoline Range Organics	UG/L	-	50	-	25 U	25 U	25 U	240	230
Metals (Non-Detect = MDL)									
Arsenic	UG/L	-	10	10	3.2 U	3.2 U	3.2 U	9.4 J	12.8
Calcium	UG/L	-	-	-	112,000	60,700	162,000	137,000	143,000
Iron	UG/L	8400	-	-	29.6 J	26.7 J	7,500	26,700	27,700
Magnesium	UG/L	-	-	-	7,400	11,800	13,600	28,600	30,300
Manganese	UG/L	1300	500	-	2.4 J	22.6	1,920	1,150	1,210
Potassium	UG/L	-	-	-	1,490 J	307 J	3,230	18,200	19,200

ROD (1)- LF-3 Bedrock and Overburden Groundwater Action Levels from Final Operable Unit 4 Record of Decision (ABB-ES, 1996).

MEG (2)- Maximum Exposure Guidelines from Maine Department of Human Services Memorandum "Maine CDC Maximum Exposure Guidelines (MEGs) for Drinking Water", December 5, 2008.

MCL (3)- Environmental Protection Agency MCL Value.

Flags assigned during chemistry validation are shown.

Concentration Exceeds ROD (1)

Concentration Exceeds MEG (2)

Border Concentration Exceeds MCL (3)

U - Not detected above the reported quantitation limit; J - The reported concentration is an estimated value.
D - Result reported from a secondary dilution analysis.; R - The data is rejected.; NA - Not Analyzed
B - The reported concentration is above the method detection limit but below the quantitation limit.
PQL - Practical quantitation limit. MDL - Method detection limit.

Detection Limits shown are PQL

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[LOGDATE] BETWEEN #03/21/09# AND #6/21/09# AND [MATRIX] = 'WG' AND ([SACODE] = 'FD' OR [SACODE] = 'N') AND [SITEID] = '9' AND [PRCCODE] <> 'STD'

TABLE B-4
LANDFILL 3 - 2009 POST-CLOSURE MONITORING GROUNDWATER ANALYTICAL RESULTS
FIVE-YEAR REVIEW REPORT
FORMER LORING AIR FORCE BASE - LIMESTONE, MAINE

Location ID					JMW0941	JMW0960	JMW0961	JMW0980	JMW0980
Sample ID					JMW0941	JMW0960	JMW0961	JMW0980	JMW9008
Matrix					Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Depth Interval (ft)					-	-	-	-	-
Date Sampled					05/13/09	05/13/09	05/12/09	05/12/09	05/12/09
Parameter	**Units**	**ROD (1)**	**MEG (2)**	**MCL (3)**					Field Duplicate (1-1)
Metals (Non-Detect = MDL)									
Sodium	UG/L	-	20000	-	1,110	2,180	4,120	20,900	21,700
Miscellaneous Parameters (Non-Detect = PQL)									
Alkalinity, bicarbonate (as CaCO3)	MG/L	-	-	-	301	200	480	629	631
Alkalinity, carbonate (as CaCO3)	MG/L	-	-	-	20 U	13 U	20 U	20 U	20 U
Alkalinity, hydroxide (as CaCO3)	MG/L	-	-	-	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Alkalinity, total (as CaCO3)	MG/L	-	-	-	301	200	480	629	631
Chemical Oxygen Demand (COD)	MG/L	-	-	-	5.0 UJ	5.0 UJ	5.0 UJ	19.6 J	19.6 J
Chloride (as Cl)	MG/L	-	-	-	2.0 U	2.0 U	2.4	12.4	10.6
Nitrogen, Total Kjeldahl	MG/L	-	-	-	0.20 U	0.20 U	2.19	27.4	26.9
Sulfate (as SO4)	MG/L	-	-	-	27.6	12.6	5.9	2.0 U	2.0 U
Total Organic Carbon (TOC)	MG/L	-	-	-	3.1	1.5	3.4	9.3	9.1
Field Parameters (Non-Detect = PQL)									
Dissolved Oxygen	MG/L	-	-	-	1.33	7.12	0.29	0.10	NA
Oxidation Reduction Potential	MILLIVOLTS	-	-	-	58	157	-36	53	NA
pH	PH UNITS	-	-	-	4.41	7.92	6.38	6.03	NA
Specific Conductance	US/CM	-	-	-	404.1	583.1	943.8	1,580	NA
Temperature	DEG C	-	-	-	8.57	5.41	7.03	7.80	NA

ROD (1)- LF-3 Bedrock and Overburden Groundwater Action Levels from Final Operable Unit 4 Record of Decision (ABB-ES, 1996).

MEG (2)- Maximum Exposure Guidelines from Maine Department of Human Services Memorandum "Maine CDC Maximum Exposure Guidelines (MEGs) for Drinking Water", December 5, 2008.

MCL (3)- Environmental Protection Agency MCL Value.

Flags assigned during chemistry validation are shown.

Concentration Exceeds ROD (1)

Concentration Exceeds MEG (2)

Border Concentration Exceeds MCL (3)

U - Not detected above the reported quantitation limit; J - The reported concentration is an estimated value.
D - Result reported from a secondary dilution analysis.; R - The data is rejected.; NA - Not Analyzed
B - The reported concentration is above the method detection limit but below the quantitation limit.
PQL - Practical quantitation limit. MDL - Method detection limit.

Detection Limits shown are PQL

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TABLE B-4
LANDFILL 3 - 2009 POST-CLOSURE MONITORING GROUNDWATER ANALYTICAL RESULTS
FIVE-YEAR REVIEW REPORT
FORMER LORING AIR FORCE BASE - LIMESTONE, MAINE

Location ID					JMW0941	JMW0960	JMW0961	JMW0980	JMW0980
Sample ID					JMW0941	JMW0960	JMW0961	JMW0980	JMW9008
Matrix					Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Depth Interval (ft)					-	-	-	-	-
Date Sampled					05/13/09	05/13/09	05/12/09	05/12/09	05/12/09
Parameter	**Units**	**ROD (1)**	**MEG (2)**	**MCL (3)**					Field Duplicate (1-1)
Field Parameters (Non-Detect = PQL)									
Turbidity	NTU	-	-	-	0.24	0.37	1.40	2.20	NA

ROD (1)- LF-3 Bedrock and Overburden Groundwater Action Levels from Final Operable Unit 4 Record of Decision (ABB-ES, 1996).

MEG (2)- Maximum Exposure Guidelines from Maine Department of Human Services Memorandum "Maine CDC Maximum Exposure Guidelines (MEGs) for Drinking Water", December 5, 2008.

MCL (3)- Environmental Protection Agency MCL Value.

Flags assigned during chemistry validation are shown.

Concentration Exceeds ROD (1)

Concentration Exceeds MEG (2)

Border Concentration Exceeds MCL (3)

U - Not detected above the reported quantitation limit; J - The reported concentration is an estimated value.
D - Result reported from a secondary dilution analysis.; R - The data is rejected.; NA - Not Analyzed
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Detection Limits shown are PQL

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TABLE B-4
LANDFILL 3 - 2009 POST-CLOSURE MONITORING GROUNDWATER ANALYTICAL RESULTS
FIVE-YEAR REVIEW REPORT
FORMER LORING AIR FORCE BASE - LIMESTONE, MAINE

Location ID					JMW0980	JMW0980	JMW0991	JMW0991	JMW0992
Sample ID					JMW0980	JMW9008	JMW0991	JMW9005	JMW0992
Matrix					Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Depth Interval (ft)					-	-	-	-	-
Date Sampled					05/29/09	05/29/09	05/12/09	05/12/09	05/12/09
Parameter	**Units**	**ROD (1)**	**MEG (2)**	**MCL (3)**		Field Duplicate (1-1)		Field Duplicate (1-1)	
Volatile Organic Compounds (Non-Detect = PQL)									
1,4-Dichlorobenzene	UG/L	27	21	75	NA	NA	1.0 U	1.0 U	NA
Benzene	UG/L	5	6	5	NA	NA	1.0 U	1.0 U	NA
Tetrachloroethylene (PCE)	UG/L	3	7	5	NA	NA	1.0 U	1.0 U	NA
Trichloroethylene (TCE)	UG/L	5	32	5	NA	NA	1.0 U	1.0 U	NA
Vinyl chloride	UG/L	0.15	0.2	2	NA	NA	1.0 U	1.0 U	NA
Selected Ion Monitoring (Non-Detect = PQL)									
Vinyl chloride	UG/L	0.15	0.2	2	NA	NA	0.11	0.14	0.10 U
Semivolatile Organic Compounds (Non-Detect = PQL)									
4-Methylphenol (p-cresol)	UG/L	140	3.5	-	NA	NA	9.4 U	9.4 U	NA
Petroleum Hydrocarbon Mixtures (Non-Detect = PQL)									
Diesel Range Organics	UG/L	-	50	-	860 J	1,200 J	50 U	50 U	50 U
Gasoline Range Organics	UG/L	-	50	-	NA	NA	25 U	25 U	25 U
Metals (Non-Detect = MDL)									
Arsenic	UG/L	-	10	10	NA	NA	9.2 J	9.8 J	3.2 U
Calcium	UG/L	-	-	-	NA	NA	146,000	141,000	101,000
Iron	UG/L	8400	-	-	NA	NA	8,440	8,160	410
Magnesium	UG/L	-	-	-	NA	NA	15,100	14,500	20,600
Manganese	UG/L	1300	500	-	NA	NA	1,570	1,520	1.1 J
Potassium	UG/L	-	-	-	NA	NA	2,120	2,030	607 J

ROD (1)- LF-3 Bedrock and Overburden Groundwater Action Levels from Final Operable Unit 4 Record of Decision (ABB-ES, 1996).

MEG (2)- Maximum Exposure Guidelines from Maine Department of Human Services Memorandum "Maine CDC Maximum Exposure Guidelines (MEGs) for Drinking Water", December 5, 2008.

MCL (3)- Environmental Protection Agency MCL Value.

Flags assigned during chemistry validation are shown.

Concentration Exceeds ROD (1)

Concentration Exceeds MEG (2)

Border Concentration Exceeds MCL (3)

U - Not detected above the reported quantitation limit; J - The reported concentration is an estimated value.
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TABLE B-4
LANDFILL 3 - 2009 POST-CLOSURE MONITORING GROUNDWATER ANALYTICAL RESULTS
FIVE-YEAR REVIEW REPORT
FORMER LORING AIR FORCE BASE - LIMESTONE, MAINE

Location ID					JMW0980	JMW0980	JMW0991	JMW0991	JMW0992
Sample ID					JMW0980	JMW9008	JMW0991	JMW9005	JMW0992
Matrix					Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Depth Interval (ft)					-	-	-	-	-
Date Sampled					05/29/09	05/29/09	05/12/09	05/12/09	05/12/09
Parameter	**Units**	**ROD (1)**	**MEG (2)**	**MCL (3)**		Field Duplicate (1-1)		Field Duplicate (1-1)	
Metals (Non-Detect = MDL)									
Sodium	UG/L	-	20000	-	NA	NA	2,510	2,420	2,610
Miscellaneous Parameters (Non-Detect = PQL)									
Alkalinity, bicarbonate (as CaCO3)	MG/L	-	-	-	NA	NA	422	425	321
Alkalinity, carbonate (as CaCO3)	MG/L	-	-	-	NA	NA	20 U	20 U	20 U
Alkalinity, hydroxide (as CaCO3)	MG/L	-	-	-	NA	NA	2.0 U	2.0 U	2.0 U
Alkalinity, total (as CaCO3)	MG/L	-	-	-	NA	NA	422	425	321
Chemical Oxygen Demand (COD)	MG/L	-	-	-	NA	NA	5.0 UJ	5.0 UJ	5.0 UJ
Chloride (as Cl)	MG/L	-	-	-	NA	NA	2.0 U	2.0 U	2.0 U
Nitrogen, Total Kjeldahl	MG/L	-	-	-	NA	NA	0.95	0.98	0.20 U
Sulfate (as SO4)	MG/L	-	-	-	NA	NA	14.0	15.7	17.1
Total Organic Carbon (TOC)	MG/L	-	-	-	NA	NA	3.4	3.1	2.0 U
Field Parameters (Non-Detect = PQL)									
Dissolved Oxygen	MG/L	-	-	-	NA	NA	3.20	NA	4.72
Oxidation Reduction Potential	MILLIVOLTS	-	-	-	NA	NA	-17	NA	110
pH	PH UNITS	-	-	-	NA	NA	6.45	NA	6.81
Specific Conductance	US/CM	-	-	-	NA	NA	787.2	NA	610.2
Temperature	DEG C	-	-	-	NA	NA	7.54	NA	7.73

ROD (1)- LF-3 Bedrock and Overburden Groundwater Action Levels from Final Operable Unit 4 Record of Decision (ABB-ES, 1996).

MEG (2)- Maximum Exposure Guidelines from Maine Department of Human Services Memorandum "Maine CDC Maximum Exposure Guidelines (MEGs) for Drinking Water", December 5, 2008.

MCL (3)- Environmental Protection Agency MCL Value.

Flags assigned during chemistry validation are shown.

Concentration Exceeds ROD (1)

Concentration Exceeds MEG (2)

Border Concentration Exceeds MCL (3)

U - Not detected above the reported quantitation limit; J - The reported concentration is an estimated value.
D - Result reported from a secondary dilution analysis.; R - The data is rejected.; NA - Not Analyzed
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TABLE B-4
LANDFILL 3 - 2009 POST-CLOSURE MONITORING GROUNDWATER ANALYTICAL RESULTS
FIVE-YEAR REVIEW REPORT
FORMER LORING AIR FORCE BASE - LIMESTONE, MAINE

Location ID					JMW0980	JMW0980	JMW0991	JMW0991	JMW0992
Sample ID					JMW0980	JMW9008	JMW0991	JMW9005	JMW0992
Matrix					Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Depth Interval (ft)					-	-	-	-	-
Date Sampled					05/29/09	05/29/09	05/12/09	05/12/09	05/12/09
Parameter	**Units**	**ROD (1)**	**MEG (2)**	**MCL (3)**		Field Duplicate (1-1)		Field Duplicate (1-1)	
Field Parameters (Non-Detect = PQL)									
Turbidity	NTU	-	-	-	NA	NA	0.52	NA	2.59

ROD (1)- LF-3 Bedrock and Overburden Groundwater Action Levels from Final Operable Unit 4 Record of Decision (ABB-ES, 1996).

MEG (2)- Maximum Exposure Guidelines from Maine Department of Human Services Memorandum "Maine CDC Maximum Exposure Guidelines (MEGs) for Drinking Water", December 5, 2008.

MCL (3)- Environmental Protection Agency MCL Value.

Flags assigned during chemistry validation are shown.

Concentration Exceeds ROD (1)

Concentration Exceeds MEG (2)

Border Concentration Exceeds MCL (3)

U - Not detected above the reported quantitation limit; J - The reported concentration is an estimated value.
D - Result reported from a secondary dilution analysis.; R - The data is rejected.; NA - Not Analyzed
B - The reported concentration is above the method detection limit but below the quantitation limit.
PQL - Practical quantitation limit. MDL - Method detection limit.

Detection Limits shown are PQL

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TABLE B-4
LANDFILL 3 - 2009 POST-CLOSURE MONITORING GROUNDWATER ANALYTICAL RESULTS
FIVE-YEAR REVIEW REPORT
FORMER LORING AIR FORCE BASE - LIMESTONE, MAINE

Location ID					LF3MW1	LF3MW2	LF3MW3	LF3MW4	LF3MW4
Sample ID					LF3MW1	LF3MW2	LF3MW3	LF3MW4	LF3MW4
Matrix					Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Depth Interval (ft)					-	-	-	-	-
Date Sampled					05/13/09	05/12/09	05/12/09	05/12/09	05/29/09
Parameter	**Units**	**ROD (1)**	**MEG (2)**	**MCL (3)**					
Volatile Organic Compounds (Non-Detect = PQL)									
1,4-Dichlorobenzene	UG/L	27	21	75	1.0 U	1.0 U	NA	1.0 U	NA
Benzene	UG/L	5	6	5	1.0 U	1.0 U	NA	1.0 U	NA
Tetrachloroethylene (PCE)	UG/L	3	7	5	1.0 U	1.0 U	NA	1.0 U	NA
Trichloroethylene (TCE)	UG/L	5	32	5	1.0 U	1.0 U	NA	1.0 U	NA
Vinyl chloride	UG/L	0.15	0.2	2	1.0 U	1.0 U	NA	1.0 U	NA
Selected Ion Monitoring (Non-Detect = PQL)									
Vinyl chloride	UG/L	0.15	0.2	2	0.10 U	0.10 U	0.10 U	0.13	NA
Semivolatile Organic Compounds (Non-Detect = PQL)									
4-Methylphenol (p-cresol)	UG/L	140	3.5	-	10 U	9.4 U	NA	9.4 U	NA
Petroleum Hydrocarbon Mixtures (Non-Detect = PQL)									
Diesel Range Organics	UG/L	-	50	-	50 U	50 U	50 U	NA	73
Gasoline Range Organics	UG/L	-	50	-	25 U	25 U	25 U	25 U	NA
Metals (Non-Detect = MDL)									
Arsenic	UG/L	-	10	10	3.2 U	3.2 U	3.2 U	19.8	NA
Calcium	UG/L	-	-	-	65,300	79,100	58,000	168,000	NA
Iron	UG/L	8400	-	-	474	10.7 J	569	19,500	NA
Magnesium	UG/L	-	-	-	11,600	11,000	18,300	21,100	NA
Manganese	UG/L	1300	500	-	101	3.5 J	27.4	2,890	NA
Potassium	UG/L	-	-	-	433 J	742 J	379 J	2,080	NA

ROD (1)- LF-3 Bedrock and Overburden Groundwater Action Levels from Final Operable Unit 4 Record of Decision (ABB-ES, 1996).

MEG (2)- Maximum Exposure Guidelines from Maine Department of Human Services Memorandum "Maine CDC Maximum Exposure Guidelines (MEGs) for Drinking Water", December 5, 2008.

MCL (3)- Environmental Protection Agency MCL Value.

Flags assigned during chemistry validation are shown.

Concentration Exceeds ROD (1)

Concentration Exceeds MEG (2)

Border Concentration Exceeds MCL (3)

U - Not detected above the reported quantitation limit; J - The reported concentration is an estimated value.
D - Result reported from a secondary dilution analysis.; R - The data is rejected.; NA - Not Analyzed
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TABLE B-4
LANDFILL 3 - 2009 POST-CLOSURE MONITORING GROUNDWATER ANALYTICAL RESULTS
FIVE-YEAR REVIEW REPORT
FORMER LORING AIR FORCE BASE - LIMESTONE, MAINE

Location ID					LF3MW1	LF3MW2	LF3MW3	LF3MW4	LF3MW4
Sample ID					LF3MW1	LF3MW2	LF3MW3	LF3MW4	LF3MW4
Matrix					Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Depth Interval (ft)					-	-	-	-	-
Date Sampled					05/13/09	05/12/09	05/12/09	05/12/09	05/29/09
Parameter	**Units**	**ROD (1)**	**MEG (2)**	**MCL (3)**					
Metals (Non-Detect = MDL)									
Sodium	UG/L	-	20000	-	2,220	2,700	10,900	3,810	NA
Miscellaneous Parameters (Non-Detect = PQL)									
Alkalinity, bicarbonate (as CaCO3)	MG/L	-	-	-	210	225	195	500	NA
Alkalinity, carbonate (as CaCO3)	MG/L	-	-	-	20 U	20 U	13 U	20 U	NA
Alkalinity, hydroxide (as CaCO3)	MG/L	-	-	-	2.0 U	2.0 U	2.0 U	2.0 U	NA
Alkalinity, total (as CaCO3)	MG/L	-	-	-	210	225	195	500	NA
Chemical Oxygen Demand (COD)	MG/L	-	-	-	5.0 UJ	5.0 UJ	5.0 UJ	14.4	NA
Chloride (as Cl)	MG/L	-	-	-	2.0 U	2.6	9.8	2.0 U	NA
Nitrogen, Total Kjeldahl	MG/L	-	-	-	0.20 U	0.20 U	0.20 U	1.23	NA
Sulfate (as SO4)	MG/L	-	-	-	12.6	17.9	39.6	21.1	NA
Total Organic Carbon (TOC)	MG/L	-	-	-	1.6	2.0 U	1.0 U	6.4	NA
Field Parameters (Non-Detect = PQL)									
Dissolved Oxygen	MG/L	-	-	-	0.79	1.91	2.04	NA	0.13
Oxidation Reduction Potential	MILLIVOLTS	-	-	-	-154	225	-36	NA	-50
pH	PH UNITS	-	-	-	8.66	7.14	7.36	NA	6.28
Specific Conductance	US/CM	-	-	-	413.4	458.2	464.1	NA	1,127
Temperature	DEG C	-	-	-	13.40	7.35	13.61	NA	7.15

ROD (1)- LF-3 Bedrock and Overburden Groundwater Action Levels from Final Operable Unit 4 Record of Decision (ABB-ES, 1996).

MEG (2)- Maximum Exposure Guidelines from Maine Department of Human Services Memorandum "Maine CDC Maximum Exposure Guidelines (MEGs) for Drinking Water", December 5, 2008.

MCL (3)- Environmental Protection Agency MCL Value.

Flags assigned during chemistry validation are shown.

Concentration Exceeds ROD (1)

Concentration Exceeds MEG (2)

Border Concentration Exceeds MCL (3)

U - Not detected above the reported quantitation limit; J - The reported concentration is an estimated value.
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TABLE B-4
LANDFILL 3 - 2009 POST-CLOSURE MONITORING GROUNDWATER ANALYTICAL RESULTS
FIVE-YEAR REVIEW REPORT
FORMER LORING AIR FORCE BASE - LIMESTONE, MAINE

Location ID					LF3MW1	LF3MW2	LF3MW3	LF3MW4	LF3MW4
Sample ID					LF3MW1	LF3MW2	LF3MW3	LF3MW4	LF3MW4
Matrix					Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Depth Interval (ft)					-	-	-	-	-
Date Sampled					05/13/09	05/12/09	05/12/09	05/12/09	05/29/09
Parameter	**Units**	**ROD (1)**	**MEG (2)**	**MCL (3)**					
Field Parameters (Non-Detect = PQL)									
Turbidity	NTU	-	-	-	0.58	0.64	5.31	NA	0.55

ROD (1)- LF-3 Bedrock and Overburden Groundwater Action Levels from Final Operable Unit 4 Record of Decision (ABB-ES, 1996).

MEG (2)- Maximum Exposure Guidelines from Maine Department of Human Services Memorandum "Maine CDC Maximum Exposure Guidelines (MEGs) for Drinking Water", December 5, 2008.

MCL (3)- Environmental Protection Agency MCL Value.

Flags assigned during chemistry validation are shown.

Concentration Exceeds ROD (1)

Concentration Exceeds MEG (2)

Border Concentration Exceeds MCL (3)

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Detection Limits shown are PQL

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TABLE B-4
LANDFILL 3 - 2009 POST-CLOSURE MONITORING GROUNDWATER ANALYTICAL RESULTS
FIVE-YEAR REVIEW REPORT
FORMER LORING AIR FORCE BASE - LIMESTONE, MAINE

Location ID					MMW0002	MMW0018A	MMW0018B	MMW0018B	RFW39
Sample ID					MMW0002	MMW0018A	MMW0018B	MMW0018B	RFW39
Matrix					Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Depth Interval (ft)					-	-	-	-	-
Date Sampled					05/12/09	05/12/09	05/12/09	05/29/09	05/12/09
Parameter	**Units**	**ROD (1)**	**MEG (2)**	**MCL (3)**					
Volatile Organic Compounds (Non-Detect = PQL)									
1,4-Dichlorobenzene	UG/L	27	21	75	1.0 U	NA	NA	NA	NA
Benzene	UG/L	5	6	5	1.0 U	NA	NA	NA	NA
Tetrachloroethylene (PCE)	UG/L	3	7	5	1.0 U	NA	NA	NA	NA
Trichloroethylene (TCE)	UG/L	5	32	5	1.0 U	NA	NA	NA	NA
Vinyl chloride	UG/L	0.15	0.2	2	1.0 U	NA	NA	NA	NA
Selected Ion Monitoring (Non-Detect = PQL)									
Vinyl chloride	UG/L	0.15	0.2	2	0.10 U	0.10 U	0.10 U	NA	0.10 U
Semivolatile Organic Compounds (Non-Detect = PQL)									
4-Methylphenol (p-cresol)	UG/L	140	3.5	-	9.4 U	NA	NA	NA	NA
Petroleum Hydrocarbon Mixtures (Non-Detect = PQL)									
Diesel Range Organics	UG/L	-	50	-	50 U	50 U	NA	50 U	50 U
Gasoline Range Organics	UG/L	-	50	-	25 U	25 U	25 U	NA	25 U
Metals (Non-Detect = MDL)									
Arsenic	UG/L	-	10	10	3.2 U	3.2 U	3.2 U	NA	3.9 J
Calcium	UG/L	-	-	-	60,000	50,800	56,600	NA	79,400
Iron	UG/L	8400	-	-	9.9 J	16.4 J	171	NA	70.1 J
Magnesium	UG/L	-	-	-	7,120	7,690	7,980	NA	15,500
Manganese	UG/L	1300	500	-	0.29 J	0.60 J	6.2 J	NA	5.9 J
Potassium	UG/L	-	-	-	546 J	602 J	635 J	NA	1,780 J

ROD (1)- LF-3 Bedrock and Overburden Groundwater Action Levels from Final Operable Unit 4 Record of Decision (ABB-ES, 1996).

MEG (2)- Maximum Exposure Guidelines from Maine Department of Human Services Memorandum "Maine CDC Maximum Exposure Guidelines (MEGs) for Drinking Water", December 5, 2008.

MCL (3)- Environmental Protection Agency MCL Value.

Flags assigned during chemistry validation are shown.

Concentration Exceeds ROD (1)

Concentration Exceeds MEG (2)

Border Concentration Exceeds MCL (3)

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PQL - Practical quantitation limit. MDL - Method detection limit.

Detection Limits shown are PQL

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[LOGDATE] BETWEEN #03/21/09# AND #6/21/09# AND [MATRIX] = 'WG' AND ([SACODE] = 'FD' OR [SACODE] = 'N') AND [SITEID] = '9' AND [PRCCODE] <> 'STD'

TABLE B-4
LANDFILL 3 - 2009 POST-CLOSURE MONITORING GROUNDWATER ANALYTICAL RESULTS
FIVE-YEAR REVIEW REPORT
FORMER LORING AIR FORCE BASE - LIMESTONE, MAINE

Location ID					MMW0002	MMW0018A	MMW0018B	MMW0018B	RFW39
Sample ID					MMW0002	MMW0018A	MMW0018B	MMW0018B	RFW39
Matrix					Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Depth Interval (ft)					-	-	-	-	-
Date Sampled					05/12/09	05/12/09	05/12/09	05/29/09	05/12/09
Parameter	**Units**	**ROD (1)**	**MEG (2)**	**MCL (3)**					
Metals (Non-Detect = MDL)									
Sodium	UG/L	-	20000	-	4,900	1,640	1,510	NA	26,500
Miscellaneous Parameters (Non-Detect = PQL)									
Alkalinity, bicarbonate (as CaCO3)	MG/L	-	-	-	179	230	167	NA	262
Alkalinity, carbonate (as CaCO3)	MG/L	-	-	-	13 U	20 U	13 U	NA	20 U
Alkalinity, hydroxide (as CaCO3)	MG/L	-	-	-	2.0 U	2.0 U	2.0 U	NA	2.0 U
Alkalinity, total (as CaCO3)	MG/L	-	-	-	179	230	167	NA	262
Chemical Oxygen Demand (COD)	MG/L	-	-	-	5.0 UJ	5.0 UJ	5.0 UJ	NA	5.0 UJ
Chloride (as Cl)	MG/L	-	-	-	6.3	2.0 U	2.0 U	NA	4.2
Nitrogen, Total Kjeldahl	MG/L	-	-	-	0.20 U	0.20 U	0.20 U	NA	0.20 U
Sulfate (as SO4)	MG/L	-	-	-	6.5	8.0	7.7	NA	61.1
Total Organic Carbon (TOC)	MG/L	-	-	-	2.0 U	1.1	1.1	NA	2.0 U
Field Parameters (Non-Detect = PQL)									
Dissolved Oxygen	MG/L	-	-	-	11.45	9.76	NA	8.23	4.52
Oxidation Reduction Potential	MILLIVOLTS	-	-	-	72	41	NA	87	240
pH	PH UNITS	-	-	-	7.21	7.16	NA	7.03	7.16
Specific Conductance	US/CM	-	-	-	396.3	307.4	NA	475.5	620.2
Temperature	DEG C	-	-	-	7.56	7.85	NA	6.61	10.19

ROD (1)- LF-3 Bedrock and Overburden Groundwater Action Levels from Final Operable Unit 4 Record of Decision (ABB-ES, 1996).

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Sample ID					MMW0002	MMW0018A	MMW0018B	MMW0018B	RFW39
Matrix					Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Depth Interval (ft)					-	-	-	-	-
Date Sampled					05/12/09	05/12/09	05/12/09	05/29/09	05/12/09
Parameter	Units	ROD (1)	MEG (2)	MCL (3)					
Field Parameters (Non-Detect = PQL)									
Turbidity	NTU	-	-	-	0.82	0.54	NA	2.33	0.43

ROD (1)- LF-3 Bedrock and Overburden Groundwater Action Levels from Final Operable Unit 4 Record of Decision (ABB-ES, 1996).

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