



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY  
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May 5, 2015

Commander,  
Radford Army Ammunition Plant  
Attn: SJMRF-OP-EQ (Jim McKenna)  
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William Barnett  
Environmental Manager  
BAE Systems Ordnance Systems, Inc.  
Radford Army Ammunition Plant  
P.O. Box 1  
Radford, VA 24141-0100

**VIA Electronic Mail**

Re: Radford Army Ammunition Plant, Radford, Virginia  
Solid Waste Management Unit 40  
Annual Long Term Monitoring Report

Dear Mr. McKenna and Mr. Barnett:

The U.S. Environmental Protection Agency (EPA) and Virginia Department of Environmental Quality (VDEQ) have reviewed the U.S. Army's (Army's) SWMU 40, Annual Long Term Monitoring Report (LTM), Year 4. SWMU 40 is located at the Radford Army Ammunition Plant (RFAAP) in Radford, Virginia. Based upon our review, the LTM Report is approved, and in accordance with Part II. (E)(5) of RFAAP's Corrective Action Permit, the LTM Report is considered final. If you have any questions, please call me at 410-305-2779.

Sincerely,

A handwritten signature in dark ink, reading "Erich Weissbart", is positioned above the typed name.

Erich Weissbart, P.G.  
RCRA Project Manager  
Office of Remediation (3LC20)

c: James Cutler, VDEQ



From: McKenna, James J CIV (US) [<mailto:james.j.mckenna16.civ@mail.mil>]

Sent: Wednesday, March 25, 2015 1:55 PM

To: Cutler, Jim; [Weissbart.Erich@epamail.epa.gov](mailto:Weissbart.Erich@epamail.epa.gov); [aziz.farahmand@deq.virginia.gov](mailto:aziz.farahmand@deq.virginia.gov)

Cc: Alberts, Matt (US SSA); MaryAnn Bogucki - Radford ([maryann.bogucki@baesystems.com](mailto:maryann.bogucki@baesystems.com)); Stewart, Jay (US SSA); Mendoza, Richard R Jr CIV USARMY IMCOM AEC (US); Meyer, Tom NAB02; Jonah Anderson; Mary Lou Rochotte; Davie, Robert N III CIV (US); Leahy, Timothy; Ortiz, Luis A LTC USARMY JMC (US); Sarah Skrobialowski; Bonnie Morris

Subject: RFAAP SWMU 40 Draft LTM Report Year 4 Certification Letter (UNCLASSIFIED)

Attachments: 15-0900-049 RFAAP SWMU 40 Annual LTM Year 4 Report\_Certified.pdf

Erich, Jim C., Aziz, All:

Attached is the certification letter for the subject report that was sent March 10, 2015.

Thank you for your support of the Radford Army Ammunition Plant Installation Restoration Program.

Jim McKenna

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March 12, 2015

Mr. Erich Weissbart, P.G.  
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Mr. James L. Cutler, Jr.  
Virginia Department of Environmental Quality  
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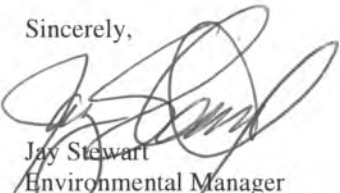
**Subject: With Certification, SWMU 40 (RAAP-009) Landfill Nitro Area, Annual Long Term  
Monitoring Report: LTM Year 4, Draft Final, March 2015  
EPA ID# VA1210020730**

Dear Mr. Weissbart and Mr. Cutler:

Enclosed is the certification for the subject documents that were sent to you on March 10, 2015. Also enclosed is the March 10, 2015 transmittal email.

Please coordinate with and provide any questions or comments to myself at 540 639 7785 or Mr. Jim McKenna, ACO Staff at (540)-731-5782.

Sincerely,



Jay Stewart  
Environmental Manager  
BAE Systems, Ordnance Systems Inc.

c: Aziz Farahmand  
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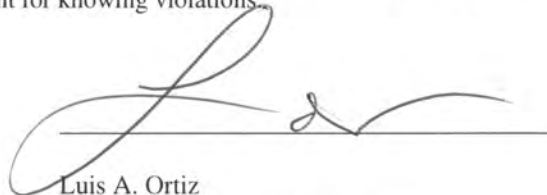
  
J. McKenna

Concerning the following:

Radford Army Ammunition Plant, Radford, Virginia  
Solid Waste Management Unit 40 (RAAP-009)  
Landfill Nitro Area  
Annual Long Term Monitoring Report: LTM Year 4  
Draft Final, March 2015  
EPA ID#: VA1210020730

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fines and imprisonment for knowing violations.

SIGNATURE:



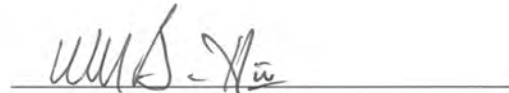
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Lieutenant Colonel, US Army  
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**From:** Mckenna, James J CIV (US) <james.j.mckenna16.civ@mail.mil>  
**Sent:** Tuesday, March 10, 2015 7:53 AM  
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**Cc:** Mary Lou Rochotte; Sandia Sommer; Jonah Anderson; Meyer, Tom NAB02; Mendoza, Richard R Jr CIV (US); Davie, Robert N III CIV (US); Evans, Donald J CIV USARMY JMC (US); Ortiz, Luis A LTC USARMY JMC (US)  
**Subject:** RFAAP Draft Final SWMU 40 LTM Yr 4 Report  
**Signed By:** jim.mckenna@us.army.mil

All:

Note the contractor will ship the subject document with a copy of this email to the POCs and tracking numbers below. Certification will follow by separate letter.

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c/o L. Pizarro  
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Thomas Meyer – 1 CD      # 7730 8028 3817

Richard Mendoza – 1 CD      # 7730 8030 0397

Thank you for your support of the Radford Army Ammunition Plant Installation Restoration Program.

Jim McKenna

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RADFORD ARMY AMMUNITION PLANT  
RADFORD, VIRGINIA

Performance Based Acquisition  
Solid Waste Management Unit 40 (RAAP-009)  
Landfill Nitro Area  
Annual Long Term Monitoring Report: LTM Year 4

DRAFT FINAL  
March 2015

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PREPARED BY:



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Contract No. W912DY-10-D-0027  
Delivery Order Number: DA01

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**PREPARED FOR:**

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INTERIM MEASURES COMPLETION REPORT  
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**LIST OF ABBREVIATIONS AND ACRONYMS**

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<b>Acronym</b>	<b>Definition</b>
AEDB-R	Army Environmental Database-Restoration Army Environmental Database-Restoration
ANOVA	Analysis of Variance
ATK	Alliant Techsystems, Inc.
ATSDR	Agency for Toxic Substances and Disease
BAE	Brigade Aviation Element
CD	Compact Disk
CMS	Corrective Measures Study
COC	Contaminant of Concern
COPC	Constituents of Potential Concern
CSL	Cooperative Security Location
DERP	Defense Environmental Restoration Program
DoD	Department of Defense
DUP	Duplicate
EPA	Environmental Protection Agency
HTRW	Hazardous Toxic and Radioactive Wastes
IM	Interim Measures
IMCR	Interim Measures Completion Report
IMWP	Interim Measures Work Plan
IRP	Installation Restoration Program
KEMRON	KEMRON Environmental Services
LOD	Limit of Detection
LOQ	Limits of Quantitation
LTM	Long Term Monitoring
MCL	Maximum Contaminant Level
MMA	Main Manufacturing Area
NATO	North Atlantic Treaty Organization
NRU	New River Unit
NTP	Notice to Proceed
NTU	Nephelometric turbidity unit
PBA TO	Performance Based Acquisition Firm Fixed Price Task Order
PCB	Polychlorinated Biphenyls
QAPP	Quality Assurance Project Plan
QSM	Quality System Manual
RCRA	Resource Conservation and Recovery Act
RFAAP	Radford Army Ammunition Plant
RFI	RCRA Facility Investigation
RL	Reporting Limit
ROM	Read Only Memory
ROS	Robust Regression on Order Statistics
RSL	Regional Screening Level
SOP	Standard Operating Procedure
SSL	Soil Screening Level

<b>Acronym</b>	<b>Definition</b>
SVOCs	Semi-Volatile Organic Compounds
SWMU	Solid Waste Management Unit
TAL	Target Analyte List
T-NCSL	Non-carcinogenic screening level
TO	Task Order
ug/L	Microgram per Liter
USACE	United States Army Corps Of Engineers
USAEC	US Army Environmental Command
USEPA	US Environmental Protection Agency
VA	Veterans Administration
VDEQ	Virginia Department of Environmental Quality
VOC	Volatile Organic Compound

## **1.0 INTRODUCTION**

KEMRON Remediation Services, LLC (KEMRON) has been contracted by the U.S. Army Corps of Engineers (USACE) to perform Interim Measures (IM) at the Landfill Nitro Area, Solid Waste Management Area (SWMU) 40, at Radford Army Ammunition Plant (RFAAP), Radford, Virginia. This SWMU also is identified as RAAP-009 for purposes of the Army Environmental Database – Restoration (AEDB-R).

The SWMU 40 LTM is being performed under a Performance Based Acquisition Firm Fixed Price Task Order (PBA TO) for environmental remediation services at RFAAP. The site is being addressed under the Installation Restoration Program (IRP). The Department of Defense (DoD) established the Defense Environmental Restoration Program (DERP) to address environmental contamination located on current and former military installations. Remedial action at this site also is authorized and conducted under the authority of the federal Resource Conservation and Recovery Act (RCRA). The contract was issued by the United States Army Corps of Engineers (USACE) – Baltimore located at 10 S. Howard Street, Box 1715, Room 7000 in Baltimore, Maryland. This TO # DA01 was issued under KEMRON's Worldwide Environmental Remediation Services contract number W912DY-10-D-0027, with an award date of 30 June 2010 and a Notice to Proceed (NTP) date of 15 July 2010.

The Interim Measures Completion Report (IMCR), which included details of mobilization, installation of one additional downgradient monitoring well, repairs to the landfill cap North Slope, and implementing institutional controls (ICs) was approved as Final by US Environmental Protection Agency (USEPA) and the Virginia Department of Environmental Quality (VDEQ) in correspondence dated July 10, 2012. All work was performed in accordance with the IM Work Plan (IMWP) as approved by the USEPA and the VDEQ. In addition to the repairs specified in the IMWP, limited additional maintenance was conducted adjacent to SWMU 40 to further enhance and assure the stability of the landfill north slope and control stormwater runoff. Following completion of the Interim Measures, Long Term Monitoring (LTM) was initiated in November 2011 and is on-going. This report provides a summary of the LTM work conducted through the December 2014 LTM event, LTM Year 4.

### **1.1 Background**

#### **1.1.1 Site Description**

RFAAP is a government owned; contractor operated manufacturing facility located in southwestern Virginia approximately eight (8) miles southwest of Blacksburg. BAE Systems is the current operator along with a variety of other tenants. RFAAP consists of two noncontiguous areas, the Main Manufacturing Area (MMA) and the New River Unit (NRU).

SWMU 40 is located within the south-central portion of the MMA at RFAAP (Figure 1). Figure 2 shows the site layout, which includes the approximate 2-acre landfill area that comprises SWMU 40.

SWMU 40 consists of an undeveloped open area covered with grass. A gravel covered and fenced area used for temporary storage of asbestos is located at the eastern edge of the site (Figure 2). A paved road, identified as Landfill South Road for purposes of this LTM Report, is located immediately south of the landfill area and undeveloped land borders the landfill area to the north (field) and west (wooded area).

### 1.1.2 Site History

The RCRA Facility Assessment (RFA) was conducted by the USEPA in 1987 and identified SWMU 40 as having the potential to release contaminants into the environment. SWMU 40 is included in the RFAAP RCRA Permit for Corrective Action (USEPA, 2000).

The Final RFI/CMS was approved by USEPA and VDEQ in April 2009. According to the Final RFI/CMS (URS, April 2009), SWMU 40 was used for the burial of materials, such as paper, office trash, concrete, and rubber tires in the 1970s and early 1980s. The unit was not permitted by the Commonwealth of Virginia as a solid waste landfill. Operations ceased and the unit was closed with a clay cap and grass cover. Subsequently, areas located northeast of the unit were used to stockpile soil derived from construction-related activities. In approximately 1991, a fenced enclosure was constructed in the northeastern corner of the SWMU 40 area for use as temporary asbestos accumulation area (Figure 2).

The results of the human health risk assessment included in the Final RFI/CMS (URS, 2009) indicated that calculated cancer risks and hazard indices are within the USEPA target risk range for each receptor with the exception of the cumulative risk for the hypothetical future lifetime resident due primarily to arsenic and PCBs in soil. A future construction worker also had potential risk based upon potential aluminum exposure via the inhalation pathway. The RFI/CMS documented that soil Constituents of Potential Concern (COPCs) are primarily limited to the landfill material itself with the exception of a surficial area of PCB contamination in soil located adjacent to the northern escarpment of the landfill.

Additionally, the Final RFI/CMS identified chloroform as a groundwater COPC. Extensive source characterization was conducted at SWMU 40 during the RFI, including the collection of 91 soil samples, many of which were collected from landfill material and soil below the landfill material at SWMU 40. Chloroform was not detected in these samples. The RFI/CMS notes that the lack of detections and absence of other volatile organic constituents in groundwater samples suggests a potential alternate source for chloroform in groundwater at SWMU 40. During conduct of the RFI, chloroform was detected in samples collected from wells 40MW3 (19 µg/L), 40MW5 DUP bae (23 µg/L), and 40MW6 (24 µg/L) at concentrations above its unadjusted tapwater risk based concentration (T-RBC) (0.155 µg/L) but below the USEPA MCL of 80 µg/L for total trihalomethanes. The Final RFI/CMS notes that the landfill area is located downgradient of developed areas containing water lines that could be leaking, and which may be the source of chloroform in groundwater at SWMU 40. Therefore, based upon the site specific data, a SWMU 40 chloroform source is not identifiable. However, based upon the groundwater detections of chloroform, chloroform was retained as a COPC until the completion of the first four quarters of data collected during the LTM. The LTM Report for Year 1 removed chloroform as well as other analytes from the monitoring network parameters and was approved by USEPA and VDEQ May 30, 2013.

Perchlorate has been detected in numerous wells at RFAAP at low concentrations. The RFI/CMS noted that updated laboratory analytical detection limits that are lower than historic limits may be the reason for low level detections. The RFI/CMS also noted that groundwater samples located immediately adjacent to and downgradient of the landfill (40MW3, 40MW5, and 40MW6) were below the unadjusted T-RBC; therefore, perchlorate was not identified as a COPC in groundwater. However, the Army agreed to retain perchlorate as a groundwater monitoring analyte at the time of CMS preparation, based on detections reported in the RFI/CMS.

The RAAP-009, SWMU 40 Final RFI/CMS was reviewed and approved by USEPA and VDEQ in correspondence dated June 30, 2009. The USEPA and VDEQ agreed to the use of Interim Measures as a means to accelerate closure of this site and begin long-term maintenance and monitoring. UXB-KEMRON prepared the Interim Measures Work Plan (IMWP) on behalf of the Army in conformance



with the specifications detailed for Alternative 2 in the approved Final RFI/CMS. The IMWP included the repair to the landfill cap in areas impacted by surface erosion, placement of cover to address the potential exposure to the surficial area of PCB contamination in soil located adjacent to the northern escarpment of the landfill, installation of one additional downgradient monitoring well, and initiation of Long Term Monitoring and Maintenance (LTM) activities associated with cap maintenance and monitoring and groundwater monitoring. The IMWP was approved by USEPA and VDEQ on August 26, 2011. The IMCR provided documentation of the completion of the IM and was approved by USEPA and VDEQ July 10, 2012. The LTM activities and resulting data for Year 4 are contained within this LTM Report in accordance with the approved August 2011 IMWP and as outlined in the approved LTM Reports for Year 1, Year 2, and Year 3.

## **1.2 Corrective Measures Objectives**

The Corrective Measures Objectives (CMOs) for SWMU 40 are:

- Maintain containment of the landfill material at the site and implement necessary controls to prevent future uncontrolled human exposure to this landfill material.
- Implement any necessary measures to stabilize and repair the landfill cover at the northern edge of the landfill area to prevent any further mass transport of soil material in this area.

## **1.3 Project Objectives**

In accordance with the *SWMU 40 Final RFI/CMS*, April 2009, and the Final IMWP, August 2011, IMs were conducted to accelerate closure of this site and begin LTM. The IMs included:

- 1. Engineering Controls (ECs) and Landfill Cap Repairs:** ECs included repairs to the landfill cap where evidence of erosion had been noted, primarily the north face of the unit. Repaired areas were stabilized and seeded to support a vegetative cover and minimize additional erosion.
- 2. Monitoring Well Installation:** Installation of 40MW7 on the downgradient side of SWMU 40. A location was preselected approximately 135 feet west-northwest of the landfill area as indicated and more fully described in the approved RAAP-009 SWMU 40 Final RFI/CMS.
- 3. Long Term Monitoring and Maintenance:** Conduct of LTM per the LTM Plan.

Section 2 of this report provides additional details of the IM implementation (specifically Long Term Monitoring and Maintenance) to achieve the project objectives.

## 2.0 LONG TERM MONITORING AND MAINTENANCE

### 2.1 Long Term Monitoring Plan

The groundwater monitoring network at SWMU 40 consists of one upgradient well, LFMW01, and three downgradient wells. The three downgradient wells include existing wells 40MW5, 40MW6, and the new well 40MW7. Installation of this new well was presented in the IMCR (UXB-KEMRON 2012). The table below summarizes the long term monitoring program that is being implemented as part of the Corrective Measures at SWMU 40.

#### Long Term Groundwater Monitoring Program, SWMU 40, RAAP-009:

Monitoring Well Designation	Relative Position to SWMU 40	Monitoring Frequency	Analytical Parameters
LFMW01	Upgradient	Year 1: Quarterly  Years 2-5: Every 9 months  Years 6-30: Annual	Field water quality: pH, turbidity, specific conductance, temperature, dissolved oxygen, oxidation/reduction potential  TCL VOCS, SW846 Method 8260B; TCL SVOCs, SW846 Method 8270C SIM; TCL Pesticides, SW846 Method 8081A; TAL Metals, SW846 Method 6000/7000; Perchlorate, SW846 6850; Dioxins/furans, SW846 Method 8290 included in initial sampling event only
40MW05	Detection Well at edge of landfill boundary		
40MW06	Detection Well at edge of landfill boundary		
40MW07	Well downgradient of Landfill		

The first year of long term monitoring (LTM) included four quarterly monitoring events with the exception of dioxins and furans which were sampled and analyzed only in the first quarterly sampling event of the first year of LTM as specified in the approved IMWP and CMS. The LTM Report for year one was submitted with outlined reduction of analyte requirements to optimize the LTM Program. The reduction of COPC's for the LTM program was approved by USEPA and VDEQ May 30, 2013. Year 2 LTM activities and results were presented in a report dated October 2013 and approved by USEPA and VDEQ January 7, 2014. The Year 3 LTM Report dated July 2014 was submitted with outlined reduction of analyte requirements to further optimize the LTM Program and was approved by USEPA and VDEQ September 9, 2014. This LTM report summarizes the sampling and analysis of the remaining analytes in the year four monitoring program (event seven). Analytical results are summarized in tabular form, and complete laboratory analyses are presented in electronic form (e.g., cms ROM).

The groundwater data were screened in accordance with the approved IMWP. Data screening was conducted in the Year 1, Year 2, and Year 3 LTM reports consistent with the IMWP to eliminate any analytes that met screening criteria outlined below to further optimize the LTM Program. Retention of analytes in the LTM monitoring and reporting are similarly evaluated in this Year 4 LTM report.

A list of the specific analytes included in the groundwater LTM program and their associated limits of detection (LODs) and limits of quantitation (LOQs) were presented in the site-specific Quality Assurance Project Plan (QAPP), Appendix B to the IMWP, Master Work Plan Addendum #30 (UXB-KEMRON, 2011).

The following criteria established in the IMWP were applied to the data evaluation and optimization of the monitoring program after the first four quarters of data generation, the year two, the year three, and the this year four data generation:

- 1) Analytes that did not exceed the laboratory LOD during three (3) consecutive monitoring events or exceed the LOQ during the first four (4) monitoring events will not require further sampling and analysis;
- 2) Analyte detections that did not exceed the established background concentration for 3 successive sampling events will not require further sampling and analysis;
- 3) Analyte detections that did not exceed half the relevant MCL or half the relevant Regional Screening Level (RSL) as presented in the approved IMWP for 3 successive sampling events and the results displayed a static or downward trend will not require further sampling and analysis.

The site specific data was evaluated using appropriate statistical methodologies, and data assessment was conducted in general conformance with the recommendations of USEPA guidance entitled *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities – Unified Guidance, March 2009* (EPA 530/R-09-007). A more detailed description on the data evaluation and remaining analytes is discussed in Sections 2.4 and 3.

## **2.2 Long Term Inspection and Maintenance Plan**

Additional long term maintenance was conducted at SWMU 40, RAAP-009; including inspection of the landfill cap to ensure that the landfill cap integrity is maintained. Inspections were conducted in conjunction with groundwater monitoring events and thus follow the same schedule specified in the table in Section 2.1, Long Term Groundwater Monitoring Program.

Inspections included visual evaluation and documentation of negative effects of the following:

1. Precipitation run-on and runoff;
2. Water and/or wind erosion;
3. Rodent and/or vector activity;
4. Deep root vegetation;
5. Vegetative stress and other cover condition;
6. Subsidence or cracks in cap;
7. Excavation or other manmade intrusive work conducted within the landfill footprint.

The previous landfill cap inspections are outlined in the relevant LTM reports (KEMRON 2012, 2013, and 2014). The seventh inspection was conducted during the LTM groundwater sampling event December 1, 2014. No major issues or deficiencies were noted during the most recent inspection. The completed inspection sheet and supporting photos are included in Appendix A.

## **2.3 Groundwater Sampling**

Groundwater samples were collected as part of the LTM. The groundwater monitoring network at SWMU 40 consists of one upgradient well, LFMW01, and three downgradient wells. The three downgradient wells include existing wells 40MW5 and 40MW6, as well as 40MW7. Monitoring wells locations are shown on Figure 2.

Sampling was conducted in conformance with approved standard operating procedure (SOP) 30.2 of the approved work plan and as described in the Section 5.2.10 of the MWP (URS, 2003). Groundwater sampling was conducted using low flow purge and sampling, consistent with past sampling events. All non-dedicated sampling equipment was decontaminated in accordance with SOP 80.1 of the approved work plan. Completed field documentation is included in Appendix B. Water level measurements were collected and the potentiometric map from the seventh event is included in Appendix C. Based on the monitoring, ground water at SWMU 40 generally flows in a northwest direction which is consistent with

historical ground water flow at the site. Please refer to Appendix C for the potentiometric surface map of SWMU 40.

## **2.4 Data Evaluation**

The site specific data was evaluated using appropriate statistical methodologies, and data assessment was conducted in general conformance with the recommendations of USEPA guidance entitled *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities – Unified Guidance, March 2009* (EPA 530/R-09-007) in accordance with the approved work plan. Appendix D contains supporting data validation with complete laboratory analytical reports, provided on CD-ROM. Appendix E contains analytical summarization tables.

The following sections provide a summary of the data evaluation and LTM Program optimization for each analyte group that remain in the LTM Program as approved from the Year 1 and subsequent LTM Plans.

### **2.4.1 VOC**

While consistently below the established screening criteria, Acetone and 2-Chloroethyl Vinyl Ether laboratory analytical results were rejected during data validation of each prior sampling event due to low response factors. The sampling events on 6/19/13, 3/27/14, and 12/2/14 resulted in validated nondetect data for both analytes. In accordance with the approved IMWP, these remaining VOCs which had no detectable concentrations in groundwater samples for three consecutive monitoring events will no longer be part of the future monitoring requirements for SWMU 40. Table 1 summarizes the VOC analytical results for all the completed groundwater events.

### **2.4.2 Metals**

Arsenic and Cobalt had no detectable concentrations in groundwater samples for three consecutive monitoring events (6/19/13, 3/27/14, and 12/2/14). Consistent with the LTM optimization criterion number 1, these analytes no longer require monitoring requirements. In addition, Arsenic concentrations in groundwater at SWMU 40 were consistently below the MCL of 10 ug/L, which also results in no further need for monitoring per LTM criterion number 3. The remaining metals (Aluminum, Barium, Calcium, Iron, Lead, Magnesium, Manganese, Potassium, Selenium, Sodium, and Vanadium) are observed to display a static or downward trend in concentration, indicating they no longer require monitoring. Detail for discontinuing monitoring for these static or downward trending metal concentrations is further described in Section 3.1 below. Table 2 summarizes the metals analytical results for all the completed groundwater events.

### **2.4.3 Perchlorate**

Perchlorate detections in the monitoring network have consistently been below the level of detections in the background monitoring well LFMW01 and consistently below the drinking water MCL. Detail regarding perchlorate is further described in Section 3.1 below. Table 3 summarizes the Perchlorate analytical results for all the completed groundwater events.

### 3.0 CONCLUSIONS

The following section describes the rational for no further monitoring of specific metals and perchlorate at RFAAP SWMU 40.

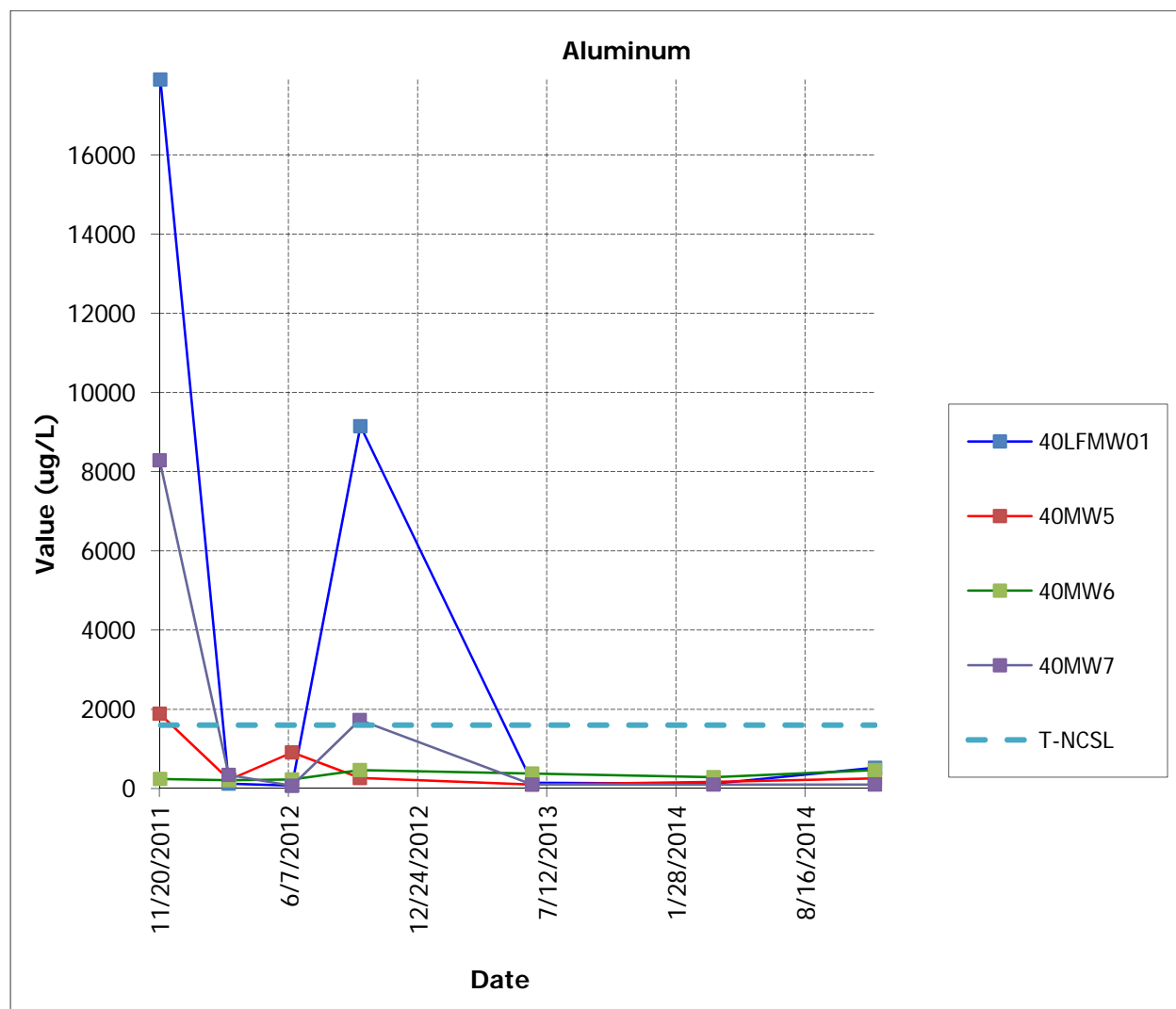
#### 3.1 Groundwater Data Evaluation

The IWMP for SWMU 40 indicated that the initial annual LTM report would include calculation of a background dataset, based upon the first four sampling events. The background well at SWMU 40 is LFMW01. The concentrations of specific constituents in downgradient wells (40MW5, 40MW6 and 40MW7) that were not eliminated due to LOQ, LOD and MCL screening criteria are evaluated and discussed below. Additionally, each analyte is compared to the Radford Army Ammunition Plant ATSDR (Agency for Toxic Substances and Disease Registry) drinking water comparison value as presented in the *Evaluation of Potential for Chemicals Released to Groundwater or Surface Water to Affect Drinking Water in the Nearby Community* dated January 28th, 2015. No downgradient monitoring wells for SWMU 40 exceeded any of the ATSDR drinking water comparison values. It should be noted that ATSDR reached two important conclusions in the health consultation. First, Public water systems in the area are not affected by releases from RFAAP. Therefore, contaminants from RFAAP in drinking water from public water systems cannot harm people's health. Secondly, Private wells near RFAAP are unlikely to be affected by releases from the facility. Therefore, contaminants from RFAAP in drinking water from private wells near RFAAP are unlikely to harm people's health. The following sections further explain the rational for no further monitoring at SWMU 40.

### Aluminum:

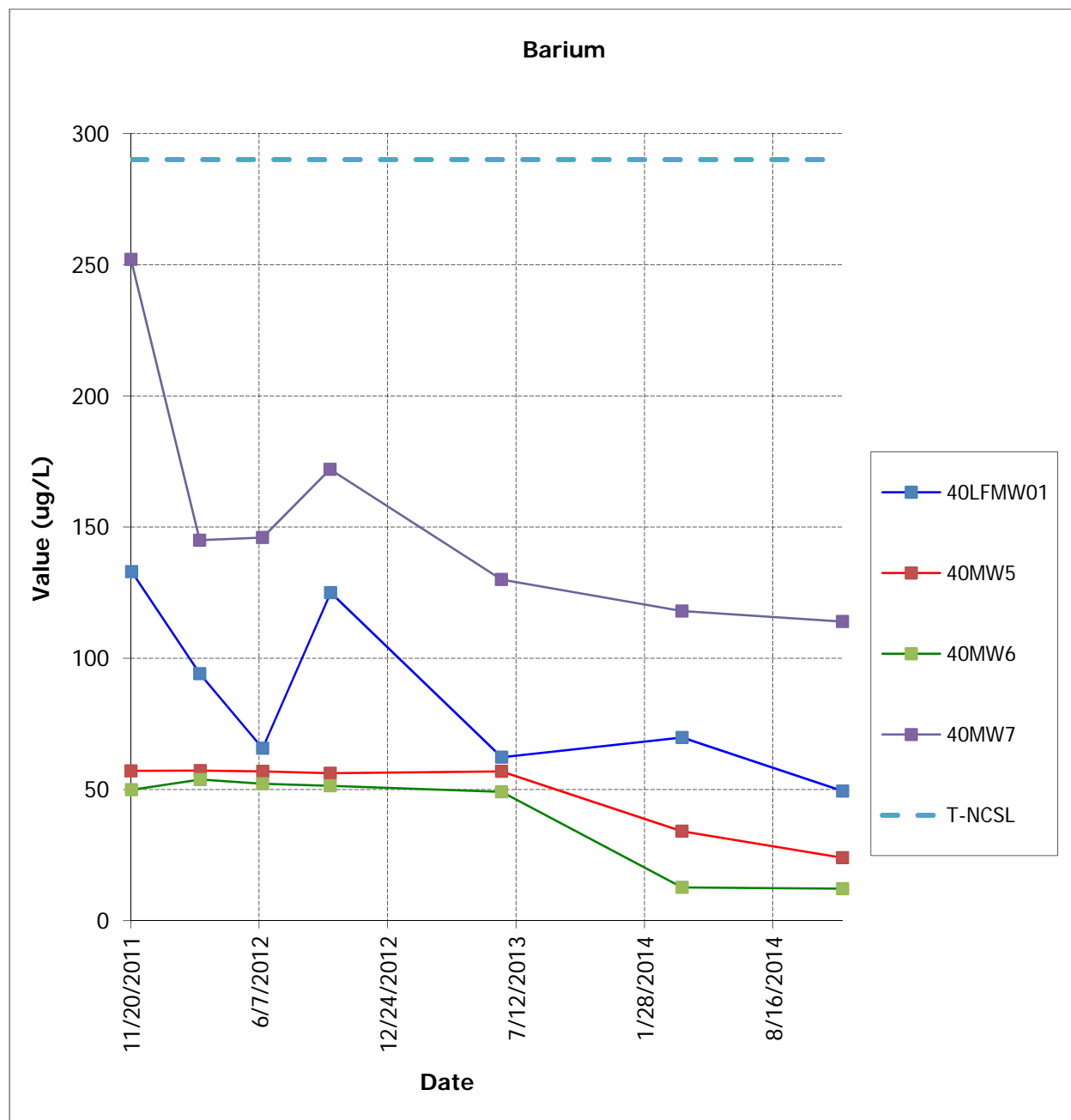
The below graph represents the analytical data for total aluminum in the monitoring well network at SWMU 40 for all groundwater monitoring events under the SWMU 40 IMWP to date. The graph shows the data in the monitoring well network have trended downward over time with the last three monitoring events being consistently below the screening level. An MCL is not established for aluminum. The screening level applied is the adjusted non-carcinogenic screening level (T-NCSL) established in the LTM portion of the IMWP. The ATSDR drinking water comparison value for aluminum is 10,000 ug/L which no downgradient monitoring wells exceeded during any of the monitoring events.

It is noted that during the initial sampling at SWMU 40, higher turbidity than latter sampling events was observed (in the range of 8.2 – 1330.8 NTU initial as compared to 0.1 – 45.4 NTU in recent monitoring events) which is interpreted as correlating with the elevated aluminum concentrations for earlier events. It is noted that while some total aluminum detections in groundwater have exceeded the T-NCSL in a limited number of events, the dissolved fraction of aluminum has been demonstrated to consistently be far below the T-NCSL (see Table 2). Additionally, it is noted that RFAAP continues to maintain the groundwater use restriction that is incorporated in the Land Use Controls for this site. Based on the downward trend of aluminum as illustrated in the graph, no further monitoring of this constituent is necessary in accordance with LTM criterion number 3.



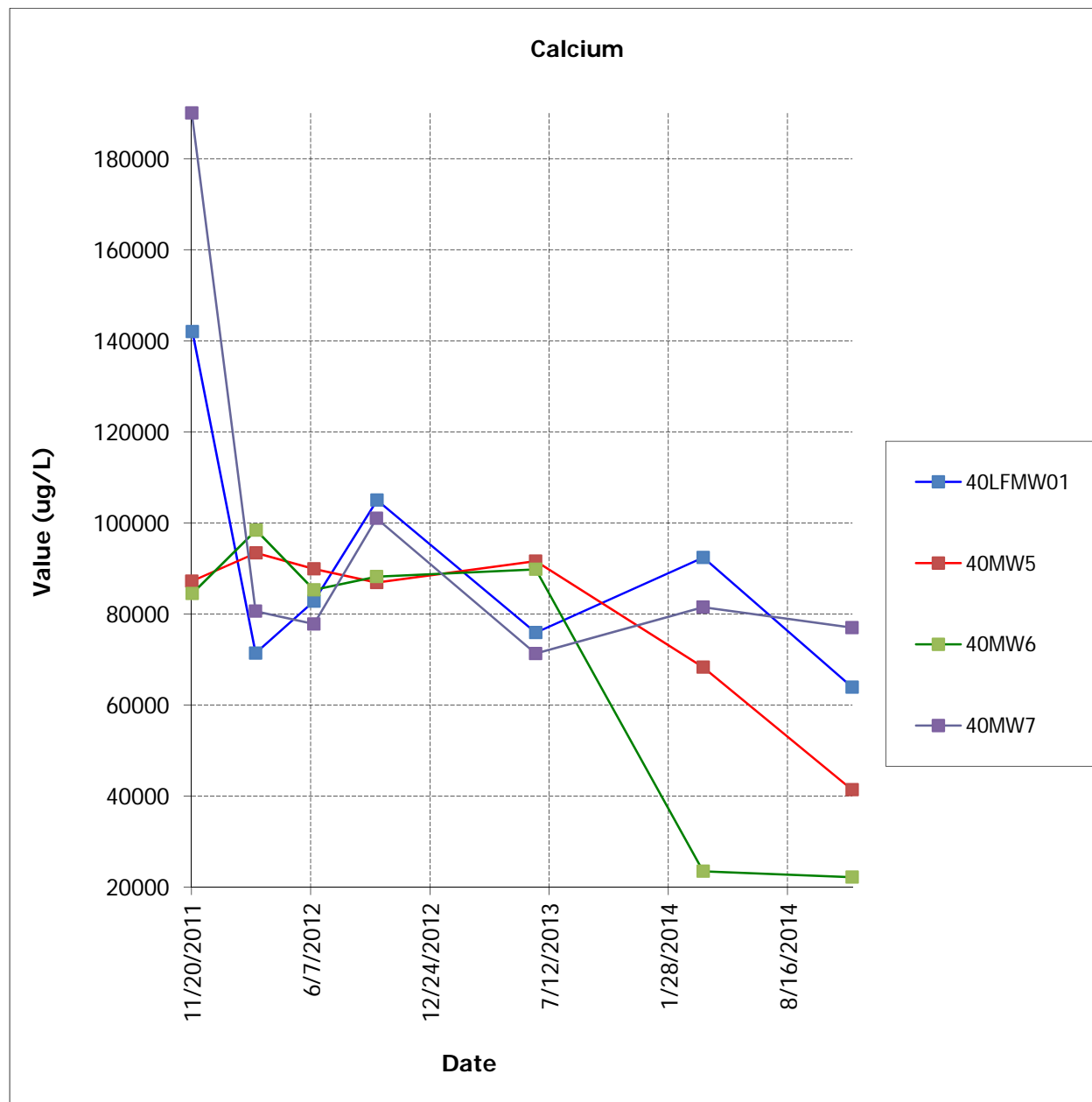
### Barium:

The below graph represents the analytical data for total barium in the monitoring well network at SWMU 40 for all LTM groundwater monitoring events to date. No detections of barium have approached the MCL (2,000 ug/L), and none have met or exceeded the T-NCSL of 290 ug/L (see Table 2 for additional data details). The graph shows the data in the monitoring well network have trended downward over time with all the monitoring events being consistently below the T-NCSL. Additionally the ATSDR drinking water comparison value for barium is 2,000 ug/L which no downgradient monitoring wells exceeded during any of the monitoring events. In accordance with LTM criterion number 3, monitoring of barium in groundwater will no longer be required.



### Calcium:

The below graph represents the analytical data for total calcium in the monitoring well network at SWMU 40 for all LTM groundwater monitoring events to date. The graph shows the data in the monitoring well network have trended downward over time. A screening level is not established for calcium and no drinking water comparison value is provided in the ATSDR Report. In accordance with the LTM data evaluation criterion number 3, monitoring of calcium concentrations will no longer be required.

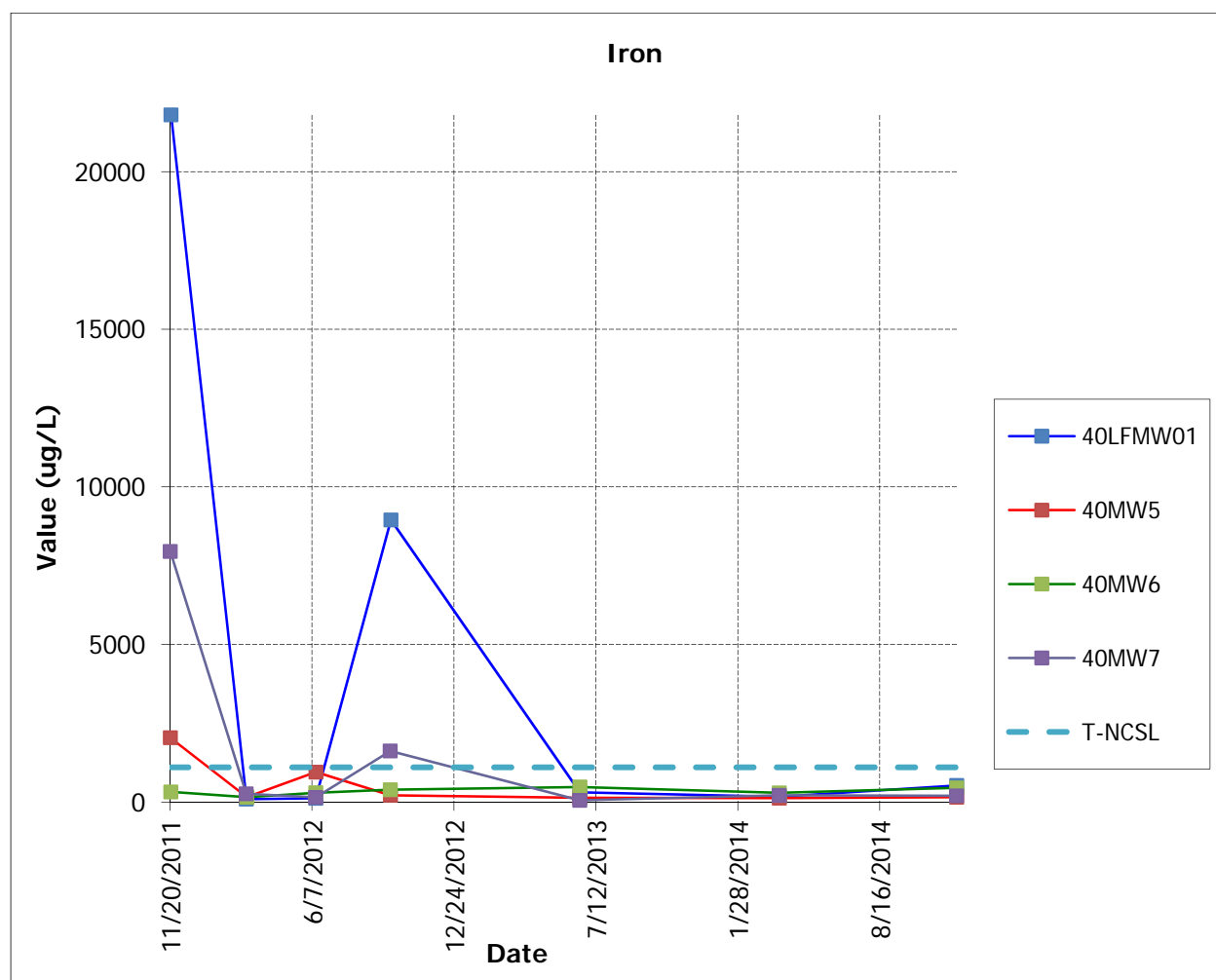




### Iron:

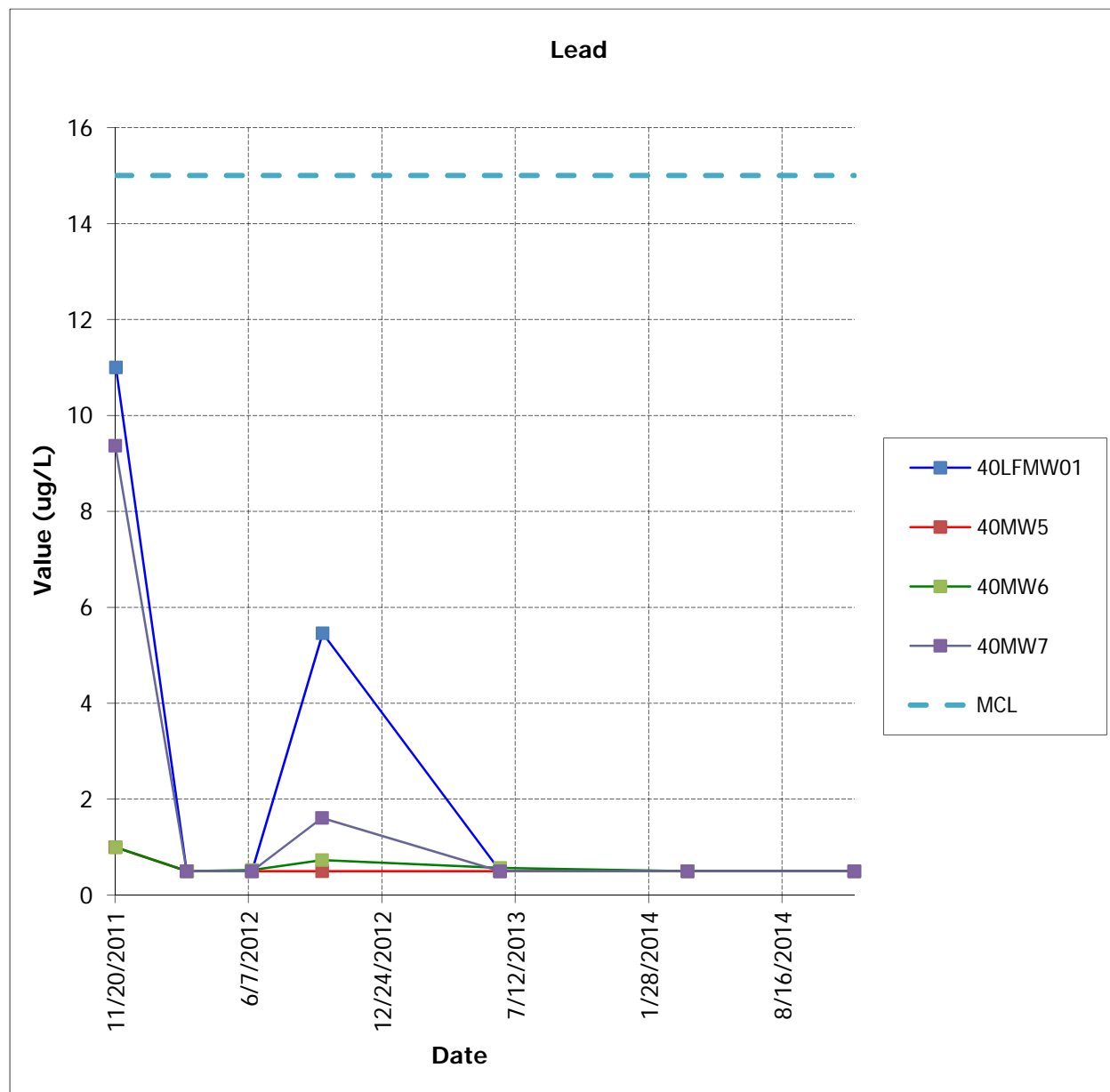
The below graph represents the analytical data for total iron in the monitoring well network at SWMU 40 for all groundwater monitoring events under the SWMU 40 IMWP to date. The graph shows the data in the monitoring well network have trended downward over time with the last three monitoring events being consistently below the screening level. An MCL is not established for iron. The screening level applied is the adjusted non-carcinogenic screening level (T-NCSL) established in the LTM portion of the IMWP. The ATSDR drinking water comparison value for iron is 11,000 ug/L which no downgradient monitoring wells exceeded during any of the monitoring events.

It is noted that during the initial sampling at SWMU 40, higher turbidity than latter sampling events was observed (in the range of 8.2 – 1330.8 NTU initial as compared to 0.1 – 45.4 NTU in recent monitoring events) which is interpreted as correlating with the elevated iron concentrations for earlier events. It is noted that while some total iron detections in groundwater have exceeded the T-NCSL in a limited number of events, the dissolved fraction of iron has been demonstrated to consistently be far below the T-NCSL (see Table 2). Additionally, it is noted that RFAAP continues to maintain the groundwater use restriction that is incorporated in the Land Use Controls for this site. Based on the downward trend of iron as illustrated in the graph, no further monitoring of this constituent is necessary in accordance with LTM criterion number 3.



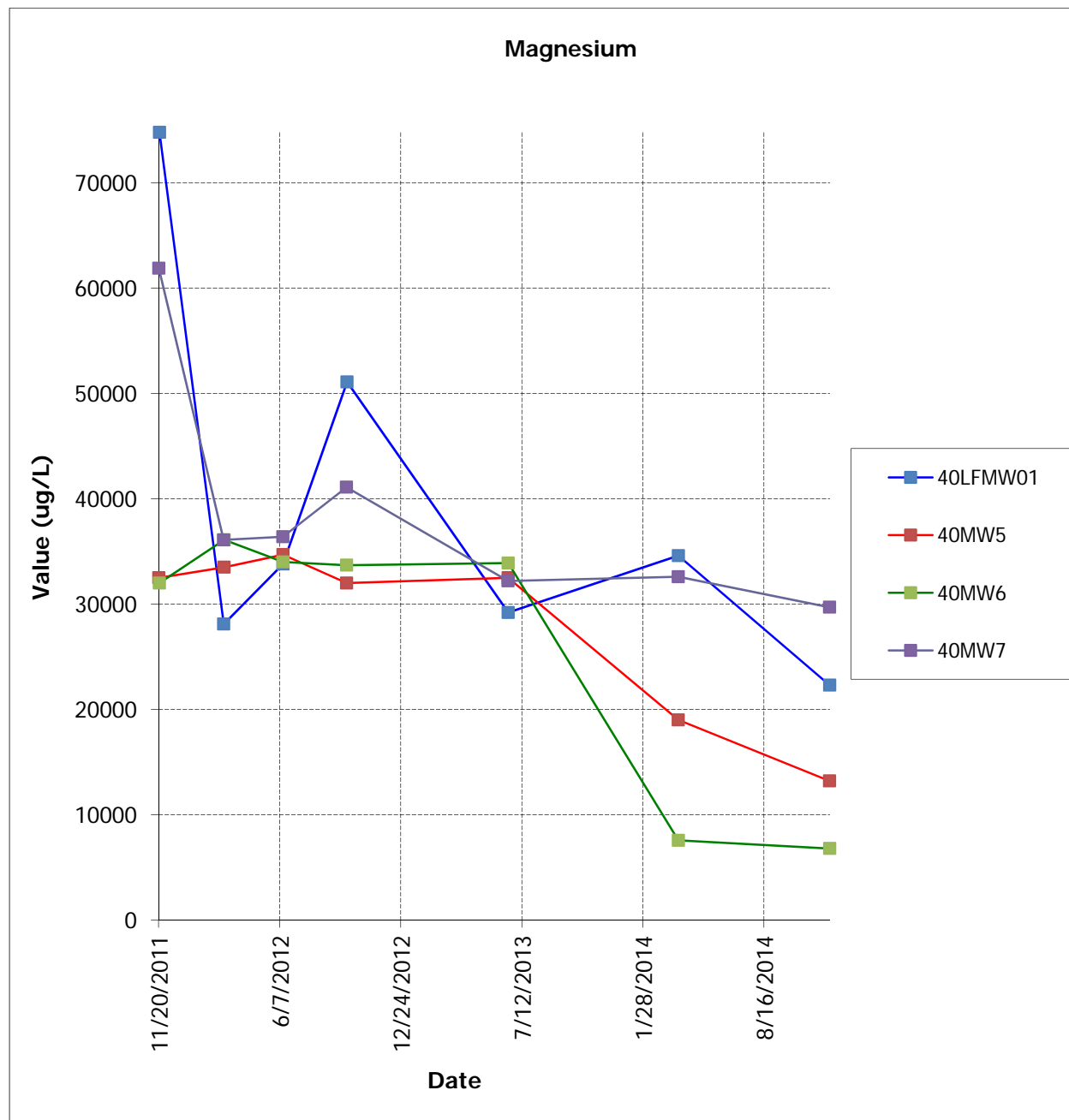
**Lead:**

The below graph represents the analytical data for total lead in the monitoring well network at SWMU 40 for all groundwater monitoring events under the SWMU 40 IMWP to date. The graph shows the data in the monitoring well network have trended downward over time with all the monitoring results being consistently below the MCL treatment technique action level of 15 ug/L. The ATSDR drinking water comparison value for lead is 15 ug/L which no downgradient monitoring wells exceeded during any of the monitoring events. In accordance with the LTM data evaluation criterion number 3, monitoring of lead will no longer be required.



### Magnesium:

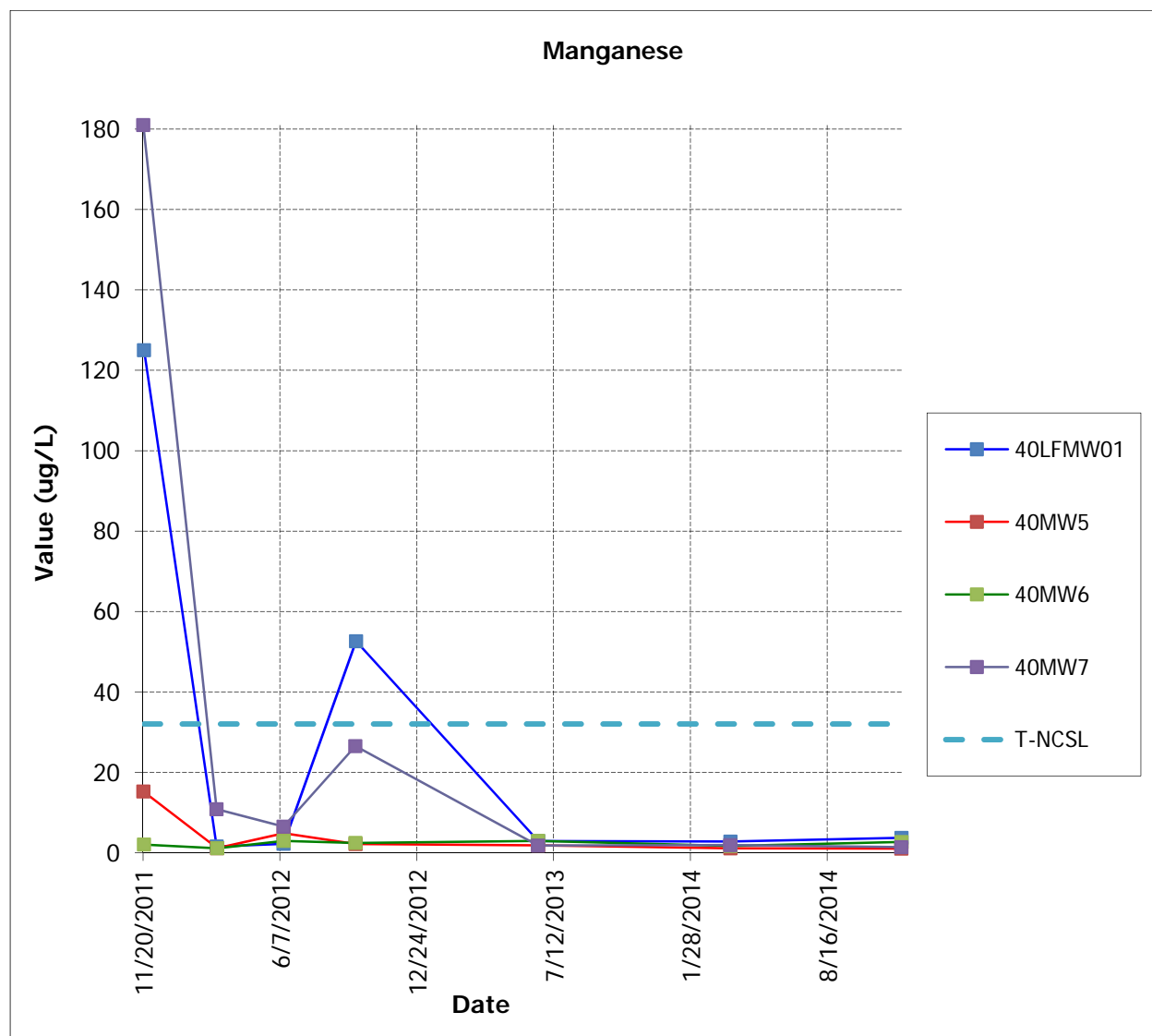
The below graph represents the analytical data for total magnesium in the monitoring well network at SWMU 40 for all groundwater monitoring events under the SWMU 40 IMWP to date. The graph shows the data in the monitoring well network have trended downward over time. No MCL or screening level is established for magnesium. In accordance with the LTM data evaluation criterion number 3, monitoring of magnesium will no longer be required.



### Manganese:

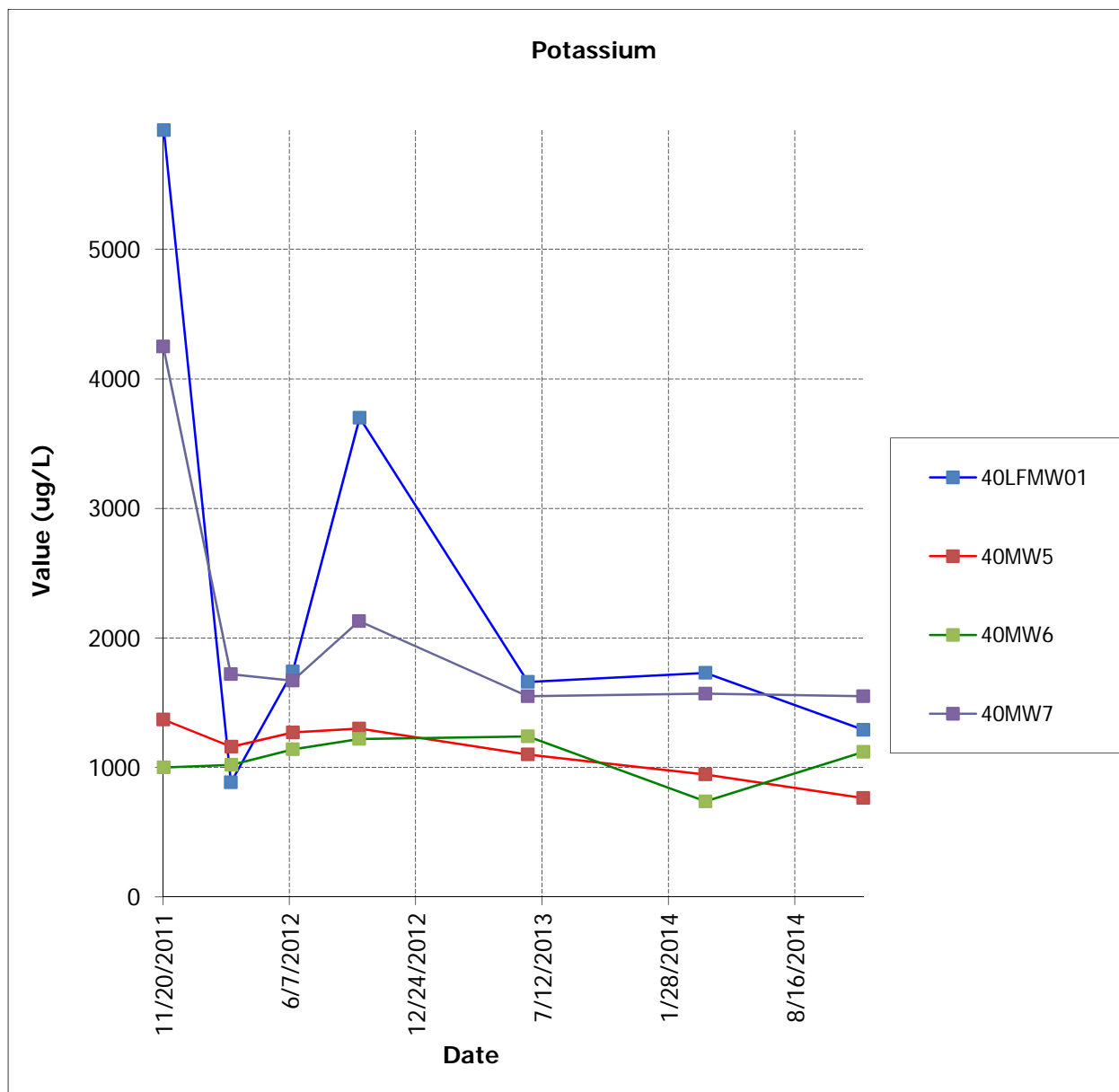
The below graph represents the analytical data for total manganese in the monitoring well network at SWMU 40 for all groundwater monitoring events under the SWMU 40 IMWP to date. The graph shows the data in the monitoring well network have trended downward over time with the last three monitoring events being consistently below the screening level. An MCL is not established for manganese. The screening level applied is the adjusted non-carcinogenic screening level (T-NCSL) established in the LTM portion of the IMWP. The ATSDR drinking water comparison value for manganese is 300 ug/L which no downgradient monitoring wells exceeded during any of the monitoring events.

It is noted that during the initial sampling at SWMU 40, higher turbidity than latter sampling events was observed (in the range of 8.2 – 1330.8 NTU initial as compared to 0.1 – 45.4 NTU in recent monitoring events) which is interpreted as correlating with the elevated manganese concentrations for earlier events. It is noted that while some total manganese detections in groundwater have exceeded the T-NCSL in a limited number of events, the dissolved fraction of manganese has been demonstrated to consistently be far below the T-NCSL (see Table 2). Additionally, it is noted that RFAAP continues to maintain the groundwater use restriction that is incorporated in the Land Use Controls for this site. Based on the downward trend of manganese as illustrated in the graph, no further monitoring of this constituent is necessary in accordance with LTM criterion number 3.



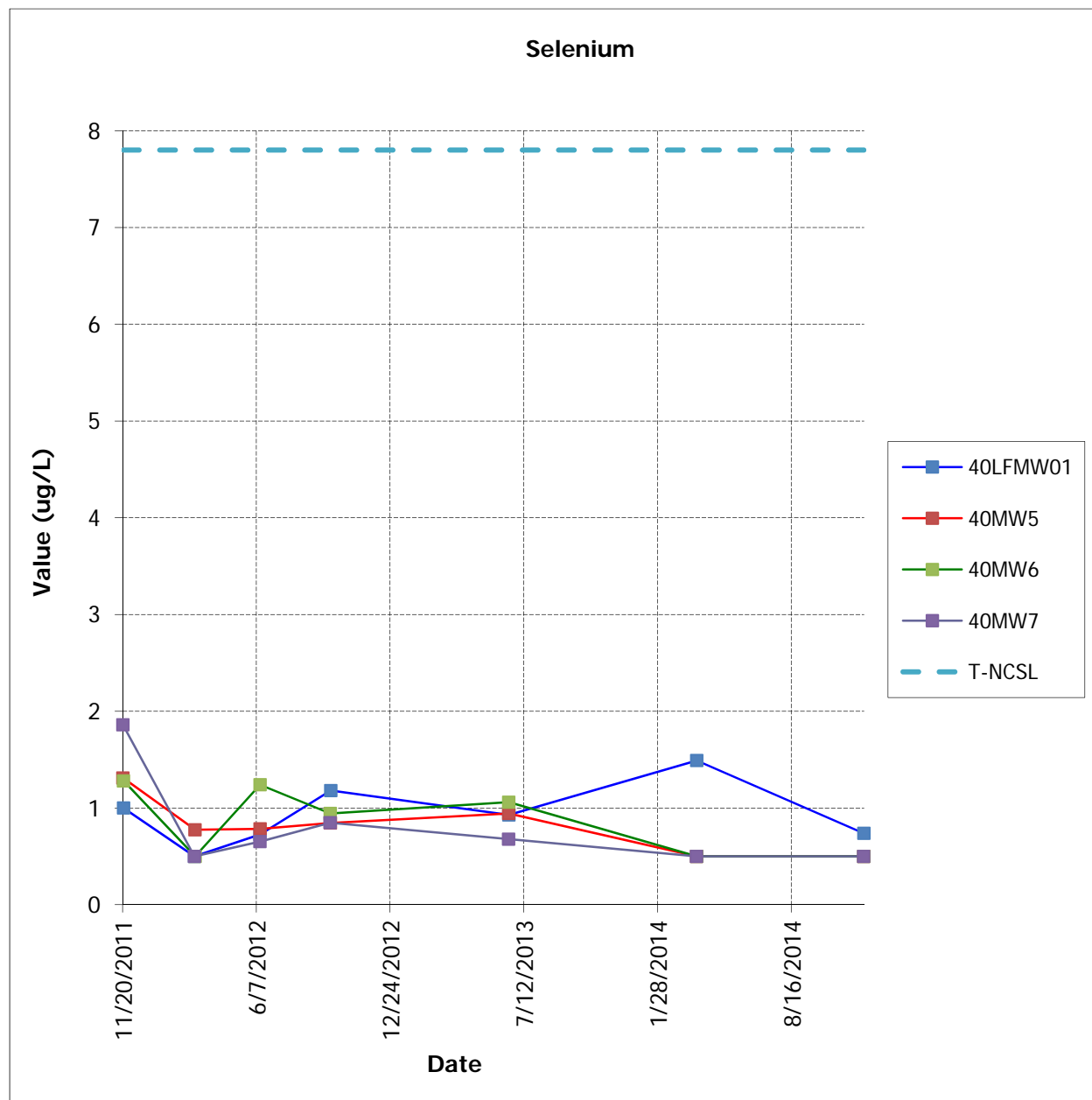
### Potassium:

The below graph represents the analytical data for total potassium in the monitoring well network at SWMU 40 for all LTM groundwater monitoring events to date. The graph shows the data in the monitoring well network are static to decreasing over time. No MCL or screening level exists for potassium. In accordance with LTM data evaluation criterion number 3, monitoring of potassium will no longer be required.



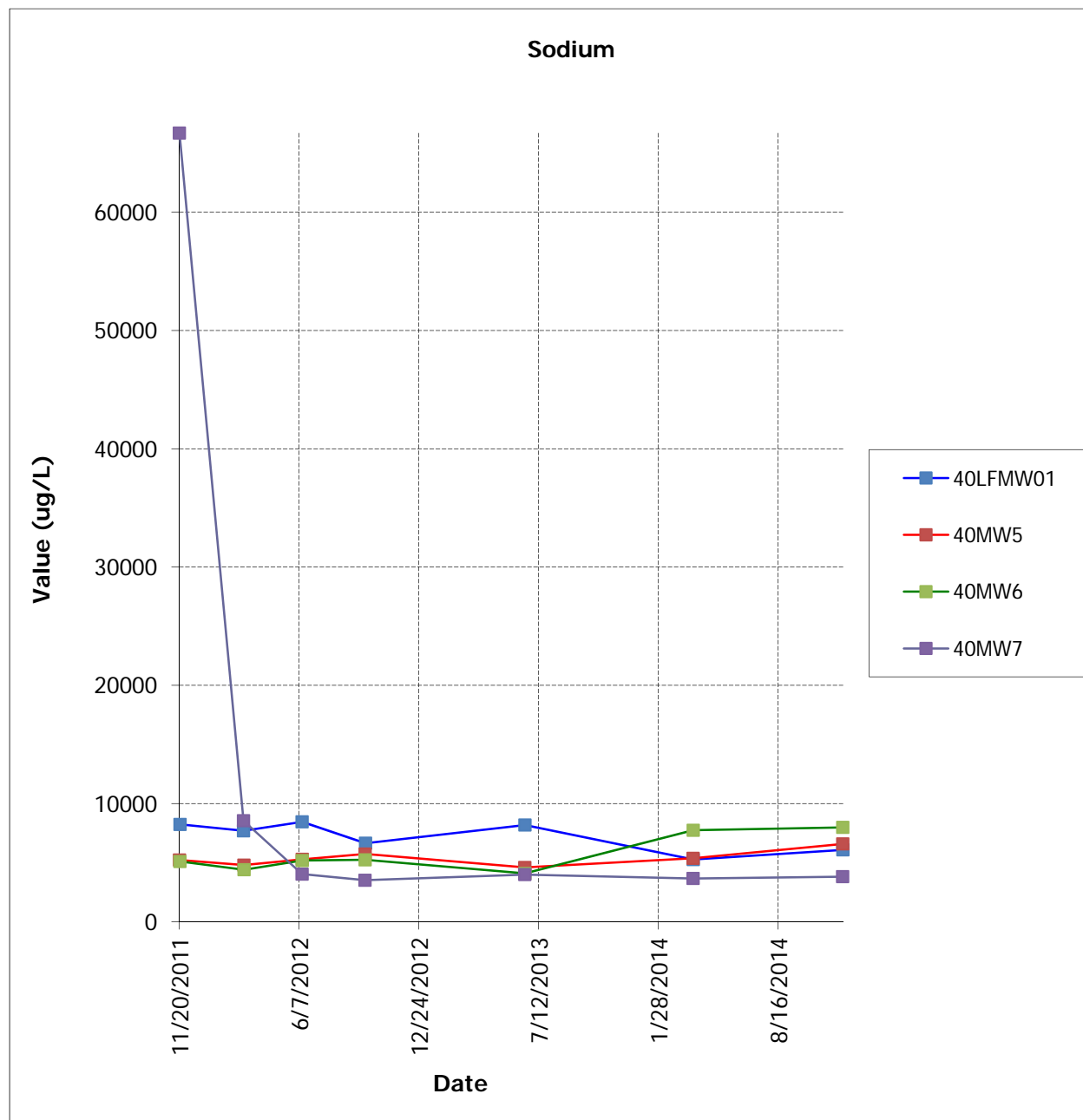
### Selenium:

The below graph represents the analytical data for total selenium in the monitoring well network at SWMU 40 for all LTM groundwater monitoring events to date. The graph shows the concentrations of selenium in the monitoring well network have been consistently below the T-NCSL and are static. None of the detections have approached the selenium MCL of 50 ug/L. The ATSDR drinking water comparison value for selenium is 50 ug/L which no downgradient monitoring wells exceeded during any of the monitoring events. In accordance with LTM data evaluation criterion number 3, monitoring of selenium will no longer be required.



### Sodium:

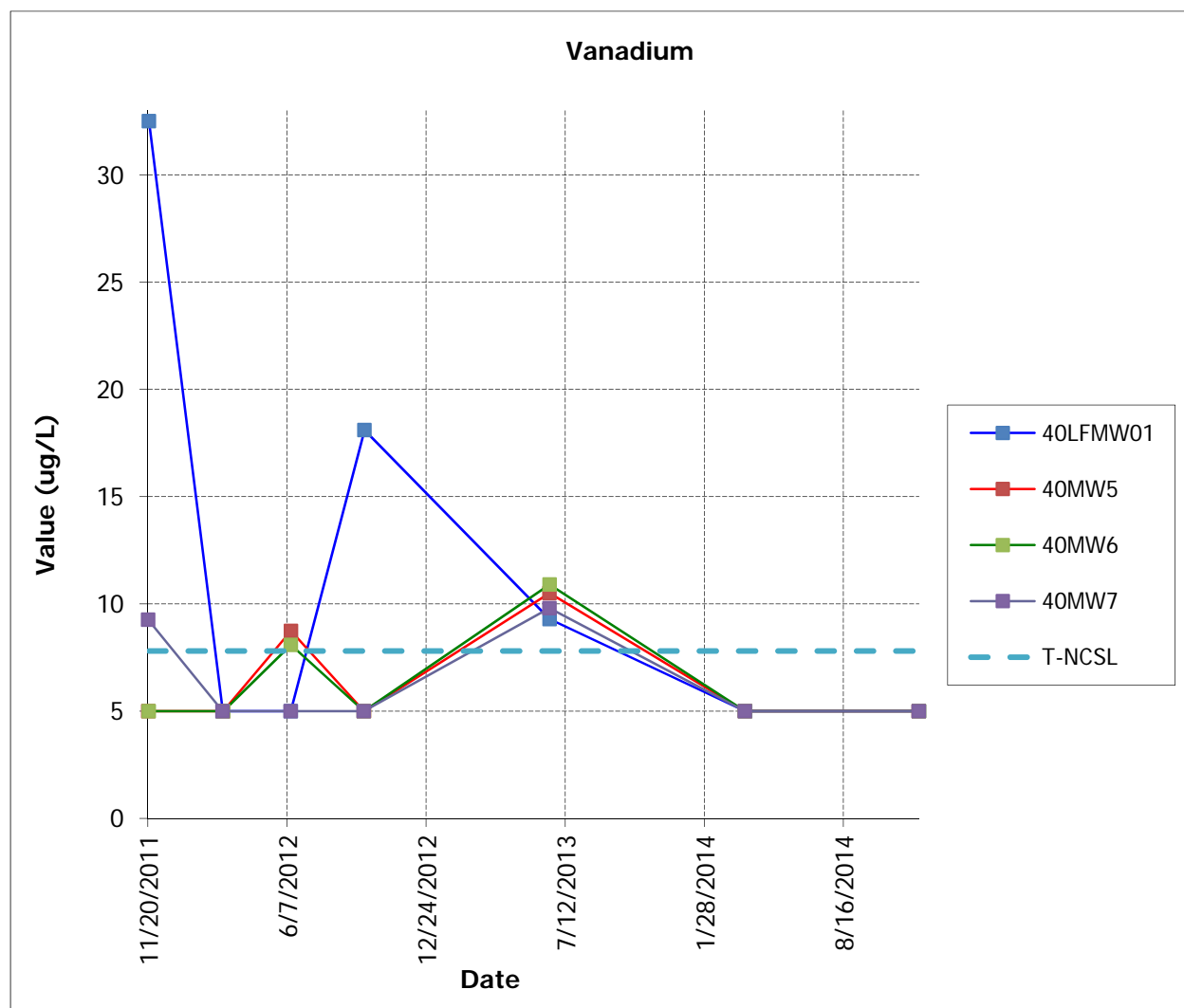
The below graph represents the analytical data for total sodium in the monitoring well network at SWMU 40 for all LTM groundwater monitoring events to date. The graph shows the data in the monitoring well network have remained static over time. No MCL or screening level is established for sodium. The detected concentrations indicate that, with the exception of the first sampling events in 40MW7, the sodium concentrations are generally equivalent detected concentrations in the background monitoring well LFMW01. In accordance with LTM data evaluation criterion number 3, monitoring of sodium will no longer be required.



### Vanadium:

The below graph represents the analytical data for total vanadium in the monitoring well network at SWMU 40 for all groundwater monitoring events under the SWMU 40 IMWP to date. An MCL is not established for vanadium. The screening level applied is the adjusted non-carcinogenic screening level (T-NCSL) established in the LTM portion of the IMWP. The ATSDR drinking water comparison value for vanadium is 100 ug/L which no downgradient monitoring wells exceeded during any of the monitoring events.

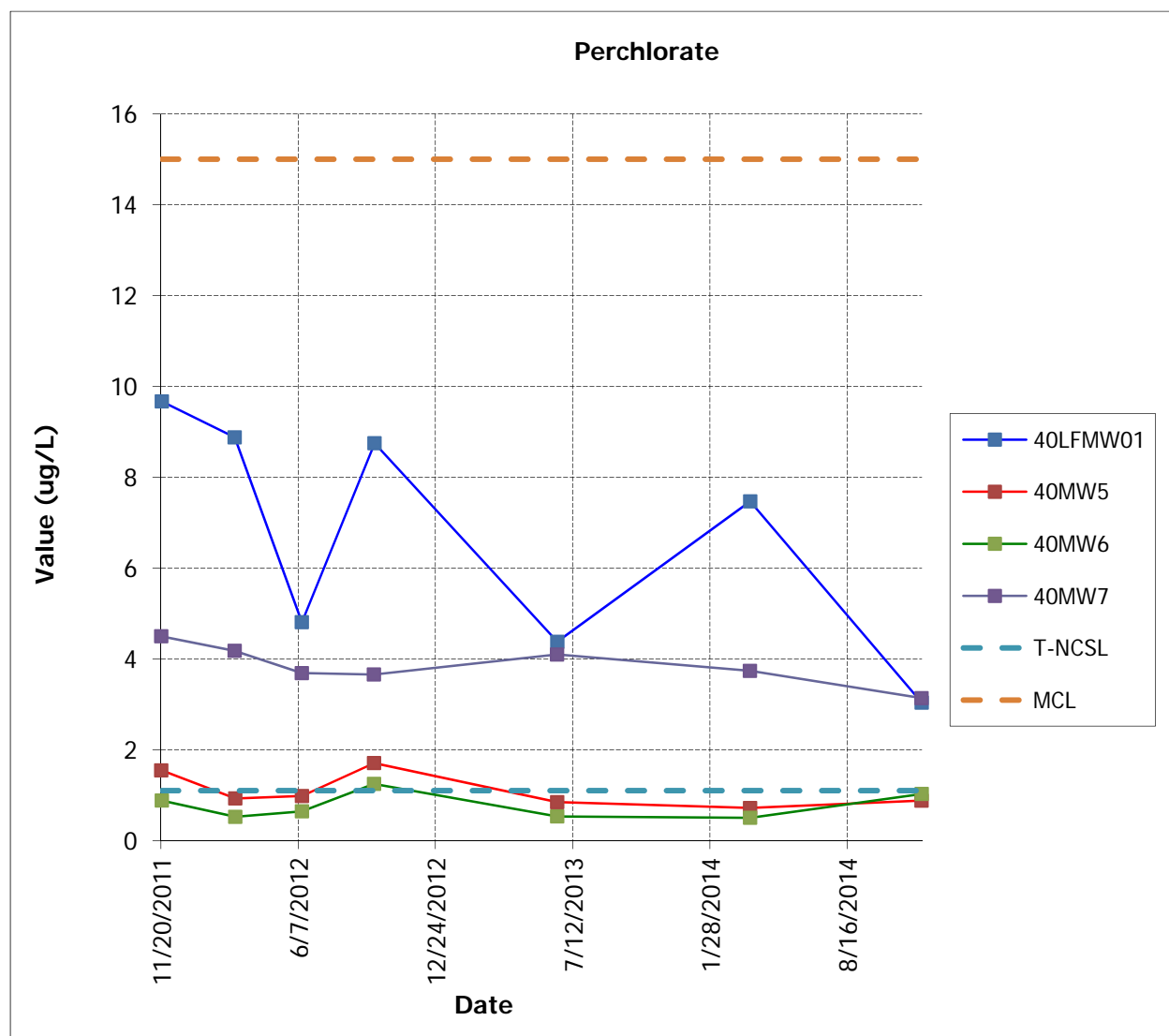
It is noted that during the initial sampling at SWMU 40, higher turbidity than latter sampling events was observed (in the range of 8.2 – 1330.8 NTU initial as compared to 0.1 – 45.4 NTU in recent monitoring events) which is interpreted as correlating with the elevated vanadium concentrations for earlier events. It is noted that while some total vanadium detections in groundwater have exceeded the T-NCSL in a limited number of events, the dissolved fraction of vanadium has been demonstrated to consistently be far below the T-NCSL (see Table 2) in the down gradient monitoring wells. Additionally, it is noted that RFAAP continues to maintain the groundwater use restriction that is incorporated in the Land Use Controls for this site. The data show that the highest recorded analysis are in the upgradient monitoring well LFMW01 with the down gradient monitoring wells reflecting concentrations that are typically below the T-NCSL. Other than the background well, the monitoring network detections indicate a static range of detected concentrations. In accordance with LTM data evaluation criterion number 3, monitoring of vanadium will no longer be required.





### Perchlorate:

The below graph represents the analytical data for perchlorate in the monitoring well network at SWMU 40 for all groundwater monitoring events under the SWMU 40 IMWP to date. The graph shows the data in the monitoring well network have been in consistent ranges below the background well LFMW01 over time with all the monitoring events being consistently below the MCL of 15 ug/L. Perchlorate has been detected in numerous wells at RFAAP at low concentrations. The RFI/CMS noted that updated laboratory analytical detection limits that are lower than historic limits may be the reason for low level detections. The RFI/CMS also noted that groundwater samples located immediately adjacent to and downgradient of the landfill (40MW3, 40MW5, and 40MW6) were below the unadjusted T-RBC; therefore, perchlorate was not identified as a COPC in groundwater in the RFI/CMS. The LTM data demonstrate that perchlorate in groundwater is not being influenced by SWMU 40. While the detected concentrations in some samples have exceeded the T-NCSL, the absence of any elevated concentration from the SWMU 40 monitoring wells indicates that there is no release of perchlorate from SWMU 40. The ATSDR drinking water comparison value for perchlorate is 7 ug/L which no downgradient monitoring wells exceeded during any of the monitoring events. The data indicate the perchlorate concentrations in the SWMU 40 monitoring wells is static. Based on the consistent detections well below the MCL and static concentrations in the LTM monitoring network, KEMRON does not recommend further groundwater monitoring of perchlorate at SWMU 40.



Within the first five years of monitoring, a remedy effectiveness evaluation will be conducted for SWMU 40. The remedy effectiveness evaluation will include a presentation of the groundwater data collected throughout the LTM program to date. It is currently anticipated that a remedy review will be conducted during Federal Fiscal Year (FFY) 2015; additional information regarding the review will be provided in correspondence between RFAAP and the regulatory personnel.

Additional LTM activities should include landfill inspections as specified in the IMWP, and consistent with inspections performed to date. The Land Use Controls established for SWMU 40 should be maintained and verified as part of the inspection process. It is currently anticipated that a remedy effectiveness evaluation will be conducted during FFY 2015, with a written report prepared and submitted. Based on the seven groundwater monitoring events conducted to date under the LTM program for SWMU 40, no further groundwater monitoring is recommended. Continued enforcement of the Land Use Controls and annual inspections of the SWMU should continue to verify on-going achievement of the CMOs for SWMU 40.

## 4.0 REFERENCES

U.S. Environmental Protection Agency (USEPA), 2000. *Permit for Corrective Action and Waste Minimization: Pursuant to the Resource Conservation and Recovery Act as Amended by the Hazardous and Solid Waste Amendment of 1984, Radford Army Ammunition Plant, Radford, Virginia.* VA1210020730.

URS Corporation (URS), 2003. *Final Master Work Plan, Quality Assurance Plan, Health and Safety Plan.* Radford Army Ammunition Plant, Radford, Virginia. Prepared for the U.S. Army Corps of Engineers, Baltimore District. August 2003.

Alliant Techsystems, Inc. (ATK), 2005. *Safety, Security and Environmental Rules for Contractors, Subcontractors, Tenants and Government Employees.* March 2005.

Intergovernmental Data Quality Task Force, 2005. *Uniform Federal Policy for Implementing Environmental Quality Systems; Evaluating, Assessing, and Documenting Environmental Data Collection/Use and Technology Program (UFP QAPP), Final, Version 2.* March 2005.

URS Corporation (URS), 2009. SWMU 40 (RAAP-009) and 71 (RAAP-002) RCRA Facility Investigation/Corrective Measures Study Report. Final. April 2009.

*Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities – Unified Guidance, March 2009 (EPA 530/R-09-007)*

U.S. Environmental Protection Agency, 2011. *Regional Screening Levels for Chemical Contaminants at Superfund Sites*, November 2011 revision. Available at: [http://www.epa.gov/reg3hwmd/risk/human/rb-concentration\\_table/Generic\\_Tables/index.htm](http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/index.htm).

U.S. Environmental Protection Agency, 2011. *List of Contaminants and Their Maximum Contaminant Levels (MCLs)*. Available at: <http://water.epa.gov/drink/contaminants/index.cfm#List>.

UXB-KEMRON, 2011. *Radford Army Ammunition Plant, Final Performance Based Acquisition Solid Waste Management Unit 40 (RAAP-009) Landfill Nitro Area Interim Measures Work Plan.* August 2011.

UXB-KEMRON, 2012. *Radford Army Ammunition Plant, Final Performance Based Acquisition Solid Waste Management Unit 40 (RAAP-009) Landfill Nitro Area Interim Measures Completion Report.* May 2012.

UXB-KEMRON, 2013. *Radford Army Ammunition Plant, Final Performance Based Acquisition Solid Waste Management Unit 40 (RAAP-009) Landfill Nitro Annual Long Term Monitoring Report.* April 2013.

UXB-KEMRON, 2013. *Radford Army Ammunition Plant, Draft as Final Performance Based Acquisition Solid Waste Management Unit 40 (RAAP-009) Landfill Nitro Annual Long Term Monitoring Report for Year 2.* October 2013.

UXB-KEMRON, 2014. *Radford Army Ammunition Plant, Draft as Final Performance Based Acquisition Solid Waste Management Unit 40 (RAAP-009) Landfill Nitro Annual Long Term Monitoring Report Year 3.* July 2014.

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES Agency for Toxic Substances and Disease Registry (ATSDR), 2015. *Health Consultation, Evaluation of Potential for Chemicals Released to Groundwater or Surface Water to Affect Drinking Water in the Nearby Community. RADFORD ARMY AMMUNITION PLANT RADFORD, VIRGINIA. EPA FACILITY ID: VA1210020730.* January 28, 2015.

## FIGURES





0 500 1000 2000 3000 4000  
Feet



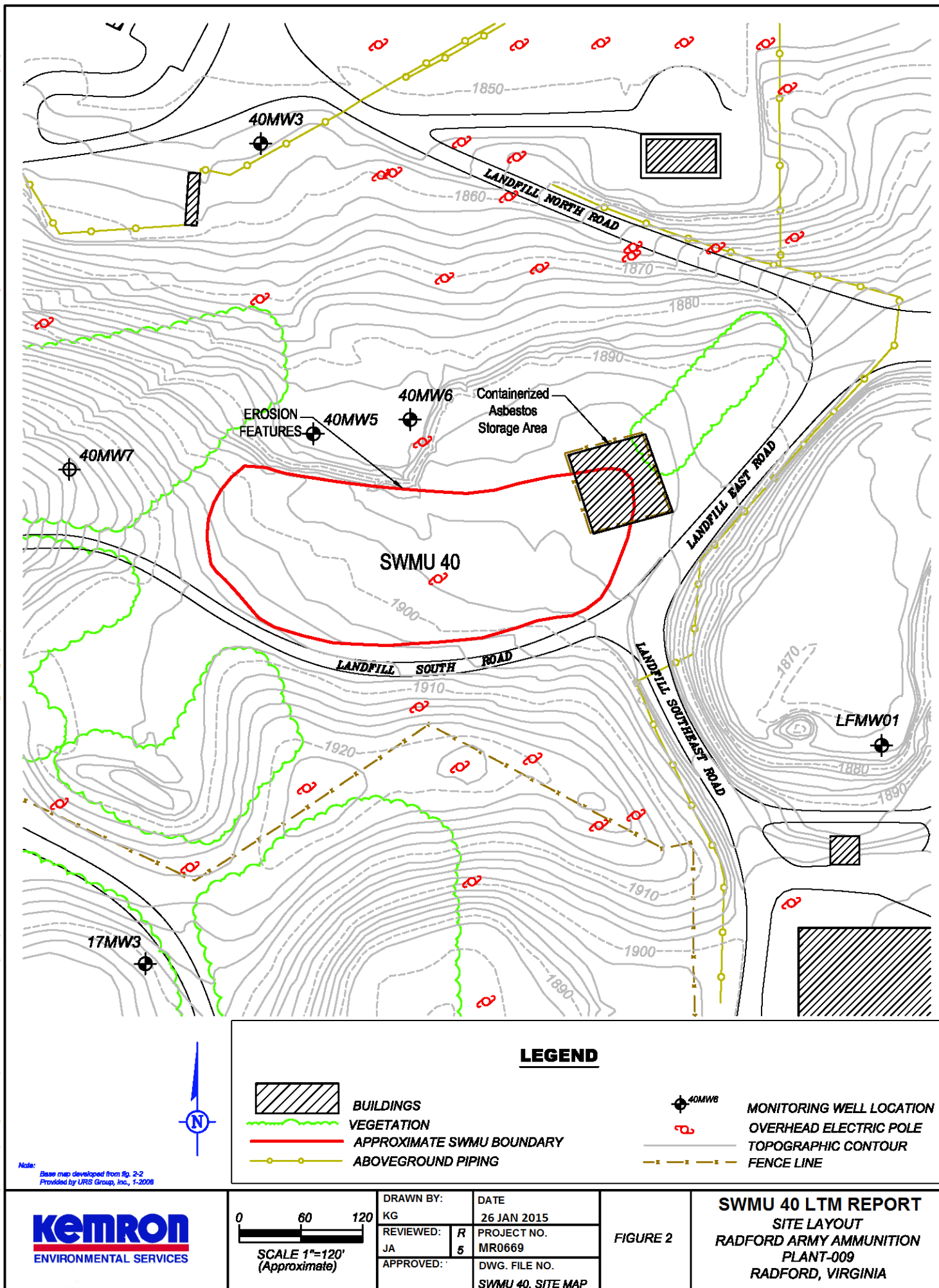
Source: Google Earth; Imagery Date: February 1, 2007



UXB-KEMRON Remediation Services, LLC  
2359-A Ellsworth Industrial Blvd.  
Atlanta, GA 30318

PROJECT NO. MR0669		DRAWING DATE: 01/26/2015
DESIGNED DRP	SITE LOCATION MAP SWMU 40 LTM REPORT	
DETAILED DRP		
CHECKED JA	LOCATION: RADFORD ARMY AMMUNITION PLANT, RADFORD, VIRGINIA	FIGURE: 1





### LEGEND



BUILDINGS



VEGETATION



APPROXIMATE SWMU BOUNDARY



ABOVEGROUND PIPING



MONITORING WELL LOCATION



OVERHEAD ELECTRIC POLE



TOPOGRAPHIC CONTOUR



FENCE LINE

Note:  
Base map developed from fig. 2-2  
Provided by URS Group, Inc., 1-2008

**KEMRON**  
ENVIRONMENTAL SERVICES

0 60 120  
SCALE 1"=120'  
(Approximate)

DRAWN BY:  
KG  
REVIEWED: R  
JA 5  
APPROVED:

DATE  
26 JAN 2015  
PROJECT NO.  
MR0669  
DWG. FILE NO.  
SWMU 40. SITE MAP

FIGURE 2

**SWMU 40 LTM REPORT**  
SITE LAYOUT  
RADFORD ARMY AMMUNITION  
PLANT-009  
RADFORD, VIRGINIA

**APPENDIX A**  
**Inspection Sheets and Site Photographs**



# INSPECTION OF CLOSED WASTE MANAGEMENT FACILITIES

Name of Waste Management Facility: RFAAP Swmu 40 (RAAP-009)

EPA Permit No. N/A

Date of Inspection 12/1/14

Time of Inspection 15:00 AM/PM

Reason for Inspection: Quarterly/ Major rainfall event (2" in 8 hr period)/ catastrophic event

ITEM	INSPECT FOR	DEFICIENCIES NOTED	REMEDIAL ACTION REQUIRED
Final Soil Cover	Erosion Settlement, Subsidence, or Displacement Pooling	<u>none</u>	
Vegetative Cover	Dead vegetation, or inadequate growth Presence of trees, shrubs, or deep rooted vegetation Need to fertilize, irrigate, or cut grass	<u>none</u>	
PVC Liner (if applicable)	Liner exposed	<u>n/a</u>	
<b>Peripheral Drainage Swales</b>	Erosion Subsidence Pooling	<u>none</u>	
Stormwater Drainage Areas	Erosion Subsidence Vegetation growth Accumulated sediment	<u>none</u>	
Security (if applicable)	Access road in place Sign legible and in place Fences not breached and no visible damage	<u>none</u>	
Monitoring Wells Outer protective casing Well caps and locks Concrete pad Inner cap and riser	Casing in good condition In place and functioning Cracks or settlement Intact and functioning	<u>none</u>	
<b>Benchmarks (2) (if applicable)</b>	Monuments present and visible Damage to monument	<u>n/a</u>	

Date and nature of repairs or remedial action: \_\_\_\_\_

Printed Name of Inspector: Jonah Anderson

Signature of Inspector: [Signature]

Company: Kemron

Date remedial action completed: \_\_\_\_\_

Remedial action approved by: \_\_\_\_\_



View of SWMU 40 to the East



View of SWMU 40 to the West





View to the North of SWMU 40



View of SWMU 40 Swale





View to the West of SWMU 40



Setting up on 40MW-5 for Ground Water Sampling

**APPENDIX B**  
**Field Documentation**



Location RADFORD, VA

Date 12-1-14

Project / Client SUMU 40, REAAP

- 1330 - ONSITE AT BADGINK  
OFFICE FOR VISITOR BRIDGE  
AND VEHICLE PASS
- 1430 - MET MATT ALBERTS, Jim McKenna  
AND SAFETY AT SUMU 40  
FOR ENTRY PERMIT, HOT WORK  
PERMIT, AND TOOL PROPERTY PASS.
- 1500 - COMPLETED SUMU 40  
INSPECTION. JIM MCKENNA  
NOTED NO ISSUES W/ SUMU 40
- 1530 - JACOB COMPLETED HIS MEETING
- 1545 - COLLECTED WATER LOGS  
40MW7 = 99.64'  
LFMW01 = 30.00'  
40MW6 = 50.58'  
40MW5 = 45.32'  
40MW3 = 64.35'
- 1600 - JACOB'S OFFSITE
- [Signature]*

Location RADFORD, VA

Date 12-2-14

Project / Client SUMU 40, REAAP

- 0630 - CALIBRATED YSI
- 0800 - JACOB'S OFFSITE  
37°F - CLOUDY
- 0815 - COMPLETED HIS MEETING
- 0830 - SETTING UP ON 40 MW 7  
WL = 99.67'
- 0915 - JIM MCKENNA STOPPED BY  
AND APPROVED PICTURES
- 0917 - COLLECTED SAMPLE  
40MW7GW12214
- 0945 - DECONNED PUMP
- 1050 - COLLECTED EQUIPMENT RISE  
40EQR12214
- 1105 - COLLECTED FIELD BLANK  
40FB12214
- 1110 - SETTING UP ON 40MW5  
WL = 65.08'
- 1158 - COLLECTED SAMPLE  
40MW5GW12214  
COLLECTED DUPLICATE SAMPLE  
40DUPGW12214
- 1205 - COLLECTED MS/MSD @ 40MW5
- 1215 - DECONNED PUMP

Location RANDOLPH, VA Date 12-2-14  
Project / Client RFAP, SWMU 40

1250 - SETTING UP ON 40 MW6  
WL = 50.27

1406 - COLLECTED SAMPLE  
40MW6 GW12214

1415 - DeZanne Pump

1505- SETTING UP ON LFMW01  
WL = 28.97

1545- COLLECTED SAMPLE  
LFMW01GW12214

1550 - DECONED PUMP

1620 - CONTAMINATED ALL DECOR  
WATER FOR TRANSPORT TO  
BIOPANT. & 80 gallons

NOTE: Jim McKenna's ONSTE  
 @ 1400 AM APPROVED PICTURES.  
 ALSO NO ISSUES w/ SWM v 40  
 WERE NOTED.

1435 - SIGNED IN w/ BIOPLANT OPERATOR  
AND DISCHARGED  $\approx 80$  gallons at  
LIFT STATION

1700 - SA/PS OFFSITE

100

Location \_\_\_\_\_ Date \_\_\_\_\_

# FIELD CALIBRATION FORM

INITIAL CALIBRATION	FINAL CALIBRATION
DATE: 12-2-14	DATE: 12-2-14
TIME: 0630 (STARTED @ 0600)	TIME: 0630

## pH METER CALIBRATION

CALIBRATION STANDARD REFERENCE NO: n/A

METER ID YSE

pH STANDARD	INITIAL READING	RECALIB. READING	FINAL READING
7.0	7.00	7.00	7.00
10.0	9.99	10.01	10.01
4.0	4.01	3.99	3.99

## CONDUCTIVITY METER CALIBRATION

CALIBRATION STANDARD REFERENCE NO: n/A

METER ID YSI

COND. STANDARD	INITIAL READING	RECALIB. READING	FINAL READING
1.413	1.418	1.413	1.413

## DISSOLVED OXYGEN METER CALIBRATION

CALIBRATION STANDARD REFERENCE NO: n/A

METER ID YSI

STANDARD	INITIAL READING	RECALIB. READING	FINAL READING
TAP	97.2%	97.1%	97.1%



# FIELD CALIBRATION FORM

## TURBIDITY METER CALIBRATION

CALIBRATION STANDARD REFERENCE NO: \_\_\_\_\_

METER ID YSI

STANDARD	INITIAL READING	RECALIB. READING	FINAL READING
124	123.2	124.1	126.1
0	0.1	0.0	0.0

## ORD METER CALIBRATION

CALIBRATION STANDARD REFERENCE NO: \_\_\_\_\_

METER ID YSI

STANDARD	INITIAL READING	RECALIB. READING	FINAL READING
254	249	254	254

## PID CALIBRATION

CALIBRATION STANDARD REFERENCE NO: N/A

METER ID N/A

STANDARD	INITIAL READING	RECALIB. READING	FINAL READING
	N/A		

COMMENTS \_\_\_\_\_

SIGNATURE [Signature]

# Daily Safety Meeting

Project Name: SWMU 40

Date: 12-1-14

Location: RADPAW, VA

Presented by: SA

## Check the Topics/Information Reviewed:

- |   |  |
|---|--|
| <ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> Daily work scope reviewed</li> <li><input checked="" type="checkbox"/> safety is everyone's responsibility</li> <li><input checked="" type="checkbox"/> site health and safety plan reviewed</li> <li><input checked="" type="checkbox"/> safety glasses, hard hat, safety boots</li> <li><input type="checkbox"/> employee Right-To- Know/MSDS location</li> <li><input type="checkbox"/> vehicle safety and driving/road conditions</li> <li><input type="checkbox"/> hazard analysis for all tasks or new technology</li> <li><input checked="" type="checkbox"/> chemical hazards</li> <li><input checked="" type="checkbox"/> first aid, safety, and PPE location</li> <li><input checked="" type="checkbox"/> sharp object, rebar, and scrap metal hazards</li> <li><input checked="" type="checkbox"/> latex gloves inner/nitrile gloves outer</li> <li><input type="checkbox"/> open pits, excavations, and trenching hazards</li> <li><input type="checkbox"/> excavation/trenching inspections/documentation</li> <li><input type="checkbox"/> full face respirators with proper cartridges</li> <li><input type="checkbox"/> upgrade to Level C at:</li> <li><input checked="" type="checkbox"/> work stoppage at:</li> <li><input type="checkbox"/> portable tool safety and awareness</li> <li><input checked="" type="checkbox"/> slips, trips, and falls</li> <li><input checked="" type="checkbox"/> strains and sprains</li> <li><input type="checkbox"/> anticipated visitors</li> <li><input checked="" type="checkbox"/> electrical ground fault</li> <li><input type="checkbox"/> public safety and fences</li> <li><input type="checkbox"/> excavator swing and loading</li> <li><input checked="" type="checkbox"/> orderly site and housekeeping</li> <li><input checked="" type="checkbox"/> smoking in designated areas</li> </ul> | <ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> leather gloves for protection</li> <li><input type="checkbox"/> effects of the night before? Rain or snow?</li> <li><input type="checkbox"/> vibration related injuries</li> <li><input type="checkbox"/> noise hazards</li> <li><input type="checkbox"/> confined space entry</li> <li><input checked="" type="checkbox"/> hot work permits</li> <li><input type="checkbox"/> overhead utility locations cleared?</li> <li><input type="checkbox"/> all underground utilities cleared?</li> <li><input type="checkbox"/> equipment and machinery familiarization</li> <li><input checked="" type="checkbox"/> fire extinguisher locations</li> <li><input checked="" type="checkbox"/> eye wash station locations</li> <li><input checked="" type="checkbox"/> directions to hospital</li> <li><input type="checkbox"/> heat and cold stress</li> <li><input checked="" type="checkbox"/> decontamination steps</li> <li><input type="checkbox"/> review emergency protocol</li> <li><input type="checkbox"/> parking and laydown area</li> <li><input checked="" type="checkbox"/> vehicle backing up hazards</li> <li><input checked="" type="checkbox"/> accidents can be costly</li> <li><input checked="" type="checkbox"/> no horse play</li> <li><input type="checkbox"/> dust and vapor control</li> <li><input type="checkbox"/> refueling procedures</li> <li><input type="checkbox"/> flying debris hazards</li> <li><input type="checkbox"/> poison ivy/oak/sumac</li> </ul> |
|---|--|

## Other Discussion Items/Comments/Follow-up Actions:

NAME (PRINT)  
Patrick Spurgeon

NAME (SIGNATURE)  


COMPANY  
KEMRON

## Instructions:

- # Conduct a daily safety meeting prior to beginning each day's site activities.
- # Complete form, obtain signatures, and file with the Daily Summary.
- # Follow-up on any noted items and document resolution of any action items.

# Daily Safety Meeting

Project Name: Sumu 40

Date: 12-2-14

Location: RAFMS, VA

Presented by: SA

## Check the Topics/Information Reviewed:

- |  |  |
|--|--|
| <ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> Daily work scope reviewed</li> <li><input checked="" type="checkbox"/> safety is everyone=s responsibility</li> <li><input checked="" type="checkbox"/> site health and safety plan reviewed</li> <li><input checked="" type="checkbox"/> safety glasses, hard hat, safety boots</li> <li><input checked="" type="checkbox"/> employee Right-To- Know/MSDS location</li> <li><input checked="" type="checkbox"/> vehicle safety and driving/road conditions</li> <li><input type="checkbox"/> hazard analysis for all tasks or new technology</li> <li><input checked="" type="checkbox"/> chemical hazards</li> <li><input checked="" type="checkbox"/> first aid, safety, and PPE location</li> <li><input type="checkbox"/> sharp object, rebar, and scrap metal hazards</li> <li><input checked="" type="checkbox"/> latex gloves inner/nitrile gloves outer</li> <li><input type="checkbox"/> open pits, excavations, and trenching hazards</li> <li><input type="checkbox"/> excavation/trenching inspections/documentation</li> <li><input type="checkbox"/> full face respirators with proper cartridges</li> <li><input type="checkbox"/> upgrade to Level C at:</li> <li><input checked="" type="checkbox"/> work stoppage at:</li> <li><input checked="" type="checkbox"/> portable tool safety and awareness</li> <li><input checked="" type="checkbox"/> slips, trips, and falls</li> <li><input checked="" type="checkbox"/> strains and sprains</li> <li><input checked="" type="checkbox"/> anticipated visitors</li> <li><input checked="" type="checkbox"/> electrical ground fault</li> <li><input type="checkbox"/> public safety and fences</li> <li><input type="checkbox"/> excavator swing and loading</li> <li><input checked="" type="checkbox"/> orderly site and housekeeping</li> <li><input checked="" type="checkbox"/> smoking in designated areas</li> </ul> | <ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> leather gloves for protection</li> <li><input type="checkbox"/> effects of the night before? Rain or snow?</li> <li><input type="checkbox"/> vibration related injuries</li> <li><input type="checkbox"/> noise hazards</li> <li><input type="checkbox"/> confined space entry</li> <li><input checked="" type="checkbox"/> hot work permits</li> <li><input type="checkbox"/> overhead utility locations cleared?</li> <li><input type="checkbox"/> all underground utilities cleared?</li> <li><input type="checkbox"/> equipment and machinery familiarization</li> <li><input checked="" type="checkbox"/> fire extinguisher locations</li> <li><input checked="" type="checkbox"/> eye wash station locations</li> <li><input checked="" type="checkbox"/> directions to hospital</li> <li><input checked="" type="checkbox"/> heat and cold stress</li> <li><input type="checkbox"/> decontamination steps</li> <li><input checked="" type="checkbox"/> review emergency protocol</li> <li><input type="checkbox"/> parking and laydown area</li> <li><input type="checkbox"/> vehicle backing up hazards</li> <li><input checked="" type="checkbox"/> accidents can be costly</li> <li><input checked="" type="checkbox"/> no horse play</li> <li><input type="checkbox"/> dust and vapor control</li> <li><input type="checkbox"/> refueling procedures</li> <li><input type="checkbox"/> flying debris hazards</li> <li><input type="checkbox"/> poison ivy/oak/sumac</li> </ul> |
|--|--|

## Other Discussion Items/Comments/Follow-up Actions:

NAME (PRINT)	NAME (SIGNATURE)	COMPANY
<u>Patrick Spurgeon</u>	<u>[Signature]</u>	<u>KEMRON</u>
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

## Instructions:

- # Conduct a daily safety meeting prior to beginning each day=s site activities.
- # Complete form, obtain signatures, and file with the Daily Summary.
- # Follow-up on any noted items and document resolution of any action items.



COC No. A 6140

2343-A State Route 821

Marietta, OH 45750



## CHAIN-OF-CUSTODY RECORD

Phone: 740-373-4308

Fax: 740-376-2536

Company Name: <b>KENRON</b>				Project Contact: <b>MARY LOU ROCHETTE</b>		Contact Phone #: <b>740-373-4308</b>		Program <input type="checkbox"/> CWA <input type="checkbox"/> RCRA <input type="checkbox"/> DOD <input type="checkbox"/> AFCEE <input type="checkbox"/> Other					
Turn Around Requirements: <b>14-DAY</b>				Location: <b>RADFORD, VA</b>		TOTAL # (LAB USE)							
Project ID: <b>MR06069-300-004 SWMU 40(REMP) GYM YR 4</b>				Signature: <i>[Signature]</i>		ADDITIONAL REQUIREMENTS							
Sampler (print): <b>JOHN ANGELO</b>				Signature: <i>[Signature]</i>		<i>APAC APP</i> <i>SWMU 40</i> <i>REMP</i> <i>AVOA's MC</i> <i>DPRESERVED</i>  <i>METALS LIST</i> <i>Al, Ar, B, Ca, Co,</i> <i>Fe, Pb, Mn, Mg,</i> <i>K, Se, Na, V</i>  <i>-8260 L-551</i> <i>-2-Chloroethyl</i> <i>Vinyl Ether</i> <i>Acetone</i>							
Sample I.D. No.	Comp	Grab	Date	Time	Matrix*	NUMBER OF CONTAINERS	Hold	RELINQUISHED BY (Signature)	RELINQUISHED BY (Date)	RECEIVED BY (Signature)	RECEIVED BY (Date)	REMARKS	
40TB12214			12-2-14		W	2							
40MW76W12214		X	12-2-14	917	W	5							
40EQR12214		X	12-2-14	1050	W	5							
40FB12214		X	12-2-14	1105	W	5							
40MW56W12214		X	12-2-14	1158	W	5							
40DUPW12214		X	12-2-14	1158	W	5							
40MW5MSGW12214		X	12-2-14	1205	W	5							
40MW5MSDGW12214		X	12-2-14	1205	W	5							
40MW4GW12214		X	12-2-14	1406	W	5							
LFMW01GW12214		X	12-2-14	1545	W	5							
<i>[Large diagonal signature across the table]</i>													
Relinquished by: <i>[Signature]</i>				Date: <b>12-3-14</b>		Time: <b>1557</b>		Received by: <i>[Signature]</i>		Date: <b>12/3/14</b>		Time: <b>1257</b>	
Relinquished by: <i>[Signature]</i>				Date: <b>12-3-14</b>		Time: <b>1557</b>		Received for Laboratory by: <i>[Signature]</i>		Date: <b>12/3/14</b>		Time: <b>1257</b>	

\*Water (W), Soil (S), Solid Waste (SD), Unknown (X)



# GROUNDWATER SAMPLING FIELD DATA SHEET

Facility: REAAP

Sample Point ID: 40MW 7

Location: SWMU 40

Field Representatives: JA/PS

Sample Matrix: Ground Water

Lab Sample #: 40MW 7GW 12214

## PURGE INFORMATION:

Method of Well Purge: Low Flow

Dedicated: Y or N

Date/Time Initiated 12-14 830

Well Volume of Standing Water (gal) N/A

Initial Water Level (ft) 99.47

Total Volume Purged (gal) 2.5

Mid-screen Depth (ft) 157.5

Was well purged to dryness? NO

Well Total Depth (ft) 167.5

Water Level After Purge (ft) 103.38

Casing Diameter, (inches) 2

Date/Time Completed 12-14 917

Sand Pack Diameter, (inches) N/A

## PURGE DATA:

Time	Depth to Water	Flow Rate (mL/min)	Temp (°C)	pH (su)	Specific Cond. (mS/cm)	Turbidity (NTU)	ORP (mV)	DO (mg/L)
850	103.25	450	11.06	7.16	0.573	4.4	259.3	7.50
853	103.54	350	11.00	7.10	0.574	4.3	255.9	7.09
856	103.34	225	10.77	7.08	0.574	3.1	252.6	6.50
859	103.14	250	10.50	7.08	0.574	2.8	250.9	5.89
902	103.42	290	10.52	7.07	0.575	1.6	249.0	4.91
905	103.30	220	10.46	7.08	0.575	0.6	247.9	3.96
908	103.30	210	10.26	7.09	0.576	0.2	245.7	3.85
911	103.42	280	10.47	7.08	0.577	0.3	243.6	3.86
914	103.35	210	10.27	7.08	0.579	0.2	242.5	3.84
917	103.38	200	10.23	7.08	0.578	0.1	242.4	3.82
<u>12/14</u>								

## GROUNDWATER SAMPLING FIELD DATA SHEET (continued)

### SAMPLING INFORMATION:

Sample Point ID: 40MW7 Method of Sampling: Low Flow

Dedicated?: no

Water Level at time of Sample Collection: 103.38

PARAMETERS: Annual ( ) Semi-Annual ( ) Quarterly ( ) Monthly ( ) Other ☒

### SAMPLING DATA:

Sample Time	Depth to Water (ft)	Sample Rate (ml/min)	Temp. (°C)	pH (su)	Specific Conduct. (mS/cm)	Turbidity (NTU)	ORP (mV)	DO (mg/L)
917	103.38	200	10.23	7.08	0.578	0.1	242.4	3.82

### GENERAL INFORMATION:

Weather conditions at time of sample collection: cloudy, cold

Sample Characteristics: cloudy, no odor

COMMENTS AND OBSERVATIONS: \_\_\_\_\_

DATE: 12-2-14

DATE: 12-2-14

SAMPLER: DS

QC Check By: JJA

# GROUNDWATER SAMPLING FIELD DATA SHEET

Facility: RFAAP

Sample Point ID: LF MW01

Location: Sumo 40

Field Representatives: JA/PS

Sample Matrix: Ground Water

Lab Sample #: LF MW01 GW12214

## PURGE INFORMATION:

Method of Well Purge: Low Flow

Dedicated: Y or (N)

Date/Time Initiated 12-2-14 1505

Well Volume of Standing Water (gal) N/A

Initial Water Level (ft) 28.97

Total Volume Purged (gal) 1.5

Mid-screen Depth (ft) ~98-93

Was well purged to dryness? no

Well Total Depth (ft) 103

Water Level After Purge (ft) 28.98

Casing Diameter, (inches) 2

Date/Time Completed 12-2-14 1545

Sand Pack Diameter, (inches) N/A

## PURGE DATA:

Time	Depth to Water	Flow Rate (mL/min)	Temp (°C)	pH (su)	Specific Cond. (mS/cm)	Turbidity (NTU)	ORP (mV)	DO (mg/L)
1530	29.03	400	11.17	7.44	0.446	1.2	236.0	5.62
1533	28.99	250	11.36	7.43	0.448	4.9	234.3	4.81
1536	29.00	240	11.39	7.46	0.450	8.6	229.2	4.14
1539	28.98	250	11.42	7.47	0.451	8.9	227.0	3.97
1542	28.98	250	11.47	7.47	0.451	9.0	225.4	3.94
1545	28.98	260	11.47	7.47	0.451	8.8	224.7	3.90

## GROUNDWATER SAMPLING FIELD DATA SHEET (continued)

### SAMPLING INFORMATION:

Sample Point ID: LFMW01

Method of Sampling: Low-Flow

Dedicated?: NO

Water Level at time of Sample Collection: 28.98

PARAMETERS: Annual ( ) Semi-Annual ( ) Quarterly ( ) Monthly ( ) Other ☒

### SAMPLING DATA:

Sample Time	Depth to Water (ft)	Sample Rate (ml/min)	Temp. (°C)	pH (su)	Specific Conduct. (mS/cm)	Turbidity (NTU)	ORP (mV)	DO (mg/L)
1545	28.98	260	11.47	7.47	0.451	8.8	224.7	3.90

### GENERAL INFORMATION:

Weather conditions at time of sample collection: cloudy, cool

Sample Characteristics: clear, no odor

COMMENTS AND OBSERVATIONS: \_\_\_\_\_

DATE: 12-2-14

DATE: 12-2-14

SAMPLER: [Signature]

QC Check By: [Signature]



# GROUNDWATER SAMPLING FIELD DATA SHEET

Facility: REAR

Sample Point ID: 40mw6

Location: Sumu 40

Field Representatives: SA/PS

Sample Matrix: Ground Water

Lab Sample #: 40mw6GW12214

## PURGE INFORMATION:

Method of Well Purge: Low-Flow

Dedicated: Y or (N)

Date/Time Initiated 12-2-14 1250

Well Volume of Standing Water (gal) N/A

Initial Water Level (ft) 50.27

Total Volume Purged (gal) 3

Mid-screen Depth (ft) 127

Was well purged to dryness? NO

Well Total Depth (ft) 137

Water Level After Purge (ft) 50.60

Casing Diameter, (inches) 2

Date/Time Completed 12-2-14 1406

Sand Pack Diameter, (inches) N/A

## PURGE DATA:

Time	Depth to Water	Flow Rate (mL/min)	Temp (°C)	pH (su)	Specific Cond. (mS/cm)	Turbidity (NTU)	ORP (mV)	DO (mg/L)
1316	51.26	650	11.44	7.97	0.193	64.7	213.5	7.64
1319	50.98	200	11.34	8.00	0.194	83.6	211.9	7.15
1322	51.21	310	11.31	8.04	0.195	123.5	210.2	6.31
1325	51.36	300	11.54	8.04	0.195	94.1	209.5	5.11
1328	51.00	170	11.50	8.06	0.195	87.1	208.9	4.91
1331	50.79	180	11.20	8.08	0.196	82.4	208.0	4.31
1334	50.76	175	10.99	8.10	0.195	65.9	207.2	4.13
1357	50.65	140	10.78	8.14	0.194	9.7	207.2	4.07
<del>1400</del> 1400	50.63	180	10.77	8.13	0.195	8.6	207.0	4.16
1403	50.60	180	10.78	8.13	0.195	5.8	206.7	*NOTE
1404	50.60	180	10.80	8.13	0.194	4.4	206.9	*NOTE

\*SEE NOTE

# GROUNDWATER SAMPLING FIELD DATA SHEET (continued)

## SAMPLING INFORMATION:

Sample Point ID: 40 ML 6

Method of Sampling: Low Flow

Dedicated?: NO

Water Level at time of Sample Collection: 50.60

PARAMETERS: Annual ( ) Semi-Annual ( ) Quarterly ( ) Monthly ( ) Other ☒

## SAMPLING DATA:

Sample Time	Depth to Water (ft)	Sample Rate (ml/min)	Temp. (°C)	pH (su)	Specific Conduct. (mS/cm)	Turbidity (NTU)	ORP (mV)	DO (mg/L)
1406	50.60	180	10.80	8.13	0.194	4.4	206.9	~ 4*

## GENERAL INFORMATION:

Weather conditions at time of sample collection: Cold, Cloudy

Sample Characteristics: Clear, no odor

COMMENTS AND OBSERVATIONS: NOTE: STOPPED READING ROTATING TO WAIT FOR TURBIDITY TO DROP. \* DO READING WAS NOT ACCURATE FOR LAST TWO READINGS.

DATE: 12-2-14

DATE: 12-2-14

SAMPLER: [Signature]

QC Check By: [Signature]

# GROUNDWATER SAMPLING FIELD DATA SHEET

Facility: RFAITP

Sample Point ID: 40 MW5

Location: Radford, VA

Field Representatives: JA/PS

Sample Matrix: Ground Water

Lab Sample #: 40MW5GW12214

## PURGE INFORMATION:

Method of Well Purge: Low Flow

Dedicated: Y or (N)

Date/Time Initiated 1110 12-2-14

Well Volume of Standing Water (gal) N/A

Initial Water Level (ft) 65.08

Total Volume Purged (gal) 3.5

Mid-screen Depth (ft) 148

Was well purged to dryness? NO

Well Total Depth (ft) 158

Water Level After Purge (ft) 67.15

Casing Diameter, (inches) 2

Date/Time Completed 12-2-14 1150

Sand Pack Diameter, (inches) w/12

## PURGE DATA:

Time	Depth to Water	Flow Rate (mL/min)	Temp (°C)	pH (su)	Specific Cond. (mS/cm)	Turbidity (NTU)	ORP (mV)	DO (mg/L)
1134	67.85	650	11.75	7.66	0.309	123.5	224.2	5.73
1137	67.35	350	11.55	7.74	0.303	68.5	219.3	5.21
1140	67.14	360	11.44	7.77	0.304	44.2	217.4	4.50
1143	67.10	350	11.44	7.79	0.305	30.7	215.9	4.12
1144	67.18	350	11.52	7.78	0.308	19.3	215.2	3.85
1149	67.15	360	11.53	7.79	0.311	12.2	214.1	3.44
1152	67.17	360	11.56	7.78	0.314	8.7	213.7	3.51
1155	67.15	350	11.53	7.78	0.320	4.8	213.2	3.47
1158	67.15	360	11.56	7.77	0.321	2.2	212.9	3.49

## GROUNDWATER SAMPLING FIELD DATA SHEET (continued)

### SAMPLING INFORMATION:

Sample Point ID: 40 MWJ

Method of Sampling: LOW FLOW

Dedicated?: NO

Water Level at time of Sample Collection: 67.15

PARAMETERS: Annual ( ) Semi-Annual ( ) Quarterly ( ) Monthly ( ) Other (X)

### SAMPLING DATA:

Sample Time	Depth to Water (ft)	Sample Rate (ml/min)	Temp. (°C)	pH (su)	Specific Conduct. (mS/cm)	Turbidity (NTU)	ORP (mV)	DO (mg/L)
1158	67.15	340	11.54	7.77	0.321	2.2	212.9	3.49

### GENERAL INFORMATION:

Weather conditions at time of sample collection: COLD, CLOUDY

Sample Characteristics: CLEAR, NO ODOOR

COMMENTS AND OBSERVATIONS: DUPLICATE SAMPLE COLLECTED AT THIS WELL. AND MS/MSD @ 1205

DATE: 12-2-14

DATE: 12-2-14

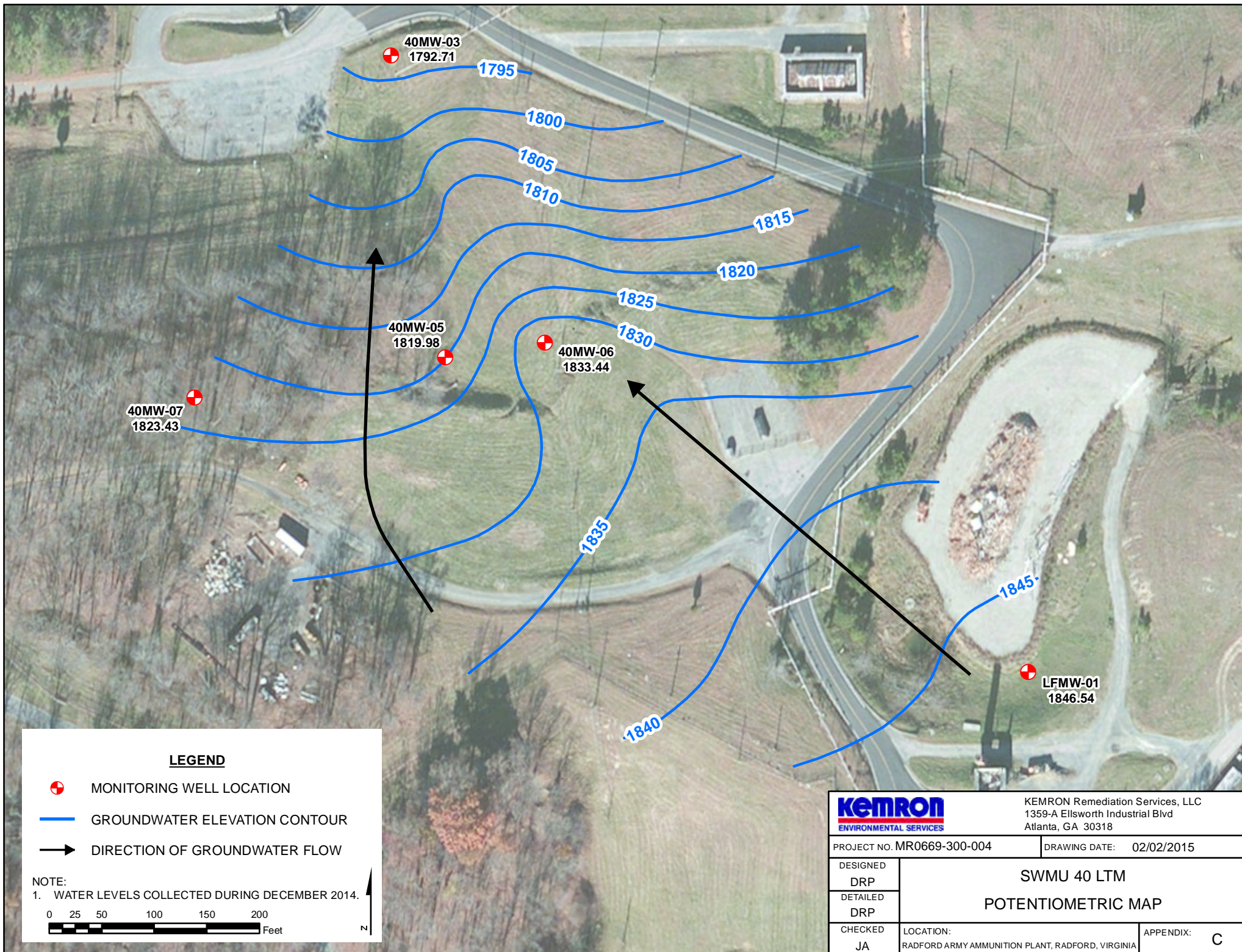
SAMPLER: [Signature]

QC Check By: [Signature]

## **APPENDIX C**

### **Potentiometric Maps**





**APPENDIX D**  
**Laboratory Reports and Data Validation Reports**  
**(CD-ROM)**

**APPENDIX E**  
**Analytical Data Tables**  
**(CD-ROM)**



Table 1  
November 2011 Screening Levels for Groundwater VOC Data - Residential Tapwater Pathway  
SWMU 40 (RAAP-009)  
Radford Army Ammunition Plant  
Longterm Monitoring Data Year 4

Location ID Sample ID Sample Date Sample Type							40LFMW01 40LFMW01GW112111 11/21/2011 N					40LFMW01 40DUPGW030612 3/6/2012 FD					40LFMW01 40LFMW01GW030612 3/6/2012 N					40LFMW01 LFMW01GW061212 6/12/2012 N					40LFMW01 LFMW01GW92612 9/26/2012 N					40LFMW01 40DUPGW61913 6/19/2013 FD					40LFMW01 LFMW01GW61913 6/19/2013 N					40LFMW01 LFMW01GW32714 3/27/2014 N					40LFMW01 LFMW01GW12214 12/2/2014 N				
Method	CAS	Chemical	CSL	T-NCSL	MCL	Units	Result	VQ	LOD	LOQ	DL Unit	Result	VQ	LOD	LOQ	DL Unit	Result	VQ	LOD	LOQ	DL Unit	Result	VQ	LOD	LOQ	DL Unit	Result	VQ	LOD	LOQ	DL Unit	Result	VQ	LOD	LOQ	DL Unit	Result	VQ	LOD	LOQ	DL Unit										
SW8260B	110-75-8	2-Chloroethyl vinyl ether				ug/L	< 2	R	2	10	ug/L	< 2	R	2	10	ug/L	< 2	R	2	10	ug/L	< 2	R	2	10	ug/L	< 2	R	2	10	ug/L	< 2	U	2	10	ug/L	< 2	U	2	10	ug/L	< 2	U	2	10	ug/L					
SW8260B	67-64-1	Acetone		1200		ug/L	2.5	R	2.5	10	ug/L	2.5	R	2.5	10	ug/L	2.5	R	2.5	10	ug/L	2.5	R	2.5	10	ug/L	2.5	U	2.5	10	ug/L	2.5	U	2.5	10	ug/L	2.5	U	2.5	10	ug/L	2.5	U	2.5	10	ug/L					

**Notes:**  
CAS = Chemical Abstracts Service  
ug/L = Microgram Per Liter  
T = Total  
D = Dissolved  
CSL = Carcinogenic Screening Level  
T-NCSL = Adjusted Noncarcinogenic Screening Level  
MCL = Maximum Contaminant Level  
### = Lowest Value For Screening  
**Bold** = Exceeds the Carcinogenic or Adjusted Noncarcinogenic Screening Level  
VQ = Validation Qualifier  
LOD = Limit of Detection  
LOQ = Limit of Quantitation  
DL = Detection Limit  
N = Normal  
FD = Field Duplicate  
Screening Levels are based on USEPA Region III Risk-Based Concentration values from the November, 2011 RBC Table.

U = Not Detected. The associated number indicates the approximate sample concentration  
B = Not detected substantially above the level reported in laboratory or field blanks.  
R = Unusable result. Analyte may or may not be present in the sample.  
J = Analyte present. Reported value may or may not be accurate or precise.  
K = Analyte present. Reported value may be biased high. Actual value is expected to be lower.  
L = Analyte present. Reported value may be biased low. Actual value is expected to be higher  
UL = Not detected. Quantitation limit may be inaccurate or imprecise.  
UL = The analyte was not detected, and the reported quantitation limit is probably higher than reported.

Table 1  
November 2011 Screening Levels for Groundwater VOC Data - Residential Tapwater Pathway  
SWMU 40 (RAAP-009)  
Radford Army Ammunition Plant  
Longterm Monitoring Data Year 4

Location ID Sample ID Sample Date Sample Type							40MW5 40DUPGW112011 11/20/2011 FD					40MW5 40MW5GW112011 11/20/2011 N					40MW5 40MW5GW030712 3/7/2012 N					40MW5 40MW5GW061212 6/12/2012 N					40MW5 40DUPGW92512 9/25/2012 FD					40MW5 40MW5GW92512 9/25/2012 N					40MW5 40MW5GW61913 6/19/2013 N					40MW5 40MW5GW32714 3/27/2014 N					40MW5 40MW5GW12214 12/2/2014 N					40MW5 40DUPGW12214 12/2/2014 FD				
Method	CAS	Chemical	CSL	T-NCSL	MCL	Units	Result	VQ	LOD	LOQ	DL Unit	Result	VQ	LOD	LOQ	DL Unit	Result	VQ	LOD	LOQ	DL Unit	Result	VQ	LOD	LOQ	DL Unit	Result	VQ	LOD	LOQ	DL Unit	Result	VQ	LOD	LOQ	DL Unit	Result	VQ	LOD	LOQ	DL Unit	Result	VQ	LOD	LOQ	DL Unit										
SW8260B	110-75-8	2-Chloroethyl vinyl ether				ug/L	< 2	R	2	10	ug/L	< 2	R	2	10	ug/L	< 2	R	2	10	ug/L	< 2	R	2	10	ug/L	< 2	R	2	10	ug/L	< 2	R	2	10	ug/L	< 2	R	2	10	ug/L	< 2	R	2	10	ug/L										
SW8260B	67-64-1	Acetone		1200		ug/L	2.5	R	2.5	10	ug/L	2.5	R	2.5	10	ug/L	2.5	R	2.5	10	ug/L	2.5	R	2.5	10	ug/L	2.5	R	2.5	10	ug/L	2.5	U	2.5	10	ug/L	2.5	UJ	2.5	10	ug/L	2.5	UJ	2.5	10	ug/L										

Notes:  
CAS = Chemical Abstracts Service  
ug/L = Microgram Per Liter  
T = Total  
D = Dissolved  
CSL = Carcinogenic Screening Level  
T-NCSL = Adjusted Noncarcinogenic Screening Level  
MCL = Maximum Contaminant Level  
##### = Lowest Value For Screening  
**Bold** = Exceeds the Carcinogenic or Adjusted Noncarcinogenic Screening Level  
VQ = Validation Qualifier  
LOD = Limit of Detection  
LOQ = Limit of Quantitation  
DL = Detection Limit  
N = Normal  
FD = Field Duplicate  
Screening Levels are based on USEPA Region III Risk-Based Concentration values from the November, 2011 RBC Table.

U = Not Detected. The associated number indicates the approximate sample concentration  
B = Not detected substantially above the level reported in laboratory or field blanks.  
R = Unusable result. Analyte may or may not be present in the sample.  
J = Analyte present. Reported value may or may not be accurate or precise.  
K = Analyte present. Reported value may be biased high. Actual value is expected to be lower.  
L = Analyte present. Reported value may be biased low. Actual value is expected to be higher  
UJ = Not detected. Quantitation limit may be inaccurate or imprecise.  
UL = The analyte was not detected, and the reported quantitation limit is probably higher than reported.

Table 1  
November 2011 Screening Levels for Groundwater VOC Data - Residential Tapwater Pathway  
SWMU 40 (RAAP-009)  
Radford Army Ammunition Plant  
Longterm Monitoring Data Year 4

MethodCASChemical			CSLT-NCSLMCL			Units			40MW6				40MW6				40MW6				40MW6				40MW6				40MW6				40MW6				40MW6			
									40MW6GW112111				40MW6GW030712				40DUPGW061212				40MW6GW061212				40MW6GW92512				40MW6GW61913				40MW6GW32714				40MW6GW12214			
									11/21/2011				3/7/2012				6/12/2012				6/12/2012				9/25/2012				6/19/2013				3/27/2014				12/2/2014			
									N				N				FD				N				N				N				N				N			
Result	VQ	LOD	LOQ	DL Unit	Result	VQ	LOD	LOQ	DL Unit	Result	VQ	LOD	LOQ	DL Unit	Result	VQ	LOD	LOQ	DL Unit	Result	VQ	LOD	LOQ	DL Unit	Result	VQ	LOD	LOQ	DL Unit	Result	VQ	LOD	LOQ	DL Unit	Result	VQ	LOD	LOQ	DL Unit	
SW8260B	110-75-8	2-Chloroethyl vinyl ether			ug/L	< 2	R	2	10	ug/L	< 2	R	2	10	ug/L	< 2	R	2	10	ug/L	< 2	R	2	10	ug/L	< 2	R	2	10	ug/L	< 2	U	2	10	ug/L	< 2	U	2	10	ug/L
SW8260B	67-64-1	Acetone		1200	ug/L	2.5	U	2.5	10	ug/L	2.5	R	2.5	10	ug/L	2.5	R	2.5	10	ug/L	2.5	R	2.5	10	ug/L	2.5	R	2.5	10	ug/L	2.5	U	2.5	10	ug/L	2.5	UJ	2.5	10	ug/L

**Notes:**  
CAS = Chemical Abstracts Service  
ug/L = Microgram Per Liter  
T = Total  
D = Dissolved  
CSL = Carcinogenic Screening Level  
T-NCSL = Adjusted Noncarcinogenic Screening Level  
MCL = Maximum Contaminant Level  
### = Lowest Value For Screening  
**Bold** = Exceeds the Carcinogenic or Adjusted Noncarcinogenic Screening Level  
VQ = Validation Qualifier  
LOD = Limit of Detection  
LOQ = Limit of Quantitation  
DL = Detection Limit  
N = Normal  
FD = Field Duplicate  
**Screening Levels are based on USEPA Region III Risk-Based Concentration values from the November, 2011 RBC Table.**

U = Not Detected. The associated number indicates the approximate sample concentration  
B = Not detected substantially above the level reported in laboratory or field blanks.  
R = Unusable result. Analyte may or may not be present in the sample.  
J = Analyte present. Reported value may or may not be accurate or precise.  
K = Analyte present. Reported value may be biased high. Actual value is expected to be lower.  
L = Analyte present. Reported value may be biased low. Actual value is expected to be higher  
UJ = Not detected. Quantitation limit may be inaccurate or imprecise.  
UL = The analyte was not detected, and the reported quantitation limit is probably higher than reported.

Table 1  
November 2011 Screening Levels for Groundwater VOC Data - Residential Tapwater Pathway  
SWMU 40 (RAAP-009)  
Radford Army Ammunition Plant  
Longterm Monitoring Data Year 4

Location ID Sample ID Sample Date Sample Type											40MW7 40MW7GW112011 11/20/2011 N					40MW7 40MW7GW030612 3/6/2012 N					40MW7 40MW7GW601212 6/12/2012 N					40MW7 40MW7GW92512 9/25/2012 N					40MW7 40MW7GW61913 6/19/2013 N					40MW7 40MW7GW32714 3/27/2014 N					40MW7 40MW7GW12214 12/2/2014 N				
Method	CAS	Chemical	CSL	T-NCSL	MCL	Units	Result	VQ	LOD	LOQ	DL Unit	Result	VQ	LOD	LOQ	DL Unit	Result	VQ	LOD	LOQ	DL Unit	Result	VQ	LOD	LOQ	DL Unit	Result	VQ	LOD	LOQ	DL Unit	Result	VQ	LOD	LOQ	DL Unit									
SW8260B	110-75-8	2-Chloroethyl vinyl ether				ug/L	< 2	R	2	10	ug/L	< 2	R	2	10	ug/L	< 2	R	2	10	ug/L	< 2	R	2	10	ug/L	< 2	U	2	10	ug/L	< 2	U	2	10	ug/L									
SW8260B	67-64-1	Acetone		1200		ug/L	4.38	L	2.5	10	ug/L	2.5	R	2.5	10	ug/L	2.5	R	2.5	10	ug/L	2.5	UJ	2.5	10	ug/L	2.5	UJ	2.5	10	ug/L	2.5	UJ	2.5	10	ug/L									

**Notes:**  
CAS = Chemical Abstracts Service  
ug/L = Microgram Per Liter  
T = Total  
D = Dissolved  
CSL = Carcinogenic Screening Level  
T-NCSL = Adjusted Noncarcinogenic Screening Level  
MCL = Maximum Contaminant Level  
### = Lowest Value For Screening  
**Bold** = Exceeds the Carcinogenic or Adjusted Noncarcinogenic Screening Level  
VQ = Validation Qualifier  
LOD = Limit of Detection  
LOQ = Limit of Quantitation  
DL = Detection Limit  
N = Normal  
FD = Field Duplicate  
Screening Levels are based on USEPA Region III Risk-Based Concentration values from the November, 2011 RBC Table.

U = Not Detected. The associated number indicates the approximate sample concentration  
B = Not detected substantially above the level reported in laboratory or field blanks.  
R = Unusable result. Analyte may or may not be present in the sample.  
J = Analyte present. Reported value may or may not be accurate or precise.  
K = Analyte present. Reported value may be biased high. Actual value is expected to be lower.  
L = Analyte present. Reported value may be biased low. Actual value is expected to be higher  
UJ = Not detected. Quantitation limit may be inaccurate or imprecise.  
UL = The analyte was not detected, and the reported quantitation limit is probably higher than reported.

Table 2  
November 2011 Screening Levels for Groundwater Metals Data - Residential Tapwater Pathway  
SWMU 40 (RAAP-009)  
Radford Army Ammunition Plant  
Longterm Monitoring Data Year 4

Location ID Sample ID Sample Date Sample Type								40LFMW01 40LFMW01GW112111 11/21/2011 N					40LFMW01 40DUPGW030612 3/6/2012 FD					40LFMW01 40LFMW01GW030612 3/6/2012 N					40LFMW01 LFMW01GW061212 6/12/2012 N					40LFMW01 LFMW01GW92612 9/26/2012 N					40LFMW01 40DUPGW61913 6/19/2013 FD					40LFMW01 LFMW01GW61913 6/19/2013 N					40LFMW01 LFMW01GW32714 3/27/2014 N					40LFMW01 LFMW01GW12214 12/2/2014 N				
Method	CAS	Chemical	fraction	CSL	T-NCSL	MCL	Units	Result	VQ	LOD	LOQ	DL Unit	Result	VQ	LOD	LOQ	DL Unit	Result	VQ	LOD	LOQ	DL Unit	Result	VQ	LOD	LOQ	DL Unit	Result	VQ	LOD	LOQ	DL Unit	Result	VQ	LOD	LOQ	DL Unit	Result	VQ	LOD	LOQ	DL Unit	Result	VQ	LOD	LOQ	DL Unit	Result	VQ	LOD	LOQ	DL Unit
SW6010B	7429-90-5	Aluminum	T		1600		ug/L	17900		50	100	ug/L	112		50	100	ug/L	123		50	100	ug/L	74.8	J	50	100	ug/L	9150	J	50	100	ug/L	127	J	100	200	ug/L	145	J	100	200	ug/L	124	J	100	200	ug/L	526		100	200	ug/L
SW6010B	7429-90-5	Aluminum	D		1600		ug/L	50	U	50	100	ug/L	NS		50	100	ug/L	NS		50	100	ug/L	92.9	J	50	100	ug/L	< 100	U	100	200	ug/L	100	U	100	200	ug/L	NS		100	200	ug/L	NS		100	200	ug/L	NS		100	200	ug/L
SW6010B	7439-89-6	Iron	T		1100		ug/L	21800	L	50	100	ug/L	87.5	J	50	100	ug/L	93	J	50	100	ug/L	120		50	100	ug/L	8950		50	100	ug/L	290		50	100	ug/L	311		50	100	ug/L	172	J	50	100	ug/L	527		50	100	ug/L
SW6010B	7439-89-6	Iron	D		1100		ug/L	102		50	100	ug/L	NS		50	100	ug/L	NS		50	100	ug/L	74.1	J	50	100	ug/L	50	U	50	100	ug/L	50	U	50	100	ug/L	NS		50	100	ug/L	NS		50	100	ug/L	NS		50	100	ug/L
SW6010B	7439-95-4	Magnesium	T				ug/L	74800		250	500	ug/L	27800		250	500	ug/L	28100		250	500	ug/L	33800		250	500	ug/L	51100		250	500	ug/L	30300		250	500	ug/L	29200		250	500	ug/L	34600		250	500	ug/L	22300		250	500	ug/L
SW6010B	7439-95-4	Magnesium	D				ug/L	33100		250	500	ug/L	NS		250	500	ug/L	NS		250	500	ug/L	32700		250	500	ug/L	35400		250	500	ug/L	29300		250	500	ug/L	29800		250	500	ug/L	NS		250	500	ug/L	NS		250	500	ug/L
SW6010B	7440-09-7	Potassium	T				ug/L	5920		500	1000	ug/L	943	J	500	1000	ug/L	885	J	500	1000	ug/L	1740		500	1000	ug/L	3700		500	1000	ug/L	1740		500	1000	ug/L	1660		500	1000	ug/L	1730		500	1000	ug/L	1290		500	1000	ug/L
SW6010B	7440-09-7	Potassium	D				ug/L	1620		500	1000	ug/L	NS		500	1000	ug/L	NS		500	1000	ug/L	1630		500	1000	ug/L	1690		500	1000	ug/L	1620		500	1000	ug/L	1690		500	1000	ug/L	NS		500	1000	ug/L	NS		500	1000	ug/L
SW6010B	7440-23-5	Sodium	T				ug/L	8230		250	500	ug/L	7840		250	500	ug/L	7690		250	500	ug/L	8450		250	500	ug/L	6640		250	500	ug/L	8410		250	500	ug/L	8180		250	500	ug/L	5260		250	500	ug/L	4080	B	250	500	ug/L
SW6010B	7440-23-5	Sodium	D				ug/L	8480		250	500	ug/L	NS		250	500	ug/L	NS		250	500	ug/L	8120		250	500	ug/L	7100		250	500	ug/L	8490		250	500	ug/L	8540		250	500	ug/L	NS		250	500	ug/L	NS		250	500	ug/L
SW6010B	7440-62-2	Vanadium	T		7.8		ug/L	32.5		5	10	ug/L	5	U	5	10	ug/L	5	U	5	10	ug/L	5	U	5	10	ug/L	18.1		5	10	ug/L	8.64	J	5	10	ug/L	9.29	J	5	10	ug/L	5	U	5	10	ug/L	5	U	5	10	ug/L
SW6010B	7440-62-2	Vanadium	D		7.8		ug/L	5	U	5	10	ug/L	NS		5	10	ug/L	NS		5	10	ug/L	5	U	5	10	ug/L	5	U	5	10	ug/L	10.9		5	10	ug/L	10.8		5	10	ug/L	NS		5	10	ug/L	NS		5	10	ug/L
SW6010B	7440-70-2	Calcium	T				ug/L	142000		100	200	ug/L	71300	J	100	200	ug/L	71400	J	100	200	ug/L	82800		1000	2000	ug/L	105000		100	200	ug/L	75800		250	500	ug/L	75900		250	500	ug/L	92400		2500	5000	ug/L	63900		2500	5000	ug/L
SW6010B	7440-70-2	Calcium	D				ug/L	81500		100	200	ug/L	NS		100	200	ug/L	NS		100	200	ug/L	82900		1000	2000	ug/L	85700		100	200	ug/L	79100		250	500	ug/L	77700		250	500	ug/L	NS		250	500	ug/L	NS		250	500	ug/L
SW6020	7439-92-1	Lead	T				ug/L	11		1	2	ug/L	0.5	U	0.5	1	ug/L	0.5	U	0.5	1	ug/L	0.5	UL	0.5	1	ug/L	5.46		0.5	1	ug/L	0.5	U	0.5	1	ug/L	0.5	U	0.5	1	ug/L	0.5	U	0.5	1	ug/L	0.5	U	0.5	1	ug/L
SW6020	7439-92-1	Lead	D				ug/L	< 1	U	1	2	ug/L	NS		1	2	ug/L	NS		1	2	ug/L	0.5	U	0.5	1	ug/L	0.5	U	0.5	1	ug/L	0.5	U	0.5	1	ug/L	0.5	U	0.5	1	ug/L	NS		1	2	ug/L	NS		1	2	ug/L
SW6020	7439-96-5	Manganese	T		32		ug/L	125		2	4	ug/L	1.25	J	1	2	ug/L	1.52	J	1	2	ug/L	2.18	L	1	2	ug/L	52.6		1	2	ug/L	2.48		1	2	ug/L	2.89		1	2	ug/L	2.75	B	1	2	ug/L	3.68	L	1	2	ug/L
SW6020	7439-96-5	Manganese	D		32		ug/L	3.95	B	2	4	ug/L	NS		2	4	ug/L	NS		2	4	ug/L	1	UL	1	2	ug/L	1	U	1	2	ug/L	1	U	1	2	ug/L	1	U	1	2	ug/L	NS		2	4	ug/L	NS		2	4	ug/L
SW6020	7440-38-2	Arsenic	T		0.045		ug/L	0.47		1	2	ug/L	2.68		1	2	ug/L	< 0.5	U	0.5	1	ug/L	< 0.5	U	0.5	1	ug/L	< 0.5	U	0.5	1	ug/L	1.43		0.5	1	ug/L	< 0.5	U	0.5	1	ug/L	< 0.5	U	0.5	1	ug/L	< 0.5	U	0.5	1	ug/L
SW6020	7440-38-2	Arsenic	D		0.045		ug/L	< 1	U	1	2	ug/L	NS		1	2	ug/L	NS		1	2	ug/L	< 0.5	U	0.5	1	ug/L	< 0.5	U	0.5	1	ug/L	< 0.5	U	0.5	1	ug/L	< 0.5	U	0.5	1	ug/L	< 0.5	U	0.5	1	ug/L	< 0.5	U	0.5	1	ug/L
SW6020	7440-39-3	Barium	T		290		ug/L	133		3	6	ug/L	94.7		1.5	3	ug/L	94.1		1.5	3	ug/L	65.7	L	1.5	3	ug/L	125		1.5	3	ug/L	61.9		1.5	3	ug/L	62.3		1.5	3	ug/L	69.8		1.5	3	ug/L	49.4		1.5	3	ug/L
SW6020	7440-39-3	Barium	D		290		ug/L	90.2		3	6	ug/L	NS		3	6	ug/L	NS		3	6	ug/L	63.4		1.5	3	ug/L	92.6		1.5	3	ug/L	61.4		1.5	3	ug/L	57.5		1.5	3	ug/L	NS		1.5	3	ug/L	NS		1.5	3	ug/L
SW6020	7440-48-4	Cobalt	T		0.47		ug/L	5.54		1	2	ug/L	< 0.5	U	0.5	1	ug/L	< 0.5	U	0.5	1	ug/L	< 0.5	U	0.5	1	ug/L	3.14		0.5	1	ug/L	< 0.5	U	0.5	1	ug/L	< 0.5	U	0.5	1	ug/L	< 0.5	U	0.5	1	ug/L	< 0.5	U	0.5	1	ug/L
SW6020	7440-48-4	Cobalt	D		0.47		ug/L	< 1	U	1	2	ug/L	NS		1	2	ug/L	NS		1	2	ug/L	< 0.5	U	0.5	1	ug/L	0.903	J	0.5	1	ug/L	< 0.5	U	0.5	1	ug/L	< 0.5	U	0.5	1	ug/L	< 0.5	U	0.5	1	ug/L	< 0.5	U	0.5	1	ug/L
SW6020	7782-49-2	Selenium	T		7.8		ug/L	50		1	2	ug/L	0.5	UL	0.5	1	ug/L	0.5	UL	0.5	1	ug/L	0.726	K	0.5	1	ug/L	1.18		0.5	1	ug/L	0.676	J	0.5	1	ug/L	0.928	J	0.5	1	ug/L	1.49		0.5	1	ug/L	0.738	L	0.5	1	ug/L
SW6020	7782-49-2	Selenium	D		7.8		ug/L	1	U	1	2	ug/L	NS		1	2	ug/L	NS		1	2	ug/L	0.7	J	0.5	1	ug/L	1.06		0.5	1	ug/L	0.523	J	0.5	1	ug/L	1.71	J	0.5	1	ug/L	NS		0.5	1	ug/L	NS		0.5	1	ug/L

Notes:  
CAS = Chemical Abstracts Service  
ug/L = Microgram Per Liter  
T = Total  
D = Dissolved  
CSL = Carcinogenic Screening Level  
T-NCSL = Adjusted Noncarcinogenic Screening Level  
MCL = Maximum Contaminant Level  
### = Lowest Value For Screening  
Bold = Exceeds the Carcinogenic or Adjusted Noncarcinogenic Screening Level  
VQ = Validation Qualifier  
LOD = Limit of Detection  
LOQ = Limit of Quantitation  
DL = Detection Limit  
N = Normal  
FD = Field Duplicate

U = Not Detected. The associated number indicates the approximate sample concentration  
B = Not detected substantially above the level reported in laboratory or field blanks  
R = Unusable result. Analyte may or may not be present in the sample  
J = Analyte present. Reported value may or may not be accurate or precise  
K = Analyte present. Reported value may be biased high. Actual value is expected to be lower  
L = Analyte present. Reported value may be biased low. Actual value is expected to be high  
UL = Not detected. Quantitation limit may be inaccurate or imprecise.  
UL = The analyte was not detected, and the reported quantitation limit is probably higher than reported  
NS=Not Sampled because Turbidity was stable at less than or equal to 10 NTU  
Screening Levels are based on USEPA Region III Risk-Based Concentration values from the November, 2011 RBC Table.

Table 2  
November 2011 Screening Levels for Groundwater Metals Data - Residential Tapwater Pathway  
SWMU 40 (RAAP-009)  
Radford Army Ammunition Plant  
Longterm Monitoring Data Year 4

Location ID Sample ID Sample Date Sample Type										40MW5 40DUPGW112011 11/20/2011 FD					40MW5 40MW5GW112011 11/20/2011 N					40MW5 40MW5GW030712 3/7/2012 N					40MW5 40MW5GW061212 6/12/2012 N					40MW5 40DUPGW92512 9/25/2012 FD					40MW5 40MW5GW92512 9/25/2012 N					40MW5 40MW5GW61913 6/19/2013 N					40MW5 40MW5GW32714 3/27/2014 N					40MW5 40DUPGW32714 3/27/2014 FD					40MW5 40MW5GW12214 12/2/2014 N					40MW5 40DUPGW12214 12/2/2014 FD				
Method	CAS	Chemical	Fraction	CSL	T-NCSL	MCL	Units	Result	VQ	LOD	LOQ	DL Unit	Result	VQ	LOD	LOQ	DL Unit	Result	VQ	LOD	LOQ	DL Unit	Result	VQ	LOD	LOQ	DL Unit	Result	VQ	LOD	LOQ	DL Unit	Result	VQ	LOD	LOQ	DL Unit	Result	VQ	LOD	LOQ	DL Unit	Result	VQ	LOD	LOQ	DL Unit	Result	VQ	LOD	LOQ	DL Unit	Result	VQ	LOD	LOQ	DL Unit							
SW6010B	7429-90-5	Aluminum	T		1600		ug/L	1540		50	100	ug/L	1890		50	100	ug/L	221		50	100	ug/L	911		50	100	ug/L	140	J	50	100	ug/L	266	J	50	100	ug/L	100	U	100	200	ug/L	169	J	100	200	ug/L	366		100	200	ug/L	256		100	200	ug/L	300		100	200	ug/L		
SW6010B	7429-90-5	Aluminum	D		1600		ug/L	50	U	50	100	ug/L	50	U	50	100	ug/L	NS		50	100	ug/L	50	U	50	100	ug/L	50	U	50	100	ug/L	NS		50	100	ug/L	NS		50	100	ug/L	NS		50	100	ug/L	NS		50	100	ug/L	NS		50	100	ug/L	NS		50	100	ug/L		
SW6010B	7439-89-6	Iron	T		1100		ug/L	1580	L	50	100	ug/L	2040	L	50	100	ug/L	156		50	100	ug/L	950		50	100	ug/L	123		50	100	ug/L	217		50	100	ug/L	137		50	100	ug/L	125	J	50	100	ug/L	115		50	100	ug/L	177		50	100	ug/L							
SW6010B	7439-89-6	Iron	D		1100		ug/L	82	J	50	100	ug/L	74.1	J	50	100	ug/L	NS		50	100	ug/L	NS		50	100	ug/L	50	U	50	100	ug/L	50	U	50	100	ug/L	NS		50	100	ug/L	NS		50	100	ug/L	NS		50	100	ug/L	NS		50	100	ug/L							
SW6010B	7439-95-4	Magnesium	T				ug/L	31300		250	500	ug/L	32500		250	500	ug/L	33500		250	500	ug/L	34700		2500	5000	ug/L	32500		250	500	ug/L	32000		250	500	ug/L	32500		250	500	ug/L	19000		250	500	ug/L	13200		250	500	ug/L	12400		250	500	ug/L							
SW6010B	7439-95-4	Magnesium	D				ug/L	29600		250	500	ug/L	29800		250	500	ug/L	NS		250	500	ug/L	NS		2500	5000	ug/L	32100		250	500	ug/L	32300		250	500	ug/L	NS		250	500	ug/L	NS		250	500	ug/L	NS		250	500	ug/L	NS		250	500	ug/L							
SW6010B	7440-09-7	Potassium	T				ug/L	1370		500	1000	ug/L	1370		500	1000	ug/L	1160		500	1000	ug/L	1270		500	1000	ug/L	1260		500	1000	ug/L	1300		500	1000	ug/L	1100		500	1000	ug/L	946	J	500	1000	ug/L	1020		500	1000	ug/L	764	J	500	1000	ug/L							
SW6010B	7440-09-7	Potassium	D				ug/L	1060		500	1000	ug/L	1080		500	1000	ug/L	NS		500	1000	ug/L	NS		500	1000	ug/L	1230		500	1000	ug/L	1230		500	1000	ug/L	NS		500	1000	ug/L	NS		500	1000	ug/L	NS		500	1000	ug/L	NS		500	1000	ug/L							
SW6010B	7440-23-5	Sodium	T				ug/L	5480		250	500	ug/L	5220		250	500	ug/L	4790		250	500	ug/L	5280		250	500	ug/L	5270		250	500	ug/L	5730		250	500	ug/L	4590		250	500	ug/L	5370		250	500	ug/L	5640		250	500	ug/L	6580	B	250	500	ug/L	6350	B	250	500	ug/L		
SW6010B	7440-23-5	Sodium	D				ug/L	5330		250	500	ug/L	5350		250	500	ug/L	NS		250	500	ug/L	NS		250	500	ug/L	5420		250	500	ug/L	5430		250	500	ug/L	NS		250	500	ug/L	NS		250	500	ug/L	NS		250	500	ug/L	NS		250	500	ug/L							
SW6010B	7440-62-2	Vanadium	T		7.8		ug/L	5	U	5	10	ug/L	5	U	5	10	ug/L	5	U	5	10	ug/L	8.74	J	5	10	ug/L	5	U	5	10	ug/L	5	U	5	10	ug/L	10.5		5	10	ug/L	5	U	5	10	ug/L	5	U	5	10	ug/L	5	U	5	10	ug/L							
SW6010B	7440-62-2	Vanadium	D		7.8		ug/L	5	U	5	10	ug/L	5	U	5	10	ug/L	NS		5	10	ug/L	NS		5	10	ug/L	5	U	5	10	ug/L	5	U	5	10	ug/L	NS		5	10	ug/L	NS		5	10	ug/L	NS		5	10	ug/L	NS		5	10	ug/L							
SW6010B	7440-70-2	Calcium	T				ug/L	84800		100	200	ug/L	87200		100	200	ug/L	93400	J	100	200	ug/L	89900		1000	2000	ug/L	84900		100	200	ug/L	86900		100	200	ug/L	91600		250	500	ug/L	68300		2500	5000	ug/L	72700		2500	5000	ug/L	41400		2500	5000	ug/L	41000		2500	5000	ug/L		
SW6010B	7440-70-2	Calcium	D				ug/L	81700		100	200	ug/L	82800		100	200	ug/L	NS		100	200	ug/L	NS		88400		1000	2000	ug/L	86100		100	200	ug/L	89200		100	200	ug/L	NS		100	200	ug/L	NS		100	200	ug/L	NS		100	200	ug/L	NS		100	200	ug/L					
SW6020	7439-92-1	Lead	T			15	ug/L	1	U	1	2	ug/L	1	U	1	2	ug/L	0.5	U	0.5	1	ug/L	0.5	UL	0.5	1	ug/L	0.5	U	0.5	1	ug/L	0.5	U	0.5	1	ug/L	0.5	U	0.5	1	ug/L	0.5	U	0.5	1	ug/L	0.5	U	0.5	1	ug/L	0.5	U	0.5	1	ug/L							
SW6020	7439-92-1	Lead	D			15	ug/L	1	U	1	2	ug/L	0.5	U	0.5	1.0	ug/L	NS		0.5	UL	0.5	1	ug/L	0.5	UL	0.5	1	ug/L	0.5	U	0.5	1	ug/L	0.5	U	0.5	1	ug/L	NS		0.5	UL	0.5	1	ug/L	NS		0.5	UL	0.5	1	ug/L											
SW6020	7439-96-5	Manganese	T		32		ug/L	7.67	B	2	4	ug/L	15.2	B	2	4	ug/L	1.11	J	1	2	ug/L	4.84	L	1	2	ug/L	4	B	1	2	ug/L	2.13	B	1	2	ug/L	1.8	J	1	2	ug/L	1.06	B	1	2	ug/L	1.57	B	1	2	ug/L	1	UL	1	2	ug/L	1	UL	1	2	ug/L		
SW6020	7439-96-5	Manganese	D		32		ug/L	2	U	2	4	ug/L	1	U	1	2	ug/L	NS		1	UL	1	2	ug/L	1	UL	1	2	ug/L	1	U	1	2	ug/L	NS		1	UL	1	2	ug/L	NS		1	UL	1	2	ug/L	NS		1	UL	1	2	ug/L									
SW6020	7440-38-2	Arsenic	T		0.045	0.47	10	ug/L	< 1	U	1	2	ug/L	< 1	U	1	2	ug/L	< 0.5	U	0.5	1	ug/L	< 0.5	U	0.5	1	ug/L	< 0.5	U	0.5	1	ug/L	< 0.5	U	0.5	1	ug/L	< 0.5	U	0.5	1	ug/L	< 0.5	U	0.5	1	ug/L	< 0.5	U	0.5	1	ug/L	< 0.5	U	0.5	1	ug/L						
SW6020	7440-38-2	Arsenic	D		0.045	0.47	10	ug/L	< 1	U	1	2	ug/L	< 0.5	U	0.5	1.0	ug/L	NS		< 0.5	U	0.5	1	ug/L	< 0.5	U	0.5	1	ug/L	< 0.5	U	0.5	1	ug/L	< 0.5	U	0.5	1	ug/L	NS		< 0.5	U	0.5	1	ug/L	NS		< 0.5	U	0.5	1	ug/L										
SW6020	7440-39-3	Barium	T		290	2000	ug/L	59.9		3	6	ug/L	57.1		3	6	ug/L	57.2		1.5	3	ug/L	56.9	L	1.5	3	ug/L	56.1		1.5	3	ug/L	56.2		1.5	3	ug/L	56.9		1.5	3	ug/L	34.1		1.5	3	ug/L	33.2		1.5	3	ug/L	24		1.5	3	ug/L							
SW6020	7440-39-3	Barium	D		290	2000	ug/L	53.2		3	6	ug/L	55.4	J	1.5	3.0	ug/L	NS		54.3	L	1.5	3	ug/L	56.3		1.5	3	ug/L	56.7		1.5	3	ug/L	NS		1.5	3	ug/L	NS		1.5	3	ug/L	NS		1.5	3	ug/L	NS		1.5	3	ug/L										
SW6020	7440-48-4	Cobalt	T		0.47		ug/L	< 1	U	1	2	ug/L	< 1	U	1	2	ug/L	< 0.5	U	0.5	1	ug/L	< 0.5	U	0.5	1	ug/L	< 0.5	U	0.5	1	ug/L	< 0.5	U	0.5	1	ug/L	< 0.5	U	0.5	1	ug/L	< 0.5	U	0.5	1	ug/L	< 0.5	U	0.5	1	ug/L	< 0.5	U	0.5	1	ug/L							
SW6020	7440-48-4	Cobalt	D		0.47		ug/L	< 1	U	1	2	ug/L	< 0.5	U	0.5	1.0	ug/L	NS		< 0.5	U	0.5	1	ug/L	< 0.5	U	0.5	1	ug/L	< 0.5	U	0.5	1	ug/L	< 0.5	U	0.5	1	ug/L	NS		< 0.5	U	0.5	1	ug/L	NS		< 0.5	U	0.5	1	ug/L											
SW6020	7782-49-2	Selenium	T		7.8	50	ug/L	1.06	J	1	2	ug/L	1.31	K	1	2	ug/L	0.775	L	0.5	1	ug/L	0.784	K	0.5	1	ug/L	1.02		0.5	1	ug/L	0.845	J	0.5	1	ug/L	0.943	J	0.5	1	ug/L	0.5	U	0.5	1	ug/L	0.5	U	0.5	1	ug/L	0.5	U	0.5	1	ug/L							
SW6020	7782-49-2	Selenium	D		7.8	50	ug/L	1.11	J	1	2	ug/L	1.19	K	0.5	1.0	ug/L	NS		0.847	K	0.5	1	ug/L	1.17		0.5	1	ug/L	1.05		0.5	1	ug/L	NS		0.5	1	ug/L	NS		0.5	1	ug/L	NS		0.5	1	ug/L	NS		0.5	1	ug/L										

**Notes:**  
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T = Total  
D = Dissolved  
CSL = Carcinogenic Screening Level  
T-NCSL = Adjusted Noncarcinogenic Screening Level  
MCL = Maximum Contaminant Level  
### = Lowest Value For Screening  
**Bold** = Exceeds the Carcinogenic or Adjusted Noncarcinogenic Screening Level  
VQ = Validation Qualifier  
LOD = Limit of Detection  
LOQ = Limit of Quantitation  
DL = Detection Limit  
N = Normal  
FD = Field Duplicate

U = Not Detected. The associated number indicates the approximate sample concentrator  
B = Not detected substantially above

Table 2  
November 2011 Screening Levels for Groundwater Metals Data - Residential Tapwater Pathway  
SWMU 40 (RAAP-009)  
Radford Army Ammunition Plant  
Longterm Monitoring Data Year 4

Location ID Sample ID Sample Date Sample Type				40MW6 40MW6GW112111 11/21/2011 N										40MW6 40MW6GW030712 3/7/2012 N										40MW6 40DUPGW061212 6/12/2012 FD										40MW6 40MW6GW061212 6/12/2012 N										40MW6 40MW6GW92512 9/25/2012 N										40MW6 40MW6GW61913 6/19/2013 N										40MW6 40MW6GW32714 3/27/2014 N										40MW6 40MW6GW12214 12/2/2014 N																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																												
				MCL		Units		Result	VQ	LOD	LOQ	DL Unit	Result	VQ	LOD	LOQ	DL Unit	Result	VQ	LOD	LOQ	DL Unit	Result	VQ	LOD	LOQ	DL Unit	Result	VQ	LOD	LOQ	DL Unit	Result	VQ	LOD	LOQ	DL Unit	Result	VQ	LOD	LOQ	DL Unit	Result	VQ	LOD	LOQ	DL Unit																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																							
Method	CAS	Chemical	fraction	CSL	T-NCSL																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	

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MCL = Maximum Contaminant Level  
### = Lowest Value For Screening  
**Bold** = Exceeds the Carcinogenic or Adjusted Noncarcinogenic Screening Level  
VO = Validation Qualifier  
LOD = Limit of Detection  
LOQ = Limit of Quantitation  
DL = Detection Limit  
N = Normal  
FD = Field Duplicate

U = Not Detected. The associated number indicates the approximate sample concentrator  
B = Not detected substantially above the level reported in laboratory or field blanks  
R = Unusable result. Analyte may or may not be present in the sample  
J = Analyte present. Reported value may or may not be accurate or precise  
K = Analyte present. Reported value may be biased high. Actual value is expected to be lower  
L = Analyte present. Reported value may be biased low. Actual value is expected to be higher  
UL = Not detected. Quantitation limit may be inaccurate or imprecise  
UL = The analyte was not detected, and the reported quantitation limit is probably higher than reported  
NS=Not Sampled because Turbidity was stable at less than or equal to 10 NTU:  
Screening Levels are based on USEPA Region III Risk-Based Concentration values from the November, 2011 RBC Table.

Table 2  
November 2011 Screening Levels for Groundwater Metals Data - Residential Tapwater Pathway  
SWMU 40 (RAAP-009)  
Radford Army Ammunition Plant  
Longterm Monitoring Data Year 4

				Location ID Sample ID Sample Date Sample Type				40MW7 40MW7GW112011 11/20/2011 N				40MW7 40MW7GW030612 3/6/2012 N				40MW7 40MW7GW601212 6/12/2012 N				40MW7 40MW7GW92512 9/25/2012 N				40MW7 40MW7GW61913 6/19/2013 N				40MW7 40MW7GW32714 3/27/2014 N				ze the 40MW7GW12214 12/2/2014 N					
Method	CAS	Chemical	fraction	CSL	T-NCSL	MCL	Units	Result	VQ	LOD	LOQ	DL Unit	Result	VQ	LOD	LOQ	DL Unit	Result	VQ	LOD	LOQ	DL Unit	Result	VQ	LOD	LOQ	DL Unit	Result	VQ	LOD	LOQ	DL Unit	Result	VQ	LOD	LOQ	DL Unit
SW60108	7429-90-5	Aluminum	T		1600		ug/L	8290		50	100	ug/L	344		50	100	ug/L	70.3	J	50	100	ug/L	1730		50	100	ug/L	100	U	100	200	ug/L	100	U	100	200	ug/L
SW60108	7429-90-5	Aluminum	D		1600		ug/L		U	50	100	ug/L	NS					NS					NS		50	100	ug/L	NS						NS			
SW60108	7439-89-6	Iron	T		1100		ug/L	7950	L	50	100	ug/L	263		50	100	ug/L	149		50	100	ug/L	1620		50	100	ug/L	55.3	J	50	100	ug/L	213	J	50	100	ug/L
SW60108	7439-89-6	Iron	D		1100		ug/L	73.1	J	50	100	ug/L	NS					NS					90	U	50	100	ug/L	NS						NS			
SW60108	7439-95-4	Magnesium	T				ug/L	61900		250	500	ug/L	36100		250	500	ug/L	36400		2500	5000	ug/L	41100		250	500	ug/L	32200		250	500	ug/L	32600		2500	5000	ug/L
SW60108	7439-95-4	Magnesium	D				ug/L	32500		250	500	ug/L	NS					NS					36100		250	500	ug/L	NS						NS			
SW60108	7440-09-7	Potassium	T				ug/L	4250		500	1000	ug/L	11720		500	1000	ug/L	1670		500	1000	ug/L	2130		500	1000	ug/L	1550		500	1000	ug/L	1570		500	1000	ug/L
SW60108	7440-09-7	Potassium	D				ug/L	2300		500	1000	ug/L	NS					NS					1770		500	1000	ug/L	NS						NS			
SW60108	7440-23-5	Sodium	T				ug/L	66700		250	500	ug/L	8540		250	500	ug/L	4030		250	500	ug/L	3510		250	500	ug/L	3990		250	500	ug/L	3660		250	500	ug/L
SW60108	7440-23-5	Sodium	D				ug/L	78300		250	500	ug/L	NS					NS					3360		250	500	ug/L	NS						NS			
SW60108	7440-62-2	Vanadium	T		7.8		ug/L	9.26	J	5	10	ug/L	5	U	5	10	ug/L	5	U	5	10	ug/L	5	U	5	10	ug/L	9.8	J	5	10	ug/L	5	U	5	10	ug/L
SW60108	7440-62-2	Vanadium	D		7.8		ug/L	5	U	5	10	ug/L	NS					NS					5	U	5	10	ug/L	NS						NS			
SW60108	7440-70-2	Calcium	T				ug/L	190000		100	200	ug/L	80600	J	100	200	ug/L	77800		1000	2000	ug/L	101000		100	200	ug/L	71300		250	500	ug/L	81500		2500	5000	ug/L
SW60108	7440-70-2	Calcium	D				ug/L	70600		100	200	ug/L	NS					NS					77700		100	200	ug/L	NS						NS			
SW6020	7439-92-1	Lead	T		15		ug/L	9.37		1	2	ug/L	0.5	U	0.5	1	ug/L	0.5	UL	0.5	1	ug/L	1.61		0.5	1	ug/L	0.5	U	0.5	1	ug/L	0.5	U	0.5	1	ug/L
SW6020	7439-92-1	Lead	D		15		ug/L	1	U	1	2	ug/L	NS					NS					0.5	U	0.5	1	ug/L	NS						NS			
SW6020	7439-96-5	Manganese	T		32		ug/L	181		2	4	ug/L	10.8		1	2	ug/L	6.47	L	1	2	ug/L	26.5		1	2	ug/L	1.76	J	1	2	ug/L	1.88	B	1	2	ug/L
SW6020	7439-96-5	Manganese	D		32		ug/L	23.9	B	2	4	ug/L	NS					NS					3.77	B	1	2	ug/L	NS						NS			
SW6020	7440-38-2	Arsenic	T	0.045	0.47	10	ug/L	2	K	1	2	ug/L	< 0.5	U	0.5	1	ug/L	< 0.5	U	0.5	1	ug/L	0.615	J	0.5	1	ug/L	< 0.5	U	0.5	1	ug/L	< 0.5	U	0.5	1	ug/L
SW6020	7440-38-2	Arsenic	D	0.045	0.47	10	ug/L	< 1	U	1	2	ug/L	NS					NS					< 0.5	U	0.5	1	ug/L	NS						NS			
SW6020	7440-39-3	Barium	T		290	2000	ug/L	252		3	6	ug/L	145		1.5	3	ug/L	146	L	1.5	3	ug/L	172		1.5	3	ug/L	130		1.5	3	ug/L	118		1.5	3	ug/L
SW6020	7440-39-3	Barium	D		290	2000	ug/L	75.8		3	6	ug/L	NS					NS					170		1.5	3	ug/L	NS						NS			
SW6020	7440-48-4	Cobalt	T		0.47		ug/L	3.04		1	2	ug/L	< 0.5	U	0.5	1	ug/L	< 0.5	U	0.5	1	ug/L	1.02		0.5	1	ug/L	< 0.5	U	0.5	1	ug/L	< 0.5	U	0.5	1	ug/L
SW6020	7440-48-4	Cobalt	D		0.47		ug/L	< 1	U	1	2	ug/L	NS					NS					0.825	J	0.5	1	ug/L	NS						NS			
SW6020	7782-49-2	Selenium	T		7.8	50	ug/L	1.86	K	1	2	ug/L	0.5	UL	0.5	1	ug/L	0.652	K	0.5	1	ug/L	0.948	J	0.5	1	ug/L	0.678	J	0.5	1	ug/L	0.5	U	0.5	1	ug/L
SW6020	7782-49-2	Selenium	D		7.8	50	ug/L	1.81	K	1	2	ug/L	NS					NS					0.913	J	0.5	1	ug/L	NS						NS			

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Bold = Exceeds the Carcinogenic or Adjusted Noncarcinogenic Screening Level  
VQ = Validation Qualifier  
LOD = Limit of Detection  
LOQ = Limit of Quantitation  
DL = Detection Limit  
N = Normal  
FD = Field Duplicate

U = Not Detected. The associated number indicates the approximate sample concentration  
B = Not detected substantially above the level reported in laboratory or field blanks  
R = Unusable result. Analyte may or may not be present in the sample  
J = Analyte present. Reported value may or may not be accurate or precise  
K = Analyte present. Reported value may be biased high. Actual value is expected to be lower  
L = Analyte present. Reported value may be biased low. Actual value is expected to be high  
UL = Not detected. Quantitation limit may be inaccurate or imprecise.  
UL = The analyte was not detected, and the reported quantitation limit is probably higher than reported  
NS=Not Sampled because Turbidity was stable at less than or equal to 10 NTU:  
Screening Levels are based on USEPA Region III Risk-Based Concentration values from the November, 2011 RBC Table.



Table 3  
November 2011 Screening Levels for Groundwater Perchlorate Data - Residential Tapwater Pathway  
SWMU 40 (RAAP-009)  
Radford Army Ammunition Plant  
Longterm Monitoring Data Year 4

Location ID Sample ID Sample Date Sample Type						40LFMW01 40LFMW01GW112111 11/21/2011 N					40LFMW01 40DUPGW030612 3/6/2012 FD					40LFMW01 40LFMW01GW030612 3/6/2012 N					40LFMW01 LFMW01GW061212 6/12/2012 N					40LFMW01 LFMW01GW92612 9/26/2012 N					40LFMW01 40DUPGW61913 6/19/2013 FD					40LFMW01 LFMW01GW61913 6/19/2013 N					40LFMW01 LFMW01GW32714 3/27/2014 N					40LFMW01 LFMW01GW12214 12/22/2014 N				
Method	CAS	Chemical	T-NCSL	MCL	Units	Result	VQ	LOD	LOQ	DL Unit	Result	VQ	LOD	LOQ	DL Unit	Result	VQ	LOD	LOQ	DL Unit	Result	VQ	LOD	LOQ	DL Unit	Result	VQ	LOD	LOQ	DL Unit	Result	VQ	LOD	LOQ	DL Unit	Result	Int Qual	VQ	LOQ	DL Unit	Result	VQ	LOD	LOQ	DL Unit	Result	VQ	LOD	LOQ	DL Unit
SW6850	14797-73-0	PERCHLORATE	1.1	15	ug/L	9.67	J	0.1	0.2	ug/L	8.93		0.1	0.2	ug/L	8.88		0.1	0.2	ug/L	4.81		0.1	0.2	ug/L	8.75		0.1	0.2	ug/L	4.44		0.2	0.4	ug/L	4.38		0.2	0.4	ug/L	7.47		0.1	0.2	ug/L	3.04		0.1	0.2	ug/L

**Notes:**  
CAS = Chemical Abstracts Service  
ug/L = Microgram Per Liter  
T = Total  
D = Dissolved  
CSL = Carcinogenic Screening Level  
T-NCSL = Adjusted Noncarcinogenic Screening Level  
MCL = Maximum Contaminant Level  
1.1 = Lowest Value For Screening  
Bold = Exceeds the Carcinogenic or Adjusted Noncarcinogenic Screening Level  
VQ = Validation Qualifier  
LOD = Limit of Detection  
LOQ = Limit of Quantitation  
DL = Detection Limit  
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L = Analyte present. Reported value may be biased low. Actual value is expected to be higher  
UJ = Not detected. Quantitation limit may be inaccurate or imprecise.  
UL = The analyte was not detected, and the reported quantitation limit is probably higher than reported.

Screening Levels are based on USEPA Region III Risk-Based Concentration values from the November, 2011 RBC Table.

Table 3  
November 2011 Screening Levels for Groundwater Perchlorate Data - Residential Tapwater Pathway  
SWMU 40 (RAAP-009)  
Radford Army Ammunition Plant  
Longterm Monitoring Data Year 4

Location ID Sample ID Sample Date Sample Type						40MW5 40DUPGW112011 11/20/2011 FD					40MW5 40MW5GW112011 11/20/2011 N					40MW5 40MW5GW030712 3/7/2012 N					40MW5 40MW5GW061212 6/12/2012 N					40MW5 40DUPGW92512 9/25/2012 FD					40MW5 40MW5GW92512 9/25/2012 N					40MW5 40MW5GW61913 6/19/2013 N					40MW5 40MW5GW32714 3/27/2014 N					40MW5 40MW5GW12214 12/2/2014 N					40MW5 40DUPGW12214 12/2/2014 FD				
						Result					Result					Result					Result					Result					Result					Result					Result					Result									
						VO	LOD	LOQ	DL Unit	Units	VO	LOD	LOQ	DL Unit	Units	VO	LOD	LOQ	DL Unit	Units	VO	LOD	LOQ	DL Unit	Units	VO	LOD	LOQ	DL Unit	Units	VO	LOD	LOQ	DL Unit	Units	VO	LOD	LOQ	DL Unit	Units	VO	LOD	LOQ	DL Unit	Units	VO	LOD	LOQ	DL Unit	Units					
						LOD	LOQ	DL Unit	Units	LOD	LOQ	DL Unit	Units	LOD	LOQ	DL Unit	Units	LOD	LOQ	DL Unit	Units	LOD	LOQ	DL Unit	Units	LOD	LOQ	DL Unit	Units	LOD	LOQ	DL Unit	Units	LOD	LOQ	DL Unit	Units	LOD	LOQ	DL Unit	Units	LOD	LOQ	DL Unit	Units	LOD	LOQ	DL Unit	Units	LOD	LOQ	DL Unit	Units		
Method	CAS	Chemical	T-NCSL	MCL	Units	Result	VO	LOD	LOQ	DL Unit	Result	VO	LOD	LOQ	DL Unit	Result	VO	LOD	LOQ	DL Unit	Result	VO	LOD	LOQ	DL Unit	Result	VO	LOD	LOQ	DL Unit	Result	VO	LOD	LOQ	DL Unit	Result	VO	LOD	LOQ	DL Unit	Result	VO	LOD	LOQ	DL Unit	Result	VO	LOD	LOQ	DL Unit					
SW6850	14797-73-0	PERCHLORATE	1.1	15	ug/L	1.55	J	0.1	0.2	ug/L	1.55	J	0.1	0.2	ug/L	0.931		0.1	0.2	ug/L	0.986		0.1	0.2	ug/L	1.81		0.1	0.2	ug/L	1.71		0.1	0.2	ug/L	0.85		0.1	0.2	ug/L	0.721		0.1	0.2	ug/L	0.883		0.1	0.2	ug/L	0.856		0.1	0.2	ug/L

**Notes:**  
CAS = Chemical Abstracts Service  
ug/L = Microgram Per Liter  
T = Total  
D = Dissolved  
CSL = Carcinogenic Screening Level  
T-NCSL = Adjusted Noncarcinogenic Screening Level  
MCL = Maximum Contaminant Level  
1.1 = Lowest Value For Screening  
**Bold** = Exceeds the Carcinogenic or Adjusted Noncarcinogenic Screening Level  
VO = Validation Qualifier  
LOD = Limit of Detection  
LOQ = Limit of Quantitation  
DL = Detection Limit  
N = Normal  
FD = Field Duplicate

U = Not Detected. The associated number indicates the approximate sample concentration  
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K = Analyte present. Reported value may be biased high. Actual value is expected to be lower.  
L = Analyte present. Reported value may be biased low. Actual value is expected to be higher  
UJ = Not detected. Quantitation limit may be inaccurate or imprecise.  
UL = The analyte was not detected, and the reported quantitation limit is probably higher than reported.

Screening Levels are based on USEPA Region III Risk-Based Concentration values from the November, 2011 RBC Table.

Table 3  
November 2011 Screening Levels for Groundwater Perchlorate Data - Residential Tapwater Pathway  
SWMU 40 (RAAP-009)  
Radford Army Ammunition Plant  
Longterm Monitoring Data Year 4

Location ID Sample ID Sample Date Sample Type						40MW6 40MW6GW112111 11/21/2011 N					40MW6 40MW6GW030712 3/7/2012 N					40MW6 40DUPGW061212 6/12/2012 FD					40MW6 40MW6GW061212 6/12/2012 N					40MW6 40MW6GW92512 9/25/2012 N					40MW6 40MW6GW61913 6/19/2013 N					40MW6 40MW6GW32714 3/27/2014 N					40MW6 40MW6GW12214 12/2/2014 N				
Method	CAS	Chemical	T-NCSL	MCL	Units	Result	VQ	LOD	LOQ	DL Unit	Result	VQ	LOD	LOQ	DL Unit	Result	VQ	LOD	LOQ	DL Unit	Result	VQ	LOD	LOQ	DL Unit	Result	VQ	LOD	LOQ	DL Unit	Result	VQ	LOD	LOQ	DL Unit	Result	VQ	LOD	LOQ	DL Unit	Result	VQ	LOD	LOQ	DL Unit
SW6850	14797-73-0	PERCHLORATE	1.1	15	ug/L	0.885	J	0.1	0.2	ug/L	0.526		0.1	0.2	ug/L	0.635		0.1	0.2	ug/L	0.647		0.1	0.2	ug/L	1.25		0.1	0.2	ug/L	0.535		0.1	0.2	ug/L	0.506		0.1	0.2	ug/L	1.03		0.1	0.2	ug/L

**Notes:**  
CAS = Chemical Abstracts Service  
ug/L = Microgram Per Liter  
T = Total  
D = Dissolved  
CSL = Carcinogenic Screening Level  
T-NCSL = Adjusted Noncarcinogenic Screening Level  
MCL = Maximum Contaminant Level  
1.1 = Lowest Value For Screening  
Bold = Exceeds the Carcinogenic or Adjusted Noncarcinogenic Screening Level  
VQ = Validation Qualifier  
LOD = Limit of Detection  
LOQ = Limit of Quantitation  
DL = Detection Limit  
N = Normal  
FD = Field Duplicate

U = Not Detected. The associated number indicates the approximate sample concentration  
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Screening Levels are based on USEPA Region III Risk-Based Concentration values from the November, 2011 RBC Table.

Table 3  
November 2011 Screening Levels for Groundwater Perchlorate Data - Residential Tapwater Pathway  
SWMU 40 (RAAP-009)  
Radford Army Ammunition Plant  
Longterm Monitoring Data Year 4

Location ID Sample ID Sample Date Sample Type						40MW7 40MW7GW112011 11/20/2011 N					40MW7 40MW7GW030612 3/6/2012 N					40MW7 40MW7GW601212 6/12/2012 N					40MW7 40MW7GW92512 9/25/2012 N					40MW7 40MW7GW61913 6/19/2013 N					40MW7 40MW7GW32714 3/27/2014 N					40MW7 40MW7GW12214 12/2/2014 N				
Method	CAS	Chemical	T-NCSL	MCL	Units	Result	VO	LOD	LOQ	DL Unit	Result	VO	LOD	LOQ	DL Unit	Result	VO	LOD	LOQ	DL Unit	Result	VO	LOD	LOQ	DL Unit	Result	Int Qual	LOD	LOQ	DL Unit	Result	VO	LOD	LOQ	DL Unit	Result	VO	LOD	LOQ	DL Unit
SW6850	14797-73-0	PERCHLORATE	1.1	15	ug/L	4.5	J	0.1	0.2	ug/L	4.18		0.1	0.2	ug/L	3.69		0.1	0.2	ug/L	3.66		0.1	0.2	ug/L	4.1		0.1	0.2	ug/L	3.74		0.1	0.2	ug/L	3.14		0.1	0.2	ug/L

**Notes:**  
CAS = Chemical Abstracts Service  
ug/L = Microgram Per Liter  
T = Total  
D = Dissolved  
CSL = Carcinogenic Screening Level  
T-NCSL = Adjusted Noncarcinogenic Screening Level  
MCL = Maximum Contaminant Level  
1.1 = Lowest Value For Screening  
**Bold** = Exceeds the Carcinogenic or Adjusted Noncarcinogenic Screening Level  
VO = Validation Qualifier  
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Screening Levels are based on USEPA Region III Risk-Based Concentration values from the November, 2011 RBC Table.

**APPENDIX F**  
**Schedule**

