FISCAL YEAR 2014 ANNUAL PERFORMANCE REPORT
NEW BRIGHTON/ARDEN HILLS SUPERFUND SITE

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Prepared for:

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WENCK ASSOCIATES, INC.
ORBITAL ATK (formerly Alliant Techsystems)
GHD (formerly CRA)

January 2016
Final Report

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

January 11, 2016

REPLY TO THE ATTENTION OF: SR-6J

Michael R. Fix
Commander's Representative
Twin Cities Army Ammunition Plant
4700 Highway 10 – Suite A
Arden Hills, MN 55112-3928

RE: Consistency Test for the Fiscal Year 2014 Annual Performance Report, New Brighton./Arden Hills Superfund Site, Arden Hills, Minnesota

Dear Mr. Fix:

Staff at the U.S. Environmental Protection Agency (U.S. EPA) and the Minnesota Pollution Control Agency (MPCA) have completed review of the Fiscal Year 2014 Annual Performance Report for the New Brighton/Arden Hills Superfund Site (FY14 APR). Our review of the FY14 APR included the following documents and communications:

- Fiscal Year 2014 Annual Performance Report, New Brighton/Arden Hills Superfund Site, Draft Final Report, Prepared for the Commander, Twin Cities Army Ammunition Plant by Wenck Associates, Inc., Alliant Techsystems, Inc., Conestoga-Rovers, Inc., February 2015;
- U.S. EPA comments on the Draft FY14 APR (March 27, 2015);
- MPCA comments on the Draft FY14 APR (November 5, 2015);
- U.S. Army (Army) responses to U.S. EPA and MPCA comments and redline changes (December 10, 2015).
- MPCA comments dated December 10, 2015 on Army's responses to comments and redline changes.

Based upon our review, you are hereby advised that, in accordance with Chapter XIV of the Federal Facility Agreement, the Fiscal Year 2014 Annual Performance Report passes the Consistency Test.

If you have any questions, please contact Amy Hadiaris at (651) 757-2402 or Tom Barounis at (312) 353-5577.

Sincerely

Tom Barounis

Tom Barounis
Remedial Project Manager
U.S. Environmental Protection Agency
Region 5

Tom Barounis for

Amy Hadiaris
Project Manager
Remediation Division
Minnesota Pollution Control Agency

Table of Contents
NEW BRIGHTON/ARDEN HILLS SUPERFUND SITE
Fiscal Year 2014 Annual Performance Report

Table of Contents (cont'd.)

Table of Contents (cont'd.)

Table of Contents (cont'd.)

TABLES

Table of Contents (cont'd.)

<u>TABLES</u> (continued)

<u>FIGURES</u>

Table of Contents (cont'd.)

FIGURES (continued)

Table of Contents (cont'd.)

List of Acronyms

ATK	-	Alliant Techsystems Inc.
APR	-	Annual Performance Report
Army	-	United States Army
Barr	-	Barr Engineering
BGRS	-	Boundary Groundwater Recovery System
BRAC	-	Base Realignment And Closure Division
COC	-	Chemical of Concern
CRA	-	Conestoga-Rovers & Associates, Inc.
DNAPL	-	Dense Non-Aqueous Phase Liquid
EBS	-	Environmental Baseline Survey
EE/CA	-	Engineering Evaluation/Cost Analysis
ERIS	-	Environmental Restoration Information System
ESD	-	Explanation of Significant Difference
EW	-	Extraction Well
FFA	-	Federal Facility Agreement
FS	-	Feasibility Study
FY	-	Fiscal Year
GAC	-	Granular Activated Carbon
GOS	-	TGRS Global Operation Strategy
gpm	-	gallons per minute
HBV	-	Health Based Value
HRC	-	Hydrogen Release Compound™
HRL	-	Health Risk Limits
IRA	-	Interim Remedial Action
LUC	-	Land Use Control
LUCRD	-	Land Use Control Remedial Design
MCES	-	Metropolitan Council Environmental Services
MCLs	-	Maximum Contaminant Levels

List of Acronyms (Cont.)

MCLGs	-	Maximum Contaminant Level Goals
MDH	-	Minnesota Department of Health
MDL	-	Method Detection Limit
MNA	-	Monitored Natural Attenuation
MOS	-	TGRS Micro Operation Strategy
MNARNG	-	Minnesota Army National Guard
MPCA	-	Minnesota Pollution Control Agency
MW	-	Monitoring Well
NB/AH	-	New Brighton/Arden Hills
NBCGRS	-	New Brighton Contaminated Groundwater Recovery System
NBM	-	New Brighton Municipal
O&M	-	Operation and Maintenance
OM	-	Operating Minimum
OS	-	TGRS Operating Strategy
OU	-	Operable Unit
OU1TG	-	OU1 Technical Group
PAR	-	Performance Assessment Report
PCBs	-	Polychlorinated Biphenyls
PGAC	-	Permanent Granular Activated Carbon
PGRS	-	Plume Groundwater Recovery System
PLC	-	Programmable Logic Controller
PM	-	Preventative Maintenance
POTW	-	Publicly-Owned Treatment Works
ppb	-	parts per billion
QAPP	-	Quality Assurance Project Plan
RAB	-	Restoration Advisory Board
RAWP	-	Remedial Action Work Plan

List of Acronyms (Cont.)

RD/RA	-	Remedial Design/Remedial Action
ROD	-	Record of Decision
scfm	-	Standard Cubic Feet per Minute
SDWA	-	Safe Drinking Water Act
Stantec	-	Stantec Consulting Corporation (formerly SECOR International, Inc.)
Shaw	-	Shaw Environmental & Infrastructure, Inc. (formerly Stone & Webster)
SVE	-	Soil Vapor Extraction
SW	-	Surface Water
TCAAP	-	Twin Cities Army Ammunition Plant
TGRS	-	TCAAP Groundwater Recovery System
TWISS	-	Tecumseh/Wenck Installation Support Services
µg/L	-	Micrograms per liter
USAEC	-	United States Army Environmental Command
USACHPPM	-	US Army Center for Health Promotion & Preventive Medicine
USEPA	-	United States Environmental Protection Agency
VOC	-	Volatile Organic Compound
Wenck	-	Wenck Associates, Inc.
WWP	-	Wet Well Pump

List of Chemical Abbreviations

Note: The abbreviations below are those that were required for data entry into the U.S. Army Environmental Center (USAEC) Installation Restoration Data Management Information System (IRDMIS), which was replaced by the USAEC Environmental Restoration Information System (ERIS) in November 2001. These abbreviations, though not used in ERIS, are still used in some tables and appendices presented in this report.

111TCE	-	1,1,1-Trichloroethane
112TCE	-	1,1,2-Trichloroethane
11DCE	-	1,1-Dichloroethene
11DCLE	-	1,1-Dichloroethane
12DCE	-	1,2-Dichloroethenes (*cis* and *trans* isomers)
12DCLB	-	1,2-Dichlorobenzene
12DCLE	-	1,2-Dichloroethane
12DCLP	-	1,2-Dichloropropane
13DCLB	-	1,3-Dichlorobenzene
14DCLB	-	1,4-Dichlorobenzene
2CLEVE	-	2-Chloroethyl vinyl ether
AG	-	Silver
BRDCLM	-	Bromodichloromethane
C12DCE	-	cis-1,2-Dichloroethene
C13DCP	-	cis-1,3-Dichloropropene
C2H3CL	-	Vinyl chloride
C2H5CL	-	Chloroethane
C6H6	-	Benzene
CCL3F	-	Trichlorofluoromethane
CCL4	-	Carbon tetrachloride
CH2CL2	-	Methylene chloride
CH3CL	-	Chloromethane
CHBR3	-	Bromoform
CHCL3	-	Chloroform

List of Chemical Abbreviations (Cont.)

CLC6H5	-	Chlorobenzene
CU	-	Copper
CYN	-	Cyanide
DBRCLM	-	Dibromochloromethane
EDTA	-	Ethylenediaminetetraacetic Acid
ETC6H5	-	Ethylbenzene
HG	-	Mercury
MEC6H5	-	Toluene
P4	-	Phosphorus
PB	-	Lead
SB	-	Antimony
T12DCE	-	trans-1,2-Dichloroethene
T13DCP	-	trans-1,3-Dichloropropene
TCLEA	-	Tetrachloroethane
TCLEE	-	Tetrachloroethene
TCLTFE	-	1,1,2-Trichloro-1,2,2-trifluoroethane
TRCLE	-	Trichloroethene
XYLEN	-	Xylenes
ZN	-	Zinc

1.0 Executive Summary

This Fiscal Year 2014 (FY 2014) Annual Performance Report (APR):

- Summarizes the status of remedy implementation; and
- Addresses how the remedies are performing,

for each of the three operable units related to the New Brighton/Arden Hills Superfund Site. Figure 2-1 shows the approximate locations of the three operable units. Fiscal Year 2014 is defined as the period from October 1, 2013 through September 30, 2014.

Records of Decision (RODs) have been signed for each of the three operable units (OUs):

- OU1 ROD signed 1993, Amended 2006
- OU2 ROD signed 1997, Amended 2007, 2009, 2012, and 2014
- OU3 ROD signed 1992, Amended 2006

The RODs, and subsequent Amendments and Explanations of Significant Differences, present the major components of the final remedies for the media of concern. This report looks at each of the major components and addresses:

1. *Are the remedies being implemented? (Compliance check with the RODs and ROD Amendments)*
2. *Are the remedies doing what they are supposed to?*

Table 1-1 summarizes the status of remedial actions at the end of FY 2014. Following are highlights of the accomplishments for each operable unit, as well as other activities during FY 2014.

Operable Unit 1 (OU1)

OU1 consists of the "north" plume of Volatile Organic Compound (VOC) groundwater contamination. The final remedy for OU1 consists of pumping from six municipal wells (New Brighton Municipal wells NBM #3, #4, #5, #6, #14, and #15) and treating the extracted groundwater through the Permanent Granular Activated Carbon (PGAC) system. Treated water is piped to the New Brighton water supply system for distribution as potable water. Other remedy components include providing alternate water supply and/or well abandonment to affected private wells, and drilling advisories for new well construction. Highlights for FY 2014 are:

- The Minnesota Department of Health (MDH) Special Well Construction Area remains in effect. The MDH has the regulatory responsibility to assure that wells constructed in the advisory area meet appropriate well construction and human health requirements. In FY 2014, there were no new recommendations for abandonment or alternate water supply.
- The PGAC treated 1.2 billion gallons of water and removed 412 pounds of VOCs during FY 2014. Approximately 23,457 pounds of VOCs have been removed since system startup.
- The effluent of the PGAC was in compliance with the applicable Safe Drinking Water Act criteria for the OU1 chemicals of concern.
- The treated groundwater was beneficially used in the New Brighton and Fridley municipal water supply systems.
- FY 2014 was a minor sampling event. The statistical trend analysis, as developed by the OU1 Technical Group, indicates that aquifer restoration is occurring.

Operable Unit 2 (OU2)

OU2 is defined as the area occupied by TCAAP in 1983, when the New Brighton/Arden Hills Superfund Site was placed on the National Priorities List. The remedial action requirements were set forth in the OU2 ROD (1997), ROD Amendment #1 related to Site C-2 (2007), ROD Amendment #2 related to Site I groundwater (2009), ROD Amendment #3 related to various soil sites (2009), Explanation of Significant Differences #1 related to groundwater (2009), Explanation of Significant Differences #2 related to various soil sites (2009), ROD Amendment #4 related to Building 102 shallow groundwater, aquatic sites, and various soil sites (2012), and ROD Amendment #5 related to various soil sites (2014). Highlights for activities within OU2 during FY 2014 are:

- Shallow Soil Sites
  - No activities other than ongoing Army implementation of land use controls.

- Deep Soil Sites
  - No activities other than ongoing Army implementation of land use controls.

- Site A Shallow Groundwater
  - In accordance with the "Site A Shallow Groundwater: 10-Year Evaluation Report" (July 2008), and with regulatory approval, the groundwater extraction system was shut down on September 24, 2008, in order to evaluate Monitored Natural Attenuation (through abiotic degradation) as a potential remedy component in lieu of groundwater extraction and discharge. The groundwater system has remained in stand-by mode in the event that MNA does not adequately control plume migration and one or more extraction wells need to be restarted.
  - Monitoring results from the four contingency wells located along the north side of County Road I did not exceed the approved trigger levels.

- It is recommended that the remedy be formally changed to MNA, based on the observed water quality trends, the lack of any *likely* groundwater receptors, and the confirmed lack of vapor intrusion risk. This recommendation is contingent on the FY 2015 groundwater monitoring result providing additional confirmation of the water quality trends, i.e., that no significant increases are expected beyond the recent "peak" concentrations observed to date. If confirmed, an ESD or ROD Modification should be finalized in late FY 2015 or early FY 2016.
- The MDH Special Well Construction Area remains in effect. In FY 2014, there were no locations identified in need of well abandonment or alternate water supply.
- Ten monitoring wells were sealed in FY 2014, with regulatory approval, since the monitoring network was deemed adequate without them.

- Site C Shallow Groundwater
  - In accordance with the "Site C Groundwater Extraction System Evaluation Report" (November 2008), and with regulatory approval, the groundwater extraction system was shut down on November 13, 2008. System operation was ceased because the area of lead concentrations that exceeded the groundwater cleanup level was no longer reaching the extraction wells.
  - Four monitoring wells located near the source area exceeded the groundwater cleanup level for lead in FY 2014.
  - None of the groundwater or surface water contingency locations exceeded the approved trigger levels in FY 2014.
  - Continued monitoring is recommended prior to any decision on whether or not to formally change the remedy to eliminate the groundwater extraction component.
  - Eleven monitoring wells were sealed in FY 2014, with regulatory approval, since the monitoring network was deemed adequate without them.

- Site I Shallow Groundwater
  - All Site I Unit 1 monitoring wells were abandoned in FY 2014; therefore, no new groundwater quality data are available to evaluate.
  - Previous investigations indicate the Unit 1 groundwater is discontinuous and does not extend beyond Site I; rather, the Unit 1 contaminants leak downward into Unit 3, which is hydraulically contained by the TGRS.
  - Monitoring well 01U667 will be reinstalled following Building 502 demolition and planned soil remediation.

- Site K Shallow Groundwater
  - At Site K, the groundwater extraction trench and treatment system continued to operate as designed. The system captured and treated 6,187,096 gallons of water and maintained a continuous zone of capture downgradient of the former Building 103. A total of 42.85 pounds of VOCs were removed in FY 2014.
  - Groundwater samples were collected from all eight wells scheduled for sampling in FY 2014. With the exception of relatively stable trichloroethene concentrations in 01U615, the overall trend throughout Site K Unit 1 monitoring wells continues to show a gradual decrease in trichloroethene concentrations over the last twenty years of sampling.
  - The extracted water was treated and discharged to Rice Creek in compliance with all discharge criteria except for total phosphorus in December 2013. The effluent was resampled in January 2014 and total phosphorus was below the effluent limit.
  - Twelve Unit 1 wells at Site K were abandoned as part of the site redevelopment activities.
  - The spring of 2014 experienced the highest recorded groundwater elevations at Site K. The high groundwater levels resulted in a trichloroethene being detected at a historically non-detect monitoring well. By August 2014, the groundwater elevations lowered to within the typical elevation range. As part

of a Site K geoprobe groundwater investigation, groundwater samples were collected downgradient of the affected monitoring well and did not detect trichloroethene, which confirms containment by the collection trench.

  - After the Building 103 concrete slab was removed, ATK voluntarily conducted a geoprobe groundwater investigation in September 2014 to better define the width of the plume. The results will be reported under a separate cover.

- Building 102 shallow groundwater
  - VOC concentrations were generally similar or decreasing relative to the increasing trend that had been observed in FY 2011/2012.
  - The well adjacent to Rice Creek continued to show that shallow groundwater discharging to Rice Creek was below the cleanup levels for this site.

- Aquatic Sites
  - In early FY 2014, the USEPA and MPCA approved the Pond G Remedial Action Completion and Close Out Report for Pond G, which recommended closure of this site with no long-term maintenance, monitoring, or land use controls.

- Deep Groundwater
  - The TCAAP Groundwater Recovery System (TGRS) operated in accordance with the OU2 ROD.
  - The TGRS operated at a rate sufficient to support the conclusion that the 5 μg/L TRCLE contour is hydraulically contained. In FY 2014, the total extraction well water pumped averaged 1,785 gpm, which is greater than the Global Operation Strategy (GOS) Operating Minimum (OM) (1,745 gpm).
  - In FY 2014, the TGRS extracted and treated approximately 937,934,854 gallons of water. The mass of VOCs removed was 2,020 pounds and is

62 pounds less than that achieved in FY 2013. The total VOC mass removed by the TGRS through FY 2014 is 211,282 pounds.

– Groundwater analytical data of the source area shows a general decrease in TRCLE concentration. This demonstrates that the TGRS is effectively removing VOC mass from the aquifer.

– Effluent VOC concentrations were below contaminant-specific requirements for all sampling events.

Operable Unit 3 (OU3)

OU3 consists of the "south" plume of VOC groundwater contamination. Highlights for FY 2014 are:

- Groundwater monitoring in FY 2014 was conducted during the annual event. Overall, the statistical evaluation indicated no clear trend in concentration at the center of the South Plume and stable concentrations at its edge. In addition, there is evidence of the North Plume mingling with the South Plume at the boundary between the two plumes and perhaps even toward the center of the South Plume.

Five-Year Review

A Five-Year Review report was completed in August 2014 for Operable Unit 1, 2, and 3. The review concluded that the remedies are functioning as intended, and that the components of the remedies remain protective of human health and the environment. It was noted that continued monitoring was required at Site A to evaluate whether MNA will adequately control plume migration (which is being done), and also that the investigations of vapor intrusion risk at Site A and attenuation levels in the Building 102 groundwater plume needed to be completed to assess these issues (which have both been completed, as documented in the FY 2013 APR).

Other Investigation and/or Remediation Activities Not Prescribed by a Current ROD

- Round Lake Supplemental Remedial Investigation and Feasibility Study
  - Through the process of submitting multiple earlier drafts of the FS, it became clear that the Army, USEPA, and MPCA did not agree on the ecological risks and commensurate remedy associated with Round Lake. In early FY 2014, the Army submitted a Supplemental RI and FS for Round Lake which incorporated a Supplemental Ecological Risk Assessment prepared by the Environmental Sciences Division at the Oak Ridge National Laboratory (ORNL). Comments received from the USEPA and MPCA in March 2014 indicated that significant disagreement remained. In April 2014, the Army notified the USEPA and MPCA that their findings were being disputed by the Army. Efforts to resolve this dispute continued through the end of FY 2014.

- Site A, 135 Primer/Tracer Area, and MNARNG EBS Area Soil Removal Actions
  - The contaminated soil excavation and offsite disposal work implemented at these sites in FY 2013 was documented in the Final Removal Action Completion Report for Soil Areas of Concern, which was approved by the USEPA and MPCA in November 2013. OU2 ROD Amendment #5, signed in March 2014, documented that the soil removal actions were the final remedies for these sites and incorporated these remedies into OU2. Discussion of these sites is now being included in Section 4.0.

Table 1-1

Status of Remedial Actions: FY 2014

Remedy Component	Is the component being implemented?	Is the component doing what it is supposed to?	Has the component undergone final closeout?	Comments
Operable Unit 1: Deep Groundwater				
#1: Alternate Water Supply/Well Abandonment	Yes	Yes	No	
#2: Drilling Advisories	Yes	Yes	No	
#3: Extract Groundwater	Yes	Yes	No	
#4: Removal of VOCs by GAC (Discharge Quality)	Yes	Yes	No	
#5: Discharge of Treated Water	Yes	Yes	No	
#6: Groundwater Monitoring with Verification of Continuing Aquifer Restoration	Yes	Yes	No	
Overall Remedy	Yes	Yes	No	
Operable Unit 2: Shallow Soil Sites				
#1-7: Soil Remediation				
Site A	Yes	Yes	Yes	
Site C	Yes	Yes	Yes	
Site E	Yes	Yes	Yes	
Site H	Yes	Yes	Yes	
Site 129-3	Yes	Yes	Yes	
Site 129-5	Yes	Yes	Yes	

Table 1-1 (continued)

Status of Remedial Actions: FY 2014

Remedy Component	Is the component being implemented?	Is the component doing what it is supposed to?	Has the component undergone final closeout?	Comments
Operable Unit 2: Shallow Soil Sites (continued)				
#1-7: Soil Remediation (continued)				
Grenade Range	Yes	Yes	Yes	
Outdoor Firing Range	Yes	Yes	Yes	
135 PTA Stormwater Ditch	Yes	Yes	Yes	
535 Primer/Tracer Area	Yes	Yes	Yes	
Site K Soils	Yes	Yes	Yes	
Water Tower Area	Yes	Yes	Yes	
Soil AOCs (Site A, 135 PTA, EBS Areas)	Yes	Yes	Yes	
#8: Groundwater Monitoring	Yes	Yes	Yes	
#9: Characterization of Dumps				
Site B	Yes	Yes	Yes	
Site 129-15	Yes	Yes	Yes	
#10: Land Use Controls	Yes	Yes	No	Implementation of the OU2 Land Use Control Remedial Design (OU2 LUCRD) is an ongoing requirement.
Overall Remedy	Yes	Yes	Partially	

Table 1-1 (continued)

Status of Remedial Actions: FY 2014

Remedy Component		Is the component being implemented?	Is the component doing what it is supposed to?	Has the component undergone final closeout?	Comments
Operable Unit 2: Deep Soil Sites					
#1:	Groundwater Monitoring	Yes	Yes	Yes	
#2:	Restrict Site Access During Remediation	Yes	Yes	Yes	Long-term land use controls are addressed by Remedy Component #8.
#3:	SVE Systems	Yes	Yes	Yes	
#4:	Enhancements to SVE Systems	Yes	Yes	Yes	Neither system required operation with enhancements. Both SVE systems have been dismantled.
#5:	Maintain Existing Site Caps	Yes	Yes	Yes	This remedy component was intended to minimize short-circuiting of airflow when the SVE systems were operating. The long-term land use controls for the cap/cover that must be maintained at Sites D and G (due to shallow soil contamination at Site D and the Site G dump) are addressed by Remedy Component #8.
#6:	Maintain Surface Drainage Controls	Yes	Yes	Yes	
#7:	Characterize Shallow Soils and Dump	Yes	Yes	Yes	
#8:	Land Use Controls	Yes	Yes	No	Implementation of the OU2 Land Use Control Remedial Design (OU2 LUCRD) is an ongoing requirement.
Overall Remedy		Yes	Yes	Partially	

Table 1-1 (continued)

Status of Remedial Actions: FY 2014

Remedy Component		Is the component being implemented?	Is the component doing what it is supposed to?	Has the component undergone final closeout?	Comments
Operable Unit 2: Site A Shallow Groundwater					
#1:	Groundwater Monitoring	Yes	Yes	No	
#2:	Groundwater Containment/Mass Removal	Yes	Yes	No	The groundwater extraction system was shut off on 9/24/08 and is currently in standby while implementation of MNA is evaluated. If MNA is ultimately deemed an acceptable remedy, a ROD modification will be prepared to document the change in this remedy component.
#3A	Land Use Controls	Yes	Yes	No	Implementation of the OU2 Land Use Control Remedial Design (OU2 LUCRD) is an ongoing requirement.
#3B:	Drilling Advisory/Alternate Water Supply/Well Abandonment	Yes	Yes	No	
#4:	Discharge of Extracted Water	Yes	Yes	No	See comment for Remedy Component #2.
#5:	Source Characterization/Remediation	Yes	Yes	Yes	
Overall Remedy		Yes	Yes	No	

Table 1-1 (continued)

Status of Remedial Actions: FY 2014

Remedy Component	Is the component being implemented?	Is the component doing what it is supposed to?	Has the component undergone final closeout?	Comments
Operable Unit 2: Site C Shallow Groundwater				
#1: Groundwater and Surface Water Monitoring	Yes	Yes	No	
#2: Groundwater Containment	Yes	Yes	No	Since the lead plume no longer extends to the extraction wells, the groundwater extraction system was shut off on 11/13/08. Future monitoring will determine whether a ROD modification will be prepared to document the change in this remedy component, or whether the Site can be closed.
#3: Discharge of Extracted Water	Yes	Yes	No	See comment for Remedy Component #2.
#4: Land Use Controls	Yes	Yes	No	Implementation of the OU2 Land Use Control Remedial Design (OU2 LUCRD) is an ongoing requirement.
Overall Remedy	Yes	Yes	No	
Operable Unit 2: Site I Shallow Groundwater				
#1: Groundwater Monitoring	Yes	Yes	No	
#2: Additional Investigation	Yes	Yes	Yes	
#3: Land Use Controls	Yes	Yes	No	Implementation of the OU2 Land Use Control Remedial Design (OU2 LUCRD) is an ongoing requirement.
Overall Remedy	Yes	Yes	No	

Table 1-1 (continued)

Status of Remedial Actions: FY 2014

Remedy Component		Is the component being implemented?	Is the component doing what it is supposed to?	Has the component undergone final closeout?	Comments
Operable Unit 2: Site K Shallow Groundwater					
#1:	Groundwater Monitoring	Yes	Yes	No	
#2:	Sentinel Wells	Yes	Yes	Yes	
#3:	Hydraulic Containment	Yes	Yes	No	
#4:	Groundwater Treatment	Yes	Yes	No	
#5:	Treated Water Discharge	Yes	Yes	No	
#6:	Discharge Monitoring	Yes	Yes	No	
#7:	Additional Investigation	Yes	Yes	Yes	
#8:	Land Use Controls	Yes	Yes	No	Implementation of the OU2 Land Use Control Remedial Design (OU2 LUCRD) is an ongoing requirement.
Overall Remedy		Yes	Yes	No	
Operable Unit 2: Building 102 Shallow Groundwater					
#1:	Monitored Natural Attenuation	Yes	Yes	No	
#2:	Groundwater Monitoring	Yes	Yes	No	
#3:	Land Use Controls	Yes	Yes	No	Implementation of the OU2 Land Use Control Remedial Design (OU2 LUCRD) is an ongoing requirement.
Overall Remedy		Yes	Yes	No	

Table 1-1 (continued)

Status of Remedial Actions: FY 2014

Remedy Component	Is the component being implemented?	Is the component doing what it is supposed to?	Has the component undergone final closeout?	Comments
Operable Unit 2: Aquatic Sites				
#1: Pond G Surface Water Treatment	Yes	Yes	Yes	
#2: Pond G Surface Water Monitoring	Yes	Yes	Yes	
Overall Remedy	Yes	Yes	Yes	The Final Pond G Close Out Report received consistency aproval in FY 2014. The Pond G site has been closed with no long-term maintenance, monitoring, or LUC requirements.
Operable Unit 2: Deep Groundwater				
#1: Hydraulic Containment and Contaminant Mass Removal	Yes	Yes	No	
#2: Groundwater Treatment	Yes	Yes	No	
#3: Treated Water Discharge	Yes	Yes	No	
#4: Land Use Controls	Yes	Yes	No	Implementation of the OU2 Land Use Control Remedial Design (OU2 LUCRD) is an ongoing requirement.
#5: Review of New Technologies	Yes	Yes	No	
#6: Groundwater Monitoring	Yes	Yes	No	
Overall Remedy	Yes	Yes	No	

Table 1-1 (continued)

Status of Remedial Actions: FY 2014

Remedy Component	Is the component being implemented?	Is the component doing what it is supposed to?	Has the component undergone final closeout?	Comments
Operable Unit 3: Deep Groundwater				
#1: Monitored Natural Attenuation	Yes	Yes	No	
#2: Groundwater Monitoring	Yes	Yes	No	
#3: Drilling Advisories	Yes	Yes	No	
Overall Remedy	Yes	Yes	No	

2.0 Introduction

2.1 PURPOSE

This Fiscal Year 2014 Annual Performance Report (APR) is intended to:

- Summarize the status of remedy implementation; and
- Address how the remedies are performing,

for remedial actions at the New Brighton/Arden Hills Superfund Site (NB/AH Site). Fiscal Year 2014 (FY 2014) extended from October 1, 2013 through September 30, 2014.

The NB/AH Superfund Site has been divided into three areas designated “Operable Units.” Operable Unit 1 (OU1) encompasses deep groundwater sometimes referred to as the “North Plume.” Operable Unit 2 (OU2) includes soil, sediment, surface water, and groundwater contamination on the area that comprised the Twin Cities Army Ammunition Plant (TCAAP) in 1983, when the NB/AH Site was placed on the National Priorities List (NPL). OU2 also includes the Site A groundwater plume that extends off the north end of the federally-owned property. Operable Unit 3 (OU3) consists of the deep groundwater sometimes referred to as the “South Plume.” Figure 2-1 shows the approximate locations of the three operable units.

Records of Decision (RODs) have been signed for each of the three operable units (OUs):

- OU1 ROD signed 1993, Amended 2006
- OU2 ROD signed 1997, Amended 2007, 2009, 2012, and 2014
- OU3 ROD signed 1992, Amended 2006

The RODs, and subsequent Amendments and Explanations of Significant Differences (ESDs), present the major components of the final remedies for the media of concern.

Monitoring activities and submittal of this report are in fulfillment of the Federal Facility Agreement (FFA) signed in 1987 between the United States Army (Army), United States Environmental Protection Agency (USEPA), and Minnesota Pollution Control Agency (MPCA).

Assessment of performance is answered with two questions:

1. *Are all of the remedies being implemented? (Compliance check with the RODs)*
2. *Are the remedies performing as required?*

To address these two questions, this report is broken into the three Operable Units. Using each ROD (along with subsequent modifications), the report addresses the major components of the selected remedy for each media. Performance standards are then presented for each of the major remedy components. The performance standards are used to determine when a remedy component has been successfully implemented and/or completed.

For some of the remedy components, the performance standards are clearly defined in the RODs (e.g., soil or groundwater cleanup levels). For other remedy components (e.g., alternate water supply) the performance standards are less clear in the RODs, but may have been agreed to through Work Plans or design documents.

With the performance standards identified, this report then addresses the two questions described above, often through a series of sub-questions. The questions are written in the text in an attempt to make the report focused and user friendly. To the extent possible, answers are in the form of figures, graphs, etc.

In addition to reporting on FY 2014, this document presents proposed monitoring for future years (Appendix A). Monitoring locations or frequencies that are new in this year's report are shown highlighted in yellow. The monitoring plan shows FY 2014 through FY 2018. The monitoring plan covers a moving 5-year time span (i.e., next year FY 2014 will drop off and FY 2019 will be added).

This report represents the collaboration of work performed by the Army and Alliant Techsystems Inc. (ATK). On behalf of the Army, Wenck Associates, Inc. (Wenck) prepared Sections 2.0 through 7.0, 10.0, 11.0 and 14.0 of this report. On behalf of ATK, Conestoga-Rovers & Associates, Inc. (CRA) prepared Sections 8.0, 9.0, 12.0 and 13.0. Wenck and CRA both contributed to Section 1.0.

2.2 BRIEF OVERVIEW OF TCAAP

TCAAP was constructed between August 1941 and January 1943 in the northern portion of the Minneapolis – St. Paul metropolitan area, in Ramsey County, and is surrounded by the cities of New Brighton, Arden Hills, Mounds View, and Shoreview, Minnesota (Figure 2-1).

TCAAP primarily produced and proof-tested small-caliber ammunition and related materials for the Army. Other uses included manufacture of munitions-related components, handling/storage of strategic and critical materials for other government agencies, and various non-military tenant activities. Production began in 1942 and then alternated between periods of activity and standby related to wars. The last manufacturing operations ceased in 2005.

During periods of activity, solvents were utilized as part of some manufacturing operations. Disposal of solvents and other wastes at the TCAAP property resulted in soil contamination and also groundwater contamination, which has migrated beyond the original TCAAP boundary. Groundwater contamination was first discovered in July 1981, which led to investigation of the soil and groundwater on and off the TCAAP property. It was determined that TCAAP was the source of contamination, and so the TCAAP property and area of affected groundwater contamination was placed on the National Priorities List (NPL) in 1983 as the New Brighton/Arden Hills Superfund Site.

A number of known and potential contaminant source areas were initially identified on the TCAAP property: Sites A, B, C, D, E, F, G, H, I, J, K, 129-3, 129-5, and 129-15 (see Figure 2-2 for locations). The 1997 OU2 ROD specified requirements for all of these sites except Site F (which was remediated prior to 1997) and Site J (a sewer line that was determined not to have a release of contamination). Other areas have also undergone investigation and/or remediation, namely the Grenade Range, Outdoor Firing Range, Trap Range, 135 Primer/Tracer Area (and adjacent stormwater ditch), 535 Primer/Tracer Area, Water Tower Area, EBS Areas, and Building 102. These areas are also shown on Figure 2-2.

Since 1983, when the NB/AH Site was placed on the NPL, the size of TCAAP has periodically shrunk as a result of property transfers. Some property has been transferred out of federal-ownership to Ramsey County and the City of Arden Hills. Other property is still owned by the federal government, but control has been reassigned to the Army Reserve or the National Guard Bureau. The National Guard Bureau has licensed the property it controls to the Minnesota Army National Guard. Figure 2-3 shows the property presently under federal ownership, along with the organizations responsible for control. The majority of the remaining TCAAP property that was controlled by the Base Realignment And Closure (BRAC) Division of the U.S. Army was transferred to Ramsey County in 2013 for redevelopment. At this point, the minimal remaining TCAAP (BRAC-controlled) property is also in the process of being transferred out of federal ownership. It is likely that within the next few years, there will no longer be an organization or property called TCAAP. These property transfers do not alter the responsibilities of the U.S. Army under the FFA.

2.3 HYDROGEOLOGIC UNITS AND WELL NOMENCLATURE

For purposes of studies and work related to the NB/AH Superfund Site, four hydrogeologic units have been designated: Unit 1 through Unit 4. Descriptions of these four units are presented in

Appendix B, along with a description of the nomenclature system used for well designations (e.g., 03U704). A well-designation cross-reference guide is included in Table B-1 in this appendix. The well index includes all wells that are owned by or have been used by the Army in the past to gather groundwater elevation or water quality data, sorted by Minnesota unique number. Well information in this appendix includes the Army designation (IRDMIS number), Minnesota unique number, and any other name(s) the wells may have. This appendix also includes information about each well. Locations of wells that are included in the monitoring plan are shown on Figure B-2 (OU1/OU3 wells) and Figure B-3 (OU2 wells) in this appendix. With a known well name, the location of that well can be determined using the "Edit, Find" or "Edit, Search" function and typing in the well name, which will highlight the desired well name on the figure. Available information concerning a well, including well logs and other information, can be viewed in the Appendix B Attachment, which is sorted by Minnesota unique number.

See the instructions in the Appendix B attachment for more information on using this appendix.

2.4 DATA COLLECTION, MANAGEMENT, AND PRESENTATION

Performance monitoring data was collected in accordance with the:

- FY 2014 Monitoring Plan for Groundwater Monitoring Wells
- FY 2014 Monitoring Plan for Remedial Treatment Systems
- FY 2014 Monitoring Plan for Surface Water
- New Brighton Water System Sampling and Analysis Plan

Data was collected principally by four parties: Wenck on behalf of the Army; CRA and Stantec Consulting Corporation (Stantec) on behalf of ATK; and Barr Engineering (Barr) on behalf of the City of New Brighton. Appendix C presents information on data collection, management, and presentation. Data tables are presented following the text at the end of each section in which it is referenced. The comprehensive groundwater level and groundwater quality databases from 1987 through FY 2014 are contained in Appendix D.1.

Is the data complete and representative (are we making decisions based on complete and technically-sound information)?

Yes. The data was collected in accordance with the FY 2014 Monitoring Plan. Data was collected, verified, and validated in accordance with two separate Quality Assurance Project Plans (QAPPs): "QAPP for Performance Monitoring", (Wenck, Revision 12, February 25, 2013) and "QAPP for Monitored Natural Attenuation of Building 102 Groundwater", (Wenck, Revision 6, February 25, 2013). The Building 102 QAPP is applicable to only that specific site, and all other sites are covered by the Performance Monitoring QAPP.

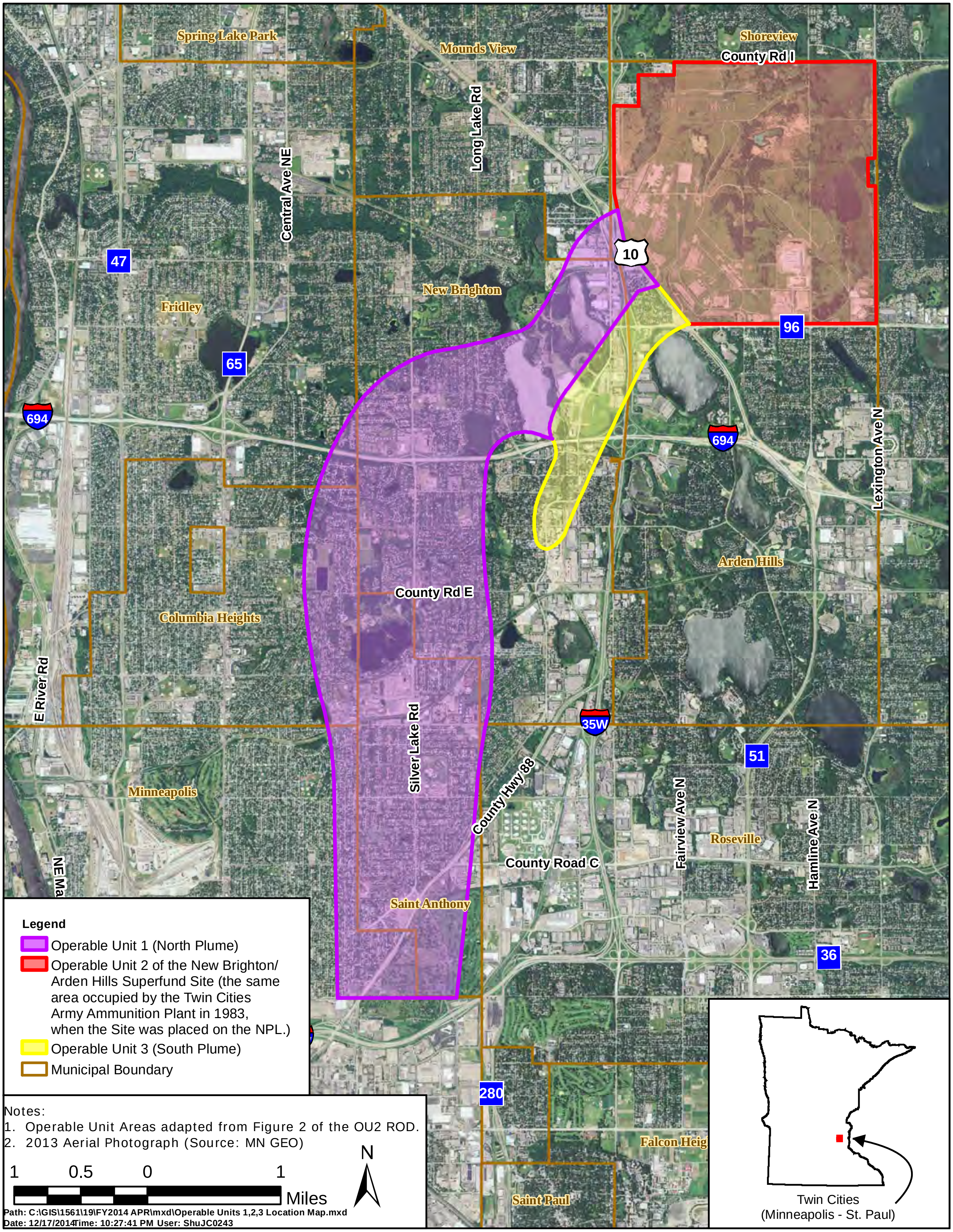
The data tables in the various report sections and the comprehensive water quality databases (Appendix D.1) show the data qualifiers that were assigned to the data as a result of data verification and/or data validation. The data qualifiers assigned to FY 2014 data are explained in the footnotes of the data tables in the various report sections. Data verification (performed on 100 percent of the data) and data validation (performed on a minimum of 10 percent of the data) were provided to the USEPA and MPCA via submittal of quarterly Data Usability Reports (DURs) covering the data collected in FY 2014. The final MPCA/USEPA approval letter for the FY 2014 DURs is included in Appendix C.3.

With regard to completeness, Appendix C.2 summarizes any deviations from the FY 2014 Monitoring Plan. The field and laboratory completeness goals for performance monitoring are both 95%, except that the completeness goals for TGRS effluent, Site K effluent, and well inventory are 100%. Actual field and laboratory completeness were both 100%, meeting the overall completeness goals (wells that were dry, frozen or inoperative were not considered as missed samples, nor were well inventory locations where the well owner refused sample collection or was nonresponsive). Also, the actual field and laboratory completeness for the subset of samples with 100% completeness goals was 100%, meeting this goal. For Building 102 shallow groundwater, the field and laboratory completeness goals are both 95%, except that the completeness goals for well 01U048 (adjacent to Rice Creek) are 100%. Actual field and laboratory completeness were 100%, meeting the completeness goals.

With regard to QC samples, both QAPPs specify that field duplicates, equipment rinse blanks, and matrix spike/matrix spike duplicates are to be collected at overall frequencies of 10%, 10%, and 5%, respectively. Actual QC sample frequencies met these goals, with respective frequencies of 21%, 10% and 13% for performance monitoring; and 18%, 18% and 9% for Building 102 shallow groundwater.

With regard to data validation, the performance monitoring QAPP specifies that data validation be completed at an overall rate of 10%, with 100% validation of Site A antimony data and well inventory samples. The actual validation rate was 42%, and all of the data requiring 100% data validation was fully validated, meeting the specified validation rates for performance monitoring. For Building 102 shallow groundwater, the QAPP specifies a 100% data validation rate, and all of the data was fully validated.

The data for FY 2014 is deemed to be representative and meet data quality objectives based on: 1) adherence to QAPP-specified sampling and laboratory analytical procedures; 2) completion of data verification and data validation; and 3) comparability to historical results (any substantial deviations from historical and/or anticipated results are discussed within the site-specific sections of this report).



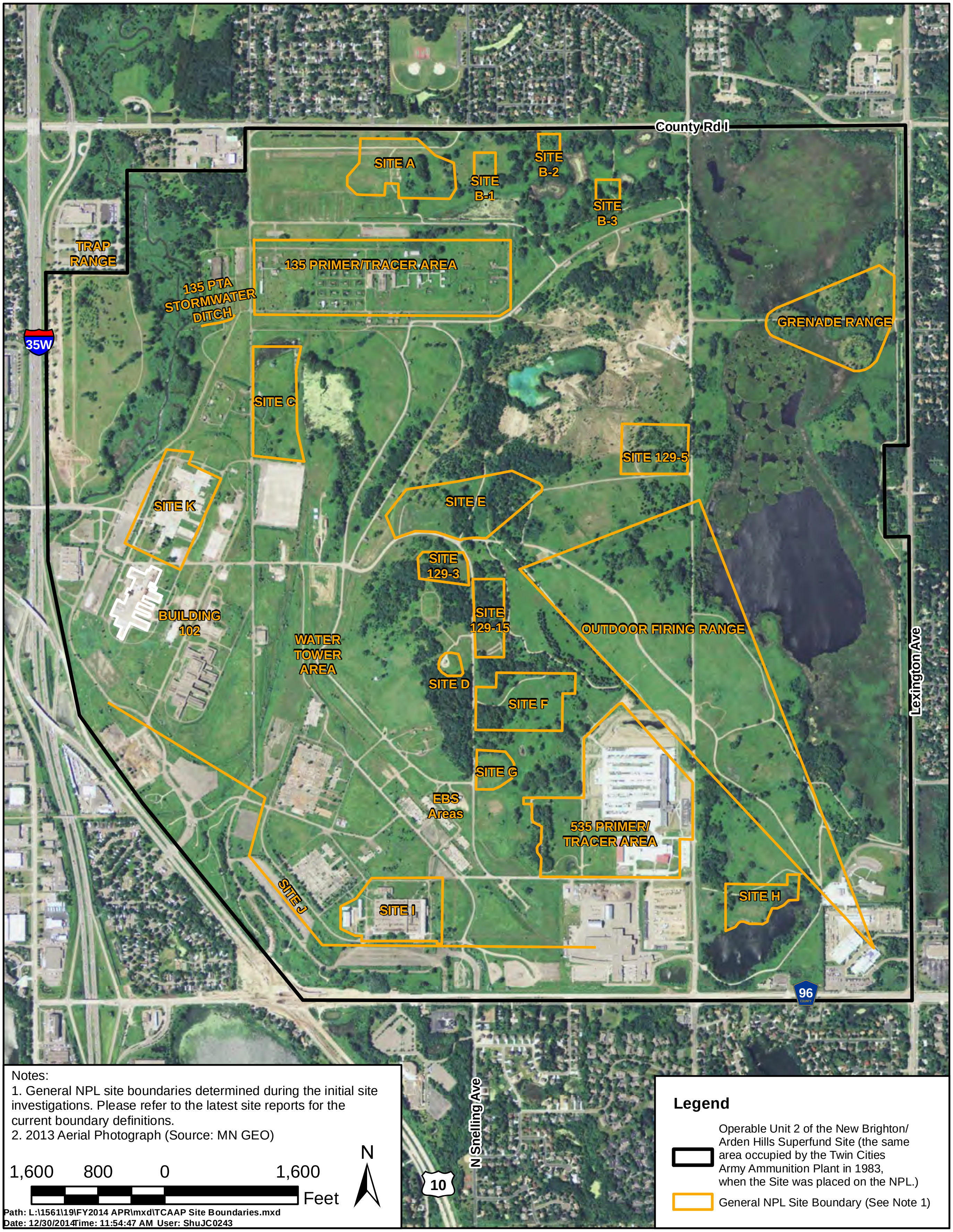
ANNUAL PERFORMANCE REPORT

Conceptual Illustration of Operable Units

WENCK ASSOCIATES
Responsive partner. Exceptional outcomes.

FY 2014

Figure 2-1



Notes:
1. General NPL site boundaries determined during the initial site investigations. Please refer to the latest site reports for the current boundary definitions.
2. 2013 Aerial Photograph (Source: MN GEO)

1,600 800 0 1,600
Feet

N

Path: L:\1561\19\FY2014 APR\mxd\TCAAP Site Boundaries.mxd
Date: 12/30/2014 Time: 11:54:47 AM User: ShuJC0243

Legend

Operable Unit 2 of the New Brighton/ Arden Hills Superfund Site (the same area occupied by the Twin Cities Army Ammunition Plant in 1983, when the Site was placed on the NPL.)

General NPL Site Boundary (See Note 1)

ANNUAL PERFORMANCE REPORT

Operable Unit 2 Site Boundaries

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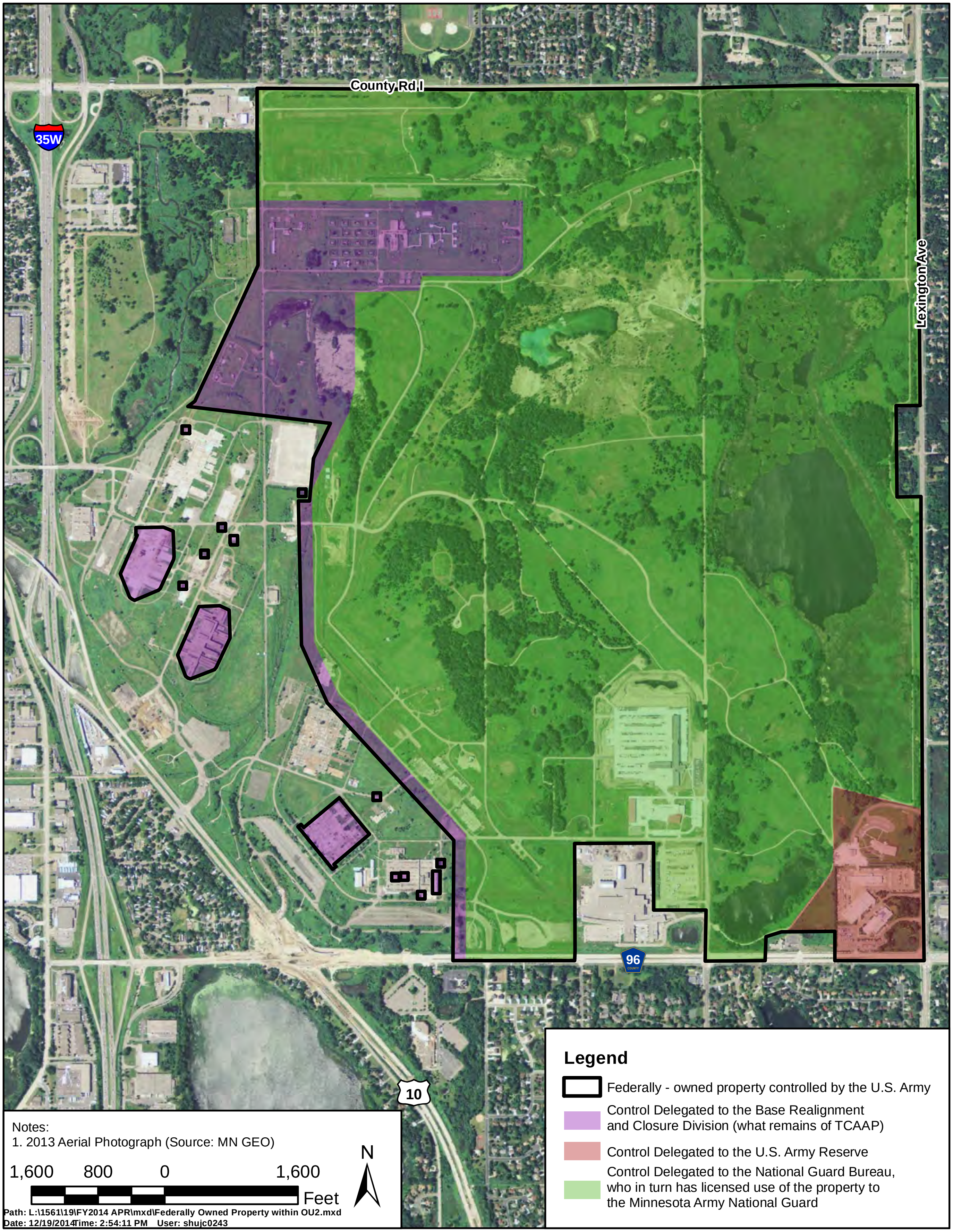
FY 2014

Figure 2-2



Legend

- Federally - owned property controlled by the U.S. Army
- Control Delegated to the Base Realignment and Closure Division (what remains of TCAAP)
- Control Delegated to the U.S. Army Reserve
- Control Delegated to the National Guard Bureau, who in turn has licensed use of the property to the Minnesota Army National Guard

Notes:
1. 2013 Aerial Photograph (Source: MN GEO)

1,600 800 0 1,600
Feet

Path: L:\1561\19\FY2014 APR\mxd\Federally Owned Property within OU2.mxd
Date: 12/19/2014 Time: 2:54:11 PM User: shujc0243

ANNUAL PERFORMANCE REPORT
Federally - Owned Property
Within Operable Unit 2

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FY 2014

Figure 2-3

3.0 Operable Unit 1: Deep Groundwater

The reference for the OU1 ROD is:

RECORD OF DECISION
Groundwater Remediation
Operable Unit 1
At New Brighton/Arden Hills Superfund Site
1993, Amended 2006

The 2006 ROD amendment formalized the adoption of the statistical analysis of groundwater quality presented in the Annual Performance Reports since FY 2003.

Following are the six primary elements of the amended ROD, with the changed elements shown in italics:

1. Providing alternate water supplies to residents with private wells within the North Plume.

2. Implementing drilling advisories that would regulate the installation of new private wells within the North Plume as a Special Well Construction Area.

3. *Extracting groundwater from the North Plume using the New Brighton Contaminated Groundwater Recovery System (NBCGRS), subject to the following:*
   a. the initial aggregate groundwater extraction rate shall be consistent with the long-term operating history of the NBCGRS;
   b. future decreases in the aggregate extraction rate shall be determined by the Army, USEPA, and MPCA using a transparent public process and rational

engineering, scientific, and economic analyses at least as rigorous as those employed in the feasibility study that was the basis for the original remedy selection;

c. future changes to the aggregate or individual well extraction rates shall be made so as to assure that the rate of restoration of the aquifer will not be slowed or result in a duration of remedy longer than was contemplated by the original ROD;

d. the facilities comprising the NBCGRS may be modified as necessary to assure the restoration of the full areal and vertical extent of the aquifer in a timeframe as contemplated in 3.c, above.

4. Pumping the extracted groundwater to the PGAC Water Treatment Facility in New Brighton for removal of VOCs by a pressurized granular activated carbon (GAC) system.

5. Discharging all of the treated water to the New Brighton municipal distribution system.

6. *Monitoring the groundwater to verify effectiveness of the remedy through measurement of overall plume shrinkage (geographically) and decreasing contaminant concentrations*.

The last requirement (No. 6) is met by evaluating the groundwater chemical data according to statistical methods contained in the "OU1 Technical Group Technical Memorandum Statistical Evaluation Method For Water Quality Data, Operable Unit 1", dated December 2004 (and any subsequent addendums or revisions approved by the USEPA and MPCA). The statistical analysis is conducted annually and is reported in the Annual Performance Reports.

Groundwater extraction is provided by six municipal wells: New Brighton Municipal (NBM) #3, #4, #5, #6, #14, and #15. The extracted water is treated in the Permanent Granular Activated

Carbon (PGAC) treatment facility for removal of VOCs, and is then used as part of the municipal water supply. NBM #3 through #6 were pre-existing wells. NBM #14 and NBM #15 began pumping in December 1996 and March 1998, respectively.

The remedy also relies on provision of an alternate water supply and/or well abandonment, as necessary, to manage risks for existing private water supply wells, and land use controls (drilling advisory) to prevent new water supply wells from being constructed into the affected portion of the aquifer.

The six major components of the remedy prescribed by the amended ROD are evaluated in the following sections.

3.1 REMEDY COMPONENT #1: ALTERNATE WATER SUPPLY/WELL ABANDONMENT

Description: "Providing an alternative water supply to residents with private wells within the North Plume." (OU1 ROD, page 2)

- Clarified by the OU1 Alternate Water Supply Plan (Montgomery Watson, October 1995) to delete "residents with" since the remedy applies to other wells in addition to residential wells. This plan also identifies the criteria for determining what wells are eligible for an alternate water supply.
- Clarified by the OU1 Alternate Water Supply Plan to also include well abandonment.
- Clarified by the OU1 Alternate Water Supply Plan (page i-2) to also encompass OU3 and the OU2 Site A shallow groundwater plume.

Performance Standard (how do you know when you're done):

- For alternate water supply, when the owners of all wells that meet all of the following criteria have been offered and provided with an alternate water supply (or when the well owners have rejected the offers):

    i. The well is located within the area affected by groundwater plumes that originate at OU2, as shown on Figures E-2 and E-3 in Appendix E; and
    ii. The well is completed in an affected aquifer; and
    iii. The well contains detectable concentrations of the New Brighton/Arden Hills Superfund Site-related chemicals of concern identified on page 18 of the OU1 ROD (or page 26 of the OU3 ROD, or Table 1 of the OU2 ROD, as appropriate for the well location); and
    iv. The well is used in a manner to cause exposure (uses are defined in the Alternate Water Supply Plan); and
    v. The well owner does not already have an alternate water supply.

    If eligible well owners refuse the offer to have an alternate water supply provided, this also satisfies the performance standard.

- For well abandonment, when the owners of all wells that meet all of the following criteria have been offered and provided abandonment (or when the well owners have rejected the offers):

    i. The well is located within the area affected by groundwater plumes that originate at OU2; and
    ii. The well is completed in an affected aquifer; and
    iii. The well contains detectable concentrations of the New Brighton/Arden Hills Superfund Site-related chemicals of concern identified on page 18 of the OU1 ROD (or page 26 of the OU3 ROD, or Table 1 of the OU2 ROD, as appropriate for the well location); and

iv. The well was constructed prior to the MDH Special Well Construction Area advisory; and

v. The well is being used by the well owner or use was discontinued due to contamination; and

vi. The well is used in a manner to cause exposure (uses are defined in the Alternate Water Supply Plan).

If eligible well owners refuse the offer for abandonment, this also satisfies the performance standard. An exception to abandonment would be if the well is needed for groundwater monitoring.

- Also, note that per Appendix E, program requirements for both alternate water supply and well abandonment have been clarified such that a well should contain an exceedance of a cleanup level (or an additivity of 1.0, similar to the MDH Hazard Index calculation), rather than merely “detectable concentrations” as noted above. On a case-by-case basis, review by the Army, USEPA, and MPCA could lead to an Army offer for alternate water supply and/or well abandonment for a given well with detectable concentrations that do not exceed a cleanup level (or additivity criteria), particularly if that well is used to supply drinking water.

Is this remedy component being implemented?

Yes. The Alternate Water Supply and Well Abandonment Program has been implemented and is an ongoing program maintained by the Army. The process of identifying wells eligible for alternate water supply and/or abandonment is accomplished by maintaining a “well inventory” (information on the well inventory is presented in Appendix E). The well inventory is a database that was initially developed in 1992, and which has been periodically updated since then (now annually as part of the Annual Performance Report). For the purposes of the well inventory, a study area was established which encompasses the groundwater plume (the study area boundary is the same as the MDH Special Well Construction Area). The well inventory is intended to include all wells within the study area. Within the study area, areas of concern are defined by the edge of the groundwater plume, plus additional buffer area. The wells are grouped into categories based on factors such as location relative to the area of concern, type of use, active/non-active status, sealed, etc. Wells in categories with the potential to be impacted are periodically sampled to see if they qualify for alternate water supply and/or abandonment.

Thus, maintenance of the well inventory consists of the following tasks:

1. Check if the area of concern needs to be adjusted based on the extent of contamination,
2. Check if there are any previously unknown wells to be added to the database (in coordination with the MDH as described in Appendix E),
3. Sample wells on a prescribed schedule,
4. Take the appropriate course of action depending on the results,
5. Update the well inventory database with any new information (e.g., water quality results, owner information, construction information, well re-categorizing),
6. Report findings through the Annual Performance Report.

The following questions and answers summarize developments since the last Annual Performance Report with respect to Operable Unit 1.

Did the area of concern within OU1 change during FY 2014, as defined by the 1 μg/L contour line?

No, the area of concern (the 1 μg/L contour line) did not change during FY 2014. The well inventory study area encompasses the FY 2014 area of concern. The next scheduled "major" sampling event is FY 2017.

Were any additional water supply wells discovered within the area of concern for OU1 that are completed within an aquifer of concern?

No. (see Appendix E for additional information)

Were any water supply wells within the area of concern for OU1 sampled during FY 2014 (outside of those included in the OU1 performance monitoring plan)? If yes, what were the findings?
No water supply wells within the area of concern for OU1 were sampled during FY 2014.

Were any well owners offered an alternate water supply and/or well abandonment during FY 2014? No.

For OU1, are there any well owners that meet the criteria, but have not yet been provided an alternate water supply? No.

For OU1, are there any wells that meet the criteria, but have not yet been abandoned? No.

Is any sampling of water supply wells (excluding those included in the OU1 performance monitoring plan) proposed prior to the next report?
No. FY 2015 is not a scheduled sampling event for well inventory wells, as shown in Appendix A.1. The next major sampling event is scheduled for FY 2017.

Are there any changes or additional actions required for this remedy component? No.

3.2 REMEDY COMPONENT #2: DRILLING ADVISORIES

Description: "Implementing drilling advisories that would regulate the installation of new private wells within the North Plume as a Special Well Construction Area." (OU1 ROD, page 2)

Performance Standard (how do you know when you're done):
For initial implementation, when the MDH has issued a Special Well Construction Area Advisory (SWCA). Implementation will continue until such time that the groundwater concentrations are below the cleanup levels.

Has the MDH issued a Special Well Construction Area Advisory?

Yes. It was issued in June 1996. In addition to covering OU1, the Special Well Construction Area also encompasses OU3 and the OU2 Site A shallow groundwater plume. In June 1999, the MPCA requested that the MDH extend the boundary of the SWCA further to the southwest to the Mississippi River and Marshall Avenue to ensure that the southern boundary fully encompassed the plume. The MDH revised the SWCA in December 1999. The current boundary is shown on Figure E-1 (Appendix E).

Are any changes or additional actions required for this remedy component? No.

3.3 REMEDY COMPONENT #3: EXTRACT GROUNDWATER

Description: "Extracting groundwater from the North Plume using the New Brighton Contaminated Groundwater Recovery System (NBCGRS), subject to the following:

a. the initial aggregate groundwater extraction rate shall be consistent with the long-term operating history of the NBCGRS;

b. future decreases in the aggregate extraction rate shall be determined by the Army, USEPA, and MPCA using a transparent public process and rational engineering, scientific, and economic analyses at least as rigorous as those employed in the feasibility study that was the basis for the original remedy selection;

c. future changes to the aggregate or individual well extraction rates shall be made so as to assure that the rate of restoration of the aquifer will not be slowed or result in a duration of remedy longer than was contemplated by the original ROD;

d. the facilities comprising the NBCGRS may be modified as necessary to assure the restoration of the full areal and vertical extent of the aquifer in a timeframe as contemplated in 3.c, above." (2006 OU1 ROD Amendment, page 5-2 & 5-3)

Through January 2008, the remedy component consisted of recovering deep (Unit 4) groundwater using three primary City of New Brighton municipal wells (NBM #4, #14, and #15) with three alternate wells (NBM #3, #5, and #6). NBM #3 and #4 were existing wells completed in both the Prairie du Chien and Jordan. NBM #5 and #6 were existing wells completed in the Jordan. NBM #14 and NBM #15 were constructed in the Prairie du Chien as part of the remedy and began pumping in December 1996 and March 1998, respectively. The locations of the recovery wells are shown on Figure 3-1.

The extracted groundwater is used as part of the New Brighton water supply system, and as such, New Brighton took the lead on design and construction of the system, and is responsible for operation of the system. New Brighton contracted Barr Engineering to provide design and construction oversight services. The federal government is paying for the OU1 remedy.

In 2006, New Brighton proposed to the Army modifying the agreement between the two parties to allow more flexibility in how they operate the NBCGRS, and to increase removal of contaminant mass from the aquifer. In November 2007, the USEPA and MPCA provided consistency approval of the revised pumping rates. Appendix A.5 (Table D-1 and Table D-2 from the settlement agreement between the Army and New Brighton) presents the new pumping rates in effect as of January 2008.

The revised pumping approach does not affect the approved statistical analysis used to evaluate the effectiveness of the remedy as set forth by the OU1 ROD Amendment. The Army has made it clear to New Brighton that if the changes somehow cause statistical evaluation results that are not in compliance with the OU1 ROD Amendment, then the pumping allocations will revert back to the previous scheme.

Performance Standard (how do you know when you're done):
When the NBCGRS is operating consistent with long-term NBCGRS operating rates.

During FY 2014, did the OU1 extraction system operate according to the New Brighton operational plan and consistent with past operations?
Yes. Based on past operations, the target average daily pumping rate is 3.168 million gallons per day (MGD) as shown in Appendix A.5. In FY 2014, the volume of water pumped by the NBCGRS was 1241 million gallons (Table 3-1), which translates to a daily average of 3.4 MGD. Hence, the pumping in FY 2014 exceeded the target and the system was operated in compliance with the amended ROD.

Are any changes or additional actions required for this remedy component? No.

3.4 REMEDY COMPONENT #4: REMOVAL OF VOCS BY GAC

Description: "Pumping the extracted groundwater to the Permanent Granular Activated Carbon (PGAC) Water Treatment Facility in New Brighton for removal of VOCs by a pressurized GAC system." (OU1 ROD, page 2)

- Treatment by the PGAC (along with iron and manganese removal and chlorination) makes the recovered groundwater suitable for municipal drinking water purposes. The PGAC is located approximately one-third mile south of Interstate 694 near Silver Lake Road. The City of New Brighton is responsible for operation and maintenance of the PGAC, with cost reimbursement from the Army for the operations related to the remedy.

Performance Standard (how do you know when you're done):
When the treated water meets the Maximum Contaminant Levels (MCLs) and non-zero Maximum Contaminant Level Goals (MCLGs) established by the Safe Drinking Water Act (SDWA) for the chemicals of concern, as identified on page 18 of the OU1 ROD.

Did the treated water meet the MCLs and non-zero MCLGs established by the SDWA for the OU1 chemicals of concern?
Yes. Table 3-2 shows that the PGAC effluent met the performance standard during FY 2014.

Treatment of extracted groundwater in the PGAC water treatment facility (remedy component #4) continues to provide effective treatment prior to its discharge into the City of New Brighton municipal water distribution system (remedy component #5). The treatment system is comprised of eight GAC vessels plumbed in parallel. Another eight GAC vessels are plumbed in series with the first eight to provide back-up treatment. The GAC vessels are labeled A or B and water is normally run in series (i.e., water passes through A then B, or B then A, depending on whether the most recent carbon change-out was the A or B vessel). Routine sampling occurs between the two sets of GAC vessels, such that when a detection occurs, a clean set of GAC vessels is present downstream of the sampling point. Upon detection, change-out of carbon in the "lead" vessels is conducted as soon as possible (typically about 1 to 2 months later). Upon changing carbon, the direction of flow is reversed so that the eight vessels with the new carbon become the downstream vessels (the "clean" vessels are always rotated into the downstream position).

Table 3-2 shows that two carbon change-outs occurred in FY 2014: one in September-October 2013 and one in April 2014.

Is any sampling of the treated water proposed prior to the next report?
Yes. Sampling will continue to be performed by the City of New Brighton or their contractor.

Are any changes or additional actions required for this remedy component? No.

3.5 REMEDY COMPONENT #5: DISCHARGE OF TREATED WATER

Description: "Discharging all of the treated water to the New Brighton municipal distribution system." (OU1 ROD, page 2)

Performance Standard (how do you know when you're done):
When the connection to the New Brighton municipal supply system has been completed and water is being discharged.

Is the treated water being discharged to the New Brighton municipal distribution system?
Yes.

Are any changes or additional actions required for this remedy component? No.

3.6 REMEDY COMPONENT #6: GROUNDWATER MONITORING WITH VERIFICATION OF CONTINUING AQUIFER RESTORATION

Description: "Monitoring the groundwater to verify the effectiveness of the remedy through measurement of overall plume shrinkage (geographically) and decreasing contaminant concentrations." (2006 OU1 ROD Amendment, page 5-3)

Performance Standard (how do you know when you're done):
When performance groundwater monitoring verifies aquifer restoration.

Is this remedy component being implemented?
Yes. Performance monitoring programs have been established to collect the data required to verify the effectiveness of remedy components #1 through #6. Table 3-3 summarizes the performance monitoring requirements, implementing parties, and the specific documents that contain the monitoring plans.

Were the groundwater monitoring requirements for this remedy met?

Yes. FY 2014 was a "minor" sampling year.

Is any groundwater monitoring proposed prior to the next report?

Yes, including the following:

- Monitoring of the extraction wells and treatment system effluent will be performed by the City of New Brighton in accordance with the "New Brighton Water System Sampling and Analysis Plan," June 1997.
- Other groundwater monitoring will be in accordance with the Groundwater Monitoring Plan included as Appendix A.1. The next "major" event will be in FY 2015.

Does groundwater monitoring show aquifer restoration is occurring?

Yes. Trend graphs for trichloroethene in NBM #3, #4, #5, #6, #14, and #15 are shown in Figure 3-2. Historical water quality values for the wells can be found in Appendix D. At both NBM #3 and NBM #4, trichloroethene significantly decreased between the start of pumping and 1998, increased slightly until approximately 2010, and have been relatively stable since then. At NBM #5, trichloroethene concentration appeared to transition from downward to a more stable trend in FY 2013/2014. At NBM #6, trichloroethene has gone through periods of downward trends followed by stable trends since 1998, but appears to be stable again in FY 2014. At NBM #14, the trichloroethene concentrations show a continuing trend below or at the cleanup level for TCE in OU1 (5 µg/L), with the exception of the April, May, and June 2014 sampling events. At NBM #15, the trichloroethene continued to trend downward compared with historical values, although the trend has leveled out since 2009, and appears to be trending slightly upward in FY 2014. Overall, the water quality data from the extraction wells supports the interpretation that the system is providing aquifer restoration.

The trichloroethene plumes in the aquifers were not mapped in FY 2014 because it was a minor sampling year.

The OU1 Technical Memorandum was prepared to develop statistical methods specifically selected to evaluate the long-term progress of remediation, plume evolution, and aquifer restoration in OU1. The OU1 Technical Memorandum states the objective of the statistical evaluation as follows:

> "Verify progress in cleanup of the plume through measurement of overall geographic plume shrinkage and decreasing contaminant concentrations."

The OU1TG identified five issues that need to be statistically addressed, now and over time, to achieve this objective:

1. Measure changing concentrations immediately downgradient of the TGRS, as this area is the first to be affected by any potential escape of contaminants from TCAAP.

2. Measure changes in the geographical size of the plume over time.

3. Measure changes in concentrations immediately downgradient of the NBCGRS, as this is the first area to be affected by any potential escape of contaminants from NBCGRS capture.

4. Measure any unforeseen changes in plume configuration. This addresses the possibility that changing flow patterns may cause a shift in the plume but not necessarily any change in size. A plume shift may require a redistribution of pumping.

5. Measure the long-term trends in overall VOC concentrations (as an indicator of contaminant mass). This provides an overall picture of remedial progress.

The OU1TG developed a series of five well groups designed to address each of the issues listed above. For each group, the appropriate statistical tools were specified and the statistical response threshold was identified that would trigger closer scrutiny by the Army and regulators (USEPA and MPCA). Table D.2.8 in Appendix D.2 shows the factors to consider and potential additional actions that may be implemented if statistical threshold is triggered. As Table D.2.8 shows, a threshold trigger initiates a closer look at the data and the context of the data in terms of remedy performance or potential risk. A threshold trigger does not automatically require any specific action. The five groups, corresponding to the five issues discussed above, are:

1. Group 1: Downgradient of the TGRS. This zone is the area downgradient of the TGRS capture zone. This zone should show overall reductions over time in response to TGRS mass removal and containment. However, it is also the stagnation zone of the TGRS so groundwater velocities are reduced and response may be slow. Furthermore, individual wells near the stagnation zone may show increases in contaminant concentrations during some points in time, as the plume shifts in response to changes in pumping.

2. Group 2: Plume Edge Wells. This zone includes wells that define the edges of the plume downgradient of the TGRS. These are wells with low concentrations of VOCs (<100 µg/L) that will indicate a reduction in overall plume size if VOC concentrations continue to decline.

3. Group 3: Downgradient Sentinel Wells. This is a zone downgradient of the NBCGRS stagnation zone. This group includes three wells but more accurately is defined as a geographic area immediately downgradient of the NBCGRS. This group should help demonstrate improvement due to the VOC mass removal by the NBCGRS over time, analogous to Group 1 and the TGRS.

4. Group 4: Lateral Sentinel Wells. These are "clean" wells downgradient of the TGRS that are beyond the current plume boundaries. These wells should help

identify large, unexpected, lateral changes in plume configuration, such as a shifting or expansion of the plume boundary.

5. Group 5: Global Plume Mass Wells. This group includes all the monitoring wells necessary to construct a contour map of the VOC plume. Production wells are not used in Group 5 since the data may not be comparable to monitoring well data. Some wells located within OU2 are included in Group 5 to support the contouring near the OU2 boundary. This group reflects the overall VOC mass in the aquifer and should show an overall reduction in VOC mass over time.

In October 2005, the Army received a consistency determination on:

Modification #1 to:
OU1 Technical Group Technical Memorandum Statistical Evaluation Method For Water Quality Data, Operable Unit 1" prepared by the Army, dated December 2004.

This modification created well Group 6 to address the Jordan portion of the Unit 4 aquifer.

6. Group 6: Jordan Wells. The group includes all Jordan monitoring wells, the Prairie du Chien wells nested with them, and New Brighton Municipal Wells 3, 4, 5, and 6. The inclusion of the Prairie du Chien wells is to facilitate comparing the trends between it and the Jordan at these locations. This group will help identify any changes in the plume occurring in the Jordan portion of the aquifer.

Additional detail on the well groups and analysis is presented in the OU1 Technical Memorandum, Modification #1, and Appendix D.2.

FY 2014 was a minor sampling year, so new comprehensive plume mapping was not completed. Three wells were sampled in FY 2014, in support of continuing data needs for statistical Group 6 and ten wells were sampled for Group 1. Table 3-4 presents the FY 2014 groundwater quality data for OU1. These data were collected to support the statistical analysis developed by the OU1TG. Historical trichloroethene concentrations at any well can be viewed in the Appendix D Groundwater Quality: Organic Data spreadsheet included on the FY 2014 APR CD-ROM.

The statistical analysis in Appendix D.2 follows the format described in the OU1 Technical Memorandum and Modification #1.

Table 3-5 presents a summary of the statistical results for all groups, from Appendix D.2, reflecting the data collected through FY 2014. Table 3-5 includes an assessment of the statistical thresholds that were triggered in the analysis and brief comments addressing these threshold triggers. Further discussion is presented below.

Group 1:

The Group 1 (downgradient of the TGRS) response threshold *was* triggered for the North Plume sub-group, with a no trend outcome. The Area Weighted Concentration (AWC) concentration for the Group 1 North Plume was 45 µg/L in FY 2014, down slightly from 51 µg/L in FY 2013. This value represents a weighted estimate of the average total VOC concentration just downgradient of the TGRS.

The Group 1 (downgradient of the TGRS) response threshold *was* triggered for the South Plume sub-group, with a stable outcome. The AWC for the South Plume was 4 µg/L and has been 4 µg/L over the analysis period (since 2007).

Group 2:

04U877 showed no trend in FY 2014, which triggered the thresholds identified for Group 2. However, the concentrations are below 2.0 µg/L, and are therefore not of concern.

Group 3 and Group 5:

No statistical analyses were performed for Groups 3 and 5 in FY 2014.

Group 4:

No statistical analyses were performed for Group 4 in FY 2014.

Group 6:

The three wells installed and sampled since FY 2005 provide additional data points between OU2 and the NBCGRS to help complete the understanding of the extent and magnitude of VOC concentrations in the Jordan portion of the aquifer. In total, three OU1 Jordan wells exhibited "Stable", "No Trend", or "Increasing" trends in FY 2014, which triggered the thresholds identified for Group 6. Below is additional discussion of these three wells:

04J847 (No Trend): This well is located just downgradient of the TGRS. To examine the history more thoroughly a second trend was run utilizing ten rounds of data collected since 2006. This 'extended trend' is included in Appendix D. The extended trend is decreasing, suggesting improvement over this extended period of monitoring. Continued annual monitoring is appropriate at this well given its central location in the plume.

04J849 (NA): This well continues to show non-detect.

04J822 (Stable): This well is located downgradient of the TGRS in the center of the plume. Overall the well appears to be trending downward over the last six years suggesting improvement. Continued annual monitoring is appropriate at this well given its central location in the plume.

The New Brighton Municipal well trends were analyzed using a linear regression for data since 1998 (see Appendix D.2.5). Due to the large number of data points, regression was considered superior to the Mann-Kendall analysis. Data from FY 1998 were used to reflect the approximate time window used throughout the statistical analysis and to avoid skewing the analysis from the earlier high concentrations. All the New Brighton wells showed downward concentration trends, except NBM #3 and #4, which show a slight upward trend (likely the result of gradual plume shifting due to changes in NBCGRS pumping). This suggests that, overall, concentrations are decreasing at the New Brighton municipal well field, which agrees with the decreasing mass removal observed over the life of the system.

<u>Overall Statistical Assessment</u>:
There were individual threshold triggers identified in FY 2014. These triggers highlight specific areas of the plume that are changing over time. This type of behavior is expected in a large complex flow system such as OU1. The thresholds triggered do not suggest any problems with the remedial systems, but suggest movement within the established plumes. The area weighted analysis for Group 1 shows continuing overall improvement or stability in the plume. Overall, therefore, the limited FY 2014 monitoring data indicates that aquifer restoration is occurring in the Prairie du Chien and Jordan.

Overall, the data meet the statistical criteria developed in this document for assessing the remedial progress in the OU1 aquifers. There are no additional actions needed to address the individual threshold triggers identified. The data show continuing improvement in the OU1 plume through FY 2014. The statistical behavior of the OU3 plume is addressed in Section 13.0.

How much VOC mass has been removed (at each well and total)?
Table 3-1 shows that the NBCGRS removed 412 pounds of VOCs during FY 2014. The total cumulative VOCs removed by the NBCGRS is 23,457 pounds. The relative contribution from each extraction well is also shown on Table 3-1.

Figure 3-3 shows the annual VOC mass removed (listed at the top of the graph), annual pumping volumes, and the trend in annual mass removal per unit volume pumped since FY 1997 (when NBM #14 was brought online). The mass removal in FY 2014 slightly decreased compared to FY 2013. The trend in annual mass removal per unit volume pumped increased slightly in FY 2008 from FY 2007 and then decreases slightly every year thereafter through FY 2014. The mass removal has been on a general decreasing trend since FY 1998, when the last extraction well was brought online (NBM #15). This overall decline in the mass removal trend agrees with the trichloroethene trends in OU1 deep groundwater, which generally show a decreasing trend, and suggests that aquifer restoration is progressing.

Are any changes or additional actions required for this remedy component? No.

Table 3-1
OU1 Pumping / VOC Mass Removal Data

Fiscal Year 2014

MONTH	WELL #3 VOC (ug/l)	WELL #3 WATER TREATED (mgallons)	WELL #3 VOC Mass Removed (lbs)	WELL #4 VOC (ug/l)	WELL #4 WATER TREATED (mgallons)	WELL #4 VOC Mass Removed (lbs)	WELL #5 VOC (ug/l)	WELL #5 WATER TREATED (mgallons)	WELL #5 VOC Mass Removed (lbs)	WELL #6 VOC (ug/l)	WELL #6 WATER TREATED (mgallons)	WELL #6 VOC Mass Removed (lbs)	WELL #14 VOC (ug/l)	WELL #14 WATER TREATED (mgallons)	WELL #14 VOC Mass Removed (lbs)	WELL #15 VOC (ug/l)	WELL #15 WATER TREATED (mgallons)	WELL #15 VOC Mass Removed (lbs)	System Totals: TOTAL WATER TREATED BY EXTRACTION SYSTEM (Mgallons)	System Totals: TOTAL VOC'S REMOVED BY EXTRACTION SYSTEM (lbs)
TOTAL GALLONS PUMPED AND VOC'S REMOVED THROUGH SEPTEMBER 30, 2013																			26,415	23,045
OCTOBER	69	26.755	15.408	65	7.339	3.981	0	0.000	0.000	39	30.610	9.963	2.2	5.365	0.099	4	15.687	0.563	86	30.02
NOVEMBER	68	23.665	13.431	59	11.607	5.715	47	14.256	5.592	44	2.413	0.886	2.7	7.789	0.176	25	38.670	8.068	98	33.87
DECEMBER	66	40.271	22.183	65	8.685	4.712	49	16.090	6.580	38	11.804	3.744	2.2	0.435	0.008	21	57.679	10.109	135	47.34
JANUARY	66	25.252	13.910	60	16.321	8.173	48	14.851	5.949	41	14.214	4.864	2.0	0.176	0.003	18	39.902	5.994	111	38.90
FEBRUARY	73	19.657	11.976	61	16.982	8.646	48	17.097	6.849	39	17.443	5.678	2.6	18.741	0.407	0	15.695	0.000	106	33.56
MARCH	61	20.062	10.214	63	17.912	9.418	50	18.814	7.851	40	18.032	6.020	3.0	27.712	0.694	26	13.243	2.874	116	37.07
APRIL	63	20.798	10.936	59	7.049	3.471	45	8.258	3.101	39	7.982	2.598	9.8	45.134	3.692	0	0.000	0.000	89	23.80
MAY	72	22.262	13.378	69	15.897	9.155	48	18.115	7.257	41	18.520	6.337	15.0	40.836	5.112	0	0.000	0.000	116	41.24
JUNE	62	23.061	11.933	60	15.520	7.772	45	7.999	3.004	38	9.261	2.937	11.0	8.743	0.803	0	32.463	0.000	97	26.45
JULY	63	22.750	11.962	64	15.410	8.231	52	8.127	3.527	40	14.725	4.916	2.6	0.146	0.003	28	40.476	9.459	102	38.10
AUGUST	53	29.324	12.971	50	16.189	6.756	0	0.365	0.000	36	18.274	5.491	3.6	0.167	0.005	29	43.906	10.627	108	35.85
SEPTEMBER	56	25.256	11.804	52	5.676	2.463	47	0.393	0.154	37	5.890	1.819	2.8	0.185	0.004	27	40.838	9.203	78	25.45
Subtotal			160.103			78.493			49.866			55.252			11.004			56.897		
% of Total Mass			38.9			19.1			12.1			13.4			2.7			13.8		
TOTAL GALLONS TREATED AND VOC'S REMOVED FOR FISCAL YEAR 2014																			1,241	411.64
TOTAL GALLONS TREATED AND VOC'S REMOVED SINCE SYSTEM START UP																			27,656	23,457

Table 3-2
OU1, PGAC Effluent Water Quality

Fiscal Year 2014

	Influent Well Monitoring						Operational Performance Monitoring															
Sampling Date	Well #3	Well #4	Well #5	Well #6	Well #14	Well #15	Contactor #1 A	Contactor #1 B	Contactor #2 A	Contactor #2 B	Contactor #3 A	Contactor #3 B	Contactor #4 A	Contactor #4 B	Contactor #5 A	Contactor #5 B	Contactor #6 A	Contactor #6 B	Contactor #7 A	Contactor #7 B	Contactor #8 A	Contactor #8 B
GAC replaced in contactors 1A, 2A, 3A, 4A, 5A, 6A, 7A, 8A September 17 - October 4, 2013. "B" Vessels become the Lead Vessels.																						
8-Oct-13	69	65	NS	39	2	4	NS	0	NS	0	NS	0	NS	0	NS	0	NS	0	NS	0	NS	0
12-Nov-13	68	59	47	44	3	25	NS	0	NS	0	NS	0	NS	0	NS	0	NS	0	NS	0	NS	0
3-Dec-13	66	65	49	38	2	21	NS	0	NS	0	NS	0	NS	0	NS	0	NS	0	NS	0	NS	0
14-Jan-14	66	60	48	41	2	18	NS	0	NS	0	NS	0	NS	0	NS	0	NS	0	NS	0	NS	0
4-Feb-14	73	61	48	39	3	NS	NS	0.0	NS	0	NS	0	NS	1.0	NS	0.0	NS	0	NS	0	NS	0
4-Mar-14	61	63	50	40	3	26	NS	1.1	NS	1.5	NS	1.6	NS	1.4	NS	1.1	NS	1.2	NS	1.4	NS	0
7-Mar-14	NS	NS	NS	NS	NS	NS	0	NS	0	NS	0	NS	0	NS	0	NS	0	NS	0	NS	0	NS
7-Apr-14	63	59	45	39	10	NS	0	2.1	0	2.1	0	2.2	0	2.0	0	1.6	0	2.0	0	2.2	0	1.3
GAC replaced in contactors 1B, 2B, 3B, 4B, 5B, 6B, 7B, 8B April 8 - April 25, 2014. "A" Vessels become the Lead Vessels.																						
12-May-14	72	69	48	41	15	NS	0	NS	0	NS	0	NS	0	NS	0	NS	0	NS	0	NS	0	NS
2-Jun-14	62	60	45	38	11	NS	0	NS	0	NS	0	NS	0	NS	0	NS	0	NS	0	NS	0	NS
14-Jul-14	63	64	52	40	3	28	0	NS	0	NS	0	NS	0	NS	0	NS	0	NS	0	NS	0	NS
11-Aug-14	53	50	NS	36	4	29	0	NS	0	NS	0	NS	0	NS	0	NS	0	NS	0	NS	0	NS
2-Sep-14	56	52	47	37	3	27	0	NS	0	NS	1.4	NS	0	NS	0	NS	0	NS	0	NS	0	NS

Notes:

1) All water quality results shown are for Total VOCs (µg/l).

2) NS = Not Sampled.

Table 3-3
Summary of OU1 Monitoring Requirements

Fiscal Year 2014

Remedy Component	Monitoring Requirements	Implementing Party	Documents Containing the Monitoring Plan
#1: Alternate Water Supply/Well Abandonment	a. Water quality data for the perimeter of the plume to define the area of concern	Army	OU1 Groundwater Monitoring Plan in the Annual Performance Report
	b. Water quality data for water supply wells to determine eligibility for alternate supply/abandonment	Army	Well Inventory Report
#2: Drilling Advisories	a. Verification that drilling advisories are in place and functioning as intended	Army/MDH	N/A
#3: Extract Groundwater	a. Pumping volume and rates for each extraction well for comparison to target flowrates	New Brighton	New Brighton Water System Sampling and Analysis Plan
	b. Water levels from monitoring wells to draw contour maps, if desired	Army	OU1 Groundwater Monitoring Plan in the Annual Performance Report
	c. Water quality, to assist in evaluation of statistical improvements in groundwater quality	Army	OU1 Groundwater Monitoring Plan in the Annual Performance Report
#4: Removal of VOCs	a. Effluent water quality to demonstrate compliance with the Safe Drinking Water Act	New Brighton	New Brighton Water System Sampling and Analysis Plan
#5: Discharge of Treated Water	a. Verification of discharge	New Brighton	N/A
#6: Groundwater Monitoring with Verification of Continuing Aquifer Restoration	a. Water quality, to assist in evaluation of statistical improvements in groundwater quality.	Army	OU1 Groundwater Monitoring Plan in the Annual Performance Report
	b. Water quality data throughout the North Plume to evaluate remedial progress	Army	OU1 Groundwater Monitoring Plan in the Annual Performance Report

Table 3-4
OU1 Groundwater Quality Data

Fiscal Year 2014

			Trichloro-ethene (µg/L)	1,1-Dichloro-ethene (µg/L)	cis-1,2-Dichloro-ethene (µg/L)	1,1,1-Trichloro-ethane (µg/L)	1,1,2-Trichloro-ethane (µg/L)	1,1-Dichloro-ethane (µg/L)
OU1 Cleanup Level [(1)]			5	6	70	200	3	70
04U871		6/12/14	**16**	1.3	JP 0.31	JP 0.61	<1	3.1
04U872		6/12/14	2.8	<1	<1	<1	<1	JP 0.33
04U877		6/11/14	1.2	<1	<1	<1	<1	1.5
04U877	D	6/11/14	1.2	<1	<1	<1	<1	1.4
04J822		6/10/14	**41**	**7.2**	1.3	6.6	<1	4.4
04J847		6/11/14	**790**	**52**	8.2	27	<2	40
04J849		6/10/14	<1	<1	<1	<1	<1	<1

Notes:

(1) Cleanup levels for OU1 deep groundwater are from page 18 of the OU1 ROD. Bolding (in red color) indicates exceedance of the cleanup level.

D Duplicate sample.

JP The value is below the Reporting Limit, but above the Method Detection Limit. Results should be considered estimated.

Table 3-5
Group 1, 2, 3, and 5 Mann-Kendall Summary and MAROS Conclusion for OU1

Group	Kendall S	N	Raw Trend	Confidence	COV	Raw Trend Decision	MAROS Conclusion	Threshold Triggered?	Comments
Group 2 Wells:									
04U877	2	6	Increasing	57.46%	0.5257	S or NT	**No Trend**	Yes	
Group 1 NP	5	6	Increasing	76.50%	0.1282	S or NT	**No Trend**	Yes	Between 36 and 51 µg/L since 2009.
Group 1 SP	0	6	Zero	41.78%	0.0000	S or NT	**Stable**	Yes	Stable, but avg. is <5 µg/L.
Group 3	--	--	--	--	--	--	**--**	--	Not sampled in FY 2014
Group 5	--	--	--	--	--	--	**--**	--	Not sampled in FY 2014

Notes:
S or NT = Stable or No Trend
N = Number of data points
COV = Coefficient of Variance
NA = Not Applicable
Response Threshold triggers are defined in Table D.2.3

MAROS Decision Matrix

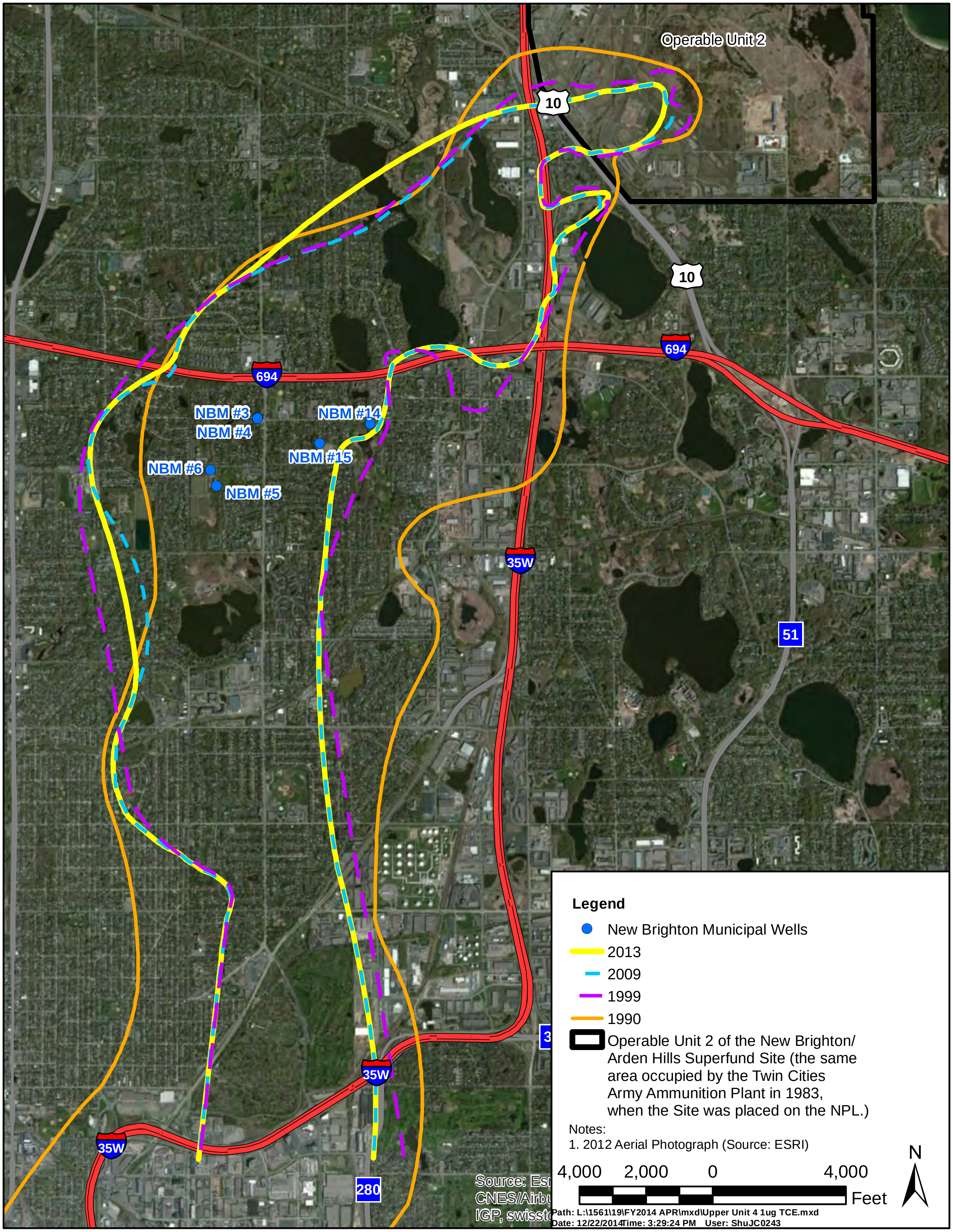
M-K S	Confidence	COV	Trend
S > 0	> 95%	na	Increasing
S > 0	90-95%	na	Pr. Incr.
S > 0	< 90%	na	No Trend
S</= 0	< 90%	>/= 1	No Trend
S </= 0	< 90%	< 1	Stable
S < 0	90-95%	na	Pr. Decr.
S < 0	>95%	na	Decreasing

Table 3-5
Group 6 Mann-Kendall Summary and MAROS Conclusion for OU1

Group	Kendall S	N	Raw Trend	Confidence	COV	Raw Trend Decision	MAROS Conclusion	Threshold Triggered?	Comments
Group 6 OU1 Jordan Wells:									
04J822	-8	6	Decreasing	89.62%	0.1463	S or NT	**Stable**	Yes	
04J847	5	6	Increasing	76.50%	0.1009	S or NT	**No Trend**	Yes	Consistent results, mean 782 µg/L
04J849	0	6	Zero	41.78%	NA	S or NT	**NA**	No	All ND

Notes:
S or NT = Stable or No Trend
N = Number of data points
COV = Coefficient of Variance
NA = Not Applicable
Response Threshold triggers are defined in Table D.2.3

MAROS Decision Matrix			
M-K S	**Confidence**	**COV**	**Trend**
S > 0	> 95%	na	Increasing
S > 0	90-95%	na	Pr. Incr.
S > 0	< 90%	na	No Trend
S</= 0	< 90%	>/= 1	No Trend
S </= 0	< 90%	< 1	Stable
S < 0	90-95%	na	Pr. Decr.
S < 0	>95%	na	Decreasing



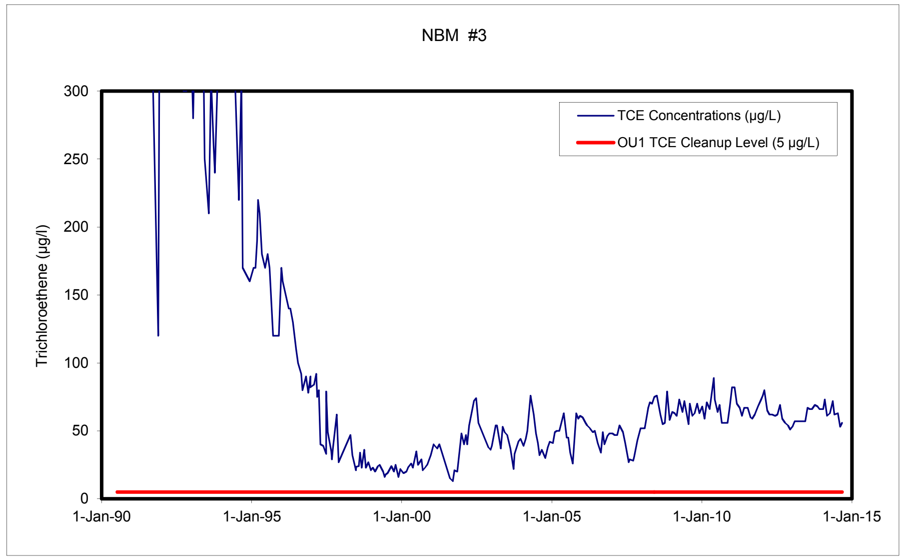
ANNUAL PERFORMANCE REPORT
Upper Unit 4,
1 µg/l Trichloroethene Isoconcentration Map

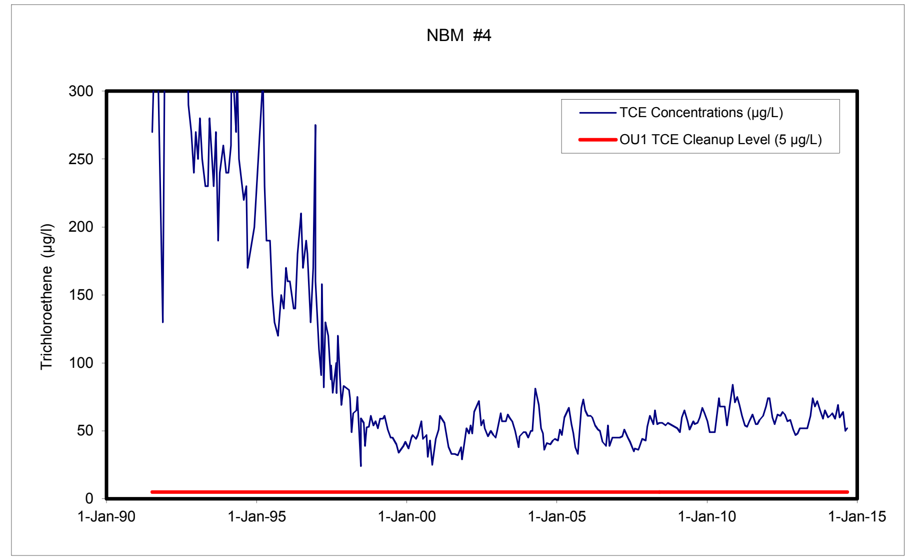
WENCK ASSOCIATES
Responsive partner. Exceptional outcomes.

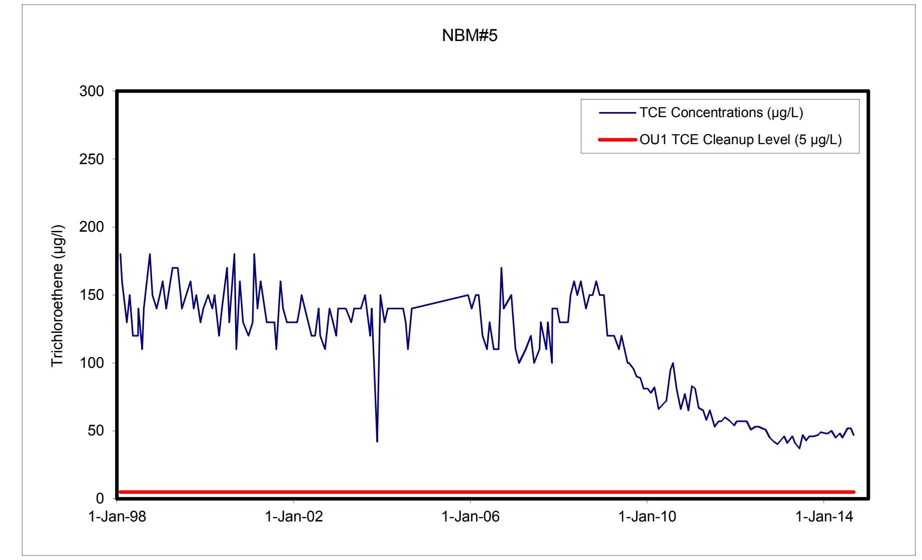
FY 2014

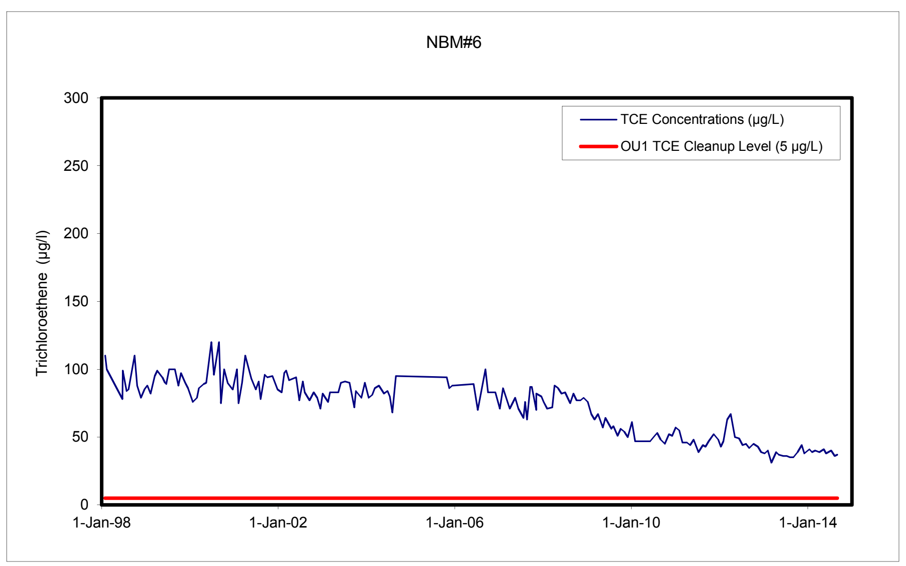
Figure 3-1

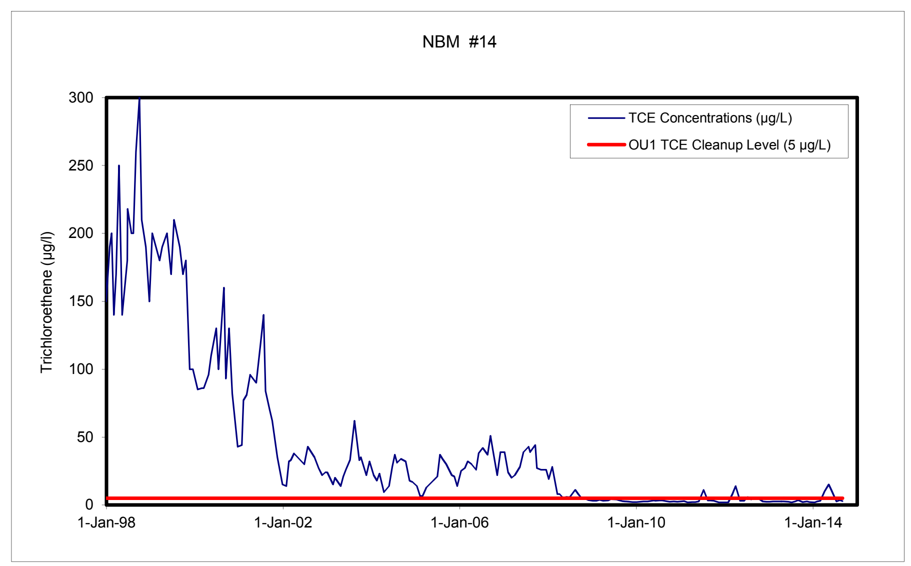
FIGURE 3-2
NEW BRIGHTON MUNICIPAL WELLS: TRICHLOROETHENE WATER QUALITY TRENDS
Annual Performance Report











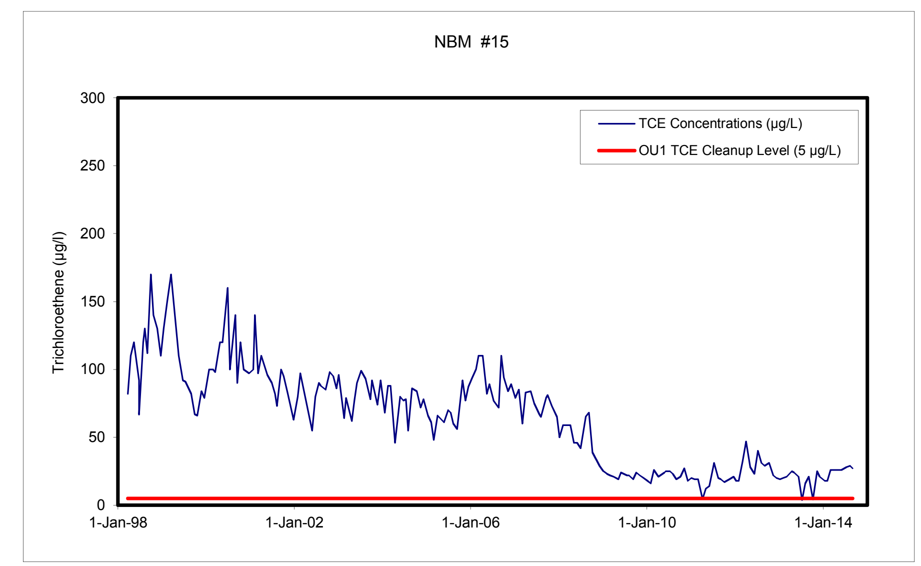
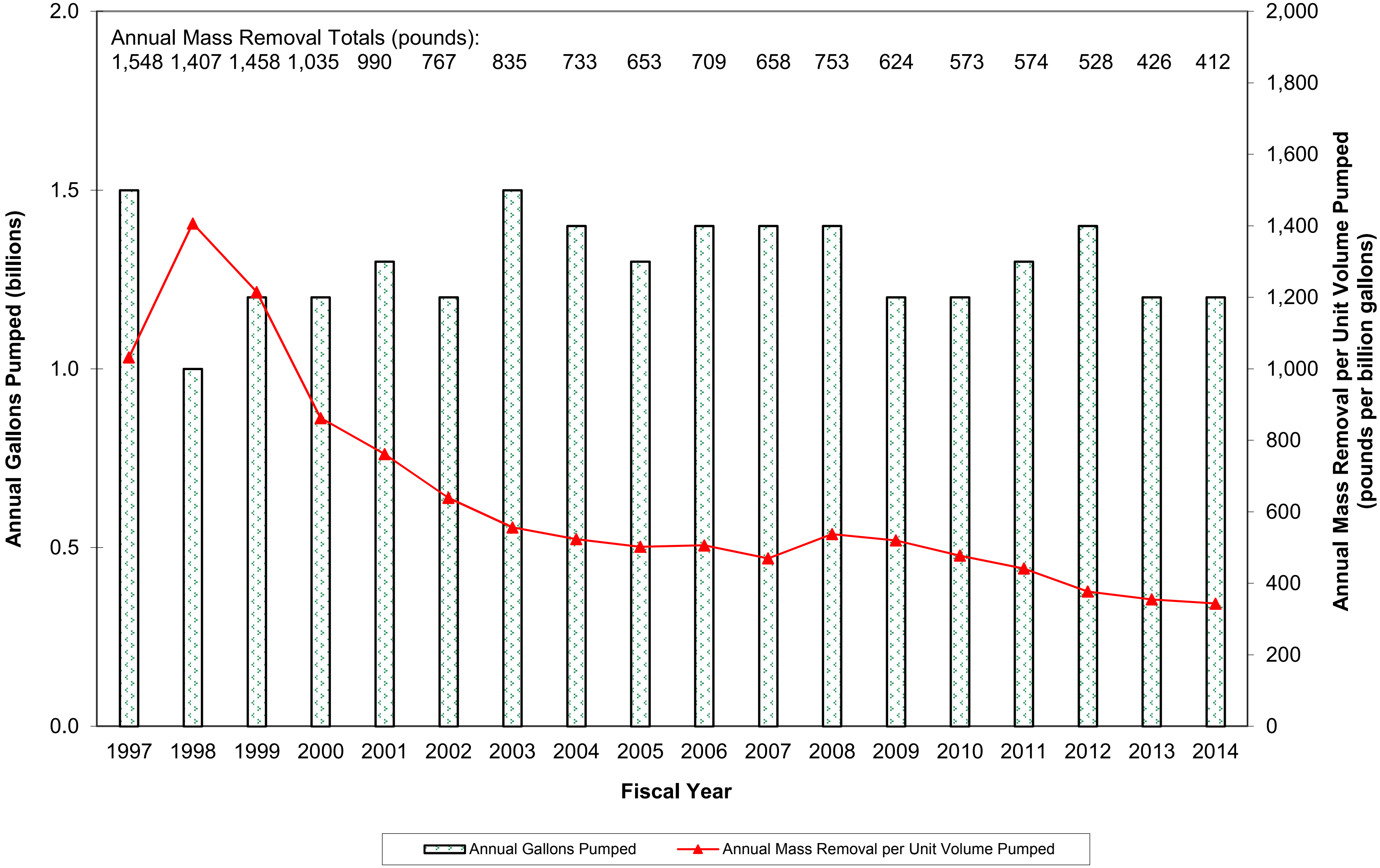


FIGURE 3-3
OU1, NBCGRS MASS REMOVAL HISTORY
Annual Performance Report



4.0 Operable Unit 2: Shallow Soil and Dump Sites

The reference for the OU2 ROD is:

Twin Cities Army Ammunition Plant
New Brighton/Arden Hills Superfund Site
Operable Unit 2
RECORD OF DECISION
1997
Amendment #1: 2007
Amendment #2 and #3: 2009
ESD #1 and #2: 2009
Amendment #4: 2012
Amendment #5: 2014

Sections 4.0 through 12.0 of this report address the various media and requirements prescribed by the OU2 ROD and/or subsequent Amendments and ESDs. This section specifically addresses the shallow soil and dump sites.

Through the OU2 Remedial Investigation/Feasibility Study (RI/FS) process, Sites A, C, E, H, 129-3, and 129-5 were found to have inorganic and/or organic contaminants above the cleanup goals specified in Table 1 of the OU2 ROD. Unpermitted landfills, or dumps, were identified within Sites A, B, E, H, and 129-15. The OU2 ROD (page 2) describes nine remedy components to address the shallow soil and dump sites.

The requirements for Site C-2 soil and sediment were later modified through ROD Amendment #1 (note that Site C groundwater and surface water is addressed separately in Section 7.0). Because the depth to groundwater is shallow at Site C-2, it was not feasible to remove all of the contaminated soil and sediment. The Amendment modified remedy component #2 related to excavation of soil, to allow the placement of a 4-foot thick soil cover

over areas where contamination remains in-place above the cleanup levels. ROD Amendment #1 also specified land use controls as an additional remedy component for Site C-2.
OU2 ROD Amendment #2 addressed shallow groundwater at Site I, which is discussed in Section 8.0.

OU2 ROD Amendment #3 affected the shallow soil and dump sites in four principal ways:

- The Amendment documented as final remedies the additional actions performed for shallow soil at Site D and the dump at Site G, after completion of the deep soil requirements set forth for these two sites in the OU2 ROD (see Section 5.0 of this report for discussion of the deep soil).
- The Amendment documented the use of soil covers as part of the final remedy at Sites E, G, H, and 129-15.
- The Amendment documented final remedies for five sites with soil contamination that were not originally included in the OU2 ROD: Grenade Range, Outdoor Firing Range, 135 Primer/Tracer Area Stormwater Ditch, Trap Range, and Water Tower Area. At these sites, either previous removal actions had been completed that reduced soil contamination to below cleanup levels, or investigations had determined that no action or no further action was needed. The Amendment incorporated remedies for these sites into the overall remedy for OU2.
- The Amendment specified land use controls as an additional remedy component for shallow soil and dump Sites D, E, G, H, 129-15, Grenade Range, and Outdoor Firing Range. Land use controls are not needed for the 135 Primer/Tracer Area Stormwater Ditch or Trap Range because contamination levels are suitable for unlimited use/ unrestricted exposure. The water tower area is also suitable for unlimited use/ unrestricted exposure; however, it is located within the area having blanket land use restrictions as specified in the LUCRD.

ESD #1 is discussed in Section 6.0 (Site A shallow groundwater), Section 9.0 (Site K shallow groundwater), and Section 12.0 (OU2 deep groundwater).

ESD #2 specified land use controls as an additional remedy component for Sites A, C-1, 129-3, and 129-5. ESD #2 also documented that no further action is required at Site B. Site B is located within the area having blanket land use restrictions.

ROD Amendment #4 was signed in January 2012. This ROD amendment documents previously-completed soil removal actions conducted at two sites: the 535 Primer/Tracer Area and Site K. No further action is required for the soils located in the vicinity of the excavation areas at these two sites; however, both sites are located within the area having blanket land use restrictions. This ROD amendment also addressed Building 102 shallow groundwater, discussed in Section 10.0, and OU2 aquatic sites, discussed in Section 11.0.

ROD Amendment #5 was signed in March 2014. This ROD amendment documents previously-completed soil removal actions conducted at soil areas of concern at three sites: Site A, the eastern portion of the 135 Primer/Tracer Area, and the MNARNG EBS Areas. It also documents that land use controls are required at these sites.

4.1 REMEDY COMPONENTS #1 THROUGH #9: SOIL REMEDIATION

The nine remedy components specified in the OU2 ROD (page 2) have been completed for the shallow soils and dumps at Sites A, C, D, E, G, H, K, 129-3, 129-5, 129-15, Grenade Range, Outdoor Firing Range, 135 Primer/Tracer Area Stormwater Ditch, the eastern portion of the 135 Primer/Tracer Area, 535 Primer Tracer Area, MNARNG EBS Areas, and Water Tower Area. Remedy Components #1 through #8 addressed the characterization, excavation, sorting, treatment, disposal, site restoration, site access restrictions (during remedial actions), and limited period of post-remediation groundwater monitoring. Remedy Component #9 addressed the characterization of dumps at Sites B and 129-15. The characterization work at both sites led to a determination that no further action was required at Site B and construction of a cover at Site 129-15, which were documented through ESD #2 and OU2 ROD Amendment #3, respectively.

4.2 REMEDY COMPONENT #10: LAND USE CONTROLS

Description: OU2 ROD Amendments and ESDs made land use controls a part of the remedy for shallow soil and dump sites where contamination remains in-place above levels that allow for unlimited use and unrestricted exposure. Land use controls are also necessary to protect the integrity of the soil covers constructed at various sites.

Performance Standard (how do you know when you're done):
Initial implementation will be done when the USEPA and MPCA have provided consistency approval for an OU2 Land Use Control Remedial Design (LUCRD) document. Implementation will continue indefinitely unless further action is taken that would allow for unlimited use and unrestricted exposure.

Has a LUCRD document been approved to address land use control (LUC) issues for OU2, and is it being implemented?
Yes. The USEPA and MPCA provided consistency approval for the OU2 LUCRD in September 2010 and it is being implemented by the Army. Revision 2 of the OU2 LUCRD was approved by the USEPA and MPCA in FY 2011; however, this revision did not affect land use controls for shallow soil sites.

Was an annual site inspection for land use controls conducted in FY 2014?
Yes. On July 30, 2014, the Army, National Guard, and Wenck conducted the annual inspection of OU2 sites. The checklist that was completed during the inspection is included as Appendix I.

Did the inspection identify any follow-up actions needed to maintain the protectiveness of the LUCs? No.

5.0 Operable Unit 2: Deep Soil Sites

For purposes of the OU2 ROD, Sites D and G were considered deep soil sites because VOC contamination extended to depths between 50 and 170 feet. Some additional shallow soil contaminants were also present at Site D, and Site G also contains a dump. The OU2 ROD (pages 2-3) describes seven remedy components to be implemented for these two sites:

- Remedy Component #1: Groundwater Monitoring
- Remedy Component #2: Restrict Site Access (During Remedial Actions)
- Remedy Component #3: SVE Systems
- Remedy Component #4: Enhancements to the SVE Systems
- Remedy Component #5: Maintain Existing Site Caps
- Remedy Component #6: Maintain Surface Drainage Controls
- Remedy Component #7: Characterize Shallow Soils and Dump

For Remedy Component #1, ongoing groundwater monitoring in the vicinity of these two sites is completed as part of OU2 deep groundwater monitoring (Section 12.0) and is not discussed separately in this section.

Remedy Components #2 to #6 were related to continued operation of the SVE systems that had been installed in 1986, along with modifications to those systems to enhance performance. The caps were in-place primarily to minimize short-circuiting of air flow, and also to minimize infiltration. Studies conducted after the 1997 ROD showed that enhancements to the SVE systems were not necessary, and in fact, the soil VOC concentrations had achieved the soil VOC cleanup levels. The systems were turned off in 1998 and were subsequently removed, hence completing Remedy Components #2 to #6 related to deep soil.

Regarding Remedy Component #7, additional shallow soil investigation work (for non-VOC contaminants) was completed at Site D, and characterization work of the dump was completed at Site G. Thus, this remedy component has been completed. The investigation/characterization work led to removal of shallow soils at Site D and construction of a cover at Site G, which were documented through OU2 ROD Amendment #3.

In summary, the deep soil requirements of the OU2 ROD have been completed. There are ongoing land use control requirements for the shallow soil at Site D and the dump at Site G, as discussed in Section 4.0.

6.0 Operable Unit 2: Site A Shallow Groundwater

Shallow groundwater at Site A has been impacted by VOCs and antimony. The selected remedy in the OU2 ROD incorporates the use of a groundwater extraction system, which began operation May 31, 1994. When operating, this system discharged the extracted groundwater to the sanitary sewer for treatment at a Publicly-Owned Treatment Works (POTW). However, as further discussed below, the groundwater system was shut off (with regulatory approval) on September 24, 2008, while implementation of Monitored Natural Attenuation (MNA) is evaluated as a potential remedy component in lieu of groundwater extraction and discharge. The groundwater system has not been removed and will be kept in place in the event that MNA does not adequately control plume migration and one or more extraction wells need to be restarted. The ROD prescribes five major components of the remedy, and until a decision is made to formally change the remedy, the original components of the ROD will be retained in this section (with discussion that is appropriate to the ongoing evaluation period for MNA).

The original 8-well groundwater extraction system that was selected in the OU2 ROD began operation May 31, 1994. On July 11, 2000, with regulatory approval, EW-5 through 8 (the "second line" of extraction wells) were shut down due to their VOC concentrations having declined below cleanup levels. In July 2008, the USEPA and MPCA approved the "Site A Shallow Groundwater: 10-Year Evaluation Report." The 10-Year Report was prepared to fulfill a requirement of the ROD, which states that for shallow groundwater contamination at Site A, "should aquifer restoration not be attained within the ten-year lifespan of the remedy, additional remedial measures will be addressed". Since the 10-year mark had been reached and contamination was still present above the cleanup levels, the 10-Year Report was prepared to discuss the status of the site and to evaluate any potential changes to the remedy that would be beneficial. MNA (through abiotic degradation) was the recommended alternative for Site A that was approved by the USEPA and MPCA.

In September 2008, the USEPA and MPCA approved the "Site A Shallow Groundwater: Monitoring and Contingency Plan," and EW-1 through 4 (the "first line" of extraction wells) were then shut off on September 24, 2008. The Monitoring and Contingency Plan presented the monitoring plan to be implemented at the point that the extraction wells were shut off, and presented the contingency actions that will be taken by the Army if groundwater monitoring indicates that any of the identified trigger points are exceeded. These monitoring and contingency actions were incorporated into the APR, and thus any changes to monitoring and contingency actions must be approved by the USEPA and MPCA through revisions to the APR.

The decision to proceed with MNA was based in part on the MPCA and USEPA natural attenuation study at this site (2000), and also on follow-up MPCA/USEPA microcosm studies that have verified that abiotic degradation of VOCs in Site A groundwater is occurring at substantial rates. Such degradation acts to reduce contaminant mass and mobility by breaking down the contaminants as they move downgradient. The decision to proceed with MNA was also based on the absence of any likely receptors. The closest potential groundwater receptor is located approximately 1,000 feet downgradient from 01U352 (EW-2) and 01U353 (EW-3), and this domestic well has not been operable for many years (and even when it was, the water was only used for irrigation purposes). Beyond this unlikely receptor, there are no other existing downgradient receptors between it and Rice Creek, which is approximately 1,800 feet away.

If, after the initial trial period of extraction system shutdown, MNA is proven to be an acceptable long-term remedy for Site A shallow groundwater, the remedy will be formally changed. This change would presumably require an Explanation of Significant Difference (ESD), at a minimum, or possibly a ROD amendment. The length of the trial period was originally anticipated to be three to five years; however, review of ongoing water quality data in will ultimately determine when the USEPA, MPCA, and Army are comfortable that the extraction system can be dismantled and the remedy can be formally changed to MNA. The end of FY 2014 was the end of the sixth year since the extraction wells were shut off.

6.1 REMEDY COMPONENT #1: GROUNDWATER MONITORING

Description: "Groundwater monitoring to track plume migration and remedy performance." (OU2 ROD, page 3)

Performance Standard (how do you know when you're done):
When a performance groundwater monitoring program has been established and ongoing monitoring is in compliance with the program.

Is this remedy component being implemented?
Yes. Table 6-1 summarizes the performance monitoring requirements, the implementing parties, and the documents that contain the monitoring plans. The FY 2014 Monitoring Plan is included in Appendix A, and the FY 2014 water quality monitoring locations and frequencies are also summarized on Figure 6-1. Any deviations are explained in Appendix C.2. Figure 6-2 presents groundwater elevation contours based on measurements in June 2014. Also, note that ten monitoring wells were sealed in FY 2014, with regulatory approval, since the monitoring network was deemed adequate without them. These ten wells were generally upgradient or sidegradient from the plume location and were only being monitored for water levels.

Were the groundwater monitoring requirements for this remedy met? Yes.

Is any groundwater sampling proposed prior to the next report?
Yes, including the following:

- Groundwater sampling of water supply wells related to alternate water supply and well abandonment will be in accordance with recommendations in Appendix E. The next "major" event will be in FY 2017.
- Other groundwater monitoring at Site A will be in accordance with the monitoring plan shown in Appendix A.1.

Are any changes or additional actions required for this remedy component?

Yes. Refer to Section 6.7 regarding returning the sampling frequency to annual for all wells, beginning in FY 2016, contingent on the observed FY 2015 results.

6.2 REMEDY COMPONENT #2: GROUNDWATER CONTAINMENT AND MASS REMOVAL

Description: "Use of existing gradient control wells to contain the contaminant plume and remove mass." (OU2 ROD, page 3)

Is this remedy component being implemented?

No. As discussed previously, since the groundwater extraction system is currently shut off for evaluation of MNA, this remedy component is not currently being implemented.

6.3 REMEDY COMPONENT #3A: LAND USE CONTROLS

Description: The OU2 ROD (page 3) listed the following: "Institutional controls to restrict new well installations and provide alternate water supplies and well abandonment as necessary." For ease of discussion, the requirement has been broken into two pieces, with this section focusing on the land use controls. OU2 ESD #1 clarified the land use control component to include protection of the groundwater monitoring and extraction system infrastructure.

Performance Standard (how do you know when you're done):

For initial implementation, when the MDH has issued a Special Well Construction Area Advisory, and when the USEPA and MPCA have provided consistency approval for an OU2 Land Use Control Remedial Design (LUCRD) document. Implementation will continue until such time that the groundwater concentrations are below the cleanup levels.

Has the MDH issued a Special Well Construction Area Advisory for the area impacted by Site A?
Yes, it was issued in June 1996 and revised in December 1999; however, this revision did not affect the boundary for the Site A vicinity.

Has a LUCRD document been approved to address land use control (LUC) issues for OU2, including Site A groundwater, and is it being implemented?
Yes. The USEPA and MPCA provided consistency approval for the OU2 LUCRD in September 2010 and it is being implemented by the Army. Revision 2 of the OU2 LUCRD was approved by the USEPA and MPCA in FY 2011; however, this revision did not affect land use controls for Site A.

Was an annual site inspection for land use controls conducted in FY 2014?
Yes. On July 30, 2014, the Army, National Guard, and Wenck conducted the annual inspection of OU2 sites. The checklist that was completed during the inspection is included as Appendix I.

Did the inspection identify any follow-up actions needed to maintain the protectiveness of the LUCs? No.

6.4 REMEDY COMPONENT #3B: ALTERNATE WATER SUPPLY/WELL ABANDONMENT

Description: The OU2 ROD (page 3) listed the following: "Institutional controls to restrict new well installations and provide alternate water supplies and well abandonment as necessary." For ease of discussion, the requirement has been broken into two pieces, with this section focusing on the alternate water supplies and well abandonment.

Performance Standard (how do you know when you're done):
When well owners who qualify have been offered and provided with alternate water supply and/or have had their wells abandoned (or the offers have been rejected).

Is the remedy component being implemented?
Yes. The OU1 Alternate Water Supply and Well Abandonment Program is underway and was expanded to cover the area affected by the OU2 Site A shallow groundwater plume. See Section 3.1 of this report for more information on this program.

Did the boundary of the Site A plume get any bigger during FY 2014, as defined by the 1 µg/L contour?
No. Table 6-2 presents the FY 2014 groundwater quality data for Site A. Using this data, Figure 6-3 shows the tetrachloroethene concentrations and Figure 6-4 shows the cis-1,2-dichloroethene concentrations. The latter is a degradation product of the former, and represents the larger areal footprint. The footprints did not increase in size from the previous year.

Were any additional water supply wells discovered within the area of concern for the Site A plume that are completed within the aquifer of concern? No.

Were any water supply wells within the Site A plume sampled during FY 2014? If yes, what were the findings? No wells were sampled.

Were any well owners offered an alternate supply and/or well abandonment in FY 2014?
No.

Within the Site A plume, are there any well owners that meet the criteria, but have not yet been provided an alternate water supply? No.

Within the Site A plume, are there any wells that meet the criteria, but have not yet been abandoned? No.

Is any sampling of water supply wells proposed prior to the next report?
No. The next major sampling event is scheduled for FY 2017.

Are any changes or additional actions required for this remedy component? No.

6.5 REMEDY COMPONENT #4: DISCHARGE OF EXTRACTED WATER

Description: "Discharge of extracted groundwater to a publicly-owned treatment works (POTW)." (OU2 ROD, page 3)

Is this remedy component being implemented?
No. As discussed previously, since the groundwater extraction system is currently shut off for evaluation of MNA, this remedy component is not currently being implemented.

6.6 REMEDY COMPONENT #5: SOURCE CHARACTERIZATION/ REMEDIATION

Description: "Source characterization/remediation." (OU2 ROD, page 3)

Performance Standard (how do you know when you're done):
For characterization, when the investigation has answered the questions needed to prepare remedial design documents. For remediation, when the contaminant concentrations in soil are below the cleanup levels specified in Table 1 of the OU2 ROD.

Is this remedy component being implemented?
Yes. Characterization work has been completed. Stone & Webster performed investigation work in 1997 and the final "Site A Investigation Report" was issued December 12, 1997. The report

delineated the extent of both VOC-contaminated and metal-contaminated soils requiring remediation. The source of VOC-contaminated soils was found to be the “1945 Trench”.

Remediation has been completed. Shaw completed removal of metal-contaminated soils in FY 1999. Construction of an air sparging/soil vapor extraction (AS/SVE) system to remediate VOC-contaminated soils was completed by Stone & Webster in FY 2000, which began operation in early FY 2001. The AS system was shut off permanently in June 2001 due to a lack of increase in SVE VOC levels and due to concern regarding potential plume spreading. The AS system was being implemented voluntarily by the Army and was not a requirement of the OU2 ROD. Soil samples were collected within the source area in July 2002 (and previously in August 2001). In both events, the results showed minimal reduction in soil VOC concentrations. Since it appeared that many years of SVE system operation would be required before soil cleanup levels would be reached (if ever), the Army ceased SVE system operation on August 21, 2002, and submitted a work plan clarification to the USEPA and MPCA for excavation of the VOC-contaminated soils in the source area. The work plan clarification received regulatory approval in early FY 2003, and 688 cubic yards of contaminated soil were excavated by Shaw and transported off-site to a permitted disposal facility (see Figure 6-3 and 6-4 for the location of the soil excavation area at the former 1945 Trench). The Site A Former 1945 Trench Closeout Report (prepared by Shaw) received regulatory consistency in FY 2004.

Are any changes or additional actions required for this remedy component? No.

6.7 OVERALL REMEDY FOR SITE A SHALLOW GROUNDWATER

Performance Standard (how do you know when you’re done):
When the cleanup levels in Table 1 of the OU2 ROD have been attained throughout the areal and vertical extent of the Site A plume (OU2 ROD, page 54).

Has the Site A shallow groundwater remedy been completed (i.e., have the cleanup levels in Table 1 of the OU2 ROD been attained throughout the areal and vertical extent of the Site A plume)?

No. Table 6-2 presents the FY 2014 groundwater quality data and highlights the values that exceed a cleanup level. FY 2014 was the sixth year of data obtained for evaluation of MNA performance. With the exception of cis-1,2-dichloroethene, none of the other COCs exceeded their respective cleanup levels in in the FY 2014. Only two wells exceeded the cleanup level of 70 µg/L for cis-1,2-dichloroethene in FY 2014: 01U139 (December: 250 µg/L, June: 350 µg/L) and 01U356/EW-6 (December: 190 µg/L, June: 160/170 µg/L).

What impact is MNA having on contaminant concentrations?

As evident in Table 6-2, and on Figure 6-3 and 6-4, tetrachloroethene and trichloroethene continue to be degraded to cis-1,2-dichloroethene via natural attenuation. This degradation generally occurs within the distance between the source area and the first line of extraction wells (EW-1 through EW-4), with primarily only cis-dichloroethene being detected downgradient of the first line of extraction wells. Figure 6-5 shows the cis-1,2-dichloroethene concentrations plotted on geologic cross sections for Site A to illustrate the vertical extent of contamination (the cross section locations are illustrated on Figure 6-4). Cis-1,2-dicholorethene continues to be degraded as the plume migrates via an abiotic process. The MPCA and USEPA initially evaluated attenuation at this Site using computer modeling of contaminant degradation, as documented in "Evaluation of Natural Attenuation of Chlorinated Solvents in Ground Water at the Twin Cities Army Ammunition Plant", MPCA and USEPA, June 2000. The MPCA conducted a follow-on microcosm study (unpublished) using samples collected from Site A, the results of which were presented to the Army, MPCA, and USEPA on April 10, 2007. The work conducted in this study showed that the degradation being observed at Site A was an abiotic process (not biological), which likely involves the presence of the mineral magnetite in soils at Site A. Note that the predominant degradation process does not "degrade through" vinyl chloride, which is no longer monitored at this site given the historical lack of detections that led to the OU2 ROD *not* selecting this compound as a contaminant of concern (COC).

Since the “first line” of extraction wells were shut off in September 2008, some wells have shown decreased concentrations and others have, in some periods, shown increased concentrations (see Figure 6-6, 6-7, 6-8, and 6-9). Of those showing an increase, several have shown an increase above cleanup levels and then decreased back below cleanup levels (e.g., 01U353/EW-3, 01U157, 01U158, and 01U140). Others, though never exceeding the cleanup level, have shown a similar pattern of increasing and then decreasing. Notably, in FY 2014, 01U904 declined from a peak (a “recent” increased) concentration of 57 µg/L in June 2013, to 56 and 44 µg/L in December 2013 and June 2014, respectively. Also, although 01U139 increased from 250 to 350 µg/L in the December 2013 to June 2014 sampling events in FY 2014, both of these concentrations actually represent a decrease from the 400 and 510 µg/L results observed in FY 2013 (December 2012 and June 2013, respectively). In fact, in FY 2014, only 01U902 (located north of County Road I) actually showed an increase from FY 2013 and has not yet seen a decrease from a peak (a “recent” increased) concentration, noting that 01U356/EW-6 appears to have peaked *within* FY 2014 (i.e., this well was 190 µg/L in December 2013 and 160/170 µg/L in June 2014). However, even at 01U902, the FY 2014 results appear to be relatively stabilized and nearing a peak concentration that is less than half the peak concentration that was observed at 01U904 (i.e., the last three results for 01U902 were 15, 17, and 20 µg/L in June and December 2013 and June 2014, respectively).

Were any trigger levels exceeded at any of the contingency locations?

No. The four contingency locations are 01U901, 902, 903 and 904, which are the four monitoring wells located along the north side of County Road I. The trigger level is equal to groundwater cleanup levels and no chemicals of concern at Site A exceeded their respective cleanup levels in these four wells in FY 2014 (Table 6-2). As noted previously, cis-1,2-dichloroethene in 01U902 increased slightly in comparison to FY 2013, but was still well below the trigger level (20 versus 70 µg/L. Most notably, cis-1,2-dichloroethene in 01U904, which was nearing the trigger level in FY 2013 (57 versus 70 µg/L), decreased in both the December 2013 (56 µg/L) and June 2014 (44 µg/L) sampling events.

The September 2008 Monitoring and Contingency Plan noted that if the groundwater trigger is exceeded, three key contingency actions were required:

1. Army will contact the well owner at 1783 Pinewood Drive to verify the well remains out of service (and will do this annually for as long as the trigger is being exceeded);

2. Army will prepare and submit a plan to address the exceedance to the USEPA and MPCA for approval; and

3. Army will prepare and submit a plan to evaluate the indoor air pathway.

The third action was perhaps the most critical item, as no soil vapor sampling had ever been conducted at Site A, and increasing VOC groundwater concentrations in any of the wells north of County Road I would raise the question of whether these increases could cause an increase in soil gas VOC concentrations leading to a vapor intrusion risk. A vapor intrusion report had been prepared previously: "Off-TCAAP Vapor Intrusion Pathway Analysis, Operable Unit 1, Operable Unit 3, and Operable Unit 2 (Site A)" prepared by Tecumseh/Wenck Installation Support Services, May 2005. This report concluded that the vapor intrusion pathway for the offsite Site A plume was incomplete, since the concentrations in groundwater were below the USEPA generic screening criteria. However, no actual soil vapor sampling was conducted for that report. In December 2012, the MPCA requested that soil vapor sampling be conducted since their 2008/2010 vapor intrusion guidance is newer than the 2005 report, and since that guidance states that groundwater screening levels should not be used as a single line of evidence for decisions regarding vapor intrusion risk. Based on this MPCA request, the Army prepared an investigation QAPP, which was approved by the USEPA and MPCA in June 2013, and then conducted the vapor intrusion investigation work in July 2013. This work was documented in "Site A Vapor Intrusion Investigation Report", prepared by Wenck, February 2014, which received regulatory consistency approval in FY 2014. The report concluded that no significant VOC concentrations are present in soil gas in the vicinity of the 14 samples collected (10 of which were located along the north side of County Road I), and that there is no significant soil vapor risk. Hence, the third contingency action has already been completed and was ultimately found not to be of concern.

With regard to the first contingency action, the Army attempted to contact the well owner at 1783 Pinewood Drive in FY 2014, even though the trigger has not been exceeded. While there is no reason to believe the owner will ever put this well back into service (and it would be physically difficult based on prior conversation), if this intention could be reconfirmed with the well owner, the well should be properly sealed. The Army was willing to voluntary conduct the sealing work. While it remains a very unlikely receptor, sealing of this well would eliminate the only known groundwater receptor between Site A and Rice Creek. Unfortunately, the resident did not respond to the two letters mailed to this address and it appears the Army will be unable to obtain approval to conduct this work.

If a trigger level should be exceeded, the only remaining contingency action would be the second one. However, the need to "address the exceedance" would have been driven primarily by either a groundwater receptor or a vapor receptor, and if these pathways are eliminated as discussed above (or deemed not to be of concern, in the case of a nonresponsive and unlikely groundwater receptor), a slight exceedance of the trigger may not require any specific remedial action, *especially given* the strong degradation evident at the site (i.e., the distance any slight exceedance would carry downgradient from the "900" wells would be expected to be minimal).

Can it be determined whether MNA is an adequate long-term remedy for Site A in lieu of groundwater extraction and discharge? (If MNA is determined to be adequate, a recommendation to formally change the remedy should be made.)

Conditionally, yes, given the following key observations:

1) Peak cis-1,2-dichloroethene concentrations appear to have been observed at all monitoring wells except 01U902;

2) The cis-1,2-Dichloroethene concentration in 01U902 appears to be near its peak and should further stabilize or decrease in FY 2015;

3) The vapor intrusion investigation concluded that there is no significant soil vapor risk.

4) The only known groundwater receptor between Site A and Rice Creek (1783 Pinewood Drive) is not believed to be operable, was only used for irrigation purposes when it was operable, and now has an unresponsive resident to a voluntary Army offer to seal this well; and

5) The strong degradation that is evident at the site.

The above items support the determination that MNA is an adequate long-term remedy for Site A. The Army recommends working with USEPA and MPCA to prepare an ESD or ROD amendment in FY 2015 to document changing the remedy to MNA. However, the Army also recommends not finalizing such a document until the December 2014 and June 2015 sampling results are reviewed by the Army, USEPA, and MPCA in order to provide final confirmation of items 1 and 2 above. If the noted observations are confirmed, the ESD or ROD amendment should then be finalized in late FY 2015 or early FY 2016, and the sampling frequency of all wells should be returned to annual beginning in FY 2016 (June of each year).

Do additional remedial measures need to be addressed?

In accordance with the above discussion, it is recommended that the remedy be changed to MNA, in lieu of groundwater extraction and discharge, pending final confirmation results in December 2014 and June 2015.

Table 6-1

Summary of Site A Shallow Groundwater Monitoring Requirements
Fiscal Year 2014

Remedy Component		Monitoring Requirements	Implementing Party	Documents Containing the Monitoring Plan
#1:	Groundwater Monitoring	Outlined below		
#2:	Containment and Mass Removal	a. None. The groundwater extraction system was shut down in September 2008 and implementation of Monitored Natural Attenuation (MNA) is being evaluated.		
#3A:	Land Use Controls	a. None		
#3B:	Alternate Water Supply/Well Abandonment	a. See OU1, Remedy Component #1 which also includes the area north of Site A		
#4:	Discharge of Extracted Water	a. None (see #2 above).		
#5:	Source Characterization/ Remediation	a. None. VOC-contaminated soils in the source area (1945 Trench) were excavated and transported to a permitted offsite disposal facility in FY 2003.		
OR:	Overall Remedy (Attainment of cleanup goals)	a. Water quality data throughout the Site A plume to evaluate attainment and to verify that Natural Attenuation is adequately controlling plume migration.	Army	Site A Monitoring Plan in the Annual Performance Report

Table 6-2
Site A Groundwater Quality Data

Fiscal Year 2014

			Tetra-chloro-ethene (µg/L)	Tri-chloro-ethene (µg/L)	cis-1,2-Di-chloro-ethene (µg/L)	1,1-Di-chloro-ethene (µg/L)	1,2-Di-chloro-ethane (µg/L)	Chloro-form (µg/L)	Benzene (µg/L)	Antimony (µg/L)
Site A Cleanup Level (1)			7	30	70	6	4	60	10	6
01U039		6/20/14	<1	<1	<1	<1	<1	<1	<1	---
01U102		6/20/14	JP 0.70	<1	<1	<1	<1	<1	<1	---
01U103		6/20/14	<1	<1	<1	<1	<1	<1	<1	3.9
01U103		6/20/14	---	---	---	---	---	---	---	4.0
01U108		6/20/14	JP 0.62	<1	<1	<1	<1	<1	<1	---
01U115		6/23/14	<1	JP 0.60	1.8	<1	<1	<1	<1	---
01U116		6/23/14	<1	1.6	JP 0.76	<1	<1	<1	<1	---
01U117		6/23/14	3.4	1.3	21	<1	<1	<1	<1	---
01U126		6/23/14	JP 0.48	<1	<1	<1	<1	<1	<1	---
01U138		6/23/14	<1	<1	<1	<1	<1	<1	<1	---
01U139		12/19/13	<1	JP 0.89	**250**	JP 0.40	<1	<1	6.4	---
01U139	D	12/19/13	<1	JP 0.97	**250**	JP 0.37	<1	<1	6.3	---
01U139		6/23/14	<1	JP 0.72	**350**	JP 0.36	<1	<1	7.6	---
01U140		12/19/13	<1	<1	43	<1	<1	<1	JP 0.53	---
01U140		6/23/14	<1	<1	24	<1	<1	<1	JP 0.51	---
01U157		12/19/13	<1	1.1	25	<1	<1	<1	<1	---
01U157	D	12/19/13	<1	1.2	22	<1	<1	<1	<1	---
01U157		6/24/14	<1	1.1	18	<1	<1	<1	JP 0.30	---
01U158		12/19/13	<1	1.2	66	<1	<1	<1	JP 0.59	---
01U158		6/24/14	<1	1.3	57	<1	<1	<1	JP 0.62	---
01U350		6/20/14	2.2	JP 0.63	<1	<1	<1	<1	<1	---
01U901		12/19/13	<1	<1	JP 0.47	<1	<1	<1	<1	---
01U901		6/24/14	<1	<1	<1	<1	<1	<1	<1	---
01U901	D	6/24/14	<1	<1	<1	<1	<1	<1	<1	---
01U902		12/19/13	<1	<1	17	<1	<1	<1	<1	---
01U902		6/24/14	<1	<1	20	<1	<1	<1	JP 0.34	<2
01U903		6/24/14	<1	<1	<1	<1	<1	<1	<1	---
01U904		12/19/13	<1	<1	56	<1	<1	<1	<1	---
01U904		6/24/14	<1	<1	44	<1	<1	<1	<1	<2

Table 6-2
Site A Groundwater Quality Data

Fiscal Year 2014

			Tetra-chloro-ethene (µg/L)	Tri-chloro-ethene (µg/L)	cis-1,2-Di-chloro-ethene (µg/L)	1,1-Di-chloro-ethene (µg/L)	1,2-Di-chloro-ethane (µg/L)	Chloro-form (µg/L)	Benzene (µg/L)	Antimony (µg/L)
Site A Cleanup Level (1)			7	30	70	6	4	60	10	6
Extraction Wells:										
01U351 (EW-1)		6/24/14	<1	<1	<1	<1	<1	<1	<1	---
01U352 (EW-2)		12/17/13	<1	<1	5.3	<1	<1	<1	<1	---
01U352 (EW-2)		6/24/14	<1	<1	<1	<1	<1	<1	<1	---
01U353 (EW-3)		12/17/13	<1	<1	47	<1	<1	<1	JP 0.58	---
01U353 (EW-3)		6/24/14	<1	<1	JP 0.33	<1	<1	<1	<1	---
01U354 (EW-4)		12/17/13	<1	JP 0.36	<1	<1	<1	<1	<1	---
01U354 (EW-4)		6/24/14	<1	<1	<1	<1	<1	<1	<1	---
01U355 (EW-5)		12/18/13	<1	JP 0.79	56	<1	<1	<1	1.3	---
01U355 (EW-5)		6/23/14	<1	JP 0.59	35	<1	<1	<1	1.1	---
01U356 (EW-6)		12/18/13	<1	JP 0.80	**190**	<1	<1	<1	1.6	---
01U356 (EW-6)		6/23/14	<1	JP 0.67	**160**	<1	<1	<1	1.4	---
01U356 (EW-6)	D	6/23/14	<1	JP 0.69	**170**	<1	<1	<1	1.4	---
01U357 (EW-7)		12/18/13	<1	<1	39	<1	<1	<1	JP 0.91	---
01U357 (EW-7)		6/20/14	<1	<1	28	<1	<1	<1	JP 0.81	---
01U358 (EW-8)		12/18/13	<1	<1	JP 0.55	<1	<1	<1	<1	---
01U358 (EW-8)		6/20/14	<1	<1	JP 0.44	<1	<1	<1	<1	---
01U358 (EW-8)	D	6/20/14	<1	<1	JP 0.44	<1	<1	<1	<1	---

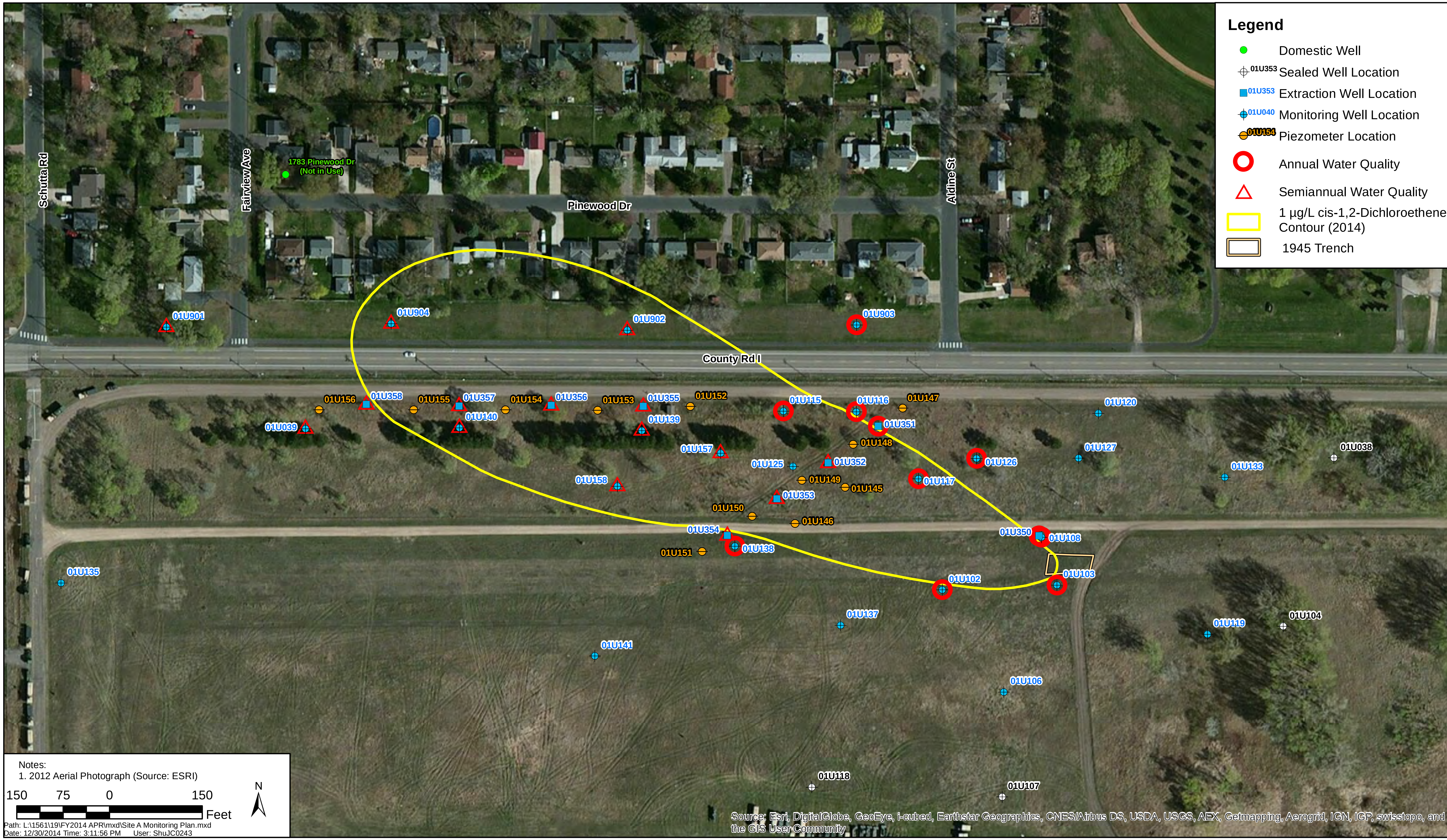
Notes:

(1) Cleanup levels for Site A Shallow Groundwater are from Table 1 of the OU2 ROD. Bolding (in red color) indicates exceedance of the cleanup level.

--- Not Sampled.

D Duplicate sample.

JP The value is below the Reporting Limit, but above the Method Detection Limit. Results should be considered estimated.



ANNUAL PERFORMANCE REPORT	WENCK ASSOCIATES	FY 2014
Site A, Groundwater Monitoring Plan	Responsive partner. Exceptional outcomes.	Figure 6-1

ANNUAL PERFORMANCE REPORT

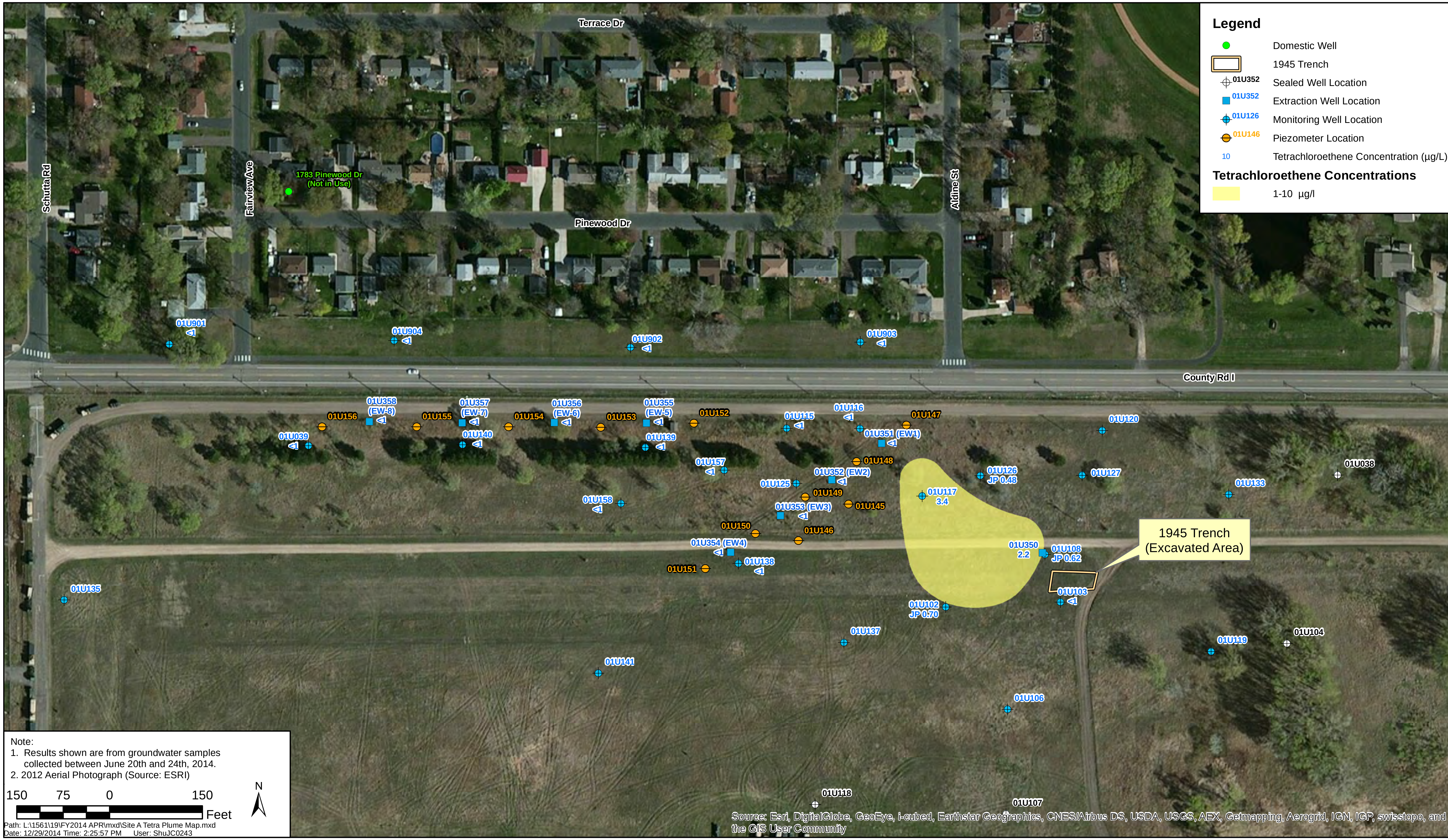
Site A, Unit 1, Potentiometric Map - June 2014

WENCK ASSOCIATES

Responsive partner. Exceptional outcomes.

FY 2014

Figure 6-2



Legend

- Domestic Well
- 1945 Trench
- 01U352 Sealed Well Location
- 01U352 Extraction Well Location
- 01U126 Monitoring Well Location
- 01U146 Piezometer Location
- 10 Tetrachloroethene Concentration (µg/L)

Tetrachloroethene Concentrations

- 1-10 µg/l

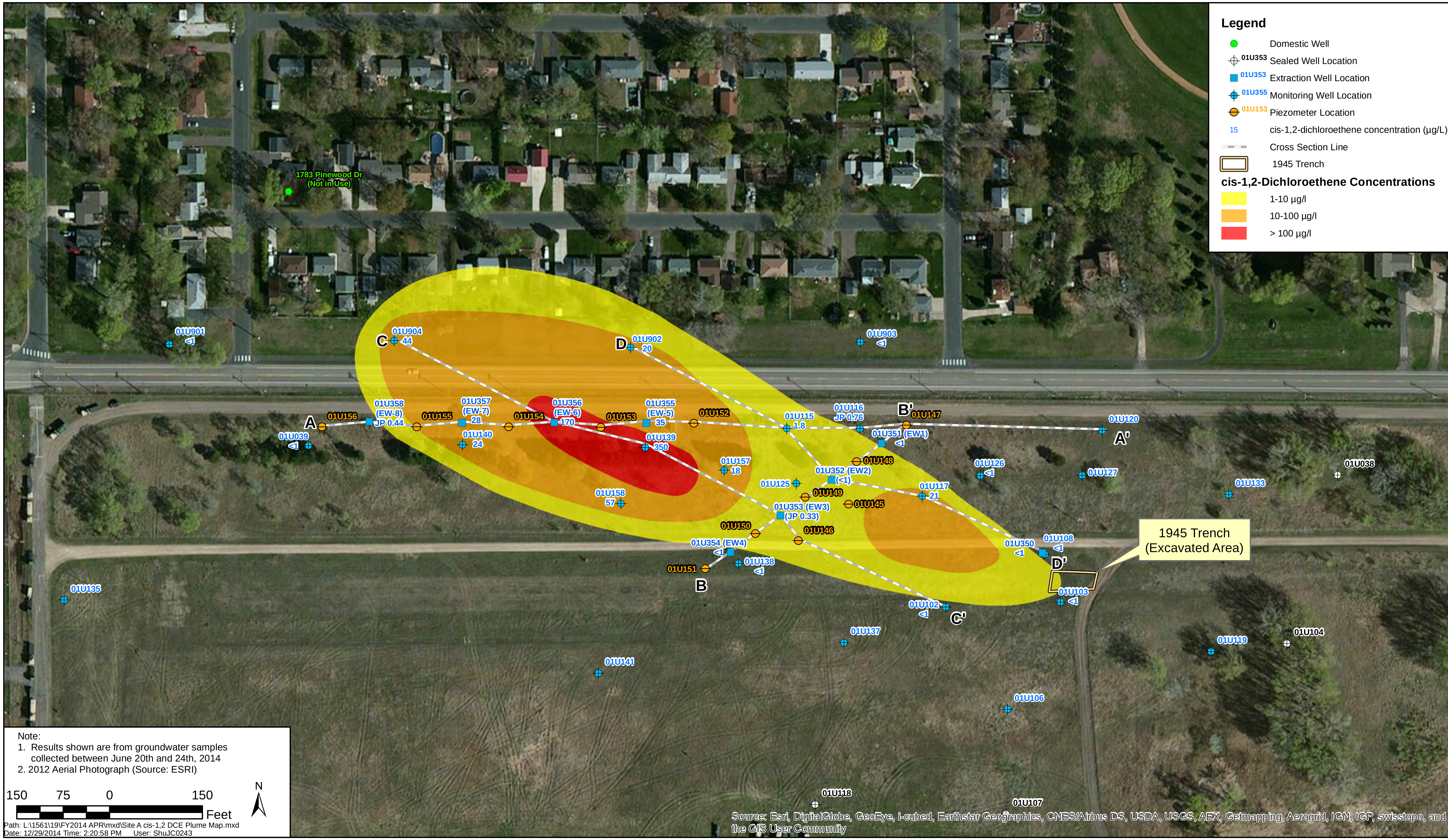
Note:
1. Results shown are from groundwater samples collected between June 20th and 24th, 2014.
2. 2012 Aerial Photograph (Source: ESRI)

150 75 0 150 Feet

N

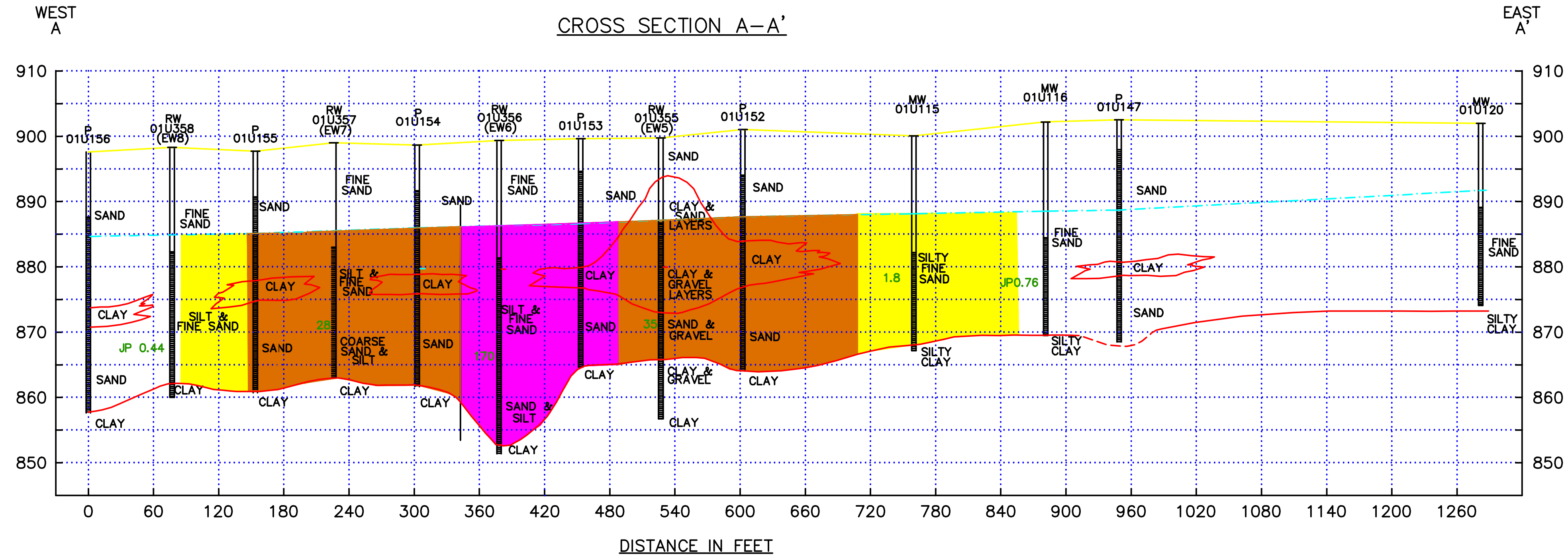
Path: L:\1561\19\FY2014 APR\mxd\Site A Tetra Plume Map.mxd
Date: 12/29/2014 Time: 2:25:57 PM User: ShuJC0243

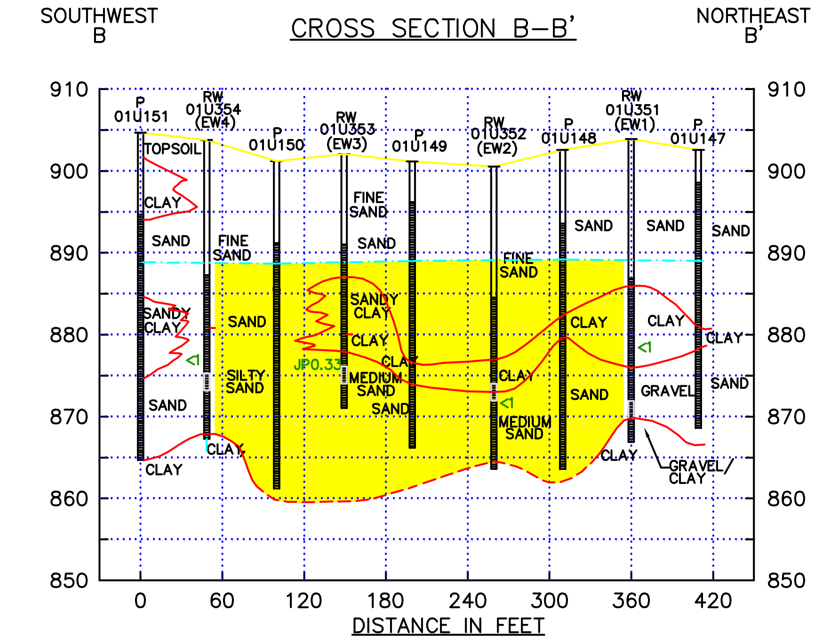
ANNUAL PERFORMANCE REPORT	WENCK ASSOCIATES Responsive partner. Exceptional outcomes.	FY 2014
Site A, Unit 1, Tetrachloroethene Isoconcentration Map, June 2014		Figure 6-3

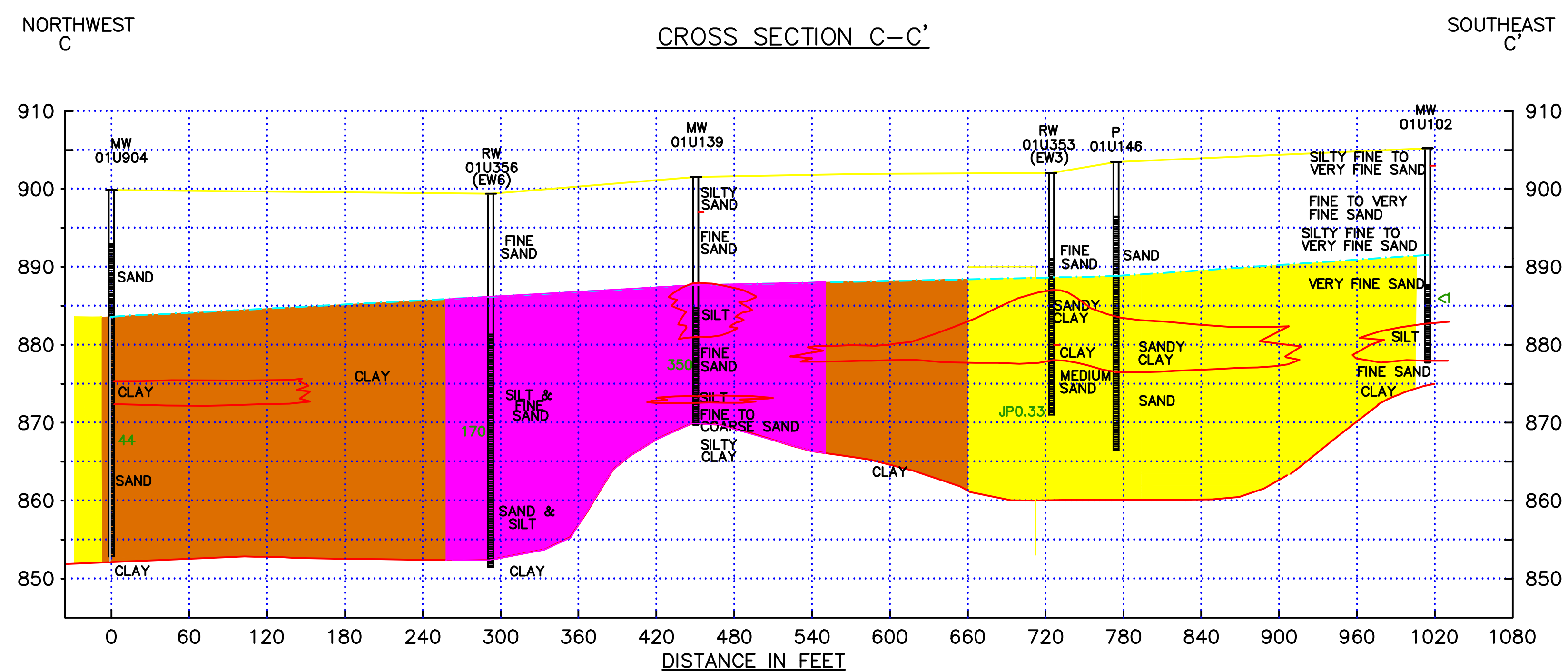


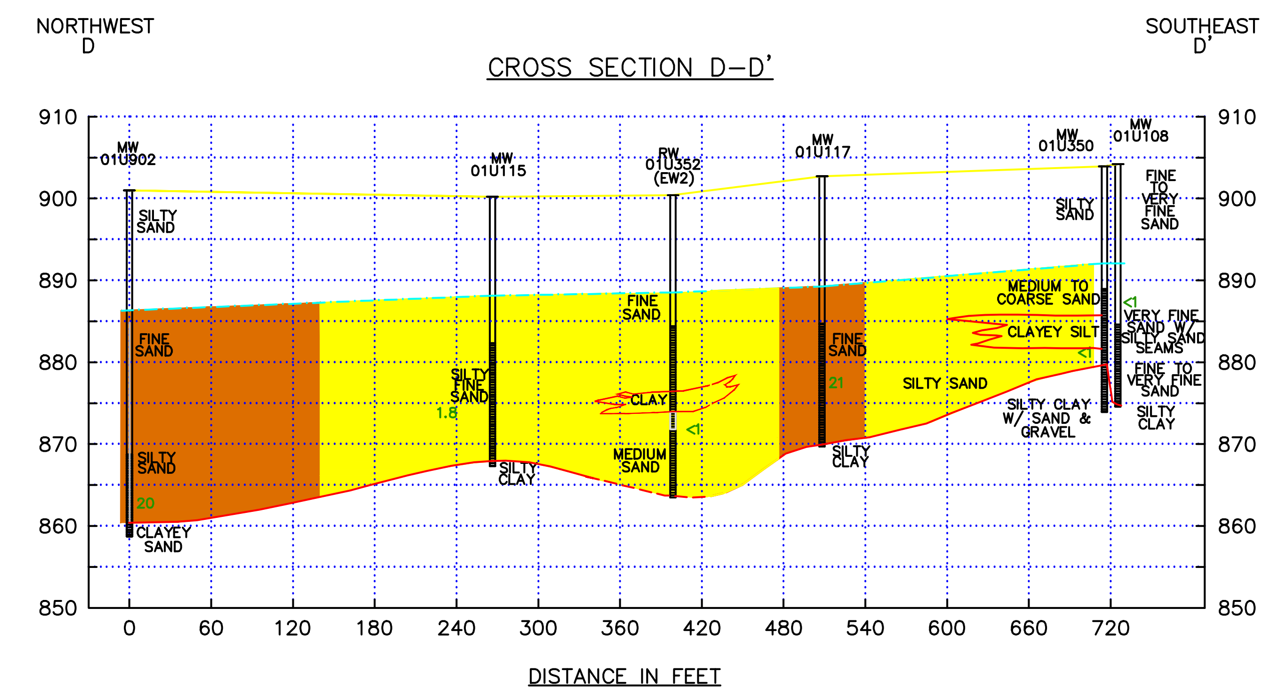
ANNUAL PERFORMANCE REPORT	WENCK ASSOCIATES Responsive partner. Exceptional outcomes.	FY 2014
Site A, Unit 1, cis-1,2-Dichloroethene Isoconcentration Map, June 2014		Figure 6-4

Plot Date & Time:8 January 2015 8:12 AM









NOTES:

1. RESULTS ARE FROM GROUNDWATER SAMPLES COLLECTED BETWEEN JUNE 20 AND JUNE 24, 2014.

2. CONSTRUCTION INFORMATION ON RECOVERY WELLS AND PIEZOMETERS WAS GENERATED BY DAHL AND ASSOCIATES, INC. AS PART OF THE SITE A REMOVAL ACTION SYSTEM CONSTRUCTION. CONSTRUCTION INFORMATION ON MONITORING WELLS WAS PROVIDED BY FEDERAL CARTRIDGE COMPANY.

SCALE

V.E. = 6X

LEGEND

- GEOLOGIC CONTACT
- INFERRED GEOLOGIC CONTACT
- SCREENED INTERVAL OF WELL
- PUMP LOCATION
- 885.0 WATER LEVEL SURFACE
- SLIGHT CHANGE IN GEOLOGIC UNIT (MARK LOCATED ALONG WELL STAFF)
- MW MONITORING WELL
- RW RECOVERY WELL
- P PIEZOMETER
- MW 01U117 12 cis–1,2–DICHLOROETHENE CONCENTRATION (μg/l)

cis–1,2–DICHLOROETHENE CONCENTRATIONS

- 1–10 μg/l
- 10–100 μg/l
- >100 μg/l

REV	REVISION DESCRIPTION	DWN	APP	REV DATE

WENCK ASSOCIATES
Responsive partner. Exceptional outcomes.

1800 PIONEER CREEK CENTER
MAPLE PLAIN, MINNESOTA
PH. 763–479–4200
FAX 763–479–4242

DWN BY	CHK'D	APP'D	PROJECT	FY 2014 ANNUAL PERFORMANCE REPORT
JVB	MH	MH		
DWG DATE	JAN. 2015		CLIENT	U.S. ARMY–TCAAP
SCALE	AS NOTED			

SHEET TITLE: cis–1,2–DICHLOROETHENE CROSS–SECTIONS A, B, C, D

PROJECT NO.	SHEET NO.	REV NO.
1561–19	FIGURE 6–5	

M:\1561\2014\Tcax02b6.dwg

FIGURE 6-6

SITE A, cis-1,2-DICHLOROETHENE WATER QUALITY TRENDS: EXTRACTION WELLS 1 - 4

FY 2014 ANNUAL PERFORMANCE REPORT

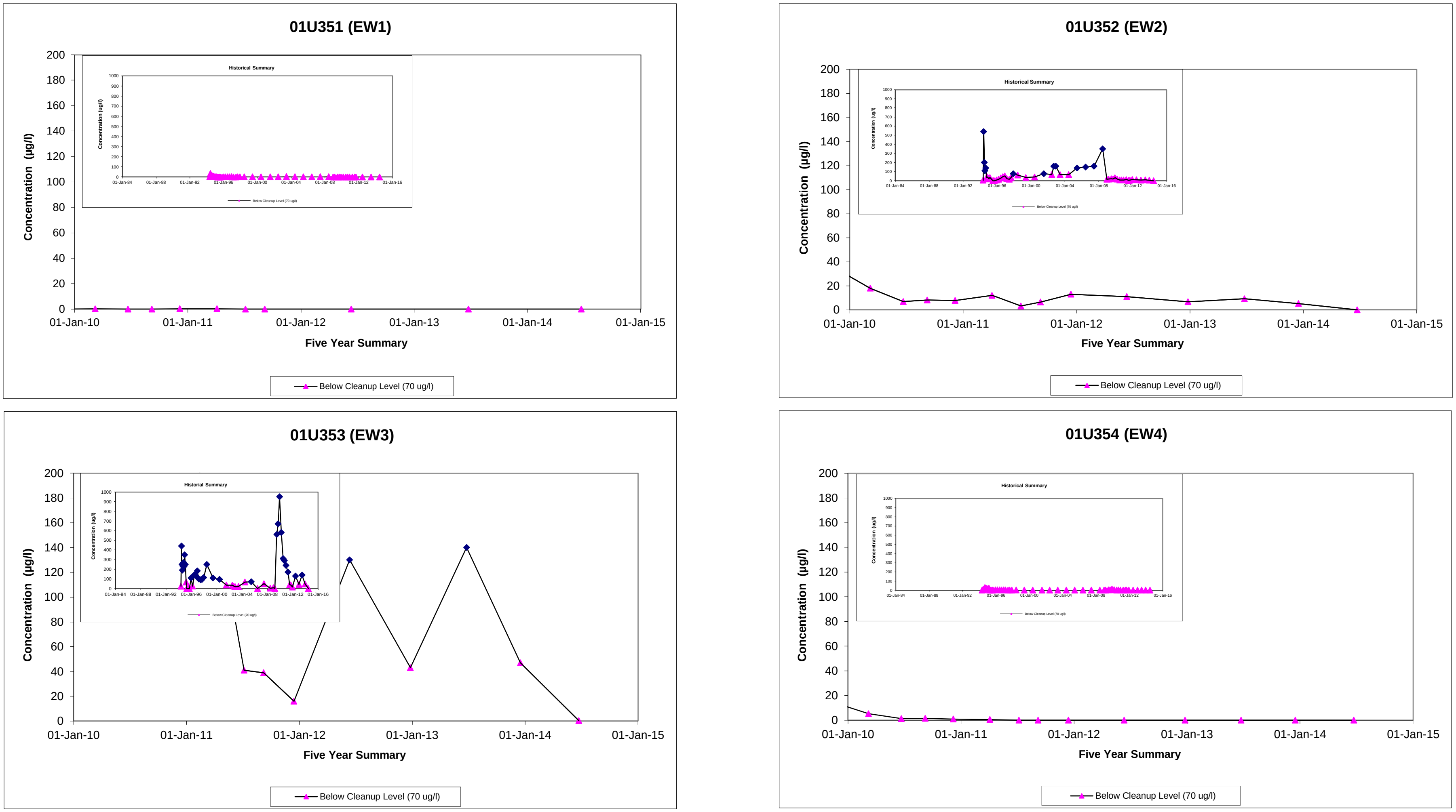
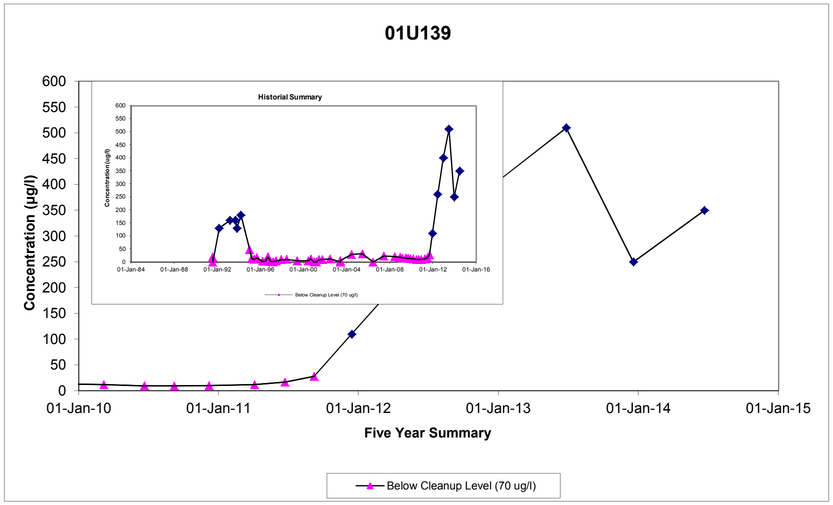
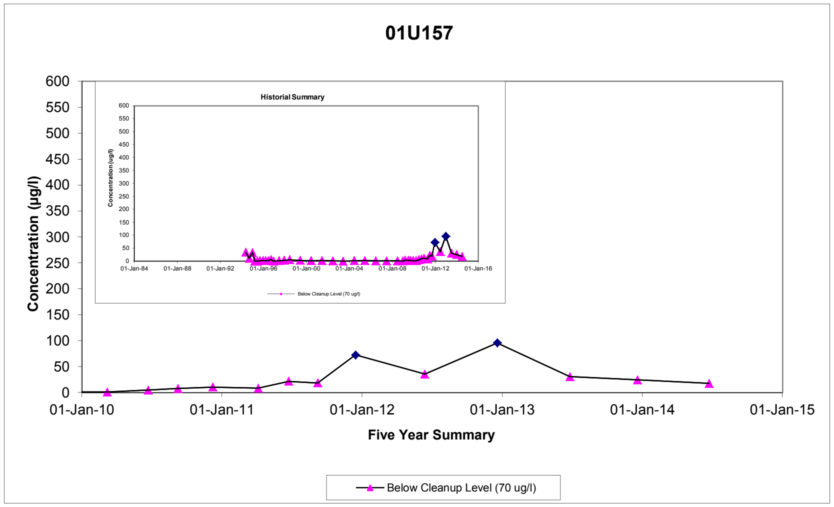
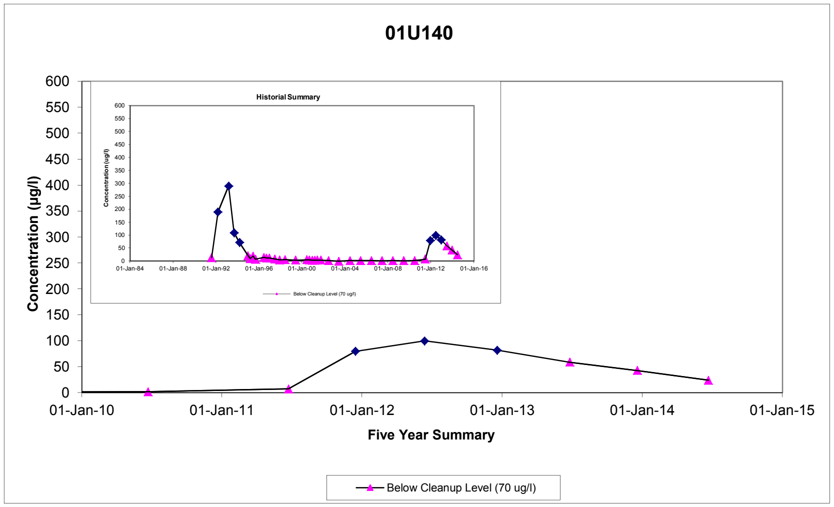


FIGURE 6-7
SITE A, cis-1,2-DICHLOROETHENE WATER QUALITY TRENDS: MONITORING WELLS
FY 2014 ANNUAL PERFORMANCE REPORT







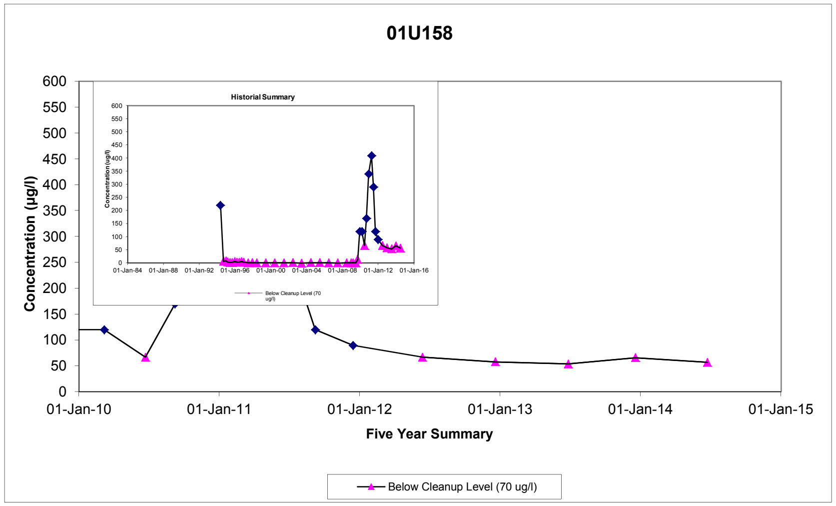
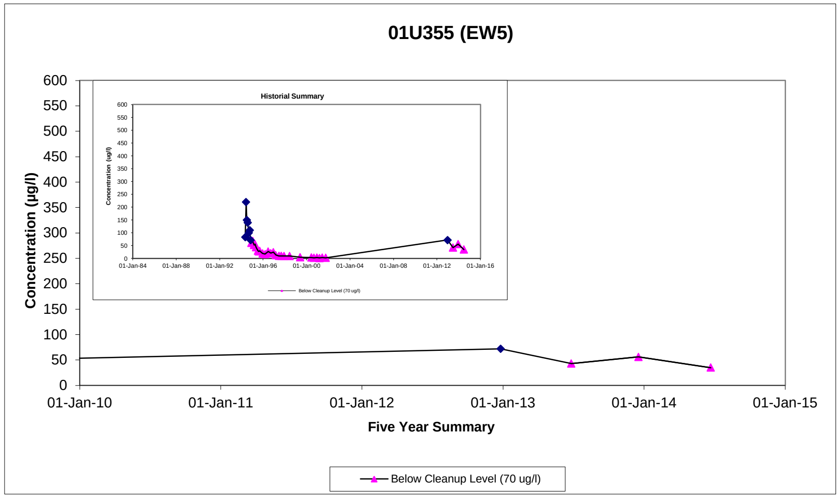
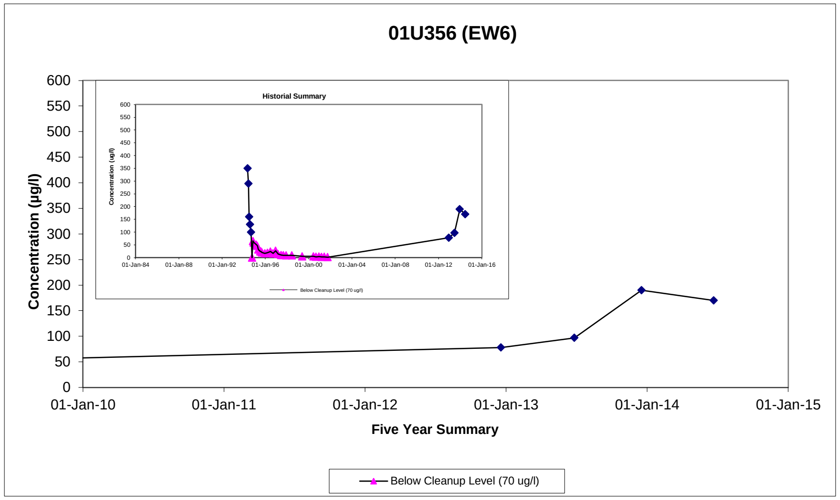


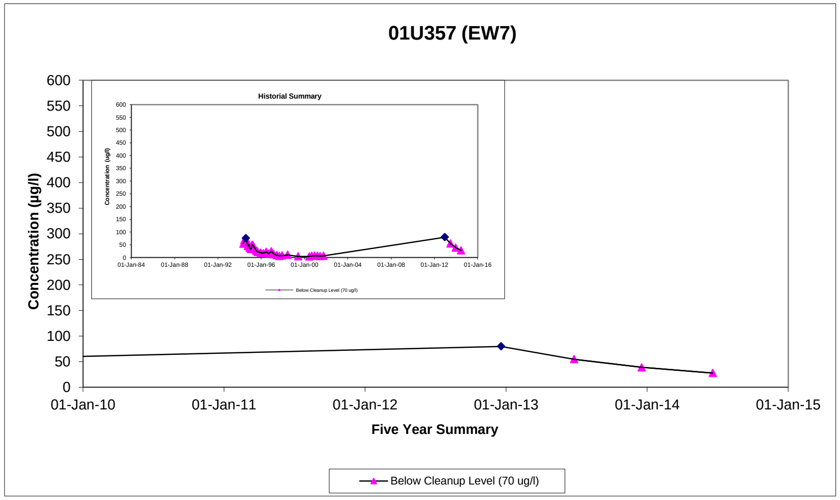
FIGURE 6-8

SITE A, cis-1,2-DICHLOROETHENE WATER QUALITY TRENDS: EXTRACTION WELLS 5 - 8

FY 2014 ANNUAL PERFORMANCE REPORT







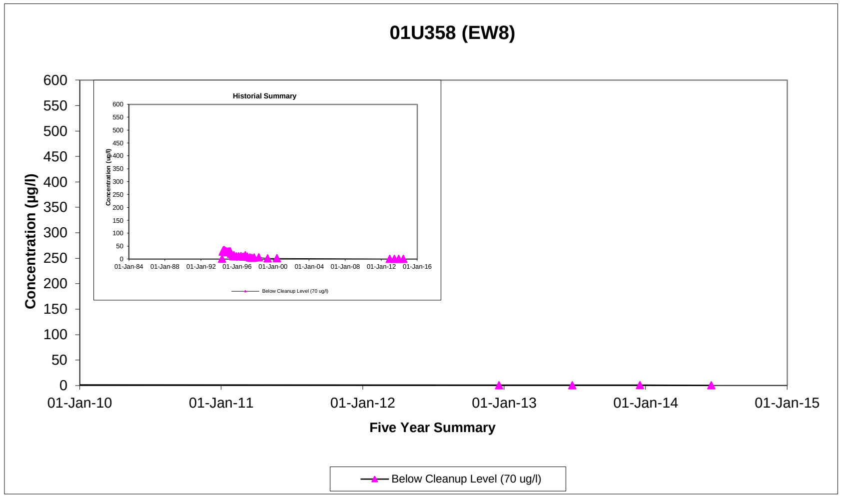
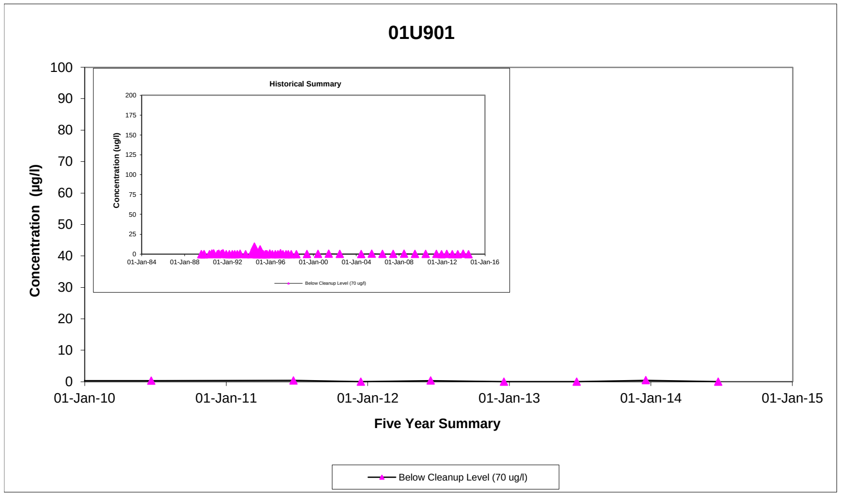
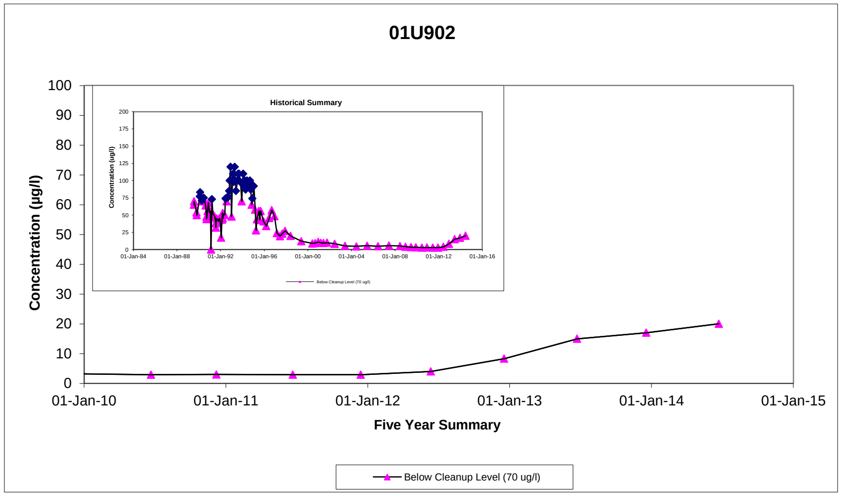


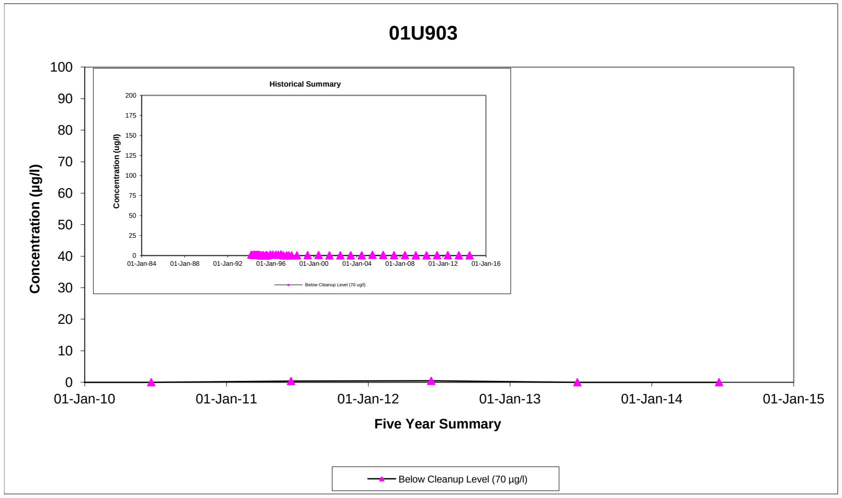
FIGURE 6-9

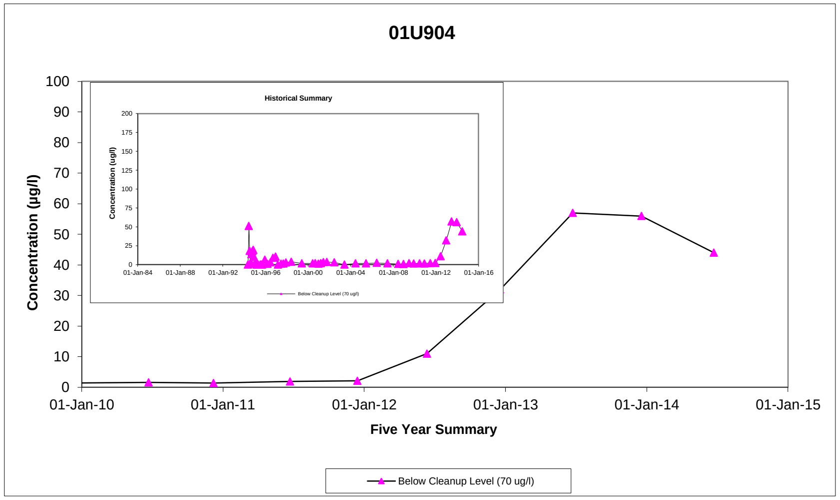
SITE A, cis-1,2-DICHLOROETHENE WATER QUALITY TRENDS: CONTINGENCY LOCATIONS

FY 2014 ANNUAL PERFORMANCE REPORT









7.0 Operable Unit 2: Site C Shallow Groundwater

Impacts to Site C shallow groundwater had not occurred at the time of the OU2 ROD (1997). In FY 1997, the U.S. Army Environmental Command (USAEC) sponsored a technology demonstration project to phytoremediate lead-contaminated soil at Site C. During the growing seasons, ethylenediaminetetraacetic acid (EDTA) and acetic acid were applied to the soils to improve the metals uptake by the crops and had the unintended consequence of causing migration of lead from the soils into the shallow groundwater at Site C, which is present within a few feet from the ground surface. In FY 2000, the MPCA took enforcement action, requiring that the Army implement corrective actions. Initially, the Army installed a groundwater recovery trench to contain the lead plume (operated between November 2000 and July 2001). On July 6, 2001, the Army began operating three extraction wells to contain the plume (replacing recovery trench operation), with discharge of extracted groundwater (treated as necessary) to a POTW. In FY 2004, a Stipulation Agreement was signed which resolved the enforcement action and directed that response actions be conducted under the authority of the FFA. The 2007 OU2 ROD Amendment #1 incorporated the existing groundwater extraction system as the final remedy.

On November 13, 2008, the groundwater system was shut off (with regulatory approval), since the lead concentrations in the three extraction wells had been below the groundwater cleanup level since March 2008 (i.e., the area of lead concentrations that exceeded the groundwater cleanup level was not even reaching the extraction wells, so operation of the extraction system was no longer required to contain the plume). The recommendation to shut the extraction system off was presented in the "Site C Groundwater Extraction System Evaluation Report," which was approved by the USEPA and MPCA in November 2008. The 2007 ROD Amendment #1 prescribes four major components of the remedy, and until a decision is made to formally change the remedy, the original components of ROD Amendment #1 will be retained in this section (with discussion that is appropriate to the current remedy implementation status).

The Evaluation Report also presented the monitoring plan to be implemented at the point that the extraction wells were shut off, and presented the contingency actions that will be taken by the Army if groundwater and/or surface water monitoring indicates that any of the stated trigger points are exceeded. These monitoring and contingency actions have been incorporated into the APR, and thus any changes to monitoring and contingency actions must be approved by the USEPA and MPCA through revisions to the APR.

At some point, the remedy could be formally changed. This change would presumably require an Explanation of Significant Difference (ESD), at a minimum, or possibly a ROD amendment. However, given that groundwater cleanup levels may be reached throughout Site C within a few years, it may not be necessary to go through the process of formally changing the remedy. Evaluation in future APRs will ultimately determine whether the USEPA, MPCA, and Army should formally change the remedy or, possibly, whether the Site should just be closed.

7.1 REMEDY COMPONENT #1: GROUNDWATER AND SURFACE WATER MONITORING

Description: "The existing Site C groundwater monitoring program will be revised as needed."
"A new surface water monitoring plan will be prepared."
(OU2 ROD Amendment #1, page 39-40)

Performance Standard (how do you know when you're done):
When a performance groundwater and surface water monitoring program has been established and ongoing monitoring is in compliance with the program.

Is this remedy component being implemented?
Yes. Table 7-1 summarizes the performance monitoring requirements, the implementing parties, and the documents that contain the monitoring plans. FY 2014 monitoring was conducted in accordance with the Monitoring Plans included in Appendix A. The water quality monitoring

locations and frequencies are also summarized on Figure 7-1, and any deviations are explained in Appendix C.2. Also, note that 11 monitoring wells were sealed in FY 2014, with regulatory approval, since the monitoring network was deemed adequate without them. The significantly reduced plume footprint allowed for this reduction in monitoring locations.

Were the monitoring requirements for this remedy met? Yes.

Is any sampling proposed prior to the next report?
Yes. Groundwater and surface water monitoring at Site C will be in accordance with the monitoring plans shown in Appendix A.1 and A.3, respectively.

Are any changes or additional actions required for this remedy component? No.

7.2 REMEDY COMPONENT #2: GROUNDWATER CONTAINMENT

Description: "Three extraction wells, EW-1 through EW-3, will continue collecting contaminated groundwater." (OU2 ROD Amendment #1, page 38)

Is this remedy component being implemented?
No. As discussed previously, since the area of lead concentrations that exceed the groundwater cleanup level no longer extends to the extraction wells, the extraction system is no longer operating and this remedy component is not currently being implemented.

7.3 REMEDY COMPONENT #3: DISCHARGE OF EXTRACTED WATER

Description: "Extracted groundwater will be pretreated onsite (as necessary) to meet the sanitary sewer discharge limit." (OU2 ROD Amendment #1, page 38)

Is this remedy component being implemented?

No. As discussed previously, since the area of lead concentrations that exceed the groundwater cleanup level no longer extends to the extraction wells, the extraction system is no longer operating and this remedy component is not currently being implemented.

7.4 REMEDY COMPONENT #4: LAND USE CONTROLS

Description: "LUCs will be established to protect the groundwater extraction, treatment, and monitoring system and to prohibit the drilling of water supply wells within the contaminated portion of the Unit 1 aquifer." (OU2 ROD Amendment #1, page 39)

Performance Standard (how do you know when you're done):

For initial implementation, when the USEPA and MPCA have provided consistency approval for an OU2 Land Use Control Remedial Design (LUCRD) document. Implementation will continue until such time that the groundwater concentrations are below the cleanup levels.

Has a LUCRD document been approved to address land use control (LUC) issues for OU2, including Site C groundwater, and is it being implemented?

Yes. The USEPA and MPCA provided consistency approval for the OU2 LUCRD in September 2010 and it is being implemented by the Army. Revision 2 of the OU2 LUCRD was approved by the USEPA and MPCA in FY 2012; however, this revision did not affect land use controls at Site C.

Was an annual site inspection for land use controls conducted in FY 2014?

Yes. On July 30, 2014, the Army, National Guard, and Wenck conducted the annual inspection of OU2 sites. The checklist that was completed during the inspection is included as Appendix I.

Did the inspection identify any follow-up actions needed to maintain the protectiveness of the LUCs? No.

7.5 OVERALL REMEDY FOR SITE C SHALLOW GROUNDWATER

Performance Standard (how do you know when you're done):
When the cleanup levels in Table 1 of OU2 ROD Amendment #1 have been attained throughout the areal and vertical extent of the Site C plume.

Has the Site C shallow groundwater remedy been completed (i.e., have the cleanup levels in Table 1 of the OU2 ROD Amendment #1 been attained throughout the areal and vertical extent of the Site C plume)?
No. Table 7-2 and 7-3 present the FY 2014 groundwater and surface water quality data, respectively, and highlight the values that exceed the lead cleanup level. Figure 7-2 presents groundwater elevation contours based on measurements in June 2014. Figure 7-3 shows the lead results for groundwater and surface water. Figure 7-4 and 7-5 show the lead concentrations plotted on geologic cross sections for Site C to illustrate the vertical extent of contamination (the cross section locations are illustrated on Figure 7-3). The water quality trends for MW-3, 13, 14, and 15 are shown on Figure 7-6. In FY 2014, lead exceeded the groundwater cleanup level of 15 µg/L in the four monitoring wells located nearest the source area, and are the ones shown on the trend figure. From closest to the source area and then moving downgradient, these four FY 2014 results were 230 µg/L (MW-13), 34 µg/L (MW-3), 69 µg/L (MW-14), and 23 µg/L (MW-15). Surface water monitoring results were all below the surface water cleanup level in FY 2014.

Looking at the water quality trends for the wells located just downgradient of the source area (Figure 7-6), the results for MW-3 and MW-15 were significantly increased from the FY 2013 results. The result for MW-13 increased versus the September 2013 result, but was substantially decreased from the June 2013 result. Only MW-14 decreased from the prior result. As another indication of the increasing trend in recent years, while all four of these wells exceeded the groundwater cleanup level (15 µg/L) in FY 2014, only two of the four exceeded it in FY 2013, and only one of the four exceeded it in FY 2012. The reason for the increases observed at MW-3 and MW-15 is not certain, but appears to be related to high groundwater levels, which have steadily increased in recent years (i.e., contaminated soils that were previously above the water table a few years ago may now be in contact with groundwater, possibly affecting recent groundwater quality trends).

Were any trigger levels exceeded at any of the contingency locations?

No. The Site C contingency locations and trigger levels are shown in Table 7-4. Depending on the location, the trigger level is either equal to the groundwater cleanup level or the surface water cleanup level. The groundwater results (Table 7-2) and surface water results (Table 7-3) show that none of the trigger levels were exceeded in FY 2014. If a trigger level were to be exceeded, the Army would implement the contingency action(s) specified in the footnotes to Table 7-4.

Can it be determined whether a formal change to the remedy should be made (to eliminate the groundwater extraction and discharge components) or, possibly, whether the Site should just be closed?

No, the determination cannot be made yet. The generally increasing trends in the most recent years (in the wells near the source area) suggest that additional monitoring is needed before this determination can be made.

Do additional remedial measures need to be addressed?

No. Continued monitoring will provide the additional data needed to determine whether a formal change to the remedy should be made or, possibly, whether the Site should just be closed.

Table 7-1

Summary of Site C Shallow Groundwater Monitoring Requirements
Fiscal Year 2014

Remedy Component	Monitoring Requirements	Implementing Party	Documents Containing the Monitoring Plan
#1: Groundwater and Surface Water Monitoring	Outlined below		
#2: Groundwater Containment	a. None. The groundwater extraction system was shut down in November 2008, since the area of groundwater that exceeded the groundwater cleanup level no longer extended to the extraction wells.		
#3: Discharge of Extracted Water	a. None (see #2 above).		
#4: LUCs to Restrict Well Installation and to Protect the Remedy Infrastructue	a. None.		
OR: Overall Remedy (Attainment of cleanup goals)	a. Groundwater quality data throughout the Site C plume to evaluate attainment and to verify that operation of a groundwater extraction system is not required. Also surface water data in the plume vicinity to verify that groundwater does not impact surface water above surface water standards.	Army	Site C Monitoring Plan in the Annual Performance Report

Table 7-2
Water Quality Data for Site C Groundwater

Fiscal Year 2014

Sample Location		Date Collected	Lead (Dissolved) (µg/L)	L	D
Groundwater Cleanup Level(1):			15		
01U561 (MW1)		6/18/14	0.45	U	
01U562 (MW2)		6/18/14	0.45	U	
01U562 (MW2)	D	6/18/14	0.45	U	
01U563 (MW3)		6/18/14	**34**		
01U564 (MW4)		6/18/14	0.45	U	
01U567 (MW7)		6/18/14	2.1		
01U571 (MW11)		6/18/14	1.6		
01U573 (MW13)		6/18/14	**230**		
01U574 (MW14)		6/18/14	**69**		
01U575 (MW15)		6/18/14	**23**		
01U576 (MW16)		6/18/14	6.2		
01U576 (MW16)	D	6/18/14	7.6		
01U046		6/18/14	1.6		

Notes:

Laboratory Concentration Qualifiers (L):

U Analyte was not detected above the Method Detection Limit (MDL).

J Reported value is between the Method Detection Limit (MDL) and the Reporting Limit (RL).

Data Validation Qualifiers (D):

(None)

Other Notes:

D Duplicate

(1) The cleanup level for Site C Groundwater is from Table 1 of OU2 ROD Amendment #1. Bolding (in red color) indicates exceedance of the cleanup level.

Table 7-3
Water Quality Data for Site C Surface Water

Fiscal Year 2014

Sample Location		Date Collected	Lead (Dissolved) (µg/L)	L	D
Surface Water Cleanup Level[1]:			6.9		
SW 05		6/17/14	1.7		
SW 05		6/18/14	0.45	U	
SW 05		6/19/14	0.92	J	
SW 06		6/17/14	0.66	J	
SW 06		6/18/14	0.45	U	
SW 06		6/19/14	0.64	J	
NE Wetland		6/17/14	0.75	J	
NE Wetland		6/18/14	0.45	U	
NE Wetland	D	6/18/14	0.45	U	
NE Wetland		6/19/14	0.45	U	

Notes:

Laboratory Concentration Qualifiers (L):

U Analyte was not detected above the Method Detection Limit (MDL).

J Reported value is between the Method Detection Limit (MDL) and the Reporting Limit (RL).

Data Validation Qualifiers (D):

(None)

Other Notes:

D Duplicate

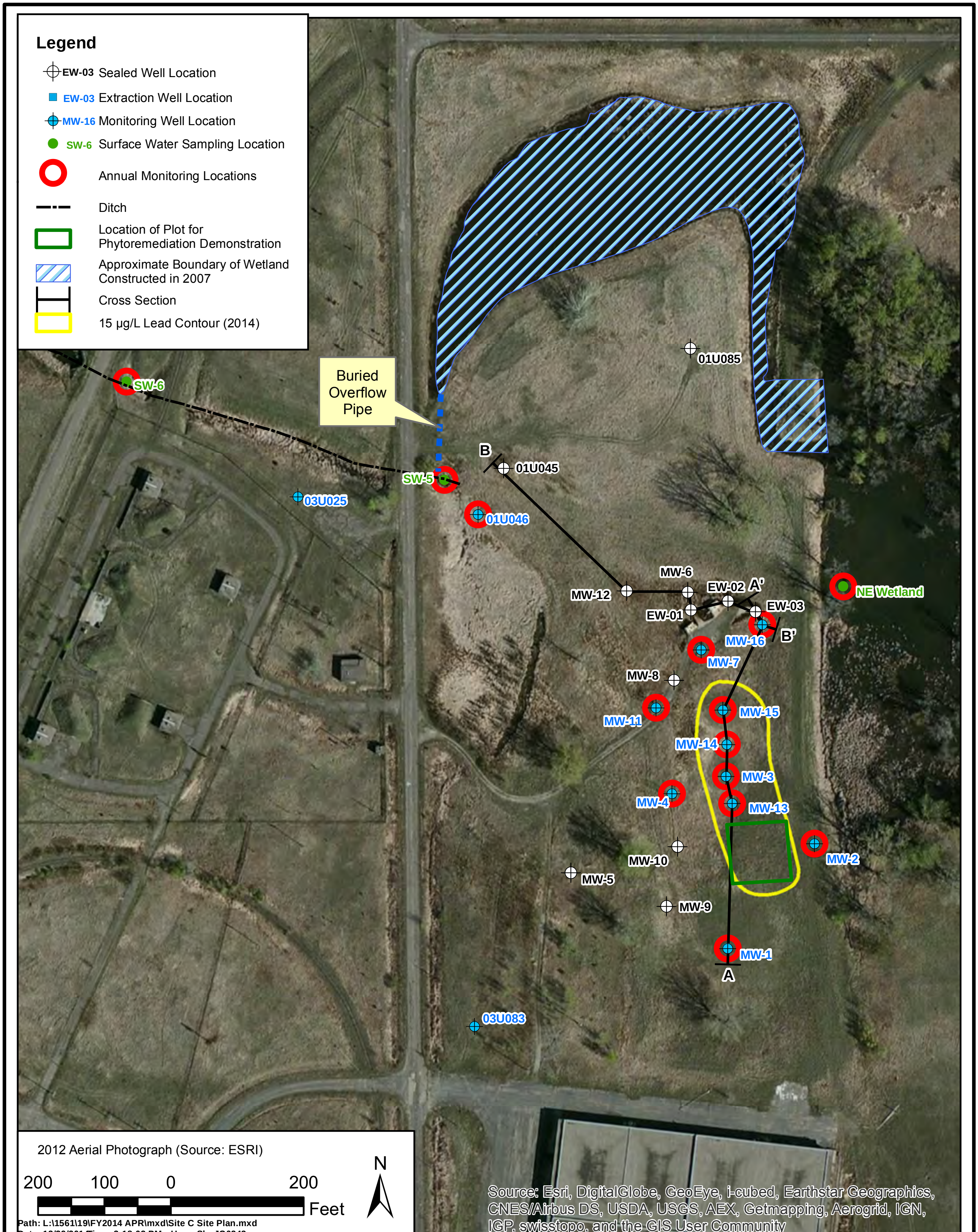
(1) The cleanup level for Site C Surface Water is from Table 1 of OU2 ROD Amendment #1.

Table 7-4
Contingency Locations for Site C Monitoring

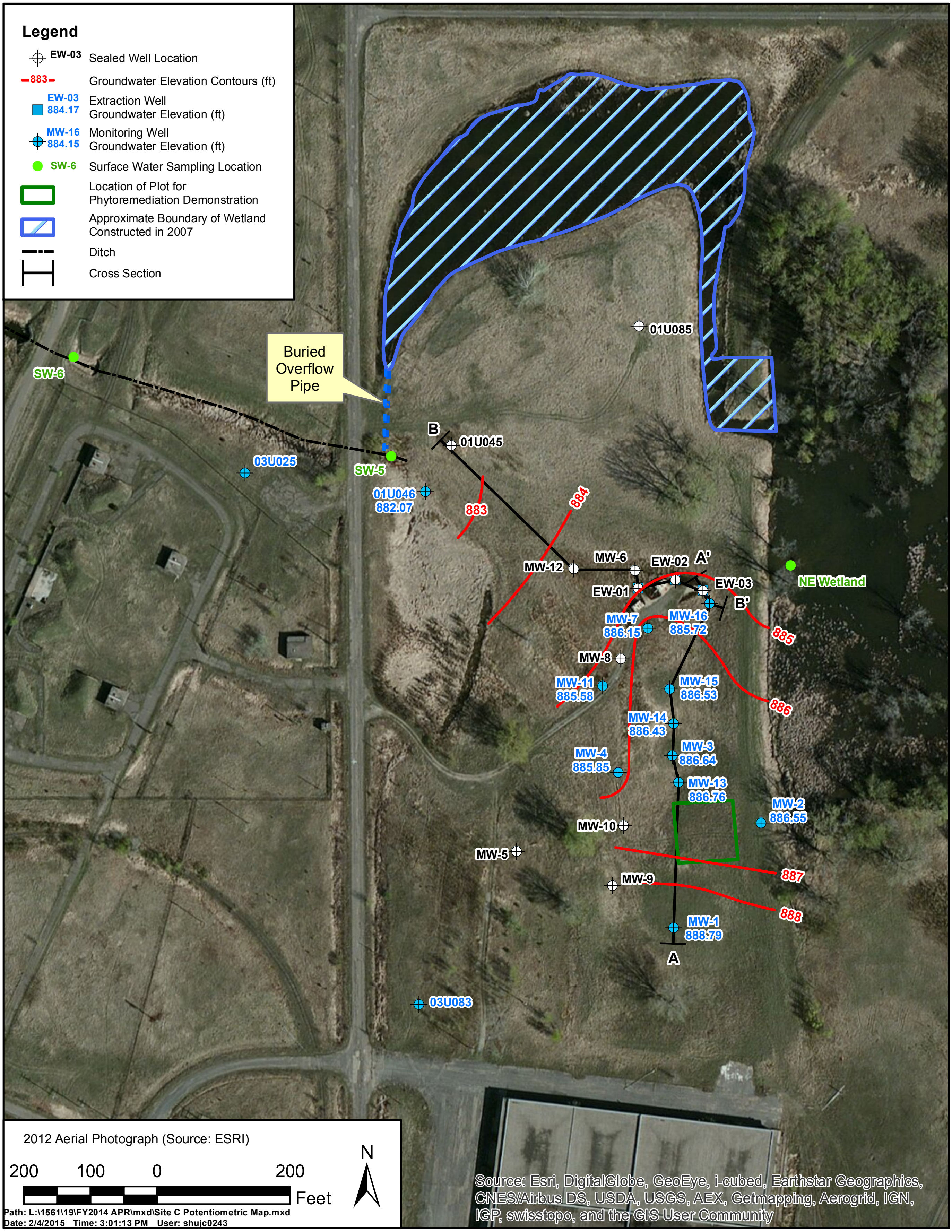
	CONTINGENCY ROLE	
	Trigger for Contingency Action(1)	Contingency Action
MW-4	If 3-event moving average > 15 µg/L	Note 3
MW-7	If 3-event moving average > 15 µg/L	Note 3
MW-11	If 3-event moving average > 15 µg/L	Note 3
MW-16	If 3-event moving average > 15 µg/L	Note 3
01U046	If 3-event moving average > 6.9 µg/L	Note 4
SW5 (2)	If one sampling event > 6.9 µg/L	Note 4
SW6 (2)	If one sampling event > 6.9 µg/L	Note 5
NE Wetland (2)	If one sampling event > 6.9 µg/L	Note 4

Notes:

1) Water quality monitoring is for dissolved lead in monitoring wells and surface water.
2) Surface water sampling is performed on three consecutive days and results are averaged for comparison to the trigger.
3) Army notify USEPA/MPCA within 1 week from receipt of data and submit an evaluation report within 30 days from notification.
4) Army notify USEPA/MPCA within 1 week from receipt of data; initiate monthly sampling of SW-5, SW-6, the NE Wetland, and the replacement wetland; and submit an evaluation report within 30 days from notification.
5) Army notify USEPA/MPCA within 1 week from receipt of data; initiate monthly sampling of SW-5, SW-6, the NE Wetland, and the replacement wetland; and submit an evaluation report within 30 days from notification. If SW-6 exceedance continues for 3 consecutive months, contain the surface water at SW-6, treat (if necessary) and discharge to sanitary sewer.



ANNUAL PERFORMANCE REPORT	WENCK ASSOCIATES	FY 2014
Site C Monitoring Plan	Responsive partner. Exceptional outcomes.	Figure 7-1



ANNUAL PERFORMANCE REPORT

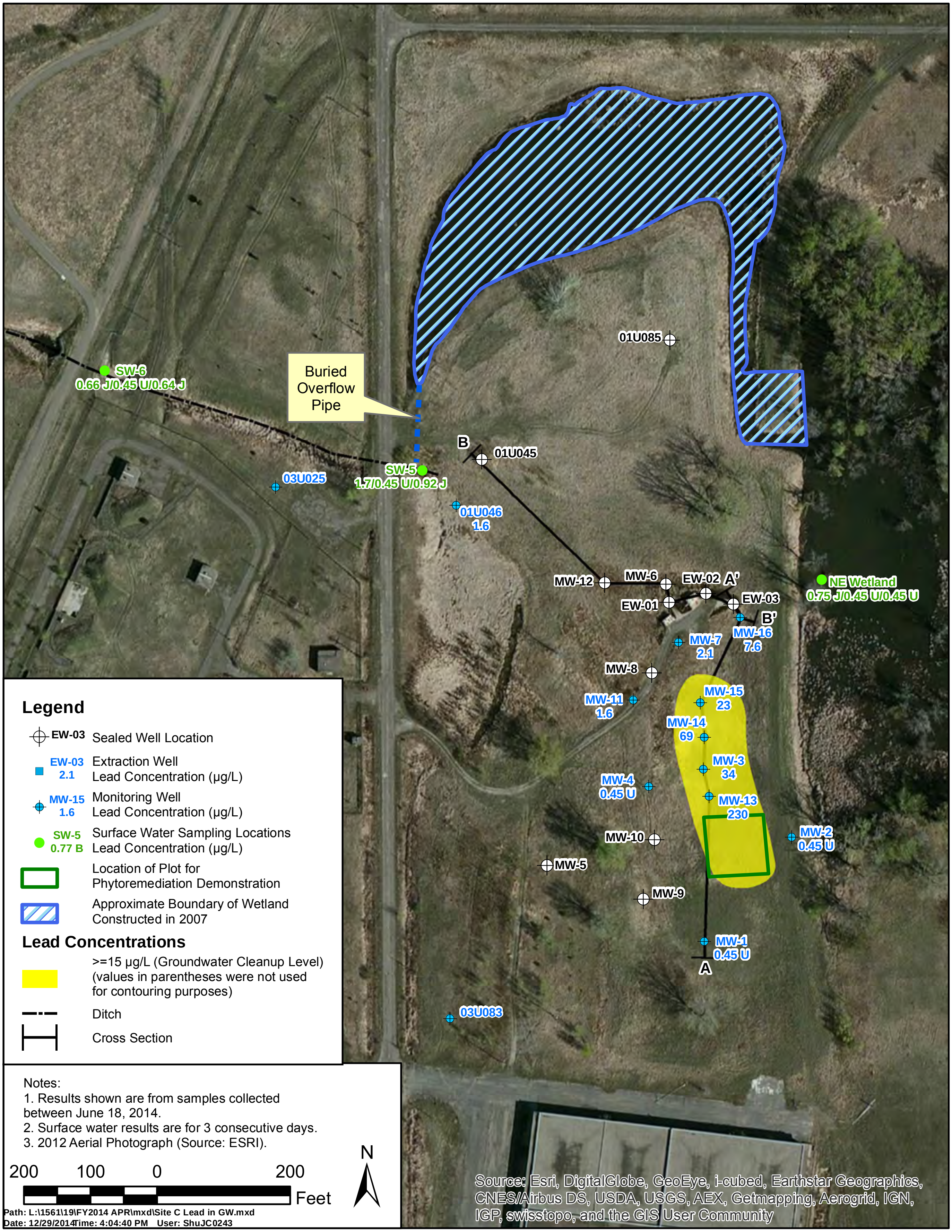
Site C, Unit 1, Potentiometric Map, June 2014

WENCK ASSOCIATES

Responsive partner. Exceptional outcomes.

FY 2014

Figure 7-2



ANNUAL PERFORMANCE REPORT

Site C, Unit 1, Lead Results, June 2014

WENCK ASSOCIATES

Responsive partner. Exceptional outcomes.

FY 2014

Figure 7-3

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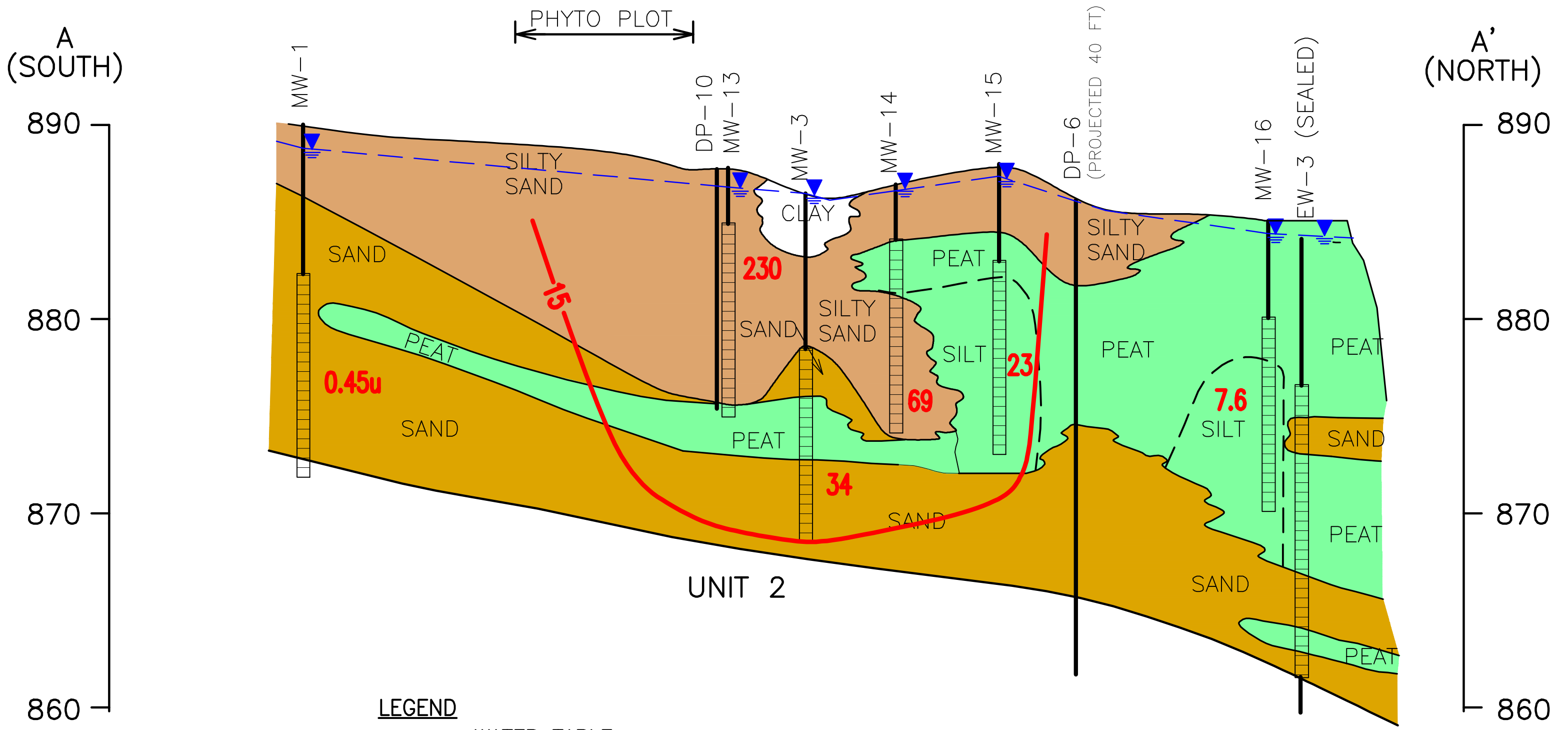
Plot Date & Time: 8 January 2015 10:14 AM



LEGEND

WATER TABLE

1.6 DISSOLVED LEAD, μg/L (JUNE 2014)

—15— 15 μg/L DISSOLVED LEAD CONCENTRATION CONTOUR (GROUNDWATER CLEANUP LEVEL)

GRAPHIC SCALE IN FEET (50, 0, 25, 50)

WENCK ASSOCIATES
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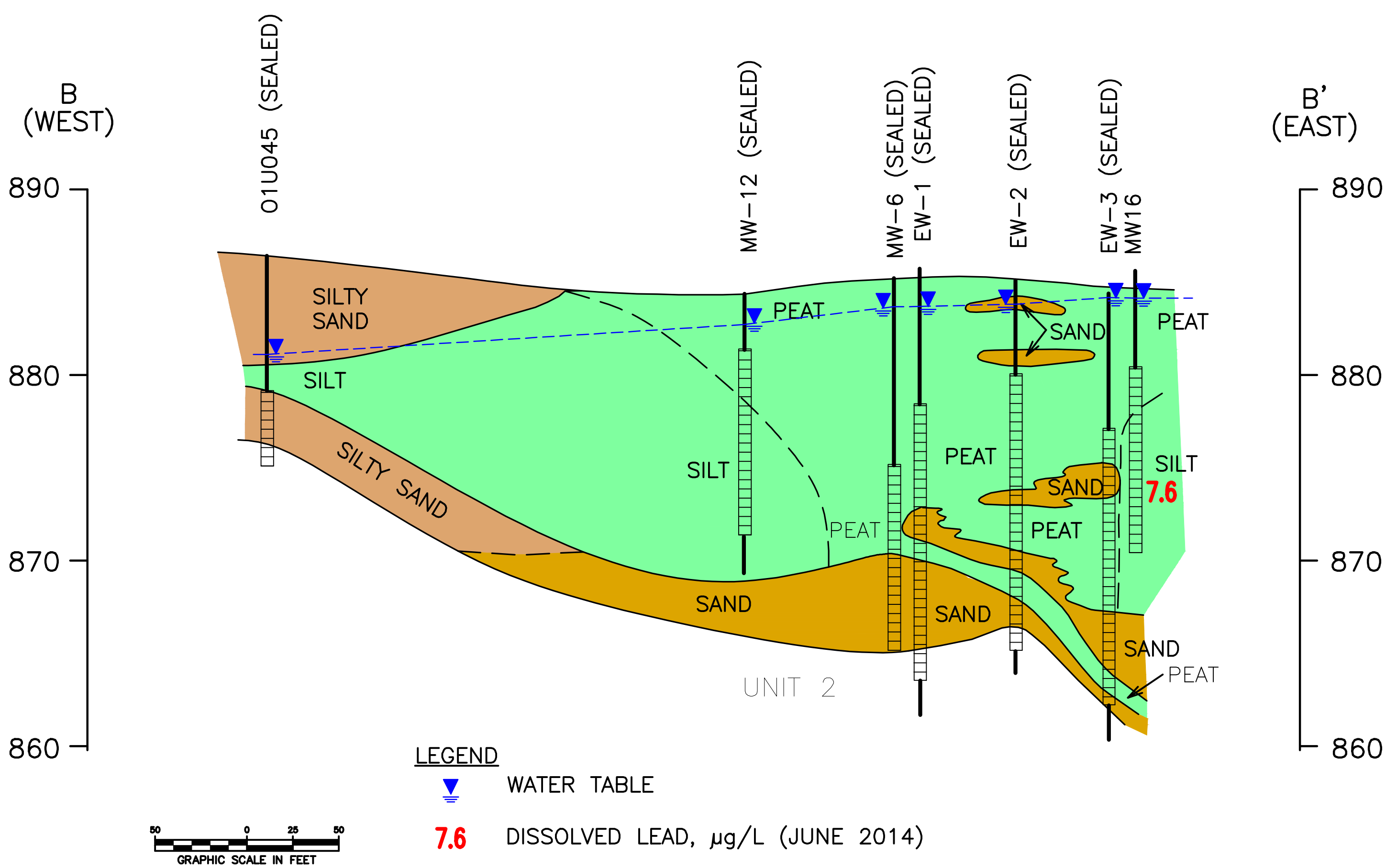
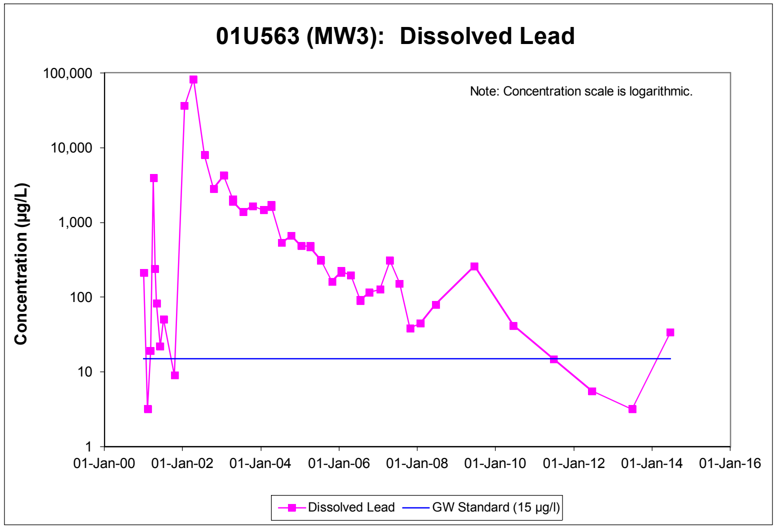
1800 PIONEER CREEK CENTER
MAPLE PLAIN, MINNESOTA
PH. 763-479-4200
FAX 763-479-4242

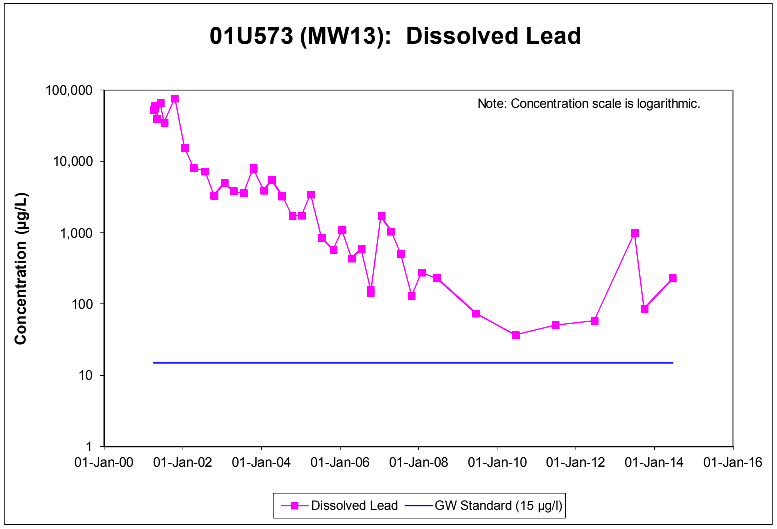
CLIENT	U.S. ARMY-TCAAP	PROJECT	FY 2014 ANNUAL PERFORMANCE REPORT								
SHEET TITLE	SITE C CROSS-SECTION A-A'										
REV	DWN	APP	REV DATE	DWN BY	CHK'D	APP'D	DWG DATE	JAN. 2015	PROJECT NO.	SHEET NO.	REV NO.
				JVB	MH	MH	SCALE	AS NOTED	1561-19	FIGURE 7-4	

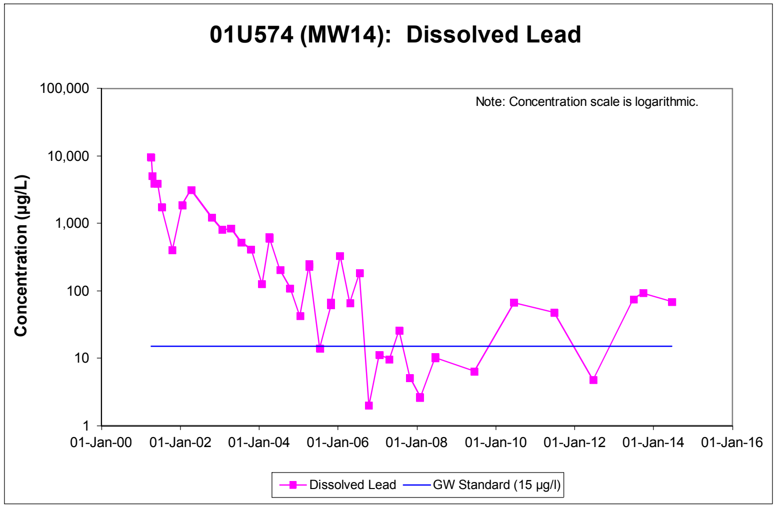


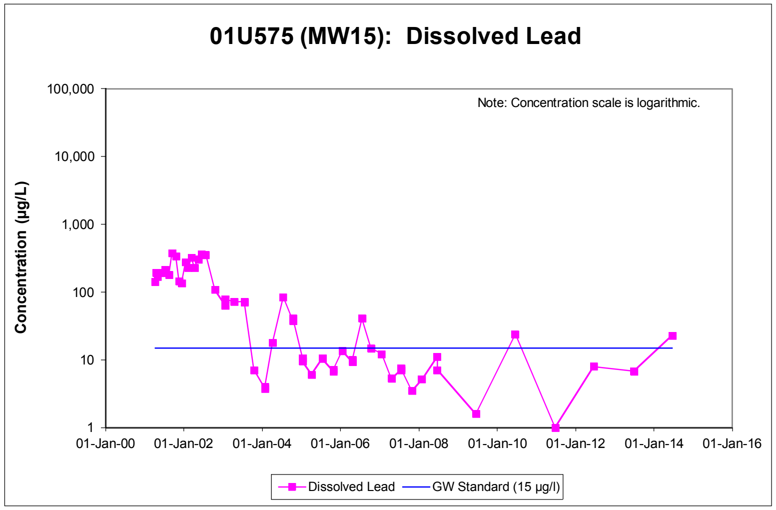
WENCK ASSOCIATES Responsive partner. Exceptional outcomes. 1800 PIONEER CREEK CENTER MAPLE PLAIN, MINNESOTA PH. 763-479-4200 FAX 763-479-4242		CLIENT U.S. ARMY-TCAAP	PROJECT FY 2014 ANNUAL PERFORMANCE REPORT		
			SHEET TITLE SITE C CROSS-SECTION B-B'		
REV / DWN / APP / REV DATE	DWN BY JVB / CHK'D MH / APP'D MH	DWG DATE JAN. 2015 SCALE AS NOTED	PROJECT NO. 1561-19	SHEET NO. FIGURE 7-5	REV NO.

FIGURE 7-6
SITE C, LEAD WATER QUALITY TRENDS: MONITORING WELLS
FY 2014 ANNUAL PERFORMANCE REPORT









8.0 Operable Unit 2: Site I Shallow Groundwater

VOCs have been identified in the Unit 1 (perched aquifer) at Site I. The selected remedy in the OU2 ROD (1997) consisted of four components:

- Groundwater monitoring
- Groundwater extraction
- POTW discharge
- Additional characterization

The additional investigation and Predesign Investigation Work Plan (Work Plan) were completed in FY 2000. Based on these documents, the remedy was proposed to consist of a dual-phase vacuum extraction system, which combined groundwater extraction with soil vapor extraction, to be installed beneath Building 502. A pilot test of dual-phase extraction subsequently determined that the technology was not feasible due to the low permeability of the Unit 1 aquifer beneath the building.

OU2 ROD Amendment #2 (2009) revised the requirements for shallow groundwater to the following:

- Groundwater monitoring
- Additional characterization
- Land use controls

These three major remedy components are evaluated in the following sections.

8.1 REMEDY COMPONENT #1: GROUNDWATER MONITORING

Description: "Groundwater monitoring to track remedy performance." (OU2 ROD, page 3)

Performance Standard (how do you know when you're done):
When a monitoring plan has been established and ongoing monitoring is in compliance with the plan.

Is the remedy component being implemented?
Yes. Table 8-1 summarizes the performance monitoring requirements, the implementing parties, and the documents that contain the monitoring plans. Appendix A summarizes the FY 2014 monitoring plan and any deviations are explained in Appendix C.2.

As previously approved by EPA/MPCA, all Site I (Building 502) Unit 1 monitoring wells were abandoned in FY 2014 prior to the demolition of Building 502. Only well 01U667 is scheduled to be replaced following the completion of Building 502 demolition and planned soil remediation. Well 01U667 was not replaced in FY 2014, so no groundwater sampling was conducted during FY 2014. Once reinstalled, monitoring well 01U667 will be sampled annually in accordance with the FY 2014 – FY 2018 Monitoring Plan (see Appendix A.1). Figure 8-1 presents a site plan for Site I, including the former locations of the now-abandoned monitoring wells, and the location of the geologic cross-section presented on Figure 8-2.

Is any groundwater sampling proposed prior to the next report? No. Monitoring well 01U667 is not expected to be reinstalled during FY 2015. It is expected that well 01U667 will be reinstalled during Spring 2016, with groundwater monitoring resuming in June 2016. Groundwater monitoring at Site I will be in accordance with the monitoring plan shown in Appendix A.1.

Are any changes or additional actions required for this remedy component? Yes. Remedy Component #1 will require modification due to the abandonment of the Unit 1 monitoring wells.

8.2 REMEDY COMPONENT #2: ADDITIONAL INVESTIGATION

Description: "Additional characterization of the Unit 1 and Unit 2 soil and groundwater." (OU2 ROD, page 3)

Performance Standard (how do you know when you're done):
When the work has been completed according to an Agency approved work plan.

Has the remedy component been implemented?
Yes. The results of the additional investigation were included in the Work Plan. The additional investigation resulted in a pilot study to evaluate the applicability of dual-phase vacuum extraction technology to the site. The report concluded that neither dual-phase extraction nor groundwater extraction is feasible at Site I. The May 2009 OU2 ROD Amendment removed the groundwater extraction and POTW discharge component of the remedy.

Are any changes or additional actions required for this remedy component? No.

8.3 REMEDY COMPONENT #3: LAND USE CONTROLS

Description: "LUCs will be established to protect the groundwater extraction, treatment, and monitoring system and to prohibit the drilling of water supply wells within the contaminated portion of the Unit 1 aquifer." (OU2 ROD Amendment #1, page 39)

Performance Standard (how do you know when you're done):
Implementation of the land use controls will continue until such time that the groundwater concentrations are below the cleanup levels.

Has a LUCRD document been approved to address land use control (LUC) issues for OU2, including Site I groundwater, and is it being implemented?

Yes. The USEPA and MPCA provided consistency approval for the Revision 2, OU2 LUCRD in June 2011 and it is being implemented by the Army.

Was an annual site inspection for land use controls conducted in FY 2014?

On July 30, 2014, the Army, National Guard, and Wenck conducted the annual inspection of OU2 sites. The checklist that was completed during the inspection is included as Appendix I.

Did the inspection identify any follow-up actions needed to maintain the protectiveness of the LUCs?

No.

8.4 OVERALL REMEDY FOR SITE I SHALLOW GROUNDWATER

Performance Standard (how do you know when you're done):

When the cleanup levels in Table 1 of the OU2 ROD have been attained throughout the areal and vertical extent of the Site I plume (OU2 ROD, page 55).

Has the Site I shallow groundwater remedy been completed (i.e., have the cleanup levels in Table 1 of the OU2 ROD been attained throughout the areal and vertical extent of the Site I plume)?

No. Groundwater monitoring was not conducted in FY 2014 due to the approved abandonment of all Unit 1 wells and Site I demolition activities; however, the most recent groundwater quality data (from FY 2013) suggests that cleanup levels have not been attained. Table 8-2 presents the most recent groundwater quality data (from FY 2013) and highlights the values that exceeded a cleanup level. The concentration of trichloroethene in former well 01U632 had decreased over time, but was still above the cleanup level in FY 2013. Results from the sampling of well 01U667 indicated concentrations of 1,2-dichloroethene and vinyl chloride remained above the cleanup levels. Figure 8-3 presents the FY 2013 Site I shallow groundwater trichloroethene and vinyl chloride sample results.

Do additional remedial measures need to be addressed? Yes. As requested by ATK in their dated August 12, 2013 and approved by the USEPA and MPCA by letter dated August 14, 2015 all Unit 1 monitoring wells were abandoned in 2014, resulting in the need for modifications to the Groundwater Monitoring Remedy Component. In accordance with the ATK request and agency approval, monitoring well 01U667 will be reinstalled at the same location and depth following completion of Building 502 demolition and planned soil remediation (expected installation to be in Spring 2016). Monitoring well 01U667 will be sampled annually in accordance with the FY 2014 – FY 2018 Monitoring Plan (see Appendix A.1).

TABLE 8-1

SUMMARY OF GROUNDWATER MONITORING REQUIREMENTS
FISCAL YEAR 2014
SITE I, OU2
ARDEN HILLS, MINNESOTA

Remedy Component		*Monitoring Requirements*	*Responsible Party*	*Documents Containing the Monitoring Plan*
#1	Groundwater Monitoring	a. Groundwater quality and water levels to track remedy progress	ATK	Site I Monitoring Plan in Annual Performance Report
#2	Additional Investigation	a. None (completed)		
#3	Land Use Controls	a. None		
OR	Overall Remedy	a. Water quality data to evaluate attainment	ATK	Site I Monitoring Plan in Annual Performance Report

TABLE 8-2

MOST RECENT GROUNDWATER QUALITY DATA (FY 2013)
SITE I, OU2
ARDEN HILLS, MINNESOTA

			cis-1,2-Dichloroethene	*trans-1,2-Dichloroethene*	*Trichloroethene*	*Vinyl Chloride*
Site I Cleanup Level [(1)]			*70 (total)*		*30*	*0.20*
Location	***Date***	***Dup***	***µg/L***	***µg/L***	***µg/L***	***µg/L***
01U064	4/26/2013		4.2	< 1.0	0.94 JP	< 1.0
01U632	4/26/2013		27	0.35 JP	120	< 1.0
01U636	4/26/2013		< 1.0	< 1.0	< 1.0	< 1.0
01U639	4/26/2013		< 1.0	< 1.0	9.5	< 1.0
01U640	4/26/2013		< 1.0	< 1.0	< 1.0	< 1.0
I01MW	4/26/2013		< 1.0	< 1.0	0.33 JP	< 1.0
I02MW	4/26/2013		< 1.0	< 1.0	0.62 JP	< 1.0
I02MW	4/26/2013	D	< 1.0	< 1.0	0.76 JP	< 1.0
I05MW	4/26/2013		< 1.0	< 1.0	1.6	< 1.0
01U667	8/13/2013		500	1.4	4.7	300

Notes:

[(1)] Cleanup levels for Site I are from the OU2 ROD. Shading indicates exceedence of the cleanup level.

D - Field Duplicate

JP - Result is qualified as estimated since the detection is below the laboratory quantitation limit.

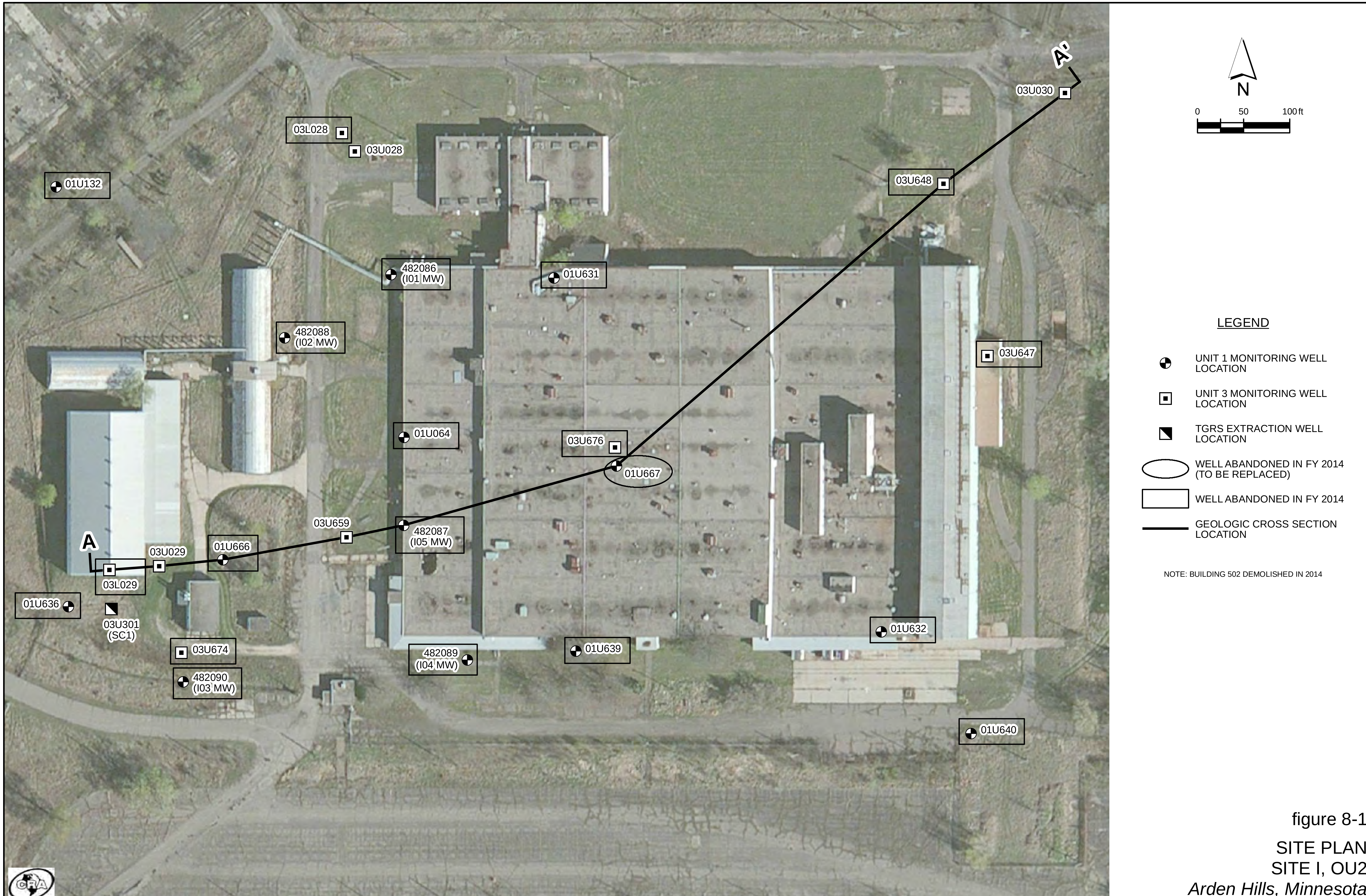
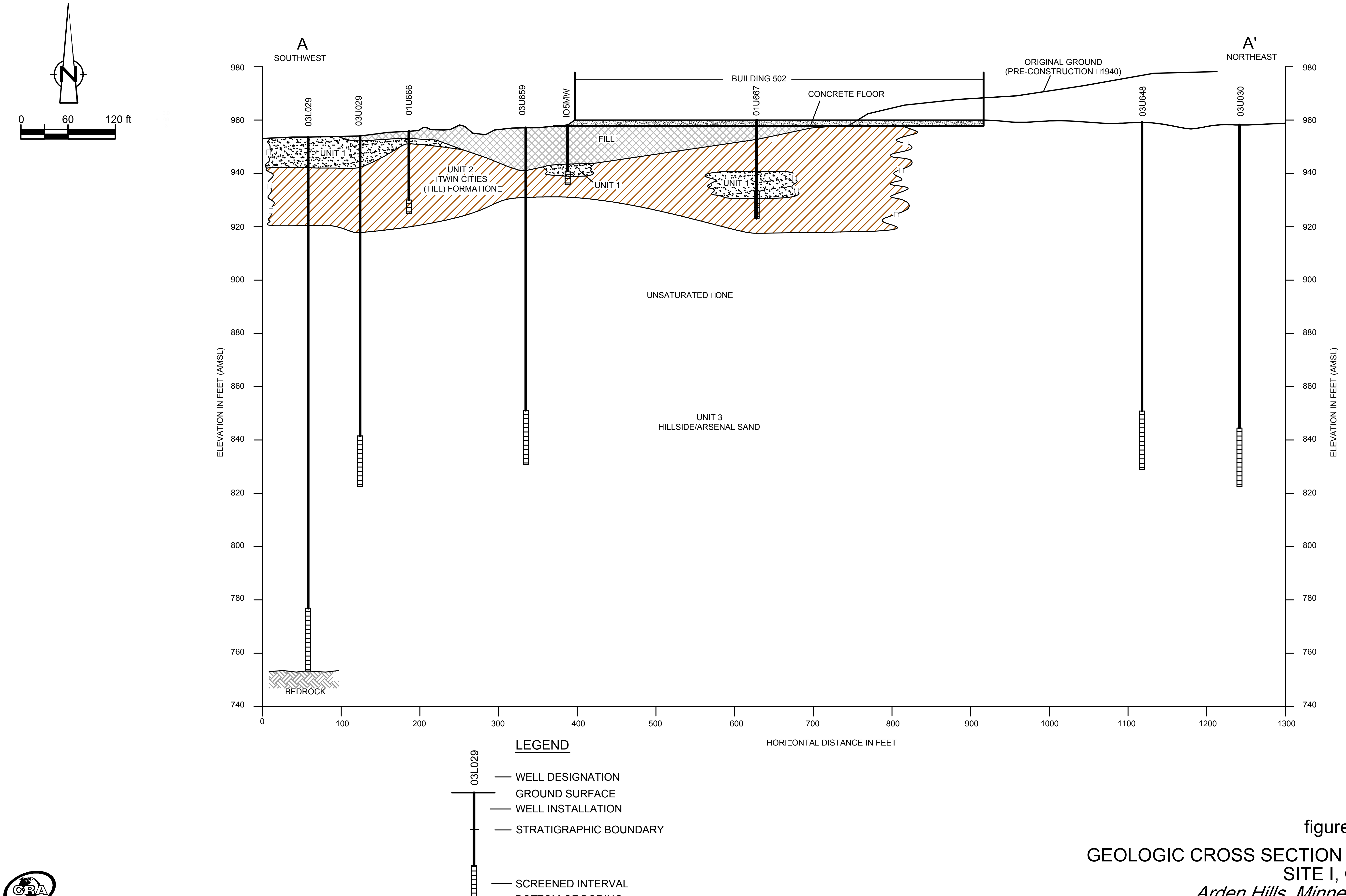


figure 8-1

SITE PLAN
SITE I, OU2
Arden Hills, Minnesota

088760-43(001)GIS-SP003 JAN 06/2015



SOURCE: STANTEC, SITE 1 CROSS SECTION DWG FILE

figure 8-2

GEOLOGIC CROSS SECTION A-A'
SITE I, OU2
Arden Hills, Minnesota

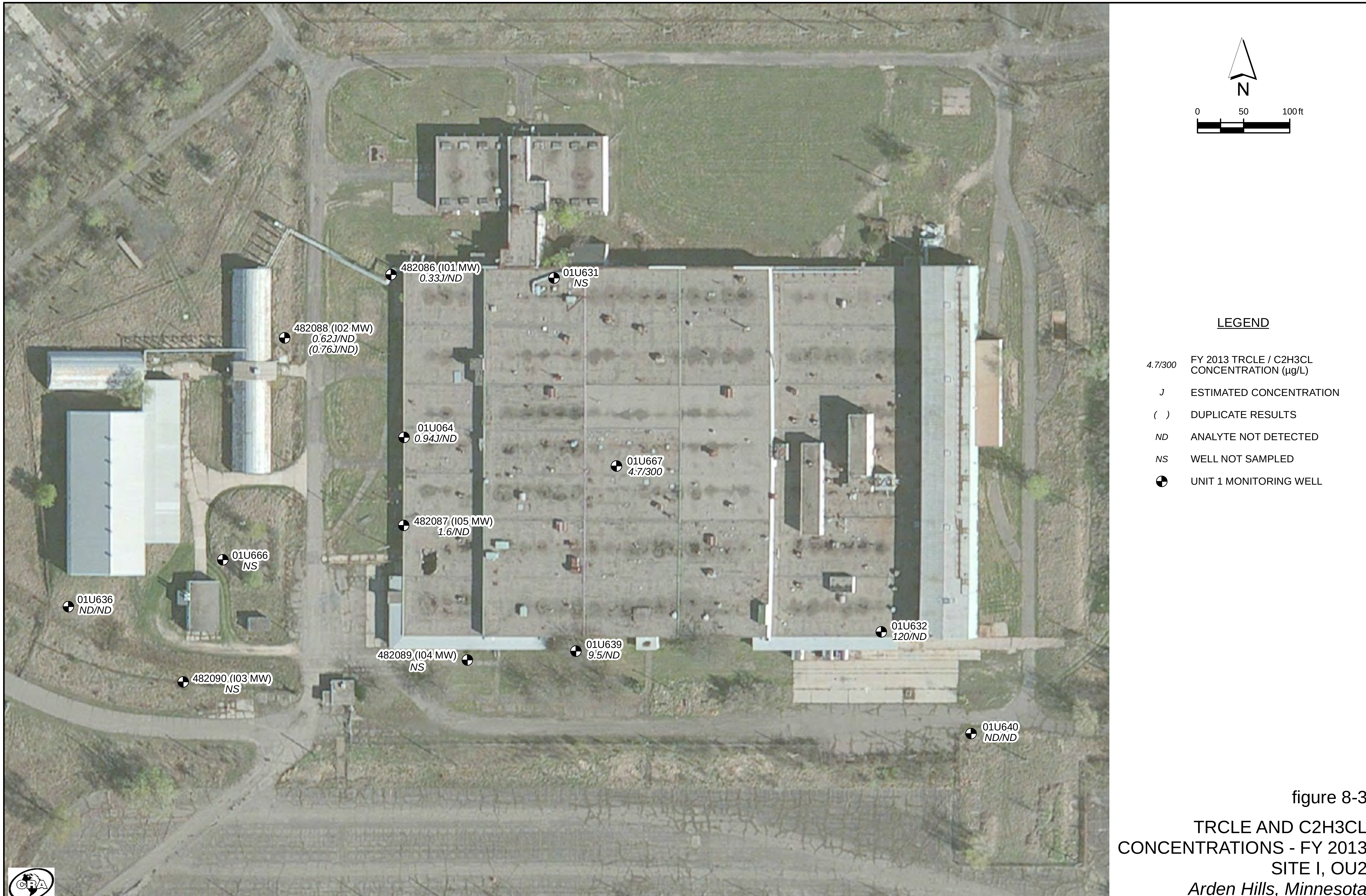


figure 8-3

TRCLE AND C2H3CL CONCENTRATIONS - FY 2013
SITE I, OU2
Arden Hills, Minnesota

088760-43(001)GIS-SP004 DEC 19/2014

9.0 Operable Unit 2: Site K Shallow Groundwater

VOC contamination has been identified in the Unit 1 (perched aquifer) at former Building 103. The limits of the VOC plume in the perched groundwater have been defined to be beneath and immediately northwest of former Building 103.

The remedy selected in the OU2 ROD consisted of seven components that incorporated the existing groundwater extraction trench and air stripper, which began operation in August 1986. The remedy also included additional investigation of the unsaturated soils beneath the building slab. OU2 ESD #1 added land use controls as a remedy component in 2009.

9.1 REMEDY COMPONENT #1: GROUNDWATER MONITORING

Description: "Groundwater monitoring to track remedy performance." (OU2 ROD, page 3)

Performance Standard (how do you know when you're done):
When a monitoring plan is established and monitoring is in compliance with the plan.

Is the remedy component being implemented?
Yes. Table 9-1 summarizes the performance monitoring requirements, the implementing parties, and the documents that contain the monitoring plans. Appendix A summarizes the FY 2014 monitoring plan and any deviations are explained in Appendix C.2.

Water levels are collected annually from the monitoring wells and bundle piezometers in the vicinity of the groundwater collection and treatment system. In FY 2014, 18 Unit 1 monitoring wells were permanently abandoned, as approved by EPA/MPCA on August 14, 2013. Two of the abandoned wells (01U619 and 01U604) had been included on the water quality sampling list, but were removed for FY 2014. The monitoring wells currently included in the Site K

Monitoring Plan were sampled in May 2014. Figure 9-1 presents the sampling and water level monitoring locations, as well as the location of the monitoring wells abandoned in FY 2014. Figure 9-1 also shows the cross-section alignment. Three additional wells 01U608, 01U609, and 01U611 were also abandoned in FY 2014, as approved by EPA and MPCA in an email dated May 7, 2014. However, these wells will be reinstalled by Spring 2016 and will remain on the annual water monitoring plan.

Is any groundwater sampling proposed prior to the next report?
Yes. Groundwater monitoring at Site K will be in accordance with the monitoring plan shown in Appendix A.1.

Are any changes or additional actions required for this remedy component?
Yes. Wells 01U608, 01U609, and 01U611, which were abandoned in 2014, may not be reinstalled until July 2015. As such, the annual sampling of the Site K wells will not be completed until August 2015.

9.2 REMEDY COMPONENT #2: SENTINEL WELLS

Description: "Installation of sentinel wells at the bottom of Unit 1 and top of Unit 3." (OU2 ROD, page 3)

Performance Standard (how do you know when you're done):
When the wells have been installed according to a regulator approved work plan.

Is the remedy component being implemented?
Yes. The upper Unit 3 sentinel well was installed in February 2000. The sentinel well was installed to monitor the potential for VOCs to migrate through the Unit 2 till and into the Unit 3 aquifer.

Existing piezometers were used to accomplish the deep Unit 1 sentry monitoring. Piezometers 01U625D, 01U626D, 01U627D, and 01U628D were used since they monitor the base of the Unit 1 aquifer near the trench. The issue is the potential for Dense Non-Aqueous Phase Liquids (DNAPLs) to migrate beneath the trench along the Unit 1/Unit 2 interface. These four piezometers are screened at that interface.

Figure 9-1 shows the location of the upper Unit 3 sentinel well (03U621) and the piezometers.

What are the results of the Unit 1 piezometer and Unit 3 sentinel well sampling?
The piezometers (Unit 1 sentinel wells) were sampled in March 2000 and the results were discussed in the FY 2000 APR. The results did not indicate the presence of DNAPLs at the Unit 1/Unit 2 interface. This was a one-time sampling event, as required by the MPCA/USEPA approved Predesign Investigation Work Plan, Site K, TCAAP, CRA, February 1999, and as documented in the Predesign Investigation Report, Site K, TCAAP, CRA, December 2001, for which concurrence was received.

The Unit 3 sentinel well (03U621) was sampled in March, July, and September 2000, of FY 2000, and in January 2001 for the quarterly sampling required by the Work Plan. After that, the well was incorporated into the regular TCAAP monitoring plan. The well was sampled in May 2014 for FY 2014. The results of the sample collected during FY 2014 are presented in Table 9-2. There were no COCs detected in the Unit 3 sentinel well at concentrations above the method detection limit.

Are any changes or additional actions required for this remedy component? No.

9.3 REMEDY COMPONENT #3: HYDRAULIC CONTAINMENT

Description: "Use of existing interceptor/recovery trench to contain the plume and remove impacted groundwater." (OU2 ROD, page 3)

Performance Standard (how do you know when you're done):
When the trench is operating as designed and capturing all groundwater exceeding the cleanup levels presented in Table 1 of the OU2 ROD, as described below.

Is the remedy component being implemented?
Yes. The groundwater collection system continues to provide capture (as described later) of the Unit 1 groundwater, upgradient of the trench and beneath the former Building 103 footprint, as designed. In FY 2014, the Building 103 slab was removed as part of the site redevelopment activities.

Is the system providing hydraulic capture of the plume?
Yes, especially under normal circumstances. However, during the spring of 2014, historically high water elevations were observed in the Site K area near and beyond the collection trench. These high elevations are believed to have caused historically high trichloroethene concentrations in monitoring well 01U603 that is approximately 50 feet downgradient from the collection trench. Well 01U603 is near the zone of capture limit of the collection trench so hydraulic containment of TRCLE may have been achieved over the year at this location even though there was such historically abnormal conditions for a few months.

Water level data are presented in Table 9-3. As shown, many wells showed historical high elevations during the May 2014 event, but returned to within historical ranges by August 2014. Figures 9-2A and 9-2B present a plan view of the groundwater contours from the May 2014 and August 2014 rounds of groundwater level measurements, respectively. For May 2014, the elevated groundwater created a flatter horizontal hydraulic gradient across the area. However, by August 2014, the groundwater elevations are approximately five feet lower and the groundwater contours are comparable to historic conditions and show a steep horizontal hydraulic gradient towards the collection trench. At nested wells, the numerically lowest water elevation was used to create the plan view contours. Monitoring wells downgradient of the extraction trench have shown consistently higher water levels than those near and upgradient of the trench; however, for May 2014 that relationship was affected by the abnormally high groundwater elevations. By August 2014, however, the groundwater contours re-established themselves back to historic conditions. This demonstrates that the horizontal hydraulic gradient has been reversed toward the extraction trench due to system operation.

During the historically high groundwater elevations in the early half of 2014, capture may have been temporarily affected. It is noted that the groundwater elevation at 01U625C is anomalously high. It was later determined that this well has been compromised and is now obstructed. However, the downgradient monitoring points at the 01U626 nest generally show an upward hydraulic gradient indicating hydraulic effects due to the collection trench. Figure 9-3B provides a vertical contour profile using August 2015 data. However, the vertical capture is less defined because some of the historical monitoring points were either abandoned (01U624A, B, C, and D and 01U628 A, B, C, and D), damaged (01U626C), or not measured (01U627A, B, C, and D). However, where measured, the observed hydraulic relationship is consistent with historical data. In particular, the upward gradient noted at the 01U626 well nest is present, which indicates hydraulic influence by the collection trench. Although 01U627 was not measured in August 2014, the groundwater data from this downgradient nested well have historically shown similar to slightly higher groundwater elevations than 01U626 throughout the vertical profile. Hence, the hydraulic influence of the collection trench pumping is noted throughout the vertical profile and indicates either inward flow from 01U627 to 01U626, or at least no flow between these two monitoring points, thus defining the limits of vertical capture across the Unit 1 aquifer. The hydraulic monitoring data demonstrate that under normal operating conditions, the collection trench is containing the plume.

Figure 9-4 presents the trichloroethene concentrations from the May 2014 annual sampling event. The plume was originally defined based on data from all of the monitoring wells. The current monitoring well network is used to confirm the plume contours and measure the progress of remediation. Thus, the contours on Figure 9-4 were drawn with consideration of the extensive historical data.

Are any changes or additional actions required for this remedy component?
No. Two monitoring wells (01U628 and 01U604) historically used to monitor hydraulic capture were abandoned in 2014 as a result of site redevelopment activities. However, existing wells (e.g., 01U603 and 01U617) located up gradient and down gradient of the collection trench provide adequate coverage to continue hydraulic and water quality monitoring of the shallow groundwater, and verify hydraulic containment at Site K. The obstruction at 01U625C will be examined and, if possible, removed and/or replaced based on review of the monitoring network. Given the consistent historical hydraulic data from this location, the remaining wells at the 01U625 nest should provide the necessary hydraulic data for assessing hydraulic capture in the future.

9.4 REMEDY COMPONENT #4: GROUNDWATER TREATMENT

Description: "Treatment of contaminated groundwater using air stripping."
(OU2 ROD, page 3)

Performance Standard (how do you know when you're done):
When the air stripping facility is treating water to the cleanup standards.

Is the remedy component being implemented?
Yes. During FY 2014, the treatment system functioned and was operational 91.7% of the time. During FY 2014, a regular maintenance schedule was maintained. Appendix F.1 summarizes operational data and events at the groundwater extraction and treatment system.

Are any changes or additional actions required for this remedy component? No.

9.5 REMEDY COMPONENT #5: TREATED WATER DISCHARGE

Description: "Discharge of treated groundwater to Rice Creek." (OU2 ROD, page 3)

Performance Standard (how do you know when you're done):
When the system is operating as designed with treated water discharge to the storm sewer that, in turn, discharges to Rice Creek. The water is required to meet the substantive requirements of Document No. MNU000579 (MPCA), which contains the state-accepted discharge limits for surface water. Sampling and analysis are performed to monitor performance (see below).

Is the remedy component being implemented?
Yes. See discussion in Section 9.6.

Are any changes or additional actions required for this remedy component? No.

9.6 REMEDY COMPONENT #6: DISCHARGE MONITORING

Description: "Monitoring to track compliance with discharge requirements."
(OU2 ROD, page 3)

Performance Standard (how do you know when you're done):
When a monitoring plan is established and is being implemented in accordance with the plan.

Is the remedy component being implemented?
Yes. Treatment system monitoring consisted of quarterly influent and effluent sampling. Influent and effluent analytical results are presented in Table 9-4 (organics) and Table 9-5 (inorganics). The discharge met all the treatment requirements during FY 2014, with the exception of total phosphorus in the effluent sample collected on December 16, 2013. The discharge concentration of total phosphorus exceeded the substantive requirements document effluent concentration limit; and therefore, the discharge was resampled on January 21, 2014 per

the requirements of the project Data Quality Objectives (Performance Monitoring QAPP, Rev. 12; Table 2e). The concentration of total phosphorus collected from the treatment system discharge on January 21, 2014 was below the defined effluent concentration limit.

Also, review of Table 9-4 shows significantly high trichloroethene concentrations in influent samples collected in June 2014 (2,300 µg/L and 1,300 µg/L), which coincided with a historically high groundwater elevation, but trichloroethene concentrations returned to the typical range (120 µg/L) in September 2014. However, even with the higher trichloroethene concentrations, the treatment system effectively reduced trichloroethene concentrations to below discharge limits.

Are any changes or additional actions required for this remedy component? No.

9.7 REMEDY COMPONENT #7: ADDITIONAL INVESTIGATION

Description: "Additional characterization of the unsaturated Unit 1 soil." (OU2 ROD, page 3)

Performance Standard (how do you know when you're done):
When the additional investigation has been completed according to a regulator approved work plan.

Is the remedy component being implemented?
Yes. The Work Plan was approved in FY 1999. A report of the investigation results received a consistency determination from the Agencies on December 6, 2001. The report defined the extent of VOC contaminated soils beneath Building 103 and refined the location of the source area. The report and subsequent follow up sampling resolved anomalous dissolved zinc, lead, and nickel data at two monitoring wells. Zinc, lead, and nickel are no longer groundwater concerns.

Are any changes or additional actions required for this remedy component? No.

9.8 REMEDY COMPONENT #8: LAND USE CONTROLS

Description: "LUCs will be established to protect the groundwater extraction, treatment, and monitoring system and to prohibit the drilling of water supply wells within the contaminated portion of the Unit 1 aquifer." (OU2 ROD Amendment #1, page 39)

Performance Standard (how do you know when you're done):
Implementation of the land use controls will continue until such time that the groundwater concentrations are below the cleanup levels.

Has a LUCRD document been approved to address land use control (LUC) issues for OU2, including Site K groundwater, and is it being implemented?
Yes. The USEPA and MPCA provided consistency approval for the Revision 2, OU2 LUCRD in June 2011 and it is being implemented by the Army.

Was an annual site inspection for land use controls conducted in FY 2014?
On July 30, 2014, the Army, National Guard, and Wenck conducted the annual inspection of OU2 sites. The checklist that was completed during the inspection is included as Appendix I.

Did the inspection identify any follow-up actions needed to maintain the protectiveness of the LUCs? No.

9.9 OVERALL REMEDY FOR SITE K

Performance Standard (how do you know when you're done):
When the cleanup levels in Table 1 of the OU2 ROD have been attained throughout the areal and vertical extent of the Site K plume (OU2 ROD, page 55).

Has the Site K shallow groundwater remedy been completed (i.e., have the cleanup levels in Table 1 of the OU2 ROD been attained throughout the areal and vertical extent of the Site K plume)?

No. Overall, the remedy for Site K continued to operate consistent with past years and in compliance with the required performance criteria.

Table 9-6 presents the VOC mass removal and monthly flow rates. The treatment system captured and treated 6,187,096 gallons of water resulting in the removal of 42.85 pounds of VOCs from the aquifer in FY 2014. The cumulative mass removal is 351.9 pounds of VOCs.

As shown on Figure 9-4, trichloroethene concentrations range from non-detect to 29,000 µg/L. The FY 2014 concentrations at wells 01U611 and 01U615, which monitor the core of the plume, showed a decrease from 11,000 µg/L to 7,600 µg/L in 01U611 and an increase from 3,300 µg/L to 3,400 µg/L in 01U615 compared to the concentrations measured in FY 2013. Trichloroethene concentrations at monitoring well 01U611 have been relatively stable over the last seven years, ranging from 4,900 µg/L to 11,000 µg/L. The FY 2014 concentration of trichloroethene at 01U615 compares with historical concentrations from the last ten years of sampling, which have ranged from 2,500 µg/L to 6,500 µg/L. Figure 9-5 shows trichloroethene and total 1,2-dichloroethene versus time for 01U611 and 01U615. Water levels measured during the FY 2014 monitoring were 2.61 feet higher at 01U611 and 4.22 feet higher at 01U615 compared to FY 2013 elevations. These wells have historically exhibited fluctuating groundwater elevations.

Monitoring well 01U603, which had always been non-detect (less than 1.0 µg/L) for trichloroethene, contained 2,000 µg/L in May 2014. Monitoring well 01U603 was resampled in July and September 2014 to confirm the results from the annual sampling. The results from resampling confirmed that elevated concentrations of trichloroethene and other VOCs are present in the well. Groundwater samples were collected downgradient of 01U603 as part of Site K geoprobe investigation. The samples were non-detect for trichloroethene and and confirm capture by the collection trench. The results of the investigation will be reported under a separate cover.

Another monitoring well in the core of the plume, 01U609, was sampled in FY 2014. The trichloroethene concentration at this well was 29,000 µg/L. Following sampling, wells 01U609, 01U608, and 01U611 were abandoned in order to facilitate Ramsey County's construction activities at the TCAAP site. As shown in the Site K Monitoring Plan presented in Appendix A.1, these wells will be replaced during Spring 2016 and included in the groundwater monitoring program. Groundwater quality samples will not be collected from 01U608 or 01U609 (water level measurements only); however, groundwater quality samples collected from 01U611 and 01U615 will provide adequate data from this vicinity in future sampling events.

Two wells (01U128 and 01U617) continue to exhibit low and relatively consistent concentrations of 1,2-dichloroethene downgradient of the groundwater collection system's capture zone. The concentrations at these wells were consistent with those measured in FY 2013 and previous years and are below the cleanup levels for Site K.

Do additional remedial measures need to be addressed? No.

9.10 OTHER RELATED ACTIVITY IN FY 2014

In FY 2014, 12 Unit 1 monitoring wells were permanently abandoned, as approved by EPA/MPCA on August 14, 2013. Three additional wells were abandoned in FY 2014, as approved on July 31, 2013 and May 7, 2014, but will be reinstalled in FY 2015. The wells were abandoned as part of the site redevelopment activities. Appendix A was modified to reflect changes in the Site K Monitoring Plan.

As a result of site redevelopment and the removal of the Building 103 concrete slab, ATK voluntarily conducted a geoprobe groundwater investigation to better define the width of the plume. The work was conducted in September 2014 and included the installation of 25 temporary PVC wells to depths between 10 and 15 feet below the ground surface using direct push technology. Groundwater samples were collected from each temporary well and analyzed for VOCs. The results of the groundwater investigation will be reported under a separate cover.

TABLE 9-1

SUMMARY OF GROUNDWATER MONITORING REQUIREMENTS
FISCAL YEAR 2014
SITE K, OU2
ARDEN HILLS, MINNESOTA

Remedy Component		*Monitoring Requirements*	*Responsible Party*	*Documents Containing the Monitoring Plan*
#1	Groundwater Monitoring	• Outlined below		
#2	Sentinel Wells	a. Water quality to monitor potential migration	ATK	Site K Monitoring Plan in Annual Performance Report
#3	Hydraulic Containment	a. Water levels for use in drawing contour maps showing capture	ATK	Site K Monitoring Plan in Annual Performance Report
		b. Pumping volumes and rates for reporting	ATK	Site K Monitoring Plan in Annual Performance Report
#4	Groundwater Treatment	• None		
#5	Treated Water Discharge	• None		
#6	Discharge Monitoring	a. Treated effluent water quality for comparison to substantive requirements criteria for discharge maximum daily concentration	ATK	Site K Monitoring Plan in Annual Performance Report
#7	Additional Investigation	a. None (completed)		

TABLE 9-2

GROUNDWATER QUALITY DATA
FISCAL YEAR 2014
SITE K, OU2
ARDEN HILLS, MINNESOTA

			cis-1,2-Dichloroethene	*trans-1,2-Dichloroethene*	*Trichloroethene*
Site K Cleanup Level [1]			***70 (total)***		***5.0***
Location	***Date***	***Dup***	***µg/L***	***µg/L***	***µg/L***
01U128	5/15/2014		1.9	0.36 JP	< 1.0
01U128	5/15/2014	D	1.9	0.39 JP	< 1.0
01U603	5/15/2014		57	21	2000
01U603	7/25/2014		150	48	5600
01U603	9/17/2014		150	51	4600
01U609	5/15/2014		3700	420	29000
01U611	5/15/2014		2100	2500	7600
01U612	9/17/2014		85	3	220
01U615	5/15/2014		550	86	3400
01U617	5/15/2014		10	0.76 JP	< 1.0
01U618	5/15/2014		5.6	1.0	7.1
01U621	5/15/2014		0.34 JP	< 1.0	< 1.0
03U621	5/15/2014		< 1.0	< 1.0	< 1.0
K04-MW	5/15/2014		< 1.0	< 1.0	< 1.0

Notes:

(1) Cleanup levels for Site K are from the OU2 ROD. Shading indicates exceedence of the cleanup level.

D - Field Duplicate

JP - Result is qualified as estimated since the detection is below the laboratory quantitation limit.

TABLE 9-3

GROUNDWATER ELEVATION MONITORING
FISCAL YEAR 2014
SITE K, OU2
ARDEN HILLS, MINNESOTA

Well ID	*Groundwater Elevation (June 3, 2013)*	*Groundwater Elevation (Historical Maximum)*	*Groundwater Elevation (May 15, 2014)*	*Groundwater Elevation (July 24, 2014)*	*Groundwater Elevation (August 15, 2014)*
01U047	874.82	875.75	875.75		
01U048	875.28	876.61	876.61		
01U052	875.84	876.64	876.64		
01U065	874.74	874.91	874.90		
01U128	876.08	877.07	877.07		
01U601	886.65	886.65	Abandoned		
01U602	885.99	886.37	Abandoned		
01U603	879.97	882.86	882.86	881.33	878.84
01U604	879.31	879.79	Abandoned		
01U605	879.24	879.61	Abandoned		
01U607	886.96	887.56	887.56		884.28
01U608	886.57	888.06	888.06		
01U609	886.63	886.83	886.83		
01U611	884.55	887.16	887.16		
01U612	880.06	884.70	884.70	880.12	878.74
01U613	886.15	886.15	Abandoned		
01U615	879.49	883.71	883.71	880.20	877.28
01U616	882.38	882.75	Abandoned		
01U617	879.76	883.22	883.22	880.45	878.17
01U618	882.69	885.58	885.58	883.30	881.50
01U619	885.58	886.60	Abandoned		
01U620	881.58	881.93	Abandoned		
01U621	880.79	883.87	883.87	881.47	879.57
01U624A	881.24	881.66	Abandoned		
01U624B	881.22	881.63	Abandoned		
01U624C	881.23	881.64	Abandoned		
01U624D	881.22	881.64	Abandoned		
01U625A	880.15	883.95	883.95		878.29
01U625B	880.12	883.90	883.90		878.21
01U625C	880.13	887.91	884.73		887.91
01U625D	880.14	883.91	883.91		878.23
01U626A	879.63	882.77	882.77		877.77
01U626B	879.67	883.50	883.50		877.61
01U626C	879.73	883.58	883.58		877.71
01U626D	879.77	883.61	883.61		877.78
01U627A	880.33	882.67	882.67		
01U627B	879.93	883.57	883.57		
01U627C	879.85	883.56	883.56		
01U627D	879.86	883.57	883.57		
01U628A	880.28	880.39	Abandoned		
01U628B	880.19	880.34	Abandoned		
01U628C	879.94	880.25	Abandoned		
01U628D	879.93	880.25	Abandoned		
482085 (K01MW)	884.18	887.09	Abandoned		
482084 (K02MW)	887.24	887.41	Abandoned		
482083 (K04MW)	880.06	885.38	885.38		881.95
03U621	854.34	855.51	855.51		

TABLE 9-4

TREATMENT SYSTEM CONCENTRATIONS (ORGANICS)
FISCAL YEAR 2014
SITE K, OU2
ARDEN HILLS, MINNESOTA

			1,1-Dichloroethane	*1,1-Dichloroethene*	*1,2-Dichloroethane*	*cis-1,2-Dichloroethene*	*trans-1,2-Dichloroethene*	*Trichloroethene*	*Vinyl chloride*
	Effluent Limit [(1)]		***--***	***7.0***	***3.8***	***70***	***100***	***10***	***0.18***
Location	***Date***		***µg/L***	***µg/L***	***µg/L***	***µg/L***	***µg/L***	***µg/L***	***µg/L***
Effluent	12/16/2013		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Effluent	12/16/2013	D	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Effluent	3/4/2014		< 1.0	< 1.0	< 1.0	0.37 JP	< 1.0	< 1.0	< 1.0
Effluent	3/4/2014	D	< 1.0	< 1.0	< 1.0	0.36 JP	< 1.0	< 1.0	< 1.0
Effluent	6/10/2014		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	2.8	< 1.0
Effluent	6/10/2014	D	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	2.8	< 1.0
Effluent	9/4/2014		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Effluent	9/4/2014	D	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Influent	12/16/2013		< 1.0	< 1.0	< 1.0	130	19	160	0.52 JP
Influent	3/4/2014		< 1.0	< 1.0	< 1.0	100	19	120	0.48 JP
Influent	6/10/2014		< 5.0	< 5.0	< 5.0	110	25	2300	< 5.0
Influent	6/30/2014	RS	< 2.0	< 2.0	< 2.0	98	17	1300	< 2.0
Influent	9/4/2014		< 1.0	< 1.0	< 1.0	72	22	120	0.41 JP

Notes:

[(1)] Substantive Requirement Document Concentration Limit, Maximum Daily Effluent Concentration
D - Field Duplicate
RS - Influent resampled on June 30th due to unusually high TRCLE concentration on June 10th
JP - Result is qualified as estimated since the detection is below the laboratory quantitation limit

TABLE 9-5

TREATMENT SYSTEM CONCENTRATIONS (INORGANICS)
FISCAL YEAR 2014
SITE K, OU2
ARDEN HILLS, MINNESOTA

			Copper	*Cyanide*	*Lead*	*Mercury*	*Silver*	*Zinc*	*Total Phosphorus*
	Effluent Limit [(1)]		***21***	***17***	***106***	***0.20***	***3.4***	***134***	***1.0***
Location	***Date***		***µg/L***	***µg/L***	***µg/L***	***µg/L***	***µg/L***	***µg/L***	***mg/L***
Effluent	12/16/2013		3.1	< 10	< 0.50	< 0.10	< 0.50	18	1.1
Effluent	1/21/2014	RS							0.94
Effluent	3/4/2014		18	< 10	< 1.0	< 0.10	< 1.0	15	0.66
Effluent	6/10/2014		3.3	< 10	< 1.0	< 0.10	< 1.0	22	< 0.50
Effluent	9/4/2014		4.3 JE	< 10	0.60 JP	< 0.10	< 1.0	110 JE	0.97

Notes:

(1) Substantive Requirement Document Concentration Limit, Maximum Daily Effluent Concentration
RS - Effluent was resampled for total phosphorus on January 21st due to exceedance of the effluent limit on December 16th
JP - Result is qualified as estimated since the detection is below the laboratory quantitation limit.
JE - Result is qualified as estimated due to outlying serial dilution result

TABLE 9-6

SUMMARY OF MONTHLY VOC REMOVAL
FISCAL YEAR 2014
SITE K, OU2
ARDEN HILLS, MINNESOTA

Month	*Total Monthly Flow (gallons)*	*Total VOC Influent (µg/L)*	*Total VOC Effluent (µg/L)*	*Total VOCs Treated (lbs)*	*Total VOCs Remaining (lbs)*	*Total VOC Mass Removed (lbs)*
Cumulative as of September 30, 2013						309.0
October[(1)]	446,890	310	0	1.15	0.00	1.15
November[(1)]	414,918	310	0	1.07	0.00	1.07
December	407,994	310	0	1.05	0.00	1.05
January[(1)]	300,666	239	0.37	0.60	0.00	0.60
February[(1)]	260,061	239	0.37	0.52	0.00	0.52
March	465,470	239	0.37	0.93	0.00	0.93
April[(1)]	560,200	2435	2.8	11.38	0.01	11.37
May[(1)]	591,004	2435	2.8	12.01	0.01	12.00
June[(2)]	649,243	1925	2.8	10.43	0.02	10.42
July[(1)]	828,808	214	0	1.48	0.00	1.48
August[(1)]	668,307	214	0	1.20	0.00	1.20
September[(1)]	593,535	214	0	1.06	0.00	1.06
Total - FY 2014						42.85
Cumulative To Date						351.9

Notes:

(1) Influent and Effluent VOC concentrations from the quarterly VOC samples collected on 12/16/2013, 3/4/2014, 6/10/2014 and 9/4/2014

(2) Due to the unusually high influent VOC concentration from the June 10th sample, a second influent VOC sample was collected on June 30th. The data presented for June is an average of the two sampling events.

figure 9-1

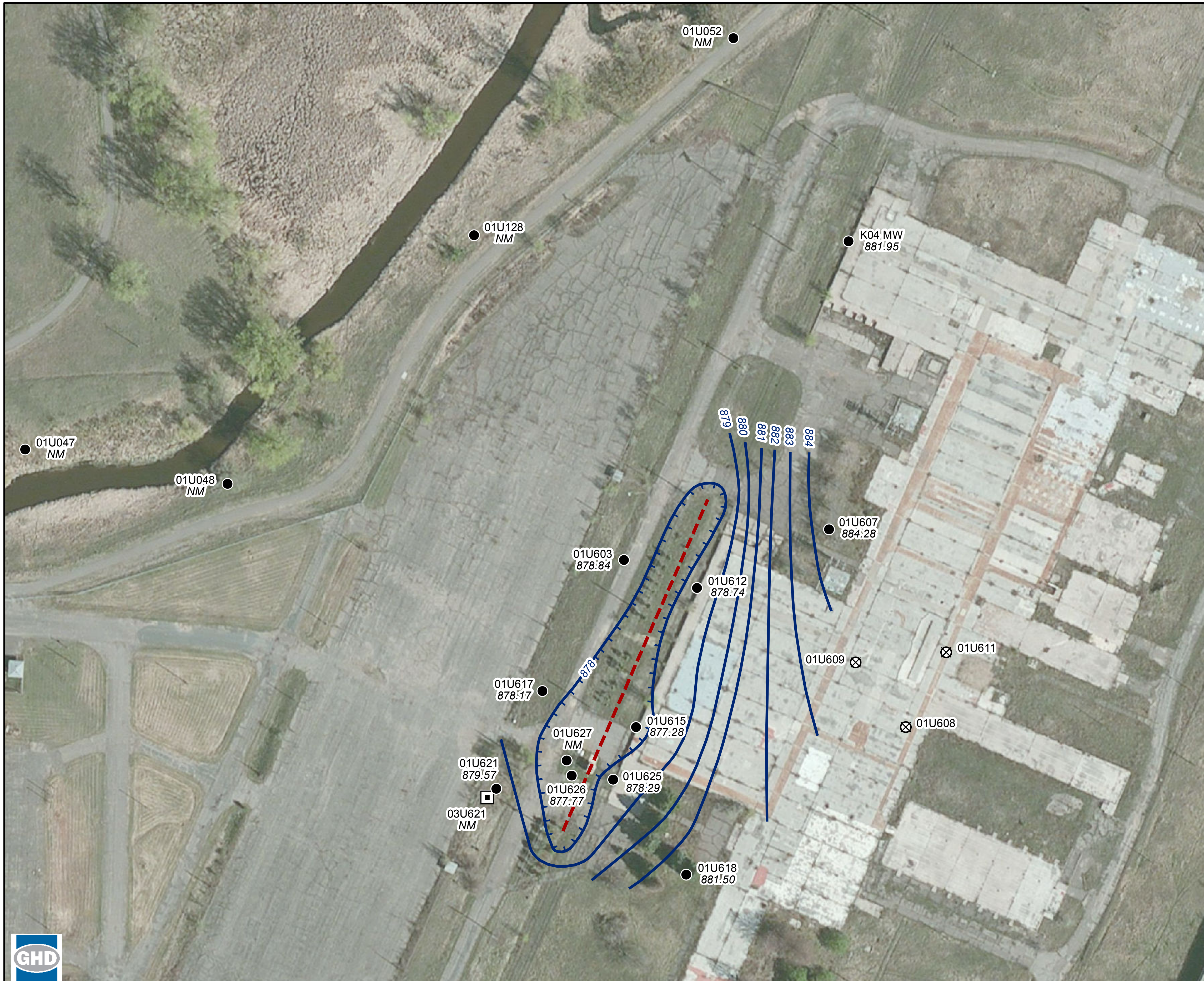
SITE PLAN
SITE K, OU2
Arden Hills, Minnesota

088760-43(001)GIS-SP005 DEC 20/2014

figure 9-2A

GROUNDWATER CONTOURS
UNIT 1 - MAY 15, 2014
SITE K, OU2
Arden Hills, Minnesota

039669-50(MEMO044)GIS-SP001 DEC 03/2015



N

0 40 80 120 ft

LEGEND

887.16	GROUNDWATER ELEVATION
NM	NOT MEASURED
	GROUNDWATER ELEVATION CONTOUR
●	ANNUAL UNIT 1 WATER LEVEL MONITORING WELL LOCATION
⊡	UNIT 3 SENTINAL WELL LOCATION
⊗	ABANDONED MONITORING WELL (TO BE REPLACED)
	SITE K COLLECTION TRENCH LOCATION

NOTE:
BUILDING 103 DEMOLISHED IN 2006;
CONCRETE SLAB REMOVED IN 2014

figure 9-2B

GROUNDWATER CONTOURS
UNIT 1 - AUGUST 15, 2014
SITE K, OU2
Arden Hills, Minnesota

039669-50(MEMO044)GIS-SP002 DEC 03/2015

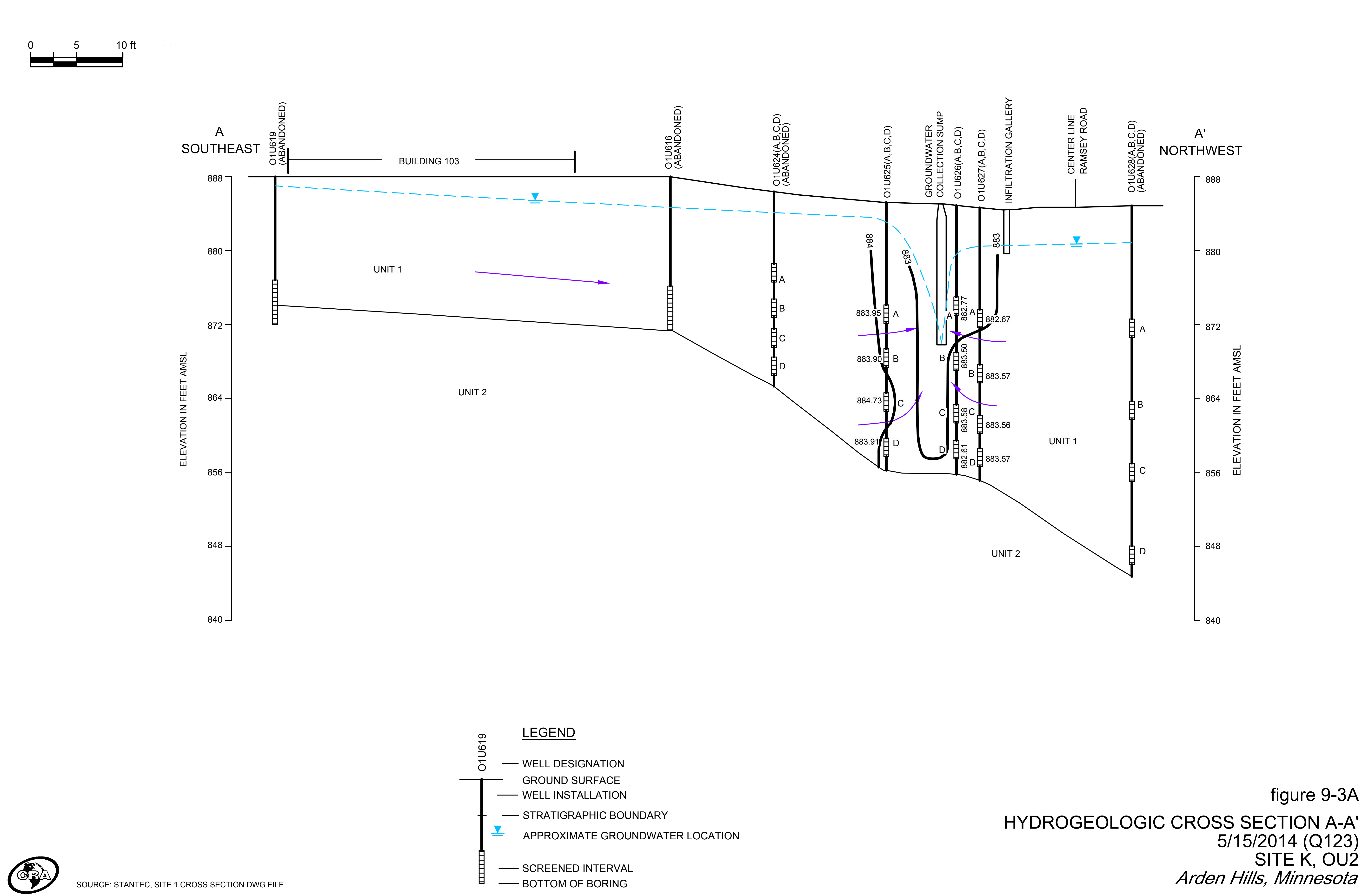
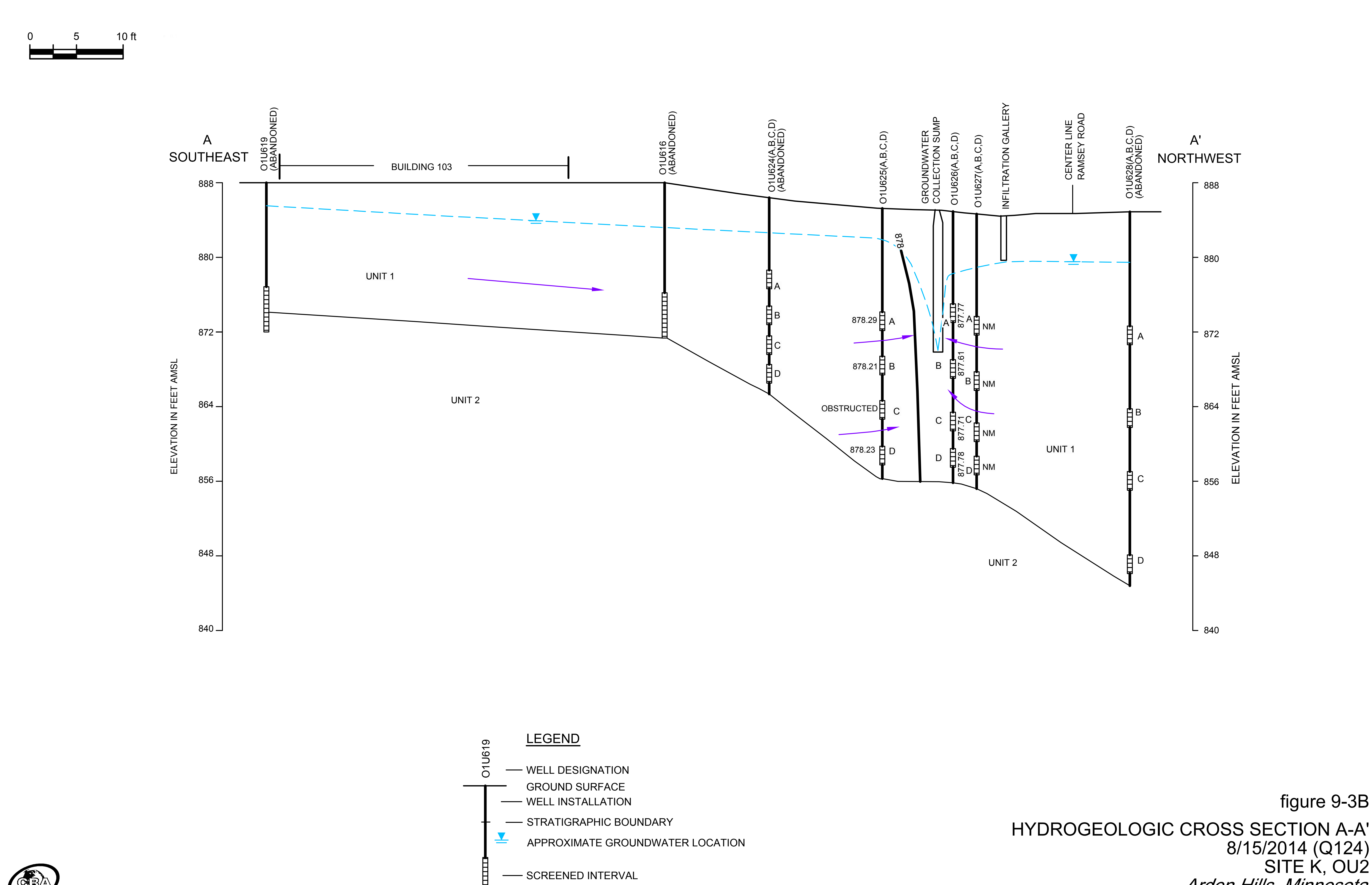


figure 9-3A

HYDROGEOLOGIC CROSS SECTION A-A'
5/15/2014 (Q123)
SITE K, OU2
Arden Hills, Minnesota



SOURCE: STANTEC, SITE 1 CROSS SECTION DWG FILE

figure 9-3B

HYDROGEOLOGIC CROSS SECTION A-A'
8/15/2014 (Q124)
SITE K, OU2
Arden Hills, Minnesota

N

0 40 80 120 ft

LEGEND

7,600 TRCLE CONCENTRATION

* NOT SCHEDULED TO BE SAMPLED

(1) TRCLE CONCENTRATION FROM RE-SAMPLING ON 7/25/2014

(2) TRCLE CONCENTRATION FROM RE-SAMPLING ON 9/17/2014

TRCLE CONCENTRATION CONTOUR

ANNUAL MONITORING WELL LOCATION

UNIT 3 SENTINAL WELL LOCATION

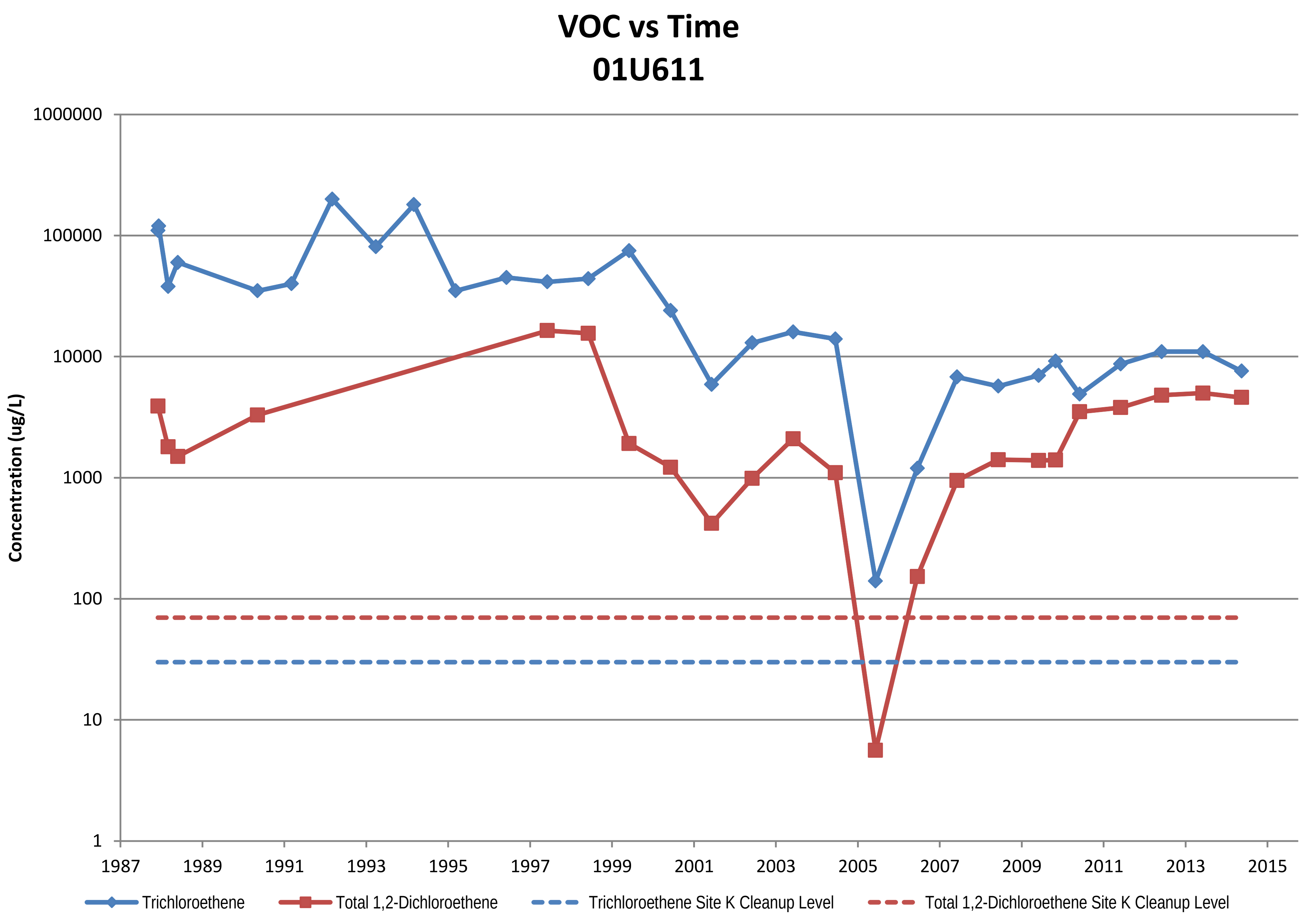
SITE K COLLECTION TRENCH LOCATION

NOTE:
BUILDING 103 DEMOLISHED IN 2006;
CONCRETE SLAB REMOVED IN 2014

figure 9-4

TRCLE CONCENTRATIONS
UNIT 1 - MAY 15, 2014
SITE K, OU2
Arden Hills, Minnesota

088760-43(001)GIS-SP007 DEC 21/2014



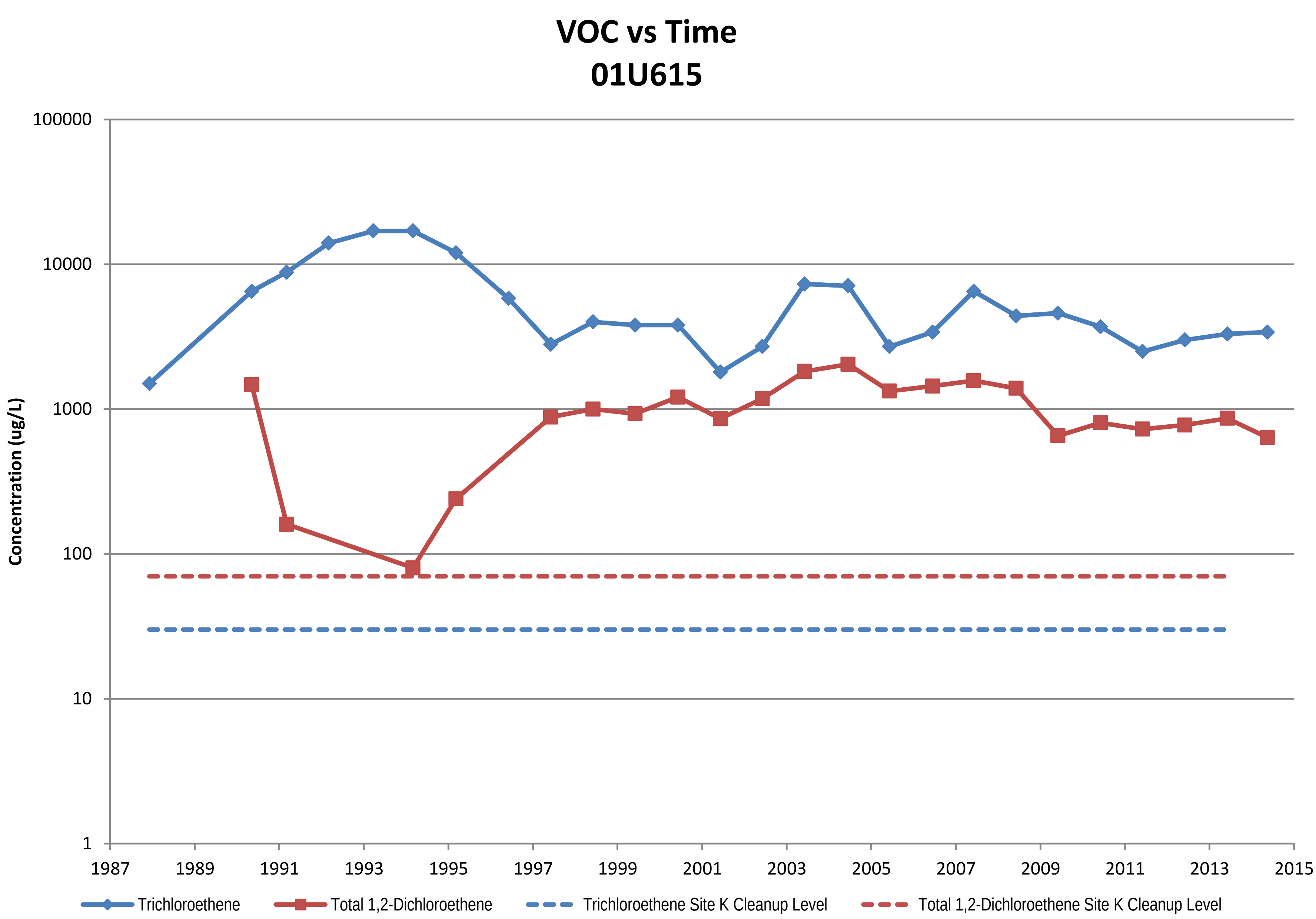


figure 9-5

VOC CONCENTRATIONS OVER TIME
WELLS 01U611 AND 01U615
SITE K, OU2
Arden Hills, Minnesota

088760-43(001)GIS-SP008 DEC 21/2014

10.0 Operable Unit 2: Building 102 Shallow Groundwater

Building 102, located as shown on Figure 10-1, was constructed in 1942 and used periodically until the 1980s for the production of small caliber ammunition and various other munitions components. Between March 2002 and February 2004, shallow (Unit 1) groundwater contamination was discovered emanating from beneath Building 102 (discovered during the Phase I and Phase II Environmental Site Assessment in support of the future transfer of the remaining TCAAP property).

Additional groundwater investigation was conducted and is documented in a Groundwater Investigation Report approved by the USEPA and MPCA in FY 2006. The Army then proceeded to address the remedy for Building 102 shallow groundwater as a non-time critical removal action under CERCLA. To support the EE/CA, additional groundwater investigation was conducted in FY 2007 and FY 2008 to further define the extent and magnitude of groundwater contamination. Delineation was completed and COCs were identified, including trichloroethene and related chlorinated VOCs (trichloroethene was found to be degrading to cis-1,2-dichloroethene and vinyl chloride through abiotic degradation). The EE/CA documenting the additional investigation work and recommending a remedy for the Building 102 shallow groundwater was approved by the USEPA and MPCA in FY 2008.

The Army Action Memorandum documenting the final remedy selection for Building 102 groundwater (monitored natural attenuation) was signed early in FY 2009. The remedy also includes LUCs to prohibit installation of water supply wells into the contaminated portion of the Unit 1 aquifer and to protect the groundwater monitoring system infrastructure (i.e., monitoring wells). OU2 ROD Amendment #4 formally documented selection of MNA and LUCs for the Building 102 groundwater remedy and thereby added this Site to the OU2 remedy.

The decision to proceed with MNA was based on the strong evidence from water quality monitoring (i.e., degradation products) and on MPCA microcosm studies that have verified that abiotic degradation of VOCs in Building 102 groundwater is occurring at substantial rates. Such degradation acts to reduce contaminant mass and mobility by breaking down the contaminants as they move downgradient. The decision to proceed with MNA was also based on the absence of any groundwater receptors.

10.1 REMEDY COMPONENT #1: MONITORED NATURAL ATTENUATION

Description: "Use of naturally-occurring abiotic degradation to limit plume mobility and to ultimately restore the aquifer." (OU2 ROD Amendment #4, page 4-1)

Performance Standard (how do you know when you're done):
When a monitoring program is established and monitoring is in compliance with the regulator approved Annual Monitoring Plan.

Is the remedy component being implemented?
Yes. Appendix A summarizes the FY 2014 monitoring plan and any deviations are explained in Appendix C.2. Details of the groundwater monitoring program are discussed in the next section.

10.2 REMEDY COMPONENT #2: GROUNDWATER MONITORING

Description: "Groundwater monitoring to track remedy performance and to verify that groundwater reaching Rice Creek does not exceed state surface water standards." (OU2 ROD Amendment #4, page 4-1)

Performance Standard (how do you know when you're done):
When a performance groundwater monitoring program has been established and ongoing monitoring is in compliance with the program.

Is this remedy component being implemented?
Yes. Table 10-1 summarizes the performance monitoring requirements, the implementing parties, and the documents that contain the monitoring plans. The FY 2014 Monitoring Plan is included in Appendix A, documenting the water quality monitoring locations and frequencies. Building 102 groundwater level data collected in June 2014 is shown as groundwater elevation contours on Figure 10-2. Note that, historically, Site K water levels have also been contoured on this same figure to provide a more complete water level map in the Site vicinity; however, Site K was monitored earlier than Building 102 this year, so the difference in monitoring dates precluded showing these contours together. Groundwater quality data collected in FY 2014 is shown in Table 10-2. Groundwater quality data for FY 2014 is also shown on plume maps for three of the chemicals of concern: trichloroethene (Figure 10-3), cis-1,2-dichlororethene (Figure 10-4), and vinyl chloride (Figure 10-5). The FY 2014 results for vinyl chloride (the chemical that has historically had the largest areal extent) are shown on geologic cross-sections A-A' (Figure 10-6) and B-B' (Figure 10-7).

Were the groundwater monitoring requirements for this remedy met? Yes.

Is any groundwater sampling proposed prior to the next report?
Yes. Groundwater monitoring at Building 102 will be in accordance with the monitoring plan shown in Appendix A.1.

Are any changes or additional actions required for this remedy component? No.

10.3 REMEDY COMPONENT #3: LAND USE CONTROLS

Description: "LUCs to restrict installation of water supply wells into the contaminated portion of the Unit 1 aquifer and to protect the infrastructure related to this alternative (monitoring wells)." (OU2 ROD Amendment #4, page 4-2)

Performance Standard (how do you know when you're done):
Implementation of the land use controls will continue until such time that the groundwater concentrations are below the cleanup levels.

Has a LUCRD document been approved to address land use control (LUC) issues for OU2, including Building 102 groundwater, and is it being implemented?
Yes. The USEPA and MPCA provided consistency approval for the OU2 LUCRD in September 2010 and it is being implemented by the Army. Revision 2 of the OU2 LUCRD was approved by the USEPA and MPCA in FY 2011; however, this revision did not affect land use controls for Building 102.

Was an annual site inspection for land use controls conducted in FY 2014?
Yes. On July 30, 2014, the Army, National Guard, and Wenck conducted the annual inspection of OU2 sites. The checklist that was completed during the inspection is included as Appendix I.

Did the inspection identify any follow-up actions needed to maintain the protectiveness of the LUCs? No.

10.4 OVERALL REMEDY FOR BUILDING 102 SHALLOW GROUNDWATER

Performance Standard (how do you know when you're done):
When the cleanup levels in OU2 ROD Amendment #4 have been attained throughout the areal and vertical extent of the Building 102 plume (OU2 ROD Amendment #4, page 2-13).

Has the Building 102 shallow groundwater remedy been completed (i.e., have the cleanup levels in the table on Page 2-13 of OU2 ROD Amendment #4 been attained throughout the areal and vertical extent of the Building 102 plume)?

No. As shown in Table 10-2, cleanup levels have not been reached throughout the areal extent of the plume and the site cannot be closed. Trichloroethene concentrations exceed the cleanup level in four of the monitoring wells, and cis-1,2-dichloroethene and vinyl chloride concentrations exceed their respective cleanup levels in one other monitoring well.

What impact is MNA having on contaminant concentrations?

Natural attenuation continues to occur at this site, with trichloroethene being the primary VOC present in the source area vicinity (01U579 and 01U580), and with primarily degradation products being present in downgradient wells (e.g., primarily cis-1,2-dichloroethene and vinyl chloride in 01L582, and only vinyl chloride in 01U048). Significant changes that were noted in the FY 2014 groundwater quality results include:

- 01U579 and 01U580 (source area): The trichloroethene concentration remained steady in 01U579 and decreased in 01U580. Historically, the concentrations in these two wells have shown relatively large increases and decreases.
- 01L582 (further downgradient of the source area): The concentration of cis-1,2-dichloroethene decreased significantly (180 to 73 μg/L) and vinyl chloride decreased slightly, continuing the decreasing trend that was observed from FY 2012 to FY 2013.
- 01U048 (adjacent to Rice Creek): Vinyl chloride was the only VOC detected in this well. Vinyl chloride increased slightly from 0.041 to 0.057 μg/L.

The FY 2011/2012 results for 01U/01L584 and 01L582 were not consistent with historical results, which had been very stable prior to FY 2011, and appeared possibly to be the result of historically high groundwater levels observed in June 2011 and June 2012. Given the unexpected VOC increases in these wells, in December 2012 the MPCA and the USEPA requested that the Army conduct supplemental groundwater investigation work. The purpose of the investigation was to acquire additional VOC data in groundwater at a location approximately halfway between 01L582 and 01U048, which is located adjacent to Rice Creek. 01L582 had been functioning as a "mid-sentinel well" before Rice Creek; however, the increasing VOC concentrations in 01L582 in FY 2011/2012 caused increased concern regarding whether an acceptable level of attenuation was still occurring prior to groundwater reaching Rice Creek. Given the sale of the property to Ramsey County and their desire to minimize permanent wells that would complicate their redevelopment plans, geoprobe methods were utilized to collect the necessary groundwater samples. This investigation work was conducted in July 2013. Nine geoprobe locations were installed on 50-foot centers approximately halfway between 01L582 and 01U048. The entire line of geoprobes was oriented perpendicular to (and approximately centered on) the axis of 01L582 and 01U048. Vertical profiling (multiple sampling depths) was conducted at four of the locations (every other location). This work was documented in "Supplemental Investigation Report for Building 102 Groundwater", prepared by Wenck, March 2014, which received regulatory consistency approval in FY 2014. The report concluded that a significant level of attenuation of the VOCs in shallow groundwater is occurring prior to reaching the line of geoprobes (i.e., prior to travelling half the distance from 01L582 to Rice Creek).

Were any trigger levels exceeded at the contingency location?
No. The contingency location is 01U048, located next to Rice Creek. The trigger level is equal to groundwater cleanup levels and no chemicals of concern for Building 102 groundwater exceeded their respective cleanup levels in FY 2014 (Table 10-2). The concentration of the only detected chemical of concern in this well, vinyl chloride, increased slightly in comparison to the FY 2013 concentration, as noted above. The FY 2014 vinyl chloride result of 0.057 µg/L was substantially below the cleanup level (trigger level) of 0.18 µg/L.

Do additional remedial measures need to be addressed? No.

Table 10-1

Summary of Building 102 Shallow Groundwater Monitoring Requirements
Fiscal Year 2014

Remedy Component		Monitoring Requirements	Implementing Party	Documents Containing the Monitoring Plan
#1:	Monitored Natural Attenuation (abiotic degradation)	a. Outlined below		
#2:	Groundwater Monitoring	a. Outlined below		
#3:	LUCs to Restrict Well Installation and to Protect the Remedy Infrastructue	a. None.		
OR:	Overall Remedy (Attainment of cleanup goals)	a. Groundwater quality data throughout the Building 102 plume to evaluate attainment and to verify that groundwater reaching Rice Creek does not exceed state surface water standards.	Army	Building 102 Monitoring Plan in the Annual Performance Report

Table 10-2
Building 102 Groundwater Quality Data

Fiscal Year 2014

			Trichloroethene (µg/L)	cis-1,2-Dichloroethene (µg/L)	1,1-Dichloroethene (µg/L)	Vinyl Chloride (µg/L)	Vinyl Chloride[(2)] (µg/L)
Building 102 Cleanup Level [(1)]			5	70	6	0.18	0.18
01U048		6/16/14	<1	<1	<1	<1	0.057
01U579		6/16/14	**48**	4.6	<1	<1	---
01U580		6/16/14	**14**	JP 0.68	<1	<1	---
01U581		6/16/14	<1	JP 0.35	<1	<1	---
01U581	D	6/16/14	<1	JP 0.37	<1	<1	---
01L581		6/16/14	**8.8**	5.0	<1	<1	---
01L581	D	6/16/14	**8.8**	5.0	<1	<1	---
01U582		6/16/14	<1	2.7	<1	<1	<0.05
01L582		6/16/14	1.2	**73**	<1	**1.1**	**0.92**
01L582	D	6/16/14	---	---	---	---	**0.79**
01U583		6/16/14	<1	<1	<1	<1	---
01L583		6/16/14	<1	<1	<1	<1	---
01U584		6/16/14	JP 0.92	<1	<1	<1	---
01L584		6/16/14	**21**	13	<1	<1	---

Notes:
(1) Cleanup levels for Building 102 Groundwater are from page 2-13 of OU2 ROD Amendment #4. Bolding (in red color) indicates exceedance of the cleanup level.
(2) This analysis of vinyl chloride is by Method 8260C-SIM to obtain a lower reporting limit for vinyl chloride.
--- Not sampled.
D Duplicate sample.
JP The value is below the Reporting Limit, but above the Method Detection Limit. Results should be considered estimated.

Operable Unit 2 of the New Brighton/ Arden Hills Superfund Site (the same area occupied by the Twin Cities Army Ammunition Plant in 1983, when the Site was placed on the NPL.)

2012 Aerial Photograph (Source: ESRI)

2,000 1,000 0 2,000 Feet

N

Path: L:\1561\19\FY2014 APR\mxd\Location of Building 102.mxd
Date: 12/22/2014 Time: 7:51:36 AM User: ShuJC0243

ANNUAL PERFORMANCE REPORT

Location of Building 102

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FY 2014

Figure 10-1

ANNUAL PERFORMANCE REPORT

Building 102, Unit 1, Potentiometric Map - June 2014

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FY 2014

Figure 10-2

ANNUAL PERFORMANCE REPORT

Trichloroethene Results - June 2014

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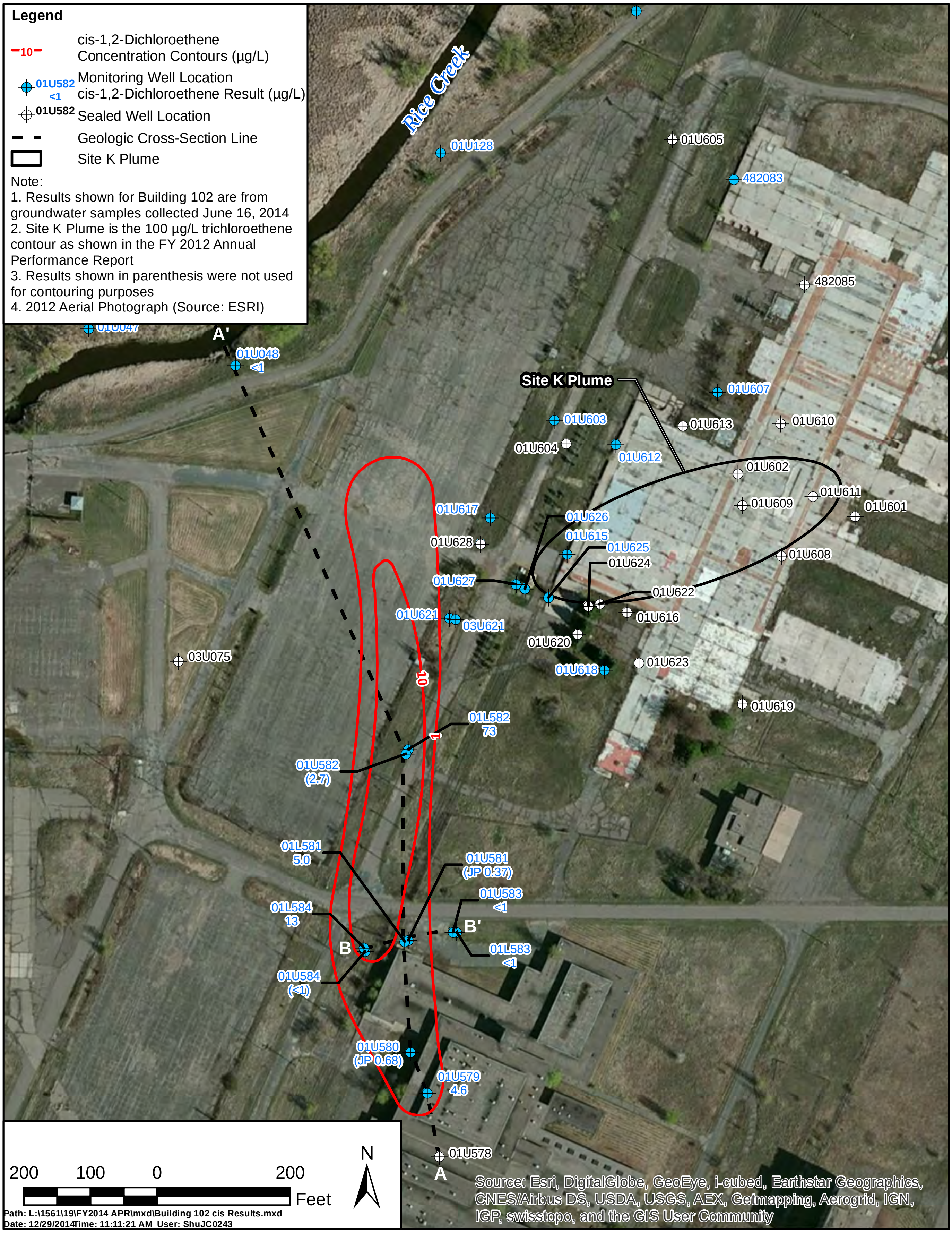
FY 2014

Figure 10-3



ANNUAL PERFORMANCE REPORT

cis-1,2-Dichloroethene Results - June 2014

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Figure 10-4

ANNUAL PERFORMANCE REPORT

Vinyl Chloride Results - June 2014

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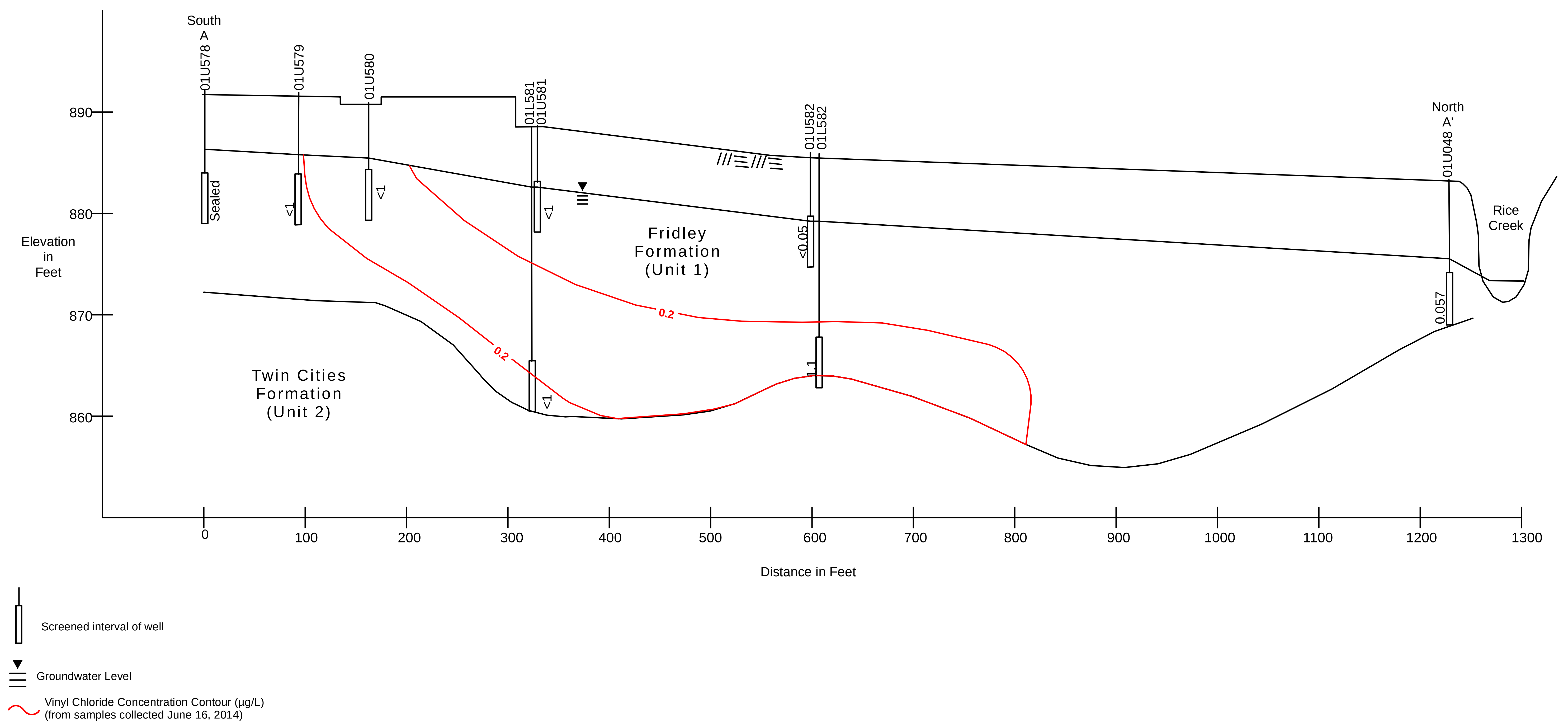
Figure 10-5



Path: L:\1561\19\FY2014 APR\mxd\Building 102 Geologic Cross Section A-A'.mxd
Date: 12/22/2014 Time: 11:45:46 AM User: ShuJC0243

ANNUAL PERFORMANCE REPORT

Geologic Cross Section A-A'

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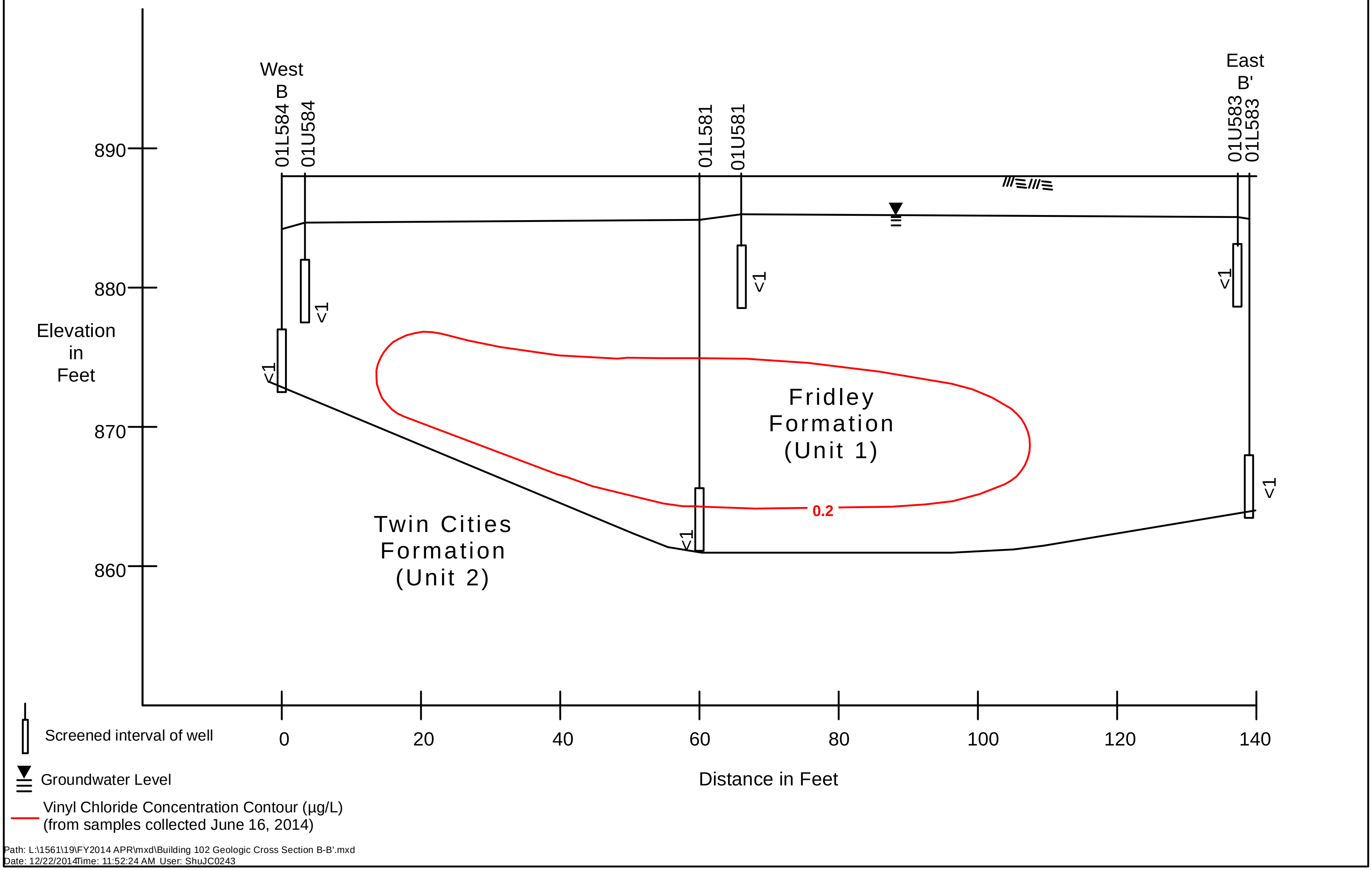
Figure 10-6



ANNUAL PERFORMANCE REPORT	FY 2014
Geologic Cross Section B-B'	Figure 10-7

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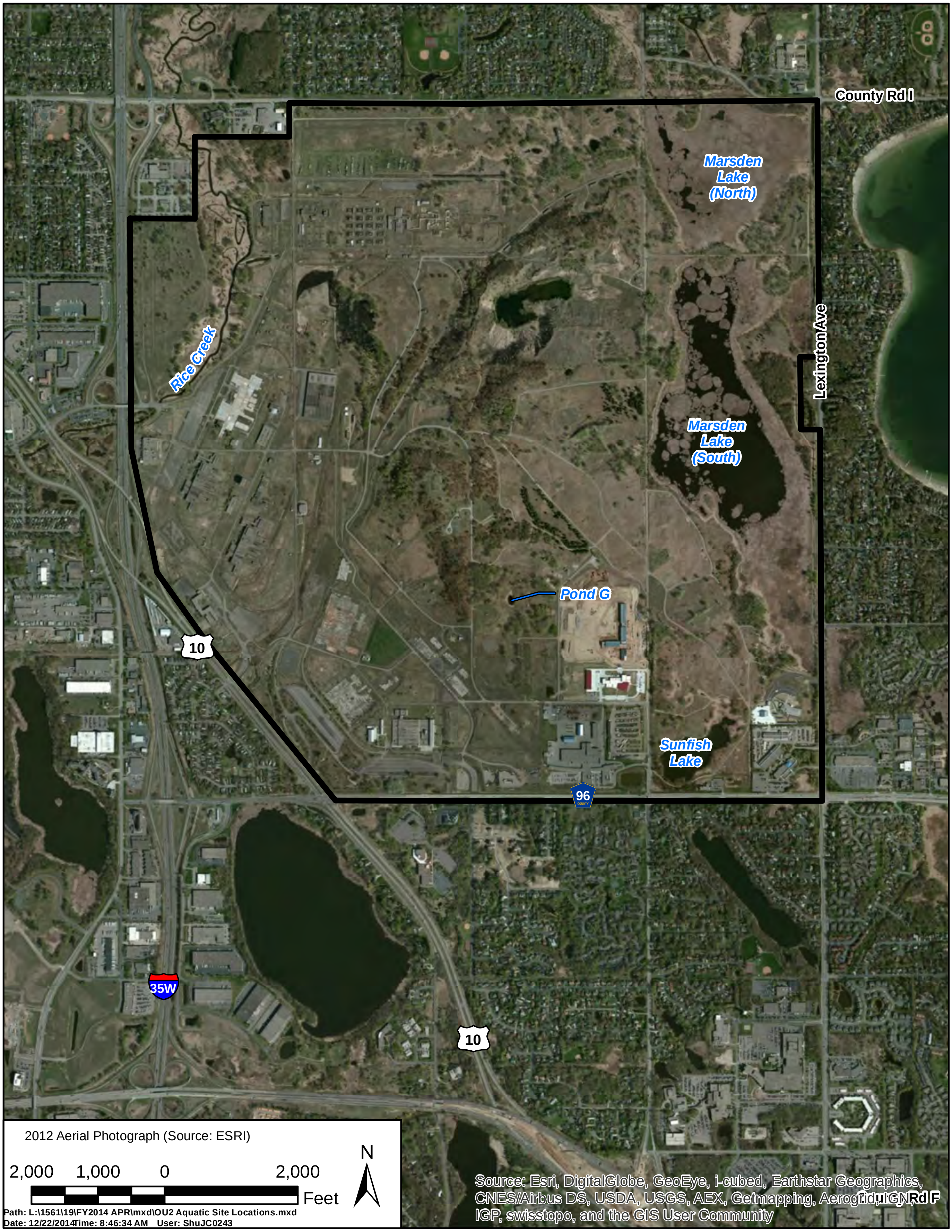
11.0 Operable Unit 2: Aquatic Sites

The Tier II Ecological Risk Assessment Report for aquatic sites, prepared by the U.S. Army Center for Health Promotion and Preventative Medicine (USACHPPM), was approved by the MPCA and USEPA in December 2004. In June 2005, the Army submitted a draft feasibility study (FS) for aquatic sites to support the risk management decisions with respect to "No Further Action" or "Implement a Remedy" for each aquatic site. As a result of comments on the draft FS, it was agreed to conduct additional sampling of Marsden Lake and Pond G, which was completed in 2008. Revised draft FS versions were submitted in January 2009, and then in April 2010. After review of the 2010 draft FS, the USEPA and MPCA requested that the Army prepare a work plan for collection of additional Round Lake sediment data (Round Lake is located off the southwest corner of OU2). Given the time required to collect the additional data, the Army, USEPA, and MPCA agreed to separate the FS into two documents: one for Round Lake and one for the OU2 aquatic sites, i.e., Rice Creek, Sunfish Lake, Marsden Lake North, Marsden Lake South, and Pond G. These sites are located as shown on Figure 11-1.

The USEPA and MPCA provided consistency for the Rice Creek, Sunfish Lake, Marsden Lake, and Pond G Feasibility Study in January 2011. No Action was recommended for Rice Creek, Sunfish Lake, Marsden Lake North, and Marsden Lake South. A remedy was recommended for Pond G (surface water hardness adjustment) in order to attain compliance with the Minnesota surface water standard for lead (Class 2Bd chronic standard). OU2 ROD Amendment #4, which documents selection of the recommended alternative, was signed in January 2012.

The USEPA and MPCA provided consistency for the Pond G RD/RA Work Plan in March 2012, and the pond was treated in June 2012. The pond surface water was then monitored in 2012 and 2013, and these results verified compliance with the surface water standard for lead. The completed Pond G remedial action work and surface water monitoring results were documented in the "Remedial Action Completion and Close Out Report, Pond G," prepared by Wenck, November 2013, which received regulatory consistency approval in FY 2014. This report recommended that the Pond G site be closed with no long-term maintenance, monitoring, or LUC requirements. The 2014 CERCLA five-year review also indicated final concurrence regarding the adequacy of the Pond G remedy, and the Pond G site has been closed. Since the completed remedy does not result in hazardous substances remaining onsite above levels that allow for unlimited use and unrestricted exposure, future CERCLA 5-year reviews are not required for Pond G and, as noted above, there are no LUC requirements.



ANNUAL PERFORMANCE REPORT

OU2 Aquatic Site Locations

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FY 2014

Figure 11-1

12.0 Operable Unit 2: Deep Groundwater

The selected remedy for the Deep Groundwater in the OU2 ROD consists of five remedial components that include continued use of the TGRS, with modifications to improve VOC contaminant removal from the source area. It also includes an annual review of new and emerging technologies potentially applicable to the Deep Groundwater. This report documents all performance and monitoring data collected from October 2013 through September 2014.

<u>Historical Design and Evaluation of TGRS Remedial Action</u>

In September 1987, a Record of Decision (1987 ROD) was prepared by the USEPA in order to implement the Interim Response Action Plan (IRAP) for TCAAP. The 1987 ROD provided specific criteria for the Boundary Groundwater Recovery System (BGRS). Following extensive interagency negotiations on the FFA and the ROD, the BGRS was started on October 19, 1987.

The BGRS consisted of six Unit 3 extraction wells (B1 through B6), that were connected by forcemain to an air stripping treatment facility. The initial six BGRS extraction wells (B1 through B6) were installed and pumping tests were conducted prior to start up of the BGRS. These pumping tests were documented in the BGRS Extraction Well Pumping Test Report.

Following the initial 90-day operation of the BGRS, the IRA–BGRS Performance Assessment Report (PAR) was prepared. The PAR assessed the hydraulic and treatment performance of the BGRS. The PAR presented an extensive database collected during the initial 90-day period of BGRS operation and prior pertinent data. The PAR also included a summary of the geology, hydrogeology, and remediation history for TCAAP. The PAR was subsequently approved by the MPCA and USEPA.

A pumping test on well B9 was conducted in August 1988 and formed the basis of the final design of the TGRS. This test, and the previous pumping tests, were utilized to determine the pumping rate required to achieve the necessary zone of capture for the TGRS; based on the plume size at that time. The PAR stated that the overall pumping rate needed for the 17 extraction wells was 2,450 gpm. During the detailed design of the TGRS, the system was designed with the capacity to operate at a maximum theoretical rate of 2,900 gpm. The additional pumpage was included to provide a safety margin for the calculations and to allow for fluctuations in system operation.

The PAR made recommendations for expansion of the BGRS into the TGRS in order to meet the Phase II remediation criteria established in the 1987 ROD. These modifications were completed and the expanded system began operation on January 31, 1989.

The 1989 Annual Monitoring Report was the first report covering the fully configured TGRS. It concluded that the TGRS developed a continuous zone of capture that was approximately 4,500 feet wide at the TCAAP boundary. The zone of capture widened to approximately 8,300 feet upgradient of the boundary. This zone of capture was demonstrated at average system pumping rates of 2,400 to 2,700 gpm.

The 1989 Annual Monitoring Report was wider in scope than subsequent annual monitoring reports for the TGRS. The 1989 report was both a performance assessment report and a monitoring report. The 1989 report represented the first year of operation of the expanded TGRS. Thus, a more detailed and exhaustive performance assessment was appropriate and possible, as there were data available from non-pumping conditions for detailed comparison with pumping conditions. Between 1990 and 2002, the system continued to operate at an essentially steady state condition, so the TGRS was evaluated by comparing the pumping rates to those achieved for the 1989 evaluation.

In FY 2003, the Army received agency approval on the TGRS Operating Strategy (OS) document. The OS was based in part on findings from the 1989 Annual Monitoring Report and presented a Global Operation Strategy (GOS) for the entire TGRS extraction system and a Micro

Operation Strategy (MOS) for selected well groups. Evaluations now consider and compare actual pumping rates to the GOS and MOS rates presented in the Final TGRS OS.

TGRS Modifications

Since 1990, a number of modifications have been made to the TGRS operation in response to changes in plume configuration or operational issues. A brief summary of the major changes is presented below:

1. Source control well SC4 was shut down in November 1996 in response to insignificant VOC mass removal by this well. SC4 operated at an average extraction rate of 29 gpm in 1989 and 45 gpm prior to shut down.
2. Boundary extraction well B12 was shut down in November 1996. The plume in the B12 area had dropped below cleanup standards for several years. Well B12 operated at an average extraction rate of 139 gpm in 1989 and 190 gpm prior to shut down.
3. As per the OS, boundary extraction well B2 was shut down and replaced with well B13 that began production in December 2002. The well screen in B2 became fouled and flow rates decreased from an average of nearly 200 gpm in the early 1990s to 52 gpm in 2002. During FY 2003, well B13 operated at maximum pumping capacity of nearly 100 gpm. The original design capacity for B13 was 200 gpm.
4. As per the OS, boundary extraction wells B7 and B10, and source control well SC3 were officially shut down in December 2002 due to the low TRCLE concentrations.
5. As per the OS, a larger capacity pump was installed at well B9 in December 2002 to raise the pumping rate from 150 gpm to approximately 300 gpm.
6. In July 2004, the TGRS was modified (Modification #3) as approved by the Agencies in May 2004. Pumps in Wells B1 and B13 were replaced and the pump in Well B13 was lowered to allow pumping below the well screen.
7. In March 2011, the TGRS was modified to allow for 2 air stripping tower treatment instead of the original design of 4 air stripping tower treatment. Wet Well Pumps 1 and 2 (WWP#1 and WWP#2 located in Wet Wells 1 and 2) and blowers 1 and 2 were shut down and the valves to Towers 1 and 2 were closed. Groundwater is effectively treated by air stripping Towers 3 and 4 while Towers 1 and 2 remain in standby.
8. Boundary extraction well B11 was shut down on February 7, 2013 as approved by the Agencies in their letter dated February 5, 2013. The plume in the B11 area had dropped below cleanup standards for several years. Well B11 operated at an average extraction rate of 178 gpm in 1989 and at approximately 100 gpm prior to shutdown.

9. Flow rates at individual wells have been modified from time to time due to plume configuration changes, operational issues, and to maintain the OS.

12.1 REMEDY COMPONENT #1: HYDRAULIC CONTAINMENT AND CONTAMINANT REMOVAL FROM THE SOURCE AREA

Description: "Groundwater extraction to hydraulically contain the contaminated source area to the 5 µg/L TRCLE concentration contour and optimize the removal of contaminants from the source area through pumping of select wells." (OU2 ROD, page 3)

Performance Standard (how do you know when you're done):
When the TGRS is containing the contaminated source area to the 5 µg/L TRCLE contour and the system is operated to maximize the contaminant removal from the source area.

Is the remedy component being implemented?
Yes. The TGRS was operated in FY 2014 consistent with the requirements of the OU2 ROD. Table 12-1 presents the cleanup requirements for the TGRS from the OU2 ROD.

During FY 2014, the TGRS average extraction rate was approximately 1,785 gpm. The total extraction well water pumping rate was above the GOS Total System Operational Minimum (1,745 gpm) where the Army and the agencies agree that OU2 ROD requirements are met with an adequate safety factor. Two of the three individual well groupings were above their respective MOS minimums for FY 2014. The B1, B11, B13 well grouping was below the MOS minimum of 415 gpm because B11 was shut down in February 2013. B11 will continue to be monitored to verify containment.

How is the system operated and what preventative maintenance measures were conducted during the year?

Summary of Operations

Beginning in FY 2003, the system operation changed to conform to the OS. Under the OS, groundwater was extracted from 9 wells along the southwest boundary of TCAAP (B1, B3, B4, B5, B6, B8, B9, B11, and B13) and three wells downgradient of interior source areas on TCAAP (SC1, SC2, and SC5). In February 2013, the Agencies approved the shutdown of B11 leaving 11 wells currently operating. Prior to the current configuration, wells B2, B7, B10, B12, SC3, and SC4 were also operating components of the system. Submersible pumps in the extraction wells discharge into a common pressurized forcemain that carries the water to the treatment system. The treatment system is located adjacent to Building 116. The TGRS layout is presented on Figure 12-1.

The TGRS was designed and constructed with three options for treated water discharge: recharge at the Arsenal Sand and Gravel Pit, discharge to Rice Creek, and discharge to the elevated water tank. Water stored in the elevated tank was "softened" and then "polished" with granular activated carbon (GAC) prior to distribution at the Facility. Due to the Army discontinuing all non-environmental services at the Facility in September 2007, the elevated water tank and the water softening and polishing equipment are no longer used. As such, the Arsenal Sand and Gravel Pit receives all of the extracted and treated water from the TGRS.

System Operation Specifications

In general, the influent and effluent water flow rates at the treatment plant are designed to be equal, thereby providing continuous operation of all processes and equipment. The following is a summary of the system design parameters:

- The groundwater extraction system, including the treatment center and 17 TGRS extraction wells, was originally designed to provide a theoretical hydraulic capacity of 2,900 gpm and a sustained daily average capacity of 2,730 gpm

- The influent to the treatment plant is divided between Towers 1 and 2, each receiving up to a maximum of 1,450 gpm.
- Wet Well Pumps 1 and 2 (WWP#1 and WWP#2 located in Wet Wells 1 and 2) transfer water to Towers 4 and 3, respectively. Each pump and tower handles up to a maximum of 1,450 gpm.
- Wet Well Pumps 3 and 4 (WWP#3 and WWP#4 located in Wet Well 3) discharge treated water to an end use at a combined rate of up to a maximum of 2,900 gpm.
- Air blowers provide air to the towers. The blowers for Towers 1 and 2 are designed to provide 6,000 – 7,000 standard cubic feet per minute (scfm) each. The blowers for Towers 3 and 4 are designed to provide 9,000 – 14,000 scfm each.

As stated earlier, the TGRS was modified to allow for 2 air stripping tower treatment instead of the original design of 4 air stripping tower treatment. This modification resulted in a reduction of energy use while still meeting the effluent discharge limit of 5 µg/L TRCLE. Wet Well Pumps 1 and 2 (40 horsepower each) and blowers 1 and 2 (5 horsepower each) were shut down and the valves to Towers 1 and 2 were closed. Since March 2010, groundwater has been effectively treated by air stripping Towers 3 and 4 while Towers 1 and 2 remain in standby.

Water level sensors within the wet wells communicate with the programmed logic controller (PLC) according to changing water levels. A complete and balanced operation should provide continuing water levels above the low-level sensors and below the high-level sensors. However, given the probability of unbalanced flows for any number of reasons (e.g., changing hydraulic heads, maintenance, repairs, temporary malfunctions), the PLC has provisions within its program to cycle-off the extraction well(s) or wet well pumps according to high water levels occurring in the wet wells; and in turn, cycle-off the wet well pumps according to low levels occurring within these wet wells.

The system operates such that the wet well pumps cycle rather than the extraction well pumps. The rationale behind this is that there are a relatively small number of motors, starters and electrically controlled valves associated with the wet wells when compared with the extraction well field. This also provides for more continuous and complete hydraulic capture within the aquifer units. However, the extraction well field will cycle if necessary, starting with the least contaminated extraction well, B7 (if operating), and followed by the other extraction wells in a predetermined sequence.

In summary, the priority of operation is as follows:

- Maintain constant operation of all extraction wells and air stripping towers above the operating minimum;
- Maintain the desired flow rates at individual wells;
- If operating in four tower mode, maintain the WWP#1 and WWP#2 pumping rate equal to or slightly above the combined pumping rate of the extraction well field; and
- Maintain treatment center WWP#3 and WWP#4 pumping rate equal to or slightly above the WWP#1 and #2 pumping rate (if operating in four tower mode) or slightly above the combined pumping rate of the extraction well field (if operating in two tower mode).

FY 2014 Maintenance and Inspection Activity

During FY 2014, the following inspection and maintenance activities occurred**:**

Preventive Maintenance (PM): The extensive PM program allowed the operations staff to identify and repair or replace equipment to avoid a downtime failure. The program consists of monthly, quarterly and annual maintenance tasks. When required, further repair work was scheduled rather than waiting for the failure to occur. A broad range of system-specific information was collected during this year's PM. This information is used to direct future repair work.

Electrical Inspection and Temperature Survey: A system-wide electrical inspection and infrared temperature survey was performed to identify loose connections and overheating components. Component overheating often precedes equipment failure. Electrical components that were identified as failing were replaced.

Verification of Flow Meters: As part of the routine PM, flow meters in the pumphouses were compared to a factory-calibrated flow meter. Flow volume measurements before and after conducting maintenance on the meters were compared to verify the consistency of measurements. Meters found to be out of calibration were replaced or recalibrated.

Daily Tracking of Flow Rates: Pumphouse and treatment center meter readings were recorded in the course of the daily inspections. Daily meter readings were tabulated and the flow rates were calculated and reviewed by the operations staff. Early detection of changes in flow rate was critical in early identification of failing equipment. By early detection of flow rate changes, equipment repair was typically scheduled before a failure occurred.

Did the system operate at a rate sufficient for complete capture?

Yes. At 1,785 gpm, the total extraction well pumping rate was above the GOS Total System Operational Minimum (1,745 gpm) where the Army and the agencies agree that capture is achieved with an adequate safety factor. Figure 12-2 plots the daily average flow rate from October 1, 2013 through September 30, 2014, and shows that the TGRS operated above the OM for the majority of the time (324 days or 89 percent of the time) in FY 2014. On a monthly basis, total TGRS extraction rates were below 1,745 gpm during the following months:

- August 2014 (1,713 gpm, lower flow rate due to B11 shutdown, multiple power outages, cleaning of the forcemain at B13, and replacing the motor at SC1)

Appendix F.2 provides additional information on the various downtimes throughout FY 2014.

The monthly and annual volume of water pumped is presented in Table 12-2 and 12-3. Table 12-2 presents the pumphouse metered monthly flow volumes of each extraction well. The individual pumphouse flow meters are used to determine the amount of groundwater extracted from the various MOS well groups, individual extraction wells, and the total amount of groundwater extracted during the fiscal year. Table 12-3 presents the combined pumphouse-metered flow volume (extraction wells) and the flow volumes metered at various stages in the treatment center along with historical data. These flow meters are used to evaluate the flow of water through the treatment process to ensure proper system operation.

As shown on Table 12-3, the TGRS successfully captured and treated approximately 937,934,854 gallons of contaminated water from October 2013 through September 2014 based on the sum of the individual pumphouse flow meters. This volume converts to an average flow rate of 1,785 gpm.

The TGRS as a whole was operational 98.2 percent of the time (i.e., 358.6 days out of 365 days in FY 2014).

Monthly Flow Reports

Each month a Monthly Flow Report is prepared. The report includes the month's meter totalizer readings, calculated flow volumes and operational notes. Flow volumes are presented on a daily basis and are totaled to provide a monthly flow volume. A compilation of FY 2014 operational notes is presented in Appendix F-2. During FY 2014, the sum of the individual pumphouse flow meters was used to measure total flow volumes in monthly reports for comparison with Operating Strategy limits. Daily variation in readings at individual wells is primarily due to differences in the time of day when meter readings were taken.

How much down time occurred during the year?

The down time for each extraction well, over the last five years, is presented in Table 12-4. A summary of average down time for the pumphouses and the treatment center by the category of failure is presented in Table 12-5. A description of each down time event, organized chronologically, is presented in Appendix F-2. The same descriptions organized by affected pumphouse, treatment center, and forcemain is presented in Appendix F-3.

Treatment center and extraction well down times resulted primarily from failure and subsequent repair of components in the pumphouses, treatment center, and electrical service. The treatment center and extraction wells were shut down for repairs less in FY 2014 than they were in FY 2013 (from 12.3 days in FY 2013 to 6.4 days in FY 2014). The decreased downtime is primarily due to less downtime in the miscellaneous category, which includes downtime due to

Site redevelopment activities. Miscellaneous category down time decreased from 4.6 days in FY 2013 to 0.5 days in FY 2014.

Description of Down Time Categories

Pumphouse component failures accounted for an average of 3.3 days down time per pumphouse. There was slightly less down time due to pumphouse maintenance in FY 2014 than there was in FY 2013. The major pumphouse repairs causing down time were:

- Pump and/or motor replacement at Pumphouses B4, B6, B9, and SC1
- ECV replacement at Pumphouse B9
- Blown fuse at Pumphouse SC1

Treatment center component failures and repairs that caused pumphouse down time consisted of electric check valve maintenance, malfunctions and repairs, and electrical control equipment failures and subsequent repairs. Treatment center component failures, repairs, and adjustments accounted for an average of 1.0 days down time per pumphouse. The major treatment center repairs causing substantial down time were PLC troubleshooting and replacement of the valve seals at ECV 4.

Electrical service system failures accounted for an average of 1.4 days down time per pumphouse. Electrical storm damage and power grid failures were the primary causes of down time.

Preventative maintenance procedures did not account for any days of down time in FY 2014. Preventative maintenance was able to be performed without interruptions to the treatment system. Preventative maintenance procedures are described in the project Operation and Maintenance Manual.

System modifications did not account for any days of down time in FY 2014.

Forcemain issues accounted for 0.2 days down time per pumphouse. The forcemain near Pumphouse B13 was cleaned to remove scale buildup in August 2014, causing downtime.

Were there any major operational changes during the year?

No.

Did the system achieve hydraulic capture?

Yes. The total extraction well water pumped was above the GOS Operational Minimum where the Army and the agencies agree that capture is achieved with an adequate safety factor. A positive sign with respect to capture is the generally stable or decreasing TRCLE concentrations evident at many wells across the TGRS boundary since FY 2001.

Groundwater elevation measurements were collected in June 2014. Appendix D contains the water level database for the monitoring wells.

How much VOC mass was removed by the system and how is it changing with time?

As discussed above, the TGRS extracted and treated approximately 937,934,854 gallons of water from October 2013 through September 2014. Based on the monthly influent and effluent VOC concentrations and the monthly flow totals as measured by the extraction well flow meters, the TGRS removed a total of 2,020 pounds of VOCs from October 2013 through September 2014. The VOC mass removal in FY 2013 was 2,082 pounds. The decrease in FY 2014 reflects an overall decrease in plume concentration. However, the FY 2014 VOC mass removal was still increased from totals observed prior to the cleaning of the forcemain near well SC5 in April 2013 that resulted in higher extraction rates at SC5. It is estimated that an additional 269 pounds of VOCs on average were removed each year from SC5 in FYs 2013 and 2014 as compared to FY 2012.

Average VOC influent concentrations decreased from 271 µg/L in FY 2013 to 260 µg/L in FY 2014 (4.1 percent lower). Table 12-6 summarizes the individual VOC mass contribution of each extraction well and the entire system. Overall, the TGRS has removed nearly 106 tons (211,282 lbs) of VOCs from the aquifers since 1987 and 15.6 tons of VOCs since the end of FY 2001 (the TGRS OS was based on data through 2001). If the annual VOC mass removal from the TGRS is less than 1,709 pounds (50 percent of the FY 2001 mass removal) then the Army and agencies have agreed that review of the OS operating minimum rates should be conducted and potentially reduced. At 2,020 pounds in FY 2014, the VOC mass removal from the TGRS is at 59 percent of the FY 2001 mass removal.

The total mass removed is based on the monthly TGRS influent and effluent sampling and flow through the treatment system. The monthly sampling of the treatment system provides the best estimate of overall mass removal, compared to the individual extraction well sampling, due to the larger number of samples and consistency in the month-to-month analytical results. The percent contributions for each well are based on the average flows from each well and the semi-annual VOC results from each well.

VOC samples were collected semi-annually from the operating extraction wells that comprise the TGRS. Wells B2 and B11 are shut down, but were temporarily operated for June 2014 sampling. Wells B7, B10, B12, SC3, and SC4 are shut down, and were not sampled, as they are now sampled biennially (next event in June 2015). Table 12-7 presents a summary of the sampling results for the extraction wells. Variations in detection limits from round to round are the result of varying sample dilution performed by the laboratory. Dilutions are required due to the high concentrations of some analytes. The locations of the extraction wells are presented on Figure 12-1.

Appendix G-1 presents TRCLE versus time graphs for each extraction well. As shown, TRCLE concentrations have declined in each well and now at many wells, the TRCLE concentrations appear to be stable or still declining. Since FY 2001, the following extraction wells have shown the most improvement (greater than 50 percent reduction) in TRCLE concentrations:

- B11 (4.8 µg/L in FY 2001 to non-detect in FY 2014 – 100% reduction)

- SC3 (5.5 µg/L in FY 2001 to 0.36 µg/L in FY 2013 – 93% reduction)
- B10 (5.1 µg/L in FY 2001 to 0.53 µg/L in FY 2013 – 90% reduction)
- B6 (230 µg/L in FY 2001 to 39 µg/L in FY 2014 – 83% reduction)
- B4 (500 µg/L in FY 2001 to 100 µg/L in FY 2014 – 80% reduction)
- B5 (410 µg/L in FY 2001 to 87 µg/L in FY 2014 – 79% reduction)
- B1 (180 µg/L in FY 2001 to 54 µg/L in FY 2014 – 70% reduction)
- SC2 (100 µg/L in FY 2001 to 36 µg/L in FY 2014 – 64% reduction)
- B3 (8.7 µg/L in FY 2001 to 3.4 µg/L in FY 2014 – 61% reduction)
- B9 (110 µg/L in FY 2001 to 50 µg/L in FY 2014 – 55% reduction)

These trends reflect the overall decline in OU2 deep groundwater contaminant concentrations. In addition, as discussed below, there had been a reduction in overall TGRS influent concentrations over the previous several years, until B11 (a clean well) was shut down in FY 2013, resulting in a slight increase to TGRS influent concentrations.

As Table 12-6 illustrates, eight wells, B1, B4, B5, B6, B9, B13, SC1 and SC5, that are located in the centers of the plume, achieve the largest rates of VOC removal. These eight wells together accounted for nearly 99 percent of the VOC mass removed.

The source control wells, SC1 through SC5, together accounted for nearly 79 percent of the VOC mass removed while accounting for only 12.0 percent of the water pumped by the system. SC5, in particular, removed over 72 percent of the total VOC mass at a rate of only approximately 124 gpm (7.0 percent of the total water pumped by the system). This illustrates the efficiency of extracting groundwater from near the source areas.

What do the long-term trends in the monitoring wells show?

A majority of wells on and off TCAAP exhibit decreasing trends in TRCLE concentration, indicating an overall improvement in water quality both upgradient and downgradient of the TGRS. Due to the complexity of the flow system, changes in flow direction over time, and the variation in chemical transport properties across the study area, the trends may not reflect a uniform or easily predictable pattern.

Several wells were identified in previous APRs, or when reviewing the FY 2014 database, that have inconsistent or upward trends in TRCLE concentrations that warrant further observation and discussion:

Well	***Trend Observation***
03L806	Trend identified in FY 2001 APR. Dropped from 1,000's of µg/L in early 1990s. TRCLE decreased steadily from 410 µg/L in 2001 to 140 µg/L in 2005. From 2006 to 2011, TRCLE concentrations varied between 120 µg/L and 240 µg/L with no apparent trend. From 2012 to 2014, TRCLE increased to 620 µg/L in 2013 and to 440 µg/L in 2014. This increase is reflected with a decrease in TRCLE concentration at well 03M806. Maintain annual sampling frequency.
04U806	Trend identified in FY 2001 APR. Dropped from 1,000's of µg/L in early to mid 1990s. TRCLE decreased steadily from 470 µg/L in 2001 to 96 µg/L in 2007. In 2008, TRCLE spiked at 380 µg/L, but concentrations decreased the next year and have varied between 130 µg/L and 220 µg/L since 2009 with no apparent trend (220 µg/L in 2014). Maintain annual sampling frequency.
03U094	Trend identified during FY 2004 data review. TRCLE increased from 170 µg/L in 2003 to 470 µg/L in 2005. Since 2005, TRCLE concentrations overall have been decreasing. In 2013, TRCLE had decreased to 80 µg/L, a historical low concentration. Maintain biennial sampling frequency (next event 2015).
03M806	Trend identified during FY 2003 data review. TRCLE concentrations dropped from near 900 µg/L in 1987, to below 100 µg/L from 1993 through 1996. Increased to 1,300 µg/L, a historical high concentration, in 2003. TRCLE concentrations have decreased from 680 µg/L in 2008 to 230 µg/L in 2014. Maintain annual sampling frequency.

Well	*Trend Observation*
03U711	Trend identified in FY 2001 APR. TRCLE concentrations decreased from near 1,000 µg/L in 1994 to 75 µg/L in 1999, but rebounded to 250 µg/L by 2004. Since 2004, concentrations have steadily decreased and were down to 44 µg/L in 2013. Maintain biennial sampling frequency (next event 2015).
03L809	Trend identified in FY 2001 APR. TRCLE concentrations decreased from over 3,000 µg/L to 67 µg/L through 1998, but rebounded to 520 µg/L by 2001. Since 2001, concentrations have decreased overall to 150 µg/L in 2013. Maintain biennial sampling frequency (next event 2015).
04U843	Trend identified in FY 2001 APR. TRCLE concentrations were below 15 µg/L from late 1980s through 1997, and then increased to between 22 µg/L and 38 µg/L from 1998 through 2001. In 2003, TRCLE dropped to below 1 µg/L, but has been steadily increasing since and is at 170 µg/L in 2013. Well is nearly 1 mile from TGRS and is part of the OU1 sampling program; therefore, moving this discussion to Section 3 is recommended. Maintain biennial sampling frequency (next event 2015).
04U841	Trend identified in FY 2001 APR. TRCLE concentrations were below 10 µg/L through 1995, and then increased to 25 µg/L in 2001. In 2003, TRCLE decreased to 5 µg/L, but rebounded to 19 µg/L in 2005. TRCLE appears to be stabilizing around 20 µg/L, with concentrations ranging between 18 and 24 µg/L since 2005 (18 µg/L in 2013). Well is nearly 0.5 mile from TGRS and is part of the OU1 sampling program; therefore, moving this discussion to Section 3 is recommended. Maintain biennial sampling frequency (next event 2015).

Well	*Trend Observation*
03U822	Trend identified during FY 2003 data review. TRCLE concentrations were below 25 µg/L through 1998, and then peaked at 375 µg/L in 1999. Concentrations have ranged between 120 and 160 µg/L from 2005 to 2013 (160 µg/L in 2013). Well is approximately 1 mile from TGRS and is part of the OU1 sampling program; therefore, moving this discussion to Section 3 is recommended. Maintain biennial sampling frequency (next event 2015).
03L822	Trend identified in FY 2001 APR. TRCLE concentration increased from below 5 µg/L during early 1990s to over 600 µg/L from 1999 through 2003. Concentrations steadily decreased from 620 µg/L in 2003 to 180 µg/L in 2011, but rebounded slightly in 2013 to 220 µg/L. Well is approximately 1 mile from TGRS and is part of the OU1 sampling program; therefore, moving this discussion to Section 3 is recommended. Well historically showed 1,1,1-trichloroethane as major contaminant. Maintain biennial sampling frequency (next event 2015).

12.2 REMEDY COMPONENT #2: GROUNDWATER TREATMENT

Description: "Groundwater treatment using air stripping." (OU2 ROD, page 3)

Performance Standard (how do you know when you're done):
When the air stripping treatment facility is treating water and meeting the clean up requirements in Table 1 of the OU2 ROD.

Is the remedy component being implemented?
Yes. The air stripping treatment facility has been operating since 1986.

Did the treatment system meet the treatment requirements in the OU2 ROD?

Yes. Influent and effluent water were sampled on a monthly basis during FY 2014. The influent/effluent database for FY 2014 is contained in Appendix G-2. Figure 12-3 presents a graph of influent TRCLE versus time. This graph is cumulative and includes data from before 1989, when the system consisted of only six extraction wells. The average FY 2014 influent TRCLE concentration was 208 μg/L, down from 218 μg/L in FY 2013. FY 2014 represents the twelfth year since the TGRS was reconfigured to achieve greater pumping in the centers of the VOC plumes and less pumping on the edges of the plumes where VOC concentrations are much lower. The influent TRCLE concentrations had been steadily decreasing for several years, likely due to the overall decrease in plume concentration, but increased in FY 2013 and remained above the FY 2012 concentration in FY 2014. However, as stated earlier, the increased influent TRCLE concentrations observed in FYs 2013 and 2014 are due, in part, to the higher extraction rate at well SC5 that resulted from the cleaning of the forcemain in April 2013, and from the shutdown of well B11 in February 2013, which was pumping clean water into the treatment system.

Figure 12-3 also presents a graph of the effluent TRCLE concentration versus time. As indicated, the effluent was below 5 μg/L TRCLE for all sampling events in FY 2014. A review of the FY 2014 database indicates that the effluent has also remained below the treatment requirements for all other VOC compounds specified in the OU2 ROD. Comparison of influent and effluent concentrations for all specified VOC compounds indicates an average removal efficiency of 99.3 percent. As expected, effluent concentrations of TRCLE increased slightly after the treatment was changed to two tower operation (two tower operation was tested in February 2011 and went into full operation in March 2011). The maximum effluent TRCLE concentration in FY 2014 was 2.4 μg/L and the average was 1.8 μg/L, both of which are well below the discharge limit.

What was the mass of VOCs emitted into the air?

The air stripping towers remove VOCs with an efficiency of approximately 99.3 percent. The air emissions are equal to the VOC mass removal rates presented in Table 12-6. Air emissions averaged 5.5 pounds per day based on the VOC mass removal rates. The total VOC emissions from October 2013 through September 2014 were 2,020 pounds.

12.3 REMEDY COMPONENT #3: TREATED WATER DISCHARGE

Description: "Discharge of treated water to the on-site gravel pit." (OU2 ROD, page 3)

Performance Standard (how do you know when you're done):

When the gravel pit is accommodating the discharge from the treatment system and allowing it to recharge to the aquifer.

Is the remedy component being implemented?

Yes. Based on visual observation during FY 2014, there were no noticeable changes in Gravel Pit performance. The Gravel Pit is accommodating the TGRS discharge as designed.

12.4 REMEDY COMPONENT #4: INSTITUTIONAL CONTROLS

Description: "Institutional controls to restrict access to contaminated aquifers and prevent exposure to contaminated groundwater." (OU2 ROD, page 4)

Performance Standard (how do you know when you're done):

When a special well construction area and alternate water supply have been established and private wells in impacted areas have been sealed.

Is the remedy component being implemented?

Yes. There are no private users of groundwater on the property and the potable water supply is no longer used. The property is a government reservation, is fenced, and access is restricted to authorized personnel.

Are any changes or additional actions required for this remedy component?

Yes. As the property transferred to Ramsey County in 2013 gets closer to actual site development, and also as the Army proceeds with establishing concurrent jurisdiction for the federally-owned property controlled by BRAC and the MNARNG (as the Army Reserve property already does), the Army, MPCA, and USEPA should coordinate with the MDH to implement a revision to the boundary of the SWCA so that it encompasses the appropriate portions of OU2.

12.5 REMEDY COMPONENT #5: REVIEW OF NEW TECHNOLOGIES

Description: "Reviews of new and emerging technologies that have the potential to cost-effectively accelerate the timeframe for aquifer restoration. Reviews shall be performed by the Army and reported annually in accordance with the consistency provisions of the TCAAP FFA." (OU2 ROD, page 4)

The intent is to consider new technologies of merit, which is not on any set schedule. To have merit, a new technology must have promise in reducing cost and the time for cleanup. There may be years where no technologies are considered. It is envisioned that at any time, any interested party (Army, USEPA, and MPCA) can suggest new technologies for consideration. If a technology is agreed to have merit by the Army, USEPA, and MPCA, then the Army will evaluate the technology. The level of effort for evaluations can range from simple literature searches to extensive treatability studies. On an annual basis, the Army will report on:

- Whether or not any new technologies were identified and considered to have merit that year

- The progress or results of any evaluations during that year
- Any planned evaluations for the following year

Performance Standard (how do you know when you're done):

When the Army reports on the status of any reviews of emerging technologies in the annual monitoring report.

Is the remedy component being implemented?

Yes. Beginning with the FY 1997 Annual Performance Report, the Army reports annually on the status of any reviews of emerging technologies.

- In September 2002, the MPCA and USEPA announced they would be conducting a natural attenuation microcosm study using carbon dating. In October 2002, Army drilled a boring at Site G to collect soil for the study. The study results were published in 2004.
- The MPCA identified a study involving the addition of vegetable oil to groundwater that is being monitored at the Navy site in Fridley, Minnesota, as a potential technology of interest.

Were any new technologies identified and considered to have merit during FY 2014?

No. The Army's review did not identify any new or emerging technologies that have the potential to cost-effectively accelerate the timeframe for aquifer restoration.

What is the status and/or findings of any previously initiated reviews of emerging technologies?

MPCA continued its research into natural attenuation processes at TCAAP. The MPCA and USEPA published the results of the microcosm study for deep groundwater sediments in 2004 showing that abiotic degradation of cis-DCE is an important factor contributing to the natural attenuation of this compound at the site. (*Non-biological Removal of cis-dichloroethylene and 1,1-dichloroethylene in aquifer sediment containing magnetite.* Environmental Science and Technology, 38: 1746-1752.)

Are any new reviews planned at this time for the coming year?
No. The Army will continue to look for emerging and new technologies, and attend relevant conferences that highlight emerging and new technologies. However, reviews of specific technologies are not planned in FY 2014.

12.6 REMEDY COMPONENT #6: GROUNDWATER MONITORING

Description: "Groundwater monitoring to track remedy performance." (OU2 ROD, page 4)

Performance Standard (how do you know when you're done):
When a regulator approved monitoring plan is in place and monitoring is conducted according to the plan.

Yes. Monitoring in FY 2014 was consistent with the OU2 ROD. Water level measurements and water quality samples were collected as stated in Appendix A.1. Appendix A summarizes the FY 2014 monitoring plan and any deviations are explained in Appendix C-2. Monitoring was as follows:

Groundwater
TGRS groundwater level measurements were collected during December 2013 and June 2014 according to the monitoring plan. Appendix D contains the comprehensive groundwater quality and water level database for the TGRS monitoring wells. Water quality samples were collected from TGRS wells according to the monitoring plan. Groundwater samples were collected at wells stated in Appendix A.1. All wells were sampled for VOC (8260B) analysis. FY 2014 was a "small round" year in the biennial sample program; samples were collected from a select list of wells. Table 12-8 presents the groundwater quality data for FY 2014.

Results from the 2014 groundwater sampling showed that most of the wells sampled continued to have declining or stable TRCLE concentrations. The most notable decreasing trend is at

03M806, which had a TRCLE concentration of 680 µg/L as recently as 2008, but has decreased to 230 µg/L in 2014. There was also a notable decrease at 03L806 (620 µg/L in 2013 to 440 µg/L in 2014), ending a steady upward trend observed since 2010 when this well had decreased to 120 µg/L. Both of these wells are likely located in a hydraulic stagnation zone, which may explain their shifting upward and downward trends, and were discussed in more detail earlier in Section 12.1.

Several wells showed a slight increase in TRCLE concentration in 2014; however, the general trend at most wells since 1999 appears to be declining or stable. The increases were most notable at 04U806 (170 µg/L in 2013 to 220 µg/L in 2014) and 03U093 (92 µg/L in 2013 to 140 µg/L in 2014). Concentrations at both of these wells have fluctuated up and down over the last several years. Well 03U093 is within the hydraulic capture zone of the TGRS system, while 04U806 is likely in a hydraulic stagnation zone. Both of these wells are currently sampled on an annual basis and will continue to be monitored. No further sampling beyond the scheduled events is necessary at this time.

The TGRS OS estimated the width of the 5 µg/L TRCLE plume at the source area to be 3,600 feet based on FY 2001 analytical data. Since that time, 15.6 tons of VOCs have been removed from the groundwater. TRCLE concentrations are decreasing across the site, especially at the following wells that have been below 5 µg/L since 2001: B10, SC4, 03L021, 03L833, 03U701, 04J702, 04U701, 04U702, and 04U833. Monitoring well 03U672 along the southern end outside 5 µg/L TRCLE plume has decreased from 3.1 µg/L in 2001 to not detectable (below 1 µg/L) since 2003. In addition, B11, which is no longer operated, reported a June 2014 TRCLE concentration of not detectable.

As a result, the width of TRCLE plume is narrowing. According to the TGRS OS, overall TGRS operating goals will be reviewed if the source area plume width shrinks to 75 percent of the FY 2001 width (2,700 feet). Based on discussions and correspondence with MPCA and EPA staff, the Agencies may be receptive to changes in the operating strategy earlier than that stated in the current TGRS OS. Under separate cover, Army will submit their recommendations for modification to the TGRS OS during FY 2015.

In FY 2014, 14 TGRS monitoring wells were permanently abandoned, as approved by the agencies, as part of the site redevelopment activities. Figure 12-4 shows the abandoned well locations. Additional sampling was conducted in December 2013 prior to the abandonment of some of the wells. If a well had been sampled during the previous annual sampling, it was not sampled again prior to abandonment. Well 03U672, abandoned by Ramsey County during road construction activities, was replaced with new well 03U677, installed in September 2014 and sampled on September 19, 2014. As shown in Table 12-8, the September 2014 sample from this well did not contain detectable concentrations of VOCs (including TRCLE). Annual sampling of this well is expected to continue. Appendix A was modified to reflect changes in the TGRS Monitoring Plan.

Treatment System

The TGRS treatment system influent and effluent was sampled monthly during FY 2014 in accordance with the FY 2014 monitoring plan. Groundwater samples from the extraction wells were collected in December 2013 and June 2014 in accordance with the FY 2014 monitoring plan.

Is additional monitoring proposed prior to the next report?

No additional monitoring for FY 2014 is proposed beyond that presented in the Monitoring Plan (Appendix A) of the FY 2013 APR. Table 12-9 and Appendix A of this report provide FY 2015 monitoring requirements.

12.7 OVERALL REMEDY FOR DEEP GROUNDWATER

Did the TGRS meet the requirements of the OU2 ROD? Yes.

- Hydraulic capture in Unit 3 extends beyond the 5 µg/L TRCLE contour. This meets the VOC capture criterion in the OU2 ROD. Hydraulic capture in Unit 4 extends beyond the 5 µg/L TRCLE contour. This meets the VOC capture criterion in the OU2 ROD.
- The total extraction well water pumped was above the Total System Operational Minimum (1,745 gpm). The FY 2014 annual average extraction rate was 1,785 gpm.
- The TGRS extracted and treated 937,934,854 gallons of water and removed 2,020 pounds of VOCs from October 2013 to September 2014. Average VOC influent concentrations decreased by 4.1% from FY 2013.
- Groundwater analytical data of the source area show a general decrease in TRCLE concentration. This demonstrates that the TGRS is effectively removing VOC mass from the aquifer.
- Effluent VOC concentrations were below contaminant-specific requirements for all sampling events.

Do any additional measures need to be addressed?

Not at this time.

TABLE 12-1

GROUNDWATER CLEANUP LEVELS
TGRS, OU2
ARDEN HILLS, MINNESOTA

Substance	***Expected Level in Discharge (ppb)***	***Operable Unit 2 Rod Requirements (ppb)***
Volatile Organic Compounds (VOCs)		
cis-1,2-Dichloroethene plus trans-1,2-Dichloroethene	<1.0	70
1,1-Dichloroethene	<1.0	6.0
1,1,1-Trichloroethane	<1.0	200
1,2-Dichloroethane	<1.0	4.0
Trichloroethene	<5.0	5.0
1,1-Dichloroethane	<1.0	70
Tetrachloroethene	<1.0	5.0

TABLE 12-2

EXTRACTION WELL WATER PUMPED
FISCAL YEAR 2014
TGRS, OU2
ARDEN HILLS, MINNESOTA

	Volume of Water Pumped (gallons)												
	B1	***B3***	***B4***	***B5***	***B6***	***B8***	***B9***	***B11***	***B13***	***SC1***	***SC2***	***SC5***	***TOTAL***
October 2013	9,791,600	7,744,100	8,799,000	10,625,800	8,167,200	6,549,600	13,050,000	0	4,094,800	1,303,600	3,071,700	5,268,700	78,466,100
(gpm)	219	173	197	238	183	147	292	0	92	29	69	118	1,758
November 2013	8,904,300	7,430,100	7,863,600	10,783,100	8,637,700	8,354,600	12,636,900	0	3,804,900	1,205,200	3,294,300	5,042,100	77,956,800
(gpm)	206	172	182	250	200	193	293	0	88	28	76	117	1,805
December 2013	9,429,100	7,981,100	8,562,800	11,644,100	9,827,900	7,937,400	12,997,900	0	4,172,000	1,284,500	3,151,900	5,927,900	82,916,600
(gpm)	211	179	192	261	220	178	291	0	93	29	71	133	1,857
January 2014	9,497,100	7,767,800	8,794,700	10,738,500	9,754,000	6,951,700	12,452,000	0	4,330,700	1,295,000	3,124,400	6,054,300	80,760,200
(gpm)	213	174	197	241	219	156	279	0	97	29	70	136	1,809
February 2014	8,606,800	6,832,800	8,080,100	9,017,700	9,279,900	5,796,000	11,652,200	0	4,080,700	1,185,500	2,507,800	5,419,900	72,459,400
(gpm)	213	169	200	224	230	144	289	0	101	29	62	134	1,797
March 2014	9,310,900	7,751,800	7,138,300	10,306,700	10,229,400	7,058,200	13,054,000	0	3,563,600	1,311,700	2,784,200	5,758,200	78,267,000
(gpm)	209	174	160	231	229	158	292	0	80	29	62	129	1,753
April 2014	8,904,700	7,878,700	9,343,800	9,529,300	9,601,200	6,458,800	12,231,600	0	3,311,700	1,290,300	2,856,600	5,306,100	76,712,800
(gpm)	206	182	216	221	222	150	283	0	77	30	66	123	1,776
May 2014	9,262,400	8,189,900	9,612,000	10,108,600	10,137,600	6,778,900	12,777,300	0	3,557,400	1,364,700	2,895,700	5,415,800	80,100,300
(gpm)	207	183	215	226	227	152	286	0	80	31	65	121	1,794
June 2014	8,865,000	7,839,700	9,387,800	9,712,100	9,724,200	6,806,500	12,264,100	0	3,488,700	1,252,500	2,989,500	4,923,500	77,253,600
(gpm)	205	181	217	225	225	158	284	0	81	29	69	114	1,788
July 2014	9,065,300	7,854,100	9,587,800	11,055,700	9,922,900	6,762,400	13,448,500	0	3,153,400	934,254	2,381,400	5,386,800	79,552,554
(gpm)	203	176	215	248	222	151	301	0	71	21	53	121	1,782
August 2014	8,598,900	7,228,200	9,397,800	9,942,800	9,608,700	6,492,500	12,431,300	0	4,646,100	845,600	1,967,300	5,311,100	76,470,300
(gpm)	193	162	211	223	215	145	278	0	104	19	44	119	1,713
September 2014	8,745,500	7,282,700	9,453,100	9,945,900	9,789,800	6,787,500	11,011,800	0	5,349,400	1,096,900	1,961,900	5,594,700	77,019,200
(gpm)	202	169	219	230	227	157	255	0	124	25	45	130	1,783
TOTAL FY 2014	**108,981,600**	**91,781,000**	**106,020,800**	**123,410,300**	**114,680,500**	**82,734,100**	**150,007,600**	**0**	**47,553,400**	**14,369,754**	**32,986,700**	**65,409,100**	**937,934,854**
Operational Minimum (gpm)	225	170	195	195	210	135	275	80	110	20	30	100	1,745

	B1, B11, B13	B4, B5, B6	B4, B5, B6, B8, B9	Total System
FY14 Average Flow Rate (gpm)	298	655	1,098	1,785
MOS Operational Minimum (gpm)	415	600	1,010	1,745

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TABLE 12-3

TREATMENT CENTER WATER METER TOTALS
FISCAL YEAR 2014
TGRS, OU2
ARDEN HILLS, MINNESOTA

	Volume of Water Pumped (gallons)									
	Extraction Wells	*Meter 1*	*Meter 2*	*Total Meters 1 & 2*	*Meter 3*	*Meter 4*	*Total Meters 3 & 4*	*Meter 5*	*Meter 6*	*Total Meters 5 & 6*
October 2013	78,466,100	0	0	0	18,000	77,746,000	77,764,000	0	0	0
November 2013	77,956,800	0	0	0	73,000	76,469,000	76,542,000	0	0	0
December 2013	82,916,600	0	0	0	73,000	80,695,000	80,768,000	0	0	0
January 2014	80,760,200	0	0	0	421,000	77,767,000	78,188,000	0	0	0
February 2014	72,459,400	0	0	0	71,000	69,623,000	69,694,000	0	0	0
March 2014	78,267,000	0	0	0	277,000	77,100,000	77,377,000	0	0	0
April 2014	76,712,800	0	0	0	10,000	75,477,000	75,487,000	0	0	0
May 2014	80,100,300	0	0	0	49,000	77,410,000	77,459,000	0	0	0
June 2014	77,253,600	0	0	0	10,000	73,492,000	73,502,000	0	0	0
July 2014	79,552,554	0	0	0	2,779,000	71,598,000	74,377,000	0	0	0
August 2014	76,470,300	0	0	0	127,000	69,448,000	69,575,000	0	0	0
September 2014	77,019,200	0	0	0	48,000	68,351,000	68,399,000	0	0	0
TOTAL FY 2014	937,934,854	0	0	0	3,956,000	895,176,000	899,132,000	0	0	0

TABLE 12-3

TREATMENT CENTER WATER METER TOTALS
FISCAL YEAR 2014
TGRS, OU2
ARDEN HILLS, MINNESOTA

	Volume of Water Pumped (gallons)									
	Extraction Wells	***Meter 1***	***Meter 2***	***Total Meters 1 & 2***	***Meter 3***	***Meter 4***	***Total Meters 3 & 4***	***Meter 5***	***Meter 6***	***Total Meters 5 & 6***
FY 1989	1,033,353,676	501,826,000	560,836,000	1,062,662,000	383,736,000	587,596,000	971,332,000	493,681,000	582,955,000	1,076,636,000
FY 1990	1,008,415,750	493,915,000	526,417,000	1,020,332,000	371,391,000	588,642,000	960,033,000	487,946,000	543,726,000	1,031,672,000
FY 1991	1,382,327,590	666,166,000	708,313,000	1,374,479,000	523,702,000	789,947,000	1,313,649,000	601,307,000	649,621,000	1,250,928,000
FY 1992	1,401,346,600	68,289,000	724,328,000	1,407,227,000	557,169,000	772,509,000	1,329,678,000	767,707,000	677,735,000	1,445,442,000
FY 1993	1,388,206,172	666,814,000	725,341,000	1,392,155,000	504,027,000	651,149,000	1,155,176,000	729,078,000	762,791,000	1,491,869,000
FY 1994	1,245,663,275	660,700,000	659,953,000	1,320,653,000	457,210,000	715,668,000	1,172,878,000	653,913,000	550,131,000	1,204,044,000
FY 1995	1,369,361,500	706,114,000	683,982,000	1,390,096,000	500,275,000	739,744,000	1,240,019,000	495,616,000	274,507,000	770,123,000
FY 1996	1,341,763,220	734,443,000	629,327,000	1,363,770,000	503,518,000	754,399,000	1,257,917,000	4,000	600,035,000	600,039,000
FY 1997	1,213,035,110	688,312,000	568,804,600	1,257,116,600	538,625,000	586,515,000	1,125,140,000	13,000	578,900,000	578,913,000
FY 1998	1,196,007,900	624,784,000	540,353,000	1,220,604,000	511,065,000	603,871,000	1,114,936,000	58,000	178,076,000	178,134,000
FY 1999	1,158,224,870	623,500,000	496,773,200	1,177,206,200	398,620,000	718,384,000	1,117,004,000	26,000	17,000	43,000
FY 2000	1,148,448,350	635,724,000	489,669,000	1,183,258,000	389,709,000	663,807,000	1,053,516,000	0	0	0
FY 2001	1,113,163,360	614,341,000	443,167,000	1,113,164,000	318,517,000	718,661,000	1,037,178,000	0	0	0
FY 2002	917,318,879	491,082,800	434,959,700	926,042,500	225,460,000	650,839,000	876,299,000	0	0	0
FY 2003	904,295,450	545,281,000	345,993,000	891,274,000	125,965,000	750,518,000	876,483,000	0	0	0
FY 2004	908,718,760	518,391,900	376,889,660	895,281,560	216,177,000	680,633,000	896,810,000	0	0	0
FY 2005	895,339,710	520,073,000	363,275,000	883,348,000	224,823,000	658,405,000	883,228,000	0	0	0
FY 2006	929,715,590	534,305,000	377,499,000	911,804,000	266,299,000	669,900,000	936,199,000	0	0	0
FY 2007	945,317,300	447,901,000	487,701,000	935,602,000	281,061,000	833,161,000	1,114,222,000	0	0	0
FY 2008	943,318,161	424,289,615	512,634,095	936,923,709	217,134,430	778,717,620	995,852,050	0	0	0
FY 2009	925,232,745	357,698,000	552,505,000	910,203,000	173,004,000	795,057,000	968,061,000	0	0	0
FY 2010	933,789,205	368,260,000	556,160,000	924,420,000	61,957,000	894,152,000	956,109,000	0	0	0
FY 2011	952,379,000	183,460,000	268,747,000	452,207,000	15,479,000	890,850,000	906,329,000	0	0	0
FY 2012	964,996,900	0	0	0	695,000	848,465,000	849,160,000	0	0	0
FY 2013	924,550,600	0	0	0	5,503,000	883,772,000	891,338,000	0	0	0
FY 2014	937,934,854	0	0	0	3,956,000	895,176,000	899,132,000	0	0	0

TABLE 12-4

PUMPHOUSE DOWN TIME (DAYS)
FISCAL YEAR 2014
TGRS, OU2
ARDEN HILLS, MINNESOTA

Well Name	*FY14 Down Time (Days)*	*FY13 Down Time (Days)*	*FY12 Down Time (Days)*	*FY11 Down Time (Days)*	*FY10 Down Time (Days)*
B1	3.4	10.7	1.5	6.2	18.0
B2	(1)	(1)	(1)	(1)	(1)
B3	3.0	4.3	1.6	26.4	7.4
B4	9.2	4.0	6.0	6.4	9.3
B5	2.0	13.0	2.0	4.5	7.7
B6	9.6	2.8	1.9	5.7	12.0
B7	(1)	(1)	(1)	(1)	(1)
B8	2.4	2.9	3.7	4.2	8.2
B9	6.8	9.4	3.6	21.1	7.9
B10	(1)	(1)	(1)	(1)	(1)
B11	(1)	16.4(2)	9.5	3.1	8.7
B12	(1)	(1)	(1)	(1)	(1)
B13	2.9	9.3	7.4	6.4	7.4
SC1	17.0	14.0	7.6	17.8	17.2
SC2	4.4	20.3	35.0	37.0	7.5
SC3	(1)	(1)	(1)	(1)	(1)
SC4	(1)	(1)	(1)	(1)	(1)
SC5	9.4	32.5	7.3	33.3	13.8

Note:

(1) The extraction well was not in operation during the fiscal year.
(2) The extraction well was in operation for only part of the fiscal year.

TABLE 12-5

DOWN TIME (DAYS) BY CATEGORY
FISCAL YEAR 2014
TGRS, OU2
ARDEN HILLS, MINNESOTA

Category	***Down Time (Days)***
Pumphouse Component	3.3
Treatment Center Component	1.0
Electrical Service	1.4
Miscellaneous	0.5
Preventive Maintenance	0.0
System Modification	0.0
Forcemain	0.2
Total System Equivalent	6.4
Anticipated Down Time for Fiscal Year 2014	
Pumphouse Component	4.0
Treatment Center Component	1.5
Electrical Service	2.0
Miscellaneous	1.0
Preventive Maintenance	1.0
System Modification	0.5
Forcemain	1.5

TABLE 12-6

VOC MASS LOADING SUMMARY
FISCAL YEAR 2014
TGRS, OU2
ARDEN HILLS, MINNESOTA

Well	*Percent Contribution to VOC Mass Removal*	*FY 2014 Total Pounds VOCs Mass Removed*
B1	2.6%	53.2
B2[1]	0.0%	0.0
B3	0.1%	2.8
B4	4.7%	95.8
B5	4.7%	94.4
B6	1.8%	36.6
B7[1]	0.0%	0.0
B8	0.5%	9.9
B9	3.3%	66.4
B10[1]	0.0%	0.0
B11[1]	0.0%	0.0
B12[1]	0.0%	0.0
B13	3.4%	68.5
SC1	5.7%	115.1
SC2	0.6%	12.4
SC3[1]	0.0%	0.0
SC4[1]	0.0%	0.0
SC5	72.5%	1,465
Fiscal Year 2014 Total (lbs)		***2,020***
Daily Average (lbs/day)		***5.5***

Notes:

[1] Extraction well was not in operation during the fiscal year.

TABLE 12-6

VOC MASS LOADING SUMMARY
FISCAL YEAR 2014
TGRS, OU2
ARDEN HILLS, MINNESOTA

HISTORICAL TOTAL

Fiscal Year		*Pounds VOC Mass Removed*
2014		2,020
2013		2,082
2012		1,801
2011		1,834
2010		2,096
2009		2,167
2008		2,292
2007		2,507
2006		2,552
2005		2,663
2004		3,291
2003	(First year of reconfigured system)	3,041
2002		2,852
2001		3,418
2000		4,499
1999		4,878
1998		6,132
1997		6,210
1996		10,655
1995		13,355
1994		15,070
1993		20,165
1992		24,527
1991		26,760
1990		18,005
1989	(First year of full scale system)	19,510
1988		4,800
1987		2,100
Total		***211,282***

TABLE 12-7

VOC CONCENTRATIONS IN TGRS EXTRACTION WELLS
FISCAL YEAR 2014
TGRS, OU2
ARDEN HILLS, MINNESOTA

Location	*Alias*	*Date*	*Dup*	*1,1,1-Trichloroethane* *µg/L*	*1,1-Dichloroethane* *µg/L*	*1,1-Dichloroethene* *µg/L*	*1,2-Dichloroethane* *µg/L*	*cis-1,2-Dichloroethene* *µg/L*	*Tetrachloroethene* *µg/L*	*Trichloroethene* *µg/L*
03F302	B1	12/3/2013		2.8	0.55 JP	0.80 JP	< 1.0	3.0	1.5	55
03F302	B1	6/3/2014		2.5	0.49 JP	0.71 JP	< 1.0	2.7	1.5	54
03F303	B2	6/3/2014		< 1.0	0.43 JP	1.2	< 1.0	1.6	0.92 JP	27
03F304	B3	12/3/2013		< 1.0	0.36 JP	0.46 JP	< 1.0	< 1.0	< 1.0	3.2
03F304	B3	6/3/2014		< 1.0	< 1.0	0.48 JP	< 1.0	< 1.0	< 1.0	3.4
03F305	B4	12/3/2013		7.3	3.5	3.3	< 1.0	2.1	< 1.0	100
03F305	B4	6/3/2014		7.4	3.4	3.3	< 1.0	2.2	< 1.0	100
03F306	B5	12/3/2013		2.7	2.3	2.1	< 1.0	0.67 JP	4.4	85
03F306	B5	6/3/2014		2.7	2.5	2.3	< 1.0	0.76 JP	4.5	87
03F307	B6	12/3/2013		0.65 JP	0.50 JP	0.60 JP	< 1.0	< 1.0	< 1.0	40
03F307	B6	6/3/2014		0.69 JP	< 1.0	0.67 JP	< 1.0	< 1.0	< 1.0	39
PJ#309	B8	12/3/2013		0.74 JP	0.56 JP	0.67 JP	< 1.0	< 1.0	< 1.0	14
PJ#309	B8	12/3/2013	D	0.75 JP	0.53 JP	0.70 JP	< 1.0	< 1.0	< 1.0	14
PJ#309	B8	6/3/2014		0.66 JP	0.48 JP	0.70 JP	< 1.0	< 1.0	< 1.0	13
PJ#310	B9	12/3/2013		2.4	2.6	2.7	< 1.0	1.1	< 1.0	46
PJ#310	B9	6/3/2014		2.4	2.7	2.9	< 1.0	1.1	< 1.0	50
03F312	B11	12/3/2013		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
03F312	B11	6/3/2014		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
03F319	B13	12/3/2013		4.8	1.4	1.2	< 1.0	9.8	0.73 JP	200
03F319	B13	6/3/2014		3.0	1.0	0.91 JP	< 1.0	6.7	0.48 JP	140
03U301	SC1	12/3/2013		9.1	1.0 JP	1.8 JP	< 2.0	58	< 2.0	990
03U301	SC1	6/3/2014		9.9	1.1 JP	1.9 JP	< 2.0	65	< 2.0	920
03U314	SC2	12/3/2013		9.8	0.78 JP	0.84 JP	< 1.0	0.66 JP	< 1.0	37
03U314	SC2	6/3/2014		9.6	0.73 JP	0.80 JP	< 1.0	0.67 JP	< 1.0	36

TABLE 12-7

VOC CONCENTRATIONS IN TGRS EXTRACTION WELLS
FISCAL YEAR 2014
TGRS, OU2
ARDEN HILLS, MINNESOTA

Location	*Alias*	*Date*	*Dup*	*1,1,1-Trichloroethane* µg/L	*1,1-Dichloroethane* µg/L	*1,1-Dichloroethene* µg/L	*1,2-Dichloroethane* µg/L	*cis-1,2-Dichloroethene* µg/L	*Tetrachloroethene* µg/L	*Trichloroethene* µg/L
03U317	SC5	12/3/2013		620	15	27	< 10	3.0 JP	4.1 JP	2200
03U317	SC5	6/3/2014		650	15	29	< 5.0	3.5 JP	4.0 JP	2200
03U317	SC5	6/3/2014	D	640	15	27	< 5.0	3.5 JP	3.9 JP	2200

Notes:

D - Field Duplicate
JP - Result is qualified as estimated since the detection is below the laboratory quantitation limit.

TABLE 12-8

GROUNDWATER QUALITY DATA
FISCAL YEAR 2014
TGRS, OU2
ARDEN HILLS, MINNESOTA

			1,1,1-Trichloroethane	*1,1-Dichloroethane*	*1,1-Dichloroethene*	*1,2-Dichloroethane*	*cis-1,2-Dichloroethene*	*Tetrachloroethene*	*Trichloroethene*
TGRS Cleanup Level [(1)]			*200*	*70*	*6.0*	*4.0*	*70*	*5.0*	*5.0*
Location	*Date*	*Dup*	*µg/L*	*µg/L*	*µg/L*	*µg/L*	*µg/L*	*µg/L*	*µg/L*
03L027	12/12/2013		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
03L028	12/11/2013		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
03L029	12/18/2013		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
03L802	6/5/2014		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	1.9
03L806	6/4/2014		0.68 JP	110	61	0.47 JP	7.8	< 1.0	440
03M802	6/5/2014		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	5.9
03M806	6/4/2014		0.53 JP	40	23	< 1.0	5.3	< 1.0	230
03U031	12/13/2013		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
03U076	12/13/2013		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
03U076	12/13/2013	D	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
03U084	12/31/2013		1.0 JH	1.0 JH	1.0 JH	1.0 JH	1.0 JH	1.0 JH	1.0 JH
03U093	6/5/2014		54	< 1.0	3.5	< 1.0	1.7	< 1.0	140
03U099	6/5/2014		1.4	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	4.1
03U647	12/18/2013		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	0.92 JP
03U648	12/11/2013		0.96 JP	< 1.0	< 1.0	< 1.0	0.42 JP	< 1.0	18
03U674	12/19/2013		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	2.7
03U674	12/19/2013	D	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	2.5
03U676	12/19/2013		< 50	67	52	< 50	16000	< 50	8300 JMS
03U677	9/19/2014		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
03U708	6/5/2014		4.4	1.2	1.8	< 1.0	0.98 JP	2.1	48
03U708	6/5/2014	D	4.3	1.2	1.7	< 1.0	1.1	2.1	47
03U801	6/4/2014		< 1.0	< 1.0	< 1.0	< 1.0	0.52 JP	< 1.0	25
03U806	6/4/2014		< 1.0	0.62 JP	0.48 JP	< 1.0	< 1.0	1.0	48
04J077	6/5/2014		2.9	5.5	5.2	< 1.0	1.6	< 1.0	92 JMS
04U027	12/12/2013		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
04U711	6/4/2014		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	0.35 JP
04U802	6/5/2014		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	0.48 JP
04U806	6/4/2014		1.3	29	17	< 1.0	3.5	< 1.0	220
04U833	6/4/2014		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	0.81 JP
PJ#027	12/12/2013		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
PJ#806	6/4/2014		0.35 JP	1.1	0.77 JP	< 1.0	< 1.0	< 1.0	23
PJ#806	6/4/2014	D	0.31 JP	1.1	0.72 JP	< 1.0	< 1.0	< 1.0	23

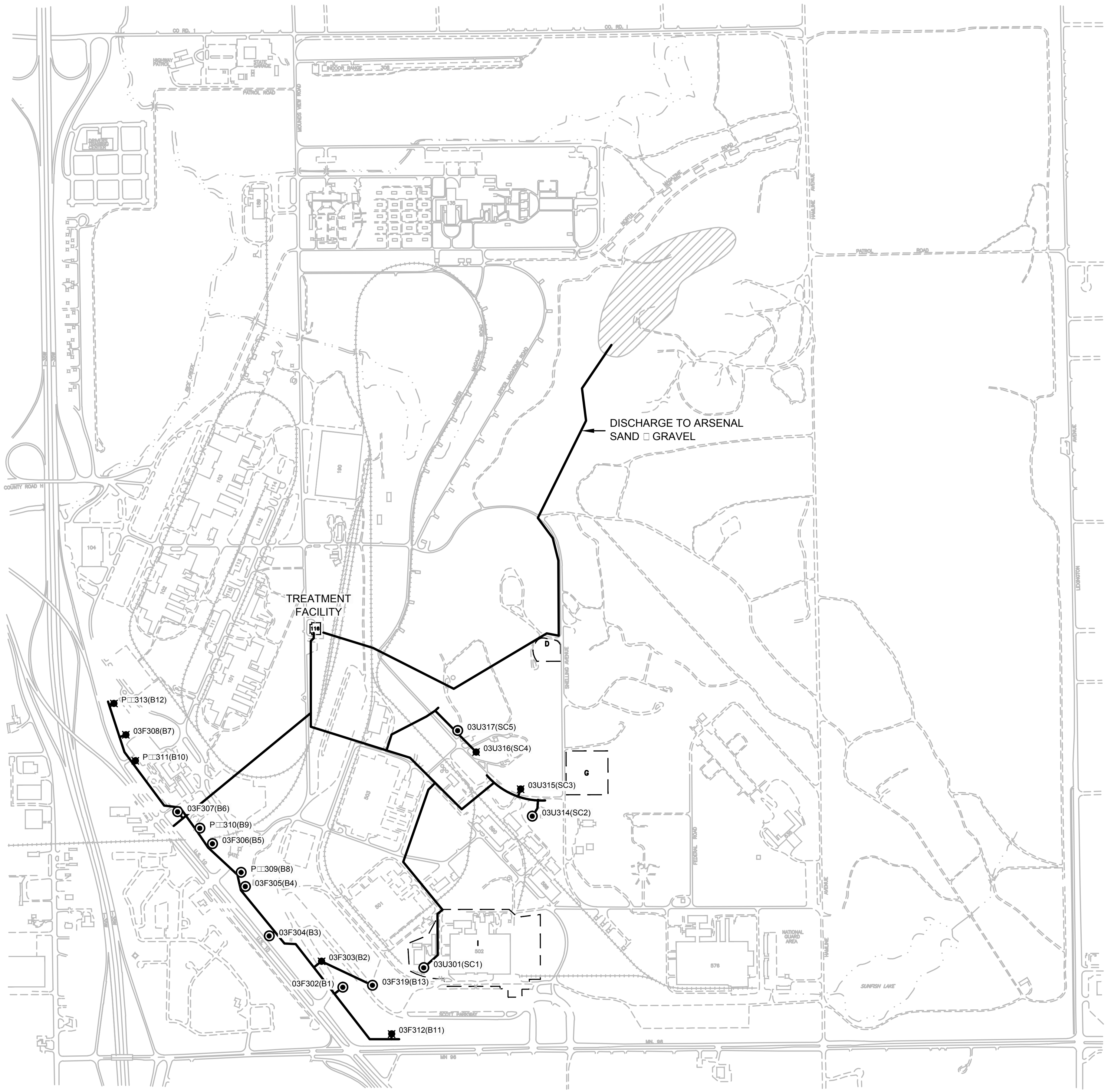
Notes:

[(1)] Cleanup levels for TGRS are from the OU2 ROD. Shading indicates exceedence of the cleanup level.
D - Field Duplicate
JH - Result is qualified as estimated due to analysis past the method holding time.
JP - Result is qualified as estimated since the detection is below the laboratory quantitation limit.
JMS - Result is qualified as estimated due to low matrix sprike recovery (<75%).

TABLE 12-9

SUMMARY OF OU2 DEEP GROUNDWATER MONITORING REQUIREMENTS
TGRS, OU2
ARDEN HILLS, MINNESOTA

Remedy Component	*Monitoring Requirements*	*Implementing Party*	*Documents Containing the Monitoring Plan*
#1 Hydraulic Containment and Mass Removal	a. Water levels to draw contour maps showing hydraulic zone of capture	ATK/Army	Deep groundwater monitoring plan in Annual Report
	b. Pumping volumes and rates for comparison to design rates	ATK/Army	Deep groundwater monitoring plan in Annual Report
	c. Influent and extraction well water quality for overall mass removal calculations	ATK/Army	Deep groundwater monitoring plan in Annual Report
#2 Groundwater Treatment	• Outlined below		
#3 Treated Water Discharge	• Effluent monitoring to verify attainment of treatment requirements	ATK/Army	Deep groundwater monitoring plan in Annual Report
#4 Land Use Controls	• None		
#5 Review of New Technologies	• None		
#6 Groundwater Monitoring	a. Water levels to draw contour maps showing hydraulic zone of capture	ATK/Army	Deep groundwater monitoring plan in Annual Report
	b. Groundwater quality to verify attainment of clean up goals	ATK/Army	Deep groundwater monitoring plan in Annual Report
Overall Remedy	a. Groundwater quality to verify attainment of clean up goals	ATK/Army	Deep groundwater monitoring plan in Annual Report



0 400 1200ft

LEGEND

PRIMARY ROAD
SECONDARY ROAD
RAILROAD
DRAINAGE
BUILDING
BUILDING REMOVED
SOURCE AREA
ACTIVE EXTRACTION WELL LOCATION
INACTIVE EXTRACTION WELL LOCATION

EXTRACTION WELL NAME CROSS REFERENCE

B1	03F302
B2	03F303
B3	03F304
B4	03F305
B5	03F306
B6	03F307
B7	03F308
B8	PJ#309
B9	PJ#310
B10	PJ#311
B11	03F312
B12	PJ#313
B13	03F319
SC1	03U301
SC2	03U314
SC3	03U315
SC4	03U316
SC5	03U317

figure 12-1

TGRS LAYOUT
OPERABLE UNIT 2
Arden Hills, Minnesota

088760-43(001)GN-SP001 N□□21/2014

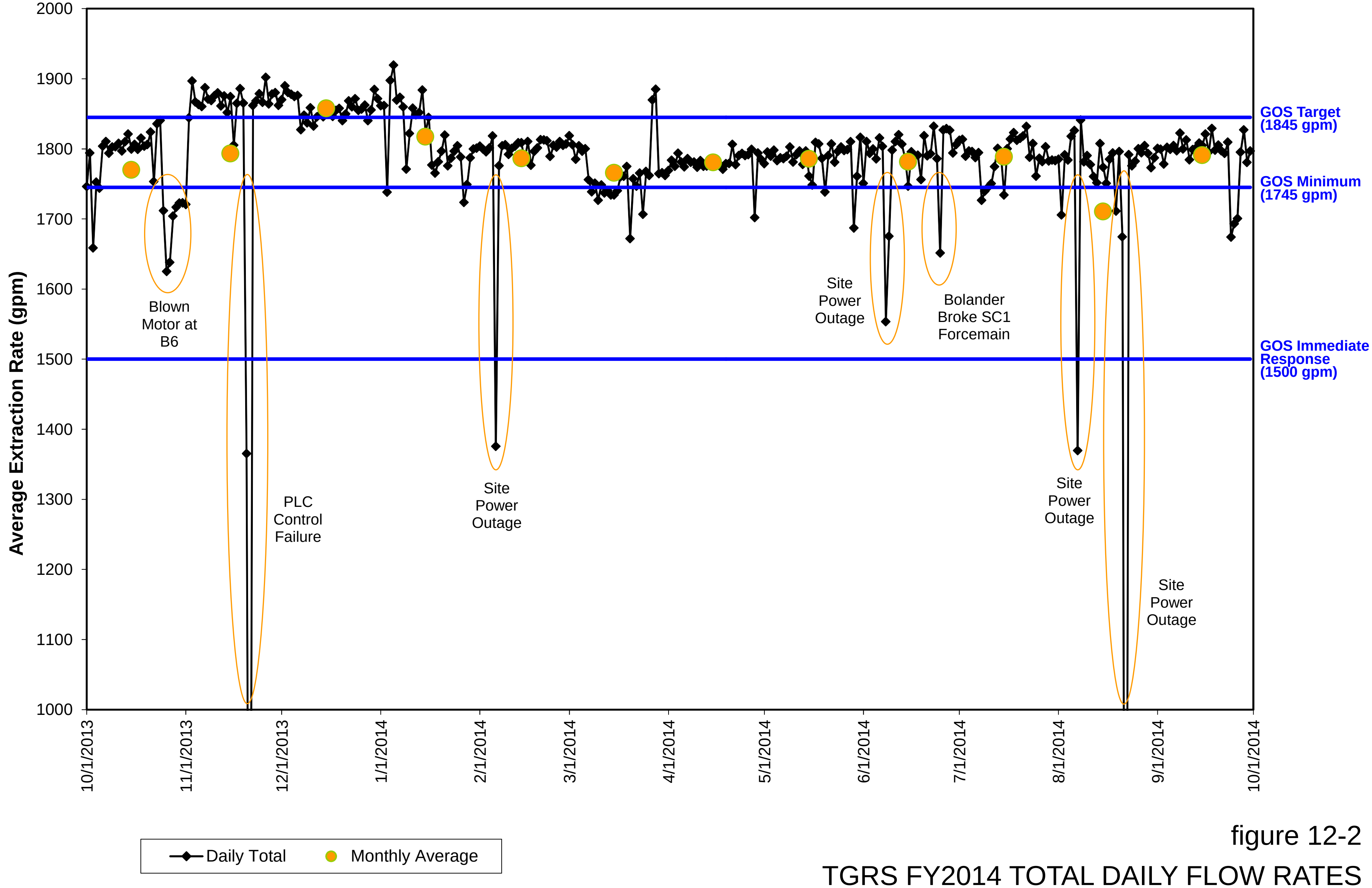
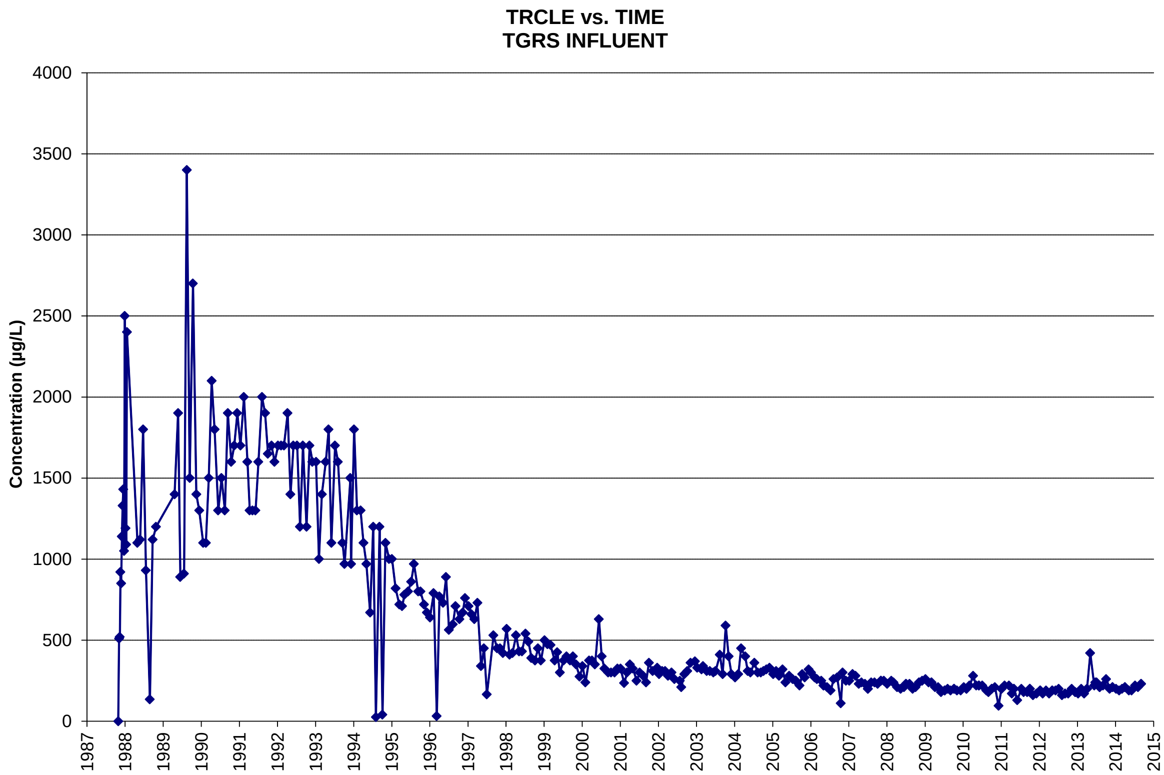
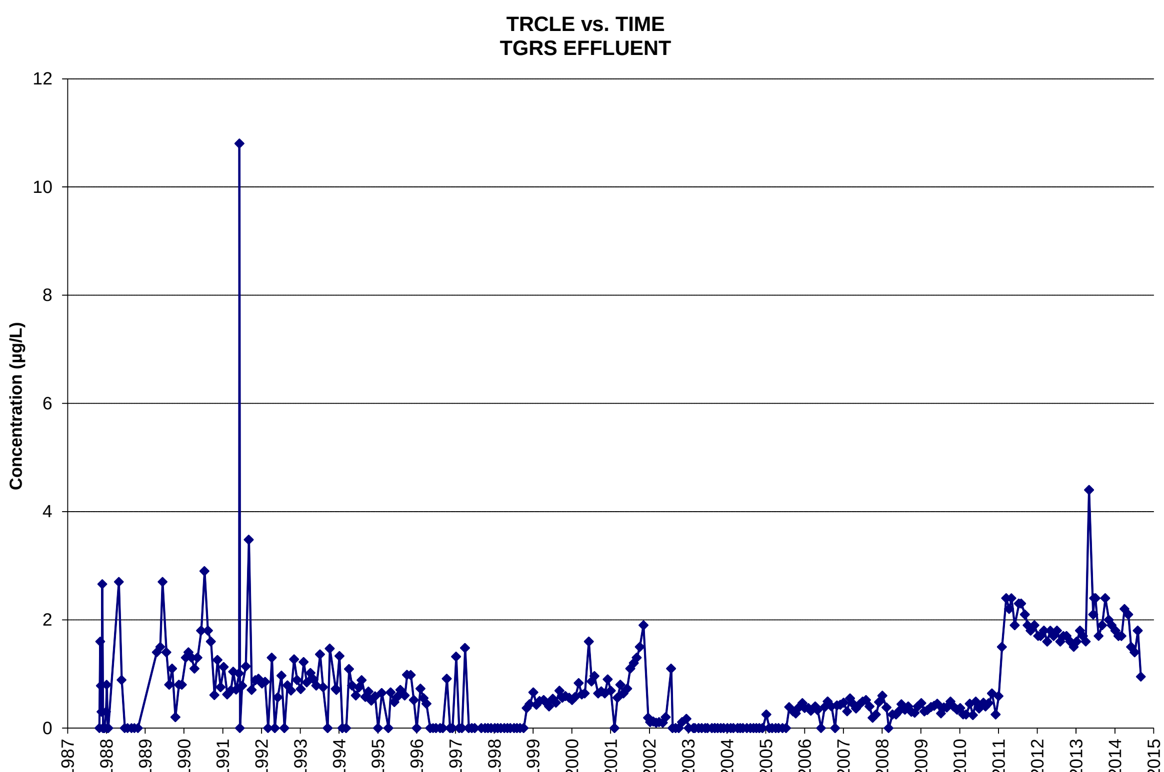


figure 12-2

TGRS FY2014 TOTAL DAILY FLOW RATES
OPERABLE UNIT 2
Arden Hills, Minnesota

088760-43(001)GIS-SP001 NOV 04/2014





NOTE: SAMPLES REPORTING CONCENTRATIONS OF NON-DETECT WERE PLOTTED AS ZERO. WHEN DUPLICATE SAMPLES WERE COLLECTED, THE HIGHER CONCENTRATION WAS REPORTED.

figure 12-3

TGRS TREATMENT SYSTEM PERFORMANCE
OPERABLE UNIT 2
Arden Hills, Minnesota

088760-43(001)GIS-SP002 DEC 21/2014

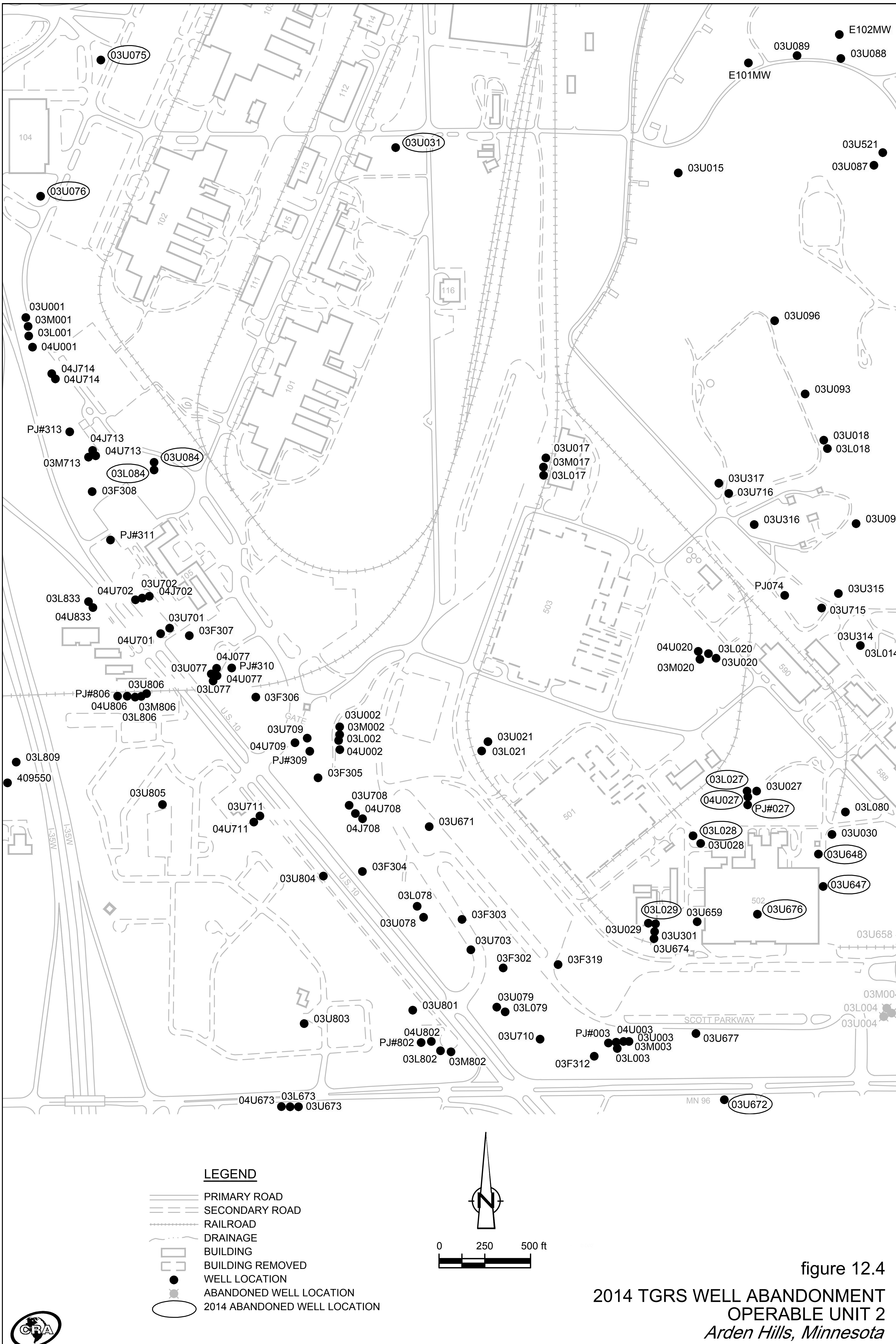


figure 12.4

2014 TGRS WELL ABANDONMENT
OPERABLE UNIT 2
Arden Hills, Minnesota

88760-43(002)GN-WA001 JAN 7/2015

13.0 Operable Unit 3: Deep Groundwater

RECORD OF DECISION
Groundwater Remediation
Operable Unit 3
at New Brighton/Arden Hills Superfund Site
September 1992

RECORD OF DECISION AMENDMENT
For Operable Unit 3
New Brighton/Arden Hills Superfund Site
August 2006

A ROD Amendment was finalized in August 2006 that significantly changed the remedy for OU3. The basis for the OU3 ROD Amendment was the "Groundwater Statistical Evaluation, OU3" technical memorandum, which received consistency on May 2, 2005. This document presented a statistical evaluation showing that the South Plume has been receding since at least 1996, including the period after the Plume Groundwater Recovery System (PGRS) was shut off in 2001. The South Plume had receded well upstream of the PGRS and the PGRS was basically pumping clean water. The ROD Amendment removed the need for a pump and treat remedy, eliminating the PGRS extraction well and treatment train.

The PGRS was an off-post groundwater extraction and treatment system and municipal potable water supply. The PGRS consisted of New Brighton Municipal Well #13 (NBM #13) and a GAC treatment plant. New Brighton used the water for municipal supply. The PGRS was designed to contain the South Plume of VOC contamination emanating from the former TCAAP property and to prevent further downgradient migration. Recovered groundwater was treated and used by the City of New Brighton to fulfill its municipal water supply demand. Figure 13-1 presents an OU3 site plan.

The PGRS began operating on May 3, 1994. In 1997, the PGRS influent dropped below the ROD required limits for all VOCs. In December 1999, under an agreement with the Agencies, the PGRS pumping rate was reduced from a nominal rate of 1,000 gpm to 400 gpm to help determine if the VOC reductions in concentration were the result of actual plume decreases or the result of dilution from over pumping. In conjunction with the flow rate decrease, a quarterly monitoring program was undertaken to monitor for potential "rebound" in VOC concentrations. By the end of FY 2000, no rebound was observed and a review of the historical database for all of OU3 and the associated source area in OU2 revealed that the entire South Plume had dramatically decreased in size and concentration since the early 1990s. The VOC concentration decreases were such that the leading edge of the South Plume, at the PGRS, dropped below the ROD requirements.

The results of this evaluation were presented to the Agencies on September 6, 2000, and a report titled "Plume History Evaluation, Operable Unit 3", CRA, was submitted to the Agencies on October 10, 2000. The report documents the history of plume size and concentration reductions throughout OU3. Based on the dramatic reductions in plume size and concentration, the report recommended shutting down the PGRS. The Agencies subsequently accepted the recommendation. The City of New Brighton stopped significant pumping in August 2001 and the PGRS was maintained in standby status. During the period May 2003 through September 2003, the PGRS was operated solely to satisfy peak water supply demands and then was placed back into standby status. The PGRS remained in standby status throughout FY 2004, FY 2005, and FY 2006. The City conducted an evaluation of its municipal system to, in part, determine the future use of the PGRS extraction well and treatment system. The City decided the PGRS treatment system and well NBM #13 were not part of the City's long-term water supply plan. During FY 2007, the PGRS treatment system was dismantled and NBM #13 was abandoned.

13.1 REMEDY COMPONENT #1: MONITORED NATURAL ATTENUATION

Description: "Monitored natural attenuation."
(OU3 ROD Amendment, page 17)

Performance Standard (how do you know when you're done):
When a monitoring program is established and monitoring is in compliance with the regulator approved Annual Monitoring Plan.

Is the remedy component being implemented?
Yes. Appendix A summarizes the FY 2014 monitoring plan and any deviations are explained in Appendix C.2. Details of the groundwater monitoring program are discussed in Section 13.2.

13.2 REMEDY COMPONENT #2: GROUNDWATER MONITORING

Description: "Monitoring of the groundwater for VOCs to verify the effectiveness of the selected remedy and the natural attenuation of the South Plume."
(OU3 ROD Amendment, page 17)

Performance Standard (how do you know when you're done):
When a monitoring program is established and monitoring is in compliance with the regulator approved Annual Monitoring Plan.

Is the remedy component being implemented?
Yes. Appendix A summarizes the FY 2014 monitoring plan and any deviations are explained in Appendix C.2.

Groundwater samples were collected from two OU3 wells in FY 2014 as part of the OU1, OU2, and OU3 annual sampling round. Samples were collected as specified in the monitoring plan and analyzed for VOCs by method SW846 8260. Well locations are shown on Figure 13-1. The specific purpose of monitoring each well is provided in Appendix A. Water elevations were also measured during the monitoring event and are presented in Appendix D.1.

Table 13-1 presents a summary of the analytical results. The TRCLE concentration in the downgradient sentry well, 04U863, remained not detectable (less than 1.0 µg/L) for the second consecutive year, after rising above 1.0 µg/L for the first time since December 1999 in 2012 (1.2 µg/L). The other well sampled in FY 2014, 03M848, had a TRCLE concentration of 150 µg/L.

Previous sampling has shown 1,1,1-Trichloroethane and its degradation products, 1,1-dichloroethane and 1,1-dichloroethene, present in wells at the boundary between OU1 and OU3, indicating a mingling of the North Plume and the South Plume in this area. No boundary wells were sampled in FY 2014; however, these parameters have also been detected at low concentrations at 03M848, a center-of-plume well, for several years, including FY 2014.

What were the results of the Statistical Analyses?

The Mann-Kendall statistical analysis was updated for the center-of-plume well (03M848) sampled in FY 2014. A statistical analysis was also added for well 04U863. A summary of the statistical analyses is presented in Table 13-2. A spreadsheet and graph presenting the Mann-Kendall test results for the wells are provided in Appendix H.

The trend for 03M848, which has historically been the center of the South Plume, changed from probably increasing to no trend as concentrations have decreased slightly over the last two sampling events after increasing slightly for several sampling events. The TRCLE concentrations at 03M848 have steadily decreased from 1,400 µg/L (FY 1996) to 700 µg/L (FY 1999) to 450 µg/L (FY 2003) to the current concentration of 150 µg/L in FY 2014. However, TRCLE concentrations at 03M848 have ranged only between 130 µg/L and 190 µg/L for the last nine years indicating that the TRCLE concentration at the well may be stabilizing. The recent low-level detections of 1,1,1-trichloroethane and/or its degradation products at

03M848, may indicate that the North Plume is not only beginning to mingle with the South Plume at the OU1-OU3 boundary, but may be present even toward the center of the South Plume. The possible mingling of these two plumes at this well may be a factor in the statistical trends.

A statistical analysis was added in FY 2014 for well 04U863 (an edge-of-plume well) to ensure any trends will be recognized immediately after recent low-level TRCLE detections were observed. The statistical analysis indicates no trend at this well.

Are contingency actions warranted?

No. The OU3 ROD Amendment requires contingency actions to be considered when the Mann-Kendall statistical analysis shows that a well at the edge of the South Plume has an increasing trend. The edge-of-plume well analyzed in FY 2014 (04U863) did not show an increasing trend.

What groundwater monitoring is proposed before the next report?

The OU3 monitoring requirements presented in Table 13-3 are proposed. Appendix A presents the FY 2014 – FY 2018 monitoring plan.

13.3 REMEDY COMPONENT #3: DRILLING ADVISORIES

Description: "Continued implementation of the drilling advisories that regulates the installation of new private wells within OU3 as a Special Well Construction Area." (OU3 ROD Amendment, page 17)

Performance Standard (how do you know when you're done):

When the Minnesota Department of Health (MDH) has issued a Special Well Construction Area Advisory.

Has the MDH issued a Special Well Construction Area Advisory?
Yes. It was issued in June 1996. The Special Well Construction Area encompasses OU1, OU3, and the OU2 Site A shallow groundwater plume. In June 1999, the MPCA requested that the MDH extend the boundary of the Special Well Construction Area further to the southwest to the Mississippi River and Marshall Avenue to ensure that the southern boundary fully encompassed the plume. The MDH revised the Special Well Construction Area in December 1999. The current boundary is shown on Figure E-1 (Appendix E).

Are any changes or additional actions required for this remedy component? No.

13.4 OVERALL REMEDY FOR OU3

Is the Remedy for OU3 Operating in Compliance with the OU3 ROD and OU3 ROD Amendment?
Yes. In FY 2014, groundwater monitoring took place as prescribed in the Annual Monitoring Plan. The annual sampling round of FY 2014 indicates that the South Plume footprint remains stable, with no clear trend at the center of the plume.

Are any changes or additional actions required for OU3?
No. A comprehensive biennial groundwater sampling event will take place in FY 2015 as planned. No additional actions are necessary because no increasing trends at the edge of the plume were identified by the statistical analysis.

TABLE 13-1

GROUNDWATER QUALITY DATA
FISCAL YEAR 2014
OPERABLE UNIT 3

			1,1,1-Trichloroethane	*1,1,2-Trichloroethane*	*1,1-Dichloroethane*	*1,1-Dichloroethene*	*cis-1,2-Dichloroethene*	*Trichloroethene*
OU3 Cleanup Level (1)			**200**	**3.0**	**70**	**6.0**	**70**	**5.0**
Location	***Date***	***Dup***	***µg/L***	***µg/L***	***µg/L***	***µg/L***	***µg/L***	***µg/L***
03M848	6/9/2014		< 1.0	< 1.0	0.84 JP	0.88 JP	9.2	150
03M848	6/9/2014	D	< 1.0	< 1.0	0.83 JP	0.84 JP	9.2	150
04U863	6/9/2014		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0

Notes:

(1) Cleanup levels for OU3 are from the OU3 ROD. Shading indicates exceedence of the cleanup level.
D - Field Duplicate
JP - Result is qualified as estimated since the detection is below the laboratory quantitation limit.

TABLE 13-2

MANN-KENDALL STATISTICAL SUMMARY
FISCAL YEAR 2014
OPERABLE UNIT 3

Well	*Kendall S*	*Number of Data Points*	*Raw Trend*	*Confidence*	*Coefficient of Variance*	*Raw Trend Decision*	*MAROS Conclusion*	*June 2014 TRCLE Conc.*
Edge of Plume Wells								
04U863	-4	6	Decreasing	70.25%	1.5493	Stable or No Trend	No Trend	<1
Center of Plume Wells								
03M848	5	6	Increasing	76.50%	0.1468	Stable or No Trend	No Trend	150

TABLE 13-3

SUMMARY OF GROUNDWATER MONITORING REQUIREMENTS
OPERABLE UNIT 3

	Remedy Component		***Monitoring Requirements***	***Implementing Party***	***Documents Containing the Monitoring Plan***
#1	Monitored Natural Attenuation		Outlined below.		
#2	Groundwater Monitoring	a.	Water levels for use in drawing contour maps.	ATK	OU3 Monitoring Plan in Annual Report
		b.	Groundwater sampling to track progress of clean-up and attenuation of plume.	ATK	OU3 Monitoring Plan in Annual Report
#3	Drilling Advisories	a.	Verification that drilling advisories are in place and functioning as intended.	Army/MDH	NA
OR:	Overall Remedy	a.	Water quality monitoring to verify attainment of clean-up goals.	ATK	OU3 Monitoring Plan in Annual Report

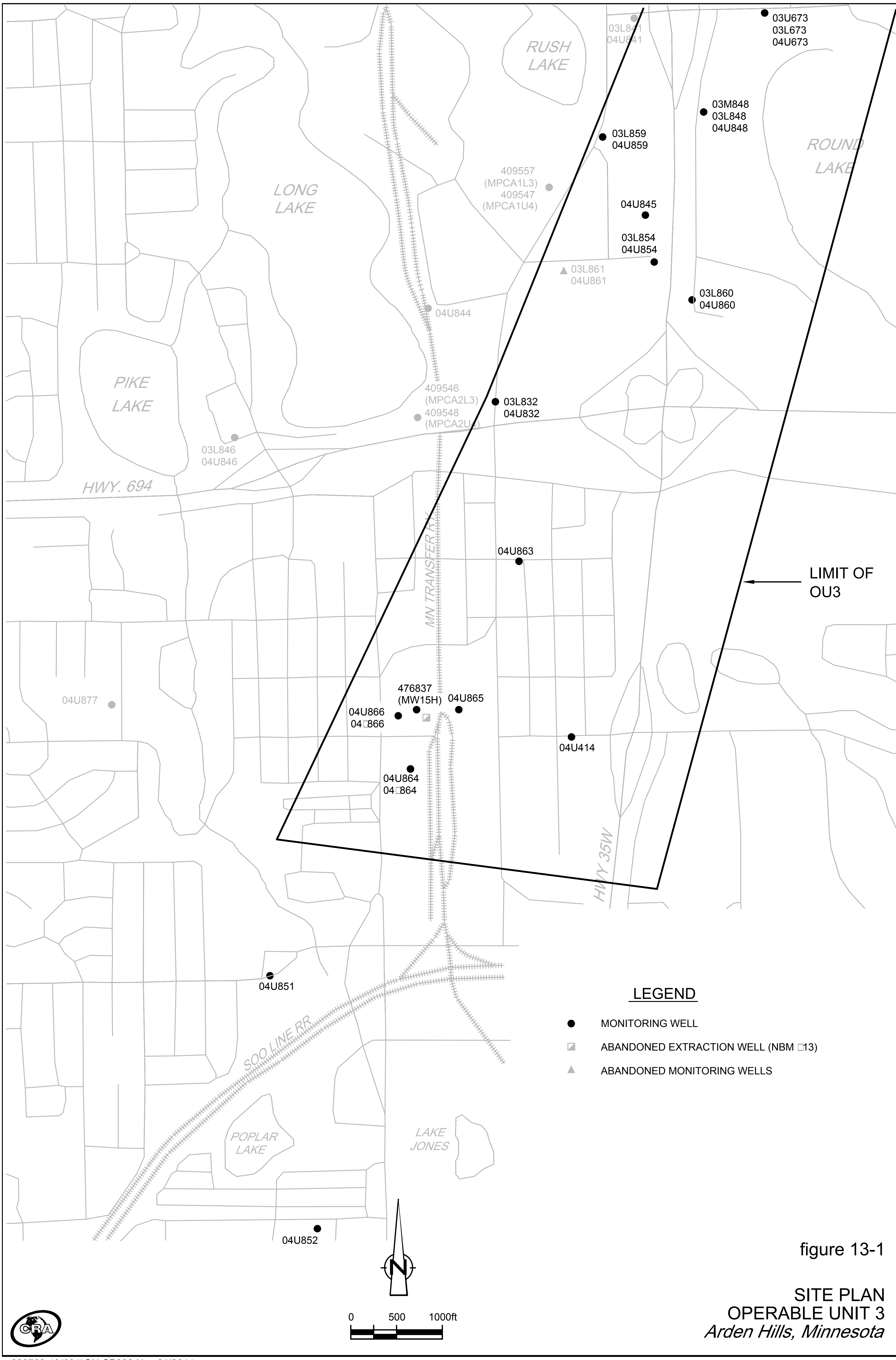


figure 13-1

SITE PLAN
OPERABLE UNIT 3
Arden Hills, Minnesota

088760-43(001)GN-SP002 N□□21/2014

14.0 Other Installation Restoration Activities During FY 2014

This section summarizes the status of other activities that are related to the Installation Restoration Program, but are not required in the RODs for OU1 through OU3.

14.1 DEEP GROUNDWATER BACKGROUND MONITORING

The Army voluntarily conducts monitoring at locations near the upgradient side of OU2 (the northeast corner and east side) to assess the quality of deep groundwater entering the operable unit. The five wells that are sampled for this purpose include 03U007, 03U009, 03L007, 04U007, and 04U510. Locations of these wells are shown on Figure B-3 in Appendix B. However, since this was a minor sampling year with respect to OU2 deep groundwater, none of these wells were sampled in FY 2014. These locations will be sampled in FY 2015 as shown in Appendix A.1 (the wells are listed under TCAAP Groundwater Recovery System in the appendix).

14.2 ROUND LAKE

The Tier II Ecological Risk Assessment Report for aquatic sites (including Round Lake), prepared by the U.S. Army Center for Health Promotion and Preventative Medicine (USACHPPM), was approved by the MPCA and USEPA in December 2004. In June 2005, the Army submitted a draft feasibility study (FS) for aquatic sites to support the risk management decisions with respect to “No Further Action” or “Implement a Remedy” for each aquatic site. As a result of comments on the draft FS, it was agreed to conduct additional sampling of Marsden Lake and Pond G, which was completed in 2008. A revised FS was submitted in January 2009. Based on comments received and resolution thereof, the Army then submitted a revised (redlined) FS in April 2010. After review of this report, USEPA and MPCA requested that the Army prepare a work plan for collection of additional Round Lake sediment data. Given the time required to collect the additional data, the Army, USEPA, and MPCA agreed to separate the FS for aquatic sites into two documents: one for Round Lake, and one for Rice Creek, Sunfish Lake, Marsden Lake, and Pond G.

The USEPA and MPCA provided consistency for the QAPP for Round Lake Sediment Investigation in January 2011. The sediment sampling work was completed in January – February 2011. A Draft Summary of Investigation Findings was submitted in May 2011, and a meeting between Army, USEPA, MPCA, MN DNR, USFWS, and the TCAAP RAB was held in June 2011 for preliminary discussion of the findings. Final core dating results were distributed in February 2012. In March 2012, the Army provided responses to the stakeholder comments on the Round Lake portion of the April 2010 FS, which had been placed on hold pending collection and evaluation of the 2011 sediment data. A comment resolution meeting was then held in April 2012, and a TCAAP Restoration Advisory Board meeting was held in May 2012, primarily to discuss the status of the Round Lake FS.

With USEPA and MPCA agreement, the Army then initiated a strategy to revise the FS in segments, with the intent to gain agreement/approval at key steps along the way. In accordance with this strategy, the Army submitted revised Sections 1 through 5 of the Round Lake FS in August 2012, and the USEPA and MPCA provided comments in September 2012. The Army sought clarifications on these comments, and ultimately submitted responses to those comments and the proposed redlines to Sections 1 through 5 in January 2013. The USEPA and MPCA provided comments to that submittal in March 2013. Through this process (and the multiple earlier drafts of the FS), it became clear that the Army, USEPA, and MPCA did not agree on the ecological risks and commensurate remedy associated with Round Lake. Given the difficulty reaching a consensus, the United States Army Environmental Command (USAEC) desired a fresh look at the ecological risk by someone who has national experience with such matters and obtained the assistance of the Risk and Regulatory Analysis Team of the Environmental Sciences Division at the Oak Ridge National Laboratory (ORNL). In early FY 2014, the Army submitted a Supplemental RI and FS for Round Lake which incorporated a Supplemental Ecological Risk Assessment prepared by ORNL. Comments received from the USEPA and MPCA in March 2014 indicated that significant disagreement remained. In April 2014, the Army notified the USEPA and MPCA that their findings were being disputed by the Army. Efforts to resolve this dispute continued through the end of FY 2014.

14.3 135 PRIMER/TRACER AREA

The Preliminary Assessment report received regulatory approval in FY 2002. It was recommended that a Site Inspection be conducted. The Site Inspection (SI) investigation report received MPCA and USEPA approval in FY 2005. The SI report recommended that an Engineering Evaluation/Cost Analysis (EE/CA) be conducted to determine what, if any, remediation is required to address contamination observed in the soil. The 135 Primer/Tracer Area (PTA) is on property that is proposed to be transferred out of federal ownership. The Army is anticipating transfer of the western portion of the 135 PTA to Ramsey County as a no-cost public conveyance for purposes of a public trail corridor. Accountability for the eastern portion may be transferred to the National Guard Bureau, who would in turn license use of the property to the Minnesota Army National Guard.

For the western portion, in anticipation of the property transfer, Ramsey County conducted soil investigation work on this portion of the 135 PTA in early FY 2012. A Draft Phase II Environmental Site Assessment report documenting this work was submitted to the MPCA (VIC Program) in December 2011.

For the eastern portion, additional soil investigation to support preparation of an EE/CA was conducted in March-June 2012. The EE/CA received consistency approval from the USEPA and MPCA in November 2012, and the EE/CA recommended soil excavation and offsite disposal. The Army published legal notices in newspapers regarding the availability of the EE/CA for public comment and established a 30-day public comment period beginning on November 7,

2012. No comments were received. The Army selected the EE/CA-recommended remedy in an Action Memorandum signed on December 18, 2012. The Army then prepared a Removal Action Work Plan to describe the implementation procedures for the soil excavation and offsite disposal. The Work Plan received consistency approval from the USEPA and MPCA in March 2013. The soil excavation and offsite disposal work was implemented in May-June 2013, with a total of 1,846 tons of contaminated soil removed from the various soil areas of concern, collectively (i.e., Site A, the eastern portion of the 135 PTA, and the MNARNG environmental baseline survey areas). The Removal Action Completion Report documenting implementation of this work received consistency approval from the USEPA and MPCA in November 2013. OU2 ROD Amendment #5, signed in March 2014, documented that the soil removal actions were the final remedies for these sites and incorporated these remedies into OU2. Discussion of this site is now being included in Section 4.0.

14.4 SITE A - SOIL AREA OF CONCERN

Soil samples collected in December 2009 as part of Minnesota Army National Guard (MNARNG) environmental baseline survey (EBS) work indicated that metals contamination was present near the southern edge of the prior soil excavation area work that was completed in 1999. Additional soil investigation to support preparation of an EE/CA was conducted in March-June 2012. The EE/CA received consistency approval from the USEPA and MPCA in November 2012, and the EE/CA recommended soil excavation and offsite disposal. The Army published legal notices in newspapers regarding the availability of the EE/CA for public comment and established a 30-day public comment period beginning on November 7, 2012. No comments were received. The Army selected the EE/CA-recommended remedy in an Action Memorandum signed on December 18, 2012. The Army then prepared a Removal Action Work Plan to describe the implementation procedures for the soil excavation and offsite disposal. The Work Plan received consistency approval from the USEPA and MPCA in March 2013. The soil excavation and offsite disposal work was implemented in May-June 2013, with a total of 1,846 tons of contaminated soil removed from the various soil areas of concern, collectively (i.e., Site A, the eastern portion of the 135 PTA, and the MNARNG environmental baseline survey areas). The Removal Action Completion Report documenting implementation of this work received consistency approval from the USEPA and MPCA in November 2013. OU2 ROD Amendment #5, signed in March 2014, documented that the soil removal actions were the final remedies for these sites and incorporated these remedies into OU2. Discussion of this site is now being included in Section 4.0.

14.5 NATIONAL GUARD EBS - SOIL AREAS OF CONCERN

Soil samples collected in June 1999 as part of MNARNG environmental baseline survey (EBS) work indicated that metals contamination was present at two areas of concern located just north of the southwest corner of the National Guard area (within a former open storage area and adjacent to a concrete foundation). Additional soil investigation to support preparation of an EE/CA was conducted in March-June 2012. The EE/CA received consistency approval from the USEPA and MPCA in November 2012, and the EE/CA recommended soil excavation and offsite disposal. The Army published legal notices in newspapers regarding the availability of the EE/CA for public comment and established a 30-day public comment period beginning on November 7, 2012. No comments were received. The Army selected the EE/CA-recommended remedy in an Action Memorandum signed on December 18, 2012. At the end of FY 2012 and early FY 2013, the Army collected additional soil samples to provide more complete delineation of the perimeters of the two EBS soil areas of concern. This additional sampling work was documented in a Removal Action Work Plan that that was prepared by the Army to describe the implementation procedures for the soil excavation and offsite disposal. The Work Plan received consistency approval from the USEPA and MPCA in March 2013. The soil excavation and offsite disposal work was implemented in May-June 2013, with a total of 1,846 tons of contaminated soil removed from the various soil areas of concern, collectively (i.e., Site A, the eastern portion of the 135 PTA, and the MNARNG EBS areas). The Removal Action Completion Report documenting implementation of this work received consistency approval from the USEPA and MPCA in November 2013. OU2 ROD Amendment #5, signed in

March 2014, documented that the soil removal actions were the final remedies for these sites and incorporated these remedies into OU2. Discussion of this site is now being included in Section 4.0.

14.6 PROPERTY TRANSFER-RELATED ENVIRONMENTAL ACTIVITIES

In 2002, the remaining 774 acres that were still under the control of TCAAP were declared excess to the needs of the Department of Defense. The Army Base Realignment and Closure Office funded environmental site assessment (ESA) work to collect information regarding the environmental condition of the property in order to facilitate property transfer. The work included document reviews and field sampling of various media. The findings were published in "Environmental Site Assessment for 774-Acre Excess Parcel, Phase I and Phase II Report, Twin Cities Army Ammunition Plant" (Plexus Scientific Corporation, February 20, 2004, final report). Based on comments from the MPCA and USEPA, additional samples were collected and analyzed in FY 2005. The Army prepared an "ESA Addendum Report" that was approved in FY 2006. Originally, it was proposed to transfer approximately 585 acres through a negotiated sale with the City of Arden Hills, who in turn had an agreement with a developer. In FY 2007, the developer collected additional samples of various media on the property proposed for transfer to Arden Hills. In FY 2009, the developer withdrew from its agreement with Arden Hills, who in turn withdrew its offer to purchase with the federal government. The federal government was then working towards a public auction of the remaining TCAAP property; however, in FY 2011, Ramsey County initiated discussions with the federal government regarding purchase of the property for the potential purpose of locating a new Minnesota Vikings stadium (and other development). Although the final decision placed the Vikings stadium in Minneapolis, Ramsey County then sought to purchase 427 acres of the TCAAP property even without locating the stadium on it. Ultimately, this deal was closed in April 2013, which initially transferred ownership of approximately 397 acres to Ramsey County and provided a lease to Ramsey County for the balance of the property (approximately 30 acres) in order to allow Ramsey County to clean up these portions of the property that had known exceedances of the MPCA industrial cleanup standards (cleanup of such exceedances must be completed before the federal government can transfer these areas to Ramsey County).

Ramsey County contracted Carl Bolander & Sons, Co. (who teamed with Wenck) to conduct contaminated soil cleanup on the 427 acre property, as well as other site work in preparation for future development (i.e., building abatement/removal, road/parking lot removal, utility removal, etc.). Ramsey County has enrolled in the MPCA Voluntary Investigation and Cleanup (VIC) Program to conduct this work. The VIC Program has primary oversight responsibility, in conjunction with USEPA review of certain key elements of the work (i.e., QAPPs, Response Action Plan Implementation Reports, and modifications to the OU2 LUCRD). Ramsey County intends to conduct soil cleanup work to meet MPCA residential cleanup standards (unrestricted use), though development is anticipated to be mixed use (residential, recreational, and commercial/industrial). The contaminated soil cleanup work is also intended to fulfill the Army's obligation under the Federal Facility Agreement (FFA) to remediate soils to industrial cleanup standards.

As of the end of FY 2014, Bolander has completed almost all of the demolition-type site work in preparation for future development (i.e., building abatement/removal, road/parking lot removal, utility removal, etc.). In early FY 2014, a QAPP for conducting soil sampling was approved by the MPCA and USEPA, and various Response Action Plans (RAPs) were also approved during FY 2014. A large portion of the additional investigative soil sampling and contaminated soil excavation (with post-excavation verification sampling) was completed in FY 2014, and the remainder is expected to be completed in FY 2015. Documentation reports for site work are also anticipated to be submitted by the end of FY 2015, and an OU2 LUCRD revision to document the property's suitability for unlimited use and unrestricted exposure (with respect to soils) is anticipated to be completed in FY 2016.

14.7 FIVE YEAR REVIEW

A Five-Year Review report was completed in August 2014 for Operable Unit 1,2, and 3. The review concluded that the remedies are functioning as intended, and that the components of the remedies remain protective of human health and the environment. It was noted that continued monitoring was required at Site A to evaluate whether MNA will adequately control plume migration (which is being done), and also that the investigations of vapor intrusion risk at Site A and attenuation levels in the Building 102 groundwater plume needed to be completed to assess these issues (which have both been completed, as documented in the FY 2013 APR).

15.0 References

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Appendix A

FY 2014 – FY 2018 Monitoring Plans

A.1 Groundwater Monitoring Wells

APPENDIX A.1
FY 2014 – FY 2018 MONITORING PLAN
FOR GROUNDWATER MONITORING WELLS

Unit Designations:

01U	-	Upper Fridley Formation	03L	-	Lower Hillside Formation	SL	-	St. Lawrence
01L	-	Lower Fridley Formation	SP	-	St. Peter	UNK	-	Unknown
03U	-	Upper Hillside Formation	PC	-	Prairie du Chien			
03M	-	Middle Hillside Formation	J	-	Jordan			

Notes:

(A) Indicates that the monitoring is the responsibility of ATK.
(B) Indicates that the monitoring is the responsibility of the Army.
(1) "L (A or B)" denotes a water level measurement by the appropriate party.
(2) "Q (A or B)" denotes a water quality sampling by the appropriate party. The required analyte list for each specific site is shown in Appendix A.4.
(3) The designations refer to the following purposes:

- ❖ Operable Unit 1 Water Quality
  - – 1.a = To contour the perimeter of the plume which defines the area of concern for alternate water supply/well abandonment
  - – OR = Overall remedy. To evaluate attainment of the cleanup levels throughout the plume
- ❖ Operable Unit 1 Water Levels
  - – 3.b = To contour water levels for evaluation of containment
- ❖ Site A Water Quality
  - – OR = Overall remedy. To evaluate attainment of the cleanup levels throughout the plume
- ❖ Site A Water Levels
  - – OR = Overall remedy. To evaluate groundwater flow direction relative to plume location
- ❖ Site C Water Quality
  - – OR = Overall remedy. To evaluate attainment of the cleanup levels throughout the plume
- ❖ Site C Water Levels
  - – OR = Overall remedy. To evaluate groundwater flow direction relative to plume location
- ❖ Site I Water Quality
  - – 1.a = To track remedy progress
  - – OR = Overall remedy. To evaluate attainment of the cleanup levels throughout the plume
- ❖ Site I Water Levels
  - – 1.a = To track remedy progress
- ❖ Site K Water Quality
  - – OR = Overall remedy. To evaluate attainment of the cleanup levels throughout the plume
- ❖ Site K Water Levels
  - – 3.a = To contour water levels for evaluation of containment
- ❖ Building 102 Water Quality
  - – OR = Overall remedy. To evaluate attainment of the cleanup levels throughout the plume
- ❖ Building 102 Water Levels
  - – OR = Overall remedy. To evaluate groundwater flow direction relative to plume location
- ❖ TGRS Water Quality
  - – OR = Overall remedy. To evaluate attainment of the cleanup levels throughout the plume
- ❖ TGRS Water Levels
  - – 1.a = To contour water levels for evaluation of containment
- ❖ Operable Unit 3 Water Quality
  - – OR = Overall remedy. To evaluate attainment of the cleanup levels throughout the plume
- ❖ Operable Unit 3 Water Levels
  - – 2.a = To contour water levels for evaluation of MNA remedy

(4) Sampling performed by the City of Saint Anthony. Army collects sample only if in production and not being sampled by City of Saint Anthony; otherwise Army uses Saint Anthony data.
(5) Sample extraction well annually or biennially, as shown, since it is no longer being pumped.
(6) Wells 04U414 and 04U851 monitored every 5 years during event preceding 5-year review
(7) Sample OU1 private water supply well as late as September 30, if necessary due to temporary inaccessibility.

APPENDIX A.1

FY 2014 - FY 2018 MONITORING PLAN FOR GROUNDWATER MONITORING WELLS

Well Information									Purpose For Monitoring (3)		
Unit	Well I.D.	Common Name	Notes	June 14	June 15	June 16	June 17	June 18	Water Quality	Water Level	Comments
Operable Unit 1			Note: Changes from the monitoring plan presented in the previous Annual Performance Report are highlighted in this appendix.								
03U	03U811			---	Q,L(B)	---	Q,L(B)	---	OR	3.b	
03U	03U821			---	Q,L(B)	---	Q,L(B)	---	OR	3.b	
03U	03U822			---	Q,L(B)	---	Q,L(B)	---	1.a, OR	None	
03U	03U831			---	---	---	---	---	---	---	abandoned 2006
03U	409550	PCA 6U3		---	Q,L(B)	---	Q,L(B)	---	OR	None	
03U	409596	BS118U3		---	---	---	---	---	---	---	abandoned 2007, may need replacement
03M	03M843			---	Q,L(B)	---	Q,L(B)	---	1.a, OR	None	
03L	03L811			---	Q,L(B)	---	Q,L(B)	---	OR	3.b	
03L	03L822			---	Q,L(B)	---	Q,L(B)	---	OR	None	
03L	03L832			---	Q,L(B)	---	Q,L(B)	---	OR	None	
03L	03L841			---	Q,L(B)	---	Q,L(B)	---	1.a, OR	None	
03L	03L846			---	Q,L(B)	---	Q,L(B)	---	1.a, OR	None	
03L	03L853			---	---	---	---	---	---	---	
03L	409556	PCA4L3		---	Q,L(B)	---	Q,L(B)	---	1.a, OR	None	
03L	409557	PCA1L3		---	Q,L(B)	---	Q,L(B)	---	1.a, OR	None	
03L	409597	BS118L3		---	---	---	---	---	---	---	abandoned 2007, may need replacement
PC	04U821			---	Q,L(B)	---	Q,L(B)	---	OR	3.b	
PC	04U834			---	Q,L(B)	---	Q,L(B)	---	OR	None	
PC	04U836	MW-1		---	Q,L(B)	---	Q,L(B)	---	OR	3.b	
PC	04U837	MW-3		---	Q,L(B)	---	Q,L(B)	---	OR	3.b	
PC	04U838	MW-5		---	Q,L(B)	---	Q,L(B)	---	OR	3.b	
PC	04U839	MW-7		---	Q,L(B)	---	Q,L(B)	---	OR	3.b	
PC	04U841			---	Q,L(B)	---	Q,L(B)	---	OR	3.b	
PC	04U843			---	Q,L(B)	---	Q,L(B)	---	1.a, OR	3.b	
PC	04U844			---	Q,L(B)	---	Q,L(B)	---	OR	3.b	
PC	04U846			---	Q,L(B)	---	Q,L(B)	---	OR	3.b	
PC	04U847			---	Q,L(B)	---	Q,L(B)	---	OR	3.b	
PC	04U849			---	Q,L(B)	---	Q,L(B)	---	OR	3.b	
PC	04U850			---	Q,L(B)	---	Q,L(B)	---	OR	3.b	
PC	04U855			---	Q,L(B)	---	Q,L(B)	---	1.a, OR	3.b	
PC	04U871			Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	3.b	
PC	04U872			Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	3.b	
PC	04U875			---	Q,L(B)	---	Q,L(B)	---	1.a, OR	3.b	
PC	04U877			Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	3.b	

APPENDIX A.1

FY 2014 - FY 2018 MONITORING PLAN FOR GROUNDWATER MONITORING WELLS

Well Information									Purpose For Monitoring (3)		
Unit	Well I.D.	Common Name	Notes	June 14	June 15	June 16	June 17	June 18	Water Quality	Water Level	Comments
PC	04U879			---	Q,L(B)	---	Q,L(B)	---	1.a, OR	3.b	
PC	04U880			---	Q,L(B)	---	Q,L(B)	---	1.a, OR	3.b	
PC	04U881			---	Q,L(B)	---	Q,L(B)	---	1.a, OR	None	
PC	04U882			---	Q,L(B)	---	Q,L(B)	---	OR	None	
PC	04U883			---	Q,L(B)	---	Q,L(B)	---	1.a, OR	None	
PC	191942	BS118U4		---	---	---	---	---	---	---	abandoned 2007, may need replacement
PC	200154	UM Golf Course	(7)	---	Q(B)	---	Q(B)	---	1.a, OR	---	
PC	200814	American Linen		---	---	---	---	---	---	---	
PC	206688	Cloverpond	(7)	---	Q(B)	---	Q(B)	---	1.a, OR	---	
PC	234547	Honeywell Ridgeway		---	---	---	---	---	---	---	
PC	409547	PCA1U4		---	Q,L(B)	---	Q,L(B)	---	OR	3.b	
PC	409548	PCA2U4		---	Q,L(B)	---	Q,L(B)	---	OR	3.b	
PC	409549	PCA3U4		---	Q,L(B)	---	Q,L(B)	---	OR	3.b	
PC	409555	PCA5U4		---	Q,L(B)	---	Q,L(B)	---	1.a, OR	3.b	
PC	512761	Gross Golf Course #2	(7)	---	Q,L(B)	---	Q,L(B)	---	OR	3.b	
PC	554216	New Brighton #14									See Appendix A.2
PC	582628	New Brighton #15									See Appendix A.2
J	04J822			Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	3.b	
J	04J834			---	Q,L(B)	---	Q,L(B)	---	OR	None	
J	04J835			---	---	---	---	---	---	---	
J	04J836	MW-2		---	Q,L(B)	---	Q,L(B)	---	OR	3.b	
J	04J837	MW-4		---	Q,L(B)	---	Q,L(B)	---	OR	3.b	
J	04J838	MW-6		---	Q,L(B)	---	Q,L(B)	---	OR	3.b	
J	04J839	MW-8		---	Q,L(B)	---	Q,L(B)	---	OR	3.b	
J	04J847			Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	3.b	
J	04J849			Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	3.b	
J	04J882			---	Q,L(B)	---	Q,L(B)	---	OR	None	
J	200524	St. Anthony #5	(4)	---	Q(B)	---	Q(B)	---	OR	---	Army gets St. Anthony Data
J	200803	St. Anthony #4	(4)	---	Q(B)	---	Q(B)	---	OR	---	Army gets St. Anthony Data
J	206796	New Brighton #5									See Appendix A.2
J	206797	New Brighton #6									See Appendix A.2
PC/J	200804	St. Anthony #3	(4)	---	Q(B)	---	Q(B)	---	OR	---	Army gets St. Anthony Data
PC/J	200812	Gross Golf #1		---	---	---	---	---	---	---	
PC/J	206792	New Brighton #4									See Appendix A.2
PC/J	206793	New Brighton #3									See Appendix A.2
PC/J	233221	R&D Systems, N. Well		---	---	---	---	---	---	---	
PC/J	234549	Reiner		---	---	---	---	---	1.a, OR	---	Well out of service
PC/J	PJ#318			---	Q,L(B)	---	Q,L(B)	---	OR	None	
UNK	234546	Honeywell Ridgeway	(7)	---	Q(B)	---	Q(B)	---	OR	---	

APPENDIX A.1

FY 2014 - FY 2018 MONITORING PLAN FOR GROUNDWATER MONITORING WELLS

Well Information									Purpose For Monitoring (3)		
Unit	Well I.D.	Common Name	Notes	June 14	June 15	June 16	June 17	June 18	Water Quality	Water Level	Comments
Operable Unit 2											
Site A Shallow Groundwater											
01U	01U038			---	---	---	---	---	---	---	abandoned FY14
01U	01U039			Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	Semiannual FY15; Annual starting FY 16
01U	01U040			---	---	---	---	---	---	---	abandoned FY14
01U	01U041			---	---	---	---	---	---	---	abandoned FY14
01U	01U063			L(B)	L(B)	L(B)	L(B)	L(B)	---	OR	
01U	01U067			---	---	---	---	---	---	---	abandoned FY14
01U	01U102			Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	Annual
01U	01U103			Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	Annual, including antimony
01U	01U104			---	---	---	---	---	---	---	abandoned FY14
01U	01U105			---	---	---	---	---	---	---	abandoned FY14
01U	01U106			L(B)	L(B)	L(B)	L(B)	L(B)	---	OR	
01U	01U107			---	---	---	---	---	---	---	abandoned FY14
01U	01U108			Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	Annual
01U	01U110			---	---	---	---	---	---	---	abandoned FY14
01U	01U115			Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	Annual
01U	01U116			Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	Annual
01U	01U117			Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	Annual
01U	01U118			---	---	---	---	---	---	---	abandoned FY14
01U	01U119			L(B)	L(B)	L(B)	L(B)	L(B)	---	OR	
01U	01U120			L(B)	L(B)	L(B)	L(B)	L(B)	---	OR	
01U	01U125			---	---	---	---	---	---	---	
01U	01U126			Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	Annual
01U	01U127			L(B)	L(B)	L(B)	L(B)	L(B)	OR	OR	
01U	01U133			L(B)	L(B)	L(B)	L(B)	L(B)	---	OR	
01U	01U135			L(B)	L(B)	L(B)	L(B)	L(B)	---	OR	
01U	01U136			---	---	---	---	---	---	---	abandoned FY14
01U	01U137			L(B)	L(B)	L(B)	L(B)	L(B)	---	OR	
01U	01U138			Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	Annual
01U	01U139			Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	Semiannual FY15; Annual starting FY 16
01U	01U140			Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	Semiannual FY15; Annual starting FY 16
01U	01U141			L(B)	L(B)	L(B)	L(B)	L(B)	---	OR	
01U	01U145	Piezometer		L(B)	L(B)	L(B)	L(B)	L(B)	---	OR	
01U	01U146	Piezometer		L(B)	L(B)	L(B)	L(B)	L(B)	---	OR	
01U	01U147	Piezometer		L(B)	L(B)	L(B)	L(B)	L(B)	---	OR	
01U	01U148	Piezometer		L(B)	L(B)	L(B)	L(B)	L(B)	---	OR	
01U	01U149	Piezometer		L(B)	L(B)	L(B)	L(B)	L(B)	---	OR	

APPENDIX A.1

FY 2014 - FY 2018 MONITORING PLAN FOR GROUNDWATER MONITORING WELLS

Well Information									Purpose For Monitoring (3)		
Unit	Well I.D.	Common Name	Notes	June 14	June 15	June 16	June 17	June 18	Water Quality	Water Level	Comments
01U	01U150	Piezometer		L(B)	L(B)	L(B)	L(B)	L(B)	---	OR	
01U	01U151	Piezometer		L(B)	L(B)	L(B)	L(B)	L(B)	---	OR	
01U	01U152	Piezometer		L(B)	L(B)	L(B)	L(B)	L(B)	---	OR	
01U	01U153	Piezometer		L(B)	L(B)	L(B)	L(B)	L(B)	---	OR	
01U	01U154	Piezometer		L(B)	L(B)	L(B)	L(B)	L(B)	---	OR	
01U	01U155	Piezometer		L(B)	L(B)	L(B)	L(B)	L(B)	---	OR	
01U	01U156	Piezometer		L(B)	L(B)	L(B)	L(B)	L(B)	---	OR	
01U	01U157			Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	Semiannual FY15; Annual starting FY 16
01U	01U158			Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	Semiannual FY15; Annual starting FY 16
01U	01U350			Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	Annual
01U	01U351	EW-1		Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	Annual
01U	01U352	EW-2		Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	Semiannual FY15; Annual starting FY 16
01U	01U353	EW-3		Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	Semiannual FY15; Annual starting FY 16
01U	01U354	EW-4		Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	Semiannual FY15; Annual starting FY 16
01U	01U355	EW-5		Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	Semiannual FY15; Annual starting FY 16
01U	01U356	EW-6		Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	Semiannual FY15; Annual starting FY 16
01U	01U357	EW-7		Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	Semiannual FY15; Annual starting FY 16
01U	01U358	EW-8		Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	Semiannual FY15; Annual starting FY 16
01U	01U901			Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	Semiannual FY15; Annual starting FY 16
01U	01U902			Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	Semiannual VOCs FY15, annual VOCs and antimony starting FY16
01U	01U903			Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	Annual
01U	01U904			Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	Semiannual VOCs FY15, annual VOCs and antimony starting FY16

APPENDIX A.1

FY 2014 - FY 2018 MONITORING PLAN FOR GROUNDWATER MONITORING WELLS

Well Information									Purpose For Monitoring (3)		
Unit	Well I.D.	Common Name	Notes	June 14	June 15	June 16	June 17	June 18	Water Quality	Water Level	Comments
Site C Shallow Groundwater											
01U	01U045			---	---	---	---	---	---	---	abandoned FY14
01U	01U046			Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	
01U	01U085			---	---	---	---	---	---	---	abandoned FY14
01U	01U551	EW-1		---	---	---	---	---	---	---	abandoned FY14
01U	01U552	EW-2		---	---	---	---	---	---	---	abandoned FY14
01U	01U553	EW-3		---	---	---	---	---	---	---	abandoned FY14
01U	01U561	MW-1		Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	
01U	01U562	MW-2		Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	
01U	01U563	MW-3		Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	
01U	01U564	MW-4		Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	
01U	01U565	MW-5		---	---	---	---	---	---	---	abandoned FY14
01U	01U566	MW-6		---	---	---	---	---	---	---	abandoned FY14
01U	01U567	MW-7		Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	
01U	01U568	MW-8		---	---	---	---	---	---	---	abandoned FY14
01U	01U569	MW-9		---	---	---	---	---	---	---	abandoned FY14
01U	01U570	MW-10		---	---	---	---	---	---	---	abandoned FY14
01U	01U571	MW-11		Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	
01U	01U572	MW-12		---	---	---	---	---	---	---	abandoned FY14
01U	01U573	MW-13		Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	
01U	01U574	MW-14		Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	
01U	01U575	MW-15		Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	
01U	01U576	MW-16		Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	

APPENDIX A.1

FY 2014 - FY 2018 MONITORING PLAN FOR GROUNDWATER MONITORING WELLS

Well Information									Purpose For Monitoring (3)		
Unit	Well I.D.	Common Name	Notes	June 14	June 15	June 16	June 17	June 18	Water Quality	Water Level	Comments
Site I Shallow Groundwater											
01U	01U064			---	---	---	---	---	---	---	abandoned FY14
01U	01U631			---	---	---	---	---	---	---	abandoned FY 14
01U	01U632			---	---	---	---	---	---	---	abandoned FY14
01U	01U636			---	---	---	---	---	---	---	abandoned FY14
01U	01U639			---	---	---	---	---	---	---	abandoned FY14
01U	01U640			---	---	---	---	---	---	---	abandoned FY14
01U	01U666			---	---	---	---	---	---	---	abandoned FY14
01U	01U667			---	---	Q,L(A)	Q,L(A)	Q,L(A)	---	---	abandoned FY14, will be replaced Spring 2016
01U	482086	I01MW		---	---	---	---	---	---	---	abandoned FY14
01U	482087	I05MW		---	---	---	---	---	---	---	abandoned FY14
01U	482088	I02MW		---	---	---	---	---	---	---	abandoned FY14
01U	482089	I04MW		---	---	---	---	---	---	---	abandoned FY14
01U	482090	I03MW		---	---	---	---	---	---	---	abandoned FY14

All of the Site I shallow groundwater wells were sealed in FY14. Following soil remediation under Building 502, only 01U667 will be re-installed (with annual sampling).

APPENDIX A.1

FY 2014 - FY 2018 MONITORING PLAN FOR GROUNDWATER MONITORING WELLS

Well Information									Purpose For Monitoring (3)		
Unit	Well I.D.	Common Name	Notes	June 14	June 15	June 16	June 17	June 18	Water Quality	Water Level	Comments
Site K Shallow Groundwater											
01U	01U047			L(A)	L(A)	L(A)	L(A)	L(A)	---	3.a	
01U	01U048			L(A)	L(A)	L(A)	L(A)	L(A)	---	3.a	
01U	01U052			L(A)	L(A)	L(A)	L(A)	L(A)	---	3.a	
01U	01U065			L(A)	L(A)	L(A)	L(A)	L(A)	---	3.a	
01U	01U128			Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	OR	3.a	
01U	01U601			---	---	---	---	---	---	---	abandoned FY14
01U	01U602			---	---	---	---	---	---	---	abandoned FY14
01U	01U603			Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	OR	3.a	
01U	01U604			---	---	---	---	---	---	---	abandoned FY14
01U	01U605			---	---	---	---	---	---	---	abandoned FY14
01U	01U607			L(A)	L(A)	L(A)	L(A)	L(A)	---	3.a	
01U	01U608			---	---	L(A)	L(A)	L(A)	---	---	abandoned FY14, will be replaced Spring 2016
01U	01U609			---	---	L(A)	L(A)	L(A)	---	---	abandoned FY14, will be replaced Spring 2016
01U	01U611			---	---	Q,L(A)	Q,L(A)	Q,L(A)	---	---	abandoned FY14, will be replaced Spring 2016
01U	01U612			L(A)	L(A)	L(A)	L(A)	L(A)	---	3.a	
01U	01U613			---	---	---	---	---	---	---	abandoned FY14
01U	01U615			Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	OR	3.a	
01U	01U616			---	---	---	---	---	---	---	abandoned FY14
01U	01U617			Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	OR	3.a	
01U	01U618			Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	OR	3.a	
01U	01U619			---	---	---	---	---	---	---	abandoned FY14
01U	01U620			---	---	---	---	---	---	---	abandoned FY14
01U	01U621			Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	OR	3.a	
01U	01U624			---	---	---	---	---	---	---	abandoned FY14
01U	01U625			L(A)	L(A)	L(A)	L(A)	L(A)	---	3.a	
01U	01U626			L(A)	L(A)	L(A)	L(A)	L(A)	---	3.a	
01U	01U627			L(A)	L(A)	L(A)	L(A)	L(A)	---	3.a	
01U	01U628			---	---	---	---	---	---	---	abandoned FY14
01U	482083	K04-MW		Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	OR	3.a	
01U	482084	K02-MW		---	---	---	---	---	---	---	abandoned FY14
01U	482085	K01-MW		---	---	---	---	---	---	---	abandoned FY14
03U	03U621			Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	OR	3.a	

APPENDIX A.1

FY 2014 - FY 2018 MONITORING PLAN FOR GROUNDWATER MONITORING WELLS

Well Information									Purpose For Monitoring (3)		
Unit	Well I.D.	Common Name	Notes	June 14	June 15	June 16	June 17	June 18	Water Quality	Water Level	Comments
Building 102 Shallow Groundwater											
01U	01U048			Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	
01U	01U578			---	---	---	---	---	---	---	abandoned FY14
01U	01U579			Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	
01U	01U580			Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	
01U	01U581			Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	
01U	01U582			Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	
01U	01U583			Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	
01U	01U584			Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	
01L	01L581			Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	
01L	01L582			Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	
01L	01L583			Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	
01L	01L584			Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	

APPENDIX A.1

FY 2014 - FY 2018 MONITORING PLAN FOR GROUNDWATER MONITORING WELLS

Well Information									Purpose For Monitoring (3)		
Unit	Well I.D.	Common Name	Notes	June 14	June 15	June 16	June 17	June 18	Water Quality	Water Level	Comments
Deep Groundwater (TGRS)											
03F	03F302	B1									See Appendix A.2
03F	03F303	B2	(5)	Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	OR	1.a	
03F	03F304	B3									See Appendix A.2
03F	03F305	B4									See Appendix A.2
03F	03F306	B5									See Appendix A.2
03F	03F307	B6									See Appendix A.2
03F	03F308	B7	(5)	---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
03F	03F312	B11	(5)	Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	OR	1.a	
03F	03F319	B13									See Appendix A.2
03U	03U001			---	L(A)	---	L(A)	---	---	1.a	
03U	03U002			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
03U	03U003			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
03U	03U004			---	---	---	---	---	---	---	Abandoned FY13
03U	03U005			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
03U	03U007			---	Q,L(A)	---	Q,L(A)	---	Background	1.a	
03U	03U008			---	L(A)	---	L(A)	---	---	1.a	
03U	03U009			---	Q,L(A)	---	Q,L(A)	---	Background	1.a	
03U	03U010			---	L(A)	---	L(A)	---	---	1.a	
03U	03U011			---	L(A)	---	L(A)	---	---	1.a	
03U	03U012			---	L(A)	---	L(A)	---	---	1.a	
03U	03U013			---	L(A)	---	L(A)	---	---	1.a	
03U	03U014			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
03U	03U015			---	L(A)	---	L(A)	---	---	1.a	
03U	03U016			---	L(A)	---	L(A)	---	---	1.a	
03U	03U017			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
03U	03U018			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
03U	03U019			---	L(A)	---	L(A)	---	---	1.a	
03U	03U020			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
03U	03U021			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
03U	03U022			---	L(A)	---	L(A)	---	---	1.a	
03U	03U023			---	L(A)	---	L(A)	---	---	1.a	
03U	03U024			---	L(A)	---	L(A)	---	---	1.a	
03U	03U025			---	L(A)	---	L(A)	---	---	1.a	

APPENDIX A.1

FY 2014 - FY 2018 MONITORING PLAN FOR GROUNDWATER MONITORING WELLS

Well Information									Purpose For Monitoring (3)		
Unit	Well I.D.	Common Name	Notes	June 14	June 15	June 16	June 17	June 18	Water Quality	Water Level	Comments
03U	03U026			---	L(A)	---	L(A)	---	---	1.a	
03U	03U027			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
03U	03U028			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
03U	03U029			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
03U	03U030			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
03U	03U031			---	---	---	---	---	---	---	abandoned FY14
03U	03U032			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
03U	03U075			---	---	---	---	---	---	---	abandoned FY14
03U	03U076			---	---	---	---	---	---	---	abandoned FY14
03U	03U077			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
03U	03U078			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
03U	03U079			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
03U	03U082			---	L(A)	---	L(A)	---	---	1.a	
03U	03U083			---	L(A)	---	L(A)	---	---	1.a	
03U	03U084			---	---	---	---	---	---	---	abandoned FY14
03U	03U087			---	L(A)	---	L(A)	---	---	1.a	
03U	03U088			---	L(A)	---	L(A)	---	---	1.a	
03U	03U089			---	L(A)	---	L(A)	---	---	1.a	
03U	03U090			---	L(A)	---	L(A)	---	---	1.a	
03U	03U092			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
03U	03U093			Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	OR	1.a	
03U	03U094			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
03U	03U096			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
03U	03U097			---	---	---	---	---	---	---	
03U	03U099			Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	OR	1.a	
03U	03U111			---	L(A)	---	L(A)	---	---	1.a	
03U	03U112			---	L(A)	---	L(A)	---	---	1.a	
03U	03U113			---	L(A)	---	L(A)	---	---	1.a	
03U	03U114			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
03U	03U121			---	---	---	---	---	---	---	
03U	03U129			---	---	---	---	---	---	---	
03U	03U301	SC1									See Appendix A.2
03U	03U314	SC2									See Appendix A.2
03U	03U315	SC3	(5)	---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
03U	03U316	SC4	(5)	---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
03U	03U317	SC5									See Appendix A.2
03U	03U521			---	---	---	---	---	---	---	
03U	03U647			---	---	---	---	---	---	---	abandoned FY14
03U	03U648			---	---	---	---	---	---	---	abandoned FY14
03U	03U658			---	---	---	---	---	---	---	abandoned FY13

APPENDIX A.1

FY 2014 - FY 2018 MONITORING PLAN FOR GROUNDWATER MONITORING WELLS

Well Information									Purpose For Monitoring (3)		
Unit	Well I.D.	Common Name	Notes	June 14	June 15	June 16	June 17	June 18	Water Quality	Water Level	Comments
03U	03U659			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
03U	03U671			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
03U	03U672			---	---	---	---	---	---	---	abandoned FY14, replaced by 03U677
03U	03U674			---	---	---	---	---	---	---	abandoned FY14
03U	03U675			---	---	---	---	---	---	---	
03U	03U676			---	---	---	---	---	---	---	abandoned FY14
03U	03U677			Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	OR	1.a	constructed FY14
03U	03U701			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
03U	03U702			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
03U	03U703			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
03U	03U704			---	L(A)	---	L(A)	---	---	1.a	
03U	03U705			---	L(A)	---	L(A)	---	---	1.a	
03U	03U706			---	L(A)	---	L(A)	---	---	1.a	
03U	03U707			---	L(A)	---	L(A)	---	---	1.a	
03U	03U708			Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	OR	1.a	
03U	03U709			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
03U	03U710			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
03U	03U711			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
03U	03U715			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
03U	03U716			---	L(A)	---	L(A)	---	---	1.a	
03U	03U801			Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	OR	1.a	
03U	03U803			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
03U	03U804			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
03U	03U805			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
03U	03U806			Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	OR	1.a	
03U	519288	E101-MW		---	---	---	---	---	---	---	
03U	519289	E102-MW		---	---	---	---	---	---	---	
03U	519290	E103-MW		---	---	---	---	---	---	---	
03M	03M001			---	L(A)	---	L(A)	---	---	1.a	
03M	03M002			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
03M	03M003			---	L(A)	---	L(A)	---	---	1.a	
03M	03M004			---	---	---	---	---	---	---	Abandoned FY13
03M	03M005			---	L(A)	---	L(A)	---	---	1.a	
03M	03M007			---	L(A)	---	L(A)	---	---	1.a	
03M	03M010			---	L(A)	---	L(A)	---	---	1.a	
03M	03M012			---	L(A)	---	L(A)	---	---	1.a	
03M	03M013			---	L(A)	---	L(A)	---	---	1.a	
03M	03M017			---	L(A)	---	L(A)	---	---	1.a	
03M	03M020			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	

APPENDIX A.1

FY 2014 - FY 2018 MONITORING PLAN FOR GROUNDWATER MONITORING WELLS

Well Information									Purpose For Monitoring (3)		
Unit	Well I.D.	Common Name	Notes	June 14	June 15	June 16	June 17	June 18	Water Quality	Water Level	Comments
03M	03M713			---	L(A)	---	L(A)	---	---	1.a	
03M	03M802			Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	OR	1.a	
03M	03M806			Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	OR	1.a	
03L	03L001			---	L(A)	---	L(A)	---	---	1.a	
03L	03L002			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
03L	03L003			---	L(A)	---	L(A)	---	---	1.a	
03L	03L004			---	---	---	---	---	---	---	Abandoned FY13
03L	03L005			---	L(A)	---	L(A)	---	---	1.a	
03L	03L007			---	Q,L(A)	---	Q,L(A)	---	Background	1.a	
03L	03L010			---	L(A)	---	L(A)	---	---	1.a	
03L	03L012			---	L(A)	---	L(A)	---	---	1.a	
03L	03L013			---	L(A)	---	L(A)	---	---	1.a	
03L	03L014			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
03L	03L017			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
03L	03L018			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
03L	03L020			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
03L	03L021			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
03L	03L027			---	---	---	---	---	---	---	abandoned FY14
03L	03L028			---	---	---	---	---	---	---	abandoned FY14
03L	03L029			---	---	---	---	---	---	---	abandoned FY14
03L	03L077			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
03L	03L078			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
03L	03L079			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
03L	03L080			---	L(A)	---	L(A)	---	---	1.a	
03L	03L081			---	L(A)	---	L(A)	---	---	1.a	
03L	03L084			---	---	---	---	---	---	---	abandoned FY14
03L	03L113			---	L(A)	---	L(A)	---	---	1.a	
03L	03L802			Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	OR	1.a	
03L	03L806			Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	OR	1.a	
03L	03L809			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
03L	03L833			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
PC	04U001			---	L(A)	---	L(A)	---	---	1.a	
PC	04U002			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
PC	04U003			---	L(A)	---	L(A)	---	---	1.a	
PC	04U007			---	Q,L(A)	---	Q,L(A)	---	Background	1.a	

APPENDIX A.1

FY 2014 - FY 2018 MONITORING PLAN FOR GROUNDWATER MONITORING WELLS

Well Information									Purpose For Monitoring (3)		
Unit	Well I.D.	Common Name	Notes	June 14	June 15	June 16	June 17	June 18	Water Quality	Water Level	Comments
PC	04U012			---	L(A)	---	L(A)	---	---	1.a	
PC	04U020			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
PC	04U027			---	---	---	---	---	---	---	abandoned FY14
PC	04U077			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
PC	04U510			---	Q,L(A)	---	Q,L(A)	---	Background	1.a	
PC	04U701			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
PC	04U702			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
PC	04U708			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
PC	04U709			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
PC	04U711			Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	OR	1.a	
PC	04U713			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
PC	04U714			---	L(A)	---	L(A)	---	---	1.a	
PC	04U802			Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	OR	1.a	
PC	04U806			Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	OR	1.a	
PC	04U833			Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	OR	1.a	
J	04J077			Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	OR	1.a	
J	04J702			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
J	04J708			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
J	04J713			---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
J	04J714			---	L(A)	---	L(A)	---	---	1.a	
PC/J	PJ#003			---	L(A)	---	L(A)	---	---	1.a	
PC/J	PJ#027			---	---	---	---	---	---	---	abandoned FY14
PC/J	PJ#309	B8									See Appendix A.2
PC/J	PJ#310	B9									See Appendix A.2
PC/J	PJ#311	B10	(5)	---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
PC/J	PJ#313	B12	(5)	---	Q,L(A)	---	Q,L(A)	---	OR	1.a	
PC/J	PJ#802			---	L(A)	---	L(A)	---	---	1.a	
PC/J	PJ#806			Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	OR	1.a	
---	Staff Gauges			---	L(A)	---	L(A)	---	---	---	
Unit 1 Wells											
01U	01U035			---	---	---	---	---	---	---	
01U	01U043			---	---	---	---	---	---	---	
01U	01U044			---	---	---	---	---	---	---	
01U	01U045			---	---	---	---	---	---	---	
01U	01U046			---	---	---	---	---	---	---	
01U	01U060			---	---	---	---	---	---	---	
01U	01U072			---	---	---	---	---	---	---	
01U	01U085			---	---	---	---	---	---	---	

APPENDIX A.1

FY 2014 - FY 2018 MONITORING PLAN FOR GROUNDWATER MONITORING WELLS

Well Information									Purpose For Monitoring (3)		
Unit	Well I.D.	Common Name	Notes	June 14	June 15	June 16	June 17	June 18	Water Quality	Water Level	Comments
Operable Unit 3											
03U	03U673			---	Q,L(A)	---	Q,L(A)	---	OR	2.a	
03M	03M848			Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	OR	2.a	
03L	03L673			---	Q,L(A)	---	Q,L(A)	---	OR	2.a	
03L	03L832			---	L(A)	---	L(A)	---	---	2.a	
03L	03L848			---	Q,L(A)	---	Q,L(A)	---	OR	2.a	
03L	03L854			---	Q,L(A)	---	Q,L(A)	---	OR	2.a	
03L	03L859			---	Q,L(A)	---	Q,L(A)	---	OR	2.a	
03L	03L860			---	L(A)	---	L(A)	---	---	2.a	
03L	03L861			---	---	---	---	---	---	---	Abandoned FY06
03L	476837	MW15H		---	---	---	---	---	---	---	
PC	04U414	414U4	(6)	---	---	---	---	Q,L(A)	OR	2.a	
PC	04U673			---	Q,L(A)	---	Q,L(A)	---	OR	2.a	
PC	04U832			---	Q,L(A)	---	Q,L(A)	---	OR	2.a	Contingency Action for FY08
PC	04U845			---	Q,L(A)	---	Q,L(A)	---	OR	2.a	Contingency Action for FY08
PC	04U848			---	Q,L(A)	---	Q,L(A)	---	OR	2.a	
PC	04U851		(6)	---	---	---	---	Q,L(A)	OR	2.a	
PC	04U852			---	---	---	---	---	---	---	Abandoned FY09
PC	04U854			---	Q,L(A)	---	Q,L(A)	---	OR	2.a	
PC	04U859			---	Q,L(A)	---	Q,L(A)	---	OR	2.a	
PC	04U860			---	Q,L(A)	---	Q,L(A)	---	OR	2.a	
PC	04U861			---	---	---	---	---	---	---	Abandoned FY06
PC	04U863	323U4		Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	OR	2.a	
PC	04U864	324U4		---	---	---	---	---	---	---	Abandoned FY09
PC	04U865	325U4		---	---	---	---	---	---	---	Abandoned FY09
PC	04U866	326U4		---	Q,L(A)	---	Q,L(A)	---	OR	2.a	
PC	520931	NBM #13		---	---	---	---	---	---	---	Abandoned FY07
J	04J864	324 J		---	---	---	---	---	---	---	Abandoned FY09
J	04J866	326 J		---	Q,L(A)	---	Q,L(A)	---	OR	2.a	

APPENDIX A.1

FY 2014 - FY 2018 MONITORING PLAN FOR GROUNDWATER MONITORING WELLS

Well Information									Purpose For Monitoring (3)		
Unit	Well I.D.	Common Name	Notes	June 14	June 15	June 16	June 17	June 18	Water Quality	Water Level	Comments
Well Inventory											
(Entries under "Notes" refer to the well inventory category)											
---	249608	Rapit Printing Inc	1a	---	---	---	Q(B)	---	Well Inventory	---	2520 Larpenteur Ave
---	S00444	Minneapolis Parks & Rec I	1a	---	---	---	Q(B)	---	Well Inventory	---	Ontario & E River Rd (Erie), Dartmoth Triangle
---	200173	KSTP Radio TV	1b	---	---	---	Q(B)	---	Well Inventory	---	3415 University Ave
---	200180	Town & Country Golf Cou	1b	---	---	---	Q(B)	---	Well Inventory	---	2279 Marshal Ave
---	200522	Windsor Green	1b	---	---	---	Q(B)	---	Well Inventory	---	Silver Lake Rd & Cty Rd E
---	200523	Windsor Green	1b	---	---	---	Q(B)	---	Well Inventory	---	Silver Lake Rd & Cty Rd E
---	234338	Bosell	1b	---	---	---	Q(B)	---	Well Inventory	---	1575 14th Ave NW
---	234421	BioClean (BioChem)	1b	---	---	---	Q(B)	---	Well Inventory	---	2151 Mustang Dr
---	234469	Palkowski, T.	1b	---	---	---	Q(B)	---	Well Inventory	---	2816 Hwy 88
---	234544	R&D Systems	1b	---	---	---	Q(B)	---	Well Inventory	---	2201 Kennedy St NE
---	249632	Montzka, Harold	1b	---	---	---	Q(B)	---	Well Inventory	---	2301 N Upland Crest NE
---	433298	Town & Country Golf Cou	1b	---	---	---	Q(B)	---	Well Inventory	---	2279 Marshall Ave
---	509052	Shriners Hospital	1b	---	---	---	Q(B)	---	Well Inventory	---	2025 E River Rd
---	756236	Alcan	1c	---	---	---	Q(B)	---	Well Inventory	---	150 26th Ave SE
---	S00437	Northern Star Co	1c	---	---	---	Q(B)	---	Well Inventory	---	3171 5th St SE
---	107405	Dimmick, Kay	2a	---	---	---	Q(B)	---	Well Inventory	---	4355 Hwy 10
---	200176	Waldorf Paper Products	2b	---	---	---	Q(B)	---	Well Inventory	---	2236 Myrtle Ave
---	249007	Walton, Toni	2b	---	---	---	Q(B)	---	Well Inventory	---	4453 Old Hwy 10
---	537801	Midway Industrial	2b	---	---	---	Q(B)	---	Well Inventory	---	4759 Old Hwy 8
---	S00002	Midland Hills Country Clul	2b	---	---	---	Q(B)	---	Well Inventory	---	2001 N Fulham St
---	200076	Old Dutch Foods, Inc	2c	---	---	---	Q(B)	---	Well Inventory	---	2375 Terminal Rd
---	236029	R&D Systems, South We	2c	---	---	---	Q(B)	---	Well Inventory	---	2201 Kennedy St NE
---	236439	Waldorf Paper Products	2c	---	---	---	Q(B)	---	Well Inventory	---	2250 Wabash Ave
---	249185	Novotny, Mark	4a	---	---	---	Q(B)	---	Well Inventory	---	1706 Malvern St
---		Amundsen, Jason & Lucy	4a	---	---	---	Q(B)	---	Well Inventory	---	2816 St. Anthony Blvd
---		Hermes, Margo	4a	---	---	---	Q(B)	---	Well Inventory	---	2935 Old Hwy 8

A.2 Remedial Treatment Systems

APPENDIX A.2
FY 2014 - FY 2018 MONITORING PLAN
FOR REMEDIAL TREATMENT SYSTEMS

OU1: DEEP GROUNDWATER [1]

Location	Sampling Frequency	Parameters
• Extraction Wells NBM#4, #14, and #15	- Monthly	- Pumping Volumes
(and also NBM#3, #5, and #6)	- Monthly	- Water Quality [2]
• PGAC Effluent	- Monthly	- Water Quality [2]

OU2: SITE K REMEDIAL ACTION

Location	Sampling Frequency	Parameters
• Extracted Groundwater	- Monthly	- Pumping Volume
• Treatment System Effluent [Outfall 391 (010)]	- See Appendix A.3	- See Appendix A.3

OU2: TCAAP GROUNDWATER RECOVERY SYSTEM (TGRS)

Location	Sampling Frequency	Parameters
• Extraction Wells	- Monthly	- Pumping Volumes
	- Semi-Annually	- Water Levels
	- Semi-Annually	- Water Quality [2]
• Treatment System Influent	- Monthly	- Pumping Volumes
	- Monthly	- Water Quality [2]
• Treatment System Effluent	- Monthly	- Water Quality [2]

Notes:
(1) Performed by the City of New Brighton using their Sampling and Analysis Plan.
(2) The required analyte list for each specific site is presented in Appendix A.4.

A.3 Surface Water

APPENDIX A.3
FY 2014 - FY 2018 MONITORING PLAN
FOR SURFACE WATER

Analysis	Analytical Method	Units	Site K Effluent (Outfall 010)	Site C Surface Water Locations (SW-5)	(SW-6)	(NE Wetland)
Flow Rate	---	gal/day	Continuous			
Total Flow	---	gal	M			
pH	(field)	(pH)	Q			
Hardness	(field)	(pH)	Q			
Cyanide	9012A	µg/L	Q			
Copper	6020	µg/L	Q			
Lead	6020	µg/L	Q	A	A	A
Mercury	7470A	µg/L	Q			
Phosphorus (Total)	365.4	µg/L	Q			
Silver	6020	µg/L	Q			
Zinc	6020	µg/L	Q			
Trichloroethene	8260C	µg/L	Q			
1,1-Dichloroethene	8260C	µg/L	Q			
1,1-Dichloroethane	8260C	µg/L	Q			
Cis-1,2-Dichloroethene	8260C	µg/L	Q			
Trans-1,2-Dichloroethene	8260C	µg/L	Q			
Vinyl Chloride	8260C	µg/L	Q			
1,2-Dichloroethane	8260C	µg/L	Q			

Notes:

M = Measurement required once per month

Q = Analysis required once per quarter

A = Annually in June

A.4 Site Specific Lists of Required Analytes

APPENDIX A.4
SITE SPECIFIC LISTS OF REQUIRED ANALYTES

Note: Cleanup Levels (in µg/L) from each Record of Decision are shown below for use in determining the required method detection limits. Also note that these lists represent the minimum list of analytes. A larger analyte list may be utilized by the monitoring organization, if so desired.

OU1 (DEEP GROUNDWATER) (1)

1,1-Dichloroethane	70
1,1-Dichloroethene	6
cis-1,2-Dichloroethene	70
1,1,1-Trichloroethane	200
1,1,2-Trichloroethane	3
Trichloroethene	5

SITE A (SHALLOW GROUNDWATER) (2)

Antimony*	6
1,1-Dichloroethene	6
1,2-Dichloroethane	4
Benzene	10
Chloroform	60
cis-1,2-Dichloroethene	70
Tetrachloroethene	7
Trichloroethene	30

*Antimony is only monitored at these 3 wells: 01U103, 01U902 and 01U904 (June only)

SITE C (SHALLOW GROUNDWATER) (3)

Lead	15

SITE I (SHALLOW GROUNDWATER) (2)

1,2-Dichloroethene (cis and trans)	70
Trichloroethene	30
Vinyl Chloride	0.2

BLDG 102 SHALLOW GROUNDWATER (4)

Vinyl Chloride(5)	0.18
cis-1,2-Dichloroethene	70
Trichloroethene	5
1,1-Dichloroethene	6

SITE K (SHALLOW GROUNDWATER) (2)

1,2-Dichloroethene (cis and trans)	70
Trichloroethene	30

OU2 (DEEP GROUNDWATER) (2)

1,1,1-Trichloroethane	200
1,1-Dichloroethane	70
1,1-Dichloroethene	6
1,2-Dichloroethane	4
cis-1,2-Dichloroethene	70
Tetrachloroethene	5
Trichloroethene	5

OU3 (DEEP GROUNDWATER) (6)

1,1-Dichloroethane	70
1,1-Dichloroethene	6
cis-1,2-Dichloroethene	70
1,1,1-Trichloroethane	200
1,1,2-Trichloroethane	3
Trichloroethene	5

WELL INVENTORY SAMPLING

VOCs (report full VOC list)

Notes:

(1) From Page 18 of the OU1 Record of Decision.
(2) From Table 1 of the OU2 Record of Decision.
(3) From Table 1 of Amendment #1 to the OU2 Record of Decision.
(4) From Page 2-13 of Amendment #4 to the OU2 Record of Decision.
(5) Vinyl chloride is also analyzed by SW-846 Method 8260C - SIM at wells 01U048, 01U582, and 01L582.
(6) From Page 26 of the OU3 Record of Decision.

Analytical Methods:

VOCs: SW-846 Method 8260C
Antimony & Lead: SW-846 Method 6020

A.5 New Brighton Operating Rates

Table D-1
Remedial Production Ranges for Normal Operation
(Effective January 2008)

NBCGRS Well	Estimated Physical Capacity Range			Remedial Production Range		Flow Rate Equivalents (24-hr Production Basis)	
	Normal Individual Low (gpm)	Normal Individual High (gpm) (See Note 1)	Peak Combined High (gpm) (See Note 1)	Lower Limit (MGD)	Upper Limit (MGD)	Lower Limit (gpm)	Upper Limit (gpm)
3 (See Note 2)	300	600	400	0.000	0.576	0	400
4 (See Note 2)	500	1,100	900	1.152	1.296	800	900
3 + 4 (See Note 2)	800	n/a	1,300	1.152	1.872	800	1,300
5	400	850	750	0.864	1.080	600	750
6	400	850	750	0.000	1.080	0	750
5 + 6 (See Note 3)	800	1,700	1,500	0.864	2.160	600	1,500
14	500	1,200	1,000	0.000	1.440	0	1,000
15	500	1,200	1,000	1.152	1.440	800	1,000
TOTAL WELL CAPACITY	2,600	n/a	4,800	**3.168**	**6.912**	**2,200**	**4,800**
TREATMENT CAPACITY		3,200	5,000				
NBCGRS SYSTEM LIMIT		3,200	4,800				

NOTES:

1. During peak production periods with all wells running, individual well capacities are limited by interference, high drawdown, and high system head losses
2. While shown individually to illustrate normal operational intent, enforceable target is for combined Well 3 plus Well 4 since the wells are located in close proximity and effectively operate as a single point source. Wells 3 and 4 can be used interchangeably to produce total daily target.
3. While shown individually to illustrate normal operational intent, enforceable target is for combined Well 5 plus Well 6 since the wells are located in close proximity and effectively operate as a single point source. Wells 5 and 6 can be used interchangeably to produce total daily target.

15 FEB 2008
Michael R. Fix
Twin Cities Army Ammunition Plant

2/15/08
Grant M. Wyffels
City of New Brighton

Table D-2
Alternate Remedial Production Ranges for Contingent Events
(Effective January 2008)

Event	Normal Operation			Well 3 and/or 4 Down			Well 5 and/or 6 Down			Well 14 Down			Well 15 Down		
Well / Pair	Priority	Lower Limit (MGD)	Upper Limit (MGD)	Priority	Lower Limit (MGD)	Upper Limit (MGD)	Priority	Lower Limit (MGD)	Upper Limit (MGD)	Priority	Lower Limit (MGD)	Upper Limit (MGD)	Priority	Lower Limit (MGD)	Upper Limit (MGD)
3 + 4	2	1.152	1.872	NA	**0.000**	**0.000**	2	1.440	1.872	2	1.152	1.872	1	1.440	1.872
5 + 6	3	0.864	2.160	2	1.728	2.160	NA	**0.000**	**0.000**	3	0.864	2.160	2	1.728	2.160
14	4	0.000	1.440	3	1.152	1.440	3	1.152	1.440	NA	**0.000**	**0.000**	3	0.720	1.152
15	1	1.152	1.440	1	1.152	1.440	1	1.152	1.440	1	1.152	1.440	NA	**0.000**	**0.000**
Total		3.168	6.912		4.032	5.040		3.744	4.752		3.168	5.472		3.888	5.184

Appendix B

FY 2014 Well Index

APPENDIX B
WELL INDEX FOR NEW BRIGHTON/ARDEN HILLS SUPERFUND SITE

FISCAL YEAR 2014

Purpose

The purpose of the well index is to identify all wells, both past and present, that:

- Have been used to collect water quality data or groundwater elevations in regard to work at the New Brighton/Arden Hills Superfund Site (including private wells and offsite monitoring wells sampled by the Army); or
- Are owned by the Army; or
- Are located within the boundaries of OU2 (the former TCAAP property)

In addition, the well index aims to identify the current status (in use, sealed, abandoned, etc.) of these wells.

The well index does not include wells identified in the Well Inventory Update (Appendix E) that have not been sampled by the Army at any point in history.

The list contained in the well index is by no means a compilation of all available data. Other data may exist regarding an individual well that was not discovered or searched out during the course of this effort. The list is intended to be a reasonable effort to gather the data concerning the wells that is readily available. Therefore, if additional data is desired concerning a certain well, it may be possible to search out and obtain that data from records not searched during the course of the investigation.

Background

OU2 and OU1/OU3 wells have been installed in four hydrogeologic units beneath the site. These hydrogeologic units, as referred to in this report, are conceptually illustrated on Figure B-1 and are described below:

Unit 1: This unit, referred to as the Fridley Formation, consists of alluvium and lacustrine deposits above the Twin Cities Formation (Unit 2). The formation is made up of fine- to medium-grained sand and clayey silt, which acts as an unconfined aquifer with an estimated hydraulic conductivity of 8.3×10^{-3} cm/sec (International Technology Corp. 1992). The Unit 1 deposits are discontinuous at the New Brighton/Arden Hills Superfund Site (NB/AH Site) and range in thickness from zero to 50 feet. They are predominantly limited to the north, east, and southwest portions of the site. Groundwater in Unit 1 is also discontinuous.

Unit 2: Known as the Twin Cities Formation, Unit 2 consists of Quaternary aged glacial till and, similar to Unit 1, is discontinuous at the NB/AH Site. Unit 2 is generally regarded as an aquitard to vertical migration of groundwater; however, sand and gravel lenses may contain water.

Unit 3: This unit consists primarily of the Quaternary aged Hillside Sand Formation, which is continuous beneath OU2. Near the center of OU2, the Hillside Sand Formation is overlain by the Arsenal Sand, which forms a kame. There is no distinct lithologic contact between the Hillside Sand and the Arsenal Sand, and both are considered included in Unit 3. Unit 3 ranges in thickness from 25 to 450 feet. For monitoring purposes, the Unit 3 aquifer thickness has been arbitrarily subdivided into thirds designated as upper, middle, and lower.

Unit 4: This unit consists collectively of bedrock from the Prairie du Chien Group and Jordan Formation (Ordovician and Cambrian periods, respectively). For monitoring purposes, the Prairie du Chien Group is referred to as Upper Unit 4, while the Jordan Formation is Lower Unit 4. The Jordan Formation varies from fine- to coarse-grained quartz sandstone. The Prairie du Chien Group in the NB/AH Site area consists of a finely crystalline dolomite of the Oneota Formation, as well as quartz sandstone and dolomite members of the Shakopee Formation. A more detailed description of the bedrock geology can be found in the Remedial Investigation Report (Argonne National Laboratory, 1991).

In order to identify the hydrogeologic unit in which each well is completed, the United States Army Environmental Center (USAEC), formerly the United States Army Toxic and Hazardous Materials Agency (USATHAMA), developed a standardized identification system for wells at the NB/AH Site (referred to as the Army Designation or IRDMIS number). Well designations consist of six characters, such as 03U093. The first two characters represent the hydrogeologic unit in which the well is completed, as follows:

01	-	Unit 1
03	-	Unit 3
04	-	Unit 4: Prairie du Chien Group <u>or</u> Jordan Formation
PJ	-	Unit 4: Prairie du Chien Group <u>and</u> Jordan Formation

The third character represents the relative position of the well screen or open hole within the specified hydrogeologic unit, as follows:

U	-	upper portion
M	-	middle portion
L	-	lower portion
J	-	Jordan Sandstone
F	-	fully penetrating Unit 3
#	-	open hole (total or partial thickness)

The remaining three characters represent the well number, as follows:

001 thru 500	USAEC wells and additional wells installed by others adjacent to an existing well with the 001-500 designation.
501 thru 600	NB/AH Site wells.
601 thru 800	OU2 Alliant Techsystems wells.
801 thru 999	OU1/OU3 Alliant Techsystems wells.

OU1/OU3 wells installed by parties other than USAEC, the Army, or Alliant Techsystems are designated by their Minnesota unique number. Table B-1 is sorted by unique number, but includes the IRDMIS number and any other name(s) the wells may have. The well type in this table is abbreviated as follows:

UN	-	Unknown
MUNI	-	Municipal
MON	-	Monitoring
DOM	-	Domestic
IND	-	Industrial
P.S.	-	Public Supply
COM	-	Commercial
IRR	-	Irrigation
ABAND	-	Abandoned
PIEZ.	-	Piezometer
REM	-	Remedial

In recent years, as property transfer of the remaining land that is still identified as TCAAP has progressed (and is now nearing completion), it became apparent that an updated well index with more information concerning each well would be of importance to pass on to future land owners. In addition, as groundwater quality continues to improve and contaminant plumes continue to shrink in vertical and horizontal extent, the index will function as a check to make sure that all Army owned wells are sealed and that all traces of the wells are removed from the area.

The FY 2014 Appendix B Table B-1 shows the most current well index. The well index continues to be a work in progress. Additional records regarding individual wells continue to become available as new wells are drilled and older unneeded wells are sealed and removed.

Figures B-2 and B-3 show the location of wells identified in Table B-1. With a known well name, the location of that well can be determined using the "Edit, Find" or "Edit, Search" function and then typing in the desired well name, which will highlight this well name on the figure.

The Appendix B Attachment contains available documentation for each well, including boring logs (if available). The attachment is sorted by Minnesota unique number. To view the information concerning a well, click on the desired well number in the bookmarks with the mouse.

FY 2014 Update

No significant changes were made compared with the FY 2013 version of the index. Note that the following wells were sealed in FY 2014, and the sealing records have been added to the Appendix B Attachment.

- 01U620
- 01U631
- 01U613
- 01U038
- 01U045
- 03L027
- 03U084
- 03U031
- 01U604
- 01U085
- 01U107
- 01U609
- 03U648
- 04U027
- 01U624C
- 01U118
- 482084
- 482087
- 482090
- 01U568
- 01U552
- 01U570
- 03U674
- 01U639
- 01U632
- 01U616
- 01U040
- 01U064
- 03L028
- 03U076
- 01U601
- 01U605
- 01U104
- 01U110
- 10U611
- 01U666
- 01U624A
- 01U624D
- 03L084
- 482085
- 482088
- 01U565
- 01U572
- 01U551
- 01U578
- 03U676
- 01U640
- 01U636
- 01U619
- 01U041
- 01U067
- 03L029
- 03U075
- 01U602
- PJ#027
- 01U105
- 01U608
- 03U647
- 01U667
- 01U624B
- 01U628A
- 01U136
- 482086
- 482089
- 01U566
- 01U553
- 01U569
- PW544U1

Ongoing Efforts to Update Appendix B

- The well index, Table B-1, has been compared with the wells identified in Appendix D, which contains historical water quality and groundwater elevation data. A number of wells were identified in Appendix D that do not exist in the well index. Ongoing efforts will be made to add information, as possible, concerning the location and status of these wells to the well index in Appendix B.

- The repository at the TCAAP office will continue to be utilized to obtain additional well information, where possible.

Appendix B Table B-1 and Attachment

Available Well Information
Sorted by Minnesota Unique Well Number

Appendix B Table B-1 contains a summary of all information available concerning a certain well, and is sorted by Minnesota unique well number.

To search for detailed records regarding a well, open the appropriate file below and select the bookmark corresponding to the Minnesota unique well number of the well being searched. If the unique number is unknown for a well, it is included and sorted in the Appendix B Attachment by IRDMIS name or OTHER. Records included in the Appendix B Attachment that may or may not be available for each well include:

- The County Well Index well log,
- Access agreement(s),
- Correspondence related to the well,
- Field notes and boring logs,
- Well construction diagrams,
- Documentation of well modifications, and
- Sealing records.

Appendix B Attachment

1. Wells Numbered 104772 through 194772
2. Wells Numbered 200070 through 225906
3. Wells Numbered 231741 through 235753
4. Wells Numbered 236066 through 257443
5. Wells Numbered 265735 through 482709
6. Wells Numbered 500248 through IRDMIS and OTHER

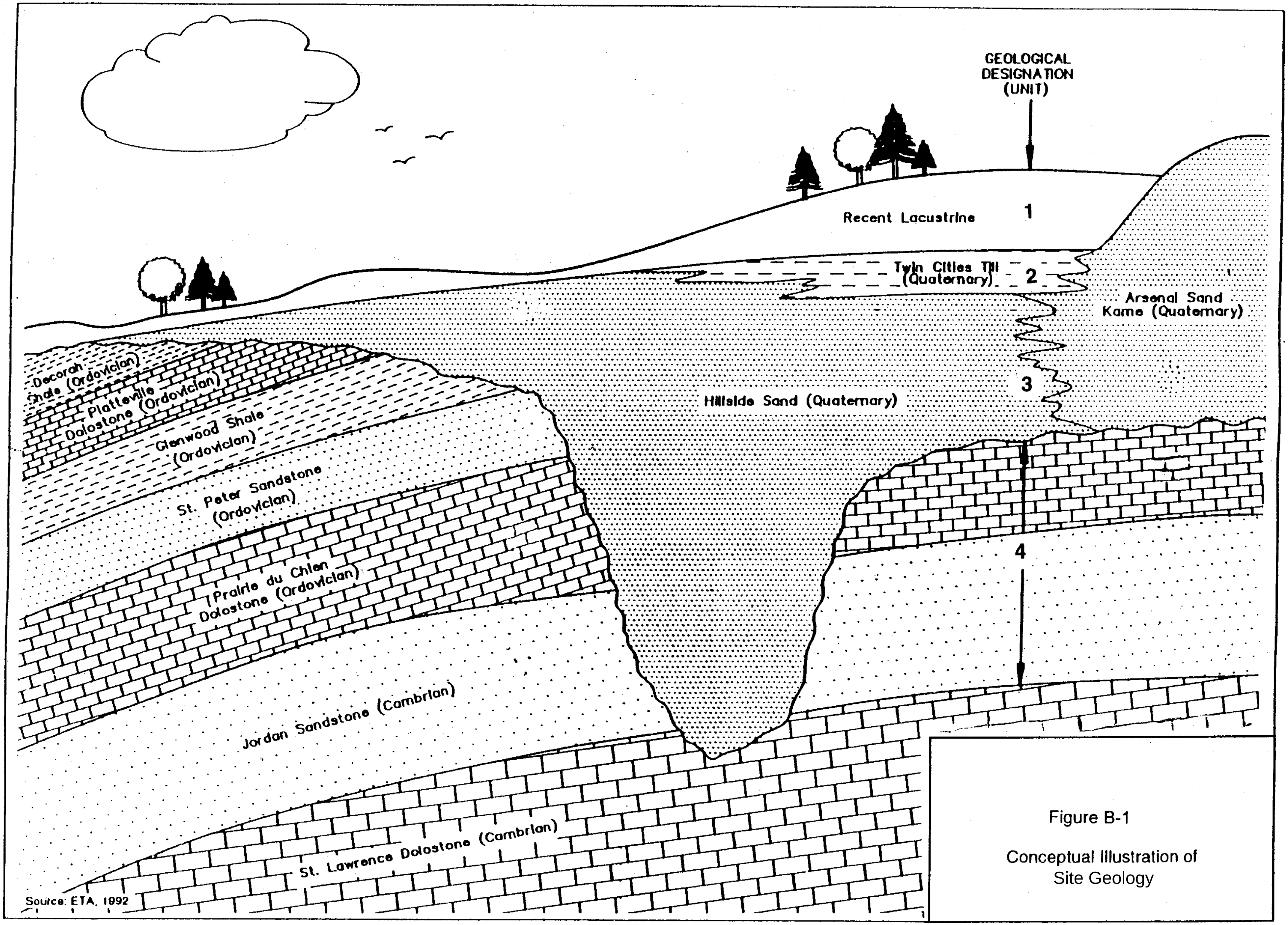


Figure B-1

Conceptual Illustration of Site Geology

ANNUAL PERFORMANCE REPORT

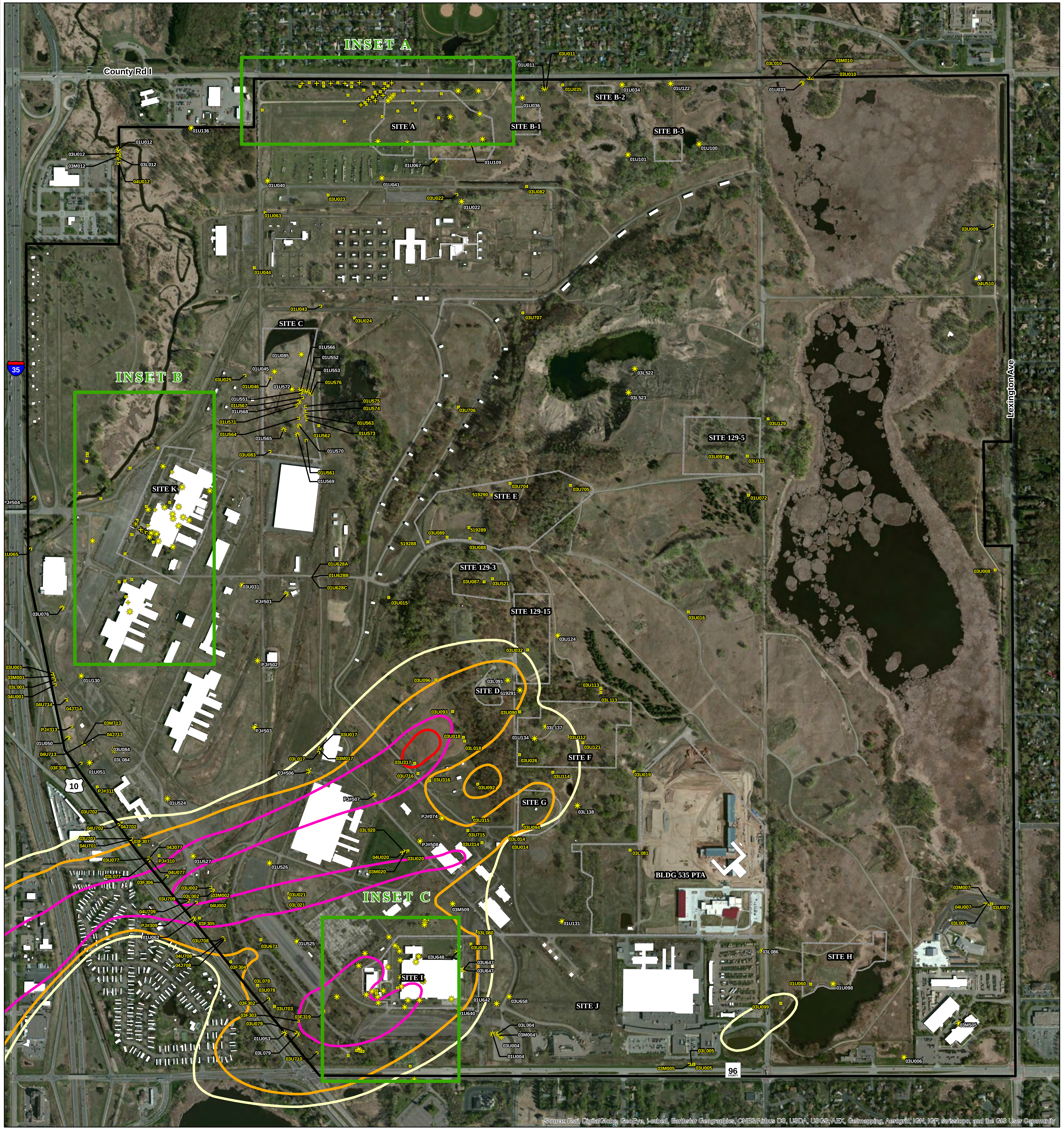
OU1 & OU3 Well Location

WENCK ASSOCIATES

Responsive partner. Exceptional outcomes.

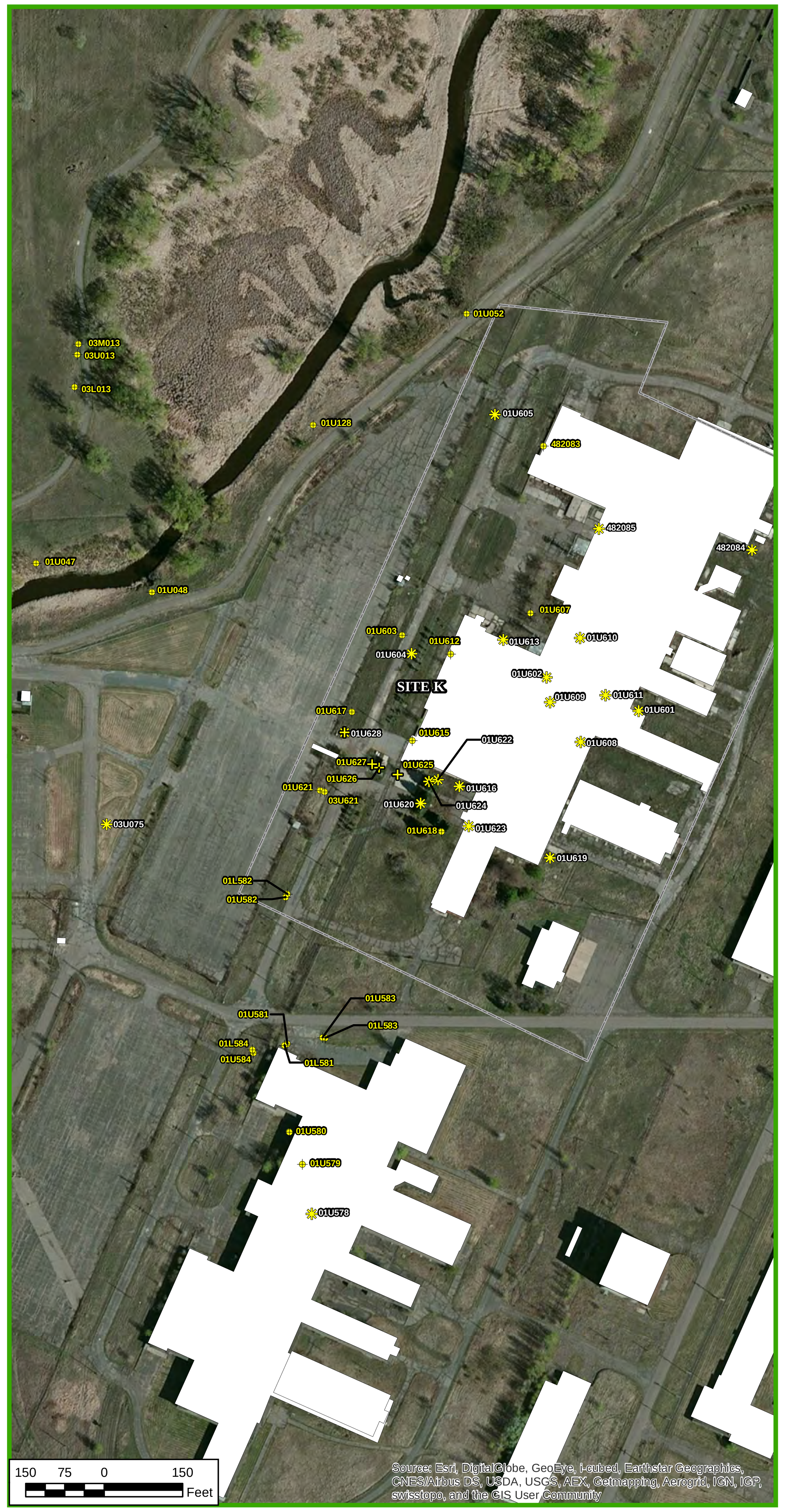
FY 2014

Figure B-2

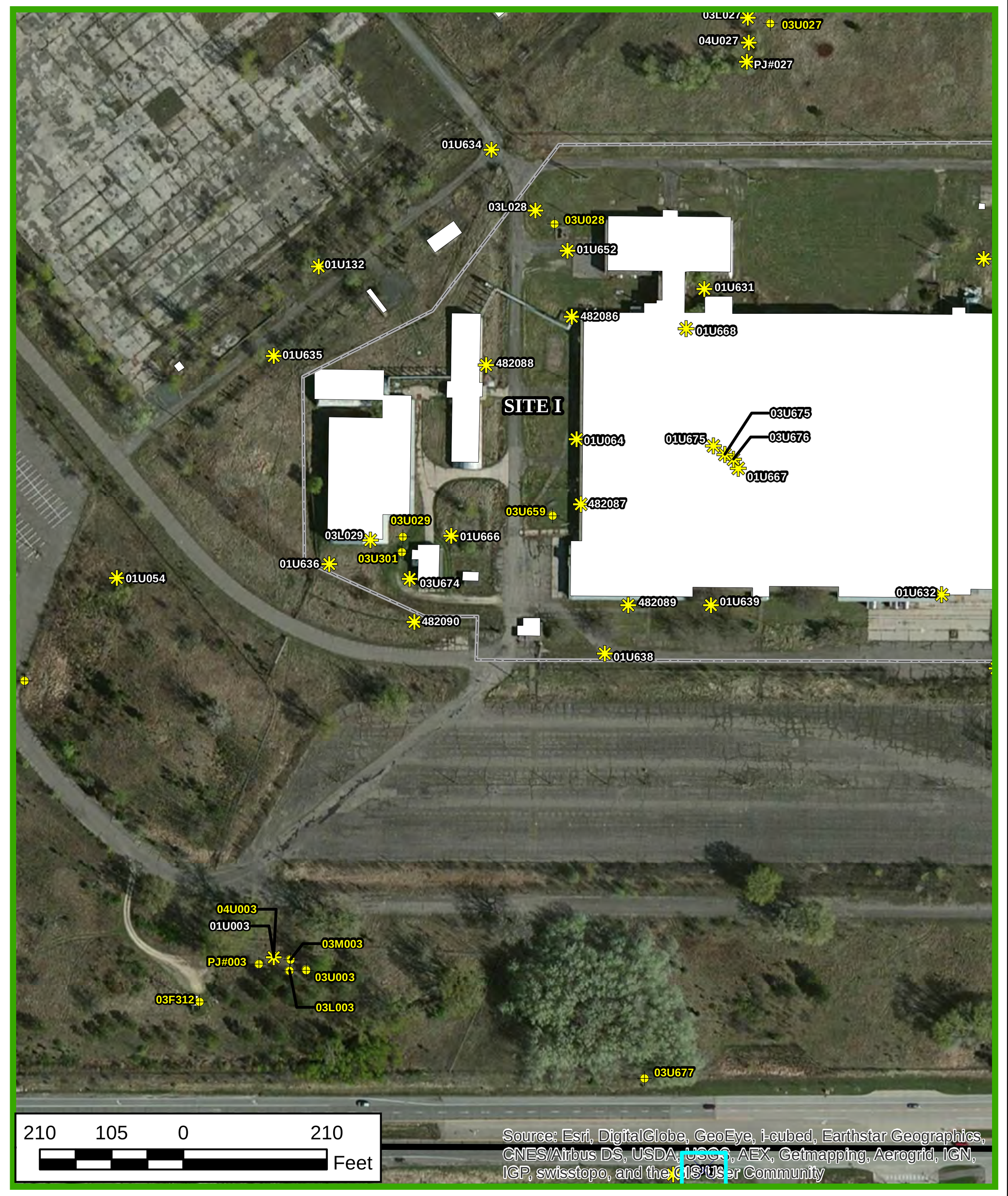


INSET A

INSET B



INSET C



Legend

- 421433 Monitoring Well
- 233520 Private Well
- 206787 Public Supply Well
- 538042 Piezometer
- 231857 Sealed Well/Abandoned Well

FY 2011 Upper Unit 3 Trichloroethene Concentrations

1 µg/l
10 µg/l
100 µg/l
1,000 µg/l

Buildings
Site Boundaries

Operable Unit 2 of the New Brighton/Arden Hills Superfund Site (the same area occupied by the Twin Cities Army Ammunition Plant in 1983, when the Site was placed on the NPL.)

Notes:
1. To locate a well go to "edit, find" or "edit, search" and type in well name.
2. 2012 Aerial Photograph (Source: ESRI)
3. Not all wells are completed at the same depth as reflected by the OU2, Upper Unit 3 plume contours shown.

1,200 600 0 1,200
Feet
N

Path: L:\1561\19\FY2014 APR\mxd\OU2 Well Location and TCE History_b1wells.mxd

ANNUAL PERFORMANCE REPORT

OU2 Well Location

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Responsive partner. Exceptional outcomes.

FY 2014

Figure B-3

Appendix C

FY 2014 Data Collection and Management

C.1 Data Collection, Management, and Presentation

APPENDIX C.1

DATA COLLECTION, MANAGEMENT, AND PRESENTATION

FISCAL YEAR 2014

1.0 INTRODUCTION

A groundwater monitoring program was initiated in January 1984 to obtain water level and water quality data at OU1, OU2 and OU3. Each year has been divided into quarters with each quarter assigned a number. Accordingly, FY 2014 was comprised of Quarter 121 (October through December), Quarter 122 (January through March), Quarter 123 (April through June), and Quarter 124 (July through September). Water sampling, water level measurements, and laboratory analyses were conducted in accordance with two separate Quality Assurance Project Plans (QAPPs): "QAPP for Performance Monitoring" (Wenck, Revision 12, February 25, 2013) and "QAPP for Monitored Natural Attenuation of Building 102 Groundwater" (Wenck, Revision 6, February 25, 2013). The Building 102 QAPP is applicable to only that specific site, and all other sites are covered by the Performance Monitoring QAPP.

Prior to November 1, 2001, data collected from OU1, OU2 and OU3 was stored in the U.S. Army Environmental Command (USAEC) Installation Restoration Data Management Information System (IRDMIS). USAEC replaced the IRDMIS System on November 1, 2001, with a new system, the Environmental Restoration Information System (ERIS), which incorporated all of the data that had previously been entered into IRDMIS. The Army has continued to enter data into ERIS; however, ERIS is not being used as the primary database for the OU1, OU2 and OU3 data. The historical databases in Appendix D.1 are the primary databases.

2.0 GROUNDWATER LEVELS AND GROUNDWATER QUALITY

2.1 Data Collection and Management

Groundwater level and groundwater quality data were collected in accordance with the FY 2014 Annual Monitoring Plan (Appendix A), which established the monitoring responsibilities for both the Army and Alliant Techsystems (ATK). Water level monitoring and water sampling were conducted by Wenck for the Army and by CRA and Stantec for ATK. Laboratory analysis of samples from all sites was performed by ALS Laboratory Group, Salt Lake City, Utah. Appendix A.4 contains lists of required analytes, as referenced by the monitoring plans in Appendix A. The lists are site-specific, based on the chemicals of concern. At sites other than Site C, halogenated volatile organic compounds are the parameters of primary interest, though some of the sites (or specific wells at a site) are sampled for aromatic volatile organic compounds and/or metals. At Site C, dissolved lead is the only chemical of concern. Appendix C.2 presents deviations from the FY 2014 Annual Monitoring Plan.

Data verification and validation was conducted in accordance with procedures and requirements outlined in the two QAPPs. Data qualifiers assigned to data through data verification and/or data validation appear in the data tables included within the individual sections of this report, with qualifier definitions given in footnotes to the tables. Data qualifiers are also included in the historical databases (Appendix D.1), which include a database of organic water quality, a database of inorganic water quality (excluding Site C), and a database for Site C water quality (for both groundwater and surface water). Data verification was performed by Wenck for the Wenck-collected data, CRA for the CRA-collected data, and Diane Short & Associates, Inc., Lakewood, Colorado, for the Stantec-collected data. Data validation was performed by CRA for the CRA-collected data, and Diane Short & Associates for the Wenck- and Stantec-collected data. Data verification and validation information from the three sampling firms was compiled by Wenck into quarterly Data Usability Reports (DURs) that were submitted to the MCPA and USEPA for review. If any MPCA/USEPA-requested revisions were necessary, a final DUR was resubmitted. The final MPCA/USEPA approval letter for the FY 2014 DURs is included in Appendix C.3.

For water level measurements, the depth to water from the surveyed top of the well casing elevation was measured. Groundwater elevations were calculated by subtracting the depth to water from the surveyed top of the well casing elevation and are included in the historical water elevation database (Appendix D.1).

2.2 Groundwater Elevation Contour Maps

The most extensive water level monitoring event performed during FY 2014 was in May and June (Quarter 123). This data was used to prepare groundwater elevation contour maps for shallow groundwater at Sites A, C, K and Building 102. Groundwater elevation contour maps are included within the individual sections of this report. There was not a comprehensive water level event for deep groundwater at OU1/OU3 and OU2 or shallow groundwater at Site I.

2.3 Groundwater Quality Contour Maps and Cross-Sections

The most extensive sampling event performed during FY 2014 was in May and June (Quarter 123). This data was used to prepare groundwater quality isoconcentration contour maps and/or cross-sections for shallow groundwater at Site A, Site C, Site K and Building 102. Contour maps were generated by hand, based on the observed contaminant concentrations and the extent of past site contamination. These maps are included within the individual sections of this report.

For deep groundwater at OU1/OU3 and OU2, groundwater quality isoconcentration maps and cross-sections were not prepared since this was a minor sampling year.

For Site A shallow groundwater, an isoconcentration map is provided for cis-1,2-dichloroethene, since this is the chemical of concern with the largest aerial extent at Site A, and also for tetrachloroethene, which illustrates the source area and contaminant degradation. Cross-sections were also prepared for Site A to illustrate the vertical distribution of cis-1,2-dichloroethene. The isoconcentration maps for Site A were prepared only for Unit 1, since this is the only contaminated aquifer.

For Site C shallow groundwater, an isoconcentration map is provided for dissolved lead, since this is the only chemical of concern at Site C. Results for surface water monitoring is also shown on this same map to show that impacts to surface water are not occurring as a result of the shallow groundwater contamination. Cross-sections were also prepared for Site C to illustrate the vertical distribution of dissolved lead. The isoconcentration map for Site C was prepared only for Unit 1, since this is the only contaminated aquifer.

For Site K shallow groundwater, an isoconcentration map is provided for trichloroethene, since this is the primary chemical of concern on a concentration basis. The isoconcentration map for Site K was prepared only for Unit 1, since this is the only contaminated aquifer.

For Building 102 shallow groundwater, an isoconcentration map is provided for vinyl chloride, since this is the chemical of concern that has historically had the largest aerial extent at Building 102, and also for trichloroethene and cis-1,2-dichloroethene, which illustrates the source area and contaminant degradation. Cross-sections were also prepared for Building 102 to illustrate the vertical distribution of vinyl chloride. The isoconcentration maps for Building 102 were prepared only for Unit 1, since this is the only contaminated aquifer.

Contaminant concentrations for recovery wells that are actively pumping are shown in parentheses on the isoconcentration maps. These values were considered, but were generally not used alone to prepare the isoconcentration contours. Concentrations of recovery wells generally represent an average contaminant value for all groundwater being drawn to the well; hence, the concentrations do not necessarily represent a discrete location or depth. Contaminant concentrations for recovery wells that are not actively pumping are fully utilized for purposes of contouring.

C.2 Deviations from Monitoring Program

APPENDIX C.2
DEVIATIONS FROM MONITORING PROGRAM

Fiscal Year 2014

OU2: Site A Shallow Groundwater

December 2013:

01U039: This well was not sampled during this sampling event due to difficulty removing a frozen well cap. In this same sampling event, the results for all VOCs in 01U140 and 01U358 were below cleanup levels, indicating that the missing data was not critical.

OU2: Site K Shallow Groundwater

June 2014:

All Wells: Sampling was shifted to May.

July 2014:

01U603: Additional sample taken in response to data spike seen in May 2014 sample results.

September 2014:

01U603: Additional sample taken in response to data spike seen in July 2014 sample results.

01U612: Additional sample taken in response to data spike seen in May 2014 sample results.

OU2: Deep Groundwater (TGRS)

June 2014:

03U672: This well was not sampled during this sampling event due to the well being sealed without permission during a road improvement project. Once it was learned that the well had been sealed without permission, a replacement well (03U677) was installed and sampled upon completion (September 19, 2014). The sampling data for the new well was included in this annual report.

C.3 Regulatory Approvals of Data Usability Reports

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

February 20, 2015

REPLY TO THE ATTENTION OF: SR-6J

Mr. Michael R. Fix
Commander's Representative
Twin Cities Army Ammunition Plant
470 West Highway 96, Suite 100
Shoreview, MN 55126-3218

Subject: **Approval of Data Usability Reports Numbers 81, 82, 83 and 84**

Dear Mr. Fix:

This letter shall serve to document that the U.S. Environmental Protection Agency (EPA) and the Minnesota Pollution Control Agency (MPCA) received and reviewed draft versions of Data Usability Reports (DURs) 81, 82, 83 and 84. EPA and MPCA provided the U.S. Army (Army) with comments on the DURs. The DURs were revised to the satisfaction of EPA and MPCA and the following final DURs were received:

- Data Usability Report Number 81 (**DUR 81**), TCAAP FY 2014 Performance Monitoring Program, 1st Quarter Monitoring (October – December, 2013), May 7, 2014;
- Data Usability Report Number 82 (**DUR 82**), TCAAP FY 2014 Performance Monitoring Program, 2nd Quarter Monitoring (January – March, 2014), June 16, 2014;
- Data Usability Report Number 83 (**DUR 83**), TCAAP FY 2014 Performance Monitoring Program, 3rd Quarter Monitoring (April – June, 2014), November 26, 2014;
- Data Usability Report Number 84 (**DUR 84**), TCAAP FY 2014 Performance Monitoring Program, 4th Quarter Monitoring (July – September, 2014), February 12, 2015.

Based upon our review of the information provided by the Army, USEPA and MPCA agree that the subject DURs are acceptable. You are hereby advised that the USEPA and the MPCA approve Data Usability Report Numbers 81, 82, 83 and 84. If you have any questions, please contact Tom Barounis of the EPA at (312) 353-5577 or Amy Hadiaris of the MPCA at (651) 757-2402.

Sincerely,

Tom Barounis

Tom Barounis
Remedial Project Manager
U.S. Environmental Protection Agency
Region 5

Tom Barounis for

Amy Hadiaris, P.G.
Project Manager
Remediation Division
Minnesota Pollution Control Agency

Appendix D

Comprehensive Groundwater Quality and Groundwater Level Databases

D.1 Comprehensive Groundwater Quality and Groundwater Level Databases

APPENDIX D.1
COMPREHENSIVE GROUNDWATER QUALITY AND GROUNDWATER LEVEL DATABASES

The historical groundwater databases are located on this CD in a folder named Appendix D.1. This folder contains four Microsoft Excel files:

File	Contents
Compelev_FY14	Groundwater elevations
Comporwq _FY14	Groundwater quality: organic data
Compinwq _FY14	Groundwater quality: inorganic data (excluding Site C)
Site C wq _FY14	Groundwater quality: inorganic data (Site C only)

D.2 Operable Unit 1 Statistical Analysis

D.2.1 Well Groups and Statistical Evaluation Criteria Tables

Table D.2.1
Statistical Evaluation
Well Groups

Group 1 – Downgradient of TGRS

03U806	04U806	03L802	03U801
03M806	PJ#806	04U802	03U711
03L806	03M802	PJ#802*	04U711

Group 2 – Areal Extent of Plume

03U805	409557	04U841	04U875
03U672	04U673	04U843	04U877
03L848	04U832	04U833	206688 out of service
03L673	04U845	04U846	04U849
03L833	04U854	04U861 abandoned	04U821
03L859	04U859	409549	191942 abandoned

Group 3 ** – Downgradient Sentinel

04U871	04U875	04U851	

Group 4 – Lateral Sentinel

03U831 abandoned	03L846	409556	409548
03U811	03L832	04U855	04U839
03U804	03L861 abandoned	04U879	04U838
03U673	03L854	04U860	04U848
03U672 abandoned	03L841	409547	04J839
03M843	03L811	04U863	03U677

Group 5 – Global Plume

04J077	04U702	04U848	04U877
04J702	04U709	04U851	04U879
04J708	04U711	04U852 abandoned	04U880
04J713	04U713	04U855	04U881
04J834	04U802	04U859	04U882
04J864 abandoned	04U806	04U860	200154
04J866	04U832	04U861 abandoned	234546
04J882	04U833	04U863	234549 out of service
04U002	04U834	04U864 abandoned	409547
04U020	04U841	04U865 abandoned	409548
04U027abandoned	04U843	04U866	409549
04U077	04U844	04U871	409555
04U673	04U845	04U872	512761
04U701	04U846	04U875	PJ#318

Group 5 Unit 3 wells (evaluated as individual trends)

03L822	03U821	03U822	03L822
409550	409596	409597	03U831abandoned

Group 6 – Jordan Aquifer

04J077	04J838	04U713	04U882
04J702	04J839	04U834	NBM#3
04J708	04J882	04U836	NBM#4
04J713	04J847	04U837	NBM#5
04J822	04J849	04U838	NBM#6
04J834	04U077	04U839	
04J836	04U702	04U847	
04J837	04U708	04U849	

* PJ#802 will not be monitored or used for evaluation unless 04U802 shows TCE concentrations greater than 1 ppb.

** Group 3 is analyzed as a rectangular area taken from the Group 5 contouring.

Table D.2.2

MAROS Decision Matrix

Mann-Kendall S	Confidence	Coefficient of Variance	Trend Conclusion
S > 0	> 95%	NA	Increasing
S > 0	90-95%	NA	Probably Increasing
S > 0	< 90%	NA	No Trend
S</= 0	< 90%	>/= 1	No Trend
S </= 0	< 90%	< 1	Stable
S < 0	90-95%	NA	Probably Decreasing
S < 0	>95%	NA	Decreasing

Table D.2.3
Summary of Groups, Purpose, and Statistical Tests

Well Group	Purpose	Measure	Time Window/ Monitoring Frequency	Test	Response Threshold
Group 1	AWC Immediately Downgradient of TGRS	AWC Trend	6 years/annual	Mann-Kendall and MAROS	Stable, Increasing, or No Trend
Group 2	Defining Plume Size (Low Concentration Edges)	Individual Well Trend for TCE	12 years/biennial	Mann-Kendall and MAROS	Increasing or No Trend
Group 3	AWC Immediately Downgradient of NBCGRS	AWC Trend	12 years/biennial	Mann-Kendall and MAROS	Stable, Increasing, or No Trend
Group 4	Lateral (Clean) Sentinel Wells	Individual Well Concentration	12 years/biennial	Individual Concentrations	Greater than ROD goals
Group 5	Global Plume Mass Reduction	AWC Trend	12 years/biennial	Mann-Kendall and MAROS	Stable, Increasing, or No Trend
Group 6	Evaluating and comparing trends in Jordan Aquifer	Individual Well Trend for TCE	12 years/biennial	Mann-Kendall and MAROS	Stable, Increasing or No Trend

Note: A Response Threshold is the test result(s) that triggers further response. See text for additional explanation of response process.

AWC = Area-Weighted Concentration.

Table D.2.4
Group 1 – Downgradient of TGRS, Evaluation Process

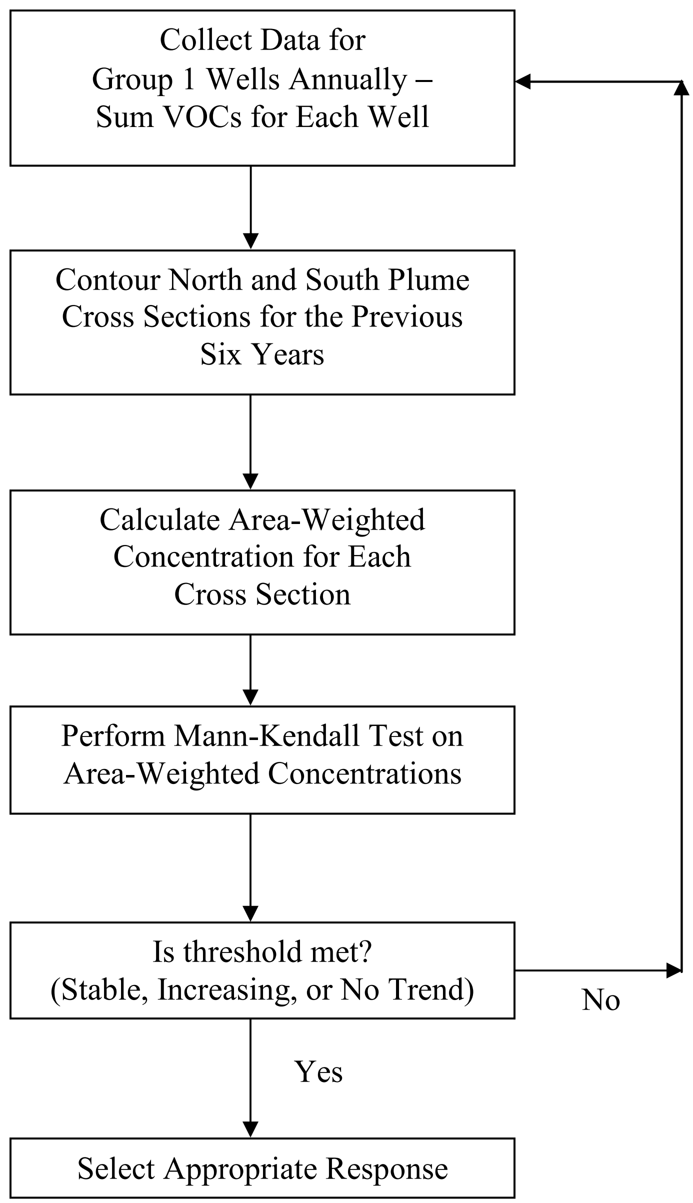


Table D.2.5
Group 2 – Areal Extent of Plume, Evaluation Process

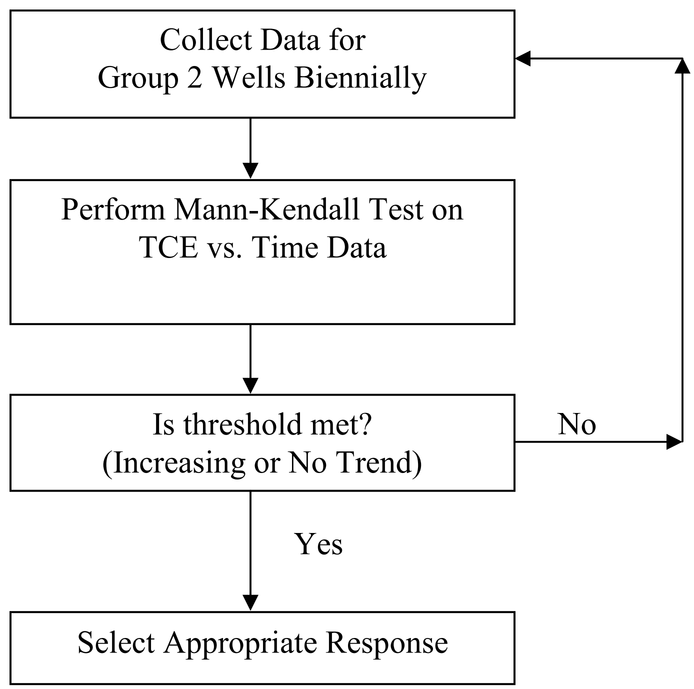


Table D.2.6

Group 3 and Group 5 – Downgradient Sentinel and Global Plume, Evaluation Processes

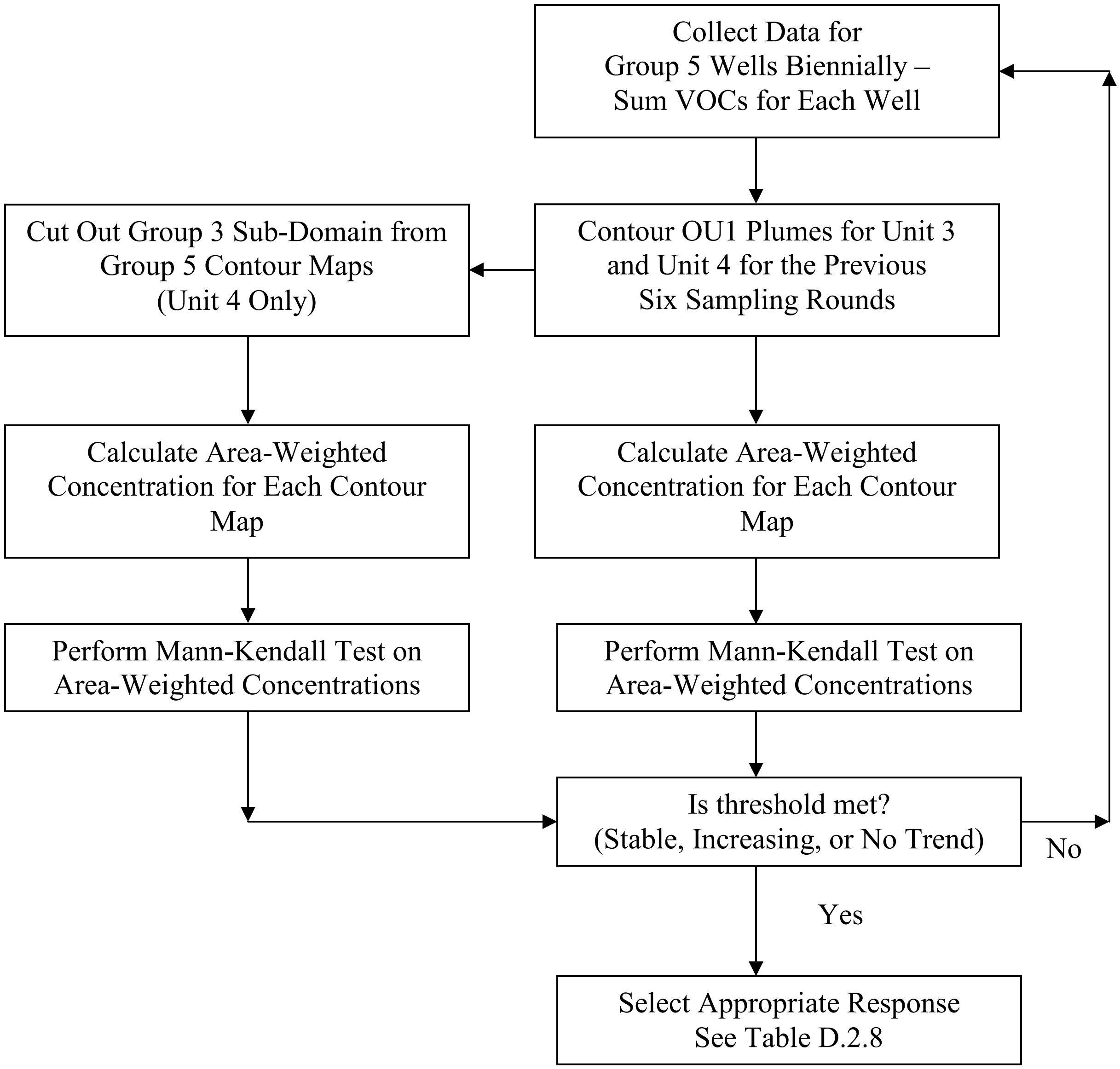


Table D.2.7
Group 4 – Lateral Sentinel Wells, Evaluation Process

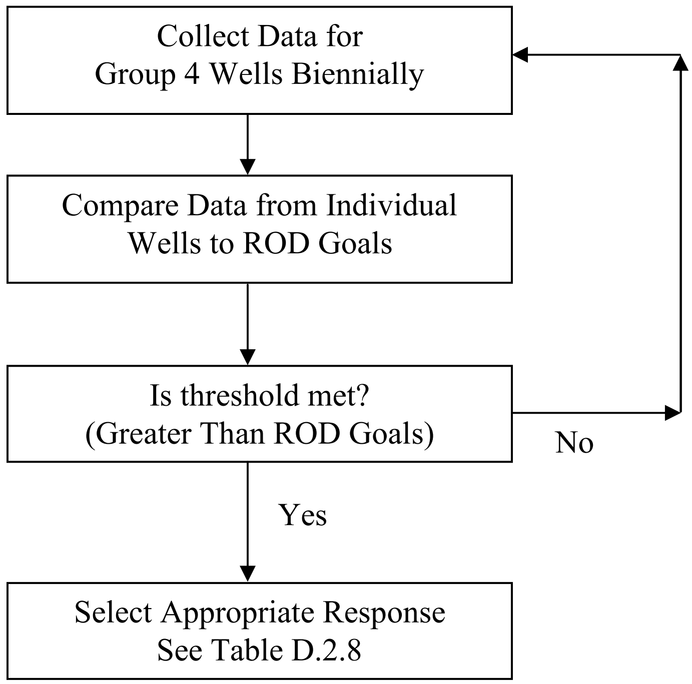


Table D.2.8

Responses to Threshold Indicators

Factors to Consider

- Contaminant concentrations
- Location (vertical and horizontal)
- Surrounding data
- Risks to human health or the environment
- Need for urgency in response

Possible Evaluation Responses

- Perform additional or confirmation sampling
- Write up in the Annual Performance Report
- Perform separate evaluation and write-up (Tech Memo)

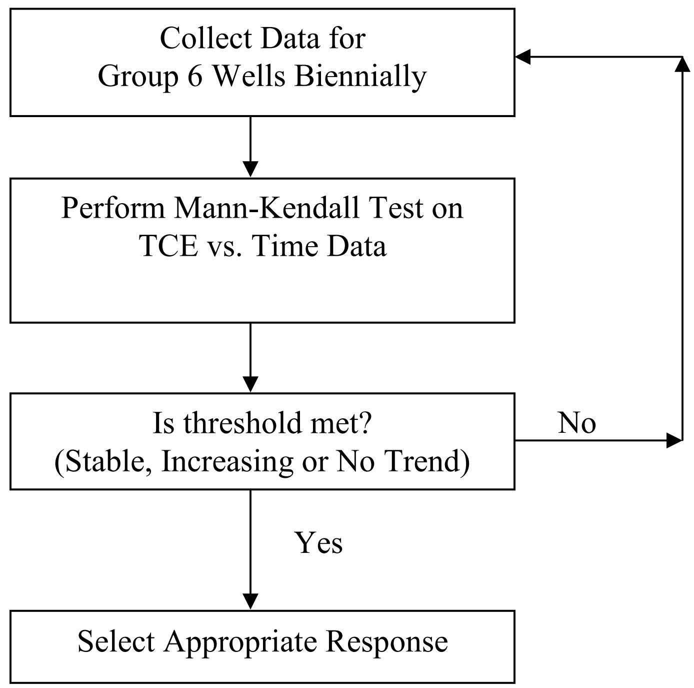
Possible Long-Term Responses

- Increase sampling frequency
- Modify operation of remedial system(s)
- Perform new remedy evaluation
- Install additional monitoring well(s)
- Modify the Special Well Construction Area
- Control risk at the receptors

Note: Threshold responses to be described and evaluated in the Annual Performance Reports.

Table D.2.9

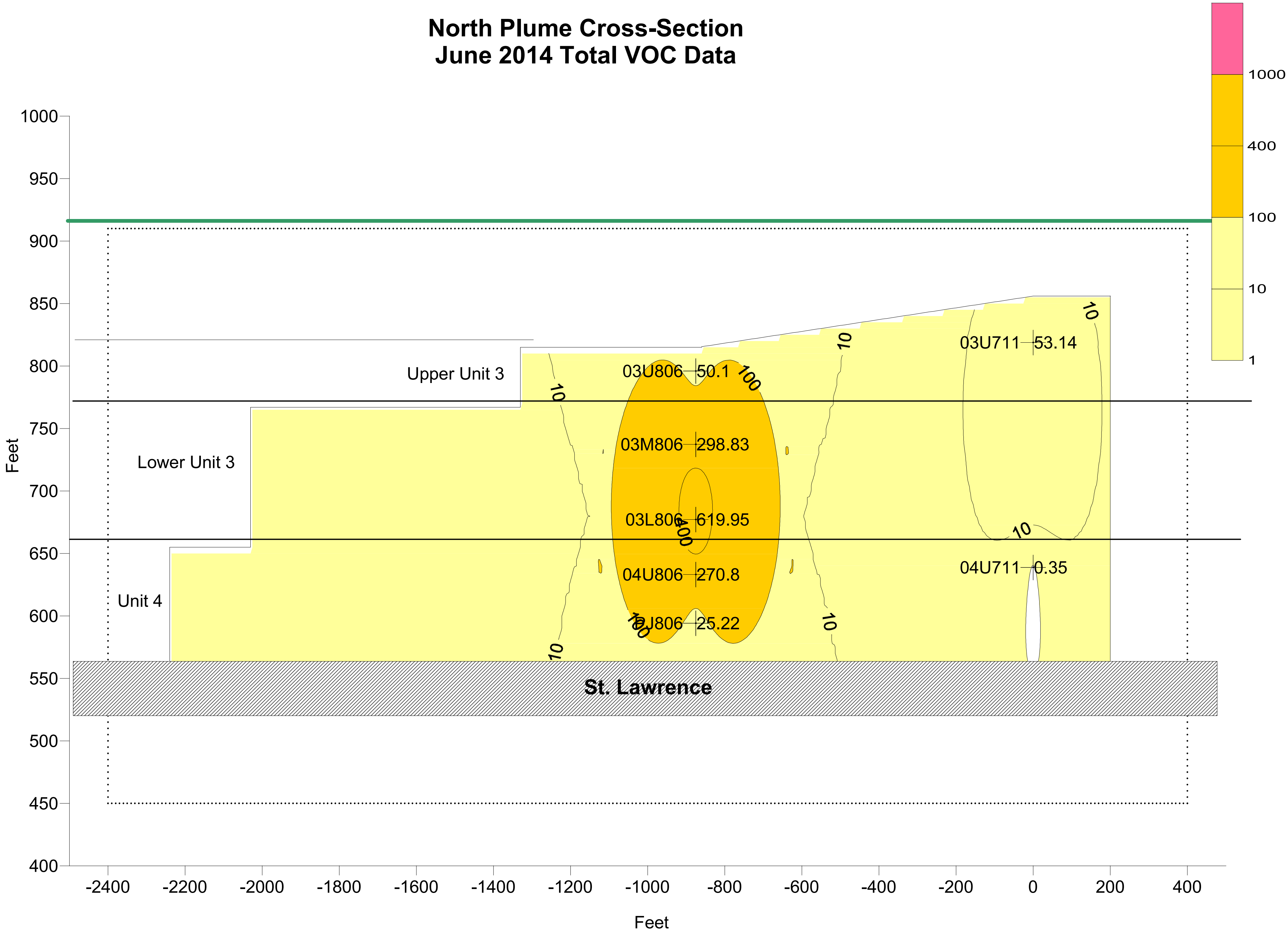
Group 6 – Jordan Aquifer, Evaluation Process



D.2.2 Group 1 Kriging Evaluation

2014

North Plume Cross-Section
June 2014 Total VOC Data



South Plume Cross-Section
June 2014 Total VOC Data

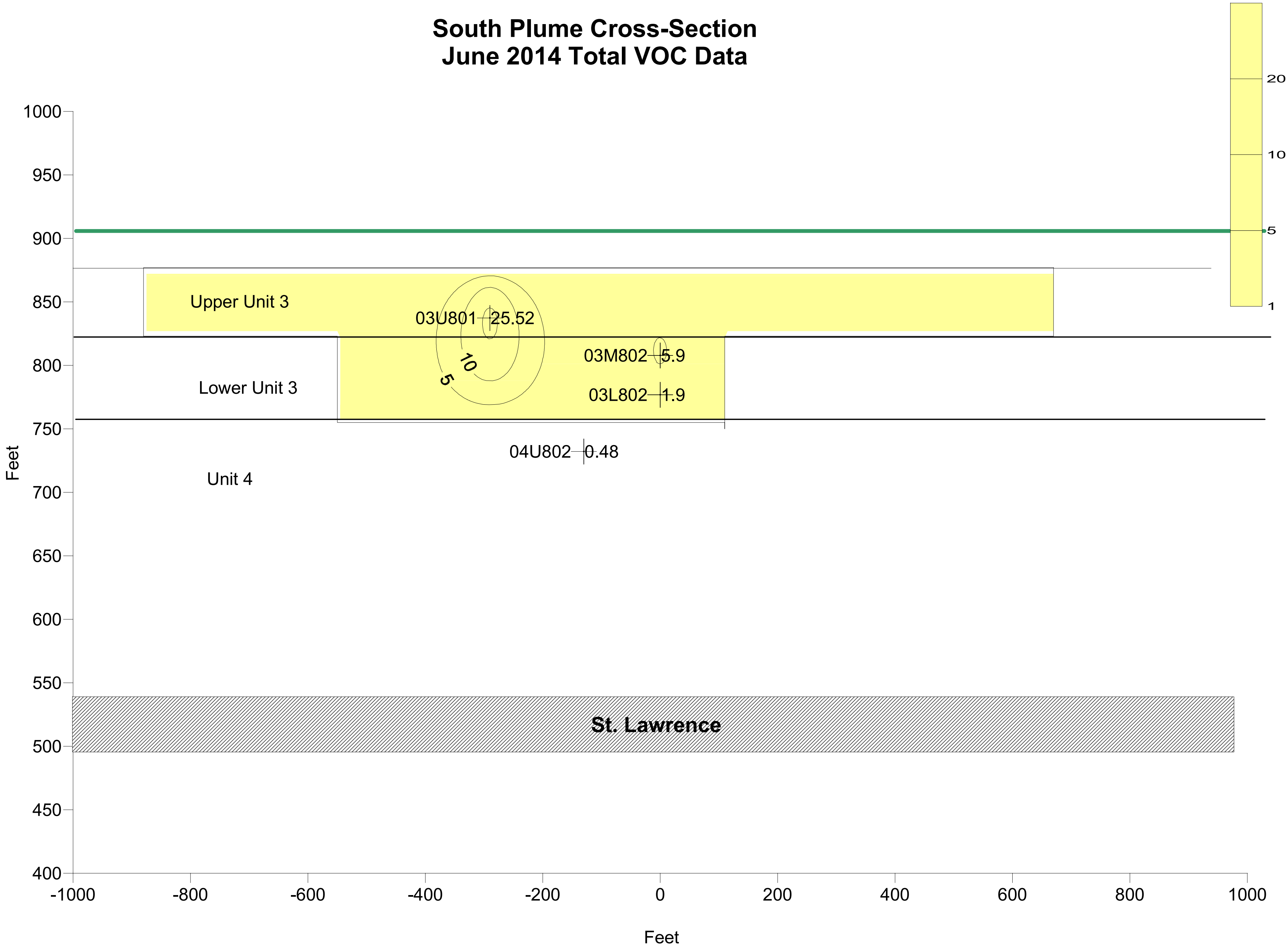


TABLE 1

VOC CONCENTRATIONS IN TGRS MONITORING WELLS

Location	Date	1,1,1-Trichloroethane µg/L	1,1-Dichloroethane µg/L	1,1-Dichloroethene µg/L	1,2-Dichloroethane µg/L	cis-1,2-Dichloroethene µg/L	Tetrachloroethene µg/L	Trichloroethene µg/L	Total VOCs
03L802	6/5/14	ND	ND	ND	ND	ND	ND	1.90	1.9
03M802	6/5/14	ND	ND	ND	ND	ND	ND	5.90	5.9
03U801	6/4/14	ND	ND	ND	ND	0.52	ND	25.00	25.52
04U802	6/5/14	ND	ND	ND	ND	ND	ND	0.48	0.48
03L806	6/4/14	0.68	110	61	0.47	7.8	ND	440	619.95
03M806	6/4/14	0.53	40	23	ND	5.3	ND	230	298.83
03U711	6/11/13	4.8	1.2	1.8	ND	0.61	0.73	44	53.14
03U806	6/4/14	ND	0.62	0.48	ND	ND	1	48	50.1
04U711	6/4/14	ND	ND	ND	ND	ND	ND	0.35	0.35
04U806	6/4/14	1.3	29	17	ND	3.5	ND	220	270.8
PJ#806	6/4/14	0.35	1.1	0.77	ND	ND	ND	23	25.22

Notes:

South Plume

North Plume

ND=Non-detect

Assumptions:

non-detect values were treated as 0

Any value with a data qualifier (e.g. JP) treated as the detection.

North Plume
Total VOC Concentration Calculations
Vertical Cross-Section
Expanded Contouring and Blanking
TCAAP
June 2014

Concentration	Positive Planar Area (ft2)
Plume to 1	570085
Plume to 5	263218
Plume to 10	231613
Plume to 50	142987
Plume to 100	82891
Plume to 200	30389
Plume to 300	12572
Plume to 400	4770
Plume to 500	1214
Plume to 600	11
Plume to 700	0
Plume to 800	0

TCE (ug/L)	Avg TCE (ug/L)	Area (ft2)	Areal Conc (ug*ft2/L)
1 to 5	3	306868	920603
5 to 10	7.5	31604	237033
10 to 50	30	88626	2658784
50 to 100	75	60096	4507198
100 to 200	150	52502	7875235
200 to 300	250	17818	4454384
300 to 400	350	7802	2730707
400 to 500	450	3556	1599993
500 to 600	550	1203	661799
600 to 700	650	11	7213
700 to 800	750	0	0
	Sum	570085	25652951

Area Wtd Conc	45	ug/L

South Plume
Total VOC Concentration Calculations
Vertical Cross-Section
Contouring and Blanking
TCAAP
June 2014

Concentration	Positive Planar Area (ft2)
Plume to 1	115236
Plume to 5	15251
Plume to 10	5739
Plume to 25	2
Plume to 50	0
Plume to 75	0

Total VOCs (ug/L)	Avg Total VOCs (ug/L)	Area (ft2)	Areal Conc (ug*ft2/L)
1 to 5	3	99985	299955
5 to 10	7.5	9512	71342
10 to 25	17.5	5737	100392
25 to 50	37.5	2	87
50 to 75	62.5	0	0
	Sum	115236	471776

Area Wtd Conc	4	ug/L

D.2.3 Group 1, 2, 3, 5, and 6 Mann-Kendall Evaluations

Summary Table

Table 3-5
Group 1, 2, 3, and 5 Mann-Kendall Summary and MAROS Conclusion for OU1

Group	Kendall S	N	Raw Trend	Confidence	COV	Raw Trend Decision	MAROS Conclusion	Threshold Triggered?	Comments
Group 2 Wells:									
04U877	2	6	Increasing	57.46%	0.5257	S or NT	**No Trend**	Yes	
Group 1 NP	5	6	Increasing	76.50%	0.1282	S or NT	**No Trend**	Yes	Between 36 and 51 µg/L since 2009.
Group 1 SP	0	6	Zero	41.78%	0.0000	S or NT	**Stable**	Yes	Stable, but avg. is <5 µg/L.
Group 3	--	--	--	--	--	--	**--**	--	Not sampled in FY 2014
Group 5	--	--	--	--	--	--	**--**	--	Not sampled in FY 2014

Notes:

S or NT = Stable or No Trend
N = Number of data points
COV = Coefficient of Variance
NA = Not Applicable
Response Threshold triggers are defined in Table D.2.3

MAROS Decision Matrix

M-K S	Confidence	COV	Trend
S > 0	> 95%	na	Increasing
S > 0	90-95%	na	Pr. Incr.
S > 0	< 90%	na	No Trend
S</= 0	< 90%	>/= 1	No Trend
S </= 0	< 90%	< 1	Stable
S < 0	90-95%	na	Pr. Decr.
S < 0	>95%	na	Decreasing

Table 3-5
Group 6 Mann-Kendall Summary and MAROS Conclusion for OU1

Group	Kendall S	N	Raw Trend	Confidence	COV	Raw Trend Decision	MAROS Conclusion	Threshold Triggered?	Comments
Group 6 OU1 Jordan Wells:									
04J822	-8	6	Decreasing	89.62%	0.1463	S or NT	**Stable**	Yes	
04J847	5	6	Increasing	76.50%	0.1009	S or NT	**No Trend**	Yes	Consistent results, mean 782 µg/L
04J849	0	6	Zero	41.78%	NA	S or NT	**NA**	No	All ND

Notes:
S or NT = Stable or No Trend
N = Number of data points
COV = Coefficient of Variance
NA = Not Applicable
Response Threshold triggers are defined in Table D.2.3

MAROS Decision Matrix			
M-K S	**Confidence**	**COV**	**Trend**
S > 0	> 95%	na	Increasing
S > 0	90-95%	na	Pr. Incr.
S > 0	< 90%	na	No Trend
S</= 0	< 90%	>/= 1	No Trend
S </= 0	< 90%	< 1	Stable
S < 0	90-95%	na	Pr. Decr.
S < 0	>95%	na	Decreasing

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Mann-Kendall Plots

Well: Group 1 NP

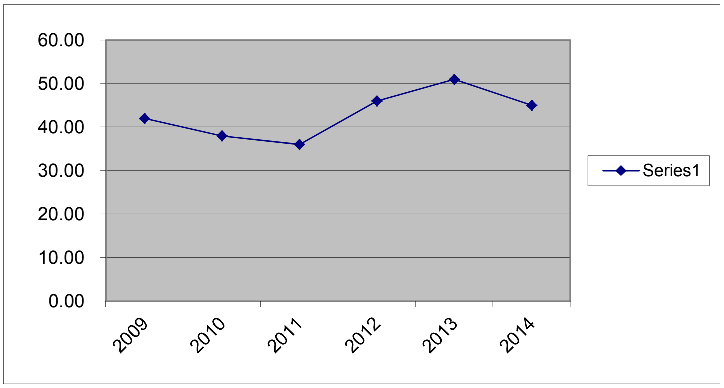
Date	TVOC (µg/L)	Mann-Kendall Calculation:					
6/11/2009	42.00	1					
6/16/2010	38.00	1	-1				
6/9/2011	36.00	1	-1	-1			
6/25/2012	46.00	1	1	1	1		
6/12/2013	51.00	1	1	1	1	1	
6/4/2014	45.00	1	1	1	1	-1	-1

N		6	5	4	3	2	1	15
	sum		1	2	3	0	-1	5
Possibles		15						

Mean 43.00
STNDEV 5.51362
COV 0.128224

Trend: Positive

Confidence (lookup) 76.5%



S 5
tau 0.333333

Decision Matrix

M-K S	Confidence	COV	Trend
S > 0	> 95%	na	Increasing
S > 0	90-95%	na	Pr. Incr.
S > 0	< 90%	na	No Trend
S</= 0	< 90%	>/= 1	No Trend
S </= 0	< 90%	< 1	Stable
S < 0	90-95%	na	Pr. Decr.
S < 0	>95%	na	Decreasing

Well: Group 1 SP

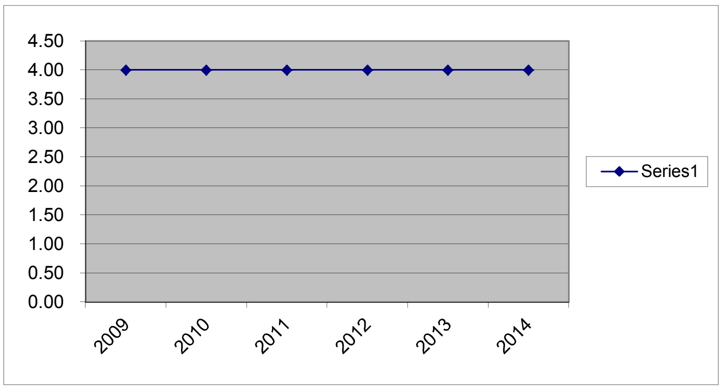
Date	TVOC (µg/L)	Mann-Kendall Calculation:					
6/11/2009	4.00	1					
6/11/2010	4.00	1	0				
6/9/2011	4.00	1	0	0			
6/25/2012	4.00	1	0	0	0		
6/28/2013	4.00	1	0	0	0	0	
6/4/2014	4.00	1	0	0	0	0	0

N		6	5	4	3	2	1	15
	sum		0	0	0	0	0	0
Possibles		15						

Mean 4.00
STNDEV 0
COV 0

Trend: Zero

Confidence (lookup) 41.8%



S 0

tau 0

Decision Matrix

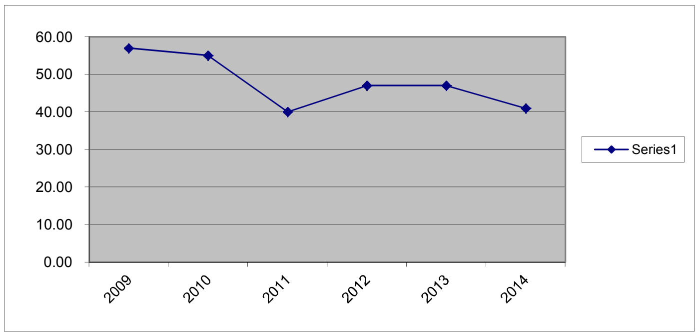
M-K S	Confidence	COV	Trend
S > 0	> 95%	na	Increasing
S > 0	90-95%	na	Pr. Incr.
S > 0	< 90%	na	No Trend
S</= 0	< 90%	>/= 1	No Trend
S </= 0	< 90%	< 1	Stable
S < 0	90-95%	na	Pr. Decr.
S < 0	>95%	na	Decreasing

Well: 04J822

Date	TCE (µg/L)	Mann-Kendall Calculation:						
6/16/2009	57.00	1						
6/9/2010	55.00	1	-1					
6/28/2011	40.00	1	-1	-1				
6/25/2012	47.00	1	-1	-1	1			
6/17/2013	47.00	1	-1	-1	1	0		47.83
6/10/2014	41.00	1	-1	-1	1	-1	-1	

N		6	5	4	3	2	1	15
	sum		-5	-4	3	-1	-1	-8
Possibles		15						

Mean	47.83
STNDEV	6.99761864
COV	0.14629168
Trend:	Negative
Confidence (lookup)	89.6%



S	-8
tau	-0.53333

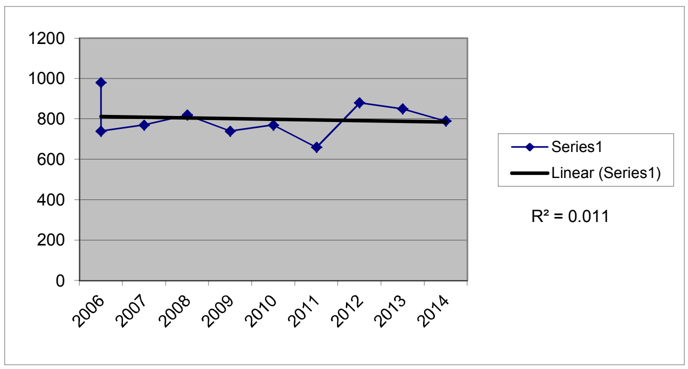
Decision Matrix

M-K S	Confidence	COV	Trend
S > 0	> 95%	na	Increasing
S > 0	90-95%	na	Pr. Incr.
S > 0	< 90%	na	No Trend
S</= 0	< 90%	>/= 1	No Trend
S </= 0	< 90%	< 1	Stable
S < 0	90-95%	na	Pr. Decr.
S < 0	>95%	na	Decreasing

Well: 04J847 (ext.)

Date	TCE (ug/l)	Mann-Kendall Calculation:										
6/6/2006	980	1										
12/11/2006	740	1	-1									
6/18/2007	770	1	-1	1								
6/25/2008	820	1	-1	1	1							
6/18/2009	740	1	-1	0	-1	-1						
6/10/2010	770	1	-1	1	0	-1	1					
6/30/2011	660	1	-1	-1	-1	-1	-1	-1				
6/25/2012	880	1	-1	1	1	1	1	1	1			
6/19/2013	850	1	-1	1	1	1	1	1	1	-1		
6/11/2014	790	1	-1	1	1	-1	1	1	1	-1	-1	
	N	10	9	8	7	6	5	4	3	2	1	45
	sum		-9	5	2	-2	3	2	3	-2	-1	1
	Possibles	45										

Mean	800.00
STNDEV	88.44333
COV	0.110554
Trend:	Positive
Confidence (lookup)	



S	1
tau	0.022222

Decsion Matrix

M-K S	Confidence	COV	Trend
S > 0	> 95%	na	Increasing
S > 0	90-95%	na	Pr. Incr.
S > 0	< 90%	na	No Trend
S</= 0	< 90%	>/= 1	No Trend
S </= 0	< 90%	< 1	Stable
S < 0	90-95%	na	Pr. Decr.
S < 0	>95%	na	Decreasing

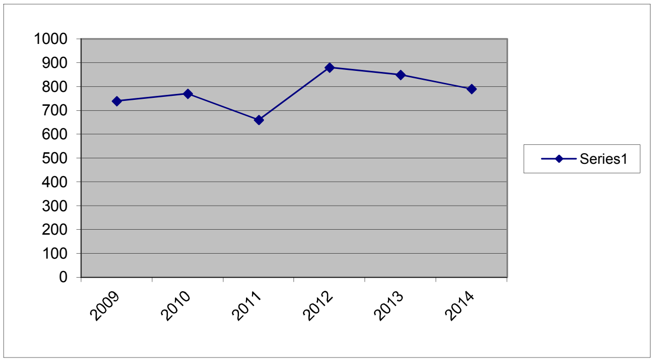
Well: 04J847

Date	TCE (µg/L)	Mann-Kendall Calculation:							
6/9/2009	740	1							
6/10/2010	770	1	1						
6/30/2011	660	1	-1	-1					
6/25/2012	880	1	1	1	1				
6/19/2013	850	1	1	1	1	-1		782	
6/11/2014	790	1	1	1	1	-1	-1		
	N	6	5	4	3	2	1		15
	sum		3	2	3	-2	-1		5
	Possibles	15							

Mean 781.67
STNDEV 78.84584
COV 0.100869

Trend: Positive

Confidence (lookup) 76.5%



S 5

tau 0.333333

Decision Matrix

M-K S	Confidence	COV	Trend
S > 0	> 95%	na	Increasing
S > 0	90-95%	na	Pr. Incr.
S > 0	< 90%	na	No Trend
S</= 0	< 90%	>/= 1	No Trend
S </= 0	< 90%	< 1	Stable
S < 0	90-95%	na	Pr. Decr.
S < 0	>95%	na	Decreasing

Well: 04J849

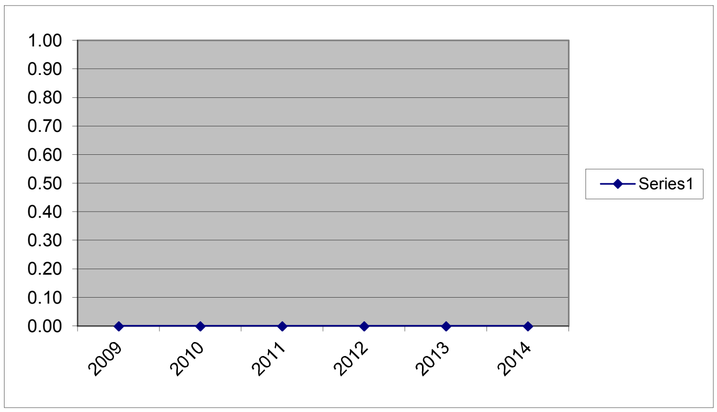
Date	TCE (µg/L)	Mann-Kendall Calculation:					
6/16/2009	0.00	1					
6/8/2010	0.00	1	0				
6/14/2011	0.00	1	0	0			
6/25/2012	0.00	1	0	0	0		
6/11/2013	0.00	1	0	0	0	0	
6/10/2014	0.00	1	0	0	0	0	0

N	6	5	4	3	2	1	15
sum		0	0	0	0	0	0
Possibles	15						

Mean 0.00
STNDEV 0
COV #DIV/0!

Trend: Zero

Confidence (lookup) 41.8%



S 0

tau 0

Decision Matrix

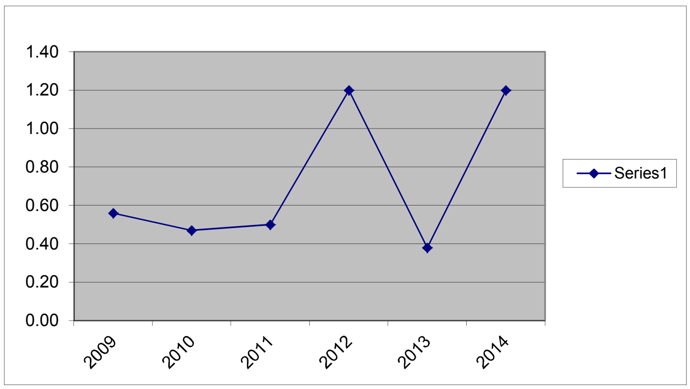
M-K S	Confidence	COV	Trend
S > 0	> 95%	na	Increasing
S > 0	90-95%	na	Pr. Incr.
S > 0	< 90%	na	No Trend
S</= 0	< 90%	>/= 1	No Trend
S </= 0	< 90%	< 1	Stable
S < 0	90-95%	na	Pr. Decr.
S < 0	>95%	na	Decreasing

Well: 04U877

Date	TCE (µg/L)	Mann-Kendall Calculation:					
6/9/2009	0.56	1					
6/8/2010	0.47	1	-1				
6/8/2011	0.50	1	-1	1			
6/26/2012	1.20	1	1	1	1		
6/11/2013	0.38	1	-1	-1	-1	-1	
6/11/2014	1.20	1	1	1	1	0	1

N		6	5	4	3	2	1	15
	sum		-1	2	1	-1	1	2
Possibles		15						

Mean	0.72
STNDEV	0.37759326
COV	0.52565186
Trend:	Positive
Confidence (lookup)	57.5%



S	2
tau	0.133333

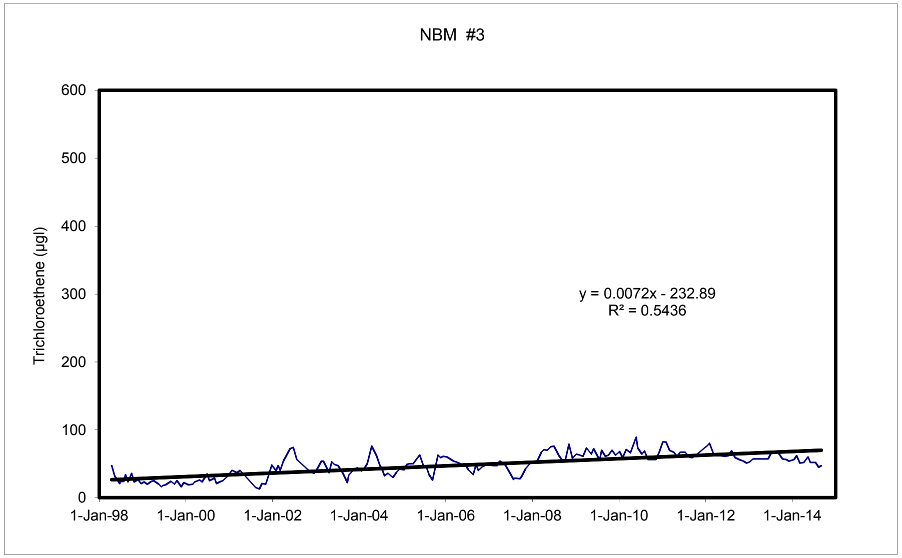
Decision Matrix

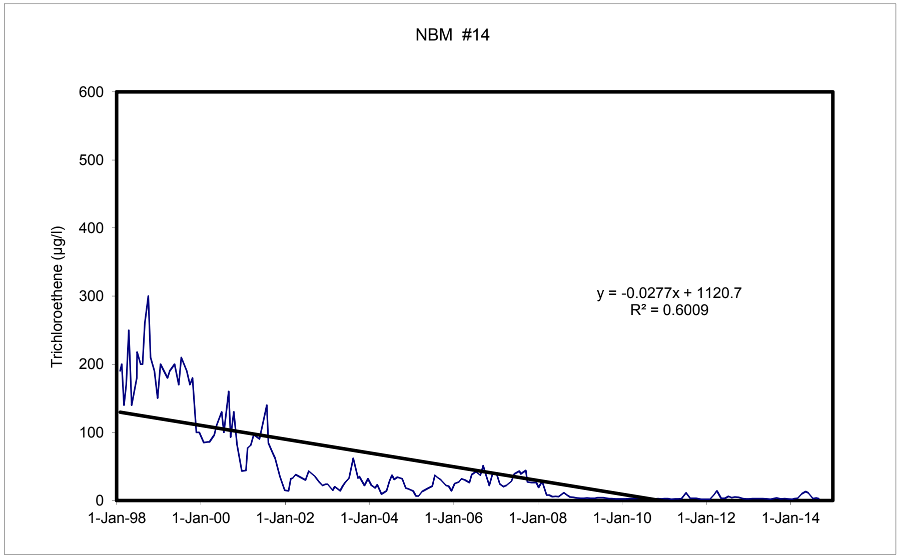
M-K S	Confidence	COV	Trend
S > 0	> 95%	na	Increasing
S > 0	90-95%	na	Prob. Incr.
S > 0	< 90%	na	No Trend
S</= 0	< 90%	>/= 1	No Trend
S </= 0	< 90%	< 1	Stable
S < 0	90-95%	na	Prob Decr.
S < 0	>95%	na	Decreasing

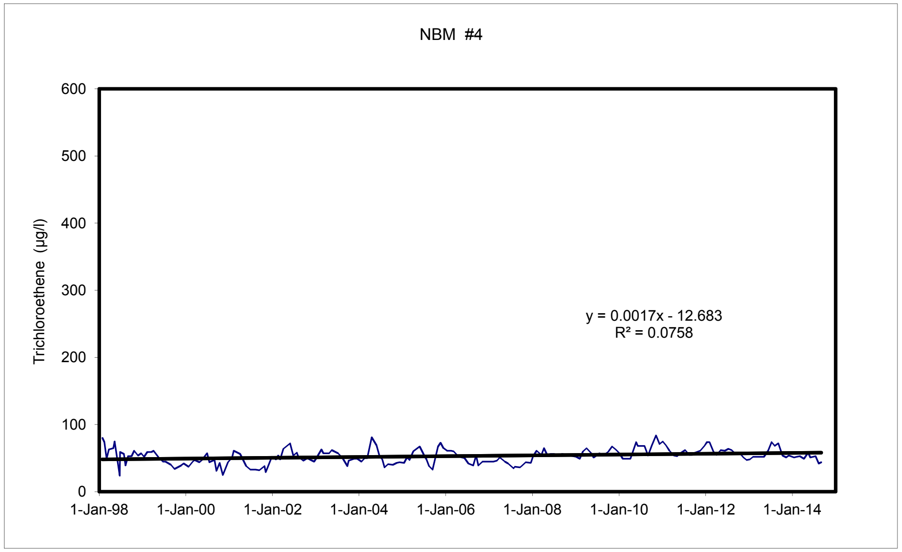
D.2.4 Group 3 and Group 5 Kriging Evaluation not completed for FY 2014.

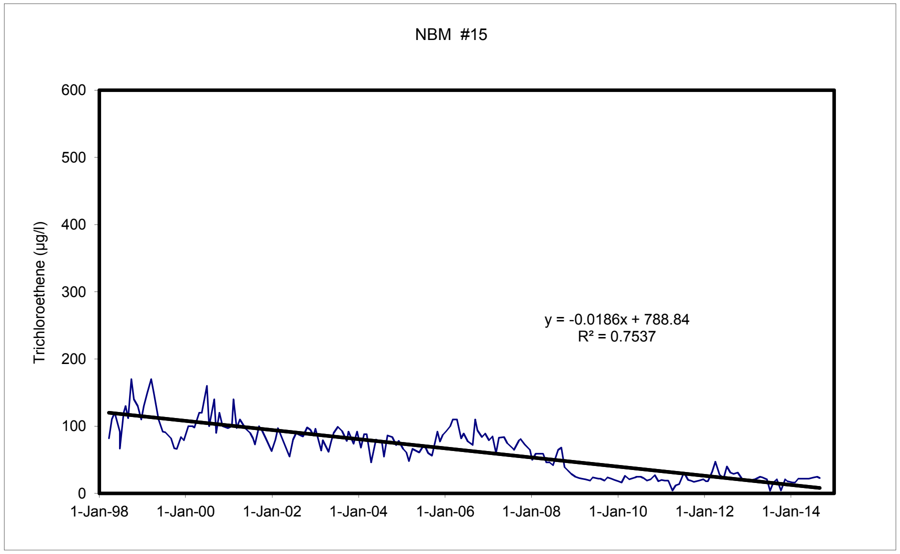
D.2.5 Group 6 New Brighton Municipal Well Regression Analysis

NEW BRIGHTON MUNICIPAL WELLS: Regression Analysis Since 1998: TRICHLOROETHENE

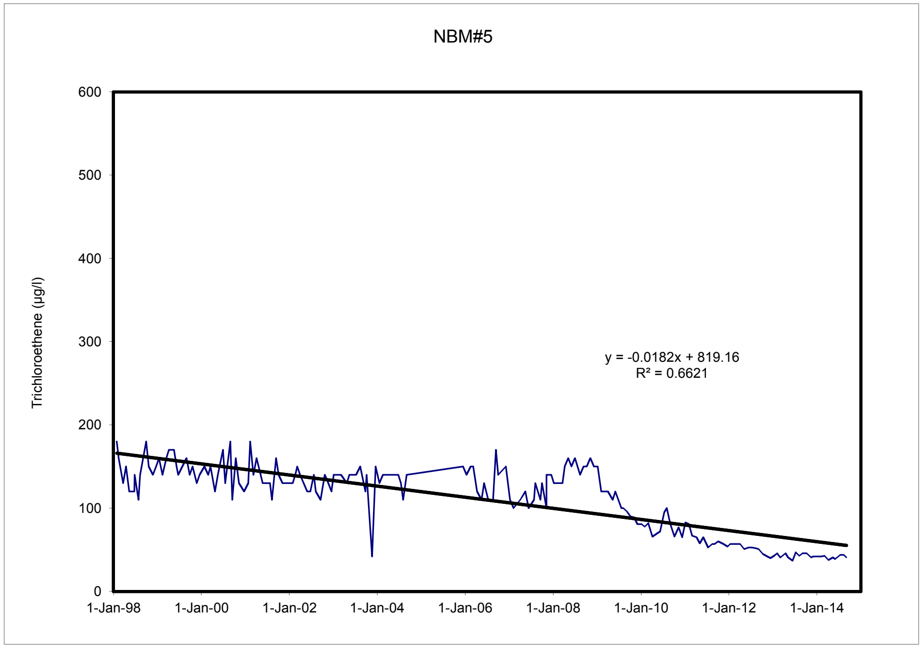


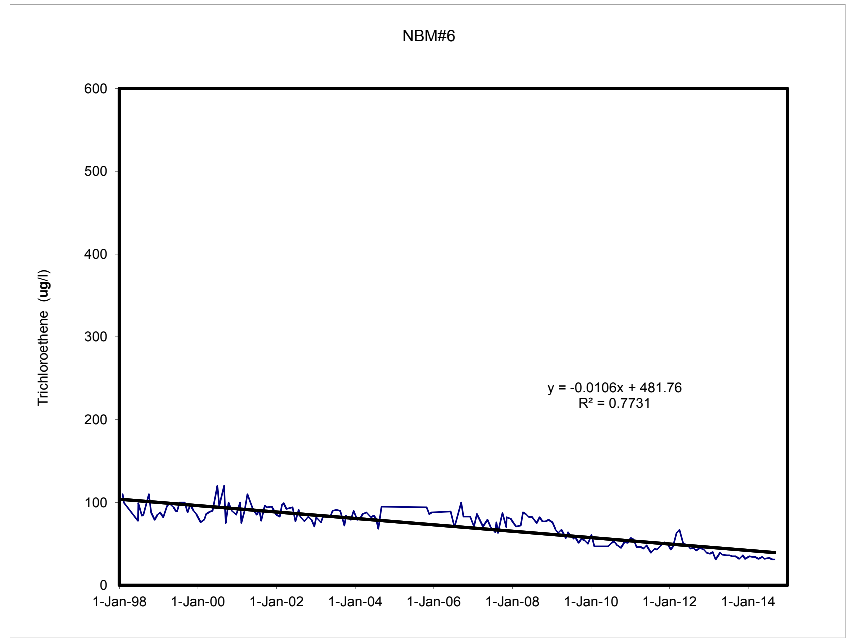






NEW BRIGHTON MUNICIPAL WELLS: Regression Analysis Since 1998: TRICHLOROETHENE





Appendix E

Well Inventory Update, FY 2014

APPENDIX E
WELL INVENTORY UPDATE

FISCAL YEAR 2014

Purpose

The purpose of well inventory is to identify wells that have been impacted or could potentially be impacted by contaminants from the New Brighton/Arden Hills Superfund Site.

Background

Developing and maintaining the well inventory is a process that was initiated in 1991, with the work efforts documented in several update reports since that time. Beginning in FY 1999, the update reporting was incorporated into the Annual Performance Reports.

The well inventory "study area," as defined by the Minnesota Pollution Control Agency, is shown on Figure E-1, and coincides with the Minnesota Department of Health (MDH) Special Well Construction Area.

The aquifers of concern are defined by the 1 µg/L trichloroethene contour for the Unit 3 and Unit 4 aquifers, and the 1 µg/L cis-1,2-dichloroethene contour for the Unit 1 aquifer at the north end of OU2.

The "area of concern" for the Unit 3 and Unit 4 aquifers is created by adding a quarter mile buffer area outside the 1 µg/L trichloroethene contour. The area of concern for the Unit 3 and Unit 4 aquifers is shown on Figure E-2.

The area of concern for the Unit 1 aquifer on the north side of OU2 is delineated by city streets. The area of concern for the Unit 1 aquifer is shown on Figure E-3.

Wells within the study area are categorized based on location, depth/aquifer, and use. Well categories for the well inventory are described in Table E-1.

Program Requirements

The well inventory program requirements have evolved over time, with changes documented through the update reports. A flowchart that describes the annual requirements for maintaining the well inventory database is shown on Figure E-4. Requirements are summarized below.

Near the beginning of each fiscal year, a database of study area wells is acquired from the MDH. This MDH database query is limited to study area wells that were constructed, sealed, or disclosed in the previous fiscal year. The MDH database consists of three lists:

1. Constructed Wells (generated through drillers submitting Water Well Records);
2. Sealed Wells (generated through drillers submitting Well Sealing Records); and
3. Disclosed Wells (made known through property transfer).

With the new MDH information, the well inventory database is updated by recategorizing wells, as necessary, and by adding any new wells that are within the study area. Any new wells found in Categories 1a, 1b, 1c, 2a, 2b, 2c, or 4a are targeted for sampling in that fiscal year; however, an attempt to reclassify any new category 4a wells will be made prior to sampling. Wells that are not sampled due to non-responsive well owners are targeted for sampling in the next major sampling event.

Category 4 wells are those with an unknown depth or unknown location, or both. Ideally, there should be no wells in Category 4. Each year, an attempt is made to reclassify Category 4 wells into one of the other categories. This is accomplished through phone calls, letters, and/or site visits in an attempt to obtain additional information. Any wells which are re-classified as Category 1a, 1b, 1c, 2a, 2b, or 2c are targeted for sampling in that fiscal year.

"Major" well inventory sampling events occur every four years and are shown in Appendix A.1. The major sampling events are scheduled to coincide with the biennial sampling events for performance purposes as delineated in the APR. For each major event, all wells in Categories 1a, 1b, 1c, 2a, 2b, 2c, and 4a are targeted for sampling. After every sampling event, each well owner is mailed a copy of their testing results. Wells that are not sampled due to non-responsive well owners are targeted for sampling in the next major sampling event.

For each sampling event, if any well has a detection which exceeds the applicable New Brighton/Arden Hills Superfund Site groundwater cleanup level for that contaminant (or an additivity of 1.0, similar to the MDH Hazard Index calculation), the well is evaluated using the flow chart presented in Figure E-4 to determine the timing of additional sampling. Wells that are used for drinking water are sampled again within one month of data validation. Wells that are not used for drinking water, but have possible contact exposure risks, are sampled the next fiscal year. If a cleanup level exceedance is confirmed (two consecutive events), and the contaminant concentrations in the well are proportional to contaminant concentrations of the New Brighton/Arden Hills Superfund Site OU1 plume, the Army offers to abandon the well and/or provide an alternate water supply.

The annual reporting requirements for the New Brighton/Arden Hills Superfund Site well inventory will include:

- A list of any wells found or reclassified.
- Analytical results and a summary of sampling efforts from that fiscal year.
- Recommendations for participation in the Well Abandonment/Alternate Water Supply Program.
- An updated well inventory database that lists wells by well category.
- An updated database listing water quality of wells.

FY 2014 Update

The updated MDH database was provided to Wenck on November 19, 2013. MDH generates the database from specific Township, Range, and Section data. This comprehensive database was screened to extract the lists of wells that were constructed, disclosed, or sealed between October 1, 2012 and September 30, 2013. Further investigative efforts were primarily focused on determining each well's location (inside or outside the study area and/or area of concern), status (active, inactive, or sealed), and water use (supply/non-supply).

Newly constructed active and inactive wells, and wells of unknown status that were determined to be located within the study area, are presented in Table E-3. Twenty wells were identified within the study area. Five of the wells were elevator shaft boreholes, one was an irrigation well, and fourteen were monitoring wells. The one irrigation well was classified into Category 3 due to it not being screened in an aquifer of concern. All other wells were classified into Category 6.

Disclosed wells that were identified as being in use, inactive, or of unknown status (but not sealed) and that were determined to be located within the study area are identified in Table E-4. There were no wells disclosed during FY14 that were located within the study area.

Sealed wells were found by reviewing the MDH sealed well list, by screening the MDH disclosed and new construction lists (which also contain sealed wells), and by talking with well owners. Wells identified as sealed are shown in Table E-5. Disclosed wells that were located within the area of concern and that the MDH identified as having a change in status from active or inactive to sealed were further investigated for confirmation of their sealed status. Any wells that were already in the well inventory database that the MDH identified as having a change in status from active or inactive to sealed are shown in Table E-5 with strikeouts through the old well category entry. Wells identified as sealed in the MDH database updates were assigned to Category 7a (documented as sealed/abandoned). Wells that were determined to be sealed through conversations with well owners were assigned to Category 7b (undocumented as sealed, or improperly abandoned).

Fourteen Category 4 wells were studied in FY 2014. This study was accomplished through mapping of well locations, internet searches, telephone calls, letters, and/or site visits in an attempt to reclassify Category 4 wells that were in the existing well inventory database into one of the other categories. Contact information was updated, if applicable. For FY 2014, none of the wells could be reclassified based on this effort, and no new wells were added to Category 4a or

4b. Therefore, the total number of wells in Category 4 at the end of FY 2014 remained at fourteen. An investigation summary is included in Table E-6.

During the FY 2014 well inventory effort, any new Category 1a, 1b, 1c, 2a, 2b, 2c, and 4a wells were to be sampled. Through the FY 2014 effort, no new wells were added to these categories; therefore, no wells were sampled and no analytical data was generated in FY 2014 (Table E-2).

Information contained in Tables E-3 through E-6 has been updated in the well inventory database (Filename "Well Inventory Main Database FY 2014", an Excel file included on this CD).

Recommendations

- At this time no wells are recommended for the Army to offer alternate water supply or well abandonment.
- The next "major" sampling event is in FY 2017. Wells to be sampled in FY 2017 are:
  - All wells in Categories 1a, 1b, 1c, 2a, 2b, 2c, and 4a
  - Any previously undiscovered wells determined to be in Categories 1a, 1b, 1c, 2a, 2b, 2c, or 4a based on the FY 2013-FY 2016 review of the MDH database.
  - Any Category 4b wells that are determined, from further investigation, to be in Category 1a, 1b, 1c, 2a, 2b, 2c, or 4a.

TABLE E-1
WELL INVENTORY CATEGORY DESCRIPTIONS

Category	*Subcategory*	*Explanation*
1		Water supply wells screened in an aquifer of concern, inside the 1 µg/l contour. Wells are divided into the following subcategories:
	1a	• Drinking water well
	1b	• Nondrinking but possible contact water
	1c	• Nondrinking, noncontact water
	1d	• Well is inoperable or has not been used for several years
	1e	• Well for which the owner has refused (or has been unresponsive to) an Army offer for abandonment, or for which the water use has been deemed acceptable
2		Water supply wells in an area of concern, inside the buffer lines, but outside the 1 µg/l contour, screened in an aquifer of concern. Wells are divided into the following subcategories:
	2a	• Drinking water well
	2b	• Nondrinking but possible contact water
	2c	• Nondrinking, noncontact water
	2d	• Well is inoperable or has not been used for several years
3		Water supply wells within the Study Area that are either outside the area of concern, or are within the area of concern but are not screened in an aquifer of concern.
4		Water supply wells with missing information, divided into the following subcategories:
	4a	• Unknown depth or aquifer, but located in the area of concern.
	4b	• Unknown location, but potentially located within the Study Area. Wells with both an unknown depth and an unknown location are included in 4b.
5		Wells that are in the study area, but that have been field checked and not located. No further action is recommended for these wells.
6		Nonsupply wells (primarily monitoring wells).
7		Sealed or abandoned wells. Wells are divided into the following subcategories:
	7a	• Documented as sealed/abandoned
	7b	• Undocumented as sealed, or improperly abandoned

TABLE E-2

WELL INVENTORY SAMPLING RESULTS
Fiscal Year 2014

No sampling conducted in FY14

TABLE E-3
CONSTRUCTED WELLS

Unique Number	Category	Last Name or Business Name	Street	City	Use	Depth	Date Drilled
783535	6	L AND H REAL ESTATE, LLC	2100 GILBERT AVENUE	St. Paul	Monitoring	40	12/20/2012
789938	6	OFFICE MAX, INC.	7000 CENTRAL AVENUE NE	Fridley	Monitoring	124	11/23/2012
790565	6	WALDORF CORP.	2250 WABASH	St. Paul	Elevator Shaft Boring	45	6/3/2013
790570	6	U OF M	14 CHURCH STREET SE	Minneapolis	Elevator Shaft Boring	37	8/8/2013
790572	6	KREMER AND YOUNG, LLC	1720 MADISON AVENUE NE	Minneapolis	Elevator Shaft Boring	26	8/16/2013
794601	6	R AND D HEMETOLOGY	2001 KENNEDY STREET NE	Minneapolis	Elevator Shaft Boring	30	12/19/2012
794607	6	R AND D HEMETOLOGY	2001 KENNEDY STREET NE	Minneapolis	Elevator Shaft Boring	20	5/22/2013
795194	6	OFFICE MAX, INC.	7000 CENTRAL AVENUE NE	Fridley	Monitoring	22	5/29/2013
796405	3	BETTY ANN ADDISON	6581 CENTRAL AVENUE	Fridley	Irrigation	142	4/26/2013
796623	6	BRENNTAG GREAT LAKES, LLC	2130 ENERGY PARK DRIVE	St. Paul	Monitoring	55	3/14/2013
796624	6	BRENNTAG GREAT LAKES, LLC	2130 ENERGY PARK DRIVE	St. Paul	Monitoring	30	3/19/2013
796625	6	BRENNTAG GREAT LAKES, LLC	2130 ENERGY PARK DRIVE	St. Paul	Monitoring	30	3/19/2013
796626	6	BRENNTAG GREAT LAKES, LLC	2130 ENERGY PARK DRIVE	St. Paul	Monitoring	55	3/20/2013
796633	6	ASHLAND, INC.	1400 OLD HIGHWAY 8 NW	New Brighton	Monitoring	15	6/26/2013
796635	6	ASHLAND, INC.	1400 OLD HIGHWAY 8 NW	New Brighton	Monitoring	16	6/25/2013
796636	6	ASHLAND, INC.	1400 OLD HIGHWAY 8 NW	New Brighton	Monitoring	17	6/25/2013
796637	6	ASHLAND, INC.	1400 OLD HIGHWAY 8 NW	New Brighton	Monitoring	17	6/25/2013
797083	6	HILLCREST DEVELOPMENT	807 BROADWAY STREET NE	Minneapolis	Monitoring	24	7/15/2013
797084	6	HILLCREST DEVELOPMENT	807 BROADWAY STREET NE	Minneapolis	Monitoring	25	7/15/2013
797963	6	FRIDLEY INDUSTRIAL, LLC	7593 HIGHWAY 65 NE	Fridley	Monitoring	15	9/23/2013

Indicates wells that were both constructed and later sealed during FY 2013.

TABLE E-4
WELLS DISCLOSED THROUGH PROPERTY TRANSFER

Unique Number	Category	Last Name or Business Name	Street	City	Use	Status	Date Sealed	Depth	Aquifer	Date Drilled

No wells were disclosed through property transfer in FY 2014.

TABLE E-5
SEALED WELLS

Unique Number	Category	Last Name or Business Name	Street	City	Status	Date Sealed
575347	7a	SOO LINE RAILROAD CO.	2800 CENTRAL AVENUE NE	Minneapolis	Monitoring	11/20/2012
575348	7a	No Owner Found	2800 CENTRAL AVENUE NE	Minneapolis	Monitoring	11/20/2012
577668	7a	CBS VIACOM, INC.	2303 KENNEDY STREET	Minneapolis	Monitoring	11/21/2012
577669	7a	CBS VIACOM, INC.	2303 KENNEDY STREET	Minneapolis	Monitoring	11/21/2012
657341	7a	SOO LINE RAILROAD CO.	2800 CENTRAL AVENUE NE	Minneapolis	Monitoring	11/20/2012
662095	~~6~~ 7a	CBS VIACOM, INC.	2303 KENNEDY STREET	Minneapolis	Monitoring	11/21/2012
662096	~~6~~ 7a	CBS VIACOM, INC.	2303 KENNEDY STREET	Minneapolis	Monitoring	11/21/2012
671157	~~6~~ 7a	CBS VIACOM, INC.	2303 KENNEDY STREET	Minneapolis	Monitoring	11/21/2012
671158	~~6~~ 7a	CBS VIACOM, INC.	2303 KENNEDY STREET	Minneapolis	Monitoring	11/21/2012
719462	~~6~~ 7a	BRENNTAG GREAT LAKES, LLC	2340 ROSE PLACE	Roseville	Monitoring	1/17/2013
719463	~~6~~ 7a	BRENNTAG GREAT LAKES, LLC	2340 ROSE PLACE	Roseville	Monitoring	1/17/2013
719464	~~6~~ 7a	BRENNTAG GREAT LAKES, LLC	2340 ROSE PLACE	Roseville	Monitoring	1/17/2013
719465	~~6~~ 7a	BRENNTAG GREAT LAKES, LLC	2340 ROSE PLACE	Roseville	Monitoring	1/17/2013
749674	~~6~~ 7a	CBS VIACOM, INC.	2303 KENNEDY STREET NE	Minneapolis	Monitoring	11/21/2012
749675	~~6~~ 7a	CBS VIACON, INC.	2303 KENNEDY STREET NE	Minneapolis	Monitoring	11/21/2012
763293	~~6~~ 7a	CBS VIACOM, INC.	2310 KENNEDY BUILDING	Minneapolis	Monitoring	11/21/2012
775955	7a	PAM BILADEAU	1654 STANBRIDGE AVENUE	Roseville	Monitoring	10/10/2012
775956	7a	PAM BILADEAU	1654 STANBRIDGE AVENUE	Roseville	Monitoring	10/10/2012
775957	7a	PAM BILADEAU	1654 STANBRIDGE AVENUE	Roseville	Monitoring	11/2/2012
767864	~~3~~ 7a	MINNEAPOLIS, CITY OF	1095 12TH AVENUE SE	Minneapolis	Other	10/18/2012
768531	~~6~~ 7a	SHAFER CONTRACTING	470 HIGHWAY 96	Shoreview	Other	4/17/2013
768530	~~6~~ 7a	SHAFER CONTRACTING	470 HIGHWAY 96	Shoreview	Other	4/17/2013
577305	~~6~~ 7a	SHAFER CONTRACTING		Arden Hills	Other	5/6/2013
577303	~~6~~ 7a	SHAFER CONSTRUCTION		Arden Hills	Other	4/17/2013
577307	~~6~~ 7a	SHAFER CONTRACTING			Other	4/17/2013
786983	~~6~~ 7a	TIOY 2012 LLC	1717 CENTRAL AVENUE NE	Minneapolis	Monitoring	10/26/2012
786982	~~6~~ 7a	TIOY 2012 LLC	1717 CENTRAL AVENUE NE	Minneapolis	Monitoring	11/6/2012
772833	7a	ST. PAUL PLANNING AND ECONOMIC DEVELOPMEN	721 RAYMOND AVENUE	St. Paul	Monitoring	3/12/2013
772834	7a	ST. PAUL PLANNING AND ECONOMIC DEVELOPMEN	721 RAYMOND AVENUE	St. Paul	Monitoring	3/12/2013
772835	7a	ST. PAUL PLANNING AND ECONOMIC DEVELOPMEN	721 RAYMOND AVENUE	St. Paul	Monitoring	3/12/2013
772836	7a	ST. PAUL PLANNING AND ECONOMIC DEVELOPMEN	721 RAYMOND AVENUE	St. Paul	Monitoring	3/12/2013
H000302718	7a	HOLIDAY STATION STORES	1920 HIGHWAY 96 W	Arden Hills	Monitoring	11/15/2012
H000306082	7a	RAMSEY COUNTY		Arden Hills	Monitoring	10/4/2012
H000292318	7a	RICHARD NELSON	107 16TH AVENUE NW	New Brighton	Water Supply	10/5/2012
H000304215	7a	ALBERT MOWLEN	1980 W COUNTY ROAD B	Roseville	Water Supply	10/9/2012
H000307214	7a	TOM EKELUND	663 12TH AVENUE NW	New Brighton	Water Supply	10/22/2012
231741	~~3~~ 7a	COLUMBIA HEIGHTS, CITY OF	40TH AVENUE NE	Columbia Heights	Water Supply	11/14/2012
H000304218	7a	THERMO KING	1973 OLD HIGHWAY 8	New Brighton	Water Supply	10/30/2012
H000305596	7a	DENNIS RADOCHA	7000 CENTRAL AVENUE NE	Fridley	Monitoring	11/13/2012
H000304817	7a	WES THOMPSON	2009 GLENPAUL AVENUE	Arden Hills	Water Supply	11/21/2012
H000309784	7a	YVONNE RINGGOLD ESTATE	3070 RICE CREEK ROAD	New Brighton	Water Supply	11/14/2012
H000309163	7a	BETTY ANN ADDISON	6581 CENTRAL AVENUE	Fridley	Water Supply	11/13/2012

TABLE E-5
SEALED WELLS

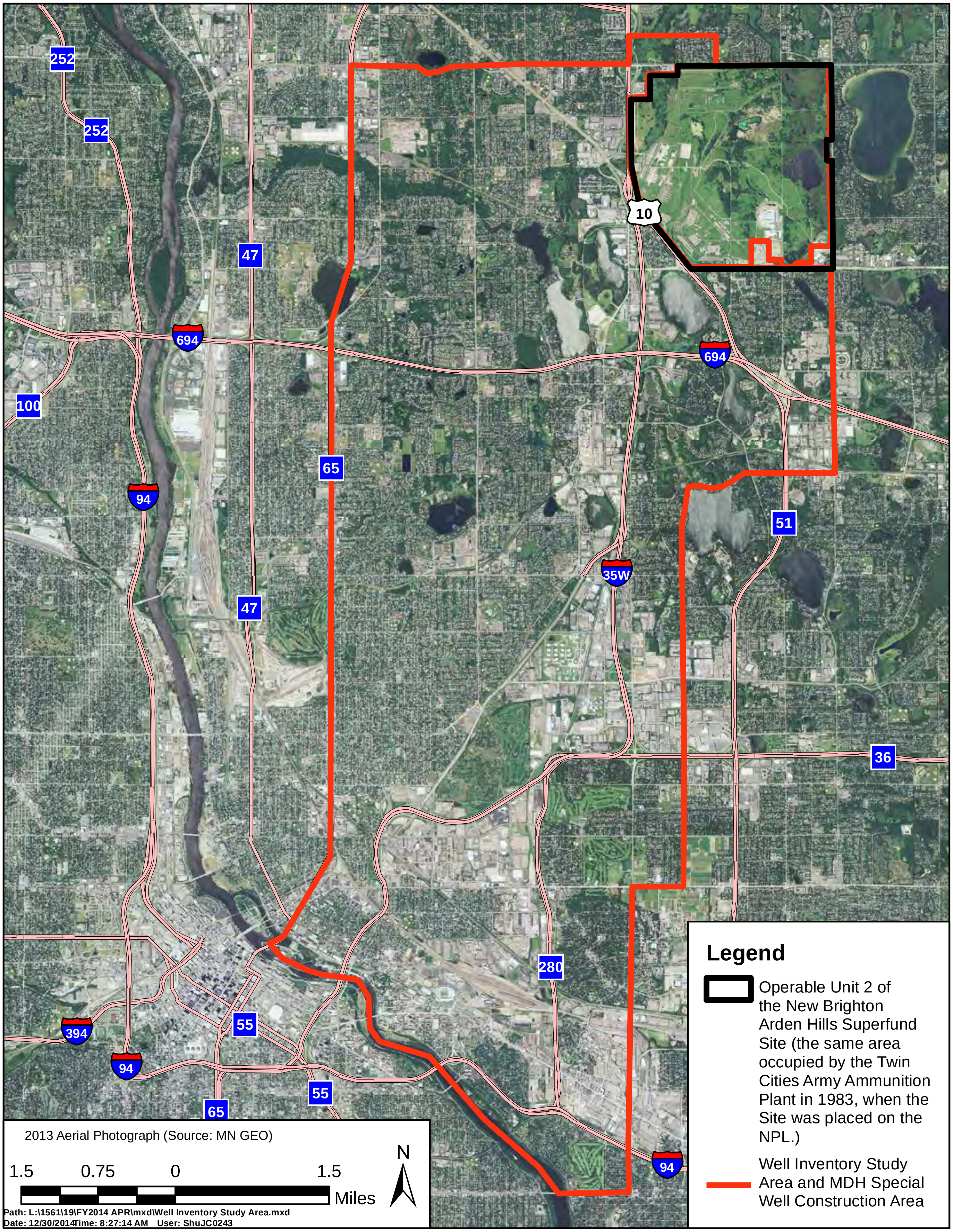
Unique Number	***Category***	***Last Name or Business Name***	***Street***	***City***	***Status***	***Date Sealed***
H000309786	7a	THOMAS P. TRI	5466 ERICKSON ROAD	Mounds View	Water Supply	11/10/2012
H000309452	7a	CHARLES RUNNING	81 CLEVELAND AVENUE	New Brighton	Monitoring	11/26/2012
H000302171	7a	MN PCA	5001 CENTRAL AVENUE	Columbia Heights	Monitoring	11/19/2012
H000306158	7a	JIM DECORSEY	3639 RUSTIC PLACE	Shoreview	Water Supply	11/29/2012
H000304223	7a	THERMO KING	1951 OLD HIGHWAY 8	New Brighton	Monitoring	12/6/2012
235511	~~6~~ 7a	DENNIS RADOCHA	7000 CENTRAL AVENUE NE	Fridley	Monitoring	12/18/2012
H000308287	7a	STEPHANIE MCCANN	389 OAKWOOD DRIVE	New Brighton	Water Supply	12/17/2012
H000308955	7a	JOHN MCDONALD	2000 STOWE AVENUE	New Brighton	Env. Boring	3/12/2013
H000308956	7a	JOHN MCDONALD	2000 STOWE AVENUE	New Brighton	Water Supply	3/12/2013
H000307343	7a	LASHINSKI SEPTIC	1315 INDIAN OAKS COURT	Arden Hills	Water Supply	1/3/2013
H000310651	7a	MICHAEL FOODS, INC.	3171 FIFTH STREET SE	Minneapolis	Env. Boring	11/8/2012
H000306325	7a	MICHAEL FOODS, INC.	3171 FIFTH STREET SE	Minneapolis	Env. Boring	11/16/2012
H000304149	7a	R AND D SYSTEMS	2001 KENNEDY STREET NE	Minneapolis	Other	10/5/2012
H000310831	7a	PHS MANAGEMENT LLC	3220 LAKE JOHANNA BOULEVARD	Arden Hills	Other	1/7/2013
H000310002	7a	BLUE FOX PROPERTIES	3833 LEXINGTON AVENUE N	Arden Hills	Monitoring	2/6/2013
H000310843	7a	PHS MANAGEMENT LLC	3220 LAKE JOHANNA BOULEVARD	Arden Hills	Other	2/26/2013
234146	~~6~~ 7a	TCAAP	4700 HIGHWAY 10	Arden Hills	Monitoring	11/29/2012
234145	~~6~~ 7a	TCAAP	4700 HIGHWAY 10	Arden Hills	Monitoring	11/29/2012
234147	~~6~~ 7a	TCAAP	4700 HIGHWAY 10	Arden Hills	Monitoring	11/29/2012
421426	~~6~~ 7a	TCAAP	4700 HIGHWAY 10	Arden Hills	Monitoring	11/29/2012
H000309686	7a	MARILYN SULLIVAN	522 66TH AVENUE NE	Fridley	Water Supply	3/8/2013
H000307235	7a	SANDRA LINDBERG	7493 GROVELAND ROAD	Mounds View	Water Supply	3/17/2013
H000309695	7a	KAREN STULC	2945 FAIRVIEW AVENUE N	Roseville	Water Supply	3/20/2013
H000311704	7a	BRAD BANDEL	5980 SIXTH STREET NE	Fridley	Water Supply	3/19/2013
H000306633	7a	GENERAL MILLS	902 22ND AVENUE SE	Minneapolis	Monitoring	12/17/2012
H000306634	7a	GENERAL MILLS	1019 21ST AVENUE SE	Minneapolis	Monitoring	12/17/2012
H000306635	7a	GENERAL MILLS	911 21ST AVENUE SE	Minneapolis	Monitoring	12/17/2012
H000306636	7a	GENERAL MILLS	1030 20TH AVENUE SE	Minneapolis	Monitoring	12/17/2012
H000306637	7a	GENERAL MILLS	909 20TH AVENUE SE	Minneapolis	Monitoring	12/17/2012
H000306638	7a	GENERAL MILLS	1042 18TH AVENUE SE	Minneapolis	Monitoring	12/17/2012
H000306639	7a	GENERAL MILLS	856 19TH AVENUE SE	Minneapolis	Monitoring	12/17/2012
H000306640	7a	GENERAL MILLS	975 18TH AVENUE SE	Minneapolis	Monitoring	12/17/2012
H000306641	7a	GENERAL MILLS	1529 17TH AVENUE SE	Minneapolis	Monitoring	12/17/2012
H000306642	7a	GENERAL MILLS	1717 ROLLING AVENUE SE	Minneapolis	Monitoring	12/17/2012
H000307238	7a	ROMAN DZIUBA	2092 FAIRWAYS LANE	Roseville	Water Supply	3/26/2013
H000303977	7a	THOMAS SANDERS	1783 PINEWOOD DRIVE	Shoreview	Water Supply	4/3/2013
H000310018	7a	MN PCA	1045 FIFTH STREET NW	New Brighton	Monitoring	4/10/2013
H000310017	7a	MN PCA	310 FIFTH AVENUE NW	New Brighton	Monitoring	4/10/2013
H000310016	7a	MN PCA	1555 FIFTH STREET NW	New Brighton	Monitoring	4/9/2013
H000306643	7a	GENERAL MILLS	2010 E HENNEPIN AVENUE	Minneapolis		12/17/2012
H000311830	7a	STANLEY L. JOHNSON	1989 SKILLMAN AVENUE W	Roseville	Water Supply	6/11/2013
H000309120	7a	ROSEMARY CASSERLY	5965 FIFTH STREET NE	Fridley	Water Supply	4/26/2013

TABLE E-5
SEALED WELLS

Unique Number	Category	Last Name or Business Name	Street	City	Status	Date Sealed
H000311486	7a	METRO TRANSIT	515 N CLEVELAND AVENUE	St. Paul	Monitoring	5/8/2013
H000311576	7a	MN DOT	1900 W COUNTY ROAD I	Arden Hills	Monitoring	5/7/2013
H000312260	7a	LILLIAN BOFELL	1575 14TH AVENUE NW	New Brighton	Water Supply	5/20/2013
H000311577	7a	OFFICE MAX, INC.	7000 CENTRAL AVENUE NE	Fridley	Monitoring	5/28/2013
H000309134	7a	TOM LUMPMAN	609 13TH AVENUE	New Brighton	Water Supply	5/24/2013
H000312261	7a	ASHLEY STARR	554 23RD AVENUE	New Brighton	Water Supply	5/28/2013
H000277628	7a	ANDREW HOLEWA	4480 PLEASANT DRIVE	Arden Hills	Water Supply	6/7/2013
H000313006	7a	AI LINH LI	1948 ROSELAWN AVENUE	Falcon Heights	Water Supply	8/1/2013
H000309138	7a	MONIKA BURAAU	2159 BELLE LANE	Mounds View	Water Supply	6/18/2013
H000312732	7a	MS RELOCATING SERVICE	1671 LAKE VALENTINE ROAD	Arden Hills	Water Supply	6/26/2013
H000310050	7a	PULTE HOMES	7400 OLD HIGHWAY 8	New Brighton	Monitoring	7/12/2013
H000297411	7a	BOB NIELSEN	1868 GRANT ROAD	Arden Hills		6/20/2013
H000312738	7a	BARBARA POLISTER	1741 GLENVIEW AVENUE	Arden Hills	Water Supply	8/13/2013
H000301787	7a	EAGLE CREST CONSTRUCTION			Water Supply	3/20/2013
H000312014	7a	SHAFER CONTRACTING		Arden Hills	Other	4/17/2013
H000312015	7a	SHAFER CONTRACTING		Arden Hills	Other	4/17/2013
H000577303	7a	SHAFER CONTRACTING		Arden Hills	Other	4/17/2013
H000312753	7a	DOUGHERTY MORTGAGE, LLC	2700 UNIVERSITY AVENUE	St. Paul	Monitoring	7/8/2013
H000312008	7a	SHAFER CONTRACTING		Arden Hills	Other	4/17/2013
H000312009	7a	SHAFER CONTRACTING		Arden Hills	Other	4/17/2013
H000311722	7a	MARTA JOHNSON	4001 FAIRVIEW AVENUE N	Arden Hills	Water Supply	8/7/2013
H000312564	7a	1313 FIFTH STREET OWNER LLC	1313 FIFTH STREET SE	Minneapolis	Other	4/22/2013
H000312563	7a	1313 FIFTH STREET OWNER LLC	1313 FIFTH STREET SE	Minneapolis	Other	4/22/2013
H000312275	7a	GERALD HANDKE	1674 STANBRIDGE AVENUE	Roseville	Water Supply	7/23/2013
H000313428	7a	TCAAP	1245 W HIGHWAY 96	Arden Hills	Monitoring	7/25/2013
H000313954	7a	COLDWELL BANKER BURNET	10 EIGHTH AVENUE SW	New Brighton	Monitoring	7/23/2013
H000277633	7a	ROBERT SMITH	1850 VENUS AVENUE	Arden Hills	Water Supply	8/16/2013
H000311839	7a	JACK BUCHAL	2578 HERSCHEL STREET	Roseville	Water Supply	7/31/2013
H000312626	7a	BOB BOESEL	1695 VALENTINE AVENUE	Arden Hills	Water Supply	8/2/2013
H000313148	7a	CURWOOD MN, LLC	150 26TH AVENUE SE	Minneapolis	Monitoring	7/2/2013
H000303881	7a	COLUMBIA HEIGHTS, CITY OF		Columbia Heights	Env. Boring	5/2/2013
H000314214	7a	JAMES LYONS	2279 COUNTY ROAD H2	Mounds View	Water Supply	7/23/2013
H000314225	7a	JERRY SKELLY	7095 KNOLLWOOD COURT	Mounds View	Water Supply	8/19/2013
242928	~~3~~ 7a	GARY BANK	2185 DRAPER AVENUE	Roseville	Water Supply	8/20/2013
H000313443	7a	PULTA HOMES	1400 OLD HIGHWAY 8	New Brighton	Monitoring	9/5/2013
H000315129	7a	KATIE POSER	1975 W COUNTY ROAD D	Arden Hills	Water Supply	9/23/2013
H000315133	7a	KATIE POSER	1975 W COUNTY ROAD D	Arden Hills	Water Supply	9/26/2013

TABLE E-6
FY 2014 FIELD INVESTIGATION AND SAMPLING SUMMARY

Unique Number	*Category*	*Last Name or Business Name*	*Street*	*City*	*Date Last Sampled*	*Status*	*Depth*	*Comments*
	4a	Kallio	2816 St. Anthony Blvd	St. Anthony		Not in Use		No letter sent FY 2014.
	4a	Hermes	2935 Old Hwy 8	Roseville	6/24/2013	Active		No letter sent FY 2014.
249185	4a	Novotny	1706 Malvern St	Lauderdale		Unknown		No letter sent FY 2014.
S00650	4b	CME		New Brighton	6/24/1984			No letter sent FY 2014.
239465	4b	Lennox				Active	256	No letter sent FY 2014.
234434	4b	Marquart		Arden Hills		Unknown		No letter sent FY 2014.
105271	4b	Nelson				Active	137	No letter sent FY 2014.
S00471	4b	R Komarek/Nelson-Miller Cons				Inactive		No letter sent FY 2014.
S00551	4b	Tamarack Care Temp			2/17/1982	Unknown		No letter sent FY 2014.
201192	4b					Unknown		No letter sent FY 2014.
234532	4b					Unknown		No letter sent FY 2014.
234537	4b					Unknown		No letter sent FY 2014.
234545	4b				PHASE I	Unknown		No letter sent FY 2014.
234658	4b				6/7/1982	Unknown		No letter sent FY 2014.



ANNUAL PERFORMANCE REPORT

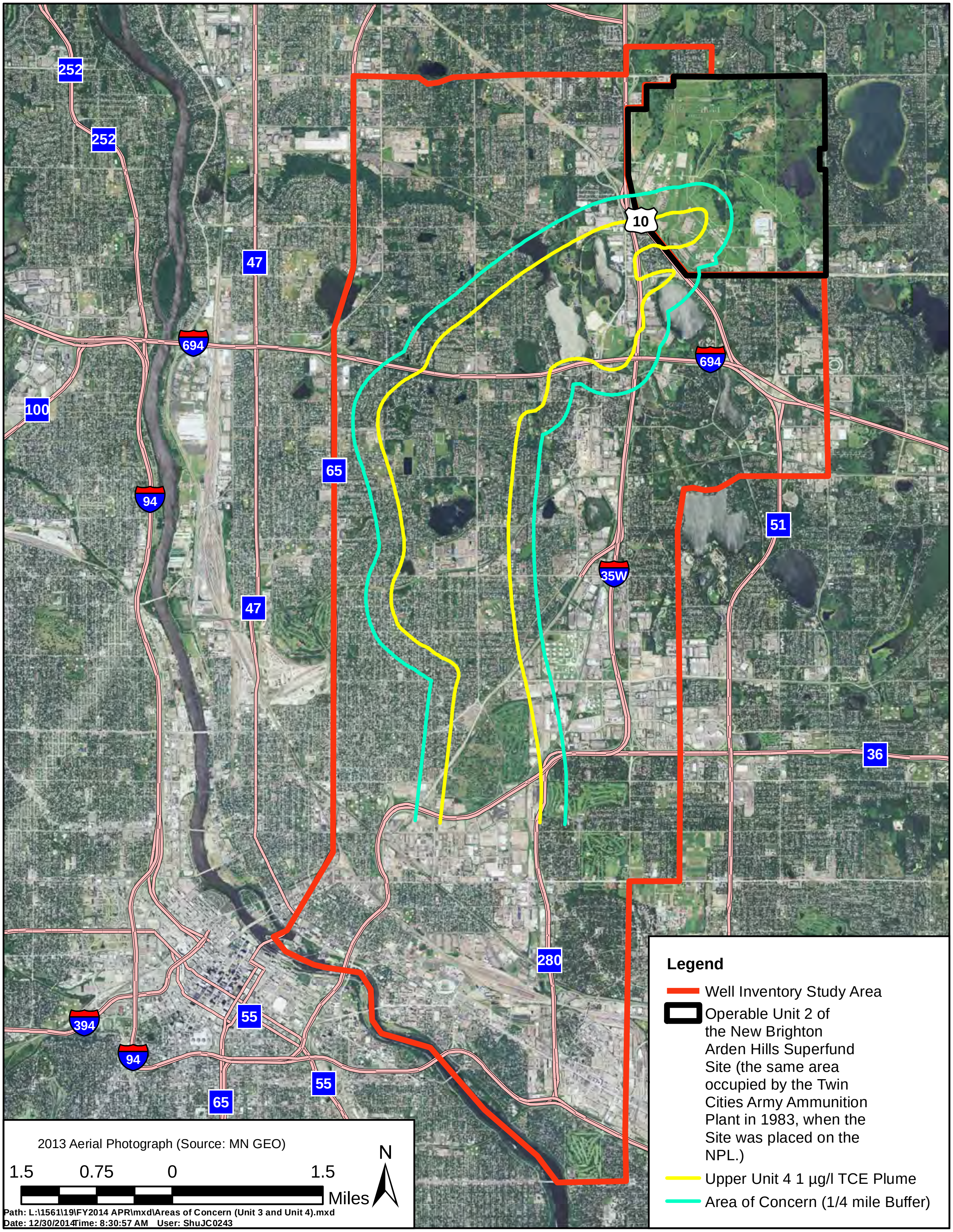
Well Inventory Study Area

WENCK ASSOCIATES

Responsive partner. Exceptional outcomes.

FY 2014

Figure E-1



ANNUAL PERFORMANCE REPORT

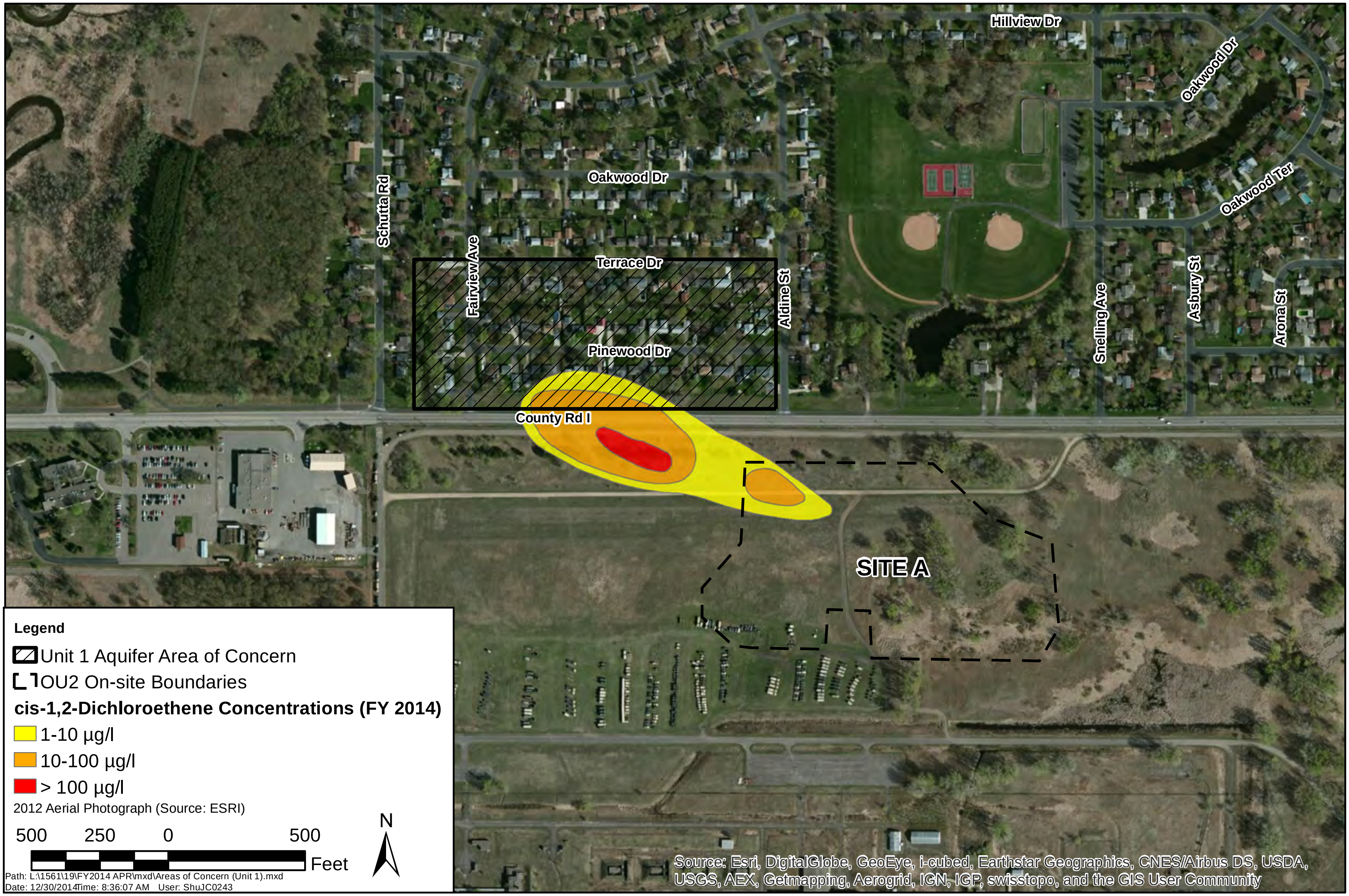
Areas of Concern (Unit 3 and Unit 4)

WENCK ASSOCIATES

Responsive partner. Exceptional outcomes.

FY 2014

Figure E-2



ANNUAL PERFORMANCE REPORT

Area of Concern (Unit 1)

WENCK ASSOCIATES

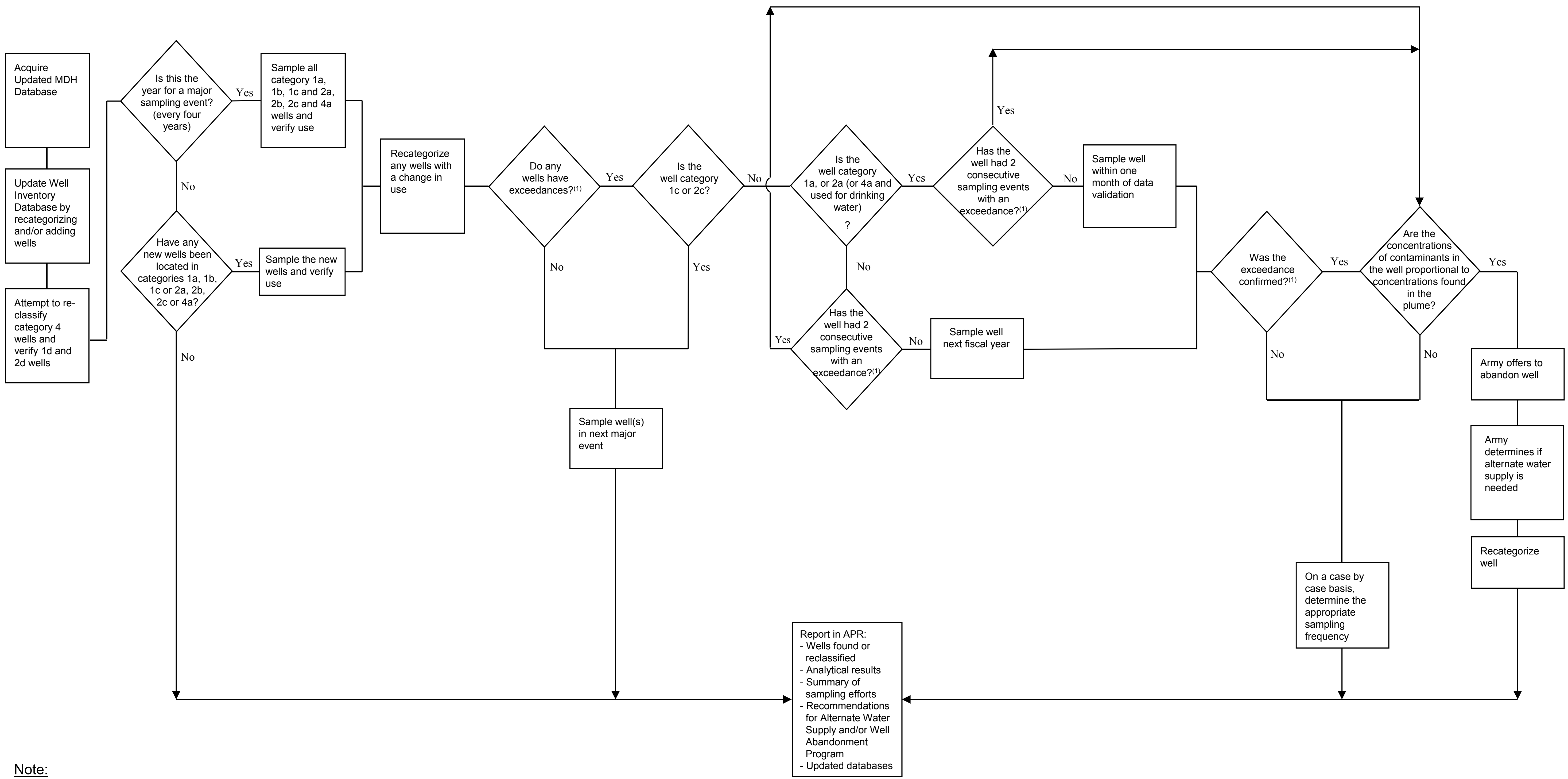
Responsive partner. Exceptional outcomes.

FY 2014

Figure E-3

Figure E-4

Annual Requirements for Maintaining Well Inventory Database



Note:

(1) = Exceedance of a New Brighton/Arden Hills Superfund Site Groundwater Cleanup Level

WELL INVENTORY DATABASE

The Well Inventory Database is located on
this CD in the following Microsoft Excel file:

Well Inventory Main Database FY 2014.xls

Appendix F

Site K and TGRS Operational Data

F.1 Inspection and Maintenance Activities, Fiscal Year 2014, Site K, OU2

APPENDIX F-1

INSPECTION AND MAINTENANCE ACTIVITIES
FISCAL YEAR 2014
SITE K, OU2
ARDEN HILLS, MINNESOTA

October 2013

10/7/2013	System down on high water - reset/restart system

November 2013

11/13/2013	System down at 10:30 a.m. due to water blown out of the stack, causing buildup of ice
11/14/2013	System restarted at approximately 11:20 a.m.

December 2013

12/2/2013	Observed fluctuating water flow; shut off and restarted system
12/4/2013	Adjusted flowrate from 8.2 gpm to 11.5 gpm
12/10/2013	System off; panel indicates low building temperature alarm. Restart system; blower is not functioning properly, low building temp alarm triggered. Left system off.
12/12/2013	Restarted system after maintenance was performed on blower motor. Set low building temp alarm to 40 degrees.

January 2014

1/3/2014	Adjusted flowrate from 8.8 gpm to 11.5 gpm
1/6/2014	System off; High high water level in stripper. Restart system at 14:20 (failed). Left system off; low outside temperatures (-20 deg F).
1/9/2014	Started system at 12:30.
1/23/2014	System off due to air stripper low air flow alarm. Restart unsuccessful; low outside temperature (-4 deg F). Left system off.
1/24/2014	Restarted system.
1/27/2014	System down due to air stripper high high water level alarm; restart unsuccessful. Low outside temperatures (-14 deg F). Off site; left system off.
1/29/2014	Restarted system.
1/31/2014	System off/cycling; system OK.

APPENDIX F-1

INSPECTION AND MAINTENANCE ACTIVITIES
FISCAL YEAR 2014
SITE K, OU2
ARDEN HILLS, MINNESOTA

February 2014

2/7/2014	System down due to air stripper high water level; restarted system
2/11/2014	System down due to air stripper high water level; restarted system
2/12/2014	System down due to air stripper high water level; restarted system
2/13/2014	System down due to air stripper high water level; restarted system
2/14/2014	System down due to air stripper high water level; restarted system
2/18/2014	System down due to air stripper high water level; restarted system
2/19/2014	System down due to air stripper high water level; restarted system
2/28/2014	System in suspense; system OK

March 2014

3/3/2014	System in suspense; operating normally
3/4/2014	System in suspense; operating normally
3/6/2014	System in suspense; operating normally
3/7/2014	System in suspense; operating normally
3/10/2014	System in suspense; operating normally

April 2014

4/10/2014	ATK retains CRA as the consultant for Site K. CRA performs the first inspection of the treatment system. Down time: None.
4/28-30/2014	Heavy rains caused flooding around the treatment building. Turned the treatment system off on 4/28/2014 to avoid the potential for damage to the electrical system. Down time: 48 hours during April

APPENDIX F-1

INSPECTION AND MAINTENANCE ACTIVITIES
FISCAL YEAR 2014
SITE K, OU2
ARDEN HILLS, MINNESOTA

May 2014

5/1/2014 Heavy rains caused flooding around the treatment building. Turned the treatment system off on 4/28/2014 to avoid the potential for damage to the electrical system. Re-started the system on 5/1/2014 and observed normal operation.
Down time: 17 hours during May

June 2014

There were no operational notes during the month of June. The treatment system operated continuously with no down time.

July 2014

There were no operational notes during the month of July. The treatment system operated continuously with no down time.

August 2014

8/12/2014 Cleaned the sump level site glass.
Down time: None.

8/20-31/2014 The system was off upon arrival. The "Pump Seal Fail" light was on. The system worked in "HAND" but not "AUTO". Turned the system off and removed the sump pump from the manhole and sent it in for repair. Re-installed the repaired sump pump on 8/21/2014. Turned the system on but the "pump seal fail" light came on again and the system would not run in "Auto". Troubleshooting indicated the PLC program was not working. Removed the PLC battery to check the status and the display went blank. Turned the system on in "Hand" and ordered a PLC battery. Boss Controls began troubleshooting the program and found the program had been erased. Obtained a copy of the program from DRC and re-installed the program and with troubleshooting, the system ran in "Auto", however, the display would not illuminate. Troubleshooting indicated the cable was not working. Ordered a new cable. Bucket tests were performed while the system was in "Hand" and they averaged 15 gpm. Total volume was estimated at 15 gpm while the system was running in "Hand".
Down time: 86 hours.

APPENDIX F-1

INSPECTION AND MAINTENANCE ACTIVITIES
FISCAL YEAR 2014
SITE K, OU2
ARDEN HILLS, MINNESOTA

September 2014

9/2/2014	Boss Controls was on site loading the new program into the PLC. Down time: 4 hours.
9/4/2014	The display was lit but was not displaying data. While attempting to open the panel door, the "on/off" switch became dislodged from the back of the inside panel. Laughlin Electric re-installed the switch and diagnosed the display problem to be a bad cable. Down time: 2 hours.
9/5/2014	Upon arrival, the system was off and the "low building temperature" light was on. Reset the building temperature variable from 60 degrees to 40 degrees and re-started the treatment system. The system re-started normally. Down time: 1 hour.
9/9/2014	Boss Controls installed a new data cable for the display. The display relit normally. Down time: None.
9/11/2014	The influent flow rate decreased to 10.6 gpm overnight. Opened the influent flow valve and reset the influent flow rate to 16 gpm. Down time: None.
9/18/2014	Cleaned the sump level site glass and inspected the pump and float wires in the manhole. Down time: None.

F.2 Maintenance Activities, Fiscal Year 2014, TGRS, OU2

APPENDIX F-2

MAINTENANCE ACTIVITIES
FISCAL YEAR 2014
TGRS, OU2
ARDEN HILLS, MINNESOTA

October 2013

10/1/2013	Pumphouse B4; The light was off on the well field panel. Reset the PLC but the light remained off. At the pumphouse, the breaker was tripped. Reset the breaker and the pump re-started normally. Down time: 1 hour.
10/3/2013	Pumphouses SC2 and SC5; The lights were flashing on the well field panel. Reset the PLC and the lights came back on normally. Down time: 16 hours at SC2 and 15 hours at SC5.
10/5/2013	Pumphouse SC2; The light was flashing on the well field panel. Reset the PLC and the light came back on normally. Down time: None.
10/25/2013	Pumphouse SC5; The light was flashing on the well field panel. Reset the PLC and the light came back on normally. Down time: 7 hours.
10/25-31/2013	Pumphouse B6; The pump motor blew. Thein well replaced the old motor with a new one. Down time: 145 hours.

November 2013

11/1-2/2013	Pumphouse B6; Blown submersible pump motor; Thein Well replaced the motor. Re-started the pump and normal operation observed. Down time: 28.5 hours.
11/16/2013	Pumphouse SC5; The light was flashing on the well field panel; Reset the PLC and SC5 relit normally. Down time: 8.5 hours.
11/17/2013	Pumphouse B1; The light was flashing on the well field panel; Reset the PLC and B1 relit normally. Down time: 1 hour.
11/19/2013	Pumphouse SC5; The light was flashing on the well field panel; Reset the PLC and SC5 relit normally. Down time: 21 hours.

APPENDIX F-2

MAINTENANCE ACTIVITIES
FISCAL YEAR 2014
TGRS, OU2
ARDEN HILLS, MINNESOTA

11/20-21/2013	Treatment System and Well Field; Cycled power to the PLC during the monthly maintenance work. Attempted to re-start the system but the PLC was unable to communicate with the scanner modules. Hired a programming company to troubleshoot. They contacted Rockwell Automation and found that a dip switch setting had changed on the PLC backplane chassis. They reset the dip switch and the system re-started normally. Down time: 15 hours at SC2; 18.5 hours at B5, B8 and SC1; 24 hours at B3; 25 hours at B4, B9 and SC5; 27 hours at B1, B6 and B13.

December 2013

12/10/2013	Treatment System; ECV 4 will not close on command. Removed portions of the downstream control piping to determine if there was mineral build up. Only minimal build up observed. The valve will need a new seal kit installed. Down time: None.
12/11-12/2013	Pumphouse SC1; The heater could not keep up with the cold temperature. Laughlin Electric installed a new heater. Down time: None.
12/11/2013	Pumphouse B8; Water was leaking from the ECV control piping. Installed new piping as necessary. Down time: None.
12/11/2013	Pumphouse B9; Water was leaking from the solenoid valve body. Replaced the valve and observed normal operation. Down time: None.

January 2014

1/3-4/2014	Pumphouse B9; The body of the ECV was leaking. Replaced the ECV and some of the associated control piping. Down time: 26 hours.
1/5/2014	Pumphouse B4; The light was off on the PLC. Reset the PLC but the light remained off. At the pumphouse, the pump was off. Reset the breaker and re-started the pump. Normal operation observed. Down time: 1 hour.
1/9/2014	Treatment System; ECV 4 no longer closes on command indicating the valve seals are in need of replacement. Replaced the valve seals and re-activated the ECV. Normal operation observed. Down time: 6 hours at B3 and 4 hours at B8.
1/10/2014	Pumphouse B6; Turned the pump off to clean the speed control valve on the ECV control piping. Re-started the pump and observed normal operation. Down time: 1 hour.

APPENDIX F-2

MAINTENANCE ACTIVITIES
FISCAL YEAR 2014
TGRS, OU2
ARDEN HILLS, MINNESOTA

1/17/2014	Pumphouse B5; Turned the pump off to clean the ECV control piping. Replaced the pilot with a re-built pilot from inventory. Down time: None.
1/26-27/2014	Pumphouse SC2; While performing the daily inspection, the pumphouse door was found open. The water in the pressure gauge piping was frozen. Turned the pump off, closed the gate valve to allow the water to thaw and made sure the pumphouse door was closed tightly. On 1/27/2014, turned the pump back on and the pressure gauge was broken otherwise everything else was normal. Replaced the pressure gauge, turned the pump back on and observed normal operation. Down time: 21.5 hours.

February 2014

2/5/2014	Treatment System and Well Field; Call from Time Communications - "TGRS fail". At Building 116, there was a leg of power out. Contacted Xcel Energy and they found a guide wire had been snapped by one of Bolander's equipment operators and had become entangled in the power wires to the west of former Building 101. That blew a fuse on the power pole between former Building 102 and pumphouse B12. Xcel removed the guide wire and replaced the fuse. Re-started the TGRS and normal operation was observed. Down time: 5 hours at B1, B3 and B4; 4 hours at B13, B8 and B9; 3 hours at B5 and B6.

March 2014

3/6/2014	Pumphouses B1, B13, B3, B4, B5, B6, B8 and B9; Compared the cold water flow meters to a calibrated cold water flow meter. Down time: None.
3/7/2014	Pumphouse B6; Removed the installed flow meter at meter reading 33100000 and installed a new meter at meter reading 1924500 at 0900 hours. Down time: None.
3/7/2014	Pumphouse SC5; Removed the installed flow meter at meter reading 13647200 and installed a new meter at meter reading 25049000 at 1100 hours. Down time: None.
3/9/2014	Treatment System and Well Field; Day light savings time. Adjusted the flow rates to account for the time change. Down time: None.
3/19/2014	Treatment System and Well Field; Water was leaking out of the ECV 2 control piping port. Turned the TGRS off to relieve pressure from ECV 2 and removed portions of the control piping. Installed a plug in the valve port and water no longer leaked from the port. Down time: 1.5 hours at B1, B3 and B4.

APPENDIX F-2

MAINTENANCE ACTIVITIES
FISCAL YEAR 2014
TGRS, OU2
ARDEN HILLS, MINNESOTA

3/23/2014	Treatment System; Call from Time Communications-"TGRS Fail". At the Site, Pump 4 was off and ECV 4 was partially open. Pump 3 was on and running normally. Exercised ECV 4's control valves, flushed the control piping and reset the opening and closing speed valves. Cycled the valve three times and observed normal operation. Down time: None (B4 was already down pending scheduled repair).
3/21-26/2014	Pumphouse B4; Pulled the lift system from the well and inspected all of the parts for wear. The pump and motor were in poor condition. Replaced the pump and motor and re-installed the lift system. Turned the pump on and observed normal operation. Down time: 150 hours.
April 2014	
4/28/2014	Pumphouse SC5; The light was flashing on the well field panel on arrival. Reset the PLC and the light relit normally. At the pumphouse, the pump was running. Down time: 17 hours.
May 2014	
5/19/2014	SC5 was flashing on the well field panel. Reset the PLC and SC5 relit normally. At the pumphouse, the well was pumping normally. Down time: 8.5 hours.
5/29/2014	Pumphouses SC2 and SC5; Lawn care technician accidentally cut the communication lines with his lawn mower. Laughlin Electric re-spliced the wires and the pumps were re-started. Down time: 5.5 hours at SC2 and 14 hours at SC5.
June 2014	
6/4/2014	Pumphouse SC5; Turned the pump off while Bolander's electrician relocated the communication wires underground. Down time: 8 hours at SC5.
6/8-9/2014	Pumphouses B1, B13, B3, B4, B6, B8 and B9; Call out from Time Communication "TGRS Fail". At the Site, there was a power outage to the boundary wells. Contacted Xcel Energy and they found a blown fuse on a power pole. They replaced the fuse and power was restored. Re-started the pumps and observed normal operation. Down time: 5 hours at B1, B13 and B4; 4 hours at B9; 2.5 hours at B8; 2 hours at B6 and 1.5 hours at B3.
6/15/2014	Pumphouse SC5; The light was flashing on the well field panel. Reset the PLC and the light relit normally. Normal operation observed during the inspection. Down time: 15 hours.

APPENDIX F-2

MAINTENANCE ACTIVITIES
FISCAL YEAR 2014
TGRS, OU2
ARDEN HILLS, MINNESOTA

6/17-25/2014	Pumphouse SC1; The pump was off upon arrival. The pump works in "Hand" but not "Auto". The communication line from pumphouse B11 was severed most likely from the weight of a large articulating dump truck. Laughlin Electric spliced the wire and installed new conduit. Turned the pump on in "Hand" while waiting for the repairs to be made. Down time: 20 hours.
6/19/2014	Pumphouse SC5; The light was flashing on the well field panel. Reset the PLC and the light relit normally. Normal operation observed during the inspection. Down time: 14 hours.
6/24-25/2014	Pumphouses SC1 and SC2; While abandoning old water lines, Bolander accidentally severed the SC1 3" HDPE forcemain. The break was located near raw water loop valve 2174 (on the road between the old electrical substation and the northeast gate of Building 502 gate). Immediately turned the well field off and closed valve 2153 to isolate the well field from the break. Bolander repaired the break and opened valve 2153. Restarted wells SC1 and SC2 and observed normal operation. Down time: 22 hours at SC1 and SC2.
6/29/2014	Pumphouse SC5; The light was flashing on the well field panel. Reset the PLC and the light relit normally. Normal operation observed during the inspection. Down time: 15 hours.

July 2014

7/4/2014	Independence Day. The daily inspection was not performed. Down time: None.
7/4-8/2014	Pumphouse SC1; The flow meter stopped totaling. Removed the flow meter and cleaned it. Replaced the flow meter and observed normal operation. Estimated the meter readings. Down time: None.
7/8/2014	Pumphouse B13; The flow meter showed the flow rate was increasing over time. Removed the flow meter and cleaned it. Replaced the flow meter and observed normal operation. Down time: None.
7/8/2014	Pumphouse SC2; The flow meter showed the flow rate was increasing over time. Removed the flow meter and cleaned it. Replaced the flow meter and observed normal operation. Down time: None.
7/8/2014	Pumphouse SC5; The light was flashing on the well field panel; Reset the PLC and the light relit normally. Down time: 12.5 hours.

APPENDIX F-2

MAINTENANCE ACTIVITIES
FISCAL YEAR 2014
TGRS, OU2
ARDEN HILLS, MINNESOTA

7/15/2014	Treatment System; The cold water flow meter from pump 4 is slowing. Removed the meter and sent it out for repair. Installed a rebuilt flow meter. The old meter was removed at 377772000 and the new meter was installed at 124824000 at 1:15 pm. Down time: 1 hour at B1; 1.5 hours at B4.
7/15/2014	Treatment System; Removed the old and re-installed new packing material in the pump 4 pump shaft. The well field cycled during the work. Down time: None, the down time has already been accounted for above.
7/24-25/2014	Pumphouse SC1; The pump was off due to a tripped motor starter. Reset the motor starter and the pump re-started normally. Down time: 18 hours.
7/25/2014	Pumphouse SC5; The light was flashing on the well field panel; Reset the PLC and the light relit normally. Down time: 2.5 hours
7/26/2014	Pumphouse SC1; The fuse above the motor starter was blown. Replaced the fuse and re-started the pump. Observed normal operation. Down time: 27 hours.
7/27-31/2014	Pumphouse SC1; The pump and motor will not pump water. Laughlin Electric diagnosed the problem to be a bad motor. Turned the pump off and scheduled the repair work. Down time: 115 hours for the remainder of July 2014.

August 2014

8/1-4/2014	Pumphouse SC1; The pump and motor will not pump water. Laughlin Electric diagnosed the problem to be a bad motor. Thein Well replaced the motor on 8/4/2014. Down time: 100 hours in August.
8/2/2014	Pumphouse SC5; The light was flashing on the PLC. Reset the PLC and the light came on steady. At the pumphouse, the pump was running normally. Down time: 15 hours.
8/7/2014	Pumphouse B13; Turned the pump off to clean the scale build-up inside the forcemain line. Thein Well jetted the line and removed scale from inside the forcemain line. Prior to removing the scale, the operating pressure was 148 psi. After removing the scale the operating pressure was 114 psi. The flow rate increased from 70 gpm to 120 gpm. Turned off several boundary wells during the work. Down time: 9 hours at B1, B13 and B3; 7 hours at B4, B8 and B9; 4 hours at B5.

APPENDIX F-2

MAINTENANCE ACTIVITIES
FISCAL YEAR 2014
TGRS, OU2
ARDEN HILLS, MINNESOTA

8/11-13/2014	Pumphouse SC1; The pump was off on arrival. The transformer by B11 had a fusible link open and the isolator was broken. Contacted Xcel Energy. They repaired the isolator and restored power to the pump. Turned the pump back on and observed normal operation. Down time: 67 hours.
8/18/2014	Pumphouses B4, B5, B6, B8 and B9; Power outage during daily inspection. Called Xcel Energy and they responded and repaired the problem. Down time: 1.5 hours at B1 and B3.
8/21/2014	Treatment System and Well Field; Power outage to the tratment system and well field. Called Xcel Energy and they responded. They repaired the problem and restored power to the site. Turned the system back on at 07:30 on 8/22/2014 and observed normal operation. Down time: 24 hours at B1, B13, B3, B4, B5, B6, B8, B9, SC1, SC2 and SC5.
8/24/2014	Pumphouse SC5; The light was flashing on the PLC. Reset the PLC and the light came on steady. At the pumphouse, the pump was running normally. Down time: 3 hours.
8/30/2014	Treatment System; Call out from Time Communications: TGRS Fail. At the Site, ECV 4 would not open on command. Replaced the solenoid valve and coil and cycled the ECV. Normal operation observed. Down time: 1 hour at B3.

September 2014

9/1/2014	Labor Day. No daily inspection performed. Meter readings estimated. Down time: None.
9/3/2014	Pumphouse SC5; The light was flashing on the PLC in Building 116. Reset the PLC and the light came back on. At the pumphouse, the pump was running normally. Down time: None.
9/23-26/2014	Pumphouse B9; The motor for the submersible pump blew. Thein Well pulled the lift system and replaced the motor. Down time: 73 hours.
9/25/2014	Pumphouse B4; The ECV valve closed slightly during the previous day. Performed maintenance on the valve and cycled the valve three times. Normal operation observed. Down time: 2 hours.

F.3 Maintenance Activities by Location, Fiscal Year 2014, TGRS, OU2

APPENDIX F-3

MAINTENANCE ACTIVITIES BY LOCATION
FISCAL YEAR 2014
TGRS, OU2
ARDEN HILLS, MINNESOTA

PUMPHOUSE B1

11/17/2013	Pumphouse B1; The light was flashing on the well field panel; Reset the PLC and B1 relit normally. Down time: 1 hour.
11/20-21/2013	Treatment System and Well Field; Cycled power to the PLC during the monthly maintenance work. Attempted to re-start the system but the PLC was unable to communicate with the scanner modules. Hired a programming company to troubleshoot. They contacted Rockwell Automation and found that a dip switch setting had changed on the PLC backplane chassis. They reset the dip switch and the system re-started normally. Down time: 15 hours at SC2; 18.5 hours at B5, B8 and SC1; 24 hours at B3; 25 hours at B4, B9 and SC5; 27 hours at B1, B6 and B13.
2/5/2014	Treatment System and Well Field; Call from Time Communications - "TGRS fail". At Building 116, there was a leg of power out. Contacted Xcel Energy and they found a guide wire had been snapped by one of Bolander's equipment operators and had become entangled in the power wires to the west of former Building 101. That blew a fuse on the power pole between former Building 102 and pumphouse B12. Xcel removed the guide wire and replaced the fuse. Re-started the TGRS and normal operation was observed. Down time: 5 hours at B1, B3 and B4; 4 hours at B13, B8 and B9; 3 hours at B5 and B6.
3/6/2014	Pumphouses B1, B13, B3, B4, B5, B6, B8 and B9; Compared the cold water flow meters to a calibrated cold water flow meter. Down time: None.
3/19/2014	Treatment System and Well Field; Water was leaking out of the ECV 2 control piping port. Turned the TGRS off to relieve pressure from ECV 2 and removed portions of the control piping. Installed a plug in the valve port and water no longer leaked from the port. Down time: 1.5 hours at B1, B3 and B4.
6/8-9/2014	Pumphouses B1, B13, B3, B4, B6, B8 and B9; Call out from Time Communication "TGRS Fail". At the Site, there was a power outage to the boundary wells. Contacted Xcel Energy and they found a blown fuse on a power pole. They replaced the fuse and power was restored. Re-started the pumps and observed normal operation. Down time: 5 hours at B1, B13 and B4; 4 hours at B9; 2.5 hours at B8; 2 hours at B6 and 1.5 hours at B3.
7/15/2014	Treatment System; The cold water flow meter from pump 4 is slowing. Removed the meter and sent it out for repair. Installed a rebuilt flow meter. The old meter was removed at 377772000 and the new meter was installed at 124824000 at 1:15 pm. Down time: 1 hour at B1; 1.5 hours at B4.

APPENDIX F-3

MAINTENANCE ACTIVITIES BY LOCATION
FISCAL YEAR 2014
TGRS, OU2
ARDEN HILLS, MINNESOTA

8/7/2014	Pumphouse B13; Turned the pump off to clean the scale build-up inside the forcemain line. Thein Well jetted the line and removed scale from inside the forcemain line. Prior to removing the scale, the operating pressure was 148 psi. After removing the scale the operating pressure was 114 psi. The flow rate increased from 70 gpm to 120 gpm. Turned off several boundary wells during the work. Down time: 9 hours at B1, B13 and B3; 7 hours at B4, B8 and B9; 4 hours at B5.
8/18/2014	Pumphouses B4, B5, B6, B8 and B9; Power outage during daily inspection. Called Xcel Energy and they responded and repaired the problem. Down time: 1.5 hours at B1 and B3.
8/21/2014	Treatment System and Well Field; Power outage to the tratment system and well field. Called Xcel Energy and they responded. They repaired the problem and restored power to the site. Turned the system back on at 07:30 on 8/22/2014 and observed normal operation. Down time: 24 hours at B1, B13, B3, B4, B5, B6, B8, B9, SC1, SC2 and SC5.

PUMPHOUSE B3

11/20-21/2013	Treatment System and Well Field; Cycled power to the PLC during the monthly maintenance work. Attempted to re-start the system but the PLC was unable to communicate with the scanner modules. Hired a programming company to troubleshoot. They contacted Rockwell Automation and found that a dip switch setting had changed on the PLC backplane chassis. They reset the dip switch and the system re-started normally. Down time: 15 hours at SC2; 18.5 hours at B5, B8 and SC1; 24 hours at B3; 25 hours at B4, B9 and SC5; 27 hours at B1, B6 and B13.
1/9/2014	Treatment System; ECV 4 no longer closes on command indicating the valve seals are in need of replacement. Replaced the valve seals and re-activated the ECV. Normal operation observed. Down time: 6 hours at B3 and 4 hours at B8.
2/5/2014	Treatment System and Well Field; Call from Time Communications - "TGRS fail". At Building 116, there was a leg of power out. Contacted Xcel Energy and they found a guide wire had been snapped by one of Bolander's equipment operators and had become entangled in the power wires to the west of former Building 101. That blew a fuse on the power pole between former Building 102 and pumphouse B12. Xcel removed the guide wire and replaced the fuse. Re-started the TGRS and normal operation was observed. Down time: 5 hours at B1, B3 and B4; 4 hours at B13, B8 and B9; 3 hours at B5 and B6.
3/6/2014	Pumphouses B1, B13, B3, B4, B5, B6, B8 and B9; Compared the cold water flow meters to a calibrated cold water flow meter. Down time: None.

APPENDIX F-3

MAINTENANCE ACTIVITIES BY LOCATION
FISCAL YEAR 2014
TGRS, OU2
ARDEN HILLS, MINNESOTA

3/19/2014	Treatment System and Well Field; Water was leaking out of the ECV 2 control piping port. Turned the TGRS off to relieve pressure from ECV 2 and removed portions of the control piping. Installed a plug in the valve port and water no longer leaked from the port. Down time: 1.5 hours at B1, B3 and B4.
6/8-9/2014	Pumphouses B1, B13, B3, B4, B6, B8 and B9; Call out from Time Communication "TGRS Fail". At the Site, there was a power outage to the boundary wells. Contacted Xcel Energy and they found a blown fuse on a power pole. They replaced the fuse and power was restored. Re-started the pumps and observed normal operation. Down time: 5 hours at B1, B13 and B4; 4 hours at B9; 2.5 hours at B8; 2 hours at B6 and 1.5 hours at B3.
8/7/2014	Pumphouse B13; Turned the pump off to clean the scale build-up inside the forcemain line. Thein Well jetted the line and removed scale from inside the forcemain line. Prior to removing the scale, the operating pressure was 148 psi. After removing the scale the operating pressure was 114 psi. The flow rate increased from 70 gpm to 120 gpm. Turned off several boundary wells during the work. Down time: 9 hours at B1, B13 and B3; 7 hours at B4, B8 and B9; 4 hours at B5.
8/18/2014	Pumphouses B4, B5, B6, B8 and B9; Power outage during daily inspection. Called Xcel Energy and they responded and repaired the problem. Down time: 1.5 hours at B1 and B3.
8/21/2014	Treatment System and Well Field; Power outage to the tratment system and well field. Called Xcel Energy and they responded. They repaired the problem and restored power to the site. Turned the system back on at 07:30 on 8/22/2014 and observed normal operation. Down time: 24 hours at B1, B13, B3, B4, B5, B6, B8, B9, SC1, SC2 and SC5.
8/30/2014	Treatment System; Call out from Time Communications: TGRS Fail. At the Site, ECV 4 would not open on command. Replaced the solenoid valve and coil and cycled the ECV. Normal operation observed. Down time: 1 hour at B3.

PUMPHOUSE B4

10/1/2013	Pumphouse B4; The light was off on the well field panel. Reset the PLC but the light remained off. At the pumphouse, the breaker was tripped. Reset the breaker and the pump re-started Down time: 1 hour.

APPENDIX F-3

MAINTENANCE ACTIVITIES BY LOCATION
FISCAL YEAR 2014
TGRS, OU2
ARDEN HILLS, MINNESOTA

11/20-21/2013	Treatment System and Well Field; Cycled power to the PLC during the monthly maintenance work. Attempted to re-start the system but the PLC was unable to communicate with the scanner modules. Hired a programming company to troubleshoot. They contacted Rockwell Automation and found that a dip switch setting had changed on the PLC backplane chassis. They reset the dip switch and the system re-started normally. Down time: 15 hours at SC2; 18.5 hours at B5, B8 and SC1; 24 hours at B3; 25 hours at B4, B9 and SC5; 27 hours at B1, B6 and B13.
1/5/2014	Pumphouse B4; The light was off on the PLC. Reset the PLC but the light remained off. At the pumphouse, the pump was off. Reset the breaker and re-started the pump. Normal operation observed. Down time: 1 hour.
2/5/2014	Treatment System and Well Field; Call from Time Communications - "TGRS fail". At Building 116, there was a leg of power out. Contacted Xcel Energy and they found a guide wire had been snapped by one of Bolander's equipment operators and had become entangled in the power wires to the west of former Building 101. That blew a fuse on the power pole between former Building 102 and pumphouse B12. Xcel removed the guide wire and replaced the fuse. Re-started the TGRS and normal operation was observed. Down time: 5 hours at B1, B3 and B4; 4 hours at B13, B8 and B9; 3 hours at B5 and B6.
3/6/2014	Pumphouses B1, B13, B3, B4, B5, B6, B8 and B9; Compared the cold water flow meters to a calibrated cold water flow meter. Down time: None.
3/19/2014	Treatment System and Well Field; Water was leaking out of the ECV 2 control piping port. Turned the TGRS off to relieve pressure from ECV 2 and removed portions of the control piping. Installed a plug in the valve port and water no longer leaked from the port. Down time: 1.5 hours at B1, B3 and B4.
3/21-26/2014	Pumphouse B4; Pulled the lift system from the well and inspected all of the parts for wear. The pump and motor were in poor condition. Replaced the pump and motor and re-installed the lift system. Turned the pump on and observed normal operation. Down time: 150 hours.
6/8-9/2014	Pumphouses B1, B13, B3, B4, B6, B8 and B9; Call out from Time Communication "TGRS Fail". At the Site, there was a power outage to the boundary wells. Contacted Xcel Energy and they found a blown fuse on a power pole. They replaced the fuse and power was restored. Re-started the pumps and observed normal operation. Down time: 5 hours at B1, B13 and B4; 4 hours at B9; 2.5 hours at B8; 2 hours at B6 and 1.5 hours at B3.

APPENDIX F-3

MAINTENANCE ACTIVITIES BY LOCATION
FISCAL YEAR 2014
TGRS, OU2
ARDEN HILLS, MINNESOTA

7/15/2014	Treatment System; The cold water flow meter from pump 4 is slowing. Removed the meter and sent it out for repair. Installed a rebuilt flow meter. The old meter was removed at 377772000 and the new meter was installed at 124824000 at 1:15 pm. Down time: 1 hour at B1; 1.5 hours at B4.
8/7/2014	Pumphouse B13; Turned the pump off to clean the scale build-up inside the forcemain line. Thein Well jetted the line and removed scale from inside the forcemain line. Prior to removing the scale, the operating pressure was 148 psi. After removing the scale the operating pressure was 114 psi. The flow rate increased from 70 gpm to 120 gpm. Turned off several boundary wells during the work. Down time: 9 hours at B1, B13 and B3; 7 hours at B4, B8 and B9; 4 hours at B5.
8/18/2014	Pumphouses B4, B5, B6, B8 and B9; Power outage during daily inspection. Called Xcel Energy and they responded and repaired the problem. Down time: 1.5 hours at B1 and B3.
8/21/2014	Treatment System and Well Field; Power outage to the tratment system and well field. Called Xcel Energy and they responded. They repaired the problem and restored power to the site. Turned the system back on at 07:30 on 8/22/2014 and observed normal operation. Down time: 24 hours at B1, B13, B3, B4, B5, B6, B8, B9, SC1, SC2 and SC5.
9/25/2014	Pumphouse B4; The ECV valve closed slightly during the previous day. Performed maintenance on the valve and cycled the valve three times. Normal operation observed. Down time: 2 hours.

PUMPHOUSE B5

11/20-21/2013	Treatment System and Well Field; Cycled power to the PLC during the monthly maintenance work. Attempted to re-start the system but the PLC was unable to communicate with the scanner modules. Hired a programming company to troubleshoot. They contacted Rockwell Automation and found that a dip switch setting had changed on the PLC backplane chassis. They reset the dip switch and the system re-started normally. Down time: 15 hours at SC2; 18.5 hours at B5, B8 and SC1; 24 hours at B3; 25 hours at B4, B9 and SC5; 27 hours at B1, B6 and B13.
1/17/2014	Pumphouse B5; Turned the pump off to clean the ECV control piping. Replaced the pilot with a re-built pilot from inventory. Down time: None.

APPENDIX F-3

MAINTENANCE ACTIVITIES BY LOCATION
FISCAL YEAR 2014
TGRS, OU2
ARDEN HILLS, MINNESOTA

2/5/2014	Treatment System and Well Field; Call from Time Communications - "TGRS fail". At Building 116, there was a leg of power out. Contacted Xcel Energy and they found a guide wire had been snapped by one of Bolander's equipment operators and had become entangled in the power wires to the west of former Building 101. That blew a fuse on the power pole between former Building 102 and pumphouse B12. Xcel removed the guide wire and replaced the fuse. Re-started the TGRS and normal operation was observed. Down time: 5 hours at B1, B3 and B4; 4 hours at B13, B8 and B9; 3 hours at B5 and B6.
3/6/2014	Pumphouses B1, B13, B3, B4, B5, B6, B8 and B9; Compared the cold water flow meters to a calibrated cold water flow meter. Down time: None.
8/7/2014	Pumphouse B13; Turned the pump off to clean the scale build-up inside the forcemain line. Thein Well jetted the line and removed scale from inside the forcemain line. Prior to removing the scale, the operating pressure was 148 psi. After removing the scale the operating pressure was 114 psi. The flow rate increased from 70 gpm to 120 gpm. Turned off several boundary wells during the work. Down time: 9 hours at B1, B13 and B3; 7 hours at B4, B8 and B9; 4 hours at B5.
8/18/2014	Pumphouses B4, B5, B6, B8 and B9; Power outage during daily inspection. Called Xcel Energy and they responded and repaired the problem. Down time: 1.5 hours at B1 and B3.
8/21/2014	Treatment System and Well Field; Power outage to the tratment system and well field. Called Xcel Energy and they responded. They repaired the problem and restored power to the site. Turned the system back on at 07:30 on 8/22/2014 and observed normal operation. Down time: 24 hours at B1, B13, B3, B4, B5, B6, B8, B9, SC1, SC2 and SC5.

PUMPHOUSE B6

10/25-31/2013	Pumphouse B6; The pump motor blew. Thein well replaced the old motor with a new one. Down time: 145 hours.
11/1-2/2013	Pumphouse B6; Blown submersible pump motor; Thein Well replaced the motor. Re-started the pump and normal operation observed. Down time: 28.5 hours.
11/20-21/2013	Treatment System and Well Field; Cycled power to the PLC during the monthly maintenance work. Attempted to re-start the system but the PLC was unable to communicate with the scanner modules. Hired a programming company to troubleshoot. They contacted Rockwell Automation and found that a dip switch setting had changed on the PLC backplane chassis. They reset the dip switch and the system re-started normally. Down time: 15 hours at SC2; 18.5 hours at B5, B8 and SC1; 24 hours at B3; 25 hours at B4, B9 and SC5; 27 hours at B1, B6 and B13.

APPENDIX F-3

MAINTENANCE ACTIVITIES BY LOCATION
FISCAL YEAR 2014
TGRS, OU2
ARDEN HILLS, MINNESOTA

1/10/2014	Pumphouse B6; Turned the pump off to clean the speed control valve on the ECV control piping. Re-started the pump and observed normal operation. Down time: 1 hour.
2/5/2014	Treatment System and Well Field; Call from Time Communications - "TGRS fail". At Building 116, there was a leg of power out. Contacted Xcel Energy and they found a guide wire had been snapped by one of Bolander's equipment operators and had become entangled in the power wires to the west of former Building 101. That blew a fuse on the power pole between former Building 102 and pumphouse B12. Xcel removed the guide wire and replaced the fuse. Re-started the TGRS and normal operation was observed. Down time: 5 hours at B1, B3 and B4; 4 hours at B13, B8 and B9; 3 hours at B5 and B6.
3/6/2014	Pumphouses B1, B13, B3, B4, B5, B6, B8 and B9; Compared the cold water flow meters to a calibrated cold water flow meter. Down time: None.
3/7/2014	Pumphouse B6; Removed the installed flow meter at meter reading 33100000 and installed a new meter at meter reading 1924500 at 0900 hours. Down time: None.
6/8-9/2014	Pumphouses B1, B13, B3, B4, B6, B8 and B9; Call out from Time Communication "TGRS Fail". At the Site, there was a power outage to the boundary wells. Contacted Xcel Energy and they found a blown fuse on a power pole. They replaced the fuse and power was restored. Re-started the pumps and observed normal operation. Down time: 5 hours at B1, B13 and B4; 4 hours at B9; 2.5 hours at B8; 2 hours at B6 and 1.5 hours at B3.
8/18/2014	Pumphouses B4, B5, B6, B8 and B9; Power outage during daily inspection. Called Xcel Energy and they responded and repaired the problem. Down time: 1.5 hours at B1 and B3.
8/21/2014	Treatment System and Well Field; Power outage to the tratment system and well field. Called Xcel Energy and they responded. They repaired the problem and restored power to the site. Turned the system back on at 07:30 on 8/22/2014 and observed normal operation. Down time: 24 hours at B1, B13, B3, B4, B5, B6, B8, B9, SC1, SC2 and SC5.

APPENDIX F-3

MAINTENANCE ACTIVITIES BY LOCATION
FISCAL YEAR 2014
TGRS, OU2
ARDEN HILLS, MINNESOTA

PUMPHOUSE B8

11/20-21/2013	Treatment System and Well Field; Cycled power to the PLC during the monthly maintenance work. Attempted to re-start the system but the PLC was unable to communicate with the scanner modules. Hired a programming company to troubleshoot. They contacted Rockwell Automation and found that a dip switch setting had changed on the PLC backplane chassis. They reset the dip switch and the system re-started normally. Down time: 15 hours at SC2; 18.5 hours at B5, B8 and SC1; 24 hours at B3; 25 hours at B4, B9 and SC5; 27 hours at B1, B6 and B13.
12/11/2013	Pumphouse B8; Water was leaking from the ECV control piping. Installed new piping as Down time: None.
1/9/2014	Treatment System; ECV 4 no longer closes on command indicating the valve seals are in need of replacement. Replaced the valve seals and re-activated the ECV. Normal operation observed. Down time: 6 hours at B3 and 4 hours at B8.
2/5/2014	Treatment System and Well Field; Call from Time Communications - "TGRS fail". At Building 116, there was a leg of power out. Contacted Xcel Energy and they found a guide wire had been snapped by one of Bolander's equipment operators and had become entangled in the power wires to the west of former Building 101. That blew a fuse on the power pole between former Building 102 and pumphouse B12. Xcel removed the guide wire and replaced the fuse. Re-started the TGRS and normal operation was observed. Down time: 5 hours at B1, B3 and B4; 4 hours at B13, B8 and B9; 3 hours at B5 and B6.
3/6/2014	Pumphouses B1, B13, B3, B4, B5, B6, B8 and B9; Compared the cold water flow meters to a calibrated cold water flow meter. Down time: None.
6/8-9/2014	Pumphouses B1, B13, B3, B4, B6, B8 and B9; Call out from Time Communication "TGRS Fail". At the Site, there was a power outage to the boundary wells. Contacted Xcel Energy and they found a blown fuse on a power pole. They replaced the fuse and power was restored. Re-started the pumps and observed normal operation. Down time: 5 hours at B1, B13 and B4; 4 hours at B9; 2.5 hours at B8; 2 hours at B6 and 1.5 hours at B3.
8/7/2014	Pumphouse B13; Turned the pump off to clean the scale build-up inside the forcemain line. Thein Well jetted the line and removed scale from inside the forcemain line. Prior to removing the scale, the operating pressure was 148 psi. After removing the scale the operating pressure was 114 psi. The flow rate increased from 70 gpm to 120 gpm. Turned off several boundary wells during the work. Down time: 9 hours at B1, B13 and B3; 7 hours at B4, B8 and B9; 4 hours at B5.

APPENDIX F-3

MAINTENANCE ACTIVITIES BY LOCATION
FISCAL YEAR 2014
TGRS, OU2
ARDEN HILLS, MINNESOTA

8/18/2014	Pumphouses B4, B5, B6, B8 and B9; Power outage during daily inspection. Called Xcel Energy and they responded and repaired the problem. Down time: 1.5 hours at B1 and B3.
8/21/2014	Treatment System and Well Field; Power outage to the tratment system and well field. Called Xcel Energy and they responded. They repaired the problem and restored power to the site. Turned the system back on at 07:30 on 8/22/2014 and observed normal operation. Down time: 24 hours at B1, B13, B3, B4, B5, B6, B8, B9, SC1, SC2 and SC5.

PUMPHOUSE B9

11/20-21/2013	Treatment System and Well Field; Cycled power to the PLC during the monthly maintenance work. Attempted to re-start the system but the PLC was unable to communicate with the scanner modules. Hired a programming company to troubleshoot. They contacted Rockwell Automation and found that a dip switch setting had changed on the PLC backplane chassis. They reset the dip switch and the system re-started normally. Down time: 15 hours at SC2; 18.5 hours at B5, B8 and SC1; 24 hours at B3; 25 hours at B4, B9 and SC5; 27 hours at B1, B6 and B13.
12/11/2013	Pumphouse B9; Water was leaking from the solenoid valve body. Replaced the valve and observed normal operation. Down time: None.
1/3-4/2014	Pumphouse B9; The body of the ECV was leaking. Replaced the ECV and some of the associated control piping. Down time: 26 hours.
2/5/2014	Treatment System and Well Field; Call from Time Communications - "TGRS fail". At Building 116, there was a leg of power out. Contacted Xcel Energy and they found a guide wire had been snapped by one of Bolander's equipment operators and had become entangled in the power wires to the west of former Building 101. That blew a fuse on the power pole between former Building 102 and pumphouse B12. Xcel removed the guide wire and replaced the fuse. Re-started the TGRS and normal operation was observed. Down time: 5 hours at B1, B3 and B4; 4 hours at B13, B8 and B9; 3 hours at B5 and B6.
3/6/2014	Pumphouses B1, B13, B3, B4, B5, B6, B8 and B9; Compared the cold water flow meters to a calibrated cold water flow meter. Down time: None.

APPENDIX F-3

MAINTENANCE ACTIVITIES BY LOCATION
FISCAL YEAR 2014
TGRS, OU2
ARDEN HILLS, MINNESOTA

6/8-9/2014	Pumphouses B1, B13, B3, B4, B6, B8 and B9; Call out from Time Communication "TGRS Fail". At the Site, there was a power outage to the boundary wells. Contacted Xcel Energy and they found a blown fuse on a power pole. They replaced the fuse and power was restored. Re-started the pumps and observed normal operation. Down time: 5 hours at B1, B13 and B4; 4 hours at B9; 2.5 hours at B8; 2 hours at B6 and 1.5 hours at B3.
8/7/2014	Pumphouse B13; Turned the pump off to clean the scale build-up inside the forcemain line. Thein Well jetted the line and removed scale from inside the forcemain line. Prior to removing the scale, the operating pressure was 148 psi. After removing the scale the operating pressure was 114 psi. The flow rate increased from 70 gpm to 120 gpm. Turned off several boundary wells during the work. Down time: 9 hours at B1, B13 and B3; 7 hours at B4, B8 and B9; 4 hours at B5.
8/18/2014	Pumphouses B4, B5, B6, B8 and B9; Power outage during daily inspection. Called Xcel Energy and they responded and repaired the problem. Down time: 1.5 hours at B1 and B3.
8/21/2014	Treatment System and Well Field; Power outage to the tratment system and well field. Called Xcel Energy and they responded. They repaired the problem and restored power to the site. Turned the system back on at 07:30 on 8/22/2014 and observed normal operation. Down time: 24 hours at B1, B13, B3, B4, B5, B6, B8, B9, SC1, SC2 and SC5.
9/23-26/2014	Pumphouse B9; The motor for the submersible pump blew. Thein Well pulled the lift system and replaced the motor. Down time: 73 hours.

PUMPHOUSE B13

11/20-21/2013	Treatment System and Well Field; Cycled power to the PLC during the monthly maintenance work. Attempted to re-start the system but the PLC was unable to communicate with the scanner modules. Hired a programming company to troubleshoot. They contacted Rockwell Automation and found that a dip switch setting had changed on the PLC backplane chassis. They reset the dip switch and the system re-started normally. Down time: 15 hours at SC2; 18.5 hours at B5, B8 and SC1; 24 hours at B3; 25 hours at B4, B9 and SC5; 27 hours at B1, B6 and B13.
2/5/2014	Treatment System and Well Field; Call from Time Communications - "TGRS fail". At Building 116, there was a leg of power out. Contacted Xcel Energy and they found a guide wire had been snapped by one of Bolander's equipment operators and had become entangled in the power wires to the west of former Building 101. That blew a fuse on the power pole between former Building 102 and pumphouse B12. Xcel removed the guide wire and replaced the fuse. Re-started the TGRS and normal operation was observed. Down time: 5 hours at B1, B3 and B4; 4 hours at B13, B8 and B9; 3 hours at B5 and B6.

APPENDIX F-3

MAINTENANCE ACTIVITIES BY LOCATION
FISCAL YEAR 2014
TGRS, OU2
ARDEN HILLS, MINNESOTA

3/6/2014	Pumphouses B1, B13, B3, B4, B5, B6, B8 and B9; Compared the cold water flow meters to a calibrated cold water flow meter. Down time: None.
6/8-9/2014	Pumphouses B1, B13, B3, B4, B6, B8 and B9; Call out from Time Communication "TGRS Fail". At the Site, there was a power outage to the boundary wells. Contacted Xcel Energy and they found a blown fuse on a power pole. They replaced the fuse and power was restored. Re-started the pumps and observed normal operation. Down time: 5 hours at B1, B13 and B4; 4 hours at B9; 2.5 hours at B8; 2 hours at B6 and 1.5 hours at B3.
7/8/2014	Pumphouse B13; The flow meter showed the flow rate was increasing over time. Removed the flow meter and cleaned it. Replaced the flow meter and observed normal operation. Down time: None.
8/7/2014	Pumphouse B13; Turned the pump off to clean the scale build-up inside the forcemain line. Thein Well jetted the line and removed scale from inside the forcemain line. Prior to removing the scale, the operating pressure was 148 psi. After removing the scale the operating pressure was 114 psi. The flow rate increased from 70 gpm to 120 gpm. Turned off several boundary wells during the work. Down time: 9 hours at B1, B13 and B3; 7 hours at B4, B8 and B9; 4 hours at B5.
8/21/2014	Treatment System and Well Field; Power outage to the tratment system and well field. Called Xcel Energy and they responded. They repaired the problem and restored power to the site. Turned the system back on at 07:30 on 8/22/2014 and observed normal operation. Down time: 24 hours at B1, B13, B3, B4, B5, B6, B8, B9, SC1, SC2 and SC5.

PUMPHOUSE SC1

11/20-21/2013	Treatment System and Well Field; Cycled power to the PLC during the monthly maintenance work. Attempted to re-start the system but the PLC was unable to communicate with the scanner modules. Hired a programming company to troubleshoot. They contacted Rockwell Automation and found that a dip switch setting had changed on the PLC backplane chassis. They reset the dip switch and the system re-started normally. Down time: 15 hours at SC2; 18.5 hours at B5, B8 and SC1; 24 hours at B3; 25 hours at B4, B9 and SC5; 27 hours at B1, B6 and B13.
12/11-12/2013	Pumphouse SC1; The heater could not keep up with the cold temperature. Laughlin Electric installed a new heater. Down time: None.

APPENDIX F-3

MAINTENANCE ACTIVITIES BY LOCATION
FISCAL YEAR 2014
TGRS, OU2
ARDEN HILLS, MINNESOTA

6/17-25/2014	Pumphouse SC1; The pump was off upon arrival. The pump works in "Hand" but not "Auto". The communication line from pumphouse B11 was severed most likely from the weight of a large articulating dump truck. Laughlin Electric spliced the wire and installed new conduit. Turned the pump on in "Hand" while waiting for the repairs to be made. Down time: 20 hours.
6/24-25/2014	Pumphouses SC1 and SC2; While abandoning old water lines, Bolander accidentally severed the SC1 3" HDPE forcemain. The break was located near raw water loop valve 2174 (on the road between the old electrical substation and the northeast gate of Building 502 gate). Immediately turned the well field off and closed valve 2153 to isolate the well field from the break. Bolander repaired the break and opened valve 2153. Restarted wells SC1 and SC2 and observed normal operation. Down time: 22 hours at SC1 and SC2.
7/4-8/2014	Pumphouse SC1; The flow meter stopped totaling. Removed the flow meter and cleaned it. Replaced the flow meter and observed normal operation. Estimated the meter readings. Down time: None.
7/24-25/2014	Pumphouse SC1; The pump was off due to a tripped motor starter. Reset the motor starter and the pump re-started normally. Down time: 18 hours.
7/26/2014	Pumphouse SC1; The fuse above the motor starter was blown. Replaced the fuse and re-started the pump. Observed normal operation. Down time: 27 hours.
7/27-31/2014	Pumphouse SC1; The pump and motor will not pump water. Laughlin Electric diagnosed the problem to be a bad motor. Turned the pump off and scheduled the repair work. Down time: 115 hours for the remainder of July 2014.
8/1-4/2014	Pumphouse SC1; The pump and motor will not pump water. Laughlin Electric diagnosed the problem to be a bad motor. Thein Well replaced the motor on 8/4/2014. Down time: 100 hours in August.
8/11-13/2014	Pumphouse SC1; The pump was off on arrival. The transformer by B11 had a fusible link open and the isolator was broken. Contacted Xcel Energy. They repaired the isolator and restored power to the pump. Turned the pump back on and observed normal operation. Down time: 67 hours.
8/21/2014	Treatment System and Well Field; Power outage to the tratment system and well field. Called Xcel Energy and they responded. They repaired the problem and restored power to the site. Turned the system back on at 07:30 on 8/22/2014 and observed normal operation. Down time: 24 hours at B1, B13, B3, B4, B5, B6, B8, B9, SC1, SC2 and SC5.

APPENDIX F-3

MAINTENANCE ACTIVITIES BY LOCATION
FISCAL YEAR 2014
TGRS, OU2
ARDEN HILLS, MINNESOTA

PUMPHOUSE SC2

10/3/2013	Pumphouses SC2 and SC5; The lights were flashing on the well field panel. Reset the PLC and the lights came back on normally. Down time: 16 hours at SC2 and 15 hours at SC5.
10/5/2013	Pumphouse SC2; The light was flashing on the well field panel. Reset the PLC and the light came back on normally. Down time: None.
11/20-21/2013	Treatment System and Well Field; Cycled power to the PLC during the monthly maintenance work. Attempted to re-start the system but the PLC was unable to communicate with the scanner modules. Hired a programming company to troubleshoot. They contacted Rockwell Automation and found that a dip switch setting had changed on the PLC backplane chassis. They reset the dip switch and the system re-started normally. Down time: 15 hours at SC2; 18.5 hours at B5, B8 and SC1; 24 hours at B3; 25 hours at B4, B9 and SC5; 27 hours at B1, B6 and B13.
1/26-27/2014	Pumphouse SC2; While performing the daily inspection, the pumphouse door was found open. The water in the pressure gauge piping was frozen. Turned the pump off, closed the gate valve to allow the water to thaw and made sure the pumphouse door was closed tightly. On 1/27/2014, turned the pump back on and the pressure gauge was broken otherwise everything else was normal. Replaced the pressure gauge, turned the pump back on and observed normal operation. Down time: 21.5 hours.
5/29/2014	Pumphouses SC2 and SC5; Lawn care technician accidentally cut the communication lines with his lawn mower. Laughlin Electric re-spliced the wires and the pumps were re-started. Down time: 5.5 hours at SC2 and 14 hours at SC5.
6/24-25/2014	Pumphouses SC1 and SC2; While abandoning old water lines, Bolander accidentally severed the SC1 3" HDPE forcemain. The break was located near raw water loop valve 2174 (on the road between the old electrical substation and the northeast gate of Building 502 gate). Immediately turned the well field off and closed valve 2153 to isolate the well field from the break. Bolander repaired the break and opened valve 2153. Restarted wells SC1 and SC2 and observed normal operation. Down time: 22 hours at SC1 and SC2.
7/8/2014	Pumphouse SC2; The flow meter showed the flow rate was increasing over time. Removed the flow meter and cleaned it. Replaced the flow meter and observed normal operation. Down time: None.

APPENDIX F-3

MAINTENANCE ACTIVITIES BY LOCATION
FISCAL YEAR 2014
TGRS, OU2
ARDEN HILLS, MINNESOTA

8/21/2014	Treatment System and Well Field; Power outage to the tratment system and well field. Called Xcel Energy and they responded. They repaired the problem and restored power to the site. Turned the system back on at 07:30 on 8/22/2014 and observed normal operation. Down time: 24 hours at B1, B13, B3, B4, B5, B6, B8, B9, SC1, SC2 and SC5.

PUMPHOUSE SC5

10/3/2013	Pumphouses SC2 and SC5; The lights were flashing on the well field panel. Reset the PLC and the lights came back on normally. Down time: 16 hours at SC2 and 15 hours at SC5.
10/25/2013	Pumphouse SC5; The light was flashing on the well field panel. Reset the PLC and the light came back on normally. Down time: 7 hours.
11/16/2013	Pumphouse SC5; The light was flashing on the well field panel; Reset the PLC and SC5 relit normally. Down time: 8.5 hours.
11/19/2013	Pumphouse SC5; The light was flashing on the well field panel; Reset the PLC and SC5 relit normally. Down time: 21 hours.
11/20-21/2013	Treatment System and Well Field; Cycled power to the PLC during the monthly maintenance work. Attempted to re-start the system but the PLC was unable to communicate with the scanner modules. Hired a programming company to troubleshoot. They contacted Rockwell Automation and found that a dip switch setting had changed on the PLC backplane chassis. They reset the dip switch and the system re-started normally. Down time: 15 hours at SC2; 18.5 hours at B5, B8 and SC1; 24 hours at B3; 25 hours at B4, B9 and SC5; 27 hours at B1, B6 and B13.
3/7/2014	Pumphouse SC5; Removed the installed flow meter at meter reading 13647200 and installed a new meter at meter reading 25049000 at 1100 hours. Down time: None.
4/28/2014	Pumphouse SC5; The light was flashing on the well field panel on arrival. Reset the PLC and the light relit normally. At the pumphouse, the pump was running. Down time: 17 hours.
5/19/2014	SC5 was flashing on the well field panel. Reset the PLC and SC5 relit normally. At the pumphouse, the well was pumping normally. Down time: 8.5 hours.

APPENDIX F-3

MAINTENANCE ACTIVITIES BY LOCATION
FISCAL YEAR 2014
TGRS, OU2
ARDEN HILLS, MINNESOTA

5/29/2014	Pumphouses SC2 and SC5; Lawn care technician accidentally cut the communication lines with his lawn mower. Laughlin Electric re-spliced the wires and the pumps were re-started. Down time: 5.5 hours at SC2 and 14 hours at SC5.
6/4/2014	Pumphouse SC5; Turned the pump off while Bolander's electrician relocated the communication wires underground. Down time: 8 hours at SC5.
6/15/2014	Pumphouse SC5; The light was flashing on the well field panel. Reset the PLC and the light relit normally. Normal operation observed during the inspection. Down time: 15 hours.
6/19/2014	Pumphouse SC5; The light was flashing on the well field panel. Reset the PLC and the light relit normally. Normal operation observed during the inspection. Down time: 14 hours.
6/29/2014	Pumphouse SC5; The light was flashing on the well field panel. Reset the PLC and the light relit normally. Normal operation observed during the inspection. Down time: 15 hours.
7/8/2014	Pumphouse SC5; The light was flashing on the well field panel; Reset the PLC and the light relit normally. Down time: 12.5 hours.
7/25/2014	Pumphouse SC5; The light was flashing on the well field panel; Reset the PLC and the light relit normally. Down time: 2.5 hours
8/2/2014	Pumphouse SC5; The light was flashing on the PLC. Reset the PLC and the light came on steady. At the pumphouse, the pump was running normally. Down time: 15 hours.
8/21/2014	Treatment System and Well Field; Power outage to the tratment system and well field. Called Xcel Energy and they responded. They repaired the problem and restored power to the site. Turned the system back on at 07:30 on 8/22/2014 and observed normal operation. Down time: 24 hours at B1, B13, B3, B4, B5, B6, B8, B9, SC1, SC2 and SC5.
8/24/2014	Pumphouse SC5; The light was flashing on the PLC. Reset the PLC and the light came on steady. At the pumphouse, the pump was running normally. Down time: 3 hours.
9/3/2014	Pumphouse SC5; The light was flashing on the PLC in Building 116. Reset the PLC and the light came back on. At the pumphouse, the pump was running normally. Down time: None.

APPENDIX F-3

MAINTENANCE ACTIVITIES BY LOCATION
FISCAL YEAR 2014
TGRS, OU2
ARDEN HILLS, MINNESOTA

TREATMENT SYSTEM

11/20-21/2013	Treatment System and Well Field; Cycled power to the PLC during the monthly maintenance work. Attempted to re-start the system but the PLC was unable to communicate with the scanner modules. Hired a programming company to troubleshoot. They contacted Rockwell Automation and found that a dip switch setting had changed on the PLC backplane chassis. They reset the dip switch and the system re-started normally. Down time: 15 hours at SC2; 18.5 hours at B5, B8 and SC1; 24 hours at B3; 25 hours at B4, B9 and SC5; 27 hours at B1, B6 and B13.
12/10/2013	Treatment System; ECV 4 will not close on command. Removed portions of the downstream control piping to determine if there was mineral build up. Only minimal build up observed. The valve will need a new seal kit installed. Down time: None.
1/9/2014	Treatment System; ECV 4 no longer closes on command indicating the valve seals are in need of replacement. Replaced the valve seals and re-activated the ECV. Normal operation observed. Down time: 6 hours at B3 and 4 hours at B8.
2/5/2014	Treatment System and Well Field; Call from Time Communications - "TGRS fail". At Building 116, there was a leg of power out. Contacted Xcel Energy and they found a guide wire had been snapped by one of Bolander's equipment operators and had become entangled in the power wires to the west of former Building 101. That blew a fuse on the power pole between former Building 102 and pumphouse B12. Xcel removed the guide wire and replaced the fuse. Re-started the TGRS and normal operation was observed. Down time: 5 hours at B1, B3 and B4; 4 hours at B13, B8 and B9; 3 hours at B5 and B6.
3/19/2014	Treatment System and Well Field; Water was leaking out of the ECV 2 control piping port. Turned the TGRS off to relieve pressure from ECV 2 and removed portions of the control piping. Installed a plug in the valve port and water no longer leaked from the port. Down time: 1.5 hours at B1, B3 and B4.
3/23/2014	Treatment System; Call from Time Communications-"TGRS Fail". At the Site, Pump 4 was off and ECV 4 was partially open. Pump 3 was on and running normally. Exercised ECV 4's control valves, flushed the control piping and reset the opening and closing speed valves. Cycled the valve three times and observed normal operation. Down time: None (B4 was already down pending scheduled repair).
7/15/2014	Treatment System; The cold water flow meter from pump 4 is slowing. Removed the meter and sent it out for repair. Installed a rebuilt flow meter. The old meter was removed at 377772000 and the new meter was installed at 124824000 at 1:15 pm. Down time: 1 hour at B1; 1.5 hours at B4.

APPENDIX F-3

MAINTENANCE ACTIVITIES BY LOCATION
FISCAL YEAR 2014
TGRS, OU2
ARDEN HILLS, MINNESOTA

7/15/2014	Treatment System; Removed the old and re-installed new packing material in the pump 4 pump shaft. The well field cycled during the work. Down time: None, the down time has already been accounted for above.
8/21/2014	Treatment System and Well Field; Power outage to the tratment system and well field. Called Xcel Energy and they responded. They repaired the problem and restored power to the site. Turned the system back on at 07:30 on 8/22/2014 and observed normal operation. Down time: 24 hours at B1, B13, B3, B4, B5, B6, B8, B9, SC1, SC2 and SC5.
8/30/2014	Treatment System; Call out from Time Communications: TGRS Fail. At the Site, ECV 4 would not open on command. Replaced the solenoid valve and coil and cycled the ECV. Normal operation observed. Down time: 1 hour at B3.

FORCEMAIN

8/7/2014	Pumphouse B13; Turned the pump off to clean the scale build-up inside the forcemain line. Thein Well jetted the line and removed scale from inside the forcemain line. Prior to removing the scale, the operating pressure was 148 psi. After removing the scale the operating pressure was 114 psi. The flow rate increased from 70 gpm to 120 gpm. Turned off several boundary wells during the work. Down time: 9 hours at B1, B13 and B3; 7 hours at B4, B8 and B9; 4 hours at B5.

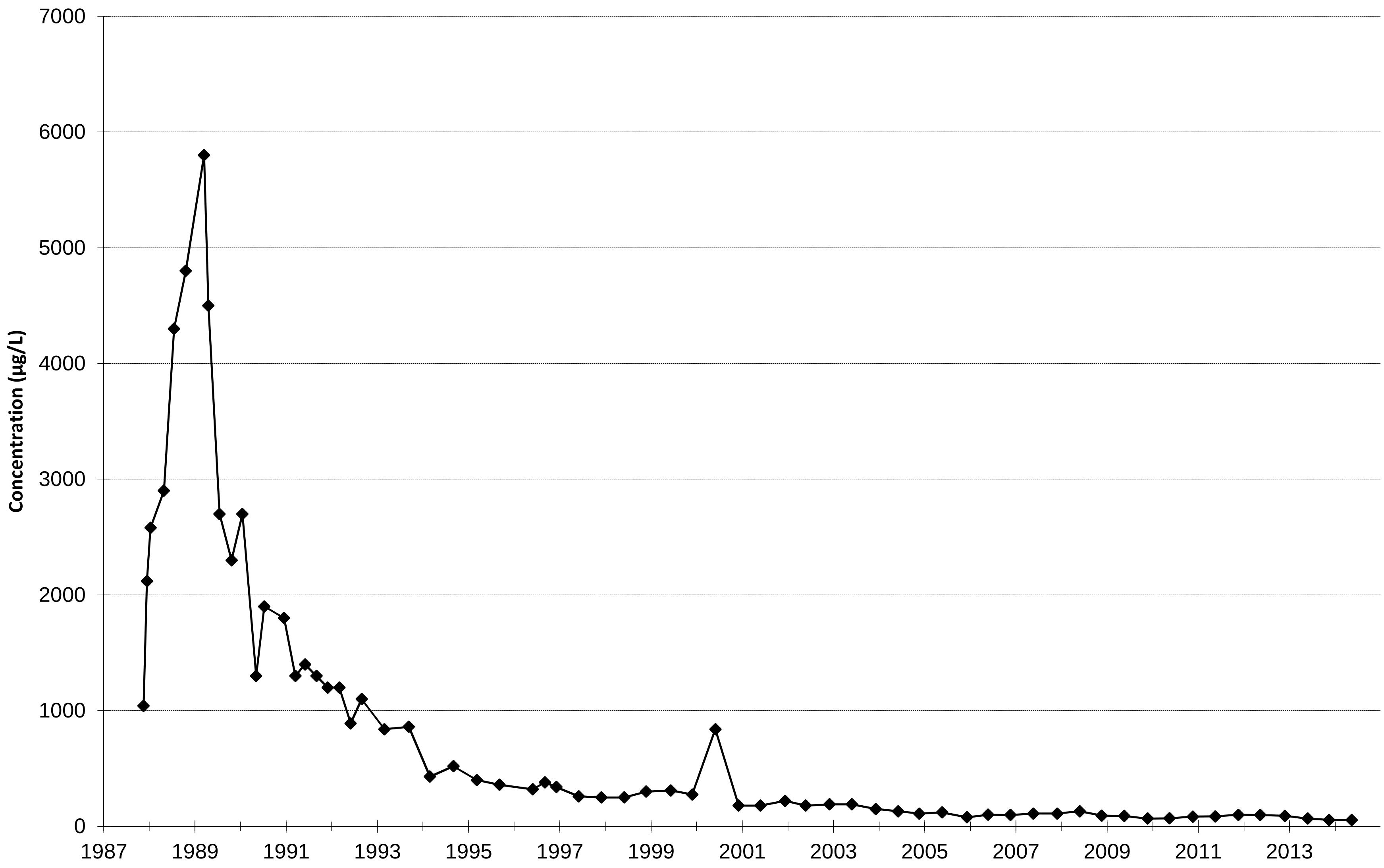
Appendix G

TGRS Chemical Data

G.1 TGRS Extraction Wells – TRCLE vs. Time

APPENDIX G-1

EXTRACTION WELL B1 - TRCLE VS.TIME

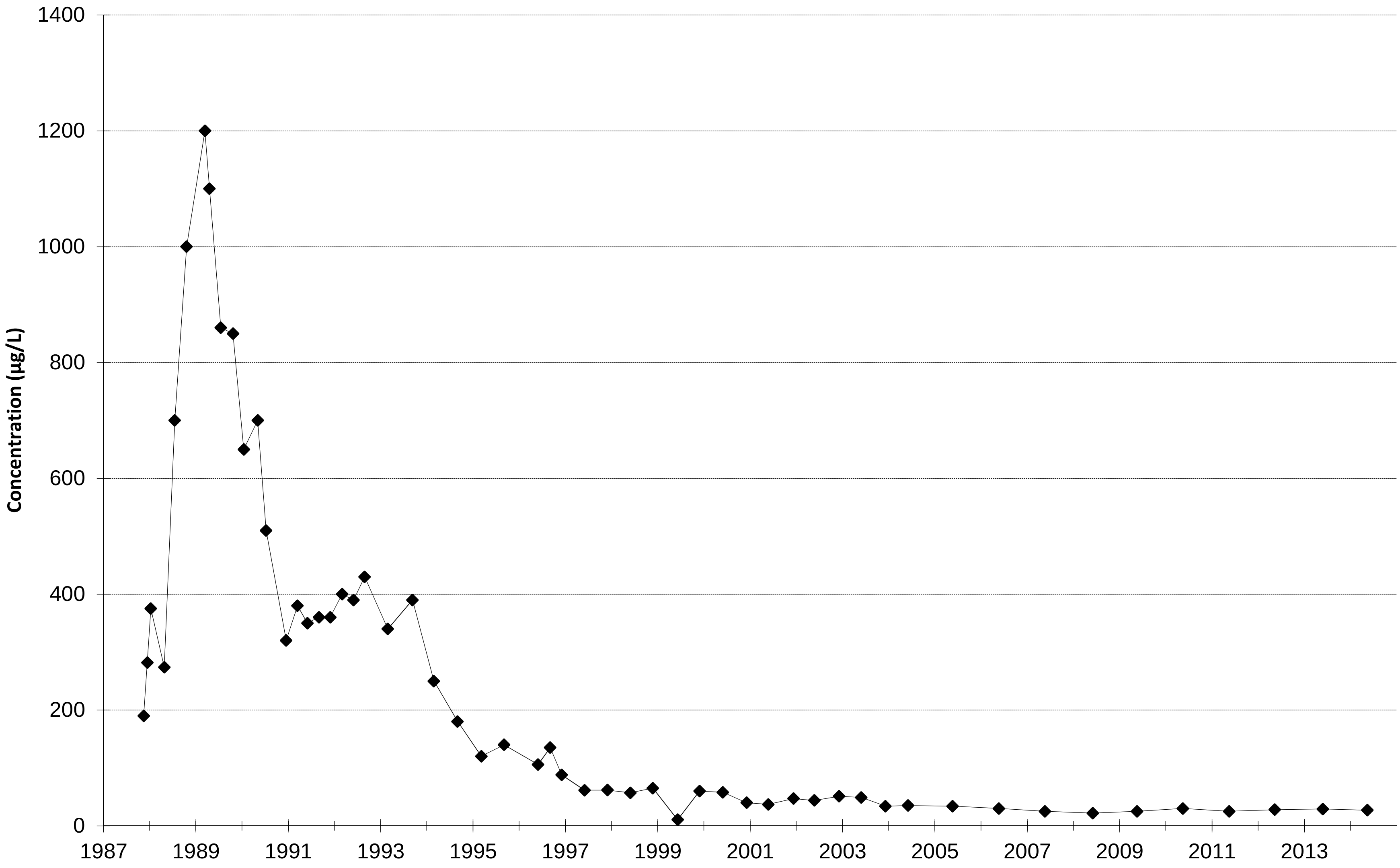


Note: Samples reporting concentrations less than the detection limit were plotted as zero.

CRA 088760 (1)

APPENDIX G-1

EXTRACTION WELL B2 - TRCLE VS. TIME

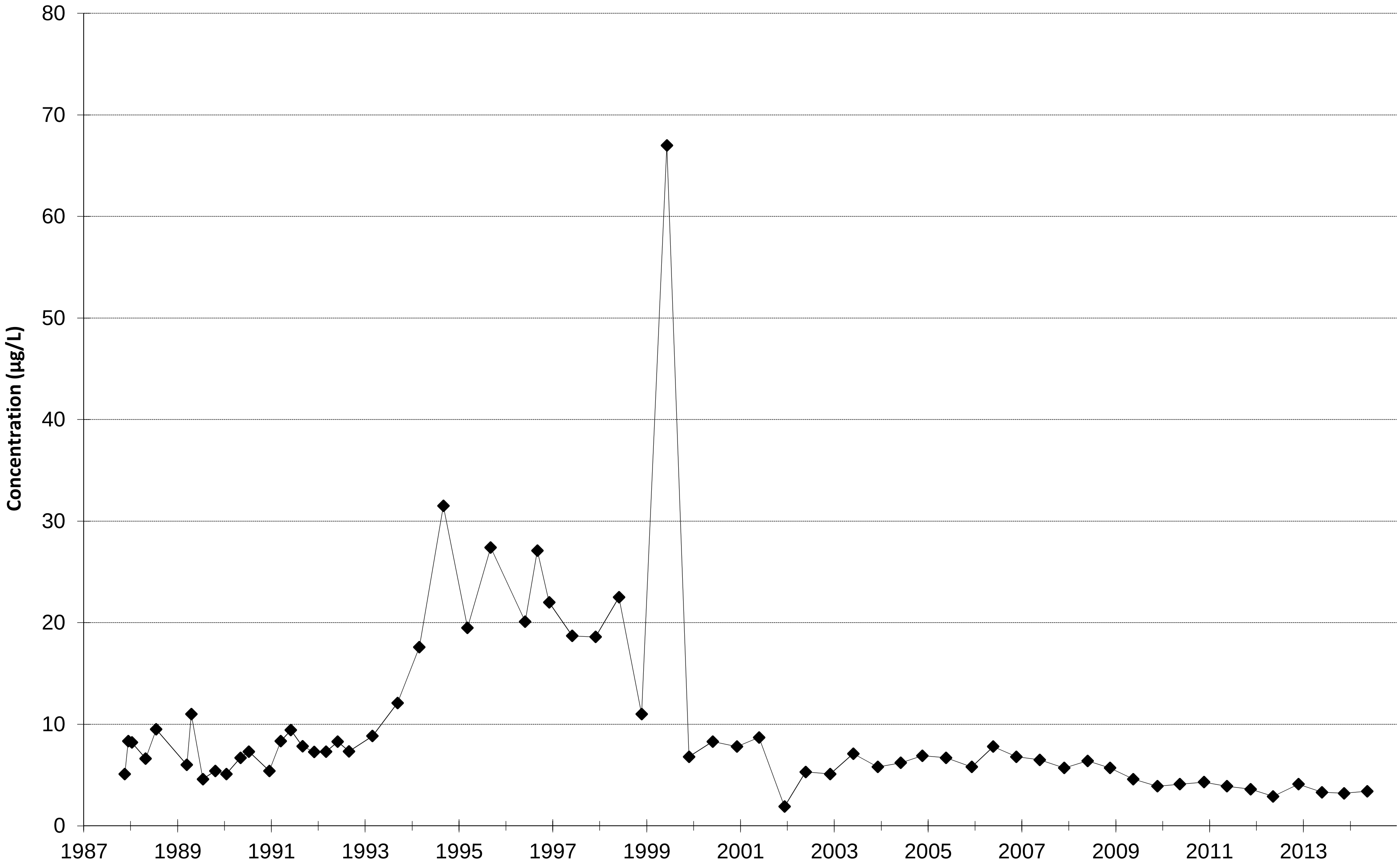


Note: Samples reporting concentrations less than the detection limit were plotted as zero.

CRA 088760 (1)

APPENDIX G-1

EXTRACTION WELL B3 - TRCLE VS. TIME

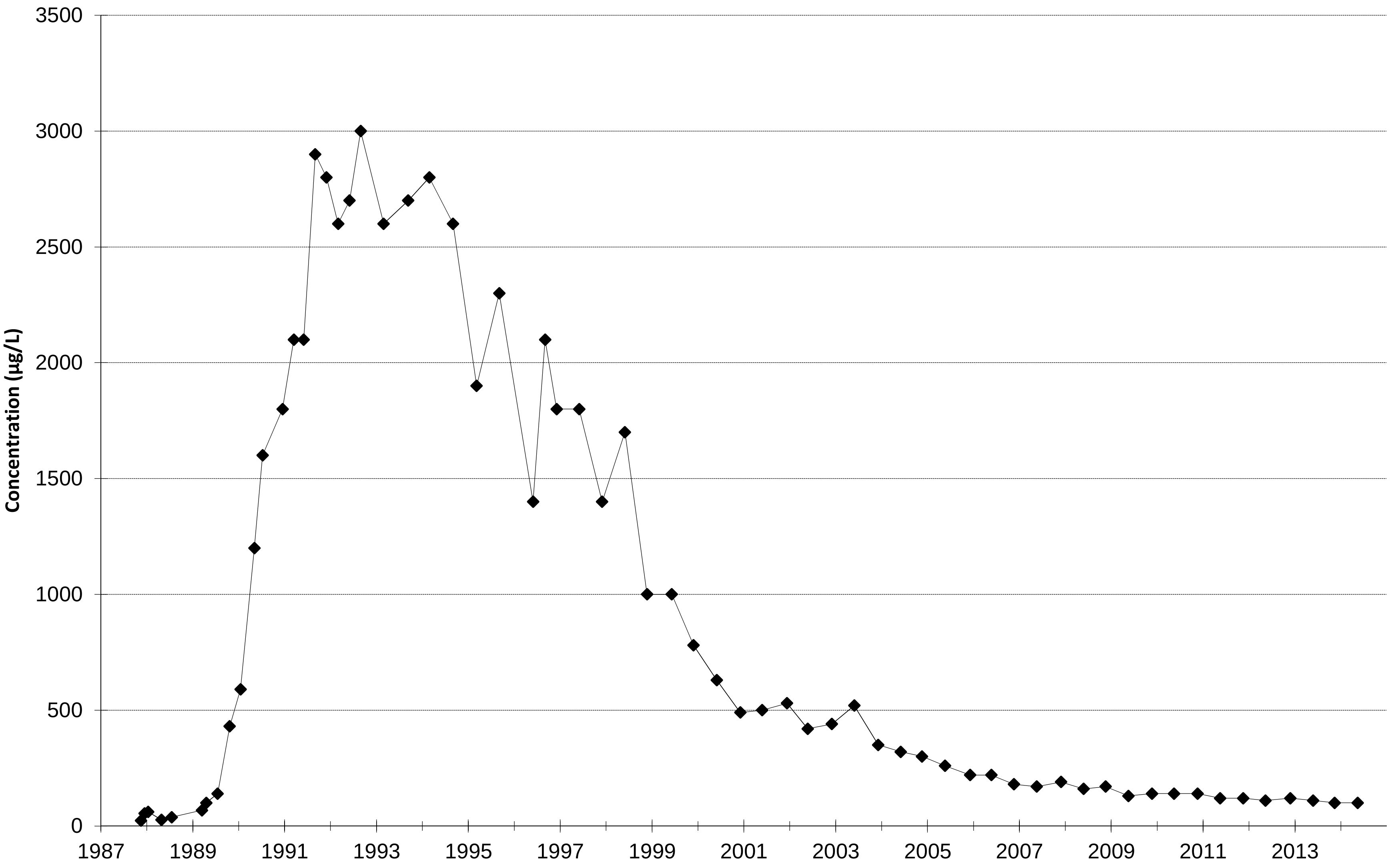


Note: Samples reporting concentrations less than the detection limit were plotted as zero.

CRA 088760 (1)

APPENDIX G-1

EXTRACTION WELL B4 - TRCLE VS. TIME

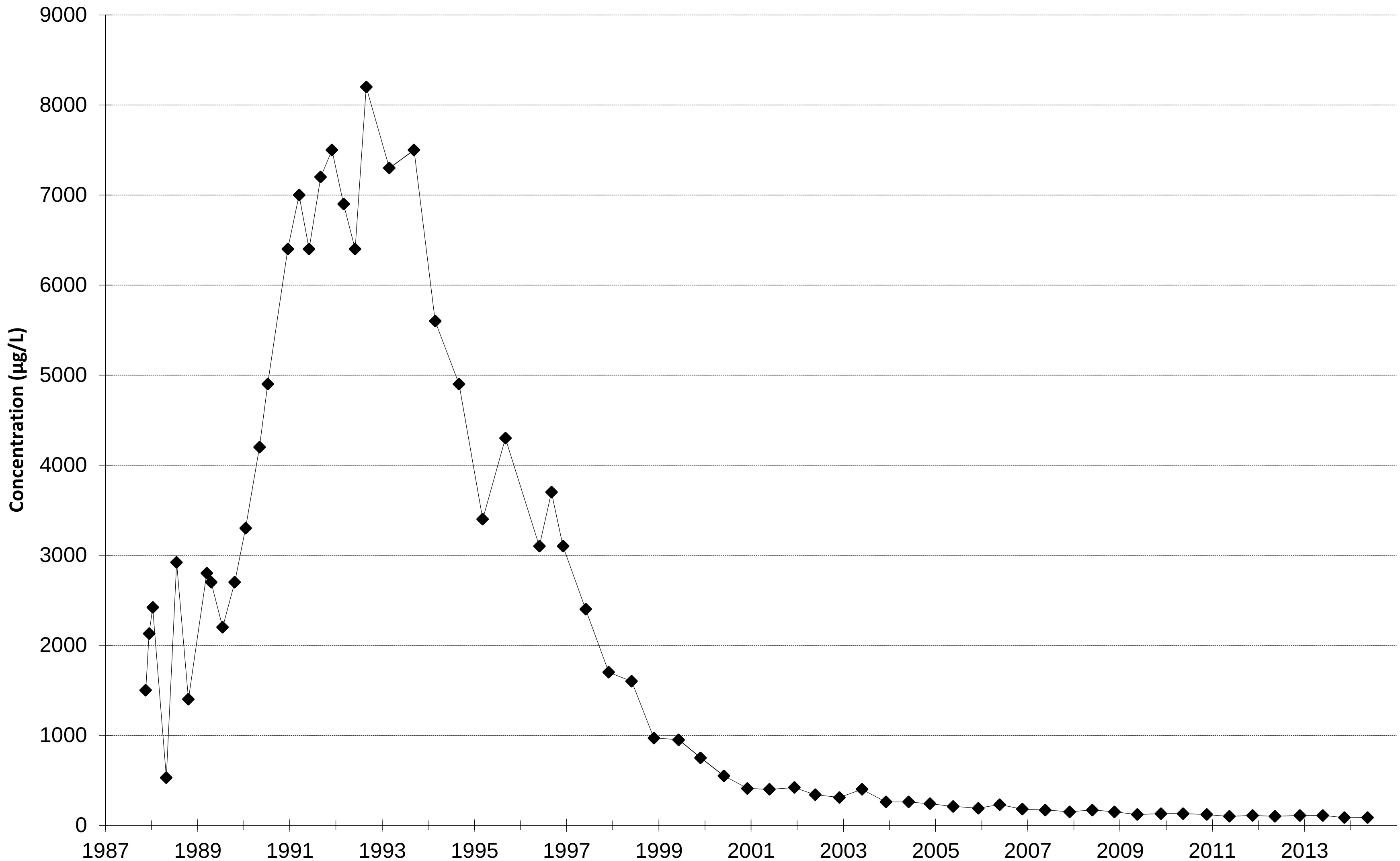


Note: Samples reporting concentrations less than the detection limit were plotted as zero.

CRA 088760 (1)

APPENDIX G-1

EXTRACTION WELL B5 - TRCLE VS. TIME

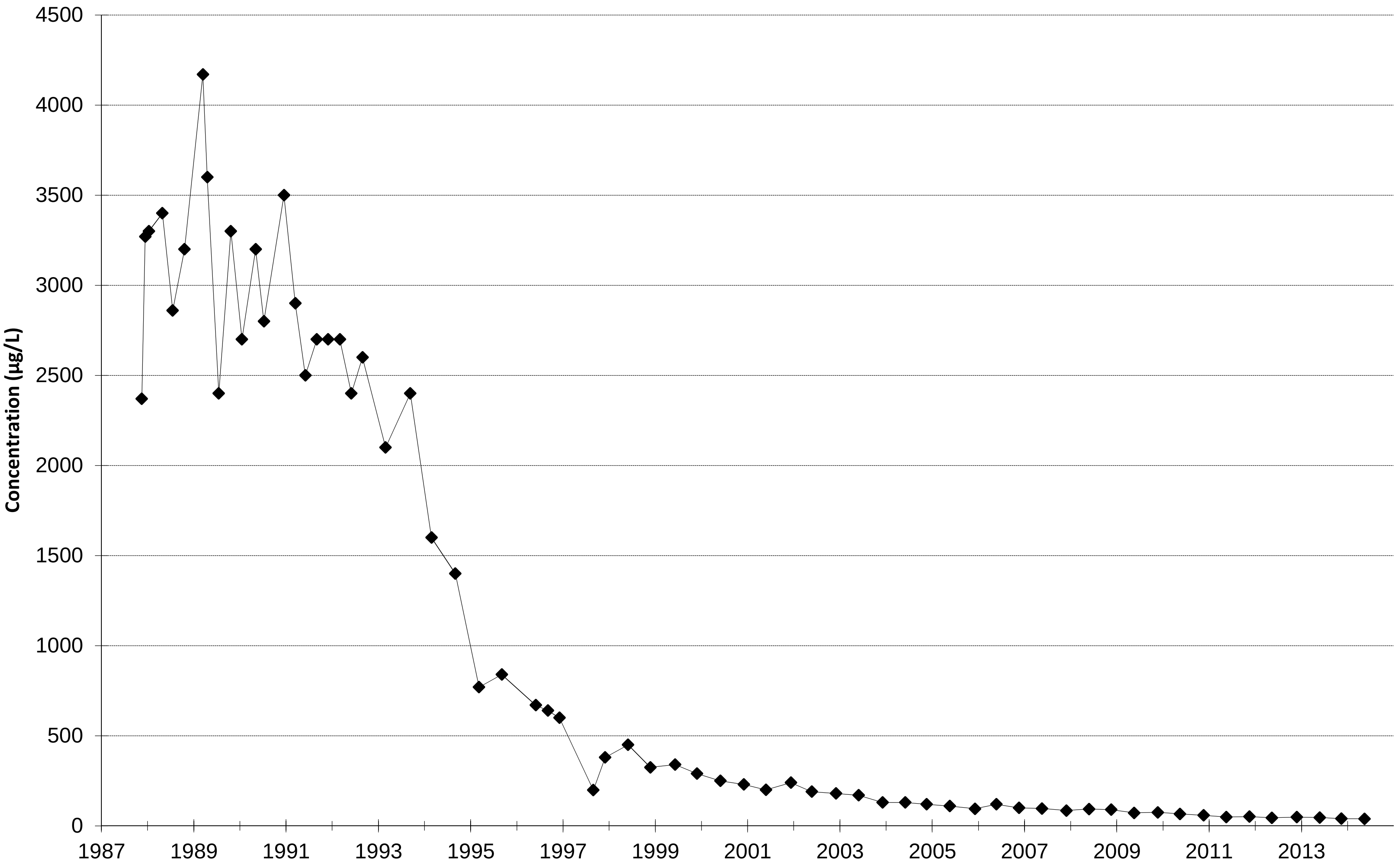


Note: Samples reporting concentrations less than the detection limit were plotted as zero.

CRA 088760 (1)

APPENDIX G-1

EXTRACTION WELL B6 - TRCLE VS. TIME

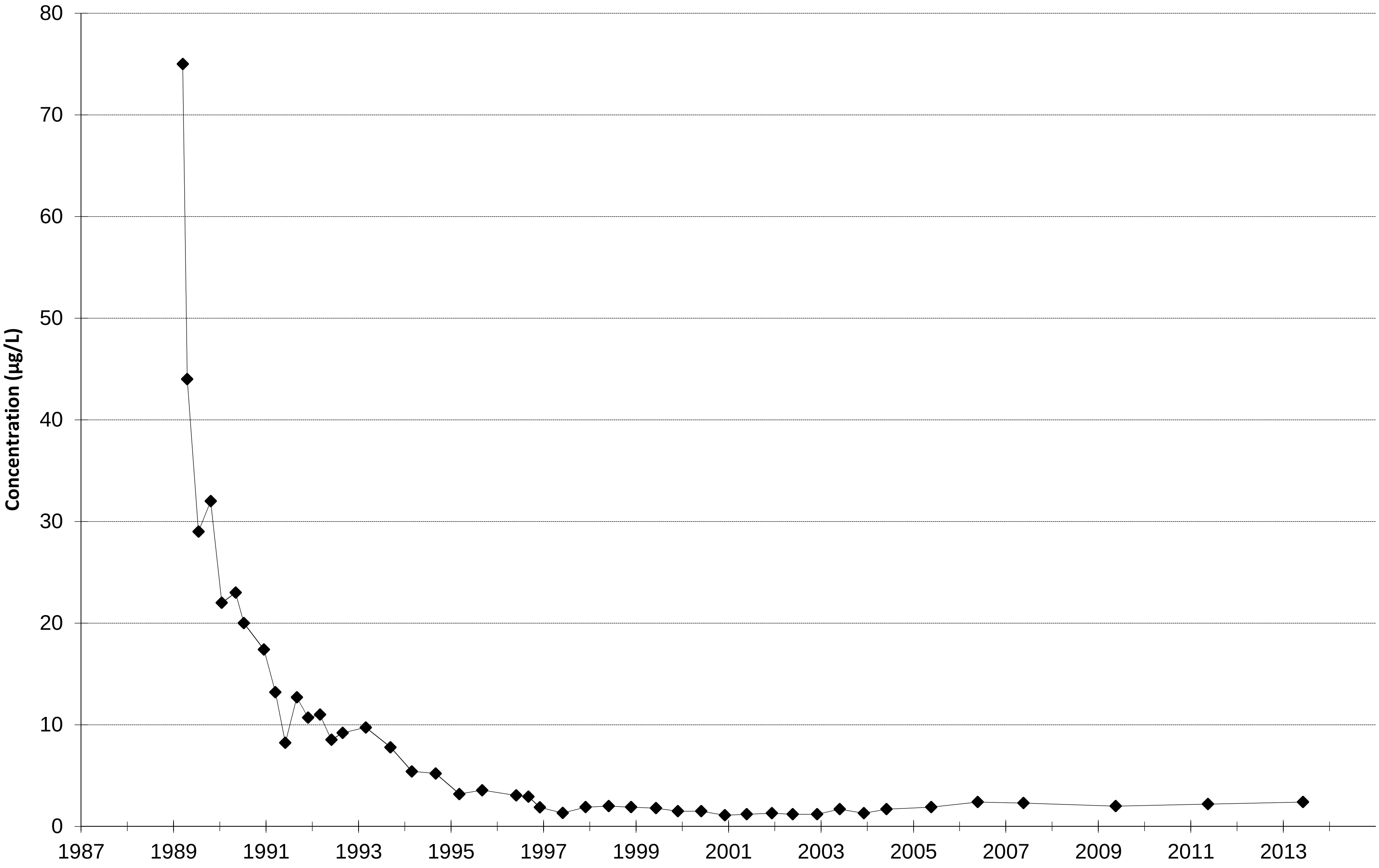


Note: Samples reporting concentrations less than the detection limit were plotted as zero.

CRA 088760 (1)

APPENDIX G-1

EXTRACTION WELL B7 - TRCLE VS. TIME

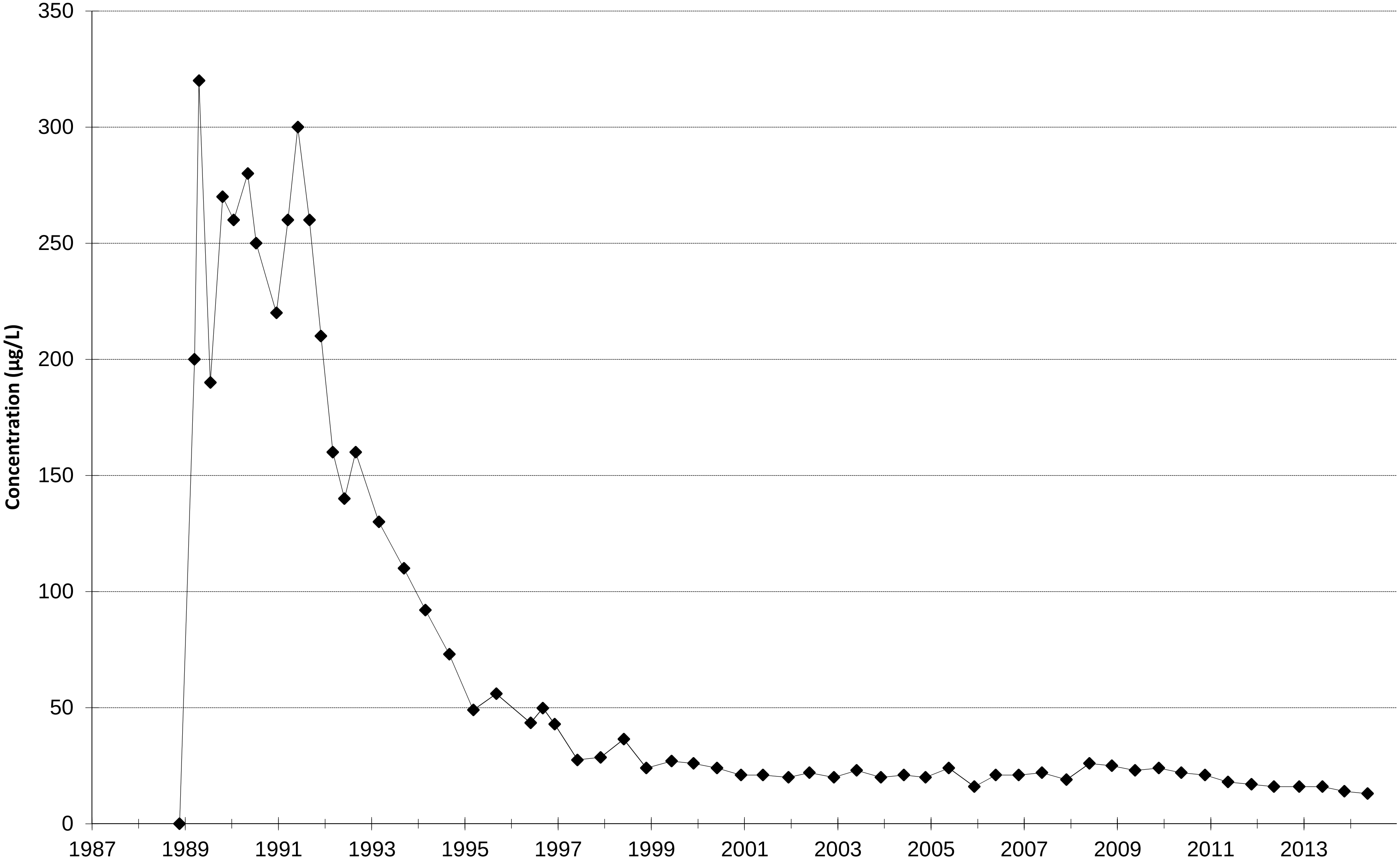


Note: Samples reporting concentrations less than the detection limit were plotted as zero.

CRA 088760 (1)

APPENDIX G-1

EXTRACTION WELL B8 - TRCLE VS. TIME



Note: Samples reporting concentrations less than the detection limit were plotted as zero.

CRA 088760 (1)

APPENDIX G-1

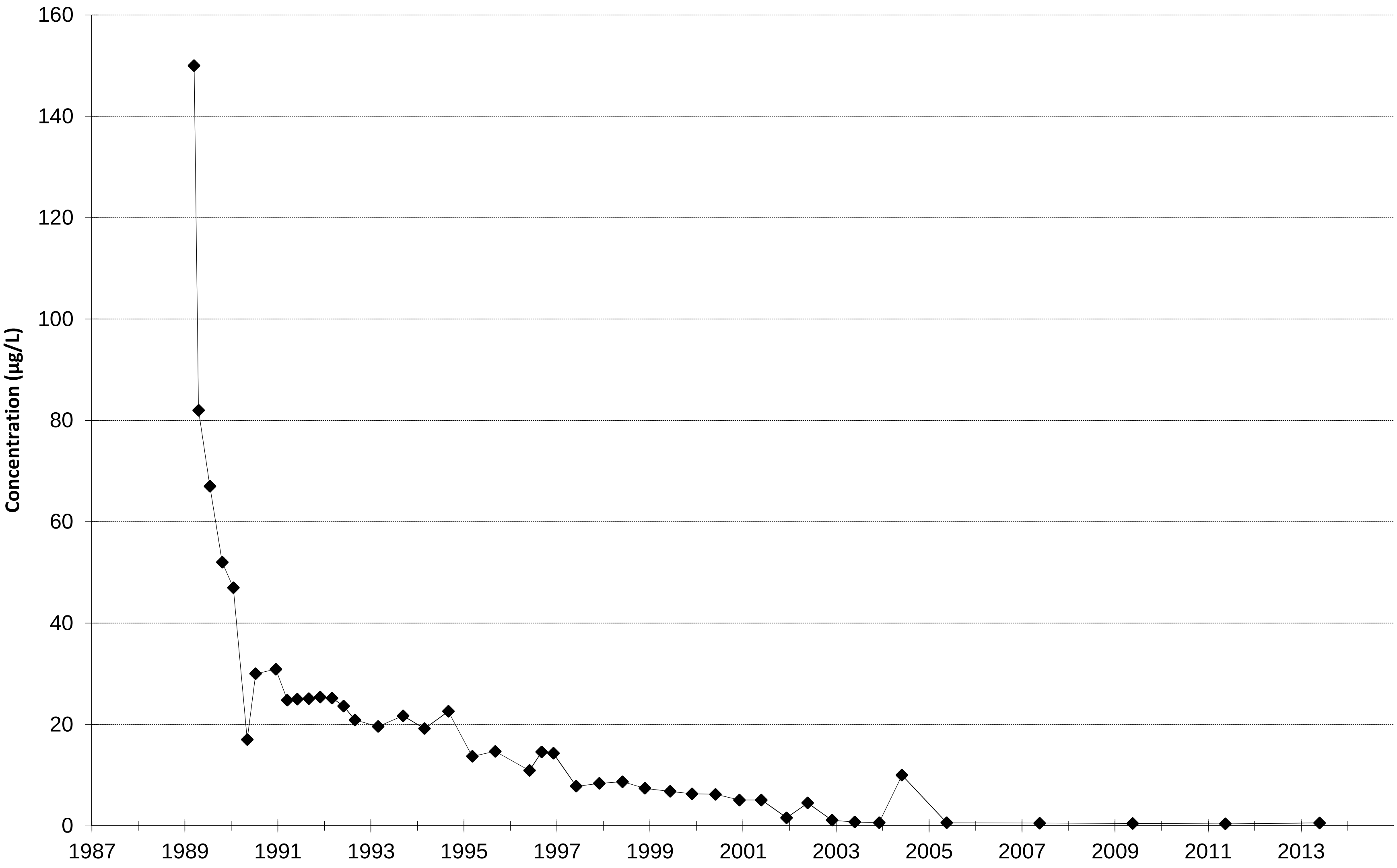
EXTRACTION WELL B9 - TRCLE VS. TIME

Note: Samples reporting concentrations less than the detection limit were plotted as zero.

CRA 088760 (1)

APPENDIX G-1

EXTRACTION WELL B10 - TRCLE VS. TIME

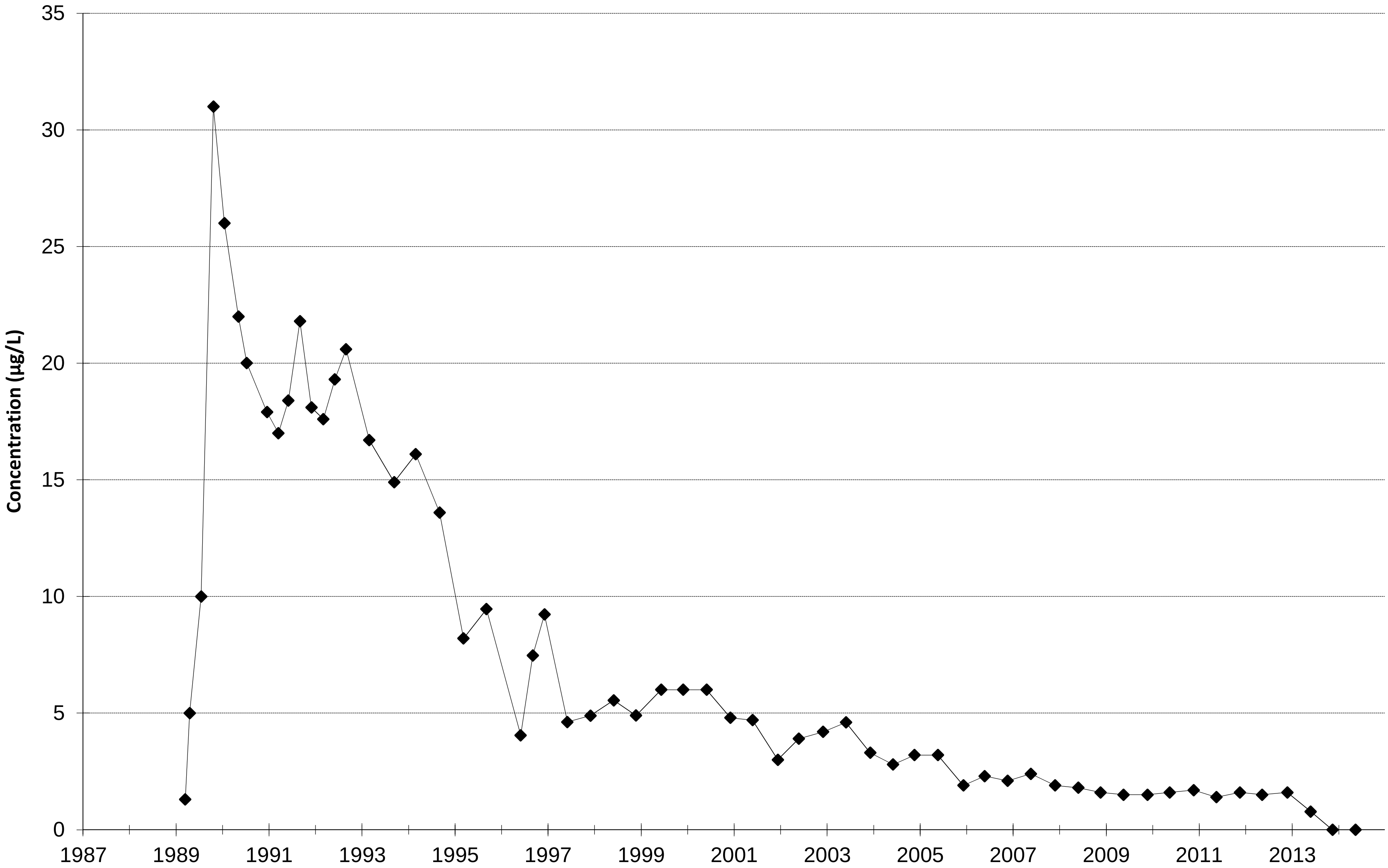


Note: Samples reporting concentrations less than the detection limit were plotted as zero.

CRA 088760 (1)

APPENDIX G-1

EXTRACTION WELL B11 - TRCLE VS. TIME

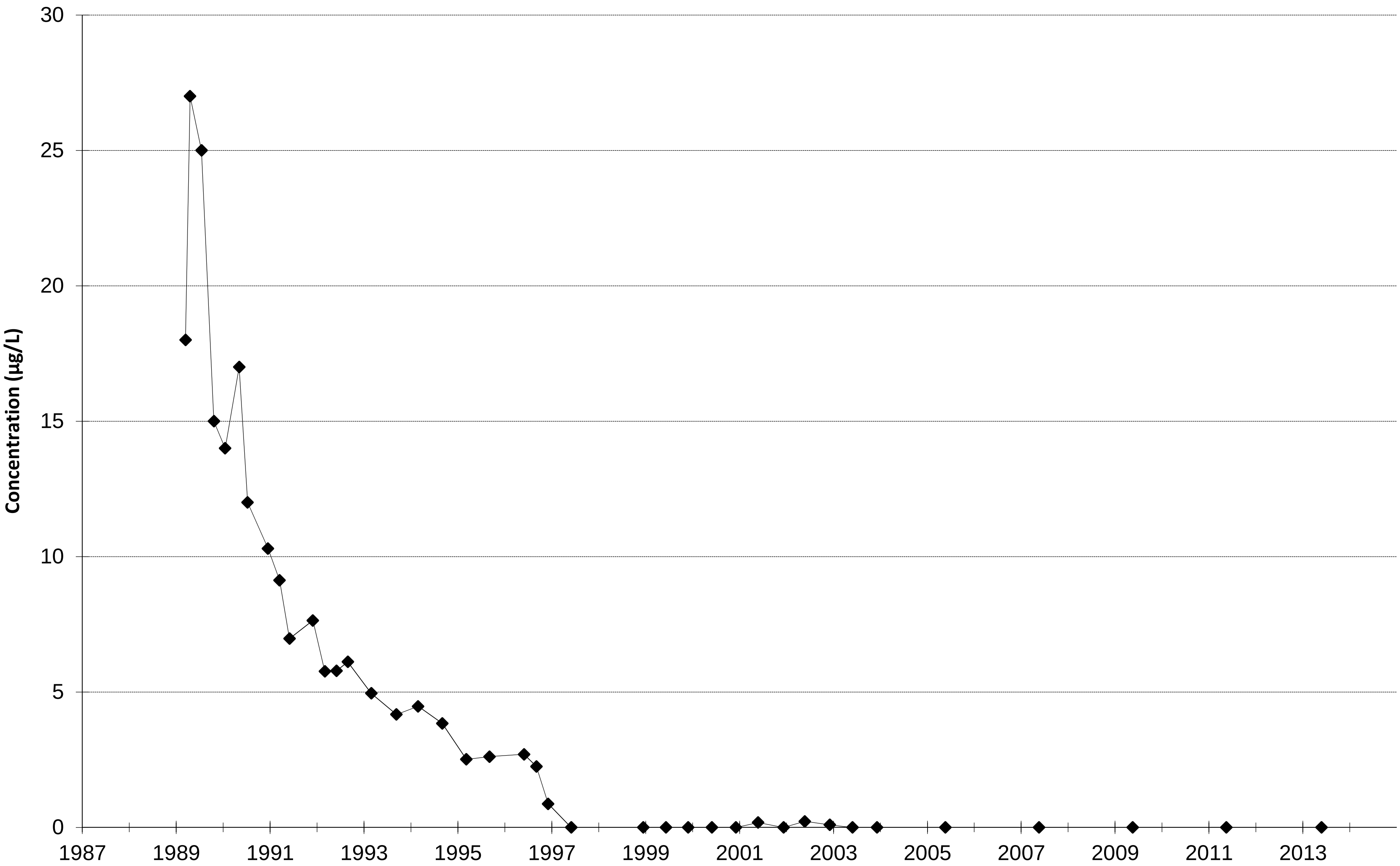


Note: Samples reporting concentrations less than the detection limit were plotted as zero.

CRA 088760 (1)

APPENDIX G-1

EXTRACTION WELL B12 - TRCLE VS. TIME

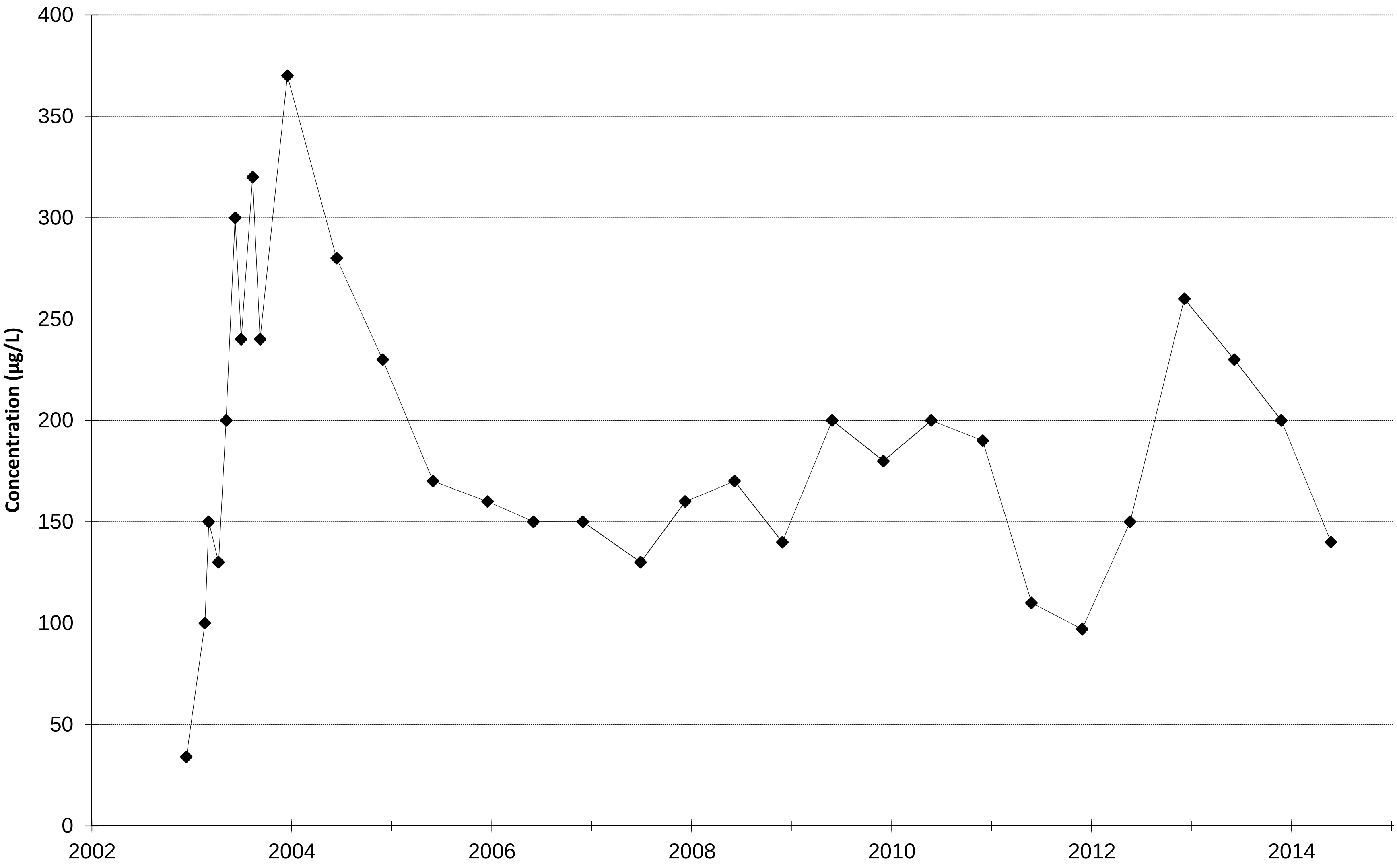


Note: Samples reporting concentrations less than the detection limit were plotted as zero.

CRA 088760 (1)

APPENDIX G-1

EXTRACTION WELL B13 - TRCLE VS. TIME

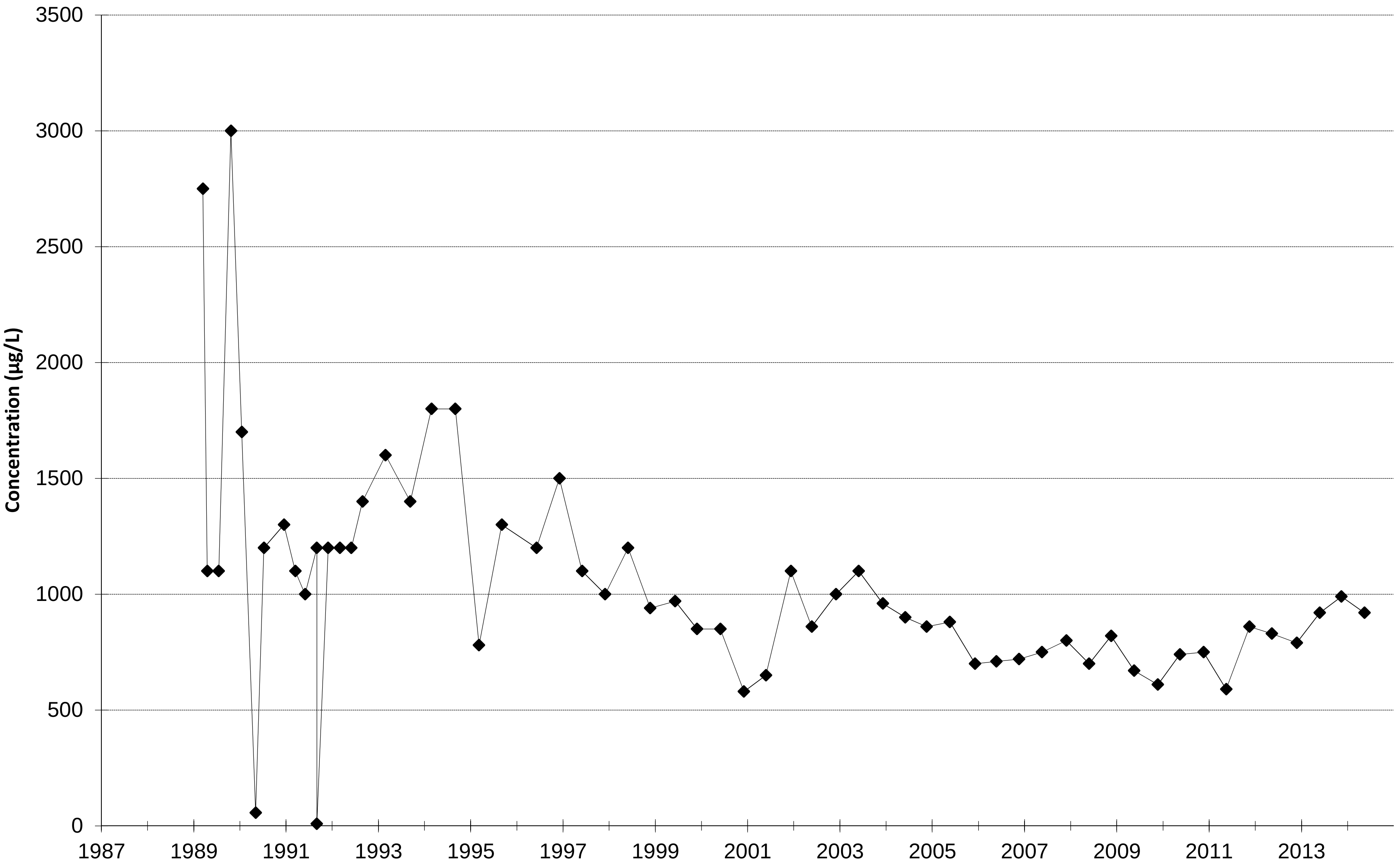


Note: Samples reporting concentrations less than the detection limit were plotted as zero.

CRA 088760 (1)

APPENDIX G-1

EXTRACTION WELL SC1 - TRCLE VS. TIME

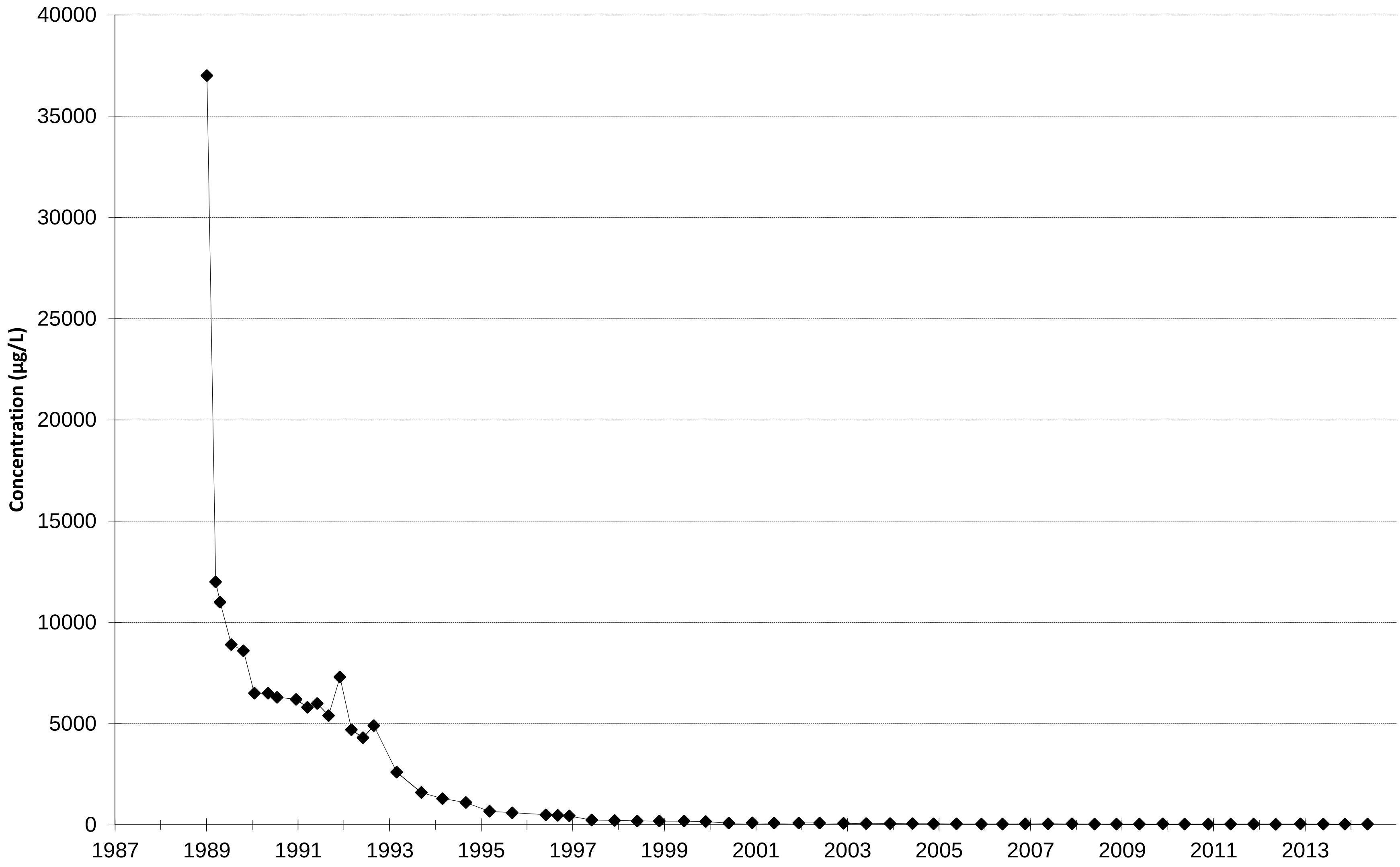


Note: Samples reporting concentrations less than the detection limit were plotted as zero.

CRA 088760 (1)

APPENDIX G-1

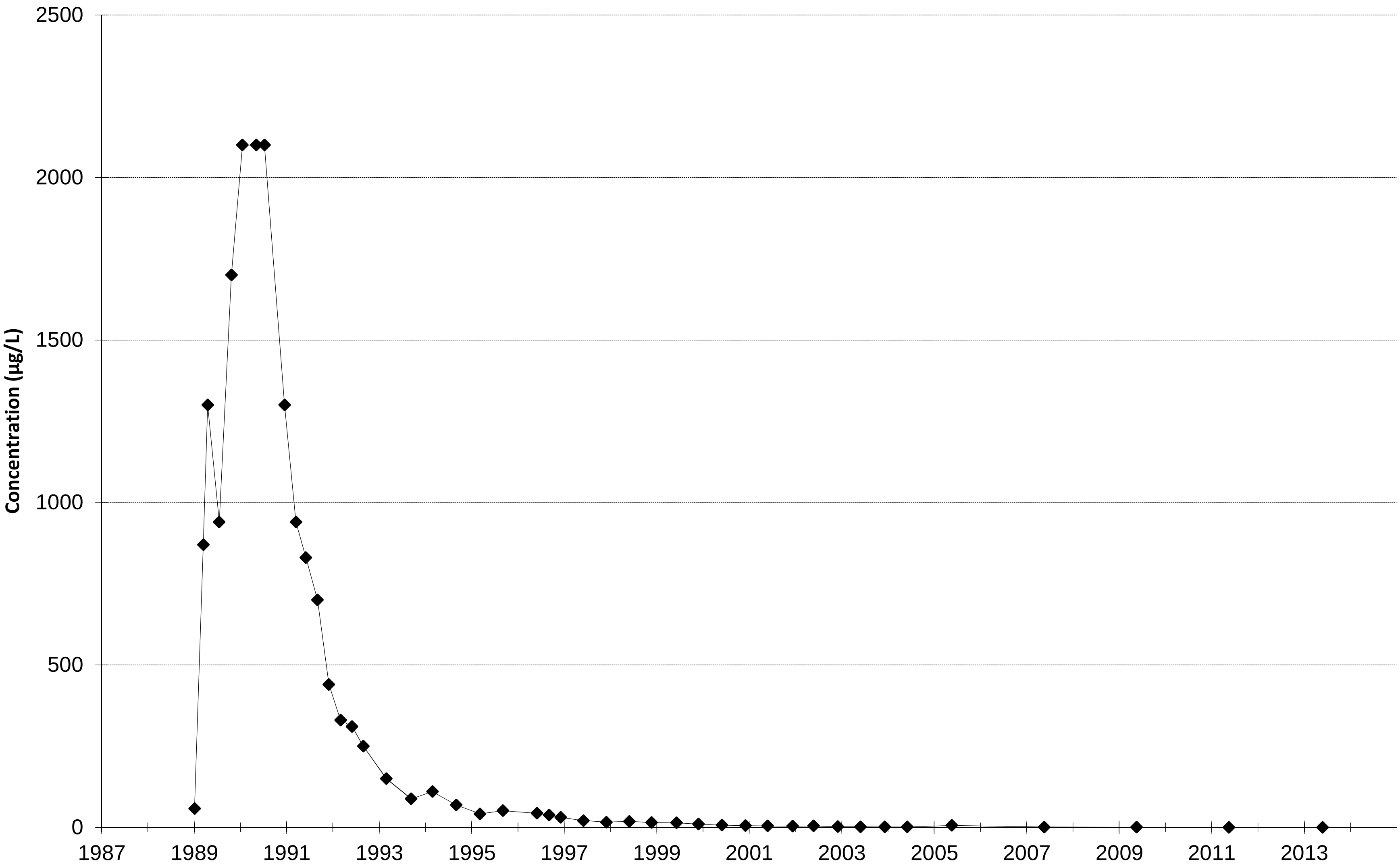
EXTRACTION WELL SC2 - TRCLE VS. TIME



Note: Samples reporting concentrations less than the detection limit were plotted as zero.

APPENDIX G-1

EXTRACTION WELL SC3 - TRCLE VS. TIME



Note: Samples reporting concentrations less than the detection limit were plotted as zero.

CRA 088760 (1)

APPENDIX G-1

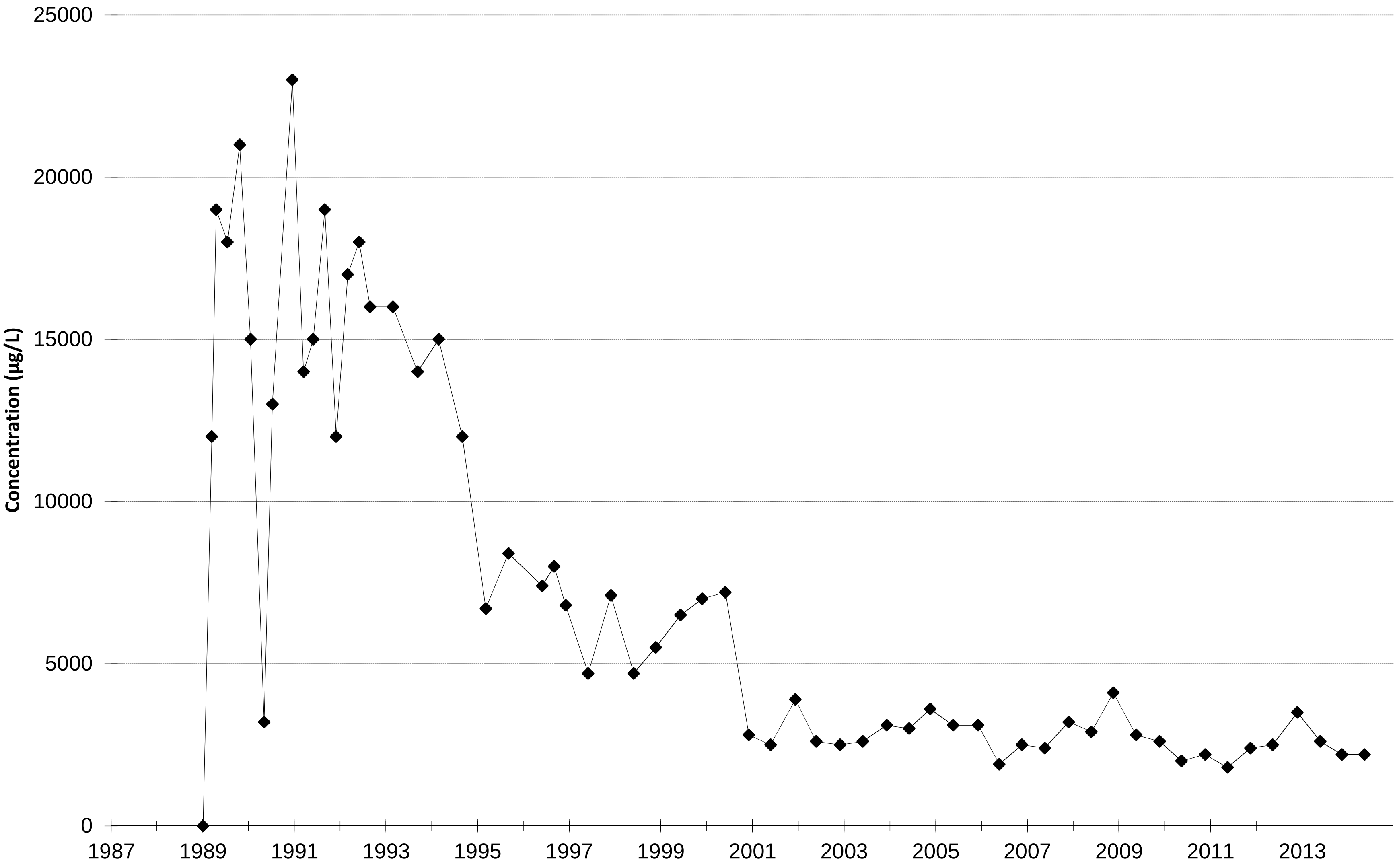
EXTRACTION WELL SC4 - TRCLE VS. TIME

Note: Samples reporting concentrations less than the detection limit were plotted as zero.

CRA 088760 (1)

APPENDIX G-1

EXTRACTION WELL SC5 - TRCLE VS. TIME



Note: Samples reporting concentrations less than the detection limit were plotted as zero.

CRA 088760 (1)

G.2 Influent/Effluent Database (μg/L), Fiscal Year 2014, TGRS, OU2

APPENDIX G-2

INFLUENT/EFFLUENT DATABASE
FISCAL YEAR 2014
TGRS, OU2
ARDEN HILLS, MINNESOTA

			1,1,1-Trichloroethane	*1,1-Dichloroethane*	*1,1-Dichloroethene*	*1,2-Dichloroethane*	*cis-1,2-Dichloroethene*	*Tetrachloroethene*	*Trichloroethene*
	TGRS Cleanup Level [(1)]		*200*	*70*	*6*	*4*	*70*	*5*	*5*
Location	*Date*		*µg/L*	*µg/L*	*µg/L*	*µg/L*	*µg/L*	*µg/L*	*µg/L*
TGRSE	10/3/2013		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	2.4
TGRSE	10/3/2013	D	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	2.4
TGRSE	11/5/2013		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	2.0
TGRSE	11/5/2013	D	0.30 JP	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	2.0
TGRSE	12/3/2013		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	1.9
TGRSE	1/6/2014		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	1.8
TGRSE	1/6/2014	D	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	1.7
TGRSE	2/5/2014		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	1.7
TGRSE	2/5/2014	D	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	1.7
TGRSE	3/4/2014		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	1.7
TGRSE	3/4/2014	D	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	1.6
TGRSE	4/1/2014		0.31 JP	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	2.2
TGRSE	5/8/2014		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	2.1
TGRSE	5/8/2014	D	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	2.1
TGRSE	6/3/2014		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	1.5
TGRSE	6/3/2014	D	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	1.4
TGRSE	7/7/2014		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	1.4
TGRSE	7/7/2014	D	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	1.4
TGRSE	8/5/2014		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	1.8
TGRSE	8/5/2014	D	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	1.8
TGRSE	9/3/2014		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	0.95 JP

APPENDIX G-2

INFLUENT/EFFLUENT DATABASE
FISCAL YEAR 2014
TGRS, OU2
ARDEN HILLS, MINNESOTA

			1,1,1-Trichloroethane	*1,1-Dichloroethane*	*1,1-Dichloroethene*		*1,2-Dichloroethane*	*cis-1,2-Dichloroethene*	*Tetrachloroethene*		*Trichloroethene*
TGRS Cleanup Level [(1)]			***200***	***70***	***6***		***4***	***70***	***5***		***5***
Location	***Date***		***µg/L***	***µg/L***	***µg/L***		***µg/L***	***µg/L***	***µg/L***		***µg/L***
TGRSI	10/3/2013		44	2.8	2.9	<	1.0	5.6	0.97	JP	260
TGRSI	11/5/2013		47	2.6	4.0	<	1.0	2.2	1.3		200
TGRSI	12/3/2013		41	2.3	2.9	<	1.0	2.3	1.1		190
TGRSI	12/3/2013	D	40	2.3	2.9	<	1.0	2.2	1.1		210
TGRSI	1/6/2014		42	2.5	4.1	<	1.0	2.0	1.4		200
TGRSI	2/5/2014		40	2.3	2.8	<	1.0	2.1	1.2		190
TGRSI	3/4/2014		47	2.6	3.2	<	1.0	2.4	1.1		200
TGRSI	4/1/2014		40	2.5	3.5	<	1.0	2.2	0.71	JP	210
TGRSI	4/1/2014	D	41	2.4	3.3	<	1.0	2.3	0.88	JP	200
TGRSI	5/8/2014		41	2.3	3.0	<	1.0	2.2	0.93	JP	190
TGRSI	6/3/2014		37	2.2	2.6	<	1.0	2.2	0.89	JP	190
TGRSI	7/7/2014		44	2.5	4.2	<	1.0	2.3	0.93	JP	220
TGRSI	8/5/2014		39	2.6	4.5	<	1.0	2.7	0.96	JP	210
TGRSI	9/3/2014		46	2.7	3.5	<	1.0	3.0	0.94	JP	230
TGRSI	9/3/2014	D	46	2.7	3.6	<	1.0	3.0	0.97	JP	230

Notes:

[(1)] Cleanup levels for TGRS are from the OU2 ROD.
D - Field Duplicate
JP - Result is qualified as estimated since the detection is below the laboratory quantitation limit.

Appendix H

Operable Unit 3 Statistical Analysis

TABLE H.1

MAROS DECISION MATRIX

Kendall S	***Confidence***	***Coefficient of Varience***	***Trend***
S > 0	> 95%	NA	Definitely Increasing
S > 0	90-95%	NA	Probably Increasing
S > 0	< 90%	NA	No Trend
S</= 0	< 90%	>/= 1	No Trend
S </= 0	< 90%	< 1	Stable
S < 0	90-95%	NA	Probably Decreasing
S < 0	>95%	NA	Definitely Decreasing

TABLE H.2

CONFIDENCE VALUES FOR SIX DATA PAIRS

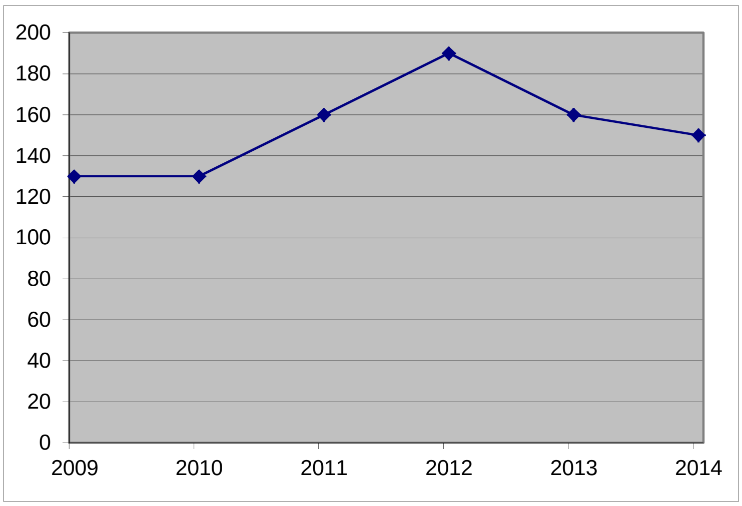
Kendall S	***Confidence***
1	50.00%
3	64.00%
5	76.50%
7	86.40%
9	93.20%
11	97.20%
13	99.17%
15	99.86%

WELL 03M848
MANN-KENDALL STATISTICAL ANALYSIS
OU3 - 2014

Date	TCE (µg/l)	Mann-Kendall Calculation:						
6/17/2009	**130**	1						
6/8/2010	**130**	1	0					
6/24/2011	**160**	1	1	1				
6/1/2012	**190**	1	1	1	1			
6/27/2013	**160**	1	1	1	0	-1		
6/9/2014	**150**	1	1	1	-1	-1	-1	

N	6	5	4	3	2	1	0		15
sum		4	4	0	-2	-1	0	Kendall S	5
Possibles	15								
								Kendall tau	0.333

Mean	153.33
STNDEV	22.5093
COV	0.1468
Trend:	Positive
Confidence (lookup)	76.50%



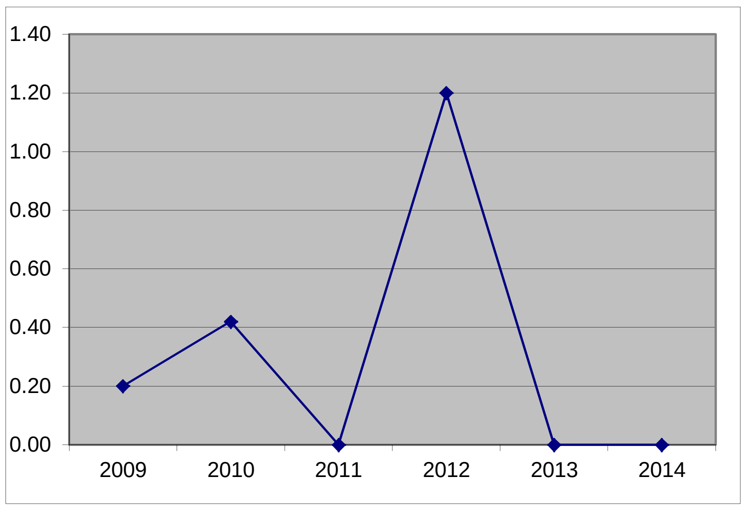
Raw Data
03M848

Date	TCE		Date	TCE	
12/2/1987	440		6/1/2003	450	
4/19/1990	190		6/21/2005	230	
7/19/1990	190		6/13/2006	190	
9/17/1990	330		6/21/2007	150	
3/18/1991	310		6/18/2008	130	
6/4/1991	730		6/17/2009	130	
9/3/1991	700		6/8/2010	130	
3/18/1992	640		6/24/2011	150	
6/3/1992	>50.10		6/24/2011	160	D
6/3/1992	570	D	6/1/2012	190	
9/3/1992	>50.10		6/1/2012	180	D
3/9/1993	1300		6/27/2013	160	
3/9/1993	970	D	6/9/2014	150	
3/17/1994	910		6/9/2014	150	D
3/16/1995	59				
6/21/1996	1400				
6/26/1997	510				
6/29/1998	660				
6/4/1999	700				
6/4/1999	650	D			
6/12/2001	370				

WELL 04U863
MANN-KENDALL STATISTICAL ANALYSIS
OU3 - 2014

Date	TCE (µg/l)	Mann-Kendall Calculation:								
6/18/2009	**0.2**	1								
6/8/2010	**0.42**	1	1							
6/23/2011	**0**	1	-1	-1						
6/1/2012	**1.2**	1	1	1	1					
6/26/2013	**0**	1	-1	-1	0	-1				
6/9/2014	**0**	1	-1	-1	0	-1	0			
N		6	5	4	3	2	1	0		15
	sum		-1	-2	1	-2	0	0	Kendall S	-4
Possibles		15								
									Kendall tau	-0.267

Mean	0.30
STNDEV	0.4700
COV	1.5493
Trend:	Negative
Confidence (lookup)	70.25%



Raw Data

04U863	Date	TCE	Date	TCE	Date	TCE
	6/9/1994	5.1	12/3/2002	0.12 JP	6/26/2013	<1
	9/14/1994	2.64	3/3/2003	<1	6/9/2014	<1
	12/7/1994	8.05	6/3/2003	<1		
	3/9/1995	7.05	9/10/2003	<1		
	6/12/1995	5.04	12/15/2003	0.26 JP		
	6/4/1996	4.59	3/15/2004	0.43 JP		
	9/16/1996	1.84	6/15/2004	<1.0		
	12/4/1996	4.73	9/15/2004	0.3 JP		
	6/3/1997	1.54	10/27/2004	0.21 JP		
	6/25/1998	1.15	6/22/2005	0.45 JP		
	6/7/1999	1.3	9/29/2005	0.27 JP		
	12/21/1999	0.69 JP	12/21/2005	0.33 JP		
	3/10/2000	0.51 JP	6/13/2006	0.33 JP		
	6/12/2000	0.67 JP	6/22/2007	0.44 JP		
	9/6/2000	0.6 JP	6/17/2008	0.33 JP, D		
	12/18/2000	0.48 JP, D	6/17/2008	0.39 JP		
	12/18/2000	0.47 JP	6/18/2009	0.2 JP		
	6/14/2001	0.22 J	6/8/2010	0.42 J		
	3/15/2002	0.11 JP	6/8/2010	0.4 J, D		
	6/15/2002	<1	6/23/2011	<1		
	9/15/2002	<1	6/1/2012	1.2		

Appendix I

Annual Site Inspection Checklist for Land Use Controls

ANNUAL SITE INSPECTION CHECKLIST FOR LAND USE CONTROLS

Operable Unit 2, New Brighton/Arden Hills Superfund Site

Date: JULY 30, 2014

Inspected by: JIM BARD, MARY LEE, MATT BOWERS

Period Covered: From prior annual inspection (7/12/12) to above date

	BLANKET LUCs				OTHER LUC AREAS	SITES WITH ADDITIONAL LUCs FOR SOIL COVERS							
					Area w/Restricted Commercial Use	C	D	E	G	H	I	129-15	Outdoor Firing Range
Property owner:	BRAC	N.G.	Reserve	R.C.	N.G.	BRAC	N.G.	N.G.	N.G.	N.G.	R.C.	N.G.	N.G.
Soil LUCs													
Are there any land uses that result in a non-compliant exposure versus the exposure assumptions described in the LUCRD?	NO	NO	NO	NO	NO	(Soil LUCs are covered under the Blanket LUCs)							
Soil Cover LUCs													
Has there been any excavation activity or any other man-made soil disturbance at the site?	N/A	N/A	N/A	N/A	N/A	No	No	No	No	No	N/A	No	No
Are there any areas of the soil cover that have inadequate vegetative cover?	N/A	N/A	N/A	N/A	N/A	No	No	No	No	No	N/A	No	No
Has there been any damage to run-on/runoff controls (swales, berms, riprap, etc.)?	N/A	N/A	N/A	N/A	N/A	No	No	No	No	No	N/A	No	No
Has there been any damage to or removal of the signs marking the edge of the soil cover?	N/A	N/A	N/A	N/A	N/A	No	No	No	No	No	N/A	No	No
If the soil cover has a permeability requirement, is there any woody vegetation present that exceeds 2-inch diameter?	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	No	N/A	N/A	N/A	N/A
Has there been any damage to or removal of the concrete slab that serves as a protective cover?	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	No	N/A	N/A
Groundwater LUCs													
Have any wells been installed that withdraw water from a contaminated aquifer, without MDH/MPCA/USEPA approval?	No	No	No	No	(Groundwater LUCs are covered under the Blanket LUCs)								
Has there been any damage to or interference with any groundwater remedy infrastructure (wells, piping, treatment systems, etc.)?	No	No	No	No									

Comments (Attach additional pages as necessary):

BRAC = Base Realignment and Closure Division N.G. = MN Army National Guard/National Guard Bureau Reserve = U.S. Army Reserve R.C. = Ramsey County

Certification:

Based on the annual site inspection, the undersigned hereby certifies that the above-named property owners and above-described land use controls have been complied with for the period noted. Alternatively, any known deficiences and completed or planned actions to address such deficiencies are described in the attached Explanation of Deficiency(ies).

Michael R. Fix (Commander's Representative)

Description of Deficiency(ies) attached? ☐ Yes ☒ No (none were identified)