FISCAL YEAR 2013 ANNUAL PERFORMANCE REPORT
NEW BRIGHTON/ARDEN HILLS SUPERFUND SITE

Prepared for:

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ALLIANT TECHSYSTEMS INC.
CONESTOGA-ROVERS & ASSOCIATES, INC.
STANTEC CONSULTING CORPORATION

October 2014
Final Report

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

October 8, 2014

REPLY TO THE ATTENTION OF: SR-6J

James R. Bard
Interim TCAAP Project Manager
U.S. Army Environmental Command
West Branch, C&MRD
JBSA Fort Sam Houston, TX 78234

RE: Consistency Test for the Fiscal Year 2013 Annual Performance Report, New Brighton./Arden Hills Superfund Site, Arden Hills, Minnesota

Dear Mr. Bard:

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 2013 Annual Performance Report for the New Brighton/Arden Hills Superfund Site (FY13 APR). Our review of the FY13 APR included the following documents and communications:

- Fiscal Year 2013 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., and Stantec Consulting Corporation, February 2014;
- U.S. EPA comments on the Draft FY13 APR (April 3, 2014);
- MPCA comments on the Draft FY13 APR (July 17, 2014);
- U.S. Army (Army) responses to U.S. EPA and MPCA comments and redline changes (September 23, 2014).

Based upon our review, you are hereby advised that, in accordance with Chapter XIV of the Federal Facility Agreement, the Fiscal Year 2013 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

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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
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
MCLGs	-	Maximum Contaminant Level Goals

List of Acronyms (Cont.)

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
RD/RA	-	Remedial Design/Remedial Action

List of Acronyms (Cont.)

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 2013 (FY 2013) 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 2013 is defined as the period from October 1, 2012 through September 30, 2013.

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, and 2012
- 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 2013. Following are highlights of the accomplishments for each operable unit, as well as other activities during FY 2013.

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 2013 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 2013, there were no new recommendations for abandonment or alternate water supply.
- The PGAC treated 1.2 billion gallons of water and removed 426 pounds of VOCs during FY 2013. Approximately 23,045 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 2013 was a major 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), and ROD Amendment #4 related to Building 102 shallow groundwater, aquatic sites, and various soil sites (2012). Highlights for activities within OU2 during FY 2013 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 remains 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.
  - The five years of water quality results since the extraction system was shut down show a mix of concentration trends (some increasing and some

decreasing), and may still be collectively reflecting a one-time "wave" of higher concentrations moving through the Site A area.

  - The Army conducted vapor intrusion investigation work in July 2013, and at the end of FY 2013, the Army was preparing an investigation report. However, the Army provided the analytical results to the USEPA and MPCA in August 2013, and these results indicated 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).
  - Continued monitoring and evaluation of MNA is recommended prior to any decision on whether or not to formally change the remedy to MNA; however, it appears that one to two more years of monitoring will be adequate to allow such a determination to be made.
  - The MDH Special Well Construction Area remains in effect. In FY 2013, there were no locations identified in need of well abandonment or alternate water supply.

- 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.
  - Only two monitoring wells located near the source area exceeded the groundwater cleanup level for lead in FY 2013.
  - None of the groundwater or surface water contingency locations exceeded the approved trigger levels in FY 2013.
  - Continued monitoring is recommended prior to any decision on whether or not to formally change the remedy to eliminate the groundwater extraction component.

- Site I Shallow Groundwater
  - Sampling at Site I indicated no significant changes in VOC concentrations in Unit 1 monitoring wells in FY 2013. Groundwater samples were collected from the eight wells scheduled for sampling in FY 2013.
  - 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.
  - EPA/MPCA granted approval to abandon all Unit 1 wells at Site I prior to demolition of Building 502 with the requirement that monitoring well 01U667 be re-installed following Building 502 demolition.

- Site K Shallow Groundwater
  - At Site K, the groundwater extraction trench and treatment system continued to operate as designed. The system captured and treated 2,100,910 gallons of water and maintained a continuous zone of capture down gradient of the former Building 103. A total of 10.07 pounds of VOCs were removed in FY 2013.
  - Groundwater samples were collected from all eleven wells scheduled for sampling in FY 2013. With the exception of relatively stable trichloroethene concentrations in 01U615 and 01U611, the overall trend throughout Site K Unit 1 monitoring wells continues to show a gradual decrease in trichloroethene concentrations over the last fifteen years of sampling.
  - EPA/MPCA granted approval to abandon 13 Unit 1 wells at Site K prior to demolition of the Building 103 slab. The wells will be abandoned in early 2014.

- Building 102 shallow groundwater
  - VOC concentrations decreased significantly in several wells, reversing the increasing trend that had been observed in FY 2011/2012. It appears that

historically high groundwater levels may have contributed to the increasing VOC trends that had been observed in FY 2011/2012.

- Supplemental groundwater investigation work (geoprobe sampling) conducted in July 2013 confirmed that a significant level of attenuation of the VOCs in shallow groundwater is occurring prior to travelling half the distance from 01L582 to Rice Creek.
- 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 June 2012, Pond G surface water was treated to raise the hardness.
  - The two Pond G surface water monitoring events in FY 2013 both indicate that surface water treatment was successful, i.e., the surface water lead results were in compliance with the Minnesota surface water standard.
  - At the end of FY 2013, the Army was preparing responses to USEPA/MPCA comments on a Draft-Final Close Out Report for Pond G, which recommends 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 2013, the total extraction well water pumped averaged 1,759 gpm, which is greater than the Global Operation Strategy (GOS) Operating Minimum (OM) (1,745 gpm).
  - In FY 2013, the TGRS extracted and treated approximately 924,550,600 gallons of water. The mass of VOCs removed was 2,082 pounds and is 282 pounds more than that achieved in FY 2012. The total VOC mass removed by the TGRS through FY 2013 is 209,262 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.

<u>Operable Unit 3 (OU3)</u>

OU1 consists of the “south” plume of VOC groundwater contamination. Highlights for FY 2013 are:

- Groundwater monitoring in FY 2013 was conducted during the annual event. Overall, the statistical evaluation showed the South Plume is decreasing to stable in concentration at its center and stable 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.

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

- Round Lake Feasibility Study
  - At the beginning of FY 2013, with USEPA and MPCA agreement, the Army continued to implement the strategy to revise the Round Lake FS in segments, with the intent to gain agreement/approval at key steps along the way. The Army sought clarifications to USEPA and MPCA comments on revised Sections 1 through 5 of the Round Lake FS (comments provided in September 2012), and then 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 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). As a result, at the end of FY 2013, the Army was preparing a Supplemental RI and FS for Round Lake which will be its best-and-final work product, incorporating a Supplemental Ecological Risk Assessment prepared by ORNL. This document will be a complete document (not in segments), with submittal to the USEPA and MPCA anticipated in early FY 2014.

- Site A, 135 Primer/Tracer Area, and MNARNG EBS Area Soil Removal Actions
  - 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 two of the 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 soil areas of concern, collectively. The Army submitted a Draft-Final Removal Action Completion Report documenting implementation of this work in August 2013. At the end of FY 2013, the Army was preparing responses to USEPA and MPCA comments.

Table 1-1

Status of Remedial Actions: FY 2013

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 2013

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	
#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 2013

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 2013

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 2013

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 2013

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 2013

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	No	At the end of FY 2013, Army was preparing responses to USEPA/MPCA comments on the Draft-Final Pond G Close Out Report
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 2013

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 2013 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 2013 (FY 2013) extended from October 1, 2012 through September 30, 2013.

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, and 2012
- 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 2013, 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 2013 through FY 2017. The monitoring plan covers a moving 5-year time span (i.e., next year FY 2013 will drop off and FY 2018 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, Stantec Consulting Corporation (Stantec) prepared Sections 8.0 and 9.0, and Conestoga-Rovers & Associates, Inc. (CRA) prepared Sections 12.0 and 13.0. Wenck, Stantec, and CRA all 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, 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 is 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 2013 Monitoring Plan for Groundwater Monitoring Wells
- FY 2013 Monitoring Plan for Remedial Treatment Systems
- FY 2013 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 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 2013 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 2013 Monitoring Plan. Data was collected, verified, and validated in accordance with two separate Quality Assurance Project Plans (QAPPs): "QAPP for Performance Monitoring", (Wenck, Revision 11, March 23, 2012) and "QAPP for Monitored Natural Attenuation of Building 102 Groundwater", (Wenck, Revision 5, March 23, 2012). The Building 102 QAPP is applicable to only that specific site, and all other sites are covered by the Performance Monitoring QAPP.

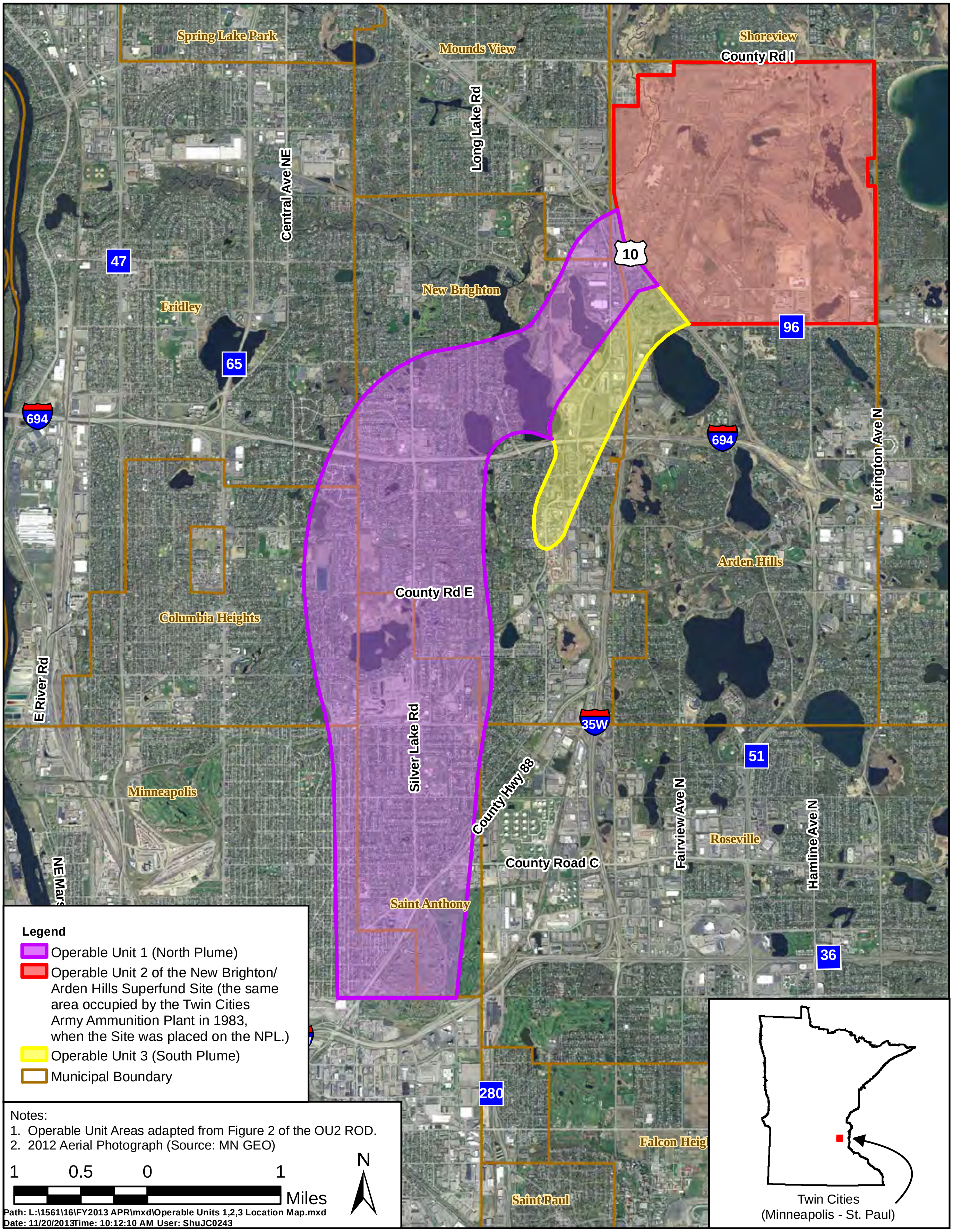
The data tables in the various report sections and the comprehensive water quality databases (Appendix D.1) show the data qualifiers that were assigned to the data as a result of data verification and/or data validation. The data qualifiers assigned to FY 2013 data are explained in the footnotes of the 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 2013. The final MPCA/USEPA approval letter for the FY 2013 DURs is included in Appendix C.3.

With regard to completeness, Appendix C.2 summarizes any deviations from the FY 2013 Monitoring Plan. The field and laboratory completeness <u>goals</u> for performance monitoring are both 95%, except that the completeness goals for TGRS effluent, Site K effluent, Pond G, and well inventory are 100%. <u>Actual</u> 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 <u>actual</u> 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 <u>goals</u> 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 16%, 11% and 12% for performance monitoring; and 17%, 17% and 17% 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, Pond G, 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 2013 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

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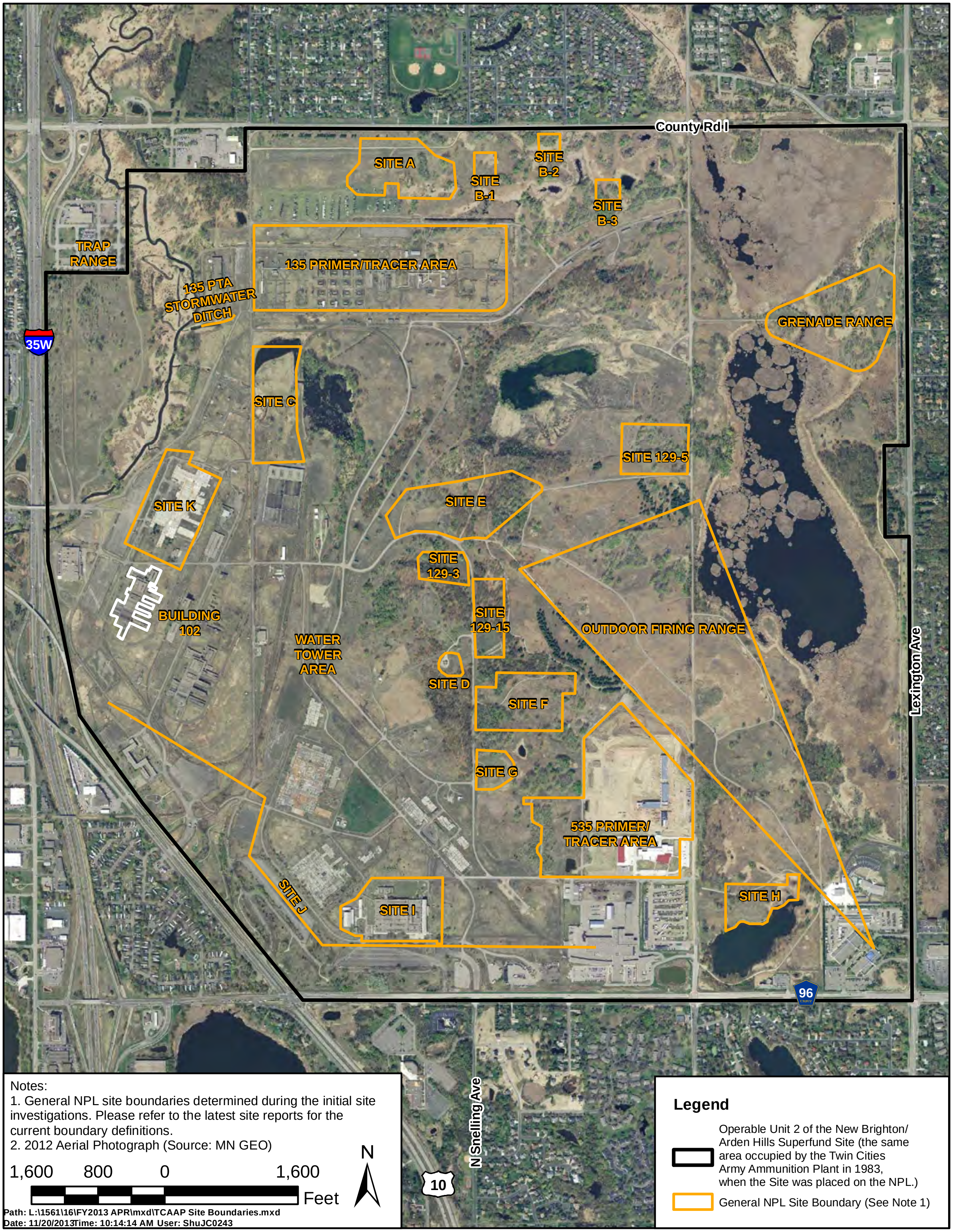
FY 2013

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. 2012 Aerial Photograph (Source: MN GEO)

1,600 800 0 1,600
Feet

N

Path: L:\1561\16\FY2013 APR\mxd\TCAAP Site Boundaries.mxd
Date: 11/20/2013 Time: 10:14:14 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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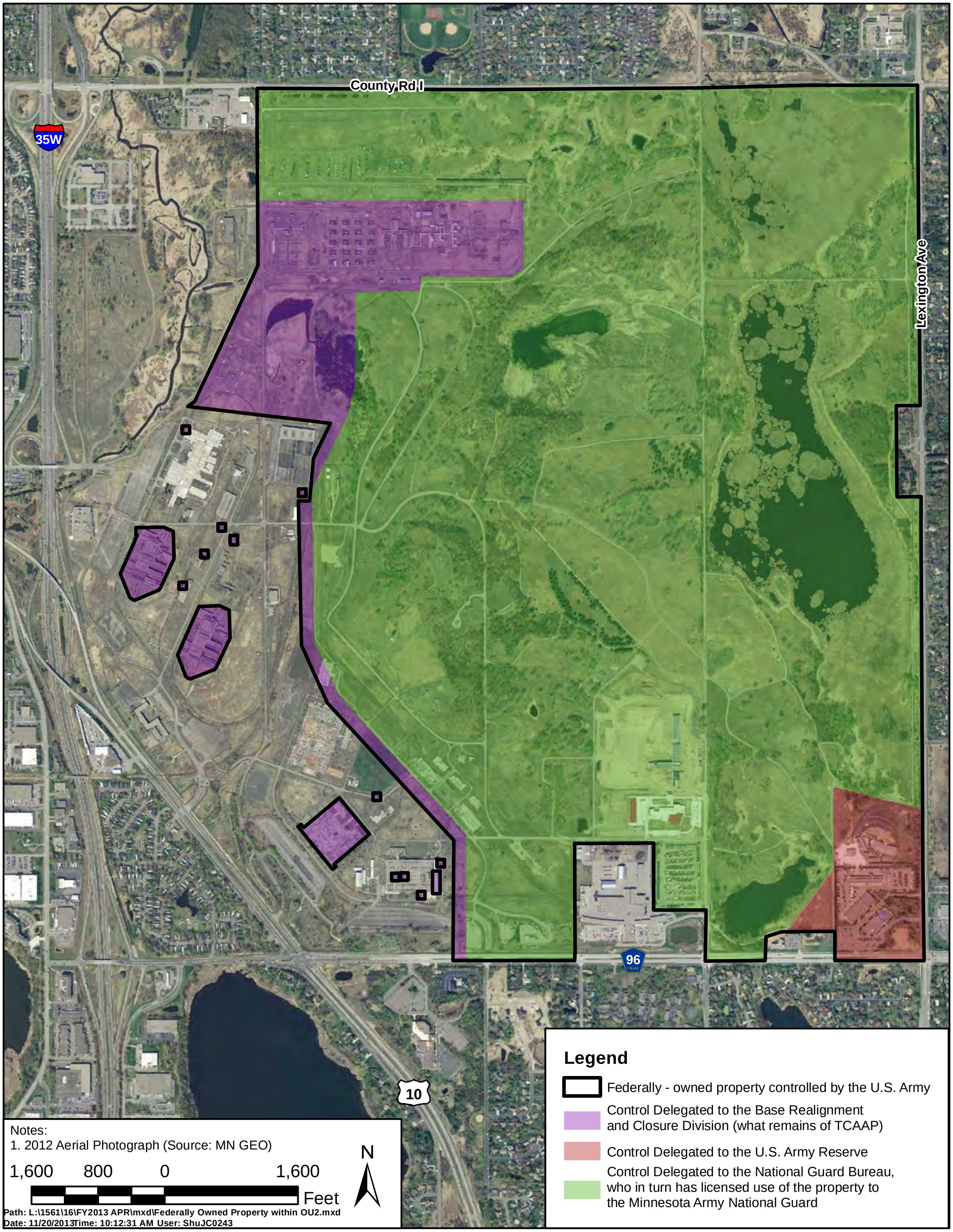
FY 2013

Figure 2-2



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Federally - Owned Property
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FY 2013

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 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 2013, 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 2013. The well inventory study area encompasses the FY 2013 area of concern. The next scheduled “major” sampling event is FY 2015.

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 2013 (outside of those included in the OU1 performance monitoring plan)? If yes, what were the findings?
Yes. Eight water supply wells within the area of concern were sampled in FY 2013. Some water supply wells that were scheduled to be sampled in FY 2013 were not sampled because the well owner refused to provide access or did not respond to the request for access. Of the eight wells sampled, six had no VOC detections. One well (200180) had detections that were below the respective TCAAP cleanup level / MDH Health Risk Limit. One well (2935 Old Hwy 8) had VOC detections where 2 of the 3 detections slightly exceeded the MDH Health Risk Limit; however, none of the VOCs detected were TCAAP Chemicals of Concern (Appendix E).

Were any well owners offered an alternate water supply and/or well abandonment during FY 2013? No. Well 200180 did not merit an offer since the detections were below the respective TCAAP cleanup level / MDH Health Risk Limit, nor did it merit an "early offer," given that the well is used for golf course irrigation (it is not a drinking water supply). The well at 2935 Old Hwy 8 did not merit an offer as the detections were not TCAAP Chemicals of Concern.

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 2014 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. 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 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.

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 Army 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 2013, 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. Table 3-1 shows the volume of water pumped by the NBCGRS during FY 2013 was 1,196 million gallons, which translates to a daily average of 3.3 MGD. Hence, the pumping in FY 2013 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 2013.

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 2013: one in September-October 2012 and one in March-April 2013.

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, with the following exceptions (as noted in Appendix C.2):

- 200804 (St. Anthony #3): This municipal well was not in service in June 2013.
- 206688 (Cloverpond): Not in operation at the time of sampling (electrical service supplying the pump for this private well had been disconnected by the owner at the time of the June sampling).
- 512761 (Gross Golf Course #2): Not in operation at the time of sampling (due to wet weather, the well owner had not yet put this well into operation at the time of the June sampling).

FY 2013 was a “major” sampling year.

Is any groundwater monitoring proposed prior to the next report? Yes.

- 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 decreased between the start of pumping and 1998, and have been relatively stable since then, though both show a slight upward trend since 1998. At NBM #5, trichloroethene concentration appeared to transition from downward to a more stable trend in FY 2013. At NBM #6, trichloroethene has gone through periods of downward trends followed by stable trends since 1998, but appears to be trending down again in FY 2013. At NBM #14, the trichloroethene concentrations show a continuing trend below or at the cleanup level for TCE in OU1 (5 µg/L). At NBM #15, the trichloroethene continued to trend downward compared with historical values, although the trend has leveled out since 2009. Overall, the water quality data from the extraction wells supports the interpretation that the system is providing aquifer restoration.

Figure 3-3, Figure 3-4, and Figure 3-5 show the trichloroethene plumes in the Upper Unit 3, Lower Unit 3, and Unit 4 portions of the aquifer for FY 2013, along with cross-section lines. Cross-sections showing the plumes are presented in Figure 3-6, Figure 3-7, and Figure 3-8. These figures show both the OU1 and OU3 plumes, which overlap to some extent and should be viewed together. Figure 3-1 shows the Upper Unit 4 1 µg/L trichloroethene contour for 1990, 1999, 2009, and 2013 to help illustrate how the edge of the plume has changed over this time. Figure 3-9 shows how the Upper Unit 4 100 µg/L trichloroethene contour has changed over the same time period. In general, the plumes continue to show overall decreasing concentrations (see statistical analysis below) while, as Figure 3-1 and Figure 3-9 show, the plume foot print remains similar to 2009.

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 2013 was a major sampling year, so new comprehensive plume mapping was completed (Figures 3-3 through 3-8). Table 3-4 presents the FY 2013 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 2013 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 2013. 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 51 µg/L in FY 2013, up slightly from 46 µg/L in FY 2012. 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:

Six wells exhibited "increasing" or "no trend" trends in FY 2013, which triggered the thresholds identified for Group 2. Below is additional discussion of these six wells, in the order they are presented in Table 3-5:

409549 (Increasing): Concentrations increased from 28 µg/L in FY 2005 to 61 µg/L in FY 2011 and 2013. The trend statistics indicate high confidence the trend is upward. This well is in the central part of the north plume and the trend most likely reflects heterogeneity as the plume migrates through the area. Since it is in the center of the plume, it is in the flow path of the capture area of the NBCGRS. Since it is many years of travel-time beyond the TGRS, and in a part of the plume that is expected to vary over time, the trend is not indicative of a capture problem at the TGRS. The historical high concentration at the well was 220 µg/L in FY 1988.

409557 (Increasing): Concentrations increased from 27 µg/L in FY 2005 to 66 µg/L in FY 2013. This well is in the Unit 3 between the North and South Plumes and the trend most likely reflects lateral dispersion between the plumes. This dispersion can be reasonably expected as the plume ages and pumping patterns change. These findings do not indicate any problem with capture at the TGRS.

03U805 (No Trend): Concentrations increased to 19 µg/L in FY 2013. This well is part of the TGRS deep groundwater monitoring and is located on the southern edge of the north plume immediately down gradient of the TGRS. The increase in FY 2013 likely indicates a minor shift in the axis of the plume rather than any problem with capture at the TGRS.

04U841 (No Trend): Concentrations have ranged between 18 and 24 µg/L since 2003, and hence are relatively stable. This well is located on the southern edge of the north plume immediately down gradient of the TGRS.

04U843 (Increasing): Concentrations at this well have been erratic but generally increasing since its installation in 1987. As shown on the OU1 plume map (Figure 3-5) the well is along the northwest edge of the North Plume where contamination appears to be turning south toward the NBCGRS. It is located downgradient of the VOC "hot spot" at 04U847. Since the 04U847 area is outside of the TGRS capture zone, this well can be expected to increase as migration of the hot spot continues. This well has not approached the magnitude of 04U847, which has exceeded 1,000 µg/L over most of its history. This suggests that the hot spot is attenuated as it migrates and/or is located east of 04U843. The long-term trend for this well is unusual compared to overall decreases throughout the plume. Well 04U855 provides a monitoring point downgradient of 04U843 to define the edge of the plume adequately. Given that well 04U843 is close to the core of the plume, the trend most likely indicates long-term redistribution of the plume in this area. This does not impact the capture provided by the NBCGRS or suggest a problem with TGRS capture.

04U846 (No Trend): Concentrations fluctuated between 4.2 µg/L and 21 µg/L from FY 2003 to FY 2013. Historically this well has been erratic with a maximum concentration of 120 µg/L in FY 1988. It is located along the southeast edge of the North Plume in an unusually tight bend in the plume as it enters the immediate hydraulic influence of the NBCGRS. The erratic trend seems to reflect the unusual plume shape in this area. The proximity to the NBCGRS has likely created varying flow patterns in this area suggesting the erratic trend history reflects redistribution of the plume over time.

The key factors that apply to Group 2 (from Table D.2.8, Appendix D) are contaminant concentrations, risk to human health and urgency of response needed. Except for 04U843, the data are generally well within historical ranges, and all locations are within the capture zones of the remedial systems. The trend at 04U843 is consistent with the migration of the hot spot upgradient of that well. There is nothing dramatic enough in these trends to suggest an expansion of the plume, so an immediate response is not needed. Human health is protected by the remedial systems and the Special Well Construction Area. In the larger context, the overall trends continue to be downward suggesting that these anomalies, while worth monitoring, are not indicative of a larger issue with long-term plume control. The current sampling frequency is adequate to continue to monitor the trends in these wells.

<u>Group 3 and Group 5</u>:

The trend in the Area Weighted Concentration (AWC) for the Group 3 (downgradient sentinel wells) was downward, showing improvement in the plume downgradient of the NBCGRS. The trend in the Group 5 (global plume mass wells) was no trend with an AWC of 43 µg/L, above the calculated mean value of 37 µg/L from 2003 to 2013. The Group 3 AWC was 19 µg/L in FY 2013. The AWC represents a weighted average of the overall Unit 4 plume concentration. For further explanation of how the AWC is calculated see Appendix D.2.

<u>Group 5 Unit 3 Wells:</u>

The Unit 3 portion of Group 5 is presented in Table 3-5. Wells already in Group 2 were not included. No wells in this group triggered a threshold except for 03U822. Other wells included in this group had a MAROS conclusion of decreasing, with the exception of the three abandoned wells included in the group (409597, 409596, and 03U831.)

03U822 (Stable): Concentrations were measured under the 2001-2013 mean of 167 µg/L with a value of 160 µg/L in FY 2013. The raw trend for this well is decreasing.

Group 4:

In Group 4, no wells exceeded the cleanup level during FY 2013.

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, eight OU1 Jordan wells exhibited “Stable”, “No Trend”, or “Increasing” trends in FY 2013, which triggered the thresholds identified for Group 6. Below is additional discussion of these eight 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 represents the entire history of sampling at this well. This ‘extended trend’ is included in Appendix D. The extended trend is decreasing, suggesting improvement over the nine years of monitoring. Continued annual monitoring is appropriate at this well given its central location in the plume.

Well 04J708 (Stable): All concentrations except for the FY 2013 concentration are below 5 µg/L, so a stable trend is acceptable. The FY 2013 concentration was 5.2 µg/L.

Well 04J713 (No Trend): Concentrations are below 0.15 µg/L, so “no trend” is not significant. The FY 2013 result was non-detect.

Two Jordan wells near the NBCGRS (04J836, 04J838) show No Trend and Increasing results, respectively. These results are not alarming, considering that they are likely due to the variability of pumping rates at the NBCGRS wells, which can cause plume shifts in the adjacent area. Also, the Jordan well in this area that had the historically highest concentrations (04J837) shows a downward trend from 147 µg/L in FY 1998 to 2.2 µg/L in FY 2013.

Well 04J839 (No Trend): Concentrations are below 5 µg/L, so “no trend” is not significant. The FY 2013 result was 2 µg/L.

Well 04J834 (Stable): All concentrations are below 0.5 µg/L, so “stable” is not significant. This well is downgradient of the St. Anthony wells.

The Group 6 nested Unit 4 wells are also shown on Table 3-5 and generally correlate with their Jordan partners. This history suggests the NBCGRS is helping to reduce the Jordan concentrations in this area and thus is providing similar long-term improvement. In FY 2013, nine nested Unit 4 wells exhibited “Stable”, “No Trend”, or “Increasing” trends which triggered the thresholds identified for Group 6. Below is additional discussion of these nine wells:

04U836 (No Trend): This well is within the influence of the NBCGRS and so concentrations can be expected to change as the plume shifts.

Well 04U882 (No Trend): This well is downgradient of the St. Anthony wells, and shows no trend while the nested Jordan well 04J882 remains non-detect. This indicates there is no significant downward vertical migration in this area.

Well 04U849 (Increasing): This well shows an increasing trend while the nested Jordan well 04J849 remains non-detect. Concentrations at this well have been erratic but generally increasing. As shown on the OU1 plume map (Figure 3-5) the well is along the west edge of the North Plume where contamination appears to be turning south toward the NBCGRS. It is located downgradient of the VOC “hot spot” at 04U847. Since the 04U847 area is outside of the TGRS capture zone, this well can be expected to increase as migration of the hot spot continues.

Well 04U847 (Stable): The well is located at the VOC “hot spot” and outside the TGRS capture zone.

Well 04U839 (Increasing): All concentrations are below 5 µg/L, so “increasing” is not significant.

Well 04U838 (No Trend): Concentrations spiked at 48 µg/L in FY 2007, but have been less than 2 µg/L since 2009 (the three most recent sampling events).

Well 04U837 (No Trend): The well is located in close proximity to the NBCGRS, so greater variability is expected. The raw trend is decreasing.

Well 04U713 (Stable): All concentrations are below 1 µg/L, so “stable” is not significant.

Well 04U702 (No Trend): All concentrations are below 3 µg/L, so “no trend” is not significant.

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.

Overall Statistical Assessment:

There were individual threshold triggers identified in FY 2013. 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 Groups 1, 3, and 5 shows continuing overall improvement or stability in the plumes. The Group 6 wells correlate with nested Prairie Du Chien wells. Overall, therefore, the monitoring data indicates that aquifer restoration is occurring in the Prairie du Chien and Jordan. The Unit 3 plume appears to be improving and remains limited geographically. The threshold triggers do not indicate a need to change the monitoring program.

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 2013. 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 426 pounds of VOCs during FY 2013. The total cumulative VOCs removed by the NBCGRS is 23,045 pounds. The relative contribution from each extraction well is also shown on Table 3-1.

Figure 3-10 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 2013 slightly decreased compared to FY 2012. The trend in annual mass removal per unit volume pumped increased slightly in FY 2008 from FY 2007 and then decreases slightly every year after that through FY 2013. 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 2013

	WELL #3			WELL #4			WELL #5			WELL #6			WELL #14			WELL #15			System Totals	
MONTH	VOC (ug/l)	WATER TREATED (mgallons)	VOC Mass Removed (lbs)	VOC (ug/l)	WATER TREATED (mgallons)	VOC Mass Removed (lbs)	VOC (ug/l)	WATER TREATED (mgallons)	VOC Mass Removed (lbs)	VOC (ug/l)	WATER TREATED (mgallons)	VOC Mass Removed (lbs)	VOC (ug/l)	WATER TREATED (mgallons)	VOC Mass Removed (lbs)	VOC (ug/l)	WATER TREATED (mgallons)	VOC Mass Removed (lbs)	TOTAL WATER TREATED BY EXTRACTION SYSTEM (Mgallons)	TOTAL VOC'S REMOVED BY EXTRACTION SYSTEM (lbs)
TOTAL GALLONS PUMPED AND VOC'S REMOVED THROUGH SEPTEMBER 30, 2012																			25,219	22,619
OCTOBER	66	24.778	13.649	69	3.537	2.037	52	32.615	14.155	53	1.588	0.702	4.8	0.194	0.008	35	41.757	12.198	104	42.75
NOVEMBER	65	29.642	16.080	61	9.040	4.602	49	22.404	9.162	51	5.002	2.129	2.6	0.157	0.003	25	38.576	8.049	105	40.03
DECEMBER	62	26.201	13.558	57	11.623	5.529	47	14.478	5.679	47	13.011	5.104	2.3	1.806	0.035	23	40.648	7.803	108	37.71
JANUARY	63	28.842	15.165	57	14.304	6.805	50	16.041	6.694	45	8.398	3.154	2.4	0.293	0.006	22	41.032	7.534	109	39.36
FEBRUARY	67	20.649	11.547	61	12.586	6.408	53	14.360	6.352	47	14.336	5.623	2.7	0.189	0.004	23	36.081	6.926	98	36.86
MARCH	0	0.000	0.000	63	17.438	9.169	48	20.631	8.265	37	17.641	5.448	2.6	0.242	0.005	24	44.416	8.897	100	31.79
APRIL	0	0.000	0.000	0	0.260	0.000	53	26.003	11.502	46	12.846	4.932	2.7	3.082	0.069	29	41.689	10.090	84	26.60
MAY	0	11.418	0.000	0	0.274	0.000	48	18.225	7.301	44	10.139	3.723	2.7	2.586	0.058	28	29.175	6.818	72	17.90
JUNE	67	10.725	5.997	72	0.269	0.162	43	19.737	7.083	43	14.185	5.091	2.3	0.218	0.004	24	30.075	6.024	75	24.36
JULY	77	17.606	11.314	86	6.104	4.381	54	34.866	15.714	42	34.131	11.964	1.9	0.138	0.002	4	14.900	0.473	108	43.85
AUGUST	76	12.747	8.085	79	4.517	2.978	49	34.731	14.203	40	42.893	14.319	2.6	0.239	0.005	18	34.112	5.125	129	44.72
SEPTEMBER	77	18.023	11.582	83	1.767	1.224	53	21.816	9.650	41	39.356	13.467	3.5	0.167	0.005	24	22.523	4.511	104	40.44
Subtotal			106.978			43.295			115.760			75.657			0.205			84.447		
% of Total Mass			25.1			10.2			27.2			17.7			0.0			19.8		
TOTAL GALLONS TREATED AND VOC'S REMOVED FOR FISCAL YEAR 2013																			1,196	426.37
TOTAL GALLONS TREATED AND VOC'S REMOVED SINCE SYSTEM START UP																			26,415	23,045

Table 3-2
OU1, PGAC Effluent Water Quality

Fiscal Year 2013

	Influent Well Monitoring						Operational Performance Monitoring															
Sampling	Well	Well	Well	Well	Well	Well	Contactor #1		Contactor #2		Contactor #3		Contactor #4		Contactor #5		Contactor #6		Contactor #7		Contactor #8	
Date	#3	#4	#5	#6	#14	#15	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
GAC replaced in contactors 1A, 2A, 3A, 4A, 5A, 6A, 7A, 8A September 18 - October 5, 2012. "B" Vessels become the Lead Vessels.																						
9-Oct-12	66	69	52	53	5	35	NS	0	NS	0	NS	0	NS	0	NS	0	NS	0	NS	0	NS	0
13-Nov-12	65	61	49	51	3	25	NS	0	NS	0	NS	0	NS	0	NS	0	NS	0	NS	0	NS	0
11-Dec-12	62	57	47	47	2	23	NS	0	NS	0	NS	0	NS	0	NS	0	NS	0	NS	0	NS	0
8-Jan-13	63	57	50	45	2	22	NS	0	NS	0	NS	0	NS	0	NS	0	NS	0	NS	0	NS	0
4-Feb-13	67	61	53	47	3	23	NS	1.0	NS	1.2	NS	1.6	NS	1.7	NS	1.0	NS	0	NS	0	NS	0
22-Feb-13	NS	NS	NS	NS	NS	NS	NS	1.7	NS	1.8	NS	2.0	NS	2.1	NS	1.4	NS	1.4	NS	1.0	NS	1.1
4-Mar-13	NS	63	48	37	3	24	0	3.5	0	4.2	0	3.7	0	5.5	0	3.3	0	3.7	0	3.0	0	3.1
GAC replaced in contactors 1B, 2B, 3B, 4B, 5B, 6B, 7B, 8B March 26 - April 12, 2013. "A" Vessels become the Lead Vessels.																						
15-Apr-13	NS	NS	53	46	3	29	0	NS	0	NS	0	NS	0	NS	0	NS	0	NS	0	NS	0	NS
6-May-13	NS	NS	48	44	3	28	0	NS	0	NS	0	NS	0	NS	0	NS	0	NS	0	NS	0	NS
11-Jun-13	67	72	43	43	2	24	0	NS	0	NS	0	NS	0	NS	0	NS	0	NS	0	NS	0	NS
9-Jul-13	77	86	54	42	2	4	0	NS	0	NS	0	NS	0	NS	0	NS	0	NS	0	NS	0	NS
6-Aug-13	76	79	49	40	3	18	0	NS	0	NS	0	NS	0	NS	0	NS	NS	NS	0	NS	0	NS
3-Sep-13	77	83	53	41	4	24	0	NS	0	NS	0	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.

3) Well #3 pulled out for scheduled maintenance February 25 - May 8, 2013 and was not in operation at time of March, April, or May sampling.

4) Well #4 pulled out for scheduled maintenance March 28 - May 13, 2013 and was not in operation at time of April or May sampling.

Table 3-3
Summary of OU1 Monitoring Requirements

Fiscal Year 2013

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 2013

			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
03U811[2]		6/10/13	<1	<1	<1	<1	<1	<1
03U821[2]		6/13/13	**16**	JP 0.90	<1	JP 0.65	<1	JP 0.76
03U822		6/17/13	**160**	5.3	1.8	1.4	<1	7.4
03M843		6/6/13	<1	<1	<1	<1	<1	<1
03L811		6/6/13	3.9	1.4	JP 0.39	<1	<1	1.2
03L822		6/17/13	**220**	5.4	3.9	3.1	<1	3.8
03L832[2]		6/11/13	1.4	<1	<1	<1	<1	<1
03L841		6/6/13	<1	JP 0.33	JP 0.65	<1	<1	JP 0.43
03L846		6/6/13	<1	**12**	26	<1	<1	16
04U821[2]		6/13/13	**23**	1.7	<1	JP 0.96	<1	1.4
04U834[2]		6/12/13	JP 0.39	<1	<1	<1	<1	<1
04U836		6/5/13	**23**	2.0	JP 0.47	JP 0.86	<1	1.5
04U837[2]		6/11/13	1.2	<1	<1	<1	<1	JP 0.46
04U838[2]		6/10/13	1.8	<1	JP 0.33 JQ	<1	<1	<1
04U839[2]		6/13/13	1.7	<1	<1	<1	<1	<1
04U841		6/13/13	**18**	2.4	JP 0.82	1.9	<1	2.0
04U843		6/18/13	**170**	**15**	1.8	11	<1	10
04U844		6/18/13	**250**	**19**	3.5	17	<1	13
04U846[2]		6/12/13	**21**	**8.0**	15	<1	<1	12
04U847		6/19/13	**1000**	**49**	7.3	13	<2	41
04U847	D	6/19/13	**960**	**57**	8.4	15	<2	47
04U849		6/17/13	**75**	**6.2**	JP 0.91	3.1	<1	5.2
04U850		6/17/13	**100**	**7.4**	4.1	2.2	<1	6.9
04U855[2]		6/12/13	4.4 JQ	JP 0.30	<1	<1	<1	JP 0.31

Table 3-4
OU1 Groundwater Quality Data

Fiscal Year 2013

			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		6/14/13	**20**	1.4	<1	JP 0.83	<1	2.9
04U872(2)		6/13/13	2.9	<1	<1	<1	<1	JP 0.30
04U875		6/17/13	<1	<1	<1	<1	<1	<1
04U877(2)		6/11/13	JP 0.34	<1	<1	<1	<1	JP 0.36
04U877(2)	D	6/11/13	JP 0.38	<1	<1	<1	<1	JP 0.41
04U879(2)		6/10/13	<1	<1	<1	<1	<1	<1
04U879(2)	D	6/10/13	<1	<1	<1	<1	<1	<1
04U880(2)		6/11/13	<1	<1	<1	<1	<1	<1
04U881(2)		6/12/13	**10**	JP 0.69	<1	JP 0.39	<1	JP 0.89
04U882		6/14/13	**23**	1.4	<1	1.2	<1	1.1
04U883(2)		6/11/13	<1	<1	<1	<1	<1	<1
04J822		6/17/13	**47**	**8.2**	1.4	8.3	<1	5.2
04J834		6/6/13	<1	<1	<1	<1	<1	<1
04J836		6/5/13	**10**	JP 0.87	<1	<1	<1	JP 0.72
04J836	D	6/5/13	**10**	JP 0.91	<1	<1	<1	JP 0.64
04J837(2)		6/12/13	2.2	<1	<1	<1	<1	JP 0.42
04J838		6/14/13	**44**	2.6	JP 0.30	JP 0.86	<1	2.1
04J839(2)		6/13/13	1.9	<1	<1	<1	<1	<1
04J839(2)	D	6/13/13	2.0	<1	<1	<1	<1	<1
04J847		6/19/13	**850**	**57**	8.9	33	<2	43
04J849(2)		6/11/13	<1	<1	<1	<1	<1	<1
04J882(2)		6/10/13	<1	<1	<1	<1	<1	<1
PJ#318		6/18/13	JP 0.88	<1	<1	<1	<1	<1
200154		6/17/13	<1	<1	<1	<1	<1	<1
234546		6/19/13	**14**	JP 0.91	<1	JP 0.32	<1	JP 0.99

Table 3-4
OU1 Groundwater Quality Data

Fiscal Year 2013

			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
409547		6/6/13	1.4	2.5	1.5	1.7	<1	3.9
409548(2)		6/12/13	1.0 JQ	JP 0.31	JP 0.51	<1	<1	JP 0.40
409549		6/14/13	**61**	5.4	JP 0.53	3.3	<1	4.4
409549	D	6/14/13	**61**	5.3	JP 0.86	3.3	<1	4.3
409550		6/14/13	**40**	JP 0.53	<1	2.6	<1	<1
409555		6/6/13	<1	<1	<1	<1	<1	<1
409555	D	6/6/13	<1	<1	<1	<1	<1	<1
409556(2)		6/10/13	<1	<1	<1	<1	<1	<1
409557		6/14/13	**66**	**14**	3.7	5.8	<1	13

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.

(2) Sample receipt temperature at the laboratory was 12°C. All analytes for this sample are qualified JT12, indicating the possibility of very slight loss of the more volatile compounds (potential low bias).

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:									
409549	10	6	Increasing	95.38%	0.5450	Definite	**Increasing**	Yes	Incr. from 28 to 61 µg/L in 6 yrs. Stable at 61 since 2011.
409557	13	6	Increasing	99.17%	0.5730	Definite	**Increasing**	Yes	Near plume center, plume shifted slightly
03L673	-12	6	Decreasing	98.66%	0.2700	Definite	**Decreasing**	No	
03L833	-11	6	Decreasing	97.20%	0.6287	Definite	**Decreasing**	No	
03L848	-1	6	Decreasing	50.00%	0.1409	S or NT	**Stable**	No	
03L859	-11	6	Decreasing	97.20%	0.1238	Definite	**Decreasing**	No	
03U672	0	6	Zero	41.78%	0.0000	S or NT	**Stable**	No	
03U805	5	6	Increasing	76.50%	1.4991	S or NT	**No Trend**	Yes	Near plume center, plume shifted slightly
04U673	-15	6	Decreasing	99.86%	0.1853	Definite	**Decreasing**	No	
04U821	-8	6	Decreasing	89.62%	0.1887	S or NT	**Stable**	No	
04U832	-3	6	Decreasing	64.00%	0.0764	S or NT	**Stable**	No	Between 46 and 56 µg/L since 2006.
04U833	-11	6	Decreasing	97.20%	0.5377	Definite	**Decreasing**	No	
04U841	2	6	Increasing	57.46%	0.1414	S or NT	**No Trend**	Yes	Between 18 and 24 µg/L since 2003.
04U843	15	6	Increasing	99.86%	0.6475	Definite	**Increasing**	Yes	Near plume center, plume shifted slightly
04U845	-3	6	Decreasing	64.00%	0.2706	S or NT	**Stable**	No	See OU3 Discussion
04U846	6	6	Increasing	81.38%	0.5652	S or NT	**No Trend**	Yes	Near plume center, looks stable
04U849									See Group 6 summary.
04U854	-10	6	Decreasing	95.38%	0.1782	Definite	**Decreasing**	No	
04U859	-4	6	Decreasing	70.66%	0.4806	S or NT	**Stable**	No	
04U861 (abandoned)	11	6	Increasing	97.00%	1.0198	Definite	**NA**	NA	Abandoned after 2006 sample, in New Brighton Development.
04U875	-9	6	Decreasing	93.20%	1.0159	Probable	**Decreasing**	No	
04U877	-5	6	Decreasing	76.50%	0.4682	S or NT	**Stable**	No	
206688	-4	6	Decreasing	70.66%	0.0719	S or NT	**Stable**	No	Well not in operation in 2013 sampling.
Group 1 NP	1	6	Increasing	50.00%	0.1379	S or NT	**No Trend**	Yes	Between 36 and 51 µg/L since 2007.
Group 1 SP	0	6	Zero	41.78%	0.0000	S or NT	**Stable**	Yes	Stable, but avg. is <5 µg/L.
Group 3	-10	6	Decreasing	95.38%	0.1013	Definite	**Decreasing**	No	
Group 5	5	6	Increasing	76.50%	0.0984	S or NT	**No Trend**	Yes	Between 33 and 43 µg/L since 2003.

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 5 Unit 3 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 5 Unit 3 Wells:									
409550	-10	6	Decreasing	95.38%	0.5216	Definite	**Decreasing**	No	
409597 (abandoned)	-11	6	Decreasing	99.00%	0.3885	Definite	**NA**	NA	Abandoned due to constr. after 2007 sampling.
409596 (abandoned)	-8	6	Decreasing	90.10%	0.6714	Probable	**NA**	NA	Abandoned due to constr. after 2007 sampling.
03U831 (abandoned)	9	6	Increasing	93.20%	1.5885	Probable	**NA**	NA	Abandoned due to constr. after 2006 sampling.
03U821	-14	6	Decreasing	99.46%	0.2034	Definite	**Decreasing**	No	
03U822	-5	6	Decreasing	76.50%	0.3450	S or NT	**Stable**	Yes	Raw trend is decreasing.
03L822	-13	6	Decreasing	99.17%	0.5121	Definite	**Decreasing**	No	
03L809	-9	6	Decreasing	93.20%	0.6343	Probable	**Decreasing**	No	

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

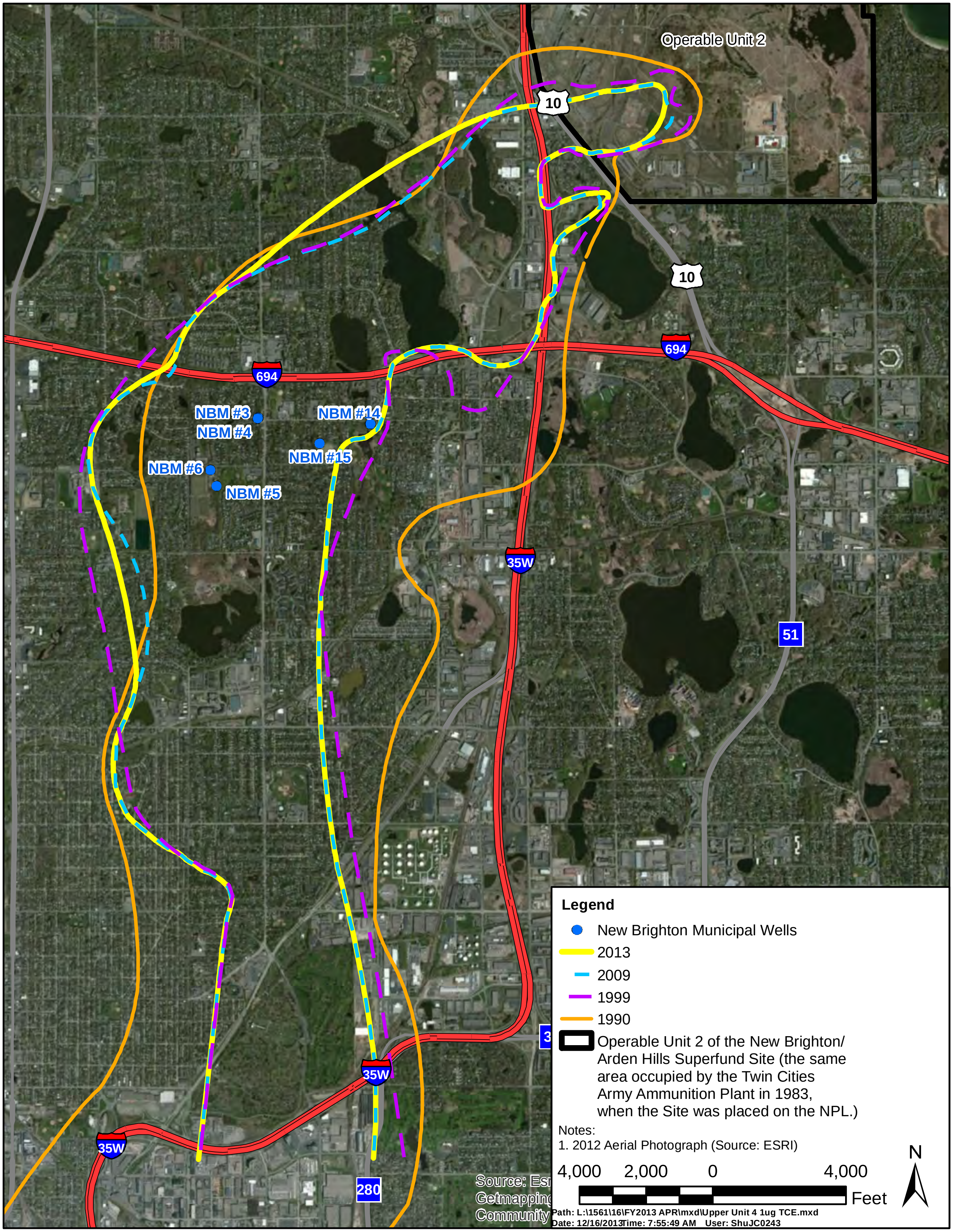
Group	Kendall S	N	Raw Trend	Confidence	COV	Raw Trend Decision	MAROS Conclusion	Threshold Triggered?	Comments
Group 6 OU1 Jordan Wells:									
04J822	-10	6	Decreasing	95.38%	0.2397	Definite	**Decreasing**	No	
04J834	-7	6	Decreasing	86.40%	0.5468	S or NT	**Stable**	Yes	All detection below 0.5 µg/L
04J836	6	6	Increasing	81.38%	0.9637	S or NT	**No Trend**	Yes	All detections at or below 10 µg/L
04J838	15	6	Increasing	99.86%	0.4554	Definite	**Increasing**	Yes	4.2-44 µg/L
04J837	-7	6	Decreasing	86.40%	0.8143	S or NT	**Stable**	Yes	Raw trend is decreasing
04J839	3	6	Increasing	64.00%	0.4825	S or NT	**No Trend**	Yes	All detections below 4 µg/L
04J847	3	6	Increasing	64.00%	0.1022	S or NT	**No Trend**	Yes	Consistent results, mean 787 µg/L
04J849	0	6	Zero	41.78%	NA	S or NT	**NA**	No	All ND
04J882	0	6	Zero	41.78%	NA	S or NT	**NA**	No	All ND
04J077	-11	6	Decreasing	97.20%	0.4343	Definite	**Decreasing**	No	
04J702	-14	6	Decreasing	99.46%	0.7948	Definite	**Decreasing**	No	
04J708	-12	6	Decreasing	76.50%	0.1650	S or NT	**Stable**	Yes	Raw trend is decreasing
04J713	-5	6	Decreasing	76.50%	2.4495	S or NT	**No Trend**	Yes	All detections at or below 0.15 µg/L
Group 6 Nested Unit 4 wells:									
04U077	-11	6	Decreasing	97.20%	0.3505	Definite	**Decreasing**	No	
04U702	5	6	Increasing	76.50%	0.1996	S or NT	**No Trend**	Yes	Detections below 3 µg/L since 2003
04U708	-12	6	Decreasing	98.66%	0.6309	Definite	**Decreasing**	No	
04U713	-6	6	Decreasing	81.38%	0.5518	S or NT	**Stable**	Yes	All detections below 1 µg/L
04U834	-15	6	Decreasing	99.86%	1.3907	Definite	**Decreasing**	No	
04U836	3	6	Increasing	64.00%	0.5530	S or NT	**No Trend**	Yes	18 - 79 µg/L
04U837	-7	6	Decreasing	86.40%	1.3523	S or NT	**No Trend**	Yes	Raw trend is decreasing
04U838	2	6	Increasing	57.46%	1.6174	S or NT	**No Trend**	Yes	Detections below 2 µg/L since 2009
04U839	9	6	Increasing	93.20%	0.5056	Probable	**Increasing**	Yes	All detection below 2 µg/L
04U847	-6	6	Decreasing	81.38%	0.2690	S or NT	**Stable**	Yes	Mean 930 µg/L
04U849	9	6	Increasing	93.20%	0.3395	Probable	**Increasing**	Yes	No evidence of migration to Jordan (04J849)
04U882	5	6	Increasing	76.50%	0.3973	S or NT	**No Trend**	Yes	No evidence of migration to Jordan (04J882)

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

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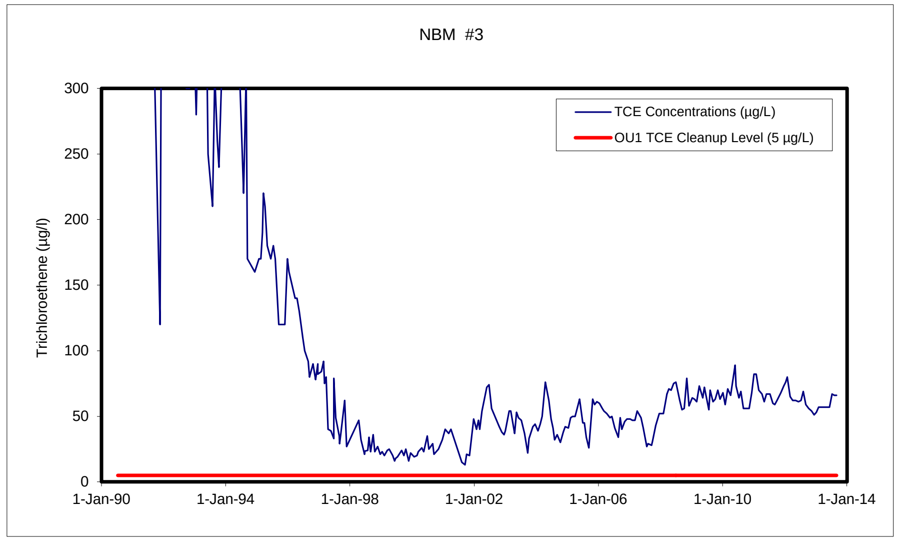
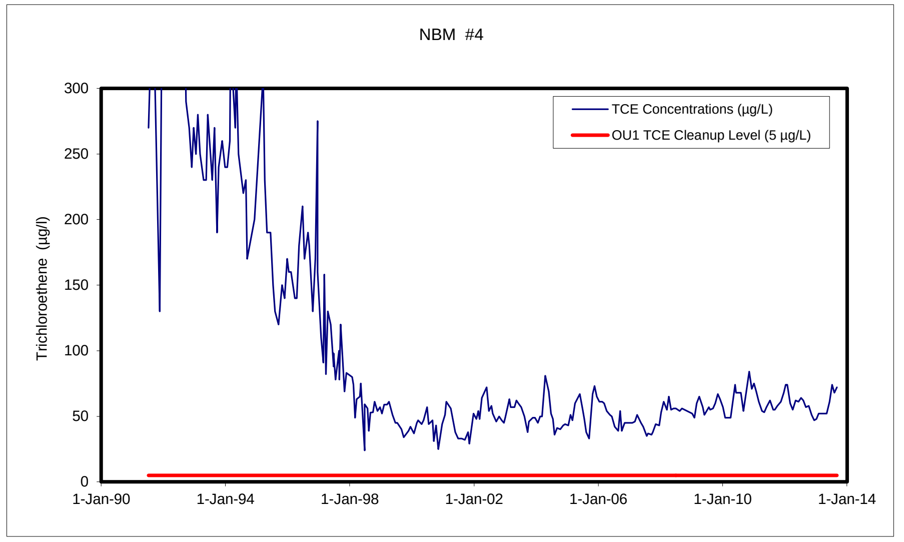
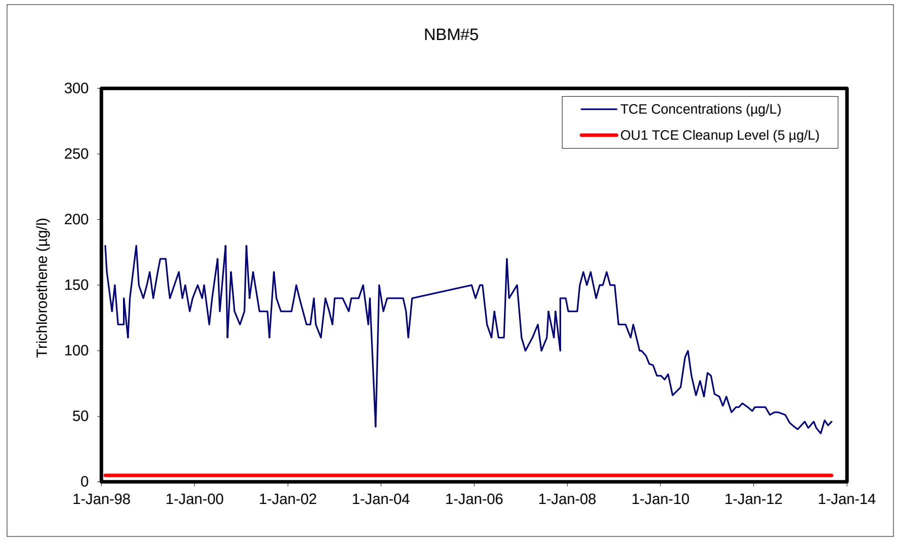
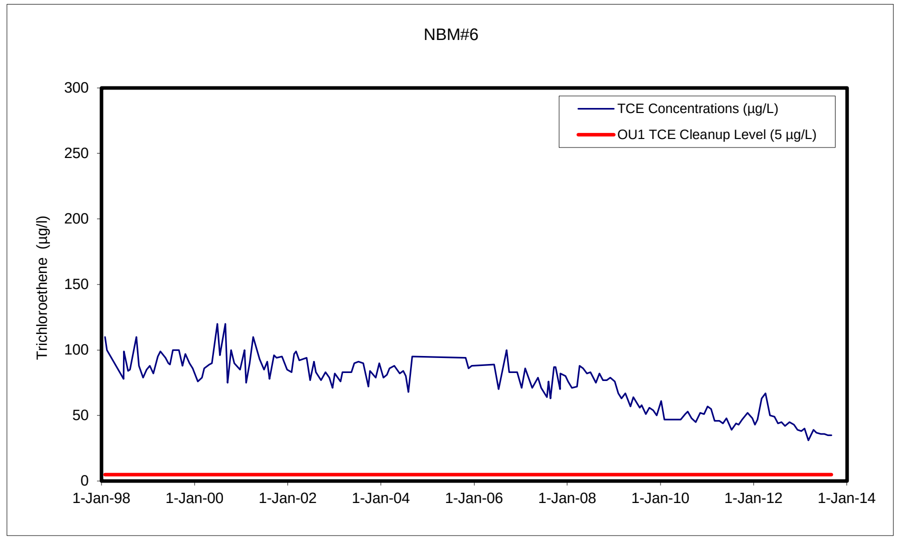
Figure 3-1

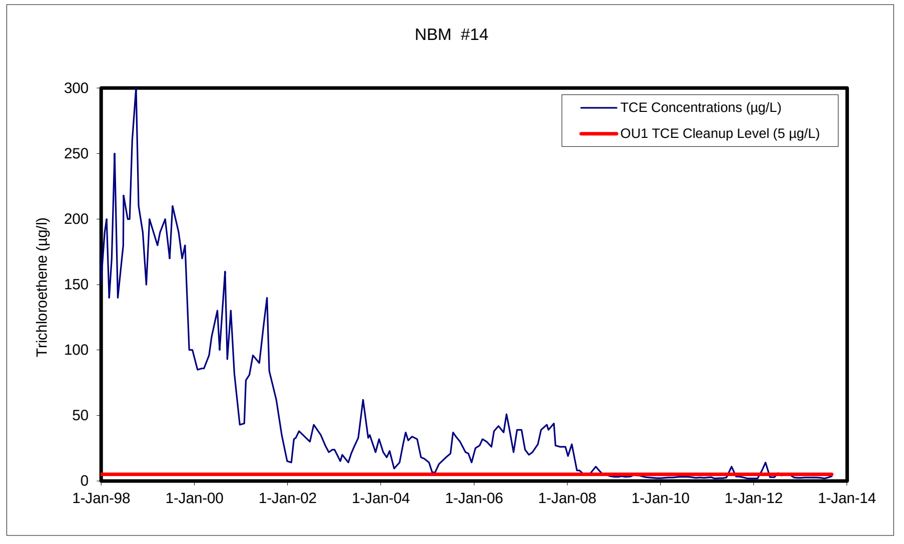
FIGURE 3-2
NEW BRIGHTON MUNICIPAL WELLS: TRICHLOROETHENE WATER QUALITY TRENDS
Annual Performance Report

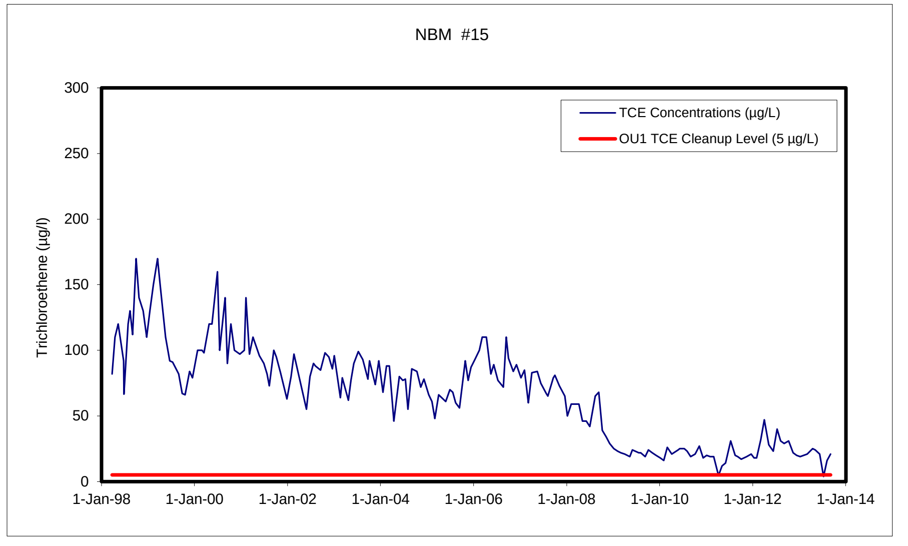


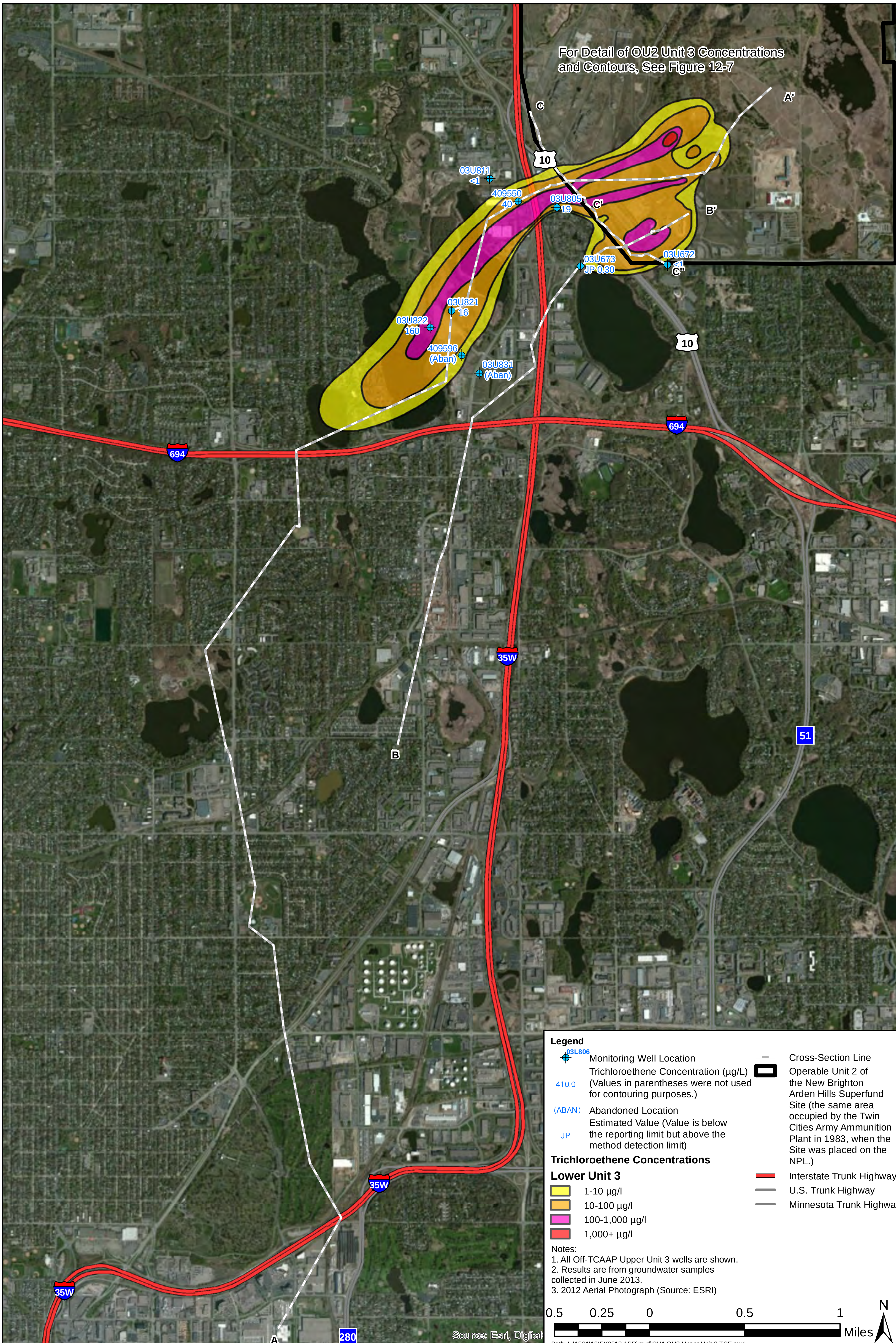












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OU1 & OU3, Upper Unit 3, Trichloroethene Isoconcentration Map, Summer 2013

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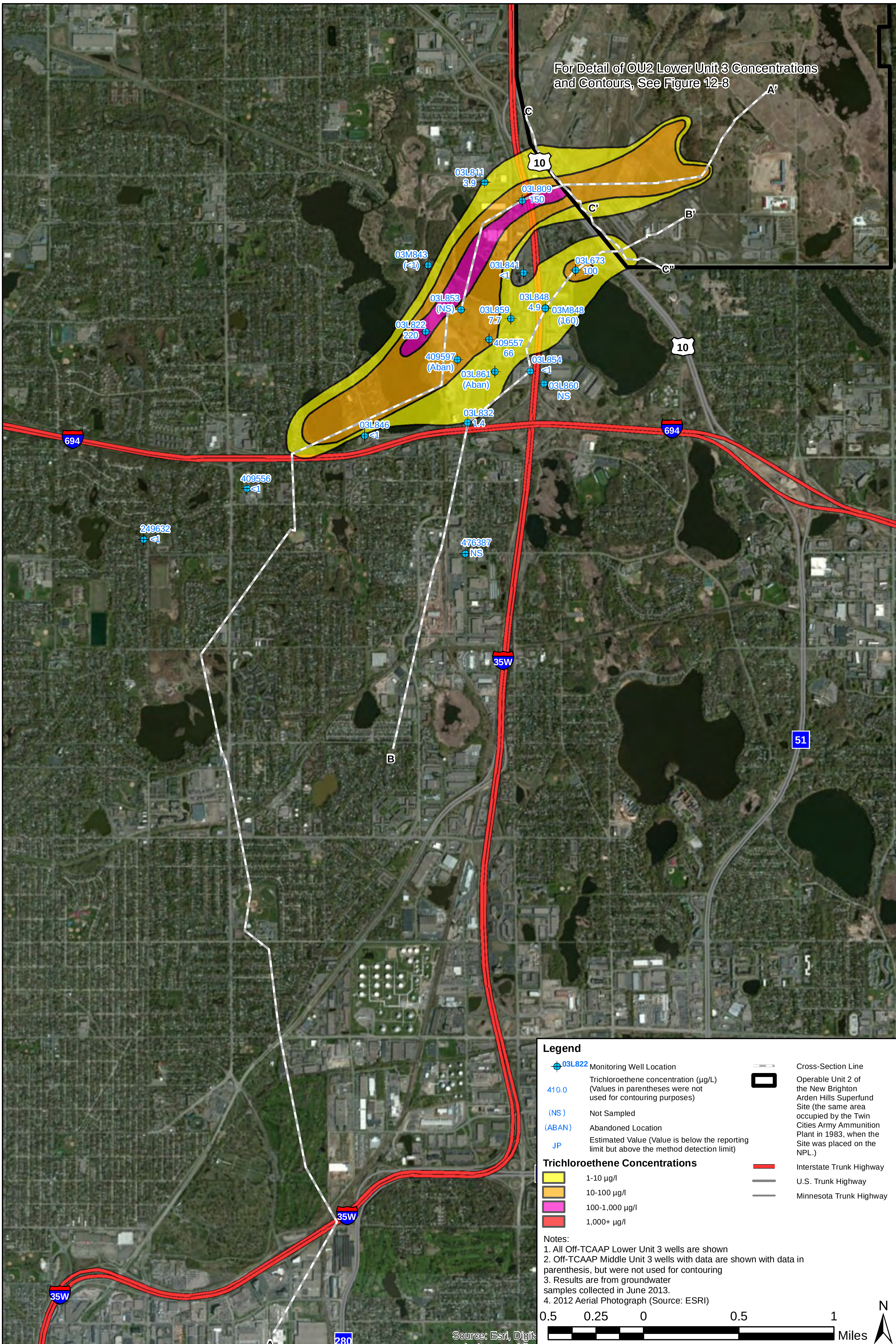
Figure 3-3



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OU1 & OU3, Lower Unit 3, Trichloroethene Isoconcentration Map, Summer 2013

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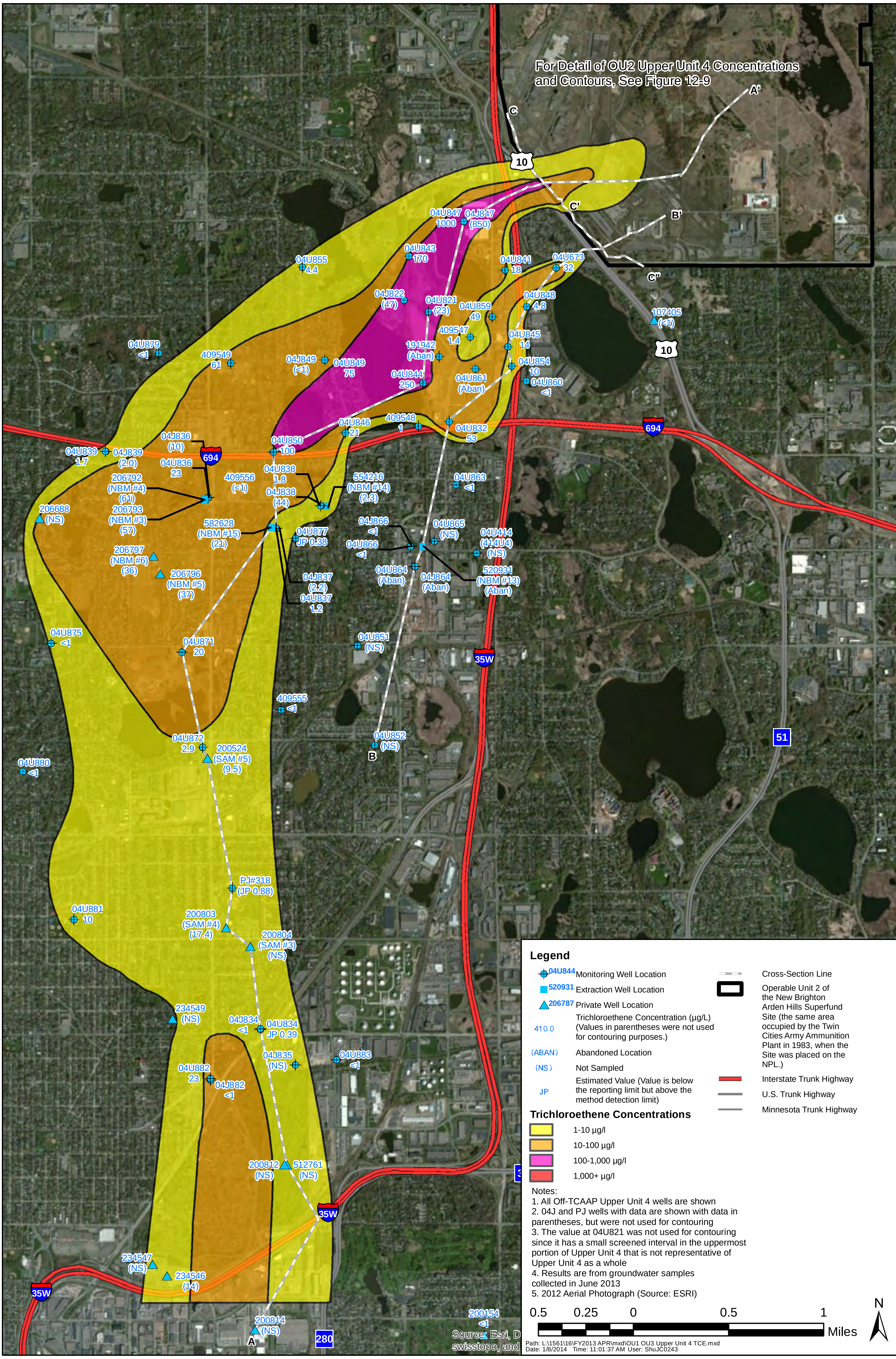
Figure 3-4



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OU1 & OU3, Upper Unit 4, Trichloroethene Isoconcentration Map, Summer 2013

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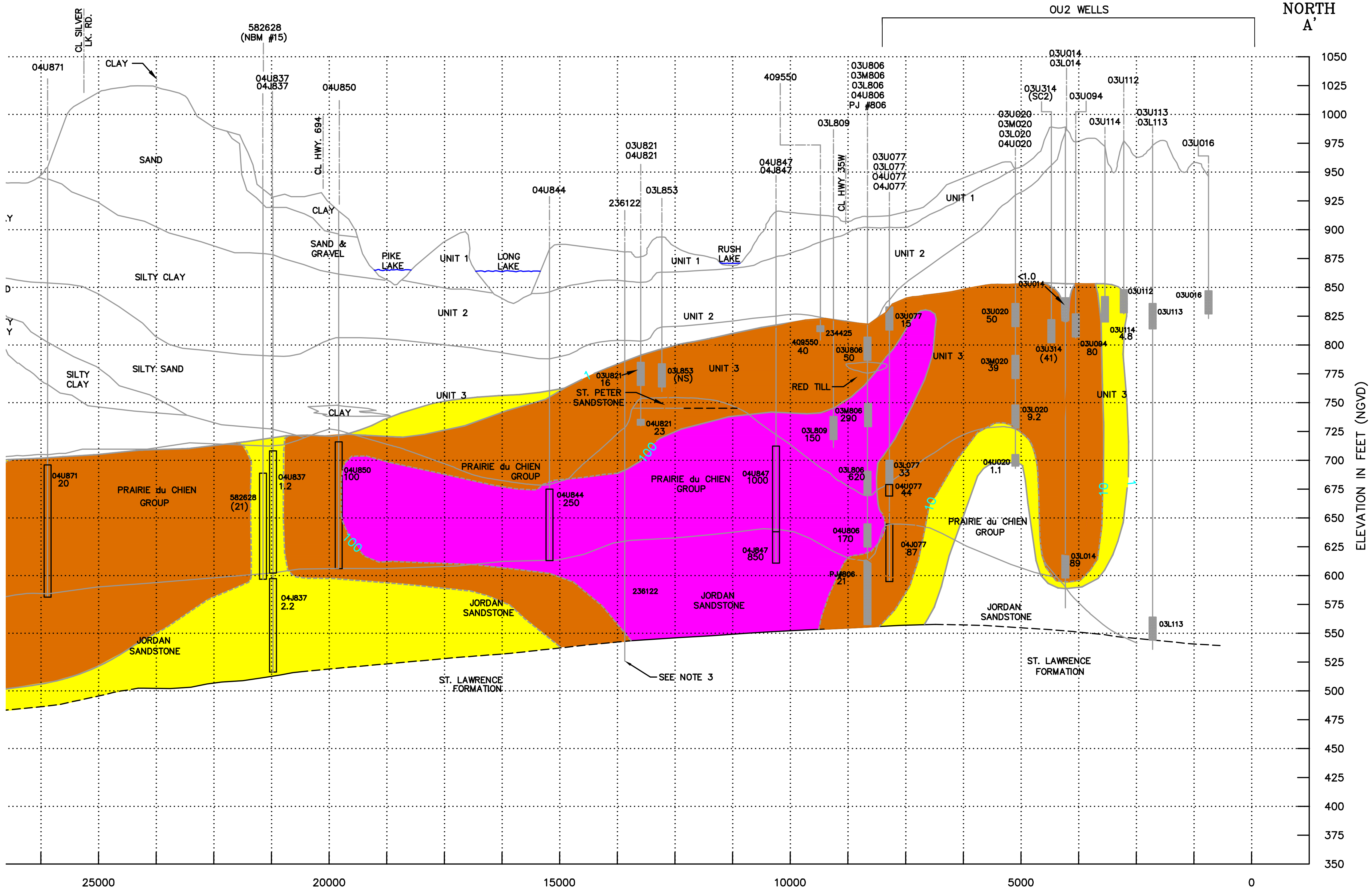
Figure 3-5



NOTES

(1) CROSS SECTION: TOPOGRAPHY CONSTRUCTED WITH DATA FROM U.S.G.S. NEW BRIGHTON 7.5 MINUTE SERIES QUAD MAP DATED 1967 (PHOTOREVISED 1972, AND 1980); WELL LOCATIONS AND THE "LINE" OF SECTION ARE SHOWN ON FIGURES 3-3 THROUGH 3-5.

(2) WELL NESTS, CONSISTING OF INDIVIDUAL WELLS IN THE SAME PROXIMITY, ARE REPRESENTED ON THE CROSS SECTION BY A SINGLE LINE WITH MULTIPLE WELL SCREENS

(3) WELL 236122 HAS BEEN SEALED, BUT IS SHOWN SINCE IT WAS USED TO PREPARE THE CROSS SECTION

LEGEND

GEOLOGIC CONTACT

INFERRED GEOLOGIC CONTACT

SCREENED INTERVAL OF WELL

OPEN HOLE INTERVAL OF WELL

04U806 2500.00 / 04U847 790.00 — TRICHLOROETHENE CONCENTRATION (μg/l) (VALUES IN PARENTHESES WERE NOT USED FOR CONTOURING PURPOSES)

10 — ISOCONCENTRATION CONTOUR (μg/l)

10 — ESTIMATED ISOCONCENTRATION CONTOUR (μg/l)

04U852 (JP 0.48) — THE VALUE IS ESTIMATED BECAUSE THE VALUE IS BELOW THE REPORTING LIMIT, BUT ABOVE THE METHOD DETECTION LEVEL.

(NS) — NOT SAMPLED

M: /1561/2013/SUMMER 2013.DWG

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OU2/OU1 TRICHLOROETHENE CROSS-SECTION A-A' (NORTH HALF), SUMMER 2013

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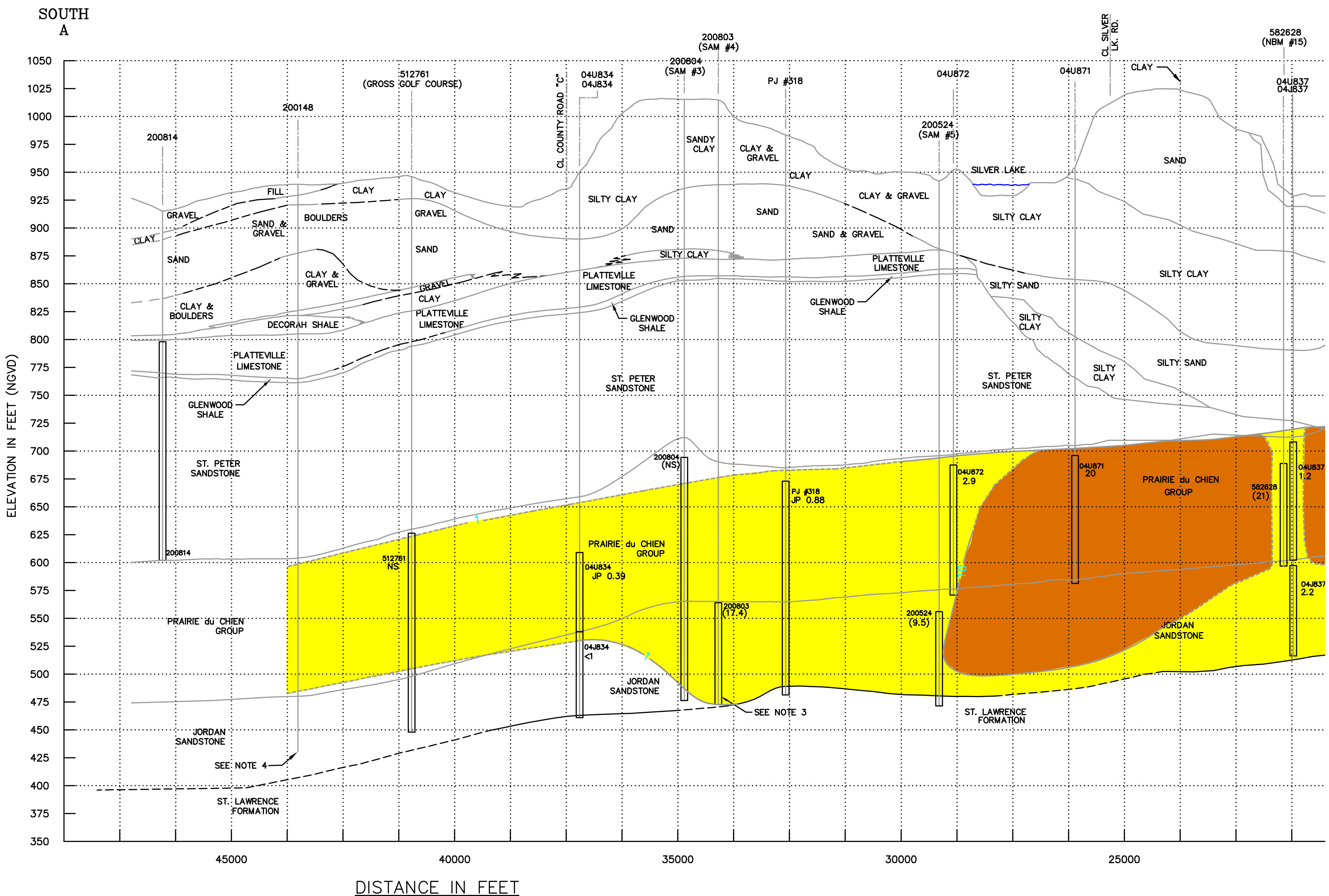
FIGURE 3-6



DISTANCE IN FEET

NOTES

(1) CROSS SECTION: TOPOGRAPHY CONSTRUCTED WITH DATA FROM U.S.G.S. NEW BRIGHTON 7.5 MINUTE SERIES QUAD MAP DATED 1967 (PHOTOREVISED 1972, AND 1980); WELL LOCATIONS AND THE "LINE" OF SECTION ARE SHOWN ON FIGURES 3-3 THROUGH 3-5.

(2) WELL NESTS, CONSISTING OF INDIVIDUAL WELLS IN THE SAME PROXIMITY, ARE REPRESENTED ON THE CROSS SECTION BY A SINGLE LINE WITH MULTIPLE WELL SCREENS

(3) NO INFORMATION WAS PROVIDED ON THE WELL LOG FOR 200803 (SAM #4) CONCERNING WELL CONSTRUCTION DETAILS, ESPECIALLY THE OPEN HOLE INTERVAL. AS THIS IS REFERRED TO AS A JORDAN WELL, THE OPEN HOLE WAS ASSUMED TO EXTEND FROM THE TOP OF THE JORDAN TO THE BOTTOM OF THE BOREHOLE.

(4) WELL 200148 HAS BEEN SEALED, BUT IS SHOWN SINCE IT WAS USED TO PREPARE THE CROSS SECTION

LEGEND

GEOLOGIC CONTACT

INFERRED GEOLOGIC CONTACT

SCREENED INTERVAL OF WELL

OPEN HOLE INTERVAL OF WELL

04U806 2500.00
04U847 790.00
TRICHLOROETHENE CONCENTRATION (μg/l) (VALUES IN PARENTHESES WERE NOT USED FOR CONTOURING PURPOSES)

10 ISOCONCENTRATION CONTOUR μg/l)

10 ESTIMATED ISOCONCENTRATION CONTOUR (μg/l)

04U852 (JP 0.48) THE VALUE IS ESTIMATED BECAUSE THE VALUE IS BELOW THE REPORTING LIMIT, BUT ABOVE THE METHOD DETECTION LEVEL.

(NS) NOT SAMPLED

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ANNUAL PERFORMANCE REPORT

OU1 TRICHLOROETHENE CROSS-SECTION A-A' (SOUTH HALF), SUMMER 2013

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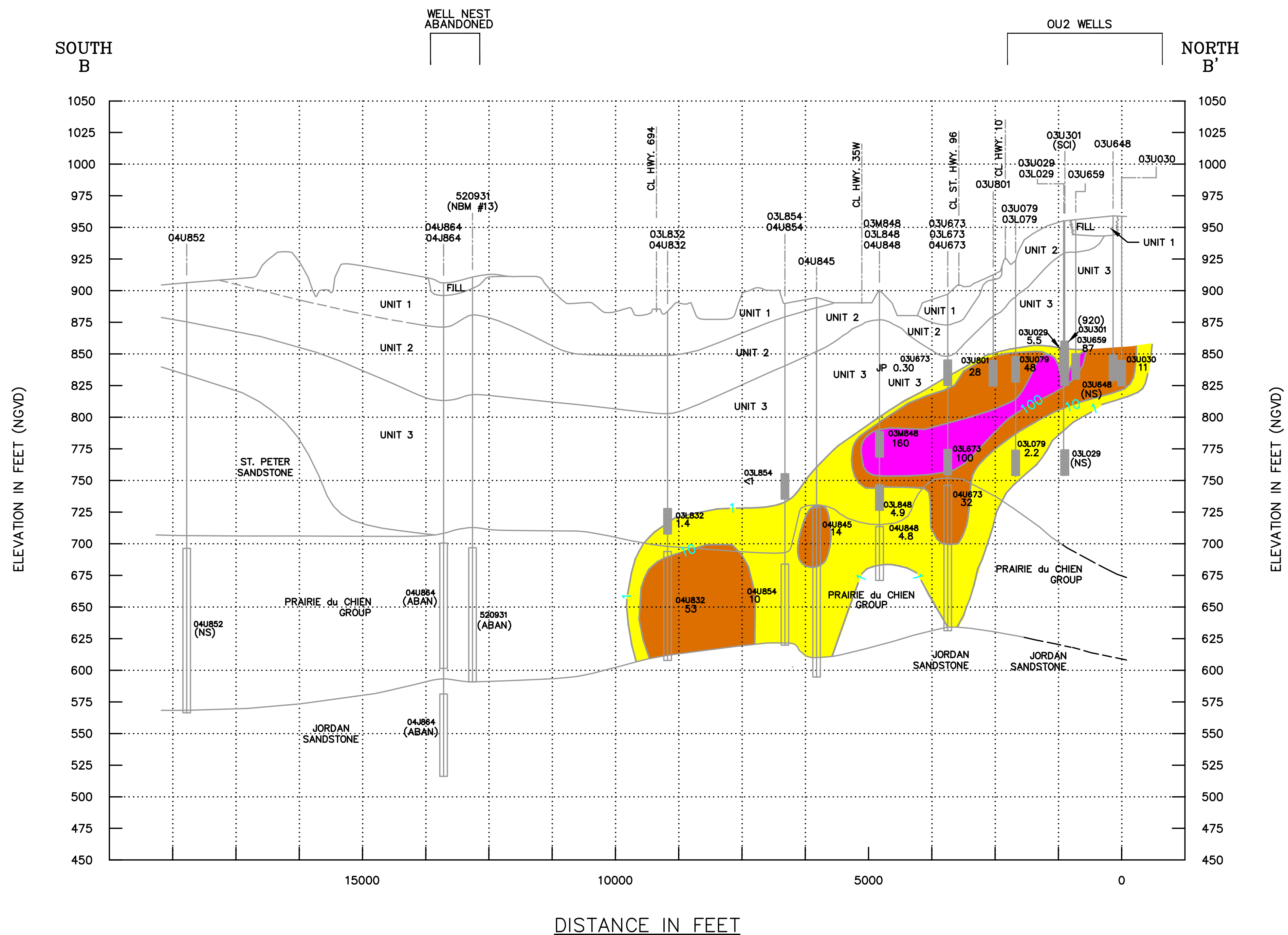
FIGURE 3-7



<u>NOTES</u>

(1) CROSS SECTION: TOPOGRAPHY CONSTRUCTED WITH DATA FROM U.S.G.S. NEW BRIGHTON 7.5 MINUTE SERIES QUAD MAP DATED 1967 (PHOTOREVISED 1972, AND 1980); WELL LOCATIONS AND THE "LINE" OF SECTION ARE SHOWN ON FIGURES 3-3 THROUGH 3-5.

(2) WELL NESTS, CONSISTING OF INDIVIDUAL WELLS IN THE SAME PROXIMITY, ARE REPRESENTED ON THE CROSS SECTION BY A SINGLE LINE WITH MULTIPLE WELL SCREENS

(3) NO INFORMATION WAS AVAILABLE ON THE WELL LOG FOR 03U029 AND 03U673 CONCERNING WELL CONSTRUCTION DETAILS, ESPECIALLY THE SCREENED INTERVALS. THE SCREENED INTERVALS FOR THESE WELLS WERE ASSUMED TO BE SIMILAR TO OTHER NEARBY UPPER UNIT 3 WELLS.

<u>LEGEND</u>

GEOLOGIC CONTACT

INFERRED GEOLOGIC CONTACT

SCREENED INTERVAL OF WELL

OPEN HOLE INTERVAL OF WELL

04U806 2500.00
04U847 790.00
TRICHLOROETHENE CONCENTRATION (μg/l) (VALUES IN PARENTHESES WERE NOT USED FOR CONTOURING PURPOSES)

10 ISOCONCENTRATION CONTOUR μg/l)

10 ESTIMATED ISOCONCENTRATION CONTOUR (μg/l)

04U852 (JP 0.48) THE VALUE IS ESTIMATED BECAUSE THE VALUE IS BELOW THE REPORTING LIMIT, BUT ABOVE THE METHOD DETECTION LEVEL.

(ABAN) ABANDONED

(NS) NOT SAMPLED

M:/1561/2011/SUMMER 2011.DWG

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OU2/OU3 TRICHLOROETHENE CROSS-SECTION B-B' (SOUTH HALF), SUMMER 2013

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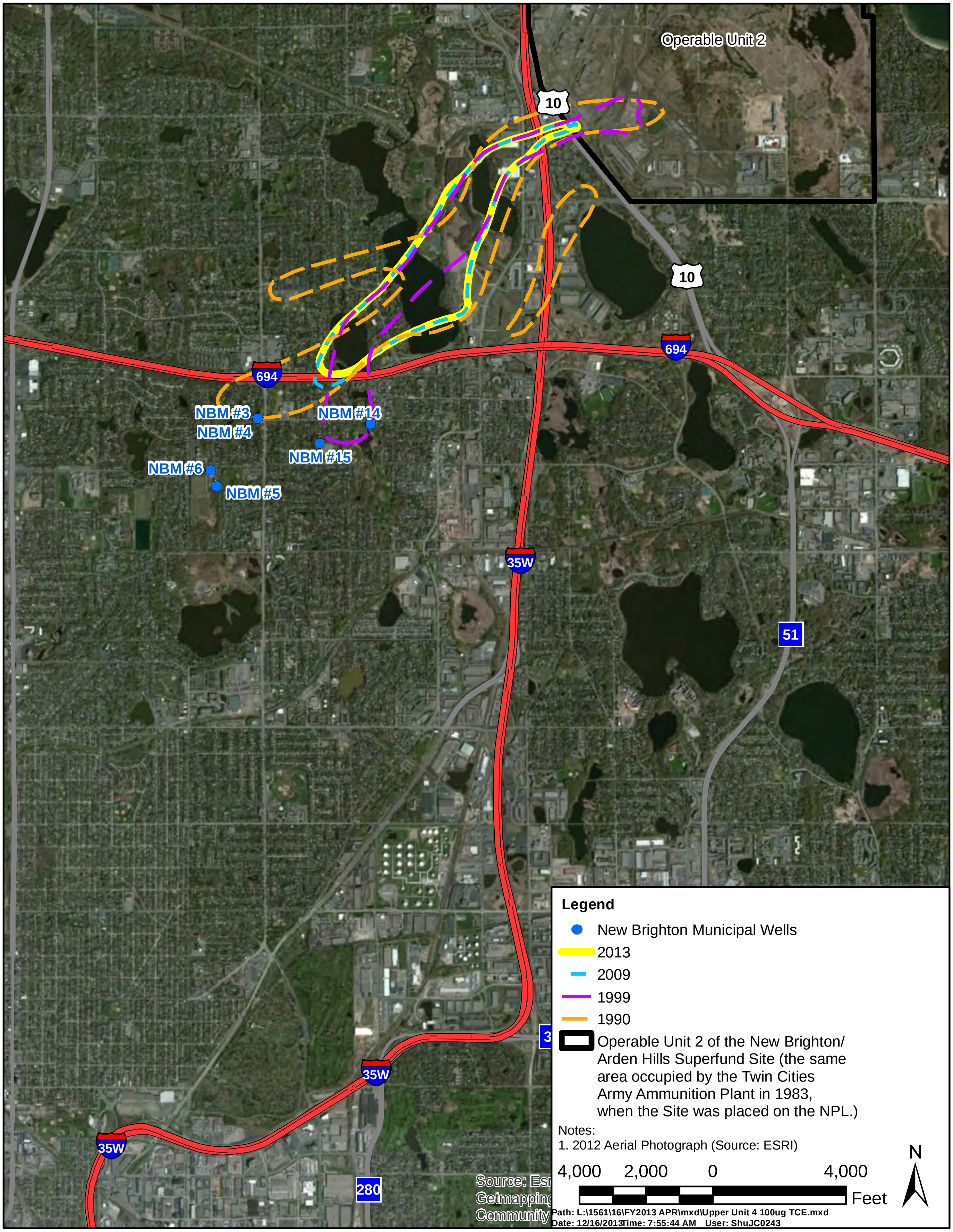
FIGURE 3-8



ANNUAL PERFORMANCE REPORT

Upper Unit 4,
100 µg/l Trichloroethene Isoconcentration Map

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Figure 3-9

FIGURE 3-10
OU1, NBCGRS MASS REMOVAL HISTORY
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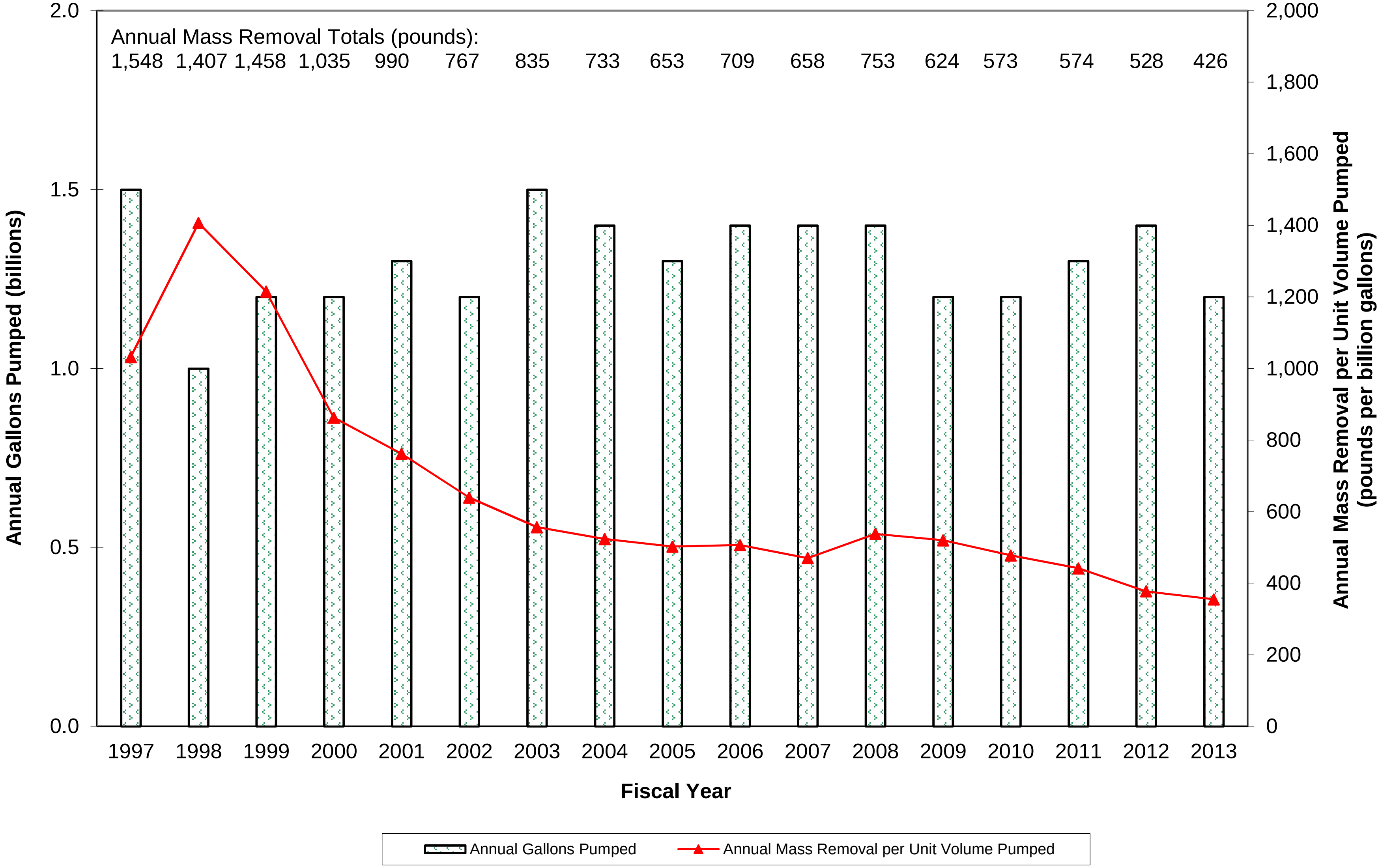

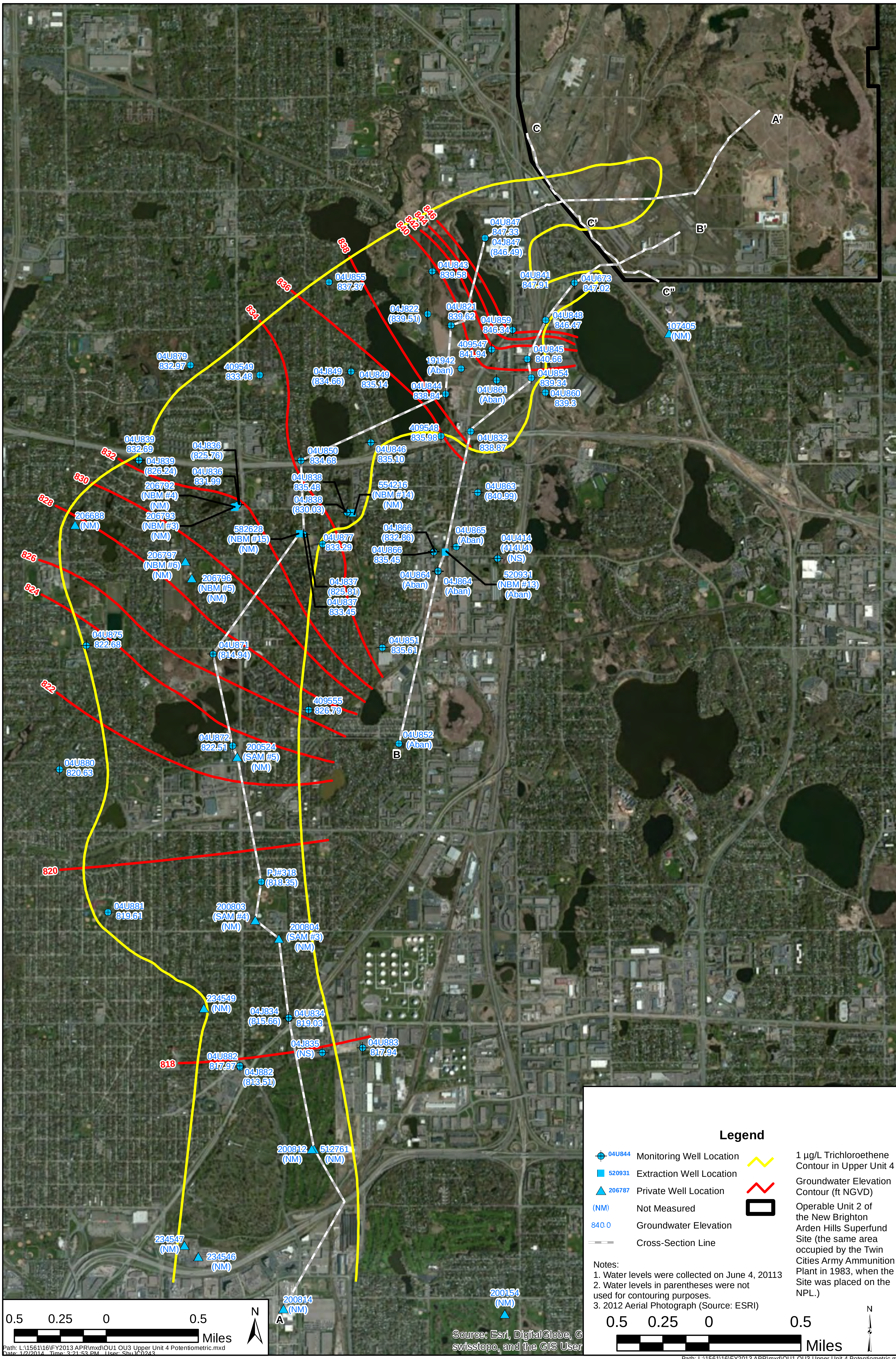

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OU1 & OU3, Upper Unit 4, Potentiometric Map, Summer 2013

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Figure 3-11

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

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.

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, 535 Primer Tracer Area, 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 2013?
Yes. On July 30, 2013, 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 the 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 future water quality data in future APRs 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 2013 was the end of the fifth 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 2013 Monitoring Plan is included in Appendix A, and the FY 2013 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 2013.

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

Is any groundwater sampling proposed prior to the next report? Yes.

- 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. Water quality monitoring locations and frequencies will remain the same; however, 10 wells that are utilized only for water level monitoring have been proposed for sealing in FY 2014, as these wells are located relatively far from the VOC plume and mostly upgradient. This change is reflected in the monitoring plan shown in Appendix A.1.

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 2013?

Yes. On July 30, 2013, 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 2013, as defined by the 1 μg/L contour?
No. Table 6-2 presents the FY 2013 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 2013? If yes, what were the findings? No wells were sampled.

Were any well owners offered an alternate supply and/or well abandonment in FY 2013?
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.

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 2013 groundwater quality data and highlights the values that exceed a cleanup level. FY 2013 was the fifth year of data obtained for evaluation of MNA performance. In the June 2013 sampling event, tetrachloroethene exceeded the cleanup level of 7 µg/L in only one well near the source area: 01U126 (8.9 µg/L). Three wells exceeded the cleanup level of 70 µg/L for cis-1,2-dichloroethene: 01U139 (510 µg/L), 01U353/EW-3 (140 µg/L), and 01U356/EW-6 (97 µg/L). Four additional wells slightly exceeded the cleanup level of 70 µg/L for cis-1,2-dichloroethene in the December 2012 sampling event, but dropped below the cleanup level in the June 2013 event (01U140, 01U157, 01U355/EW-5, and 01U357/EW-7). Lastly, 01U139, in addition to its cis-1,2-dichloroethene exceedance, also slightly exceeded the cleanup level of 10 µg/L for benzene (16 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 occurs within the distance between the source area and the first line of extraction wells (EW-1 through EW-4). 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 (01U352/EW-2), while others have shown increased concentrations (see Figure 6-6, 6-7, and 6-8). Of those showing an increase, several have shown an increase above cleanup levels, and then decreased back below (or around) cleanup levels (e.g., 01U353/EW-3, 01U157, 01U158, and 01U140). Others are still on an increasing trend (01U139, 01U902, and 01U904). 01U902 and 01U904 are located north of County Road I, and thus are two of the “most-downgradient” wells among this group (i.e., any “increase followed by decrease” pattern observed in the wells upgradient from these two wells may still be in the early “increasing” phase of this pattern). The increases in concentration may be resulting from one or both of two causes. First, a one-time “wave” of higher concentrations may be moving through the Site A area. Such an area of higher concentrations could have been held in a stagnation zone between two adjacent extraction well capture zones (most likely between EW-2 and EW-3), and then when the extraction system was shut off, that area of higher concentrations started moving downgradient in a one-time event. Note that increases in the cis-1,2-dicloroethene concentrations in wells downgradient of EW-1 through 4 were anticipated (10-Year Report), and were the reason for the increased monitoring frequency in some of the Site A wells. A second potential cause of a “wave” of higher concentrations is the unusually high groundwater levels observed at the site during the June 2011 event (groundwater levels measured in June 2011 were approximately five feet higher as compared to the groundwater level measured at the time of extraction well shut down in 2008). The unusually high groundwater levels may have brought groundwater into better contact with contaminated source area soil which, at lower groundwater levels, is located at or just above the water table.

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 2013 (Table 6-2). In two of the four wells (01U902 and 01U904), concentrations of cis-1,2-dichloroethene increased slightly in comparison to the FY 2012 concentrations, as discussed previously. Most notably 01U904 is nearing the trigger level (57 versus 70 µg/L). 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. At the end of FY 2013, the Army was preparing an investigation report. However, the Army provided the analytical results to the

USEPA and MPCA in August 2013, and these results indicated 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). With the exception of tetrachloroethene, no analytes were detected in any of the 14 samples. Low detections of tetrachloroethene (well below the action level) appear to be an artifact (contamination) from either a field or laboratory source. Hence, the third contingency action has already been completed and was ultimately found not to be of concern, i.e., the vapor intrusion pathway was confirmed to be incomplete.

With regard to the first contingency action, the Army intends to contact the well owner at 1783 Pinewood Drive in FY 2014 (even if the trigger is not exceeded) and discuss the possibility of the Army sealing this well for them. While there is no reason to believe the owner will ever put this well back into service (based on prior conversation), if that is indeed the well owner's intention, the well should be properly sealed. While it is currently a very unlikely receptor, sealing of this well would eliminate the only known groundwater receptor between Site A and Rice Creek. If this is done, and 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, 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.)

No, the determination cannot be made yet. With a few wells still showing increasing VOC concentration trends, additional groundwater monitoring is still needed to confirm that the plume has reached relatively stable conditions. However, it appears likely that after another year or two of monitoring, it could be concluded that MNA is an adequate long-term remedy.

Do additional remedial measures need to be addressed?

No. Continued monitoring will provide the additional data needed for evaluation of MNA as a potential remedy.

Table 6-1

Summary of Site A Shallow Groundwater Monitoring Requirements
Fiscal Year 2013

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 2013

			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		12/19/12	<1	<1	<1	<1	<1	<1	<1	---
01U039		6/26/13	<1	<1	<1	<1	<1	<1	<1	---
01U102		6/25/13	JP 0.72	<1	<1	<1	<1	<1	<1	---
01U103		6/25/13	<1	<1	<1	<1	<1	<1	<1	2.8
01U103	D	6/25/13	---	---	---	---	---	---	---	2.9
01U108		6/25/13	JP 0.72	<1	<1	<1	<1	<1	<1	---
01U115		6/26/13	<1	JP 0.44	2.3	<1	<1	<1	<1	---
01U115	D	6/26/13	<1	JP 0.45	2.3	<1	<1	<1	<1	---
01U116		6/26/13	<1	JP 0.94	JP 0.66	<1	<1	<1	<1	---
01U117		6/25/13	2.2	1.4	15	<1	<1	<1	<1	---
01U126		6/25/13	**8.9**	4.0	<1	<1	<1	<1	<1	---
01U138		6/25/13	<1	JP 0.50	<1	<1	<1	<1	<1	---
01U139		12/19/12	<1	1.5	**400**	JP 0.44	<1	<1	9.5	---
01U139		6/27/13	<1	1.1	**510**	JP 0.76	<1	<1	**16**	---
01U140		12/19/12	<1	<1	**82**	<1	<1	<1	JP 0.75	---
01U140		6/26/13	<1	<1	59	<1	<1	<1	JP 0.72	---
01U140	D	6/26/13	<1	<1	59	<1	<1	<2	JP 0.63	---
01U157		12/19/12	<1	1.6	**96**	<1	<1	<1	JP 0.55	---
01U157		6/26/13	<1	1.7	31	<1	<1	<1	JP 0.30	---
01U157	D	6/26/13	<1	1.8	32	<1	<1	<1	<1	---
01U158		12/19/12	<1	JP 0.92	58	<1	<1	<1	JP 0.77	---
01U158		6/27/13	<1	1.2	54	<1	<1	<1	JP 0.73	---
01U158	D	6/27/13	<1	1.2	55	<1	<1	<1	JP 0.73	---
01U350		6/25/13	2.8	JP 0.75	<1	<1	<1	<1	<1	---
01U901		12/18/12	<1	<1	<1	<1	<1	<1	<1	---
01U901		6/24/13	<1	<1	<1	<1	<1	<1	<1	---
01U902		12/18/12	<1	<1	8.3	<1	<1	<1	<1	---
01U902		6/24/13	<1	<1	15	<1	<1	<1	<1	<1
01U903		6/24/13	<1	<1	<1	<1	<1	<1	<1	---
01U904		12/18/12	<1	<1	32	<1	<1	<1	<1	---
01U904		6/24/13	<1	<1	57	<1	<1	<1	<1	<1

Table 6-2
Site A Groundwater Quality Data

Fiscal Year 2013

			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)		6/25/13	<1	JP 0.51	JP 0.85	<1	<1	<1	<1	---
01U352 (EW-2)		12/26/12	<1	<1	6.7	<1	<1	<1	<1	---
01U352 (EW-2)		6/26/13	<1	<1	9.2	<1	<1	<1	<1	---
01U353 (EW-3)		12/26/12	<1	JP 0.32	43	<1	<1	<1	JP 0.74	---
01U353 (EW-3)	D	12/26/12	<1	<1	42	<1	<1	<1	JP 0.69	---
01U353 (EW-3)		6/26/13	<1	JP 0.51	**140**	<1	<1	<1	3.5	---
01U354 (EW-4)		12/26/12	<1	JP 0.54	<1	<1	<1	<1	<1	---
01U354 (EW-4)		6/25/13	<1	JP 0.84	<1	<1	<1	<1	<1	---
01U355 (EW-5)		12/26/12	<1	JP 0.89	**72**	<1	<1	<1	2.4	---
01U355 (EW-5)		6/27/13	<1	JP 0.70	43	<1	<1	<1	1.7	---
01U356 (EW-6)		12/19/12	<1	JP 0.57	**78**	<1	<1	<1	1.7	---
01U356 (EW-6)		6/27/13	<1	JP 0.67	**97**	<1	<1	<1	1.6	---
01U357 (EW-7)		12/19/12	<1	<1	**80**	<1	<1	<1	1.7	---
01U357 (EW-7)		6/26/13	<1	<1	55	<1	<1	<1	1.2	---
01U358 (EW-8)		12/19/12	<1	<1	JP 0.45	<1	<1	<1	<1	---
01U358 (EW-8)	D	12/19/12	<1	<1	JP 0.52	<1	<1	<1	<1	---
01U358 (EW-8)		6/26/13	<1	<1	JP 0.49	<1	<1	<1	<1	---

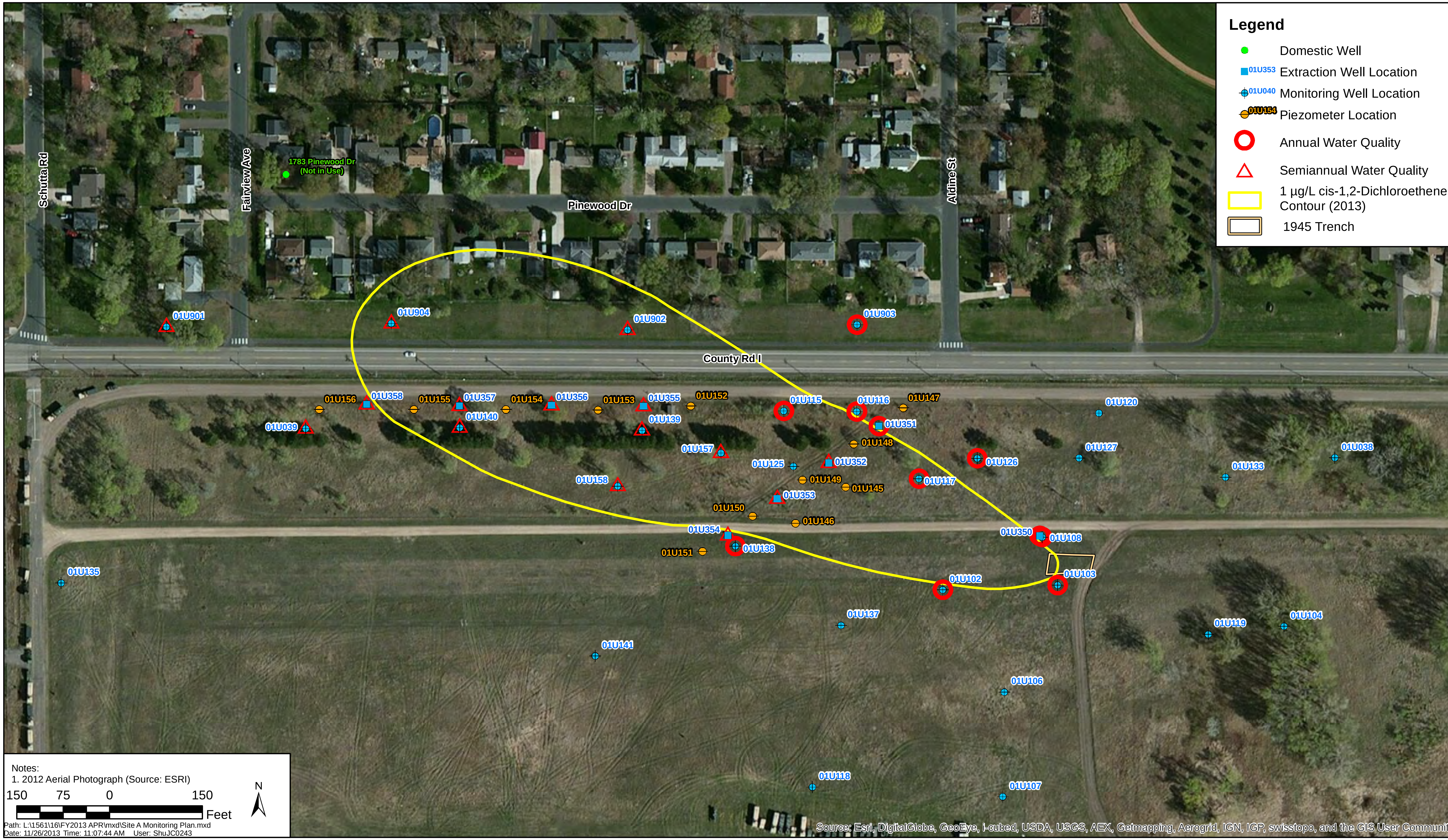
Notes:

(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	FY 2013
Site A, Groundwater Monitoring Plan	Engineers - Scientists Business Professionals www.wenck.com 1800 Pioneer Creek Center Maple Plain, MN 55359-0429 1-800-472-2232	Figure 6-1

ANNUAL PERFORMANCE REPORT

Site A, Unit 1, Potentiometric Map - Summer 2013

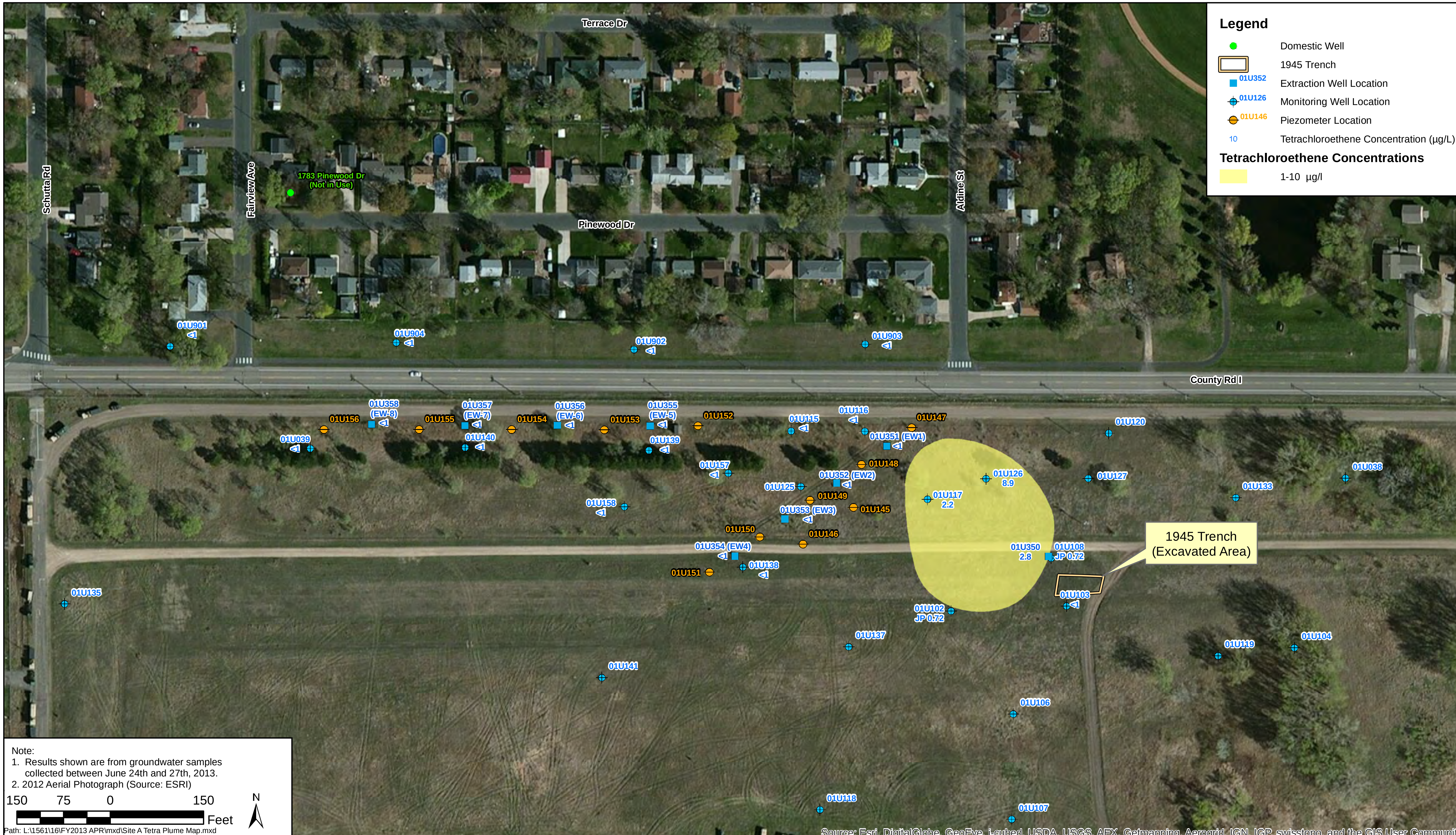
Wenck

Engineers - Scientists
Business Professionals
www.wenck.com

1800 Pioneer Creek Center
Maple Plain, MN 55359-0429
1-800-472-2232

FY 2013

Figure 6-2



ANNUAL PERFORMANCE REPORT	Wenck	FY 2013
Site A, Unit 1, Tetrachloroethene Isoconcentration Map, Summer 2013	Engineers - Scientists Business Professionals www.wenck.com 1800 Pioneer Creek Center Maple Plain, MN 55359-0429 1-800-472-2232	Figure 6-3

ANNUAL PERFORMANCE REPORT

Site A, Unit 1, cis-1,2-Dichloroethene Isoconcentration Map, Summer 2013

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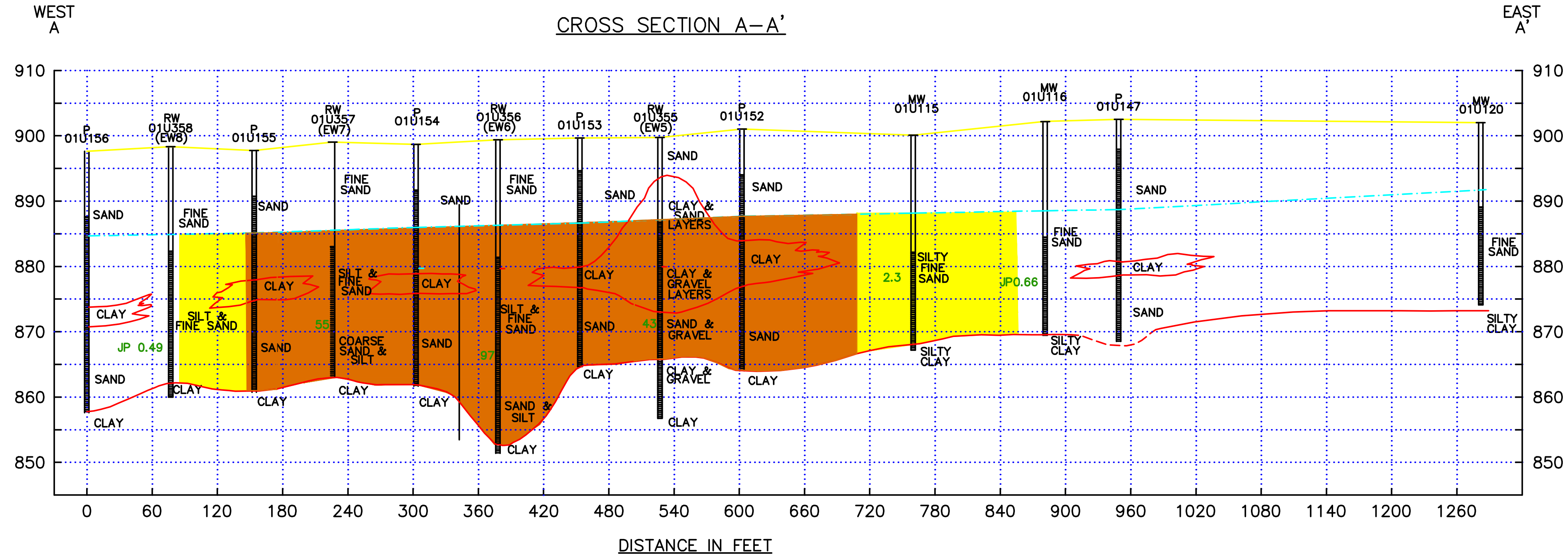
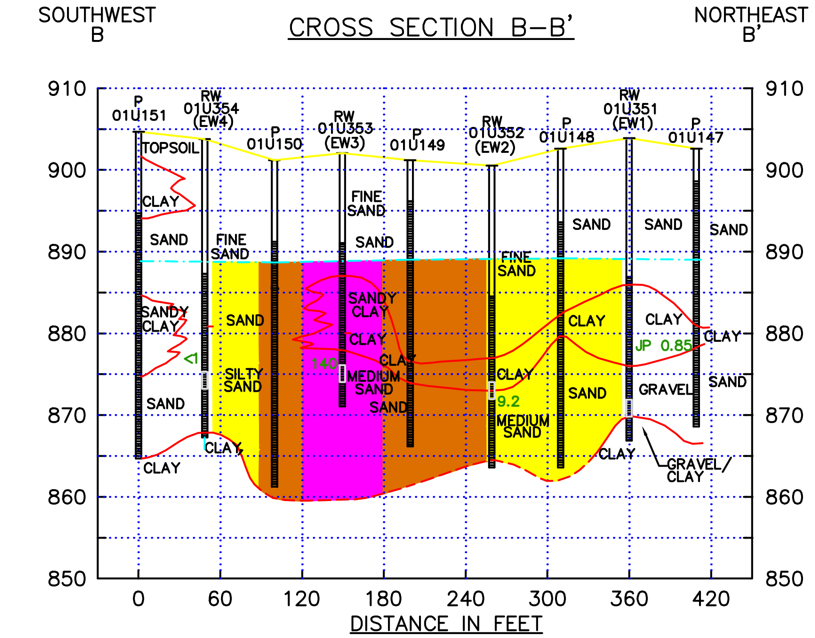
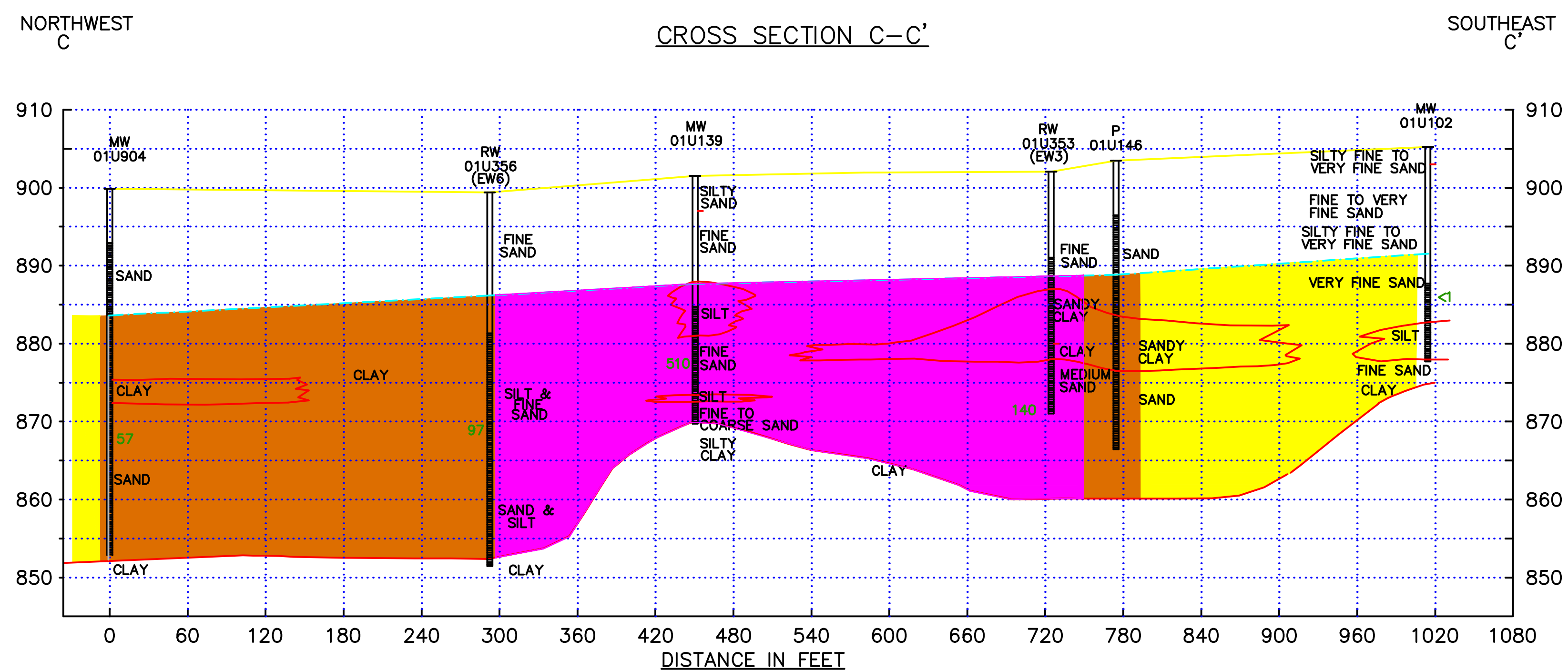
Engineers - Scientists
Business Professionals
www.wenck.com
1800 Pioneer Creek Center
Maple Plain, MN 55359-0429
1-800-472-2232

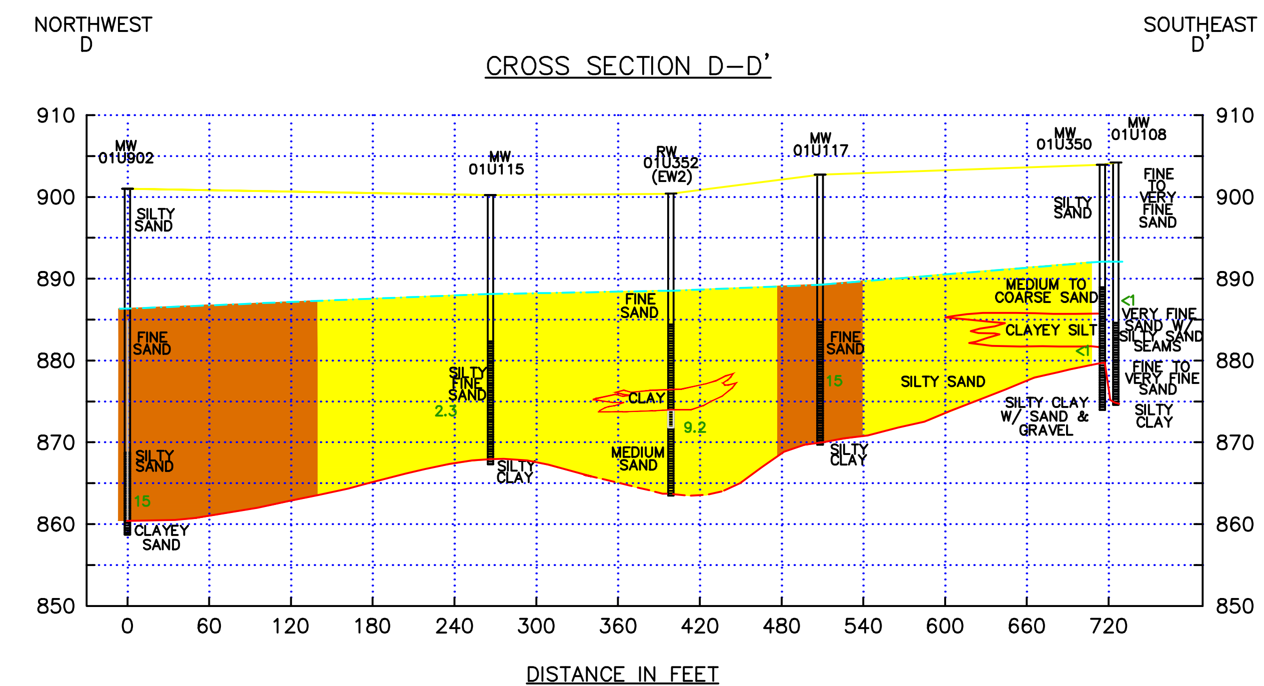
FY 2013

Figure 6-4









NOTES:

1. RESULTS ARE FROM GROUNDWATER SAMPLES COLLECTED BETWEEN JUNE 24 AND JUNE 27, 2013.
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

M:\1561\2013\Tcax02b6.dwg

ANNUAL PERFORMANCE REPORT

cis–1,2–Dichloroethene Cross Sections A–A', B–B', C–C' and D–D', Summer 2013

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Maple Plain, Mn. 55359

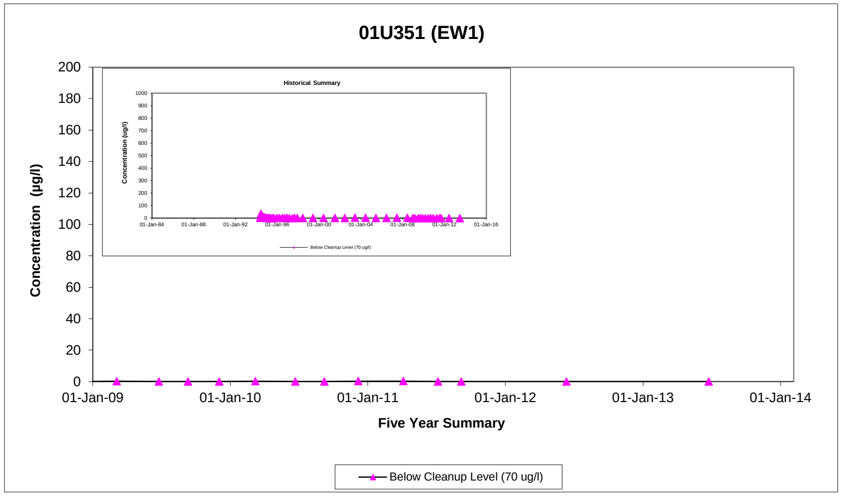
FY 2013

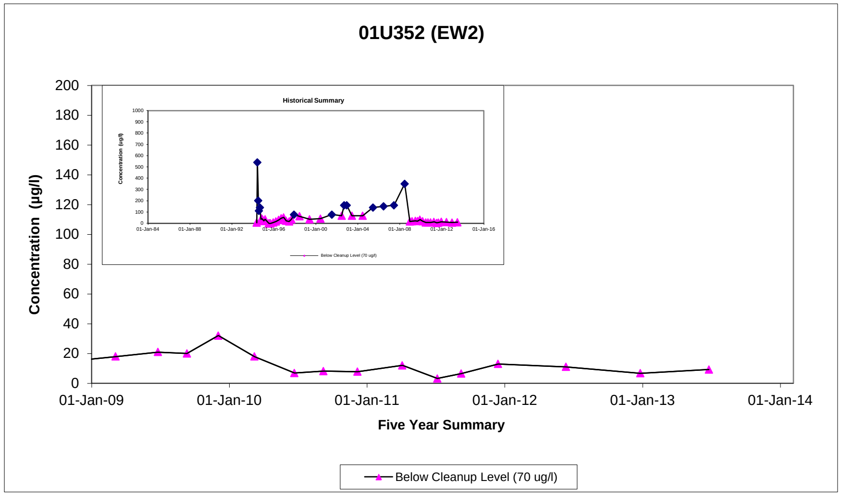
Figure 6–5

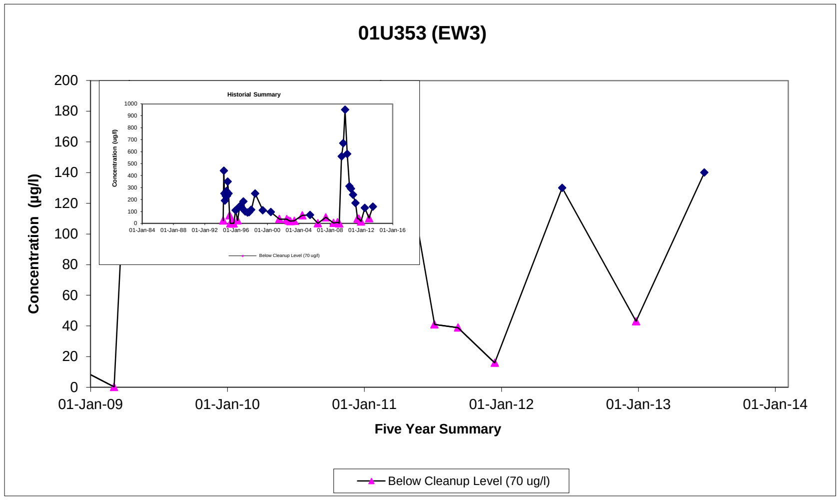
FIGURE 6-6

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

FY 2013 ANNUAL PERFORMANCE REPORT







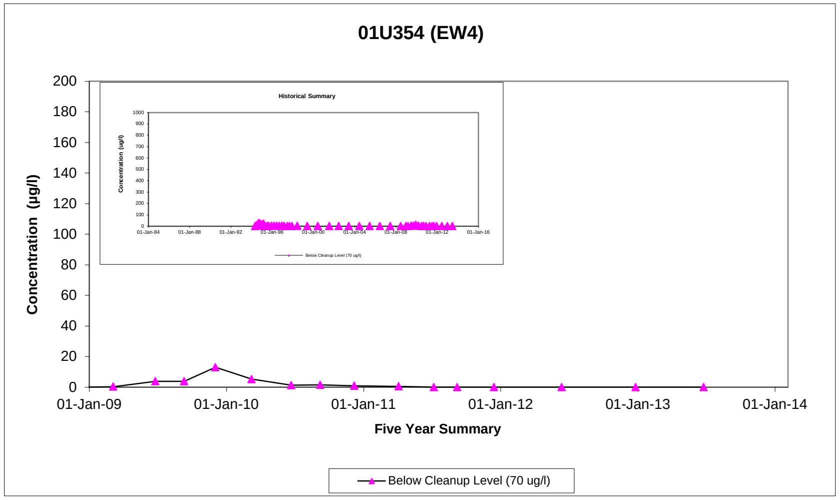
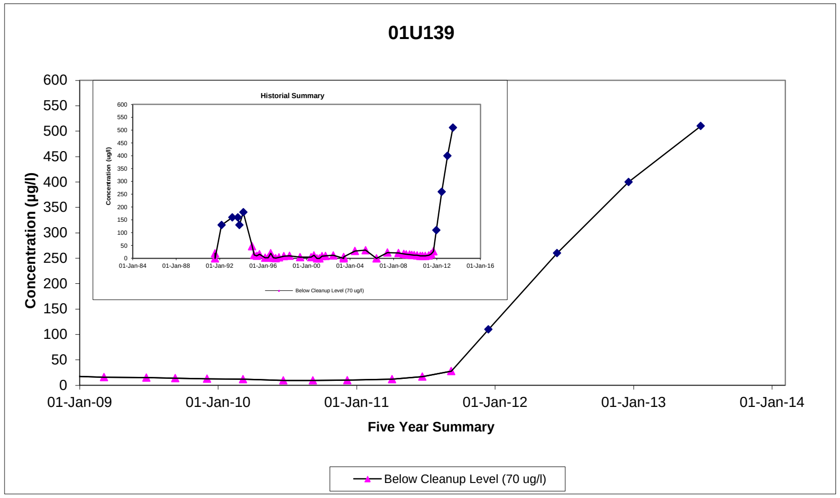
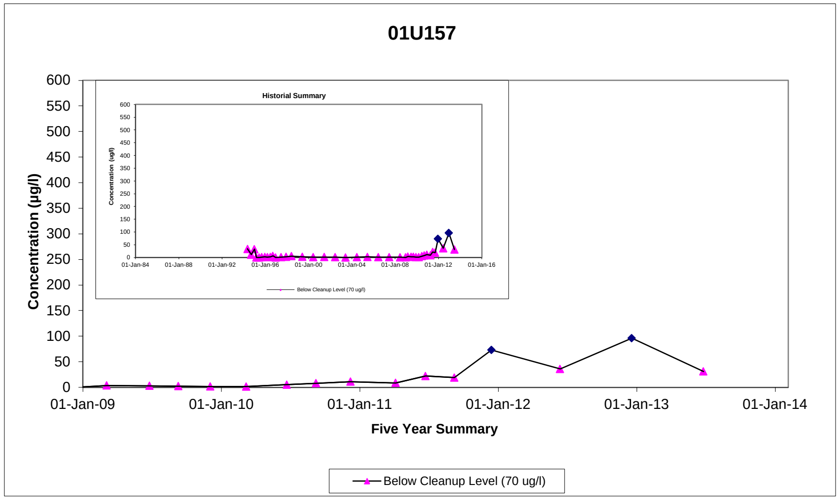
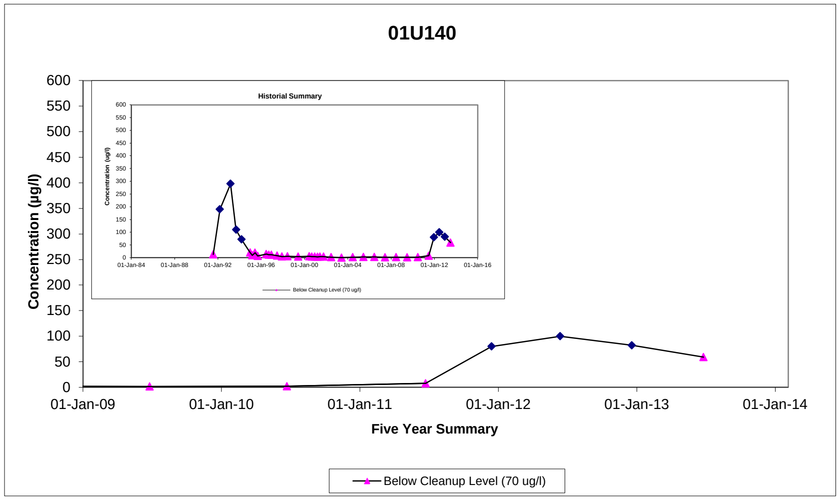


FIGURE 6-7
SITE A, cis-1,2-DICHLOROETHENE WATER QUALITY TRENDS: MONITORING WELLS
FY 2013 ANNUAL PERFORMANCE REPORT







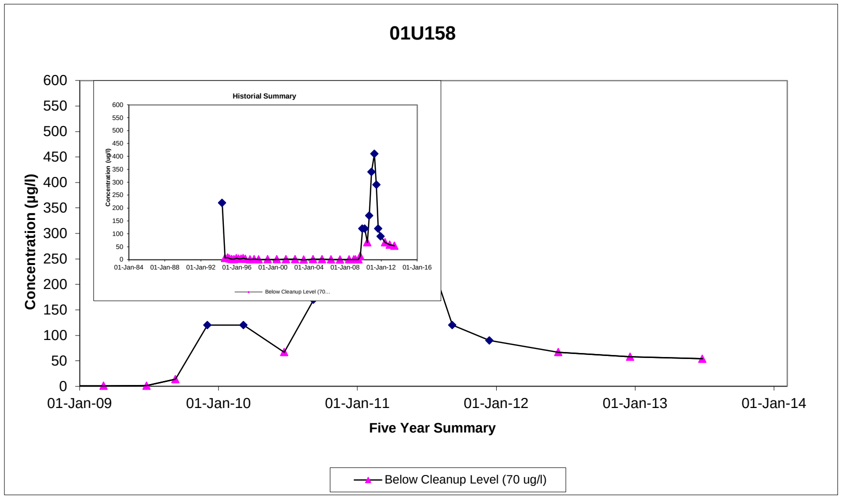


FIGURE 6-8

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

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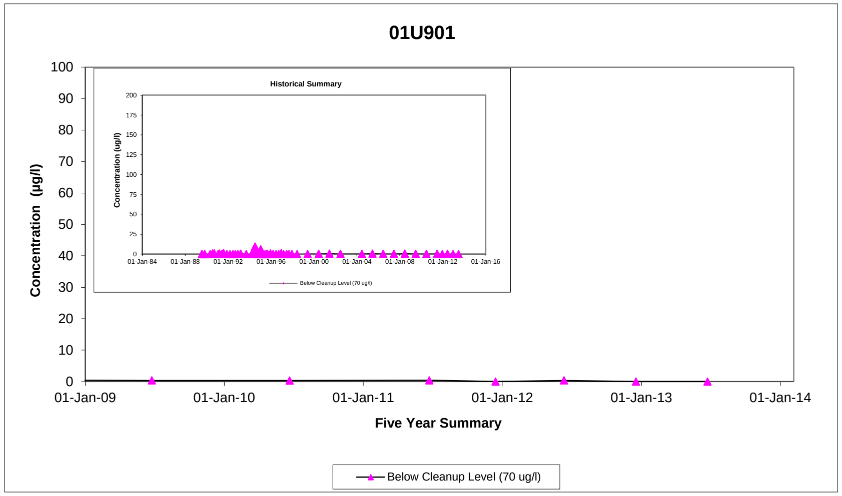
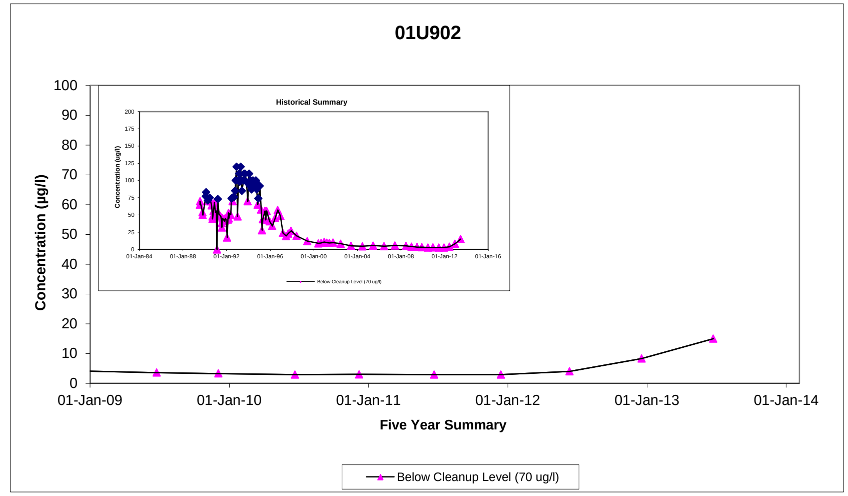
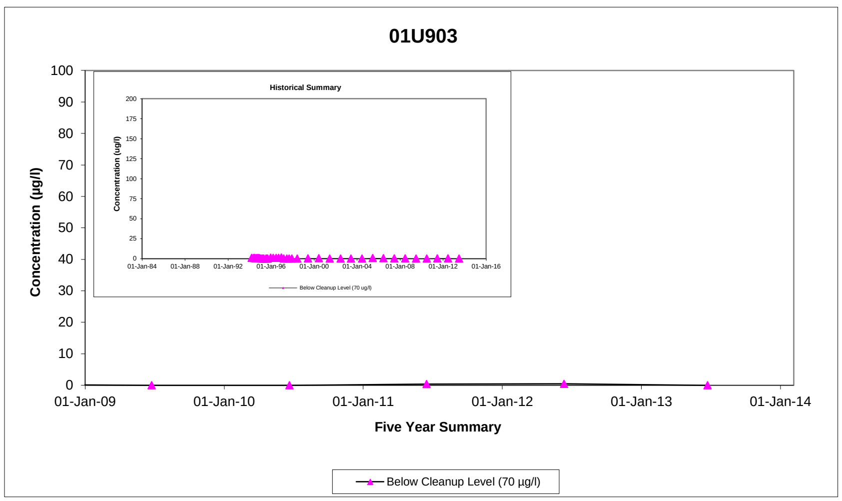
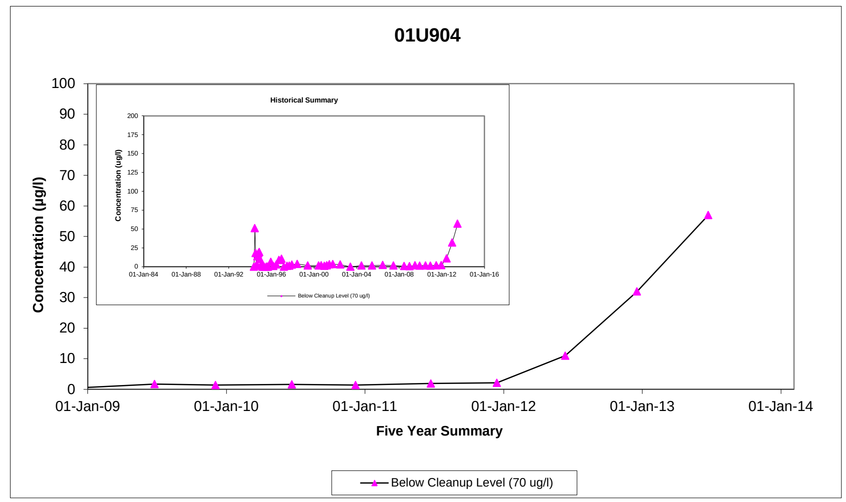








7.0 Operable Unit 2: Site C Shallow Groundwater

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 2013 monitoring was conducted in

accordance with the Monitoring Plans included in Appendix A, and any deviations are explained in Appendix C.2.

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 plan shown in Appendix A.1 and A.3, respectively. 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 7-1.

Are any changes or additional actions required for this remedy component? Yes.
Eleven wells (including the three extraction wells) have been proposed for sealing in FY 2014. These wells are not needed because the lead plume has decreased in size over recent years and because the eleven wells that are being retained will provide an adequate network to monitor the small remaining plume. The extraction wells were sealed because they were no longer functional. If the extraction system ever needed to be restarted, new extraction wells would be installed first. This change is reflected in the monitoring plan shown in Appendix A.1 and on Figure 7-1.

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 2013?

Yes. On July 30, 2013, 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 2013 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 2013. 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 2013, lead exceeded the groundwater cleanup level of 15 µg/L in only two monitoring wells located near the source area. MW-13 had a concentration of 1,000 µg/L in June 2013 (86 µg/L when resampled in September 2013), and MW-14 had a concentration of 76 µg/L in June 2013 (93 µg/L when resampled in September 2013). The June 2013 result at MW-13 was somewhat anomalous, as evident on Figure 7-6, and was the reason for the unscheduled resampling in September 2013. Surface water monitoring results were all below the surface water cleanup level in FY 2013.

The water quality trends for the wells located just downgradient of the source area (MW-3, 13, 14, and 15) are shown on Figure 7-6. The results for MW-3 and MW-15 were a slight decrease from the FY 2012 result, and remained below the groundwater cleanup level of 15 µg/L. The results for MW-13 and MW-14 increased from the FY 2012 result, with a particularly large increase at MW-13, as noted above (though the September 2013 result decreased to a concentration closer to the FY 2012 result). These two wells are above the groundwater cleanup level of 15 µg/L. The reason for the increases at MW-13 and MW-14 is not certain, but may be related to higher 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. These were modified slightly for this APR, due to the proposed well sealing (as discussed in Section 7.1). 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 2013. 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 FY 2013 increases in concentrations at MW-13 and MW-14 suggest that additional monitoring is needed before this determination can be made. However, the longer-term “overall” decreasing lead concentration trends in the monitoring wells closest to the source area continue to suggest that, overall, this site is trending towards meeting the cleanup levels, especially given that only two monitoring wells were above the cleanup level in FY 2013 (MW-13 and MW-14).

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 2013

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 2013

Sample Location		Date Collected	Lead (Dissolved) (µg/L)	
				L D
Groundwater Cleanup Level[1]:			15	
Monitoring Wells:				
01U561 (MW1)		6/27/13	0.45	U
01U562 (MW2)		6/27/13	0.45	U
01U563 (MW3)		6/28/13	3.2	
01U564 (MW4)		6/27/13	0.45	U
01U565 (MW5)		9/25/13	0.45	U
01U566 (MW6)		6/27/13	0.45	U
01U567 (MW7)		6/27/13	0.45	U
01U568 (MW8)		6/27/13	0.45	U
01U568 (MW8)	D	6/27/13	0.45	U
01U569 (MW9)		9/25/13	0.45	U
01U570 (MW10)		6/27/13	0.45	U
01U571 (MW11)		6/27/13	0.45	U
01U572 (MW12)		6/28/13	0.45	U
01U573 (MW13)		6/28/13	**1000**	
01U573 (MW13)		9/25/13	**86**	
01U574 (MW14)		6/28/13	**76**	
01U574 (MW14)		9/25/13	**93**	
01U575 (MW15)		6/28/13	6.8	
01U576 (MW16)		6/27/13	0.45	U
01U045		6/28/13	0.45	U
01U046		6/28/13	0.45	U
01U046	D	6/28/13	0.45	U
01U085		6/28/13	0.45	U

Table 7-2
Water Quality Data for Site C Groundwater

Fiscal Year 2013

Sample Location		Date Collected	Lead (Dissolved) (µg/L)	L	D
Groundwater Cleanup Level(1):			15		
Extraction Wells:					
01U551 (EW1)		6/27/13	0.45	U	
01U552 (EW2)		6/27/13	0.45	U	
01U552 (EW2)	D	6/27/13	0.45	U	
01U553 (EW3)		6/27/13	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 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 2013

Sample Location		Date Collected	Lead (Dissolved) (µg/L)	L	D
Surface Water Cleanup Level(1):			6.9		
SW 05		6/24/13	0.45	U	
SW 05		6/25/13	0.50		
SW 05	D	6/25/13	0.45	U	
SW 05		6/26/13	0.45	U	
SW 06		6/24/13	0.45	U	
SW 06		6/25/13	0.45	U	
SW 06		6/26/13	0.45	U	
NE Wetland		6/24/13	0.45	U	
NE Wetland		6/25/13	0.45	U	
NE Wetland		6/26/13	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

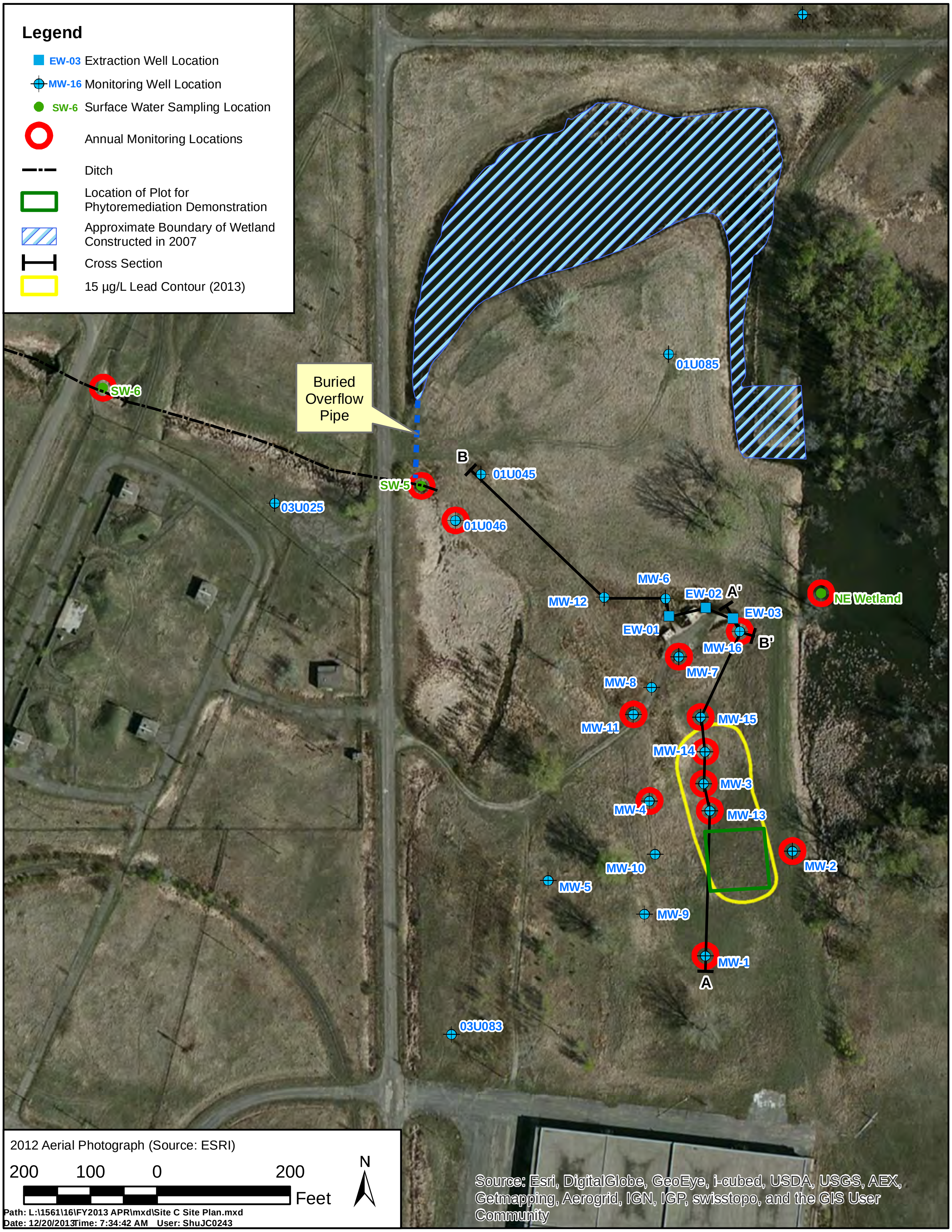
(1) The cleanup level for Site C Surface Water is from Table 1 of OU2 ROD Amendment #1.

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.



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Site C, Monitoring Plan

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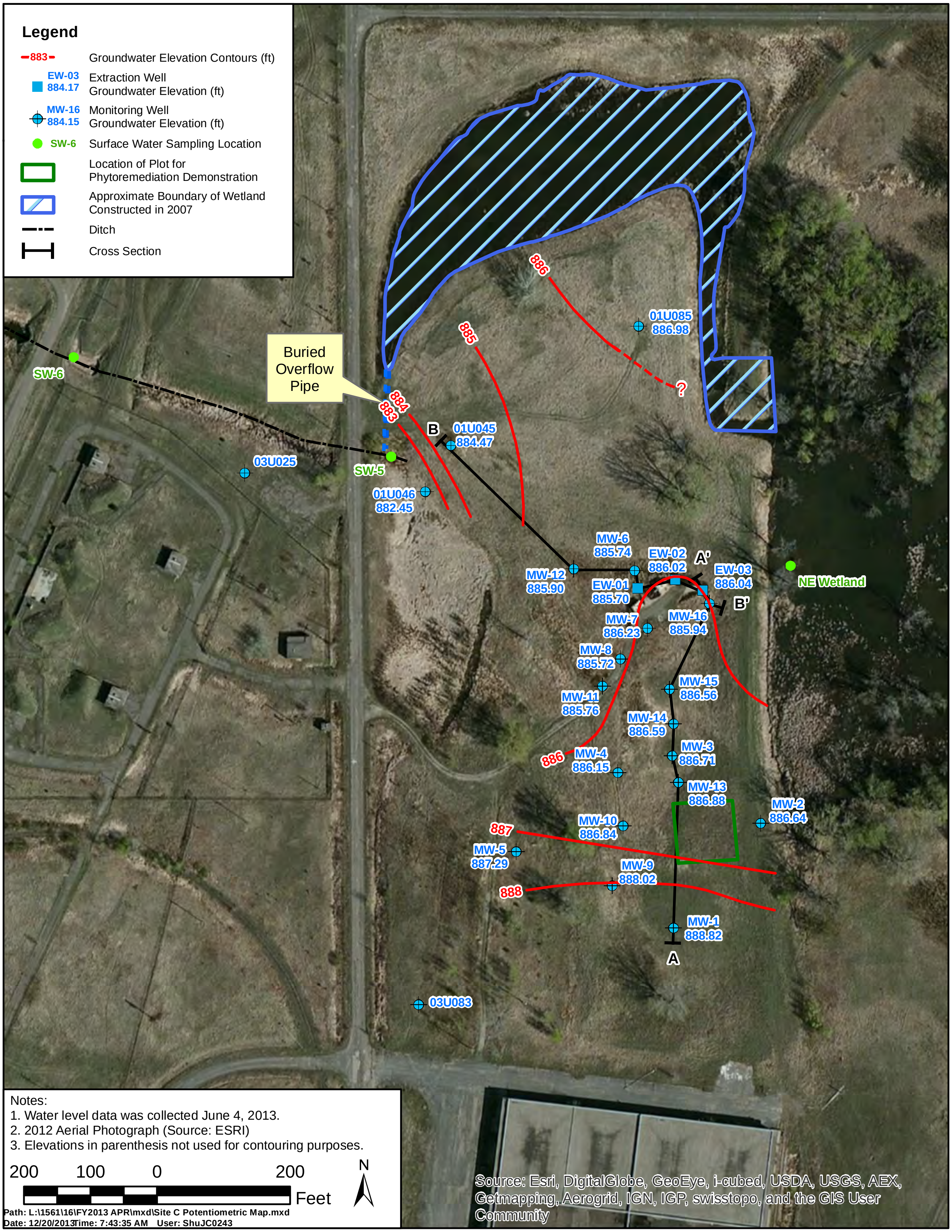
FY 2013

Figure 7-1



Notes:
1. Water level data was collected June 4, 2013.
2. 2012 Aerial Photograph (Source: ESRI)
3. Elevations in parenthesis not used for contouring purposes.

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Date: 12/20/2013 Time: 7:43:35 AM User: ShuJC0243

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Site C, Unit 1, Potentiometric Map, Summer 2013

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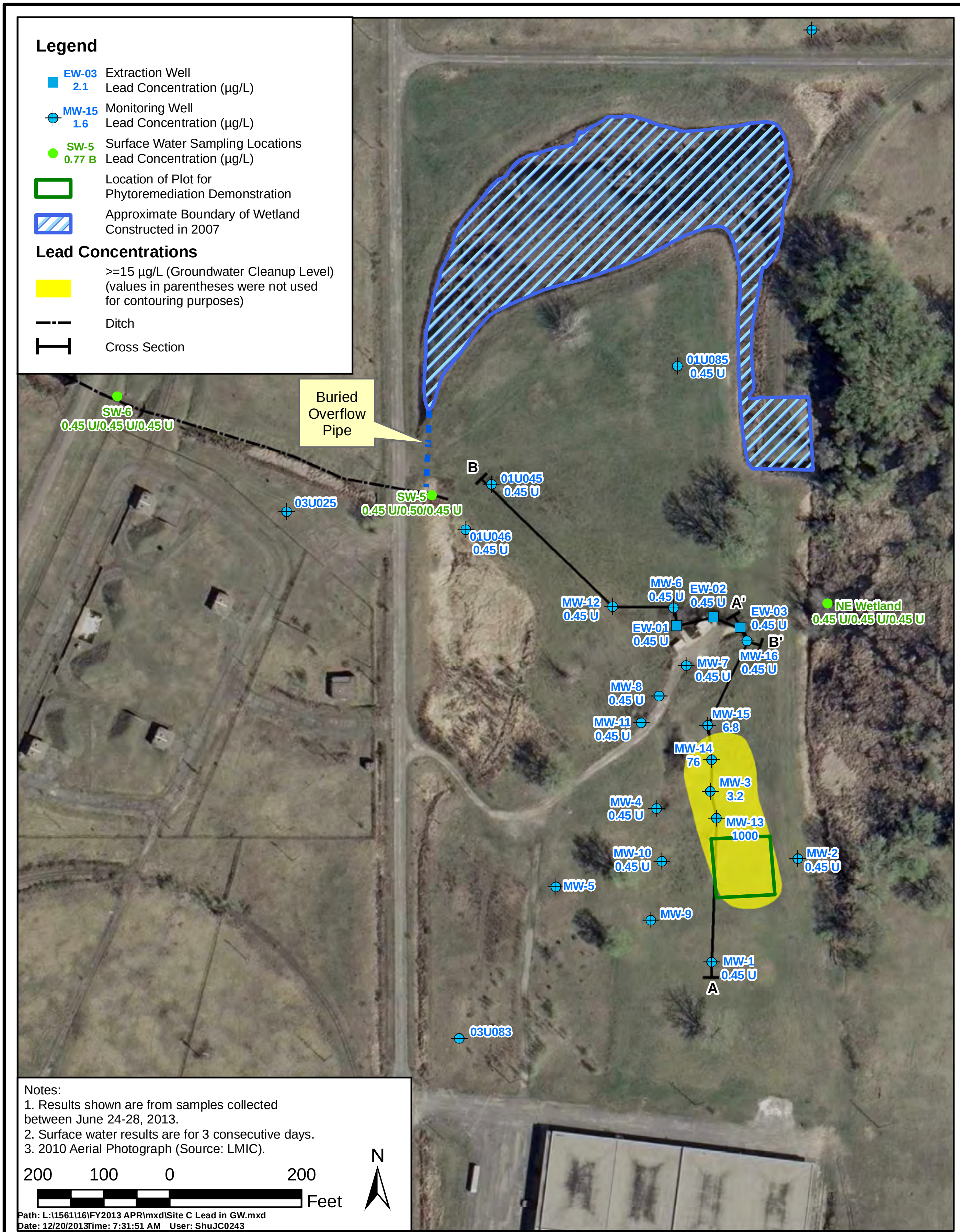
Figure 7-2



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Site C, Unit 1, Lead Results, Summer 2013

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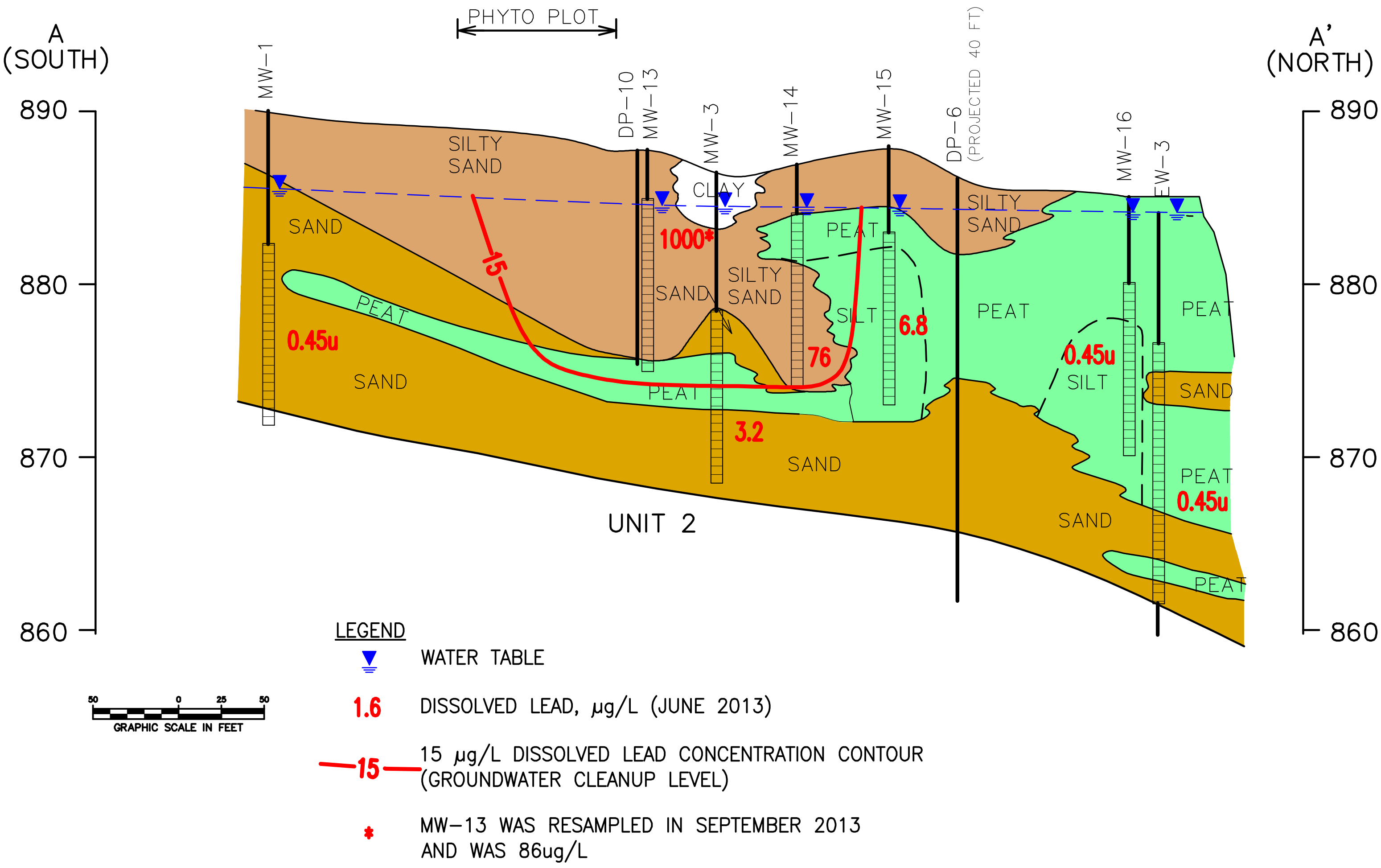
FY 2013

Figure 7-3



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Site C, Cross-Section A-A'

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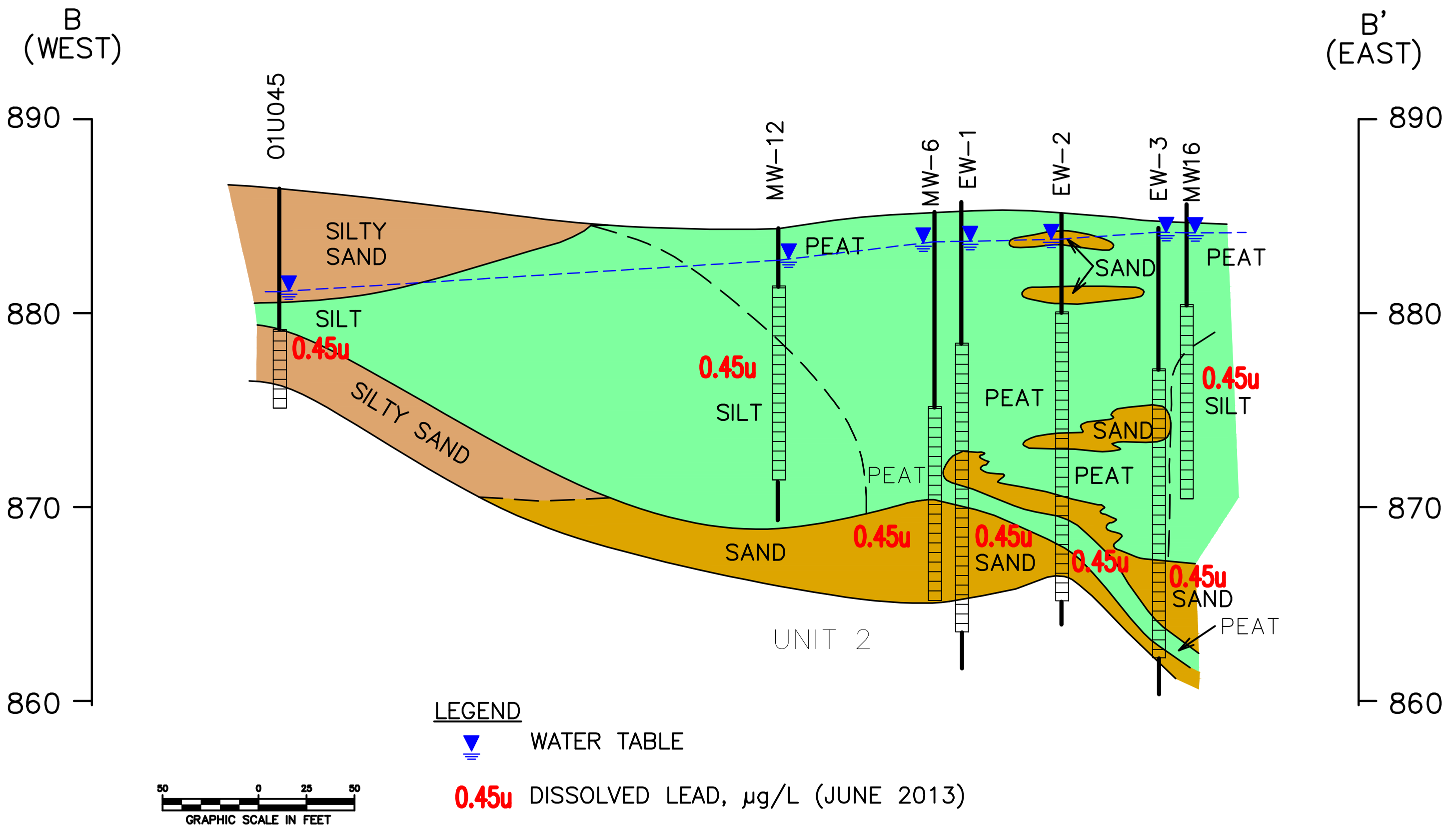
(763) 479-4200

FY 2013

Figure 7-4



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Site C, Cross-Section B-B'

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Figure 7-5

FIGURE 7-6
SITE C, LEAD WATER QUALITY TRENDS: MONITORING WELLS
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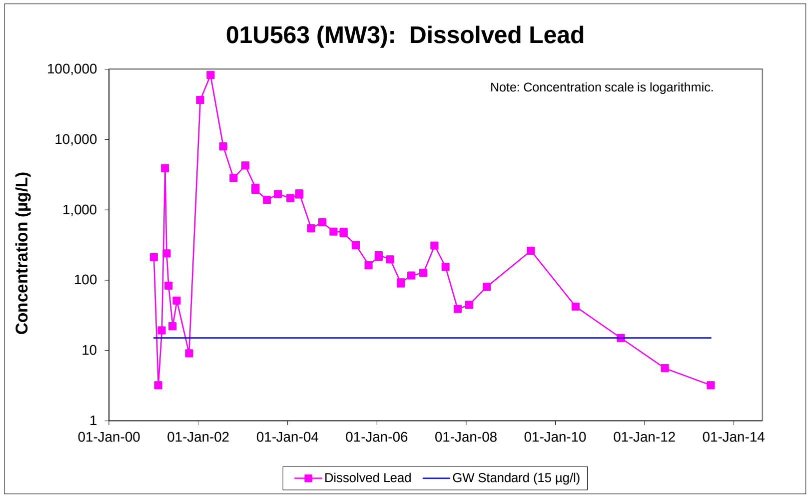
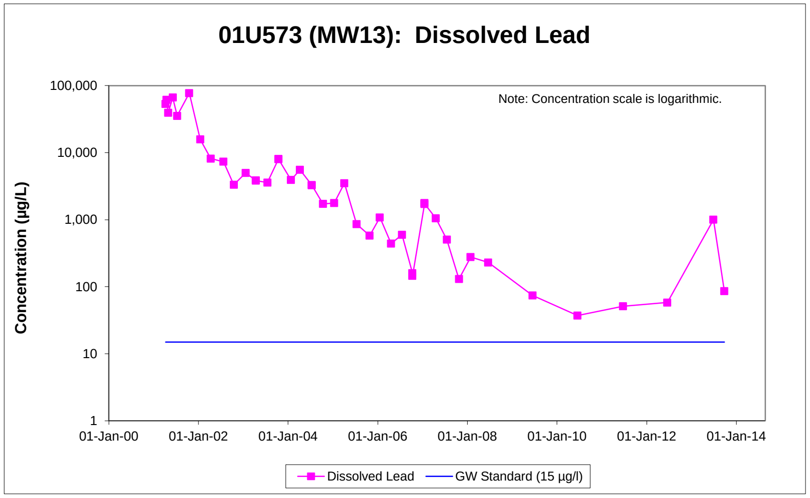
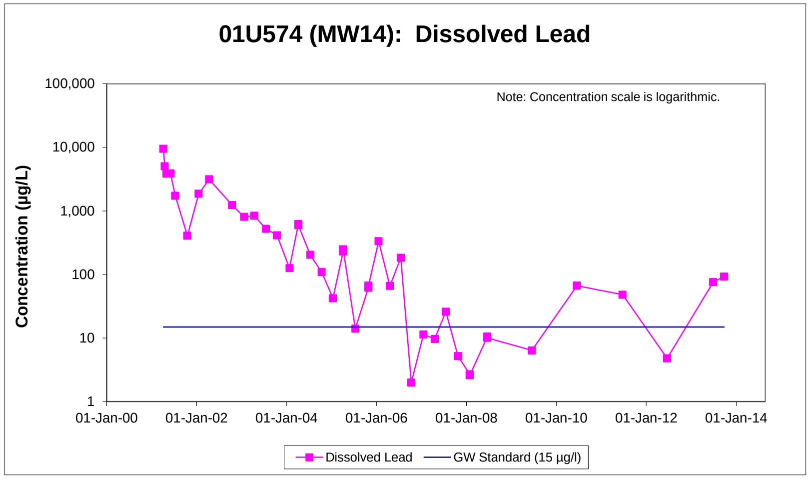
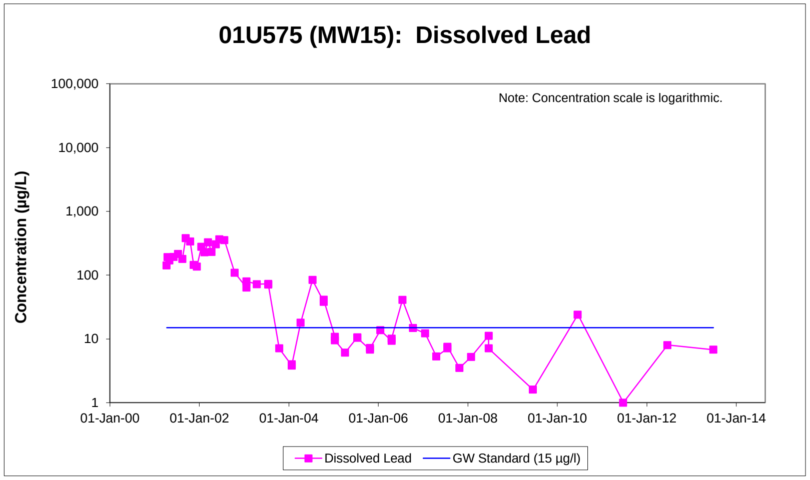








8.0 Operable Unit 2: Site I Shallow Groundwater

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 2013 monitoring plan and any deviations are explained in Appendix C.2.

Eight Unit 1 monitoring wells were planned for sampling at Site I (Building 502) during FY 2013. These wells were 01U064, 01U632, 01U636, 01U639, 01U640, I01MW, I02MW, I05MW and I04MW as an alternate. For FY 2013, both monitoring wells 01U639 and I04MW were included on the list of monitoring locations. Of the two wells, well 01U639 is the primary sampling location and (I04MW) is the alternate sampling location in the event monitoring well 01U639 is dry. If it is not possible to collect a groundwater sample from 01U639, then an attempt is made to collect a sample from I04MW. Well 01U639 is selected as the primary location because there are more years of analytical data associated with this location. At the request of the MPCA and EPA, a one-time sample was collected from well 01U667 prior to well abandonment. Figure 8-1 shows Site I monitoring well locations, Figure 8-2 shows groundwater elevations and cross-section locations, and Figure 8-3 shows the Site I geologic cross-section.

Groundwater samples were collected from wells 01U064, 01U632, 01U636, 01U639, 01U640, I01MW, I02MW, I05MW. The groundwater samples were analyzed using EPA Method 8260 for VOCs. Hydraulic monitoring well 01U668 was not located during the 2013 monitoring event and groundwater elevations were not collected. During an evaluation of Site I wells, and in preparation for monitoring well abandonment, it was determined that well 01U668 has been incorrectly identified and is actually 01U631. Well 01U668 was located south of 01U631 and appears to have been abandoned. Figure 8-1 and Figure 8-2 have been revised to show the proper location of this well.

Is any groundwater sampling proposed prior to the next report? Yes. EPA/MPCA provided approval to abandon several Unit 1 Site I monitoring wells, and 01U667 will be replaced. Groundwater sampling will be performed in 2014 as per the FY 2013 – FY 2017 Monitoring Plan (see Appendix A.1).

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

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 2012?
On July 30, 2013, 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. Table 8-2 presents the FY 2013 groundwater quality data and highlights the values that exceed a cleanup level. The concentration of trichloroethene in 01U632 has decreased over time, but was still above the cleanup level in FY 2013. Results from the one time sampling of well 01U667 indicated concentrations of trichloroethene and vinyl chloride remain above the cleanup levels. Figure 8-4 presents the FY 2013 Site I shallow groundwater trichloroethene and vinyl chloride sample results.

Do additional remedial measures need to be addressed? Yes. All Unit 1 monitoring wells will be abandoned in 2014, resulting in the need for modifications to the Groundwater Monitoring Remedy Component. Monitoring well 01U667, which was sampled in August 2013, will be re-installed at the same location and depth following completion of Building 502 demolition and planned soil remediation. Monitoring well 01U667 will be sampled annually in accordance with the FY 2013 – FY 2017 Monitoring Plan (see Appendix A.1).

TABLE 8-1

SUMMARY OF GROUNDWATER MONITORING REQUIREMENTS
FISCAL YEAR 2013
SITE I, OU2
ARDEN HILLS, MINNESOTA

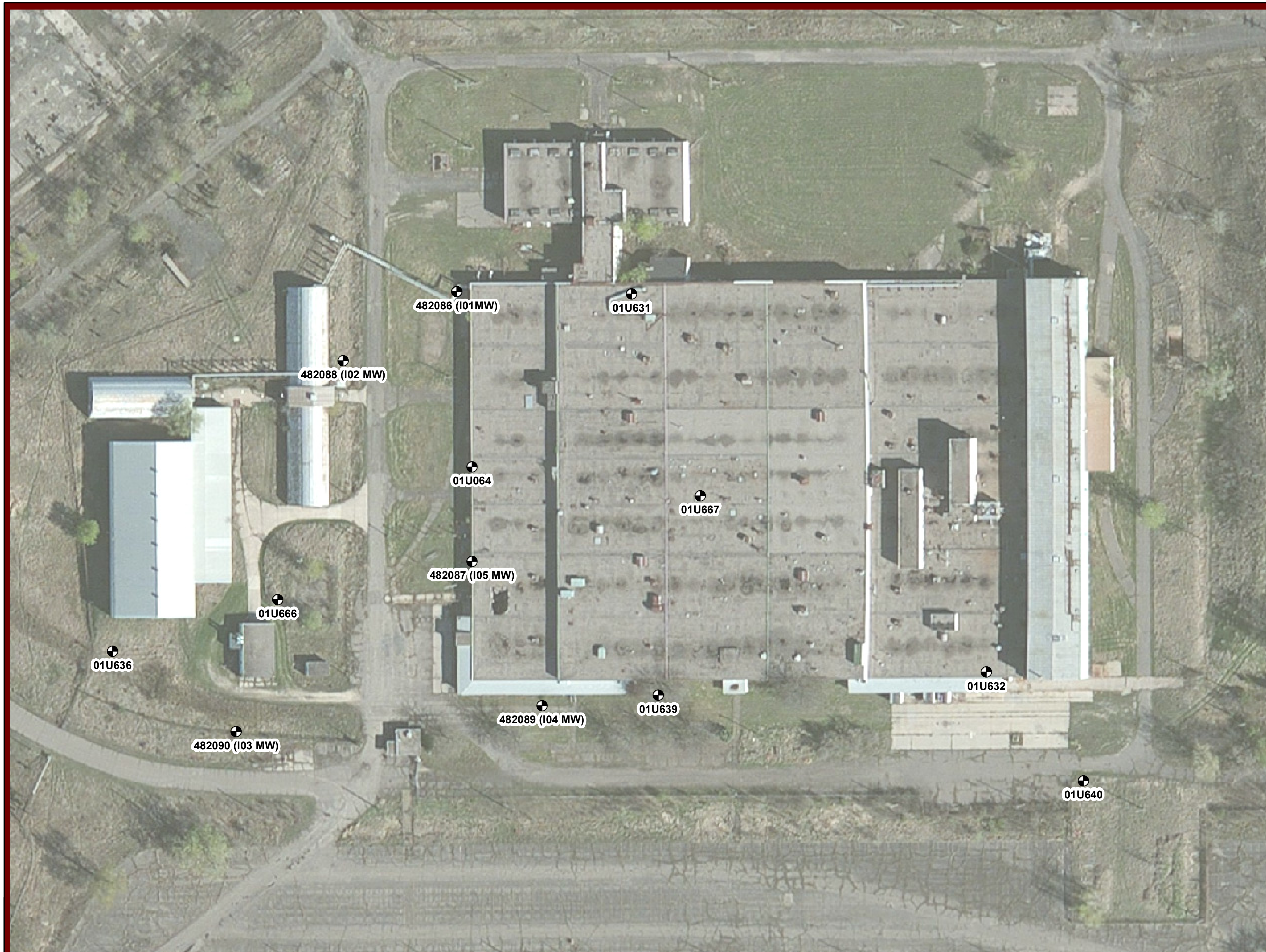
Remedy Component		Monitoring Requirements	Responsible Party	Document Containing the Monitoring Plan
#1: Groundwater Monitoring	a.	Groundwater quality and water levels to track remedy progress.	ATK	Site I Monitoring Plan in Annual Performance Report
#2: Additional Investigation	a.	None (completed)		
#3: 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

GROUNDWATER QUALITY DATA
FISCAL YEAR 2013
SITE I, TCAAP
ARDEN HILLS, MINNESOTA

		Trichloroethene	*cis-1,2-Dichloroethylene*	*trans-1,2-Dichloroethylene*	*Vinyl chloride*
Site I Cleanup Level (1)		30	70 (total)		0.2
Location	**Date**	**TRCLE**	**C12DCE**	**T12DCE**	**C2H3CL**
01U064	4/26/2013	0.94 (JP)	4.2	<1	<1
01U632	4/26/2013	**120**	27	0.35 (JP)	<1
01U636	4/26/2013	<1	<1	<1	<1
01U639	4/26/2013	9.5	<1	<1	<1
01U640	4/26/2013	<1	<1	<1	<1
I01MW	4/26/2013	0.33 (JP)	<1	<1	<1
I02MW	4/26/2013	0.62 (JP)	<1	<1	<1
I02MW D	4/26/2013	0.76 (JP)	<1	<1	<1
I04MW	4/26/2013	NS	NS	NS	NS
I05MW	4/26/2013	1.6	<1	<1	<1
01U667 (2)	8/13/2013	4.7	**500**	1.4	**300**

Notes:
Concentrations in ug/L.
D - Duplicate Sample
JP - Analyte value is between the Method Detection Limit and the Reporting Limit
NS - Not sampled, primary well 01U639 was sampled instead
(1) Cleanup levels for Site I Shallow Groundwater are from the OU2 ROD
(2) On August 13, 2013, monitoring well 01U667 was sampled at the request of EPA/MPCA
Bolding indicates exceedances of cleanup levels



LEGEND:

UNIT 1 MONITORING WELLS

NOTE:

WELL NOMENCLATURE:
ERIS OR MN UNIQUE # NAME
(COMMON NAME)

0 50 100 200 Feet

1 inch = 100 feet

N

Geographic Information Systems

W:\0-GIS\TCAAP\GIS\Site I\2013\Figure 8-1 (Site I MW Map) (112113)11x17.mxd

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ARDEN HILLS, MINNESOTA

SITE I MONITORING
WELL LOCATION MAP

FIGURE: 8-1

JOB NUMBER: 182602642 | DRAWN BY: TF | CHECKED BY: AG | APPROVED BY: AG | DATE: 11/21/13

LEGEND:

- UNIT 1 MONITORING WELLS
- UNIT 3 MONITORING WELLS
- 948.38 GROUNDWATER ELEVATION (FEET AMSL)
- NM NOT MEASURED
- A — A' GEOLOGIC CROSS SECTION LOCATION

NOTE:

WELL NOMENCLATURE:
ERIS OR MN UNIQUE # NAME
(COMMON NAME)

0 50 100 200 Feet
1 inch = 100 feet

N

Geographic Information Systems

W:\0-GIS\TCAAP\GIS\Site I\2013\Figure 8-2 (Geo X Section)(112113)11X17.mxd

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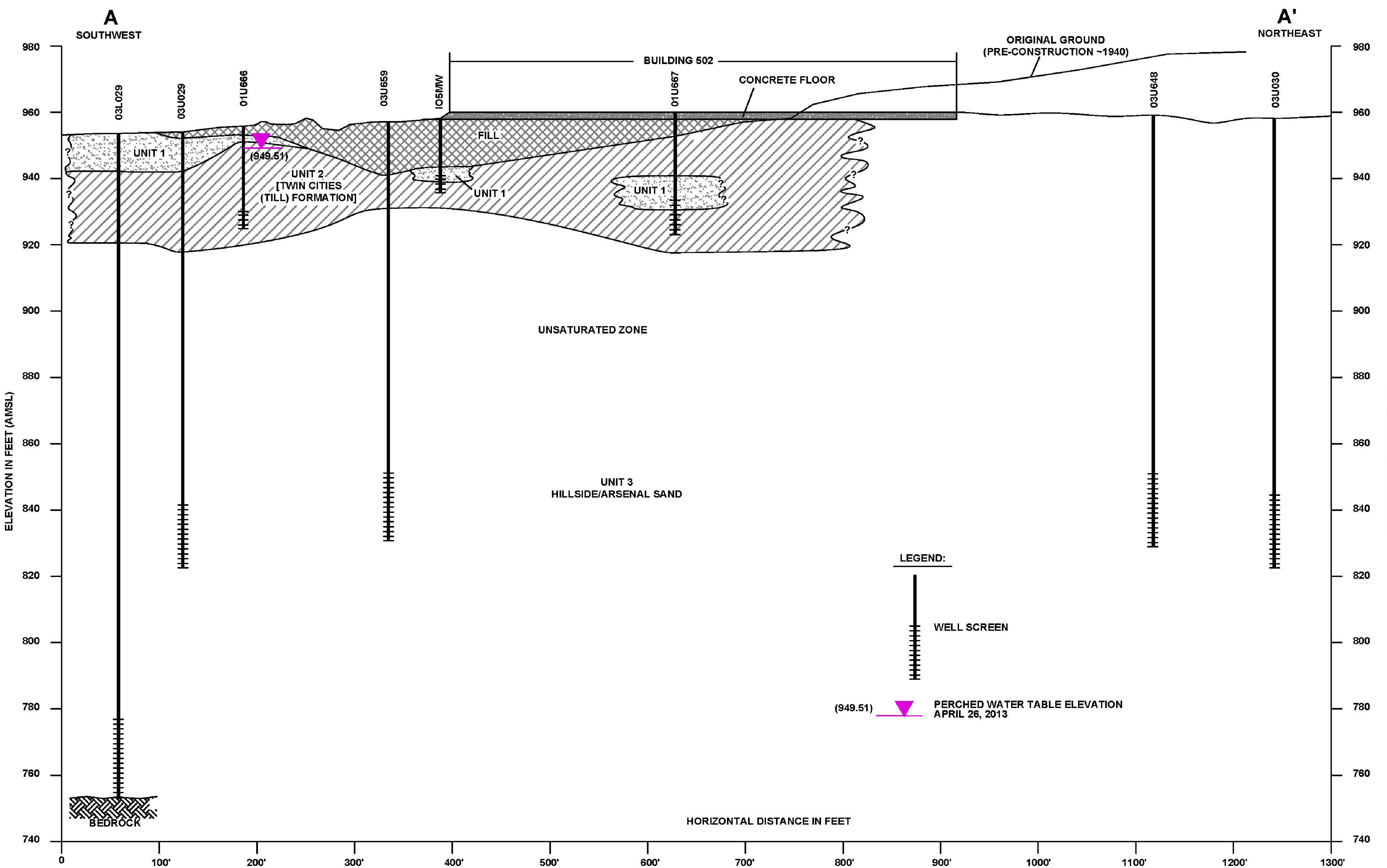
SITE I, UNIT 1
04/26/13 GROUNDWATER ELEVATION MAP
AND GEOLOGIC CROSS SECTION

FIGURE: 8-2

JOB NUMBER:	DRAWN BY:	CHECKED BY:	APPROVED BY:	DATE:
182602642	TF	AG	AG	11/21/13



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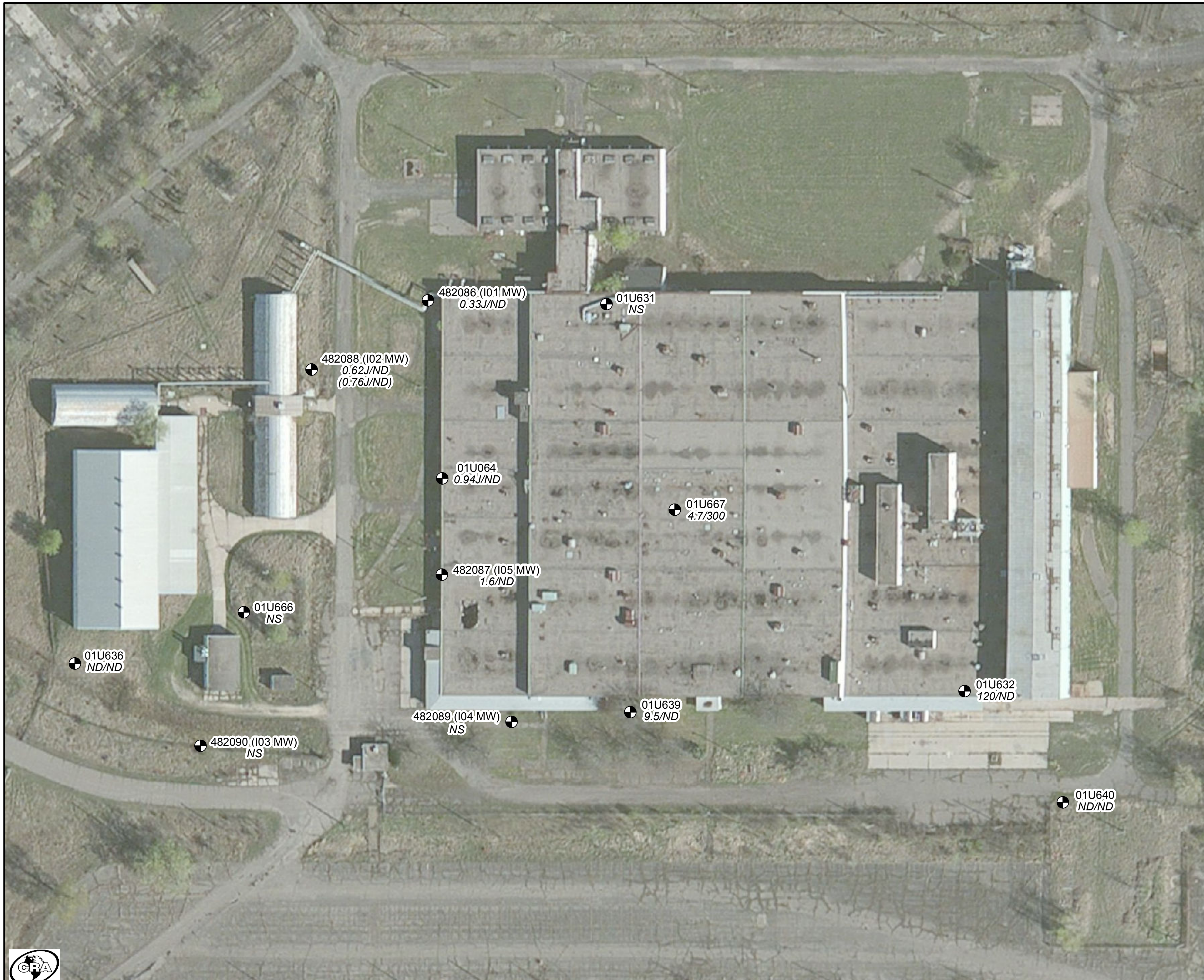
PREPARED FOR: ALLIANT TECHSYSTEMS TWIN CITY ARMY AMMUNITION PLANT ARDEN HILLS, MINNESOTA		GEOLOGIC CROSS SECTION A-A'		FIGURE: 8-3
JOB NUMBER: 182602642	DRAWN BY: KM	CHECKED BY: AG	APPROVED BY: AG	DATE: 11/21/13



LEGEND

4.7/300	TRCLE / C2H3CL CONCENTRATION (µg/L)
J	ESTIMATED CONCENTRATION
( )	DUPLICATE RESULTS
ND	ANALYTE NOT DETECTED
NS	WELL NOT SAMPLED
◕	UNIT 1 MONITORING WELL

figure 8-4

SITE I TRCLE AND C2H3CL CONCENTRATIONS - FY2013
OPERABLE UNIT 2
Arden Hills, Minnesota

083145-43(001)GIS-SP003 AUG 12/2014

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 2013 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. The comprehensive monitoring well sampling round was conducted in June 2013. Figure 9-1 presents the sampling and water level monitoring locations. Figure 9-1 also shows the cross-section alignment.

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., which will identify modifications to previous years sampling as a result of monitoring well abandonment. In addition, ATK notified the EPA/MPCA in a letter dated November 7, 2013, of their intent to conduct voluntary push probe shallow groundwater sampling following removal of the concrete slab to better define the width of the plume.

Are any changes or additional actions required for this remedy component? Yes. In 2014 two monitoring wells will be removed from the water quality sampling list as a result of monitoring well abandonment.

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 June 2013 for FY 2013. The results of the sample collected during FY 2013 are presented in Table 9-2. There were no COCs detected in the Unit 3 sentinel well at concentrations above the method detection limit.

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 Building 103 slab, as designed.

Is the system providing hydraulic capture of the plume?

Yes. Water level data are presented in Table 9-3. Figure 9-2 presents a plan view of the groundwater contours from the June 2013 round of groundwater level measurements. At nested wells, the numerically lowest water elevation was used to create the plan view contours. Monitoring wells downgradient of the extraction trench show consistently higher water levels than those near and upgradient of the trench. This demonstrates that the horizontal hydraulic gradient has been reversed toward the extraction trench due to system operation.

Vertical capture was also effective as illustrated on Figure 9-3. As seen in the figure, groundwater both upgradient and downgradient of the trench is captured and collected. The upward gradient beneath the trench indicates that groundwater does not migrate below the trench. The monitoring coverage provided by the bundle piezometers, demonstrates complete vertical and horizontal hydraulic capture.

Figure 9-4 presents the trichloroethene concentrations from the June 2013 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. Comparison of Figure 9-4 to the groundwater elevation contour maps indicates that the VOC plume is hydraulically contained by the treatment system.

Are any changes or additional actions required for this remedy component? Yes. As a result of site redevelopment activities, two monitoring wells (01U628 and 01U604) historically used to monitor hydraulic capture have been approved for abandonment in 2014. Existing wells (e.g., 01U603 and 01U617) located up gradient and down gradient of the collection trench will provide adequate coverage to continue hydraulic and water quality monitoring of the shallow groundwater, and verify hydraulic containment at Site K.

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 2013, the treatment system functioned and was operational 98% of the time. During FY 2013, 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 2013, with the exception of copper and zinc in the effluent sample collected on March 12, 2013. Discharge concentrations of copper and zinc exceeded the substantive requirements document effluent concentration limit (REQ); and therefore, the discharge was resampled on April 8, 2013 per the requirements of the project Data Quality Objectives (Performance Monitoring QAPP, Rev. 12; Table 2e). Concentrations of copper and zinc collected from the treatment system discharge on April 8, 2013 were below the defined effluent concentration 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 2013?

On July 30, 2013, 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 2,100,910 gallons of water resulting in the removal of 10.07 pounds of VOCs from the aquifer in FY 2013. The cumulative mass removal is 309.0 pounds of VOCs.

As shown on Figure 9-4, trichloroethene concentrations range from non-detect to 11,000 μg/L. The FY 2013 concentrations at wells 01U615 and 01U611, which monitor the core of the plume, showed a decrease from 3,400 μg/L to 3,300 μg/L in 01U615 and the same result of 11,000 μg/L in 01U611, compared to the concentrations measured in FY 2012. The FY 2013 concentration of trichloroethene at 01U615 compares with historical concentrations from the last fifteen years of sampling, which have ranged from 1,800 μg/L to 7,300 μg/L. Trichloroethene concentrations at monitoring wells 01U611 and 01U615 have been relatively stable over the last ten years of monitoring. Figure 9-5 shows trichloroethene and total 1,2-dichloroethene versus time for 01U611 and 01U615. Water levels measured during the FY 2013 monitoring were 0.64 feet lower at 01U615 and 1.77 feet lower at 01U611 compared to FY 2012 elevations. These wells have historically exhibited fluctuating groundwater elevations.

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 2012 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 2013

On August 14, 2013, EPA/MPCA approved modifications to the Site K monitoring well network to allow permanent abandonment of 13 Unit 1 monitoring wells. Appendix A has been modified to reflect changes in the Site K Monitoring Plan.

TABLE 9-1

SUMMARY OF GROUNDWATER MONITORING REQUIREMENTS
FISCAL YEAR 2013
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 and mass removal calculation.	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).		

T:\1561 TCAAP\APR\FY13 APR\Report\Tables\Section 9\T9-1 Site K Monitoring Requirements 2013-Sheet1

TABLE 9-2

GROUNDWATER QUALITY DATA
FISCAL YEAR 2013
SITE K, TCAAP
ARDEN HILLS, MINNESOTA

		Trichloroethene	cis-1,2-Dichloroethene	trans-1,2-Dichloroethene
Site K Cleanup Level (1)		30	70 (total)	
Location	**Date**	**TRCLE**	**C12DCE**	**T12DCE**
01U128	6/4/2013	<1	1.8	<1
01U603	6/4/2013	<1	<1	<1
01U604	6/4/2013	<1	<1	<1
01U611	6/4/2013	**11000 (3)**	**2500 (2)**	**2500 (2)**
01U615	6/4/2013	**3300 (5)**	**800 (4)**	**62 (4)**
01U615 D	6/4/2013	**3200 (5)**	**800 (4)**	**60 (4)**
01U617	6/4/2013	<1	11	0.74 (JP)
01U618	6/4/2013	9.2	7.2	1.5
01U619	6/4/2013	0.46 (JP)	<1	<1
01U621	6/4/2013	<1	0.49 (JP)	<1
01U621 D	6/4/2013	<1	<1	<1
03U621	6/4/2013	<1	<1	<1
K04MW	6/4/2013	<1	<1	<1

Notes:
Concentrations in ug/L.
D - Duplicate analysis.
JP - Value is estimated, result is less than reporting level but greater than method detection limit.
(1) Cleanup levels for Site K Shallow Groundwater are from the OU2 ROD.
Bolding indicates exceedance of the cleanup level.
Sample dilution = 1, unless noted otherwise.
(2) Sample dilution = 25
(3) Sample dilution = 250.
(4) Sample dilution = 10
(5) Sample diliution = 100

Table 9-3

GROUNDWATER ELEVATION MONITORING
Fiscal Year 2013
SITE K, OU2
ARDEN HILLS, MINNESOTA

Well ID	*TOC Elevation*	*Depth to Water (ft. BGS)*	*Groundwater Elevation 6/3/2013*
01U047	880.31	5.49	874.82
01U048	885.32	10.04	875.28
01U052	886.51	10.67	875.84
01U065	883.90	9.16	874.74
01U128	883.69	7.61	876.08
01U601	892.68	6.03	886.65
01U602	889.35	3.36	885.99
01U603	887.31	7.34	879.97
01U604	888.98	9.67	879.31
01U605	887.76	8.52	879.24
01U607	891.01	4.05	886.96
01U608	889.30	2.73	886.57
01U609	889.33	2.7	886.63
01U611	889.29	4.74	884.55
01U612	886.91	6.85	880.06
01U613	892.07	5.92	886.15
01U615	888.66	9.17	879.49
01U616	890.37	7.99	882.38
01U617	887.72	7.96	879.76
01U618	891.52	8.83	882.69
01U619	891.75	6.17	885.58
01U620	888.65	7.07	881.58
01U621	886.57	5.78	880.79
01U624A	889.88	8.64	881.24
01U624B	889.88	8.66	881.22
01U624C	889.91	8.68	881.23
01U624D	889.89	8.67	881.22
01U625A	886.92	6.77	880.15
01U625B	886.91	6.79	880.12
01U625C	886.91	6.78	880.13
01U625D	886.92	6.78	880.14
01U626A	886.87	7.24	879.63
01U626B	886.88	7.21	879.67
01U626C	886.88	7.15	879.73
01U626D	886.88	7.11	879.77
01U627A	886.46	6.13	880.33
01U627B	886.47	6.54	879.93
01U627C	886.47	6.62	879.85
01U627D	886.48	6.62	879.86
01U628A	887.82	7.54	880.28
01U628B	887.83	7.64	880.19
01U628C	887.82	7.88	879.94
01U628D	887.84	7.91	879.93
482085 (K01MW)	891.24	7.06	884.18
482084 (K02MW)	891.35	4.11	887.24
482083 (K04MW)	887.66	7.6	880.06
03U621	887.01	32.67	854.34

TABLE 9-4

TREATMENT SYSTEM CONCENTRATIONS (ORGANICS)
FISCAL YEAR 2013
SITE K, OU2
ARDEN HILLS, MINNESOTA

Location	***Sample Date***	1,1-Dichloroethane µg/L		1,1-Dichloroethene µg/L		1,2-Dichloroethane µg/L		cis-1,2-Dichloroethene µg/L		trans-1,2-Dichloroethene µg/L		Trichloroethene µg/L		Vinyl chloride µg/L	
Effluent	12/12/2012	<1		<1		<1		<1		<1		<1		<1	
Effluent	3/12/2013	<1		<1		<1		<1		<1		<1		<1	
Effluent	6/4/2013	<1		<1		<1		0.69	JP	<1		7		<1	
Effluent	9/12/2013	<1		<1		<1		<1		<1		<1		<1	
Effluent (Dup)	9/12/2013	<1	D	<1	D	<1	D	<1	D	<1	D	<1	D	<1	D
Influent	12/12/2012	<1		<1		<1		5.6		1.1		10		<1	
Influent (Dup)	12/12/2012	<1	D	<1	D	<1	D	5.0	D	0.75	D,JP	8.3	D	<1	
Influent	3/12/2013	<1		<1		<1		100		16		150		0.43	JP
Influent (Dup)	3/12/2013	<1	D	<1	D	<1	D	98	D	15	D	140	D	0.47	JP
Influent	6/4/2013	<1		<1		<1		110		19		230		0.61	JP
Influent (Dup)	6/4/2013	<1	D	<1	D	<1	D	110	D	19	D	230	D	0.63	JP
Influent	9/12/2013	<1		<1		<1		110		17		120		0.48	JP
MDL	12/12/2012, 3/12/2013, 6/4/2013, 9/12/2013	0.30		0.30		0.30		0.30		0.30		0.30		0.30	
RL		1		1		1		1		1		1		1	
REQ.		--		7.0		3.8		70		100		10		0.18	

Notes:
RL - Reporting Limit
D - Duplicate Analysis
JP - Value Estimated. Result is less than reporting level but greater than method detection limit.
MDL - Method Detection Limit
REQ - Substantive Requirement Document Concentration Limit, Maximum Daily Effluent Concentration

TABLE 9-5

TREATMENT SYSTEM CONCENTRATIONS (INORGANICS)
FISCAL YEAR 2013
SITE K, OU2
ARDEN HILLS, MINNESOTA

Location	*Sample Date*	*Phosphorus Total*		*Copper* µg/L		*Cyanide* µg/L		*Lead* µg/L	*Mercury* µg/L		*Silver* µg/L		*Zinc* µg/L
Effluent	12/12/2012	540		5.7		3.9	U	1	0.031	U	0.15	U	9.9
Effluent	3/12/2013	740		51.0		3.1	U	10	0.031	U	0.33	U	240
Effluent	4/8/2013[1]	NS		2.9		NS		NS	NS		NS		21
Effluent	6/4/2013	320	JP, UMB.085	6.1	J3.35	3.1	U	1.1	0.031	U	0.33	U	24
Effluent	9/12/2013	920		14.0		3.1	U	0.90	0.031	U	0.33	U	71
MDL	12/12/2012	150		0.30		3.90		0.15	0.031		0.15		0.41
MDL	3/12/2013	160		0.60		3.10		0.45	0.031		0.33		1.70
MDL	4/8/2013	NS		0.60		NS		NS	NS		NS		1.70
MDL	6/4/2013	160		0.60		3.1		0.45	0.031		0.33		1.70
MDL	9/12/2013	160		0.60		3.1		0.45	0.031		0.33		1.70
RL		500		1		10		0.5	0.1		0.5		2
REQ.		1000		21		17		106	0.2		3.4		134

Notes:
RL - Reporting Limit
MDL - Method Detection Limit
REQ - Substantive Requirement Document Concentration Limit, Maximum Daily Effluent Concentration
JP - Analyte value is between the MDL and RL.
U- Analyte not detected above Method Detection Limit
NS - Not Sampled
1 - Copper and Zinc resampled as a result of REQ exceedences during March 2013 sampling
UMB - Contamination in method blank; # = concentration present in Blank
J# - MD pair for copper was out of imit; # = MD pair difference

TABLE 9-6

SUMMARY OF MONTHLY VOC REMOVAL
FISCAL YEAR 2013
SITE K, TCAAP
ARDEN HILLS, MINNESOTA

Month	Total Monthly Flow (million gallons)	Total VOC Influent Concentration	Total VOC Effluent Concentration	Total VOCs in Treatment Center Discharge (g)	Total VOC Mass Removed (g)	Total VOC Mass Removed (lb)
Cumulative As Of September 2013 (FY13)						298.9
October[(1)]	0.20373	16.7	0	0.00	12.86	0.03
November[(1)]	0.33428	16.7	0	0.00	21.10	0.05
December	0.34413	16.7	0	0.00	21.72	0.05
January[(1)]	0.29316	266.00	0	0.00	294.77	0.65
February[(1)]	0.23597	266.00	0	0.00	237.26	0.52
March	0.30353	266.00	0	0.00	305.19	0.67
April[(1)]	0.45842	359.60	7.7	13.34	609.78	1.34
May[(1)]	0.59609	359.60	7.7	17.35	792.91	1.75
June	0.63325	359.60	7.7	18.43	842.34	1.86
July[(1)]	0.58027	249.48	0	0.00	547.21	1.21
August[(1)]	0.48144	249.48	0	0.00	454.01	1.00
September	0.45682	249.48	0	0.00	430.79	0.95
Totals - FY13	2.10091			49.1	4570.0	10.1
Cumulative To Date						309.0

Notes:
[(1)] Influent and Effluent VOC concentrations from 12/12/12, 03/12/13, 06/04/13 and 09/12/13 quarterly samples, respectively.
Calculations based on compounds with concentrations above the CRDL only.

Legend

- ANNUAL WELLS
- MONITORING WELLS
- CLASS 3 SENTINAL WELL
- SITE K COLLECTION TRENCH LOCATION
- CROSS SECTION LOCATION

NOTE:

1) WELL NOMENCLATURE: ERIS OR MN UNIQUE # NAME (COMMON NAME)
2) BUILDING 103 DEMOLISHED IN 2006; CONCRETE SLAB REMAINS

0 60 120 240 Feet

1 inch = 120 feet

N

Geographic Information Systems

W:\0-GIS\TCAAP\GIS\Site K\2013\Figure9-1.mxd

Stantec

2335 HIGHWAY 36 WEST, ST. PAUL, MINNESOTA 55113 PHONE 651.636.4600 www.stantec.com

PREPARED FOR: ALLIANT TECHSYSTEMS TWIN CITY ARMY AMMUNITION PLANT ARDEN HILLS, MINNESOTA		SITE K MONITORING WELL LOCATION MAP		FIGURE: 9-1
JOB NUMBER: 182602642	DRAWN BY: TF	CHECKED BY: AG	APPROVED BY: AG	DATE: 11/21/13

Legend

- ANNUAL WELLS
- MONITORING WELLS
- CLASS 3 SENTINAL WELL
- POTENTIOMETRIC SURFACE
- TRENCH LOCATION
- 874.10 GROUNDWATER ELEVATION (FEET AMSL)
- NOT USED FOR CONTOURING

NOTE:

1) WELL NOMENCLATURE: ERIS OR MN UNIQUE # NAME (COMMON NAME)
2) BUILDING 103 DEMOLISHED IN 2006; CONCRETE SLAB REMAINS

0 60 120 240 Feet

1 inch = 120 feet

N

Geographic Information Systems

W:\0-GIS\TCAAP\GIS\Site K\2013\Figure9-2.mxd

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PREPARED FOR:
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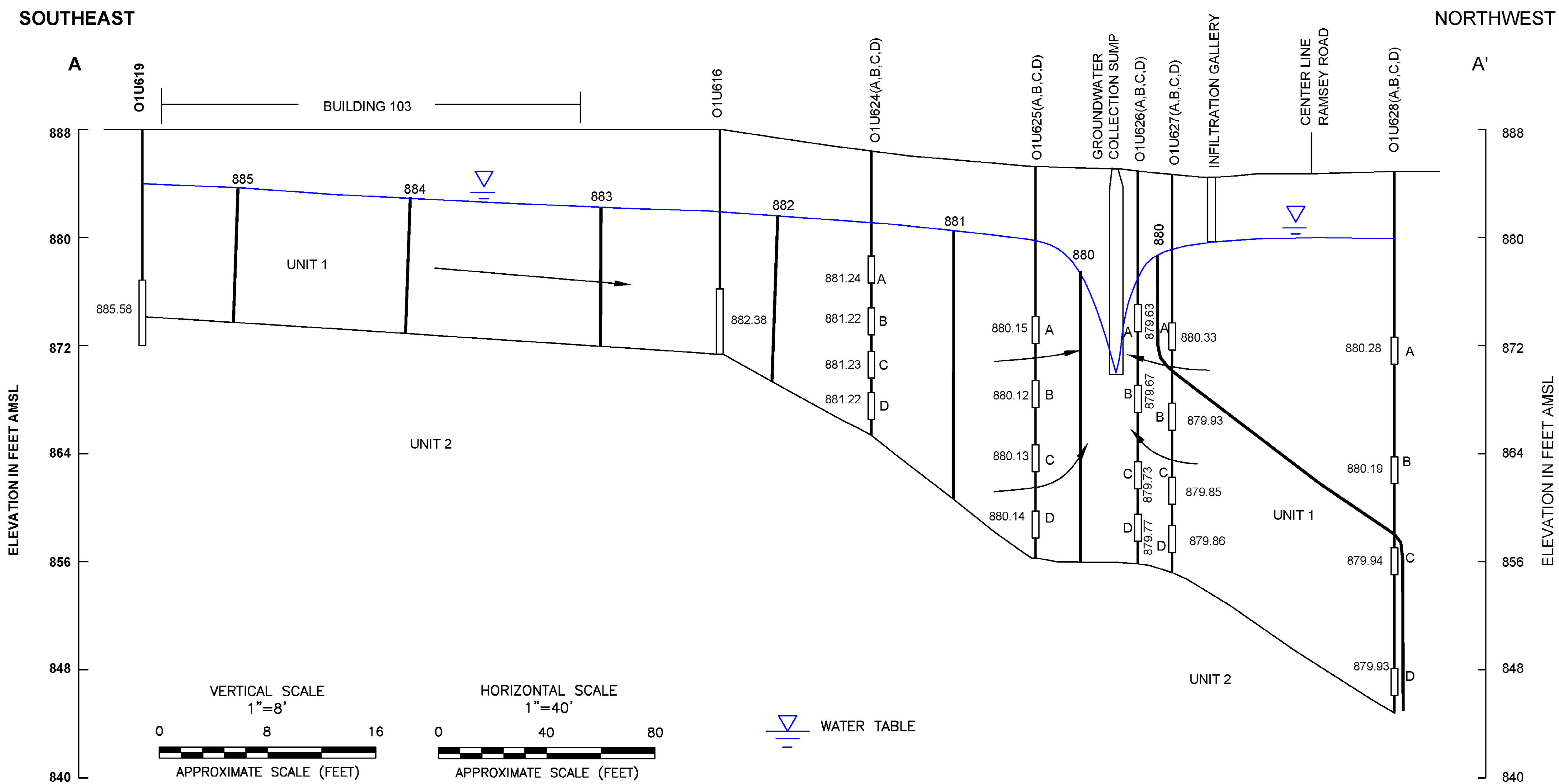
TWIN CITY ARMY AMMUNITION PLANT
ARDEN HILLS, MINNESOTA

SITE K, UNIT 1 AND UNIT 3
GROUNDWATER ELEVATION DATA
06/04/13

FIGURE: 9-2

JOB NUMBER:	DRAWN BY:	CHECKED BY:	APPROVED BY:	DATE:
182602642	TF	AG	AG	11/21/13



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TWIN CITY ARMY AMMUNITION PLANT
ARDEN HILLS, MINNESOTA

SITE K
HYDROGEOLOGIC CROSS SECTION A-A'
06/01/12 (Q115)

FIGURE: 9-3

JOB NUMBER:	DRAWN BY:	CHECKED BY:	APPROVED BY:	DATE:
182602642	TF	AG	AG	11/21/13

Legend

- ANNUAL WELLS
- MONITORING WELLS
- CLASS 3 SENTINAL WELL
- TRENCH LOCATION
- TRICHLOROETHENE CONCENTRATION CONTOUR
- 4400 TRICHLOROETHENE CONCENTRATION (µg/L)
- ND NOT DETECTED
- J VALUE IS ESTIMATED

NOTE:

1) WELL NOMENCLATURE: ERIS OR MN UNIQUE # NAME (COMMON NAME)

2) BUILDING 103 DEMOLISHED IN 2006; CONCRETE SLAB REMAINS

0 60 120 240 Feet

1 inch = 120 feet

N

Geographic Information Systems

W:\0-GIS\TCAAP\GIS\Site K\2013\Figure9-4.mxd

Stantec

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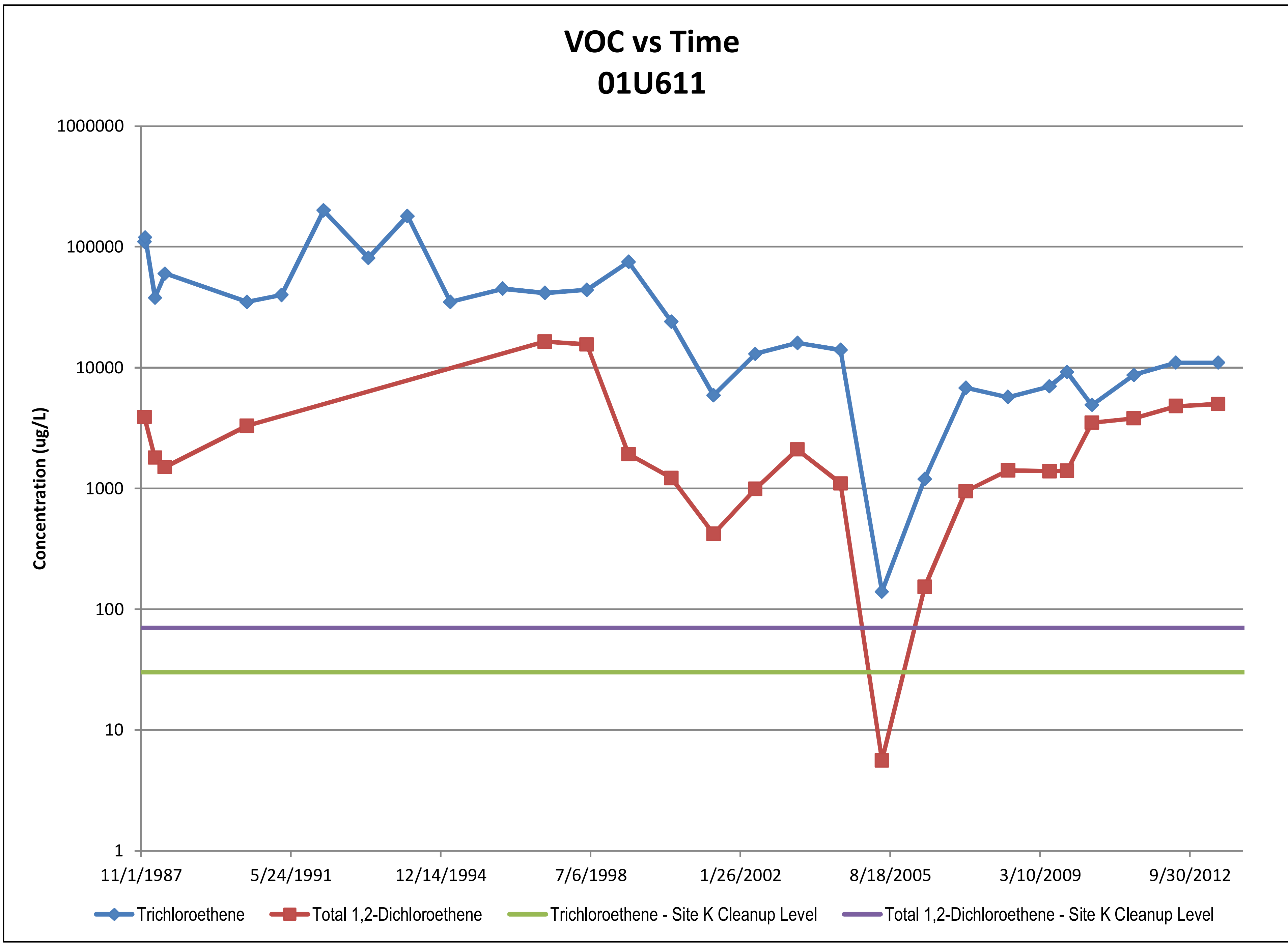
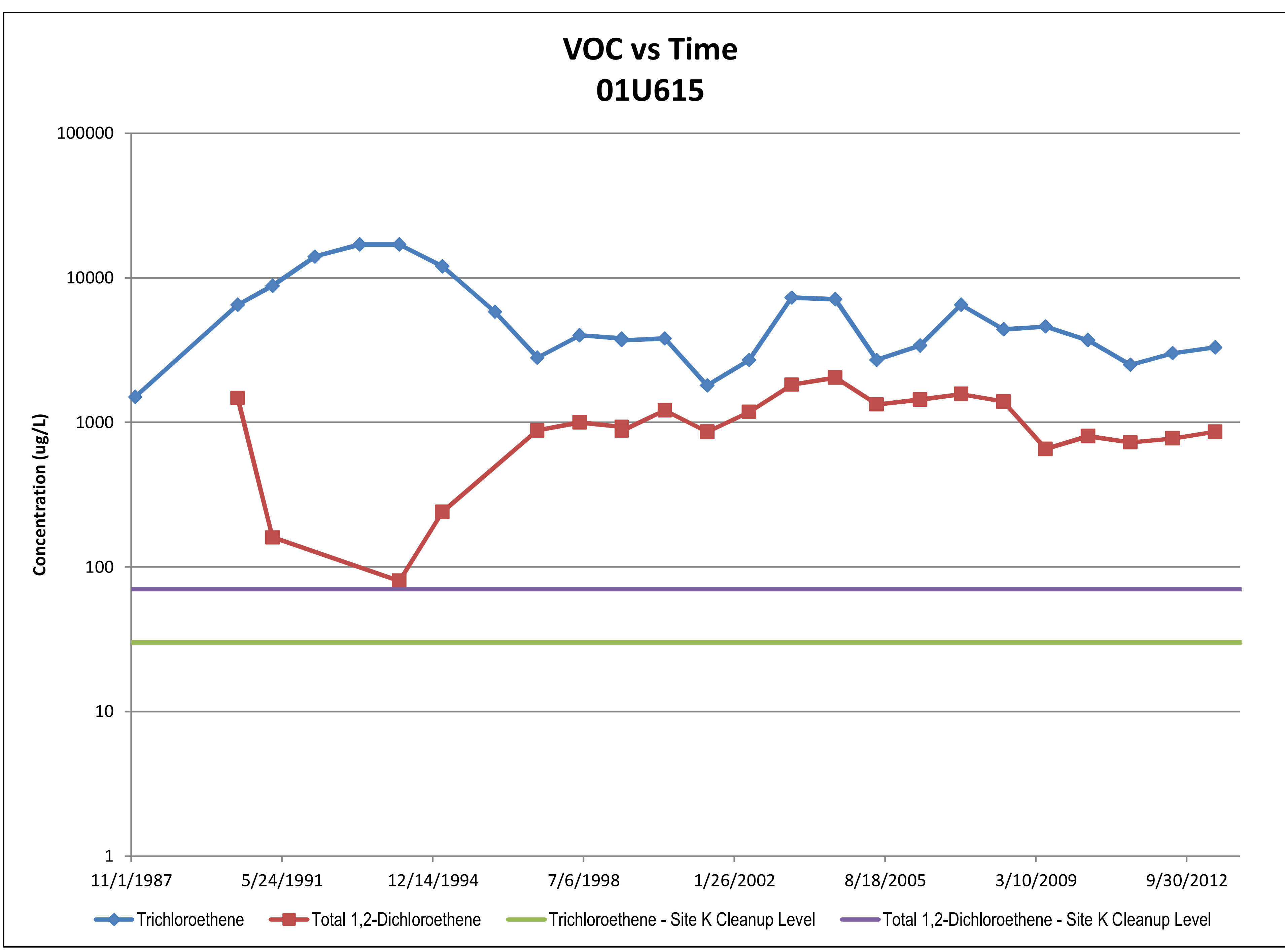
PREPARED FOR:					FIGURE:
ALLIANT TECHSYSTEMS TWIN CITY ARMY AMMUNITION PLANT ARDEN HILLS, MINNESOTA		SITE K, UNIT 1 AND UNIT 3 TCE CONCENTRATION MAP 06/04/13 (Q119)			9-4
JOB NUMBER: 182602642	DRAWN BY: TF	CHECKED BY: AG	APPROVED BY: AG		DATE: 11/21/13





Geographic Information Systems

W:\0-GIS\TCAAP\GIS\Site K\2013\Figure9-5.mxd

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PREPARED FOR: ALLIANT TECHSYSTEMS TWIN CITY ARMY AMMUNITION PLANT ARDEN HILLS, MINNESOTA		SITE K VOC VS TIME MW-01U615 & MW-01U611 PLOTS		FIGURE: 9-5
JOB NUMBER: 182602642	DRAWN BY: TF	CHECKED BY: AG	APPROVED BY: AG	DATE: 11/21/13

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 2013 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 2013 Monitoring Plan is included in Appendix A, documenting the water quality monitoring locations and frequencies. Building 102 groundwater level data collected in June 2013 is shown as groundwater elevation contours on Figure 10-2 (Site K water levels are also contoured on this figure to provide a more complete water level map in the Site vicinity). Groundwater quality data collected in FY 2013 is shown in Table 10-2. Groundwater quality data for FY 2013 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 2013 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? Yes. One well has been proposed for sealing in FY 2014, as this well is located upgradient from the VOC plume and has consistently shown no detectable VOCs from 2001 through 2013. This change is reflected in the monitoring plan shown in Appendix A.1.

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 2013?
Yes. On July 30, 2013, 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 2013 groundwater quality results include:

- 01U579 and 01U580 (source area): The trichloroethene concentration increased moderately. Historically, the concentrations in these two wells have shown relatively large increases and decreases.
- 01U/01L584 (just downgradient of the source area on the west side): Trichloroethene and cis-1,2-dichloroethene concentrations decreased significantly (in the range of an order of magnitude), reversing the increasing trend that had been observed in FY 2011/2012. The plume appears to be shifting (and/or narrowing) in the vicinity of this well nest (see Figures 10-3, 10-4, 10-5 and 10-7).
- 01L582 (further downgradient of the source area): Trichloroethene, cis-1,2-dichloroethene, and vinyl chloride concentrations decreased significantly, reversing the increasing trend that had been observed in FY 2011/2012 (e.g., cis-1,2-dichloroethene decreased from 300 to 180 µg/L).
- 01U048 (adjacent to Rice Creek): Vinyl chloride was the only VOC detected in this well. Vinyl chloride decreased from 0.073 to 0.041 µg/L, reversing the increasing trend that had been observed in FY 2011/2012.

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. 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). At the end of FY 2013, the Army was preparing an investigation report documenting this work, which the Army will submit for regulatory review in early FY 2014. However, the following key conclusion is supported by the data obtained: since no VOCs were detected in any of the geoprobe groundwater samples at concentrations above their respective cleanup levels, the supplemental investigation work confirms 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).

It appears that high groundwater levels may have contributed to the increasing VOC trends observed in FY 2011/2012, likely by putting groundwater in contact with more contaminated source area soils that had previously been above the water table. Groundwater levels steadily increased from December 2008 through June 2012 (an increase of over four feet with historic highs in June 2011 and June 2012), but were then slightly lower in June 2013, which may correlate with the start of declining VOC concentrations at 01U/01L584 and 01L582 in FY 2013.

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 2013 (Table 10-2). The concentration of the only detected chemical of concern in this well, vinyl chloride, decreased (by approximately half) in comparison to the FY 2012 concentration, as noted above. The FY 2013 vinyl chloride result of 0.041 µg/L was substantially below the cleanup level (trigger level) of 0.18 µg/L.

Do additional remedial measures need to be addressed?

No. Continued monitoring will verify whether the FY 2013 reversal of the increasing VOC trend that had been observed in FY 2011/2012 will continue. In any case, the July 2013 supplemental groundwater investigation work confirmed that a significant level of attenuation of the VOCs in shallow groundwater is occurring prior to travelling half the distance from 01L582 to Rice Creek, as expected, given the results of microcosm studies conducted at this Site.

Table 10-1

Summary of Building 102 Shallow Groundwater Monitoring Requirements
Fiscal Year 2013

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 2013

			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		7/25/13	<1	<1	<1	<1	0.041 JD22
01U578		7/25/13	<1	<1	<1	<1	---
01U579		7/25/13	**47**	2.6	<1	<1	---
01U580		7/25/13	**41**	JP 0.65	<1	<1	---
01U580	D	7/25/13	**39**	JP 0.71	<1	<1	
01U581		7/25/13	<1	2.8	<1	<1	---
01L581		7/25/13	**9.4**	5.7	<1	<1	---
01L581	D	7/25/13	**9.7**	5.7	<1	<1	---
01U582		7/25/13	JP 0.44	2.2	<1	<1	<0.05
01U582	D	7/25/13	---	---	---	---	<0.05
01L582		7/25/13	JP 0.57	**180**	JP 0.74	**1.5**	**1.4**
01U583		7/25/13	<1	<1	<1	<1	---
01L583		7/25/13	<1	<1	<1	<1	---
01U584		7/25/13	**29**	13	<1	<1	---
01L584		7/25/13	2.6	11	<1	<1	---

Notes:

(1) Cleanup levels for Building 102 Groundwater are from Table 3-5 of the Building 102 Groundwater EE/CA. Bolding (in red color) indicates exceedance of the cleanup level.

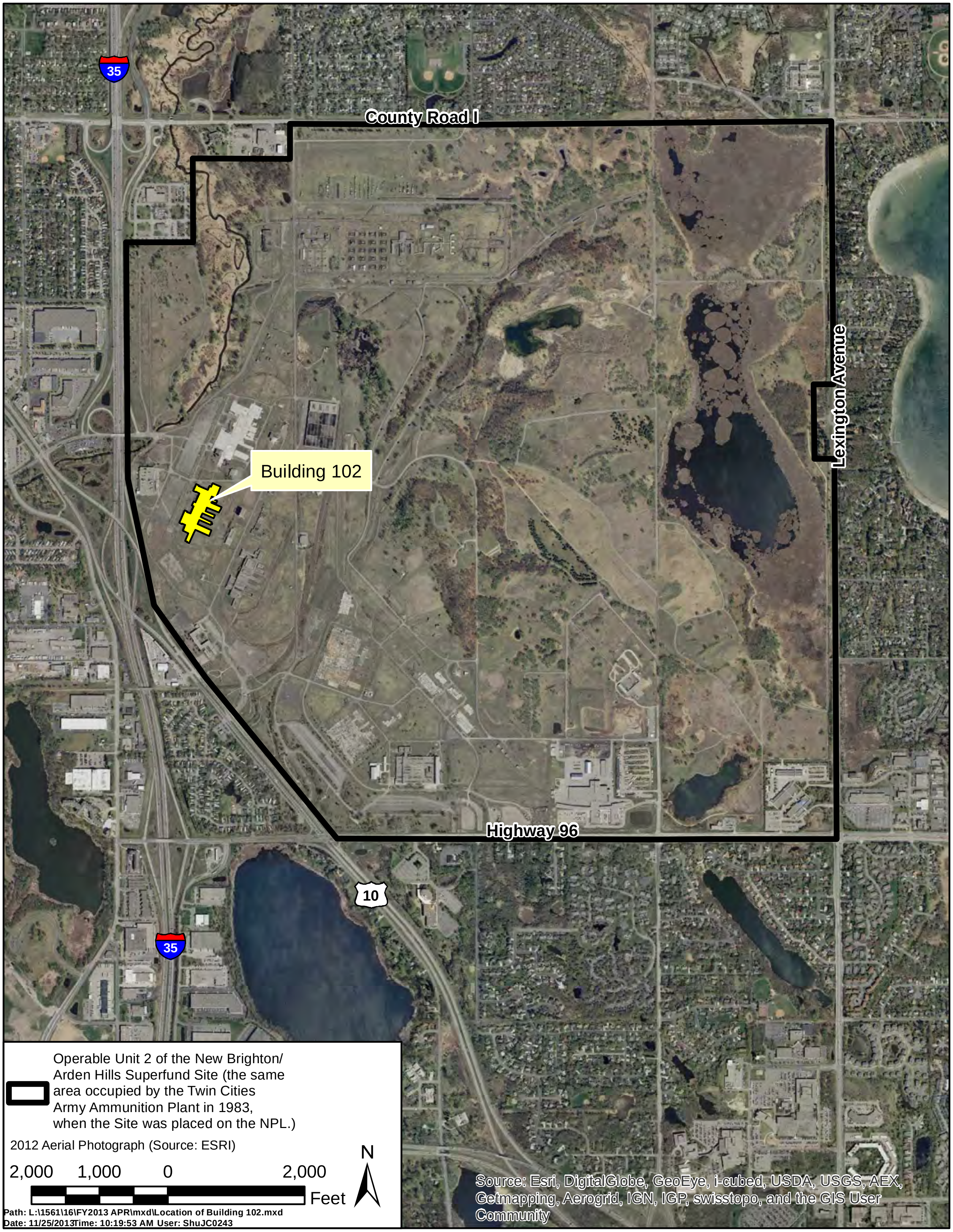
(2) This analysis of vinyl chloride is by Method 8260C-SIM to obtain a lower reporting limit for vinyl chloride.

--- Not sampled.

D Duplicate sample.

JD = The relative percent difference (rpd) of a duplicate sample was above the QC limit (the result for the rpd is listed after "JD"). If no number appears after the "JD", then the +/- RL criteria was not met. Result should be considered estimated.

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



ANNUAL PERFORMANCE REPORT

Location of Building 102

Engineers - Scientists
Business Professionals
www.wenck.com

Wenck
1800 Pioneer Creek Center
Maple Plain, MN 55359-0429
1-800-472-2232

FY 2013

Figure 10-1

ANNUAL PERFORMANCE REPORT

Building 102, Unit 1, Potentiometric Map - Summer 2013

Wenck

Engineers - Scientists
Business Professionals
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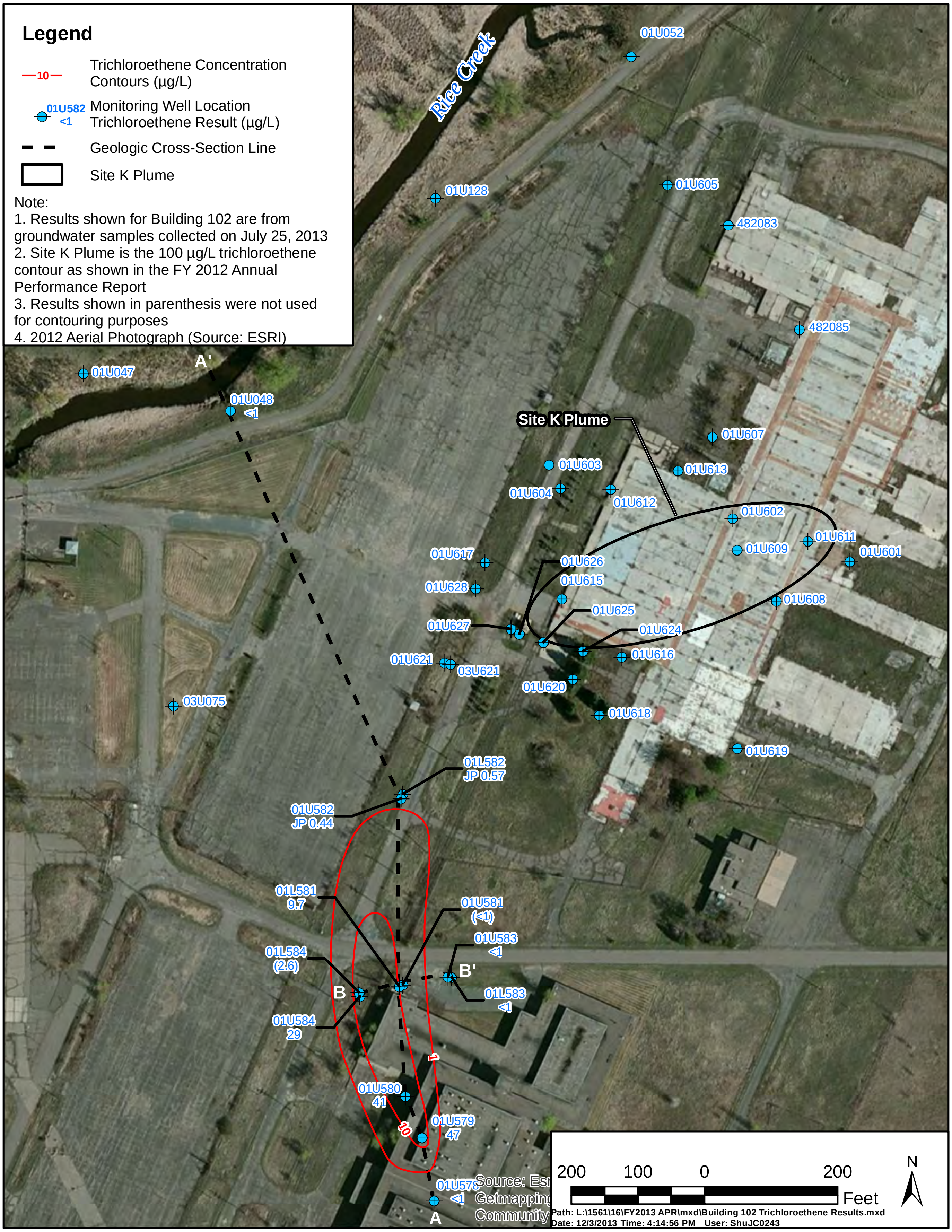
1800 Pioneer Creek Center
Maple Plain, MN 55359-0429
1-800-472-2232

FY 2013

Figure 10-2



ANNUAL PERFORMANCE REPORT

Trichloroethene Results - Summer 2013

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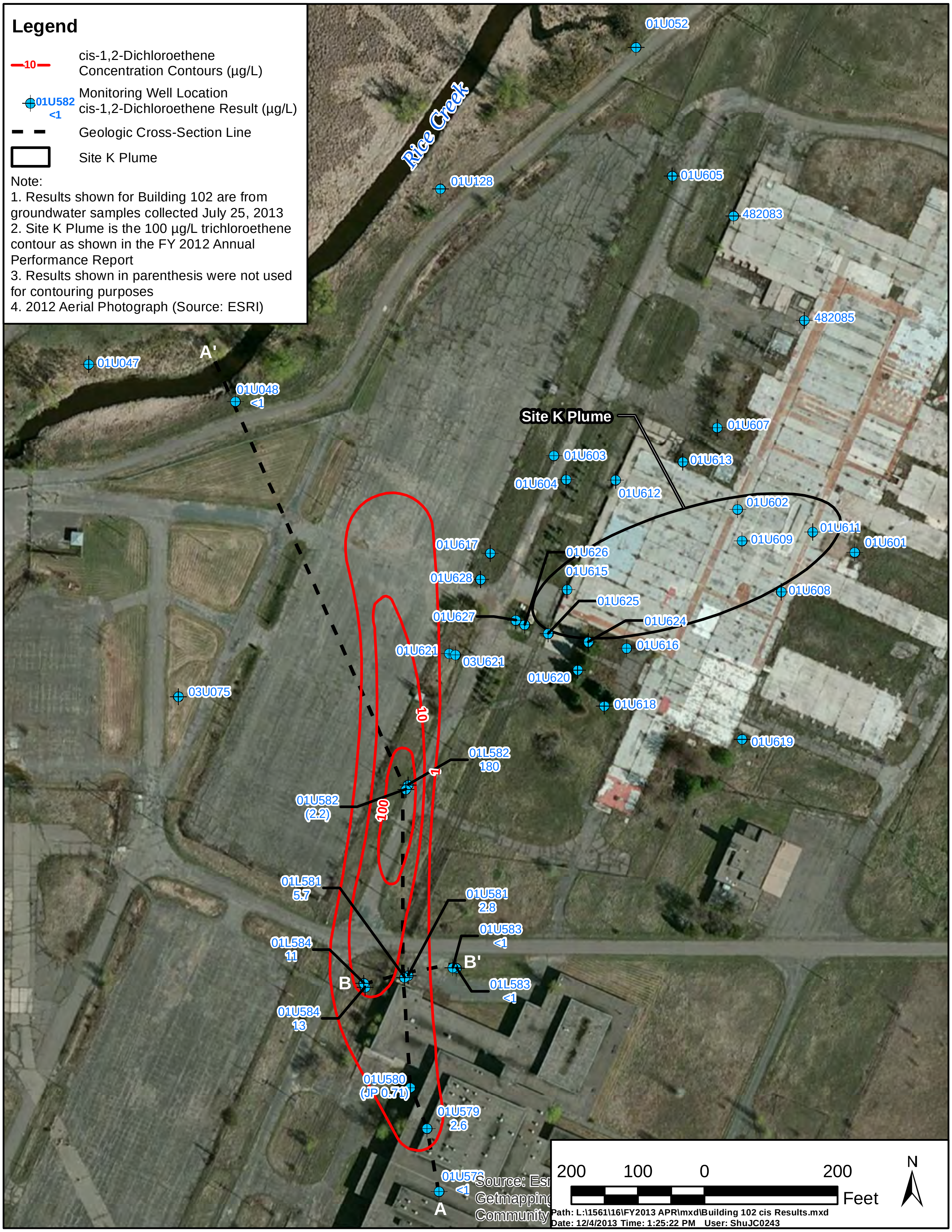
FY 2013

Figure 10-3



ANNUAL PERFORMANCE REPORT

cis-1,2-Dichloroethene Results - Summer 2013

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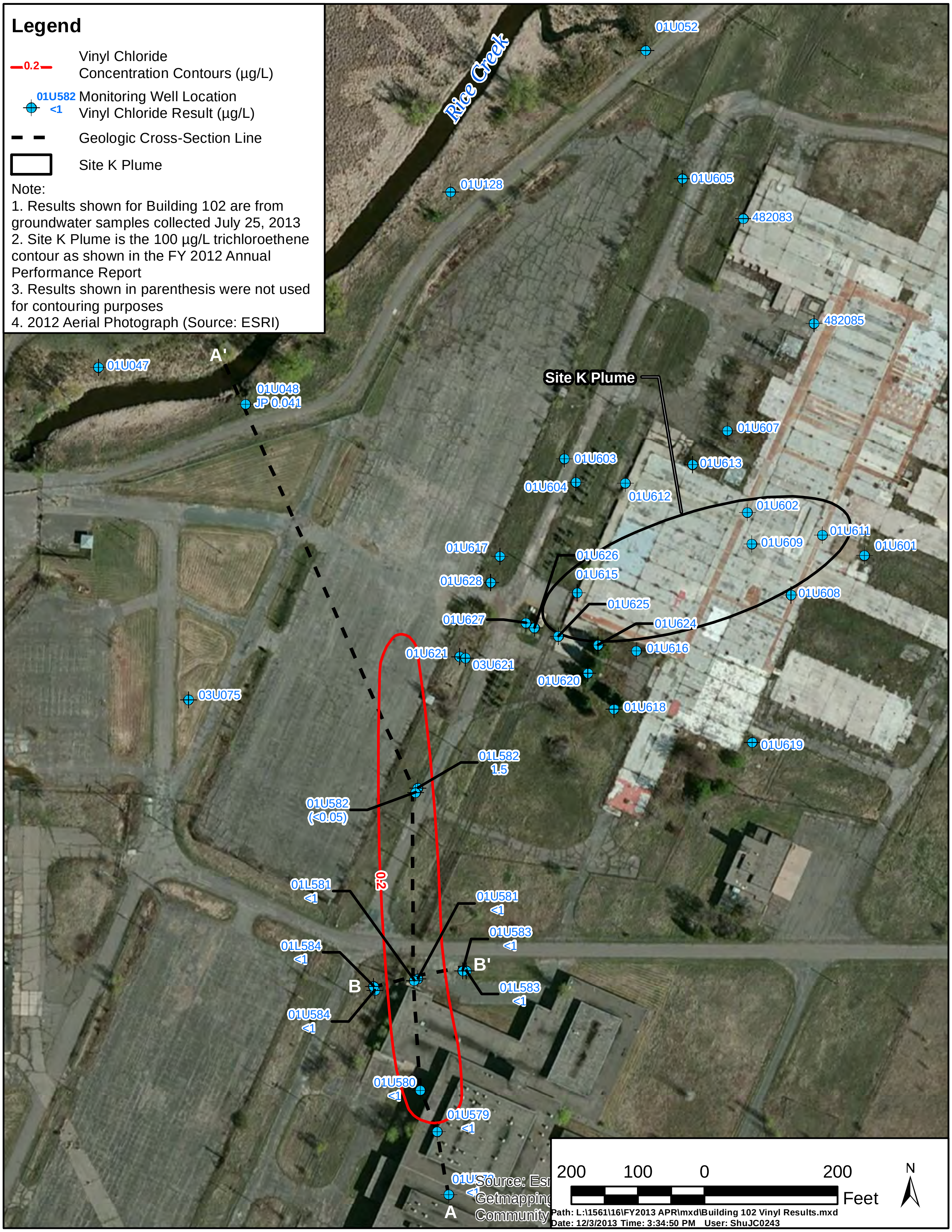
FY 2013

Figure 10-4



ANNUAL PERFORMANCE REPORT

Vinyl Chloride Results - Summer 2013

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1800 Pioneer Creek Center
Maple Plain, MN 55359-0429
1-800-472-2232

FY 2013

Figure 10-5

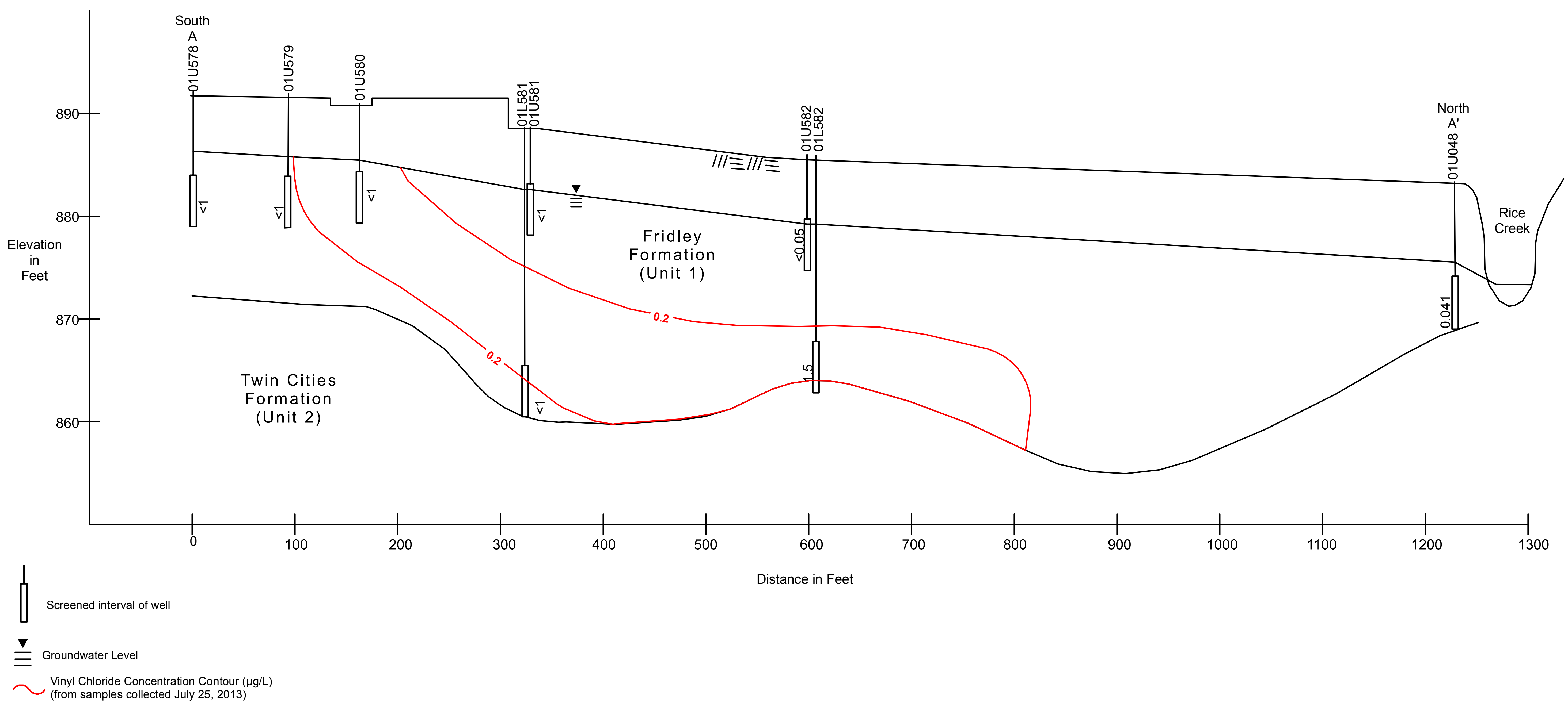

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Figure 10-6

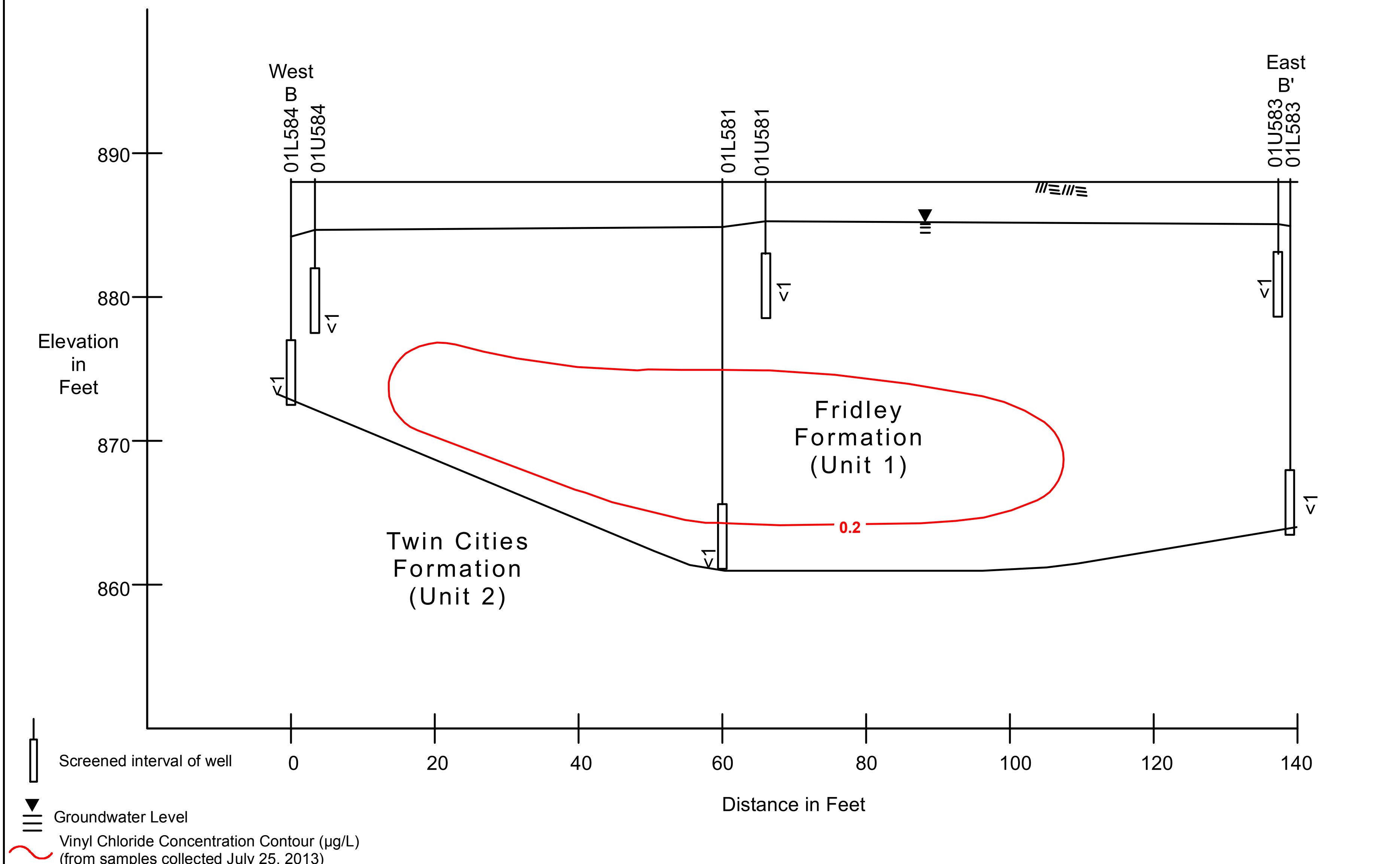

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Figure 10-7

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. 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 alternatives, 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 remainder of this section evaluates the performance of this remedy.

11.1 REMEDY COMPONENT #1: POND G SURFACE WATER TREATMENT

Description: "Chemical alteration of Pond G surface water hardness."
(OU2 ROD Amendment #4, page 4-2)

Performance Standard (how do you know when you're done):
When Pond G surface water has been treated to raise the hardness of the water. Minnesota's surface water lead standard is dependent on the hardness of the water body and the lead standard decreases with decreasing hardness, meaning that the relatively low hardness of Pond G results in a relatively low standard for lead. Hence, the increase in water hardness is intended to increase the standard for lead, thereby achieving compliance with the standard.

Is the remedy component being implemented?
Yes. Pond G was treated on June 6, 2012, using both agricultural limestone (calcium carbonate) and calcium chloride. Bench testing conducted just prior to the pond treatment indicated that the agricultural limestone alone would not achieve the target hardness increase, and hence calcium chloride was also added, with USEPA and MPCA approval. OU2 ROD Amendment #4 had also noted the possible benefit of adding lime to the surrounding watershed soils. The Army applied agricultural limestone to the soils on August 29, 2012. Details of the surface water monitoring program to verify treatment effectiveness are discussed in the next section.

11.2 REMEDY COMPONENT #2: POND G SURFACE WATER MONITORING

Description: "A monitoring period is part of this alternative to verify the effectiveness of the remedy. Monitoring will include multiple sampling events of the Pond G surface water, which will be completed prior to the end of the review period for the next CERCLA Section 121(c) 5-year review (the review period ends September 30, 2013)." (OU2 ROD Amendment #4, page 4-3)

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

Is this remedy component being implemented?
Yes. The FY 2013 Monitoring Plan is included in Appendix A, documenting the surface water monitoring requirements. Three Pond G surface water monitoring events were scheduled for FY 2013; however, this was altered to accommodate the USEPA's request to accelerate the schedule for the TCAAP CERCLA 5-year review. OU2 ROD Amendment #4 specified that the next 5-year review would document the final determination on the effectiveness of the Pond G remedy. Hence, in a March 7, 2013 letter to the USEPA, the Army noted this schedule constraint and requested that the third event in 2013 be dropped, and also requested accelerating the second event to be one month after the first event (versus three months after). The USEPA provided approval of the proposed 2013 monitoring changes in their letter of April 12, 2013. Hence, two Pond G sampling events were conducted in FY 2013: April 2013 and May 2013, as shown in Table 11-1.

Were the surface water monitoring requirements for this remedy met? Yes.

Is any surface water sampling proposed prior to the next report? No. Closure of the Pond G site (without further monitoring) has been recommended, as discussed in the next section.

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

11.3 OVERALL REMEDY FOR POND G

Performance Standard (how do you know when you're done):
Monitoring will include multiple sampling events of the Pond G surface water, which will be completed prior to the end of the review period for the next CERCLA Section 121(c) 5-year

review. This 5-year review, which must be completed and signed in 2014, will review the adequacy of the Pond G remedy and, if demonstrated to be an effective remedy, the Pond G site will be closed with no long-term maintenance, monitoring, or LUC requirements. (OU2 ROD Amendment #4, page 4-3).

Has the Pond G remedy been completed (i.e., has the 5-year review concluded that the Pond G remedy is adequate and that the site can be closed)?

No. The specified 5-year review will be signed in 2014.

Has the surface water treatment resulted in compliance with the state surface water standard for lead?

Yes. The two Pond G surface water monitoring events conducted in FY 2013 indicate that the surface water lead results were in compliance with the state surface water standard (see Table 11-1), which was also the case for the two Pond G surface water monitoring events that were conducted in FY 2012. Note that each surface water monitoring event consists of three consecutive days of sample collection, with analysis for both total lead and hardness. For each sampling event, the calculated average of the three hardness results is used to calculate the Minnesota surface water quality standard for lead, and then the calculated average of the three lead results is compared to the calculated surface water standard to determine compliance with the standard.

The completed Pond G remedial action work and the 2012 - 2013 Pond G surface water monitoring results were documented in the "Remedial Action Completion and Close Out Report, Pond G," prepared by Wenck, November 2013. This report recommended that the Pond G site be closed with no long-term maintenance, monitoring, or land use control requirements. Assuming that final concurrence regarding the adequacy of the Pond G remedy is provided in the 2014 CERCLA five-year review, the Pond G site will be closed. Also, 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 (beyond 2014) will not be required for Pond G.

Do additional remedial measures need to be addressed?

No.

Table 11-1
Water Quality Data for Pond G Surface Water

Fiscal Year 2013

Sample Location		Date Collected	Total Hardness (as $CaCO_3$) (mg/L)	L	D	Total Lead (µg/L)	L	D	Calculated Lead Standard for Each Event (µg/L)	Lead Standard was Met (y/n)?
PG1		4/29/13	59			0.45	U			
PG1		4/30/13	59			0.45	U			
PG1	D	4/30/13	67			0.45	U			
PG1		5/1/13	57			0.45	U			
	Average:		**60**			**0.23**			**1.6**	**Yes**
PG1		5/22/13	73			0.45	U			
PG1		5/23/13	63			0.45	U			
PG1		5/24/13	77			0.45	U			
PG1	D	5/24/13	61			0.45	U			
	Average:		**68**			**0.23**			**2.0**	**Yes**

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):

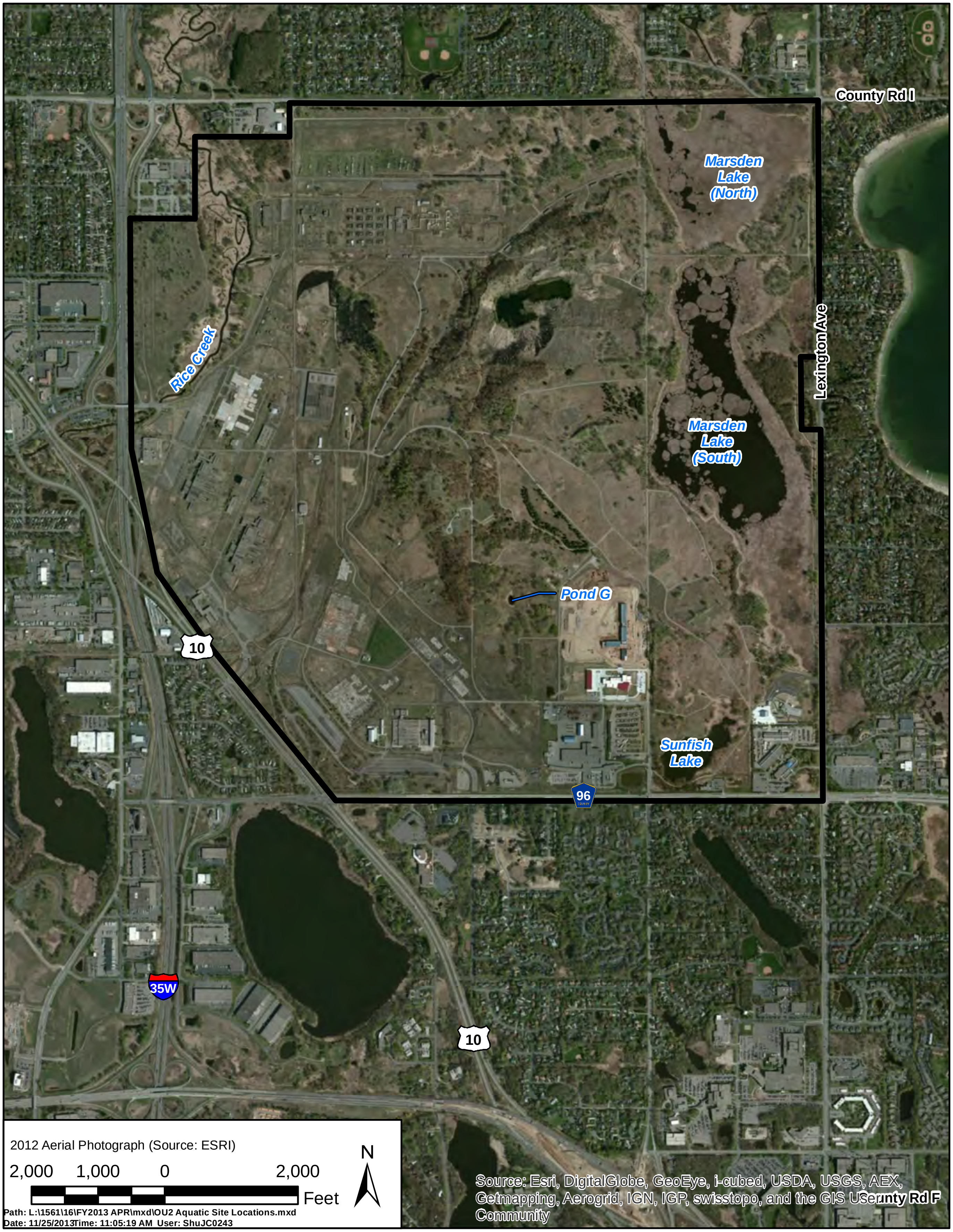
(None)

Other Notes:

D Duplicate

(1) Average results are calculated by first averaging any sample/duplicate pairs into a single result for that date, and then averaging the the three sampling dates. For any result that is non detect, a value of half the MDL is used in the calculation.

(2) The lead standard is calculated using the average total hardness and the calculation specified in MN Rule 7050.0222 (Class 2Bd Chronic Standard).



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OU2 Aquatic Site Locations

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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 2012 through September 2013.

Historical Design and Evaluation of TGRS Remedial Action

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 2013 consistent with the requirements of the OU2 ROD. Table 12-1 presents the cleanup requirements for the TGRS from the OU2 ROD.

During FY 2013, the average extraction well water pumped was approximately 1,759 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 2013. The B1, B11, B13 well grouping was below the MOS minimum of 415 gpm because B11 was shut down in February 2013, but 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 2013 Maintenance and Inspection Activity

During FY 2013, 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 1,759 gpm, the total extraction well water pumped 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, 2012 through September 30, 2013, and shows that the TGRS operated above the OM for the majority of the time (295 days or 81 percent of the time) in FY 2013. On a monthly basis, total TGRS extraction rates were below 1,745 gpm during the following months:

- December 2012 (1,713 gpm, lower flow rate due to copper thieves cutting down a power pole that supplied electricity to the treatment center and well field)
- February 2013 (1,688 gpm, lower flow rate due to B11 shutdown and copper thieves cutting down power poles that supplied electricity to the treatment center and well field)
- April 2013 (1,720 gpm, lower flow rate due to B11 shutdown, well redevelopment at B1, B5, B13, and SC5, and a forcemain obstruction)
- July 2013 (1,738 gpm, lower flow rate due to B11 shutdown and power outages)
- August 2013 (1,674 gpm, lower flow rate due to B11 shutdown and communication lines to B8, B9, SC2, and SC5 being severed during Site redevelopment activities)

Appendix F.2 provides additional information on the various downtimes throughout FY 2013.

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 924,550,600 gallons of contaminated water from October 2012 through September 2013 based on the sum of the individual pumphouse flow meters. This converts to an average flow rate of 1,759 gpm.

The TGRS as a whole was operational 96.6 percent of the time (i.e., 352.7 days out of 365 days in FY 2013).

<u>Monthly Flow Reports</u>

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 2013 operational notes is presented in Appendix F.2. During FY 2013, 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 more in FY 2013 than they were in FY 2012. The increased downtime is primarily due to more downtime in the miscellaneous category, which includes downtime due to vandalism (copper thieves) and outages due to Site redevelopment activities. Miscellaneous category down time increased from 0.8 days in FY 2012 to 4.6 days in FY 2013.

Description of Down Time Categories

Pumphouse component failures accounted for an average of 3.5 days down time per pumphouse. There was less down time due to pumphouse maintenance in FY 2013 than there was in FY 2012. The major pumphouse repairs causing down time were:

- Pump and/or motor replacement at Pumphouses B1, SC2, and SC5
- Well redevelopment at Pumphouses B1, B5, B13, SC2, and SC5
- Communication problems between the PLC and pump at 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 0.9 days down time per pumphouse. The major treatment center repairs causing substantial down time were the failure and replacement of blower motor 3 and problems with ECV 4 and the PLC throughout the year.

Electrical service system failures accounted for an average of 1.1 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 2013. 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 accounted for 1.3 days down time per pumphouse. A B11 shutdown evaluation was performed in November 2012.

Forcemain issues accounted for 0.8 days down time per pumphouse. An obstruction in the forcemain caused downtime in April/May 2013.

Were there any major operational changes during the year?
Yes. Pumphouse B11 was shut down on February 7, 2013, after receipt of the Agency approval letter dated February 5, 2013.

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 2013. Appendix D contains the water level database for the monitoring wells. Figure 12-3 through 12-5 present the groundwater elevations for Upper Unit 3, Lower Unit 3, and Unit 4 during this time period. These figures present the potentiometric contours from three vertical portions of the aquifer. The groundwater elevation contours and limits of capture in the three portions of the aquifer are similar to those observed in FY 2003 after the modification to the OS was implemented. The zone of capture created by the TGRS extends beyond the 5 μg/L TRCLE contour, in both the Unit 3 and the Unit 4 aquifers.

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 924,550,600 gallons of water from October 2012 through September 2013. 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 2,082 pounds of VOCs from October 2012 through September 2013. The VOC mass removal in FY 2012 was 1,801 pounds. The increase in FY 2013 is due, in part, to the higher extraction rate at Well SC-5 that resulted from the cleaning of the forcemain in April 2013. It is estimated that an additional 245 pounds of VOCs were removed from SC-5 in FY2013 as compared to FY2012.

Average VOC influent concentrations increased from 225 μg/L in FY 2012 to 271 μg/L in FY 2013 (20.4 percent higher). Table 12-6 summarizes the individual VOC mass contribution of each extraction well and the entire system. Overall, the TGRS has removed nearly 105 tons (209,262 lbs) of VOCs from the aquifers since 1987 and 14.6 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 2,082 pounds in FY 2013, the VOC mass removal from the TGRS is at 61 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, B7, B10, B11, B12, SC3, and SC4 are shut down, but were temporarily operated for June 2013 sampling. 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 many wells 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:

- 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)
- B11 (4.8 µg/L in FY 2001 to 0.78 µg/L in FY 2013 – 84% reduction)
- B6 (230 µg/L in FY 2001 to 46 µg/L in FY 2013 – 80% reduction)
- B4 (500 µg/L in FY 2001 to 110 µg/L in FY 2013 – 78% reduction)
- B5 (410 µg/L in FY 2001 to 110 µg/L in FY 2013 – 73% reduction)
- B3 (8.7 µg/L in FY 2001 to 3.3 µg/L in FY 2013 – 62% reduction)
- B1 (180 µg/L in FY 2001 to 68 µg/L in FY 2013 – 62% reduction)
- SC2 (100 µg/L in FY 2001 to 41 µg/L in FY 2013 – 59% reduction)
- B9 (110 µg/L in FY 2001 to 54 µg/L in FY 2013 – 51% 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 over 75 percent of the VOC mass removed while accounting for only 11.4 percent of the water pumped by the system. SC5, in particular, removed over 68 percent of the total VOC mass at a rate of only approximately 91 gpm (5.2 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 2013 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 1000's of ppb in early 1990s. TRCLE decreased steadily from 410 ppb in 2001 to 140 ppb in 2005. From 2006 to 2011, TRCLE concentrations varied between 120 ppb and 240 ppb with no apparent trend. TRCLE increased to 490 ppb in 2012 and to 620 ppb in 2013 (the highest concentration since 1992). 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 1000's of ppb in early to mid 1990s. TRCLE decreased steadily from 470 ppb in 2001 to 96 ppb in 2007. In 2008, TRCLE spiked at 380 ppb, but concentrations decreased the next year and have varied between 130 ppb and 190 ppb since 2009 with no apparent trend (170 ppb in 2013). Maintain annual sampling frequency.
03U094	Trend identified during FY 2004 data review. TRCLE increased from 170 ppb in 2003 to 470 ppb in 2005. Since 2005, TRCLE concentrations overall have been decreasing. In 2013, TRCLE had decreased to 80 ppb, 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 ppb in 1987, to below 100 ppb from 1993 through 1996. Increased to 1300 ppb, a historical high concentration, in 2003. TRCLE concentrations have decreased from 680 ppb in 2008 to 290 ppb in 2013. Maintain annual sampling frequency.

Well	***Trend Observation***
03U711	Trend identified in FY 2001 APR. TRCLE concentrations decreased from near 1,000 ppb in 1994 to 75 ppb in 1999, but rebounded to 250 ppb by 2004. Since 2004, concentrations have steadily decreased and were down to 44 ppb in 2013. Maintain biennial sampling frequency (next event 2015).
03L809	Trend identified in FY 2001 APR. TRCLE concentrations decreased from over 3,000 ppb to 67 ppb through 1998, but rebounded to 520 ppb by 2001. Since 2001, concentrations have decreased overall to 150 ppb in 2013. Maintain biennial sampling frequency (next event 2015).
04U843	Trend identified in FY 2001 APR. TRCLE concentrations were below 15 ppb from late 1980s through 1997, and then increased to between 22 ppb and 38 ppb from 1998 through 2001. In 2003, TRCLE dropped to below 1 ppb, but has been steadily increasing since and is at 170 ppb in 2013. Well is nearly 1 mile from TGRS and is part of the OU1 sampling program and discussed in greater detail in Section 3.0. Maintain biennial sampling frequency (next event 2015).
04U841	Trend identified in FY 2001 APR. TRCLE concentrations were below 10 ppb through 1995, and then increased to 25 ppb in 2001. In 2003, TRCLE decreased to 5 ppb, but rebounded to 19 ppb in 2005. TRCLE appears to be stabilizing around 20 ppb, with concentrations ranging between 18 and 24 ppb since 2005 (18 ppb in 2013). Well is nearly 0.5 mile from TGRS and is part of the OU1 sampling program discussed in Section 3.0. Maintain biennial sampling frequency (next event 2015).
03U822	Trend identified during FY 2003 data review. TRCLE concentrations were below 25 ppb through 1998, and then peaked at 375 ppb in 1999. Concentrations have ranged between 120 and 160 ppb from 2005 to 2013 (160 ppb in 2013). Well is approximately 1 mile from TGRS and

Well	*Trend Observation*
	is part of the OU1 sampling program discussed in Section 3.0. Maintain biennial sampling frequency (next event 2015).
03L822	Trend identified in FY 2001 APR. TRCLE concentration increased from below 5 ppb during early 1990s to over 600 ppb from 1999 through 2003. Concentrations steadily decreased from 620 ppb in 2003 to 180 ppb in 2011, but rebounded slightly in 2013 to 220 ppb. Well is approximately 1 mile from TGRS and is part of the OU1 sampling program discussed in Section 3.0. 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 was sampled on a monthly basis during FY 2013. The influent/effluent database for FY 2013 is contained in Appendix G.2. Figure 12-6 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 2013 influent

TRCLE concentration was 218 µg/L, up from 180 µg/L in FY 2012. FY 2013 represents the eleventh 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 TRCLE concentrations had been steadily decreasing for several years, likely due to the overall decrease in plume concentration. As stated earlier, the increased TRCLE concentration in FY 2013 is due, in part, to the higher extraction rate at Well SC-5 that resulted from the cleaning of the forcemain in April 2013.

Figure 12-6 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 2013. A review of the FY 2013 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 99.2 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 2013 was 4.4 µg/L and the average was 2.0 µg/L, which are still below the discharge limit. The maximum effluent concentration was attributed to maximizing the extraction at SC-5 to over 155 gpm in May 2013 that resulted in a much higher TRCLE concentration in the influent water (TGRSI). By reducing SC-5 extraction to below 130 gpm, the effluent TRCLE concentrations have consistently been less than 2.5 µg/L.

What was the mass of VOCs emitted into the air?

The air stripping towers remove VOCs with an efficiency of approximately 99.2 percent. The air emissions are equal to the VOC mass removal rates presented in Table 12-6. Air emissions averaged 5.7 pounds/day based on the VOC mass removal rates. The total VOC emissions from October 2012 through September 2013 were 2,082 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 2013, 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.

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 2013?
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.

Is the remedy component being implemented?

Yes. Monitoring in FY 2013 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 2013 monitoring plan and any deviations are explained in Appendix C.2. Monitoring was as follows:

<u>Groundwater</u>

TGRS groundwater level measurements were collected during December 2012 and June 2013 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 2013 was a "big round" year in the biennial sample program, so samples were collected for the full list of wells. Table 12-8 presents the groundwater quality data for FY 2013. Figures 12-7 through 12-9 present plan views of the TRCLE plumes and Figure 12-10 and Figure 12-11 present a cross sectional view of the plume along the property boundary.

Results from the 2013 groundwater sampling showed that most of the wells sampled continued to have declining or stable TRCLE concentrations. The most notable decreasing trend is at 03U030 (steady decrease from 43 μg/L in 2007 to 11 μg/L in 2013).There were also notable decreases at 03U029 (21 μg/L in 2011 to 5.5 μg/L in 2013), 03M002 (43 μg/L in 2011 to 22 μg/L in 2013), and 03U093 (140 μg/L in 2012 to 92 μg/L in 2013).

Although the general trend at most monitoring wells since 1999 appears to be declining or stable, the monitoring wells listed below had notable increases in TRCLE concentration since 2011:

- 03L806(200 μg/L in 2011, 490 μg/L in 2012, and 620 μg/L in 2013)
- 03L809 (90 μg/L in 2011 to 150 μg/L in 2013)
- 03U079 (19 μg/L in 2011 to 48 μg/L in 2013)
- 03U708 (35 μg/L in 2011 to 57 μg/L in 2013)

- 04J077 (63 μg/L in 2011 to 87 μg/L in 2013)
- 03U659 (41 μg/L in 2011 to 87 μg/L in 2013)
- 03U805 (2.1 μg/L in 2011 to 19 μg/L and 18 μg/L in 2013)

Wells 03L806 and 03L809 were discussed earlier in Section 12.1 (no change in monitoring schedule). The increases in the remaining wells listed are generally within historical ranges within the last 10 years. The exception to this is Well 03U805 which contained a historical high TRCLE concentration of 19 μg/L, but this well is located adjacent to the higher concentration TRCLE plume (as shown on Figure 12-7) so a TRCLE concentration of this magnitude is not unexpected. All of these wells will continue to be monitored and no further sampling beyond the scheduled events is recommended at this time.

Well B11 Shutdown Effect

The shutdown of B11 was first suggested by the Agencies on their March 2012 comments on the Draft Fiscal Year 2011 Annual Performance Report. The suggestion was based on its relative location as the southernmost most extraction well and its continued reduced TRCLE concentrations that were less than half the cleanup goal (5 μg/L) for several years. The Army and ATK submitted a shutdown evaluation scope of work on September 7, 2012, which was approved by the Agencies on October 15, 2012. The results of the shutdown evaluation were submitted to the Agencies in a technical memorandum dated January 15, 2013. The Agencies approved the B11 shutdown in a letter to the Army dated February 5, 2013. B11 was shut down on February 7, 2013.

As part of the B11 shutdown evaluation, hydraulic monitoring and water quality sampling were conducted in June 2013, approximately five months after shutdown, to determine if the TGRS was potentially compromised and allowed for elevated off-Site plume migration. Groundwater samples were collected from 03U710, 03U003, 03L003, and 03U672 as part of the FY2013 APR. In addition, site-wide groundwater levels were collected from the Upper Unit 3, Lower Unit 3, and Upper Unit 4 monitoring wells and TGRS extraction wells to evaluate groundwater flow patterns in the different hydrostratigraphic units in the B11 area.

When B11 was shut down, the flow rates at B1 and B13 increased, which were also noted during the 2012 B11 shutdown evaluation. The flow rates at B1 increased between 8 and 18 percent and between 0 and 9 percent at B13. Figures 12-3 and 12-4 show the potentiometric surface for the Upper Unit 3 and Lower Unit 3, respectively. As noted on these two figures, B1 and B13 pull groundwater from the B11 area towards these two extraction wells and shows hydraulic capture within the Unit 3 to the southern TCAAP property boundary.

The 2013 sample results essentially show no changes in groundwater chemistry that could be attributed to the B11 shutdown. The wells closest to and/or downgradient from well B11 contained TRCLE concentrations that were similar or lower than those reported in 2011. The one exception was well 03U003 which showed an increase in TRCLE from 41 µg/L (in June 2011) to 56 µg/L in June 2013. However, in 2009 and 2010 TRCLE concentrations in this well ranged from 85 µg/L to 110 µg/L in 6 separate sampling events. Hence, the 03U003 TRCLE concentration change is considered normal fluctuation.

Overall, the B11 shutdown is consistent with the results identified in the 2012 shutdown evaluation and does not show any evidence of elevated off-site plume migration from the B11 area.

<u>Estimated TRCLE Plume Width</u>

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, 14.6 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 2013 TRCLE concentration of 0.78 µg/L.

As a result, the width of TRCLE plume is narrowing. Figure 12-12 shows FY 2013 TRCLE data with the 5 µg/L TRCLE contours for FY 2001 and FY 2013. Based on these contours, the estimated width of the source area TRCLE plume has decreased approximately 17 percent from 3,600 feet to 3,000 feet or approximately 83 percent of the FY 2001 width. 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). At the boundary, the TRCLE plume narrowing is more pronounced, having decreased approximately 24 percent from 4,600 to 3,500 feet, which represents a decrease of approximately 76 percent of the FY 2001 width. 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 2014.

__Treatment System__

The TGRS treatment system influent and effluent was sampled monthly during FY 2013 in accordance with the FY 2013 monitoring plan. Groundwater samples from the extraction wells were collected in December 2012 and June 2013 in accordance with the FY 2013 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 2012 APR. Table 12-9 and Appendix A of this report provide FY 2014 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 2013 annual average extraction rate was 1,759 gpm.
- The TGRS extracted and treated 924,550,600 gallons of water and removed 2,082 pounds of VOCs from October 2012 to September 2013. Average VOC influent concentrations increased by 20.4% from FY 2012.
- 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	70
1,1-Dichloroethene	<1	6
1,1,1-Trichloroethane	<1	200
1,2-Dichloroethane	<1	4
Trichloroethene	<5	5
1,1-Dichloroethane	<1	70
Tetrachloroethene	<1	5

TABLE 12-2

EXTRACTION WELL WATER PUMPED
FISCAL YEAR 2013
TGRS, OU2
ARDEN HILLS, MINNESOTA

	Volume of Water Pumped (gallons)												
	B1	***B3***	***B4***	***B5***	***B6***	***B8***	***B9***	***B11***	***B13***	***SC1***	***SC2***	***SC5***	***TOTAL***
October 2012	10,639,100	7,604,100	9,131,400	9,020,800	9,307,300	6,242,200	12,830,900	4,727,200	3,667,100	1,553,700	2,950,800	3,570,200	81,244,800
(gpm)	238	170	205	202	208	140	287	106	82	35	66	80	1,820
November 2012	10,671,100	7,762,400	9,035,100	8,859,800	9,215,900	6,152,500	12,817,500	2,357,100	3,752,600	1,555,700	2,854,200	3,510,600	78,544,500
(gpm)	247	180	209	205	213	142	297	55	87	36	66	81	1,818
December 2012	8,838,600	7,750,800	8,669,700	8,506,000	9,138,200	6,064,300	11,237,500	4,825,000	3,882,700	1,574,500	2,505,000	3,484,800	76,477,100
(gpm)	198	174	194	191	205	136	252	108	87	35	56	78	1,713
January 2013	8,846,200	7,645,000	8,993,500	8,440,400	9,613,000	6,438,700	12,700,100	4,714,600	4,099,400	1,721,400	3,328,500	3,456,900	79,997,700
(gpm)	198	171	201	189	215	144	285	106	92	39	75	77	1,792
February 2013	8,330,100	6,984,200	7,836,800	7,151,300	8,256,400	6,309,100	11,386,300	733,700	3,840,800	1,473,700	2,643,500	3,098,300	68,044,200
(gpm)	207	173	194	177	205	156	282	85	95	37	66	77	1,688
March 2013	9,365,500	8,390,400	9,032,900	8,453,500	9,852,600	8,292,600	13,218,100	0	4,066,700	1,722,400	3,635,500	3,525,200	79,555,400
(gpm)	210	188	202	189	221	186	296	0	91	39	81	79	1,782
April 2013	7,860,200	8,502,800	8,673,200	6,146,500	9,949,600	8,698,400	13,487,300	0	3,398,600	1,658,100	3,755,600	2,159,000	74,289,300
(gpm)	182	197	201	142	230	201	312	0	79	38	87	50	1,720
May 2013	10,280,900	6,538,900	8,482,600	10,266,500	9,970,300	6,686,500	12,630,600	0	3,535,900	1,683,700	3,805,000	6,159,600	80,040,500
(gpm)	230	146	190	230	223	150	283	0	79	38	85	138	1,793
June 2013	10,232,300	5,827,500	8,494,900	9,665,000	9,539,300	5,713,700	12,238,200	0	3,602,300	1,617,600	3,653,900	5,494,600	76,079,300
(gpm)	237	135	197	224	221	132	283	0	83	37	85	127	1,761
July 2013	10,192,300	6,072,100	8,611,500	9,865,700	9,763,100	5,755,800	12,603,800	0	3,699,700	1,593,300	4,211,500	5,231,100	77,599,900
(gpm)	228	136	193	221	219	129	282	0	83	36	94	117	1,738
August 2013	9,835,800	6,832,300	8,427,300	10,253,400	10,094,100	6,682,200	12,271,300	0	3,661,900	1,655,500	2,263,100	2,744,600	74,721,500
(gpm)	220	153	189	230	226	150	275	0	82	37	51	61	1,674
September 2013	9,674,600	7,363,300	8,384,700	10,255,200	9,845,900	6,345,300	13,076,300	0	3,841,700	831,000	3,054,100	5,284,300	77,956,400
(gpm)	224	170	194	237	228	147	303	0	89	19	71	122	1,805
TOTAL FY 2013	**114,766,700**	**87,273,800**	**103,773,600**	**106,884,100**	**114,545,700**	**79,381,300**	**150,497,900**	**17,357,600**	**45,049,400**	**18,640,600**	**38,660,700**	**47,719,200**	**924,550,600**
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
FY13 Average Flow Rate (gpm)	337	619	1,056	1,759
MOS Operational Minimum (gpm)	415	600	1,010	1,745

TABLE 12-3

TREATMENT CENTER WATER METER TOTALS
FISCAL YEAR 2013
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 2012	81,244,800	0	0	0	419,000	75,039,000	75,458,000	0	0	0
November 2012	78,544,500	0	0	0	3,000	72,625,000	72,628,000	0	0	0
December 2012	76,477,100	0	0	0	169,000	71,530,000	71,699,000	0	0	0
January 2013	79,997,700	0	0	0	32,000	75,271,000	75,303,000	0	0	0
February 2013	68,044,200	0	0	0	145,000	63,784,000	63,929,000	0	0	0
March 2013	79,555,400	0	0	0	428,000	75,433,000	75,861,000	0	0	0
April 2013	74,289,300	0	0	0	1,280,000	70,634,000	71,914,000	0	0	0
May 2013	80,040,500	0	0	0	1,812,000	77,245,000	79,057,000	0	0	0
June 2013	76,079,300	0	0	0	114,000	75,063,000	75,177,000	0	0	0
July 2013	77,599,900	0	0	0	521,000	77,248,000	77,769,000	0	0	0
August 2013	74,721,500	0	0	0	138,000	73,018,000	75,219,000	0	0	0
September 2013	77,956,400	0	0	0	442,000	76,882,000	77,324,000	0	0	0
TOTAL FY 2013	924,550,600	0	0	0	5,503,000	883,772,000	891,338,000	0	0	0

TABLE 12-3

TREATMENT CENTER WATER METER TOTALS
FISCAL YEAR 2013
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

TABLE 12-4

PUMPHOUSE DOWN TIME (DAYS)
FISCAL YEAR 2013
TGRS, OU2
ARDEN HILLS, MINNESOTA

Well Name	*FY13 Down Time (Days)*	*FY12 Down Time (Days)*	*FY11 Down Time (Days)*	*FY10 Down Time (Days)*	*FY09 Down Time (Days)*
B1	10.7	1.5	6.2	18.0	9.5
B2	(1)	(1)	(1)	(1)	(1)
B3	4.3	1.6	26.4	7.4	12.1
B4	4.0	6.0	6.4	9.3	16.4
B5	13.0	2.0	4.5	7.7	8.6
B6	2.8	1.9	5.7	12.0	10.2
B7	(1)	(1)	(1)	(1)	(1)
B8	2.9	3.7	4.2	8.2	23.2
B9	9.4	3.6	21.1	7.9	9.4
B10	(1)	(1)	(1)	(1)	(1)
B11	16.4	9.5	3.1	8.7	8.7
B12	(1)	(1)	(1)	(1)	(1)
B13	9.3	7.4	6.4	7.4	16.1
SC1	14.0	7.6	17.8	17.2	10.8
SC2	20.3	35.0	37.0	7.5	14.2
SC3	(1)	(1)	(1)	(1)	(2)
SC4	(1)	(1)	(1)	(1)	(1)
SC5	32.5	7.3	33.3	13.8	21.0

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 2013
TGRS, OU2
ARDEN HILLS, MINNESOTA

Category	***Down Time (Days)***
Pumphouse Component	3.5
Treatment Center Component	0.9
Electrical Service	1.1
Miscellaneous	4.6
Preventive Maintenance	0.0
System Modification	1.3
Forcemain	0.8
Total System Equivalent	12.3
Anticipated Down Time for Fiscal Year 2014	
Pumphouse Component	4.5
Treatment Center Component	2.0
Electrical Service	3.0
Miscellaneous	0.5
Preventive Maintenance	1.0
System Modification	0.5
Forcemain	1.5

TABLE 12-6

VOC MASS LOADING SUMMARY
FISCAL YEAR 2013
TGRS, OU2
ARDEN HILLS, MINNESOTA

Well	*Percent Contribution to VOC Mass Removal*	*FY 2013 Total Pounds VOCs Mass Removed*
B1	3.9%	80.7
B2[1]	0.0%	0.0
B3	0.2%	3.2
B4	5.1%	106.0
B5	5.0%	103.4
B6	2.1%	43.4
B7[1]	0.0%	0.0
B8	0.5%	11.2
B9	3.6%	75.5
B10[1]	0.0%	0.0
B11[2]	0.0%	0.2
B12[1]	0.0%	0.0
B13	4.4%	91.4
SC1	6.3%	132.0
SC2	0.8%	16.8
SC3[1]	0.0%	0.0
SC4[1]	0.0%	0.0
SC5	68.1%	1,419
Fiscal Year 2013 Total (lbs)		***2,082***
Daily Average (lbs/day)		***5.7***

Notes:

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

[2] Extraction well was in operation from 10/1/2012 through 2/6/2013.

TABLE 12-6

VOC MASS LOADING SUMMARY
FISCAL YEAR 2013
TGRS, OU2
ARDEN HILLS, MINNESOTA

HISTORICAL TOTAL

Fiscal Year		*Pounds VOC Mass Removed*
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		***209,262***

TABLE 12-7

VOC CONCENTRATIONS IN TGRS EXTRACTION WELLS (µg/L)
FISCAL YEAR 2013
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	12/13/12		4.6	0.85 JP	1.2	< 1	4.8	2.3	91
03F302	B1	6/14/13		3.1	0.7 JP	1.1	< 1	3.6	1.6	68
03F303	B2	6/14/13		< 1	0.5 JP	1.4	< 1	1.3	0.99 JP	29
03F303	B2	6/14/13	D	< 1	0.49 JP	1.3	0.3 JP	1.4	0.89 JP	28
03F304	B3	12/13/12		< 1	0.46 JP	0.57 JP	< 1	< 1	< 1	4.1
03F304	B3	6/14/13		< 1	0.36 JP	0.54 JP	< 1	< 1	< 1	3.3
03F305	B4	12/13/12		7.5	4.3	4.2	< 1	2.6	< 1	120
03F305	B4	6/14/13		6.5	3.8	4	< 1	2.2	< 1	110
03F306	B5	12/13/12		2.9	3.3	3	< 1	0.89 JP	5.3	110
03F306	B5	12/13/12	D	2.9	3.3	3.1	< 1	0.87 JP	5.3	110
03F306	B5	6/14/13		2.9	2.8	3.2	< 1	0.84 JP	6.1	110
03F307	B6	12/13/12		0.81 JP	0.68 JP	0.91 JP	< 1	< 1	< 1	48
03F307	B6	6/14/13		0.66 JP	0.55 JP	0.85 JP	< 1	< 1	< 1	46
03F308	B7	6/25/13		< 1	< 1	< 1	< 1	< 1	< 1	2.4
PJ#309	B8	12/13/12		0.92 JP	0.66 JP	0.78 JP	< 1	< 1	< 1	16
PJ#309	B8	6/14/13		0.75 JP	0.56 JP	0.81 JP	< 1	< 1	< 1	16
PJ#310	B9	12/13/12		3.2	3.2	3.5	< 1	1.2	< 1	55
PJ#310	B9	6/14/13		2.5	2.5	3	< 1	1.1	< 1	54
PJ#310	B9	6/14/13	D	2.7	2.9	3.5	< 1	1.2	< 1	55
PJ#311	B10	6/14/13		< 1	< 1	< 1	< 1	< 1	< 1	0.57 JP
PJ#311	B10	6/14/13	D	< 1	< 1	< 1	< 1	< 1	< 1	0.53 JP
03F312	B11	12/13/12		< 1	< 1	< 1	< 1	< 1	< 1	1.6
03F312	B11	6/14/13		< 1	< 1	< 1	< 1	< 1	< 1	0.78 JP
PJ#313	B12	6/14/13		< 1	< 1	< 1	< 1	< 1	< 1	< 1

TABLE 12-7

VOC CONCENTRATIONS IN TGRS EXTRACTION WELLS (µg/L)
FISCAL YEAR 2013
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*
03F319	B13	12/13/12		4.6	1.4	1.4	< 1	11	0.9 JP	260
03F319	B13	6/14/13		4	1.5	1.4	< 1	10	0.73 JP	230
03U301	SC1	12/13/12		8	0.94 JP	1.9 JP	< 2	59	< 2	790
03U301	SC1	6/14/13		7.1	0.98 JP	2	< 2	52	< 2	920
03U314	SC2	12/13/12		12	0.76 JP	1.2	< 1	0.52 JP	< 1	47
03U314	SC2	6/14/13		8.8	0.66 JP	1.1	< 1	0.47 JP	< 1	41
03U315	SC3	6/14/13		< 1	< 1	< 1	< 1	< 1	< 1	0.36 JP
03U316	SC4	6/24/13		< 1	< 1	< 1	< 1	< 1	< 1	3.5
03U317	SC5	12/13/12		1000	22	57	< 10	3.5 JP	7.3 JP	3500
03U317	SC5	12/13/12	D	1000	23	53	< 10	3.6 JP	7.6 JP	3500
03U317	SC5	6/14/13		640	14	41	< 10	3.8 JP	4.7 JP	2600

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 (µg/L)
FISCAL YEAR 2013
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***	***Dup***	***µg/L***	***µg/L***	***µg/L***	***µg/L***	***µg/L***	***µg/L***	***µg/L***
03L002	6/10/13		0.84 JP	0.67 JP	1.3	< 1	< 1	< 1	25
03L003	6/17/13		< 1	< 1	< 1	< 1	< 1	< 1	< 1
03L007	6/6/13		< 1	< 1	< 1	< 1	< 1	< 1	< 1
03L014	6/17/13		23	2.1	1.6	< 1	0.97 JP	< 1	89
03L017	6/6/13		< 1	< 1	< 1	< 1	< 1	< 1	< 1
03L018	6/17/13		< 1	< 1	< 1	< 1	< 1	< 1	< 1
03L020	6/7/13		0.49 JP	< 1	< 1	< 1	< 1	< 1	9.2
03L021	6/7/13		< 1	< 1	< 1	< 1	< 1	< 1	2.5
03L077	6/10/13		2.2	< 1	1.1	< 1	< 1	< 1	33
03L078	6/13/13		< 1	< 1	< 1	< 1	< 1	< 1	< 1
03L079	6/13/13		< 1	< 1	< 1	< 1	< 1	< 1	2.2
03L084	6/24/13		< 1	< 1	< 1	< 1	< 1	< 1	< 1
03L802	6/28/13		< 1	< 1	< 1	< 1	< 1	< 1	2.3
03L802	6/28/13	D	< 1	< 1	< 1	< 1	< 1	< 1	2.2
03L806	6/12/13		1.1	90	56	0.63 JP	8.4	0.41 JP	620
03L809	6/28/13		3.4	0.99 JP	2.3	< 1	0.78 JP	< 1	150
03L833	6/11/13		< 1	< 1	< 1	< 1	< 1	< 1 JMS	2.4
03M002	6/10/13		0.74 JP	2	1.4	< 1	0.41 JP	< 1	21
03M002	6/10/13	D	0.68 JP	2	1.4	< 1	0.42 JP	< 1	22
03M020	6/7/13		2.1	0.73 JP	0.63 JP	< 1	< 1	< 1	39
03M802	6/28/13		< 1	< 1	< 1	< 1	< 1	< 1	7.6
03M806	6/12/13		< 1	34	19	< 1	4.3	< 1	290
03U002	6/26/13		1.9	0.55 JP	0.68 JP	< 1	0.33 JP	< 1	20
03U003	6/17/13		11	1	2.1	< 1	5.6	< 1	56
03U005	6/6/13		< 1	< 1	< 1	< 1	< 1	< 1 JMS	< 1
03U007	6/6/13		< 1	< 1	< 1	< 1	< 1	< 1	< 1
03U009	6/20/13		< 1	< 1	< 1	< 1	< 1	< 1	< 1
03U014	6/17/13		< 1	< 1	< 1	< 1	< 1	< 1	< 1
03U017	6/6/13		< 1	< 1	< 1	< 1	< 1	< 1	1.4
03U017	6/6/13	D	< 1	< 1	< 1	< 1	< 1	< 1	1.5
03U018	6/17/13		17	0.36 JP	1.4	< 1	8.6	< 1	35
03U020	6/7/13		11	0.82 JP	2.7	< 1	0.59 JP	< 1	50
03U021	6/7/13		61	7.3	11	< 1	4.1	< 1	290
03U021	6/7/13	D	61	7.4	11	< 1	4.2	< 1	280
03U027	6/17/13		0.86 JP	< 1	< 1	< 1	0.84 JP	< 1	13

TABLE 12-8

GROUNDWATER QUALITY DATA (µg/L)
FISCAL YEAR 2013
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***	***Dup***	***µg/L***	***µg/L***	***µg/L***	***µg/L***	***µg/L***	***µg/L***	***µg/L***
03U028	6/18/13		3.7	< 1	1	< 1	3.2	< 1	44
03U029	6/18/13		0.6 JP	< 1	< 1	< 1	< 1	< 1	5.5
03U030	6/18/13		< 1	< 1	< 1	< 1	0.61 JP	< 1	11
03U032	6/19/13		< 1	< 1	< 1	< 1	< 1	< 1	< 1
03U075	6/24/13		< 1	< 1	< 1	< 1	< 1	< 1	< 1
03U077	6/10/13		1	< 1	< 1	< 1	< 1	< 1	15
03U078	6/13/13		1.9	< 1	1.2	< 1	0.84 JP	15	81
03U078	6/13/13	D	1.9	< 1	1	< 1	0.71 JP	16	81
03U079	6/13/13		8	0.39 JP	1.8	< 1	1.6	< 1 JMS	48
03U092	6/19/13		0.45 JP	< 1	< 1	< 1	2.6	< 1	17
03U093	6/19/13		52	< 1	3.5	< 1	1.4	< 1	92
03U094	6/20/13		27	6.7	3.8	< 1	8.3	< 1	80
03U096	6/19/13		2.6	0.88 JP	0.59 JP	< 1	< 1	< 1	9.6
03U099	6/20/13		1.6	< 1	< 1	< 1	< 1	< 1	4.7
03U114	6/19/13		0.73 JP	< 1	< 1	< 1	< 1	< 1	4.8
03U659	6/18/13		6.9	1.4	1.3	< 1	17	< 1	87
03U671	6/18/13		5.2	0.41 JP	1.6	< 1	0.5 JP	7.2	75
03U671	6/18/13	D	5.4	0.33 JP	1.5	< 1	0.45 JP	7.3	76
03U672	6/24/13		< 1	< 1	< 1	< 1	< 1	< 1	< 1
03U701	6/11/13		< 1	< 1	< 1	< 1	< 1	< 1	1.2
03U702	6/11/13		< 1	< 1	< 1	< 1	< 1	< 1	0.78 JP
03U703	6/18/13		1.9	< 1	0.49 JP	< 1	2.2	10	41
03U708	6/10/13		5.8	2.8	3.1	< 1	1.7	2.1	57
03U709	6/13/13		2.2	0.82 JP	1.2	< 1	0.4 JP	< 1	29
03U710	6/26/13		5	< 1	1.1	< 1	1.1	< 1	45
03U711	6/11/13		4.8	1.2	1.8	< 1	0.61 JP	0.73 JP	44
03U715	6/19/13		5.9	0.44 JP	1.3	< 1	< 1	< 1	35
03U801	6/28/13		< 1	< 1	< 1	< 1	0.47 JP	< 1	28
03U803	6/24/13		< 1	< 1	< 1	< 1	< 1	< 1	< 1
03U804	6/24/13		< 1	< 1	< 1	< 1	< 1	< 1	< 1
03U805	6/24/13		< 1	12	7.2	< 1	2.8	1	18
03U805	6/24/13	D	0.37 JP	12	7.5	< 1	3	1.1	19
03U806	6/12/13		< 1	0.71 JP	0.59 JP	< 1	< 1	1.1	50
03U806	6/12/13	D	< 1	0.72 JP	0.53 JP	< 1	< 1	1	50
04J077	6/10/13		3.7	5.8	5.6	< 1	1.7	< 1	87

TABLE 12-8

GROUNDWATER QUALITY DATA (µg/L)
FISCAL YEAR 2013
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*	*Dup*		µg/L		µg/L		µg/L		µg/L		µg/L		µg/L		µg/L
04J702	6/11/13		<	1	<	1	<	1	<	1	<	1	<	1		1.4
04J708	6/10/13			0.51 JP		0.54 JP		0.43 JP	<	1	<	1	<	1		5.2
04J713	6/12/13		<	1	<	1	<	1	<	1	<	1	<	1	<	1
04U002	6/10/13		<	1	<	1	<	1	<	1	<	1	<	1		1.6
04U007	6/6/13		<	1	<	1	<	1	<	1	<	1	<	1	<	1
04U020	6/7/13		<	1	<	1	<	1	<	1	<	1	<	1		1.1
04U027	6/17/13		<	1	<	1	<	1	<	1	<	1	<	1	<	1
04U077	6/10/13			2.2		0.53 JP		1.4	<	1		0.3 JP	<	1		44
04U510	6/19/13		<	1	<	1	<	1	<	1	<	1	<	1	<	1
04U701	6/11/13		<	1	<	1	<	1	<	1	<	1	<	1		3
04U702	6/11/13		<	1	<	1	<	1	<	1	<	1	<	1		1.9
04U708	6/10/13		<	1	<	1	<	1	<	1	<	1	<	1	<	1
04U709	6/13/13			0.75 JP		0.38 JP		0.93 JP	<	1	<	1	<	1		16
04U711	6/11/13		<	1	<	1	<	1	<	1	<	1	<	1	<	1
04U713	6/12/13		<	1	<	1	<	1	<	1	<	1	<	1		0.31 JP
04U802	6/28/13		<	1	<	1	<	1	<	1	<	1	<	1		0.47 JP
04U806	6/12/13			1.2		20		11	<	1		2.5		0.33 JP		170
04U833	6/11/13		<	1	<	1	<	1	<	1	<	1	<	1		0.56 JP
PJ#806	6/12/13			0.33 JP		0.91 JP		0.69 JP	<	1	<	1	<	1		21

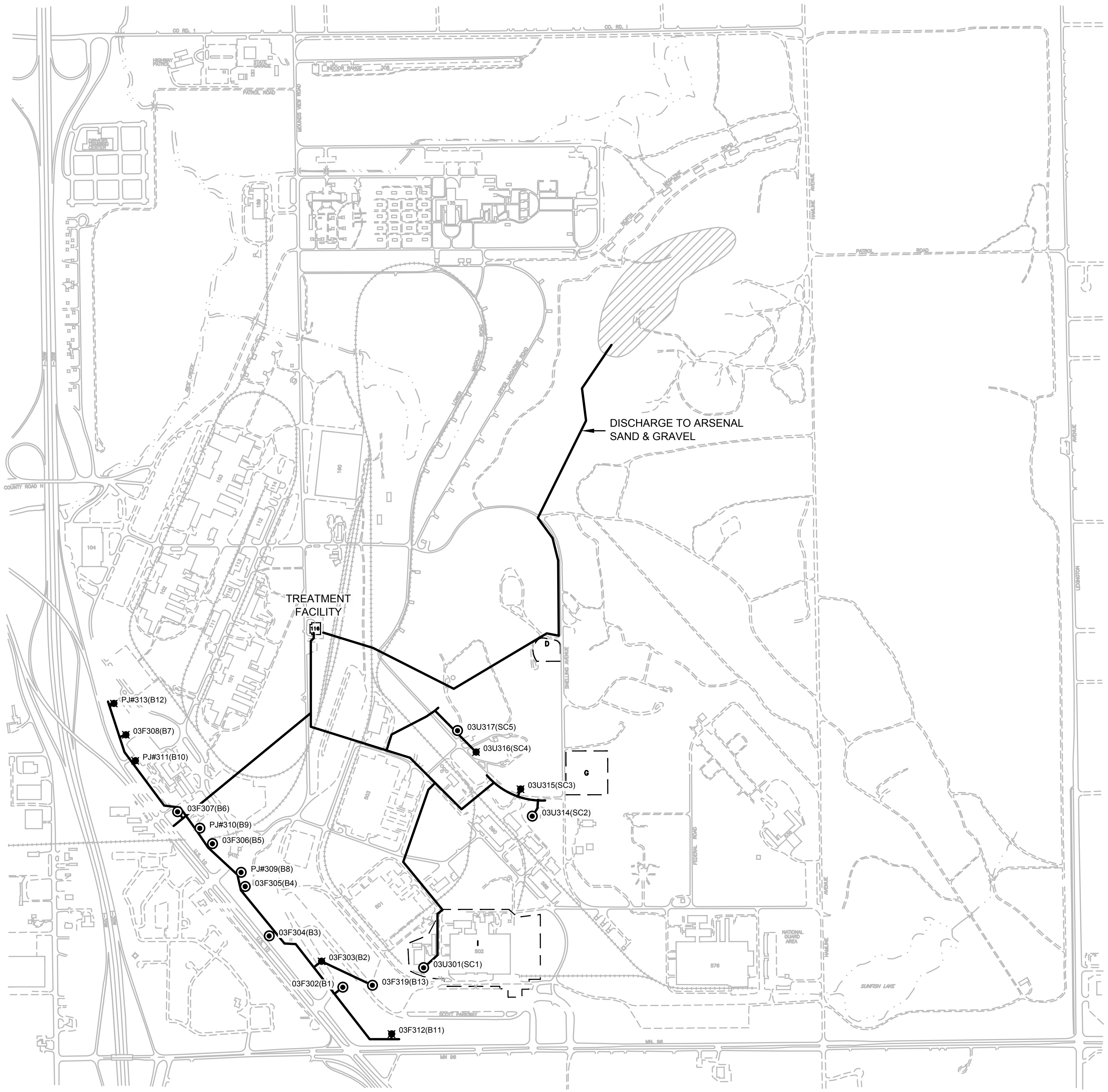
Notes:

(1) Cleanup levels for TGRS 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.
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



N

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

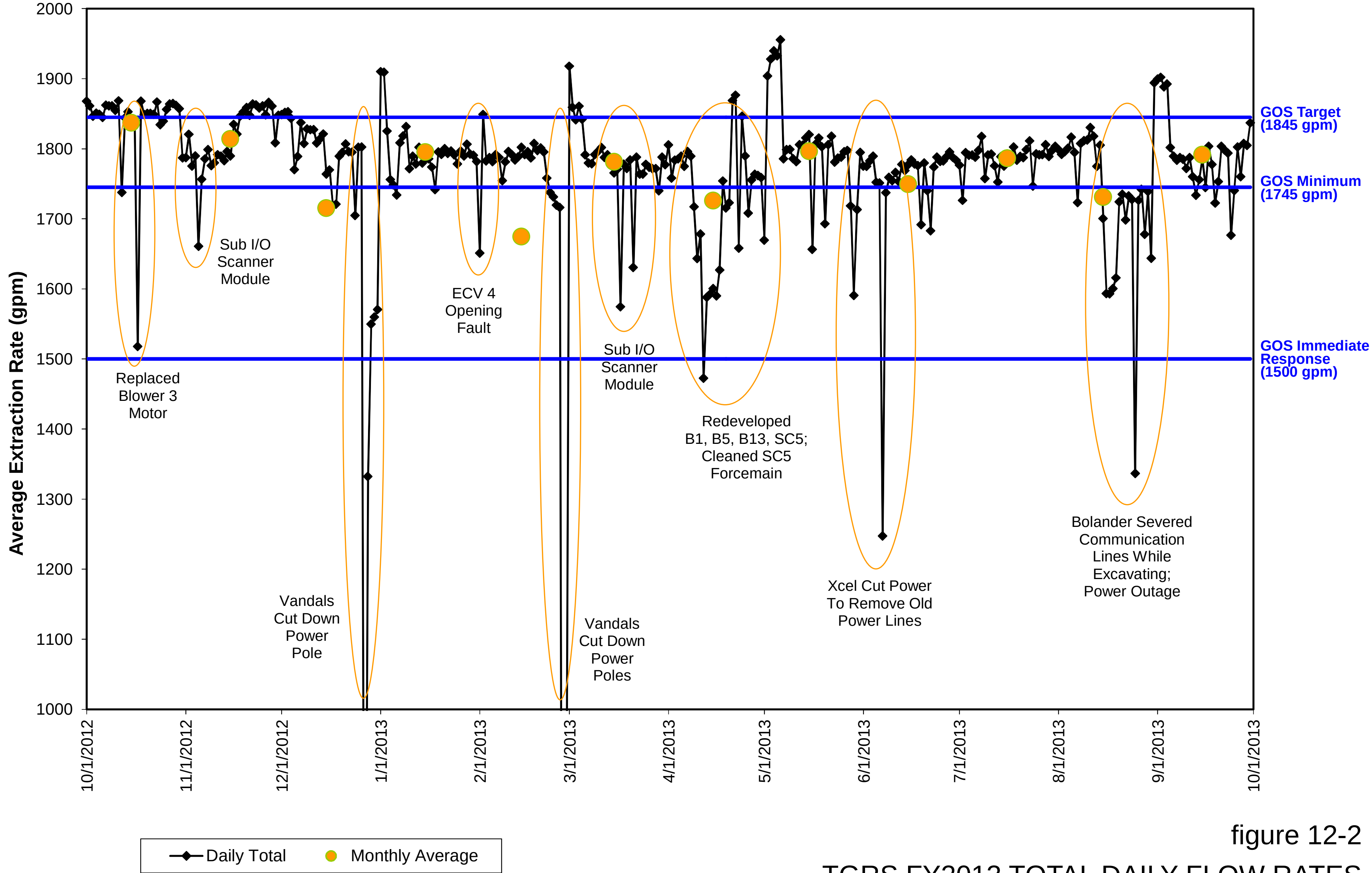
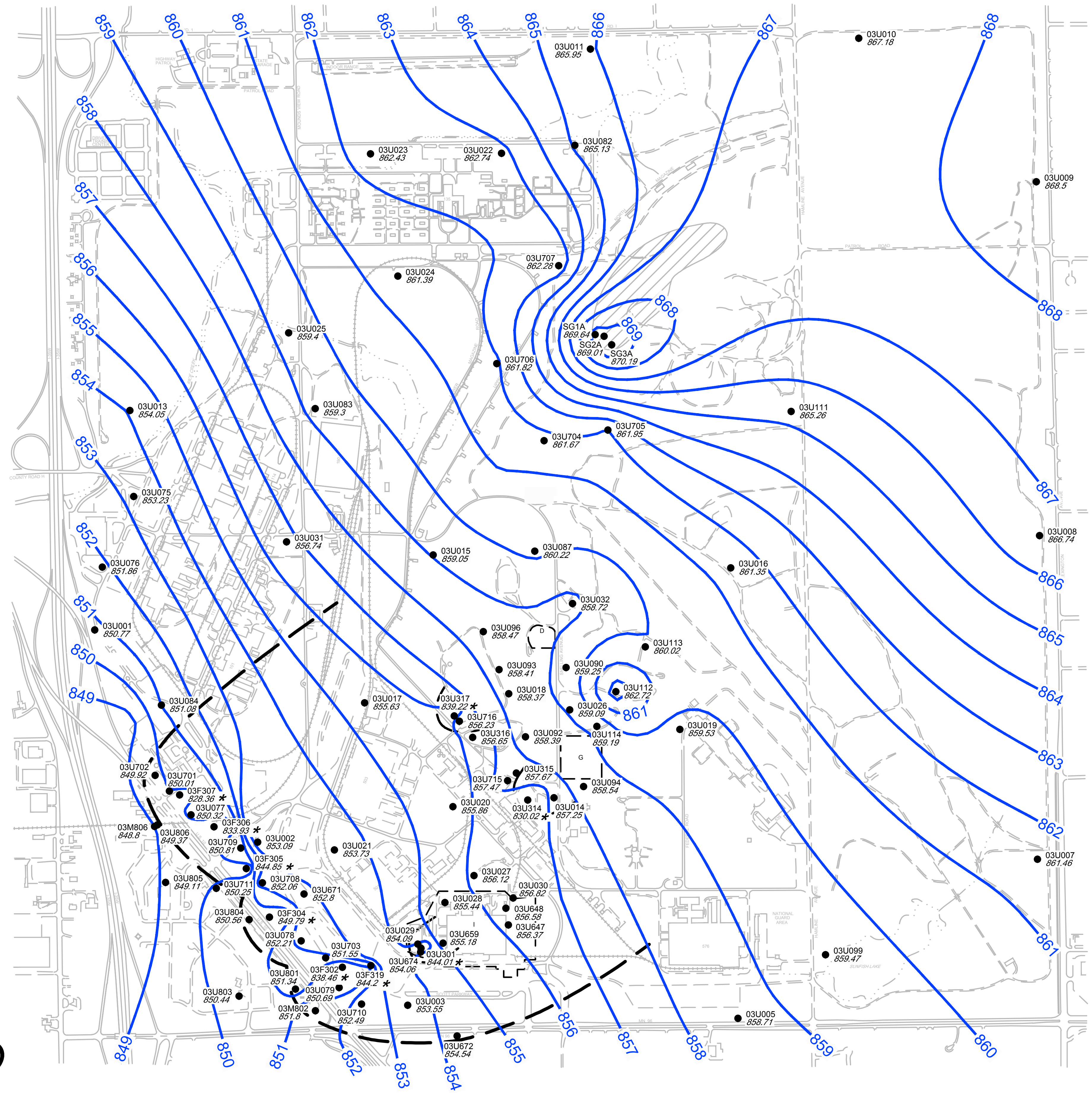
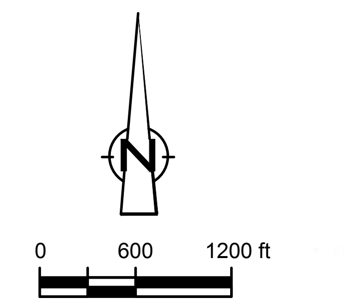


figure 12-2

TGRS FY2013 TOTAL DAILY FLOW RATES
OPERABLE UNIT 2
Arden Hills, Minnesota

083145-43(001)GIS-SP001 DEC 16/2013





LEGEND

- PRIMARY ROAD
- SECONDARY ROAD
- RAILROAD
- DRAINAGE
- BUILDING
- BUILDING REMOVED
- SOURCE AREA
- WELL LOCATION
- 865.26 GROUNDWATER ELEVATION IN FEET AMSL
- 868 GROUNDWATER CONTOUR
- DIRECTION OF GROUNDWATER FLOW
- LIMIT OF CAPTURE
- NOTE: GROUNDWATER CONTOURS ARE INTERPOLATED FROM THE DATA POINTS SHOWN.
- * GROUNDWATER ELEVATION NOT USED IN CONTOURING
- ARSENAL SAND AND GRAVEL PIT TREATED WATER DISCHARGE AREA. (APPROXIMATE BOUNDARIES)

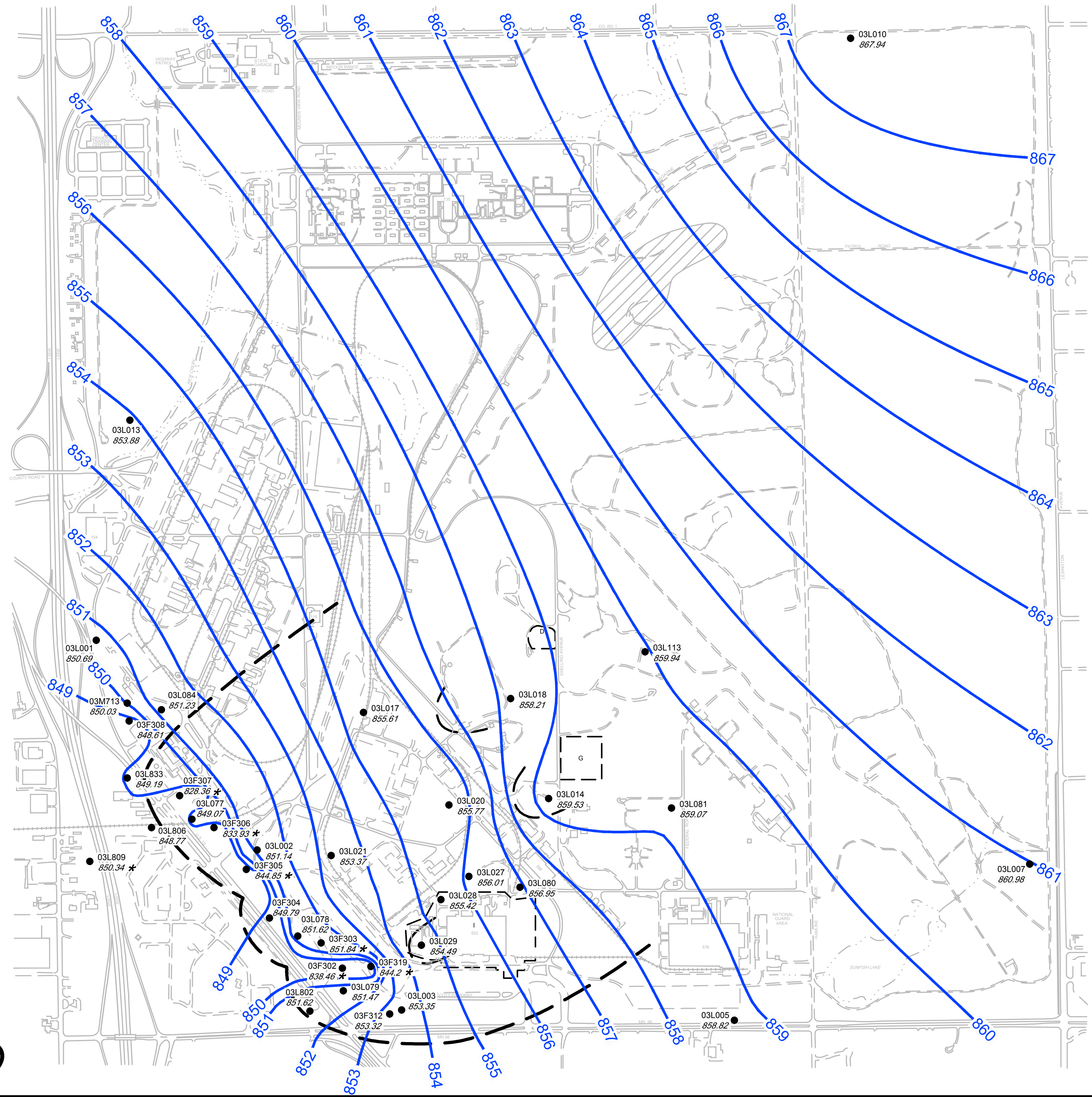
EXTRACTION WELL NAME CROSS REFERENCE

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 12-3

OU2, UPPER UNIT 3, POTENTIOMETRIC MAP
6/3/2013 (Q119)
OPERABLE UNIT 2
Arden Hills, Minnesota

083145-43(001)GN-WA002 JAN 9/2014



0 600 1200 ft

LEGEND

- PRIMARY ROAD
- SECONDARY ROAD
- RAILROAD
- DRAINAGE
- BUILDING
- BUILDING REMOVED
- SOURCE AREA
- WELL LOCATION
- *860.98* GROUNDWATER ELEVATION IN FEET AMSL
- 864 GROUNDWATER CONTOUR
- DIRECTION OF GROUNDWATER FLOW
- LIMIT OF CAPTURE
- NOTE: GROUNDWATER CONTOURS ARE INTERPOLATED FROM THE DATA POINTS SHOWN.
- * GROUNDWATER ELEVATION NOT USED IN CONTOURING
- ARSENAL SAND AND GRAVEL PIT TREATED WATER DISCHARGE AREA. (APPROXIMATE BOUNDARIES)

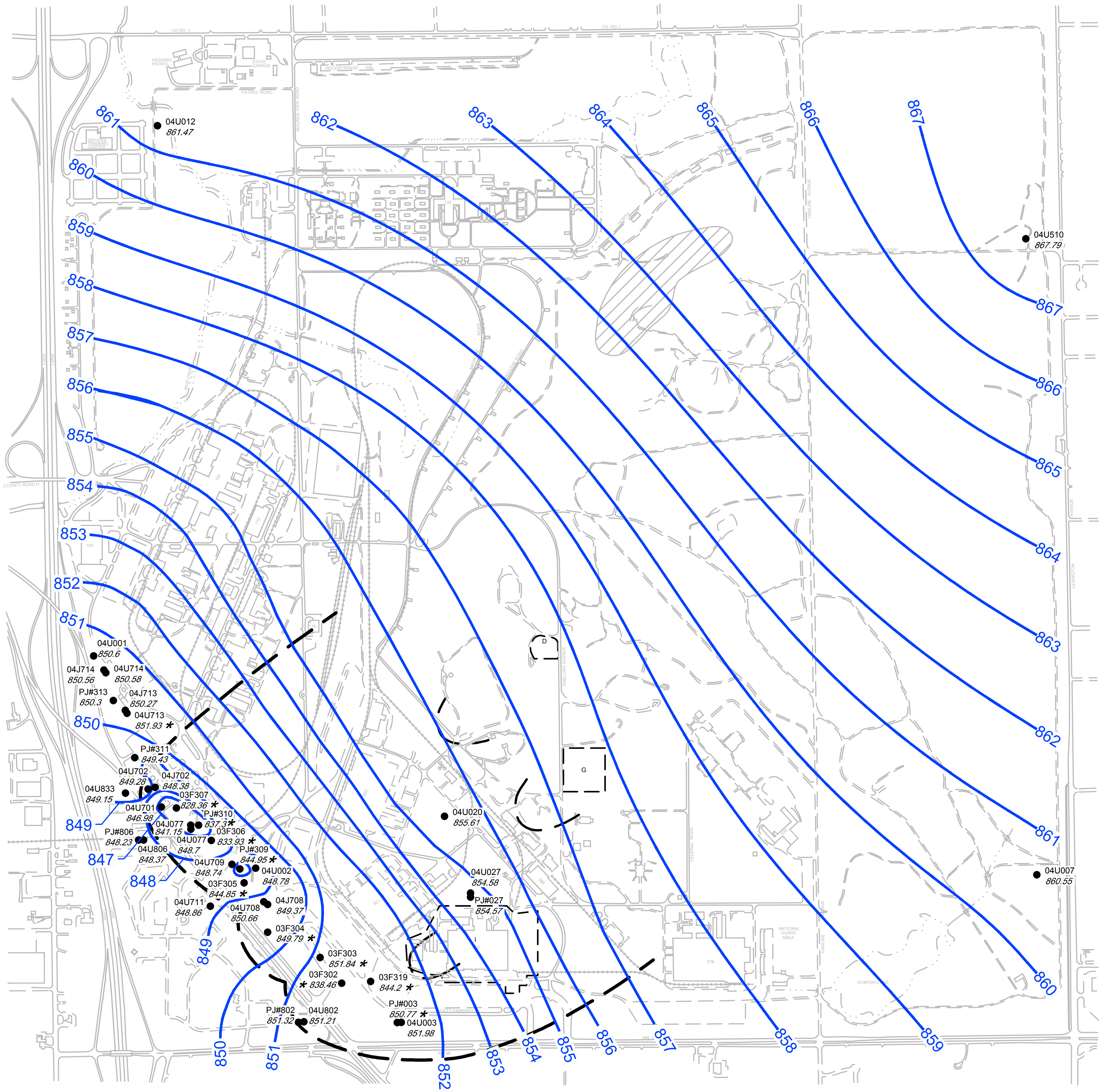
EXTRACTION WELL NAME CROSS REFERENCE

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 12-4

OU2, LOWER UNIT 3, POTENTIOMETRIC MAP
6/3/2013 (Q119)
OPERABLE UNIT 2
Arden Hills, Minnesota

083145-43(001)GN-WA003 JAN 9/2014



0 600 1200 ft

LEGEND

- PRIMARY ROAD
- SECONDARY ROAD
- RAILROAD
- DRAINAGE
- BUILDING
- BUILDING REMOVED
- SOURCE AREA
- WELL LOCATION
- 867.79 GROUNDWATER ELEVATION IN FEET AMSL
- 866 GROUNDWATER CONTOUR
- DIRECTION OF GROUNDWATER FLOW
- LIMIT OF CAPTURE
- NOTE: GROUNDWATER CONTOURS ARE INTERPOLATED FROM THE DATA POINTS SHOWN.
- * GROUNDWATER ELEVATION NOT USED IN CONTOURING
- ARSENAL SAND AND GRAVEL PIT TREATED WATER DISCHARGE AREA. (APPROXIMATE BOUNDARIES)

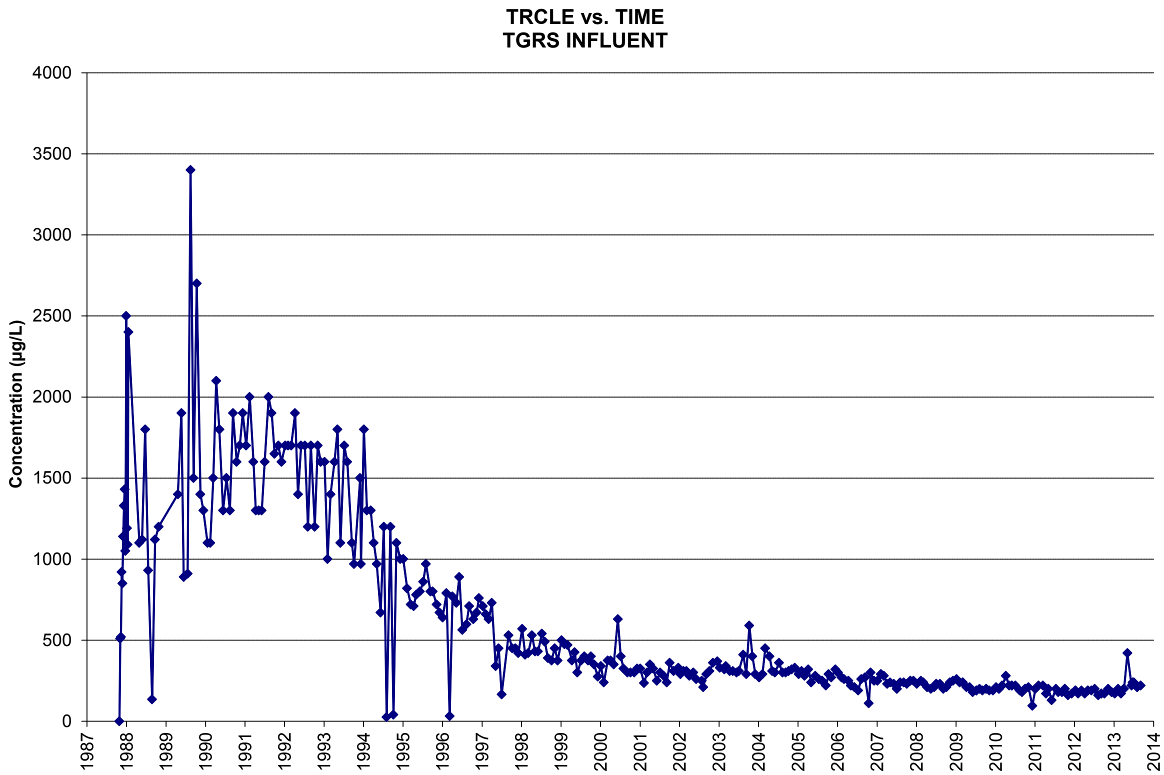
EXTRACTION WELL NAME CROSS REFERENCE

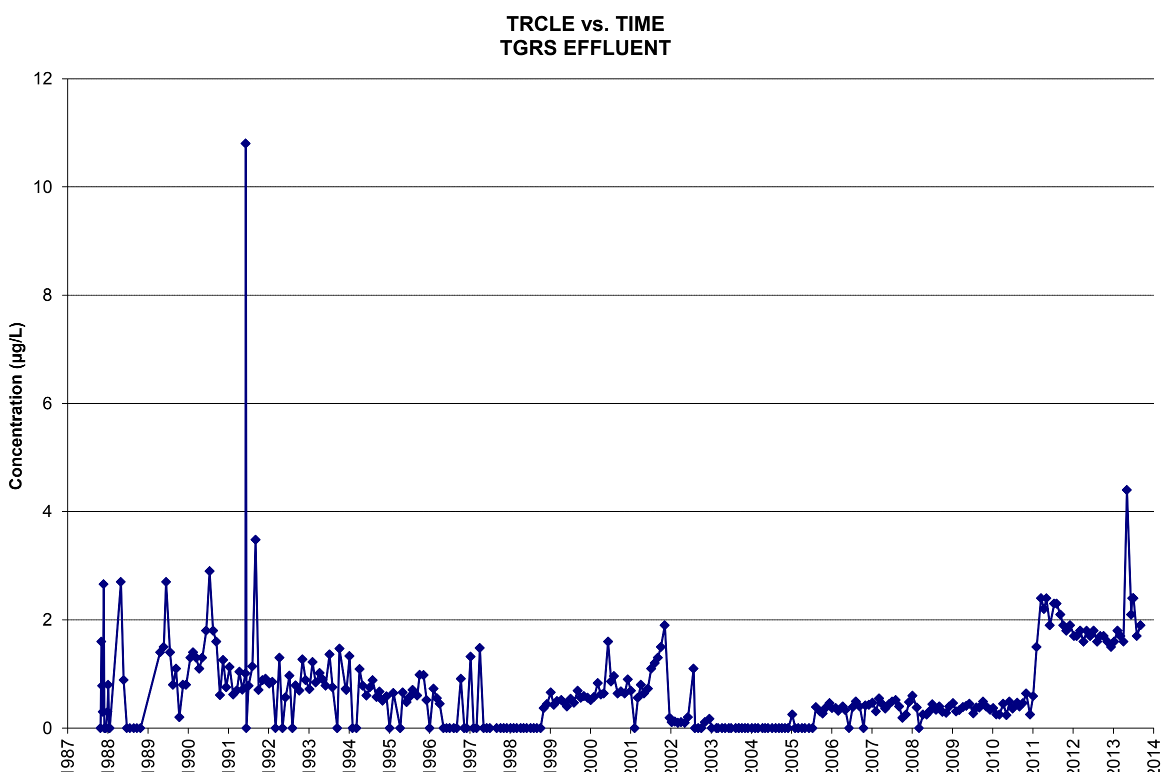
B1	03F302
B2	03F303
B3	03F304
B4	03F305
B5	03F306
B6	03F307
B7	03F308
B8	PJ#309
B9	PJ#310
B10	PJ#311
B11	03F312
B12	PJ#313
B13	03F319
SC1	03U301
SC2	03U314
SC3	03U315
SC4	03U316
SC5	03U317

figure 12-5

OU2, UPPER UNIT 4, POTENTIOMETRIC MAP
6/3/2013 (Q119)
OPERABLE UNIT 2
Arden Hills, Minnesota

083145-43(001)GN-WA004 JAN 9/2014

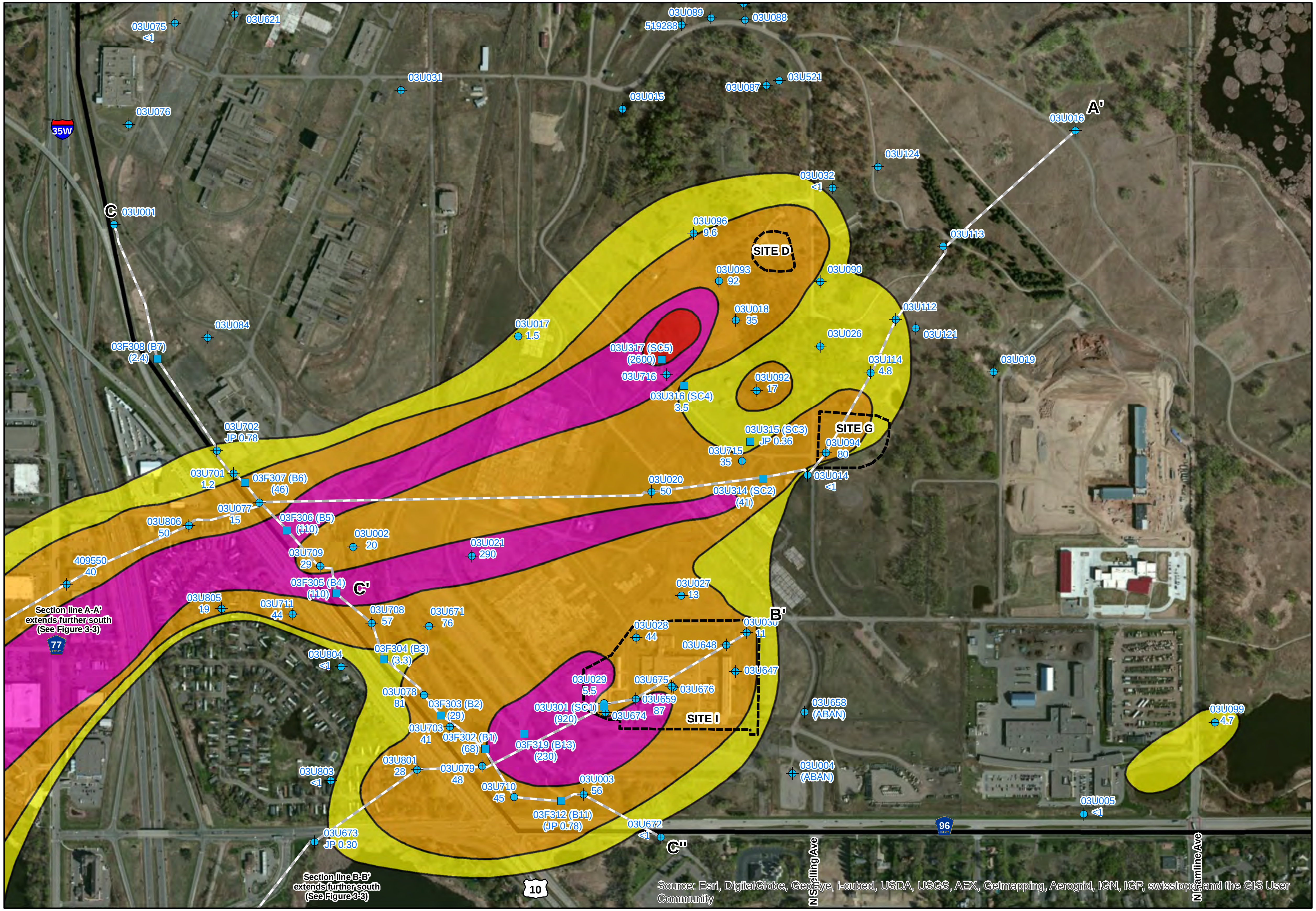




NOTE: SAMPLES REPORTING CONCENTRATIONS OF NON-DETECT WERE PLOTTED AS ZERO. WHEN DUPLICATE SAMPLES WERE COLLECTED, THE HIGHER CONCENTRATION WAS REPORTED.

figure 12-6

TGRS TREATMENT SYSTEM PERFORMANCE
OPERABLE UNIT 2
Arden Hills, Minnesota



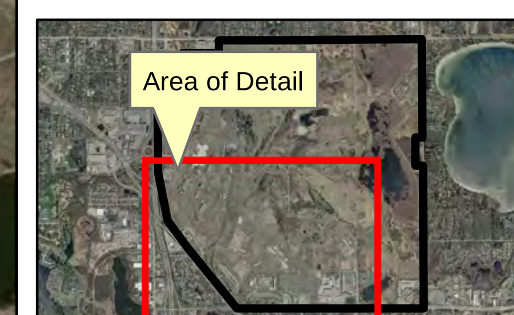
Legend

- 03F306 Monitoring Well Location
- 03U021 Extraction Well Location
- 410.0 Trichloroethene Concentration (µg/L) (Values in parentheses were not used for contouring purposes.)
- (ABAN) Abandoned Location
- JP Estimated Value (Value is below the reporting limit but above the method detection limit)
- Cross-Section Line
- Site Boundary
- 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.)

Trichloroethene Concentrations

- 1-10 µg/l
- 10-100 µg/l
- 100-1,000 µg/l
- 1,000+ µg/l

Notes:
1. 03F and 03U extraction wells are shown with data in parentheses, but concentrations were not used for contouring (except for SC-3 and SC-4, which were used for contouring since they are being sampled as monitoring wells and since they are screened only within Upper Unit 3.
2. Results are from groundwater samples collected in June 2013.
3. 2012 Aerial Photograph (Source: ESRI)



N
W E
S

700 350 0 700
Feet

Path: L:\1561\16\FY2013 APR\mxd\OU2 Upper Unit 3 TCE_Iso_map.mxd

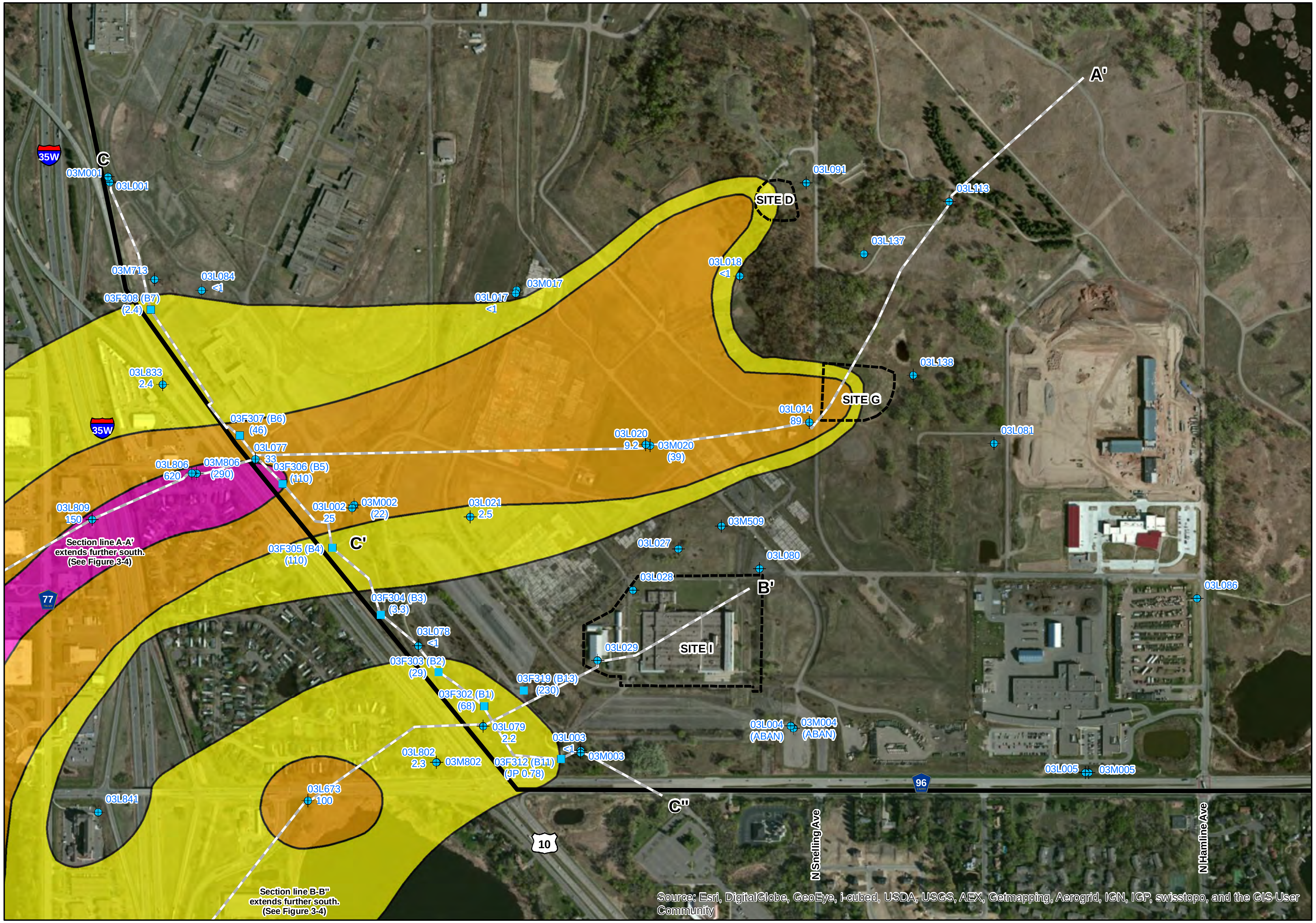
ANNUAL PERFORMANCE REPORT

OU2, Upper Unit 3, Trichloroethene Isoconcentration Map, Summer 2013

Wenck
Engineers - Scientists
Business Professionals
www.wenck.com
1800 Pioneer Creek Center
Maple Plain, MN 55359-0429
1-800-472-2232

FY 2013

Figure 12-7



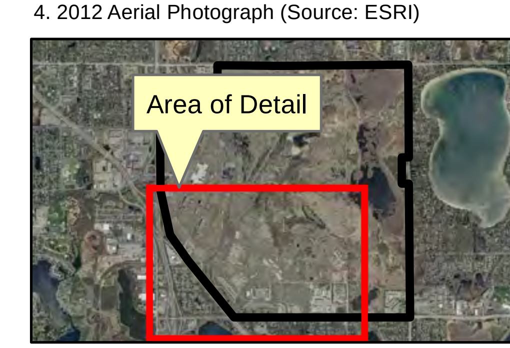
Legend

- 03L077 Monitoring Well Location
- 03F303 Extraction Well Location
- 410.0 Trichloroethene Concentration (µg/L) (Values in parentheses were not used for contouring purposes.)
- (ABAN) Abandoned Location
- (NS) Not Sampled
- JP Estimated Value (Value is below the reporting limit but above the method detection limit)
- Cross-Section Line
- Site Boundary
- 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.)

Trichloroethene Concentrations

- 1-10 µg/l
- 10-100 µg/l
- 100-1,000 µg/l
- 1,000+ µg/l

Notes:
1. Middle Unit 3 wells with data are shown with data in parentheses, but were not used for contouring.
2. 03F extraction wells are shown with data in parentheses, but were not used for contouring.
3. Results are from groundwater samples collected in June 2013.
4. 2012 Aerial Photograph (Source: ESRI)



N
W E
S

700 350 0 700 Feet

Path: L:\1561\16\FY2013 APR\mxd\OU2 Lower Unit 3 TCE_Iso_map.mxd

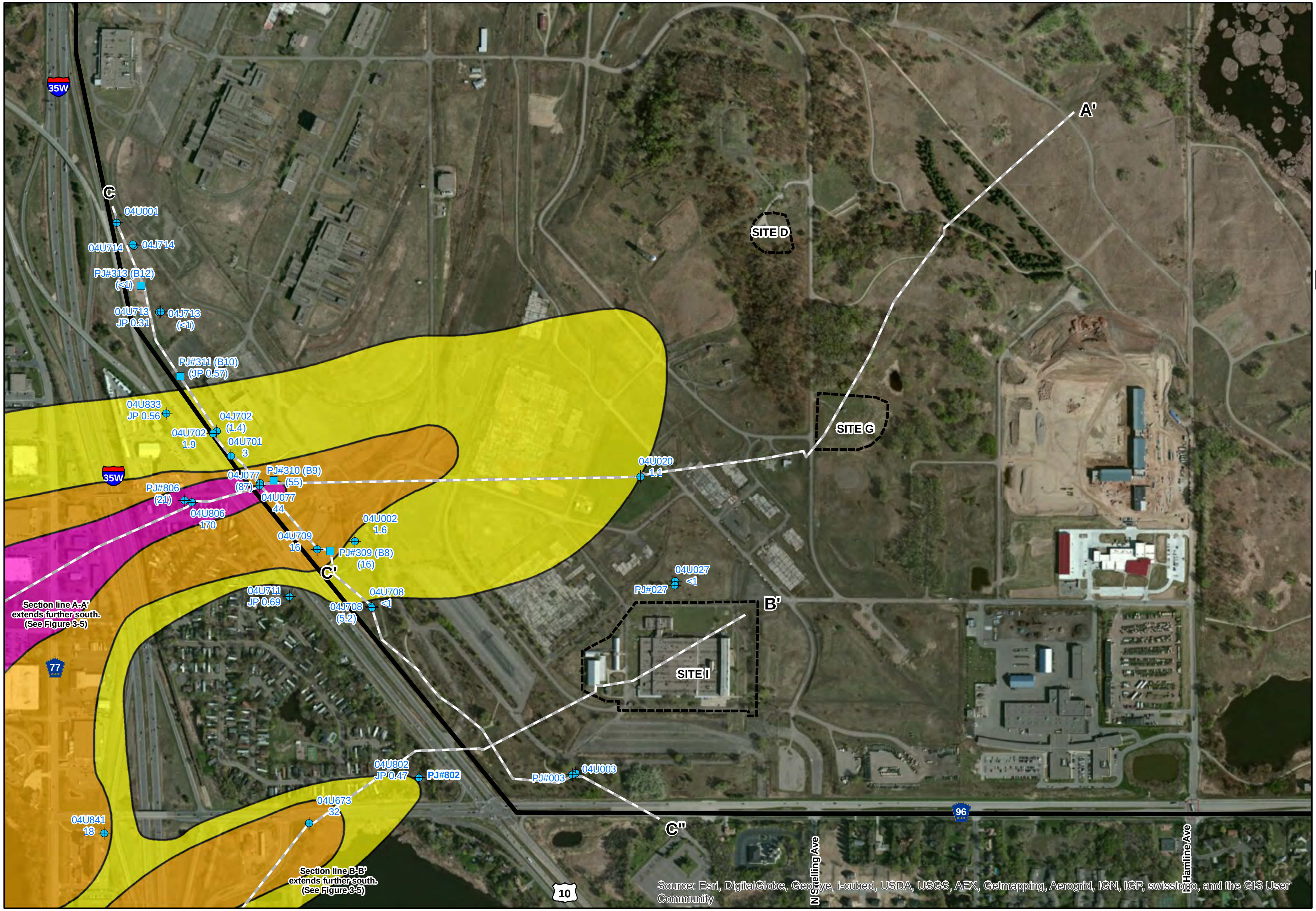
ANNUAL PERFORMANCE REPORT

OU2, Lower Unit 3, Trichloroethene Isoconcentration Map, Summer 2013

Wenck
Engineers - Scientists
Business Professionals
www.wenck.com
1800 Pioneer Creek Center
Maple Plain, MN 55359-0429
1-800-472-2232

FY 2013

Figure 12-8



Legend

- PJ#309 Monitoring Well Location
- 04U701 Extraction Well Location
- 410.0 Trichloroethene Concentration (µg/L) (Values in parentheses were not used for contouring purposes.)
- (ABAN) Abandoned Location
- (NS) Not Sampled
- JP Estimated Value (Value is below the reporting limit but above the method detection limit)
- Cross-Section Line
- Site Boundary
- 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.)

Trichloroethene Concentrations

- 1-10 µg/l
- 10-100 µg/l
- 100-1,000 µg/l
- 1,000+ µg/l

Notes:
1. All 04J wells (Jordan Wells) with data are shown with data in parentheses, but were not for countouring.
2. All PJ# Extraction wells are shown with data in parentheses, but were not used for countouring.
3. PJ# monitoring wells are shown with data in parentheses, but were not used for countouring.
4. Results are from groundwater samples collected in June 2013.
5. 2013 Aerial Photograph (Source: ESRI)

N W E S

700 350 0 700 Feet

Path: L:\1561\16\FY2013 APR\mxd\OU2 Upper Unit 4 TCE_iso_map.mxd

ANNUAL PERFORMANCE REPORT	Wenck	FY 2013
OU2, Upper Unit 4, Trichloroethene Isoconcentration Map, Summer 2013	Engineers - Scientists Business Professionals www.wenck.com 1800 Pioneer Creek Center Maple Plain, MN 55359-0429 1-800-472-2232	Figure 12-9

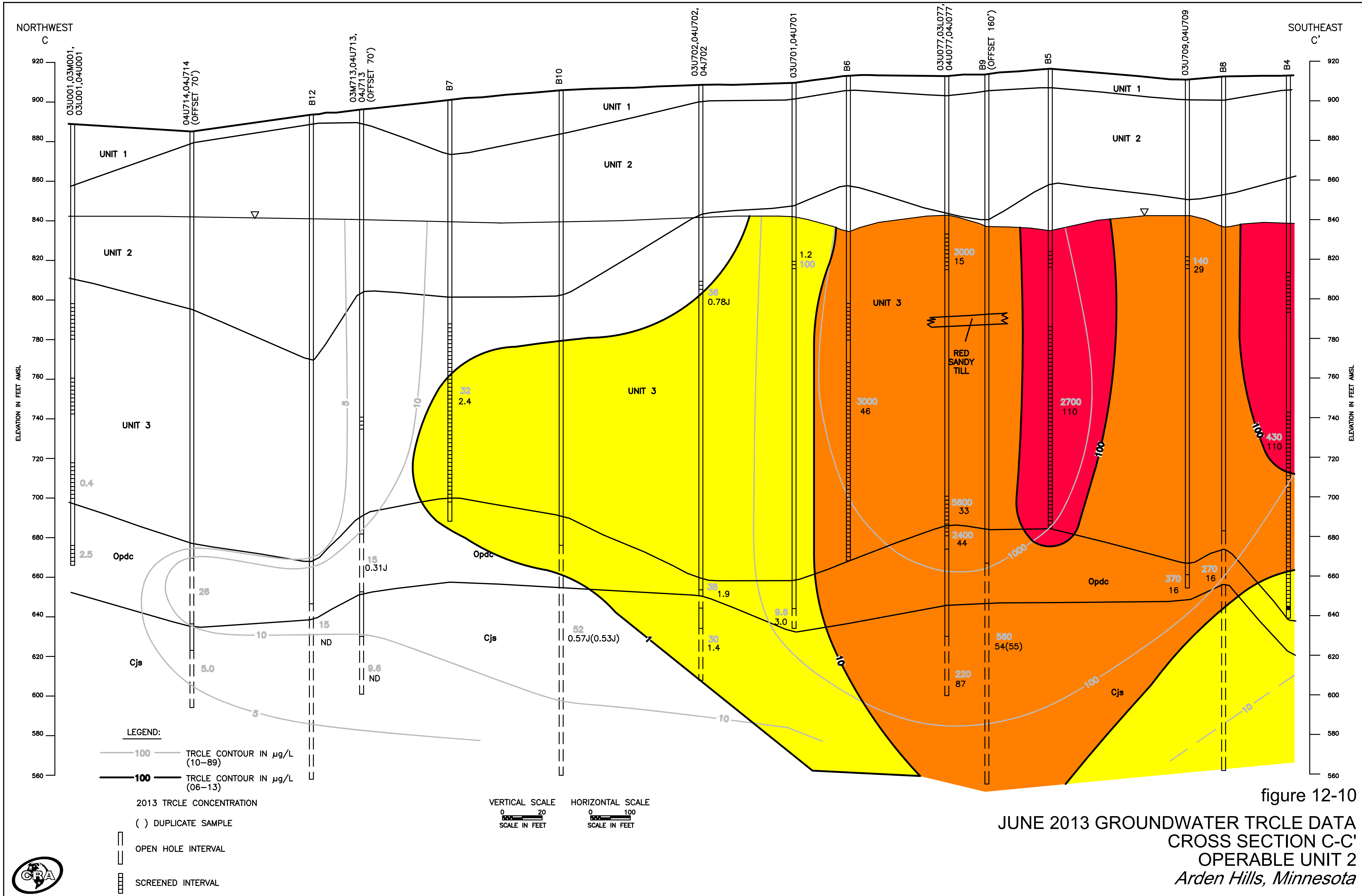


figure 12-10

JUNE 2013 GROUNDWATER TRCLE DATA
CROSS SECTION C-C'
OPERABLE UNIT 2
Arden Hills, Minnesota

083145-43(001)GN-SP004 APR 13/2012

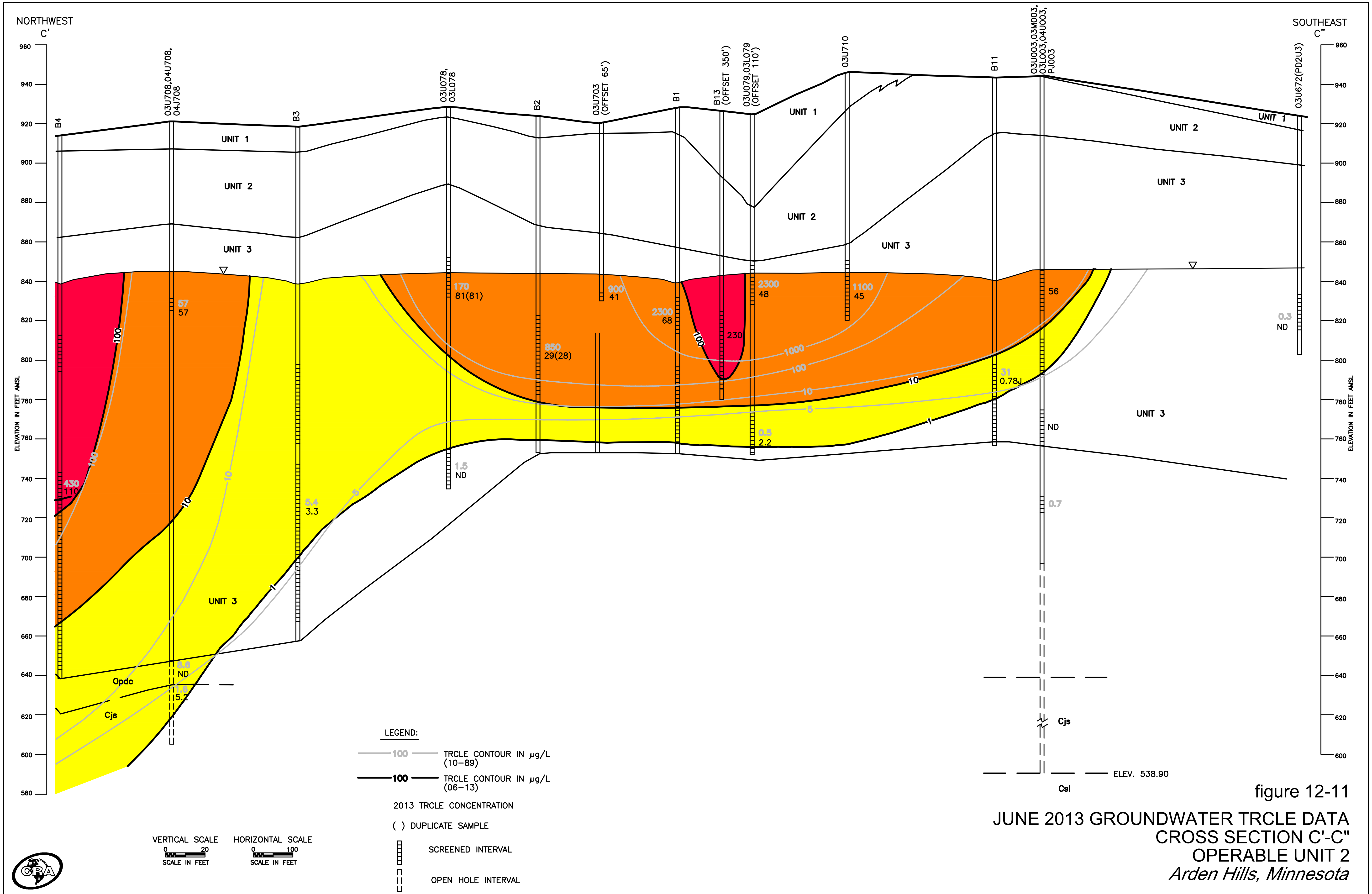
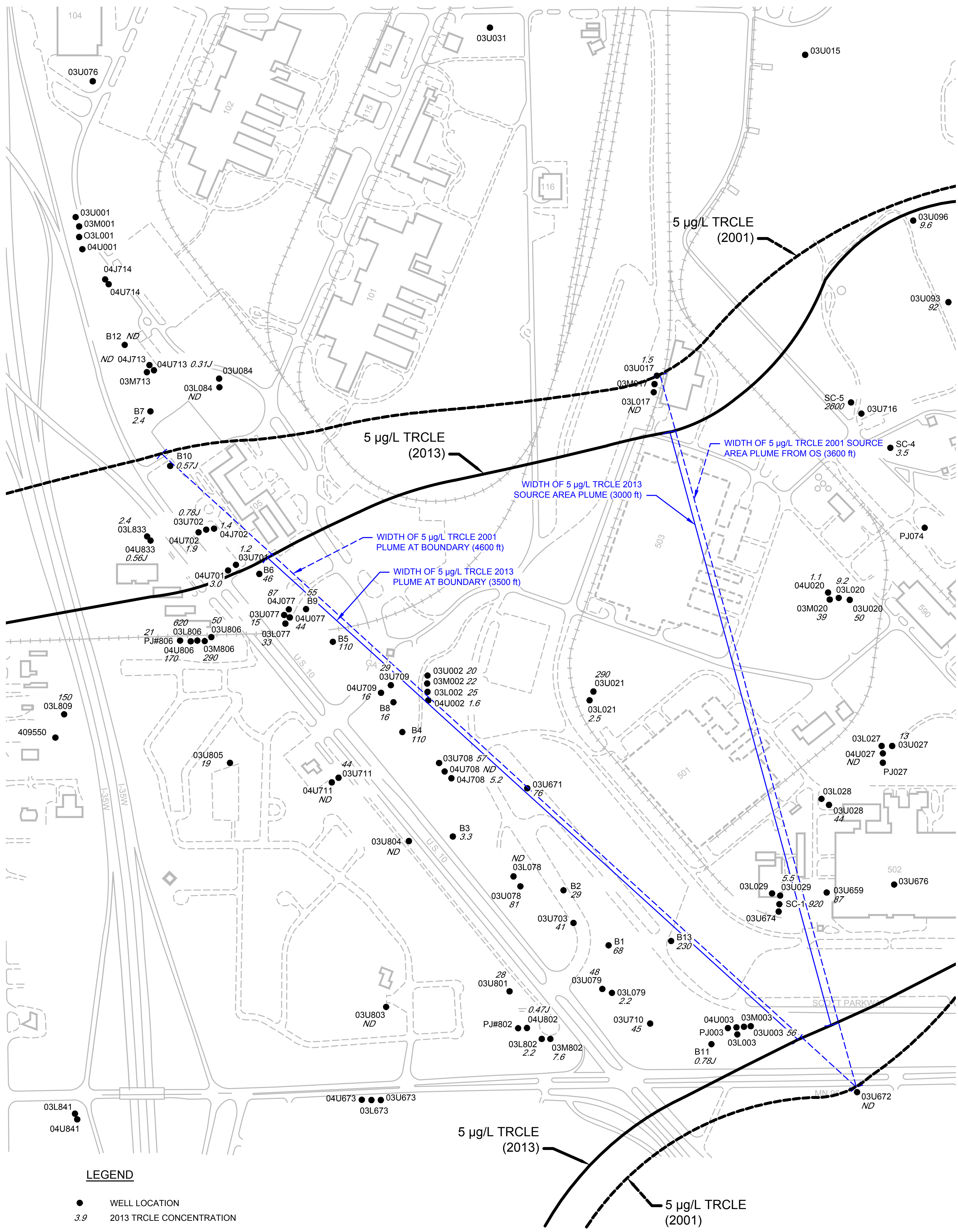


figure 12-11

JUNE 2013 GROUNDWATER TRCLE DATA
CROSS SECTION C'-C"
OPERABLE UNIT 2
Arden Hills, Minnesota

083145-43(001)GN-SP005 APR 13/2012



0 200 500ft

figure 12-12

TGRS ANNUAL MONITORING DATA - WEST PORTION
TRCLE CONCENTRATIONS (µg/L) JUNE 2013
OPERABLE UNIT 2
Arden Hills, Minnesota

083145-43(001)GN-SP002 Dec 16/2013

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 2013 monitoring plan and any deviations are explained in Appendix C.2. Details of the groundwater monitoring program are discussed in the next section.

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 2013 monitoring plan and any deviations are explained in Appendix C.2.

Groundwater samples were collected from 18 OU3 wells in FY 2013 as part of the OU1, OU2, and OU3 comprehensive biennial 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. All of the wells sampled contained TRCLE concentrations similar to those reported for the previous sampling event (either 2011 or 2012). TRCLE concentrations in the downgradient sentry well, 04U863, returned to less than 1.0 μg/L, after rising above 1.0 μg/L for the first time since December 1999 in 2012 (1.2 μg/L). TRCLE concentrations were also less than 1.0 μg/L in wells 03L854, 03U673, 04J866, 04U414, 04U851, 04U860, and 04U866. Two wells, 03L848 and 04U848, had TRCLE concentrations greater than 1.0 μg/L, but below the cleanup standard of 5 μg/L. The other eight wells had TRCLE concentrations above the cleanup standard of 5 μg/L, ranging from 7.7 μg/L to 160 μg/L.

1,1,1-Trichloroethane and/or its degradation products, 1,1-dichloroethane and 1,1-dichloroethene, were present in four wells at the boundary between OU1 and OU3 (03L673, 03L859, 04U859, and 04U832), indicating a mingling of the North Plume and the South Plume at these locations. These parameters have also been detected at low concentrations at 03M848, a center-of-plume well, for several years, including FY 2013.

What were the results of the Statistical Analyses?

The Mann-Kendall statistical analysis was updated for nine edge-of-plume and center-of-plume wells sampled in 2013. A statistical analysis was also added for two additional wells (03L859 and 04U854) that now have enough recent data points to perform an analysis. 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 no trend to probably increasing as concentrations have increased slightly over the last three sampling events after being stable for several sampling events. The TRCLE concentrations at 03M848 have steadily decreased from 1,400 μg/L in FY 1996 to 700 μg/L in FY 1999 to

450 µg/L in FY 2003 to the current concentration of 160 µg/L in FY 2013. However, TRCLE concentrations at 03M848 have ranged only between 130 µg/L and 190 µg/L for the last eight 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.

The statistical analysis for well 04U859, which is classified as a center-of-plume well and is at the boundary with OU1, shows a stable trend. It had previously showed no trend. The presence of 1,1,1-trichloroethane, and its degradation products, which have historically been present in 04U859, indicates that the North Plume is present at this location and may be a factor in analysis.

The trends for wells 03L673, 03L848, 409548, 04U673, and 04U832, located at the edge-of-plume, all changed since the last statistical analysis. Wells 03L673 and 04U673 changed from stable to definitely decreasing, while wells 03L848 and 04U832 changed from no trend to stable. Well 409548 (an OU1 well) changed from definitely decreasing to stable. The trends for wells 04U845 and 04U848 remained unchanged from the last statistical analysis. A stable trend was again noted at well 04U845 and no trend continued at 04U848.

A statistical analysis was added in FY 2013 for wells 03L859 and 04U854 because there are now enough recent data points to perform an analysis since these wells were added to the biennial sampling program. Both 03L859 (a center-of-plume well) and 04U854 (an edge-of-plume well) show a definitely decreasing trend.

In summary, based on the data collected in FY 2013, the center of the South Plume, represented by 03M848, appears to indicate slightly increasing concentrations; however, wells 03L859 and 04U859, also classified as center-of-plume wells, indicate decreasing and stable trends, respectively. The edge of the South Plume appears to remain stable or even decreasing. A stable trend at the edge of the plume indicates that the South Plume is not expanding. In addition, the presence of 1,1,1-trichloroethane, and its degradation products near the OU1-OU3 boundary indicates that the North Plume may be mingling with the South Plume and may be a factor in the trends noted at the wells near the boundary. Recent data show that the North Plume may be present even toward the center of the South Plume and may also be a factor in the trends noted there.

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. No edge-of-plume wells analyzed in FY 2013 showed 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 2013 – FY 2017 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 2013, groundwater monitoring took place as prescribed in the Annual Monitoring Plan. The comprehensive biennial sampling round of FY 2013 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 limited annual groundwater sampling event will take place in FY 2014 as planned. No additional actions are necessary because no increasing trends at the edge of the plume were identified by the statistical analysis.

Monitoring well 04U861 was abandoned in February 2006 at the request of the City of New Brighton to allow for property redevelopment. The Army initially committed to replacing 04U861 when the City completed the property redevelopment. With the redevelopment schedule uncertain and the questionable value of any information to be gained from a replacement well, the Army and ATK requested to forego replacement of the monitoring well in a letter to USEPA and MPCA dated September 6, 2012. The Army and ATK received approval from the agencies for this request on September 19, 2013.

TABLE 13-1

GROUNDWATER QUALITY DATA (µg/L)
OPERABLE UNIT 3
FISCAL YEAR 2013

			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*	*70*	*6*	*70*	*5*
Location	*Date*	*Dup*	*µg/L*	*µg/L*	*µg/L*	*µg/L*	*µg/L*	*µg/L*
03L673	6/27/13		< 1	< 1	0.32 JP	0.44 JP	5	100
03L673	6/27/13	D	< 1	< 1	0.33 JP	0.46 JP	5.4	100
03L848	6/27/13		< 1	< 1	< 1	< 1	0.53 JP	4.9
03L854	6/25/13		< 1	< 1	< 1	< 1	< 1	< 1
03L859	6/27/13		2.7 JMS	< 1	6.2	6.9	1.2	7.7
03M848	6/27/13		0.34 JP	< 1	0.95 JP	1	9.9	160
03U673	6/27/13		< 1	< 1	< 1	< 1	< 1	0.3 JP
04J866	6/25/13		< 1	< 1	< 1	< 1	< 1	< 1
04U414	6/26/13		< 1	< 1	< 1	< 1	< 1	< 1
04U673	6/27/13		< 1	< 1	< 1	< 1	1.1	32
04U832	6/27/13		2	< 1	3.2	4	3.5	53
04U845	6/25/13		< 1	< 1	< 1	< 1	0.67 JP	14
04U848	6/27/13		< 1	< 1	< 1	< 1	< 1	4.8
04U851	6/25/13		< 1	< 1	< 1	< 1	< 1	< 1
04U854	6/25/13		< 1	< 1	< 1	< 1	0.44 JP	10
04U859	6/27/13		6.1	< 1	4.8	6.4	2.2	49
04U860	6/27/13		< 1	< 1	< 1	< 1	< 1	< 1
04U863	6/26/13		< 1	< 1	< 1	< 1	< 1	< 1
04U866	6/25/13		< 1	< 1	< 1	< 1	< 1	< 1
04U866	6/25/13	D	< 1	< 1	< 1	< 1	< 1	< 1

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.
JMS - Result is qualified as estimated due to low matrix sprike recovery (<75%).

TABLE 13-2

MANN-KENDALL STATISTICAL SUMMARY
OPERABLE UNIT 3
FISCAL YEAR 2013

Well	*Kendall S*	*Number of Data Points*	*Raw Trend*	*Confidence*	*Coefficient of Variance*	*Raw Trend Decision*	*MAROS Conclusion*	*June 2013 TRCLE Conc.*
Edge of Plume Wells								
03L673	-12	6	Decreasing	98.19%	0.2700	Definite	Decreasing	100
03L848	-3	6	Decreasing	64.00%	0.1465	Stable or No Trend	Stable	4.6
409548	-8	6	Decreasing	89.81%	0.1858	Stable or No Trend	Stable	1
04U673	-15	6	Decreasing	99.86%	0.1853	Definite	Decreasing	32
04U832	-3	6	Decreasing	64.00%	0.0764	Stable or No Trend	Stable	53
04U845	-3	6	Decreasing	64.00%	0.2706	Stable or No Trend	Stable	14
04U848	1	6	Increasing	50.00%	0.4503	Stable or No Trend	No Trend	4.8
04U854	-10	6	Decreasing	95.20%	0.1782	Definite	Decreasing	10
Center of Plume Wells								
03L859	-11	6	Decreasing	97.20%	0.1238	Definite	Decreasing	7.7
03M848	9	6	Increasing	93.20%	0.1633	Probable	Increasing	160
04U859	-4	6	Decreasing	70.25%	0.4806	Stable or No Trend	Stable	49

TABLE 13-3

SUMMARY OF GROUNDWATER MONITORING REQUIREMENTS
OPERABLE UNIT 3
FISCAL YEAR 2013

	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

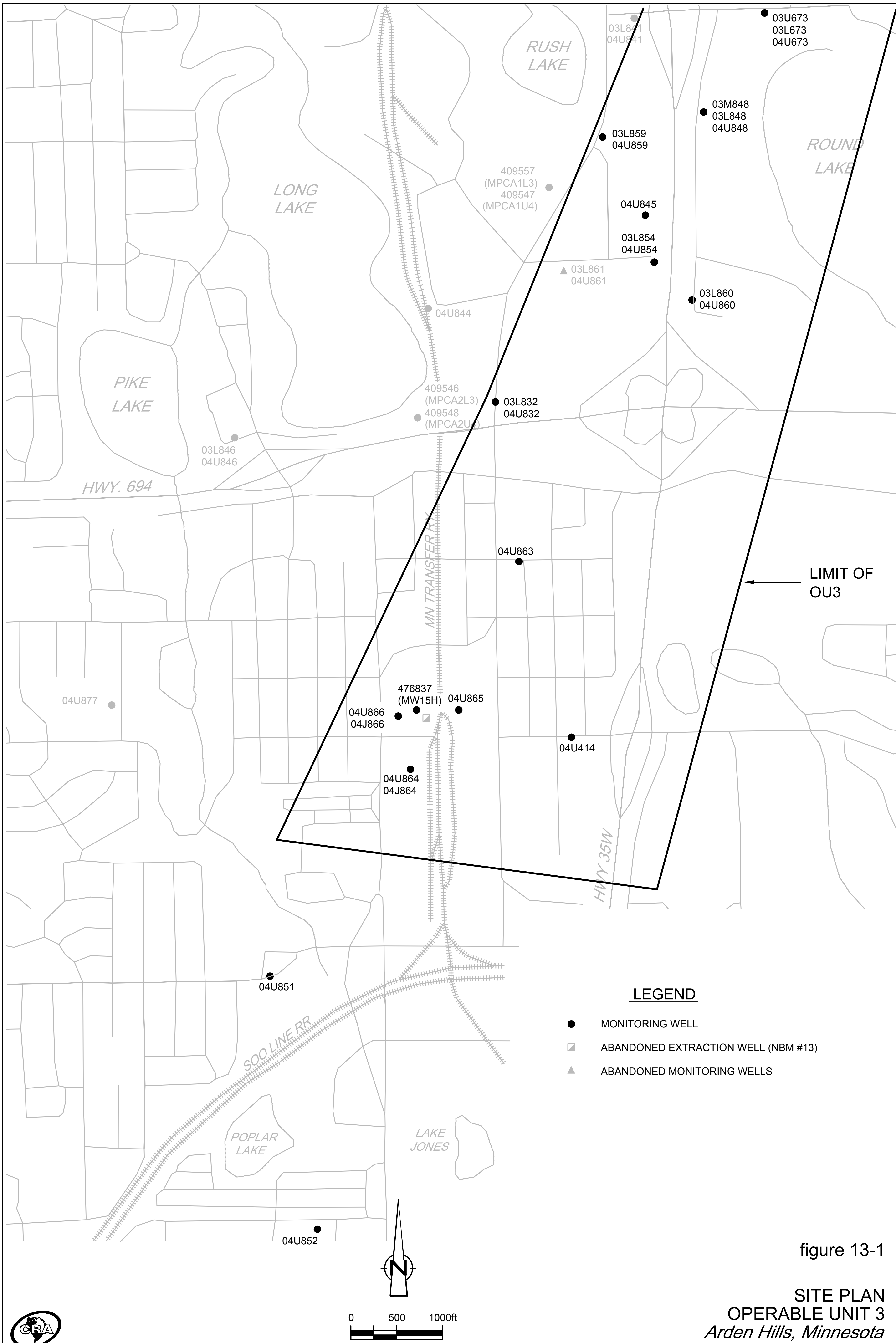


figure 13-1

SITE PLAN
OPERABLE UNIT 3
Arden Hills, Minnesota

083145-43(001)GN-SP003 Dec 16/2013

14.0 Other Installation Restoration Activities During FY 2013

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 groundwater entering the operable unit. Locations of these wells are shown on Figure B-3 in Appendix B. The FY 2013 results were:

Well	Trichloroethene
03U007	<1.0
03U009	<1.0
03L007	<1.0
04U007	<1.0
04U510	<1.0

The results indicate that no contamination is flowing into OU2 from upgradient.

These locations will be sampled again 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 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). As a result, at the end of FY 2013, the Army was preparing a Supplemental RI and FS for Round Lake which will be its best-and-final work product, incorporating a Supplemental Ecological Risk Assessment prepared by ORNL. This document will be a complete document (not in segments), with submittal to the USEPA and MPCA anticipated in early 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 Phase II Environmental

Site Assessment report documenting this work was submitted to the MPCA (VIC Program) in December 2011. Final resolution of comments has not yet been completed.

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 Army submitted a Draft-Final Removal Action Completion Report documenting implementation of this work in August 2013. At the end of FY 2013, the Army was preparing responses to USEPA and MPCA comments.

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 Army submitted a Draft-Final Removal Action Completion Report documenting implementation of this work in August 2013. At the end of FY 2013, the Army was preparing responses to USEPA and MPCA comments.

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 Army submitted a Draft-Final Removal Action Completion Report documenting implementation of this work in August 2013. At the end of FY 2013, the Army was preparing responses to USEPA and MPCA comments.

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 (commercial/residential/recreational). The contaminated soil cleanup work is intended to also fulfill the Army's obligation under the Federal Facility Agreement (FFA) to remediate soils to industrial cleanup standards.

In FY 2013, Bolander completed a significant portion of the site work in preparation for future development (i.e., building abatement/removal, road/parking lot removal, utility removal, etc.), and will continue conducting this work in FY 2014. At the end of FY 2013, a QAPP for conducting soil sampling was undergoing final resolution of MPCA comments. A Response Action Plan (RAP) to address most of the areas within the 427 acres was also under review. Sampling and contaminated soil excavation is anticipated to begin in early FY 2014, and additional QAPPs/RAPs (or addenda thereto) covering the remainder of the 427 acres are anticipated to be submitted and finalized in FY 2014.

15.0 References

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Appendix A

FY 2013 – FY 2017 Monitoring Plans

A.1 Groundwater Monitoring Wells

APPENDIX A.1
FY 2013 – FY 2017 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) Flexibility will be maintained to allow for groundwater sampling to occur in either March or April depending on current conditions.

(8) Sample OU1 private water supply well as late as September 30, if necessary due to temporary inaccessibility.

APPENDIX A.1

FY 2013 - FY 2017 MONITORING PLAN FOR GROUNDWATER MONITORING WELLS

Well Information									Purpose For Monitoring (3)		
Unit	Well I.D.	Common Name	Notes	June 13	June 14	June 15	June 16	June 17	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)	---	Q,L(B)	OR	3.b	
03U	03U821			Q,L(B)	---	Q,L(B)	---	Q,L(B)	OR	3.b	
03U	03U822			Q,L(B)	---	Q,L(B)	---	Q,L(B)	1.a, OR	None	
03U	03U831			---	---	---	---	---	---	---	abandoned 2006
03U	409550	PCA 6U3		Q,L(B)	---	Q,L(B)	---	Q,L(B)	OR	None	
03U	409596	BS118U3		---	---	---	---	---	---	---	abandoned 2007, may need replacement
03M	03M843			Q,L(B)	---	Q,L(B)	---	Q,L(B)	1.a, OR	None	
03L	03L811			Q,L(B)	---	Q,L(B)	---	Q,L(B)	OR	3.b	
03L	03L822			Q,L(B)	---	Q,L(B)	---	Q,L(B)	OR	None	
03L	03L832			Q,L(B)	---	Q,L(B)	---	Q,L(B)	OR	None	
03L	03L841			Q,L(B)	---	Q,L(B)	---	Q,L(B)	1.a, OR	None	
03L	03L846			Q,L(B)	---	Q,L(B)	---	Q,L(B)	1.a, OR	None	
03L	03L853			---	---	---	---	---	---	---	
03L	409556	PCA4L3		Q,L(B)	---	Q,L(B)	---	Q,L(B)	1.a, OR	None	
03L	409557	PCA1L3		Q,L(B)	---	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)	---	Q,L(B)	OR	3.b	
PC	04U834			Q,L(B)	---	Q,L(B)	---	Q,L(B)	OR	None	
PC	04U836	MW-1		Q,L(B)	---	Q,L(B)	---	Q,L(B)	OR	3.b	
PC	04U837	MW-3		Q,L(B)	---	Q,L(B)	---	Q,L(B)	OR	3.b	
PC	04U838	MW-5		Q,L(B)	---	Q,L(B)	---	Q,L(B)	OR	3.b	
PC	04U839	MW-7		Q,L(B)	---	Q,L(B)	---	Q,L(B)	OR	3.b	
PC	04U841			Q,L(B)	---	Q,L(B)	---	Q,L(B)	OR	3.b	
PC	04U843			Q,L(B)	---	Q,L(B)	---	Q,L(B)	1.a, OR	3.b	
PC	04U844			Q,L(B)	---	Q,L(B)	---	Q,L(B)	OR	3.b	
PC	04U846			Q,L(B)	---	Q,L(B)	---	Q,L(B)	OR	3.b	
PC	04U847			Q,L(B)	---	Q,L(B)	---	Q,L(B)	OR	3.b	
PC	04U849			Q,L(B)	---	Q,L(B)	---	Q,L(B)	OR	3.b	
PC	04U850			Q,L(B)	---	Q,L(B)	---	Q,L(B)	OR	3.b	
PC	04U855			Q,L(B)	---	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)	---	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	
PC	04U879			Q,L(B)	---	Q,L(B)	---	Q,L(B)	1.a, OR	3.b	
PC	04U880			Q,L(B)	---	Q,L(B)	---	Q,L(B)	1.a, OR	3.b	
PC	04U881			Q,L(B)	---	Q,L(B)	---	Q,L(B)	1.a, OR	None	
PC	04U882			Q,L(B)	---	Q,L(B)	---	Q,L(B)	OR	None	
PC	04U883			Q,L(B)	---	Q,L(B)	---	Q,L(B)	1.a, OR	None	
PC	191942	BS118U4		---	---	---	---	---	---	---	abandoned 2007, may need replacement

APPENDIX A.1

FY 2013 - FY 2017 MONITORING PLAN FOR GROUNDWATER MONITORING WELLS

Well Information									Purpose For Monitoring (3)		
Unit	Well I.D.	Common Name	Notes	June 13	June 14	June 15	June 16	June 17	Water Quality	Water Level	Comments
PC	200154	UM Golf Course	(8)	Q(B)	---	Q(B)	---	Q(B)	1.a, OR	---	
PC	200814	American Linen		---	---	---	---	---	---	---	
PC	206688	Cloverpond	(8)	Q(B)	---	Q(B)	---	Q(B)	1.a, OR	---	well not in service for FY 13 sampling event
PC	234547	Honeywell Ridgeway		---	---	---	---	---	---	---	
PC	409547	PCA1U4		Q,L(B)	---	Q,L(B)	---	Q,L(B)	OR	3.b	
PC	409548	PCA2U4		Q,L(B)	---	Q,L(B)	---	Q,L(B)	OR	3.b	
PC	409549	PCA3U4		Q,L(B)	---	Q,L(B)	---	Q,L(B)	OR	3.b	
PC	409555	PCA5U4		Q,L(B)	---	Q,L(B)	---	Q,L(B)	1.a, OR	3.b	
PC	512761	Gross Golf Course #2	(8)	Q,L(B)	---	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)	---	Q,L(B)	OR	None	
J	04J835			---	---	---	---	---	---	---	
J	04J836	MW-2		Q,L(B)	---	Q,L(B)	---	Q,L(B)	OR	3.b	
J	04J837	MW-4		Q,L(B)	---	Q,L(B)	---	Q,L(B)	OR	3.b	
J	04J838	MW-6		Q,L(B)	---	Q,L(B)	---	Q,L(B)	OR	3.b	
J	04J839	MW-8		Q,L(B)	---	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)	---	Q,L(B)	OR	None	
J	200524	St. Anthony #5	(4)	Q(B)	---	Q(B)	---	Q(B)	OR	---	Army gets St. Anthony Data
J	200803	St. Anthony #4	(4)	Q(B)	---	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)	---	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)	---	Q,L(B)	OR	None	
UNK	234546	Honeywell Ridgeway	(8)	Q(B)	---	Q(B)	---	Q(B)	OR	---	

Well Information									Purpose For Monitoring (3)		
Unit	Well I.D.	Common Name	Notes	June 13	June 14	June 15	June 16	June 17	Water Quality	Water Level	Comments

Operable Unit 2

Site A Shallow Groundwater

Unit	Well I.D.	Common Name	Notes	June 13	June 14	June 15	June 16	June 17	Water Quality	Water Level	Comments
01U	01U038			L(B)	---	---	---	---	---	---	scheduled to be abandoned FY 14
01U	01U039			Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	Semiannual
01U	01U040			L(B)	---	---	---	---	---	---	scheduled to be abandoned FY 14
01U	01U041			L(B)	---	---	---	---	---	---	scheduled to be abandoned FY 14
01U	01U063			L(B)	L(B)	L(B)	L(B)	L(B)	---	OR	
01U	01U067			L(B)	---	---	---	---	---	---	scheduled to be abandoned FY 14
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			L(B)	---	---	---	---	---	---	scheduled to be abandoned FY 14
01U	01U105			L(B)	---	---	---	---	---	---	scheduled to be abandoned FY 14
01U	01U106			L(B)	L(B)	L(B)	L(B)	L(B)	---	OR	
01U	01U107			L(B)	---	---	---	---	---	---	scheduled to be abandoned FY 14
01U	01U108			Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	Annual
01U	01U110			L(B)	---	---	---	---	---	---	scheduled to be abandoned FY 14
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			L(B)	---	---	---	---	---	---	scheduled to be abandoned FY 14
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			L(B)	---	---	---	---	---	---	scheduled to be abandoned FY 14
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
01U	01U140			Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	Semiannual
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 2013 - FY 2017 MONITORING PLAN FOR GROUNDWATER MONITORING WELLS

Well Information									Purpose For Monitoring (3)		
Unit	Well I.D.	Common Name	Notes	June 13	June 14	June 15	June 16	June 17	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
01U	01U158			Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	Semiannual
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
01U	01U353	EW-3		Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	Semiannual
01U	01U354	EW-4		Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	Semiannual
01U	01U355	EW-5		Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	Semiannual
01U	01U356	EW-6		Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	Semiannual
01U	01U357	EW-7		Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	Semiannual
01U	01U358	EW-8		Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	Semiannual
01U	01U901			Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	Semiannual
01U	01U902			Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	Semiannual VOCs, annual antimony
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, annual antimony

FY 2013 - FY 2017 MONITORING PLAN FOR GROUNDWATER MONITORING WELLS

Well Information									Purpose For Monitoring (3)		
Unit	Well I.D.	Common Name	Notes	June 13	June 14	June 15	June 16	June 17	Water Quality	Water Level	Comments
Site C Shallow Groundwater											
01U	01U045			Q,L(B)	---	---	---	---	---	---	scheduled to be abandoned FY14
01U	01U046			Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	Q,L(B)	OR	OR	
01U	01U085			Q,L(B)	---	---	---	---	---	---	scheduled to be abandoned FY14
01U	01U551	EW-1		Q,L(B)	---	---	---	---	---	---	scheduled to be abandoned FY14
01U	01U552	EW-2		Q,L(B)	---	---	---	---	---	---	scheduled to be abandoned FY14
01U	01U553	EW-3		Q,L(B)	---	---	---	---	---	---	scheduled to be 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		L(B)	---	---	---	---	---	---	scheduled to be abandoned FY14
01U	01U566	MW-6		Q,L(B)	---	---	---	---	---	---	scheduled to be 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		Q,L(B)	---	---	---	---	---	---	scheduled to be abandoned FY14
01U	01U569	MW-9		L(B)	---	---	---	---	---	---	scheduled to be abandoned FY14
01U	01U570	MW-10		Q,L(B)	---	---	---	---	---	---	scheduled to be 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		Q,L(B)	---	---	---	---	---	---	scheduled to be 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 2013 - FY 2017 MONITORING PLAN FOR GROUNDWATER MONITORING WELLS

Well Information									Purpose For Monitoring (3)		
Unit	Well I.D.	Common Name	Notes	June 13	June 14	June 15	June 16	June 17	Water Quality	Water Level	Comments
Site I Shallow Groundwater											
01U	01U064			Q,L(A)	---	---	---	---	---	---	scheduled to be abandoned FY14
01U	01U632			Q,L(A)	---	---	---	---	---	---	scheduled to be abandoned FY14
01U	01U636			Q,L(A)	---	---	---	---	---	---	scheduled to be abandoned FY14
01U	01U639			Q,L(A)	---	---	---	---	---	---	scheduled to be abandoned FY14
01U	01U640			Q,L(A)	---	---	---	---	---	---	scheduled to be abandoned FY14
01U	01U666			L(A)	---	---	---	---	---	---	scheduled to be abandoned FY14
01U	01U667		(7)	L(A)	---	Q,L(A)	Q,L(A)	Q,L(A)	1a, OR	1a, OR	Sample in Mar/Apr
01U	01U668			L(A)	---	---	---	---	---	---	scheduled to be abandoned FY14
01U	482086	I01MW		Q,L(A)	---	---	---	---	---	---	scheduled to be abandoned FY14
01U	482087	I05MW		Q,L(A)	---	---	---	---	---	---	scheduled to be abandoned FY14
01U	482088	I02MW		Q,L(A)	---	---	---	---	---	---	scheduled to be abandoned FY14
01U	482089	I04MW		Q,L(A)	---	---	---	---	---	---	scheduled to be abandoned FY14
01U	482090	I03MW		L(A)	---	---	---	---	---	---	scheduled to be abandoned FY14

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

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FY 2013 - FY 2017 MONITORING PLAN FOR GROUNDWATER MONITORING WELLS

Well Information									Purpose For Monitoring (3)		
Unit	Well I.D.	Common Name	Notes	June 13	June 14	June 15	June 16	June 17	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			L(A)	---	---	---	---	---	---	abandoned FY14
01U	01U602			L(A)	---	---	---	---	---	---	abandoned FY14
01U	01U603			Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	OR	3.a	
01U	01U604			Q,L(A)	---	---	---	---	---	---	abandoned FY14
01U	01U605			L(A)	---	---	---	---	---	---	abandoned FY14
01U	01U607			L(A)	L(A)	L(A)	L(A)	L(A)	---	3.a	
01U	01U608			L(A)	L(A)	L(A)	L(A)	L(A)	---	3.a	
01U	01U609			L(A)	L(A)	L(A)	L(A)	L(A)	---	3.a	
01U	01U611			Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	OR	3.a	
01U	01U612			L(A)	L(A)	L(A)	L(A)	L(A)	---	3.a	
01U	01U613			L(A)	---	---	---	---	---	---	abandoned FY14
01U	01U615			Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	OR	3.a	
01U	01U616			L(A)	---	---	---	---	---	---	scheduled to be 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			Q,L(A)	---	---	---	---	---	---	abandoned FY14
01U	01U620			L(A)	---	---	---	---	---	---	abandoned FY14
01U	01U621			Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	OR	3.a	
01U	01U624			L(A)	---	---	---	---	---	---	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			L(A)	---	---	---	---	---	---	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		L(A)	---	---	---	---	---	---	abandoned FY14
01U	482085	K01-MW		L(A)	---	---	---	---	---	---	scheduled to be abandoned FY14
03U	03U621			Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	Q,L(A)	OR	3.a	

Well Information									Purpose For Monitoring (3)		
Unit	Well I.D.	Common Name	Notes	June 13	June 14	June 15	June 16	June 17	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			Q,L(B)	---	---	---	---	---	---	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	

Well Information									Purpose For Monitoring (3)		
Unit	Well I.D.	Common Name	Notes	June 13	June 14	June 15	June 16	June 17	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)	---	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)	---	L(A)	---	1.a	
03U	03U002			Q,L(A)	---	Q,L(A)	---	Q,L(A)	OR	1.a	
03U	03U003			Q,L(A)	---	Q,L(A)	---	Q,L(A)	OR	1.a	
03U	03U004			---	---	---	---	---	---	---	Abandoned FY13
03U	03U005			Q,L(A)	---	Q,L(A)	---	Q,L(A)	OR	1.a	
03U	03U007			Q,L(A)	---	Q,L(A)	---	Q,L(A)	Background	1.a	
03U	03U008			L(A)	---	L(A)	---	L(A)	---	1.a	
03U	03U009			Q,L(A)	---	Q,L(A)	---	Q,L(A)	Background	1.a	
03U	03U010			L(A)	---	L(A)	---	L(A)	---	1.a	
03U	03U011			L(A)	---	L(A)	---	L(A)	---	1.a	
03U	03U012			L(A)	---	L(A)	---	L(A)	---	1.a	
03U	03U013			L(A)	---	L(A)	---	L(A)	---	1.a	
03U	03U014			Q,L(A)	---	Q,L(A)	---	Q,L(A)	OR	1.a	
03U	03U015			L(A)	---	L(A)	---	L(A)	---	1.a	
03U	03U016			L(A)	---	L(A)	---	L(A)	---	1.a	
03U	03U017			Q,L(A)	---	Q,L(A)	---	Q,L(A)	OR	1.a	
03U	03U018			Q,L(A)	---	Q,L(A)	---	Q,L(A)	OR	1.a	
03U	03U019			L(A)	---	L(A)	---	L(A)	---	1.a	
03U	03U020			Q,L(A)	---	Q,L(A)	---	Q,L(A)	OR	1.a	
03U	03U021			Q,L(A)	---	Q,L(A)	---	Q,L(A)	OR	1.a	
03U	03U022			L(A)	---	L(A)	---	L(A)	---	1.a	
03U	03U023			L(A)	---	L(A)	---	L(A)	---	1.a	
03U	03U024			L(A)	---	L(A)	---	L(A)	---	1.a	
03U	03U025			L(A)	---	L(A)	---	L(A)	---	1.a	

APPENDIX A.1

FY 2013 - FY 2017 MONITORING PLAN FOR GROUNDWATER MONITORING WELLS

Well Information									Purpose For Monitoring (3)		
Unit	Well I.D.	Common Name	Notes	June 13	June 14	June 15	June 16	June 17	Water Quality	Water Level	Comments
03U	03U026			L(A)	---	L(A)	---	L(A)	---	1.a	
03U	03U027			Q,L(A)	---	Q,L(A)	---	Q,L(A)	OR	1.a	
03U	03U028			Q,L(A)	---	Q,L(A)	---	Q,L(A)	OR	1.a	
03U	03U029			Q,L(A)	---	Q,L(A)	---	Q,L(A)	OR	1.a	
03U	03U030			Q,L(A)	---	Q,L(A)	---	Q,L(A)	OR	1.a	
03U	03U031			L(A)	---	---	---	---	---	---	scheduled to be abandoned FY14
03U	03U032			Q,L(A)	---	Q,L(A)	---	Q,L(A)	OR	1.a	
03U	03U075			Q,L(A)	---	---	---	---	---	---	abandoned FY14
03U	03U076			L(A)	---	---	---	---	---	---	scheduled to be abandoned FY14
03U	03U077			Q,L(A)	---	Q,L(A)	---	Q,L(A)	OR	1.a	
03U	03U078			Q,L(A)	---	Q,L(A)	---	Q,L(A)	OR	1.a	
03U	03U079			Q,L(A)	---	Q,L(A)	---	Q,L(A)	OR	1.a	
03U	03U082			L(A)	---	L(A)	---	L(A)	---	1.a	
03U	03U083			L(A)	---	L(A)	---	L(A)	---	1.a	
03U	03U084			L(A)	---	---	---	---	---	---	scheduled to be abandoned FY14
03U	03U087			L(A)	---	L(A)	---	L(A)	---	1.a	
03U	03U088			L(A)	---	L(A)	---	L(A)	---	1.a	
03U	03U089			L(A)	---	L(A)	---	L(A)	---	1.a	
03U	03U090			L(A)	---	L(A)	---	L(A)	---	1.a	
03U	03U092			Q,L(A)	---	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)	---	Q,L(A)	OR	1.a	
03U	03U096			Q,L(A)	---	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)	---	L(A)	---	1.a	
03U	03U112			L(A)	---	L(A)	---	L(A)	---	1.a	
03U	03U113			L(A)	---	L(A)	---	L(A)	---	1.a	
03U	03U114			Q,L(A)	---	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)	---	Q,L(A)	OR	1.a	
03U	03U316	SC4	(5)	Q,L(A)	---	Q,L(A)	---	Q,L(A)	OR	1.a	
03U	03U317	SC5									See Appendix A.2
03U	03U521			---	---	---	---	---	---	---	
03U	03U647			L(A)	---	---	---	---	---	---	scheduled to be abandoned FY14
03U	03U648			L(A)	---	---	---	---	---	---	scheduled to be abandoned FY14
03U	03U658			---	---	---	---	---	---	---	Abandoned FY13

Well Information									Purpose For Monitoring (3)		
Unit	Well I.D.	Common Name	Notes	June 13	June 14	June 15	June 16	June 17	Water Quality	Water Level	Comments
03U	03U659			Q,L(A)	---	Q,L(A)	---	Q,L(A)	OR	1.a	
03U	03U671			Q,L(A)	---	Q,L(A)	---	Q,L(A)	OR	1.a	
03U	03U672			Q,L(A)	---	---	---	---	---	---	abandoned FY14
03U	03U674			L(A)	---	---	---	---	---	---	scheduled to be abandoned FY14
03U	03U675			---	---	---	---	---	---	---	
03U	03U676			L(A)	---	---	---	---	---	---	scheduled to be abandoned FY14
03U	03U701			Q,L(A)	---	Q,L(A)	---	Q,L(A)	OR	1.a	
03U	03U702			Q,L(A)	---	Q,L(A)	---	Q,L(A)	OR	1.a	
03U	03U703			Q,L(A)	---	Q,L(A)	---	Q,L(A)	OR	1.a	
03U	03U704			L(A)	---	L(A)	---	L(A)	---	1.a	
03U	03U705			L(A)	---	L(A)	---	L(A)	---	1.a	
03U	03U706			L(A)	---	L(A)	---	L(A)	---	1.a	
03U	03U707			L(A)	---	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)	---	Q,L(A)	OR	1.a	
03U	03U710			Q,L(A)	---	Q,L(A)	---	Q,L(A)	OR	1.a	
03U	03U711			Q,L(A)	---	Q,L(A)	---	Q,L(A)	OR	1.a	
03U	03U715			Q,L(A)	---	Q,L(A)	---	Q,L(A)	OR	1.a	
03U	03U716			L(A)	---	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)	---	Q,L(A)	OR	1.a	
03U	03U804			Q,L(A)	---	Q,L(A)	---	Q,L(A)	OR	1.a	
03U	03U805			Q,L(A)	---	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)	---	L(A)	---	1.a	
03M	03M002			Q,L(A)	---	Q,L(A)	---	Q,L(A)	OR	1.a	
03M	03M003			L(A)	---	L(A)	---	L(A)	---	1.a	
03M	03M004			---	---	---	---	---	---	---	Abandoned FY13
03M	03M005			L(A)	---	L(A)	---	L(A)	---	1.a	
03M	03M007			L(A)	---	L(A)	---	L(A)	---	1.a	
03M	03M010			L(A)	---	L(A)	---	L(A)	---	1.a	
03M	03M012			L(A)	---	L(A)	---	L(A)	---	1.a	
03M	03M013			L(A)	---	L(A)	---	L(A)	---	1.a	
03M	03M017			L(A)	---	L(A)	---	L(A)	---	1.a	
03M	03M020			Q,L(A)	---	Q,L(A)	---	Q,L(A)	OR	1.a	
03M	03M713			L(A)	---	L(A)	---	L(A)	---	1.a	

APPENDIX A.1

FY 2013 - FY 2017 MONITORING PLAN FOR GROUNDWATER MONITORING WELLS

Well Information									Purpose For Monitoring (3)		
Unit	Well I.D.	Common Name	Notes	June 13	June 14	June 15	June 16	June 17	Water Quality	Water Level	Comments
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)	---	L(A)	---	1.a	
03L	03L002			Q,L(A)	---	Q,L(A)	---	Q,L(A)	OR	1.a	
03L	03L003			L(A)	---	L(A)	---	L(A)	---	1.a	
03L	03L004			---	---	---	---	---	---	---	Abandoned FY13
03L	03L005			L(A)	---	L(A)	---	L(A)	---	1.a	
03L	03L007			Q,L(A)	---	Q,L(A)	---	Q,L(A)	Background	1.a	
03L	03L010			L(A)	---	L(A)	---	L(A)	---	1.a	
03L	03L012			L(A)	---	L(A)	---	L(A)	---	1.a	
03L	03L013			L(A)	---	L(A)	---	L(A)	---	1.a	
03L	03L014			Q,L(A)	---	Q,L(A)	---	Q,L(A)	OR	1.a	
03L	03L017			Q,L(A)	---	Q,L(A)	---	Q,L(A)	OR	1.a	
03L	03L018			Q,L(A)	---	Q,L(A)	---	Q,L(A)	OR	1.a	
03L	03L020			Q,L(A)	---	Q,L(A)	---	Q,L(A)	OR	1.a	
03L	03L021			Q,L(A)	---	Q,L(A)	---	Q,L(A)	OR	1.a	
03L	03L027			L(A)	---	---	---	---	---	---	scheduled to be abandoned FY14
03L	03L028			L(A)	---	---	---	---	---	---	scheduled to be abandoned FY14
03L	03L029			L(A)	---	---	---	---	---	---	scheduled to be abandoned FY14
03L	03L077			Q,L(A)	---	Q,L(A)	---	Q,L(A)	OR	1.a	
03L	03L078			Q,L(A)	---	Q,L(A)	---	Q,L(A)	OR	1.a	
03L	03L079			Q,L(A)	---	Q,L(A)	---	Q,L(A)	OR	1.a	
03L	03L080			L(A)	---	L(A)	---	L(A)	---	1.a	
03L	03L081			L(A)	---	L(A)	---	L(A)	---	1.a	
03L	03L084			Q,L(A)	---	---	---	---	---	---	abandoned FY14
03L	03L113			L(A)	---	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)	---	Q,L(A)	OR	1.a	
03L	03L833			Q,L(A)	---	Q,L(A)	---	Q,L(A)	OR	1.a	
PC	04U001			L(A)	---	L(A)	---	L(A)	---	1.a	
PC	04U002			Q,L(A)	---	Q,L(A)	---	Q,L(A)	OR	1.a	
PC	04U003			L(A)	---	L(A)	---	L(A)	---	1.a	
PC	04U007			Q,L(A)	---	Q,L(A)	---	Q,L(A)	Background	1.a	

Well Information									Purpose For Monitoring (3)		
Unit	Well I.D.	Common Name	Notes	June 13	June 14	June 15	June 16	June 17	Water Quality	Water Level	Comments
PC	04U012			L(A)	---	L(A)	---	L(A)	---	1.a	
PC	04U020			Q,L(A)	---	Q,L(A)	---	Q,L(A)	OR	1.a	
PC	04U027			Q,L(A)	---	---	---	---	---	---	scheduled to be abandoned FY 14
PC	04U077			Q,L(A)	---	Q,L(A)	---	Q,L(A)	OR	1.a	
PC	04U510			Q,L(A)	---	Q,L(A)	---	Q,L(A)	Background	1.a	
PC	04U701			Q,L(A)	---	Q,L(A)	---	Q,L(A)	OR	1.a	
PC	04U702			Q,L(A)	---	Q,L(A)	---	Q,L(A)	OR	1.a	
PC	04U708			Q,L(A)	---	Q,L(A)	---	Q,L(A)	OR	1.a	
PC	04U709			Q,L(A)	---	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)	---	Q,L(A)	OR	1.a	
PC	04U714			L(A)	---	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)	---	Q,L(A)	OR	1.a	
J	04J708			Q,L(A)	---	Q,L(A)	---	Q,L(A)	OR	1.a	
J	04J713			Q,L(A)	---	Q,L(A)	---	Q,L(A)	OR	1.a	
J	04J714			L(A)	---	L(A)	---	L(A)	---	1.a	
PC/J	PJ#003			L(A)	---	L(A)	---	L(A)	---	1.a	
PC/J	PJ#027			L(A)	---	---	---	---	---	---	scheduled to be abandoned FY 14
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)	---	Q,L(A)	OR	1.a	
PC/J	PJ#313	B12	(5)	Q,L(A)	---	Q,L(A)	---	Q,L(A)	OR	1.a	
PC/J	PJ#802			L(A)	---	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)	---	L(A)	---	---	

Unit 1 Wells

01U	01U035			---	---	---	---	---	---	---	
01U	01U043			---	---	---	---	---	---	---	
01U	01U044			---	---	---	---	---	---	---	
01U	01U045			---	---	---	---	---	---	---	
01U	01U046			---	---	---	---	---	---	---	
01U	01U060			---	---	---	---	---	---	---	
01U	01U072			---	---	---	---	---	---	---	
01U	01U085			---	---	---	---	---	---	---	

Well Information									Purpose For Monitoring (3)		
Unit	Well I.D.	Common Name	Notes	June 13	June 14	June 15	June 16	June 17	Water Quality	Water Level	Comments
Operable Unit 3											
03U	03U673			Q,L(A)	---	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)	---	Q,L(A)	OR	2.a	
03L	03L832			L(A)	---	L(A)	---	L(A)	---	2.a	
03L	03L848			Q,L(A)	---	Q,L(A)	---	Q,L(A)	OR	2.a	
03L	03L854			Q,L(A)	---	Q,L(A)	---	Q,L(A)	OR	2.a	
03L	03L859			Q,L(A)	---	Q,L(A)	---	Q,L(A)	OR	2.a	
03L	03L860			L(A)	---	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)	---	Q,L(A)	OR	2.a	
PC	04U832			Q,L(A)	---	Q,L(A)	---	Q,L(A)	OR	2.a	Contingency Action for FY08
PC	04U845			Q,L(A)	---	Q,L(A)	---	Q,L(A)	OR	2.a	Contingency Action for FY08
PC	04U848			Q,L(A)	---	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)	---	Q,L(A)	OR	2.a	
PC	04U859			Q,L(A)	---	Q,L(A)	---	Q,L(A)	OR	2.a	
PC	04U860			Q,L(A)	---	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)	---	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)	---	Q,L(A)	OR	2.a	

APPENDIX A.1

FY 2013 - FY 2017 MONITORING PLAN FOR GROUNDWATER MONITORING WELLS

Well Information									Purpose For Monitoring (3)		
Unit	Well I.D.	Common Name	Notes	June 13	June 14	June 15	June 16	June 17	Water Quality	Water Level	Comments
Well Inventory											
(Entries under "Notes" refer to the well inventory category)											
---	249608	Rapit Printing Inc	1a	Q(B)	---	---	---	Q(B)	Well Inventory	---	2520 Larpenteur Ave
---	S00444	Minneapolis Parks & Rec Dep	1a	Q(B)	---	---	---	Q(B)	Well Inventory	---	Ontario & E River Rd (Erie), Dartmoth Triangle
---	200173	KSTP Radio TV	1b	Q(B)	---	---	---	Q(B)	Well Inventory	---	3415 University Ave
---	200180	Town & Country Golf Course	1b	Q(B)	---	---	---	Q(B)	Well Inventory	---	2279 Marshal Ave
---	200522	Windsor Green	1b	Q(B)	---	---	---	Q(B)	Well Inventory	---	Silver Lake Rd & Cty Rd E
---	200523	Windsor Green	1b	Q(B)	---	---	---	Q(B)	Well Inventory	---	Silver Lake Rd & Cty Rd E
---	234338	Bosell	1b	Q(B)	---	---	---	Q(B)	Well Inventory	---	1575 14th Ave NW
---	234421	BioClean (BioChem)	1b	Q(B)	---	---	---	Q(B)	Well Inventory	---	2151 Mustang Dr
---	234469	Palkowski, T.	1b	Q(B)	---	---	---	Q(B)	Well Inventory	---	2816 Hwy 88
---	234544	R&D Systems	1b	Q(B)	---	---	---	Q(B)	Well Inventory	---	2201 Kennedy St NE
---	249632	Montzka, Harold	1b	Q(B)	---	---	---	Q(B)	Well Inventory	---	2301 N Upland Crest NE
---	433298	Town & Country Golf Course	1b	Q(B)	---	---	---	Q(B)	Well Inventory	---	2279 Marshall Ave
---	509052	Shriners Hospital	1b	Q(B)	---	---	---	Q(B)	Well Inventory	---	2025 E River Rd
---	756236	Alcan	1c	Q(B)	---	---	---	Q(B)	Well Inventory	---	150 26th Ave SE
---	S00437	Northern Star Co	1c	Q(B)	---	---	---	Q(B)	Well Inventory	---	3171 5th St SE
---	107405	Dimmick, Kay	2a	Q(B)	---	---	---	Q(B)	Well Inventory	---	4355 Hwy 10
---	200176	Waldorf Paper Products	2b	Q(B)	---	---	---	Q(B)	Well Inventory	---	2236 Myrtle Ave
---	249007	Walton, Toni	2b	Q(B)	---	---	---	Q(B)	Well Inventory	---	4453 Old Hwy 10
---	537801	Midway Industrial	2b	Q(B)	---	---	---	Q(B)	Well Inventory	---	4759 Old Hwy 8
---	S00002	Midland Hills Country Club	2b	Q(B)	---	---	---	Q(B)	Well Inventory	---	2001 N Fulham St
---	200076	Old Dutch Foods, Inc	2c	Q(B)	---	---	---	Q(B)	Well Inventory	---	2375 Terminal Rd
---	236029	R&D Systems, South Well	2c	Q(B)	---	---	---	Q(B)	Well Inventory	---	2201 Kennedy St NE
---	236439	Waldorf Paper Products	2c	Q(B)	---	---	---	Q(B)	Well Inventory	---	2250 Wabash Ave
---	249185	Novotny, Mark	4a	Q(B)	---	---	---	Q(B)	Well Inventory	---	1706 Malvern St
---		Amundsen, Jason & Lucy	4a	Q(B)	---	---	---	Q(B)	Well Inventory	---	2816 St. Anthony Blvd
---		Hermes, Margo	4a	Q(B)	---	---	---	Q(B)	Well Inventory	---	2935 Old Hwy 8

A.2 Remedial Treatment Systems

APPENDIX A.2
FY 2013 - FY 2017 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 2013 - FY 2017 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)	Pond G
Flow Rate	---	gal/day	Continuous				
Total Flow	---	gal	M				
pH	(field)	(pH)	Q				(Note 1)
Hardness	(field)	(pH)	Q				(Note 1)
Cyanide	9012A	μg/L	Q				
Copper	6020	μg/L	Q				
Lead	6020	μg/L	Q	A	A	A	(Note 1)
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-Dichloroethen	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

(1) Pond G sampling for pH, hardness, and total lead is scheduled for March, June, and September 2013.

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

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) (4)

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

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 26 of the OU3 Record of Decision.

Analytical Methods:

VOCs: SW-846 Method 8260C

Antimony & Lead: SW-846 Method 6020

APPENDIX A.4 (cont'd)
SITE SPECIFIC LISTS OF REQUIRED ANALYTES

OTHER INSTALLATION RESTORATION ACTIVITIES

BUILDING 102 SHALLOW GROUNDWATER[(5)]

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

WELL INVENTORY SAMPLING

VOCs (report full VOC list)

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

Analytical Methods:
VOCs: SW-846 Method 8260C (see Note 6 above)

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 2013 Well Index

APPENDIX B
NEW BRIGHTON/ARDEN HILLS SUPERFUND SITE WELL INDEX

FISCAL YEAR 2013

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 wells.
801 thru 999	OU1/OU3 Alliant wells.

OU1/OU3 wells installed by parties other than USAEC, the Army, or Alliant 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 2013 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 in the desired well number in the bookmarks with the mouse.

FY 2013 Update

No significant changes were made compared with the FY 2012 version of the index. Note that wells 03U004, 03M004, 03L004, and 03U658 (located on AHATS) were sealed in early FY 2013, and the sealing records have been added to the Appendix B Attachment.

Future updates to 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. More efforts will continue to be made in the coming years to add information concerning the location and status of these wells to the well index in Appendix B.
- The repository at the current TCAAP office is planned to be searched for additional well information.
- The well maintenance permit and well owner columns are intended to be completed for each well in the index.

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

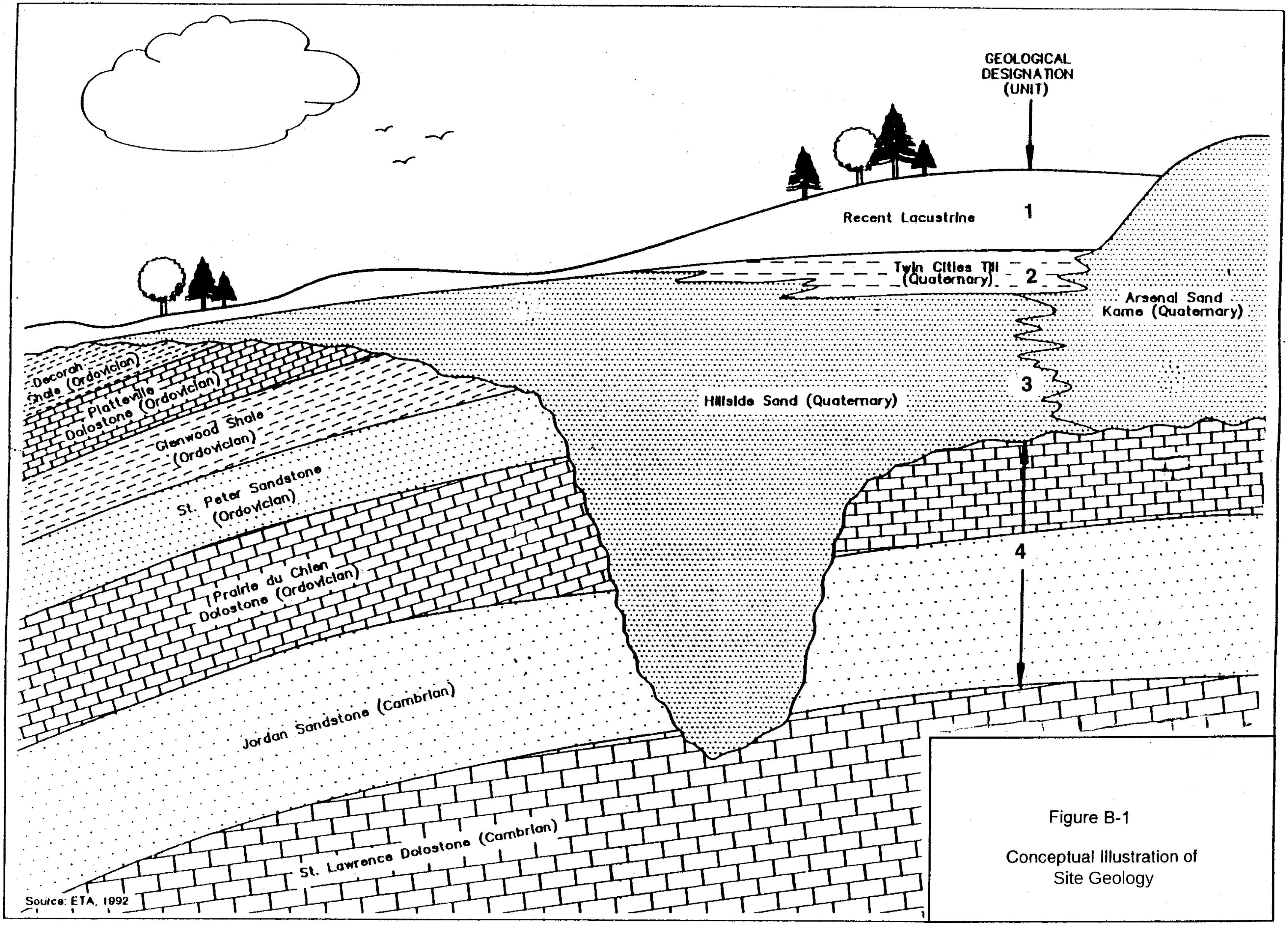


Figure B-1

Conceptual Illustration of Site Geology

ANNUAL PERFORMANCE REPORT	Wenck	FY 2013
OU1 & OU3 Well Location	Engineers - Scientists Business Professionals www.wenck.com 1800 Pioneer Creek Center Maple Plain, MN 55359-0429 1-800-472-2232	Figure B-2

ANNUAL PERFORMANCE REPORT	Wenck		FY 2013
OU2 Well Location	Engineers - Scientists Business Professionals www.wenck.com	1800 Pioneer Creek Center Maple Plain, MN 55359-0429 1-800-472-2232	Figure B-3

Appendix C

FY 2013 Data Collection and Management

C.1 Data Collection, Management, and Presentation

APPENDIX C.1
DATA COLLECTION, MANAGEMENT, AND PRESENTATION

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 2013 was comprised of Quarter 117 (October through December), Quarter 118 (January through March), Quarter 119 (April through June), and Quarter 120 (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 11, February 23, 2012) and "QAPP for Monitored Natural Attenuation of Building 102 Groundwater" (Wenck, Revision 5, February 23, 2012, including Addendum 1, June 3, 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 2013 Annual Monitoring Plan (Appendix A), which established the monitoring responsibilities for both the Army and Alliant. Water level monitoring and water sampling were conducted by Wenck for the Army and by CRA and Stantec for Alliant. 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 2013 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 2013 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 2013 was in June (Quarter 119). This data was used to prepare groundwater elevation contour maps for deep groundwater at OU1, OU2, and OU3, and for shallow groundwater at Sites A, C, K and Building 102. The ongoing Site I annual monitoring was moved from June to March/April to coincide with typically higher groundwater elevations, and hence a groundwater elevation map for Site I was prepared for April 2013. Groundwater elevation contour maps are included within the individual sections of this report.

2.3 Groundwater Quality Contour Maps and Cross-Sections

The most extensive sampling event performed during FY 2013 was in June (Quarter 119). This data was used to prepare groundwater quality isoconcentration contour maps and/or cross-sections for deep groundwater at OU1/OU3 and OU2 (OU3 is shown on the same figures as OU1 in the OU1 section of this report), and 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, isoconcentration maps and cross-sections are provided for trichloroethene, since this is the primary chemical of concern on a concentration basis. These isoconcentration maps include individual maps for Upper Unit 3, Lower Unit 3, and Upper Unit 4. To complement the isoconcentration maps, cross-sections were prepared to illustrate the vertical distribution of trichloroethene. One section line passes through the source area at Site G in OU2 and follows the north plume (OU1) through well 582628 (NBM#15) of the

New Brighton Contaminated Groundwater Recovery System (NBCGRS). A second section line passes through the source area at Site I in OU2 and follows the south plume (OU3).

Contaminant concentrations for Middle Unit 3 wells and wells that fully penetrate Unit 3 (03F) (including any recovery wells that fully penetrate Unit 3 and that are being sampled as a monitoring well) are shown in parentheses on the Lower Unit 3 isoconcentration maps, but were not used for contouring purposes except when no Lower Unit 3 wells are located in the vicinity. Similarly, wells completed in the Jordan aquifer (04J) and wells completed as open holes intersecting both the Prairie du Chien and Jordan aquifers (PJ#) are shown with the data in parentheses on the Upper Unit 4 isoconcentration maps, but were not used for contouring purposes.

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 2013

OU1 Deep Groundwater

June 2013:

200804: No sample collected, since this St. Anthony municipal well was not in use.
206688: No sample collected, since the well was not operational.
512761: No sample collected, since the well was not in use.

OU2: Site A Shallow Groundwater

June 2013:

All Wells: Sampling was shifted to July 2013 to coincide with soil vapor investigation work.

OU2: Site C Shallow Groundwater

September 2013:

01U565: Sampled voluntarily by Army due to anticipated sealing in FY 2014.
01U569: Sampled voluntarily by Army due to anticipated sealing in FY 2014.
01U573: Sampled voluntarily by Army due to unusually high result in June 2013.
01U574: Sampled voluntarily by Army due to unusually high result in June 2013

OU2: Site I Shallow Groundwater

March 2013:

01U667: Not located during this event and was not monitored.
01U668: Not located during this event and was not monitored.

August 2013:

01U667: Sampled at the request of USEPA/MPCA.

OU2: Site K Shallow Groundwater

June 2013:

03U621: Well pumped dry after purging approximately 30 gallons. It was allowed to recover until sufficient groundwater was present to collect a sample.

OU2: Building 102 Shallow Groundwater

June 2013:
All Wells: Sampling was shifted to July 2013 to coincide with supplemental groundwater investigation work (geoprobe sampling).

OU2: Pond G Surface Water

March 2013:
PG1: Sampling was shifted to April 2013 since the pond was frozen in March.

June 2013:
PG1: Sampling was shifted to May 2013 due to expediting the 2014 Five Year Review.

September 2013:
PG1: Sampling was eliminated due to expediting the 2014 Five Year Review.

OU2: OU2 Deep Groundwater

June 2013:
System: Extra TGRS treatment system samples (TGRSE and TGRSI) were collected in June 2013 (sample dates 6/11/13 and 6/20/13).

C.3 Regulatory Approvals of Data Usability Reports

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

June 26, 2014

REPLY TO THE ATTENTION OF: SR-6J

Mr. James Bard, Remedial Project Manager
Twin Cities Army Ammunition Plant
U.S. Army Environmental Command
West Branch, C&MRD
2450 Connell Road, Building 2264
JBSA Fort Sam Houston, TX 78234

Subject: **Approval of Data Usability Reports Numbers 77, 78, 79 and 80**

Dear Mr. Bard:

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) 77, 78, 79 and 80. 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 77 (**DUR 77**), TCAAP FY 2013 Performance Monitoring Program, 1st Quarter Monitoring (October – December, 2012), May 28, 2013;
- Data Usability Report Number 78 (**DUR 78**), TCAAP FY 2013 Performance Monitoring Program, 2nd Quarter Monitoring (January – March, 2013), July 25, 2013;
- Data Usability Report Number 79 (**DUR 79**), TCAAP FY 2013 Performance Monitoring Program, 3rd Quarter Monitoring (April – June, 2013), February 25, 2014;
- Data Usability Report Number 80 (**DUR 80**), TCAAP FY 2013 Performance Monitoring Program, 4th Quarter Monitoring (July – September, 2013), March 3, 2014.

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 77, 78, 79 and 80. 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

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

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 tables are located on this CD in a directory named Appendix D.1. This directory contains four Microsoft Excel files:

File	Contents
Compelev_FY13	Groundwater elevations
Comporwq _FY13	Groundwater quality: organic data
Compinwq _FY13	Groundwater quality: inorganic data (excluding Site C)
Site C wq _FY13	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

03U831abandoned	03L846	409556	409548
03U811	03L832	04U855	04U839
03U804	03L861 abandoned	04U879	04U838
03U673	03L854	04U860	04U848
03U672	03L841	409547	04J839
03M843	03L811	04U863	

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
04U027	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

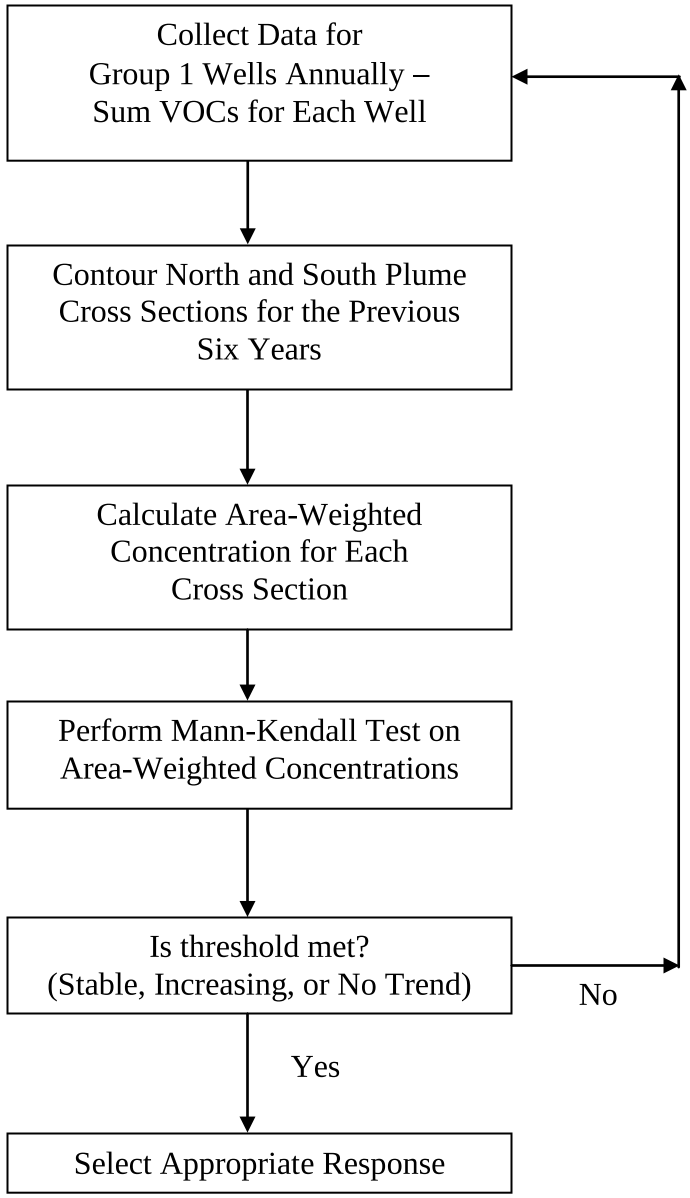


Table D.2.5
Group 2 – Areal Extent of Plume, Evaluation Process

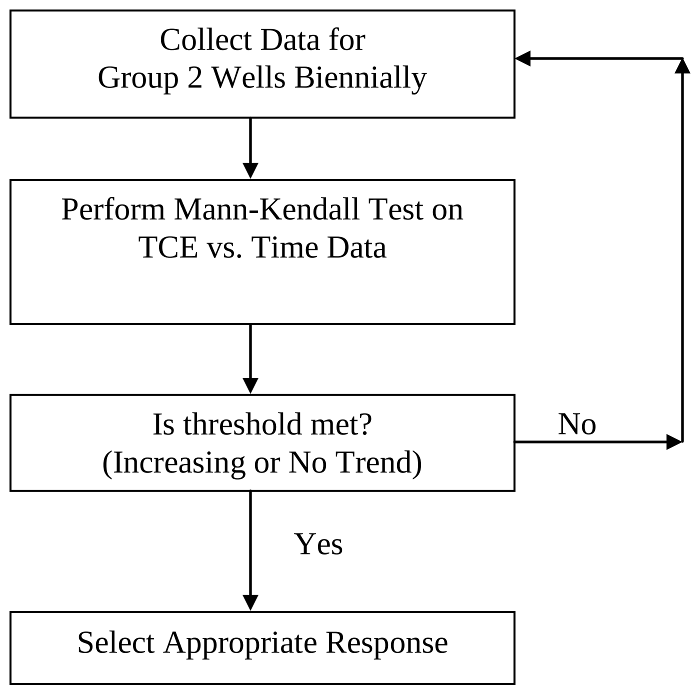


Table D.2.6
Group 3 and Group 5 – Downgradient Sentinel and Global Plume, Evaluation Processes

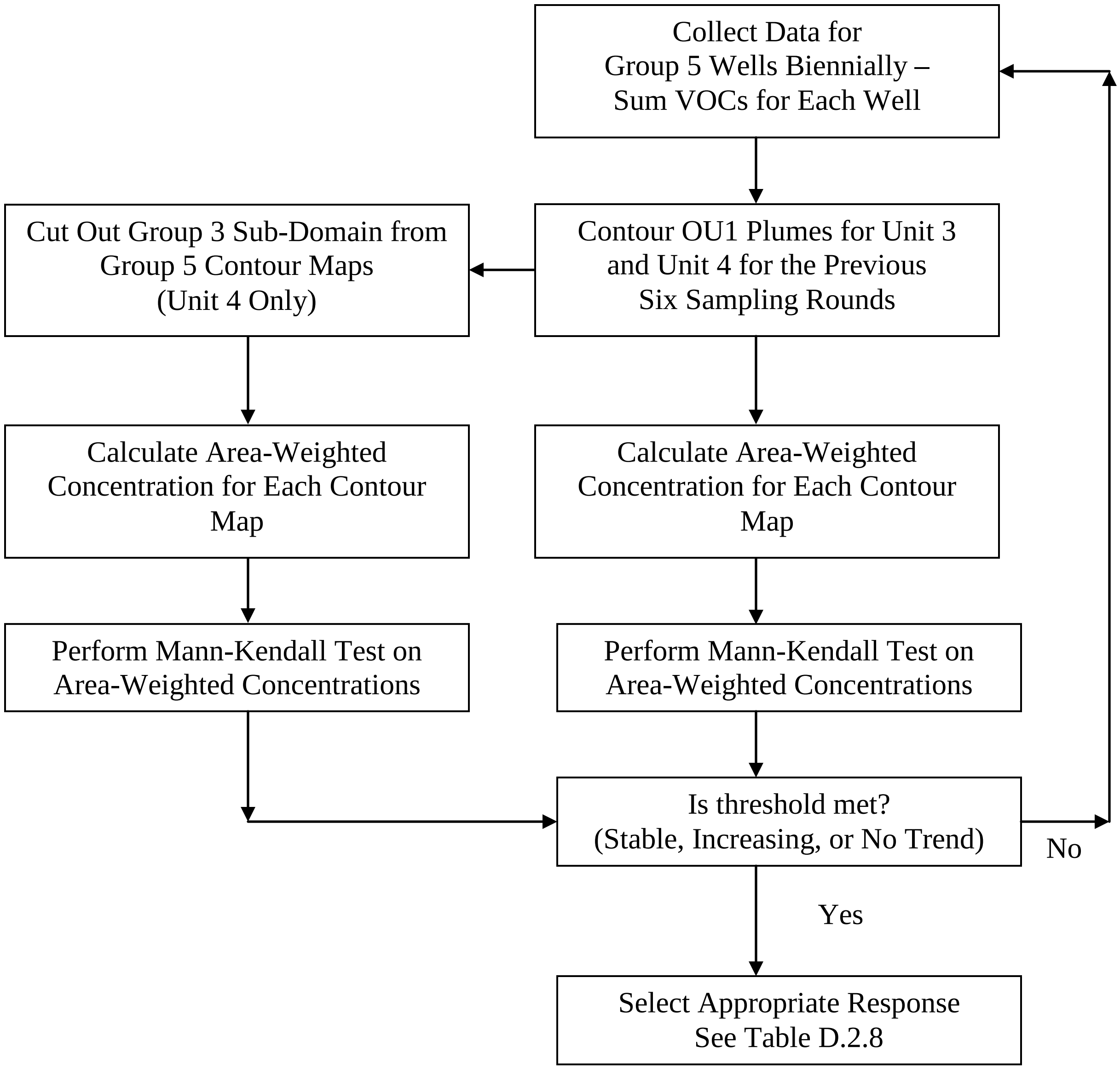


Table D.2.7
Group 4 – Lateral Sentinel Wells, Evaluation Process

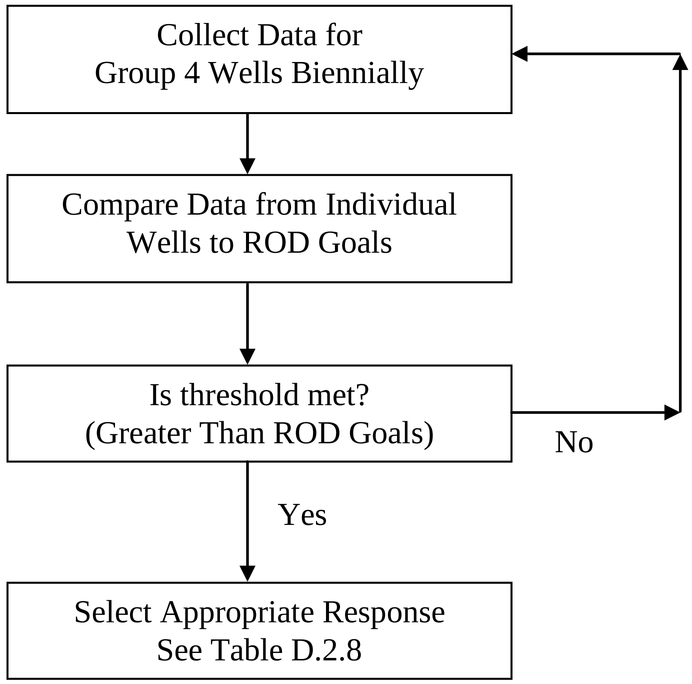


Table D.2.8

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)

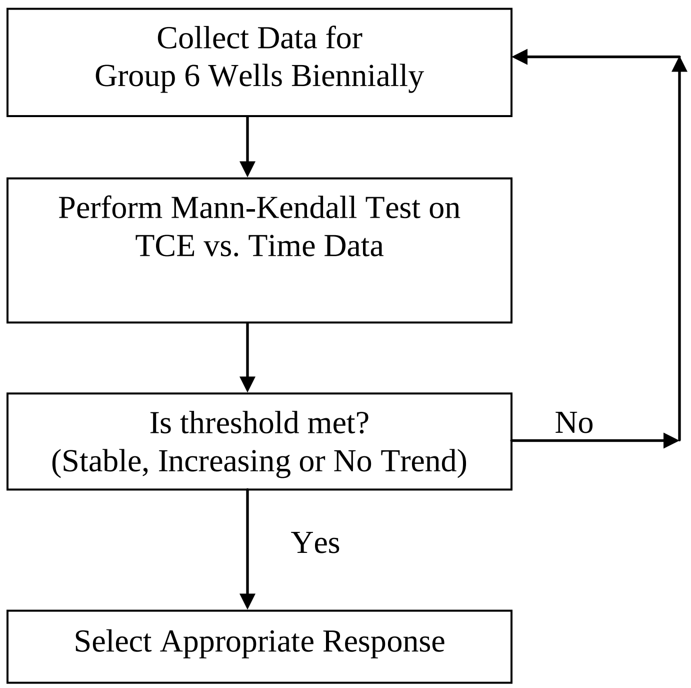
Possible Long-Term Responses

- 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.

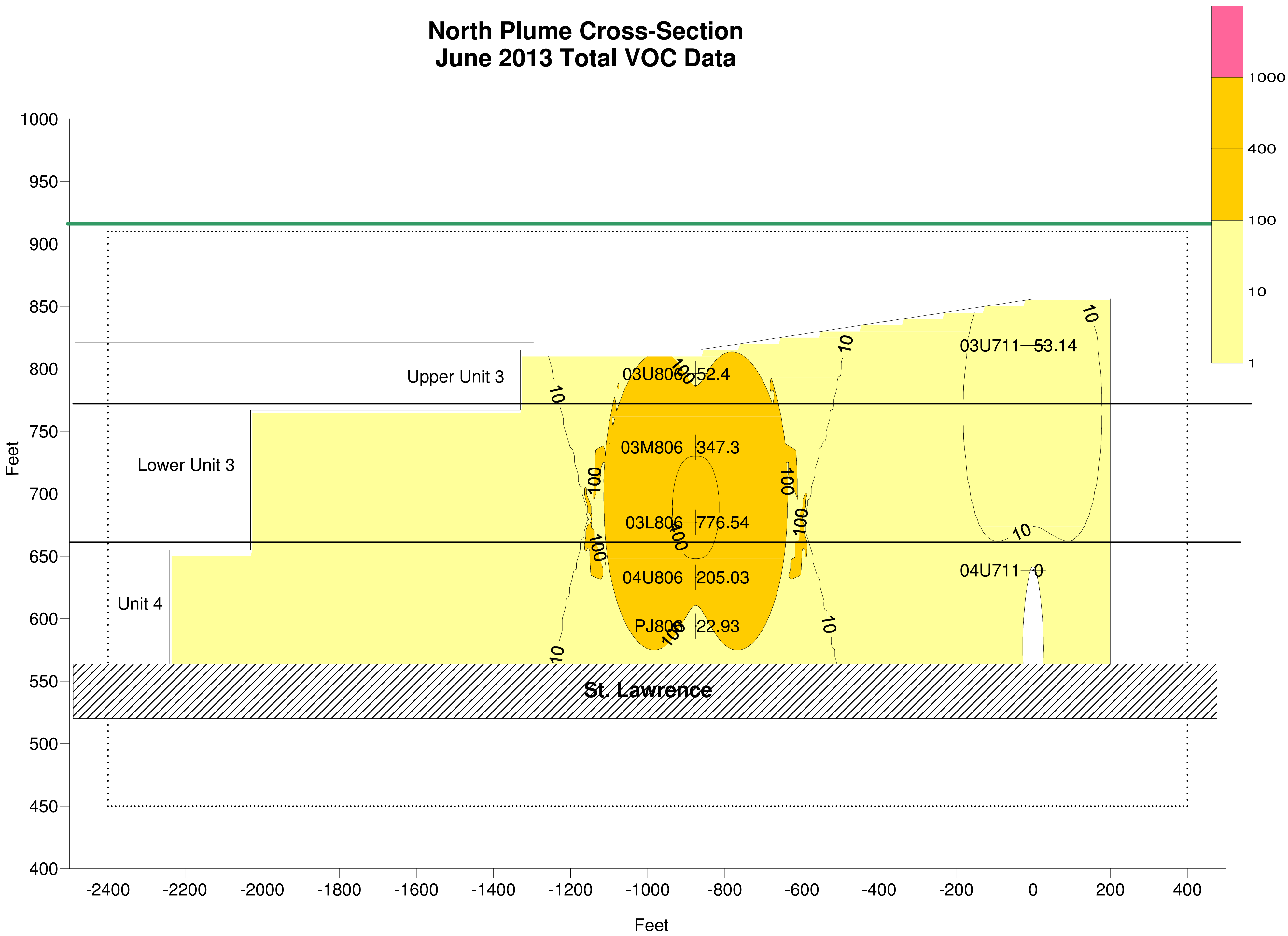
Table D.2.9

Group 6 – Jordan Aquifer, Evaluation Process

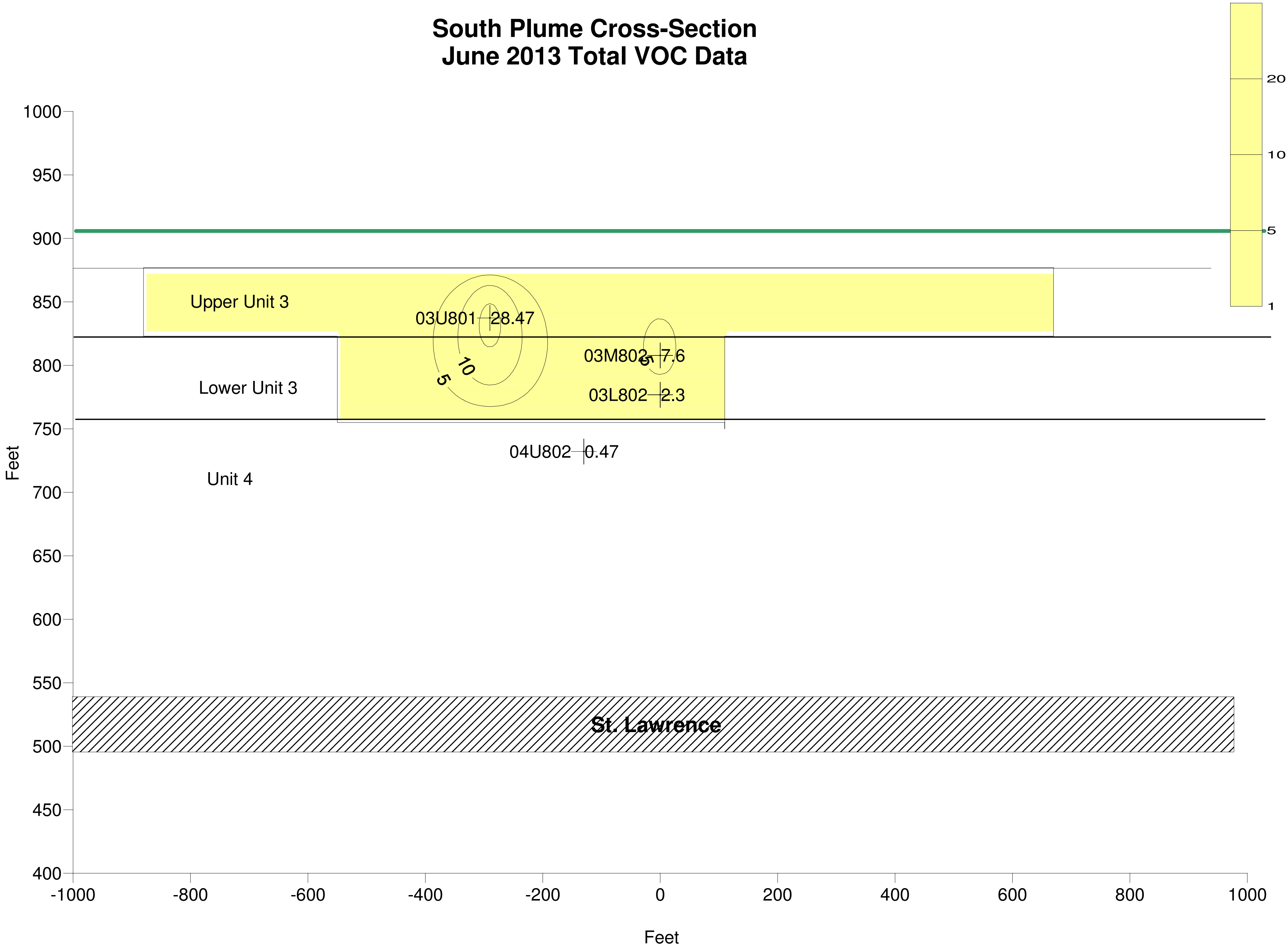


D.2.2 Group 1 Kriging Evaluation

2013



North Plume Cross-Section
June 2013 Total VOC Data
1000
400
100
10
1
Feet
1000
950
900
850
800
750
700
650
600
550
500
450
400
-2400
-2200
-2000
-1800
-1600
-1400
-1200
-1000
-800
-600
-400
-200
0
200
400
Upper Unit 3
Lower Unit 3
Unit 4
St. Lawrence
03U806 52.4
03M806 347.3
03L806 776.54
04U806 205.03
PJ806 22.93
03U711 53.14
04U711 0



South Plume Cross-Section
June 2013 Total VOC Data
20
10
5
1
1000
950
900
850
800
750
700
650
600
550
500
450
400
Feet
Upper Unit 3
03U801
28.47
03M802
7.6
03L802
2.3
10
5
5
Lower Unit 3
04U802
0.47
Unit 4
St. Lawrence
-1000
-800
-600
-400
-200
0
200
400
600
800
1000
Feet

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	6/28/13	ND	ND	ND	ND	ND	ND	2.30	2.3
03M802	6/28/13	ND	ND	ND	ND	ND	ND	7.60	7.6
03U801	6/28/13	ND	ND	ND	ND	0.47	ND	28.00	28.47
04U802	6/28/13	ND	ND	ND	ND	ND	ND	0.47	0.47
03L806	6/12/13	1.1	90	56	0.63	8.4	0.41	620	776.54
03M806	6/12/13	ND	34	19	ND	4.3	ND	290	347.3
03U711	6/11/13	4.8	1.2	1.8	ND	0.61	0.73	44	53.14
03U806	6/12/13	ND	0.71	0.59	ND	ND	1.1	50	52.4
04U711	6/11/13	ND	ND	ND	ND	ND	ND	ND	0
04U806	6/12/13	1.2	20	11	ND	2.5	0.33	170	205.03
PJ#806	6/12/13	0.33	0.91	0.69	ND	ND	ND	21	22.93

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 2013

Concentration	Positive Planar Area (ft2)
Plume to 1	569041
Plume to 5	262200
Plume to 10	230968
Plume to 50	148117
Plume to 100	98632
Plume to 200	36828
Plume to 300	17116
Plume to 400	8174
Plume to 500	3654
Plume to 600	1292
Plume to 700	207
Plume to 800	0

TCE (ug/L)	Avg TCE (ug/L)	Area (ft2)	Areal Conc (ug*ft2/L)
1 to 5	3	306841	920523
5 to 10	7.5	31232	234241
10 to 50	30	82850	2485504
50 to 100	75	49485	3711404
100 to 200	150	61804	9270593
200 to 300	250	19712	4928032
300 to 400	350	8941	3129501
400 to 500	450	4520	2034017
500 to 600	550	2362	1299138
600 to 700	650	1085	705421
700 to 800	750	207	155341
	Sum	569041	28873714

Area Wtd Conc	51	ug/L

T:\1561 TCAAP\APR\FY13 APR\Report\Appendices\App D\App D.2.2 FY13\NorthplumeGroup1\North Flux Conc 2013

South Plume
Total VOC Concentration Calculations
Vertical Cross-Section
Contouring and Blanking
TCAAP
June 2013

Concentration	Positive Planar Area (ft2)
Plume to 1	115236
Plume to 5	17989
Plume to 10	6739
Plume to 25	133
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	97248	291743
5 to 10	7.5	11249	84369
10 to 25	17.5	6606	115603
25 to 50	37.5	133	5006
50 to 75	62.5	0	0
	Sum	115236	496721

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:									
409549	10	6	Increasing	95.38%	0.5450	Definite	**Increasing**	Yes	Incr. from 28 to 61 µg/L in 6 yrs. Stable at 61 since 2011.
409557	13	6	Increasing	99.17%	0.5730	Definite	**Increasing**	Yes	Near plume center, plume shifted slightly
03L673	-12	6	Decreasing	98.66%	0.2700	Definite	**Decreasing**	No	
03L833	-11	6	Decreasing	97.20%	0.6287	Definite	**Decreasing**	No	
03L848	-1	6	Decreasing	50.00%	0.1409	S or NT	**Stable**	No	
03L859	-11	6	Decreasing	97.20%	0.1238	Definite	**Decreasing**	No	
03U672	0	6	Zero	41.78%	0.0000	S or NT	**Stable**	No	
03U805	5	6	Increasing	76.50%	1.4991	S or NT	**No Trend**	Yes	Near plume center, plume shifted slightly
04U673	-15	6	Decreasing	99.86%	0.1853	Definite	**Decreasing**	No	
04U821	-8	6	Decreasing	89.62%	0.1887	S or NT	**Stable**	No	
04U832	-3	6	Decreasing	64.00%	0.0764	S or NT	**Stable**	No	Between 46 and 56 µg/L since 2006.
04U833	-11	6	Decreasing	97.20%	0.5377	Definite	**Decreasing**	No	
04U841	2	6	Increasing	57.46%	0.1414	S or NT	**No Trend**	Yes	Between 18 and 24 µg/L since 2003.
04U843	15	6	Increasing	99.86%	0.6475	Definite	**Increasing**	Yes	Near plume center, plume shifted slightly
04U845	-3	6	Decreasing	64.00%	0.2706	S or NT	**Stable**	No	See OU3 Discussion
04U846	6	6	Increasing	81.38%	0.5652	S or NT	**No Trend**	Yes	Near plume center, looks stable
04U849									See Group 6 summary.
04U854	-10	6	Decreasing	95.38%	0.1782	Definite	**Decreasing**	No	
04U859	-4	6	Decreasing	70.66%	0.4806	S or NT	**Stable**	No	
04U861 (abandoned)	11	6	Increasing	97.00%	1.0198	Definite	**NA**	NA	Abandoned after 2006 sample, in New Brighton Development.
04U875	-9	6	Decreasing	93.20%	1.0159	Probable	**Decreasing**	No	
04U877	-5	6	Decreasing	76.50%	0.4682	S or NT	**Stable**	No	
206688	-4	6	Decreasing	70.66%	0.0719	S or NT	**Stable**	No	Well not in operation in 2013 sampling.
Group 1 NP	1	6	Increasing	50.00%	0.1379	S or NT	**No Trend**	Yes	Between 36 and 51 µg/L since 2007.
Group 1 SP	0	6	Zero	41.78%	0.0000	S or NT	**Stable**	Yes	Stable, but avg. is <5 µg/L.
Group 3	-10	6	Decreasing	95.38%	0.1013	Definite	**Decreasing**	No	
Group 5	5	6	Increasing	76.50%	0.1054	S or NT	**No Trend**	Yes	Between 32 and 43 µg/L since 2003.

__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 5 Unit 3 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 5 Unit 3 Wells:									
409550	-10	6	Decreasing	95.38%	0.5216	Definite	**Decreasing**	No	
409597 (abandoned)	-11	6	Decreasing	99.00%	0.3885	Definite	**NA**	NA	Abandoned due to constr. after 2007 sampling.
409596 (abandoned)	-8	6	Decreasing	90.10%	0.6714	Probable	**NA**	NA	Abandoned due to constr. after 2007 sampling.
03U831 (abandoned)	9	6	Increasing	93.20%	1.5885	Probable	**NA**	NA	Abandoned due to constr. after 2006 sampling.
03U821	-14	6	Decreasing	99.46%	0.2034	Definite	**Decreasing**	No	
03U822	-5	6	Decreasing	76.50%	0.3450	S or NT	**Stable**	Yes	Raw trend is decreasing.
03L822	-13	6	Decreasing	99.17%	0.5121	Definite	**Decreasing**	No	
03L809	-9	6	Decreasing	93.20%	0.6343	Probable	**Decreasing**	No	

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	-10	6	Decreasing	95.38%	0.2397	Definite	**Decreasing**	No	
04J834	-7	6	Decreasing	86.40%	0.5468	S or NT	**Stable**	Yes	All detection below 0.5 µg/L
04J836	6	6	Increasing	81.38%	0.9637	S or NT	**No Trend**	Yes	All detections at or below 10 µg/L
04J838	15	6	Increasing	99.86%	0.4554	Definite	**Increasing**	Yes	4.2-44 µg/L
04J837	-7	6	Decreasing	86.40%	0.8143	S or NT	**Stable**	Yes	Raw trend is decreasing
04J839	3	6	Increasing	64.00%	0.4825	S or NT	**No Trend**	Yes	All detections below 4 µg/L
04J847	3	6	Increasing	64.00%	0.1022	S or NT	**No Trend**	Yes	Consistent results, mean 787 µg/L
04J849	0	6	Zero	41.78%	NA	S or NT	**NA**	No	All ND
04J882	0	6	Zero	41.78%	NA	S or NT	**NA**	No	All ND
04J077	-11	6	Decreasing	97.20%	0.4343	Definite	**Decreasing**	No	
04J702	-14	6	Decreasing	99.46%	0.7948	Definite	**Decreasing**	No	
04J708	-12	6	Decreasing	76.50%	0.1650	S or NT	**Stable**	Yes	Raw trend is decreasing
04J713	-5	6	Decreasing	76.50%	2.4495	S or NT	**No Trend**	Yes	All detections at or below 0.15 µg/L
Group 6 Nested Unit 4 wells:									
04U077	-11	6	Decreasing	97.20%	0.3505	Definite	**Decreasing**	No	
04U702	5	6	Increasing	76.50%	0.1996	S or NT	**No Trend**	Yes	Detections below 3 µg/L since 2003
04U708	-12	6	Decreasing	98.66%	0.6309	Definite	**Decreasing**	No	
04U713	-6	6	Decreasing	81.38%	0.5518	S or NT	**Stable**	Yes	All detections below 1 µg/L
04U834	-15	6	Decreasing	99.86%	1.3907	Definite	**Decreasing**	No	
04U836	3	6	Increasing	64.00%	0.5530	S or NT	**No Trend**	Yes	18 - 79 µg/L
04U837	-7	6	Decreasing	86.40%	1.3523	S or NT	**No Trend**	Yes	Raw trend is decreasing
04U838	2	6	Increasing	57.46%	1.6174	S or NT	**No Trend**	Yes	Detections below 2 µg/L since 2009
04U839	9	6	Increasing	93.20%	0.5056	Probable	**Increasing**	Yes	All detection below 2 µg/L
04U847	-6	6	Decreasing	81.38%	0.2690	S or NT	**Stable**	Yes	Mean 930 µg/L
04U849	9	6	Increasing	93.20%	0.3395	Probable	**Increasing**	Yes	No evidence of migration to Jordan (04J849)
04U882	5	6	Increasing	76.50%	0.3973	S or NT	**No Trend**	Yes	No evidence of migration to Jordan (04J882)

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

Mann-Kendall Plots

Well: **Group 1 NP**

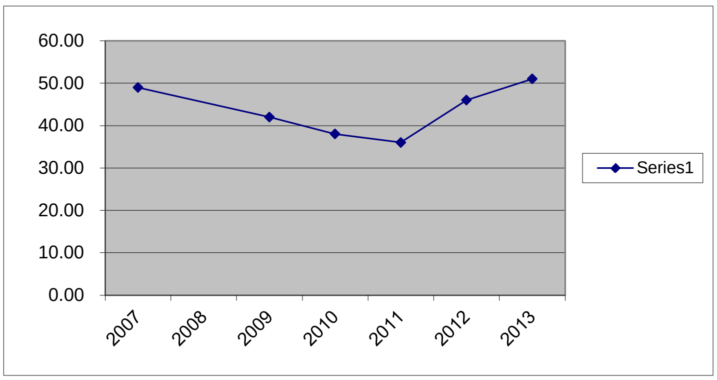
Date	TVOC (µg/L)	Mann-Kendall Calculation:					
6/11/2007	49.00	1					
6/11/2009	42.00	1	-1				
6/16/2010	38.00	1	-1	-1			
6/9/2011	36.00	1	-1	-1	-1		
6/25/2012	46.00	1	-1	1	1	1	
6/12/2013	51.00	1	1	1	1	1	1

N		6	5	4	3	2	1	15
	sum		-3	0	1	2	1	1
Possibles		15						

Mean 43.67
STNDEV 6.022181
COV 0.137913

Trend: Positive

Confidence (lookup) 50.0%



S 1

tau 0.066667

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**

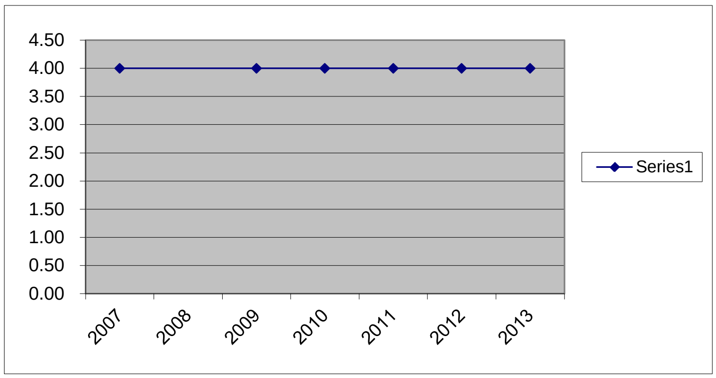
Date	TVOC (µg/L)	Mann-Kendall Calculation:					
6/11/2007	4.00	1					
6/11/2009	4.00	1	0				
6/11/2010	4.00	1	0	0			
6/9/2011	4.00	1	0	0	0		
6/25/2012	4.00	1	0	0	0	0	
6/28/2013	4.00	1	0	0	0	0	0

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: **Group 3**

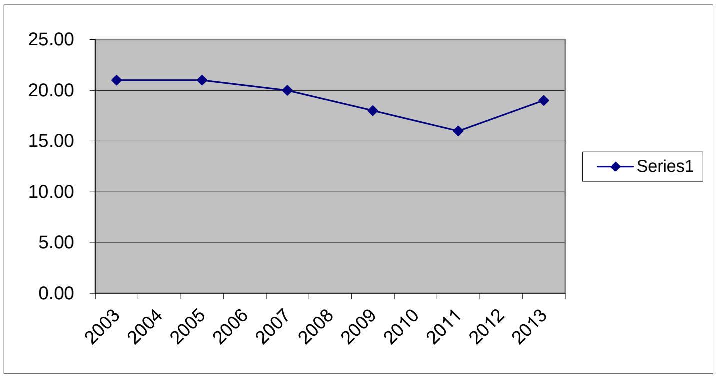
Date	TVOC (µg/L)	Mann-Kendall Calculation:					
6/18/2003	21.00	1					
6/18/2005	21.00	1	0				
6/11/2007	20.00	1	-1	-1			
6/11/2009	18.00	1	-1	-1	-1		
6/29/2011	16.00	1	-1	-1	-1	-1	
6/27/2013	19.00	1	-1	-1	-1	1	1

N		6	5	4	3	2	1	15
	sum		-4	-4	-3	0	1	-10
Possibles		15						

Mean	19.17
STNDEV	1.94079
COV	0.101259

Trend: Negative

Confidence (lookup) 95.4%



S	-10
tau	-0.66667

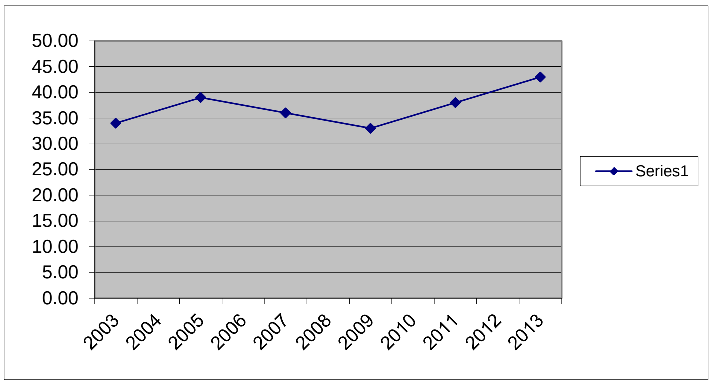
Decision Matrix

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 5**

Mann-Kendall Calculation:

Date	TVOC (µg/L)												
6/18/2003	34.00	1											
6/18/2005	39.00	1	1										
6/18/2007	36.00	1	1	-1									
6/18/2009	33.00	1	-1	-1	-1								
6/29/2011	38.00	1	1	-1	1	1							
6/27/2013	43.00	1	1	1	1	1	1						
	N	6	5	4	3	2	1	0	-1	-2	-3	-4	5
	sum		3	-2	1	2	1	0	0	0	0	0	5
	Possibles	15											



Mean	37.17
STNDEV	3.656045
COV	0.098369
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: 03U672

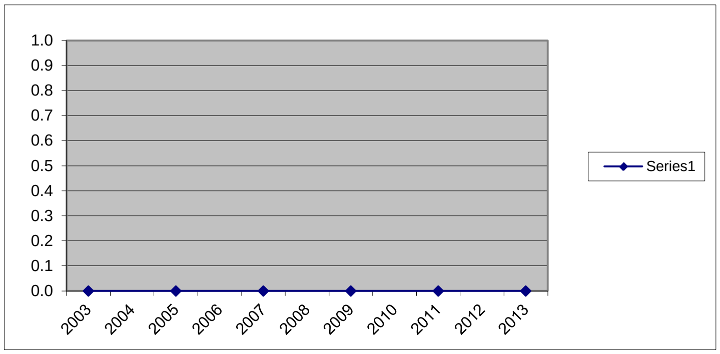
Date	TCE (µg/L)	Mann-Kendall Calculation:					
6/1/2003	0.0	1					
6/17/2005	0.0	1	0				
6/18/2007	0.0	1	0	0			
6/15/2009	0.0	1	0	0	0		
6/13/2011	0.0	1	0	0	0	0	
6/24/2013	0.0	1	0	0	0	0	0

N		6	5	4	3	2	1	15
	sum		0	0	0	0	0	0
Possibles		15						

Mean 0.00
STNDEV 0
COV 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	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

Well: 03U805

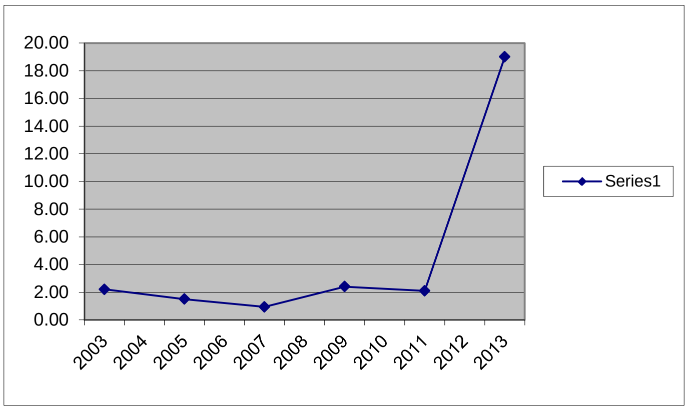
Date	TCE (µg/L)	Mann-Kendall Calculation:					
6/1/2003	2.20	1					
6/15/2005	1.50	1	-1				
6/20/2007	0.94	1	-1	-1			
6/15/2009	2.40	1	1	1	1		
6/9/2011	2.10	1	-1	1	1	-1	
6/24/2013	19.00	1	1	1	1	1	1

N		6	5	4	3	2	1	15
	sum		-1	2	3	0	1	5
Possibles		15						

Mean 4.69
STNDEV 7.030889
COV 1.4991235

Trend: Positive

Confidence (lookup) 76.5%



S 5

tau 0.333333

Decision Matrix

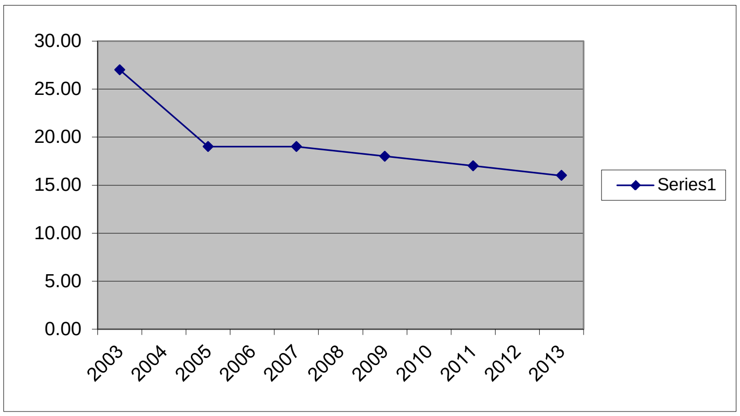
M-K S	Confidence	COV	Trend
S > 0	> 95%	na	Increasing
S > 0	90-95%	na	Pr. Incr.
S > 0	< 90%	na	No Trend
S</= 0	< 90%	>/= 1	No Trend
S </= 0	< 90%	< 1	Stable
S < 0	90-95%	na	Pr. Decr.
S < 0	>95%	na	Decreasing

Well: **03U821**

Date	TCE (µg/L)	Mann-Kendall Calculation:					
6/16/2003	27.00	1					
6/10/2005	19.00	1	-1				
6/13/2007	19.00	1	-1	0			
6/11/2009	18.00	1	-1	-1	-1		
6/16/2011	17.00	1	-1	-1	-1	-1	
6/13/2013	16.00	1	-1	-1	-1	-1	-1

N		6	5	4	3	2	1	15
	sum		-5	-3	-3	-2	-1	-14
Possibles		15						

Mean	19.33
STNDEV	3.932768
COV	0.203419
Trend:	Negative
Confidence (lookup)	99.5%



S	-14
tau	-0.93333

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: 03U822

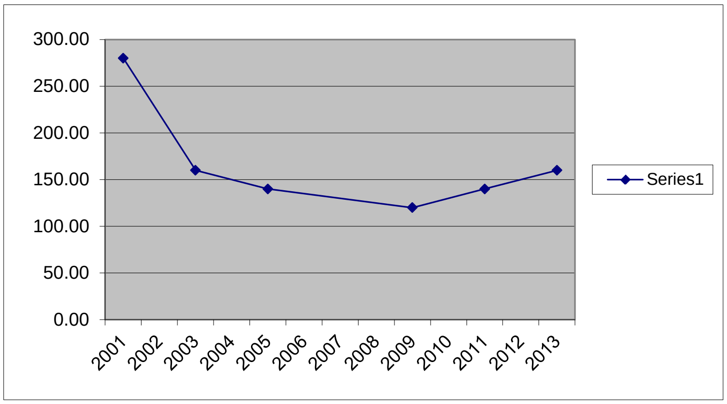
Date	TCE (µg/L)	Mann-Kendall Calculation:					
6/25/2001	280.00	1					
6/16/2003	160.00	1	-1				
6/10/2005	140.00	1	-1	-1			
6/17/2009	120.00	1	-1	-1	-1		
6/29/2011	140.00	1	-1	-1	0	1	
6/17/2013	160.00	1	-1	0	1	1	1

N		6	5	4	3	2	1	15
	sum		-5	-3	0	2	1	-5
Possibles		15						

Mean 166.67
STNDEV 57.50362
COV 0.345022

Trend: Negative

Confidence (lookup) 76.5%



S -5

tau -0.33333

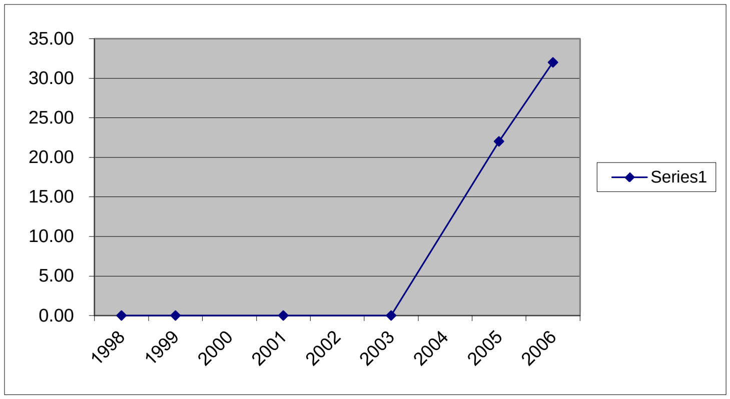
Decision Matrix

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: **03U831 (abandoned)**

Date	TCE (µg/L)	Mann-Kendall Calculation:					
6/23/1998	0.00	1					
6/15/1999	0.00	1	0				
6/15/2001	0.00	1	0	0			
6/9/2003	0.00	1	0	0	0		
6/7/2005	22.00	1	1	1	1	1	
2/1/2006	32.00	1	1	1	1	1	1
Abandoned							

N		6	5	4	3	2	1	15
	sum		2	2	2	2	1	9
Possibles		15						



Mean	9.00
STNDEV	14.29685
COV	1.588539
Trend:	Positive
Confidence (lookup)	93.20%

S	9
tau	0.6

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: **03L673**

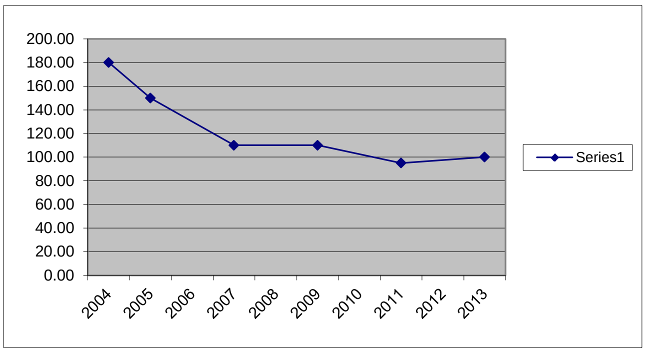
Date	TCE (µg/L)	Mann-Kendall Calculation:					
6/15/2004	180.00	1					
6/22/2005	150.00	1	-1				
6/21/2007	110.00	1	-1	-1			
6/18/2009	110.00	1	-1	-1	0		
6/24/2011	95.00	1	-1	-1	-1	-1	
6/27/2013	100.00	1	-1	-1	-1	-1	1

N		6	5	4	3	2	1	0	15
	sum		-5	-4	-2	-2	1	0	-12
Possibles		15							

Mean 124.17
STNDEV 33.528595
COV 0.270029

Trend: Negative

Confidence (lookup) 98.7%



S -12

tau -0.8

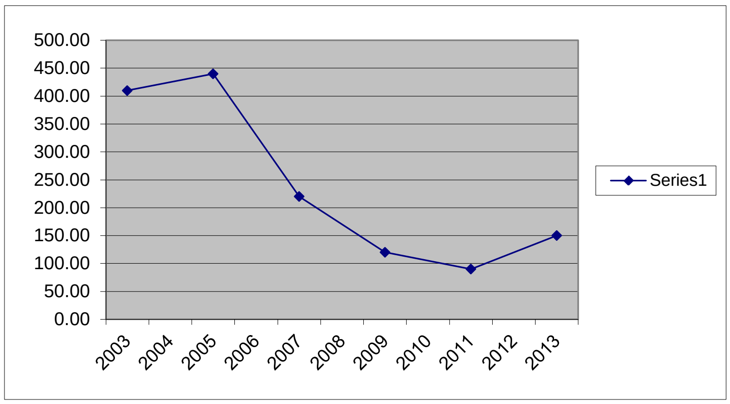
Decision Matrix

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

Well: **03L809**

Date	TCE (µg/L)	Mann-Kendall Calculation:					
6/19/2003	410.00	1					
6/9/2005	440.00	1	1				
6/20/2007	220.00	1	-1	-1			
6/12/2009	120.00	1	-1	-1	-1		
6/13/2011	90.00	1	-1	-1	-1	-1	
6/28/2013	150.00	1	-1	-1	-1	1	1

N		6	5	4	3	2	1	15
	sum		-3	-4	-3	0	1	-9
Possibles		15						



S	-9
tau	-0.6

Mean	238.33
STNDEV	151.1842
COV	0.634339

Trend: Negative

Confidence (lookup) 93.2%

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: **03L822**

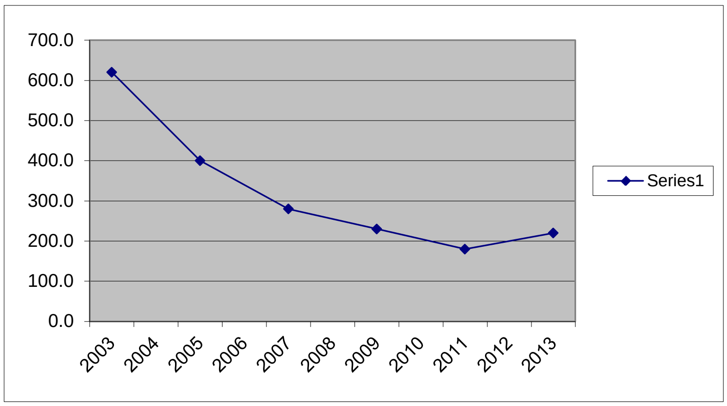
Date	TCE (µg/L)	Mann-Kendall Calculation:					
6/16/2003	620.0	1					
6/14/2005	400.0	1	-1				
6/15/2007	280.0	1	-1	-1			
6/17/2009	230.0	1	-1	-1	-1		
6/29/2011	180.0	1	-1	-1	-1	-1	
6/17/2013	220.0	1	-1	-1	-1	-1	1

N		6	5	4	3	2	1	15
	sum		-5	-4	-3	-2	1	-13
Possibles		15						

Mean	321.67
STNDEV	164.7321
COV	0.512121

Trend: Negative

Confidence (lookup) 99.2%



S	-13
tau	-0.86667

Decision Matrix

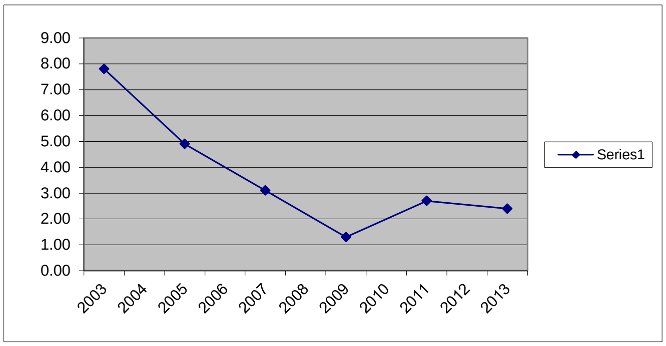
M-K S	Confidence	COV	Trend
S > 0	> 95%	na	Increasing
S > 0	90-95%	na	Pr. Incr.
S > 0	< 90%	na	No Trend
S</= 0	< 90%	>/= 1	No Trend
S </= 0	< 90%	< 1	Stable
S < 0	90-95%	na	Pr. Decr.
S < 0	>95%	na	Decreasing

Well: **03L833**

Date	TCE (µg/L)	Mann-Kendall Calculation:						
6/1/2003	7.80	1						
6/9/2005	4.90	1	-1				29.70	
6/14/2007	3.10	1	-1	-1			20.80	
6/12/2009	1.30	1	-1	-1	-1		16.00	
6/9/2011	2.70	1	-1	-1	-1	1	13.00	
6/11/2013	2.40	1	-1	-1	-1	1	-1 7.80	

N		6	5	4	3	2	1	15
	sum		-5	-4	-3	2	-1	-11
Possibles		15						

Mean	3.70
STNDEV	2.326371
COV	0.628749
Trend:	Negative
Confidence (lookup)	97.2%



S	-11
tau	-0.73333

Decision Matrix

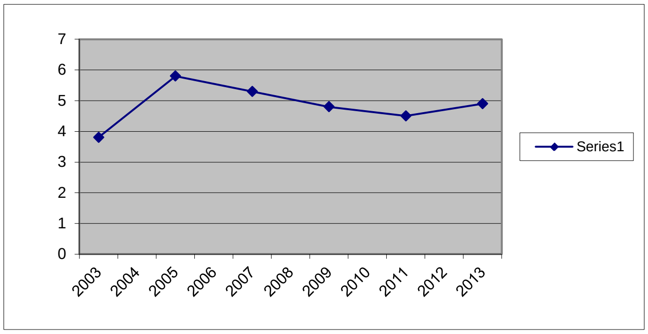
M-K S	Confidence	COV	Trend
S > 0	> 95%	na	Increasing
S > 0	90-95%	na	Prob. Incr.
S > 0	< 90%	na	No Trend
S</= 0	< 90%	>/= 1	No Trend
S </= 0	< 90%	< 1	Stable
S < 0	90-95%	na	Prob Decr.
S < 0	>95%	na	Decreasing

Well: 03L848

Date	TCE (µg/L)	Mann-Kendall Calculation:					
6/1/2003	3.8	1					
6/21/2005	5.8	1	1				
6/21/2007	5.3	1	1	-1			
6/17/2009	4.8	1	1	-1	-1		
6/24/2011	4.5	1	1	-1	-1	-1	
6/27/2013	4.9	1	1	-1	-1	1	1

N		6	5	4	3	2	1	0	15
	sum		5	-4	-3	0	1	0	-1
Possibles		15							

Mean	4.85
STNDEV	0.683374
COV	0.1409019
Trend:	Negative
Confidence (lookup)	50.0%



S	-1
tau	-0.06667

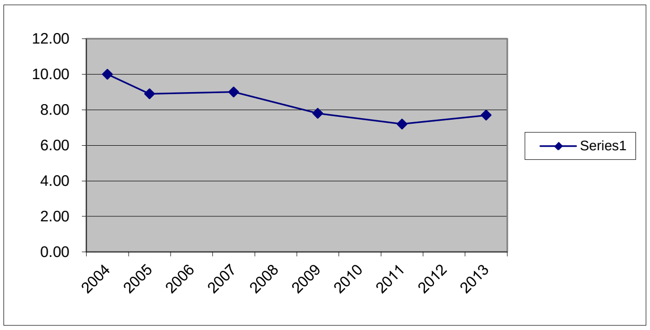
Decision Matrix

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

Well: 03L859

Date	TCE (µg/L)	Mann-Kendall Calculation:					
6/15/2004	10.00	1					
6/22/2005	8.90	1	-1				
6/21/2007	9.00	1	-1	1			
6/21/2009	7.80	1	-1	-1	-1		
6/24/2011	7.20	1	-1	-1	-1	-1	
6/27/2013	7.70	1	-1	-1	-1	-1	1

N		6	5	4	3	2	1	15
	sum		-5	-2	-3	-2	1	-11
Possibles		15						



Mean	8.43
STNDEV	1.0443499
COV	0.123836
Trend:	Negative
Confidence (lookup)	97.2%

S	-11
tau	-0.73333

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

Well: 04U077

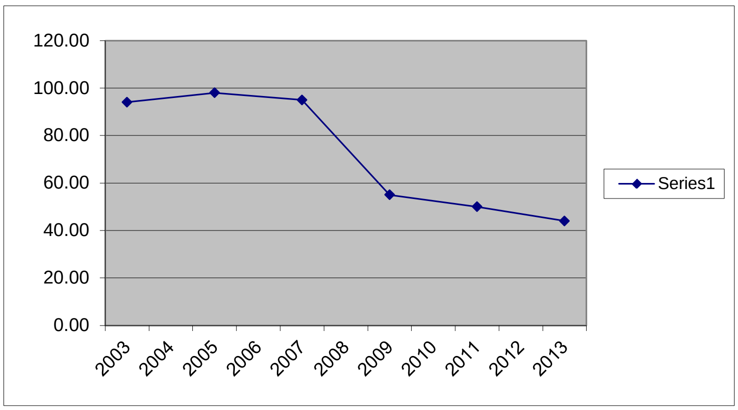
Date	TCE (µg/L)	Mann-Kendall Calculation:					
6/13/2003	94.00	1					
6/7/2005	98.00	1	1				
6/12/2007	95.00	1	1	-1			
6/9/2009	55.00	1	-1	-1	-1		
6/15/2011	50.00	1	-1	-1	-1	-1	
6/10/2013	44.00	1	-1	-1	-1	-1	-1

N		6	5	4	3	2	1	15
	sum		-1	-4	-3	-2	-1	-11
Possibles		15						

Mean 72.67
STNDEV 25.46894
COV 0.35049

Trend: Negative

Confidence (lookup) 97.2%



S -11

tau -0.73333

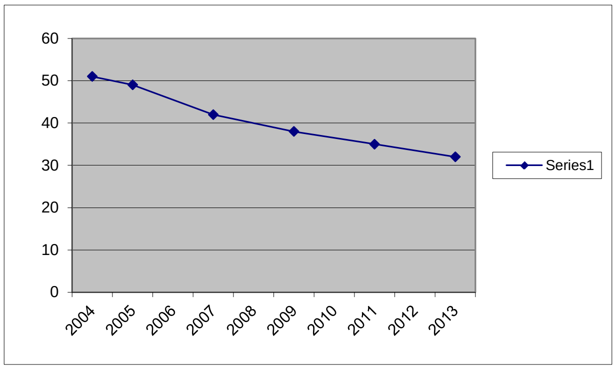
Decision Matrix

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: **04U673**

Date	TCE (µg/L)	Mann-Kendall Calculation:					
6/15/2004	51	1					
6/22/2005	49	1	-1				
6/21/2007	42	1	-1	-1			
6/18/2009	38	1	-1	-1	-1		
6/24/2011	35	1	-1	-1	-1	-1	
6/27/2013	32	1	-1	-1	-1	-1	-1

N		6	5	4	3	2	1	15
	sum		-5	-4	-3	-2	-1	-15
Possibles		15						



Mean 41.17
STNDEV 7.6267075
COV 0.1852641

Trend: Negative

Confidence (lookup) 99.9%

S -15

tau -1

Decision Matrix

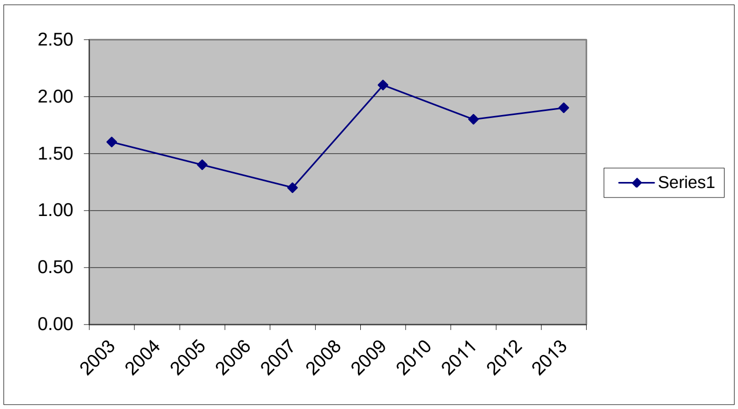
M-K S	Confidence	COV	Trend
S > 0	> 95%	na	Increasing
S > 0	90-95%	na	Prob. Incr.
S > 0	< 90%	na	No Trend
S</= 0	< 90%	>/= 1	No Trend
S </= 0	< 90%	< 1	Stable
S < 0	90-95%	na	Prob Decr.
S < 0	>95%	na	Decreasing

Well: **04U702**

Date	TCE (µg/L)	Mann-Kendall Calculation:					
6/16/2003	1.60	1					
6/8/2005	1.40	1	-1				
6/11/2007	1.20	1	-1	-1			
6/10/2009	2.10	1	1	1	1		
6/6/2011	1.80	1	1	1	1	-1	
6/11/2013	1.90	1	1	1	1	-1	1

N		6	5	4	3	2	1	15
	sum		1	2	3	-2	1	5
Possibles		15						

Mean	1.67
STNDEV	0.332666
COV	0.1996
Trend:	Positive
Confidence (lookup)	76.5%



S	5
tau	0.333333

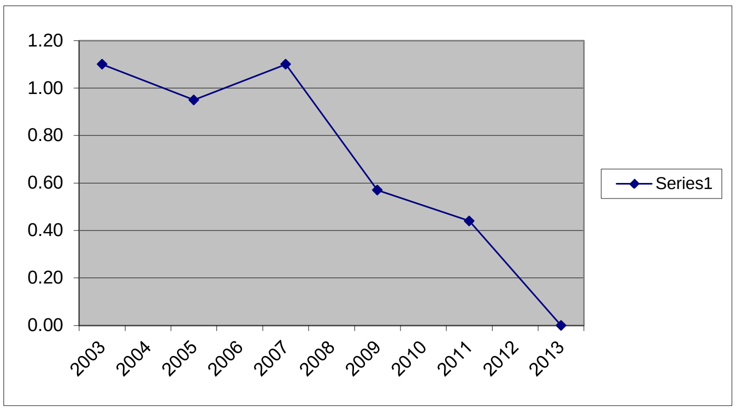
Decision Matrix

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: 04U708

Date	TCE (µg/L)	Mann-Kendall Calculation:						
6/20/2003	1.10	1						
6/9/2005	0.95	1	-1					
6/11/2007	1.10	1	0	1				
6/3/2009	0.57	1	-1	-1	-1			
6/7/2011	0.44	1	-1	-1	-1	-1		
6/10/2013	0.00	1	-1	-1	-1	-1	-1	
	N	6	5	4	3	2	1	15
	sum		-4	-2	-3	-2	-1	-12
	Possibles	15						

Mean	0.69
STNDEV	0.437432
COV	0.630911
Trend:	Negative
Confidence (lookup)	98.7%



S	-12
tau	-0.8

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: **04U713**

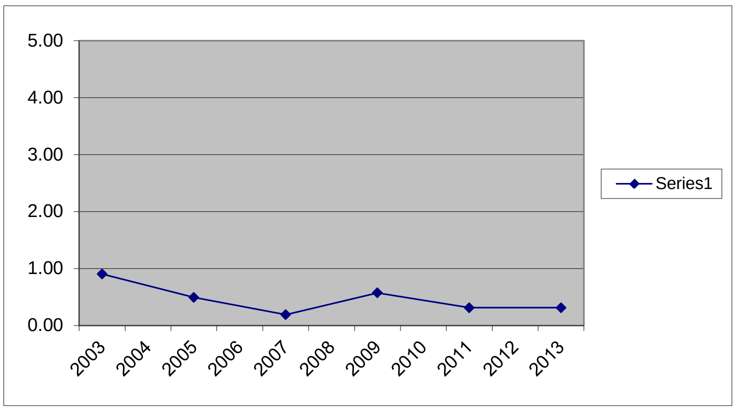
Date	TCE (µg/L)	Mann-Kendall Calculation:					
6/12/2003	0.90	1					
6/9/2005	0.49	1	-1				
6/11/2007	0.19	1	-1	-1			
6/10/2009	0.57	1	-1	1	1		
6/7/2011	0.31	1	-1	-1	1	-1	
6/12/2013	0.31	1	-1	-1	1	-1	0

N		6	5	4	3	2	1	15
	sum		-5	-2	3	-2	0	-6
Possibles		15						

Mean 0.46
STNDEV 0.254748
COV 0.551801

Trend: Negative

Confidence (lookup) 81.4%



S -6

tau -0.4

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: 04U821

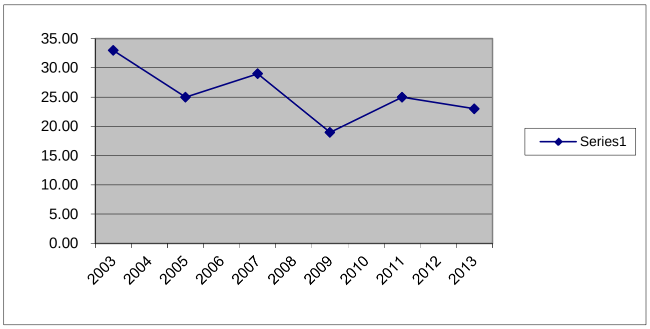
Date	TCE (µg/L)	Mann-Kendall Calculation:					
6/16/2003	33.00	1					
6/13/2005	25.00	1	-1				
6/13/2007	29.00	1	-1	1			
6/12/2009	19.00	1	-1	-1	-1		
6/16/2011	25.00	1	-1	0	-1	1	
6/13/2013	23.00	1	-1	-1	-1	1	-1

N		6	5	4	3	2	1	15
	sum		-5	-1	-3	2	-1	-8
Possibles		15						

Mean	25.67
STNDEV	4.8442406
COV	0.1887366

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	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

Well: **04U832**

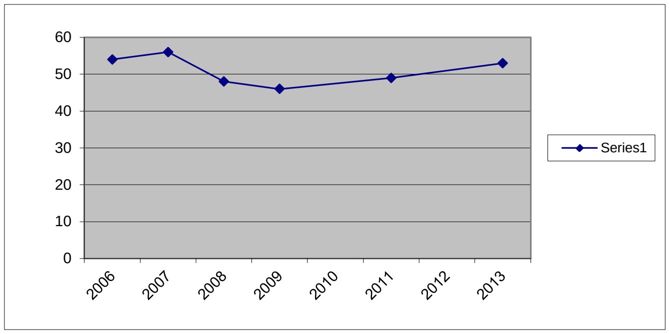
Date	TCE (µg/L)	Mann-Kendall Calculation:					
6/13/2006	54	1					
6/22/2007	56	1	1				
6/17/2008	48	1	-1	-1			
6/19/2009	46	1	-1	-1	-1		
6/23/2011	49	1	-1	-1	1	1	
6/27/2013	53	1	-1	-1	1	1	1

N		6	5	4	3	2	1	0	15
	sum		-3	-4	1	2	1	0	-3
Possibles		15							

Mean 51.00
STNDEV 3.8987177
COV 0.0764454

Trend: Negative

Confidence (lookup) 64.0%



S -3

tau -0.2

Decision Matrix

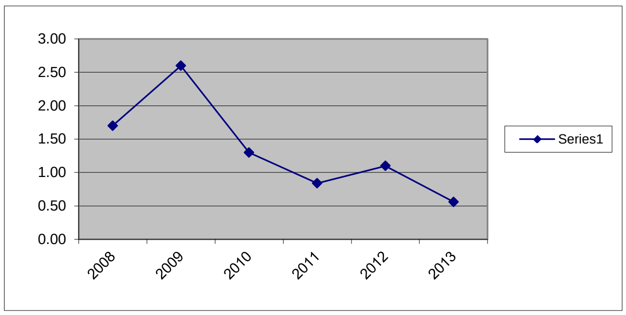
M-K S	Confidence	COV	Trend
S > 0	> 95%	na	Increasing
S > 0	90-95%	na	Prob. Incr.
S > 0	< 90%	na	No Trend
S</= 0	< 90%	>/= 1	No Trend
S </= 0	< 90%	< 1	Stable
S < 0	90-95%	na	Prob Decr.
S < 0	>95%	na	Decreasing

Well: **04U833**

Date	TCE (µg/L)	Mann-Kendall Calculation:					
6/13/2008	1.70	1					
6/12/2009	2.60	1	1				
6/3/2010	1.30	1	-1	-1			
6/9/2011	0.84	1	-1	-1	-1		
5/31/2012	1.10	1	-1	-1	-1	1	
6/11/2013	0.56	1	-1	-1	-1	-1	-1

N		6	5	4	3	2	1	15
	sum		-3	-4	-3	0	-1	-11
Possibles		15						

Mean	1.35
STNDEV	0.7258374
COV	0.5376574
Trend:	Negative
Confidence (lookup)	97.2%



S -11

tau -0.73333

Decision Matrix

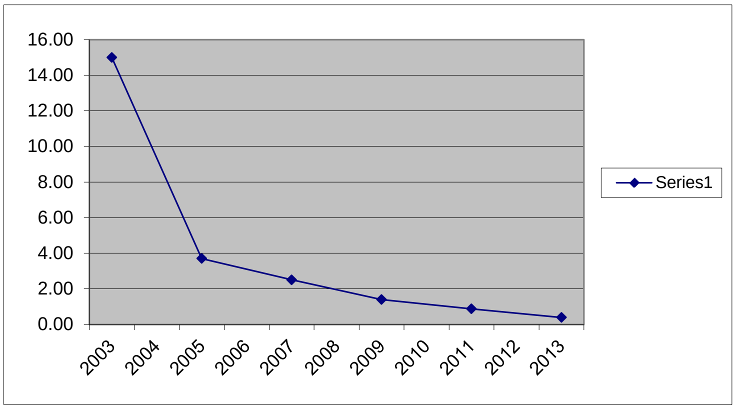
M-K S	Confidence	COV	Trend
S > 0	> 95%	na	Increasing
S > 0	90-95%	na	Prob. Incr.
S > 0	< 90%	na	No Trend
S</= 0	< 90%	>/= 1	No Trend
S </= 0	< 90%	< 1	Stable
S < 0	90-95%	na	Prob Decr.
S < 0	>95%	na	Decreasing

Well: **04U834**

Date	TCE (µg/L)	Mann-Kendall Calculation:					
6/17/2003	15.00	1					
6/21/2005	3.70	1	-1				
6/7/2007	2.50	1	-1	-1			
6/12/2009	1.40	1	-1	-1	-1		
6/9/2011	0.87	1	-1	-1	-1	-1	
6/12/2013	0.39	1	-1	-1	-1	-1	-1

N		6	5	4	3	2	1	15
	sum		-5	-4	-3	-2	-1	-15
Possibles		15						

Mean	3.98
STNDEV	5.530384
COV	1.390708
Trend:	Negative
Confidence (lookup)	99.9%



S	-15
tau	-1

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

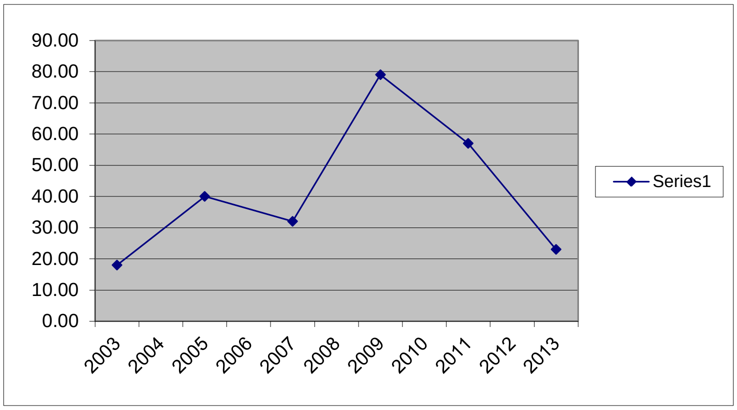
Well: **04U836**

Date	TCE (µg/L)	Mann-Kendall Calculation:							
6/10/2003	18.00	1							
6/21/2005	40.00	1	1						
6/15/2007	32.00	1	1	-1					
6/23/2009	79.00	1	1	1	1				
6/22/2011	57.00	1	1	1	1	-1		41.50	
6/5/2013	23.00	1	1	-1	-1	-1	-1		
N		6	5	4	3	2	1		15
sum			5	0	1	-2	-1		3
Possibles		15							

Mean 41.50
STNDEV 22.94995
COV 0.553011

Trend: Positive

Confidence (lookup) 64.0%



S 3

tau 0.2

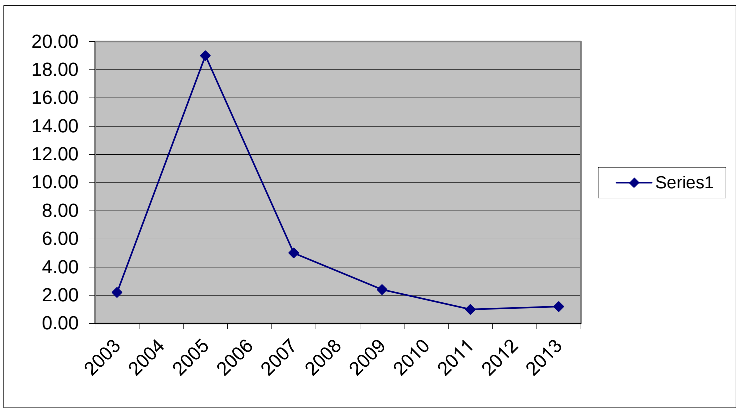
Decision Matrix

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: **04U837**

Date	TCE (µg/L)	Mann-Kendall Calculation:						
6/10/2003	2.20	1						
6/15/2005	19.00	1	1					
6/12/2007	5.00	1	1	-1				
6/18/2009	2.40	1	1	-1	-1			
6/14/2011	1.00	1	-1	-1	-1	-1		
6/11/2013	1.20	1	-1	-1	-1	-1	1	
	N	6	5	4	3	2	1	15
	sum		1	-4	-3	-2	1	-7
	Possibles	15						

Mean	5.13
STNDEV	6.941662
COV	1.352272
Trend:	Negative
Confidence (lookup)	86.4%



S	-7
tau	-0.46667

Decision Matrix

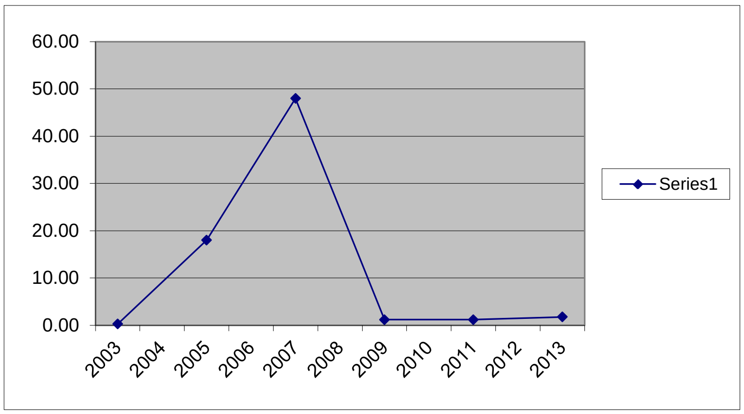
M-K S	Confidence	COV	Trend
S > 0	> 95%	na	Increasing
S > 0	90-95%	na	Pr. Incr.
S > 0	< 90%	na	No Trend
S</= 0	< 90%	>/= 1	No Trend
S </= 0	< 90%	< 1	Stable
S < 0	90-95%	na	Pr. Decr.
S < 0	>95%	na	Decreasing

Well: **04U838**

Date	TCE (µg/L)	Mann-Kendall Calculation:					
6/9/2003	0.30	1					
6/7/2005	18.00	1	1				
6/12/2007	48.00	1	1	1			
6/23/2009	1.20	1	1	-1	-1		
6/8/2011	1.20	1	1	-1	-1	0	
6/10/2013	1.80	1	1	-1	-1	1	1

N		6	5	4	3	2	1	15
	sum		5	-2	-3	1	1	2
Possibles		15						

Mean	11.75
STNDEV	19.00439
COV	1.617395
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	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: **04U839**

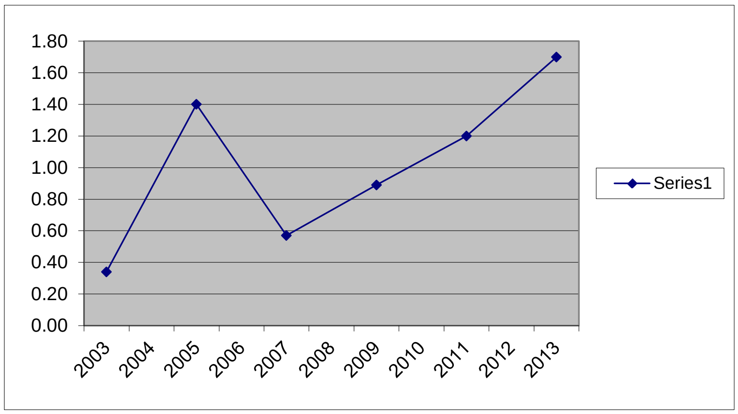
Date	TCE (µg/L)	Mann-Kendall Calculation:					
6/6/2003	0.34	1					
6/7/2005	1.40	1	1				
6/8/2007	0.57	1	1	-1			
6/9/2009	0.89	1	1	-1	1		
6/8/2011	1.2	1	1	-1	1	1	
6/13/2013	1.7	1	1	1	1	1	1

N		6	5	4	3	2	1	15
	sum		5	-2	3	2	1	9
Possibles		15						

Mean	1.02
STNDEV	0.513991
COV	0.505565

Trend: Positive

Confidence (lookup) 93.2%



S 9

tau 0.6

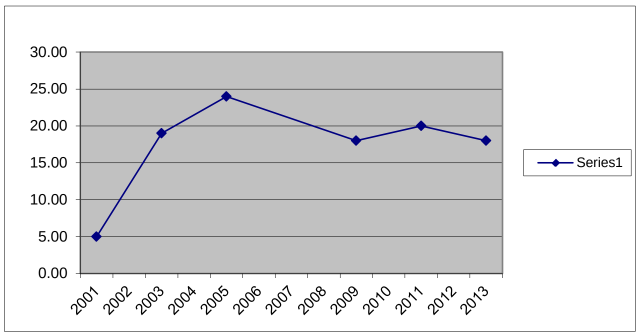
Decision Matrix

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: 04U841

Date	TCE (µg/L)	Mann-Kendall Calculation:					
6/21/2001	5.00	1					
6/11/2003	19.00	1	1				
6/9/2005	24.00	1	1	1			
6/9/2009	18.00	1	1	-1	-1		
6/16/2011	20.00	1	1	1	-1	1	
6/13/2013	18.00	1	1	-1	-1	0	-1

N		6	5	4	3	2	1	15
	sum		5	0	-3	1	-1	2
Possibles		15						



S 2

tau 0.133333

Mean	20.00
STNDEV	2.8284271
COV	0.1414214

Trend: Positive

Confidence (lookup) 57.5%

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

Well: **04U843**

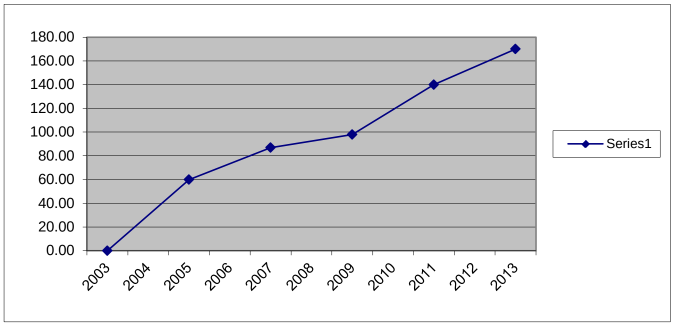
Date	TCE (µg/L)	Mann-Kendall Calculation:						
6/12/2003	0.00	1						
6/7/2005	60.00	1	1					
6/14/2007	87.00	1	1	1				
6/15/2009	98.00	1	1	1	1			
6/28/2011	140.00	1	1	1	1	1		
6/18/2013	170.00	1	1	1	1	1	1	0

N		6	5	4	3	2	1	15
	sum		5	4	3	2	1	15
Possibles		15						

Mean 92.50
STNDEV 59.8924035
COV 0.64748544

Trend: Positive

Confidence (lookup) 99.9%



S 15

tau 1

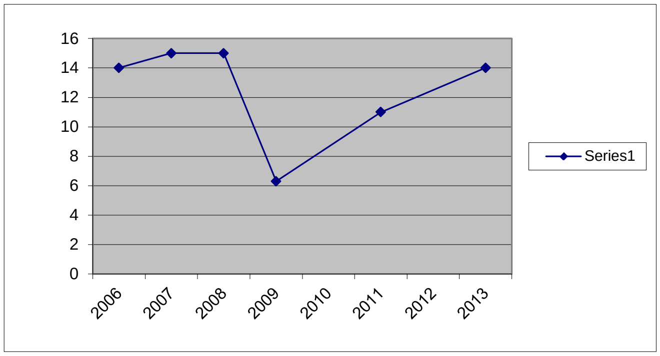
Decision Matrix

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

Well: **04U845**

Date	TCE (µg/L)	Mann-Kendall Calculation:					
6/13/2006	14	1					
6/22/2007	15	1	1				
6/17/2008	15	1	1	0			
6/13/2009	6.3	1	-1	-1	-1		
6/23/2011	11	1	-1	-1	-1	1	
6/25/2013	14	1	0	-1	-1	1	1

N		6	5	4	3	2	1	15
	sum		0	-3	-3	2	1	-3
Possibles		15						



S -3

tau -0.2

Mean 12.55
STNDEV 3.3963215
COV 0.2706232

Trend: Negative

Confidence (lookup) 64.0%

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

Well: **04U846**

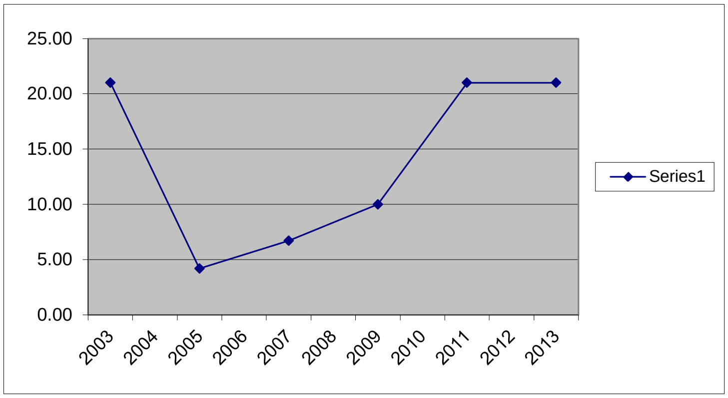
Date	TCE (µg/L)	Mann-Kendall Calculation:					
6/9/2003	21.00	1					
6/10/2005	4.20	1	-1				
6/12/2007	6.70	1	-1	1			
6/9/2009	10.00	1	-1	1	1		
6/15/2011	21.00	1	0	1	1	1	
6/12/2013	21.00	1	0	1	1	1	0

N		6	5	4	3	2	1	-1	14
	sum		-3	4	3	2	0	0	6
Possibles		15							

Mean 13.98
STNDEV 7.9035224
COV 0.5652102

Trend: Positive

Confidence (lookup) 81.4%



S 6

tau 0.4

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

Well: **04U847**

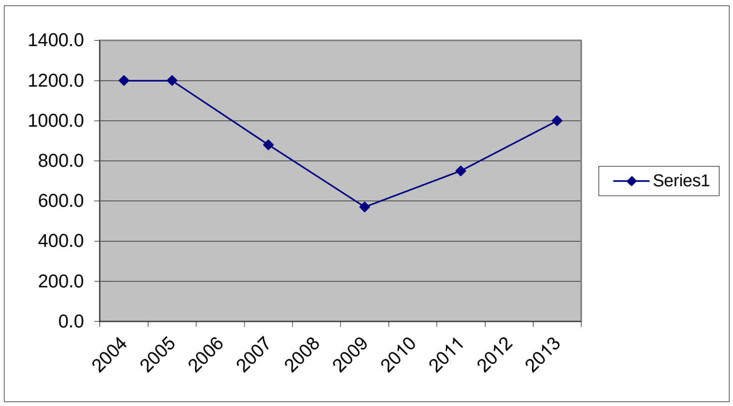
Date	TCE (µg/L)	Mann-Kendall Calculation:					
6/24/2004	1200.0	1					
6/15/2005	1200.0	1	0				
6/18/2007	880.0	1	-1	-1			
6/19/2009	570.0	1	-1	-1	-1		
6/29/2011	750.0	1	-1	-1	-1	1	
6/19/2013	1000.0	1	-1	-1	1	1	1

N		6	5	4	3	2	1	15
	sum		-4	-4	-1	2	1	-6
Possibles		15						

Mean	933.33
STNDEV	251.0511
COV	0.268983

Trend: Negative

Confidence (lookup) 81.4%



S -6

tau -0.4

Decision Matrix

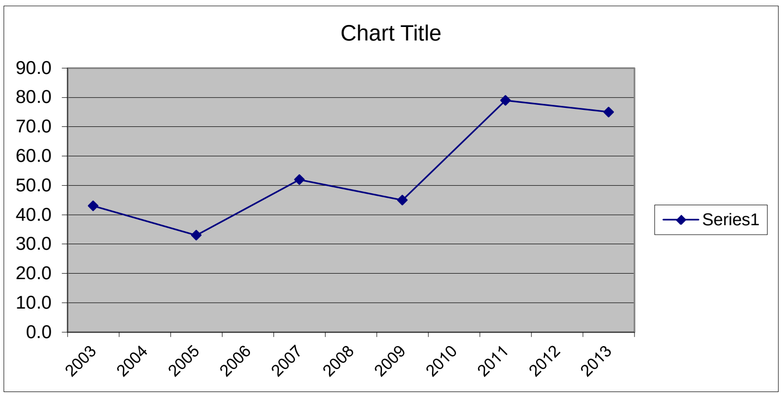
M-K S	Confidence	COV	Trend
S > 0	> 95%	na	Increasing
S > 0	90-95%	na	Pr. Incr.
S > 0	< 90%	na	No Trend
S</= 0	< 90%	>/= 1	No Trend
S </= 0	< 90%	< 1	Stable
S < 0	90-95%	na	Pr. Decr.
S < 0	>95%	na	Decreasing

Well: 04U849

Date	TCE (µg/L)	Mann-Kendall Calculation:					
6/12/2003	43.0	1					
6/16/2005	33.0	1	-1				
6/11/2007	52.0	1	1	1			
6/12/2009	45.0	1	1	1	-1		
6/21/2011	79.0	1	1	1	1	1	
6/17/2013	75.0	1	1	1	1	1	-1

N		6	5	4	3	2	1	15
	sum		3	4	1	2	-1	9
Possibles		15						

Mean	54.50
STNDEV	18.50135
COV	0.339474
Trend:	Positive
Confidence (lookup)	93.2%



S	9
tau	0.6

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: 04U854

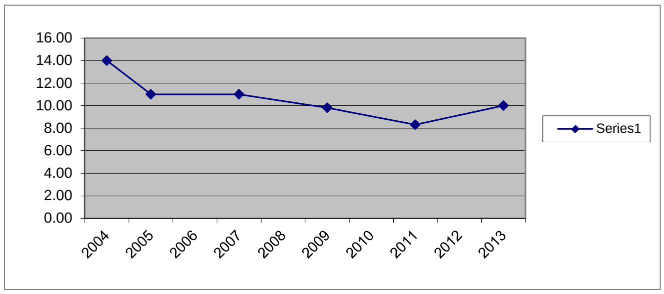
Date	TCE (µg/L)	Mann-Kendall Calculation:					
6/16/2004	14.00	1					
6/23/2005	11.00	1	-1				
6/21/2007	11.00	1	-1	0			
6/18/2009	9.80	1	-1	-1	-1		
6/23/2011	8.30	1	-1	-1	-1	-1	
6/25/2013	10.00	1	-1	-1	-1	1	1

N		6	5	4	3	2	1	15
	sum		-5	-3	-3	0	1	-10
Possibles		15						

Mean	10.68
STNDEV	1.9041183
COV	0.1782326

Trend: Negative

Confidence (lookup) 95.4%



S -10

tau -0.66667

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

Well: **04U859**

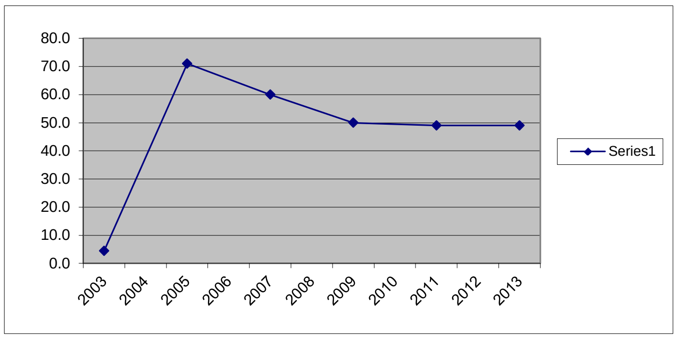
Date	TCE (µg/L)	Mann-Kendall Calculation:					
6/1/2003	4.4	1					
6/22/2005	71.0	1	1				
6/21/2007	60.0	1	1	-1			
6/18/2009	50.0	1	1	-1	-1		
6/24/2011	49.0	1	1	-1	-1	-1	
6/27/2013	49.0	1	1	-1	-1	-1	0

N		6	5	4	3	2	1	15
	sum		5	-4	-3	-2	0	-4
Possibles		15						

Mean	47.23
STNDEV	22.699927
COV	0.4805912

Trend: Negative

Confidence (lookup) 70.7%



S	-4
tau	-0.26667

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

Well: **04U861 (abandoned)**

Date	TCE (µg/L)	Mann-Kendall Calculation:					
6/29/1998	17.1	1					
6/7/1999	28.0	1	1				
6/11/2001	19.0	1	1	-1			
6/1/2003	48.0	1	1	1	1		
6/23/2005	200.0	1	1	1	1	1	
2/8/2006	160.0	1	1	1	1	1	-1

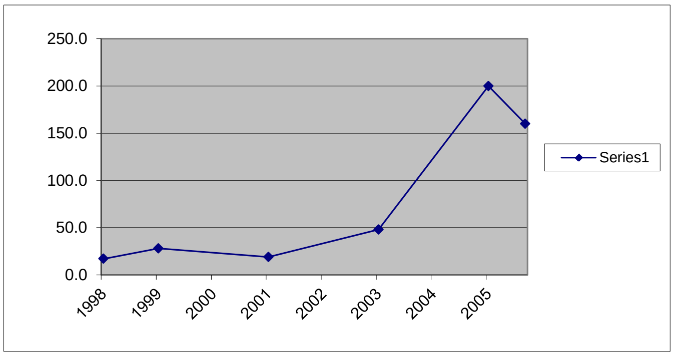
Abandoned

N		6	5	4	3	2	1	15
	sum		5	2	3	2	-1	11
Possibles		15						

Mean	78.68
STNDEV	80.24339
COV	1.019827

Trend: Positive

Confidence (lookup) 97.00%



S	11
tau	0.733333

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

Well: 04U875

Mann-Kendall Calculation:

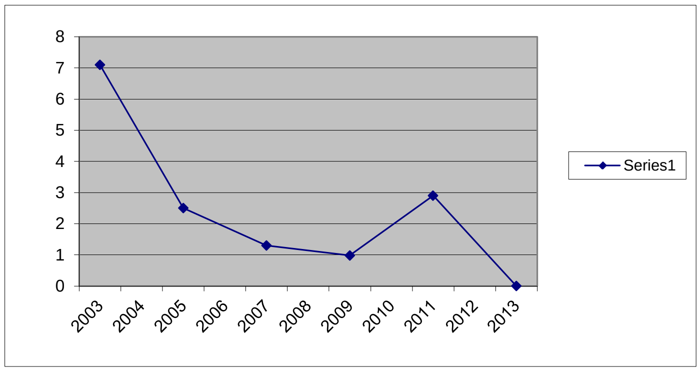
Date	TCE (µg/L)						
6/12/2003	7.1	1					
6/22/2005	2.5	1	-1				
6/7/2007	1.3	1	-1	-1			
6/12/2009	0.98	1	-1	-1	-1		
6/9/2011	2.9	1	-1	1	1	1	
6/17/2013	0	1	-1	-1	-1	-1	-1

N		6	5	4	3	2	1	15
	sum		-5	-2	-1	0	-1	-9
Possibles		15						

Mean 2.46
STNDEV 2.5024921
COV 1.0158967

Trend: Negative

Confidence (lookup) 93.2%



S -9

tau -0.6

Decision Matrix

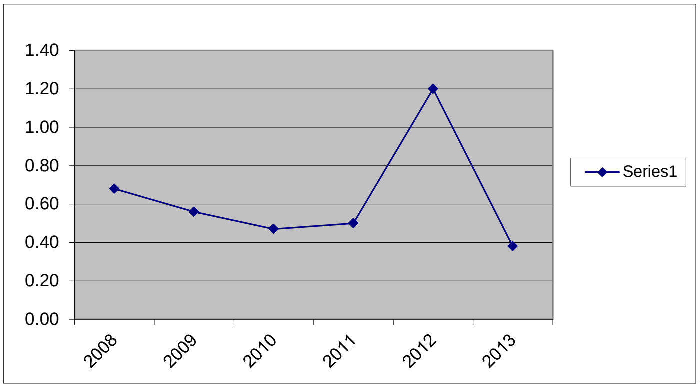
M-K S	Confidence	COV	Trend
S > 0	> 95%	na	Increasing
S > 0	90-95%	na	Prob. Incr.
S > 0	< 90%	na	No Trend
S</= 0	< 90%	>/= 1	No Trend
S </= 0	< 90%	< 1	Stable
S < 0	90-95%	na	Prob Decr.
S < 0	>95%	na	Decreasing

Well: 04U877

Date	TCE (µg/L)	Mann-Kendall Calculation:					
6/24/2008	0.68	1					
6/9/2009	0.56	1	-1				
6/8/2010	0.47	1	-1	-1			
6/8/2011	0.50	1	-1	-1	1		
6/26/2012	1.20	1	1	1	1	1	
6/11/2013	0.38	1	-1	-1	-1	-1	-1

N		6	5	4	3	2	1	15
	sum		-3	-2	1	0	-1	-5
Possibles		15						

Mean	0.63
STNDEV	0.2957307
COV	0.4681753
Trend:	Negative
Confidence (lookup)	76.5%



S	-5
tau	-0.33333

Decision Matrix

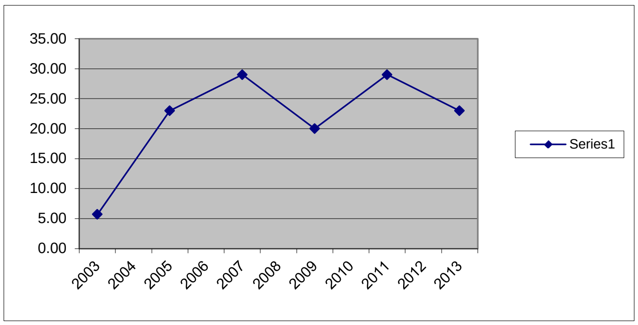
M-K S	Confidence	COV	Trend
S > 0	> 95%	na	Increasing
S > 0	90-95%	na	Prob. Incr.
S > 0	< 90%	na	No Trend
S</= 0	< 90%	>/= 1	No Trend
S </= 0	< 90%	< 1	Stable
S < 0	90-95%	na	Prob Decr.
S < 0	>95%	na	Decreasing

Well: **04U882**

Date	TCE (µg/L)	Mann-Kendall Calculation:					
6/11/2003	5.70	1					
6/17/2005	23.00	1	1				
6/12/2007	29.00	1	1	1			
6/23/2009	20.00	1	1	-1	-1		
6/21/2011	29.00	1	1	1	0	1	
6/14/2013	23.00	1	1	0	-1	1	-1

N	6	5	4	3	2	1	15
sum		5	1	-2	2	-1	5
Possibles	15						

Mean	21.62
STNDEV	8.5884613
COV	0.3973074
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	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

Well: **04J077**

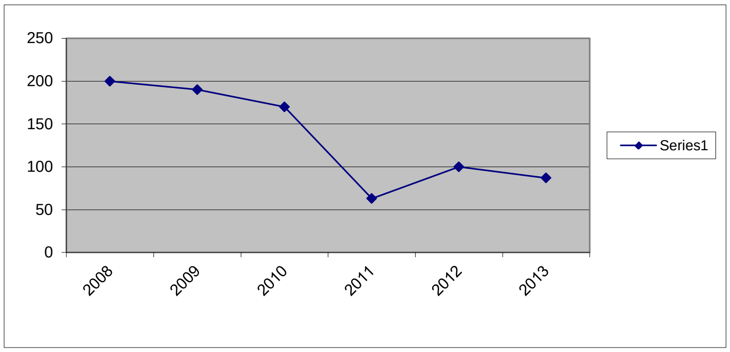
Date	TCE (µg/L)	Mann-Kendall Calculation:					
6/13/2008	200	1					
6/9/2009	190	1	-1				
6/3/2010	170	1	-1	-1			
6/15/2011	63	1	-1	-1	-1		
5/30/2012	100	1	-1	-1	-1	1	
6/10/2013	87	1	-1	-1	-1	1	-1

N		6	5	4	3	2	1	15
	sum		-5	-4	-3	2	-1	-11
Possibles		15						

Mean 135.00
STNDEV 58.63105
COV 0.434304

Trend: Negative

Confidence (lookup) 97.2%



S -11

tau -0.73333

Decision Matrix

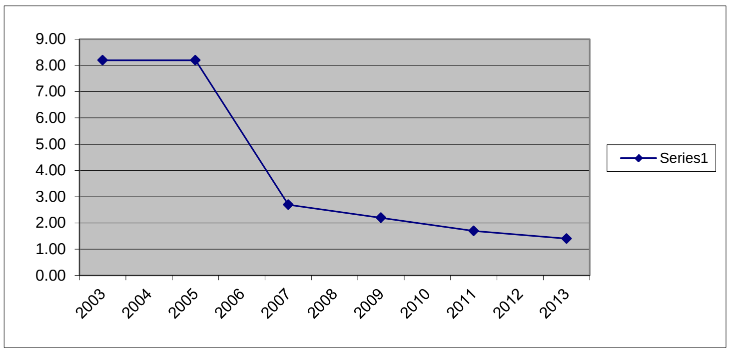
M-K S	Confidence	COV	Trend
S > 0	> 95%	na	Increasing
S > 0	90-95%	na	Pr. Incr.
S > 0	< 90%	na	No Trend
S</= 0	< 90%	>/= 1	No Trend
S </= 0	< 90%	< 1	Stable
S < 0	90-95%	na	Pr. Decr.
S < 0	>95%	na	Decreasing

Well: 04J702

Date	TCE (µg/L)	Mann-Kendall Calculation:					
6/16/2003	8.20	1					
6/8/2005	8.20	1	0				
6/11/2007	2.70	1	-1	-1			
6/10/2009	2.20	1	-1	-1	-1		
6/6/2011	1.70	1	-1	-1	-1	-1	
6/11/2013	1.40	1	-1	-1	-1	-1	-1

N		6	5	4	3	2	1	15
	sum		-4	-4	-3	-2	-1	-14
Possibles		15						

Mean	4.07
STNDEV	3.23213
COV	0.794786
Trend:	Negative
Confidence (lookup)	99.5%



S	-14
tau	-0.93333

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

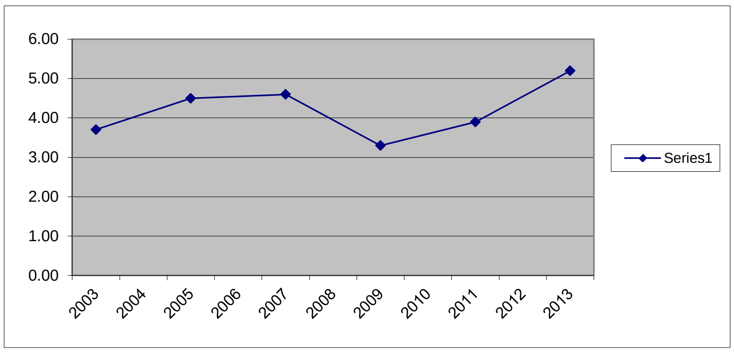
Well: 04J708

Date	TCE (µg/L)	Mann-Kendall Calculation:						
6/12/2003	3.70	1						
6/9/2005	4.50	1	1					
6/6/2007	4.60	1	1	1				
6/3/2009	3.30	1	-1	-1	-1			
6/7/2011	3.90	1	1	-1	-1	1		
6/10/2013	5.20	1	1	1	1	1	1	
	N	6	5	4	3	2	1	15
	sum		3	0	-1	2	1	5
	Possibles	15						

Mean	4.20
STNDEV	0.69282
COV	0.164957

Trend: Positive

Confidence (lookup) 76.5%



S	5
tau	0.333333

Decision Matrix

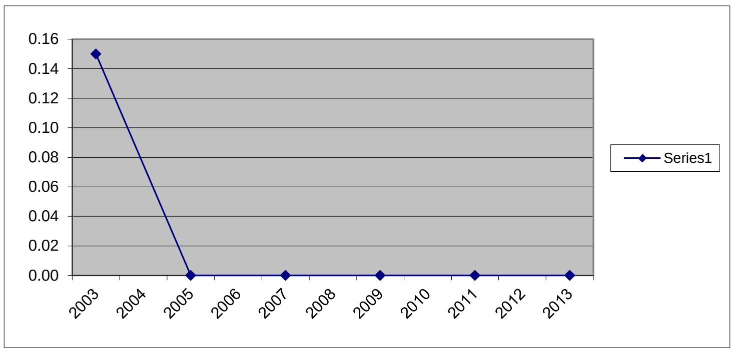
M-K S	Confidence	COV	Trend
S > 0	> 95%	na	Increasing
S > 0	90-95%	na	Pr. Incr.
S > 0	< 90%	na	No Trend
S</= 0	< 90%	>/= 1	No Trend
S </= 0	< 90%	< 1	Stable
S < 0	90-95%	na	Pr. Decr.
S < 0	>95%	na	Decreasing

Well: **04J713**

Date	TCE (µg/L)	Mann-Kendall Calculation:					
6/12/2003	0.15	1					
6/9/2005	0.00	1	-1				
6/11/2007	0.00	1	-1	0			
6/10/2009	0.00	1	-1	0	0		
6/7/2011	0.00	1	-1	0	0	0	
6/12/2013	0.00	1	-1	0	0	0	0

N		6	5	4	3	2	1	15
	sum		-5	0	0	0	0	-5
Possibles		15						

Mean	0.03
STNDEV	0.061237
COV	2.44949
Trend:	Negative
Confidence (lookup)	76.5%



S	-5
tau	-0.33333

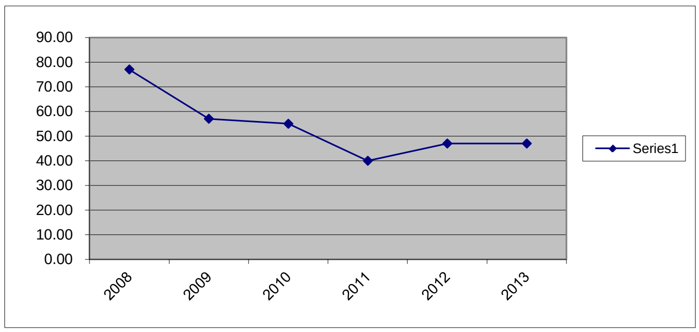
Decision Matrix

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:						
6/25/2008	77.00	1						
6/16/2009	57.00	1	-1					
6/9/2010	55.00	1	-1	-1				
6/28/2011	40.00	1	-1	-1	-1			
6/25/2012	47.00	1	-1	-1	-1	1		53.83
6/17/2013	47.00	1	-1	-1	-1	1	0	

N		6	5	4	3	2	1	15
	sum		-5	-4	-3	2	0	-10
Possibles		15						



Mean	53.83
STNDEV	12.906071
COV	0.2397413
Trend:	Negative
Confidence (lookup)	95.4%

S	-10
tau	-0.66667

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: 04J834

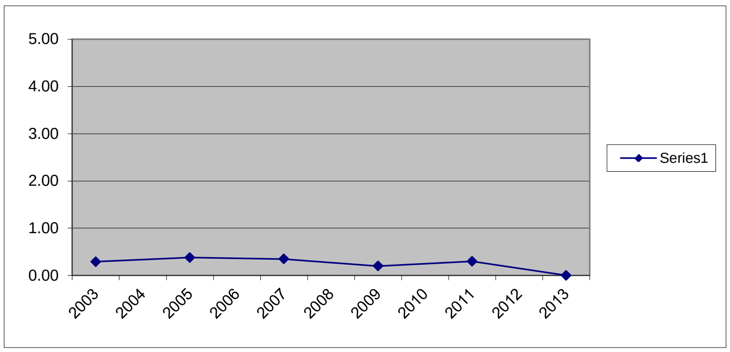
Date	TCE (µg/L)	Mann-Kendall Calculation:					
6/9/2003	0.29	1					
6/8/2005	0.38	1	1				
6/4/2007	0.35	1	1	-1			
6/4/2009	0.20	1	-1	-1	-1		
6/3/2011	0.30	1	1	-1	-1	1	
6/6/2013	0.00	1	-1	-1	-1	-1	-1

N		6	5	4	3	2	1	15
	sum		1	-4	-3	0	-1	-7
Possibles		15						

Mean 0.25
STNDEV 0.138516
COV 0.546773

Trend: Negative

Confidence (lookup) 86.4%



S -7

tau -0.46667

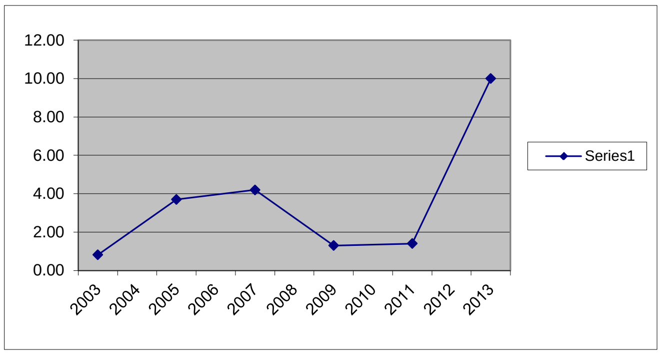
Decision Matrix

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: **04J836**

Date	TCE (µg/L)	Mann-Kendall Calculation:						
6/10/2003	0.82	1						
6/21/2005	3.70	1	1					
6/13/2007	4.20	1	1	1				
6/22/2009	1.30	1	1	-1	-1			
6/22/2011	1.40	1	1	-1	-1	1		
6/5/2013	10.00	1	1	1	1	1	1	
	N	6	5	4	3	2		14
	sum		5	0	-1	2		6
	Possibles	15						

Mean	3.57
STNDEV	3.440436
COV	0.963708
Trend:	Positive
Confidence (lookup)	81.4%



S	6
tau	0.4

Decision Matrix

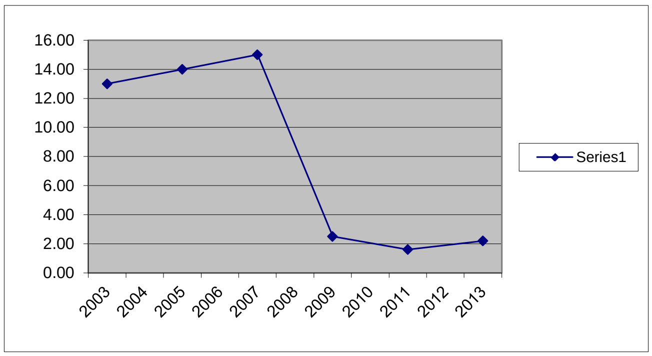
M-K S	Confidence	COV	Trend
S > 0	> 95%	na	Increasing
S > 0	90-95%	na	Pr. Incr.
S > 0	< 90%	na	No Trend
S</= 0	< 90%	>/= 1	No Trend
S </= 0	< 90%	< 1	Stable
S < 0	90-95%	na	Pr. Decr.
S < 0	>95%	na	Decreasing

Well: **04J837**

Date	TCE (µg/L)	Mann-Kendall Calculation:					
6/16/2003	13.00	1					
6/20/2005	14.00	1	1				
6/8/2007	15.00	1	1	1			
6/19/2009	2.50	1	-1	-1	-1		
6/15/2011	1.60	1	-1	-1	-1	-1	
6/12/2013	2.20	1	-1	-1	-1	-1	1

N		6	5	4	3	2	1	15
	sum		-1	-2	-3	-2	1	-7
Possibles		15						

Mean	8.05
STNDEV	6.554922
COV	0.814276
Trend:	Negative
Confidence (lookup)	86.4%



S	-7
tau	-0.46667

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: **04J838**

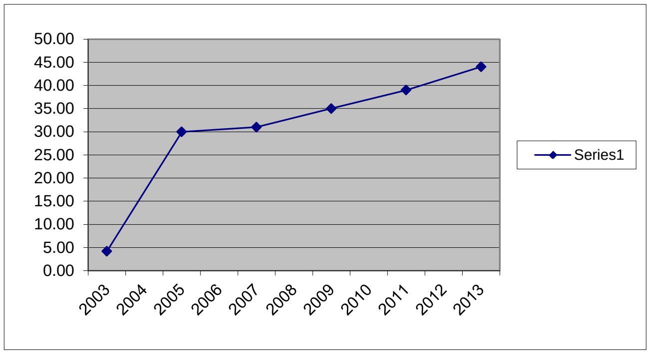
Date	TCE (µg/L)	Mann-Kendall Calculation:					
6/9/2003	4.20	1					
6/17/2005	30.00	1	1				
6/12/2007	31.00	1	1	1			
6/22/2009	35.00	1	1	1	1		
6/21/2011	39.00	1	1	1	1	1	
6/14/2013	44.00	1	1	1	1	1	1

N		6	5	4	3	2	1	15
	sum		5	4	3	2	1	15
Possibles		15						

Mean 30.53
STNDEV 13.90635
COV 0.455448

Trend: Positive

Confidence (lookup) 99.9%



S 15

tau 1

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: **04J839**

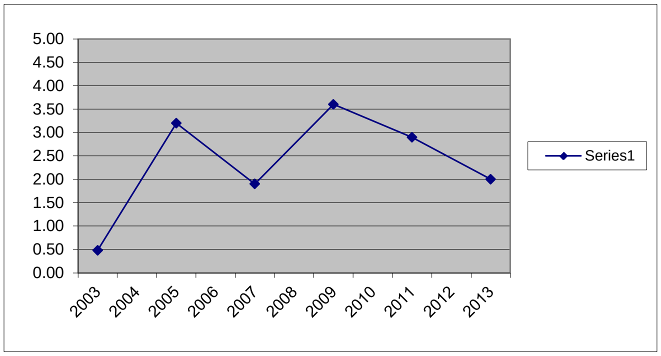
Date	TCE (µg/L)	Mann-Kendall Calculation:					
6/5/2003	0.48	1					
6/17/2005	3.20	1	1				
6/8/2007	1.90	1	1	-1			
6/10/2009	3.60	1	1	1	1		
6/15/2011	2.90	1	1	-1	1	-1	
6/13/2013	2.00	1	1	-1	1	-1	-1

N		6	5	4	3	2	1	15
	sum		5	-2	3	-2	-1	3
Possibles		15						

Mean 2.35
STNDEV 1.132196
COV 0.48247

Trend: Positive

Confidence (lookup) 64.0%



S 3

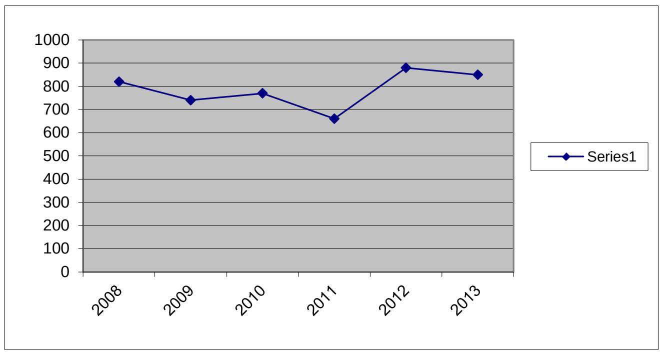
tau 0.2

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**

Date	TCE (µg/L)	Mann-Kendall Calculation:							
6/25/2008	820	1							
6/9/2009	740	1	-1						
6/10/2010	770	1	-1	1					
6/30/2011	660	1	-1	-1	-1				
6/25/2012	880	1	1	1	1	1		787	
6/19/2013	850	1	1	1	1	1	-1		
	N	6	5	4	3	2	1		15
	sum		-1	2	1	2	-1		3
	Possibles	15							



Mean	786.67
STNDEV	80.41559
COV	0.102223
Trend:	Positive
Confidence (lookup)	64.0%

S	3
tau	0.2

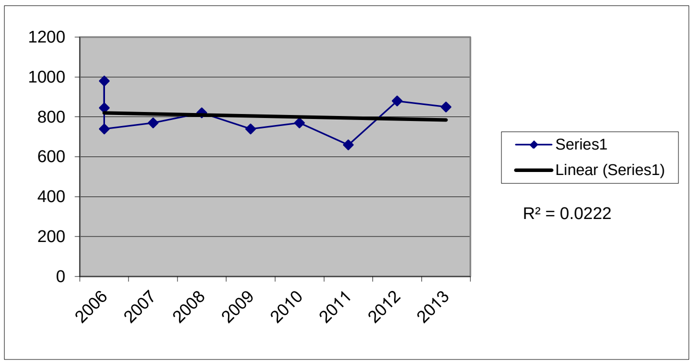
Decision Matrix

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:										
1/11/2006	845		1										
6/6/2006	980		1	1									
12/11/2006	740		1	-1	-1								
6/18/2007	770		1	-1	-1	1							
6/25/2008	820		1	-1	-1	1	1						
6/18/2009	740		1	-1	-1	0	-1	-1					
6/10/2010	770		1	-1	-1	1	0	-1	1				
6/30/2011	660		1	-1	-1	-1	-1	-1	-1	-1			
6/25/2012	880		1	1	-1	1	1	1	1	1	1		
6/19/2013	850		1	1	-1	1	1	1	1	1	1	-1	
	N		10	9	8	7	6	5	4	3	2	1	45
		sum		-3	-8	4	1	-1	2	1	2	-1	-3
	Possibles		45										

Mean	805.50
STNDEV	89.45669
COV	0.111057
Trend:	Negative
Confidence (lookup)	



S	-3
tau	-0.06667

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: 04J849

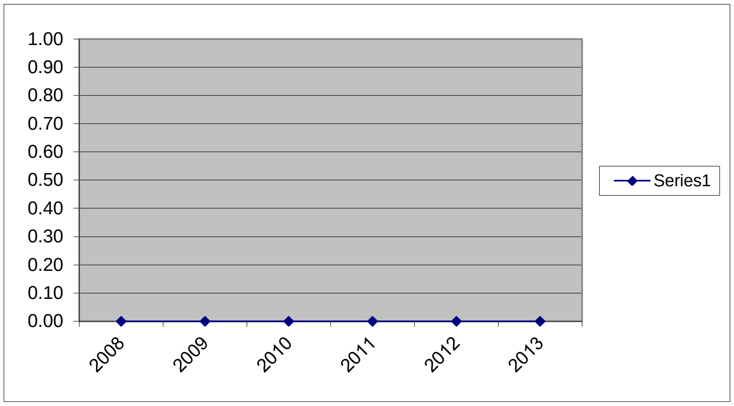
Date	TCE (µg/L)	Mann-Kendall Calculation:					
6/25/2008	0.00	1					
6/16/2009	0.00	1	0				
6/8/2010	0.00	1	0	0			
6/14/2011	0.00	1	0	0	0		
6/25/2012	0.00	1	0	0	0	0	
6/11/2013	0.00	1	0	0	0	0	0

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: **04J882**

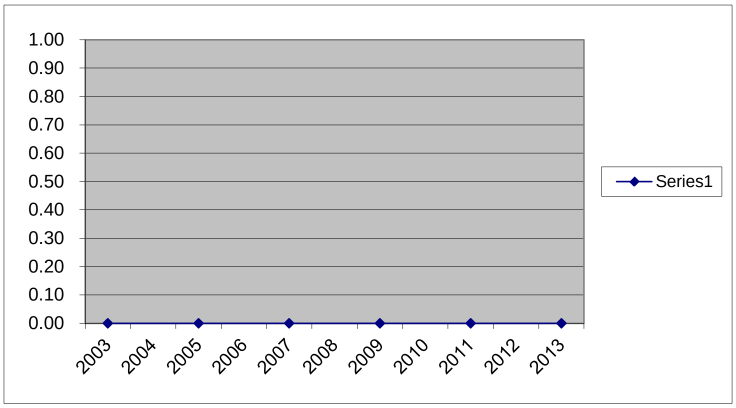
Date	TCE (µg/L)	Mann-Kendall Calculation:					
6/6/2003	0.00	1					
6/8/2005	0.00	1	0				
6/6/2007	0.00	1	0	0			
6/5/2009	0.00	1	0	0	0		
6/3/2011	0.00	1	0	0	0	0	
6/10/2013	0.00	1	0	0	0	0	0

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: **206688**

Date	TCE (µg/L)	Mann-Kendall Calculation:					
6/9/1999	9.70	1					
6/23/2004	11.00	1	1				
6/6/2005	9.50	1	-1	-1			
6/11/2007	11.00	1	1	0	1		
6/19/2009	10.00	1	1	-1	1	-1	
6/23/2011	9.40	1	-1	-1	-1	-1	-1

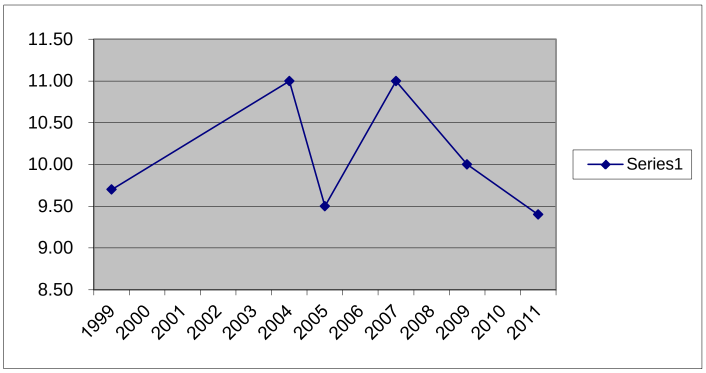
No sample could be collected in 2013: power to the well pump had been disconnected.

N		6	5	4	3	2	1	15
	sum		1	-3	1	-2	-1	-4
Possibles		15						

Mean	10.10
STNDEV	0.7266361
COV	0.0719442

Trend: Negative

Confidence (lookup) 70.7%



S -4

tau -0.26667

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

Well: **409549**

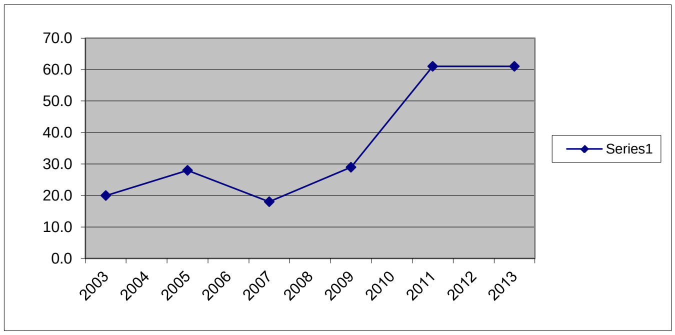
Date	TCE (µg/L)	Mann-Kendall Calculation:					
6/11/2003	20.0	1					
6/10/2005	28.0	1	1				
6/13/2007	18.0	1	-1	-1			
6/10/2009	29.0	1	1	1	1		
6/17/2011	61.0	1	1	1	1	1	
6/14/2013	61.0	1	1	1	1	1	0

N		6	5	4	3	2	1	15
	sum		3	2	3	2	0	10
Possibles		15						

Mean 36.17
STNDEV 19.71209
COV 0.545035

Trend: Positive

Confidence (lookup) 95.4%



S 10

tau 0.666667

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

Well: **409550**

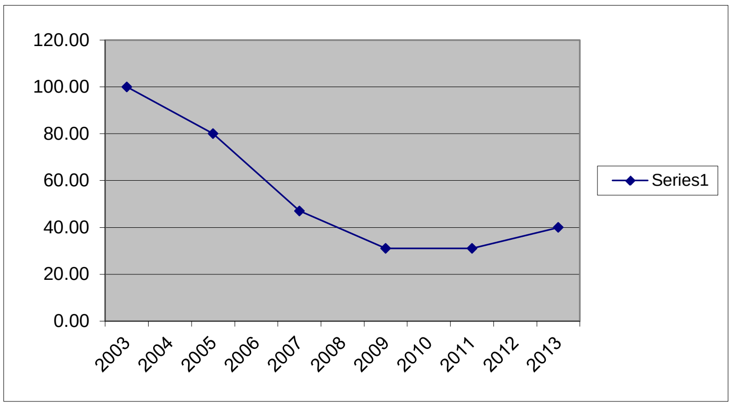
Date	TCE (µg/L)	Mann-Kendall Calculation:					
6/13/2003	100.00	1					
6/14/2005	80.00	1	-1				
6/15/2007	47.00	1	-1	-1			
6/12/2009	31.00	1	-1	-1	-1		
6/21/2011	31.00	1	-1	-1	-1	0	
6/14/2013	40.00	1	-1	-1	-1	1	1

N		6	5	4	3	2	1	15
	sum		-5	-4	-3	1	1	-10
Possibles		15						

Mean 54.83
STNDEV 28.60361
COV 0.521646

Trend: Negative

Confidence (lookup) 95.4%



S -10

tau -0.66667

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: **409557**

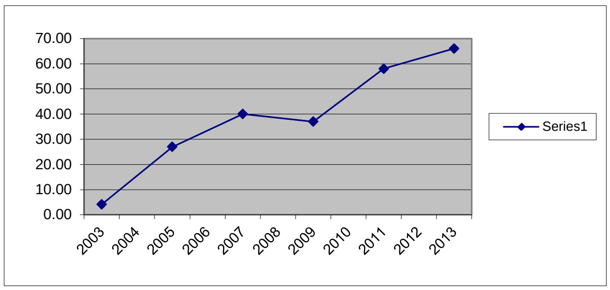
Date	TCE (µg/L)	Mann-Kendall Calculation:					
6/1/2003	4.10	1					
6/9/2005	27.00	1	1				
6/11/2007	40.00	1	1	1			
6/11/2009	37.00	1	1	1	-1		
6/21/2011	58.00	1	1	1	1	1	
6/14/2013	66.00	1	1	1	1	1	1

N		6	5	4	3	2	1	15
	sum		5	4	1	2	1	13
Possibles		15						

Mean 38.68
STNDEV 22.164875
COV 0.5729825

Trend: Positive

Confidence (lookup) 99.2%



S 13

tau 0.866667

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

Well: **409596 (abandoned)**

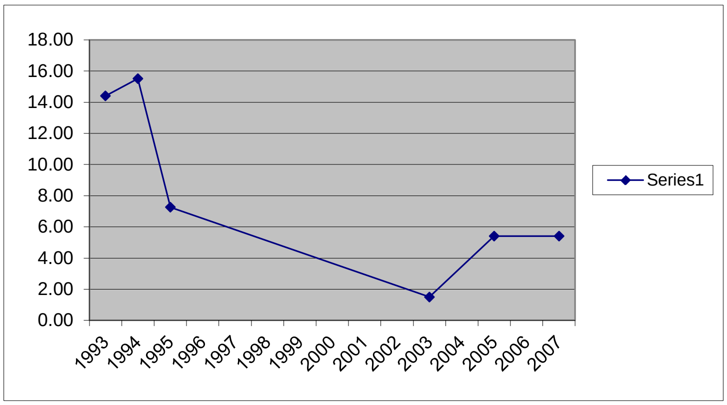
Date	TCE (µg/L)	Mann-Kendall Calculation:					
3/15/1993	14.40	1					
3/18/1994	15.50	1	1				
3/20/1995	7.26	1	-1	-1			
6/13/2003	1.50	1	-1	-1	-1		
6/9/2005	5.40	1	-1	-1	-1	1	
6/14/2007	5.40	1	-1	-1	-1	1	0
abandoned							

N		6	5	4	3	2	1	15
	sum		-3	-4	-3	2	0	-8
Possibles		15						

Mean	8.24
STNDEV	5.534841
COV	0.671432

Trend: Negative

Confidence (lookup) 90.10%



S	-8
tau	-0.53333

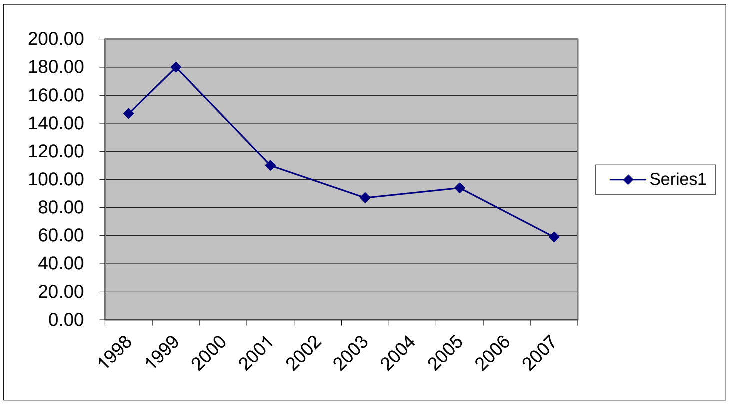
Decision Matrix

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: **409597 (abandoned)**

Date	TCE (µg/L)	Mann-Kendall Calculation:						
6/23/1998	147.00	1						
6/15/1999	180.00	1	1					
6/23/2001	110.00	1	-1	-1				
6/13/2003	87.00	1	-1	-1	-1			
6/14/2005	94.00	1	-1	-1	-1	1		
6/15/2007	59.00	1	-1	-1	-1	-1	-1	
Abandoned								
	N	6	5	4	3	2	1	15
	sum		-3	-4	-3	0	-1	-11
	Possibles	15						

Mean	112.83
STNDEV	43.8334
COV	0.388479
Trend:	Negative
Confidence (lookup)	99.00%



S	-11
tau	-0.73333

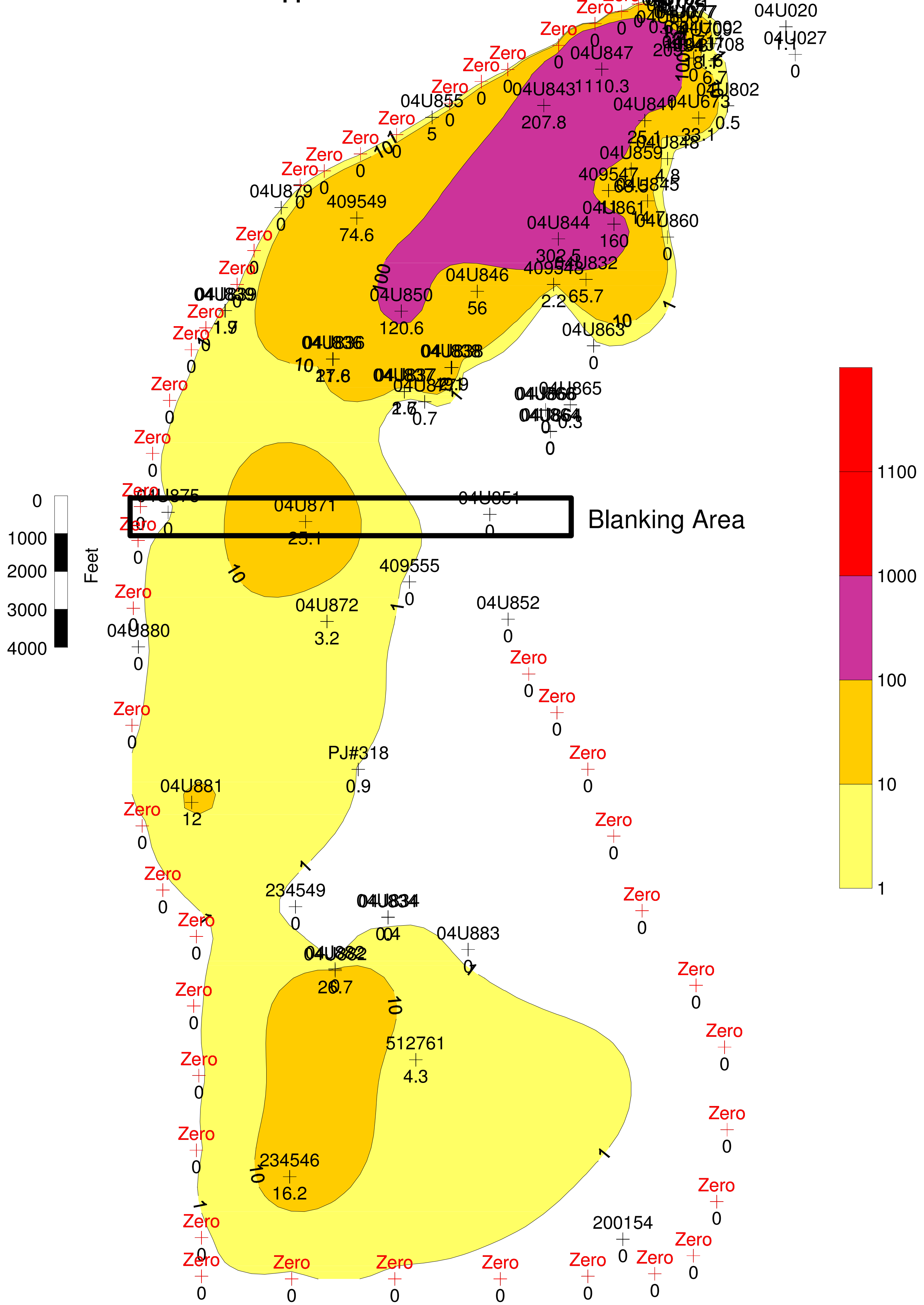
Decision Matrix

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

D.2.4 Group 3 and Group 5 Kriging Evaluation

2013

Total VOC Concentrations in Upper Unit 4 - 2013



North Plume
Total VOC Cocentrations for Surfer Plots
FY 2013

Well	Date	Total VOCs for Surfer
04J077	6/10/13	**103.8**
04J702	6/11/13	**1.4**
04J708	6/10/13	**6.7**
04J713	6/12/13	**0.0**
04J834	6/6/13	**0.0**
04J836	6/5/13	**11.6**
04J837	6/12/13	**2.6**
04J838	6/14/13	**49.9**
04J839	6/13/13	**1.9**
04J864	10/27/04	**0.0**
04J866	6/25/13	**0.0**
04J882	6/10/13	**0.0**
04U002	6/12/13	**1.6**
04U020	6/7/13	**1.1**
04U027	6/17/13	**0.0**
04U077	6/10/13	**48.4**
04U673	6/27/13	**33.1**
04U701	6/11/13	**3.0**
04U702	6/11/13	**1.9**
04U709	6/13/13	**18.1**
04U711	6/11/13	**0.0**
04U713	6/12/13	**0.3**
04U802	6/28/13	**0.5**
04U806	6/12/13	**205.0**
04U832	6/27/13	**65.7**
04U833	6/11/13	**0.6**
04U834	6/12/13	**0.4**
04U836	6/5/13	**27.8**
04U837	6/11/13	**1.7**
04U838	6/10/13	**2.1**
04U839	6/13/13	**1.7**
04U841	6/13/13	**25.1**
04U843	6/18/13	**207.8**
04U844	6/18/13	**302.5**
04U845	6/25/13	**14.7**
04U846	6/12/13	**56.0**
04U847	6/19/13	**1110.3**
04U848	6/27/13	**4.8**
04U850	6/17/13	**120.6**
04U851	6/25/13	**0.0**
04U852	6/24/05	**0.0**
04U855	6/12/13	**5.0**
04U859	6/27/13	**68.5**
04U860	6/27/13	**0.0**
04U861	2/8/06	**160.0**
04U863	6/26/13	**0.0**
04U864	10/27/04	**0.0**
04U865	6/22/05	**0.3**
04U866	6/25/13	**0.0**
04U871	6/14/13	**25.1**
04U872	6/13/13	**3.2**
04U875	6/17/13	**0.0**

North Plume
Total VOC Cocentrations for Surfer Plots
FY 2013

Well	Date	Total VOCs for Surfer
04U877	6/11/13	**0.7**
04U879	6/10/13	**0.0**
04U880	6/11/13	**0.0**
04U881	6/12/13	**12.0**
04U882	6/14/13	**26.7**
04U883	6/11/13	**0.0**
200154	6/17/13	**0.0**
234546	6/19/13	**16.2**
234549	6/17/2003	**0.0**
409547	6/6/13	**11.0**
409548	6/12/13	**2.2**
409549	6/14/13	**74.6**
409555	6/6/13	**0.0**
512761	6/29/11	**4.3**
PJ#318	6/18/2013	**0.9**

North Plume
Average Total VOC Concentration Calculations
Group 3 Blanked Area
June 2013

Concentration	Positive Planar Area (m^2)
Plume to 1	426004
Plume to 5	324626
Plume to 10	230550
Plume to 50	0

Total VOCs (µg/L)	Avg Total VOCs (µg/L)	Area (m^2)	Areal Conc (µg*m^2/L)
1 to 5	3	101379	304136
5 to 10	7.5	94076	705570
10 to 50	30	230550	6916487
	Sum	426004	7926193

Area Wtd Conc	19	µg/L

North Plume
Average Total VOC Concentration Calculations
Group 5 Blanked Area
June 2013

Concentration	Positive Planar Area (m^2)
Plume to 1	23185017
Plume to 5	14908852
Plume to 10	9629681
Plume to 50	4507788
Plume to 100	2717739
Plume to 200	1064208
Plume to 300	490900
Plume to 400	325667
Plume to 500	214203
Plume to 600	135809
Plume to 700	79396
Plume to 800	39743
Plume to 900	9965
Plume to 1000	0

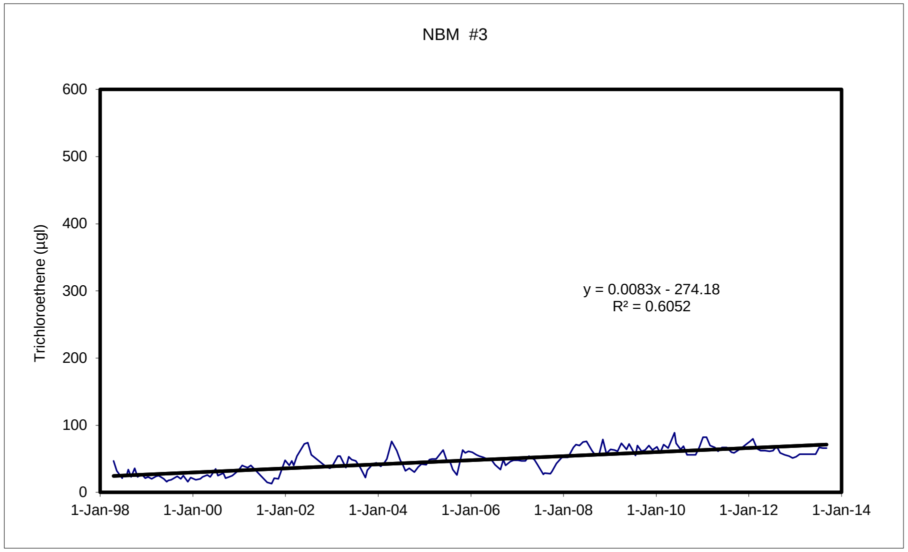
Total VOCs (µg/L)	Avg Total VOCs (µg/L)	Area (m^2)	Areal Conc (µg*m^2/L)
1 to 5	3	8276165	24828496
5 to 10	7.5	5279171	39593784
10 to 50	30	5121893	153656775
50 to 100	75	1790049	134253680
100 to 200	150	1653532	248029742
200 to 300	250	573307	143326845
300 to 400	350	165233	57831563
400 to 500	450	111464	50158760
500 to 600	550	78394	43116912
600 to 700	650	56413	36668399
700 to 800	750	39654	29740203
800 to 900	850	29777	25310557
900 to 1000	950	9965	9467146
	Sum	23185017	995982861

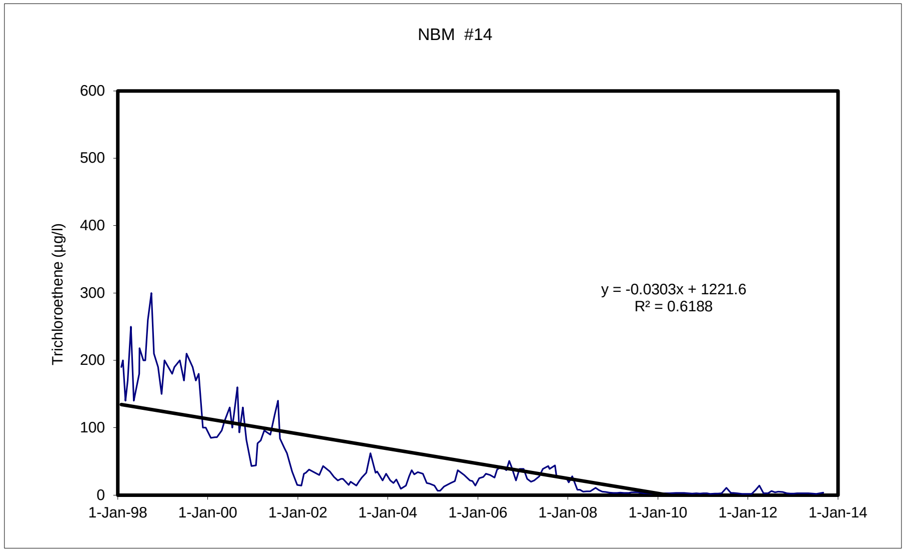
Area Wtd Conc	43	µg/L

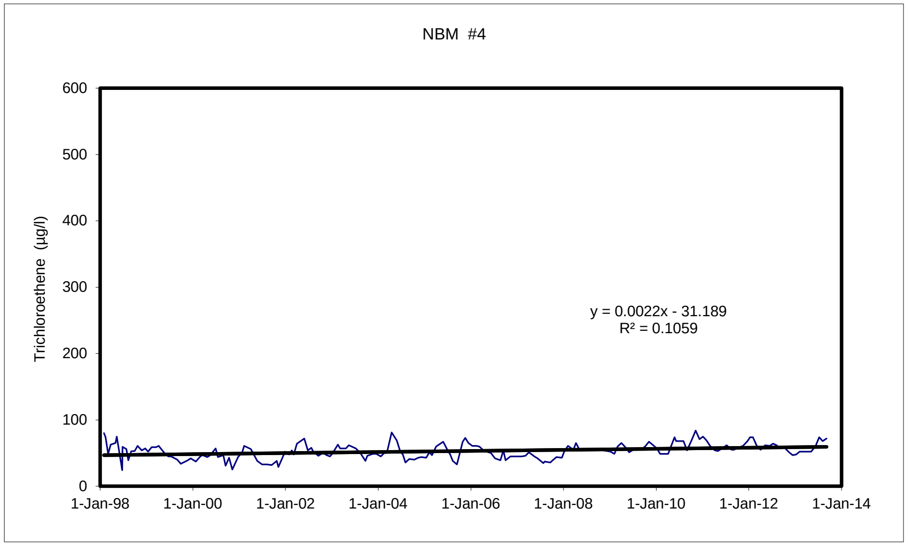
\\stp_fs1\stpaul\0000-dan\total vocs\group3and5\2003\2003 conc group 3 and 5.xls

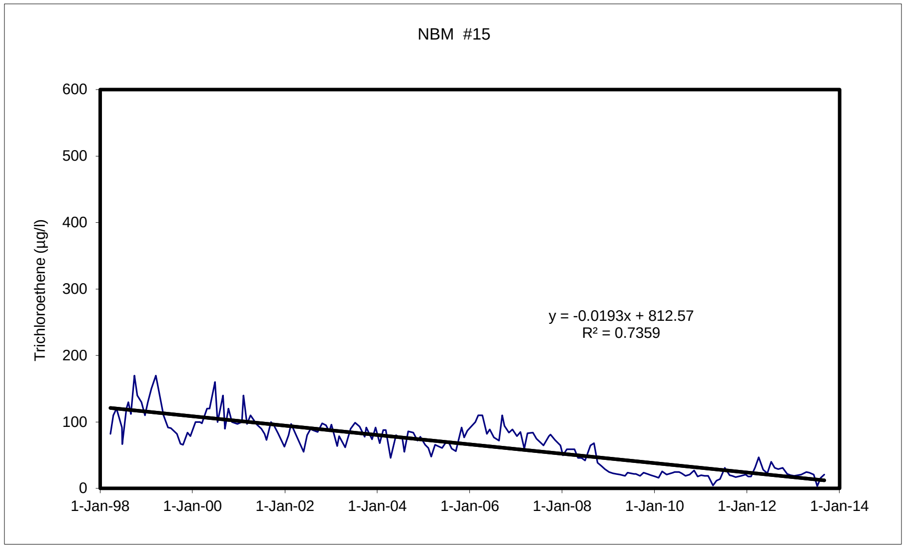
D.2.5 Group 6 New Brighton Municipal Well Regression Analysis

NEW BRIGHTON MUNICIPAL WELLS: Regression Analysis Since 1998: TRICHLOROETHENE

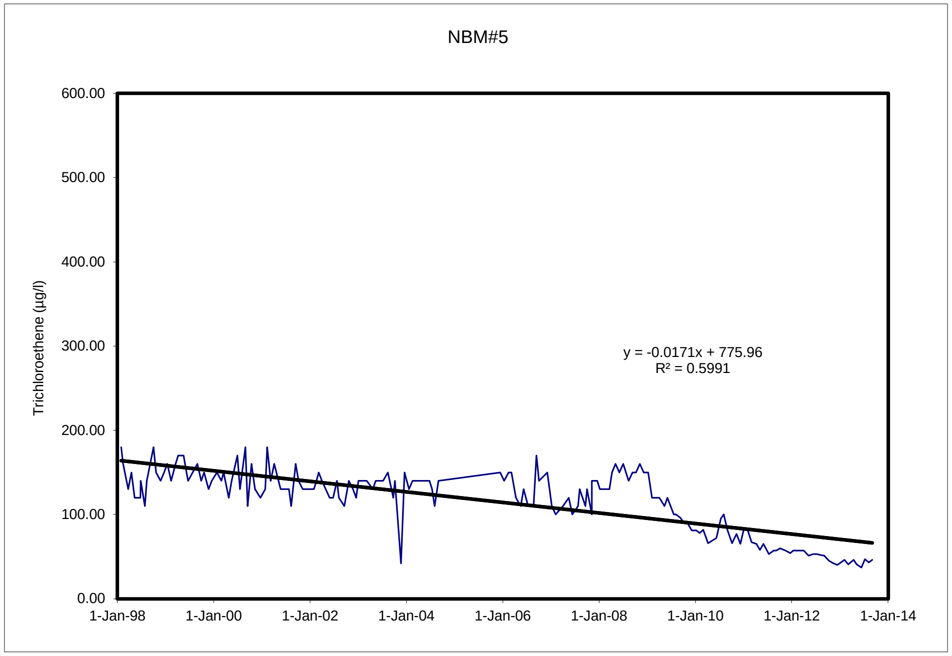


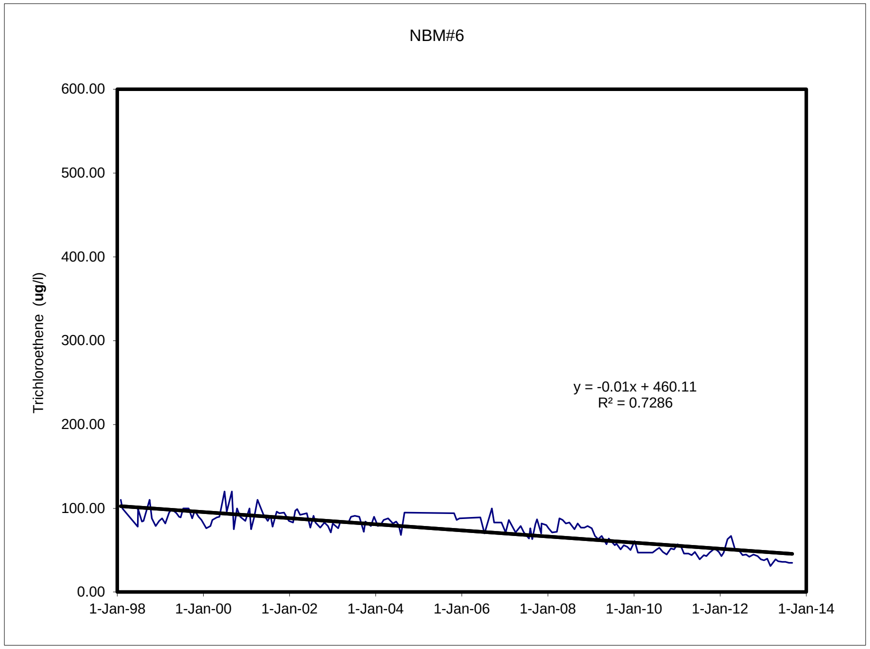






NEW BRIGHTON MUNICIPAL WELLS: Regression Analysis Since 1998: TRICHLOROETHENE





Appendix E

Well Inventory Update, FY 2013

APPENDIX E
WELL INVENTORY UPDATE

FISCAL YEAR 2013

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 north 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 north 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 2013 Update

The updated MDH database was provided to Wenck on November 14, 2012. 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, 2011 and September 30, 2012. 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-seven wells were identified within the study area. Five of the wells were elevator shaft boreholes, eight of the wells were environmental boreholes, four of the wells were recovery wells, and ten were monitoring wells. All 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. Three of the wells were outside of the area or aquifer of concern and were classified into Category 3. One well was disclosed as a non-supply well and was classified into Category 6.

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 2013. 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 2013, 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 2013 remained at fourteen. An investigation summary is included in Table E-6.

FY 2013 was a “major” well inventory sampling event, which occur every four years and which target the wells in Categories 1a, 1b, 1c, 2a, 2b, 2c, and 4a. Eight wells were sampled in FY 2013. Any wells in the above categories that were not sampled were due to one of the following reasons: the well owner refused the offer to sample; the well owner did not respond to the request for access to sample; or the well was found to be abandoned, non-existent, or inoperable. The analytical data from the FY 2013 sampling effort are summarized in Table E-2. The locations of the wells sampled in FY 2013 are shown on Figure E-5.

Of the eight wells sampled, six had no VOC detections, and one had detections that were below the respective TCAAP cleanup level / MDH Health Risk Limit. One well (2935 Old Hwy 8) had VOC detections where 2 of the 3 detections slightly exceeded the MDH Health Risk Limit; however, none of the VOCs detected were TCAAP Chemicals of Concern

Information contained in Tables E-3 through E-6 has been updated in the well inventory database (Filename “Well Inventory Main Database FY 2013”, 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 2013

Unique Number		Address	Sampling Date	*OU1 / OU3 COCs:* Trichloroethene	1,1-Dichloroethene	cis-1,2-Dichloroethene	1,1,1-Trichloroethane	1,1,2-Trichloroethane	1,1-Dichloroethane	*Other Analytes:* 1,1,2,2-Tetrachloroethane	1,2-Dichloroethane	1,2-Dichloropropane	2-Hexanone
			Cleanup Level(1)	5	6	70	200	3	70				
			MDH HRL(2)							2	4	5	(Note 3)
200180		Town & Country #1	7/25/13	JP 0.36	<1	5.2	<1	<1	<1	<1	<1	<1	<5
---		2935 Old Hwy 8	6/24/13	<1	<1	<1	<1	<1	<1	<1	<1	<1	<5
234421		2151 Mustang Dr	6/21/13	<1	<1	<1	<1	<1	<1	<1	<1	<1	<5
249632		2301 N Upland Crest NE	6/21/13	<1	<1	<1	<1	<1	<1	<1	<1	<1	<5
249632	D	2301 N Upland Crest NE	6/21/13	<1	<1	<1	<1	<1	<1	<1	<1	<1	<5
249007		4453 Old Hwy 10	6/24/13	<1	<1	<1	<1	<1	<1	<1	<1	<1	<5
200523		Windsor Green South	6/24/13	<1	<1	<1	<1	<1	<1	<1	<1	<1	<5
200522		Windsor Green East	6/24/13	<1	<1	<1	<1	<1	<1	<1	<1	<1	<5
107405		4355 Old Hwy 10	6/21/13	<1	<1	<1	<1	<1	<1	<1	<1	<1	<5

TABLE E-2

WELL INVENTORY SAMPLING RESULTS
Fiscal Year 2013

Other Analytes:

Unique Number		Address	Sampling Date	Acetone	Benzene	Bromodichloro-methane	Bromoform	Bromomethane	Carbon disulfide	Carbon tetrachloride	Chlorobenzene	Chloroethane	Chloroform	Chloromethane
			Cleanup Level(1) MDH HRL(2)	700	2	6	40	10	700	3	100	300*	30	(Note 3)
200180		Town & Country #1	7/25/13	<5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
---		2935 Old Hwy 8	6/24/13	<5 JL73	<1	**7.2**	<1	<1	<1	<1	<1	<1	**33**	<1
234421		2151 Mustang Dr	6/21/13	<5 JL73	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
249632		2301 N Upland Crest NE	6/21/13	<5 JMS52L73	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
249632	D	2301 N Upland Crest NE	6/21/13	<5 JL73	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
249007		4453 Old Hwy 10	6/24/13	<5 JL73	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
200523		Windsor Green South	6/24/13	<5 JL73	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
200522		Windsor Green East	6/24/13	<5 JL73	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
107405		4355 Old Hwy 10	6/21/13	<5 JL73	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1

TABLE E-2

WELL INVENTORY SAMPLING RESULTS
Fiscal Year 2013

Unique Number	Address	Sampling Date	*Other Analytes:* cis-1,3-Dichloropropene	Dibromochloro-methane	Ethyl benzene	m,p-Xylene	Methyl ethyl ketone	Methyl isobutyl ketone	Methylene chloride	o-Xylene	Styrene	Tetrachloroethene	Toluene	trans-1,2-Dichloroethene	trans-1,3-Dichloropropene	Vinyl chloride
		Cleanup Level[(1)]														
		MDH HRL[(2)]	2	10	700	10,000	4000	300	5	10,000	(Note 3)	5	1000	100	2	0.2
200180	Town & Country #1	7/25/13	<1	<1	<1	<2	<5 JMS71	<5	<1	<1	<1	<1	<1	JP 0.50	<1	<1
---	2935 Old Hwy 8	6/24/13	<1	JP 0.62	<1	<2	<5	<5	<1	<1	<1	<1	<1	<1	<1	<1
234421	2151 Mustang Dr	6/21/13	<1	<1	<1	<2	<5	<5	<1	<1	<1	<1	<1	<1	<1	<1
249632	2301 N Upland Crest NE	6/21/13	<1	<1	<1	<2	<5	<5	<1	<1	<1	<1	<1	<1	<1	<1
249632 D	2301 N Upland Crest NE	6/21/13	<1	<1	<1	<2	<5	<5	<1	<1	<1	<1	<1	<1	<1	<1
249007	4453 Old Hwy 10	6/24/13	<1	<1	<1	<2	<5	<5	<1	<1	<1	<1	<1	<1	<1	<1
200523	Windsor Green South	6/24/13	<1	<1	<1	<2	<5	<5	<1	<1	<1	<1	<1	<1	<1	<1
200522	Windsor Green East	6/24/13	<1	<1	<1	<2	<5	<5	<1	<1	<1	<1	<1	<1	<1	<1
107405	4355 Old Hwy 10	6/21/13	<1	<1	<1	<2	<5	<5	<1	<1	<1	<1	<1	<1	<1	<1

Notes:

All Results in ug/l.

(1) Cleanup levels for OU1 deep groundwater are from page 18 of the OU1 ROD.

(2) Minnesota Department of Health's Health Risk Limits (HRLs), for reference (* Indicates a Health Based Value, rather than a HRL).

(3) No HRL has been established for this analyte.

D Duplicate sample.

JL The percent recovery for the laboratory control sample was above or below the QC limits (the percent recovery is listed after "JL"). The sample result could be biased high (if over >100 percent recovery) or low (if <100 percent recovery).

JP The value is below the reporting level, but above the method detection limit. Results should be considered estimated.

JMS The percent recovery for the matrix spike was above or below the QC limits (the percent recovery is listed after "JMS"). The sample result could be biased high (if over >100 percent recovery) or low (if <100 percent recovery).

TABLE E-3
CONSTRUCTED WELLS

Unique Number	Category	Last Name or Business Name	Street	City	Use	Depth	Date Drilled
787901	6	PRESBYTERIAN HOMES ARDEN HILLS	3220 LAKE JOHANNA BOULEVARD	Arden Hills	Elevator Shaft Boring	48	1/1/2012
787902	6	PRESBYTERIAN HOMES ARDEN HILLS	3221 LAKE JOHANNA BOULEVARD	Arden Hills	Elevator Shaft Boring	48	1/1/2012
787903	6	PRESBYTERIAN HOMES ARDEN HILLS	3222 LAKE JOHANNA BOULEVARD	Arden Hills	Elevator Shaft Boring	48	1/1/2012
787904	6	PRESBYTERIAN HOMES ARDEN HILLS	3223 LAKE JOHANNA BOULEVARD	Arden Hills	Elevator Shaft Boring	48	1/1/2012
787905	6	PRESBYTERIAN HOMES ARDEN HILLS	3224 LAKE JOHANNA BOULEVARD	Arden Hills	Elevator Shaft Boring	16	1/1/2012
780893	6	ST. PAUL, CITY OF	EUSTIS STREET	St. Paul	Env. Boring	208	9/1/2011
787896	6	BMO HARRIS BANK	7593 HIGHWAY 65 NE	Fridley	Monitoring	16	12/1/2011
787897	6	BMO HARRIS BANK	7593 HIGHWAY 65 NE	Fridley	Monitoring	15	12/1/2011
780898	6	TRAVIS RICHINS	2250 WABASH AVENUE	St. Paul	Env. Boring	30	10/1/2011
787879	6	CRI HOTEL INCOME ON MN, LLC	2407 UNIVERSITY AVENUE SE	Minneapolis	Recovery	30	10/1/2011
787878	6	CRI HOTEL INCOME ON MN, LLC	2407 UNIVERSITY AVENUE SE	Minneapolis	Recovery	30	10/1/2011
787877	6	CRI HOTEL INCOME ON MN, LLC	2407 UNIVERSITY AVENUE SE	Minneapolis	Recovery	30	10/1/2011
787876	6	CRI HOTEL INCOME ON MN, LLC	2407 UNIVERSITY AVENUE SE	Minneapolis	Recovery	30	10/1/2011
577305	6	MN DOT			Env. Boring	37	10/1/2011
577303	6	MN DOT			Env. Boring	28	10/1/2011
577307	6	MN DOT			Env. Boring	29	10/1/2011
780901	6	ST. PAUL, CITY OF	RAYMOND AVENUE	St. Paul	Env. Boring	37	1/1/2012
780902	6	ST. PAUL, CITY OF	RAYMOND AVENUE	St. Paul	Env. Boring	38	1/1/2012
780903	6	ST. PAUL, CITY OF	RAYMOND AVENUE	St. Paul	Env. Boring	38	1/1/2012
789187	6	BARRY HOOSLINE	1240 73½ AVENUE NE	Fridley	Monitoring	22	7/1/2012
789188	6	BARRY HOOSLINE	1240 73½ AVENUE NE	Fridley	Monitoring	22	7/1/2012
789189	6	BARRY HOOSLINE	1240 73½ AVENUE NE	Fridley	Monitoring	23	7/1/2012
789190	6	BARRY HOOSLINE	1240 73½ AVENUE NE	Fridley	Monitoring	23	7/1/2012
786983	6	TIOY 2012, LLC	1717 CENTRAL AVENUE NE	Minneapolis	Monitoring	14	2/1/2012
786982	6	TIOY 2012, LLC	1717 CENTRAL AVENUE NE	Minneapolis	Monitoring	14	2/1/2012
786985	6	TIOY 2012, LLC	1717 CENTRAL AVENUE NE	Minneapolis	Monitoring	14	2/1/2012
786984	6	TIOY 2012, LLC	1717 CENTRAL AVENUE NE	Minneapolis	Monitoring	16	2/1/2012

Indicates wells that were both constructed and later sealed during FY 2012.

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
777181	6	NEW BRIGHTON, CITY OF	1 14TH STREET NW	New Brighton		In Use				
UNK0498435	3	~~Roberts,~~ Beetner	5608 SCHUTTA ROAD	Shoreview		In Use				
UNK0502435	3	TOM HATCH	1201 36TH AVENUE NE	Minneapolis		No Status Reported				
UNK0503929	3	JOHN M. SOBIECK	2133 BELLE LANE	Mounds View		In Use				

TABLE E-5
SEALED WELLS

Unique Number	Category	Last Name or Business Name	Street	City	Status	Date Sealed
200158	~~3,~~ 7a	CORVAL GROUP	1633 EUSTIS STREET	St. Paul	Water Supply	6/12/2012
785574	~~3,~~ 7a	ST. PAUL, CITY OF	EUSTIS AVENUE	St. Paul	Other	4/4/2012
463060	~~6,~~ 7a	NORTHERN STAR CO.	520 MALCOLM AVENUE	Minneapolis	Monitoring	2/17/2012
463061	~~6,~~ 7a	NORTHERN STAR CO.	520 MALCOLM AVENUE	Minneapolis	Monitoring	2/17/2012
469422	~~6,~~ 7a	MN PCA, ATTN: GARY KRUEGER	600 KASOTA AVENUE	Minneapolis	Monitoring	9/23/2011
469423	~~6,~~ 7a	MN PCA, ATTN: GARY KRUEGER	600 KASOTA AVENUE	Minneapolis	Monitoring	9/23/2011
469424	~~6,~~ 7a	MN PCA, ATTN: GARY KRUEGER	600 KASOTA AVENUE	Minneapolis	Monitoring	9/23/2011
495203	~~6,~~ 7a	CP RAILWAY	2800 CENTRAL AVENUE NE	Minneapolis	Monitoring	8/30/2011
506345	~~6,~~ 7a	NORTHERN STAR CO.	520 MALCOLM AVENUE	Minneapolis	Monitoring	2/17/2012
506346	~~6,~~ 7a	NORTHERN STAR CO.	520 MALCOLM AVENUE	Minneapolis	Monitoring	2/20/2012
506347	~~6,~~ 7a	NORTHERN STAR CO.	520 MALCOLM AVENUE	Minneapolis	Monitoring	2/17/2012
557661	~~6,~~ 7a	NORTHERN STAR CO.	3171 FIFTH STREET SE	Minneapolis	Monitoring	2/20/2012
557662	~~6,~~ 7a	NORTHERN STAR CO.	3171 FIFTH STREET SE	Minneapolis	Monitoring	2/20/2012
557664	~~6,~~ 7a	NORTHERN STAR CO.	3171 FIFTH STREET SE	Minneapolis	Monitoring	2/20/2012
678226	~~6,~~ 7a	MRP PROPERTIES CO., LLC, C/O ROGER LEVIN	3673 N LEXINGTON AVENUE	Arden Hills	Other	2/1/2012
678227	~~6,~~ 7a	MRP PROPERTIES CO., LLC, C/O ROGER LEVIN	3673 N LEXINGTON AVENUE	Arden Hills	Other	2/1/2012
699649	~~6,~~ 7a	NORTHERN STAR CO.	526 MALCOLM AVENUE SE	Minneapolis	Monitoring	2/17/2012
701932	~~6,~~ 7a	CP RAILWAY	2800 CENTRAL AVENUE NE	Minneapolis	Monitoring	8/1/2011
506348	7a	NORTHERN STAR CO.	520 MALCOM AVENUE SE	Minneapolis	Monitoring	2/17/2012
75232	7a	MN DOT			Env. Boring	8/10/2011
75233	7a	MN DOT			Env. Boring	8/16/2011
75241	7a	MN DOT			Env. Boring	8/25/2011
75242	7a	MN DOT			Env. Boring	8/23/2011
200142	7a	ANN NORRIS	1766 FRY STREET	Falcon Heights	Water Supply	7/16/2012
272040	7a	NW ASPHALT CO.	2996 N CLEVELAND AVENUE	Roseville	Water Supply	10/26/2011
478244	7a	US EPA REGION 5	327 EIGHTH AVENUE NW	New Brighton	Monitoring	10/10/2011
495202	7a	CP RAILWAY	2800 CENTRAL AVENUE NE	Minneapolis	Monitoring	8/30/2011
495204	7a	CP RAILWAY	2800 CENTRAL AVENUE NE	Minneapolis	Monitoring	8/30/2011
495208	7a	CP RAILWAY	2800 CENTRAL AVENUE NE	Minneapolis	Monitoring	8/30/2011
495209	7a	CP RAILWAY	2800 CENTRAL AVENUE NE	Minneapolis	Monitoring	8/29/2011
506418	7a	CP RAILWAY	2800 CENTRAL AVENUE NE	Minneapolis	Monitoring	8/30/2011
506419	7a	CP RAILWAY	2800 CENTRAL AVENUE NE	Minneapolis	Monitoring	8/30/2011
506420	7a	CP RAILWAY	2800 CENTRAL AVENUE NE	Minneapolis	Monitoring	8/29/2011
568183	7a	MRP PROPERTIES CO., LLC, C/O ROGER LEVIN	3673 LEXINGTON AVENUE N	Arden Hills	Monitoring	5/2/2012
568184	7a	MRP PROPERTIES CO., LLC, C/O ROGER LEVIN	3673 LEXINGTON AVENUE N	Arden Hills	Monitoring	2/1/2012
588396	7a	MN PCA	670 25TH AVENUE SE	Minneapolis	Monitoring	7/8/2011
588397	7a	MN PCA	670 25TH AVENUE SE	Minneapolis	Monitoring	7/8/2011
594630	7a	CP RAILWAY	2500 CENTRAL AVENUE NE	Minneapolis	Monitoring	8/29/2011
594631	7a	CP RAILWAY	2800 CENTRAL AVENUE NE	Minneapolis	Monitoring	8/30/2011
599606	7a	MN PCA, ATTN: GARY KRUEGER	600 KASOTA AVENUE		Monitoring	9/23/2011
599613	7a	CP RAILWAY	2800 CENTRAL AVENUE	Minneapolis	Monitoring	8/30/2011
599616	7a	CP RAILWAY	2800 CENTRAL AVENUE N	Minneapolis	Monitoring	8/30/2011

TABLE E-5
SEALED WELLS

Unique Number	Category	Last Name or Business Name	Street	City	Status	Date Sealed
602278	7a	MRP PROPERTIES CO., LLC, C/O ROGER LEVIN	3673 LEXINGTON AVENUE N	Arden Hills	Monitoring	2/1/2012
660047	7a	CP RAILWAY	2800 CENTRAL AVENUE NE	Minneapolis	Monitoring	8/30/2011
686720	7a	CP RAILWAY		Minneapolis	Monitoring	8/1/2011
699638	7a	MRP PROPERTIES CO., LLC, C/O ROGER LEVIN	3673 N LEXINGTON AVENUE	Arden Hills	Monitoring	2/1/2012
717752	7a	CP RAILWAY	2800 CENTRAL AVENUE	Minneapolis	Monitoring	8/29/2011
737635	7a	CP RAILWAY	2800 CENTRAL AVENUE NE	Minneapolis	Monitoring	8/30/2011
H000014659	7a	NEW BRIGHTON, CITY OF	1 14TH STREET NW	New Brighton	Sealed	7/30/2012 15:20
H000014661	7a	NEW BRIGHTON, CITY OF	1 14TH STREET NW	New Brighton	Sealed	7/30/2012 15:20
H000052039	7a	TRACY L. HOL ZMUDA	980 MISSISSIPPI STREET	Fridley	Sealed	10/27/2011 10:08
H000059289	7a	BRADLEY L. GUERTIN	1995 BEACON STREET	Roseville	Sealed	4/16/2012 20:20
H000100080	7a	WILLIAM P. BEHRENS	5085 GREENWOOD DRIVE	Mounds View	Sealed	8/9/2012 9:59
H000143774	7a	BARRY K. ADAMS	1631 KRISTIN COURT	Fridley	Sealed	6/21/2012 13:53
H000148670	7a	TERENCE CHRISTOPHER NIZNIK	5219 SIXTH STREET NE	Columbia Heights	Sealed	3/28/2012 12:49
H000164268	7a	NAI SIANG JIANG	1931 STOWE AVENUE	Arden Hills	Sealed	7/30/2012 15:23
H000182462	7a	KRISTIAN A. OLSON	1749 VENUS STREET	Arden Hills	Sealed	12/20/2011 14:59
H000198735	7a	JAMES L. SMITH	2701 PAHL AVENUE	St. Anthony	Sealed	11/17/2011 15:52
H000199940	7a	MATTHEW WOLFE	2106 MIDLOTHIAN	Roseville	Sealed	8/9/2012 9:49
H000212145	7a	CALEB A. NEWBY	1641 STANBRIDGE AVENUE	Roseville	Sealed	3/13/2012 20:20
H000217549	7a	DONNA M. DRAKE	1294 OAKCREST AVENUE	Roseville	Sealed	5/11/2012 14:05
H000222052	7a	NATHAN E. BRUHN	1670 MILLWOOD AVENUE	Roseville	Sealed	3/20/2012 12:49
H000252298	7a	ELIZABETH J. SAWYER	2521 27TH AVENUE NE	St. Anthony	Sealed	11/17/2011 11:21
H000267588	7a	ALLISON F. SLIPKA	2095 FAIRWAY LANE	Roseville	Sealed	8/27/2012 14:28
H000276899	7a	LEONARD PASSON	6211 RAINBOW DRIVE NE	Fridley	Water Supply	3/12/2012
H000277603	7a	JOHN NAUMANN	1887 STOWE AVENUE	Arden Hills	Water Supply	4/24/2012
H000277605	7a	PUGLEASA CO., INC.	1253 CONNELLY AVENUE	Arden Hills	Water Supply	5/15/2012
H000277611	7a	GOLDIE SIEDERW	3776 CONNELLY AVENUE	Arden Hills	Water Supply	8/6/2012
H000289647	7a	CHEVRON ENVIRONMENTAL MGMT. CO., ATTN; JOI	3647 MCKINLEY STREET NE	Minneapolis	Monitoring	9/7/2011
H000289941	7a	BRIAN E. WIGER	2206 HIGHWAY 36 W	Roseville	Water Supply	11/3/2011
H000289943	7a	DAVID B. MURPHY	1725 TATUM STREET	Falcon Heights	Water Supply	12/12/2011
H000289948	7a	NANCY HILDRETH	7325 PLEASANTVIEW DRIVE	Mounds View	Water Supply	2/16/2012
H000290670	7a	U OF M, ENVIRONMENT HEALTH		Minneapolis	Monitoring	4/22/2011
H000290993	7a	TESORO COS.	2288 W COUNTY ROAD C	Roseville	Env. Boring	5/23/2011
H000292218	7a	ARTIS REIT	601 STINSON BOULEVARD NE	Minneapolis	Monitoring	1/20/2011
H000292219	7a	ARTIS REIT	323 STINSON BOULEVARD NE	Minneapolis	Monitoring	1/24/2011
H000292220	7a	ARTIS REIT	400 ROOSEVELT STREET NE	Minneapolis	Monitoring	1/24/2011
H000292221	7a	ARTIS REIT	400 STINSON BOULEVARD NE	Minneapolis	Monitoring	1/18/2011
H000292222	7a	No Owner Found	332 STINSON BOULEVARD NE	Minneapolis	Monitoring	1/19/2011
H000292307	7a	ED YAROCH	1836 GRAMSIE ROAD	Arden Hills	Water Supply	6/29/2012
H000292416	7a	HIAWATHA BUSINESS CENTER	2800 E 34TH STREET	Minneapolis	Monitoring	6/24/2011
H000293615	7a	SURLY BREWING CO.	3171 FIFTH STREET SE	St. Paul		8/24/2012
H000293648	7a	MN PCA	1900 MONROE STREET	Minneapolis	Monitoring	9/9/2011
H000293870	7a	TECHNE CORP.	2001 KENNEDY STREET NE	Minneapolis	Monitoring	10/25/2011

TABLE E-5
SEALED WELLS

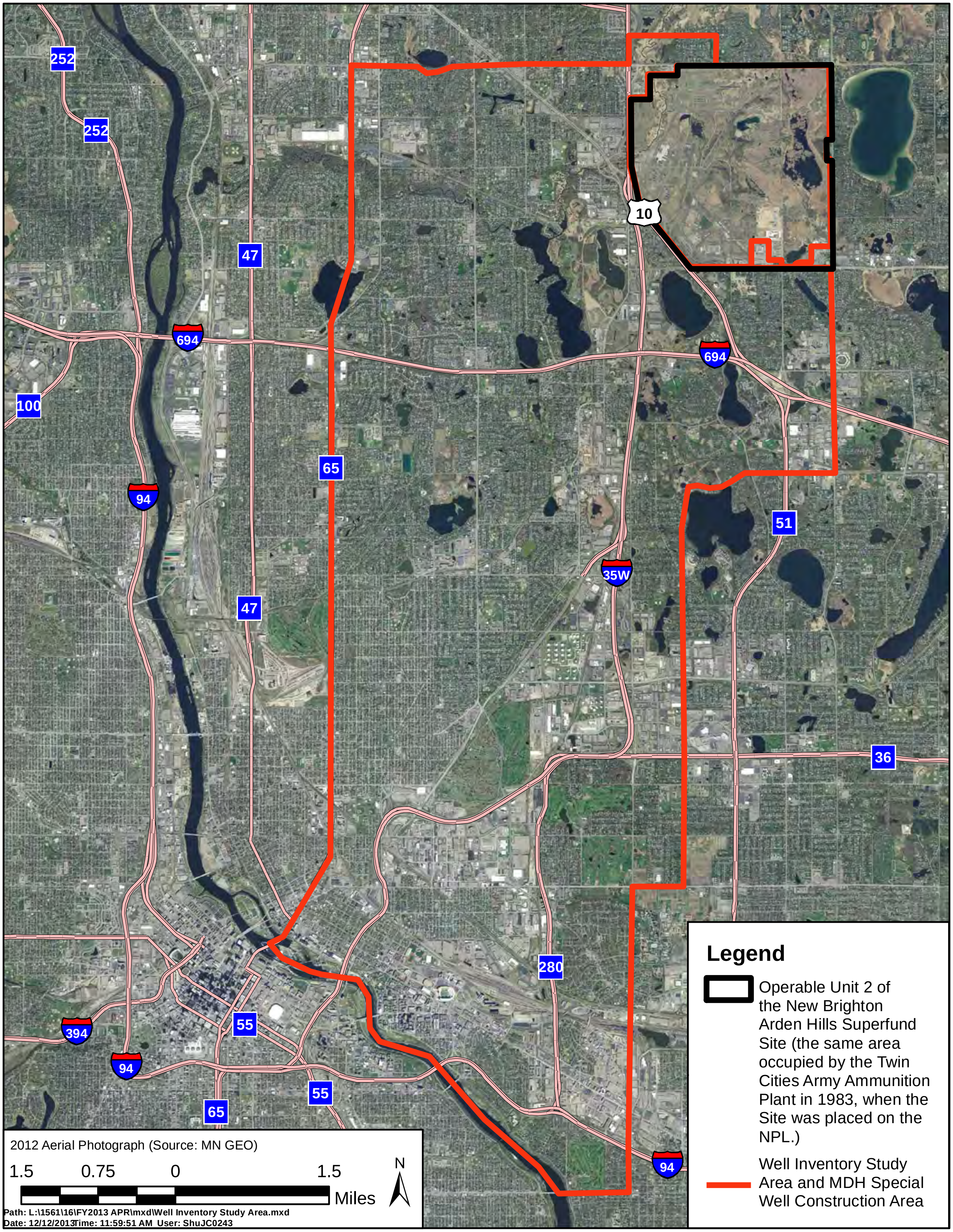
Unique Number	Category	Last Name or Business Name	Street	City	Status	Date Sealed
H000293872	7a	BODYCOTE THERMAL PROCESSING, INC.	331 FILLMORE STREET NE	Minneapolis	Monitoring	10/31/2011
H000294007	7a	XCEL ENERGY, C/O HDR	3900 BETHEL DRIVE	Arden Hills	Env. Boring	7/1/2011
H000294018	7a	HILLCREST DEVELOPMENT, LLC	1717 CENTRAL AVENUE NE	Minneapolis	Monitoring	8/16/2011
H000294022	7a	DORAN COS.	1101 UNIVERSITY AVENUE SE	Minneapolis	Monitoring	11/10/2011
H000294023	7a	ROCK TENN, ATTN: TRAVIS RICHINS	2250 WABASH AVENUE	St. Paul	Env. Boring	10/20/2011
H000294030	7a	SOLHEM COS. LLC	515 HURON BOULEVARD	Minneapolis	Env. Boring	7/1/2011
H000294544	7a	DARRELL A. PETERSEN	7431 VANBUREN STREET NE	Fridley	Water Supply	11/1/2011
H000294549	7a	GEORGE MOUA	6231 SUNRISE DRIVE NE	Fridley	Water Supply	11/29/2011
H000295142	7a	DON MESSERLY	3915 FAIRVIEW AVENUE	Arden Hills	Water Supply	10/22/2011
H000295615	7a	CATHY TOSTENSON	704 63RD AVENUE NE	Fridley	Water Supply	11/11/2011
H000296071	7a	QUYNH ANH NGUYEN	2544 FAIRVIEW AVENUE	Roseville	Water Supply	4/18/2012
H000296543	7a	MN PCA, ATTN: GARY ZARLING	445 MALCOLM AVENUE SE	Minneapolis	Monitoring	12/21/2011
H000296699	7a	DON HARSTAD CO.	7101 HIGHWAY 65 NE	Fridley	Monitoring	5/8/2012
H000297112	7a	PHYLLIS HANSON	1906 SHRYER AVENUE W	Roseville	Water Supply	12/15/2011
H000297129	7a	FANNIE MAE	2954 MILDRED DRIVE	Roseville	Water Supply	6/22/2012
H000297304	7a	SOLHEIM COS.	515 HURON BOULEVARD SE	Minneapolis	Monitoring	7/1/2011
H000297330	7a	MN DOT.		Minneapolis	Env. Boring	9/9/2011
H000297508	7a	ADAM E. BROWN	4757 SECOND STREET	Fridley	Sealed	9/6/2012 12:52
H000297589	7a	K AND J WALCHER JR.	630 ARTHUR STREET NE	Minneapolis	Monitoring	8/31/2011
H000297696	7a	U OF M	2609 FOURTH STREET SE	Minneapolis	Monitoring	5/25/2011
H000297835	7a	CUMMINGS POWER GENERATION	1440 73RD AVENUE NE	Fridley	Env. Boring	9/23/2011
H000297839	7a	SCOTT M. STENZEL	509 12TH AVENUE	New Brighton	Water Supply	10/13/2011
H000298325	7a	JOSEPH P. WURST	2600 FAIRVIEW AVENUE N	Roseville	Water Supply	10/21/2011
H000298518	7a	RYAN VANNURDEN	5020 WASHINGTON STREET	Columbia Heights	Water Supply	11/10/2011
H000299095	7a	ELENORE GILBERTSON	3308 ROAD	Arden Hills	Water Supply	10/21/2011
H000299338	7a	S AND S WELDING CO.	416 35TH AVENUE NE	Minneapolis	Monitoring	9/28/2011
H000299342	7a	KENNETH HANNAY	1708 CENTRAL AVENUE NE	Minneapolis	Monitoring	10/12/2011
H000299527	7a	MRP PROPERTIES CO., LLC, C/O ROGER LEVIN	3673 N LEXINGTON AVENUE	Arden Hills	Monitoring	2/1/2012
H000299534	7a	ART SPACE	1839 JACKSON STREET NE	Minneapolis	Env. Boring	2/22/2012
H000299709	7a	WAGSTAFF PROPERTIES MN, LLC	1624 RICE STREET	St. Paul	Monitoring	8/23/2012
H000299742	7a	THOMAS R. SCHUESSLER TRST	1657 PENINSULA ROAD NW	New Brighton	Water Supply	10/21/2011
H000299743	7a	EUGENE HAAS	1144 LONG LAKE ROAD	New Brighton	Water Supply	11/2/2011
H000299856	7a	NW ASPHALT CO.	2986 N CLEVELAND AVENUE	Roseville	Water Supply	10/24/2011
H000299863	7a	NORTHWEST ASPHALT	2996 N CLEVELAND AVENUE	Roseville	Water Supply	10/24/2011
H000300038	7a	ST. ANTHONY SHOPPING CENTER	2900 PENTAGON DRIVE	St. Anthony	Monitoring	12/1/2011
H000300215	7a	ERP MN PORTFOLIO, LLC, ATTN: DANIEL PHELPS	1720 TERRACE DRIVE	Roseville	Monitoring	10/26/2011
H000300495	7a	BOSTON SCIENTIFIC	4100 HAMLINE AVENUE	Arden Hills	Other	12/19/2011
H000300571	7a	CROIX OIL CO., C/O PAUL MUILENBERG		New Brighton	Monitoring	12/22/2011
H000300701	7a	SENIOR HOUSING PARTNERS	3151 LAKE JOHANNA BOULEVARD	Arden Hills	Monitoring	11/15/2011
H000300705	7a	BODYCOTE THERMAL PROCESSING, INC.	983 HENNEPIN AVENUE E	Minneapolis	Other	12/7/2011
H000300752	7a	BODYCOTE THERMAL PROCESSING, INC.	331 FILLMORE STREET	Minneapolis	Other	12/7/2011
H000300855	7a	GREG PARK, 8763 HIGHWOOD WAY	4732 SECOND STREET NE	Fridley	Water Supply	2/9/2012

TABLE E-5
SEALED WELLS

Unique Number	Category	Last Name or Business Name	Street	City	Status	Date Sealed
H000300915	7a	SUSAN JUNE, 1500 MISSISSIPPI STREET	1500 MISSISSIPPI STREET	New Brighton	Water Supply	5/4/2012
H000300921	7a	JOE EVERTZ, 2816 WOODALE DRIVE	2816 WOODALE DRIVE	Mounds View	Water Supply	6/13/2012
H000301055	7a	CHRISTOPHER SCHEEVEL	1983 SUNNYSIDE TERRACE	New Brighton	Water Supply	11/28/2011
H000301073	7a	ASHLEE R. STACHOWSKI	5649 FIFTH STREET NE	Fridley	Other	1/18/2012
H000301200	7a	CROWN COCO	949 E HENNEPIN AVENUE	Minneapolis	Monitoring	1/25/2012
H000301206	7a	HANNAYS, INC.	1708 CENTRAL AVENUE NE	Minneapolis	Monitoring	2/10/2012
H000301218	7a	PIKOUSKY MANAGEMENT, LLC	2680 PRIOR AVENUE N	Roseville	Monitoring	2/21/2012
H000301236	7a	JIM JAROSCAK	3049 SHOREWOOD LANE	Roseville	Water Supply	5/10/2012
H000301675	7a	FEDEX FREIGHT	2323 TERMINAL ROAD	Roseville	Monitoring	2/10/2012
H000301777	7a	US BANK NA, ATTN: STEPHANIE TAYLOR	1203 W COUNTY ROAD E	Arden Hills	Water Supply	1/27/2012
H000301792	7a	JUDITH V. JONES.	6735 CHANNEL DRIVE NE	Fridley	Water Supply	4/13/2012
H000301831	7a	ST.PAUL, CITY OF	RAYMOND STREET	St. Paul	Env. Boring	1/13/2012
H000301927	7a	U OF M NORRIS HALL	172 PILLSBURY DRIVE SE	Minneapolis	Other	1/9/2012
H000301939	7a	GLORIA JOHNSON TRUSTEES	5242 SIXTH STREET NE	Columbia Heights	Water Supply	2/14/2012
H000301943	7a	IAF C AND E LLC	2410 UNIVERSITY AVENUE	St. Paul	Other	3/8/2012
H000301949	7a	COLLEN LARSON ESTATE	6031 FOURTH STREET	Fridley	Water Supply	3/29/2012
H000302113	7a	1926 GRAND AVENUE LLC	2211 COUNTY ROAD C2 W	Roseville	Monitoring	6/12/2012
H000302203	7a	LITTLE CANADA GAS RE LLC	300 ROAD	Little Canada	Monitoring	2/2/2012
H000302320	7a	MN PCA, REMEDIATION DIVISION	2428 DELAWARE STREET SE	Minneapolis	Monitoring	3/15/2012
H000303021	7a	GAY CARPENTER	1746 FRY STREET	Falcon Heights	Water Supply	7/12/2012
H000303059	7a	U OF M, REGENTS SHOPS	1708 FOURTH STREET	Minneapolis	Other	3/27/2012
H000303510	7a	DENISE WALDON	1732 PINEWOOD DRIVE	Shoreview	Water Supply	5/15/2012
H000303537	7a	BETTY ELHOLM	1785 STANBRIDGE AVENUE	Roseville	Water Supply	7/31/2012
H000304126	7a	MURPHY WAREHOUSE	701 24TH AVENUE SE	Minneapolis	Other	5/17/2012
H000305480	7a	RITA M. CARLSON	124 HORIZON CIRCLE NE	Fridley	Water Supply	6/17/2012
H000305488	7a	MIKE MAURER	4559 WASHINGTON STREET NE	Columbia Heights	Water Supply	8/15/2012
H000305955	7a	HARSTAD CO.	7101 HIGHWAY 65 NE	Fridley	Monitoring	7/5/2012
H000305973	7a	LOWRY GROVE PARTNERSHIP, ATTN; BRIAN NELS	2501 LOWRY AVENUE NE	St. Anthony	Monitoring	8/23/2012
H000306259	7a	SHARON WALLACE	1859 STOWE AVENUE	Arden Hills	Water Supply	7/25/2012
UNK0498437	7a	MARK NELSON	2990 CLEVELAND AVENUE N	Roseville	Sealed	10/27/2011 15:25
UNK0498438	7a	MARK NELSON	2990 CLEVELAND AVENUE N	Roseville	Sealed	10/27/2011 15:25
UNK0501693	7a	BLAINE C. FYKSEN	5045 EASTWOOD ROAD	Mounds View	Sealed	4/12/2012 14:26

TABLE E-6
FY 2013 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		Sent letter FY 2013. No response.
	4a	Hermes	2935 Old Hwy 8	Roseville	6/16/2009	Active		Sampled June 24, 2013
249185	4a	Novotny	1706 Malvern St	Lauderdale		Unknown		Sent letter FY 2013. No response.
S00650	4b	CME		New Brighton	6/24/1984			No letter sent FY 2013.
239465	4b	Lennox				Active	256	No letter sent FY 2013.
234434	4b	Marquart		Arden Hills		Unknown		No letter sent FY 2013.
105271	4b	Nelson				Active	137	No letter sent FY 2013.
S00471	4b	R Komarek/Nelson-Miller Cons				Inactive		No letter sent FY 2013.
S00551	4b	Tamarack Care Temp			2/17/1982	Unknown		No letter sent FY 2013.
201192	4b					Unknown		No letter sent FY 2013.
234532	4b					Unknown		No letter sent FY 2013.
234537	4b					Unknown		No letter sent FY 2013.
234545	4b				PHASE I	Unknown		No letter sent FY 2013.
234658	4b				6/7/1982	Unknown		No letter sent FY 2013.



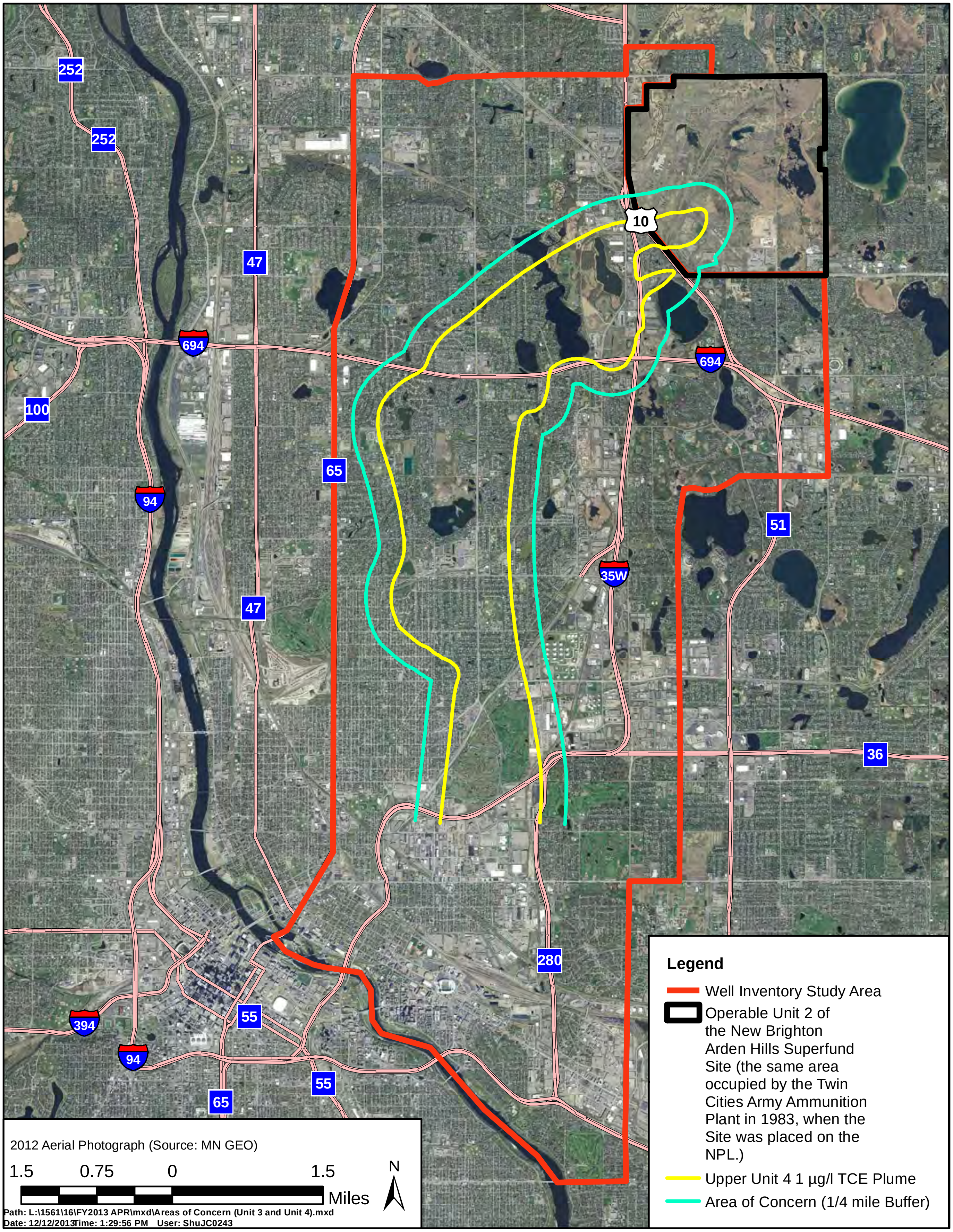
ANNUAL PERFORMANCE REPORT

Well Inventory Study Area

Wenck
Engineers - Scientists
Business Professionals
www.wenck.com
1800 Pioneer Creek Center
Maple Plain, MN 55359-0429
1-800-472-2232

FY 2013

Figure E-1



ANNUAL PERFORMANCE REPORT

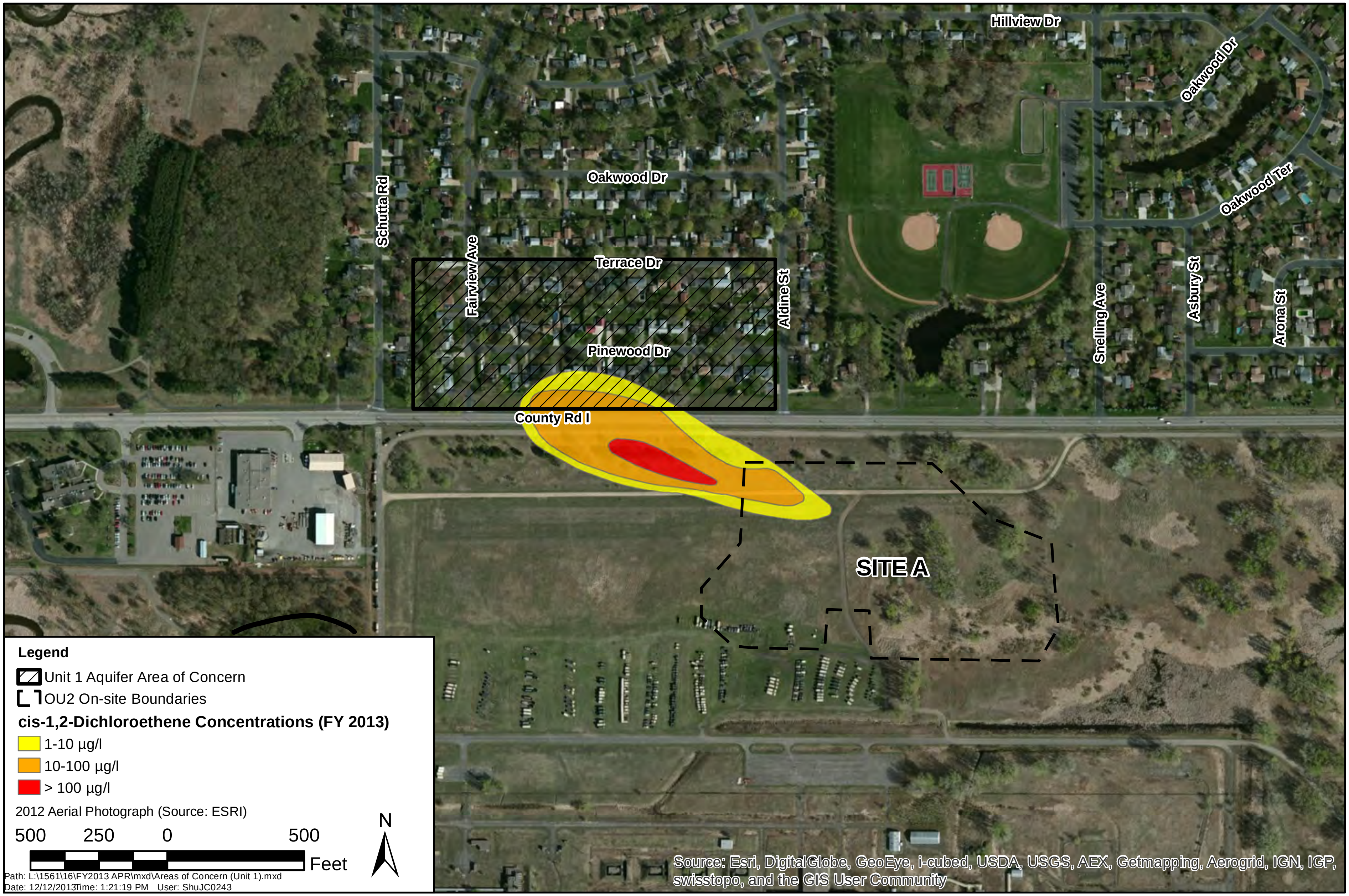
Areas of Concern (Unit 3 and Unit 4)

Engineers - Scientists
Business Professionals
www.wenck.com

Wenck
1800 Pioneer Creek Center
Maple Plain, MN 55359-0429
1-800-472-2232

FY 2013

Figure E-2



ANNUAL PERFORMANCE REPORT

Area of Concern (Unit 1)

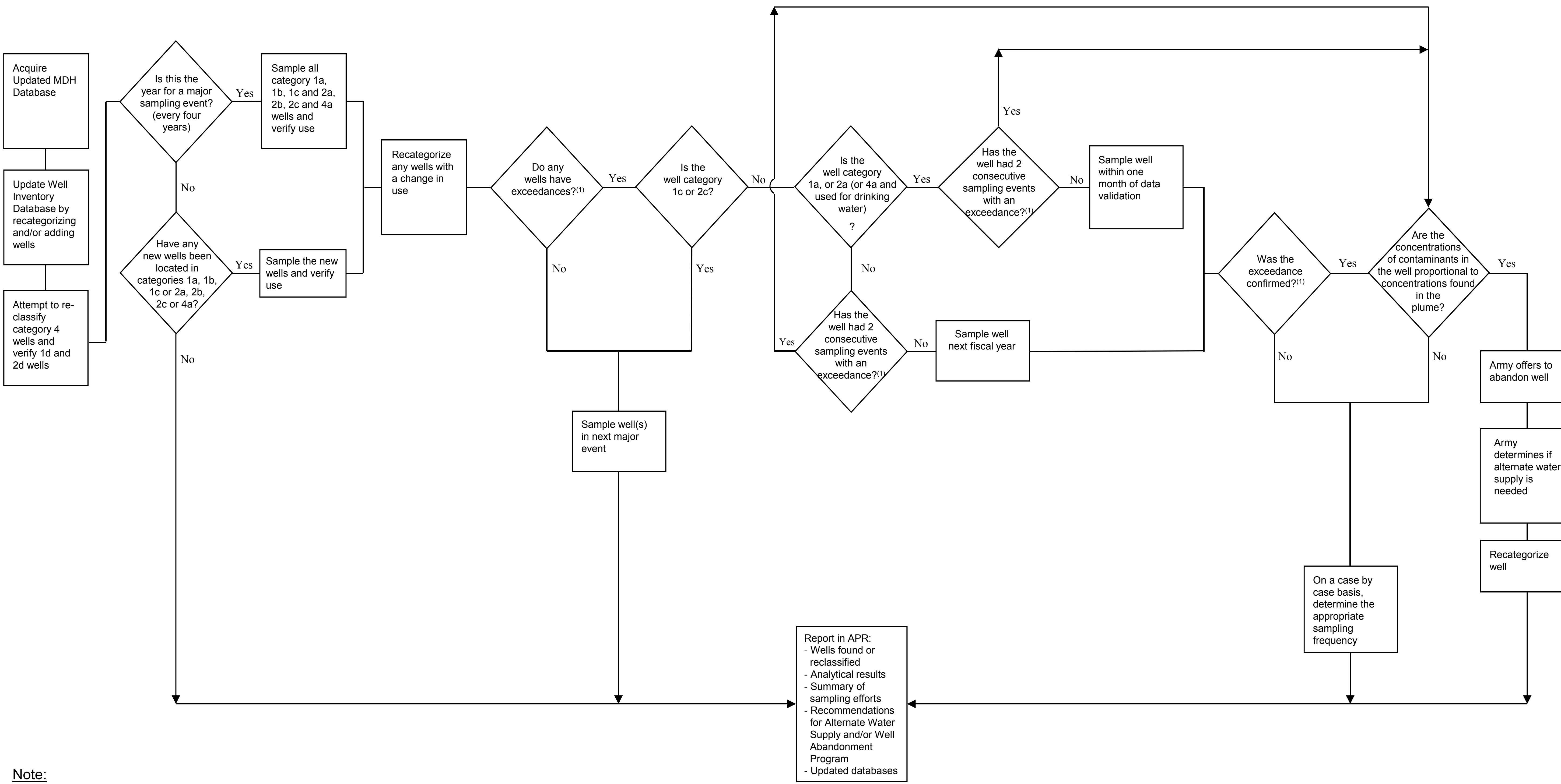
Wenck
Engineers - Scientists
Business Professionals
www.wenck.com
1800 Pioneer Creek Center
Maple Plain, MN 55359-0429
1-800-472-2232

FY 2013

Figure E-3

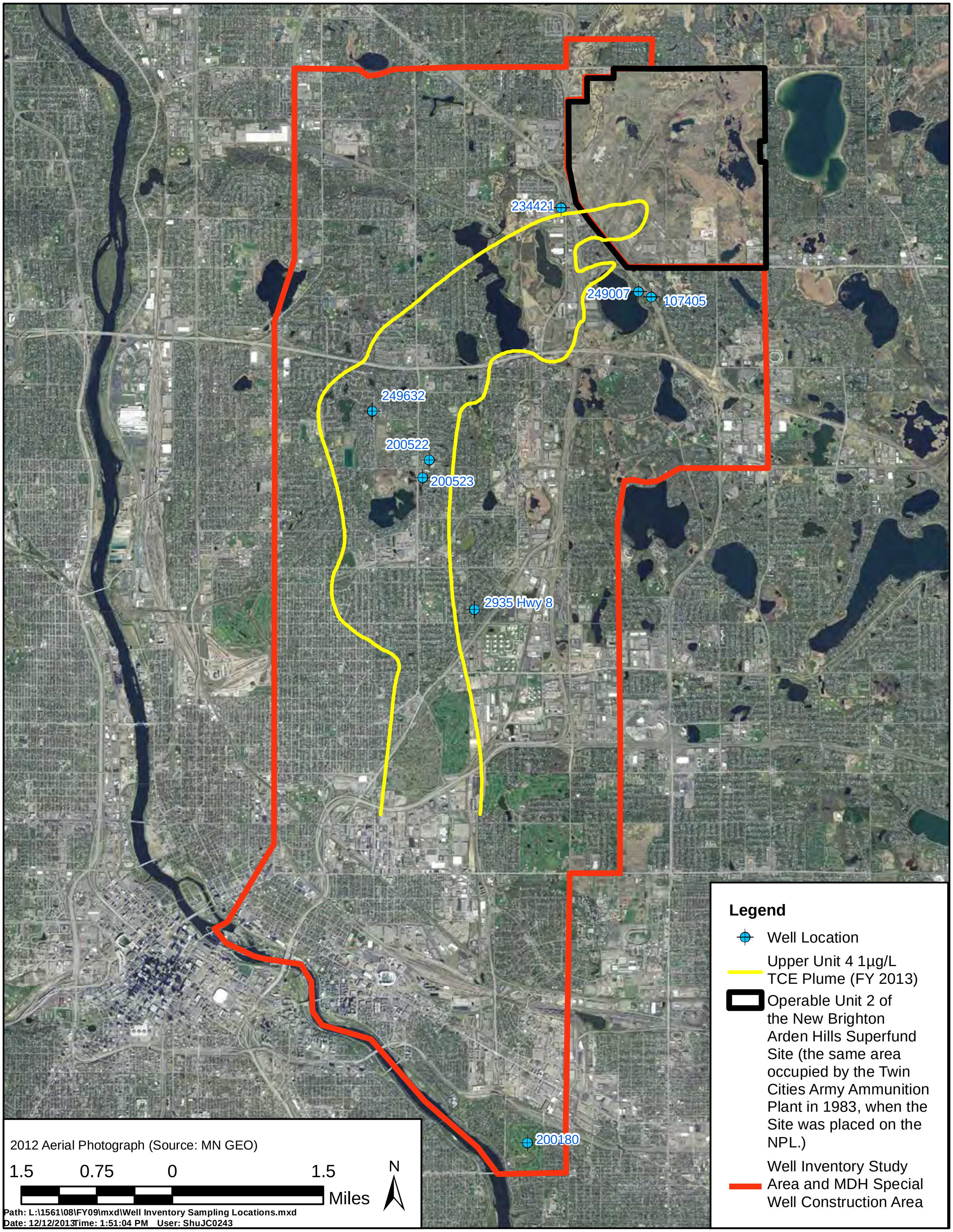
Figure E-4

Annual Requirements for Maintaining Well Inventory Database



Note:

(1) = Exceedance of a New Brighton/Arden Hills Superfund Site Groundwater Cleanup Level



ANNUAL PERFORMANCE REPORT

FY 2013 Well Inventory Sampling Locations

Wenck
Engineers - Scientists
Business Professionals
www.wenck.com
1800 Pioneer Creek Center
Maple Plain, MN 55359-0429
1-800-472-2232

FY 2013

Figure E-5

WELL INVENTORY DATABASE

The Well Inventory Database is located on
this CD in the following Microsoft Excel file:

Well Inventory Main Database FY 2013.xls

Appendix F

Site K and TGRS Operational Data

F.1 Inspection and Maintenance Activities, Fiscal Year 2013, Site K, OU2

APPENDIX F.1

INSPECTION AND MAINTENANCE ACTIVITIES
FISCAL YEAR 2013
SITE K, TCAAP
ARDEN HILLS, MINNESOTA

October 2012

1)	10/9/12 - Performed annual cleaning - system down. Packing media showed excessive wear.
2)	10/12/12 - Replacement media installed.
3)	10/19/12 - System down on low flow. Flow adjusted and restarted.
4)	10/22/12 - System down on low flow alarm. Did not restart system - will have Steve/Andy check. flow valve and flow nozzle in A.M.
5)	10/23/12 - Nozzle unplugged, system restarted.
6)	10/26/12 - Increased flow to approximately 9 gpm.

November 2012

1)	11/20/12 - Performed monthly O&M.
2)	11/30/12 - Replaced tower media.

December 2012

1)	12/4/12 - System off due to low water alarm. System reset.
2)	12/5/12 - System off due to low water alarm. System reset.
3)	12/7/12 - Adjusted influent flow to 13 gpm.
4)	12/10/12 - Adjusted flow rate to 13 gpm.
5)	12/11/12 - System off due to low water alarm, system reset / restarted.
6)	12/12/12 - Low building temp light on - system reset, adjusted flow rate to 13 gpm.
7)	12/17/12 - In suspense, system OK.
8)	12/18/12 - Adjusted influent flow to 12 gpm.
9)	12/19/12 - In suspense, system OK. Adjusted influent flow to 11 gpm.
10)	12/21/12 - In suspense, system OK.
11)	12/28/12 - Adjusted flow rate to 11 gpm.

January 2013

1)	1/4/13 - In suspense, system OK.
2)	1/9/13 - In suspense, system OK.
3)	1/10/13 - In suspense, system OK.
4)	1/14/13 - Monthly system inspection performed.
5)	1/21/13 - System down on Low Flow Alarm.
6)	1/24/13 - System down on Low Flow Alarm - cleared obstruction from nozzle.
7)	1/28/13 - System down on Low building temperature alarm - reset system , thermostat OK.

February 2013

1)	2/1/13 - System in suspense. Monthly system inspection performed. System cycled - ran on manual to observe influent rate (10.3 gpm); system reset.
2)	2/8/13 - High water light on, drained hose, system reset.
3)	2/12/13 - High water, opened hose.
4)	2/13/13 - High water.
5)	2/15/13 - System down on repairs to discharge piping.
6)	2/18/13 to 2/20/13 - System down on repairs to discharge piping and frost build-up on treatment system components.

APPENDIX F.1

INSPECTION AND MAINTENANCE ACTIVITIES
FISCAL YEAR 2013
SITE K, TCAAP
ARDEN HILLS, MINNESOTA

March 2013

1)	3/5/13 - System in suspense. Monthly system inspection performed.
2)	3/13/13 - System in suspense
3)	3/18/13 - Adjusted flow rate to 10 gpm.
4)	3/20/13 - System in suspense.
5)	3/21/13 - System in suspense.
6)	3/25/13 - System in suspense.
7)	3/27/13 - System in suspense.

April 2013

1)	04-02-13 - Increased flow to 10 gpm.
2)	04-08-13 - Collected effluent - resample metals, increased flow to 11 gpm.

May 2013

1)	05-08-13 - Performed monthly preventative maintenance.

June 2013

1)	6-25-13 - Decreased flow from 18.1 to 15.0 gpm.
2)	6-25-13 - Performed monthly inspection.

July 2013

1)	7-9-13 - Power failure transformer blown - partial power 2-phase only. Xcel called.
2)	7-10-13 - Xcel fixed blown circuit upstream but not near Site K - Xcel called again.
3)	7-11-13 - System up; downtime approximately 48 hours.
4)	7-25-13 - Monthly O & M.

August 2013

1)	8/20/13 - System shut down at 9:20 AM for annual maintenance.
2)	8/21/13 - System restarted at 12:30 PM.
3)	8/26/13 - System down on "low building temp" alarm - suspect partial power outage as cause.
4)	8/28/13 - Flow at 8.9 - increased to 15.0.
5)	8/29/13 - System down on low air flow - adjusted low set point to 18".

September 2013

1)	9/12/13 - Flow decreased from 15.5 to 10.3 gallons per minute

F.2 Maintenance Activities, Fiscal Year 2013, TGRS, OU2

APPENDIX F-2

MAINTENANCE ACTIVITIES
FISCAL YEAR 2013
TGRS, OU2
ARDEN HILLS, MINNESOTA

October 2012

10/11/2012	Pumphouse SC1; The locking hasp was pryed from the door frame. No harm was done to the forcemain piping or the control panel. Repaired and re-installed the locking hasp. Down time: None.
10/12/2012	Treatment System; Removed the back pressure sustaining pilot from ECV 4 and installed a re-built one from inventory. The re-built one leaks as well and will be re-built again later. Down time: B3 and B9 for 4.5 hours each and B6 for 2 hours.
10/16/2012	Treatment System; Installed a new seal kit in the ECV4 pilot. Re-installed the pilot on the control piping and observed normal operation. Down time: B3 for 3 hours and B9 for 3 hours.
10/16-17/2012	Treatment System; The blower motor for blower 3 has blown. Removed and replaced the old motor with a new motor from inventory. Turned B3 and B9 off and closed the influent valve to tower 3 to mitigate well field cycling. Down time: 27 hours at B3 and 27 hours at B9.
10/26/2012	Treatment System; There is a fault light illuminated on the B8, B11 sub I/O scanner module. Cycled power to the TGRS and the B8, B11 sub I/O scanner module reset itself. Down time: None.
10/29/2012	Pumphouse B13; Installed a re-built flow meter in line. Later comparison to a calibrated flow meter showed the re-built meter was totaling slower than it should. Cleaned and re-installed the previous flow meter and adjusted the flow total on the spreadsheet accordingly. Down time: None.
10/30/2012	Pumphouse B11; Turned the pump off and began monitoring the recovery portion of the B11 shutdown aquifer test. Down time: None.

November 2012

11/1-15/2012	Pumphouse B11; Turned the pump off to conduct the B11 shutdown aquifer response test. Down time: 358.5 hours.
11/5/2012	Pumphouses B1 and B13; Transient voltage blew the B1, B13 sub I/O scanner module in the PLC. Cycled power to the PLC and the scanner module reset. Observed normal operation of the two pumps in Auto mode. Down time: 7 hours at B1 and 8 hours at B13.

APPENDIX F-2

MAINTENANCE ACTIVITIES
FISCAL YEAR 2013
TGRS, OU2
ARDEN HILLS, MINNESOTA

11/5/2012	Treatment System; The autodialer does not respond to inputs. Cycled power to the autodialer and the autodialer reset. Observed normal operation. Down time: None.
11/7/2012	Pumphouse SC2; Removed, cleaned and re-installed the flow meter. Down time: None.
11/17/2012	Treatment System and Well Field; Turned the treatment system off to perform monthly preventive maintenance work. Down time: None.
11/22/2012	Treatment System and Well Field; The daily inspection was not performed due to the Thanksgiving holiday. The meter readings were estimated. Down time: None.
11/27/2012	Pumphouse B4; According to the PLC, the pump was on at the start of the daily inspection. At the pumphouse during the daily inspection, the pump was off. The pump started in "Hand" but not "Auto". Cycled power to the starter and controls and the pump started normally in "Auto". Down time: None.
11/28/2012	Treatment System; The fault light is lit on the B8/B11 sub I/O scanner control module. Cycled power to the treatment system and well field and the fault light did not re-light and all operation at B8 and B11 remained on. Down time: None.
11/29/2012	Treatment System; Performed repair and maintenance work on ECV 4. The valve now opens and closes properly. Down time: None.
11/29/2012	Pumphouse B11; The starter in the control panel was making a loud humming noise. Turned the pump off and cycled power to the starter. The starter re-started and sounded normal. Down time: None.

December 2012

12/4/2012	Treatment System; The B8/B11 sub I/O adapter module showed a fault. Cycled power to the TGRS and reset the fault on the module. Down time: None.
12/5-17/2012	Pumphouse B1; The flow meter stopped totaling. Replaced it with a new one. Readings are estimated. Down time: None.

APPENDIX F-2

MAINTENANCE ACTIVITIES
FISCAL YEAR 2013
TGRS, OU2
ARDEN HILLS, MINNESOTA

12/5/2012 Pumphouse B4; There is no power to the pumphouse. One of the three wires coming from the power pole is broken off where the power line enters the building. Contacted Xcel Energy and they fixed the wire. Re-started the pump and observed normal operation.
Down time: 10.5 hours.

12/14/2012 Pumphouse SC2; Performed maintenance work on the pump and well screen.
Down time: 82.5 hours.

12/17/2012 Pumphouse SC5; The light was flashing on the PLC. Reset the PLC and the light re-lit a normal steady glow. At the pumphouse, the pump was running normally.
Down time: 6.5 hours.

12/18/2012 Treatment System; ECV 4 will not close on command. Replaced the solenoid valve and portions of the control piping. Re-started pump 4 and ECV 4 operated normally.
Down time: B3 for 2 hours and B4 for for 2.5 hours.

12/19/2012 Treatment System and Well Field; Turned the TGRS off to troubleshoot Pump 3 not turning on in "Auto" mode. Identified the problem to be the pump 3 stop float in wet well 3.
Down time: B5 for 1 hour.

12/24/2012 Treatment System and Well Field; Turned the TGRS off to replace the pump 3 stop float. Replaced the stop float and pump 3 worked normally in the "Auto" mode.
Down time: 1.5 hours each at B1, B5, B6 and SC5.

12/26-27/2012 Treatment System and Well Field; Copper thieves cut down a power pole that fed power to the treatment system and well field. The treatment center and pumphouse electric heaters lost power. Drained the forcemain and each pumphouse's control piping. Xcel energy installed a new power pole and restored power to the site on 12/27/2012.
Down time: 11.5 hours at SC2; 13.5 hours at and SC1; 15.5 hours at B11; 17 hours at B4; 18 hours at B13; 19 hours at B1, B3, B6 and B8; 21 hours at B5 and SC5.

12/26-31/2012 Pumphouse B9; The power surge from the power line hitting the ground stopped the pump from running in "Auto". Troubleshooting found a blown power supply card. Replaced the power supply card with one from inventory and the pump restarted in "Auto".
Down time: 109 hours.

January 2013

1/1/2013 TGRS; No daily inspection not performed due to the New Years Day holiday. Meter readings were estimated.
Down time: None.

APPENDIX F-2

MAINTENANCE ACTIVITIES
FISCAL YEAR 2013
TGRS, OU2
ARDEN HILLS, MINNESOTA

1/4/2013	Pumphouse B11; The light was blinking on the PLC. Reset the PLC and the light relit steady. At the pumphouse the pump was running normally. Down time: 19 hours.
1/4/2013	Pumphouse B5; The water level is 21 feet above the pump inlet at 109.0 feet below the top of the casing. Down time: None.
1/5-6/2013	Pumphouse SC5; On January 5th, the forcemain pressure in the pumphouse was higher than normal and the ECV was partially closed which slowed the flow rate. Flushed the control piping and observed normal operation. On January 6th, observed the same issue. Removed and inspected portions of the control piping. The downstream port on the bottom side of the ECV was partially blocked with manganese. Removed and cleaned the piping at the downstream port of the ECV. Re-started the pump and observed normal ECV operation. Down time: 35 hours.
1/6/2013	Pumphouse B9; The ECV control piping was partially blocked with sand particles. Removed and cleaned out portions of the control piping. Re-started the pump and observed normal ECV operation. Down time: 2.5 hours.
1/18/2013	Pumphouse B1; The pump was unable to maintain the target flow rate. Replaced the pump and motor with new. Down time: 8.5 hours.
1/24/2013	Pumphouse B11; Turned the pump off to test the output rate of the pump in B1. The flow rate from the pump in B1 increased from 203 gpm to 225 gpm with B11 off. Down time: None.
1/29/2013	Pumphouse B11; Slowed the flow rate to the target rate. Down time: None.

February 2013

2/1/2013	Treatment System; Call out from Time Communications-TGRS fail. Upon arrival there was an opening fault at ECV4. Flushed the control piping, exercised the control piping opening and closing speed valves, reset the speed control valves and cycled the valve. Normal operation was observed. Down time: 2 hours at B1, B5, B8, B9 and B13. Three hours at B3.
2/7/2013	Pumphouse B11; Turned off the pump because it was no longer necessary for hydraulic containment as authorized by the EPA and the MPCA. Down time: None.

APPENDIX F-2

MAINTENANCE ACTIVITIES
FISCAL YEAR 2013
TGRS, OU2
ARDEN HILLS, MINNESOTA

2/18/2013	Pumphouse B3; The ECV will not open. Replaced the solenoid valve coil and body. Exercised the control piping valves, reset the speed control valves and flushed the control piping. Down time: None.
2/19/2013	Treatment System; The limit switch on ECV 3 was no longer working properly. Removed the old switch and installed a new limit switch from inventory. Cycled the valve and observed normal operation. Down time: None.
2/27-28/2013	Treatment System and Well Field; Vandals (copper thieves) cut down power poles to the west of Building 190 interrupting power to Building 116 and the treatment system. Xcel Energy repaired the power lines and power was restored to the treatment system. Re-started the TGRS and normal operation resumed. Down time: 33 hours at B1, B3, B4, B5, B6 and B9; 34 hours at SC5; 31 hours at SC2; 30 hours at B8 and 25 hours at SC1.

March 2013

3/1/2013	The chain on the National Guard gate was cut. Met Mary Lee of the National Guard and re-locked the gate with a new chain. Down time: None.
3/5/2013	Pumphouse B5; The pumping water level has drawn down to the pump inlet. Increased the pressure on the ECV and slowed the flow rate. Scheduled re-development of the well screen for April. Down time: None.
3/5/2013	Treatment System; ECV 3 will not close. Replaced portions of the control piping but the valve will still not close. Troubleshooting indicates the ECV will have to be rebuilt. Down time: None.
3/7/2013	Pumphouse B1; Performed maintenance work. Down time: 1 hour.
3/14/2013	Pumphouse SC2; Changed out the flow meter with a new one at 16:00. The old meter reading was 401200 and the new meter reading was 81485500. Down time: None.
3/17/2013	Treatment System; The PLC lights for B1 and B13 were off. The B1/B13 sub I/O scanner module showed a fault. Replaced the module with one from inventory and the wells re-started normally. Down time: B1 and B13 for 18.5 hours each.

APPENDIX F-2

MAINTENANCE ACTIVITIES
FISCAL YEAR 2013
TGRS, OU2
ARDEN HILLS, MINNESOTA

3/21/2013	Treatment System; The PLC lights for B1 and B13 were off again and the B1/B13 sub I/O scanner module again showed a fault. Again replaced the module with one from inventory and the wells re-started normally. Down Time: B1 and B13 for 10 hours each.

April 2013

4/4/2013	Treatment System; The opening speed control valve on the ECV 3 control piping was leaking. Replaced the valve with a new one from inventory. Down time: None.
4/5/2013	Treatment System; The drain port on ECV 1 was leaking. Installed a plug to stop the leak. Down time: None.
4/8-30/2013	Pumphouse SC5; Turned off the pump to re-develop the well. Completed the well re-development work and replaced the 20 hp pump with a 20 hp pump that produced more head. Upon start-up the flow rate was the same but the pressure was very high. The high pressure was due to an obstruction in the SC4/SC5 forcemain line between SC5 and the blow off valve. Jetted the forcemain line and backflushed the obstruction from the line. Down time: 249 hours.
4/9/2013	Pumphouse SC5; Replaced the cold water flow meter with a re-built one from inventory. Down time: None, the pump was already off for re-development.
4/11-20/2013	Pumphouse B5; Turned the pump off to re-develop the well. Down time: 222 hours.
4/12/2013	Treatment System and Well Field; Briefly turned the TGRS off to troubleshoot the SC4/SC5 forcemain line blockage. Troubleshooting work did not remove the blockage. Additional troubleshooting will be necessary. Down time: Down time has already been accounted for above.
4/16/2013	Pumphouses SC2 and SC5; The national guard gate was locked by others making access to the pumphouses not possible to obtain meter readings. Met Mary Lee (AHATS) at the gate and called Xcel Energy to resolve the lock problem. Meter readings were estimated. Down time: None.
4/17/2013	Pumphouses B3, B6 and B8; Decreased the ECV pressures and increased the flow rates to maximum. Down time: None.
4/17/2013	Pumphouse SC5; Increased the ECV pressure to decrease the amount of pressure on the SC4/SC5 forcemain pressure. Down time: None, already accounted for above.

APPENDIX F-2

MAINTENANCE ACTIVITIES
FISCAL YEAR 2013
TGRS, OU2
ARDEN HILLS, MINNESOTA

4/22-26/2013	Pumphouse B13; Turned the pump off to re-develop the well. Down time: 99 hours.
4/22/2013	Pumphouse B13; Replaced the cold water flow meter with a re-built one from inventory. Down time: None, already accounted for above.
4/22/2013	Treatment System; The upstream check valve on the ECV 3 control piping was not working. Removed and replaced the check valve and installed a blow off port on the ECV 3 pressure gauge. Down time: 1 hour at B4.
4/23/2013	Pumphouse B5; The light was not lit on the PLC. Reset the PLC but the light did not illuminate. At the pumphouse, turned off all power to the control cards and panel and then reset all switches. Re-started the pump and observed normal operation. Down time: 22 hours.
4/25-30/2013	Pumphouse B1; Turned the pump off to re-develop the well. Down time: 117 hours.

May 2013

5/1/2013	Pumphouse B1; The well was re-developed. Re-started the pump following re-development work and observed normal operation. Down time: 22 hours.
5/1/2013	Pumphouse B4; The pump was not running. Reset the PLC but the light remained off. At the pumphouse, reset the control panel and the pump re-started normally. Possibly a storm knocked out power to the pump. Down time: 17 hours.
5/1/2013	Pumphouse SC5; Turned the pump off to clean debris/build-up from the SC4/SC5 forcemain line. Used a jetting truck to remove the blockage from the forcemain line. Following removal of the blockage the pressure in the forcemain line decreased from an operating pressure of 176 psi to 30 psi. Down time: 8 hours.
5/7/2013	Pumphouse B13; Removed and cleaned the 3" ECV and associated control piping and re-assembled. Down time: 20 hours.

APPENDIX F-2

MAINTENANCE ACTIVITIES
FISCAL YEAR 2013
TGRS, OU2
ARDEN HILLS, MINNESOTA

5/16/2013	Treatment System; Upon entering Building 116 to perform the daily inspection, pump 3 was running and pump 4 was off. The well field began to cycle (extraction wells were turning off). Attempted to reset pump 4 by switching from auto to off and back to auto again but pump 4 again did not start. I turned pump 4 to hand and it started indicating a communication error. I read the input cards for the wet well 3 pump 4 on and off floats and noticed the pump 4 pump stop light was flickering indicating the float was failing. Removed and replaced the pump 4 pump stop float and reset the TGRS. The TGRS restarted normally. Down time: 1.5 hours each at B3, B6, B8 and B9.
5/22/2013	Pumphouse SC2; Removed, cleaned and replaced the SC2 flow meter. Down time: None.
5/28/2013	Pumphouses SC2 and SC5; Turned the pumps off so Xcel Energy/Donovan Construction could remove old power lines on the National Guard property. Re-started the pumps after they re-energized power and observed normal operation. Down time: 21 hours at SC2 and at SC5.
5/30/2013	Pumphouse SC5; The light was flashing on the PLC, probably related to last nights storm. Reset the PLC and SC5 re-started normally. Down time: 4 hours.
5/30/2013	Pumphouse SC1; Turned the pump off so Xcel Energy/Donovan Construction could remove old power lines. Restarted the pump after they re-energized power and observed normal operation. Down time: 0.5 hours

June 2013

6/6/2013	Pumphouses B1, B13, B3, B4, B5, B6, B8 and B9; Turned off the boundary wells so Xcel Energy could remove the old copper power lines from the power poles that the boundary well power lines run on. Down time: 8 hours at B1, B13, B3, B4, B5, B6, B8 and B9.
6/18/2013	Treatment System and Well Field; Turned the TGRS off to troubleshoot a slower airflow rate at tower 3. Replaced the demister pads in towers 3 and 4 and re-started the system. The airflow rate improved but additional work will be necessary. Down time: 2 hours at B1, B8 and SC5.
6/20/2013	Treatment System; Removed, cleaned and repaired the tower 3 airflow bank. Re-installed the airflow bank and the airflow rate improved significantly. Down time: None.
6/21/2013	Pumphouse SC5; The light was flashing on the PLC. Reset the PLC and SC5 relit normally. At the pumphouse, the pump was running normally. Down time: 8 hours.

APPENDIX F-2

MAINTENANCE ACTIVITIES
FISCAL YEAR 2013
TGRS, OU2
ARDEN HILLS, MINNESOTA

6/22/2013	Treatment System; Call out from Time Communications "TGRS Fail". At TCAAP, the PDU showed that the ECV for pump 4 failed to open. Flushed the control piping, exercised the opening and closing speed control valves and reset the opening speed control valve. Cycled the valve and observed normal operation. Down time: 1.5 hours at B1 and B8.
6/27-28/2013	Laughlin Electric on site to perform the annual electrical inspection. Down time: None.

July 2013

7/1/2013	Pumphouse SC1; There was no power at the pumphouse. Contacted Xcel and they informed me there were 2 blown fuses on a power pole near the old Lind electrical substation. They could not find a reason for the fuses to have blown. They replaced the fuses and the pump re-started normally. Down time: 19 hours.
7/8/2013	Treatment System and Well Field; Call out from Time Communications that the TGRS had failed. ECV 4 had failed to open 4 times. Exercised the control valves, flushed the control piping and reset the opening control speed valve. Cycled the valve three times and observed normal operation. Down time: 1.5 hours at B3 and B8.
7/13/2013	Pumphouse SC5; The light was flashing on the PLC. Reset the PLC and the light lit normally. Down time: 4 hours.
7/23/2013	Pumphouse SC5; The light was off on the PLC. At the pumphouse there was no power. Contacted Xcel and they replaced a blown fuse on the power pole near SC4. Down time: 3 hours.

August 2013

8/7/2013	Pumphouse SC5; The light was flashing on the well field panel. Reset the PLC and the light came back on. At the pumphouse, the pump was running normally. Down time: 16 hours.
8/14/2013	Pumphouse SC2; Removed the old flow meter and installed a new flow meter. Down time: None.

APPENDIX F-2

MAINTENANCE ACTIVITIES
FISCAL YEAR 2013
TGRS, OU2
ARDEN HILLS, MINNESOTA

8/15-29/2013	Pumphouses SC2 and SC5; Bolander was excavating and removing old steam pipe near the north side of Building 116 when they accidentally severed the communication cables between the PLC and the wells. Their electricians attempted to splice the cables but there was no continuity. New cable was ordered and pulled from the well houses to Building 116. The communication cables were connected and the pumps were turned to "Auto". Normal operation was observed. Down time: SC2 for 328 hours and SC5 for 332 hours.
8/19/2013	Pumphouses B3, B5, B6, B8 and B9; Increased their flow rates to maximum while SC2 and SC5 were off. Down time: None.
8/20-21/2013	Pumphouses SC2 and SC5; Bolander's electrician begins troubleshooting communication line breaks. A decision is reached to run two new wires (preferably without splices) from Building 116 to SC2 and SC5. When the backhoe severed the cables it likely stretched a portion of each of the cables to the point of disrepair. Down time: Already accounted for above.
8/21/2013	Treatment System and Well Field; Accidentally set the opening speed control valve on ECV 4 too slow causing the well field to cycle. Reset the opening speed control valve and ECV 4 opened normally. Down time: None.
8/25/2013	Treatment System and Well Field; Call from Time Communication that the TGRS had failed. At the site, found that one phase of power was out. Contacted Xcel Energy and they found a link open on the power pole across from Scherer Brothers Lumber. They repaired the problem and the TGRS was re-started. Everything came back on normal except B4. At the pumphouse, the phase monitor was tripped. Cycled the power and re-started the pump. The pump started normally. Down time: B1, B13 and B4 for 6 hours each. B6 for 2 hours and B9 for 3 hours.
8/29-31/2013	Pumphouses B8 and B9; Bolander was excavating and removing old steam pipe approximately 400 feet south of Building 116 when they accidentally severed the communication cables between the PLC and the well houses. Bolander had their electricians splice the cables together but the pumps would not operate in "Auto". The pumps were then operated in "Hand" while additional troubleshooting was completed. Down time: B9 for 26 hours.

September 2013

9/1-4/2013	Pumphouses B8, B9 and SC1; The pumps are running in "Hand" due to the severed communication lines approximately 400 feet south of Building 116. Bolander accidentally severed the communication lines on August 29th while excavating to remove underground steam pipe. Down time: None.

APPENDIX F-2

MAINTENANCE ACTIVITIES
FISCAL YEAR 2013
TGRS, OU2
ARDEN HILLS, MINNESOTA

9/4/2013	Pumphouse B8, B9 and SC1; Bolander's electrician (Laterneau) took apart and re-spliced the communication lines for B8/B11/SC1; B9/B10 and B7/B12. There are now two splice locations south of Building 116. Pumps B8, B9 and SC1 now operate in "Auto", however, the B8 and SC1 well field panel lights do not light. Additional troubleshooting is necessary. Down time: None.
9/10/2013	Treatment System and Well Field; Turned blowers 3 and 4 off to simulate a failure. The entire well field turned off except SC1. Further troubleshooting is necessary. Down time: None.
9/12-24/2013	Pumphouse SC1. Turned the pump off because there is a communication problem between the PLC and the pump. Additional troubleshooting is necessary. Down time: 278 hours.
9/12/2013	Pumphouse B4; The light was flashing on the well field panel. At the pumphouse, there was build-up blocking the solenoid valve so the ECV could not open and allow water to flow. Removed the blockage from the control piping and re-started the pump. Normal operation observed. Down time: 1.5 hours.
9/12/2013	Pumphouse SC1; Performed troubleshooting with Laughlin Electric to figure out the communication problem between SC1 and the PLC. Determined that the relay coil was stuck open. Replaced the relay but now insufficient power from the output card at B11. Additional troubleshooting is necessary. Down time: Already accounted for above.
9/13/2013	Pumphouse SC5; The light was on at the well field panel but the pump was off at the pumphouse. The remote I/O adapter communication light was off. At Building 116, the I/O scanner module was showing a fault. Turned the TGRS off and replaced the I/O scanner module with one from inventory. Re-started SC5 and normal operation resumed. Down time: 15 hours.
9/16/2013	Treatment System; The ARV for pump 4 in the treatment system was leaking water and the isolation valve to the ARV no longer operated. Removed and replaced the ARV piping. Also, acid washed the ARV and reinstalled it. Observed normal operation. Down time: 1.2 hours at B3.
9/17/2013	Treatment System and Well Field; Turned the TGRS off to perform maintenance on Towers 3 and 4. Down time: None.
9/19/2013	Pumphouse SC5; The light was flashing on the well field panel. Reset the PLC and the light came on steady. Down time: None.

APPENDIX F-2

MAINTENANCE ACTIVITIES
FISCAL YEAR 2013
TGRS, OU2
ARDEN HILLS, MINNESOTA

9/24/2013	Pumphouse SC1; The pump will not turn on in "Auto" and will not turn off when the high float in wet well 3 is activated. Laughlin Electric re-wired the output module in pumphouse B11 so that SC1 operates in "Auto" instead of B11 (B11 is now shut down as per the agencies). B11 will now operate in "Hand" for sampling purposes and SC1 now turns off when the high float in wet well 3 is activated. Down time: 1.5 hours at B3, B6 and B8.
9/25/2013	Pumphouse SC2; The light was flashing on the well field panel. Reset the PLC and the light came back on normally. Down time: 12 hours.
9/26/2013	Pumphouse SC5; The light was off on the well field panel in Building 116. Reset the PLC and the light came back on normally. Down time: None.
9/27/2013	Pumphouse SC2; The light was flashing on the well field panel. Reset the PLC and the light came back on normally. Down time: None.

F.3 Maintenance Activities by Location, Fiscal Year 2013, TGRS, OU2

APPENDIX F-3

MAINTENANCE ACTIVITIES BY LOCATION
FISCAL YEAR 2013
TGRS, OU2
ARDEN HILLS, MINNESOTA

PUMPHOUSE B1

11/5/2012	Pumphouses B1 and B13; Transient voltage blew the B1, B13 sub I/O scanner module in the PLC. Cycled power to the PLC and the scanner module reset. Observed normal operation of the two pumps in Auto mode. Down time: 7 hours at B1 and 8 hours at B13.
12/5-17/2012	Pumphouse B1; The flow meter stopped totaling. Replaced it with a new one. Readings are estimated. Down time: None.
12/24/2012	Treatment System and Well Field; Turned the TGRS off to replace the pump 3 stop float. Replaced the stop float and pump 3 worked normally in the "Auto" mode. Down time: 1.5 hours each at B1, B5, B6 and SC5.
12/26-27/2012	Treatment System and Well Field; Copper thieves cut down a power pole that fed power to the treatment system and well field. The treatment center and pumphouse electric heaters lost power. Drained the forcemain and each pumphouse's control piping. Xcel energy installed a new power pole and restored power to the site on 12/27/2012. Down time: 11.5 hours at SC2; 13.5 hours at and SC1; 15.5 hours at B11; 17 hours at B4; 18 hours at B13; 19 hours at B1, B3, B6 and B8; 21 hours at B5 and SC5.
1/18/2013	Pumphouse B1; The pump was unable to maintain the target flow rate. Replaced the pump and motor with new. Down time: 8.5 hours.
2/1/2013	Treatment System; Call out from Time Communications-TGRS fail. Upon arrival there was an opening fault at ECV4. Flushed the control piping, exercised the control piping opening and closing speed valves, reset the speed control valves and cycled the valve. Normal operation was observed. Down time: 2 hours at B1, B5, B8, B9 and B13. Three hours at B3.
2/27-28/2013	Treatment System and Well Field; Vandals (copper thieves) cut down power poles to the west of Building 190 interrupting power to Building 116 and the treatment system. Xcel Energy repaired the power lines and power was restored to the treatment system. Re-started the TGRS and normal operation resumed. Down time: 33 hours at B1, B13, B3, B4, B5, B6 and B9; 34 hours at SC5; 31 hours at SC2; 30 hours at B8 and 25 hours at SC1.
3/7/2013	Pumphouse B1; The upstream ECV control piping valve was leaking. Performed maintenance work on the ECV. Down time: 1 hour.

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MAINTENANCE ACTIVITIES BY LOCATION
FISCAL YEAR 2013
TGRS, OU2
ARDEN HILLS, MINNESOTA

3/17/2013	Treatment System; The PLC lights for B1 and B13 were off. The B1/B13 sub I/O scanner module showed a fault. Replaced the module with one from inventory and the wells re-started normally. Down time: B1 and B13 for 18.5 hours each.
3/21/2013	Treatment System; The PLC lights for B1 and B13 were off again and the B1/B13 sub I/O scanner module again showed a fault. Again replaced the module with one from inventory and the wells re-started normally. Down Time: B1 and B13 for 10 hours each.
4/25-30/2013	Pumphouse B1; Turned the pump off to re-develop the well. Down time: 117 hours.
5/1/2013	Pumphouse B1; The well was re-developed. Re-started the pump following re-development work and observed normal operation. Down time: 22 hours.
6/6/2013	Pumphouses B1, B13, B3, B4, B5, B6, B8 and B9; Turned off the boundary wells so Xcel Energy could remove the old copper power lines from the power poles that the boundary well power lines run on. Down time: 8 hours at B1, B13, B3, B4, B5, B6, B8 and B9.
6/18/2013	Treatment System and Well Field; Turned the TGRS off to troubleshoot a slower airflow rate at tower 3. Replaced the demister pads in towers 3 and 4 and re-started the system. The airflow rate improved but additional work will be necessary. Down time: 2 hours at B1, B8 and SC5.
6/22/2013	Treatment System; Call out from Time Communications "TGRS Fail". At TCAAP, the PDU showed that the ECV for pump 4 failed to open. Flushed the control piping, exercised the opening and closing speed control valves and reset the opening speed control valve. Cycled the valve and observed normal operation. Down time: 1.5 hours at B1 and B8.
8/25/2013	Treatment System and Well Field; Call from Time Communication that the TGRS had failed. At the site, found that one phase of power was out. Contacted Xcel Energy and they found a link open on the power pole across from Scherer Brothers Lumber. They repaired the problem and the TGRS was re-started. Everything came back on normal except B4. At the pumphouse, the phase monitor was tripped. Cycled the power and re-started the pump. The pump started normally. Down time: B1, B13 and B4 for 6 hours each. B6 for 2 hours and B9 for 3 hours.

PUMPHOUSE B3

10/12/2012	Treatment System; Removed the back pressure sustaining pilot from ECV 4 and installed a re-built one from inventory. The re-built one leaks as well and will be re-built again later. Down time: B3 and B9 for 4.5 hours each and B6 for 2 hours.

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MAINTENANCE ACTIVITIES BY LOCATION
FISCAL YEAR 2013
TGRS, OU2
ARDEN HILLS, MINNESOTA

10/16/2012	Treatment System; Installed a new seal kit in the ECV4 pilot. Re-installed the pilot on the control piping and observed normal operation. Down time: B3 for 3 hours and B9 for 3 hours.
10/16-17/2012	Treatment System; The blower motor for blower 3 has blown. Removed and replaced the old motor with a new motor from inventory. Turned B3 and B9 off and closed the influent valve to tower 3 to mitigate well field cycling. Down time: 27 hours at B3 and 27 hours at B9.
12/18/2012	Treatment System; ECV 4 will not close on command. Replaced the solenoid valve and portions of the control piping. Re-started pump 4 and ECV 4 operated normally. Down time: B3 for 2 hours and B4 for for 2.5 hours.
12/26-27/2012	Treatment System and Well Field; Copper thieves cut down a power pole that fed power to the treatment system and well field. The treatment center and pumphouse electric heaters lost power. Drained the forcemain and each pumphouse's control piping. Xcel energy installed a new power pole and restored power to the site on 12/27/2012. Down time: 11.5 hours at SC2; 13.5 hours at and SC1; 15.5 hours at B11; 17 hours at B4; 18 hours at B13; 19 hours at B1, B3, B6 and B8; 21 hours at B5 and SC5.
2/1/2013	Treatment System; Call out from Time Communications-TGRS fail. Upon arrival there was an opening fault at ECV4. Flushed the control piping, exercised the control piping opening and closing speed valves, reset the speed control valves and cycled the valve. Normal operation was observed. Down time: 2 hours at B1, B5, B8, B9 and B13. Three hours at B3.
2/18/2013	Pumphouse B3; The ECV will not open. Replaced the solenoid valve coil and body. Exercised the control piping valves, reset the speed control valves and flushed the control piping. Down time: None.
2/27-28/2013	Treatment System and Well Field; Vandals (copper thieves) cut down power poles to the west of Building 190 interrupting power to Building 116 and the treatment system. Xcel Energy repaired the power lines and power was restored to the treatment system. Re-started the TGRS and normal operation resumed. Down time: 33 hours at B1, B13, B3, B4, B5, B6 and B9; 34 hours at SC5; 31 hours at SC2; 30 hours at B8 and 25 hours at SC1.
4/17/2013	Pumphouses B3, B6 and B8; Decreased the ECV pressures and increased the flow rates to maximum. Down time: None.

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MAINTENANCE ACTIVITIES BY LOCATION
FISCAL YEAR 2013
TGRS, OU2
ARDEN HILLS, MINNESOTA

5/16/2013 Treatment System; Upon entering Building 116 to perform the daily inspection, pump 3 was running and pump 4 was off. The well field began to cycle (extraction wells were turning off). Attempted to reset pump 4 by switching from auto to off and back to auto again but pump 4 again did not start. I turned pump 4 to hand and it started indicating a communication error. I read the input cards for the wet well 3 pump 4 on and off floats and noticed the pump 4 pump stop light was flickering indicating the float was failing. Removed and replaced the pump 4 pump stop float and reset the TGRS. The TGRS restarted normally.
Down time: 1.5 hours each at B3, B6, B8 and B9.

6/6/2013 Pumphouses B1, B13, B3, B4, B5, B6, B8 and B9; Turned off the boundary wells so Xcel Energy could remove the old copper power lines from the power poles that the boundary well power lines run on.
Down time: 8 hours at B1, B13, B3, B4, B5, B6, B8 and B9.

7/8/2013 Treatment System and Well Field; Call out from Time Communications that the TGRS had failed. ECV 4 had failed to open 4 times. Exercised the control valves, flushed the control piping and reset the opening control speed valve. Cycled the valve three times and observed normal operation.
Down time: 1.5 hours at B3 and B8.

8/19/2013 Pumphouses B3, B5, B6, B8 and B9; Increased their flow rates to maximum while SC2 and SC5 were off.
Down time: None.

8/25/2013 Treatment System and Well Field; Call from Time Communication that the TGRS had failed. At the site, found that one phase of power was out. Contacted Xcel Energy and they found a link open on the power pole across from Scherer Brothers Lumber. They repaired the problem and the TGRS was re-started. Everything came back on normal except B4. At the pumphouse, the phase monitor was tripped. Cycled the power and re-started the pump. The pump started normally.
Down time: B1, B13 and B4 for 6 hours each. B6 for 2 hours and B9 for 3 hours.

9/24/2013 Pumphouse SC1; The pump will not turn on in "Auto" and will not turn off when the high float in wet well 3 is activated. Laughlin Electric re-wired the output module in pumphouse B11 so that SC1 operates in "Auto" instead of B11 (B11 is now shut down as per the agencies). B11 will now operate in "Hand" for sampling purposes and SC1 now turns off when the high float in wet well 3 is activated.
Down time: 1.5 hours at B3, B6 and B8.

PUMPHOUSE B4

11/27/2012 Pumphouse B4; According to the PLC, the pump was on at the start of the daily inspection. At the pumphouse during the daily inspection, the pump was off. The pump started in "Hand" but not "Auto". Cycled power to the starter and controls and the pump started normally in "Auto".
Down time: None.

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MAINTENANCE ACTIVITIES BY LOCATION
FISCAL YEAR 2013
TGRS, OU2
ARDEN HILLS, MINNESOTA

12/5/2012	Pumphouse B4; There is no power to the pumphouse. One of the three wires coming from the power pole is broken off where the power line enters the building. Contacted Xcel Energy and they fixed the wire. Re-started the pump and observed normal operation. Down time: 10.5 hours.
12/18/2012	Treatment System; ECV 4 will not close on command. Replaced the solenoid valve and portions of the control piping. Re-started pump 4 and ECV 4 operated normally. Down time: B3 for 2 hours and B4 for for 2.5 hours.
12/26-27/2012	Treatment System and Well Field; Copper thieves cut down a power pole that fed power to the treatment system and well field. The treatment center and pumphouse electric heaters lost power. Drained the forcemain and each pumphouse's control piping. Xcel energy installed a new power pole and restored power to the site on 12/27/2012. Down time: 11.5 hours at SC2; 13.5 hours at and SC1; 15.5 hours at B11; 17 hours at B4; 18 hours at B13; 19 hours at B1, B3, B6 and B8; 21 hours at B5 and SC5.
2/27-28/2013	Treatment System and Well Field; Vandals (copper thieves) cut down power poles to the west of Building 190 interrupting power to Building 116 and the treatment system. Xcel Energy repaired the power lines and power was restored to the treatment system. Re-started the TGRS and normal operation resumed. Down time: 33 hours at B1, B13, B3, B4, B5, B6 and B9; 34 hours at SC5; 31 hours at SC2; 30 hours at B8 and 25 hours at SC1.
4/22/2013	Treatment System; The upstream check valve on the ECV 3 control piping was not working. Removed and replaced the check valve and installed a blow off port on the ECV 3 pressure gauge. Down time: 1 hour at B4.
5/1/2013	Pumphouse B4; The pump was not running. Reset the PLC but the light remained off. At the pumphouse, reset the control panel and the pump re-started normally. Possibly a storm knocked out power to the pump. Down time: 17 hours.
6/6/2013	Pumphouses B1, B13, B3, B4, B5, B6, B8 and B9; Turned off the boundary wells so Xcel Energy could remove the old copper power lines from the power poles that the boundary well power lines run on. Down time: 8 hours at B1, B13, B3, B4, B5, B6, B8 and B9.
8/25/2013	Treatment System and Well Field; Call from Time Communication that the TGRS had failed. At the site, found that one phase of power was out. Contacted Xcel Energy and they found a link open on the power pole across from Scherer Brothers Lumber. They repaired the problem and the TGRS was re-started. Everything came back on normal except B4. At the pumphouse, the phase monitor was tripped. Cycled the power and re-started the pump. The pump started normally. Down time: B1, B13 and B4 for 6 hours each. B6 for 2 hours and B9 for 3 hours.

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MAINTENANCE ACTIVITIES BY LOCATION
FISCAL YEAR 2013
TGRS, OU2
ARDEN HILLS, MINNESOTA

9/12/2013	Pumphouse B4; The light was flashing on the well field panel. At the pumphouse, there was build-up blocking the solenoid valve so the ECV could not open and allow water to flow. Removed the blockage from the control piping and re-started the pump. Normal operation observed. Down time: 1.5 hours.

PUMPHOUSE B5

12/19/2012	Treatment System and Well Field; Turned the TGRS off to troubleshoot Pump 3 not turning on in "Auto" mode. Identified the problem to be the pump 3 stop float in wet well 3. Down time: B5 for 1 hour.
12/24/2012	Treatment System and Well Field; Turned the TGRS off to replace the pump 3 stop float. Replaced the stop float and pump 3 worked normally in the "Auto" mode. Down time: 1.5 hours each at B1, B5, B6 and SC5.
12/26-27/2012	Treatment System and Well Field; Copper thieves cut down a power pole that fed power to the treatment system and well field. The treatment center and pumphouse electric heaters lost power. Drained the forcemain and each pumphouse's control piping. Xcel energy installed a new power pole and restored power to the site on 12/27/2012. Down time: 11.5 hours at SC2; 13.5 hours at and SC1; 15.5 hours at B11; 17 hours at B4; 18 hours at B13; 19 hours at B1, B3, B6 and B8; 21 hours at B5 and SC5.
1/4/2013	Pumphouse B5; The water level is 21 feet above the pump inlet at 109.0 feet below the top of the casing. Down time: None.
2/1/2013	Treatment System; Call out from Time Communications-TGRS fail. Upon arrival there was an opening fault at ECV4. Flushed the control piping, exercised the control piping opening and closing speed valves, reset the speed control valves and cycled the valve. Normal operation was observed. Down time: 2 hours at B1, B5, B8, B9 and B13. Three hours at B3.
2/27-28/2013	Treatment System and Well Field; Vandals (copper thieves) cut down power poles to the west of Building 190 interrupting power to Building 116 and the treatment system. Xcel Energy repaired the power lines and power was restored to the treatment system. Re-started the TGRS and normal operation resumed. Down time: 33 hours at B1, B13, B3, B4, B5, B6 and B9; 34 hours at SC5; 31 hours at SC2; 30 hours at B8 and 25 hours at SC1.
3/5/2013	Pumphouse B5; The pumping water level has drawn down to the pump inlet. Increased the pressure on the ECV and slowed the flow rate. Scheduled re-development of the well screen for April. Down time: None.

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MAINTENANCE ACTIVITIES BY LOCATION
FISCAL YEAR 2013
TGRS, OU2
ARDEN HILLS, MINNESOTA

4/11-20/2013	Pumphouse B5; Turned the pump off to re-develop the well. Down time: 222 hours.
4/23/2013	Pumphouse B5; The light was not lit on the PLC. Reset the PLC but the light did not illuminate. At the pumphouse, turned off all power to the control cards and panel and then reset all switches. Re-started the pump and observed normal operation. Down time: 22 hours.
6/6/2013	Pumphouses B1, B13, B3, B4, B5, B6, B8 and B9; Turned off the boundary wells so Xcel Energy could remove the old copper power lines from the power poles that the boundary well power lines run on. Down time: 8 hours at B1, B13, B3, B4, B5, B6, B8 and B9.
8/19/2013	Pumphouses B3, B5, B6, B8 and B9; Increased their flow rates to maximum while SC2 and SC5 were off. Down time: None.
8/25/2013	Treatment System and Well Field; Call from Time Communication that the TGRS had failed. At the site, found that one phase of power was out. Contacted Xcel Energy and they found a link open on the power pole across from Scherer Brothers Lumber. They repaired the problem and the TGRS was re-started. Everything came back on normal except B4. At the pumphouse, the phase monitor was tripped. Cycled the power and re-started the pump. The pump started normally. Down time: B1, B13 and B4 for 6 hours each. B6 for 2 hours and B9 for 3 hours.

PUMPHOUSE B6

10/12/2012	Treatment System; Removed the back pressure sustaining pilot from ECV 4 and installed a re-built one from inventory. The re-built one leaks as well and will be re-built again later. Down time: B3 and B9 for 4.5 hours each and B6 for 2 hours.
12/24/2012	Treatment System and Well Field; Turned the TGRS off to replace the pump 3 stop float. Replaced the stop float and pump 3 worked normally in the "Auto" mode. Down time: 1.5 hours each at B1, B5, B6 and SC5.
12/26-27/2012	Treatment System and Well Field; Copper thieves cut down a power pole that fed power to the treatment system and well field. The treatment center and pumphouse electric heaters lost power. Drained the forcemain and each pumphouse's control piping. Xcel energy installed a new power pole and restored power to the site on 12/27/2012. Down time: 11.5 hours at SC2; 13.5 hours at and SC1; 15.5 hours at B11; 17 hours at B4; 18 hours at B13; 19 hours at B1, B3, B6 and B8; 21 hours at B5 and SC5.

APPENDIX F-3

MAINTENANCE ACTIVITIES BY LOCATION
FISCAL YEAR 2013
TGRS, OU2
ARDEN HILLS, MINNESOTA

2/27-28/2013	Treatment System and Well Field; Vandals (copper thieves) cut down power poles to the west of Building 190 interrupting power to Building 116 and the treatment system. Xcel Energy repaired the power lines and power was restored to the treatment system. Re-started the TGRS and normal operation resumed. Down time: 33 hours at B1, B13, B3, B4, B5, B6 and B9; 34 hours at SC5; 31 hours at SC2; 30 hours at B8 and 25 hours at SC1.
4/17/2013	Pumphouses B3, B6 and B8; Decreased the ECV pressures and increased the flow rates to maximum. Down time: None.
5/16/2013	Treatment System; Upon entering Building 116 to perform the daily inspection, pump 3 was running and pump 4 was off. The well field began to cycle (extraction wells were turning off). Attempted to reset pump 4 by switching from auto to off and back to auto again but pump 4 again did not start. I turned pump 4 to hand and it started indicating a communication error. I read the input cards for the wet well 3 pump 4 on and off floats and noticed the pump 4 pump stop light was flickering indicating the float was failing. Removed and replaced the pump 4 pump stop float and reset the TGRS. The TGRS restarted normally. Down time: 1.5 hours each at B3, B6, B8 and B9.
6/6/2013	Pumphouses B1, B13, B3, B4, B5, B6, B8 and B9; Turned off the boundary wells so Xcel Energy could remove the old copper power lines from the power poles that the boundary well power lines run on. Down time: 8 hours at B1, B13, B3, B4, B5, B6, B8 and B9.
8/19/2013	Pumphouses B3, B5, B6, B8 and B9; Increased their flow rates to maximum while SC2 and SC5 were off. Down time: None.
8/25/2013	Treatment System and Well Field; Call from Time Communication that the TGRS had failed. At the site, found that one phase of power was out. Contacted Xcel Energy and they found a link open on the power pole across from Scherer Brothers Lumber. They repaired the problem and the TGRS was re-started. Everything came back on normal except B4. At the pumphouse, the phase monitor was tripped. Cycled the power and re-started the pump. The pump started normally. Down time: B1, B13 and B4 for 6 hours each. B6 for 2 hours and B9 for 3 hours.
9/24/2013	Pumphouse SC1; The pump will not turn on in "Auto" and will not turn off when the high float in wet well 3 is activated. Laughlin Electric re-wired the output module in pumphouse B11 so that SC1 operates in "Auto" instead of B11 (B11 is now shut down as per the agencies). B11 will now operate in "Hand" for sampling purposes and SC1 now turns off when the high float in wet well 3 is activated. Down time: 1.5 hours at B3, B6 and B8.

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MAINTENANCE ACTIVITIES BY LOCATION
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TGRS, OU2
ARDEN HILLS, MINNESOTA

PUMPHOUSE B8

12/26-27/2012	Treatment System and Well Field; Copper thieves cut down a power pole that fed power to the treatment system and well field. The treatment center and pumphouse electric heaters lost power. Drained the forcemain and each pumphouse's control piping. Xcel energy installed a new power pole and restored power to the site on 12/27/2012. Down time: 11.5 hours at SC2; 13.5 hours at and SC1; 15.5 hours at B11; 17 hours at B4; 18 hours at B13; 19 hours at B1, B3, B6 and B8; 21 hours at B5 and SC5.
2/1/2013	Treatment System; Call out from Time Communications-TGRS fail. Upon arrival there was an opening fault at ECV4. Flushed the control piping, exercised the control piping opening and closing speed valves, reset the speed control valves and cycled the valve. Normal operation was observed. Down time: 2 hours at B1, B5, B8, B9 and B13. Three hours at B3.
2/27-28/2013	Treatment System and Well Field; Vandals (copper thieves) cut down power poles to the west of Building 190 interrupting power to Building 116 and the treatment system. Xcel Energy repaired the power lines and power was restored to the treatment system. Re-started the TGRS and normal operation resumed. Down time: 33 hours at B1, B13, B3, B4, B5, B6 and B9; 34 hours at SC5; 31 hours at SC2; 30 hours at B8 and 25 hours at SC1.
4/17/2013	Pumphouses B3, B6 and B8; Decreased the ECV pressures and increased the flow rates to maximum. Down time: None.
5/16/2013	Treatment System; Upon entering Building 116 to perform the daily inspection, pump 3 was running and pump 4 was off. The well field began to cycle (extraction wells were turning off). Attempted to reset pump 4 by switching from auto to off and back to auto again but pump 4 again did not start. I turned pump 4 to hand and it started indicating a communication error. I read the input cards for the wet well 3 pump 4 on and off floats and noticed the pump 4 pump stop light was flickering indicating the float was failing. Removed and replaced the pump 4 pump stop float and reset the TGRS. The TGRS restarted normally. Down time: 1.5 hours each at B3, B6, B8 and B9.
6/6/2013	Pumphouses B1, B13, B3, B4, B5, B6, B8 and B9; Turned off the boundary wells so Xcel Energy could remove the old copper power lines from the power poles that the boundary well power lines run on. Down time: 8 hours at B1, B13, B3, B4, B5, B6, B8 and B9.
6/18/2013	Treatment System and Well Field; Turned the TGRS off to troubleshoot a slower airflow rate at tower 3. Replaced the demister pads in towers 3 and 4 and re-started the system. The airflow rate improved but additional work will be necessary. Down time: 2 hours at B1, B8 and SC5.

APPENDIX F-3

MAINTENANCE ACTIVITIES BY LOCATION
FISCAL YEAR 2013
TGRS, OU2
ARDEN HILLS, MINNESOTA

6/22/2013	Treatment System; Call out from Time Communications "TGRS Fail". At TCAAP, the PDU showed that the ECV for pump 4 failed to open. Flushed the control piping, exercised the opening and closing speed control valves and reset the opening speed control valve. Cycled the valve and observed normal operation. Down time: 1.5 hours at B1 and B8.
7/8/2013	Treatment System and Well Field; Call out from Time Communications that the TGRS had failed. ECV 4 had failed to open 4 times. Exercised the control valves, flushed the control piping and reset the opening control speed valve. Cycled the valve three times and observed normal operation. Down time: 1.5 hours at B3 and B8.
8/19/2013	Pumphouses B3, B5, B6, B8 and B9; Increased their flow rates to maximum while SC2 and SC5 were off. Down time: None.
8/25/2013	Treatment System and Well Field; Call from Time Communication that the TGRS had failed. At the site, found that one phase of power was out. Contacted Xcel Energy and they found a link open on the power pole across from Scherer Brothers Lumber. They repaired the problem and the TGRS was re-started. Everything came back on normal except B4. At the pumphouse, the phase monitor was tripped. Cycled the power and re-started the pump. The pump started normally. Down time: B1, B13 and B4 for 6 hours each. B6 for 2 hours and B9 for 3 hours.
8/29-31/2013	Pumphouses B8 and B9; Bolander was excavating and removing old steam pipe approximately 400 feet south of Building 116 when they accidentally severed the communication cables between the PLC and the well houses. Bolander had their electricians splice the cables together but the pumps would not operate in "Auto". The pumps were then operated in "Hand" while additional troubleshooting was completed. Down time: B9 for 26 hours.
9/1-4/2013	Pumphouses B8, B9 and SC1; The pumps are running in "Hand" due to the severed communication lines approximately 400 feet south of Building 116. Bolander accidentally severed the communication lines on August 29th while excavating to remove underground steam pipe. Down time: None.
9/4/2013	Pumphouse B8, B9 and SC1; Bolander's electrician (Laterneau) took apart and re-spliced the communication lines for B8/B11/SC1; B9/B10 and B7/B12. There are now two splice locations south of Building 116. Pumps B8, B9 and SC1 now operate in "Auto", however, the B8 and SC1 well field panel lights do not light. Additional troubleshooting is necessary. Down time: None.

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9/24/2013	Pumphouse SC1; The pump will not turn on in "Auto" and will not turn off when the high float in wet well 3 is activated. Laughlin Electric re-wired the output module in pumphouse B11 so that SC1 operates in "Auto" instead of B11 (B11 is now shut down as per the agencies). B11 will now operate in "Hand" for sampling purposes and SC1 now turns off when the high float in wet well 3 is activated. Down time: 1.5 hours at B3, B6 and B8.

PUMPHOUSE B9

10/12/2012	Treatment System; Removed the back pressure sustaining pilot from ECV 4 and installed a re-built one from inventory. The re-built one leaks as well and will be re-built again later. Down time: B3 and B9 for 4.5 hours each and B6 for 2 hours.
10/16/2012	Treatment System; Installed a new seal kit in the ECV4 pilot. Re-installed the pilot on the control piping and observed normal operation. Down time: B3 for 3 hours and B9 for 3 hours.
10/16-17/2012	Treatment System; The blower motor for blower 3 has blown. Removed and replaced the old motor with a new motor from inventory. Turned B3 and B9 off and closed the influent valve to tower 3 to mitigate well field cycling. Down time: 27 hours at B3 and 27 hours at B9.
12/26-27/2012	Treatment System and Well Field; Copper thieves cut down a power pole that fed power to the treatment system and well field. The treatment center and pumphouse electric heaters lost power. Drained the forcemain and each pumphouse's control piping. Xcel energy installed a new power pole and restored power to the site on 12/27/2012. Down time: 11.5 hours at SC2; 13.5 hours at and SC1; 15.5 hours at B11; 17 hours at B4; 18 hours at B13; 19 hours at B1, B3, B6 and B8; 21 hours at B5 and SC5.
12/26-31/2012	Pumphouse B9; The power surge from the power line hitting the ground stopped the pump from running in "Auto". Troubleshooting found a blown power supply card. Replaced the power supply card with one from inventory and the pump restarted in "Auto". Down time: 109 hours.
1/6/2013	Pumphouse B9; The ECV control piping was partially blocked with sand particles. Removed and cleaned out portions of the control piping. Re-started the pump and observed normal ECV operation. Down time: 2.5 hours.
2/1/2013	Treatment System; Call out from Time Communications-TGRS fail. Upon arrival there was an opening fault at ECV4. Flushed the control piping, exercised the control piping opening and closing speed valves, reset the speed control valves and cycled the valve. Normal operation was observed. Down time: 2 hours at B1, B5, B8, B9 and B13. Three hours at B3.

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2/27-28/2013	Treatment System and Well Field; Vandals (copper thieves) cut down power poles to the west of Building 190 interrupting power to Building 116 and the treatment system. Xcel Energy repaired the power lines and power was restored to the treatment system. Re-started the TGRS and normal operation resumed. Down time: 33 hours at B1, B13, B3, B4, B5, B6 and B9; 34 hours at SC5; 31 hours at SC2; 30 hours at B8 and 25 hours at SC1.
5/16/2013	Treatment System; Upon entering Building 116 to perform the daily inspection, pump 3 was running and pump 4 was off. The well field began to cycle (extraction wells were turning off). Attempted to reset pump 4 by switching from auto to off and back to auto again but pump 4 again did not start. I turned pump 4 to hand and it started indicating a communication error. I read the input cards for the wet well 3 pump 4 on and off floats and noticed the pump 4 pump stop light was flickering indicating the float was failing. Removed and replaced the pump 4 pump stop float and reset the TGRS. The TGRS restarted normally. Down time: 1.5 hours each at B3, B6, B8 and B9.
6/6/2013	Pumphouses B1, B13, B3, B4, B5, B6, B8 and B9; Turned off the boundary wells so Xcel Energy could remove the old copper power lines from the power poles that the boundary well power lines run on. Down time: 8 hours at B1, B13, B3, B4, B5, B6, B8 and B9.
8/19/2013	Pumphouses B3, B5, B6, B8 and B9; Increased their flow rates to maximum while SC2 and SC5 were off. Down time: None.
8/25/2013	Treatment System and Well Field; Call from Time Communication that the TGRS had failed. At the site, found that one phase of power was out. Contacted Xcel Energy and they found a link open on the power pole across from Scherer Brothers Lumber. They repaired the problem and the TGRS was re-started. Everything came back on normal except B4. At the pumphouse, the phase monitor was tripped. Cycled the power and re-started the pump. The pump started normally. Down time: B1, B13 and B4 for 6 hours each. B6 for 2 hours and B9 for 3 hours.
8/29-31/2013	Pumphouses B8 and B9; Bolander was excavating and removing old steam pipe approximately 400 feet south of Building 116 when they accidentally severed the communication cables between the PLC and the well houses. Bolander had their electricians splice the cables together but the pumps would not operate in "Auto". The pumps were then operated in "Hand" while additional troubleshooting was completed. Down time: B9 for 26 hours.
9/1-4/2013	Pumphouses B8, B9 and SC1; The pumps are running in "Hand" due to the severed communication lines approximately 400 feet south of Building 116. Bolander accidentally severed the communication lines on August 29th while excavating to remove underground steam pipe. Down time: None.

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9/4/2013	Pumphouse B8, B9 and SC1; Bolander's electrician (Laterneau) took apart and re-spliced the communication lines for B8/B11/SC1; B9/B10 and B7/B12. There are now two splice locations south of Building 116. Pumps B8, B9 and SC1 now operate in "Auto", however, the B8 and SC1 well field panel lights do not light. Additional troubleshooting is necessary. Down time: None.

PUMPHOUSE B11

10/30/2012	Pumphouse B11; Turned the pump off and began monitoring the recovery portion of the B11 shutdown aquifer test. Down time: None.
11/1-15/2012	Pumphouse B11; Turned the pump off to conduct the B11 shutdown aquifer response test. Down time: 358.5 hours.
11/29/2012	Pumphouse B11; The starter in the control panel was making a loud humming noise. Turned the pump off and cycled power to the starter. The starter re-started and sounded normal. Down time: None.
12/26-27/2012	Treatment System and Well Field; Copper thieves cut down a power pole that fed power to the treatment system and well field. The treatment center and pumphouse electric heaters lost power. Drained the forcemain and each pumphouse's control piping. Xcel energy installed a new power pole and restored power to the site on 12/27/2012. Down time: 11.5 hours at SC2; 13.5 hours at and SC1; 15.5 hours at B11; 17 hours at B4; 18 hours at B13; 19 hours at B1, B3, B6 and B8; 21 hours at B5 and SC5.
1/4/2013	Pumphouse B11; The light was blinking on the PLC. Reset the PLC and the light relit steady. At the pumphouse the pump was running normally. Down time: 19 hours.
1/24/2013	Pumphouse B11; Turned the pump off to test the output rate of the pump in B1. The flow rate from the pump in B1 increased from 203 gpm to 225 gpm with B11 off. Down time: None.
1/29/2013	Pumphouse B11; Slowed the flow rate to the target rate. Down time: None.
2/7/2013	Pumphouse B11; Turned off the pump because it was no longer necessary for hydraulic containment as authorized by the EPA and the MPCA. Down time: None.

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PUMPHOUSE B13

10/29/2012	Pumphouse B13; Installed a re-built flow meter in line. Later comparison to a calibrated flow meter showed the re-built meter was totaling slower than it should. Cleaned and re-installed the previous flow meter and adjusted the flow total on the spreadsheet accordingly. Down time: None.
11/5/2012	Pumphouses B1 and B13; Transient voltage blew the B1, B13 sub I/O scanner module in the PLC. Cycled power to the PLC and the scanner module reset. Observed normal operation of the two pumps in Auto mode. Down time: 7 hours at B1 and 8 hours at B13.
12/26-27/2012	Treatment System and Well Field; Copper thieves cut down a power pole that fed power to the treatment system and well field. The treatment center and pumphouse electric heaters lost power. Drained the forcemain and each pumphouse's control piping. Xcel energy installed a new power pole and restored power to the site on 12/27/2012. Down time: 11.5 hours at SC2; 13.5 hours at and SC1; 15.5 hours at B11; 17 hours at B4; 18 hours at B13; 19 hours at B1, B3, B6 and B8; 21 hours at B5 and SC5.
2/1/2013	Treatment System; Call out from Time Communications-TGRS fail. Upon arrival there was an opening fault at ECV4. Flushed the control piping, exercised the control piping opening and closing speed valves, reset the speed control valves and cycled the valve. Normal operation was observed. Down time: 2 hours at B1, B5, B8, B9 and B13. Three hours at B3.
2/27-28/2013	Treatment System and Well Field; Vandals (copper thieves) cut down power poles to the west of Building 190 interrupting power to Building 116 and the treatment system. Xcel Energy repaired the power lines and power was restored to the treatment system. Re-started the TGRS and normal operation resumed. Down time: 33 hours at B1, B13, B3, B4, B5, B6 and B9; 34 hours at SC5; 31 hours at SC2; 30 hours at B8 and 25 hours at SC1.
3/17/2013	Treatment System; The PLC lights for B1 and B13 were off. The B1/B13 sub I/O scanner module showed a fault. Replaced the module with one from inventory and the wells re-started normally. Down time: B1 and B13 for 18.5 hours each.
3/21/2013	Treatment System; The PLC lights for B1 and B13 were off again and the B1/B13 sub I/O scanner module again showed a fault. Again replaced the module with one from inventory and the wells re-started normally. Down Time: B1 and B13 for 10 hours each.
4/22-26/2013	Pumphouse B13; Turned the pump off to re-develop the well. Down time: 99 hours.

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4/22/2013	Pumphouse B13; Replaced the cold water flow meter with a re-built one from inventory. Down time: None, already accounted for above.
5/7/2013	Pumphouse B13; Removed and cleaned the 3" ECV and associated control piping and re-assembled. Down time: 20 hours.
6/6/2013	Pumphouses B1, B13, B3, B4, B5, B6, B8 and B9; Turned off the boundary wells so Xcel Energy could remove the old copper power lines from the power poles that the boundary well power lines run on. Down time: 8 hours at B1, B13, B3, B4, B5, B6, B8 and B9.
8/25/2013	Treatment System and Well Field; Call from Time Communication that the TGRS had failed. At the site, found that one phase of power was out. Contacted Xcel Energy and they found a link open on the power pole across from Scherer Brothers Lumber. They repaired the problem and the TGRS was re-started. Everything came back on normal except B4. At the pumphouse, the phase monitor was tripped. Cycled the power and re-started the pump. The pump started normally. Down time: B1, B13 and B4 for 6 hours each. B6 for 2 hours and B9 for 3 hours.

PUMPHOUSE SC1

10/11/2012	Pumphouse SC1; The locking hasp was pryed from the door frame. No harm was done to the forcemain piping or the control panel. Repaired and re-installed the locking hasp. Down time: None.
12/26-27/2012	Treatment System and Well Field; Copper thieves cut down a power pole that fed power to the treatment system and well field. The treatment center and pumphouse electric heaters lost power. Drained the forcemain and each pumphouse's control piping. Xcel energy installed a new power pole and restored power to the site on 12/27/2012. Down time: 11.5 hours at SC2; 13.5 hours at and SC1; 15.5 hours at B11; 17 hours at B4; 18 hours at B13; 19 hours at B1, B3, B6 and B8; 21 hours at B5 and SC5.
2/27-28/2013	Treatment System and Well Field; Vandals (copper thieves) cut down power poles to the west of Building 190 interrupting power to Building 116 and the treatment system. Xcel Energy repaired the power lines and power was restored to the treatment system. Re-started the TGRS and normal operation resumed. Down time: 33 hours at B1, B13, B3, B4, B5, B6 and B9; 34 hours at SC5; 31 hours at SC2; 30 hours at B8 and 25 hours at SC1.
5/30/2013	Pumphouse SC1; Turned the pump off so Xcel Energy/Donovan Construction could remove old power lines. Restarted the pump after they re-energized power and observed normal operation. Down time: 0.5 hours

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7/1/2013	Pumphouse SC1; There was no power at the pumphouse. Contacted Xcel and they informed me there were 2 blown fuses on a power pole near the old Lind electrical substation. They could not find a reason for the fuses to have blown. They replaced the fuses and the pump re-started normally. Down time: 19 hours.
8/25/2013	Treatment System and Well Field; Call from Time Communication that the TGRS had failed. At the site, found that one phase of power was out. Contacted Xcel Energy and they found a link open on the power pole across from Scherer Brothers Lumber. They repaired the problem and the TGRS was re-started. Everything came back on normal except B4. At the pumphouse, the phase monitor was tripped. Cycled the power and re-started the pump. The pump started normally. Down time: B1, B13 and B4 for 6 hours each. B6 for 2 hours and B9 for 3 hours.
9/1-4/2013	Pumphouses B8, B9 and SC1; The pumps are running in "Hand" due to the severed communication lines approximately 400 feet south of Building 116. Bolander accidentally severed the communication lines on August 29th while excavating to remove underground steam pipe. Down time: None.
9/4/2013	Pumphouse B8, B9 and SC1; Bolander's electrician (Laterneau) took apart and re-spliced the communication lines for B8/B11/SC1; B9/B10 and B7/B12. There are now two splice locations south of Building 116. Pumps B8, B9 and SC1 now operate in "Auto", however, the B8 and SC1 well field panel lights do not light. Additional troubleshooting is necessary. Down time: None.
9/10/2013	Treatment System and Well Field; Turned blowers 3 and 4 off to simulate a failure. The entire well field turned off except SC1. Further troubleshooting is necessary. Down time: None.
9/12-24/2013	Pumphouse SC1; Turned the pump off because there is a communication problem between the PLC and the pump. Additional troubleshooting is necessary. Down time: 278 hours.
9/12/2013	Pumphouse SC1; Performed troubleshooting with Laughlin Electric to figure out the communication problem between SC1 and the PLC. Determined that the relay coil was stuck open. Replaced the relay but now insufficient power from the output card at B11. Additional troubleshooting is necessary. Down time: Already accounted for above.
9/24/2013	Pumphouse SC1; The pump will not turn on in "Auto" and will not turn off when the high float in wet well 3 is activated. Laughlin Electric re-wired the output module in pumphouse B11 so that SC1 operates in "Auto" instead of B11 (B11 is now shut down as per the agencies). B11 will now operate in "Hand" for sampling purposes and SC1 now turns off when the high float in wet well 3 is activated. Down time: 1.5 hours at B3, B6 and B8.

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PUMPHOUSE SC2

11/7/2012	Pumphouse SC2; Removed, cleaned and re-installed the flow meter. Down time: None.
12/14/2012	Pumphouse SC2; Performed maintenance work on the pump and well screen. Down time: 82.5 hours.
12/26-27/2012	Treatment System and Well Field; Copper thieves cut down a power pole that fed power to the treatment system and well field. The treatment center and pumphouse electric heaters lost power. Drained the forcemain and each pumphouse's control piping. Xcel energy installed a new power pole and restored power to the site on 12/27/2012. Down time: 11.5 hours at SC2; 13.5 hours at and SC1; 15.5 hours at B11; 17 hours at B4; 18 hours at B13; 19 hours at B1, B3, B6 and B8; 21 hours at B5 and SC5.
2/27-28/2013	Treatment System and Well Field; Vandals (copper thieves) cut down power poles to the west of Building 190 interrupting power to Building 116 and the treatment system. Xcel Energy repaired the power lines and power was restored to the treatment system. Re-started the TGRS and normal operation resumed. Down time: 33 hours at B1, B13, B3, B4, B5, B6 and B9; 34 hours at SC5; 31 hours at SC2; 30 hours at B8 and 25 hours at SC1.
3/14/2013	Pumphouse SC2; Changed out the flow meter with a new one at 16:00. The old meter reading was 401200 and the new meter reading was 81485500. Down time: None.
4/16/2013	Pumphouses SC2 and SC5; The national guard gate was locked by others making access to the pumphouses not possible to obtain meter readings. Met Mary Lee (AHATS) at the gate and called Xcel Energy to resolve the lock problem. Meter readings were estimated. Down time: None.
5/22/2013	Pumphouse SC2; Removed, cleaned and replaced the SC2 flow meter. Down time: None.
5/28/2013	Pumphouses SC2 and SC5; Turned the pumps off so Xcel Energy/Donovan Construction could remove old power lines on the National Guard property. Re-started the pumps after they re-energized power and observed normal operation. Down time: 21 hours at SC2 and at SC5.
8/14/2013	Pumphouse SC2; Removed the old flow meter and installed a new flow meter. Down time: None.

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8/15-29/2013	Pumphouses SC2 and SC5; Bolander was excavating and removing old steam pipe near the north side of Building 116 when they accidentally severed the communication cables between the PLC and the wells. Their electricians attempted to splice the cables but there was no continuity. New cable was ordered and pulled from the well houses to Building 116. The communication cables were connected and the pumps were turned to "Auto". Normal operation was observed. Down time: SC2 for 328 hours and SC5 for 332 hours.
8/20-21/2013	Pumphouses SC2 and SC5; Bolander's electrician begins troubleshooting communication line breaks. A decision is reached to run two new wires (preferably without splices) from Building 116 to SC2 and SC5. When the backhoe severed the cables it likely stretched a portion of each of the cables to the point of disrepair. Down time: Already accounted for above.
8/25/2013	Treatment System and Well Field; Call from Time Communication that the TGRS had failed. At the site, found that one phase of power was out. Contacted Xcel Energy and they found a link open on the power pole across from Scherer Brothers Lumber. They repaired the problem and the TGRS was re-started. Everything came back on normal except B4. At the pumphouse, the phase monitor was tripped. Cycled the power and re-started the pump. The pump started normally. Down time: B1, B13 and B4 for 6 hours each. B6 for 2 hours and B9 for 3 hours.
9/25/2013	Pumphouse SC2; The light was flashing on the well field panel. Reset the PLC and the light came back on normally. Down time: 12 hours.
9/27/2013	Pumphouse SC2; The light was flashing on the well field panel. Reset the PLC and the light came back on normally. Down time: None.

PUMPHOUSE SC5

12/17/2012	Pumphouse SC5; The light was flashing on the PLC. Reset the PLC and the light re-lit a normal steady glow. At the pumphouse, the pump was running normally. Down time: 6.5 hours.
12/24/2012	Treatment System and Well Field; Turned the TGRS off to replace the pump 3 stop float. Replaced the stop float and pump 3 worked normally in the "Auto" mode. Down time: 1.5 hours each at B1, B5, B6 and SC5.
12/26-27/2012	Treatment System and Well Field; Copper thieves cut down a power pole that fed power to the treatment system and well field. The treatment center and pumphouse electric heaters lost power. Drained the forcemain and each pumphouse's control piping. Xcel energy installed a new power pole and restored power to the site on 12/27/2012. Down time: 11.5 hours at SC2; 13.5 hours at and SC1; 15.5 hours at B11; 17 hours at B4; 18 hours at B13; 19 hours at B1, B3, B6 and B8; 21 hours at B5 and SC5.

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1/5-6/2013	Pumphouse SC5; On January 5th, the forcemain pressure in the pumphouse was higher than normal and the ECV was partially closed which slowed the flow rate. Flushed the control piping and observed normal operation. On January 6th, observed the same issue. Removed and inspected portions of the control piping. The downstream port on the bottom side of the ECV was partially blocked with manganese. Removed and cleaned the piping at the downstream port of the ECV. Re-started the pump and observed normal ECV operation. Down time: 35 hours.
2/27-28/2013	Treatment System and Well Field; Vandals (copper thieves) cut down power poles to the west of Building 190 interrupting power to Building 116 and the treatment system. Xcel Energy repaired the power lines and power was restored to the treatment system. Re-started the TGRS and normal operation resumed. Down time: 33 hours at B1, B13, B3, B4, B5, B6 and B9; 34 hours at SC5; 31 hours at SC2; 30 hours at B8 and 25 hours at SC1.
4/8-30/2013	Pumphouse SC5; Turned off the pump to re-develop the well. Completed the well re-development work and replaced the 20 hp pump with a 20 hp pump that produced more head. Upon start-up the flow rate was the same but the pressure was very high. The high pressure was due to an obstruction in the SC4/SC5 forcemain line between SC5 and the blow off valve. Jetted the forcemain line and backflushed the obstruction from the line. Down time: 249 hours.
4/9/2013	Pumphouse SC5; Replaced the cold water flow meter with a re-built one from inventory. Down time: None, the pump was already off for re-development.
4/16/2013	Pumphouses SC2 and SC5; The national guard gate was locked by others making access to the pumphouses not possible to obtain meter readings. Met Mary Lee (AHATS) at the gate and called Xcel Energy to resolve the lock problem. Meter readings were estimated. Down time: None.
4/17/2013	Pumphouse SC5; Increased the ECV pressure to decrease the amount of pressure on the SC4/SC5 forcemain pressure. Down time: None, already accounted for above.
5/1/2013	Pumphouse SC5; Turned the pump off to clean debris/build-up from the SC4/SC5 forcemain line. Used a jetting truck to remove the blockage from the forcemain line. Following removal of the blockage the pressure in the forcemain line decreased from an operating pressure of 176 psi to 30 psi. Down time: 8 hours.
5/28/2013	Pumphouses SC2 and SC5; Turned the pumps off so Xcel Energy/Donovan Construction could remove old power lines on the National Guard property. Re-started the pumps after they re-energized power and observed normal operation. Down time: 21 hours at SC2 and at SC5.

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5/30/2013	Pumphouse SC5; The light was flashing on the PLC, probably related to last nights storm. Reset the PLC and SC5 re-started normally. Down time: 4 hours.
6/18/2013	Treatment System and Well Field; Turned the TGRS off to troubleshoot a slower airflow rate at tower 3. Replaced the demister pads in towers 3 and 4 and re-started the system. The airflow rate improved but additional work will be necessary. Down time: 2 hours at B1, B8 and SC5.
6/21/2013	Pumphouse SC5; The light was flashing on the PLC. Reset the PLC and SC5 relit normally. At the pumphouse, the pump was running normally. Down time: 8 hours.
7/13/2013	Pumphouse SC5; The light was flashing on the PLC. Reset the PLC and the light lit normally. Down time: 4 hours.
7/23/2013	Pumphouse SC5; The light was off on the PLC. At the pumphouse there was no power. Contacted Xcel and they replaced a blown fuse on the power pole near SC4. Down time: 3 hours.
8/7/2013	Pumphouse SC5; The light was flashing on the well field panel. Reset the PLC and the light came back on. At the pumphouse, the pump was running normally. Down time: 16 hours.
8/15-29/2013	Pumphouses SC2 and SC5; Bolander was excavating and removing old steam pipe near the north side of Building 116 when they accidentally severed the communication cables between the PLC and the wells. Their electricians attempted to splice the cables but there was no continuity. New cable was ordered and pulled from the well houses to Building 116. The communication cables were connected and the pumps were turned to "Auto". Normal operation was observed. Down time: SC2 for 328 hours and SC5 for 332 hours.
8/20-21/2013	Pumphouses SC2 and SC5; Bolander's electrician begins troubleshooting communication line breaks. A decision is reached to run two new wires (preferably without splices) from Building 116 to SC2 and SC5. When the backhoe severed the cables it likely stretched a portion of each of the cables to the point of disrepair. Down time: Already accounted for above.
8/25/2013	Treatment System and Well Field; Call from Time Communication that the TGRS had failed. At the site, found that one phase of power was out. Contacted Xcel Energy and they found a link open on the power pole across from Scherer Brothers Lumber. They repaired the problem and the TGRS was re-started. Everything came back on normal except B4. At the pumphouse, the phase monitor was tripped. Cycled the power and re-started the pump. The pump started normally. Down time: B1, B13 and B4 for 6 hours each. B6 for 2 hours and B9 for 3 hours.

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9/13/2013	Pumphouse SC5; The light was on at the well field panel but the pump was off at the pumphouse. The remote I/O adapter communication light was off. At Building 116, the I/O scanner module was showing a fault. Turned the TGRS off and replaced the I/O scanner module with one from inventory. Re-started SC5 and normal operation resumed. Down time: 15 hours.
9/19/2013	Pumphouse SC5; The light was flashing on the well field panel. Reset the PLC and the light came on steady. Down time: None.
9/26/2013	Pumphouse SC5; The light was off on the well field panel in Building 116. Reset the PLC and the light came back on normally. Down time: None.

TREATMENT SYSTEM

10/12/2012	Treatment System; Removed the back pressure sustaining pilot from ECV 4 and installed a re-built one from inventory. The re-built one leaks as well and will be re-built again later. Down time: B3 and B9 for 4.5 hours each and B6 for 2 hours.
10/16/2012	Treatment System; Installed a new seal kit in the ECV4 pilot. Re-installed the pilot on the control piping and observed normal operation. Down time: B3 for 3 hours and B9 for 3 hours.
10/16-17/2012	Treatment System; The blower motor for blower 3 has blown. Removed and replaced the old motor with a new motor from inventory. Turned B3 and B9 off and closed the influent valve to tower 3 to mitigate well field cycling. Down time: 27 hours at B3 and 27 hours at B9.
10/26/2012	Treatment System; There is a fault light illuminated on the B8, B11 sub I/O scanner module. Cycled power to the TGRS and the B8, B11 sub I/O scanner module reset itself. Down time: None.
11/5/2012	Treatment System; The autodialer does not respond to inputs. Cycled power to the autodialer and the autodialer reset. Observed normal operation. Down time: None.
11/17/2012	Treatment System and Well Field; Turned the treatment system off to perform monthly preventive maintenance work. Down time: None.
11/22/2012	Treatment System and Well Field; The daily inspection was not performed due to the Thanksgiving holiday. The meter readings were estimated. Down time: None.

APPENDIX F-3

MAINTENANCE ACTIVITIES BY LOCATION
FISCAL YEAR 2013
TGRS, OU2
ARDEN HILLS, MINNESOTA

11/28/2012	Treatment System; The fault light is lit on the B8/B11 sub I/O scanner control module. Cycled power to the treatment system and well field and the fault light did not re-light and all operation at B8 and B11 remained on. Down time: None.
11/29/2012	Treatment System; Performed repair and maintenance work on ECV 4. The valve now opens and closes properly. Down time: None.
12/4/2012	Treatment System; The B8/B11 sub I/O adapter module showed a fault. Cycled power to the TGRS and reset the fault on the module. Down time: None.
12/18/2012	Treatment System; ECV 4 will not close on command. Replaced the solenoid valve and portions of the control piping. Re-started pump 4 and ECV 4 operated normally. Down time: B3 for 2 hours and B4 for for 2.5 hours.
12/19/2012	Treatment System and Well Field; Turned the TGRS off to troubleshoot Pump 3 not turning on in "Auto" mode. Identified the problem to be the pump 3 stop float in wet well 3. Down time: B5 for 1 hour.
12/24/2012	Treatment System and Well Field; Turned the TGRS off to replace the pump 3 stop float. Replaced the stop float and pump 3 worked normally in the "Auto" mode. Down time: 1.5 hours each at B1, B5, B6 and SC5.
12/26-27/2012	Treatment System and Well Field; Copper thieves cut down a power pole that fed power to the treatment system and well field. The treatment center and pumphouse electric heaters lost power. Drained the forcemain and each pumphouse's control piping. Xcel energy installed a new power pole and restored power to the site on 12/27/2012. Down time: 11.5 hours at SC2; 13.5 hours at and SC1; 15.5 hours at B11; 17 hours at B4; 18 hours at B13; 19 hours at B1, B3, B6 and B8; 21 hours at B5 and SC5.
1/1/2013	TGRS; The daily inspection was not performed due to the New Years Day holiday. Meter readings were estimated. Down time: None.
2/1/2013	Treatment System; Call out from Time Communications-TGRS fail. Upon arrival there was an opening fault at ECV4. Flushed the control piping, exercised the control piping opening and closing speed valves, reset the speed control valves and cycled the valve. Normal operation was observed. Down time: 2 hours at B1, B5, B8, B9 and B13. Three hours at B3.

APPENDIX F-3

MAINTENANCE ACTIVITIES BY LOCATION
FISCAL YEAR 2013
TGRS, OU2
ARDEN HILLS, MINNESOTA

2/19/2013	Treatment System; The limit switch on ECV 3 was no longer working properly. Removed the old switch and installed a new limit switch from inventory. Cycled the valve and observed normal operation. Down time: None.
2/27-28/2013	Treatment System and Well Field; Vandals (copper thieves) cut down power poles to the west of Building 190 interrupting power to Building 116 and the treatment system. Xcel Energy repaired the power lines and power was restored to the treatment system. Re-started the TGRS and normal operation resumed. Down time: 33 hours at B1, B13, B3, B4, B5, B6 and B9; 34 hours at SC5; 31 hours at SC2; 30 hours at B8 and 25 hours at SC1.
3/1/2013	The chain on the National Guard gate was cut. Met Mary Lee of the National Guard and re-locked the gate with a new chain. Down time: None.
3/5/2013	Treatment System; ECV 3 will not close. Replaced portions of the control piping but the valve will still not close. Troubleshooting indicates the ECV will have to be rebuilt. Down time: None.
3/17/2013	Treatment System; The PLC lights for B1 and B13 were off. The B1/B13 sub I/O scanner module showed a fault. Replaced the module with one from inventory and the wells re-started normally. Down time: B1 and B13 for 18.5 hours each.
3/21/2013	Treatment System; The PLC lights for B1 and B13 were off again and the B1/B13 sub I/O scanner module again showed a fault. Again replaced the module with one from inventory and the wells re-started normally. Down Time: B1 and B13 for 10 hours each.
4/4/2013	Treatment System; The opening speed control valve on the ECV 3 control piping was leaking. Replaced the valve with a new one from inventory. Down time: None.
4/5/2013	Treatment System; The drain port on ECV 1 was leaking. Installed a plug to stop the leak. Down time: None.
4/12/2013	Treatment System and Well Field; Briefly turned the TGRS off to troubleshoot the SC4/SC5 forcemain line blockage. Troubleshooting work did not remove the blockage. Additional troubleshooting will be necessary. Down time: Down time has already been accounted for above.
4/22/2013	Treatment System; The upstream check valve on the ECV 3 control piping was not working. Removed and replaced the check valve and installed a blow off port on the ECV 3 pressure gauge. Down time: 1 hour at B4.

APPENDIX F-3

MAINTENANCE ACTIVITIES BY LOCATION
FISCAL YEAR 2013
TGRS, OU2
ARDEN HILLS, MINNESOTA

5/16/2013	Treatment System; Upon entering Building 116 to perform the daily inspection, pump 3 was running and pump 4 was off. The well field began to cycle (extraction wells were turning off). Attempted to reset pump 4 by switching from auto to off and back to auto again but pump 4 again did not start. I turned pump 4 to hand and it started indicating a communication error. I read the input cards for the wet well 3 pump 4 on and off floats and noticed the pump 4 pump stop light was flickering indicating the float was failing. Removed and replaced the pump 4 pump stop float and reset the TGRS. The TGRS restarted normally. Down time: 1.5 hours each at B3, B6, B8 and B9.
6/18/2013	Treatment System and Well Field; Turned the TGRS off to troubleshoot a slower airflow rate at tower 3. Replaced the demister pads in towers 3 and 4 and re-started the system. The airflow rate improved but additional work will be necessary. Down time: 2 hours at B1, B8 and SC5.
6/20/2013	Treatment System; Removed, cleaned and repaired the tower 3 airflow bank. Re-installed the airflow bank and the airflow rate improved significantly. Down time: None.
6/22/2013	Treatment System; Call out from Time Communications "TGRS Fail". At TCAAP, the PDU showed that the ECV for pump 4 failed to open. Flushed the control piping, exercised the opening and closing speed control valves and reset the opening speed control valve. Cycled the valve and observed normal operation. Down time: 1.5 hours at B1 and B8.
6/27-28/2013	Laughlin Electric on site to perform the annual electrical inspection. Down time: None.
7/8/2013	Treatment System and Well Field; Call out from Time Communications that the TGRS had failed. ECV 4 had failed to open 4 times. Exercised the control valves, flushed the control piping and reset the opening control speed valve. Cycled the valve three times and observed normal operation. Down time: 1.5 hours at B3 and B8.
8/21/2013	Treatment System and Well Field; Accidentally set the opening speed control valve on ECV 4 too slow causing the well field to cycle. Reset the opening speed control valve and ECV 4 opened normally. Down time: None.
8/25/2013	Treatment System and Well Field; Call from Time Communication that the TGRS had failed. At the site, found that one phase of power was out. Contacted Xcel Energy and they found a link open on the power pole across from Scherer Brothers Lumber. They repaired the problem and the TGRS was re-started. Everything came back on normal except B4. At the pumphouse, the phase monitor was tripped. Cycled the power and re-started the pump. The pump started normally. Down time: B1, B13 and B4 for 6 hours each. B6 for 2 hours and B9 for 3 hours.

APPENDIX F-3

MAINTENANCE ACTIVITIES BY LOCATION
FISCAL YEAR 2013
TGRS, OU2
ARDEN HILLS, MINNESOTA

9/10/2013	Treatment System and Well Field; Turned blowers 3 and 4 off to simulate a failure. The entire well field turned off except SC1. Further troubleshooting is necessary. Down time: None.
9/12-24/2013	Pumphouse SC1; Turned the pump off because there is a communication problem between the PLC and the pump. Additional troubleshooting is necessary. Down time: 278 hours.
9/13/2013	Pumphouse SC5; The light was on at the well field panel but the pump was off at the pumphouse. The remote I/O adapter communication light was off. At Building 116, the I/O scanner module was showing a fault. Turned the TGRS off and replaced the I/O scanner module with one from inventory. Re-started SC5 and normal operation resumed. Down time: 15 hours.
9/16/2013	Treatment System; The ARV for pump 4 in the treatment system was leaking water and the isolation valve to the ARV no longer operated. Removed and replaced the ARV piping. Also, acid washed the ARV and reinstalled it. Observed normal operation. Down time: 1.2 hours at B3.
9/17/2013	Treatment System and Well Field; Turned the TGRS off to perform maintenance on blowers 3 and 4. Down time: None.

FORCEMAIN

4/8-30/2013	Pumphouse SC5; Turned off the pump to re-develop the well. Completed the well re-development work and replaced the 20 hp pump with a 20 hp pump that produced more head. Upon start-up the flow rate was the same but the pressure was very high. The high pressure was due to an obstruction in the SC4/SC5 forcemain line between SC5 and the blow off valve. Jetted the forcemain line and backflushed the obstruction from the line. Down time: 249 hours.
4/12/2013	Treatment System and Well Field; Briefly turned the TGRS off to troubleshoot the SC4/SC5 forcemain line blockage. Troubleshooting work did not remove the blockage. Additional troubleshooting will be necessary. Down time: Down time has already been accounted for above.
5/1/2013	Pumphouse SC5; Turned the pump off to clean debris/build-up from the SC4/SC5 forcemain line. Used a jetting truck to remove the blockage from the forcemain line. Following removal of the blockage the pressure in the forcemain line decreased from an operating pressure of 176 psi to 30 psi. Down time: 8 hours.

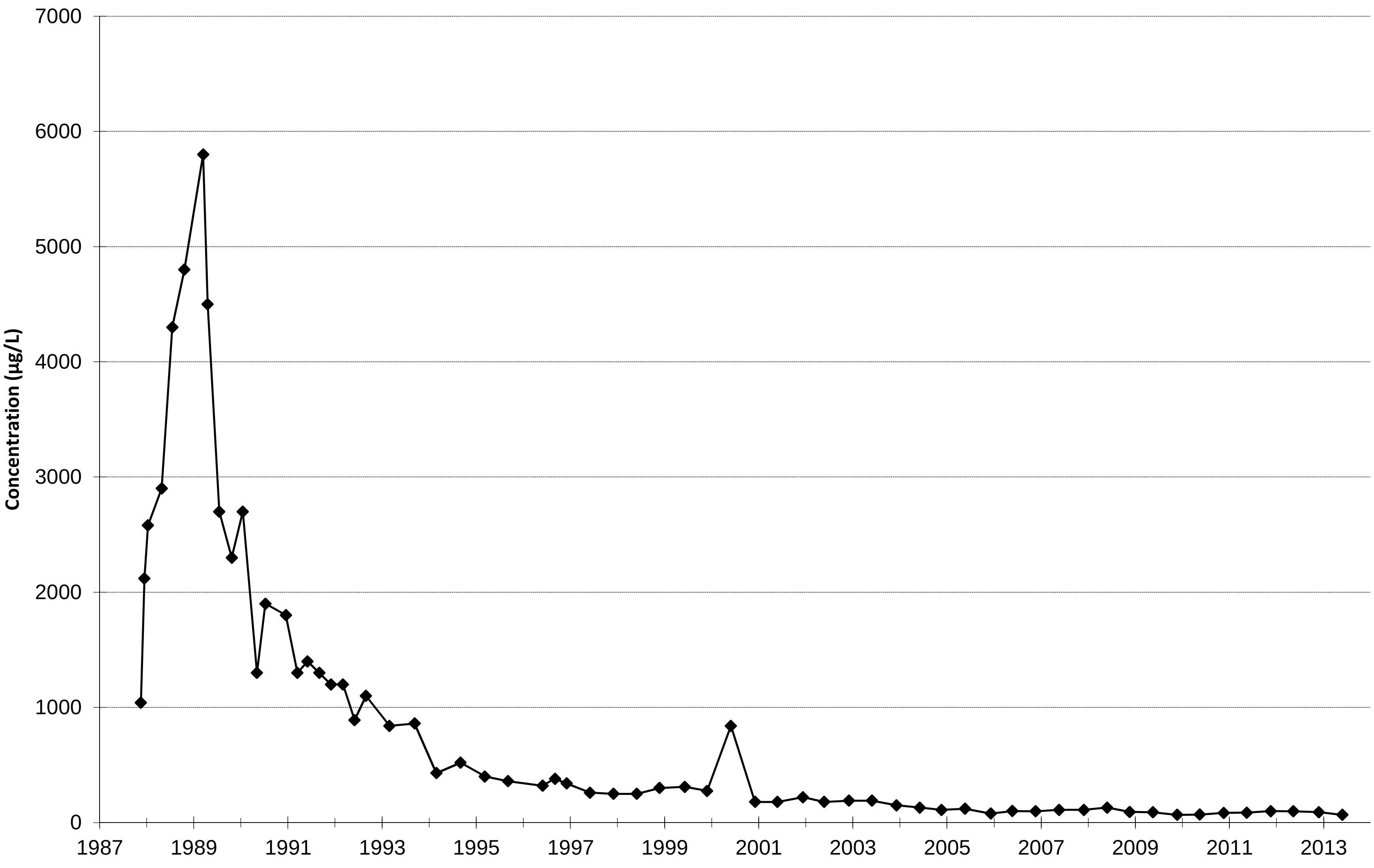
Appendix G

TGRS Chemical Data

G.1 TGRS Extraction Wells – TRCLE vs. Time

APPENDIX G-1

EXTRACTION WELL B1 - TRCLE VS.TIME

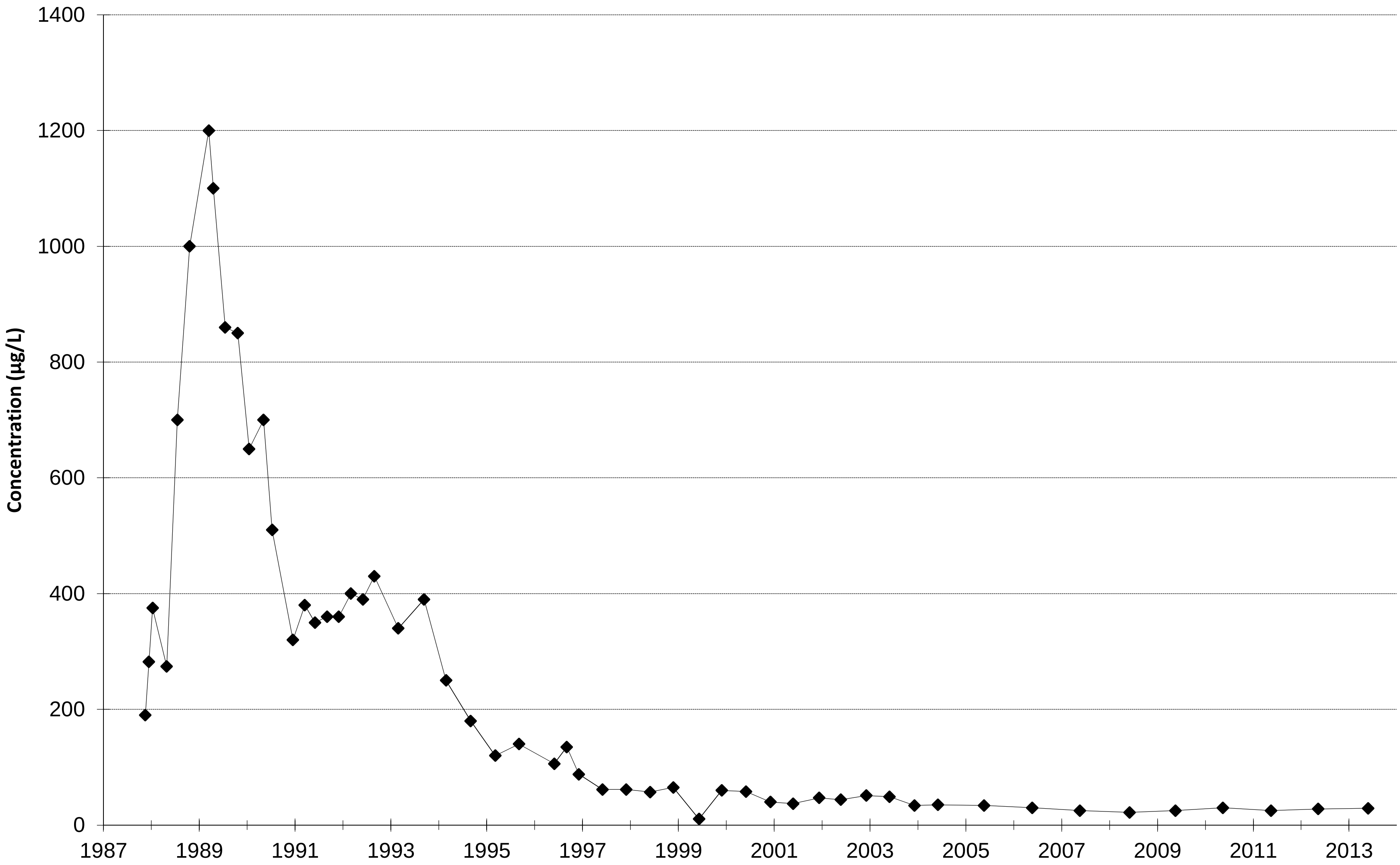


Note: Samples reporting concentrations less than the detection limit were plotted as zero.

CRA 083145 (1)

APPENDIX G-1

EXTRACTION WELL B2 - TRCLE VS. TIME

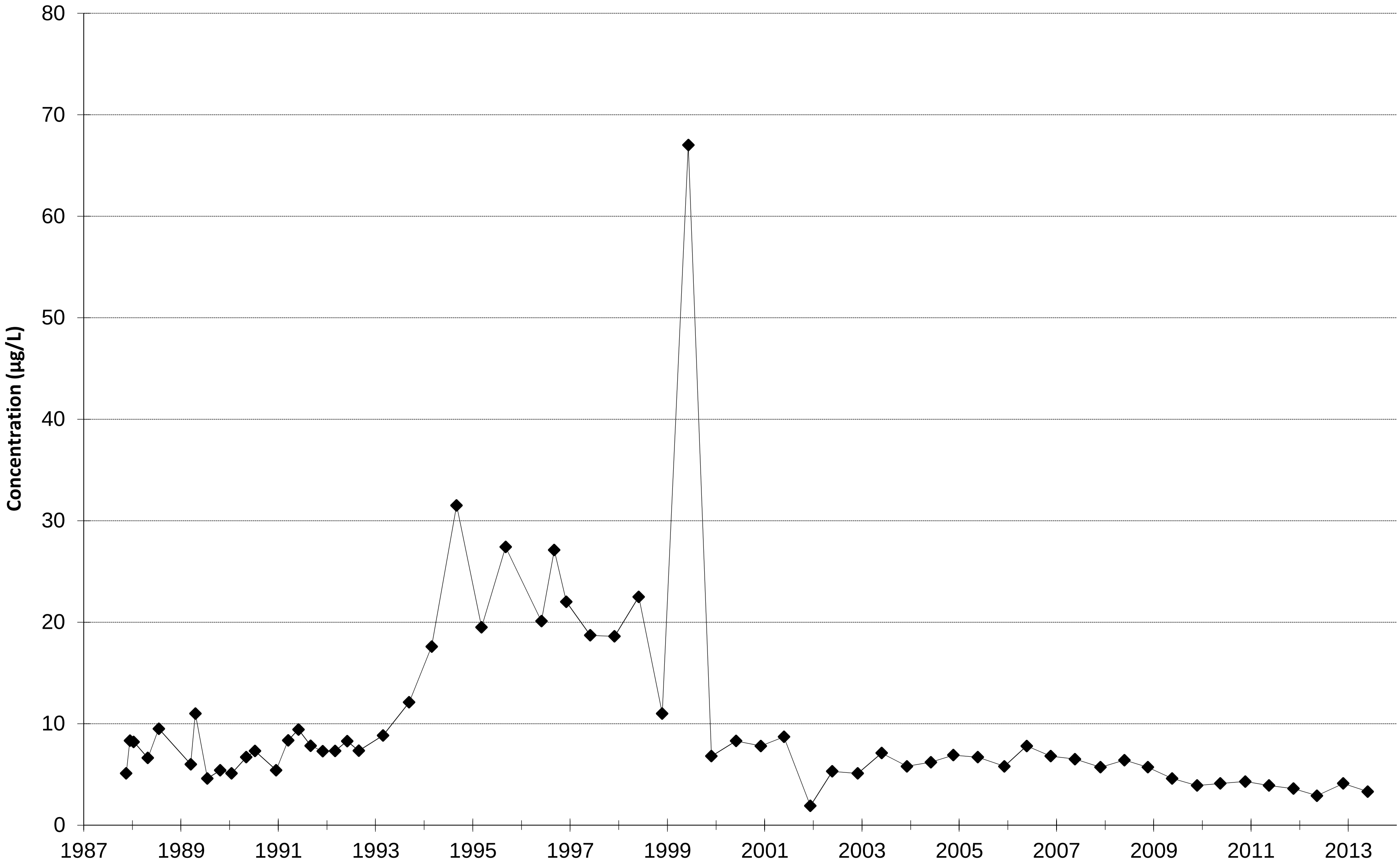


Note: Samples reporting concentrations less than the detection limit were plotted as zero.

CRA 083145 (1)

APPENDIX G-1

EXTRACTION WELL B3 - TRCLE VS. TIME

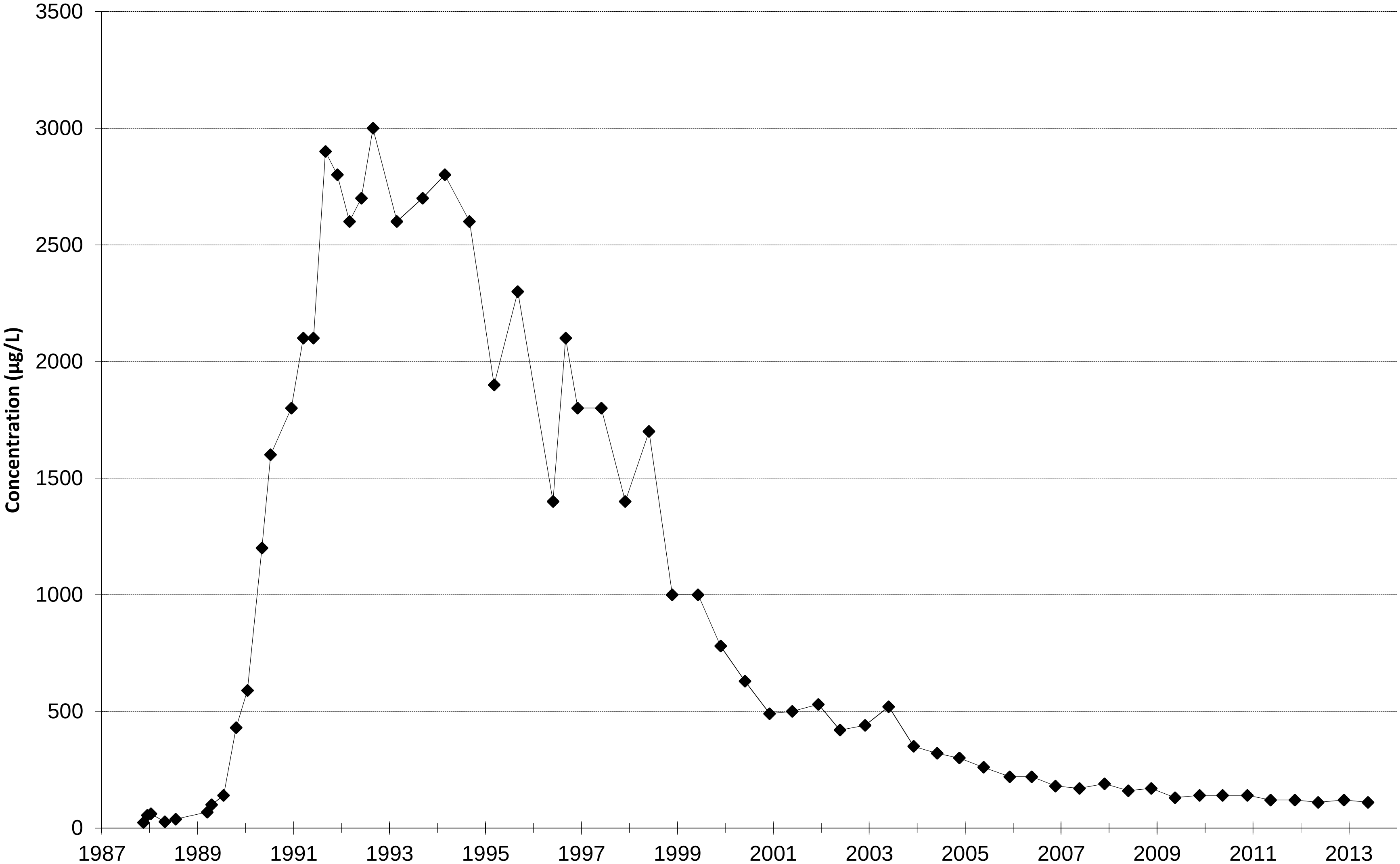


Note: Samples reporting concentrations less than the detection limit were plotted as zero.

CRA 083145 (1)

APPENDIX G-1

EXTRACTION WELL B4 - TRCLE VS. TIME

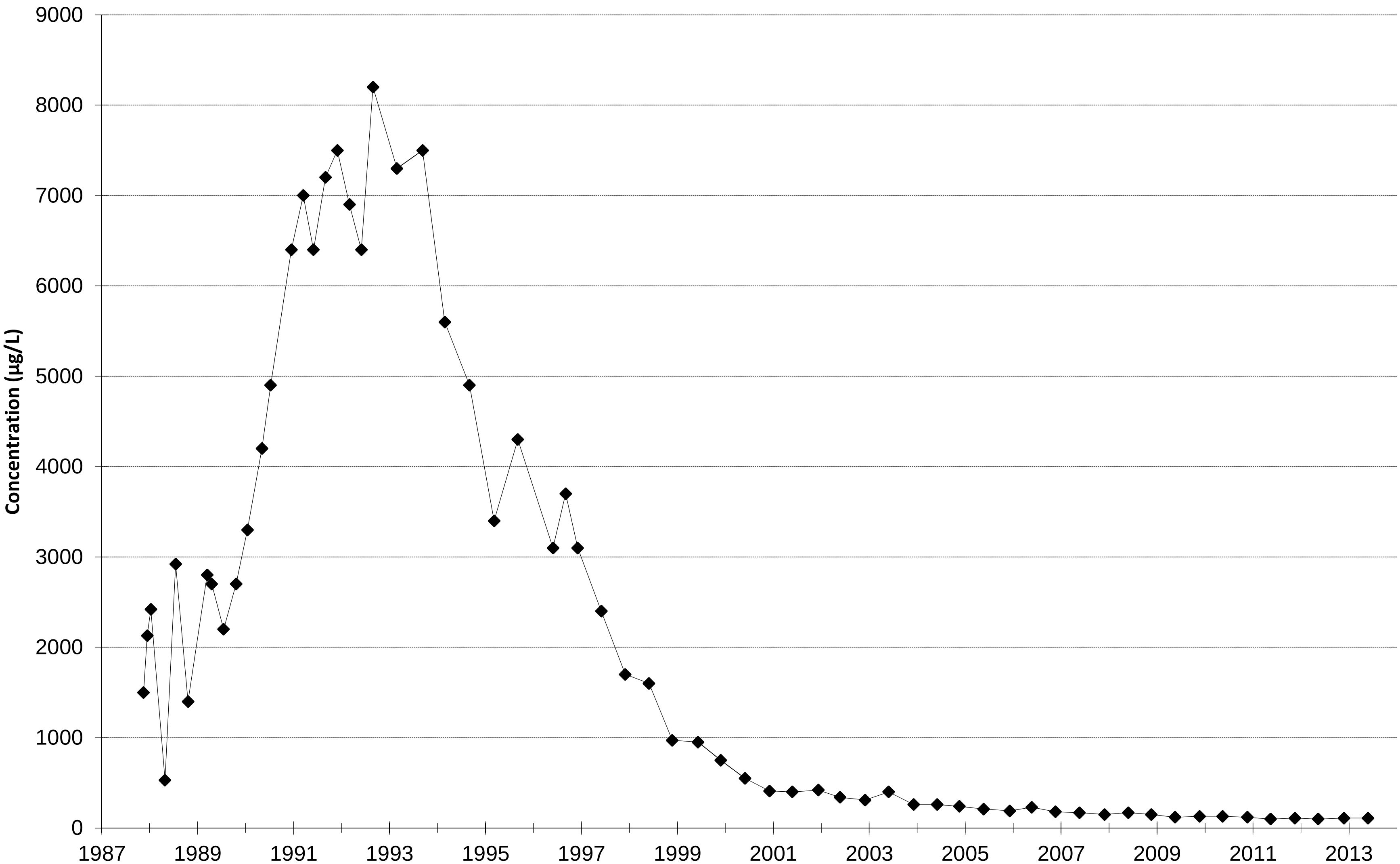


Note: Samples reporting concentrations less than the detection limit were plotted as zero.

CRA 083145 (1)

APPENDIX G-1

EXTRACTION WELL B5 - TRCLE VS. TIME

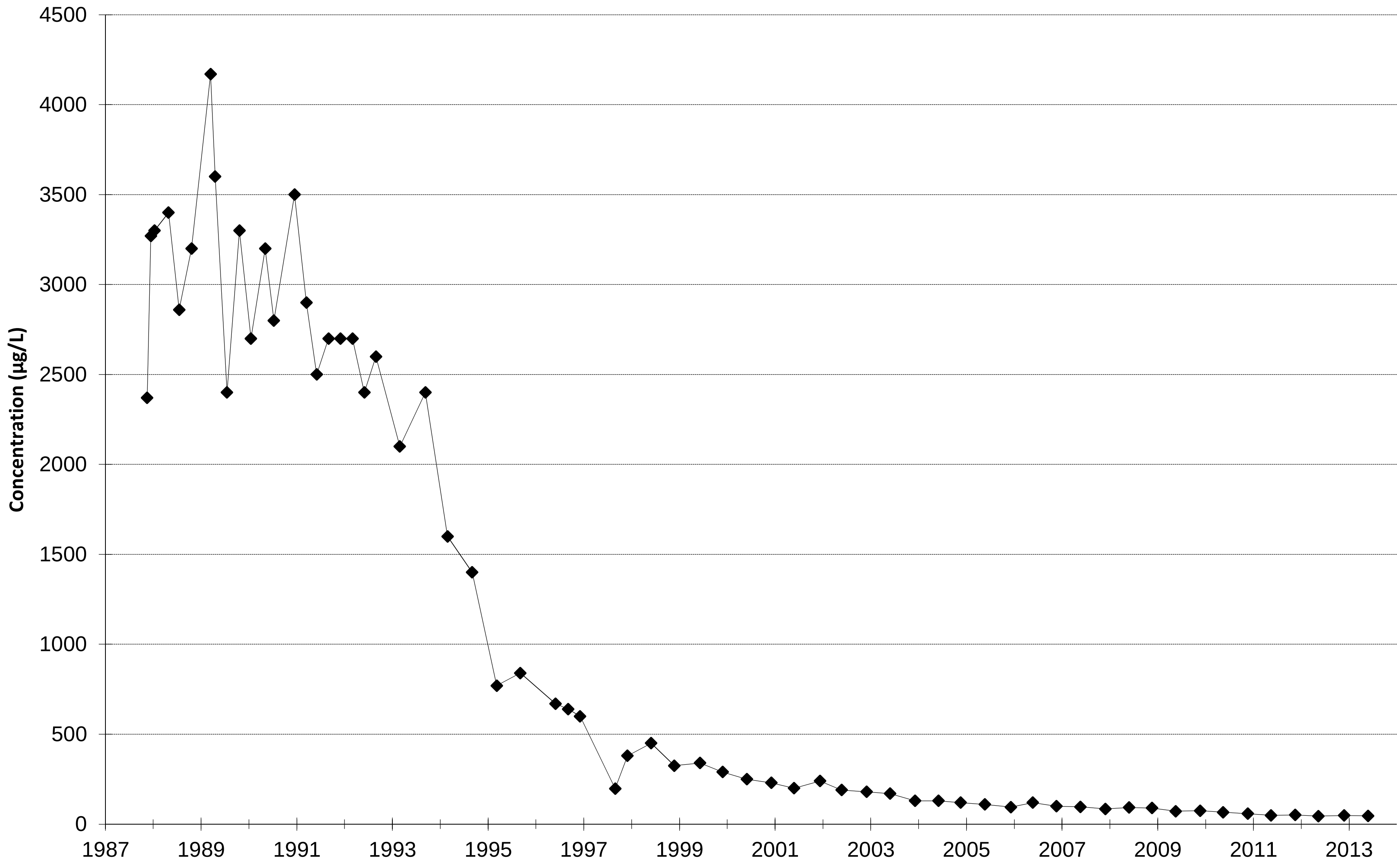


Note: Samples reporting concentrations less than the detection limit were plotted as zero.

CRA 083145 (1)

APPENDIX G-1

EXTRACTION WELL B6 - TRCLE VS. TIME

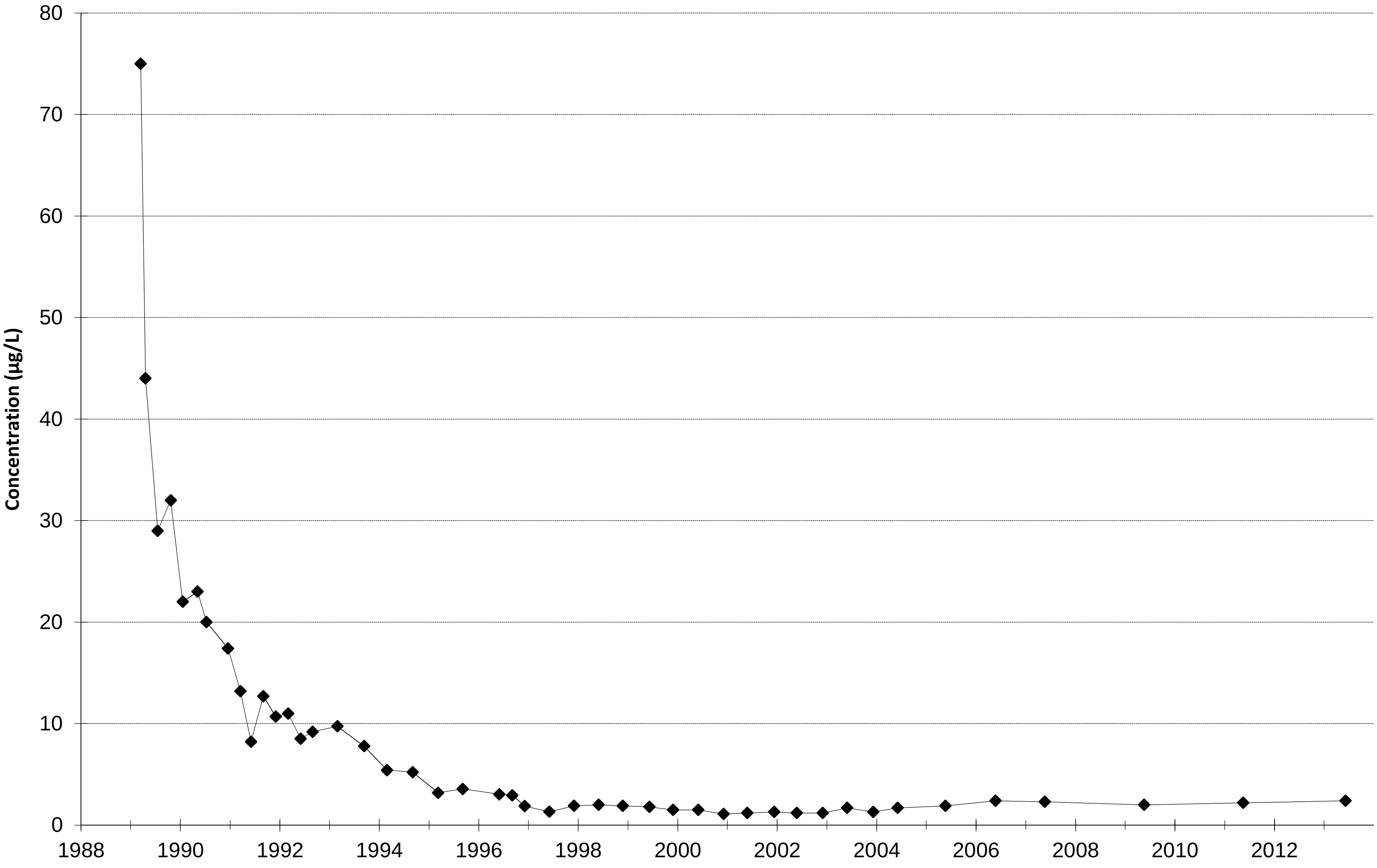


Note: Samples reporting concentrations less than the detection limit were plotted as zero.

CRA 083145 (1)

APPENDIX G-1

EXTRACTION WELL B7 - TRCLE VS. TIME

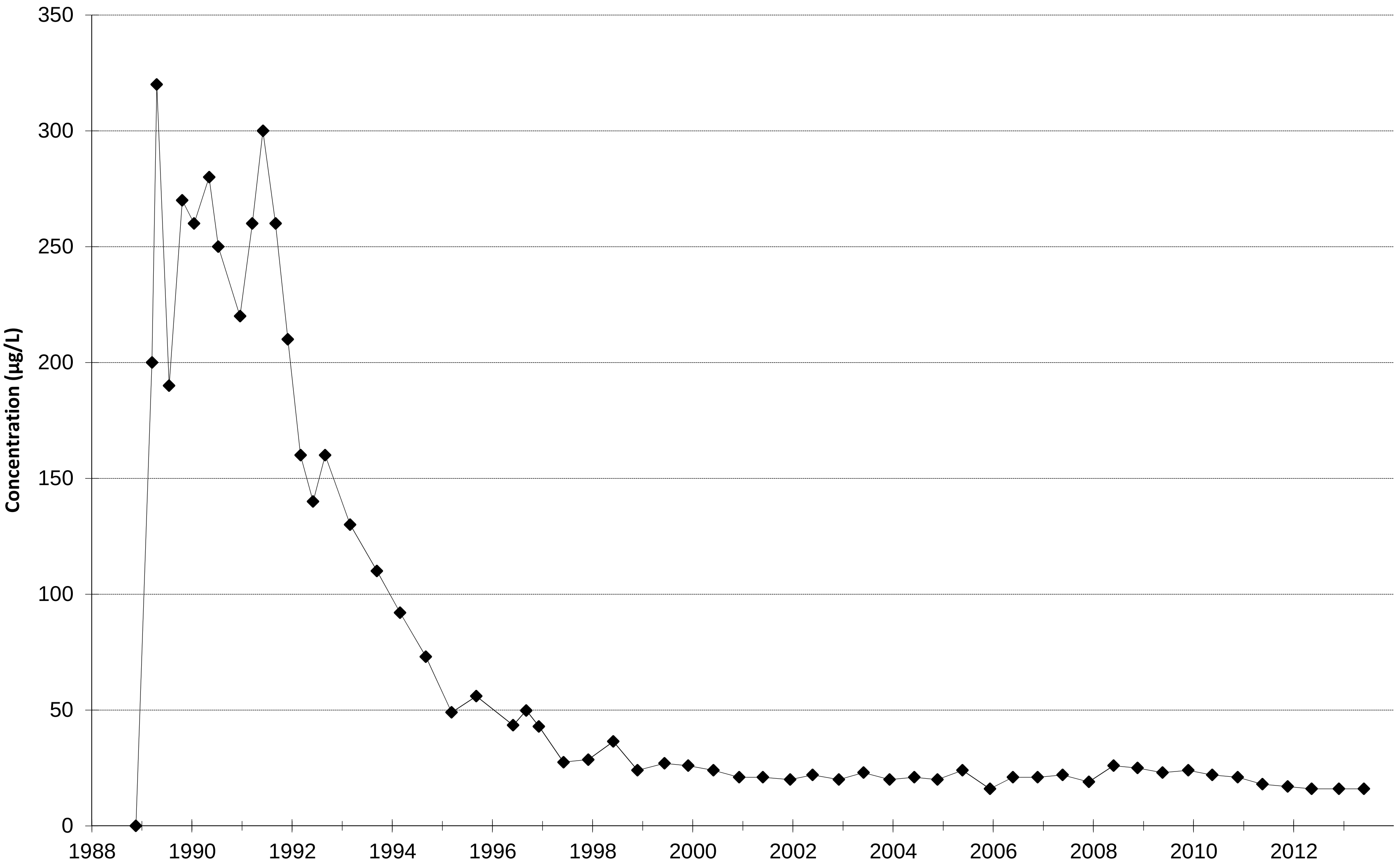


Note: Samples reporting concentrations less than the detection limit were plotted as zero.

CRA 083145 (1)

APPENDIX G-1

EXTRACTION WELL B8 - TRCLE VS. TIME

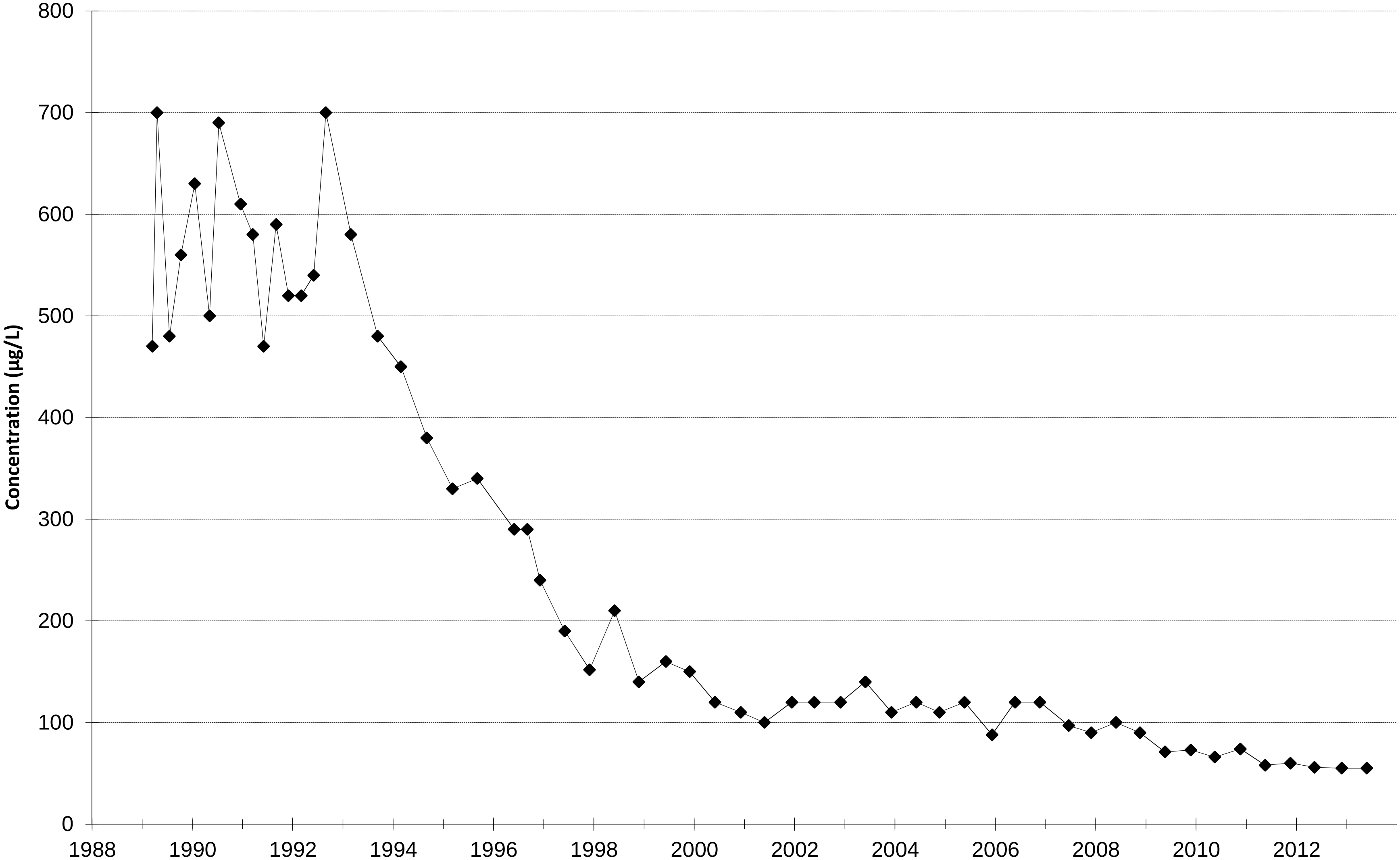


Note: Samples reporting concentrations less than the detection limit were plotted as zero.

CRA 083145 (1)

APPENDIX G-1

EXTRACTION WELL B9 - TRCLE VS. TIME

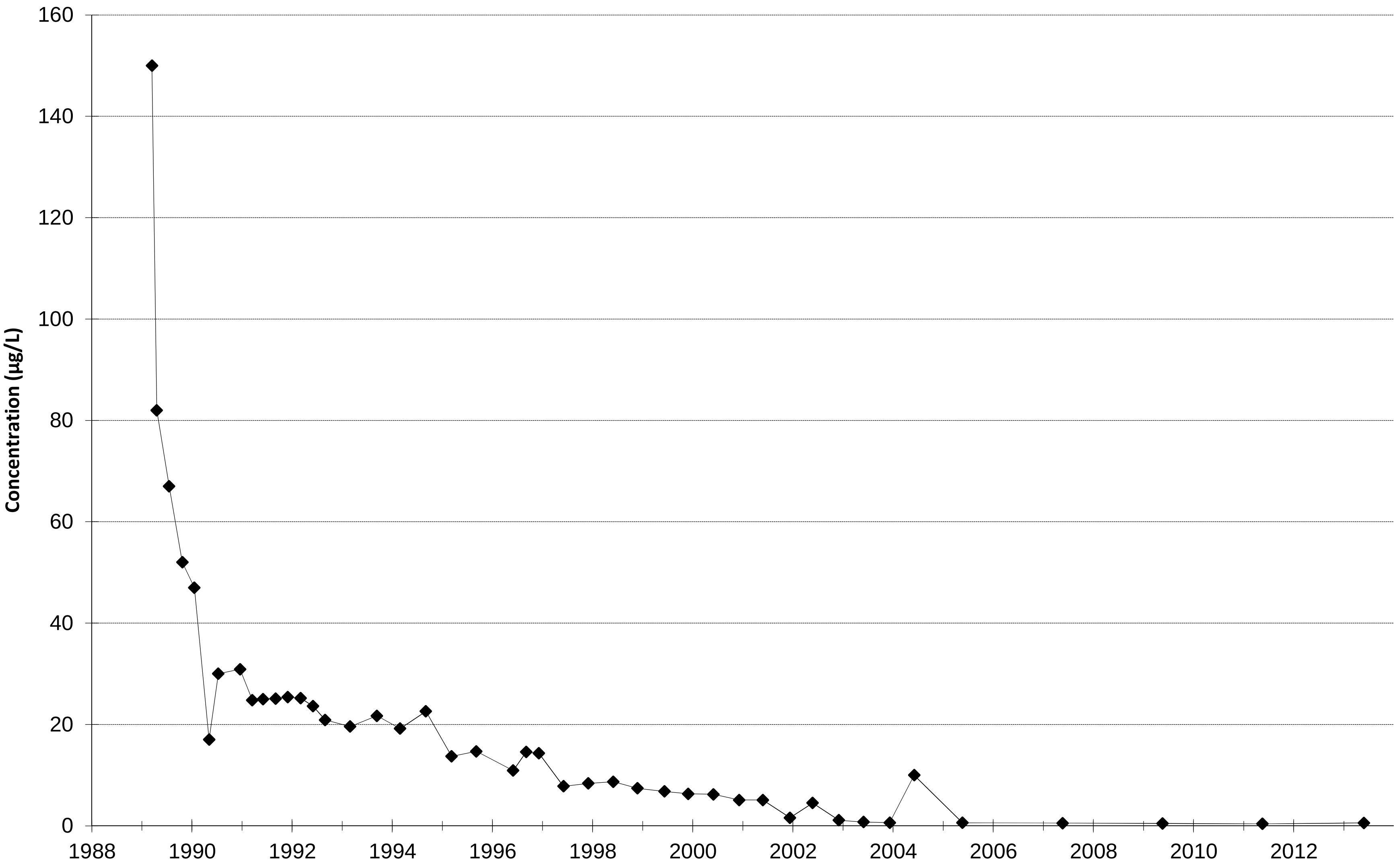


Note: Samples reporting concentrations less than the detection limit were plotted as zero.

CRA 083145 (1)

APPENDIX G-1

EXTRACTION WELL B10 - TRCLE VS. TIME

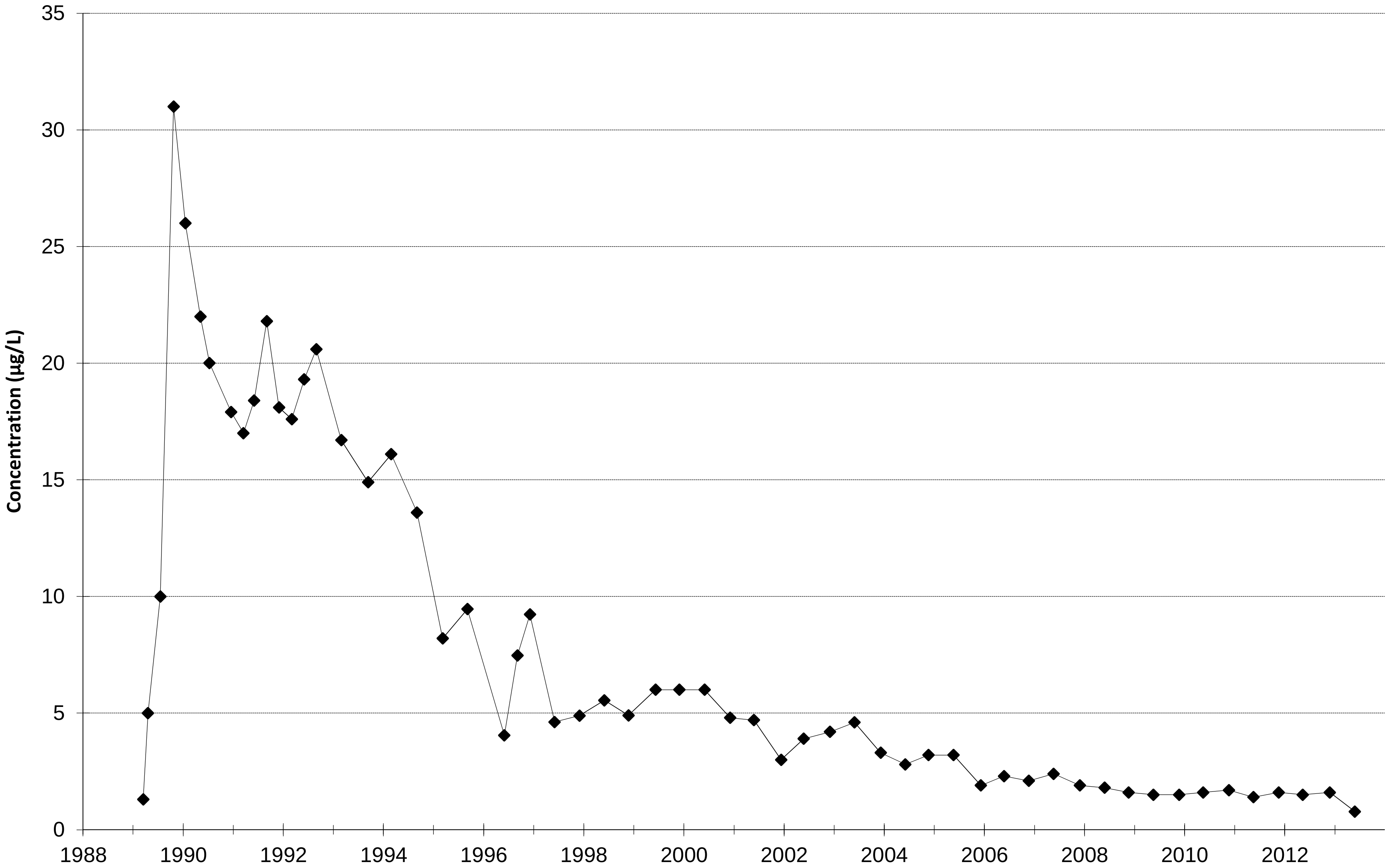


Note: Samples reporting concentrations less than the detection limit were plotted as zero.

CRA 083145 (1)

APPENDIX G-1

EXTRACTION WELL B11 - TRCLE VS. TIME

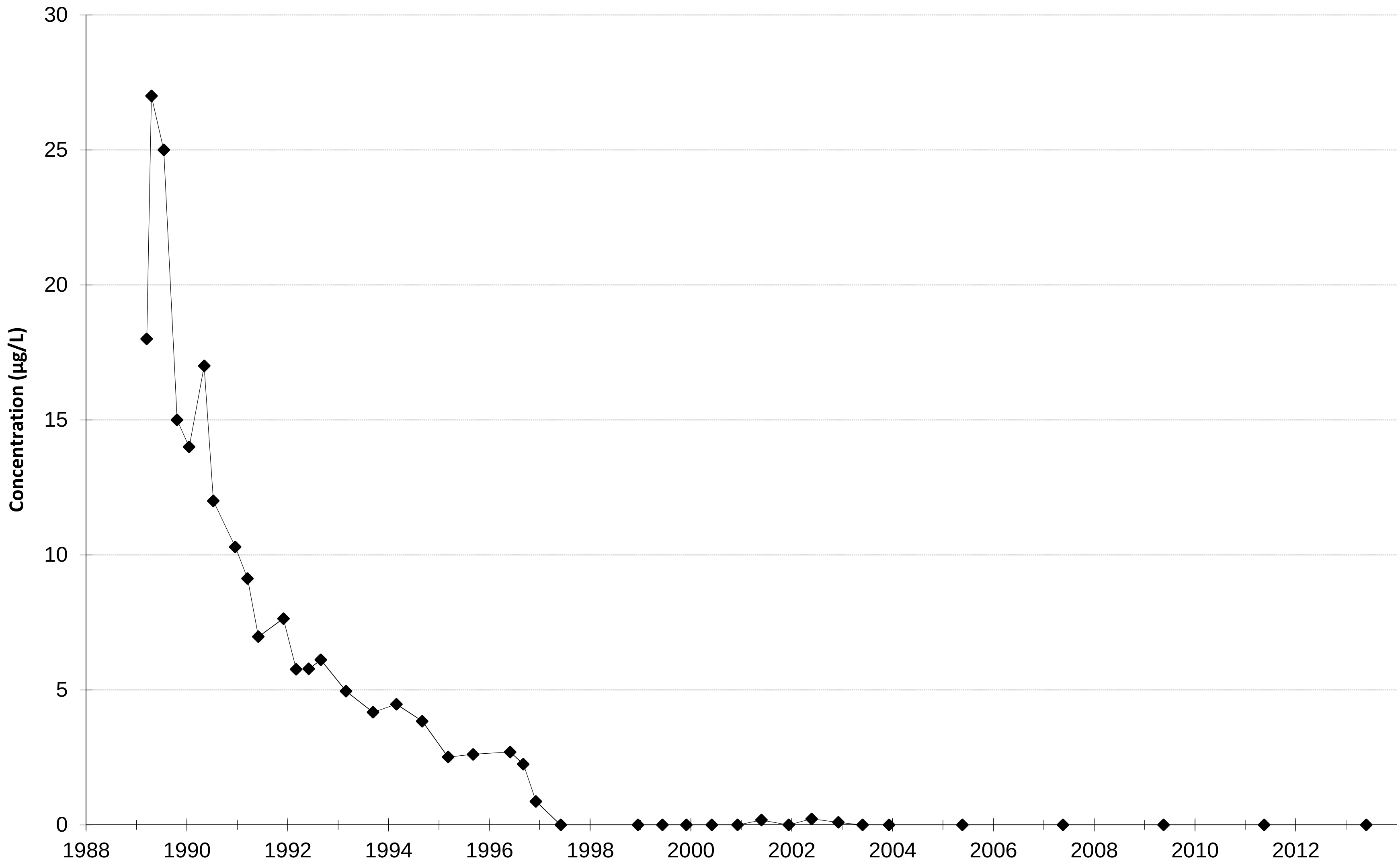


Note: Samples reporting concentrations less than the detection limit were plotted as zero.

CRA 083145 (1)

APPENDIX G-1

EXTRACTION WELL B12 - TRCLE VS. TIME

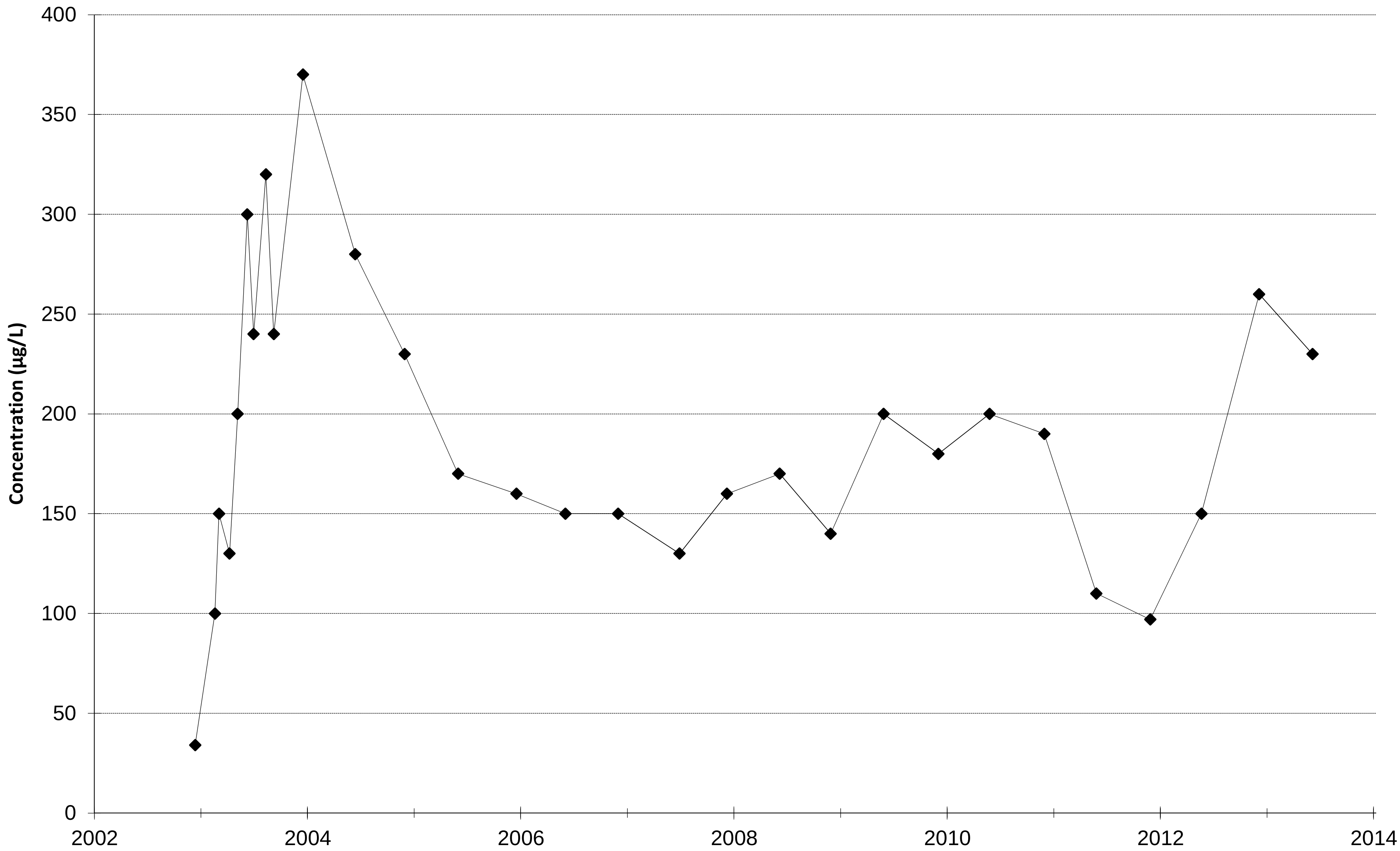


Note: Samples reporting concentrations less than the detection limit were plotted as zero.

CRA 083145 (1)

APPENDIX G-1

EXTRACTION WELL B13 - TRCLE VS. TIME

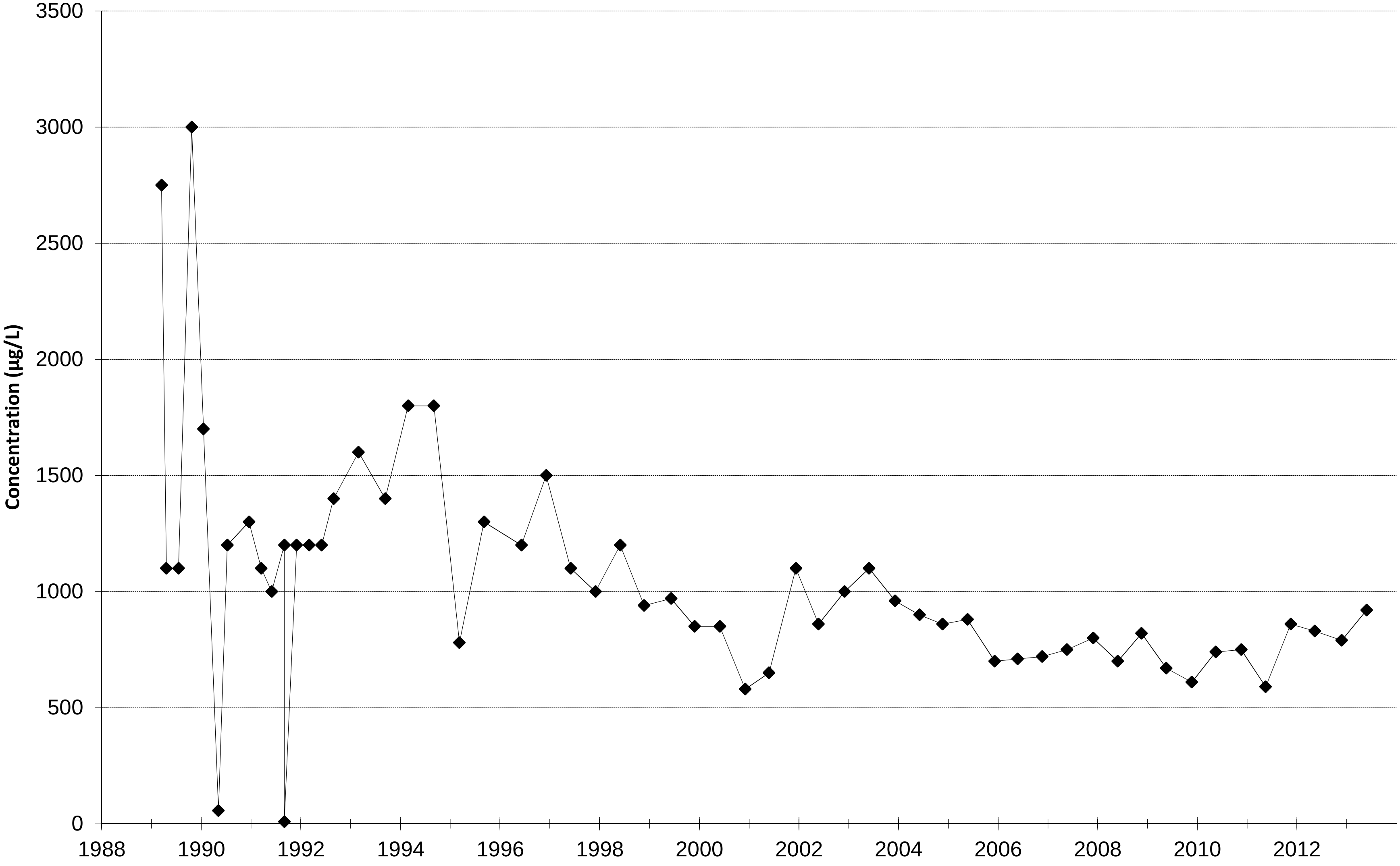


Note: Samples reporting concentrations less than the detection limit were plotted as zero.

CRA 083145 (1)

APPENDIX G-1

EXTRACTION WELL SC1 - TRCLE VS. TIME

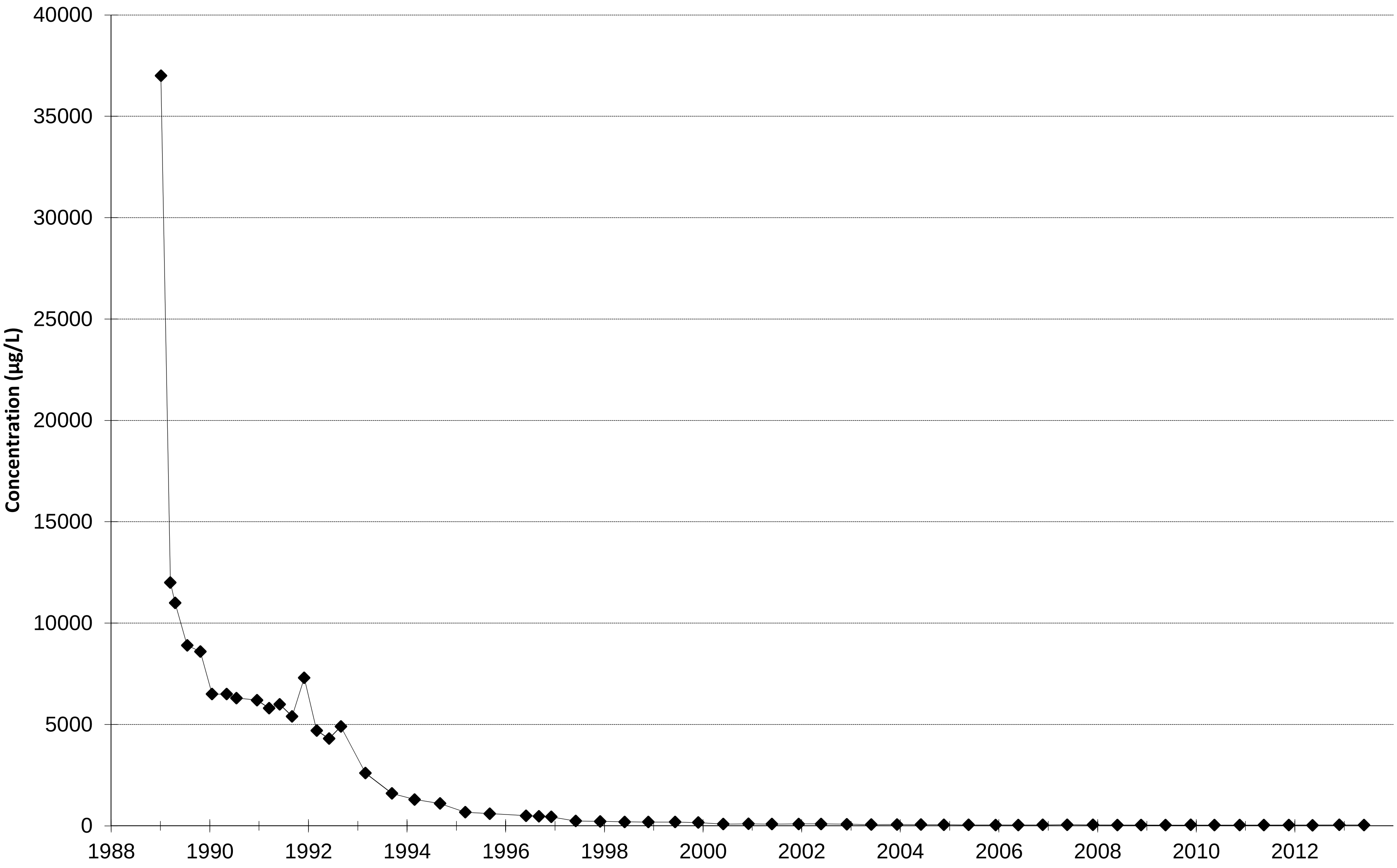


Note: Samples reporting concentrations less than the detection limit were plotted as zero.

CRA 083145 (1)

APPENDIX G-1

EXTRACTION WELL SC2 - TRCLE VS. TIME

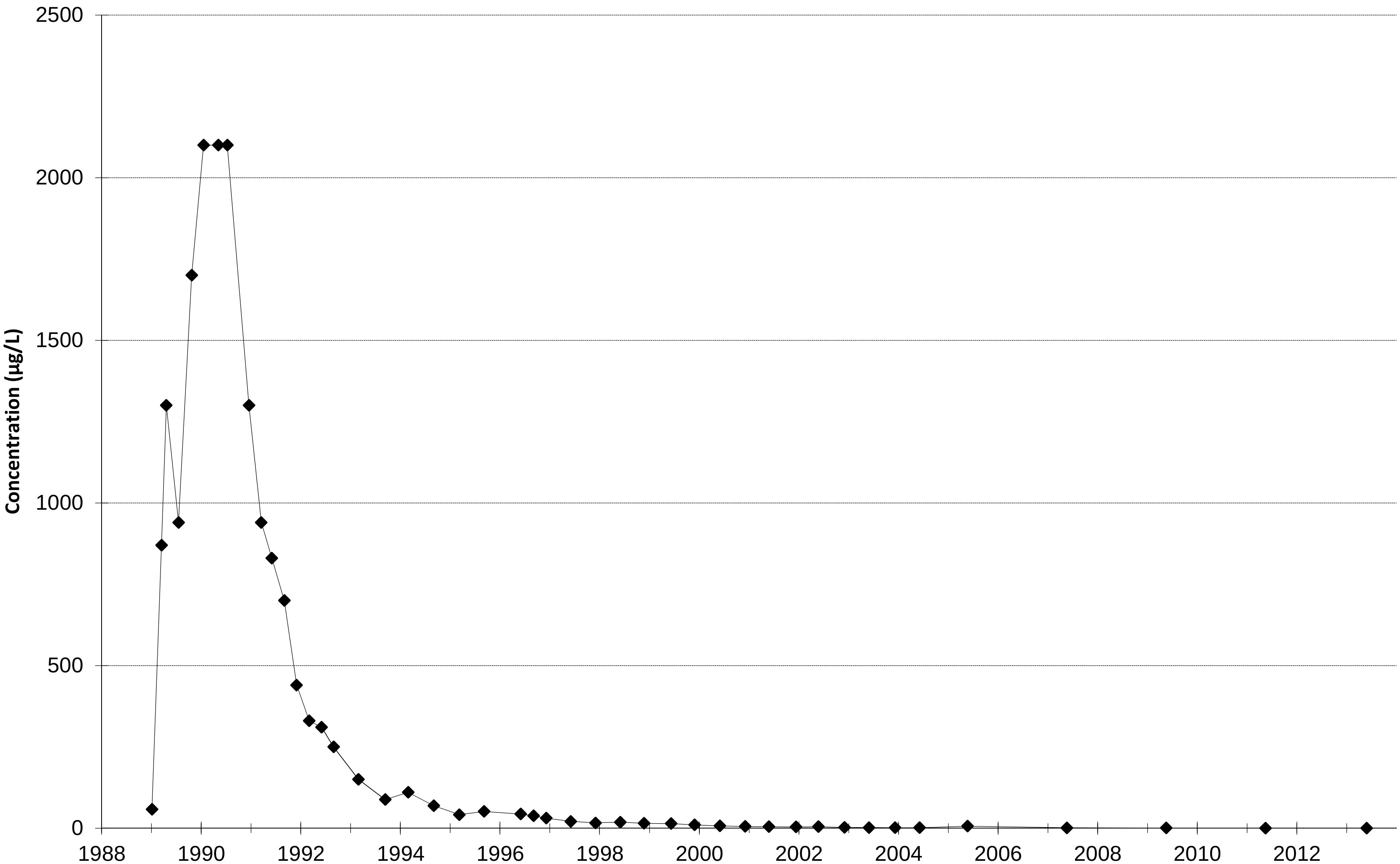


Note: Samples reporting concentrations less than the detection limit were plotted as zero.

CRA 083145 (1)

APPENDIX G-1

EXTRACTION WELL SC3 - TRCLE VS. TIME

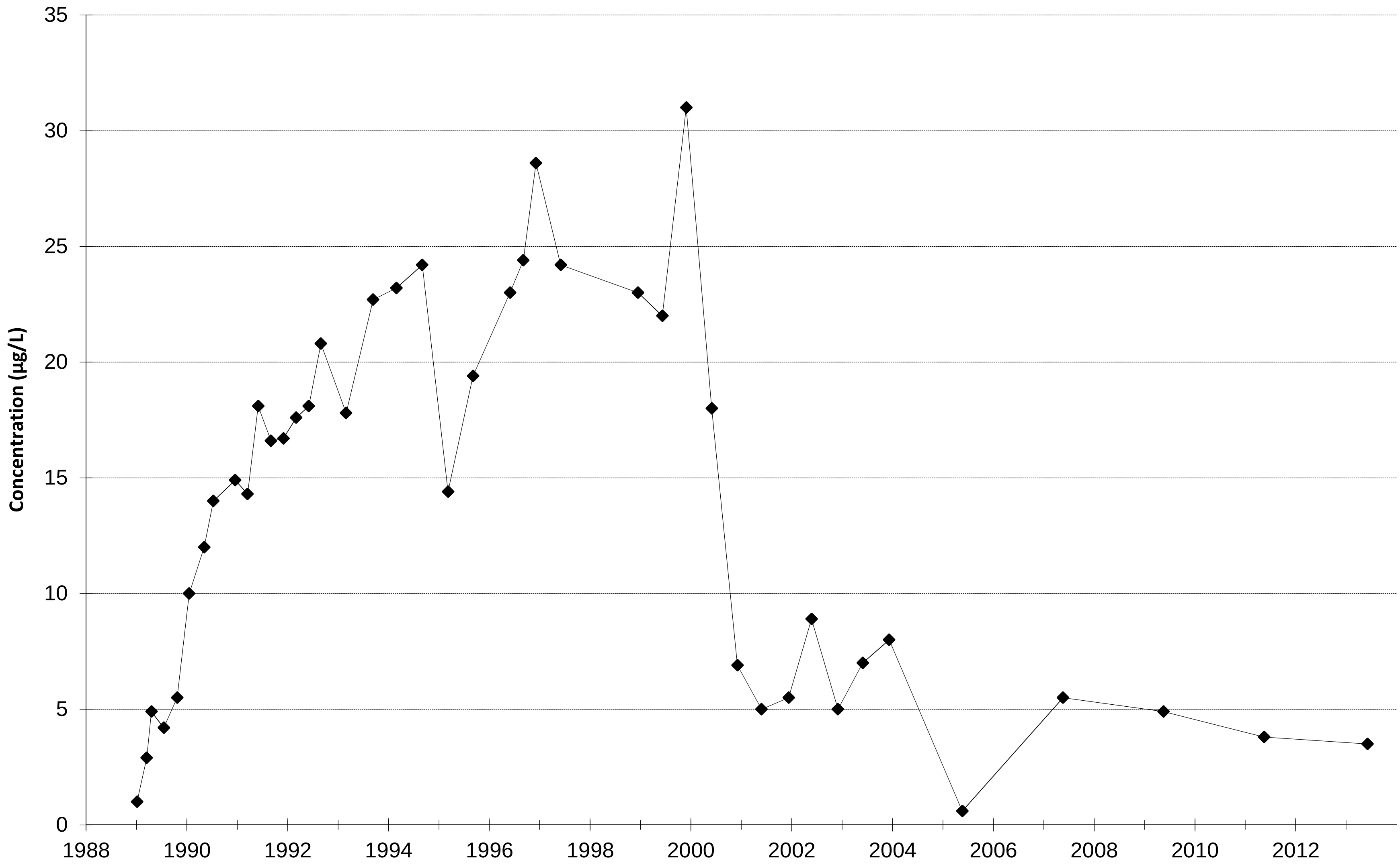


Note: Samples reporting concentrations less than the detection limit were plotted as zero.

CRA 083145 (1)

APPENDIX G-1

EXTRACTION WELL SC4 - TRCLE VS. TIME

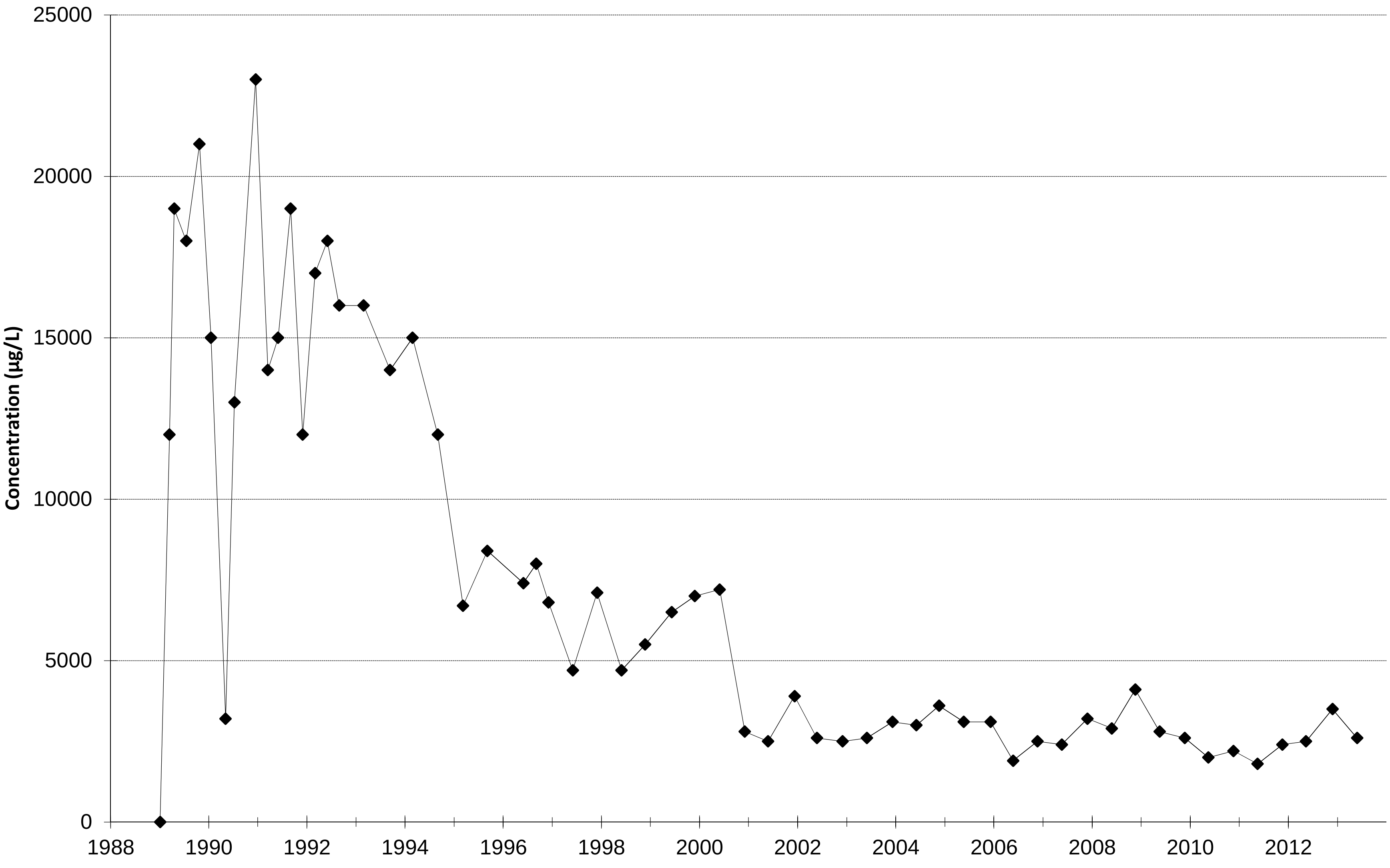


Note: Samples reporting concentrations less than the detection limit were plotted as zero.

CRA 083145 (1)

APPENDIX G-1

EXTRACTION WELL SC5 - TRCLE VS. TIME



Note: Samples reporting concentrations less than the detection limit were plotted as zero.

CRA 083145 (1)

G.2 Influent/Effluent Database (µg/L), Fiscal Year 2013, TGRS, OU2

APPENDIX G-2

INFLUENT/EFFLUENT DATABASE (µg/L)
FISCAL YEAR 2013
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	10/3/12		<	1	<	1	<	1	<	1	<	1	<	1	1.6
TGRSE	10/3/12	D	<	1	<	1	<	1	<	1	<	1	<	1	1.7
TGRSE	11/6/12		<	1	<	1	<	1	<	1	<	1	<	1	1.6
TGRSE	11/6/12	D	<	1	<	1	<	1	<	1	<	1	<	1	1.6
TGRSE	12/10/12		<	1	<	1	<	1	<	1	<	1	<	1 JMS	1.5
TGRSE	1/7/13		<	1	<	1	<	1	<	1	<	1	<	1	1.6
TGRSE	1/7/13	D	<	1	<	1	<	1	<	1	<	1	<	1	1.4
TGRSE	2/6/13		<	1	<	1	<	1	<	1	<	1	<	1 JD	1.8
TGRSE	2/6/13	D	<	1	<	1	<	1	<	1	<	1	<	1	1.7
TGRSE	3/5/13		<	1	<	1	<	1	<	1	<	1	<	1	1.7
TGRSE	3/5/13	D	<	1	<	1	<	1	<	1	<	1	<	1	1.6
TGRSE	4/2/13		<	1	<	1	<	1	<	1	<	1	<	1	1.6
TGRSE	5/3/13			0.78 JL, JP	<	1	<	1	<	1	<	1	<	1	4.4
TGRSE	5/3/13	D		0.78 JL, JP	<	1	<	1	<	1	<	1	<	1	4.2
TGRSE	6/11/13			0.31 JP	<	1	<	1	<	1	<	1	<	1	2
TGRSE	6/11/13	D	<	1	<	1	<	1	<	1	<	1	<	1	2.1
TGRSE	6/20/13		<	1	<	1	<	1	<	1	<	1	<	1	2.4
TGRSE	7/2/13			0.38 JP	<	1	<	1	<	1	<	1	<	1	2.4
TGRSE	7/2/13	D	<	1	<	1	<	1	<	1	<	1	<	1	2.2
TGRSE	8/1/13		<	1	<	1	<	1	<	1	<	1	<	1	1.7
TGRSE	9/3/13		<	1	<	1	<	1	<	1	<	1	<	1	1.9
TGRSE	9/3/13	D	<	1	<	1	<	1	<	1	<	1	<	1	1.9

APPENDIX G-2

INFLUENT/EFFLUENT DATABASE (μg/L)
FISCAL YEAR 2013
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	10/3/12		32	2.4	2.4	<	1	2.8	0.65 JP	170
TGRSI	11/6/12		35	2.5	2.5	<	1	3.2	1	200
TGRSI	12/10/12		28	2.3	2.7	<	1	2.6	1	170
TGRSI	12/10/12	D	29	2.3	2.8	<	1	2.5	1	180
TGRSI	1/7/13		29	2.1	1.9	<	1	2.4	1.1	170
TGRSI	2/6/13		39	2.3	4.3	<	1	2.4	1.2	200
TGRSI	3/5/13		32	2.3	4.1	<	1	2.4	0.94 JP	170
TGRSI	4/2/13		39	2.5	3	<	1	2.8	1.1	200
TGRSI	4/2/13	D	37	2.5	2.9	<	1	2.8	1.1	200
TGRSI	5/3/13		130 JL	4.1	8.1	<	1	2.8	1.9	420
TGRSI	6/11/13		44	2.6	3	<	1	2.7	1.1	220
TGRSI	6/20/13		32	2.3	2.8	<	1	2.6	1	240
TGRSI	7/2/13		48	3.6	3.6	<	1	3	1.1	240
TGRSI	8/1/13		40	2.6	3.6	<	1	2.6	1.1	200
TGRSI	8/1/13	D	40	2.6	3.6	<	1	2.7	1	210
TGRSI	9/3/13		45	2.7	3.9	<	1	2.5	1.4	220

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.
JMS - Result is qualified as estimated due to low matrix spike recovery (<75%).
JL - Result is qualified as estimated due to high laboratory control spike recovery (>125%).

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

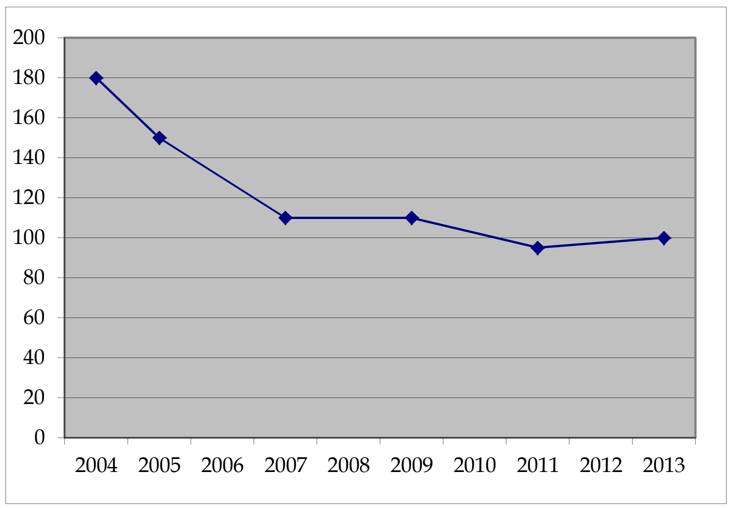
Kendall S	***Confidence***
1	50.00%
3	64.00%
5	76.50%
7	86.40%
9	93.20%
11	97.20%
13	99.17%
15	99.86%

WELL 03L673
MANN-KENDALL STATISTICAL ANALYSIS
OU3 - 2013

Date	TCE (µg/l)	Mann-Kendall Calculation:						
6/1/2004	**180**	1						
6/22/2005	**150**	1	-1					
6/21/2007	**110**	1	-1	-1				
6/18/2009	**110**	1	-1	-1	0			
6/24/2011	**95**	1	-1	-1	-1	-1		
6/27/2013	**100**	1	-1	-1	-1	-1	1	

N	6	5	4	3	2	1	0		15
sum		-5	-4	-2	-2	1	0	Kendall S	-12
Possibles	15								
								Kendall tau	-0.8

Mean	124.17
STNDEV	33.5286
COV	0.2700
Trend:	Negative
Confidence (lookup)	98.19%



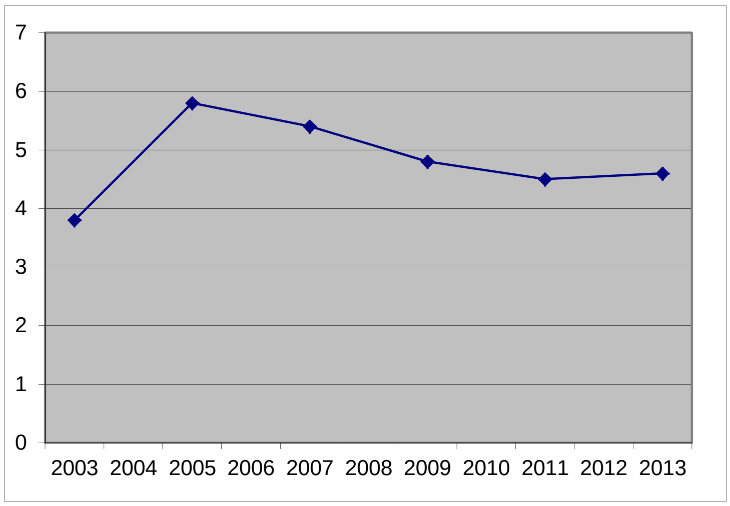
Raw Data

03L673	Date	TCE		Date	TCE	
	11/12/1987	1200		6/21/2007	110	
	5/2/1990	3200		6/18/2009	110	
	3/11/1991	2000		6/24/2011	95	
	3/11/1991	1900	D	6/27/2013	100	
	6/17/1991	5500		6/27/2013	100	D
	3/12/1992	3900				
	3/3/1993	2100				
	3/4/1994	3300				
	6/6/1994	2000				
	6/6/1994	2000	D			
	9/14/1994	1600				
	12/8/1994	1400				
	3/15/1995	910				
	6/12/1996	650				
	6/12/1997	240				
	6/25/1998	270				
	6/4/1999	280				
	6/12/2001	24				
	6/1/2003	6.3				
	6/1/2004	180				
	6/22/2005	150				

WELL 03L848
MANN-KENDALL STATISTICAL ANALYSIS
OU3 - 2013

Date	TCE (µg/l)	Mann-Kendall Calculation:								
6/1/2003	**3.8**	1								
6/21/2005	**5.8**	1	1							
6/21/2007	**5.4**	1	1	-1						
6/14/2009	**4.8**	1	1	-1	-1					
6/24/2011	**4.5**	1	1	-1	-1	-1				
6/27/2013	**4.6**	1	1	-1	-1	-1	1			
	N	6	5	4	3	2	1	0		15
	sum		5	-4	-3	-2	1	0	Kendall S	-3
	Possibles	15								
									Kendall tau	-0.2

Mean	4.82
STNDEV	0.7055
COV	0.1465
Trend:	Negative
Confidence (lookup)	64.00%



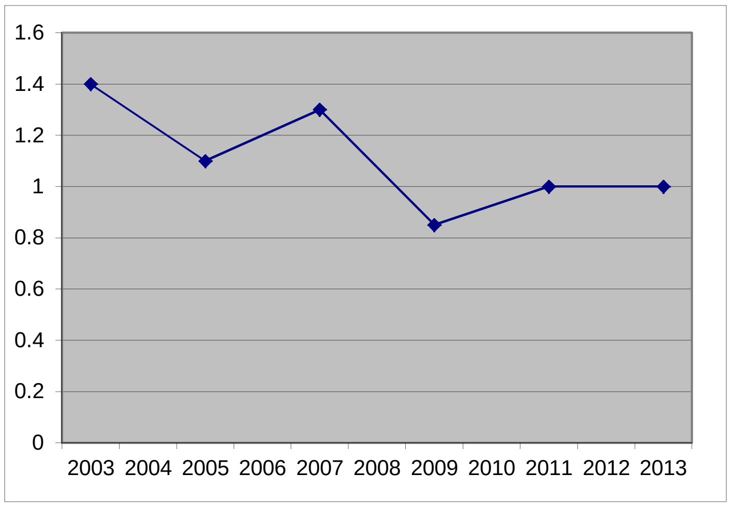
Raw Data

03L848	Date	TCE		Date	TCE	
	12/2/1987	570		6/21/2007	5.4	
	5/3/1989	270		6/21/2007	5.3	D
	7/20/1989	130		6/17/2009	4.8	
	10/19/1989	610		6/17/2009	2.6	D
	4/19/1990	460		6/24/2011	4.5	
	7/19/1990	260		6/27/2013	4.9	
	3/18/1991	250				
	3/18/1992	92				
	3/9/1993	52.9				
	6/6/1994	27				
	9/15/1994	27.1				
	12/8/1994	22				
	3/10/1995	16.6				
	6/3/1996	11.3				
	6/5/1997	9.34				
	6/5/1997	8.57	D			
	6/29/1998	10.7				
	6/4/1999	7.3				
	6/12/2001	3.5				
	6/1/2003	3.8				
	6/21/2005	5.8				

WELL 409548
MANN-KENDALL STATISTICAL ANALYSIS
OU3 - 2013

Date	TCE (µg/l)	Mann-Kendall Calculation:								
6/11/2003	**1.4**	1								
6/8/2005	**1.1**	1	-1							
6/12/2007	**1.3**	1	-1	1						
6/8/2009	**0.85**	1	-1	-1	-1					
6/15/2011	**1**	1	-1	-1	-1	1				
6/12/2013	**1**	1	-1	-1	-1	1	0			
N		6	5	4	3	2	1	0		15
	sum		-5	-2	-3	2	0	0	Kendall S	-8
Possibles		15								
									Kendall tau	-0.533

Mean	1.11
STNDEV	0.2060
COV	0.1858
Trend:	Negative
Confidence (lookup)	89.81%



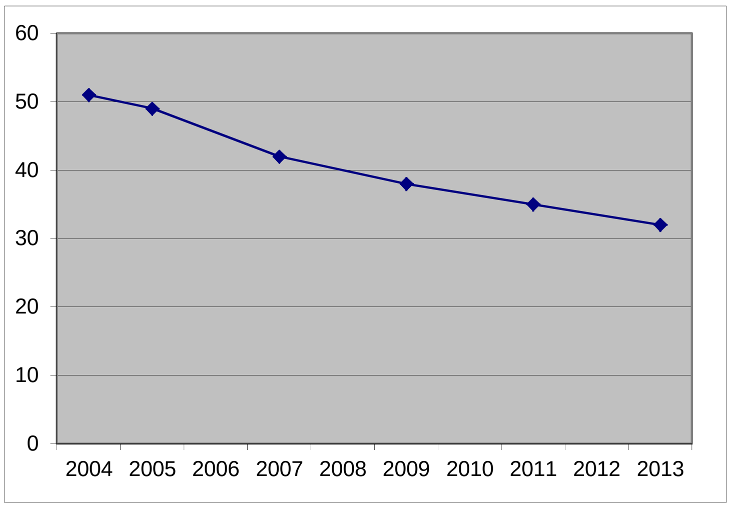
Raw Data

409548	Date	TCE		Date	TCE	
	5/10/1989	<0.50		6/8/2005	1.1	
	7/20/1989	<1.10		6/12/2007	1.3	
	10/18/1989	<1.10		6/8/2009	0.85	JP
	4/17/1990	1.17		6/15/2011	1	
	3/18/1991	0.88		6/12/2013	1	
	3/25/1992	>50.10				
	3/18/1993	1.05				
	3/18/1993	2				
	3/21/1994	2.66				
	3/21/1994	2.96				
	6/9/1994	2.8				
	9/16/1994	2.73				
	12/9/1994	22.7				
	3/10/1995	2.03				
	6/4/1996	2.84				
	6/4/1997	2.7	JP			
	6/22/1998	2.91				
	6/14/1999	2.8				
	6/14/1999	2.9				
	6/19/2001	1.6				
	6/11/2003	1.4				

WELL 04U673
MANN-KENDALL STATISTICAL ANALYSIS
OU3 - 2013

Date	TCE (µg/l)	Mann-Kendall Calculation:								
6/1/2004	**51**	1								
6/22/2005	**49**	1	-1							
6/21/2007	**42**	1	-1	-1						
6/18/2009	**38**	1	-1	-1	-1					
6/24/2011	**35**	1	-1	-1	-1	-1				
6/24/2013	**32**	1	-1	-1	-1	-1	-1			
N		6	5	4	3	2	1	0		15
	sum		-5	-4	-3	-2	-1	0	Kendall S	-15
Possibles		15								
									Kendall tau	-1

Mean	41.17
STNDEV	7.6267
COV	0.1853
Trend:	Negative
Confidence (lookup)	99.86%



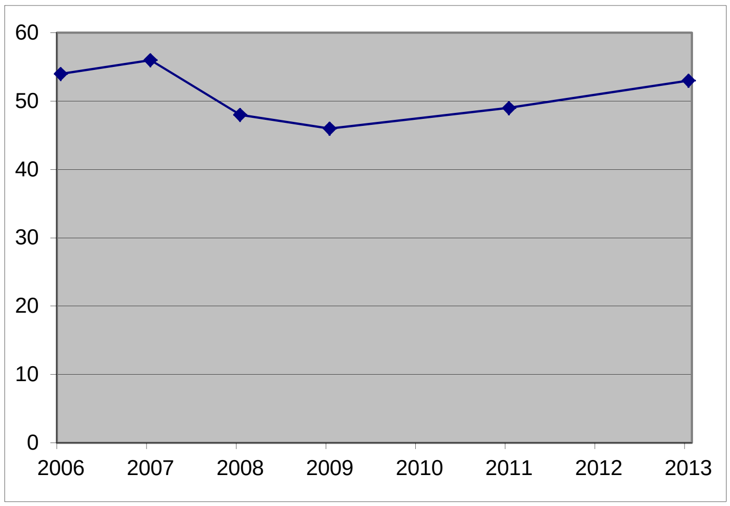
Raw Data
04U673

Date	TCE	Date	TCE
11/24/1987	145	3/15/1995	160
1/21/1988	580	3/15/1995	140
5/16/1988	560	9/12/1995	260
8/4/1988	253	6/12/1996	125
11/1/1988	1700	6/12/1997	60.4
5/3/1989	700	6/25/1998	81.9
7/21/1989	1200	6/4/1999	74
10/19/1989	1100	6/12/2001	2.9
5/1/1990	3100	6/1/2003	15
3/11/1991	990	6/1/2004	51
3/11/1991	940	6/22/2005	49
6/17/1991	410	6/21/2007	42
3/12/1992	460	6/18/2009	38
6/4/1992	430	6/24/2011	35
9/8/1992	540	6/27/2013	32
3/3/1993	280		
9/13/1993	190		
3/3/1994	270		
6/6/1994	210		
9/8/1994	170		
12/8/1994	190		

WELL 04U832
MANN-KENDALL STATISTICAL ANALYSIS
OU3 - 2013

Date	TCE (µg/l)	Mann-Kendall Calculation:								
6/13/2006	**54**	1								
6/22/2007	**56**	1	1							
6/17/2008	**48**	1	-1	-1						
6/19/2009	**46**	1	-1	-1	-1					
6/23/2011	**49**	1	-1	-1	1	1				
6/27/2013	**53**	1	-1	-1	1	1	1			
N		6	5	4	3	2	1	0		15
	sum		-3	-4	1	2	1	0	Kendall S	-3
Possibles		15								
									Kendall tau	-0.2

Mean	51.00
STNDEV	3.8987
COV	0.0764
Trend:	Negative
Confidence (lookup)	64.00%



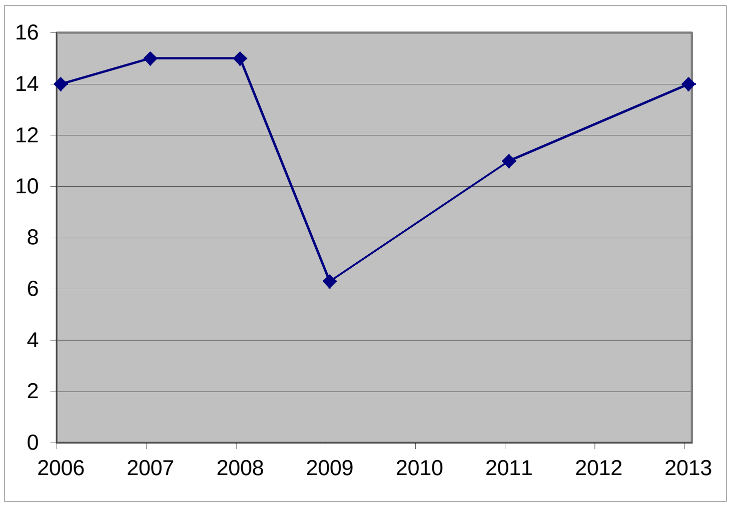
Raw Data

04U832	Date	TCE	Date	TCE
	11/24/1987	100	6/17/2008	48
	12/16/1988	65	6/19/2009	46
	4/25/1990	69.53	6/23/2011	49
	3/19/1991	47.6	6/27/2013	53
	3/25/1992	52.5		
	3/16/1993	42		
	3/16/1993	45.9		
	6/10/1994	49		
	9/13/1994	49.5		
	12/7/1994	43.3		
	12/7/1994	47.1		
	3/10/1995	56		
	6/3/1996	41		
	6/4/1997	35.2		
	6/25/1998	36.4		
	6/7/1999	29		
	6/14/2001	3.5		
	6/1/2003	4.1		
	6/23/2005	41		
	6/13/2006	54		
	6/22/2007	56		

WELL 04U845
MANN-KENDALL STATISTICAL ANALYSIS
OU3 - 2013

Date	TCE (µg/l)	Mann-Kendall Calculation:								
6/13/2006	**14**	1								
6/22/2007	**15**	1	1							
6/17/2008	**15**	1	1	0						
6/17/2009	**6.3**	1	-1	-1	-1					
6/23/2011	**11**	1	-1	-1	-1	1				
6/25/2013	**14**	1	0	-1	-1	1	1			
	N	6	5	4	3	2	1	0		15
	sum		0	-3	-3	2	1	0	Kendall S	-3
	Possibles	15								
									Kendall tau	-0.2

Mean	12.55
STNDEV	3.40
COV	0.27
Trend:	Negative
Confidence (lookup)	64.00%



Raw Data

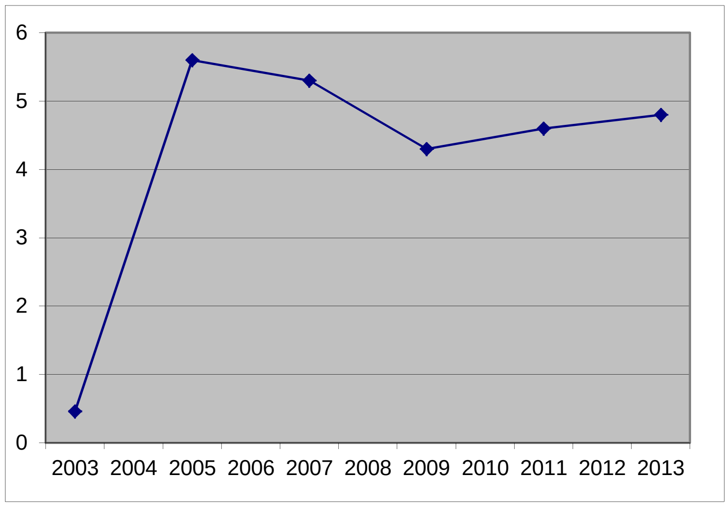
04U845	Date	TCE
	12/1/1987	59
	12/16/1988	155
	5/4/1989	100
	7/20/1989	160
	10/20/1989	62
	4/26/1990	38
	3/20/1991	100
	3/23/1992	>50.10
	3/23/1992	100
	3/15/1993	84
	6/8/1994	64
	9/13/1994	70
	12/7/1994	54
	3/10/1995	39.5
	6/4/1996	51.2
	6/5/1997	30.8
	6/25/1998	32.9
	6/7/1999	35
	6/13/2001	4.3
	6/1/2003	4
	6/22/2005	20

Date	TCE
6/13/2006	14
6/13/2006	14
6/22/2007	15
6/17/2008	15
6/17/2009	6.3
6/23/2011	11
6/25/2013	14

WELL 04U848
MANN-KENDALL STATISTICAL ANALYSIS
OU3 - 2013

Date	TCE (µg/l)	Mann-Kendall Calculation:								
6/1/2003	**0.46**	1								
6/21/2005	**5.6**	1	1							
6/21/2007	**5.3**	1	1	-1						
6/17/2009	**4.3**	1	1	-1	-1					
6/24/2011	**4.6**	1	1	-1	-1	1				
6/27/2013	**4.8**	1	1	-1	-1	1	1			
N		6	5	4	3	2	1	0		15
	sum		5	-4	-3	2	1	0	Kendall S	1
Possibles		15								
									Kendall tau	0.067

Mean	4.18
STNDEV	1.8807
COV	0.4503
Trend:	Positive
Confidence (lookup)	50.00%



Raw Data
04U848

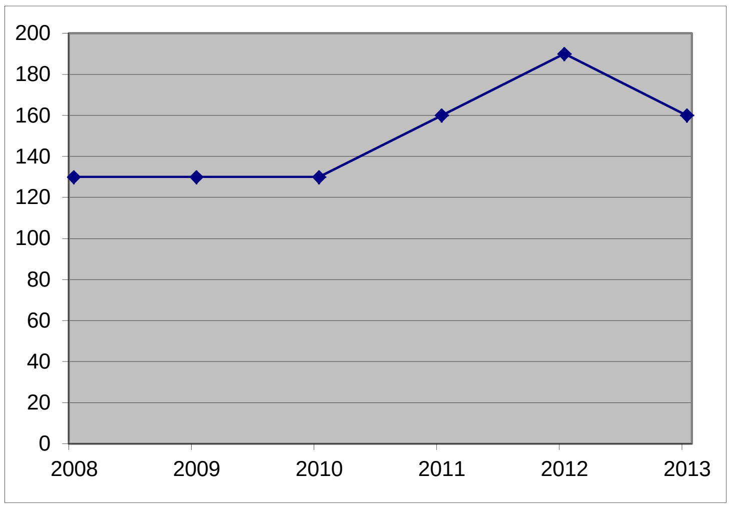
Date	TCE
12/2/1987	700
8/24/1988	470
5/3/1989	150
7/20/1989	700
10/19/1989	280
4/19/1990	240
7/19/1990	140
9/17/1990	150
3/18/1991	64
3/18/1992	22.5
3/18/1992	23.4
3/10/1993	26
6/6/1994	12.2
9/15/1994	16.8
12/8/1994	15.6
3/10/1995	9.94
6/3/1996	6.15
6/5/1997	3.3
6/29/1998	4.19
6/4/1999	3.6
6/12/2001	0.49 J

Date	TCE
6/1/2003	0.46 JP
6/21/2005	5.6
6/21/2007	5.3
6/17/2009	4.3
6/24/2011	4.6
6/27/2013	4.8

WELL 03M848
MANN-KENDALL STATISTICAL ANALYSIS
OU3 - 2013

Date	TCE (µg/l)	Mann-Kendall Calculation:								
6/18/2008	**130**	1								
6/17/2009	**130**	1	0							
6/8/2010	**130**	1	0	0						
6/24/2011	**160**	1	1	1	1					
6/1/2012	**190**	1	1	1	1	1				
6/27/2013	**160**	1	1	1	1	0	-1			
N		6	5	4	3	2	1	0		15
	sum		3	3	3	1	-1	0	Kendall S	9
Possibles		15								
									Kendall tau	0.6

Mean	150.00
STNDEV	24.4949
COV	0.1633
Trend:	Positive
Confidence (lookup)	93.20%



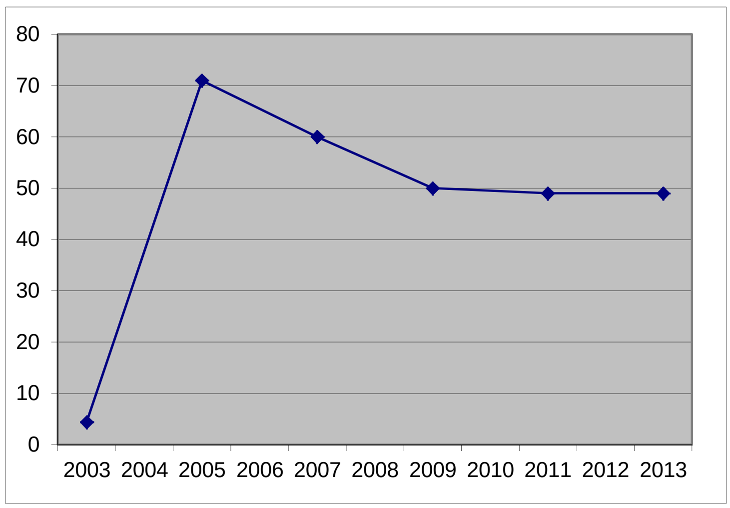
Raw Data
03M848

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			
3/17/1994	910				
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 04U859
MANN-KENDALL STATISTICAL ANALYSIS
OU3 - 2013

Date	TCE (µg/l)	Mann-Kendall Calculation:								
6/1/2003	**4.4**	1								
6/22/2005	**71**	1	1							
6/21/2007	**60**	1	1	-1						
6/18/2009	**50**	1	1	-1	-1					
6/24/2011	**49**	1	1	-1	-1	-1				
6/27/2013	**49**	1	1	-1	-1	-1	0			
N		6	5	4	3	2	1	0		15
	sum		5	-4	-3	-2	0	0	Kendall S	-4
Possibles		15								
									Kendall tau	-0.267

Mean	47.23
STNDEV	22.6999
COV	0.4806
Trend:	Negative
Confidence (lookup)	70.25%



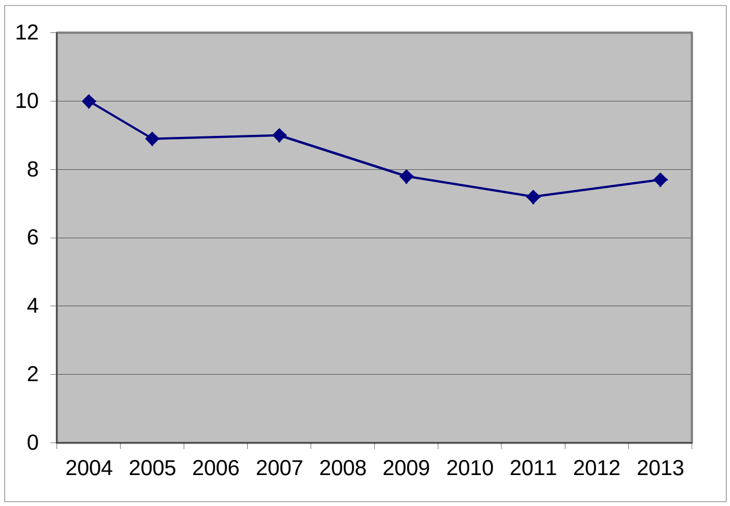
Raw Data

04U859	Date	TCE	Date	TCE
	11/13/1987	0.3	6/18/2009	50
	12/15/1988	8.5	6/24/2011	49
	4/30/1990	5.59	6/27/2013	49
	3/19/1991	5.24		
	3/20/1992	9.29		
	3/11/1993	40.5		
	3/18/1994	47		
	3/18/1994	49.5		
	6/9/1994	48.9		
	9/14/1994	64		
	12/7/1994	52.5		
	3/10/1995	43.8		
	6/3/1996	50.8		
	6/4/1997	31.9		
	6/25/1998	42		
	6/25/1998	46.8		
	6/7/1999	75		
	6/13/2001	8.4		
	6/1/2003	4.4		
	6/22/2005	71		
	6/21/2007	60		

WELL 03L859
MANN-KENDALL STATISTICAL ANALYSIS
OU3 - 2013

Date	TCE (µg/l)	Mann-Kendall Calculation:							
6/1/2004	**10**	1							
6/22/2005	**8.9**	1	-1						
6/21/2007	**9**	1	-1	1					
6/18/2009	**7.8**	1	-1	-1	-1				
6/24/2011	**7.2**	1	-1	-1	-1	-1			
6/27/2013	**7.7**	1	-1	-1	-1	-1	1		
N		6	5	4	3	2	1	0	15
	sum		-5	-2	-3	-2	1	0	Kendall S -11
Possibles		15							
									Kendall tau -0.733

Mean	8.43
STNDEV	1.0443
COV	0.1238
Trend:	Negative
Confidence (lookup)	97.20%



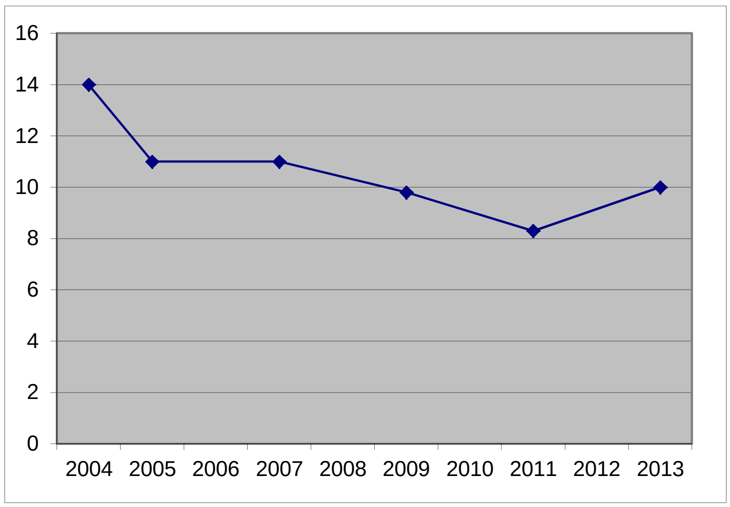
Raw Data

03L859	Date	TCE	
	11/13/1987	<0.2	
	12/15/1988	<1	
	4/30/1990	<0.5	
	3/19/1991	<0.5	
	3/20/1992	2.14	
	3/11/1993	3.5	
	3/18/1994	2.98	
	6/9/1994	6.27	
	9/14/1994	5.67	D
	9/14/1994	5.67	
	12/7/1994	4.75	
	3/10/1995	4.55	
	6/3/1996	5.96	
	6/4/1997	2.86	
	6/1/2004	10	
	6/22/2005	8.9	
	6/21/2007	9	
	6/18/2009	7.8	
	6/24/2011	7.2	
	6/27/2013	7.7	

WELL 04U854
MANN-KENDALL STATISTICAL ANALYSIS
OU3 - 2013

Date	TCE (µg/l)	Mann-Kendall Calculation:								
6/1/2004	**14**	1								
6/23/2005	**11**	1	-1							
6/21/2007	**11**	1	-1	0						
6/18/2009	**9.8**	1	-1	-1	-1					
6/23/2011	**8.3**	1	-1	-1	-1	-1				
6/25/2013	**10**	1	-1	-1	-1	1	1			
	N	6	5	4	3	2	1	0		15
	sum		-5	-3	-3	0	1	0	Kendall S	-10
	Possibles	15								
									Kendall tau	-0.667

Mean	10.68
STNDEV	1.9041
COV	0.1782
Trend:	Negative
Confidence (lookup)	95.20%



Raw Data

04U854	Date	TCE		Date	TCE
	10/20/1987	48.4		6/23/2011	8.3
	11/13/1987	50.7		6/25/2013	10
	12/16/1988	140			
	5/4/1989	27.3			
	7/20/1989	360			
	10/17/1989	89			
	4/30/1990	67			
	3/13/1992	83			
	3/15/1993	70			
	6/8/1994	35.3			
	9/14/1994	36.6			
	12/7/1994	32			
	3/9/1995	25			
	6/4/1996	26.7			
	6/5/1997	17.6	D		
	6/5/1997	16.5			
	6/1/2004	<1.0	D		
	6/1/2004	14			
	6/23/2005	11			
	6/21/2007	11			
	6/18/2009	9.8			

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, 2013

Inspected by: MIKE FIX, 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 deficiencies 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)