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

May 21, 2010

REPLY TO THE ATTENTION OF: SR-6J

Mr. Michael R. Fix
Remedial Project Manager
Twin Cities Army Ammunition Plant
470 West Highway 96, Suite 100
Shoreview, MN 55126

RE: Consistency Test for the Fiscal Year 2009 Annual Performance Report, Twin Cities Army Ammunition Plant, Arden Hills, Minnesota

Dear Mr. Fix:

Staff at the U.S. Environmental Protection Agency (U.S. EPA) and the Minnesota Pollution Control Agency (MPCA) have completed review of the Fiscal Year 2009 Annual Performance Report for the Twin Cities Army Ammunition Plant (FY09 APR). Our review of the FY09 APR included the following documents and communications:

- Fiscal Year 2009 Annual Performance Report, Draft 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 2010;
- U.S. EPA and MPCA comments on the Draft FY09 APR (March 24, 2010 and March 30, 2010);
- U.S. Army (Army) responses to U.S. EPA and MPCA comments and redline changes (April 15, 2010);

Based upon our review, you are hereby advised that, in accordance with Chapter XIV of the Federal Facility Agreement, the Fiscal Year 2009 Annual Performance Report passes the Consistency Test.

If you have any questions, please contact Deepa deAlwis at (651) 757-2572 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 Deepa de Alwis
Project Manager
Closed Landfill and Superfund Section
Remediation Division
Minnesota Pollution Control Agency

# FISCAL YEAR 2009 ANNUAL PERFORMANCE REPORT
# NEW BRIGHTON/ARDEN HILLS SUPERFUND SITE



**Prepared for:**

**Commander**
**Twin Cities Army Ammunition Plant**
**470 West Highway 96, Suite 100**
**ATTN: DAIM-BD-TW**
**Shoreview, Minnesota 55126-3218**

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

**May 2010**
**Final Report**

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# Fiscal Year 2009 Annual Performance Report

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**<u>FIGURES</u> (continued)**

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**APPENDICES**

# List of Acronyms

| | | |
|---|---|---|
| ATK | - | Alliant Techsystems Inc. |
| APR | - | Annual Performance Report |
| Army | - | United States Army |
| Barr | - | Barr Engineering |
| BGRS | - | Boundary Groundwater Recovery System |
| 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 |
| EW | - | Extraction Well |
| FFA | - | Federal Facilities Agreement |
| 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 |
| LUCIP | - | Land Use Control Implementation Plan |
| LUCRD | - | Land Use Control Remedial Design |
| MCES | - | Metropolitan Council Environmental Services |
| MCLs | - | Maximum Contaminant Levels |
| MCLGs | - | Maximum Contaminant Level Goals |
| MDH | - | Minnesota Department of Health |

# List of Acronyms (Cont.)

| | | |
|---|---|---|
| MDL | - | Method Detection Limit |
| MNA | - | Monitored Natural Attenuation |
| MOS | - | TGRS Micro Operation Strategy |
| 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 |
| RAWP | - | Remedial Action Work Plan |
| RD/RA | - | Remedial Design/Remedial Action |
| ROD | - | Record of Decision |
| scfm | - | Standard Cubic Feet per Minute |
| SDWA | - | Safe Drinking Water Act |

# List of Acronyms (Cont.)

| | | |
|---|---|---|
| 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 Center |
| 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 |

# List of Chemical Abbreviations (Cont.)

| | | |
|---|---|---|
| CHCL3 | - | Chloroform |
| 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 2009 (FY 2009) Annual Performance Report:

- 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 2009 is defined as the period from October 1, 2008 through September 30, 2009.

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 and 2009
- 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, at the end of this section, summarizes the status of remedial actions at the end of FY 2009. Following are highlights of the accomplishments for each operable unit, as well as other activities during FY 2009.

**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 2009 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 2009, there were no new recommendations for abandonment or alternate water supply.
- The PGAC treated 1.22 billion gallons of water and removed 624 pounds of VOCs during FY 2009. Approximately 20,944 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 2009 was a major sampling event. The statistical trend analysis, as developed by the OU1 Technical Group, indicate that aquifer restoration is occurring, and that the extent and magnitude of contamination in the Prairie du Chien aquifer is stable or improving. Trends in the Jordan aquifer improved in FY 2009, but a stable trend remains at one Jordan well requiring continued evaluation.

**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), and Explanation of Significant Differences #2 related to various soil sites (2009). Highlights for activities within OU2 during FY 2009 are:

- ROD Amendments and Explanations of Significant Differences (ESDs)
  As noted above, two Amendments and two ESDs were signed in FY 2009. The principal modifications were to 1) amend the remedy for Site I groundwater (see below for further discussion), 2) incorporate land use controls into the remedies, and 3) document No Further Action for several sites where work had been performed outside of the original OU2 ROD.

- OU2 Land Use Control Remedial Design (OU2 LUCRD)
  With the Amendments and ESDs prescribing the need for land use controls as part of the remedies, the Army prepared a draft OU2 LUCRD explaining how the land use controls are to be implemented. The document was under regulatory review at the end of FY 2009.

- Shallow Soil Sites
  - The Closeout Report for Site C received partial approval. A number of closeout reports await final consistency following regulatory approval of the OU2 LUCRD.
  - The 5 year groundwater monitoring period has been completed for the shallow soil sites, except at Site H where monitoring continues to evaluate copper detected in groundwater above surface water standards.

- Deep Soil Sites
  - Closeout reports for the work at Sites D and G continue to await final consistency following regulatory approval of the OU2 LUCRD.

- 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, just prior to the beginning of FY 2009. It was agreed 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.
  - As predicted in the 10-Year Report, water quality results for the first year of MNA show some wells with increasing VOC concentrations and some wells with decreasing concentrations. Also, the results suggest that the axis of the highest concentrations of cis-1,2-dicloroethene shifted from the vicinity of EW-2 to the vicinity of EW-3 (i.e., a more westerly direction relative to the source area).
  - Monitoring results from the four contingency wells located along the north side of County Road I did not exceed the approved trigger levels.
  - Continued monitoring and evaluation of MNA is recommended prior to any decision on whether or not to formally change the remedy to MNA.
  - The MDH Special Well Construction Area remains in effect. In FY 2009, 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, near the beginning of FY 2009. The system was shut off because 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 groundwater system remains in stand-by mode in the event that one or more extraction wells need to be restarted.
  - Only the two monitoring wells nearest to the source area exceeded the groundwater cleanup level for lead in FY 2009.
  - None of the groundwater or surface water contingency locations exceeded the approved trigger levels in FY 2009.
  - 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 2009. Eight of the nine wells scheduled for sampling and hydraulic monitoring were dry. Therefore, groundwater samples were collected from one of the nine wells scheduled for sampling in FY 2009.

- Site K Shallow Groundwater
  - At Site K, the groundwater extraction trench and treatment system continued to operate as designed. The system captured and treated 4,467,780 gallons of

water and maintained a continuous zone of capture downgradient of former Building 103. A total of 23.4 pounds of VOCs were removed in FY 2009.

- The extracted water was treated and discharged to Rice Creek in compliance with all discharge criteria.

- 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 2009, the total extraction well water pumped averaged 1,760 gpm, which is greater than the Global Operation Strategy (GOS) Operating Minimum (OM) (1,745 gpm).
  - In FY 2009, the TGRS extracted and treated approximately 925,232,745 gallons of water. The mass of VOCs removed was 2,167 pounds and is 125 pounds less than that achieved in FY 2008. The total VOC mass removed by the TGRS through FY 2009 is 201,449 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>**

- Groundwater monitoring in FY 2009 was conducted during the annual event. Overall, the statistical evaluation showed the South Plume is decreasing in concentration at its center and stable at its edge. In addition, there is evidence of the North Plume commingling with the South Plume at the boundary between the two plumes.

## Five-Year Review

A Five-Year Review report was completed in August 2009 for Operable Units 1 to 3. The review concluded that the remedies are functioning as intended, and that the components of the remedies remain protective of human health and the environment.

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

- Building 102 shallow groundwater contamination is not part of the OU2 ROD and is being addressed by the Army as a non-time critical removal action. The EE/CA documenting groundwater investigation work and recommending MNA received regulatory approval in FY 2008. The Army Action Memorandum documenting the selection of MNA for Building 102 groundwater was signed early in FY 2009. A Quality Assurance Project Plan for MNA was approved in FY 2009 and ongoing performance monitoring was performed.
    - The FY 2009 groundwater quality results were generally comparable to the FY 2008 results, suggesting that the plume remains stable due to the natural attenuation that is occurring at this site.
    - The well adjacent to Rice Creek continued to show that shallow groundwater discharging to Rice Creek was below the cleanup levels for this site.

- Site K Soil Removal Action

Alliant Techsystems, under agreement with the Army, prepared an EE/CA documenting investigation work and recommending excavation and off-site landfill disposal for VOC-contaminated soil beneath a portion of the floor slab at former Building 103. The EE/CA received regulatory approval in FY 2008. In FY 2009, the Army signed the Action Memorandum documenting selection of the remedy, work plans were developed and approved, the soil removal action was performed, and the Completion Report was under regulatory review.

- Building 535 Primer/Tracer Area Soil Removal Action

In FY 2009, an EE/CA was approved documenting investigation work and recommending excavation and off-site landfill disposal of contaminated soil from two areas near Building 535. The Army signed the Action Memorandum documenting selection of the remedy, work plans were developed and approved, the soil removal action was performed, and the Closeout Report was being prepared.

- Feasibility Study for Aquatic Sites

In FY 2009, the Army submitted a revised draft Feasibility Study. At the end of FY 2009, the comment resolution process was in-progress.

**Table 1-1**

**Status of Remedial Actions: FY 2009**

| 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 | Partially | Closeout Report for metals was partially approved; however, see Note 1 at the end of the OU2 Deep Soil Sites section of this table. See OU2 Site A Shallow Groundwater (below) for status on VOC soils. |
| Site C | Yes | Yes | Partially | Closeout Report was partially approved; however, see Note 1 at the end of the OU2 Deep Soil Sites section of this table. |
| Site E | Yes | Yes | Partially | Closeout Report was partially approved; however, see Note 1 at the end of the OU2 Deep Soil Sites section of this table. |

**Status of Remedial Actions: FY 2009**

| 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) | | | | |
| Site H | Yes | Yes | Partially | Closeout Report was partially approved; however, see Note 1 at the end of the OU2 Deep Soil Sites section of this table. |
| Site 129-3 | Yes | Yes | Partially | Closeout Report was partially approved; however, see Note 1 at the end of the OU2 Deep Soil Sites section of this table. |
| Site 129-5 | Yes | Yes | Partially | Closeout Report was partially approved; however, see Note 1 at the end of the OU2 Deep Soil Sites section of this table. |
| Grenade Range | Yes | Yes | Partially | Soil remediation work was performed as a removal action. OU2 ROD Amendment #3 documented No Further Action except land use controls. Closeout Report was partially approved; however, see Note 1 at the end of the OU2 Deep Soil Sites section of this table. |
| Outdoor Firing Range | Yes | Yes | Partially | Soil remediation work was performed as a removal action. OU2 ROD Amendment #3 documented No Further Action except land use controls. Closeout Report was partially approved; however, see Note 1 at the end of the OU2 Deep Soil Sites section of this table. |
| 135 PTA Stormwater Ditch | Yes | Yes | Yes | Soil remediation work was performed as a removal action. OU2 ROD Amendement #3 documented No Further Action. |
| Trap Range Site | Yes | Yes | Yes | The Preliminary Assessment recommended No Further Action, which was documented in OU2 ROD Amendment #3. |

**Table 1-1** (continued)

**Status of Remedial Actions: FY 2009**

| 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) | | | | | |
| | Water Tower Area | Yes | Yes | Yes | Removal of solid waste was performed as a removal action. OU2 ROD Amendment #3 documented No Further Action. |
| #8: | Groundwater Monitoring | Yes | Yes | Partially | The 5-year monitoring has been completed for all shallow soil sites except Site H. |
| #9: | Characterization of Dumps: | | | | |
| | Site B | Yes | Yes | Yes | No further action was documented through OU2 ESD #2. |
| | Site 129-15 | Yes | Yes | Partially | Closeout Report was partially approved; however, see Note 1 at the end of the OU2 Deep Soil Sites section of this table. |
| #10: | Land Use Controls | Yes | Yes | No | The OU2 Land Use Control Remedial Design document was under regulatory review a the end of FY 2009. |
| Overall Remedy | | Yes | Yes | Partially | |

**Table 1-1** (continued)

**Status of Remedial Actions: FY 2009**

| 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 | No | |
| #2: | Restrict Site Access During Remediation | Yes | Yes | Yes | Long-term land use controls are addressed by Remedy Component #8. |
| #3: | SVE Systems (Deep) | Yes | Yes | Partially | Deep SVE systems will not be required at Sites D or G. The Site D VOC Closeout Report has received consistency. The Site G (VOC) Closeout Report was partially approved; however, see Note 1 below. |
| #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 | No | |
| #6: | Maintain Surface Drainage Controls | Yes | Yes | No | |
| #7: | Characterize Shallow Soils and Dump | Yes | Yes | Partially | Closeout Reports for Site D shallow soils and Site G were partially approved; however, see Note 1 below. |
| #8: | Land Use Controls | Yes | Yes | No | The OU2 Land Use Control Remedial Design document was under regulatory review a the end of FY 2009. |
| Overall Remedy | | Yes | Yes | Partially | |

*Note 1: Closeout report has been approved, but final consistency will not be provided until the land use control section of the report is completed and approved. This will occur after consistency approval of the OU2 LUCRD.*

**Table 1-1** (continued)

**Status of Remedial Actions: FY 2009**

| 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 | The OU2 Land Use Control Remedial Design document was under regulatory review a the end of FY 2009. |
| #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 | See comment for Remedy Component #2. |

**Table 1-1** (continued)

**Status of Remedial Actions: FY 2009**

| 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 and is currently in standby while ongoing groundwater and surface water monitoring continue. |
| #3: Discharge of Extracted Water | Yes | Yes | No | See comment for Remedy Component #2. |
| #4: Land Use Controls | Yes | Yes | No | The OU2 Land Use Control Remedial Design document was under regulatory review a the end of FY 2009. |
| Overall Remedy | Yes | Yes | No | See comment for Remedy Component #2. |
| 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 | The OU2 Land Use Control Remedial Design document was under regulatory review a the end of FY 2009. |
| Overall Remedy | Yes | Yes | No | |

**Table 1-1** (continued)

**Status of Remedial Actions: FY 2009**

| 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 | Well 03U621 was added as a sentinel well and is sampled annually, as listed in the monitoring plan |
| #8: | Land Use Controls | Yes | Yes | No | The OU2 Land Use Control Remedial Design document was under regulatory review a the end of FY 2009. |
| Overall Remedy | | Yes | Yes | No | |

**Table 1-1** (continued)

**Status of Remedial Actions: FY 2009**

| 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 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 | The OU2 Land Use Control Remedial Design document was under regulatory review a the end of FY 2009. |
| #5: | Review of New Technologies | Yes | Yes | No | |
| #6: | Groundwater Monitoring | Yes | Yes | No | |
| Overall Remedy | | Yes | Yes | No | |
| 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 2009 Annual Performance Report 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 2009 (FY 2009) extended from October 1, 2008 through September 30, 2009

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 and 2009
- 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.

Monitoring activities and submittal of this report are in fulfillment of the Federal Facilities 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 2009, 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 2009 through FY 2013. The monitoring plan covers a moving 5-year time span (i.e., next year FY 2009 will drop off and FY 2014 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, 12.0, and 13.0 of this report. On behalf of ATK, Stantec prepared Sections 8.0 and 9.0, and Conestoga-Rovers & Associates, Inc. (CRA) prepared Sections 10.0 and 11.0. 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 2004.

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 the Minnesota Department of Transportation, 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 remaining 585 acres that is still controlled by TCAAP is in the process of being transferred out of federal control. 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 (sorted two different ways) is included in Tables B-1 and B-2 in Appendix B. The well index lists wells of concern, including the Army designation (IRDMIS number), Minnesota unique number, and any other name(s) the wells may have. 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 Appendix B (on the included CD). 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 well logs can be viewed by selecting the well of interest in Table B-3 (OU2 wells) and Table B-4 (OU1/OU3 wells) in Appendix B (click on the well name with the mouse).

See the instructions on the attached CD for more information on using Appendix B.

## 2.4 DATA COLLECTION, MANAGEMENT, AND PRESENTATION

Performance monitoring data was collected in accordance with the:

- FY 2009 Monitoring Plan for Groundwater Monitoring Wells
- FY 2009 Monitoring Plan for Remedial Treatment Systems
- FY 2009 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 2009 are contained in Appendix D.1. Groundwater quality trend graphs for the primary chemical of concern (trichloroethene) can be viewed by selecting the well of interest on Figure B-2 (OU1/OU3 wells) and Figure B-3 (OU2 wells) in Appendix B (click on the well name with the mouse). The trend graphs for Site A shallow groundwater also include tetrachloroethene and cis-1,2-dichloroethene, in addition to trichloroethene, and the trend graphs for Building 102 shallow groundwater also include cis-1,2-dichloroethene and vinyl chloride, in addition to trichloroethene. Since the chemical of concern for Site C shallow groundwater is dissolved lead, these graphs show dissolved lead instead of trichloroethene.

**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 2009 Monitoring Plan. Data was collected, assessed, and validated in accordance with three separate Quality Assurance Project Plans (QAPPs): "QAPP for Performance Monitoring", (Wenck, Revision 7, May 9, 2008), "QAPP for Site C Groundwater and Surface Water", (Wenck, Revision 7, May 9, 2008), and "QAPP for Monitored Natural Attenuation of Building 102 Groundwater", (Wenck, Revision 1, October 24, 2008). The Site C and Building 102 QAPPs are applicable to only those specific sites, and all other sites are covered by the Performance Monitoring QAPP.

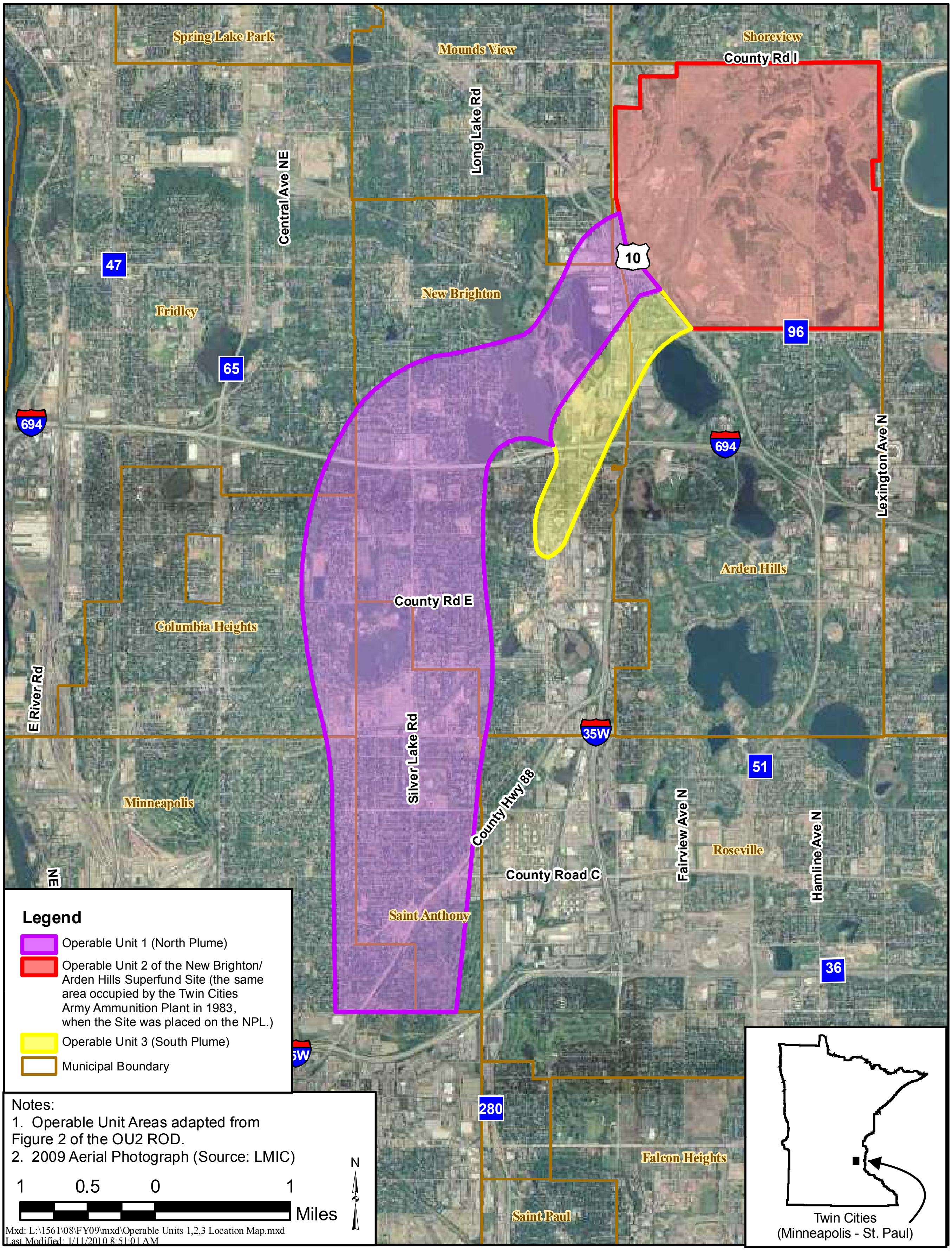
The data tables in the various report sections and the comprehensive water quality databases (Appendix D.1) show the data qualifiers that were assigned to the data as a result of data verification and/or data validation. The data qualifiers assigned to FY 2009 data are explained in the footnotes of the 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 2009. The final MPCA/USEPA approval letter for the FY 2009 DURs is included in Appendix C.3.

With regard to completeness, Appendix C.2 summarizes any deviations from the FY 2009 Monitoring Plan. The field and laboratory completeness goals for performance monitoring are both 95%, except that the completeness goals for TGRS effluent, Site K effluent, and well inventory are 100%. For performance monitoring, the actual field completeness for FY 2009 was 99.7% and the actual laboratory completeness was 100%, both of which meet the overall completeness goals (wells that were dry, frozen or inoperative were not considered as missed samples, nor were well inventory locations where the well owner refused sample collection or was nonresponsive). Also, the actual field and laboratory completeness for the subset of samples with 100% completeness goals was 100%, meeting this goal. For Site C shallow groundwater, the field and laboratory completeness goals are both 95%. Actual field and laboratory completeness were 100%, meeting the completeness goals. For Building 102 shallow groundwater, the field and laboratory completeness goals are both 95%, except that the completeness goals for well 01U048 (adjacent to Rice Creek) are 100%. Actual field and laboratory completeness were 100%, meeting the completeness goals.

With regard to QC samples, all three 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. The actual QC sample frequencies were met in all three cases, with respective frequencies of 15%, 10% and 11% for performance monitoring; 11%, 11% and 11% for Site C shallow groundwater; and 19%, 19% and 19% 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 OU2 shallow soil site data, Site A antimony data, and well inventory samples. The actual validation rate was 29%, and all of the data requiring 100% data validation was fully validated, meeting the specified validation rates for performance monitoring. For Site C shallow groundwater, the QAPP specifies that data validation be completed at an overall rate of 10%. The actual data validation rate was 25%, meeting the specified validation rate. For Building 102 shallow groundwater, the QAPP specifies a 100% data validation rate, and all data was fully validated.

The data for FY 2009 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 assessments and data validation; and 3) comparability to historical results (any substantial deviations from historical/anticipated results are discussed within the site-specific sections of this report).

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Conceptual Illustration of Operable Units

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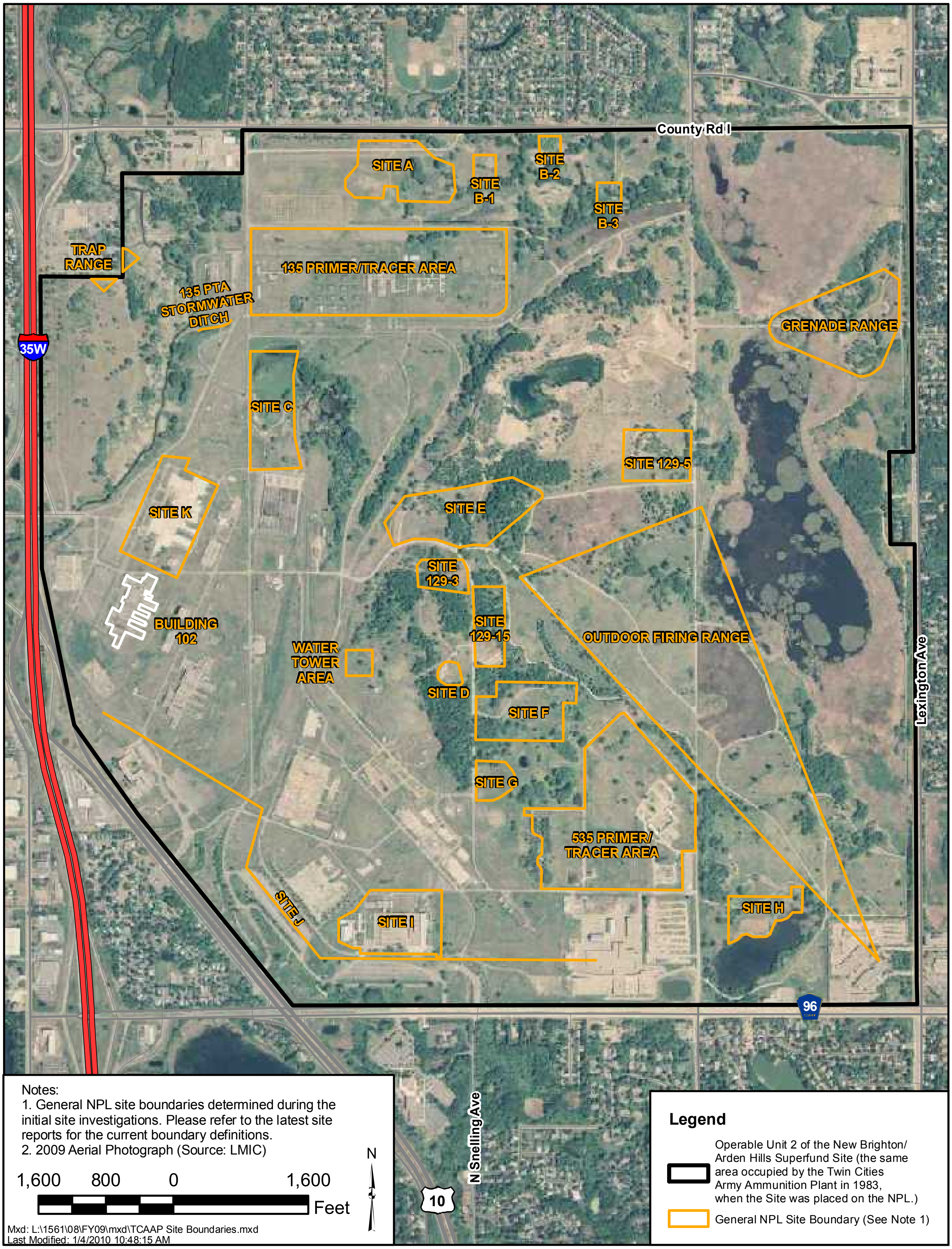
1800 Pioneer Creek Center Maple Plain, MN 55359-0429

FY 2009

Figure 2-1

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Operable Unit 2 Site Boundaries

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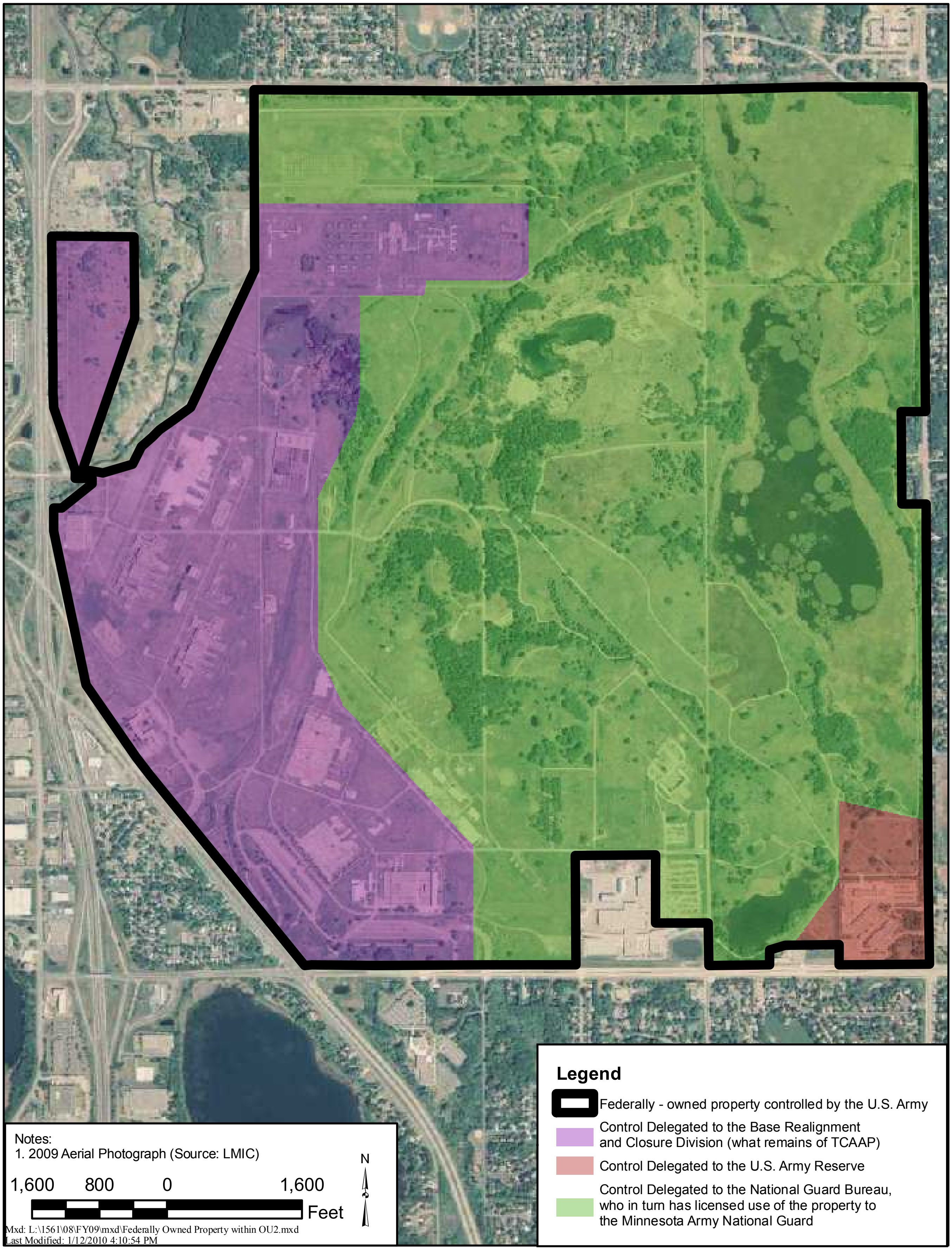
FY 2009

Figure 2-2

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Federally - Owned Property Within Operable Unit 2

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FY 2009

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.

**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. 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 2009, as defined by the 1 μg/l contour line?**

No. There was a comprehensive sampling round conducted in FY 2009. The 1 μg/l contour line remained essentially the same as in FY 2007, which was the last comprehensive sampling round (see Figure 3-1).

**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 2009 (outside of those included in the OU1 performance monitoring plan)? If yes, what were the findings?** Yes. Through the FY 2009 well inventory update effort, fourteen wells were sampled. The wells of concern that were not sampled were either found to be abandoned, non-existent, inoperable, or the well owners were not responsive to requests for access to sample. Seven wells did not have any detections of New Brighton/Arden Hills Superfund Site-related contaminants and seven wells had one or more detections of these contaminants. None of the sampled wells had detections of these contaminants above their respective OU1/OU3 cleanup levels. (see Appendix E for details)

**Were any well owners offered an alternate water supply and/or well abandonment during FY 2009?** No.

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

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

**Is any sampling of water supply wells (excluding those included in the OU1 performance monitoring plan) proposed prior to the next report?**
No. FY 2010 is not a sampling event for well inventory wells as shown in Appendix A.1. The next major event is in FY 2013.

**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. Following is additional background discussion that explains the scope of the changes.

New Brighton expressed interest in pumping from wells NBM #5 and/or NBM #6, completed in the Jordan aquifer. New Brighton indicated they do not want to sacrifice cleanup in the Prairie du Chien; rather, they want to supplement these efforts with additional pumping in the Jordan. They observed that contaminant concentrations have declined in the Prairie du Chien wells to the point where the contamination is now higher in Jordan wells #5 and #6.

New Brighton proposed the pumping rates in Appendix A.5. The tables show a column for "Normal Operation" that has the revised lower and upper limits for pumping, along with the "priority" for each well. Well NBM #15 was considered the highest priority because it was located near the center of the plume and had the highest contaminant concentrations of the wells completed in the Prairie du Chien. Well pair NBM #3/4 was the second priority because it was the next highest concentrations in the Prairie du Chien. New Brighton deemed Jordan well pair NBM #5/6 as the next highest priority because these wells had the highest contaminant concentrations of all the extraction wells. Finally, well NBM #14 was assigned the lowest priority because it was near the edge of the plume in the Prairie du Chien with relatively low contaminant concentrations. The priorities reflected New Brighton's desire to still focus on the core of the Prairie du Chien plume (wells NBM #15 and NBM #3/4), while starting to enhance mass removal in the Jordan (well pair NBM #5/6). The lower limit for well NBM #14 is zero. New Brighton proposed this in anticipation that this well will likely be the first to reach remediation goals (NBM #14 has since fallen below the remediation standard for TCE of 5 μg/L), and its use could be discontinued for remediation purposes. In practice, New Brighton intends to keep pumping from NBM #14 (albeit at a lower rate than previously) in order to meet their water supply demand.

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 believes that the changes should enhance the overall aquifer restoration by re-allocating some pumping to wells with higher contaminant concentrations. Nevertheless, 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 2009, 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 2009 was 1,222 million gallons, which translates to a daily average of 3.348 MGD. Hence, the pumping in FY 2009 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 2009.

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 2009: one in October and one in April/May. Both were triggered by breakthrough detections.

**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:

- 200804 (St Anthony #3): Not in operation at the time of sampling. The monitoring plan does not require this well to be sampled unless it is in service.

This well is not critical to the performance evaluations. Therefore, the groundwater monitoring requirements were met. Well 234549 (Reiner), west of the St. Anthony wells, was deleted from the sampling plan because the well is no longer in service (see Appendix A.1). Well 234549 has helped to draw the 1 μg/L contour south of the NBCGRS in the past. It was always non-detect (sampled 1994 through 2003). Monitoring wells 04U880 and 04U881 provide adequate coverage to determine the boundaries of the 1 μg/L contour, especially given the long-term decreasing trends in the aquifer and the nearby operation of the St. Anthony GAC groundwater treatment system.

**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 2011.

**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 1991 and 1998, and has been relatively stable since then. At NBM #5 and #6, trichloroethene was trending downward in

FY 2009, but remained within the historical range. At NBM #14, the trichloroethene concentrations show a continuing downward trend in addition to being below the cleanup level for TCE in OU1 (5 µg/L). At NBM #15, the trichloroethene continued to show a downward trend. 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 2009, 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, the previous comprehensive sampling round (FY 2007), and FY 2009 to help illustrate how the edge of the plume has behaved over this time. Figure 3-9 shows how the Upper Unit 4 100 µg/l trichloroethene contour has behaved 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 the last comprehensive sampling round in FY 2007.

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 2009 was a major sampling year, so new comprehensive plume mapping was completed (Figures 3-3 through 3-8). Table 3-4 presents the FY 2009 groundwater quality data for OU1. These data were collected to support the statistical analysis developed by the OU1TG. Graphs of historical trichloroethene concentrations at any well can be viewed electronically by clicking on a well on Figure B-2 (Appendix B). The graphs help illustrate the long-term changes that have occurred throughout OU1 and provide a visual aid for examining the trichloroethene history at any well.

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

When the statistical evaluation first started it was determined that the data points for the Unit 3 portion of Group 5 lacked consistent sampling histories over time to complete a kriging-based contour map for the Unit 3 similar to the Unit 4 Group 5 wells. In addition, there are not large numbers of data points for each of the sub-levels of the Unit 3 (e.g., upper and lower Unit 3). Instead, the wells that define the Unit 3 plume are evaluated as individual well trends.

Table 3-5 presents a summary of the statistical results for all groups, from Appendix D.2, reflecting the data collected through FY 2009. 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.

<u>Group 1</u>:

The Group 1 (downgradient of the TGRS) response threshold was not triggered for the North Plume sub-group, with a decreasing outcome. North Plume statistics improved from stable to decreasing between FY 2007 and 2009. The Area Weighted Concentration (AWC) concentration for the Group 1 North Plume was 42 µg/L in FY 2009, down from 49 µg/L in 2007. 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 due to a stable outcome of the South Plume analysis. The South Plume trend was decreasing in FY 2007, but became stable in FY 2009. The AWC for the South Plume was 4 µg/L and has been 4 or 5 µg/L over the analysis period (since 2001). The analysis of this sub-group is driven by the concentration at 03U801. The concentration in FY 2009 was 25 µg/L. Historically, this well peaked at 11,000 µg/L in 1993 and has consistently been below 70 µg/L since 1998. It has been stable at between 39 µg/L and 15 µg/L since 2002. Upgradient of the TGRS (within the capture zone) in this area, the South Plume concentrations continue to be over 100 µg/L. Given the history and currently low average concentrations in the area, the stable result appears accurate and consistent with proper performance of the TGRS in the South Plume. In addition, even though a threshold was triggered because the plume trend switched from decreasing to stable, due to the factors discussed above no evaluation responses are considered required.

Group 2:

Ten wells exhibited “increasing” or “no trend” trends in FY 2009, which triggered the thresholds identified for Group 2. Below is discussion following the order they are presented in Table 3-5:

409549 (Increasing) Concentrations increased from 5 µg/L in FY 2003 to 29 µg/L in FY 2009. 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 (No Trend): Concentrations increased from 4.1 µg/L in FY 2003 to 37 µg/L in FY 2009. The highest concentration at this well was in FY 2007 (40 µg/L). The ‘No Trend’ conclusion reflects a confidence level of less than 90% in the upward trend results and a coefficient of variance greater than 1 in the data. 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 impact the degree of capture at the New Brighton Well Field and does not indicate any problem with capture at the TGRS.

03L673 (No Trend): This well in OU3. See discussion of OU3, Section 11.

03L859 (No Trend): Historically this well had consistent detections below 10 µg/l, and currently is at 7.8 µg/l and appears to be stable. This is a Unit 3 well located between the North and South plumes in an area where they co-mingle and can be expected to reflect long-term shifting of plumes.

03U672 (No Trend): Historically this well was non-detect for five of the six rounds in the trend. The statistics are driven by the single detection (3.1 µg/l) in 2001. The well is currently non-detect.

04U673 (No Trend): This well in OU3. See discussion of OU3, Section 11.

04U821 (No Trend): This well dropped below 100 µg/L after 1992. It is near the center of the plume and appears to be stabilizing. Given the location of this well, distance from the remedial systems, and moderate concentration, a fairly stable history would be expected.

04U832 (Increasing): Concentrations increased from 3.5 µg/L in FY 2001 to 46 in FY 2009. Historically this well has been fairly stable with concentrations between 29 and 100 µg/L. The well is in the overlap area of the North and South plumes. Given the longer term stable history of this well, the trend statistics are driven by low concentrations in 2001 and 2003. This well appears to be more a part of the North Plume based on the presence of 1,1,1-trichloroethane in its VOC profile (the South Plume typically exhibits low to non-detect concentrations of 1,1,1 trichloroethane). Given its history there is no reason to be concerned about the present trend from a remedial performance standpoint. Given the distance of this well from the remedial systems, and moderate concentration, a fairly stable history would be expected.

04U843 (Increasing): Concentrations at this well have been erratic but generally increasing since its installation in 1987. A 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 (Increasing): Concentrations fluctuated between 0.3 µg/L and 21 µg/L from FY 1998 to FY 2009. 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 a 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.

04U861 (Increasing): This well was abandoned in 2006 due to redevelopment by the City of New Brighton in the immediate area.

The key factors that apply to Group 2 (from Table D.2.5, 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 trends in the Area Weighted Concentration (AWC) for the Group 3 (downgradient sentinel wells) and the Group 5 (global plume mass wells) were both downward, showing improvement in the plume both overall and downgradient of the NBCGRS. In FY 2009, the trend certainty increased from probable to definite, based on an increase in statistical certainty to 97% for Group 5. The AWC for the entire OU1 plume dropped to 32 µg/L in FY 2009, from 45 µg/l in FY 1999. The Group 3 AWC dropped to 18 µg/L in FY 2009 from 48 µg/L in FY 1999. 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.

Group 5 Unit 3 Wells:

The Unit 3 portion of Group 5 is presented in Table 3-5. Wells already in Group 2 were not included.

The trend at 03U822 and 03L822 appears to correlate with the trend at the nested Jordan well (04J822). The concentrations appear to have peaked and both well trends have improved since FY 2007 from No Trend at 03U822 and Stable at 03L822 to Stable and Decreasing in FY 2009. As such 03L822 is no longer above the threshold trigger. Continued monitoring of these wells remains appropriate.

Well 03L809 also improved from a No Trend result in FY 2007 to Stable in FY 2009. This is a continuing improvement from the FY 2005 upward trend. Continued monitoring is appropriate for this well.

Group 4:

In Group 4, one well exceeded the cleanup level. This was 04U848. Monitoring well 04U848 is in OU3, which is addressed in Section 11.0.

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.

04J847 remains stable. The trend is consistent with the nested Unit 4 well (04U847). Continued annual monitoring is appropriate at this well given its stability and central location in the plume.

04J849 shows No Trend, which triggered the threshold for Group 6. However, the concentrations are below 0.5 µg/l, and are therefore not of concern, and it is likely the trend is an artifact of analytical variability at these levels.

Well 04J822 improved from Increasing in FY 2007 to Stable in FY 2009. This well is in the central part of the plume and downgradient of the hot spot at well nest 04U847 to the northeast. The trend suggests there is not a horizontal expansion of the plume. It does appear to suggest the hot spot is migrating to the southwest as expected, as was observed in the Unit 4 trends discussed above. The annual monitoring planned for this well remains appropriate to further examine this trend.

Well 04J708 shows a stable trend, however, all concentrations are below 5 µg/L, so a stable trend is acceptable.

Jordan wells near the NBCGRS (04J836, 04J838) show No Trend or Stable results. 04J839 is increasing but the concentrations are below 5 µg/L, so the trend is not significant. This is consistent with its low to moderate concentrations and proximity to the NBCGRS. The Jordan well in this area with the highest concentrations (04J837) shows a clear downward trend from 147 µg/l in FY 1998 to 2.5µg/l in FY 2009. Well 04J834 shows No Trend, however, all concentrations are below 1 µg/L, and therefore are not of concern.

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 bringing the two parts of the aquifer to similar concentration and similar long-term improvement. 04U836 has an increasing trend. This well is well within the influence of the NBCGRS and so can be expected to change as the plume shifts. 04U882, near

St. Anthony shows a stable trend while the nested Jordan well 04J882 remains non-detect. This shows there is no downward vertical migration in this area.

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, which shows a slight upward trend. 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 2009. 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 show continuing improvement in the plumes. The Group 6 wells show improving trends in the highest concentration Jordan wells and 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 in a more stable configuration 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 2009. The statistical behavior of the OU3 plume is addressed in Section 11.0.

**How much VOC mass has been removed (at each well and total)?**

Table 3-1 shows that the NBCGRS removed 624 pounds of VOCs during FY 2009. The total cumulative VOCs removed by the NBCGRS is 20,944 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 2009 slightly decreased compared to FY 2008. The trend in annual mass removal per unit volume pumped increased slightly in FY 2008 from FY 2007 and then decreases slightly from FY 2008 to FY 2009. 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 2009**

| | WELL #3 | | | WELL #4 | | | WELL #5 | | | WELL #6 | | | WELL #14 | | | WELL #15 | | | System Totals | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MONTH | VOC (µg/l) | WATER TREATED (mgallons) | VOC Mass Removed (lbs) | VOC (µg/l) | WATER TREATED (mgallons) | VOC Mass Removed (lbs) | VOC (µg/l) | WATER TREATED (mgallons) | VOC Mass Removed (lbs) | VOC (µg/l) | WATER TREATED (mgallons) | VOC Mass Removed (lbs) | VOC (µg/l) | WATER TREATED (mgallons) | VOC Mass Removed (lbs) | VOC (µg/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, 2008 | | | | | | | | | | | | | | | | | | | 20,119 | 20,321 |
| OCTOBER | 68 | 5.583 | 3.169 | 63 | 33.000 | 17.351 | 170 | 0.410 | 0.582 | 90 | 1.428 | 1.073 | 5 | 23.549 | 0.983 | 46 | 22.507 | 8.641 | 86.5 | 31.800 |
| NOVEMBER | 91 | 0.137 | 0.104 | 65 | 36.291 | 19.688 | 170 | 0.515 | 0.731 | 85 | 19.111 | 13.558 | 5 | 1.470 | 0.056 | 39 | 40.303 | 13.118 | 98 | 47.258 |
| DECEMBER | 69 | 7.485 | 4.310 | 67 | 35.396 | 19.793 | 170 | 7.427 | 10.538 | 92 | 16.817 | 12.913 | 4 | 0.192 | 0.006 | 33 | 35.946 | 9.900 | 103 | 57.464 |
| JANUARY | 76 | 10.626 | 6.740 | 62 | 33.368 | 17.266 | 170 | 11.172 | 15.851 | 89 | 13.346 | 9.913 | 3 | 0.163 | 0.004 | 29 | 35.734 | 8.649 | 104 | 58.428 |
| FEBRUARY | 76 | 1.752 | 1.111 | 59 | 29.687 | 14.618 | 140 | 12.456 | 14.554 | 79 | 14.014 | 9.240 | 3 | 0.213 | 0.006 | 26 | 32.025 | 6.949 | 90 | 46.482 |
| MARCH | 73 | 0.266 | 0.162 | 72 | 34.896 | 20.969 | 140 | 12.837 | 14.999 | 73 | 14.456 | 8.807 | 4 | 0.247 | 0.008 | 25 | 35.301 | 7.366 | 98 | 52.315 |
| APRIL | 87 | 0.116 | 0.084 | 78 | 33.859 | 22.042 | 140 | 9.805 | 11.457 | 79 | 12.076 | 7.962 | 3 | 0.190 | 0.005 | 25 | 36.405 | 7.596 | 92.5 | 49.149 |
| MAY | 76 | 1.706 | 1.082 | 68 | 34.720 | 19.705 | 130 | 13.338 | 14.471 | 67 | 15.080 | 8.432 | 3 | 0.360 | 0.010 | 22 | 36.733 | 6.745 | 102 | 50.449 |
| JUNE | 85 | 3.978 | 2.822 | 60 | 35.990 | 18.022 | 140 | 21.173 | 24.739 | 74 | 23.825 | 14.714 | 4 | 0.190 | 0.007 | 28 | 36.212 | 8.462 | 121 | 68.772 |
| JULY | 65 | 4.584 | 2.487 | 67 | 34.966 | 19.552 | 110 | 22.675 | 20.817 | 65 | 21.343 | 11.578 | 4 | 0.214 | 0.007 | 25 | 38.547 | 8.043 | 122 | 62.489 |
| AUGUST | 83 | 6.282 | 4.352 | 65 | 30.512 | 16.552 | 110 | 16.495 | 15.143 | 68 | 15.158 | 8.603 | 4 | 0.189 | 0.006 | 25 | 35.589 | 7.426 | 104 | 52.085 |
| SEPTEMBER | 72 | 33.944 | 20.397 | 66 | 3.564 | 1.963 | 110 | 16.681 | 15.314 | 60 | 3.890 | 1.948 | 3 | 0.148 | 0.003 | 22 | 41.230 | 7.570 | 99.5 | 47.200 |
| Subtotal | | | 46.821 | | | 207.522 | | | 159.196 | | | 108.741 | | | 1.100 | | | 100.465 | | |
| % of Total Mass | | | 7.5 | | | 33.3 | | | 25.5 | | | 17.4 | | | 0.2 | | | 16.1 | | |
| TOTAL GALLONS TREATED AND VOC'S REMOVED FOR FISCAL YEAR 2009 | | | | | | | | | | | | | | | | | | | 1,222 | 624 |
| TOTAL GALLONS TREATED AND VOC'S REMOVED SINCE SYSTEM START UP | | | | | | | | | | | | | | | | | | | 21,341 | 20,944 |

# Table 3-2

## OU1, PGAC Effluent Water Quality
## Fiscal Year 2009

| Sampling Date | Influent Well Monitoring: Well #3 | Well #4 | Well #5 | Well #6 | Well #14 | Well #15 | Operational Performance Monitoring: Contactor #1 A | Contactor #1 B | Contactor #2 A | Contactor #2 B | Contactor #3 A | Contactor #3 B | Contactor #4 A | Contactor #4 B | Contactor #5 A | Contactor #5 B | Contactor #6 A | Contactor #6 B | Contactor #7 A | Contactor #7 B | Contactor #8 A | Contactor #8 B |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *"A" Vessels are the Lead Vessels.* | | | | | | | | | | | | | | | | | | | | | | |
| 6-Oct-08 | 68 | 63 | 170 | 90 | 5 | 46 | 0 | NS | 2.3 | NS | 2.2 | NS | 1.8 | NS | 2.6 | NS | 0 | NS | 2.3 | NS | 2.1 | NS |
| 7-Oct-08 | NS | NS | NS | NS | NS | NS | NS | 0 | NS | 0 | NS | 0 | NS | NS | NS | 0 | NS | 0 | NS | 0 | NS | 0 |
| *GAC replaced in contactors 1A, 2A, 3A, 4A, 5A, 6A, 7A, 8A between October 7, 2008 and October 24, 2008. "B" Vessels become the Lead Vessels.* | | | | | | | | | | | | | | | | | | | | | | |
| 10-Oct-08 | NS | NS | NS | NS | NS | NS | 0 | NS | 0 | NS | 0 | NS | 0 | NS | NS | NS | NS | NS | NS | NS | NS | NS |
| 21-Oct-08 | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | 0 | NS | 0 | NS | 0 | NS | 0 | NS |
| 5-Nov-08 | 91 | 65 | 170 | 85 | 4.6 | 39 | NS | 0 | NS | 0 | NS | 0 | NS | 0 | NS | NS | NS | 0 | NS | 0 | NS | 0 |
| *GAC Contactor #5 not in operation at time of November sampling event, therefore not sampled in November.* | | | | | | | | | | | | | | | | | | | | | | |
| 3-Dec-08 | 69 | 67 | 170 | 92 | 4 | 33 | NS | 0 | NS | 0 | NS | 0 | NS | 0 | NS | 0 | NS | 0 | NS | 0 | NS | 0 |
| 6-Jan-09 | 76 | 62 | 170 | 89 | 3 | 29 | NS | 0 | NS | 0 | NS | 0 | NS | 0 | NS | 0 | NS | 0 | NS | 0 | NS | 0 |
| 4-Feb-09 | 76 | 59 | 140 | 79 | 3 | 26 | NS | 0 | NS | 0 | NS | 0 | NS | 0 | NS | 0 | NS | 0 | NS | 0 | NS | 0 |
| 2-Mar-09 | 73 | 72 | 140 | 73 | 4 | 25 | NS | 0 | NS | 0 | NS | 0 | NS | 0 | NS | 0 | NS | 0 | NS | 0 | NS | 0 |
| 1-Apr-09 | 87 | 78 | 140 | 79 | 3 | 25 | NS | 0 | NS | 0 | NS | 1.4 | NS | 1.4 | NS | 0 | NS | 0 | NS | 0 | NS | 0 |
| *GAC replaced in contactors 1B, 2B, 3B, 4B, 5B, 6B, 7B, 8B between April 21, 2009 and May 8, 2009. "A" Vessels become the Lead Vessels.* | | | | | | | | | | | | | | | | | | | | | | |
| 11-May-09 | 76 | 68 | 130 | 67 | 3 | 22 | 0 | NS | 0 | NS | 0 | NS | 0 | NS | 0 | NS | 0 | NS | 0 | NS | 0 | NS |
| 1-Jun-09 | 85 | 60 | 140 | 74 | 4 | 28 | 0 | NS | 0 | NS | 0 | NS | 0 | NS | 0 | NS | 0 | NS | 0 | NS | 0 | NS |
| 21-Jul-09 | 65 | 67 | 110 | 65 | 4 | 25 | 0 | NS | 0 | NS | 0 | NS | 0 | NS | 0 | NS | 0 | NS | 0 | NS | 0 | NS |
| 5-Aug-09 | 83 | 65 | 110 | 68 | 4 | 25 | 0 | NS | 0 | NS | 1.0 | NS | 0 | NS | 0 | NS | 0 | NS | 0 | NS | 0 | NS |
| 8-Sep-09 | 72 | 66 | 110 | 60 | 3 | 22 | 0 | NS | 0 | NS | 1.7 | NS | 0 | NS | 0 | NS | 0 | NS | 0 | NS | 0 | NS |

Notes:

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

2) NS = Not Sampled.

# Table 3-3

## Summary of OU1 Monitoring Requirements
## Fiscal Year 2009

| 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 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 showing the influences of pumping | Army | OU1 Groundwater Monitoring Plan in the Annual Report |
| | | c. | Water quality, to assist in evaluation of statistical improvements in groundwater quality. | Army | OU1 Groundwater Monitoring Plan in the Annual 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 Report |
| | | b. | Water quality data throughout the North Plume to evaluate remedial progress | Army | OU1 Groundwater Monitoring Plan in the Annual Report |

# Table 3-4
# OU1 Groundwater Quality Data

## Fiscal Year 2009

| | | | 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 | | 6/5/09 | <1 | <1 | <1 | <1 | <1 | <1 |
| 03U821 | | 6/11/09 | **18** | 1.1 | JP 0.21 | 1.1 | <1 | JP 0.89 |
| 03U822 | | 6/17/09 | **120** | 5.6 | 1.7 | 1.5 | <1 | 8.2 |
| 03M843 | | 6/2/09 | <1 | <1 | <1 | <1 | <1 | <1 |
| 03L811 | | 6/8/09 | <1 | 1.8 | JP 0.45 | <1 | <1 | 1.6 |
| 03L822 | | 6/17/09 | **210** | **6.6** | 2.5 | 3.8 | <1 | 4.6 |
| 03L822 | D | 6/17/09 | **230** | **6.4** | 2.5 | 3.8 | <1 | 4.4 |
| 03L832 | | 6/10/09 | 1.1 | JP 0.16 | JP 0.2 | <1 | <1 | JP 0.24 |
| 03L841 | | 6/4/09 | <1 | JP 0.22 | JP 0.35 | <1 | <1 | JP 0.46 |
| 03L846 | | 6/8/09 | JP 0.19 | 6.0 | 7.8 | <1 | <1 | 14 |
| 04U821 | | 6/12/09 | **19** | 1.6 | JP 0.2 | 1.2 | <1 | 1.2 |
| 04U834 | | 6/12/09 | 1.4 | <1 | <1 | <1 | <1 | <1 |
| 04U836 | | 6/23/09 | **79** | **7.6** | 1.7 | 3.3 | <1 | 5.9 |
| 04U837 | | 6/18/09 | 2.4 | JP 0.23 | <1 | <1 | <1 | JP 0.31 |
| 04U838 | | 6/23/09 | 1.2 | <1 | <1 | <1 | <1 | <1 |
| 04U839 | | 6/9/09 | JP 0.89 | JP 0.22 | <1 | <1 | <1 | <1 |
| 04U841 | | 6/9/09 | **18** | 2.8 | JP 0.88 | 2.8 | <1 | 2.6 |
| 04U843 | | 6/15/09 | **98** | **13** | 1.2 | 9.8 | <1 | 9.2 |
| 04U844 | | 6/18/09 | **190** | **20** | 2.5 | 26 | JP 0.33 | 13 |
| 04U846 | | 6/9/09 | **9.9** | 5.6 | 7.0 | <1 | <1 | 9.4 |
| 04U846 | D | 6/9/09 | **10** | 5.5 | 7.0 | <1 | <1 | 9.7 |
| 04U847 | | 6/19/09 | **570** | **38** | 5.0 | 18 | <2 | 28 |
| 04U849 | | 6/12/09 | **45** | 4.9 | JP 0.66 | 3.0 | <1 | 4.0 |
| 04U850 | | 6/15/09 | **110** | **10** | 3.2 | 3.9 | <1 | 9.3 |
| 04U850 | D | 6/15/09 | **110** | **11** | 3.5 | 4.2 | <1 | 9.5 |

# Table 3-4
# OU1 Groundwater Quality Data

## Fiscal Year 2009

| | | | 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 |
| 04U855 | | 6/5/09 | JP 0.53 | <1 | <1 | <1 | <1 | <1 |
| 04U871 | | 6/25/09 | **19** | 1.3 | JP 0.17 | JP 0.92 | <1 | 3.1 |
| 04U872 | | 6/24/09 | **6.2** | JP 0.41 | <1 | <1 | <1 | JP 0.48 |
| 04U875 | | 6/12/09 | JP 0.98 | <1 | <1 | <1 | <1 | <1 |
| 04U877 | | 6/9/09 | JP 0.51 | <1 | <1 | <1 | <1 | <1 |
| 04U877 | D | 6/9/09 | JP 0.56 | <1 | <1 | <1 | <1 | JP 0.18 |
| 04U879 | | 6/5/09 | <1 | <1 | <1 | <1 | <1 | <1 |
| 04U880 | | 6/8/09 | <1 | <1 | <1 | <1 | <1 | <1 |
| 04U881 | | 6/17/09 | 1.8 | <1 | <1 | <1 | <1 | <1 |
| 04U882 | | 6/23/09 | **20** | 1.6 | <1 | 1.3 | <1 | 1.2 |
| 04U883 | | 6/8/09 | <1 | <1 | <1 | <1 | <1 | <1 |
| 04J822 | | 6/16/09 | **57** | **11** | 1.3 | 10 | <1 | 7.6 |
| 04J834 | | 6/4/09 | JP 0.2 | <1 | <1 | <1 | <1 | <1 |
| 04J836 | | 6/22/09 | 1.3 | <1 | <1 | <1 | <1 | <1 |
| 04J836 | D | 6/22/09 | 1.1 | <1 | <1 | <1 | <1 | <1 |
| 04J837 | | 6/19/09 | 2.5 | JP 0.23 | <1 | <1 | <1 | JP 0.33 |
| 04J838 | | 6/22/09 | **35** | 2.3 | JP 0.17 | JP 0.93 | <1 | 2.0 |
| 04J839 | | 6/10/09 | 3.6 | JP 0.29 | <1 | <1 | <1 | <1 |
| 04J847 | | 6/18/09 | **740** | **49** | 7.1 | 43 | <2 | 34 |
| 04J849 | | 6/16/09 | <1 | <1 | <1 | <1 | <1 | <1 |
| 04J882 | | 6/5/09 | <1 | <1 | <1 | <1 | <1 | <1 |
| PJ#318 | | 6/18/09 | 2.1 | JP 0.18 | <1 | <1 | <1 | JP 0.12 |
| 200154 | | 6/5/09 | <1 | <1 | <1 | <1 | <1 | <1 |
| 200524 | | 6/23/09 | **9.7** | JP 0.7 | <1 | <1 | <1 | JP 0.5 |
| 200803 | | 6/23/09 | 4.0 | JP 0.21 | <1 | <1 | <1 | JP 0.19 |

# Table 3-4
# OU1 Groundwater Quality Data

## Fiscal Year 2009

| | | | 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 |
| 206688 | | 6/19/09 | **10** | 1.0 | <1 | JP 0.73 | <1 | JP 0.97 |
| 234546 | | 6/23/09 | **12** | JP 0.73 | <1 | <1 | <1 | JP 0.77 |
| 409547 | | 6/3/09 | JP 0.27 | 1.5 | 1.1 | 1.2 | <1 | 1.9 |
| 409548 | | 6/8/09 | JP 0.85 | JP 0.19 | <1 | <1 | <1 | JP 0.43 |
| 409549 | | 6/10/09 | **29** | 3.4 | JP 0.49 | 2.2 | <1 | 2.8 |
| 409550 | | 6/12/09 | **31** | JP 0.6 | JP 0.16 | 1.9 | <1 | JP 0.38 |
| 409555 | | 6/5/09 | <1 | <1 | <1 | <1 | <1 | <1 |
| 409555 | D | 6/5/09 | <1 | <1 | <1 | <1 | <1 | <1 |
| 409556 | | 6/4/09 | <1 | <1 | <1 | <1 | <1 | <1 |
| 409557 | | 6/11/09 | **37** | **11** | 2.5 | 5.6 | <1 | 8.8 |
| 512761 | | 6/19/09 | **7.2** | JP 0.56 | <1 | JP 0.5 | <1 | JP 0.38 |

Notes:

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

D Duplicate sample.

JP The value is below the reporting level, 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**

| Group | Kendall S | N | Raw Trend | Confidence | COV | Raw Trend Decision | MAROS Conclusion | Threshold Triggered? | Comments |
|---|---|---|---|---|---|---|---|---|---|
| **Group 2 Wells:** | | | | | | | | | |
| 409549 | 11 | 6 | Increasing | 97.00% | 0.5538 | Definite | **Increasing** | Yes | Incr. from 5 to 29 µg/L in 6yrs. |
| 409557 | 7 | 6 | Increasing | 86.00% | 0.6211 | S or NT | **No Trend** | Yes | near plume center, plume shifted slightly |
| 03L673 | 2 | 6 | Increasing | 57.00% | 0.7102 | S or NT | **No Trend** | Yes | see OU3 Discussion |
| 03L833 | -15 | 6 | Decreasing | 99.00% | 0.7521 | Definite | **Decreasing** | No | |
| 03L848 | -1 | 6 | Decreasing | 50.00% | 0.2741 | S or NT | **Stable** | No | |
| 03L859 | 3 | 6 | Increasing | 64.00% | 0.3536 | S or NT | **No Trend** | Yes | see OU3 Discussion |
| 03U672 | -3 | 6 | Decreasing | 64.00% | 2.4495 | S or NT | **No Trend** | Yes | see OU3 Discussion |
| 03U805 | -1 | 6 | Decreasing | 50.00% | 0.4541 | S or NT | **Stable** | No | |
| 04U673 | 3 | 6 | Increasing | 64.00% | 0.5935 | S or NT | **No Trend** | Yes | see OU3 Discussion |
| 04U821 | -7 | 6 | Decreasing | 86.00% | 1.0583 | S or NT | **No Trend** | Yes | In center of plume, stable since large decrease in '92 |
| 04U832 | 9 | 6 | Increasing | 93.00% | 0.7360 | Probable | **Increasing** | Yes | stable over long term |
| 04U833 | -13 | 6 | Decreasing | 99.00% | 1.2295 | Definite | **Decreasing** | No | |
| 04U841 | -2 | 6 | Decreasing | 57.00% | 0.4911 | S or NT | **Stable** | No | |
| 04U843 | 11 | 6 | Increasing | 97.00% | 0.7463 | Definite | **Increasing** | Yes | near plume center, plume shifted slightly |
| 04U845 | -3 | 6 | Decreasing | 64.00% | 0.8577 | S or NT | **Stable** | No | |
| 04U846 | 9 | 6 | Increasing | 93.00% | 1.0723 | Probable | **Increasing** | Yes | near plume center, looks stable |
| 04U849 | | | | | | | | | see Group 6 summary below |
| 04U854 | -14 | 6 | Decreasing | 99.00% | 0.4250 | Definite | **Decreasing** | No | |
| 04U859 | -3 | 6 | Decreasing | 64.00% | 0.6926 | S or NT | **Stable** | No | |
| 04U861 (abandoned) | 11 | 6 | Increasing | 97.00% | 1.0262 | Definite | **Increasing** | Yes | Abandoned after 2006 sample,in New Brighton Development |
| 04U875 | -15 | 6 | Decreasing | 99.00% | 0.8348 | Definite | **Decreasing** | No | |
| 04U877 | -11 | 6 | Decreasing | 97.00% | 0.5491 | Definite | **Decreasing** | No | |
| 206688 | -4 | 6 | Decreasing | 70.00% | 0.0704 | S or NT | **Stable** | No | |
| **Group 5** | -11 | 6 | Decreasing | 97.00% | 0.1267 | Definite | **Decreasing** | No | |
| **Group 3** | -14 | 6 | Decreasing | 99.00% | 0.4450 | Definite | **Decreasing** | No | |
| **Group 1 NP** | -9 | 6 | Decreasing | 93.00% | 0.3774 | Probable | **Decreasing** | No | |
| **Group 1 SP** | -8 | 6 | Decreasing | 89.00% | 0.1107 | S or NT | **Stable** | Yes | Stable for 6yrs, but avg. is <5 µg/L |

**Notes:**
S or NT = Stable or No Trend
N = Number of data points
COV = Coefficient of Variance
Threshold Criteria defined in Table D.2.8

**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**

| Group | Kendall S | N | Raw Trend | Confidence | COV | Raw Trend Decision | MAROS Conclusion | Threshold Triggered? | Comments |
|---|---|---|---|---|---|---|---|---|---|
| **Group 6 OU1 Jordan Wells:** | | | | | | | | | |
| 04J822 | -7 | 6 | Decreasing | 86.00% | 0.1824 | S or NT | **Stable** | Yes | Mean 75 µg/L, decr. last 3 years |
| 04J834 | 3 | 6 | Increasing | 64.00% | 0.5461 | S or NT | **No Trend** | Yes | All detection below 0.5 µg/L |
| 04J836 | 3 | 6 | Increasing | 64.00% | 0.7297 | S or NT | **No Trend** | Yes | All detection below 5 µg/L |
| 04J838 | 3 | 6 | Increasing | 64.00% | 0.5857 | S or NT | **Stable** | Yes | 4.2-46 µg/L |
| 04J837 | -9 | 6 | Decreasing | 93.00% | 0.9224 | Probable | **Decreasing** | No | |
| 04J839 | 9 | 6 | Increasing | 93.00% | 0.7800 | Probable | **Increasing** | Yes | All detections below 5 µg/L |
| 04J847 | -6 | 6 | Decreasing | 81.00% | 0.1113 | S or NT | **Stable** | Yes | Consistent reuslts, mean 816 µg/L |
| 04J849 | 1 | 6 | Increasing | 50.00% | 1.5543 | S or NT | **No Trend** | Yes | All detection below 0.5 µg/L |
| 04J882 | 0 | 6 | Zero | 43.00% | NA | S or NT | **NA** | No | All ND |
| 04J077 | -10 | 6 | Decreasing | 95.10% | 0.8406 | Definite | **Decreasing** | No | |
| 04J702 | -14 | 6 | Decreasing | 99.00% | 0.9269 | Definite | **Decreasing** | No | |
| 04J708 | -6 | 6 | Decreasing | 76.00% | 0.2302 | S or NT | **Stable** | Yes | Last 5 rounds below 5 µg/L |
| 04J713 | -12 | 6 | Decreasing | 99.00% | 1.8489 | Definite | **Decreasing** | No | All detection below 5 µg/L, currently ND |
| **Group 6 Nested Unit 4 wells:** | | | | | | | | | |
| 04U077 | -11 | 6 | Decreasing | 97.00% | 0.4179 | Definite | **Decreasing** | No | |
| 04U702 | -9 | 6 | Decreasing | 93.00% | 1.1403 | Probable | **Decreasing** | No | |
| 04U708 | -6 | 6 | Decreasing | 81.00% | 0.2457 | S or NT | **Stable** | Yes | Abandoned after 2006 sample for New Brighton Development |
| 04U713 | -11 | 6 | Decreasing | 76.50% | 0.6245 | S or NT | **Stable** | Yes | Stable but well below 5 µg/L |
| 04U834 | -15 | 6 | Decreasing | 99.00% | 1.3927 | Definite | **Decreasing** | No | |
| 04U836 | 9 | 6 | Increasing | 93.00% | 0.7102 | Probable | **Increasing** | Yes | Increased from 11 µg/L in '01 to 79 µg/L in '09 |
| 04U837 | -3 | 6 | Decreasing | 64.00% | 0.9649 | S or NT | **Stable** | Yes | 2.2-19 µg/L |
| 04U838 | 1 | 6 | Increasing | 50.00% | 1.3800 | S or NT | **No Trend** | Yes | 1.2 - 48 µg/L |
| 04U839 | 0 | 6 | Zero | 50.00% | 0.4791 | S or NT | **Stable** | Yes | Stable but well below 5 µg/L |
| 04U847 | -4 | 6 | Decreasing | 70.00% | 0.2895 | S or NT | **Stable** | Yes | Mean 938 µg/L |
| 04U849 | -5 | 6 | Decreasing | 76.50% | 0.2555 | S or NT | **Stable** | Yes | no evidence of migration to Jordan (04J849) |
| 04U882 | 7 | 6 | Increasing | 86.00% | 0.5874 | S or NT | **Stable** | 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

**MAROS Decision Matrix**

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

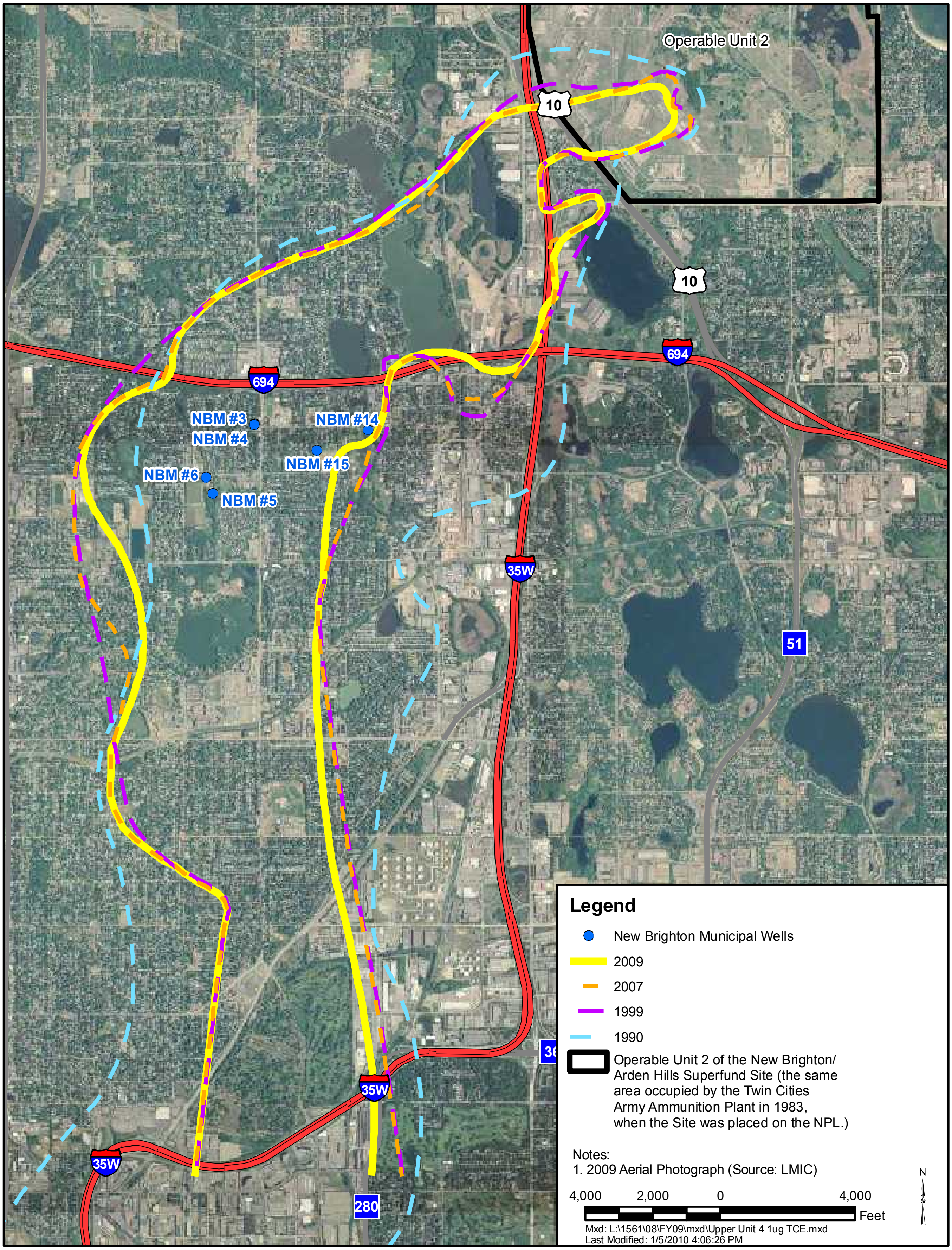
**Table 3-5**
**Group 5 Unit 3 Mann-Kendall Summary and MAROS Conclusion**

| Group | Kendall S | N | Raw Trend | Confidence | COV | Raw Trend Decision | MAROS Conclusion | Threshold Triggered? | Comments |
|---|---|---|---|---|---|---|---|---|---|
| **Group 5 Unit 3 Wells:** | | | | | | | | | |
| 409550 | -15 | 6 | Decreasing | 99.00% | 1.0090 | Definite | **Decreasing** | No | |
| 409597 | -11 | 6 | Decreasing | 99.00% | 0.3885 | Definite | **NA** | NA | Abandoned for constr. after 2007 sampling |
| 409596 | -8 | 6 | Decreasing | 90.10% | 0.6714 | Probable | **NA** | NA | Abandoned for constr. after 2007 sampling |
| 03U831 | 9 | 6 | Increasing | 93.20% | 1.5885 | Probable | **NA** | NA | Abandoned in 2006 for construction |
| 03U821 | -14 | 6 | Decreasing | 99.60% | 0.5997 | Definite | **Decreasing** | No | |
| 03U822 | -3 | 6 | Decreasing | 64.00% | 0.4360 | S or NT | **Stable** | Yes | Appears to have peaked in 2001, decr. since |
| 03L822 | -15 | 6 | Decreasing | 99.00% | 0.4064 | Definite | **Decreasing** | No | |
| 03L809 | -5 | 6 | Decreasing | 76.50% | 0.5413 | S or NT | **Stable** | Yes | Decreasing since peak in 2001 |

Notes:
S or NT = Stable or No Trend
N = Number of data points
COV = Coefficient of Variance

**MAROS Decision Matrix**

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




ANNUAL PERFORMANCE REPORT

Upper Unit 4,
1 µg/l Trichloroethene Isoconcentration Map



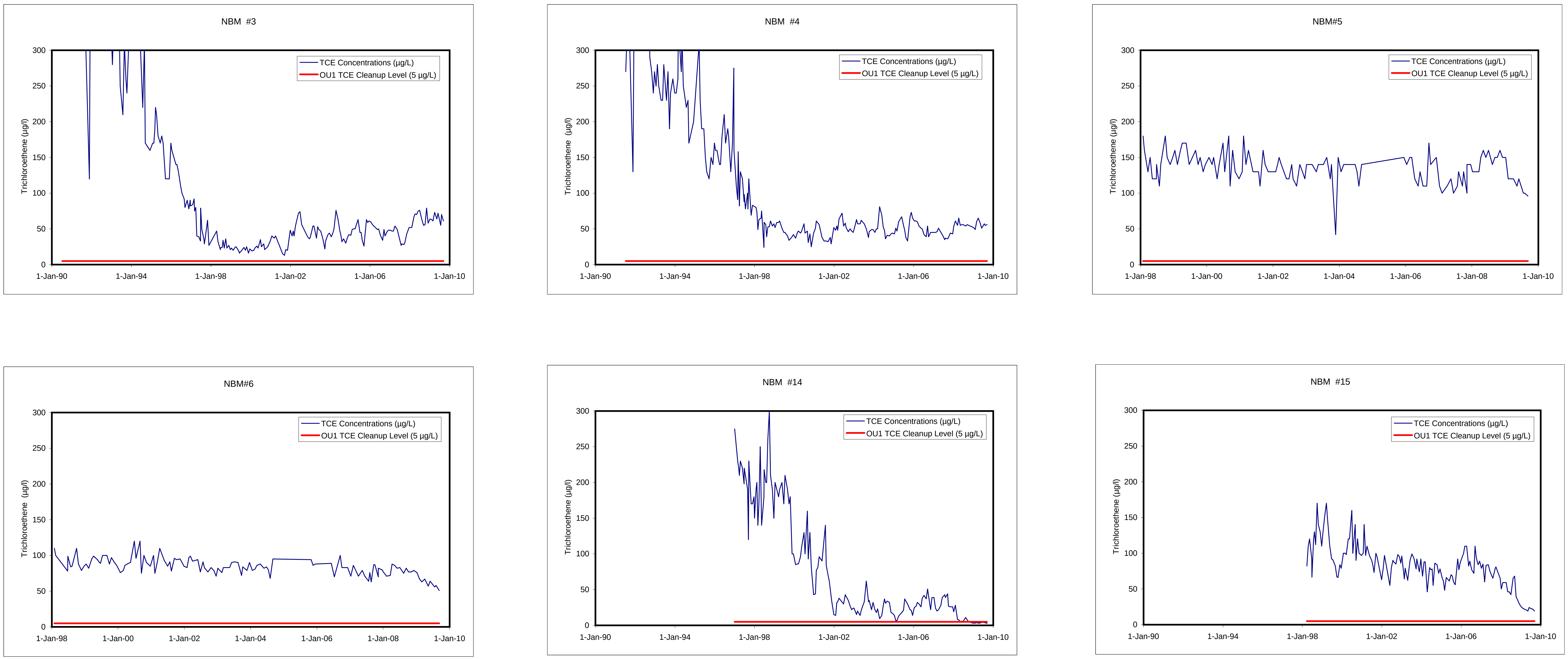
Wenck

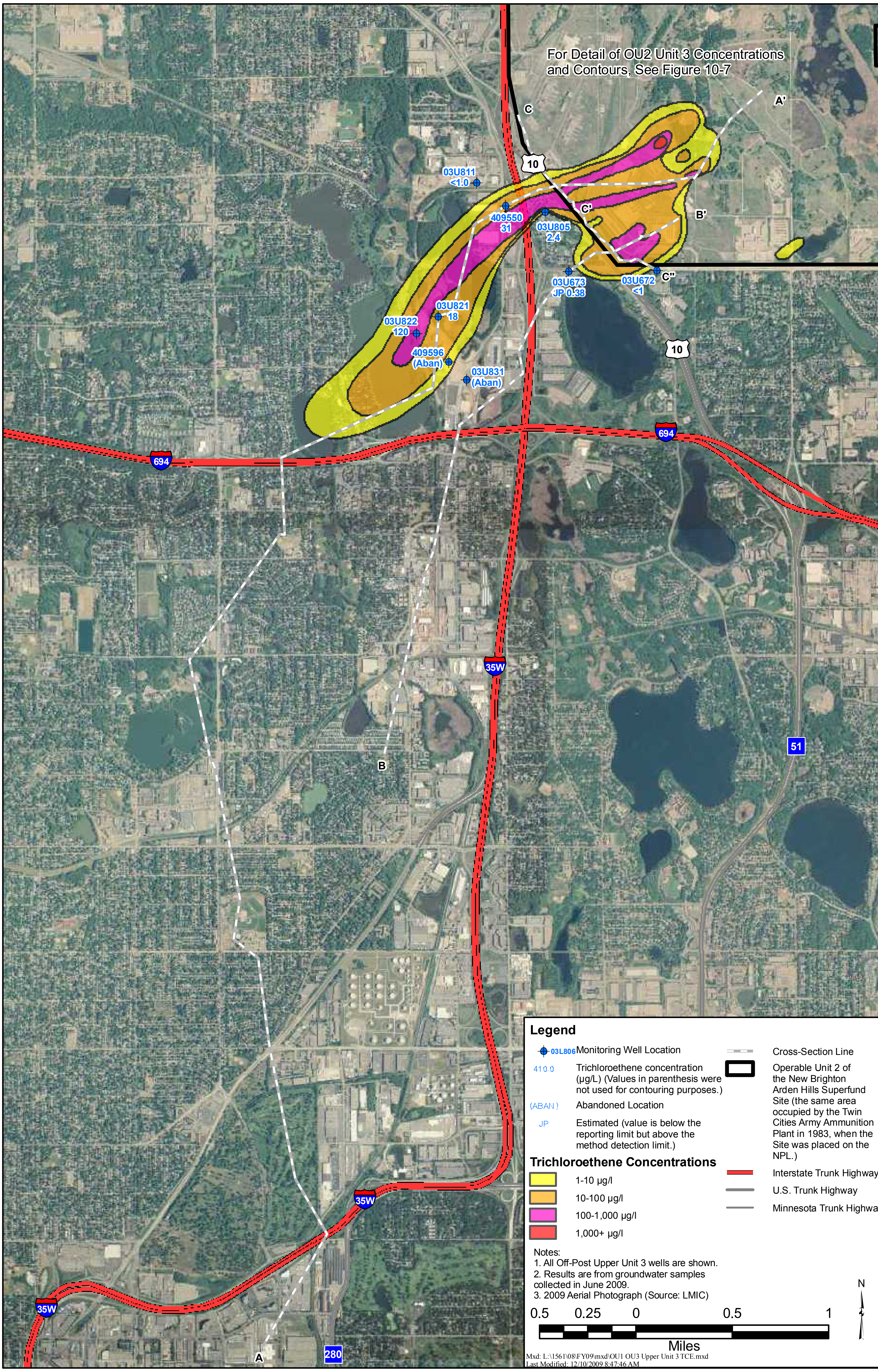
Wenck Associates, Inc. Environmental Engineers
1800 Pioneer Creek Center Maple Plain, MN 55359-0429

FY 2009

Figure 3-1

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






ANNUAL PERFORMANCE REPORT

OU1 & OU3, Upper Unit 3, Trichloroethene Isoconcentration Map
Summer 2009

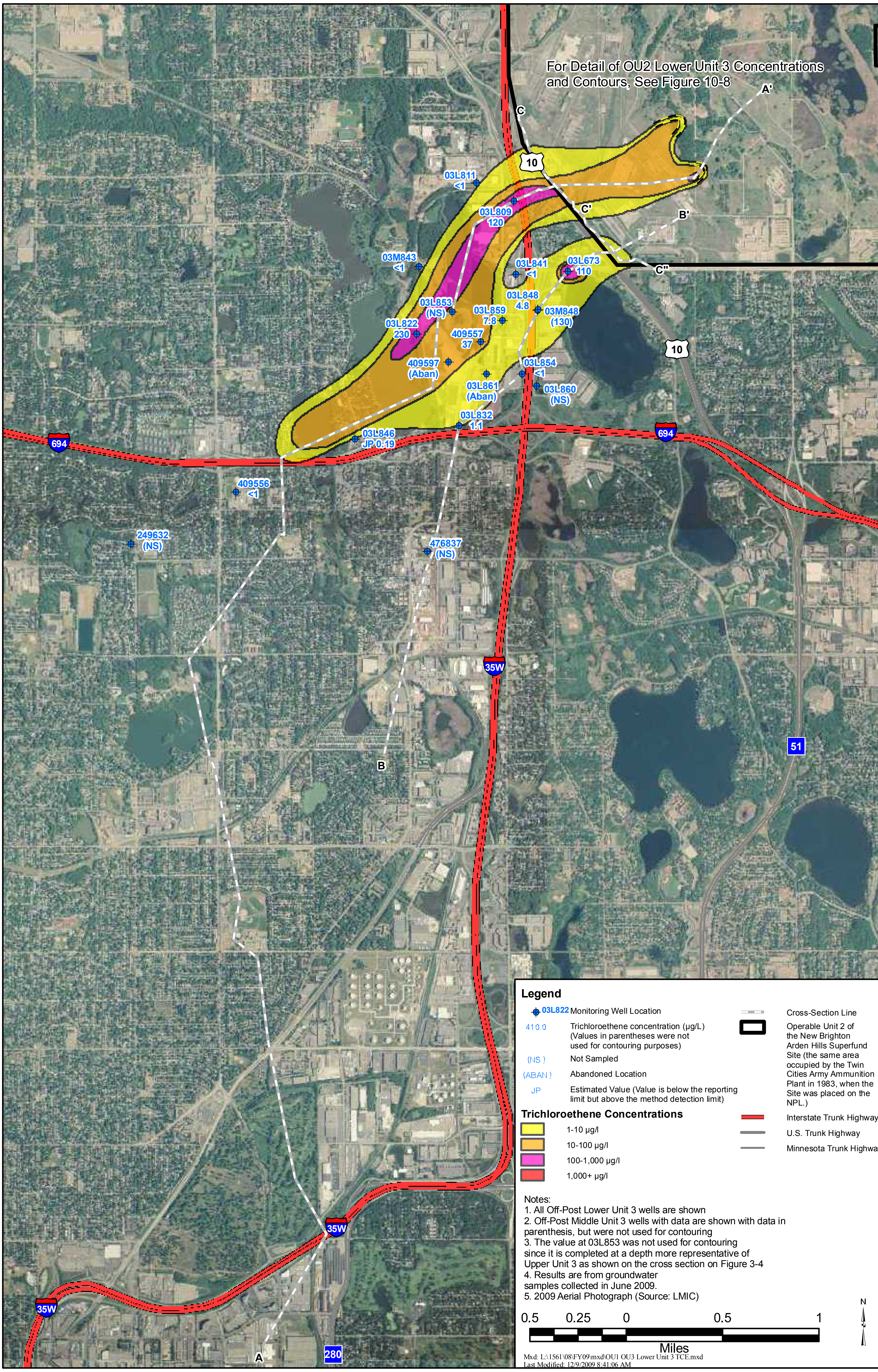


Wenck

Wenck Associates, Inc. 1800 Pioneer Creek Center
Environmental Engineers Maple Plain, MN 55359-0429

FY 2009

Figure 3-3




ANNUAL PERFORMANCE REPORT

OU1 & OU3, Lower Unit 3, Trichloroethene Isoconcentration Map
Summer 2009



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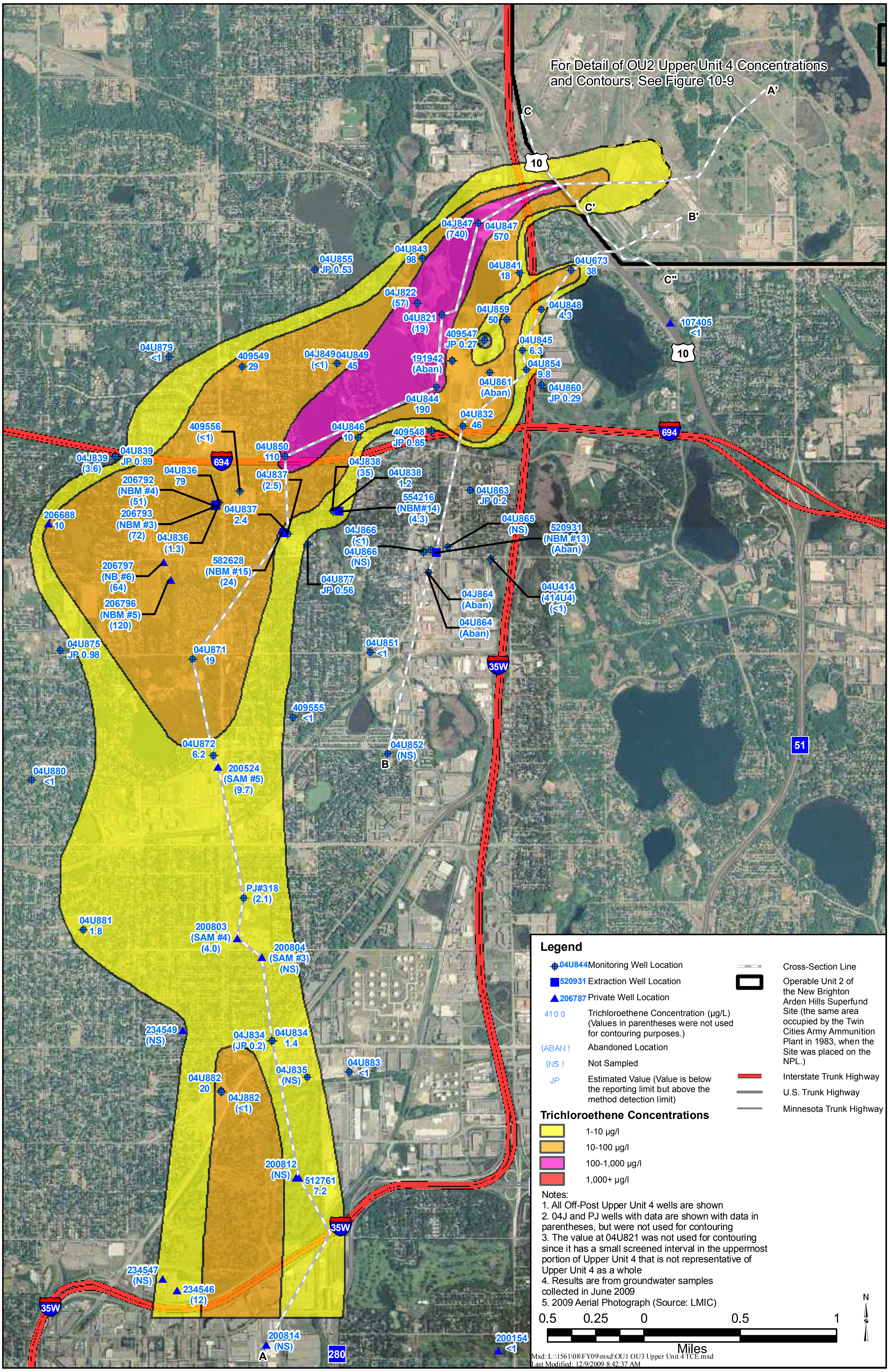
Environmental Engineers Maple Plain, MN 55359-0429

FY 2009

Figure 3-4




ANNUAL PERFORMANCE REPORT

OU1 & OU3, Upper Unit 4, Trichloroethene Isoconcentration Map
Summer 2009



Wenck

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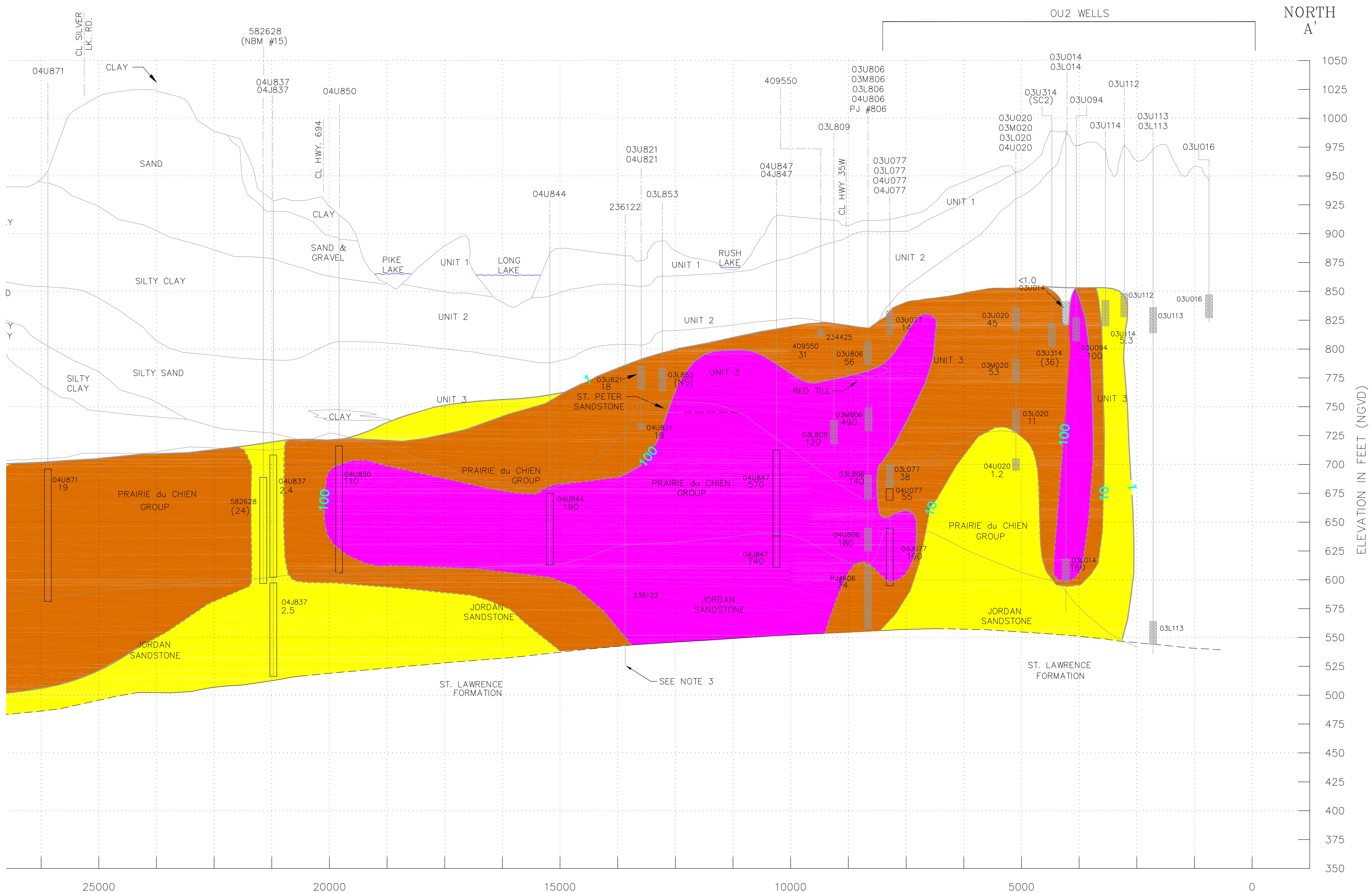
1800 Pioneer Creek Center Maple Plain, MN 55359-0429

FY 2009

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 (ug/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: /1561/2009/JUNE 2009.DWG

ANNUAL PERFORMANCE REPORT

OU2/OU1 TRICHLOROETHENE CROSS-SECTION A-A' (NORTH HALF), SUMMER 2009

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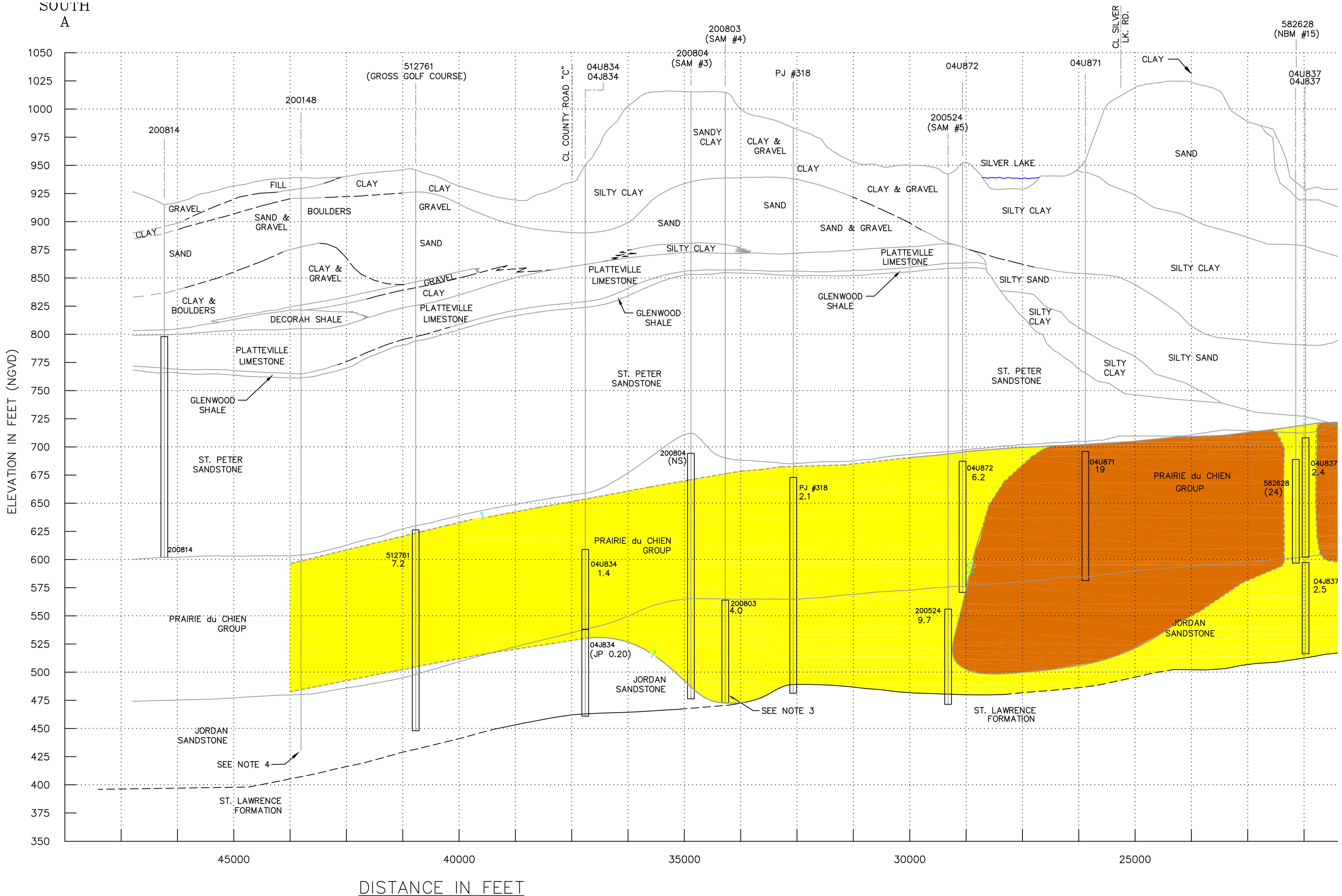
Environmental Engineers
1800 Pioneer Creek Center
Maple Plain, MN 55339

FY 2009

FIGURE 3-6




## 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 (ug/l) (VALUES IN PARENTHESES WERE NOT USED FOR CONTOURING PURPOSES)

10 ISOCONCENTRATION CONTOUR $\mu$g/l)

10 ESTIMATED ISOCONCENTRATION CONTOUR ($\mu$g/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: /1561/2009/JUNE 2009.DWG

ANNUAL PERFORMANCE REPORT

OU1 TRICHLOROETHENE CROSS-SECTION A-A' (SOUTH HALF), SUMMER 2009

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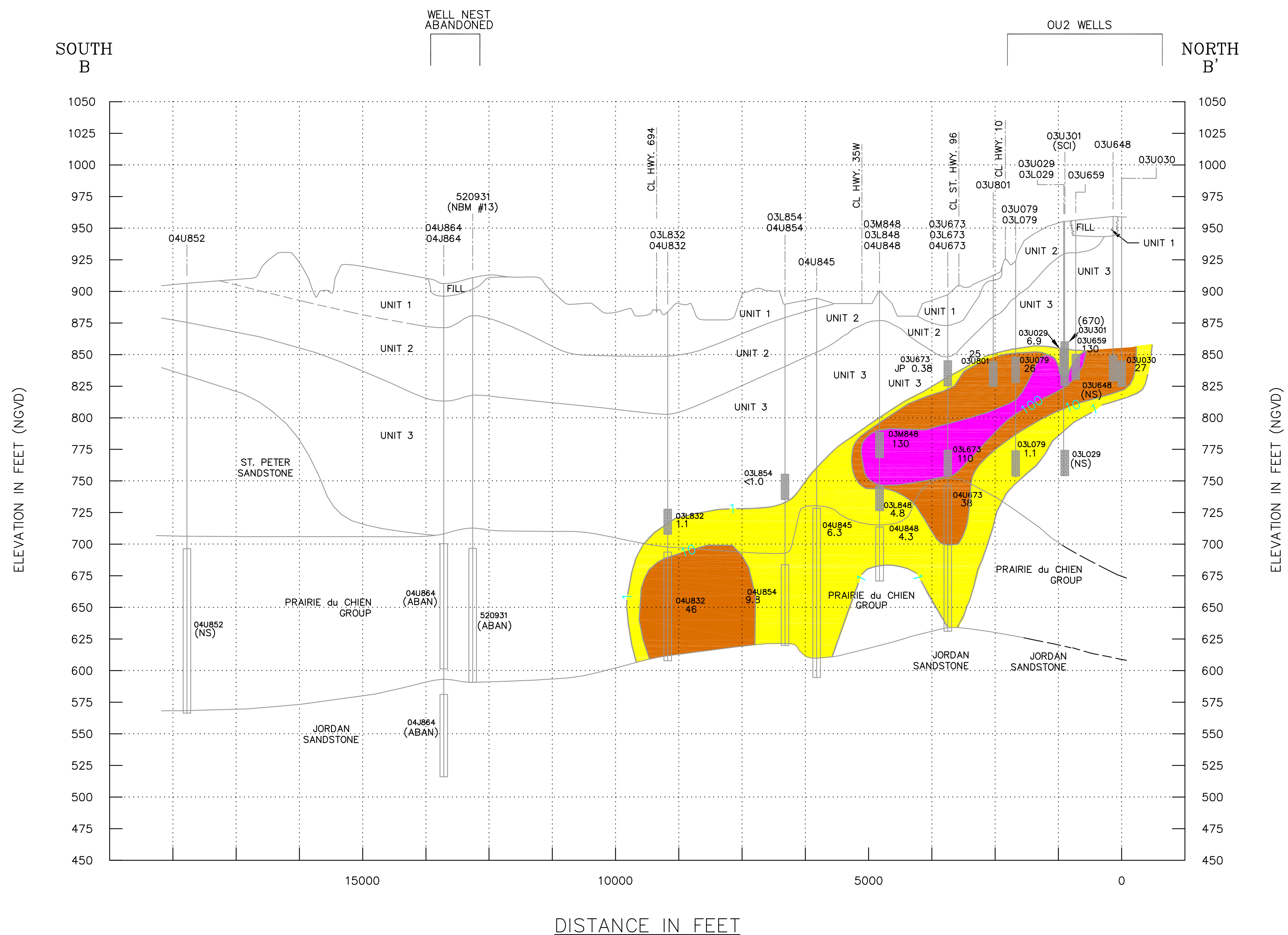
FY 2009

FIGURE 3-7




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 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.

LEGEND

GEOLOGIC CONTACT

INFERRED GEOLOGIC CONTACT

SCREENED INTERVAL OF WELL

OPEN HOLE INTERVAL OF WELL

04U806 2500.00
04U847 790.00
TRICHLOROETHENE CONCENTRATION (ug/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:/1561/05/2007/JAN 2007.DWG

ANNUAL PERFORMANCE REPORT

OU2/OU3 TRICHLOROETHENE CROSS-SECTION B-B' (SOUTH HALF), SUMMER 2009

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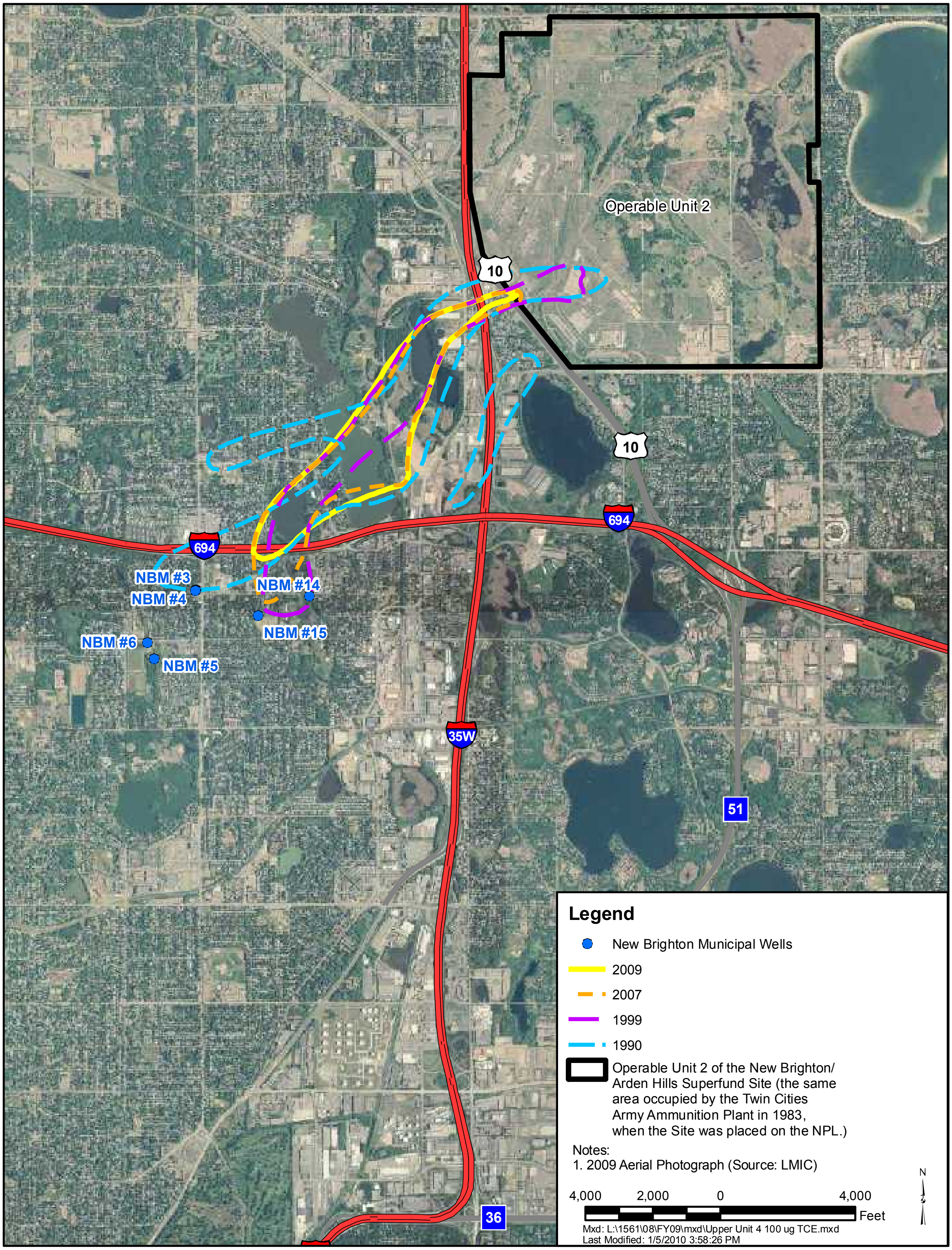
FY 2009

FIGURE 3-8




ANNUAL PERFORMANCE REPORT

Upper Unit 4,
100 µg/l Trichloroethene Isoconcentration Map

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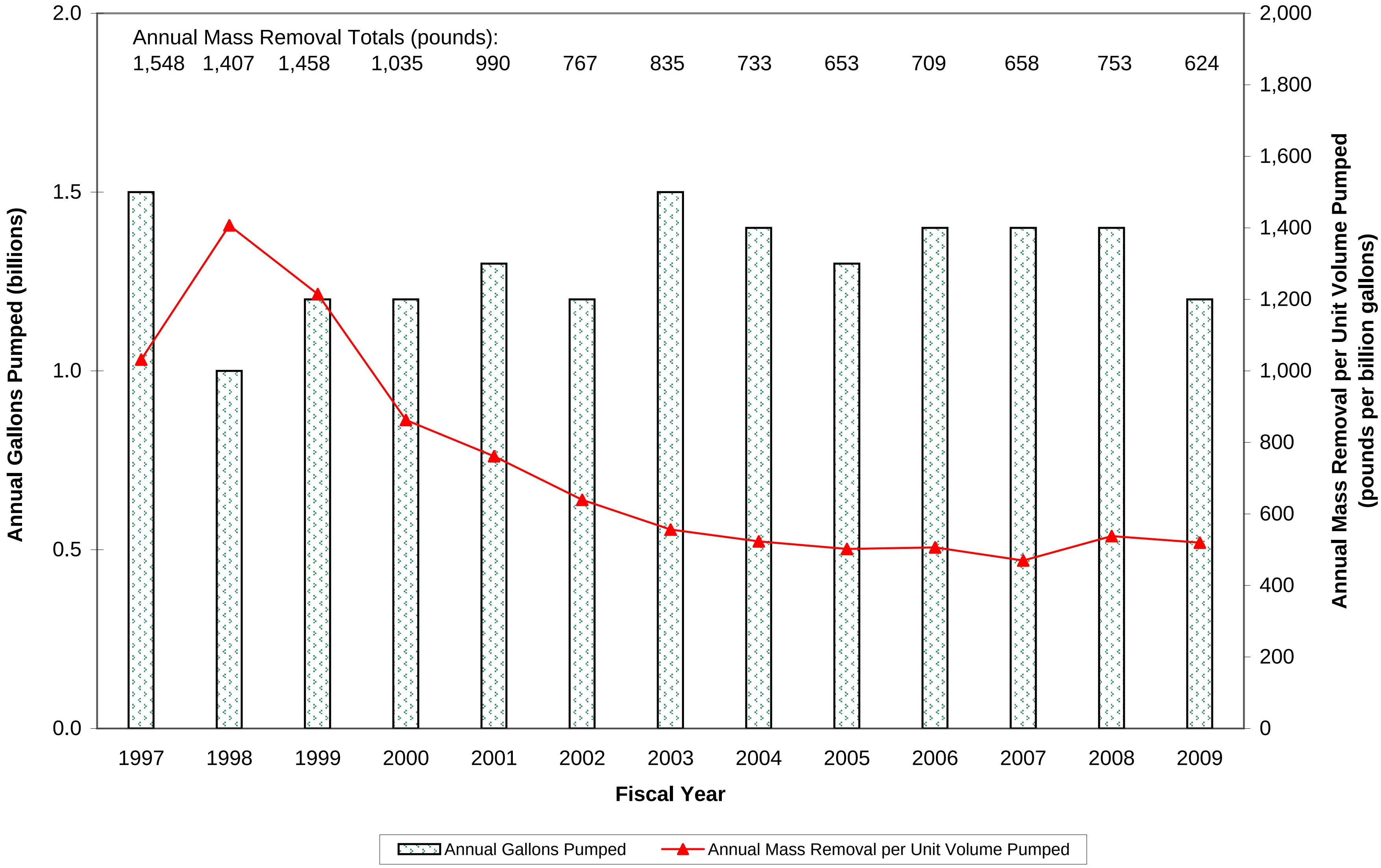
FY 2009

Figure 3-9

FIGURE 3-10

OU1, NBCGRS MASS REMOVAL HISTORY

**Annual Performance Report**



# 4.0 Operable Unit 2: Shallow Soil and Dump Sites

The reference for the OU2 ROD is:

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

Sections 4.0 through 10.0 of this report address the various media and requirements prescribed by the OU2 ROD and/or subsequent Amendments and ESDs. This section, 4.0, 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: 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 an additional remedy component for Site C-2, namely land use controls.

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 work performed at these sites was similar in nature to the soil remediation requirements set forth in the OU2 ROD, and so through the Amendment, these sites were in essence folded into the OU2 ROD.
- 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, Trap Range, or Water Tower Area because contamination levels are suitable for unlimited use or unrestricted exposure.

ESD #1 is discussed in Section 6.0 (Site A shallow groundwater), Section 9.0 (Site K shallow groundwater), and Section 10.0 (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, and it is available for unrestricted use.

## 4.1 REMEDY COMPONENTS #1 THROUGH 7: SOIL REMEDIATION

**Description:** These seven components collectively address the characterization, excavation, sorting, treatment, disposal, site restoration, and site access restrictions (during remedial actions) for the shallow soils and dumps at Sites A, C, D, E, G, H, 129-3, 129-5, 129-15, Grenade Range, Outdoor Firing Range, 135 Primer/Tracer Area Stormwater Ditch, and Water Tower Area. The remedy components were amended to allow for the use of soil covers at Sites C-2, D, E, G, H, 129-15, and the Outdoor Firing Range.

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

When the soils at these sites have been remediated such that the contaminant concentrations are below the cleanup levels specified in the OU2 ROD (or subsequent Amendments and ESDs); or soil covers have been constructed over contamination remaining in-place.

**Are these remedy components being implemented?**

Yes. Soil and dump remediation field work has been completed at all 13 sites listed in the description above. The closeout reports for the 135 Primer/Tracer Area Stormwater Ditch and Water Tower Area have consistency approval and there is no need for land use controls. The closeout reports for the other sites have received partial regulatory approval, but final consistency will not be provided until concurrence on the land use control section of each report has been reached between the Army and the regulators (see Section 4.4 for information on land use controls).

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

Yes. Land use control issues need to be resolved in order to complete final consistency approval on the various closeout reports.

## 4.2 REMEDY COMPONENT #8: GROUNDWATER MONITORING

**Description:** "Five-year period of groundwater monitoring to verify no adverse remedy impacts at Sites A, C, E, H, 129-3, and 129-5" (OU2 ROD, page 2), and amended to include groundwater monitoring at Site D and the Grenade Range.

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

When five years have elapsed with groundwater monitoring results below the groundwater cleanup levels.

**Is this remedy component being implemented?**

Yes. The intent of this remedy component is to verify that soil remediation activities did not somehow cause impacts to groundwater. The shallow soil remediation work has been completed and this groundwater monitoring component was started in FY 2003 for all sites except the Grenade Range, where monitoring began in FY 1999.

Monitoring at the Grenade Range was completed in FY 2004. Monitoring at Sites A, D, E, 129-3, and 129-5 was completed in FY 2007. The results were below the screening criteria and this remedy component is complete for these sites.

Monitoring at Site H has continued beyond FY 2007 because the copper concentration in groundwater is above the surface water criterion for copper in Sunfish Lake. Site H is located on the north side of Sunfish Lake, so it is possible that shallow groundwater in the vicinity of Site H could discharge into the lake.

**Monitoring Plan For Site H:**

Monitoring point: 01U060

Rationale for selected location: Well is on the downgradient edge of Site H and is also the only available Unit 1 monitoring well at the Site.

Parameter: Copper

Frequency: Annual

**Monitoring Results for FY 2009:**

Results for the June 2009 sampling event at Site H are summarized in Table 4-1. Copper exceeded the background value for Unit 1 groundwater (9.5 µg/L versus background of 4 µg/L). This well showed similar results in the past (e.g., 9.38 µg/L in FY 2006, 8.48 µg/L in FY 2007, and 12.2 µg/L in FY 2008). The MDH Health Risk Limit (HRL) for copper in groundwater is 1,000 µg/L, so the result is acceptable from that perspective. The only concern is potential discharge into Sunfish Lake. The surface water chronic standard is dependent on the hardness of the surface water body. In FY 2008, a hardness sample was collected from Sunfish Lake at the time of the groundwater sampling. The hardness was 59.7 milligrams per liter (mg/L), yielding a surface water chronic standard of 7.1 µg/L . Thus, the groundwater results for FY 2009 are above the surface water chronic standard as determined in FY 2008.

The Tier II Ecological Risk Assessment Report (USACHPPM, Final Report, December 2004) evaluated metals, including copper in Sunfish Lake. Copper was eliminated as a contaminant of concern based on water and sediment sampling in Sunfish Lake. Therefore, based on recent sampling results for copper at Site H, annual monitoring at Site H will be discontinued in FY 2010.

Antimony, arsenic, lead, and manganese were detected below both the MDH HRLs and the background values for Unit 1 groundwater.

**Are any changes or additional actions required for this remedy component?**
Yes. Monitoring of groundwater at Site H will be discontinued.

## 4.3 REMEDY COMPONENT #9: CHARACTERIZATION OF DUMPS

**Description:** "Characterization of dumps at Sites B and 129-15 to determine their contents. If contents are found to be toxic, hazardous, or contaminated, then a remedy for the landfill will be utilized and documented through a post-ROD amendment. If the contents are not toxic, hazardous or contaminated, a no further action remedy would be employed." (OU2 ROD, page 2)

**Performance Standard (how do you know when you're done):**
When characterization has been sufficient to determine if the contents are toxic, hazardous, or contaminated, and if they are, when the remedy is in place.

**Is this remedy component being implemented?**
Yes. Characterization work was completed at both sites in early FY 1999. At Site B, characterization revealed that a no further action remedy was appropriate. The "Site B Dump Investigation, Characterization, and Closeout Report" received consistency approval in FY 2001. The determination of No Further Action and availability of this site for unrestricted use was documented in OU2 ROD ESD #2. At Site 129-15, characterization led to construction of a soil cover in FY 2002. The Closeout Report for Site 129-15 received partial regulatory approval in FY 2003, but final consistency will not be provided until concurrence on the land use control section of this report has been reached between the Army and the regulators. The remedy selection at Site 129-15 was documented in ROD Amendment #3, which also added land use controls as a remedy component (see Section 4.4).

**Are any changes or additional actions required for this remedy component?** Yes. Land use control issues need to be resolved in order to complete final consistency approval on the Site 129-15 closeout report.

### 4.4 REMEDY COMPONENT #10: LAND USE CONTROLS

**Description:** OU2 ROD Amendments #2 and #3, and ESDs #1 and #2 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 a 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?**
No. The Army submitted a draft OU2 LUCRD in July 2009 that was under review by the USEPA and MPCA at the end of the fiscal year. It is expected that the OU2 LUCRD will be approved in FY 2010. In the meantime, the Army continued to implement land use controls for the remedial action sites, following the draft Land Use Control Implementation Plan (LUCIP) that was prepared in 2003, but not approved by the MPCA or USEPA. When approved, the OU2 LUCRD will supersede the draft LUCIP.

**Was an annual site inspection for land use controls conducted in FY 2009?**

On July 16, 2009, 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.

# Table 4-1
## Groundwater Quality Data for Shallow Soil Site Monitoring at Site H

Fiscal Year 2009

| | Site H | | TCAAP | |
|---|---|---|---|---|
| | 01U060<br>6/26/09 | 01U060 D<br>6/26/09 | Unit 1 Groundwater<br>Background (1) | MDH HRL |
| Antimony | JP 2 UB2.2 | JP 2 UB2.2 | <10 | 6 |
| Arsenic | JP 2.2 | JP 1.7 | 6.8 | (Note 2) |
| Copper | **9.5** | **9.6** | 4 (3) | 1,000* |
| Lead | JP 0.4 UB0.6 | JP 0.23 UB0.6 | 4.2 | 15 (4) |
| Manganese | 880 | 690 | 7,500 | 1,000* |

Notes:

All Results in µg/l.

MDH HRL = Minnesota Department of Health, Health Risk Limit (* indicates a Health Based Value, rather than a HRL).

(1) Background values for Unit 1 groundwater from Appendix C, Table 6 in the OU2 ROD.
Bolding (in red color) indicates exceedance of the respective background value.

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

(3) The calculated chronic surface water standard for copper (hardness-dependent) was 7.1 µg/l. This calculated standard is based on Sunfish Lake monitoring conducted in FY 2008 (the lake hardness was determined to be 59.7 mg/l).

(4) No HRL has been established for this analyte. MDH utilizes 15 µg/l as the Action Level "at the tap".

D Duplicate sample.

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

UB The sample result was less than 5 times the level detected in a blank (the result for the blank is listed after "UB").
The sample result can be considered non detect at an elevated detection limit.

# 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 10.0) 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 at both sites 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 on-going land use control requirements for the shallow soil at Site D and dump at Site G that are addressed 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 stated trigger points are exceeded. These monitoring and contingency actions have been incorporated into the FY 2009 APR. Going forward, the APR is now the document which will govern Site A monitoring and contingency actions, and is the document through which any changes to monitoring and contingency actions must be approved by the USEPA and MPCA.

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 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 is 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.

## 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 2009 Monitoring Plan is included in Appendix A, and the water quality monitoring locations and frequencies are also summarized on Figure 6-1. Figure 6-2 presents groundwater elevation contours based on measurements in June 2009. The inferred groundwater flow direction confirms that the monitoring plan specifies the appropriate locations to track plume migration.

**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 2013.
- 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?** No (see discussion in Section 6.6).

## 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?**

No. The Army submitted a draft OU2 LUCRD in July 2009 that was under review by the USEPA and MPCA at the end of the fiscal year. It is expected that the OU2 LUCRD will be approved in FY 2010. In the meantime, the Army continued to implement land use controls for the remedial action sites, following the draft Land Use Control Implementation Plan (LUCIP) that was prepared in 2003, but not approved by the MPCA or USEPA. When approved, the OU2 LUCRD will supersede the draft LUCIP.

**Was an annual site inspection for land use controls conducted in FY 2009?**

On July 16, 2009, 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 2009, as defined by the 1 μg/L contour?**

No. Table 6-2 presents the FY 2009 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 footprint 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 2009? If yes, what were the findings?** No wells were sampled.

**Were any well owners offered an alternate supply and/or well abandonment in FY 2009?** 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 Figure 6-4 for the location of 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 2009 groundwater quality data and highlights the values that exceed a cleanup level. FY 2009 was the first year of data for evaluation of MNA performance. Tetrachloroethene exceeds the cleanup level of 7 µg/L in only two wells near the source area: 01U126 (21 µg/L) and 01U350 (8.7 µg/L). The only other well with exceedances of cleanup levels is 01U353 (EW-3), where cis-1,2-dichloroethene was 560 and 670 µg/L in June and

September 2009, respectively (versus the cleanup level of 70 μg/L), and benzene was 42 and 28 μg/L in June and September 2009, respectively (versus the cleanup level of 10 μg/L).

**What impact is MNA having on contaminant concentrations?**

As evident in Table 6-2, and on Figure 6-3 and Figure 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. Figure 6-5 shows the cis-1,2-dichloroethene concentrations plotted on geologic cross sections for Site A to help see the vertical and horizontal extent of contamination (the cross section locations are illustrated on Figure 6-4).

After the extraction system was shut off, the axis of the highest cis-1,2-dichloroethene concentrations shifted to the south during FY 2009, as evidenced by the concentration trends in the extraction wells (Figure 6-6). In June 2008, the cis-1,2-dichloroethene concentration in EW-2 was much higher than in EW-3 (350 versus 4.3 μg/L), with EW-1 and EW-4 both less than 4 μg/L. In December 2008 (about three months after the extraction system was shut off), EW-2 dropped down to 16 μg/L and remained near this level throughout the next three quarterly sampling events of FY 2009. Conversely, EW-3 remained at a relatively low concentration in December 2008 and March 2009, but increased sharply to 560 and 670 μg/L in June and September 2009, respectively. EW-1 and EW-4 both remained less than 4 μg/L throughout FY 2009. This data shows that the axis of the highest concentrations of cis-1,2-dicloroethene shifted from the vicinity of EW-2 to the vicinity of EW-3. Given the sharp changes in concentration at EW-2 and EW-3, quarterly monitoring of the extraction wells should be continued to verify that the shifting axis has stabilized.

Among the six monitoring wells located downgradient of these extraction wells and south of County Road I, the cis-1,2-dicloroethene concentrations remained comparable to the FY 2008 concentrations (Figure 6-7). A slight increase was observed for 01U158 in September 2009, with a concentration of 14 μg/L versus concentrations near 1 μg/L in the previous three quarterly sampling events. Well 01U058 is located approximately 250 feet downgradient of EW-3. With a groundwater velocity of approximately 200 feet per year (10-Year Report), the slight increase at 01U158 may be the beginning of an increasing trend, as predicted by the 10-Year Report for wells immediately downgradient of the first line of extraction wells.

**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 compounds of concern at Site A exceeded their respective cleanup levels in these four wells in FY 2009 (Table 6-2). The FY 2009 cis-1,2-dichloroethene concentrations in these four wells remained comparable to the FY 2008 concentrations, as shown on Figure 6-8. All of the FY 2009 cis-1,2-dichloroethene results in these wells were below 5 µg/L, versus the cleanup level of 70 µg/L.

**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. FY 2009 was the first year of evaluation following extraction system shutdown, and a time period of three to five years was anticipated before this determination could be made. The changes in concentrations observed in some of the wells in FY 2009 suggest that additional monitoring is needed before this determination can be made.

**Do additional remedial measures need to be addressed?**

No. The water quality monitoring plan that is shown on Figure 6-1 should continue to be implemented to provide the data needed for evaluation of MNA as a potential remedy.

## Table 6-1

## Summary of Site A Shallow Groundwater Monitoring Requirements
## Fiscal Year 2009

| 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 2009

| | | | Tetra-chloro-ethene (µg/l) | Tri-chloro-ethene (µg/l) | 1,1-Di-chloro-ethene (µg/l) | 1,2-Di-chloro-ethane (µg/l) | cis-1,2-Di-chloro-ethene (µg/l) | Chloro-form (µg/l) | Benzene (µg/l) | Antimony (µg/l) |
|---|---|---|---|---|---|---|---|---|---|---|
| Site A Cleanup Level (1) | | | 7 | 30 | 6 | 4 | 70 | 60 | 10 | 6 |
| 01U039 | | 6/24/09 | <1 | <1 | <1 | <1 | JP 0.37 | <1 | <1 | --- |
| 01U039 | D | 6/24/09 | <1 | <1 | <1 | <1 | JP 0.41 | <1 | <1 | --- |
| 01U102 | | 6/25/09 | JP 0.69 | JP 0.2 | <1 | <1 | JP 0.24 | <1 | <1 | --- |
| 01U103 | | 6/25/09 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | JP 1.1 UB2.2 |
| 01U108 | | 6/25/09 | 3.0 | JP 0.42 | <1 | <1 | JP 0.6 | <1 | <1 | --- |
| 01U115 | | 12/19/08 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | --- |
| 01U115 | D | 12/19/08 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | --- |
| 01U115 | | 3/6/09 | <1 | <1 | <1 | <1 | JP 0.14 | <1 | <1 | --- |
| 01U115 | | 6/26/09 | <1 | <1 | <1 | <1 | JP 0.2 | <1 | <1 | --- |
| 01U115 | | 9/10/09 | <1 | <1 | <1 | <1 | JP 0.28 | <1 | <1 | --- |
| 01U115 | D | 9/10/09 | <1 | <1 | <1 | <1 | JP 0.18 | <1 | <1 | --- |
| 01U116 | | 12/19/08 | <1 | <1 | <1 | <1 | JP 0.32 | <1 | <1 | --- |
| 01U116 | | 3/6/09 | <1 | <1 | <1 | <1 | JP 0.58 | <1 | <1 | --- |
| 01U116 | | 6/25/09 | <1 | <1 | <1 | <1 | JP 0.5 | <1 | <1 | --- |
| 01U116 | D | 6/25/09 | <1 | <1 | <1 | <1 | JP 0.52 | <1 | <1 | --- |
| 01U116 | | 9/11/09 | <1 | <1 | <1 | <1 | JP 0.52 | <1 | <1 | --- |
| 01U117 | | 6/26/09 | 4.6 | JP 0.73 | <1 | <1 | 9.4 | 7.5 | <1 | --- |
| 01U126 | | 12/20/08 | **18** | <1 | <1 | <1 | <1 | <1 | <1 | --- |
| 01U126 | | 6/25/09 | **21** | <1 | <1 | <1 | <1 | <1 | <1 | --- |
| 01U127 | | 6/24/09 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | --- |
| 01U138 | | 6/26/09 | <1 | JP 0.19 | <1 | <1 | JP 0.34 | <1 | <1 | --- |
| 01U138 | D | 6/26/09 | <1 | JP 0.22 | <1 | <1 | JP 0.39 | <1 | <1 | --- |
| 01U139 | | 12/19/08 | <1 | JP 0.18 UB0.17 | <1 | <1 | 18 | <1 | JP 0.98 | --- |
| 01U139 | | 3/6/09 | <1 | JP 0.24 | <1 | <1 | 16 | JP 0.33 UB0.4 | JP 0.89 | --- |
| 01U139 | | 6/26/09 | <1 | JP 0.17 | <1 | <1 | 15 | JP 0.85 UB0.26 | JP 0.88 | --- |
| 01U139 | | 9/10/09 | <1 | JP 0.18 | <1 | <1 | 14 | <1 | JP 0.84 | --- |
| 01U140 | | 6/26/09 | <1 | <1 | <1 | <1 | 1.6 | <1 | JP 0.41 | --- |

Table 6-2
Site A Groundwater Quality Data

Fiscal Year 2009

| | | | Tetra-chloro-ethene (µg/l) | Tri-chloro-ethene (µg/l) | 1,1-Di-chloro-ethene (µg/l) | 1,2-Di-chloro-ethane (µg/l) | cis-1,2-Di-chloro-ethene (µg/l) | Chloro-form (µg/l) | Benzene (µg/l) | Antimony (µg/l) |
|---|---|---|---|---|---|---|---|---|---|---|
| Site A Cleanup Level (1) | | | 7 | 30 | 6 | 4 | 70 | 60 | 10 | 6 |
| 01U157 | | 12/19/08 | <1 | JP 0.35 UB0.17 | <1 | <1 | JP 0.50 | <1 | <1 | --- |
| 01U157 | | 3/5/09 | <1 | JP 0.32 | <1 | <1 | 3.7 | JP 0.31 UB0.4 | <1 | --- |
| 01U157 | | 6/26/09 | <1 | JP 0.3 | <1 | <1 | 2.9 | <1 | <1 | --- |
| 01U157 | | 9/10/09 | <1 | JP 0.38 | <1 | <1 | 2.5 | <1 | <1 | --- |
| 01U158 | | 12/19/08 | <1 | JP 0.20 UB0.17 | <1 | <1 | 1.0 | <1 | <1 | --- |
| 01U158 | | 3/5/09 | <1 | <1 | <1 | <1 | JP 0.98 | <1 | <1 | --- |
| 01U158 | | 6/26/09 | <1 | <1 | <1 | <1 | 1.2 | <1 | <1 | --- |
| 01U158 | | 9/10/09 | <1 | JP 0.18 | <1 | <1 | 14 | <1 | <1 | --- |
| 01U350 | | 6/25/09 | **8.7** | 1.6 | <1 | <1 | 3.4 | <1 | <1 | --- |
| 01U901 | | 6/25/09 | <1 | <1 | <1 | <1 | JP 0.33 | JP 0.25 UB0.26 | <1 | --- |
| 01U902 | | 12/20/08 | <1 | <1 | <1 | <1 | 4.1 | <1 | <1 | --- |
| 01U902 | | 6/25/09 | <1 | <1 | <1 | <1 | 3.6 | <1 | <1 | JP 0.4 UB2.2 |
| 01U902 | D | 6/25/09 | --- | --- | --- | --- | --- | --- | --- | JP 0.4 UB2.2 |
| 01U903 | | 6/25/09 | <1 | <1 | <1 | <1 | <1 | JP 0.31 UB0.26 | <1 | --- |
| 01U904 | | 12/20/08 | <1 | <1 | <1 | <1 | JP 0.52 | <1 | <1 | --- |
| 01U904 | D | 12/20/08 | <1 | <1 | <1 | <1 | JP 0.53 | <1 | <1 | --- |
| 01U904 | | 6/26/09 | <1 | <1 | <1 | <1 | 1.7 | <1 | <1 | JP 0.37 UB2.2 |

# Table 6-2
# Site A Groundwater Quality Data

## Fiscal Year 2009

| | | | Tetra-chloro-ethene (µg/l) | Tri-chloro-ethene (µg/l) | 1,1-Di-chloro-ethene (µg/l) | 1,2-Di-chloro-ethane (µg/l) | cis-1,2-Di-chloro-ethene (µg/l) | Chloro-form (µg/l) | Benzene (µg/l) | Antimony (µg/l) |
|---|---|---|---|---|---|---|---|---|---|---|
| Site A Cleanup Level (1) | | | 7 | 30 | 6 | 4 | 70 | 60 | 10 | 6 |
| *Extraction Wells:* | | | | | | | | | | |
| 01U351 (EW-1) | | 12/19/08 | JP 0.45 | <1 | <1 | <1 | JP 0.13 | <1 | <1 | --- |
| 01U351 (EW-1) | | 3/6/09 | JP 0.64 | <1 | <1 | <1 | JP 0.14 | JP 0.40 UB0.4 | <1 | --- |
| 01U351 (EW-1) | | 6/26/09 | JP 0.48 | <1 | <1 | <1 | <1 | <1 | <1 | --- |
| 01U351 (EW-1) | | 9/11/09 | JP 0.44 | <1 | <1 | <1 | <1 | <1 | <1 | --- |
| 01U352 (EW-2) | | 12/19/08 | <1 | JP 0.24 UB0.17 | <1 | <1 | 16 | <1 | JP 0.14 UB0.17 | --- |
| 01U352 (EW-2) | | 3/6/09 | <1 | JP 0.61 | <1 | <1 | 18 | <1 | JP 0.46 | --- |
| 01U352 (EW-2) | | 6/26/09 | <1 | JP 0.39 | <1 | <1 | 21 | <1 | JP 0.17 | --- |
| 01U352 (EW-2) | | 9/11/09 | JP 0.41 | JP 0.92 | <1 | <1 | 20 | <1 | <1 | --- |
| 01U353 (EW-3) | | 12/19/08 | <1 | JP 0.38 UB0.17 | <1 | <1 | 10 | <1 | JP 0.29 UB0.17 | --- |
| 01U353 (EW-3) | | 3/5/09 | <1 | JP 0.39 | <1 | <1 | JP 0.21 | JP 0.58 UB0.4 | 4.9 | --- |
| 01U353 (EW-3) | | 6/26/09 | <1 | JP 0.5 | JP 0.63 | JP 0.91 | **560** | <1 | **42** | --- |
| 01U353 (EW-3) | | 9/11/09 | <1 | JP 0.59 | JP 0.83 | <1 | **670** | <1 | **28** | --- |
| 01U354 (EW-4) | | 12/19/08 | <1 | JP 0.28 UB0.17 | <1 | <1 | <1 | <1 | <1 | --- |
| 01U354 (EW-4) | | 3/5/09 | <1 | JP 0.50 | <1 | <1 | JP 0.35 | <1 | <1 | --- |
| 01U354 (EW-4) | D | 3/5/09 | <1 | JP 0.49 | <1 | <1 | JP 0.36 | <1 | <1 | --- |
| 01U354 (EW-4) | | 6/26/09 | <1 | JP 0.97 | <1 | <1 | 3.9 | <1 | <1 | --- |
| 01U354 (EW-4) | | 9/11/09 | <1 | 1.0 | <1 | <1 | 3.9 | <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.

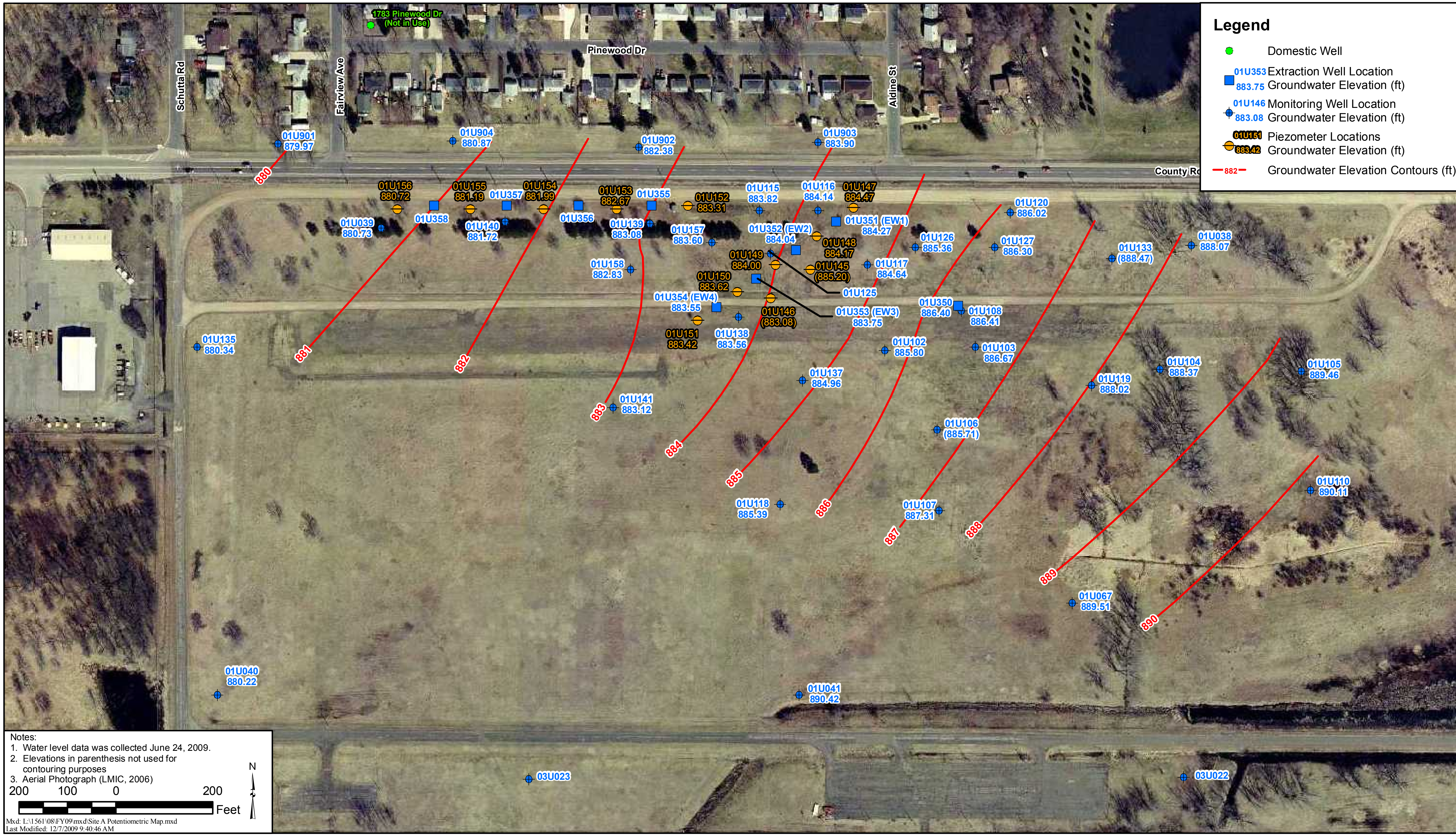
--- Not Sampled.

D Duplicate sample.

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

UB The sample result was less than 5 times the level detected in a blank (the result for the blank is listed after "UB"). The sample result can be considered non detect at an elevated detection limit.


| ANNUAL PERFORMANCE REPORT | Wenck | FY 2009 |
|---|---|---|
| Site A, Groundwater Monitoring Plan | Wenck Associates, Inc. Environmental Engineers 1800 Pioneer Creek Center Maple Plain, MN 55359-0429 | Figure 6-1 |

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Site A, Unit 1, Potentiometric Map - Summer 2009

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FY 2009

Figure 6-2


Mxd: L:\1561\08\FY09\mxd\Site A Tetra Plume Map.mxd
Last Modified: 12/8/2009 3:03:32 PM

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Site A, Unit 1, Tetrachloroethene Isoconcentration Map, Summer 2009

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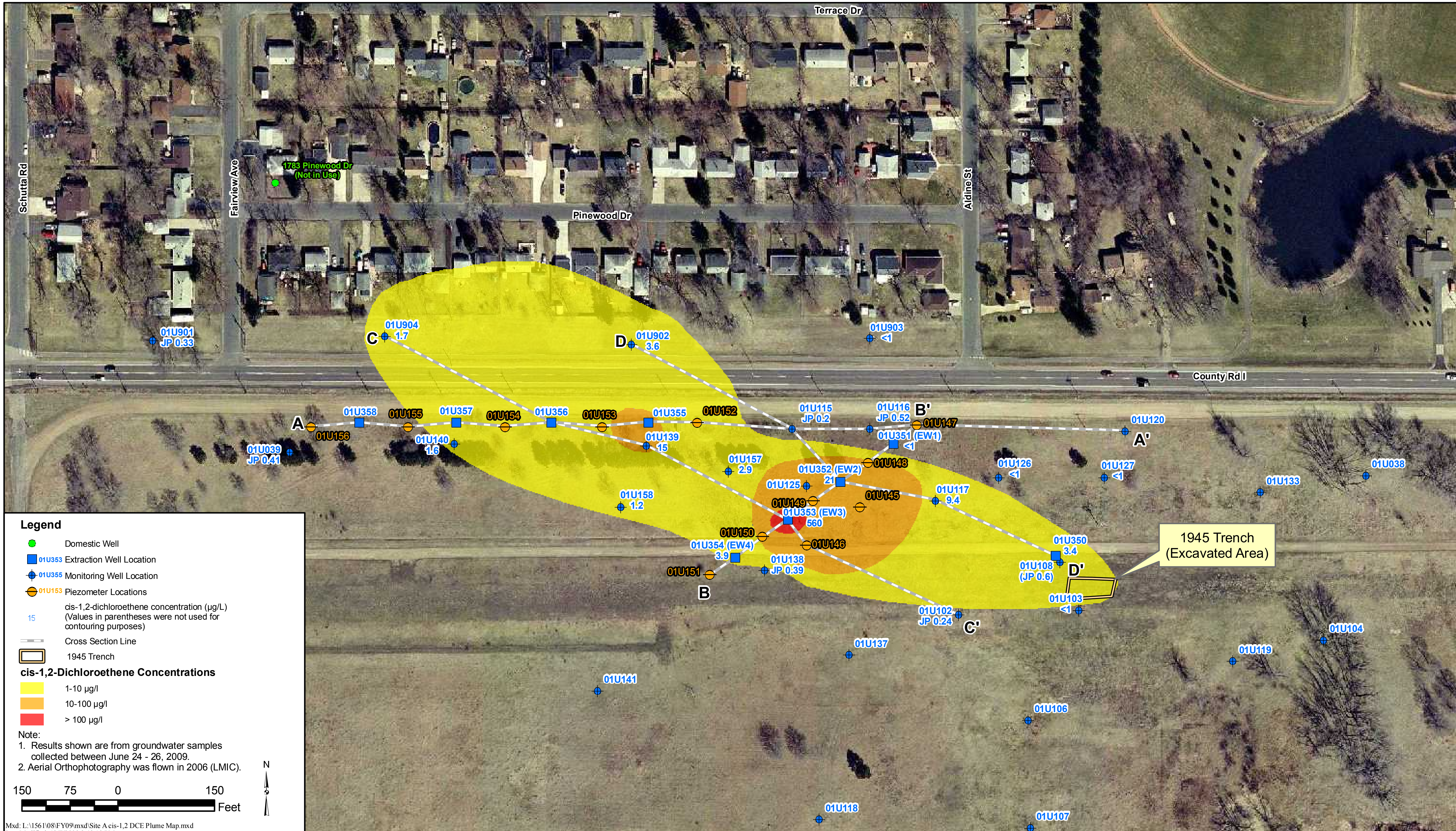
FY 2009

Figure 6-3

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Site A, Unit 1, cis-1,2-Dichloroethene Isoconcentration Map, Summer 2009



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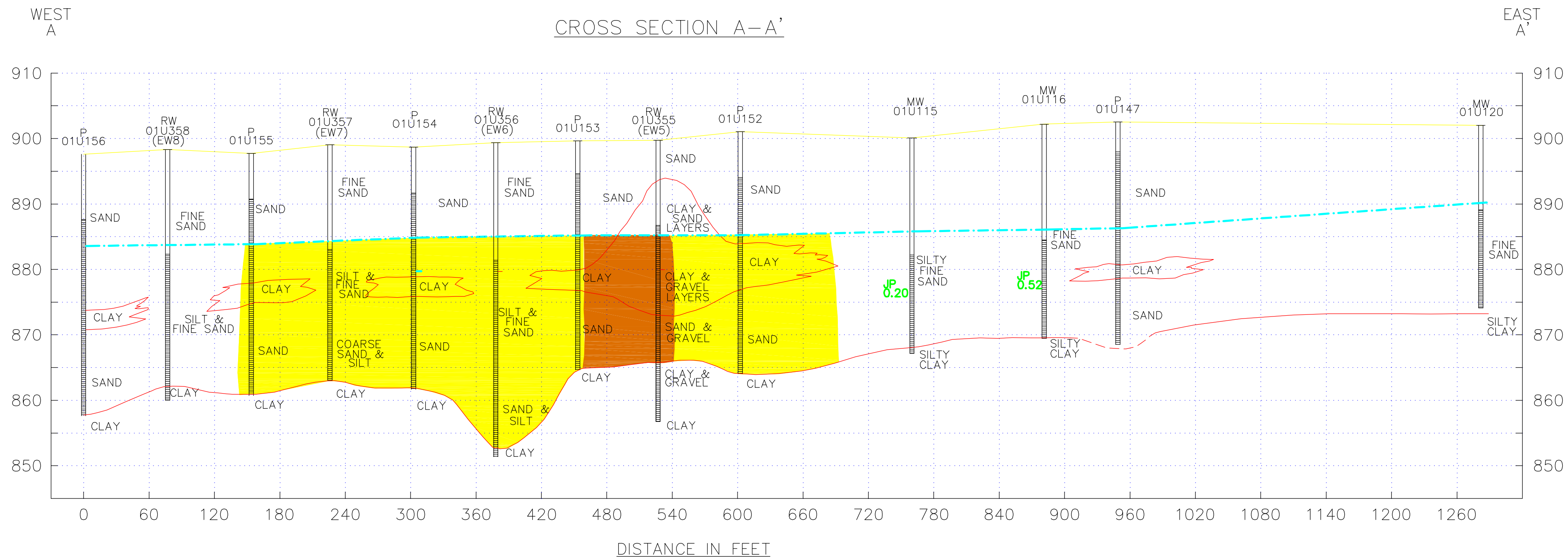
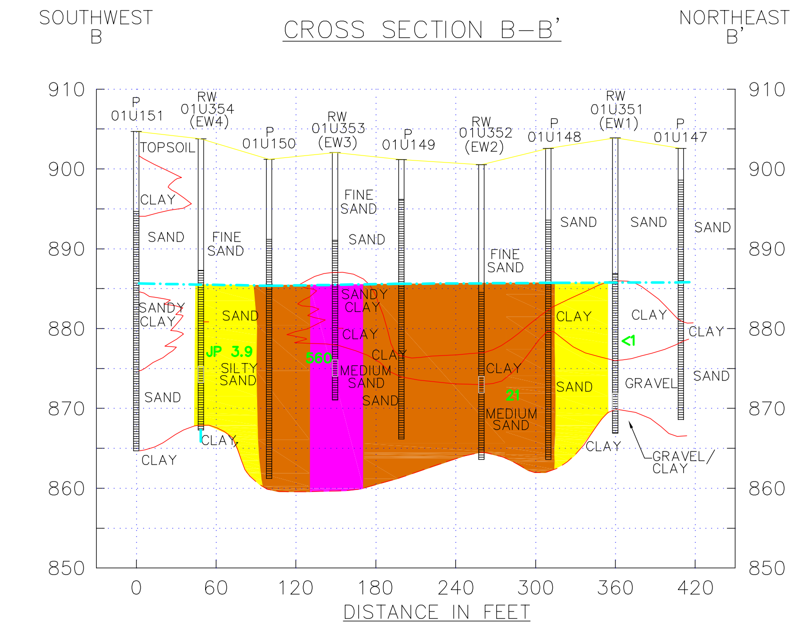
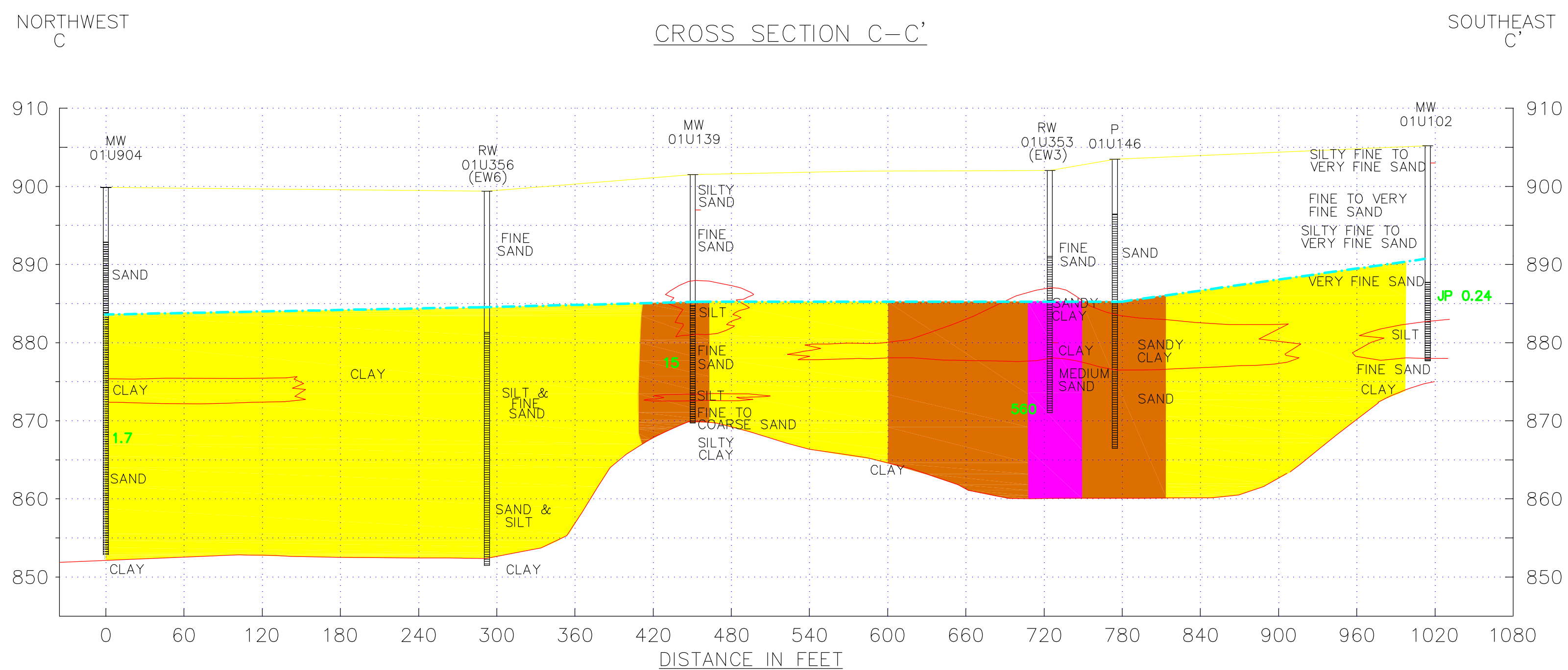
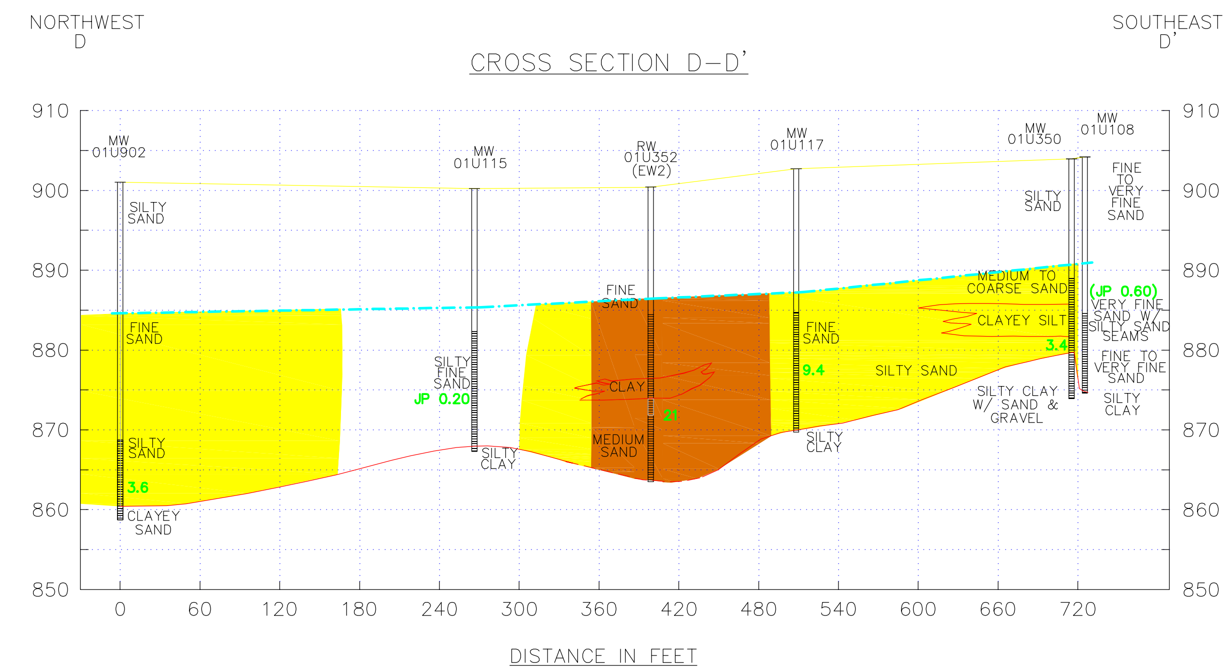
FY 2009

Figure 6-4




NOTES:

1. RESULTS ARE FROM GROUNDWATER SAMPLES COLLECTED JUNE 13, 14 AND 15, 2007
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

VERTICAL:
1 INCH = 10 FEET

HORIZONTAL:
1 INCH = 60 FEET

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 28 cis–1,2–DICHLOROETHENE CONCENTRATION (ug/l) (VALUES IN PARENTHESES WERE NOT USED FOR CONTOURING PURPOSES)

cis–1,2–DICHLOROETHENE CONCENTRATIONS

- 1–10 ug/l
- 10–100 ug/l
- >100 ug/l

M:/1561/2009/TCAX02B6.DWG

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cis–1,2–Dichloroethene Cross Sections A–A', B–B', C–C' and D–D', June 2009

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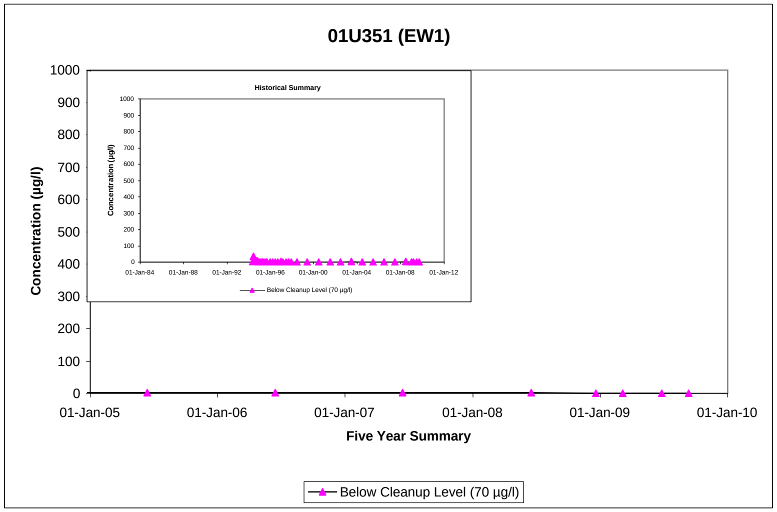
FY 2009

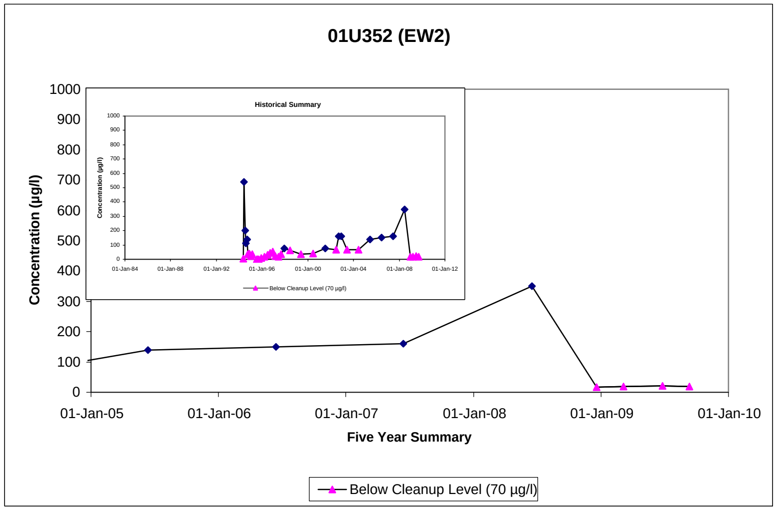
Figure 6–5

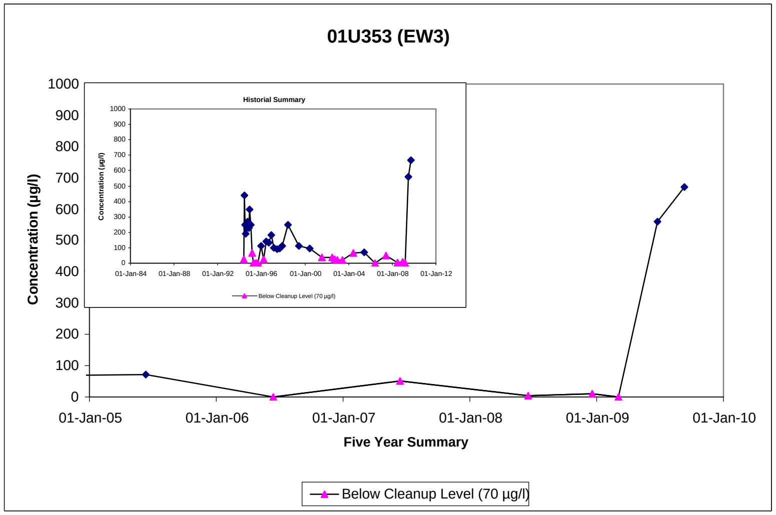
FIGURE 6-6

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

**FY 2009 ANNUAL PERFORMANCE REPORT**



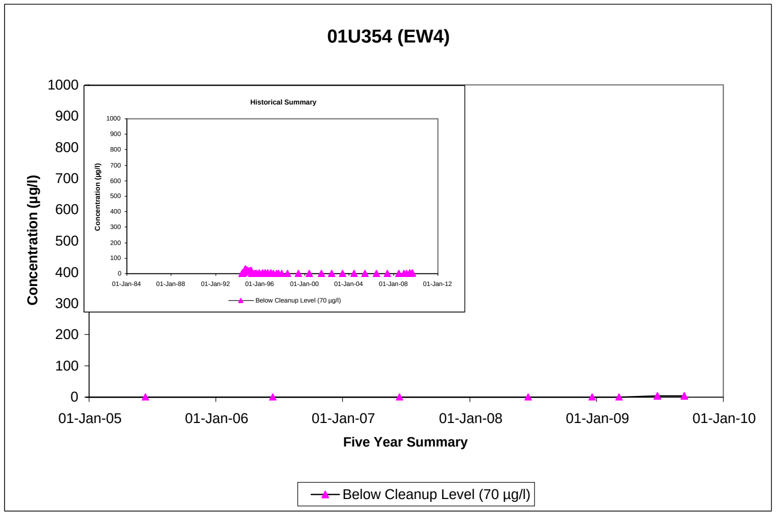
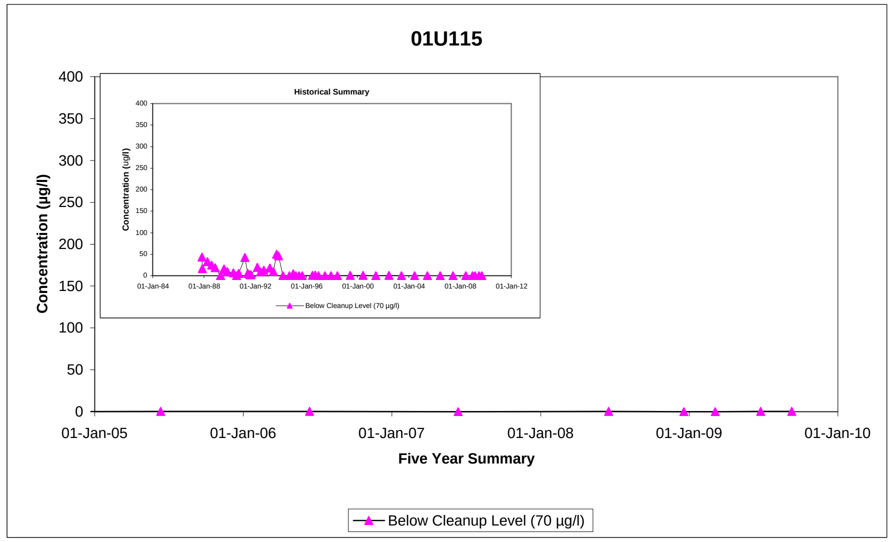
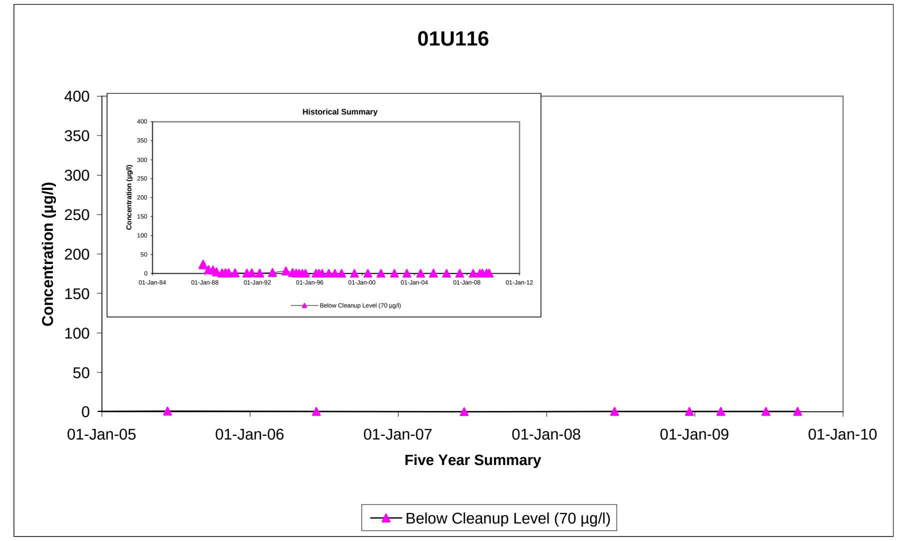
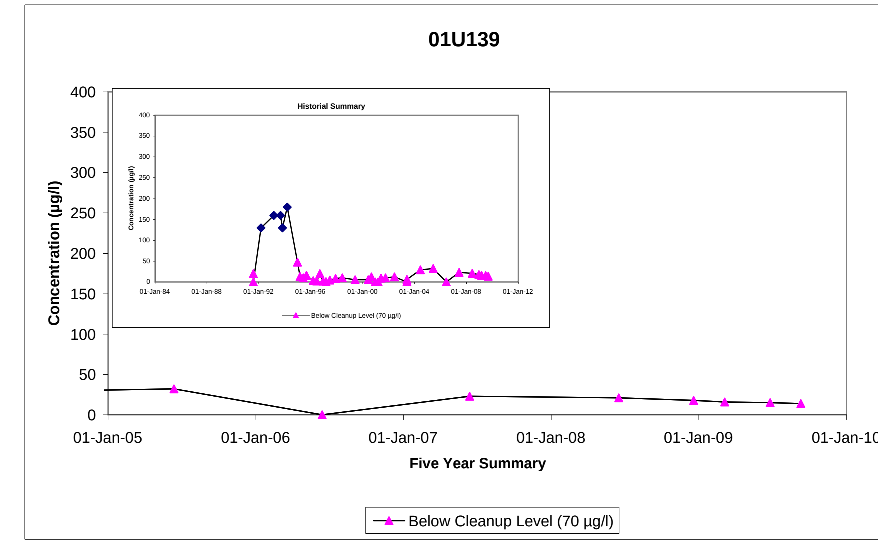
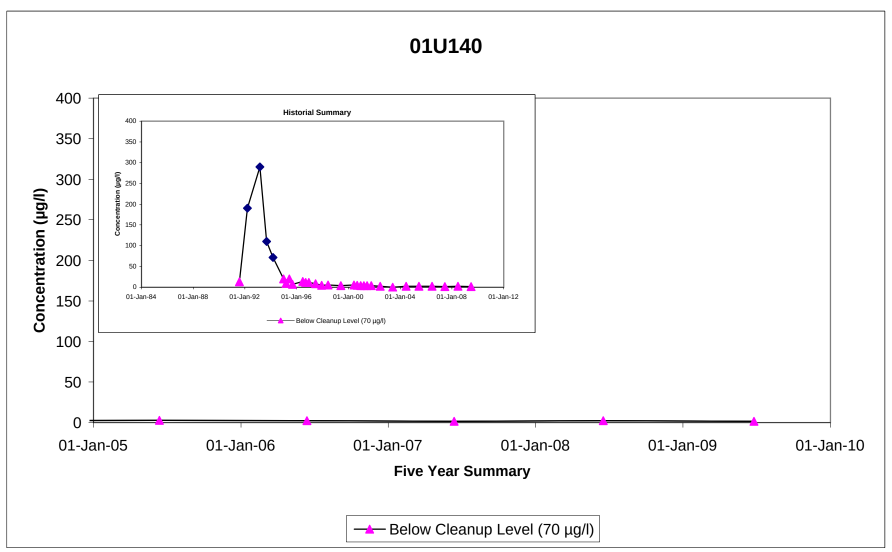



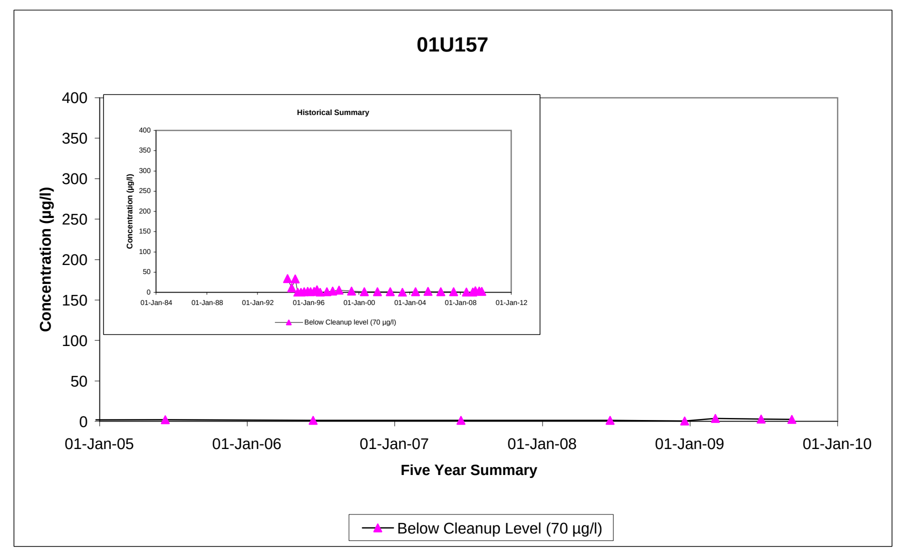
FIGURE 6-7
SITE A, cis-1,2-DICHLOROETHENE WATER QUALITY TRENDS: MONITORING WELLS
**FY 2009 ANNUAL PERFORMANCE REPORT**



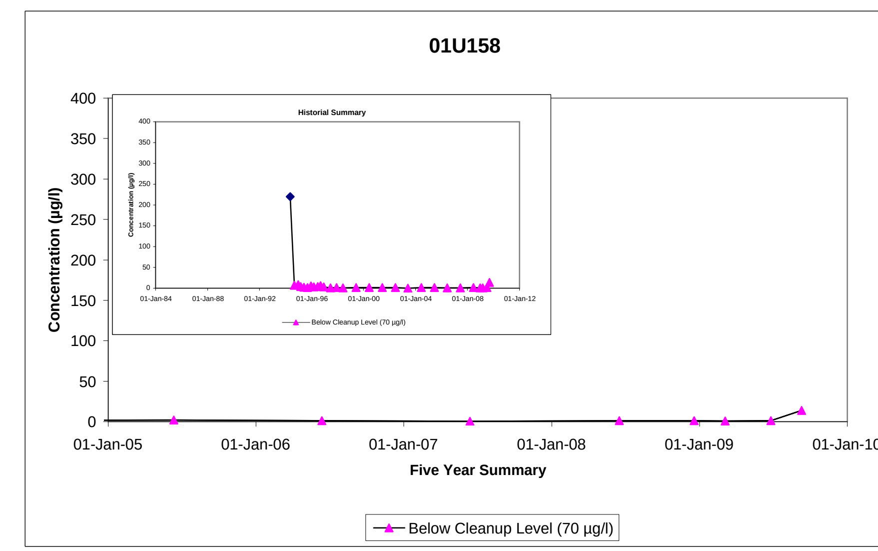
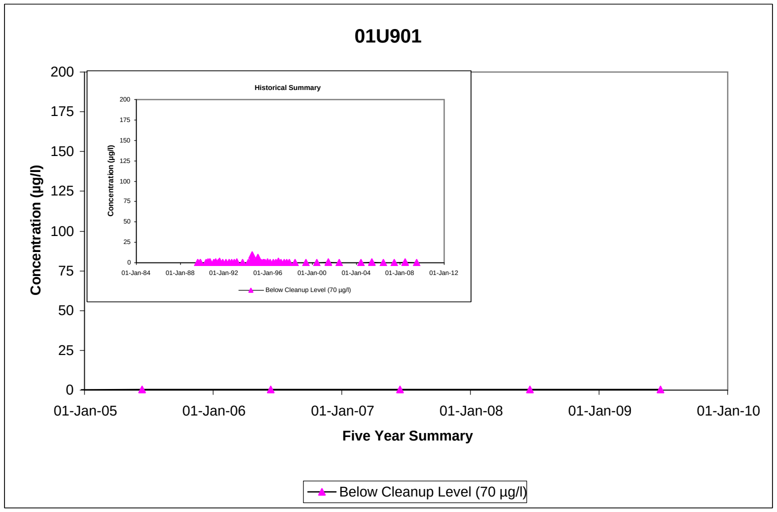
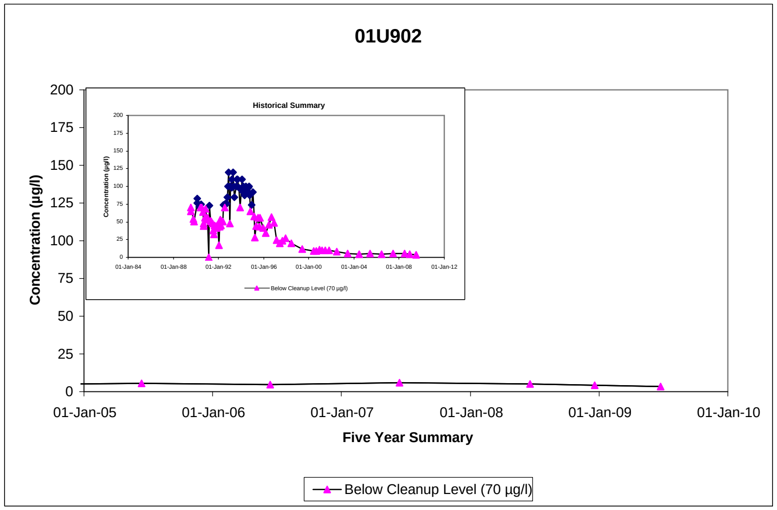
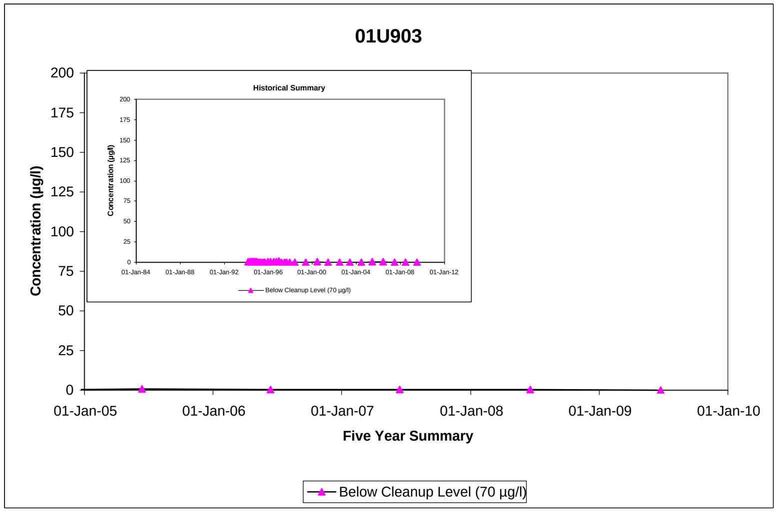
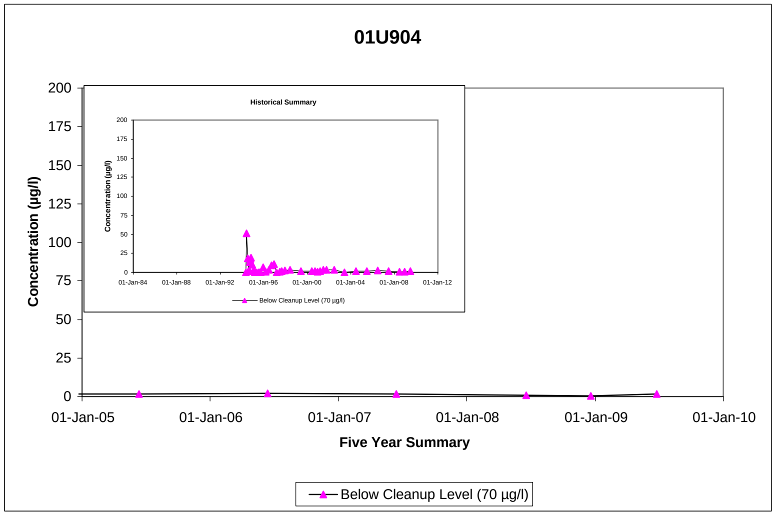



FIGURE 6-8
SITE A, cis-1,2-DICHLOROETHENE WATER QUALITY TRENDS: CONTINGENCY LOCATIONS
**FY 2009 ANNUAL PERFORMANCE REPORT**



# 7.0 Operable Unit 2: Site C Shallow Groundwater

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

On November 13, 2008, the groundwater system was shut off (with regulatory approval), since the lead concentrations in the three extraction wells had been below the groundwater cleanup level since March 2008 (i.e., the area of lead concentrations that exceeded the groundwater cleanup level was not even reaching the extraction wells, so operation of the extraction system was no longer required to contain the plume). The recommendation to shut the extraction system off was presented in the “Site C Groundwater Extraction System Evaluation Report,” which was approved by the USEPA and MPCA in November 2008. The groundwater system has not been removed and will be kept in place in the event that one or more extraction wells need to be restarted. 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 FY 2009 APR. Going forward, the APR is now the document that will govern Site C monitoring and contingency actions, and is the document through which any changes to monitoring and contingency actions must be approved by the USEPA and MPCA.

If, after an initial trial period of extraction system shutdown, it is proven that extraction system operation is no longer necessary, 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. Future APRs will ultimately determine when the USEPA, MPCA, and Army are comfortable that the extraction system can be dismantled, and will also monitor the progress towards reaching the groundwater cleanup levels throughout the Site.

## 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. The FY 2009 Monitoring Plan is included in Appendix A, and the water quality monitoring locations and frequencies are also summarized on Figure 7-1. Figure 7-2 presents groundwater elevation contours based on measurements in June 2009. The inferred groundwater flow direction confirms that the monitoring plan specifies the appropriate locations to track plume migration.

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

**Is any groundwater 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.

**Are any changes or additional actions required for this remedy component?** Yes (see discussion in Section 7.5). No change to water quality locations or frequencies are proposed; however, the frequency of water level monitoring will be reduced from quarterly to annual at the end of FY 2010.

## 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 has been shut off 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 has been shut off 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?**

No. The Army submitted a draft OU2 LUCRD in July 2009 that was under review by the USEPA and MPCA at the end of the fiscal year. It is expected that the OU2 LUCRD will be approved in FY 2010. In the meantime, the Army continued to implement land use controls for the remedial action sites, following the draft Land Use Control Implementation Plan (LUCIP) that was prepared in 2003, but not approved by the MPCA or USEPA. When approved, the OU2 LUCRD will supersede the draft LUCIP.

**Was an annual site inspection for land use controls conducted in FY 2009?**

On July 16, 2009, 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 Table 7-3 present the FY 2009 groundwater and surface water quality data, respectively, and highlight the values that exceed the cleanup level. Figure 7-3 shows the lead results. In FY 2009, lead exceeded the groundwater cleanup level of 15 µg/L in only the two monitoring wells nearest the source area: MW-3 (261 µg/L) and MW-13 (74.1 µg/L). Figure 7-4 and Figure 7-5 show the lead concentrations plotted on geologic cross sections for Site C to help see the vertical and horizontal extent of contamination (the cross section locations are illustrated on Figure 7-3).

The water quality trends for MW-3 and MW-13 are shown on Figure 7-6. MW-13 continued to show a decreasing trend. The MW-3 result was higher than FY 2008 results, and was similar to results observed in the first half of FY 2007. Since 2002, the overall trend in this well has been decreasing. Additional monitoring results will be needed at MW-13 to determine whether the water quality trend at this well is changing.

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

No. The Site C contingency locations and trigger levels are shown in Table 7-4. Depending on the location, the trigger level is either equal to 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 2009. 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 the extraction system should be dismantled? (If the extraction system should be dismantled and site closure is not yet possible, a recommendation to formally change the remedy should be made.)**

No, the determination cannot be made yet. FY 2009 was the first year of evaluation following extraction system shutdown. The increased concentration observed at MW-3 suggests that additional monitoring is needed before this determination can be made.

**Do additional remedial measures need to be addressed?**

No. The water quality monitoring plan that is shown on Figure 7-1 should continue to be implemented to provide the data needed to verify that the extraction system can remain off. The frequency of water level monitoring will be reduced from quarterly to annual at the end of FY 2010. Two years of quarterly water levels will have been completed at this point, providing adequate verification of flow direction following extraction system shutdown.

**Table 7-1**

**Summary of Site C Shallow Groundwater Monitoring Requirements**
**Fiscal Year 2009**

| 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 the groundwater extraction system can remain off. 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 Report |

# Table 7-2
# Water Quality Data for Site C Groundwater

Fiscal Year 2009

| Sample Location | Date Collected | Lead (Dissolved) (µg/l) | (L) | (D) |
|---|---|---|---|---|
| Groundwater Cleanup Level[1]: | | 15 | | |
| **Monitoring Wells:** | | | | |
| MW 1 | 6/15/09 | 0.50 | B | |
| MW 1 D | 6/15/09 | 0.055 | U | |
| MW 2 | 6/15/09 | 0.15 | B | UB0.088 |
| MW 3 | 6/16/09 | **261** | | |
| MW 4 | 12/17/08 | 0.055 | U | |
| MW 4 | 3/18/09 | 0.055 | U | |
| MW 4 | 6/15/09 | 0.055 | U | |
| MW 4 | 9/8/09 | 0.073 | B | UB0.09 |
| MW 6 | 12/17/08 | 0.055 | U | |
| MW 6 | 3/18/09 | 0.055 | U | |
| MW 6 | 6/15/09 | 0.055 | U | |
| MW 6 | 9/9/09 | 0.069 | B | UB0.09 |
| MW 7 | 12/17/08 | 0.055 | U | |
| MW 7 | 3/18/09 | 0.055 | U | |
| MW 7 | 6/15/09 | 0.055 | U | |
| MW 7 | 9/9/09 | 0.072 | B | UB0.09 |
| MW 8 | 12/17/08 | 0.055 | U | |
| MW 8 D | 12/17/08 | 0.058 | B | |
| MW 8 | 3/18/09 | 0.055 | U | |
| MW 8 | 6/15/09 | 0.055 | U | |
| MW 8 | 9/8/09 | 0.055 | U | |
| MW 10 | 6/16/09 | 0.055 | U | |
| MW 11 | 12/17/08 | 0.055 | U | |
| MW 11 | 3/18/09 | 0.096 | B | |
| MW 11 | 6/15/09 | 0.063 | B | UB0.088 |
| MW 11 | 9/9/09 | 0.078 | B | UB0.09 |
| MW 12 | 12/17/08 | 0.055 | U | |
| MW 12 | 3/18/09 | 0.072 | B | |
| MW 12 | 6/15/09 | 0.055 | U | |
| MW 12 D | 6/15/09 | 0.055 | U | |
| MW 12 | 9/9/09 | 0.055 | U | |
| MW 13 | 6/16/09 | **74.1** | | |
| MW 14 | 6/16/09 | 6.4 | | |

# Table 7-2
# Water Quality Data for Site C Groundwater

Fiscal Year 2009

| Sample Location | Date Collected | Lead (Dissolved) (µg/l) | (L) | (D) |
|---|---|---|---|---|
| Groundwater Cleanup Level[1]: | | 15 | | |
| MW 15 | 6/16/09 | 1.6 | | |
| MW 16 | 6/16/09 | 0.055 | U | |
| 01U045 | 6/15/09 | 0.36 | B | UB0.088 |
| 01U046 | 12/17/08 | (Frozen) | | |
| 01U046 | 3/18/09 | (Frozen) | | |
| 01U046 | 6/15/09 | 0.21 | B | UB0.088 |
| 01U046 | 9/9/09 | 0.12 | B | UB0.09 |
| 01U085 | 6/15/09 | 0.055 | U | |
| **Extraction Wells:** | | | | |
| EW 1 | 10/29/08 | 0.15 | B | JS |
| EW 1 D | 10/29/08 | 0.17 | B | JS |
| EW 1 | 11/12/08 | 0.16 | B | |
| EW 1 | 12/18/08 | 0.055 | U | |
| EW 1 | 3/18/09 | 0.091 | B | |
| EW 1 | 6/15/09 | 0.062 | B | UB0.088 |
| EW 1 | 9/9/09 | 0.27 | B | UB0.09 |
| EW 1 D | 9/9/09 | 0.21 | B | UB0.09 |
| EW 2 | 10/29/08 | 0.69 | B | JS |
| EW 2 | 11/12/08 | 2.5 | | |
| EW 2 | 12/17/08 | 0.25 | B | |
| EW 2 | 3/18/09 | 0.10 | B | |
| EW 2 D | 3/18/09 | 0.14 | B | |
| EW 2 | 6/15/09 | 0.12 | B | UB0.088 |
| EW 2 | 9/9/09 | 0.20 | B | UB0.09 |
| EW 3 | 10/29/08 | 13.4 | | JS |
| EW 3 | 11/12/08 | 10.8 | | |
| EW 3 | 12/17/08 | 1.6 | | |
| EW 3 | 3/18/09 | 1.9 | | |
| EW 3 | 6/15/09 | 2.1 | | |
| EW 3 | 9/9/09 | 1.5 | | |

# Table 7-2
# Water Quality Data for Site C Groundwater

Fiscal Year 2009

| Sample Location | Date Collected | Lead (Dissolved) (µg/l) | | |
|---|---|---|---|---|
| | | | (L) | (D) |
| Groundwater Cleanup Level[(1)]: | | 15 | | |

Notes:

Laboratory Concentration Qualifiers (L):

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

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

Data Validation Qualifiers (D):

JS The percent recovery for the matrix spike was outside QC limits and the post digestion spike recovery was within QC limits. Result should be considered estimated.

UB The sample result was less than 5 times the level detected in a blank (the result for the blank is listed after "UB"). The sample result can be considered non detect at an elevated detection limit.

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 2009

| Sample Location | Date Collected | Lead (Dissolved) (µg/l) | (L) | (D) |
|---|---|---|---|---|
| Surface Water Cleanup Level[1]: | | 6.9 | | |
| SW 05 | 3/17/09 | 0.43 | B | |
| SW 05 | 3/18/09 | 0.87 | B | |
| SW 05 | 3/19/09 | 1.7 | | |
| SW 05 | 6/15/09 | (Dry) | | |
| SW 05 | 6/16/09 | (Dry) | | |
| SW 05 | 6/17/09 | 0.77 | B | J |
| SW 05 | 9/8/09 | 0.23 | B | |
| SW 05 | 9/9/09 | 0.16 | B | |
| SW 05 | 9/10/09 | 0.20 | B | |
| SW 05 - D | 9/10/09 | 0.33 | B | |
| SW 06 | 3/17/09 | 0.35 | B | |
| SW 06 | 3/18/09 | 0.33 | B | |
| SW 06 | 3/19/09 | 0.35 | B | |
| SW 06 | 6/15/09 | 0.13 | B | UB0.088 |
| SW 06 | 6/16/09 | 0.091 | B | UB0.088 |
| SW 06 | 6/17/09 | 0.055 | U | UJ |
| SW 06 | 9/8/09 | 0.073 | B | |
| SW 06 | 9/9/09 | 0.066 | B | |
| SW 06 | 9/10/09 | 0.055 | U | |
| NE Wetland | 3/17/09 | 0.35 | B | |
| NE Wetland - D | 3/17/09 | 0.39 | B | |
| NE Wetland | 3/18/09 | 0.33 | B | |
| NE Wetland | 3/19/09 | 0.43 | B | |
| NE Wetland | 6/15/09 | 0.16 | B | UB0.088 |
| NE Wetland | 6/16/09 | 0.54 | B | |
| NE Wetland - D | 6/16/09 | 0.055 | U | |
| NE Wetland | 6/17/09 | 0.77 | B | J |
| NE Wetland | 9/8/09 | 0.18 | B | |
| NE Wetland | 9/9/09 | 0.37 | B | |
| NE Wetland | 9/10/09 | 0.070 | B | |

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

Fiscal Year 2009

| Sample Location | Date Collected | | Lead (Dissolved) (µg/l) | |
|---|---|---|---|---|
| | | | (L) | (D) |
| Surface Water Cleanup Level[(1)]: | | 6.9 | | |

Notes:

Laboratory Concentration Qualifiers (L):

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

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

Data Validation Qualifiers (D):

J Sample result is estimated. Calibration blanks had both positive and negative detections.

UB The sample result was less than 5 times the level detected in a blank (the result for the blank is listed after "UB"). The sample result can be considered non detect at an elevated detection limit.

UJ Sample result is estimated. Calibration blanks had both positive and negative detections.

Other Notes:

D Duplicate

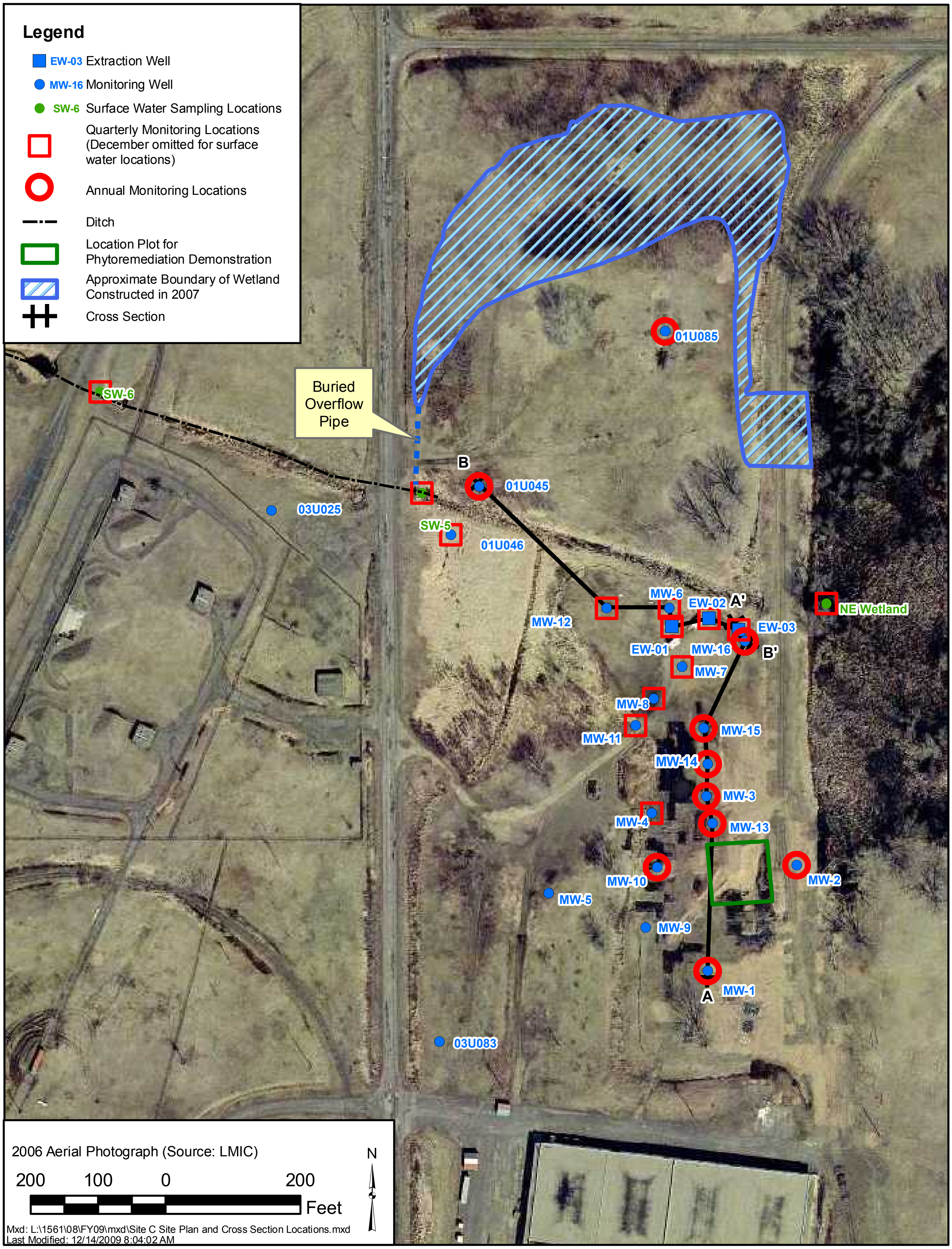
(1) The cleanup level for Site C Surface Water is from Table 1 of OU2 ROD Amendment #1.

# 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 ug/l | Note 3 |
| MW-6 | If 3-event moving average > 6.9 ug/l | Note 3 |
| MW-7 | If 3-event moving average > 15 ug/l | Note 3 |
| MW-8 | If 3-event moving average > 15 ug/l | Note 3 |
| MW-11 | If 3-event moving average > 15 ug/l | Note 3 |
| MW-12 | If 3-event moving average > 6.9 ug/l | Note 3 |
| 01U046 | If 3-event moving average > 6.9 ug/l | Note 4 |
| EW-1 | If 3-event moving average > 15 ug/l | Note 5 |
| EW-2 | If 3-event moving average > 15 ug/l | Note 5 |
| EW-3 | If 3-event moving average > 15 ug/l | Note 5 |
| SW5 (2) | If one sampling event > 6.9 ug/l | Note 4 |
| SW6 (2) | If one sampling event > 6.9 ug/l | Note 6 |
| NE Wetland (2) | If one sampling event > 6.9 ug/l | Note 4 |

Notes:

1) Water quality monitoring is for dissolved lead in monitoring/extraction 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; turn GW Extraction System back on; 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; turn GW Extraction System back on; and submit an evaluation report within 30 days from notification.
6) Army notify USEPA/MPCA within 1 week from receipt of data; turn GW Extraction System back on; 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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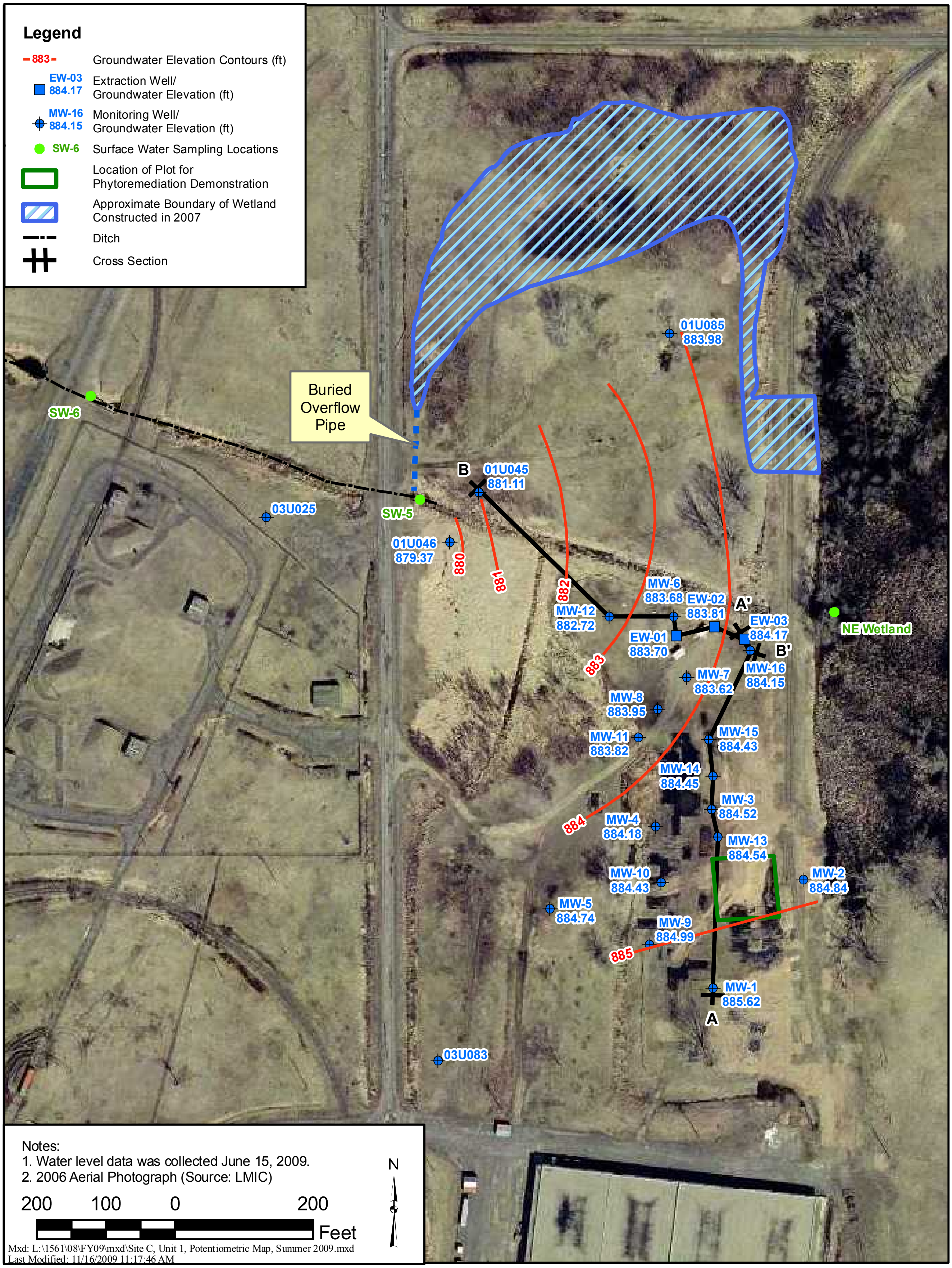
Figure 7-1

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Site C, Unit 1, Potentiometric Map, Summer 2009

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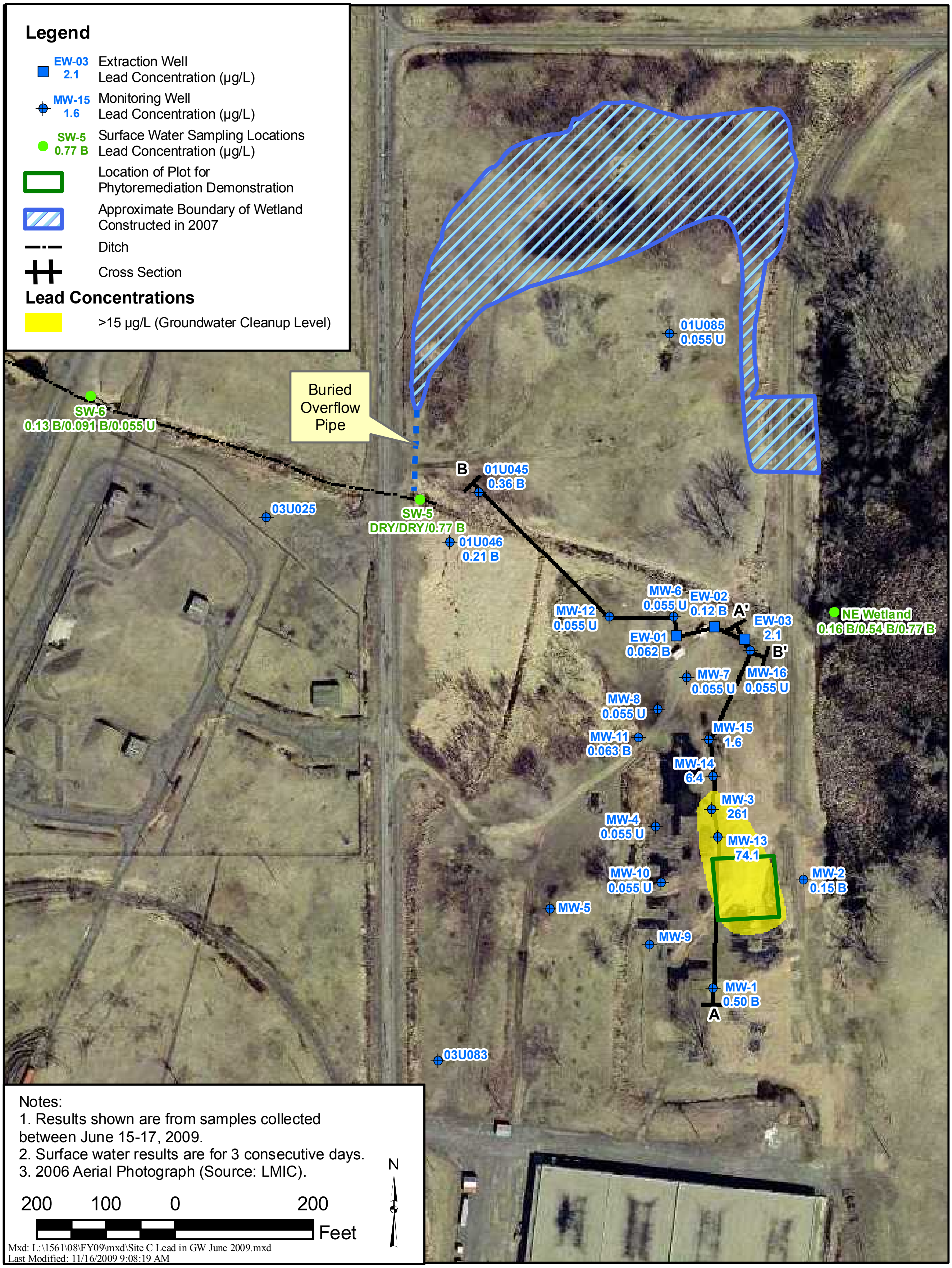
Figure 7-2




Notes:
1. Results shown are from samples collected between June 15-17, 2009.
2. Surface water results are for 3 consecutive days.
3. 2006 Aerial Photograph (Source: LMIC).

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Site C, Unit 1, Lead Results, Summer 2009

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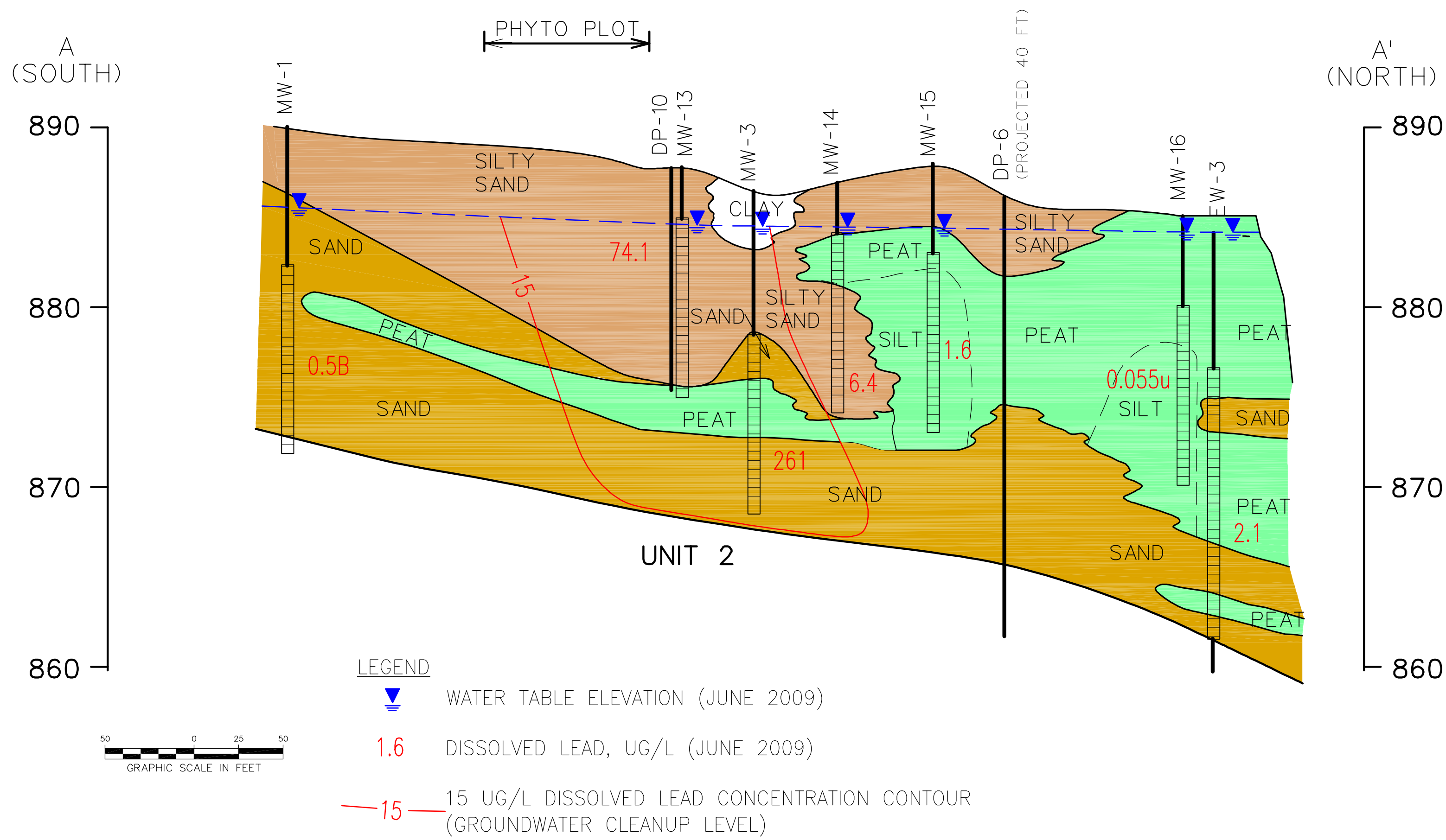
Figure 7-3

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Site C: Cross–Section A–A'

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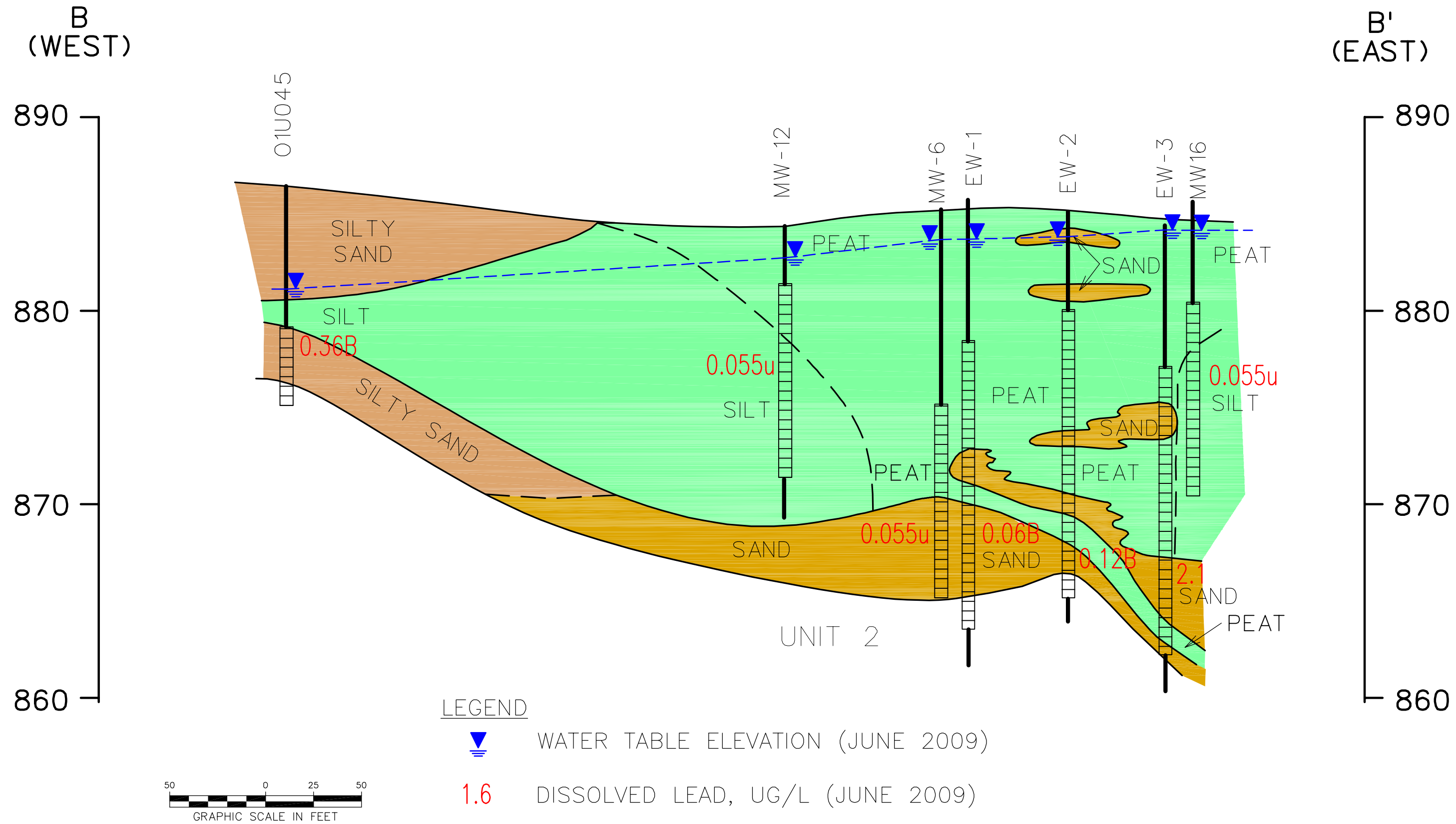
Figure 7–4

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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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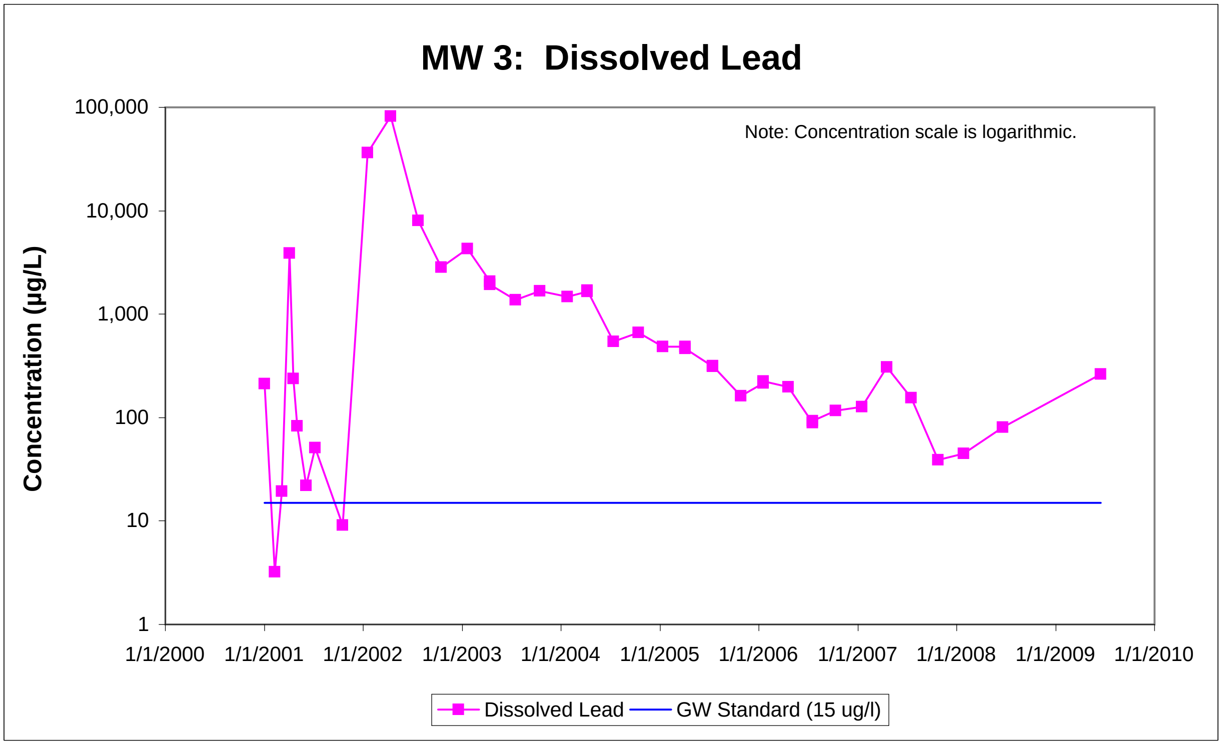


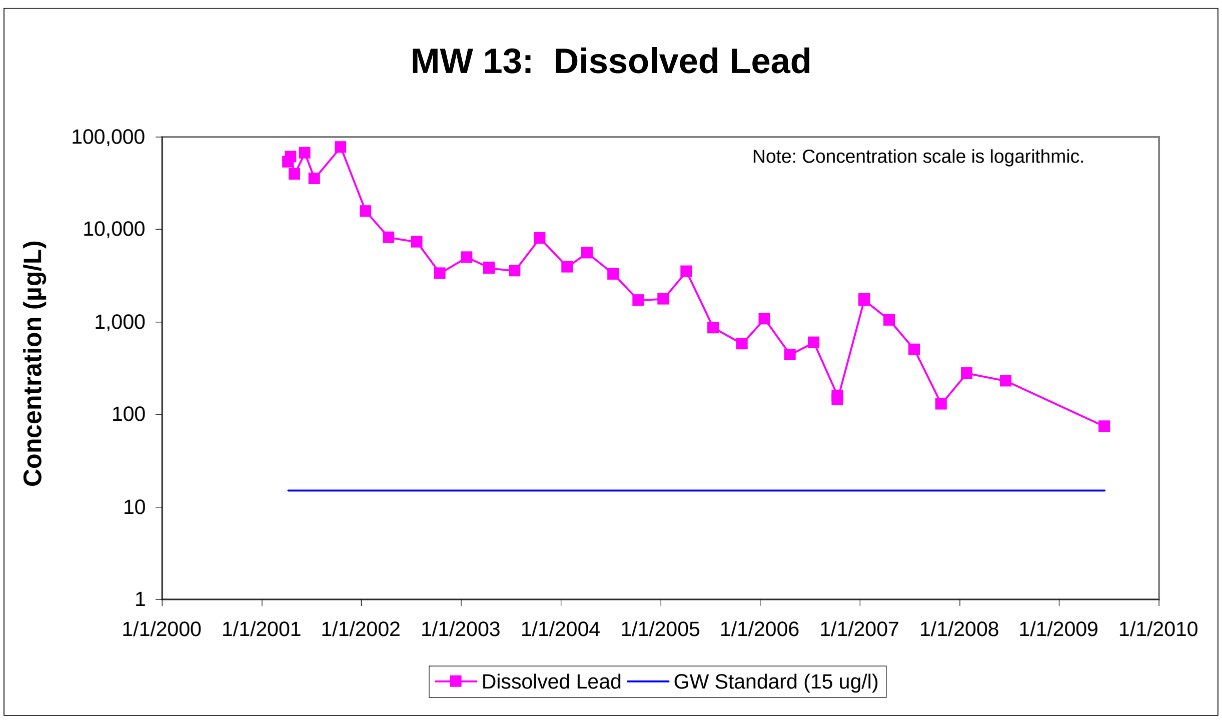

# 8.0 Operable Unit 2: Site I Shallow Groundwater

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 2009 monitoring plan and any deviations are explained in Appendix C.2.

Nine Unit 1 monitoring wells were planned for sampling at Site I (Building 502) during FY 2009. These wells were 01U064, 01U632, 01U636, 01U639, 01U640, I01MW, I02MW, I04MW, and I05MW. Figure 8-1 shows these well locations. For FY 2009, both monitoring wells 01U639 and 482089 (I04MW) were included on the list of monitoring locations. Of the two wells, well 01U639 is the primary sampling location and 482089 (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 482089 (I04MW). Well 01U639 is selected as the primary location because there are more years of analytical data associated with this location.

Wells 01U632, 01U636, 01U639, 01U640, I01MW, I02MW, I04MW and I05MW were dry at the time of sampling and hydraulic monitoring (see Figure 8-2). Well 01U064 bailed dry after collecting approximately two well volumes; however, there was sufficient groundwater to collect samples for analysis. The groundwater sample was analyzed using EPA Method 8260 for VOCs.

The lack of water in Site I monitoring wells during the June 2009 monitoring event is partially attributable to drier than normal precipitation in each of the six months preceding the June sampling event. In addition, perched aquifers in general, and the Site I perched aquifer in particular (due to the presence of the impermeable Building 502 footprint), receive far fewer water inputs than a typical regionally connected groundwater aquifer.

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

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

## 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. However, the dual-phase extraction pilot study determined that the technology was not feasible due to low permeability of the soils (a conclusion agreed to by USEPA and MPCA).

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

### 8.3 REMEDY COMPONENT #3: LAND USE CONTROLS

**Description:** "Implement LUCs to prohibit water supply wells within the plume [and] to protect the groundwater monitoring infrastructure." (OU2 ROD Amendment #2, page 2)

**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 I groundwater, and is it being implemented?**
No. The Army submitted a draft OU2 LUCRD in July 2009 that was under review by the USEPA and MPCA at the end of the fiscal year. It is expected that the OU2 LUCRD will be approved in FY 2010. In the meantime, the Army continued to implement land use controls for the remedial action sites, following the draft Land Use Control Implementation Plan (LUCIP) that was prepared in 2003, but not approved by the MPCA or USEPA. When approved, the OU2 LUCRD will supersede the draft LUCIP.

**Was an annual site inspection for land use controls conducted in FY 2009?**
On July 16, 2009, 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 2009 groundwater quality data and highlights the values that exceed a cleanup level. Groundwater was present in sufficient volumes to collect groundwater monitoring samples from one Site I monitoring well (01U064). Monitoring well 01U064 continues to exhibit concentrations of trichloroethene and 1,2-dichloroethene that are below the cleanup levels for Site I. The concentration of vinyl chloride in 01U064 has decreased over time, but was still above the cleanup level in FY 2009.

**Do additional remedial measures need to be addressed?** No.

**TABLE 8-1**

**SUMMARY OF GROUNDWATER MONITORING REQUIREMENTS**
**FISCAL YEAR 2009**
**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 2009**
**SITE I, OU2**
**ARDEN HILLS, MINNESOTA**

| | | Trichloroethene | cis-1,2-Dichloroethene | trans-1,2-Dichloroethene | Vinyl chloride |
|---|---|---|---|---|---|
| Site I Cleanup Level [1] | | 30 | 70 (total) | | 0.2 |
| Location | Date | µg/l | µg/l | µg/l | µg/l |
| 01U064 | 6/1/2009 | 0.29 J | 20 | 1.1 | 0.52 J |
| 01U064 D | 6/1/2009 | 0.39 J | 21 | 1.1 | 0.64 J |
| 01U632 | 6/1/2009 | Dry | Dry | Dry | Dry |
| 01U636 | 6/1/2009 | Dry | Dry | Dry | Dry |
| 01U639 | 6/1/2009 | Dry | Dry | Dry | Dry |
| 01U640 | 6/1/2009 | Dry | Dry | Dry | Dry |
| 482086 (I01MW) | 6/1/2009 | Dry | Dry | Dry | Dry |
| 482088 (I02MW) | 6/1/2009 | Dry | Dry | Dry | Dry |
| 482089 (I04MW) | 6/1/2009 | Dry | Dry | Dry | Dry |
| 482087 (I05MW) | 6/1/2009 | Dry | Dry | Dry | Dry |

Notes:
(1) Cleanup levels for Site I Shallow Groundwater are from the OU2 ROD
J Value is estimated.
D Duplicate Sample


## Legend

MONITORING WELL LOCATION

**NOTE:**

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

N

0 125 250 500 750 1,000

Feet

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| | | | |
|---|---|---|---|
| PREPARED FOR: ALLIANT TECHSYSTEMS TWIN CITY ARMY AMMUNITION PLANT ARDEN HILLS, MINNESOTA | | SITE I, UNIT 1 GROUNDWATER QUALITY MONITORING LOCATIONS | FIGURE: 8-1 |
| JOB NUMBER: 182602056 | DRAWN BY: TF | CHECKED BY: AG | APPROVED BY: AG |
| DATE: 12/14/09 | | | |


## Legend

MONITORING WELL LOCATION

(948.38) GROUNDWATER ELEVATION (FEET AMSL)

**NOTE:**

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

0 125 250 500 750 1,000
Feet

N

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TWIN CITY ARMY AMMUNITION PLANT
ARDEN HILLS, MINNESOTA

SITE I, UNIT 1
GROUNDWATER ELEVATION MAP
06/02/09

FIGURE: 8-2

| JOB NUMBER: | DRAWN BY: | CHECKED BY: | APPROVED BY: | DATE: |
|---|---|---|---|---|
| 182602056 | TF | AG | AG | 12/14/09 |

# 9.0 Operable Unit 2: Site K Shallow Groundwater

VOC contamination has been identified in the Unit 1 (perched aquifer) at Building 103. The limits of the VOC plume in the perched groundwater have been defined to be beneath and immediately northwest of 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 2009 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 2009. 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.

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

## 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

2/Unit 3 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 2009 for FY 2009. The results of the sample collected during FY 2009 are presented in Table 9-2. VOCs were not detected in the Unit 3 sentinel well at a concentration above the laboratory reporting limit.

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

## 9.3 REMEDY COMPONENT #3: HYDRAULIC CONTAINMENT

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

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

**Is the remedy component being implemented?**
Yes. The groundwater collection system continues to provide capture (as described later) of the Unit 1 groundwater, upgradient of the trench and beneath the 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 2009 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 2009 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?** No.

## 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 2009, the treatment system functioned and was operational 95.2% of the time. During FY 2009, 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 treatment system discharge met all treatment requirements except for zinc in March 2009 (215 µg/L) and June 2009 (190 µg/L). Notifications of exceedances were provided to EPA and MPCA in Data Usability Reports 62 and 63. Resampling was not performed because the treatment system does not treat inorganics; therefore, resampling would not provide any additional information on treatment system performance.

**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

**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 K groundwater, and is it being implemented?**

No. The Army submitted a draft OU2 LUCRD in July 2009 that was under review by the USEPA and MPCA at the end of the fiscal year. It is expected that the OU2 LUCRD will be approved in FY 2010. In the meantime, the Army continued to implement land use controls for the remedial action sites, following the draft Land Use Control Implementation Plan (LUCIP) that was prepared in 2003, but not approved by the MPCA or USEPA. When approved, the OU2 LUCRD will supersede the draft LUCIP.

**Was an annual site inspection for land use controls conducted in FY 2009?**

On July 16, 2009, 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 4,467,780 gallons of water resulting in the removal of 23.4 pounds of VOCs from the aquifer in FY 2009. The cumulative mass removal is 242.4 pounds of VOCs.

As shown on Figure 9-4, trichloroethene concentrations range from non-detect to 7,000 μg/L. The FY 2009 concentrations at wells 01U615 and 01U611, which monitor the core of the plume, showed an increase from 4,400 μg/L to 4,600 μg/L in 01U615 and an increase from 5,700 μg/L to 7,000 μg/L in 01U611 compared to the concentrations measured in FY 2008. The FY 2009 concentration of trichloroethene at 01U615 compares with historical concentrations from the last ten years of sampling, which have ranged from 1,800 μg/L to 7,300 μg/L. Trichloroethene concentrations at monitoring well 01U611 have been relatively stable over the last three years; however, over the last ten years concentrations have decreased an order of magnitude. Appendix B presents trichloroethene concentrations versus time for wells 01U611 and 01U615. With the exception of relatively stable trichloroethene concentrations in 01U615, the overall trend throughout Site K continues to show a gradual decrease in trichloroethene concentrations over the last fifteen years of sampling. Water levels measured during the FY 2009 monitoring were 0.68 feet lower at 01U615 and 0.64 feet lower at 01U611 compared to FY 2008 elevations. These wells have historically exhibited fluctuating groundwater elevations.

Three wells (01U128, 01U617, and 01U621) continue to exhibit low concentrations of 1,2-dichloroethene downgradient of the groundwater collection system's capture zone. Two of these wells (01U128 and 01U617) have exhibited relatively consistent concentrations of 1,2-dichloroethene since 1987. The third well, 01U621, has exhibited 1,2-dichloroethene since September 1993. The concentrations at these wells were consistent with those measured in FY 2008 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 2009

Although not required by the OU2 ROD, the Army and ATK have addressed the soil contamination in the area that was the source of the groundwater contamination. During FY 2008, an Engineering Evaluation/Cost Analysis (EE/CA) for Site K received consistency determination from USEPA and MPCA. The Army signed an Action Memorandum in early FY 2009 selecting the removal action alternative for Site K soils.

During FY 2009, the Removal Action Work Plan (RAWP) for Site K received consistency determination from the USEPA and MPCA. Following receipt of the consistency determination, ATK completed the removal action for Site K soils. Work consisted of the following tasks:

1. Removal of concrete slab (approximate dimensions: 34 feet x 27 feet);
2. Excavation of soil (maximum depth: 8 feet, approximately 180 cubic yards);
3. Verification and characterization for disposal sampling;

4. Disposal of concrete, debris and contaminated soil; and
5. Backfilling open excavation to grade.

In addition, ATK received approval from the regulatory agencies to place 450 pounds of granular potassium permanganate into the open excavation in an effort to reduce the mass of VOCs in groundwater through chemical oxidation. Water samples were collected from the groundwater that had collected in the bottom of the excavation and also from two down gradient wells (01U611 and 01U609) before and after placing the permanganate. A letter report will be submitted to the USEPA and MPCA in FY 2010 summarizing the groundwater analytical results.

The work is described in the Removal Action Completion Report, Site K, dated August 2009 by CRA. Based on the soil removal work and verification sampling conducted, it was determined that unsaturated soil remaining at Site K meets the cleanup goals approved by the USEPA and MPCA. As such, no further soil investigation or remediation was recommended. Furthermore, since the remaining soil concentrations were not only below the industrial use criteria, but also are below residential use criteria, it was concluded that the Site K soils were acceptable for unrestricted use and land use controls are not needed for the soil.

By letter dated, November 9, 2009, the USEPA and MPCA concluded that the Removal Action Completion Report, Site K passed the Consistency Test with the FFA.

## TABLE 9-1

## SUMMARY OF GROUNDWATER MONITORING REQUIREMENTS
## FISCAL YEAR 2009
## 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 | a. | None | | |
| #5: | Treated Water Discharge | a. | None | | |
| #6: | Discharge Monitoring | a. | Treated effluent water quality for comparison to substantive requirements criteria for discharge maximum daily concentration. | ATK | Site K Monitoring Plan in Annual Performance Report |
| #7: | Additional Investigation | a. | None (completed). | | |

**TABLE 9-2**

**GROUNDWATER QUALITY DATA**
**FISCAL YEAR 2009**
**SITE K, OU2**
**ARDEN HILLS, MINNESOTA**

| | | Trichloroethene | cis-1,2-Dichloroethene | trans-1,2-Dichloroethene |
|---|---|---|---|---|
| Site K Cleanup Level (1) | | 30 | 70 (total) | |
| Location | Date | µg/l | µg/l | µg/l |
| 01U128 | 6/2/2009 | <1 | 2.8 | 0.37 J |
| OW103 (01U603) | 6/1/2009 | <1 | <1 | <1 |
| 01U604 | 6/1/2009 | <1 | 0.14 J | <1 |
| OW111 (01U611) | 6/1/2009 | **7000** | **700** | **690** |
| OW115 (01U615) | 6/2/2009 | **4600** | **570** | **85** |
| OW117 (01U617) | 6/2/2009 | <1 | 2.6 | 0.45 J |
| OW118 (01U618) | 6/2/2009 | 0.76 J | 8.6 | 0.37 J |
| OW119 (01U619) | 6/2/2009 | 0.36 J | <1 | <1 |
| OW119 (01U619) D | 6/2/2009 | 0.39 J | <1 | <1 |
| OW121 (01U621) | 6/2/2009 | 0.19 J | 1.5 | 0.19 J |
| 03U621 | 6/2/2009 | <1 | <1 | <1 |
| 482083 (K04MW) | 6/1/2009 | 1.3 | <1 | <1 |

Notes:
(1) Cleanup levels for Site K Shallow Groundwater are from the OU2 ROD. Bolding in **red** indicates exceedance of the cleanup level.
D - Duplicate analysis.
J - Value is estimated.

**Table 9-3**

**GROUNDWATER ELEVATION MONITORING**
**Fiscal Year 2009**
**SITE K, OU2**
**ARDEN HILLS, MINNESOTA**

| *Well ID* | *TOC Elevation* | *Depth to Water (ft. BGS)* | *Groundwater Elevation 6/1/2009* |
|---|---|---|---|
| 01U047 | 880.31 | 7.69 | 872.62 |
| 01U048 | 885.32 | 12.1 | 873.22 |
| 01U052 | 886.51 | 13.14 | 873.37 |
| 01U065 | 883.90 | 10.58 | 873.32 |
| 01U128 | 883.69 | 10.75 | 872.94 |
| 01U601 | 892.68 | 8.54 | 884.14 |
| 01U602 | 889.35 | 5.01 | 884.34 |
| 01U603 | 887.31 | 10.77 | 876.54 |
| 01U604 | 888.98 | 13.11 | 875.87 |
| 01U605 | 887.76 | 11.56 | 876.20 |
| 01U607 | 891.01 | 7.34 | 883.67 |
| 01U608 | 889.30 | 5.24 | 884.06 |
| 01U609 | 889.33 | 5.1 | 884.23 |
| 01U611 | 889.29 | 4.9 | 884.39 |
| 01U612 | 886.91 | 9.65 | 877.26 |
| 01U613 | 892.07 | 8.29 | 883.78 |
| 01U615 | 888.66 | 13.07 | 875.59 |
| 01U616 | 890.37 | 11.52 | 878.85 |
| 01U617 | 887.72 | 10.61 | 877.11 |
| 01U618 | 891.52 | 12.81 | 878.71 |
| 01U619 | 891.75 | 8.21 | 883.54 |
| 01U620 | 888.65 | 7.05 | 881.60 |
| 01U621 | 886.57 | 9.5 | 877.07 |
| 01U624A | 889.88 | 12.63 | 877.25 |
| 01U624B | 889.88 | 12.66 | 877.22 |
| 01U624C | 889.91 | 12.69 | 877.22 |
| 01U624D | 889.89 | 12.65 | 877.24 |
| 01U625A | 886.92 | 10.65 | 876.27 |
| 01U625B | 886.91 | 10.69 | 876.22 |
| 01U625C | 886.91 | 10.66 | 876.25 |
| 01U625D | 886.92 | 10.7 | 876.22 |
| 01U626A | 886.87 | 10.78 | 876.09 |
| 01U626B | 886.88 | 11.07 | 875.81 |
| 01U626C | 886.88 | 11 | 875.88 |
| 01U626D | 886.88 | 10.96 | 875.92 |
| 01U627A | 886.46 | 9.53 | 876.93 |
| 01U627B | 886.47 | 10.36 | 876.11 |
| 01U627C | 886.47 | 10.44 | 876.03 |
| 01U627D | 886.48 | 10.44 | 876.04 |
| 01U628A | 887.82 | 11.12 | 876.70 |
| 01U628B | 887.83 | 11.2 | 876.63 |
| 01U628C | 887.82 | 11.57 | 876.25 |
| 01U628D | 887.84 | 11.6 | 876.24 |
| 482085 (K01MW) | 891.24 | 6.18 | 885.06 |
| 482084 (K02MW) | 891.35 | 8.46 | 882.89 |
| 482083 (K04MW) | 887.66 | 8.18 | 879.48 |
| 03U621 | 887.01 | 36.32 | 850.69 |

**TABLE 9-4**

**TREATMENT SYSTEM CONCENTRATIONS (ORGANICS)**
**FISCAL YEAR 2009**
**SITE K, OU2**
**ARDEN HILLS, MINNESOTA**

| Location | Sample Date | 1,1-Dichloroethane 11DCLE | | 1,1-Dichloroethene 11DCE | | 1,2-Dichloroethane 12DCLE | | cis-1,2-Dichloroethene C12DCE | | trans-1,2-Dichloroethene T12DCE | | Trichloroethene TRCLE | | Vinyl chloride C2H3CL | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Effluent | 12/15/2008 | ND | | ND | | ND | | ND | | ND | | ND | | ND | |
| Effluent | 12/15/2008 | ND | D | ND | D | ND | D | ND | D | ND | D | ND | D | ND | D |
| Effluent | 3/9/2009 | ND | | ND | | ND | | ND | | ND | | ND | | ND | |
| Effluent | 3/9/2009 | ND | D | ND | D | ND | D | ND | D | ND | D | 0.2 | D, JQ | ND | D |
| Effluent | 6/2/2009 | ND | | ND | | ND | | ND | | ND | | 0.28 | J | ND | |
| Effluent | 6/2/2009 | ND | D | ND | D | ND | D | ND | D | ND | D | 0.26 | D,J | ND | D |
| Effluent | 9/1/2009 | ND | | ND | | ND | | ND | | ND | | ND | J | ND | |
| Effluent | 9/1/2009 | ND | D | ND | D | ND | D | ND | D | ND | D | ND | D,J | ND | D |
| Influent | 12/15/2008 | ND | | 0.22 | | ND | | 240 | | 17 | | 450 | | 1.8 | |
| Influent | 3/9/2009 | 0.2 | J | ND | | ND | | 83 | | 14 | | 420 | | 1.1 | |
| Influent | 6/2/2009 | ND | | 0.32 | J | ND | | 170 | | 15 | | 340 | | 1.6 | |
| Influent | 9/1/2009 | ND | | 0.23 | J | ND | | 220 | | 16 | | 490 | | 1.8 | |
| MDL | | 0.083 | | 0.14 | | 0.13 | | 0.090 | | 0.084 | | 0.17 | | 0.22 | |
| RL | | 1 | | 1 | | 1 | | 1 | | 1 | | 1 | | 1 | |
| REQ. | | -- | | 7.0 | | 3.8 | | 70 | | 100 | | 10 | | 0.18 | |

Notes:
Results are reported in µg/L unless otherwise noted.
RL - Reporting Limit
D - Duplicate Analysis
J - Value Estimated
MDL - Method Detection Limit
ND - Not Detected above MDL
REQ - Substantive Requirement Document Concentration Limit, Maximum Daily Concentration
JQ - Value Estimated Due To Poor Mass Ratios

**TABLE 9-5**

**TREATMENT SYSTEM CONCENTRATIONS (INORGANICS)**
**FISCAL YEAR 2009**
**SITE K, OU2**
**ARDEN HILLS, MINNESOTA**

| ***Location*** | ***Sample Date*** | ***Phosphorus Total*** | | ***Copper*** | | ***Cyanide*** | ***Lead*** | | ***Mercury*** | ***Silver*** | | ***Zinc*** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Effluent | 12/15/08 | 390 | B | 6.14 | | ND | 1.1 | B | ND | ND | | 46.1 |
| Effluent | 3/9/09 | 690 | | 10.9 | | ND | 3.92 | | ND | 0.22 | B, UB.28 | **215** |
| Effluent | 6/2/09 | 330 | J, UB.103 | 2.9 | | ND | 5.5 | | ND | 0.031 | J, UB.102 | **190** |
| Effluent | 9/1/09 | 280 | J | 1.8 | J | ND | 1.5 | J | ND | ND | | 48 |
| MDL | 12/15/08 | 92.8 | | 0.154 | | 3.93 | 0.0512 | | 0.0158 | 0.042 | | 0.568 |
| MDL | 3/9/09 | 77.0 | | 0.154 | | 1.34 | 0.0512 | | 0.0199 | 0.042 | | 0.568 |
| MDL | 6/2/09 | 96 | | 0.083 | | 1.4 | 0.051 | | 0.020 | 0.028 | | 0.26 |
| MDL | 9/1/09 | 77 | | 0.083 | | 1.6 | 0.051 | | 0.020 | 0.028 | | 0.26 |
| RL | | 500 | | 2 | | 10 | 2 | | 0.100 | 2 | | 3 |
| REQ. | | 1000 | | 21 | | 17 | 106 | | 0.2 | 3.4 | | 134 |

Notes:
Results are reported in ug/L unless otherwise noted.
RL - Reporting Limit
MDL - Method Detection Limit
ND - Not Detected above MDL
B - Value is between the MDL and RL
J - Analyte value is between the MDL and RL.

REQ - Substantive Requirement Document Concentration Limit, Maximum Daily Conc.
Bolding in Red indicates exceedance of Max. Daily Concentration.

UB# - Analytes reported as contamination in the preperation blank; # = value of the blank corrected to the units of the sample

**TABLE 9-6**

**SUMMARY OF MONTHLY VOC REMOVAL**
**FISCAL YEAR 2009**
**SITE K, OU2**
**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 2008 (FY08) | | | | | | 219.0 |
| October[1] | 0.41945 | 709.02 | 0 | 0.00 | 1124.17 | 2.48 |
| November[1] | 0.41122 | 709.02 | 0 | 0.00 | 1102.10 | 2.43 |
| December | 0.34362 | 709.02 | 0 | 0.00 | 920.92 | 2.03 |
| January[1] | 0.29008 | 518.30 | 0 | 0.00 | 568.32 | 1.25 |
| February[1] | 0.22406 | 518.30 | 0 | 0.00 | 438.97 | 0.97 |
| March | 0.34212 | 518.30 | 0 | 0.00 | 670.27 | 1.48 |
| April[1] | 0.39394 | 526.92 | 0.28 | 0.42 | 784.22 | 1.73 |
| May[1] | 0.37875 | 526.92 | 0.28 | 0.40 | 753.98 | 1.66 |
| June | 0.40183 | 526.92 | 0.28 | 0.43 | 799.93 | 1.76 |
| July[1] | 0.44128 | 728.03 | 0 | 0.00 | 1214.38 | 2.67 |
| August[1] | 0.41278 | 728.03 | 0 | 0.00 | 1135.96 | 2.50 |
| September | 0.40866 | 728.03 | 0 | 0.00 | 1124.61 | 2.48 |
| Totals - FY09 | 4.46778 | | | 1.2 | 10637.8 | 23.4 |
| Cumulative To Date | | | | | | 242.4 |

Notes:
[1] Influent and Effluent VOC concentrations from 12/15/08, 03/09/09, 06/02/09 and 09/01/09 quarterly samples, respectively.
Calculations based on compounds with concentrations above the CRDL only.
Analytical data has not received Level IV review and may be revised after completion of review.


## Legend

- MONITORING WELL LOCATION
- ANNUAL MONITORING LOCATION
- UNIT 3 SENTINEL WELL
- 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

0 150 300 600 900 1,200
Feet

N

Geographic Information Systems

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ALLIANT TECHSYSTEMS
TWIN CITY ARMY AMMUNITION PLANT
ARDEN HILLS, MINNESOTA

SITE K, UNIT 1 AND UNIT 3 GROUNDWATER MONITORING LOCATIONS MAP

FIGURE: 9-1

| JOB NUMBER: | DRAWN BY: | CHECKED BY: | APPROVED BY: | DATE: |
|---|---|---|---|---|
| 182602056 | TF | AG | AG | 12/14/09 |


## Legend

- MONITORING WELL LOCATION
- ANNUAL MONITORING LOCATION
- UNIT 3 SENTINEL WELL
- NOT CONTOURED
- POTENTIOMETRIC SURFACE
- TRENCH LOCATION
- (882.89) GROUNDWATER ELEVATION (FEET AMSL)

**NOTE:**

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

0 150 300 600 900 1,200
Feet

N

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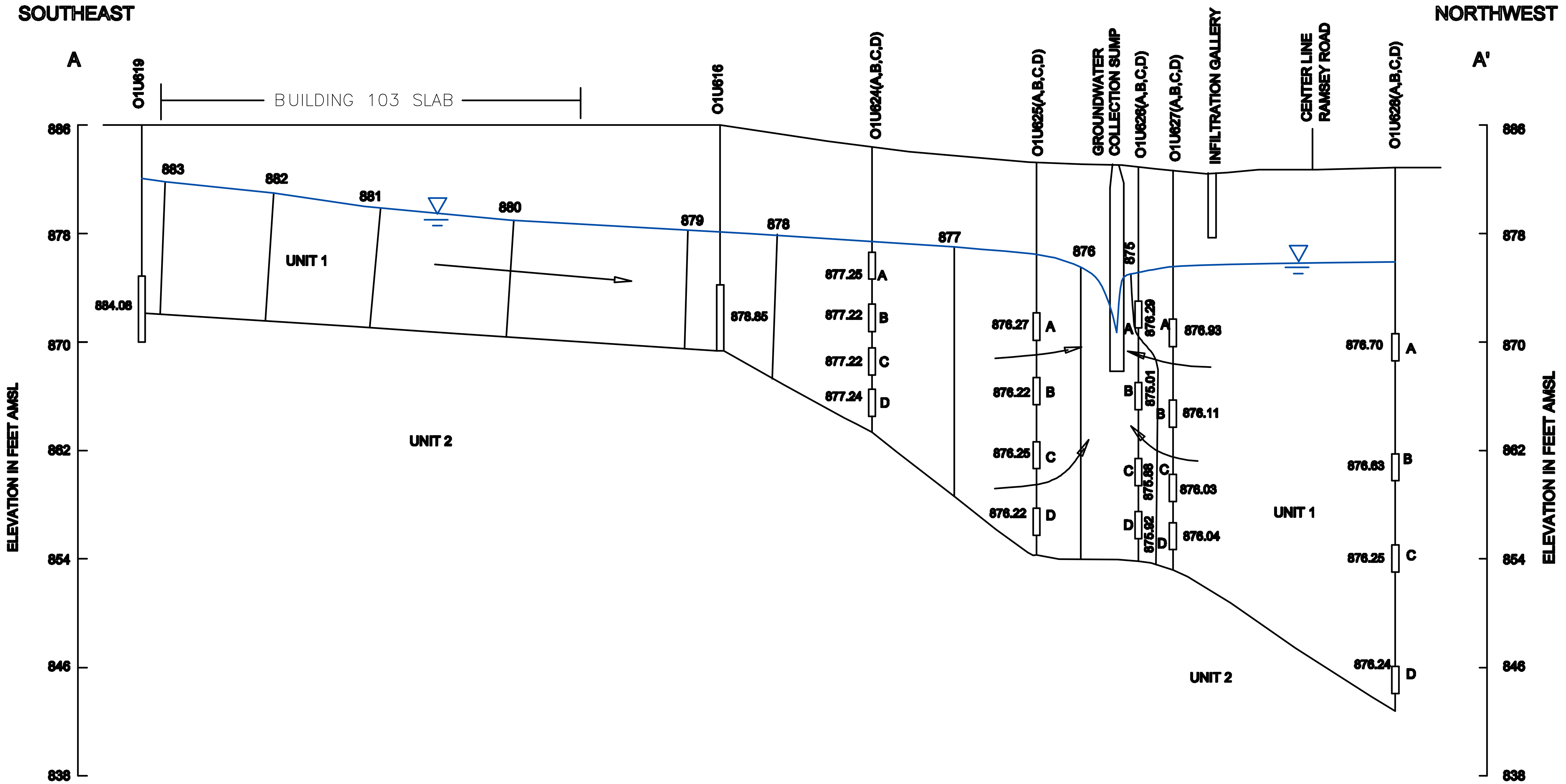
| PREPARED FOR: | | SITE K, UNIT 1 AND UNIT 3 GROUNDWATER ELEVATION DATA 06/02/09 | | FIGURE: |
|---|---|---|---|---|
| ALLIANT TECHSYSTEMS TWIN CITY ARMY AMMUNITION PLANT ARDEN HILLS, MINNESOTA | | | | 9-2 |
| JOB NUMBER: 182602056 | DRAWN BY: TF | CHECKED BY: AG | APPROVED BY: AG | DATE: 12/14/09 |




## LEGEND:

WATER TABLE

VERTICAL SCALE 1"=8'

8 16

APPROXIMATE SCALE (FEET)

HORIZONTAL SCALE 1"=40'

40 80

APPROXIMATE SCALE (FEET)

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ARDEN HILLS, MINNESOTA

SITE K
HYDROGEOLOGIC CROSS SECTION A-A'
06/02/09 (Q103)

FIGURE: 9-3

| JOB NUMBER: | DRAWN BY: | CHECKED BY: | APPROVED BY: | DATE: |
|---|---|---|---|---|
| 182602056 | TF | AG | AG | 12/14/09 |


## Legend

- MONITORING WELL LOCATION
- ANNUAL MONITORING LOCATION
- UNIT 3 SENTINEL 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

0 150 300 600 900 1,200
Feet

N

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| | | | |
|---|---|---|---|
| PREPARED FOR: ALLIANT TECHSYSTEMS TWIN CITY ARMY AMMUNITION PLANT ARDEN HILLS, MINNESOTA | SITE K, UNIT 1 AND UNIT 3 TCE CONCENTRATION MAP 06/02/09 (Q103) | | FIGURE: 9-4 |
| JOB NUMBER: 182602056 | DRAWN BY: TF | CHECKED BY: AG | APPROVED BY: AG |
| DATE: 12/14/09 | | | |

# 10.0 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 2008 through September 2009.

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

## 10.1 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 2009 consistent with the requirements of the OU2 ROD. Table 10-1 presents the cleanup requirements for the TGRS from the OU2 ROD.

During FY 2009, the average extraction well water pumped was approximately 1,760 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 2009. The southernmost well grouping (03U003, B11, B1, and B13 achieved an average flow rate of 404 gpm, which is slightly below the MOS minimum flow rate of 415 gpm. Pump upgrades and well cleanings will be conducted during FY 2010 to increase the extraction rate of this grouping above the MOS minimum flow rate.

**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 is extracted from 8 wells along the southwest boundary of TCAAP (B1, B3 through B6, B8, B9, B11 and B13) and three wells downgradient of interior source areas on TCAAP (SC1, SC2 and SC5). Prior to this, wells B2, B7, B10 and SC3 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 10-1.

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.

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;
- Maintain treatment center 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 WWP#1 and #2.

FY 2009 Maintenance and Inspection Activity

**During FY 2009, 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 1,760 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 10-2 plots the daily average flow rate since October 1, 2008, and shows that the TGRS operated above the OM for the majority of the time (298 days or 81.6 percent of the time) in FY 2009. On a monthly basis, total TGRS extraction rates were below 1,745 gpm during the following months:

- March 2009 (1,741 gpm, lower flow rate due to 3 separate power outages and failed o-ring at the pitless adapter at B3)
- April 2009 (1,724 gpm, lower flow rate due to B13 and SC2 well rehabilitations, preventative maintenance, and power outage)
- May 2009 (1,668 gpm, lower flow rate due to reoccurring power outages resulting in 931 hours of pumphouse downtime during the month)
- August 2009 (1,630 gpm, lower flow rate due to preventative maintenance, blown communication card at SC2, blown pump motor at B4, power outage, and forcemain leak repair)

Appendix F.2 provides additional information on the various downtimes throughout FY 2009.

The monthly and annual volume of water pumped is presented in Table 10-2 and 10-3. Table 10-2 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 10-3 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. In addition, treatment center meters #1 and #2, located after the first set of air stripping towers, are used as a check on the total extracted groundwater calculation.

As shown on Table 10-3, the TGRS successfully captured and treated approximately 925,232,745 gallons of contaminated water from October 2008 through September 2009 based on the sum of the individual pumphouse flow meters. This converts to an average flow rate of 1,760 gpm.

The TGRS as a whole was operational 96.3 percent of the time (i.e., 351.6 days out of 365 days in FY 2009).

<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 2009 operational notes is presented in Appendix F-2. During FY 2009, 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 10-4. A summary of average down time for the pumphouses and the treatment center by the category of failure is presented in Table 10-5. 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 slightly more in FY 2009 than they were in FY 2008. The increased downtime is primarily due to an increase in interruptions to electrical service from 3.9 days in FY 2008 to 6.5 days in FY 2009.

Description of Down Time Categories

Pumphouse component failures accounted for an average of 3.7 days down time per pumphouse. There was less down time due to pumphouse maintenance in FY 2009 than there was in FY 2008. The major pumphouse repairs causing down time were:

- Troubleshooting ongoing issues at Pumphouse B8;
- Motor failure and replacement at Pumphouses B4 and SC5;
- Well redevelopment at Pumphouses B13, SC2, and SC5.

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 0.8 days down time per pumphouse. The major treatment center repairs causing substantial down time were maintenance on ECV 3 in January and problems with the Pump 4 starter wiring in November and December.

Electrical service system failures accounted for an average of 6.5 days down time per pumphouse. Electrical storm damage and power grid failures were the primary causes of down time.

Preventative maintenance procedures accounted for an average of 0.5 days of down time per pumphouse. Preventative maintenance procedures are described in the project Operation and Maintenance Manual.

System modifications accounted for an average of 0.0 days down time per pumphouse. There was no down time due to system modifications in FY 2009.

Forcemain issues accounted for an average of 1.8 days down time per pumphouse. Repairs to a forcemain leak in August account for all of the down time due to forcemain issues in FY 2009.

**Were there any major operational changes during the year?**

Yes. In July 2009, following approval by the regulatory agencies, temporary continuous pumping of monitoring well 03U003 commenced in order to increase VOC mass removal from this area. This well was pumped at an average rate of 12 gpm until October 2009 when pumping stopped and the pump was removed from the well. A separate letter is being prepared to evaluate the effectiveness of this pumping.

Well SC-3 was also turned on in September to increase total flow caused by the downtime in August 2009. Pumping of this well was discontinued in October 2009.

The pumping of these wells contributed approximately 6 gpm to the total annual average TGRS extraction rate of 1760 gpm. As such, even without these short-term pumping measures the TGRS would have achieved an average extraction rate above the GOS Operational Minimum (1,745 gpm).

**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 2009. Appendix D contains the water level database for the monitoring wells. Figures 10-3 through 10-5 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 925,232,745 gallons of water from October 2008 through September 2009. 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 2,167 pounds of VOCs from October 2008 through September 2009. The VOC mass removal in FY 2008 was 2,292 pounds. The decrease in FY 2009 reflects an overall decrease in plume concentration.

Average VOC influent concentrations decreased from 291 µg/L in FY 2008 to 281 µg/L in FY 2009 (3.4 percent lower). Table 10-6 summarizes the individual VOC mass contribution of each extraction well and the entire system. Overall, the TGRS has removed over 100 tons (201,449 lbs) of VOCs from the aquifers since 1987 and 10.7 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 2,167 pounds in FY 2009, the VOC mass removal from the TGRS is at 63 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, B12, SC3, and SC4 are shut down, but were temporarily operated for June 2009 sampling. Table 10-7 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 10-1.

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:

- B10 (5.1 µg/L in FY 2001 to 0.47 µg/L in FY 2009 – 91% reduction)
- SC3 (5.5 µg/L in FY 2001 to 0.58 µg/L in FY 2009 – 89% reduction)
- B4 (500 µg/L in FY 2001 to 130 µg/L in FY 2009 – 74% reduction)
- B5 (410 µg/L in FY 2001 to 120 µg/L in FY 2009 – 71% reduction)
- B6 (230 µg/L in FY 2001 to 72 µg/L in FY 2009 – 69% reduction)
- B11 (4.8 µg/L in FY 2001 to 1.5 µg/L in FY 2009 – 69% reduction)
- SC2 (100 µg/L in FY 2001 to 36 µg/L in FY 2009 – 64% reduction)
- B1 (180 µg/L in FY 2001 to 89 µg/L in FY 2009 – 51% reduction)

These trends reflect the overall decline in OU2 deep groundwater contaminant concentrations. In addition, as discussed below, there has been a reduction in overall TGRS influent concentrations over the previous several years.

As Table 10-6 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. As predicted, the pumping of Well 03U003 tripled the mass removal in the well B11 area. However, the combined mass removal from these two wells amounts to 0.1% of the total mass removal.

The source control wells, SC1 through SC5, together accounted for over 71 percent of the VOC mass removed while accounting for only 7.9 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 84 gpm (4.8 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?**

Appendix B presents the TRCLE graphs over time for monitoring wells. Although a formal statistical analysis has not been conducted, the large majority of these graphs reflect downward trends in TRCLE concentration, indicating an overall improvement in water quality both up gradient and down gradient 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 graphs may not reflect a uniform or easily predictable pattern.

Several wells were identified in previous APRs or when reviewing the FY 2009 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. Showed upward trend from 2006 (160 ppb) to 2008 (240 ppb). Back down to 140 ppb in 2009. 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. Spiked in 2008 to 380 ppb. Down to 180 ppb in 2009. Maintain annual sampling frequency. |
| 03U094 | Trend identified during FY 2004 data review. Increased from 170 ppb in 2003 to 470 ppb in 2005. Down to 119 ppb in 2008 and 100 ppb in 2009. Appears to be stabilizing in low 100's of ppb. Maintain annual sampling frequency. |
| 03M806 | Trend identified during FY 2003 data review. 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. Decreased to 910 ppb in 2006 and 520 ppb in 2007. Up slightly in 2008 to 680 ppb and back down to 490 ppb in 2009. Maintain annual sampling frequency. |

| Well | Trend Observation |
|---|---|
| 03U711 | Trend identified in FY 2001 APR. Dropped from near 1000 ppb in 1994 to 75 ppb in 1999. Increased to 250 ppb in 2004 and has been decreasing since, to 68 ppb in 2009. Maintain annual sampling frequency. |
| 03L809 | Trend identified in FY 2001 APR. Dropped from over 3,000 ppb to 67 ppb through 1998. At 220 ppb in 2007 and 120 ppb in 2009. Maintain biennial sampling frequency (next event 2011). |
| 04U843 | Trend identified in FY 2001 APR. Below 15 ppb from late 1980s through 1997, increased to between 22 ppb and 38 ppb from 1998 through 2001, dropped to below 1 ppb in 2003, and recently peaked at 87 ppb in 2007 and 98 ppb in 2009. Maintain biennial sampling frequency (next event 2011). |
| 04U841 | Trend identified in FY 2001 APR. Below 10 ppb through 1995, increased to 25 ppb in 2001, decreased to 5 ppb in 2003, increased to 24 ppb by 2007, and down to 18 ppb in 2009. Maintain biennial sampling frequency (next event 2011). |
| 03U822 | Trend identified during FY 2003 data review. Below 25 ppb through 1998, peaked at 375 ppb in 1999, decreasing since 2003 (280 ppb) to 120 ppb in 2009. Maintain biennial sampling frequency (next event 2011). |

| Well | Trend Observation |
|---|---|
| 03L822 | Trend identified in FY 2001 APR. Increased from below 5 ppb during early 1990s to over 600 ppb from 1999 through 2003. Steady decrease since 620 ppb in 2003 to 230 ppb in 2009. Approximately 1 mile from TGRS. Well historically showed 1,1,1-trichloroethane as major contaminant. Maintain biennial sampling frequency (next event 2011). |

Wells 04U847 and 04J847 are OU1 wells. See Section 3.6 and Table 3.5 for information on these wells.

## 10.2 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 2009. The influent/effluent database for FY 2009 is contained in Appendix G-2. Figure 10-3 presents a graph of influent TRCLE versus time. This graph is cumulative and includes data from before 1989, when the system consisted of only six extraction wells. The average FY 2009 influent TRCLE concentration was 217 μg/L, down from 228 μg/L in FY 2008. FY 2009 represents the

sixth 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 decreasing TRCLE concentration could be due in part to the overall decrease in plume concentration.

Figure 10-3 also presents a graph of the effluent TRCLE concentration versus time. As indicated, the effluent was below 5-µg/L TRCLE for all sampling events in FY 2009. A review of the FY 2009 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 TRCLE concentrations indicates average removal efficiency of 99.8 percent.

**What was the mass of VOCs emitted into the air?**

The air stripping towers remove VOCs with an efficiency of approximately 99.8 percent. Thus, the air emissions are essentially equal to the VOC mass removal rates presented in Table 10-6. Air emissions therefore averaged 5.9 pounds/day based on the VOC mass removal rates. The total VOC emissions from October 2008 through September 2009 were 2,167 pounds.

## 10.3 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 2009, there were no noticeable changes in Gravel Pit performance. The Gravel Pit is accommodating the TGRS discharge as designed.

## 10.4 REMEDY COMPONENT #4: LAND USE CONTROLS

**Description:** "Institutional controls to restrict access to contaminated aquifers and prevent exposure to contaminated groundwater." (OU2 ROD, page 4) 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 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 deep groundwater, and is it being implemented?**
No. The Army submitted a draft OU2 LUCRD in July 2009 that was under review by the USEPA and MPCA at the end of the fiscal year. It is expected that the OU2 LUCRD will be approved in FY 2010. In the meantime, the Army continued to implement land use controls for the remedial action sites, following the draft Land Use Control Implementation Plan (LUCIP) that was prepared in 2003, but not approved by the MPCA or USEPA. When approved, the OU2 LUCRD will supersede the draft LUCIP.

**Was an annual site inspection for land use controls conducted in FY 2009?**
On July 16, 2009, 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.

## 10.5 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. At a minimum, the Technical Review Committee meetings can serve as a forum for discussion of possible technologies. 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, and
    - 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.

- “New technologies” is an ongoing agenda item for the Technical Review Committee meetings between the Army, USEPA, and MPCA. No emerging technologies were identified through the process during FY 2009.

**Were any new technologies identified and considered to have merit during FY 2009?**
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. Although not a new technology, the pumping of monitoring well 03U003 represented a modified approach to enhance VOC mass removal in the southern plume.

**What is the status and/or findings of any previously initiated reviews of emerging technologies?**
There are no on-going reviews.

**Are any new reviews planned at this time for the coming year?**
No. The Army will continue to have new technologies on the agenda for the Technical Review Committee meeting, and attend conferences that highlight emerging and new technologies. However, reviews of specific technologies are not planned in FY 2010.

## 10.6 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 2009 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 2009 monitoring plan and any deviations are explained in Appendix C-2. Monitoring was as follows:

Groundwater

TGRS groundwater level measurements were collected during December 2008 and June 2009 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 2009 was a "big round" year in the biennial sample program, so samples were collected for the full list of wells. Table 10-8 presents the groundwater quality data for FY 2009. Figures 10-7 through 10-9 present plan views of the TRCLE plumes and Figures 10-10 and 10-11 present a cross sectional view of the plume along the property boundary.

Results from the 2009 groundwater sampling showed that most of the wells sampled continued to have declining or stable TRCLE concentrations. The most notable decreases were at 03U708 (steady decrease from 270 µg/L in 2002 to 31 µg/L in 2009), 03M806 (decrease from 680 µg/L in 2008 to 490 µg/L in 2009), 03U021 (steady decrease from 2,000 µg/L in 1999 to 190 µg/L in 2009), and 03U711 (steady decrease from 250 µg/L in 2004 to 68 µg/L in 2009). Several wells showed a slight increase in TRCLE concentration in 2009; however, the general trend at most wells since 1999 appears to be declining or stable. The increases were most notable at 04U709 (7.8 µg/L in 2007 to 69 µg/L in 2009) and 03U078 (60 µg/L in 2007 to 90 µg/L in 2009). However these apparent increases do not warrant further sampling beyond the biennial events. Both wells are within the hydraulic capture zone of the TGRS system (Figures 10-3 to 10-5). Furthermore, the 2009 TRCLE concentration in Well 03U078 is still less than the concentrations reported between 1999 and 2005 (110 μg/L to 160 μg/L) indicating that the 2007 result may have been anomalously low.

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, 10.7 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, 03U099, 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) in 2009.

As a result, the width of TRCLE plume is narrowing. Figure 10-12 shows FY 2009 TRCLE data with the 5 μg/l TRCLE contours for FY 2001 and FY 2009. Based on these contours, the estimated width of the source area TRCLE plume has decreased approximately 15 percent from 3,600 feet to 3,050 feet or approximately 85 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 23 percent from 4,600 feet to 3,550 feet or approximately 77 percent of the FY 2001 width.

Treatment System

The TGRS treatment system influent and effluent was sampled monthly during FY 2009 in accordance with the FY 2009 monitoring plan. Groundwater samples from the extraction wells were collected in December 2008 and June 2009 in accordance with the FY 2009 monitoring plan.

**Is additional monitoring proposed prior to the next report?**

No additional monitoring for FY 2010 is proposed beyond that presented in the Monitoring Plan (Appendix A) of the FY 2008 APR. Table 10-9 and Appendix A of this report provide FY 2010 monitoring requirements.

## 10.7 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 2009 annual average extraction rate was 1,760 gpm. Additional pumping was conducted at well 03U003 between July and October 2009 and at well SC-3 in September 2009.
- The TGRS extracted and treated 925,232,745 gallons of water and removed 2,167 pounds of VOCs from October 2008 to September 2009. Average VOC influent concentrations decreased by 3.4% from FY 2008.
- 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 remedial measures need to be addressed?**
No. Pump and well improvements have been implemented at Wells B1 and B13 to increase the extraction rates above the MOS operating rate for the well grouping.

**TABLE 10-1**

**GROUNDWATER CLEANUP LEVELS**
**TGRS, OU2**
**ARDEN HILLS, MINNESOTA**

| *Substance* | *Expected Level in Discharge (ppb)* | *Operable Unit 2 Rod Requirements (ppb)* |
|---|---|---|
| <u>*Volatile Organic Compounds (VOCs)*</u> | | |
| 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 10-2**

**EXTRACTION WELL WATER PUMPED**
**FISCAL YEAR 2009**
**TGRS, OU2**
**ARDEN HILLS, MINNESOTA**

| | *Volume of Water Pumped (gallons)* | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *B1* | *B3* | *B4* | *B5* | *B6* | *B8* | *B9* | *B11* | *B13* | *03U003* | *SC1* | *SC2* | *SC3* | *SC5* | *TOTAL* |
| October 2008 | 10,076,800 | 7,022,200 | 9,407,900 | 9,102,200 | 9,839,700 | 6,191,700 | 11,725,400 | 4,300,500 | 4,708,700 | 0 | 1,017,400 | 1,210,100 | 0 | 3,988,000 | 78,590,600 |
| (gpm) | 226 | 157 | 211 | 204 | 220 | 139 | 263 | 96 | 105 | 0 | 23 | 27 | 0 | 89 | 1,761 |
| November 2008 | 9,755,800 | 7,021,500 | 9,390,100 | 8,739,700 | 9,363,000 | 5,793,800 | 12,513,700 | 4,005,200 | 4,276,400 | 0 | 976,100 | 938,300 | 0 | 3,073,000 | 75,846,600 |
| (gpm) | 226 | 163 | 217 | 202 | 217 | 134 | 290 | 93 | 99 | 0 | 23 | 22 | 0 | 71 | 1,756 |
| December 2008 | 10,149,300 | 7,899,200 | 9,795,000 | 9,099,000 | 10,149,700 | 4,136,900 | 13,068,500 | 4,117,900 | 3,864,600 | 0 | 978,050 | 1,088,100 | 0 | 4,156,075 | 78,502,325 |
| (gpm) | 227 | 177 | 219 | 204 | 227 | 93 | 293 | 92 | 87 | 0 | 22 | 24 | 0 | 93 | 1,759 |
| January 2009 | 10,064,500 | 7,498,800 | 9,743,300 | 8,985,500 | 9,755,400 | 5,708,400 | 12,003,400 | 4,054,100 | 4,008,800 | 0 | 865,600 | 1,014,600 | 0 | 4,333,500 | 78,035,900 |
| (gpm) | 225 | 168 | 218 | 201 | 219 | 128 | 269 | 91 | 90 | 0 | 19 | 23 | 0 | 97 | 1,748 |
| February 2009 | 8,703,700 | 6,796,700 | 9,383,200 | 7,527,500 | 8,369,300 | 6,887,800 | 11,575,830 | 3,496,900 | 3,617,100 | 0 | 754,900 | 528,300 | 0 | 3,682,700 | 71,323,930 |
| (gpm) | 216 | 169 | 233 | 187 | 208 | 171 | 287 | 87 | 90 | 0 | 19 | 13 | 0 | 91 | 1,769 |
| March 2009 | 9,572,900 | 7,273,000 | 10,601,800 | 8,285,500 | 9,393,300 | 7,138,600 | 12,740,600 | 3,888,600 | 3,773,100 | 0 | 818,200 | 371,100 | 0 | 3,840,200 | 77,696,900 |
| (gpm) | 214 | 163 | 237 | 186 | 210 | 160 | 285 | 87 | 85 | 0 | 18 | 8 | 0 | 86 | 1,741 |
| April 2009 | 9,168,500 | 7,404,800 | 9,698,600 | 8,206,300 | 8,986,500 | 6,286,800 | 12,126,500 | 3,705,400 | 4,110,300 | 0 | 780,500 | 402,900 | 0 | 3,616,400 | 74,493,500 |
| (gpm) | 212 | 171 | 225 | 190 | 208 | 146 | 281 | 86 | 95 | 0 | 18 | 9 | 0 | 84 | 1,724 |
| May 2009 | 8,714,100 | 7,476,000 | 9,080,500 | 7,641,000 | 9,108,900 | 6,699,400 | 11,746,800 | 4,096,900 | 4,369,000 | 0 | 735,600 | 1,452,900 | 0 | 3,346,500 | 74,467,600 |
| (gpm) | 195 | 167 | 203 | 171 | 204 | 150 | 263 | 92 | 98 | 0 | 16 | 33 | 0 | 75 | 1,668 |
| June 2009 | 8,979,400 | 8,039,200 | 9,715,100 | 7,735,400 | 9,545,300 | 8,508,400 | 12,190,300 | 4,491,000 | 4,533,800 | 0 | 772,000 | 2,397,600 | 0 | 3,389,900 | 80,297,400 |
| (gpm) | 208 | 186 | 225 | 179 | 221 | 197 | 282 | 104 | 105 | 0 | 18 | 56 | 0 | 78 | 1,859 |
| July 2009 | 9,406,100 | 7,912,520 | 10,907,300 | 6,817,650 | 9,730,600 | 8,865,400 | 12,852,200 | 4,612,300 | 3,927,520 | 171,300 | 800,100 | 3,001,000 | 0 | 3,581,900 | 82,585,890 |
| (gpm) | 211 | 177 | 244 | 153 | 218 | 199 | 288 | 103 | 88 | 4 | 18 | 67 | 0 | 80 | 1,850 |
| August 2009 | 8,627,800 | 7,288,300 | 7,326,500 | 6,360,900 | 9,008,200 | 7,568,200 | 11,873,600 | 4,363,600 | 3,656,900 | 531,500 | 735,700 | 2,166,100 | 0 | 3,268,600 | 72,775,900 |
| (gpm) | 193 | 163 | 164 | 142 | 202 | 170 | 266 | 98 | 82 | 12 | 16 | 49 | 0 | 73 | 1,630 |
| September 2009 | 9,090,800 | 7,797,200 | 9,115,000 | 6,529,100 | 9,290,800 | 8,628,900 | 12,461,100 | 4,432,000 | 4,082,000 | 612,700 | 757,000 | 2,019,100 | 2,102,600 | 3,697,900 | 80,616,200 |
| (gpm) | 210 | 180 | 211 | 151 | 215 | 200 | 288 | 103 | 94 | 14 | 18 | 47 | 49 | 86 | 1,866 |
| **TOTAL FY 2009** | **112,309,700** | **89,429,420** | **114,164,300** | **95,029,750** | **112,540,700** | **82,414,300** | **146,877,930** | **49,564,400** | **48,928,220** | **1,315,500** | **9,991,150** | **16,590,100** | **2,102,600** | **43,974,675** | **925,232,745** |
| Operational Minimum (gpm) | 225 | 170 | 195 | 195 | 210 | 135 | 275 | 80 | 110 | 0 | 20 | 30 | 0 | 100 | 1,745 |

| | B11, B1, B13,03U003 | B4, B5, B6 | B4, B5, B6, B8, B9 | Total System |
|---|---|---|---|---|
| FY09 Average Flow Rate (gpm) | 404 | 612 | 1048 | 1,760 |
| MOS Operational Minimum (gpm) | 415 | 600 | 1,010 | 1,745 |

**TABLE 10-3**

**TREATMENT CENTER WATER METER TOTALS**
**FISCAL YEAR 2009**
**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 2008 | 78,590,600 | 31,087,000 | 46,020,000 | 77,107,000 | 18,323,000 | 63,687,000 | 82,010,000 | 0 | 0 | 0 |
| November 2008 | 75,846,600 | 27,233,000 | 47,247,000 | 74,480,000 | 17,896,000 | 61,295,000 | 79,191,000 | 0 | 0 | 0 |
| December 2008 | 78,502,325 | 32,093,000 | 44,780,000 | 76,873,000 | 20,826,000 | 61,201,000 | 82,027,000 | 0 | 0 | 0 |
| January 2009 | 78,035,900 | 34,405,000 | 42,373,000 | 76,778,000 | 18,742,000 | 63,398,000 | 82,140,000 | 0 | 0 | 0 |
| February 2009 | 71,323,930 | 26,706,000 | 43,411,000 | 70,117,000 | 13,644,000 | 61,427,000 | 75,071,000 | 0 | 0 | 0 |
| March 2009 | 77,696,900 | 26,871,000 | 49,603,000 | 76,474,000 | 14,803,000 | 66,954,000 | 81,757,000 | 0 | 0 | 0 |
| April 2009 | 74,493,500 | 27,857,000 | 45,187,000 | 73,044,000 | 12,828,000 | 65,374,000 | 78,202,000 | 0 | 0 | 0 |
| May 2009 | 74,467,600 | 27,868,000 | 45,049,000 | 72,917,000 | 14,035,000 | 63,961,000 | 77,996,000 | 0 | 0 | 0 |
| June 2009 | 80,297,400 | 29,283,000 | 48,712,000 | 77,995,000 | 10,348,000 | 72,897,000 | 83,245,000 | 0 | 0 | 0 |
| July 2009 | 82,585,890 | 31,388,000 | 51,351,000 | 82,739,000 | 10,683,000 | 77,619,000 | 88,302,000 | 0 | 0 | 0 |
| August 2009 | 72,775,900 | 27,814,000 | 44,165,000 | 71,979,000 | 10,348,000 | 64,806,000 | 75,154,000 | 0 | 0 | 0 |
| September 2009 | 80,616,200 | 35,093,000 | 44,607,000 | 79,700,000 | 10,528,000 | 72,438,000 | 82,966,000 | 0 | 0 | 0 |
| TOTAL 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 |

**TABLE 10-3**

**TREATMENT CENTER WATER METER TOTALS**
**FISCAL YEAR 2009**
**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* |
| FY89 | 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 |

**TABLE 10-4**

**PUMPHOUSE DOWN TIME (DAYS)**
**FISCAL YEAR 2009**
**TGRS, OU2**
**ARDEN HILLS, MINNESOTA**

| *Well Name* | *FY09 Down Time (Days)* | *FY08 Down Time (Days)* | *FY07 Down Time (Days)* | *FY06 Down Time (Days)* | *FY05 Down Time (Days)* |
|---|---|---|---|---|---|
| B1 | 9.5 | 4.4 | 10.6 | 6.9 | 11.5 |
| B2 | (1) | (1) | (1) | (1) | (1) |
| B3 | 12.1 | 9.5 | 6.4 | 23.5 | 34.0 |
| B4 | 16.4 | 34.7 | 6.0 | 10.4 | 26.2 |
| B5 | 8.6 | 3.4 | 1.3 | 27.1 | 13.9 |
| B6 | 10.2 | 4.5 | 2.2 | 11.9 | 15.6 |
| B7 | (1) | (1) | (1) | (1) | (1) |
| B8 | 23.2 | 21.7 | 8.6 | 34.6 | 18.5 |
| B9 | 9.4 | 5.4 | 10.2 | 20.8 | 23.1 |
| B10 | (1) | (1) | (1) | (1) | (1) |
| B11 | 8.7 | 6.0 | 12.4 | 24.9 | 22.7 |
| B12 | (1) | (1) | (1) | (1) | (1) |
| B13 | 16.1 | 15.2 | 6.2 | 14.1 | 13.7 |
| 03U003 | 0.3(2) | (1) | (1) | (1) | (1) |
| SC1 | 10.8 | 5.8 | 8.9 | 13.4 | 21.8 |
| SC2 | 14.2 | 11.9 | 21.8 | 17.5 | 13.9 |
| SC3 | (3) | (1) | (1) | (1) | (1) |
| SC4 | (1) | (1) | (1) | (1) | (1) |
| SC5 | 21.0 | 3.9 | 18.5 | 37.1 | 11.9 |

Note:

(1) The extraction well was not in operation during the fiscal year.
(2) The extraction well was in operation from 7/21/09 to 9/30/09 during the fiscal year.
(3) The extraction well was in operation from 9/1/09 to 9/30/09 during the fiscal year.

**TABLE 10-5**

**DOWN TIME (DAYS) BY CATEGORY**
**FISCAL YEAR 2009**
**TGRS, OU2**
**ARDEN HILLS, MINNESOTA**

| *Category* | *Down Time (Days)* |
|---|---|
| Pumphouse Component | 3.7 |
| Treatment Center Component | 0.8 |
| Electrical Service | 6.5 |
| Miscellaneous | 0.0 |
| Preventive Maintenance | 0.5 |
| System Modification | 0.0 |
| Forcemain | 1.8 |
| **Total System Equivalent** | 13.4 |
| | |
| *Anticipated Down Time for Fiscal Year 2010* | |
| Pumphouse Component | 3.5 |
| Treatment Center Component | 3.0 |
| Electrical Service | 1.0 |
| Miscellaneous | 0.1 |
| Preventive Maintenance | 3.5 |
| System Modification | 1.0 |
| Forcemain | 2.0 |

**TABLE 10-6**

**VOC MASS LOADING SUMMARY**
**FISCAL YEAR 2009**
**TGRS, OU2**
**ARDEN HILLS, MINNESOTA**

| *Well* | *Percent Contribution to VOC Mass Removal* | *FY 2009 Total Pounds VOCs Mass Removed* |
|---|---|---|
| B1 | 4.1% | 88.1 |
| B2[1] | 0.0% | 0.0 |
| B3 | 0.2% | 4.7 |
| B4 | 7.0% | 151.0 |
| B5 | 5.1% | 110.9 |
| B6 | 3.4% | 72.8 |
| B7[1] | 0.0% | 0.0 |
| B8 | 0.8% | 17.5 |
| B9 | 5.1% | 109.8 |
| B10[1] | 0.0% | 0.0 |
| B11 | 0.0% | 0.6 |
| B12[1] | 0.0% | 0.0 |
| B13 | 3.1% | 66.9 |
| 03U003[2] | 0.1% | 1.3 |
| SC1 | 2.8% | 60.8 |
| SC2 | 0.2% | 5.3 |
| SC3[3] | 0.0% | 0.0 |
| SC4[1] | 0.0% | 0.0 |
| SC5 | 68.2% | 1,477 |
| ***Fiscal Year 2009 Total (lbs)*** | | ***2,167*** |
| ***Daily Average (lbs/day)*** | | ***5.9*** |

Notes:

[1] Extraction well was not in operation during the fiscal year.
[2] The extraction well was in operation from 7/21/09 to 9/30/09 during the fiscal year.
[3] The extraction well was in operation from 9/1/09 to 9/30/09 during the fiscal year.

**TABLE 10-6**

**VOC MASS LOADING SUMMARY**
**FISCAL YEAR 2009**
**TGRS, OU2**
**ARDEN HILLS, MINNESOTA**

**HISTORICAL TOTAL**

| *Fiscal Year* | | *Pounds VOC Mass Removed* |
|---|---|---|
| 2009 | | 2,167 |
| 2008 | | 2,292 |
| 2007 | | 2,507 |
| 2006 | | 2,552 |
| 2005 | | 2,663 |
| 2004 | | 3,291 |
| 2003 | | 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*** | | ***201,449*** |

**TABLE 10-7**

**VOC CONCENTRATIONS IN TGRS EXTRACTION WELLS (µg/L)**
**FISCAL YEAR 2009**
**TGRS, OU2**
**ARDEN HILLS, MINNESOTA**

| *Location* | *Alias* | *Date* | *Dup* | *1,1,1-Trichloroethane* µg/L | *1,1-Dichloroethane* µg/L | *1,1-Dichloroethene* µg/L | *1,2-Dichloroethane* µg/L | *cis-1,2-Dichloroethene* µg/L | *Tetrachloroethene* µg/L | *Trichloroethene* µg/L |
|---|---|---|---|---|---|---|---|---|---|---|
| 03F302 | B1 | 12/3/08 | | 5.7 | 1.2 | 1.2 | < 1 | 5.2 | 2.4 JL134 | 93 |
| 03F302 | B1 | 6/3/09 | | 4.8 | 1.1 | 1.4 | < 1 | 5.1 | 2.5 | 89 |
| | | | | | | | | | | |
| 03F303 | B2 | 6/3/09 | | < 1 | 0.84 JP | 1.6 | < 1 | 1.5 | 0.8 JP | 25 |
| | | | | | | | | | | |
| 03F304 | B3 | 12/3/08 | | < 1 | 0.78 JP | 0.78 JP | < 1 | 0.26 JP | < 1 | 5.7 |
| 03F304 | B3 | 6/3/09 | | 0.42 JP | 0.65 JP | 0.79 JP | < 1 | 0.29 JP | < 1 | 4.6 |
| | | | | | | | | | | |
| 03F305 | B4 | 12/3/08 | | 11 | 8.5 | 7 | < 1 | 4 | < 1 | 170 |
| 03F305 | B4 | 12/3/08 | D | 11 | 8.8 | 6.7 | < 1 | 4 | < 1 | 170 |
| 03F305 | B4 | 6/3/09 | | 9.4 | 7.5 | 7 | < 1 | 3.5 | < 1 | 130 |
| | | | | | | | | | | |
| 03F306 | B5 | 12/3/08 | | 5.4 | 4.8 | 3.7 | < 1 | 0.97 JP | 6.8 JL134 | 150 |
| 03F306 | B5 | 6/3/09 | | 5 | 4.4 | 4.2 | < 1 | 0.92 JP | 8 | 120 |
| | | | | | | | | | | |
| 03F307 | B6 | 12/3/08 | | 1.4 | 2.8 | 2.3 | < 1 | 0.65 JP | < 1 | 90 |
| 03F307 | B6 | 6/3/09 | | 1.2 | 2.3 | 2.2 | < 1 | 0.56 JP | < 1 | 72 |
| | | | | | | | | | | |
| 03F308 | B7 | 6/3/09 | | < 1 | < 1 | < 1 | < 1 | < 1 | < 1 | 2 |
| | | | | | | | | | | |
| 03F312 | B11 | 12/3/08 | | < 1 | < 1 | < 1 | < 1 | < 1 | < 1 | 1.6 |
| 03F312 | B11 | 6/3/09 | | < 1 | < 1 | < 1 | < 1 | < 1 | < 1 | 1.5 |
| | | | | | | | | | | |
| 03F319 | B13 | 12/3/08 | | 3.2 | 0.99 JP | 0.73 JP | < 1 | 5.5 | 0.5 JP,JL134 | 140 |
| 03F319 | B13 | 6/3/09 | | 4.9 | 1.9 | 1.7 | < 1 | 10 | 0.7 JP | 200 |
| | | | | | | | | | | |
| 03U301 | SC1 | 12/3/08 | | 10 | 1.2 JP | 1.7 JP | < 2 | 65 | < 2 | 820 |
| 03U301 | SC1 | 6/3/09 | | 8.6 | 1.2 JP | 1.8 JP | < 2 | 60 | < 2 | 670 |
| | | | | | | | | | | |
| 03U314 | SC2 | 12/3/08 | | 3.9 | 0.9 JP | 0.48 JP | < 1 | 0.37 JP | < 1 | 37 |
| 03U314 | SC2 | 6/3/09 | | 5.2 | 0.97 JP | 0.91 JP | < 1 | 0.41 JP | < 1 | 36 |
| | | | | | | | | | | |

**TABLE 10-7**

**VOC CONCENTRATIONS IN TGRS EXTRACTION WELLS (µg/L)**
**FISCAL YEAR 2009**
**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 |
|---|---|---|---|---|---|---|---|---|---|---|
| 03U315 | SC3 | 6/3/09 | | < 1 | < 1 | < 1 | < 1 | < 1 | < 1 | 0.58 JP |
| | | | | | | | | | | |
| 03U316 | SC4 | 6/3/09 | | < 1 | < 1 | < 1 | < 1 | < 1 | < 1 | 4.9 |
| | | | | | | | | | | |
| 03U317 | SC5 | 12/3/08 | | 1200 | 33 | 44 | < 5 | 2.2 JP | 8.2 JL134 | 4100 |
| 03U317 | SC5 | 6/3/09 | | 770 | 23 | 40 | < 5 | 2.6 JP | 6 | 2800 |
| | | | | | | | | | | |
| PJ#309 | B8 | 12/3/08 | | 2.1 | 1.2 | 1.2 | < 1 | 0.44 JP | < 1 | 25 |
| PJ#309 | B8 | 6/3/09 | | 1.8 | 1.1 | 1.4 | < 1 | 0.45 JP | < 1 | 23 |
| PJ#309 | B8 | 6/3/09 | D | 1.7 | 1.2 | 1.5 | < 1 | 0.49 JP | < 1 | 23 |
| | | | | | | | | | | |
| PJ#310 | B9 | 12/3/08 | | 7.5 | 6.2 | 5.6 | < 1 | 2.1 | < 1 | 90 |
| PJ#310 | B9 | 6/3/09 | | 6.4 | 5.7 | 6.2 | < 1 | 2 | < 1 | 71 |
| | | | | | | | | | | |
| PJ#311 | B10 | 6/3/09 | | < 1 | < 1 | < 1 | < 1 | < 1 | < 1 | 0.47 JP |
| | | | | | | | | | | |
| PJ#313 | B12 | 6/3/09 | | < 1 | < 1 | < 1 | < 1 | < 1 | < 1 | < 1 |

Notes:

D - Field Duplicate
JP - Result is qualified as estimated since the detection is below the laboratory quantitation limit.
JL - Result is qualified as estimated due to LCS % recoveries above the upper control limit.

**TABLE 10-8**

**GROUNDWATER QUALITY DATA (µg/L)**
**FISCAL YEAR 2009**
**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 | 6/3/09 | | 1.2 | 0.77 JP | 1.6 | < 1 | 0.15 JP | < 1 | 20 |
| 03L002 | 6/3/09 | D | 1.3 | 0.76 JP | 1.7 | < 1 | 0.14 JP | < 1 | 21 |
| 03L007 | 6/9/09 | | < 1 | < 1 | < 1 | < 1 | < 1 | < 1 | 0.21 JP |
| 03L014 | 6/8/09 | | 120 | 1.4 | 4.8 | 0.16 JP | 0.64 JP | < 1 | 160 |
| 03L017 | 6/5/09 | | < 1 | < 1 | < 1 | < 1 | < 1 | < 1 | 0.29 JP |
| 03L018 | 6/8/09 | | < 1 | < 1 | < 1 | < 1 | < 1 | < 1 | 0.27 JP |
| 03L020 | 6/4/09 | | 0.54 JP | 0.24 JP | 0.16 JP | < 1 | 0.2 JP | < 1 | 11 |
| 03L021 | 6/5/09 | | < 1 | < 1 | < 1 | < 1 | < 1 | < 1 | 3.2 |
| 03L077 | 6/9/09 | | 2.9 | 0.21 JP | 1.3 | < 1 | 0.15 JP | < 1 | 38 |
| 03L078 | 6/10/09 | | < 1 | < 1 | < 1 | < 1 | < 1 | < 1 | 0.18 JP |
| 03L079 | 6/5/09 | | < 1 | < 1 | < 1 | < 1 | < 1 | < 1 | 1.1 |
| 03L084 | 6/12/09 | | < 1 | < 1 | < 1 | < 1 | < 1 | < 1 | < 1 |
| 03L802 | 6/11/09 | | < 1 | < 1 | < 1 | < 1 | < 1 | < 1 | 2.6 |
| 03L806 | 6/9/09 | | 1.9 | 20 | 19 | < 1 | 2.1 | 0.38 JP | 140 |
| 03L809 | 6/12/09 | | 3.4 | 4 | 4.8 | < 1 | 0.93 JP | 0.35 JP | 120 |
| 03L833 | 6/12/09 | | < 1 | < 1 | < 1 | < 1 | < 1 | < 1 | 1.3 |
| 03M002 | 6/3/09 | | 1.2 | 4.8 | 3.7 | < 1 | 0.84 JP | < 1 | 43 |
| 03M020 | 6/4/09 | | 16 | 0.97 JP | 3.3 | < 1 | 0.69 JP | < 1 | 53 |
| 03M802 | 6/11/09 | | < 1 | < 1 | < 1 | < 1 | 0.2 JP | < 1 | 6.7 |
| 03M806 | 6/9/09 | | < 2 | 76 | 31 | < 2 | 4.3 | < 2 | 490 |
| 03U002 | 6/16/09 | | 2.2 | 0.84 JP | 0.94 JP | < 1 | 0.16 JP | < 1 | 18 |
| 03U003 | 6/11/09 | | 17 | 2.1 | 3.1 | < 1 | 6.2 | < 1 | 110 |
| 03U003 | 9/1/09 | | 23 | 2 | 3.7 | < 1 | 7.4 | < 1 | 99 |
| 03U004 | 6/16/09 | | < 1 | < 1 | < 1 | < 1 | < 1 | < 1 | 0.33 JP |
| 03U005 | 6/16/09 | | < 1 | 0.25 JP | < 1 | < 1 | 0.39 JP | < 1 | 0.21 JP |
| 03U007 | 6/9/09 | | < 1 | < 1 | < 1 | < 1 | < 1 | < 1 | < 1 |
| 03U009 | 6/15/09 | | < 1 | < 1 | < 1 | < 1 | < 1 | < 1 | < 1 |
| 03U014 | 6/8/09 | | < 1 | < 1 | < 1 | < 1 | < 1 | < 1 | < 1 |
| 03U017 | 6/5/09 | | < 1 | < 1 | < 1 | < 1 | < 1 | < 1 | 1.5 |
| 03U018 | 6/8/09 | | 10 | 0.38 JP | 1.1 | < 1 | 5.5 | < 1 | 30 |
| 03U020 | 6/4/09 | | 2.7 | 0.93 JP | 0.69 JP | < 1 | 0.29 JP | < 1 | 45 |
| 03U021 | 6/5/09 | | 47 | 4.9 | 8.3 | < 1 | 3.2 | < 1 | 190 |

**TABLE 10-8**

**GROUNDWATER QUALITY DATA (µg/L)**
**FISCAL YEAR 2009**
**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* |
| 03U027 | 6/4/09 | | 1.4 | < 1 | 0.49 JP | < 1 | 1.1 | < 1 | 15 |
| 03U028 | 6/15/09 | | 2.8 | < 1 | 0.95 JP | < 1 | 4.2 | < 1 | 46 |
| 03U029 | 6/16/09 | | 0.65 JP | < 1 | < 1 | < 1 | 0.45 JP | < 1 | 6.9 |
| 03U030 | 6/12/09 | | < 1 | < 1 | < 1 | < 1 | 3 | < 1 | 27 |
| 03U032 | 6/5/09 | | < 1 | < 1 | < 1 | < 1 | < 1 | < 1 | 0.27 JP |
| 03U075 | 6/16/09 | | < 1 | < 1 | < 1 | < 1 | < 1 | < 1 | < 1 |
| 03U077 | 6/9/09 | | 1.1 | < 1 | 0.16 JP | < 1 | < 1 | < 1 | 14 |
| 03U078 | 6/10/09 | | 3.1 | 0.21 JP | 1 | < 1 | 0.68 JP | 11 | 90 |
| 03U079 | 6/5/09 | | 0.92 JP | < 1 | 0.2 JP | < 1 | 0.33 JP | < 1 | 24 |
| 03U079 | 6/5/09 | D | 1.2 | 0.16 JP | 0.27 JP | < 1 | 0.29 JP | < 1 | 26 |
| 03U092 | 6/17/09 | | 0.66 JP | < 1 | < 1 | < 1 | 4.1 | < 1 | 19 |
| 03U093 | 6/8/09 | | 65 | 0.5 JP | 5.1 | < 1 | 2.4 | < 1 | 93 |
| 03U094 | 6/5/09 | | 36 | 4.6 | 5.2 | < 1 | 3.9 | < 1 | 100 |
| 03U096 | 6/8/09 | | 1.4 | 2.5 | 1.2 | < 1 | < 1 | < 1 | 10 |
| 03U099 | 6/15/09 | | 2.1 | < 1 | < 1 | < 1 | < 1 | < 1 | 4.5 |
| 03U114 | 6/16/09 | | 0.64 JP | < 1 | < 1 | < 1 | < 1 | < 1 | 5.3 |
| 03U114 | 6/16/09 | D | 0.68 JP | < 1 | < 1 | < 1 | < 1 | < 1 | 5.1 |
| 03U659 | 6/15/09 | | 4.9 | 0.82 JP | 1.2 | < 1 | 24 | < 1 | 130 |
| 03U671 | 6/16/09 | | 4.6 | 1.4 | 1.8 | < 1 | 0.76 JP | 2.4 | 35 |
| 03U672 | 6/15/09 | | < 1 | < 1 | < 1 | < 1 | < 1 | < 1 | < 1 |
| 03U701 | 6/10/09 | | < 1 | < 1 | < 1 | < 1 | < 1 | < 1 | 2.1 |
| 03U701 | 6/10/09 | D | < 1 | < 1 | < 1 | < 1 | < 1 | < 1 | 2.3 |
| 03U702 | 6/10/09 | | < 1 | < 1 | < 1 | < 1 | < 1 | < 1 | 1.2 |
| 03U702 | 6/10/09 | D | < 1 | < 1 | < 1 | < 1 | < 1 | < 1 | 1.1 |
| 03U703 | 6/11/09 | | 2.5 | < 1 | 0.59 JP | < 1 | 2.5 | 15 | 67 |
| 03U708 | 6/11/09 | | 4.7 | 1 | 1.5 | < 1 | 0.55 JP | 1.5 | 31 |
| 03U709 | 6/11/09 | | 3.5 | 2 | 2.2 | < 1 | 0.52 JP | < 1 | 38 |
| 03U710 | 6/16/09 | | 2.5 | 0.29 JP | 0.53 JP | < 1 | 0.62 JP | < 1 | 26 |
| 03U711 | 6/11/09 | | 7.5 | 2.6 | 3.1 | < 1 | 1.3 | 1 | 68 |
| 03U711 | 6/11/09 | D | 7.7 | 2.6 | 3.1 | < 1 | 1.3 | 0.97 JP | 62 |
| 03U715 | 6/17/09 | | 17 | 0.65 JP | 2.8 | < 1 | 0.11 JP | < 1 | 46 |
| 03U801 | 6/15/09 | | < 1 | < 1 | < 1 | < 1 | 0.58 JP | < 1 | 25 |

**TABLE 10-8**

**GROUNDWATER QUALITY DATA (µg/L)**
**FISCAL YEAR 2009**
**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* |
| 03U803 | 6/12/09 | | < 1 | < 1 | < 1 | < 1 | < 1 | < 1 | 0.6 JP |
| 03U804 | 6/15/09 | | < 1 | < 1 | < 1 | < 1 | < 1 | < 1 | < 1 |
| 03U805 | 6/15/09 | | 0.51 JP | 6.7 | 2.4 | < 1 | 0.48 JP | 0.39 JP | 2.4 |
| 03U805 | 6/15/09 | D | 0.52 JP | 7.2 | 2.4 | < 1 | 0.5 JP | 0.4 JP | 2.3 |
| 03U806 | 6/9/09 | | < 1 | 1.6 | 1.3 | < 1 | 0.35 JP | 1 | 56 |
| 04J077 | 6/9/09 | | 13 | 20 | 18 | < 1 | 6.6 | 0.27 JP | 190 |
| 04J702 | 6/10/09 | | < 1 | < 1 | < 1 | < 1 | < 1 | < 1 | 2.2 |
| 04J708 | 6/3/09 | | < 1 | 0.39 JP | 0.31 JP | < 1 | < 1 | < 1 | 3.3 |
| 04J713 | 6/10/09 | | < 1 | < 1 | < 1 | < 1 | < 1 | < 1 | < 1 |
| 04U002 | 6/3/09 | | < 1 | 0.19 JP | < 1 | < 1 | < 1 | < 1 | 2.2 |
| 04U007 | 6/9/09 | | < 1 | < 1 | < 1 | < 1 | < 1 | < 1 | 0.25 JP |
| 04U020 | 6/4/09 | | < 1 | 0.17 JP | < 1 | < 1 | < 1 | < 1 | 1.2 |
| 04U027 | 6/4/09 | | < 1 | < 1 | < 1 | < 1 | < 1 | < 1 | < 1 |
| 04U077 | 6/9/09 | | 3.1 | 1.1 | 2.1 | < 1 | 0.37 JP | < 1 | 55 |
| 04U510 | 6/11/09 | | < 1 | < 1 | < 1 | < 1 | < 1 | < 1 | < 1 |
| 04U701 | 6/10/09 | | < 1 | < 1 | 0.17 JP | < 1 | < 1 | < 1 | 4.6 |
| 04U702 | 6/10/09 | | < 1 | < 1 | < 1 | < 1 | < 1 | < 1 | 2.1 |
| 04U708 | 6/3/09 | | < 1 | < 1 | < 1 | < 1 | < 1 | < 1 | 0.57 JP |
| 04U709 | 6/11/09 | | 5.5 | 0.97 JP | 2.2 | < 1 | 0.23 JP | < 1 | 69 |
| 04U711 | 6/11/09 | | < 1 | < 1 | < 1 | < 1 | < 1 | < 1 | 0.55 JP |
| 04U713 | 6/10/09 | | < 1 | < 1 | < 1 | < 1 | < 1 | < 1 | 0.57 JP |
| 04U802 | 6/11/09 | | < 1 | < 1 | < 1 | < 1 | < 1 | < 1 | 0.46 JP |
| 04U806 | 6/9/09 | | 2.3 | 23 | 17 | < 1 | 2.1 | 0.41 JP | 180 |
| 04U833 | 6/12/09 | | < 1 | < 1 | < 1 | < 1 | < 1 | < 1 | 2.6 |
| 04U833 | 6/12/09 | D | < 1 | < 1 | < 1 | < 1 | < 1 | < 1 | 2.5 |
| PJ#806 | 6/9/09 | | 0.57 JP | 2.3 | 1.8 | < 1 | 0.26 JP | < 1 | 34 |

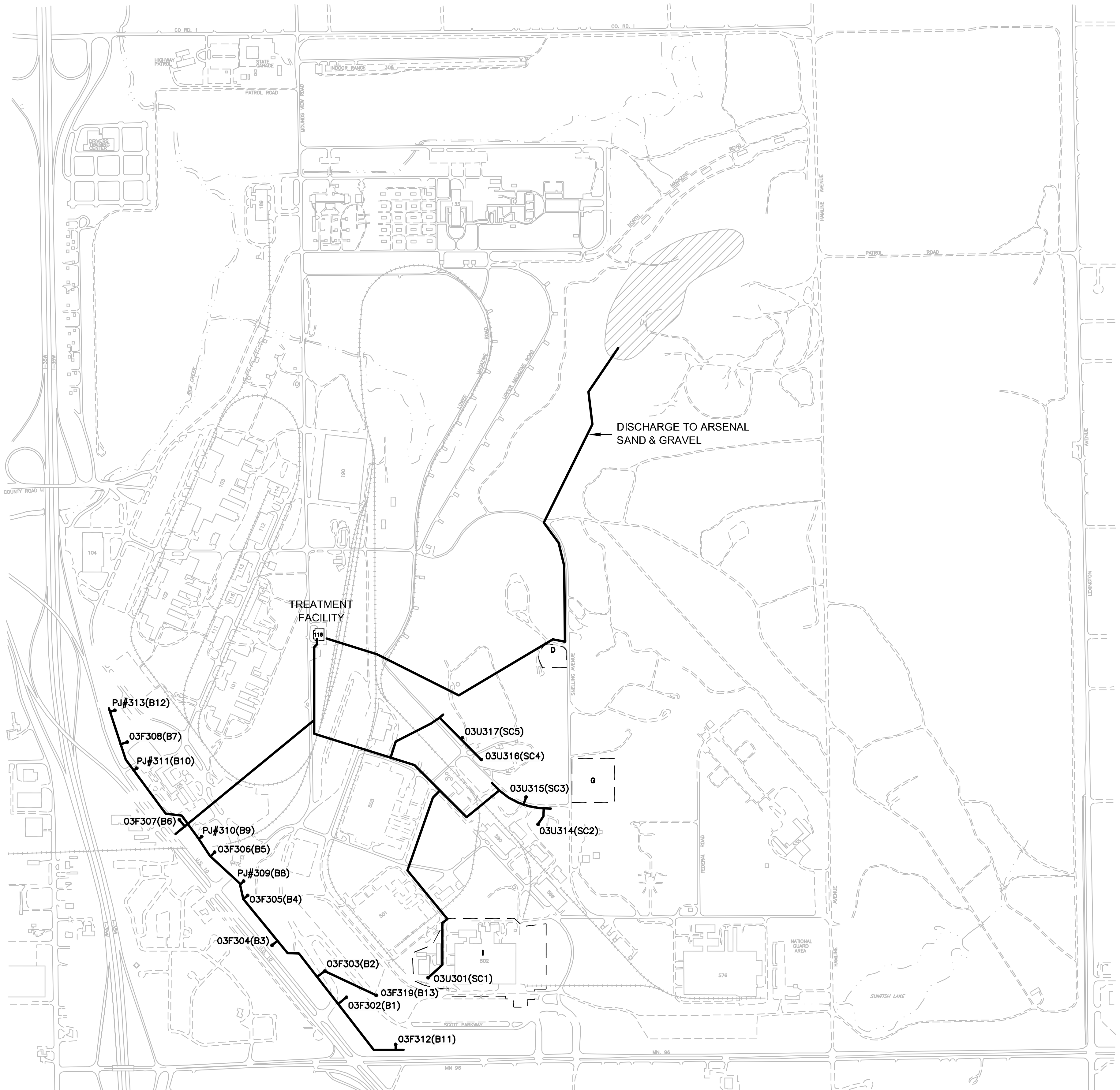
Notes:

(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.

**TABLE 10-9**

**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
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 10-1

TGRS LAYOUT
OPERABLE UNIT 2
*Arden Hills, Minnesota*

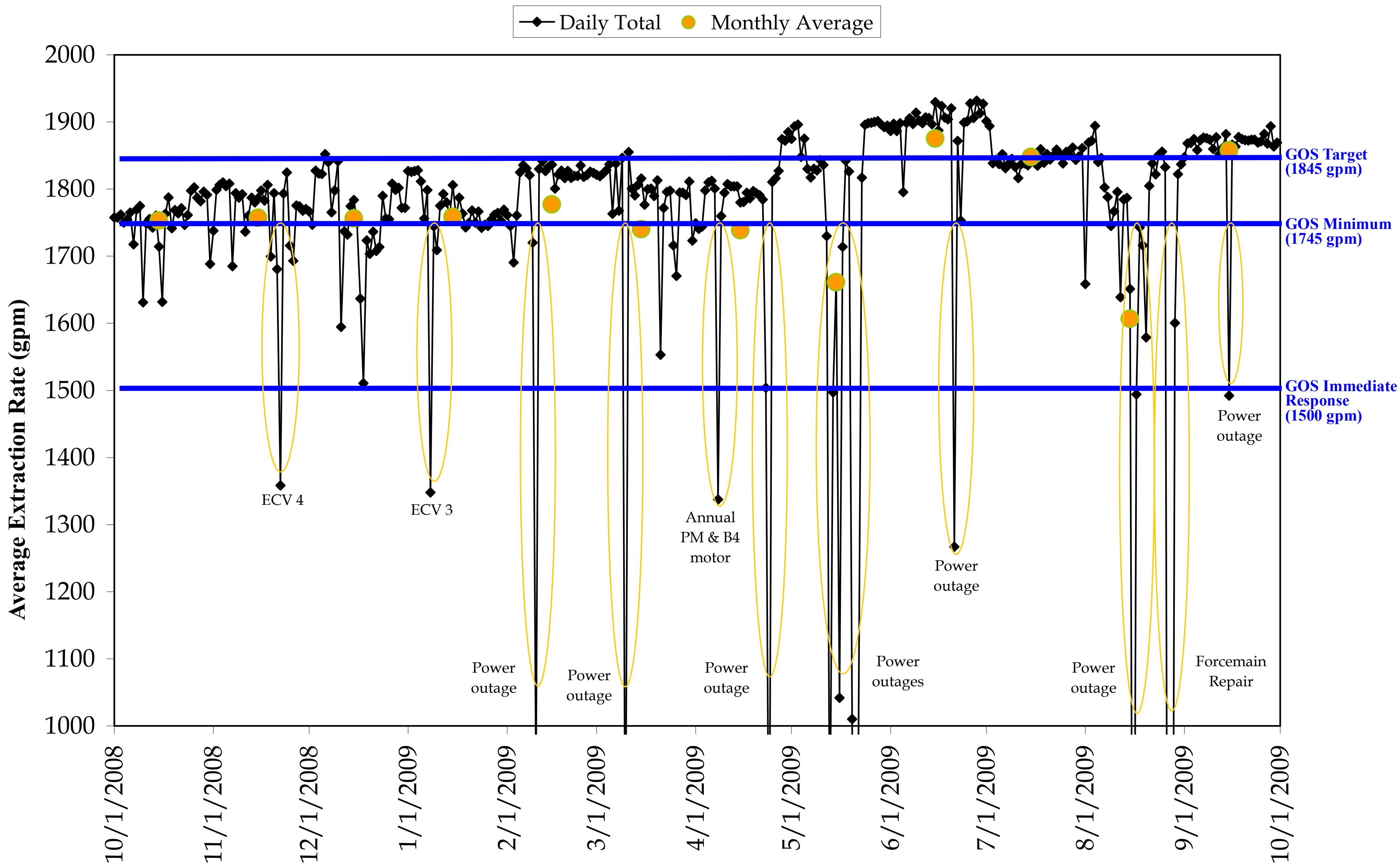
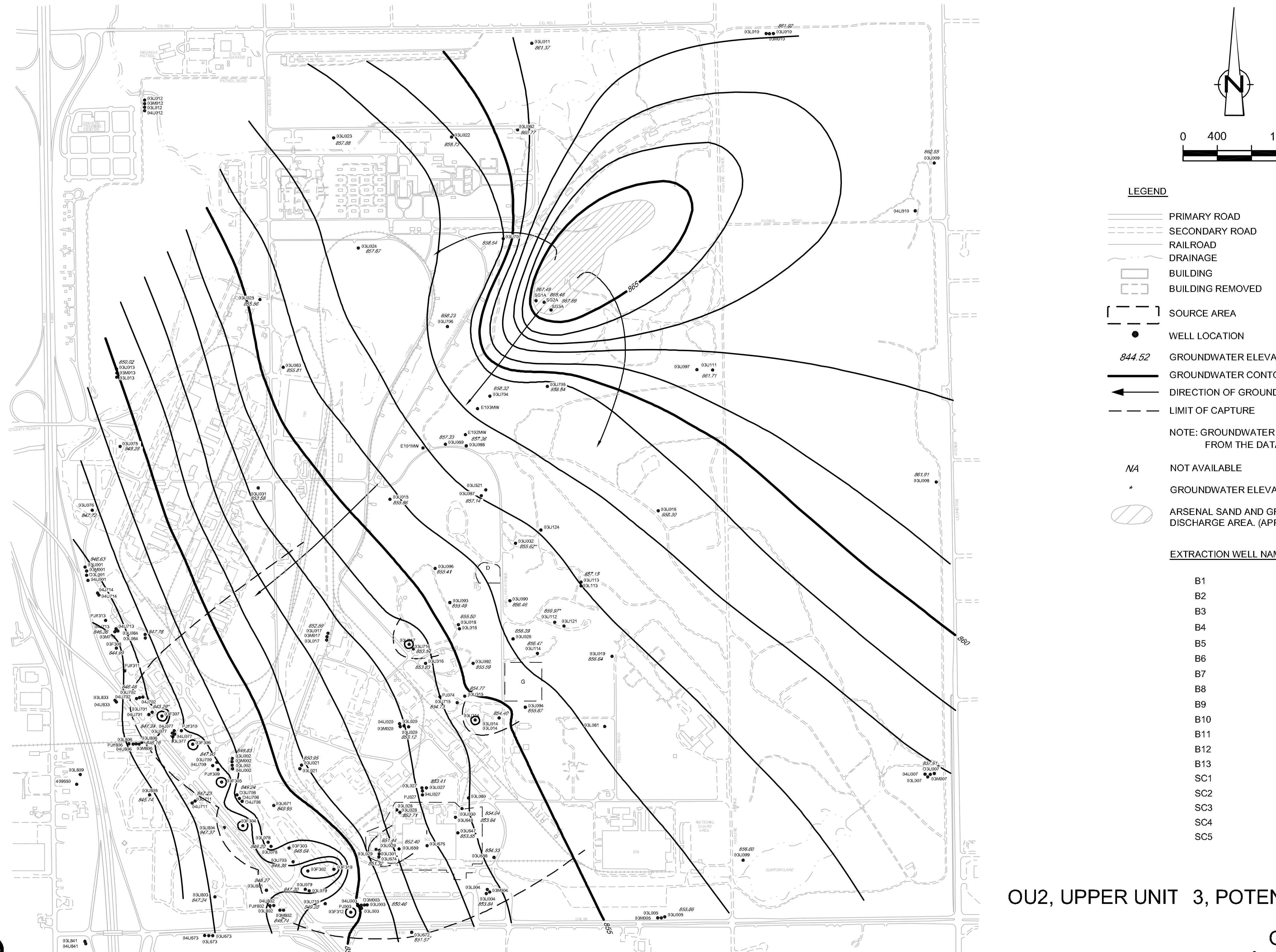



figure 10-2

TGRS FY2009 TOTAL DAILY FLOW RATES
OPERABLE UNIT 2
*Arden Hills, Minnesota*

54651-43(002)GIS-SP001 FEB 1/2010



LEGEND

PRIMARY ROAD
SECONDARY ROAD
RAILROAD
DRAINAGE
BUILDING
BUILDING REMOVED
SOURCE AREA
WELL LOCATION
844.52 GROUNDWATER ELEVATION IN FEET AMSL
GROUNDWATER CONTOUR
DIRECTION OF GROUNDWATER FLOW
LIMIT OF CAPTURE

NOTE: GROUNDWATER CONTOURS ARE INTERPOLATED FROM THE DATA POINTS SHOWN.

NA NOT AVAILABLE
* GROUNDWATER ELEVATION NOT USED IN CONTOURING
ARSENAL SAND AND GRAVEL PIT TREATED WATER DISCHARGE AREA. (APPROXIMATE BOUNDARIES)

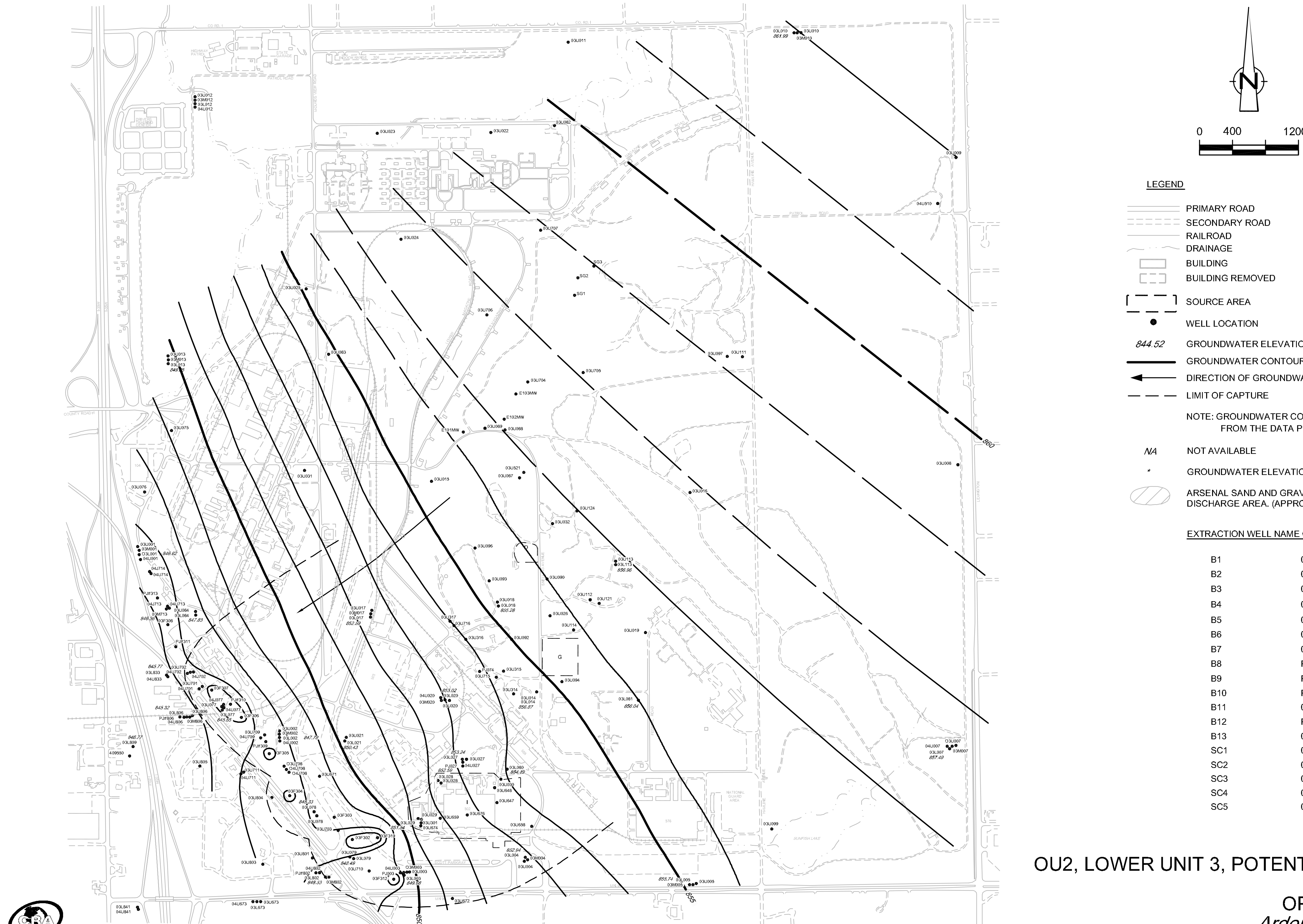
EXTRACTION WELL NAME CROSS REFERENCE

| | |
|---|---|
| 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 10-3

OU2, UPPER UNIT 3, POTENTIOMETRIC MAP
6/1/09 (Q103)
OPERABLE UNIT 2
*Arden Hills, Minnesota*

054651-43(002)GN-SP005 Feb 01/2010



LEGEND

PRIMARY ROAD
SECONDARY ROAD
RAILROAD
DRAINAGE
BUILDING
BUILDING REMOVED
SOURCE AREA
WELL LOCATION
844.52 GROUNDWATER ELEVATION IN FEET AMSL
GROUNDWATER CONTOUR
DIRECTION OF GROUNDWATER FLOW
LIMIT OF CAPTURE

NOTE: GROUNDWATER CONTOURS ARE INTERPOLATED FROM THE DATA POINTS SHOWN.

NA NOT AVAILABLE
* GROUNDWATER ELEVATION NOT USED IN CONTOURING
ARSENAL SAND AND GRAVEL PIT TREATED WATER DISCHARGE AREA. (APPROXIMATE BOUNDARIES)

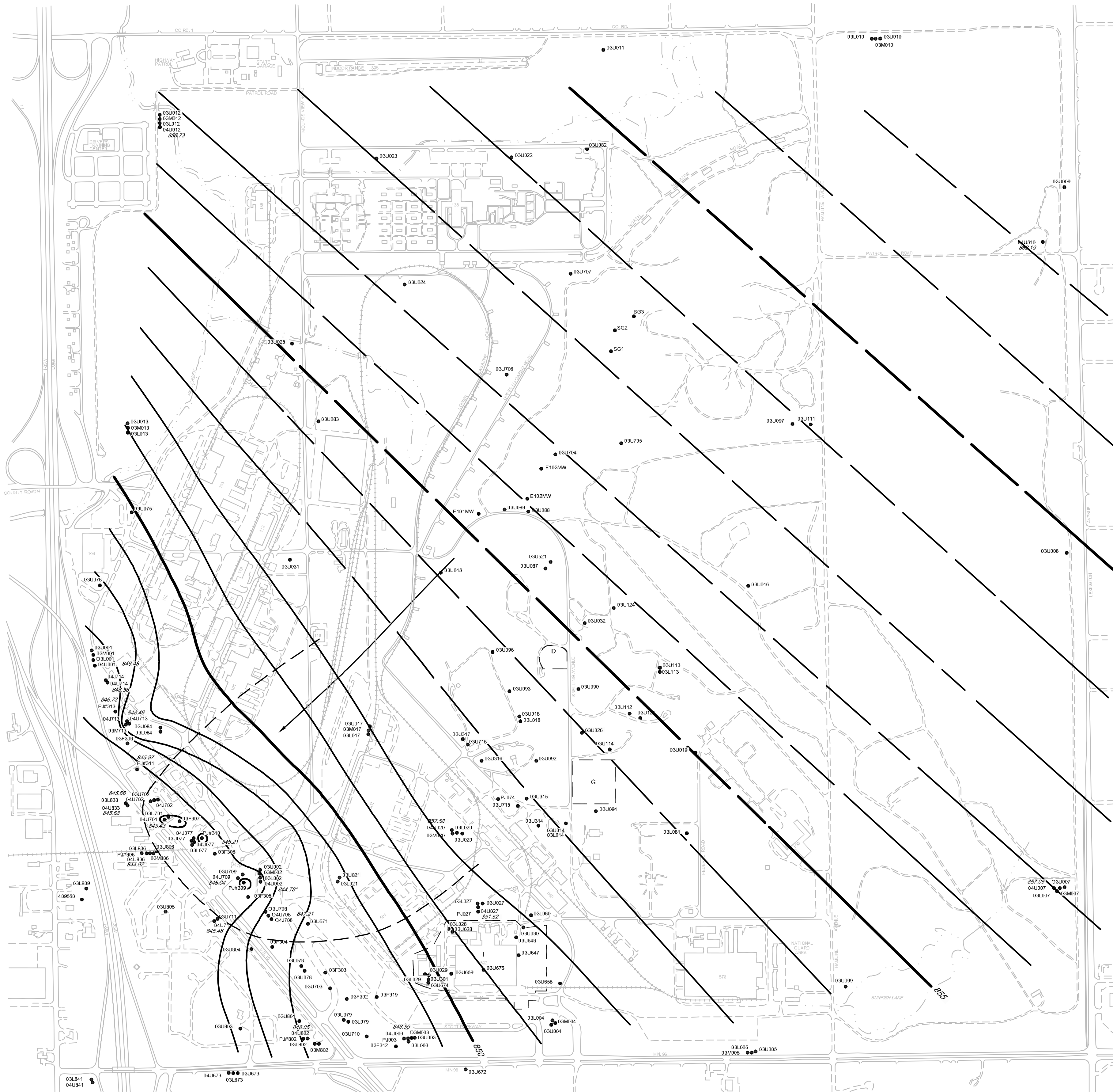
EXTRACTION WELL NAME CROSS REFERENCE

| | |
|---|---|
| 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 10-4

OU2, LOWER UNIT 3, POTENTIOMETRIC MAP
6/1/09 (Q103)
OPERABLE UNIT 2
*Arden Hills, Minnesota*

054651-43(002)GN-SP006 Apr 09/2010




0 400 1200ft

LEGEND

PRIMARY ROAD
SECONDARY ROAD
RAILROAD
DRAINAGE
BUILDING
BUILDING REMOVED
SOURCE AREA
WELL LOCATION
844.52 GROUNDWATER ELEVATION IN FEET AMSL
GROUNDWATER CONTOUR
DIRECTION OF GROUNDWATER FLOW
LIMIT OF CAPTURE

NOTE: GROUNDWATER CONTOURS ARE INTERPOLATED FROM THE DATA POINTS SHOWN.

NA NOT AVAILABLE
* GROUNDWATER ELEVATION NOT USED IN CONTOURING
ARSENAL SAND AND GRAVEL PIT TREATED WATER DISCHARGE AREA. (APPROXIMATE BOUNDARIES)

EXTRACTION WELL NAME CROSS REFERENCE

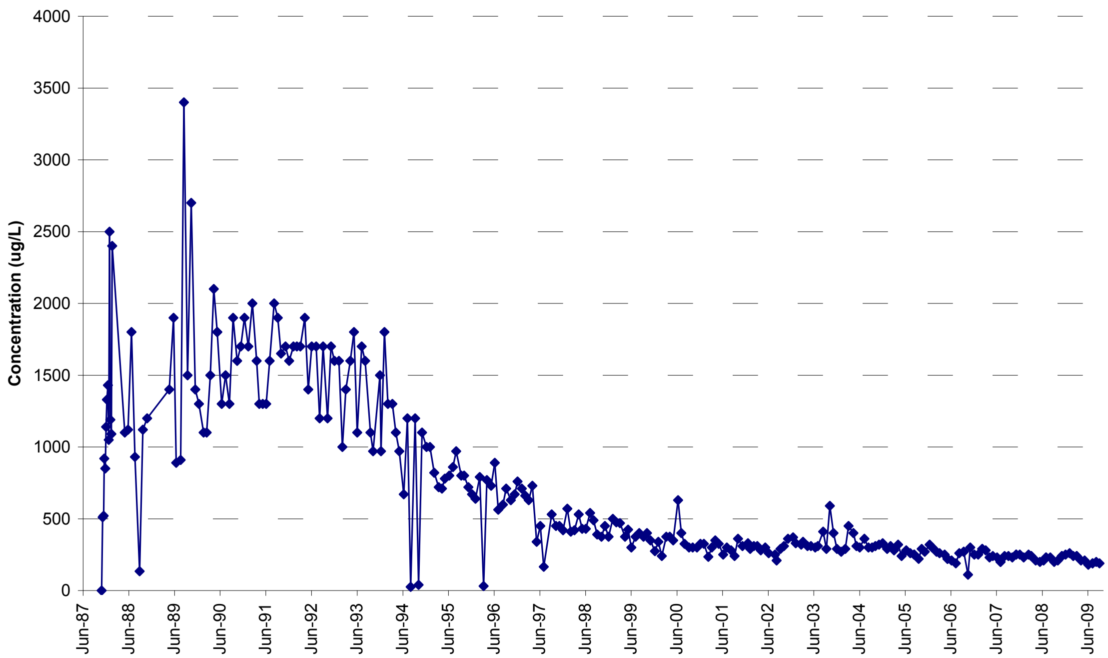
| | |
|---|---|
| B1 | 03F302 |
| B2 | 03F303 |
| B3 | 03F304 |
| B4 | 03F305 |
| B5 | 03F306 |
| B6 | 03F307 |
| B7 | 03F308 |
| B8 | PJ#309 |
| B9 | PJ#310 |
| B10 | PJ#311 |
| B11 | 03F312 |
| B12 | PJ#313 |
| B13 | 03F319 |
| SC1 | 03U301 |
| SC2 | 03U314 |
| SC3 | 03U315 |
| SC4 | 03U316 |
| SC5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

figure 10-5

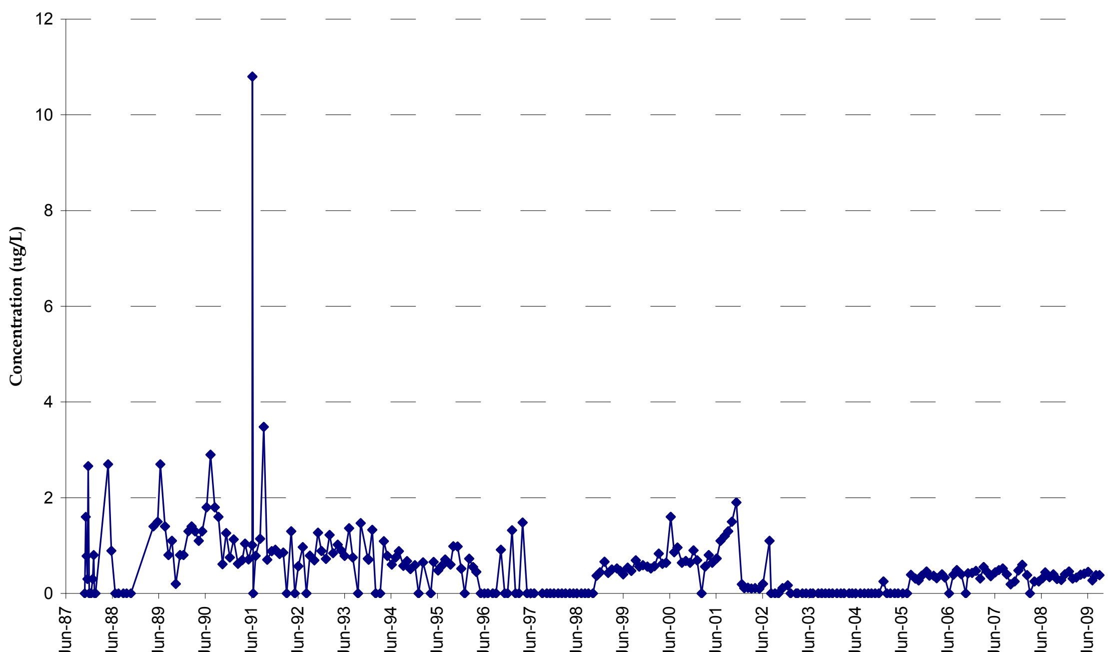
OU2, UPPER UNIT 4, POTENTIOMETRIC MAP
6/1/09 (Q103)
OPERABLE UNIT 2
*Arden Hills, Minnesota*

054651-43(002)GN-SP007 Feb 01/2010

TRCLE vs. TIME
TGRS INFLUENT



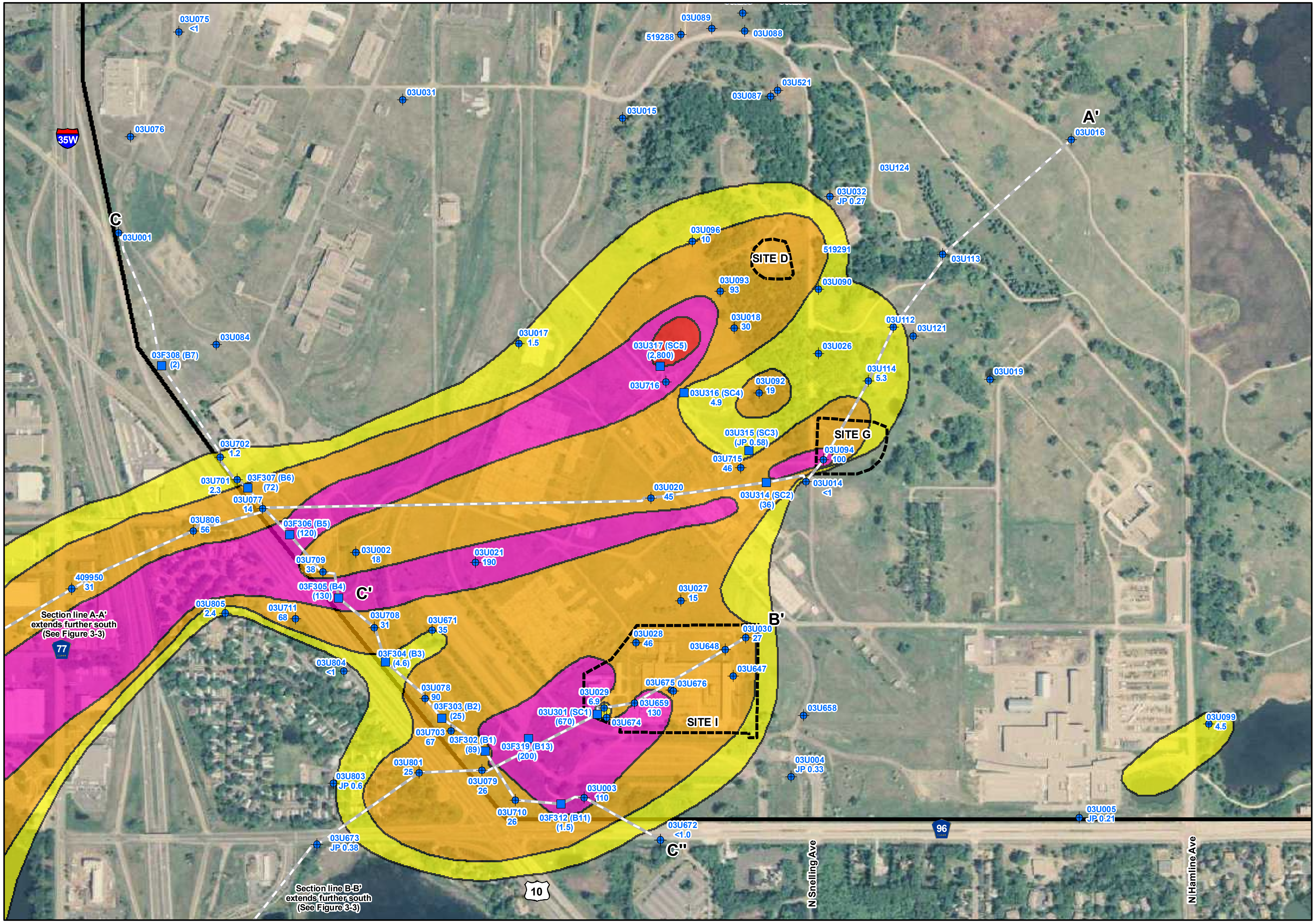

TRCLE vs. TIME
TGRS EFFLUENT




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

figure 10-6

TGRS TREATMENT SYSTEM PERFORMANCE
OPERABLE UNIT 2
*Arden Hills, Minnesota*



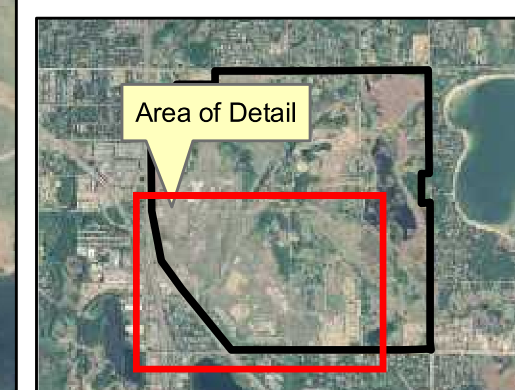

## Legend

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

### Trichloroethene Concentrations

- 1-10 µg/l
- 10-100 µg/l
- 100-1,000 µg/l
- 1,000+ µg/l
- Operable Unit 2 of the New Brighton Arden Hills Superfund Site (the same area occupied by the Twin Cities Army Ammunition Plant in 1983, when the Site was placed on the NPL.)

Notes:
1. 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 2009.
3. 2009 Aerial Photograph (Source: LMIC)




N W E S

700 350 0 700 Feet

Mxd: L:\1561\08\FY09\mxd\OU2 Upper Unit 3 TCE_Iso_map.mxd
Last Modified: 12/14/2009 2:21:58 PM

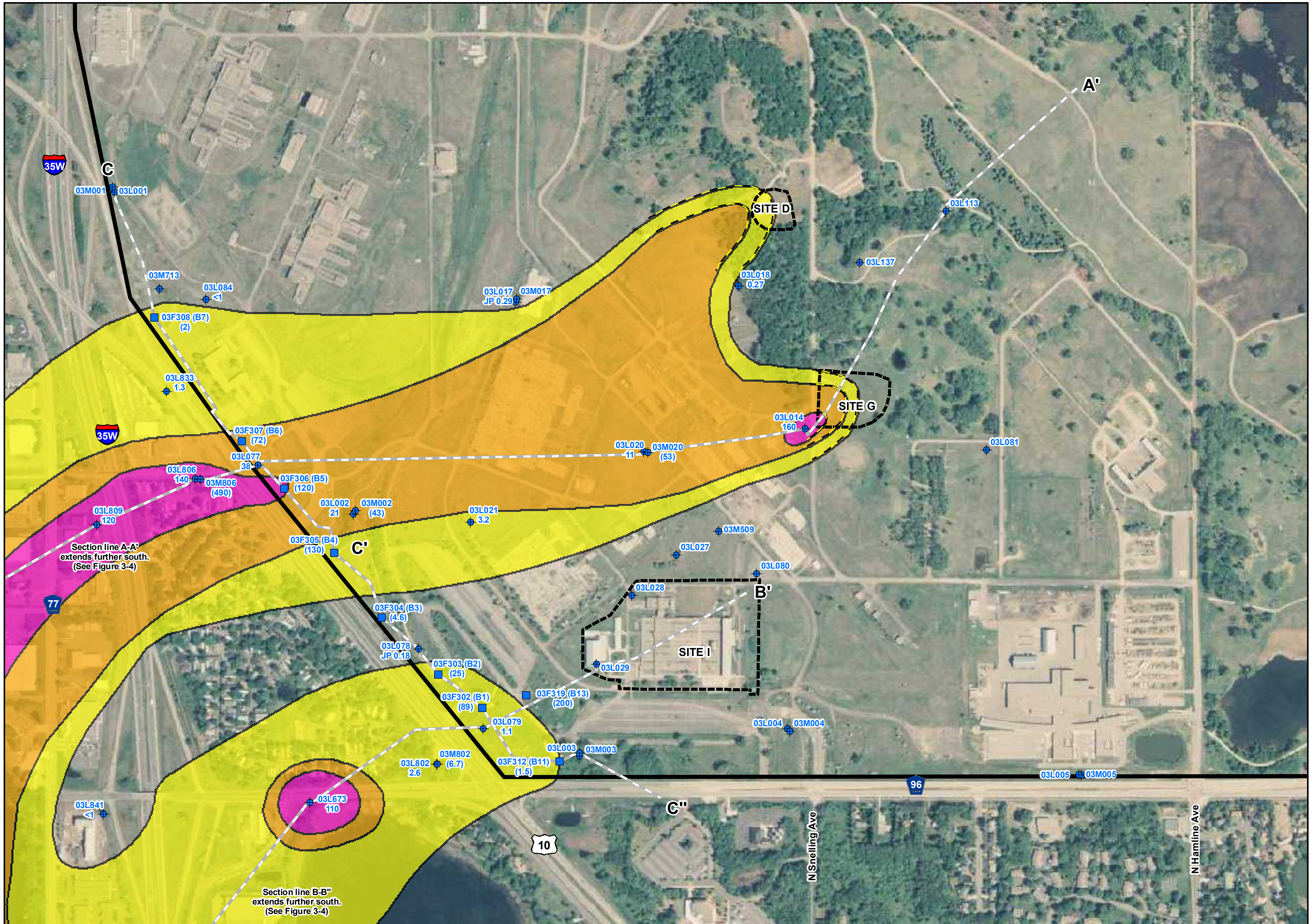
ANNUAL PERFORMANCE REPORT

OU2, Upper Unit 3, Trichloroethene Isoconcentration Map, Summer 2009


Wenck
Wenck Associates, Inc.
Environmental Engineers
1800 Pioneer Creek Center
Maple Plain, MN 55359-0429


FY 2009

Figure 10-7




## Legend

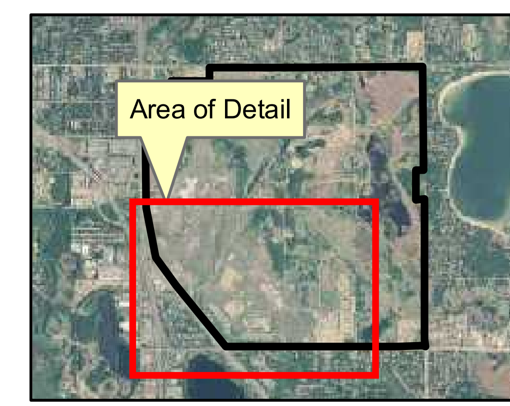
- 03L077 Monitoring Well Location
- 03F303 Extraction Well Location
- 410.0 Trichloroethene concentrations (µg/L) (Values in parentheses were not used for contouring purposes)
- JP Estimated (Value is below the reporting limit but above the method detection limit)
- Cross-Section Line
- Site Boundary
- 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 2009.
4. 2009 Aerial Photograph (Source: LMIC)




N W E S

700 350 0 700 Feet

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ANNUAL PERFORMANCE REPORT

OU2, Lower Unit 3, Trichloroethene Isoconcentration Map, Summer 2009

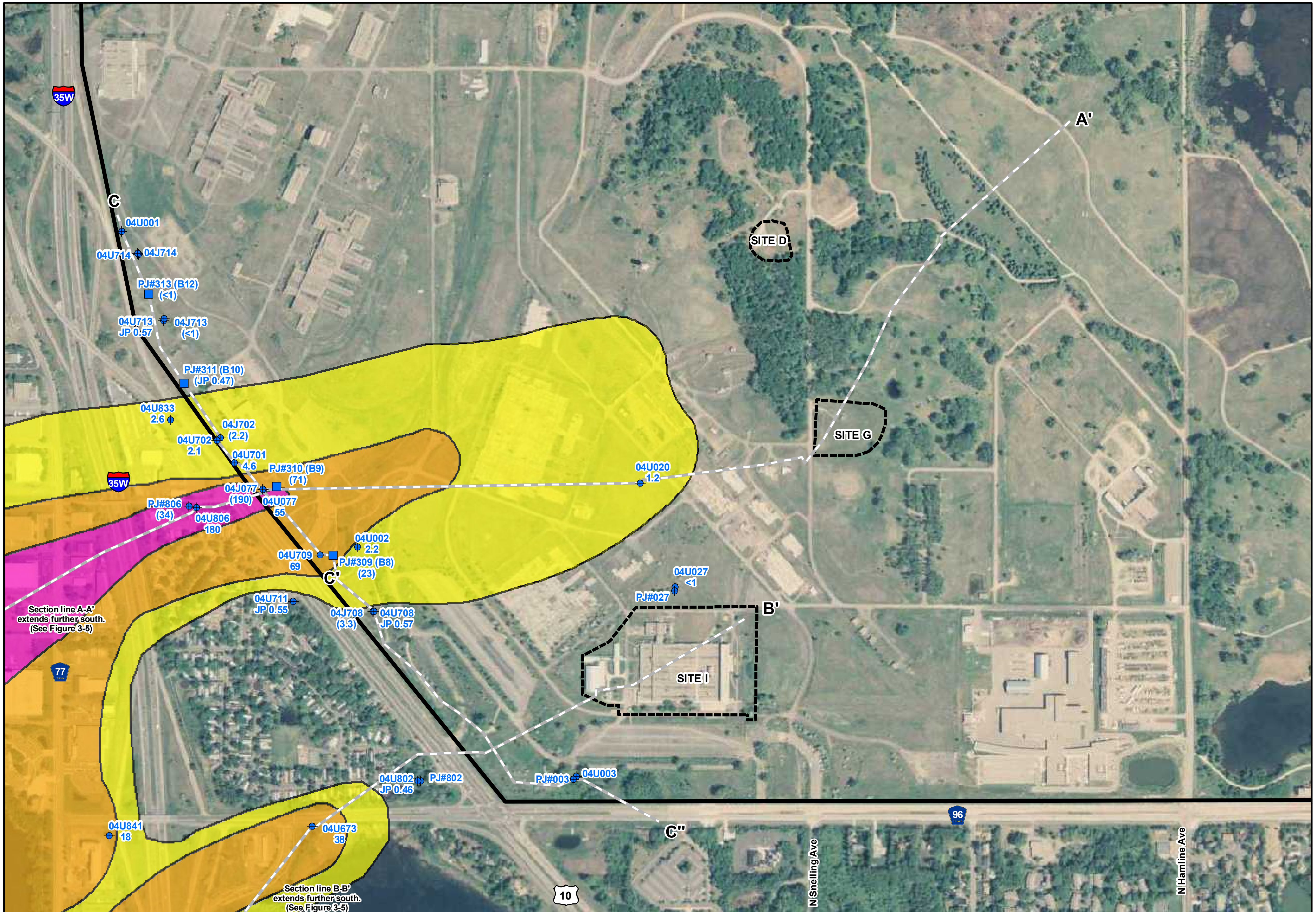


Wenck

Wenck Associates, Inc. Environmental Engineers
1800 Pioneer Creek Center Maple Plain, MN 55359-0429

FY 2009

Figure 10-8




## Legend

PJ#309 Extraction Well Location

04U701 Monitoring Well Location

55 Trichloroethene Concentrations (µg/L) (Values in parentheses were not used for contouring purposes.)

JP Estimated (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 wth 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 2009.
5. 2009 Aerial Photograph (Source: LMIC)


N
W E
S

700 350 0 700 Feet

Mxd: L:\1561\08\FY09\mxd\OU2 Upper Unit 4 TCE_Iso_map.mxd
Last Modified: 12/14/2009 3:41:59 PM

ANNUAL PERFORMANCE REPORT

OU2, Upper Unit 4, Trichloroethene Isoconcentration Map, Summer 2009



Wenck

Wenck Associates, Inc. Environmental Engineers
1800 Pioneer Creek Center Maple Plain, MN 55359-0429

FY 2009

Figure 10-9

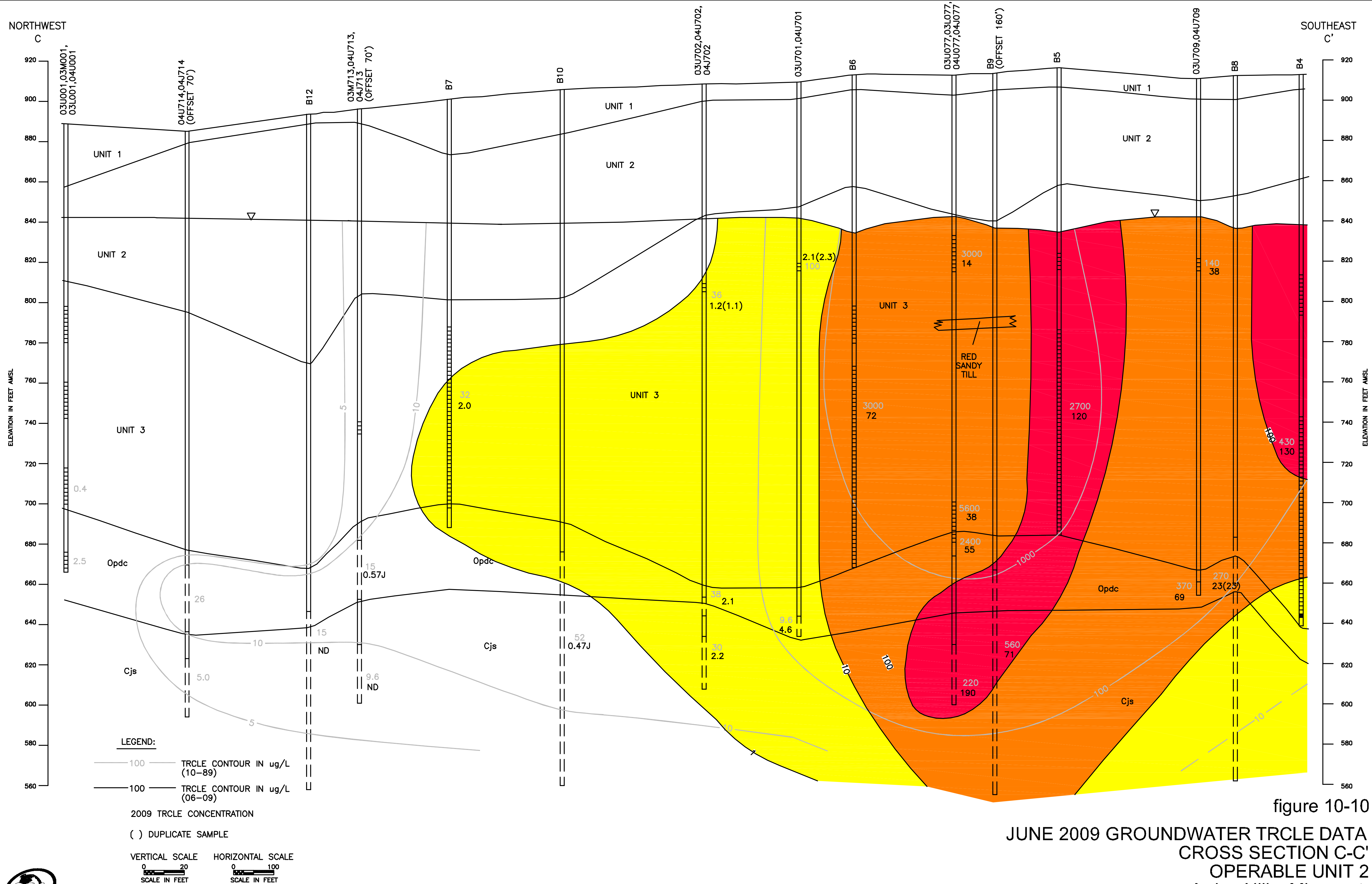



figure 10-10

JUNE 2009 GROUNDWATER TRCLE DATA
CROSS SECTION C-C'
OPERABLE UNIT 2
*Arden Hills, Minnesota*

054651-43(002)GN-SP001 Feb 01/2010

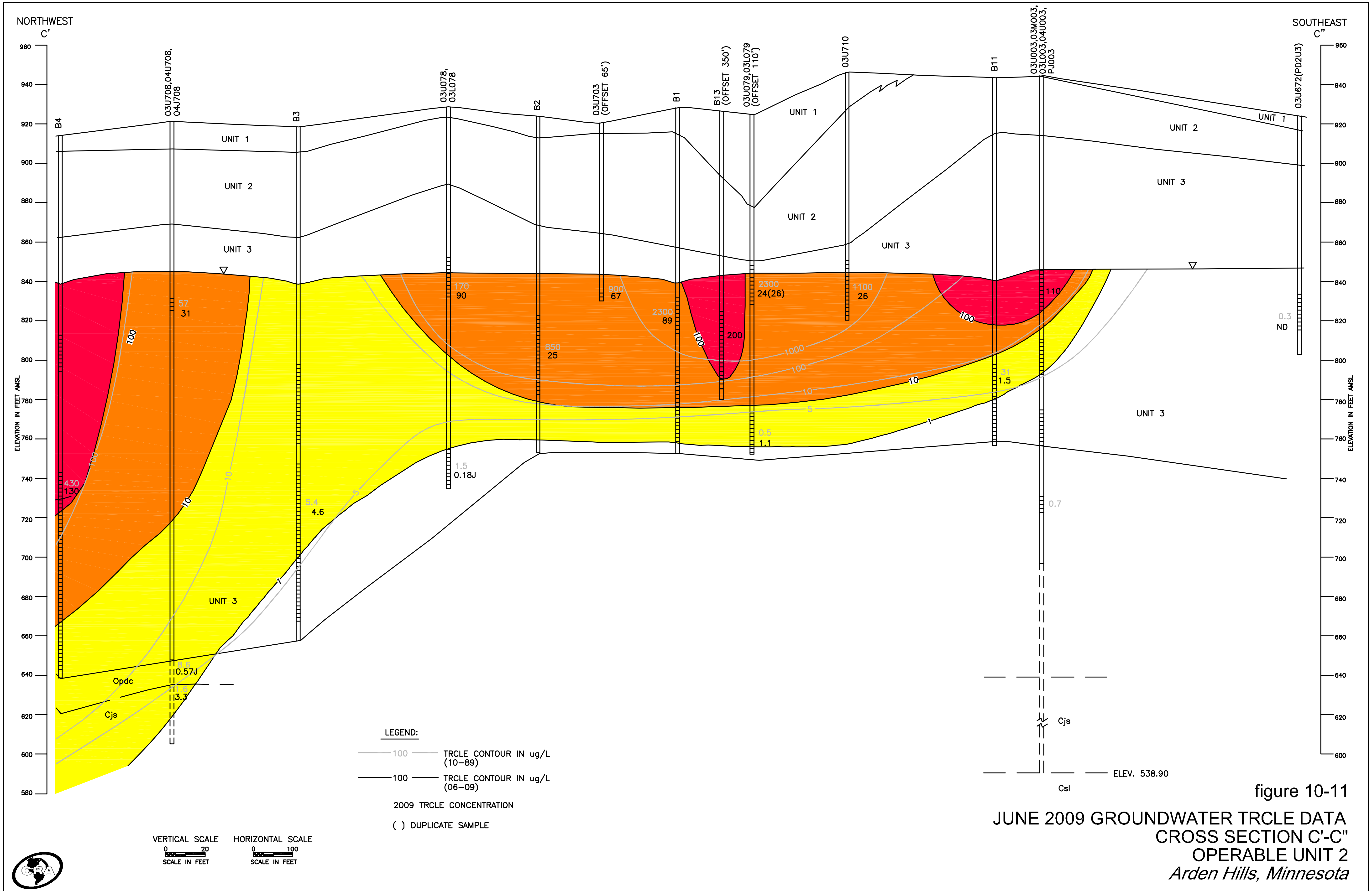
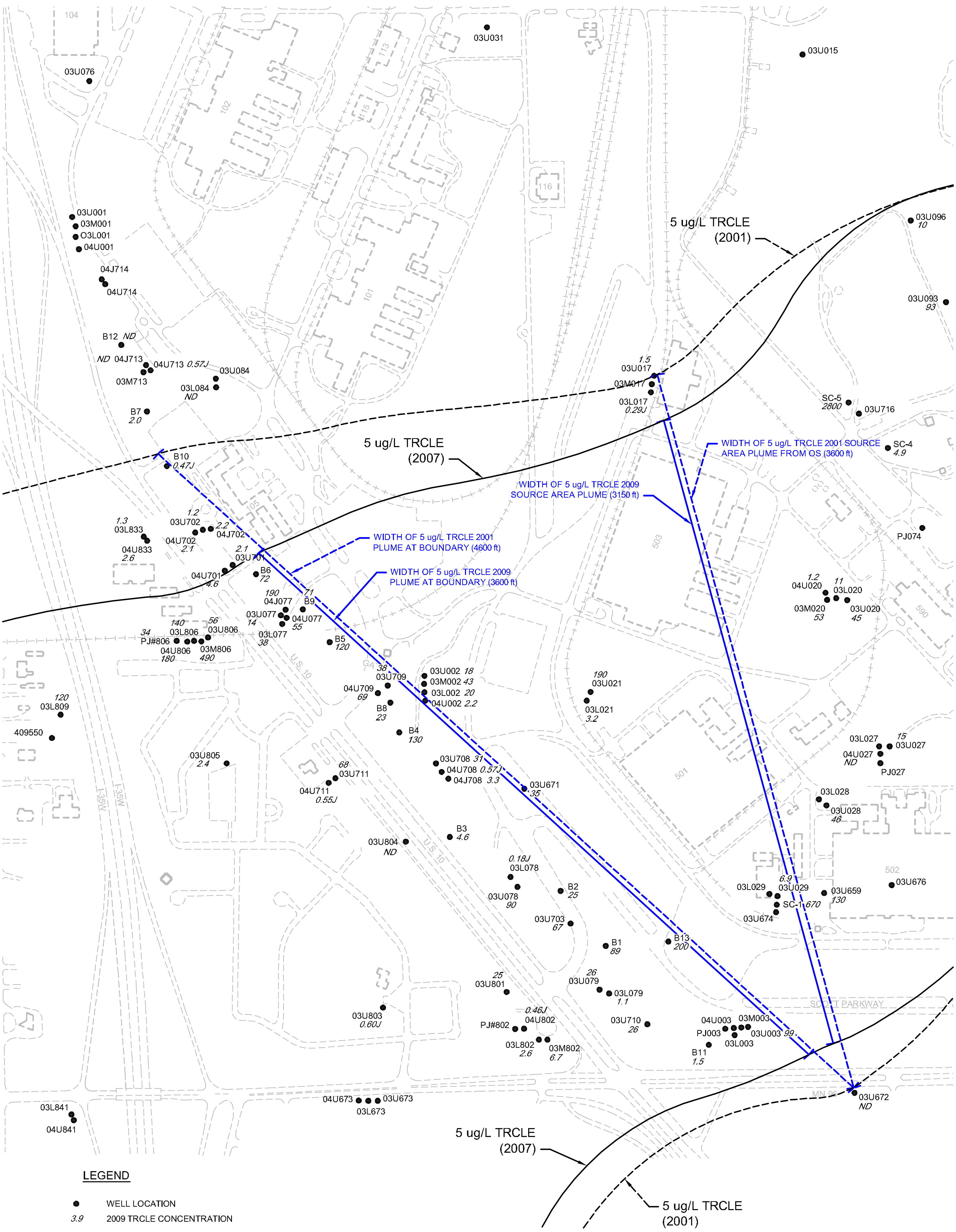



figure 10-11

JUNE 2009 GROUNDWATER TRCLE DATA
CROSS SECTION C'-C"
OPERABLE UNIT 2
*Arden Hills, Minnesota*

054651-43(002)GN-SP002 Feb 01/2010




LEGEND

● WELL LOCATION

*3.9* 2009 TRCLE CONCENTRATION

0 200 500ft

figure 10-12

TGRS ANNUAL MONITORING DATA - WEST PORTION
TRCLE CONCENTRATIONS (ug/L) JUNE 2009
OPERABLE UNIT 2
*Arden Hills, Minnesota*

054651-43(002)GN-SP004 Feb 01/2010

# 11.0 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 11-1 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.

## 11.1 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 2009 monitoring plan and any deviations are explained in Appendix C.2. Details of the groundwater monitoring program are discussed in Section 11.2.

## 11.2 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 2009 monitoring plan and any deviations are explained in Appendix C.2. Specifically, well 04U866 was inadvertently omitted from the 2009 sampling event. The well has consistently contained TRCLE concentrations below 1 µg/L. Regardless, 04U866 will be sampled in 2010.

Groundwater samples were collected from seventeen OU3 wells in FY 2009 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 11-1. 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 11-1 presents a summary of the analytical results. Each well sampled contained TRCLE concentrations at or below those reported for the previous sampling event (either 2007 or 2008). TRCLE concentrations in the downgradient sentry well, 04U863, remained less than 1.0 µg/L, as it has been since December 1999. TRCLE concentrations were also less than 1.0 µg/L in wells 03U673, 03L854, 04U414, 04U851, 04U860, and 04J866. 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 6.3 µg/L to 130 µg/L.

1,1,1-Trichloroethane and its degradation products 1,1-dichloroethane and 1,1-dichloroethene were present in three wells at the boundary between OU1 and OU3 (03L859, 04U859, and 04U832), indicating a commingling of the North Plume and the South Plume at these locations.

**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 2009. A summary of the statistical analyses is presented in Table 11-2. Individual spreadsheets and graphs presenting the Mann-Kendall test results for each well are provided in Appendix H.

The trend for 03M848, which has historically been the center of the South Plume, continued to be definitely decreasing. The TRCLE concentration decreased from 700 µg/L in FY 1999 to 130 µg/L in FY 2009. Well 03M848 had the highest TRCLE concentration in the South Plume in FY 2009, but at a concentration much lower than historic concentrations. The decrease in concentration at the core of the South Plume indicates that the South Plume continues to dissipate.

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 TRCLE concentration since 1999; although, the TRCLE concentration decreased from 60 µg/L in 2007 to 50 µg/L in 2009. 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 the stable trend.

The trend for wells 03L848, 409548 and 04U845 located at the edge-of-plume remained unchanged since the last statistical analysis. A stable trend continued for well 03L848, a decreasing trend was again noted at well 409548, and no trend continued at 04U848. Wells 03L673 and 04U673 changed from stable to no trend and well 04U845 changed from no trend to stable.

The statistical conclusion for 04U832 changed from increasing to no trend in FY 2009. The long-term trend (beyond the six sample events included in the statistical evaluation) of 04U832 is very consistent. Results have been between 29 µg/L and 56 µg/L since 1991, with the exception of FY 2001 and FY 2003 with concentrations of approximately 4 µg/L. These anomalous results caused the increasing statistical evaluation for the last several years. Evidence of 04U832 returning to a stable trend is demonstrated by the change from increasing to no trend now that the 2001 data are no longer included in the statistical evaluation. Once the 2003 results are excluded from the statistical analysis after the next sampling event in 2011, the trend should change to stable. Consistent with historical data, 1,1,1-trichloroethane and its degradation products were present in 04U832, indicating that the North Plume is commingling with the South Plume at this well, which may be a factor in the statistical trends.

In summary, based on the data collected in FY 2009, the center of the South Plume, represented by 03M848, exhibits a strong trend of decreasing concentrations, while the edge of the South Plume appears stable. 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 is commingling with the South Plume and may be a factor in the trends noted at the wells near the boundary.

**Are contingency actions warranted?**

The OU3 ROD Amendment requires contingency actions to be considered when the Mann-Kendall statistical analysis shows that a well at the edge of the South Plume has an increasing trend. The edge-of-plume and center-of-plume wells analyzed in FY 2009 are identified on Table 11-2.

Wells 04U832 and 04U845 were sampled as a contingency action during the annual sampling rounds of FY 2006 and FY 2008 because of an increasing trend observed at 04U832. After the FY 2009 biennial sampling event, these two wells have been sampled for five consecutive years, providing enough data to determine if the low concentrations observed in FY 2001 and FY 2003 at well 04U832 were an aberration. Since the statistical analysis changed to no trend, and no others wells demonstrated an increasing trend, no contingency actions are necessary.

**What groundwater monitoring is proposed before the next report?**

The OU3 monitoring requirements presented in Table 11-3 are proposed. Appendix A presents the FY 2009 – FY 2013 monitoring plan. Well 04U866 has been added to the 2010 sampling event.

## 11.3 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.

## 11.4 OVERALL REMEDY FOR OU3

**Is the Remedy for OU3 Operating in Compliance with the OU3 ROD and OU3 ROD Amendment?**
Yes. In FY 2009, groundwater monitoring took place as prescribed in the Annual Monitoring Plan. The comprehensive biennial sampling round of FY 2009 indicates that the South Plume footprint remains stable, with decreasing concentrations 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 2010 as planned. No additional actions are necessary since no increasing trends 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 has committed to replacing 04U861 when the City completes property redevelopment. The schedule for redevelopment is uncertain; however, redevelopment is not expected to progress enough to allow for a replacement well to be installed in FY 2010.

**TABLE 11-1**

**GROUNDWATER QUALITY DATA (µg/L)**
**OPERABLE UNIT 3**
**FISCAL YEAR 2009**

| | | | *Trichloroethene* | *1,1,1-Trichloroethane* | *1,1,2-Trichloroethane* | *1,1-Dichloroethane* | *1,1-Dichloroethene* | *cis-1,2-Dichloroethene* |
|---|---|---|---|---|---|---|---|---|
| ***OU3 Cleanup Level*** (1) | | | ***5*** | ***200*** | ***3*** | ***70*** | ***6*** | ***70*** |
| ***Location*** | ***Date*** | ***Dup*** | ***µg/L*** | ***µg/L*** | ***µg/L*** | ***µg/L*** | ***µg/L*** | ***µg/L*** |
| 03L673 | 6/18/09 | | 110 | < 1 JC 28.9 | < 1 | 0.5 JP | 0.65 JP | 5.7 |
| 03L848 | 6/17/09 | | 2.6 JD 59 | < 1 JC 28.9 | < 1 | < 1 | < 1 | 0.4 JP |
| 03L848 | 6/17/09 | D | 4.8 JD 59 | < 1 JC 28.9 | < 1 | < 1 | < 1 | 0.56 JP |
| 03L854 | 6/18/09 | | < 1 | < 1 JC 34.8 | < 1 | < 1 | < 1 | < 1 |
| 03L859 | 6/18/09 | | 7.8 | 3.9 JC 28.9, JL 135 | < 1 | 5.4 | 3 | 0.86 JP |
| 03M848 | 6/17/09 | | 130 | < 1 JC 28.9 | < 1 | 0.85 JP | 1 | 8.9 |
| 03U673 | 6/18/09 | | 0.38 JP | < 1 JC 28.9 | < 1 | < 1 | < 1 | < 1 |
| 04J866 | 6/17/09 | | < 1 | < 1 JC 28.9 | < 1 | < 1 | < 1 | < 1 |
| 04J866 | 6/17/09 | D | < 1 | < 1 JC 28.9 | < 1 | < 1 | < 1 | < 1 |
| 04U414 | 6/17/09 | | < 1 | < 1 JC 28.9 | < 1 | < 1 | < 1 | < 1 |
| 04U673 | 6/18/09 | | 38 | < 1 JC 28.9 | < 1 | 0.14 JP | 0.22 JP | 1.5 |
| 04U832 | 6/19/09 | | 46 | 3.1 JC 34.8, JL 135 | < 1 | 2.9 | 4.2 | 3.2 |
| 04U845 | 6/17/09 | | 6.3 | < 1 JC 28.9 | < 1 | < 1 | < 1 | 0.39 JP |
| 04U848 | 6/17/09 | | 4.3 | < 1 JC 28.9 | < 1 | < 1 | < 1 | 0.16 JP |
| 04U851 | 6/18/09 | | < 1 | < 1 JC 28.9 | < 1 | < 1 | < 1 | < 1 |
| 04U854 | 6/18/09 | | 9.8 | < 1 JC 34.8 | < 1 | < 1 | < 1 | 0.51 JP |
| 04U859 | 6/18/09 | | 50 | 11 JC 28.9, JL 135 | < 1 | 5.6 | 8.4 | 2.2 |
| 04U860 | 6/17/09 | | 0.29 JP | < 1 JC 28.9 | < 1 | < 1 | < 1 | < 1 |
| 04U863 | 6/18/09 | | 0.2 JP | < 1 JC 34.8 | < 1 | < 1 | < 1 | < 1 |

Notes:

(1) Cleanup levels for OU3 are from the OU3 ROD. Shading indicates exceedence of the cleanup level.
D - Duplicate analysis
JD - Value is estimated due to field duplicate precision (# = RPD)
JP - Results are less than the reporting limit, but greater than the instrument detection limit. Value is estimated.
JC - Value is estimated due to instrument calibration issues
JL - Value is estimated due to laboratory control sample (# = percent recovery)

**TABLE 11-2**

**MANN-KENDALL STATISTICAL SUMMARY**
**OPERABLE UNIT 3**
**FISCAL YEAR 2009**

| *Well* | *Kendall S* | *Number of Data Points* | *Raw Trend* | *Confidence* | *Coefficient of Varience* | *Raw Trend Decision* | *MAROS Conclusion* | *June 2009 TRCLE Conc.* |
|---|---|---|---|---|---|---|---|---|
| **Edge of Plume Wells** | | | | | | | | |
| 03L673 | 2 | 6 | Increasing | 57.00% | 0.7102 | Stable or No Trend | No Trend | 110 |
| 03L848 | -1 | 6 | Decreasing | 50.00% | 0.2739 | Stable or No Trend | Stable | 4.8 |
| 409548 | -13 | 6 | Decreasing | 99.17% | 0.4727 | Definite | Decreasing | 0.85 |
| 04U673 | 3 | 6 | Increasing | 64.00% | 0.5935 | Stable or No Trend | No Trend | 38 |
| 04U832 | 5 | 6 | Increasing | 76.50% | 0.4606 | Stable or No Trend | No Trend | 46 |
| 04U845 | 0 | 6 | None | 50.00% | 0.4867 | Stable or No Trend | Stable | 6.3 |
| 04U848 | 3 | 6 | Increasing | 64.00% | 0.6973 | Stable or No Trend | No Trend | 4.3 |
| **Center of Plume Wells** | | | | | | | | |
| 03M848 | -14 | 6 | Decreasing | 99.52% | 0.5731 | Definite | Decreasing | 130 |
| 04U859 | -3 | 6 | Decreasing | 64.00% | 0.6926 | Stable or No Trend | Stable | 50 |

**TABLE 11-3**

**SUMMARY OF GROUNDWATER MONITORING REQUIREMENTS**
**OPERABLE UNIT 3**
**FISCAL YEAR 2009**

| | 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. | Alliant | OU3 Monitoring Plan in Annual Report |
| | | b. | Groundwater sampling to track progress of clean-up and attenuation of plume. | Alliant | 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. | Alliant | OU3 Monitoring Plan in Annual Report |

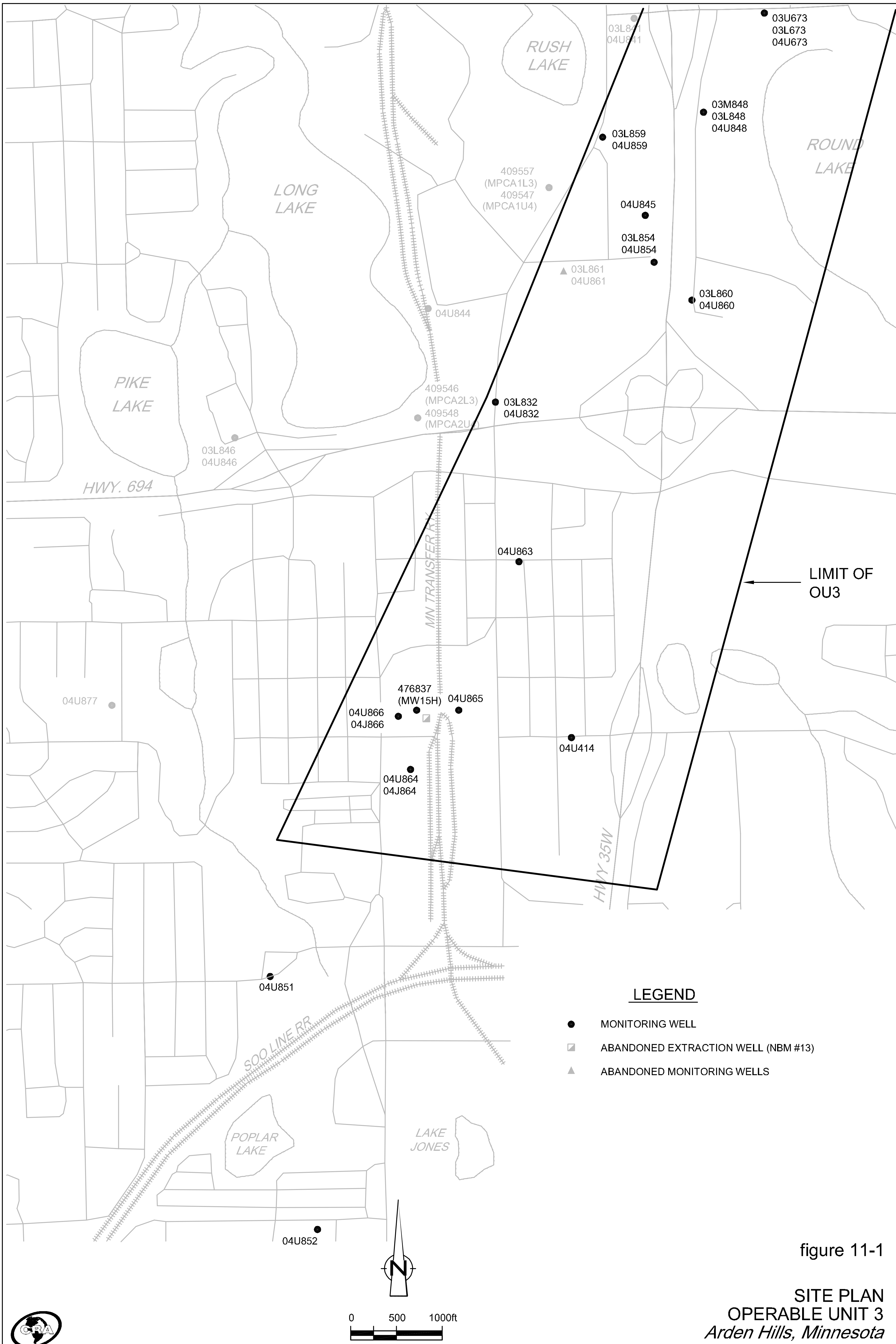



figure 11-1

SITE PLAN
OPERABLE UNIT 3
*Arden Hills, Minnesota*

054651-43(002)GN-SP008 Feb 01/2010

# 12.0 Other Installation Restoration Activities During FY 2009

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.

## 12.1 BUILDING 102 SHALLOW GROUNDWATER

Building 102, (see Figure 12-1 for location), 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 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 a LUC to prohibit installation of water supply wells into the contaminated portion of the Unit 1 aquifer. A Quality Assurance Project Plan for MNA was approved in FY 2009 and ongoing performance monitoring was performed.

Building 102 groundwater level data collected in June 2009 is shown as groundwater elevation contours on Figure 12-2 (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 2009 is shown in Table 12-1. Groundwater quality data for June 2009 is also shown on plume maps for three of the chemicals of concern: trichloroethene (Figure 12-3), cis-1,2-dichlororethene (Figure 12-4), and vinyl chloride (Figure 12-5). The June 2009 results for vinyl chloride (chemical with the largest areal extent) are shown on geologic cross-sections A-A' (Figure 12-6) and B-B' (Figure 12-7).

As shown in Table 12-1, cleanup levels have not been reached throughout the areal extent of the plume and the site cannot be closed. Concentrations of trichloroethene, cis-1,2-dichlororethene, and/or vinyl chloride exceed their respective cleanup levels in four of the monitoring wells at this site.

The FY 2009 groundwater quality results were generally comparable to the FY 2008 results, suggesting that the plume remains stable due to the natural attenuation that is occurring at this site. The only well with a noticeable increase was 01L581. In this well, trichloroethene increased to 32 μg/L from approximately 9 μg/L in FY 2008 (both of these concentrations exceed the cleanup level of 5 μg/L), and cis-1,2-dichlororethene increased to 15 μg/L from approximately 8 μg/L in FY 2008 (both of these concentrations are well below the cleanup level of 70 μg/L). There were no significant increases in the wells downgradient from 01L581 (the 582 nest and 01U048). The well adjacent to Rice Creek (01U048) continued to show that groundwater discharging to Rice Creek was below the cleanup levels for this site. The slight increase in concentrations observed at 01L581 is likely the result of a slight shift in the axis of the plume due to minor variations in groundwater flow over time and not a significant change in plume stability; however, future monitoring results will need to be evaluated to verify this.

The monitoring plan shown in Appendix A.1 is adequate to monitor the shallow groundwater at this site. No changes to the monitoring plan or to the natural attenuation remedy are needed. Note that FY 2009 marked the third year of the three years of planned monitoring of Unit 3 groundwater (03U001 and 03U076 were sampled in FY 2007 through FY 2009). This monitoring was conducted to verify that there have been no impacts to the Unit 3 aquifer from the shallow groundwater (Unit 1) VOC contamination at Building 102, which are separated by the Unit 2 aquitard. Given that there were no significant VOC detections during this monitoring, no further monitoring of Unit 3 groundwater will be conducted.

Regarding the LUC for Building 102 groundwater, the Army submitted a draft OU2 LUCRD in July 2009 that was under review by the USEPA and MPCA at the end of the fiscal year. It is expected that the OU2 LUCRD will be approved in FY 2010. In the meantime, the Army continued to implement land use controls for the remedial action sites, following the draft Land Use Control Implementation Plan (LUCIP) that was prepared in 2003, but not approved by the MPCA or USEPA. When approved, the OU2 LUCRD will supersede the draft LUCIP. On July 16, 2009, the Army, National Guard, and Wenck conducted the annual inspection of LUCs. The checklist that was completed during the inspection is included as Appendix I. The inspection did not identify any follow-up actions that were needed to maintain the protectiveness of the LUC for Building 102 groundwater.

### 12.2 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 2009 results were:

| Well | Trichloroethene |
|---|---|
| 03U007 | <1.0 |
| 03U009 | <1.0 |
| 03L007 | 0.21 JP |
| 04U007 | 0.25 JP |
| 04U510 | <1.0 |

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

These locations will be sampled again in FY 2011 as shown in Appendix A.1 (the wells are listed under TCAAP Groundwater Recovery System in the appendix).

### 12.3 AQUATIC STUDIES

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) 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. At the end of FY 2009, the Army, USEPA, and MPCA were in the process of resolving comments for the revised FS.

### 12.4 135 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 is on property that is proposed to be transferred out of federal ownership. It is the Army's current intention to have the purchaser conduct further work at this area as part of the transfer negotiations.

## 12.5 535 PRIMER/TRACER AREA

The Preliminary Assessment received regulatory approval in FY 2002 and the Site Inspection investigation report received approval in FY 2005. The Army conducted additional soil sampling during FY 2008, which delineated the approximate extent of two areas of shallow soil contamination: one with lead contaminated soil and one with PAH-contaminated soil. Activities during FY 2009 included:

- The EE/CA was approved by the USEPA and MPCA on January 28, 2009.
- 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 February 4, 2009. No comments were received. The Army selected the recommended remedy in an Action Memorandum signed on March 20, 2009.
- The Removal Action Work Plan for the 535 PTA was approved by the USEPA and MPCA on May 13, 2009.
- The soil removal action field work was completed on September 30, 2009.
- At the end of FY 2009, the soil removal action closeout report was being prepared by the Army.

Once the closeout report is approved, the only on-going activity will be maintenance of LUCs, which were part of the selected remedy. Eventually, it will be necessary to amend the OU2 ROD to formally adopt the removal action as the final remedy for the 535 PTA.

## 12.6 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. Some, but not all of the data from this work was made available to the regulators and Army. In FY 2009, the developer withdrew from its agreement with Arden Hills, who in turn withdrew its offer to purchase with the federal government. No property transfer-related environmental investigation or cleanup work was performed in FY 2009.

## 12.7 FIVE-YEAR REVIEW

A Five-Year Review report was completed in August 2009 for Operable Units 1 to 3. The review concluded that the remedies are functioning as intended, and that the components of the remedies remain protective of human health and the environment.

# TABLE 12-1
# BUILDING 102 GROUNDWATER QUALITY DATA

## Fiscal Year 2009

| | | | 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 | | 12/18/08 | <1 | <1 | <1 | <1 | JP 0.032 |
| 01U048 | D | 12/18/08 | <1 | <1 | <1 | <1 | JP 0.030 |
| 01U048 | | 3/5/09 | <1 | <1 | <1 | <1 | JP 0.035 |
| 01U048 | | 6/1/09 | <1 | <1 | <1 | <1 | JP 0.022 |
| 01U578 | | 6/3/09 | <1 | <1 | <1 | <1 | --- |
| 01U578 | D | 6/3/09 | <1 | <1 | <1 | <1 | --- |
| 01U579 | | 6/3/09 | **39** | 18 | <1 | **JP 0.26** | --- |
| 01U580 | | 6/3/09 | **2,600** | **1,100** | JP 2.3 | **JP 2.2** | --- |
| 01U581 | | 6/3/09 | 1.7 | 6 | <1 | <1 | --- |
| 01L581 | | 6/3/09 | **32** | 15 | JP 0.21 | **JP 0.25** | --- |
| 01U582 | | 6/1/09 | <1 | <1 | <1 | <1 | <0.05 |
| 01U582 | D | 6/1/09 | --- | --- | --- | --- | <0.05 |
| 01L582 | | 6/1/09 | <1 | 16 | <1 | **JP 0.27** | **0.33** |
| 01U583 | | 6/1/09 | JP 0.6 | JP 0.3 | <1 | <1 | --- |
| 01L583 | | 6/1/09 | <1 | <1 | <1 | <1 | --- |
| 01U584 | | 6/3/09 | <1 | <1 | <1 | <1 | --- |
| 01U584 | D | 6/3/09 | <1 | <1 | <1 | <1 | --- |
| 01L584 | | 6/3/09 | <1 | <1 | <1 | <1 | --- |
| 03U001 | | 6/3/09 | JP 0.25 | <1 | <1 | <1 | --- |
| 03U076 | | 6/3/09 | <1 | <1 | <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.

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


| ANNUAL PERFORMANCE REPORT | Wenck | FY 2009 |
|---|---|---|
| Location of Building 102 | Wenck Associates, Inc. Environmental Engineers 1800 Pioneer Creek Center Maple Plain, MN 55359-0429 | Figure 12-1 |

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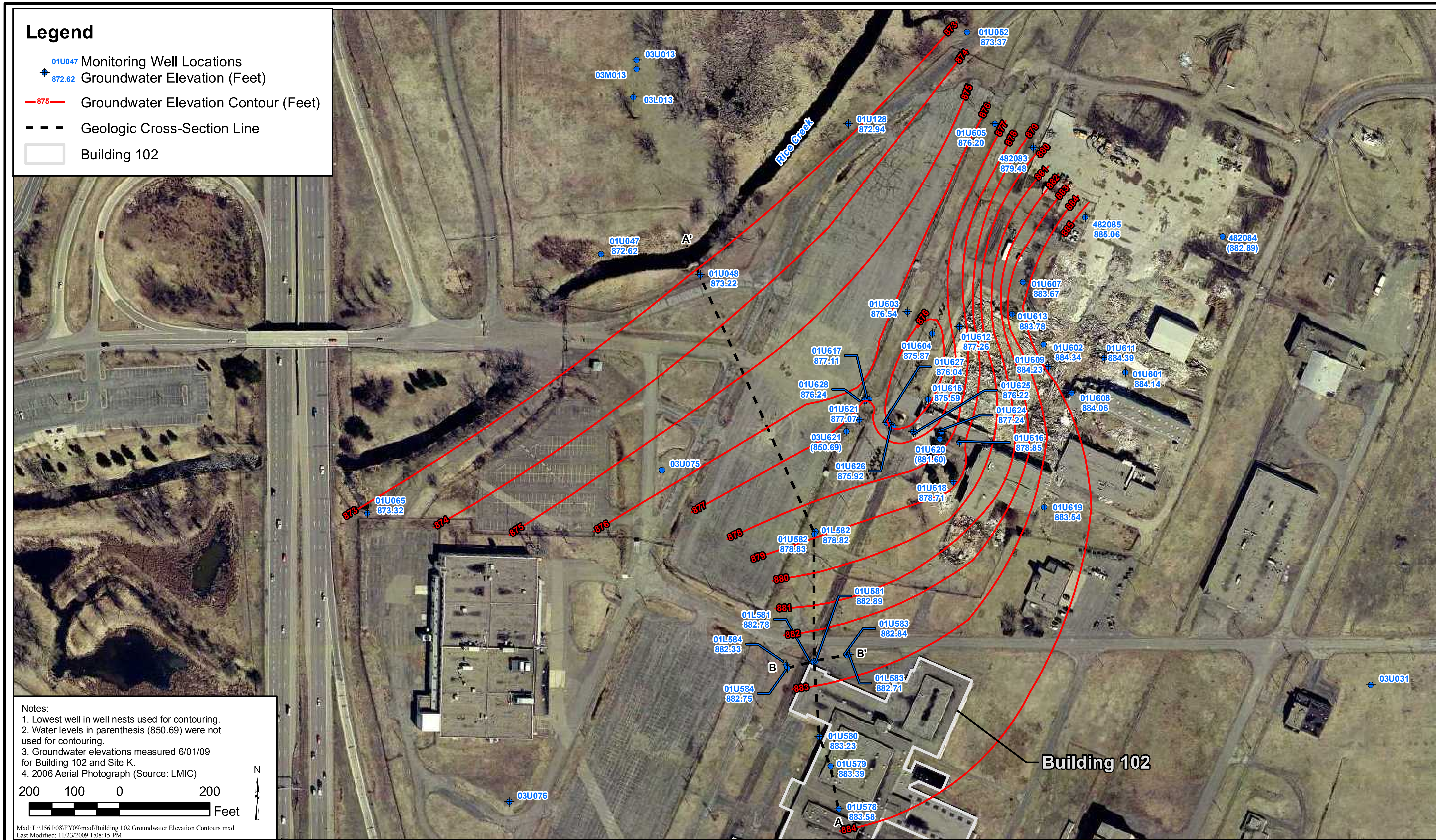


ANNUAL PERFORMANCE REPORT

Building 102 , Unit 1, Potentiometric Map - Summer 2009

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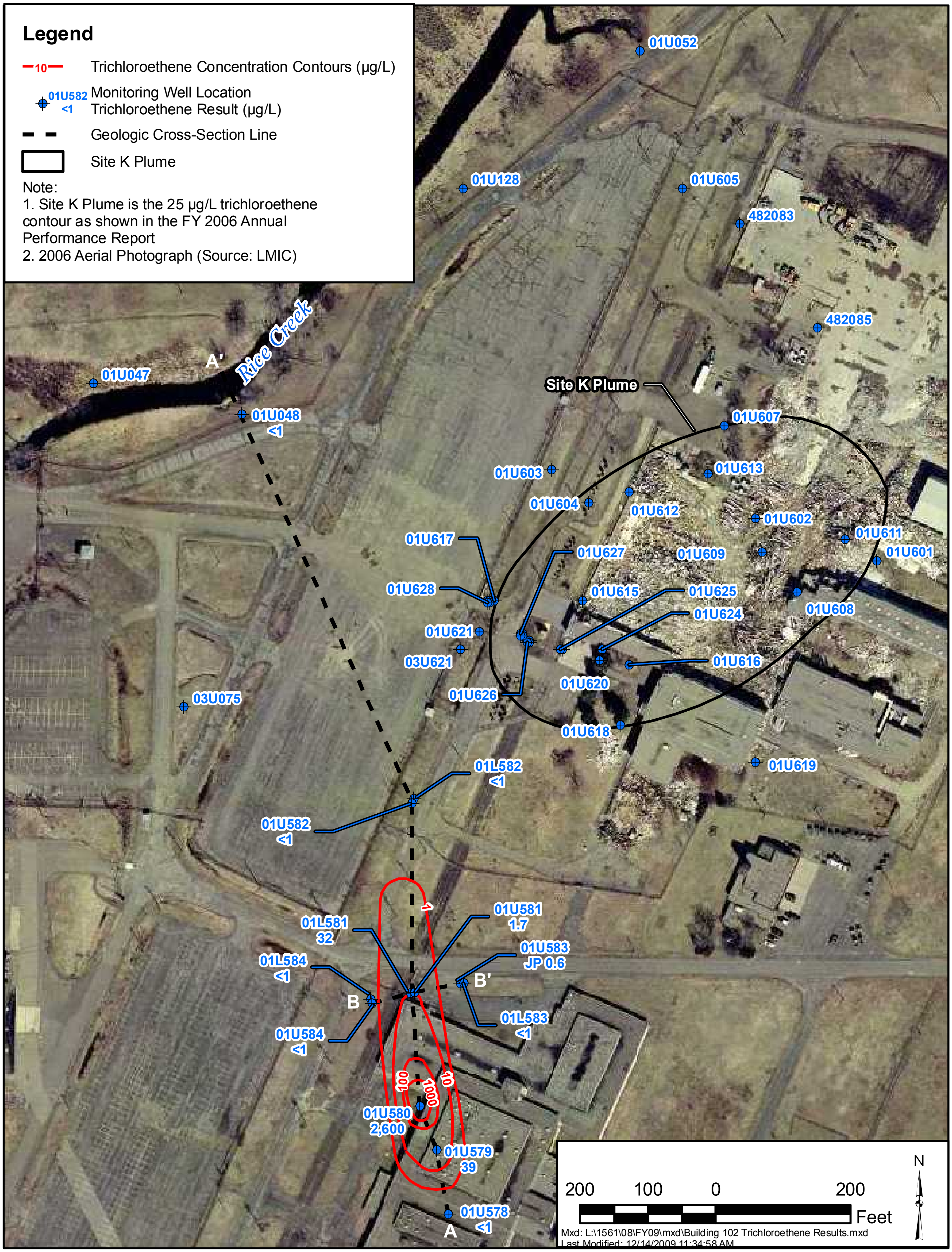
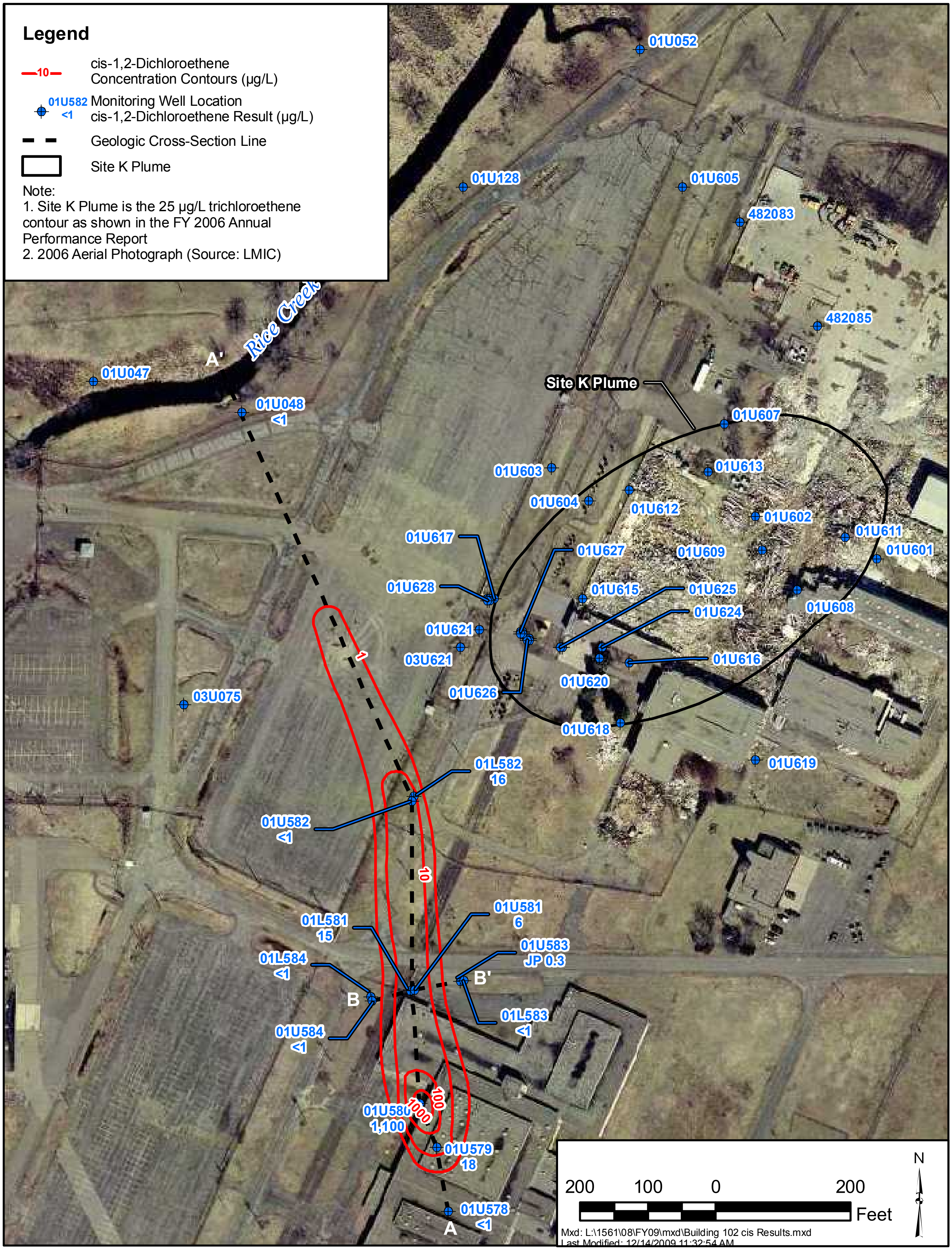
FY 2009

Figure 12-2




| ANNUAL PERFORMANCE REPORT | Wenck | FY 2009 |
|---|---|---|
| Trichloroethene Results - Summer 2009 | Wenck Associates, Inc. Environmental Engineers 1800 Pioneer Creek Center Maple Plain, MN 55359-0429 | Figure 12-3 |




ANNUAL PERFORMANCE REPORT

cis-1,2-Dichloroethene Results - Summer 2009

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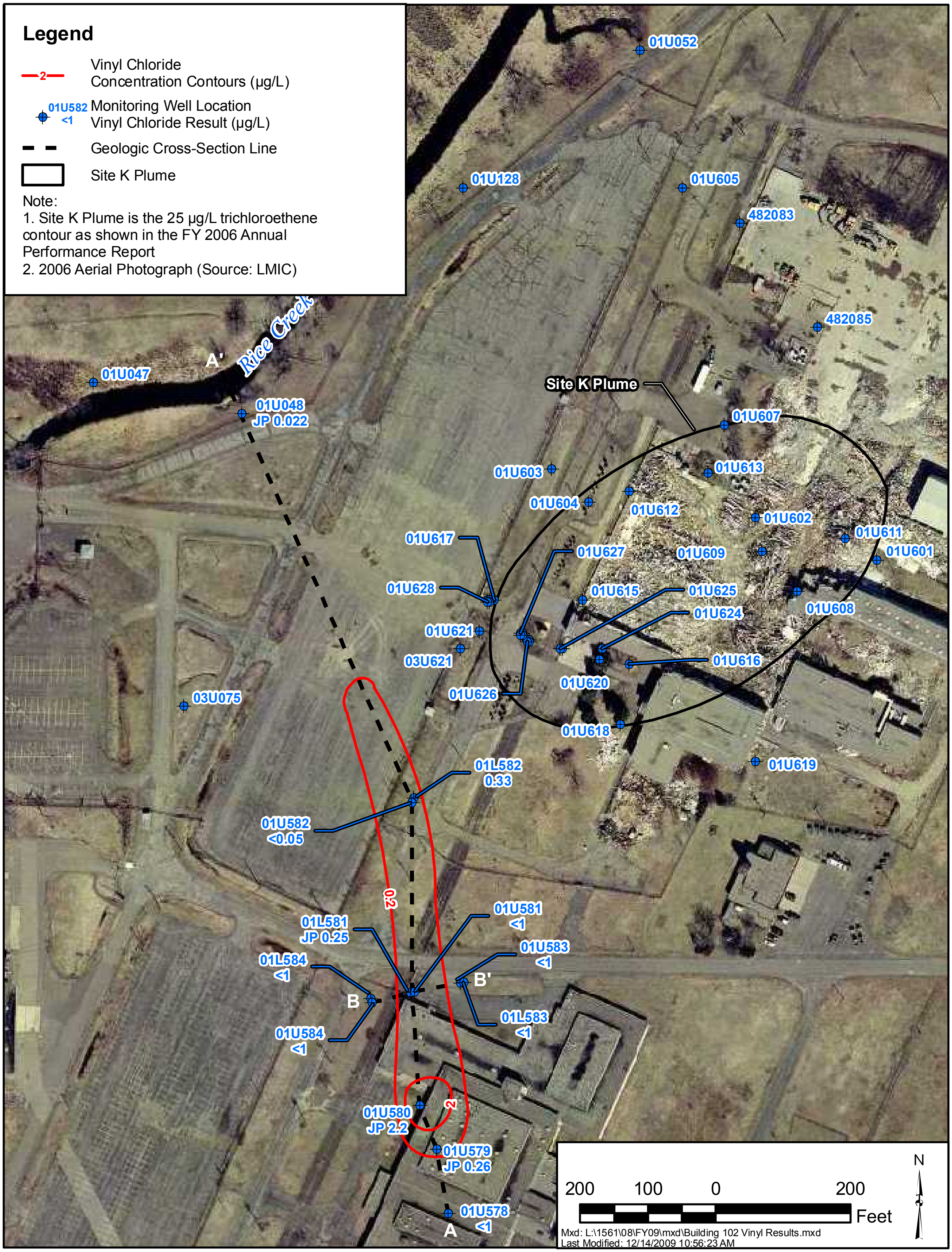
FY 2009

Figure 12-4




ANNUAL PERFORMANCE REPORT

Vinyl Chloride Results - Summer 2009



Wenck

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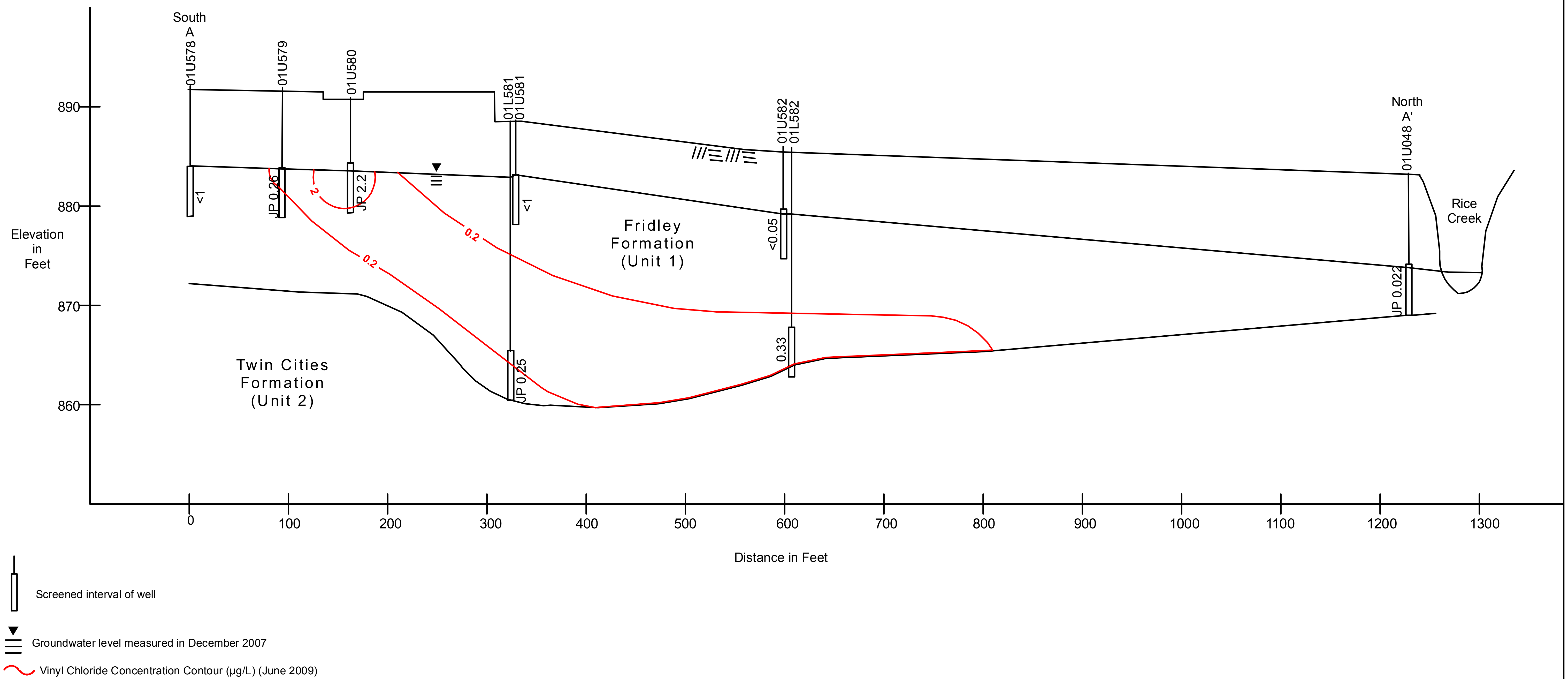
1800 Pioneer Creek Center Maple Plain, MN 55359-0429

FY 2009

Figure 12-5

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Last Modified: 12/15/2009 11:15:45 AM

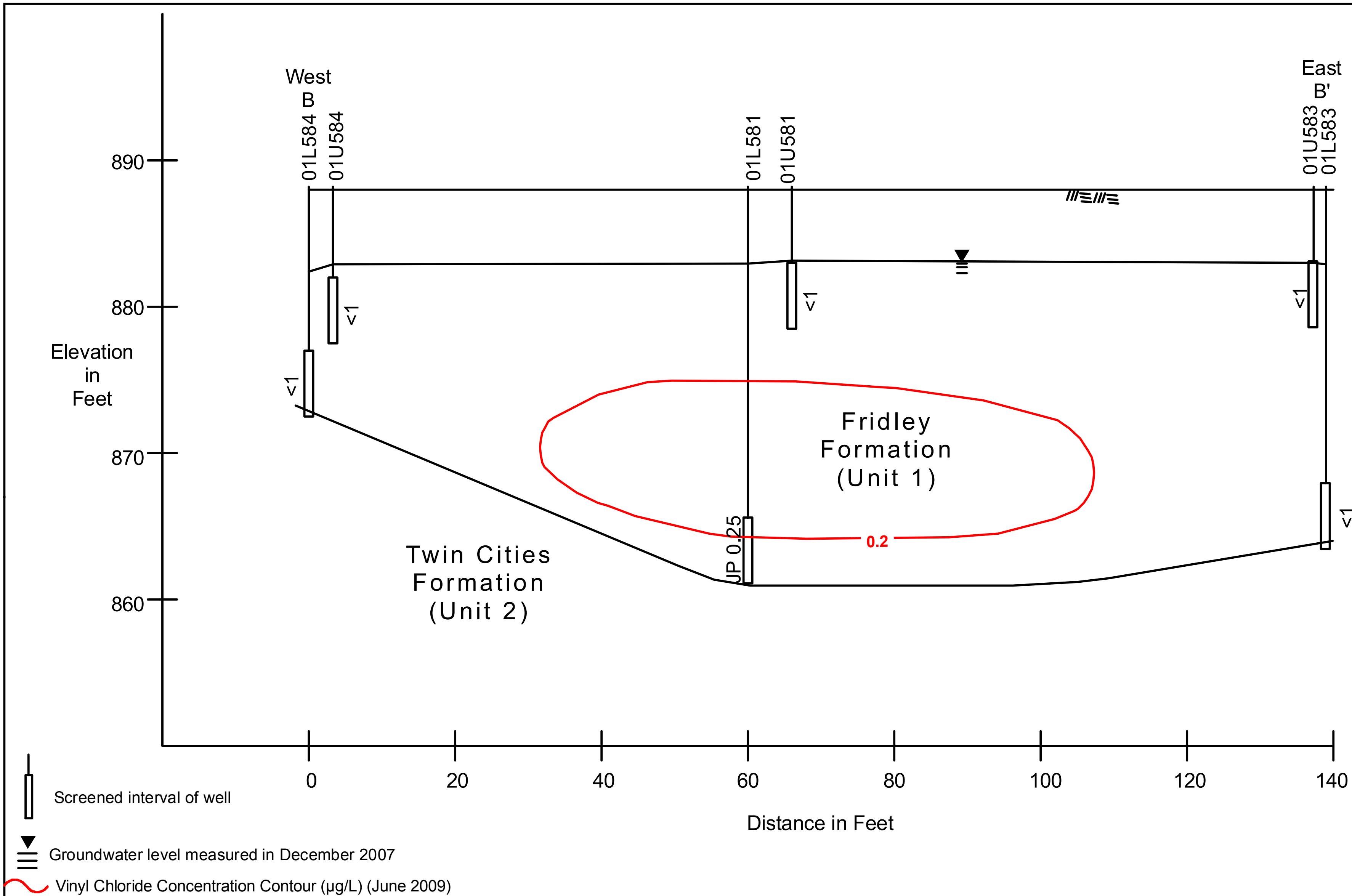
ANNUAL PERFORMANCE REPORT

Geologic Cross Section A-A'

Wenck Associates, Inc. Environmental Engineers
1800 Pioneer Creek Center
Maple Plain, MN 55359-0429

FY 2009

Figure 12-6

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| ANNUAL PERFORMANCE REPORT | Wenck | FY 2009 |
|---|---|---|
| Geologic Cross Section B-B' | Wenck Associates, Inc. Environmental Engineers 1800 Pioneer Creek Center Maple Plain, MN 55359-0429 | Figure 12-7 |

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# Appendix A

# FY 2009 – FY 2013 Monitoring Plans

# A.1 Groundwater Monitoring Wells

# APPENDIX A.1
# FY 2009 – FY 2013 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
- ❖ TGRS Water Quality
  - – OR = Overall remedy. To evaluate attainment of the cleanup levels throughout the plume
- ❖ TGRS Water Levels
  - – 1.a = To contour water levels for evaluation of containment
- ❖ Operable Unit 3 Water Quality
  - – OR = Overall remedy. To evaluate attainment of the cleanup levels throughout the plume
- ❖ Operable Unit 3 Water Levels
  - – 2.a = To contour water levels for evaluation of MNA remedy

(4) Sampling performed by the City of Saint Anthony. Army collects sample only if in production and not being sampled by City of Saint Anthony, otherwise Army uses Saint Anthony data.
(5) Sample extraction well annually or biennially, as shown, since it is no longer being pumped.
(6) Wells 04U414 and 04U851 monitored every 5 years during event preceding 5-year review
(7) Sample annually for copper through FY2009 to verify possible impacts to surface water quality in Sunfish Lake.
(8) Of the two wells, well 01U639 will be the primary sampling location and 482089 (I04MW) will be the alternate sampling location. If it is not possible to collect a groundwater sample from 01U639, then an attempt will be made to collect a sample from 482089 (I04MW).
(9) Flexibility will be maintained to allow for groundwater sampling to occur in either March or April depending on current conditions.

**APPENDIX A.1**

**FY 2009 - FY 2013 MONITORING PLAN FOR GROUNDWATER MONITORING WELLS**

| Well Information | | | | | | | | | Purpose For Monitoring (3) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Unit | Well I.D. | Common Name | Notes | June 09 | June 10 | June 11 | June 12 | June 13 | 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 | | | --- | --- | --- | --- | --- | --- | None | abandoned 2006 |
| 03U | 409550 | PCA 6U3 | | Q,L(B) | --- | Q,L(B) | --- | Q,L(B) | OR | None | |
| 03U | 409596 | BS118U3 | | --- | --- | --- | --- | --- | --- | None | aband.2007, may need replacem |
| 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 | | | --- | --- | --- | --- | --- | OR | None | |
| 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 | | --- | --- | --- | --- | --- | --- | None | aband. 2007, may need replacem |
| 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 | |

**FY 2009 - FY 2013 MONITORING PLAN FOR GROUNDWATER MONITORING WELLS**

| Well Information | | | | | | | | | Purpose For Monitoring (3) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Unit | Well I.D. | Common Name | Notes | June 09 | June 10 | June 11 | June 12 | June 13 | Water Quality | Water Level | Comments |
| 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 | | --- | --- | --- | --- | --- | | None | aband. 2007, may need replacem |
| PC | 200154 | UM Golf Course | | Q(B) | --- | Q(B) | --- | Q(B) | 1.a, OR | --- | |
| PC | 200814 | American Linen | | --- | --- | --- | --- | --- | --- | --- | |
| PC | 206688 | Cloverpond | | Q(B) | --- | Q(B) | --- | Q(B) | 1.a, OR | --- | |
| PC | 234547 | Honywell Ridgway | | --- | --- | --- | --- | --- | --- | --- | |
| 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 | | 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 |

**APPENDIX A.1**

**FY 2009 - FY 2013 MONITORING PLAN FOR GROUNDWATER MONITORING WELLS**

| Well Information | | | | | | | | | Purpose For Monitoring (3) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Unit | Well I.D. | Common Name | Notes | June 09 | June 10 | June 11 | June 12 | June 13 | Water Quality | Water Level | Comments |
| 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 | Honywell Ridgway | | Q(B) | --- | Q(B) | --- | Q(B) | OR | --- | |

**APPENDIX A.1**

**FY 2009 - FY 2013 MONITORING PLAN FOR GROUNDWATER MONITORING WELLS**

| Well Information | | | | | | | | | Purpose For Monitoring (3) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Unit | Well I.D. | Common Name | Notes | June 09 | June 10 | June 11 | June 12 | June 13 | Water Quality | Water Level | Comments |

## Operable Unit 2

### Site A Shallow Groundwater

| Unit | Well I.D. | Common Name | Notes | June 09 | June 10 | June 11 | June 12 | June 13 | Water Quality | Water Level | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 01U | 01U038 | | | L(B) | L(B) | L(B) | L(B) | L(B) | --- | OR | |
| 01U | 01U039 | | | Q,L(B) | Q,L(B) | Q,L(B) | Q,L(B) | Q,L(B) | OR | OR | |
| 01U | 01U040 | | | L(B) | L(B) | L(B) | L(B) | L(B) | --- | OR | |
| 01U | 01U041 | | | L(B) | L(B) | L(B) | L(B) | L(B) | --- | OR | |
| 01U | 01U063 | | | L(B) | L(B) | L(B) | L(B) | L(B) | --- | OR | |
| 01U | 01U067 | | | L(B) | L(B) | L(B) | L(B) | L(B) | --- | OR | |
| 01U | 01U102 | | | Q,L(B) | Q,L(B) | Q,L(B) | Q,L(B) | Q,L(B) | OR | OR | |
| 01U | 01U103 | | | Q,L(B) | Q,L(B) | Q,L(B) | Q,L(B) | Q,L(B) | OR | OR | |
| 01U | 01U104 | | | L(B) | L(B) | L(B) | L(B) | L(B) | --- | OR | |
| 01U | 01U105 | | | L(B) | L(B) | L(B) | L(B) | L(B) | --- | OR | |
| 01U | 01U106 | | | L(B) | L(B) | L(B) | L(B) | L(B) | --- | OR | |
| 01U | 01U107 | | | L(B) | L(B) | L(B) | L(B) | L(B) | --- | OR | |
| 01U | 01U108 | | | Q,L(B) | Q,L(B) | Q,L(B) | Q,L(B) | Q,L(B) | OR | OR | |
| 01U | 01U110 | | | L(B) | L(B) | L(B) | L(B) | L(B) | --- | OR | |
| 01U | 01U115 | | | Q,L(B) | Q,L(B) | Q,L(B) | Q,L(B) | Q,L(B) | OR | OR | Sample quarterly |
| 01U | 01U116 | | | Q,L(B) | Q,L(B) | Q,L(B) | Q,L(B) | Q,L(B) | OR | OR | Sample quarterly |
| 01U | 01U117 | | | Q,L(B) | Q,L(B) | Q,L(B) | Q,L(B) | Q,L(B) | OR | OR | |
| 01U | 01U118 | | | L(B) | L(B) | L(B) | L(B) | L(B) | --- | OR | |
| 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 | Sample semiannually |
| 01U | 01U127 | | | Q,L(B) | Q,L(B) | Q,L(B) | Q,L(B) | Q,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) | L(B) | L(B) | L(B) | L(B) | --- | OR | |
| 01U | 01U137 | | | L(B) | L(B) | L(B) | L(B) | L(B) | --- | OR | |

**APPENDIX A.1**

**FY 2009 - FY 2013 MONITORING PLAN FOR GROUNDWATER MONITORING WELLS**

| Well Information | | | | | | | | | Purpose For Monitoring (3) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Unit | Well I.D. | Common Name | Notes | June 09 | June 10 | June 11 | June 12 | June 13 | Water Quality | Water Level | Comments |
| 01U | 01U138 | | | Q,L(B) | Q,L(B) | Q,L(B) | Q,L(B) | Q,L(B) | OR | OR | |
| 01U | 01U139 | | | Q,L(B) | Q,L(B) | Q,L(B) | Q,L(B) | Q,L(B) | OR | OR | Sample quarterly |
| 01U | 01U140 | | | Q,L(B) | Q,L(B) | Q,L(B) | Q,L(B) | Q,L(B) | OR | OR | |
| 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 | |
| 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 | Sample quarterly |
| 01U | 01U158 | | | Q,L(B) | Q,L(B) | Q,L(B) | Q,L(B) | Q,L(B) | OR | OR | Sample quarterly |
| 01U | 01U350 | | | Q,L(B) | Q,L(B) | Q,L(B) | Q,L(B) | Q,L(B) | OR | OR | |
| 01U | 01U351 | EW-1 | | Q,L(B) | Q,L(B) | Q,L(B) | Q,L(B) | Q,L(B) | OR | OR | Sample quarterly |
| 01U | 01U352 | EW-2 | | Q,L(B) | Q,L(B) | Q,L(B) | Q,L(B) | Q,L(B) | OR | OR | Sample quarterly |
| 01U | 01U353 | EW-3 | | Q,L(B) | Q,L(B) | Q,L(B) | Q,L(B) | Q,L(B) | OR | OR | Sample quarterly |
| 01U | 01U354 | EW-4 | | Q,L(B) | Q,L(B) | Q,L(B) | Q,L(B) | Q,L(B) | OR | OR | Sample quarterly |
| 01U | 01U355 | EW-5 | | --- | --- | --- | --- | --- | --- | --- | |
| 01U | 01U356 | EW-6 | | --- | --- | --- | --- | --- | --- | --- | |
| 01U | 01U357 | EW-7 | | --- | --- | --- | --- | --- | --- | --- | |
| 01U | 01U358 | EW-8 | | --- | --- | --- | --- | --- | --- | --- | |
| 01U | 01U901 | | | Q,L(B) | Q,L(B) | Q,L(B) | Q,L(B) | Q,L(B) | OR | OR | |
| 01U | 01U902 | | | Q,L(B) | Q,L(B) | Q,L(B) | Q,L(B) | Q,L(B) | OR | OR | Sample semiannually |
| 01U | 01U903 | | | Q,L(B) | Q,L(B) | Q,L(B) | Q,L(B) | Q,L(B) | OR | OR | |
| 01U | 01U904 | | | Q,L(B) | Q,L(B) | Q,L(B) | Q,L(B) | Q,L(B) | OR | OR | Sample semiannually |

**APPENDIX A.1**

**FY 2009 - FY 2013 MONITORING PLAN FOR GROUNDWATER MONITORING WELLS**

| Well Information | | | | | | | | | Purpose For Monitoring (3) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Unit | Well I.D. | Common Name | Notes | June 09 | June 10 | June 11 | June 12 | June 13 | Water Quality | Water Level | Comments |
| **Site C Shallow Groundwater** | | | | | | | | | | | |
| Note: The Site C monitoring plan shown below was not shown in Appendix A.1 in the previous Annual Performance Report; however, the plan shown below is in accordance with the groundwater monitoring plan that was approved by the USEPA and MPCA in the QAPP for Site C Groundwater and Surface Water (Revision 8, April 2009). | | | | | | | | | | | |
| 01U | 01U045 | | | Q,L(B) | Q,L(B) | Q,L(B) | Q,L(B) | Q,L(B) | OR | OR | |
| 01U | 01U046 | | | Q,L(B) | Q,L(B) | Q,L(B) | Q,L(B) | Q,L(B) | OR | OR | Sample quarterly |
| 01U | 01U085 | | | Q,L(B) | Q,L(B) | Q,L(B) | Q,L(B) | Q,L(B) | OR | OR | |
| 01U | 01U551 | EW-1 | | Q,L(B) | Q,L(B) | Q,L(B) | Q,L(B) | Q,L(B) | OR | OR | Sample quarterly |
| 01U | 01U552 | EW-2 | | Q,L(B) | Q,L(B) | Q,L(B) | Q,L(B) | Q,L(B) | OR | OR | Sample quarterly |
| 01U | 01U553 | EW-3 | | Q,L(B) | Q,L(B) | Q,L(B) | Q,L(B) | Q,L(B) | OR | OR | Sample quarterly |
| 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 | Sample quarterly |
| 01U | 01U565 | MW-5 | | L(B) | L(B) | L(B) | L(B) | L(B) | --- | OR | |
| 01U | 01U566 | MW-6 | | Q,L(B) | Q,L(B) | Q,L(B) | Q,L(B) | Q,L(B) | OR | OR | Sample quarterly |
| 01U | 01U567 | MW-7 | | Q,L(B) | Q,L(B) | Q,L(B) | Q,L(B) | Q,L(B) | OR | OR | Sample quarterly |
| 01U | 01U568 | MW-8 | | Q,L(B) | Q,L(B) | Q,L(B) | Q,L(B) | Q,L(B) | OR | OR | Sample quarterly |
| 01U | 01U569 | MW-9 | | L(B) | L(B) | L(B) | L(B) | L(B) | --- | OR | |
| 01U | 01U570 | MW-10 | | Q,L(B) | Q,L(B) | Q,L(B) | Q,L(B) | Q,L(B) | OR | OR | |
| 01U | 01U571 | MW-11 | | Q,L(B) | Q,L(B) | Q,L(B) | Q,L(B) | Q,L(B) | OR | OR | Sample quarterly |
| 01U | 01U572 | MW-12 | | Q,L(B) | Q,L(B) | Q,L(B) | Q,L(B) | Q,L(B) | OR | OR | Sample quarterly |
| 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 | |

| Well Information | | | | | | | | | Purpose For Monitoring (3) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Unit | Well I.D. | Common Name | Notes | June 09 | June 10 | June 11 | June 12 | June 13 | Water Quality | Water Level | Comments |
| **Site I Shallow Groundwater** | | | | | | | | | | | |
| 01U | 01U064 | | (9) | Q,L(A) | Q,L(A) | Q,L(A) | Q,L(A) | Q,L(A) | 1a, OR | 1a, OR | Sample in Mar/Apr |
| 01U | 01U632 | | (9) | Q,L(A) | Q,L(A) | Q,L(A) | Q,L(A) | Q,L(A) | 1a, OR | 1a, OR | Sample in Mar/Apr |
| 01U | 01U636 | | (9) | Q,L(A) | Q,L(A) | Q,L(A) | Q,L(A) | Q,L(A) | 1a, OR | 1a, OR | Sample in Mar/Apr |
| 01U | 01U639 | | (8) (9) | Q,L(A) | Q,L(A) | Q,L(A) | Q,L(A) | Q,L(A) | 1a, OR | 1a, OR | Sample in Mar/Apr |
| 01U | 01U640 | | (9) | Q,L(A) | Q,L(A) | Q,L(A) | Q,L(A) | Q,L(A) | 1a, OR | 1a, OR | Sample in Mar/Apr |
| 01U | 01U666 | | (9) | L(A) | L(A) | L(A) | L(A) | L(A) | --- | 1a, OR | GW elevations in Mar/Apr |
| 01U | 01U667 | | (9) | L(A) | L(A) | L(A) | L(A) | L(A) | --- | 1a, OR | GW elevations in Mar/Apr |
| 01U | 01U668 | | (9) | L(A) | L(A) | L(A) | L(A) | L(A) | --- | 1a, OR | GW elevations in Mar/Apr |
| 01U | 482086 | I01MW | (9) | Q,L(A) | Q,L(A) | Q,L(A) | Q,L(A) | Q,L(A) | 1a, OR | 1a, OR | Sample in Mar/Apr |
| 01U | 482087 | I05MW | (9) | Q,L(A) | Q,L(A) | Q,L(A) | Q,L(A) | Q,L(A) | 1a, OR | 1a, OR | Sample in Mar/Apr |
| 01U | 482088 | I02MW | (9) | Q,L(A) | Q,L(A) | Q,L(A) | Q,L(A) | Q,L(A) | 1a, OR | 1a, OR | Sample in Mar/Apr |
| 01U | 482089 | I04MW | (8)(9) | Q,L(A) | Q,L(A) | Q,L(A) | Q,L(A) | Q,L(A) | 1a, OR | 1a, OR | Sample in Mar/Apr |
| 01U | 482090 | I03MW | (9) | L(A) | L(A) | L(A) | L(A) | L(A) | --- | 1a, OR | GW elevations in Mar/Apr |

# APPENDIX A.1

## FY 2009 - FY 2013 MONITORING PLAN FOR GROUNDWATER MONITORING WELLS

| Well Information | | | | | | | | | Purpose For Monitoring (3) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Unit | Well I.D. | Common Name | Notes | June 09 | June 10 | June 11 | June 12 | June 13 | 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) | L(A) | L(A) | L(A) | L(A) | --- | 3.a | |
| 01U | 01U602 | | | L(A) | L(A) | L(A) | L(A) | L(A) | --- | 3.a | |
| 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) | Q,L(A) | Q,L(A) | Q,L(A) | Q,L(A) | OR | 3.a | |
| 01U | 01U605 | | | L(A) | L(A) | L(A) | L(A) | L(A) | --- | 3.a | |
| 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) | L(A) | L(A) | L(A) | L(A) | OR | 3.a | |
| 01U | 01U615 | | | Q,L(A) | Q,L(A) | Q,L(A) | Q,L(A) | Q,L(A) | OR | 3.a | |
| 01U | 01U616 | | | L(A) | L(A) | L(A) | L(A) | L(A) | --- | 3.a | |
| 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) | Q,L(A) | Q,L(A) | Q,L(A) | Q,L(A) | OR | 3.a | |
| 01U | 01U620 | | | L(A) | L(A) | L(A) | L(A) | L(A) | OR | 3.a | |
| 01U | 01U621 | | | Q,L(A) | Q,L(A) | Q,L(A) | Q,L(A) | Q,L(A) | OR | 3.a | |
| 01U | 01U624 | | | L(A) | L(A) | L(A) | L(A) | L(A) | --- | 3.a | |
| 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) | L(A) | L(A) | L(A) | L(A) | --- | 3.a | |

**APPENDIX A.1**

**FY 2009 - FY 2013 MONITORING PLAN FOR GROUNDWATER MONITORING WELLS**

| Well Information | | | | | | | | | Purpose For Monitoring (3) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Unit | Well I.D. | Common Name | Notes | June 09 | June 10 | June 11 | June 12 | June 13 | Water Quality | Water Level | Comments |
| 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) | L(A) | L(A) | L(A) | L(A) | --- | 3.a | |
| 01U | 482085 | K01-MW | | L(A) | L(A) | L(A) | L(A) | L(A) | --- | 3.a | |
| 03U | 03U621 | | | Q,L(A) | Q,L(A) | Q,L(A) | Q,L(A) | Q,L(A) | OR | 3.a | |

**FY 2009 - FY 2013 MONITORING PLAN FOR GROUNDWATER MONITORING WELLS**

| Unit | Well I.D. | Common Name | Notes | June 09 | June 10 | June 11 | June 12 | June 13 | Water Quality | Water Level | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Well Information | | | | | | | | | Purpose For Monitoring (3) | | |
| **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 | | | | | | | | | See Appendix A.2 |
| 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 | | | Q,L(A) | --- | Q,L(A) | --- | Q,L(A) | OR | 1.a | |
| 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 | |

**APPENDIX A.1**

**FY 2009 - FY 2013 MONITORING PLAN FOR GROUNDWATER MONITORING WELLS**

| Well Information | | | | | | | | | Purpose For Monitoring (3) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Unit | Well I.D. | Common Name | Notes | June 09 | June 10 | June 11 | June 12 | June 13 | Water Quality | Water Level | Comments |
| 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 | |
| 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) | --- | L(A) | --- | L(A) | --- | 1.a | |
| 03U | 03U032 | | | Q,L(A) | --- | Q,L(A) | --- | Q,L(A) | OR | 1.a | |
| 03U | 03U075 | | | Q,L(A) | --- | Q,L(A) | --- | Q,L(A) | OR | 1.a | |
| 03U | 03U076 | | | L(A) | --- | L(A) | --- | L(A) | --- | 1.a | |
| 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) | --- | L(A) | --- | L(A) | --- | 1.a | |
| 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) | 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 | |

## APPENDIX A.1

## FY 2009 - FY 2013 MONITORING PLAN FOR GROUNDWATER MONITORING WELLS

| Well Information | | | | | | | | | Purpose For Monitoring (3) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Unit | Well I.D. | Common Name | Notes | June 09 | June 10 | June 11 | June 12 | June 13 | Water Quality | Water Level | Comments |
| 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) | --- | L(A) | --- | L(A) | --- | 1.a | |
| 03U | 03U648 | | | L(A) | --- | L(A) | --- | L(A) | --- | 1.a | |
| 03U | 03U658 | | | L(A) | --- | L(A) | --- | L(A) | --- | 1.a | |
| 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) | --- | Q,L(A) | --- | Q,L(A) | OR | 1.a | |
| 03U | 03U674 | | | L(A) | --- | L(A) | --- | L(A) | --- | 1.a | |
| 03U | 03U675 | | | --- | --- | --- | --- | --- | --- | --- | |
| 03U | 03U676 | | | L(A) | --- | L(A) | --- | L(A) | --- | 1.a | |
| 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) | Q,L(A) | Q,L(A) | OR | 1.a | |

**APPENDIX A.1**

**FY 2009 - FY 2013 MONITORING PLAN FOR GROUNDWATER MONITORING WELLS**

| Well Information | | | | | | | | | Purpose For Monitoring (3) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Unit | Well I.D. | Common Name | Notes | June 09 | June 10 | June 11 | June 12 | June 13 | Water Quality | Water Level | Comments |
| 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 | | | L(A) | --- | L(A) | --- | L(A) | --- | 1.a | |
| 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 | |
| 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 | | | L(A) | --- | L(A) | --- | L(A) | --- | 1.a | |
| 03L | 03L005 | | | L(A) | --- | L(A) | --- | L(A) | --- | 1.a | |

**APPENDIX A.1**

**FY 2009 - FY 2013 MONITORING PLAN FOR GROUNDWATER MONITORING WELLS**

| Well Information | | | | | | | | | Purpose For Monitoring (3) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Unit | Well I.D. | Common Name | Notes | June 09 | June 10 | June 11 | June 12 | June 13 | Water Quality | Water Level | Comments |
| 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) | --- | L(A) | --- | L(A) | --- | 1.a | |
| 03L | 03L028 | | | L(A) | --- | L(A) | --- | L(A) | --- | 1.a | |
| 03L | 03L029 | | | L(A) | --- | L(A) | --- | L(A) | --- | 1.a | |
| 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) | --- | Q,L(A) | --- | Q,L(A) | OR | 1.a | |
| 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 | |
| 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) | --- | Q,L(A) | --- | Q,L(A) | OR | 1.a | |

**APPENDIX A.1**

**FY 2009 - FY 2013 MONITORING PLAN FOR GROUNDWATER MONITORING WELLS**

| Well Information | | | | | | | | | Purpose For Monitoring (3) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Unit | Well I.D. | Common Name | Notes | June 09 | June 10 | June 11 | June 12 | June 13 | Water Quality | Water Level | Comments |
| 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) | --- | L(A) | --- | L(A) | --- | 1.a | |
| 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) | --- | --- | |

**APPENDIX A.1**

**FY 2009 - FY 2013 MONITORING PLAN FOR GROUNDWATER MONITORING WELLS**

| Well Information | | | | | | | | | Purpose For Monitoring (3) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Unit | Well I.D. | Common Name | Notes | June 09 | June 10 | June 11 | June 12 | June 13 | Water Quality | Water Level | Comments |

## Unit 1 Wells

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 01U | 01U035 | | | --- | --- | --- | --- | --- | --- | --- | |
| 01U | 01U043 | | | --- | --- | --- | --- | --- | --- | --- | |
| 01U | 01U044 | | | --- | --- | --- | --- | --- | --- | --- | |
| 01U | 01U045 | | | --- | --- | --- | --- | --- | --- | --- | |
| 01U | 01U046 | | | --- | --- | --- | --- | --- | --- | --- | |
| 01U | 01U060 | | (7) | Q(B) | --- | --- | --- | --- | (Note 7) | --- | Monitoring cont'd after 2007 |
| 01U | 01U072 | | | --- | --- | --- | --- | --- | --- | --- | |
| 01U | 01U085 | | | --- | --- | --- | --- | --- | --- | --- | |

**APPENDIX A.1**

**FY 2009 - FY 2013 MONITORING PLAN FOR GROUNDWATER MONITORING WELLS**

| Well Information | | | | | | | | | Purpose For Monitoring (3) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Unit | Well I.D. | Common Name | Notes | June 09 | June 10 | June 11 | June 12 | June 13 | 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) | --- | --- | --- | 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) | --- | --- | --- | Q,L(A) | OR | 2.a | |
| PC | 04U852 | | | --- | --- | --- | --- | --- | --- | --- | Proposed for Abandonment |
| 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 | | -- | -- | -- | -- | -- | -- | -- | Proposed for Abandonment |
| PC | 04U865 | 325U4 | | --- | -- | --- | -- | --- | --- | --- | Proposed for Abandonment |
| PC | 04U866 | 326U4 | | Q,L(A) | Q,L(A) | Q,L(A) | -- | Q,L(A) | OR | 2.a | |
| PC | 520931 | NBM #13 | | -- | -- | -- | -- | -- | -- | -- | Abandoned FY07 |

## APPENDIX A.1

## FY 2009 - FY 2013 MONITORING PLAN FOR GROUNDWATER MONITORING WELLS

| Well Information | | | | | | | | | Purpose For Monitoring (3) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Unit | Well I.D. | Common Name | Notes | June 09 | June 10 | June 11 | June 12 | June 13 | Water Quality | Water Level | Comments |
| J | 04J864 | 324 J | | -- | -- | -- | -- | -- | -- | -- | Proposed for Abandonment |
| J | 04J866 | 326 J | | Q,L(A) | -- | Q,L(A) | -- | Q,L(A) | OR | 2.a | |

| Well Information | | | | | | | | | Purpose For Monitoring (3) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Unit | Well I.D. | Common Name | Notes | June 09 | June 10 | June 11 | June 12 | June 13 | Water Quality | Water Level | Comments |

## Other Installation Restoration Activities

### Building 102 Shallow Groundwater

Note: The Building 102 monitoring plan shown below was not shown in Appendix A.1 in the previous Annual Performance Report; however, the plan shown below is in accordance with the groundwater monitoring plan that was approved by the USEPA and MPCA in the QAPP for MNA of Building 102 Groundwater (Revision 2, April 2009).

| Unit | Well I.D. | Common Name | Notes | June 09 | June 10 | June 11 | June 12 | June 13 | Water Quality | Water Level | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 01U | 01U048 | | | Q,L(B) | Q,L(B) | Q,L(B) | Q,L(B) | Q,L(B) | OR | OR | |
| 01U | 01U578 | | | Q,L(B) | Q,L(B) | Q,L(B) | Q,L(B) | Q,L(B) | OR | OR | |
| 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 09 | June 10 | June 11 | June 12 | June 13 | 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), I |
| --- | 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 |

**APPENDIX A.1**

**FY 2009 - FY 2013 MONITORING PLAN FOR GROUNDWATER MONITORING WELLS**

| Well Information | | | | | | | | | Purpose For Monitoring (3) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Unit | Well I.D. | Common Name | Notes | June 09 | June 10 | June 11 | June 12 | June 13 | Water Quality | Water Level | Comments |
| --- | 249185 | Novotny, Mark | 4a | Q(B) | --- | --- | --- | Q(B) | Well Inventory | --- | 1706 Malvern St |
| --- | S00295 | Alfson, Loren | 4a | Q(B) | --- | --- | --- | Q(B) | Well Inventory | --- | 2351 Summer St |
| --- | | Amundsen, Jason & Lucy | 4a | Q(B) | --- | --- | --- | Q(B) | Well Inventory | --- | 2816 St. Anthony Blvd |
| --- | | Burton, Jason | 4a | Q(B) | --- | --- | --- | Q(B) | Well Inventory | --- | 2073 10th St NW |
| --- | | Cuddihy, Michael & Amy | 4a | Q(B) | --- | --- | --- | Q(B) | Well Inventory | --- | 2933 Troseth Road |
| --- | | Hermes, Margo | 4a | Q(B) | --- | --- | --- | Q(B) | Well Inventory | --- | 2935 Old Hwy 8 |
| --- | | Holland, Justin | 4a | Q(B) | --- | --- | --- | Q(B) | Well Inventory | --- | 1475 16th St NW |
| --- | | Macdonald, Jason | 4a | Q(B) | --- | --- | --- | Q(B) | Well Inventory | --- | 1672 14th Ave NW |
| --- | | Olson, Nathan | 4a | Q(B) | --- | --- | --- | Q(B) | Well Inventory | --- | 4439 Old Hwy 10 |
| --- | | Weisenberger, Heidi | 4a | Q(B) | --- | --- | --- | Q(B) | Well Inventory | --- | 2816 Silver Lake Rd |

# A.2 Remedial Treatment Systems

# APPENDIX A.2
# FY 2009 - FY 2013 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 2009 - FY 2013 MONITORING PLAN
# FOR SURFACE WATER

| Analysis | Analytical Method | Units | Site K Effluent (Outfall 010) | Site C Surface Water Locations (SW-5) | (SW-5) | (NE Wetland) |
|---|---|---|---|---|---|---|
| Flow Rate | - - | M gal/day | Continuous | | | |
| Total Flow | - - | M gal | M | | | |
| pH | (field) | (pH) | Q | | | |
| Cyanide | 9012A | µg/l | Q | | | |
| Copper | 6020 | µg/l | Q | | | |
| Lead | 6020 | µg/l | Q | 3Q | 3Q | 3Q |
| Mercury | 7470A | µg/l | Q | | | |
| Phosphorus (Total) | 365.4 | µg/l | Q | | | |
| Silver | 6020 | µg/l | Q | | | |
| Zinc | 6020 | µg/l | Q | | | |
| Trichloroethene | 8260C | µg/l | Q | | | |
| 1,1-Dichloroethene | 8260C | µg/l | Q | | | |
| 1,1-Dichloroethane | 8260C | µg/l | Q | | | |
| Cis-1,2-Dichloroethene | 8260C | µg/l | Q | | | |
| Trans-1,2-Dichloroethene | 8260C | µg/l | Q | | | |
| Vinyl Chloride | 8260C | µg/l | Q | | | |
| 1,2-Dichloroethane | 8260C | µg/l | Q | | | |

**Notes:**

M = Measurement required once per month

Q = Analysis required once per quarter

3Q = Analysis required in three quarters (March, June, and September)

# A.4 Site Specific Lists of Required Analytes

# APPENDIX A.4
# SITE SPECIFIC LISTS OF REQUIRED ANALYTES

Note: Cleanup levels (in ug/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 wells: 01U103, 01U902 and 01U904

**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 OU2 Record of Decision - Amendment #1.
(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

### OU2 SHALLOW SOIL SITE GROUNDWATER MONITORING

Site H (Well 01U060) No further monitoring proposed

### 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 Table 3-5 of the Building 102 Groundwater Engineering Evaluation/Cost Analysis (EE/CA).
(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)
Metals: SW-846 Method 6020

# A.5 New Brighton Operating Rates

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

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

NOTES:

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

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

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

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

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

# Appendix B

## Description of Hydrogeologic Units/Well Nomenclature and Trichloroethene Trends

*(Trichloroethene Trend Graphs are located at the end of this Appendix)*

**APPENDIX B**
**DESCRIPTION OF HYDROGEOLOGIC UNITS/WELL NOMENCLATURE AND TRICHLOROETHENE TRENDS**

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 $8.3 \times 10^{-3}$ cm/sec (International Technology Corp. 1992). The Unit 1 deposits are discontinuous at the New Brighton/Arden Hills Superfund Site (NB/AH Site) and ranges 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. For reference, a well-designation cross-reference guide is included as Tables B-1 and B-2, which lists all wells of concern, the Minnesota unique number, the IRDMIS number, and any other name(s) the wells may have. Table B-1 is sorted by unique number and Table B-2 is sorted by IRDMIS number. The well type in these two tables 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 |

Tables B-3 and B-4, which contain the same list of wells as Table B-2 (i.e., a listing that is sorted by IRDMIS number), can be used to view the boring log for a given well, if available. To view the well log, click on the desired well name in the table with the mouse. Table B-3 provides the boring logs for OU2 wells and Table B-4 provides the boring logs for OU1/OU3 wells.

Figures B-2 and B-3 show locations for OU1/OU3 and OU2 wells, respectively. 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. Using either of the figures, the trichloroethene trend graph for a specific well can be viewed by clicking on the desired well name with the mouse. Some of the wells do not have trend graphs available (primarily sealed wells). Refer to the historical water quality database in Appendix D for this information.

# TABLE B-1
# WELL INDEX
# SORTED BY UNIQUE NUMBER

| Minnesota Unique # | IRDMIS # | Other Name(s) | On or Off of OU2 | Well Type | Well Sealed | Second Unique # |
|---|---|---|---|---|---|---|
| 107405 | | ROEBKE | OFF | UN | | |
| 110485 | | NEW BRIGHTON #12 | OFF | MUNI | | |
| 114410 | 03U521 | | OFF | MON | | |
| 122210 | | ST. PAUL PORT AUTH. #3 | OFF | IND | | |
| 127537 | | MIDWEST ASPHALT | OFF | DOM | | |
| 134318 | | LORENZ W SEUTTER | OFF | DOM | | |
| 139035 | | WATERGATE MARINA | OFF | P.S. | | |
| 151568 | | ARDEN MANOR MOBILE HOME | OFF | P.S. | | |
| 161432 | | NEW BRIGHTON #10 | OFF | MUN | | |
| 191942 | | 118PDC/MODEL STONE | OFF | MON | ✓ | |
| 194701 | 01U620 | OW120U1 | ON | MON | | |
| 194702 | 01U621 | PW121U1 | ON | MON | | |
| 194703 | 01U622 | OW122U1 | ON | MON | ✓ | |
| 194704 | 01U623 | OW123U1 | ON | MON | ✓ | |
| 194716 | 01U634 | OW504U1 | ON | MON | ✓ | |
| 194717 | 01U638 | OW508U1 | | MON | ✓ | |
| 194718 | 01U639 | OW509U1 | ON | MON | | |
| 194719 | 01U640 | OW510U1 | ON | MON | | |
| 194720 | 01U631 | OW501U1 | ON | MON | | |
| 194721 | 01U632 | OW502U1 | | MON | | |
| 194722 | 01U635 | OW505U1 | ON | MON | ✓ | |
| 194723 | 01U636 | OW506U1 | ON | MON. | | |
| 194724 | 01U642 | OW512U1 | ON | MON | ✓ | |
| 194725 | 01U612 | OW112U1 | ON | MON | | 194758 |
| 194726 | 01U613 | | ON | MON | | 194759 |
| 194727 | 01U615 | OW115U1 | ON | MON | | 194760 |
| 194728 | 01U616 | OW116U1 | ON | MON | | 194761 |
| 194729 | 01U617 | OW117U1 | ON | MON | | 194770 |
| 194730 | 01U618 | OW118U1 | ON | MON | | 194771 |
| 194772 | 01U619 | PW119U1 | ON | MON | | |
| 200070 | | RUAN TRANSPORT | OFF | COM | ✓ | |
| 200071 | | PRESTRESSED CONCRETE | OFF | IND | ✓ | |
| 200072 | | WITTE TRANSPORTATION | OFF | IND | ✓ | |
| 200073 | | WILSON TRANSFER & STORAGE | OFF | IND | | |
| 200074 | | ASBESTOS PROD | OFF | IND | ✓ | |
| 200075 | | PHILLIPS PETROLEUM | OFF | IND | ✓ | |
| 200076 | | OLD DUTCH FOODS INC | OFF | IND | | |
| 200077 | | JOHN CONLIN | OFF | DOM | ✓ | |
| 200078 | | WILLIAM CLASS | OFF | DOM | | |
| 200079 | | LAWRENCE SCHOENING | OFF | DOM | | |
| 200080 | | CARL A OSTROM & SON | OFF | DOM | | |
| 200081 | | A. O. LIEBIG | OFF | DOM | | |
| 200082 | | 2196 MARION ROAD | OFF | DOM | | |
| 200148 | | PAPER CALMERSON | OFF | IND | ✓ | |
| 200154 | | U OF M GOLF COURSE | OFF | IRR | | |
| 200167 | | KOPPERS COKE #1 | OFF | IND | | |
| 200171 | | PLATING INC | OFF | IND | | |
| 200197 | | SNOW FLAKE DAIRY | OFF | COM | | |
| 200264 | | 1620 CENTRAL | OFF | IND | | |

**TABLE B-1**
**WELL INDEX**
**SORTED BY UNIQUE NUMBER**

| Minnesota Unique # | IRDMIS # | Other Name(s) | On or Off of OU2 | Well Type | Well Sealed | Second Unique # |
|---|---|---|---|---|---|---|
| 200384 | | METALLURGICAL INC. WELL #1 | OFF | IND | | |
| 200524 | | ST. ANTHONY #5 | OFF | MUNI | | |
| 200525 | | PLETSCHER | OFF | UN | | |
| 200531 | | NAZARETH | OFF | UN | | |
| 200599 | | CEDAR AVE. TRIANGLE | OFF | P.S. | | |
| 200602 | | ATKINSON MILL CO. | OFF | IND | | |
| 200629 | | GENERAL MILLS | OFF | IND | | |
| 200803 | | ST. ANTHONY #4 | OFF | P.S. | | |
| 200804 | | ST. ANTHONY #3 | OFF | MUNI | | |
| 200812 | | GROSS GOLF COURSE #1 | OFF | COM | | |
| 200814 | | AMERICAN LINEN | OFF | IND | | |
| 201074 | | GLEASSON MORTUARY | OFF | COM | | |
| 201082 | | NORTHWESTERN HOSPITAL | OFF | P.S. | | |
| 206669 | | FRIDLEY #8 | OFF | MUNI | | |
| 206672 | | FRIDLEY #9 | OFF | MUNI | | |
| 206673 | | FRIDLEY #6 | OFF | MUNI | | |
| 206688 | | CLOVERPOND WELL | OFF | DOM | | |
| 206689 | | JAMES K. O'NEIL | OFF | UN | | |
| 206693 | | FERNELIUS | OFF | UN | | |
| 206702 | | MINN E.S. | OFF | UN | | |
| 206720 | | MOUNDSVIEW | OFF | MUNI | | |
| 206722 | | M0UNDSVIEW #5 | OFF | MUNI | | |
| 206724 | PJ#504 | TWIN CITIES ARSENAL | OFF | ABAND | ✓ | |
| 206725 | 03L523 | ARSENAL GRAVEL PIT | ON | ABAND | ✓ | |
| 206750 | | SHORE #4 | OFF | MUNI | | |
| 206753 | PJ#506 | TWIN CITIES ARSENAL NO. 6 | ON | | ✓ | |
| 206754 | PJ#501 | TWIN CITIES ARSENAL NO. 1 | ON | P.S. | ✓ | |
| 206755 | PJ#507 | TWIN CITIES ARSENAL NO. 7 | ON | ABAND | ✓ | |
| 206756 | PJ#502 | TWIN CITIES ARSENAL NO. 2 | ON | IND | ✓ | |
| 206758 | PJ#503 | TWIN CITIES ARSENAL NO. 3 | ON | IND | ✓ | |
| 206759 | PJ#508 | TWIN CITIES ARSENAL NO. 8 | ON | ABAND | ✓ | |
| 206760 | 03M509 | | ON | | ✓ | |
| 206760 | PJ#509 | TWIN CITIES ARSENAL NO.9 | ON | DOM | ✓ | |
| 206787 | | MOUNDSVIEW H.S. | OFF | P.S. | | |
| 206789 | | NEW BRIGHTON #1 | OFF | MUNI | ✓ | |
| 206791 | | NEW BRIGHTON #7 | OFF | MUNI | | |
| 206792 | | NEW BRIGHTON #4 | | | | |
| 206793 | | NEW BRIGHTON #3 | OFF | MUNI | | |
| 206794 | | NEW BRIGHTON #9 | OFF | MUNI | | |
| 206795 | | NEW BRIGHTON #8 | OFF | MUNI | | |
| 206796 | | NEW BRIGHTON #5 | OFF | MUNI | | |
| 206797 | | NEW BRIGHTON #6 | OFF | MUNI | | |
| 206798 | | NEW BRIGHTON #2 | OFF | MUNI | ✓ | |
| 223844 | | KURTH MALTING CO EAST WL | OFF | IND | | |
| 223992 | | BOOM ISLAND | OFF | IND | | |
| 225886 | | FRANKLIN STEEL SQUARE | OFF | P.S. | | |
| 225905 | | ST PAUL TERM. WAREHOUSE | OFF | IND | | |
| 225906 | | ST PAUL TERM. WAREHOUSE | OFF | IND | | |
| 231741 | | LABELLE | OFF | UN | | |

**TABLE B-1**
**WELL INDEX**
**SORTED BY UNIQUE NUMBER**

| Minnesota Unique # | IRDMIS # | Other Name(s) | On or Off of OU2 | Well Type | Well Sealed | Second Unique # |
|---|---|---|---|---|---|---|
| 231742 | 04U510 | GRENADE PLANT PROOF RANGES | ON | IND | | |
| 231845 | | MNDOT CIVIL DEFENSE TRAIN. | ON/OFF | P.S. | | |
| 231854 | 03L522 | ARSENAL GRAVEL PIT | ON | ABAND 8/9 | ✓ | |
| 231857 | 03M505 | | | ABAND | ✓ | |
| 231878 | | MENGELKOCH #2 | OFF | UN | | |
| 232067 | | NBR 135 | OFF | UN | | |
| 232069 | | UHIL | OFF | UN | | |
| 233221 | | REUBEN MEAT | OFF | DOM | | |
| 233222 | | LOWRY GROVE TRAILER | OFF | ABAND | ✓ | |
| 233241 | | KOZAH'S MARKET | OFF | UN | ✓ | |
| 233520 | | MCGILLIS | OFF | UN | | |
| 233533 | | ROSELAWN CEMETARY | OFF | IRR | | |
| 233763 | | P. L. MORGAN | OFF | DOM | | |
| 233806 | | 2581 NORTH CLEVELAND | OFF | DOM | | |
| 234135 | 03U001 | S1U3 | ON | MON | | |
| 234136 | 03M001 | S1M3 | ON | MON | | |
| 234137 | 03L001 | S1L3 | ON | MON | | |
| 234138 | 04U001 | S1U4 | ON | MON | | |
| 234139 | 03U002 | S2U3 | ON | MON | | |
| 234140 | 03M002 | S2M3 | ON | MON | | |
| 234141 | 03L002 | S2L3 | ON | MON | | |
| 234142 | 03U003 | S3U3 | ON | MON | | |
| 234143 | 03M003 | S3M3 | ON | MON | | |
| 234144 | 03L003 | S3L3 | ON | MON | | |
| 234145 | 03U004 | S4U3 | ON | MON | | |
| 234146 | 03M004 | S4M3 | ON | MON | | |
| 234147 | 03L004 | S4L3 | ON | MON | | |
| 234148 | 03U005 | S5U3 | ON | MON | | |
| 234149 | 03U006 | S6U3 | ON | MON | ✓ | |
| 234150 | 03U007 | S7U3 | ON | MON | | |
| 234151 | 03M007 | S7M3 | ON | MON | | |
| 234152 | 03L007 | S7L3 | ON | MON | | |
| 234153 | 03U008 | S8U3 | ON | MON | | |
| 234154 | 03U009 | S9U3 | ON | MON | | |
| 234155 | 03U010 | S10U3 | ON | MON | | |
| 234156 | 03M010 | S10M3 | ON | MON | | |
| 234157 | 03L010 | S10L3 | ON | MON | | |
| 234158 | 03U011 | S11U3 | ON | MON | | |
| 234159 | 03U012 | S12U3 | ON | MON | | |
| 234160 | 03M012 | S12M3 | ON | MON | | |
| 234161 | 03L012 | S12L3 | ON | MON | | |
| 234162 | 03U013 | S13U3 | ON | MON | | |
| 234163 | 03M013 | S13M3 | ON | MON | | |
| 234164 | 03L013 | S13L3 | ON | MON | | |
| 234165 | 03U014 | S14U3 | ON | MON | | |
| 234166 | 03U015 | S15U3 | ON | MON | | |
| 234167 | 03U016 | S16U3 | ON | MON | | |
| 234168 | 03U017 | S17U3 | ON | MON | | |
| 234169 | 03M017 | S17M3 | ON | MON | | |

**TABLE B-1**
**WELL INDEX**
**SORTED BY UNIQUE NUMBER**

| Minnesota Unique # | IRDMIS # | Other Name(s) | On or Off of OU2 | Well Type | Well Sealed | Second Unique # |
|---|---|---|---|---|---|---|
| 234170 | 03L017 | S17L3 | ON | MON | | |
| 234171 | 03U018 | S18U3 | ON | MON | | |
| 234172 | 03U019 | S19U3 | ON | MON | | |
| 234173 | 03U020 | S20U3 | ON | MON | | |
| 234174 | 03M020 | S20M3 | ON | MON | | |
| 234175 | 03L020 | S20L3 | ON | MON | | |
| 234176 | 03U021 | S21U3 | ON | MON | | |
| 234193 | 04U003 | S3U4 | ON | MON | | |
| 234194 | 04U002 | S2U4 | ON | MON | | |
| 234195 | 04U007 | S7U4 | ON | MON | | |
| 234196 | 04U012 | S12U4 | ON | MON | | |
| 234197 | 04U020 | S20U4 | ON | MON | | |
| 234198 | 01U004 | S4U1 | ON | MON | ✓ | |
| 234199 | 01U011 | S11U1 | ON | MON | ✓ | |
| 234200 | 01U012 | S12U1 | ON | MON | ✓ | |
| 234201 | 01U022 | S22U1 | ON | MON | ✓ | |
| 234202 | 01U033 | S33U1 | ON | MON | ✓ | |
| 234204 | 01U034 | S34U1 | ON | MON | ✓ | |
| 234205 | 01U035 | S35U1 | ON | TEST | | |
| 234206 | 01U036 | S36U1 | ON | MON | ✓ | |
| 234207 | 01U037 | S37U1 | | MON | ✓ | |
| 234208 | 01U038 | S38U1 | | MON | | |
| 234209 | 01U039 | S39U1 | ON | MON | | |
| 234210 | 01U040 | S40U1 | ON | MON | | |
| 234211 | 01U041 | S41U1 | ON | MON | | |
| 234212 | 01U044 | S44U1 | ON | MON | | |
| 234215 | 01U045 | S45U1 | ON | MON | | |
| 234216 | 01U046 | S46U1 | ON | MON | | |
| 234217 | 01U047 | S47U1 | ON | MON | | |
| 234218 | 01U048 | S48U1 | | MON | | |
| 234221 | 01U050 | S50AU1 | | MON | ✓ | |
| 234222 | 01U051 | S51U1 | ON | MON | ✓ | |
| 234223 | 01U052 | S52U1 | ON | MON | | |
| 234225 | 01U053 | S53AU1 | ON | MON | ✓ | |
| 234227 | 01U054 | S54AU1 | | MON | ✓ | |
| 234235 | 01U060 | S60U1 | ON | MON | | |
| 234237 | 01U062 | S62U1 | ON | MON | ✓ | |
| 234239 | 01U063 | S63U1 | ON | MON | | |
| 234240 | 01U064 | S64U1 | ON | MON | | |
| 234241 | 01U065 | S65U1 | ON | MON | | |
| 234243 | 01U067 | S67U1 | ON | MON | | |
| 234250 | 01U072 | S72AU1 | ON | MON | | |
| 234301 | | DEWITT | OFF | UN | ✓ | |
| 234305 | | GLENN BEGGIN | OFF | UN | | |
| 234319 | | HIDE & TALLOW #1 | OFF | UN | | |
| 234327 | | BRESKE | OFF | UN | | |
| 234335 | | MENGELKOCH #1 | OFF | UN | | |
| 234337 | | MENGELKOCH #3 | OFF | UN | ✓ | |
| 234350 | | GORDON | OFF | UN | | |

**TABLE B-1**
**WELL INDEX**
**SORTED BY UNIQUE NUMBER**

| Minnesota Unique # | IRDMIS # | Other Name(s) | On or Off of OU2 | Well Type | Well Sealed | Second Unique # |
|---|---|---|---|---|---|---|
| 234351 | | YEMPA | OFF | UN | | |
| 234352 | | 1206 12TH AV NW | OFF | UN | ✓ | |
| 234353 | | LENTSCH'S ICE WK. | OFF | UN | | |
| 234355 | | KINGDOM HALL | OFF | UN | | |
| 234356 | | NORDQUIST P43 | OFF | UN | | |
| 234357 | | PHILLIPS PET P46 | OFF | UN | | |
| 234386 | | ZELL OLS. | OFF | UN | | |
| 234391 | | SHERER L. | OFF | UN | | |
| 234396 | | DEWITT | OFF | UN | ✓ | |
| 234406 | | KLAPP | OFF | UN | ✓ | |
| 234409 | | HIDE & TALLOW | OFF | UN | | |
| 234425 | | KEN GEREBI | OFF | UN | ✓ | |
| 234430 | | CMIEL | OFF | UN | ✓ | |
| 234431 | | HARSTAD | OFF | UN | | |
| 234463 | | KEN SOLIE | OFF | UN | | |
| 234546 | | HONEYWELL RIDGEWAY | OFF | UN | | |
| 234547 | | HONEYWELL RIDGEWAY | OFF | UN | | |
| 234549 | | REINER | OFF | IRR | | |
| 235539 | | OLD HOTEL | OFF | UN | | |
| 235557 | | HIDDEN FALLS PARK W.WELL | OFF | P.S. | | |
| 235565 | PJ#074 | S74PJ | | MON | ✓ | |
| 235619 | | SHRINERS HOSPITAL | OFF | P.S. | | |
| 235735 | | FLOUR CITY ARCHITECTURAL | OFF | COM | | |
| 235748 | 03L014 | S14L3 | ON | MON | | |
| 235749 | 03L018 | S18L3 | ON | MON | | |
| 235750 | 03L021 | S21L3 | ON | MON | | |
| 235751 | 03L027 | S27L3 | ON | MON | | |
| 235752 | 03L028 | S28L3 | | MON | | |
| 235753 | 03L029 | S29L3 | | MON | | 236066 |
| 236066 | 03U094 | S94U3 | ON | MON | | |
| 236067 | 03L091 | S91L3 | ON | MON | ✓ | |
| 236068 | 03L086 | S86L3 | ON | MON | ✓ | |
| 236069 | 03U084 | S84U3 | ON | MON | | |
| 236070 | 03L081 | S81L3 | ON | MON | | |
| 236071 | 03L080 | S80L3 | ON | MON | | |
| 236072 | 03U079 | S79U3 | ON | MON | | |
| 236073 | 03U078 | S78U3 | ON | MON | | |
| 236074 | 03L078 | S78L3 | ON | MON | | |
| 236075 | 03U077 | S77U3 | ON | MON | | |
| 236076 | 03L077 | S77L3 | ON | MON | | |
| 236077 | 03U076 | S76U3 | ON | MON | | |
| 236078 | 03U075 | S75U3 | ON | MON | | |
| 236079 | 03L005 | S5L3 | ON | MON | | |
| 236080 | 03L113 | WF1L3 | ON | MON | | |
| 236122 | | NWR | OFF | ABAND | | |
| 236176 | 01U003 | S3U1 | ON | MON | ✓ | |
| 236177 | 01U043 | S43AU1 | | MON | | |
| 236178 | 03U022 | S22U3 | | MON | | |
| 236179 | 03U023 | S23U3 | | MON | | |

# TABLE B-1
# WELL INDEX
# SORTED BY UNIQUE NUMBER

| Minnesota Unique # | IRDMIS # | Other Name(s) | On or Off of OU2 | Well Type | Well Sealed | Second Unique # |
|---|---|---|---|---|---|---|
| 236180 | 03U024 | S24U3 | | MON | | |
| 236181 | 03U025 | S25U3 | | MON | | |
| 236182 | 03U026 | S26U3 | ON | MON | | |
| 236183 | 03U027 | S27U3 | | MON | | |
| 236184 | 03U028 | S28U3 | | MON | | |
| 236185 | 03U029 | S29U3 | | MON | | |
| 236186 | 03U030 | S30U3 | | MON | | |
| 236187 | 03U031 | S31U3 | | MON | | |
| 236188 | 03U032 | S32U3 | | MON | | |
| 236189 | 01U601 | OW101U1 | ON | MON | | |
| 236190 | 01U602 | OW102U1 | ON | MON | | |
| 236191 | 01U603 | OW103U1 | ON | MON | | |
| 236192 | 01U604 | OW104U1 | ON | MON | | |
| 236193 | 01U605 | OW10571 | ON | MON | | |
| 236194 | 01U524 | FA4U1 | ON | PIEZ. | ✓ | |
| 236195 | 01U527 | FV8U1 | ON | PIEZ. | ✓ | |
| 236196 | 01U525 | FW5U1 | ON | PIEZ. | ✓ | |
| 236197 | 01U526 | FV12U1 | ON | PIEZ. | ✓ | |
| 236437 | PJ#802 | T2PJ | OFF | MON | | 421437 |
| 236449 | 03U801 | T1U3 | OFF | MON | | |
| 236450 | 04U802 | T2U4 | OFF | MON | | |
| 236452 | 01U803 | T3U1 | OFF | TEST | ✓ | 424053 |
| 236453 | 03U803 | T3U3 | OFF | MON | | 421434 |
| 236455 | 03U804 | T4U3 | OFF | MON | | 421433 |
| 236457 | 01U805 | T5U1 | OFF | MON | ✓ | 424060 |
| 236458 | 03U805 | T5U3 | OFF | MON | | 421432 |
| 236460 | 01U806 | T6U1 | OFF | MON | ✓ | 424058 |
| 236461 | 03U806 | T6U3 | OFF | MON | | 421431 |
| 236462 | 03M806 | T6M3 | OFF | MON | | 421430 |
| 236463 | 03L806 | T6L3 | OFF | MON | | 421429 |
| 236464 | 04U806 | T6U4 | OFF | MON | | 421428 |
| 236465 | PJ#806 | T6PJ | OFF | MON | | 421427 |
| 236468 | PJ#003 | S3PJ | ON | MON | | |
| 236469 | PJ#027 | S27PJ | ON | MON | | |
| 236471 | 01U807 | T7U1 | OFF | TEST | ✓ | 424059 |
| 236476 | 03U082 | S82U3 | ON | MON | | |
| 236478 | 03U083 | S83U3 | ON | MON | | |
| 236479 | 01U085 | S85U1 | ON | MON | | |
| 236480 | 03U087 | S87U3 | ON | MON | | |
| 236482 | 03U088 | S88U3 | ON | MON | | |
| 236483 | 03U089 | S89U3 | ON | MON | | |
| 236485 | 03U090 | S90U3 | ON | MON | | |
| 236487 | 03U092 | S92U3 | ON | MON | | |
| 236489 | 03U093 | S93U3 | ON | MON | | |
| 236491 | 03U096 | S96U3 | ON | MON | | |
| 236493 | 03U097 | S97U3 | ON | MON | | |
| 236494 | 01U098 | S98U1 | ON | MON | ✓ | |
| 236495 | 03U099 | S99U3 | ON | MON | | |
| 236497 | 01U100 | S100U1 | ON | MON | ✓ | |

**TABLE B-1**
**WELL INDEX**
**SORTED BY UNIQUE NUMBER**

| Minnesota Unique # | IRDMIS # | Other Name(s) | On or Off of OU2 | Well Type | Well Sealed | Second Unique # |
|---|---|---|---|---|---|---|
| 236498 | 01U101 | S101U1 | ON | MON | ✓ | |
| 236499 | 01U102 | S102U1 | ON | MON | | |
| 236500 | 01U103 | S103U1 | ON | MON | | |
| 236501 | 01U104 | S104U1 | ON | MON | | |
| 236502 | 01U105 | S105U1 | ON | MON | | |
| 236503 | 01U106 | S106U1 | ON | MON | | |
| 236504 | 01U107 | S107U1 | ON | MON | | |
| 236505 | 01U108 | S108U1 | ON | MON | | |
| 236506 | 01U109 | S109U1 | ON | MON | ✓ | |
| 236507 | 01U110 | S11OU1 | ON | MON | | |
| 236508 | 03U111 | S111U3 | ON | MON | | |
| 236510 | 03U112 | S112U3 | ON | MON | | |
| 242124 | 03U113 | WF1U3 | ON | MON | | |
| 242125 | 03U114 | WF2U3 | ON | MON | | |
| 242127 | 01U607 | OW107U1 | ON | MON | | |
| 242128 | 01U608 | OW108U1 | ON | MON | | |
| 242129 | 01U609 | OW109U1 | ON | MON | | |
| 242130 | 01U610 | OW110U1 | ON | MON | | |
| 242131 | 01U611 | OW111U1 | ON | MON | | |
| 242132 | 03U647 | OW517U3 | ON | MON | | |
| 242133 | 03U648 | OW518U3 | ON | MON | | |
| 242134 | 01U652 | OW522U1 | ON | MON | ✓ | |
| 242135 | 01U666 | OW536U1 | ON | MON | | |
| 242136 | 01U667 | OW537U1 | ON | MON | | |
| 242137 | 01U668 | OW538U1 | ON | MON | | |
| 242138 | 04U027 | S27U4 | | MON | | |
| 242153 | 01U813 | H3U1 | OFF | MON | ✓ | |
| 242160 | 03L079 | S79L3 | ON | MON | | |
| 242162 | | 301PB | OFF | UN | | |
| 242182 | 01U624A | BP185A | ON | PIEZ | | |
| 242183 | 01U624B | BP185B | ON | PIEZ | | |
| 242184 | 01U624C | BP185C | ON | PIEZ | | |
| 242185 | 01U624D | BP185D | ON | PIEZ | | |
| 242186 | 01U625A | BP285A | ON | PIEZ | | |
| 242187 | 01U625B | BP285B | ON | PIEZ | | |
| 242188 | 01U625C | BP285C | ON | PIEZ | | |
| 242189 | 01U625D | BP285D | ON | PIEZ | | |
| 242190 | 01U626A | BP385A | ON | PIEZ | | |
| 242191 | 01U626B | BP385B | ON | PIEZ | | |
| 242192 | 01U626C | BP385C | ON | PIEZ | | |
| 242193 | 01U626D | BP385D | ON | PIEZ | | |
| 242194 | 01U627A | BP485A | ON | PIEZ | | |
| 242195 | 01U627B | BP485B | ON | PIEZ | | |
| 242196 | 01U627C | BP485C | ON | PIEZ | | |
| 242197 | 01U627D | BP485D | ON | PIEZ | | |
| 242198 | 01U628A | BP585A | ON | PIEZ | | |
| 242199 | 01U628B | BP585B | ON | PIEZ | | |
| 242200 | 01U628C | BP585C | ON | PIEZ | | |
| 242201 | 01U628D | BP585D | ON | PIEZ | | |

**TABLE B-1**
**WELL INDEX**
**SORTED BY UNIQUE NUMBER**

| Minnesota Unique # | IRDMIS # | Other Name(s) | On or Off of OU2 | Well Type | Well Sealed | Second Unique # |
|---|---|---|---|---|---|---|
| 242207 | | SUNSET MEMORIAL CEMETARY | OFF | UN | | |
| 249152 | | BOYLE | OFF | DOM | | |
| 265735 | | FLOUR CITY ARCH | OFF | UN | | |
| 322664 | | ABBOTT NW HOSP | OFF | UN | | |
| 405651 | | METAL-MATIC INC. | OFF | IND | | |
| 406198 | 04U851 | 311U4 | OFF | MON | | |
| 409546 | | PCA2L3 | OFF | TEST | ✓ | |
| 409547 | | PCA1U4 | OFF | TEST | | |
| 409548 | | PCA2U4 | OFF | TEST | | |
| 409549 | | PCA3U4 | OFF | TEST | | |
| 409550 | | PCA6U3 | OFF | TEST | | |
| 409555 | | PCA5U4 | OFF | TEST | | |
| 409556 | | PCA4L3 | OFF | TEST | | |
| 409557 | | PCA1L3 | OFF | TEST | | |
| 409595 | | B109U3 | OFF | ABAND | | |
| 409596 | | B118U3 | OFF | MON | ✓ | |
| 409597 | | B118L3 | OFF | IND | ✓ | |
| 409598 | | B117U3 | OFF | ABAND | | |
| 416051 | 03M848 | 308M3 | OFF | MON | | |
| 416078 | 04U848 | 308U4 | OFF | TEST | | |
| 416080 | 04U852 | 312U4 | OFF | MON | | |
| 416081 | 03L858 | 318L3 | OFF | MON | ✓ | |
| 416082 | 04U849 | 309U4 | OFF | MON | | |
| 416143 | | | OFF | ABAND | | |
| 416198 | | 311U4 | OFF | MON | | |
| 416199 | 03L848 | 308L3 | OFF | MON | | |
| 416200 | 04U850 | 310U4 | OFF | MON | | |
| 420713 | | HERBST LANDFILL | OFF | MON | | |
| 421425 | 03U659 | OW529U3 | ON | MON | | |
| 421426 | 03U658 | OW528U3 | ON | MON | | |
| 421438 | 03U671 | PO-1 | ON | MON | | |
| 421440 | 03U672 | PD2U3 | OFF | MON | | |
| 421441 | 03U673 | PD3U3 | OFF | MON | | |
| 424052 | 01L822 | NW2L1 | OFF | TEST | ✓ | |
| 424054 | 01L821 | NW1L1 | OFF | TEST | ✓ | |
| 424055 | 01L811 | H1L1; MDNR Well | OFF | TEST | | |
| 424056 | 01L816 | H6L1 | OFF | ABAND | ✓ | |
| 424057 | 01U808 | T8U1 | ON | MON | ✓ | |
| 424061 | 01L823 | NW3L1 | OFF | TEST | ✓ | |
| 424062 | 01L813 | H3L1 | OFF | TEST | ✓ | |
| 426808 | 03U811 | H1U3 | OFF | TEST | | |
| 426809 | 03L811 | H1L3 | OFF | TEST | | |
| 426810 | 03U821 | NW1U3 | OFF | TEST | | |
| 426811 | 04U821 | NW1U4 | OFF | TEST | | |
| 426812 | 03U822 | NW2U3 | OFF | TEST | | |
| 426813 | 03L822 | NW2L3 | OFF | TEST | | |
| 426814 | 03U824 | NW4U3 | OFF | TEST | ✓ | |
| 426815 | 03L673 | PD3L3 | OFF | TEST | | |
| 426816 | 03L813 | H3L3 | OFF | TEST | ✓ | |

# TABLE B-1
# WELL INDEX
# SORTED BY UNIQUE NUMBER

| Minnesota Unique # | IRDMIS # | Other Name(s) | On or Off of OU2 | Well Type | Well Sealed | Second Unique # |
|---|---|---|---|---|---|---|
| 426817 | 03L802 | T2L3 | OFF | TEST | | |
| 426818 | 03M802 | T2M3 | OFF | TEST | | |
| 426842 | 03F302 | B1 | ON | REM | | |
| 426843 | 03F303 | B2 | ON | REM | | |
| 426844 | 03F304 | B3 | ON | REM | | |
| 426845 | 03F305 | B4 | ON | REM | | |
| 426846 | 03F306 | B5 | ON | REM | | |
| 426847 | 03F307 | B6 | ON | REM | | |
| 426848 | 03U701 | 701U3 | ON | MON | | |
| 426849 | 04U701 | 701U4 | ON | MON | | |
| 426850 | 03U702 | 702U3 | ON | MON | | |
| 426851 | 04U841 | 301U4 | OFF | TEST | | |
| 426852 | 03M843 | 303M3 | OFF | TEST | | |
| 426853 | 04U843 | 303U4 | OFF | TEST | | |
| 426854 | 04U844 | 304U4 | OFF | TEST | | |
| 426855 | 04U845 | 305U4 | OFF | MON | | |
| 426856 | 04U846 | 306U4 | OFF | MON | | |
| 426857 | 04U847 | 307U4 | OFF | MON | | |
| 426858 | 03L853 | 313L3 | OFF | MON | | |
| 426859 | 03L854 | 314L3 | OFF | MON | | |
| 426860 | 04U855 | 315U4 | OFF | MON | | |
| 426861 | 03L856 | 316L3 | OFF | MON | ✓ | |
| 426862 | 03U815 | H5U3 | OFF | TEST | ✓ | |
| 426863 | 03U831 | OM1U3 | OFF | TEST | ✓ | |
| 426864 | 03U832 | OM2U3 | OFF | TEST | ✓ | |
| 426865 | 03L832 | OM2L3 | OFF | TEST | | |
| 426866 | 04U832 | OM2U4 | OFF | TEST | | |
| 426867 | 04U673 | PD3U4 | OFF | TEST | | |
| 426868 | 03L809 | T9L3 | OFF | MON | | |
| 426876 | 04U702 | 702U4 | ON | MON | | |
| 426877 | 04U077 | ST77U4 | ON | MON | | |
| 426878 | 03U703 | 703U3 | | MON | | |
| 426879 | 03U708 | 708U3 | ON | MON | | |
| 426880 | 04U708 | 708U4 | ON | MON | | |
| 426881 | 03U709 | 709U3 | ON | MON | | |
| 426882 | 04U709 | 709U4 | ON | MON | | |
| 426883 | 03U704 | 704U3 | ON | MON | | |
| 426884 | 03U705 | 705U3 | ON | MON | | |
| 426885 | 03U706 | 706U3 | ON | MON | | |
| 426886 | 03U707 | 707U3 | ON | MON | | |
| 427410 | 01U120 | | ON | MON | | |
| 427411 | 01U115 | | ON | MON | | |
| 427412 | 01U116 | | ON | MON | | |
| 427413 | 01U117 | | ON | MON | | |
| 427414 | 01U118 | | ON | MON | | |
| 427415 | 01U119 | | ON | MON | | |
| 434031 | 04U711 | 711U4 | OFF | MON | | |
| 434032 | 03U710 | 71OU3 | ON | MON | | |
| 434033 | 03U711 | 711U3 | OFF | MON | | |

**TABLE B-1**
**WELL INDEX**
**SORTED BY UNIQUE NUMBER**

| Minnesota Unique # | IRDMIS # | Other Name(s) | On or Off of OU2 | Well Type | Well Sealed | Second Unique # |
|---|---|---|---|---|---|---|
| 434034 | 04U861 | 321U4 | OFF | MON | | |
| 434035 | 04U860 | 320U4 | OFF | MON | | |
| 434036 | 04U859 | 319U4 | OFF | MON | | |
| 434037 | 03L841 | 301L3 | OFF | MON | | |
| 434038 | 03L860 | 320L3 | OFF | MON | | |
| 434039 | 03L861 | 321L3 | OFF | MON | ✓ | |
| 434040 | 03L859 | 319L3 | OFF | MON | | |
| 439701 | 04U854 | 314U4 | OFF | MON | | |
| 440884 | 03U121 | | ON | MON | | |
| 440885 | 03M005 | ST-5-M3 | ON | MON | | |
| 440886 | 03U129 | | ON | MON | | |
| 440887 | 03L084 | ST84L3 | ON | MON | | |
| 440888 | 01U122 | | ON | MON | ✓ | |
| 440889 | 01U125 | | ON | MON | | |
| 440890 | 01U126 | | ON | MON | | |
| 440891 | 01U127 | | ON | MON | | |
| 440892 | 01U128 | | ON | MON | | |
| 440893 | 01U133 | | ON | MON | | |
| 440894 | 01U134 | | OFF | MON | | |
| 440895 | 01U130 | | ON | MON | ✓ | |
| 440896 | 03U124 | | ON | MON | ✓ | |
| 447889 | 04U871 | 401U4 | OFF | MON | | |
| 447890 | 04U882 | 412U4 | OFF | MON | | |
| 447891 | 04U881 | 411U4 | OFF | MON | | |
| 447892 | 04U883 | 413U4 | OFF | MON | | |
| 447893 | 01U350 | | ON | MON | | |
| 447894 | PJ#318 | 318U4 | OFF | MON | | |
| 447895 | 04U880 | 410U4 | OFF | MON | | |
| 447896 | 04U877 | 407U4 | OFF | MON | | |
| 447898 | 04U875 | 405U4 | OFF | MON | | |
| 447899 | 03L846 | 306L3 | OFF | MON | | |
| 447900 | 04U879 | 409U4 | OFF | MON | | |
| 447988 | 04U872 | 402U4 | OFF | MON | | |
| 447998 | 01U135 | | ON | MON | | |
| 447999 | 01U136 | | ON | MON | | |
| 453821 | 03U317 | SC-5 | ON | REM | | |
| 453822 | 03U316 | SC-4 | ON | REM | | |
| 453823 | 03F308 | B7 | ON | REM | | |
| 453824 | 03F312 | B11 | ON | REM | | |
| 453825 | PJ#309 | B8 | ON | REM | | |
| 453826 | PJ#310 | B9 | ON | REM | | |
| 453827 | PJ#311 | B10 | ON | REM | | |
| 453828 | PJ#313 | B12 | ON | REM | | |
| 453829 | 04J708 | | ON | MON | | |
| 453830 | 04J713 | | ON | MON | | |
| 453831 | 03M713 | | ON | MON | | |
| 453832 | 04U714 | | ON | MON | | |
| 453833 | 03U715 | SM1 | ON | MON | | |
| 453834 | 03U716 | SM2 | ON | MON | | |

# TABLE B-1
# WELL INDEX
# SORTED BY UNIQUE NUMBER

| Minnesota Unique # | IRDMIS # | Other Name(s) | On or Off of OU2 | Well Type | Well Sealed | Second Unique # |
|---|---|---|---|---|---|---|
| 471394 | 04U863 | 323U4 | OFF | MON | | |
| 476387 | | MW15H | OFF | MON | | |
| 482083 | | K04-MW | ON | MON | | |
| 482084 | | K02-MW | ON | MON | | |
| 482085 | | K01-MW | ON | MON | | |
| 482086 | | I01-MW | ON | MON | | |
| 482087 | | I05-MW | ON | MON | | |
| 482088 | | I02-MW | ON | MON | | |
| 482089 | | I04-MW | ON | MON | | |
| 482090 | | I03-MW | ON | MON | | |
| 482707 | 04J882 | | OFF | MON | | |
| 482708 | 04J835 | | OFF | MON | | |
| 482709 | 04J834 | | OFF | MON | | |
| 500691 | 04U414 | 414U4/EZ SELF SERVICE | OFF | MON | | |
| 500694 | 03L137 | | ON | MON | ✓ | |
| 505189 | 01U137 | | ON | MON | | |
| 505190 | 01U138 | | ON | MON | | |
| 505191 | 01U139 | | ON | MON | | |
| 505192 | 01U140 | | ON | MON | | |
| 505193 | 01U141 | | ON | MON | | |
| 505209 | 01U902 | | OFF | MON | | |
| 505210 | 01U901 | H3U1 | OFF | MON | | |
| 505618 | 03L138 | | ON | MON | ✓ | |
| 508115 | 04U322 | 322U4 | OFF | MON | | |
| 508117 | 04J702 | | ON | MON | | |
| 508118 | 04J077 | | ON | MON | | |
| 508119 | 04U713 | | ON | MON | | |
| 508120 | 04J714 | | ON | MON | | |
| 508122 | 03U314 | SC-2 | ON | REM | | |
| 509083 | | NEW BRIGHTON #11 | OFF | MUNI | | |
| 512761 | | GROSS GOLF #2 | OFF | IRR | | |
| 519288 | | E101-MW | ON | MON | | |
| 519289 | | E102-MW | ON | MON | | |
| 519290 | | E103-MW | ON | MON | | |
| 519291 | | 129-1501-MW | ON | MON | ✓ | |
| 519836 | 04U834 | | OFF | MON | | |
| 519956 | 03L833 | | OFF | MON | | |
| 519957 | 04U833 | | OFF | MON | | |
| 520931 | | NEW BRIGHTON #13 | OFF | MUNI | | |
| 524047 | 04U865 | 325U4 | OFF | MON | | |
| 524048 | 04J866 | 326J | OFF | MON | | |
| 524049 | 04U866 | 326U4 | OFF | MON | | |
| 524050 | 04U864 | 324U4 | OFF | MON | | |
| 524051 | 04J864 | 324J | OFF | MON | | |
| 538039 | 01U145 | | ON | PIEZ. | | |
| 538040 | 01U146 | | ON | PIEZ. | | |
| 538041 | 01U147 | | ON | PIEZ. | | |
| 538042 | 01U148 | | ON | PIEZ. | | |
| 538043 | 01U149 | | ON | PIEZ. | | |

# TABLE B-1
# WELL INDEX
# SORTED BY UNIQUE NUMBER

| Minnesota Unique # | IRDMIS # | Other Name(s) | On or Off of OU2 | Well Type | Well Sealed | Second Unique # |
|---|---|---|---|---|---|---|
| 538044 | 01U150 | | ON | PIEZ. | | |
| 538045 | 01U151 | | ON | PIEZ. | | |
| 538046 | 01U152 | | ON | PIEZ. | | |
| 538047 | 01U153 | | ON | PIEZ. | | |
| 538048 | 01U154 | | ON | PIEZ. | | |
| 538049 | 01U155 | | ON | PIEZ. | | |
| 538050 | 01U156 | | ON | PIEZ. | | |
| 538051 | 01U351 | EW1 | ON | REM | | |
| 538052 | 01U352 | EW2 | ON | REM | | |
| 538053 | 01U353 | EW3 | ON | REM | | |
| 538054 | 01U354 | EW4 | ON | REM | | |
| 538055 | 01U355 | EW5 | ON | REM | | |
| 538056 | 01U356 | EW6 | ON | REM | | |
| 538057 | 01U357 | EW7 | ON | REM | | |
| 538058 | 01U358 | EW8 | ON | REM | | |
| 538059 | 01U904 | | OFF | MON | | |
| 538060 | 01U903 | | OFF | MON | | |
| 538062 | 01U157 | | ON | MON | | |
| 538063 | 01U158 | | ON | MON | | |
| 554216 | | NEW BRIGHTON #14 | OFF | MUNI | | |
| 582628 | | NEW BRIGHTON #15 | OFF | MUNI | | |
| 589650 | | CM1MW | ON | MON | | |
| 596628 | 04U836 | MW-1 | OFF | MON | | |
| 596629 | 04J836 | MW-2 | OFF | MON | | |
| 596630 | 04U837 | MW-3 | OFF | MON | | |
| 596631 | 04J837 | MW-4 | OFF | MON | | |
| 596632 | 04U838 | MW-5 | OFF | MON | | |
| 596633 | 04J838 | MW-6 | OFF | MON | | |
| 596634 | 04U839 | MW-7 | OFF | MON | | |
| 596635 | 04J839 | MW-8 | OFF | MON | | |
| 616601 | | CM2MW | ON | MON | | |
| 616602 | | CM3MW | ON | MON | | |
| 624019 | | CM5MW | ON | MON | | |
| 643379 | | | ON | PIEZ. | ✓ | |
| 643380 | | | ON | PIEZ. | ✓ | |
| 643381 | | | ON | PIEZ. | ✓ | |
| 643382 | | | ON | PIEZ. | ✓ | |
| 653903 | | GR1-1 | ON | MON | | |
| 653904 | | GR1-2 | ON | MON | | |
| 653905 | | GR2-1 | ON | MON | | |
| 675976 | | GR-DF1 | ON | MON | | |
| 687112 | 03F319 | B13 | ON | REM | | |
| 706043 | 04J822 | | OFF | MON | | |
| 706044 | 04J849 | | OFF | MON | | |
| 706045 | 04J947 | | OFF | MON | | |
| | 01U131 | | | | ✓ | |
| | 01U132 | | | | | |
| | 01U142 | | | | ✓ | |
| | 01U143 | | | | ✓ | |

# TABLE B-1
# WELL INDEX
# SORTED BY UNIQUE NUMBER

| Minnesota Unique # | IRDMIS # | Other Name(s) | On or Off of OU2 | Well Type | Well Sealed | Second Unique # |
|---|---|---|---|---|---|---|
| | 01U144 | | | | ✓ | |
| | 01U653 | | | MON | | |
| | 01U675 | | | | ✓ | |
| | 03L306 | | ON | MON | | |
| | 03L843 | 303L3 | OFF | MON | | |
| | 03U301 | SC-1 | ON | REM | | |
| | 03U315 | SC-3 | | REM | | |
| | 03U674 | OW541U3 | ON | MON | | |
| | 03U675 | | | | | |
| | 03U676 | OW543U3 | ON | MON | | |
| | 04U842 | | | MON | | |
| | PJ#006 | | ON | MON | | |
| | | MW15D | OFF | MON | | |
| | | MW15S | OFF | MON | | |

**TABLE B-2**
**WELL INDEX**
**SORTED BY IRDMIS NUMBER**

| Minnesota Unique # | IRDMIS # | Other Name(s) | On or Off of OU2 | Well Type | Well Sealed | Second Unique # |
|---|---|---|---|---|---|---|
| 424055 | 01L811 | H1L1; MDNR Well | OFF | TEST | | |
| 424062 | 01L813 | H3L1 | OFF | TEST | ✓ | |
| 424056 | 01L816 | H6L1 | OFF | ABAND | ✓ | |
| 424054 | 01L821 | NW1L1 | OFF | TEST | ✓ | |
| 424052 | 01L822 | NW2L1 | OFF | TEST | ✓ | |
| 424061 | 01L823 | NW3L1 | OFF | TEST | ✓ | |
| 236176 | 01U003 | S3U1 | ON | MON | ✓ | |
| 234198 | 01U004 | S4U1 | ON | MON | ✓ | |
| 234199 | 01U011 | S11U1 | ON | MON | ✓ | |
| 234200 | 01U012 | S12U1 | ON | MON | ✓ | |
| 234201 | 01U022 | S22U1 | ON | MON | ✓ | |
| 234202 | 01U033 | S33U1 | ON | MON | ✓ | |
| 234204 | 01U034 | S34U1 | ON | MON | ✓ | |
| 234205 | 01U035 | S35U1 | ON | TEST | | |
| 234206 | 01U036 | S36U1 | ON | MON | ✓ | |
| 234207 | 01U037 | S37U1 | | MON | ✓ | |
| 234208 | 01U038 | S38U1 | | MON | | |
| 234209 | 01U039 | S39U1 | ON | MON | | |
| 234210 | 01U040 | S40U1 | ON | MON | | |
| 234211 | 01U041 | S41U1 | ON | MON | | |
| 236177 | 01U043 | S43AU1 | | MON | | |
| 234212 | 01U044 | S44U1 | ON | MON | | |
| 234215 | 01U045 | S45U1 | ON | MON | | |
| 234216 | 01U046 | S46U1 | ON | MON | | |
| 234217 | 01U047 | S47U1 | ON | MON | | |
| 234218 | 01U048 | S48U1 | | MON | | |
| 234221 | 01U050 | S50AU1 | | MON | ✓ | |
| 234222 | 01U051 | S51U1 | ON | MON | ✓ | |
| 234223 | 01U052 | S52U1 | ON | MON | | |
| 234225 | 01U053 | S53AU1 | ON | MON | ✓ | |
| 234227 | 01U054 | S54AU1 | | MON | ✓ | |
| 234235 | 01U060 | S60U1 | ON | MON | | |
| 234237 | 01U062 | S62U1 | ON | MON | ✓ | |
| 234239 | 01U063 | S63U1 | ON | MON | | |
| 234240 | 01U064 | S64U1 | ON | MON | | |
| 234241 | 01U065 | S65U1 | ON | MON | | |
| 234243 | 01U067 | S67U1 | ON | MON | | |
| 234250 | 01U072 | S72AU1 | ON | MON | | |
| 236479 | 01U085 | S85U1 | ON | MON | | |
| 236494 | 01U098 | S98U1 | ON | MON | ✓ | |
| 236497 | 01U100 | S100U1 | ON | MON | ✓ | |
| 236498 | 01U101 | S101U1 | ON | MON | ✓ | |
| 236499 | 01U102 | S102U1 | ON | MON | | |
| 236500 | 01U103 | S103U1 | ON | MON | | |
| 236501 | 01U104 | S104U1 | ON | MON | | |
| 236502 | 01U105 | S105U1 | ON | MON | | |
| 236503 | 01U106 | S106U1 | ON | MON | | |
| 236504 | 01U107 | S107U1 | ON | MON | | |
| 236505 | 01U108 | S108U1 | ON | MON | | |

# TABLE B-2
# WELL INDEX
# SORTED BY IRDMIS NUMBER

| Minnesota Unique # | IRDMIS # | Other Name(s) | On or Off of OU2 | Well Type | Well Sealed | Second Unique # |
|---|---|---|---|---|---|---|
| 236506 | 01U109 | S109U1 | ON | MON | ✓ | |
| 236507 | 01U110 | S11OU1 | ON | MON | | |
| 427411 | 01U115 | | ON | MON | | |
| 427412 | 01U116 | | ON | MON | | |
| 427413 | 01U117 | | ON | MON | | |
| 427414 | 01U118 | | ON | MON | | |
| 427415 | 01U119 | | ON | MON | | |
| 427410 | 01U120 | | ON | MON | | |
| 440888 | 01U122 | | ON | MON | ✓ | |
| 440889 | 01U125 | | ON | MON | | |
| 440890 | 01U126 | | ON | MON | | |
| 440891 | 01U127 | | ON | MON | | |
| 440892 | 01U128 | | ON | MON | | |
| 440895 | 01U130 | | ON | MON | ✓ | |
| | 01U131 | | | | ✓ | |
| | 01U132 | | | | | |
| 440893 | 01U133 | | ON | MON | | |
| 440894 | 01U134 | | OFF | MON | | |
| 447998 | 01U135 | | ON | MON | | |
| 447999 | 01U136 | | ON | MON | | |
| 505189 | 01U137 | | ON | MON | | |
| 505190 | 01U138 | | ON | MON | | |
| 505191 | 01U139 | | ON | MON | | |
| 505192 | 01U140 | | ON | MON | | |
| 505193 | 01U141 | | ON | MON | | |
| | 01U142 | | | | ✓ | |
| | 01U143 | | | | ✓ | |
| | 01U144 | | | | ✓ | |
| 538039 | 01U145 | | ON | PIEZ. | | |
| 538040 | 01U146 | | ON | PIEZ. | | |
| 538041 | 01U147 | | ON | PIEZ. | | |
| 538042 | 01U148 | | ON | PIEZ. | | |
| 538043 | 01U149 | | ON | PIEZ. | | |
| 538044 | 01U150 | | ON | PIEZ. | | |
| 538045 | 01U151 | | ON | PIEZ. | | |
| 538046 | 01U152 | | ON | PIEZ. | | |
| 538047 | 01U153 | | ON | PIEZ. | | |
| 538048 | 01U154 | | ON | PIEZ. | | |
| 538049 | 01U155 | | ON | PIEZ. | | |
| 538050 | 01U156 | | ON | PIEZ. | | |
| 538062 | 01U157 | | ON | MON | | |
| 538063 | 01U158 | | ON | MON | | |
| 447893 | 01U350 | | ON | MON | | |
| 538051 | 01U351 | EW1 | ON | REM | | |
| 538052 | 01U352 | EW2 | ON | REM | | |
| 538053 | 01U353 | EW3 | ON | REM | | |
| 538054 | 01U354 | EW4 | ON | REM | | |
| 538055 | 01U355 | EW5 | ON | REM | | |
| 538056 | 01U356 | EW6 | ON | REM | | |

TABLE B-2
WELL INDEX
SORTED BY IRDMIS NUMBER

| Minnesota Unique # | IRDMIS # | Other Name(s) | On or Off of OU2 | Well Type | Well Sealed | Second Unique # |
|---|---|---|---|---|---|---|
| 538057 | 01U357 | EW7 | ON | REM | | |
| 538058 | 01U358 | EW8 | ON | REM | | |
| 236194 | 01U524 | FA4U1 | ON | PIEZ. | ✓ | |
| 236196 | 01U525 | FW5U1 | ON | PIEZ. | ✓ | |
| 236197 | 01U526 | FV12U1 | ON | PIEZ. | ✓ | |
| 236195 | 01U527 | FV8U1 | ON | PIEZ. | ✓ | |
| 236189 | 01U601 | OW101U1 | ON | MON | | |
| 236190 | 01U602 | OW102U1 | ON | MON | | |
| 236191 | 01U603 | OW103U1 | ON | MON | | |
| 236192 | 01U604 | OW104U1 | ON | MON | | |
| 236193 | 01U605 | OW10571 | ON | MON | | |
| 242127 | 01U607 | OW107U1 | ON | MON | | |
| 242128 | 01U608 | OW108U1 | ON | MON | | |
| 242129 | 01U609 | OW109U1 | ON | MON | | |
| 242130 | 01U610 | OW110U1 | ON | MON | | |
| 242131 | 01U611 | OW111U1 | ON | MON | | |
| 194725 | 01U612 | OW112U1 | ON | MON | | 194758 |
| 194726 | 01U613 | | ON | MON | | 194759 |
| 194727 | 01U615 | OW115U1 | ON | MON | | 194760 |
| 194728 | 01U616 | OW116U1 | ON | MON | | 194761 |
| 194729 | 01U617 | OW117U1 | ON | MON | | 194770 |
| 194730 | 01U618 | OW118U1 | ON | MON | | 194771 |
| 194772 | 01U619 | PW119U1 | ON | MON | | |
| 194701 | 01U620 | OW120U1 | ON | MON | | |
| 194702 | 01U621 | PW121U1 | ON | MON | | |
| 194703 | 01U622 | OW122U1 | ON | MON | ✓ | |
| 194704 | 01U623 | OW123U1 | ON | MON | ✓ | |
| 242182 | 01U624A | BP185A | ON | PIEZ | | |
| 242183 | 01U624B | BP185B | ON | PIEZ | | |
| 242184 | 01U624C | BP185C | ON | PIEZ | | |
| 242185 | 01U624D | BP185D | ON | PIEZ | | |
| 242186 | 01U625A | BP285A | ON | PIEZ | | |
| 242187 | 01U625B | BP285B | ON | PIEZ | | |
| 242188 | 01U625C | BP285C | ON | PIEZ | | |
| 242189 | 01U625D | BP285D | ON | PIEZ | | |
| 242190 | 01U626A | BP385A | ON | PIEZ | | |
| 242191 | 01U626B | BP385B | ON | PIEZ | | |
| 242192 | 01U626C | BP385C | ON | PIEZ | | |
| 242193 | 01U626D | BP385D | ON | PIEZ | | |
| 242194 | 01U627A | BP485A | ON | PIEZ | | |
| 242195 | 01U627B | BP485B | ON | PIEZ | | |
| 242196 | 01U627C | BP485C | ON | PIEZ | | |
| 242197 | 01U627D | BP485D | ON | PIEZ | | |
| 242198 | 01U628A | BP585A | ON | PIEZ | | |
| 242199 | 01U628B | BP585B | ON | PIEZ | | |
| 242200 | 01U628C | BP585C | ON | PIEZ | | |
| 242201 | 01U628D | BP585D | ON | PIEZ | | |
| 194720 | 01U631 | OW501U1 | ON | MON | | |
| 194721 | 01U632 | OW502U1 | | MON | | |

**TABLE B-2**
**WELL INDEX**
**SORTED BY IRDMIS NUMBER**

| Minnesota Unique # | IRDMIS # | Other Name(s) | On or Off of OU2 | Well Type | Well Sealed | Second Unique # |
|---|---|---|---|---|---|---|
| 194716 | 01U634 | OW504U1 | ON | MON | ✓ | |
| 194722 | 01U635 | OW505U1 | ON | MON | ✓ | |
| 194723 | 01U636 | OW506U1 | ON | MON. | | |
| 194717 | 01U638 | OW508U1 | | MON | ✓ | |
| 194718 | 01U639 | OW509U1 | ON | MON | | |
| 194719 | 01U640 | OW510U1 | ON | MON | | |
| 194724 | 01U642 | OW512U1 | ON | MON | ✓ | |
| 242134 | 01U652 | OW522U1 | ON | MON | ✓ | |
| | 01U653 | | | MON | | |
| 242135 | 01U666 | OW536U1 | ON | MON | | |
| 242136 | 01U667 | OW537U1 | ON | MON | | |
| 242137 | 01U668 | OW538U1 | ON | MON | | |
| | 01U675 | | | | ✓ | |
| 236452 | 01U803 | T3U1 | OFF | TEST | ✓ | 424053 |
| 236457 | 01U805 | T5U1 | OFF | MON | ✓ | 424060 |
| 236460 | 01U806 | T6U1 | OFF | MON | ✓ | 424058 |
| 236471 | 01U807 | T7U1 | OFF | TEST | ✓ | 424059 |
| 424057 | 01U808 | T8U1 | ON | MON | ✓ | |
| 242153 | 01U813 | H3U1 | OFF | MON | ✓ | |
| 505210 | 01U901 | H3U1 | OFF | MON | | |
| 505209 | 01U902 | | OFF | MON | | |
| 538060 | 01U903 | | OFF | MON | | |
| 538059 | 01U904 | | OFF | MON | | |
| 426842 | 03F302 | B1 | ON | REM | | |
| 426843 | 03F303 | B2 | ON | REM | | |
| 426844 | 03F304 | B3 | ON | REM | | |
| 426845 | 03F305 | B4 | ON | REM | | |
| 426846 | 03F306 | B5 | ON | REM | | |
| 426847 | 03F307 | B6 | ON | REM | | |
| 453823 | 03F308 | B7 | ON | REM | | |
| 453824 | 03F312 | B11 | ON | REM | | |
| 687112 | 03F319 | B13 | ON | REM | | |
| 234137 | 03L001 | S1L3 | ON | MON | | |
| 234141 | 03L002 | S2L3 | ON | MON | | |
| 234144 | 03L003 | S3L3 | ON | MON | | |
| 234147 | 03L004 | S4L3 | ON | MON | | |
| 236079 | 03L005 | S5L3 | ON | MON | | |
| 234152 | 03L007 | S7L3 | ON | MON | | |
| 234157 | 03L010 | S10L3 | ON | MON | | |
| 234161 | 03L012 | S12L3 | ON | MON | | |
| 234164 | 03L013 | S13L3 | ON | MON | | |
| 235748 | 03L014 | S14L3 | ON | MON | | |
| 234170 | 03L017 | S17L3 | ON | MON | | |
| 235749 | 03L018 | S18L3 | ON | MON | | |
| 234175 | 03L020 | S20L3 | ON | MON | | |
| 235750 | 03L021 | S21L3 | ON | MON | | |
| 235751 | 03L027 | S27L3 | ON | MON | | |
| 235752 | 03L028 | S28L3 | | MON | | |
| 235753 | 03L029 | S29L3 | | MON | | 236066 |

**TABLE B-2**
**WELL INDEX**
**SORTED BY IRDMIS NUMBER**

| Minnesota Unique # | IRDMIS # | Other Name(s) | On or Off of OU2 | Well Type | Well Sealed | Second Unique # |
|---|---|---|---|---|---|---|
| 236076 | 03L077 | S77L3 | ON | MON | | |
| 236074 | 03L078 | S78L3 | ON | MON | | |
| 242160 | 03L079 | S79L3 | ON | MON | | |
| 236071 | 03L080 | S80L3 | ON | MON | | |
| 236070 | 03L081 | S81L3 | ON | MON | | |
| 440887 | 03L084 | ST84L3 | ON | MON | | |
| 236068 | 03L086 | S86L3 | ON | MON | ✓ | |
| 236067 | 03L091 | S91L3 | ON | MON | ✓ | |
| 236080 | 03L113 | WF1L3 | ON | MON | | |
| 500694 | 03L137 | | ON | MON | ✓ | |
| 505618 | 03L138 | | ON | MON | ✓ | |
| | 03L306 | | ON | MON | | |
| 231854 | 03L522 | ARSENAL GRAVEL PIT | ON | ABAND | ✓ | |
| 206725 | 03L523 | ARSENAL GRAVEL PIT | ON | ABAND | ✓ | |
| 426815 | 03L673 | PD3L3 | OFF | TEST | | |
| 426817 | 03L802 | T2L3 | OFF | TEST | | |
| 236463 | 03L806 | T6L3 | OFF | MON | | 421429 |
| 426868 | 03L809 | T9L3 | OFF | MON | | |
| 426809 | 03L811 | H1L3 | OFF | TEST | | |
| 426816 | 03L813 | H3L3 | OFF | TEST | ✓ | |
| 426813 | 03L822 | NW2L3 | OFF | TEST | | |
| 426865 | 03L832 | OM2L3 | OFF | TEST | | |
| 519956 | 03L833 | | OFF | MON | | |
| 434037 | 03L841 | 301L3 | OFF | MON | | |
| | 03L843 | 303L3 | OFF | MON | | |
| 447899 | 03L846 | 306L3 | OFF | MON | | |
| 416199 | 03L848 | 308L3 | OFF | MON | | |
| 426858 | 03L853 | 313L3 | OFF | MON | | |
| 426859 | 03L854 | 314L3 | OFF | MON | | |
| 426861 | 03L856 | 316L3 | OFF | MON | ✓ | |
| 416081 | 03L858 | 318L3 | OFF | MON | ✓ | |
| 434040 | 03L859 | 319L3 | OFF | MON | | |
| 434038 | 03L860 | 320L3 | OFF | MON | | |
| 434039 | 03L861 | 321L3 | OFF | MON | ✓ | |
| 234136 | 03M001 | S1M3 | ON | MON | | |
| 234140 | 03M002 | S2M3 | ON | MON | | |
| 234143 | 03M003 | S3M3 | ON | MON | | |
| 234146 | 03M004 | S4M3 | ON | MON | | |
| 440885 | 03M005 | ST-5-M3 | ON | MON | | |
| 234151 | 03M007 | S7M3 | ON | MON | | |
| 234156 | 03M010 | S10M3 | ON | MON | | |
| 234160 | 03M012 | S12M3 | ON | MON | | |
| 234163 | 03M013 | S13M3 | ON | MON | | |
| 234169 | 03M017 | S17M3 | ON | MON | | |
| 234174 | 03M020 | S20M3 | ON | MON | | |
| 231857 | 03M505 | | | ABAND | ✓ | |
| 206760 | 03M509 | | ON | | ✓ | |
| 453831 | 03M713 | | ON | MON | | |
| 426818 | 03M802 | T2M3 | OFF | TEST | | |

**TABLE B-2**
**WELL INDEX**
**SORTED BY IRDMIS NUMBER**

| Minnesota Unique # | IRDMIS # | Other Name(s) | On or Off of OU2 | Well Type | Well Sealed | Second Unique # |
|---|---|---|---|---|---|---|
| 236462 | 03M806 | T6M3 | OFF | MON | | 421430 |
| 426852 | 03M843 | 303M3 | OFF | TEST | | |
| 416051 | 03M848 | 308M3 | OFF | MON | | |
| 234135 | 03U001 | S1U3 | ON | MON | | |
| 234139 | 03U002 | S2U3 | ON | MON | | |
| 234142 | 03U003 | S3U3 | ON | MON | | |
| 234145 | 03U004 | S4U3 | ON | MON | | |
| 234148 | 03U005 | S5U3 | ON | MON | | |
| 234149 | 03U006 | S6U3 | ON | MON | ✓ | |
| 234150 | 03U007 | S7U3 | ON | MON | | |
| 234153 | 03U008 | S8U3 | ON | MON | | |
| 234154 | 03U009 | S9U3 | ON | MON | | |
| 234155 | 03U010 | S10U3 | ON | MON | | |
| 234158 | 03U011 | S11U3 | ON | MON | | |
| 234159 | 03U012 | S12U3 | ON | MON | | |
| 234162 | 03U013 | S13U3 | ON | MON | | |
| 234165 | 03U014 | S14U3 | ON | MON | | |
| 234166 | 03U015 | S15U3 | ON | MON | | |
| 234167 | 03U016 | S16U3 | ON | MON | | |
| 234168 | 03U017 | S17U3 | ON | MON | | |
| 234171 | 03U018 | S18U3 | ON | MON | | |
| 234172 | 03U019 | S19U3 | ON | MON | | |
| 234173 | 03U020 | S20U3 | ON | MON | | |
| 234176 | 03U021 | S21U3 | ON | MON | | |
| 236178 | 03U022 | S22U3 | | MON | | |
| 236179 | 03U023 | S23U3 | | MON | | |
| 236180 | 03U024 | S24U3 | | MON | | |
| 236181 | 03U025 | S25U3 | | MON | | |
| 236182 | 03U026 | S26U3 | ON | MON | | |
| 236183 | 03U027 | S27U3 | | MON | | |
| 236184 | 03U028 | S28U3 | | MON | | |
| 236185 | 03U029 | S29U3 | | MON | | |
| 236186 | 03U030 | S30U3 | | MON | | |
| 236187 | 03U031 | S31U3 | | MON | | |
| 236188 | 03U032 | S32U3 | | MON | | |
| 236078 | 03U075 | S75U3 | ON | MON | | |
| 236077 | 03U076 | S76U3 | ON | MON | | |
| 236075 | 03U077 | S77U3 | ON | MON | | |
| 236073 | 03U078 | S78U3 | ON | MON | | |
| 236072 | 03U079 | S79U3 | ON | MON | | |
| 236476 | 03U082 | S82U3 | ON | MON | | |
| 236478 | 03U083 | S83U3 | ON | MON | | |
| 236069 | 03U084 | S84U3 | ON | MON | | |
| 236480 | 03U087 | S87U3 | ON | MON | | |
| 236482 | 03U088 | S88U3 | ON | MON | | |
| 236483 | 03U089 | S89U3 | ON | MON | | |
| 236485 | 03U090 | S90U3 | ON | MON | | |
| 236487 | 03U092 | S92U3 | ON | MON | | |
| 236489 | 03U093 | S93U3 | ON | MON | | |

**TABLE B-2**
**WELL INDEX**
**SORTED BY IRDMIS NUMBER**

| Minnesota Unique # | IRDMIS # | Other Name(s) | On or Off of OU2 | Well Type | Well Sealed | Second Unique # |
|---|---|---|---|---|---|---|
| 236066 | 03U094 | S94U3 | ON | MON | | |
| 236491 | 03U096 | S96U3 | ON | MON | | |
| 236493 | 03U097 | S97U3 | ON | MON | | |
| 236495 | 03U099 | S99U3 | ON | MON | | |
| 236508 | 03U111 | S111U3 | ON | MON | | |
| 236510 | 03U112 | S112U3 | ON | MON | | |
| 242124 | 03U113 | WF1U3 | ON | MON | | |
| 242125 | 03U114 | WF2U3 | ON | MON | | |
| 440884 | 03U121 | | ON | MON | | |
| 440896 | 03U124 | | ON | MON | ✓ | |
| 440886 | 03U129 | | ON | MON | | |
| | 03U301 | SC-1 | ON | REM | | |
| 508122 | 03U314 | SC-2 | ON | REM | | |
| | 03U315 | SC-3 | | REM | | |
| 453822 | 03U316 | SC-4 | ON | REM | | |
| 453821 | 03U317 | SC-5 | ON | REM | | |
| 114410 | 03U521 | | OFF | MON | | |
| 242132 | 03U647 | OW517U3 | ON | MON | | |
| 242133 | 03U648 | OW518U3 | ON | MON | | |
| 421426 | 03U658 | OW528U3 | ON | MON | | |
| 421425 | 03U659 | OW529U3 | ON | MON | | |
| 421438 | 03U671 | PO-1 | ON | MON | | |
| 421440 | 03U672 | PD2U3 | OFF | MON | | |
| 421441 | 03U673 | PD3U3 | OFF | MON | | |
| | 03U674 | OW541U3 | ON | MON | | |
| | 03U675 | | | | | |
| | 03U676 | OW543U3 | ON | MON | | |
| 426848 | 03U701 | 701U3 | ON | MON | | |
| 426850 | 03U702 | 702U3 | ON | MON | | |
| 426878 | 03U703 | 703U3 | | MON | | |
| 426883 | 03U704 | 704U3 | ON | MON | | |
| 426884 | 03U705 | 705U3 | ON | MON | | |
| 426885 | 03U706 | 706U3 | ON | MON | | |
| 426886 | 03U707 | 707U3 | ON | MON | | |
| 426879 | 03U708 | 708U3 | ON | MON | | |
| 426881 | 03U709 | 709U3 | ON | MON | | |
| 434032 | 03U710 | 71OU3 | ON | MON | | |
| 434033 | 03U711 | 711U3 | OFF | MON | | |
| 453833 | 03U715 | SM1 | ON | MON | | |
| 453834 | 03U716 | SM2 | ON | MON | | |
| 236449 | 03U801 | T1U3 | OFF | MON | | |
| 236453 | 03U803 | T3U3 | OFF | MON | | 421434 |
| 236455 | 03U804 | T4U3 | OFF | MON | | 421433 |
| 236458 | 03U805 | T5U3 | OFF | MON | | 421432 |
| 236461 | 03U806 | T6U3 | OFF | MON | | 421431 |
| 426808 | 03U811 | H1U3 | OFF | TEST | | |
| 426862 | 03U815 | H5U3 | OFF | TEST | ✓ | |
| 426810 | 03U821 | NW1U3 | OFF | TEST | | |
| 426812 | 03U822 | NW2U3 | OFF | TEST | | |

# TABLE B-2
# WELL INDEX
# SORTED BY IRDMIS NUMBER

| Minnesota Unique # | IRDMIS # | Other Name(s) | On or Off of OU2 | Well Type | Well Sealed | Second Unique # |
|---|---|---|---|---|---|---|
| 426814 | 03U824 | NW4U3 | OFF | TEST | ✓ | |
| 426863 | 03U831 | OM1U3 | OFF | TEST | ✓ | |
| 426864 | 03U832 | OM2U3 | OFF | TEST | ✓ | |
| 508118 | 04J077 | | ON | MON | | |
| 508117 | 04J702 | | ON | MON | | |
| 453829 | 04J708 | | ON | MON | | |
| 453830 | 04J713 | | ON | MON | | |
| 706043 | 04J822 | | OFF | MON | | |
| 508120 | 04J714 | | ON | MON | | |
| 482709 | 04J834 | | OFF | MON | | |
| 482708 | 04J835 | | OFF | MON | | |
| 596629 | 04J836 | MW-2 | OFF | MON | | |
| 596631 | 04J837 | MW-4 | OFF | MON | | |
| 596633 | 04J838 | MW-6 | OFF | MON | | |
| 596635 | 04J839 | MW-8 | OFF | MON | | |
| 706045 | 04J847 | | OFF | MON | | |
| 706044 | 04J840 | | OFF | MON | | |
| 524051 | 04J864 | 324J | OFF | MON | | |
| 524048 | 04J866 | 326J | OFF | MON | | |
| 482707 | 04J882 | | OFF | MON | | |
| 234138 | 04U001 | S1U4 | ON | MON | | |
| 234194 | 04U002 | S2U4 | ON | MON | | |
| 234193 | 04U003 | S3U4 | ON | MON | | |
| 234195 | 04U007 | S7U4 | ON | MON | | |
| 234196 | 04U012 | S12U4 | ON | MON | | |
| 234197 | 04U020 | S20U4 | ON | MON | | |
| 242138 | 04U027 | S27U4 | | MON | | |
| 426877 | 04U077 | ST77U4 | ON | MON | | |
| 508115 | 04U322 | 322U4 | OFF | MON | | |
| 500691 | 04U414 | 414U4/EZ SELF SERVICE | OFF | MON | | |
| 231742 | 04U510 | GRENADE PLANT PROOF RANGES | ON | IND | | |
| 426867 | 04U673 | PD3U4 | OFF | TEST | | |
| 426849 | 04U701 | 701U4 | ON | MON | | |
| 426876 | 04U702 | 702U4 | ON | MON | | |
| 426880 | 04U708 | 708U4 | ON | MON | | |
| 426882 | 04U709 | 709U4 | ON | MON | | |
| 434031 | 04U711 | 711U4 | OFF | MON | | |
| 508119 | 04U713 | | ON | MON | | |
| 453832 | 04U714 | | ON | MON | | |
| 236450 | 04U802 | T2U4 | OFF | MON | | |
| 236464 | 04U806 | T6U4 | OFF | MON | | 421428 |
| 426811 | 04U821 | NW1U4 | OFF | TEST | | |
| 426866 | 04U832 | OM2U4 | OFF | TEST | | |
| 519957 | 04U833 | | OFF | MON | | |
| 519836 | 04U834 | | OFF | MON | | |
| 596628 | 04U836 | MW-1 | OFF | MON | | |
| 596630 | 04U837 | MW-3 | OFF | MON | | |
| 596632 | 04U838 | MW-5 | OFF | MON | | |
| 596634 | 04U839 | MW-7 | OFF | MON | | |

# TABLE B-2
# WELL INDEX
# SORTED BY IRDMIS NUMBER

| Minnesota Unique # | IRDMIS # | Other Name(s) | On or Off of OU2 | Well Type | Well Sealed | Second Unique # |
|---|---|---|---|---|---|---|
| 426851 | 04U841 | 301U4 | OFF | TEST | | |
| | 04U842 | | | MON | | |
| 426853 | 04U843 | 303U4 | OFF | TEST | | |
| 426854 | 04U844 | 304U4 | OFF | TEST | | |
| 426855 | 04U845 | 305U4 | OFF | MON | | |
| 426856 | 04U846 | 306U4 | OFF | MON | | |
| 426857 | 04U847 | 307U4 | OFF | MON | | |
| 416078 | 04U848 | 308U4 | OFF | TEST | | |
| 416082 | 04U849 | 309U4 | OFF | MON | | |
| 416200 | 04U850 | 310U4 | OFF | MON | | |
| 406198 | 04U851 | 311U4 | OFF | MON | | |
| 416080 | 04U852 | 312U4 | OFF | MON | | |
| 439701 | 04U854 | 314U4 | OFF | MON | | |
| 426860 | 04U855 | 315U4 | OFF | MON | | |
| 434036 | 04U859 | 319U4 | OFF | MON | | |
| 434035 | 04U860 | 320U4 | OFF | MON | | |
| 434034 | 04U861 | 321U4 | OFF | MON | | |
| 471394 | 04U863 | 323U4 | OFF | MON | | |
| 524050 | 04U864 | 324U4 | OFF | MON | | |
| 524047 | 04U865 | 325U4 | OFF | MON | | |
| 524049 | 04U866 | 326U4 | OFF | MON | | |
| 447889 | 04U871 | 401U4 | OFF | MON | | |
| 447988 | 04U872 | 402U4 | OFF | MON | | |
| 447898 | 04U875 | 405U4 | OFF | MON | | |
| 447896 | 04U877 | 407U4 | OFF | MON | | |
| 447900 | 04U879 | 409U4 | OFF | MON | | |
| 447895 | 04U880 | 410U4 | OFF | MON | | |
| 447891 | 04U881 | 411U4 | OFF | MON | | |
| 447890 | 04U882 | 412U4 | OFF | MON | | |
| 447892 | 04U883 | 413U4 | OFF | MON | | |
| 236468 | PJ#003 | S3PJ | ON | MON | | |
| | PJ#006 | | ON | MON | | |
| 236469 | PJ#027 | S27PJ | ON | MON | | |
| 235565 | PJ#074 | S74PJ | | MON | ✓ | |
| 453825 | PJ#309 | B8 | ON | REM | | |
| 453826 | PJ#310 | B9 | ON | REM | | |
| 453827 | PJ#311 | B10 | ON | REM | | |
| 453828 | PJ#313 | B12 | ON | REM | | |
| 447894 | PJ#318 | 318U4 | OFF | MON | | |
| 206754 | PJ#501 | TWIN CITIES ARSENAL NO. 1 | ON | P.S. | ✓ | |
| 206756 | PJ#502 | TWIN CITIES ARSENAL NO. 2 | ON | IND | ✓ | |
| 206758 | PJ#503 | TWIN CITIES ARSENAL NO. 3 | ON | IND | ✓ | |
| 206724 | PJ#504 | TWIN CITIES ARSENAL | OFF | ABAND | ✓ | |
| 206753 | PJ#506 | TWIN CITIES ARSENAL NO. 6 | ON | | ✓ | |
| 206755 | PJ#507 | TWIN CITIES ARSENAL NO. 7 | ON | ABAND | ✓ | |
| 206759 | PJ#508 | TWIN CITIES ARSENAL NO. 8 | ON | ABAND | ✓ | |
| 206760 | PJ#509 | TWIN CITIES ARSENAL NO.9 | ON | DOM | ✓ | |
| 236437 | PJ#802 | T2PJ | OFF | MON | | 421437 |
| 236465 | PJ#806 | T6PJ | OFF | MON | | 421427 |

**TABLE B-2**
**WELL INDEX**
**SORTED BY IRDMIS NUMBER**

| Minnesota Unique # | IRDMIS # | Other Name(s) | On or Off of OU2 | Well Type | Well Sealed | Second Unique # |
|---|---|---|---|---|---|---|
| 107405 | | ROEBKE | OFF | UN | | |
| 110485 | | NEW BRIGHTON #12 | OFF | MUNI | | |
| 122210 | | ST. PAUL PORT AUTH. #3 | OFF | IND | | |
| 127537 | | MIDWEST ASPHALT | OFF | DOM | | |
| 134318 | | LORENZ W SEUTTER | OFF | DOM | | |
| 139035 | | WATERGATE MARINA | OFF | P.S. | | |
| 151568 | | ARDEN MANOR MOBILE HOME | OFF | P.S. | | |
| 161432 | | NEW BRIGHTON #10 | OFF | MUNI | | |
| 191942 | | 118PDC/MODEL STONE | OFF | MON | ✓ | |
| 200070 | | RUAN TRANSPORT | OFF | COM | ✓ | |
| 200071 | | PRESTRESSED CONCRETE | OFF | IND | ✓ | |
| 200072 | | WITTE TRANSPORTATION | OFF | IND | ✓ | |
| 200073 | | WILSON TRANSFER & STORAGE | OFF | IND | | |
| 200074 | | ASBESTOS PROD | OFF | IND | ✓ | |
| 200075 | | PHILLIPS PETROLEUM | OFF | IND | ✓ | |
| 200076 | | OLD DUTCH FOODS INC | OFF | IND | | |
| 200077 | | JOHN CONLIN | OFF | DOM | ✓ | |
| 200078 | | WILLIAM CLASS | OFF | DOM | | |
| 200079 | | LAWRENCE SCHOENING | OFF | DOM | | |
| 200080 | | CARL A OSTROM & SON | OFF | DOM | | |
| 200081 | | A. O. LIEBIG | OFF | DOM | | |
| 200082 | | 2196 MARION ROAD | OFF | DOM | | |
| 200148 | | PAPER CALMERSON | OFF | IND | ✓ | |
| 200154 | | U OF M GOLF COURSE | OFF | IRR | | |
| 200167 | | KOPPERS COKE #1 | OFF | IND | | |
| 200171 | | PLATING INC | OFF | IND | | |
| 200197 | | SNOW FLAKE DAIRY | OFF | COM | | |
| 200264 | | 1620 CENTRAL | OFF | IND | | |
| 200384 | | METALLURGICAL INC. WELL #1 | OFF | IND | | |
| 200524 | | ST. ANTHONY #5 | OFF | MUNI | | |
| 200525 | | PLETSCHER | OFF | UN | | |
| 200531 | | NAZARETH | OFF | UN | | |
| 200599 | | CEDAR AVE. TRIANGLE | OFF | P.S. | | |
| 200602 | | ATKINSON MILL CO. | OFF | IND | | |
| 200629 | | GENERAL MILLS | OFF | IND | | |
| 200803 | | ST. ANTHONY #4 | OFF | P.S. | | |
| 200804 | | ST. ANTHONY #3 | OFF | MUNI | | |
| 200812 | | GROSS GOLF COURSE #1 | OFF | COM | | |
| 200814 | | AMERICAN LINEN | OFF | IND | | |
| 201074 | | GLEASSON MORTUARY | OFF | COM | | |
| 201082 | | NORTHWESTERN HOSPITAL | OFF | P.S. | | |
| 206669 | | FRIDLEY #8 | OFF | MUNI | | |
| 206672 | | FRIDLEY #9 | OFF | MUNI | | |
| 206673 | | FRIDLEY #6 | OFF | MUNI | | |
| 206688 | | CLOVERPOND WELL | OFF | DOM | | |
| 206689 | | JAMES K. O'NEIL | OFF | UN | | |
| 206693 | | FERNELIUS | OFF | UN | | |
| 206702 | | MINN E.S. | OFF | UN | | |
| 206720 | | MOUNDSVIEW | OFF | MUNI | | |

# TABLE B-2
# WELL INDEX
# SORTED BY IRDMIS NUMBER

| Minnesota Unique # | IRDMIS # | Other Name(s) | On or Off of OU2 | Well Type | Well Sealed | Second Unique # |
|---|---|---|---|---|---|---|
| 206722 | | M0UNDSVIEW #5 | OFF | MUNI | | |
| 206750 | | SHORE #4 | OFF | MUNI | | |
| 206787 | | MOUNDSVIEW H.S. | OFF | P.S. | | |
| 206789 | | NEW BRIGHTON #1 | OFF | MUNI | ✓ | |
| 206791 | | NEW BRIGHTON #7 | OFF | MUNI | | |
| 206792 | | NEW BRIGHTON #4 | | | | |
| 206793 | | NEW BRIGHTON #3 | OFF | MUNI | | |
| 206794 | | NEW BRIGHTON #9 | OFF | MUNI | | |
| 206795 | | NEW BRIGHTON #8 | OFF | MUNI | | |
| 206796 | | NEW BRIGHTON #5 | OFF | MUNI | | |
| 206797 | | NEW BRIGHTON #6 | OFF | MUNI | | |
| 206798 | | NEW BRIGHTON #2 | OFF | MUNI | ✓ | |
| 223844 | | KURTH MALTING CO EAST WL | OFF | IND | | |
| 223992 | | BOOM ISLAND | OFF | IND | | |
| 225886 | | FRANKLIN STEEL SQUARE | OFF | P.S. | | |
| 225905 | | ST PAUL TERM. WAREHOUSE | OFF | IND | | |
| 225906 | | ST PAUL TERM. WAREHOUSE | OFF | IND | | |
| 231741 | | LABELLE | OFF | UN | | |
| 231845 | | MNDOT CIVIL DEFENSE TRAIN. | ON/OFF | P.S. | | |
| 231878 | | MENGELKOCH #2 | OFF | UN | | |
| 232067 | | NBR 135 | OFF | UN | | |
| 232069 | | UHIL | OFF | UN | | |
| 233221 | | REUBEN MEAT | OFF | DOM | | |
| 233222 | | LOWRY GROVE TRAILER | OFF | ABAND | ✓ | |
| 233241 | | KOZAH'S MARKET | OFF | UN | ✓ | |
| 233520 | | MCGILLIS | OFF | UN | | |
| 233533 | | ROSELAWN CEMETARY | OFF | IRR | | |
| 233763 | | P. L. MORGAN | OFF | DOM | | |
| 233806 | | 2581 NORTH CLEVELAND | OFF | DOM | | |
| 234301 | | DEWITT | OFF | UN | ✓ | |
| 234305 | | GLENN BEGGIN | OFF | UN | | |
| 234319 | | HIDE & TALLOW #1 | OFF | UN | | |
| 234327 | | BRESKE | OFF | UN | | |
| 234335 | | MENGELKOCH #1 | OFF | UN | | |
| 234337 | | MENGELKOCH #3 | OFF | UN | ✓ | |
| 234350 | | GORDON | OFF | UN | | |
| 234351 | | YEMPA | OFF | UN | | |
| 234352 | | 1206 12TH AV NW | OFF | UN | ✓ | |
| 234353 | | LENTSCH'S ICE WK. | OFF | UN | | |
| 234355 | | KINGDOM HALL | OFF | UN | | |
| 234356 | | NORDQUIST P43 | OFF | UN | | |
| 234357 | | PHILLIPS PET P46 | OFF | UN | | |
| 234386 | | ZELL OLS. | OFF | UN | | |
| 234391 | | SHERER L. | OFF | UN | | |
| 234396 | | DEWITT | OFF | UN | ✓ | |
| 234406 | | KLAPP | OFF | UN | ✓ | |
| 234409 | | HIDE & TALLOW | OFF | UN | | |
| 234425 | | KEN GEREBI | OFF | UN | ✓ | |
| 234430 | | CMIEL | OFF | UN | ✓ | |

**TABLE B-2**
**WELL INDEX**
**SORTED BY IRDMIS NUMBER**

| Minnesota Unique # | IRDMIS # | Other Name(s) | On or Off of OU2 | Well Type | Well Sealed | Second Unique # |
|---|---|---|---|---|---|---|
| 234431 | | HARSTAD | OFF | UN | | |
| 234463 | | KEN SOLIE | OFF | UN | | |
| 234546 | | HONEYWELL RIDGEWAY | OFF | UN | | |
| 234547 | | HONEYWELL RIDGEWAY | OFF | UN | | |
| 234549 | | REINER | OFF | IRR | | |
| 235539 | | OLD HOTEL | OFF | UN | | |
| 235557 | | HIDDEN FALLS PARK W.WELL | OFF | P.S. | | |
| 235619 | | SHRINERS HOSPITAL | OFF | P.S. | | |
| 235735 | | FLOUR CITY ARCHITECTURAL | OFF | COM | | |
| 236122 | | NWR | OFF | ABAND | | |
| 242162 | | 301PB | OFF | UN | | |
| 242207 | | SUNSET MEMORIAL CEMETARY | OFF | UN | | |
| 249152 | | BOYLE | OFF | DOM | | |
| 265735 | | FLOUR CITY ARCH | OFF | UN | | |
| 322664 | | ABBOTT NW HOSP | OFF | UN | | |
| 405651 | | METAL-MATIC INC. | OFF | IND | | |
| 409546 | | PCA2L3 | OFF | TEST | ✓ | |
| 409547 | | PCA1U4 | OFF | TEST | | |
| 409548 | | PCA2U4 | OFF | TEST | | |
| 409549 | | PCA3U4 | OFF | TEST | | |
| 409550 | | PCA6U3 | OFF | TEST | | |
| 409555 | | PCA5U4 | OFF | TEST | | |
| 409556 | | PCA4L3 | OFF | TEST | | |
| 409557 | | PCA1L3 | OFF | TEST | | |
| 409595 | | B109U3 | OFF | ABAND | | |
| 409596 | | B118U3 | OFF | MON | ✓ | |
| 409597 | | B118L3 | OFF | IND | ✓ | |
| 409598 | | B117U3 | OFF | ABAND | | |
| 416143 | | | OFF | ABAND | | |
| 416198 | | 311U4 | OFF | MON | | |
| 420713 | | HERBST LANDFILL | OFF | MON | | |
| 476387 | | MW15H | OFF | MON | | |
| 482083 | | K04-MW | ON | MON | | |
| 482084 | | K02-MW | ON | MON | | |
| 482085 | | K01-MW | ON | MON | | |
| 482086 | | I01-MW | ON | MON | | |
| 482087 | | I05-MW | ON | MON | | |
| 482088 | | I02-MW | ON | MON | | |
| 482089 | | I04-MW | ON | MON | | |
| 482090 | | I03-MW | ON | MON | | |
| 509083 | | NEW BRIGHTON #11 | OFF | MUNI | | |
| 512761 | | GROSS GOLF #2 | OFF | IRR | | |
| 519288 | | E101-MW | ON | MON | | |
| 519289 | | E102-MW | ON | MON | | |
| 519290 | | E103-MW | ON | MON | | |
| 519291 | | 129-1501-MW | ON | MON | ✓ | |
| 520931 | | NEW BRIGHTON #13 | OFF | MUNI | | |
| 554216 | | NEW BRIGHTON #14 | OFF | MUNI | | |
| 582628 | | NEW BRIGHTON #15 | OFF | MUNI | | |

# TABLE B-2
# WELL INDEX
# SORTED BY IRDMIS NUMBER

| Minnesota Unique # | IRDMIS # | Other Name(s) | On or Off of OU2 | Well Type | Well Sealed | Second Unique # |
|---|---|---|---|---|---|---|
| 589650 | | CM1MW | ON | MON | | |
| 616601 | | CM2MW | ON | MON | | |
| 616602 | | CM3MW | ON | MON | | |
| 624019 | | CM5MW | ON | MON | | |
| 643379 | | | ON | PIEZ. | ✓ | |
| 643380 | | | ON | PIEZ. | ✓ | |
| 643381 | | | ON | PIEZ. | ✓ | |
| 643382 | | | ON | PIEZ. | ✓ | |
| 653903 | | GR1-1 | ON | MON | | |
| 653904 | | GR1-2 | ON | MON | | |
| 653905 | | GR2-1 | ON | MON | | |
| 675976 | | GR-DF1 | ON | MON | | |
| | | MW15D | OFF | MON | | |
| | | MW15S | OFF | MON | | |

# Appendix B: Table B-3

Boring Logs OU2 Wells
Sorted by IRDMIS Number

OU2 Well Boring Logs are included on this DVD as Table B-3

# Appendix B: Table B-4

Boring Logs OU1/OU3 Wells
Sorted by IRDMIS Number

OU1/OU3 Well Boring Logs are included on this DVD as Table B-4

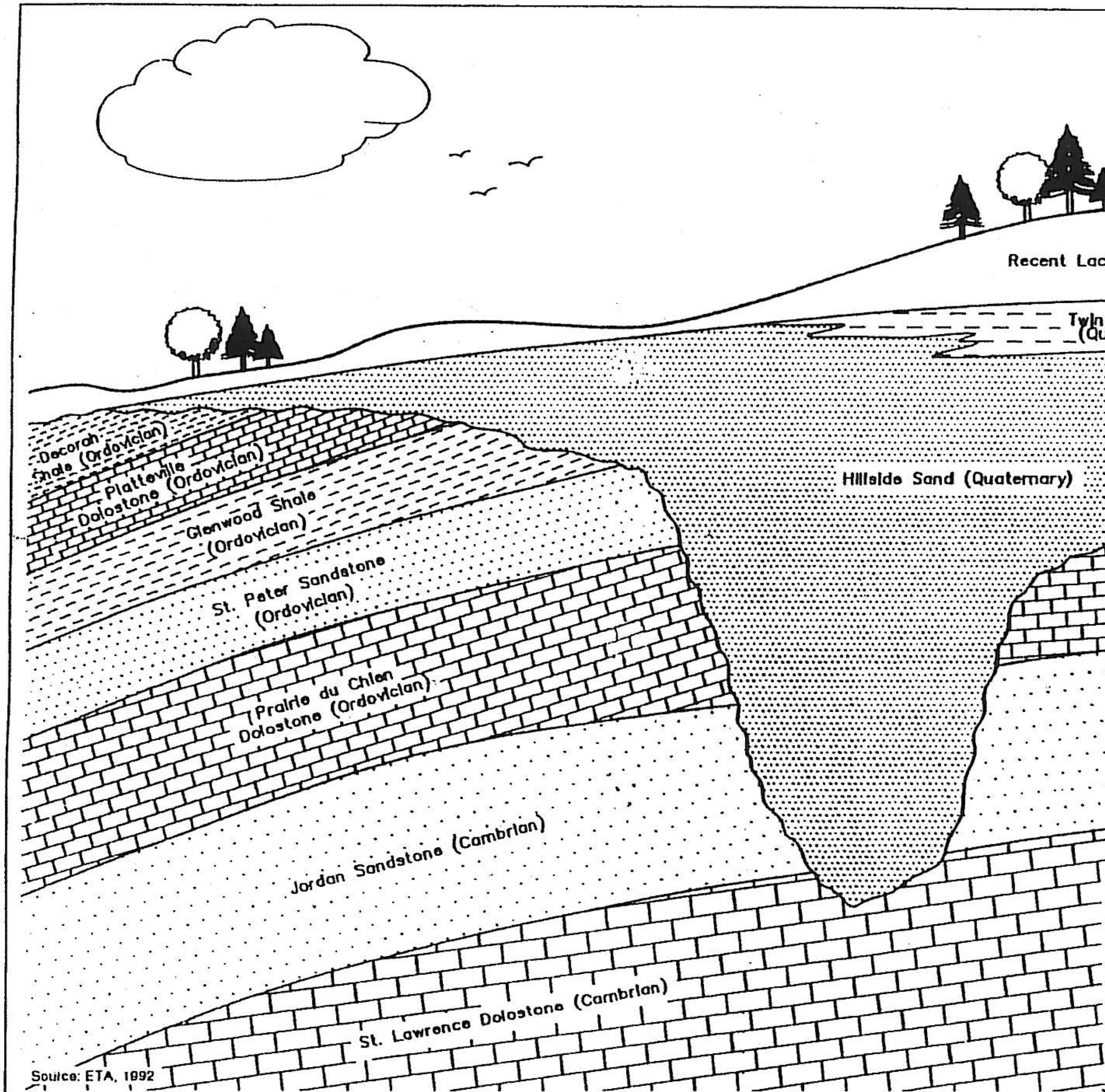
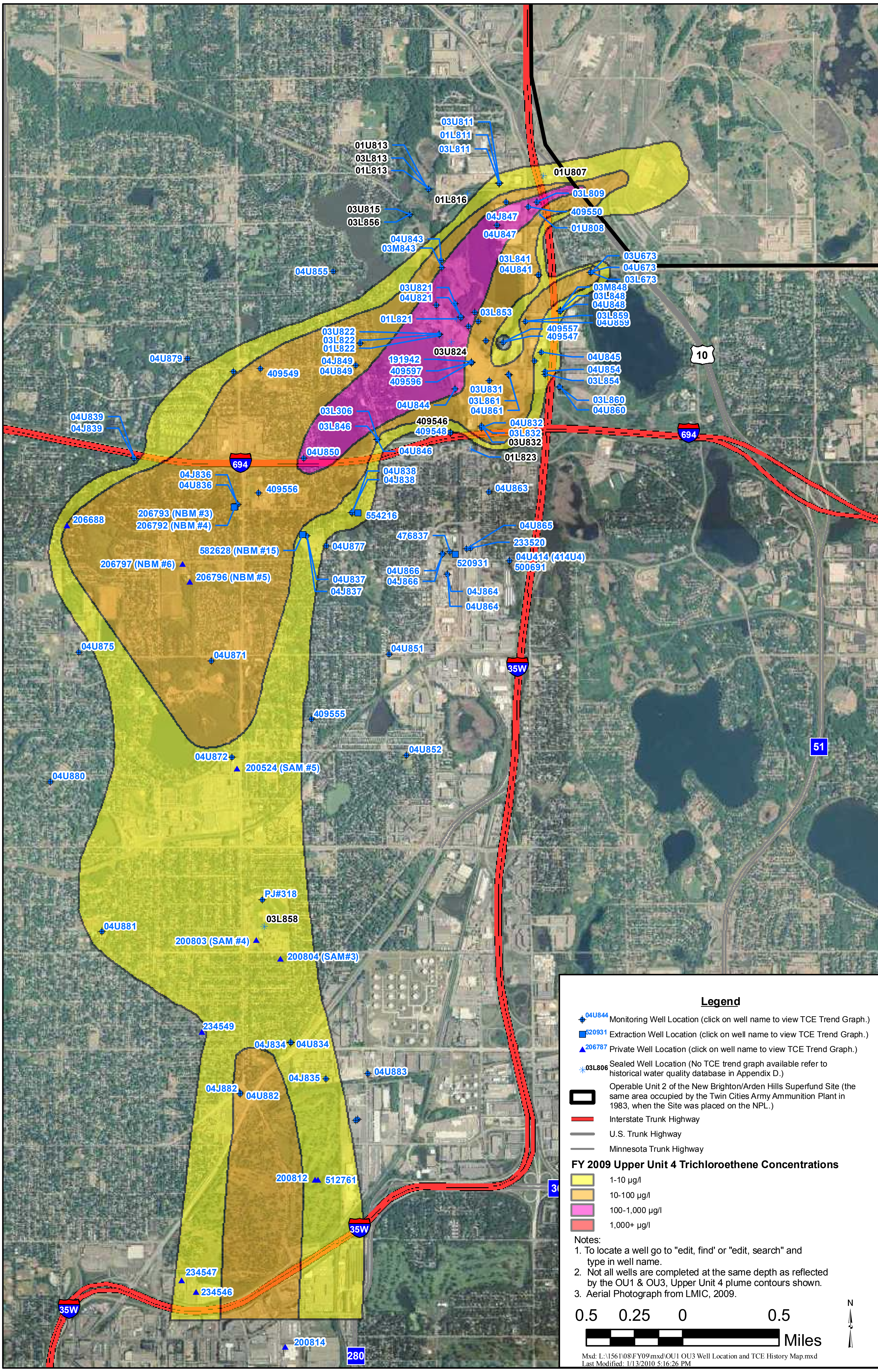



Figure B-1

Conceptual Illustration of Site Geology




## Legend

- 04U844 Monitoring Well Location (click on well name to view TCE Trend Graph.)
- 520931 Extraction Well Location (click on well name to view TCE Trend Graph.)
- 206787 Private Well Location (click on well name to view TCE Trend Graph.)
- 03L806 Sealed Well Location (No TCE trend graph available refer to historical water quality database in Appendix D.)
- 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.)
- Interstate Trunk Highway
- U.S. Trunk Highway
- Minnesota Trunk Highway

**FY 2009 Upper Unit 4 Trichloroethene Concentrations**

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

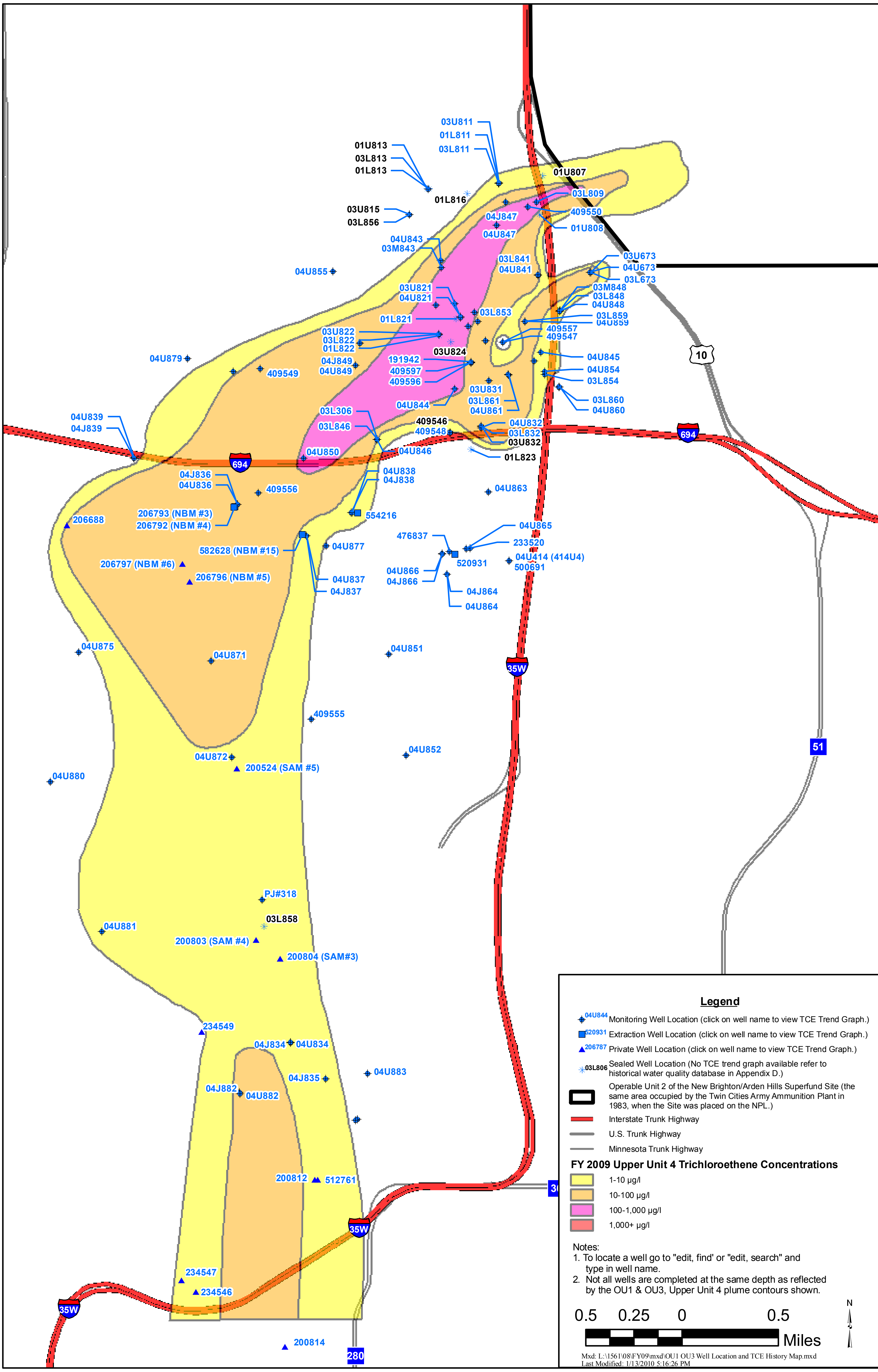
Notes:
1. To locate a well go to "edit, find" or "edit, search" and type in well name.
2. Not all wells are completed at the same depth as reflected by the OU1 & OU3, Upper Unit 4 plume contours shown.
3. Aerial Photograph from LMIC, 2009.

0.5 0.25 0 0.5 Miles

N

Mxd: L:\1561\08\FY09\mxd\OU1 OU3 Well Location and TCE History Map.mxd
Last Modified: 1/13/2010 5:16:26 PM

| | | |
|---|---|---|
| ANNUAL PERFORMANCE REPORT | COPYRIGHT Wenck<br>Wenck Associates, Inc. 1800 Pioneer Creek Center<br>Environmental Engineers Maple Plain, MN 55359-0429 | FY 2009 |
| OU1 & OU3 Well Location and TCE History Map | | Figure B-2 |




ANNUAL PERFORMANCE REPORT

OU1 & OU3 Well Location and TCE History Map



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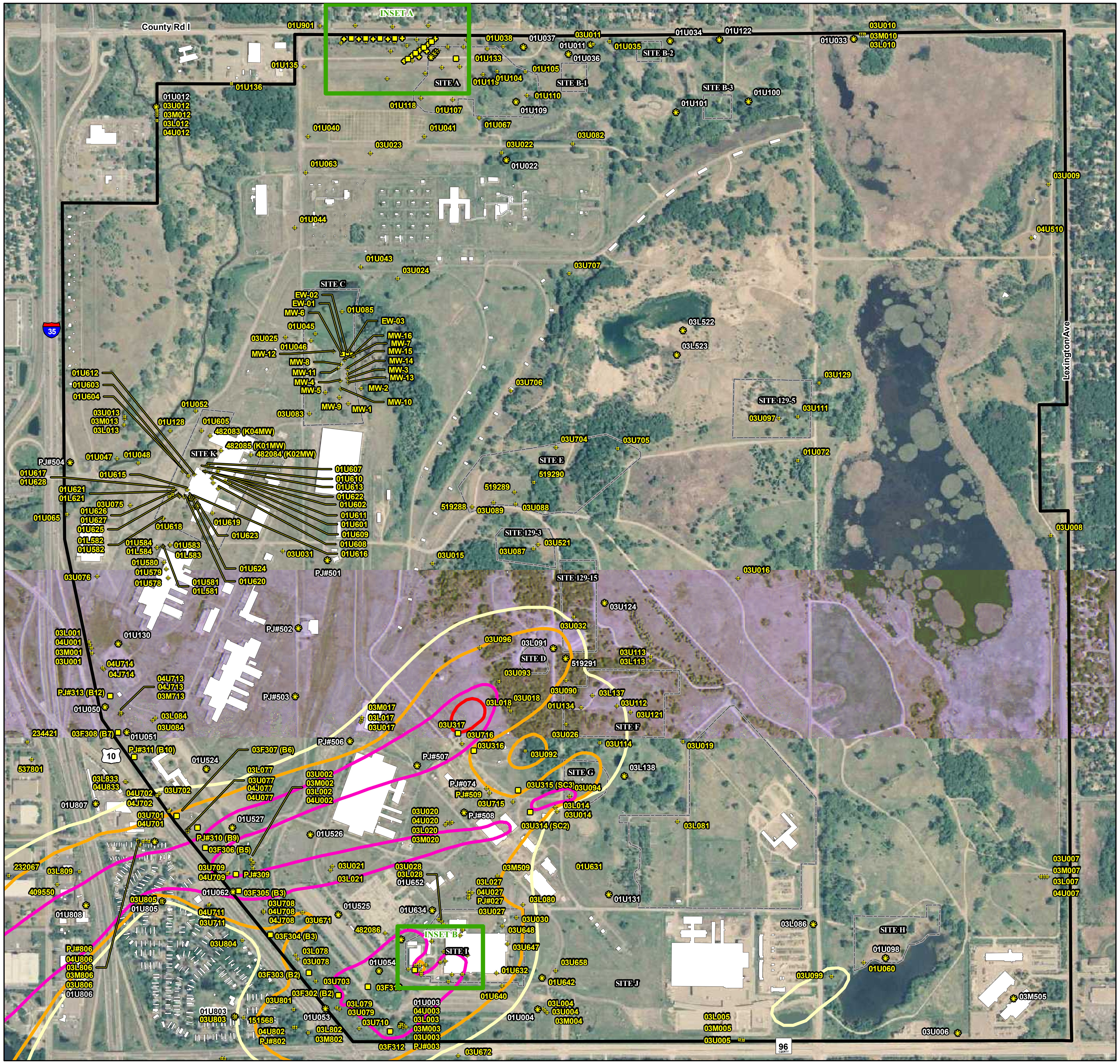
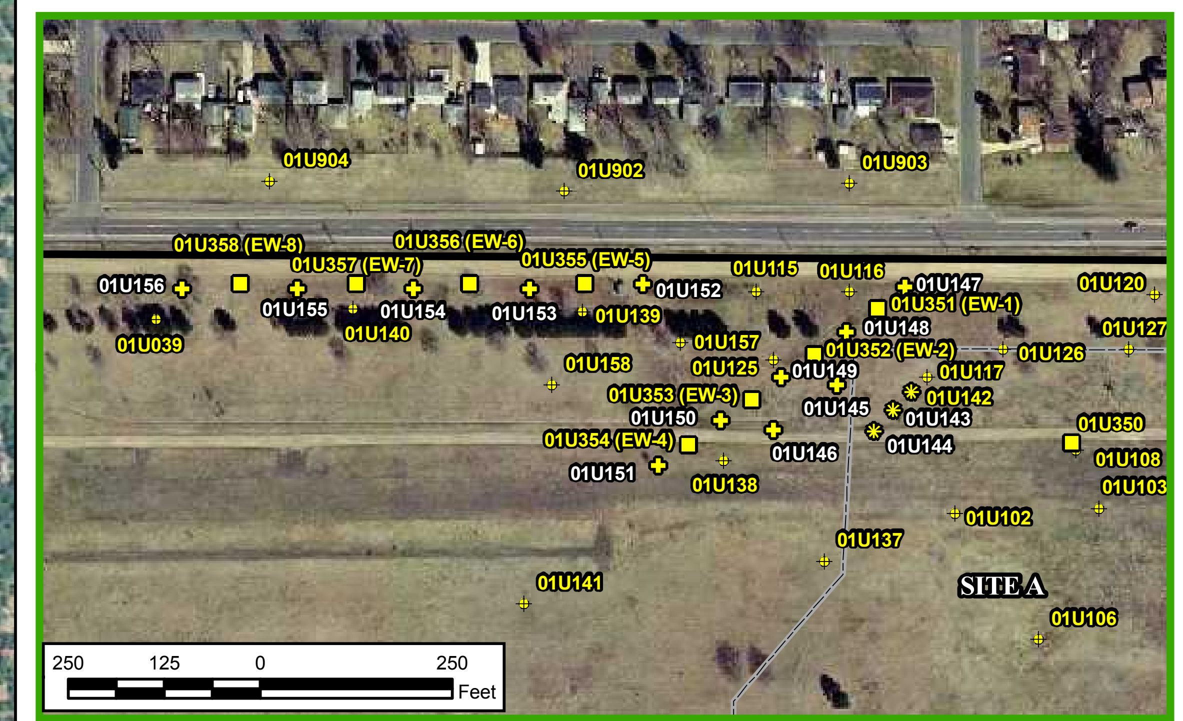
FY 2009

Figure B-2




## INSET A




## INSET B


**Legend**

- Monitoring Well Location (click on well name to view TCE trend graph)
- Extraction Well Location (click on well name to view TCE trend graph)
- Piezometer Location (for groundwater elevation only; no water quality data is collected.
- Sealed Well Location (No TCE trend graph available; refer to historical water quality databse in Appendix D.)

FY2009 Upper Unit 3 Trichloroethene Concentrations

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

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

Notes:
1. To locate a well go to "edit, find" or "edit, search" and type in well name.
2. 2009 Aerial Photograph (Source: LMIC), 2006 Aerial Photograph shown on insets.
3. Not all wells are completed at the same depth as reflected by the OU2, Upper Unit 3 plume contours shown.

1,600 800 0 1,600
Feet

N

Mxd: L:\1561\08\FY09\mxd\OU2 Well Location and TCE History.mxd

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OU2 Well Location and TCE History Map



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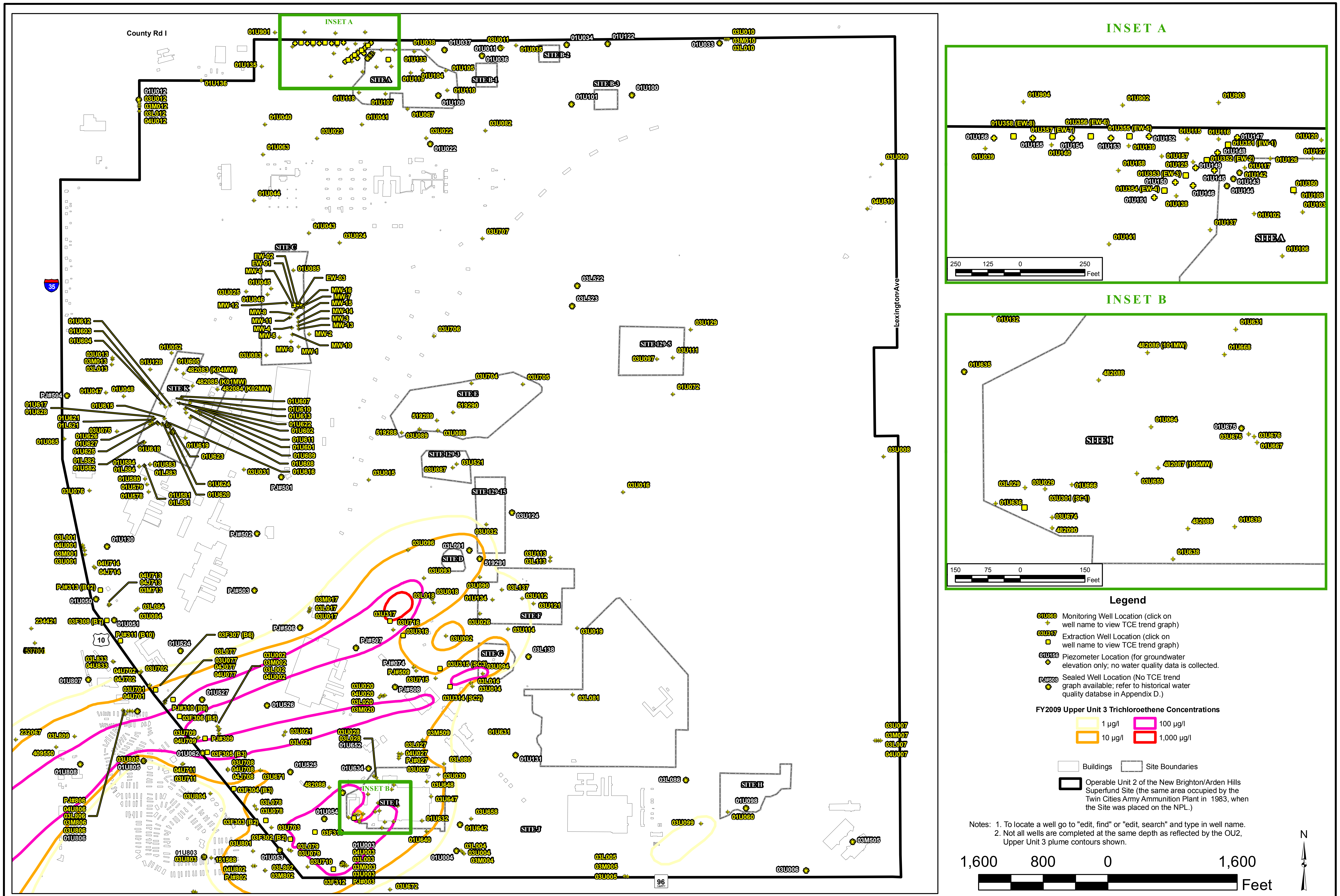
Figure B-3

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OU2 Well Location and TCE History Map



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FY 2009

Figure B-3

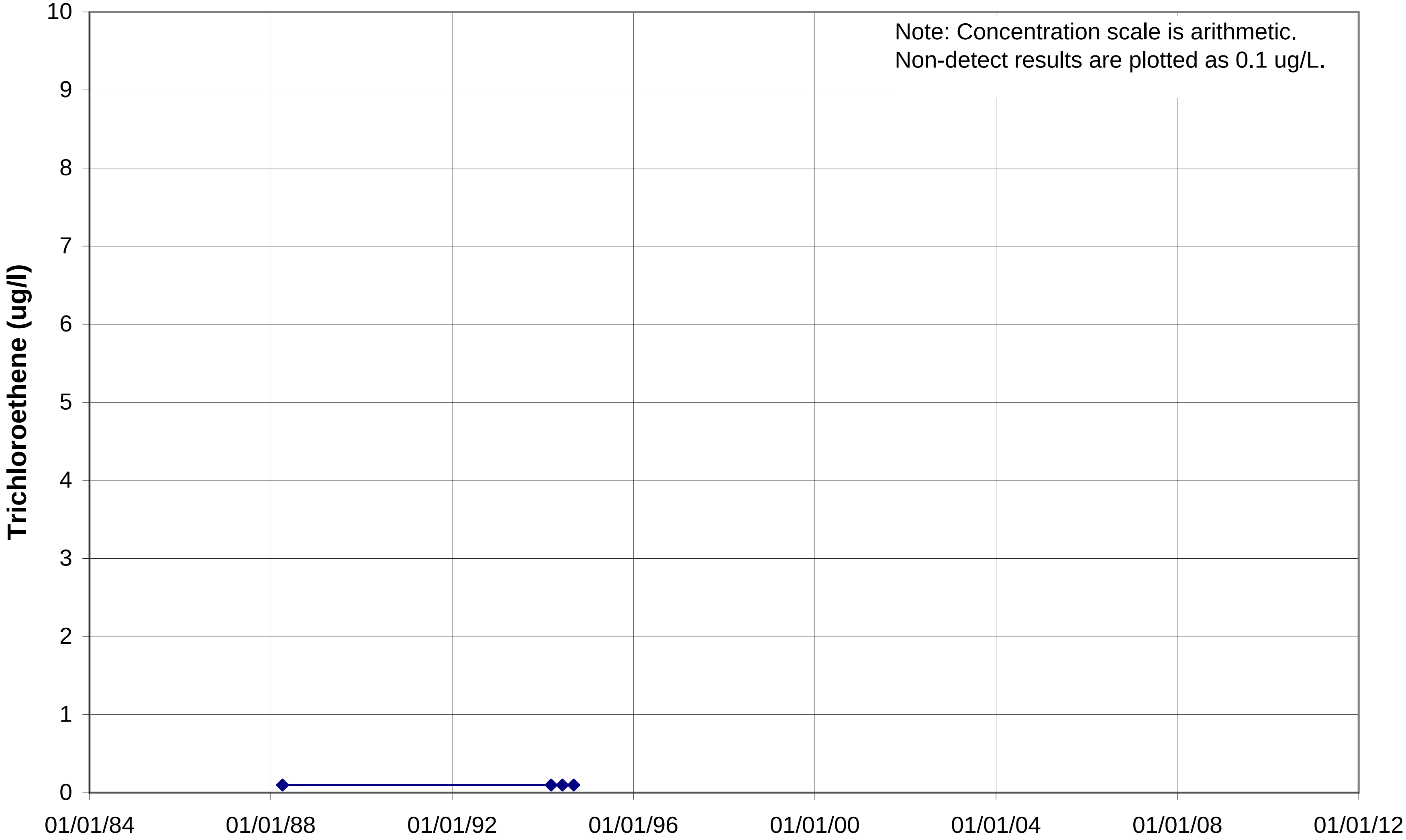
# Trend Graph Not Available, Well No Longer Routinely Sampled

**TO RETURN TO MAP:** Click on "Go to Previous View" Button in the Tool Bar

# Monitoring Well Has Been Sealed

**TO RETURN TO MAP:** Click on "Go to Previous View" Button in the Tool Bar

# 01U038

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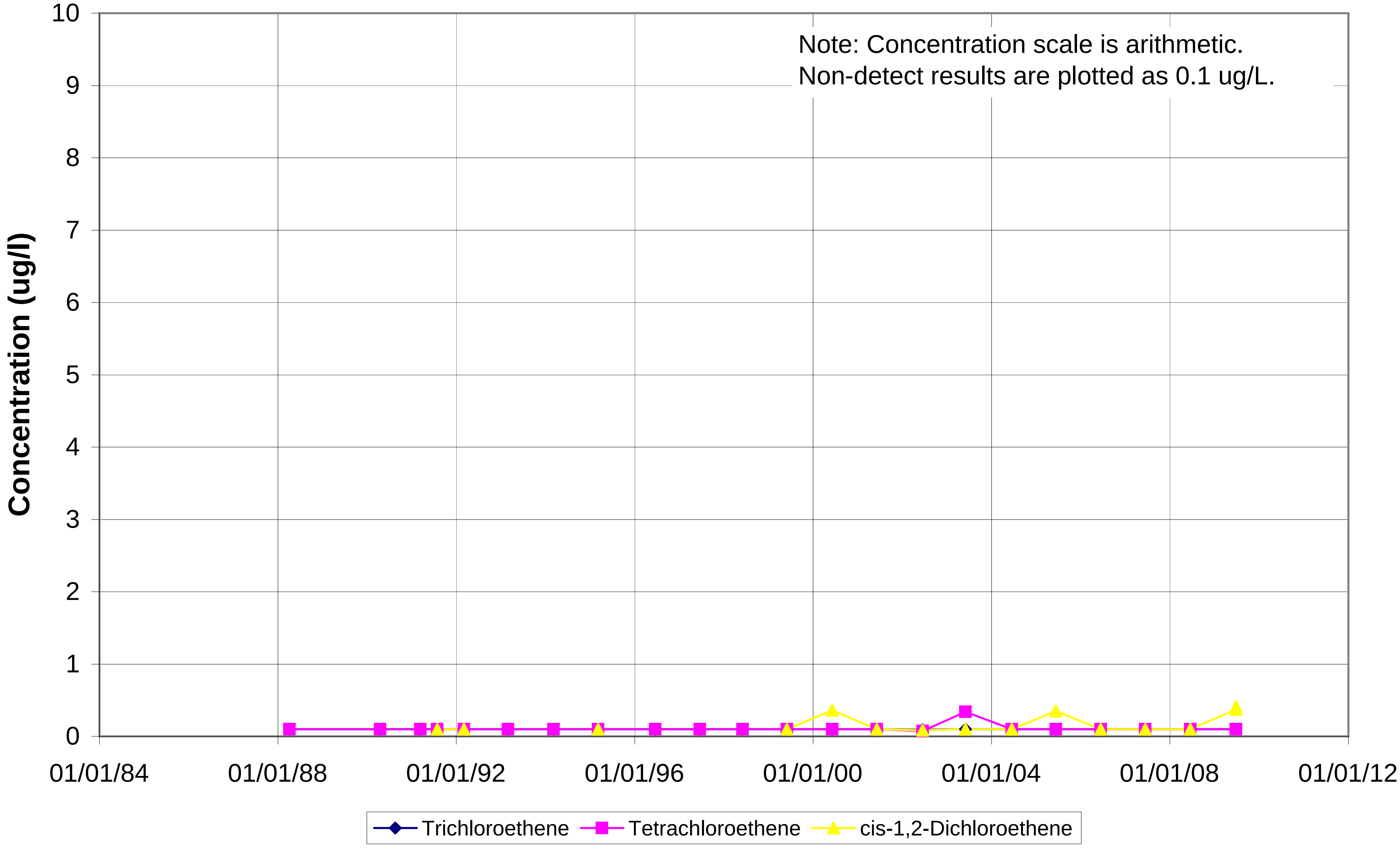


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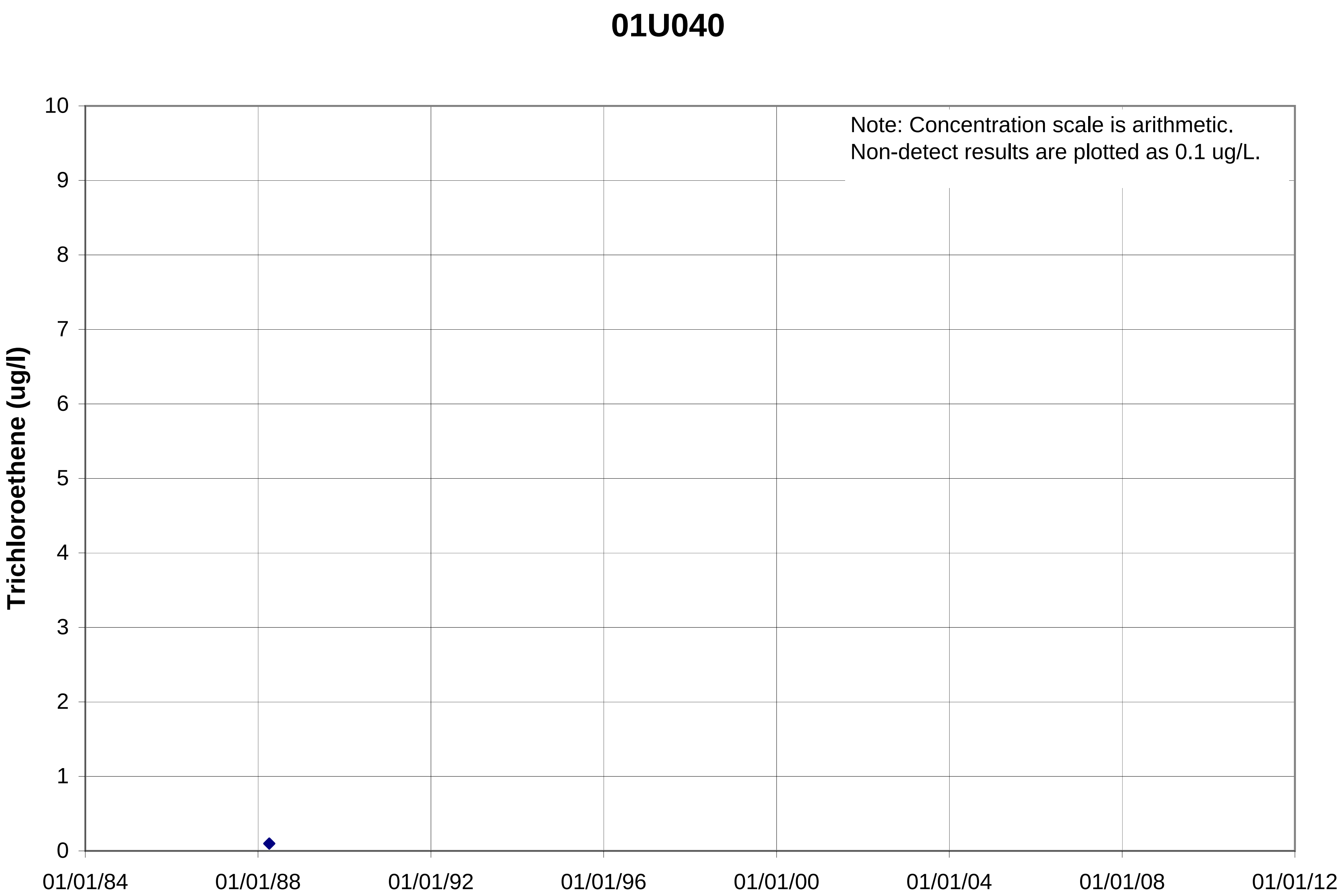


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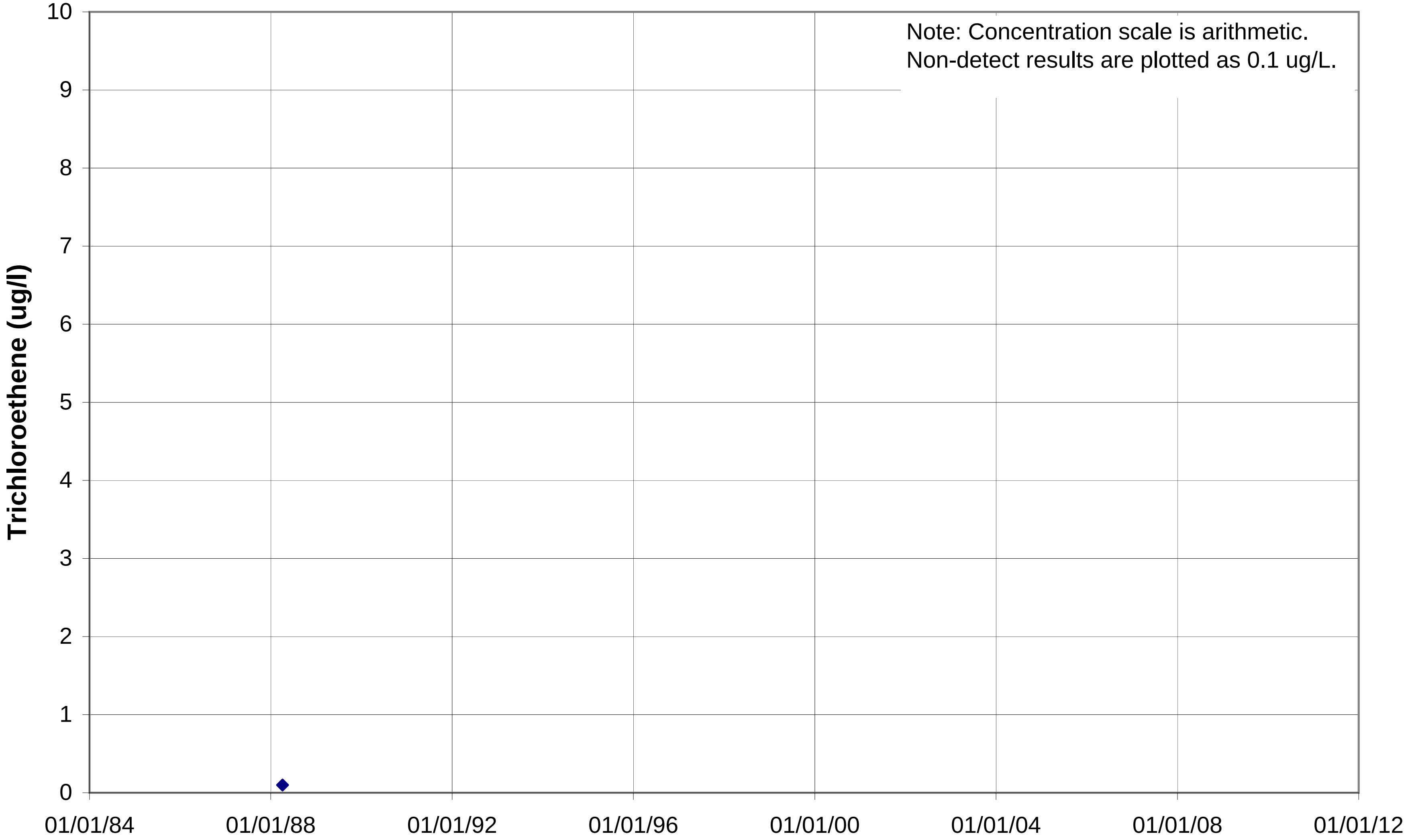


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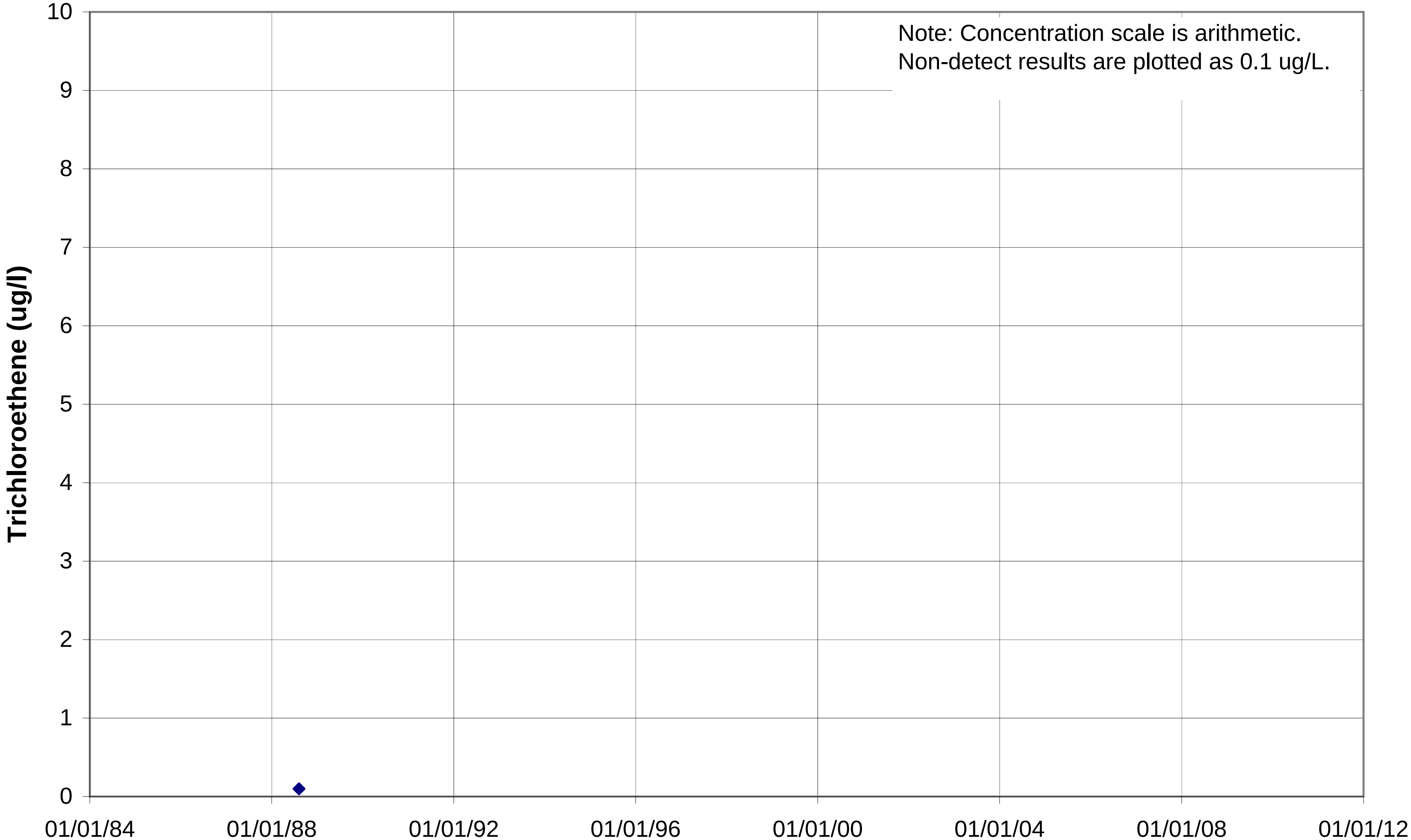


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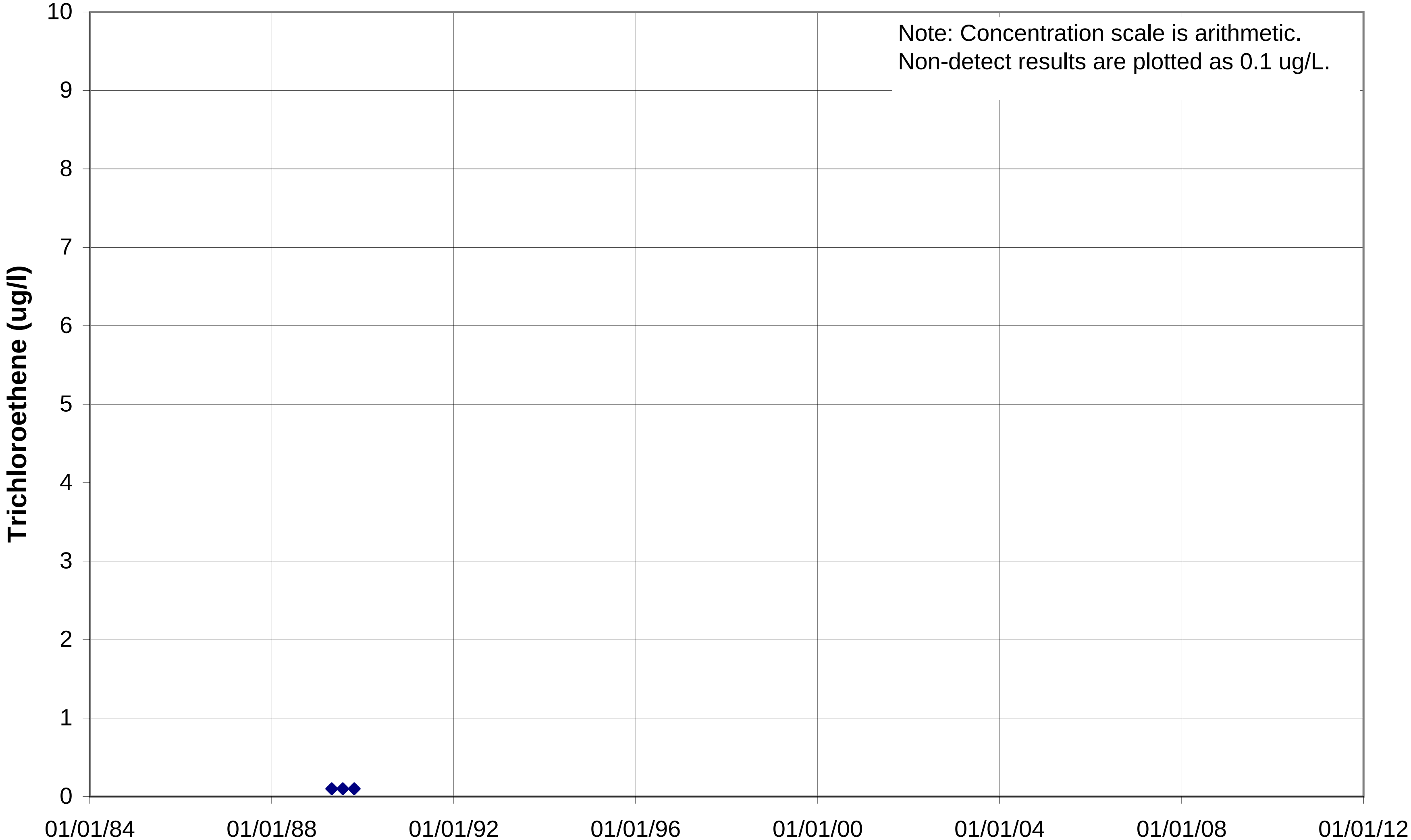


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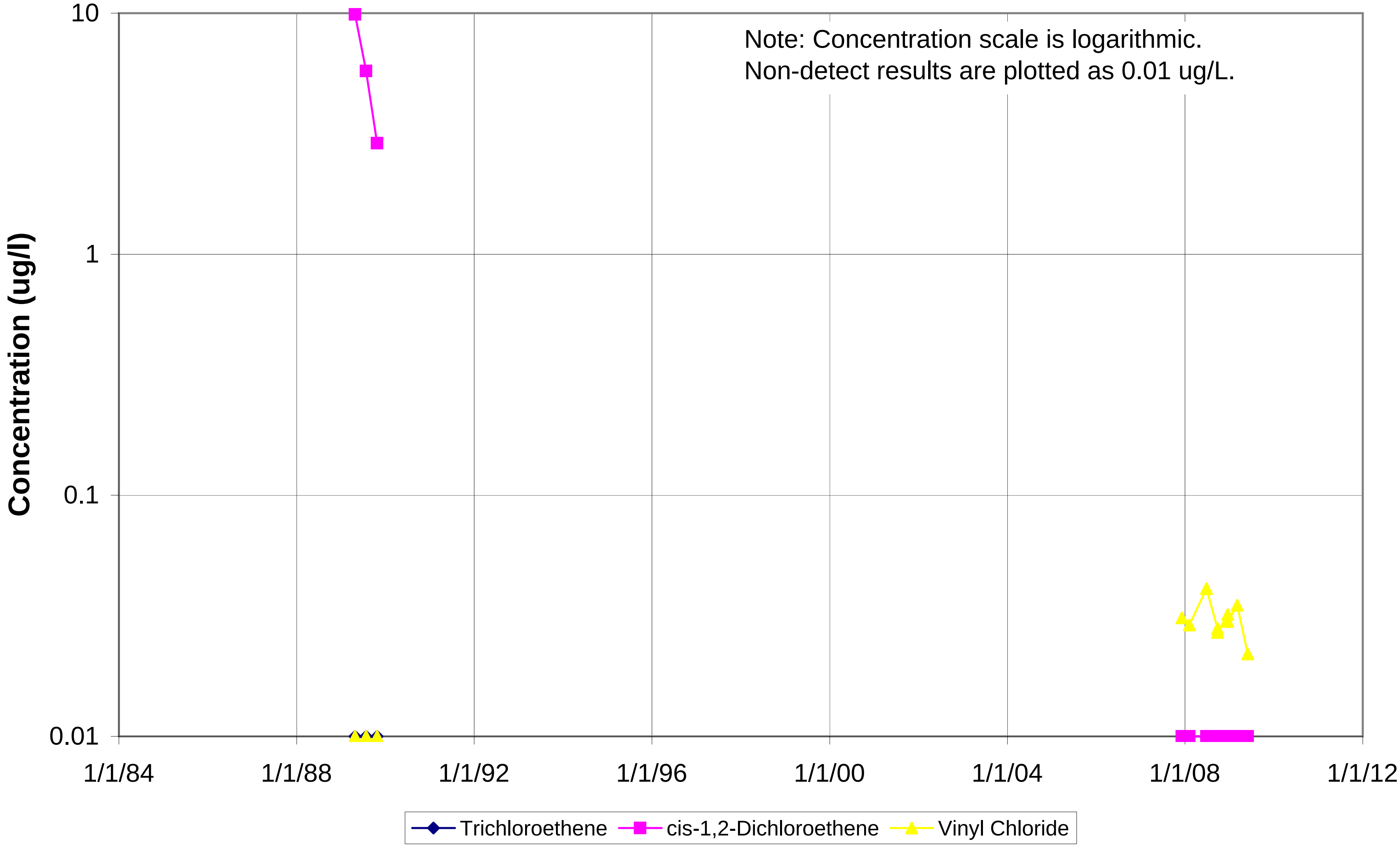


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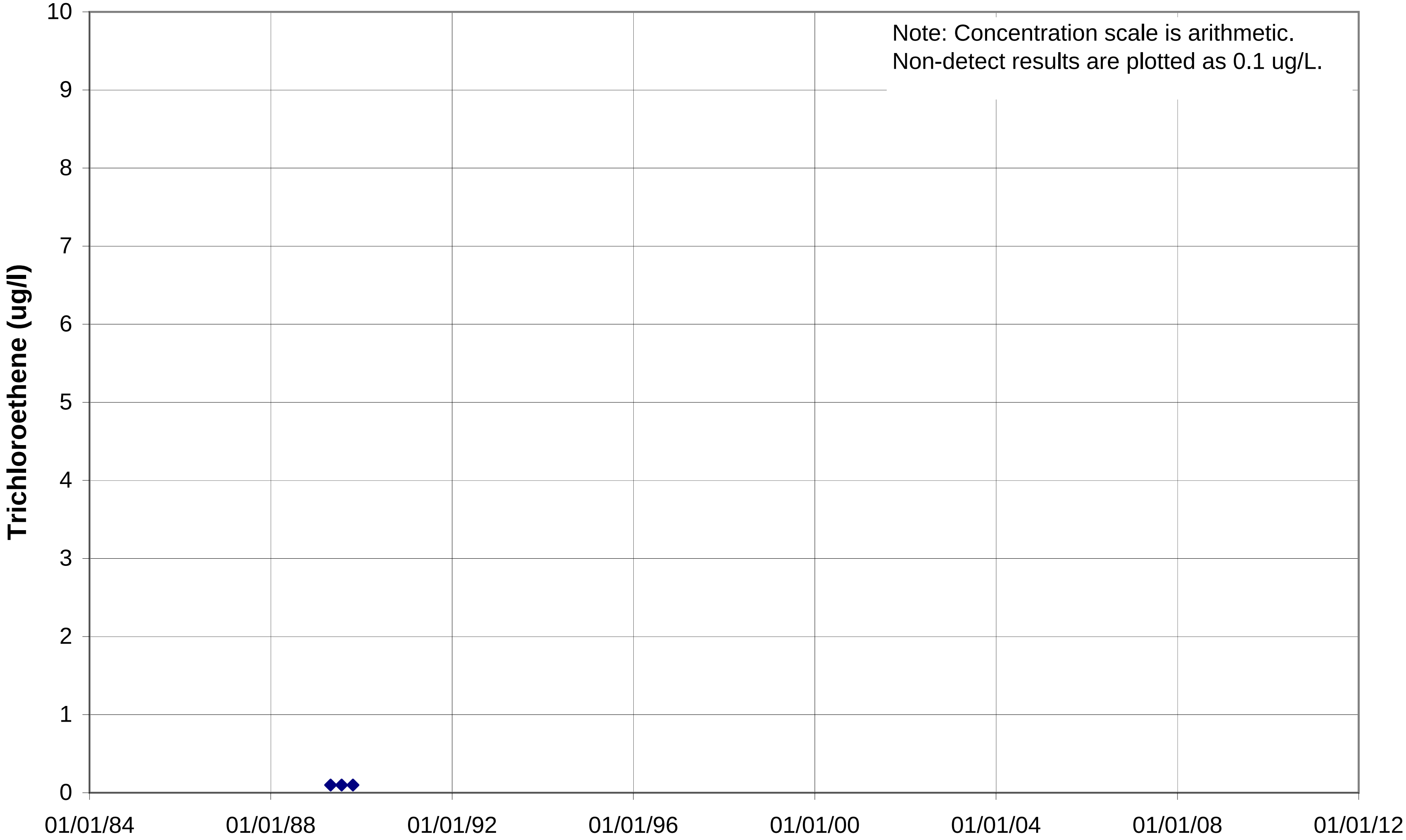


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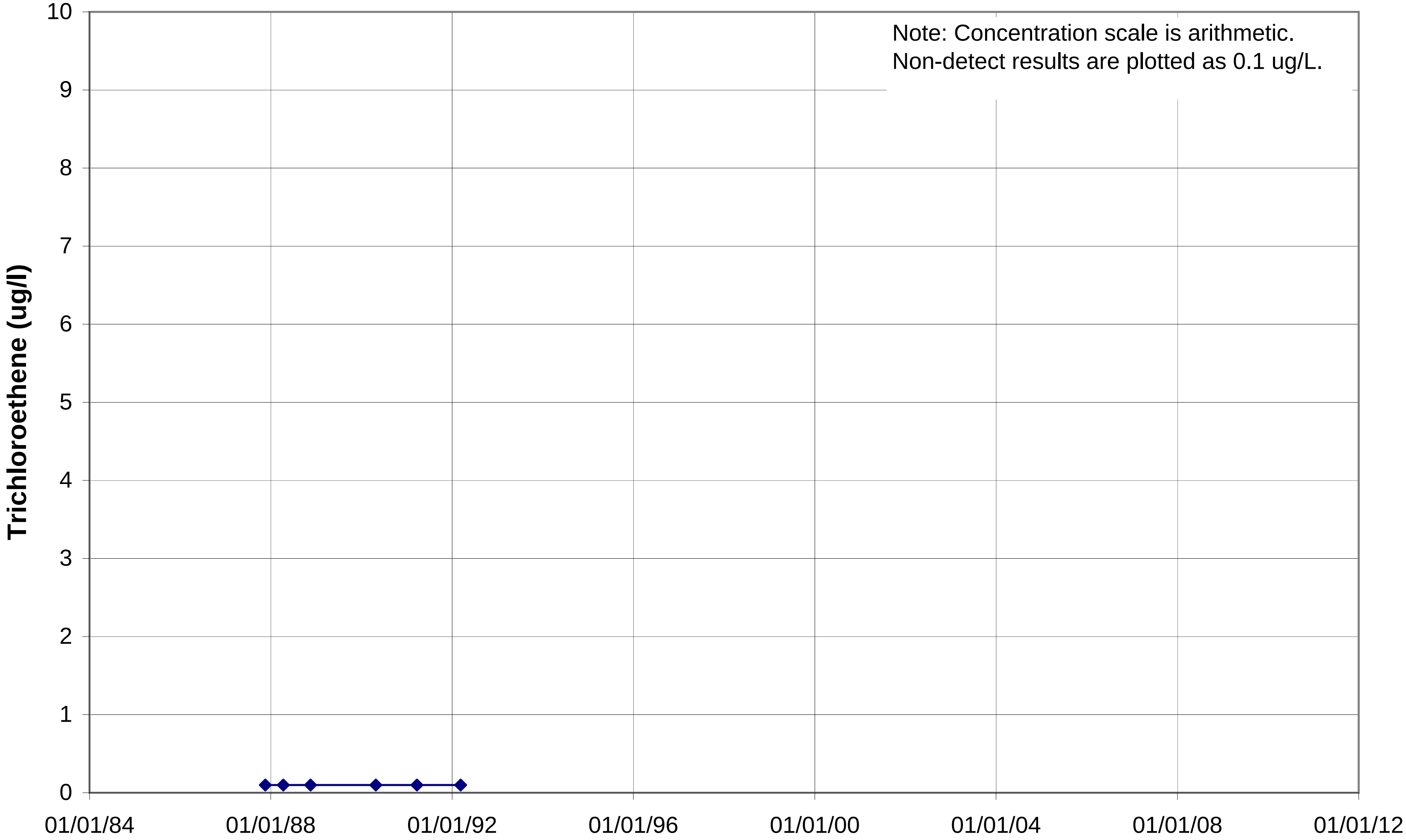


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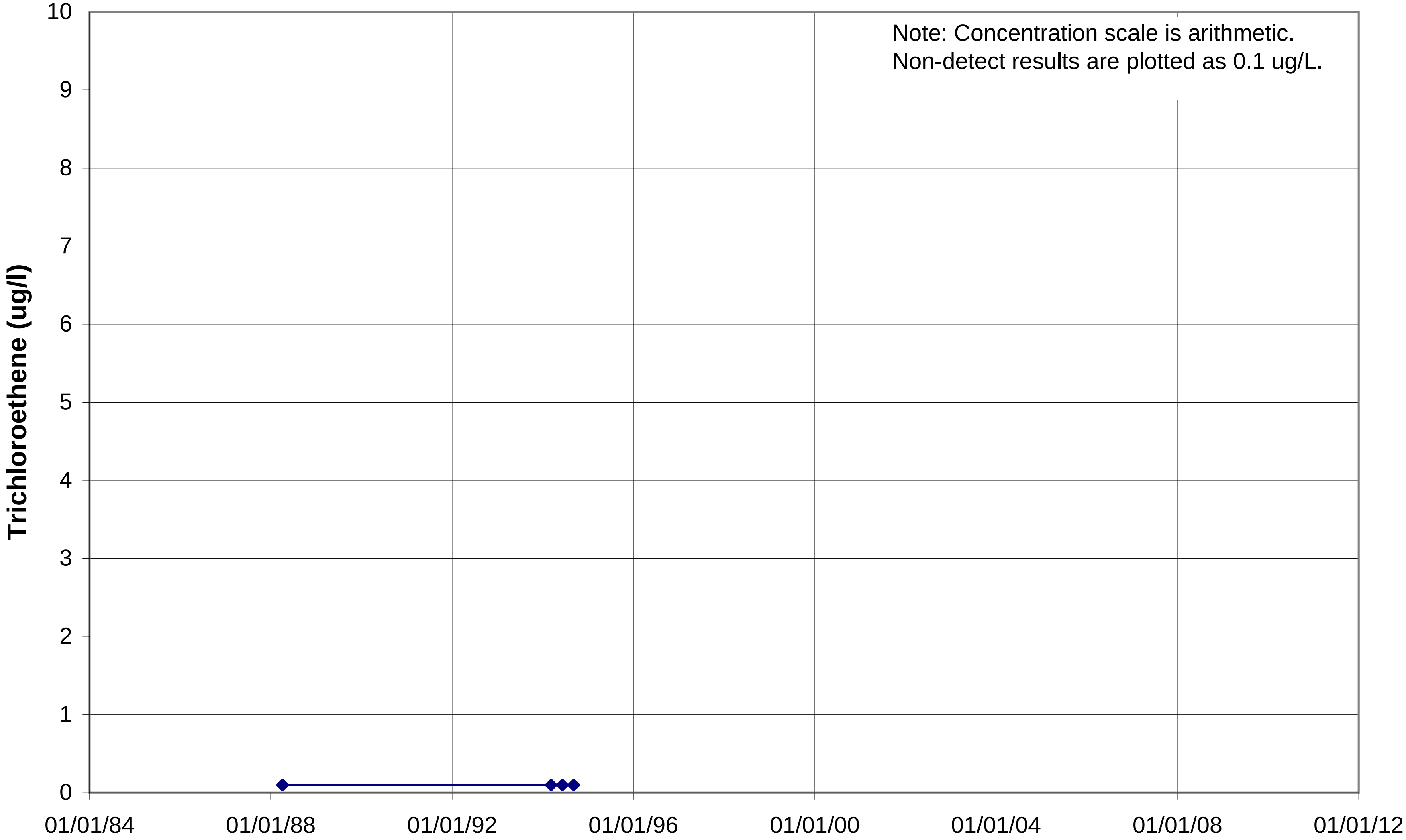
# 01U063

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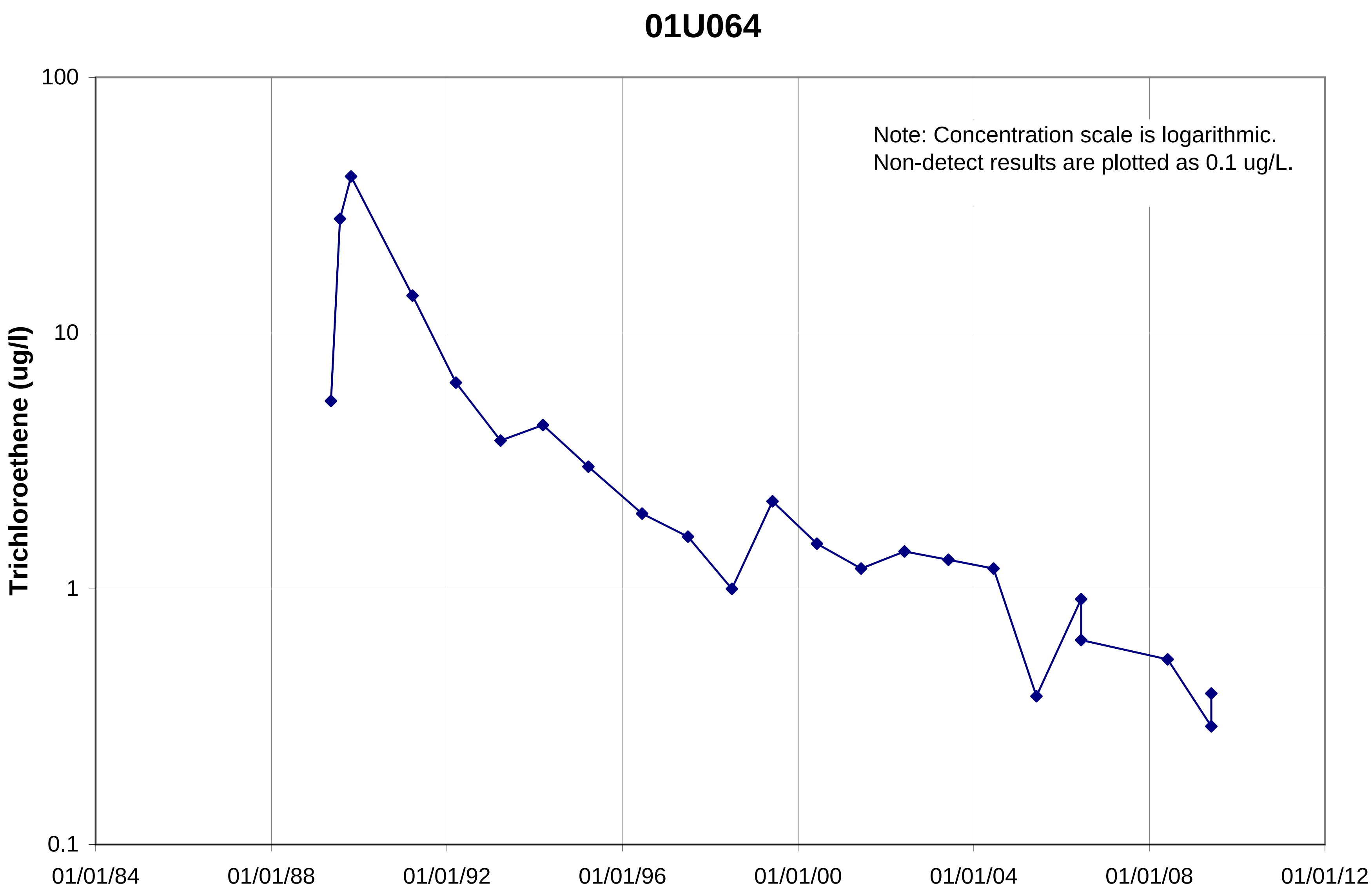


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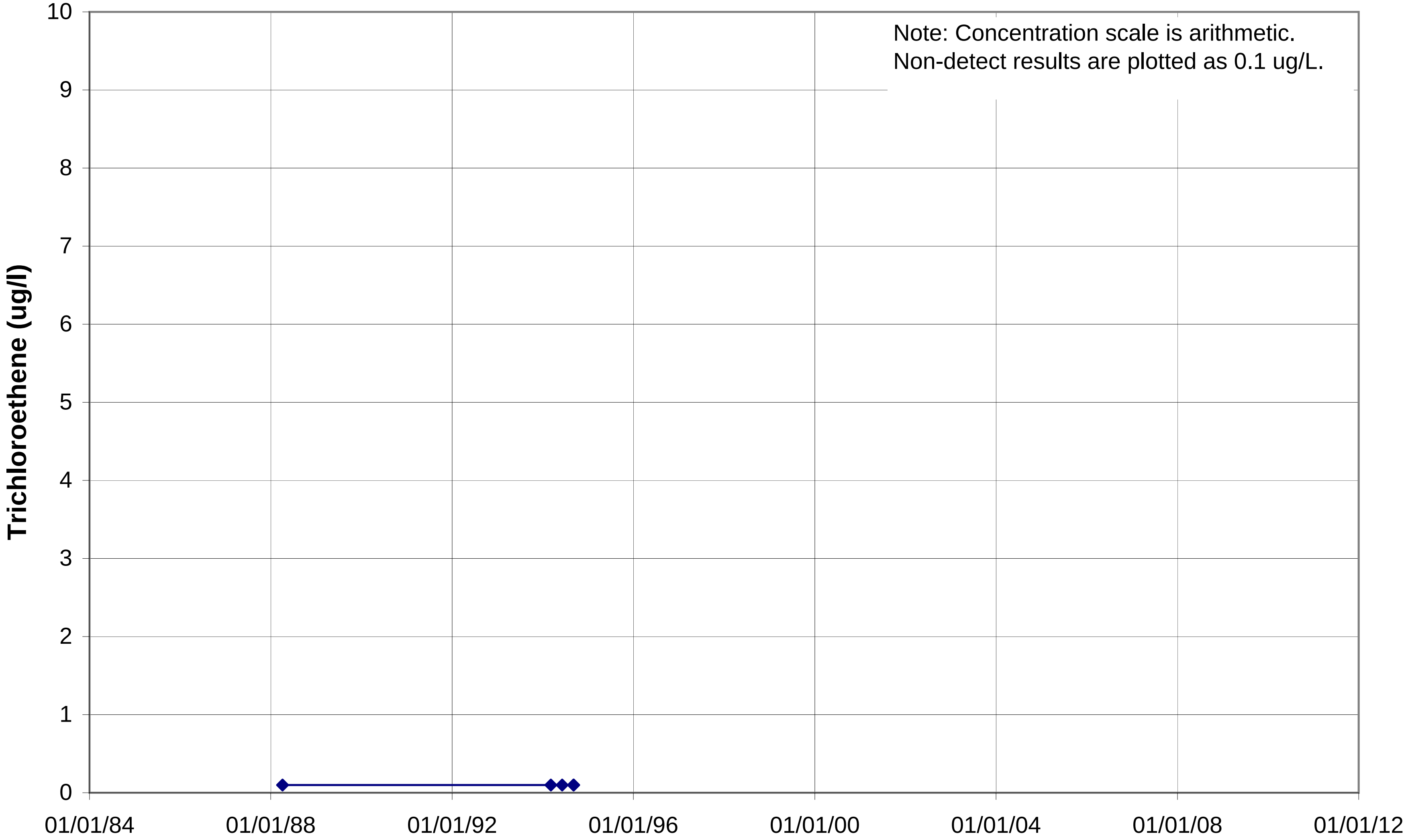


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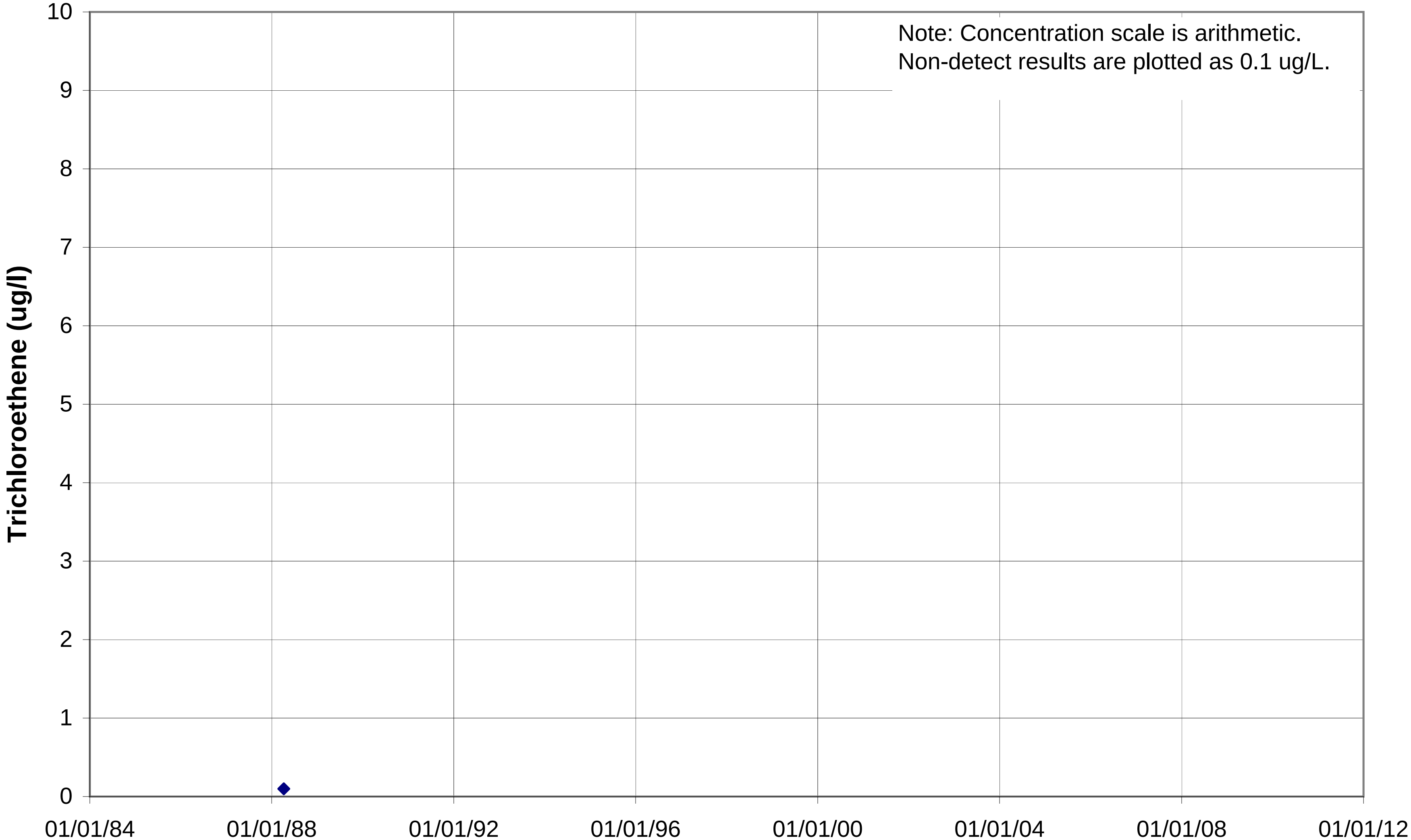


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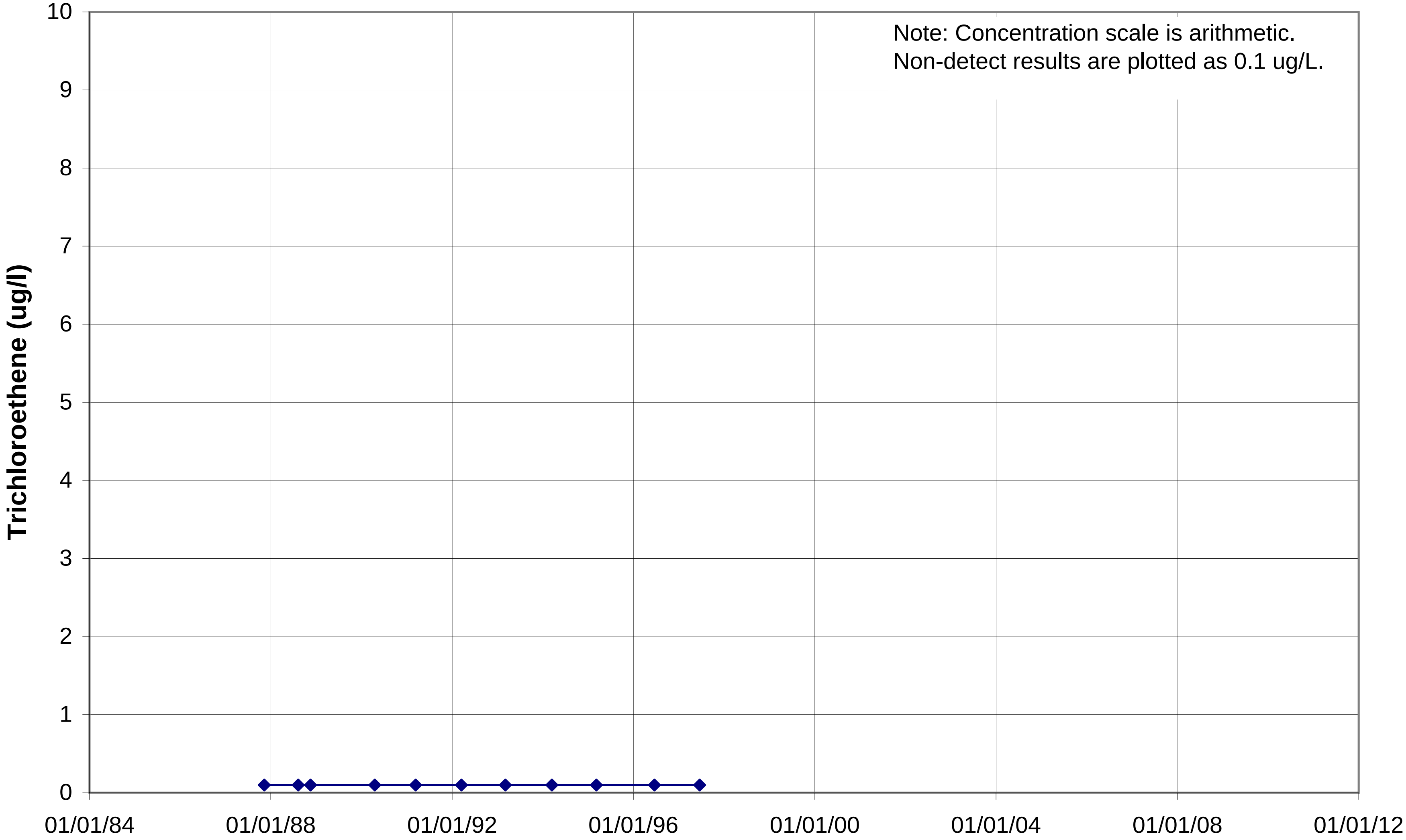


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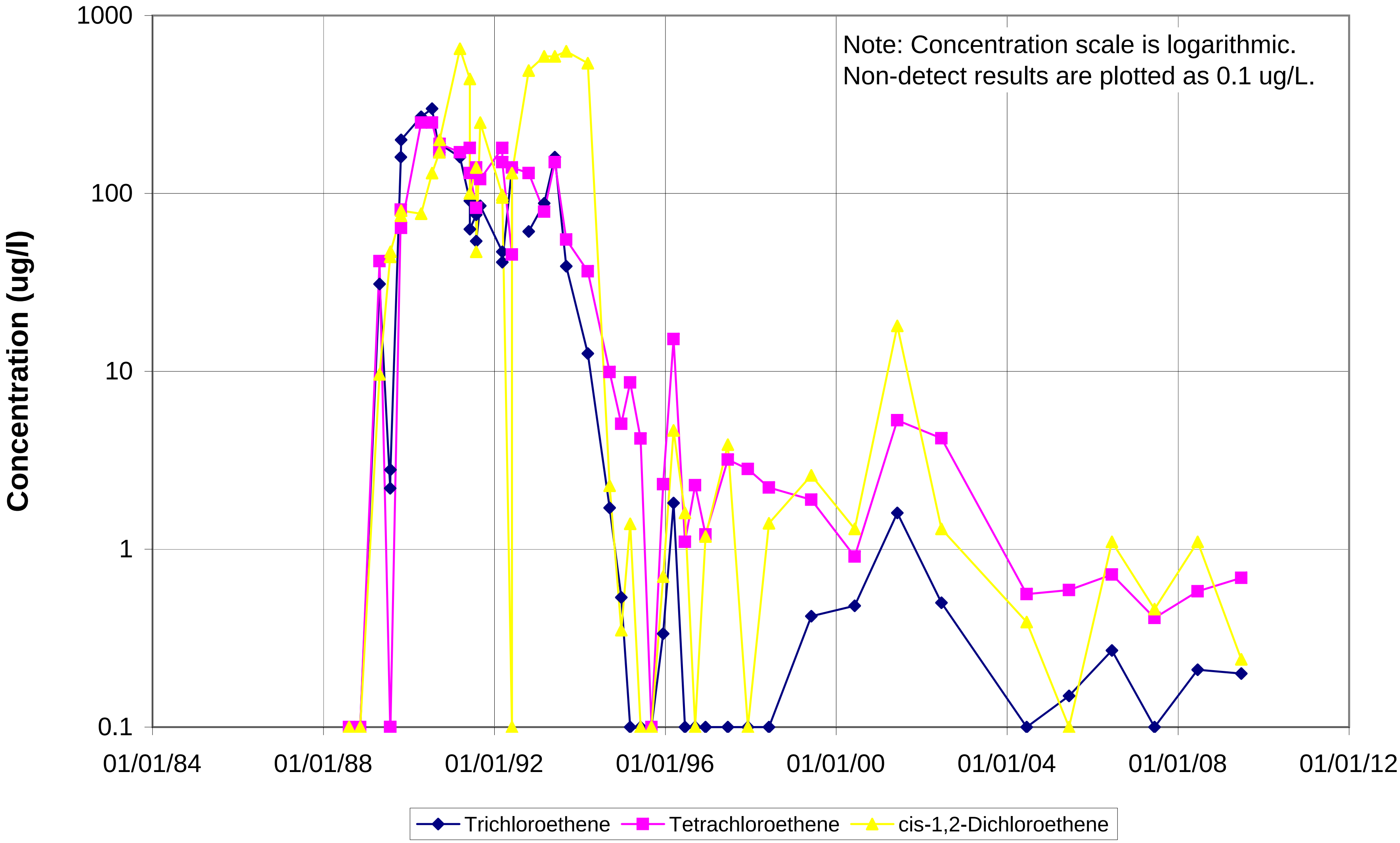


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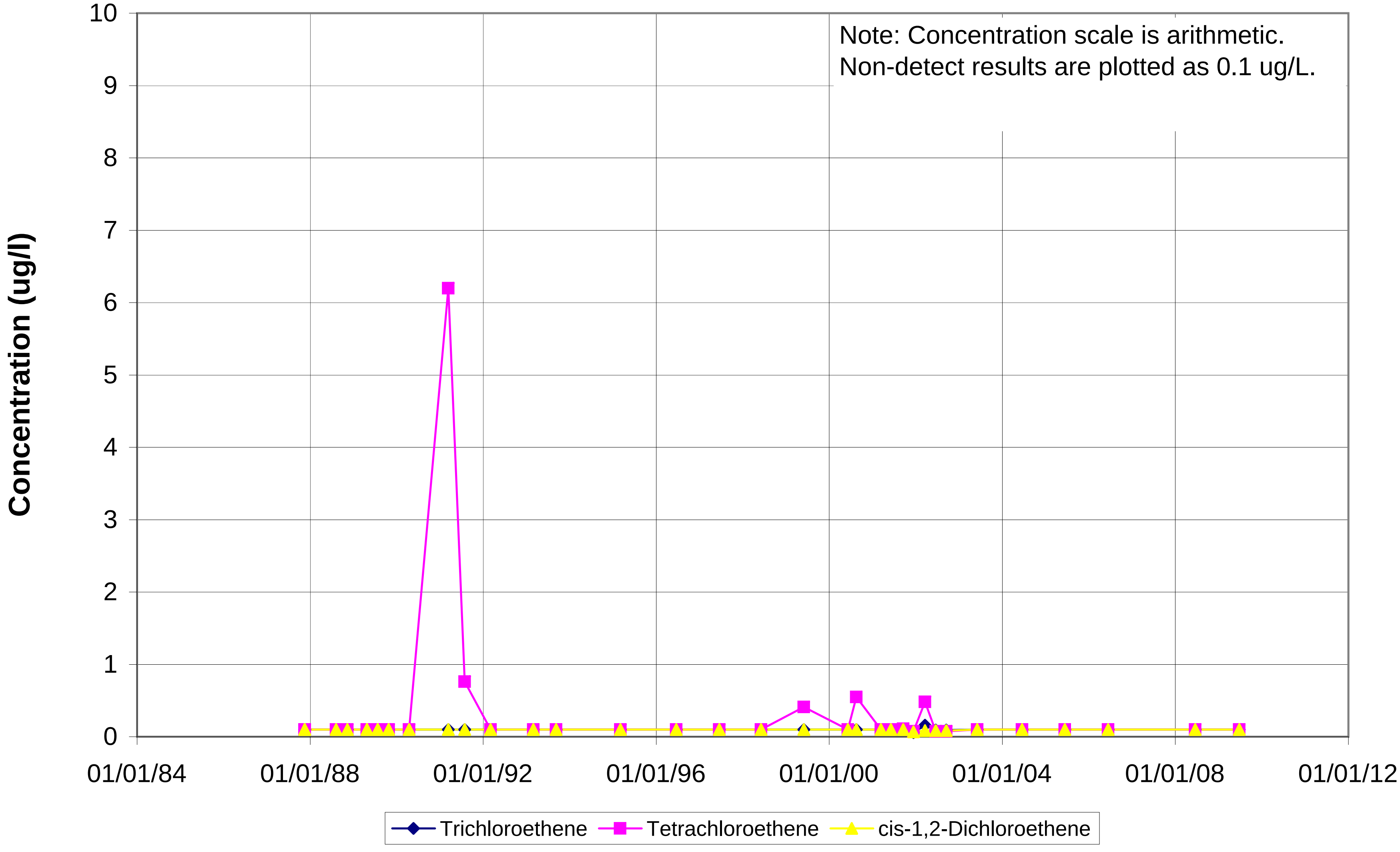


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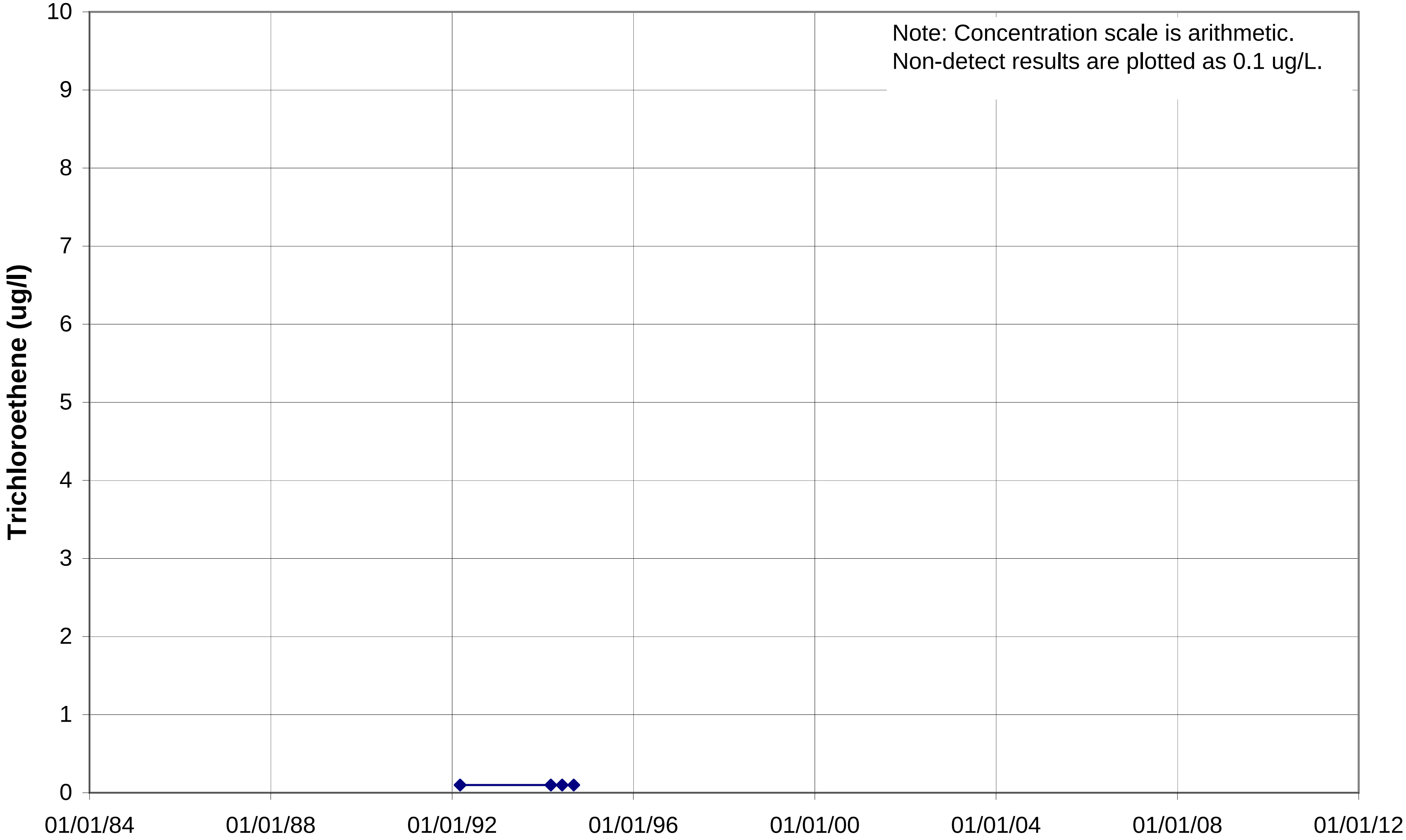


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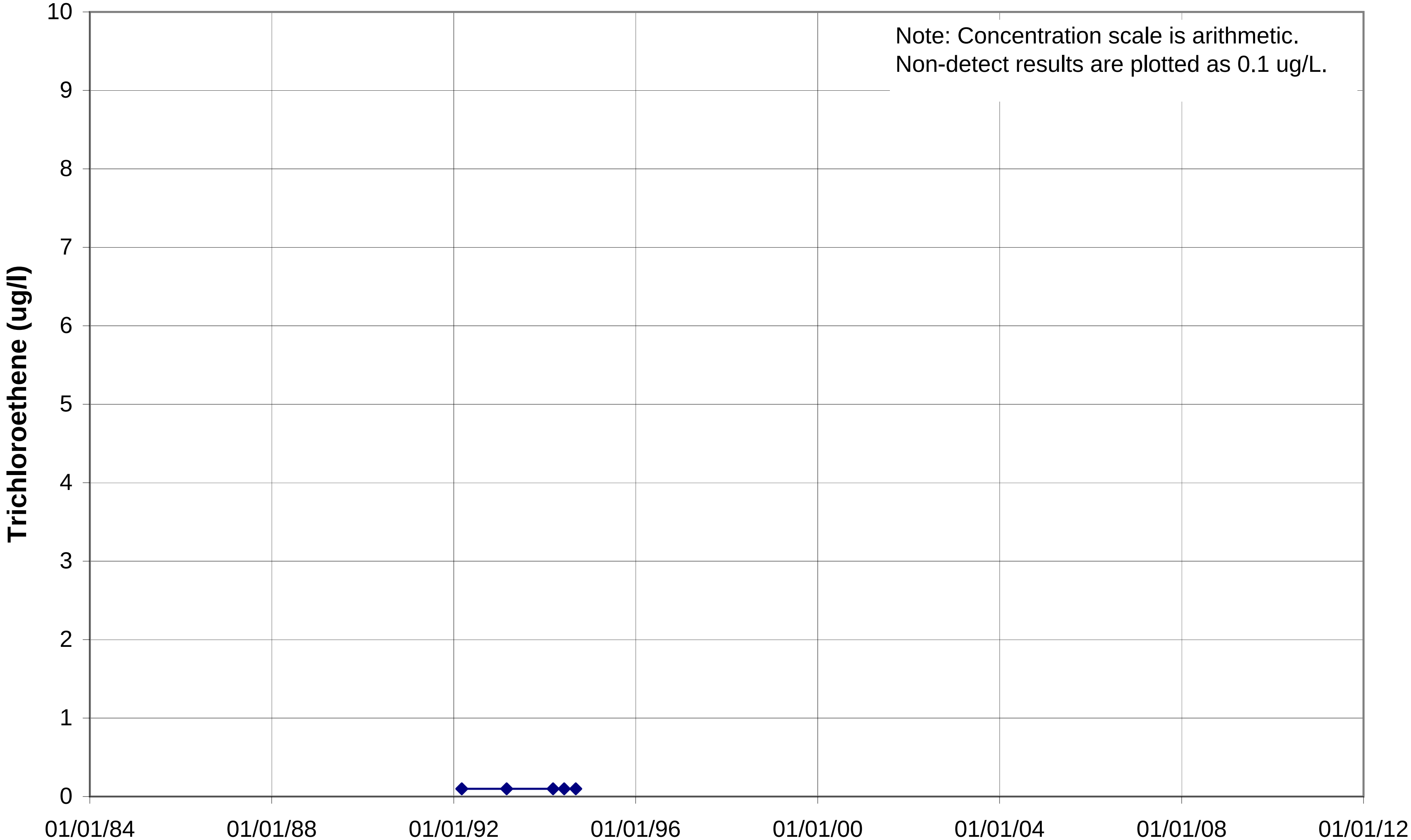


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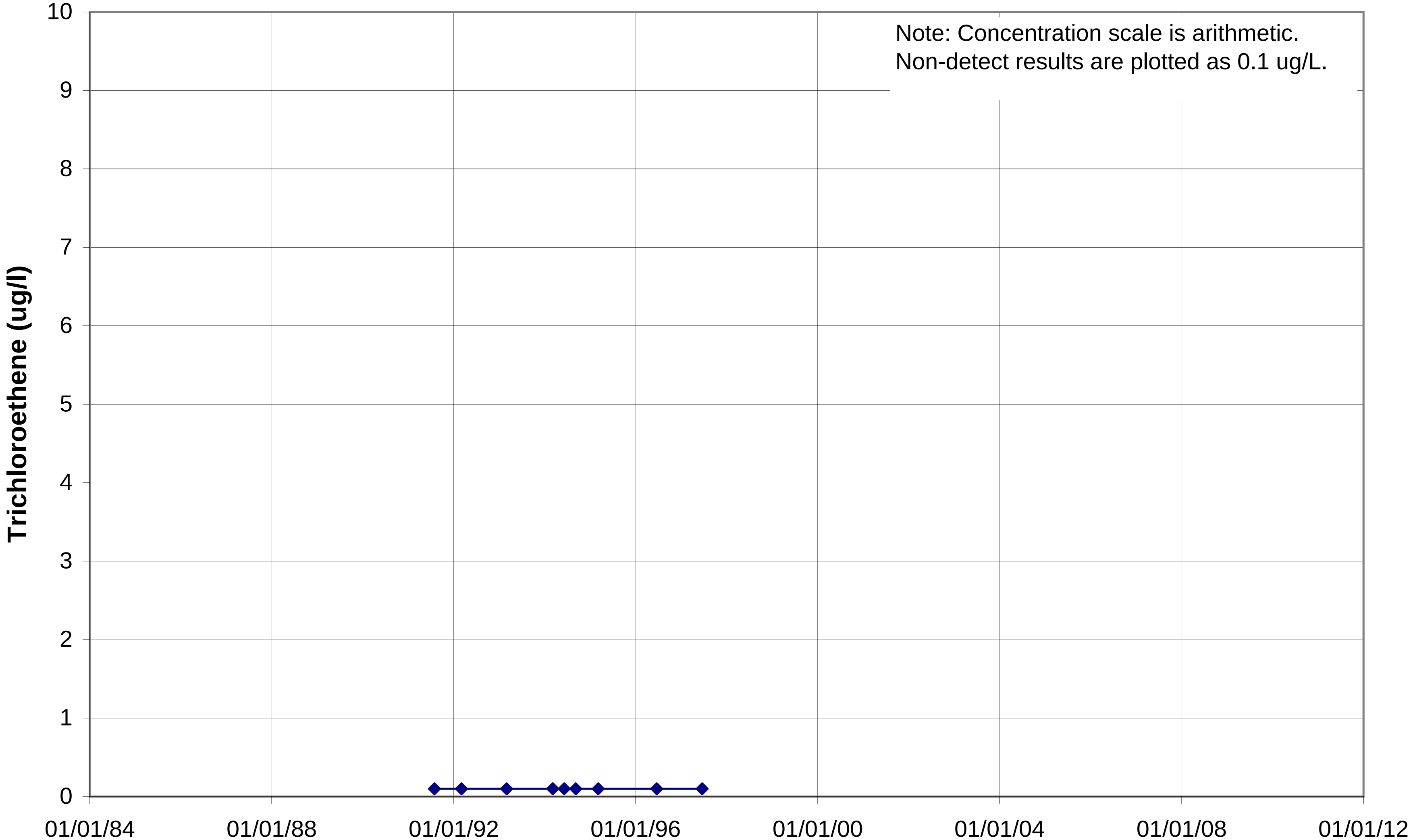


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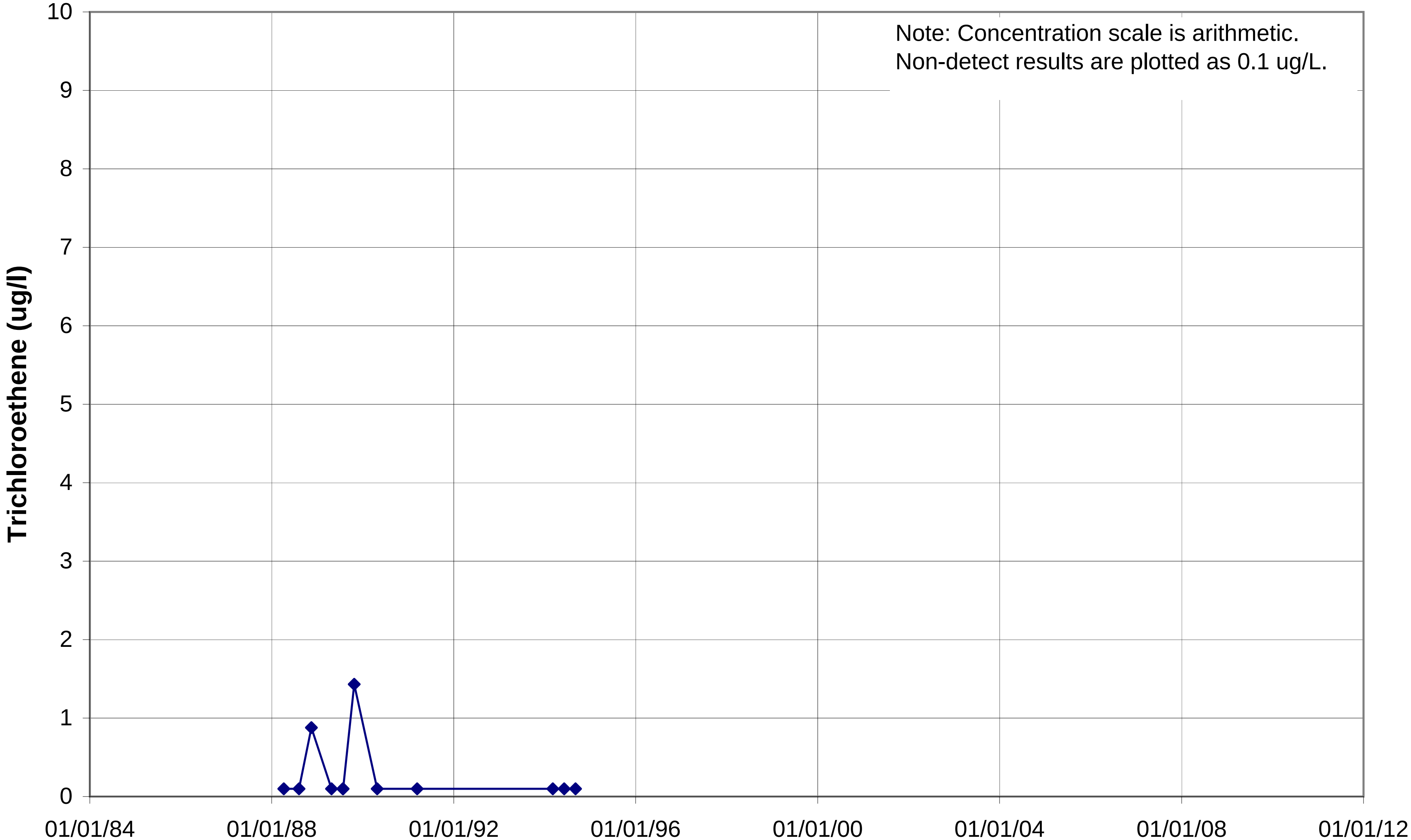


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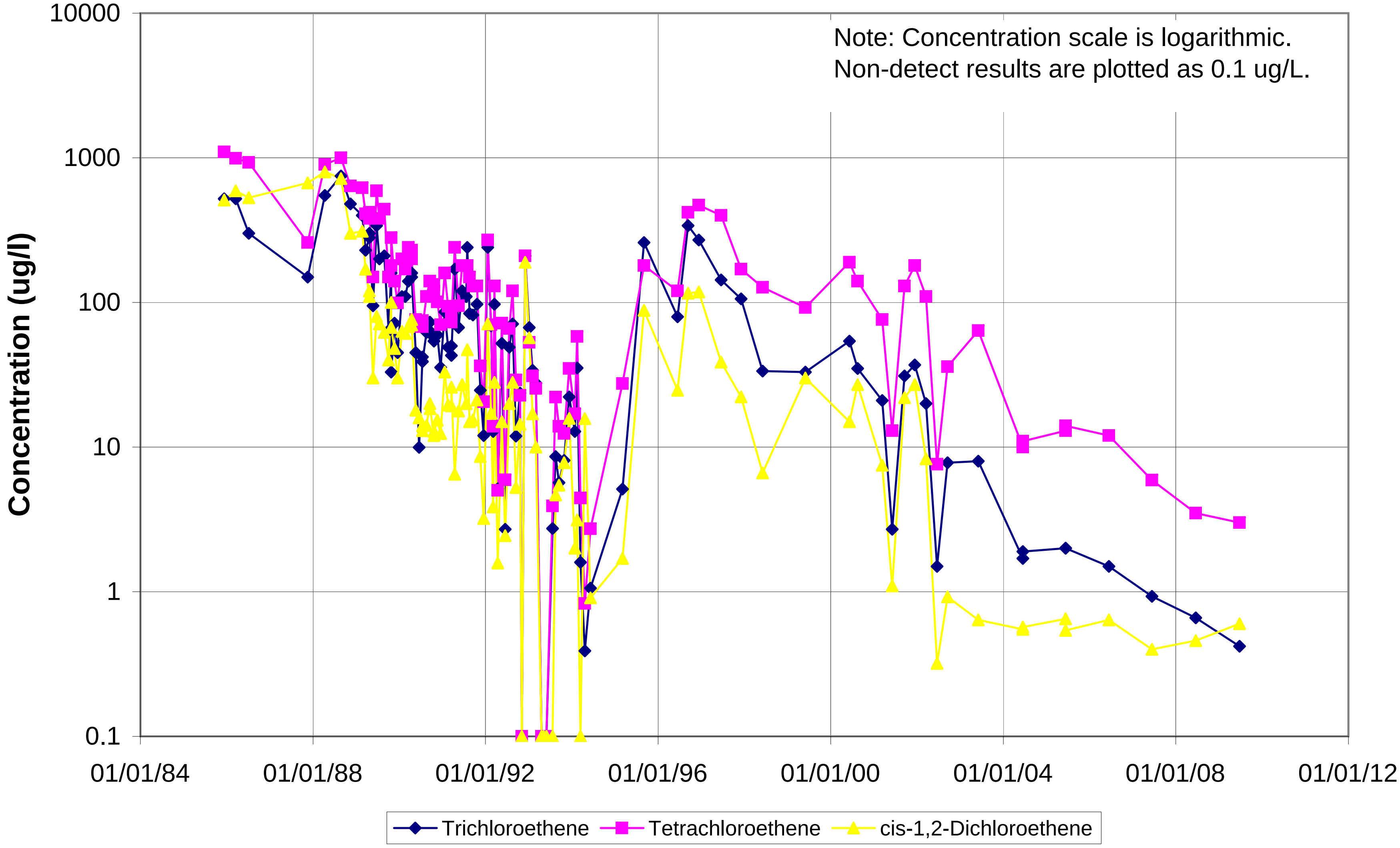


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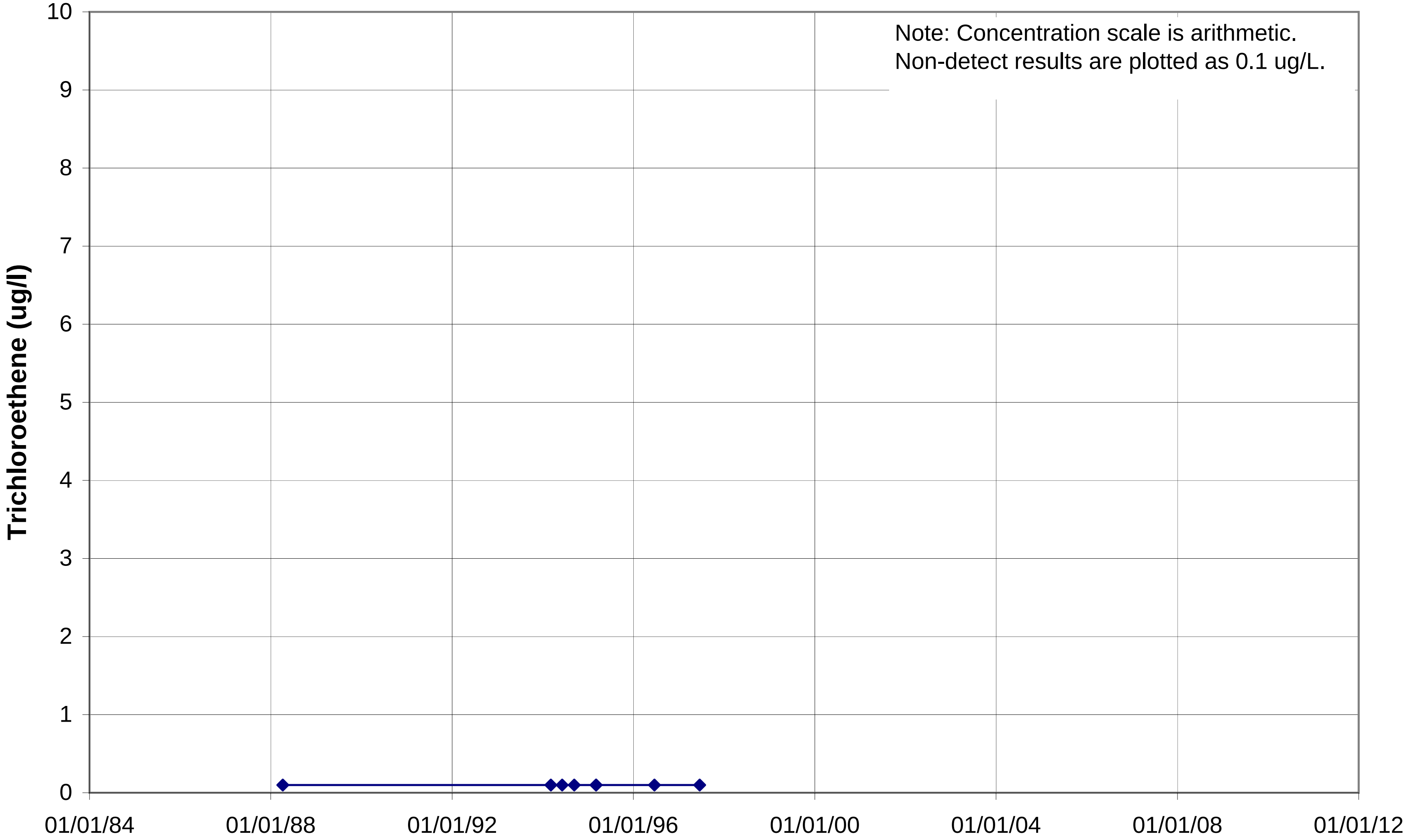


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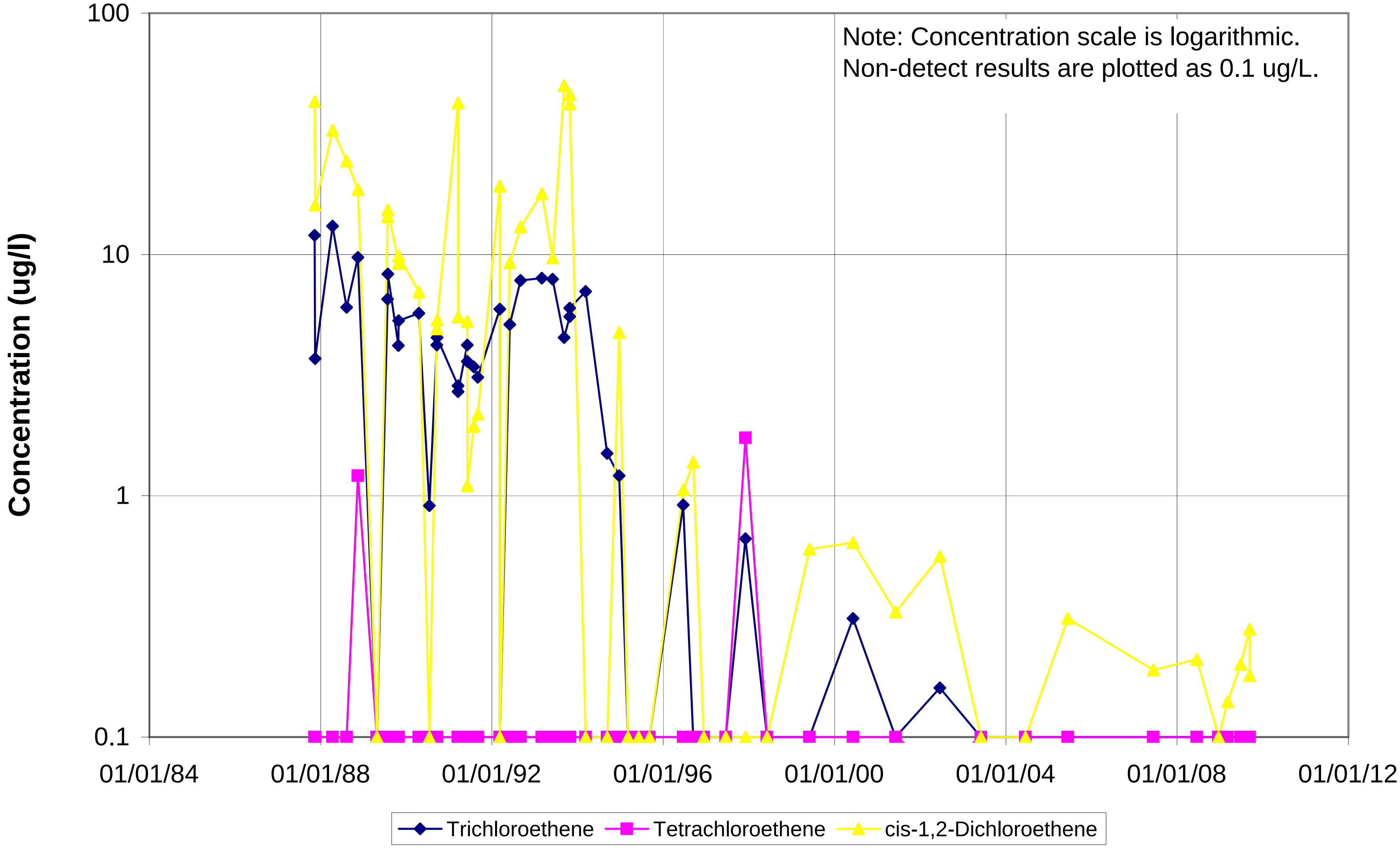


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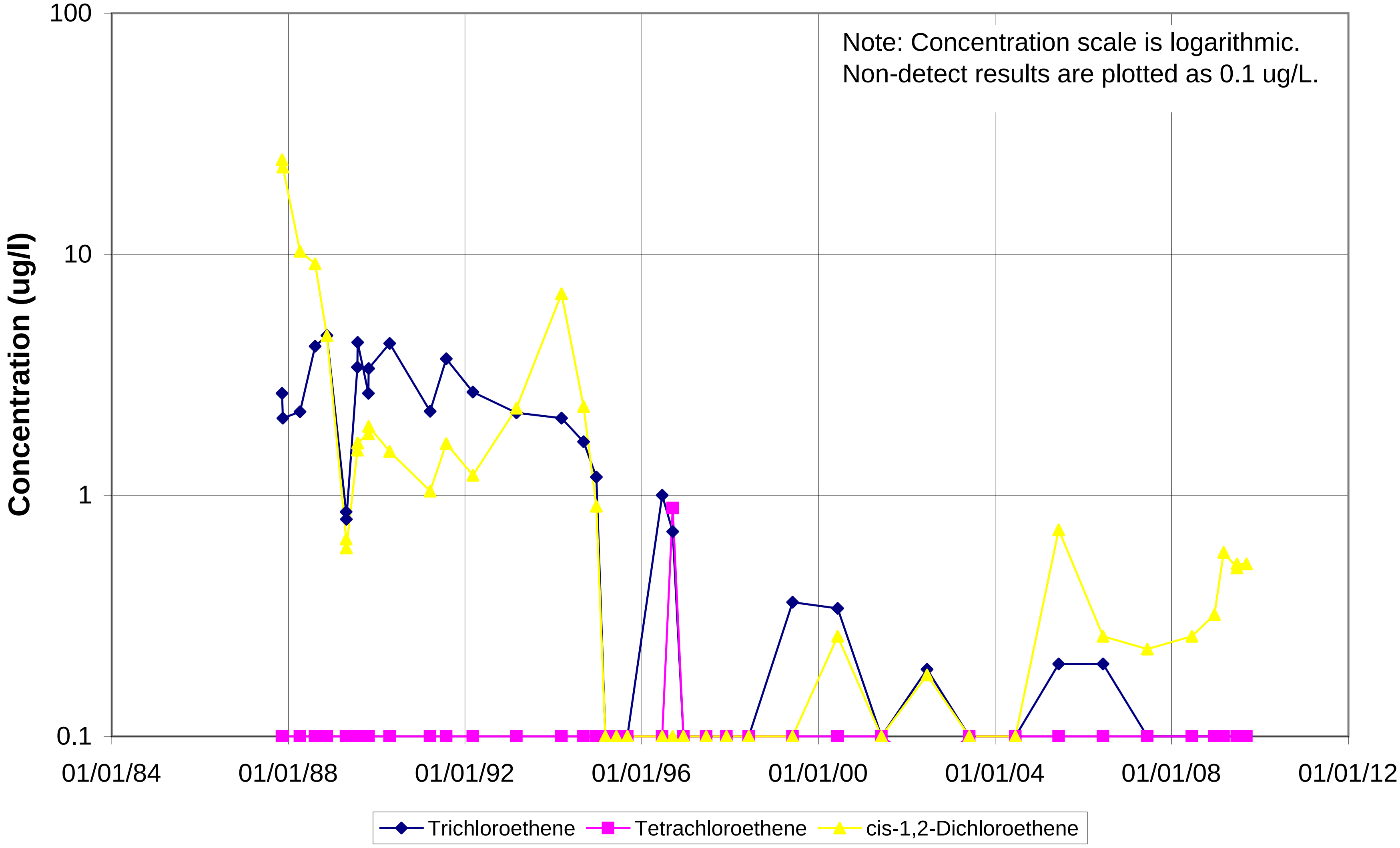


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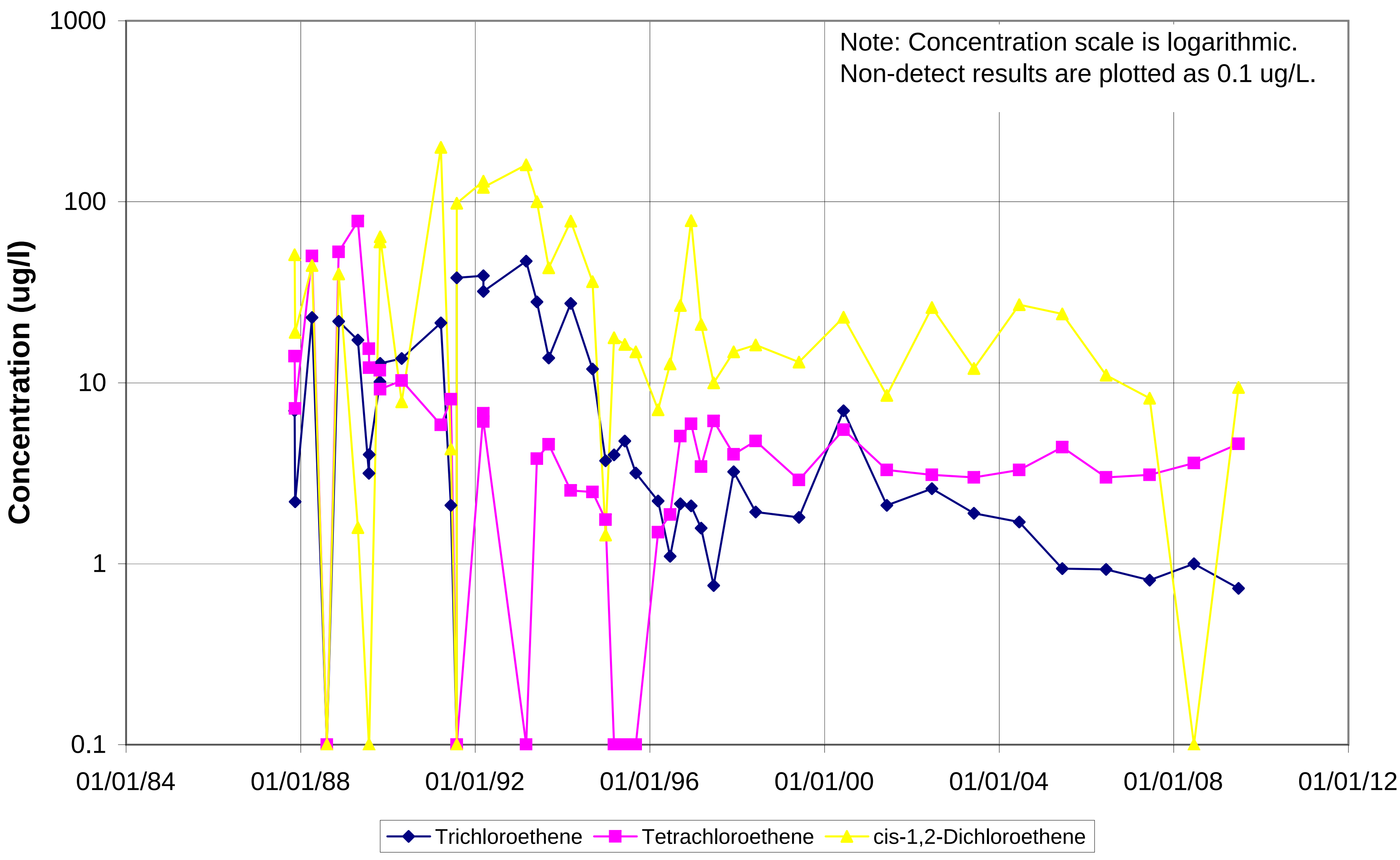


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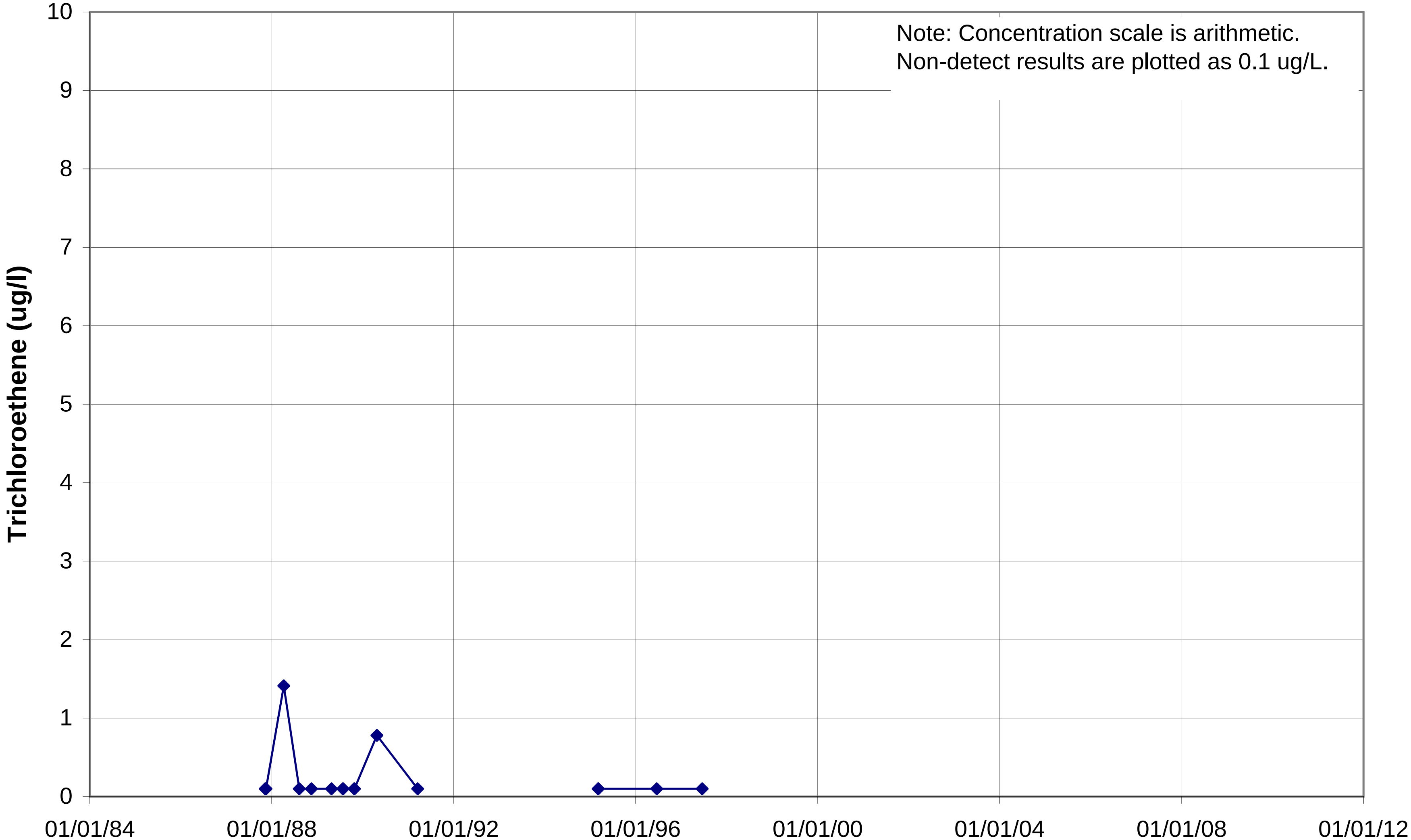


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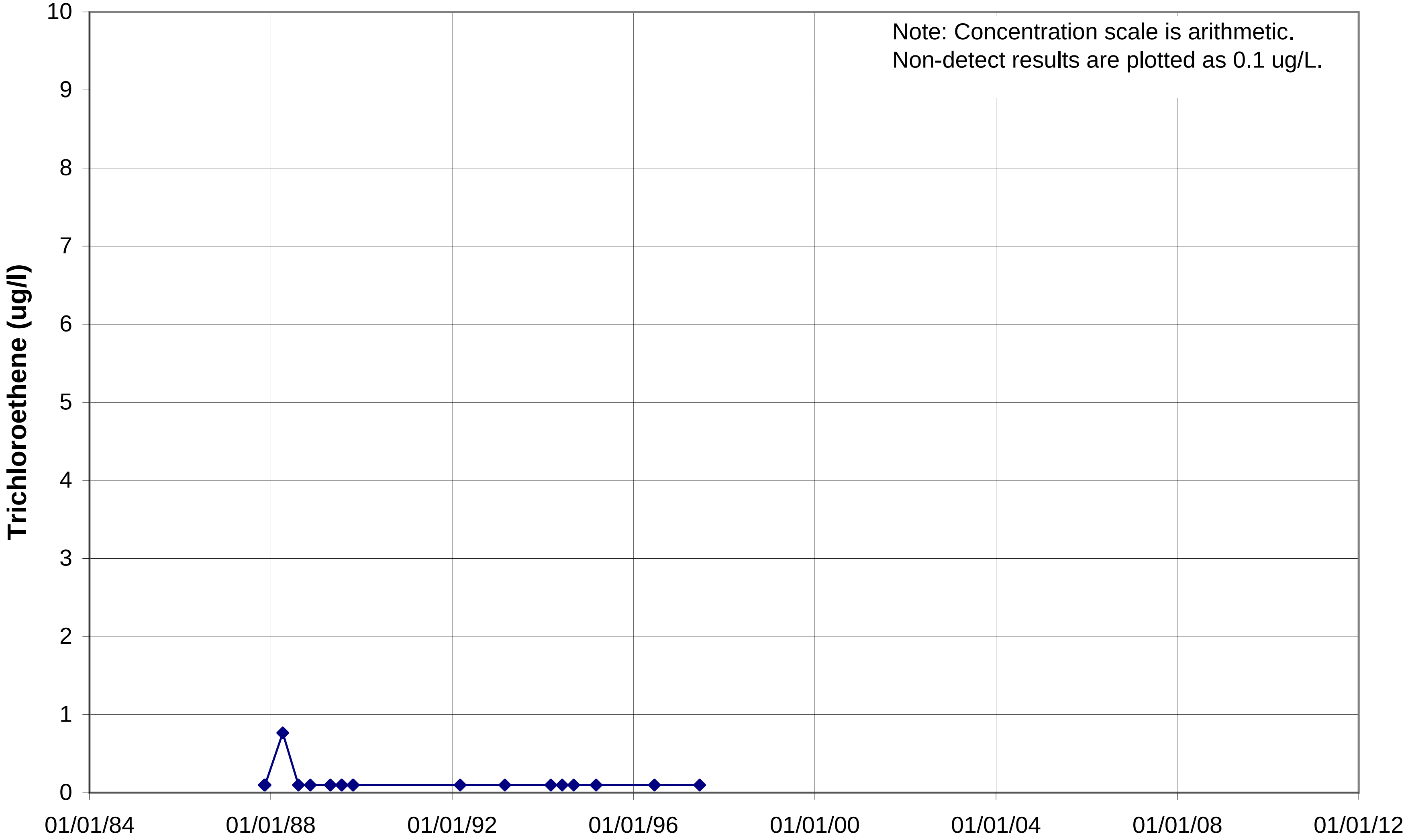


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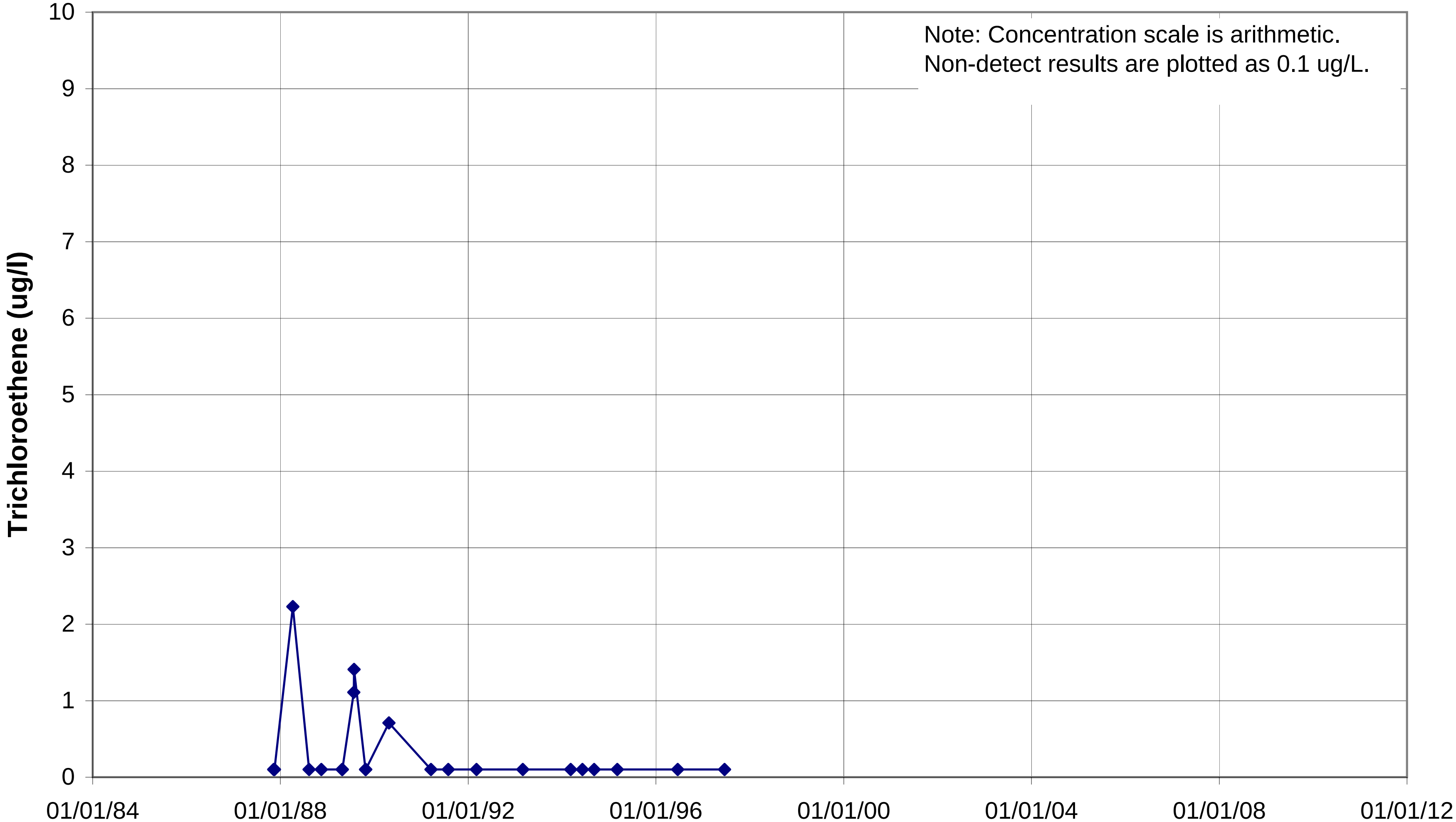


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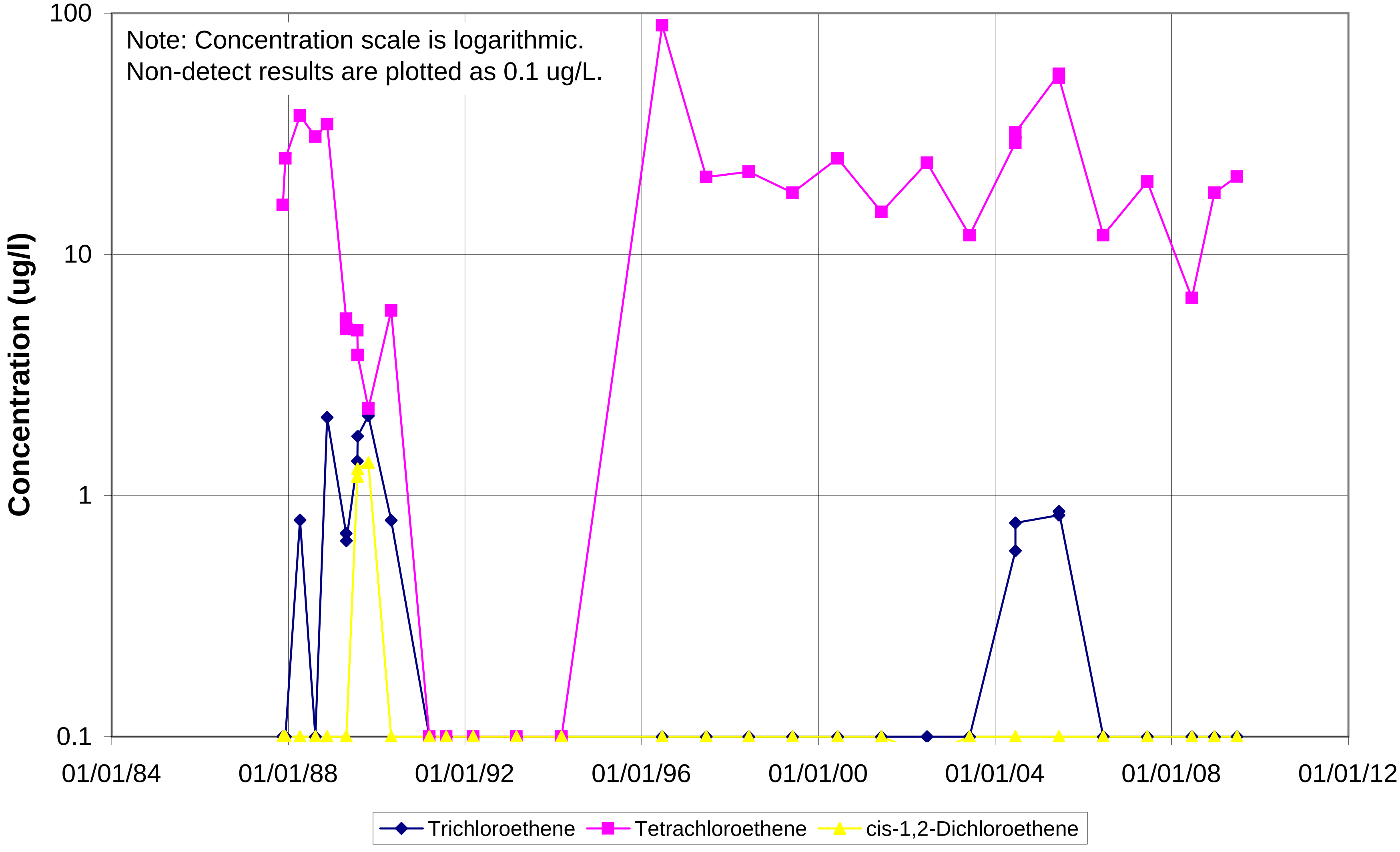


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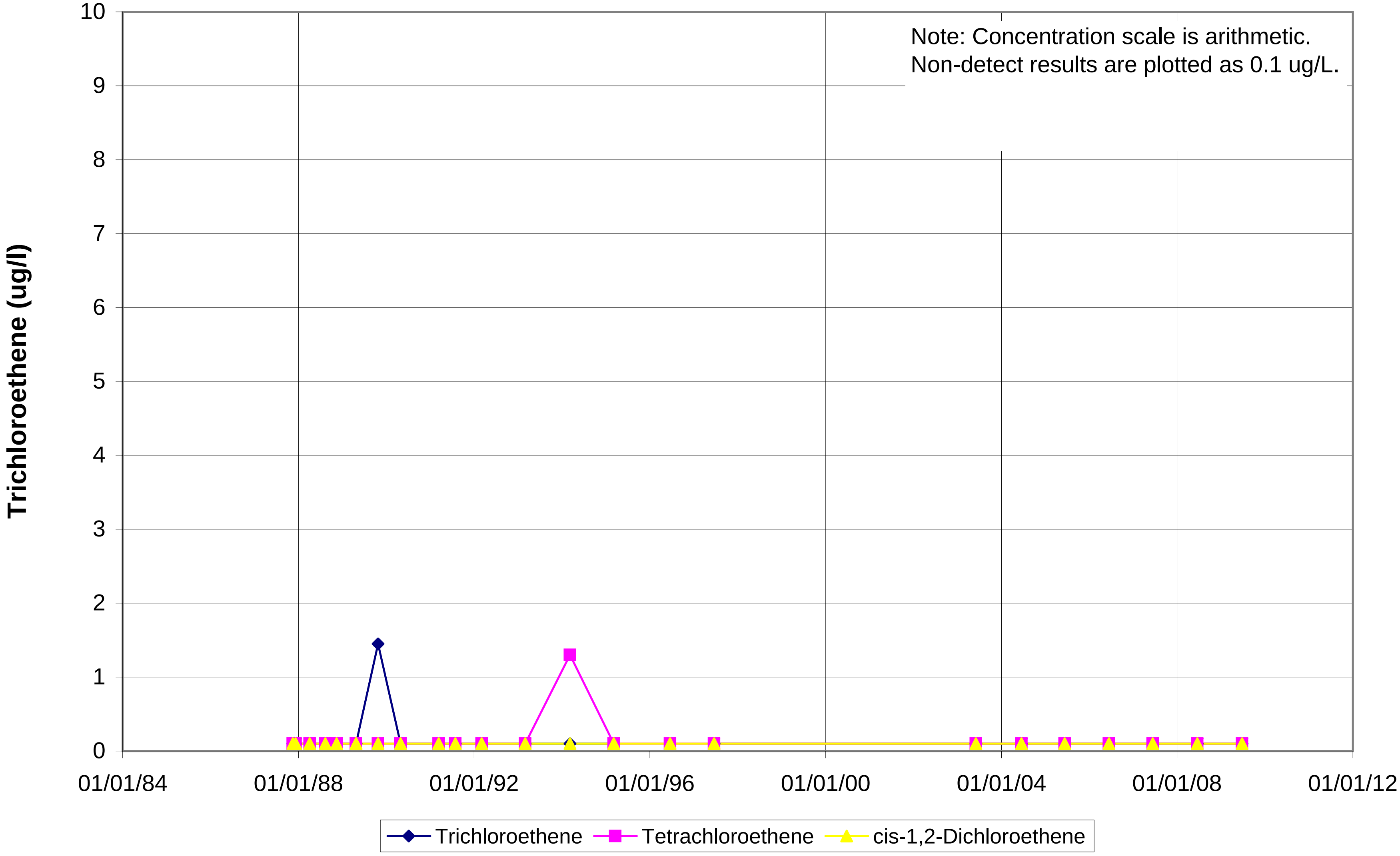


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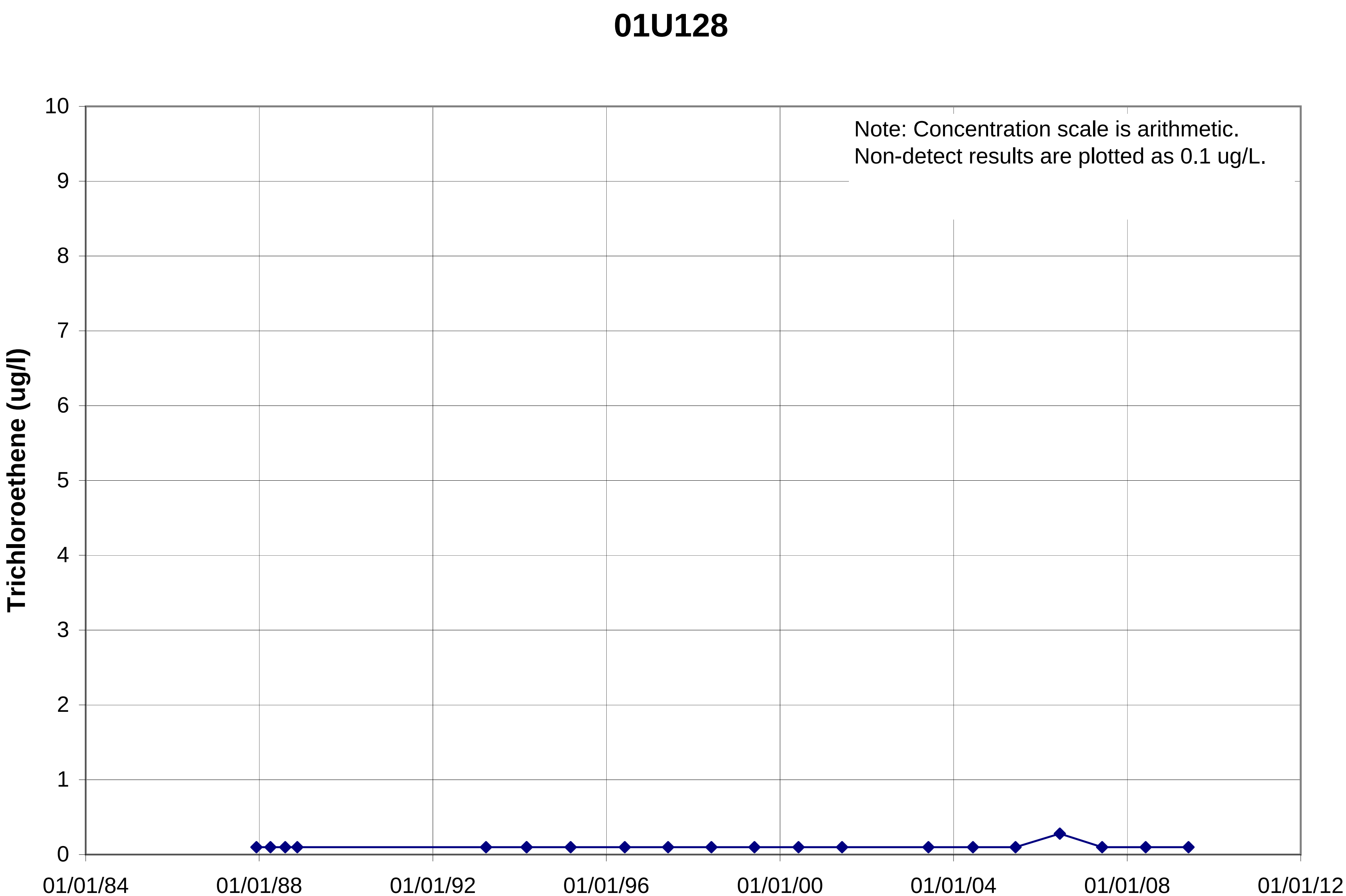


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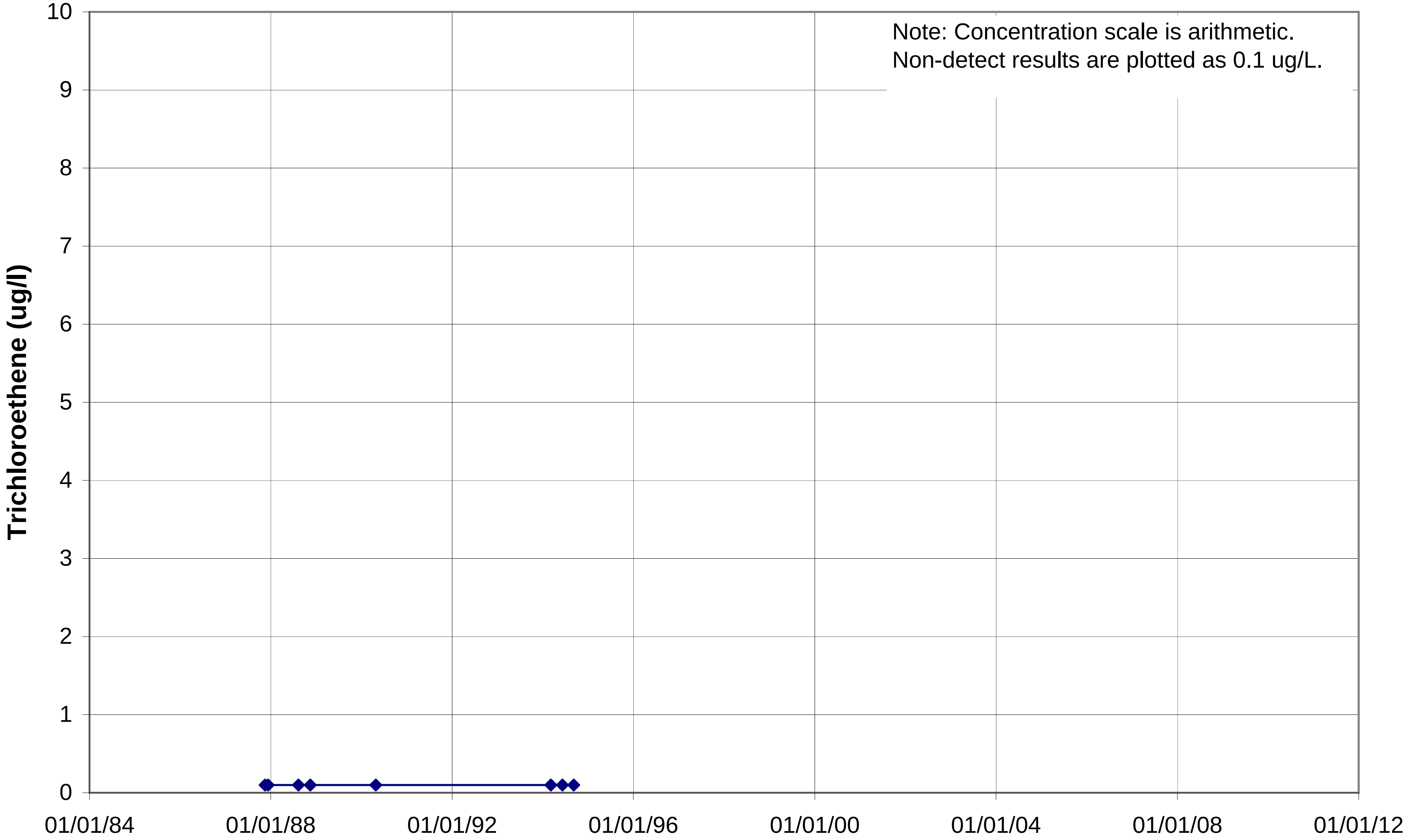


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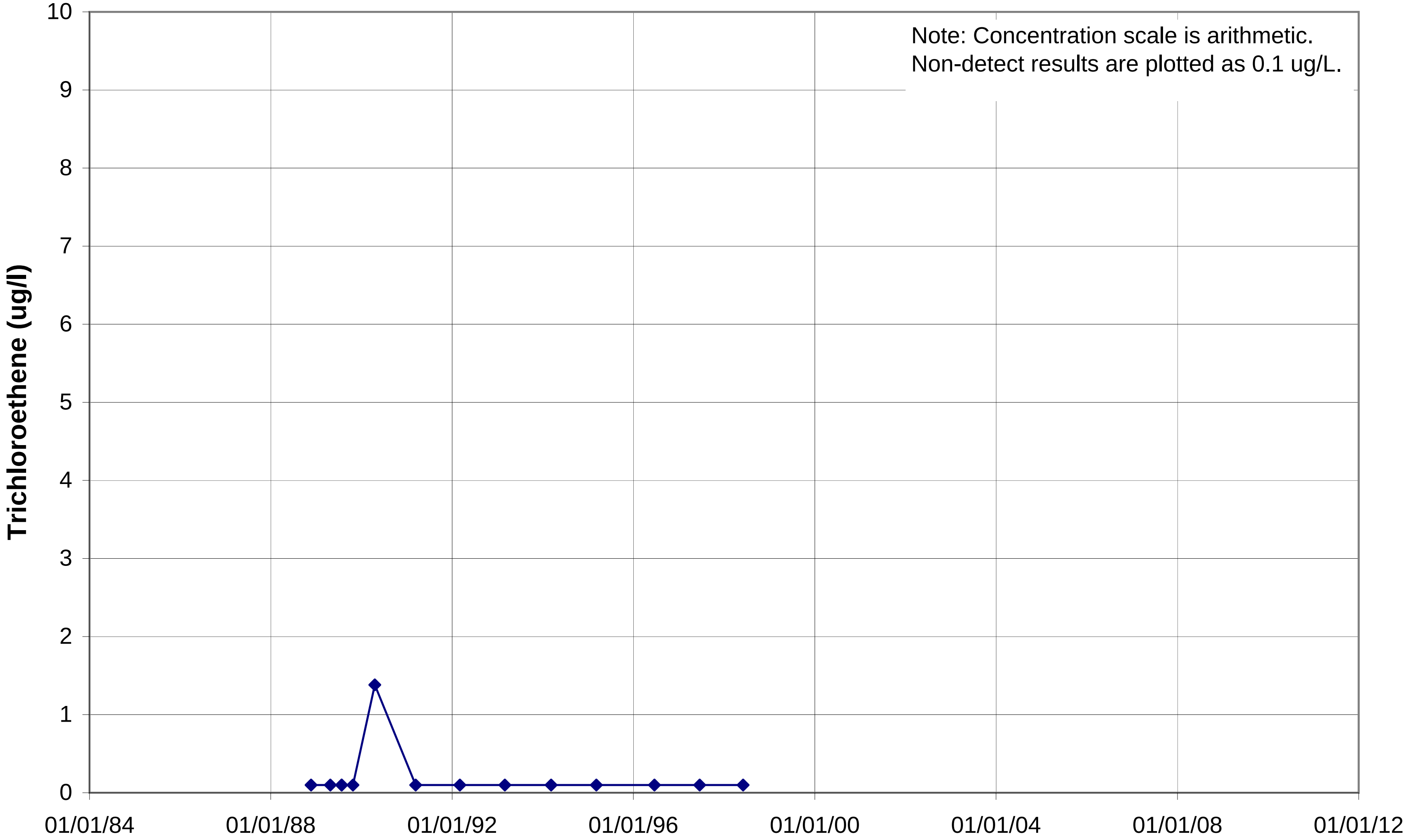


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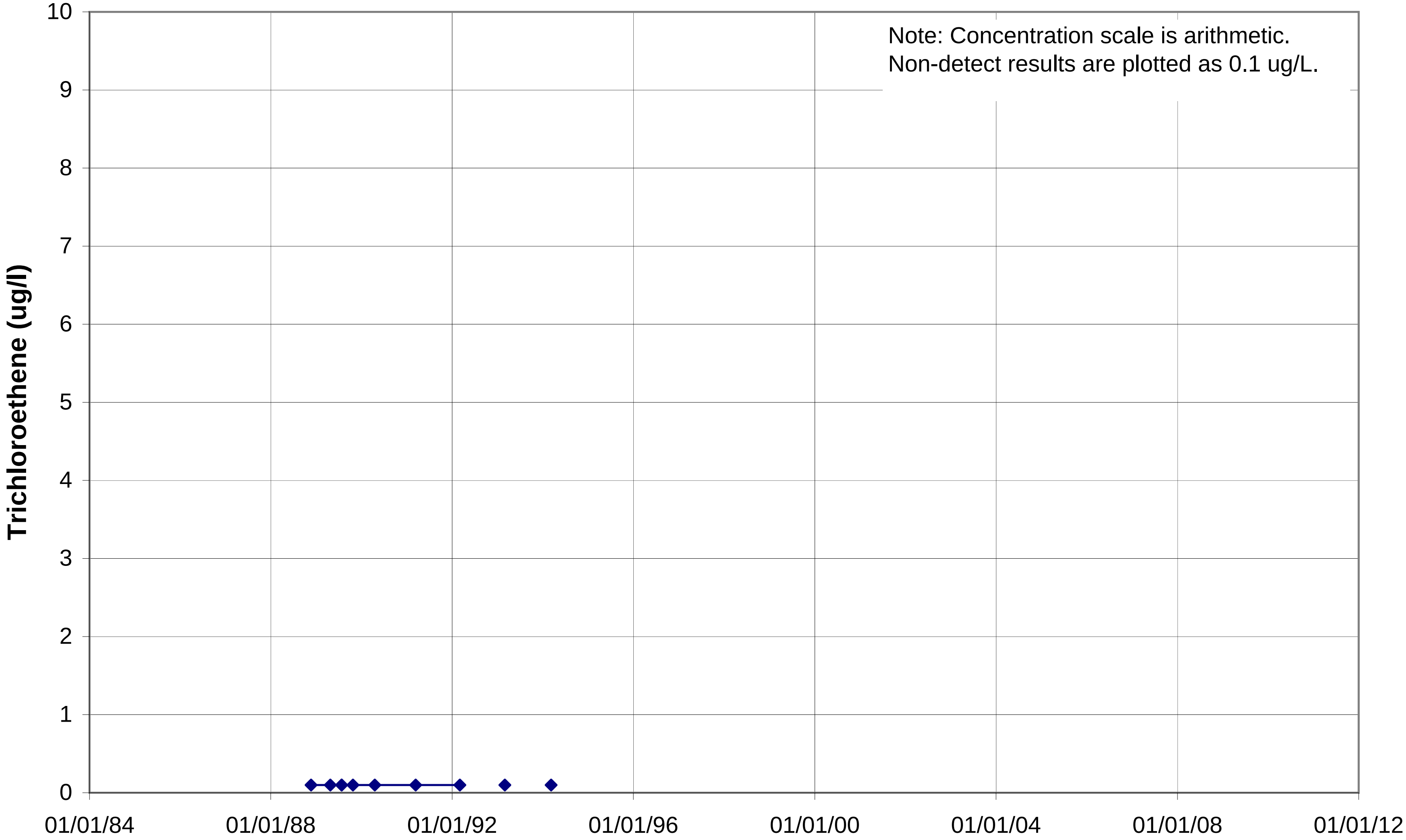


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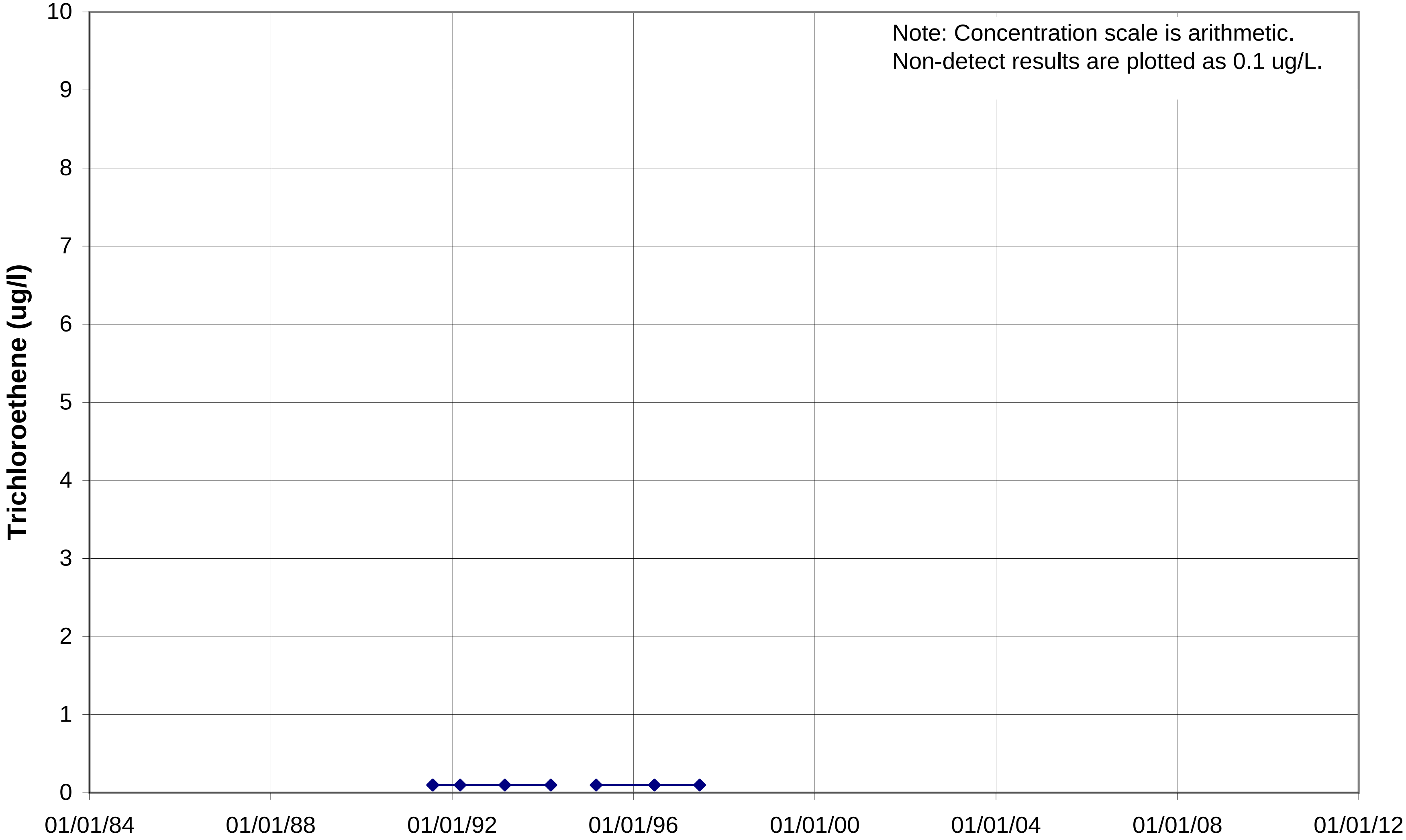


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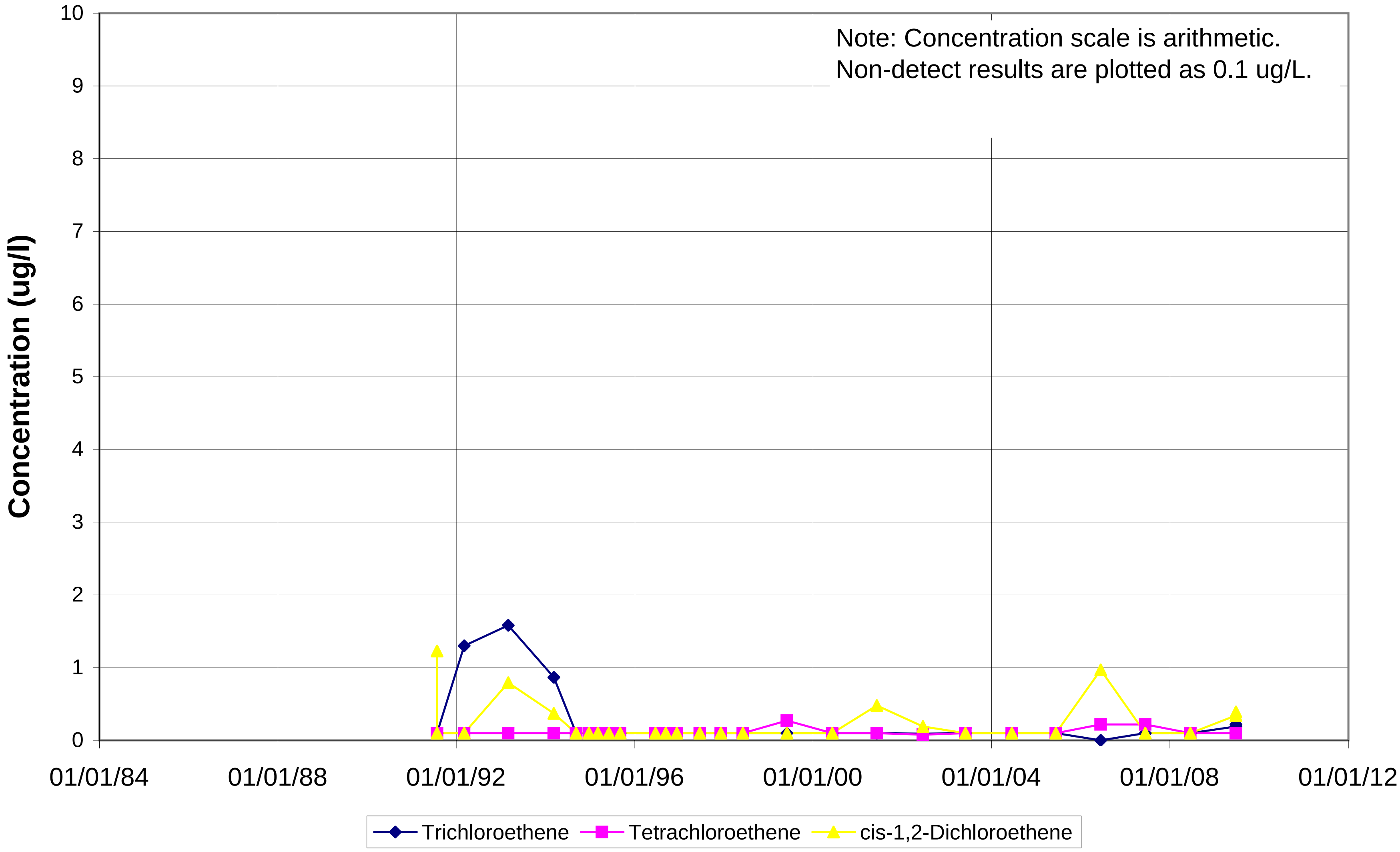


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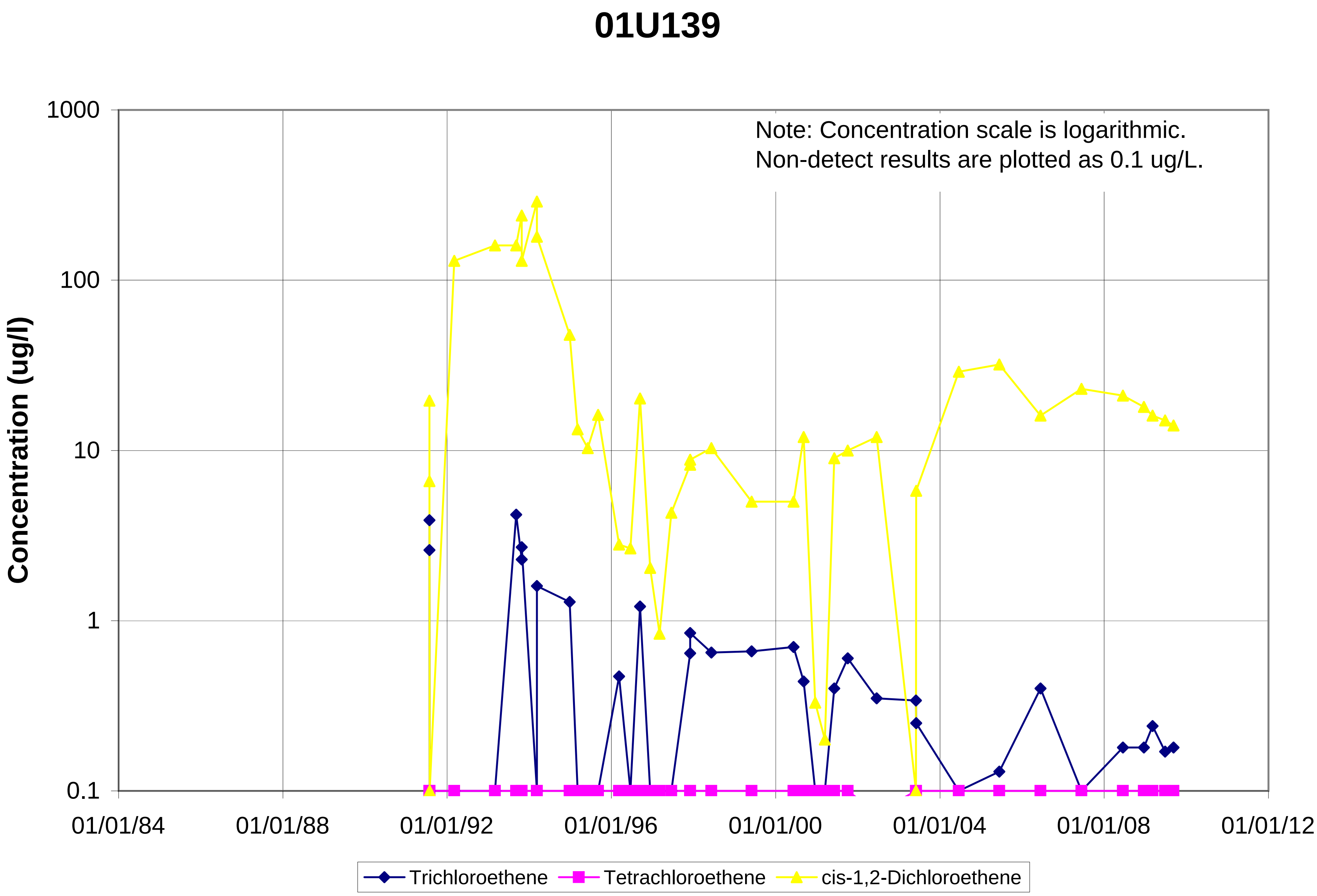


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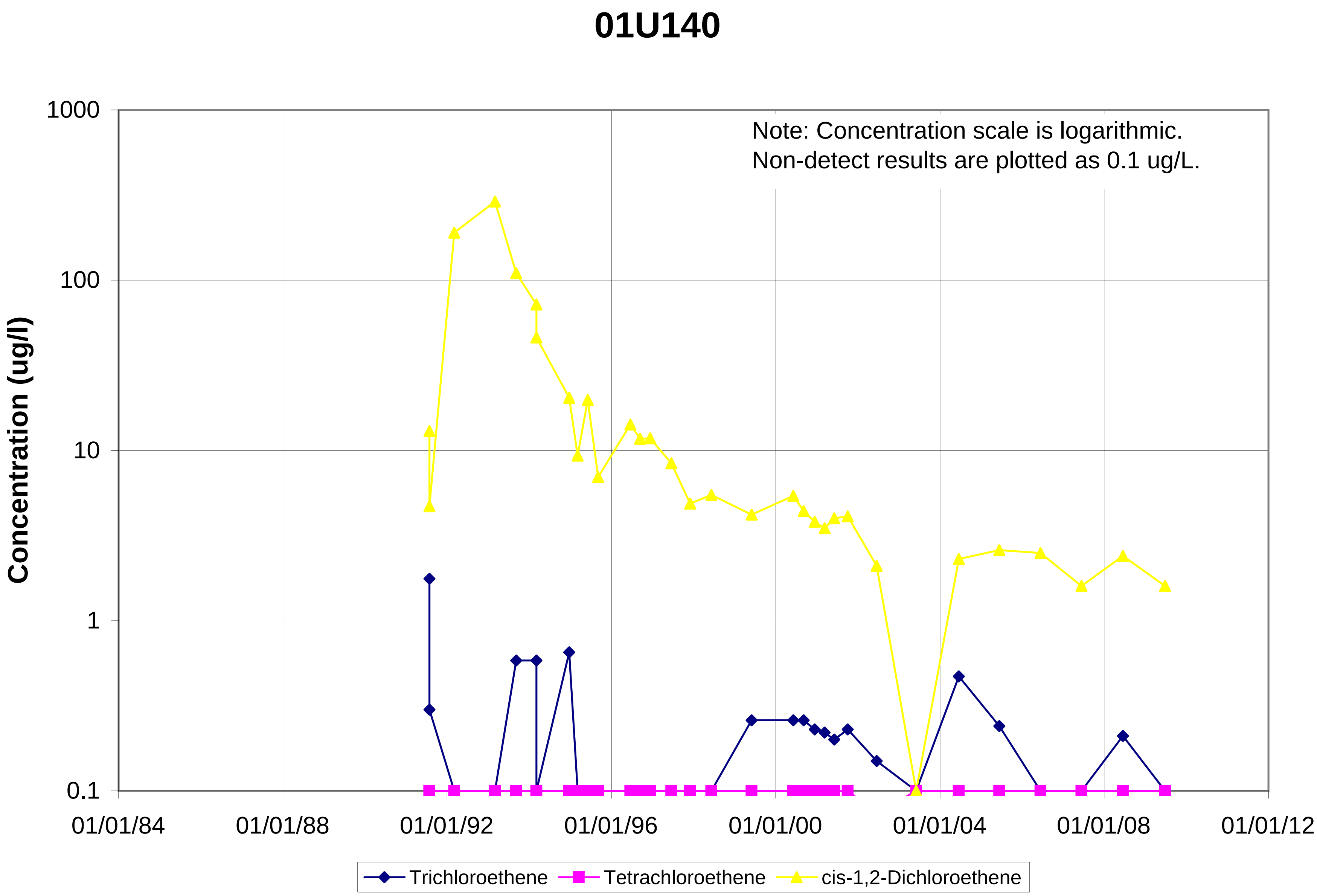


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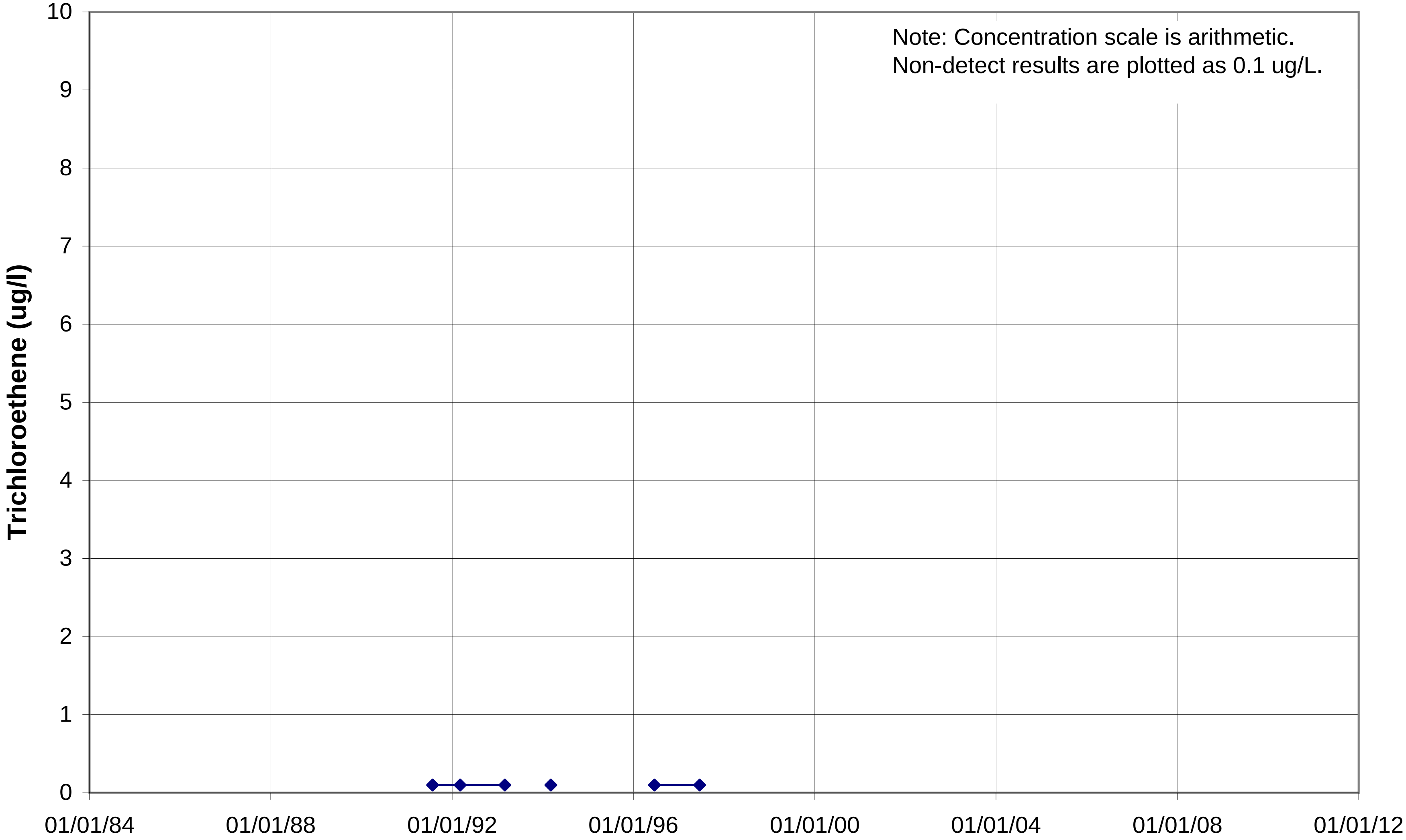


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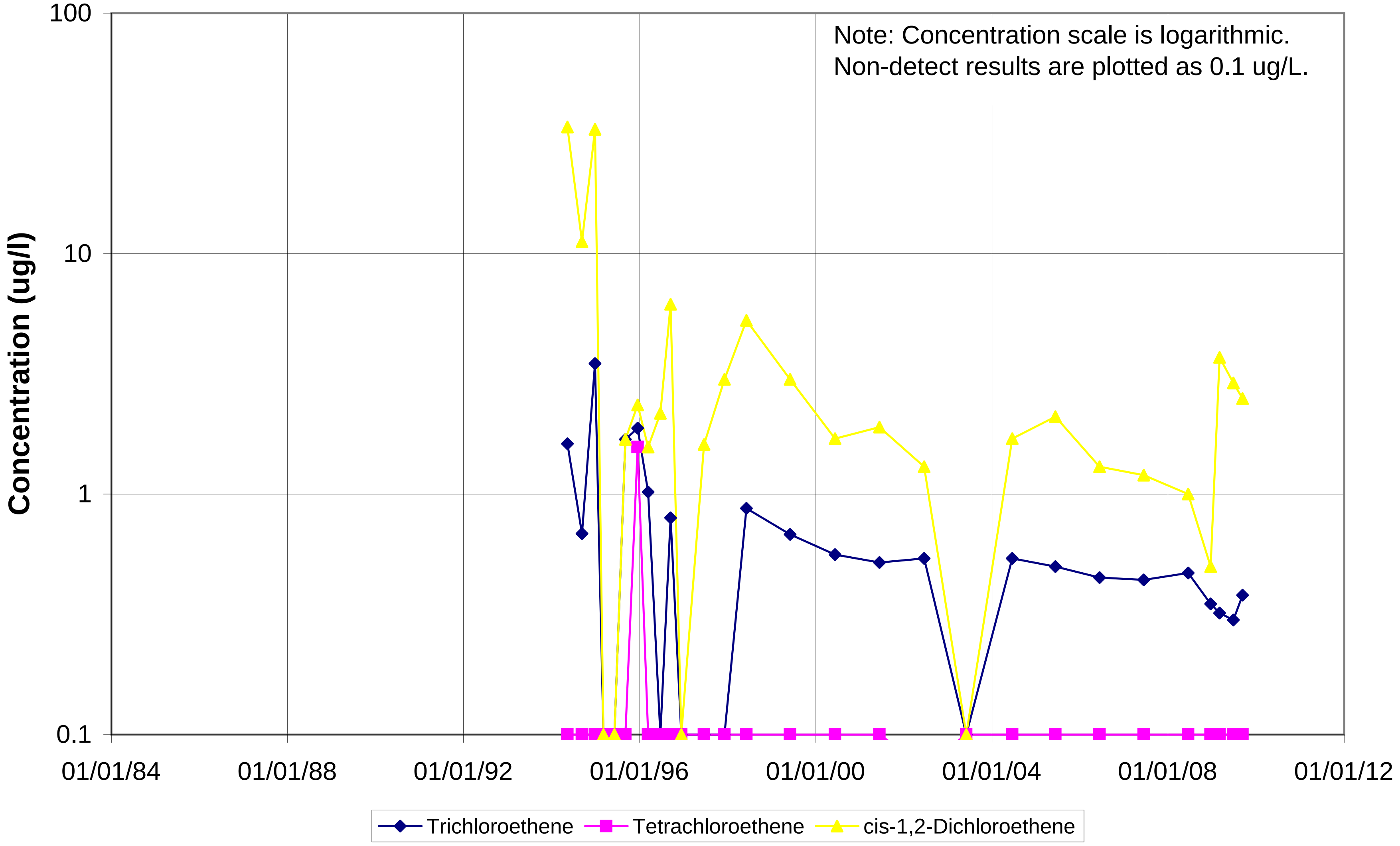


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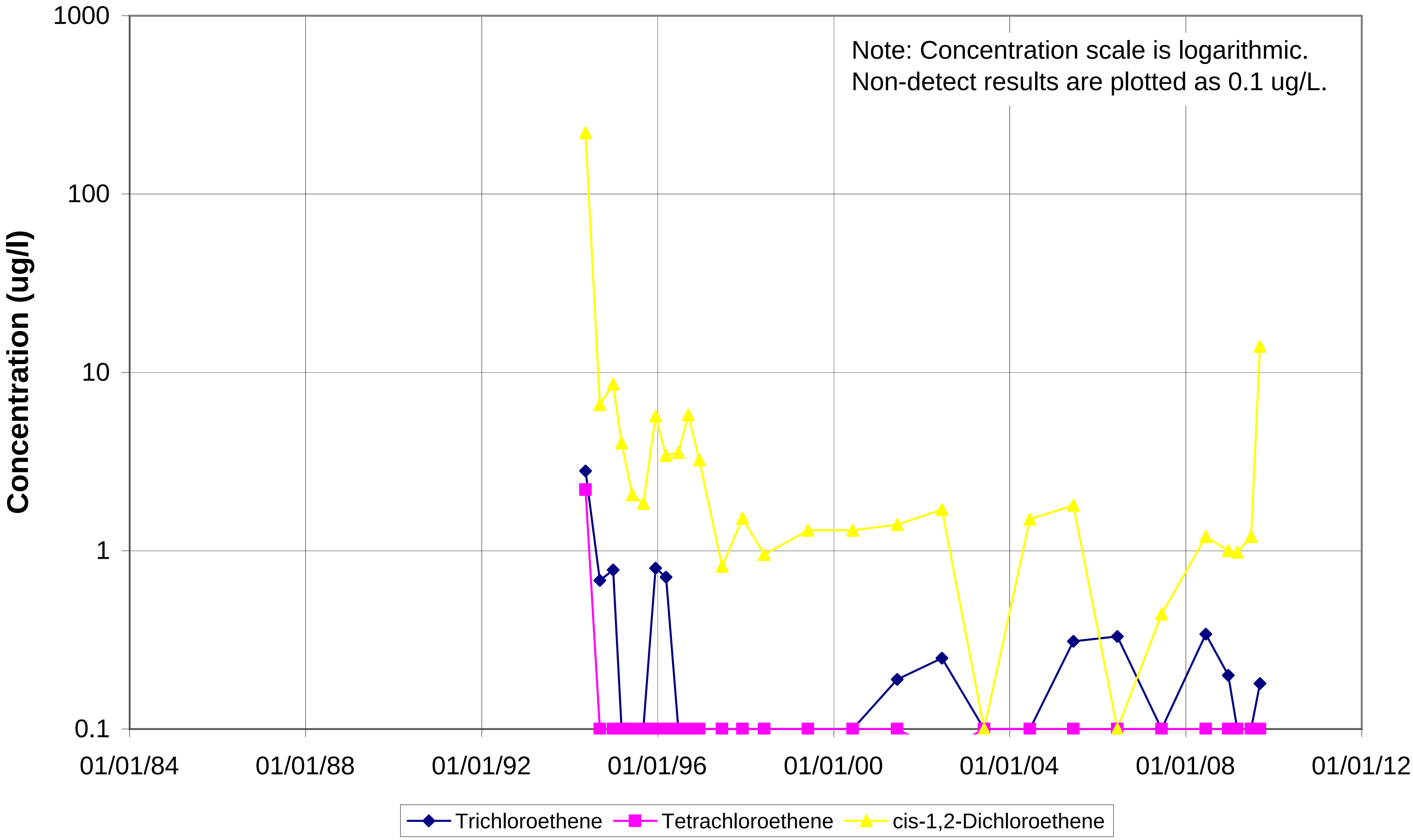


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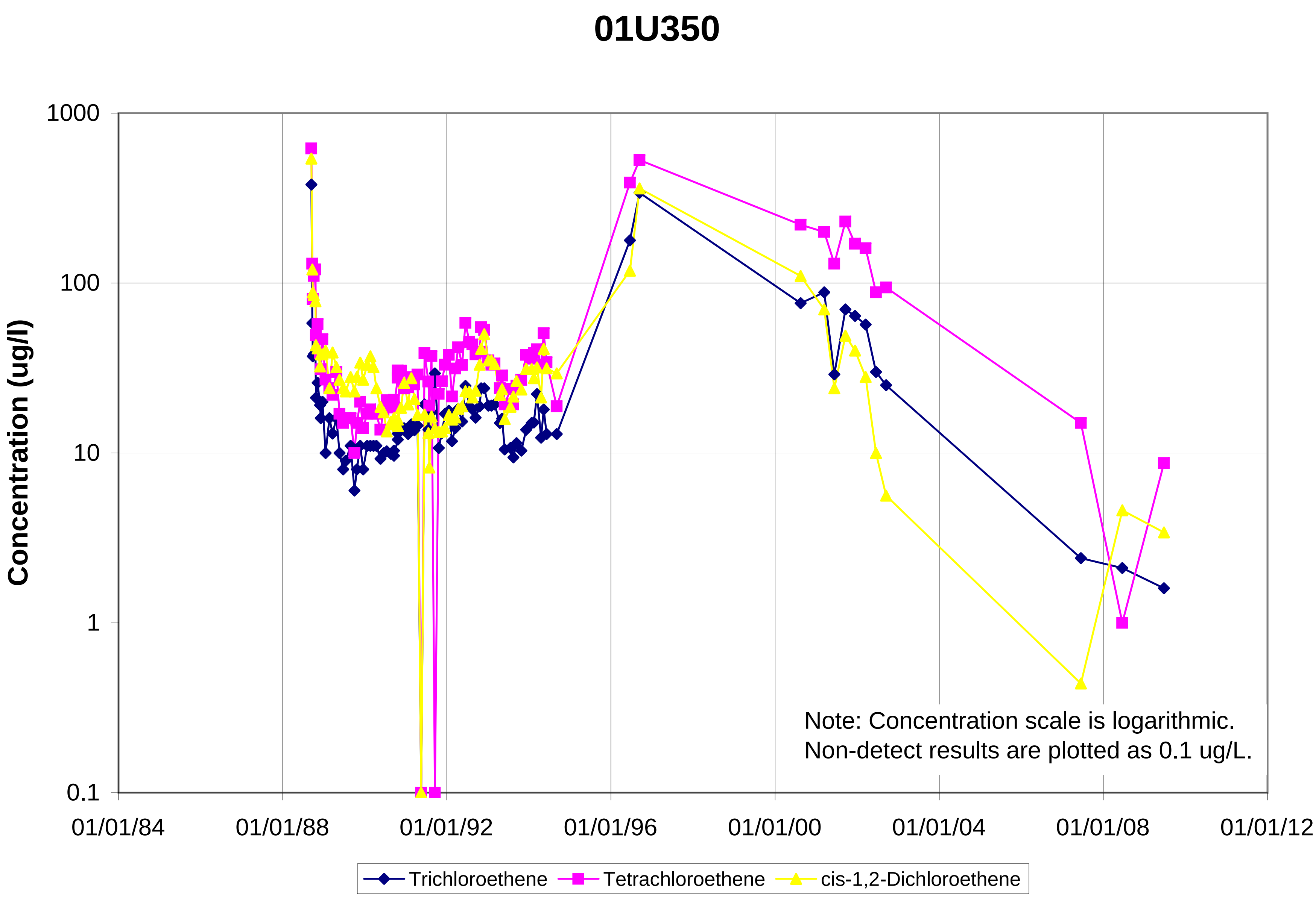


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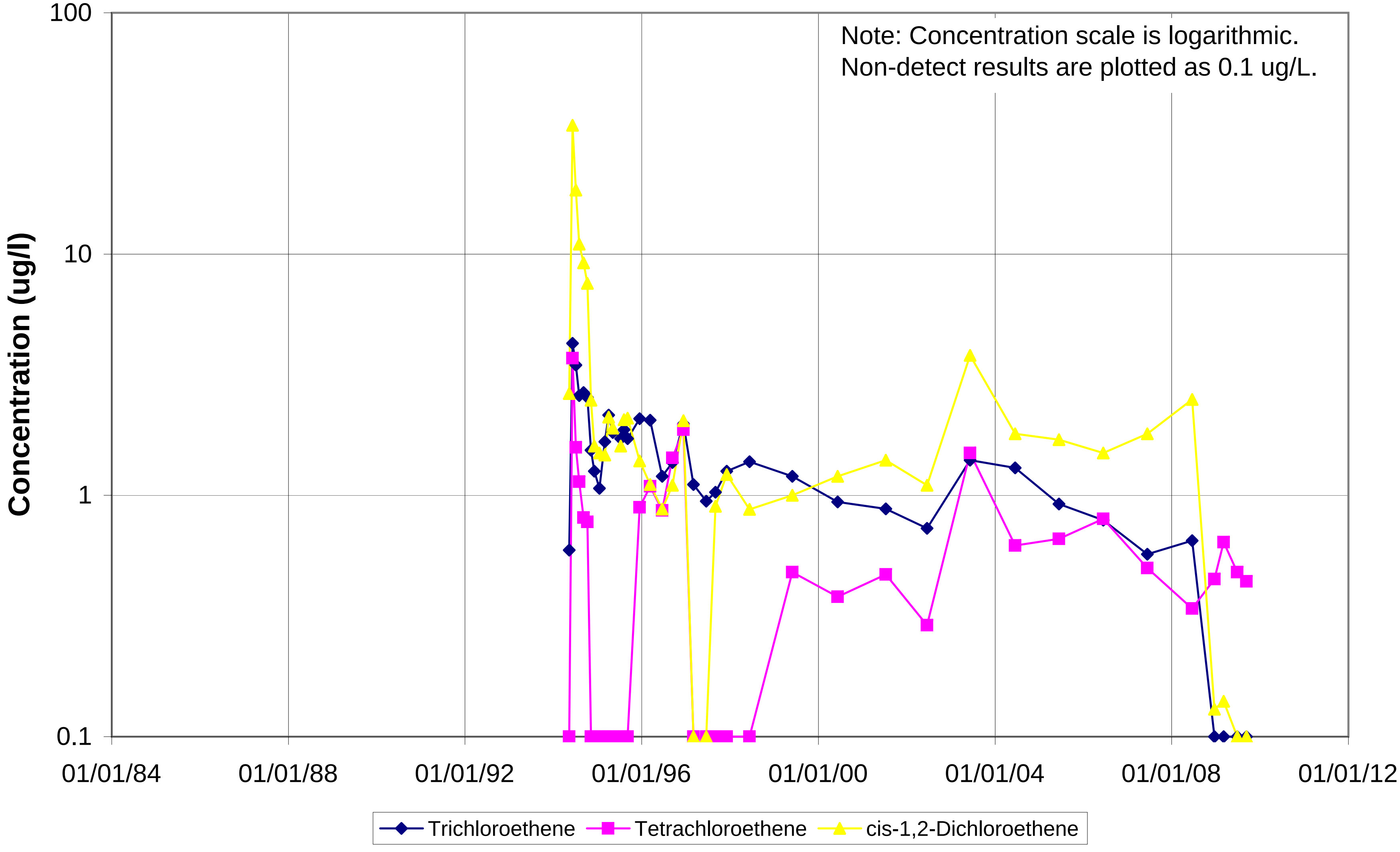
# 01U351 (EW-1)

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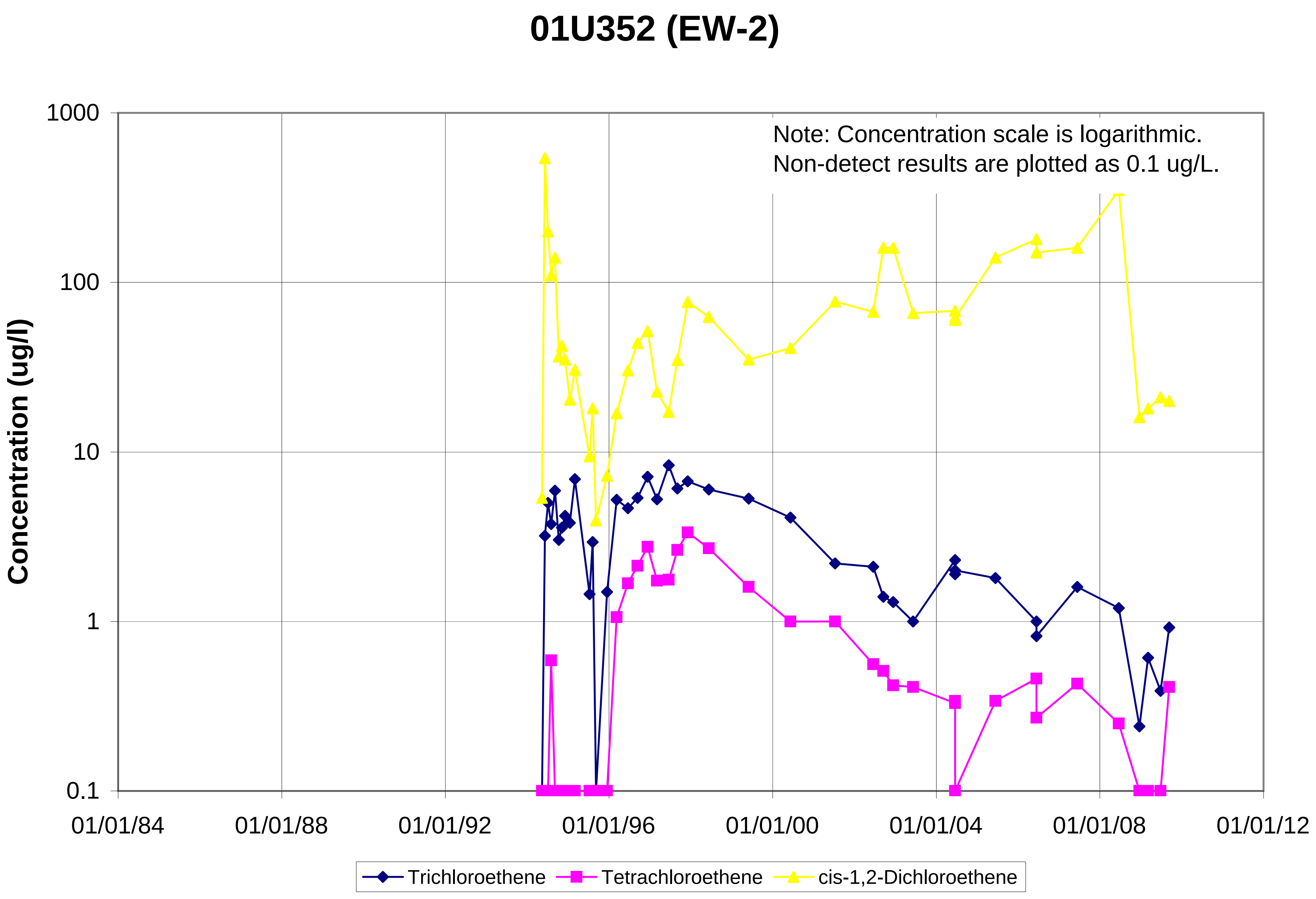


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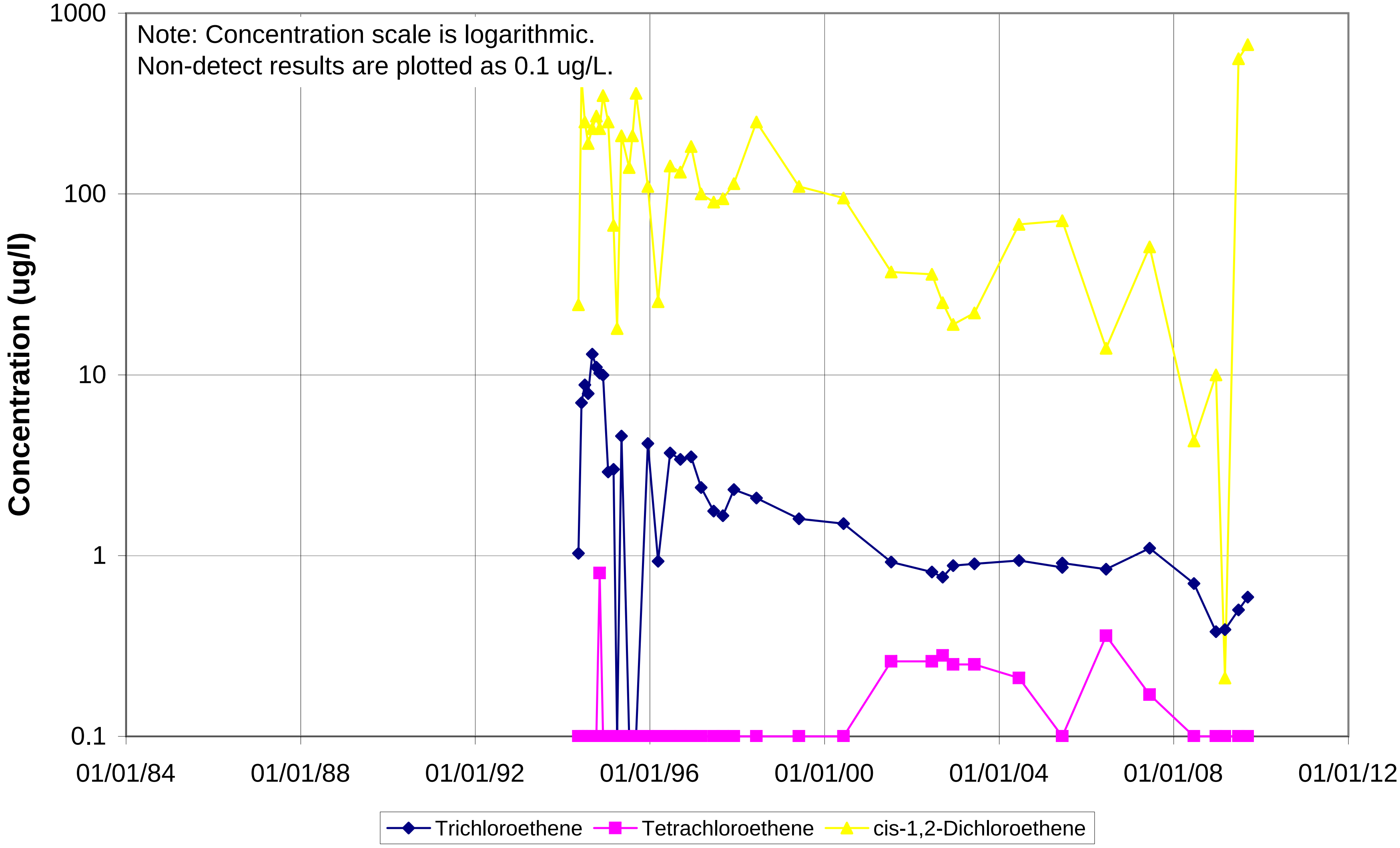


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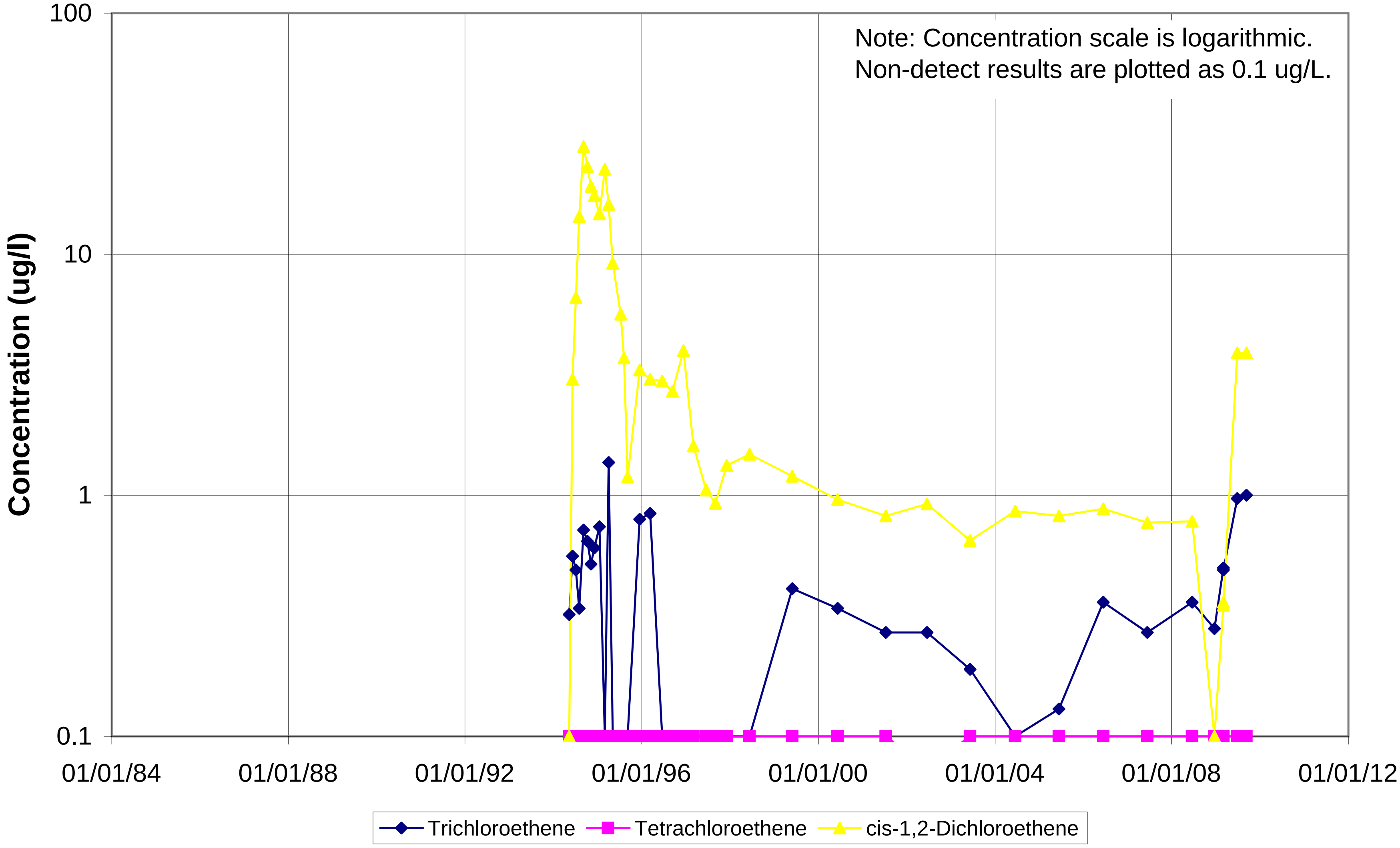


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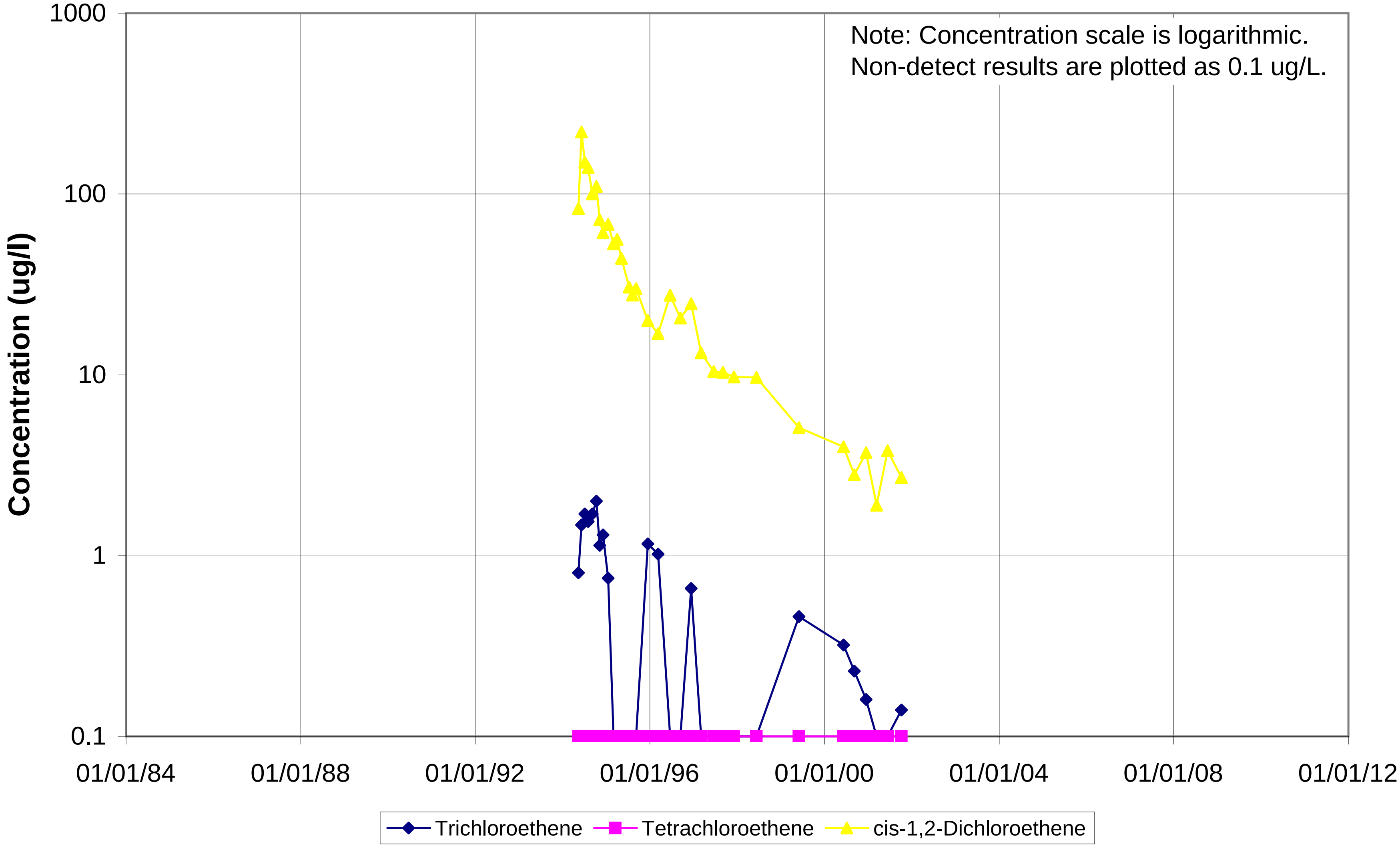


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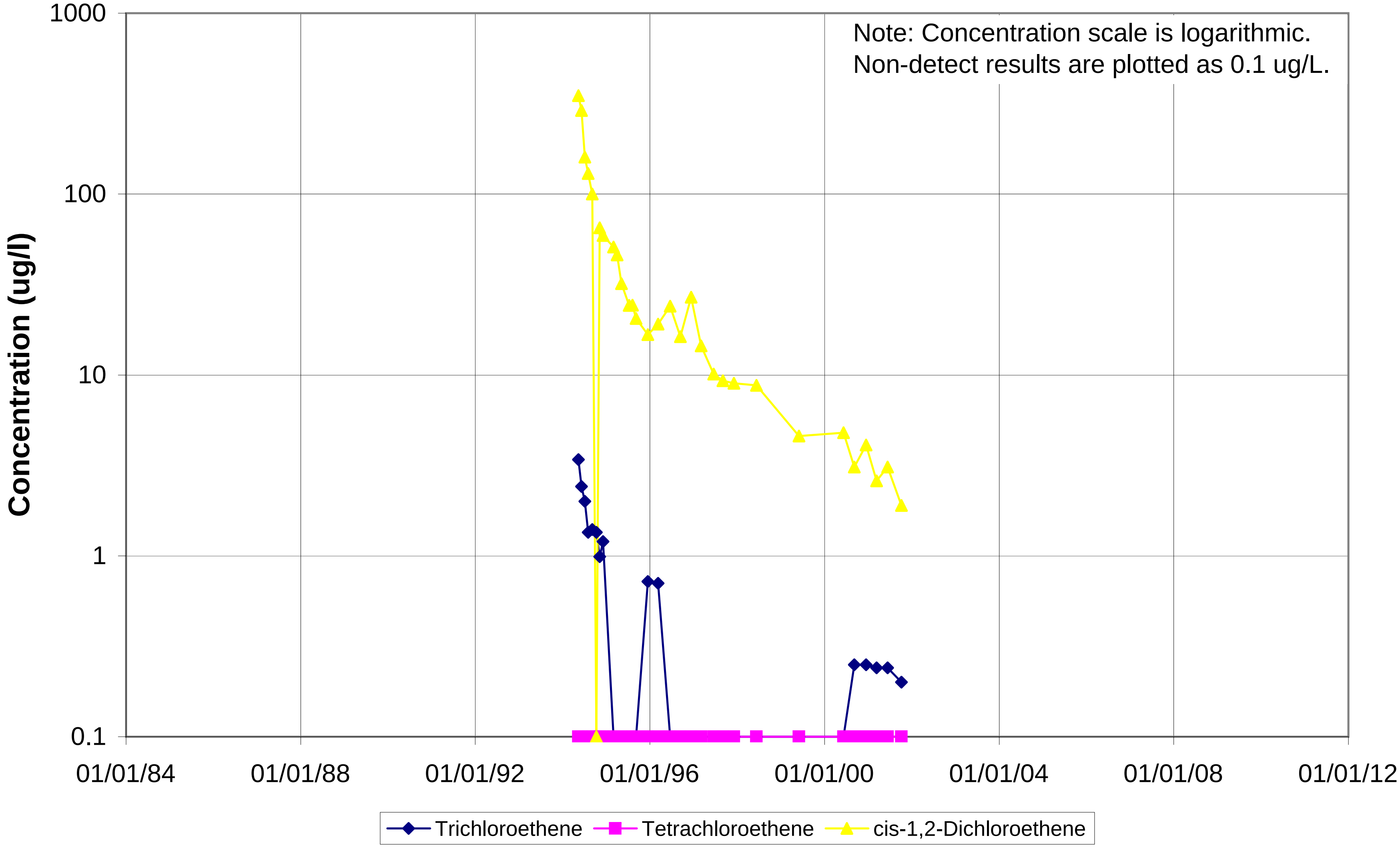
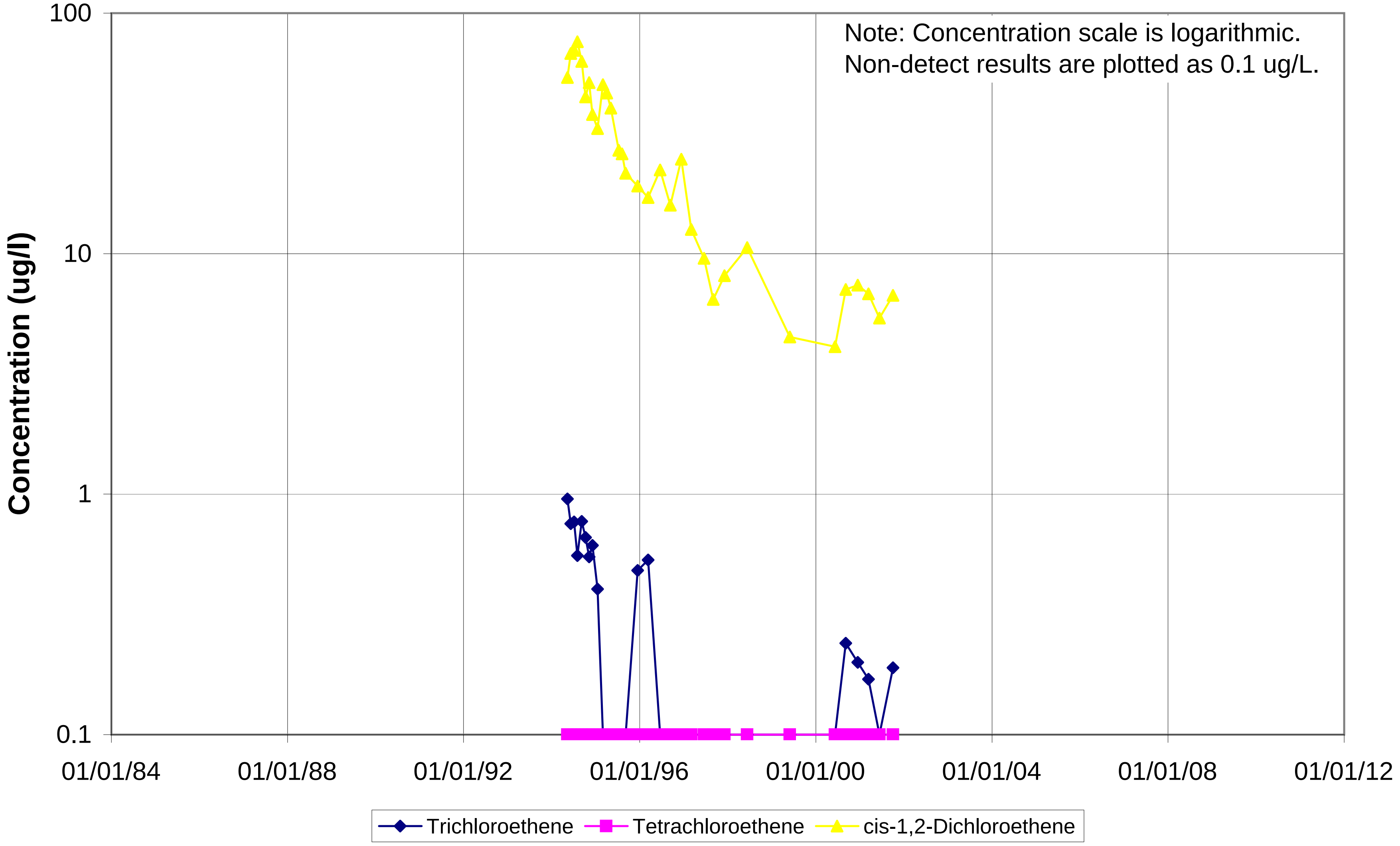
# 01U356 (EW-6)



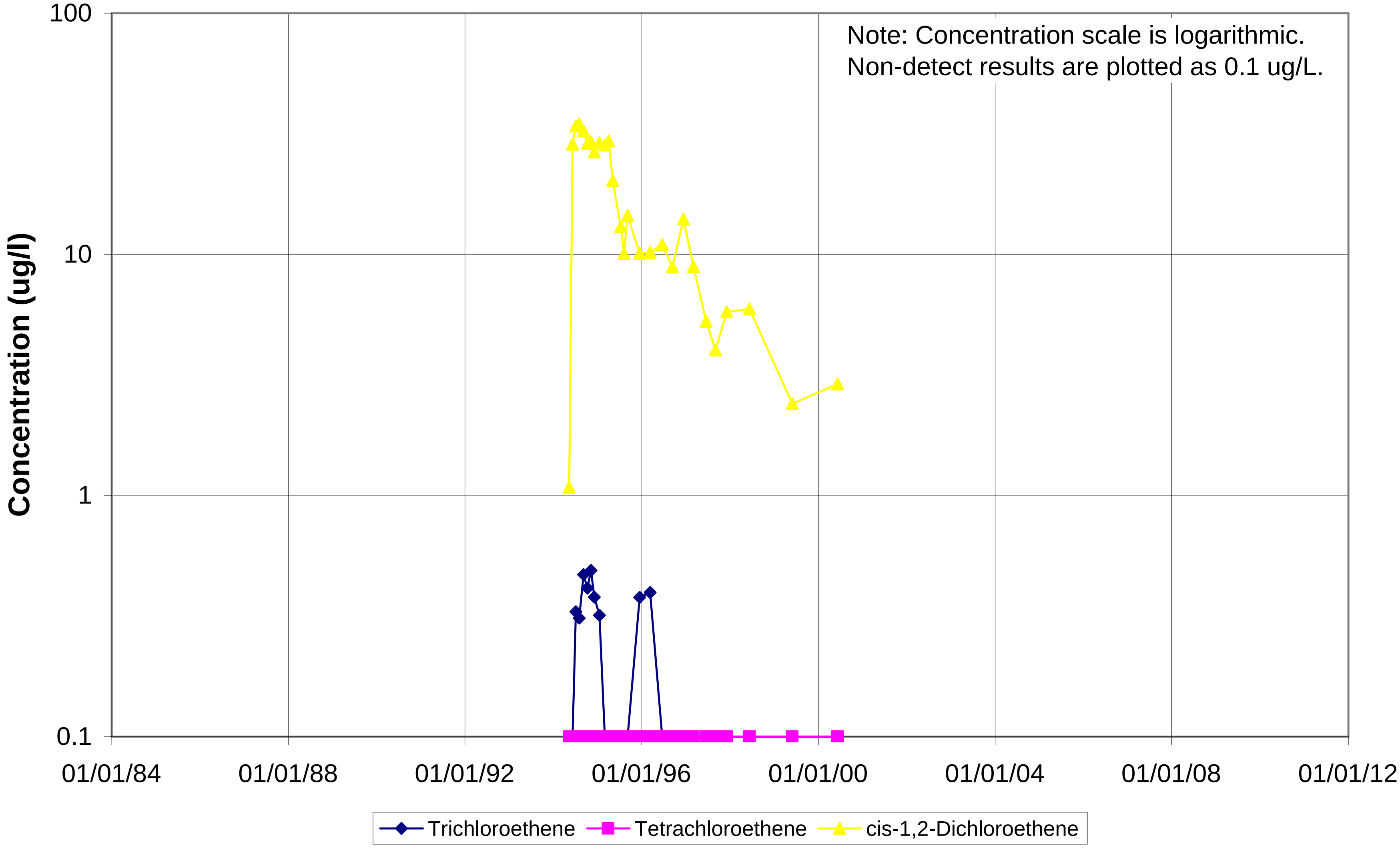

**TO RETURN TO MAP:** Click on "Go to Previous View" Button in the Tool Bar

# 01U357 (EW-7)



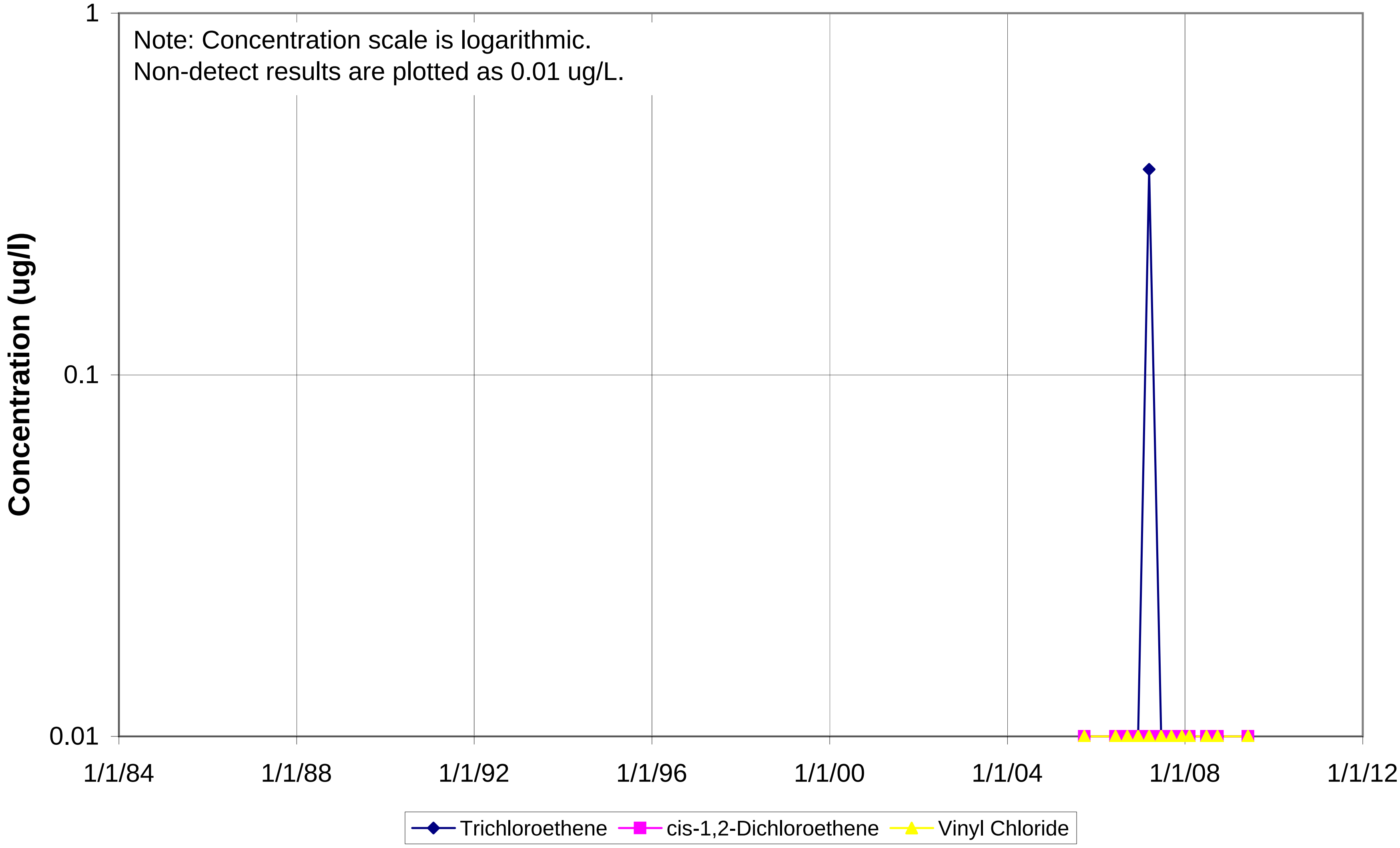

**TO RETURN TO MAP:** Click on "Go to Previous View" Button in the Tool Bar

# 01U358 (EW-8)



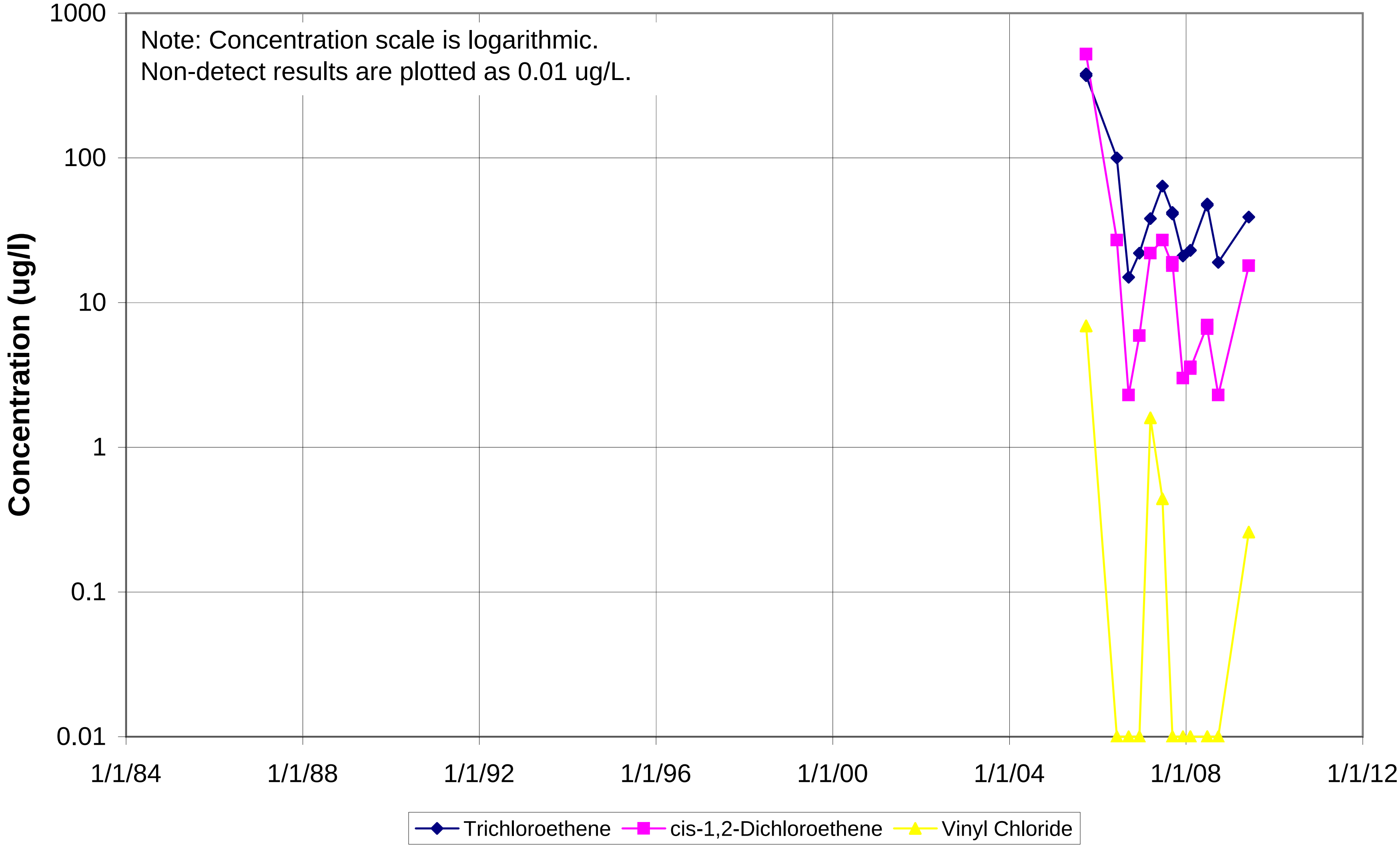

**TO RETURN TO MAP:** Click on "Go to Previous View" Button in the Tool Bar

# 01U578

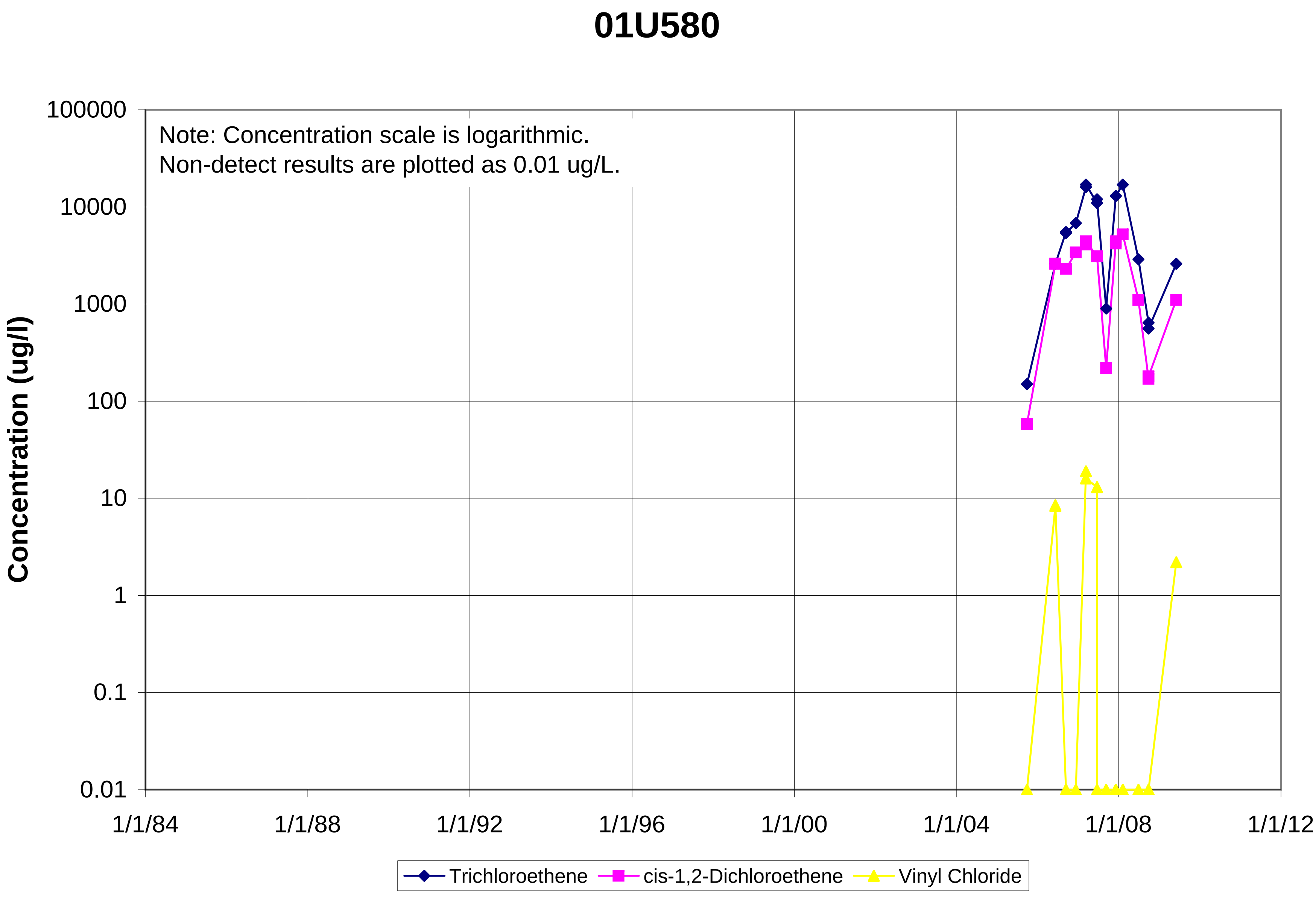



**TO RETURN TO MAP:** Click on "Go to Previous View" Button in the Tool Bar

# 01U579

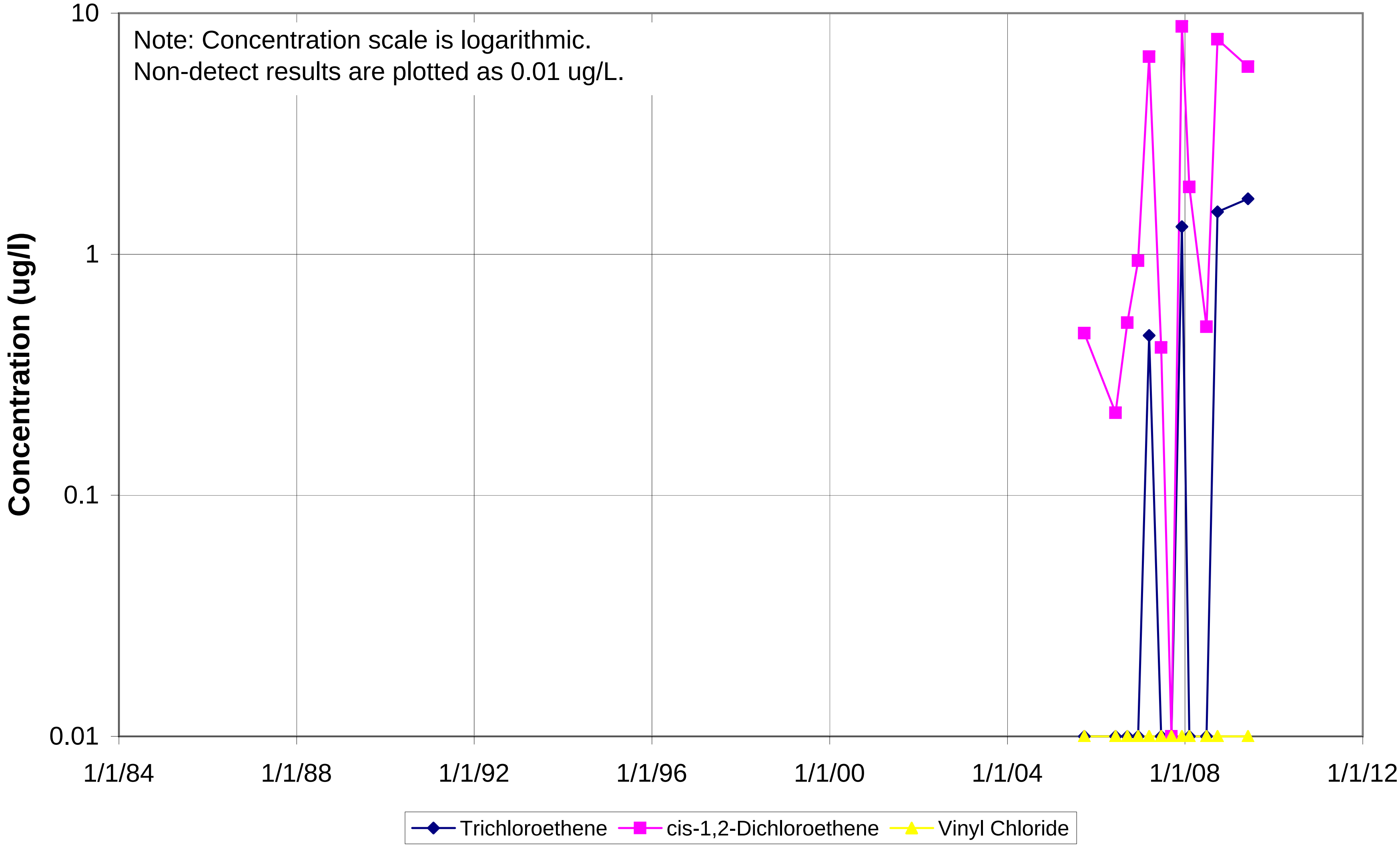



**TO RETURN TO MAP:** Click on "Go to Previous View" Button in the Tool Bar



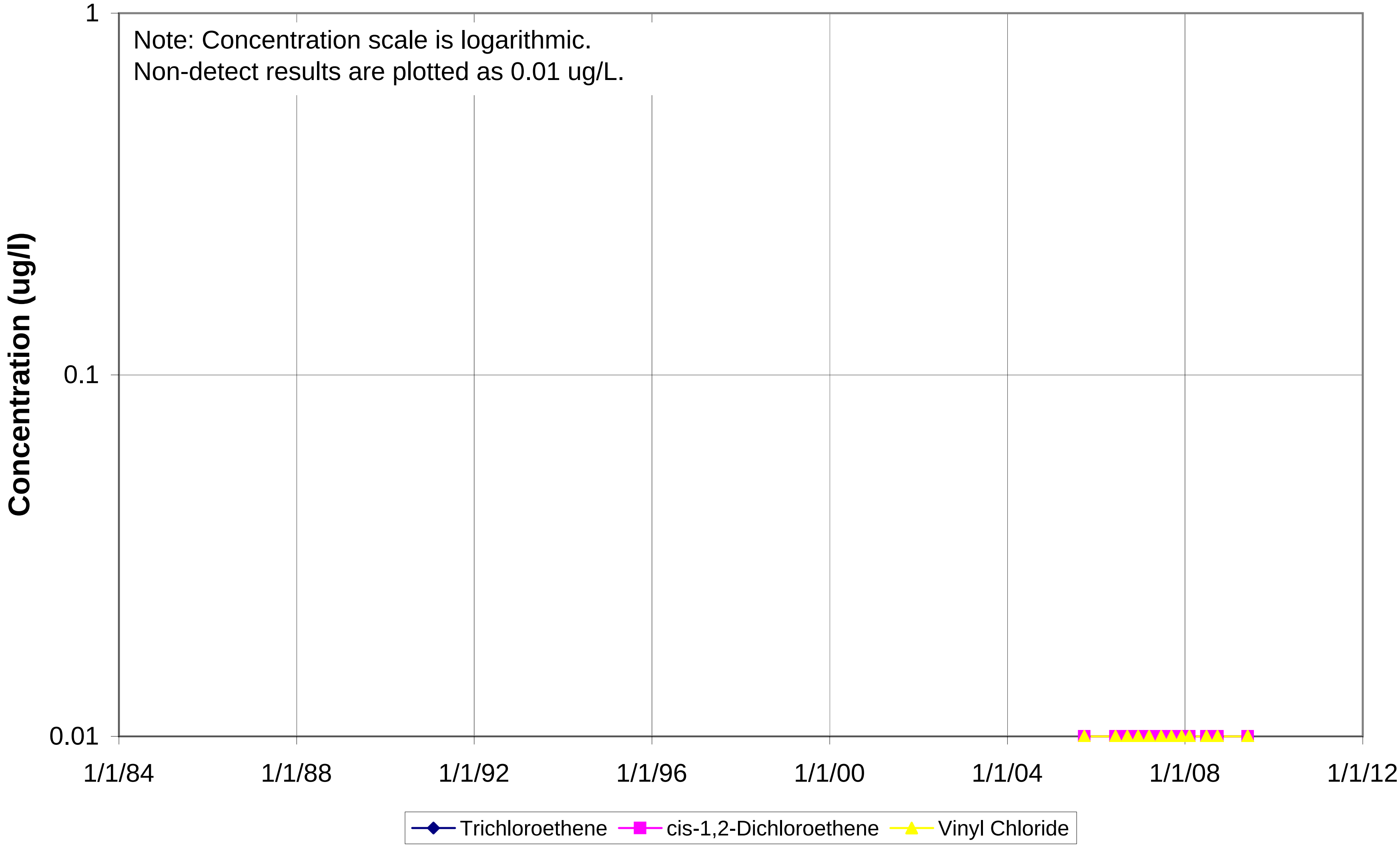

**TO RETURN TO MAP:** Click on "Go to Previous View" Button in the Tool Bar

# 01U581



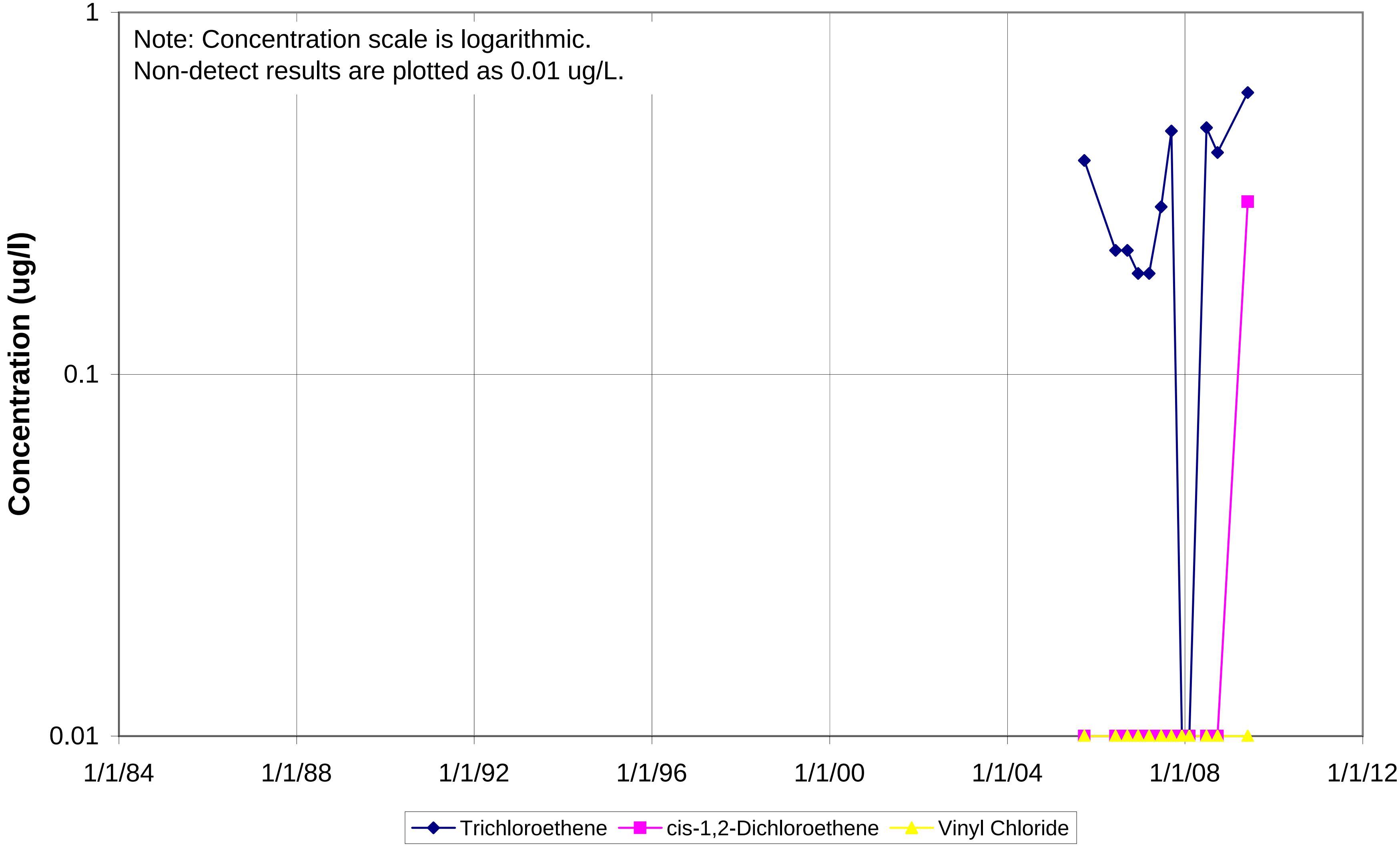

**TO RETURN TO MAP:** Click on "Go to Previous View" Button in the Tool Bar

# 01U582



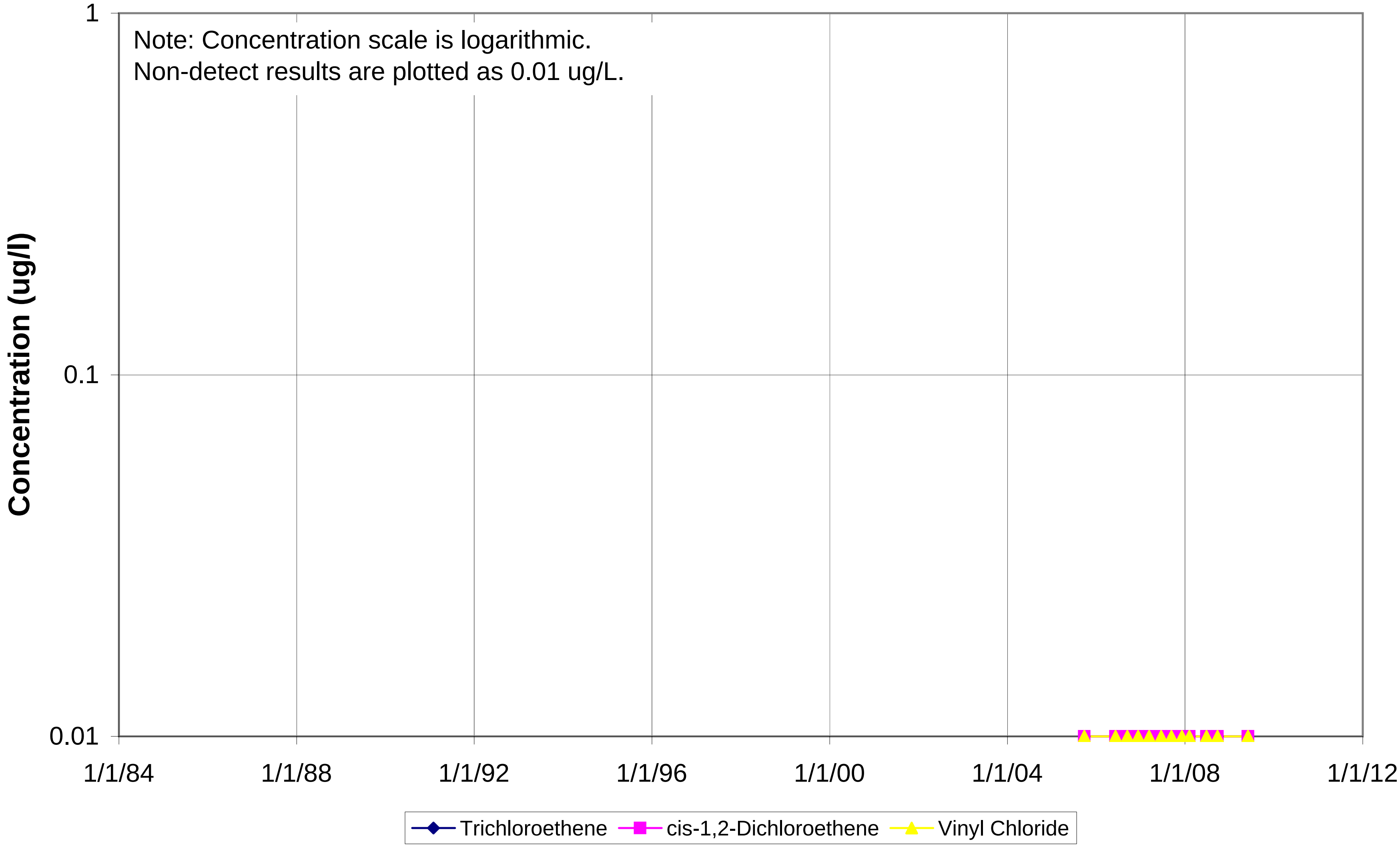

**TO RETURN TO MAP:** Click on "Go to Previous View" Button in the Tool Bar

# 01U583



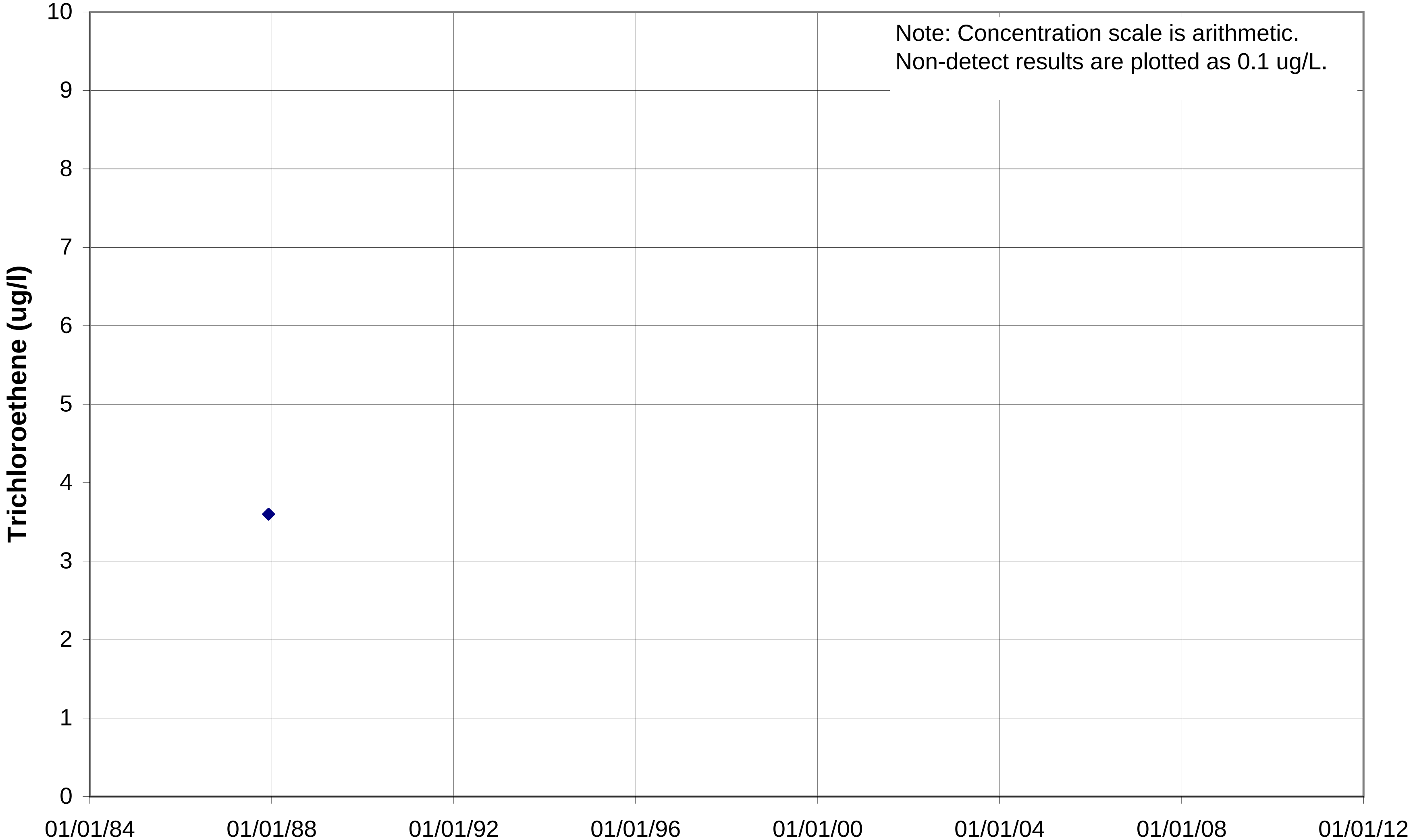

**TO RETURN TO MAP:** Click on "Go to Previous View" Button in the Tool Bar

# 01U584



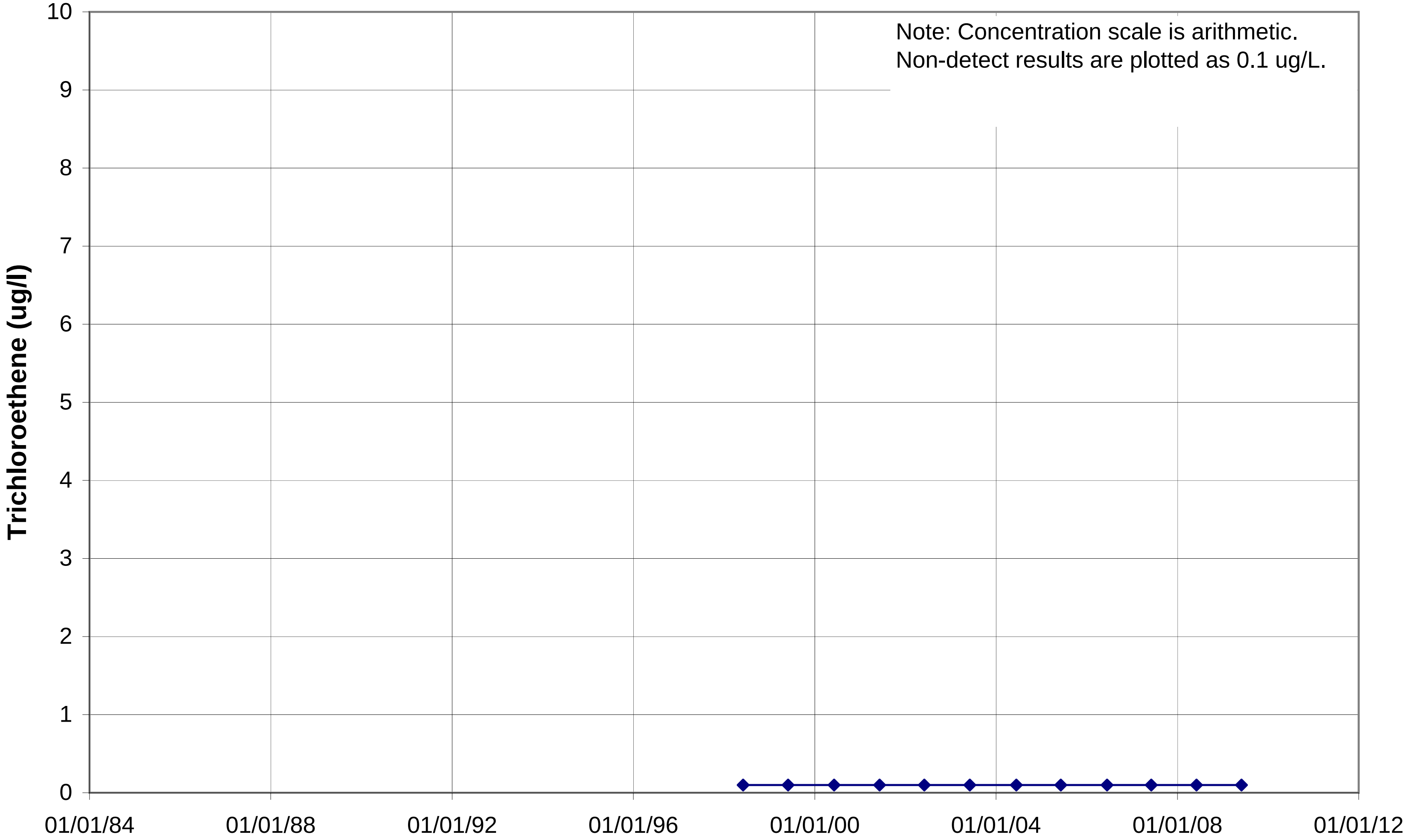

**TO RETURN TO MAP:** Click on "Go to Previous View" Button in the Tool Bar

# 01U601



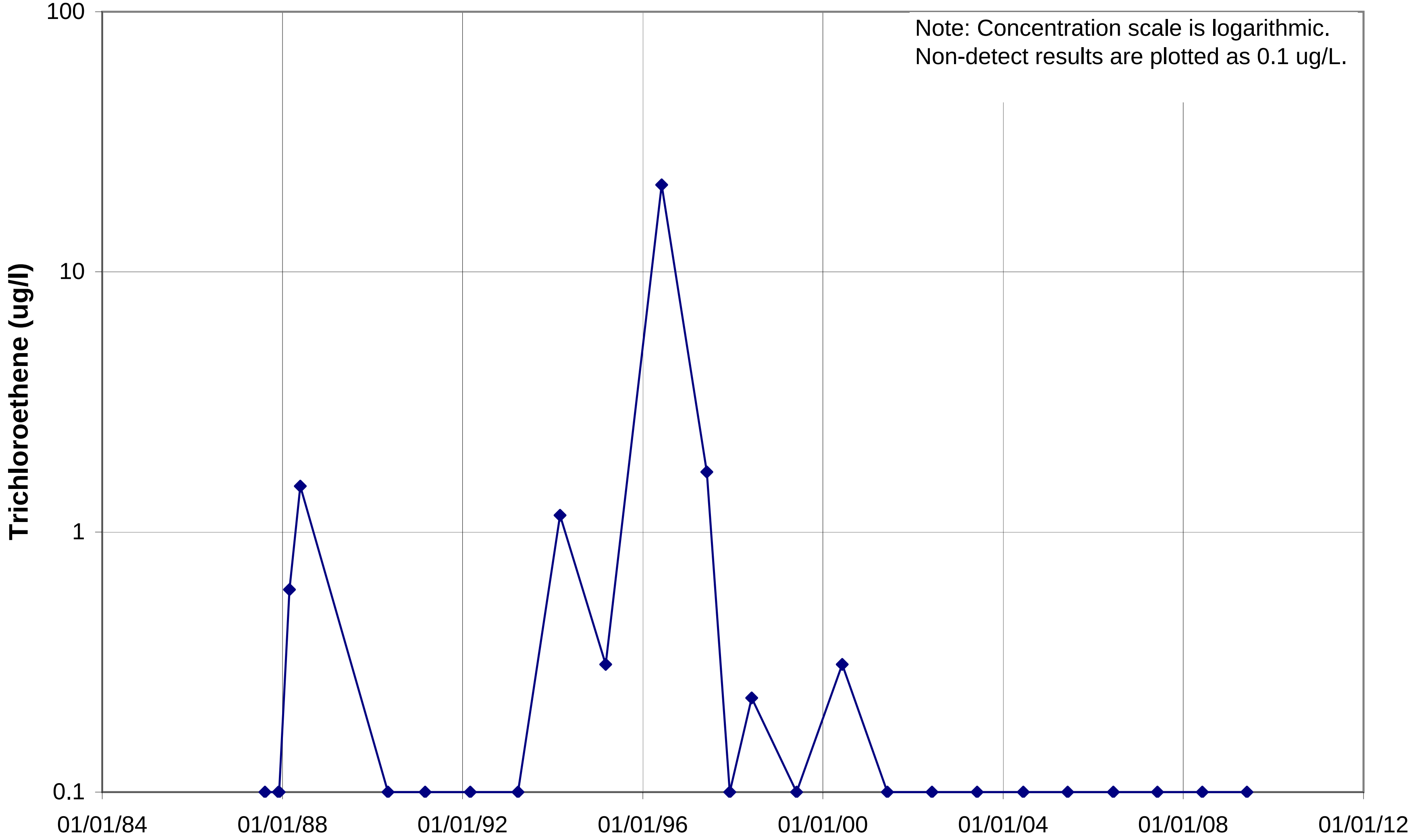

**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 01U603



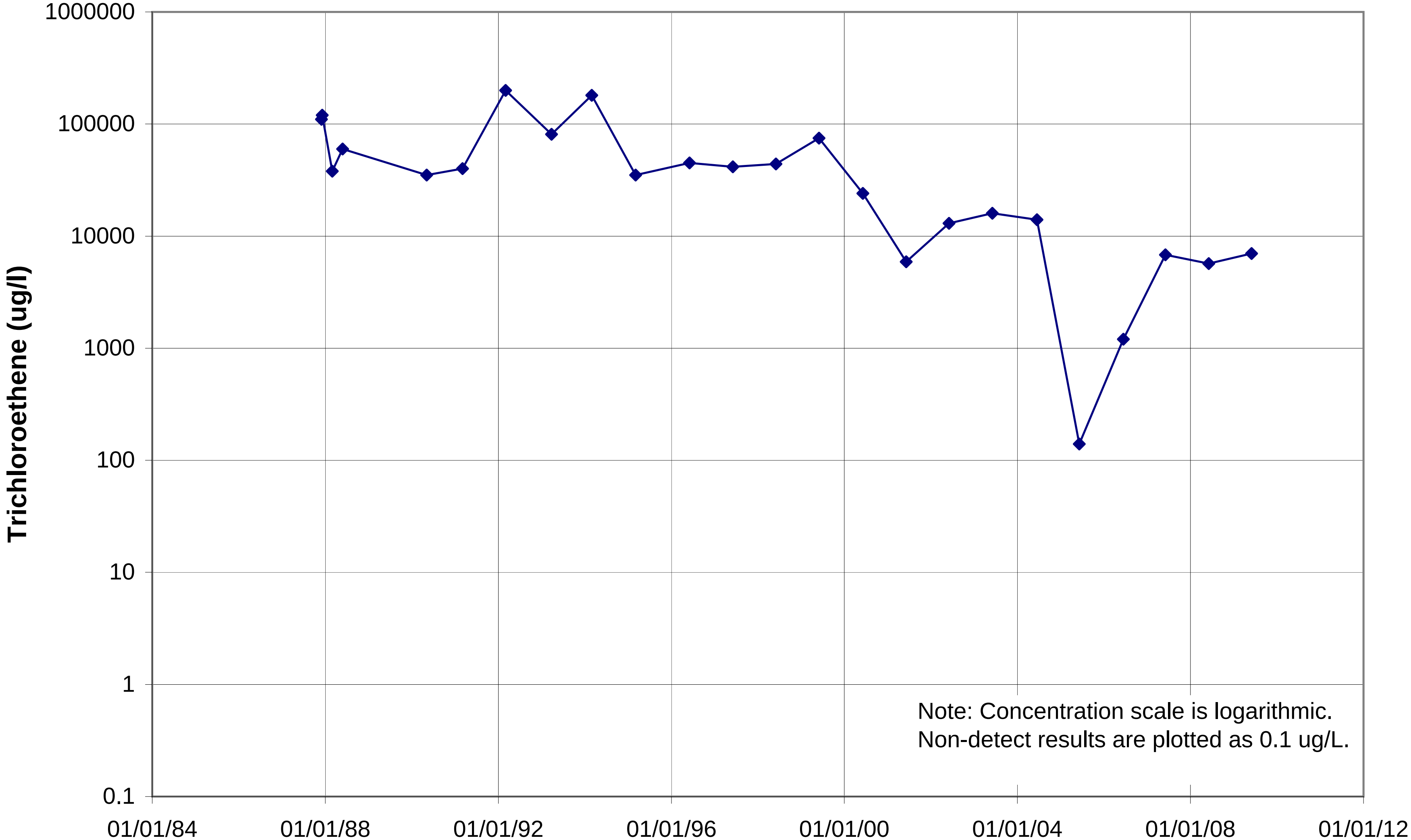

**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 01U604



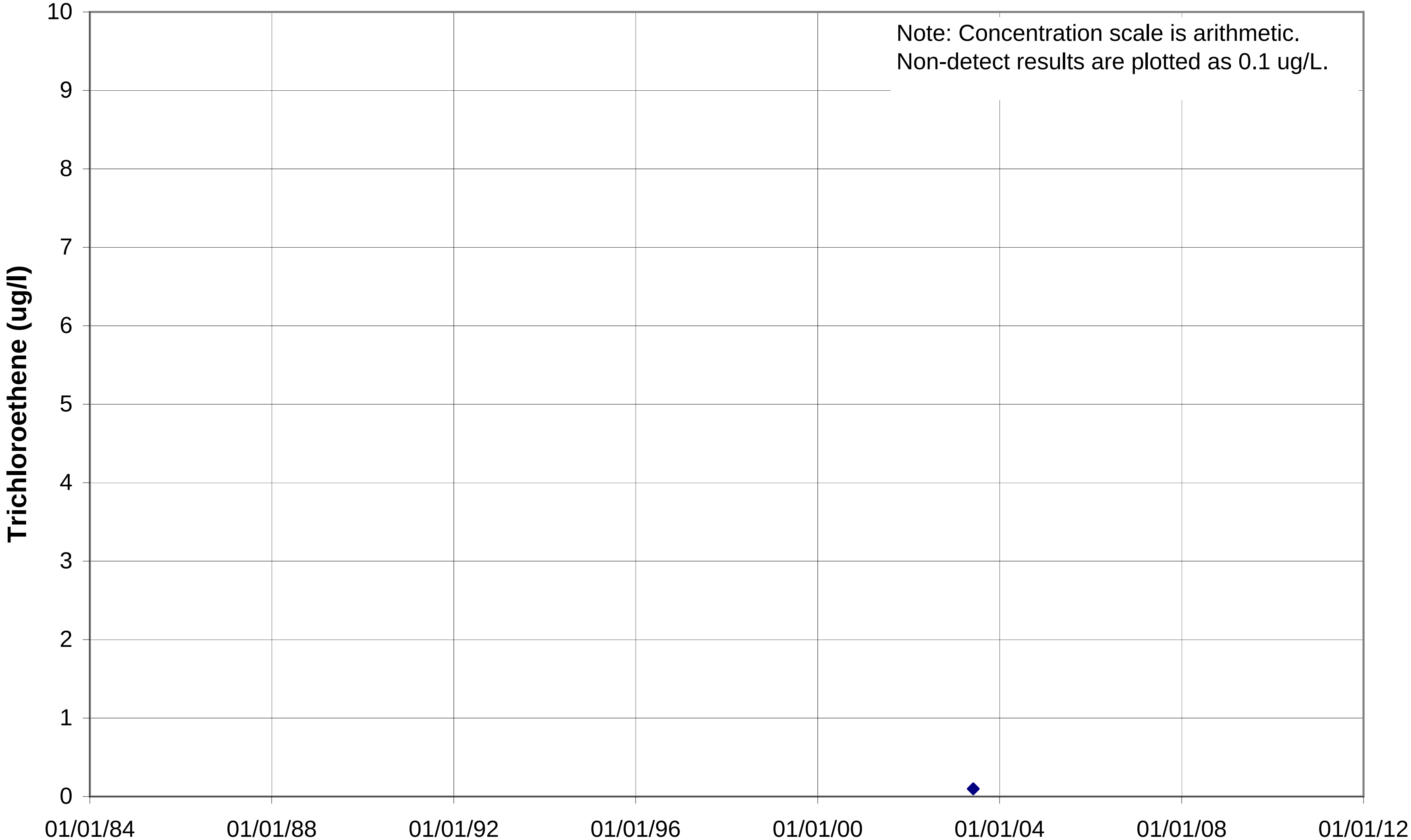

**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 01U611




**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 01U613




**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

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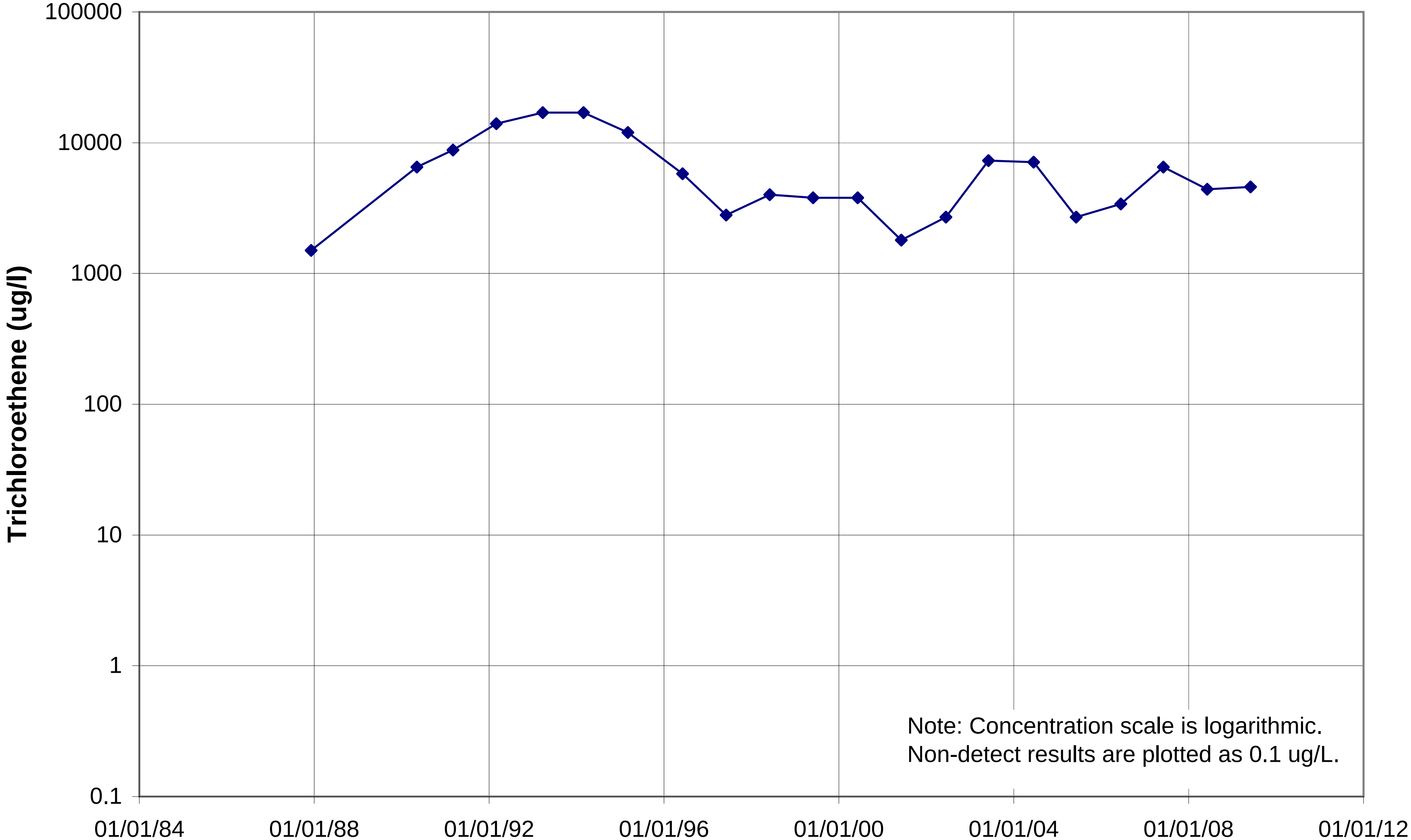
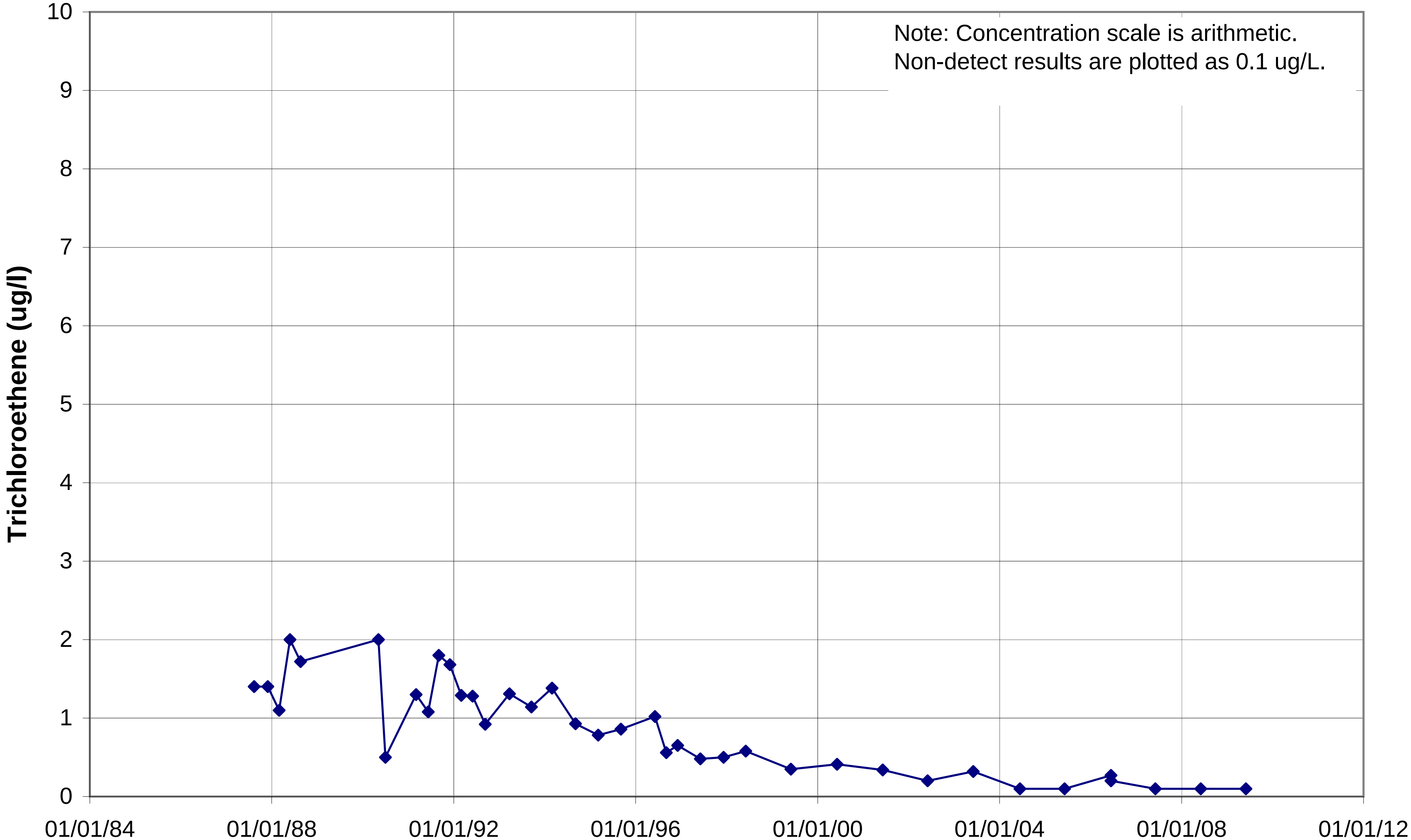


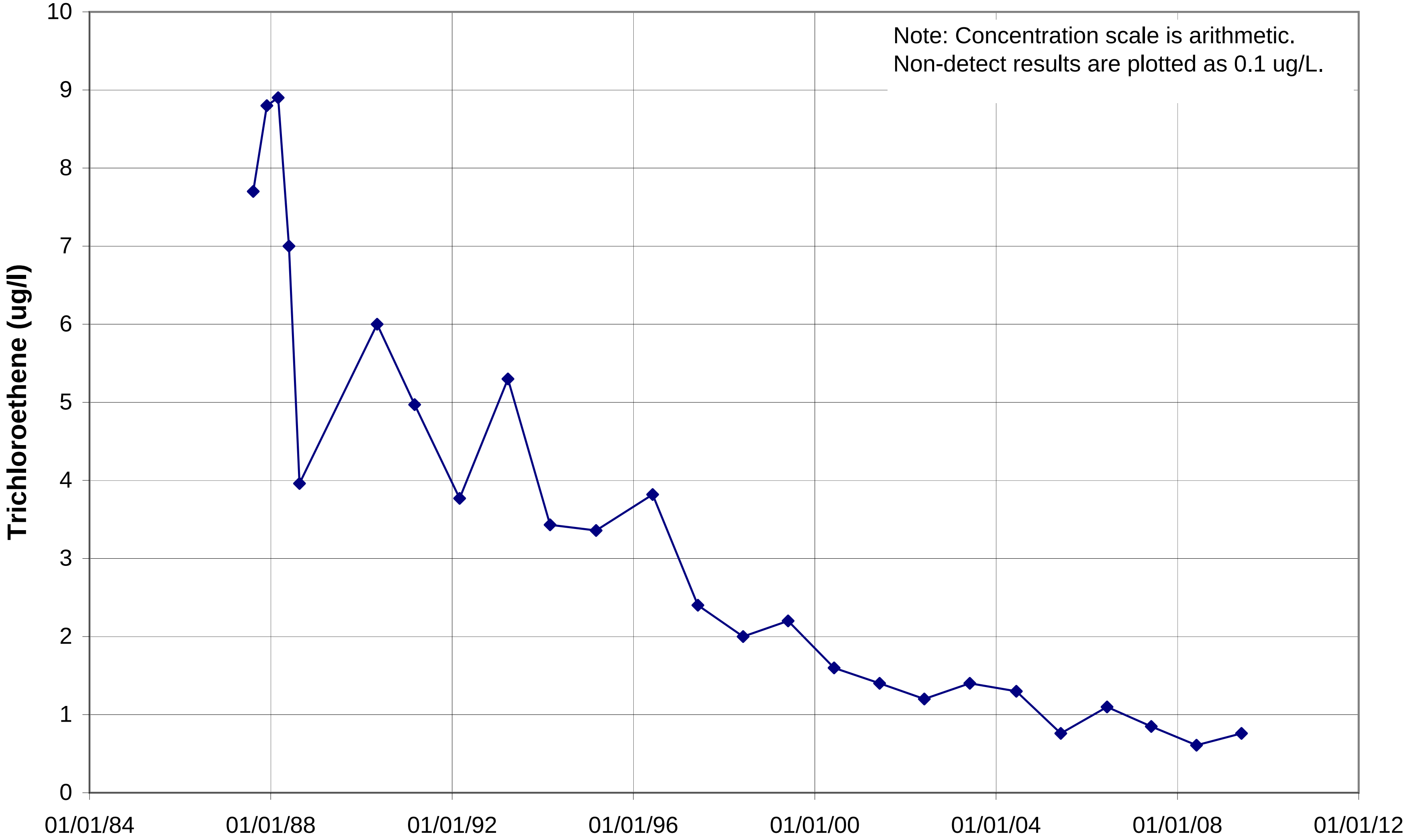

**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 01U617



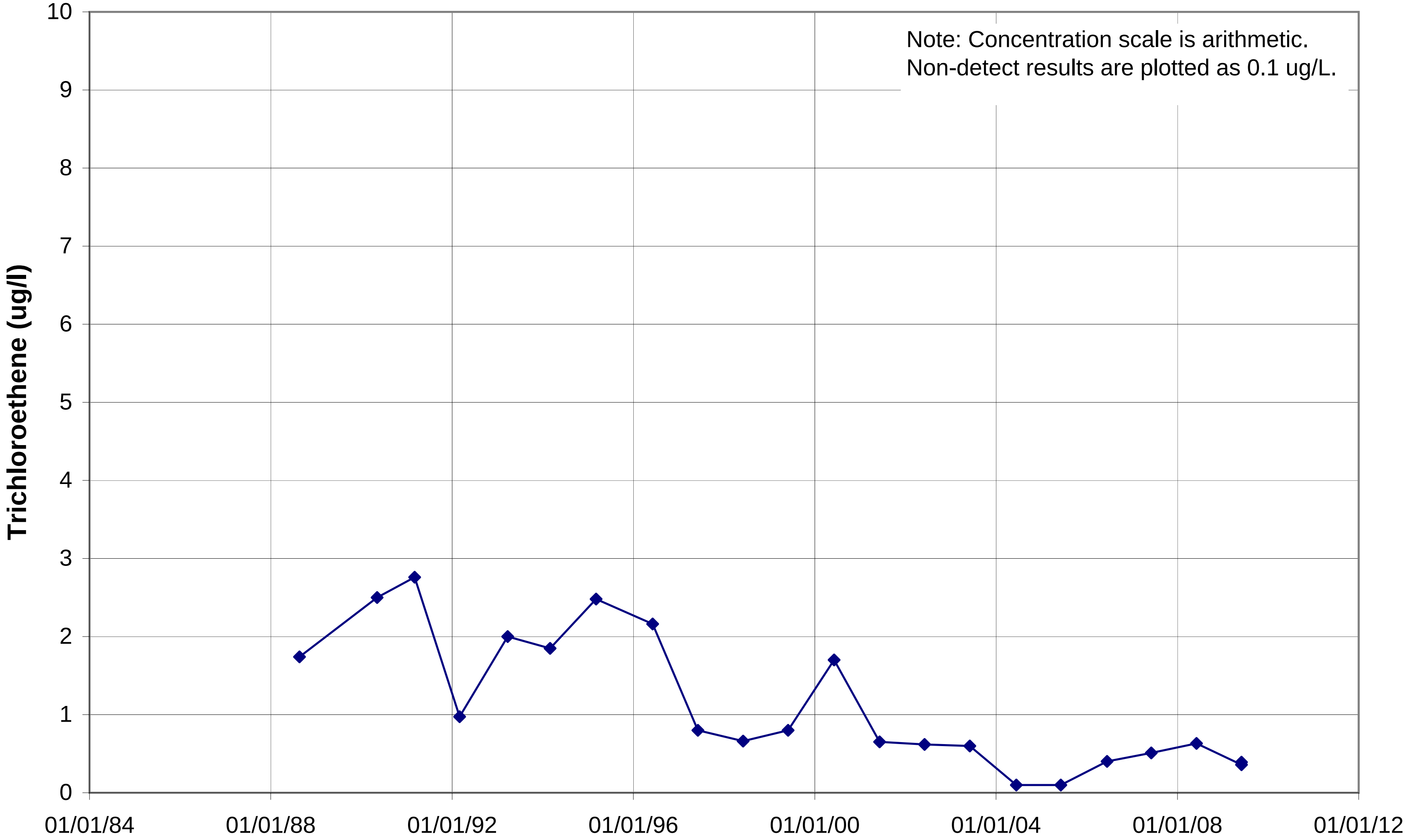

**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 01U618



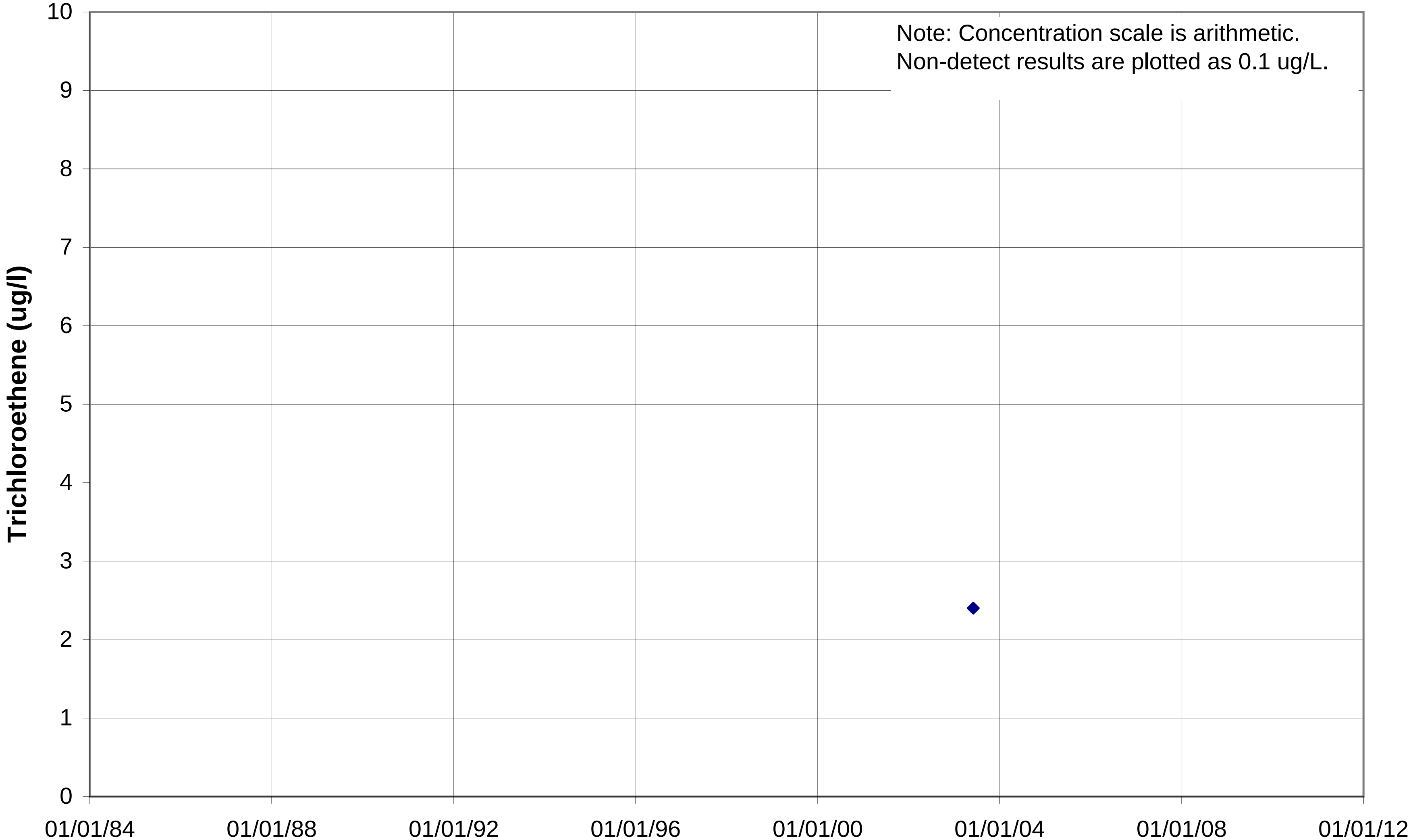

**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 01U619

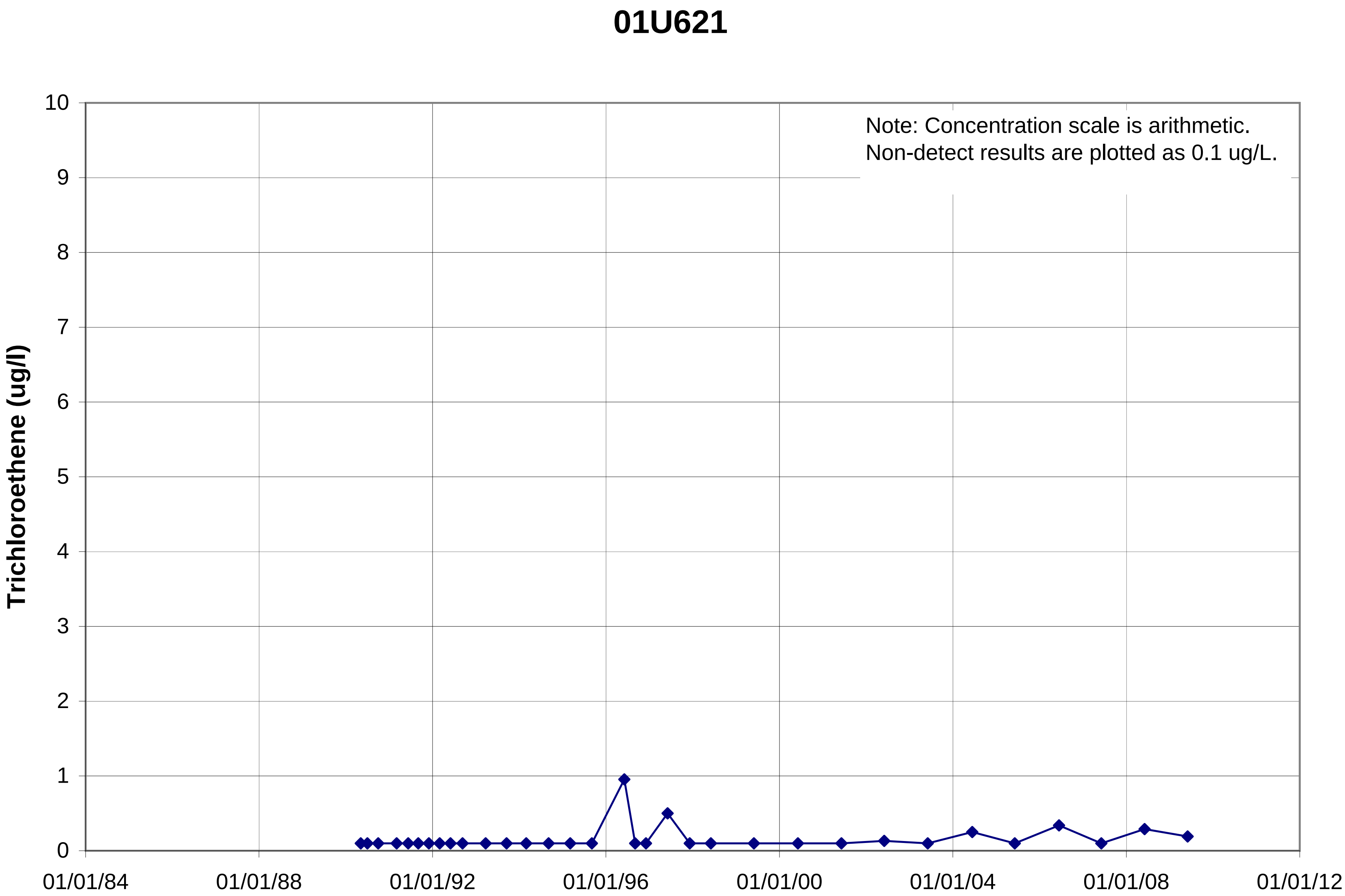



**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 01U620

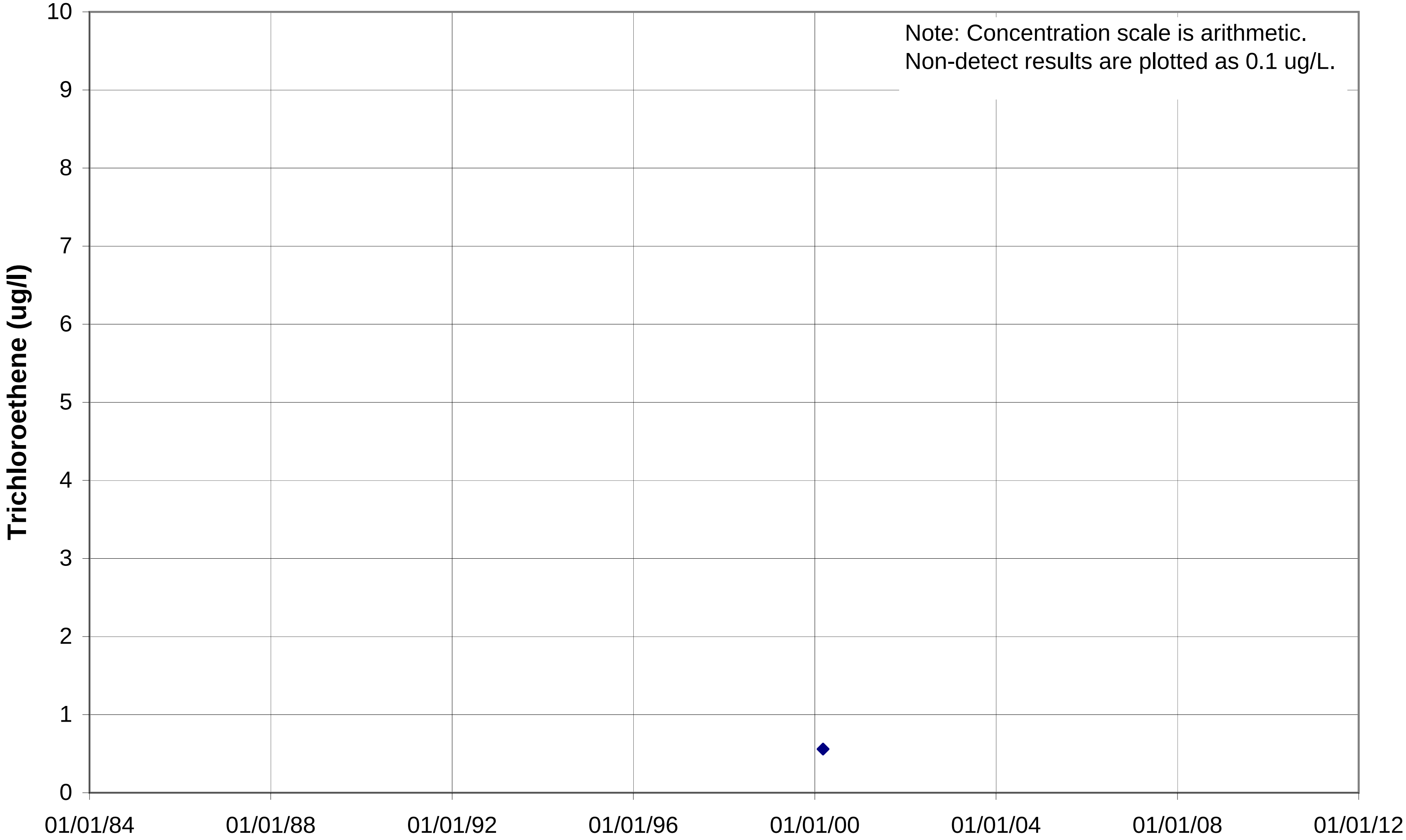



**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar



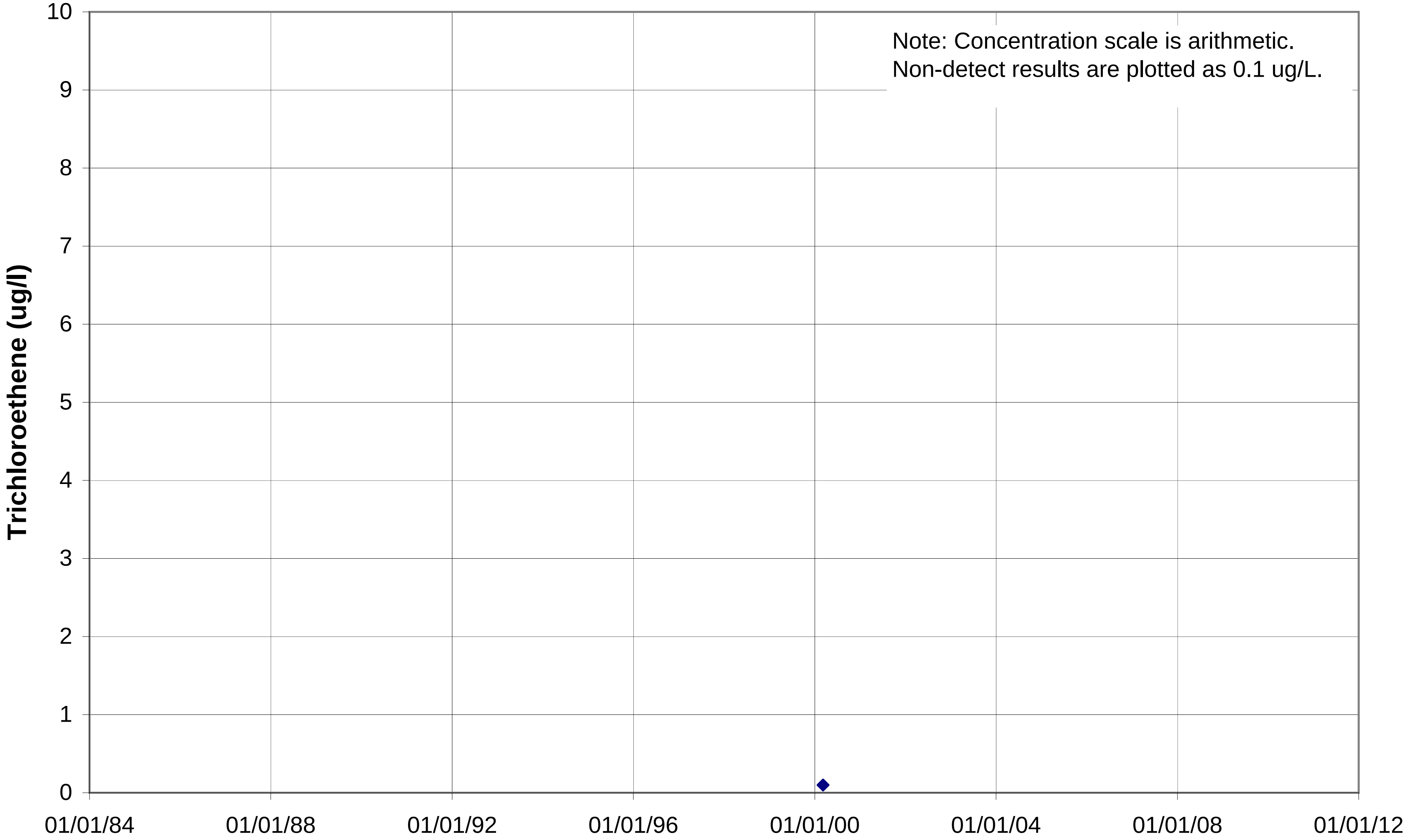

**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 01U626



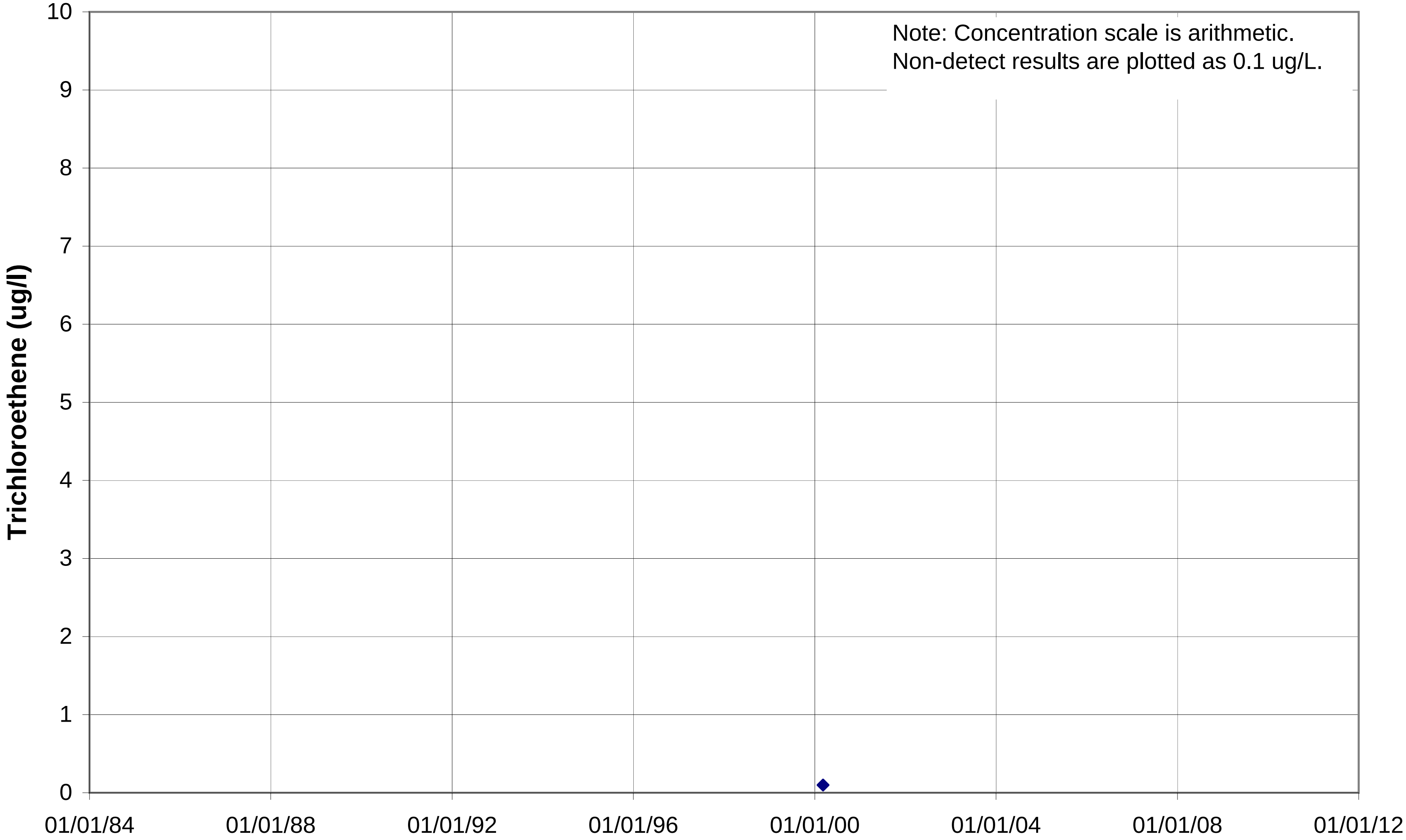

**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 01U627



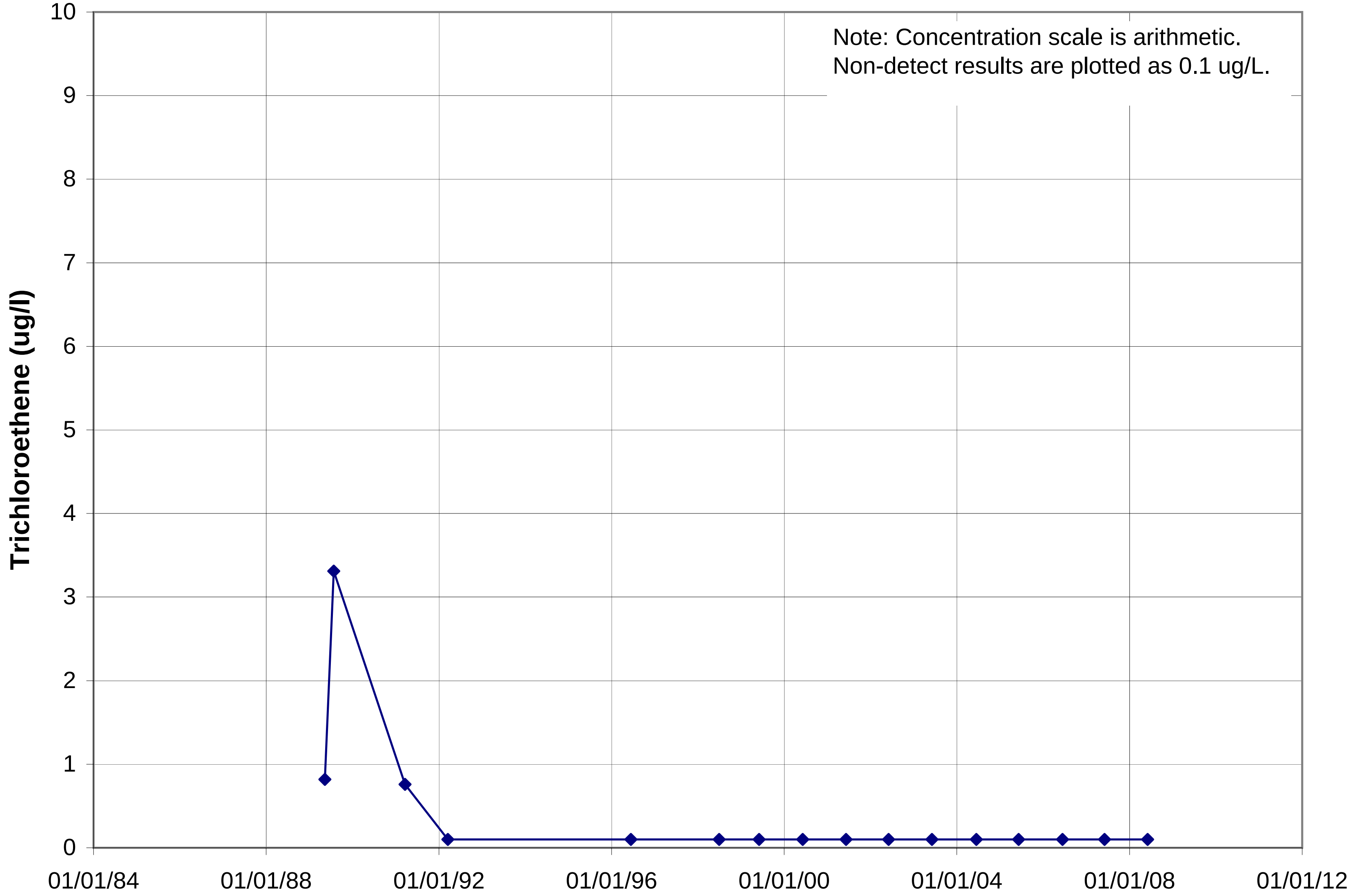

**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 01U628



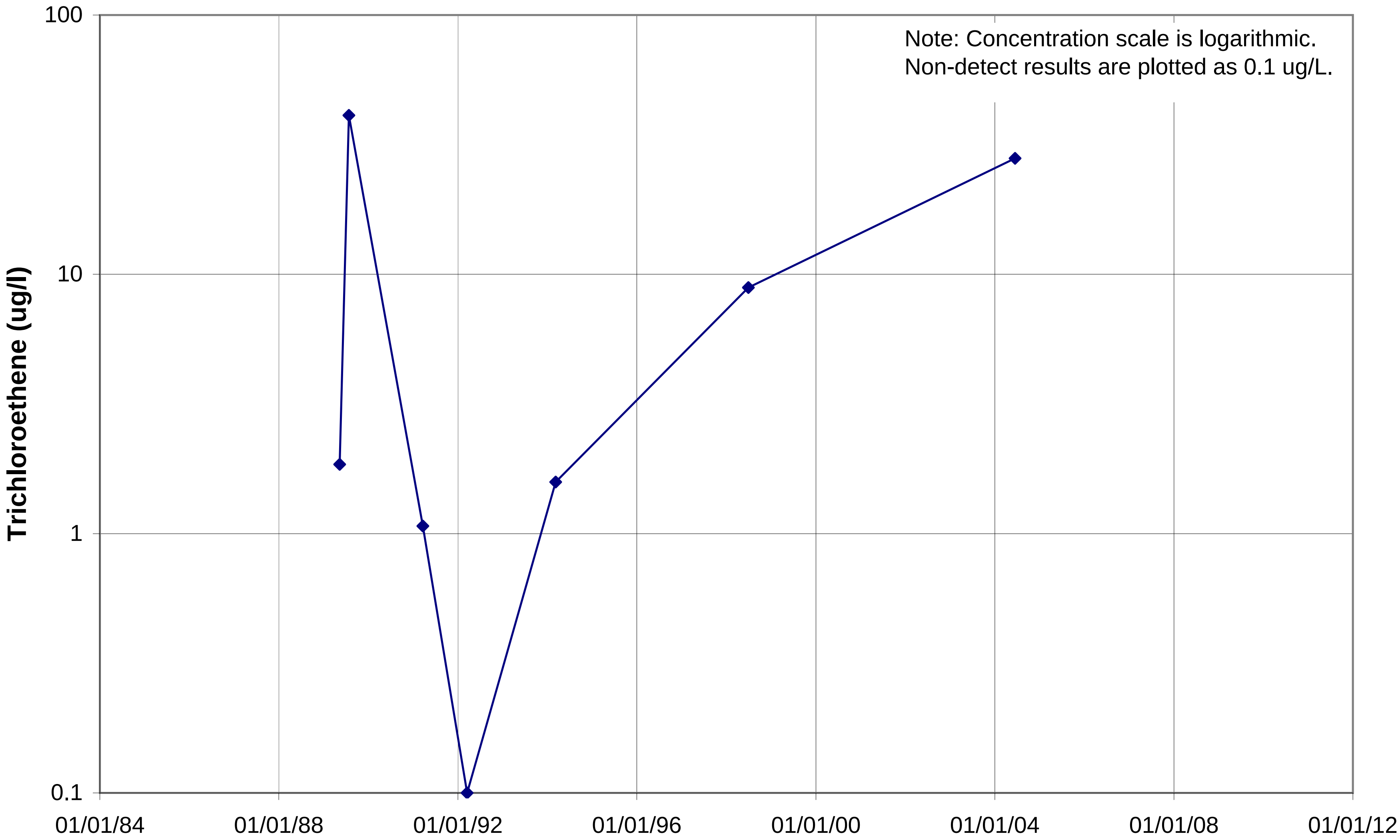

**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 01U636

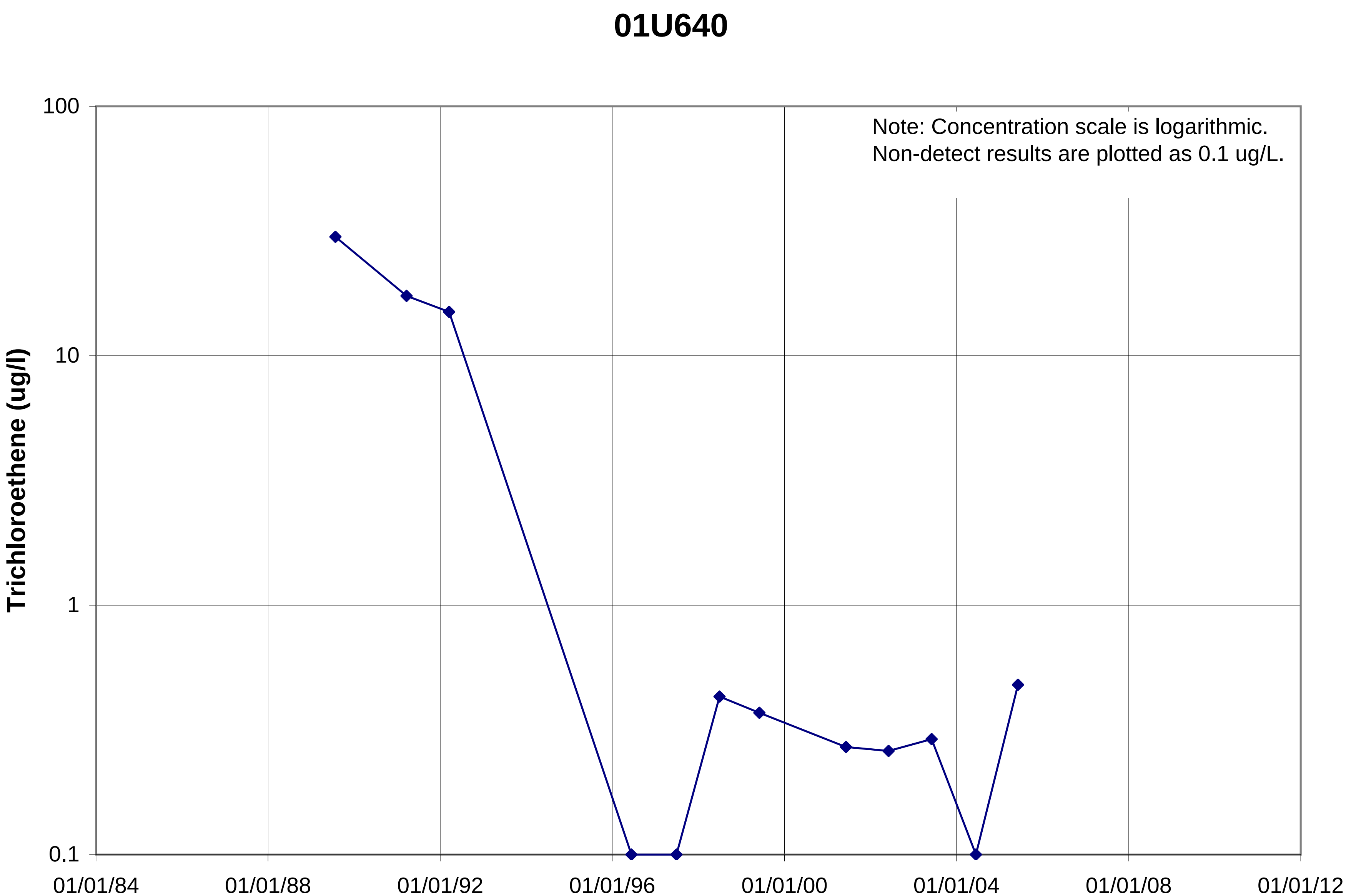



**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 01U639

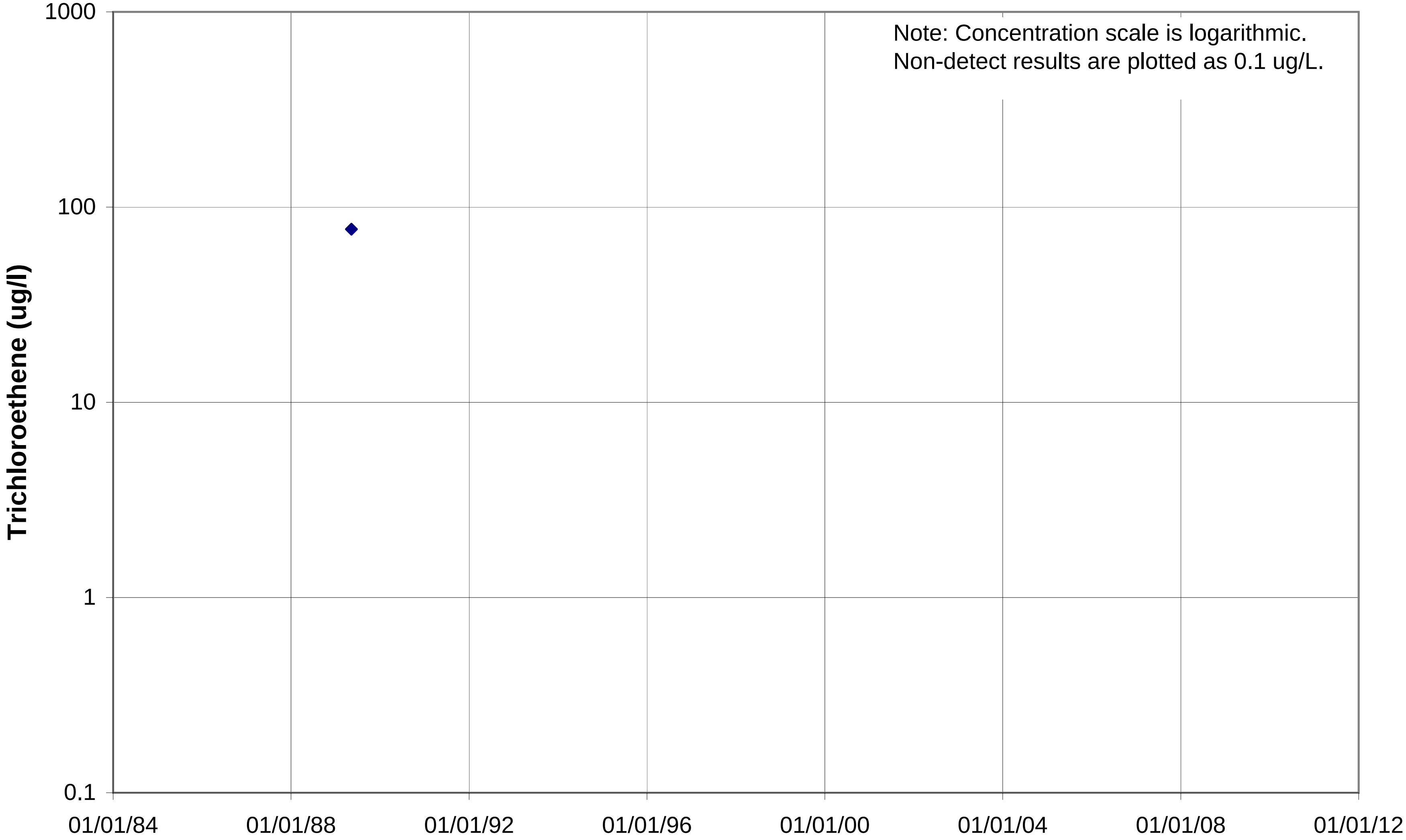



**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar



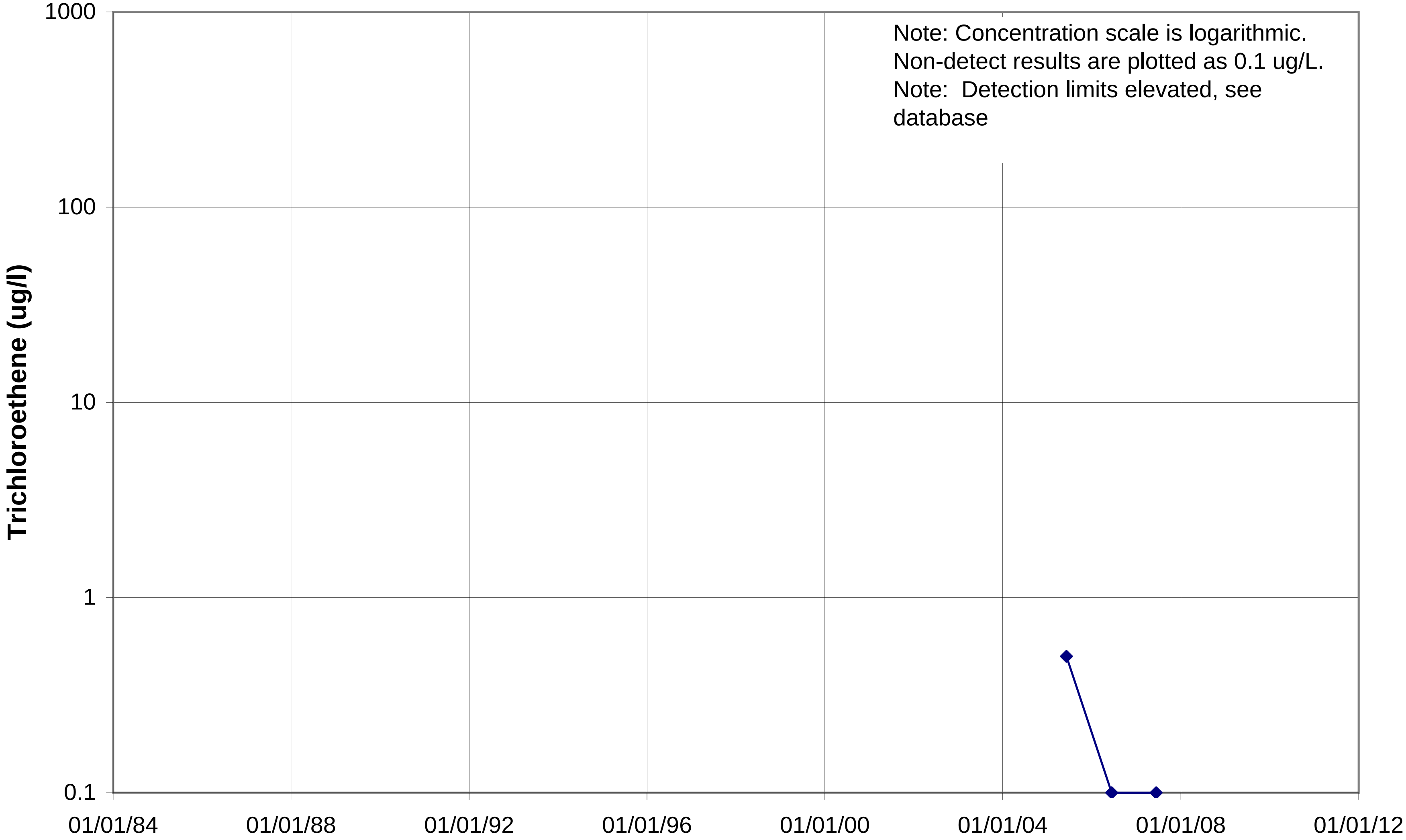

**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 01U666




**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 01U667

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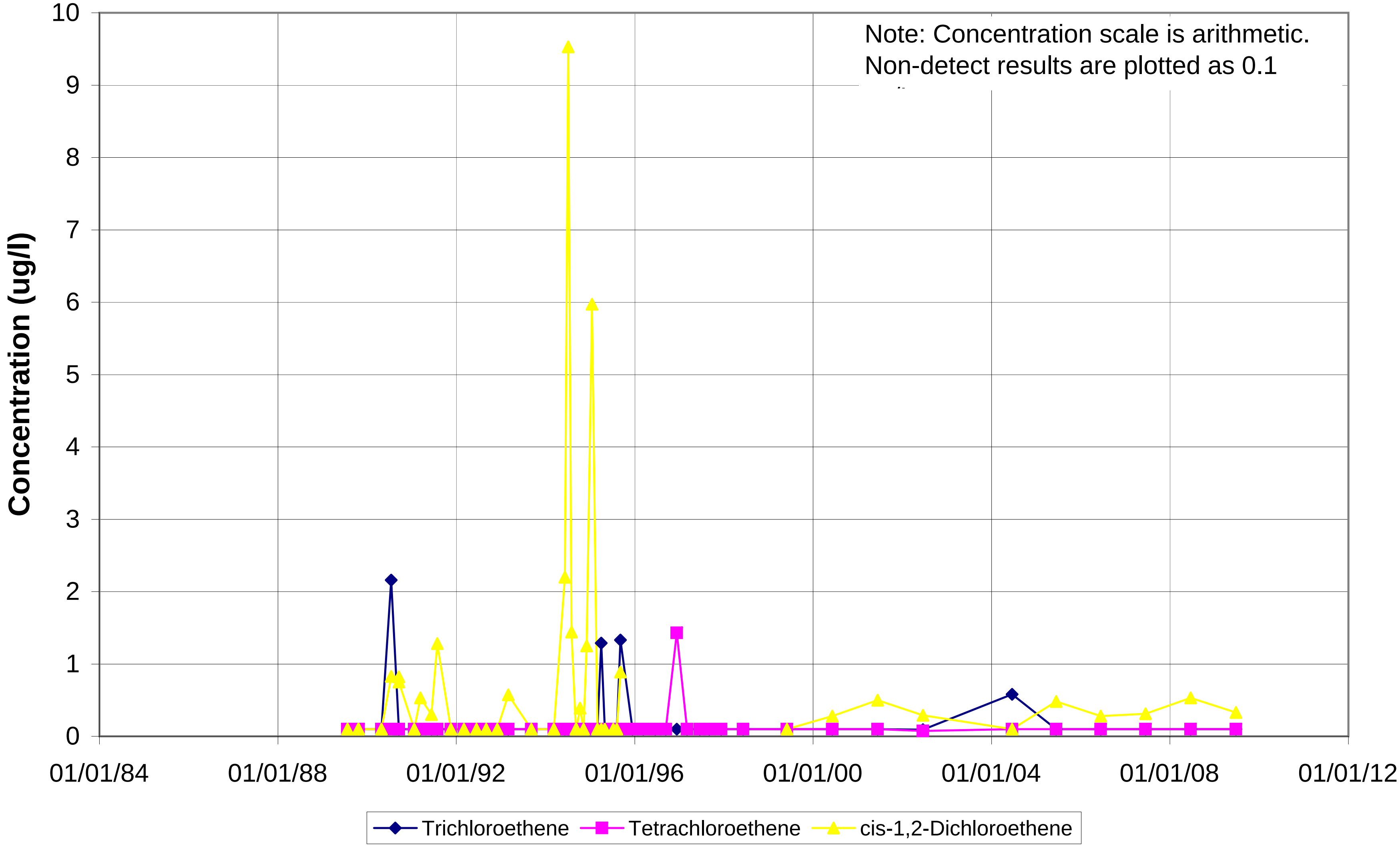
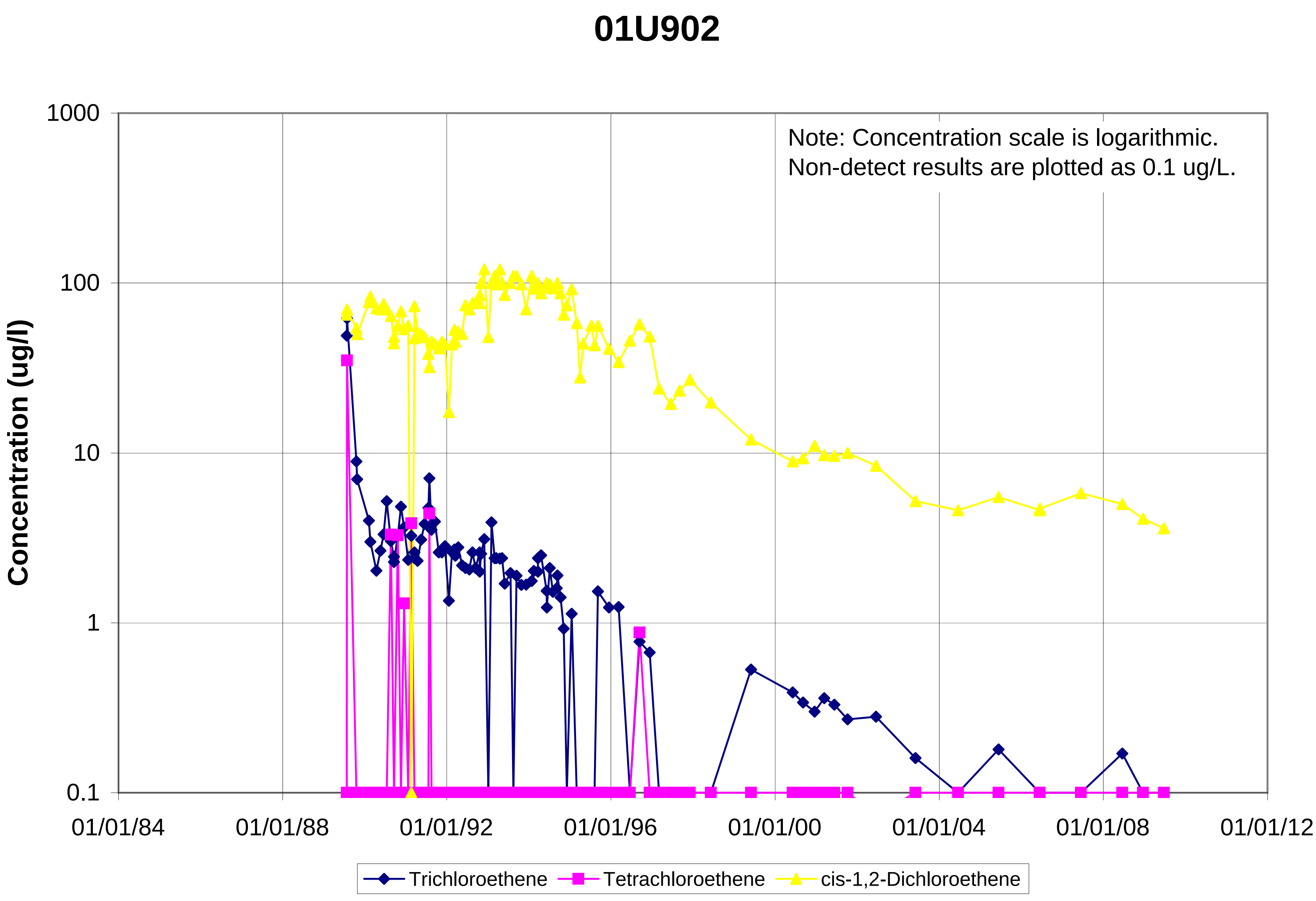
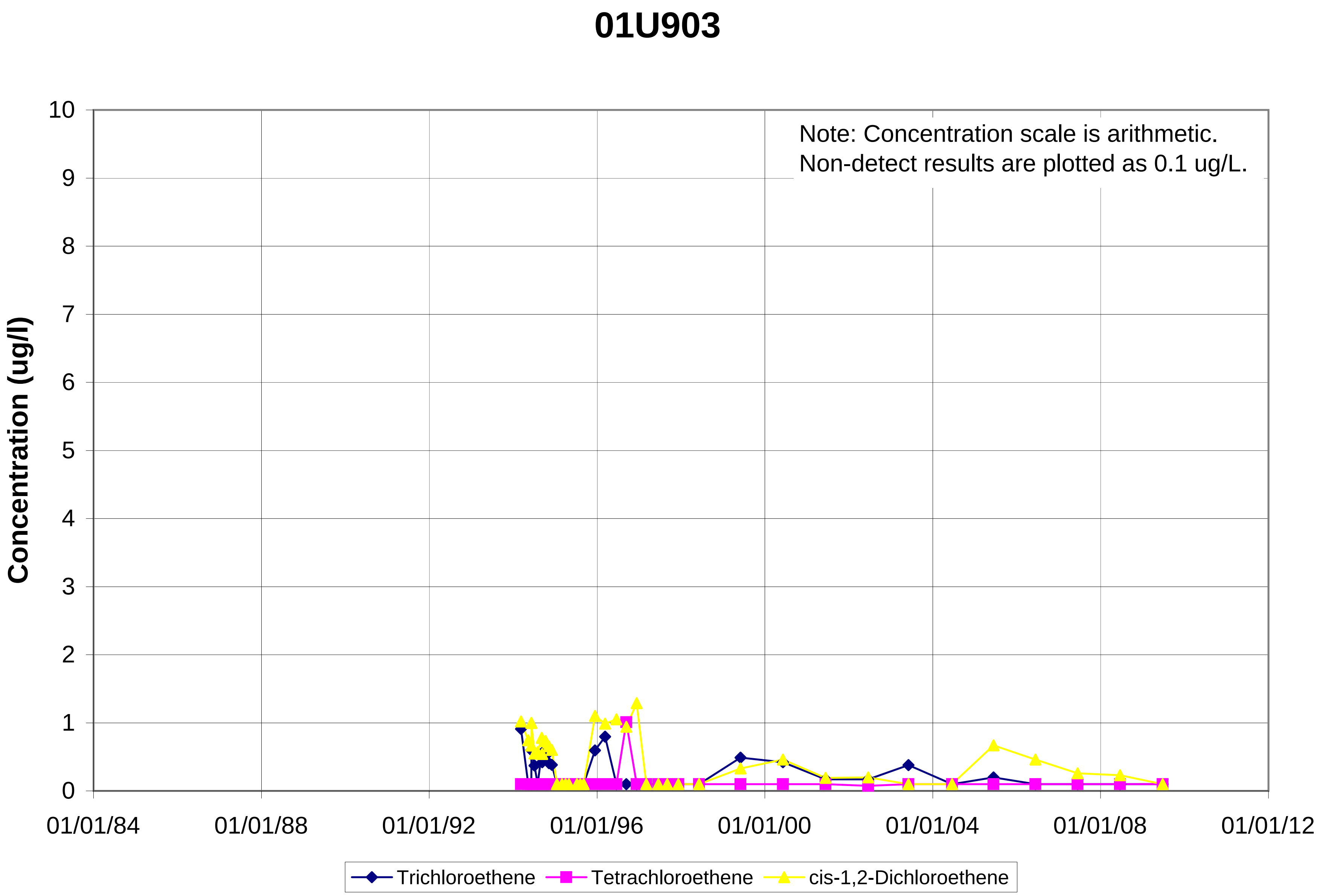



**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

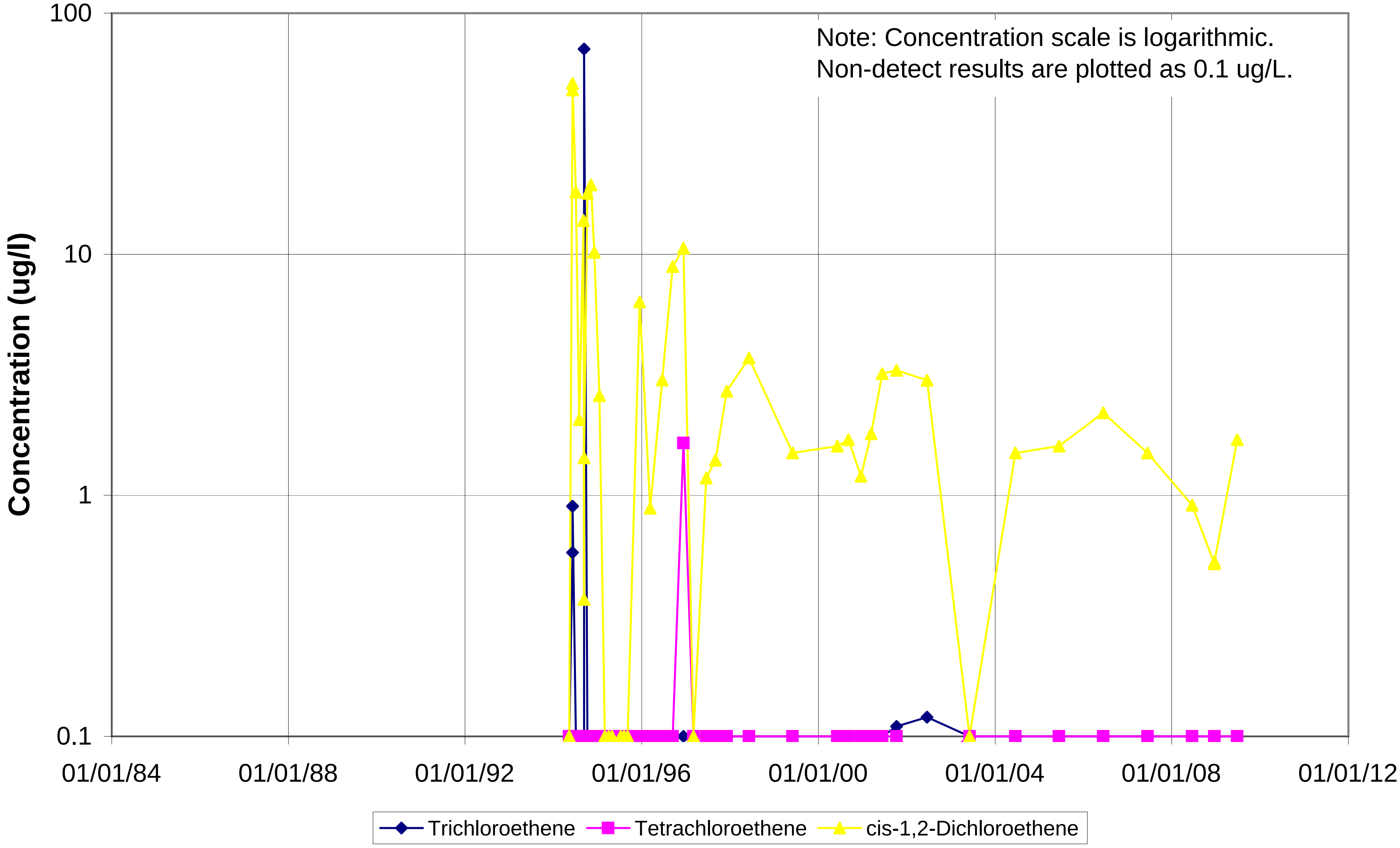



**TO RETURN TO MAP:** Click on "Go to Previous View" Button in the Tool Bar



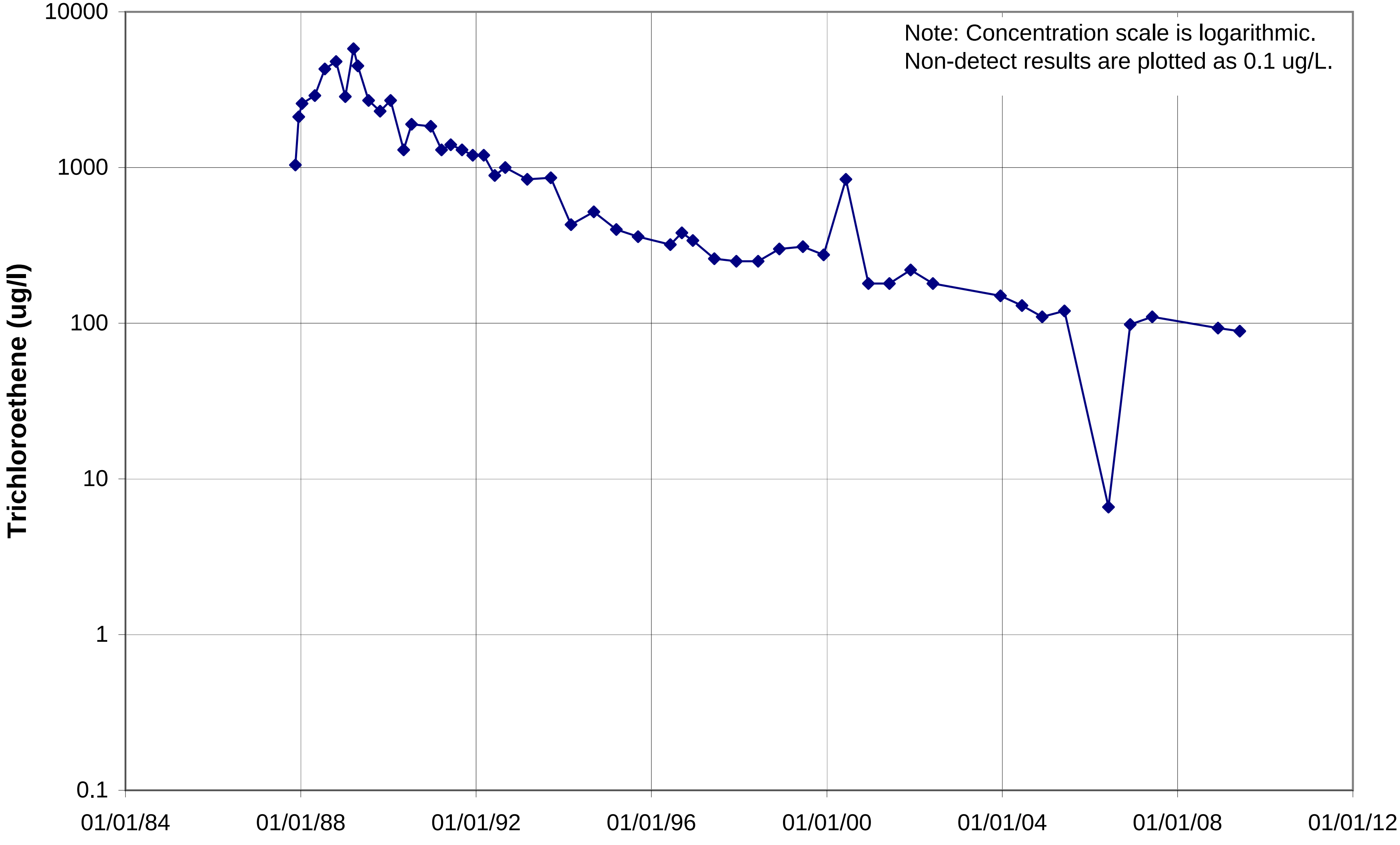

**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 01U904



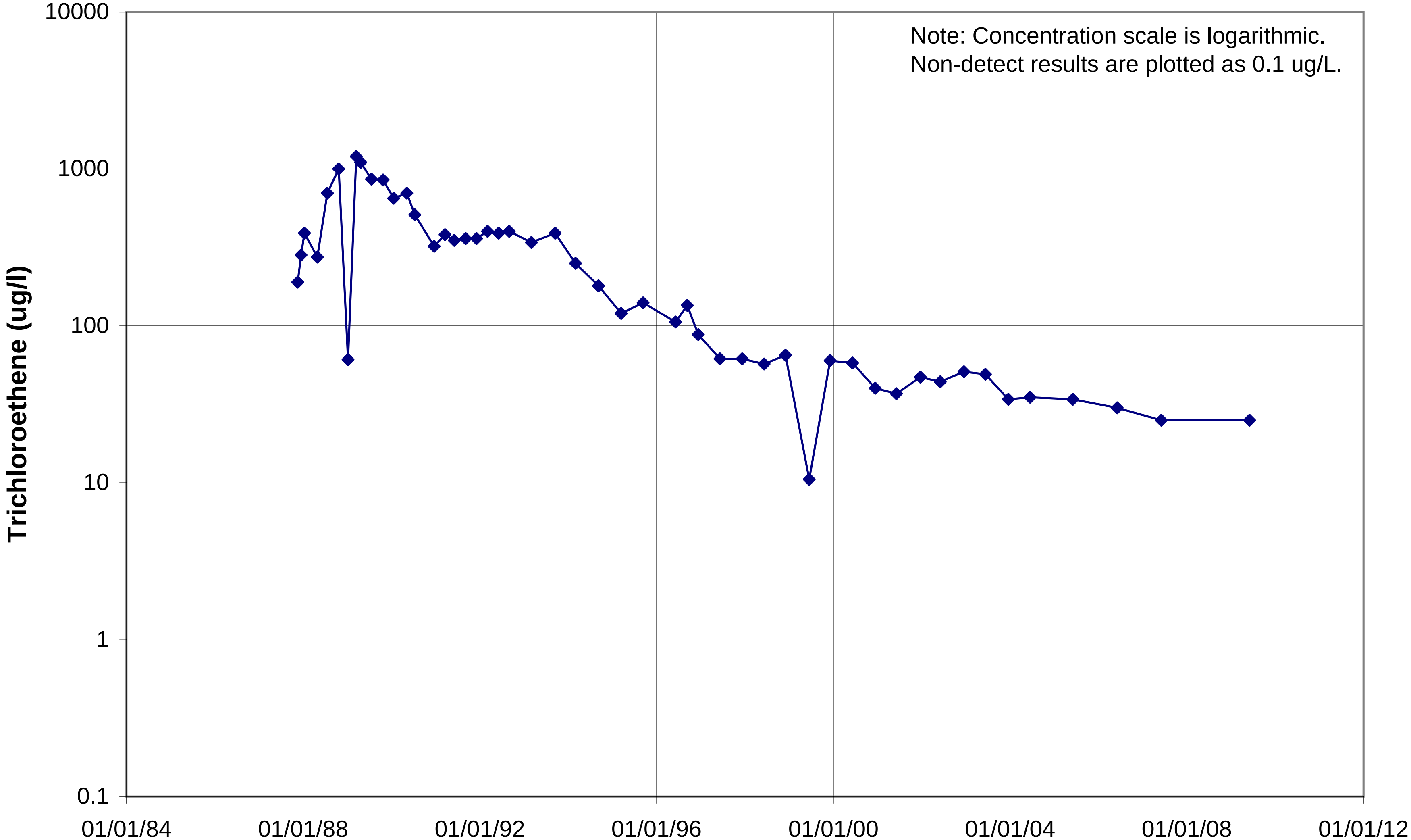

**TO RETURN TO MAP:** Click on "Go to Previous View" Button in the Tool Bar

# 03F302 (B1)



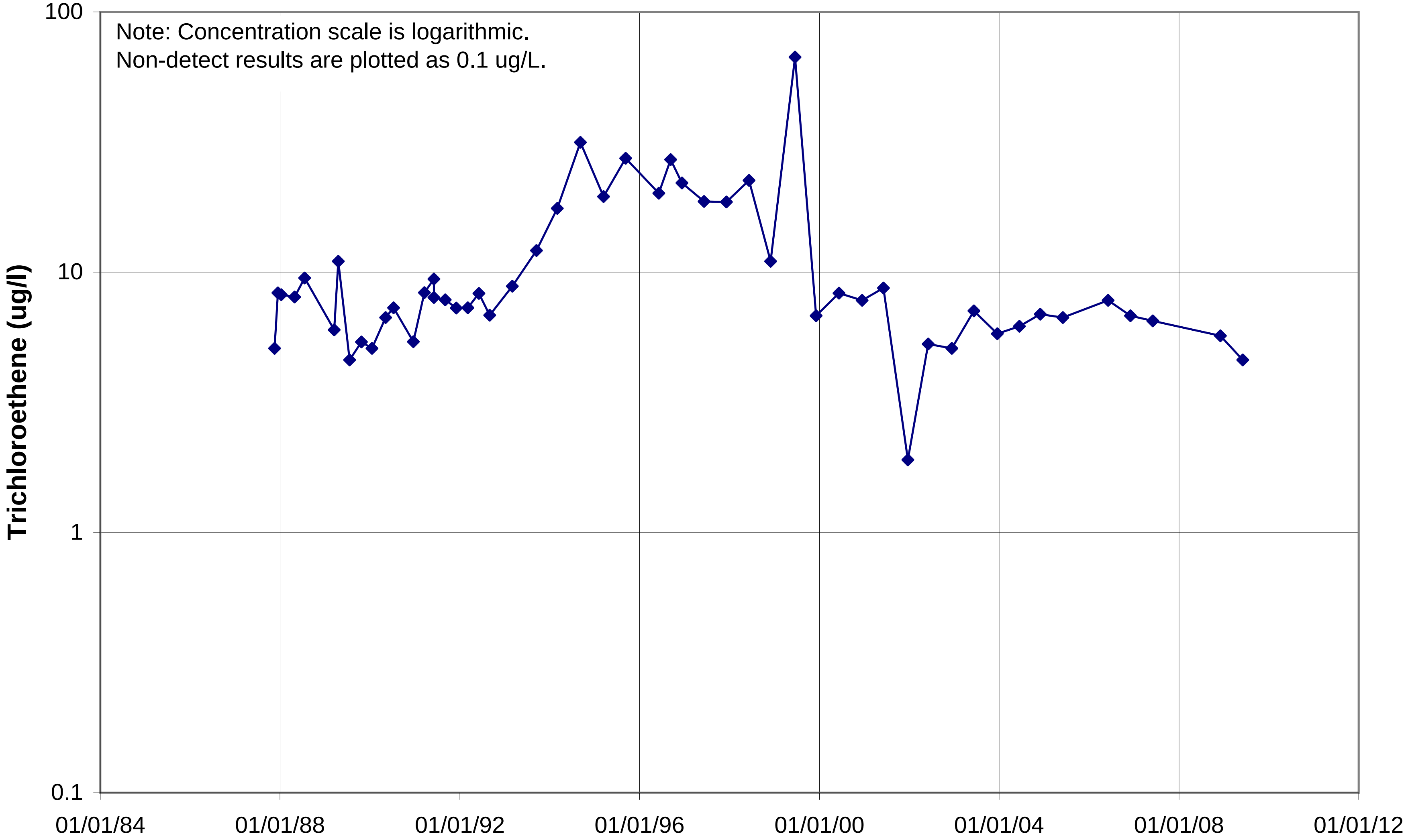

**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 03F303 (B2)

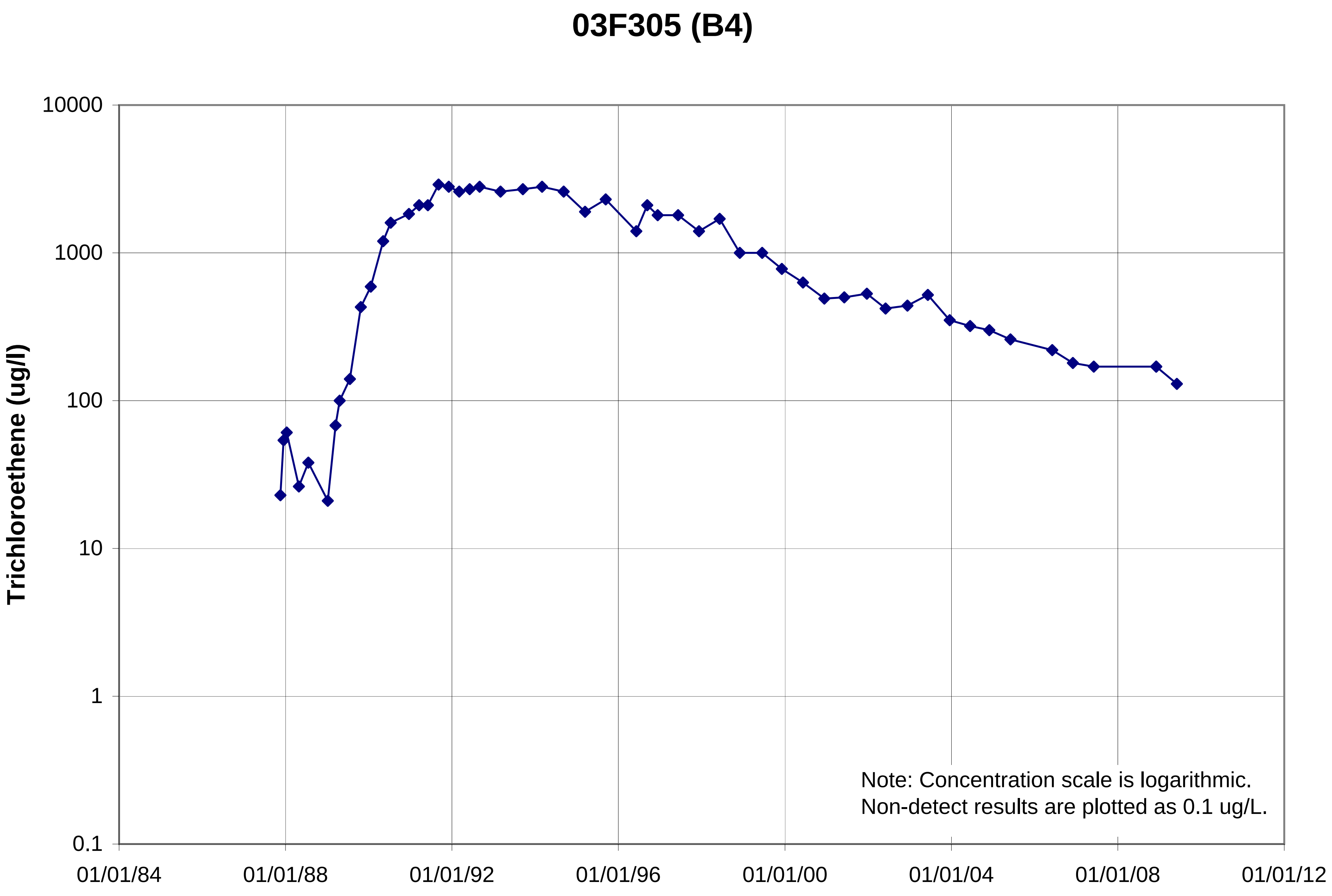



**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

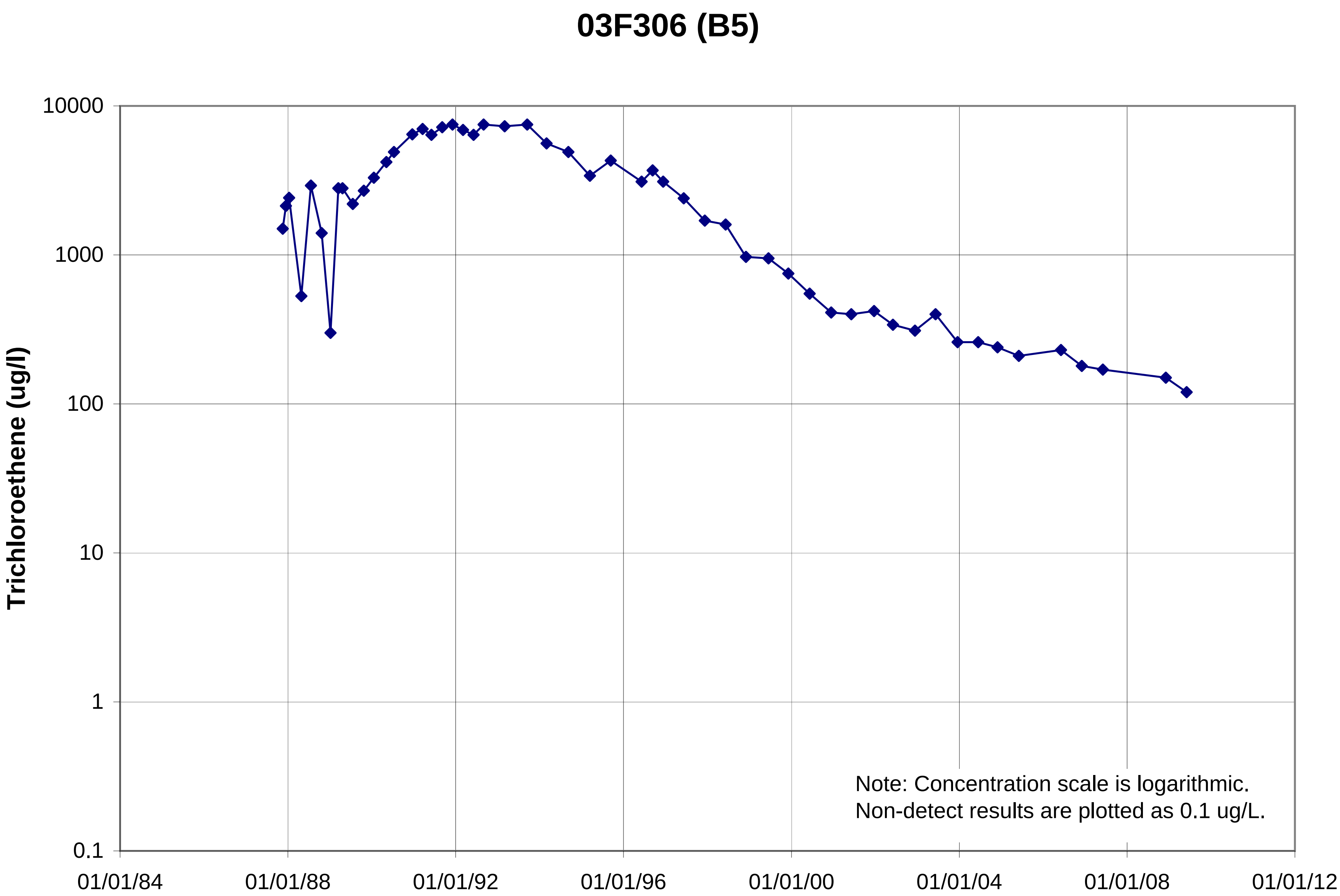
# 03F304 (B3)




**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

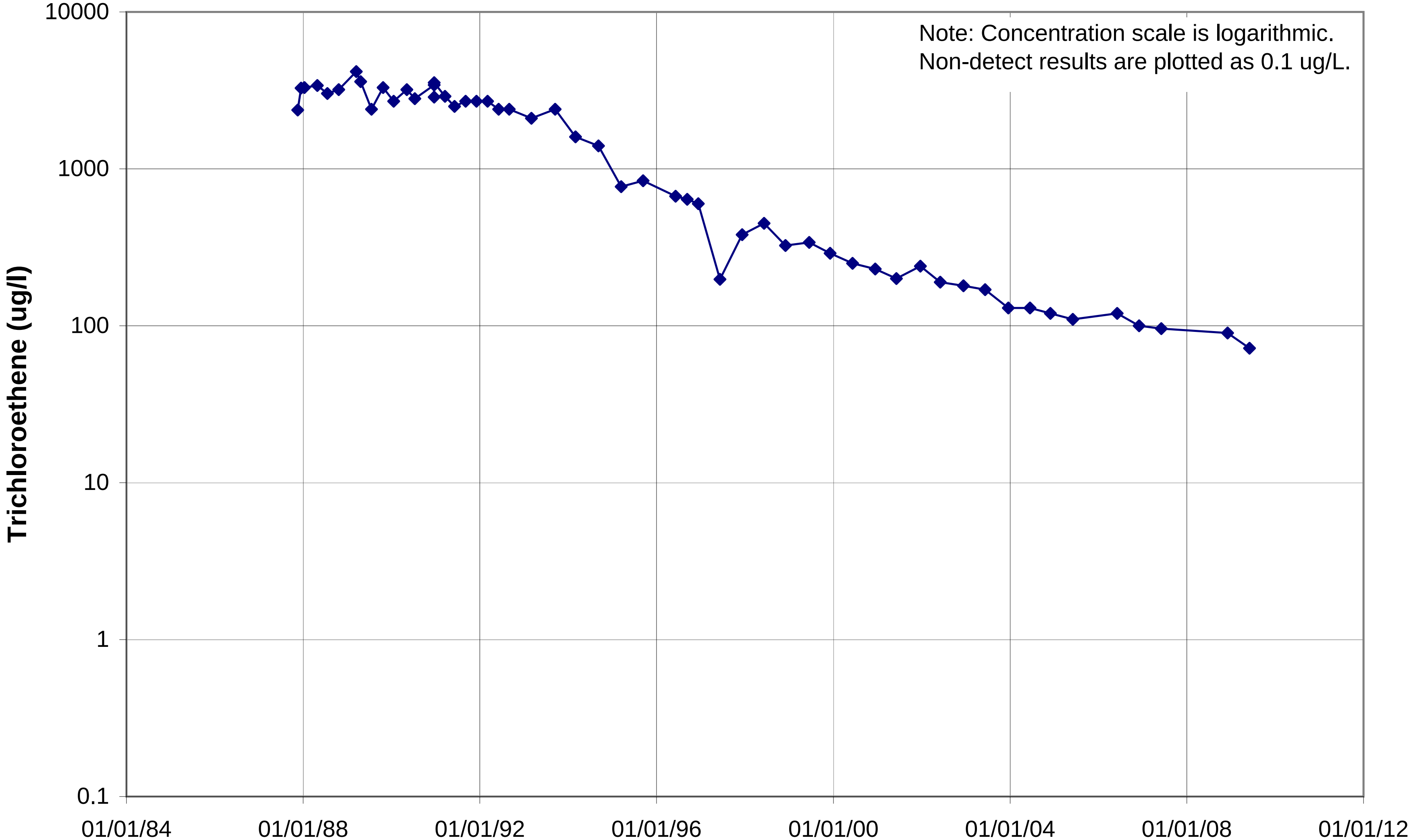



**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar



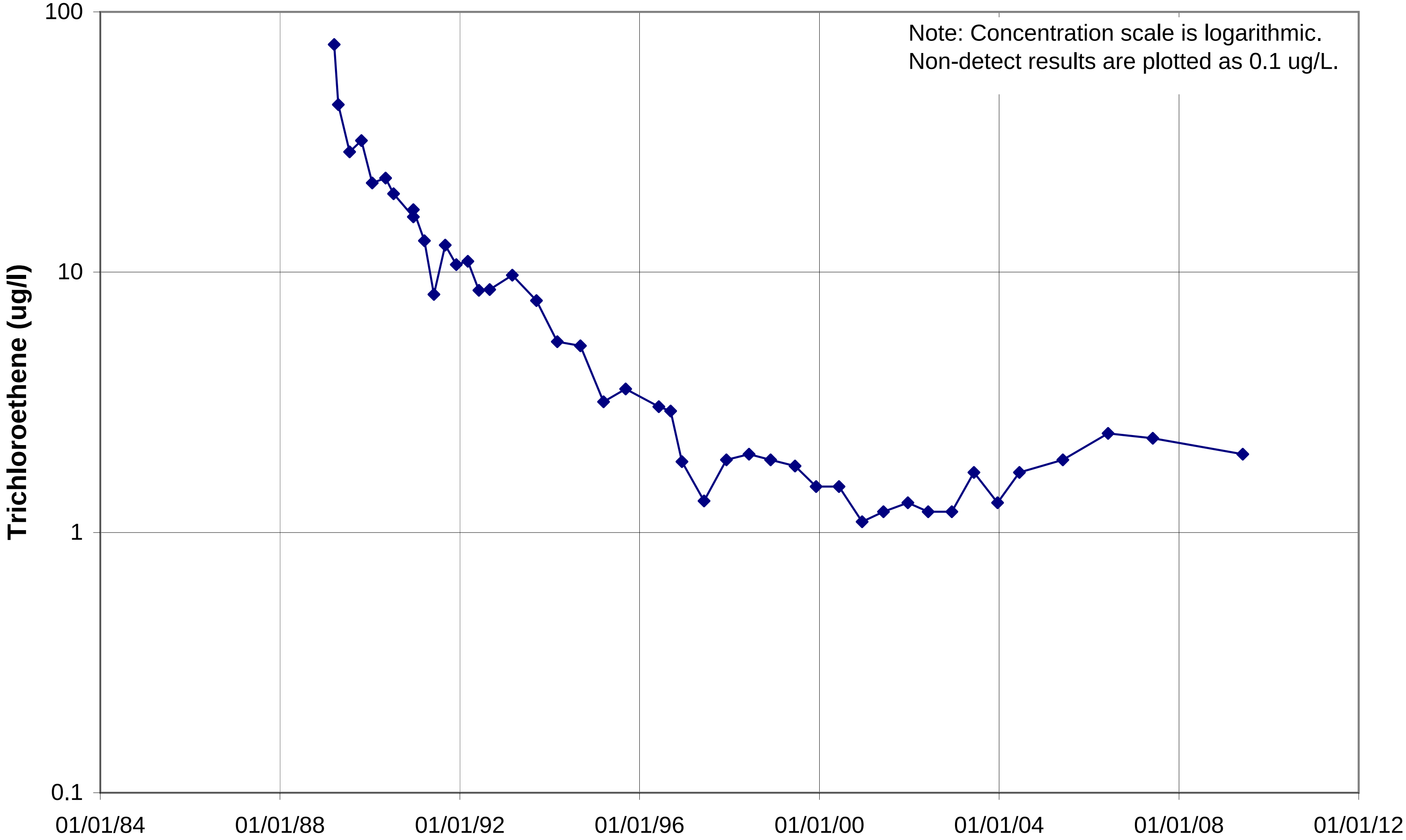

**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 03F307 (B6)



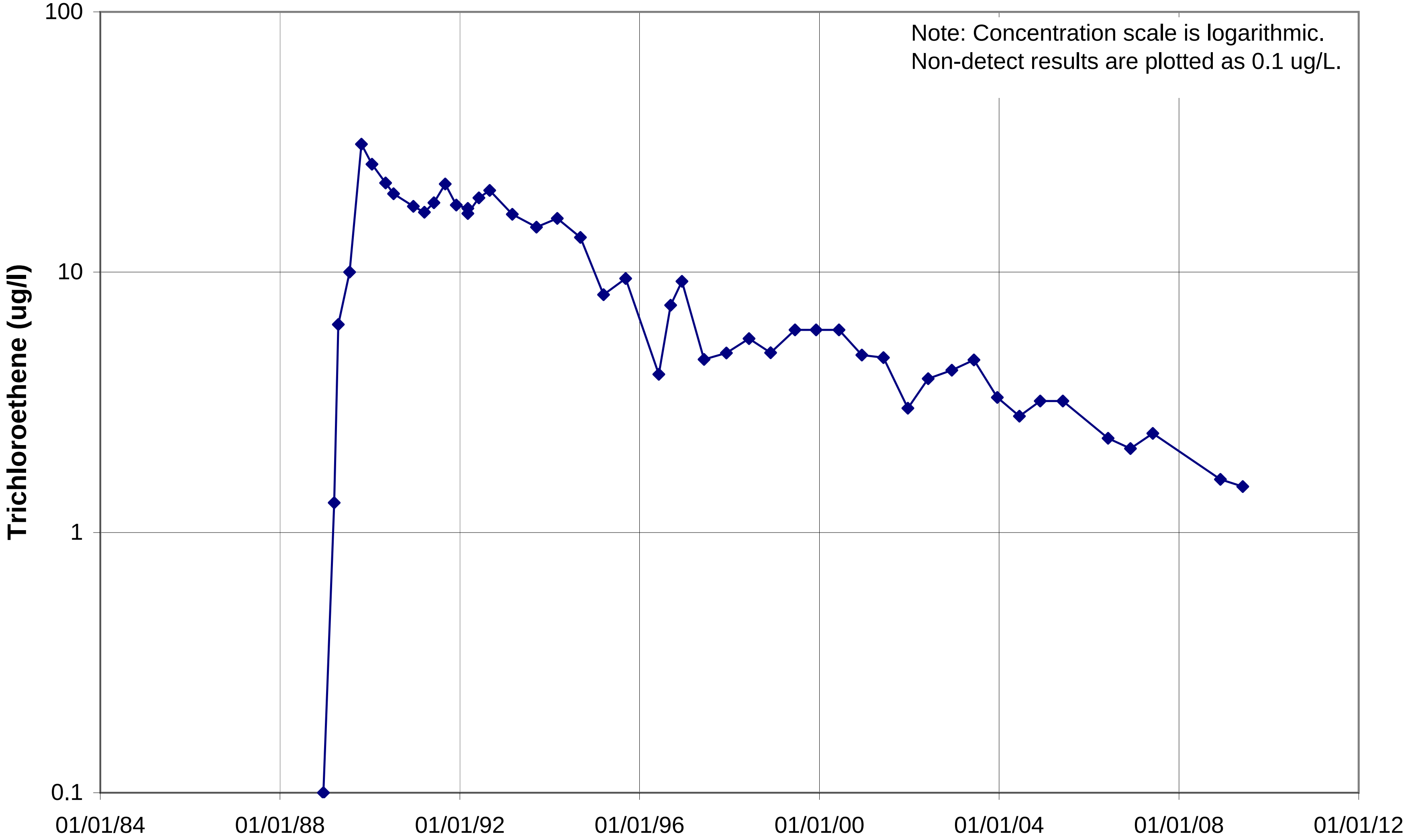

**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 03F308 (B7)



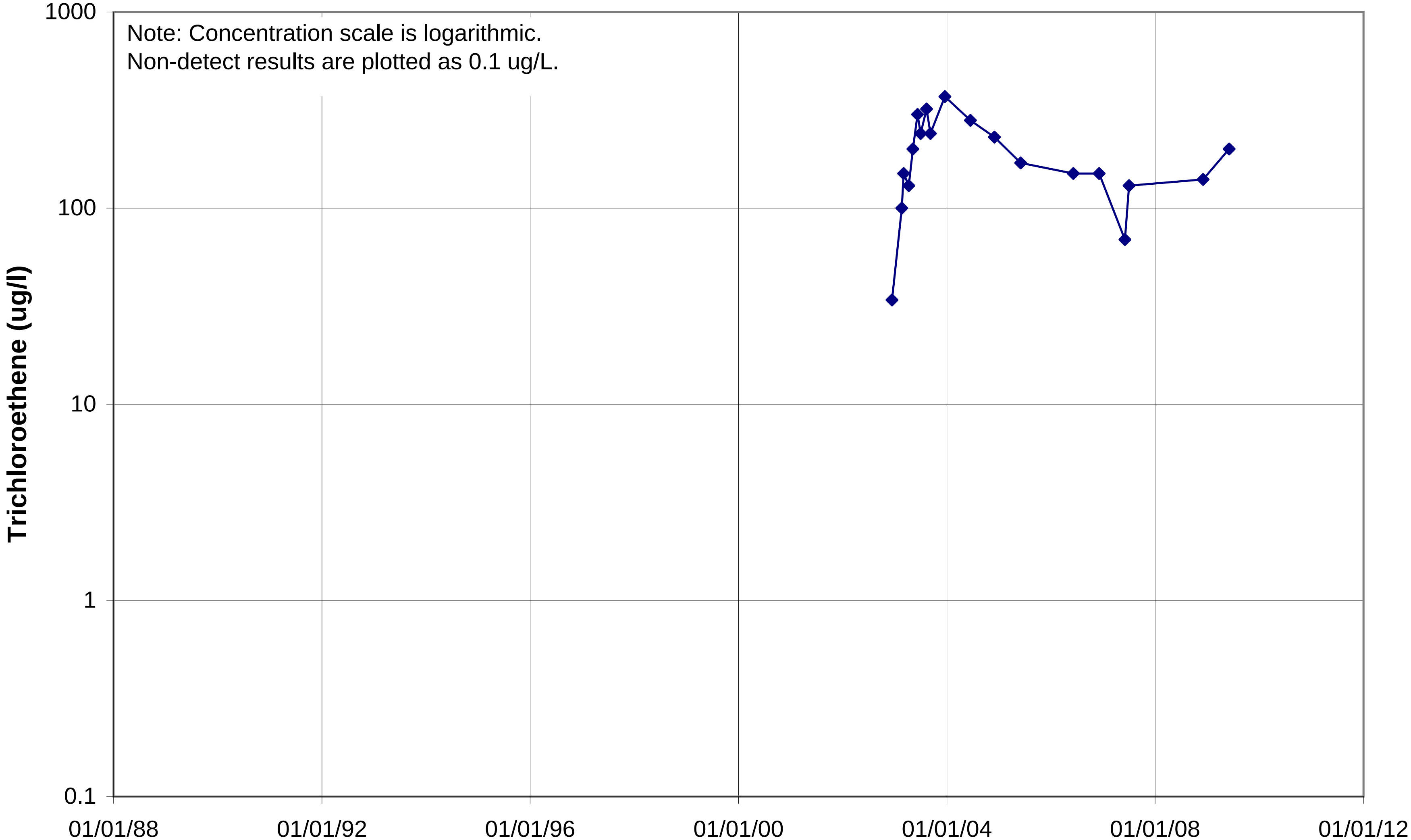

**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 03F312 (B11)

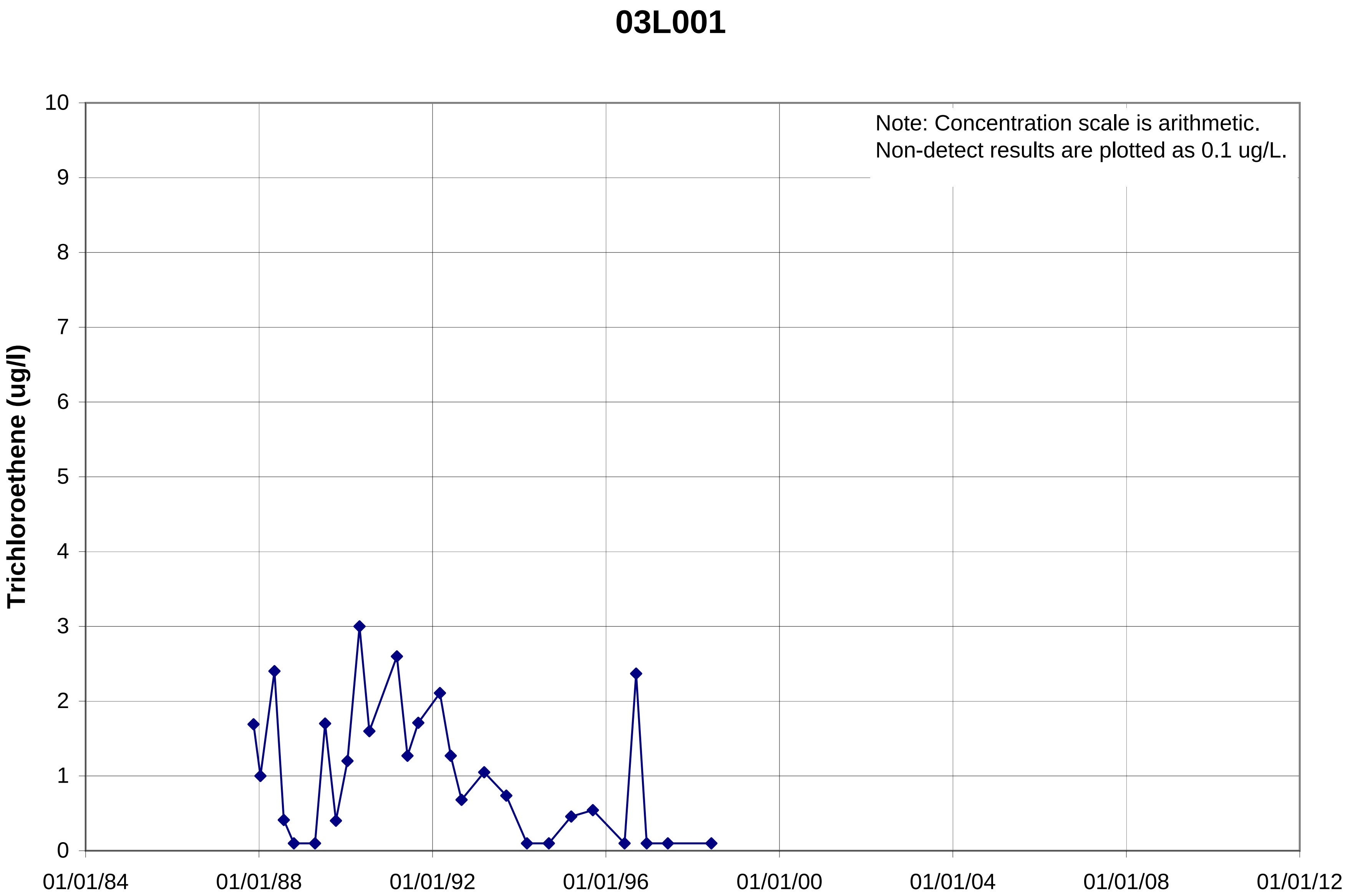



**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 03F319 (B13)

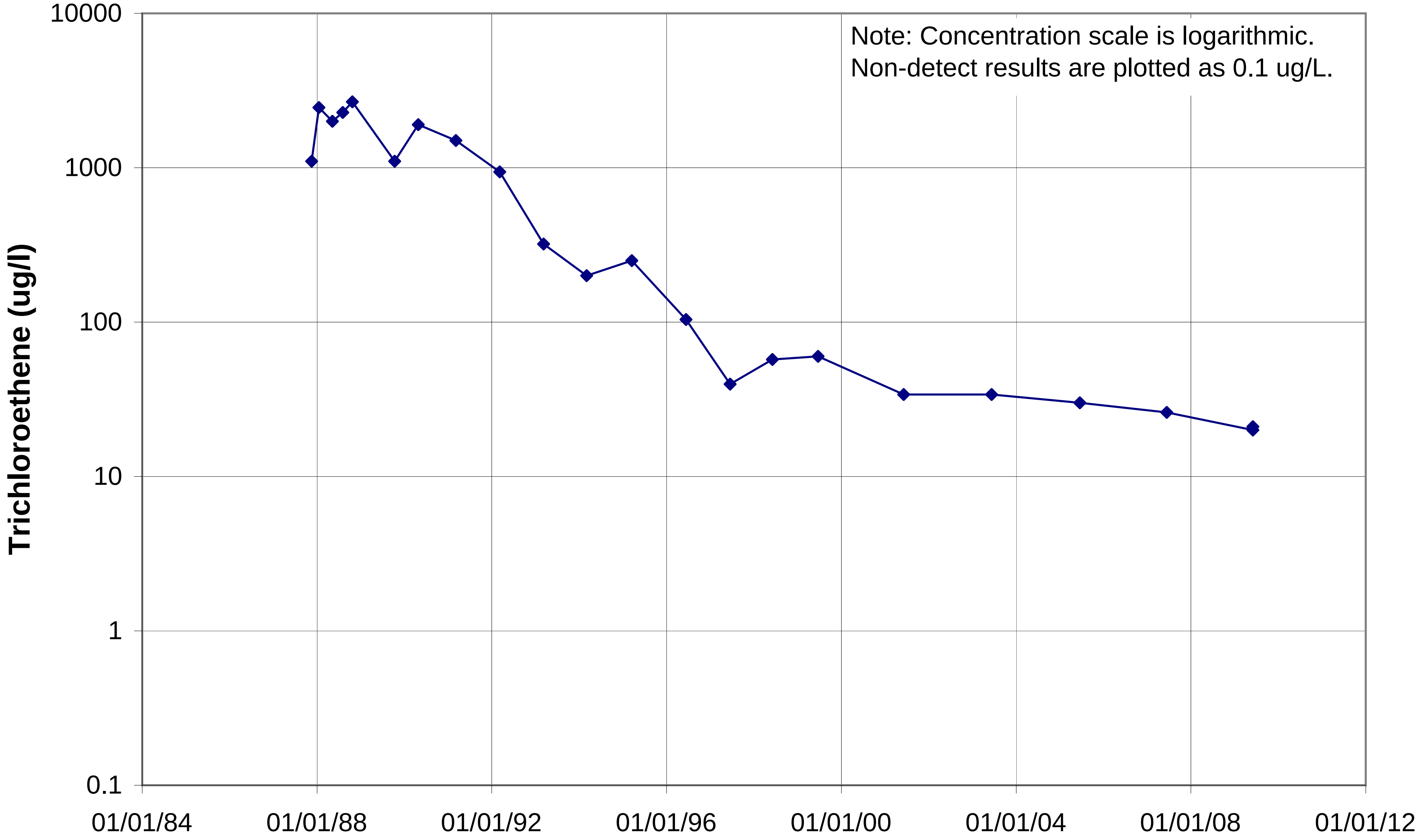



**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar



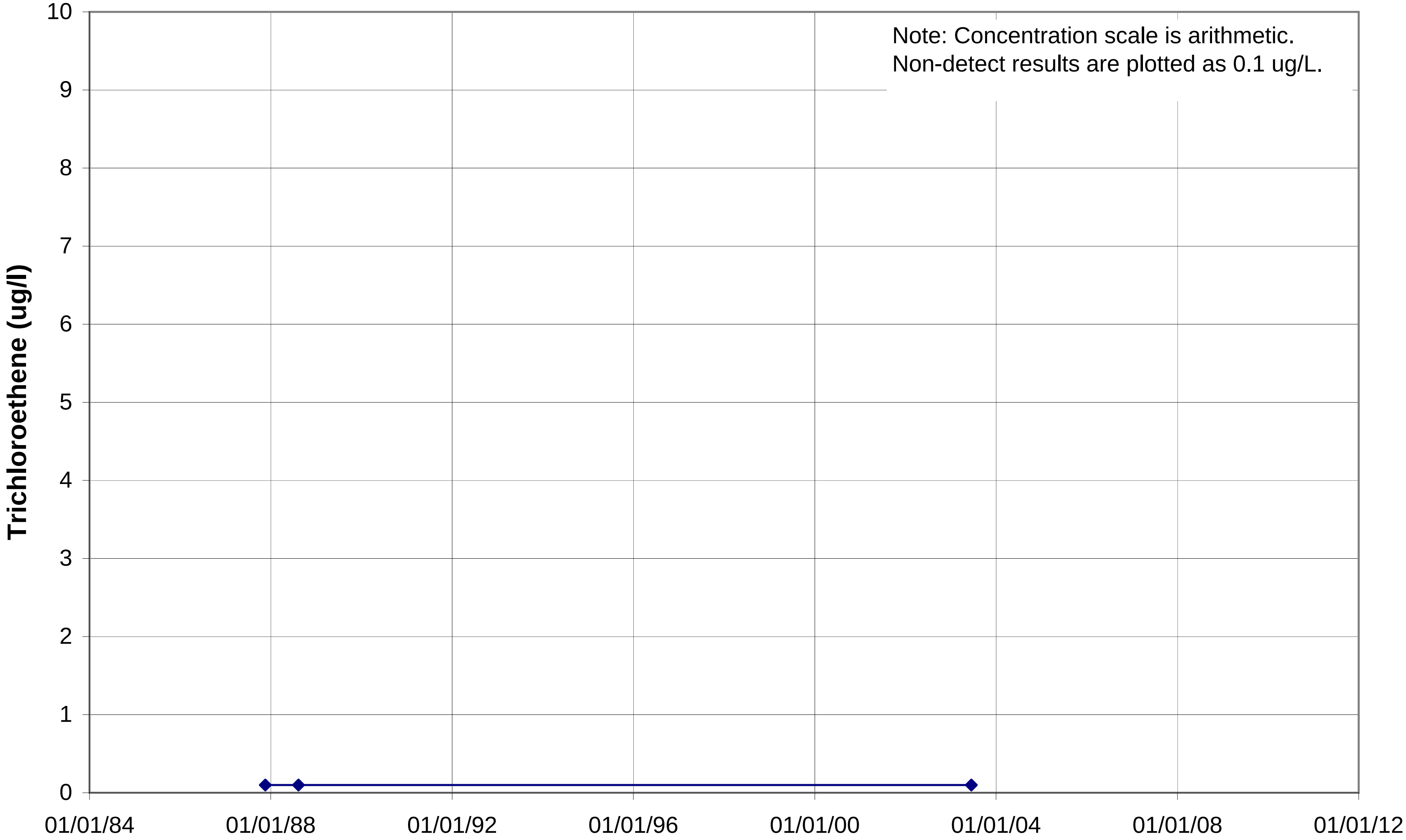

**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 03L002



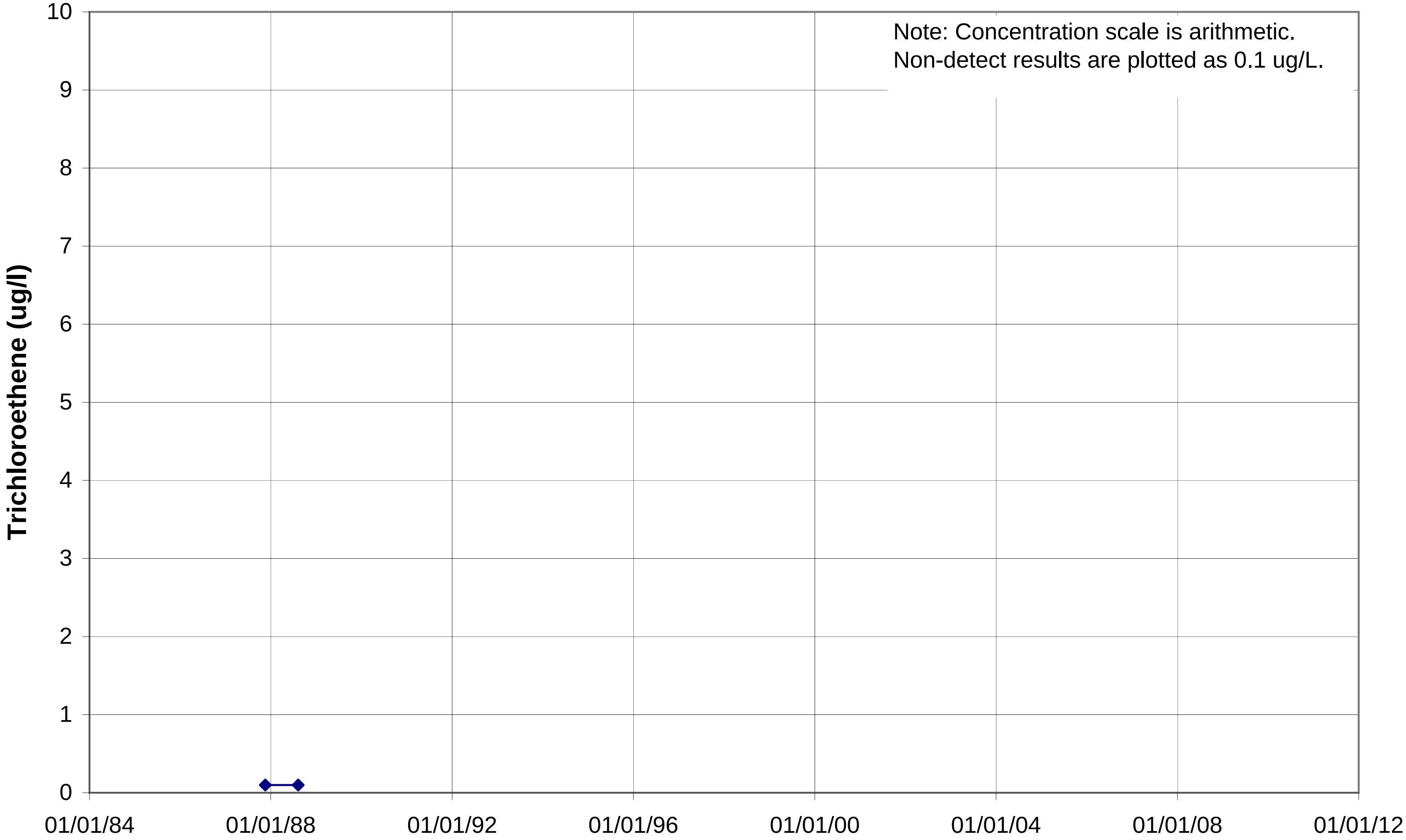

**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 03L003



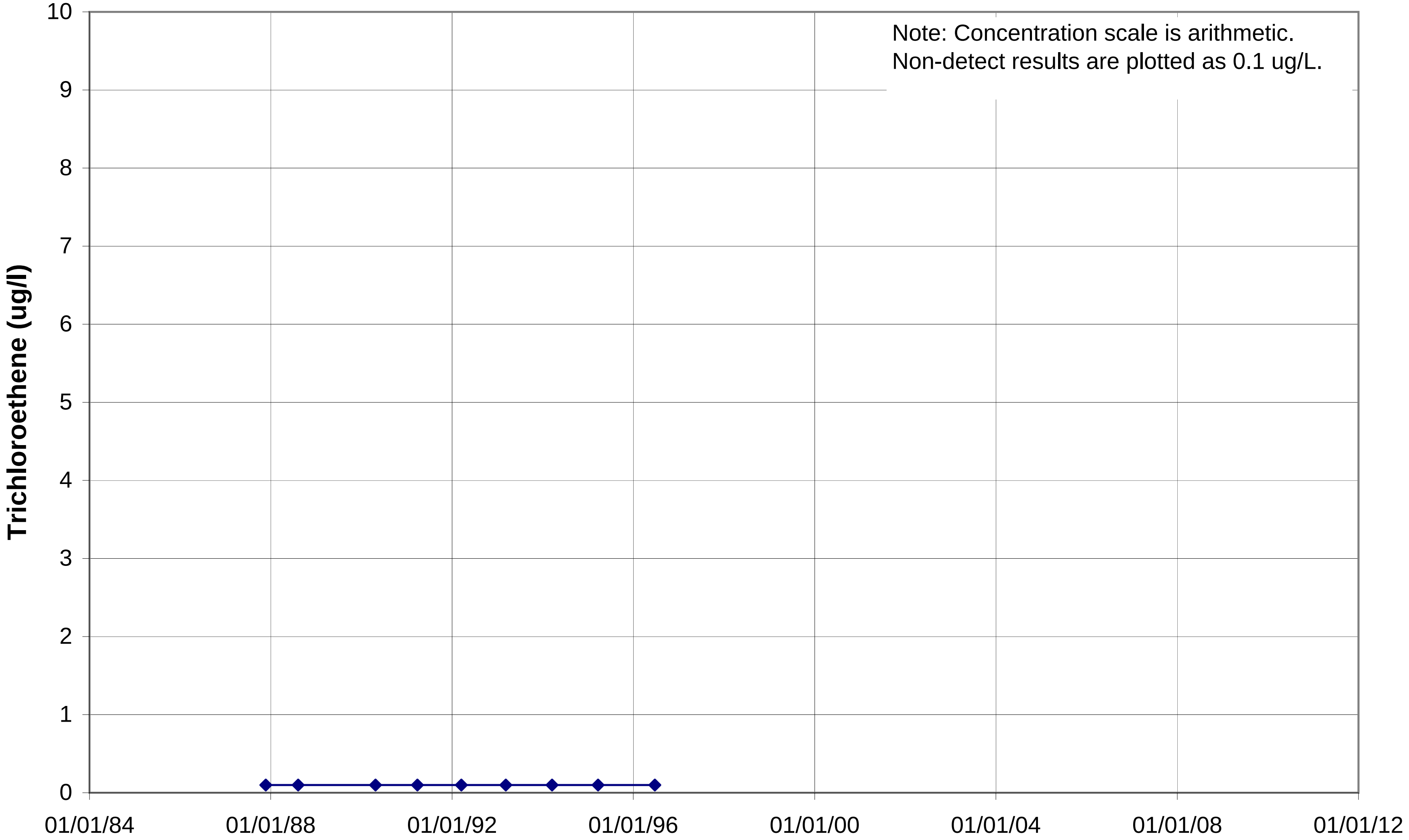

**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 03L004



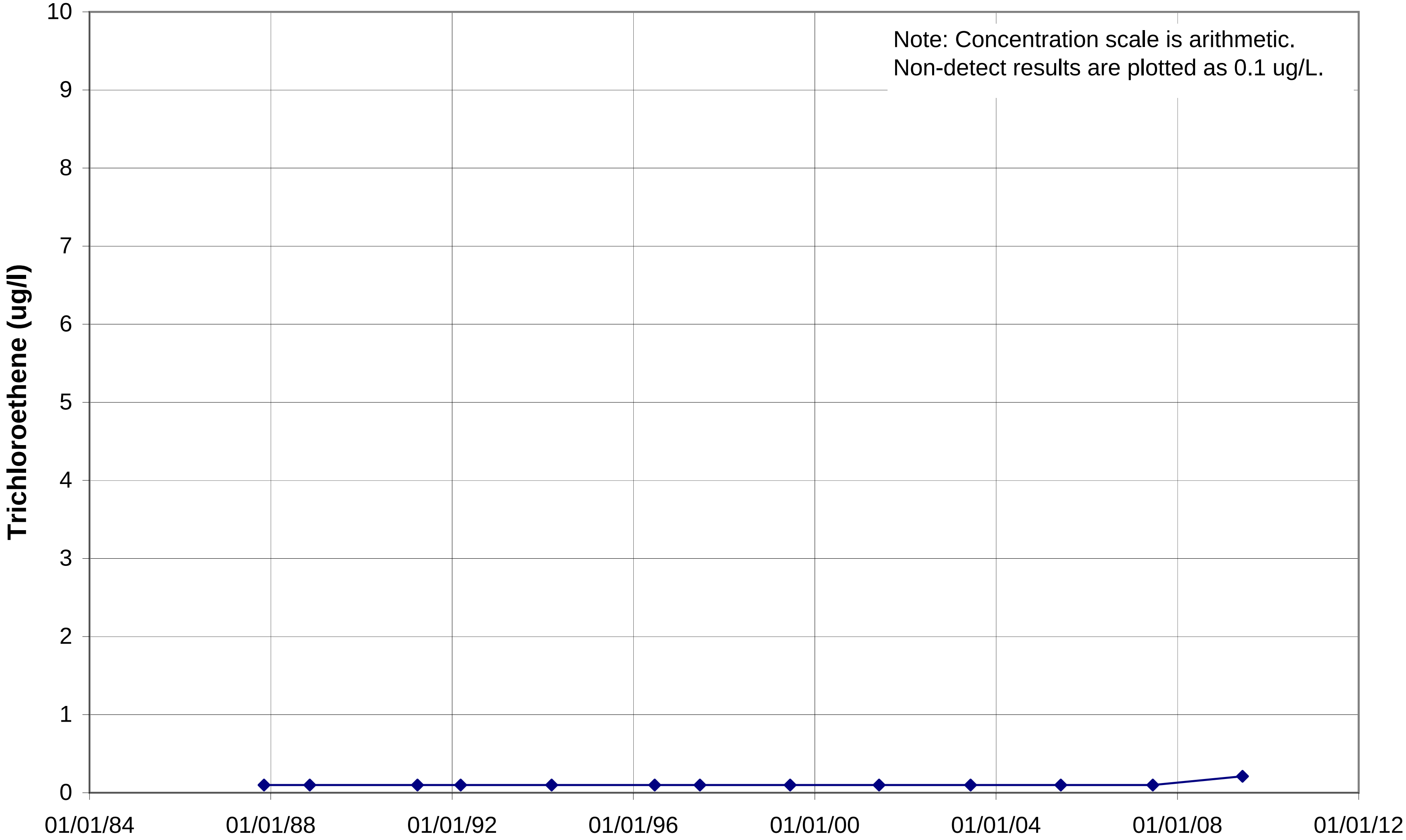

**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 03L005



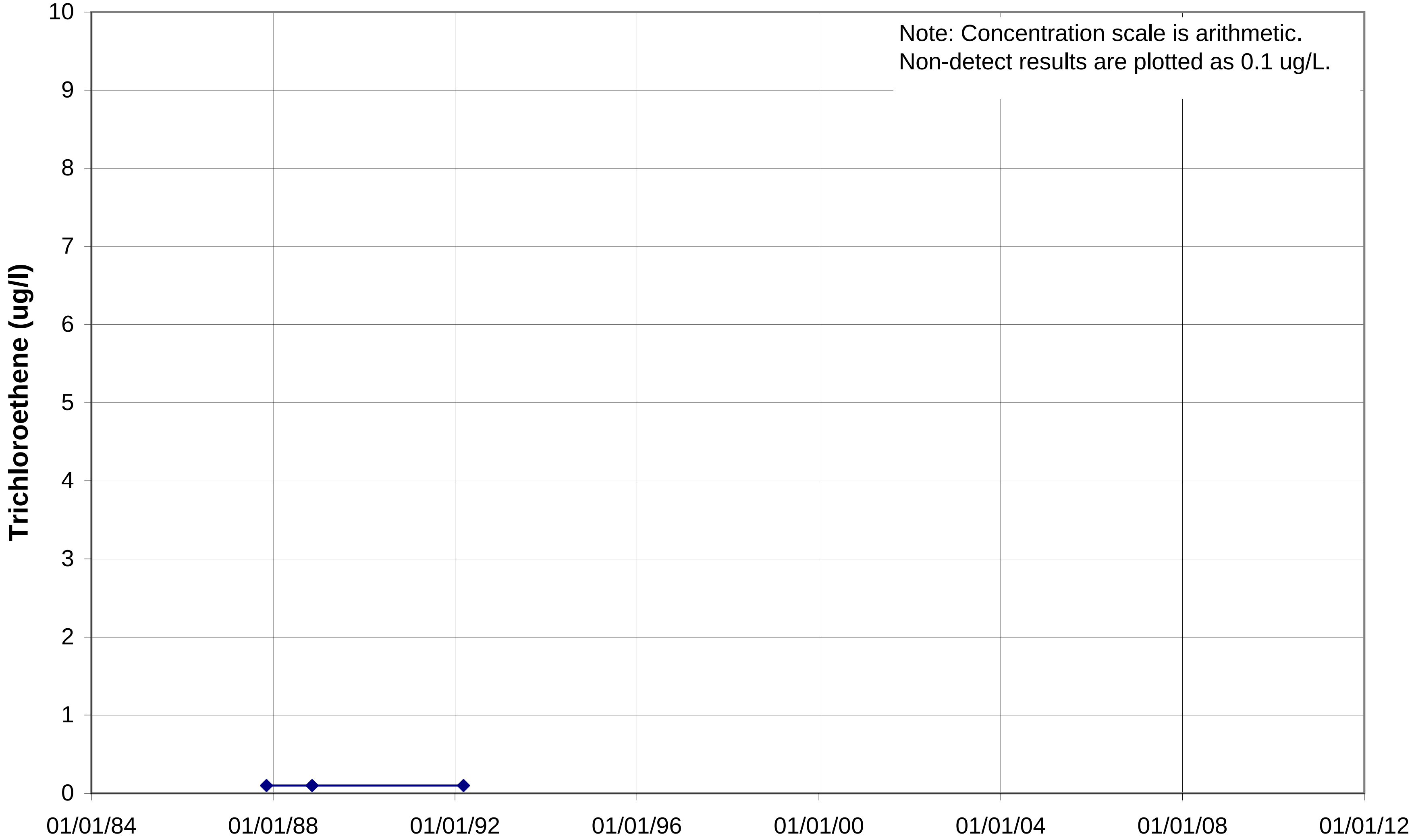

**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 03L007



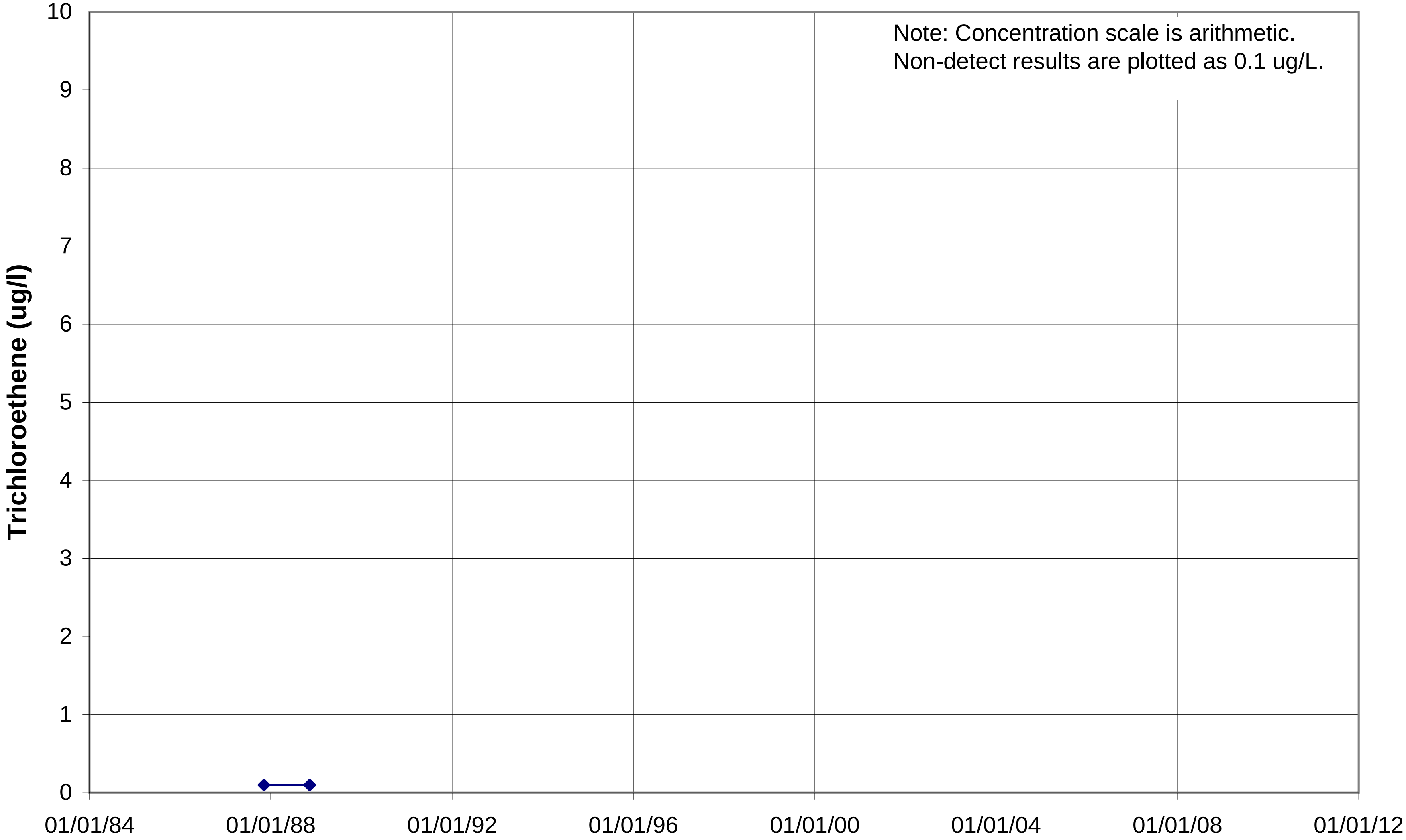

**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 03L010



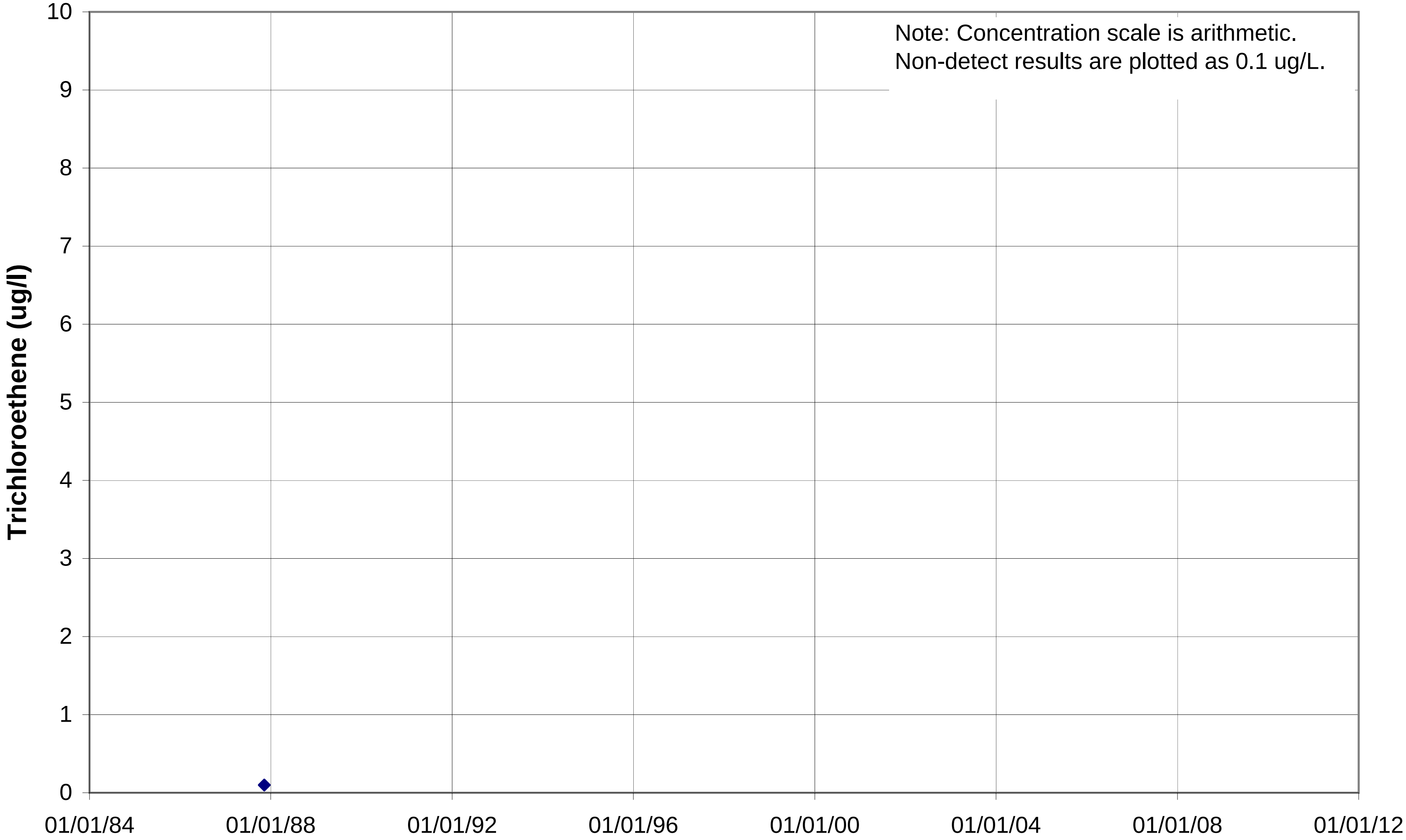

**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 03L012



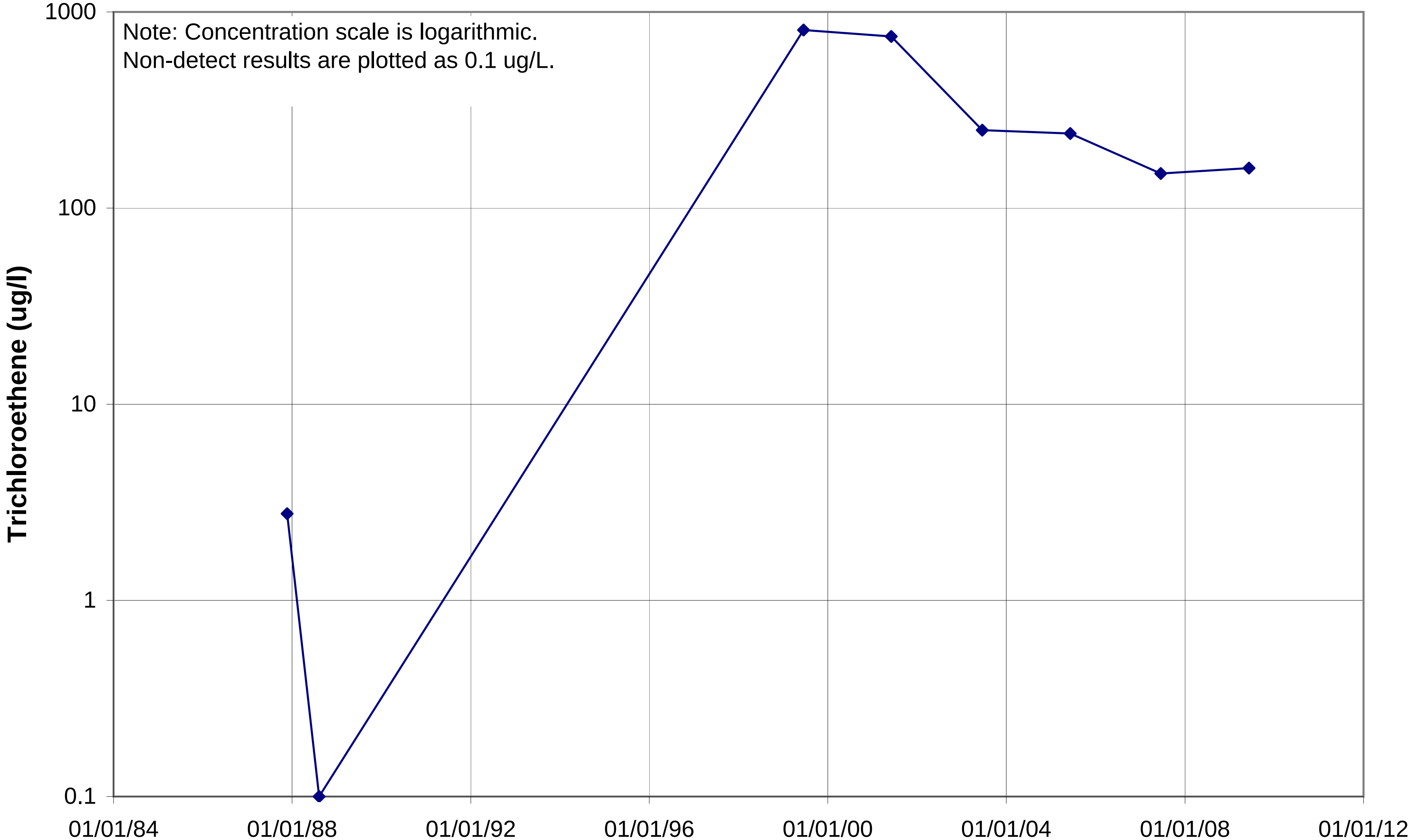

**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 03L013



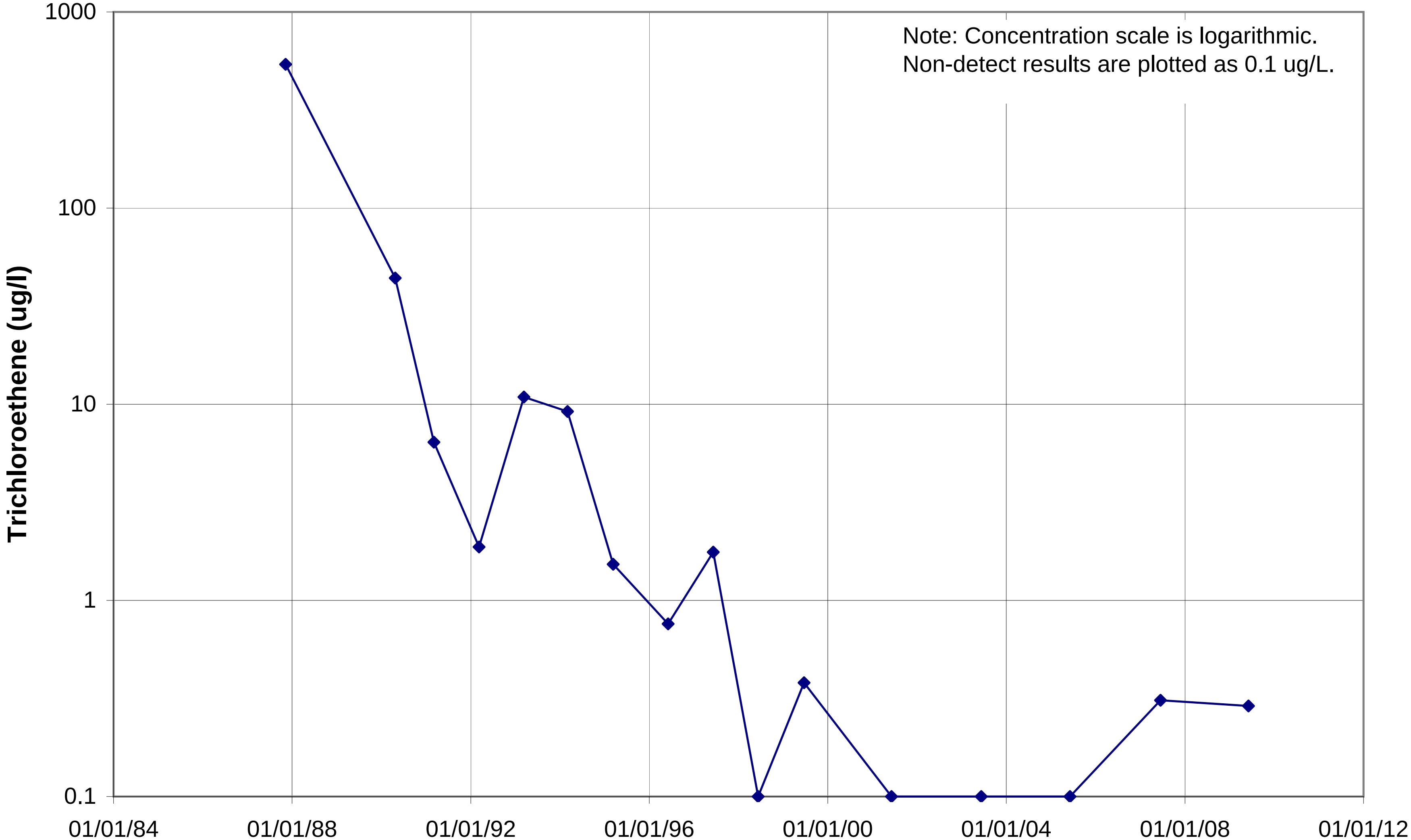

**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 03L014



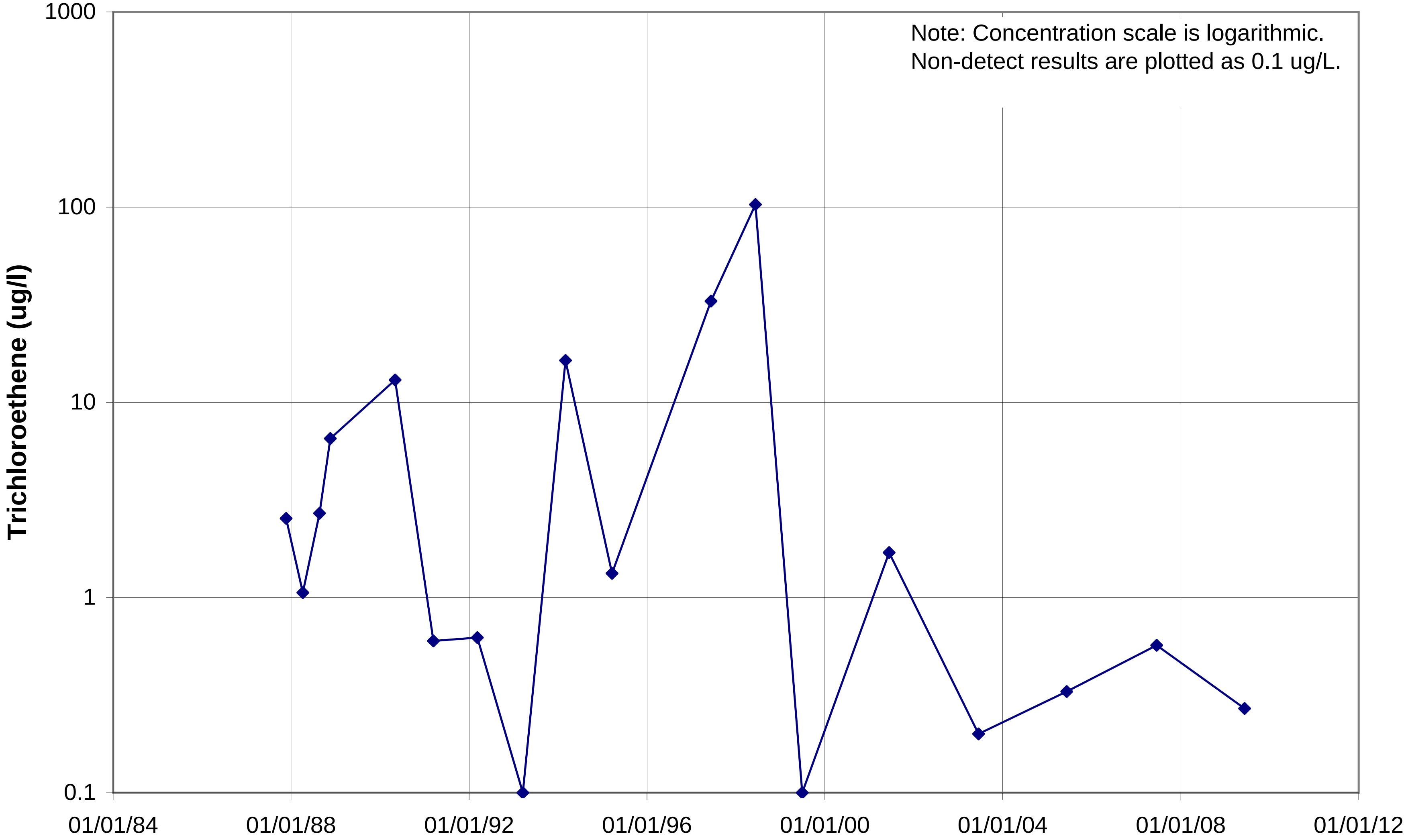

**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 03L017



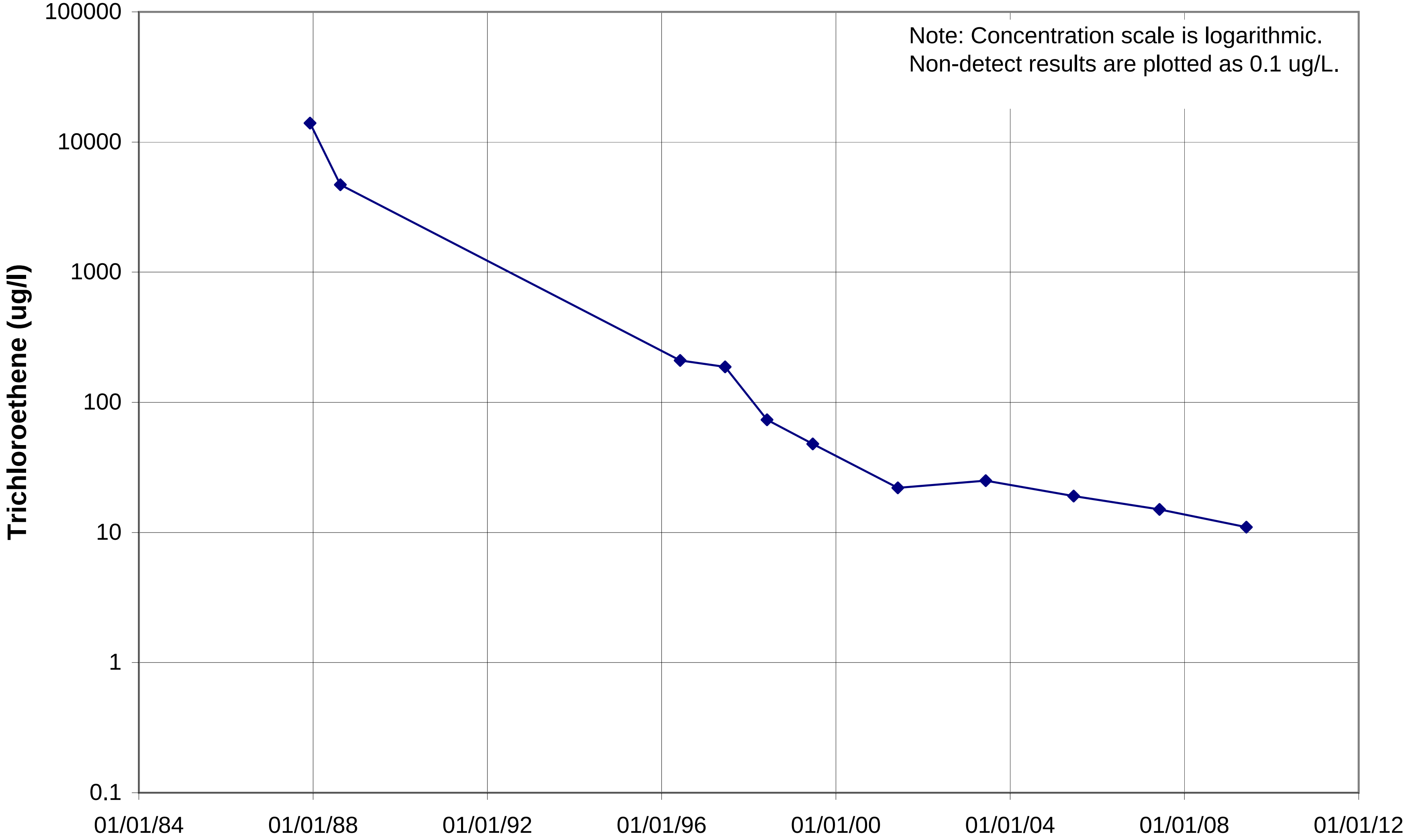

**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 03L018



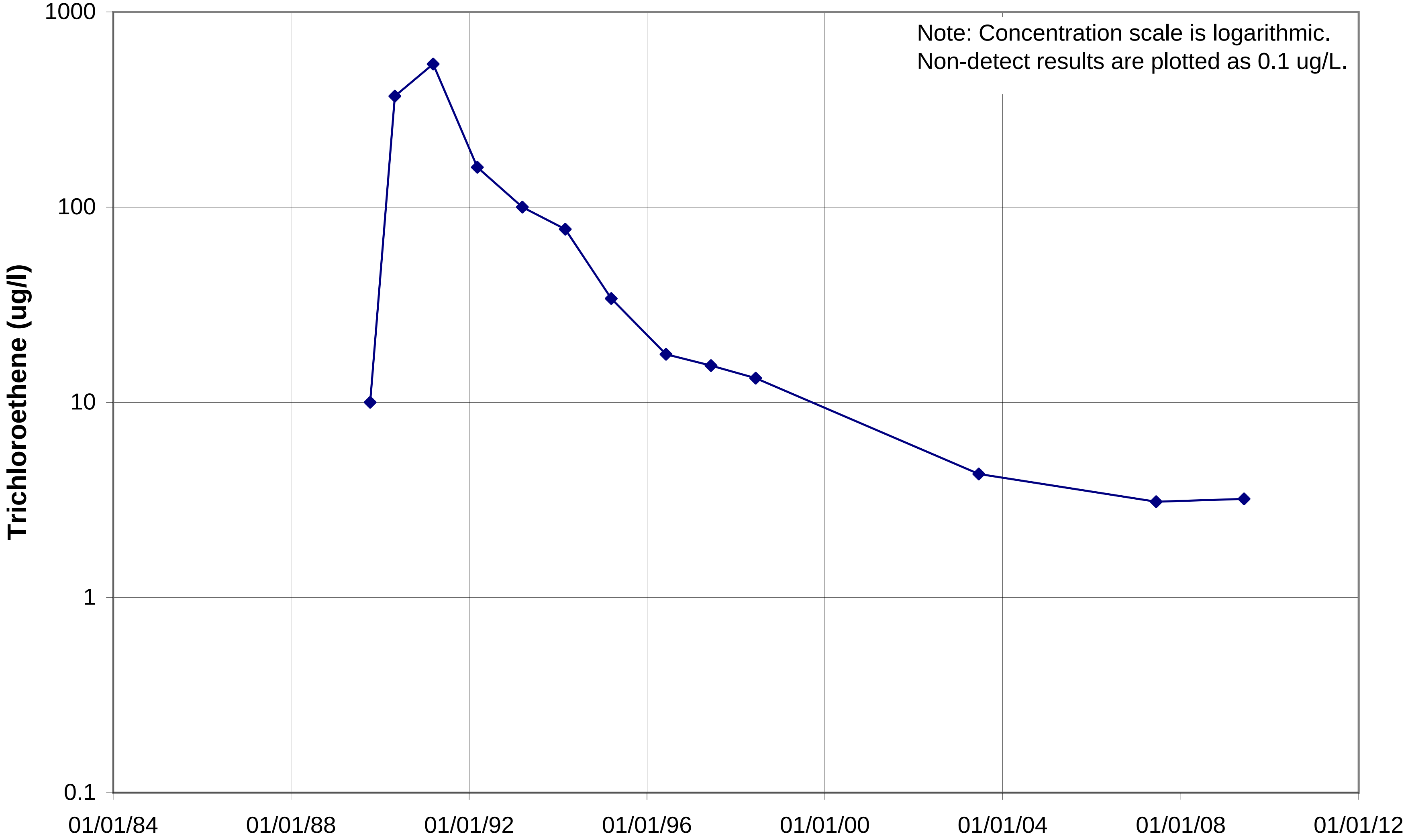

**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 03L020



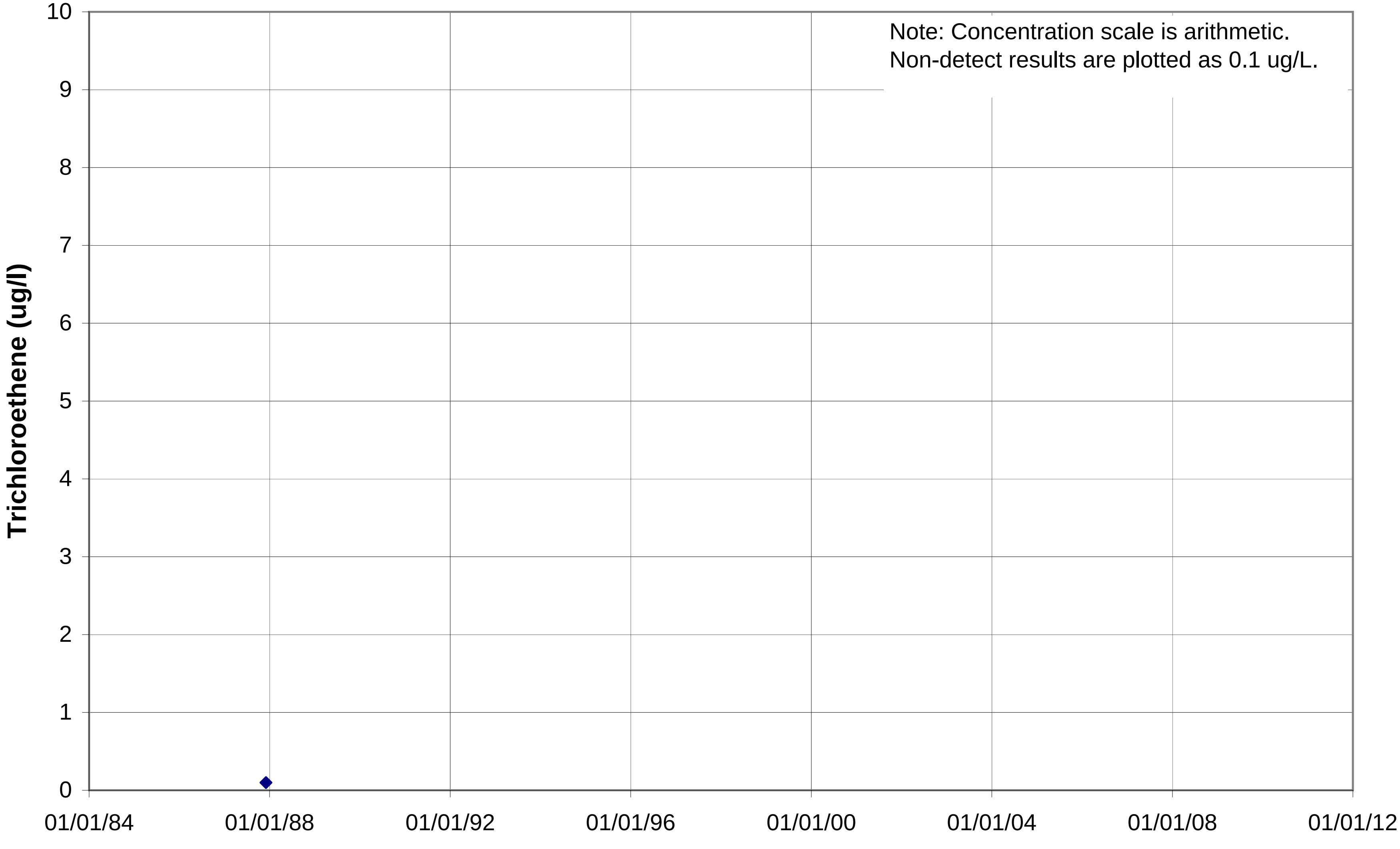

**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 03L021



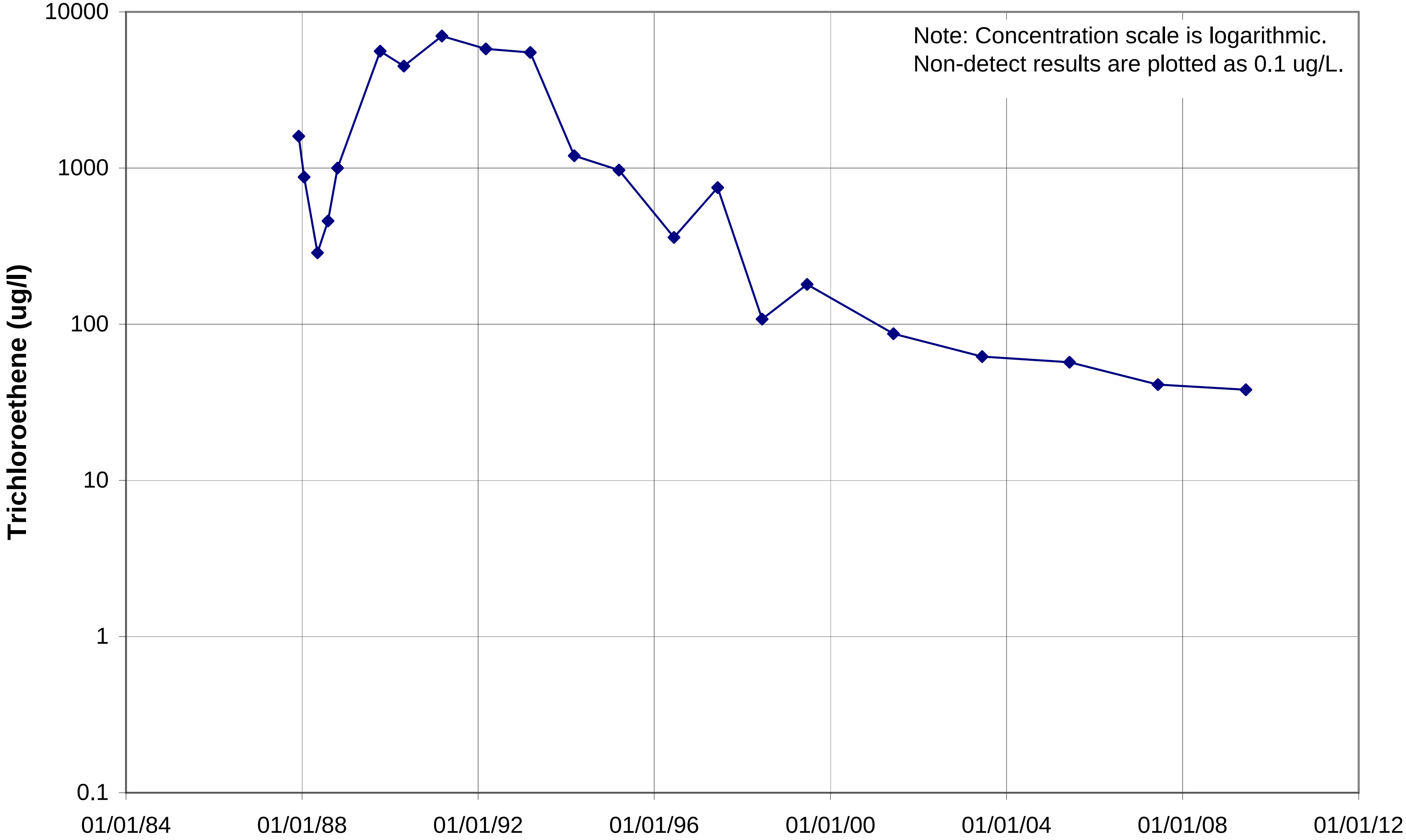

**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 03L029



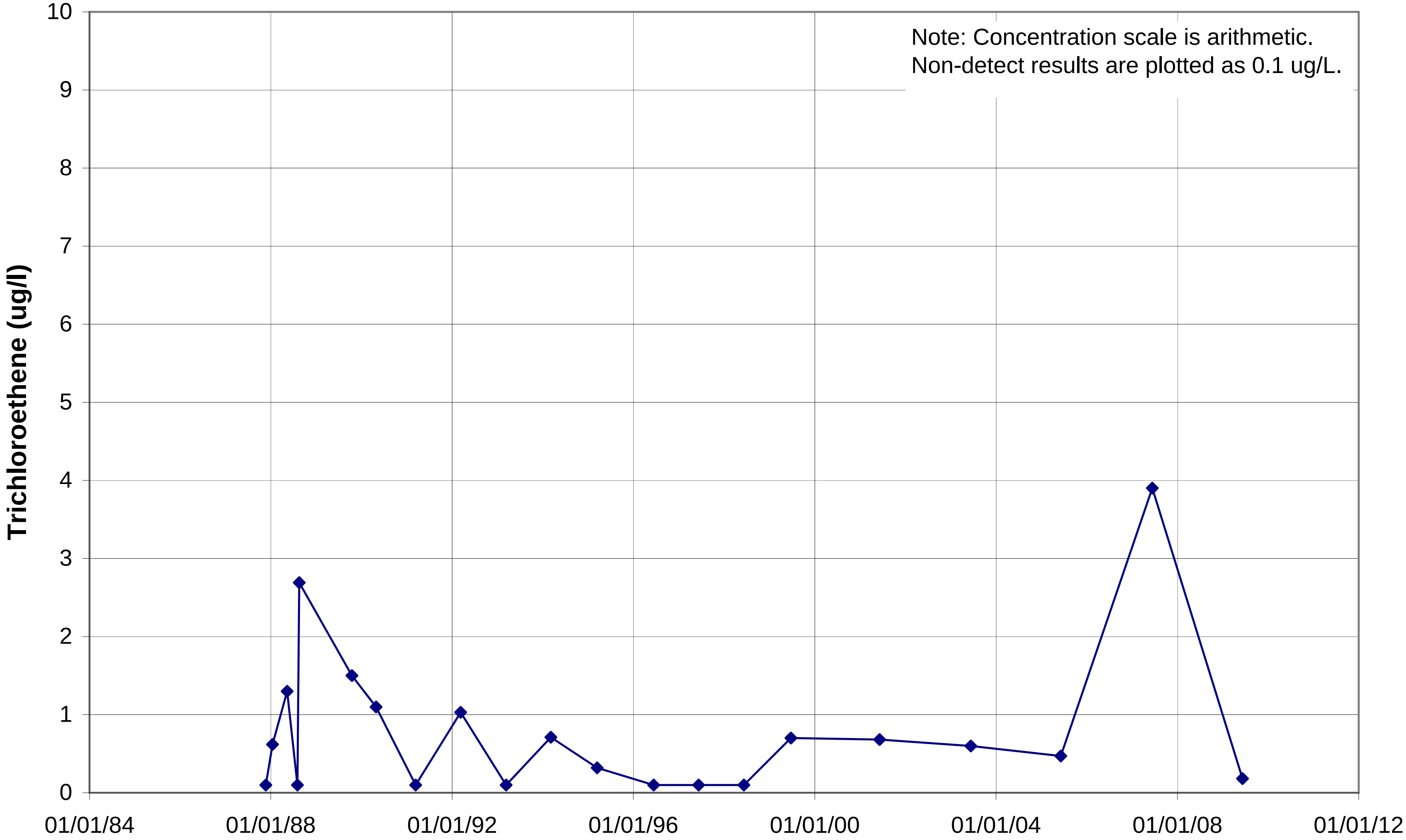

**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 03L077



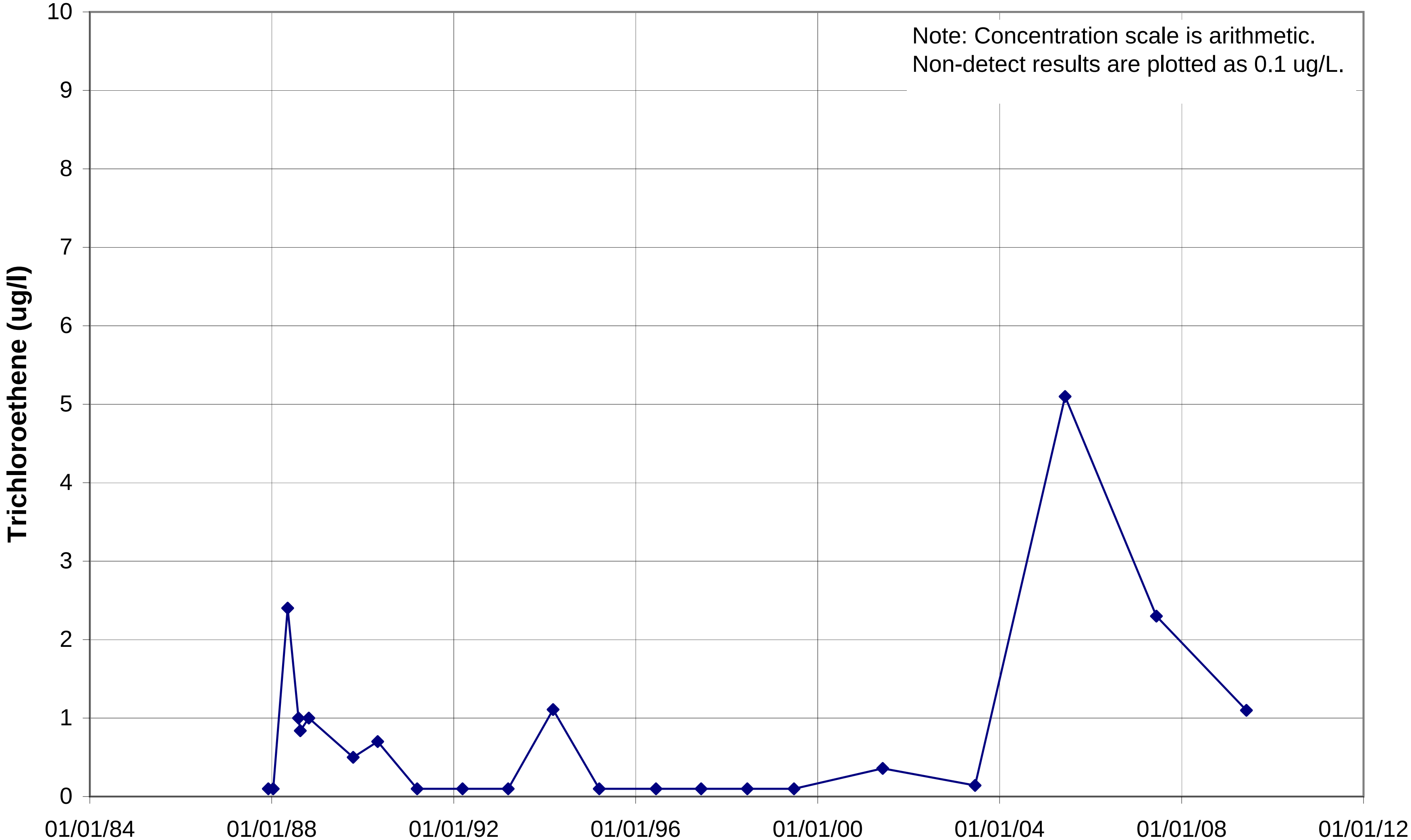

**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 03L078



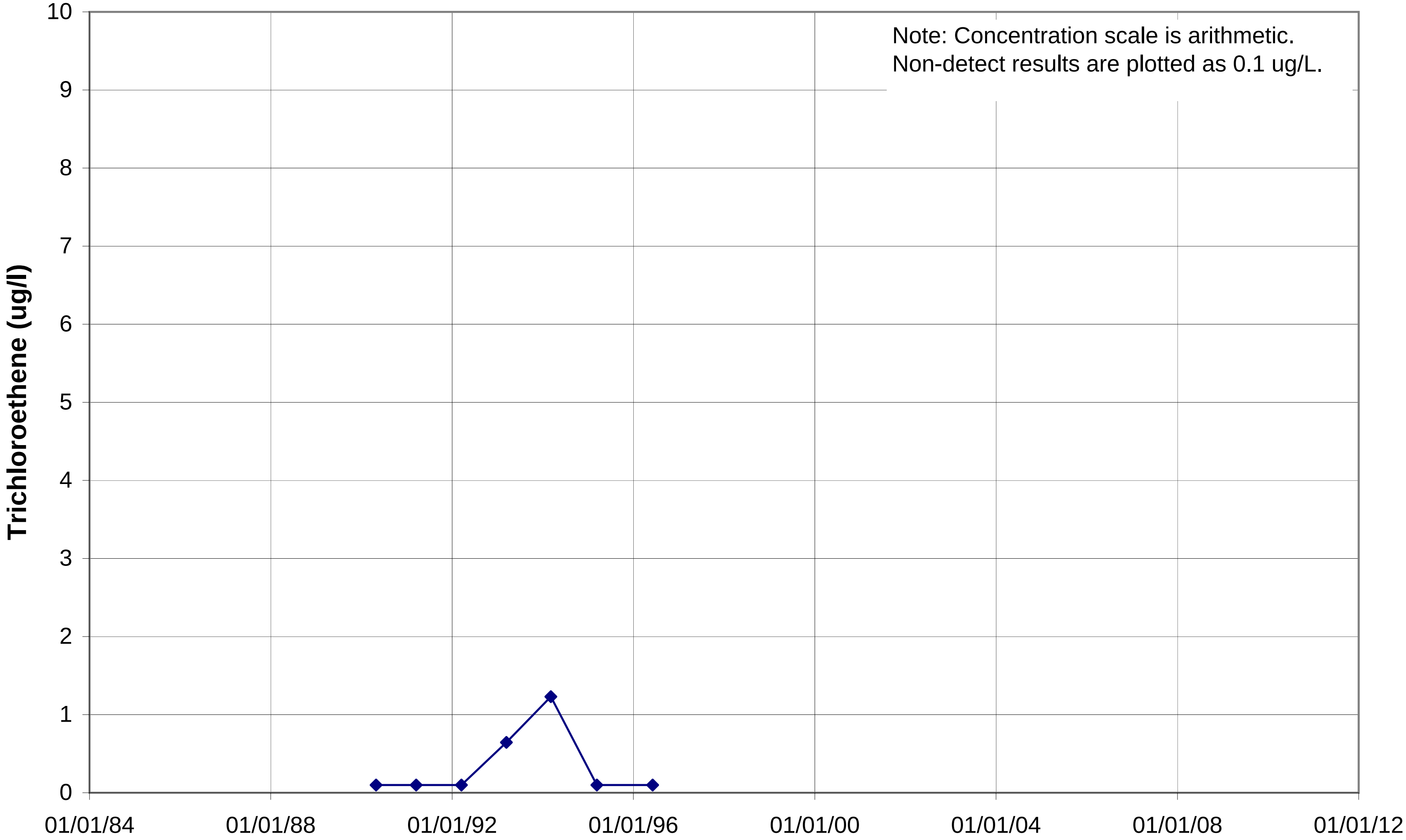

**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 03L079

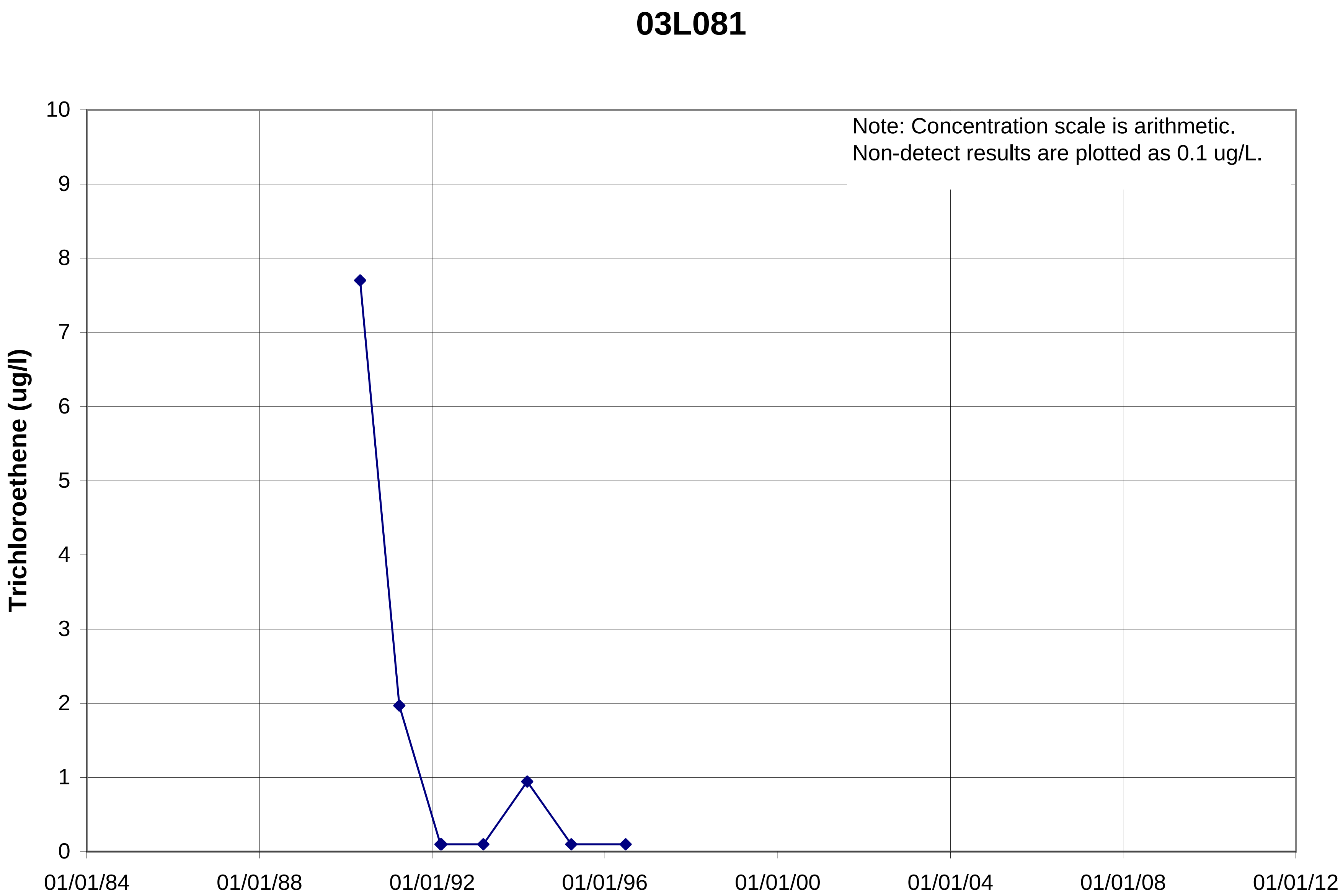



**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 03L080

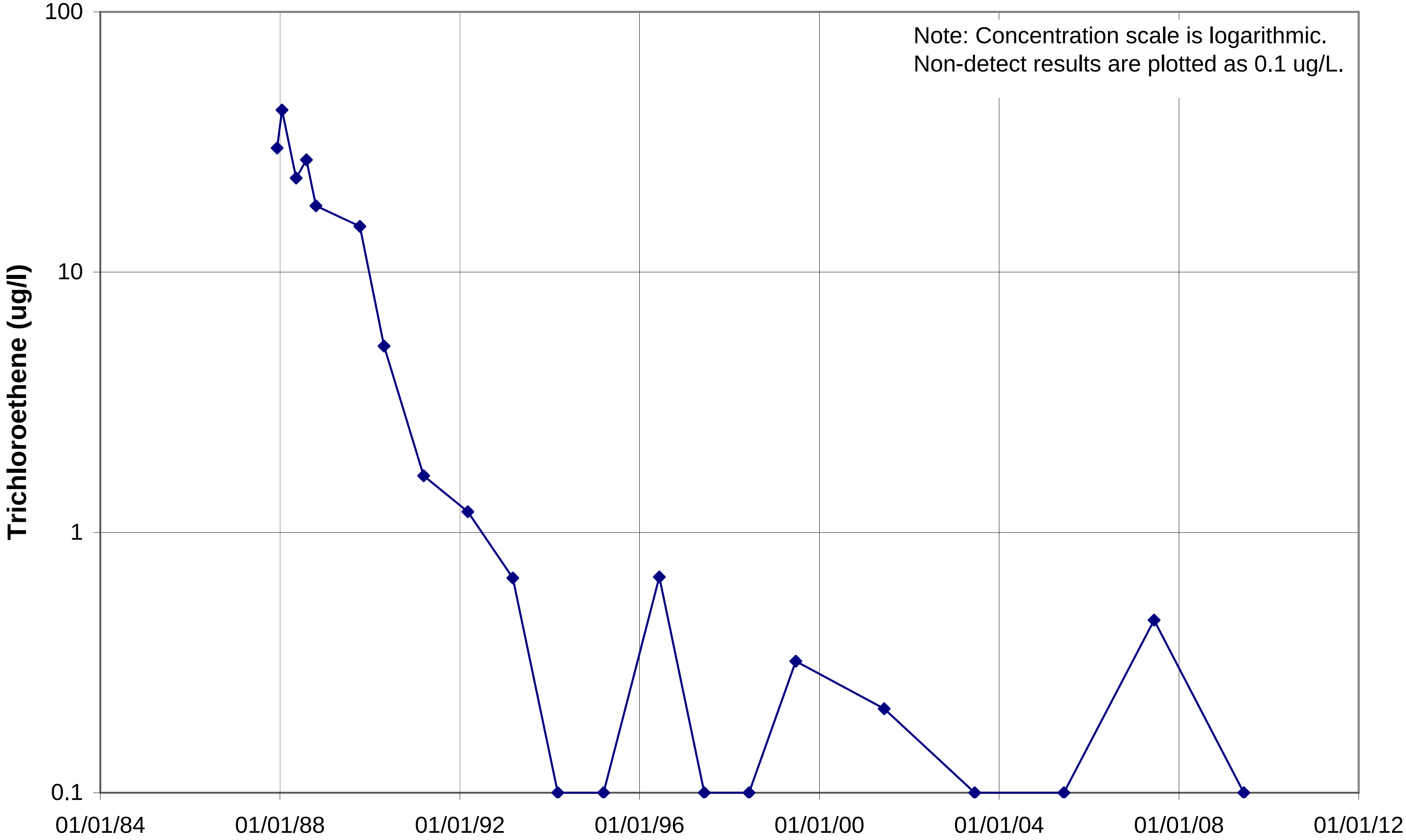



**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar



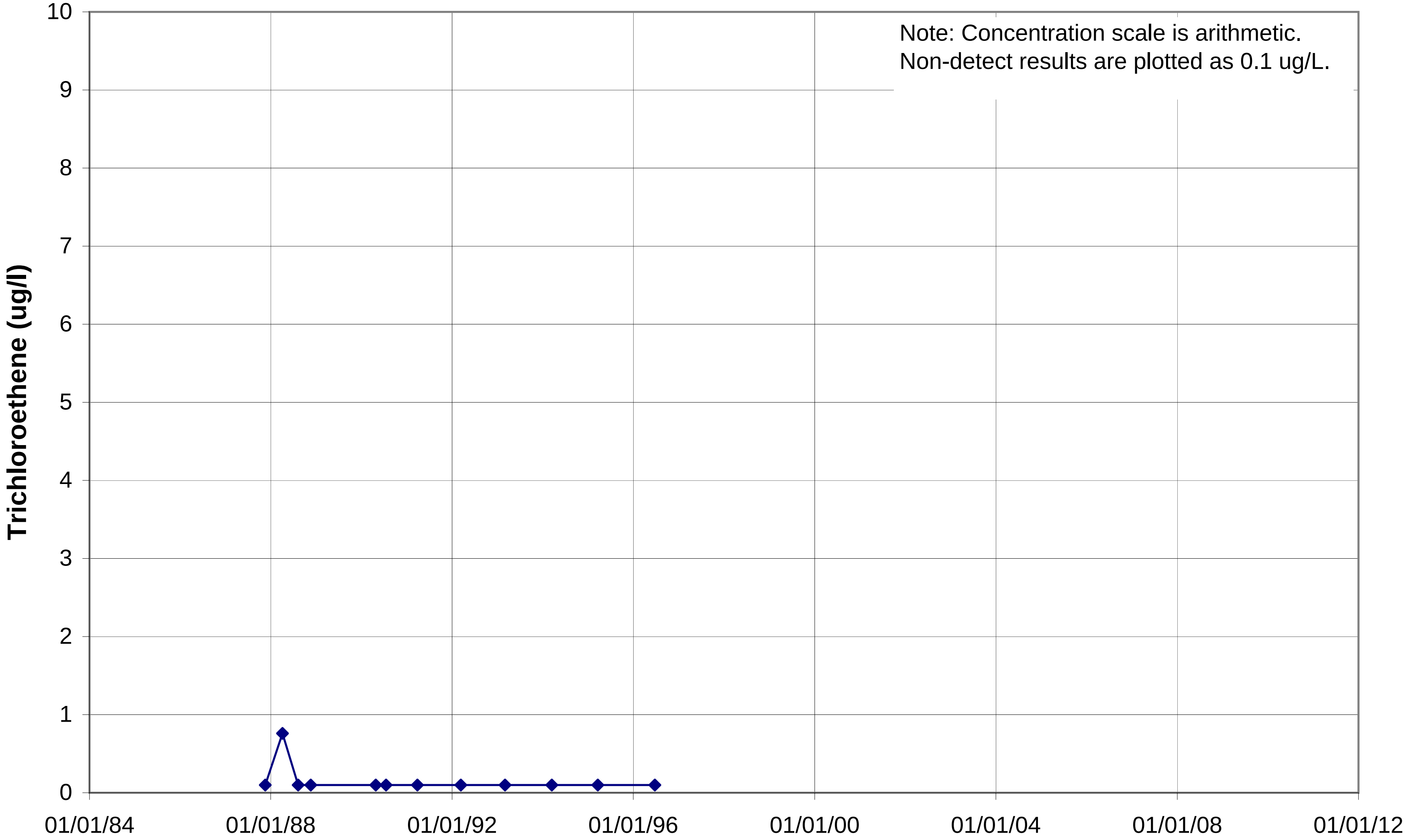

**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 03L084



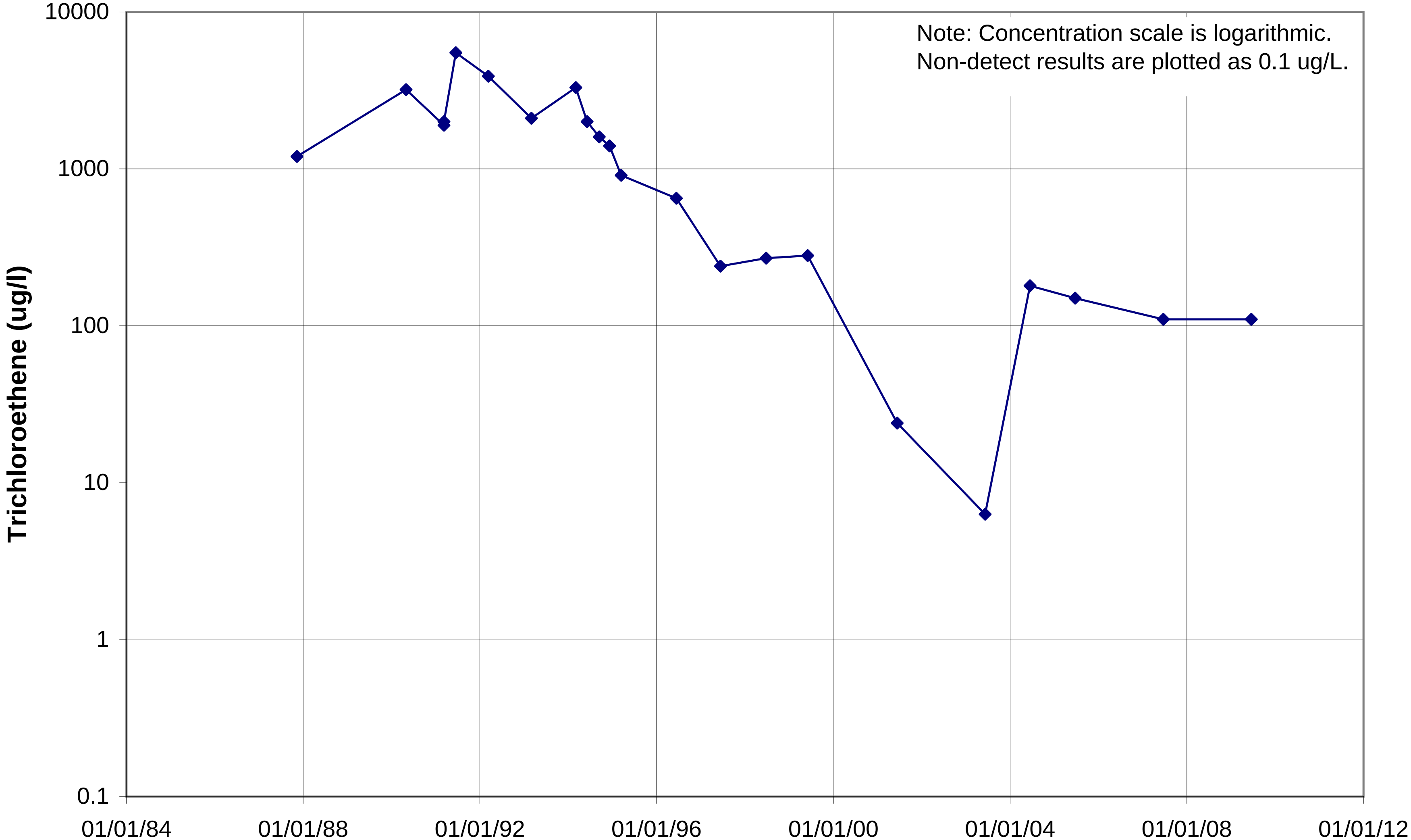

**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 03L113



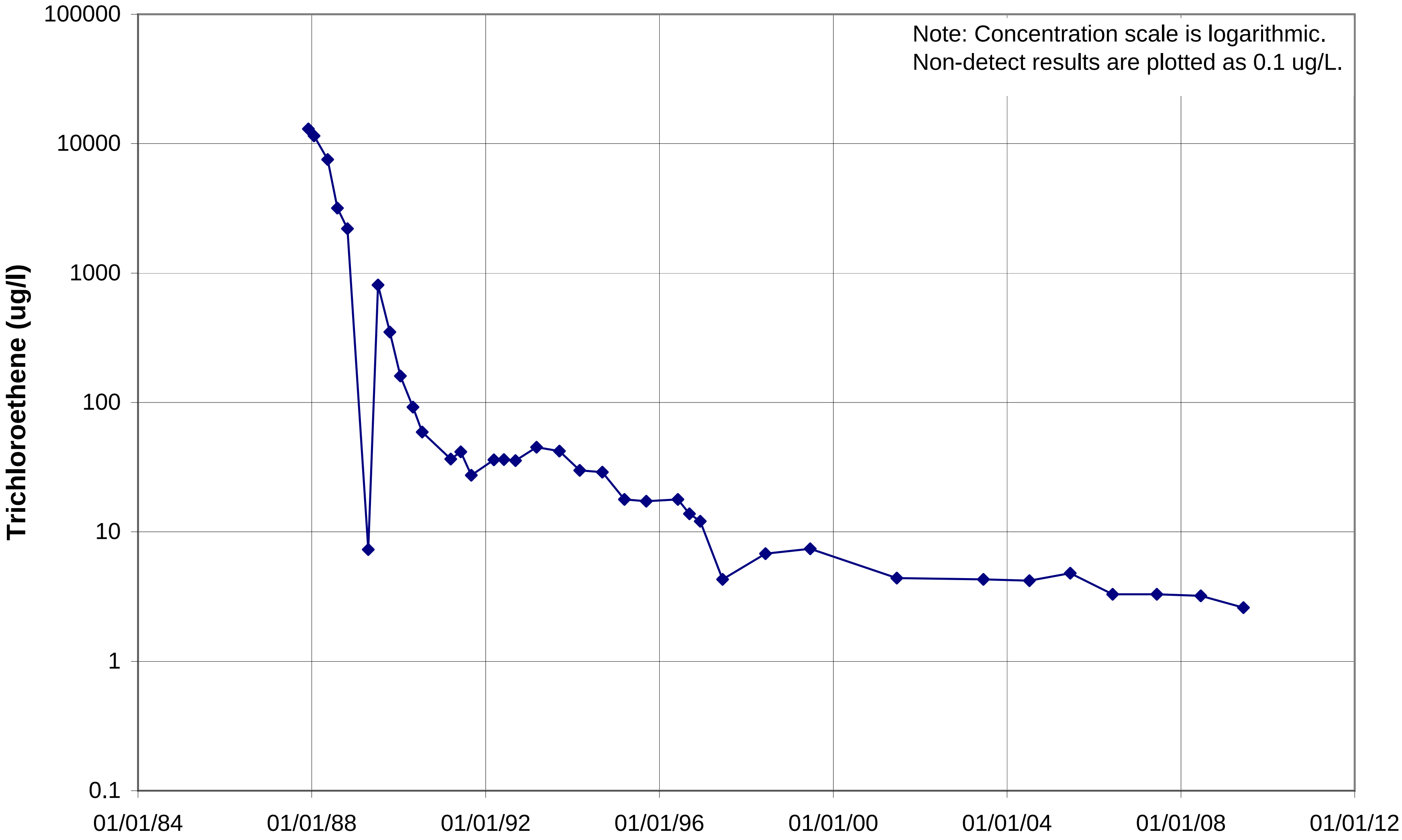

**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 03L673



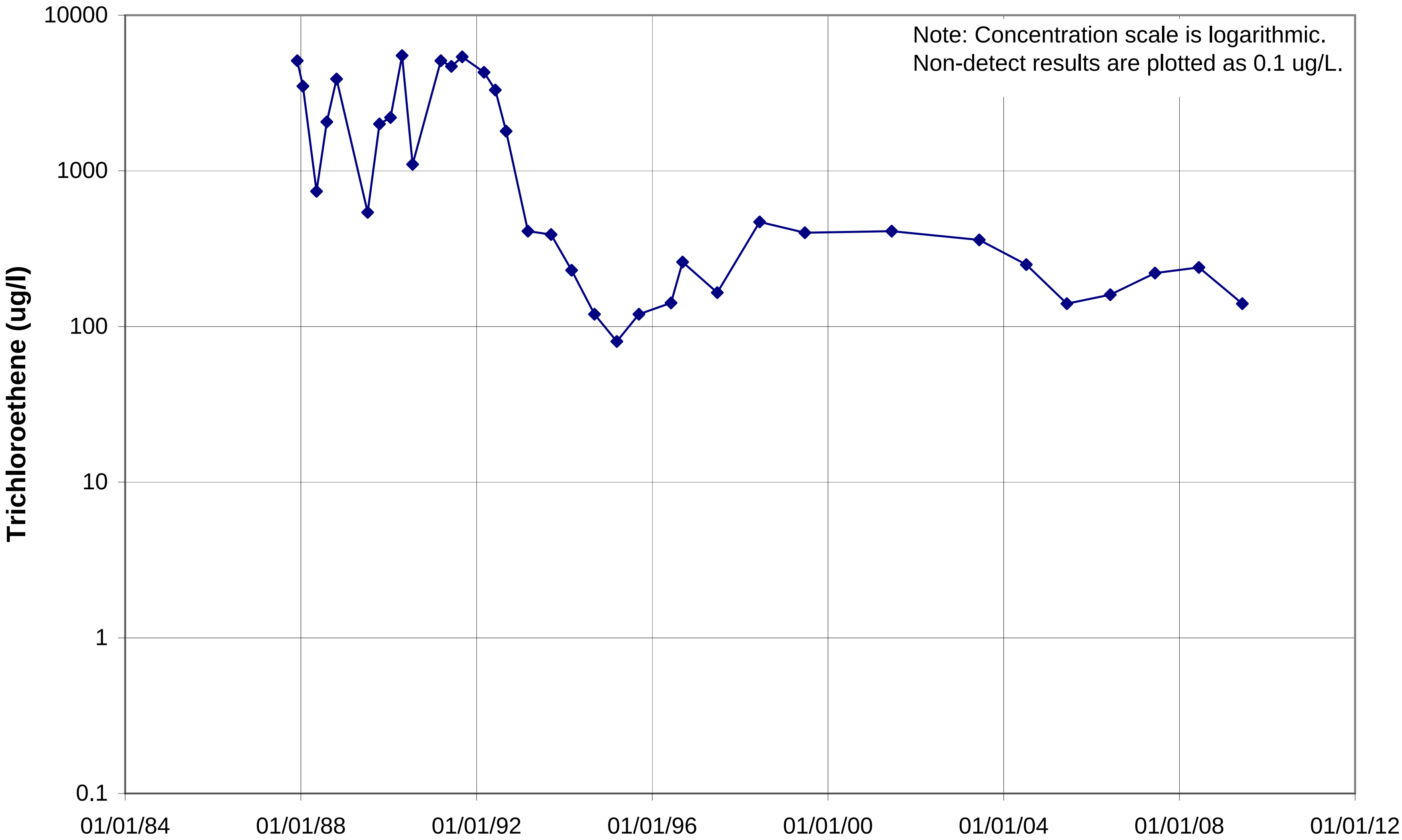

**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 03L802




**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 03L806




**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

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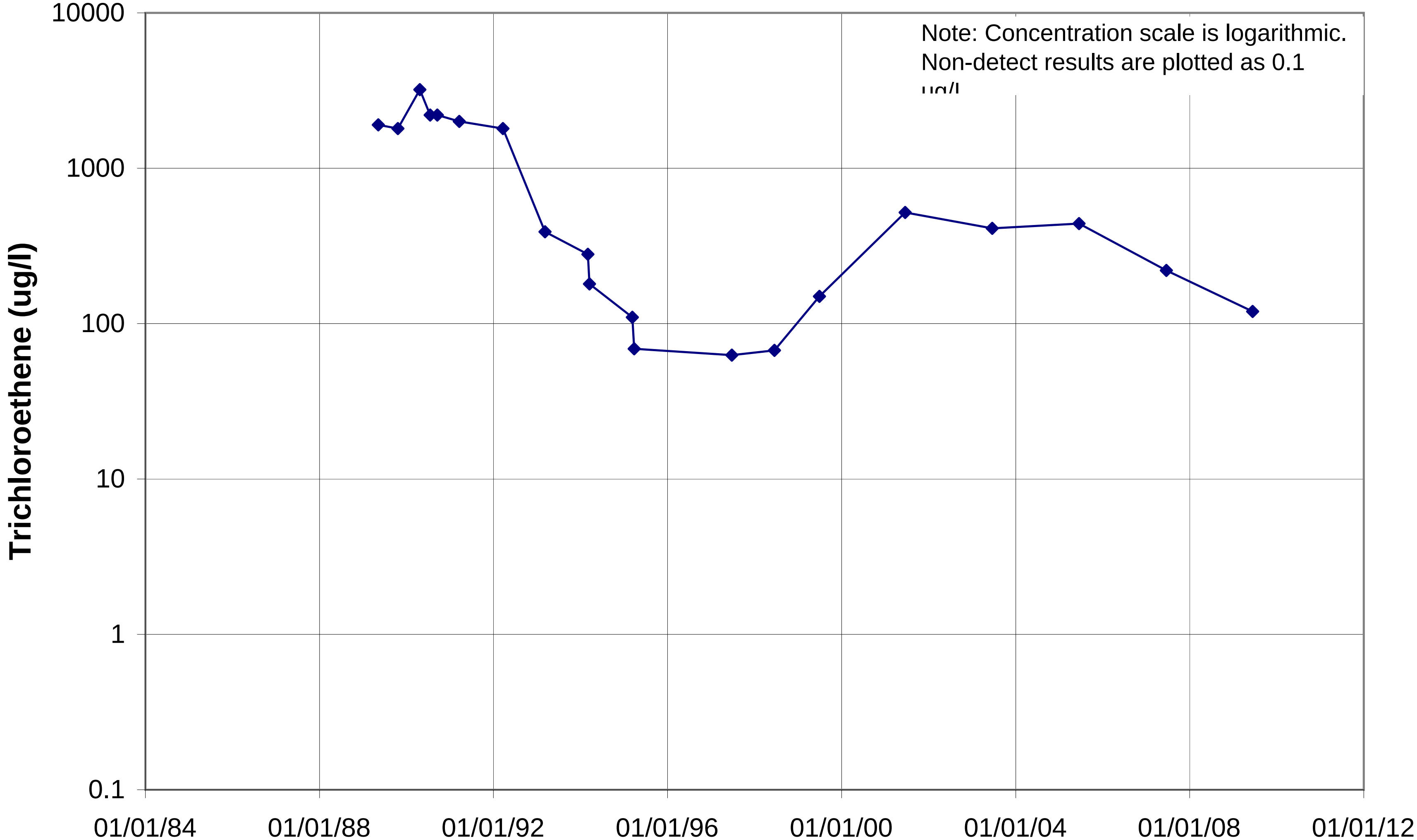
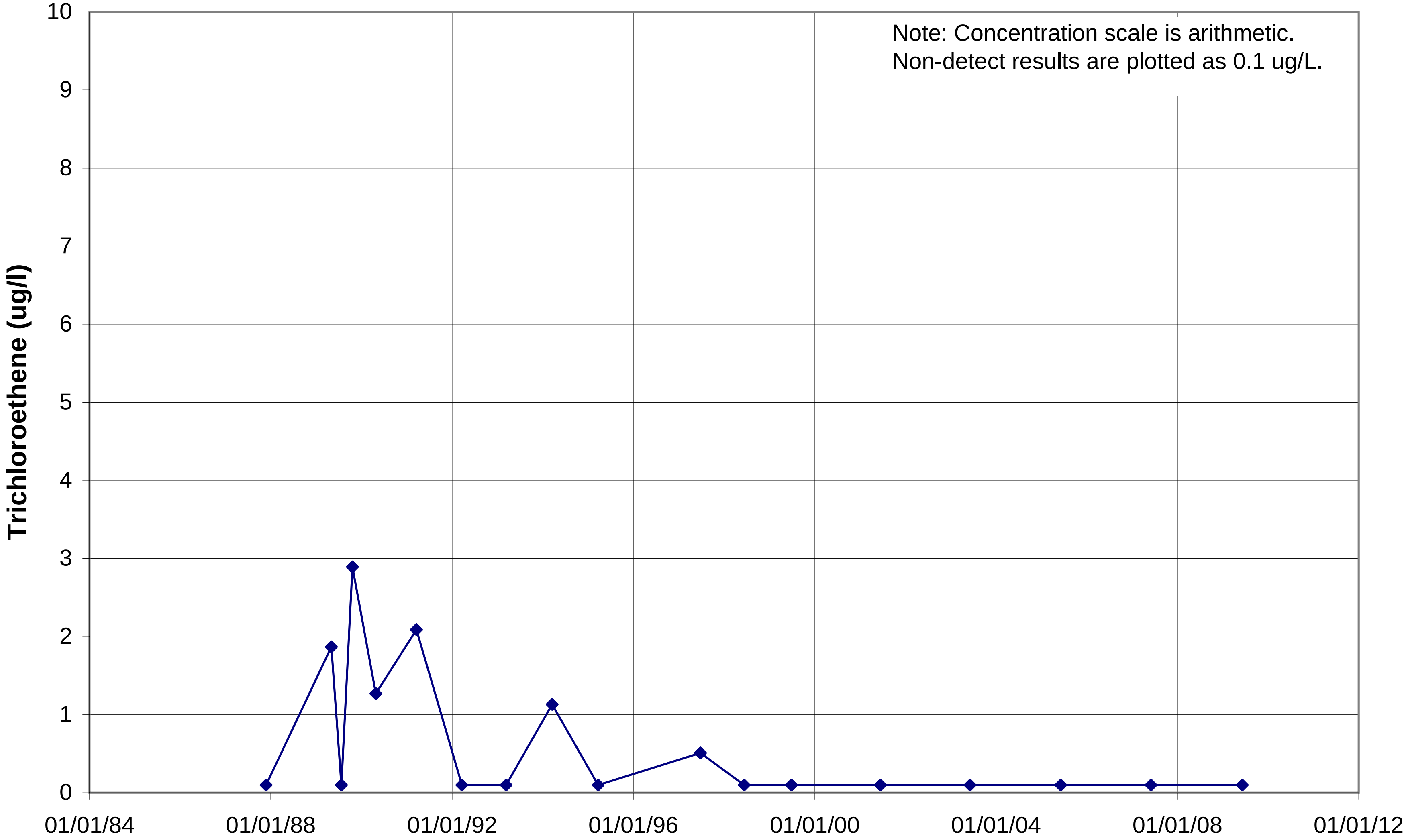


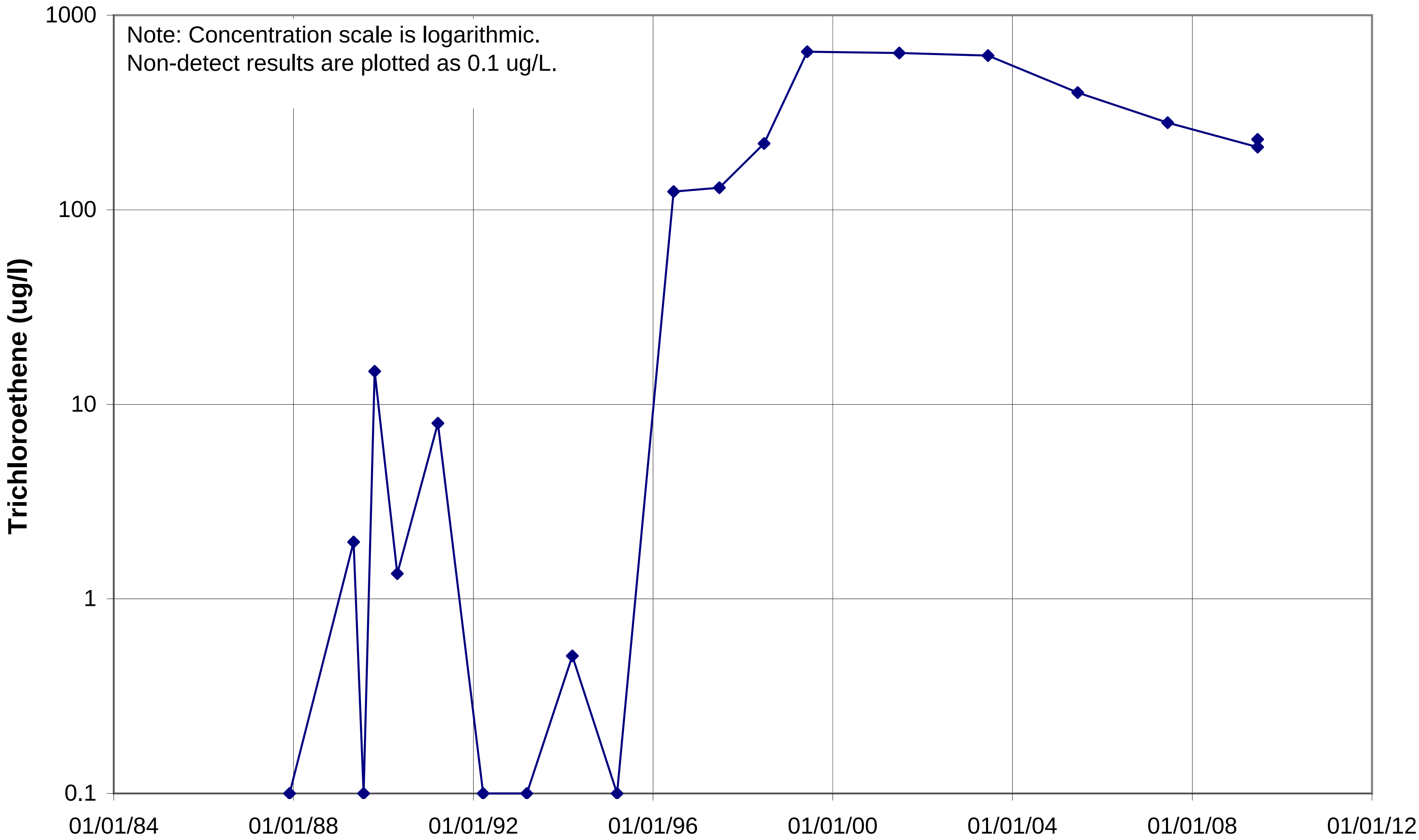

**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 03L811




**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 03L822




**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

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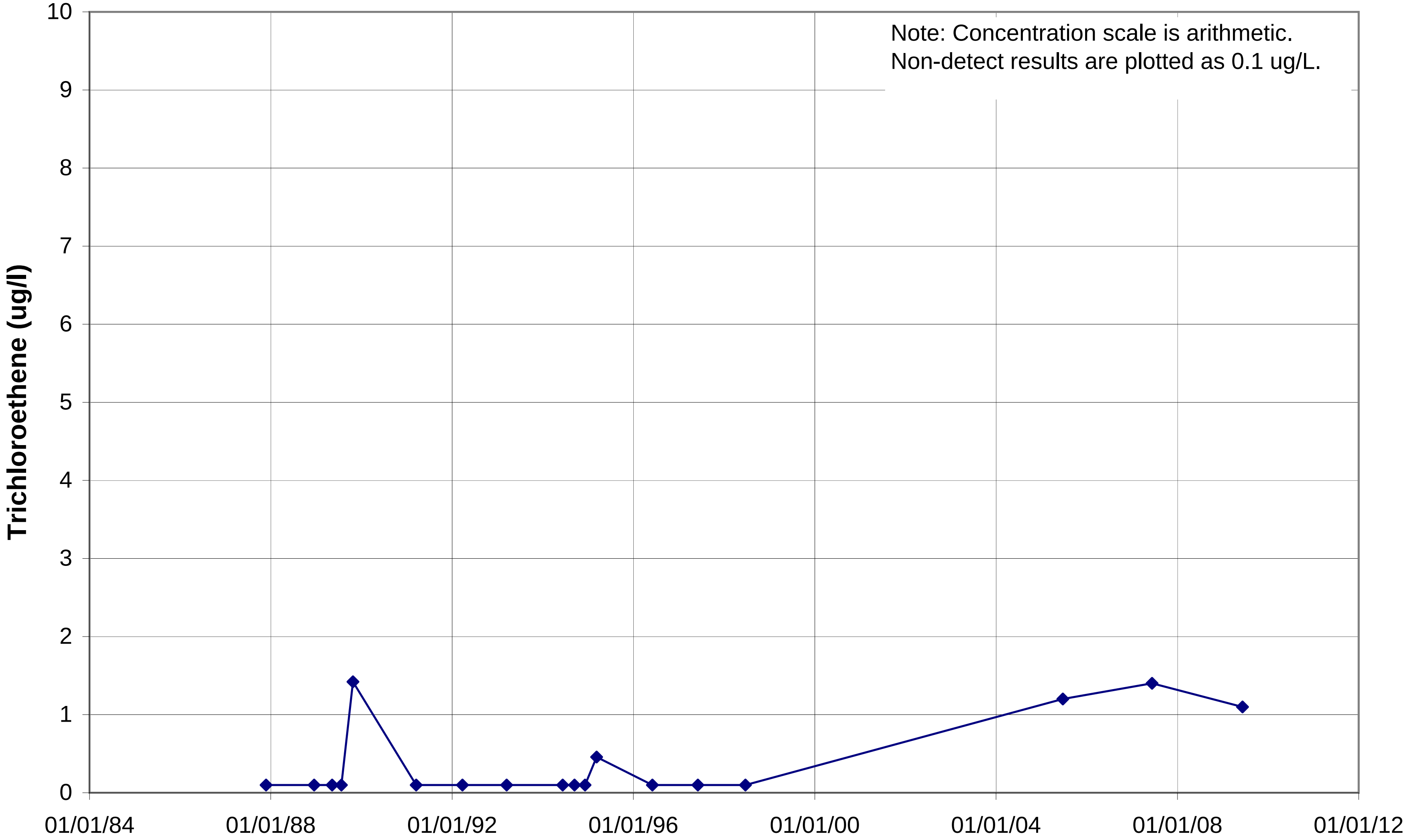


**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

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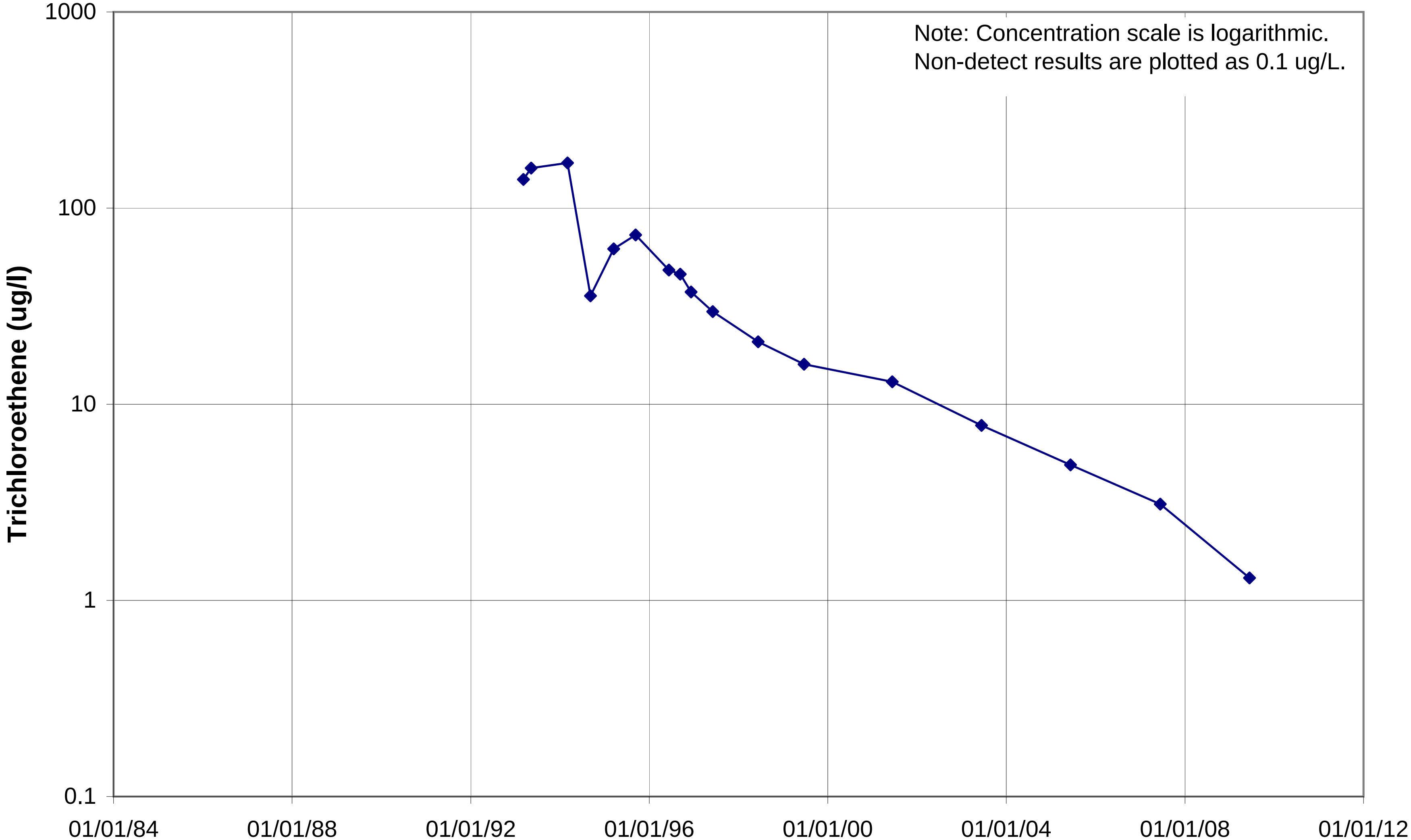


**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

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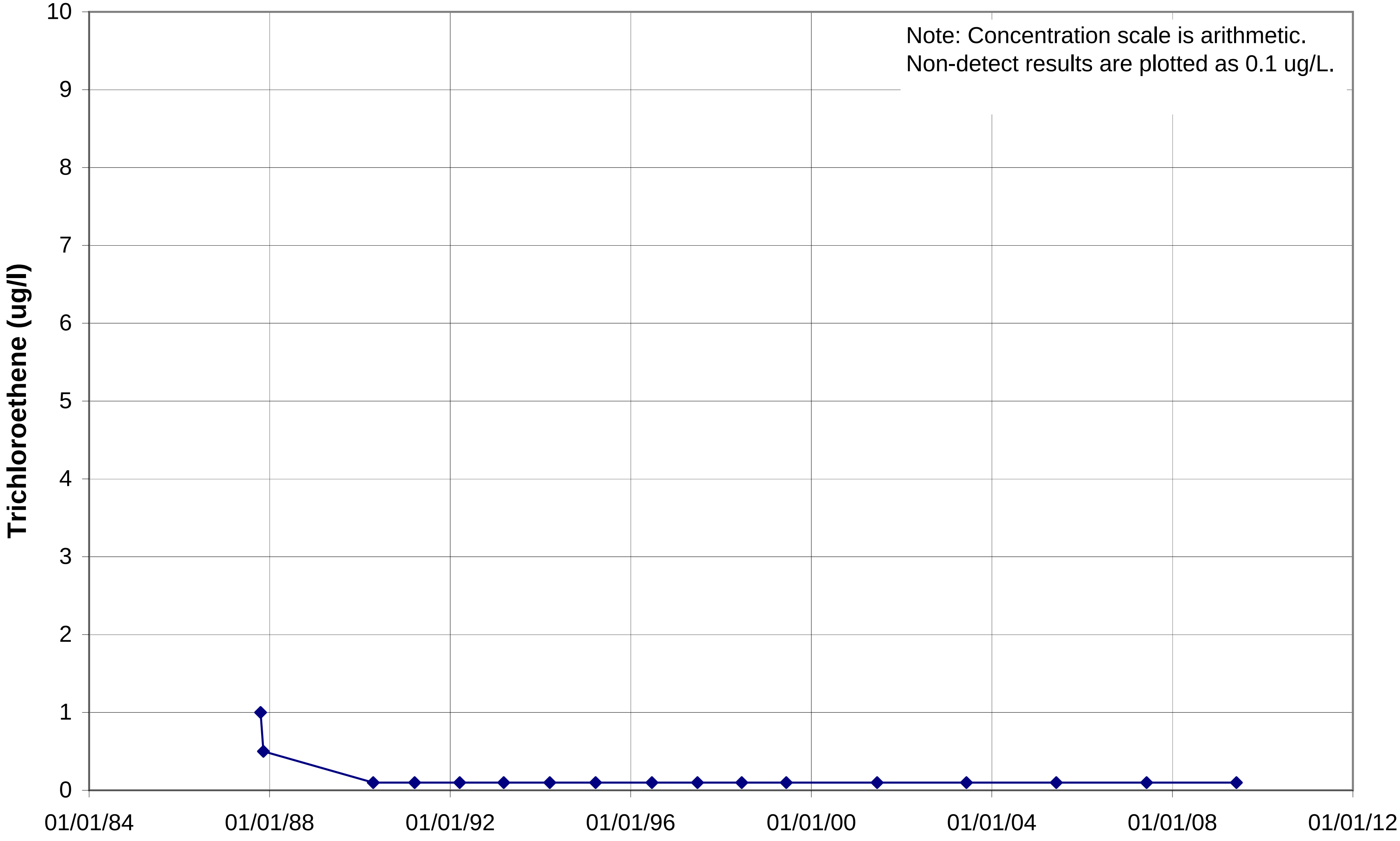
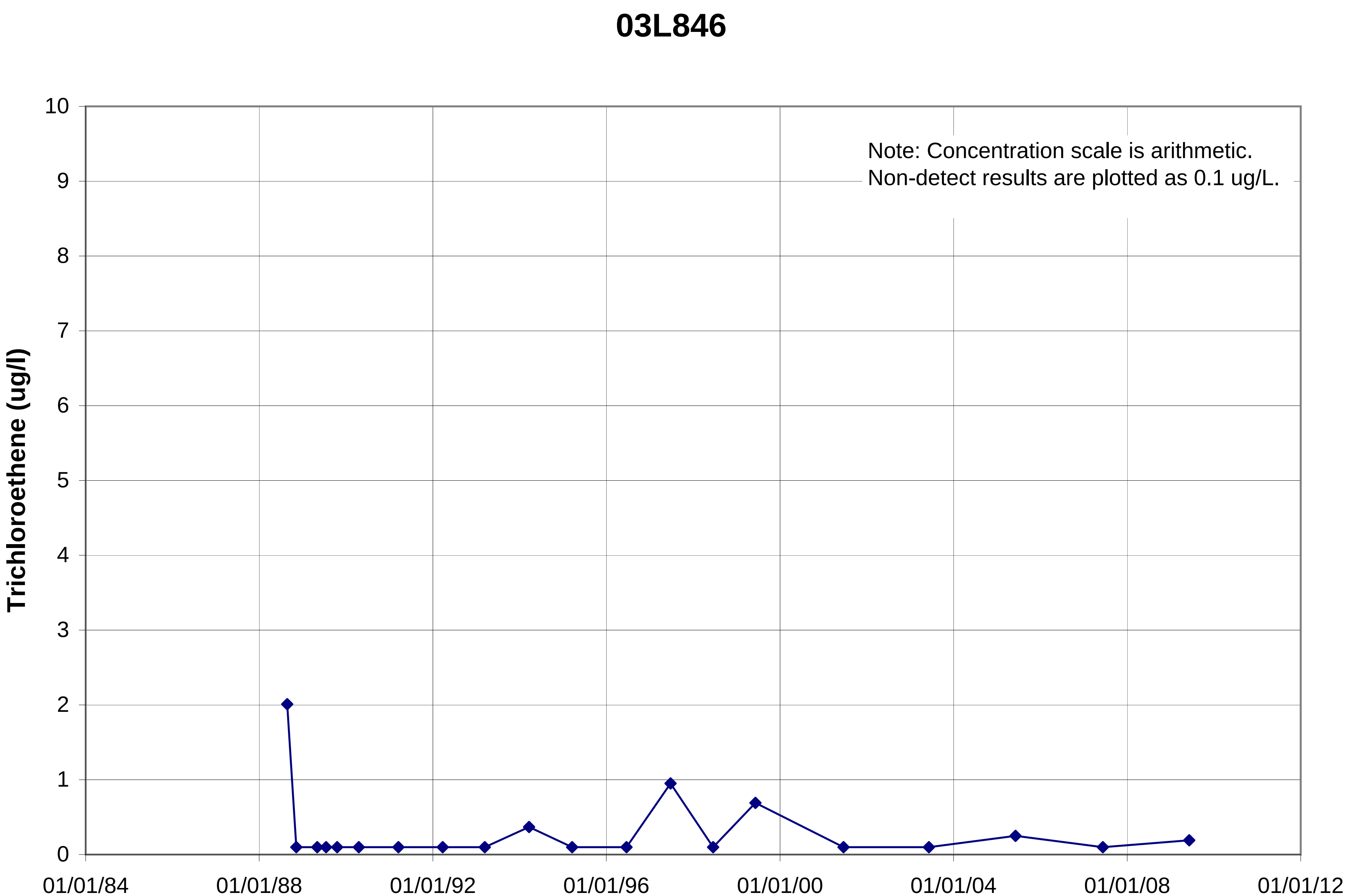



**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

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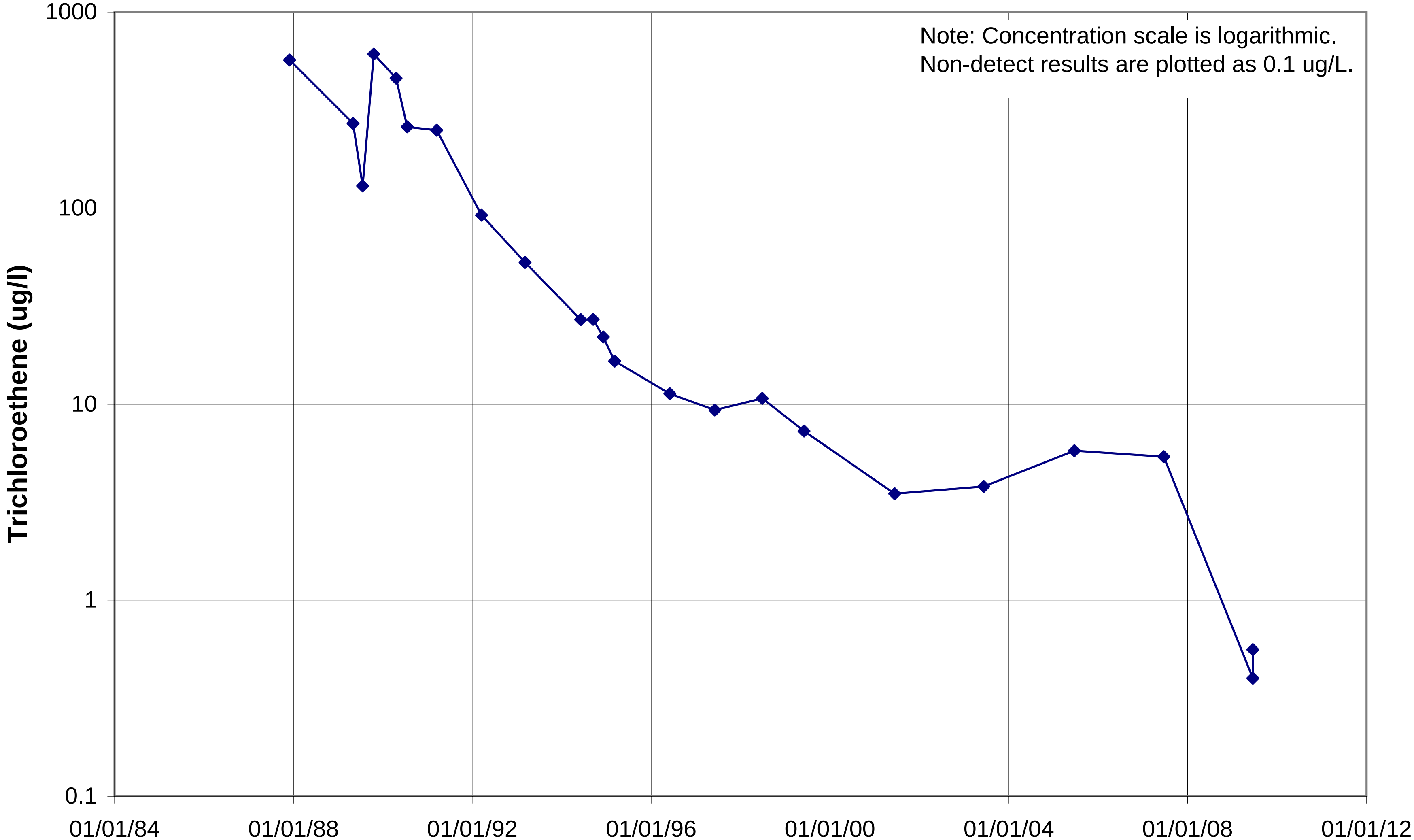


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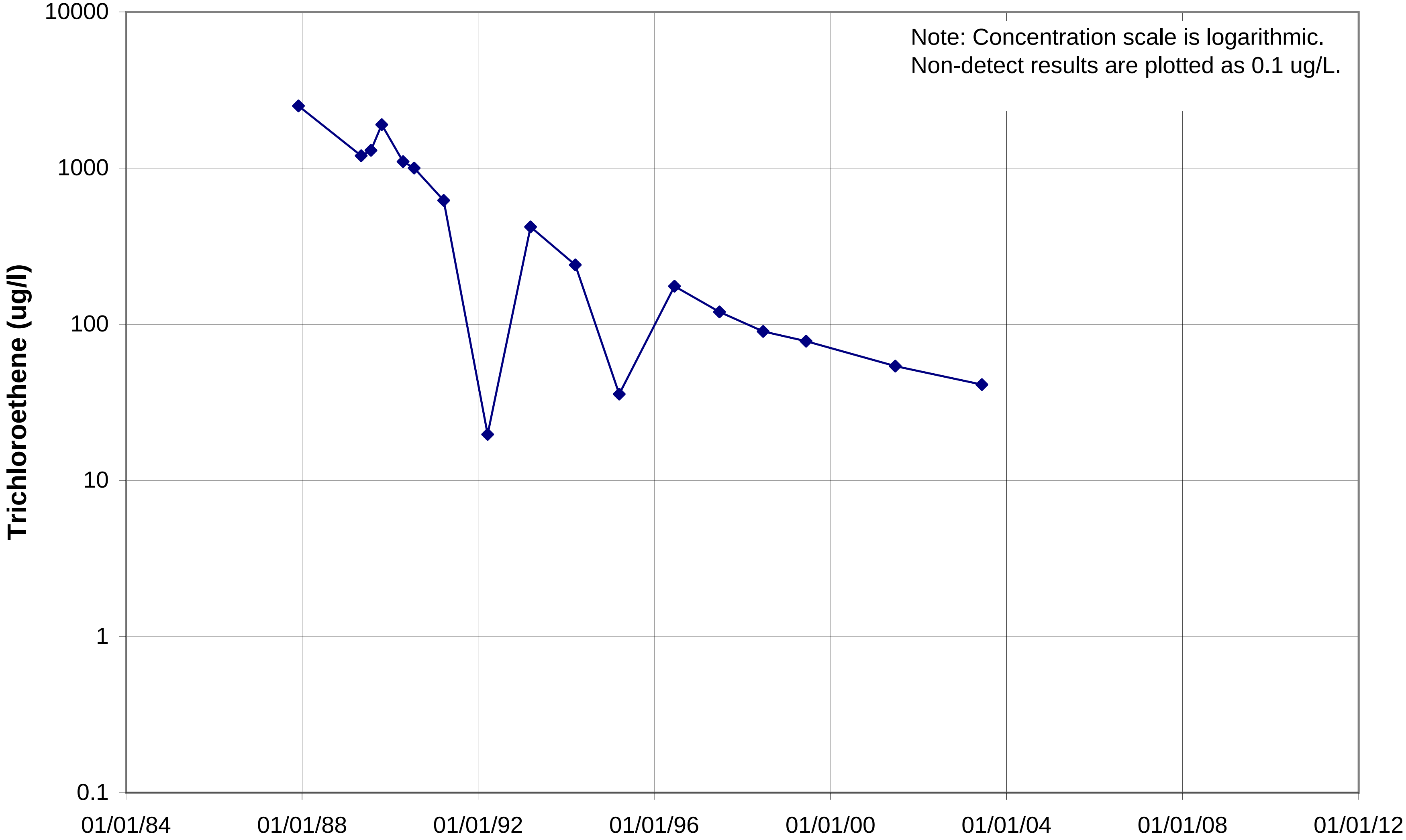
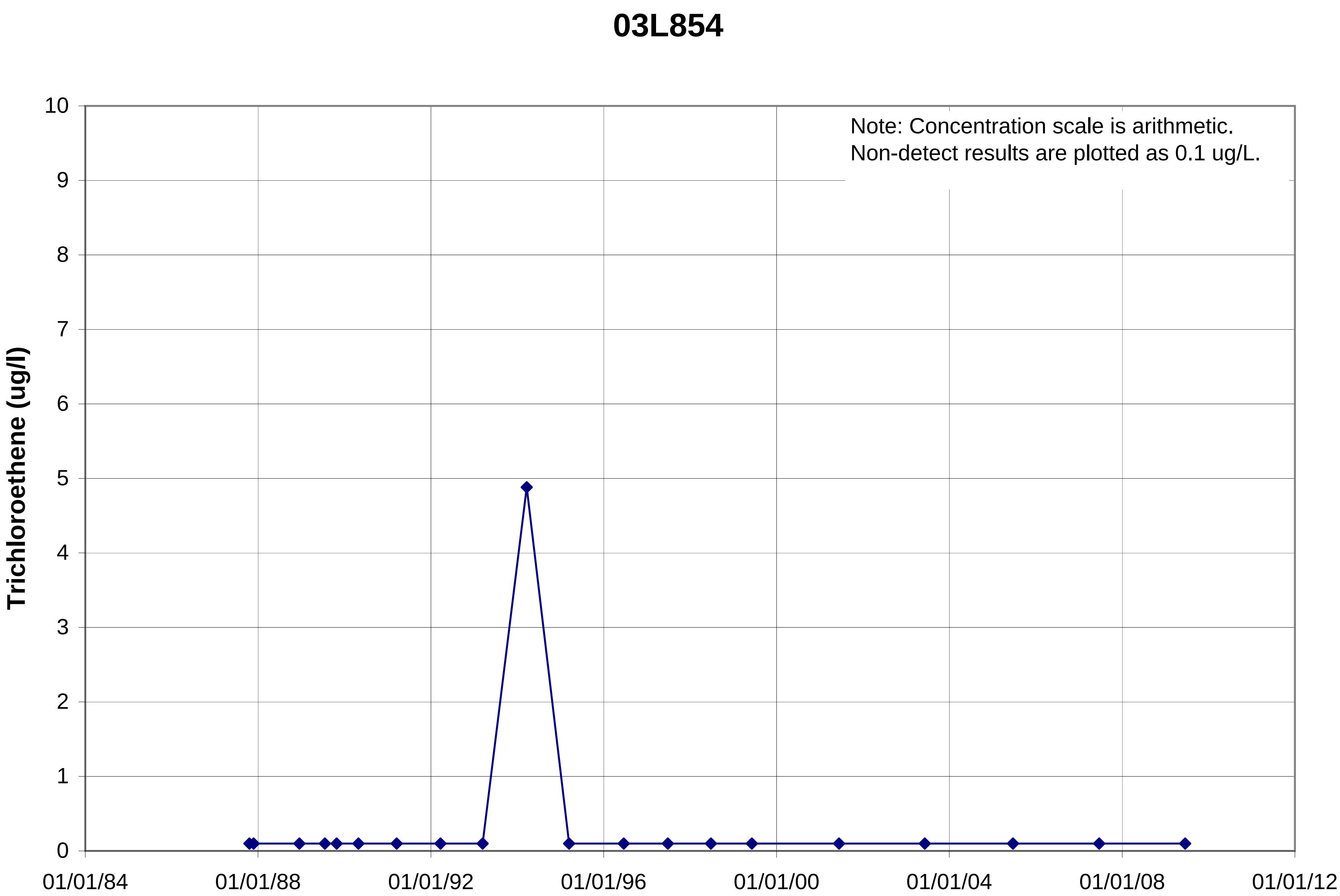



**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

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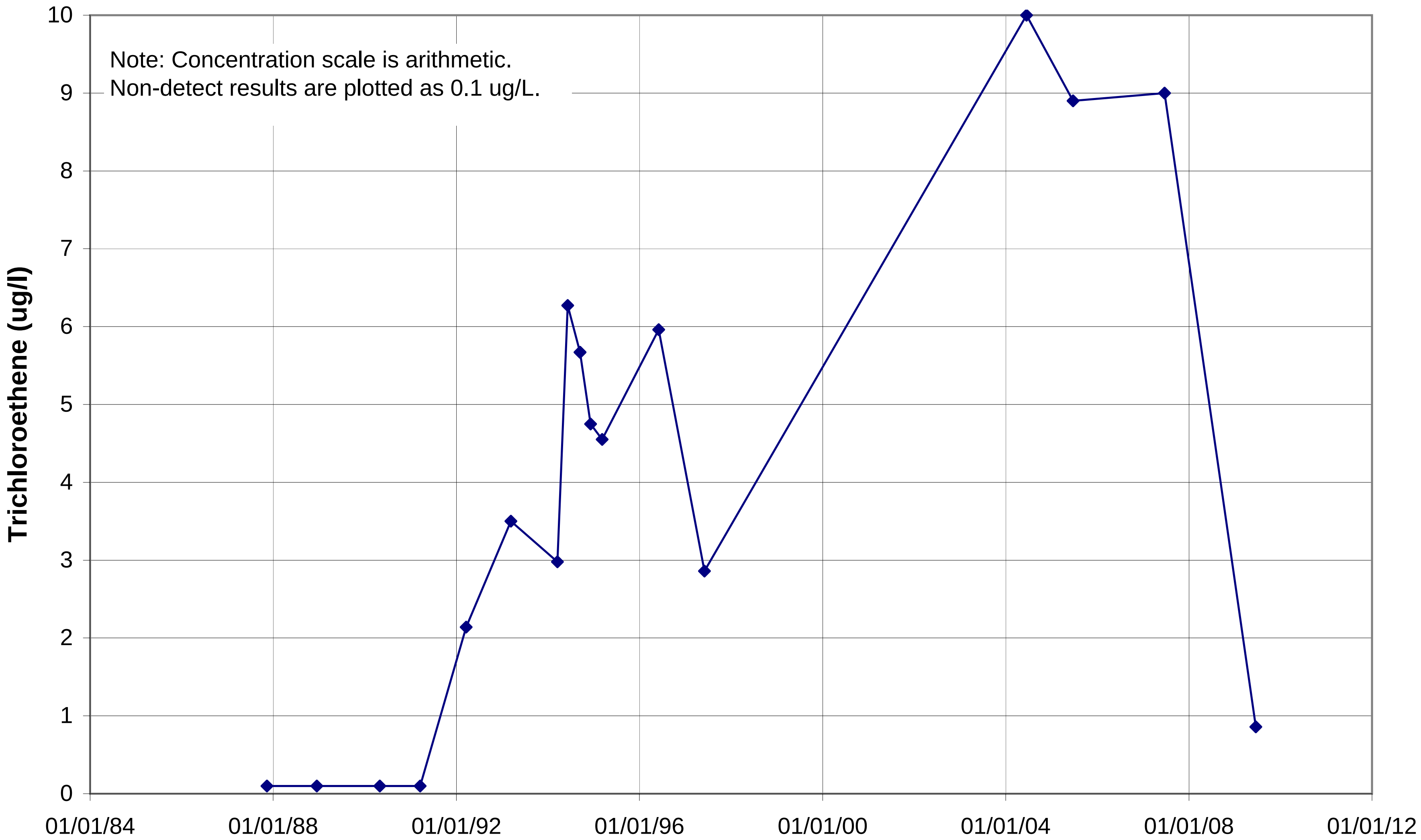


**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

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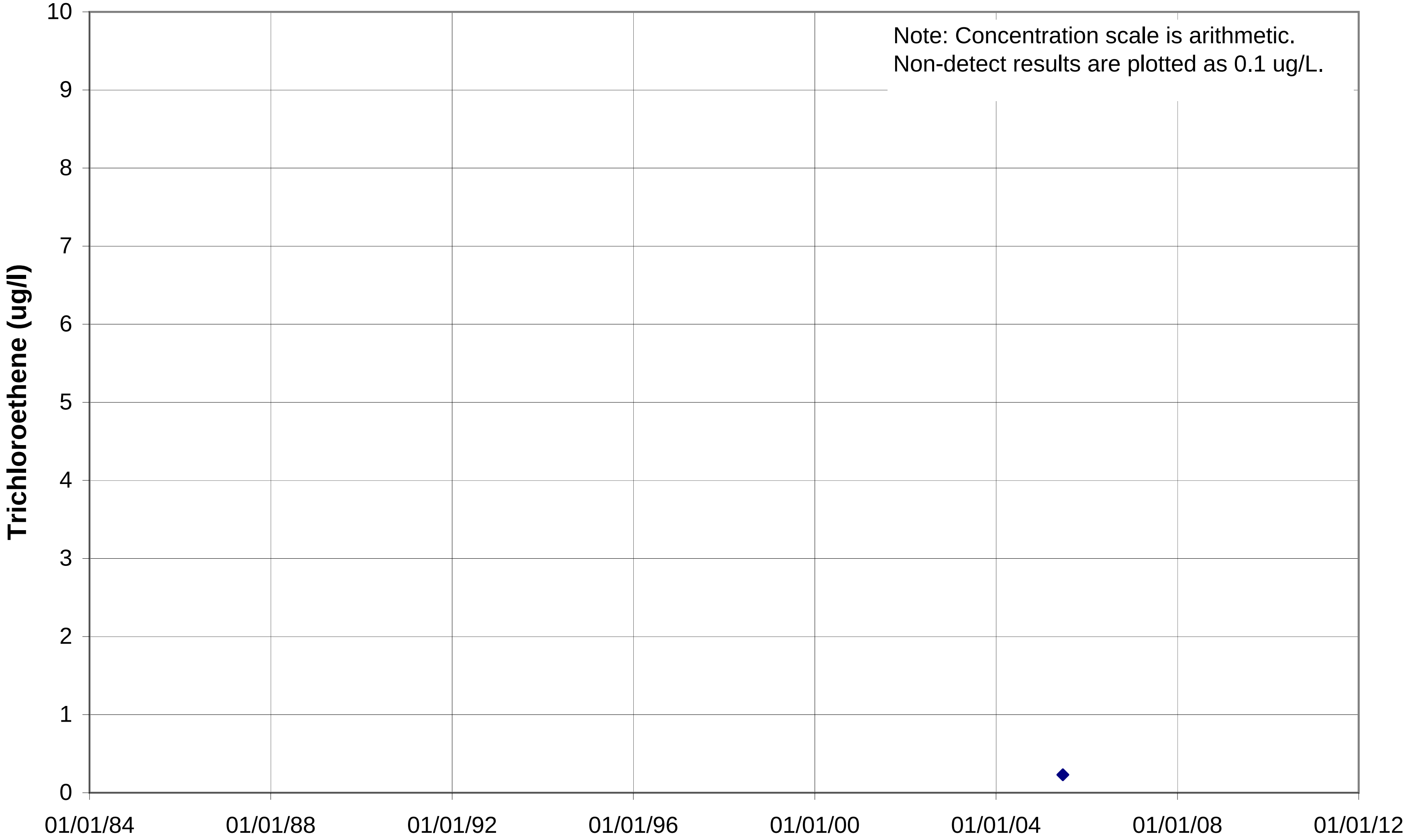
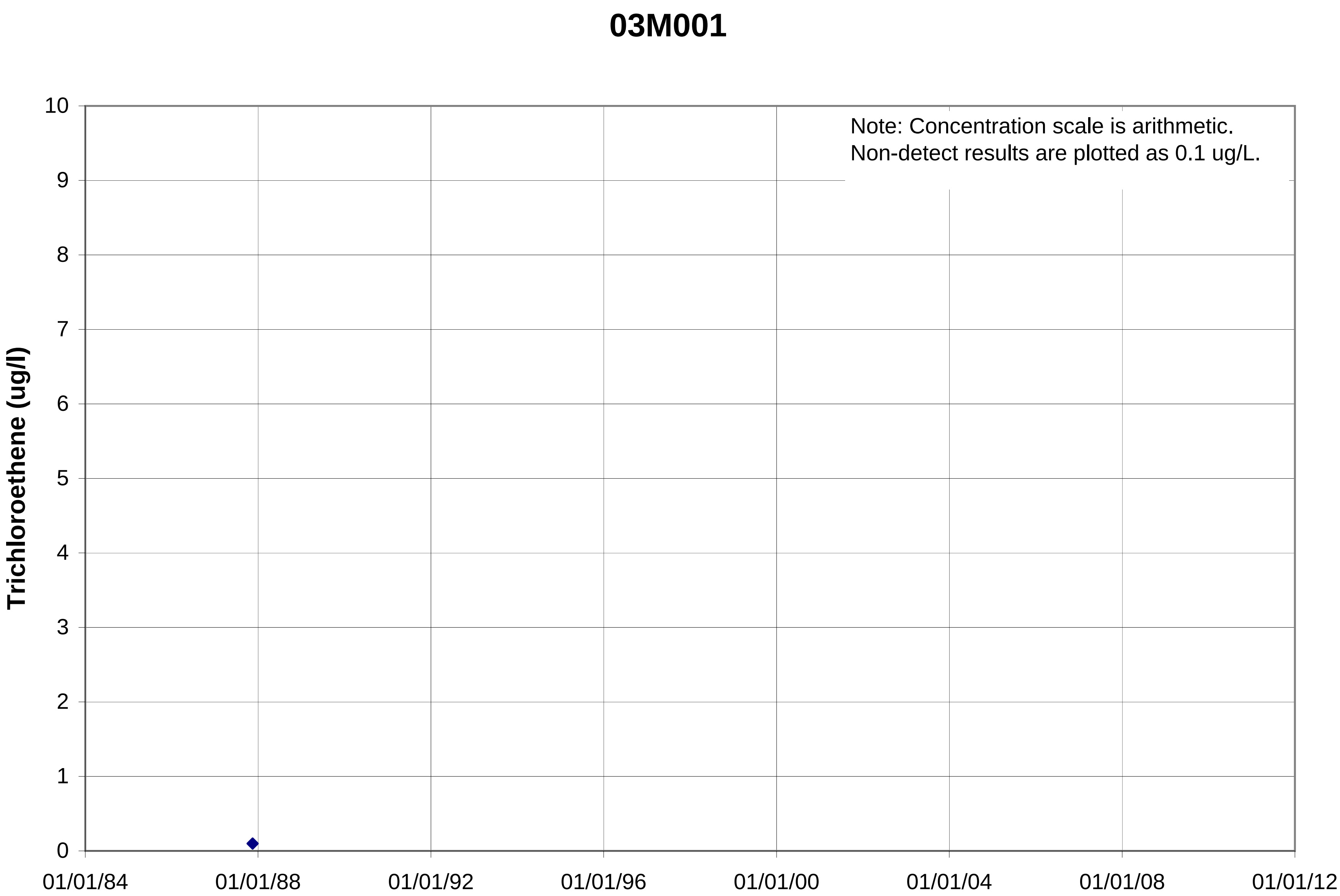
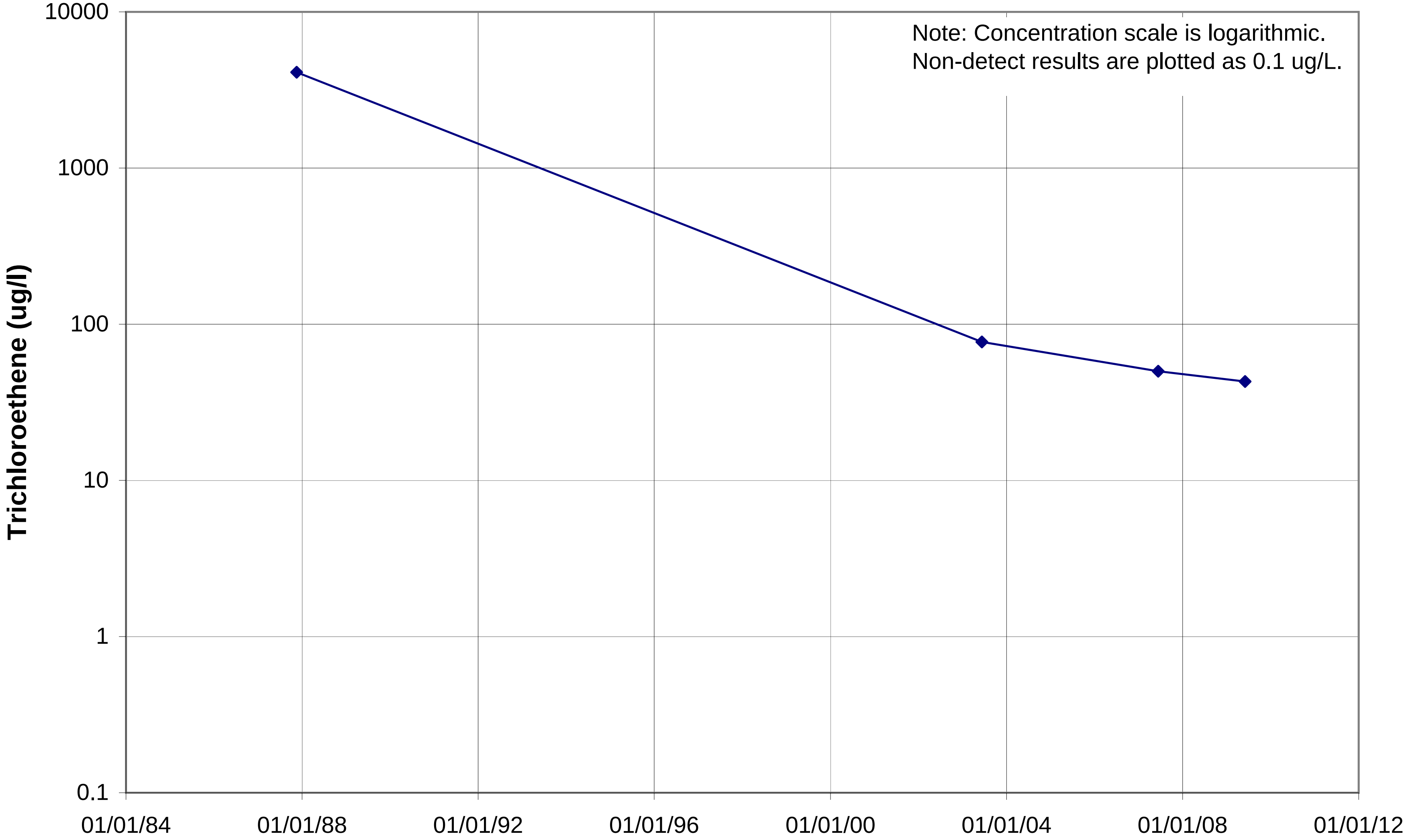



**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar



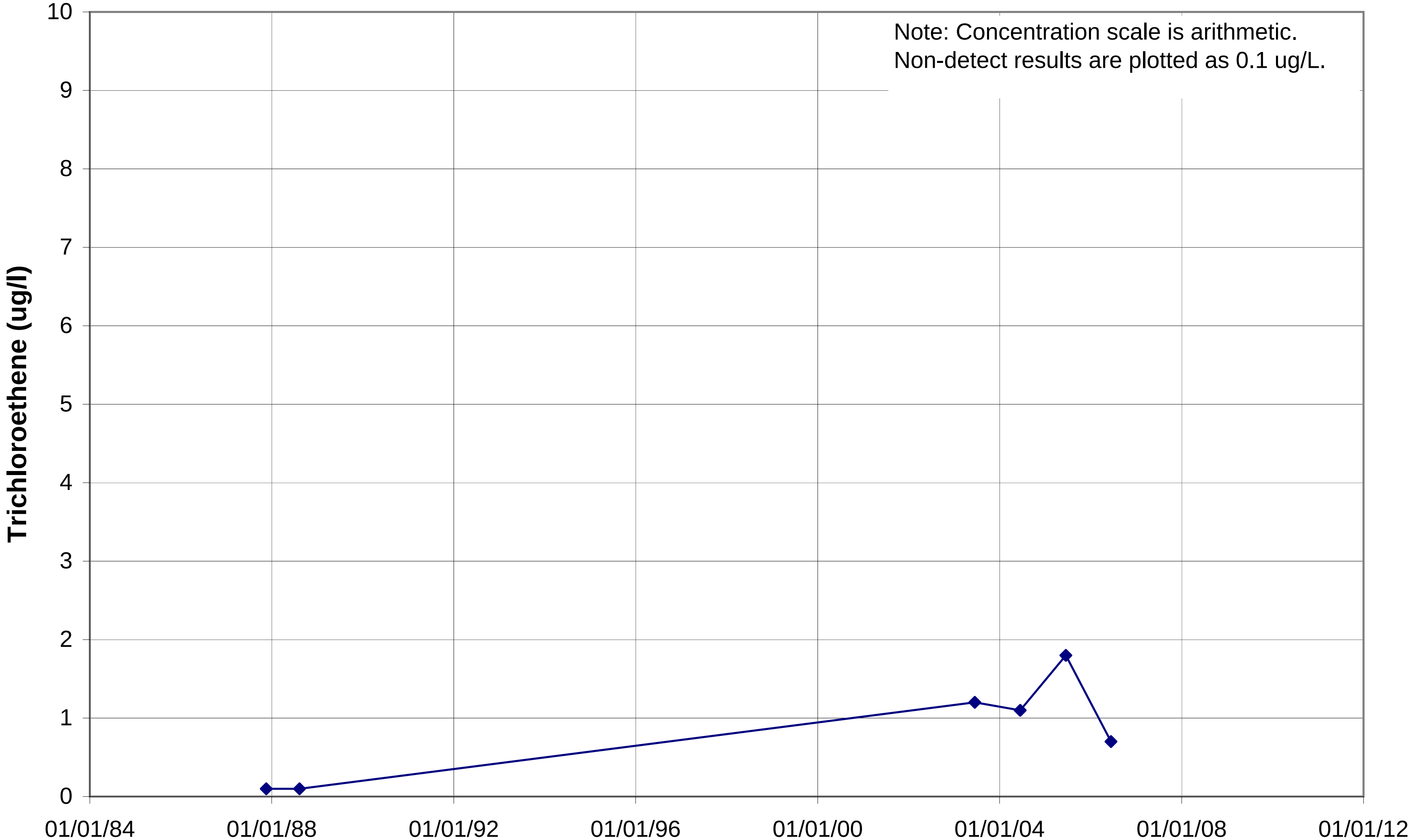

**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 03M002

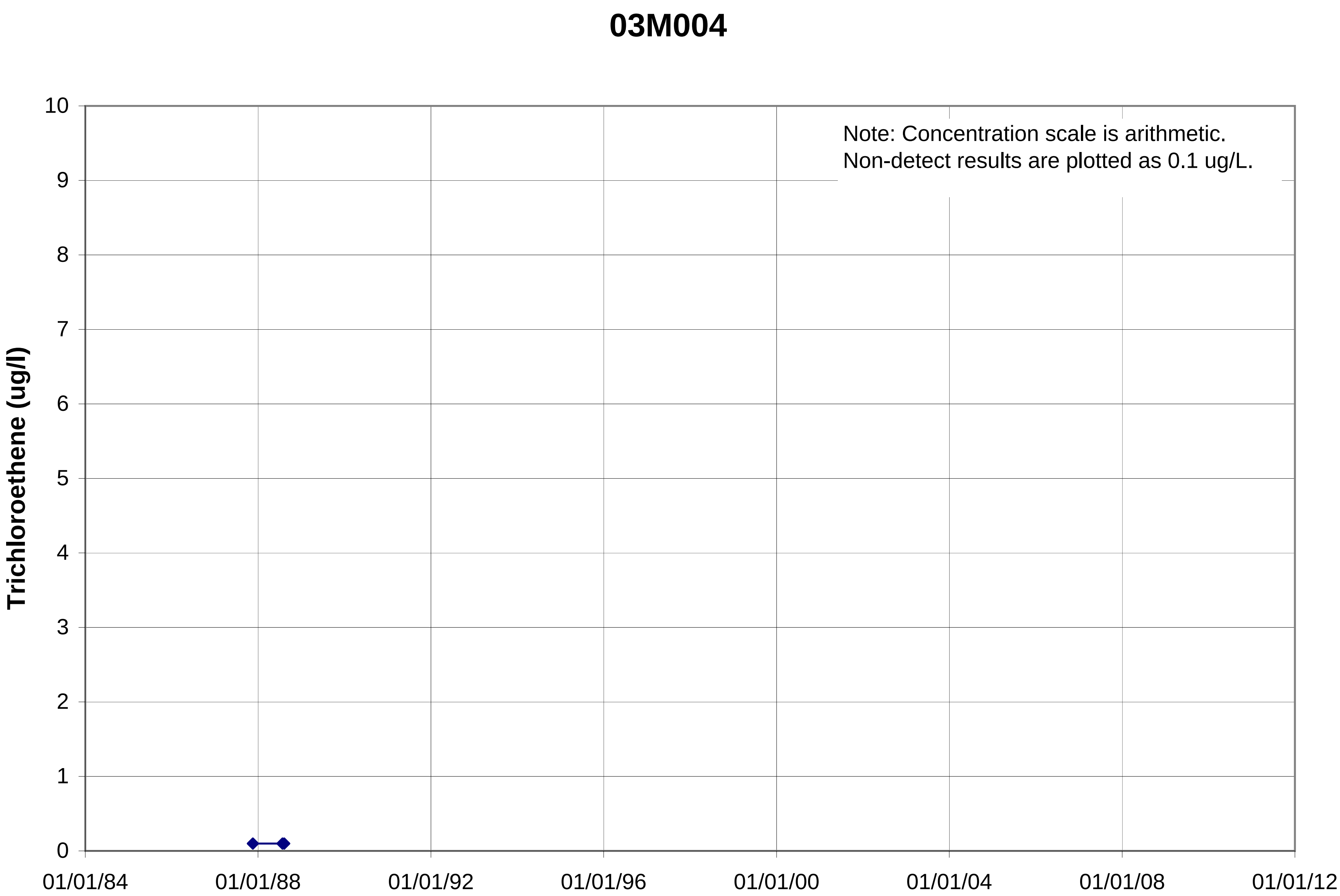



**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 03M003

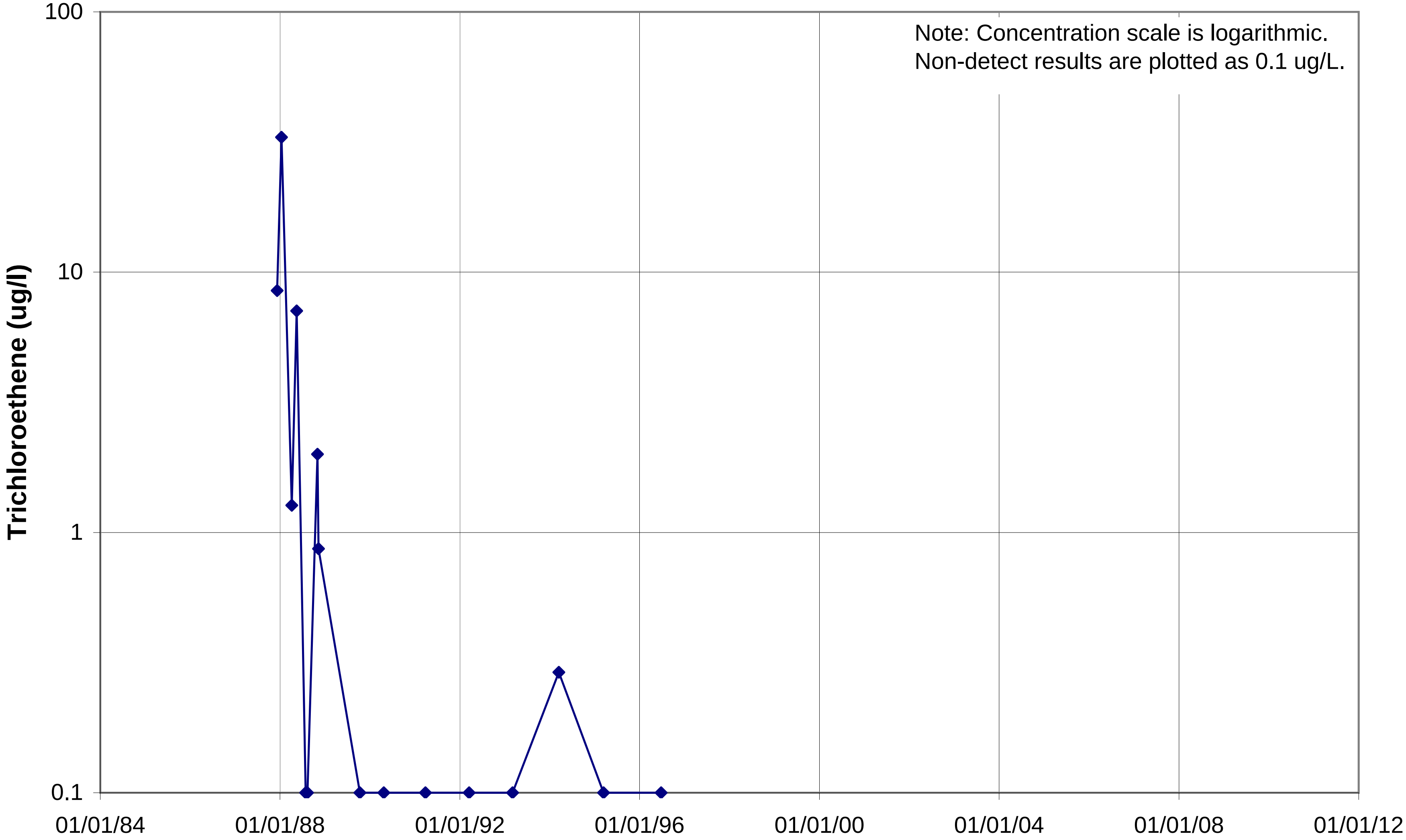



**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

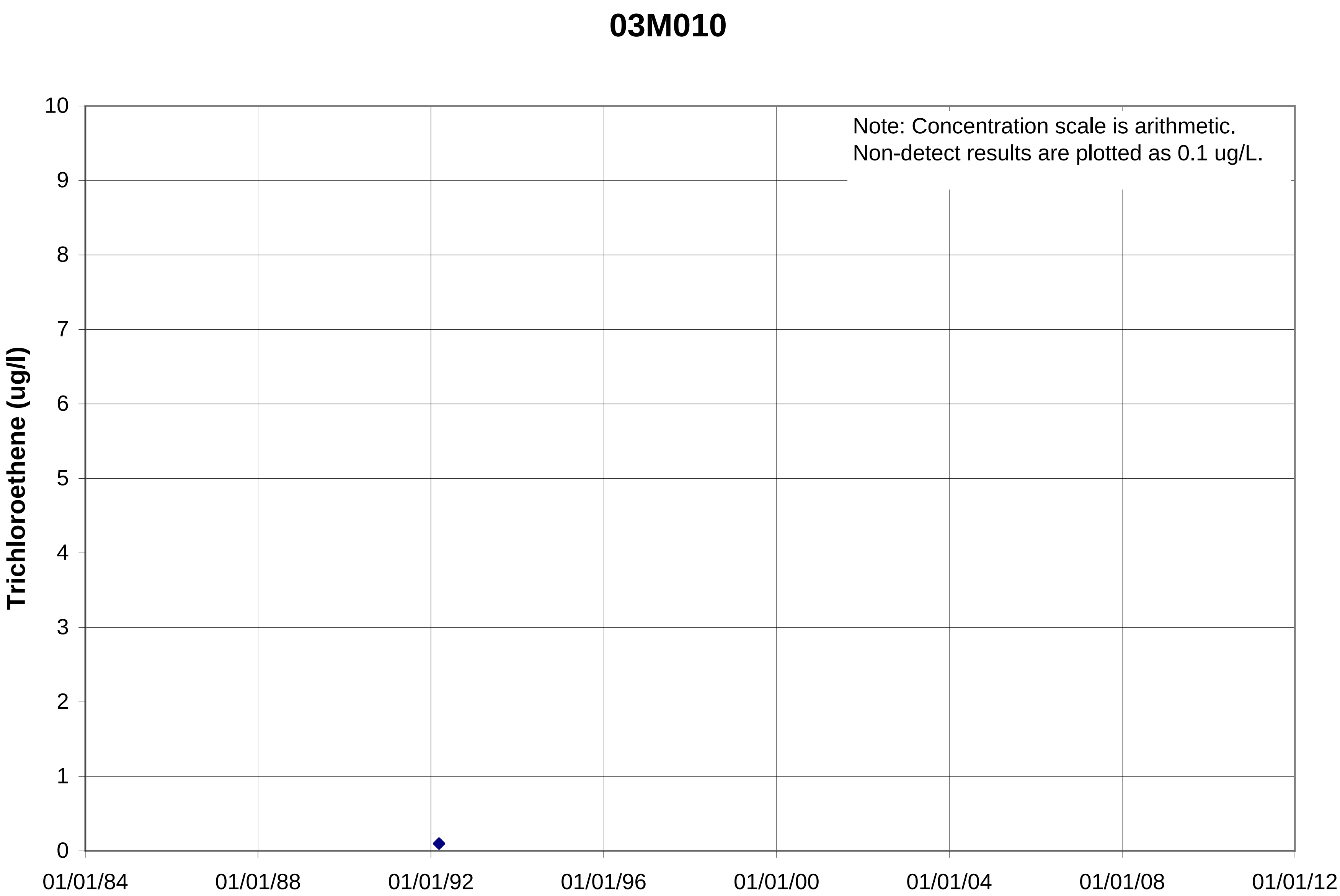



**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 03M005




**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar




**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

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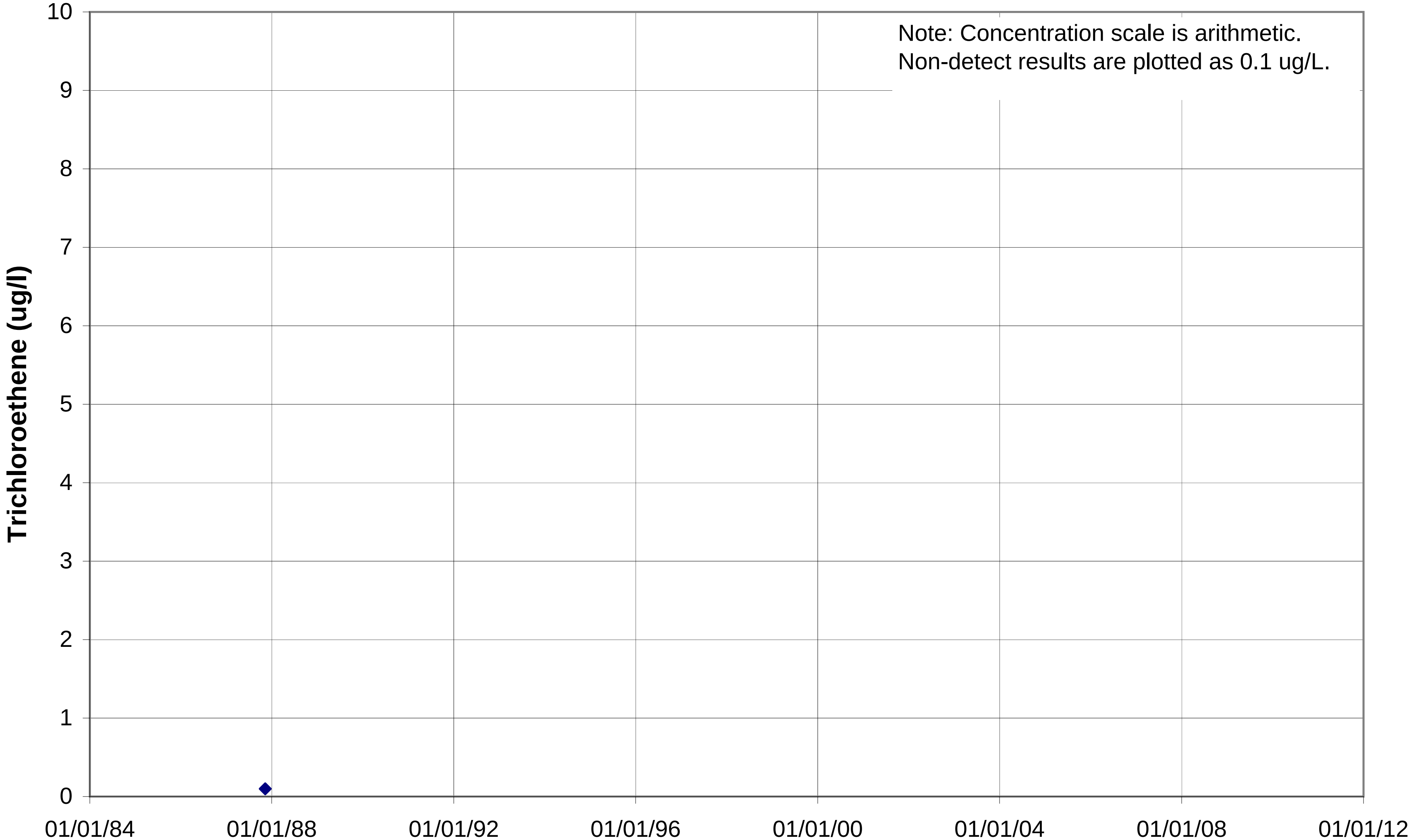
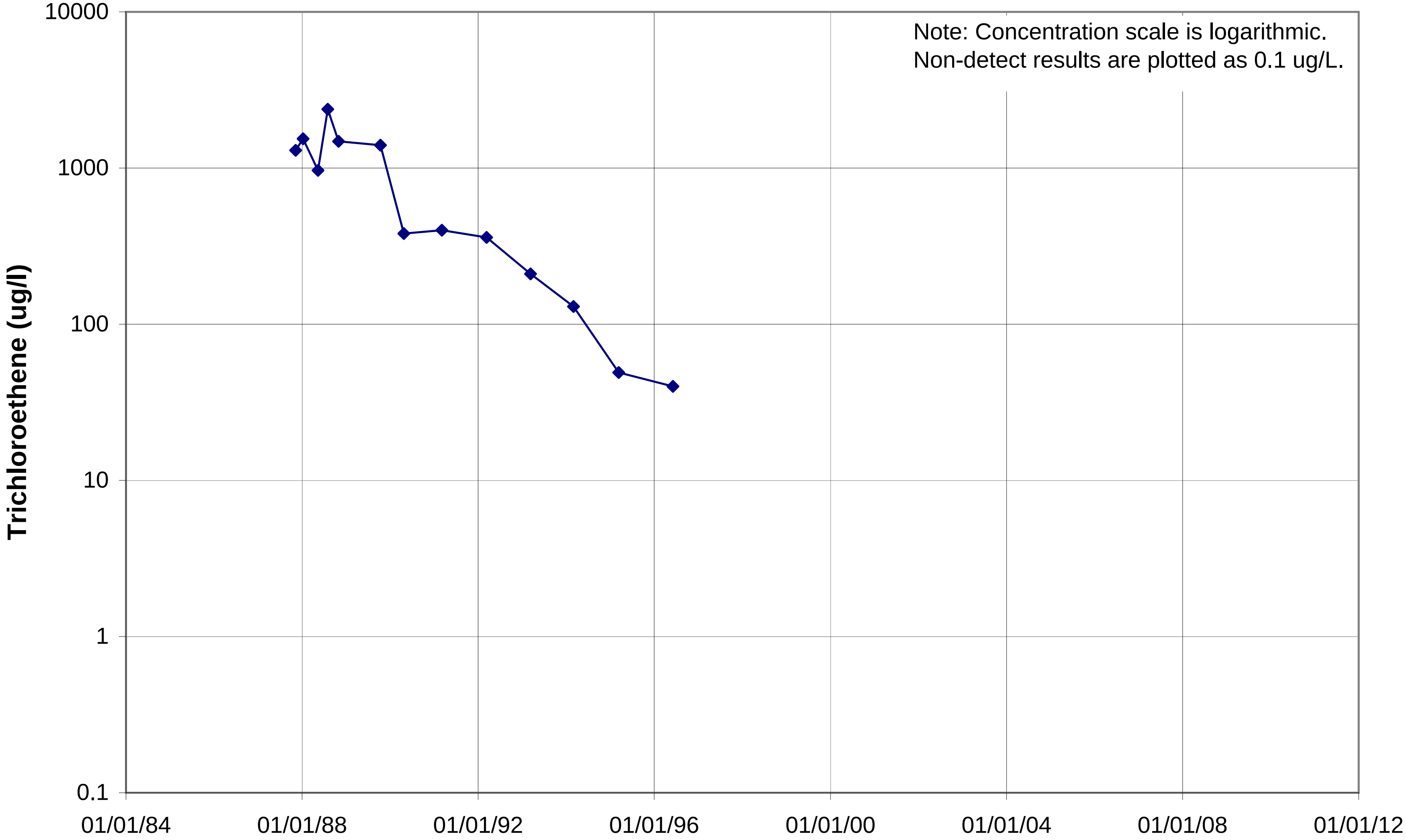


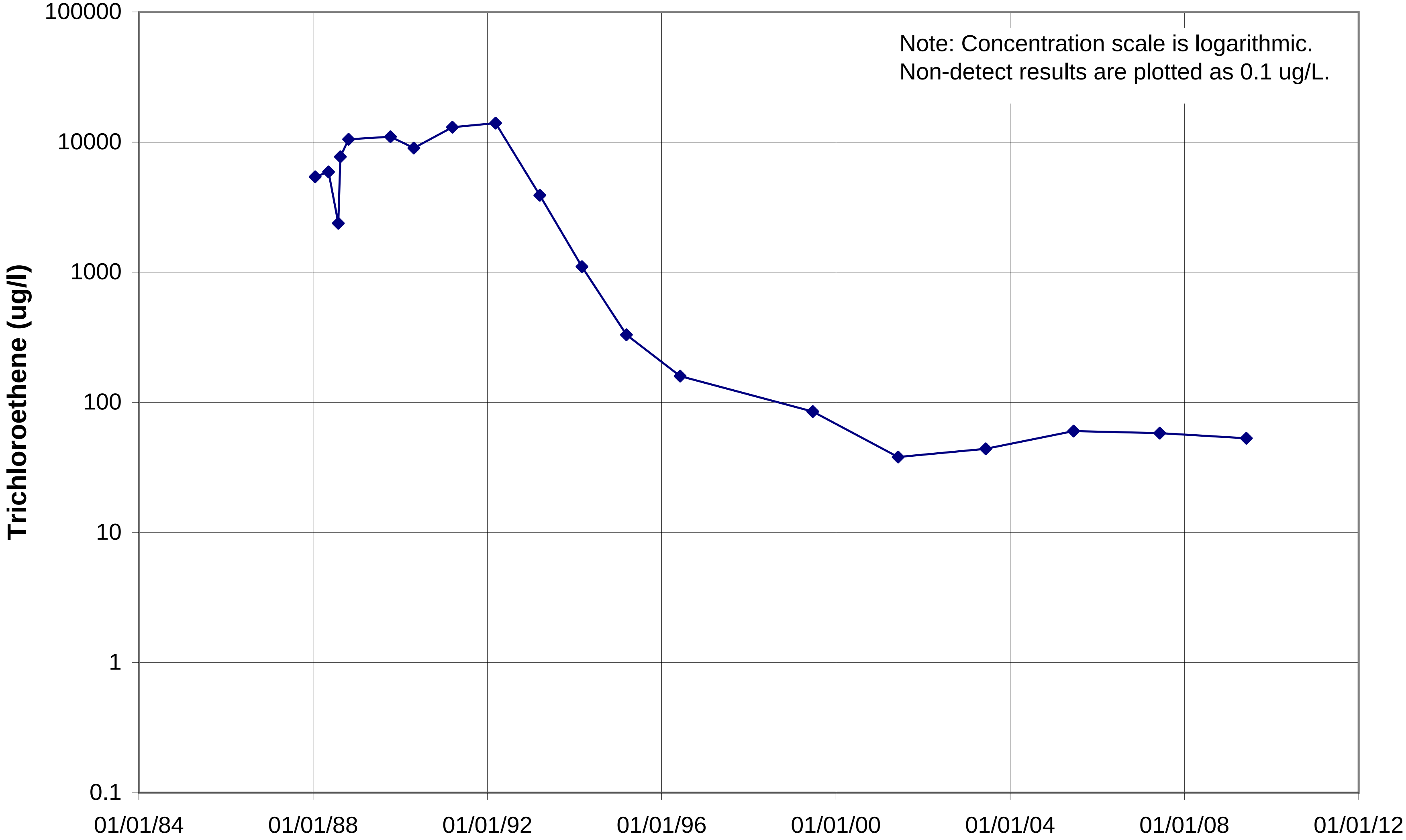

**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 03M017

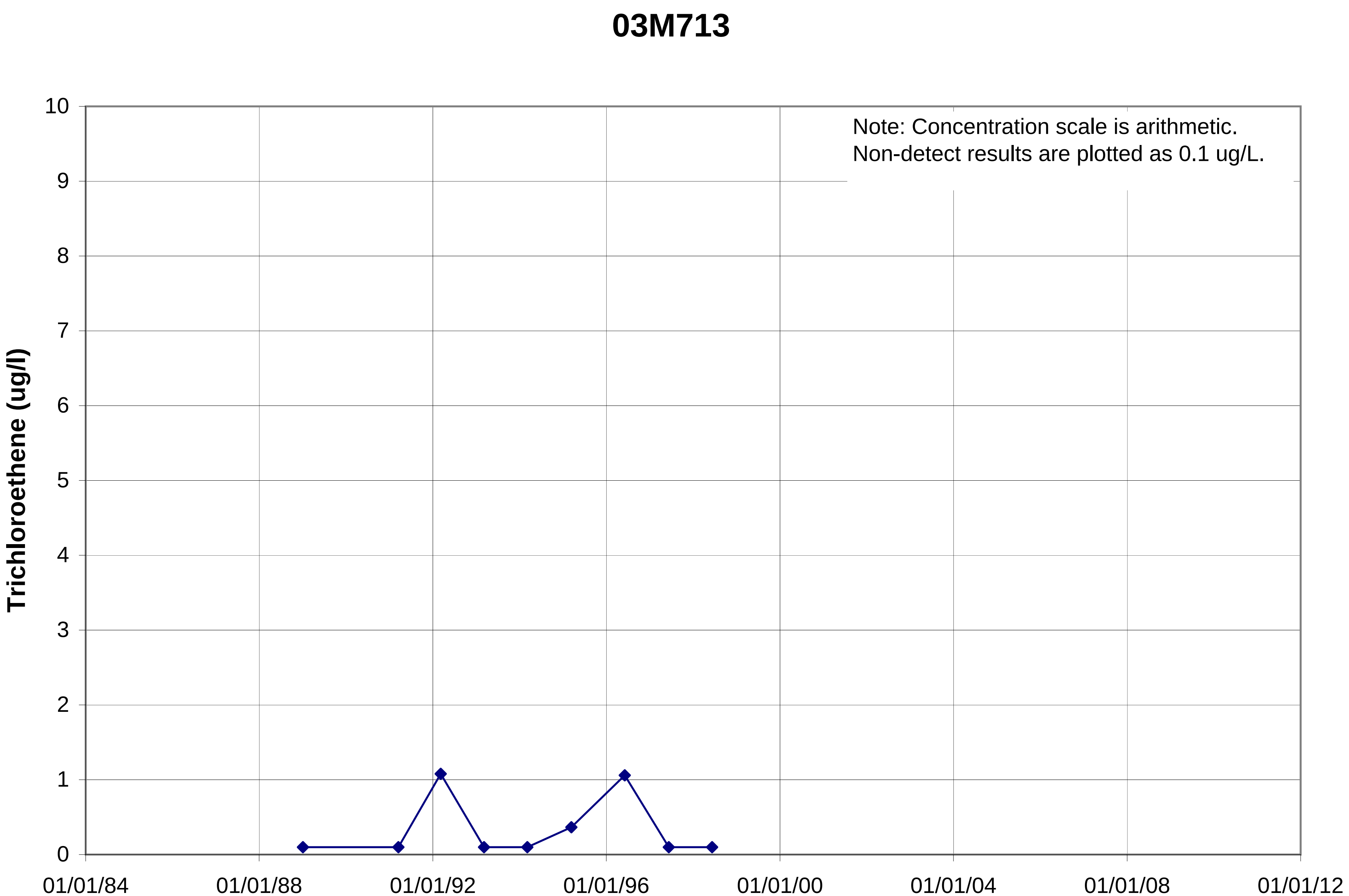



**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 03M020

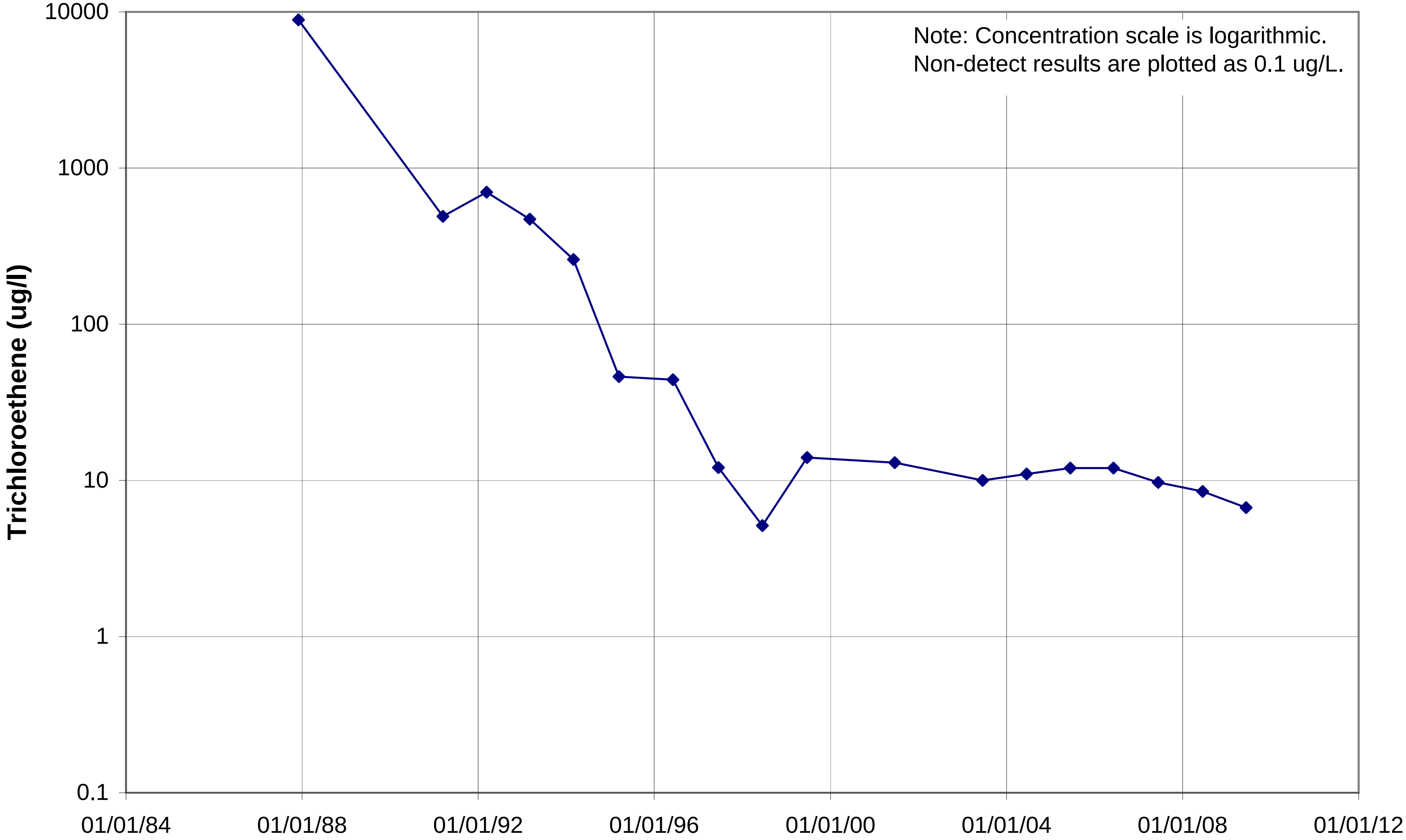



**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar




**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 03M802

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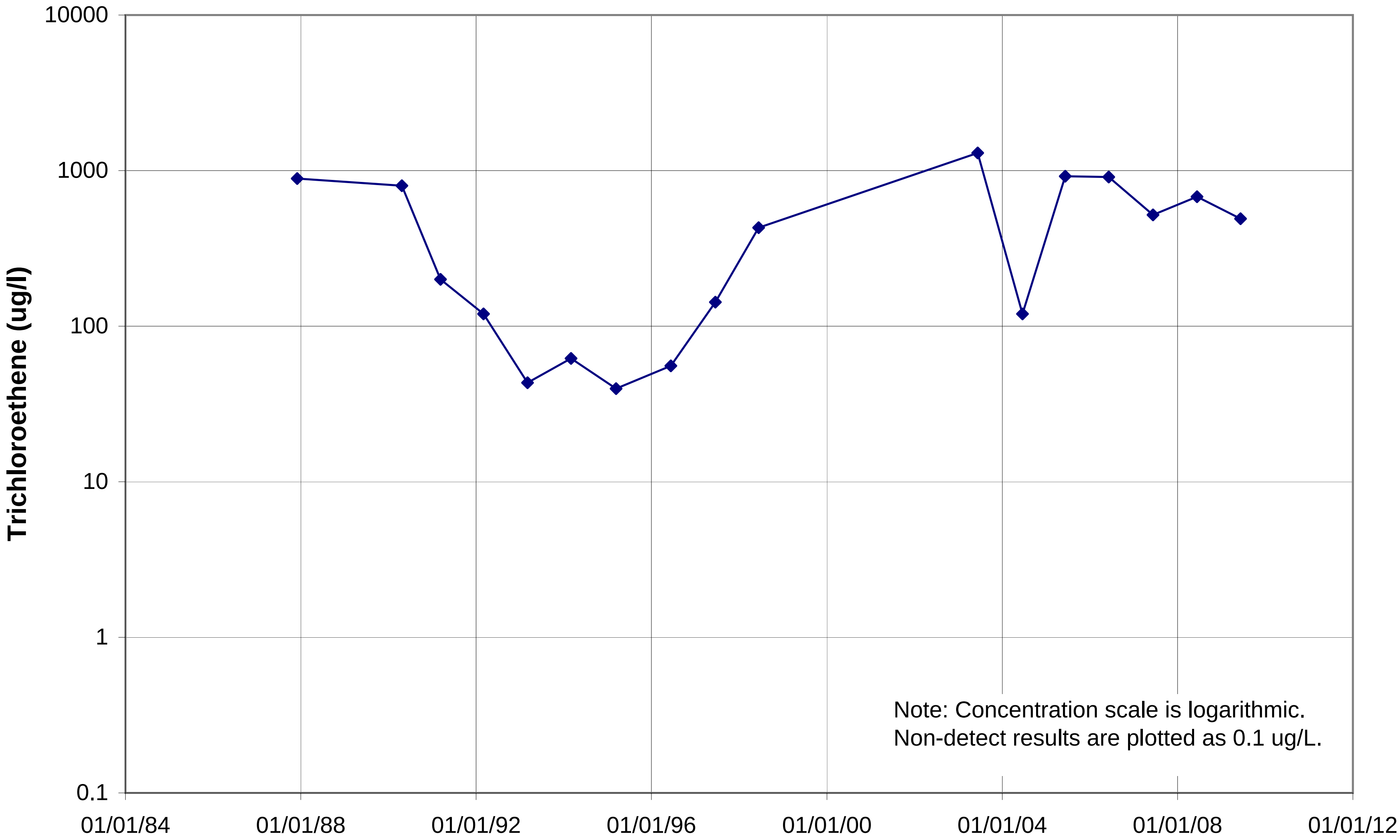


**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

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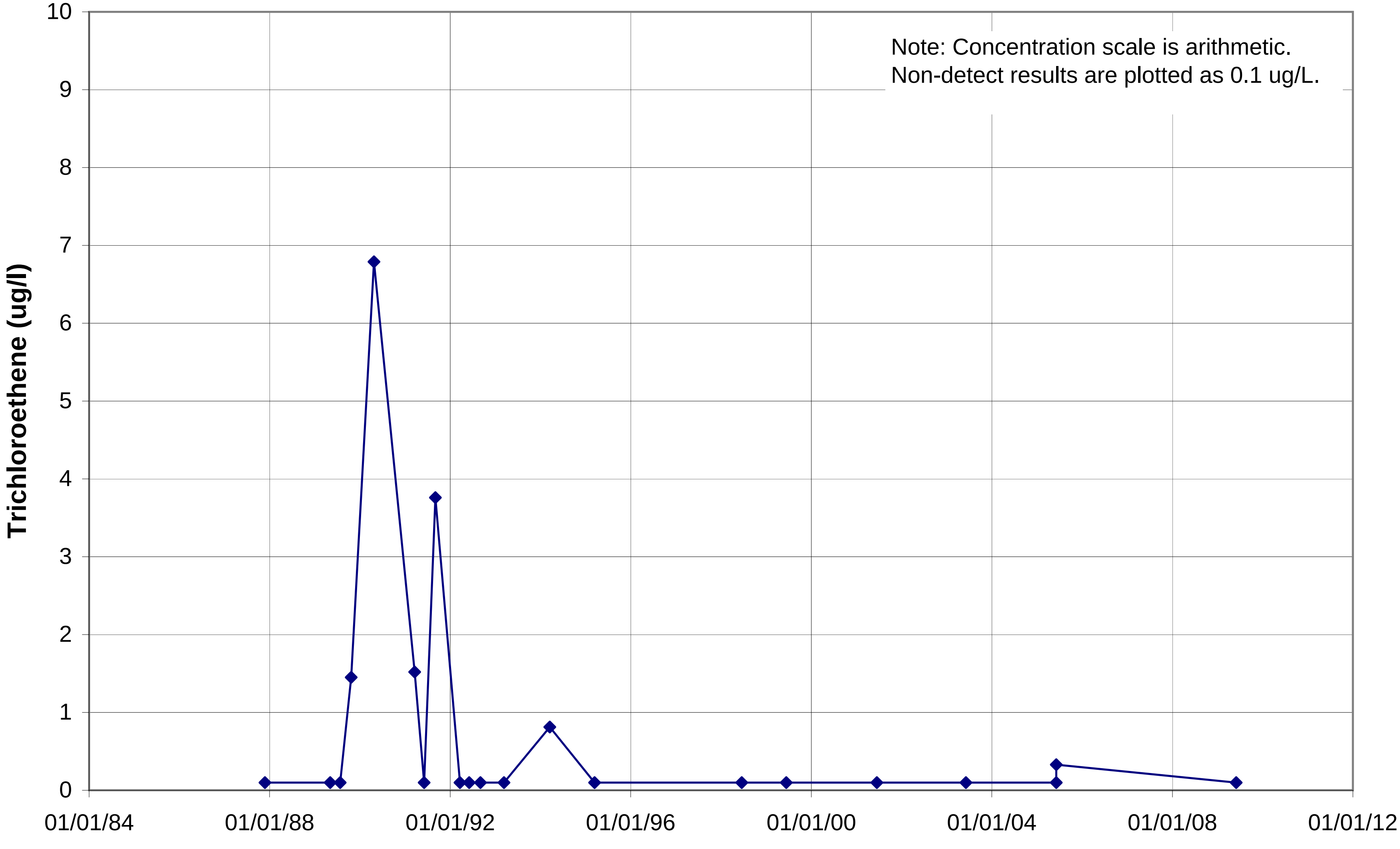


**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

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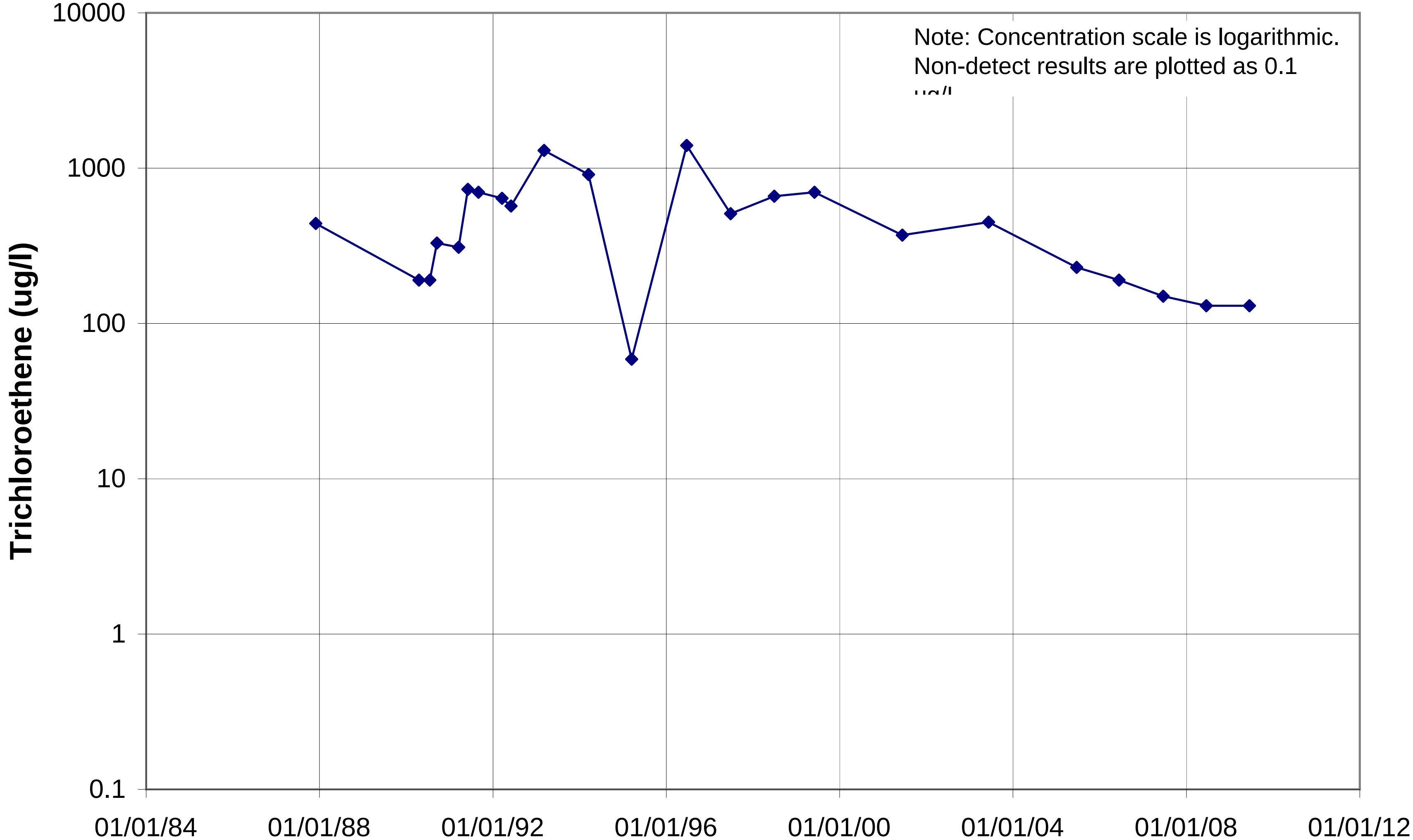
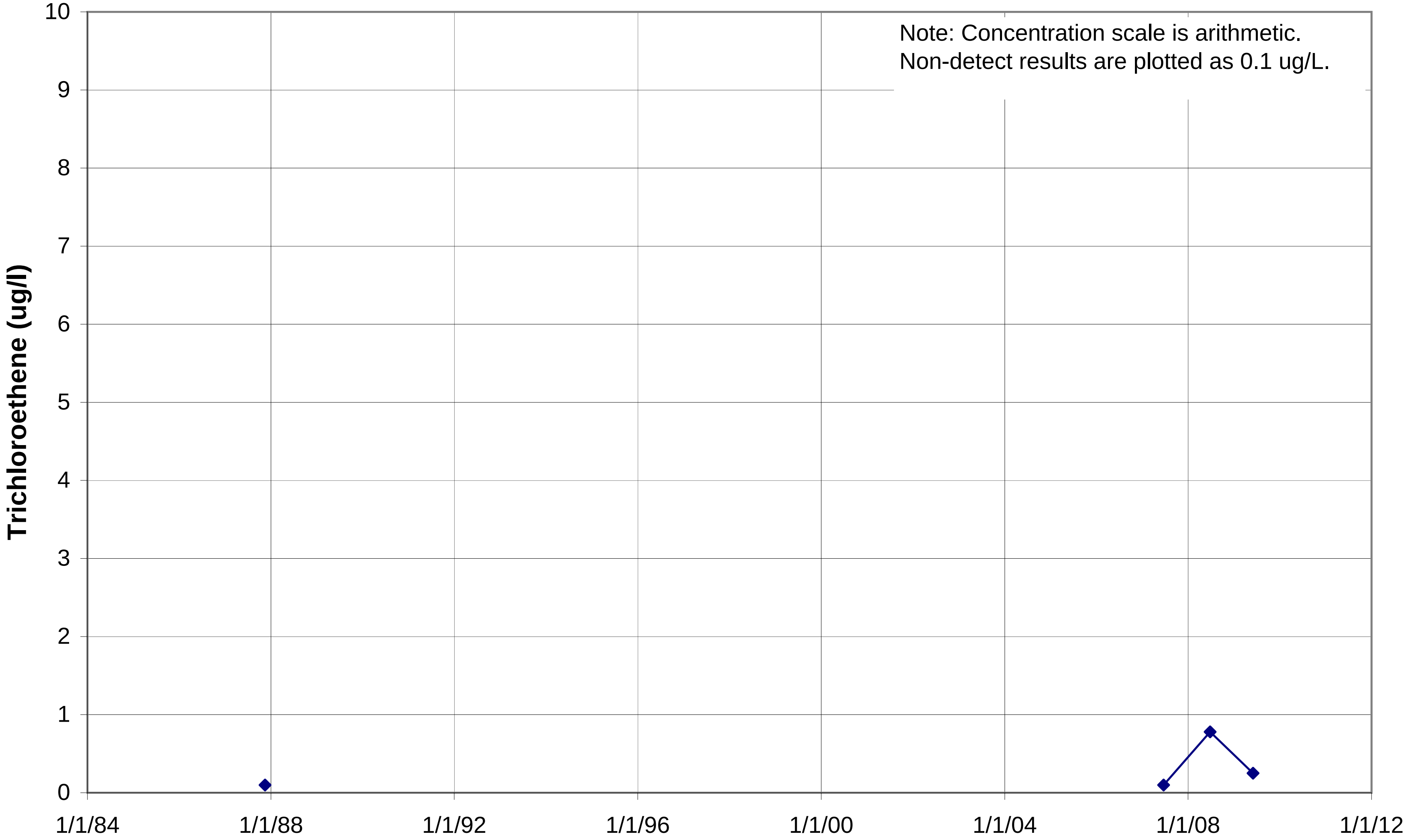



**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 03U001




**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

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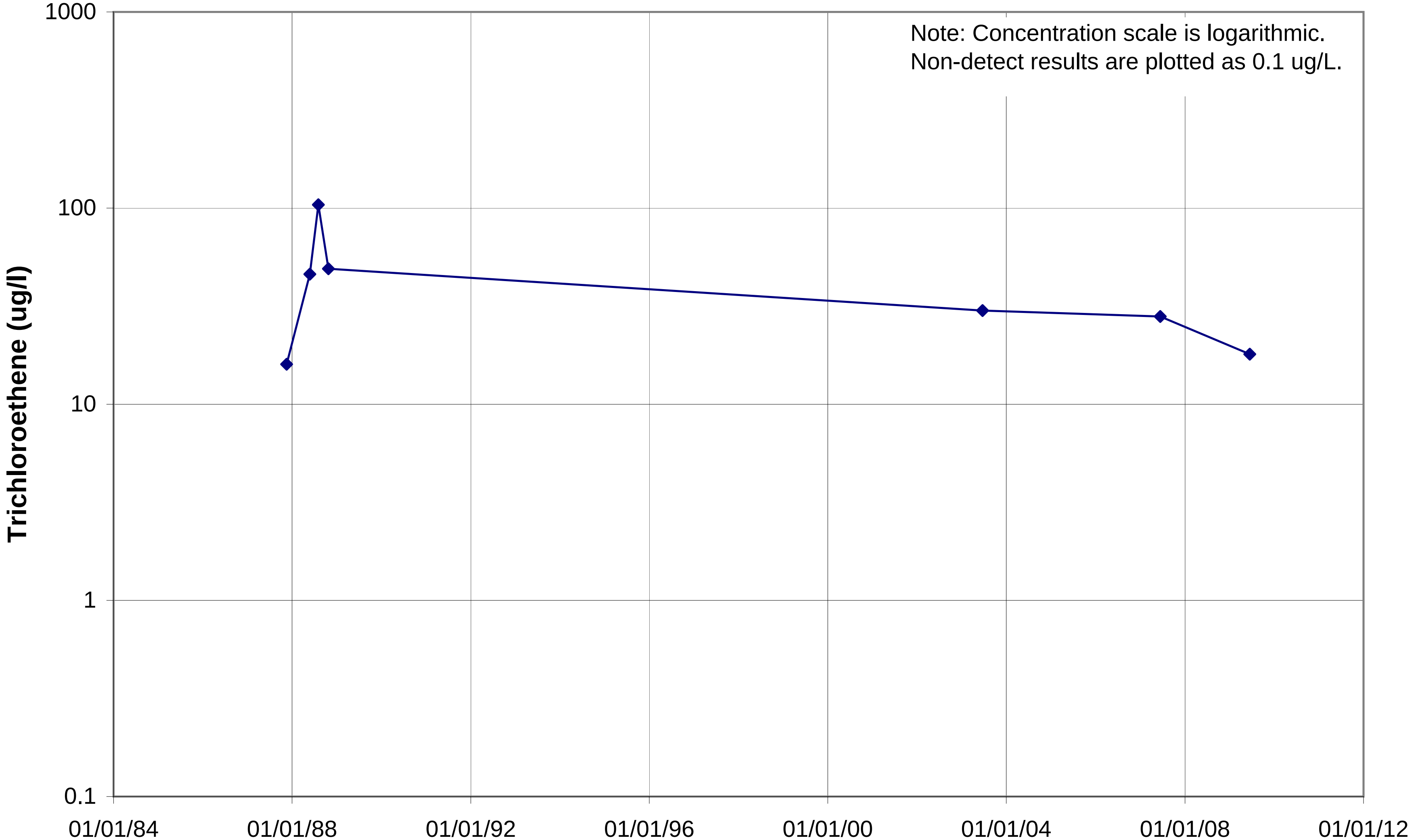


**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

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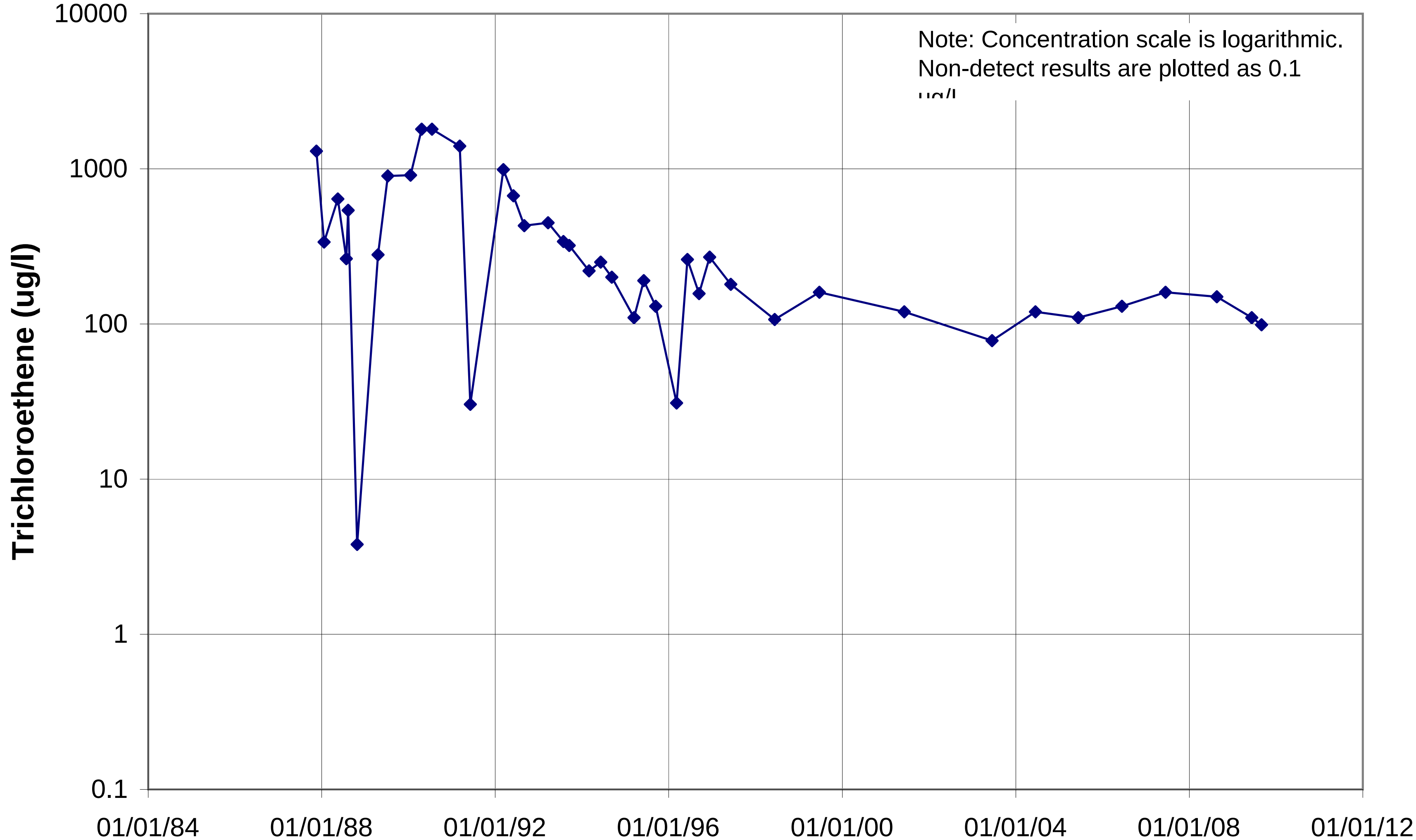


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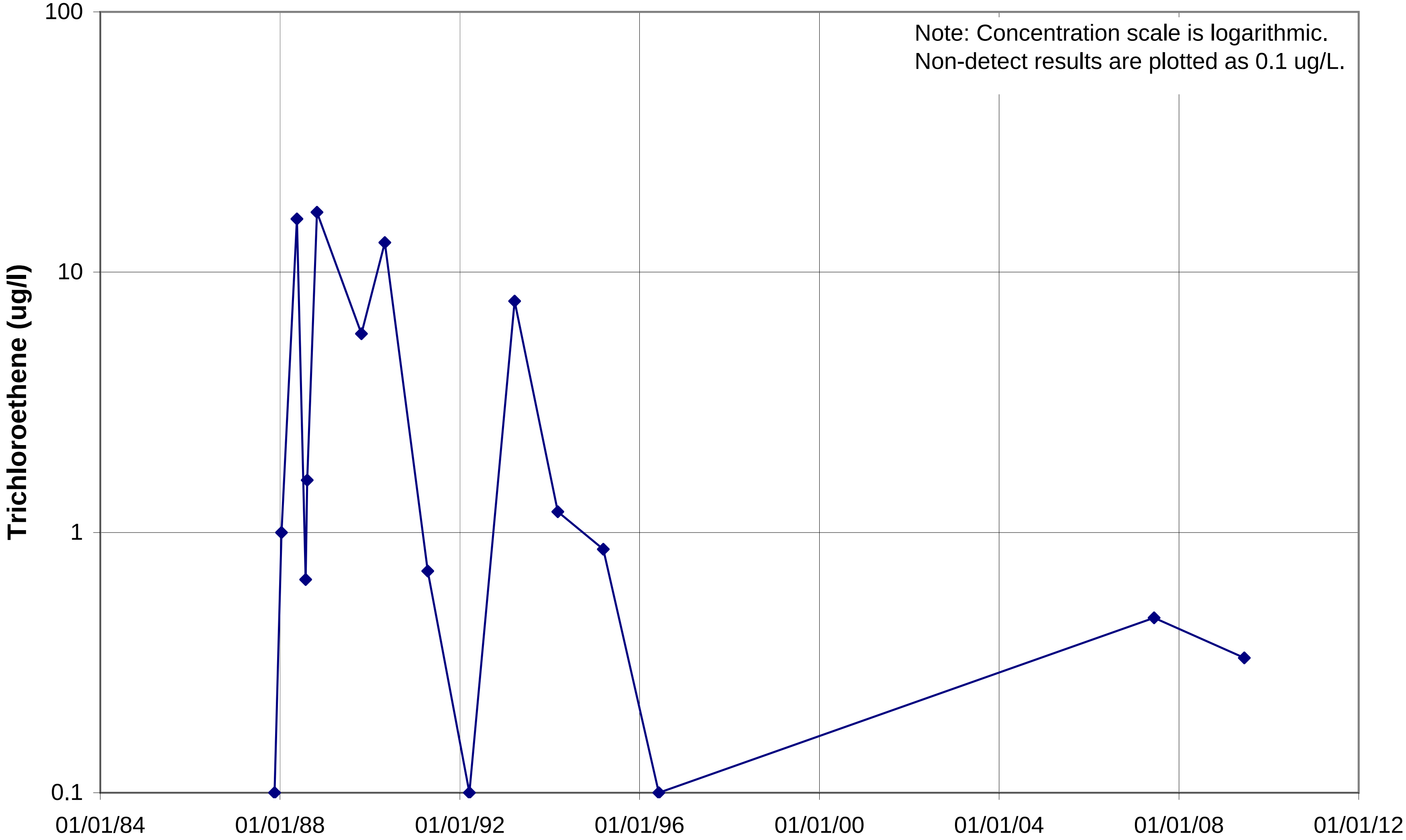
# 03U004

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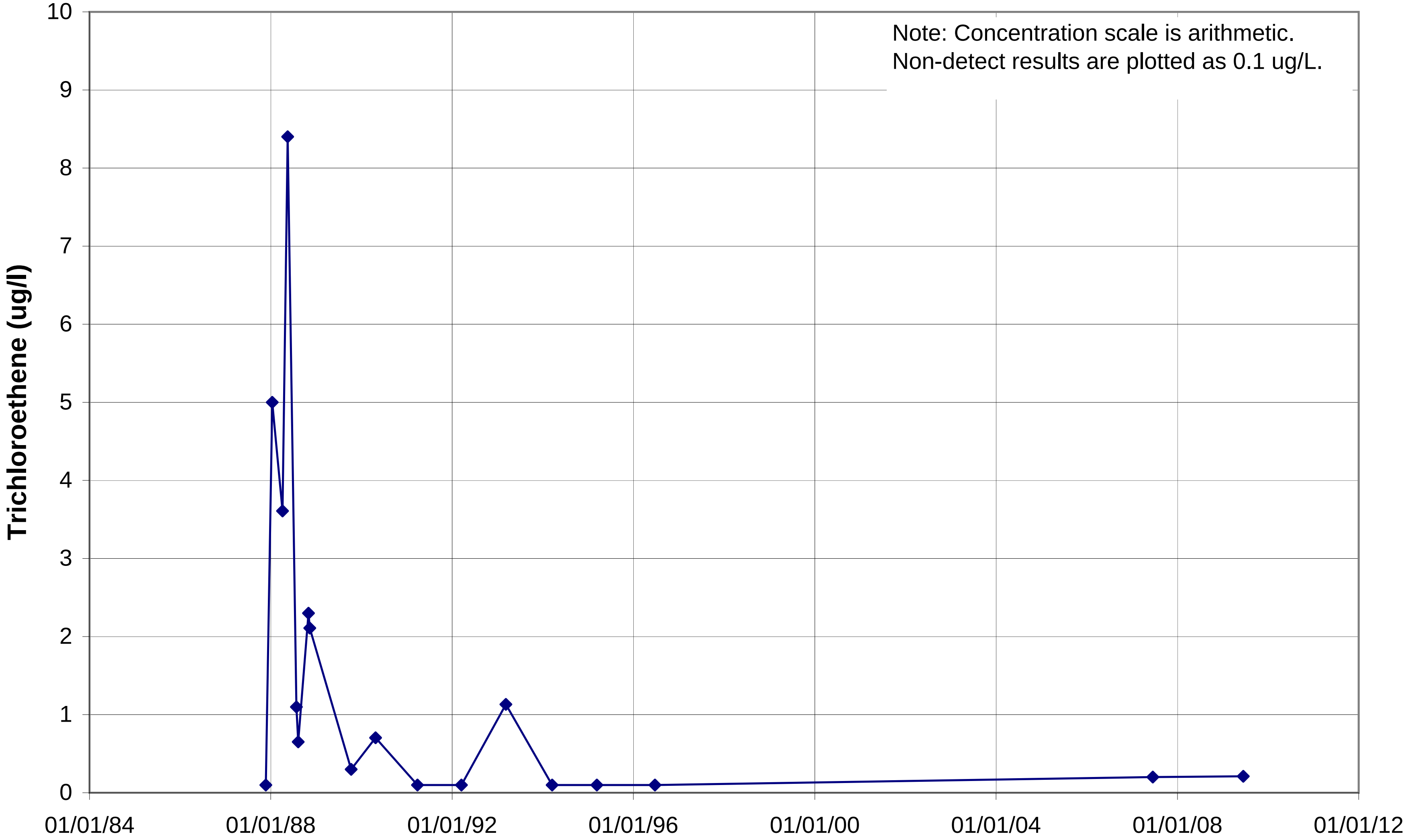


**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

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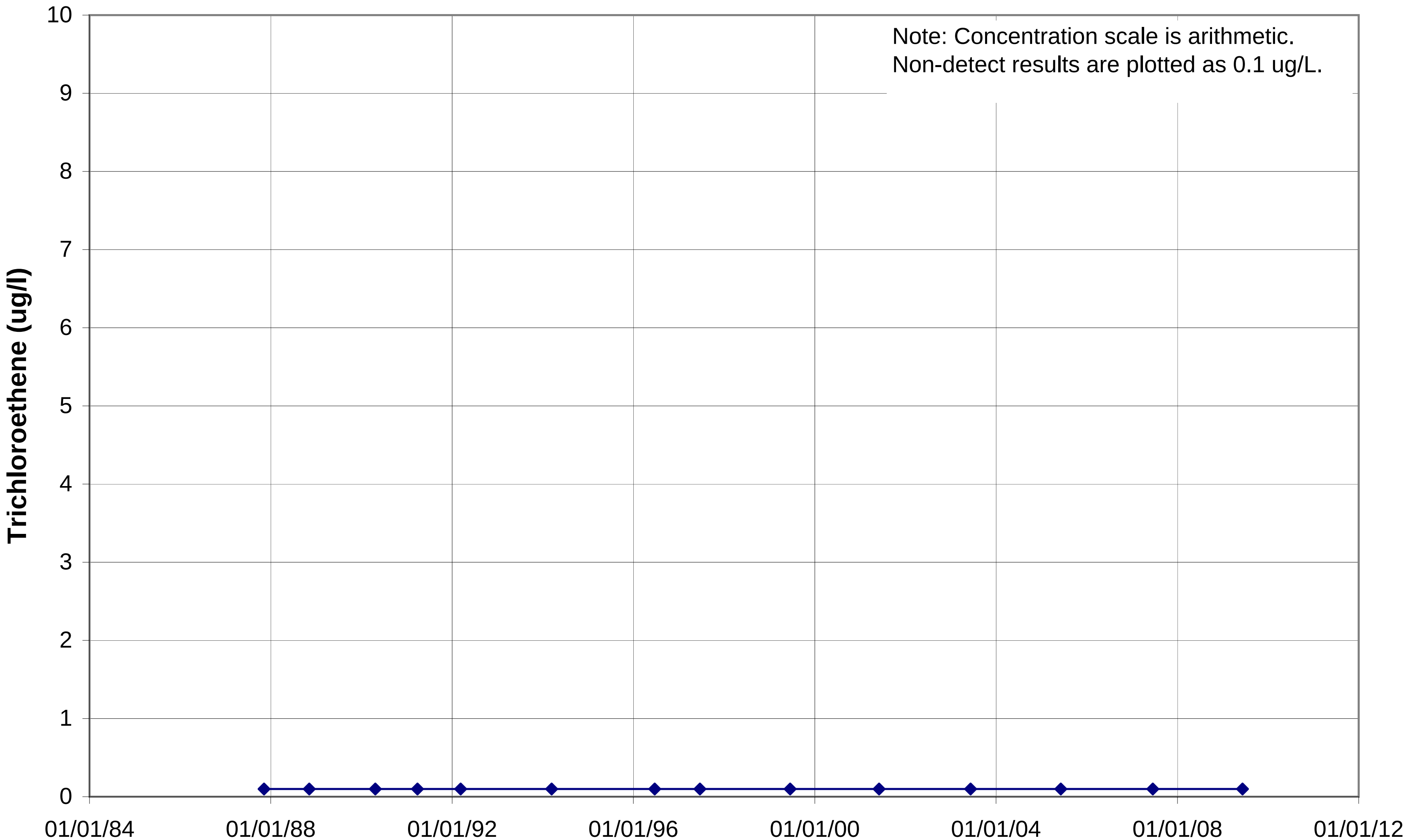


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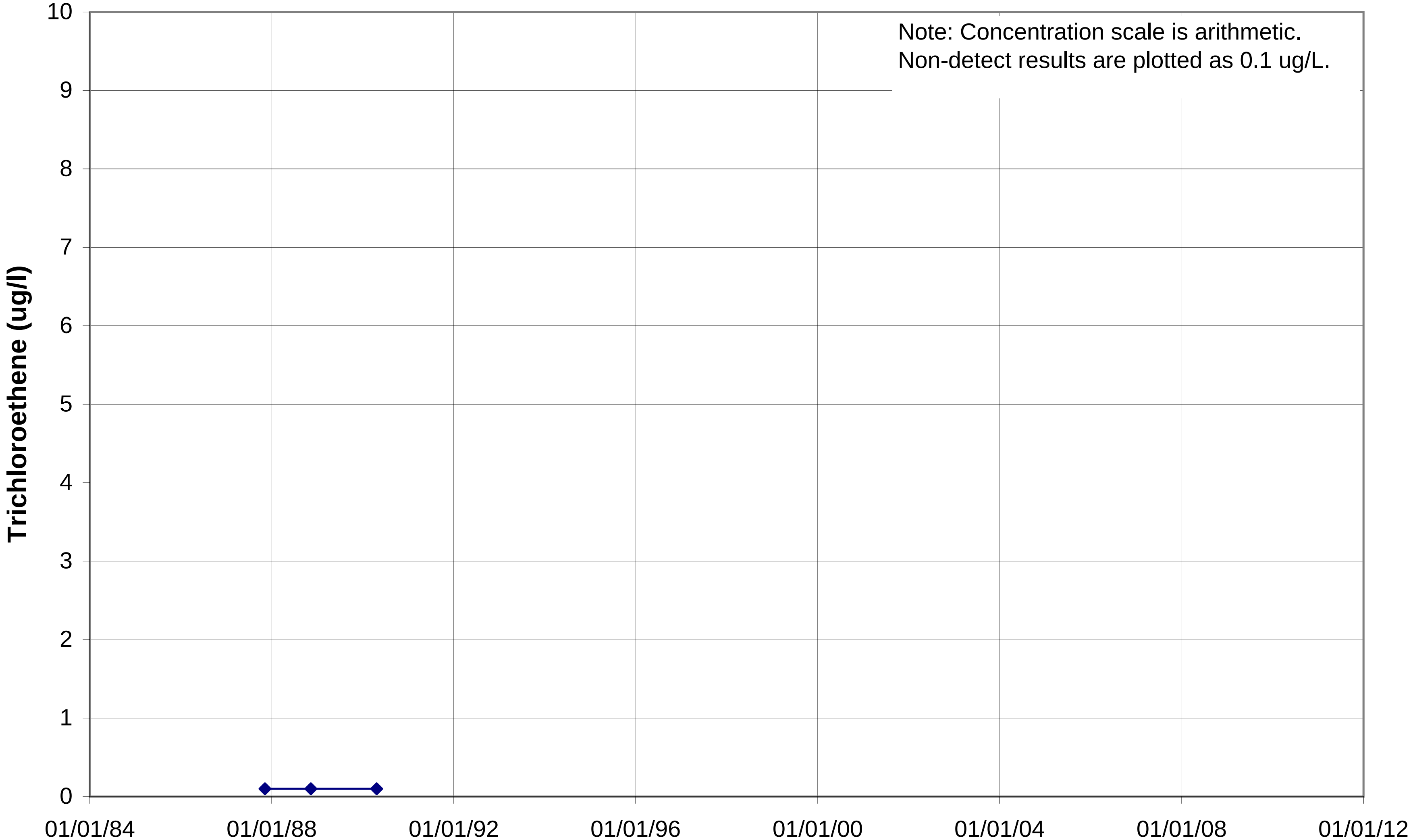
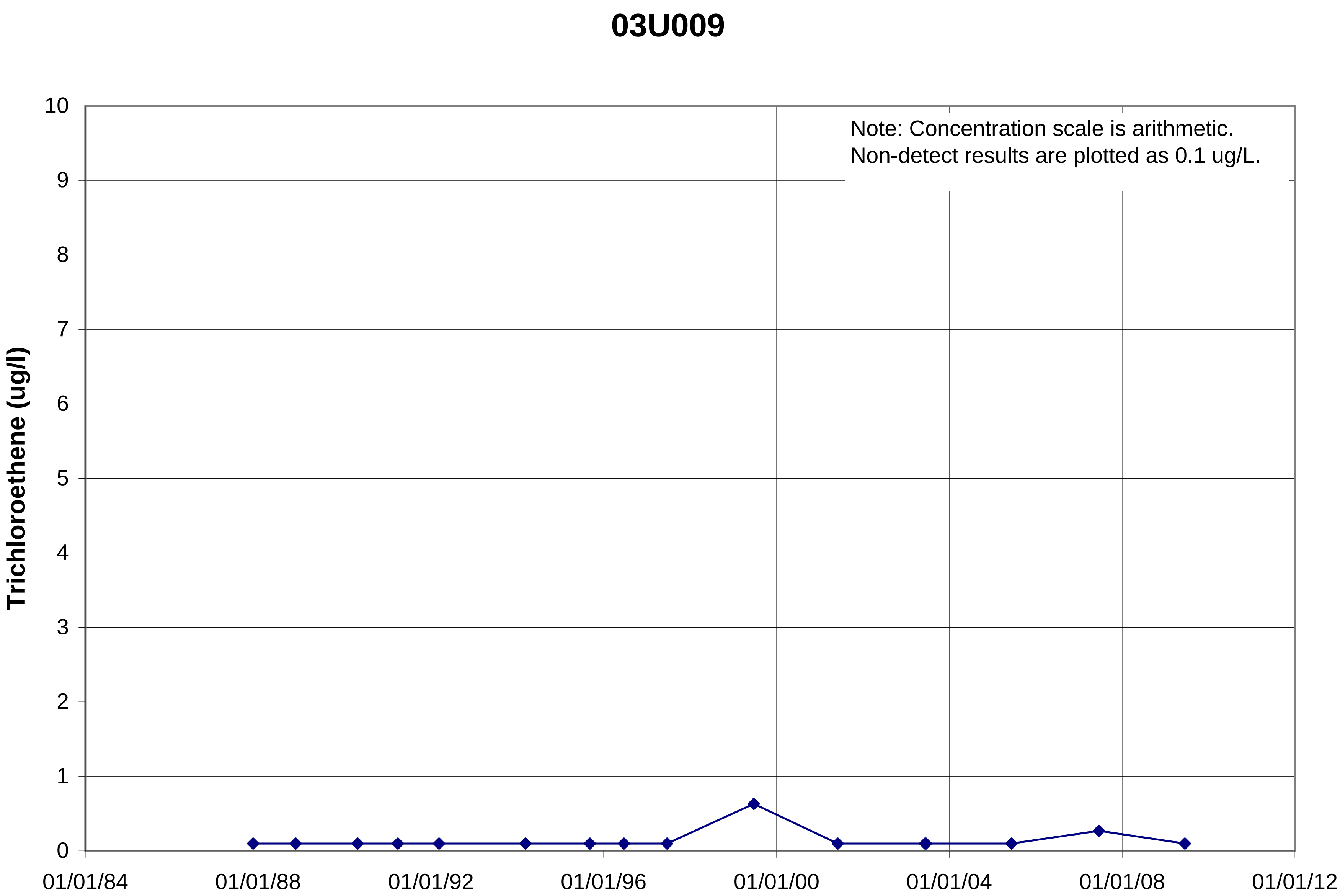
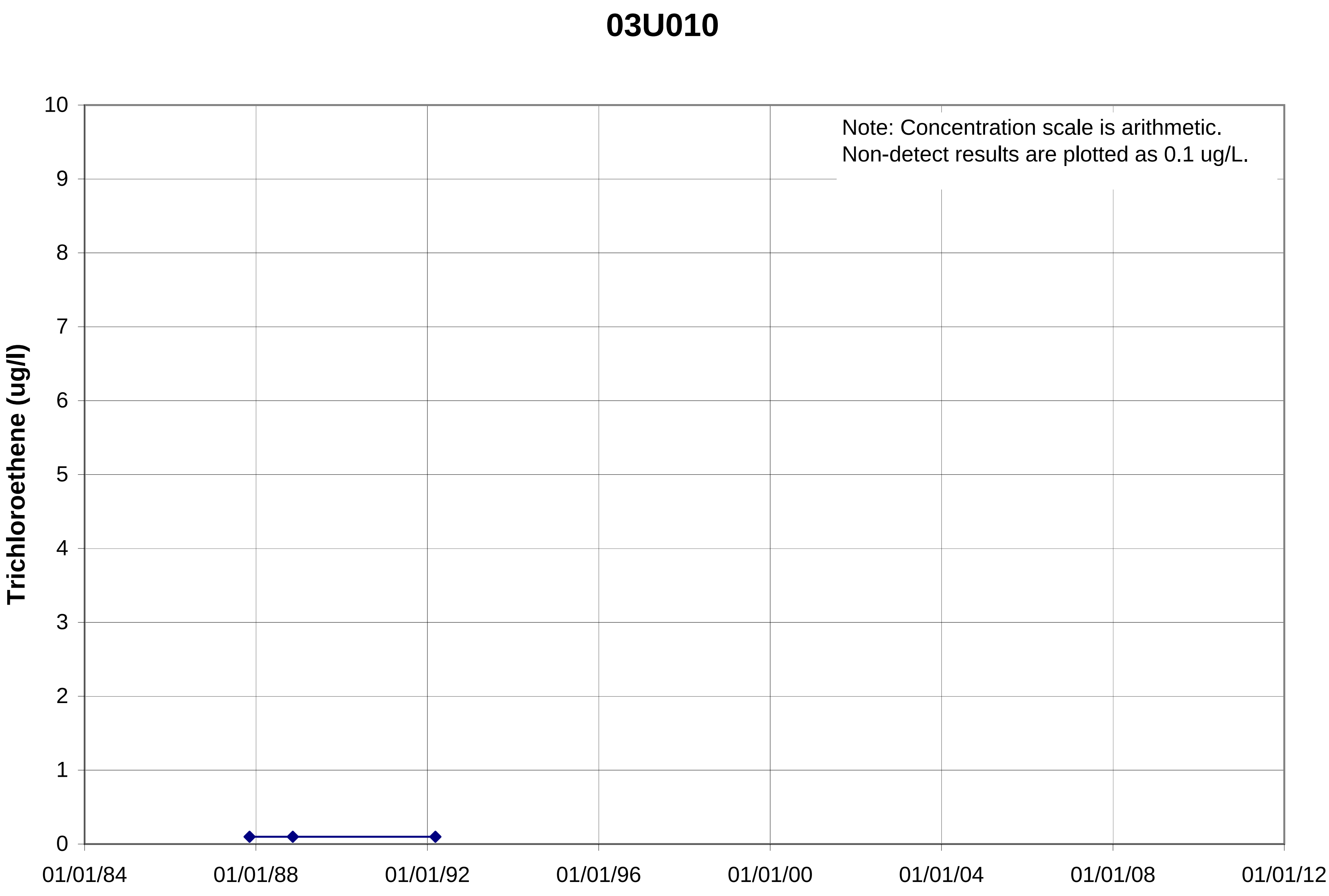
# 03U008




**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

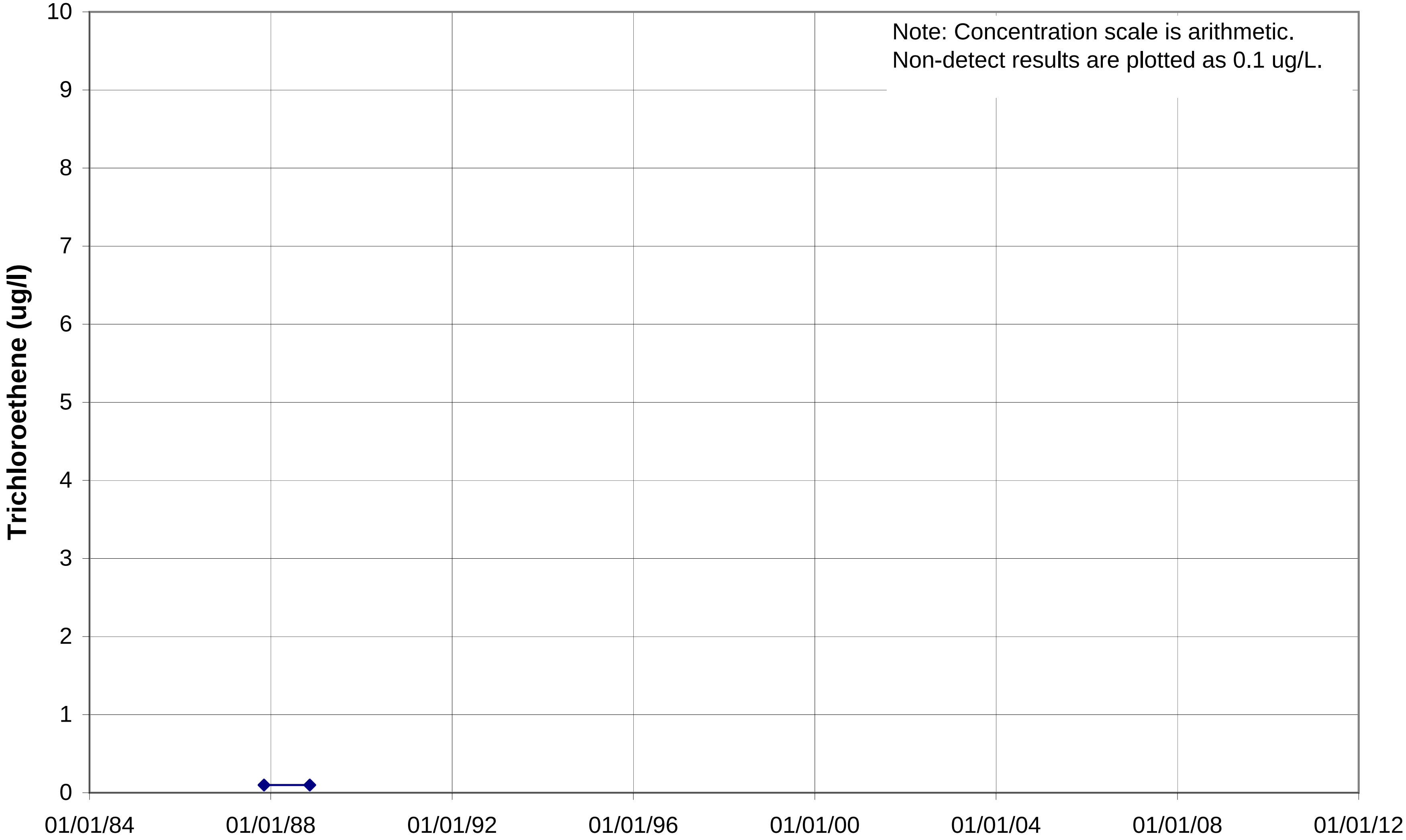



**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

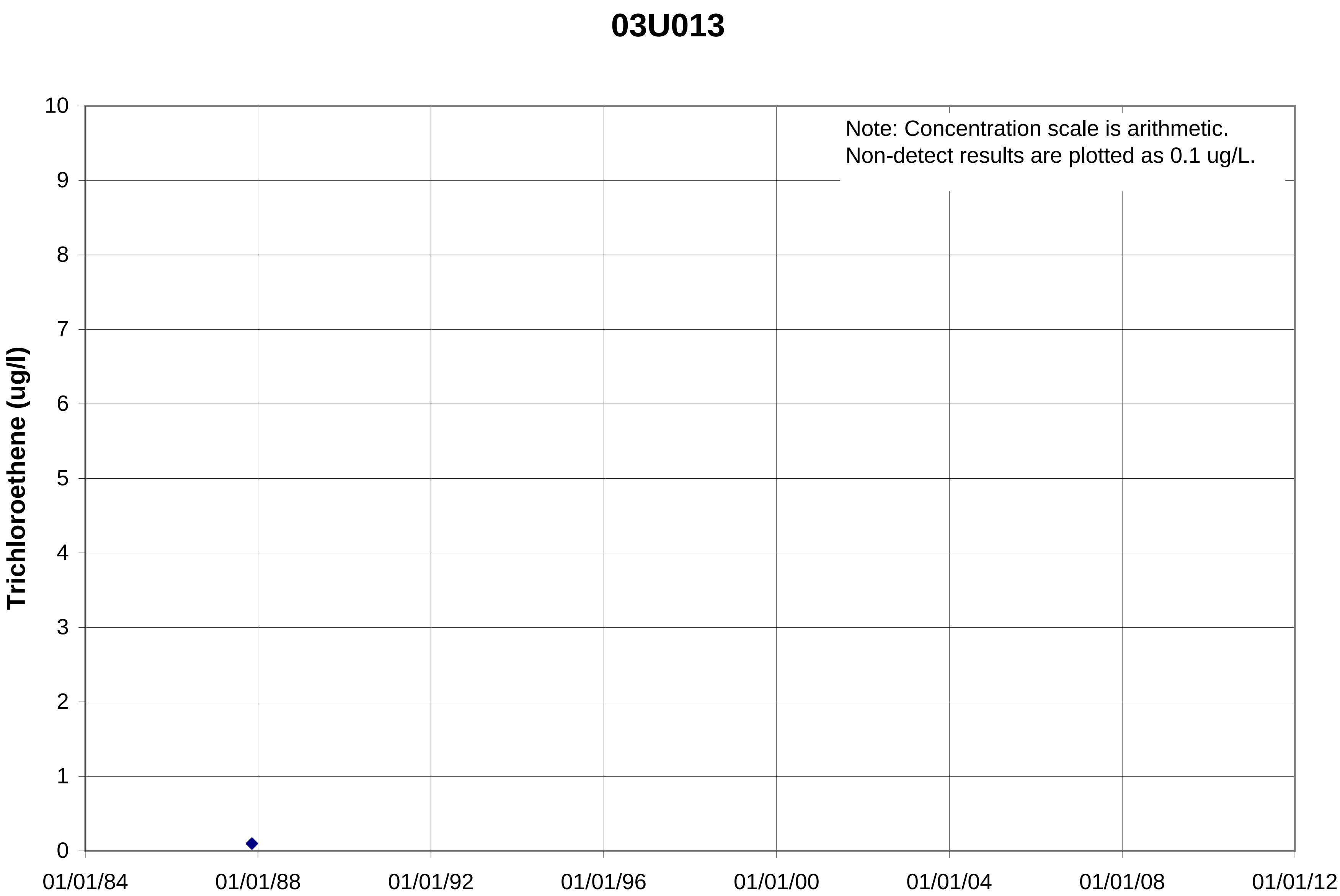



**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 03U012




**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar




**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

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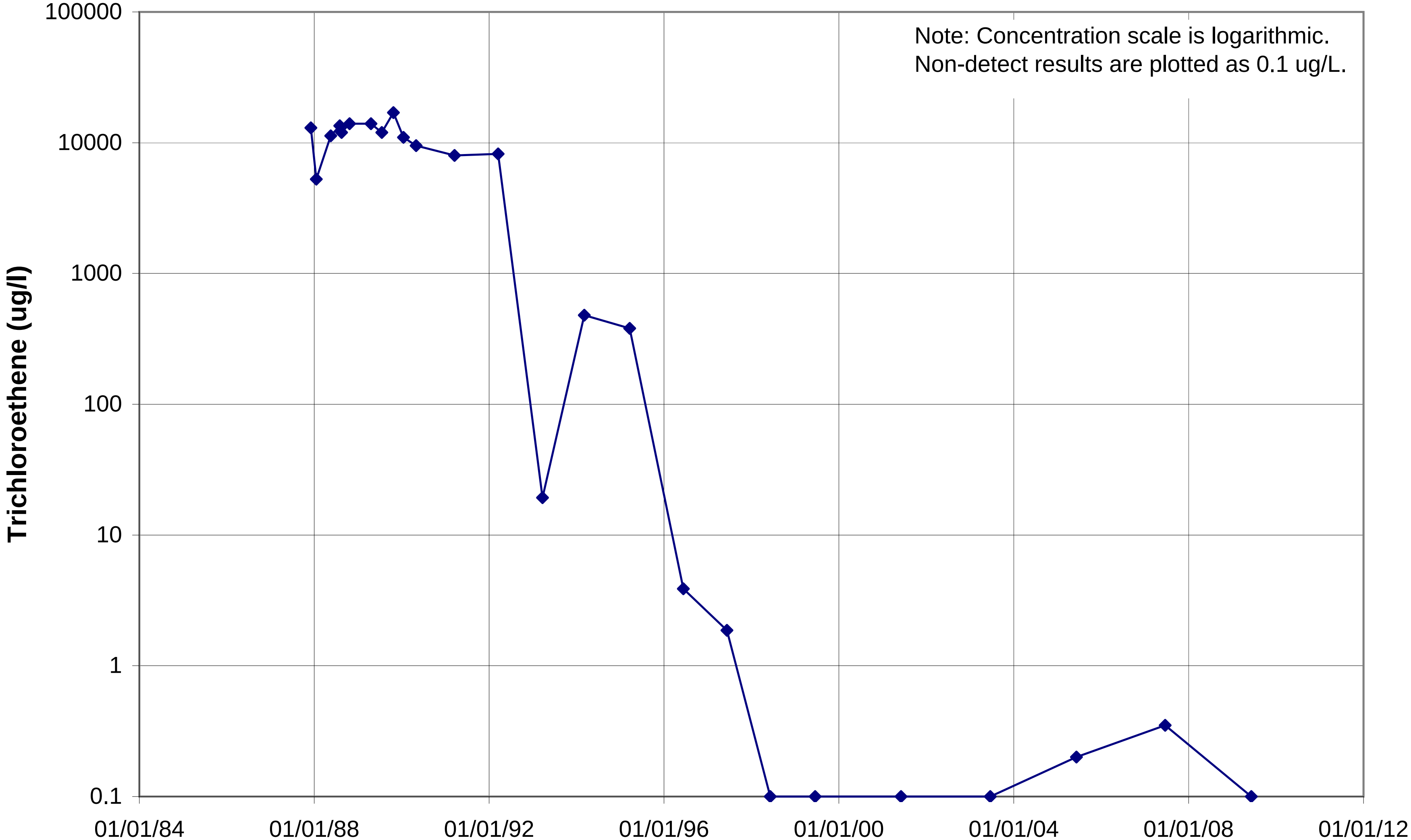


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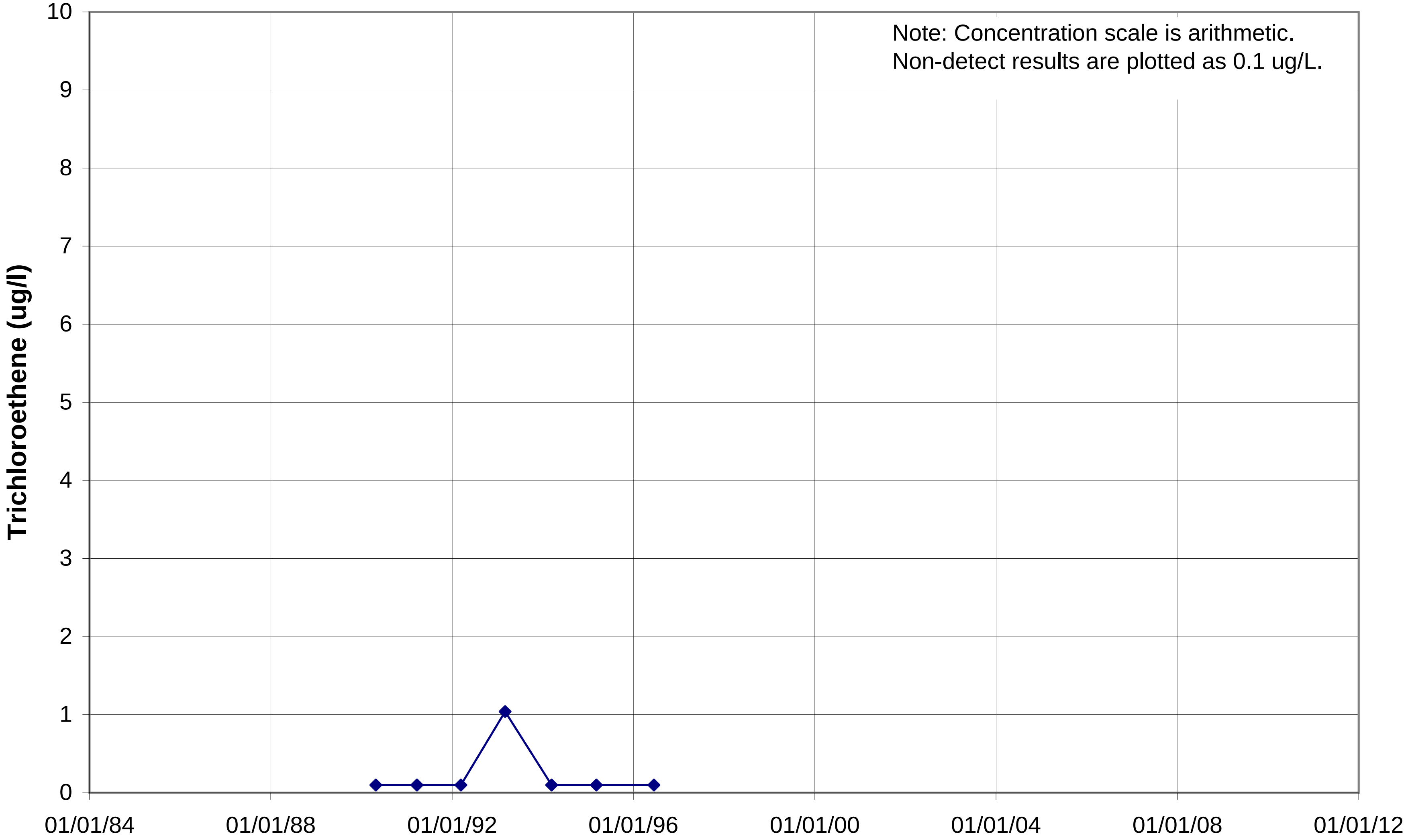
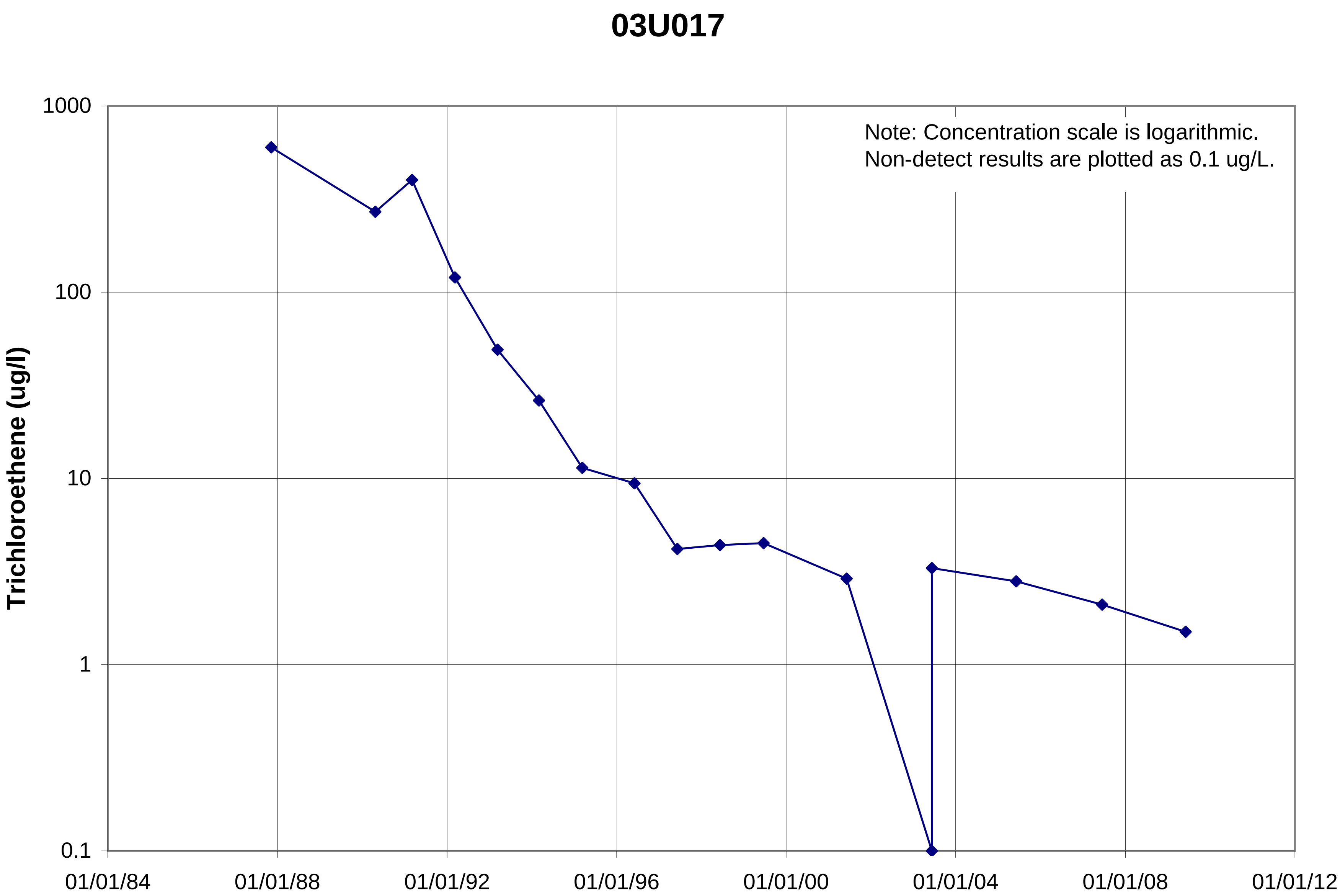



**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

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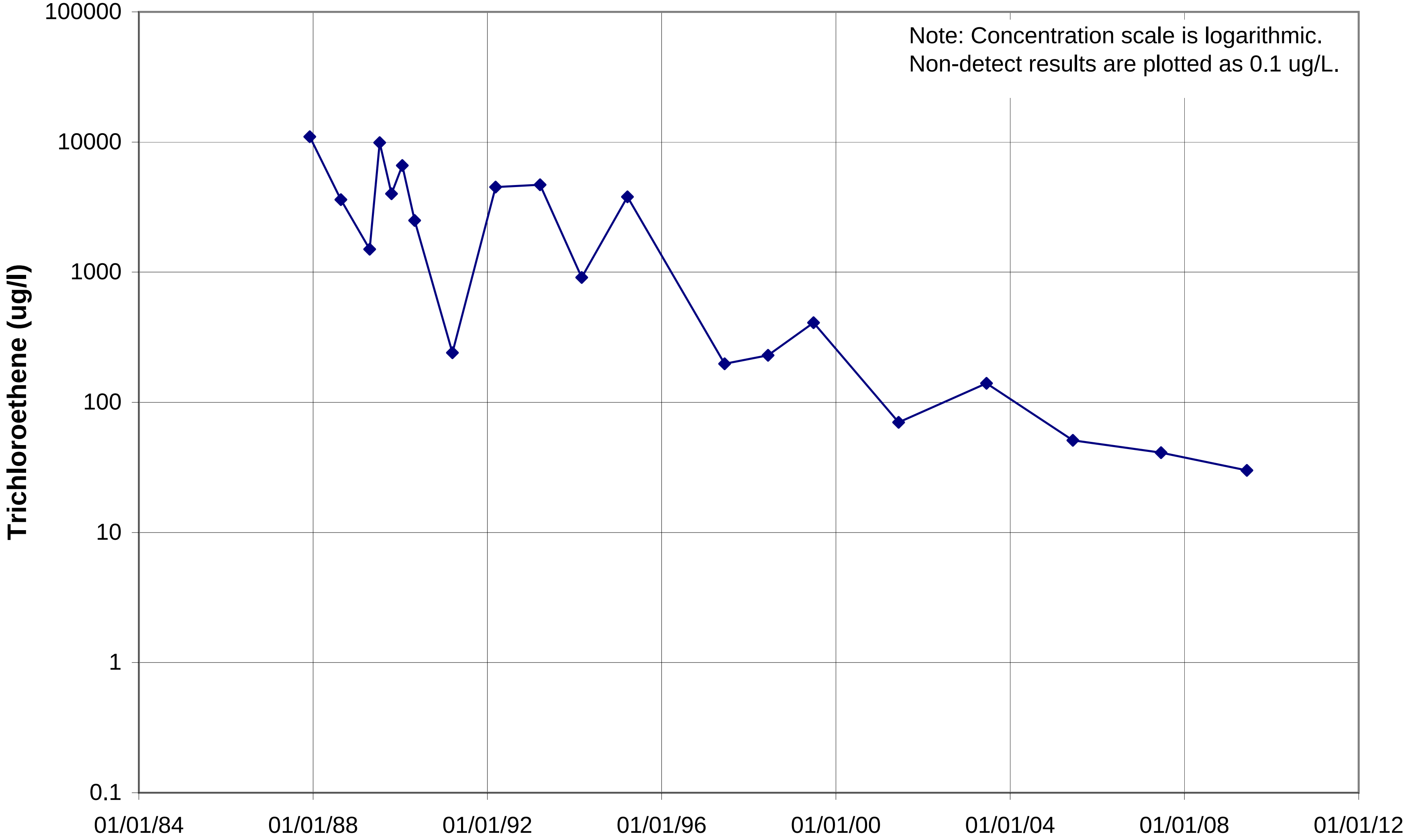


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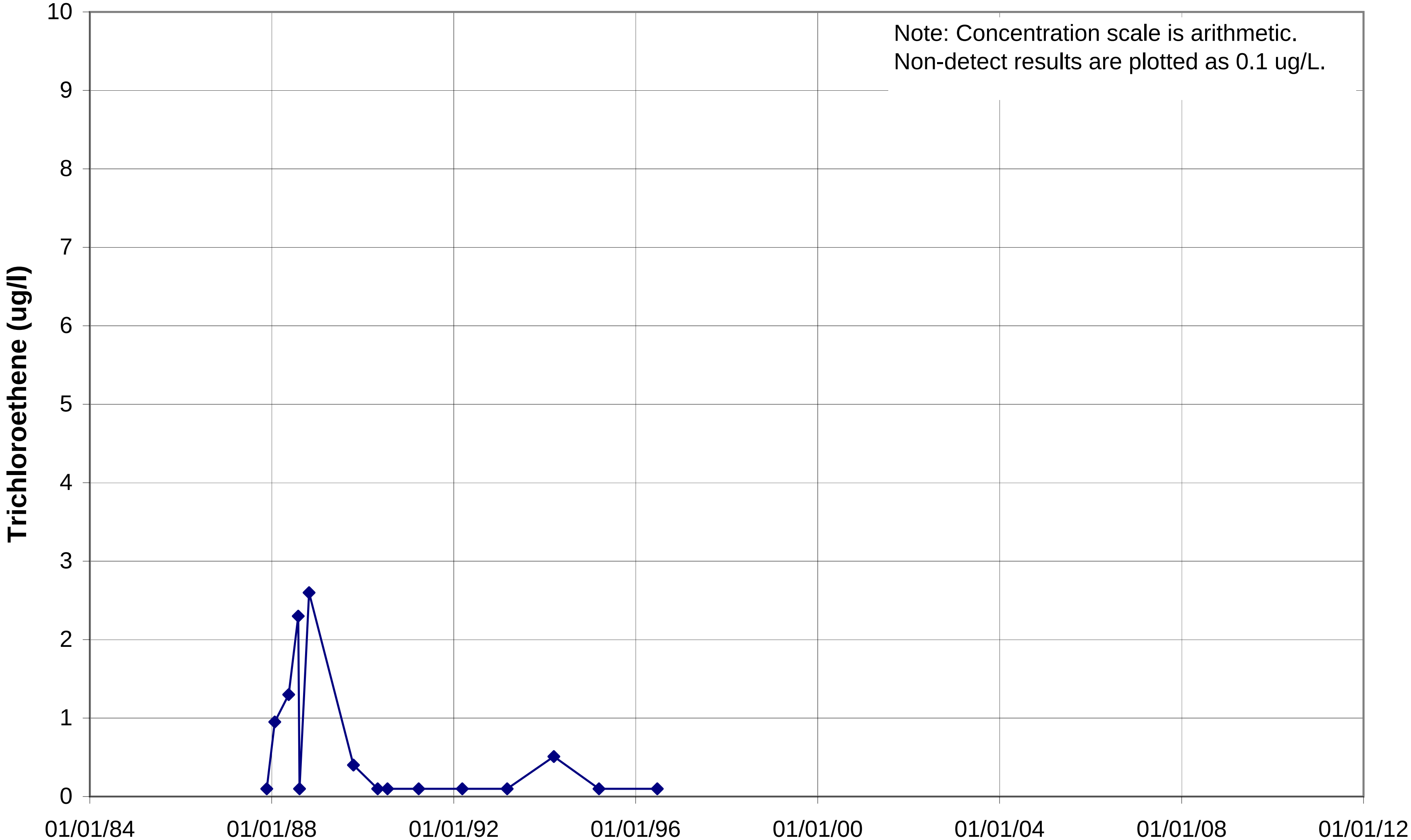
# 03U019

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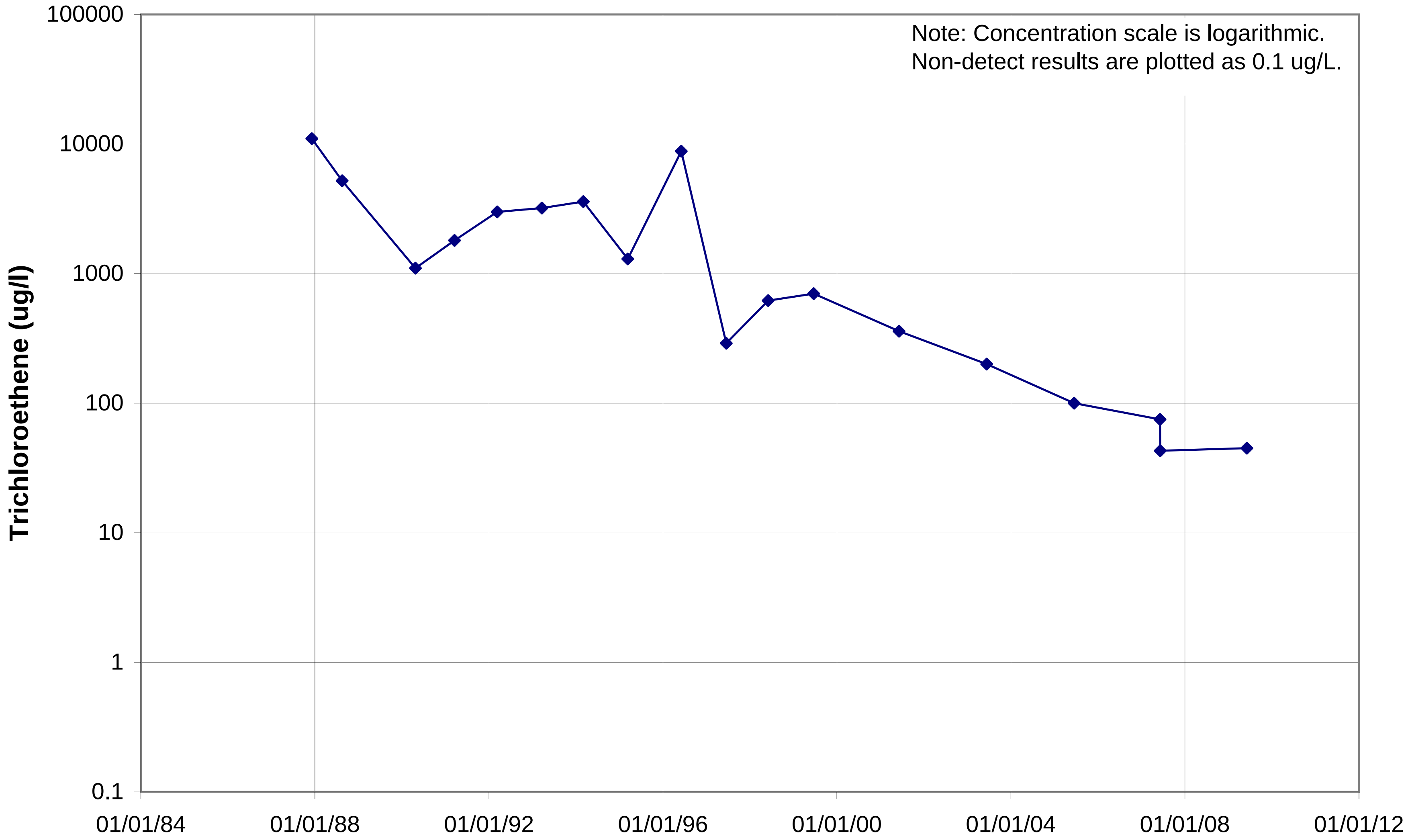
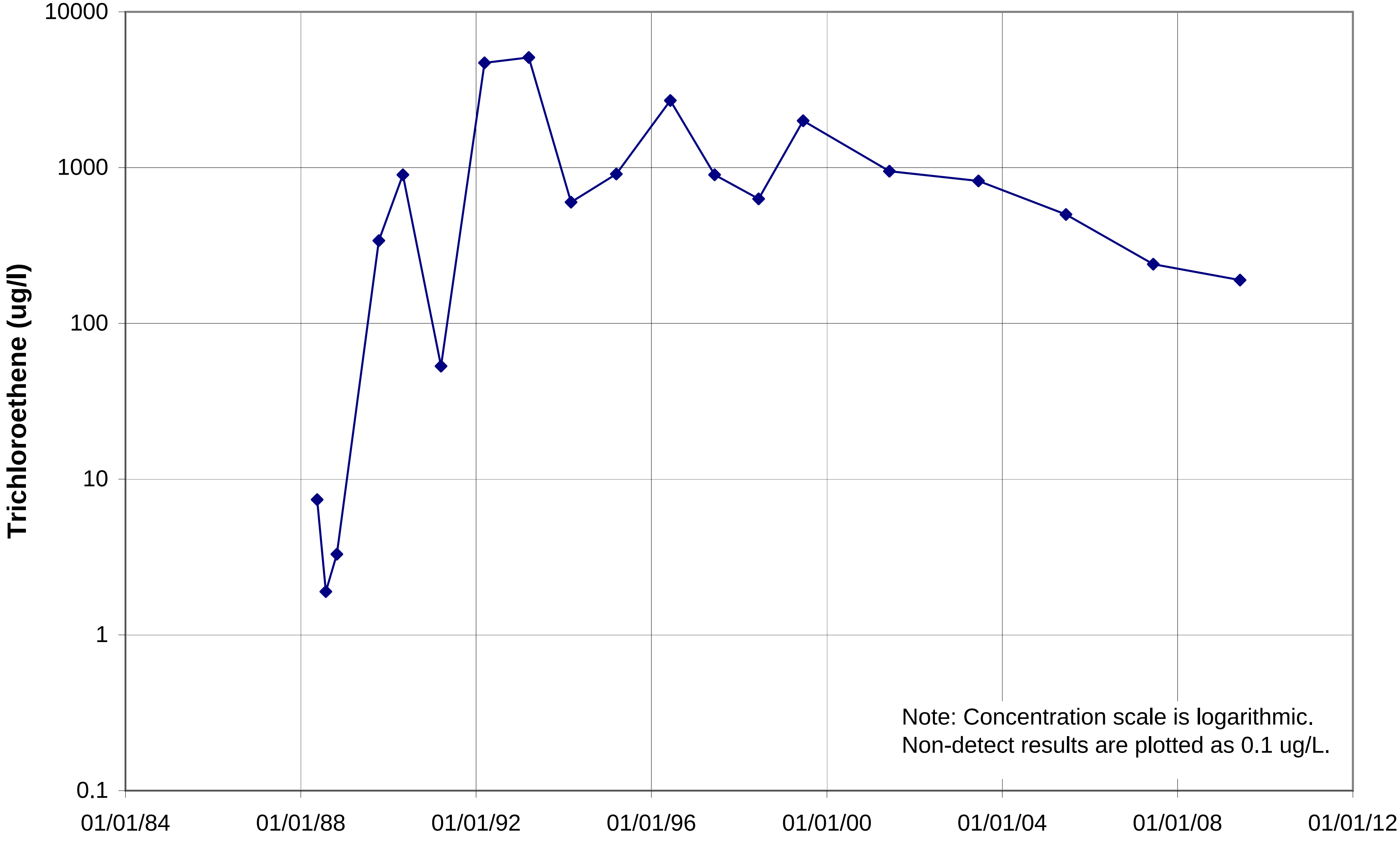
# 03U020



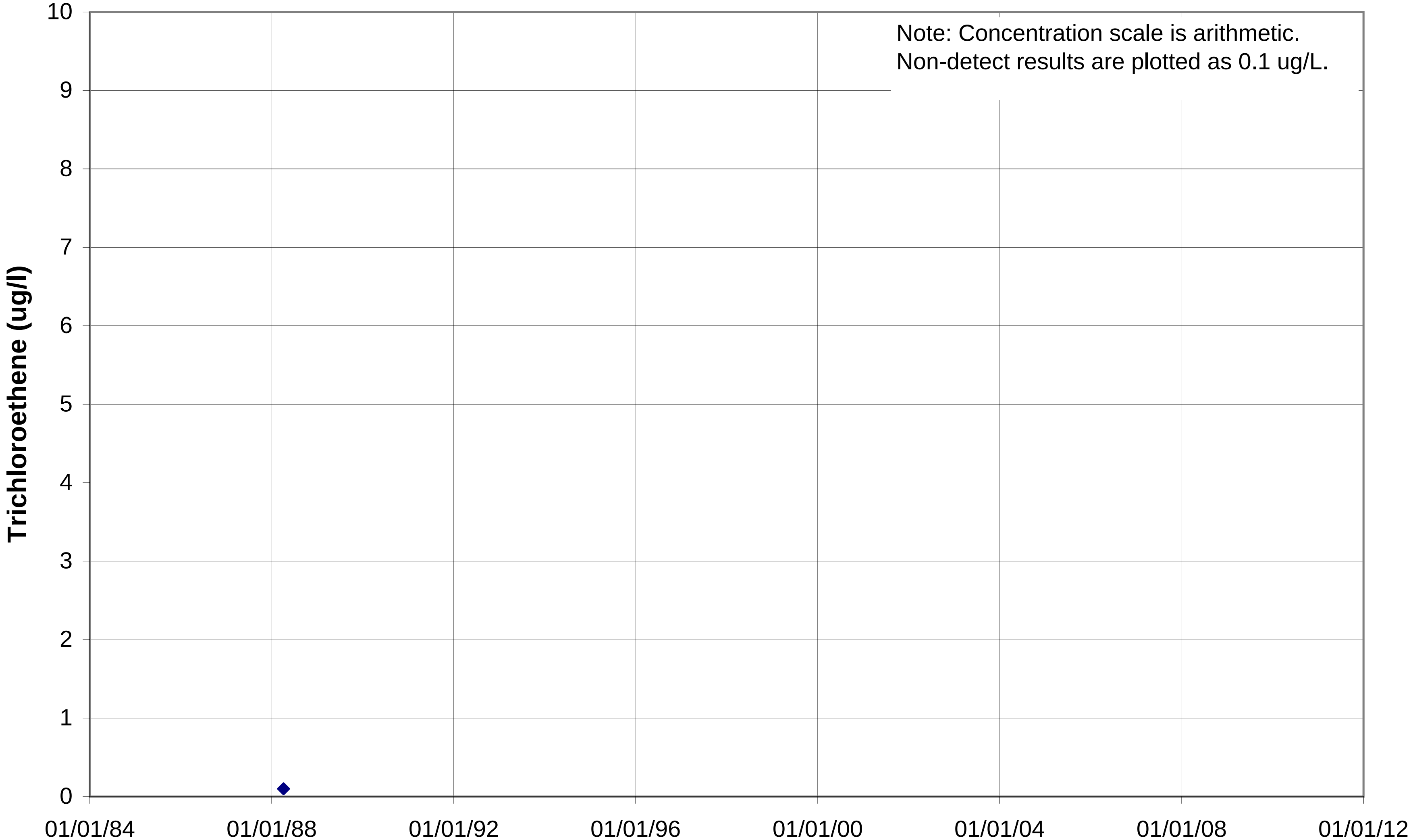

**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 03U021




**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 03U022

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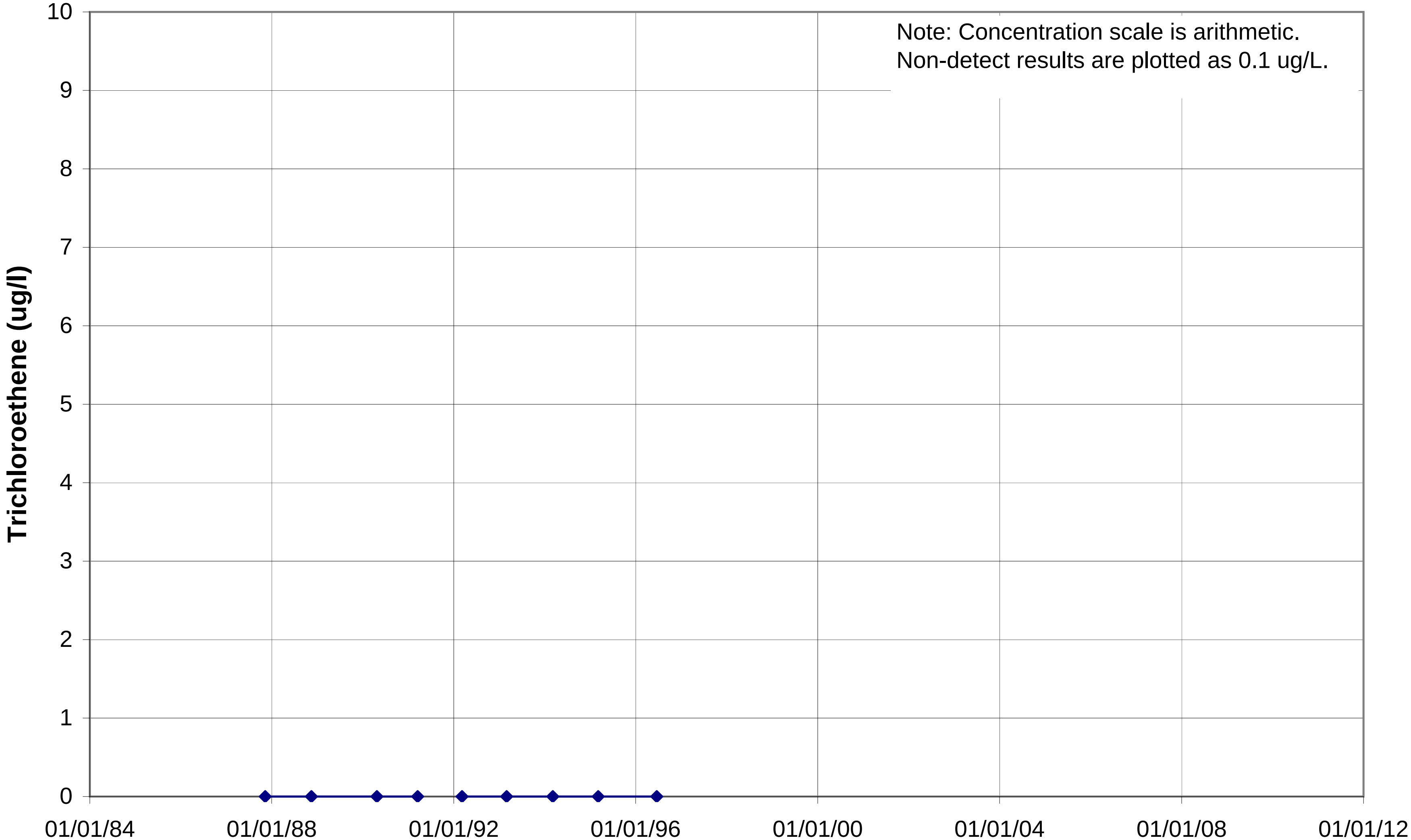
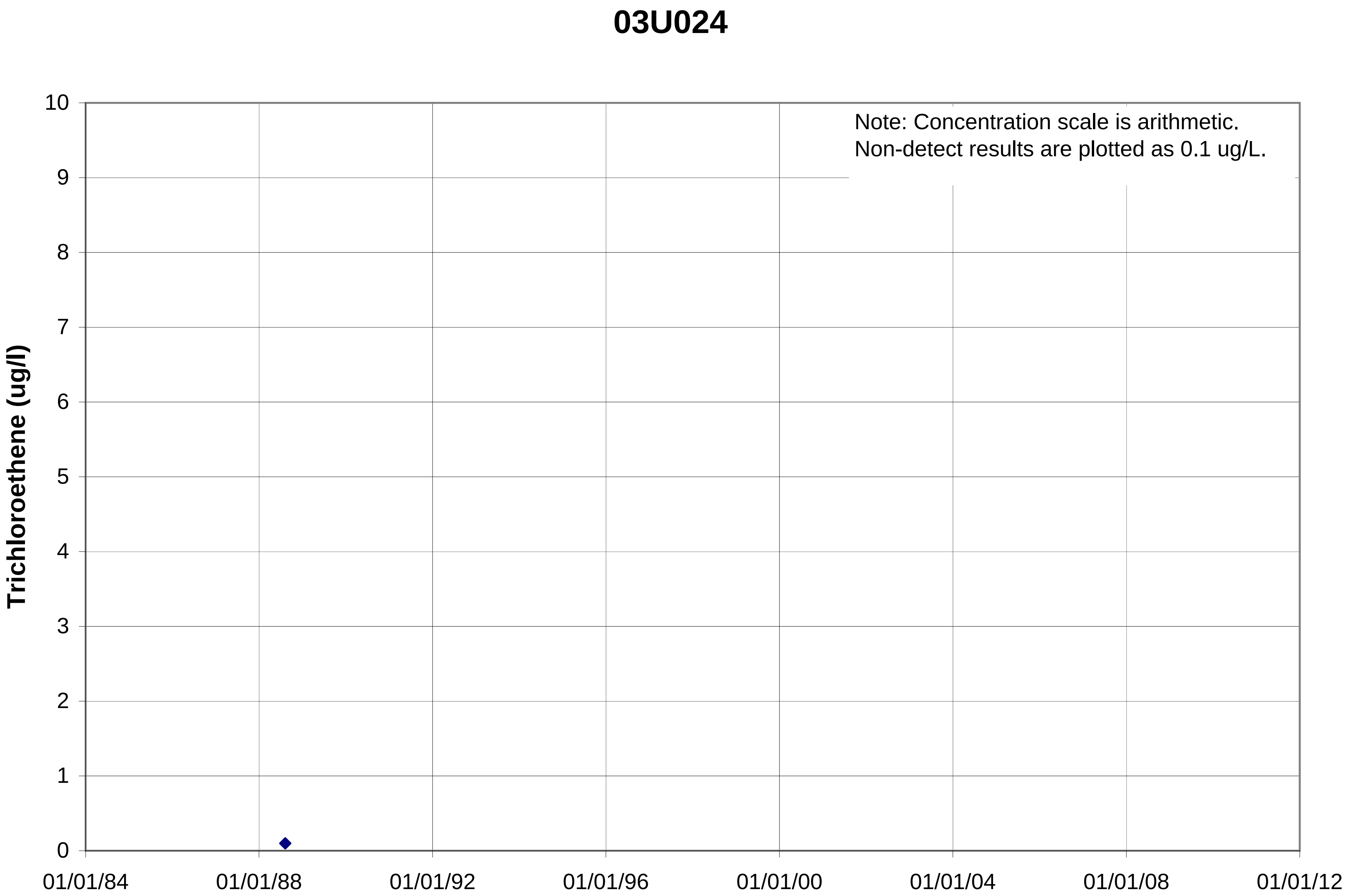
# 03U023




**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

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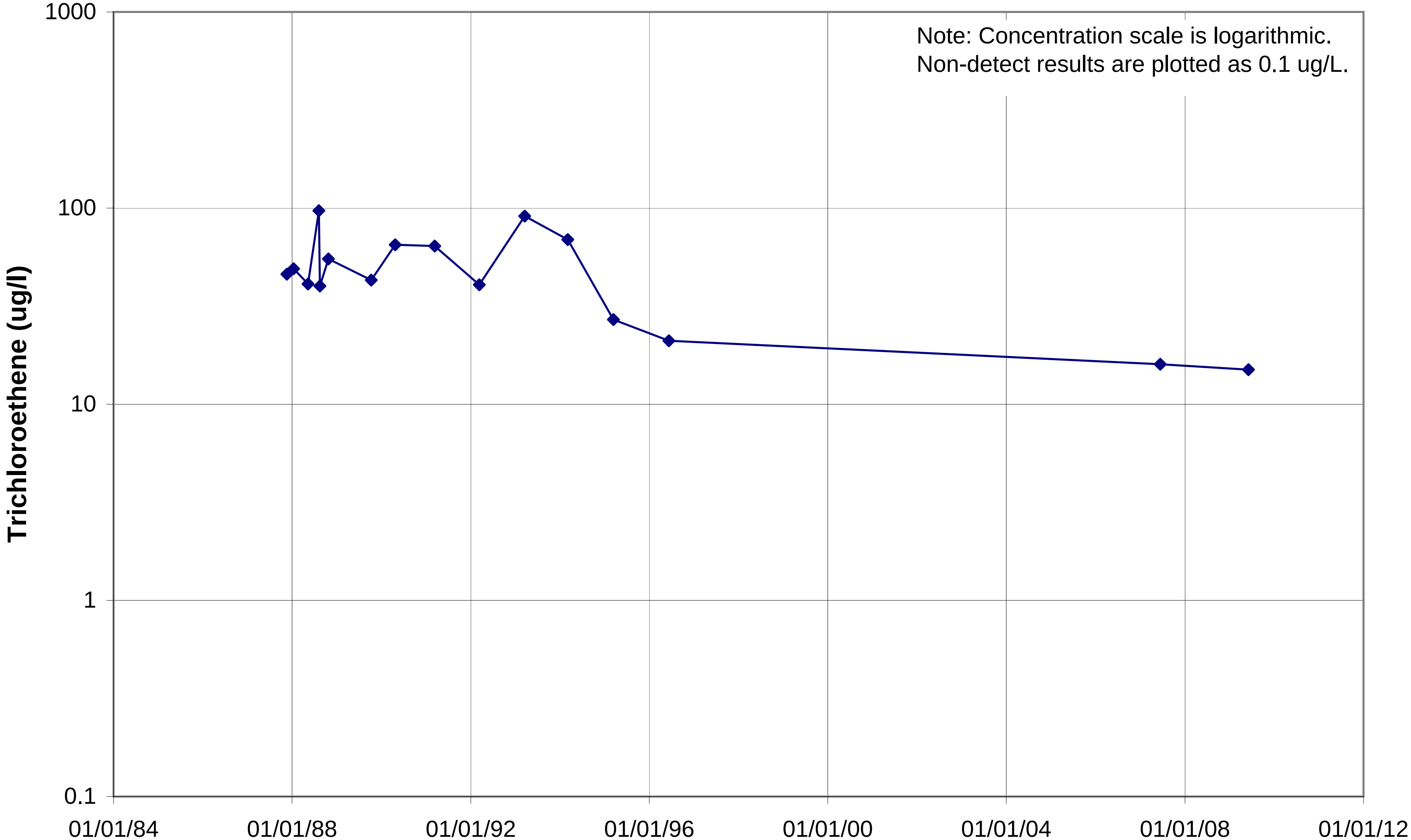
# 03U027

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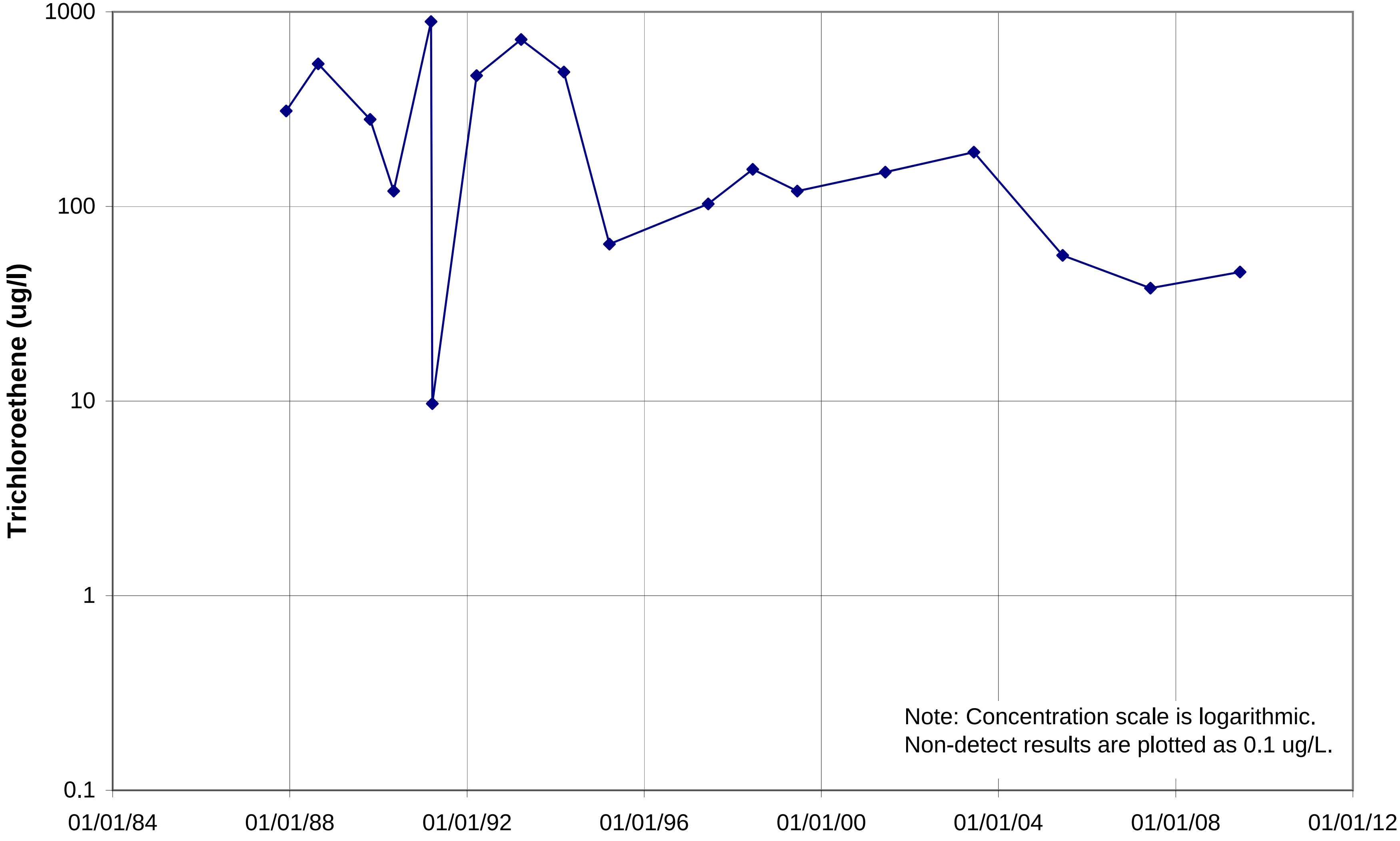
# 03U028




**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

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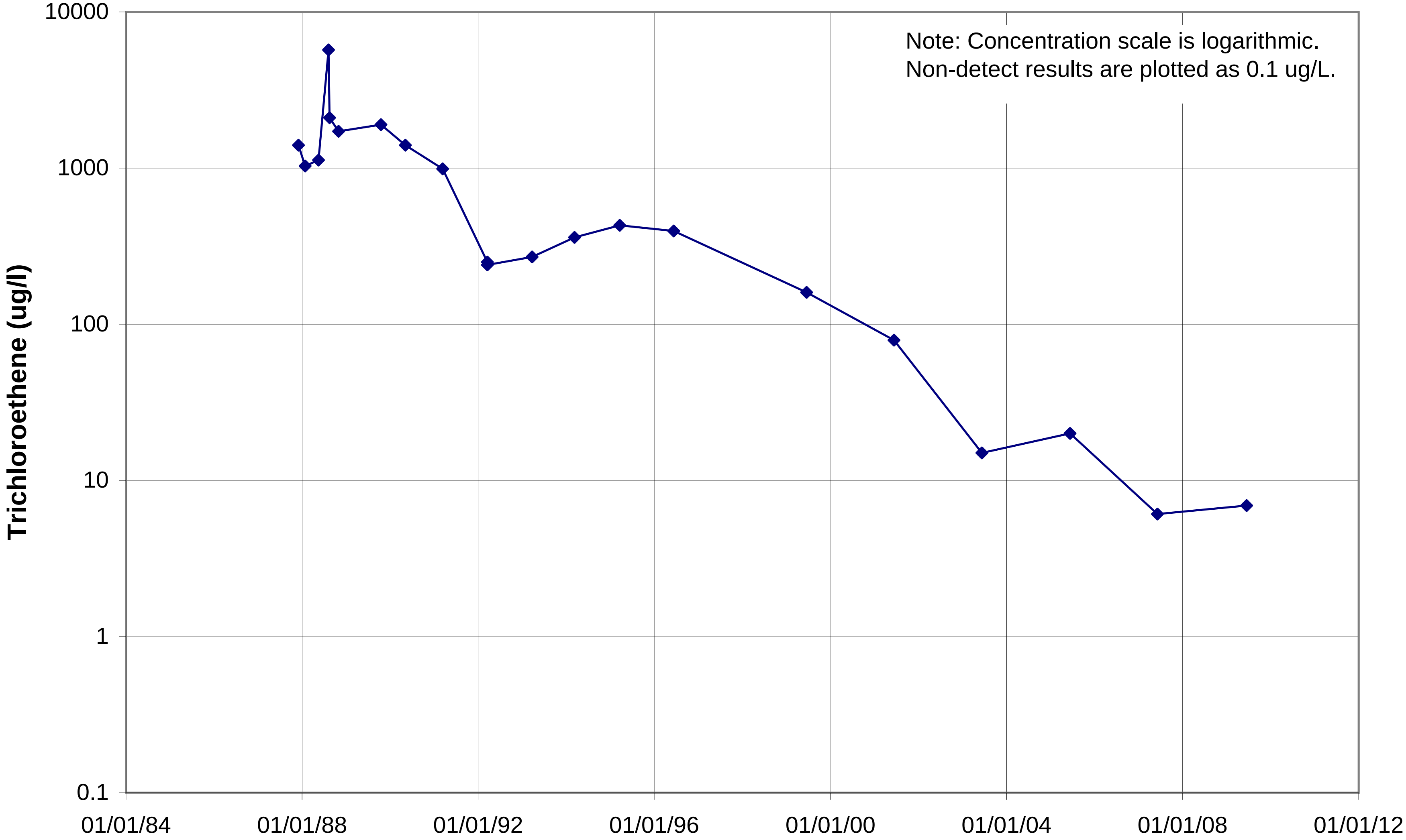


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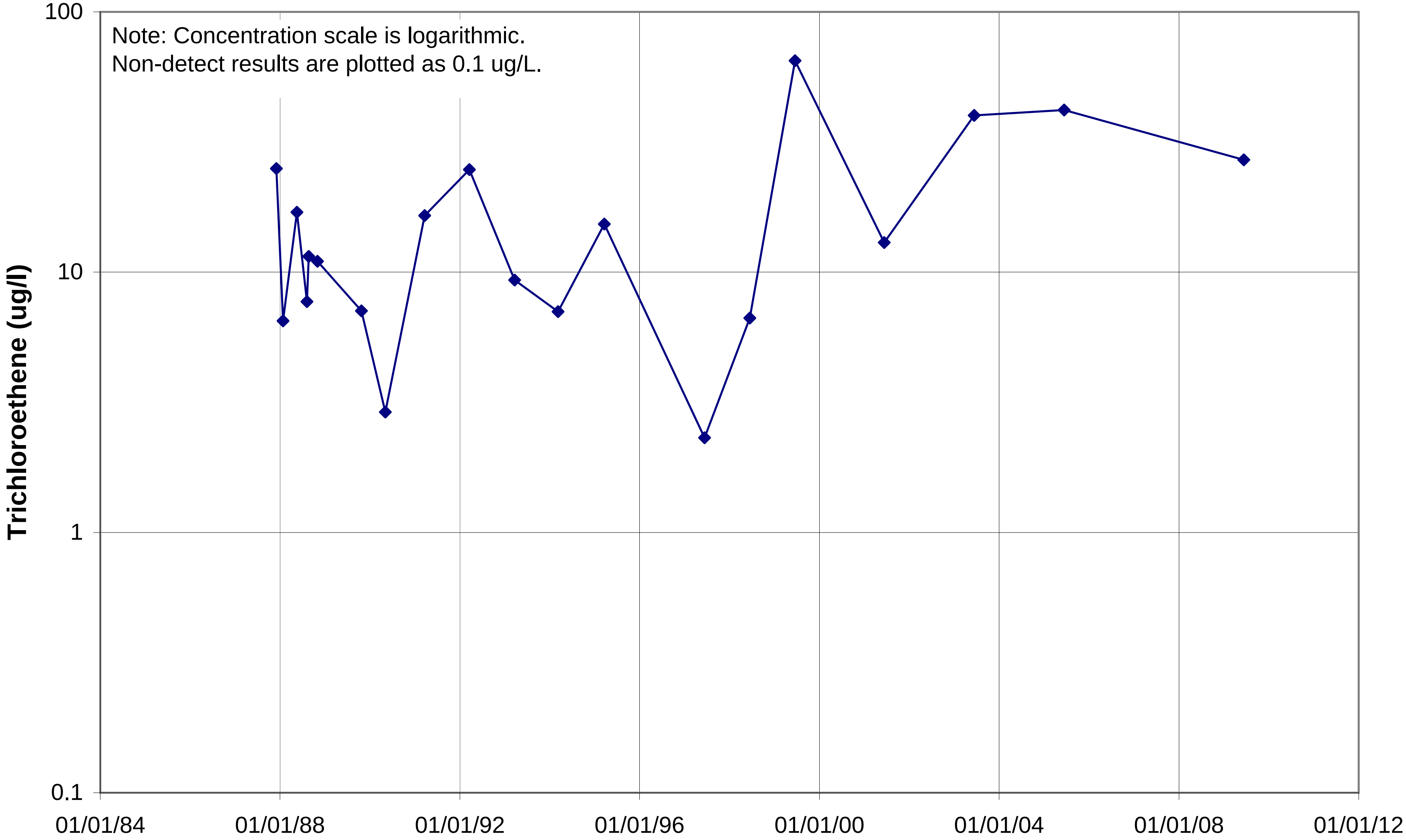


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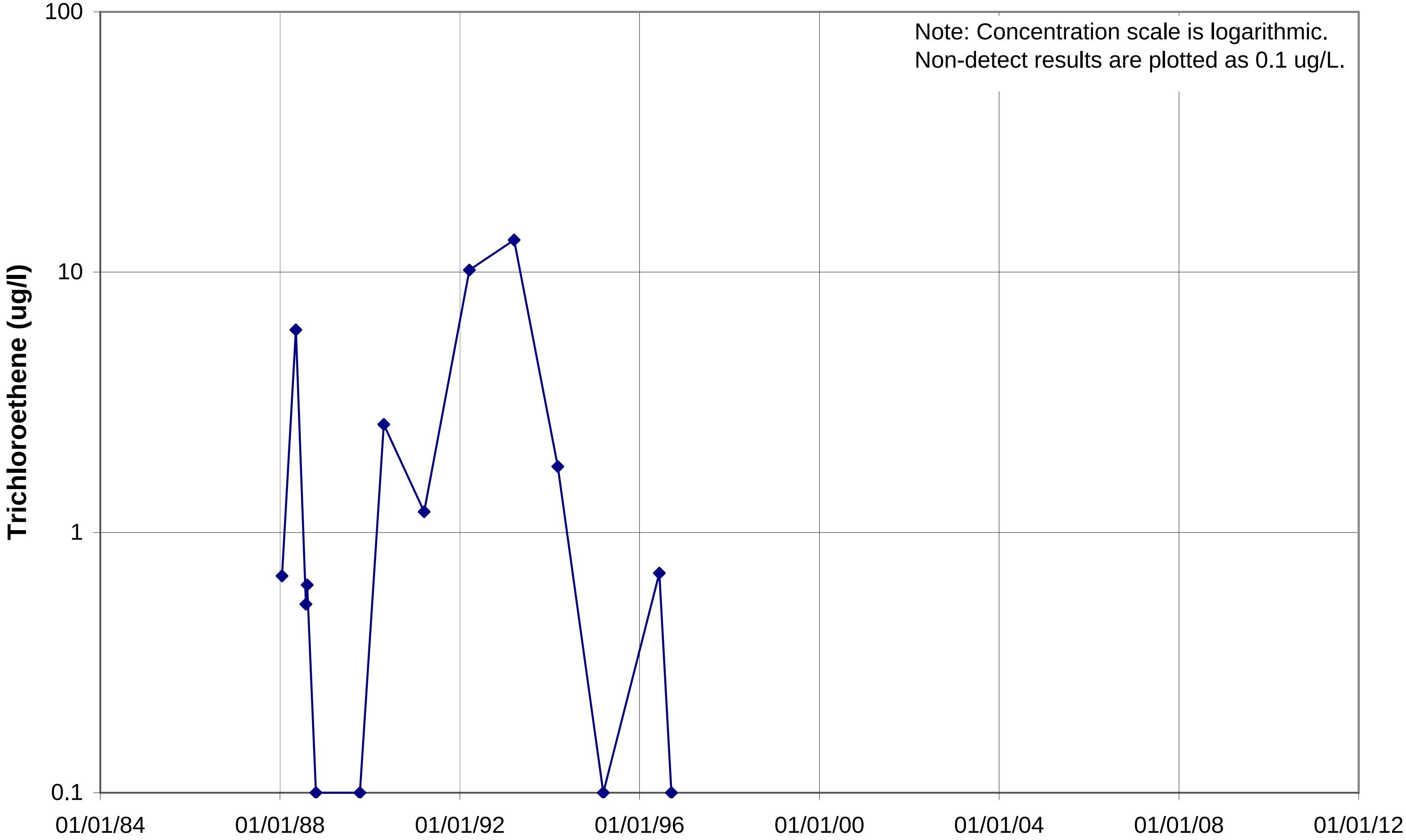
# 03U031

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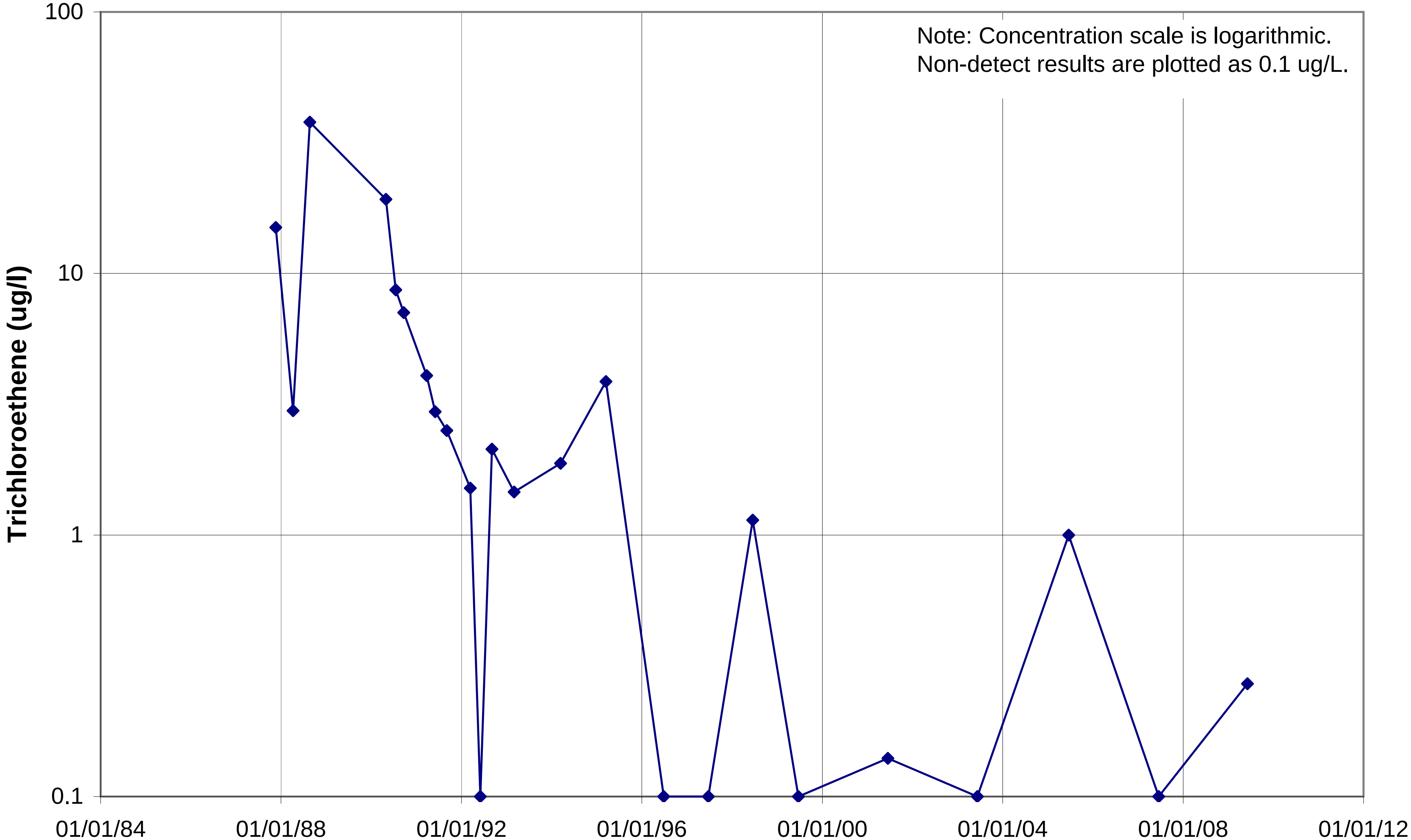
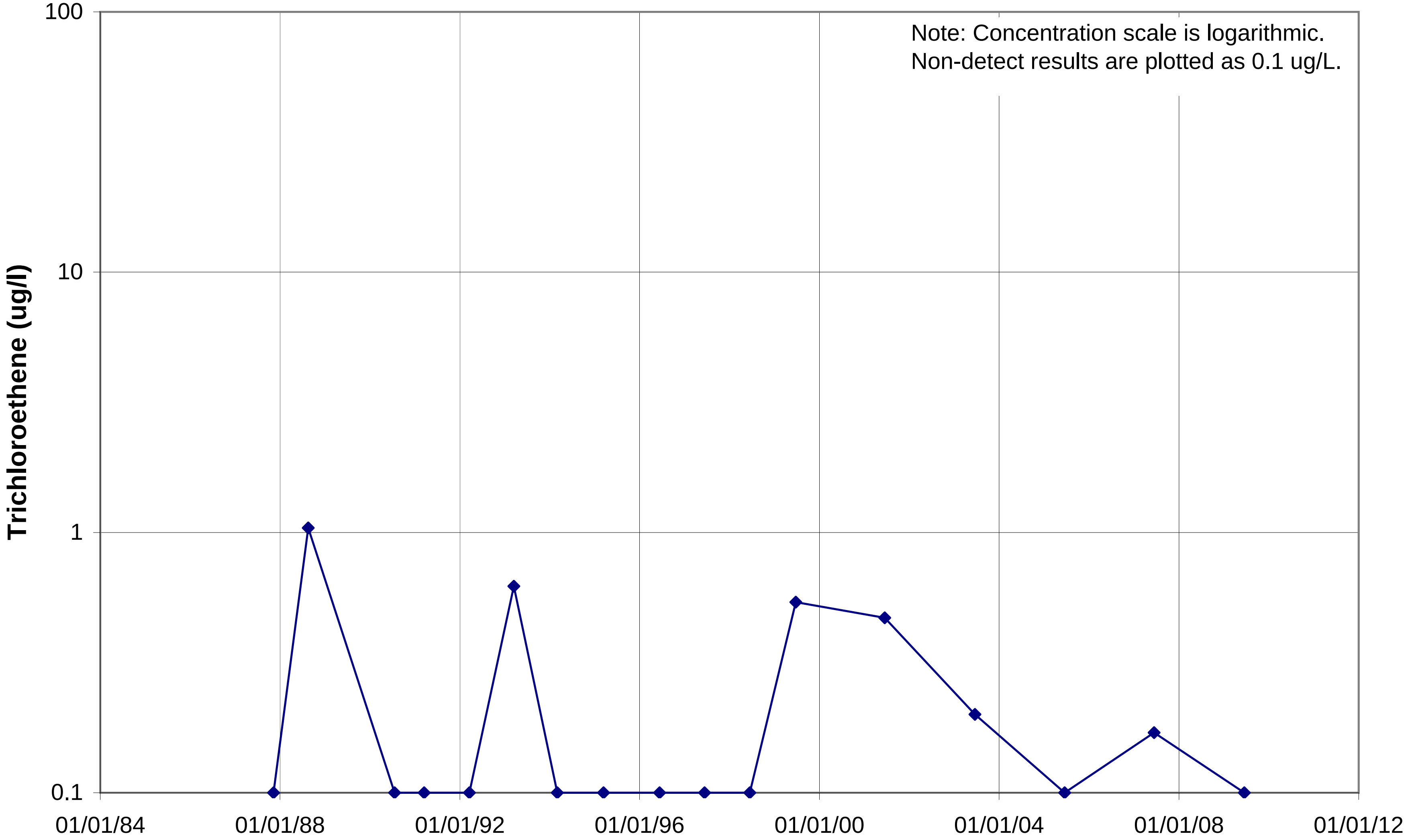
# 03U032



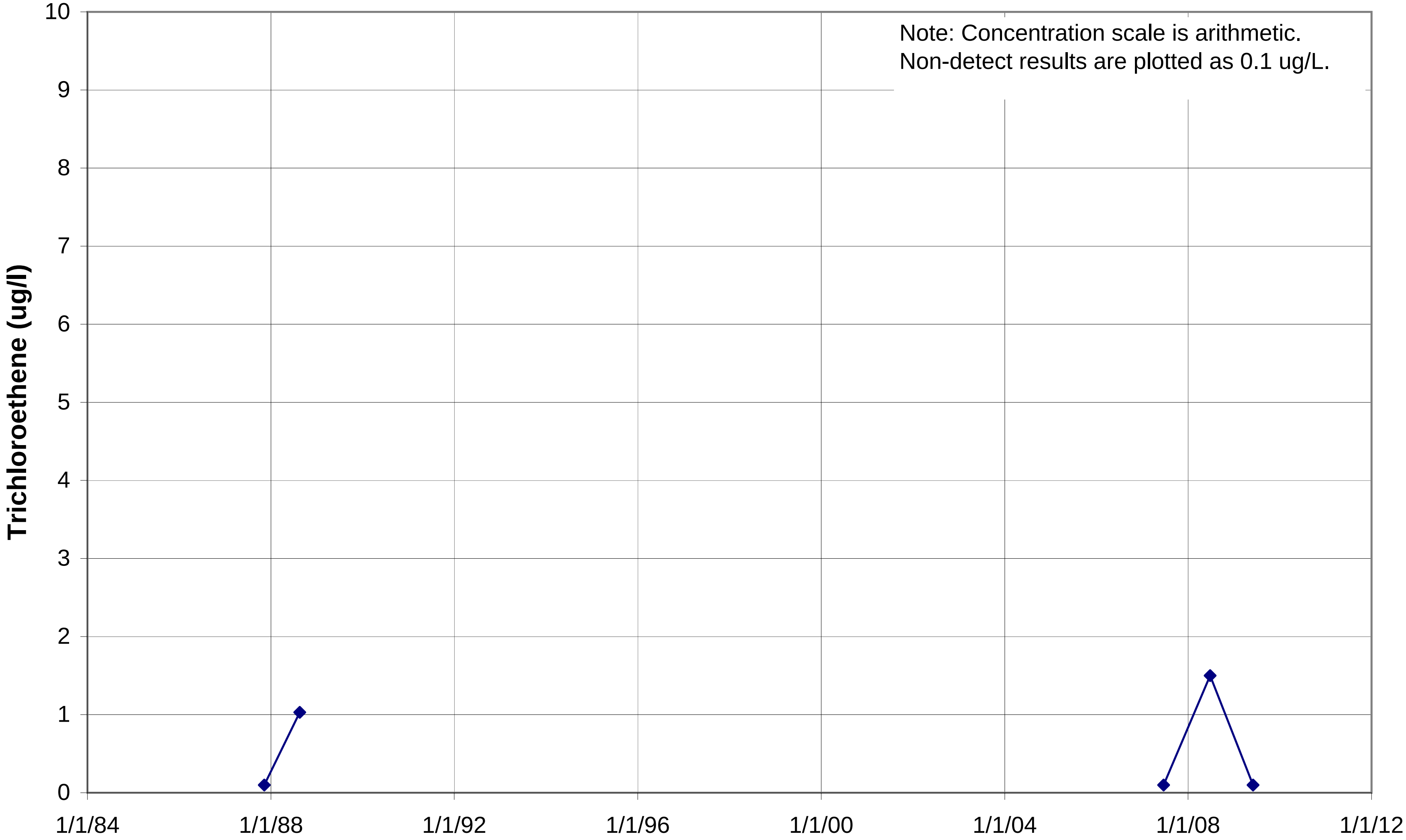

**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 03U075



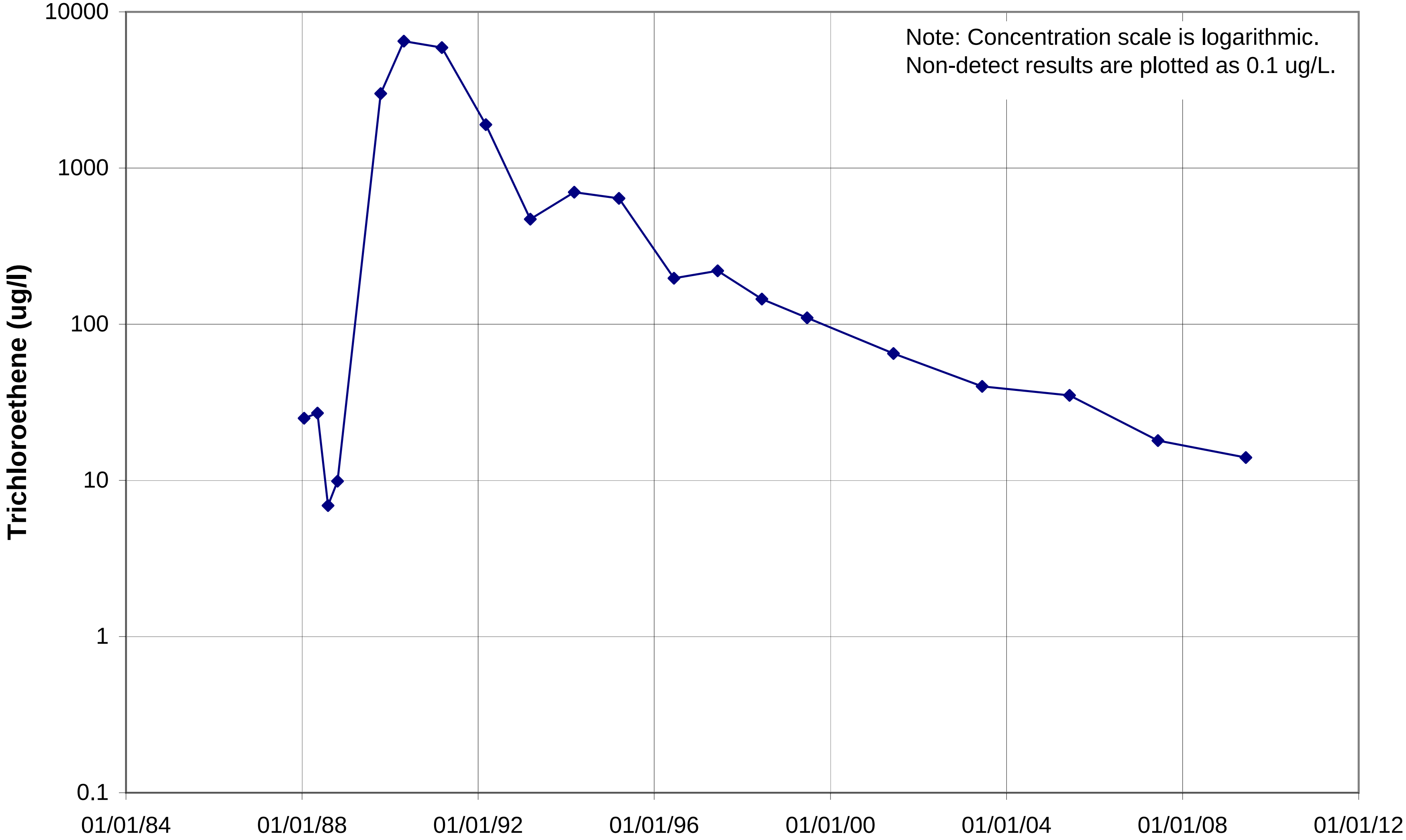

**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 03U076

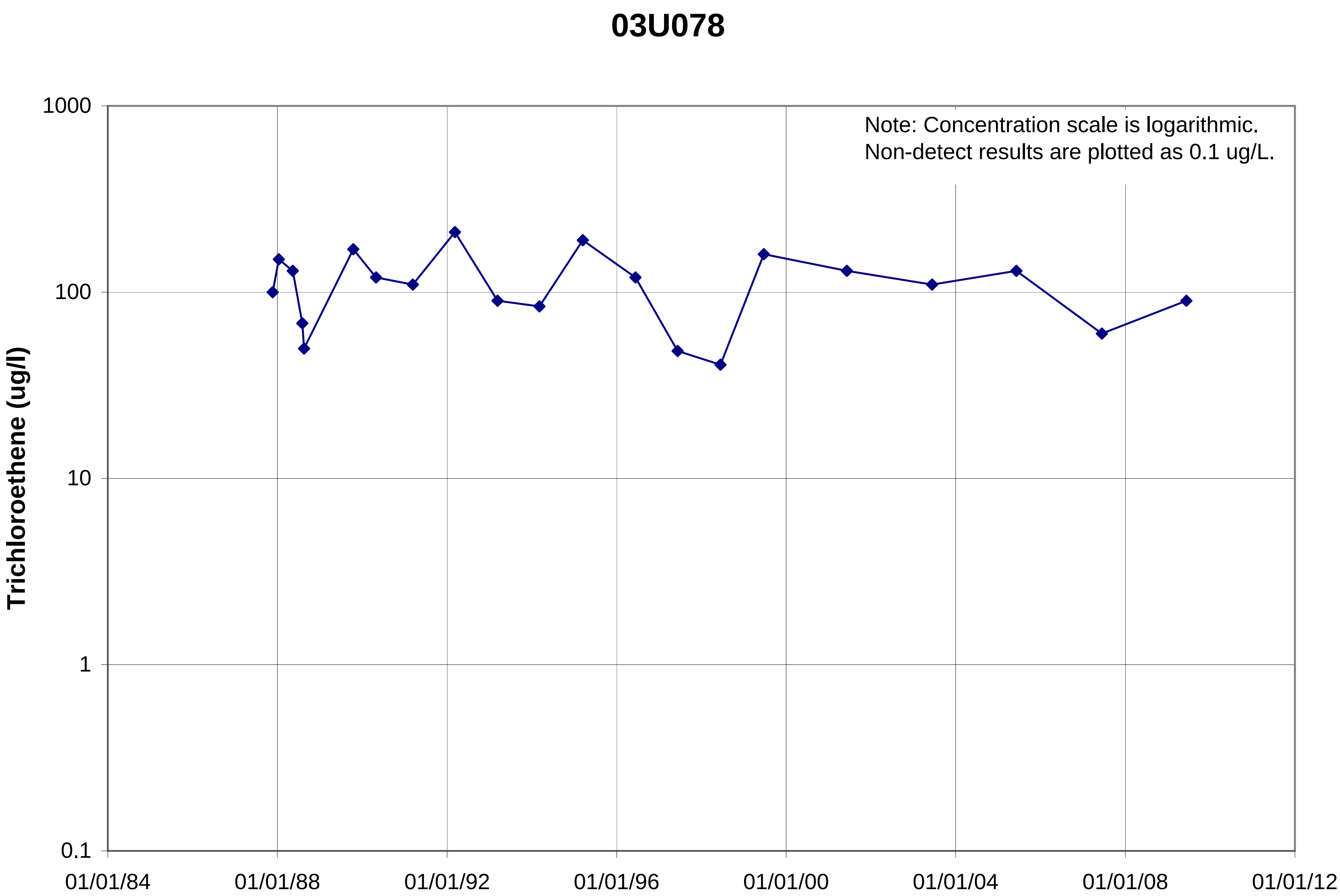



**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 03U077




**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

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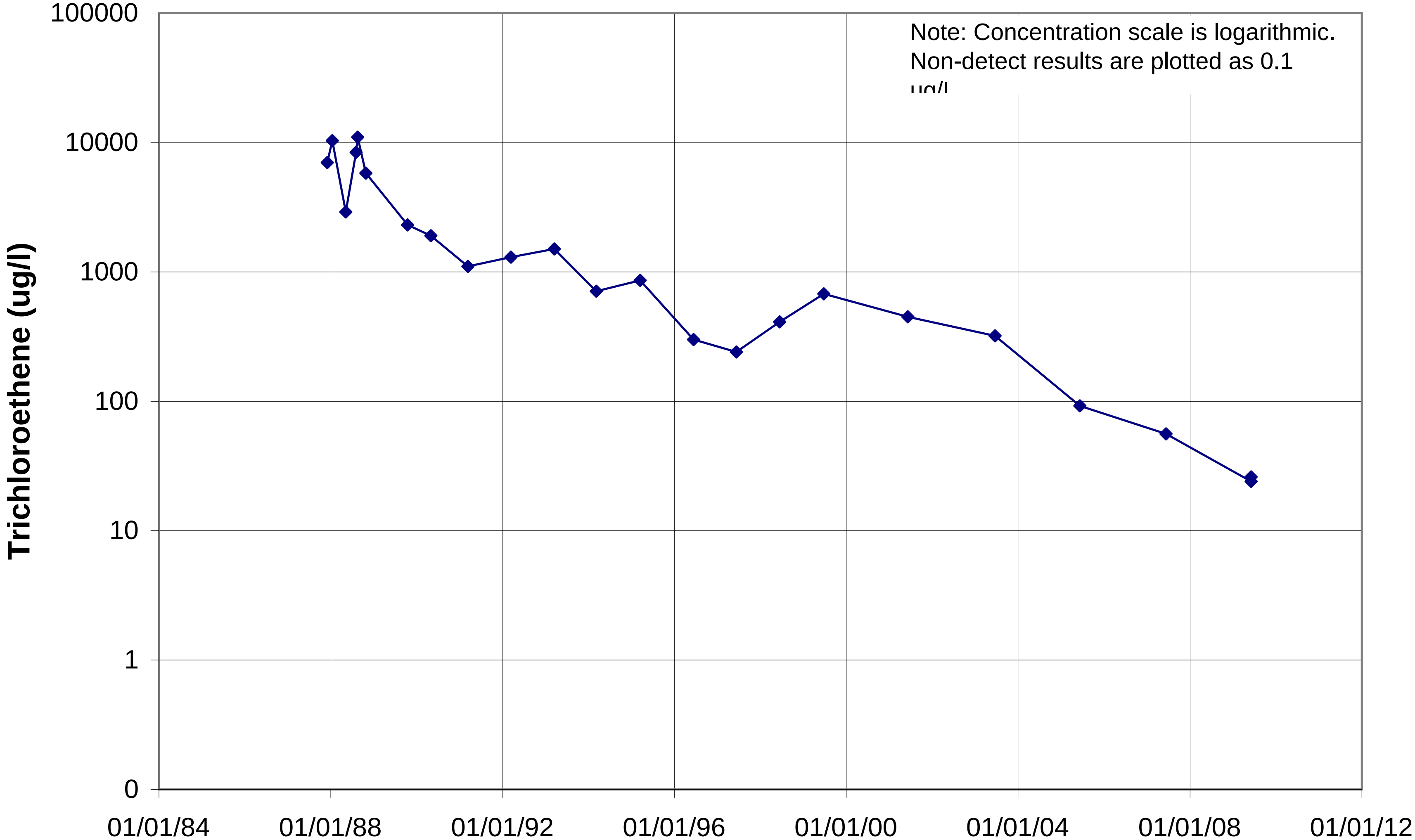
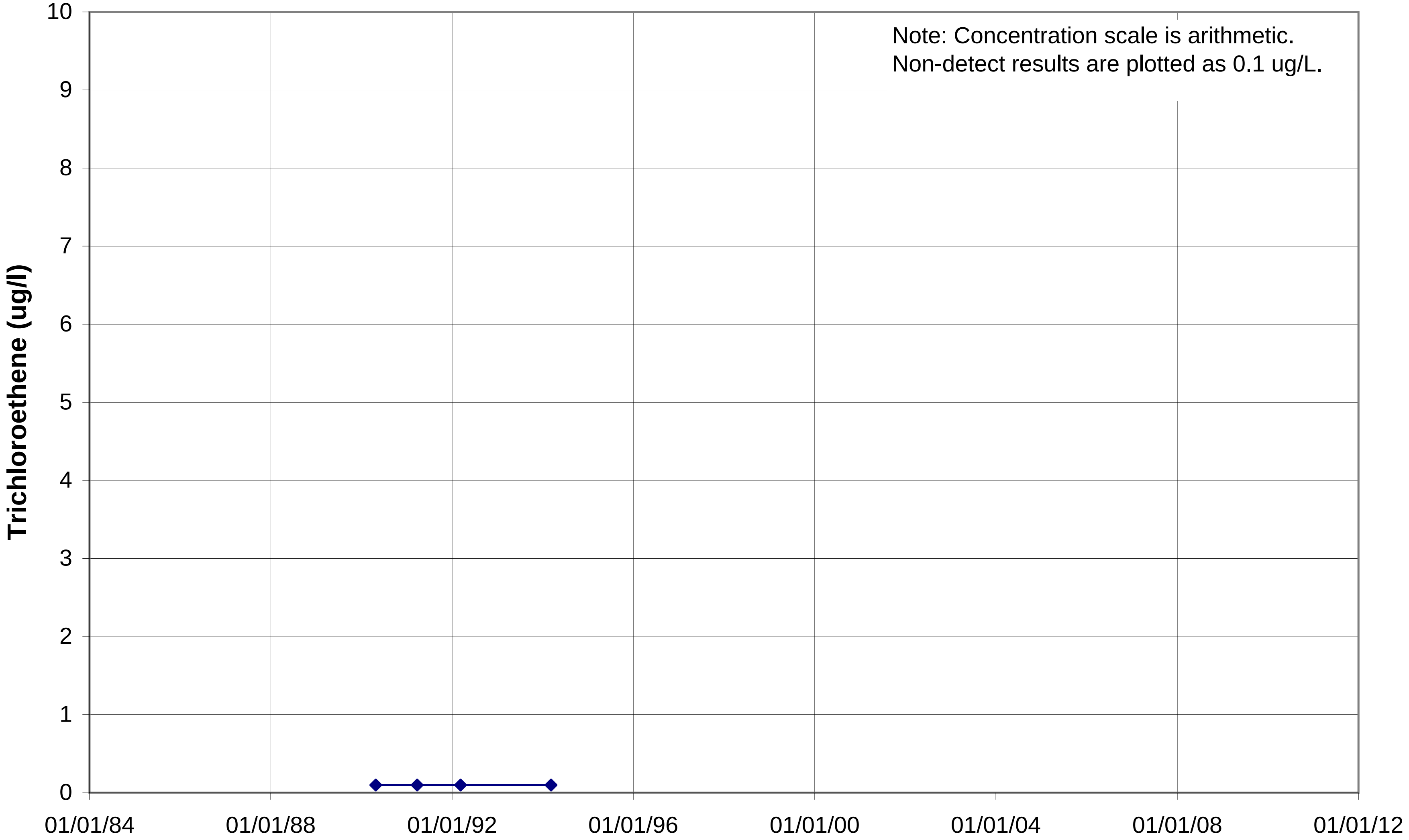
# 03U079



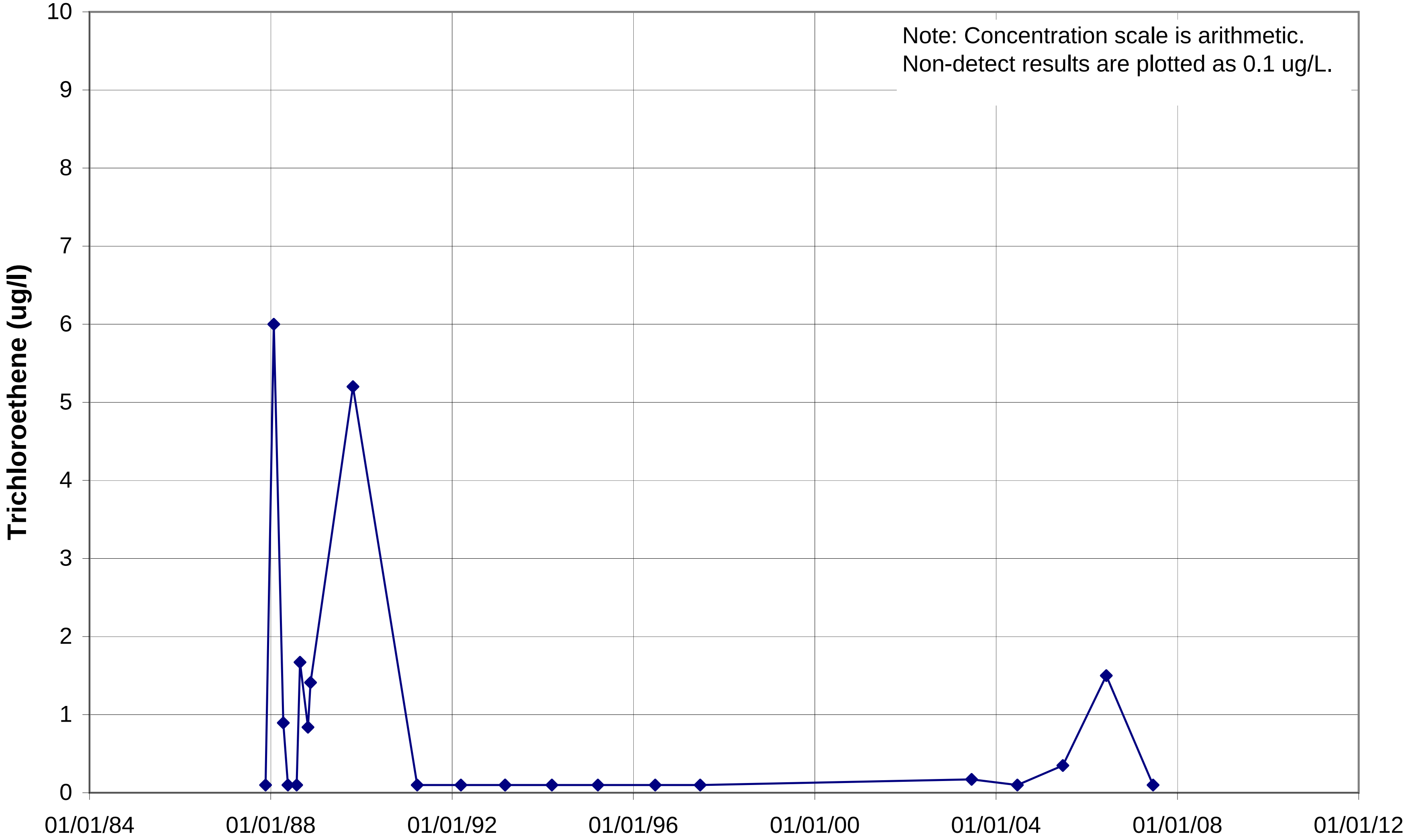

**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 03U082



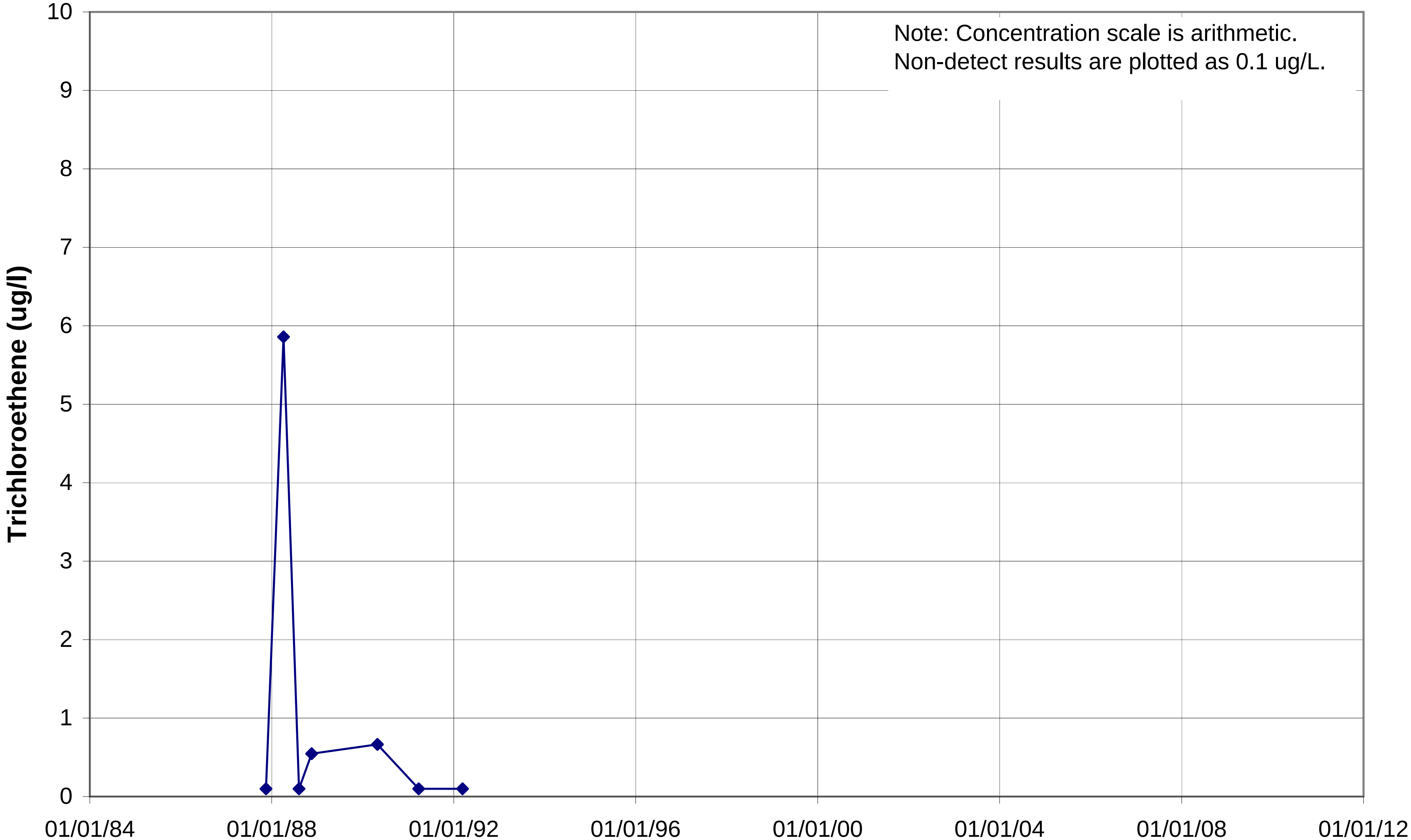

**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 03U087



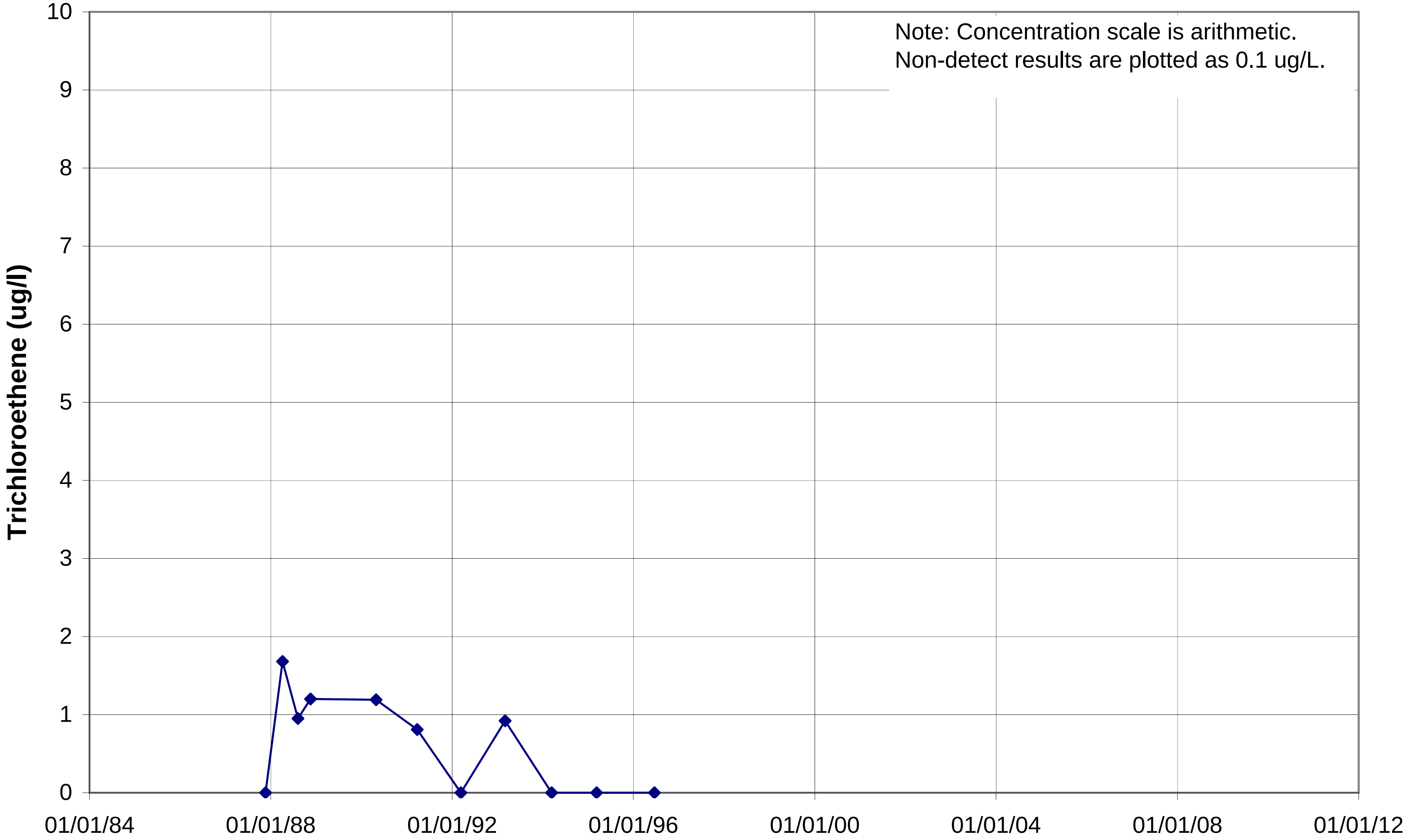

**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 03U088



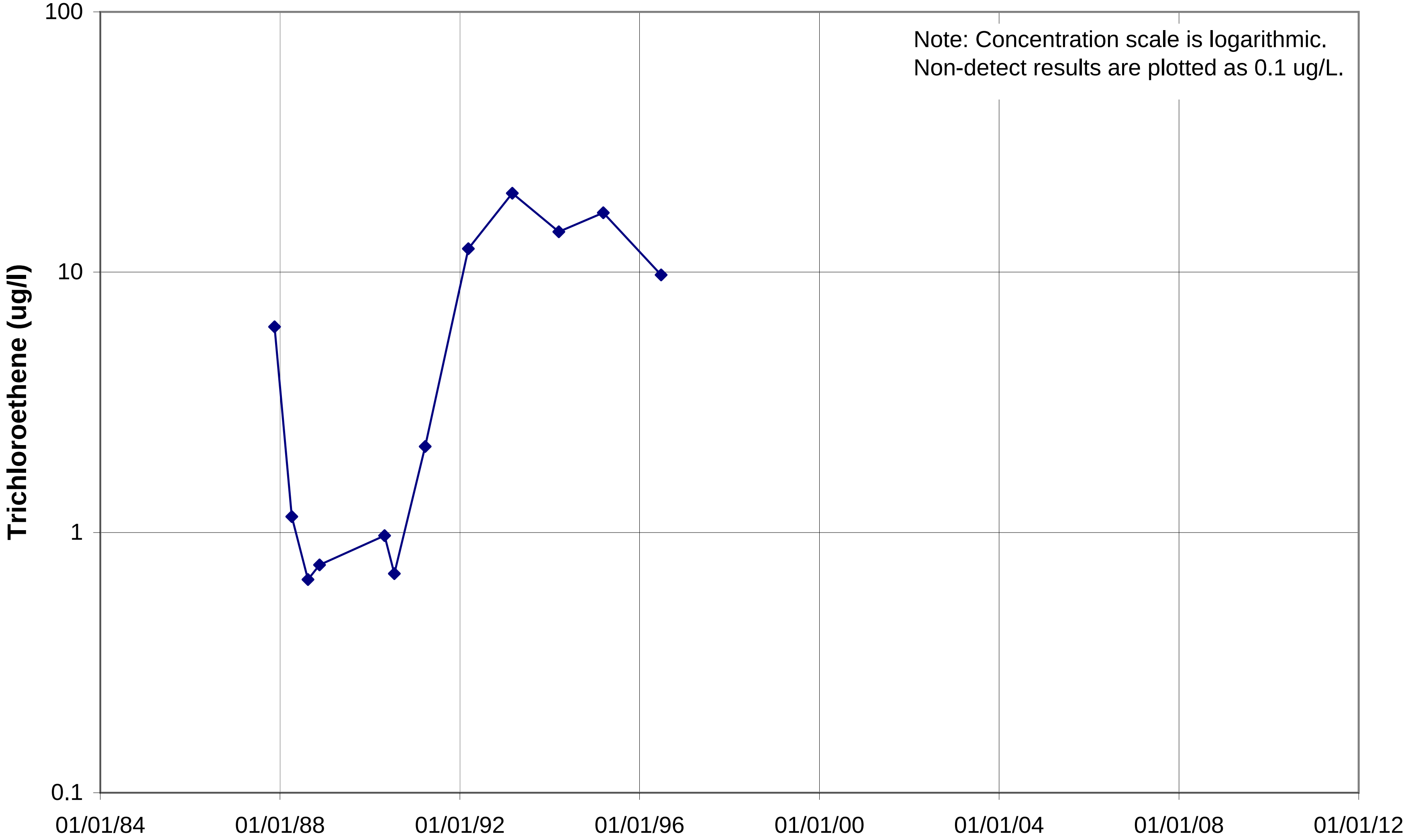

**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 03U089

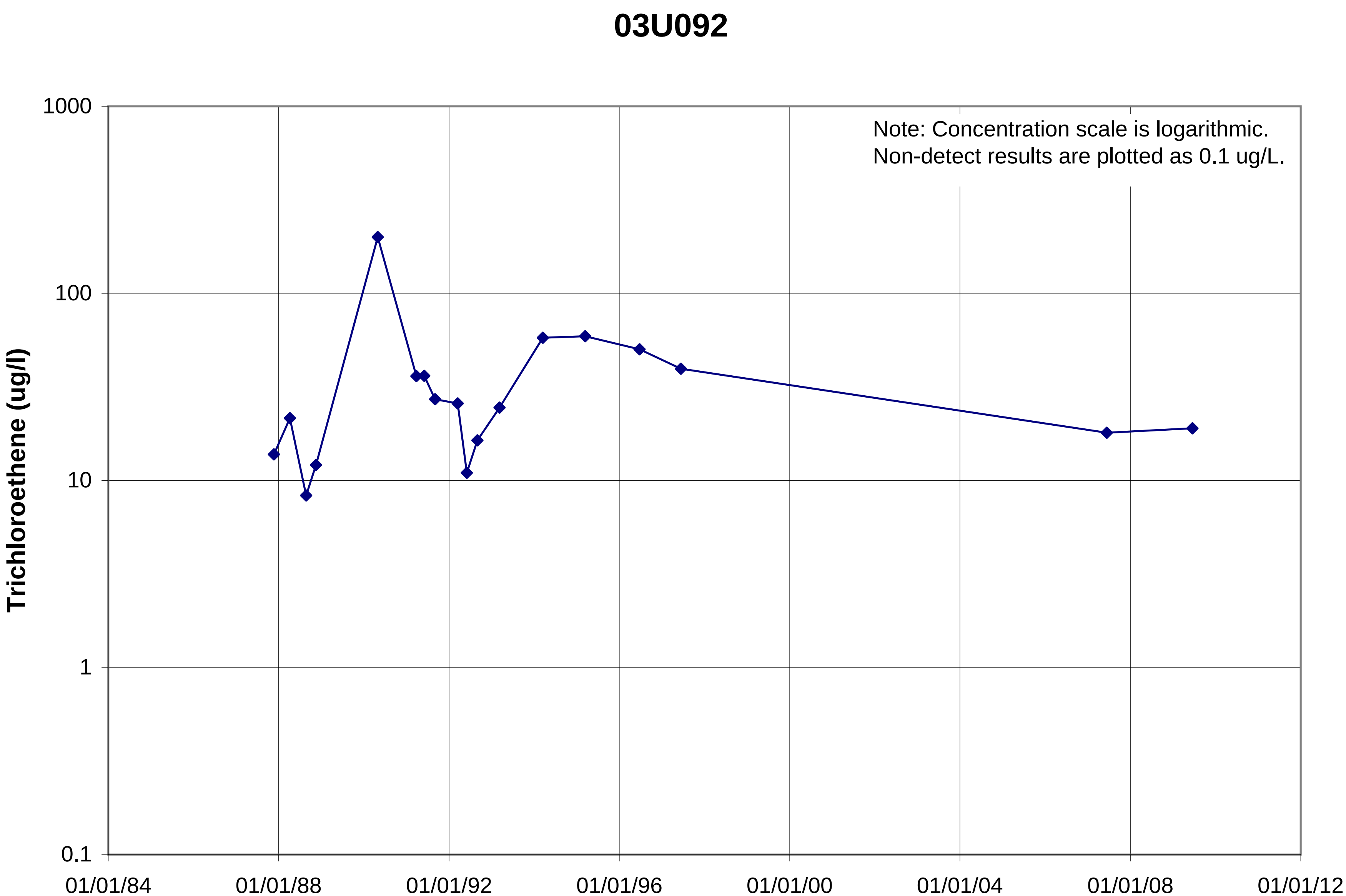



**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 03U090




**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar




**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

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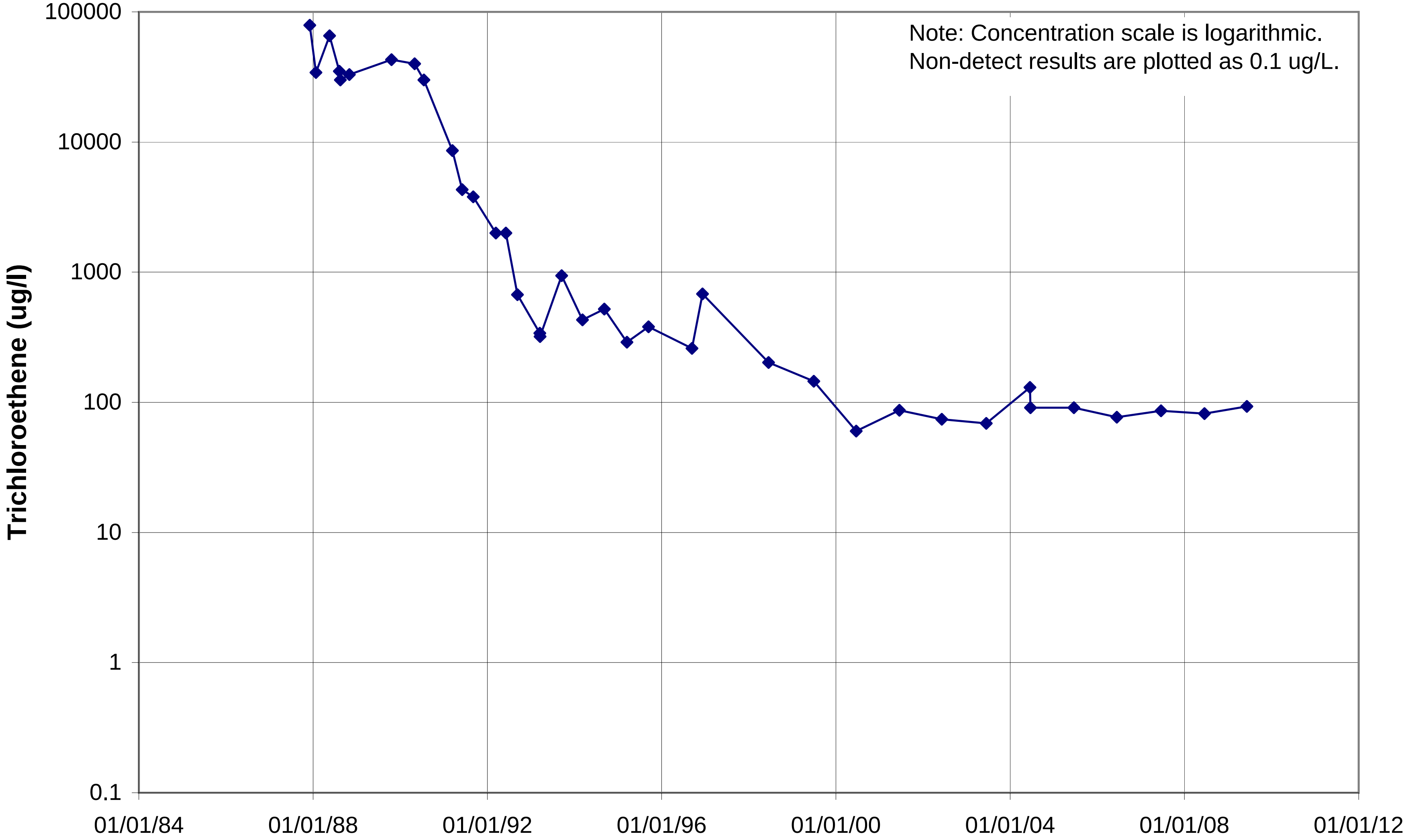


**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

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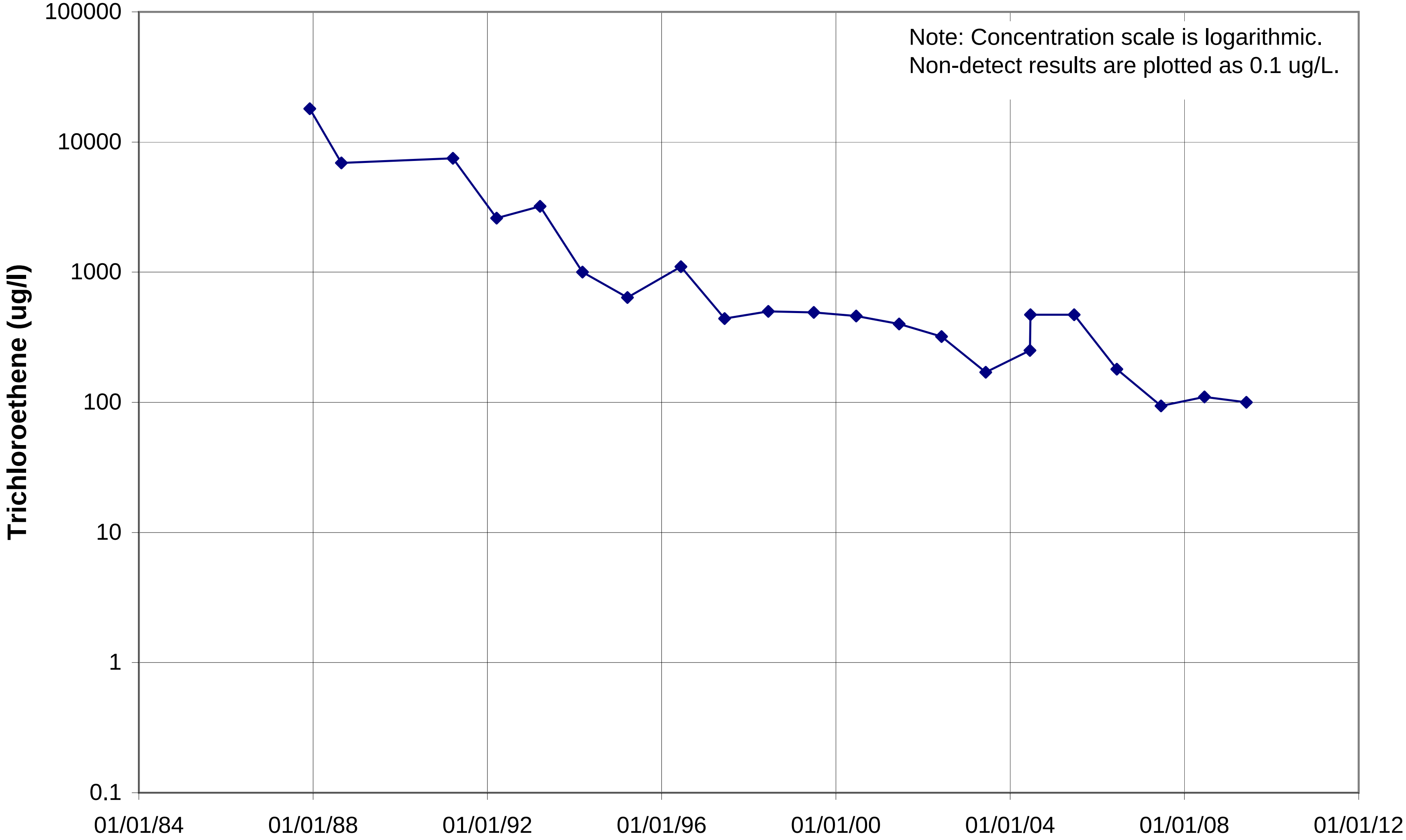


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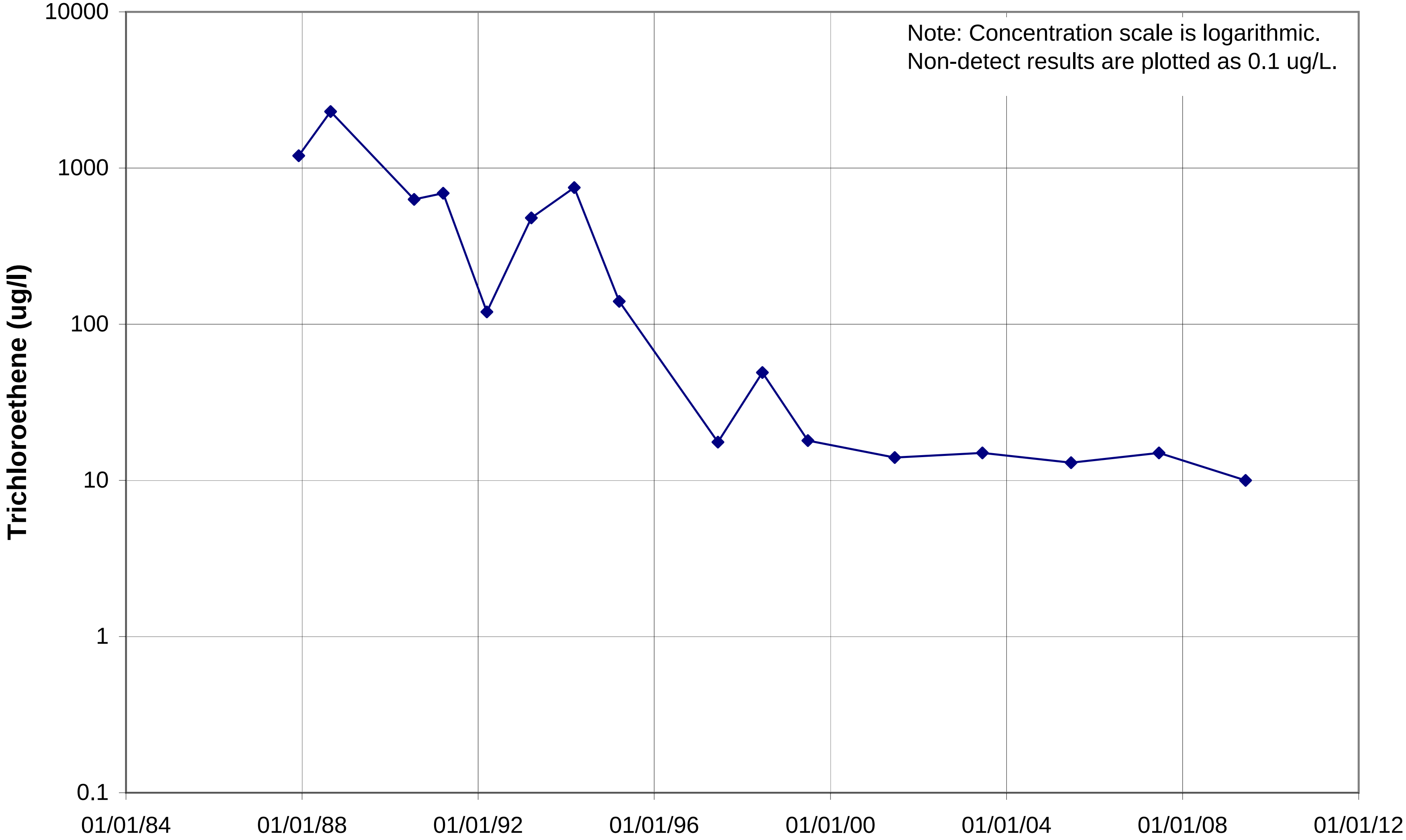


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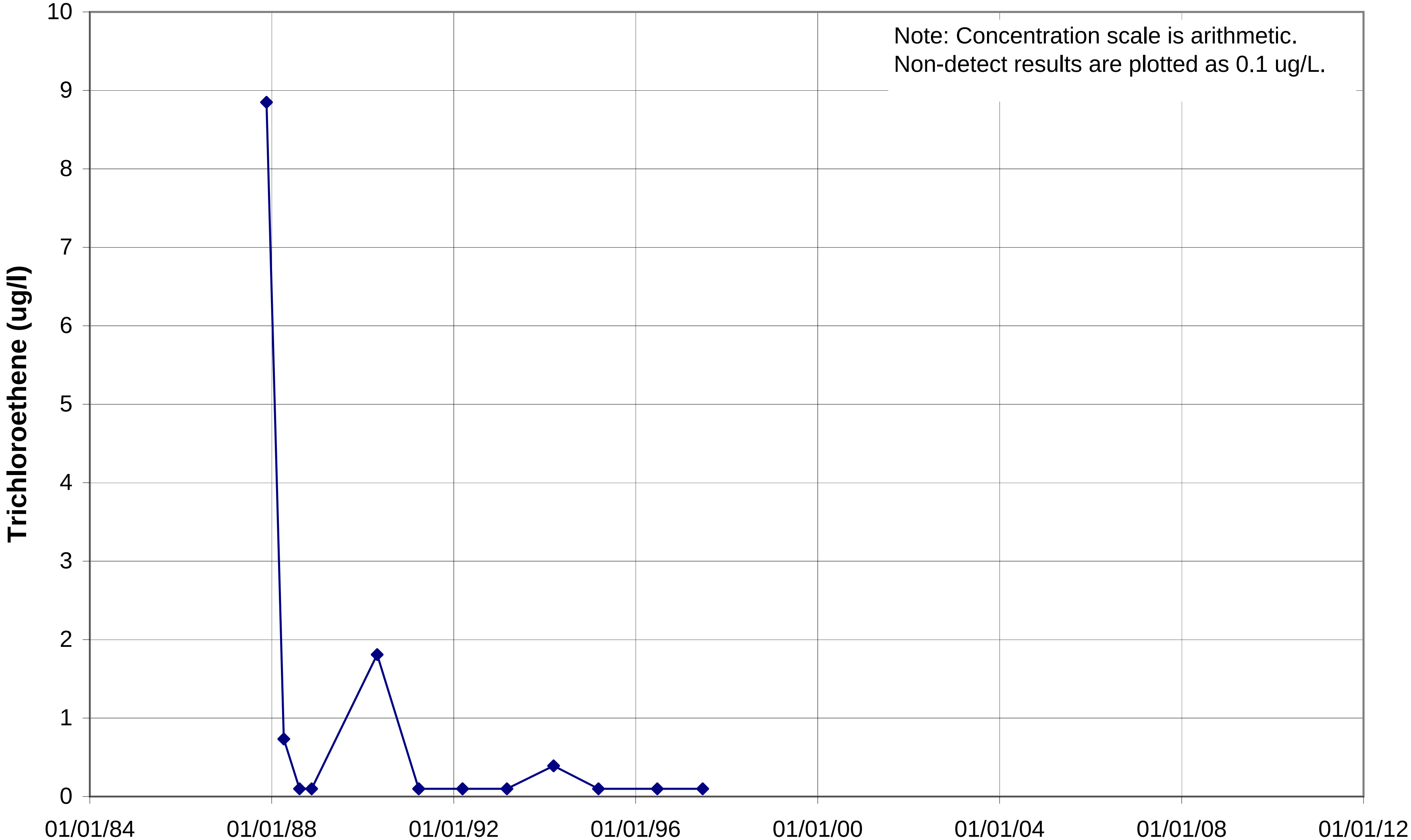


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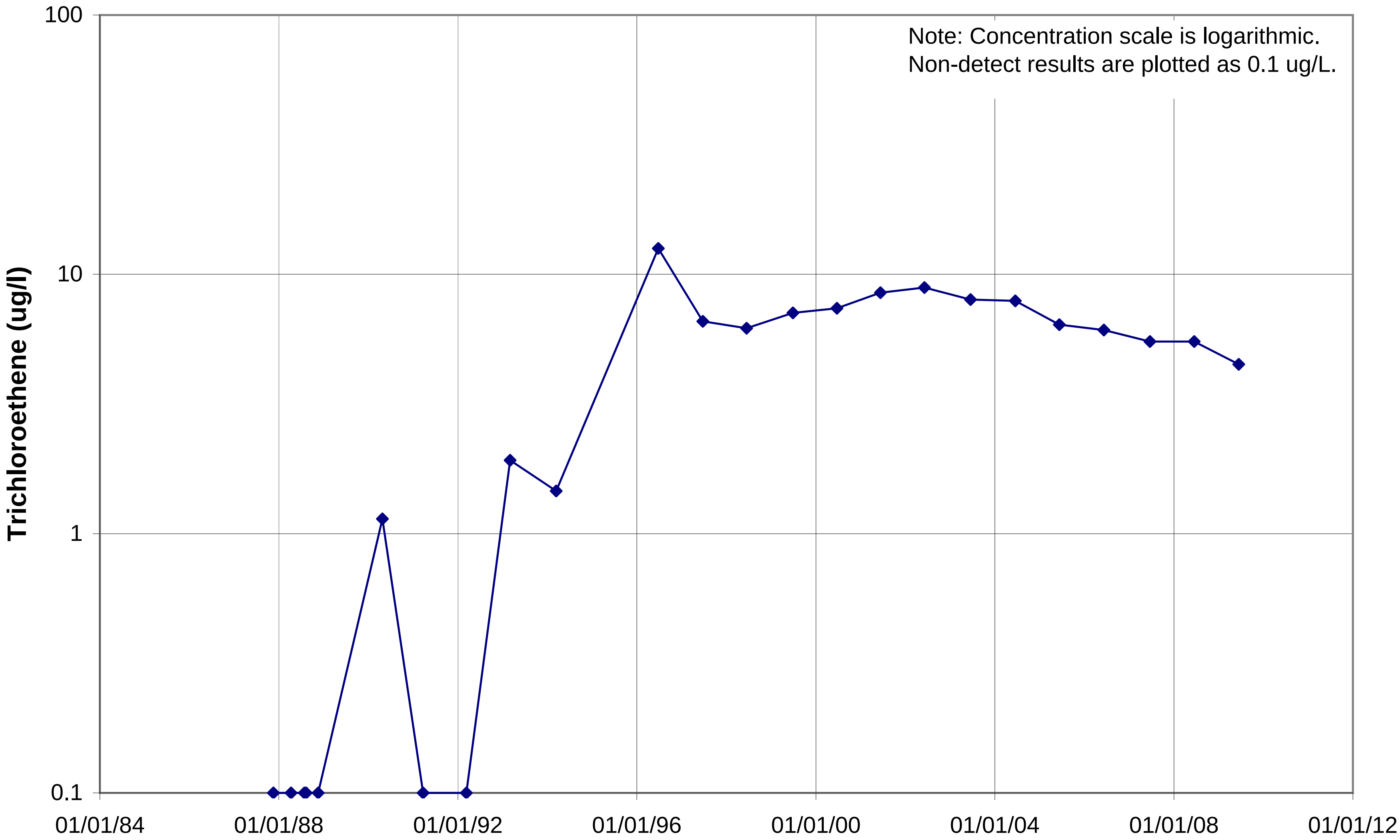


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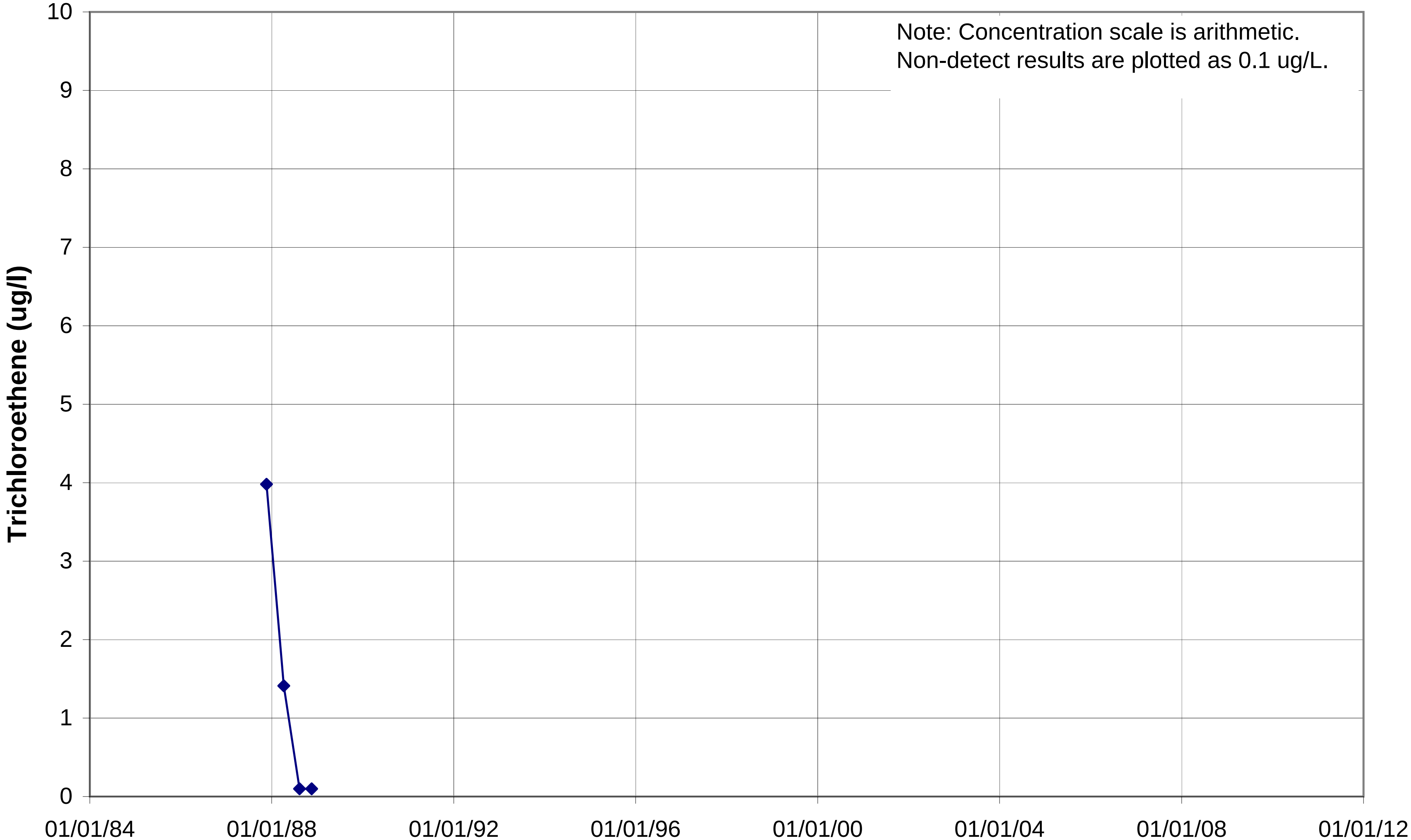


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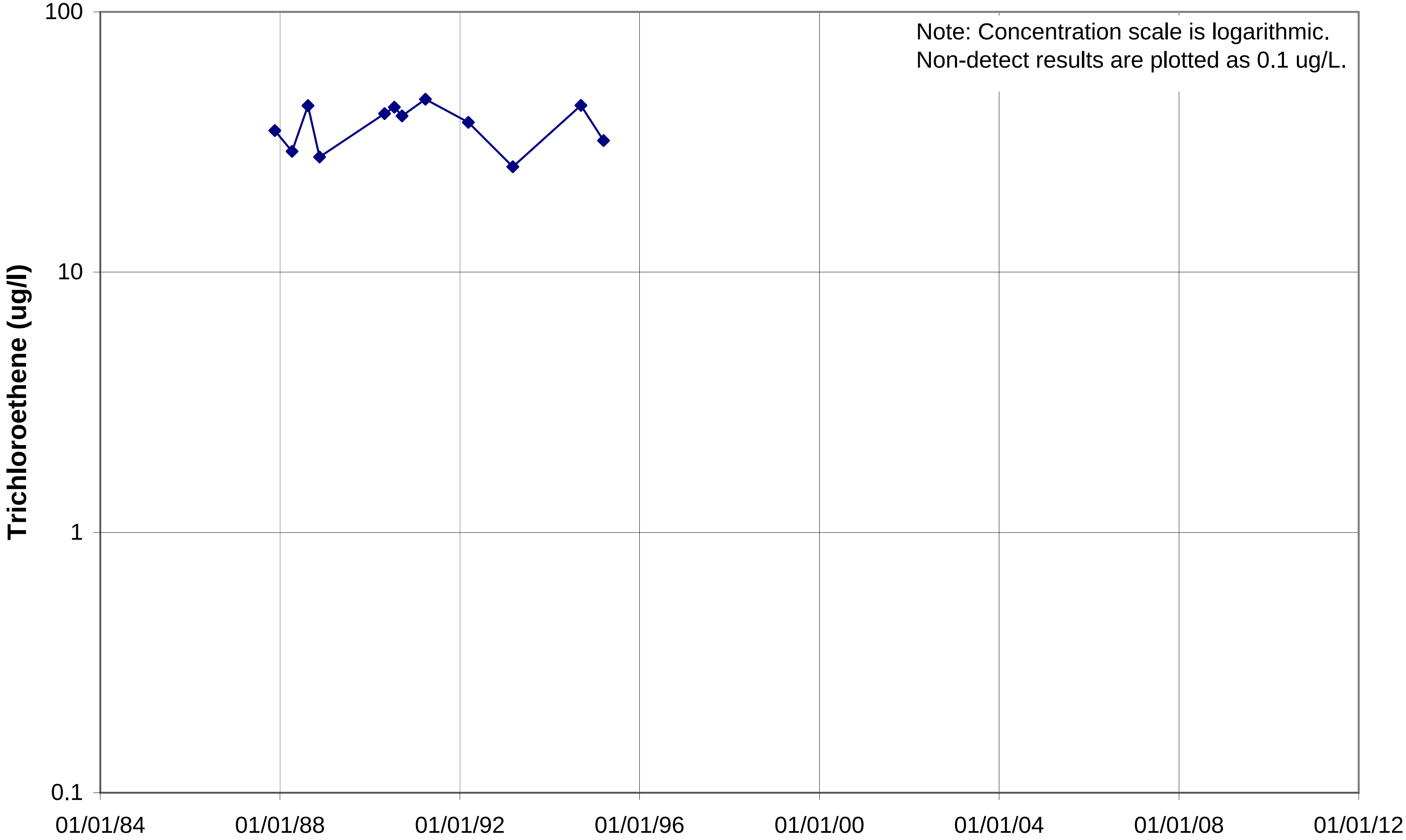


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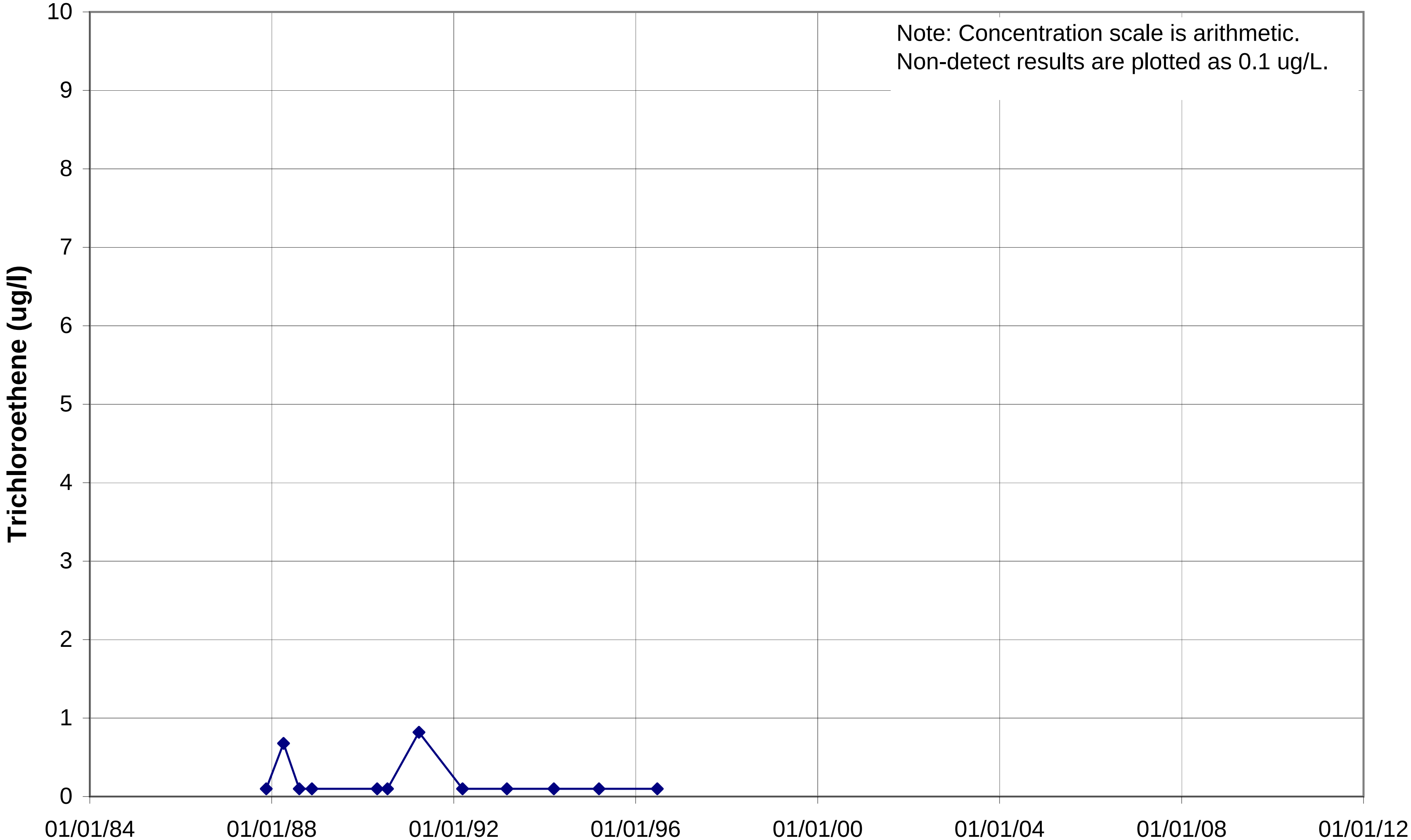
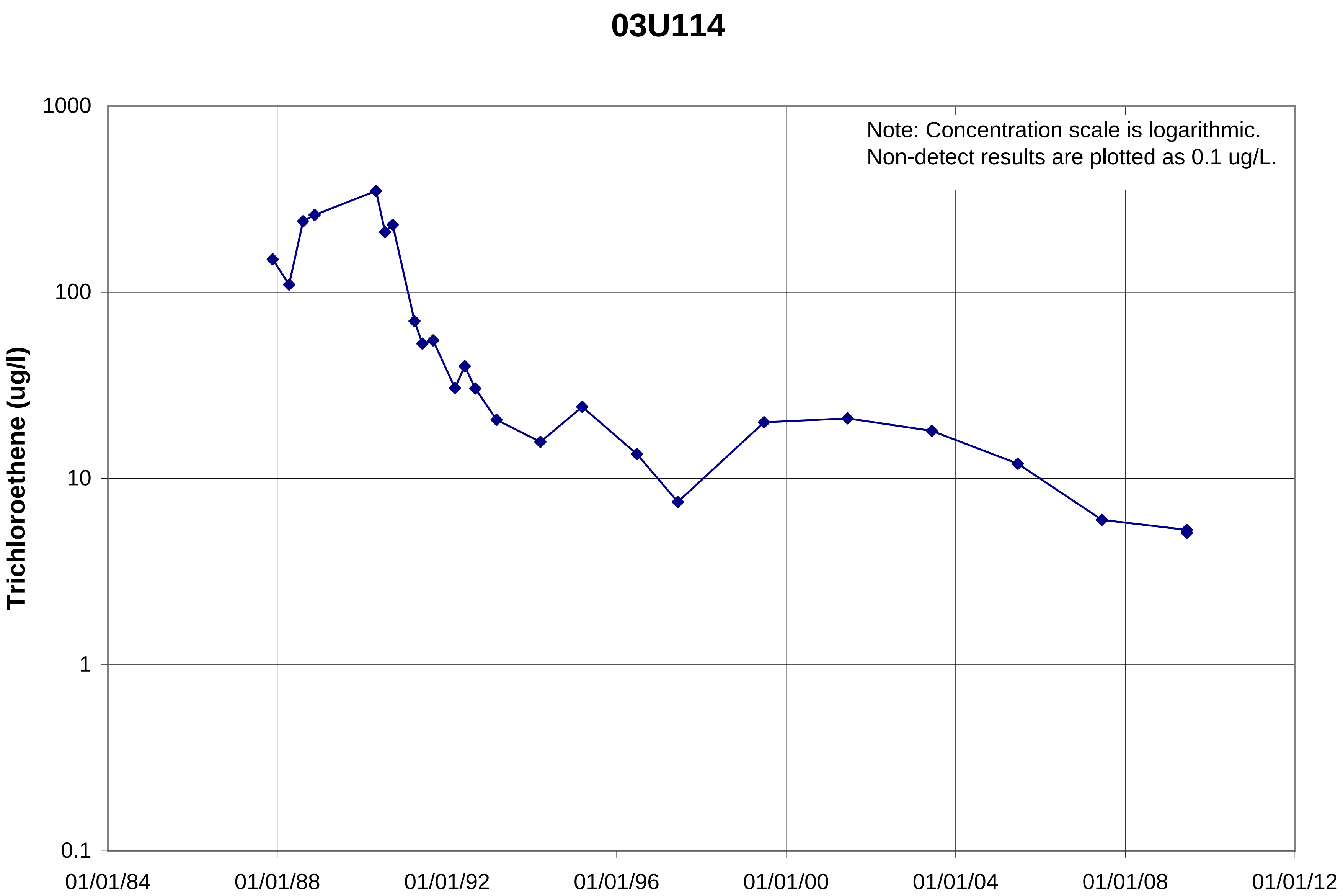
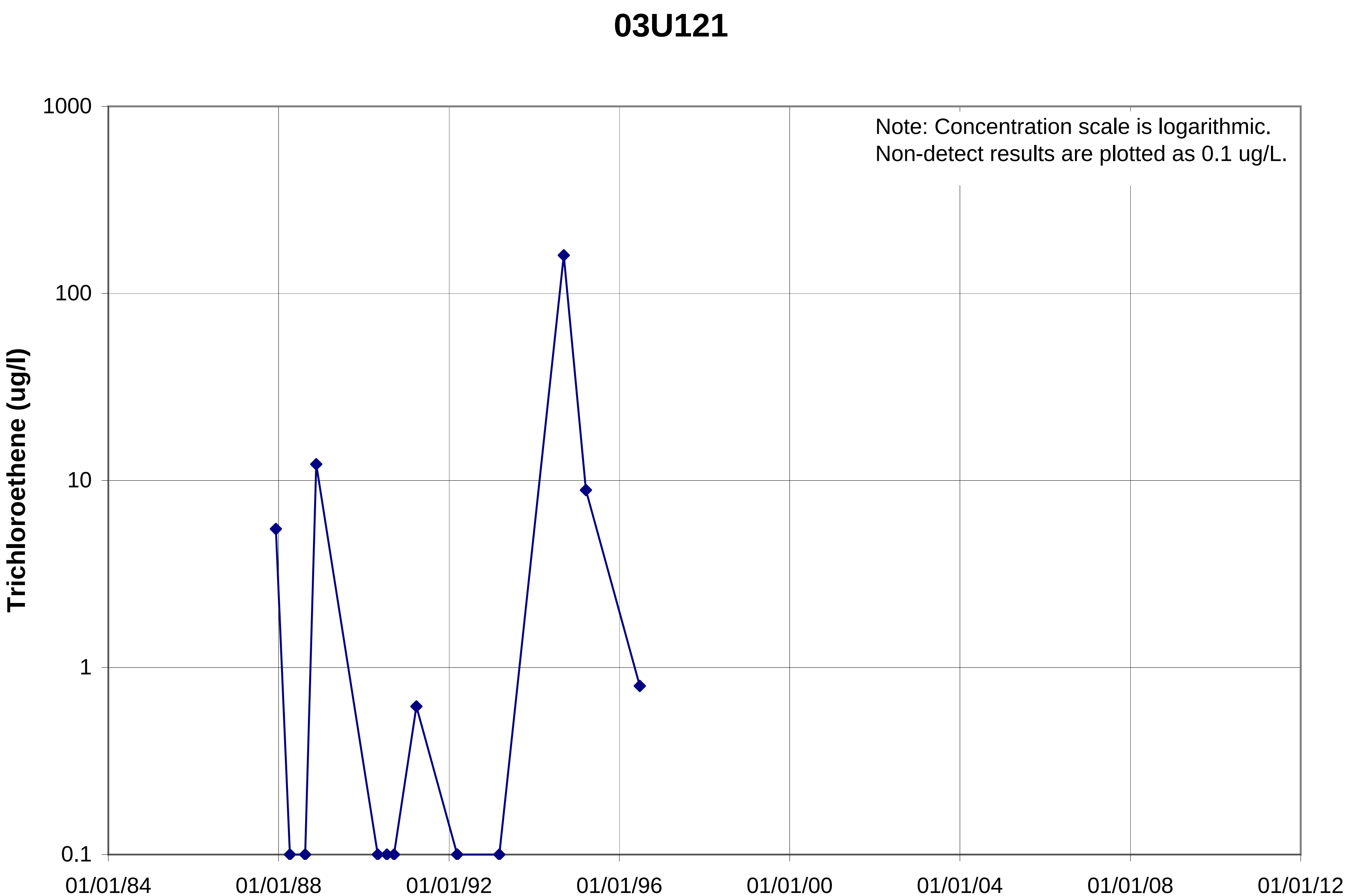



**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar




**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

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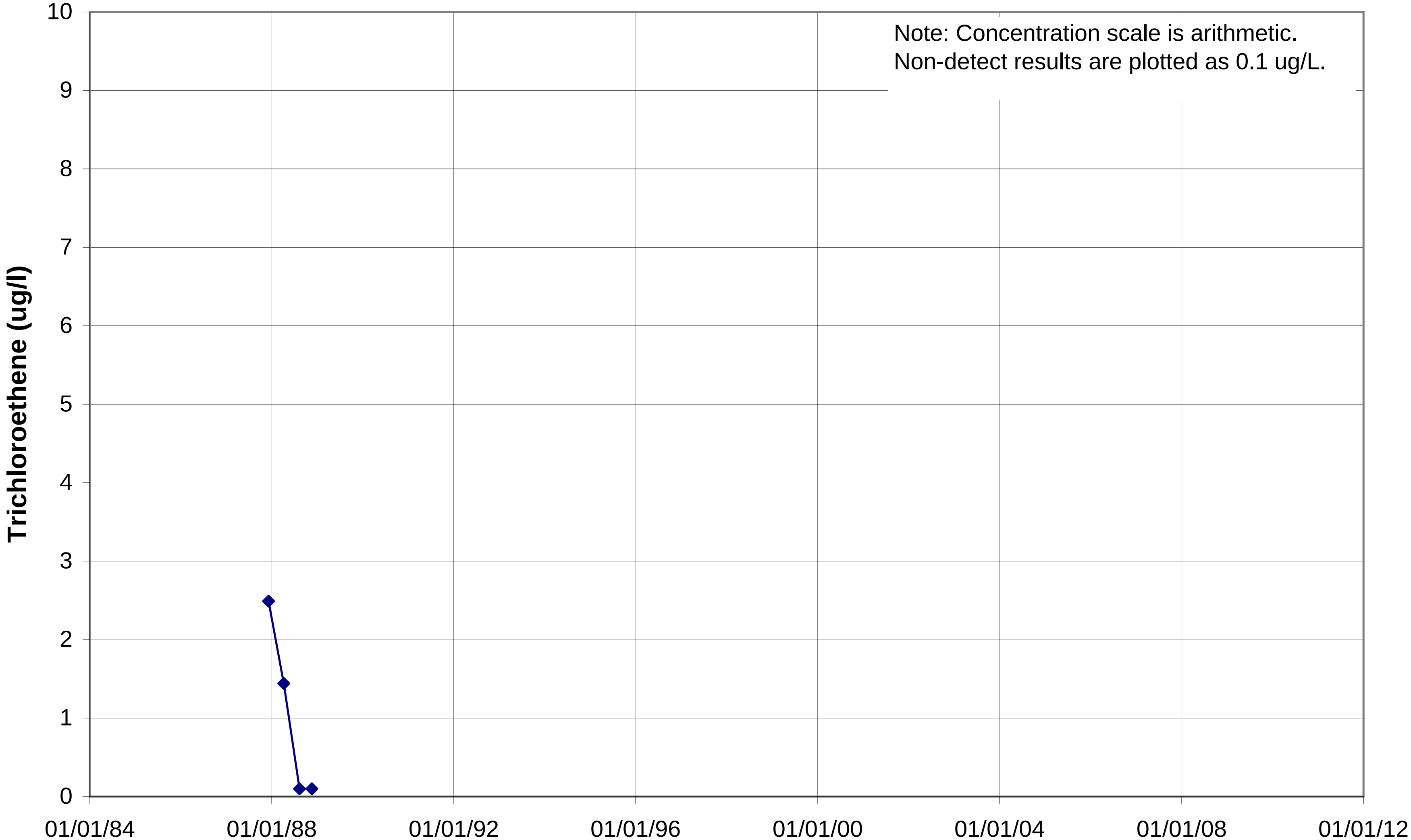
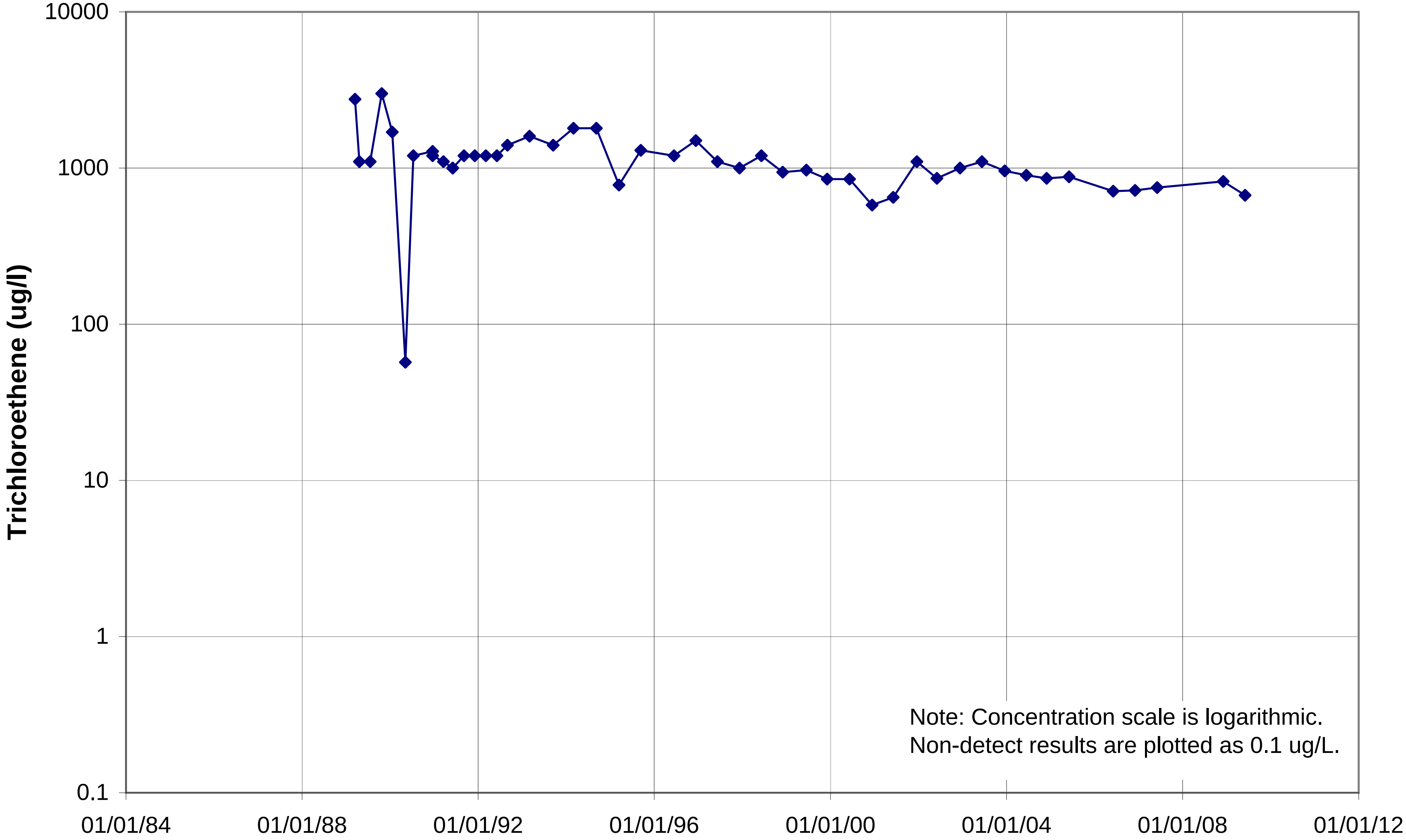


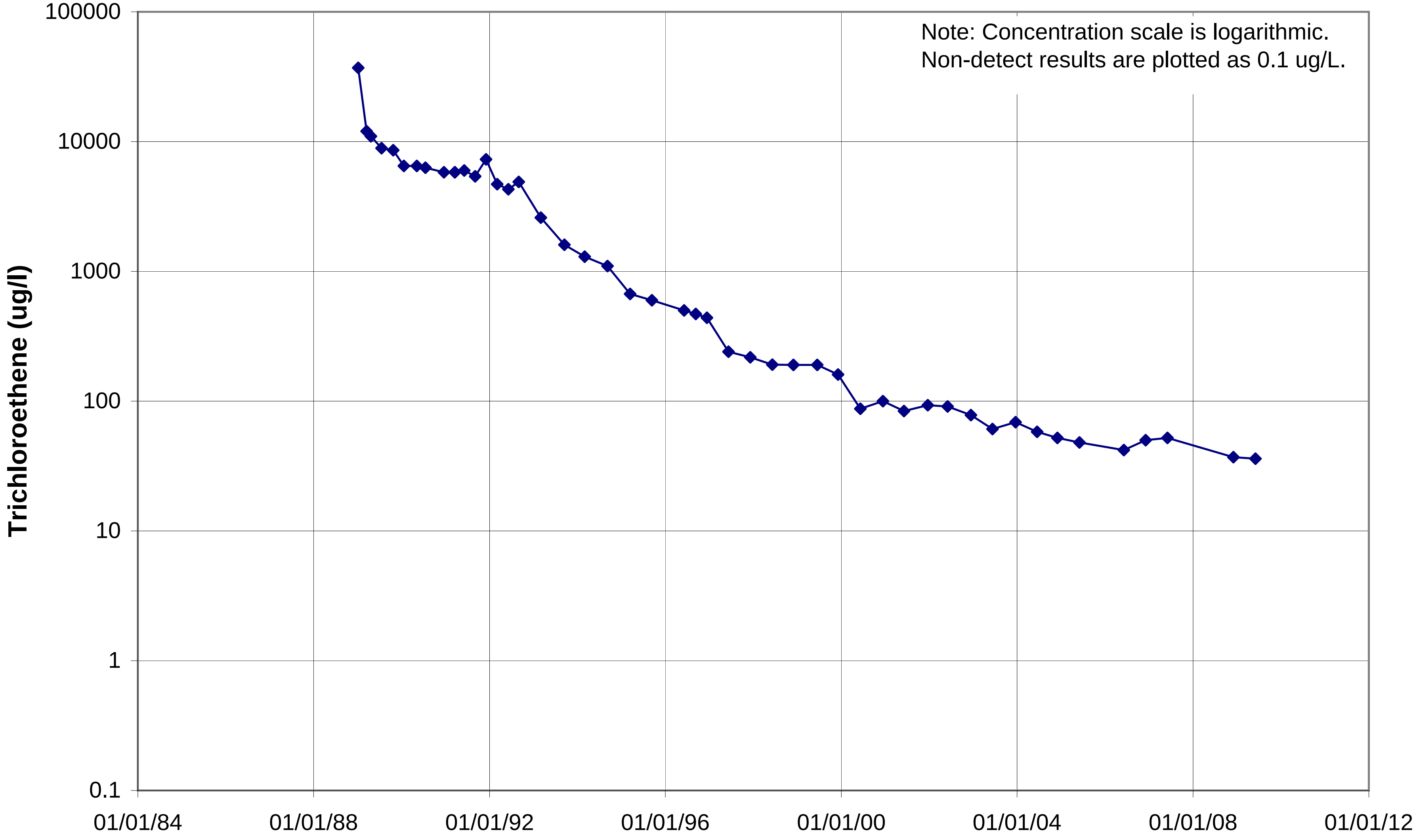

**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 03U301 (SC1)

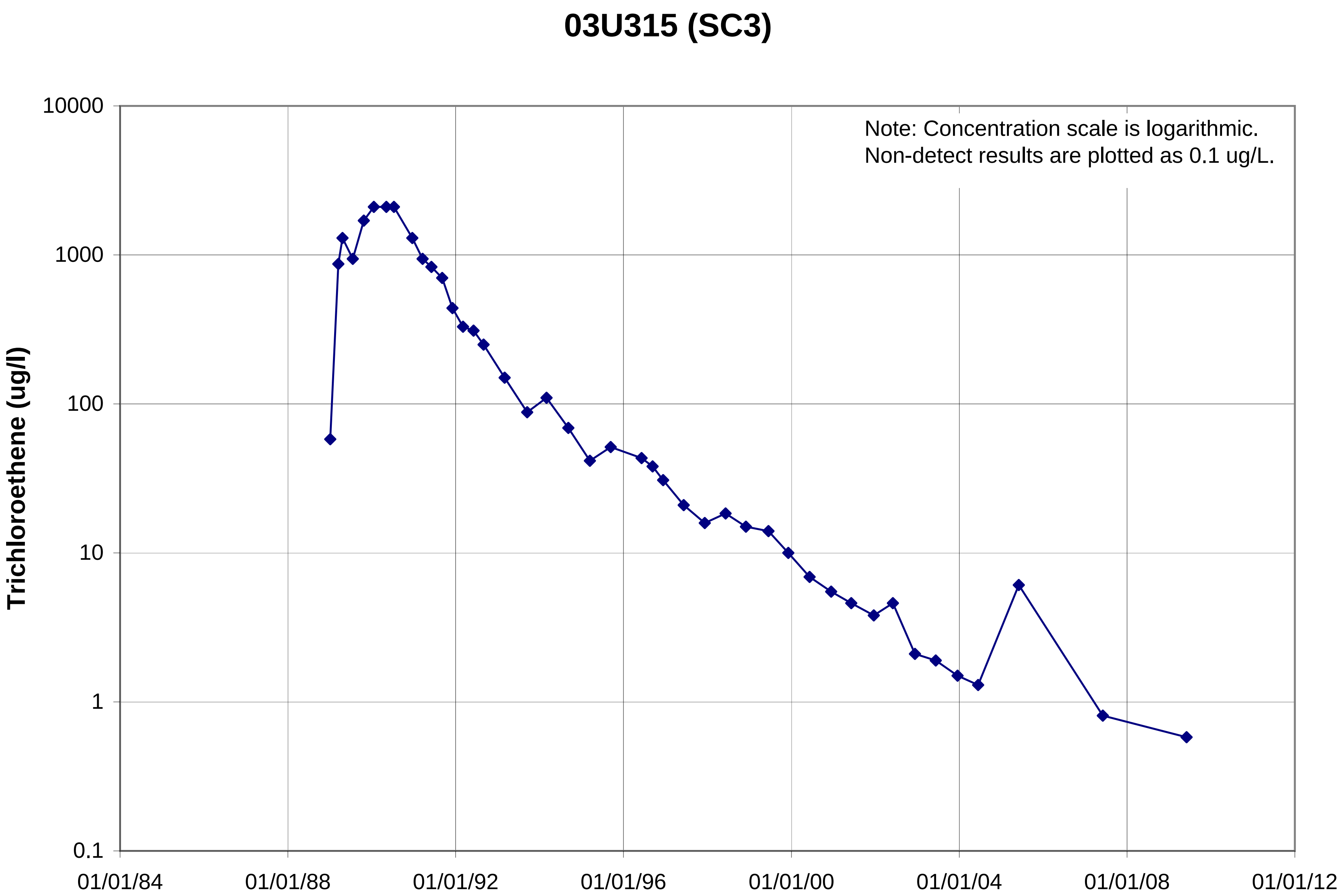



**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

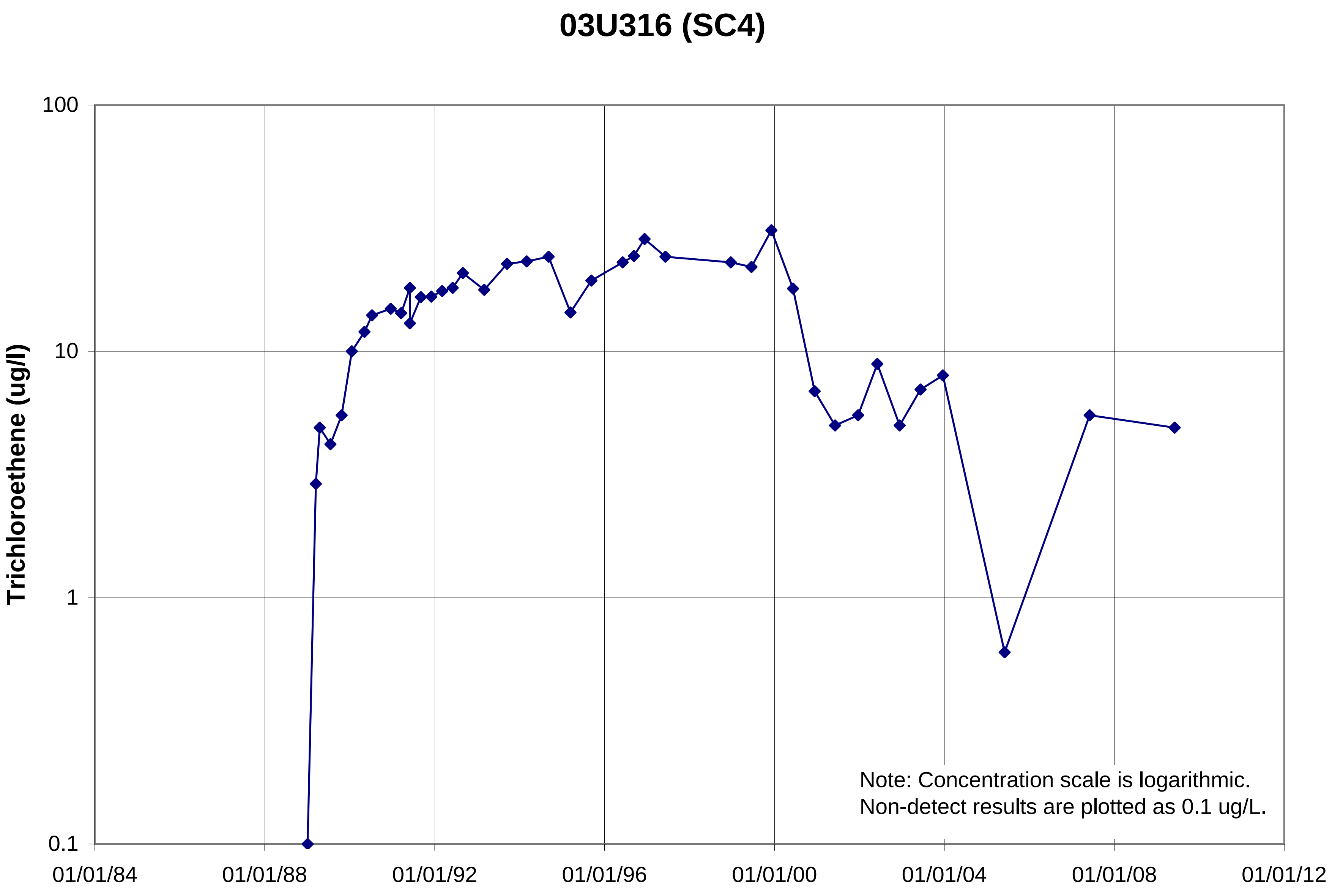
# 03U314 (SC2)




**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

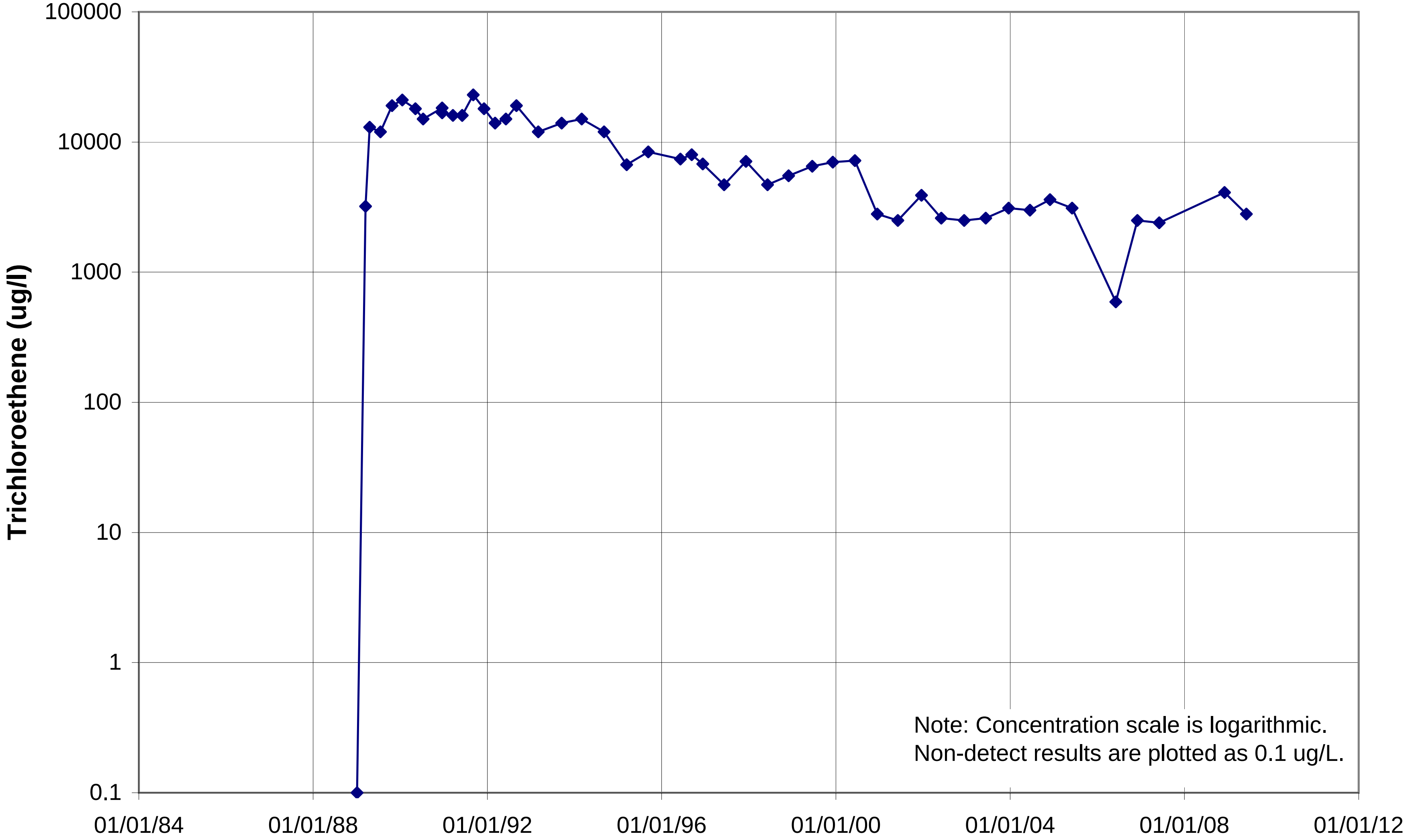



**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar




**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 03U317 (SC5)

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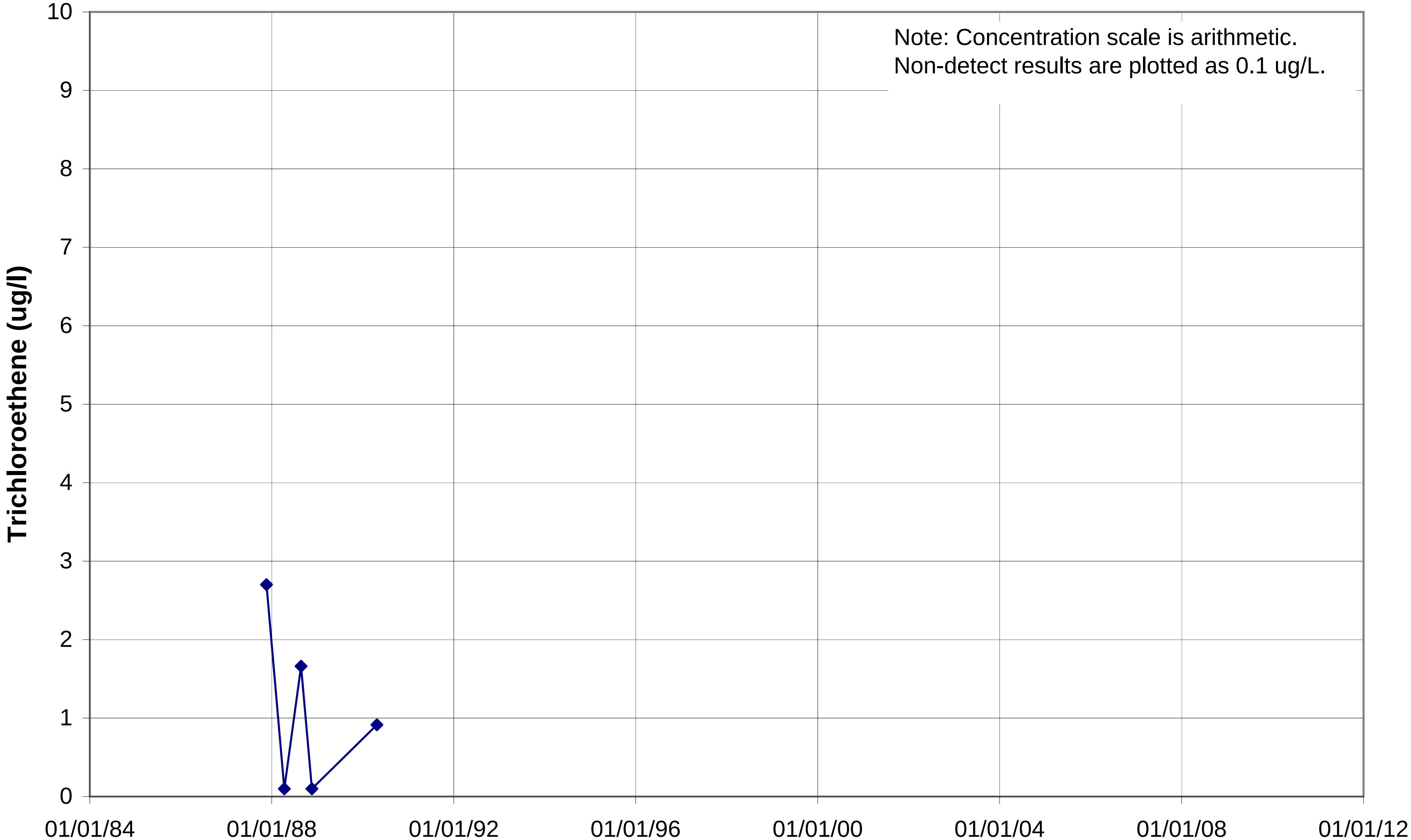
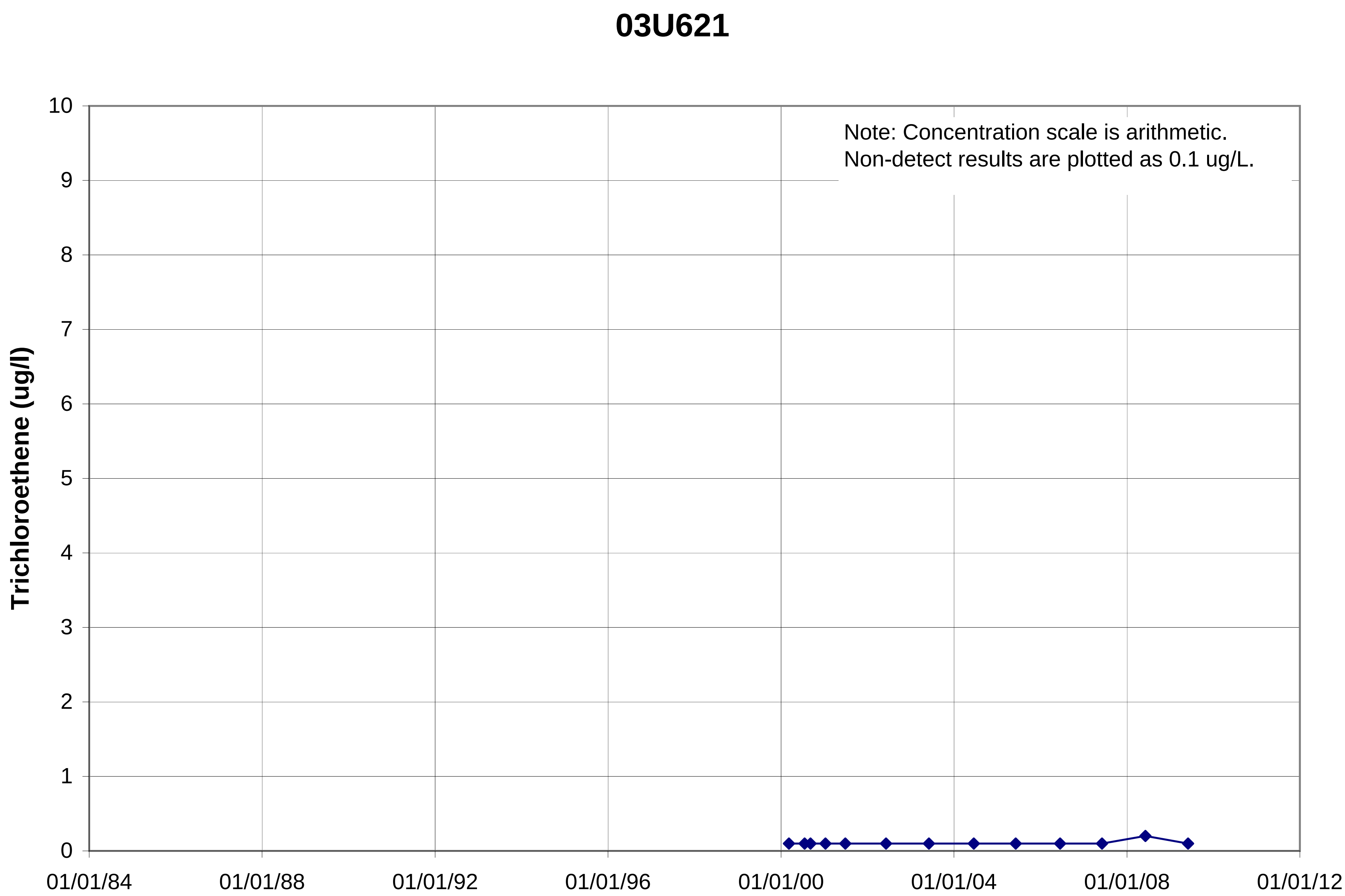
# 03U521

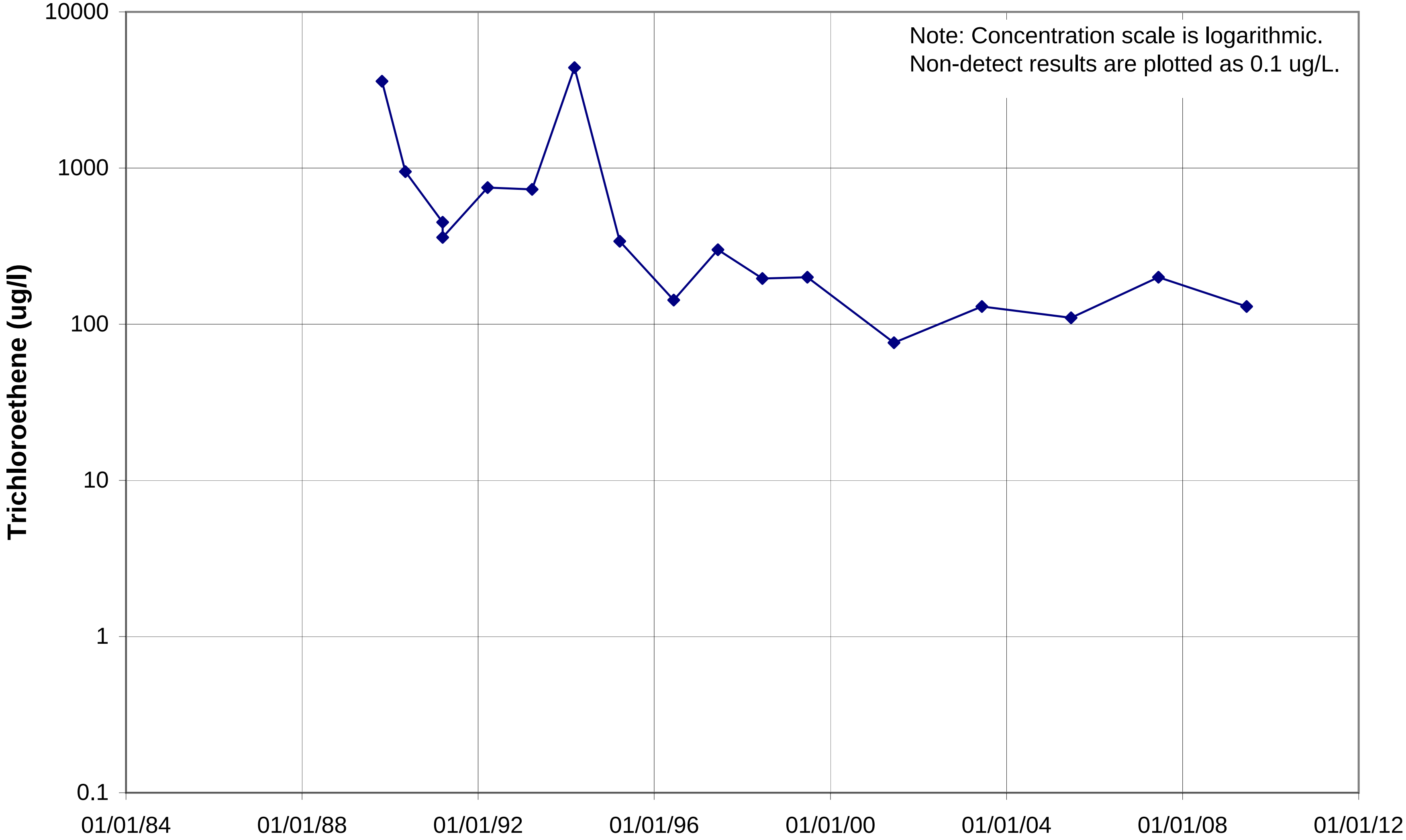



**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

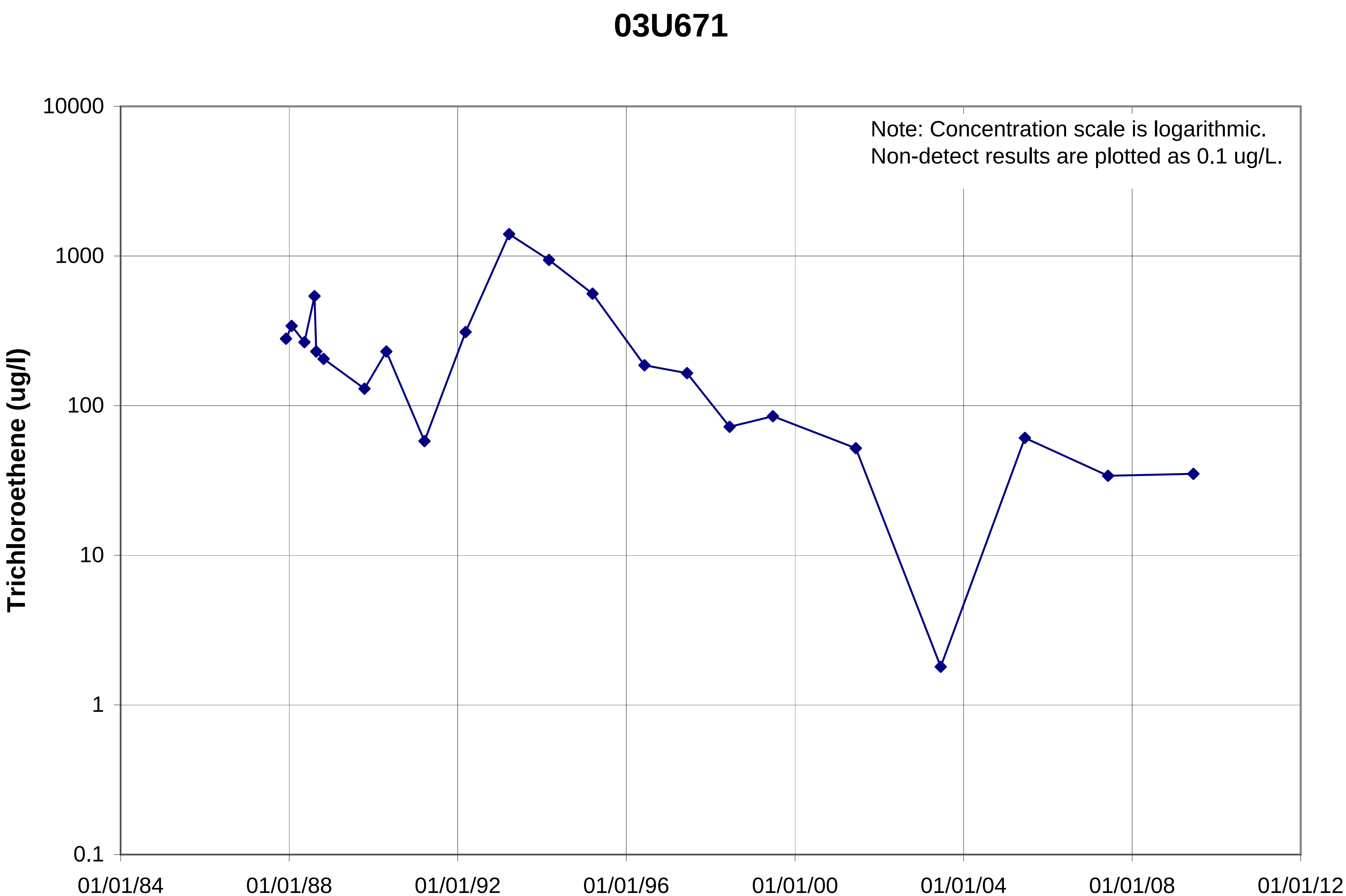



**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

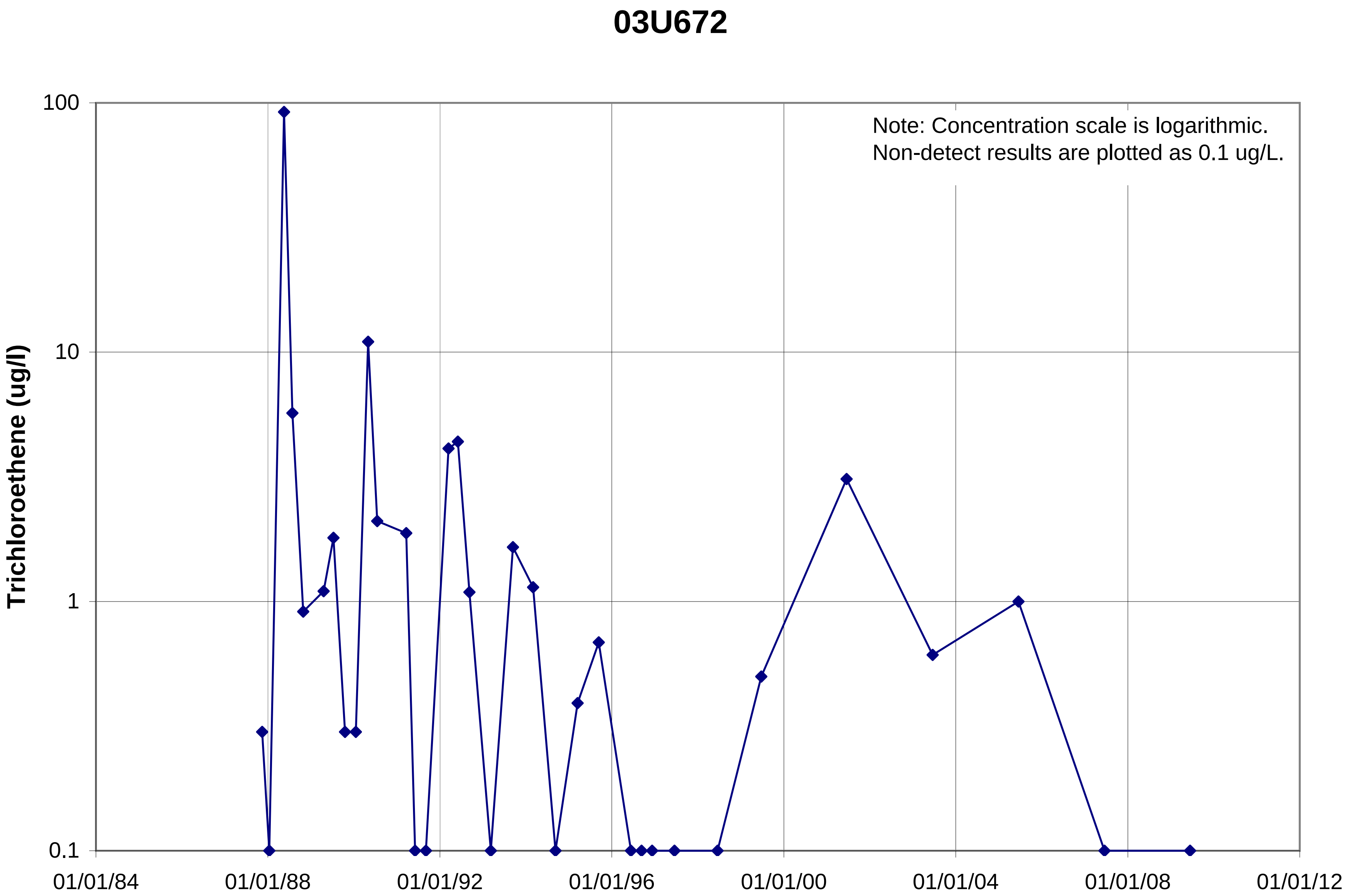
# 03U659




**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar




**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar




**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

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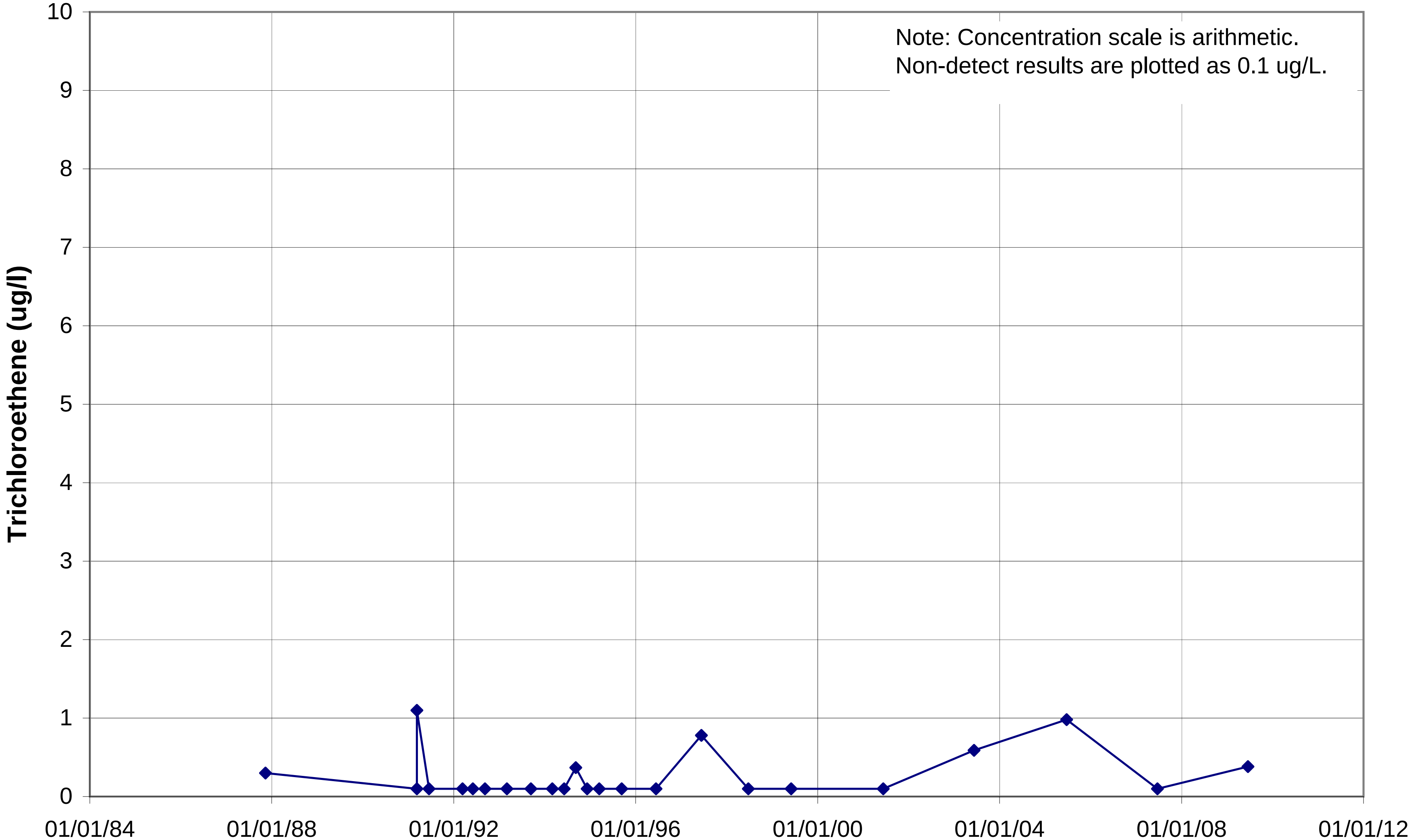


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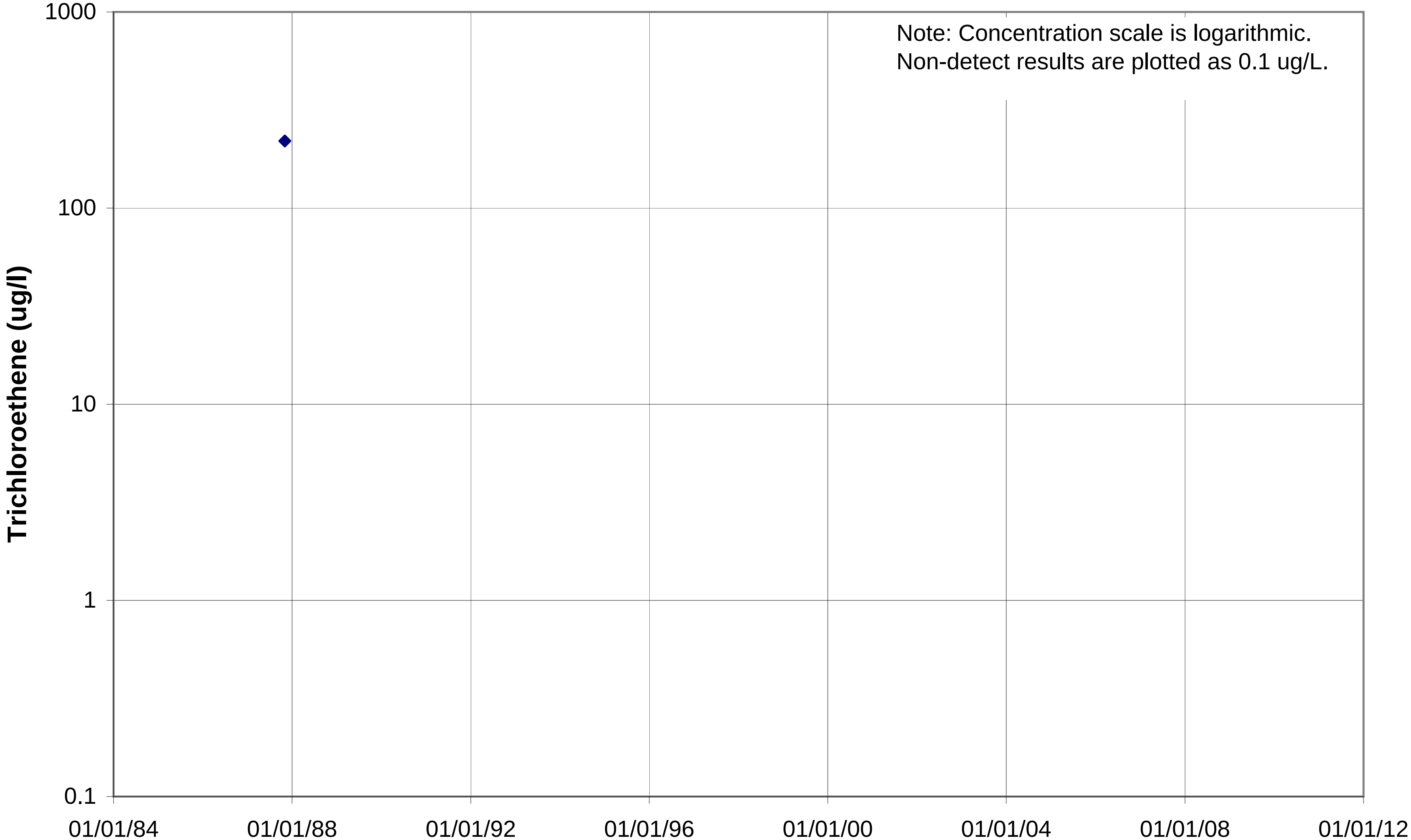


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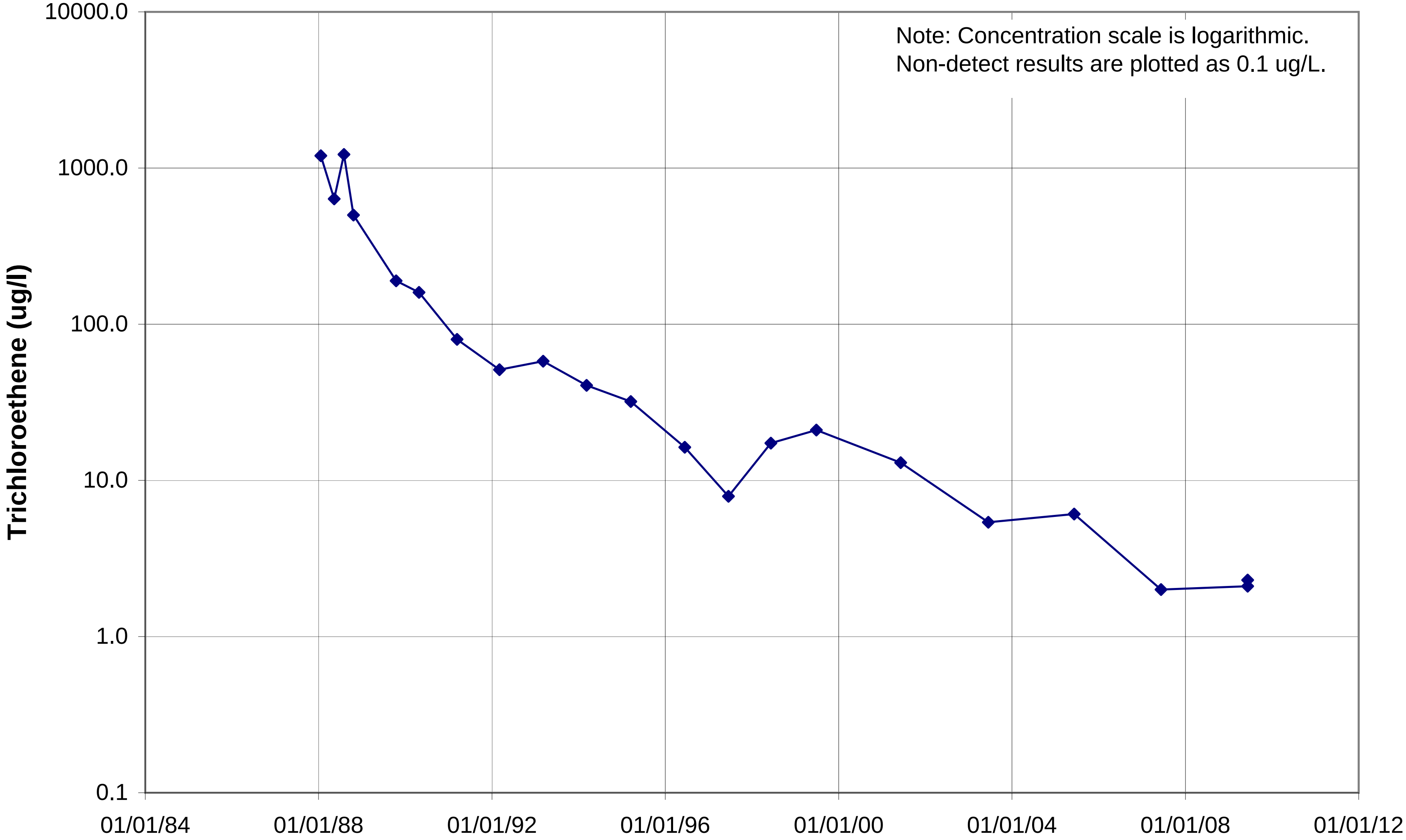


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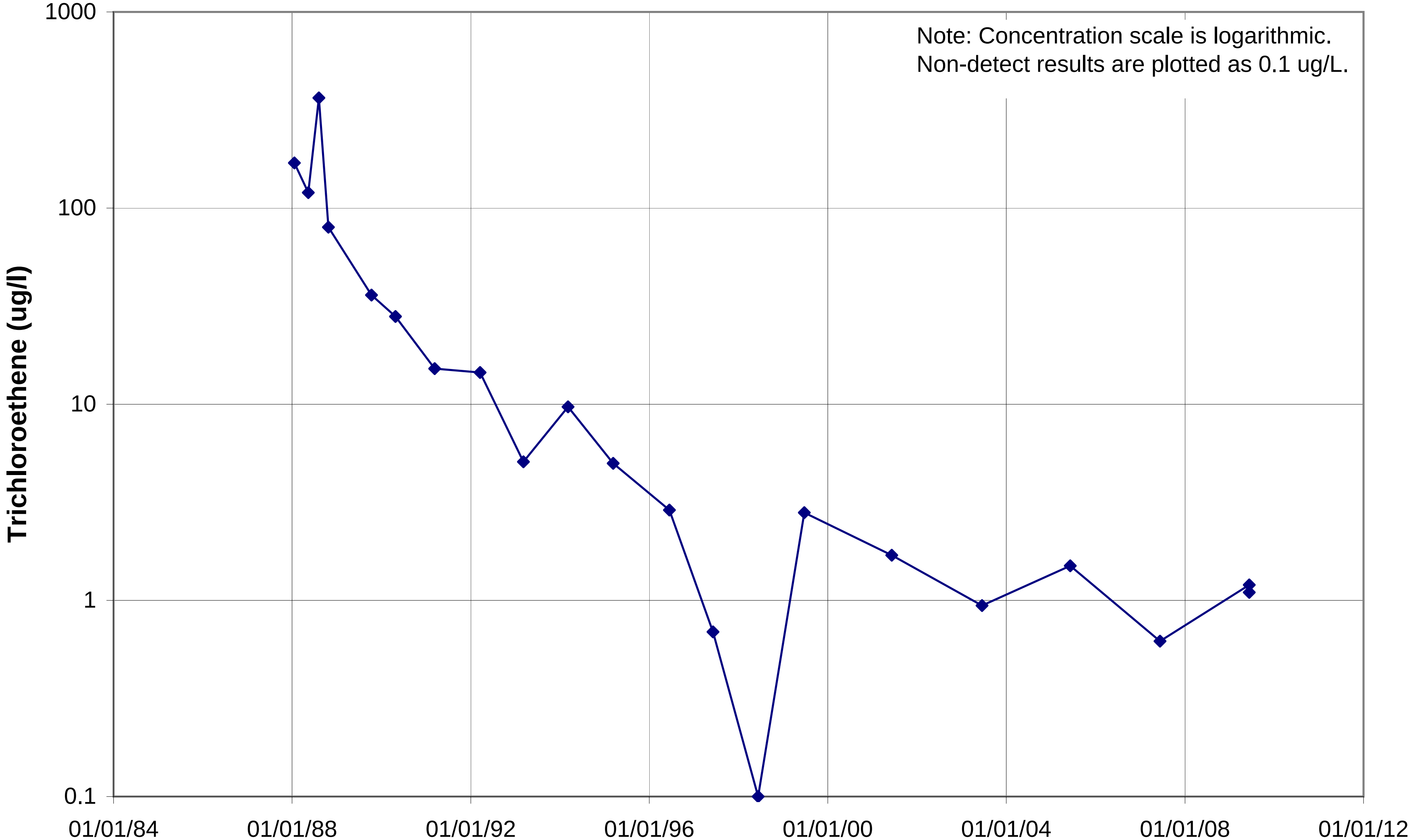


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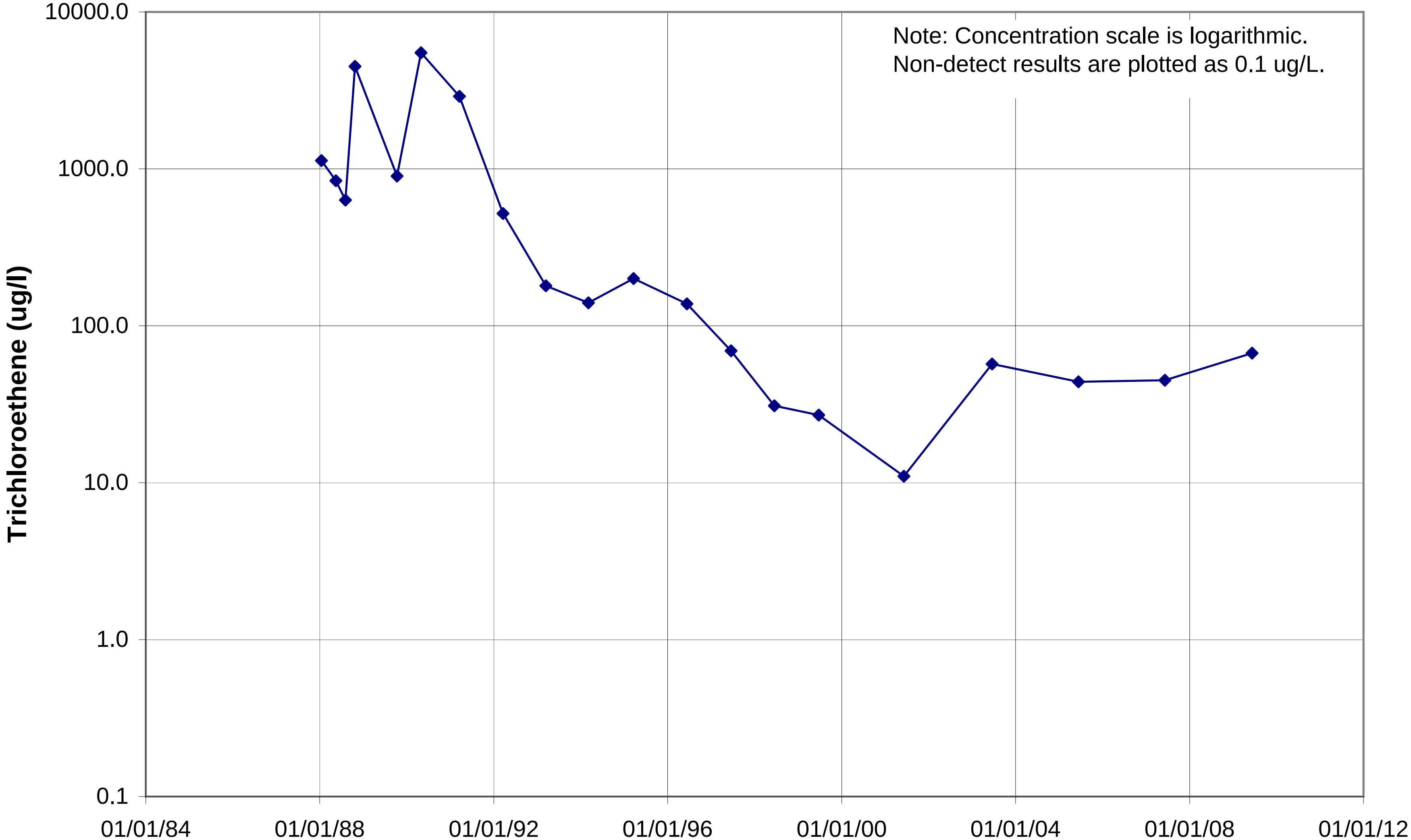


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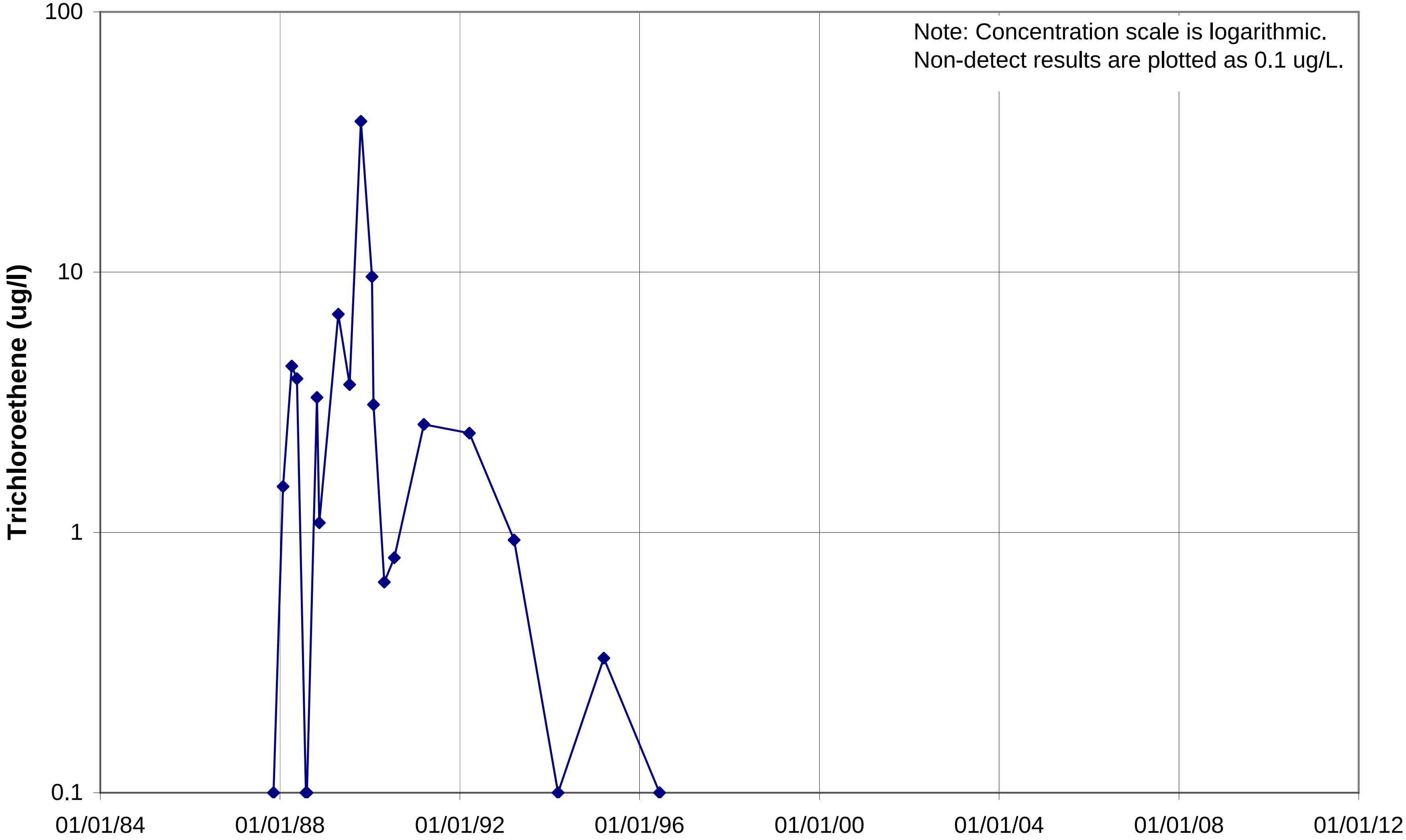


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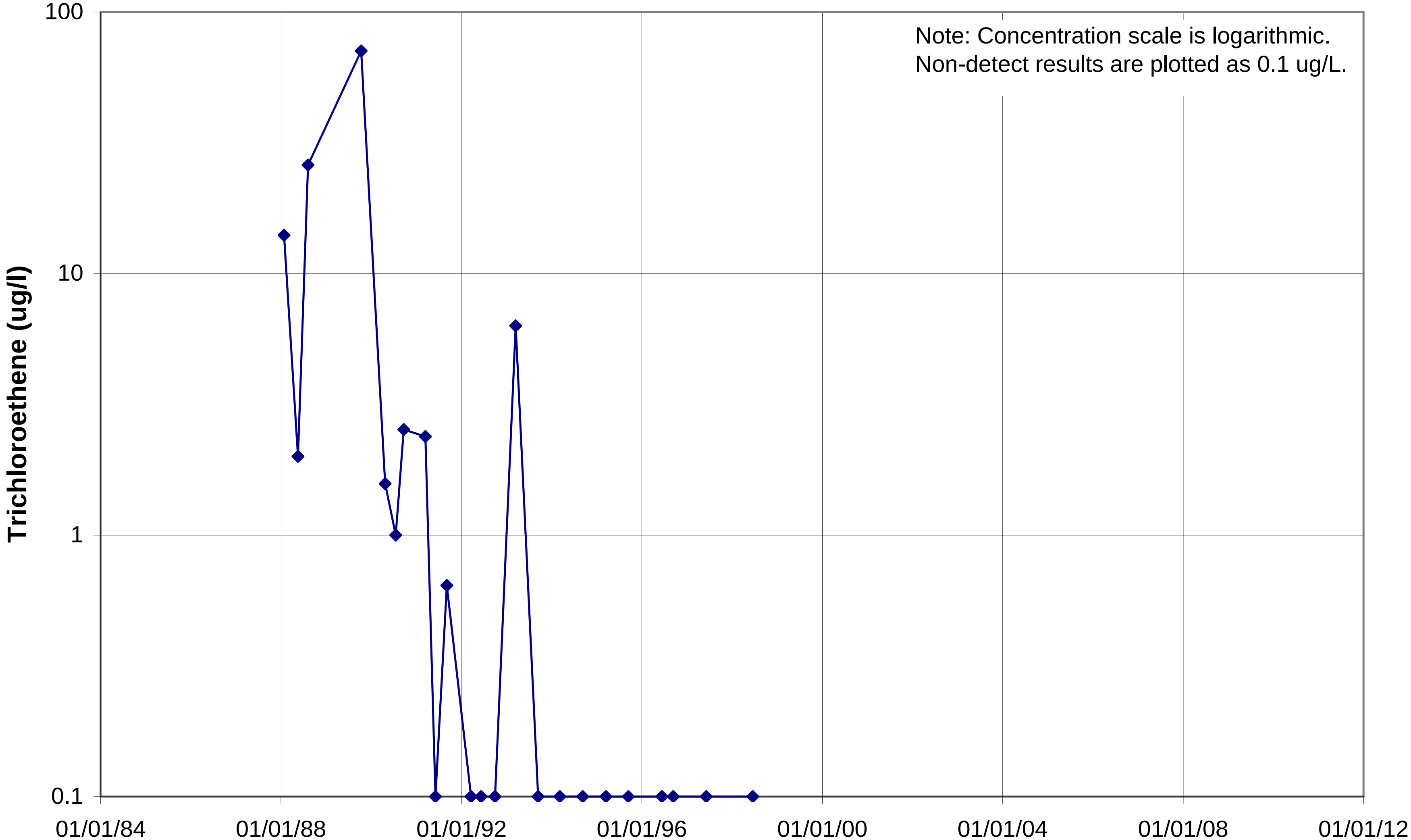


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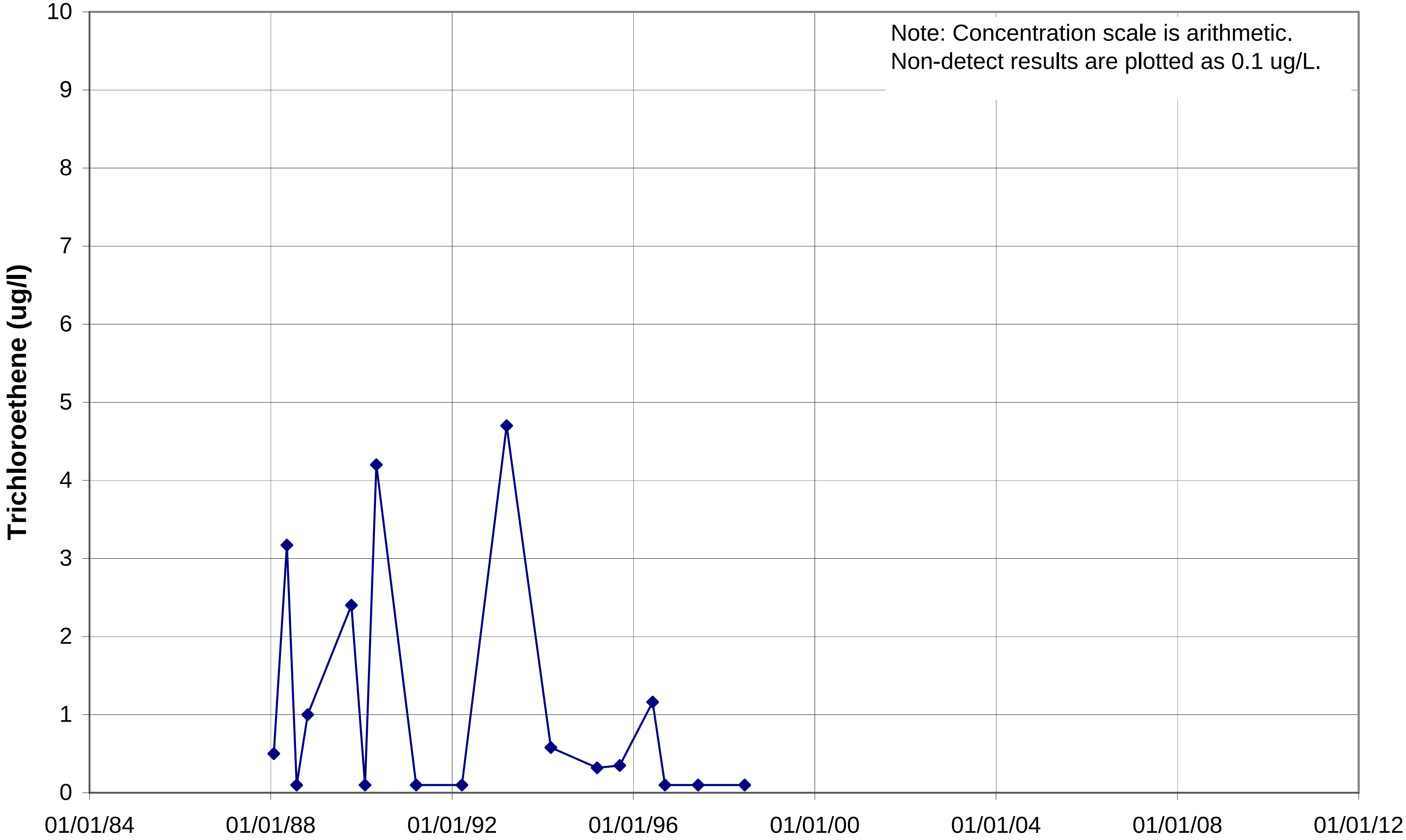


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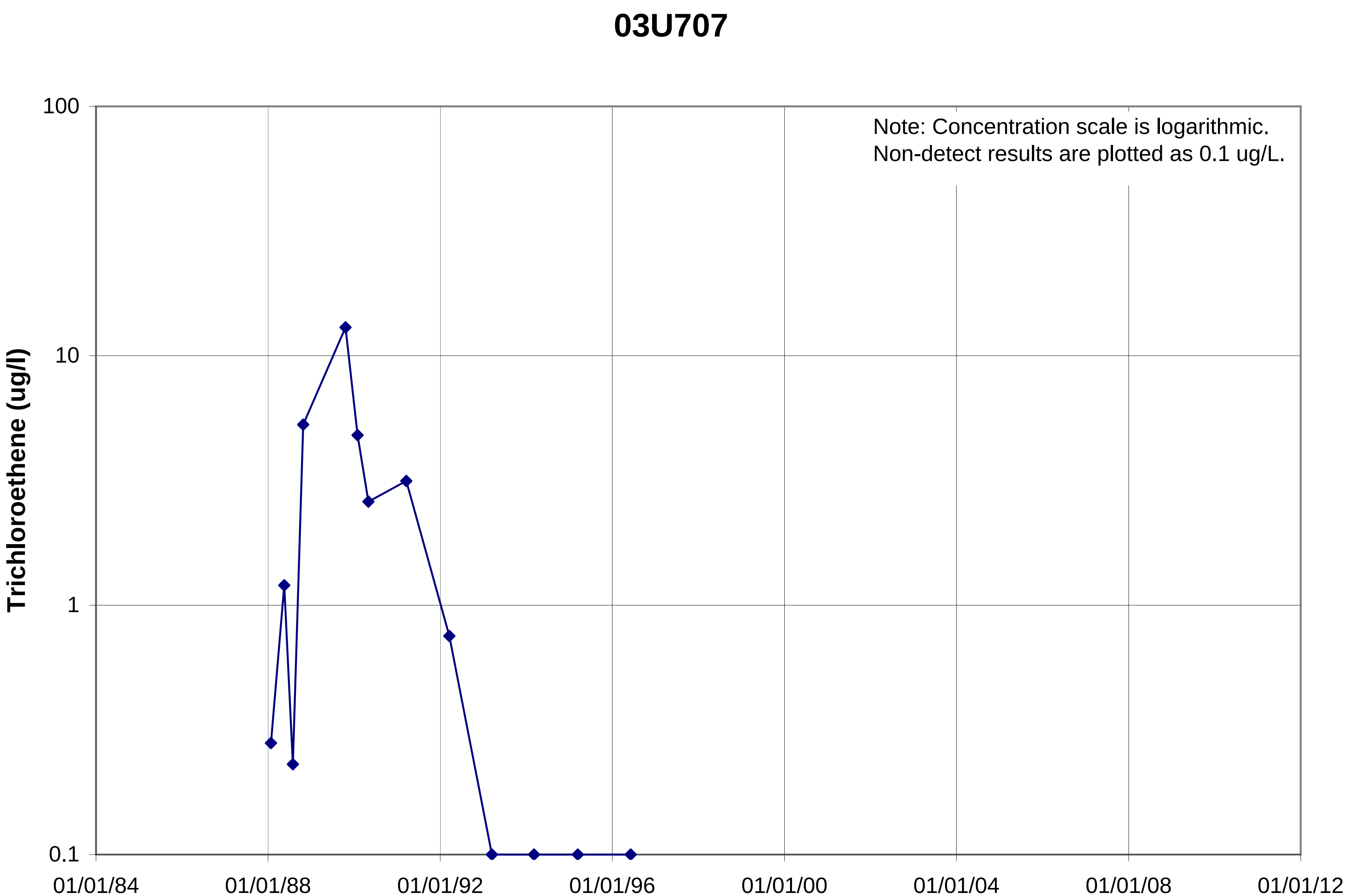


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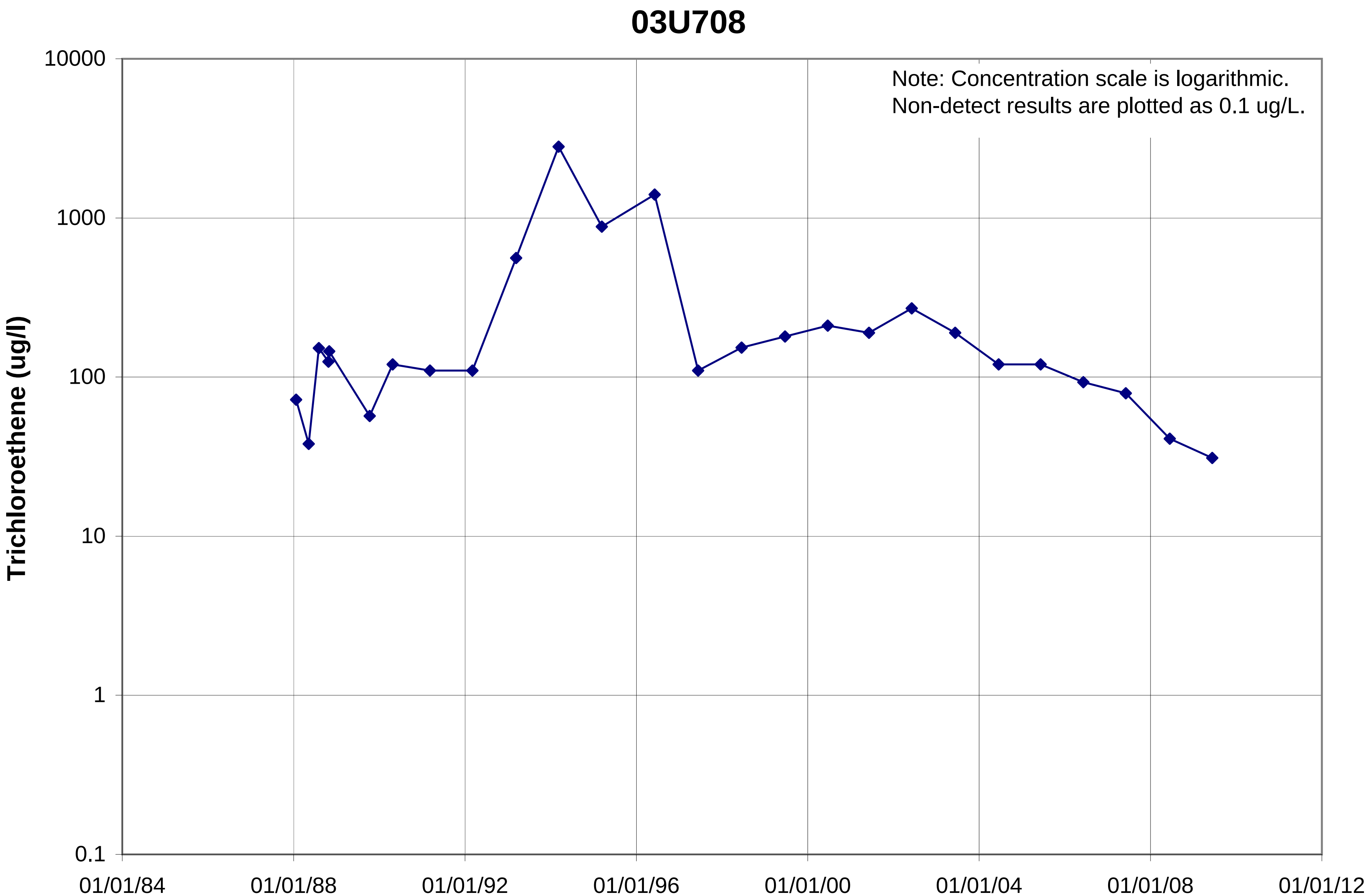


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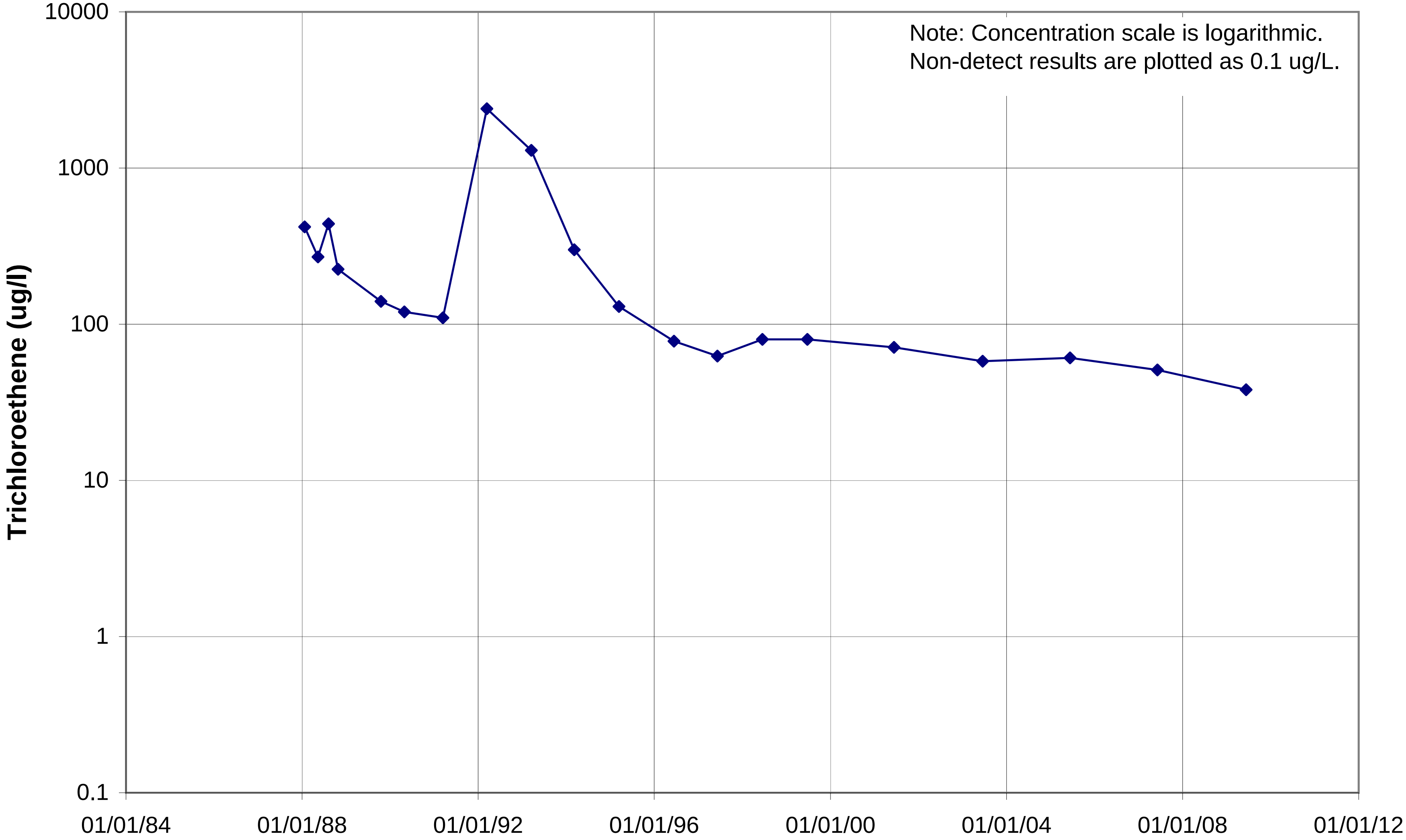


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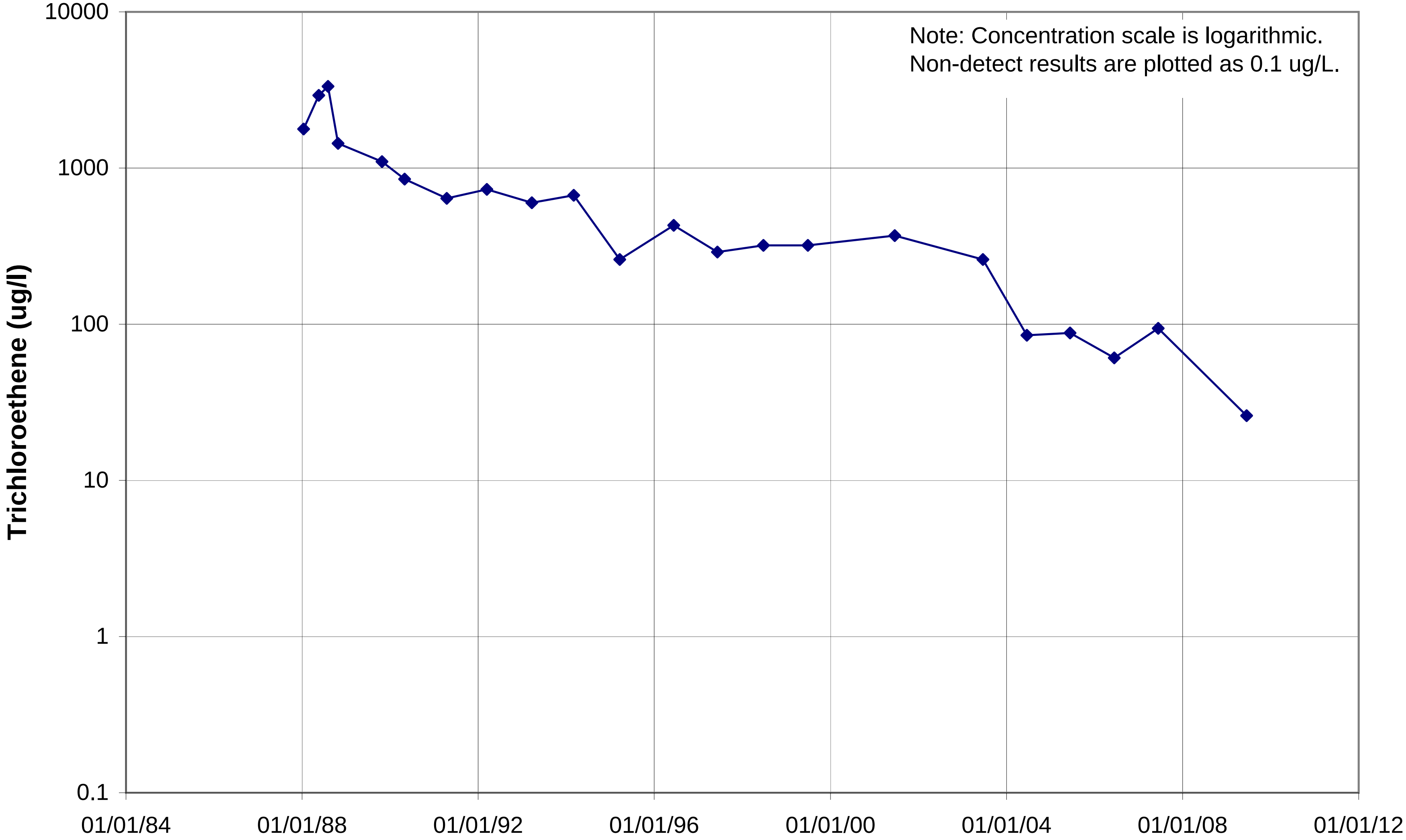


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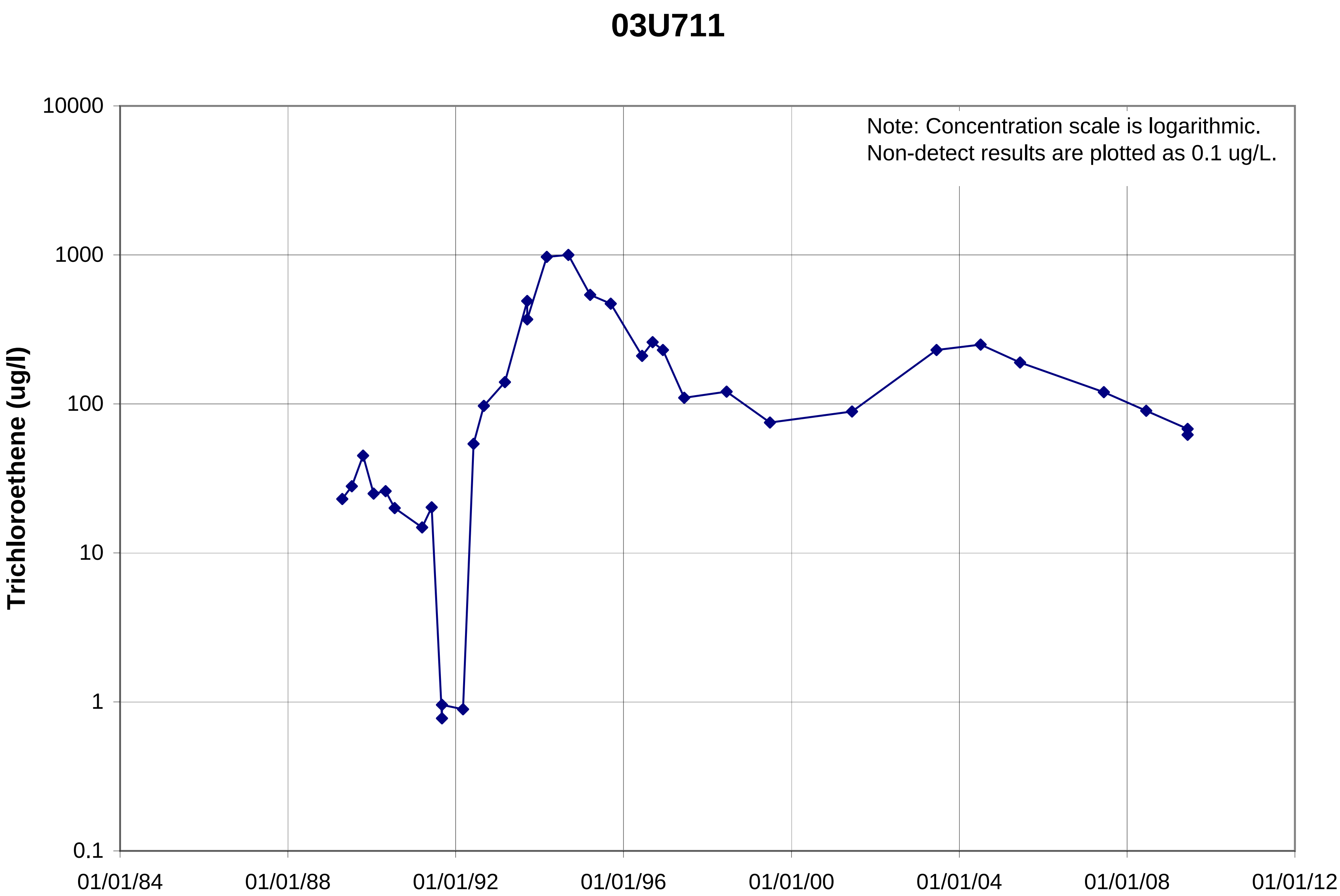


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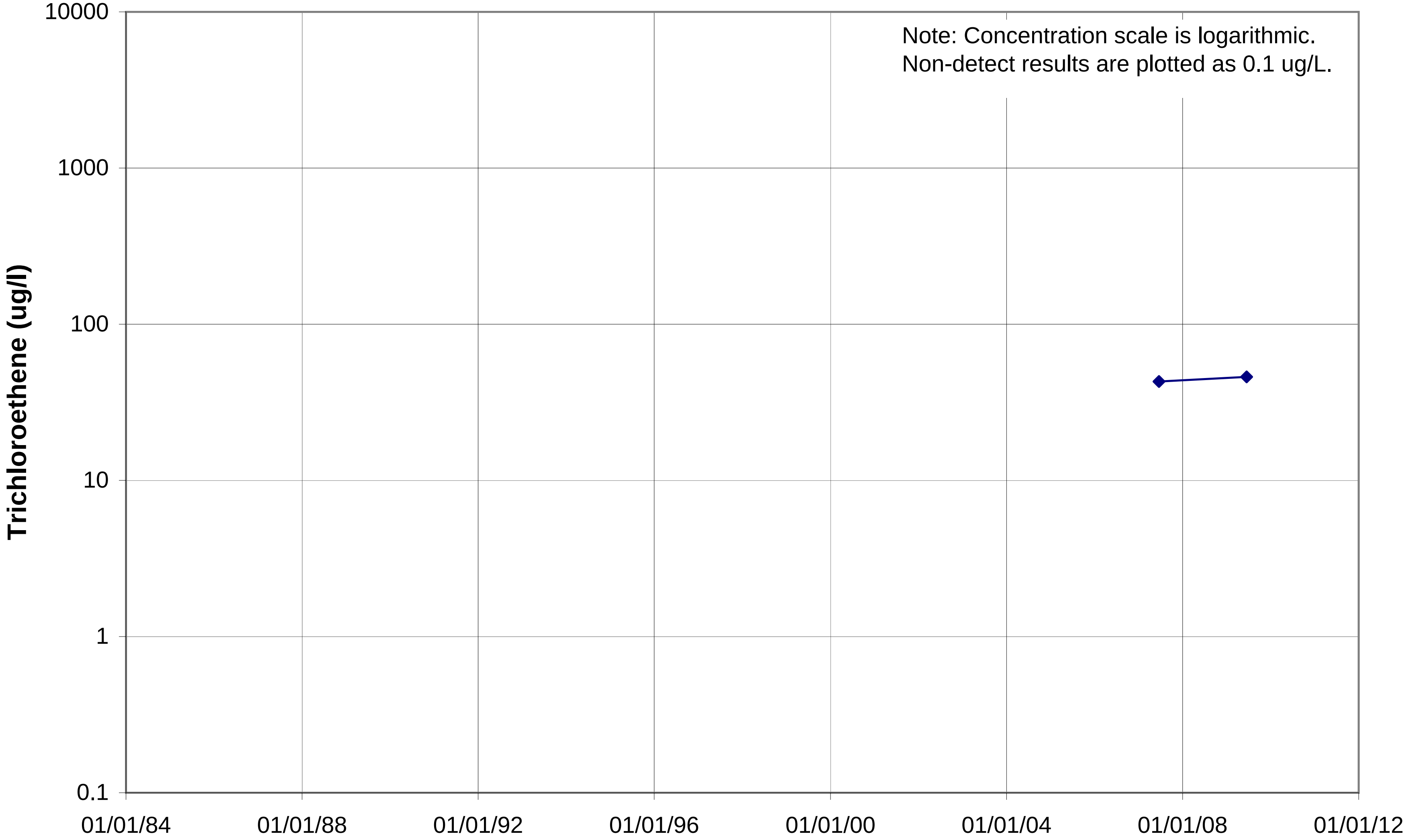
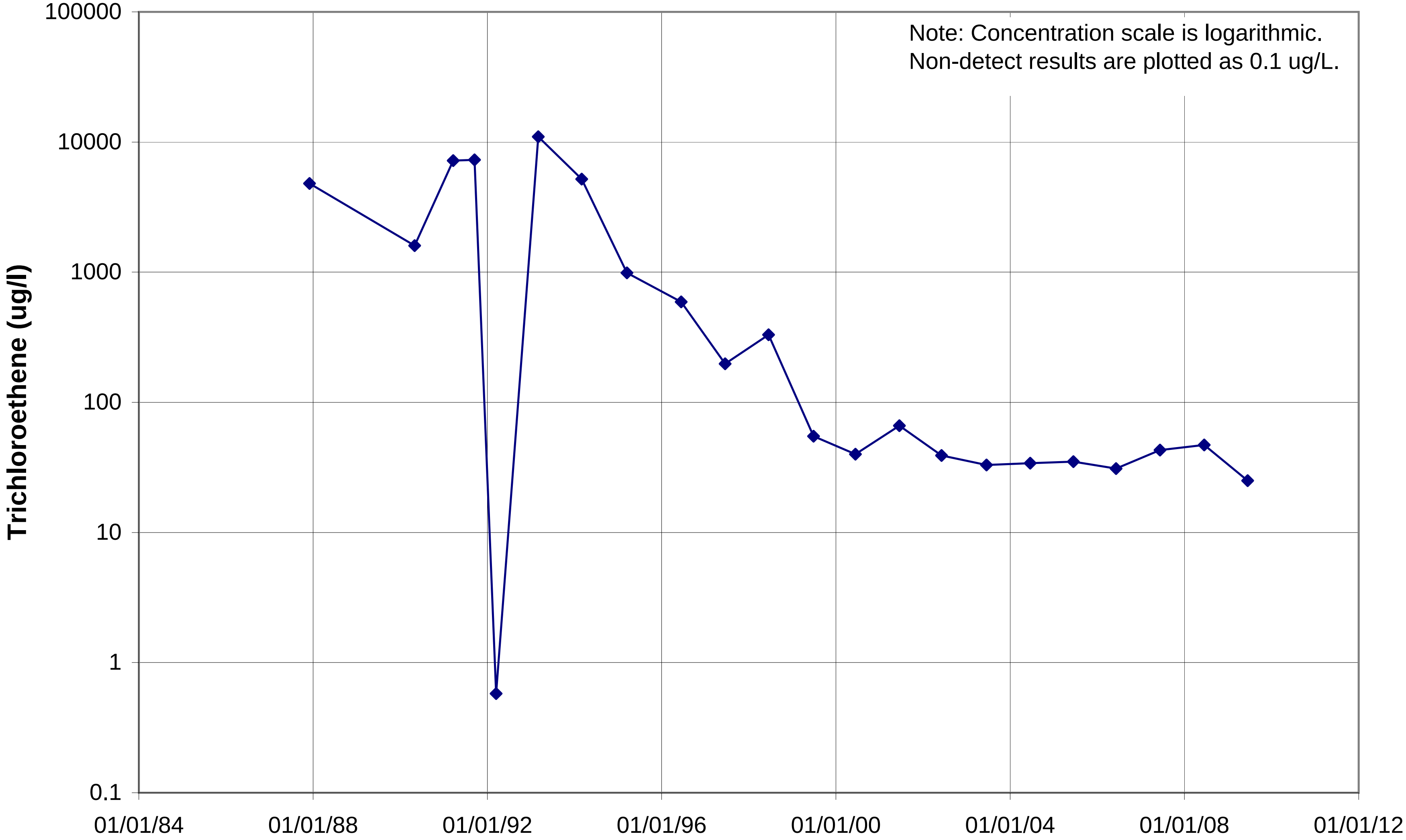
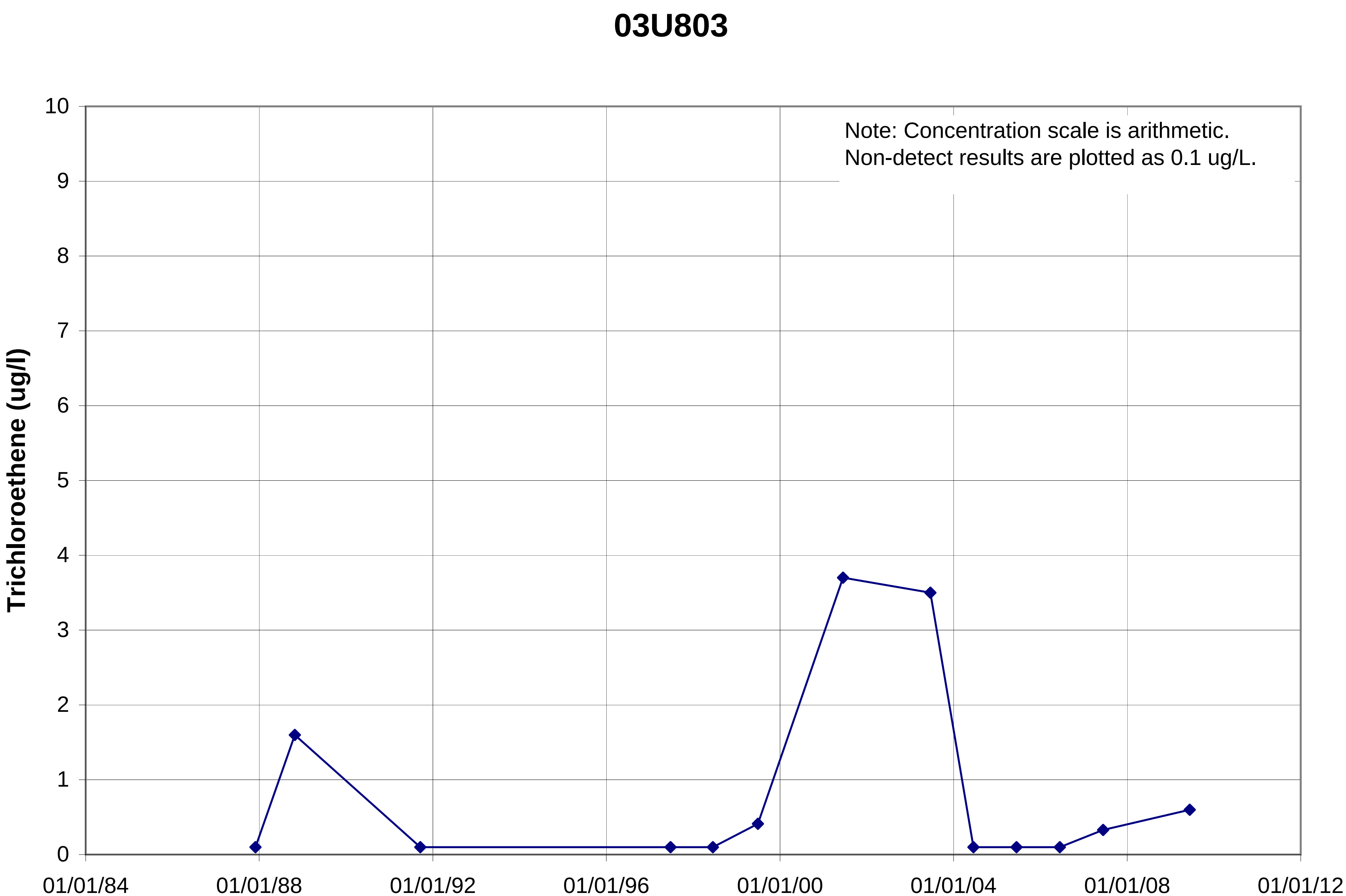



**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

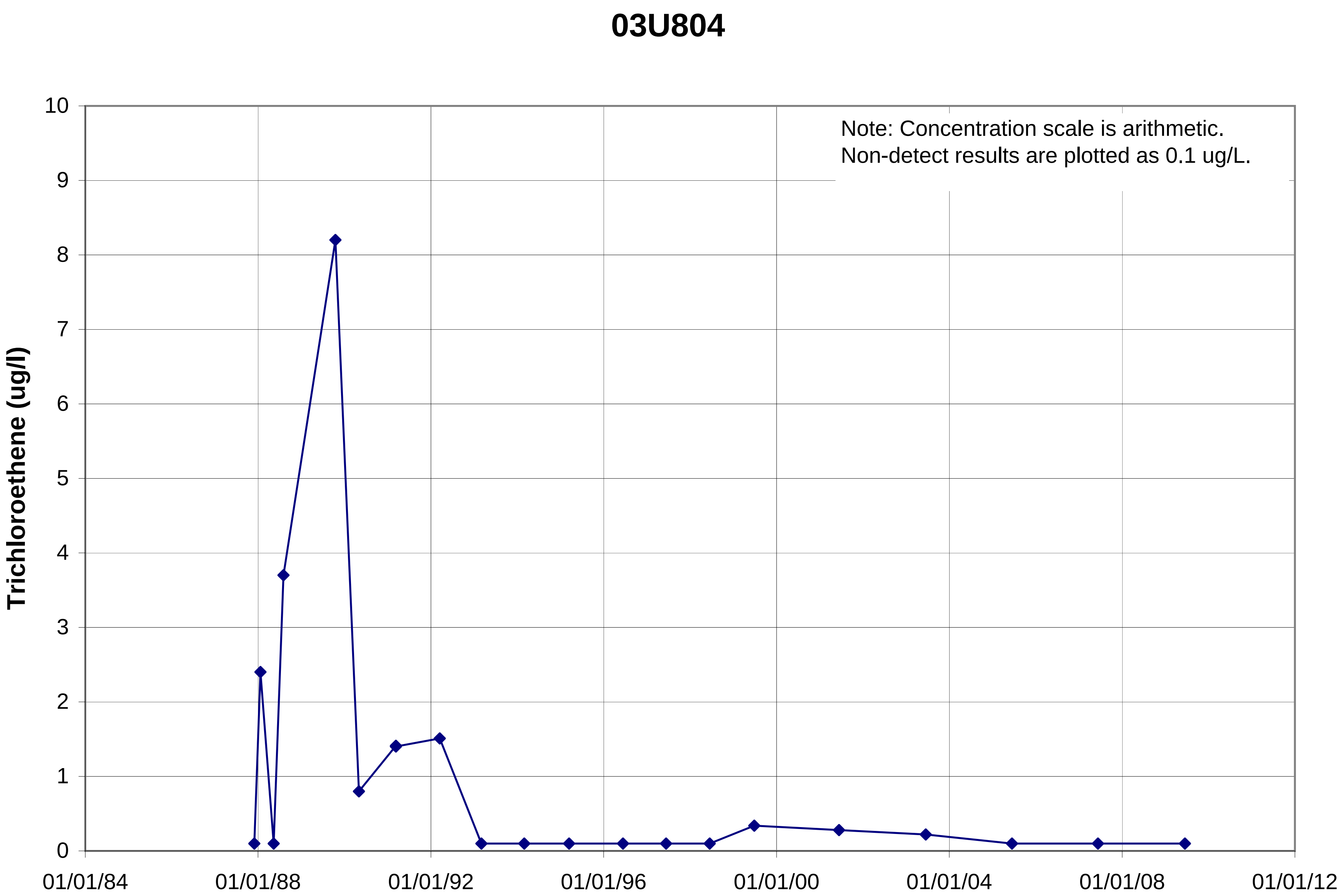
# 03U801




**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar




**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar




**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

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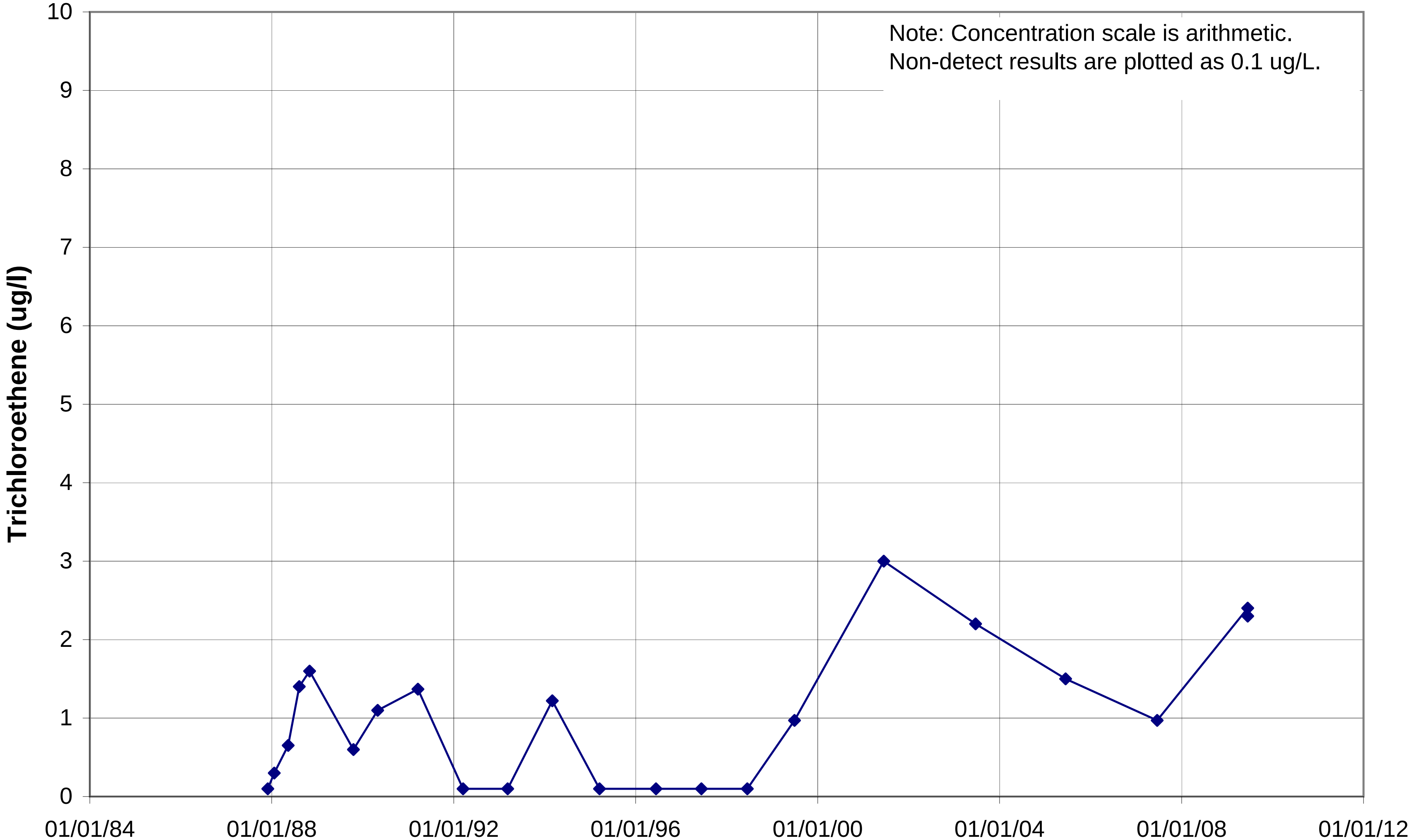


**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

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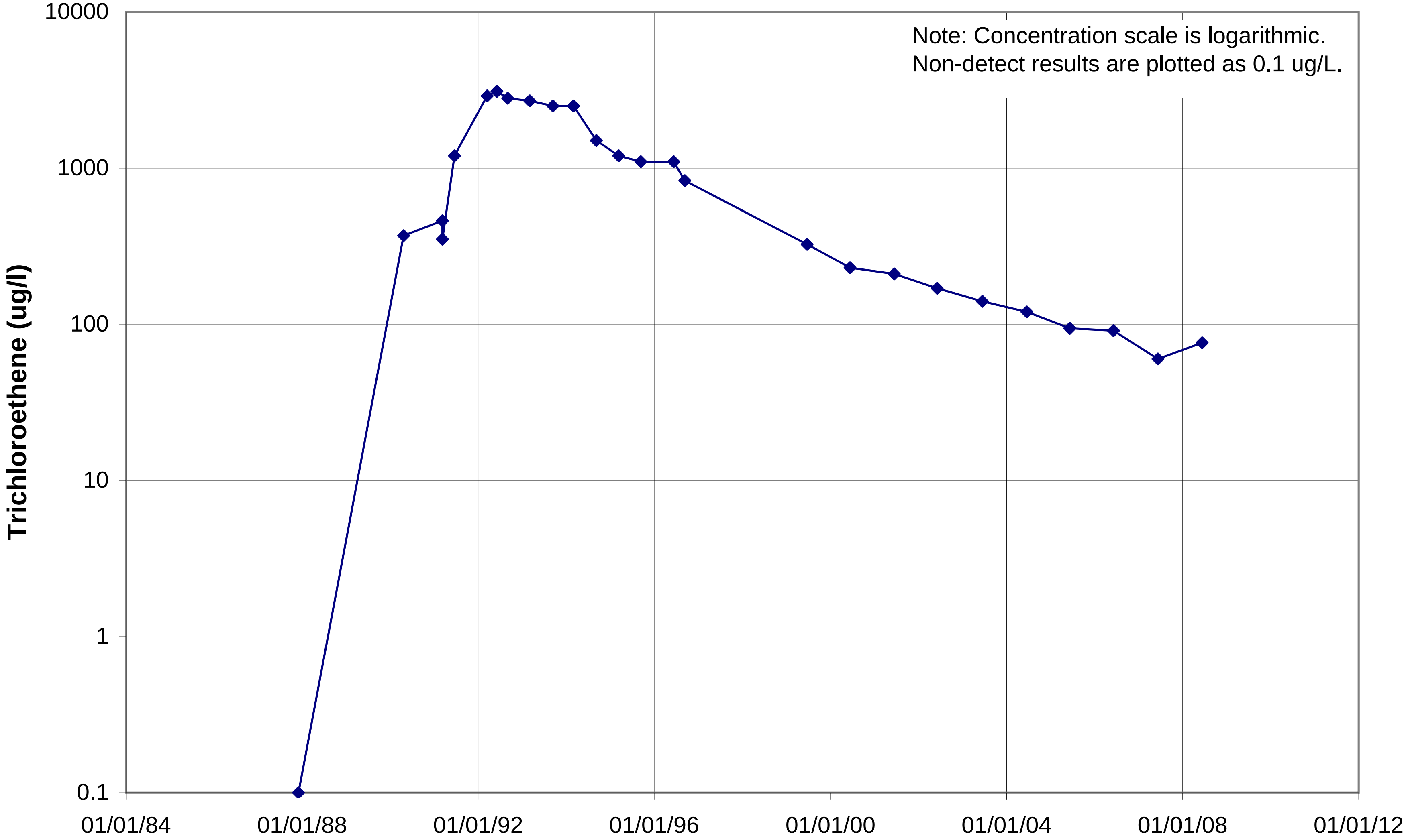


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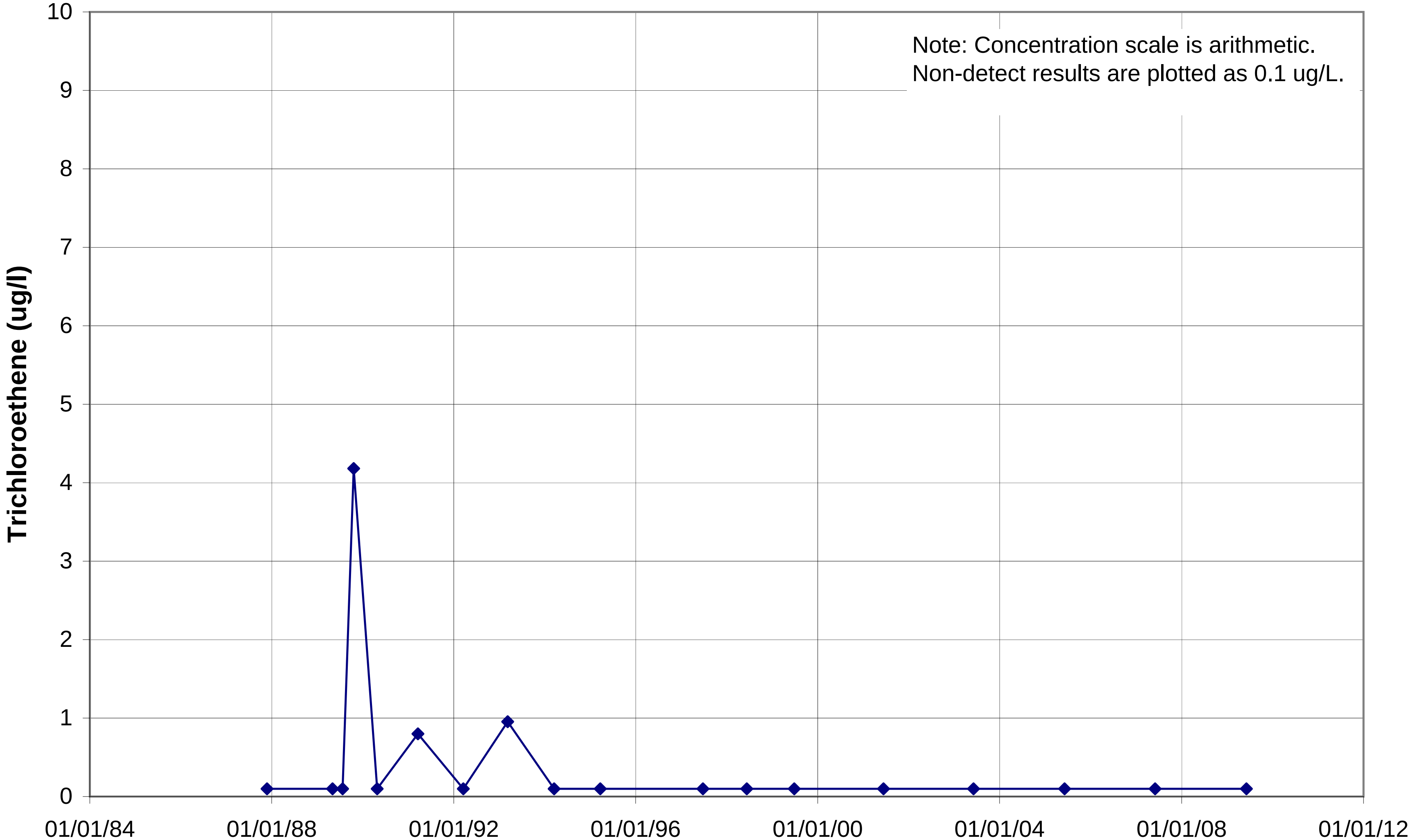
# 03U811

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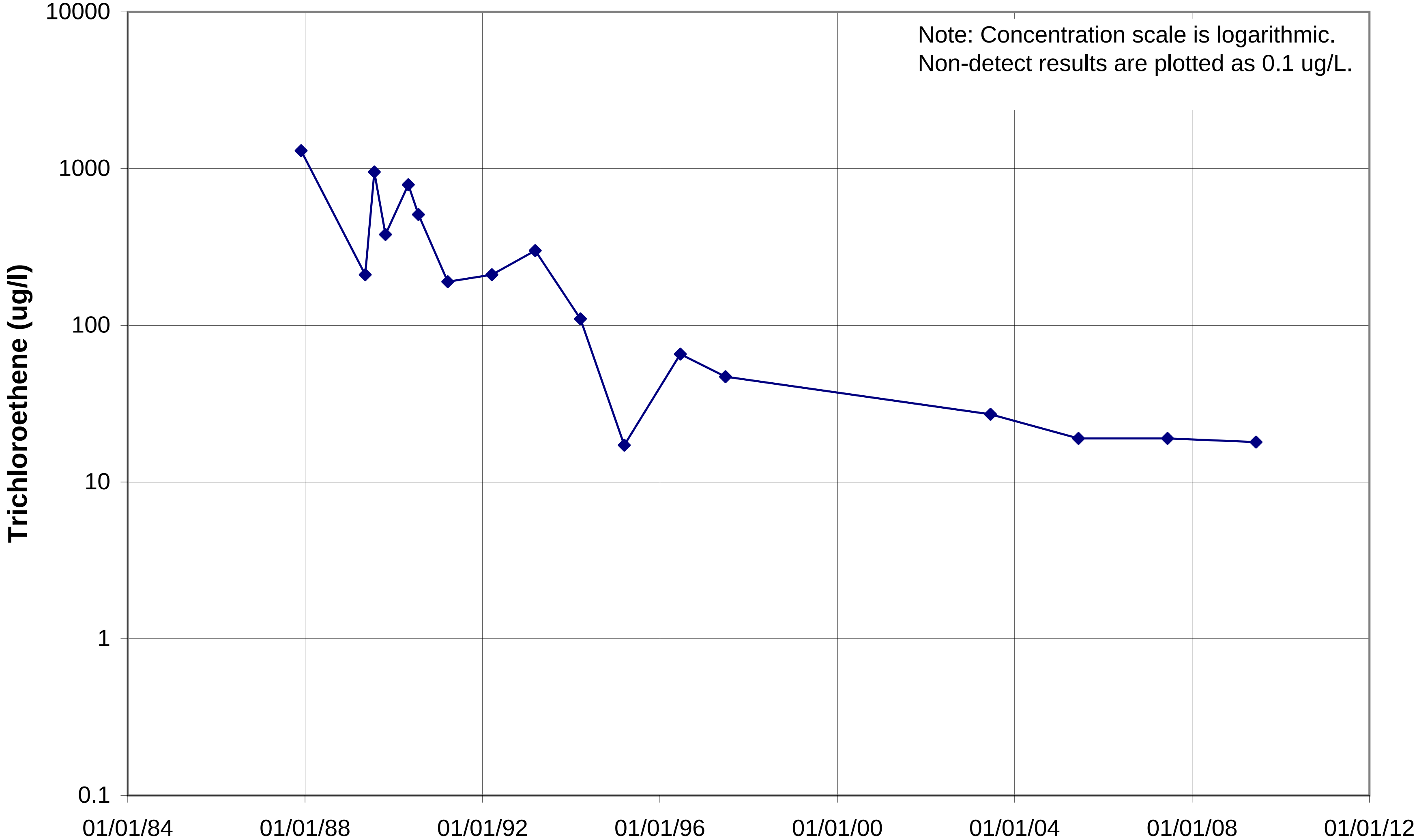
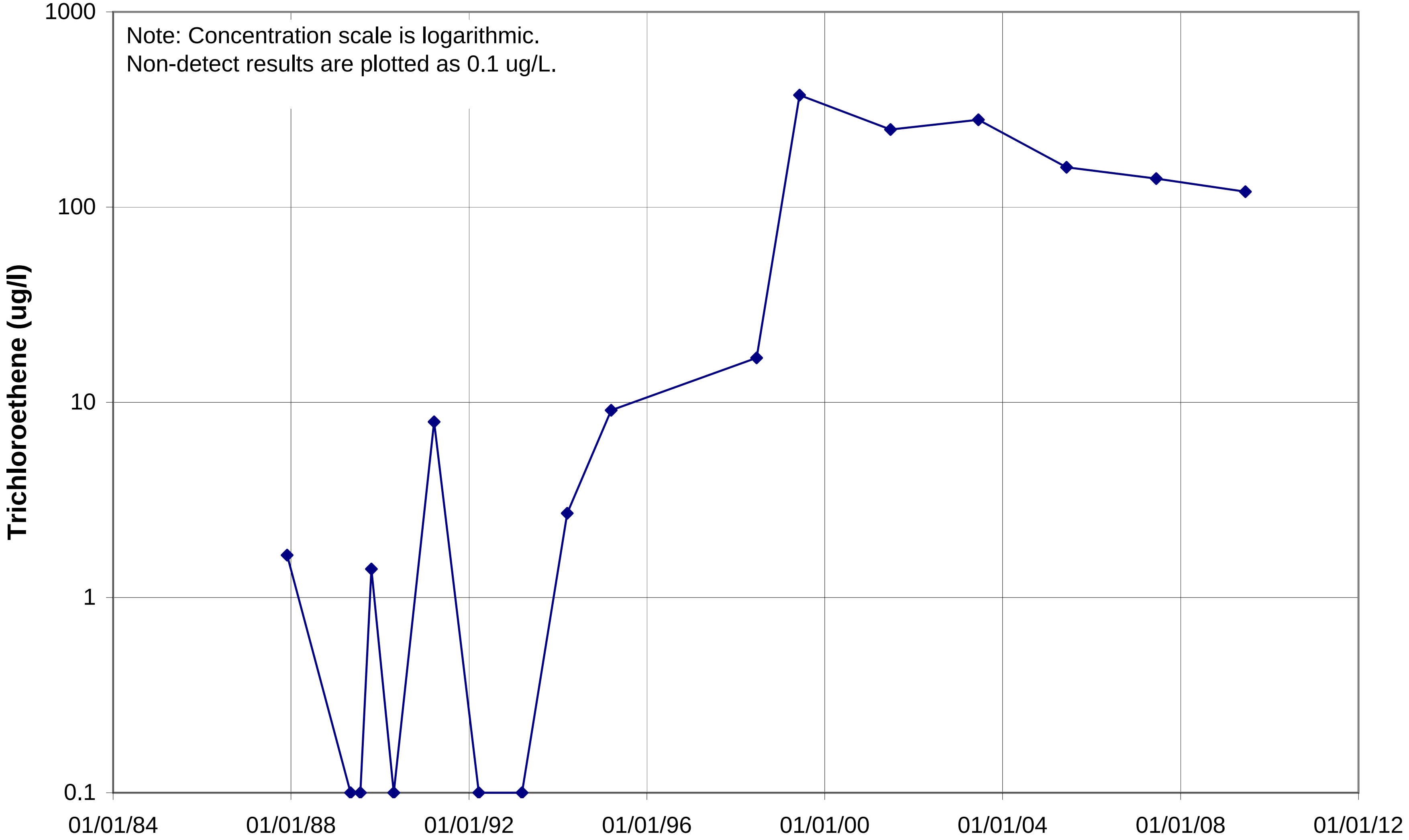


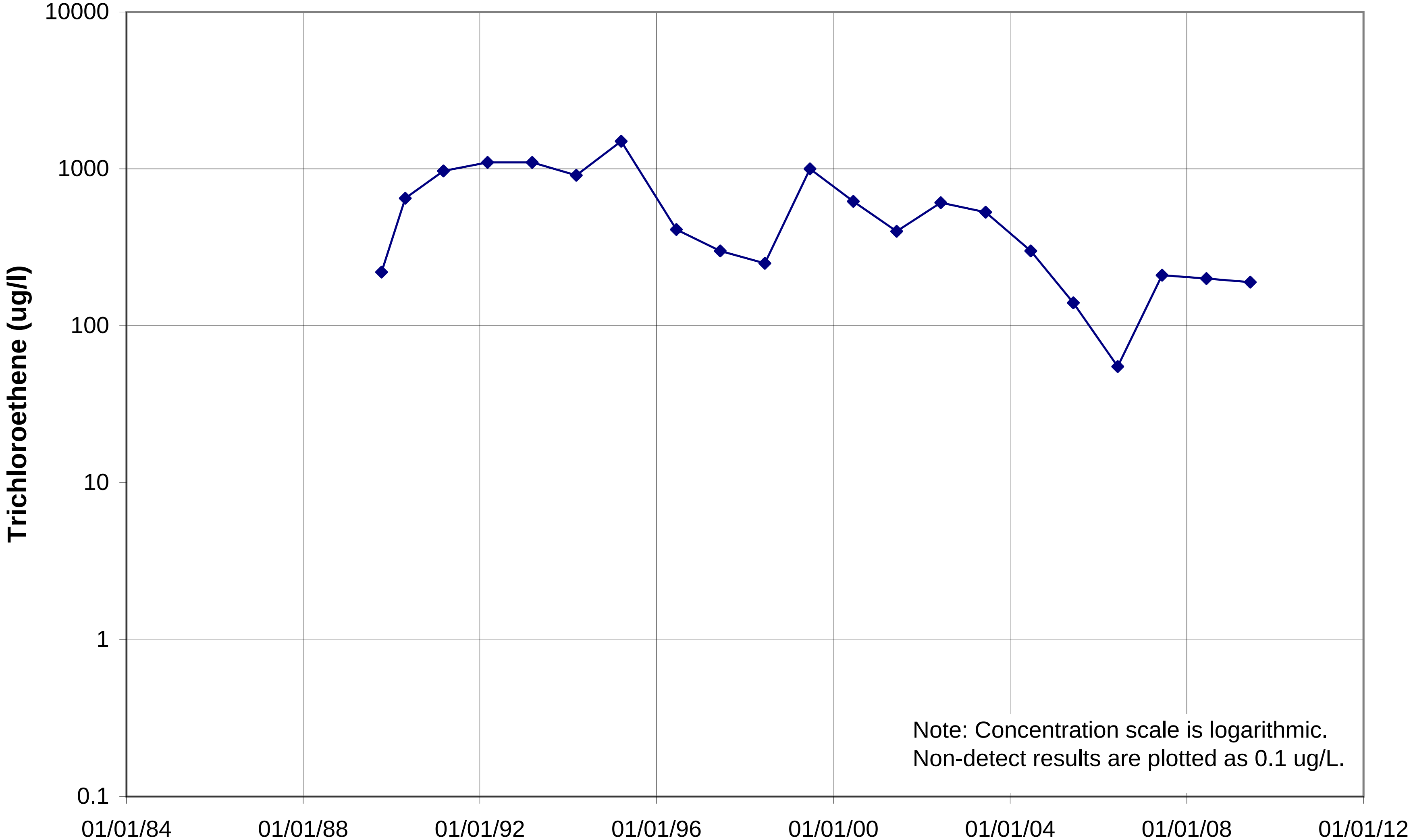

**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 03U822




**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 04J077




**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

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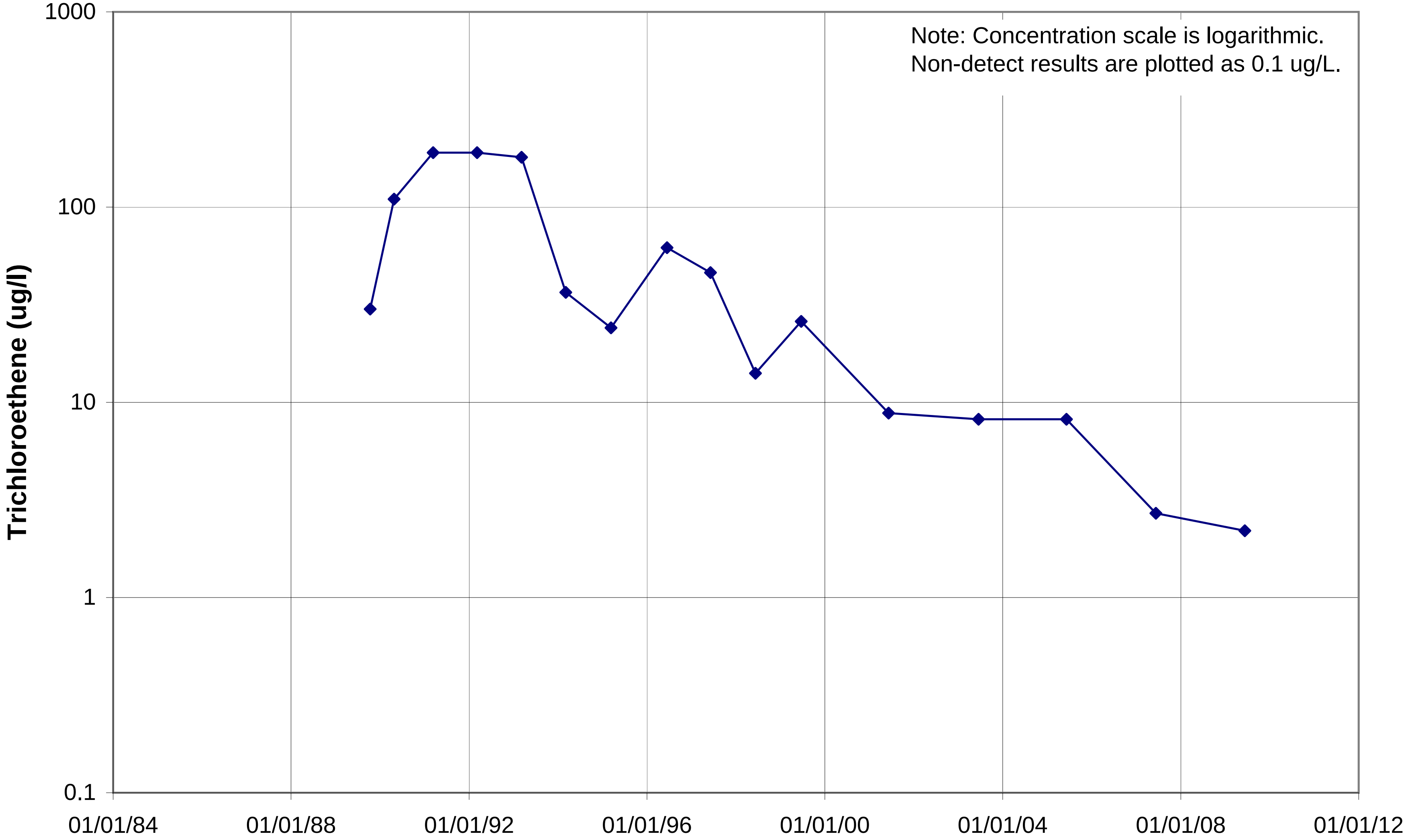


**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

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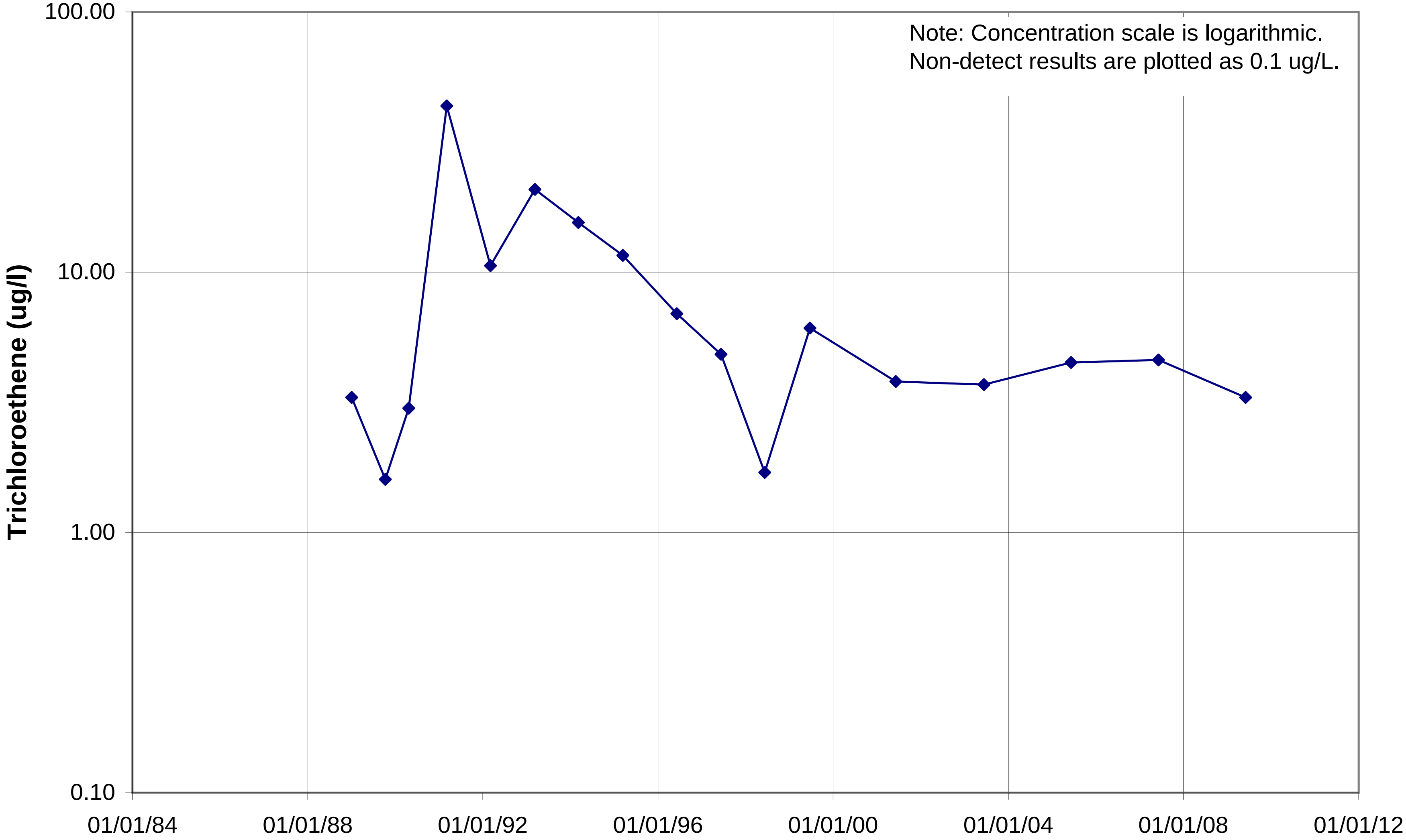


**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

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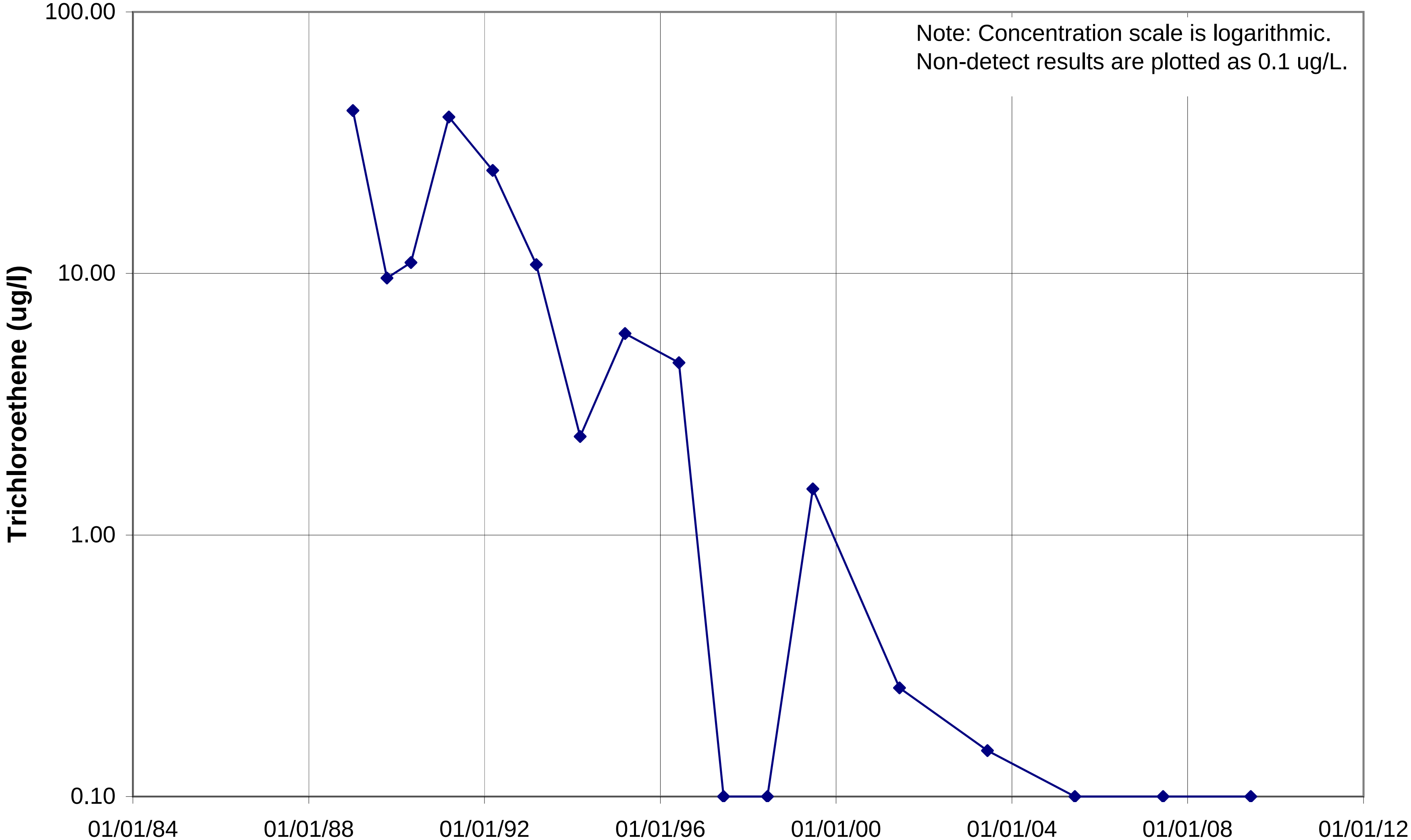


**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

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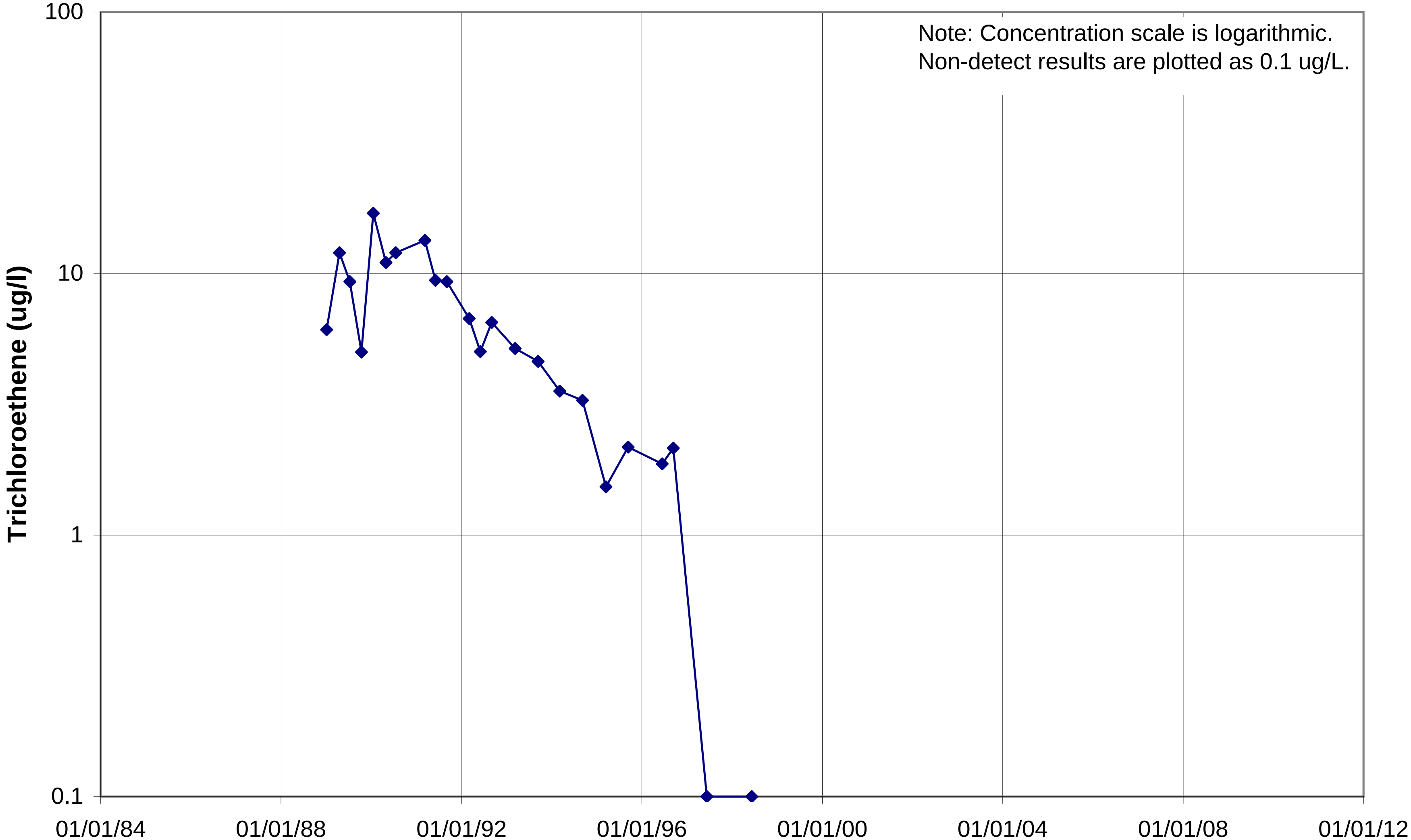


**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

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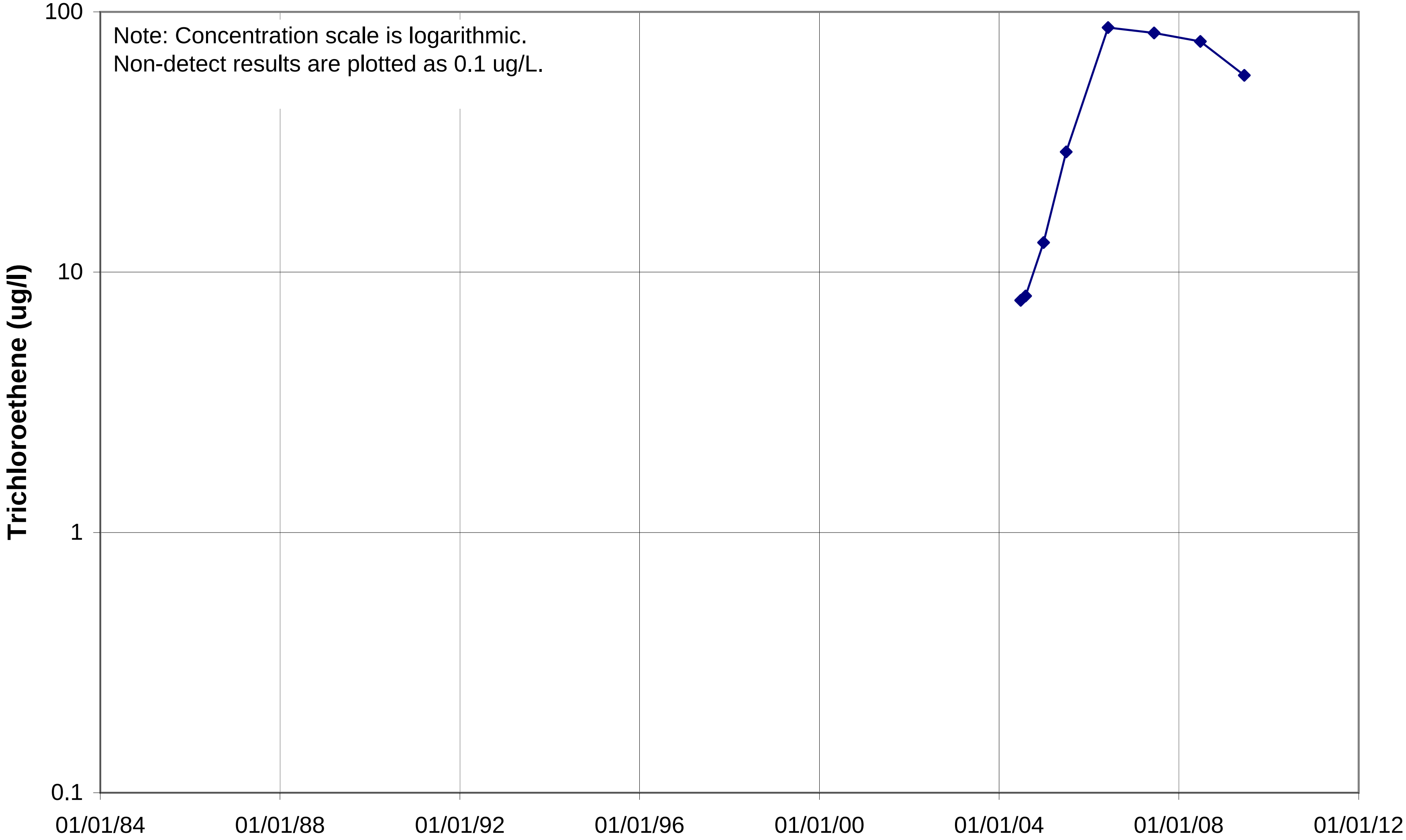
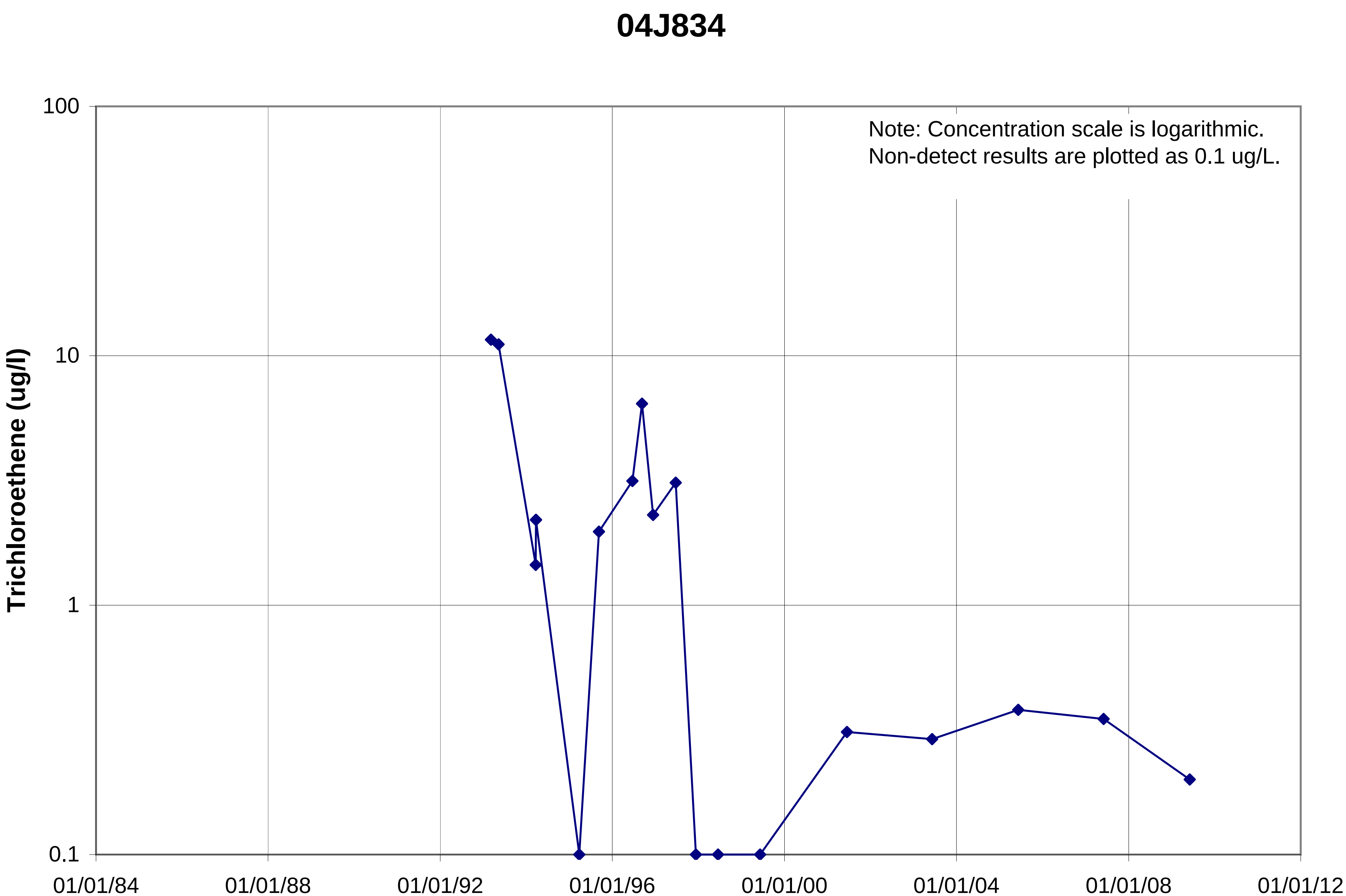
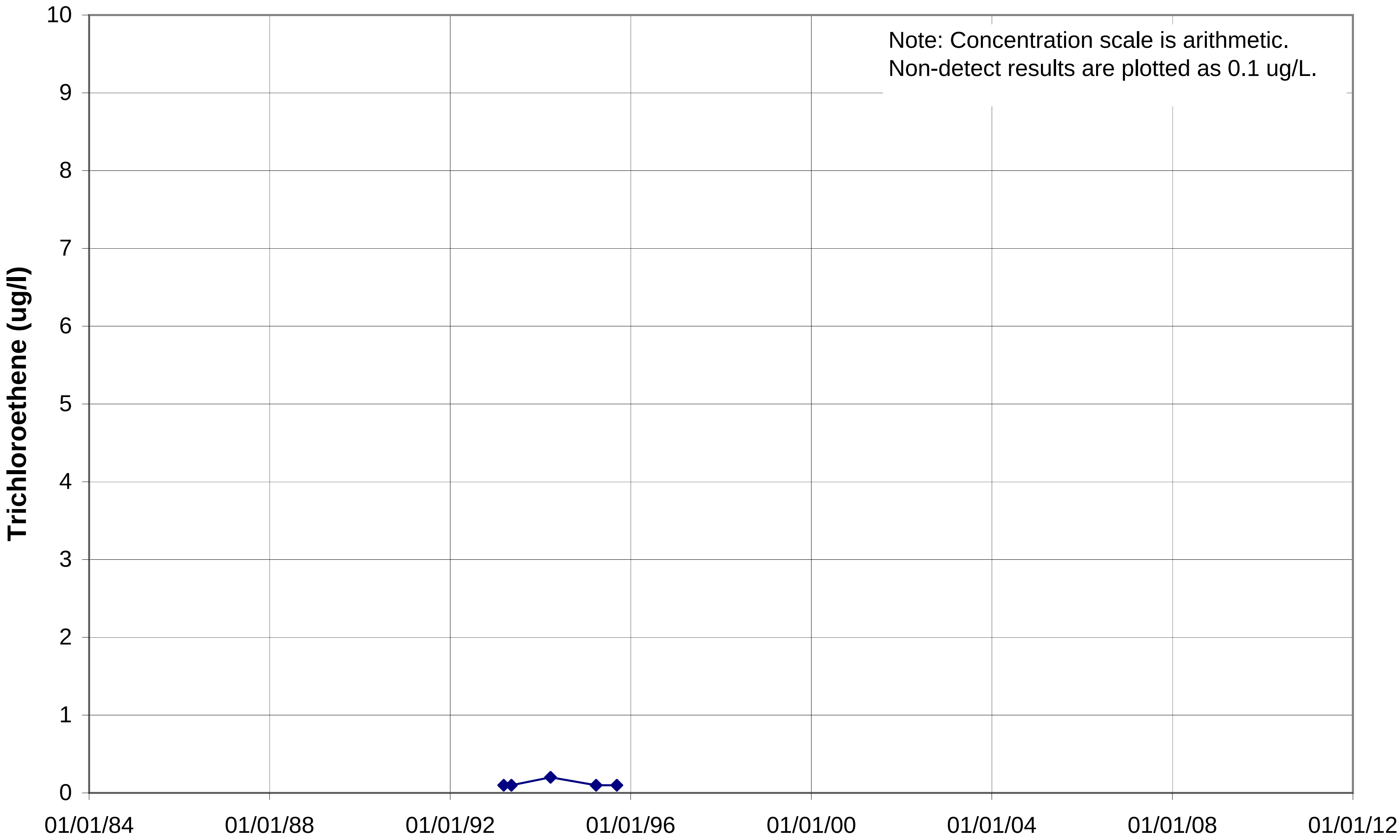



**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar




**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 04J835




**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

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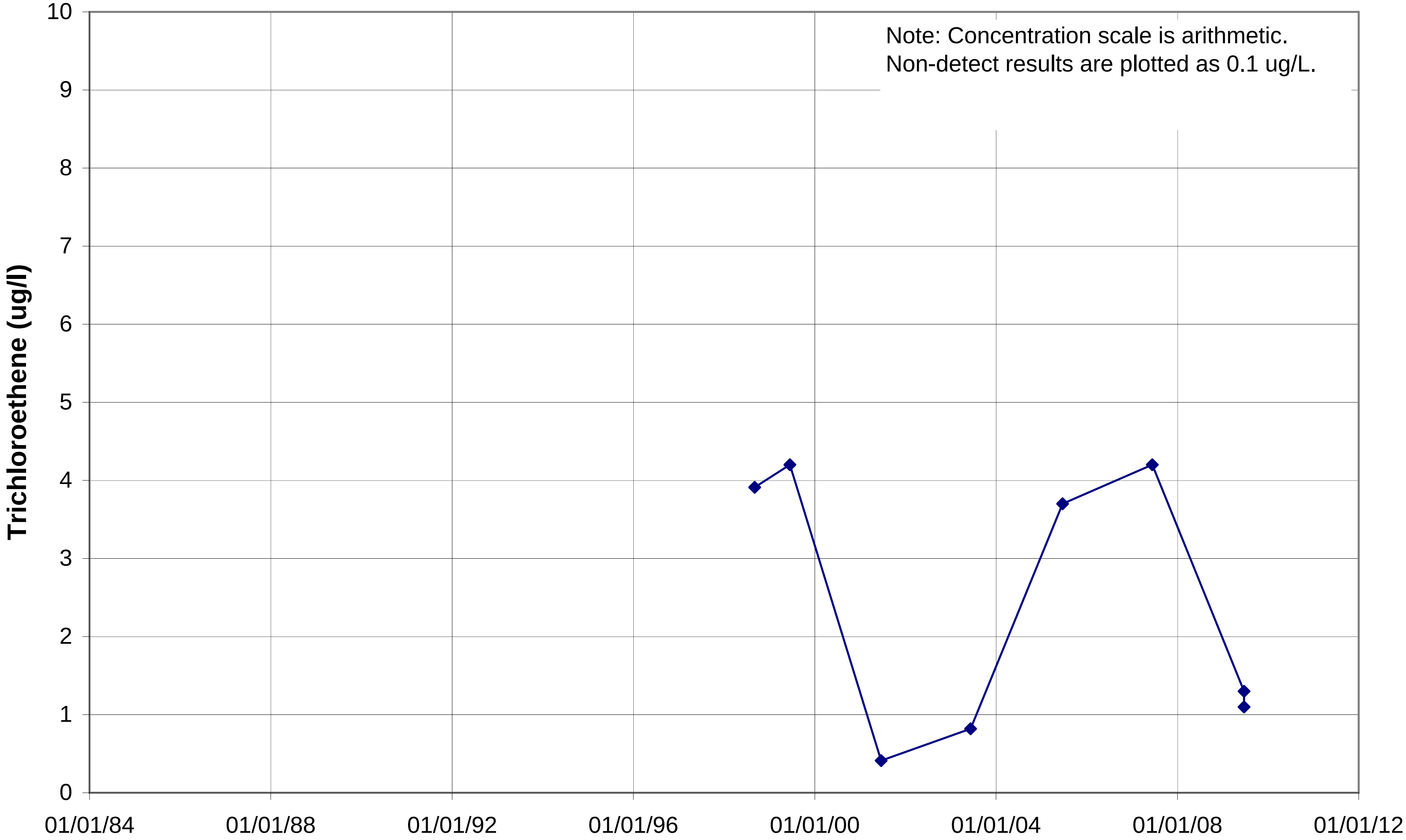


**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

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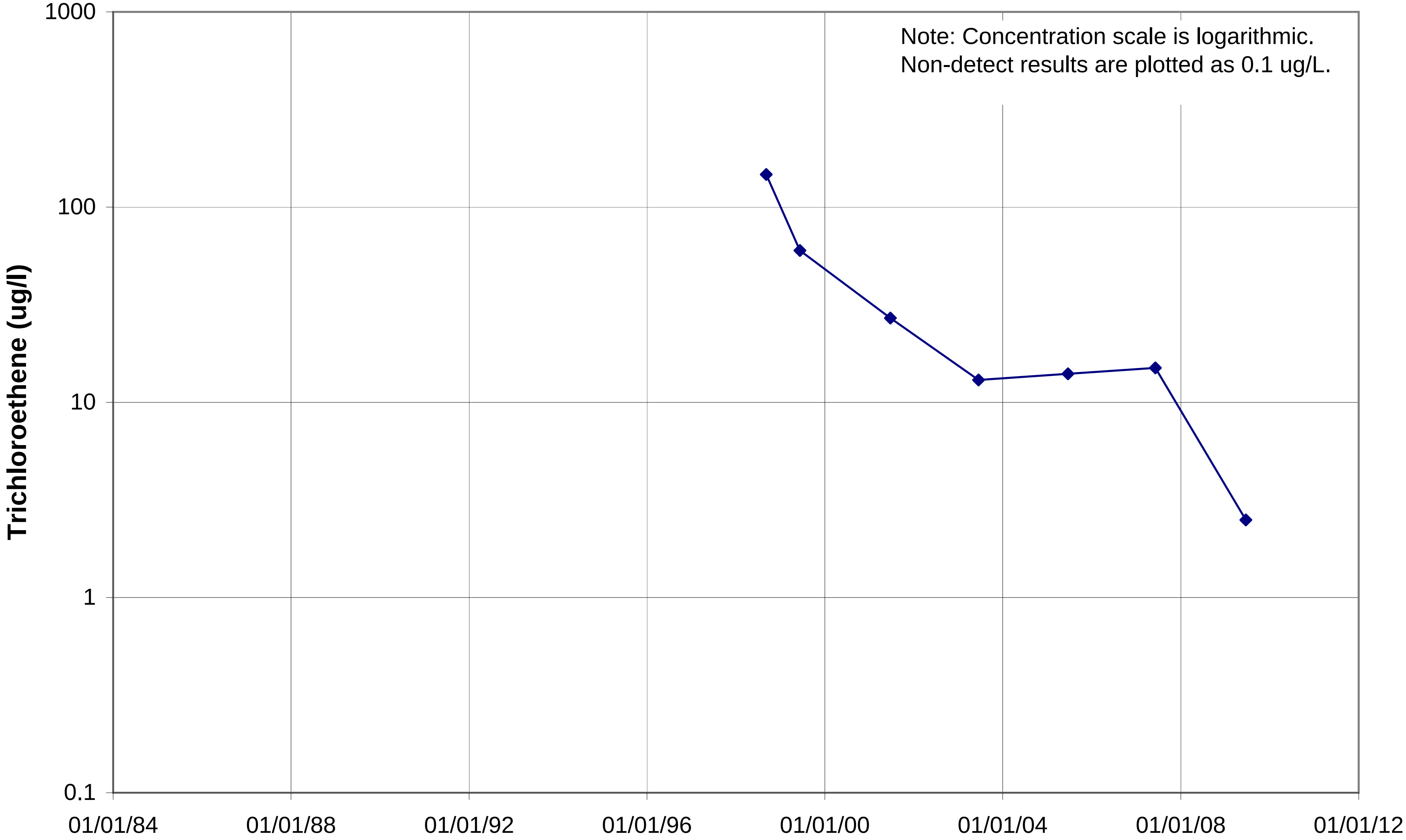


**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

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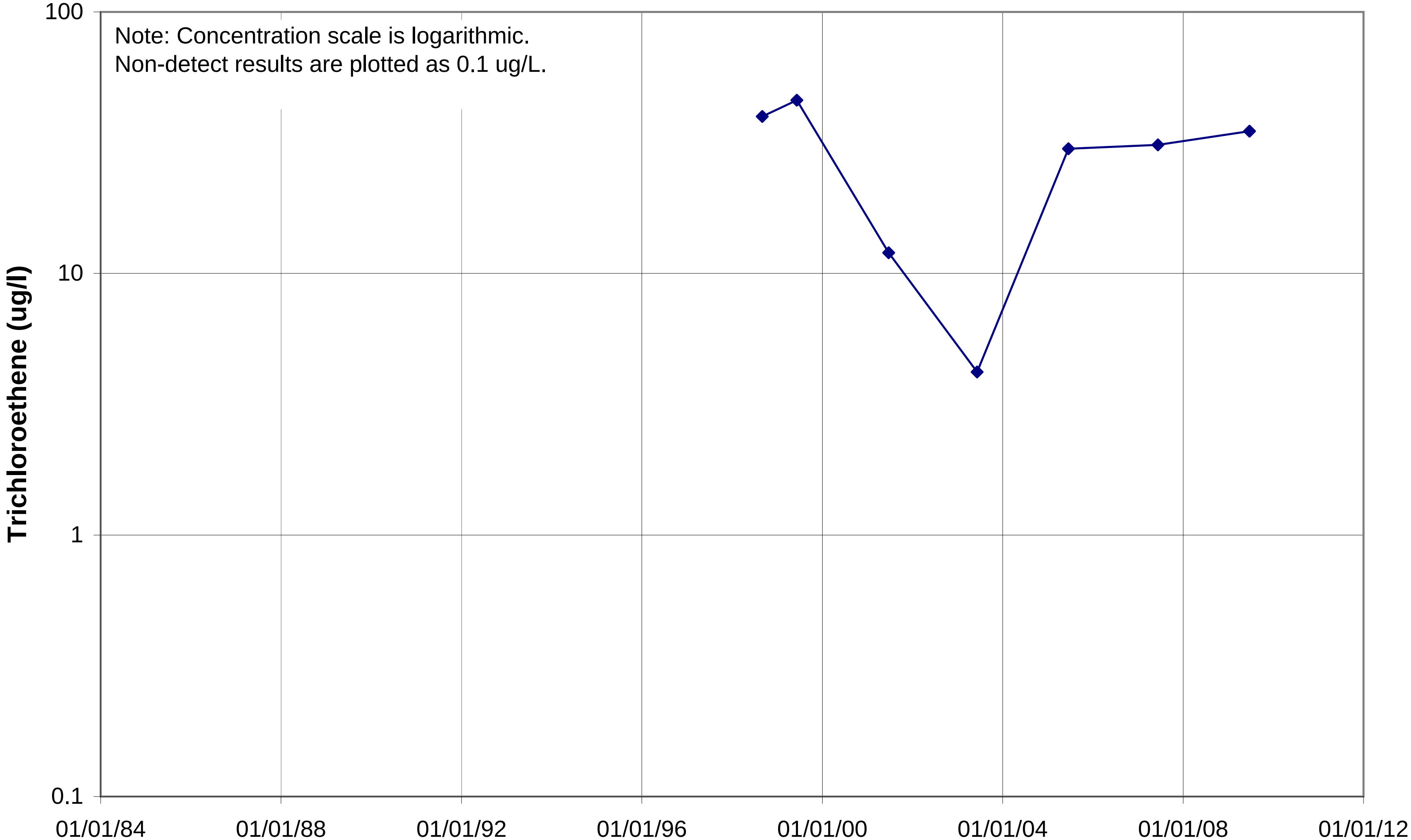


**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

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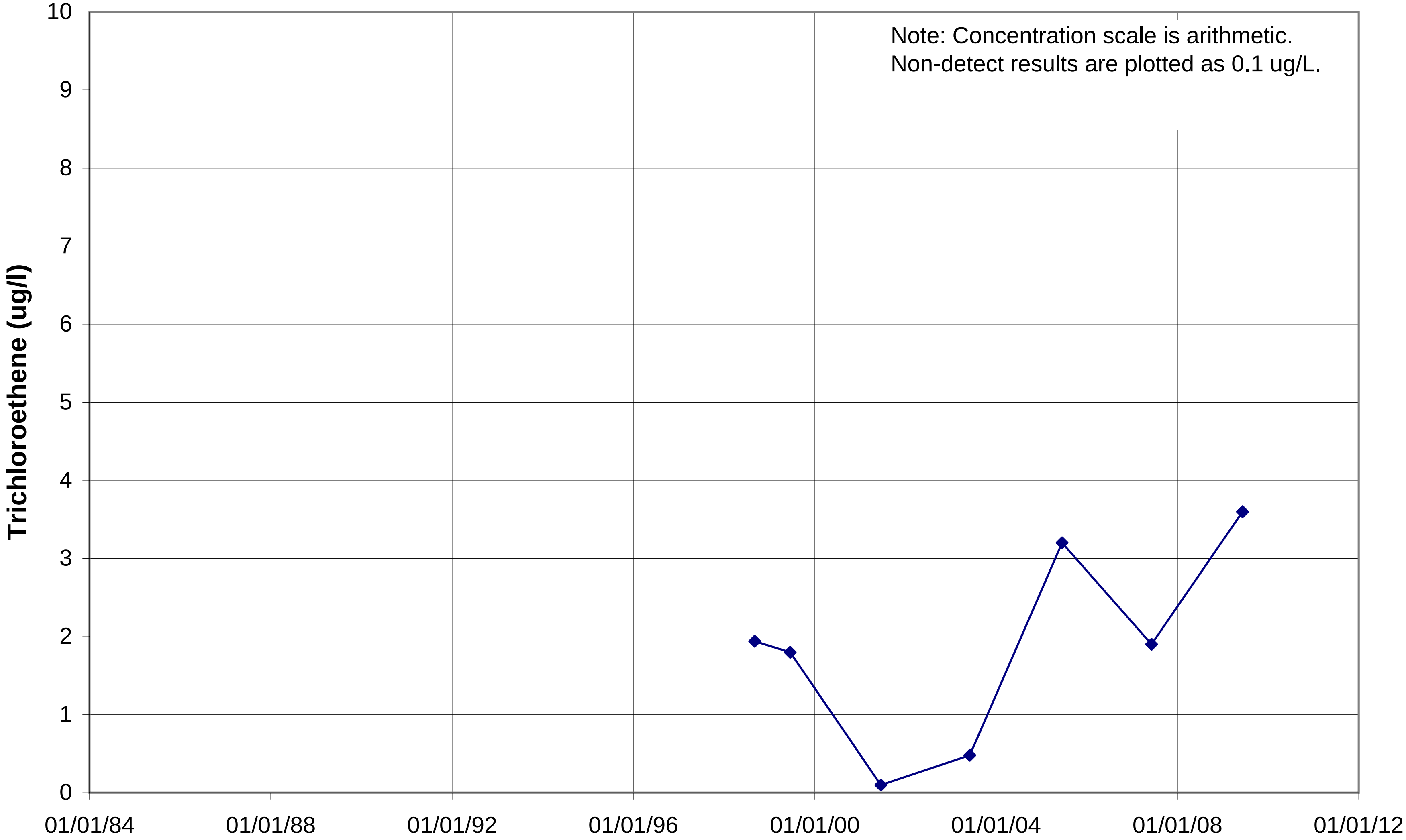
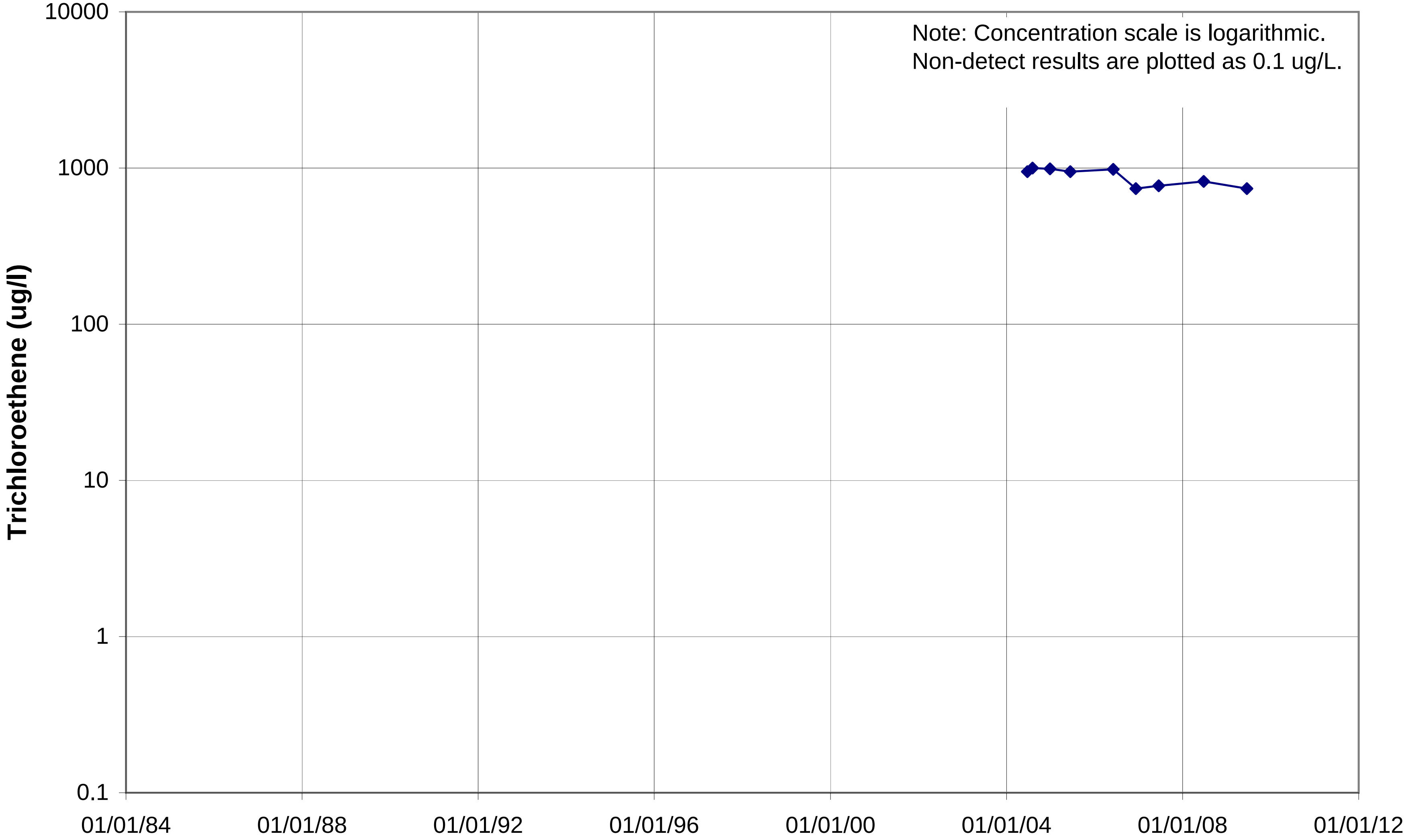



**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 04J847

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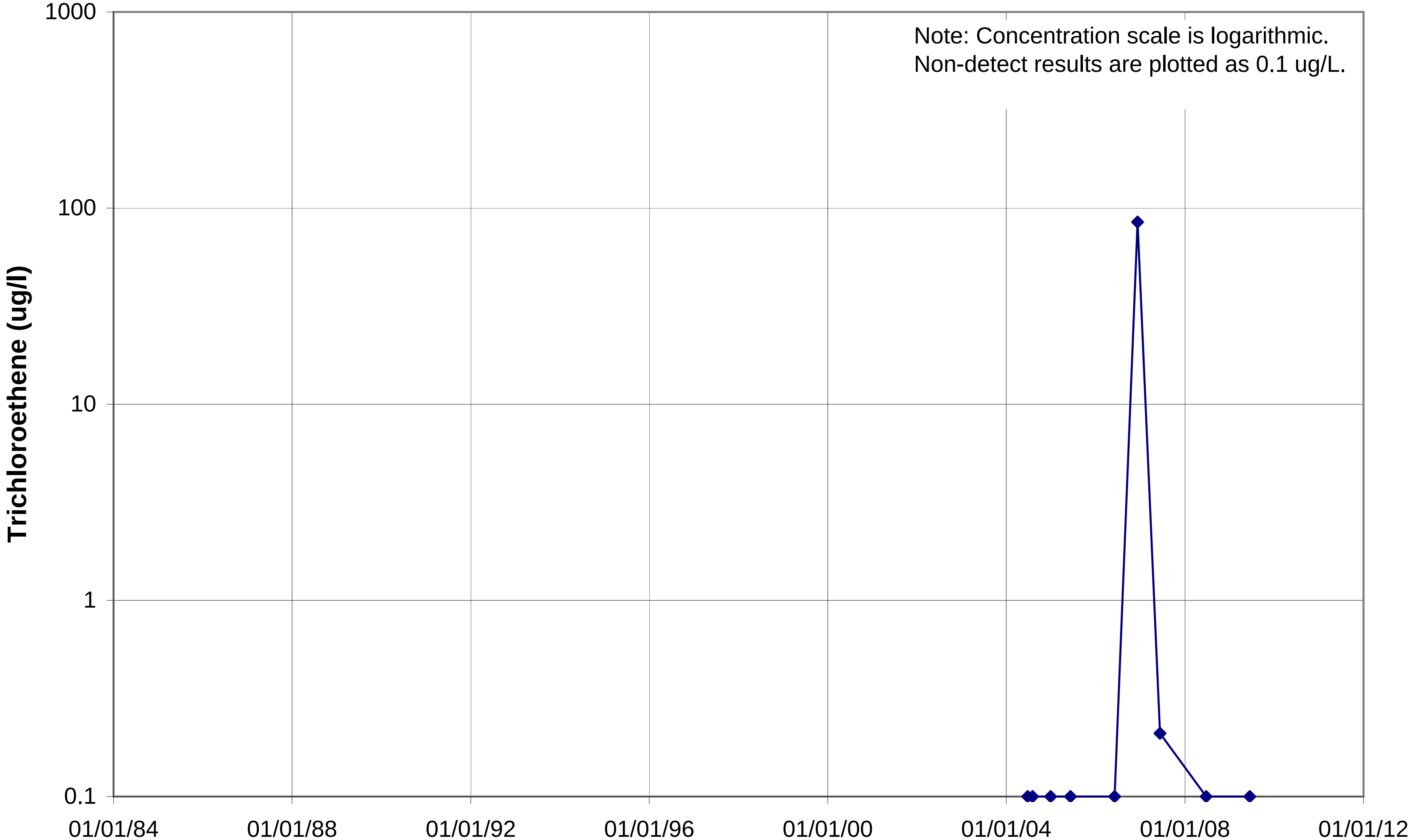
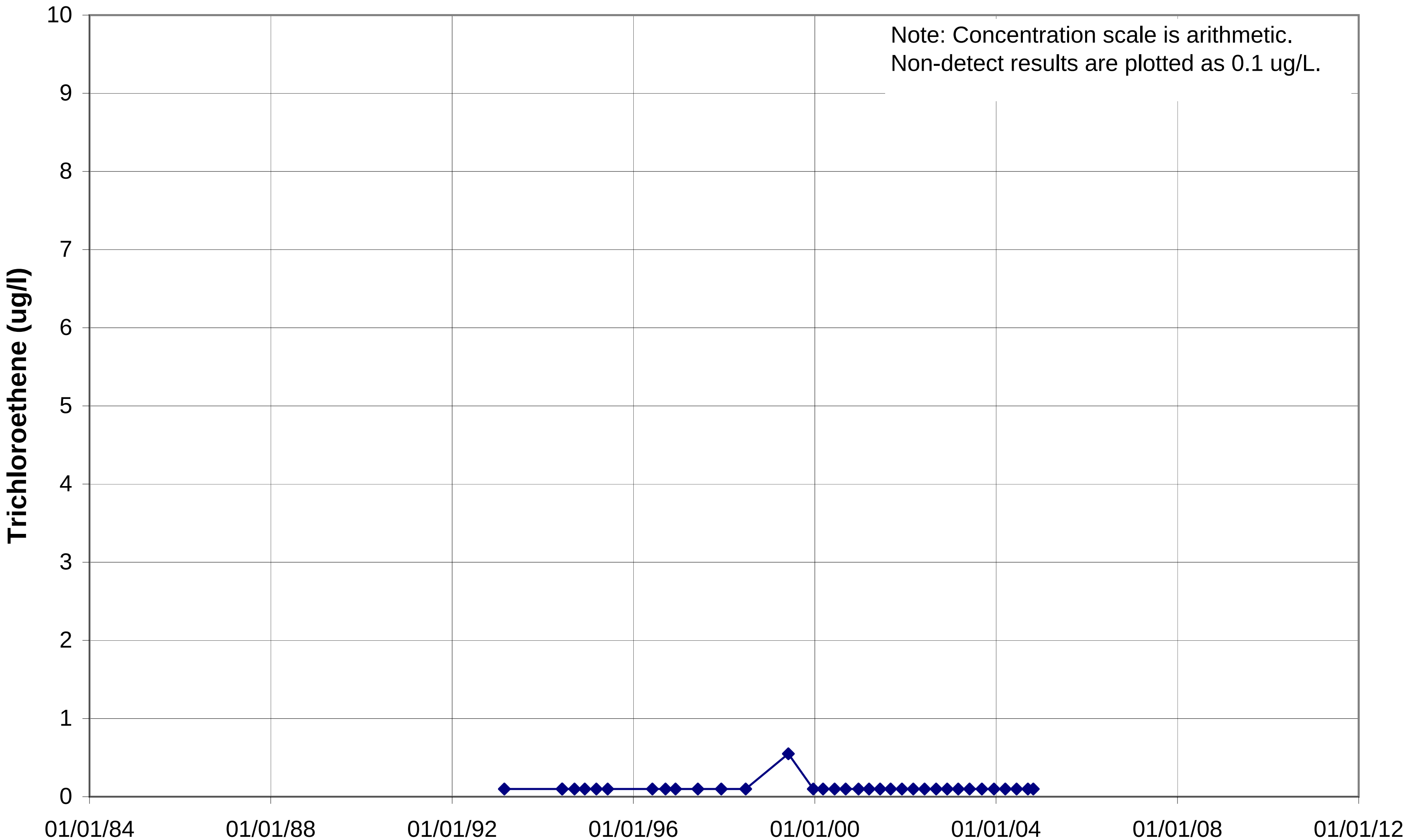
# 04J849



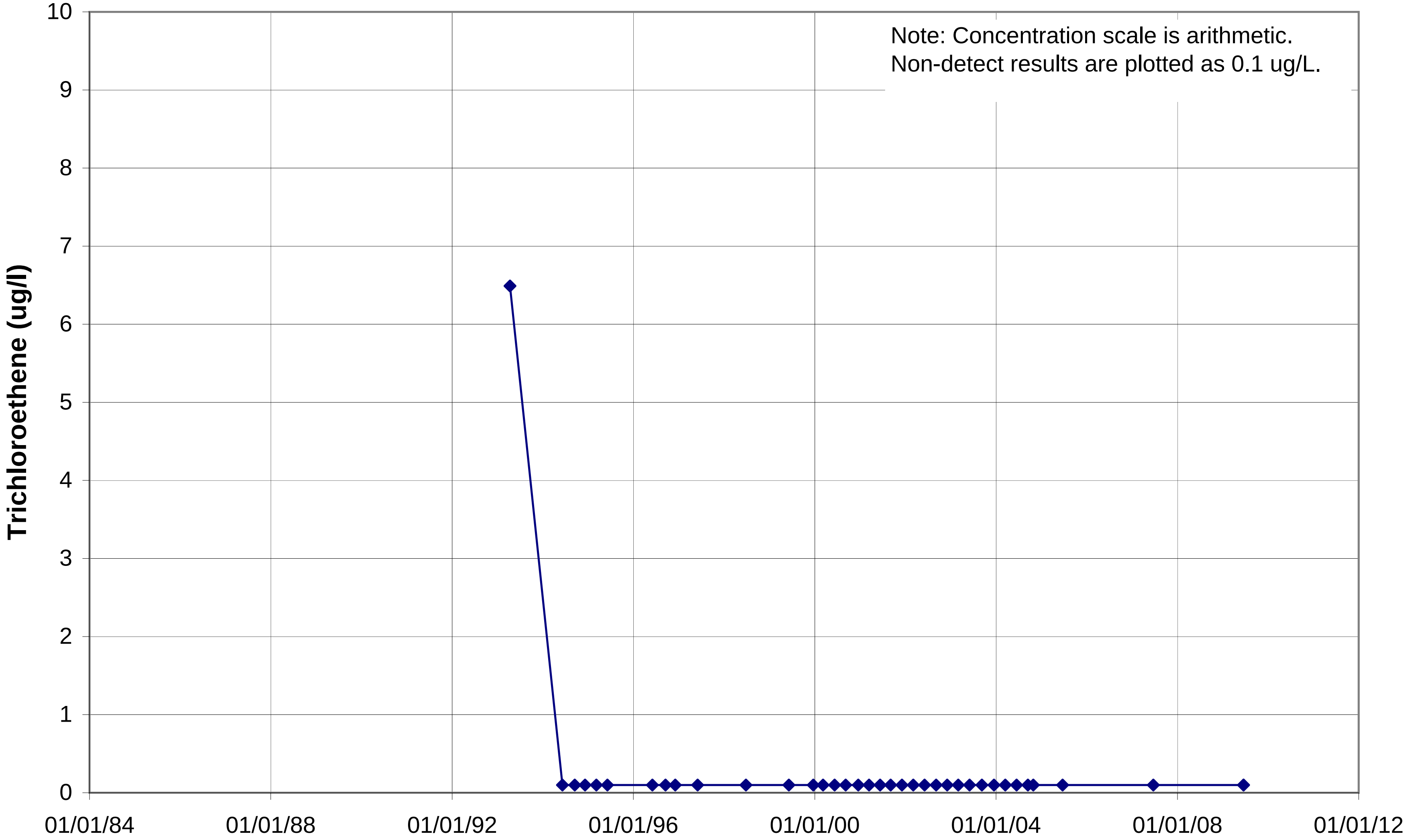

**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 04J864



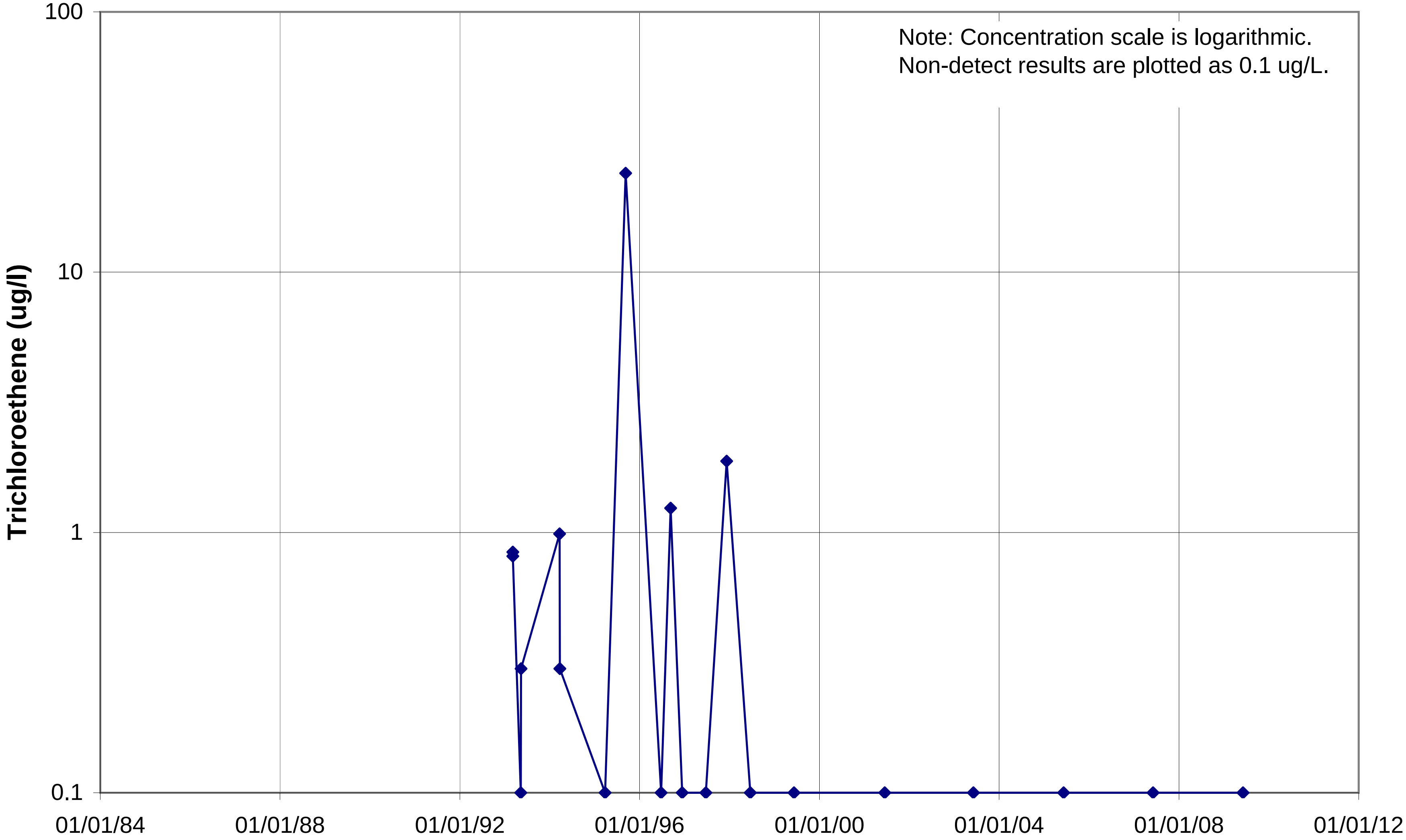

**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 04J866



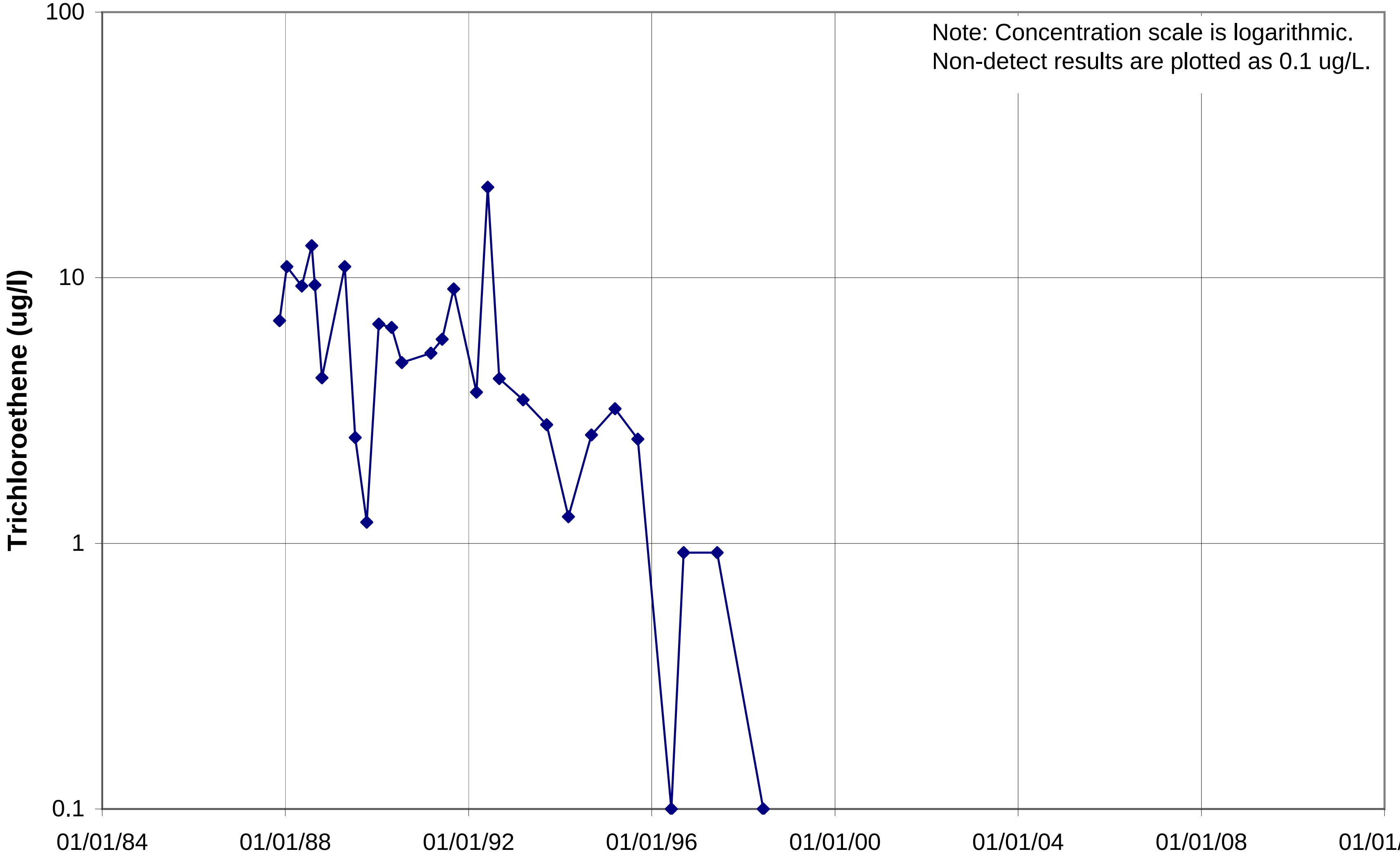

**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 04J882



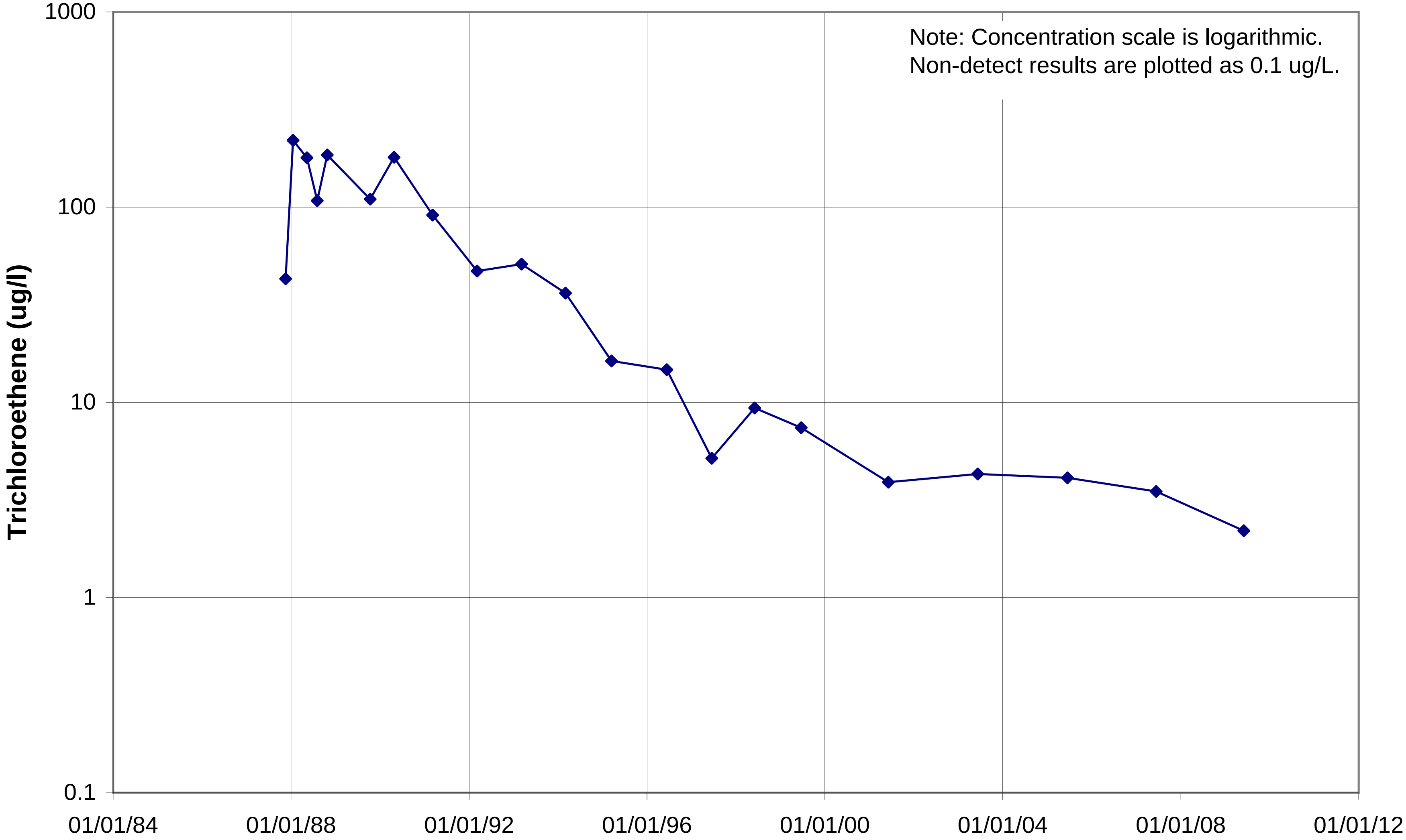

**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 04U001



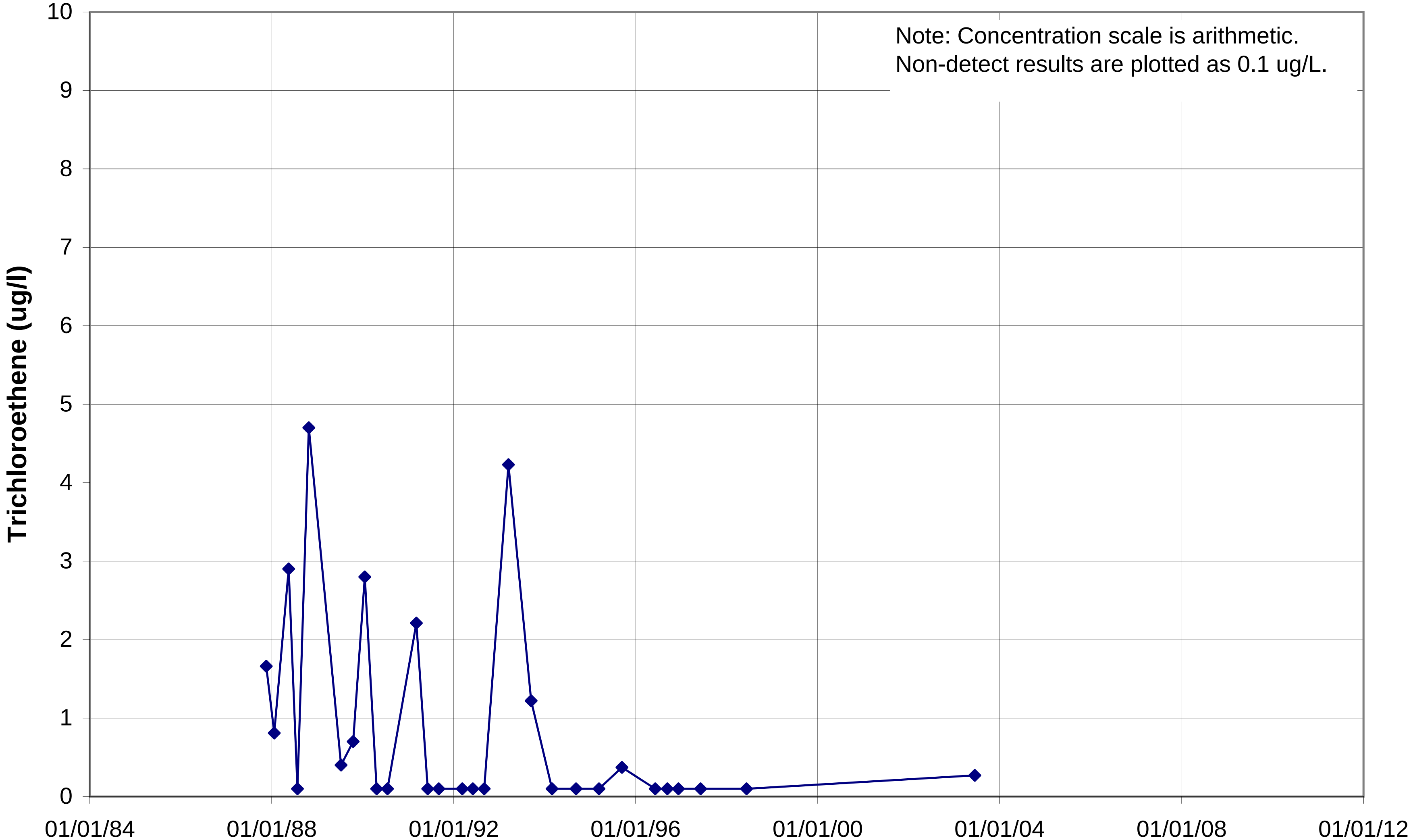

**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 04U002



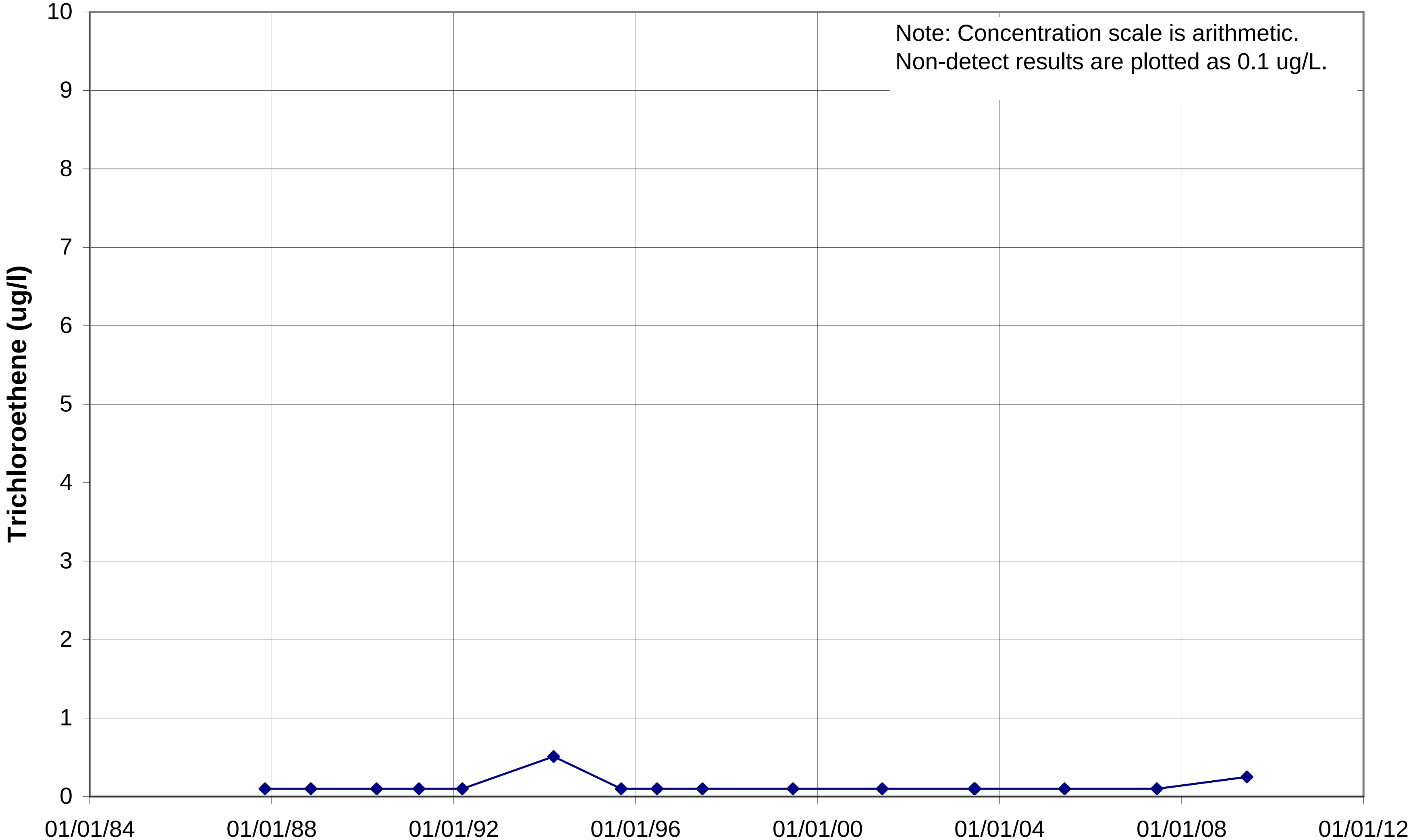

**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 04U003



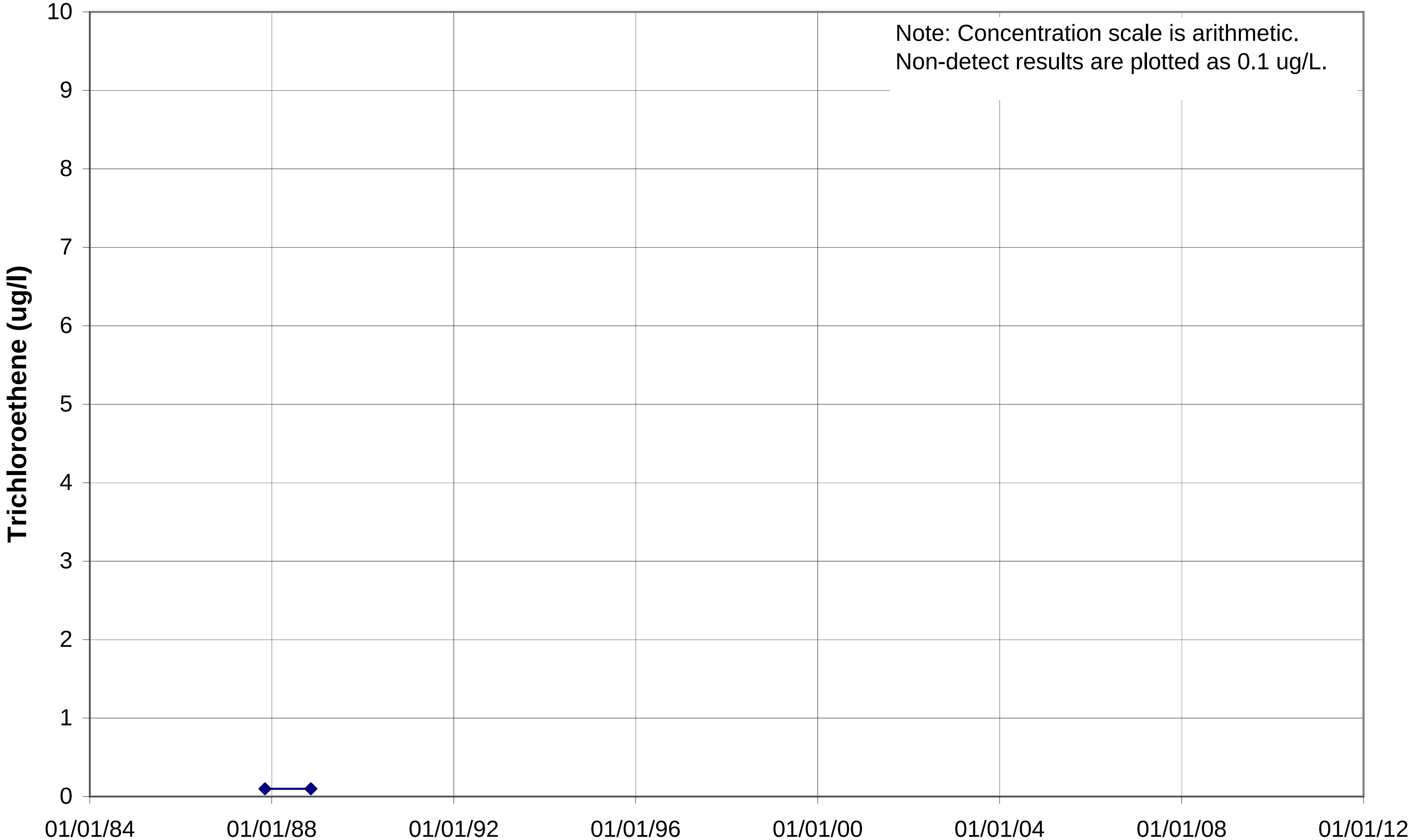

**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 04U007

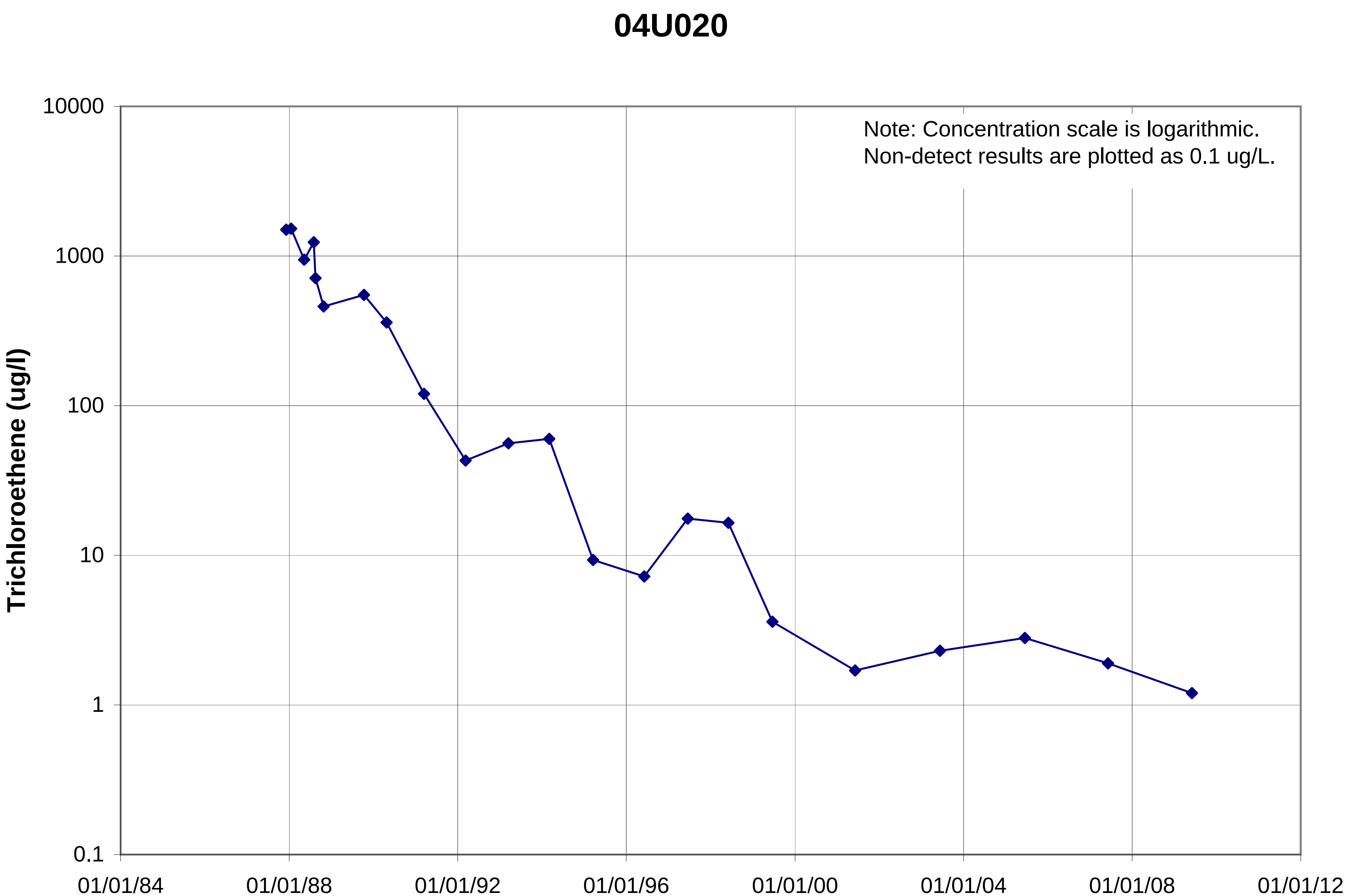



**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 04U012

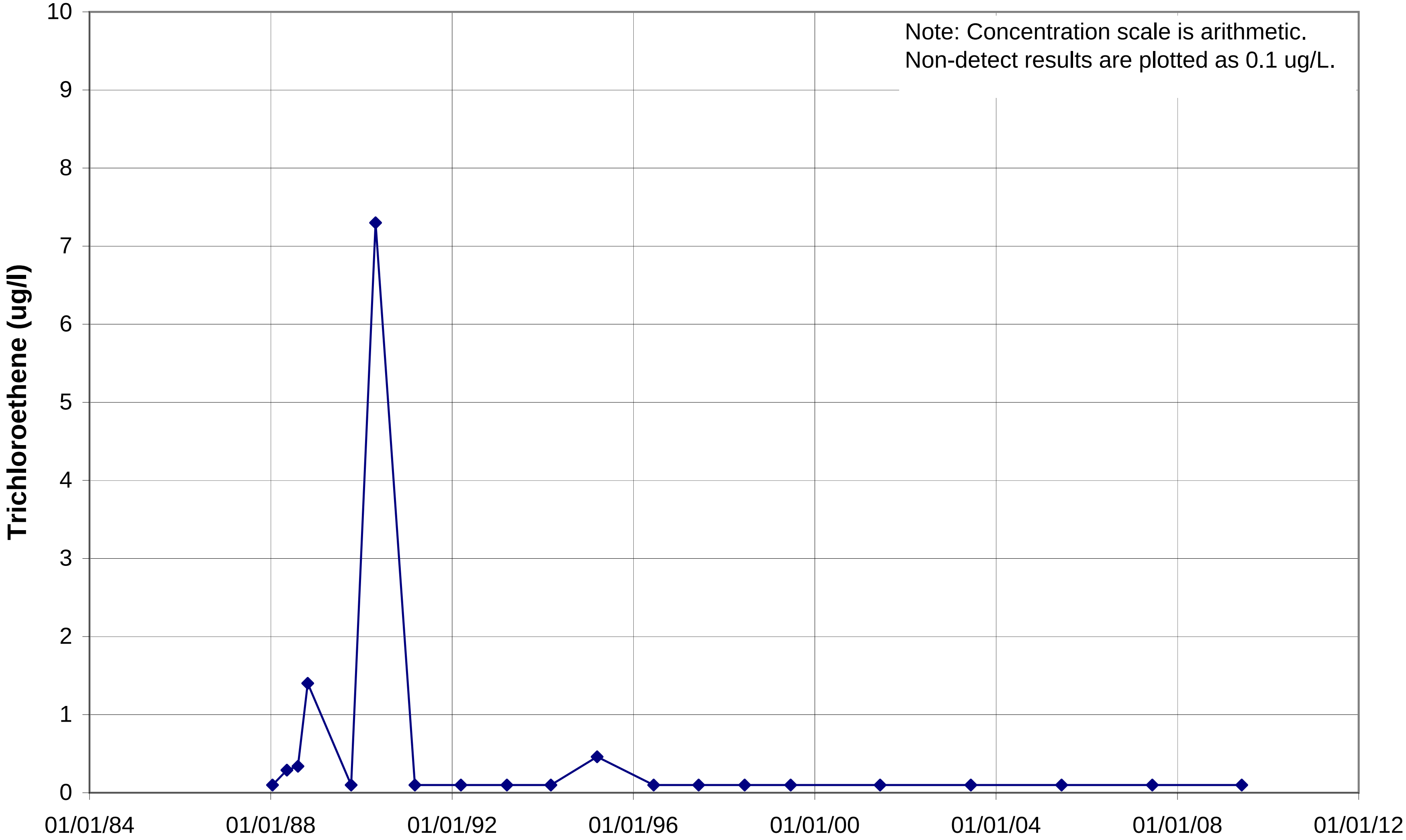



**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar



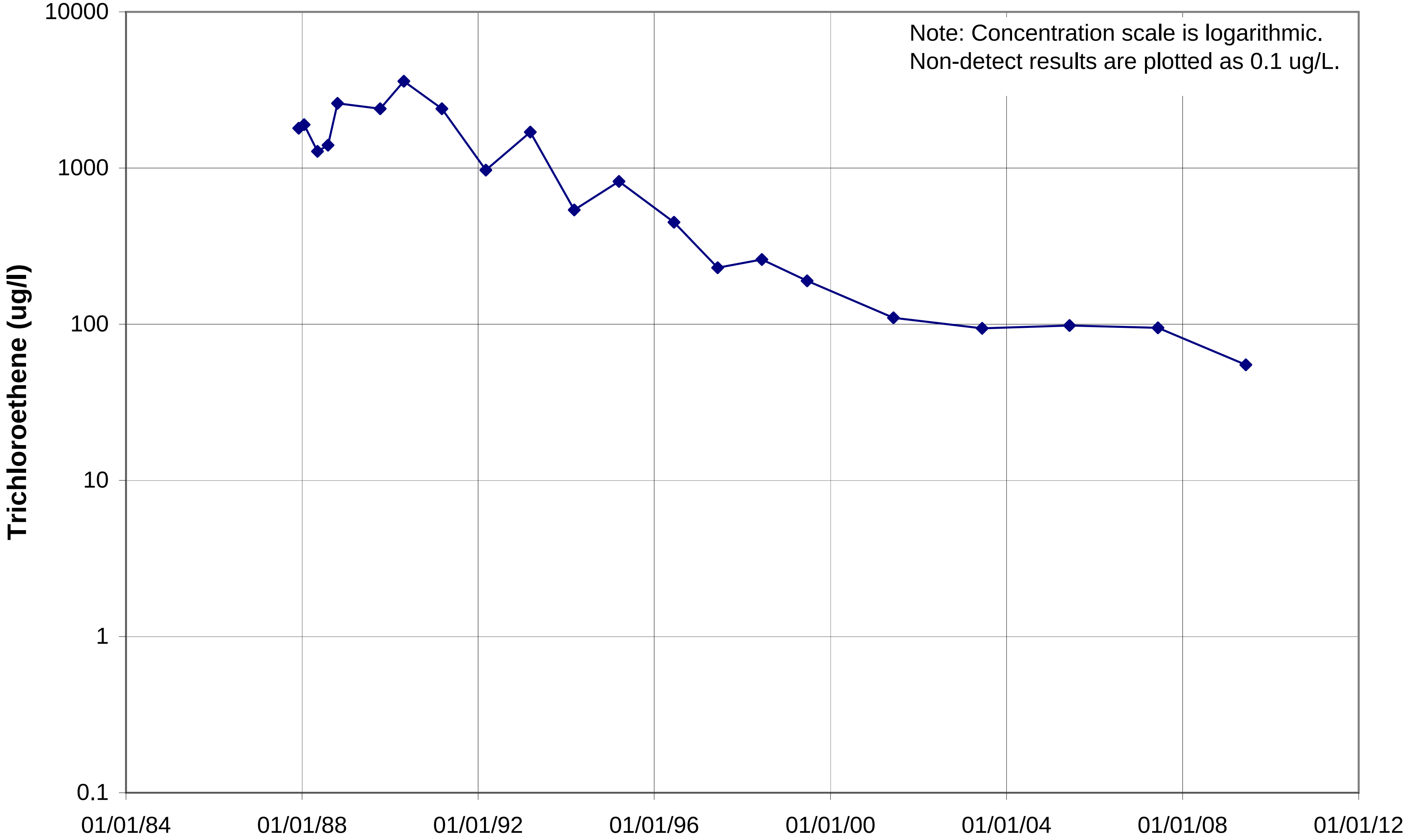

**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 04U027



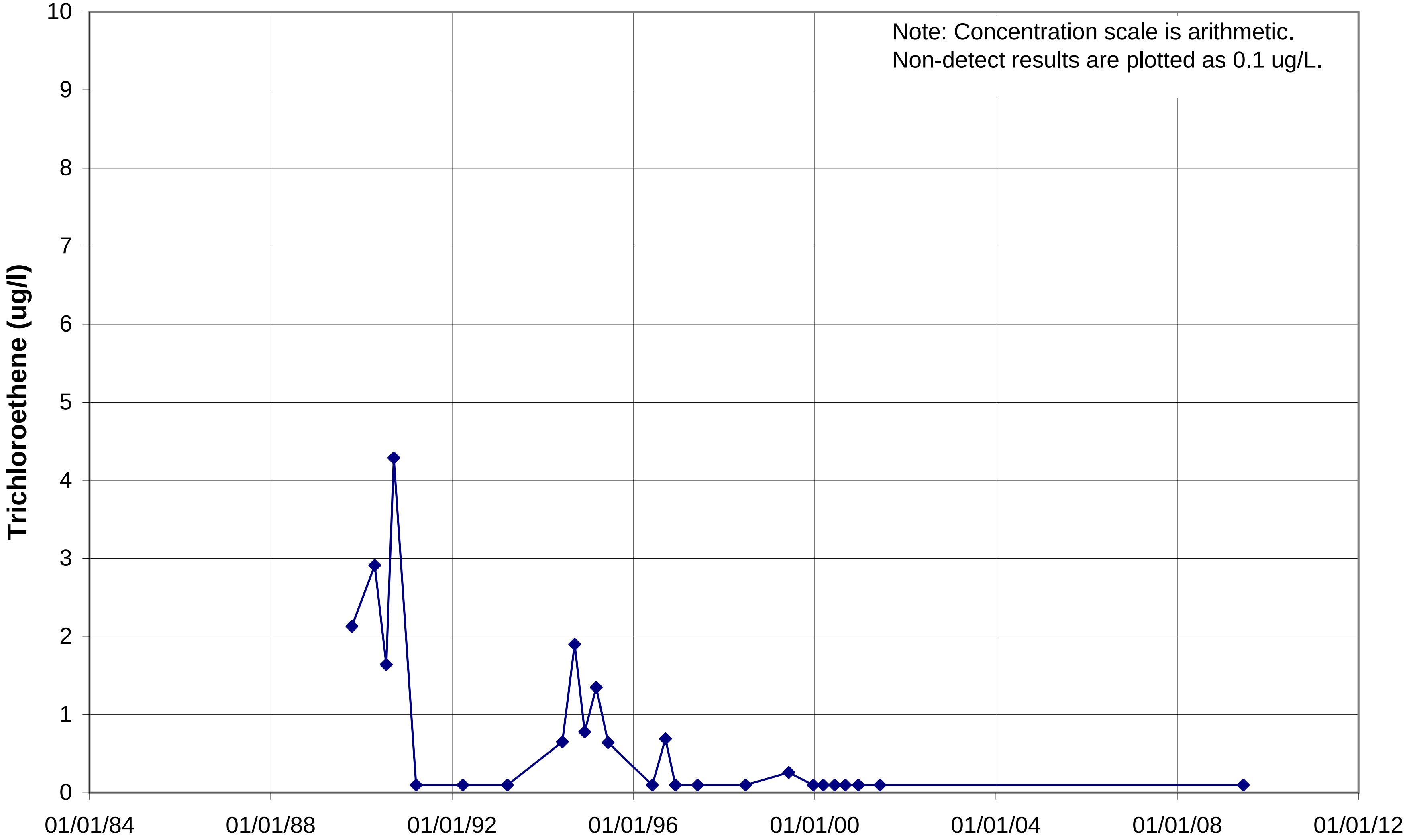

**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 04U077



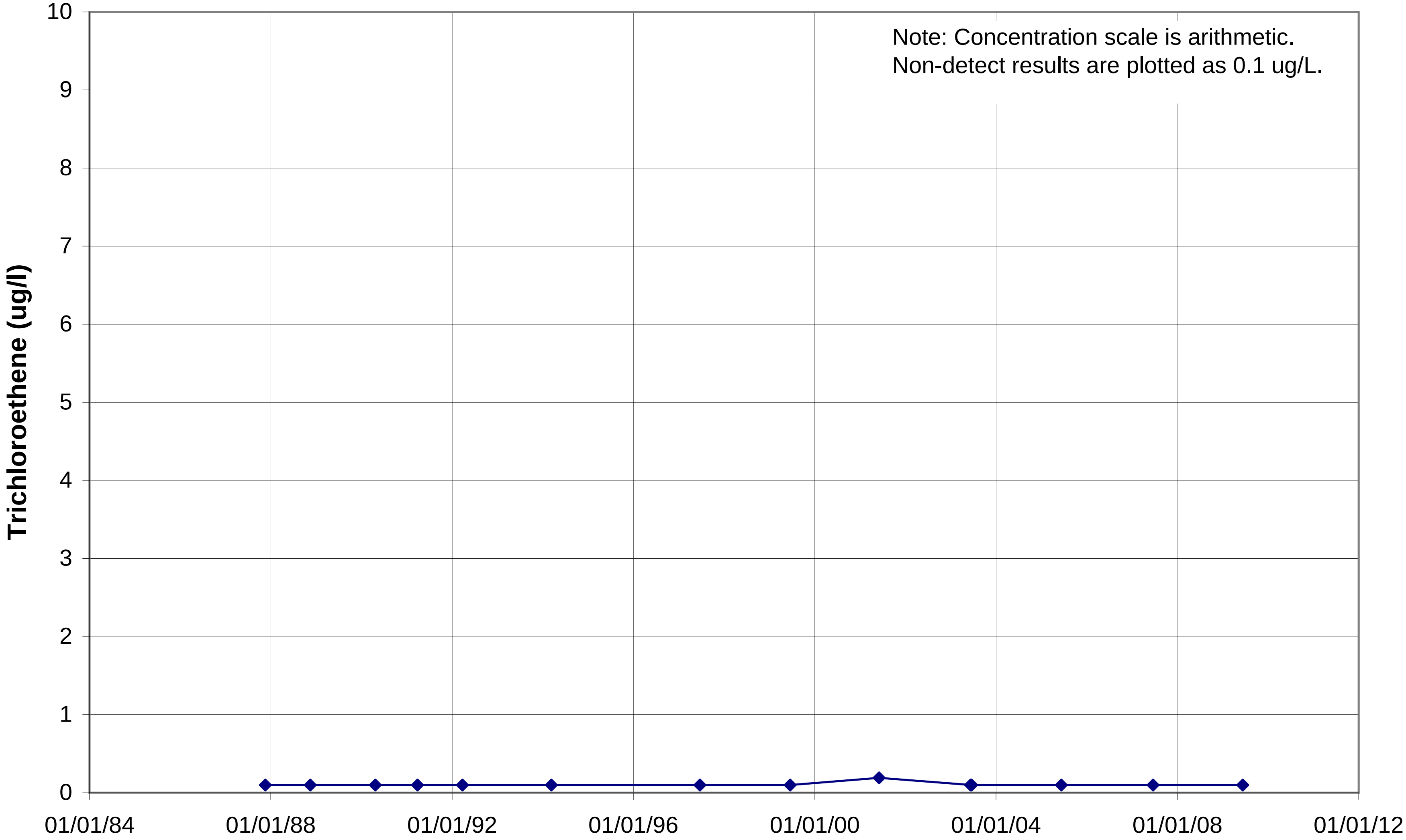

**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 04U414 (414U4)



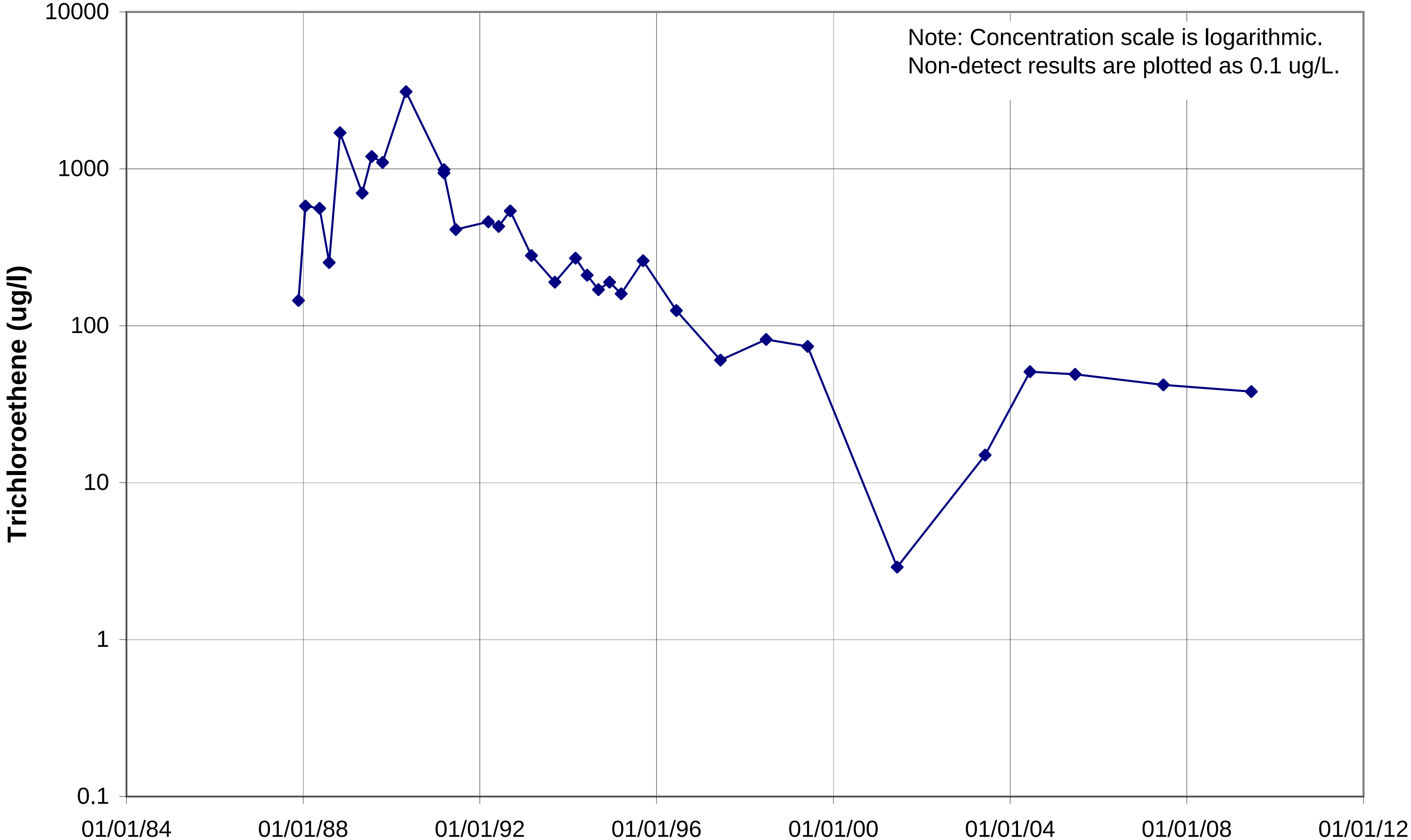

**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 04U510



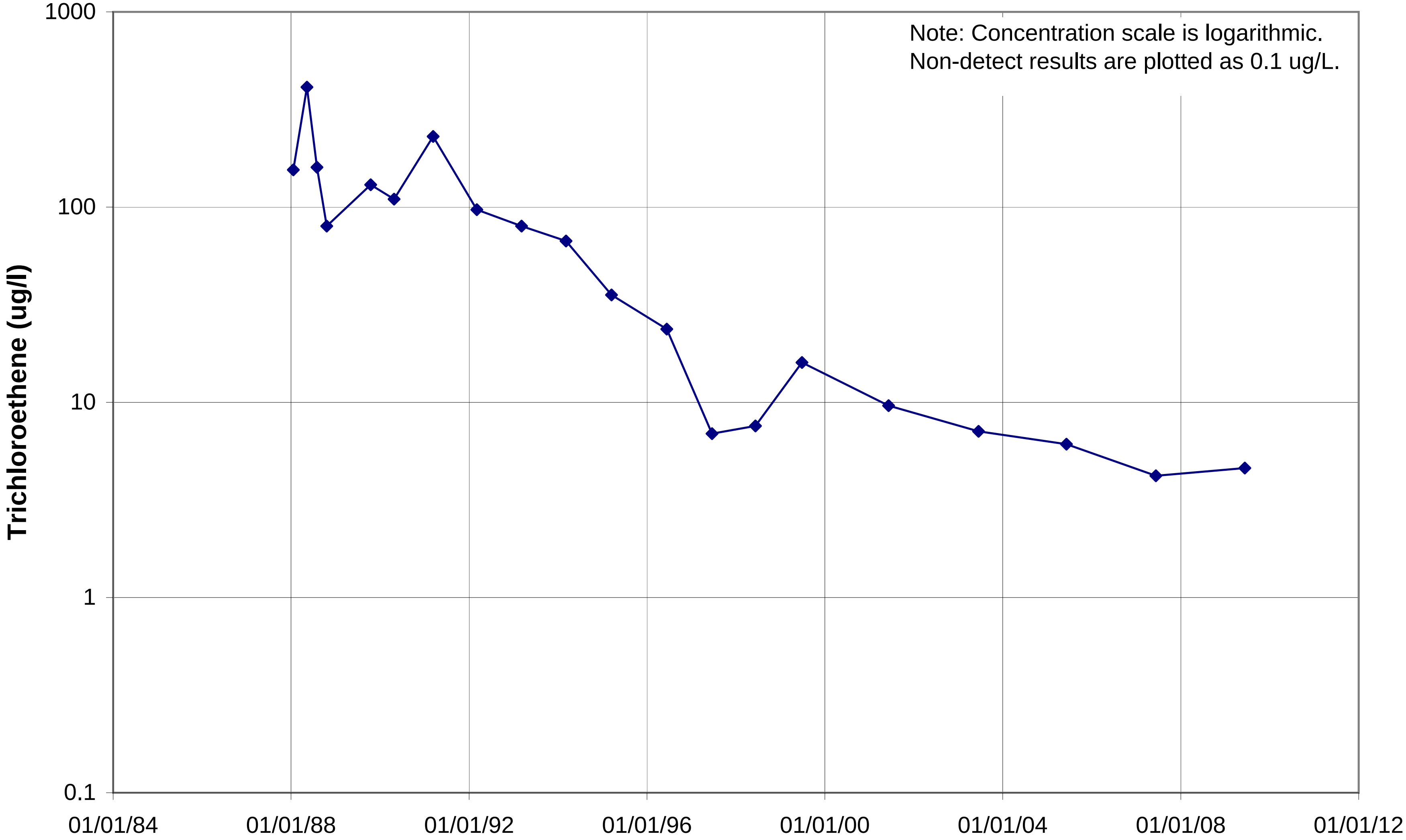

**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 04U673



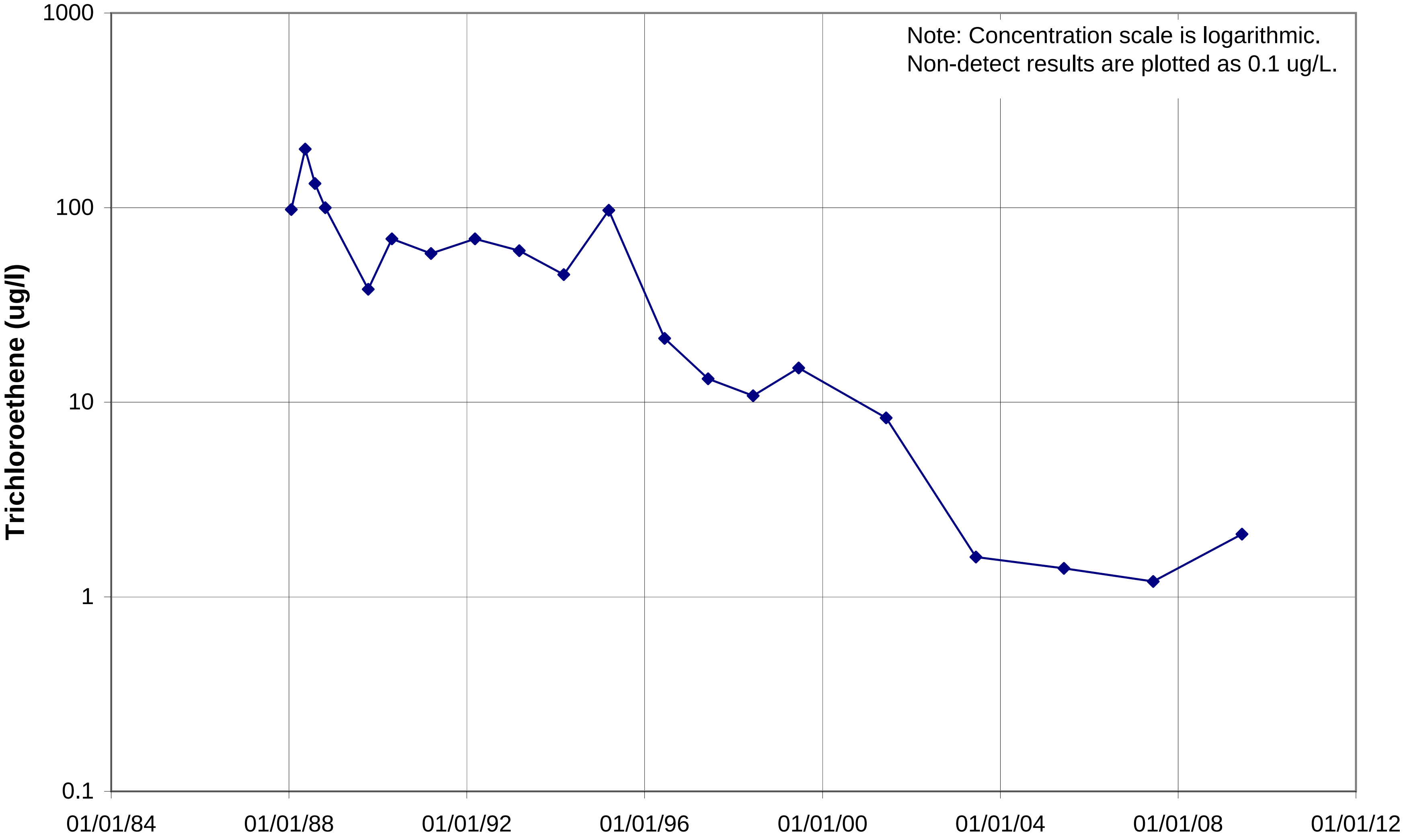

**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 04U701



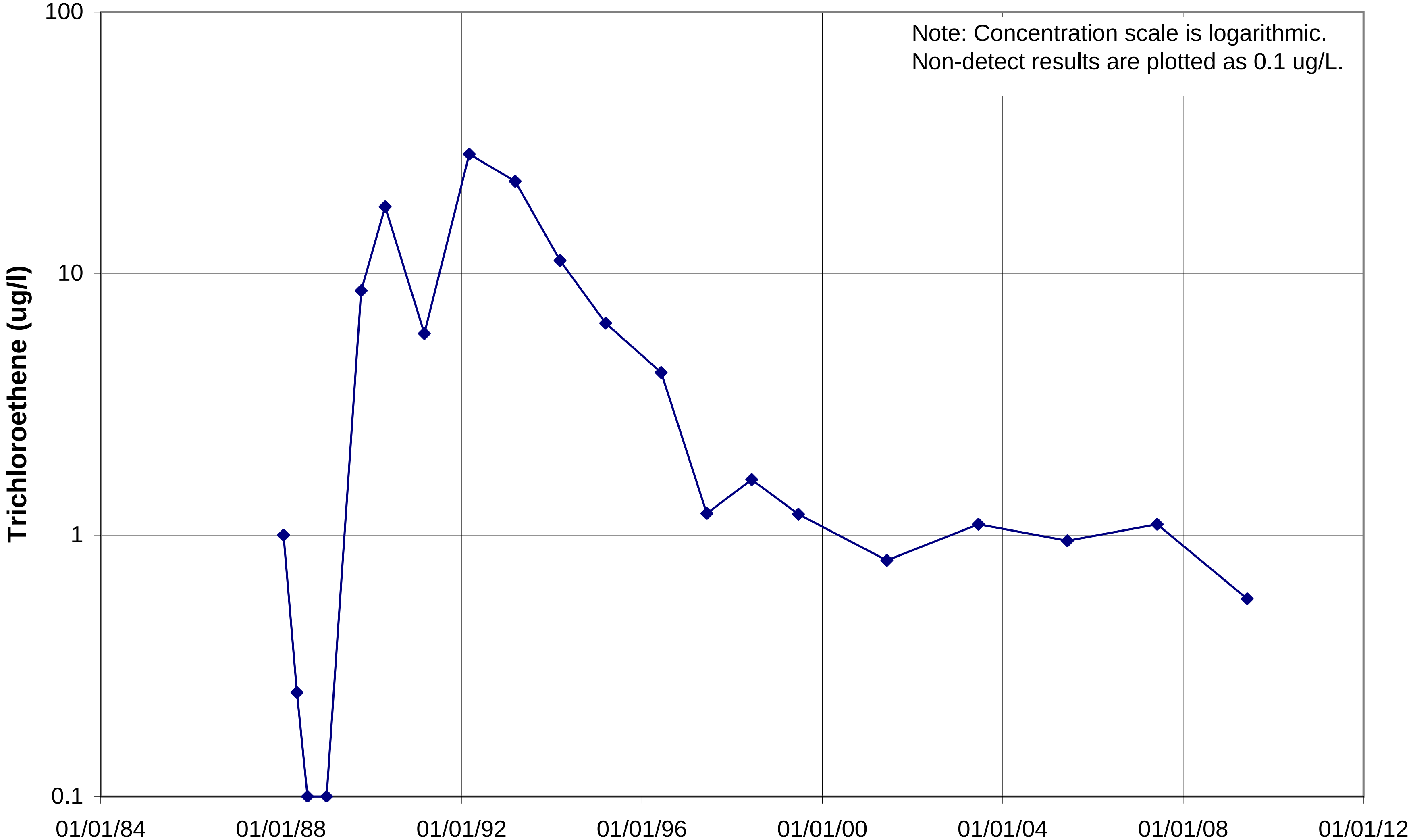

**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 04U702




**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 04U708




**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

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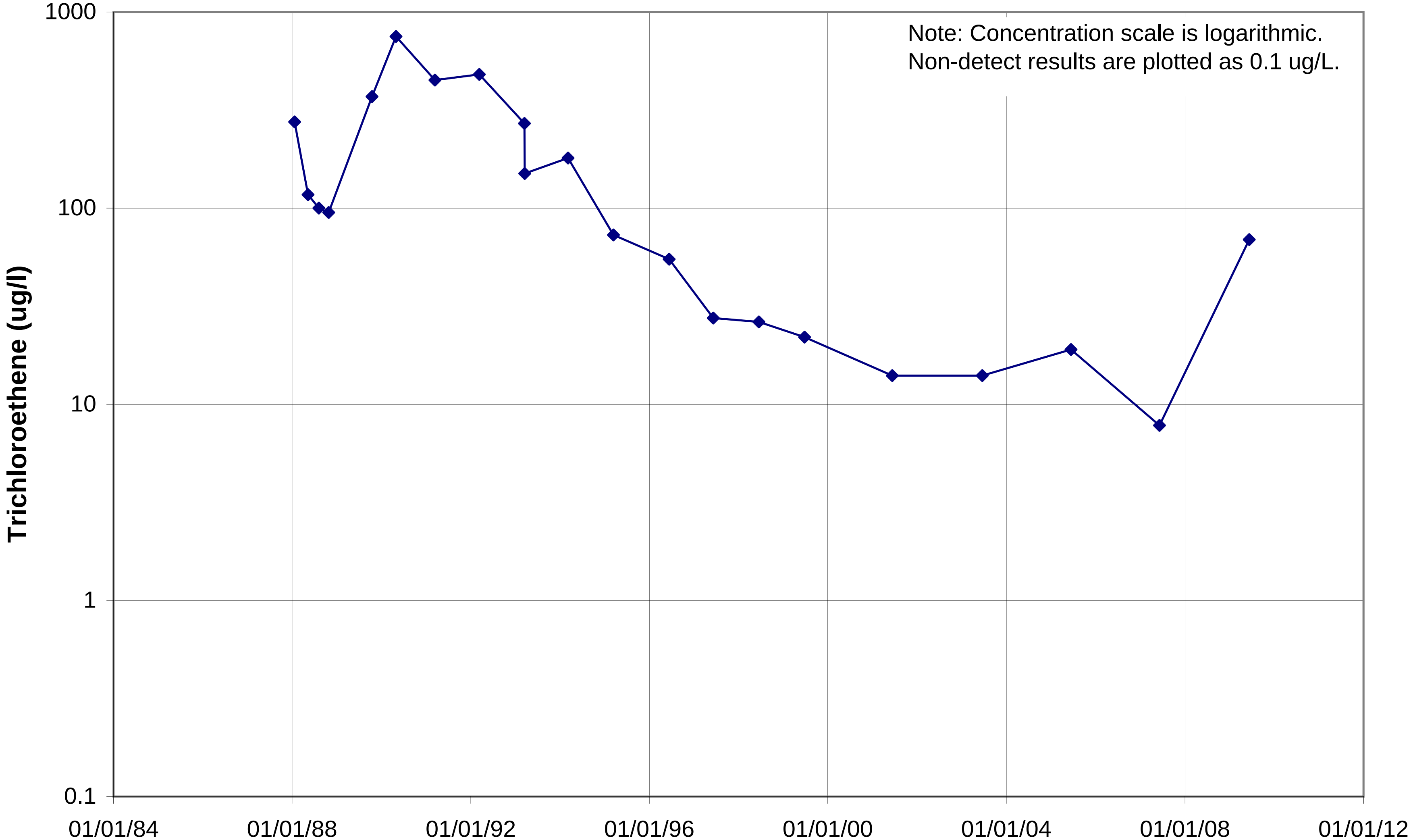
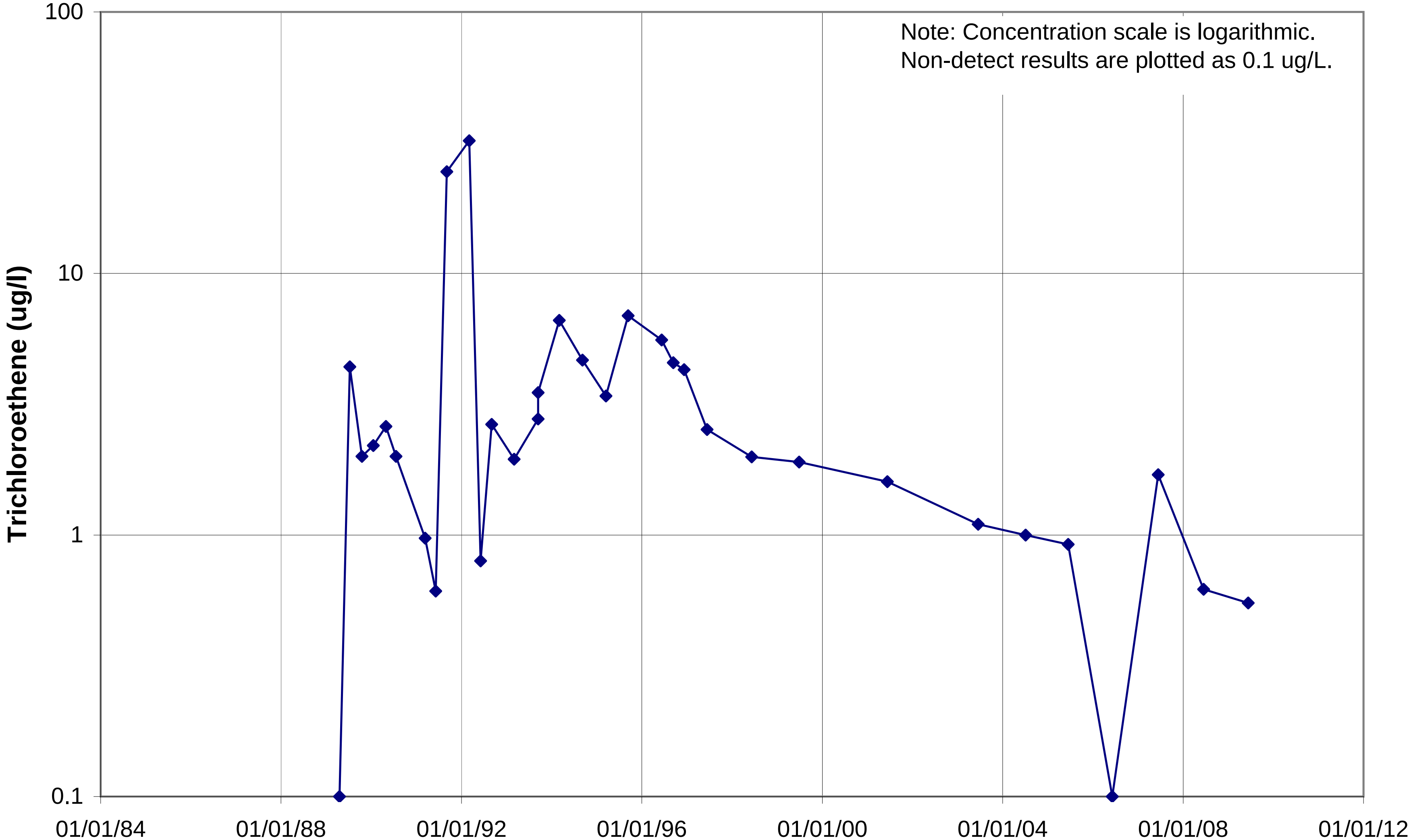


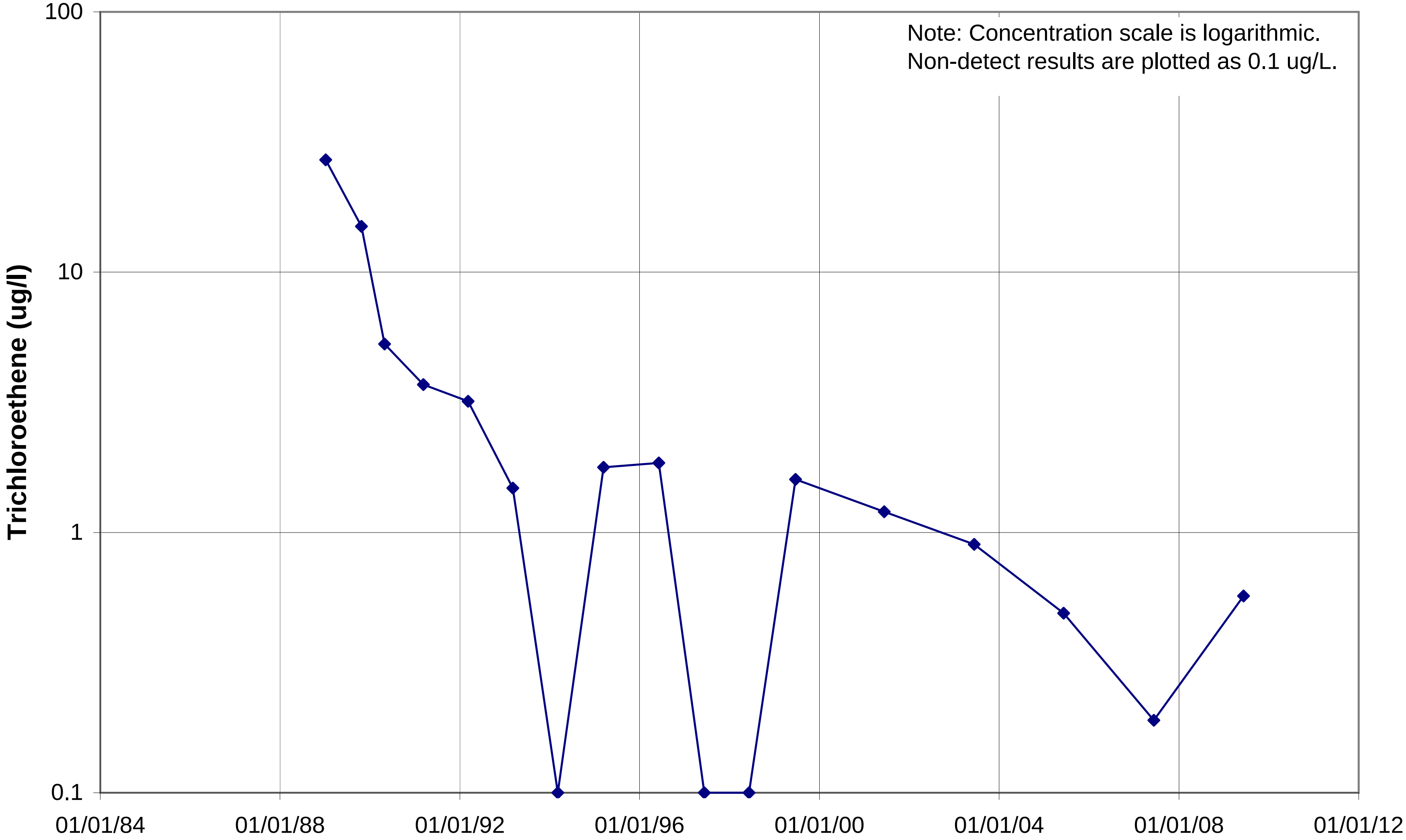

**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 04U711



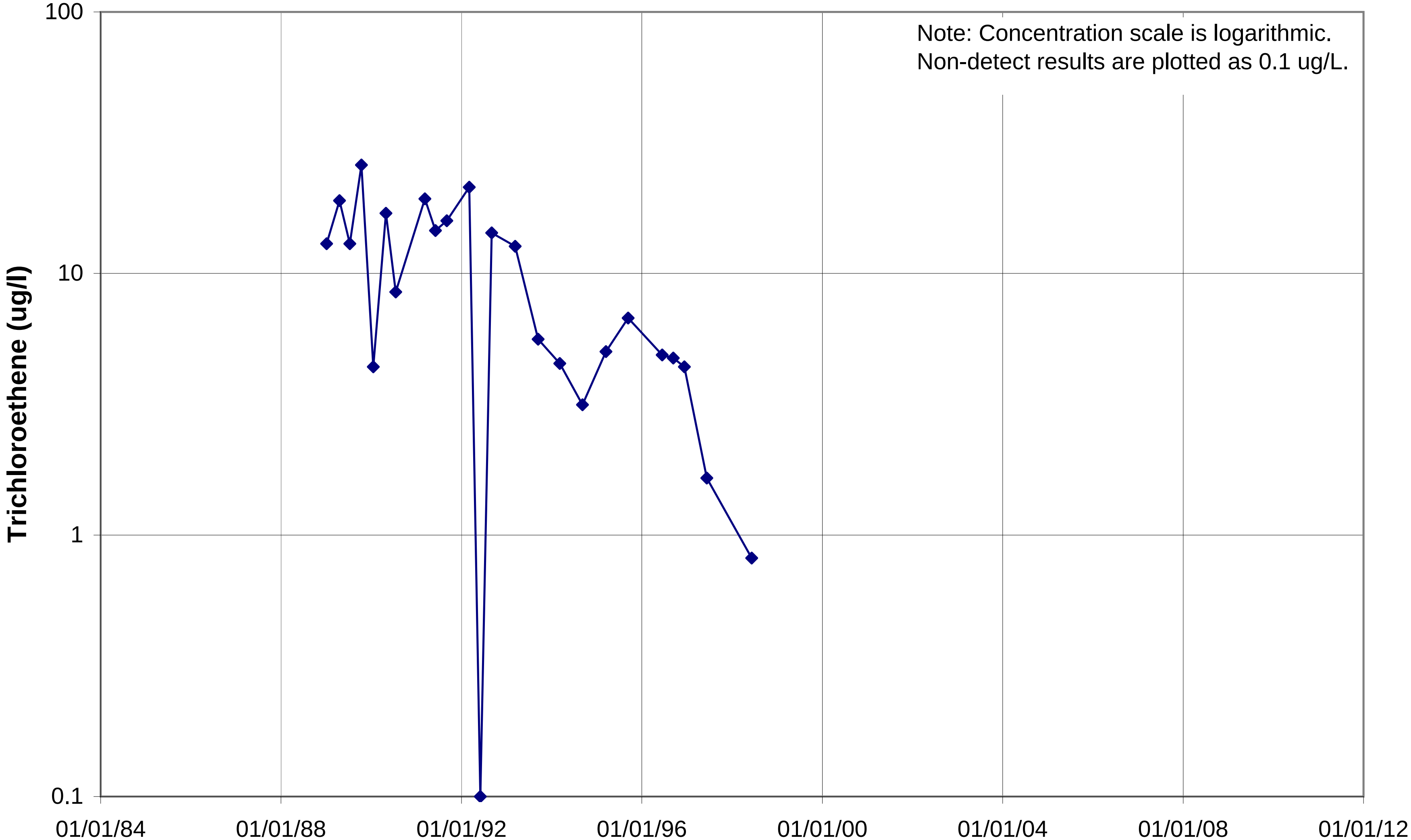

**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 04U713



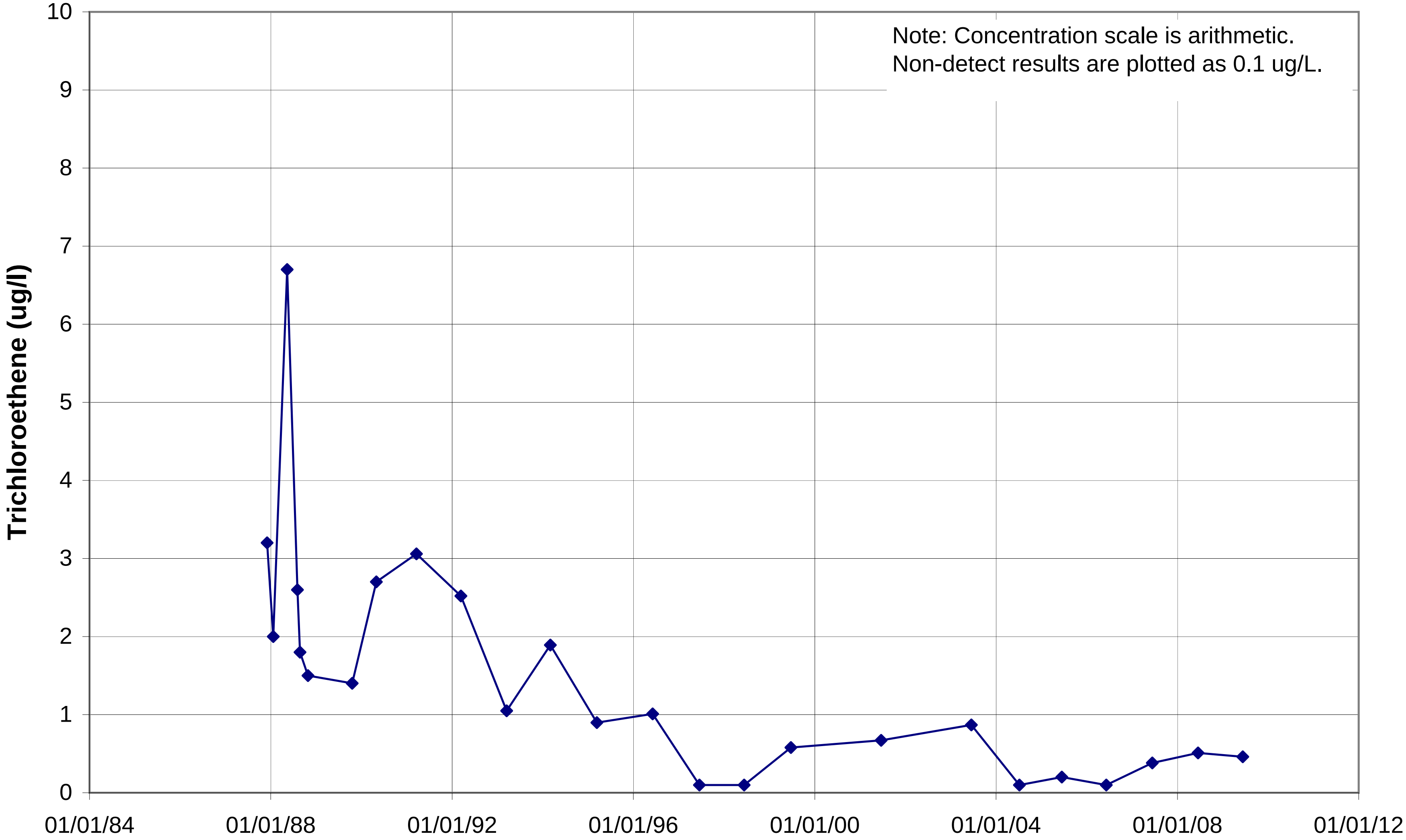

**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 04U714



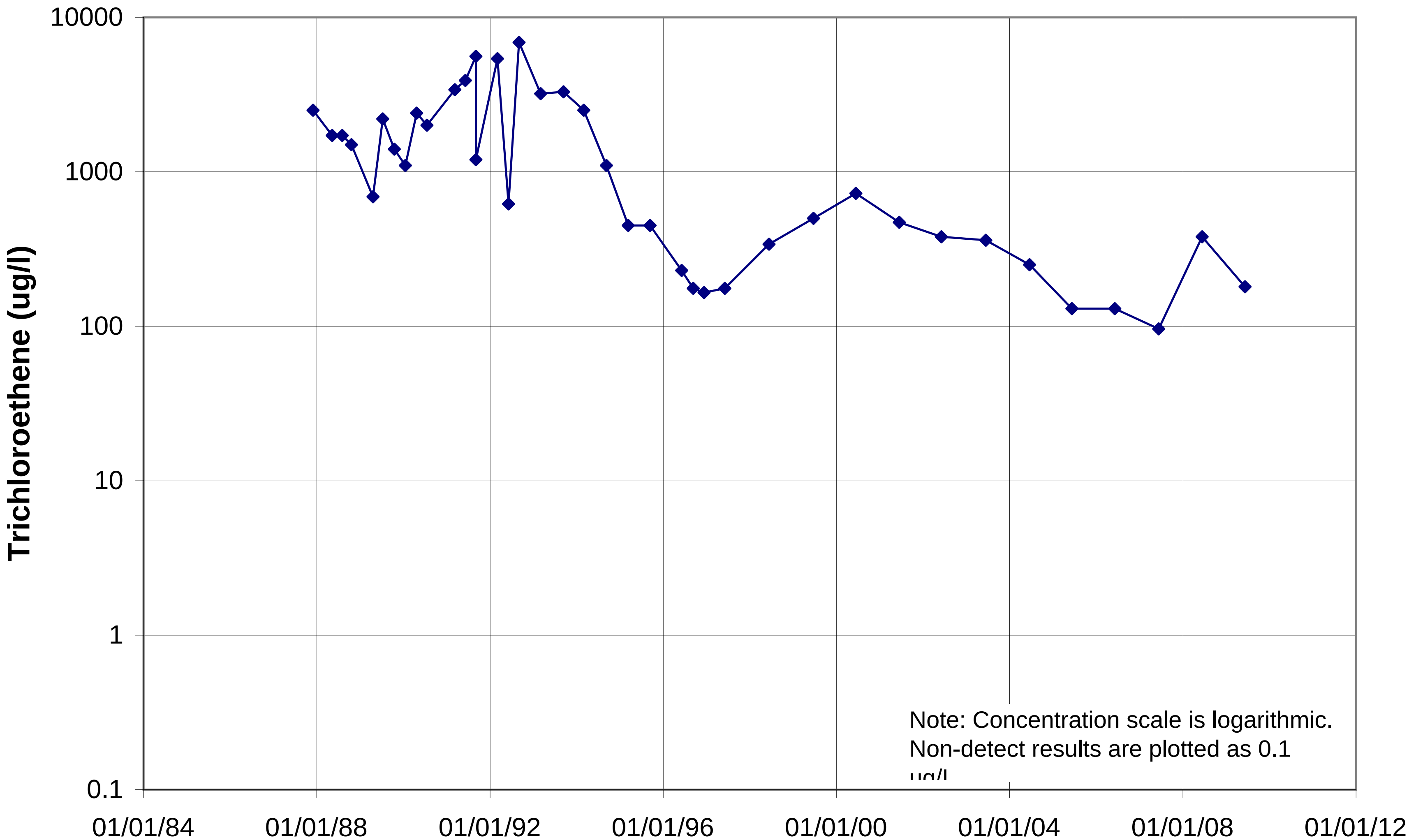

**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 04U802

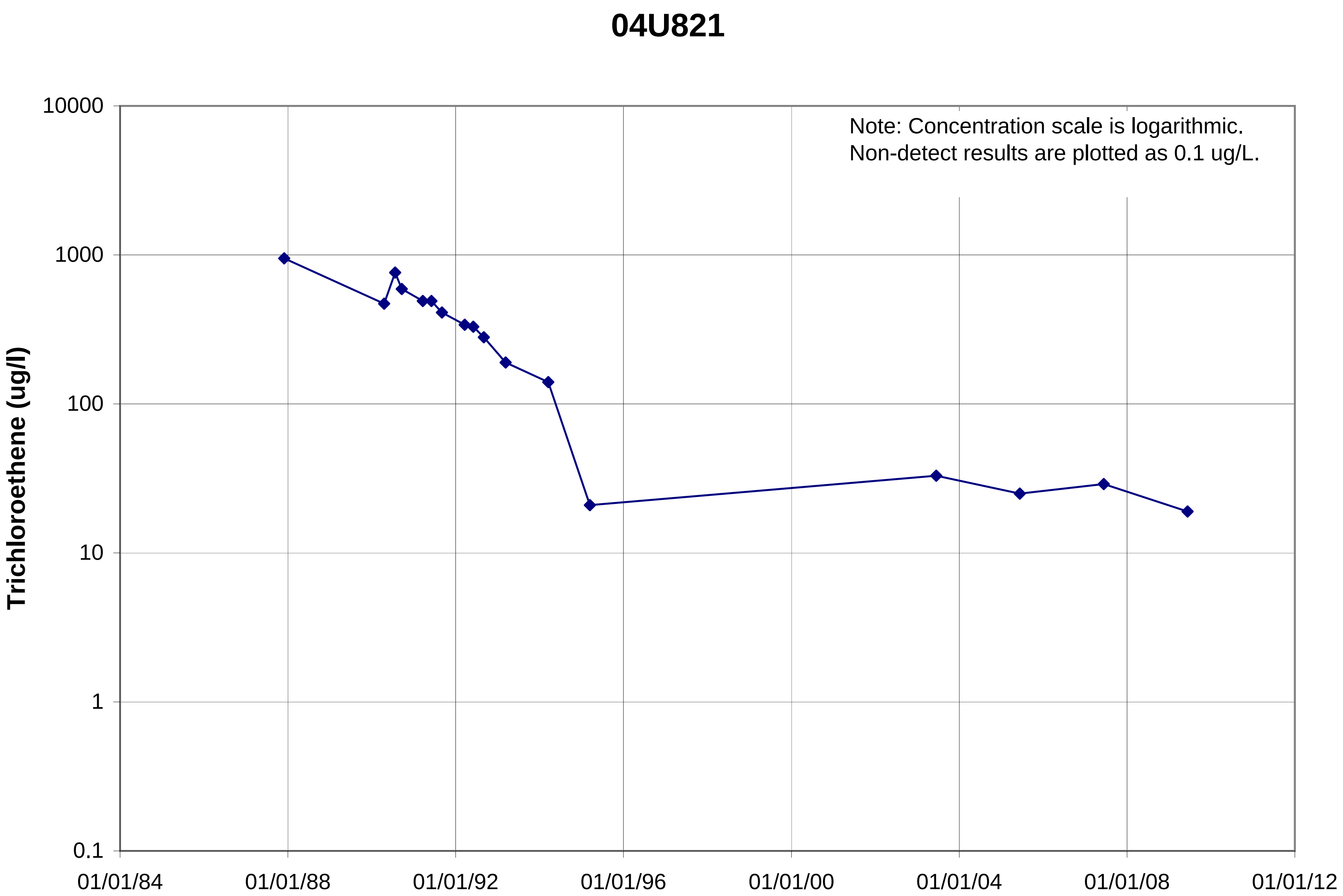



**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 04U806

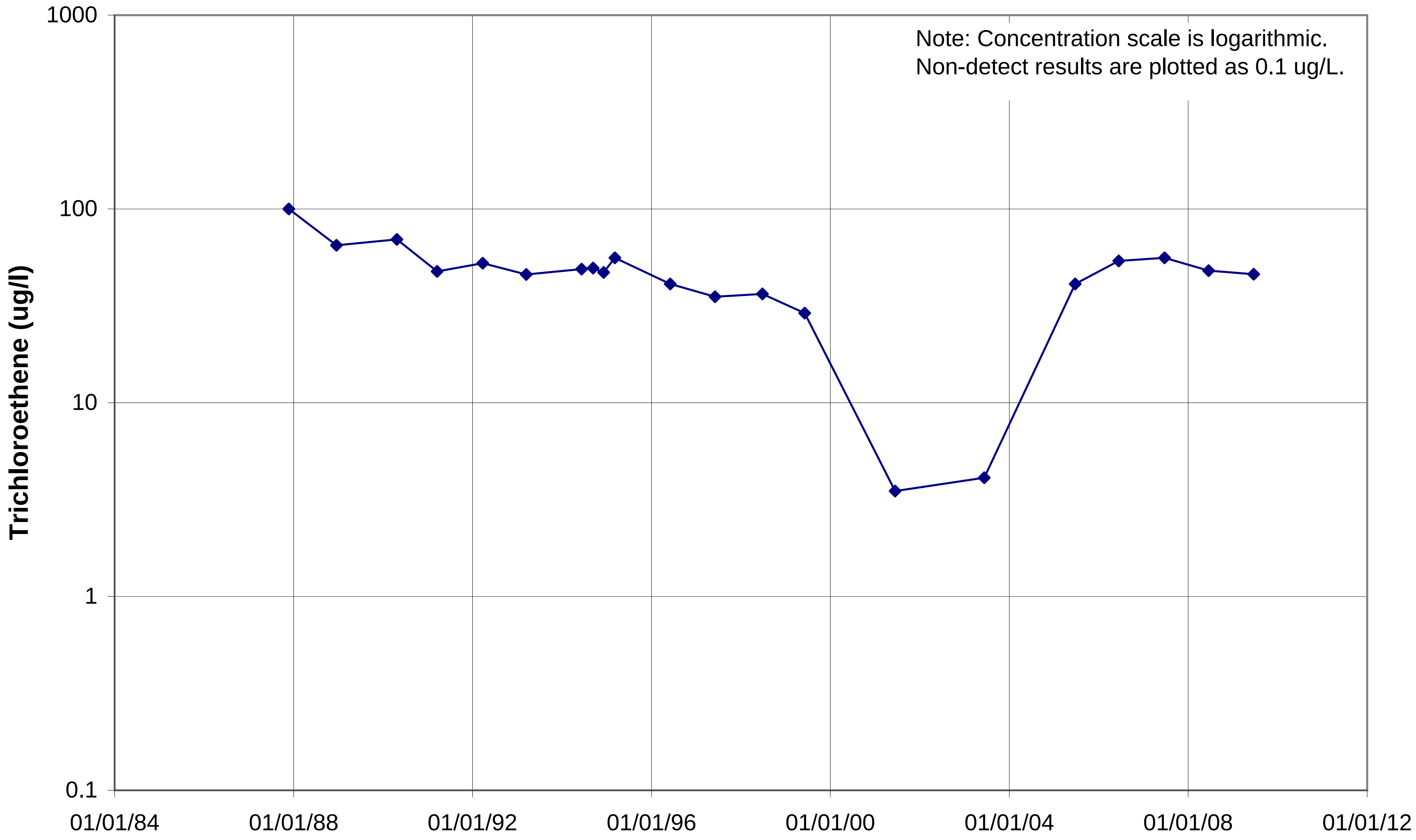



**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar



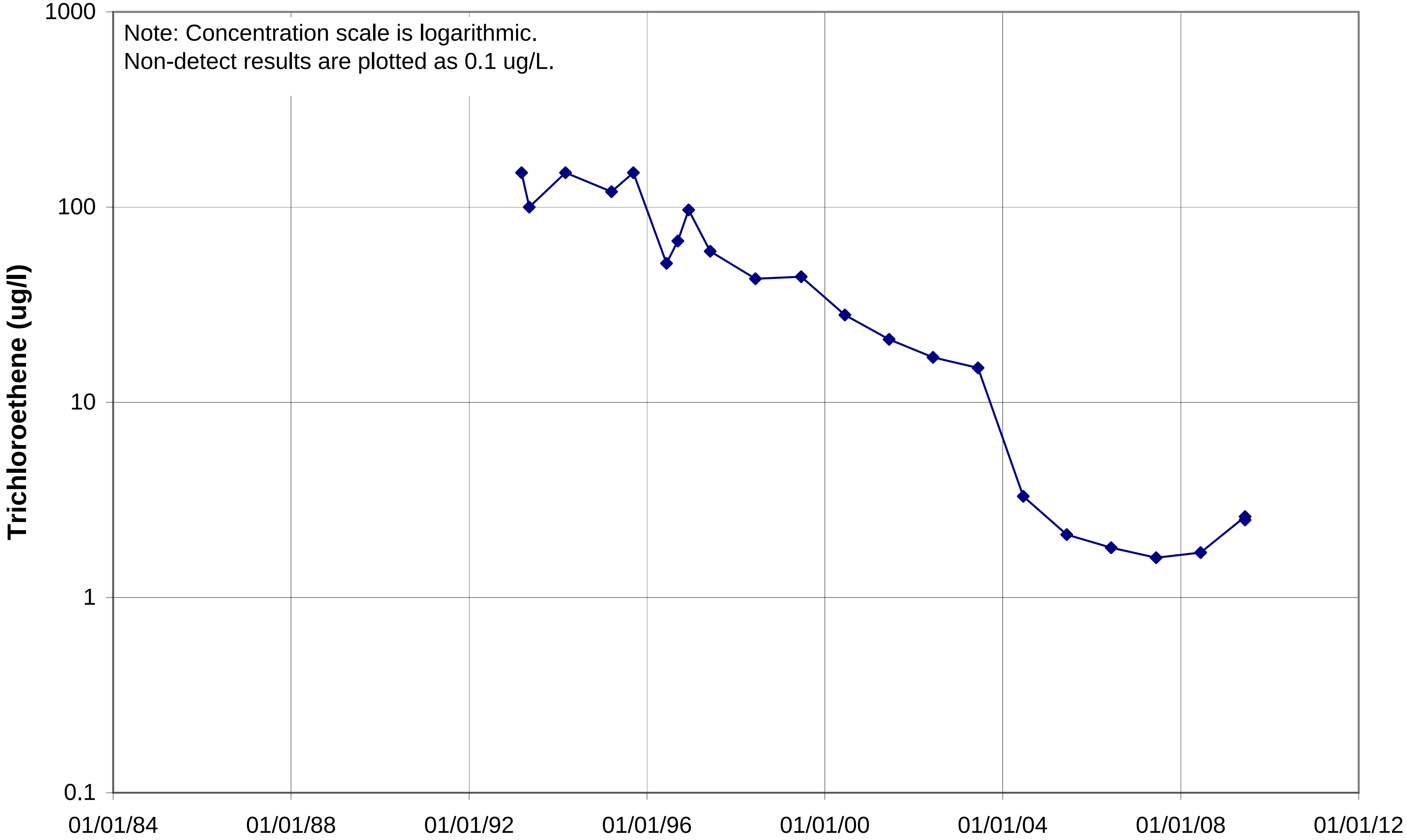

**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 04U832

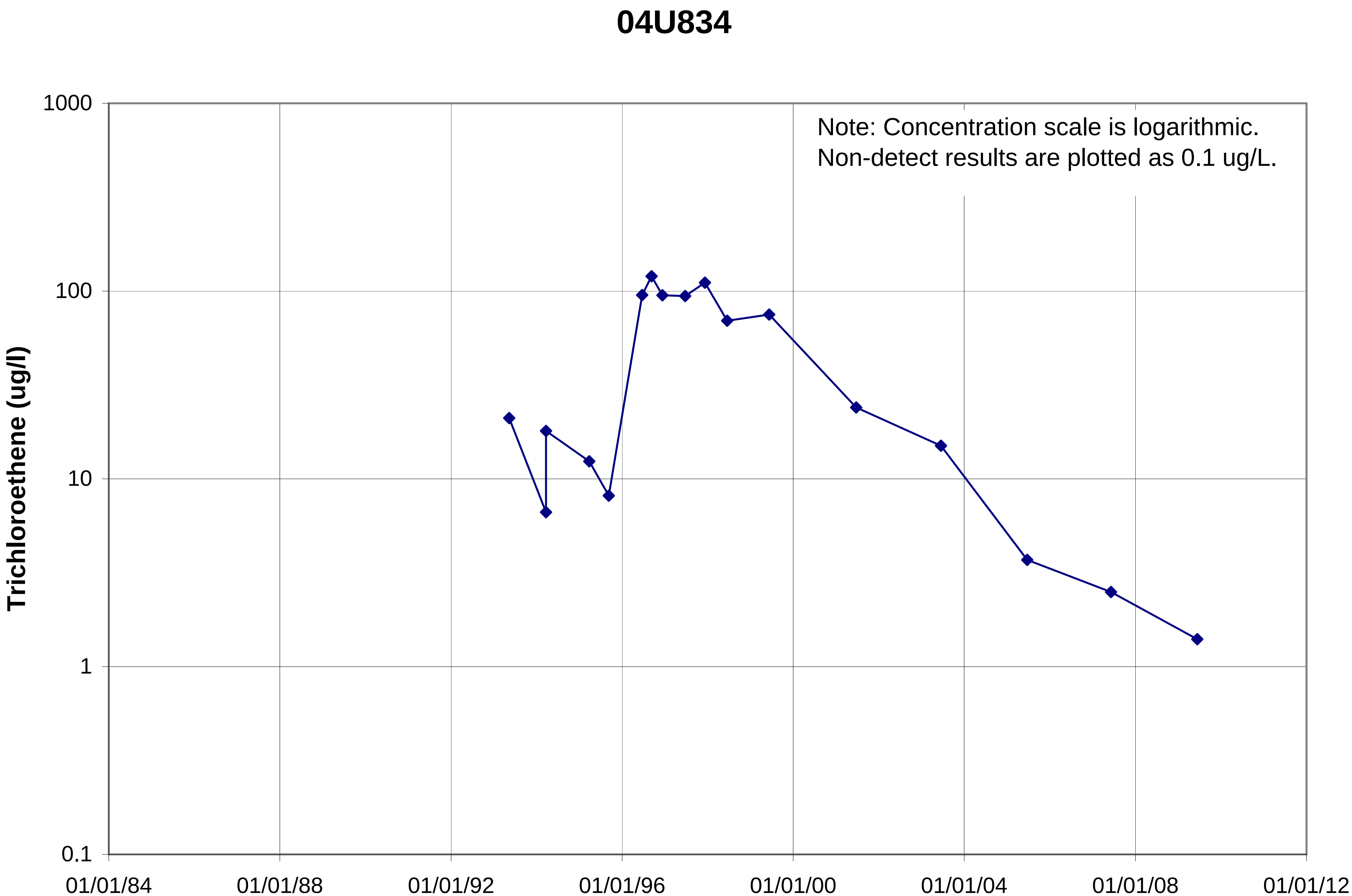



**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 04U833

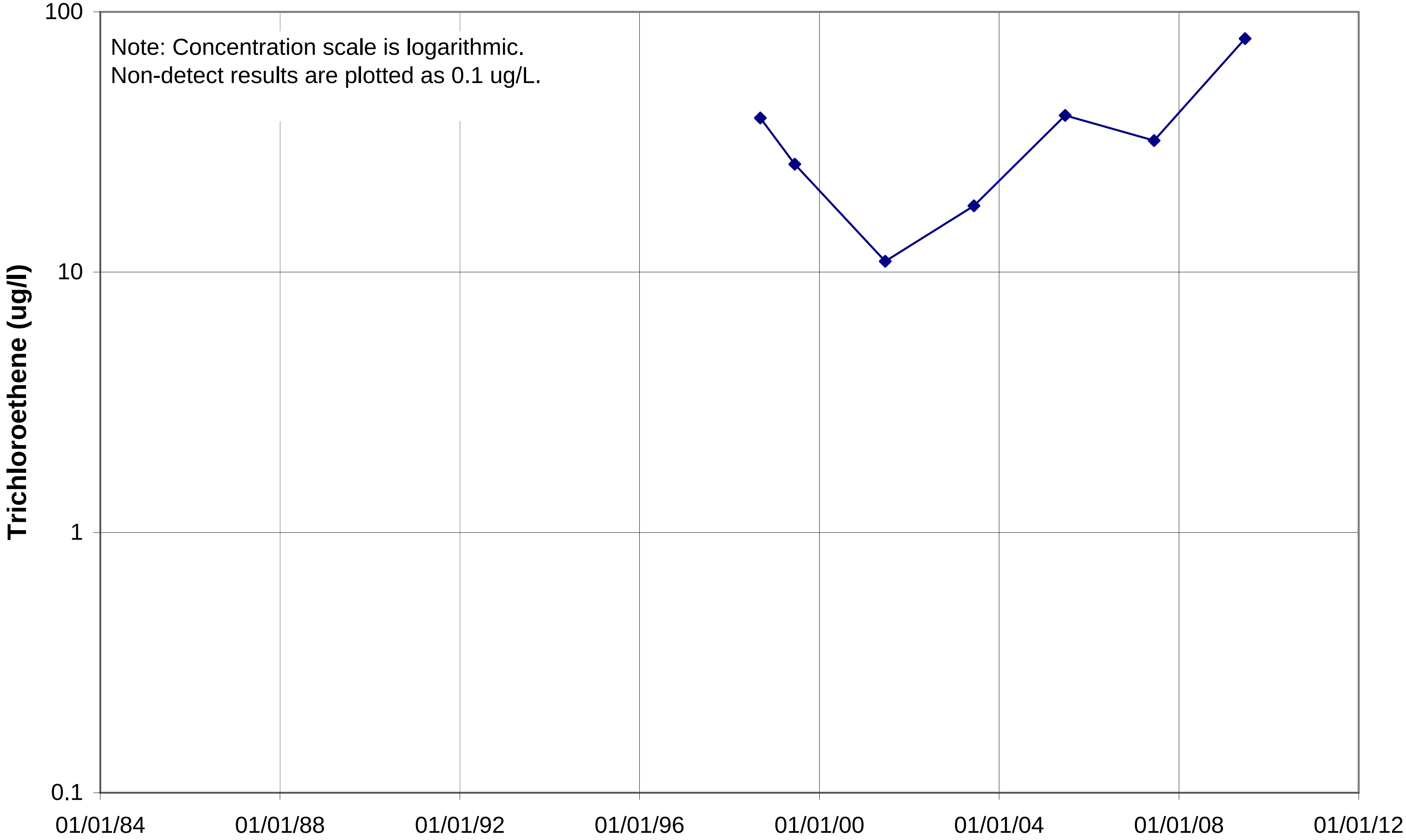



**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar



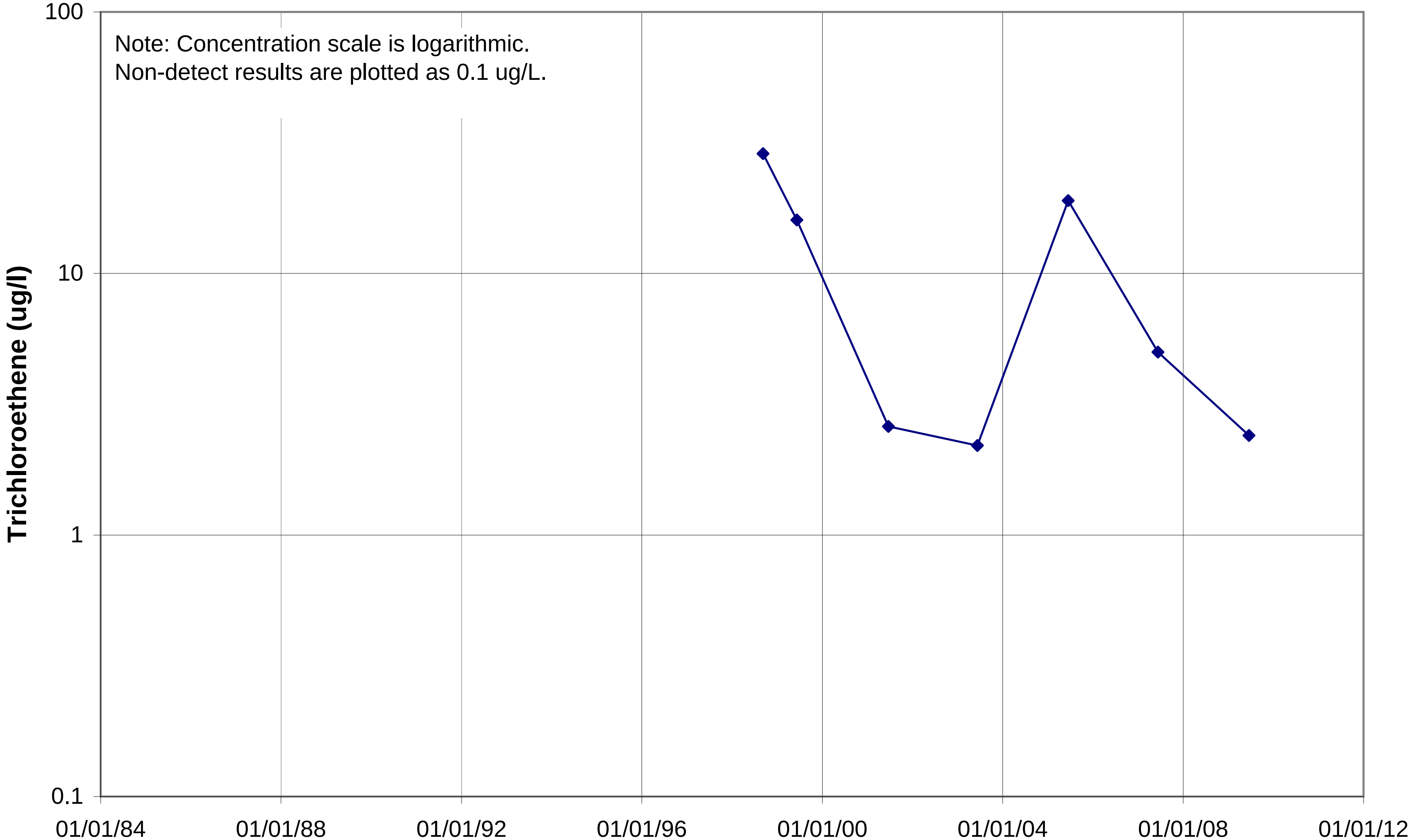

**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 04U836




**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 04U837




**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

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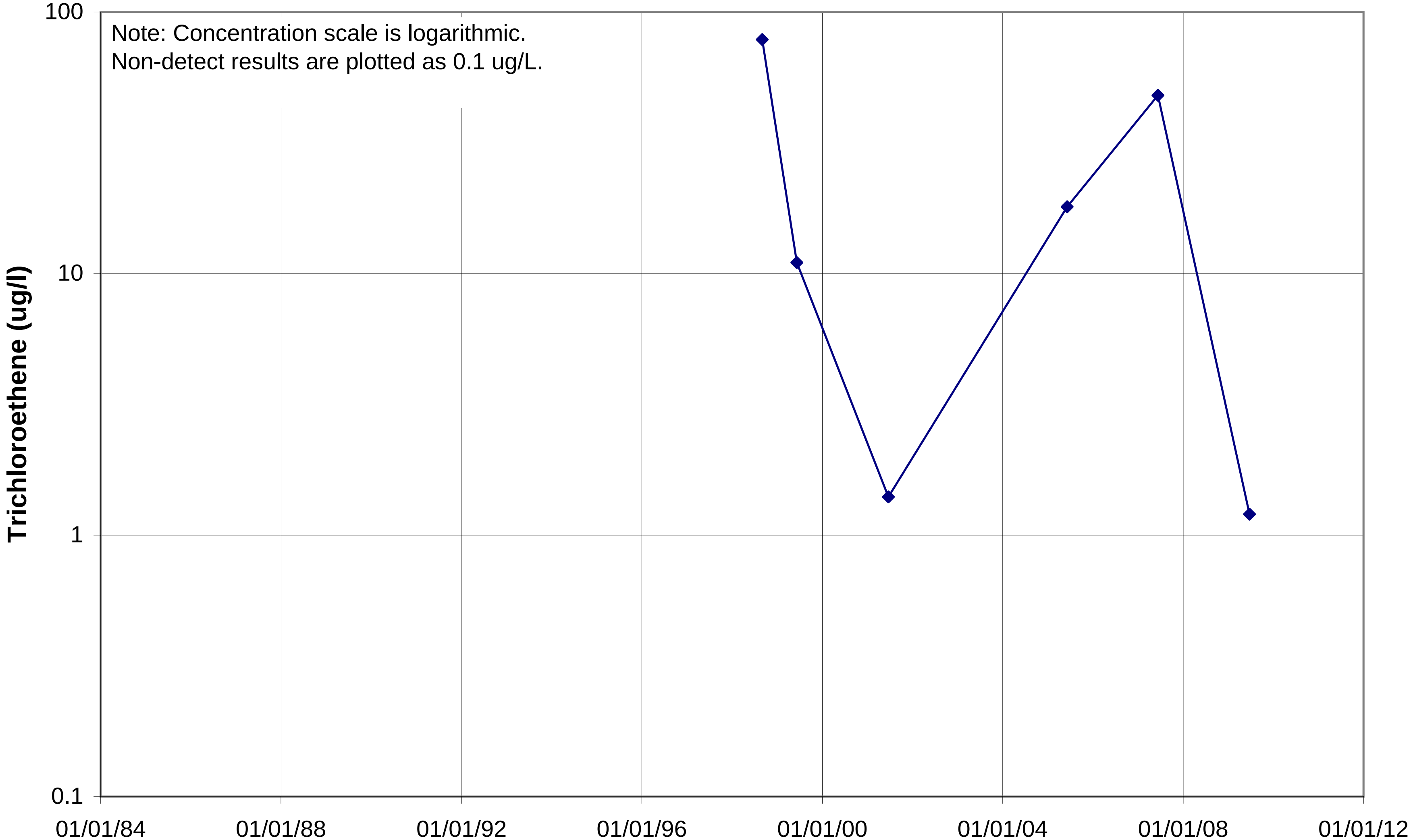
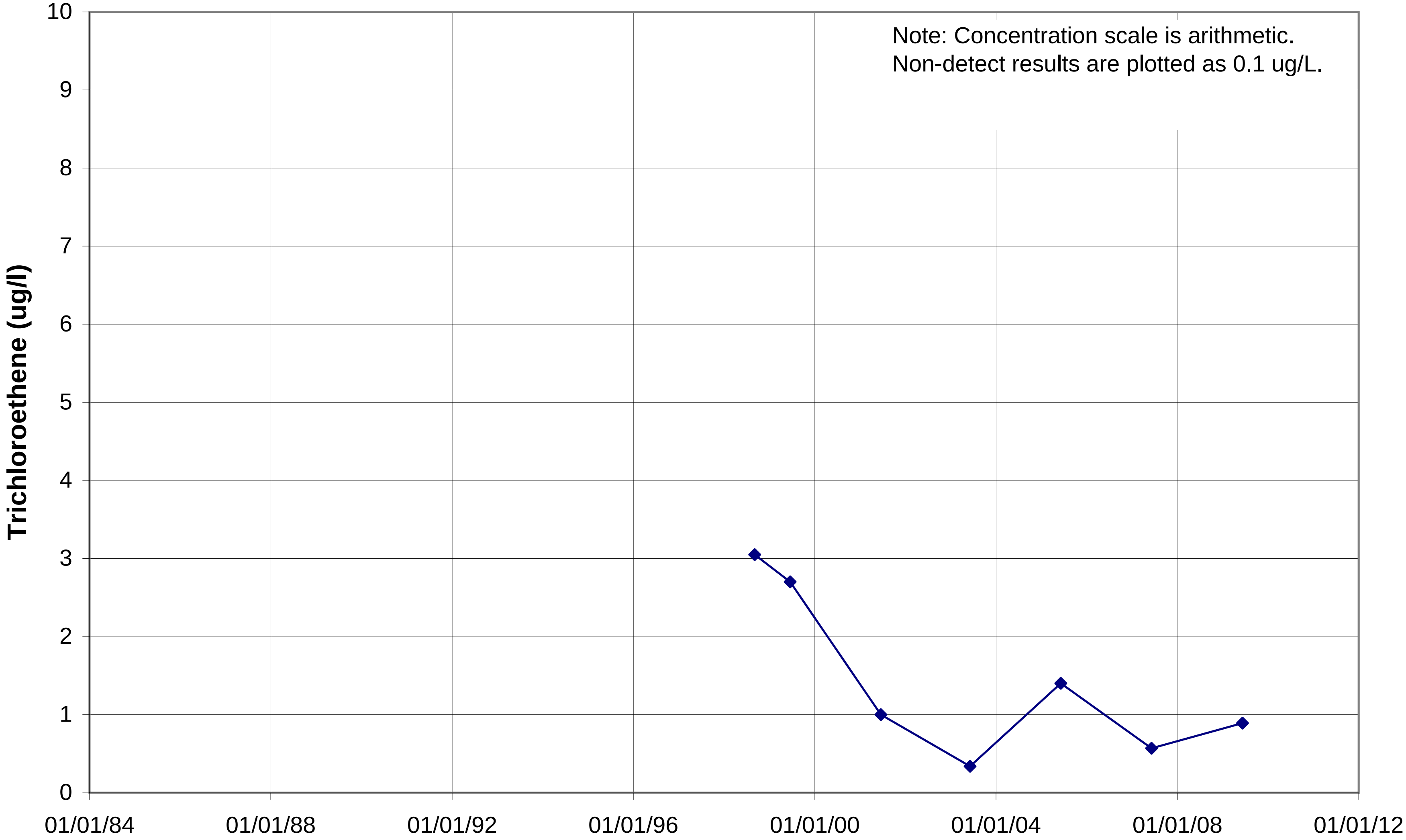



**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 04U839




**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

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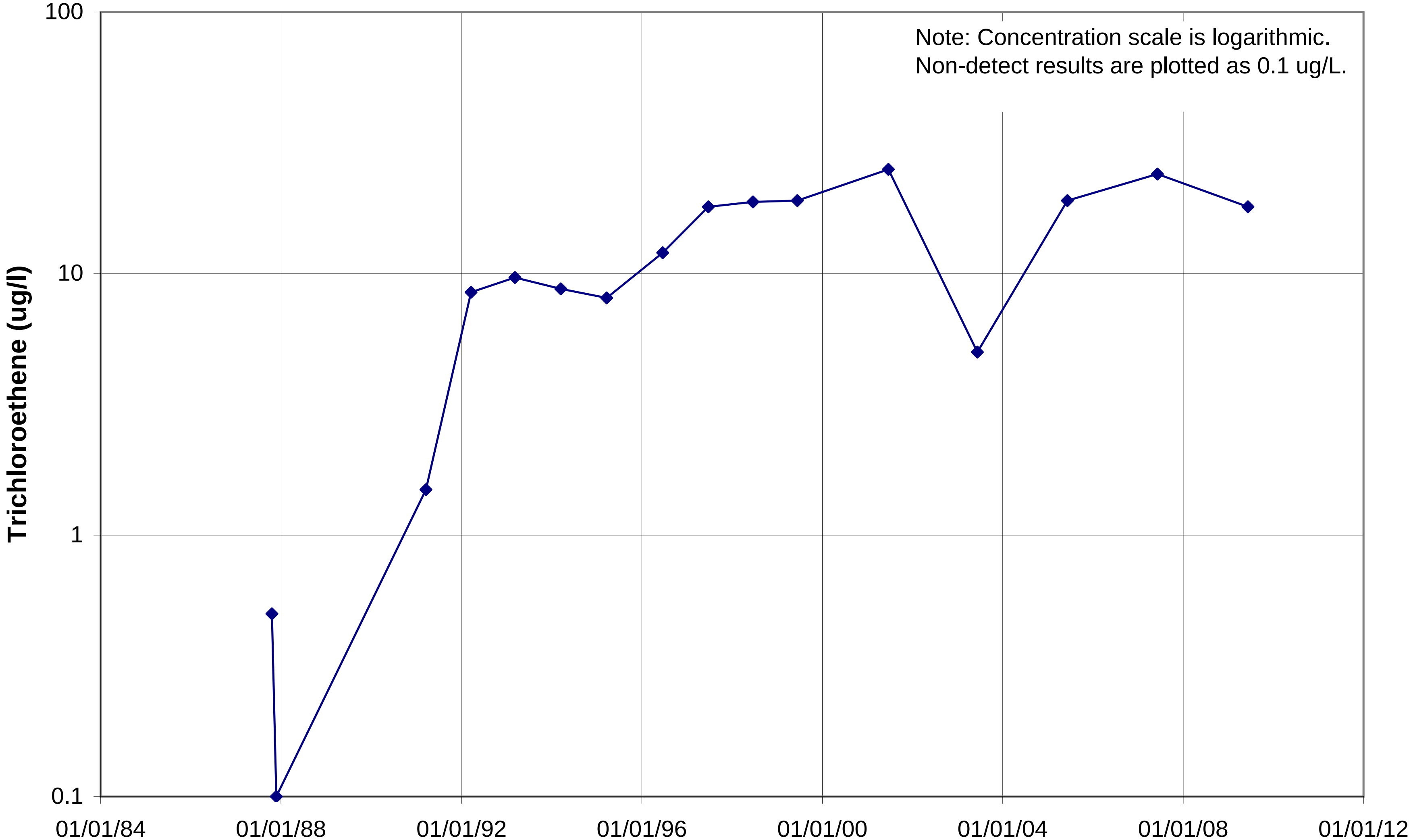
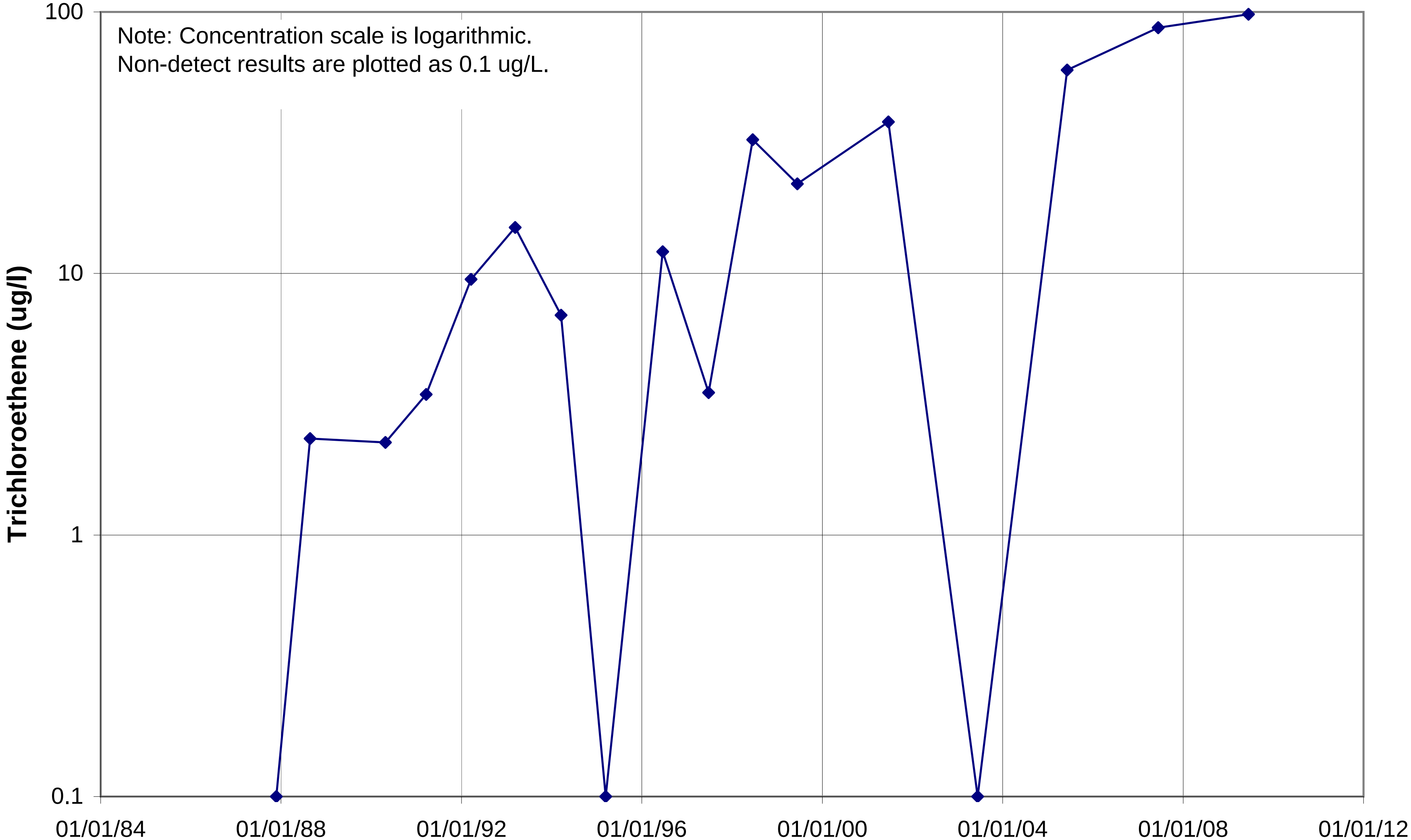



**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 04U843




**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

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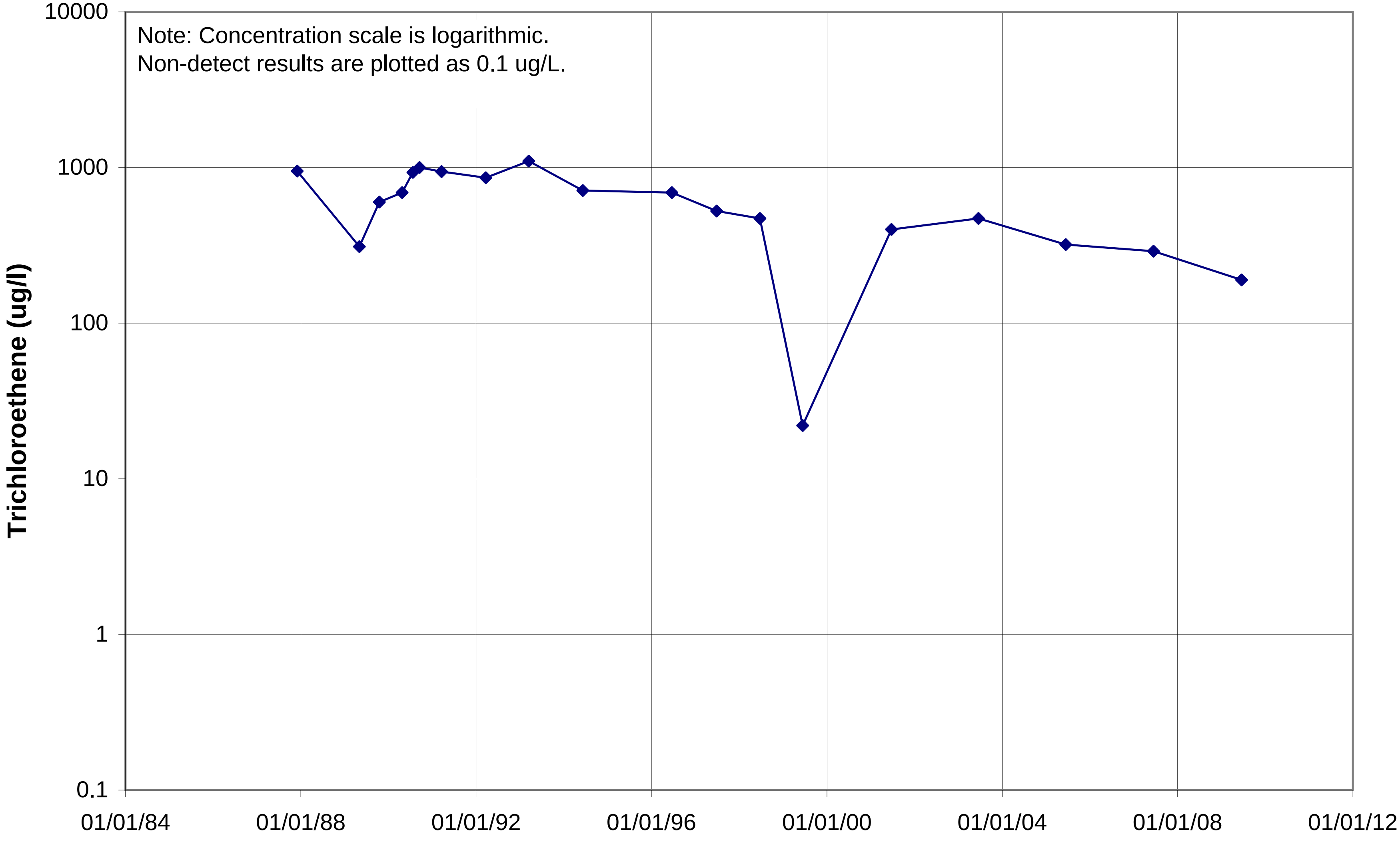
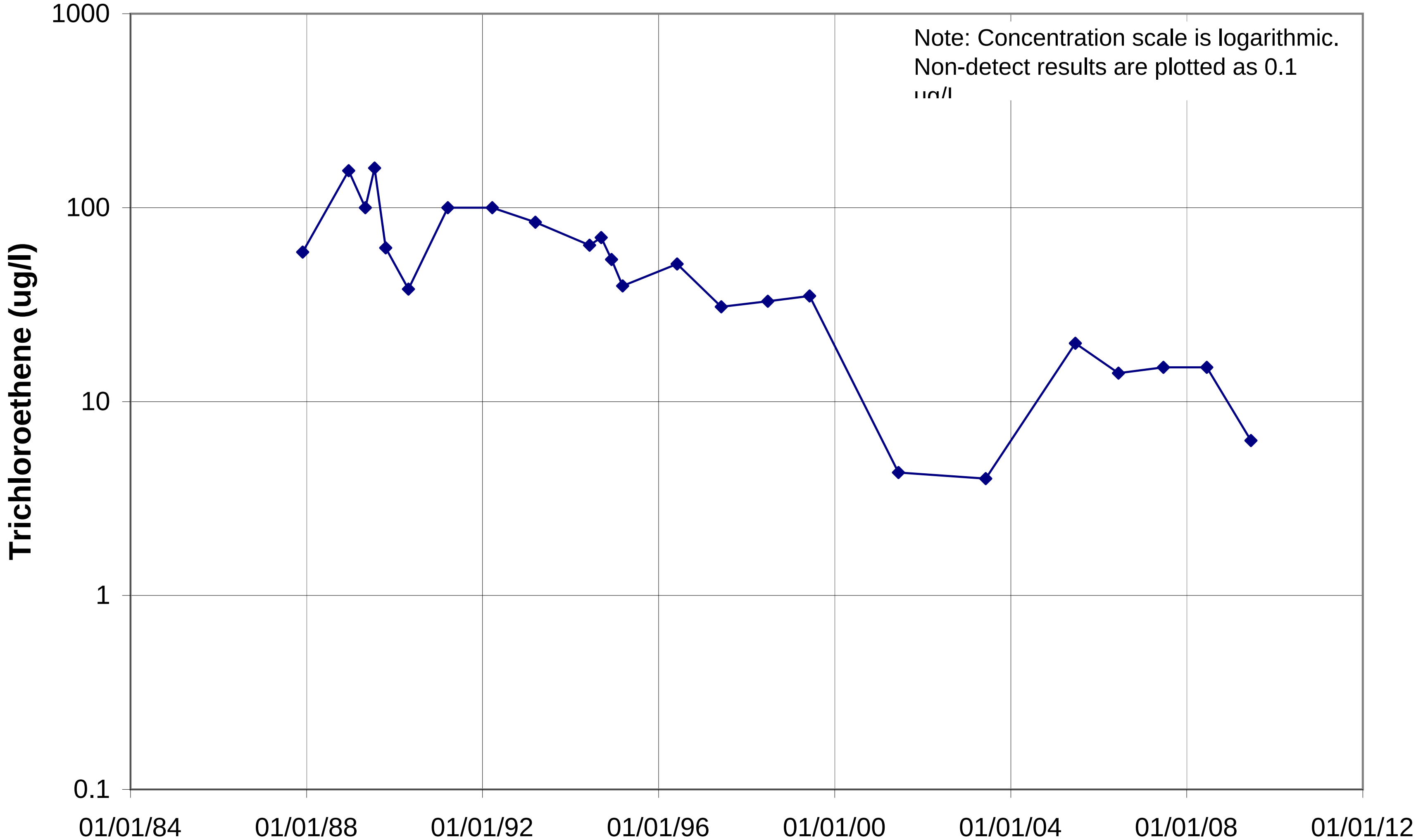


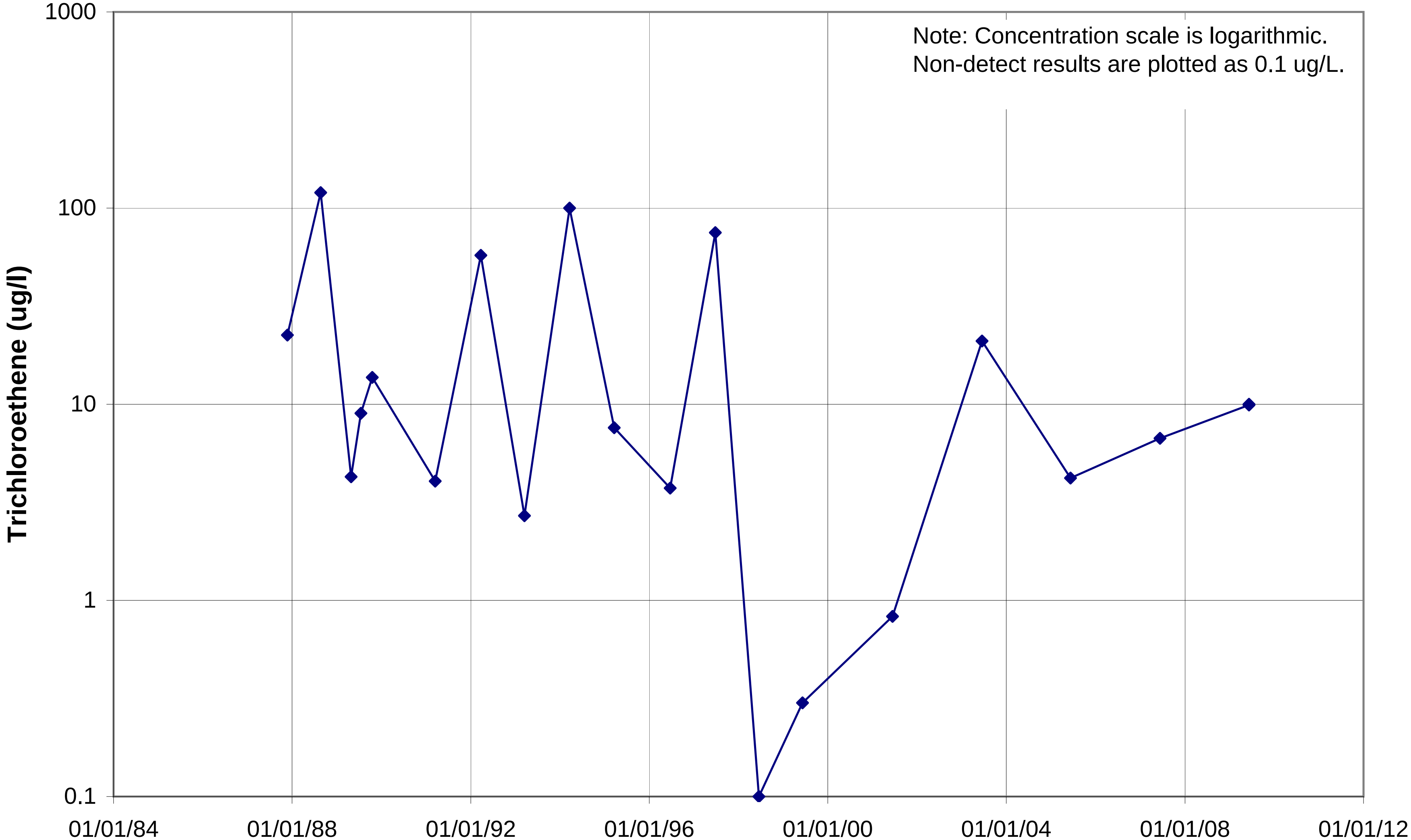

**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 04U845




**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 04U846




**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

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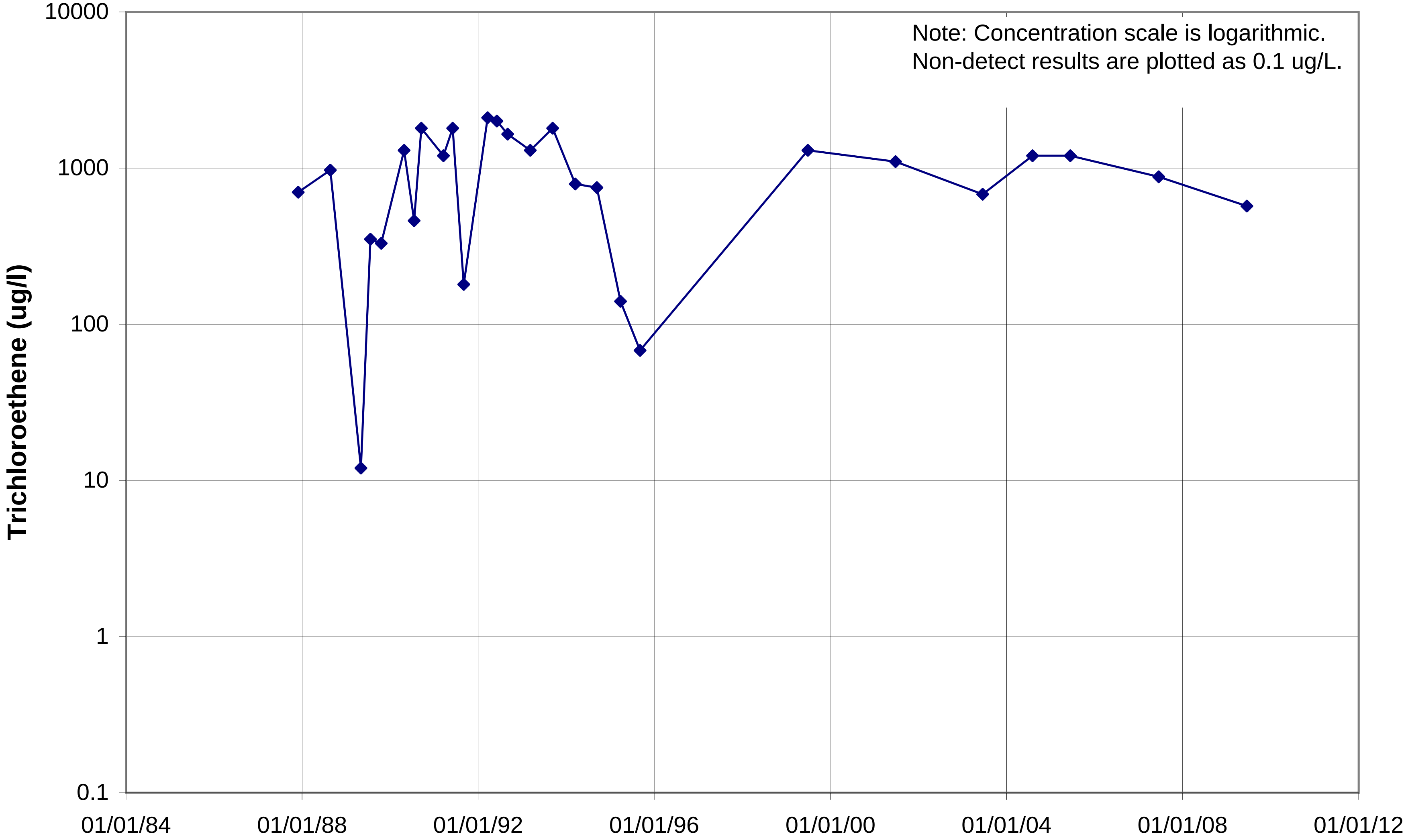


**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

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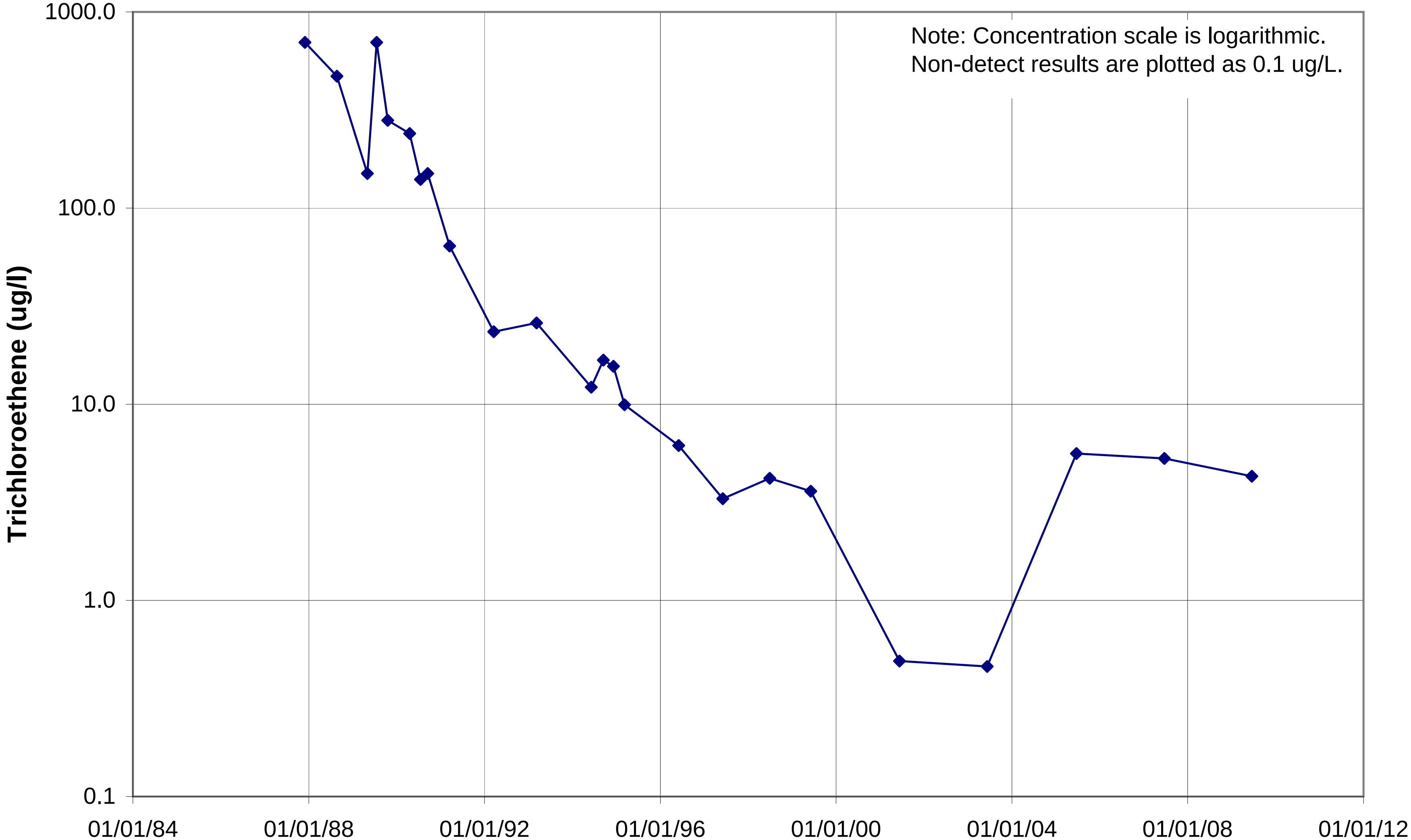


**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

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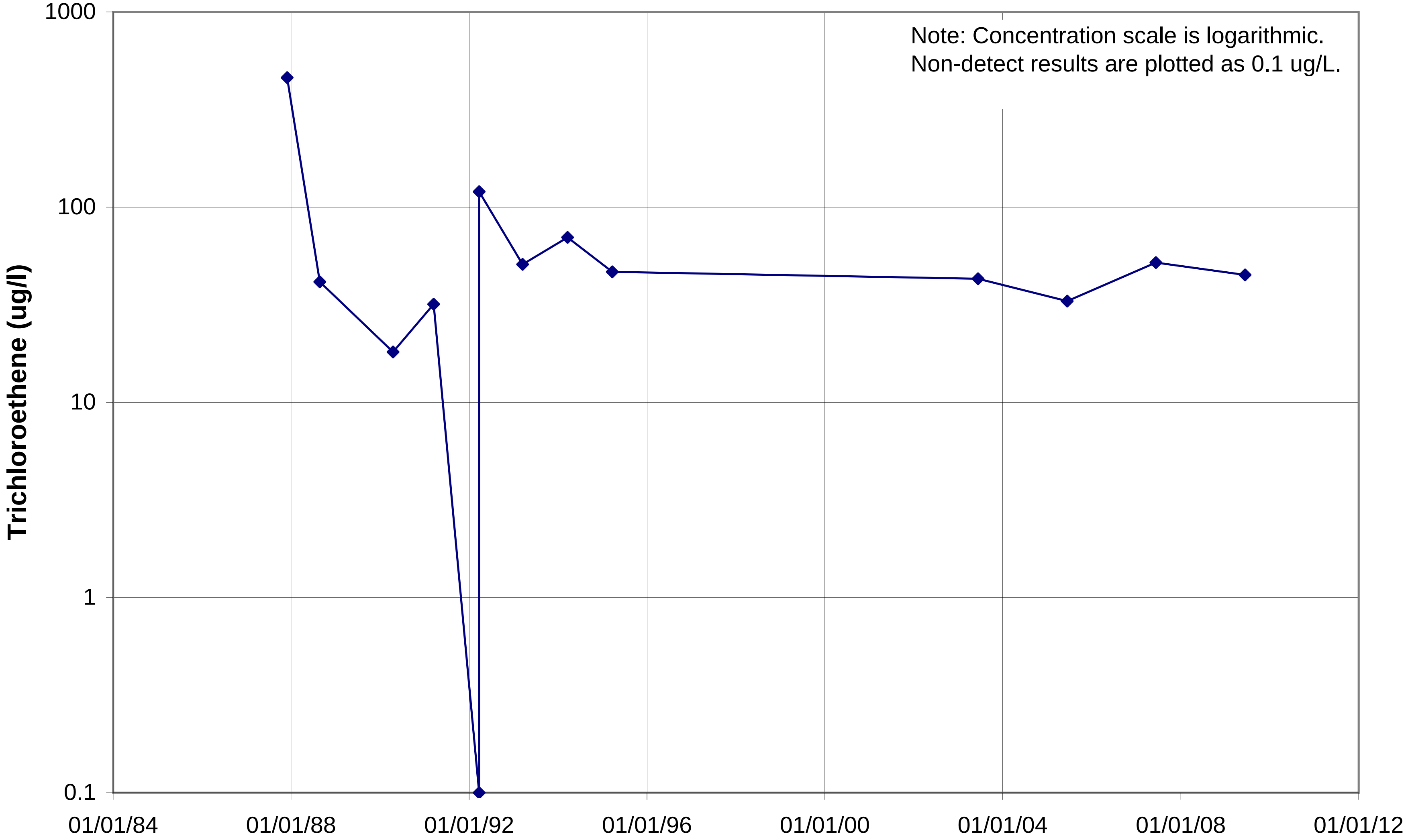
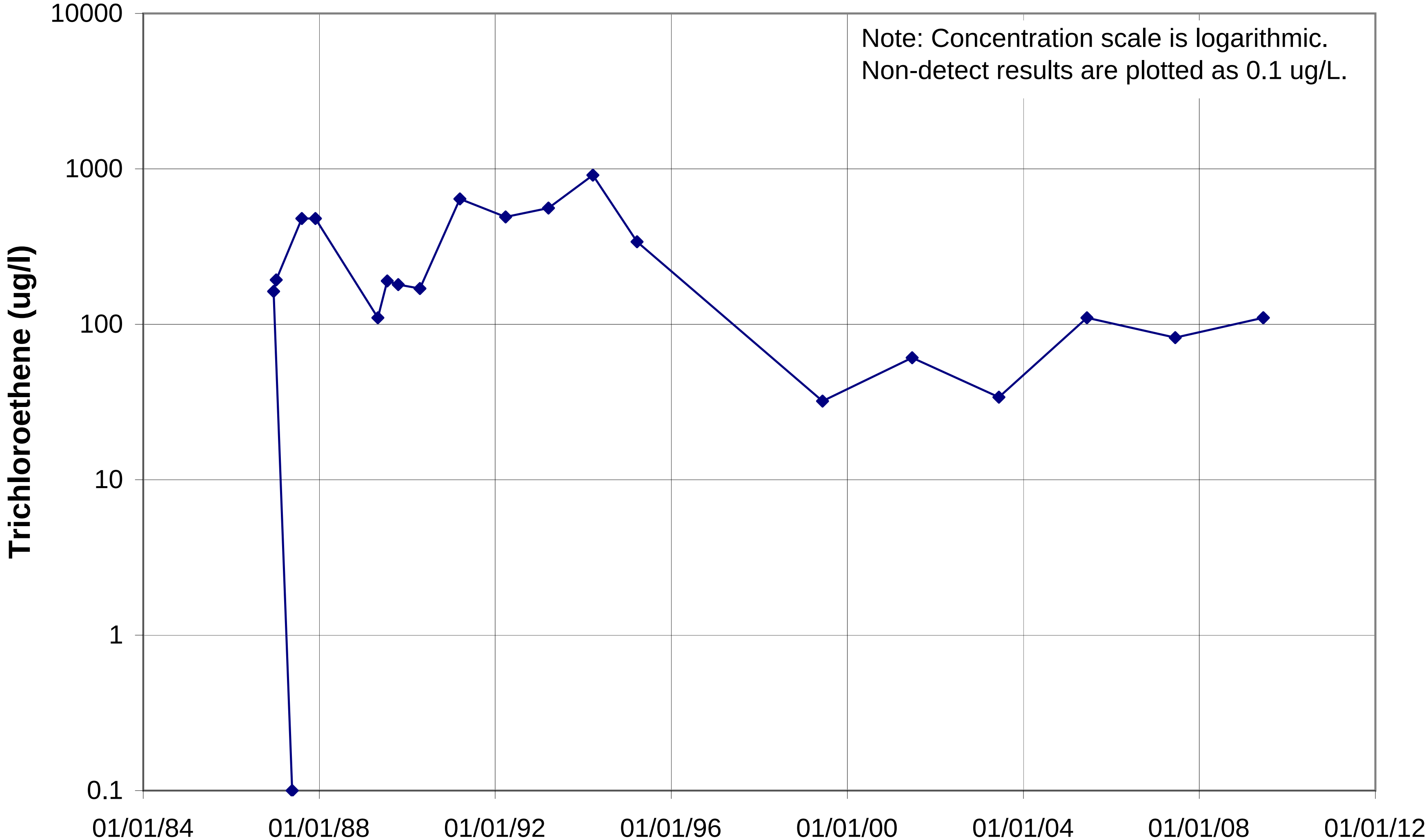



**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 04U850




**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

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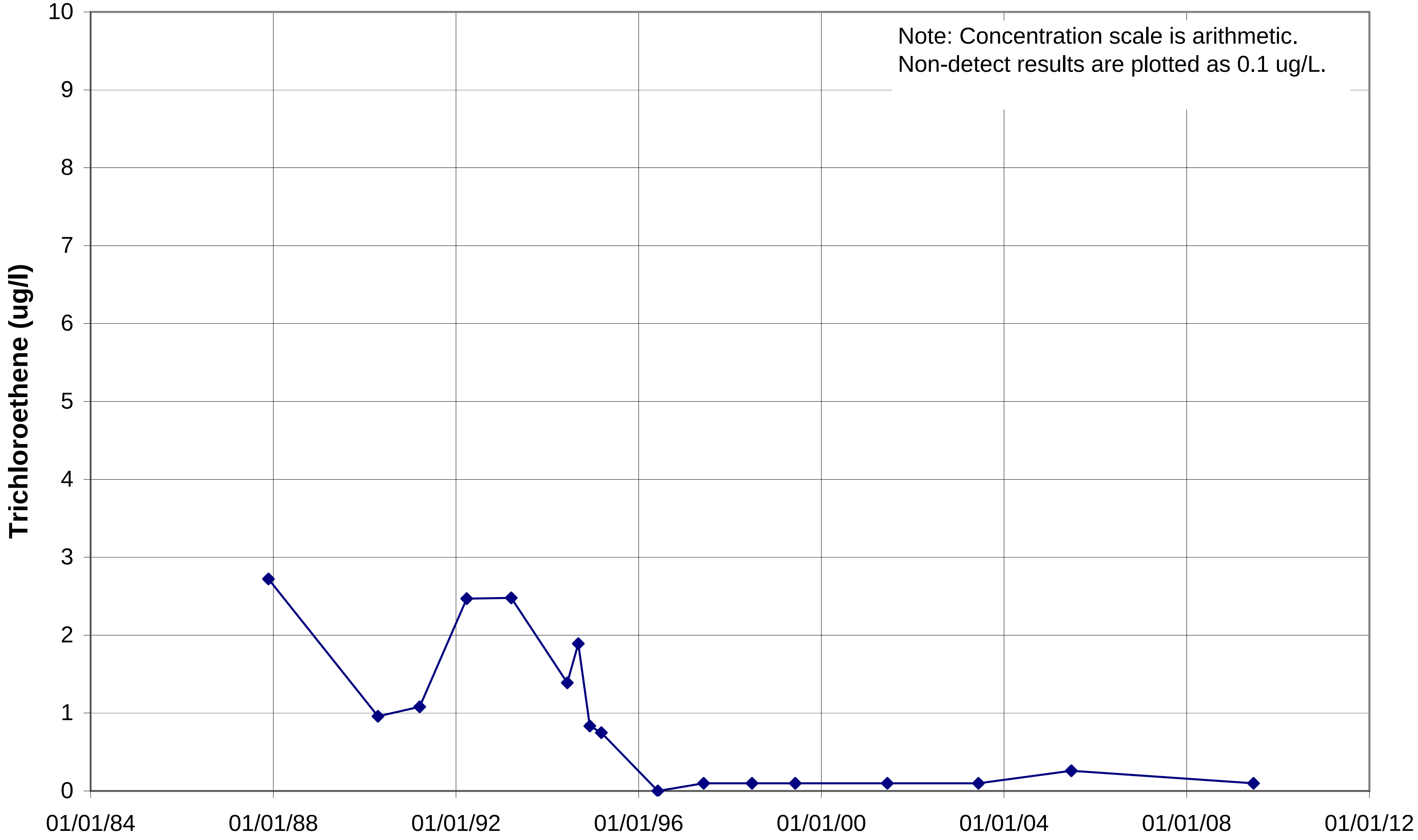


**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

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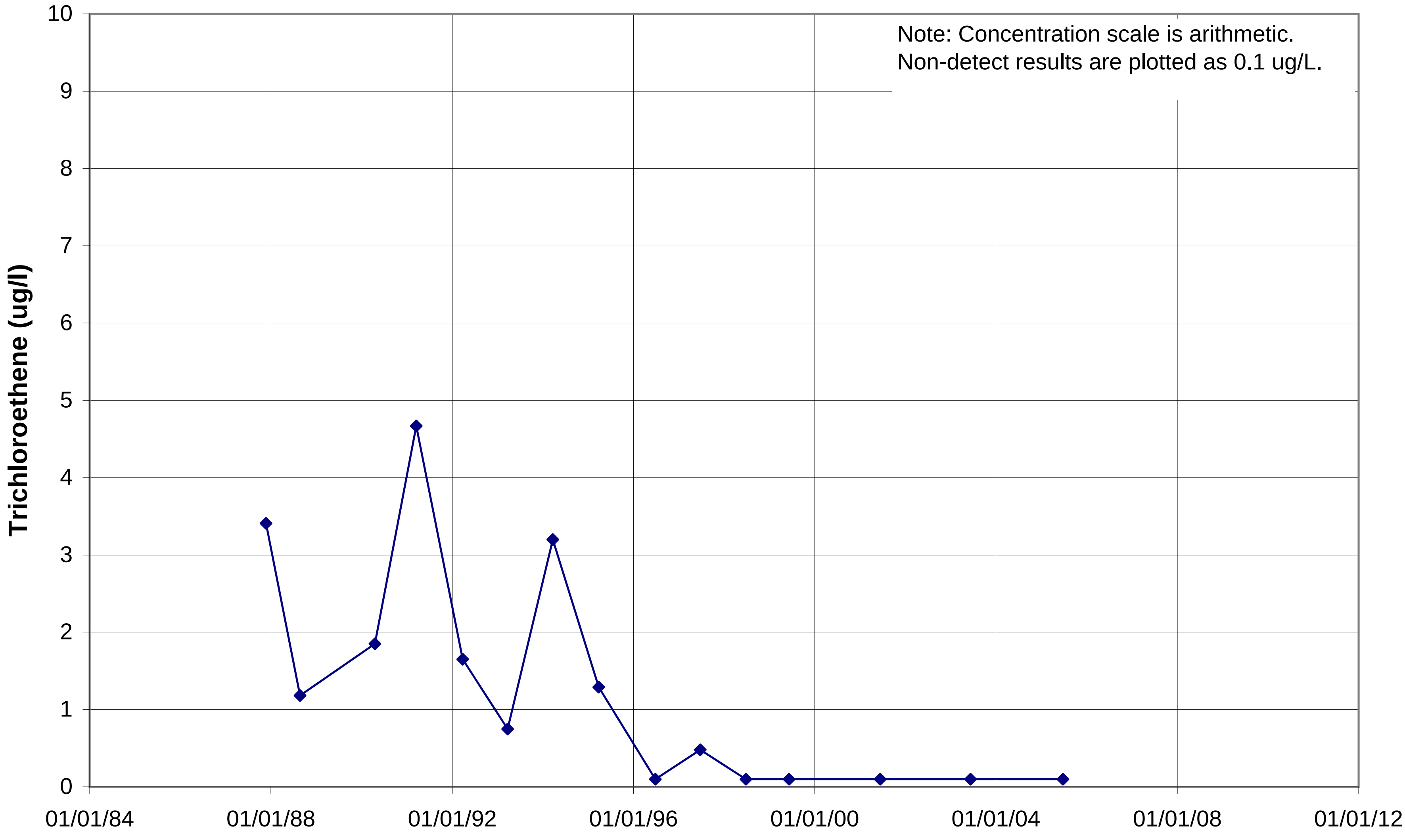


**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

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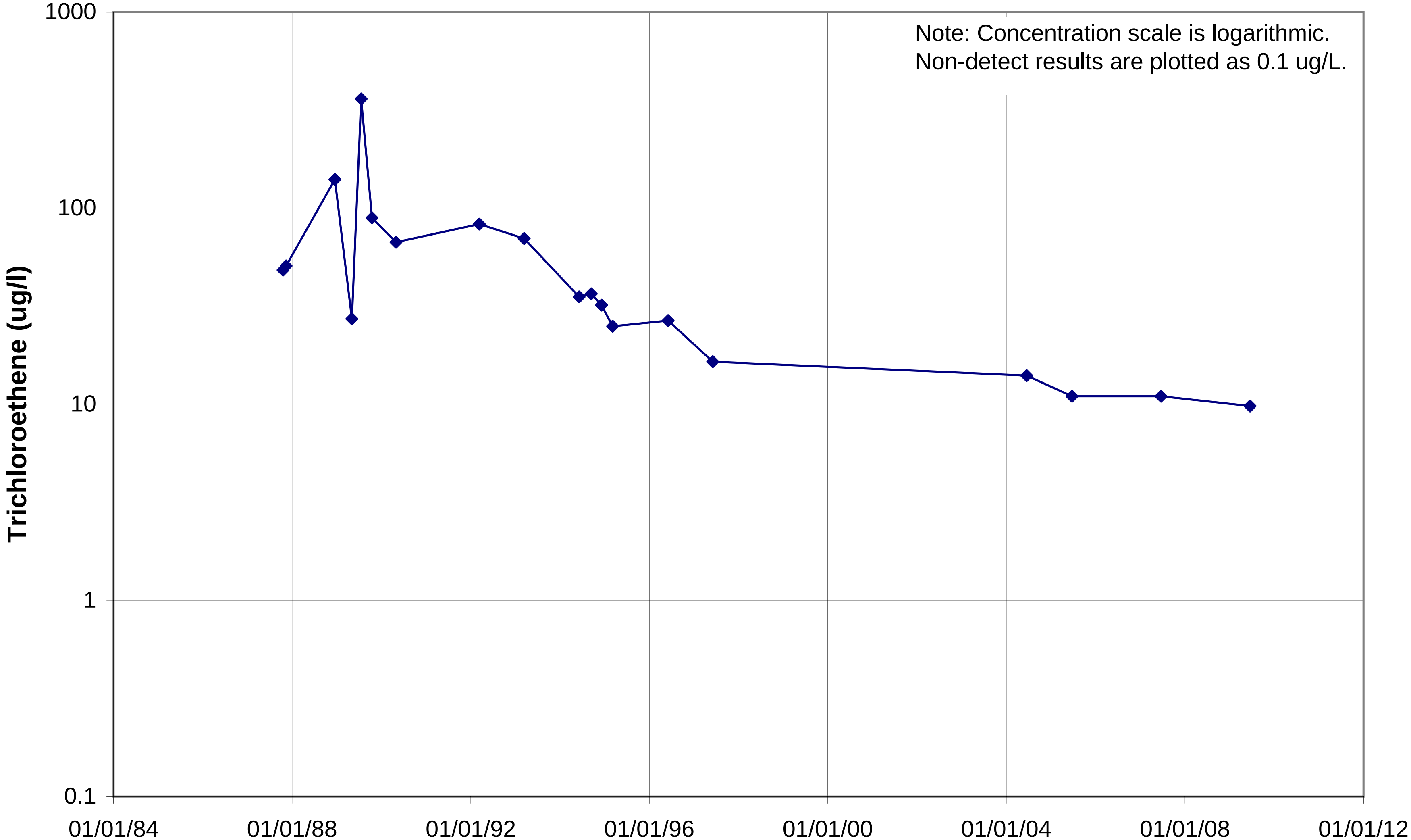


**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

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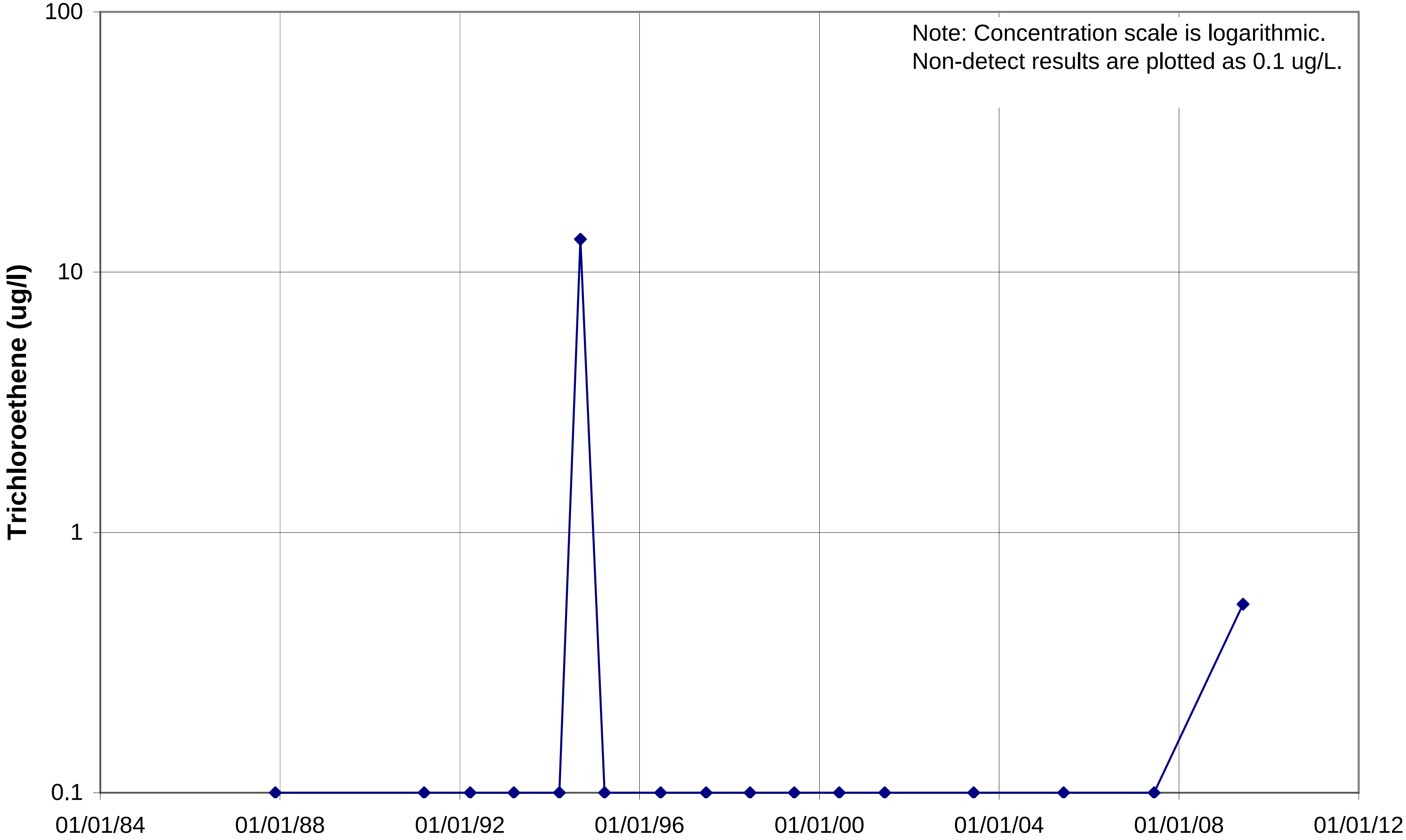


**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

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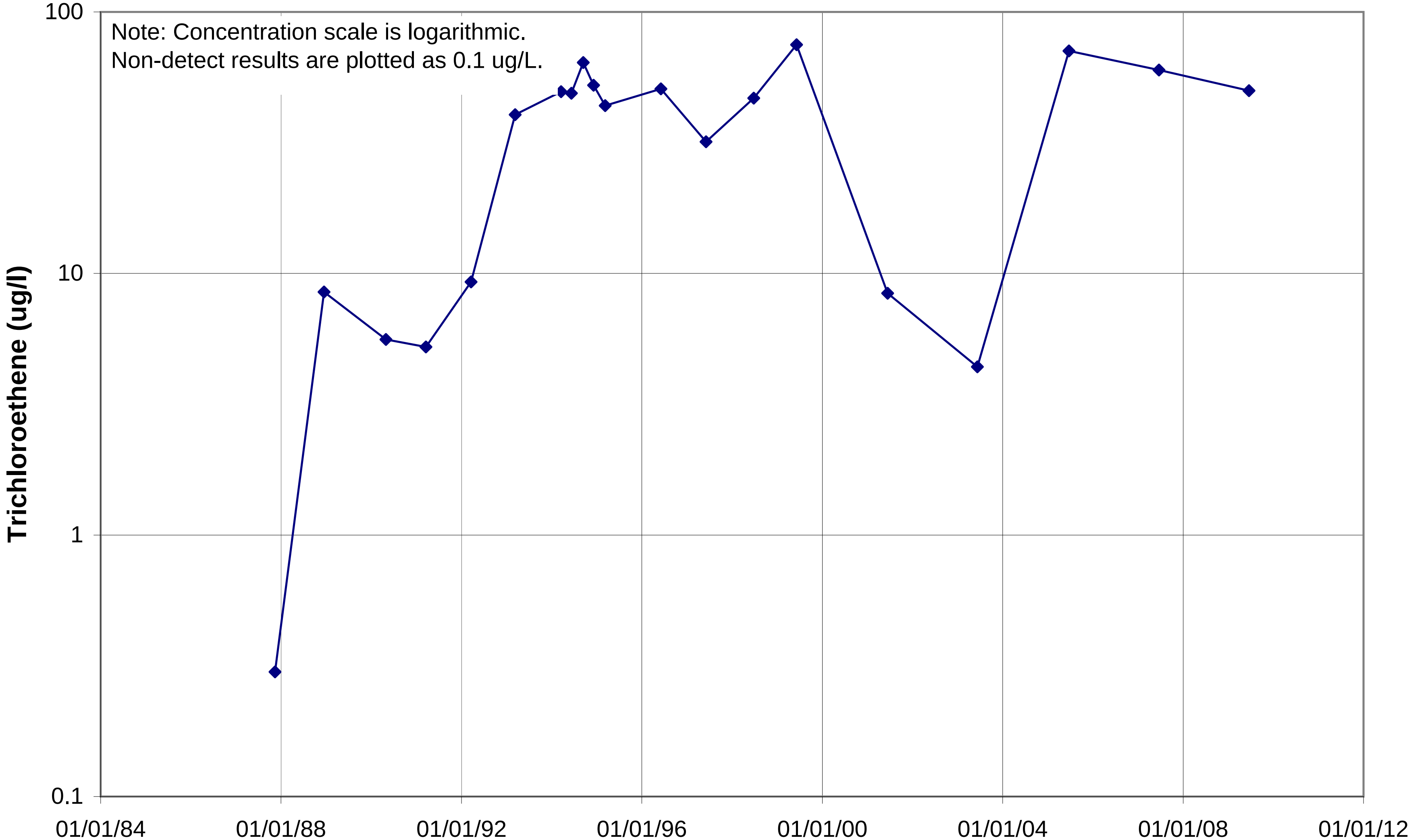


**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

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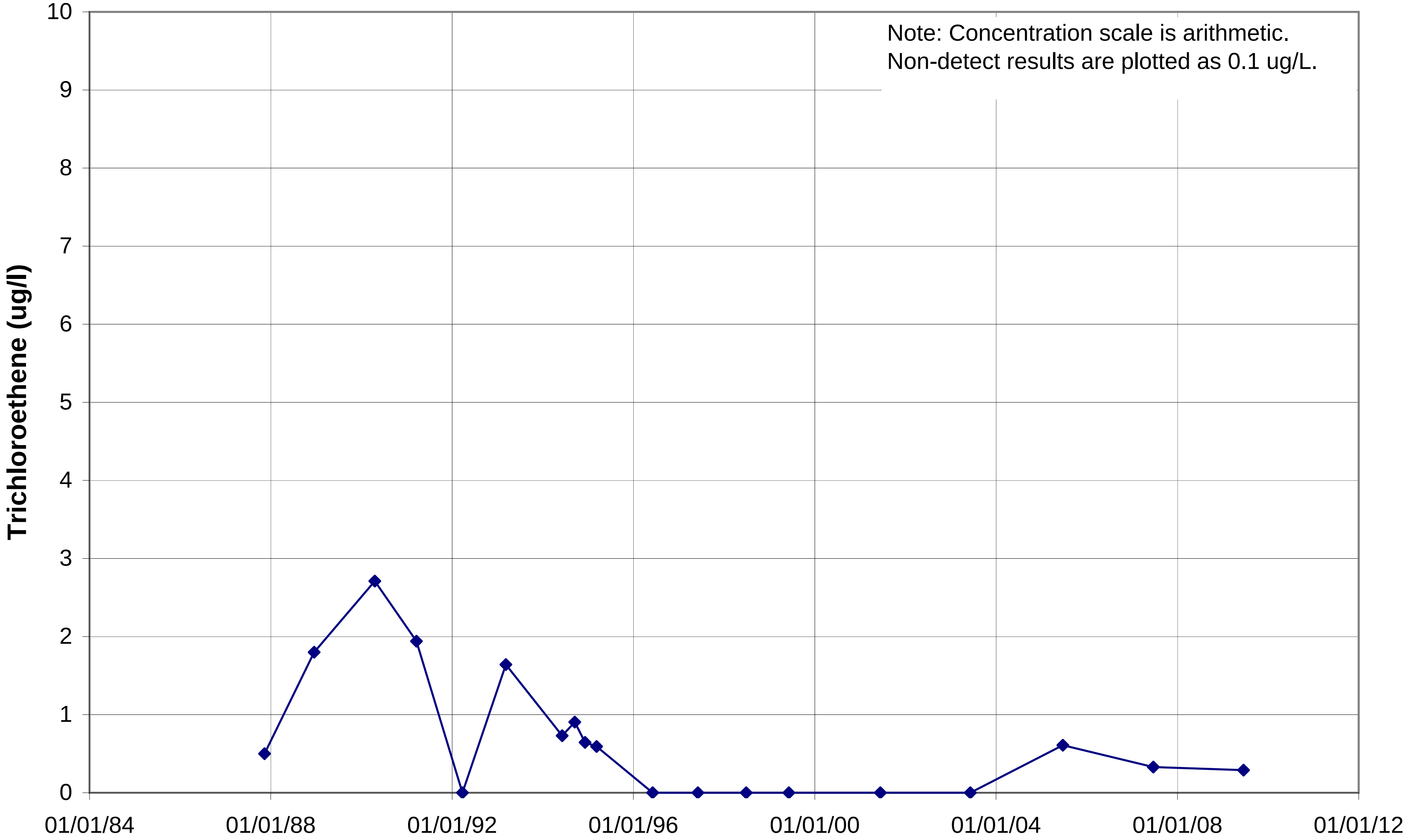
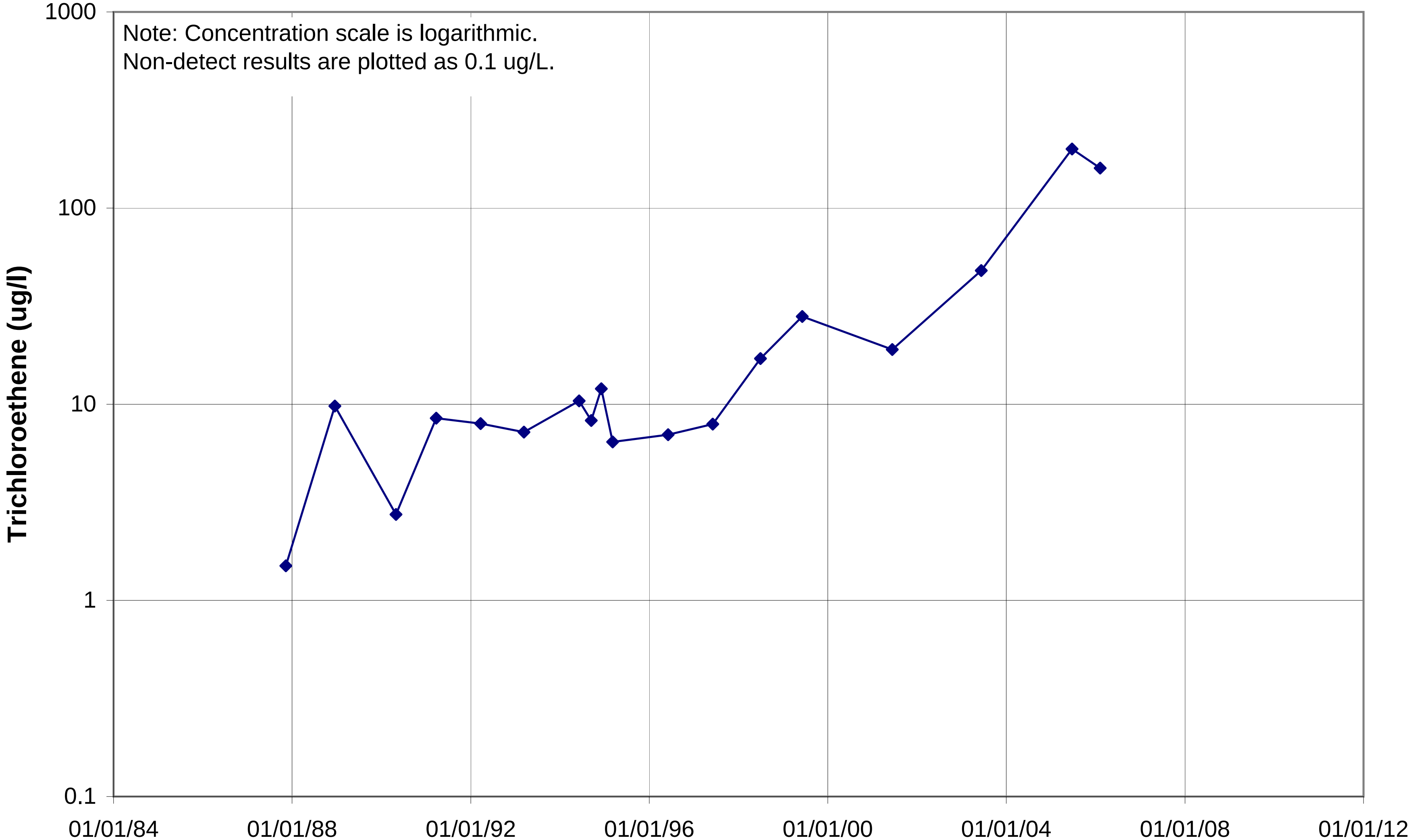



**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 04U861




**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

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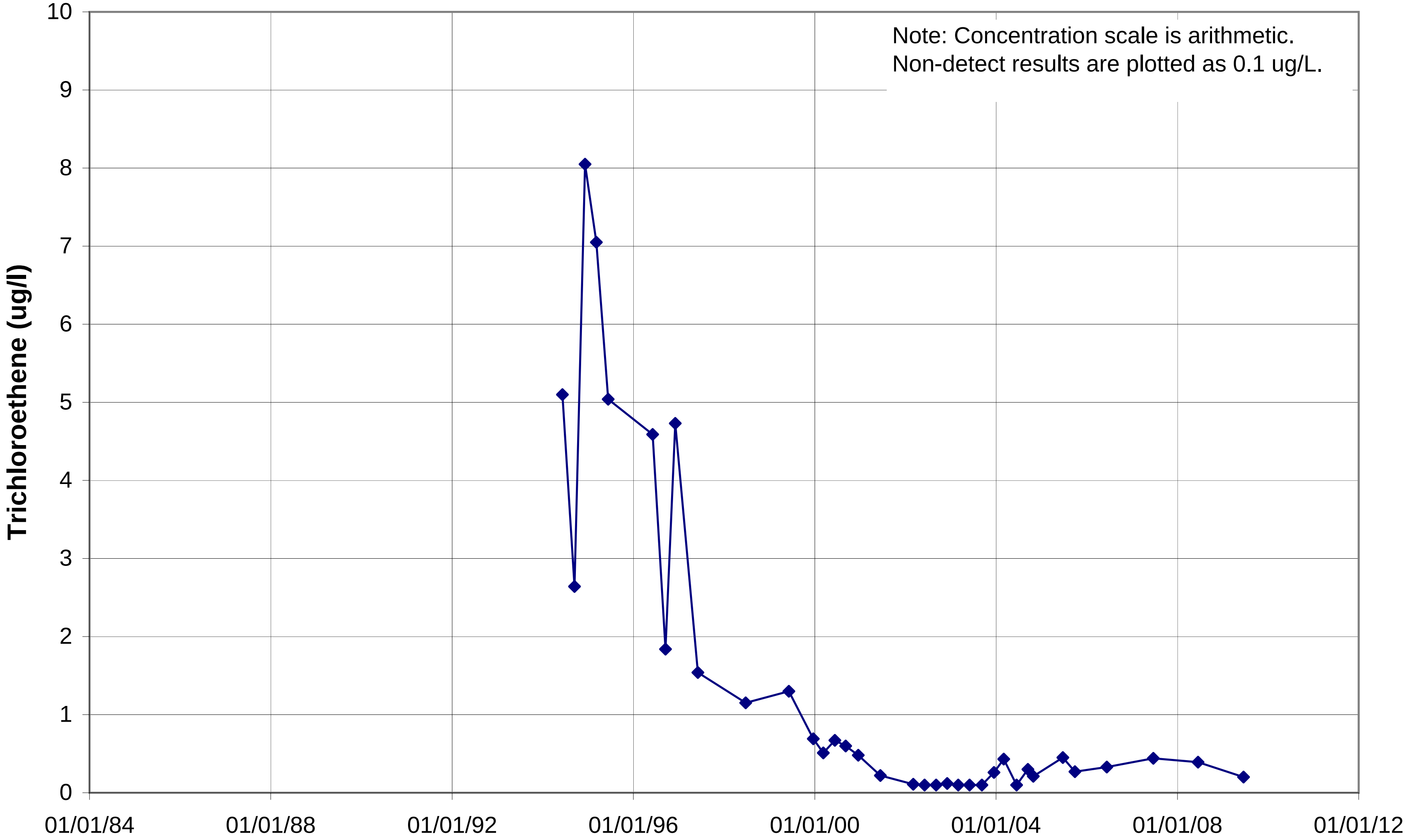


**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

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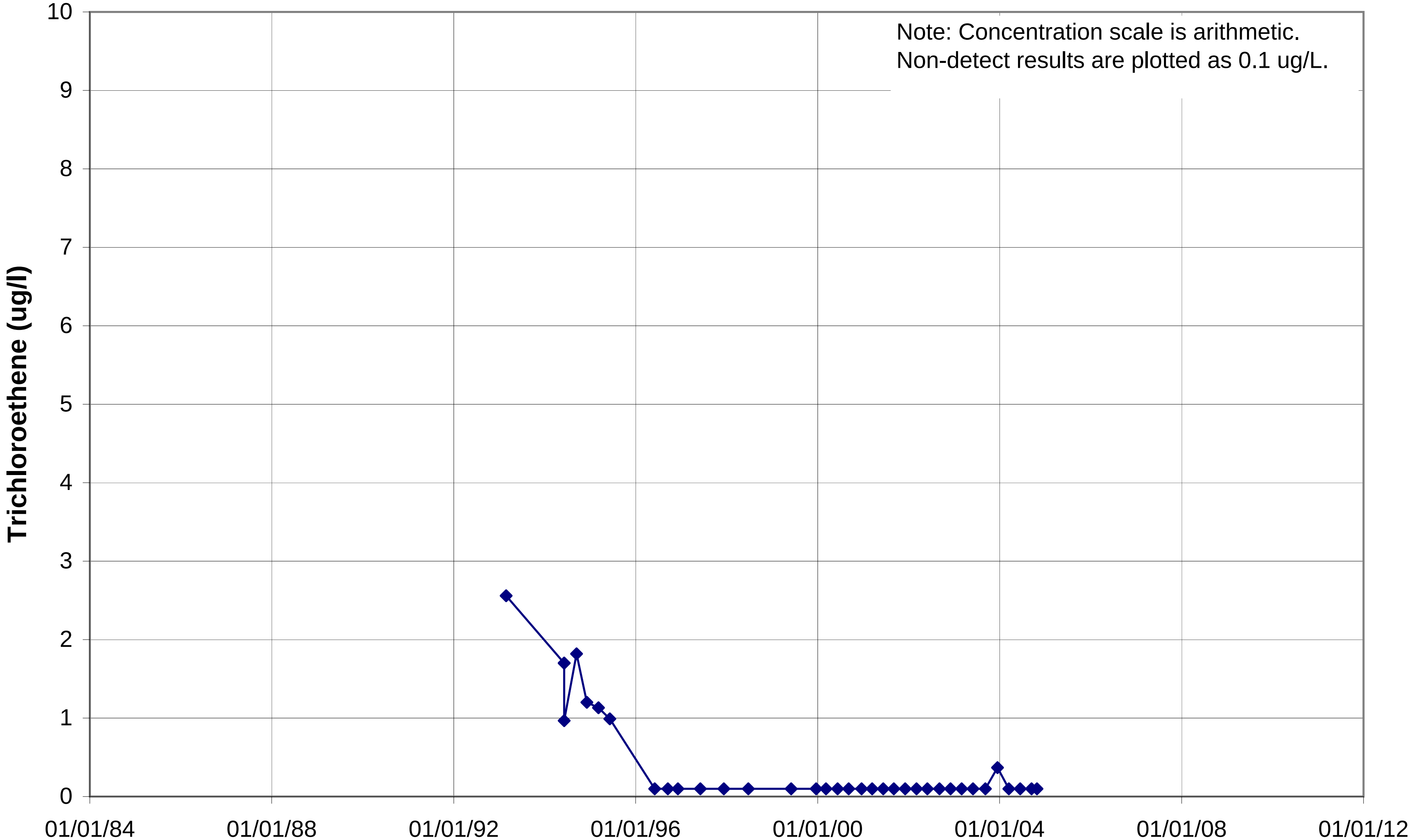
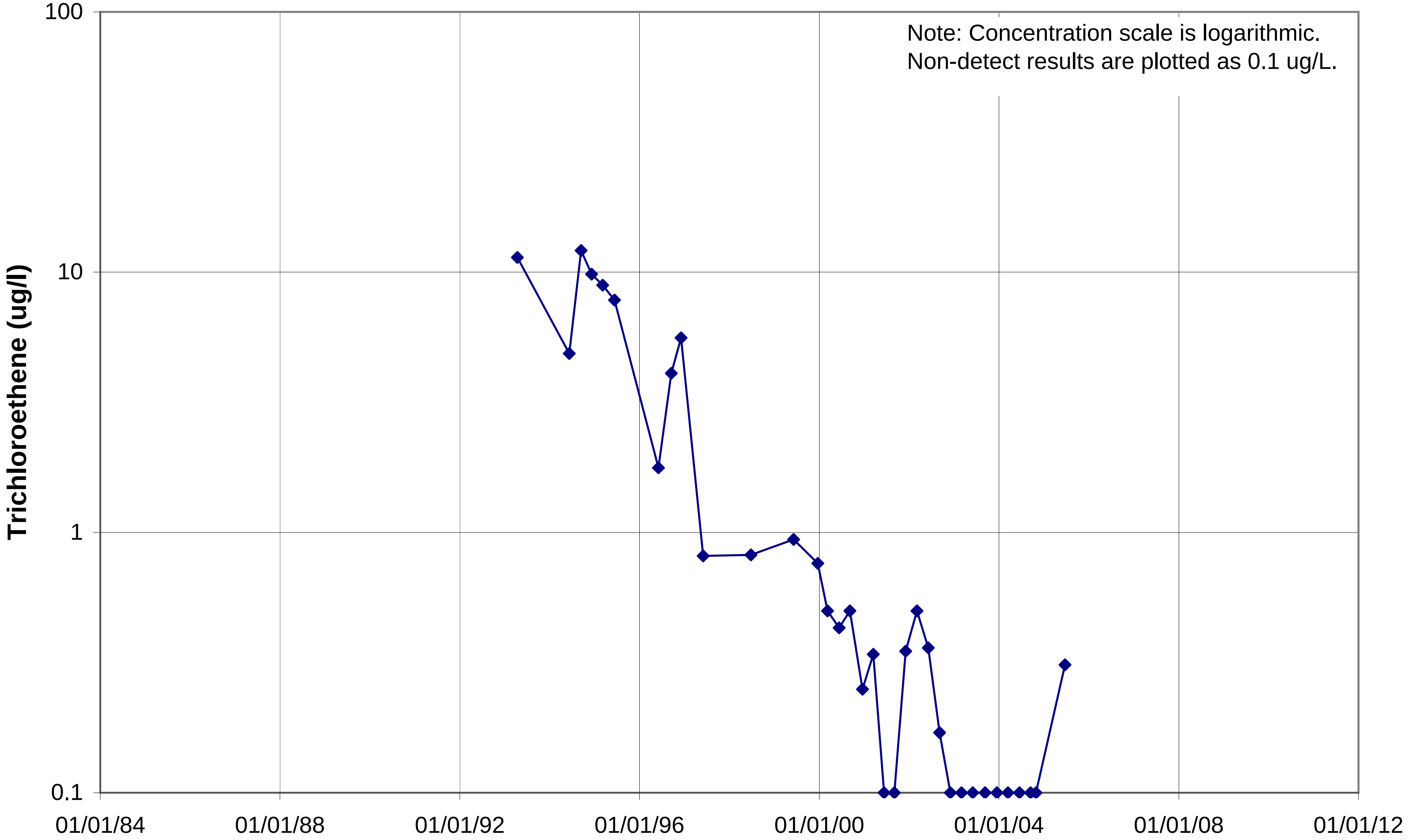
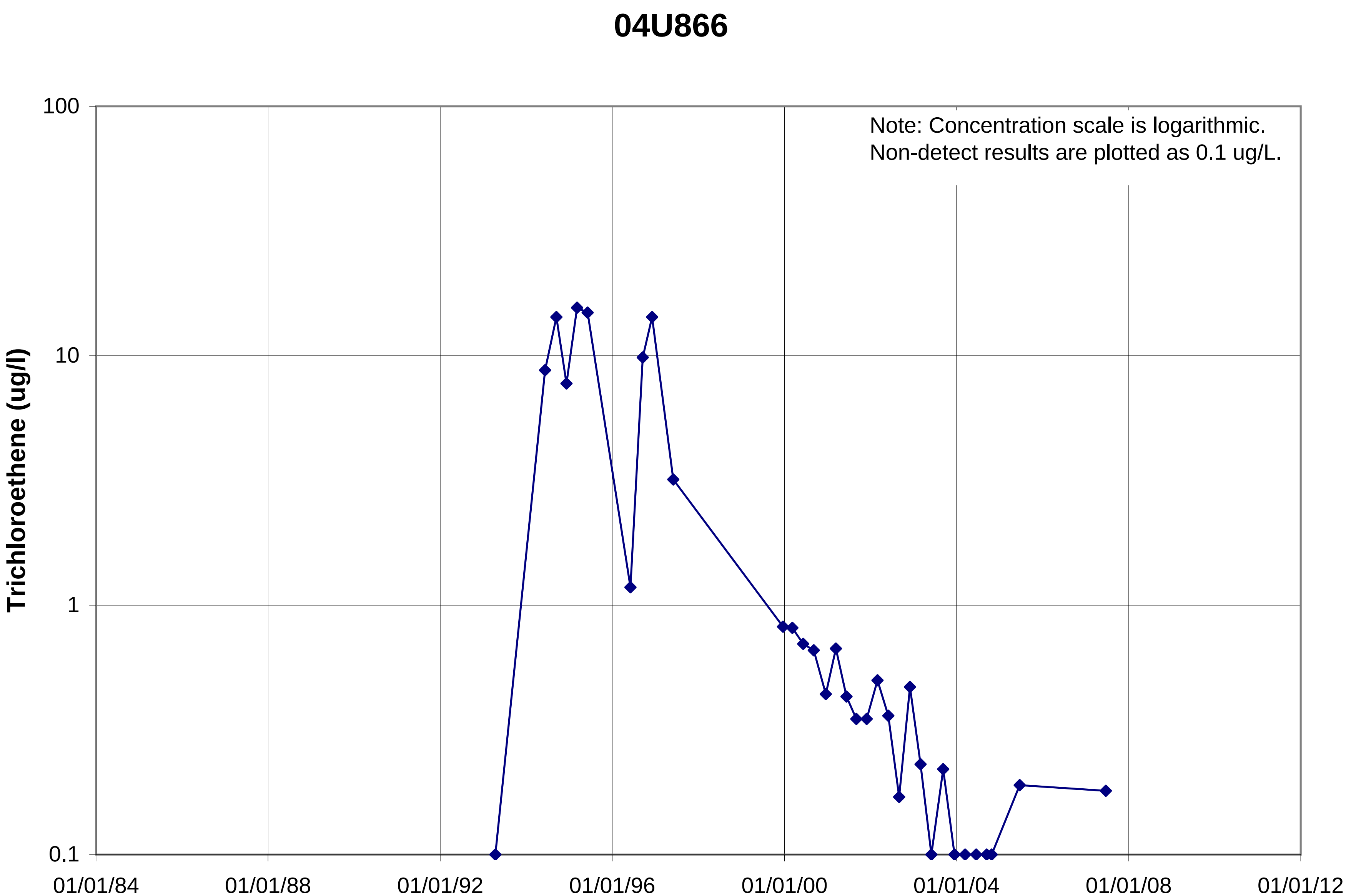



**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

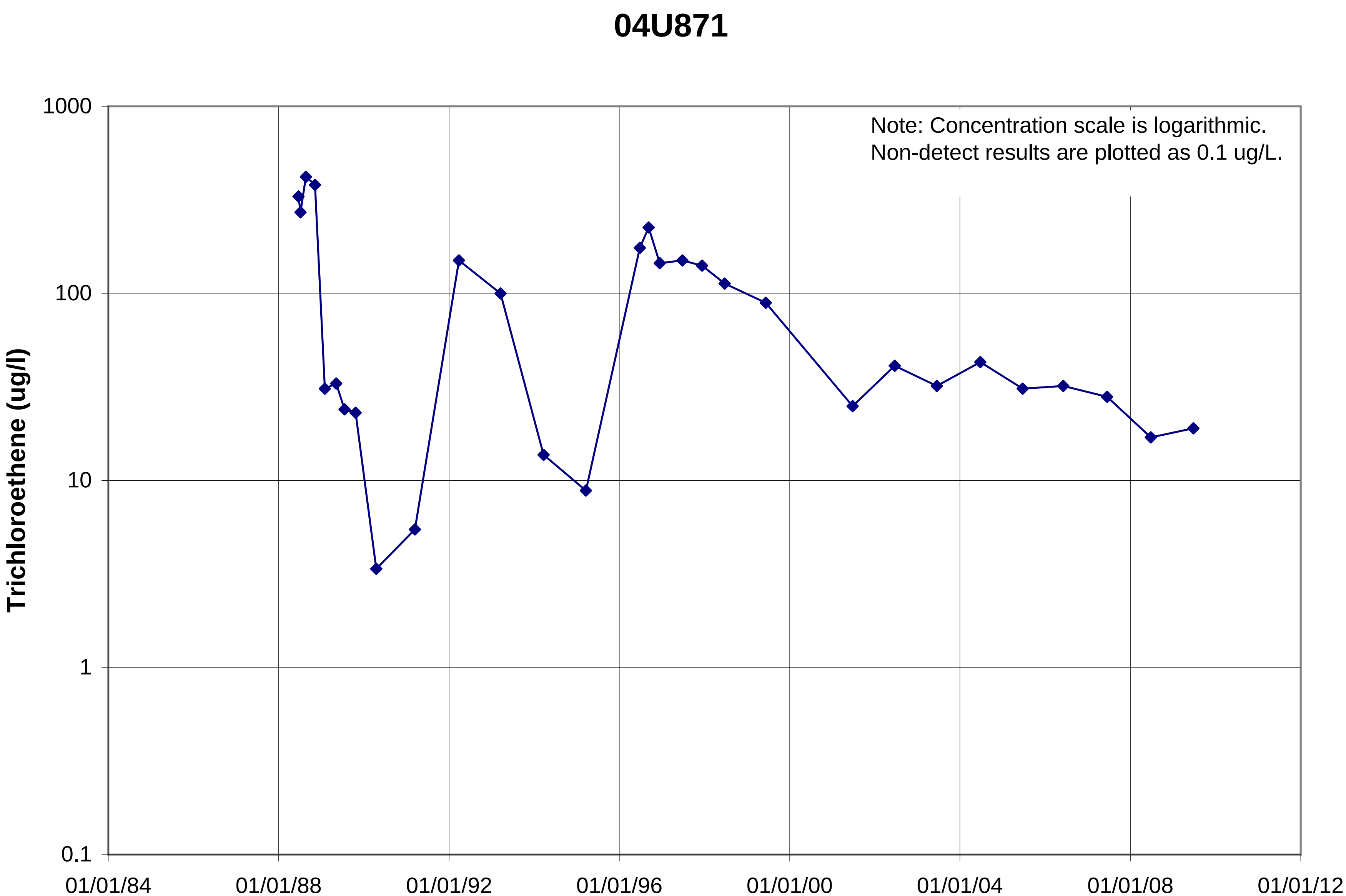
# 04U865




**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar




**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar




**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

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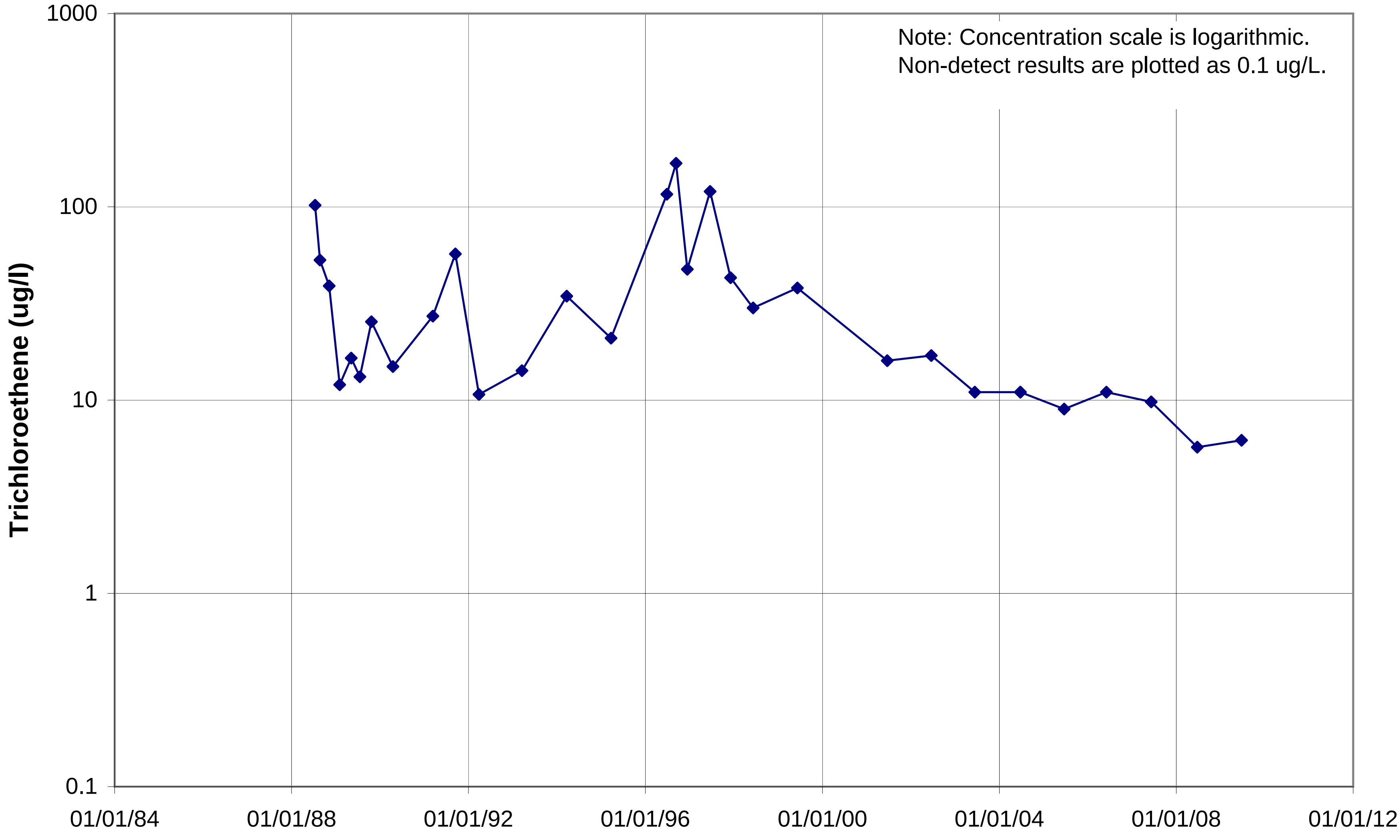


**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

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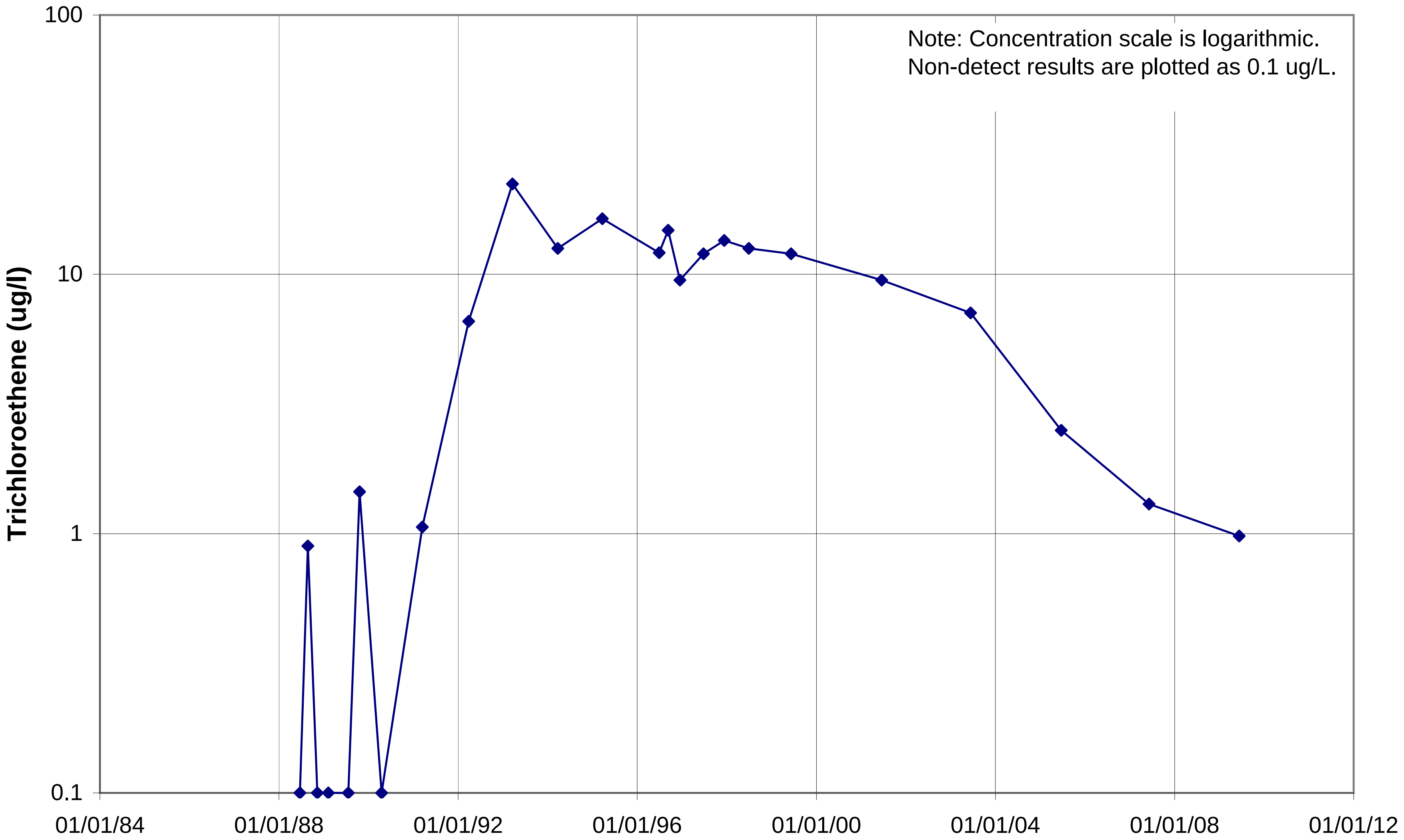


**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

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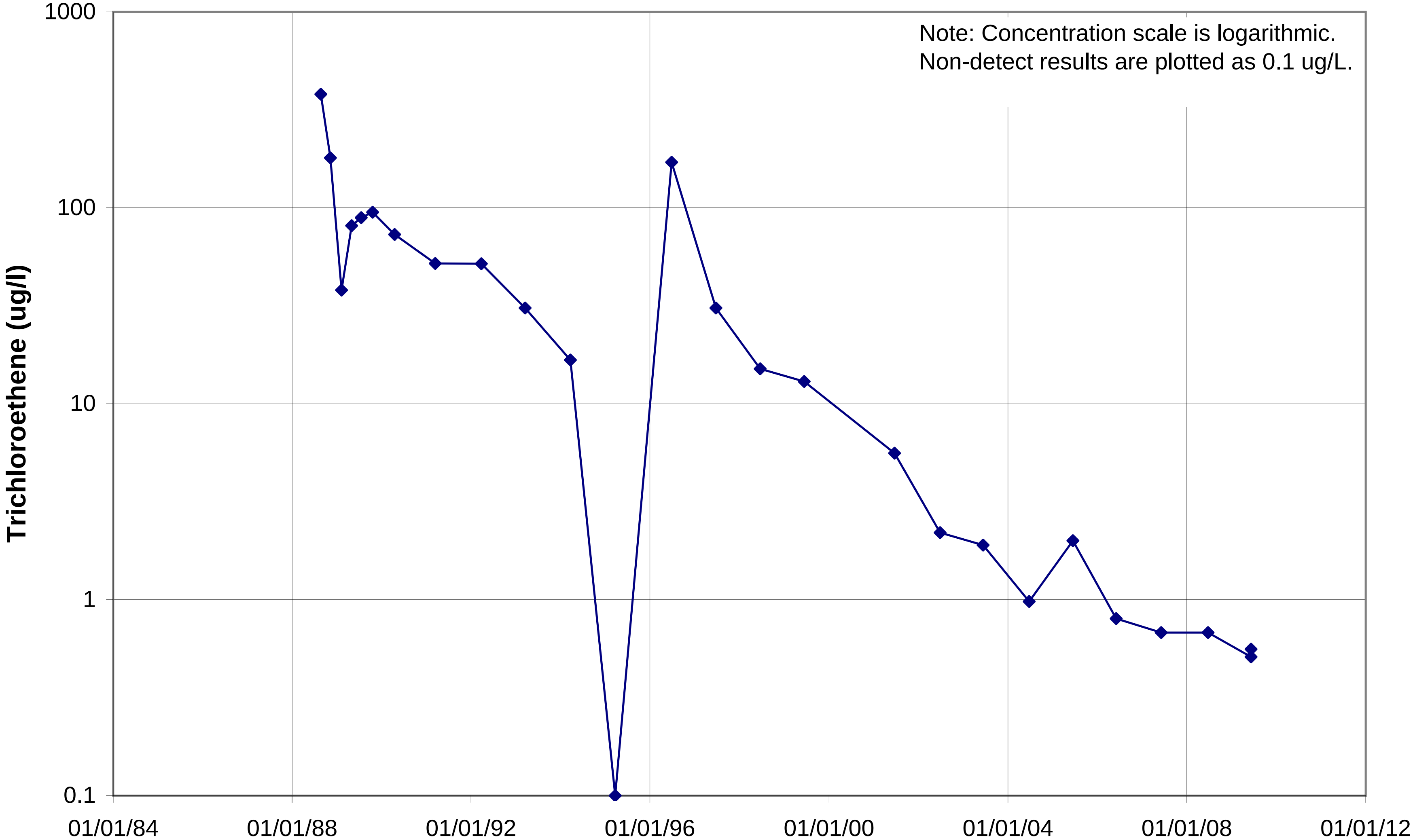
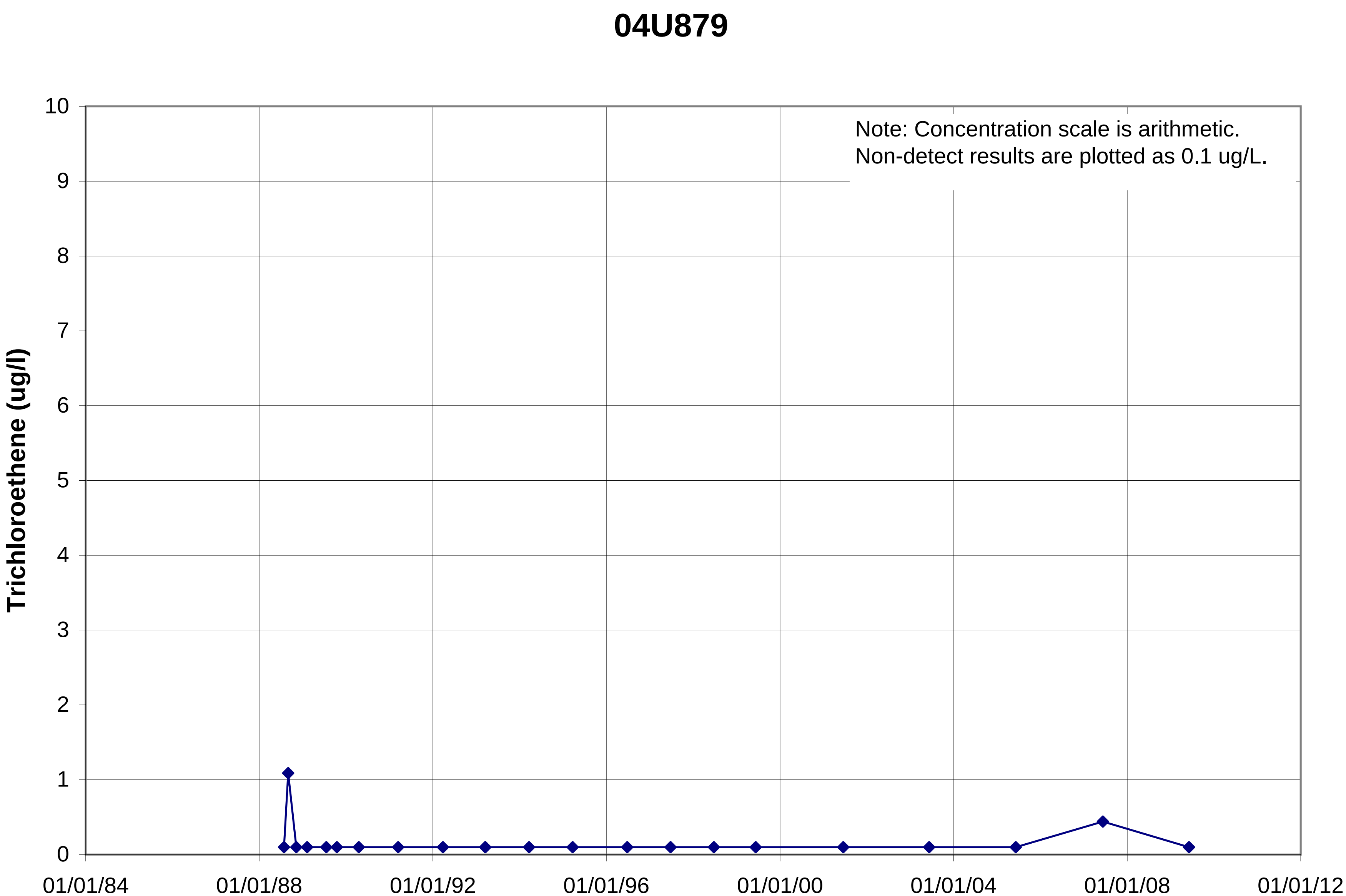
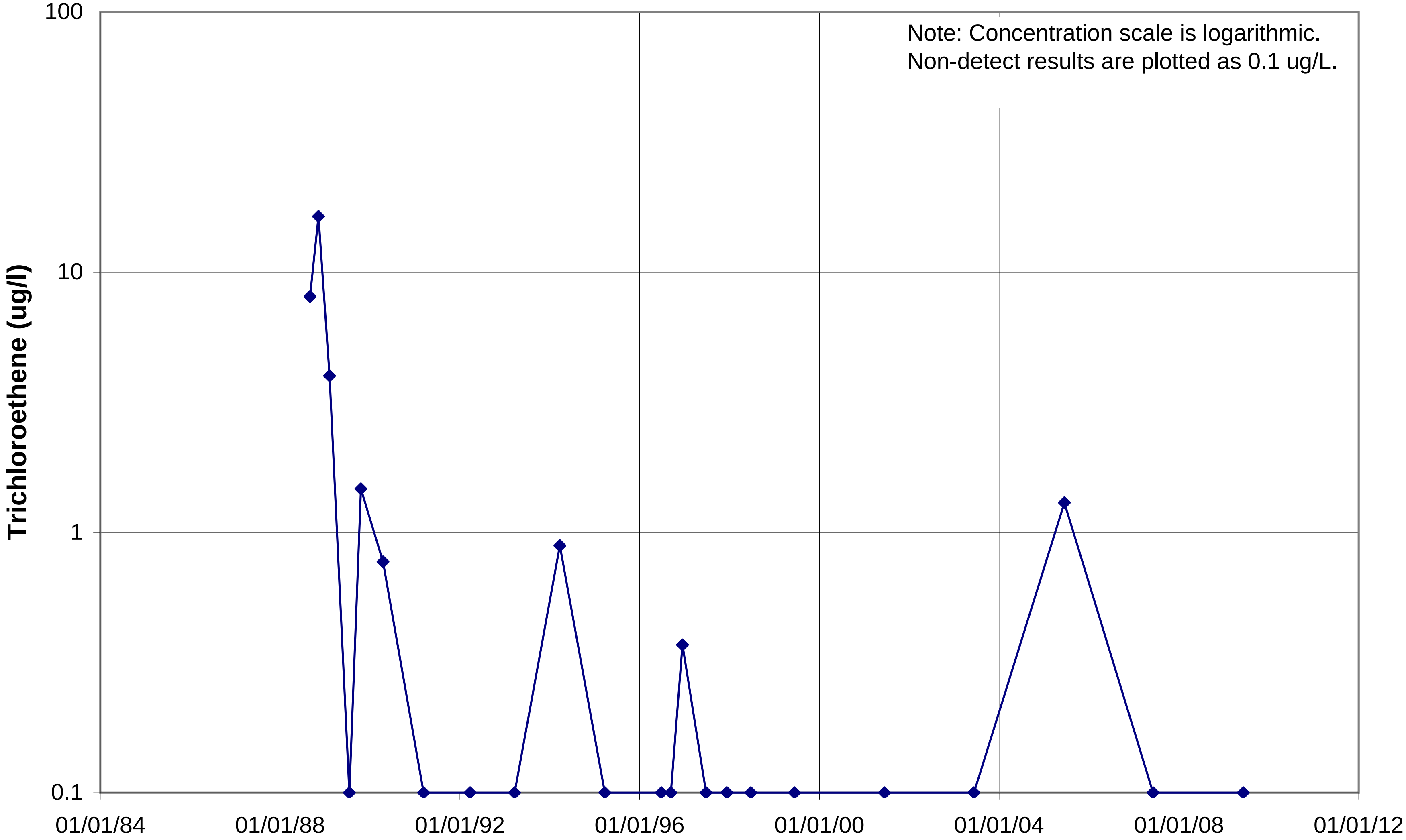



**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

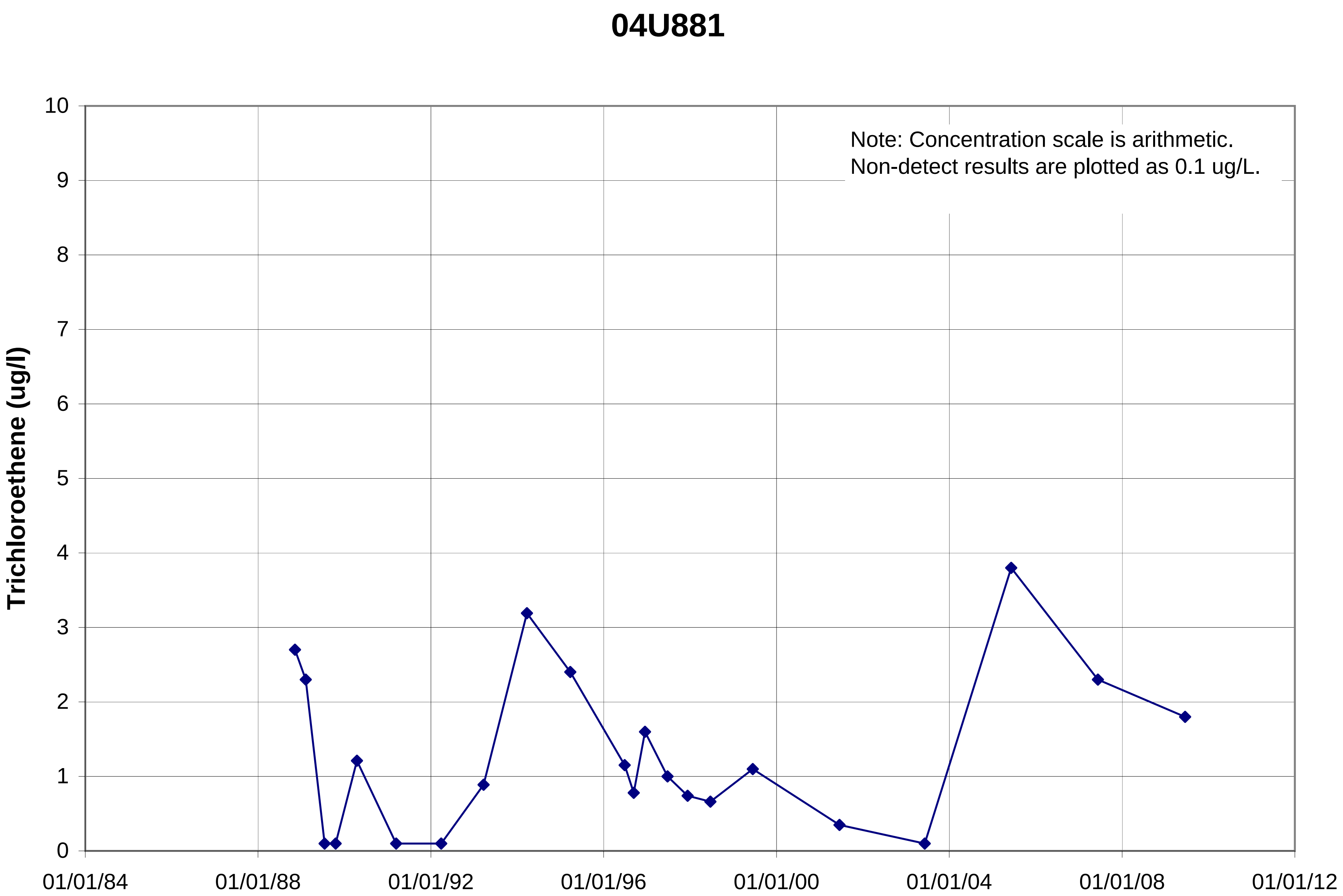



**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 04U880

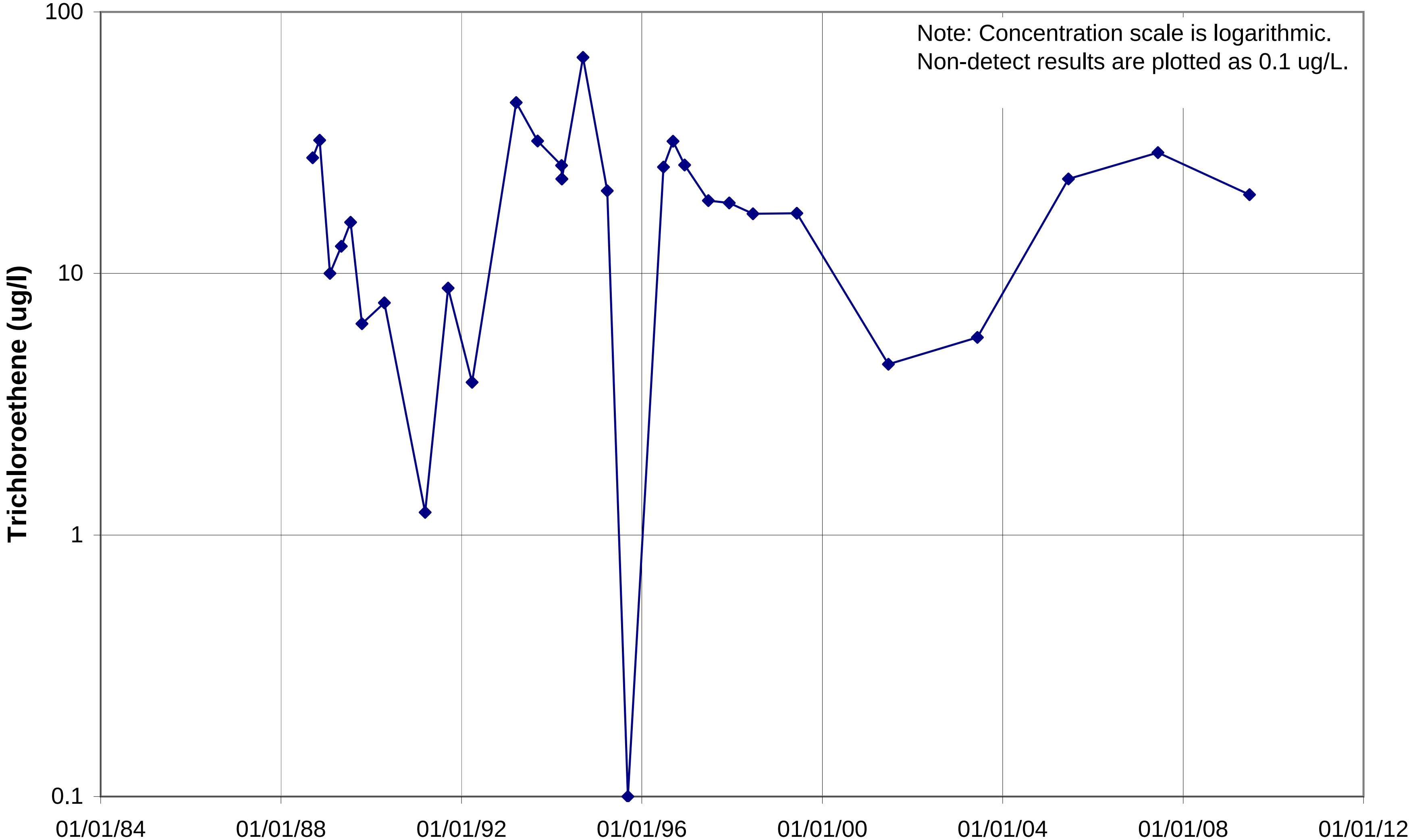



**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar




**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 04U882




**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

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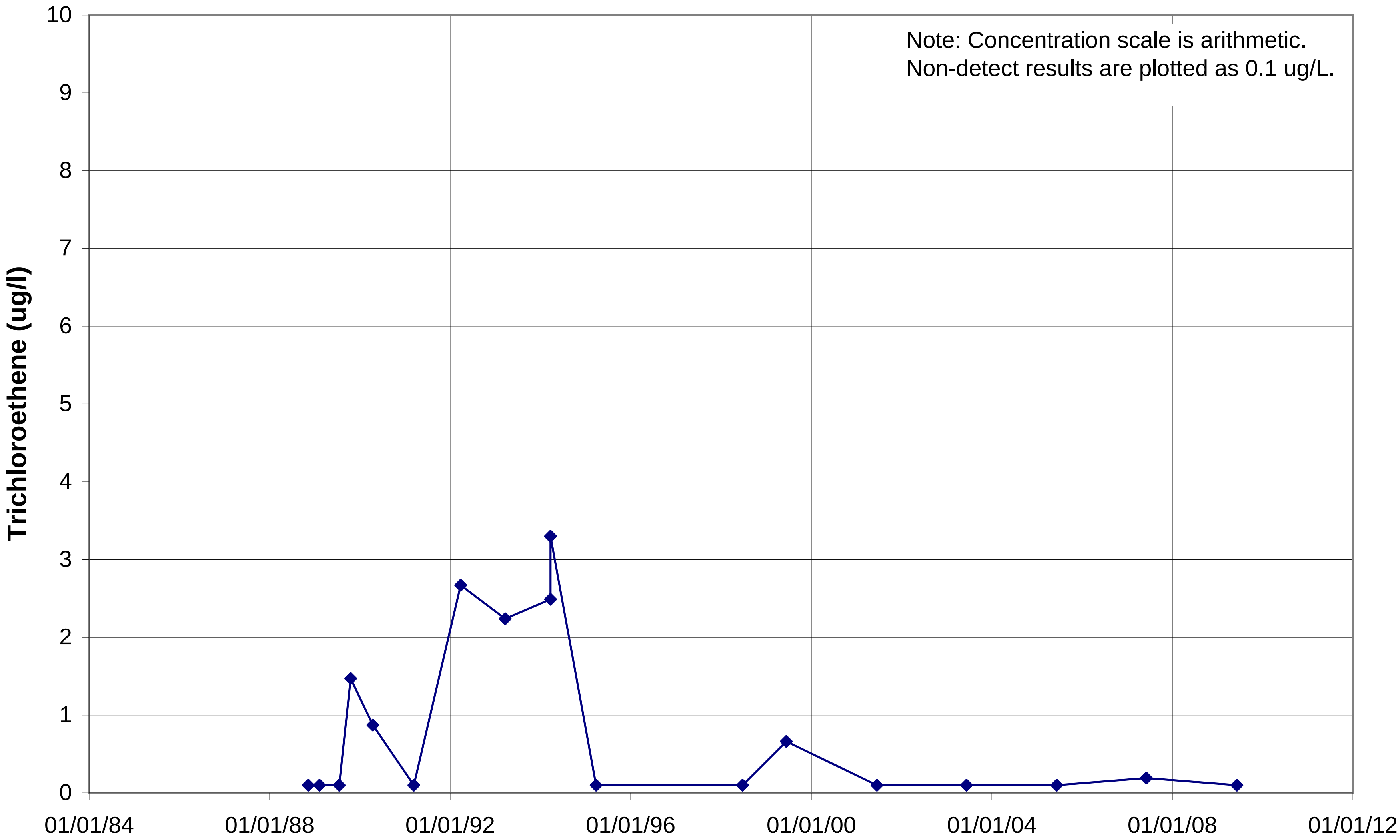
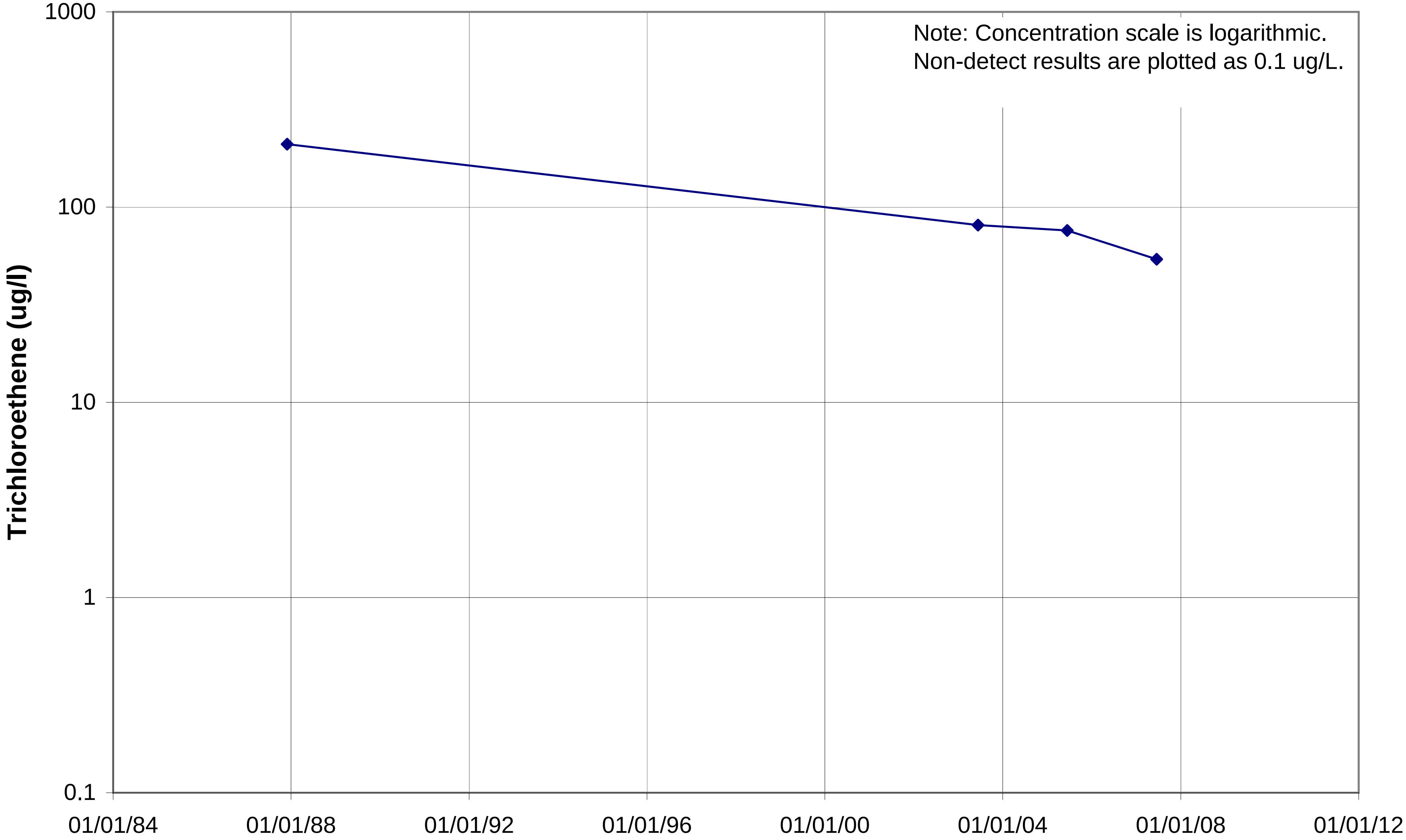


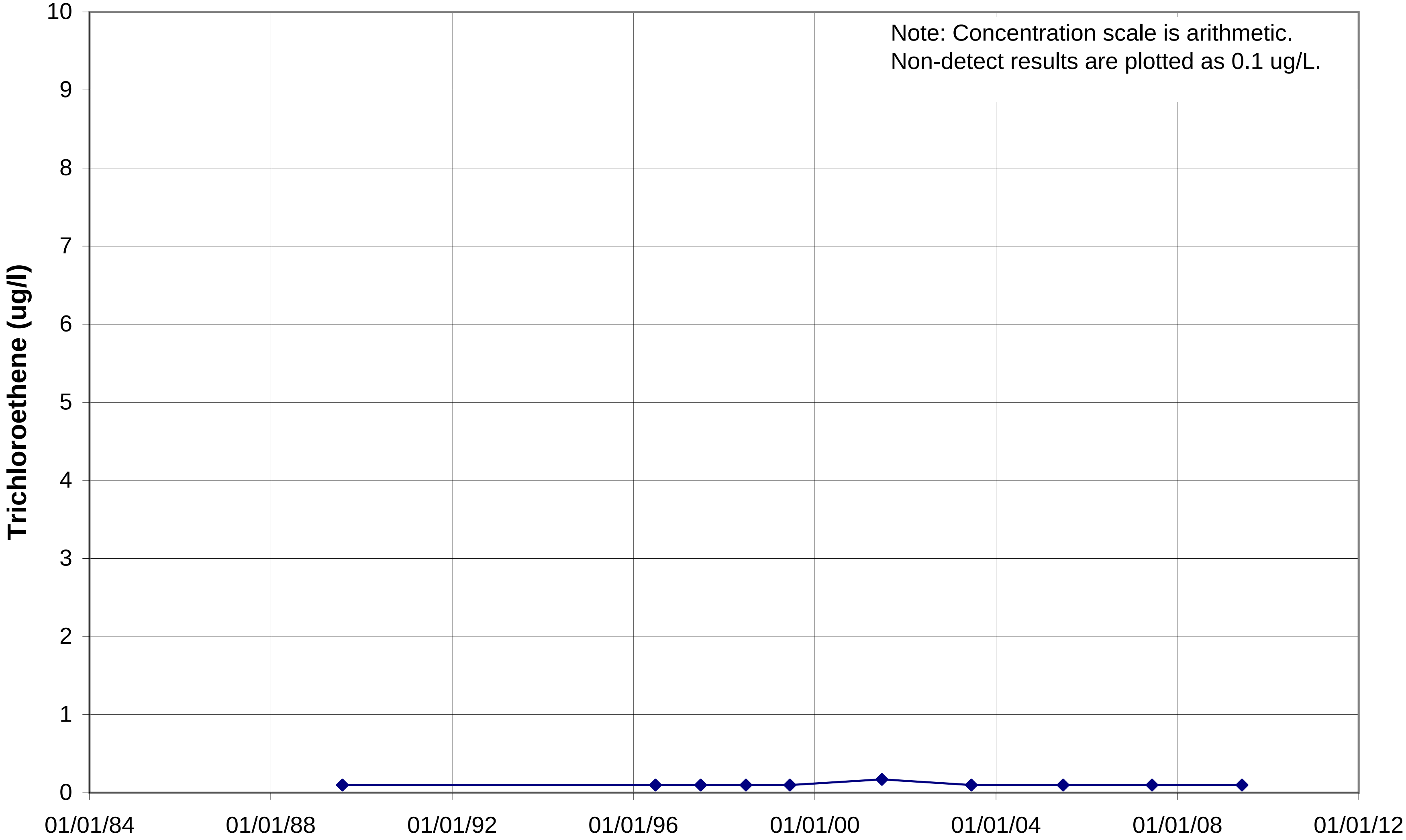

**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 191942




**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

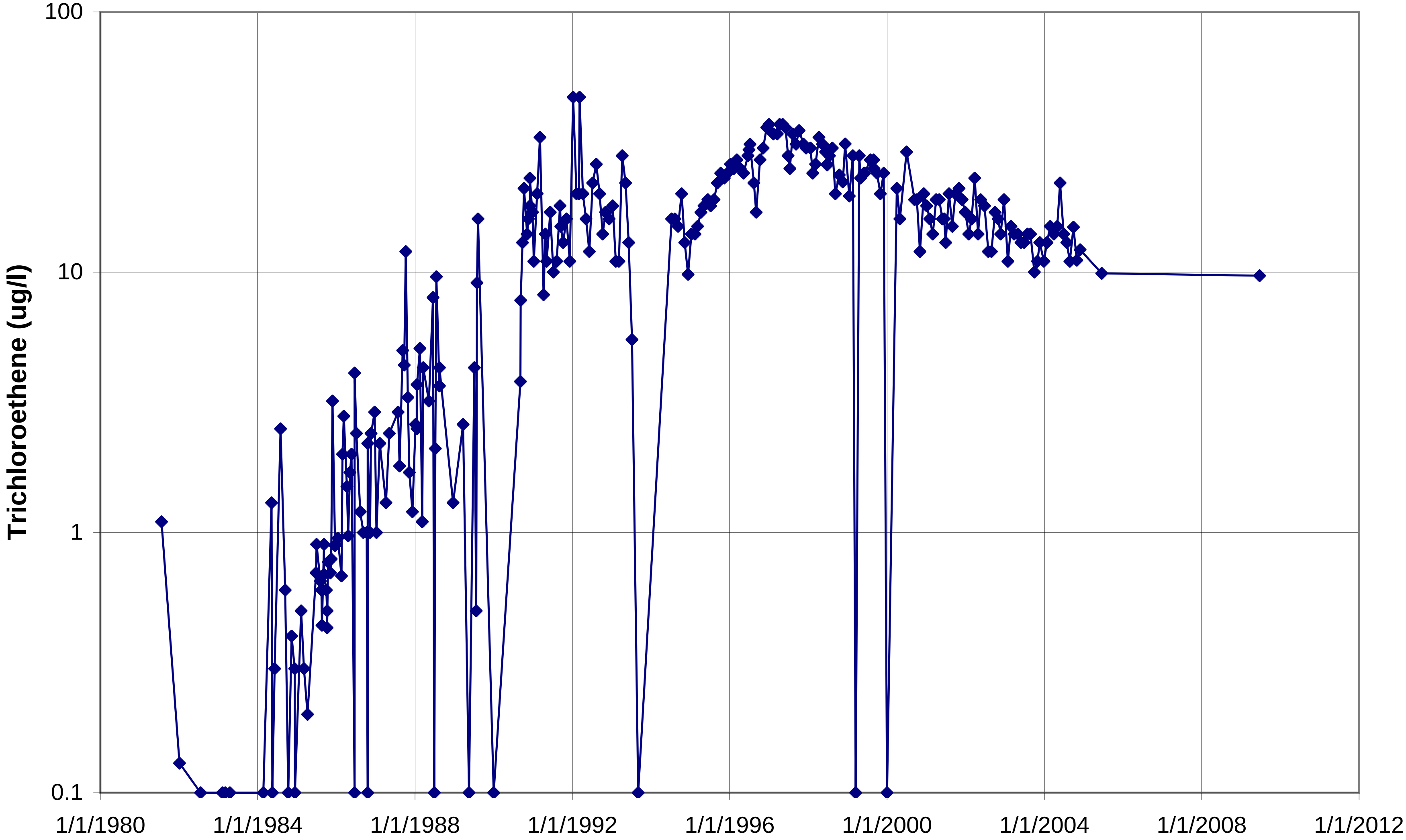
# 200154




**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

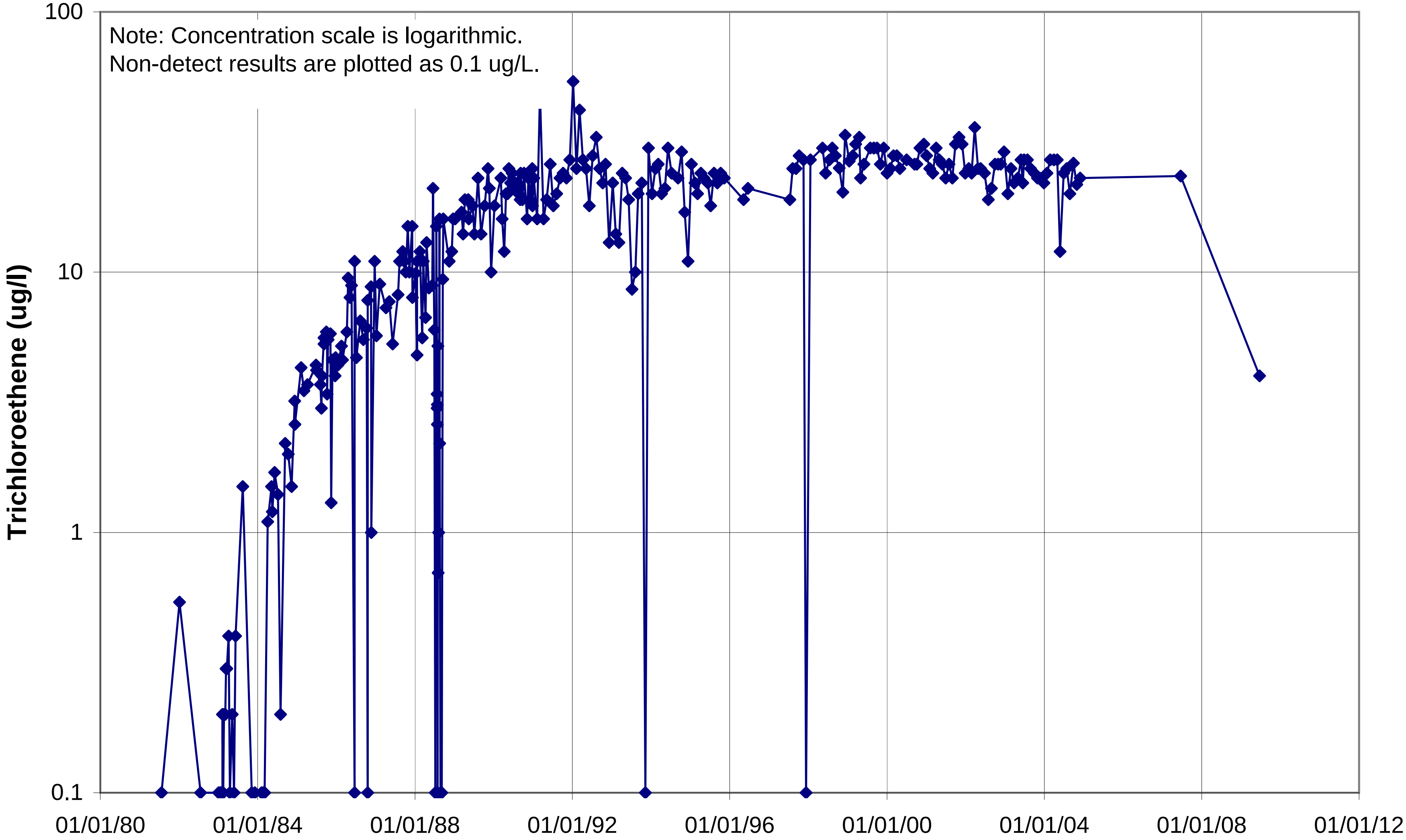
# 200524

Note: Concentration scale is logarithmic.
Non-detect results are plotted as 0.1 ug/L.

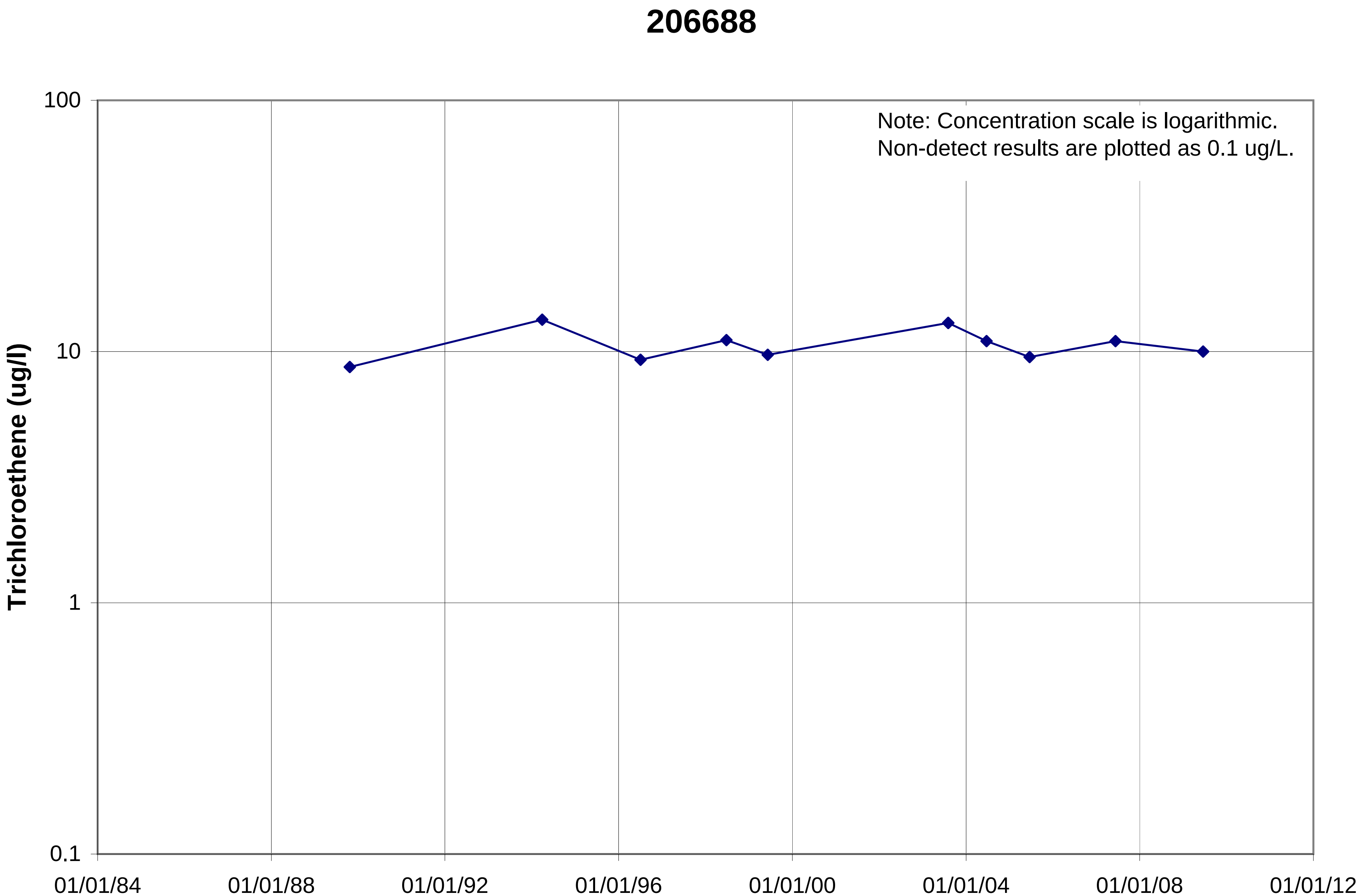



**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 200803 (SAM#4)

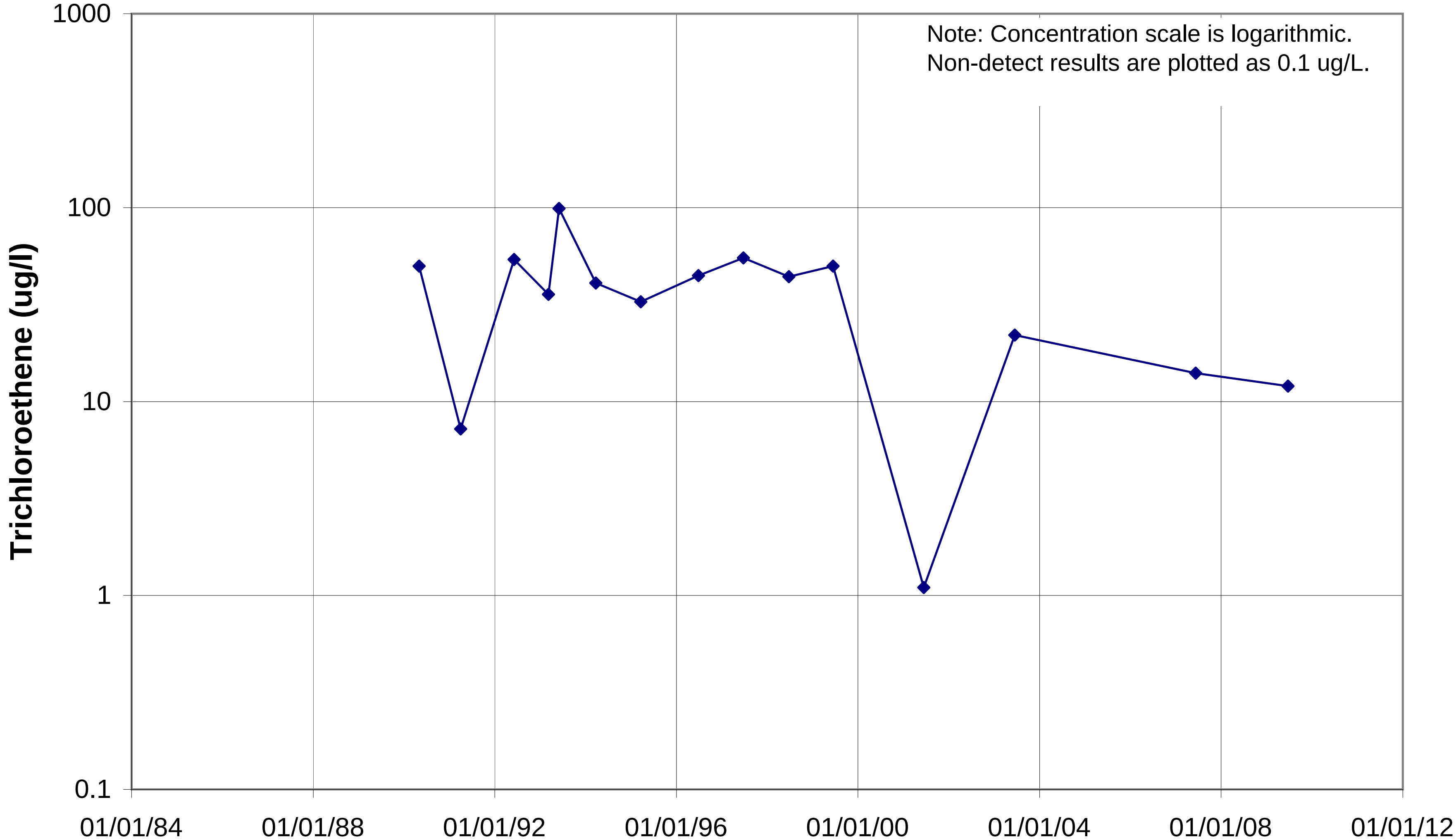



**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar



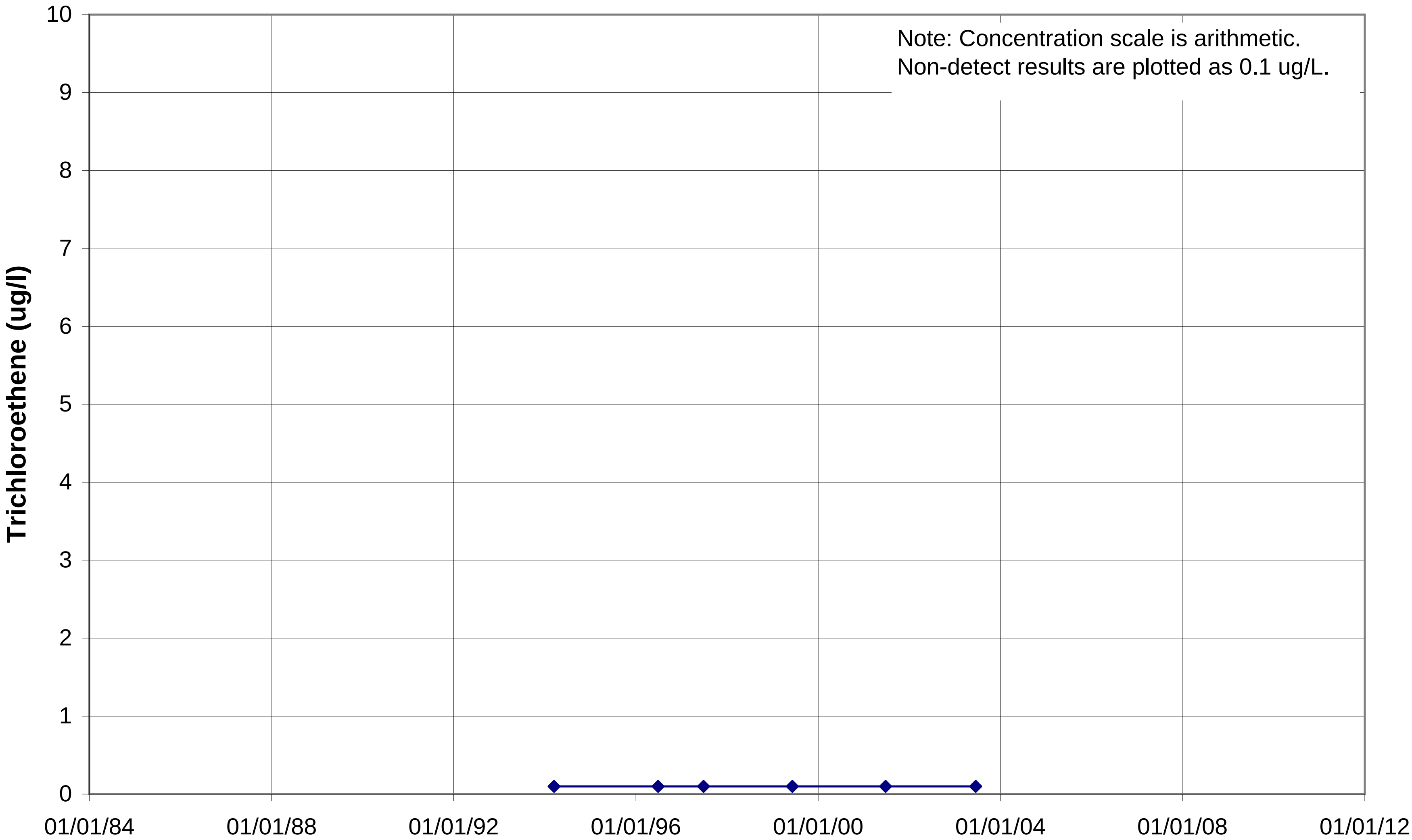

**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 234546



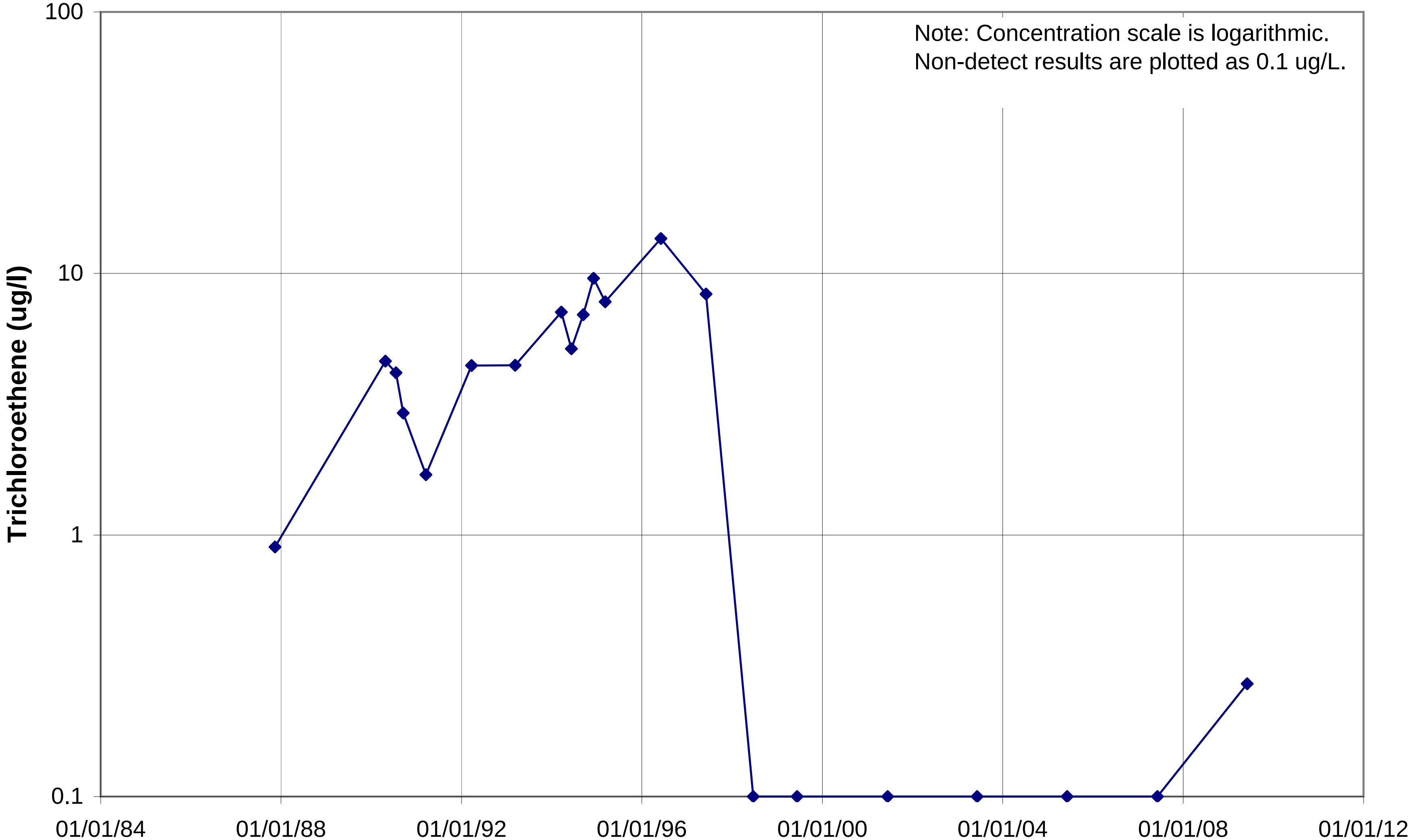

**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 234549



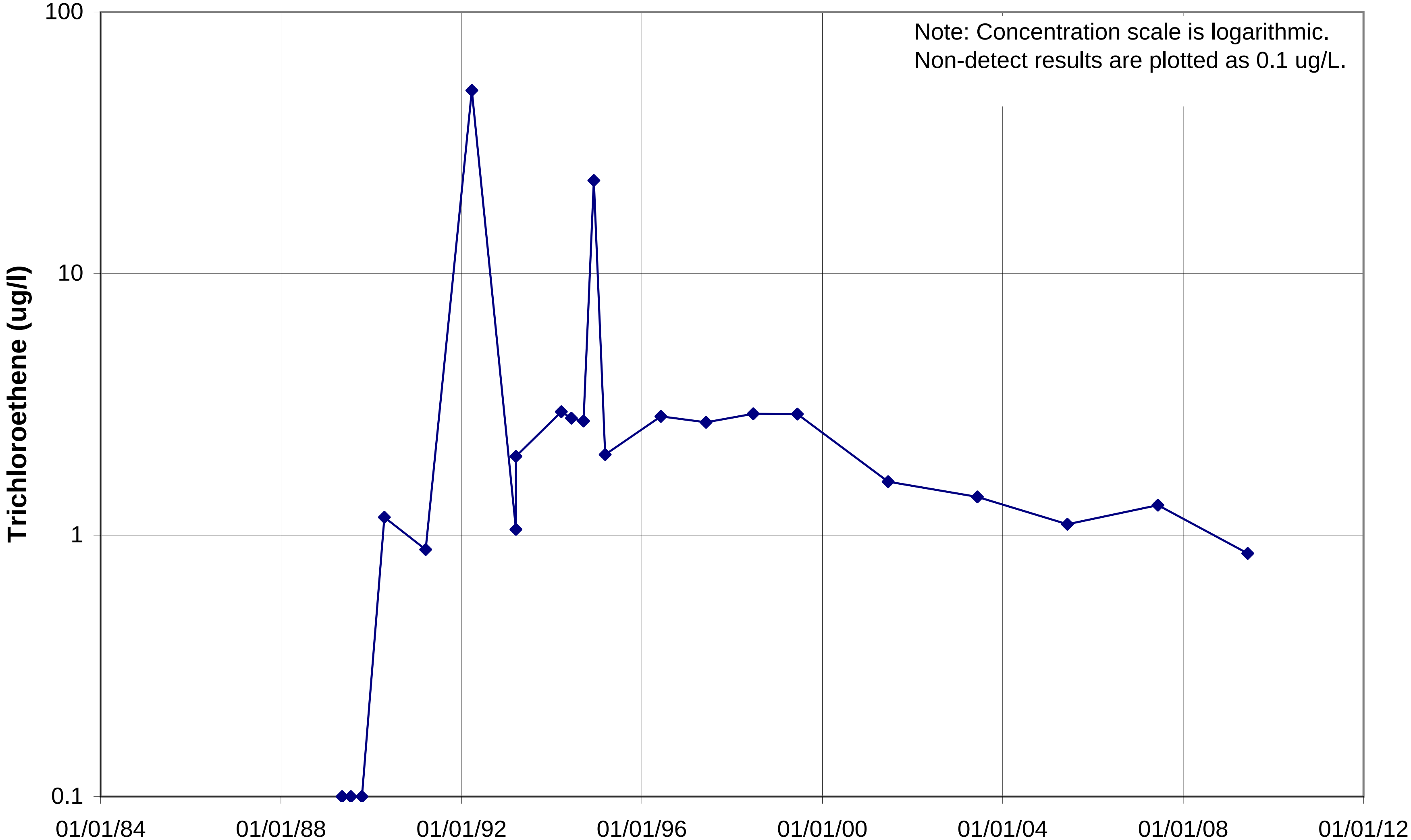

**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 409547



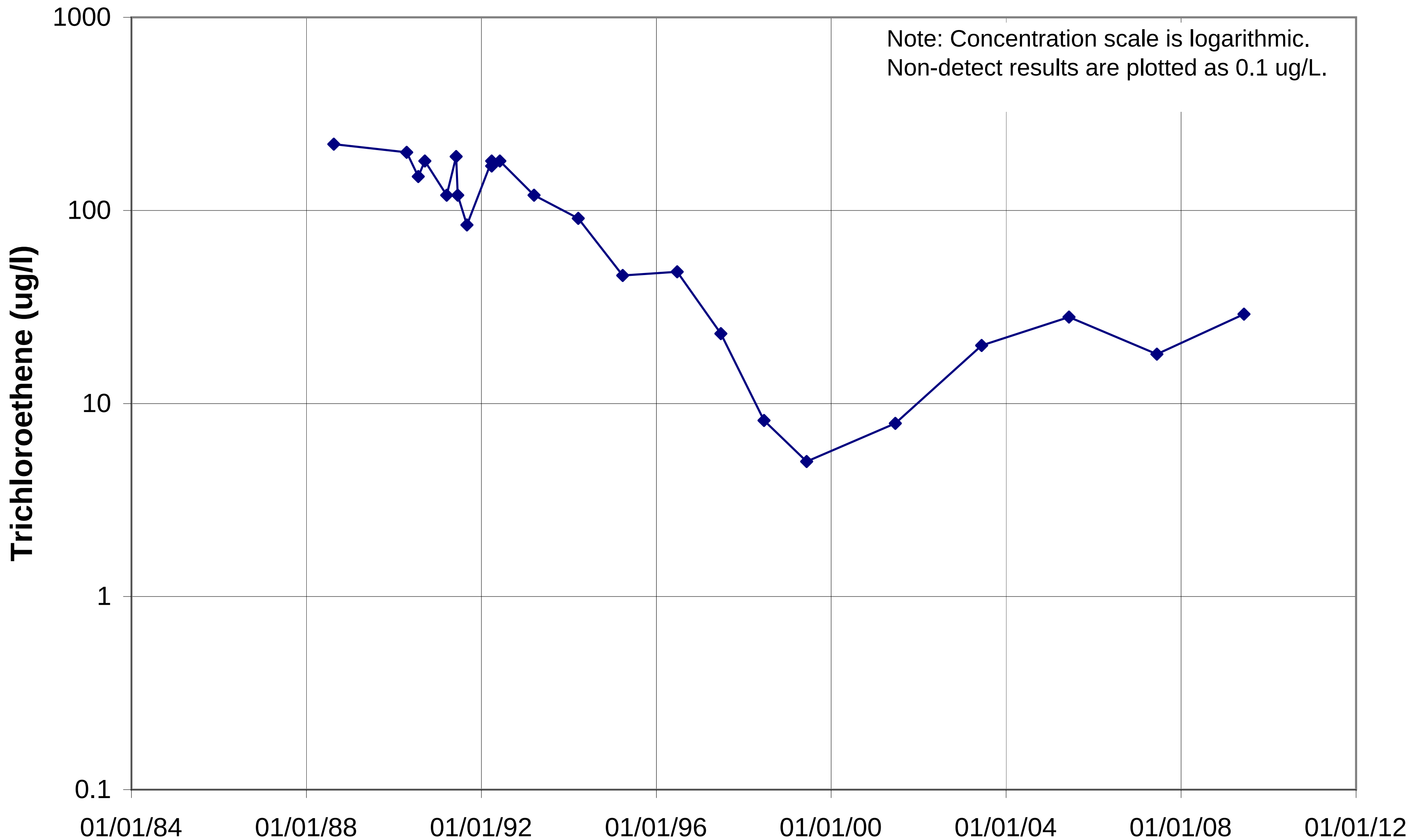

**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 409548



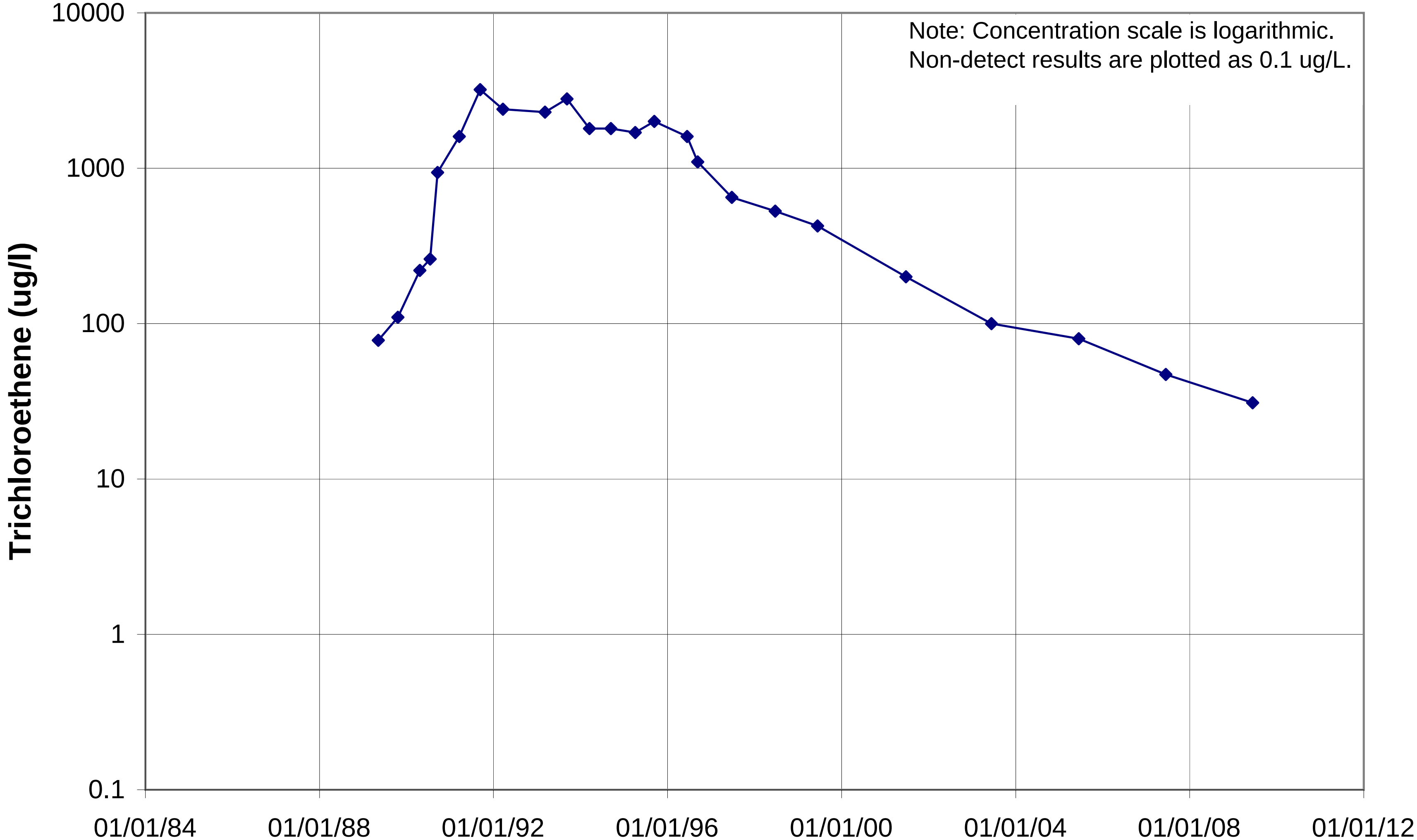

**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 409549



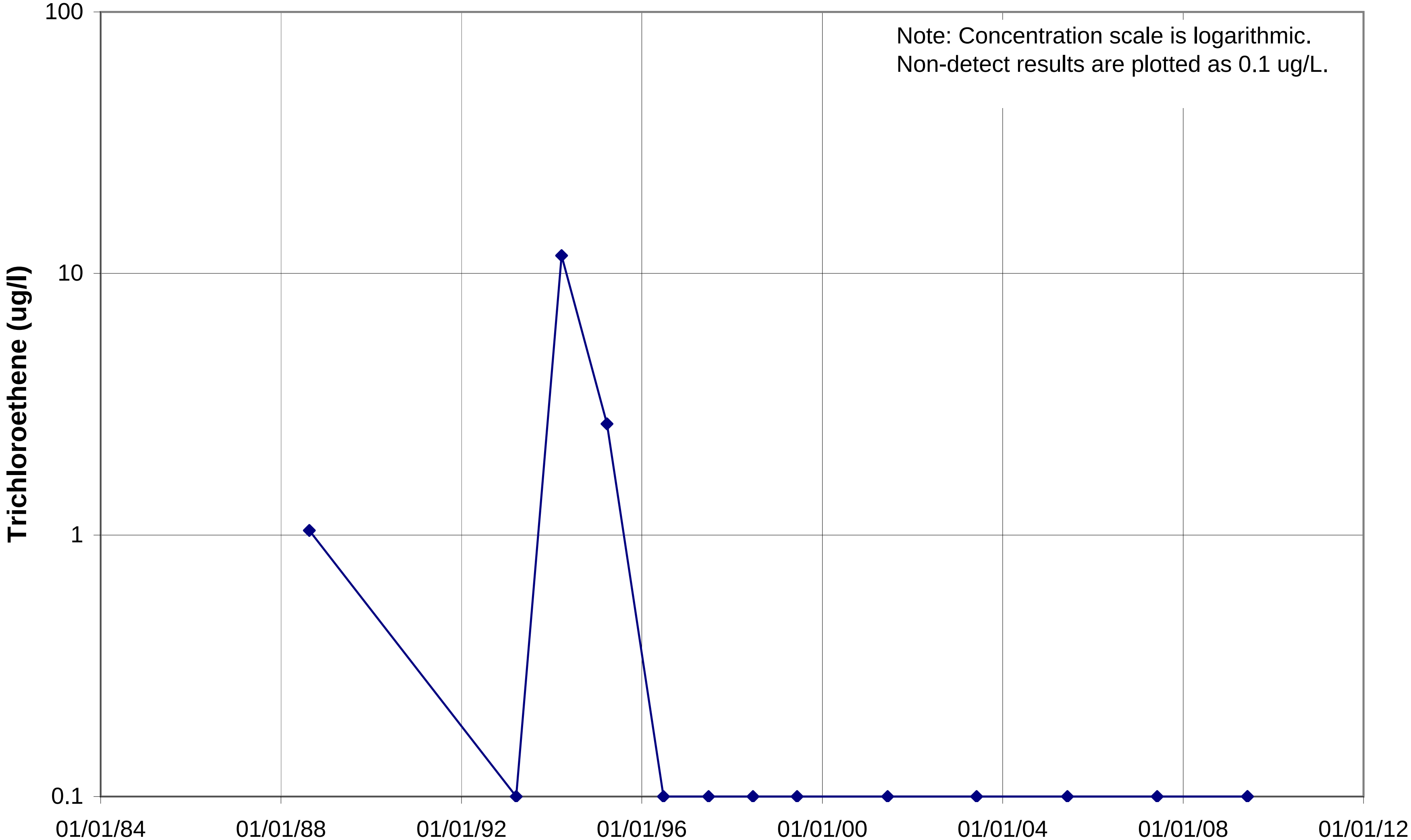

**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 409550



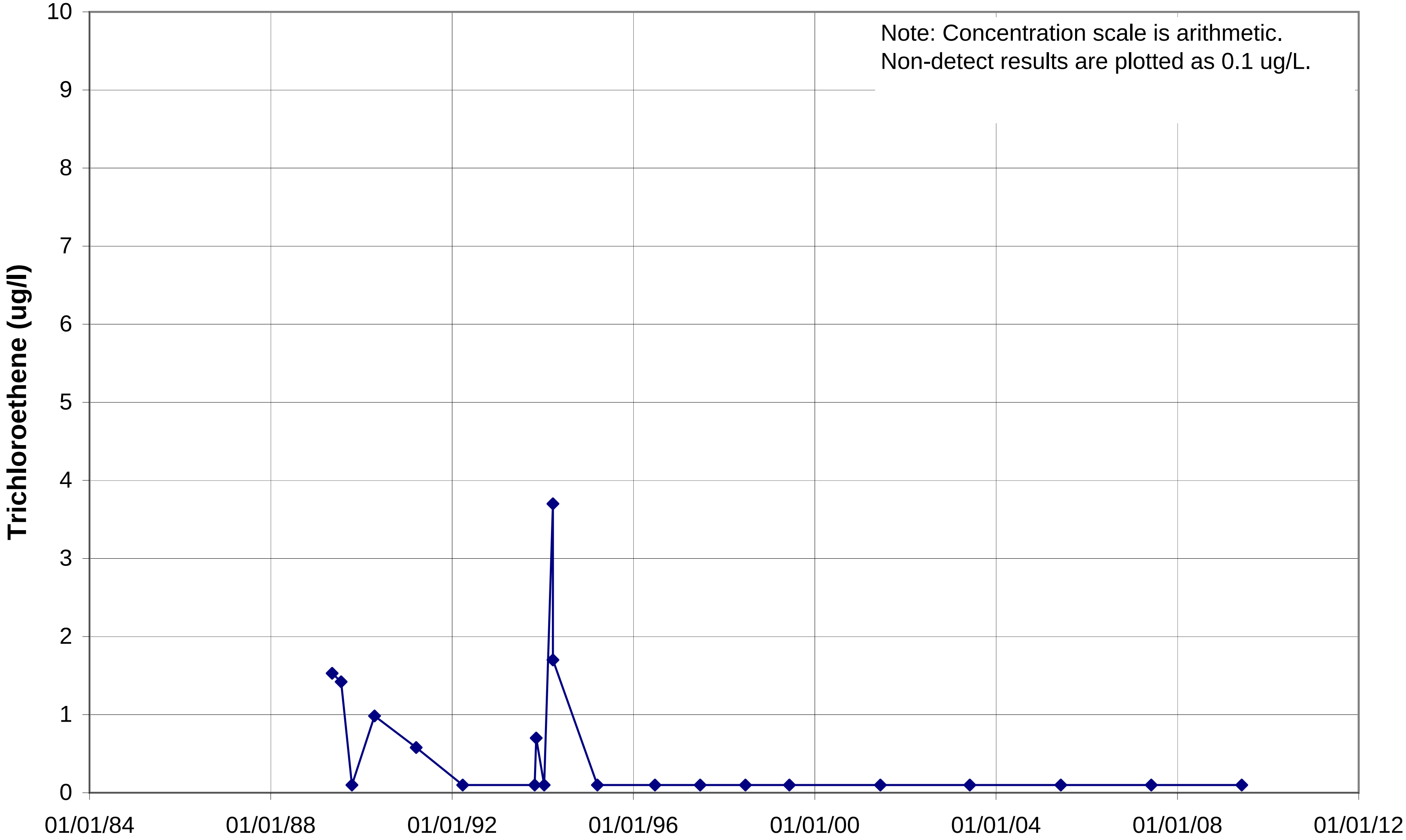

**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 409555

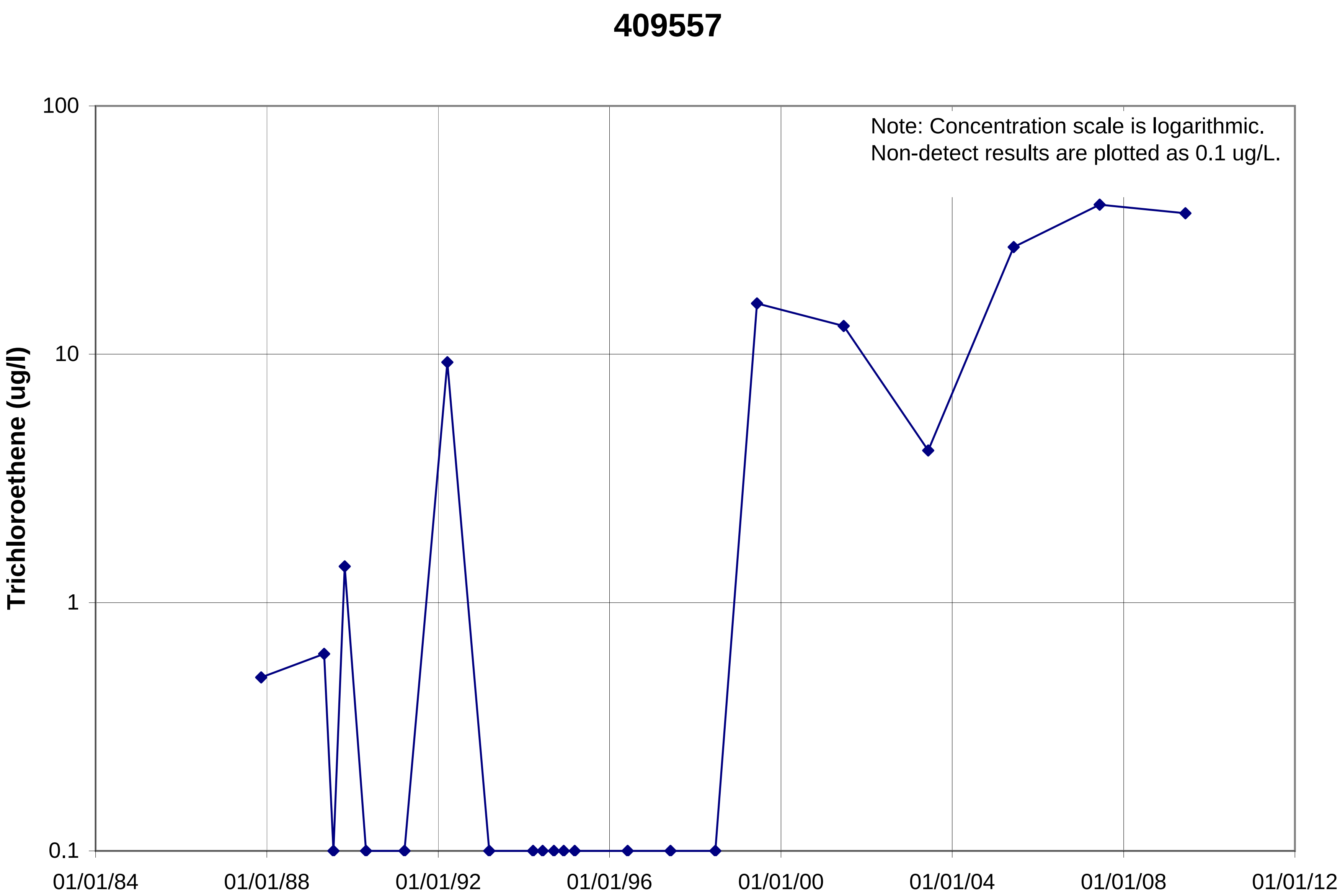



**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

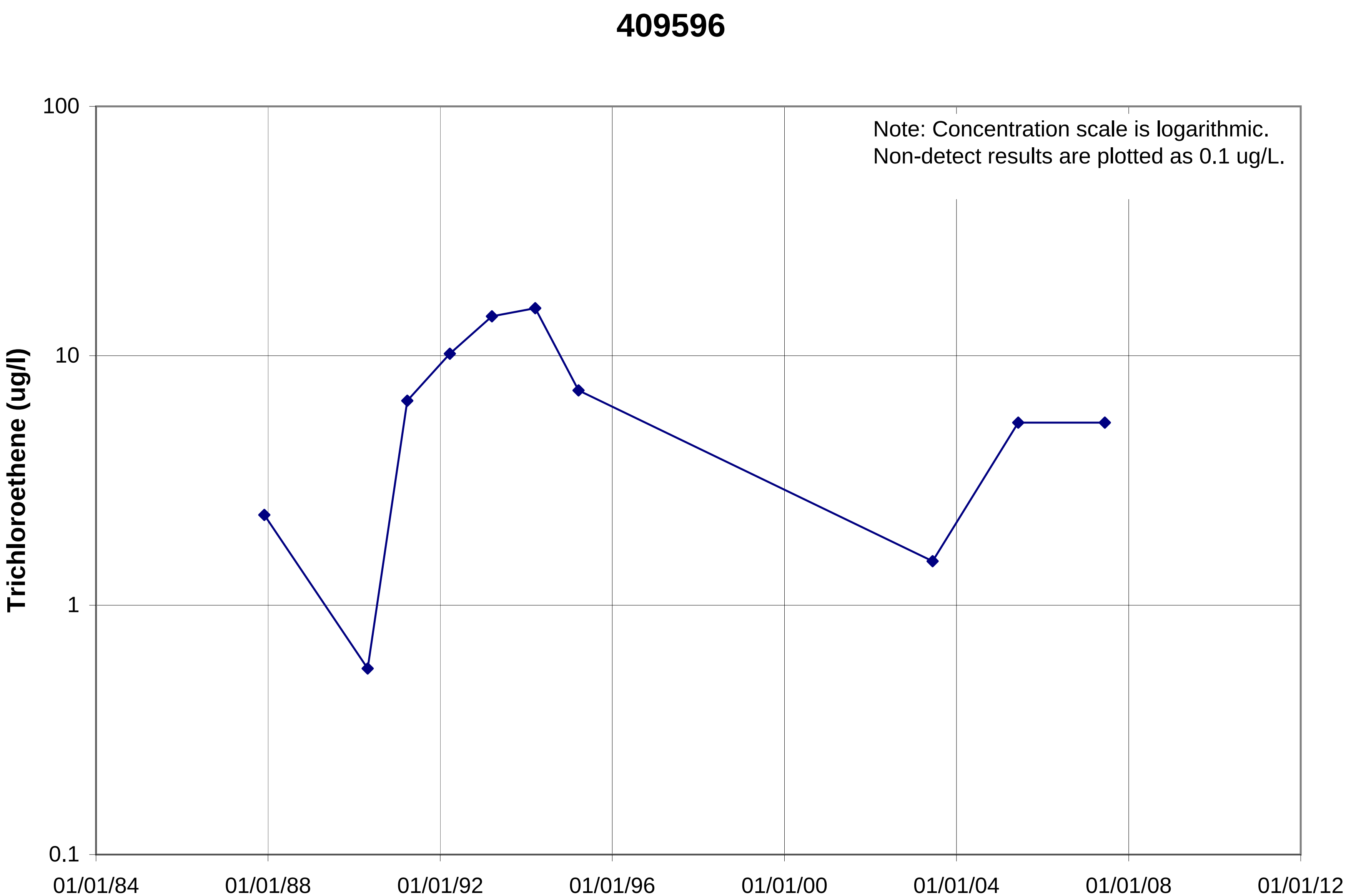
# 409556




**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

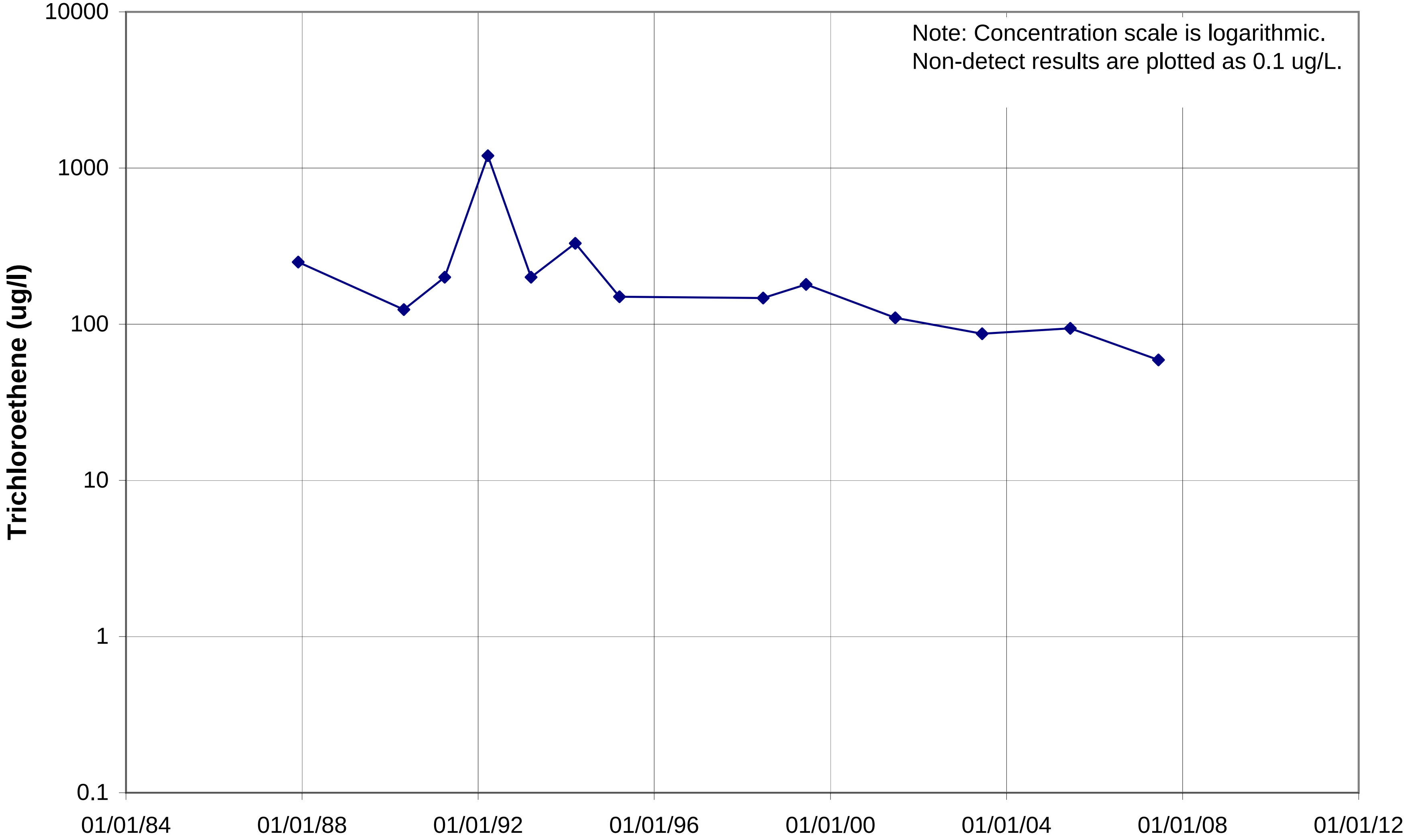



**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar



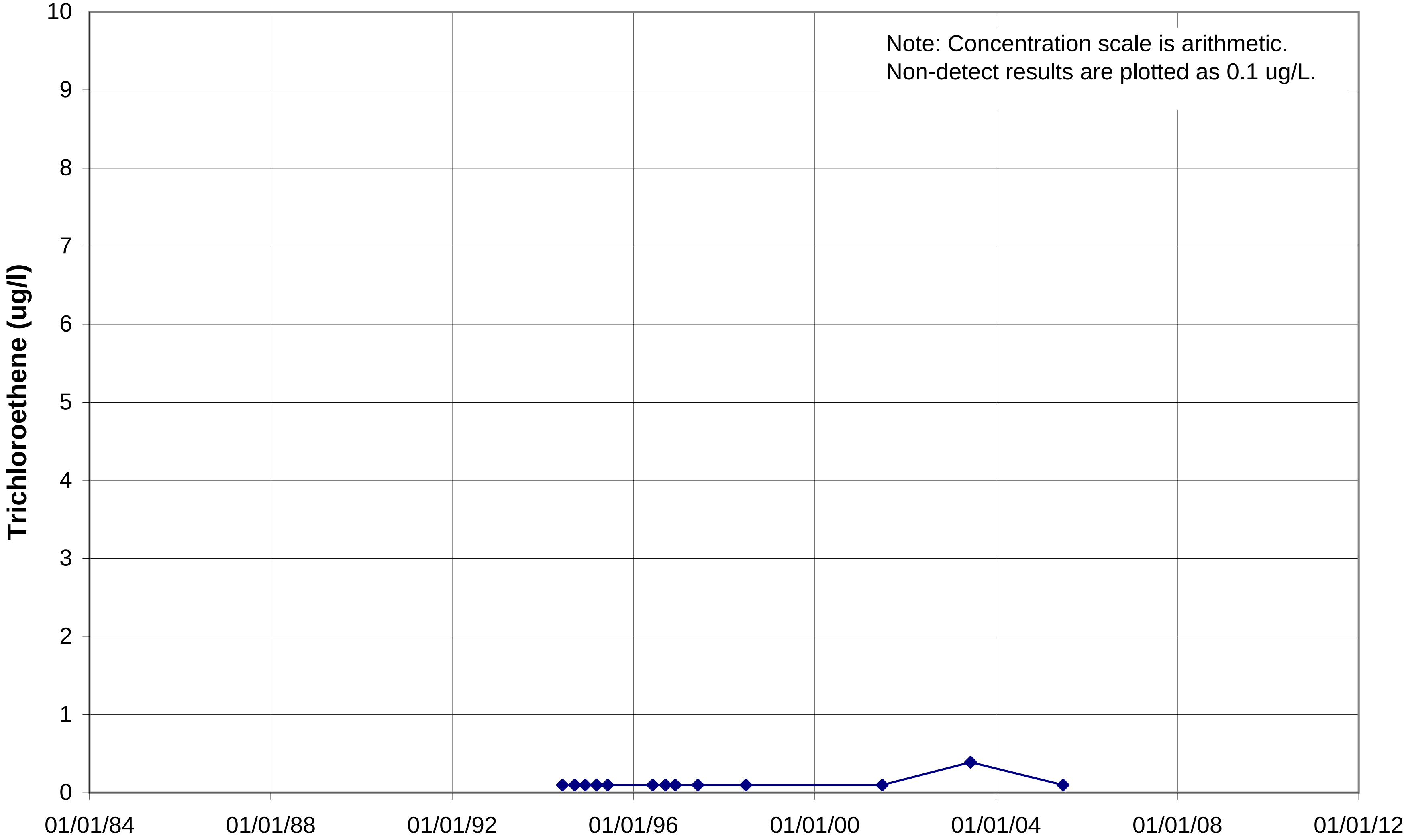

**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 409597



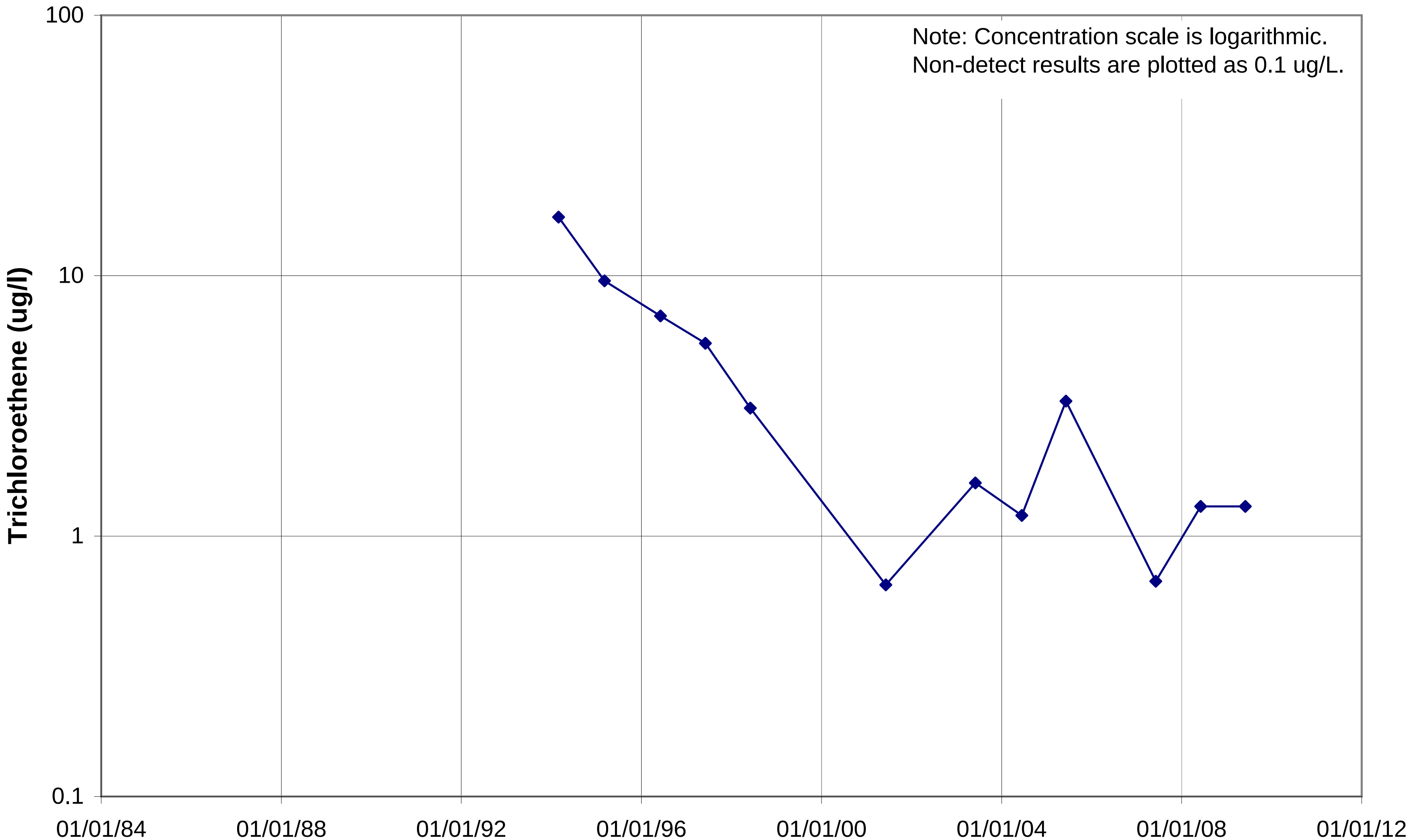

**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 476837 (MW15H)

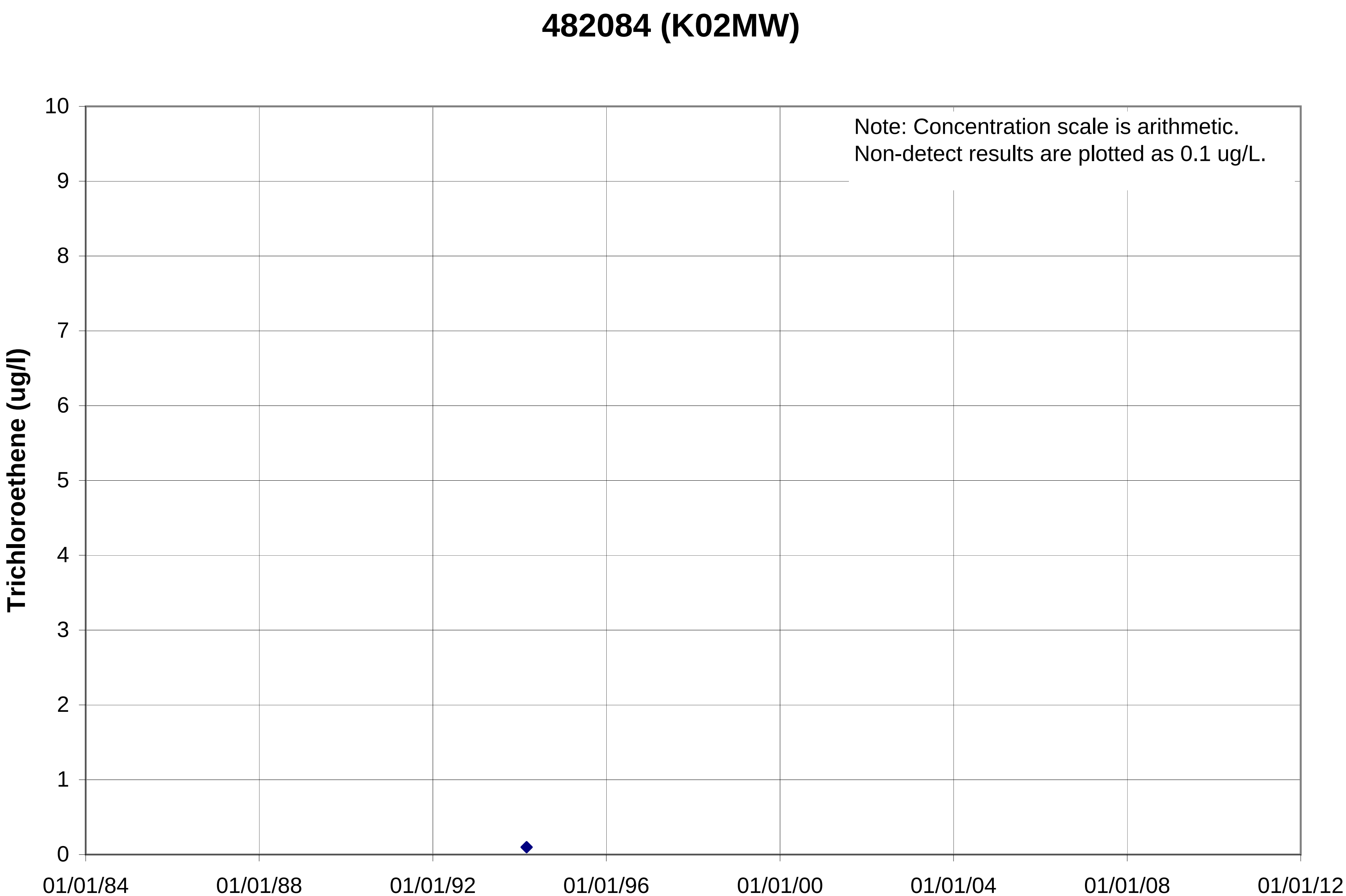



**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 482083 (K04MW)

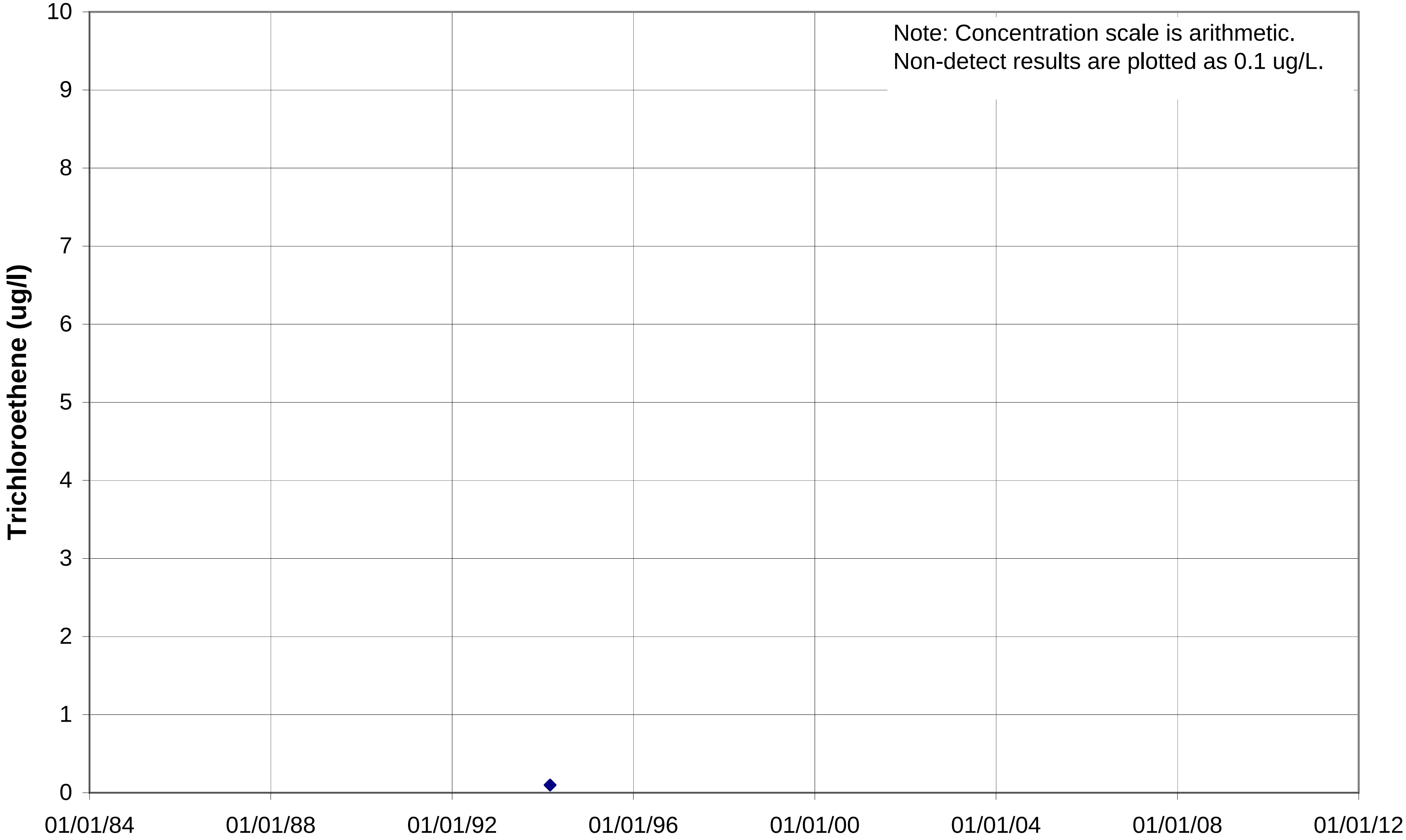



**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar



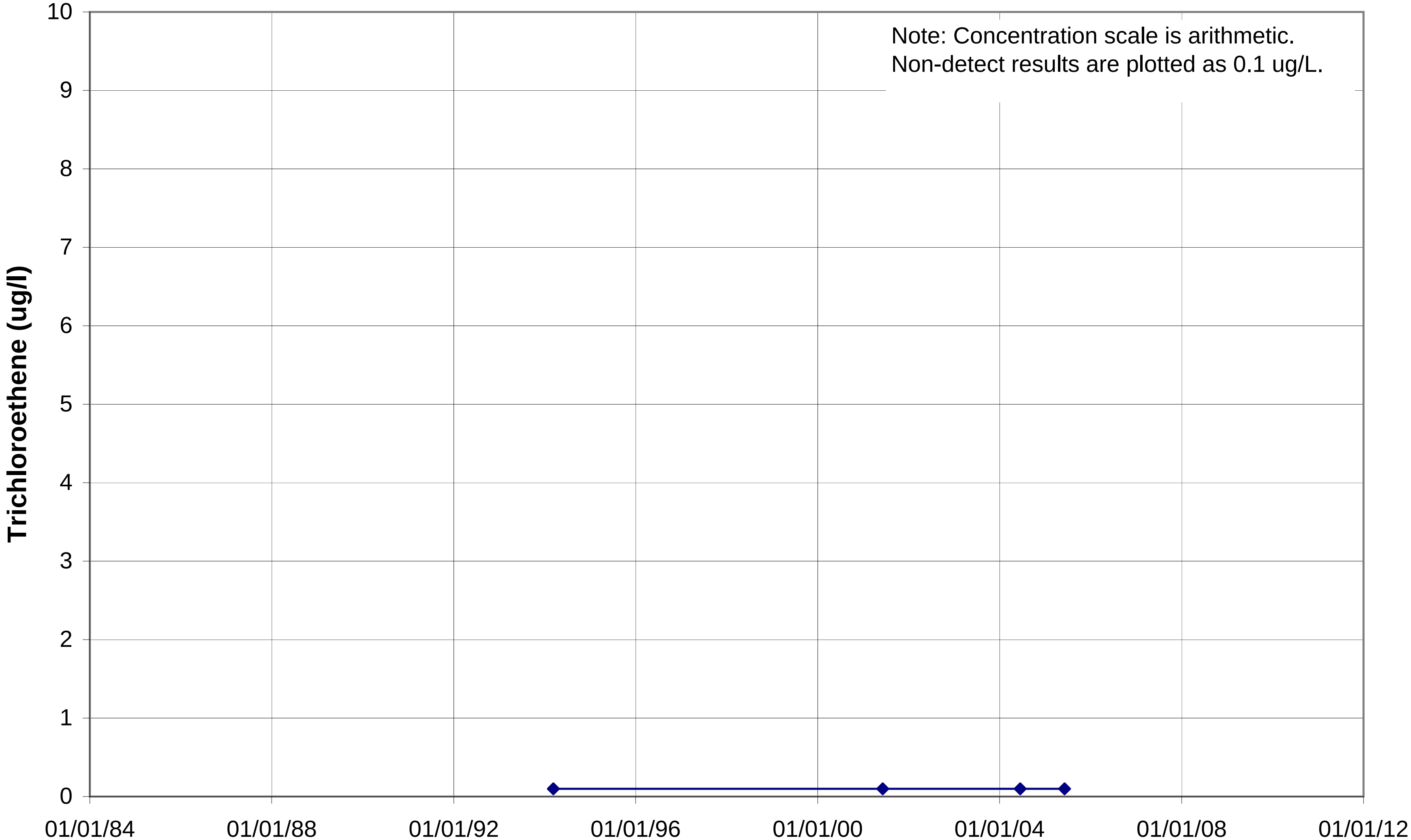

**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 482085 (K01MW)



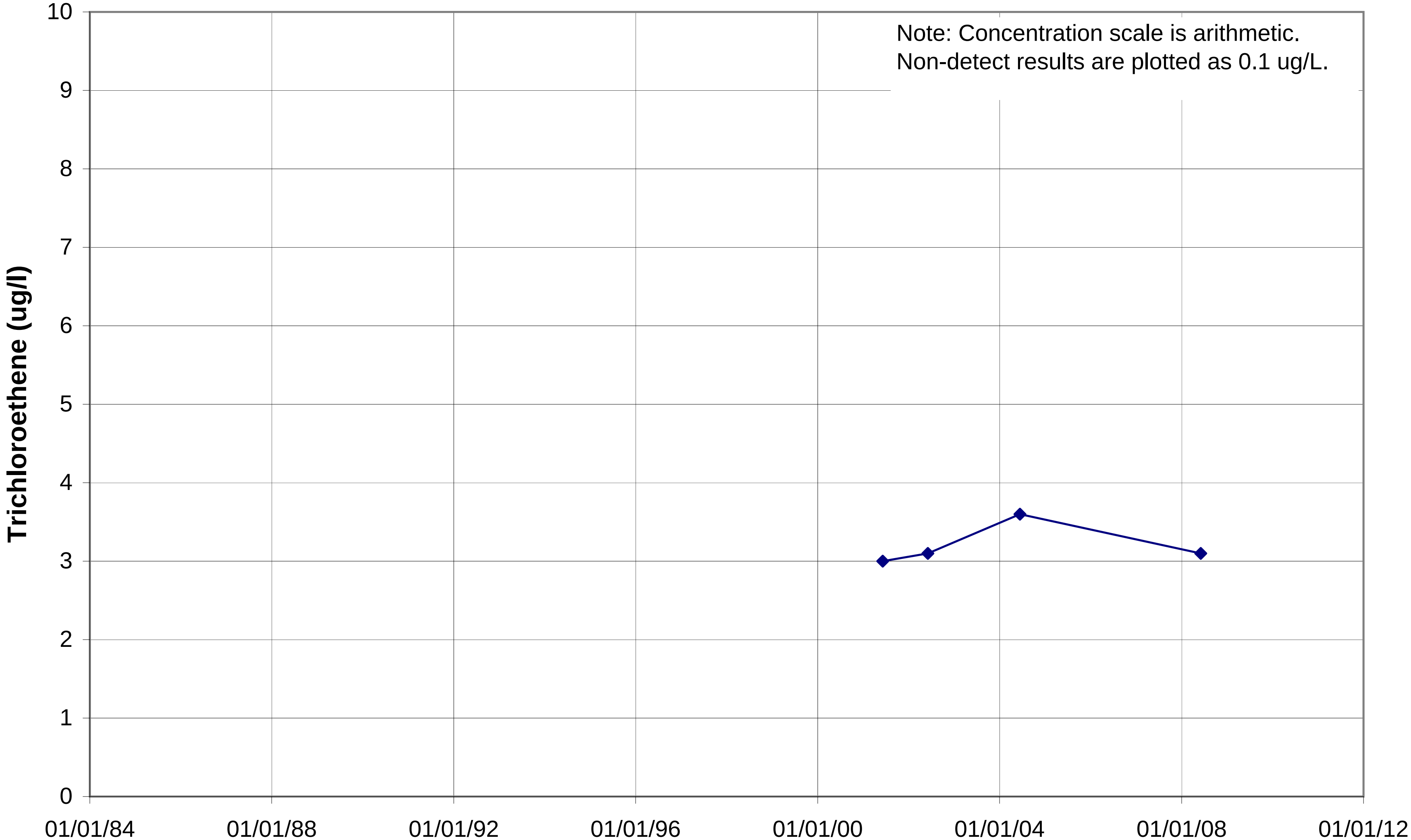

**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 482086 (I01MW)



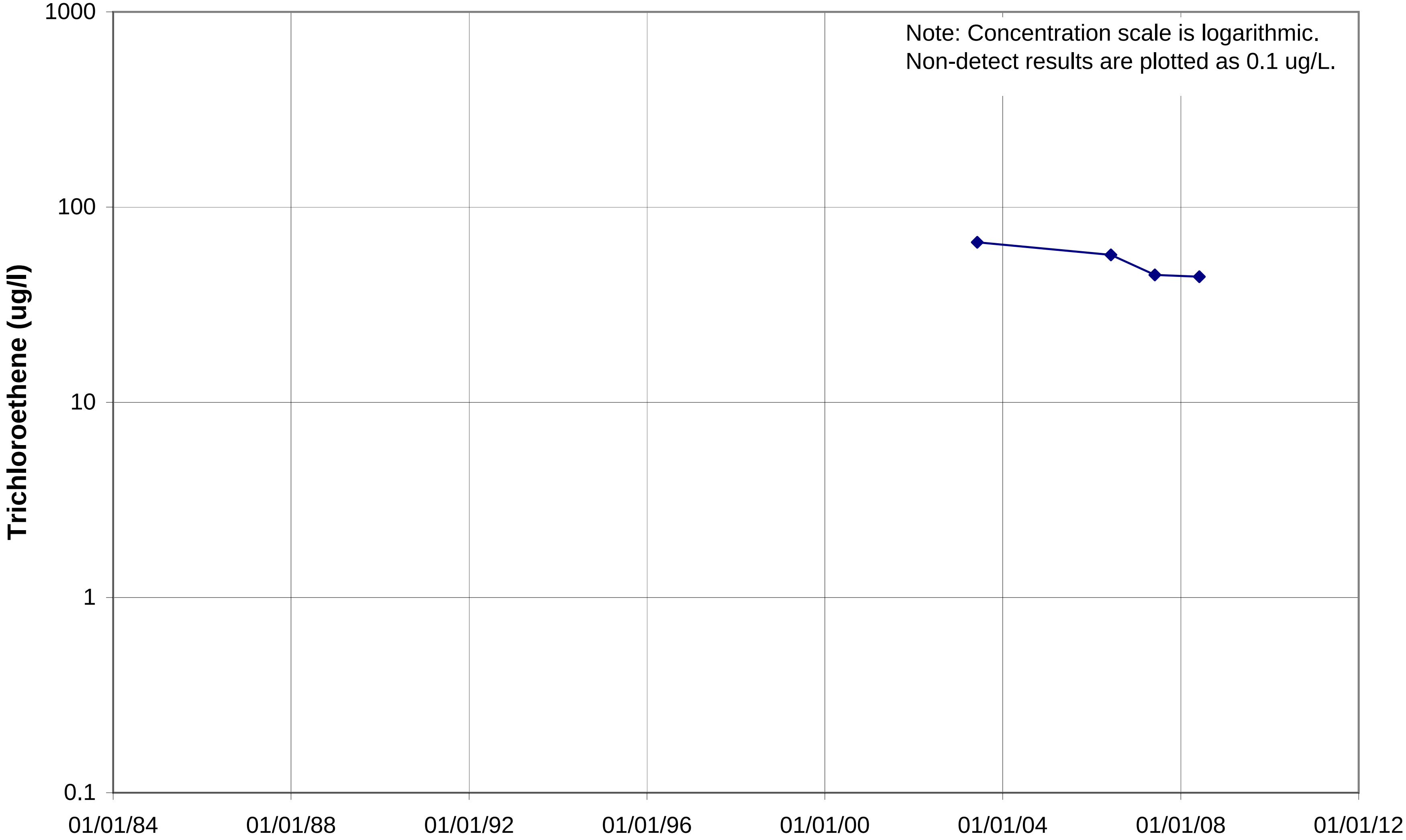

**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 482087 (I05MW)



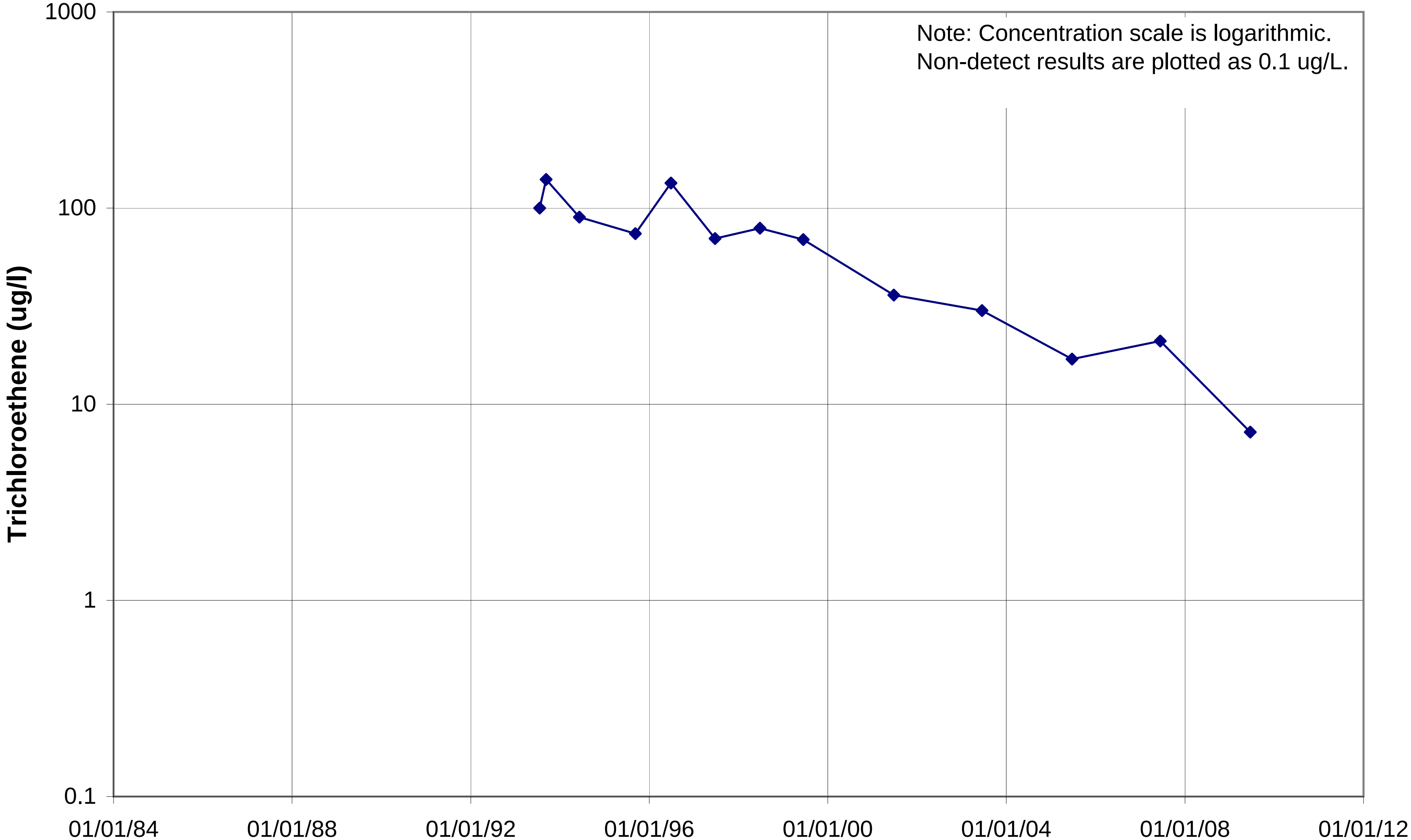

**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 482089 (I04MW)



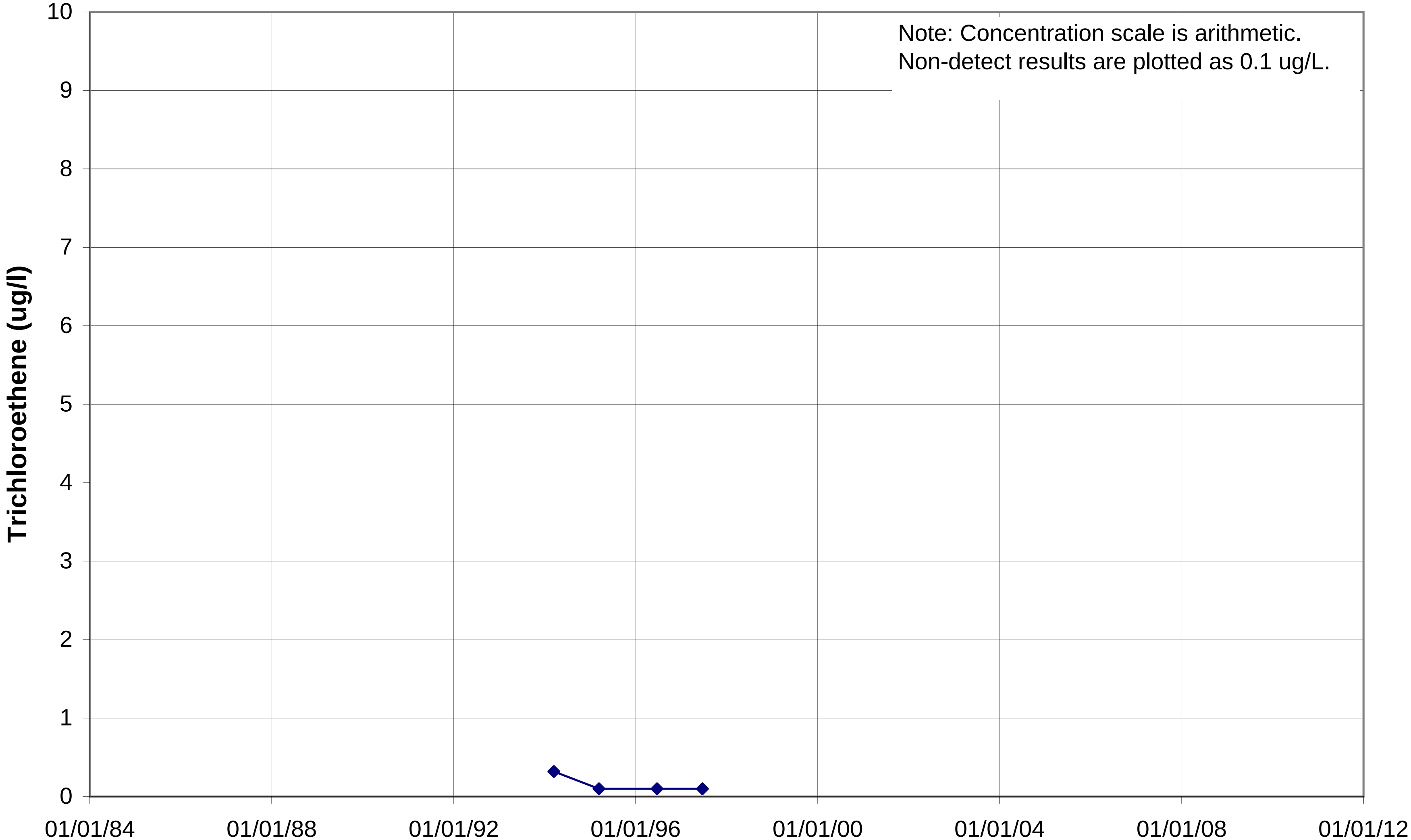

**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 512761



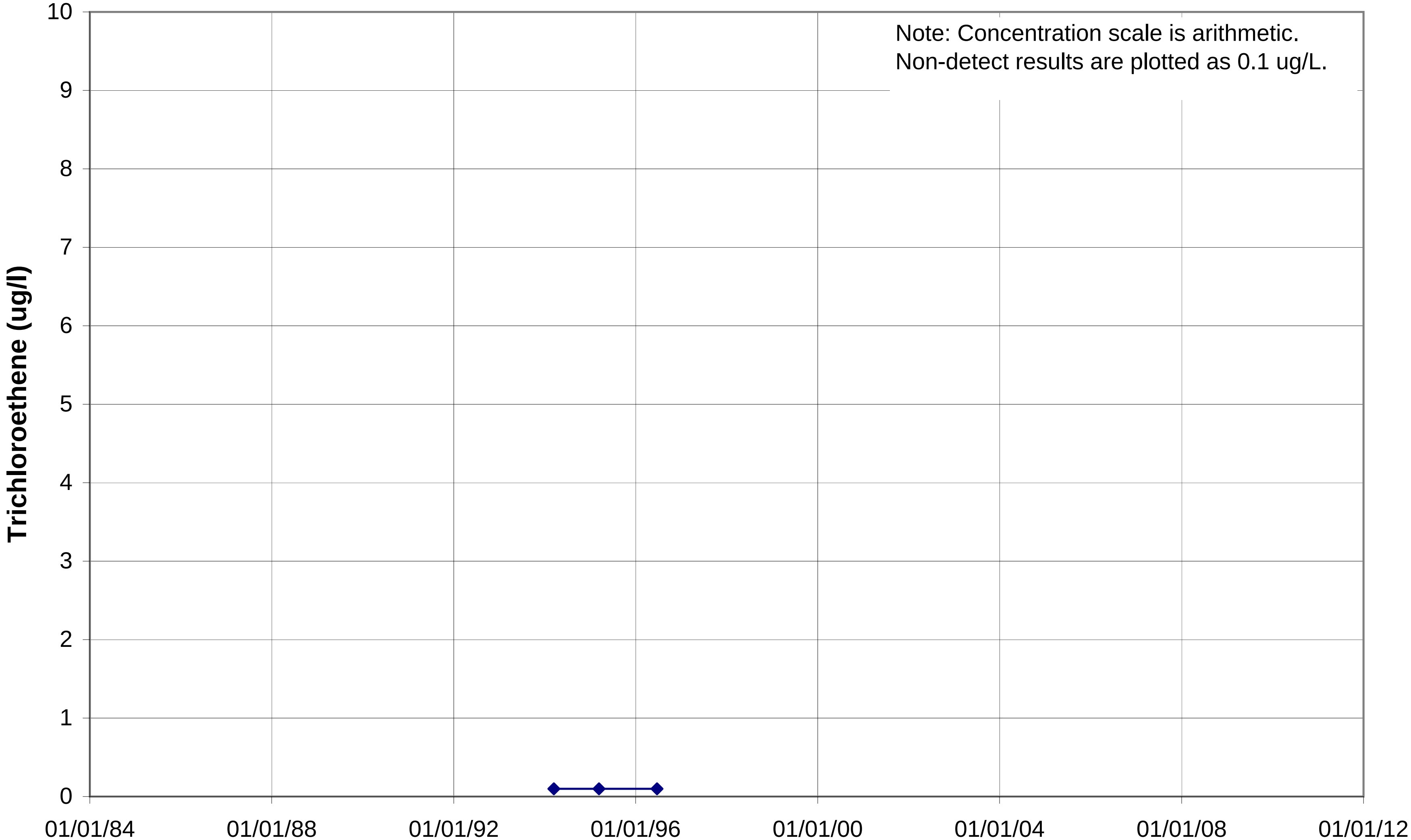

**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 519288

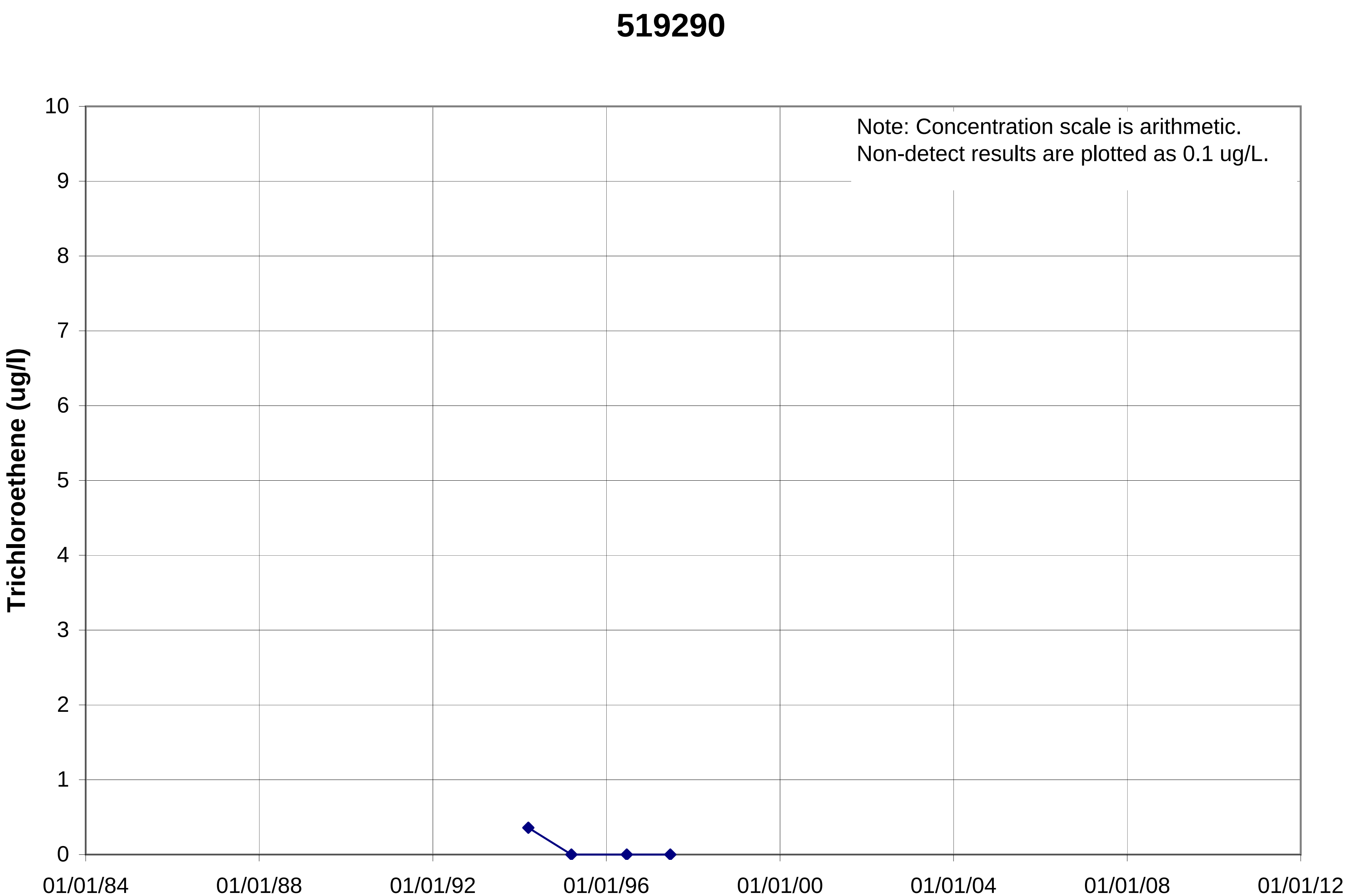



**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 519289

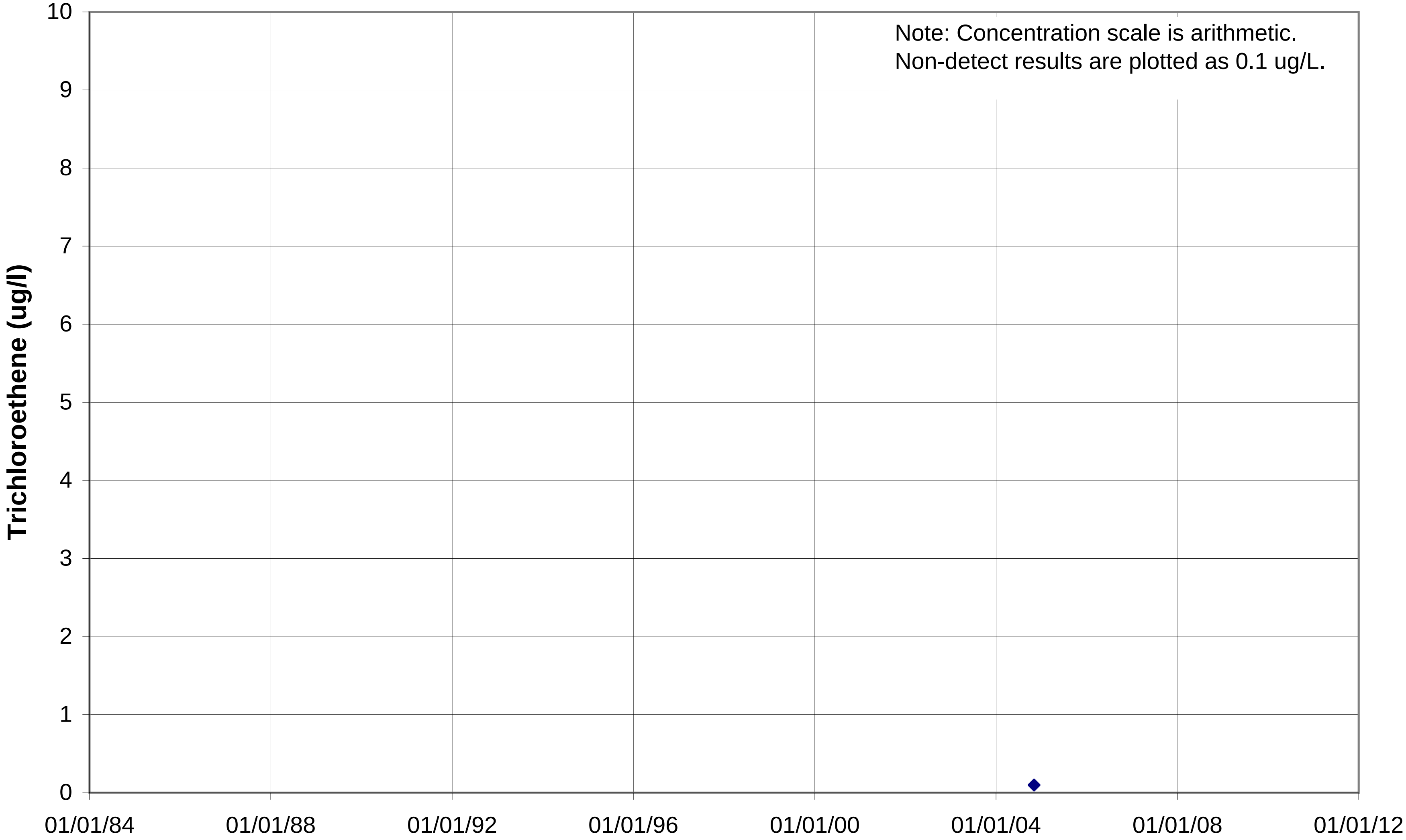



**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar



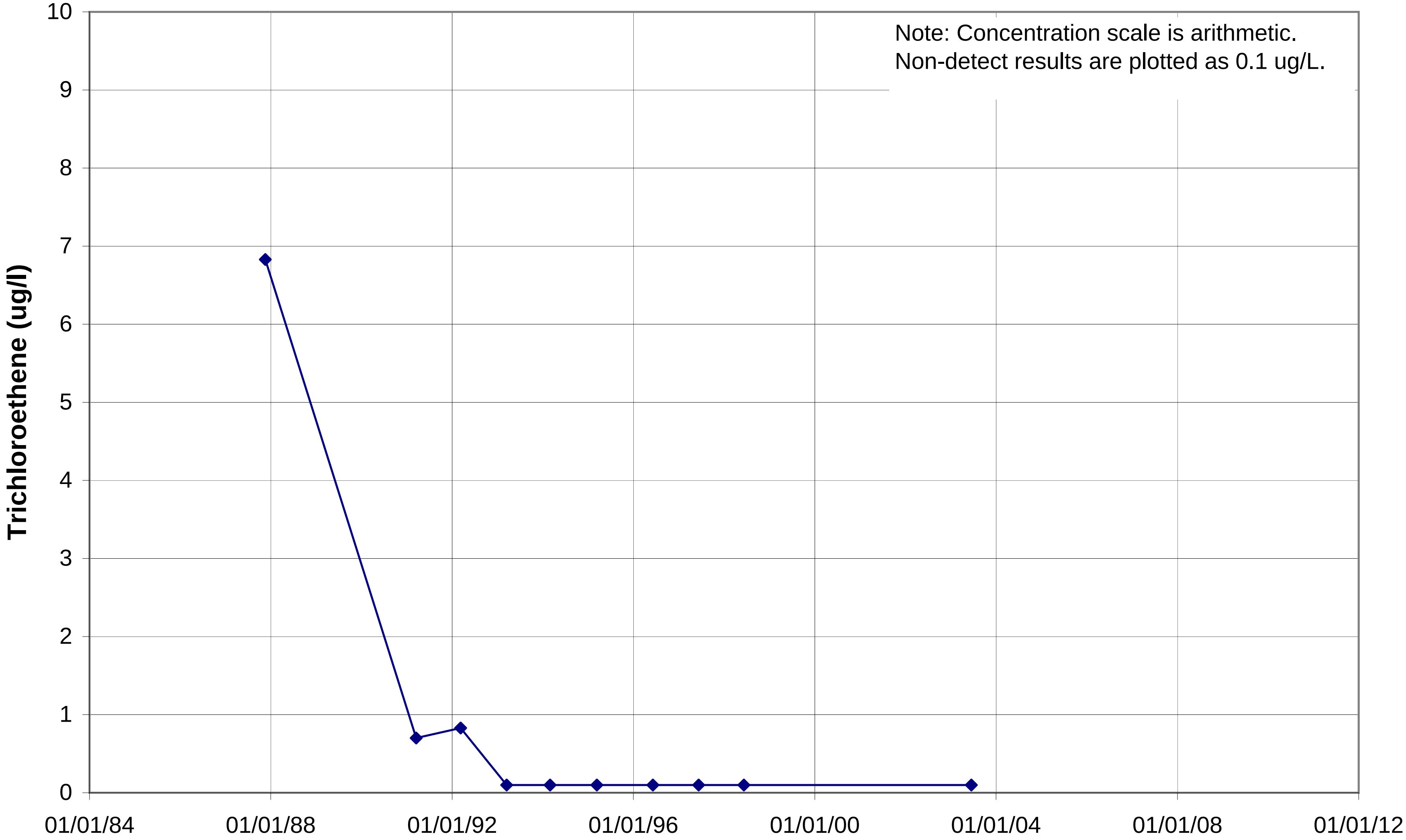

**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 520931



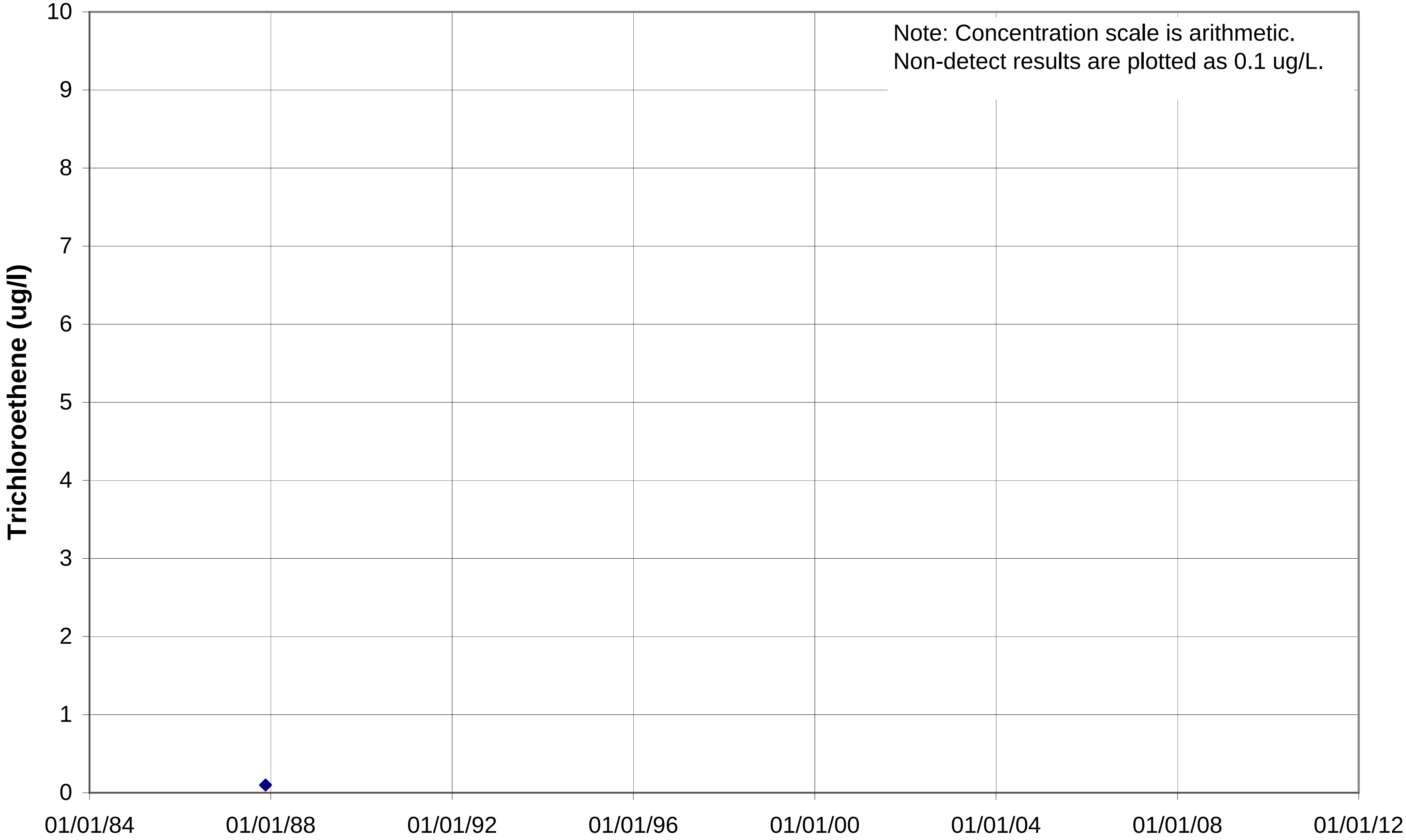

**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# PJ#003



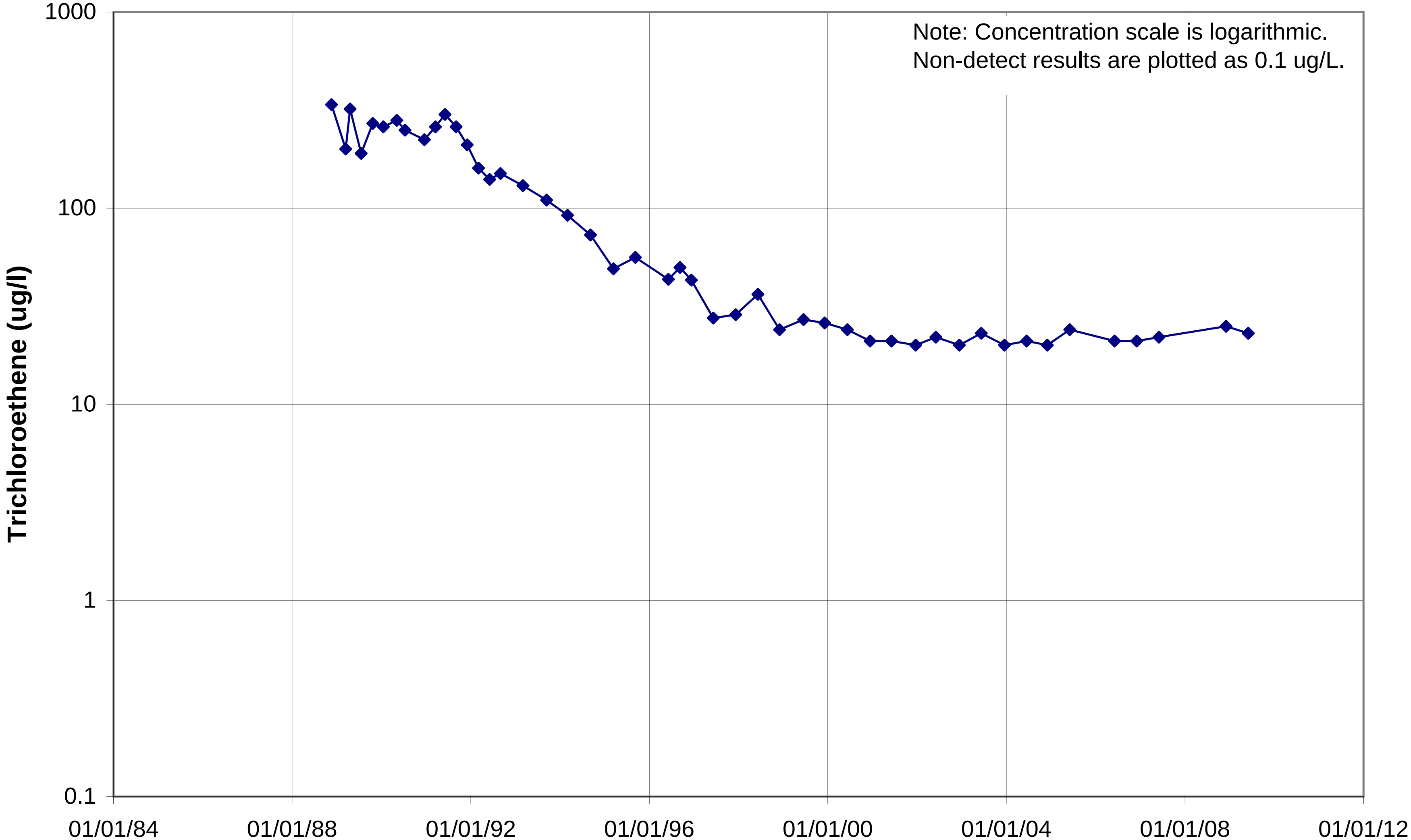

**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# PJ#027



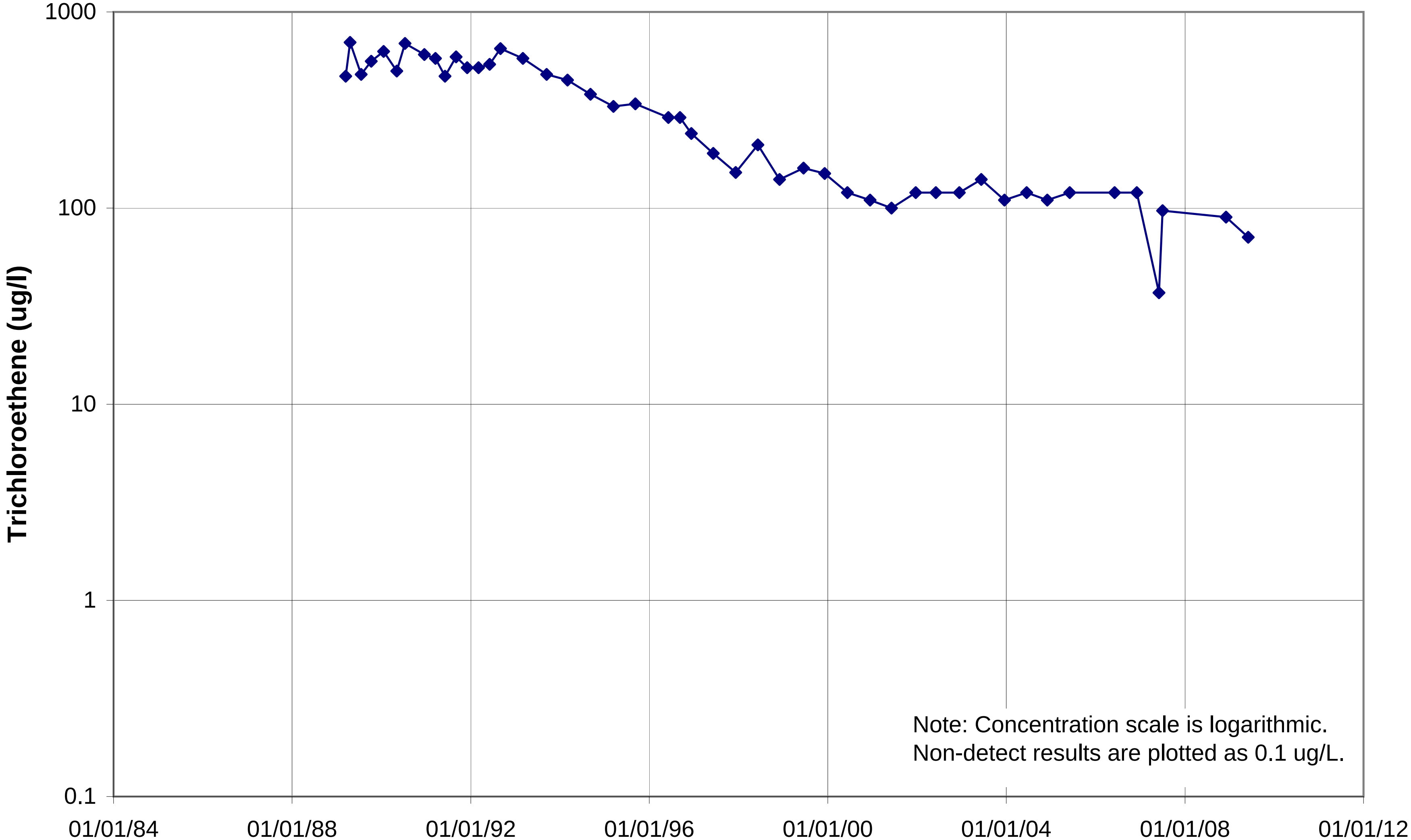

**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# PJ#309 (B8)



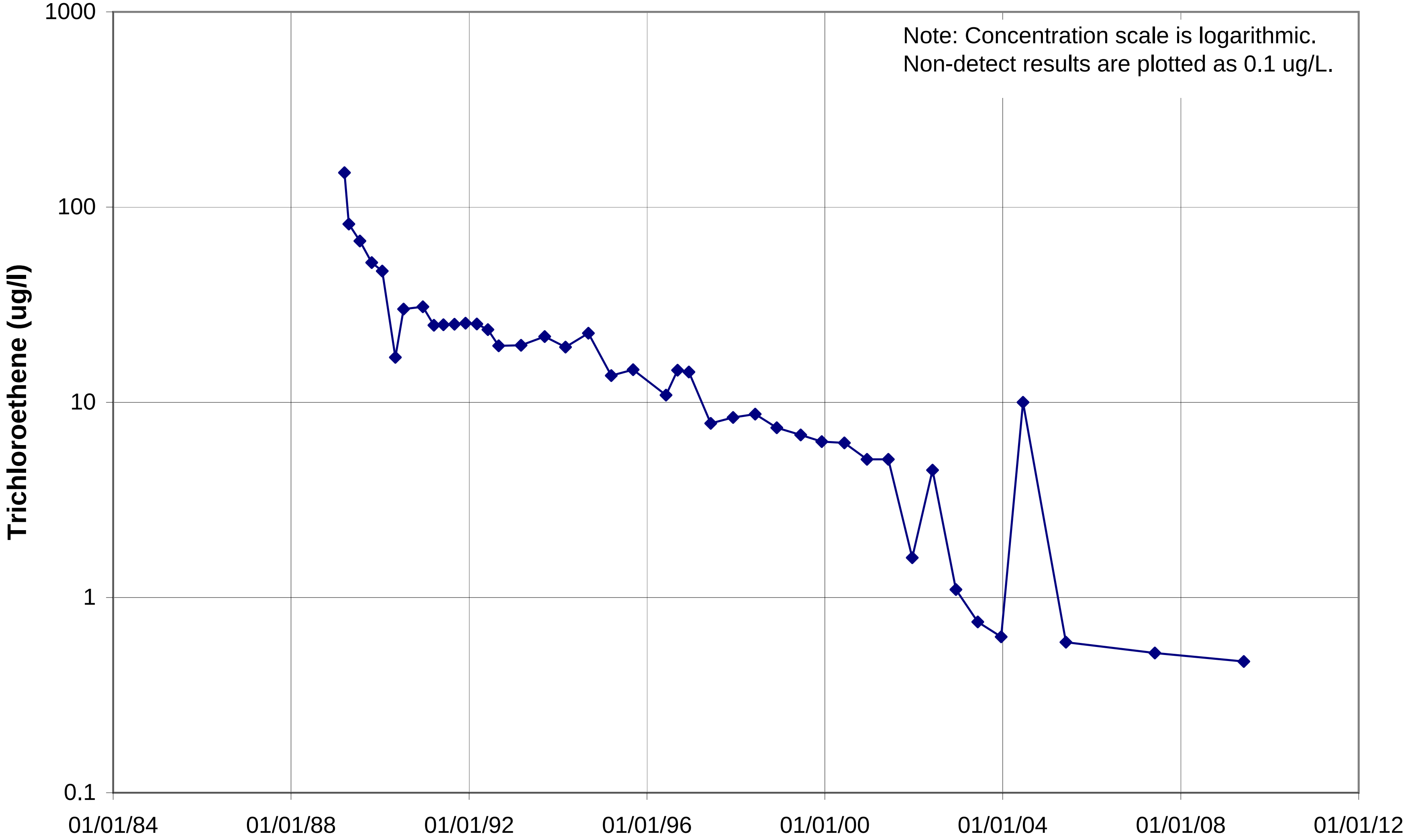

**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# PJ#310 (B9)



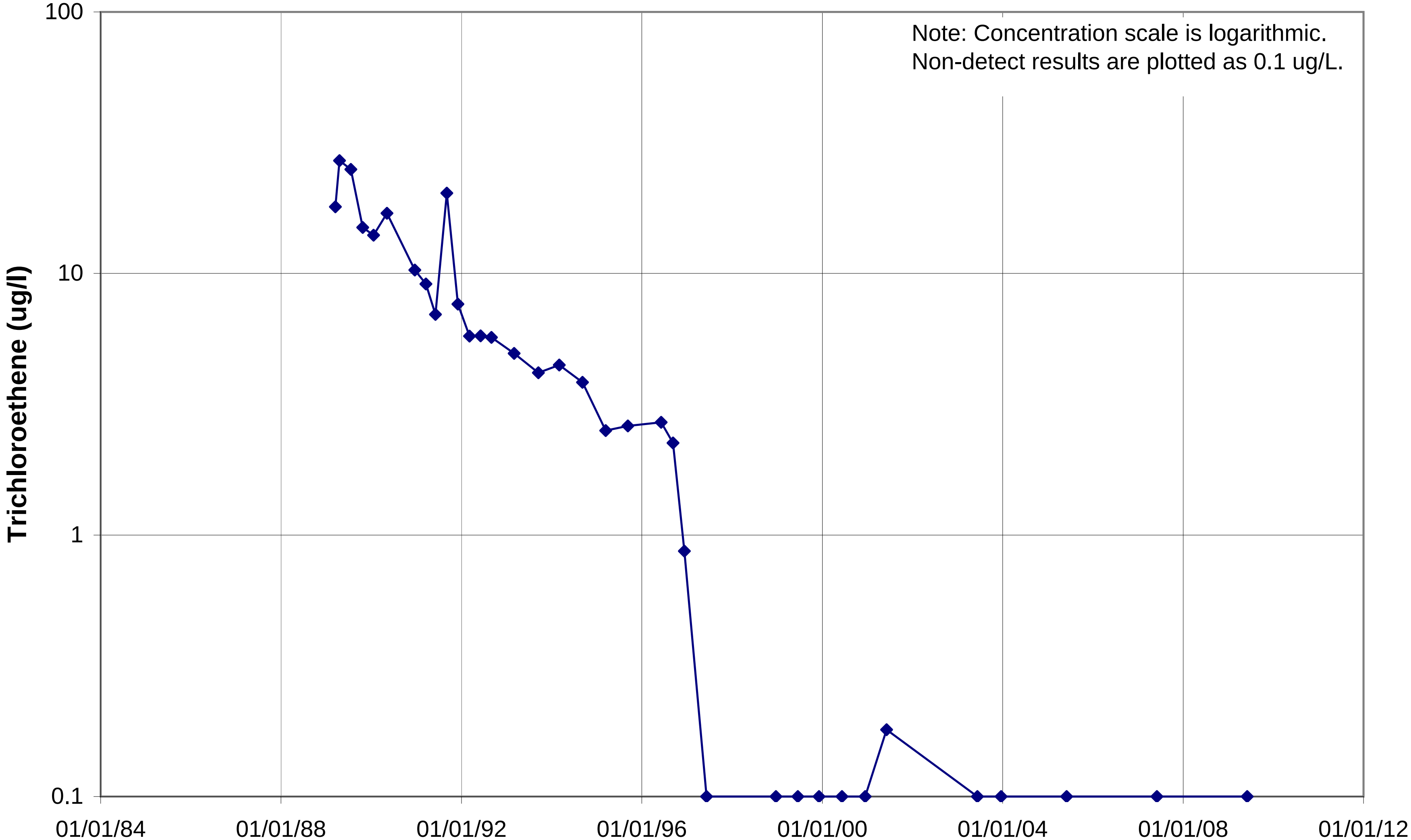

**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# PJ#311 (B10)



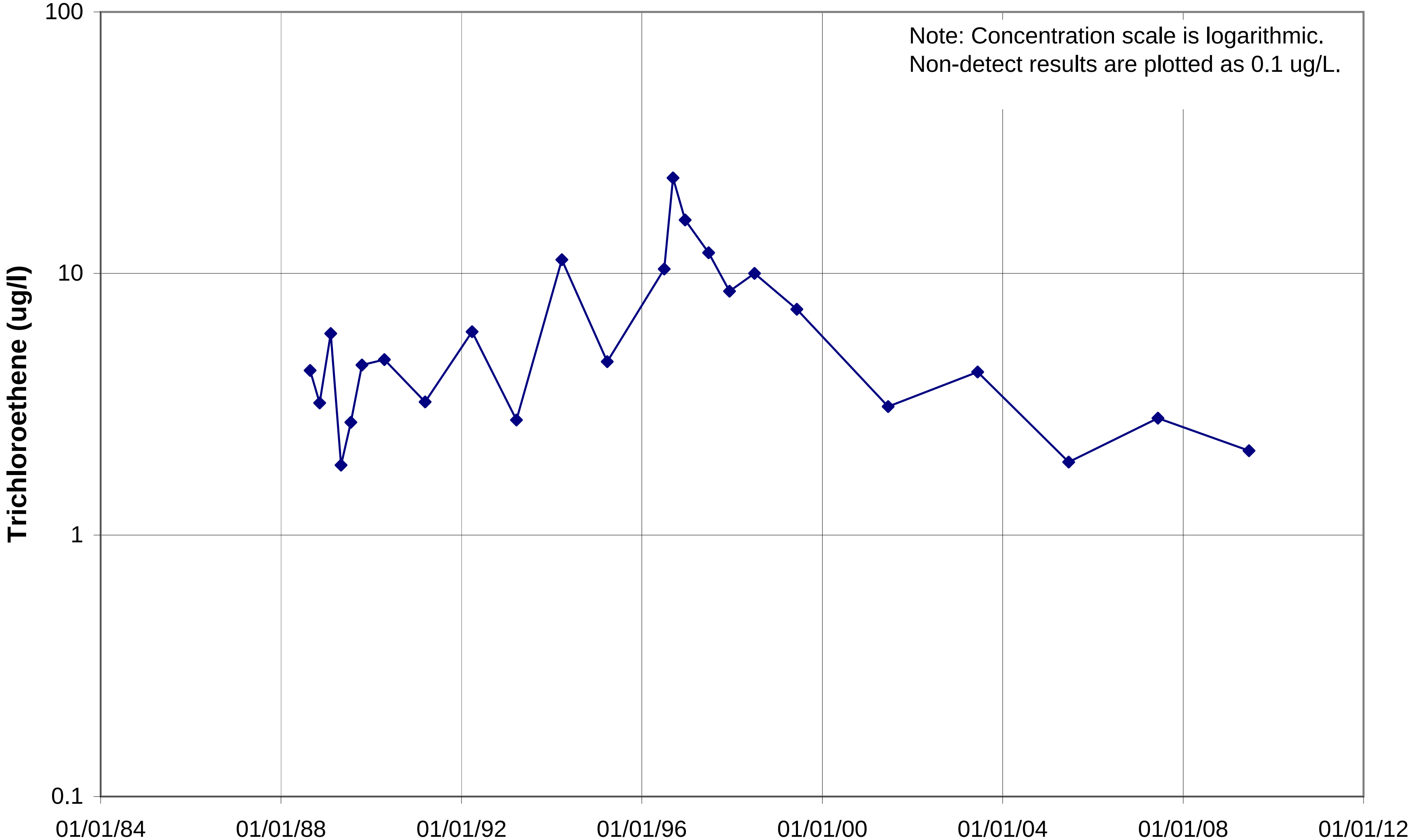

**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# PJ#313 (B12)



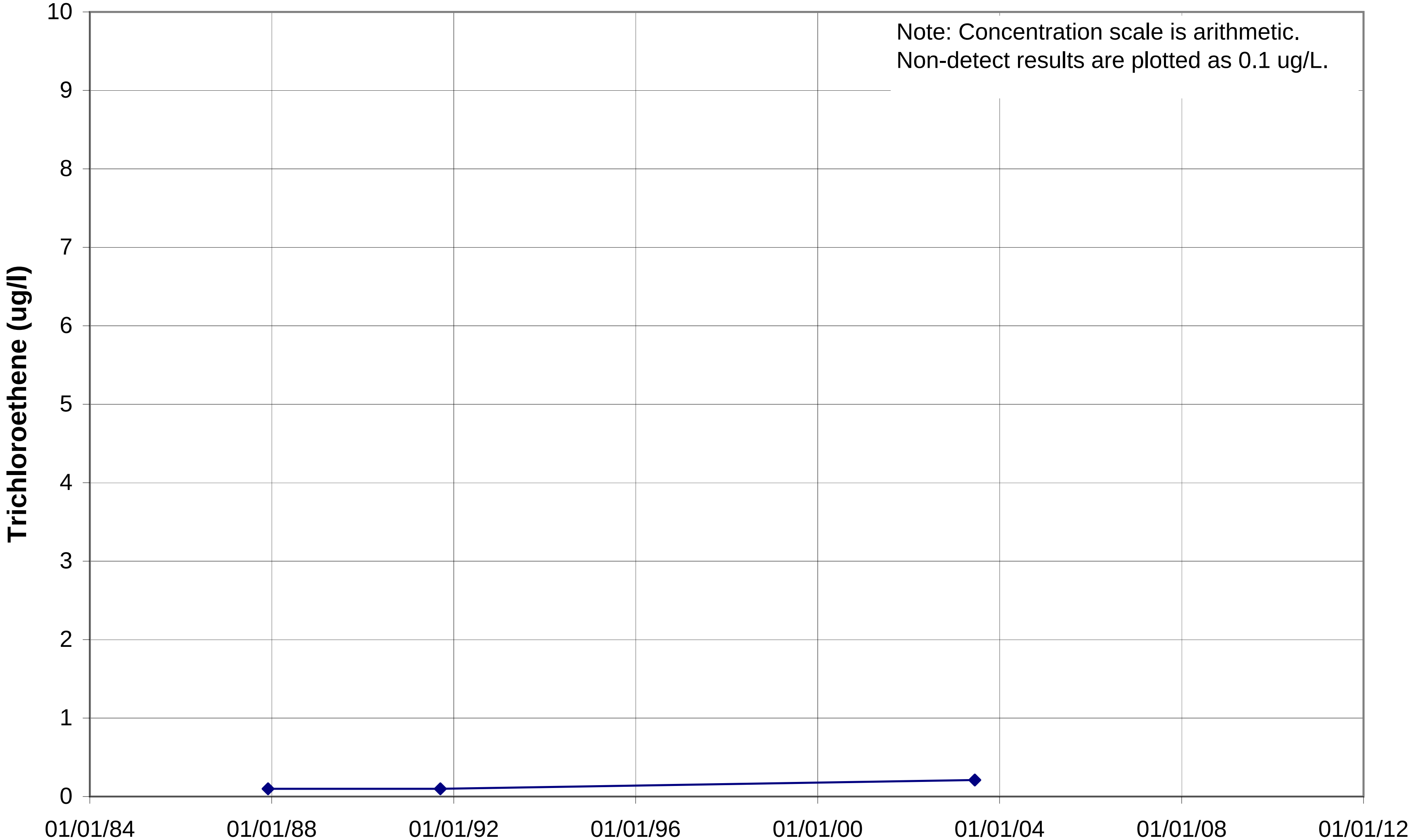

**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# PJ#318



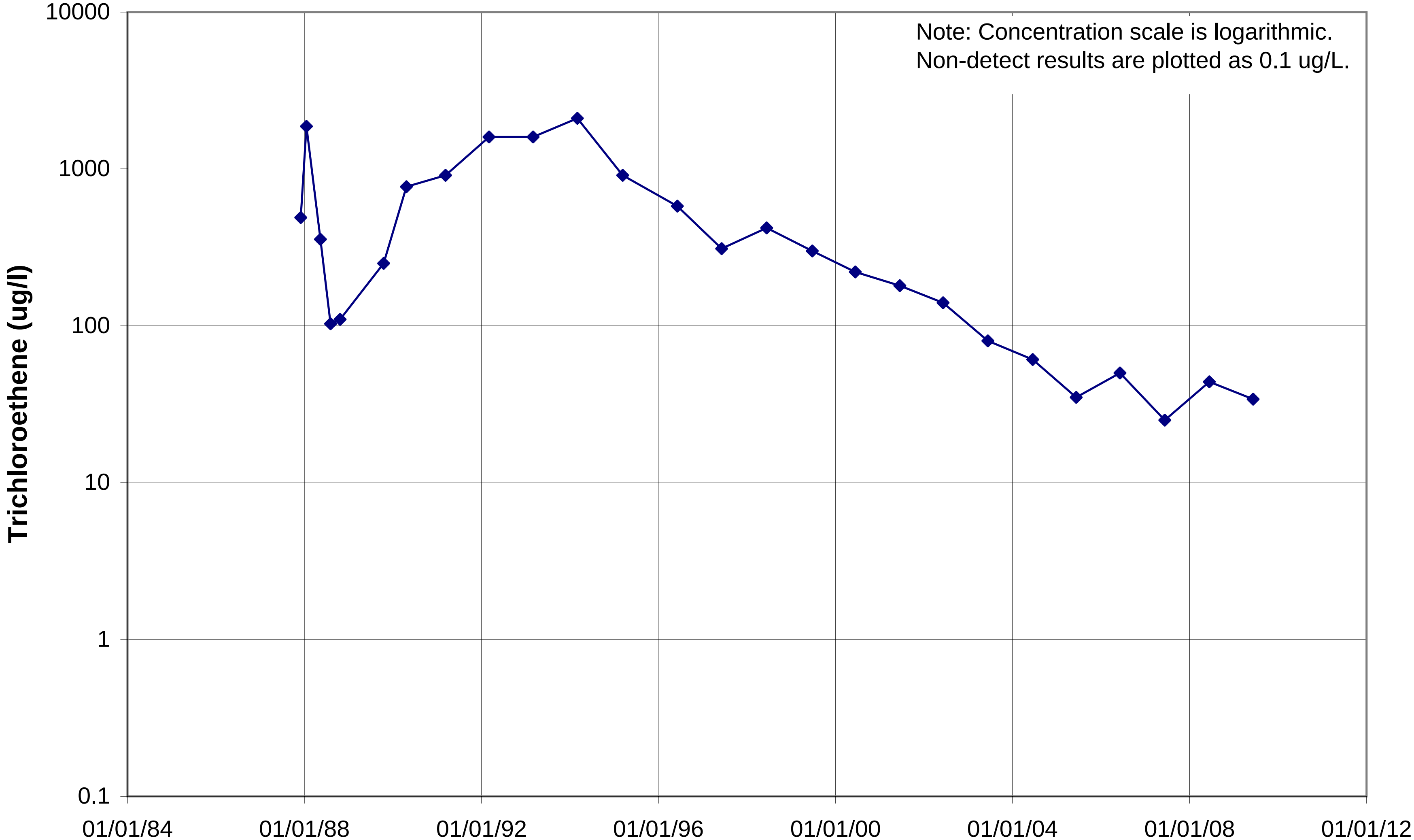

**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# PJ#802



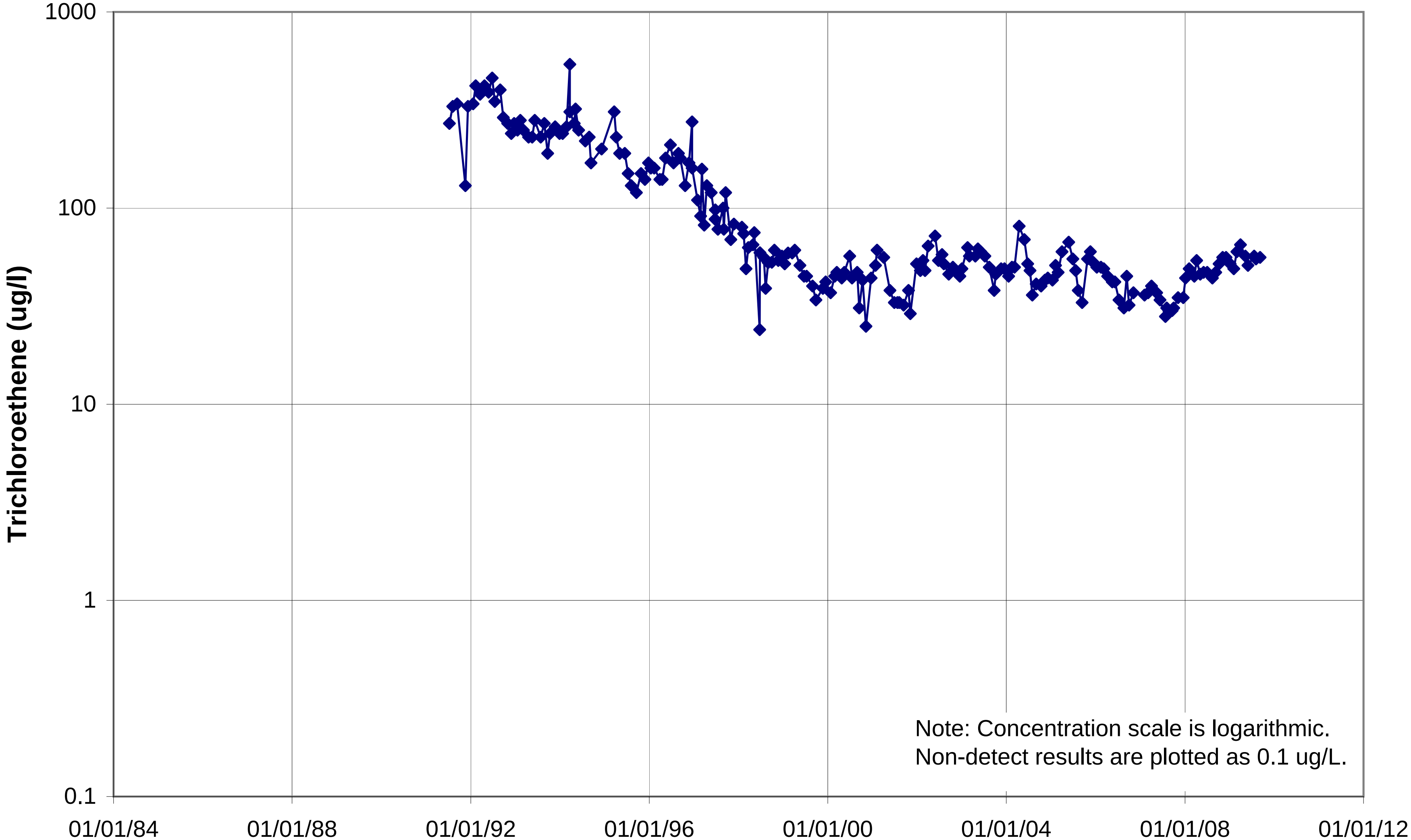

**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# PJ#806



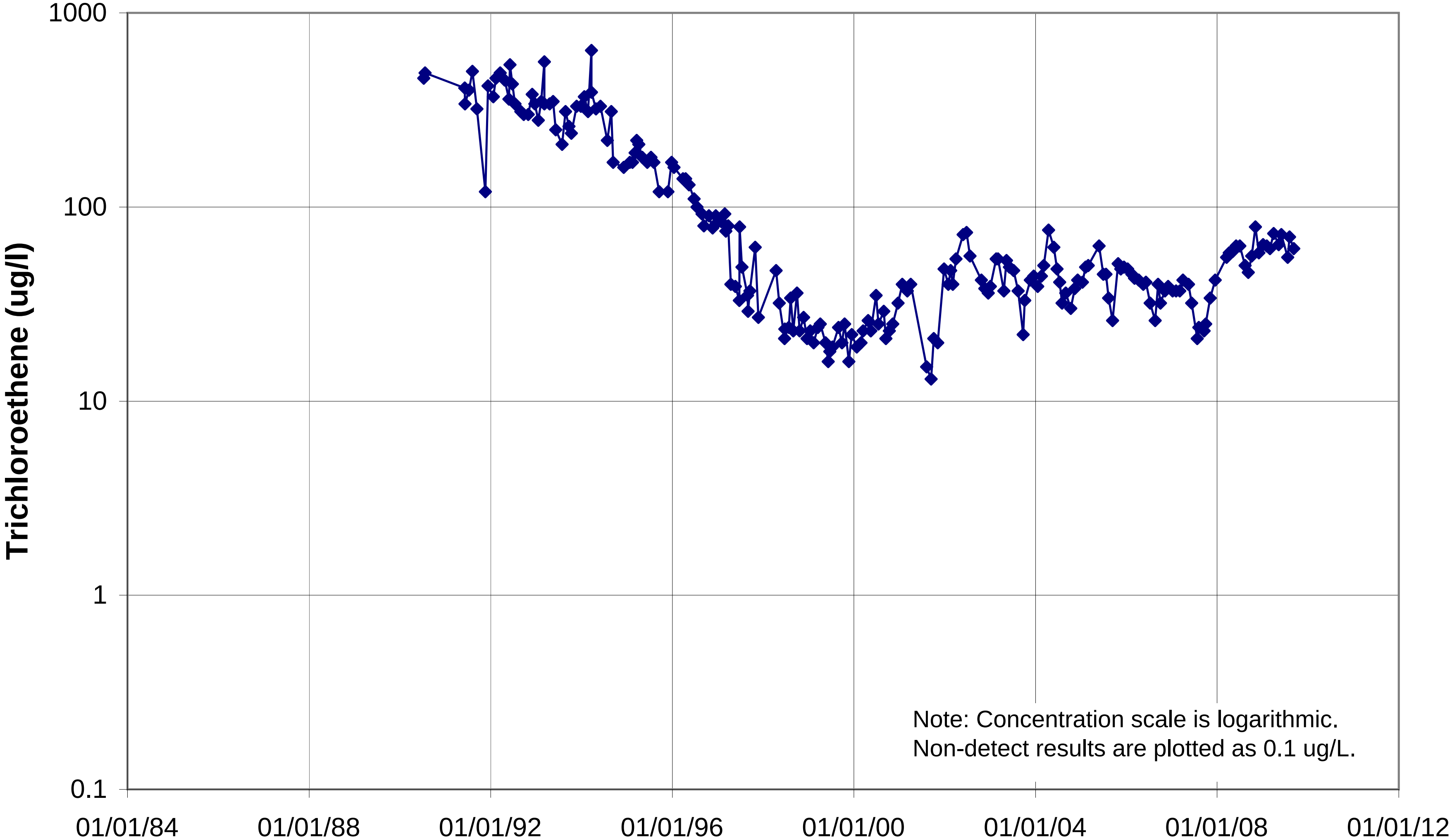

**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 206792 (NBM#4)



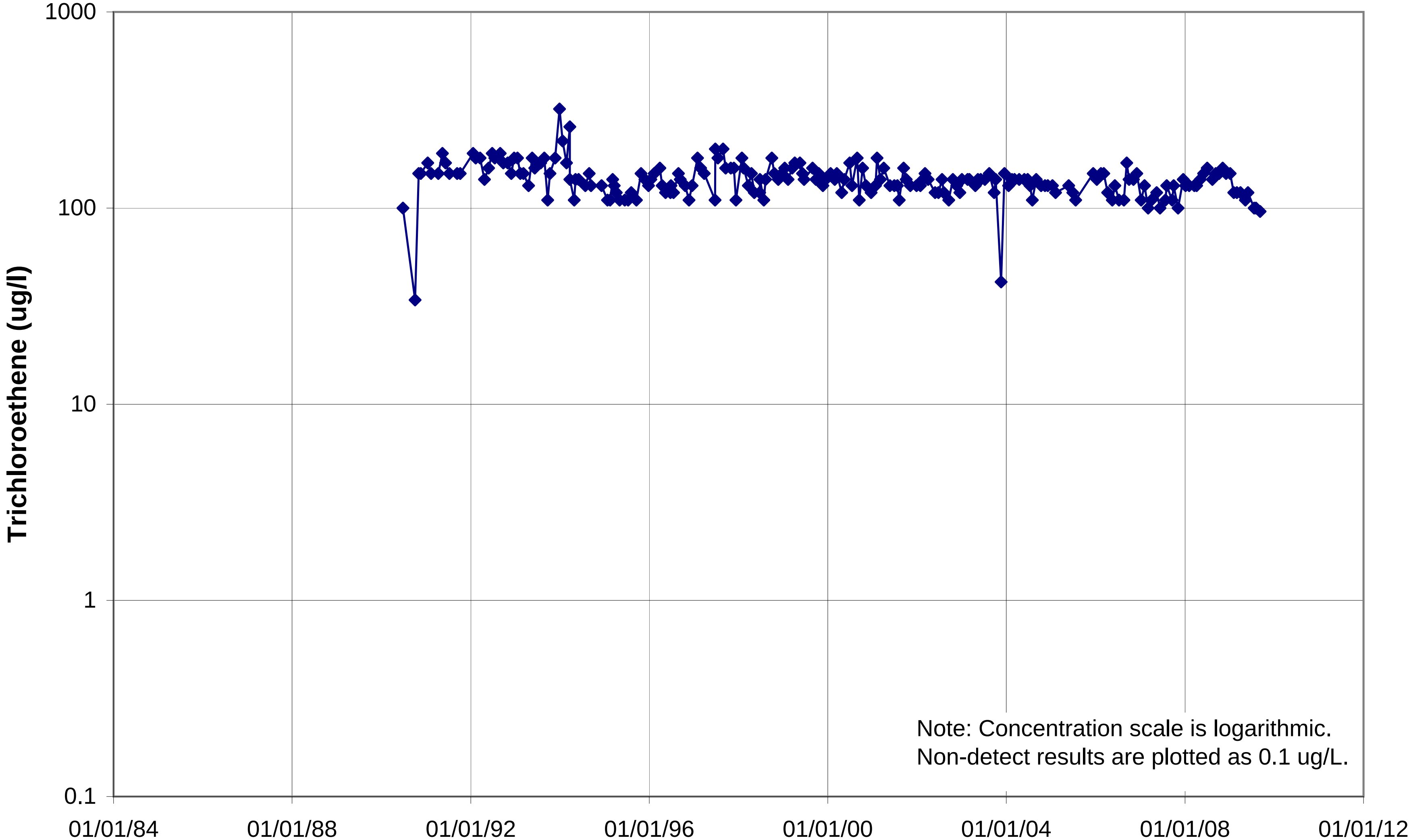

**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 206793 (NBM#3)



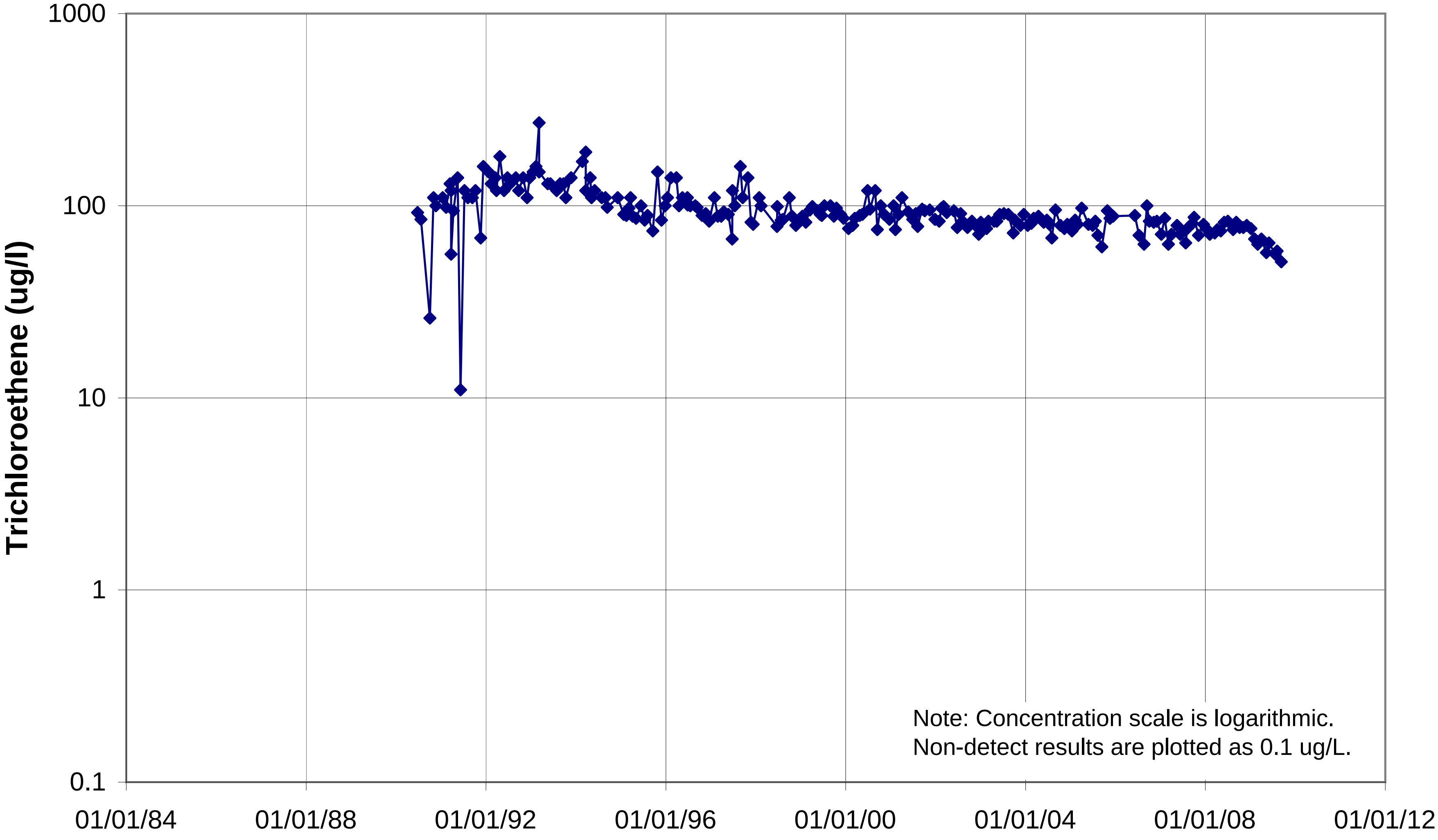

**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 206796 (NBM#5)

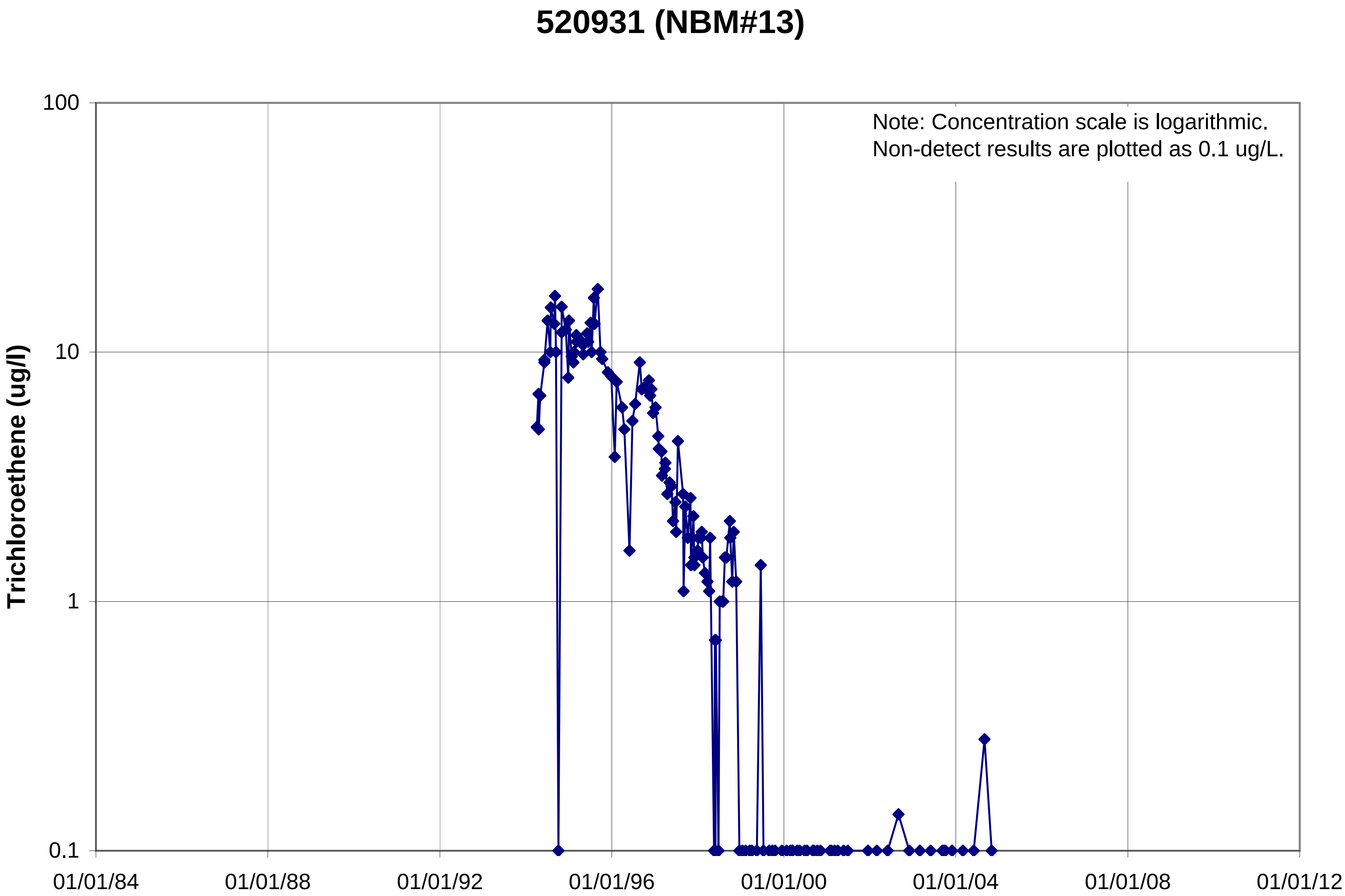



**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 206797 (NBM#6)

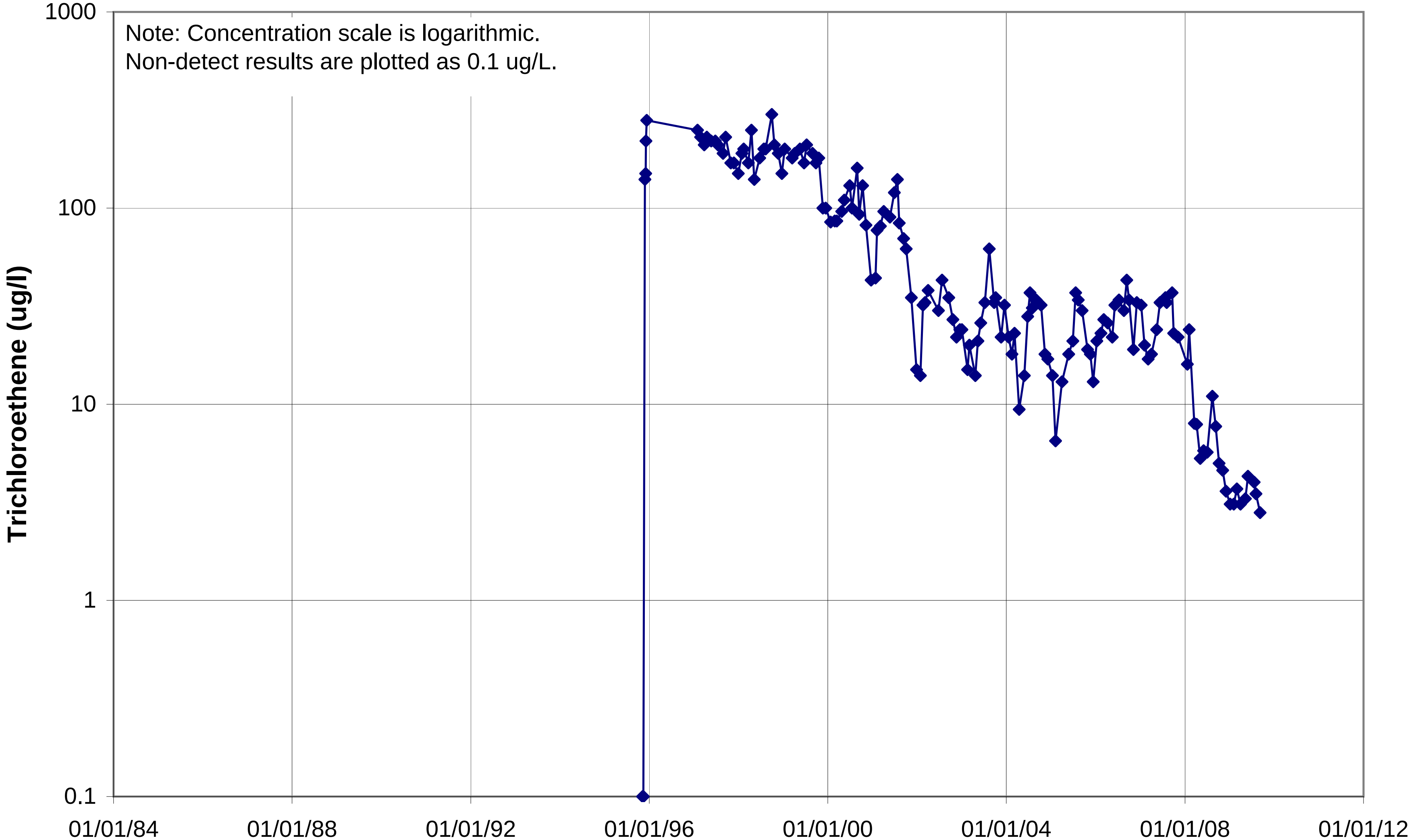



**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar



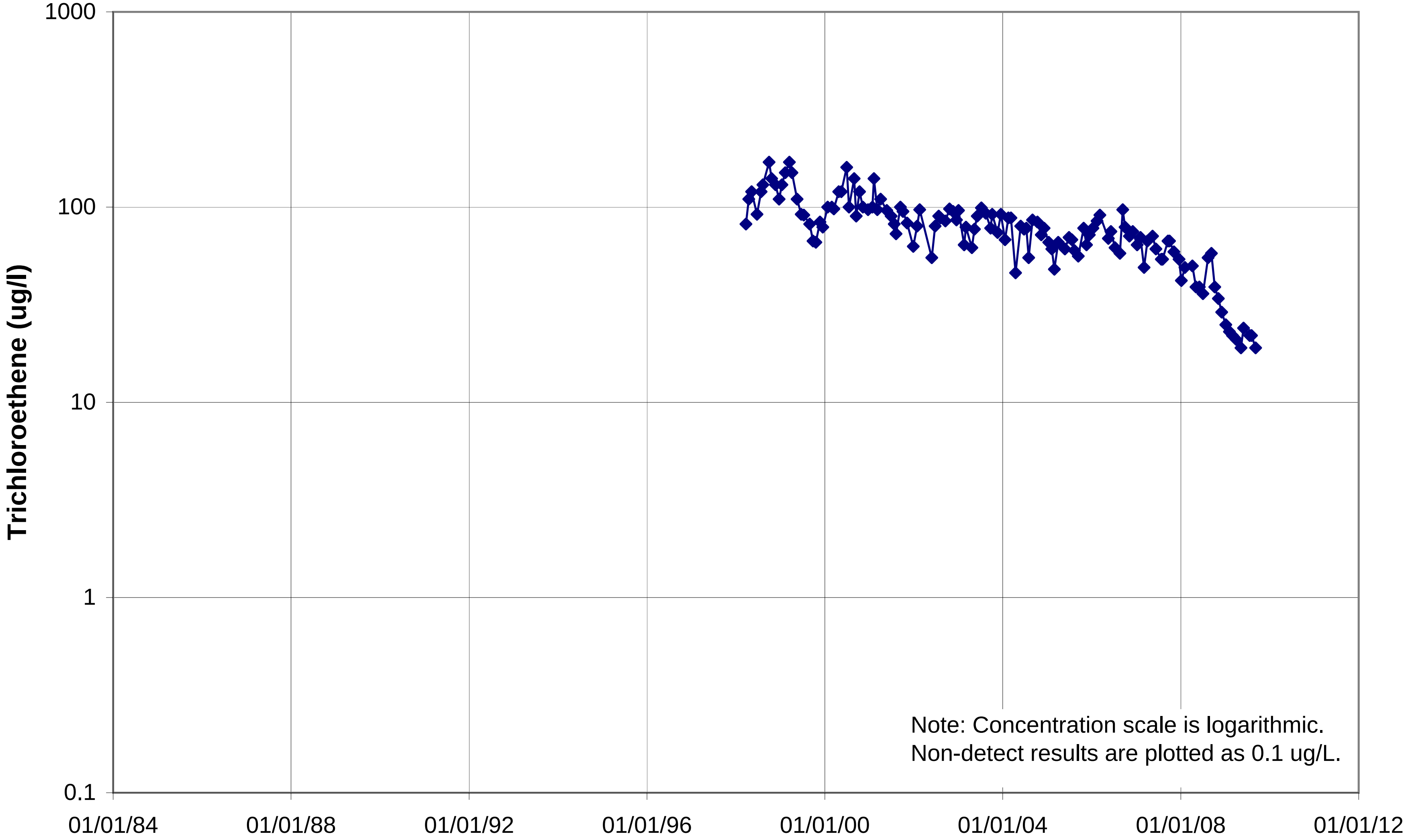

**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 554216 (NBM#14)

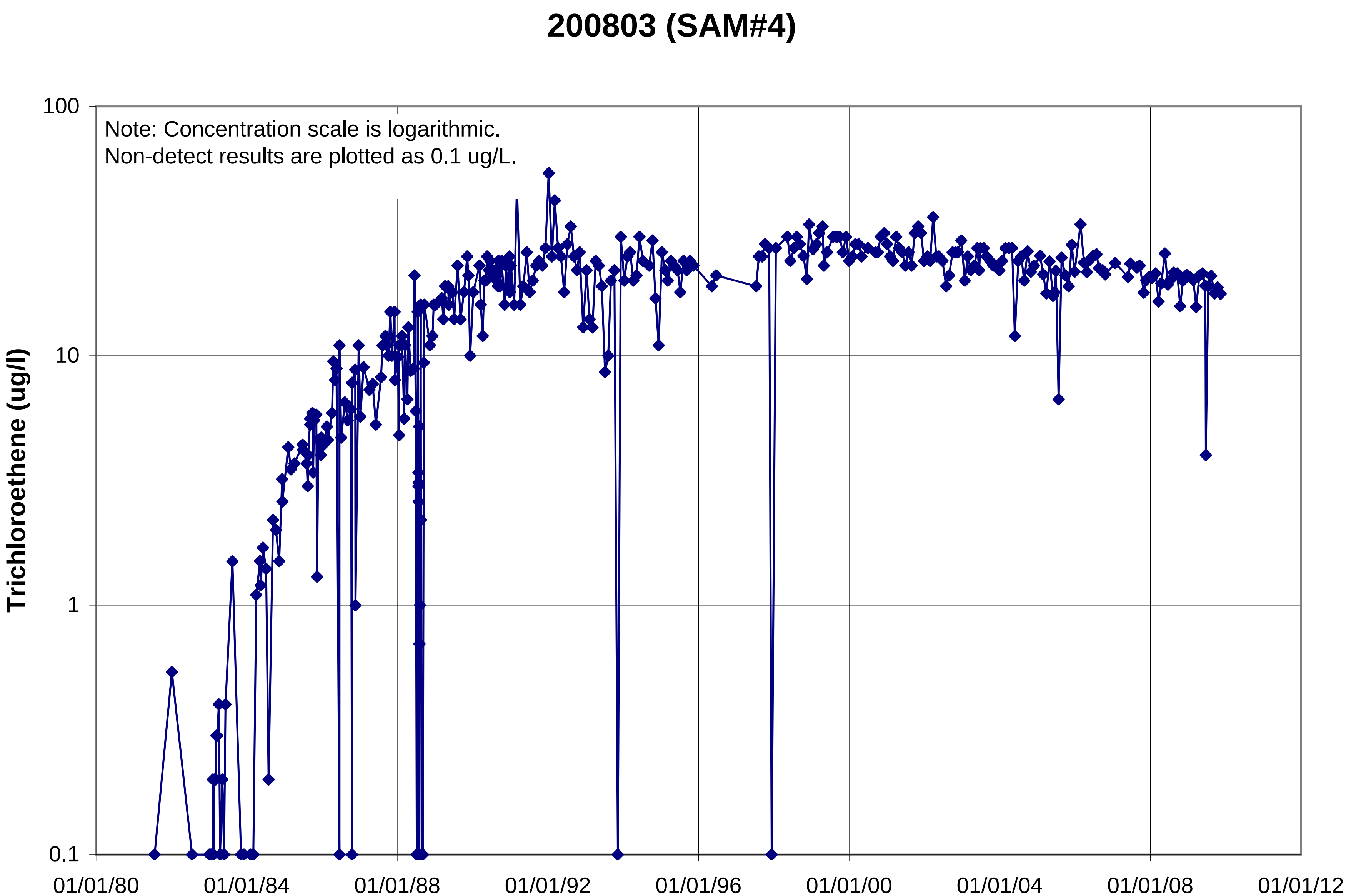



**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

# 582628 (NBM#15)

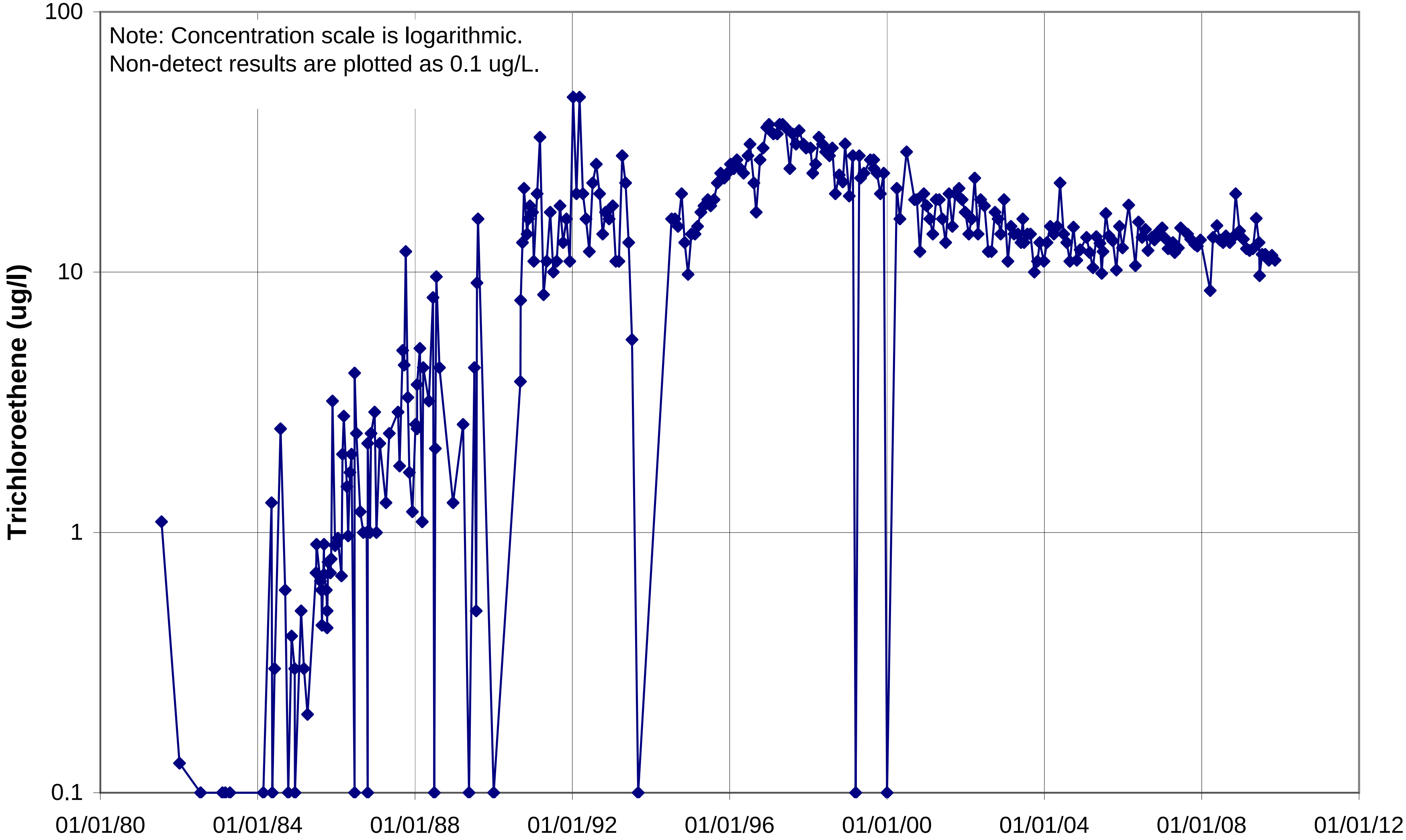



**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

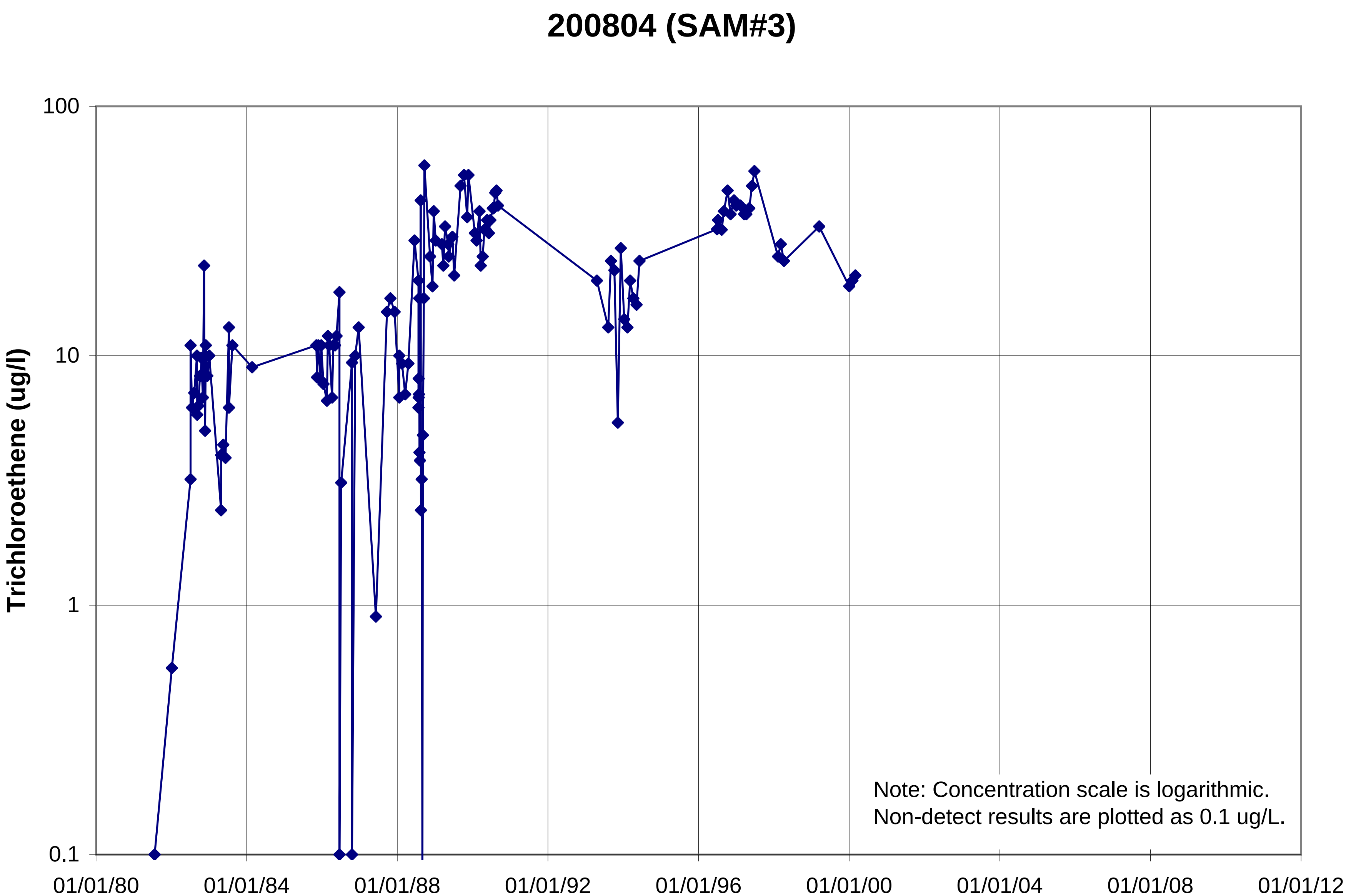



**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

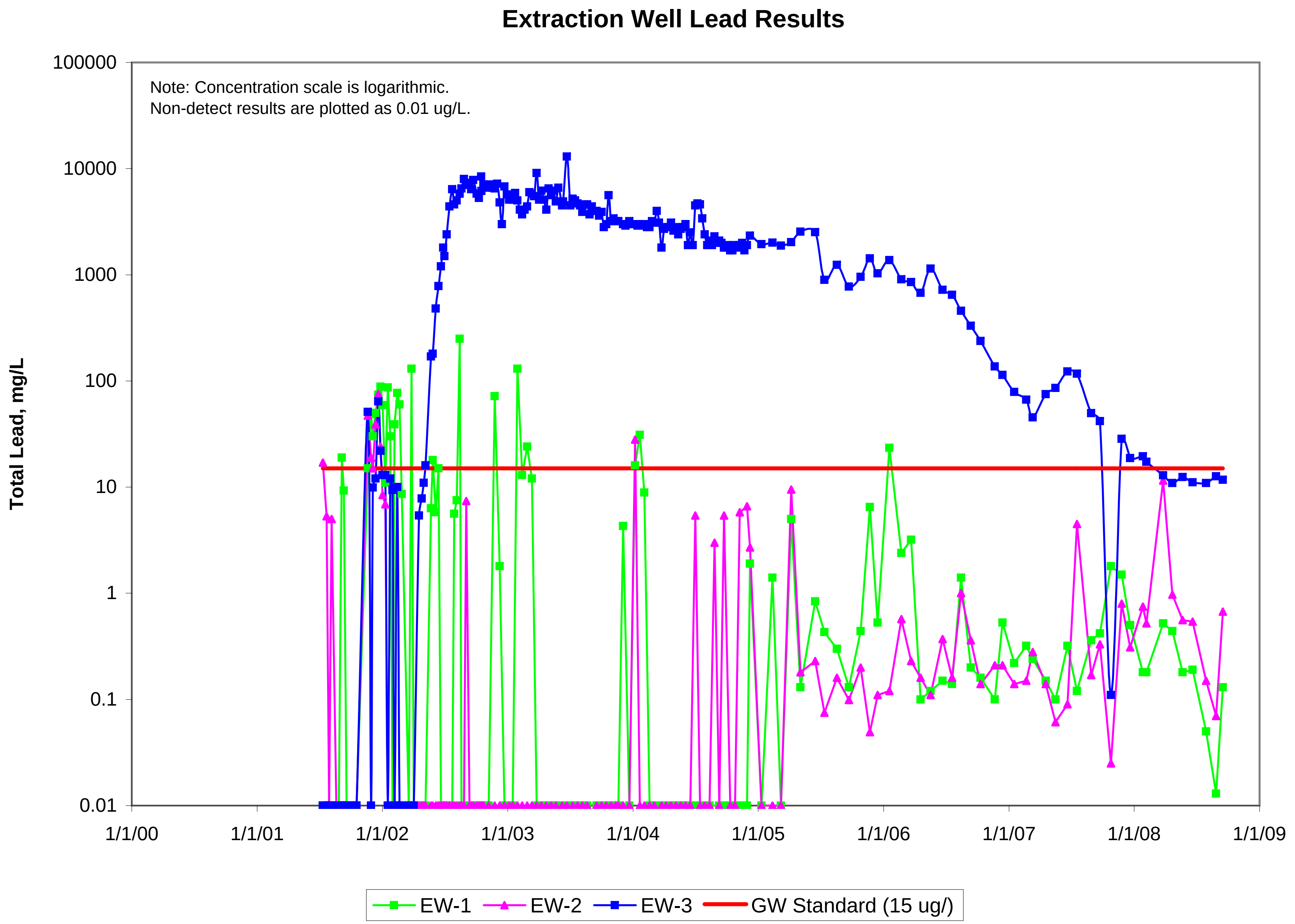
# 200524 (SAM#5)



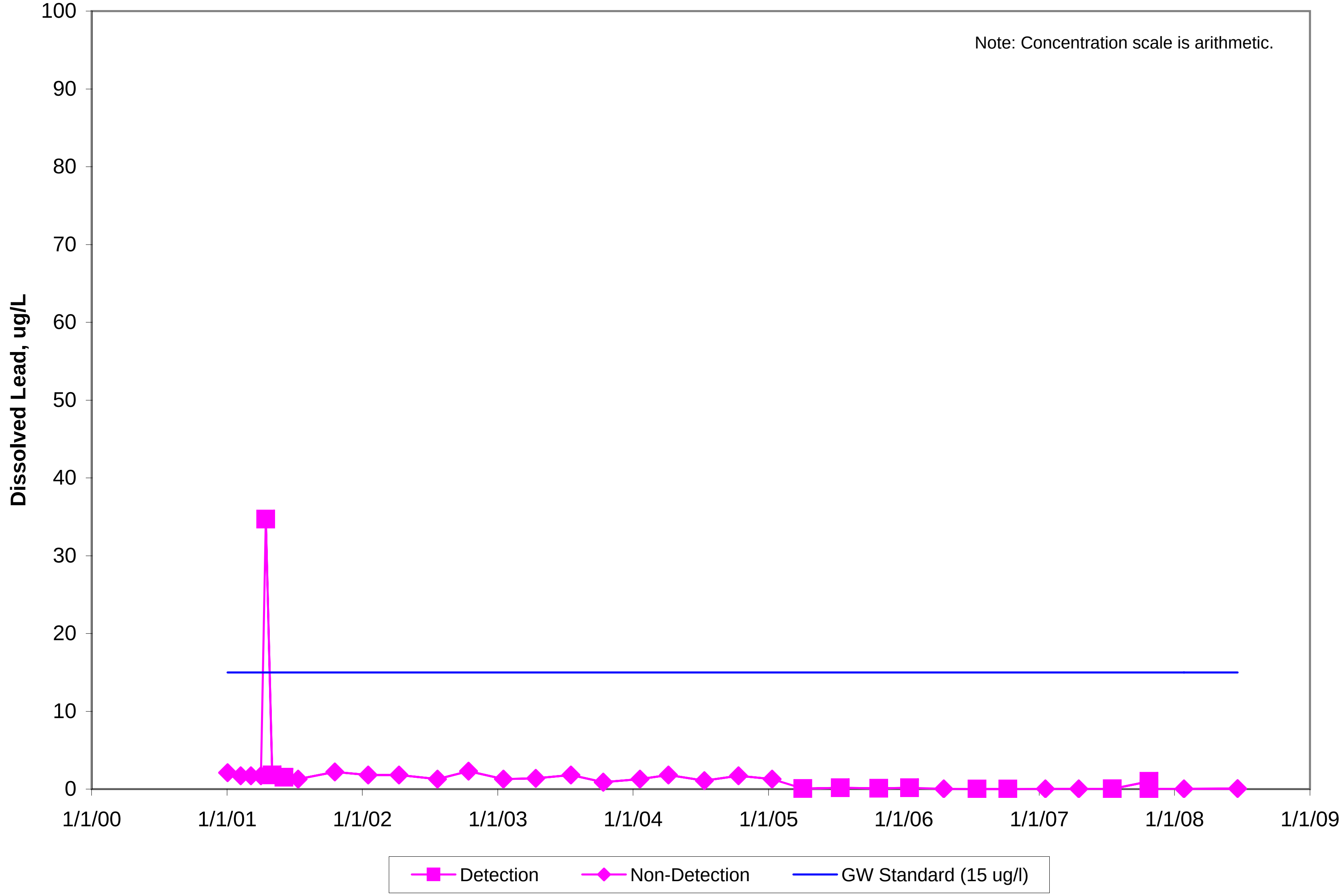

**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

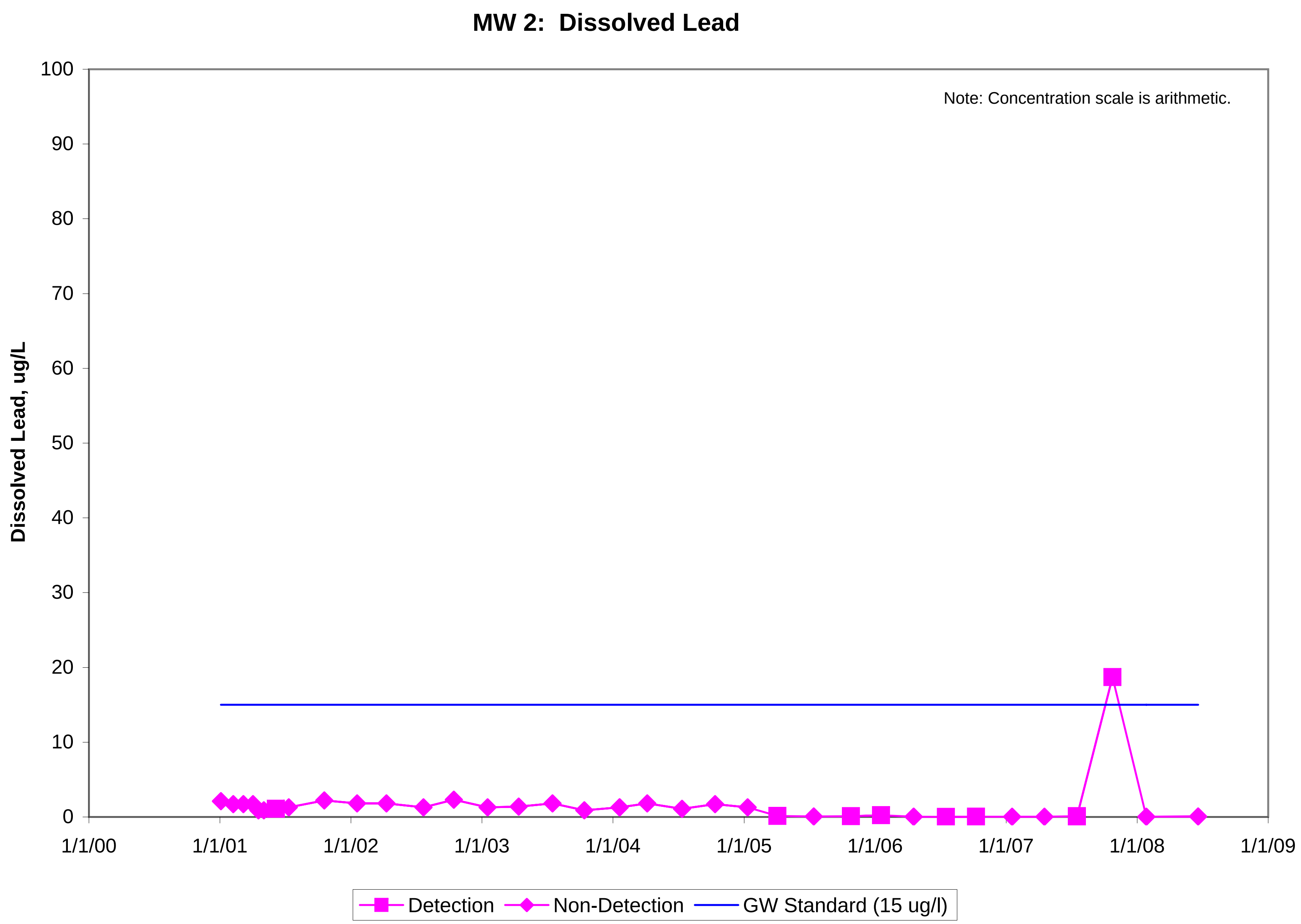


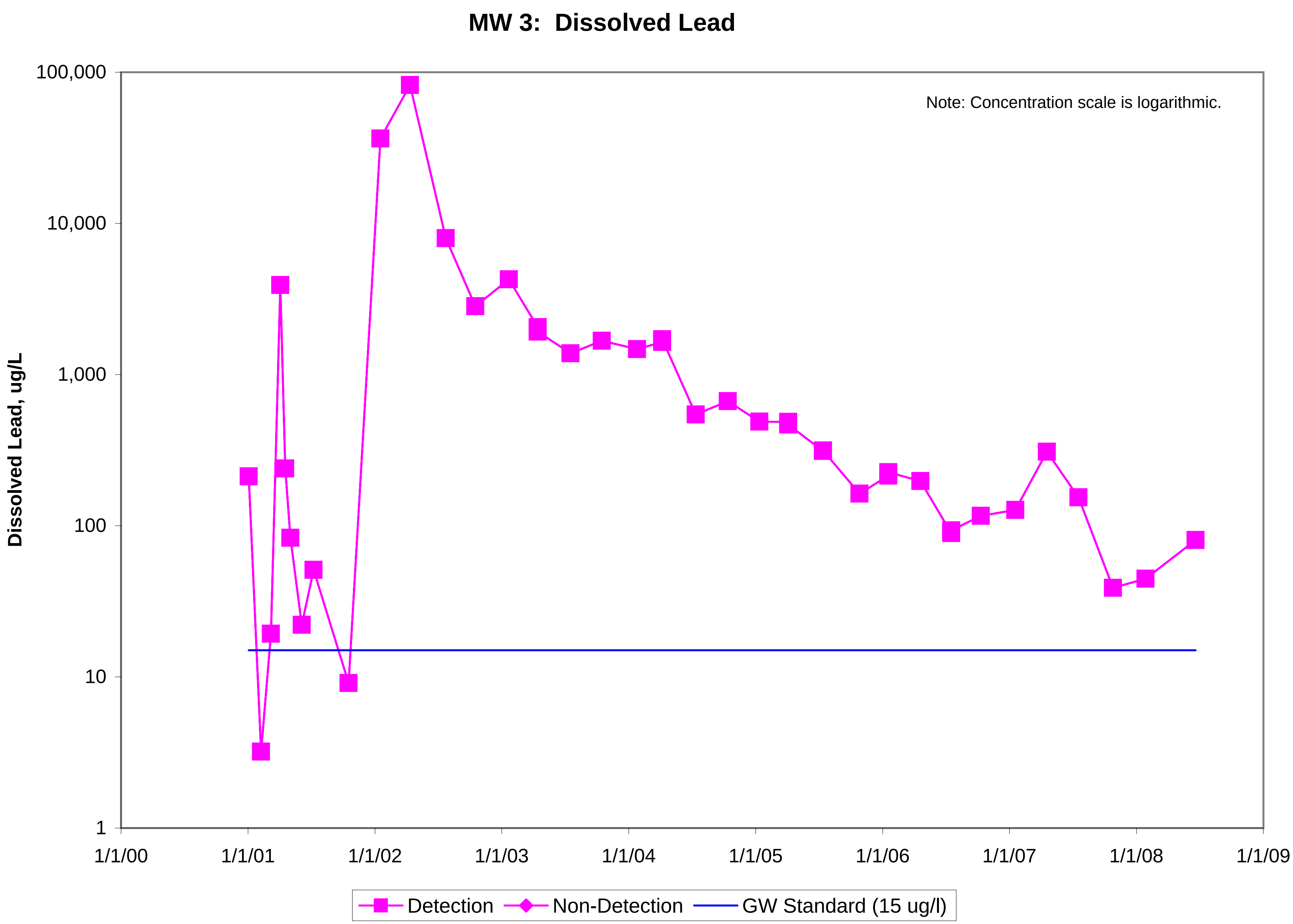

**TO RETURN TO MAP:** Click on "Go To Previous View" Button in the Tool Bar

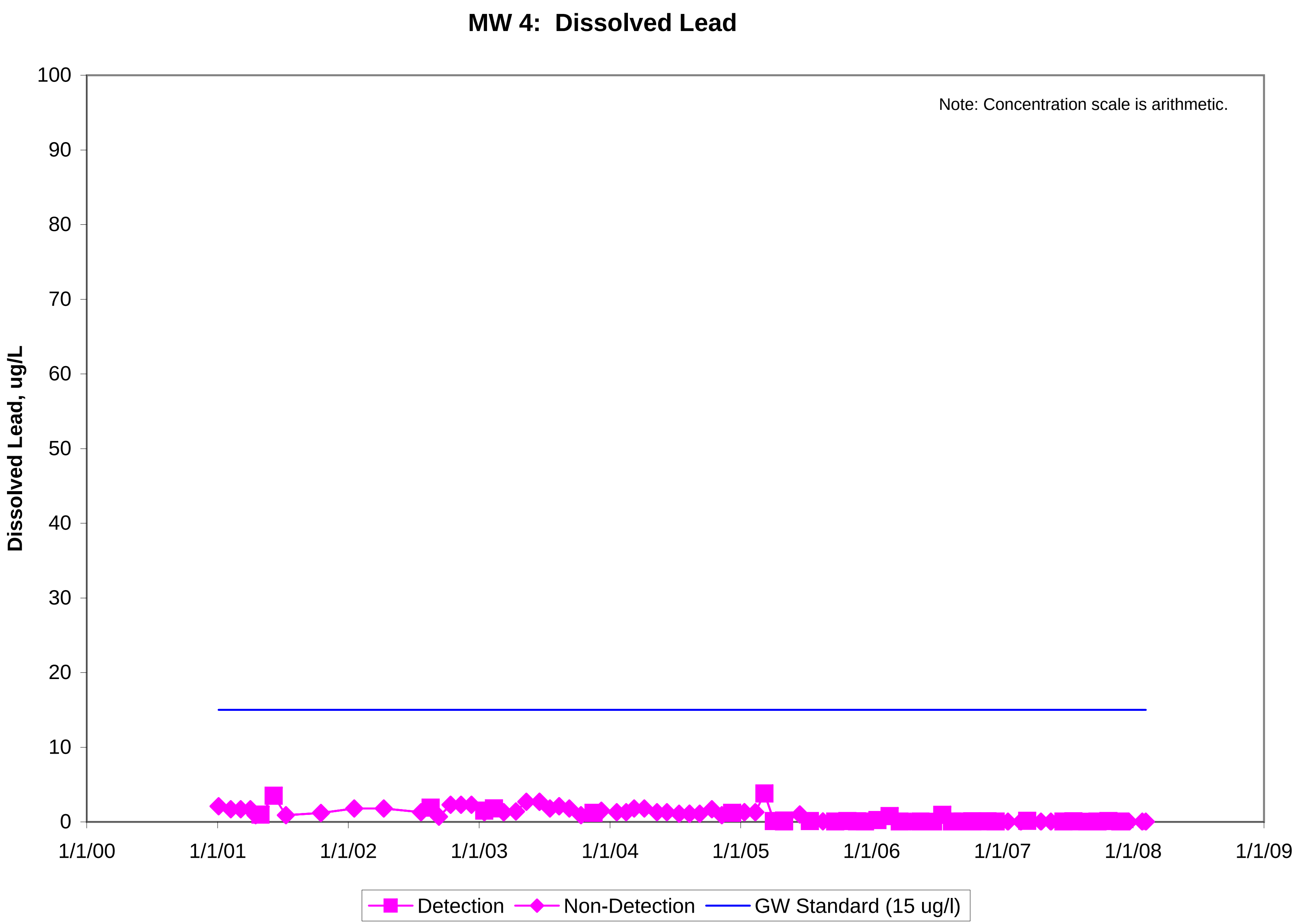

Extraction Well Lead Results
Note: Concentration scale is logarithmic.
Non-detect results are plotted as 0.01 ug/L.
Total Lead, mg/L
100000
10000
1000
100
10
1
0.1
0.01
1/1/00
1/1/01
1/1/02
1/1/03
1/1/04
1/1/05
1/1/06
1/1/07
1/1/08
1/1/09
EW-1
EW-2
EW-3
GW Standard (15 ug/)

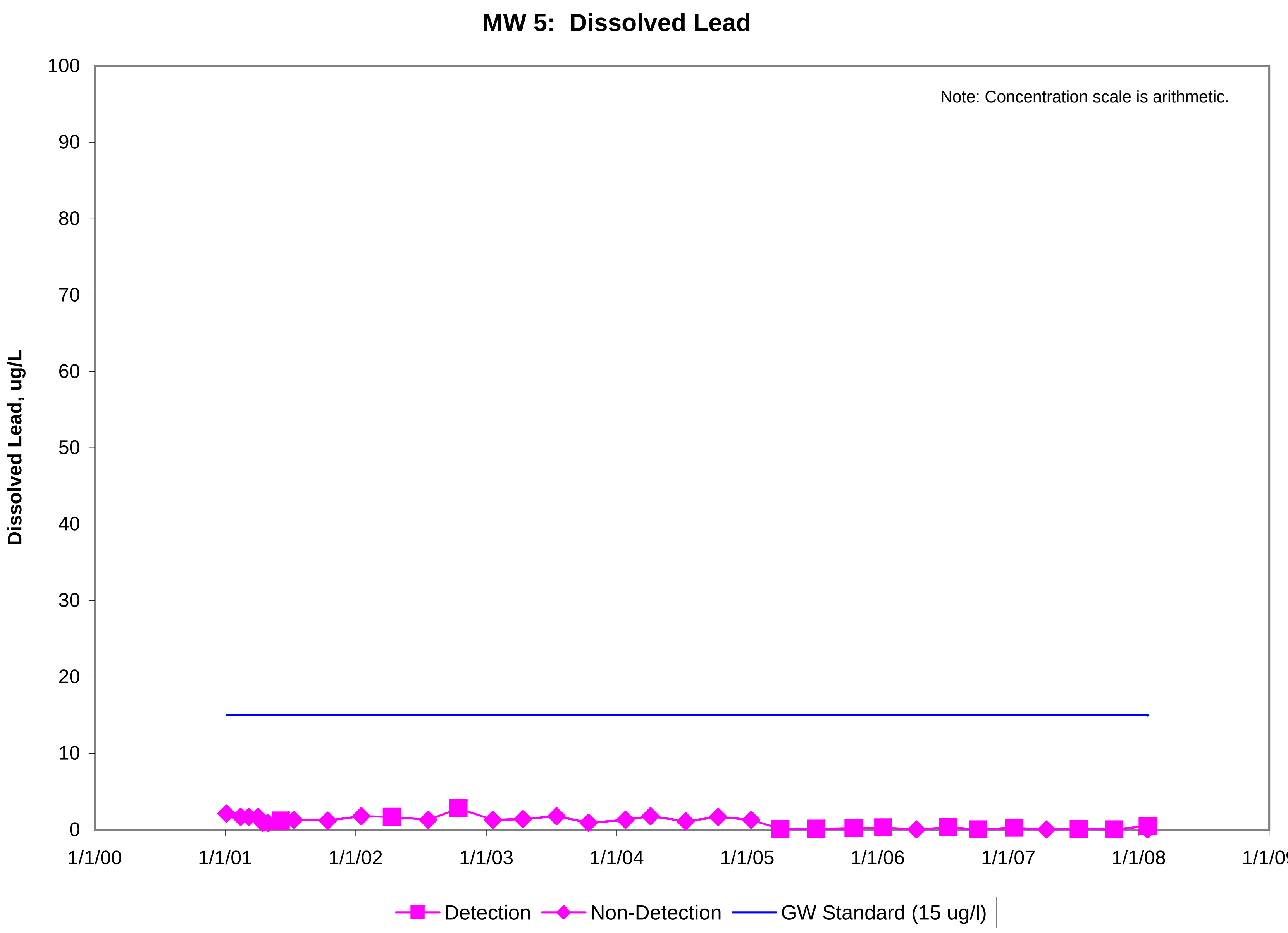
## MW 1:  Dissolved Lead




MW 2: Dissolved Lead
Note: Concentration scale is arithmetic.
Dissolved Lead, ug/L
100
90
80
70
60
50
40
30
20
10
0
1/1/00
1/1/01
1/1/02
1/1/03
1/1/04
1/1/05
1/1/06
1/1/07
1/1/08
1/1/09
Detection
Non-Detection
GW Standard (15 ug/l)

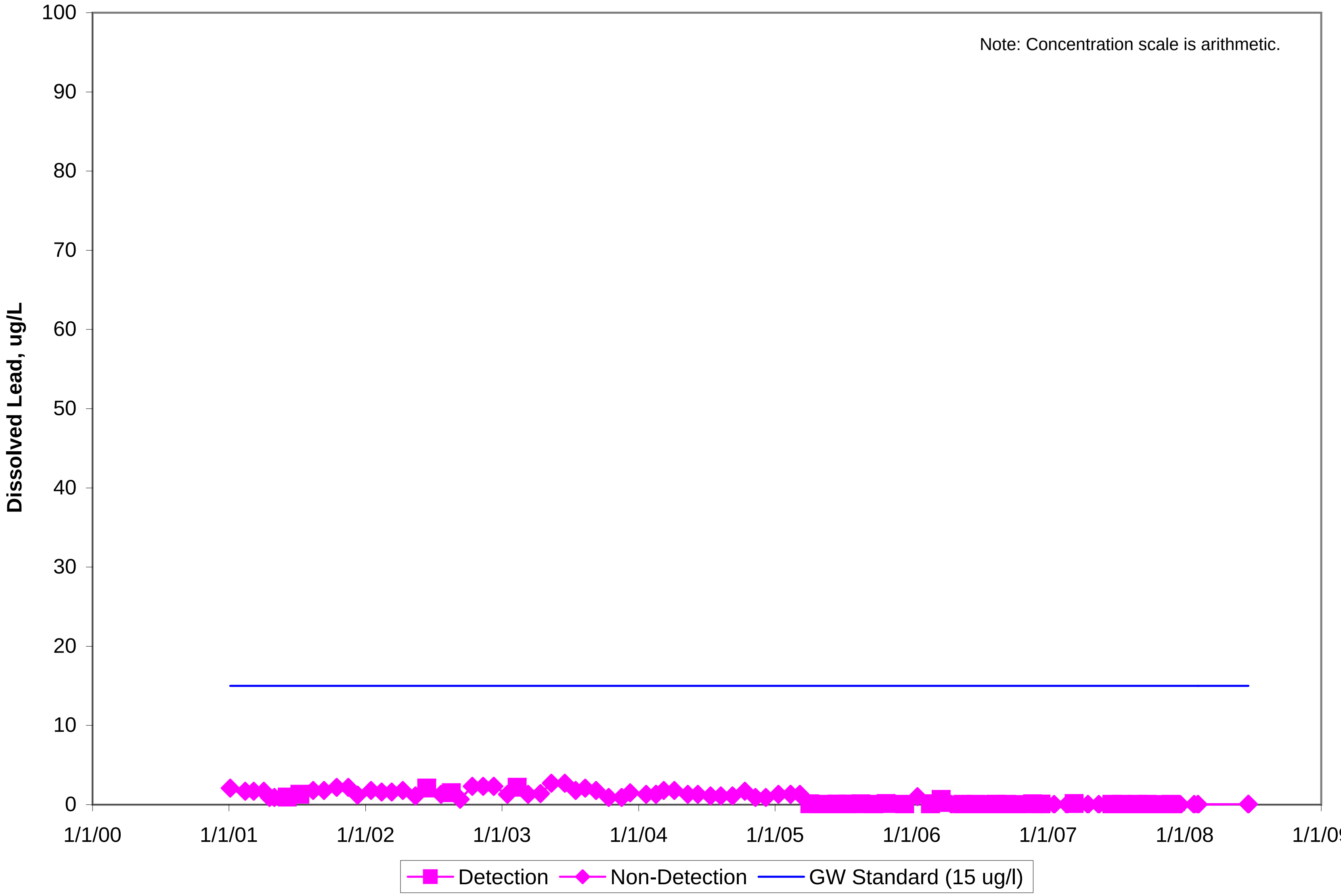

MW 3: Dissolved Lead
Note: Concentration scale is logarithmic.
Dissolved Lead, ug/L
100,000
10,000
1,000
100
10
1
1/1/00
1/1/01
1/1/02
1/1/03
1/1/04
1/1/05
1/1/06
1/1/07
1/1/08
1/1/09
Detection
Non-Detection
GW Standard (15 ug/l)

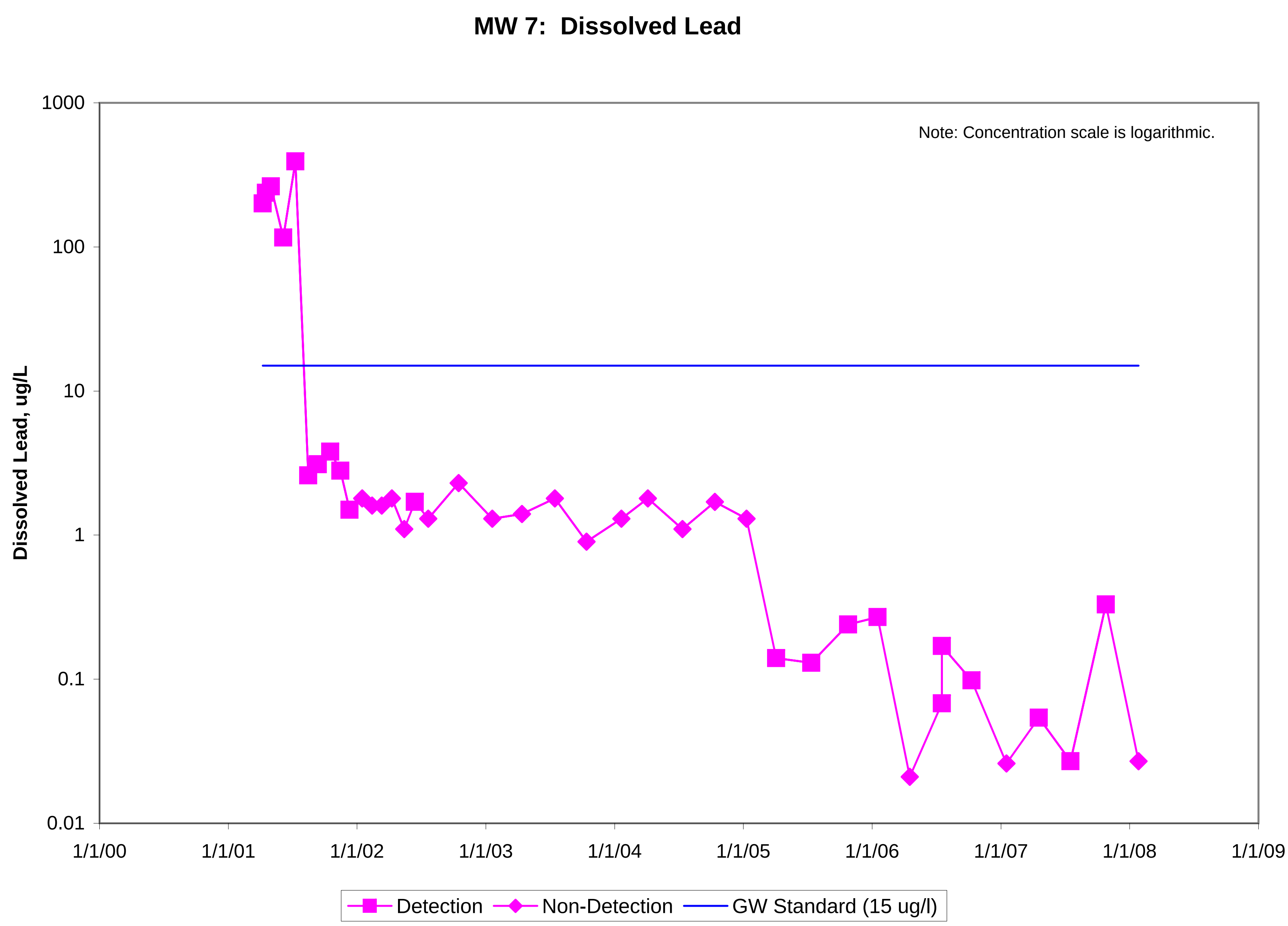

MW 4: Dissolved Lead
Note: Concentration scale is arithmetic.
Dissolved Lead, ug/L
100
90
80
70
60
50
40
30
20
10
0
1/1/00
1/1/01
1/1/02
1/1/03
1/1/04
1/1/05
1/1/06
1/1/07
1/1/08
1/1/09
Detection
Non-Detection
GW Standard (15 ug/l)

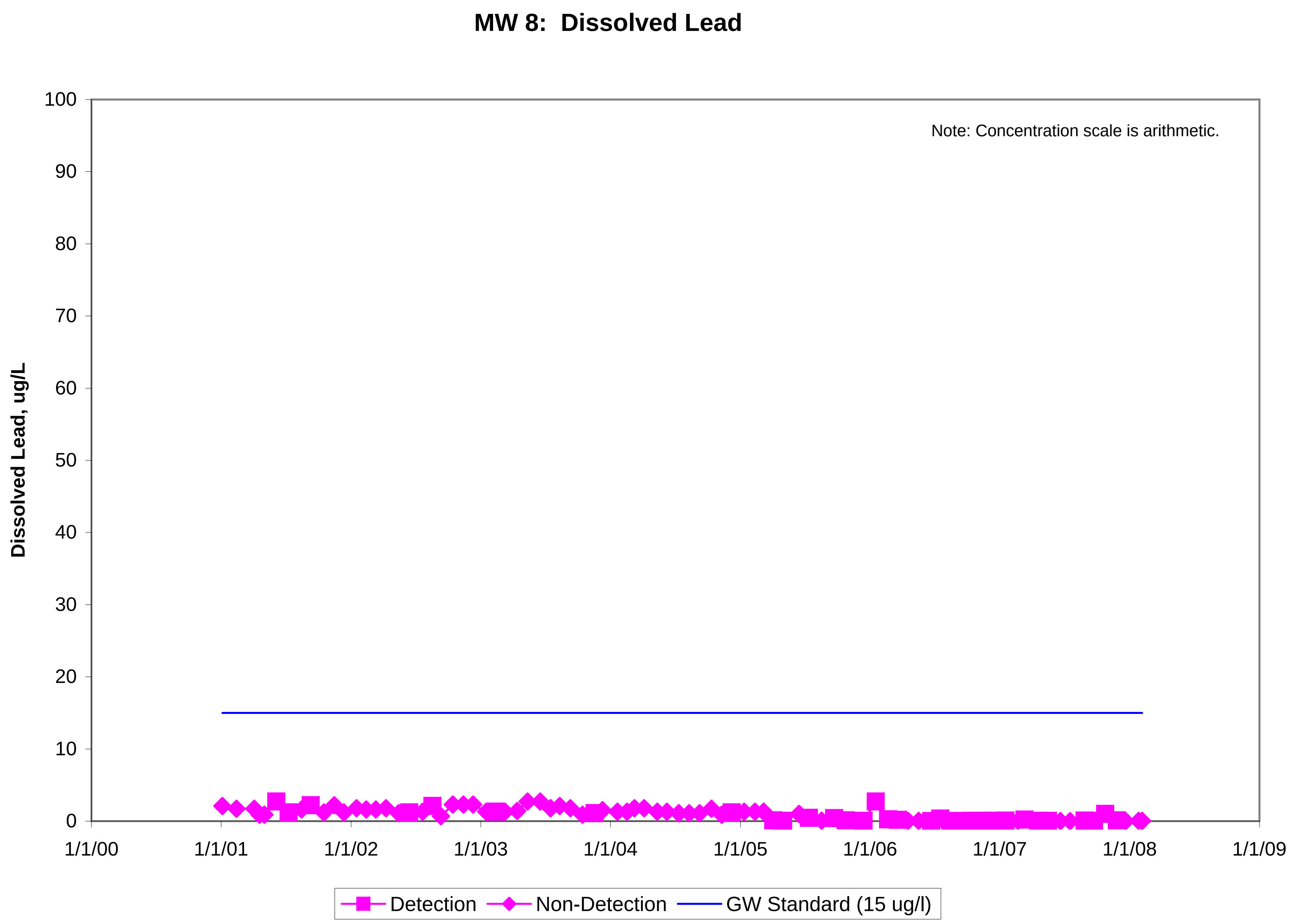


MW 5: Dissolved Lead
Note: Concentration scale is arithmetic.
Dissolved Lead, ug/L
100
90
80
70
60
50
40
30
20
10
0
1/1/00
1/1/01
1/1/02
1/1/03
1/1/04
1/1/05
1/1/06
1/1/07
1/1/08
1/1/09
Detection
Non-Detection
GW Standard (15 ug/l)

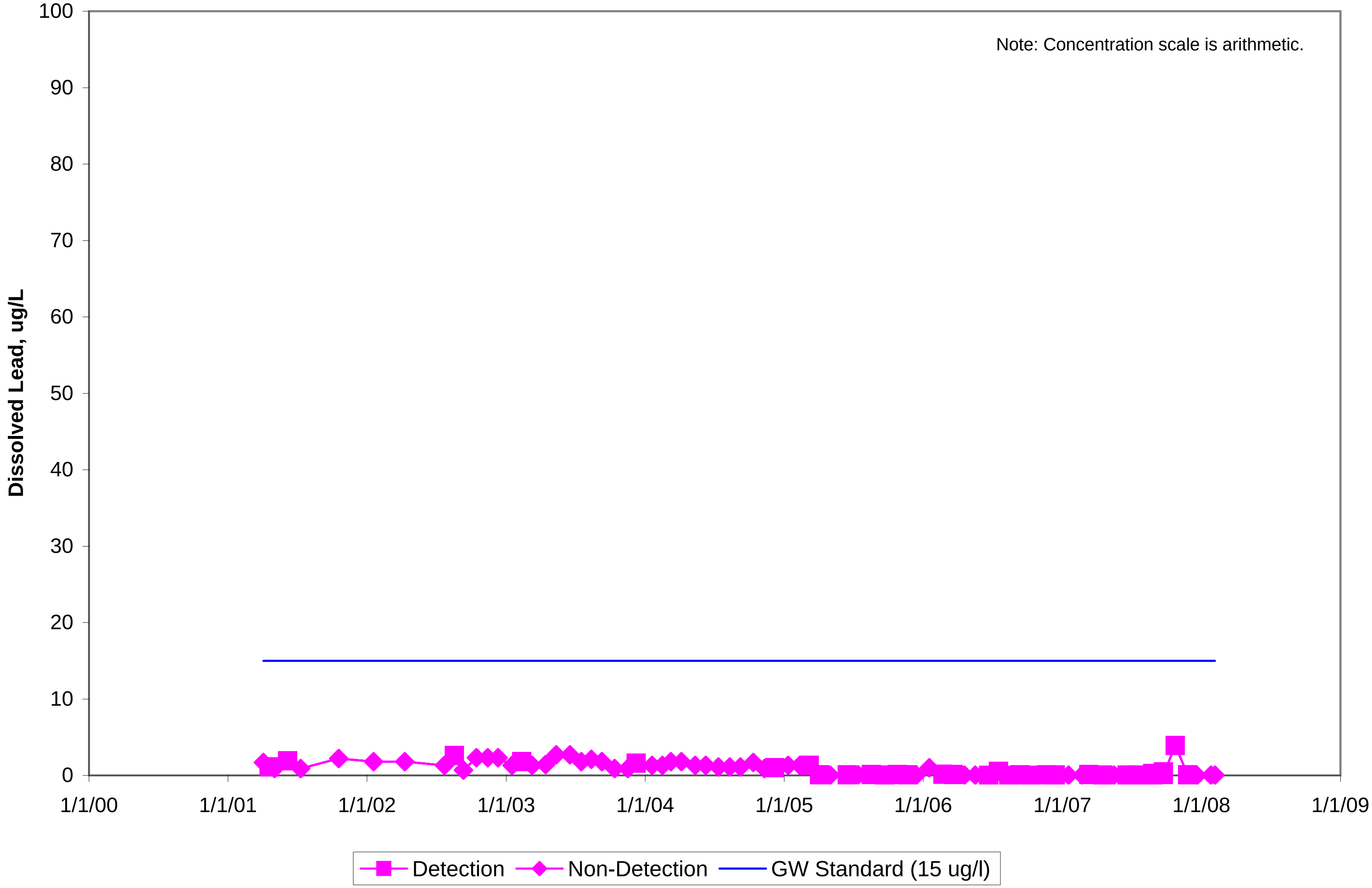
## MW 6:  Dissolved Lead

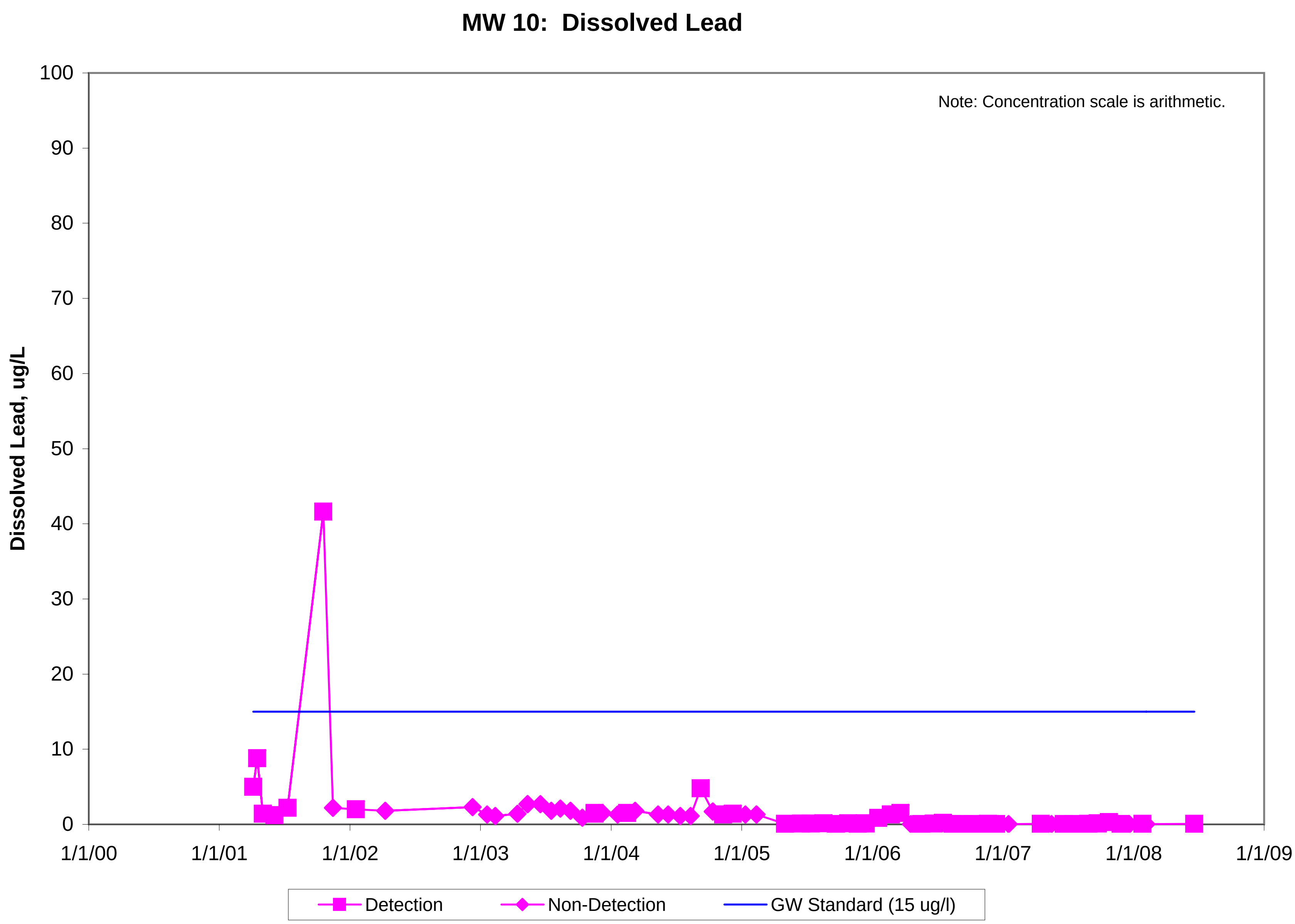



MW 7: Dissolved Lead
Note: Concentration scale is logarithmic.
Dissolved Lead, ug/L
1000
100
10
1
0.1
0.01
1/1/00
1/1/01
1/1/02
1/1/03
1/1/04
1/1/05
1/1/06
1/1/07
1/1/08
1/1/09
Detection
Non-Detection
GW Standard (15 ug/l)

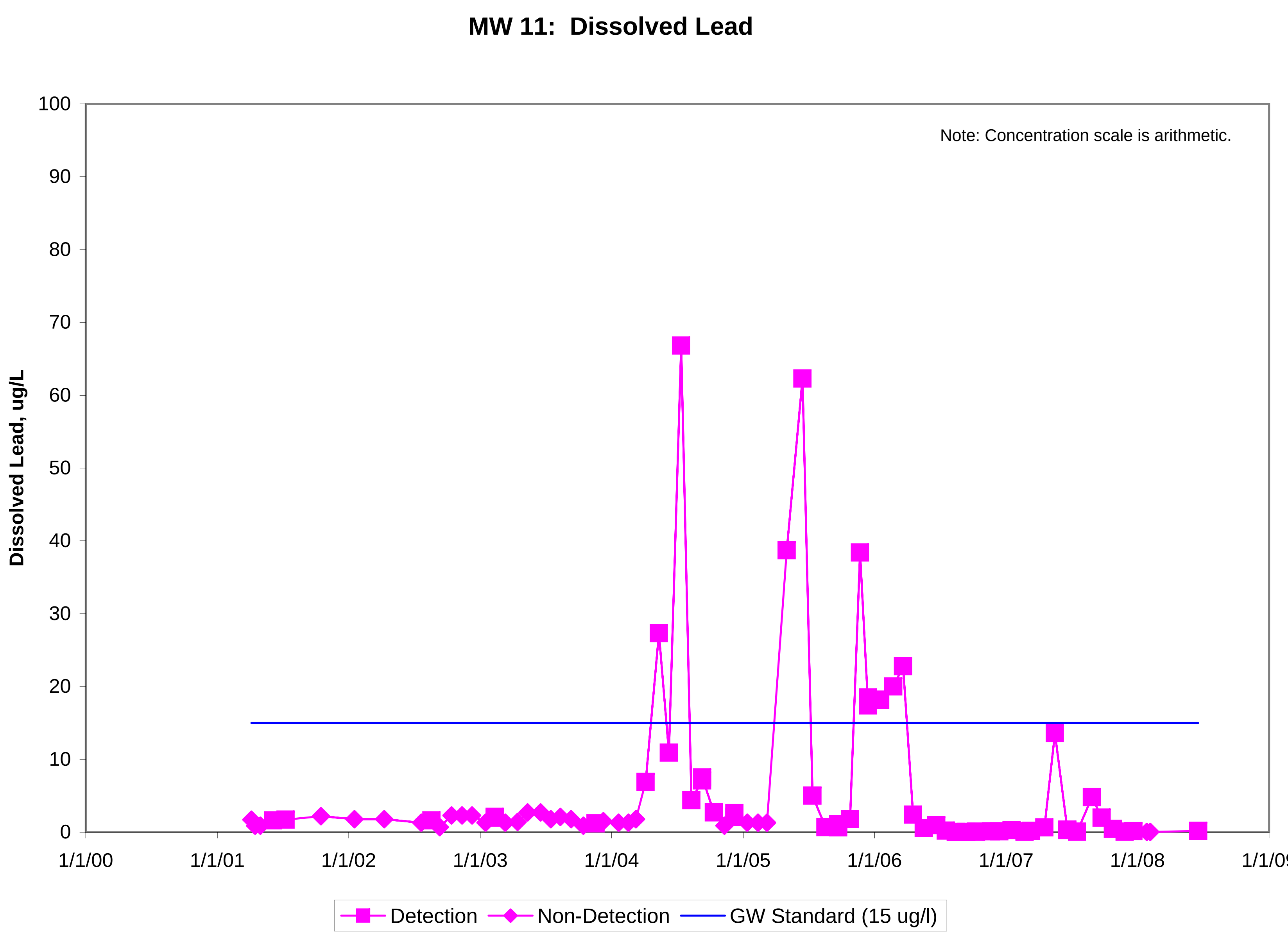

MW 8: Dissolved Lead
Note: Concentration scale is arithmetic.
Dissolved Lead, ug/L
100
90
80
70
60
50
40
30
20
10
0
1/1/00
1/1/01
1/1/02
1/1/03
1/1/04
1/1/05
1/1/06
1/1/07
1/1/08
1/1/09
Detection
Non-Detection
GW Standard (15 ug/l)

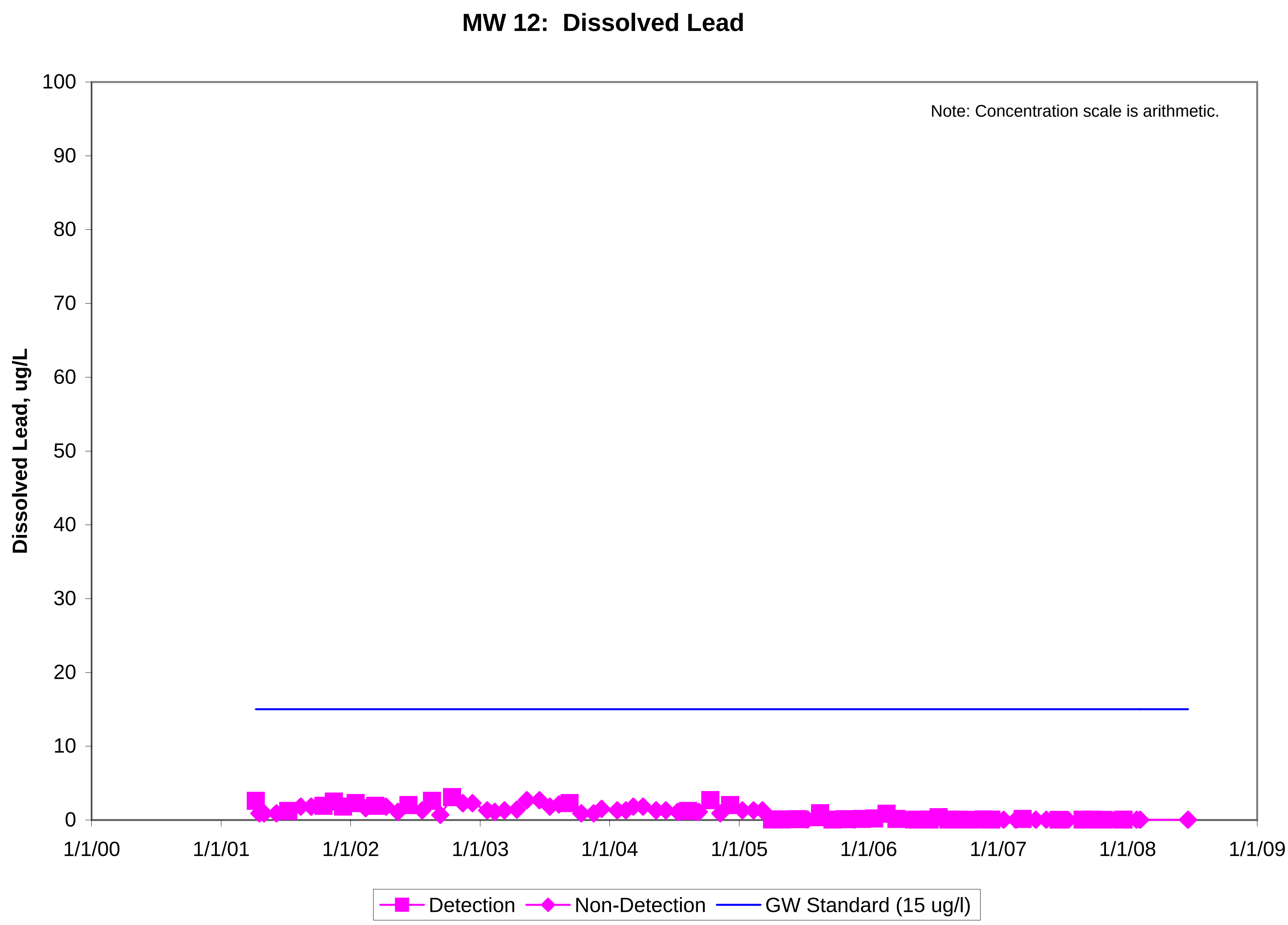
## MW 9: Dissolved Lead



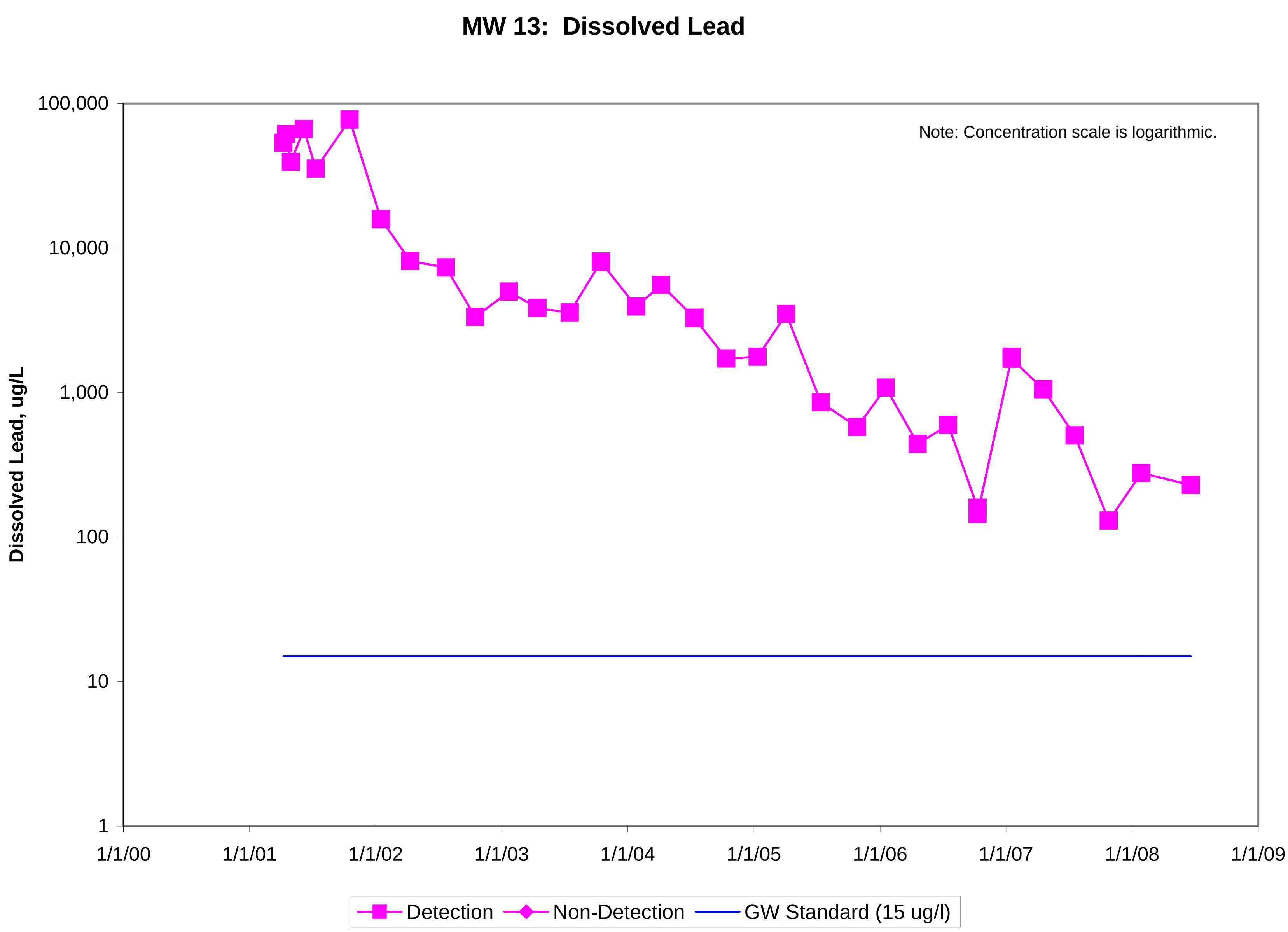


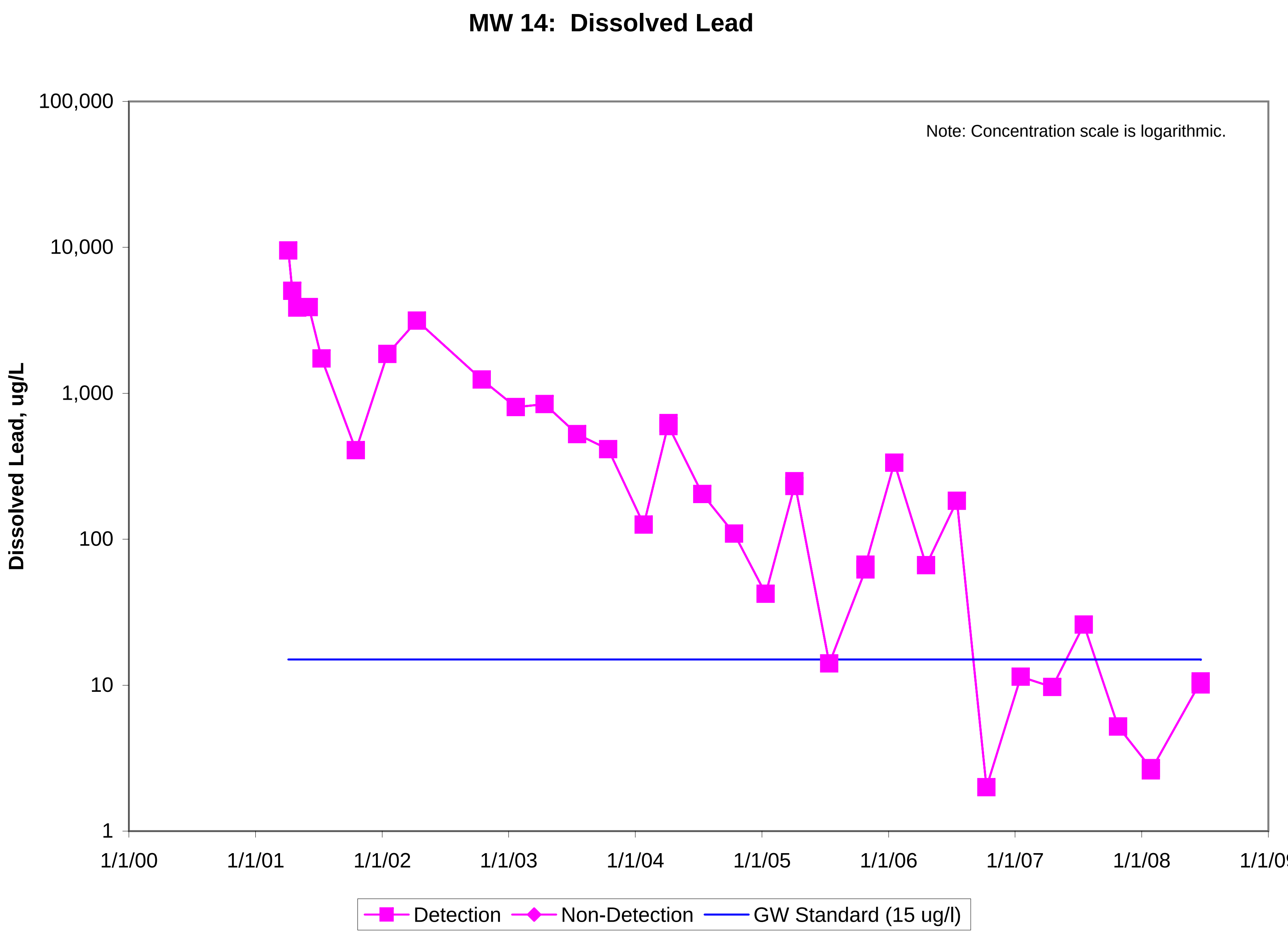
MW 10: Dissolved Lead
Note: Concentration scale is arithmetic.
Dissolved Lead, ug/L
0
10
20
30
40
50
60
70
80
90
100
1/1/00
1/1/01
1/1/02
1/1/03
1/1/04
1/1/05
1/1/06
1/1/07
1/1/08
1/1/09
Detection
Non-Detection
GW Standard (15 ug/l)

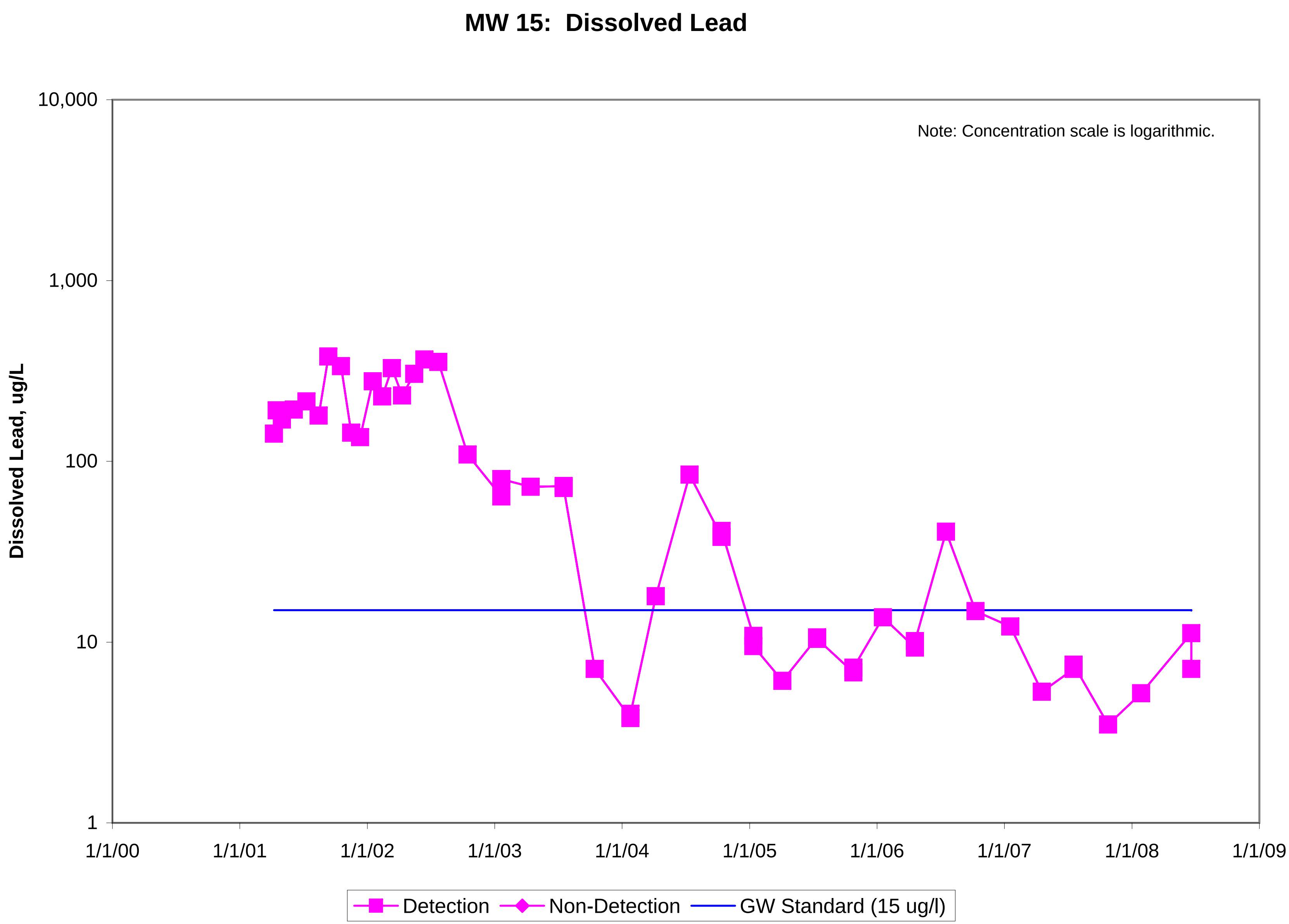

MW 11: Dissolved Lead
Note: Concentration scale is arithmetic.
Dissolved Lead, ug/L
100
90
80
70
60
50
40
30
20
10
0
1/1/00
1/1/01
1/1/02
1/1/03
1/1/04
1/1/05
1/1/06
1/1/07
1/1/08
1/1/09
Detection
Non-Detection
GW Standard (15 ug/l)



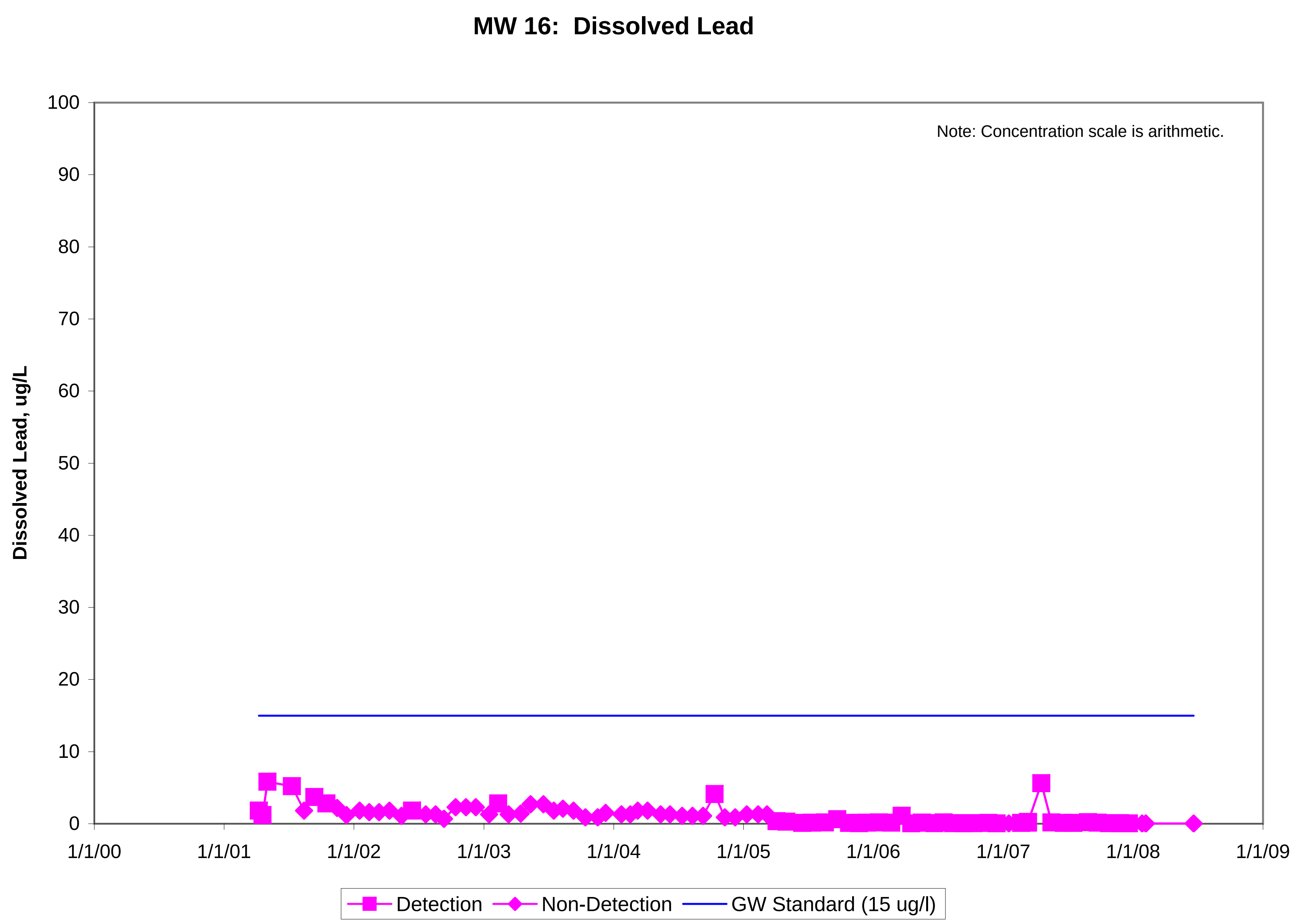
MW 12: Dissolved Lead
Note: Concentration scale is arithmetic.
Dissolved Lead, ug/L
100
90
80
70
60
50
40
30
20
10
0
1/1/00
1/1/01
1/1/02
1/1/03
1/1/04
1/1/05
1/1/06
1/1/07
1/1/08
1/1/09
Detection
Non-Detection
GW Standard (15 ug/l)

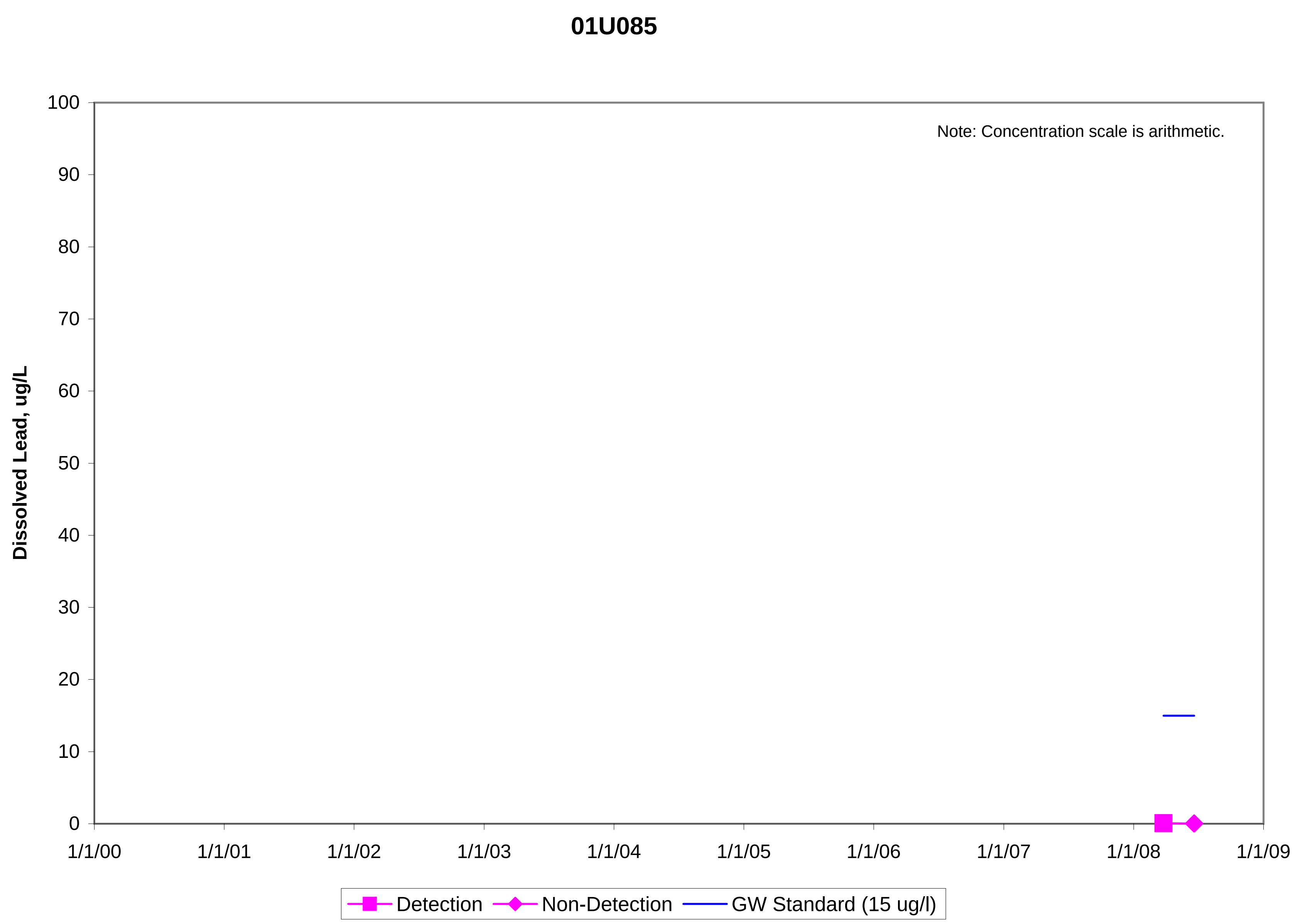

MW 13: Dissolved Lead
Note: Concentration scale is logarithmic.
Dissolved Lead, ug/L
100,000
10,000
1,000
100
10
1
1/1/00
1/1/01
1/1/02
1/1/03
1/1/04
1/1/05
1/1/06
1/1/07
1/1/08
1/1/09
Detection
Non-Detection
GW Standard (15 ug/l)


MW 14: Dissolved Lead
Note: Concentration scale is logarithmic.
Dissolved Lead, ug/L
100,000
10,000
1,000
100
10
1
1/1/00
1/1/01
1/1/02
1/1/03
1/1/04
1/1/05
1/1/06
1/1/07
1/1/08
1/1/09
Detection
Non-Detection
GW Standard (15 ug/l)



MW 15: Dissolved Lead
Note: Concentration scale is logarithmic.
Dissolved Lead, ug/L
10,000
1,000
100
10
1
1/1/00
1/1/01
1/1/02
1/1/03
1/1/04
1/1/05
1/1/06
1/1/07
1/1/08
1/1/09
Detection
Non-Detection
GW Standard (15 ug/l)


MW 16: Dissolved Lead
Note: Concentration scale is arithmetic.
Dissolved Lead, ug/L
100
90
80
70
60
50
40
30
20
10
0
1/1/00
1/1/01
1/1/02
1/1/03
1/1/04
1/1/05
1/1/06
1/1/07
1/1/08
1/1/09
Detection
Non-Detection
GW Standard (15 ug/l)


01U085
Note: Concentration scale is arithmetic.
Dissolved Lead, ug/L
100
90
80
70
60
50
40
30
20
10
0
1/1/00
1/1/01
1/1/02
1/1/03
1/1/04
1/1/05
1/1/06
1/1/07
1/1/08
1/1/09
Detection
Non-Detection
GW Standard (15 ug/l)

# Appendix C

# FY 2009 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 2009 was comprised of Quarter 101 (October through December), Quarter 102 (January through March), Quarter 103 (April through June), and Quarter 104 (July through September). Water sampling, water level measurements, and laboratory analyses were conducted in accordance with three separate Quality Assurance Project Plans (QAPPs): "QAPP for Performance Monitoring", (Wenck, Revision 8, April 3, 2009), "QAPP for Site C Groundwater and Surface Water", (Wenck, Revision 8, April 3, 2009), and "QAPP for Monitored Natural Attenuation of Building 102 Groundwater", (Wenck, Revision 2, April 3, 2009). The Site C and Building 102 QAPPs are applicable to only those specific sites, 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 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 2009 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 except Site C was performed by ALS Laboratory Group, Salt Lake City, Utah. Samples from Site C were analyzed by CompuChem Labs, Inc., Cary, North Carolina. 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 clarifications and deviations from the FY 2009 Annual Monitoring Plan.

Data verification and validation was conducted in accordance with procedures and requirements outlined in the three 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 the table footnotes. 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 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 2009 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 2009 was in June (Quarter 103). 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. These 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 2009 was in June (Quarter 103). 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 Sites A, C, 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 maps for Site C were 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 with 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.

For Site K, 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.

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 2009

### OU1 Deep Groundwater

*June 2009:*
200804: No sample collected, this St. Anthony municipal well was not in use.

### OU2: Site I Shallow Groundwater

*June 2009:*
Well I01MW: No sample collected, well was dry.
Well I02MW: No sample collected, well was dry.
Well I05MW: No sample collected, well was dry.
Well 01U639: No sample collected, well was dry.
Well I04MW: No sample collected, well was dry.
Well 01U640: No sample collected, well was dry.
Well 01U632: No sample collected, well was dry.
Well 01U636: No sample collected, well was dry.

### OU2: Site C Shallow Groundwater

*December 2008:*
Well 01U046: No sample collected, well was frozen.

*March 2009:*
Well 01U046: No sample collected, well was frozen.

*June 2009:*
SW05: No sample collected on 1st day of 3-day sampling event, ditch was dry.
SW05: No sample collected on 2nd day of 3-day sampling event, ditch was dry.

### OU3 Deep Groundwater

*June 2009:*
Well 04U866: No sample collected, inadvertently.

# C.3 Regulatory Approvals of Data Usability Reports

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

February 10, 2010 SR-6J

REPLY TO THE ATTENTION OF:

Mr. Michael R. Fix
Commander's Representative
Twin Cities Army Ammunition Plant
470 West Highway 96 - Suite 100
Shoreview, MN 55126

Subject: **Approval of Data Usability Report Numbers 61, 62, 63 and 64**

Dear Mr. Fix:

This letter shall serve to document that the U.S. Environmental Protection Agency (EPA) and the Minnesota Pollution Control Agency (MPCA) have completed their review of the U.S. Army's (Army) subject Data Usability Reports (DURs) Numbers 61, 62, 63, and 64. USEPA and MPCA review included review of the following:

- Data Usability Report Number 61 **(DUR 61)**, TCAAP FY 2009 Performance Monitoring Program, 1st Quarter Monitoring (October – December, 2008), March 30, 2009; EPA comments (April 28, 2009) and MPCA comments (April 6, 2009); Army responses to comments (May 7, 2009); Data Usability Report #61, Final Report (May 14, 2009);

- Data Usability Report Number 62 **(DUR 62)**, TCAAP FY 2009 Performance Monitoring Program, 2nd Quarter Monitoring (January – March, 2009) ; EPA comments (June 9, 2009) and MPCA comments (June 9, 2009); Army responses (June 16, 2009); Data Usability Report #62, Final Report, July 30, 2009;

- Data Usability Report Number 63 **(DUR 63)**, TCAAP FY 2009 Performance Monitoring Program, 3rd Quarter Monitoring (April – June, 2009), November 3, 2009; MPCA comments (December 10, 2009) and EPA comments (December 10, 2010); Army responses to comments (January 14, 2010); Data Usability Report #63, February 5, 2010;

- Data Usability Report Number 64 **(DUR 64)**, TCAAP FY 2009 Performance Monitoring Program, 4th Quarter Monitoring (July – September, 2009); USEPA comments (December 23, 2009) and MPCA comments (January 5, 2010); Army responses to comments (January 14, 2010); Data Usability Report #64, Final Report.

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 61, 62, 63, 64. If you have any questions, please contact Tom Barounis of the EPA at (312) 353-5577 or Dagmar Romano of the MPCA at (651) 757-2676.

Sincerely,

Tom Barounis

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

Tom Barounis for

Dagmar Romano
Superfund Unit 2
Superfund, RCRA and VIC Section
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 DVD in a directory named Appendix D. This directory contains three Microsoft Excel files:

| File | Contents |
|---|---|
| Compelev.xls | Groundwater elevations |
| Comporwq.xls | Groundwater quality: organic data |
| Compinwq.xls | Groundwater quality: inorganic data |

# 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 |
| 03L673 | 04U845 | 04U846 | 04U849 |
| 03L833 | 04U854 | 04U861 abandoned | 04U821 |
| 03L859 | 04U859 | 409549 | 191942 abandoned |

Group 3 ** – Downgradient Sentinel

| | | | |
|---|---|---|---|
| 04U871 | 04U875 | 04U851 | |

Group 4 – Lateral Sentinel

| | | | |
|---|---|---|---|
| 03U831 abandoned | 03L846 | 409556 | 409548 |
| 03U811 | 03L832 | 04U855 | 04U839 |
| 03U804 | 03L861 abandoned | 04U879 | 04U838 |
| 03U673 | 03L854 | 04U860 | 04U848 |
| 03U672 | 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

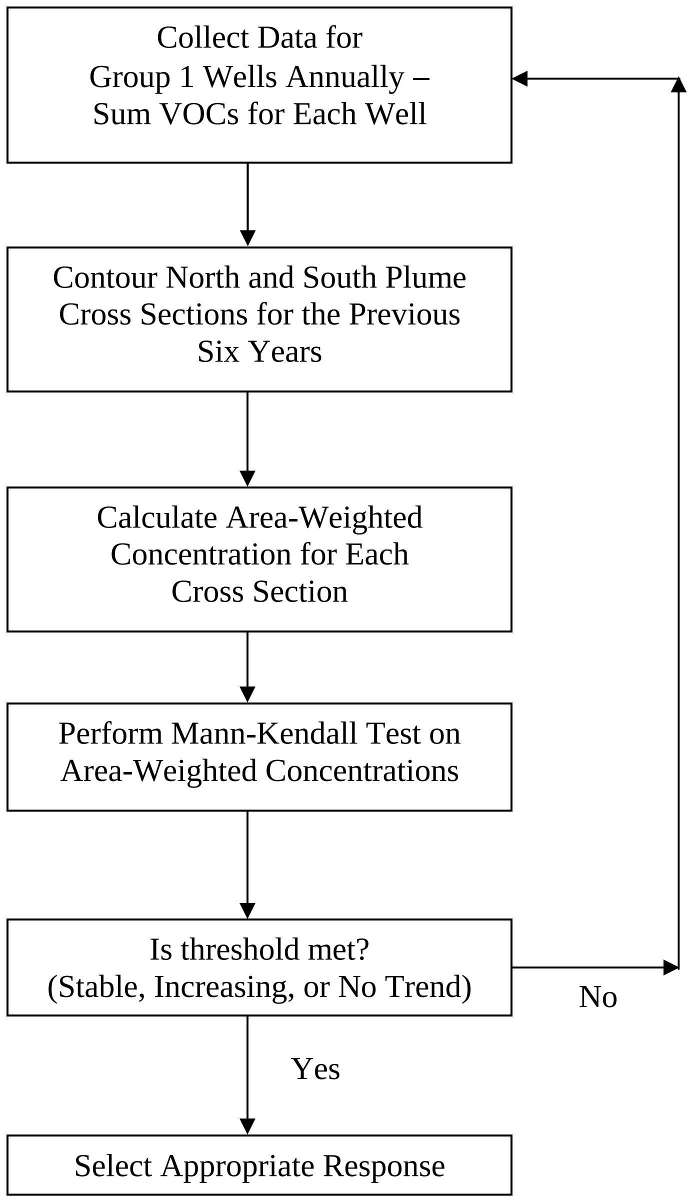


Table D.2.5
Group 2 – Areal Extent of Plume, Evaluation Process

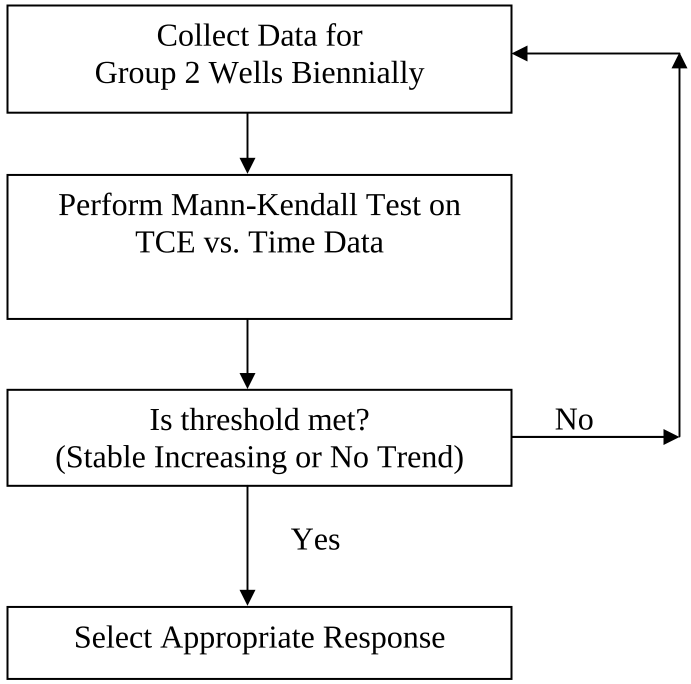


Table D.2.6
Group 3 and Group 5 – Downgradient Sentinel and Global Plume, Evaluation Processes

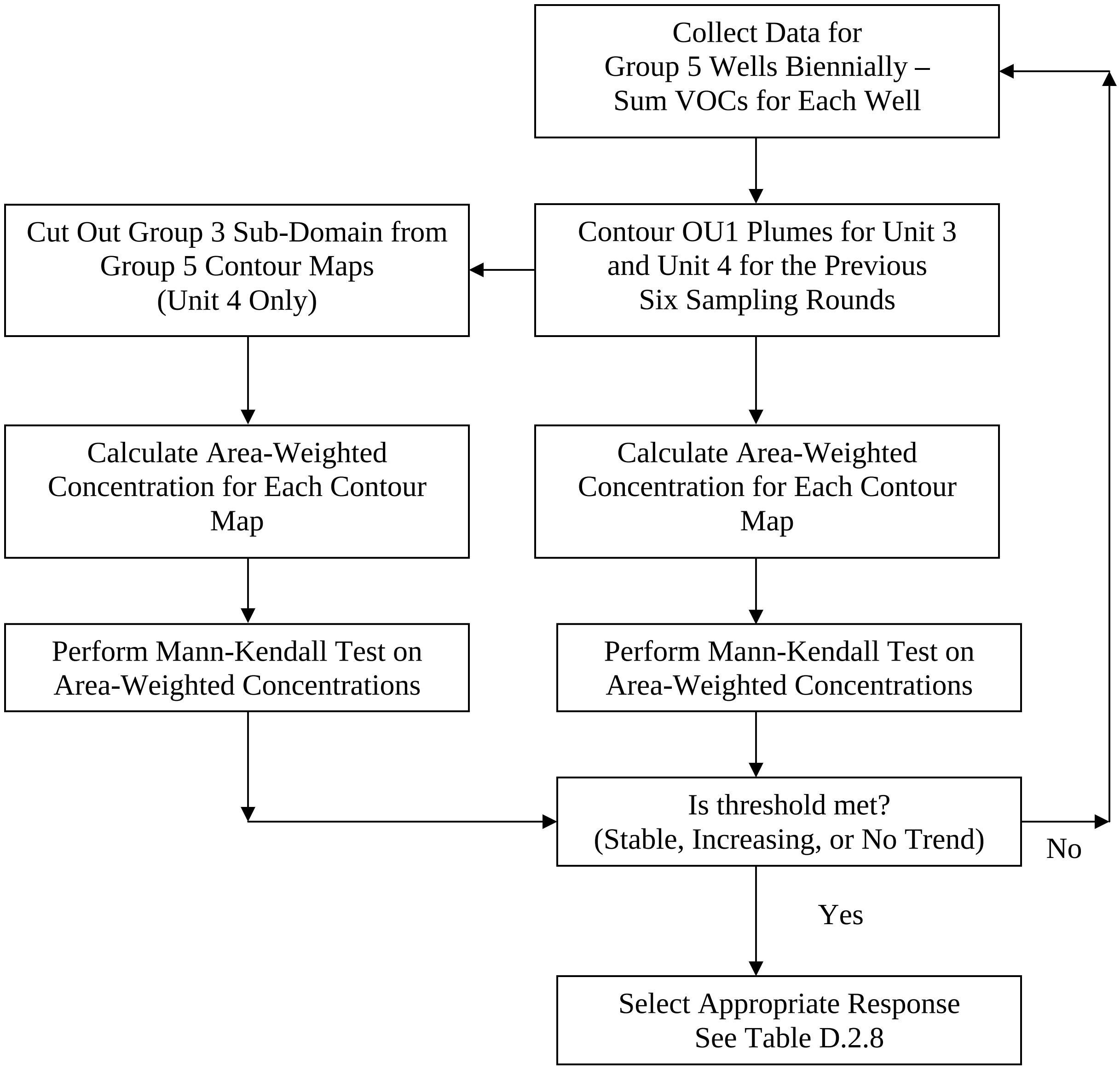


Table D.2.7
Group 4 – Lateral Sentinel Wells, Evaluation Process

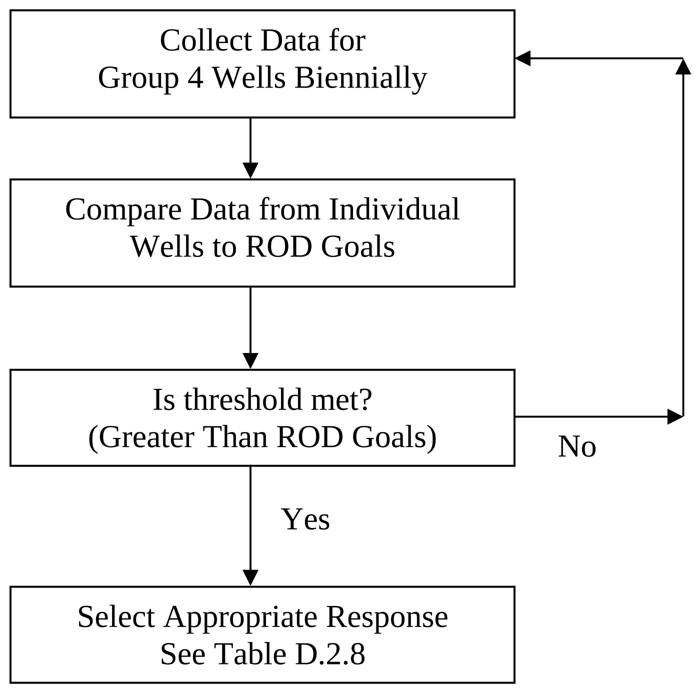


Table D.2.8

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)

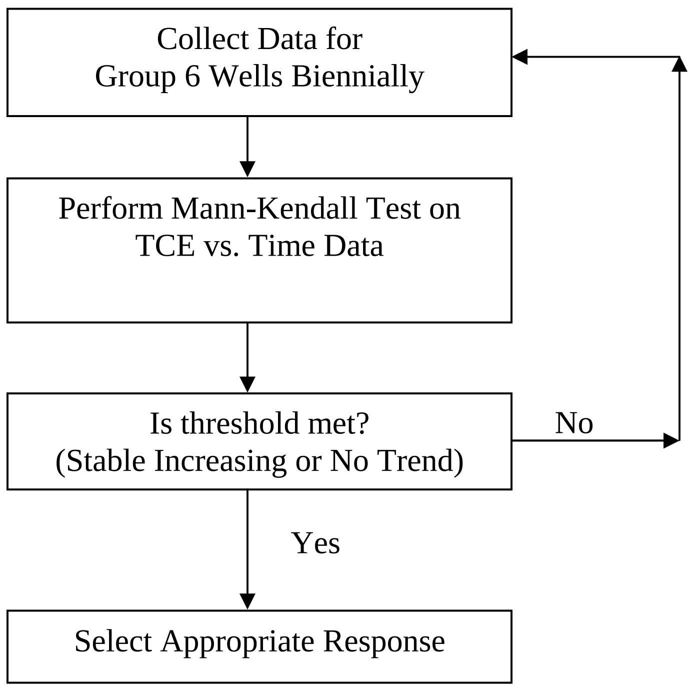
**Possible Long-Term Responses**

- 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.

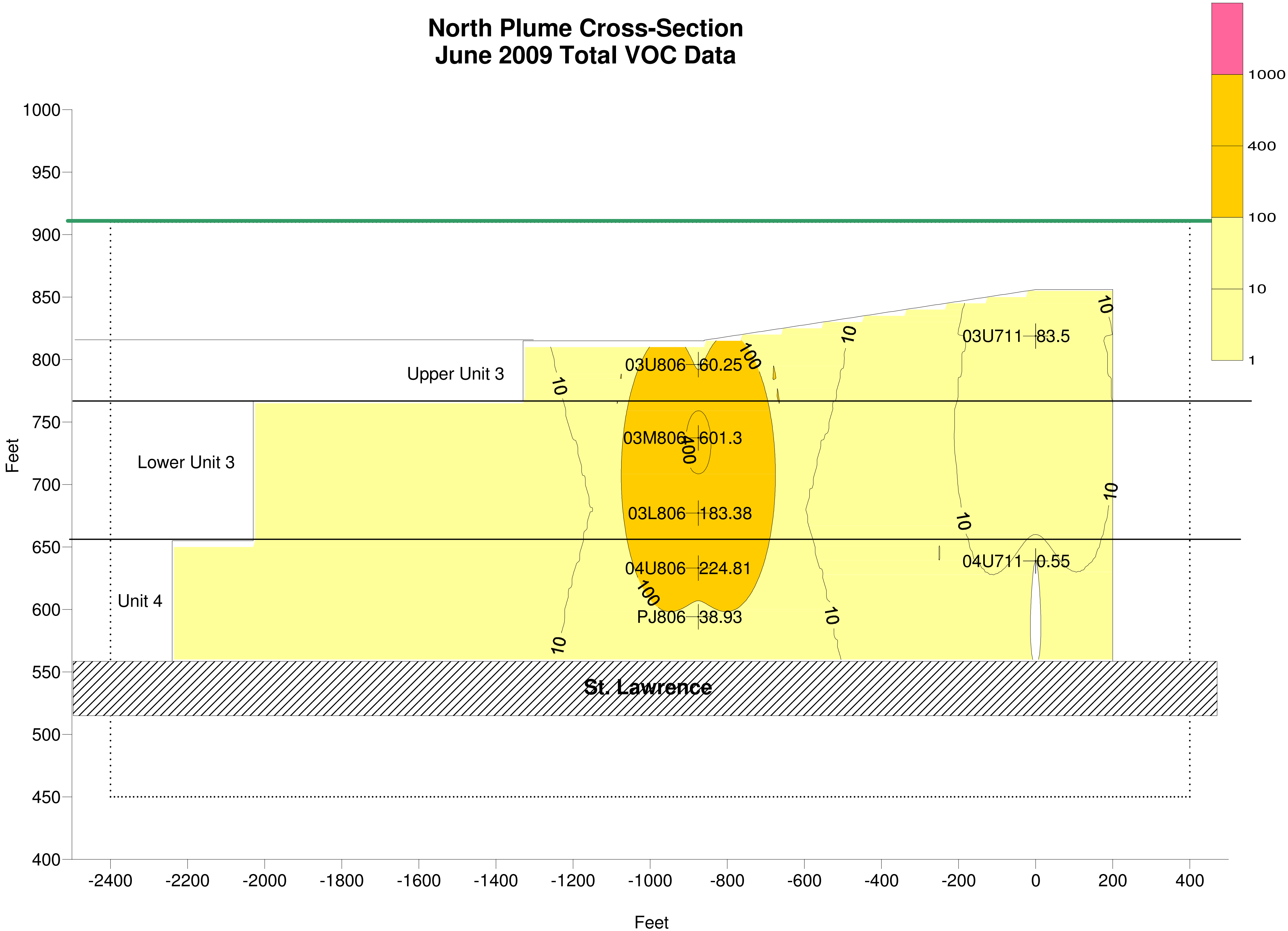
Table D.2.9

Group 6 – Jordan Aquifer, Evaluation Process



## D.2.2 Group 1 Kriging Evaluation

2009


North Plume Cross-Section
June 2009 Total VOC Data
1000
400
100
10
1
Feet
Upper Unit 3
Lower Unit 3
Unit 4
03U806 60.25
03M806 601.3
03L806 183.38
04U806 224.81
PJ806 38.93
03U711 83.5
04U711 0.55
St. Lawrence
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
Feet

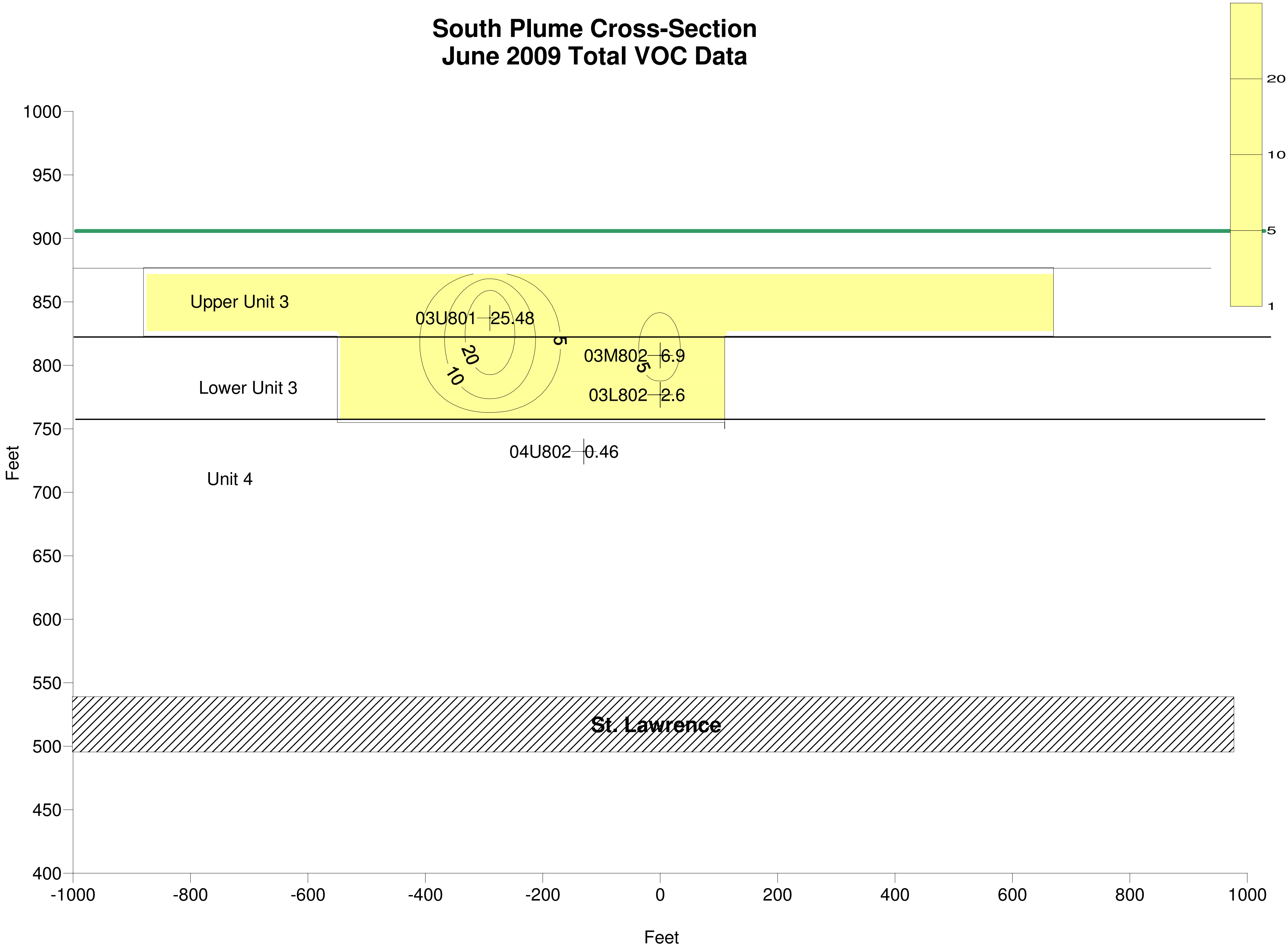

South Plume Cross-Section
June 2009 Total VOC Data
1000
950
900
850
800
750
700
650
600
550
500
450
400
Feet
-1000
-800
-600
-400
-200
0
200
400
600
800
1000
Feet
20
10
5
1
Upper Unit 3
Lower Unit 3
Unit 4
03U801
25.48
03M802
6.9
03L802
2.6
04U802
0.46
20
10
5
5
St. Lawrence

**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 | 6/11/09 | ND | ND | ND | ND | ND | ND | 2.60 | 2.6 |
| 03M802 | 6/11/09 | ND | ND | ND | ND | 0.20 | ND | 6.70 | 6.9 |
| 03U801 | 6/15/09 | ND | ND | ND | ND | 0.48 | ND | 25.00 | 25.48 |
| 04U802 | 6/11/09 | ND | ND | ND | ND | ND | ND | 0.46 | 0.46 |
| 03L806 | 6/9/09 | 1.9 | 20 | 19 | ND | 2.1 | 0.38 | 140 | 183.38 |
| 03M806 | 6/9/09 | ND | 76 | 31 | ND | 4.3 | ND | 490 | 601.3 |
| 03U711 | 6/11/09 | 7.5 | 2.6 | 3.1 | ND | 1.3 | 1 | 68 | 83.5 |
| 03U806 | 6/9/09 | ND | 1.6 | 1.3 | ND | 0.35 | 1 | 56 | 60.25 |
| 04U711 | 6/11/09 | ND | ND | ND | ND | ND | ND | 0.55 | 0.55 |
| 04U806 | 6/9/09 | 2.3 | 23 | 17 | ND | 2.1 | 0.41 | 180 | 224.81 |
| PJ#806 | 6/9/09 | 0.57 | 2.3 | 1.8 | ND | 0.26 | ND | 34 | 38.93 |

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
# June 2009

| Concentration | Positive Planar Area ($ft^2$) |
|---|---|
| Plume to 1 | 570858 |
| Plume to 5 | 276164 |
| Plume to 10 | 250375 |
| Plume to 50 | 138208 |
| Plume to 100 | 73688 |
| Plume to 200 | 24793 |
| Plume to 300 | 7843 |
| Plume to 400 | 2632 |
| Plume to 500 | 554 |
| Plume to 600 | 0 |
| Plume to 700 | 0 |

| TCE (µg/L) | Avg TCE (µg/L) | Area ($ft^2$) | Areal Conc (µg*$ft^2$/L) |
|---|---|---|---|
| **1 to 5** | 3 | 294694 | 884081 |
| **5 to 10** | 7.5 | 25790 | 193422 |
| **10 to 50** | 30 | 112166 | 3364990 |
| **50 to 100** | 75 | 64521 | 4839056 |
| **100 to 200** | 150 | 48895 | 7334199 |
| **200 to 300** | 250 | 16950 | 4237511 |
| **300 to 400** | 350 | 5211 | 1823760 |
| **400 to 500** | 450 | 2078 | 935189 |
| **500 to 600** | 550 | 554 | 304744 |
| **600 to 700** | 650 | 0 | 0 |
| | **Sum** | 570858 | 23916952 |

| **Area Wtd Conc** | 42 | µg/L |
|---|---|---|

## South Plume
## Total VOC Concentration Calculations
## Vertical Cross-Section
## Contouring and Blanking
## June 2009

| Concentration | Positive Planar Area (ft$^2$) |
|---|---|
| Plume to 1 | 115236 |
| Plume to 5 | 16189 |
| Plume to 10 | 5725 |
| Plume to 25 | 2 |
| Plume to 50 | 0 |

| Total VOCs (µg/L) | Avg Total VOCs (µg/L) | Area (ft$^2$) | Areal Conc (µg*ft$^2$/L) |
|---|---|---|---|
| **1 to 5** | 3 | 99047 | 297142 |
| **5 to 10** | 7.5 | 10464 | 78477 |
| **10 to 25** | 17.5 | 5723 | 100160 |
| **25 to 50** | 37.5 | 2 | 72 |
| | **Sum** | 115236 | 475851 |

| **Area Wtd Conc** | 4 | µg/L |
|---|---|---|

## D.2.3 Group 1, 2, 3, 5, and 6 Mann-Kendall Evaluations

Summary Table

**Group 1, 2, 3, and 5 Mann-Kendall Summary and MAROS Conclusion**

| Group | Kendall S | N | Raw Trend | Confidence | COV | Raw Trend Decision | MAROS Conclusion | Threshold Triggered? | Comments |
|---|---|---|---|---|---|---|---|---|---|
| **Group 2 Wells:** | | | | | | | | | |
| 409549 | 11 | 6 | Increasing | 97.00% | 0.5538 | Definite | **Increasing** | Yes | Incr. from 5 to 29 µg/L in 6yrs. |
| 409557 | 7 | 6 | Increasing | 86.00% | 0.6211 | S or NT | **No Trend** | Yes | near plume center, plume shifted slightly |
| 03L673 | 2 | 6 | Increasing | 57.00% | 0.7102 | S or NT | **No Trend** | Yes | see OU3 Discussion |
| 03L833 | -15 | 6 | Decreasing | 99.00% | 0.7521 | Definite | **Decreasing** | No | |
| 03L848 | -1 | 6 | Decreasing | 50.00% | 0.2741 | S or NT | **Stable** | No | |
| 03L859 | 3 | 6 | Increasing | 64.00% | 0.3536 | S or NT | **No Trend** | Yes | see OU3 Discussion |
| 03U672 | -3 | 6 | Decreasing | 64.00% | 2.4495 | S or NT | **No Trend** | Yes | see OU3 Discussion |
| 03U805 | -1 | 6 | Decreasing | 50.00% | 0.4541 | S or NT | **Stable** | No | |
| 04U673 | 3 | 6 | Increasing | 64.00% | 0.5935 | S or NT | **No Trend** | Yes | see OU3 Discussion |
| 04U821 | -7 | 6 | Decreasing | 86.00% | 1.0583 | S or NT | **No Trend** | Yes | In center of plume, stable since large decrease in '92 |
| 04U832 | 9 | 6 | Increasing | 93.00% | 0.7360 | Probable | **Increasing** | Yes | stable over long term |
| 04U833 | -13 | 6 | Decreasing | 99.00% | 1.2295 | Definite | **Decreasing** | No | |
| 04U841 | -2 | 6 | Decreasing | 57.00% | 0.4911 | S or NT | **Stable** | No | |
| 04U843 | 11 | 6 | Increasing | 97.00% | 0.7463 | Definite | **Increasing** | Yes | near plume center, plume shifted slightly |
| 04U845 | -3 | 6 | Decreasing | 64.00% | 0.8577 | S or NT | **Stable** | No | |
| 04U846 | 9 | 6 | Increasing | 93.00% | 1.0723 | Probable | **Increasing** | Yes | near plume center, looks stable |
| 04U849 | | | | | | | | | see Group 6 summary below |
| 04U854 | -14 | 6 | Decreasing | 99.00% | 0.4250 | Definite | **Decreasing** | No | |
| 04U859 | -3 | 6 | Decreasing | 64.00% | 0.6926 | S or NT | **Stable** | No | |
| 04U861 (abandoned) | 11 | 6 | Increasing | 97.00% | 1.0262 | Definite | **Increasing** | Yes | Abandoned after 2006 sample,in New Brighton Development |
| 04U875 | -15 | 6 | Decreasing | 99.00% | 0.8348 | Definite | **Decreasing** | No | |
| 04U877 | -11 | 6 | Decreasing | 97.00% | 0.5491 | Definite | **Decreasing** | No | |
| 206688 | -4 | 6 | Decreasing | 70.00% | 0.0704 | S or NT | **Stable** | No | |
| **Group 5** | -11 | 6 | Decreasing | 97.00% | 0.1267 | Definite | **Decreasing** | No | |
| **Group 3** | -14 | 6 | Decreasing | 99.00% | 0.4450 | Definite | **Decreasing** | No | |
| **Group 1 NP** | -9 | 6 | Decreasing | 93.00% | 0.3774 | Probable | **Decreasing** | No | |
| **Group 1 SP** | -8 | 6 | Decreasing | 89.00% | 0.1107 | S or NT | **Stable** | Yes | Stable for 6yrs, but avg. is <5 µg/L |

**Notes:**
S or NT = Stable or No Trend
N = Number of data points
COV = Coefficient of Variance
Threshold Criteria defined in Table D.2.8

**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 |

**Group 6 Mann-Kendall Summary and MAROS Conclusion**

| Group | Kendall S | N | Raw Trend | Confidence | COV | Raw Trend Decision | MAROS Conclusion | Threshold Triggered? | Comments |
|---|---|---|---|---|---|---|---|---|---|
| **Group 6 OU1 Jordan Wells:** | | | | | | | | | |
| 04J822 | -7 | 6 | Decreasing | 86.00% | 0.1824 | S or NT | **Stable** | Yes | Mean 75 µg/L, decr. last 3 years |
| 04J834 | 3 | 6 | Increasing | 64.00% | 0.5461 | S or NT | **No Trend** | Yes | All detection below 0.5 µg/L |
| 04J836 | 3 | 6 | Increasing | 64.00% | 0.7297 | S or NT | **No Trend** | Yes | All detection below 5 µg/L |
| 04J838 | 3 | 6 | Increasing | 64.00% | 0.5857 | S or NT | **Stable** | Yes | 4.2-46 µg/L |
| 04J837 | -9 | 6 | Decreasing | 93.00% | 0.9224 | Probable | **Decreasing** | No | |
| 04J839 | 9 | 6 | Increasing | 93.00% | 0.7800 | Probable | **Increasing** | Yes | All detections below 5 µg/L |
| 04J847 | -6 | 6 | Decreasing | 81.00% | 0.1113 | S or NT | **Stable** | Yes | Consistent reuslts, mean 816 µg/L |
| 04J849 | 1 | 6 | Increasing | 50.00% | 1.5543 | S or NT | **No Trend** | Yes | All detection below 0.5 µg/L |
| 04J882 | 0 | 6 | Zero | 43.00% | NA | S or NT | **NA** | No | All ND |
| 04J077 | -10 | 6 | Decreasing | 95.10% | 0.8406 | Definite | **Decreasing** | No | |
| 04J702 | -14 | 6 | Decreasing | 99.00% | 0.9269 | Definite | **Decreasing** | No | |
| 04J708 | -6 | 6 | Decreasing | 76.00% | 0.2302 | S or NT | **Stable** | Yes | Last 5 rounds below 5 µg/L |
| 04J713 | -12 | 6 | Decreasing | 99.00% | 1.8489 | Definite | **Decreasing** | No | All detection below 5 µg/L, currently ND |
| **Group 6 Nested Unit 4 wells:** | | | | | | | | | |
| 04U077 | -11 | 6 | Decreasing | 97.00% | 0.4179 | Definite | **Decreasing** | No | |
| 04U702 | -9 | 6 | Decreasing | 93.00% | 1.1403 | Probable | **Decreasing** | No | |
| 04U708 | -6 | 6 | Decreasing | 81.00% | 0.2457 | S or NT | **Stable** | Yes | Abandoned after 2006 sample for New Brighton Development |
| 04U713 | -11 | 6 | Decreasing | 76.50% | 0.6245 | S or NT | **Stable** | Yes | Stable but well below 5 µg/L |
| 04U834 | -15 | 6 | Decreasing | 99.00% | 1.3927 | Definite | **Decreasing** | No | |
| 04U836 | 9 | 6 | Increasing | 93.00% | 0.7102 | Probable | **Increasing** | Yes | Increased from 11 µg/L in '01 to 79 µg/L in '09 |
| 04U837 | -3 | 6 | Decreasing | 64.00% | 0.9649 | S or NT | **Stable** | Yes | 2.2-19 µg/L |
| 04U838 | 1 | 6 | Increasing | 50.00% | 1.3800 | S or NT | **No Trend** | Yes | 1.2 - 48 µg/L |
| 04U839 | 0 | 6 | Zero | 50.00% | 0.4791 | S or NT | **Stable** | Yes | Stable but well below 5 µg/L |
| 04U847 | -4 | 6 | Decreasing | 70.00% | 0.2895 | S or NT | **Stable** | Yes | Mean 938 µg/L |
| 04U849 | -5 | 6 | Decreasing | 76.50% | 0.2555 | S or NT | **Stable** | Yes | no evidence of migration to Jordan (04J849) |
| 04U882 | 7 | 6 | Increasing | 86.00% | 0.5874 | S or NT | **Stable** | 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

**MAROS Decision Matrix**

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

## Group 5 Unit 3 Mann-Kendall Summary and MAROS Conclusion

| Group | Kendall S | N | Raw Trend | Confidence | COV | Raw Trend Decision | MAROS Conclusion | Threshold Triggered? | Comments |
|---|---|---|---|---|---|---|---|---|---|
| **Group 5 Unit 3 Wells:** | | | | | | | | | |
| 409550 | -15 | 6 | Decreasing | 99.00% | 1.0090 | Definite | **Decreasing** | No | |
| 409597 | -11 | 6 | Decreasing | 99.00% | 0.3885 | Definite | **NA** | NA | Abandoned for constr. after 2007 sampling |
| 409596 | -8 | 6 | Decreasing | 90.10% | 0.6714 | Probable | **NA** | NA | Abandoned for constr. after 2007 sampling |
| 03U831 | 9 | 6 | Increasing | 93.20% | 1.5885 | Probable | **NA** | NA | Abandoned in 2006 for construction |
| 03U821 | -14 | 6 | Decreasing | 99.60% | 0.5997 | Definite | **Decreasing** | No | |
| 03U822 | -3 | 6 | Decreasing | 64.00% | 0.4360 | S or NT | **Stable** | Yes | Appears to have peaked in 2001, decr. since |
| 03L822 | -15 | 6 | Decreasing | 99.00% | 0.4064 | Definite | **Decreasing** | No | |
| 03L809 | -5 | 6 | Decreasing | 76.50% | 0.5413 | S or NT | **Stable** | Yes | Decreasing since peak in 2001 |

Notes:
S or NT = Stable or No Trend
N = Number of data points
COV = Coefficient of Variance

**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**

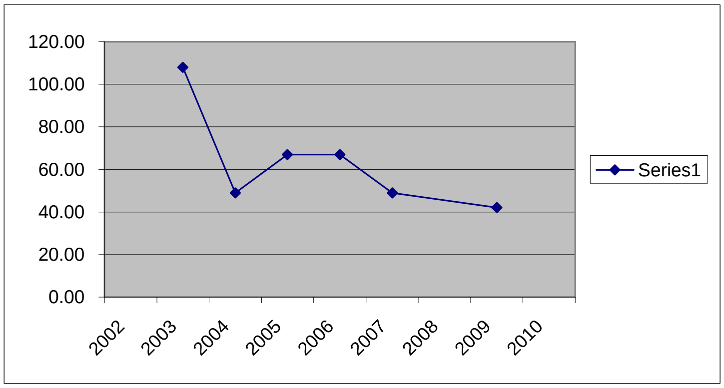
| Date | TVOC (µg/L) | Mann-Kendall Calculation: | | | | | |
|---|---|---|---|---|---|---|---|
| 6/18/2003 | 108.00 | 1 | | | | | |
| 6/18/2004 | 49.00 | 1 | -1 | | | | |
| 6/18/2005 | 67.00 | 1 | -1 | 1 | | | |
| 6/8/2006 | 67.00 | 1 | -1 | 1 | 0 | | |
| 6/11/2007 | 49.00 | 1 | -1 | 0 | -1 | -1 | |
| 6/11/2009 | 42.00 | 1 | -1 | -1 | -1 | -1 | -1 |

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

Mean 63.67
STNDEV 24.03054
COV 0.377443

Trend: Negative

Confidence (lookup) 93.00%




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:** **Group 1 SP**

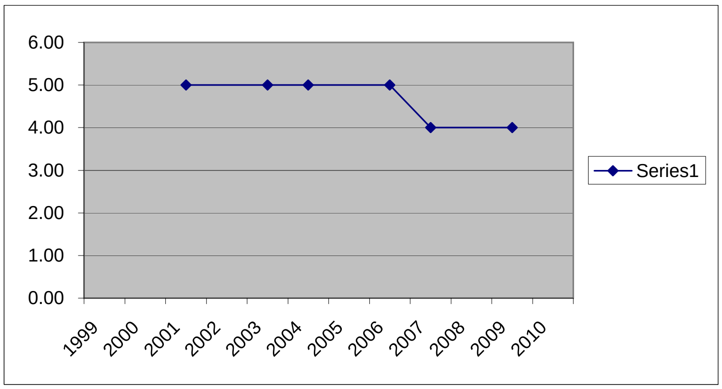
| Date | TVOC (µg/L) | Mann-Kendall Calculation: | | | | | |
|---|---|---|---|---|---|---|---|
| 6/18/2001 | 5.00 | 1 | | | | | |
| 6/18/2003 | 5.00 | 1 | 0 | | | | |
| 6/18/2004 | 5.00 | 1 | 0 | 0 | | | |
| 6/8/2006 | 5.00 | 1 | 0 | 0 | 0 | | |
| 6/11/2007 | 4.00 | 1 | -1 | -1 | -1 | -1 | |
| 6/11/2009 | 4.00 | 1 | -1 | -1 | -1 | -1 | 0 |

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

Mean 4.67
STNDEV 0.516398
COV 0.110657

Trend: Negative

Confidence (lookup) 89.00%




S -8

tau -0.533333

**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**

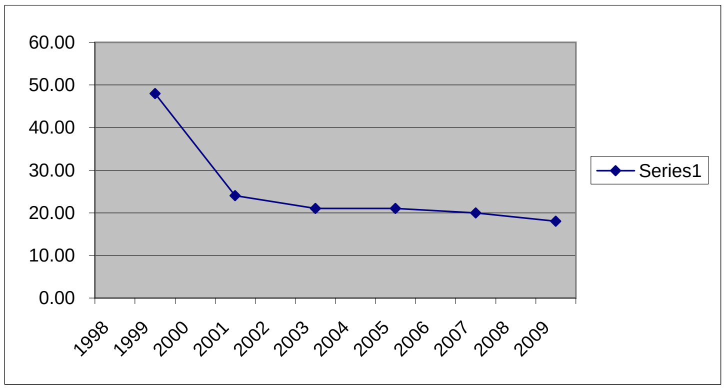
| Date | TVOC (µg/L) | Mann-Kendall Calculation: | | | | | |
|---|---|---|---|---|---|---|---|
| 6/18/1999 | 48.00 | 1 | | | | | |
| 6/18/2001 | 24.00 | 1 | -1 | | | | |
| 6/18/2003 | 21.00 | 1 | -1 | -1 | | | |
| 6/18/2005 | 21.00 | 1 | -1 | -1 | 0 | | |
| 6/11/2007 | 20.00 | 1 | -1 | -1 | -1 | -1 | |
| 6/11/2009 | 18.00 | 1 | -1 | -1 | -1 | -1 | -1 |

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

| | |
|---|---|
| Mean | 25.33 |
| STNDEV | 11.27239 |
| COV | 0.444963 |

Trend: Negative

Confidence (lookup) 99.00%




S -14

tau -0.933333

**Decision Matrix**

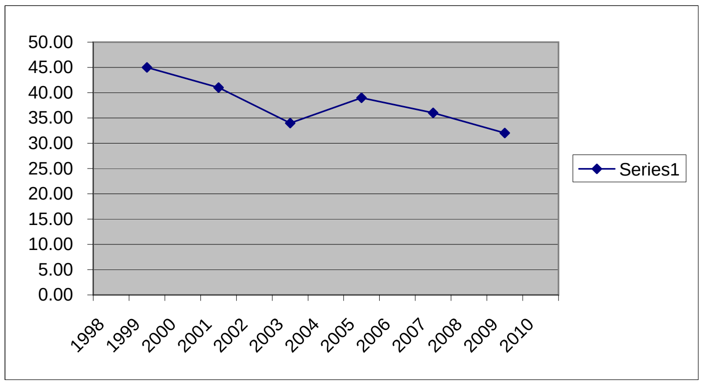
| M-K S | Confidence | COV | Trend |
|---|---|---|---|
| S > 0 | > 95% | na | Increasing |
| S > 0 | 90-95% | na | Pr. Incr. |
| S > 0 | < 90% | na | No Trend |
| S</= 0 | < 90% | >/= 1 | No Trend |
| S </= 0 | < 90% | < 1 | Stable |
| S < 0 | 90-95% | na | Pr. Decr. |
| S < 0 | >95% | na | Decreasing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

**Well:** **Group 5**

| Date | TVOC (µg/L) | Mann-Kendall Calculation: | | | | | |
|---|---|---|---|---|---|---|---|
| 6/18/1999 | 45.00 | 1 | | | | | |
| 6/18/2001 | 41.00 | 1 | -1 | | | | |
| 6/18/2003 | 34.00 | 1 | -1 | -1 | | | |
| 6/18/2005 | 39.00 | 1 | -1 | -1 | 1 | | |
| 6/18/2007 | 36.00 | 1 | -1 | -1 | 1 | -1 | |
| 6/18/2009 | 32.00 | 1 | -1 | -1 | -1 | -1 | -1 |

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

| | |
|---|---|
| Mean | 37.83 |
| STNDEV | 4.792355 |
| COV | 0.12667 |
| Trend: | Negative |
| Confidence (lookup) | 97.00% |




| | |
|---|---|
| S | -11 |
| tau | -0.73333 |

**Decision Matrix**

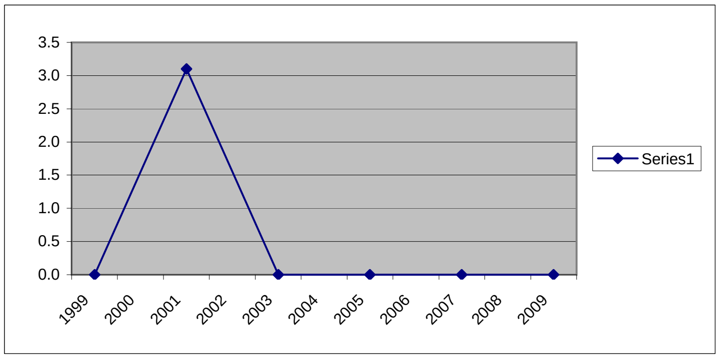
| M-K S | Confidence | COV | Trend |
|---|---|---|---|
| S > 0 | > 95% | na | Increasing |
| S > 0 | 90-95% | na | Pr. Incr. |
| S > 0 | < 90% | na | No Trend |
| S</= 0 | < 90% | >/= 1 | No Trend |
| S </= 0 | < 90% | < 1 | Stable |
| S < 0 | 90-95% | na | Pr. Decr. |
| S < 0 | >95% | na | Decreasing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

**Well: 03U672**

| Date | TCE (µg/L) | Mann-Kendall Calculation: | | | | | |
|---|---|---|---|---|---|---|---|
| 6/24/1999 | 0.0 | 1 | | | | | |
| 6/18/2001 | 3.1 | 1 | 1 | | | | |
| 6/1/2003 | 0.0 | 1 | 0 | -1 | | | |
| 6/17/2005 | 0.0 | 1 | 0 | -1 | 0 | | |
| 6/18/2007 | 0.0 | 1 | 0 | -1 | 0 | 0 | |
| 6/15/2009 | 0.0 | 1 | 0 | -1 | 0 | 0 | 0 |

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

| | |
|---|---|
| Mean | 0.52 |
| STNDEV | 1.2655697 |
| COV | 2.44948974 |
| Trend: | Negative |
| Confidence (lookup) | 64.0% |



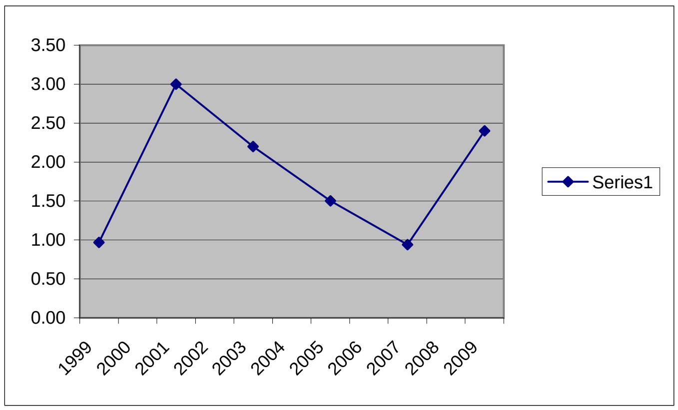

| | |
|---|---|
| S | -3 |
| tau | -0.2 |

**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: 03U805**

| Date | TCE (µg/L) | Mann-Kendall Calculation: | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 6/29/1999 | 0.97 | 1 | | | | | | |
| 6/15/2001 | 3.00 | 1 | 1 | | | | | |
| 6/1/2003 | 2.20 | 1 | 1 | -1 | | | | |
| 6/15/2005 | 1.50 | 1 | 1 | -1 | -1 | | | |
| 6/20/2007 | 0.94 | 1 | -1 | -1 | -1 | -1 | | |
| 6/15/2009 | 2.40 | 1 | 1 | -1 | 1 | 1 | 1 | |
| N | | 6 | 5 | 4 | 3 | 2 | 1 | 15 |
| | sum | | 3 | -4 | -1 | 0 | 1 | -1 |
| Possibles | | 15 | | | | | | |




| | |
|---|---|
| Mean | 1.84 |
| STNDEV | 0.8332047 |
| COV | 0.4540625 |
| Trend: | Negative |
| Confidence (lookup) | 50.00% |

| | |
|---|---|
| S | -1 |
| tau | -0.06667 |

**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**

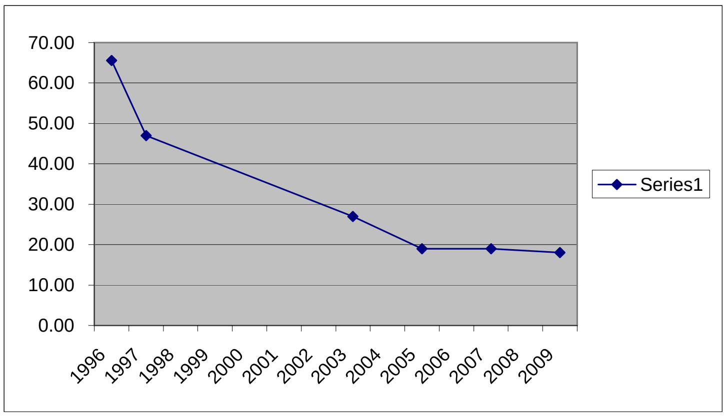
| Date | TCE (µg/L) | Mann-Kendall Calculation: | | | | | |
|---|---|---|---|---|---|---|---|
| 6/18/1996 | 65.60 | 1 | | | | | |
| 6/26/1997 | 47.00 | 1 | -1 | | | | |
| 6/16/2003 | 27.00 | 1 | -1 | -1 | | | |
| 6/10/2005 | 19.00 | 1 | -1 | -1 | -1 | | |
| 6/13/2007 | 19.00 | 1 | -1 | -1 | -1 | 0 | |
| 6/11/2009 | 18.00 | 1 | -1 | -1 | -1 | -1 | -1 |

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

| | |
|---|---|
| Mean | 32.60 |
| STNDEV | 19.54891 |
| COV | 0.59966 |

Trend: Negative

Confidence (lookup) 99.60%




| | |
|---|---|
| S | -14 |
| tau | -0.933333 |

**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**

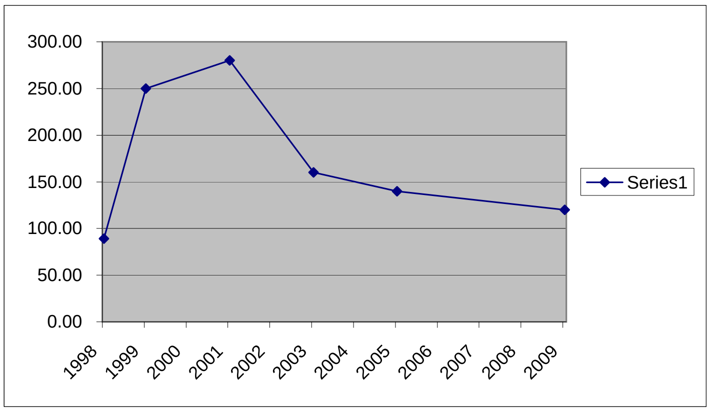
| Date | TCE (µg/L) | Mann-Kendall Calculation: | | | | | |
|---|---|---|---|---|---|---|---|
| 6/22/1998 | 89.00 | 1 | | | | | |
| 6/16/1999 | 250.00 | 1 | 1 | | | | |
| 6/25/2001 | 280.00 | 1 | 1 | 1 | | | |
| 6/16/2003 | 160.00 | 1 | 1 | -1 | -1 | | |
| 6/10/2005 | 140.00 | 1 | 1 | -1 | -1 | -1 | |
| 6/17/09 | 120.00 | 1 | 1 | -1 | -1 | -1 | -1 |

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

Mean 173.17
STNDEV 75.49945
COV 0.435993

Trend: Negative

Confidence (lookup) 64.00%




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:** **03U831**

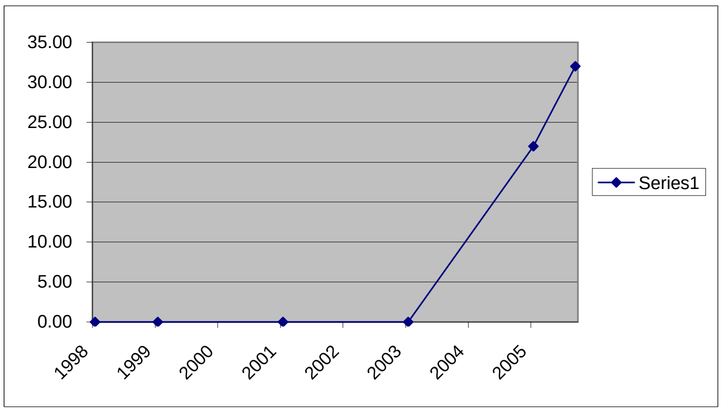
| Date | TCE (µg/L) | Mann-Kendall Calculation: | | | | | |
|---|---|---|---|---|---|---|---|
| 6/23/1998 | 0.00 | 1 | | | | | |
| 6/15/1999 | 0.00 | 1 | 0 | | | | |
| 6/15/2001 | 0.00 | 1 | 0 | 0 | | | |
| 6/9/2003 | 0.00 | 1 | 0 | 0 | 0 | | |
| 6/7/2005 | 22.00 | 1 | 1 | 1 | 1 | 1 | |
| 2/1/2006 |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

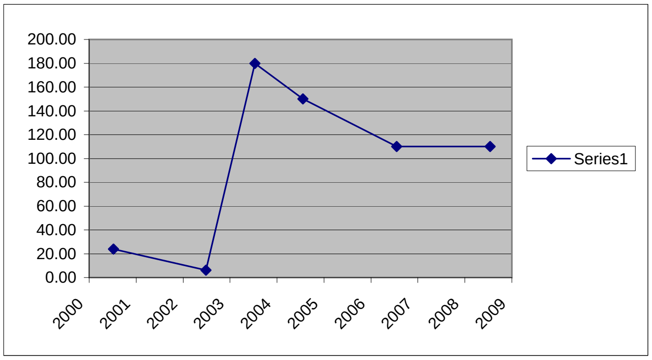
| Date | TCE (µg/L) | Mann-Kendall Calculation: | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 6/12/2001 | 24.00 | 1 | | | | | | |
| 6/1/2003 | 6.30 | 1 | -1 | | | | | |
| 6/15/2004 | 180.00 | 1 | 1 | 1 | | | | |
| 6/22/2005 | 150.00 | 1 | 1 | 1 | -1 | | | |
| 6/21/2007 | 110.00 | 1 | 1 | 1 | -1 | -1 | | |
| 6/18/2009 | 110.00 | 1 | 1 | 1 | -1 | -1 | 0 | |

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

Mean 96.72
STNDEV 68.689167
COV 0.7102102

Trend: Positive

Confidence (lookup) 57.0%




S 2

tau 0.133333

**Decision Matrix**

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

**Well:** **03L809**

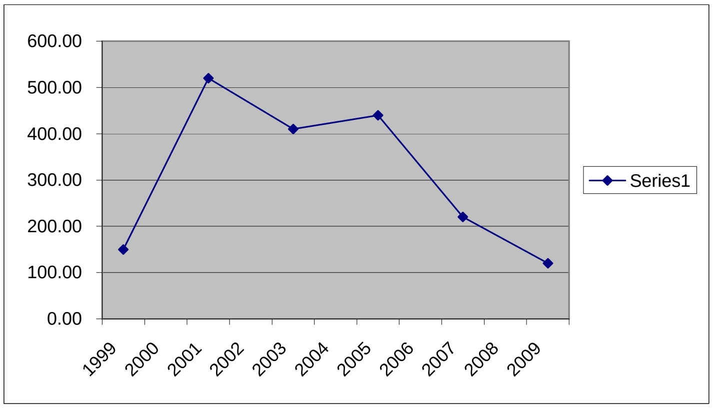
| Date | TCE (µg/L) | Mann-Kendall Calculation: | | | | | |
|---|---|---|---|---|---|---|---|
| 6/29/1999 | 150.00 | 1 | | | | | |
| 6/18/2001 | 520.00 | 1 | 1 | | | | |
| 6/19/2003 | 410.00 | 1 | 1 | -1 | | | |
| 6/9/2005 | 440.00 | 1 | 1 | -1 | 1 | | |
| 6/20/2007 | 220.00 | 1 | 1 | -1 | -1 | -1 | |
| 6/12/2009 | 120.00 | 1 | -1 | -1 | -1 | -1 | -1 |

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

Mean 310.00
STNDEV 167.8094
COV 0.541321

Trend: Negative

Confidence (lookup) 76.50%




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:** **03L822**

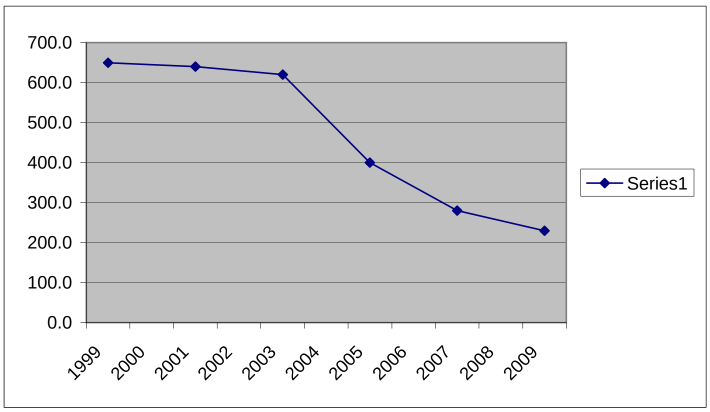
| Date | TCE (µg/L) | Mann-Kendall Calculation: | | | | | |
|---|---|---|---|---|---|---|---|
| 6/9/1999 | 650.0 | 1 | | | | | |
| 6/25/2001 | 640.0 | 1 | -1 | | | | |
| 6/16/2003 | 620.0 | 1 | -1 | -1 | | | |
| 6/14/2005 | 400.0 | 1 | -1 | -1 | -1 | | |
| 6/15/2007 | 280.0 | 1 | -1 | -1 | -1 | -1 | |
| 6/17/2009 | 230.0 | 1 | -1 | -1 | -1 | -1 | -1 |

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

Mean 470.00
STNDEV 190.9974
COV 0.406377

Trend: Negative

Confidence (lookup) 99.00%




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:** **03L848**

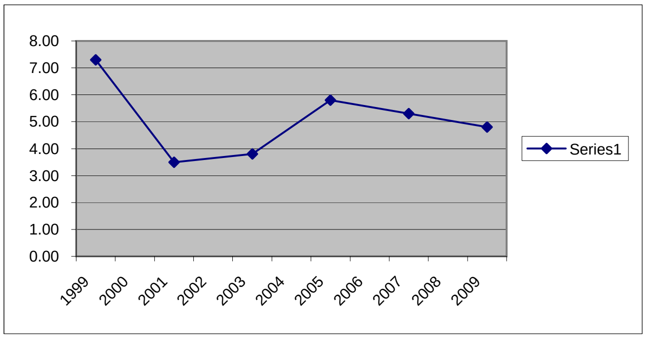
| Date | TCE (µg/L) | Mann-Kendall Calculation: | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 6/4/1999 | 7.30 | 1 | | | | | | |
| 6/12/2001 | 3.5 | 1 | -1 | | | | | |
| 6/1/2003 | 3.8 | 1 | -1 | 1 | | | | |
| 6/21/2005 | 5.8 | 1 | -1 | 1 | 1 | | | |
| 6/21/2007 | 5.3 | 1 | -1 | 1 | 1 | -1 | | |
| 6/17/2009 | 4.8 | 1 | -1 | 1 | 1 | -1 | -1 | |

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

| | |
|---|---|
| Mean | 5.08 |
| STNDEV | 1.393437 |
| COV | 0.2741188 |

Trend: Negative

Confidence (lookup) 50.0%




S -1

tau -0.06667

**Decision Matrix**

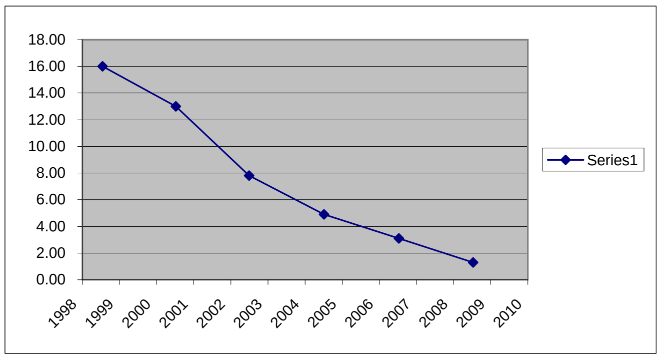
| M-K S | Confidence | COV | Trend |
|---|---|---|---|
| S > 0 | > 95% | na | Increasing |
| S > 0 | 90-95% | na | Prob. Incr. |
| S > 0 | < 90% | na | No Trend |
| S</= 0 | < 90% | >/= 1 | No Trend |
| S </= 0 | < 90% | < 1 | Stable |
| S < 0 | 90-95% | na | Prob Decr. |
| S < 0 | >95% | na | Decreasing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

**Well:** **03L833**

| Date | TCE (µg/L) | Mann-Kendall Calculation: | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 6/22/1999 | 16.00 | 1 | | | | | | |
| 6/13/2001 | 13.00 | 1 | -1 | | | | | 29.70 |
| 6/1/2003 | 7.80 | 1 | -1 | -1 | | | | 20.80 |
| 6/9/2005 | 4.90 | 1 | -1 | -1 | -1 | | | 16.00 |
| 6/14/2007 | 3.10 | 1 | -1 | -1 | -1 | -1 | | 13.00 |
| 6/12/2009 | 1.30 | 1 | -1 | -1 | -1 | -1 | -1 | 7.80 |

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

| | |
|---|---|
| Mean | 7.68 |
| STNDEV | 5.778379 |
| COV | 0.752067 |
| Trend: | Negative |
| Confidence (lookup) | 99.0% |




| | |
|---|---|
| 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: 03L859**

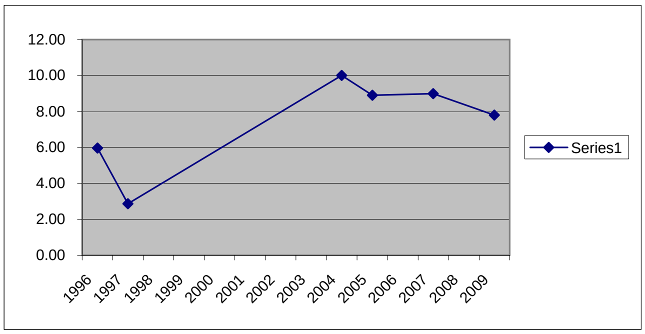
| Date | TCE (µg/L) | Mann-Kendall Calculation: | | | | | |
|---|---|---|---|---|---|---|---|
| 6/3/1996 | 5.96 | 1 | | | | | |
| 6/4/1997 | 2.86 | 1 | -1 | | | | |
| 6/15/2004 | 10.00 | 1 | 1 | 1 | | | |
| 6/22/2005 | 8.90 | 1 | 1 | 1 | -1 | | |
| 6/21/2007 | 9.00 | 1 | 1 | 1 | -1 | 1 | |
| 6/21/2009 | 7.80 | 1 | 1 | 1 | -1 | -1 | -1 |

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

Mean 7.42
STNDEV 2.6234634
COV 0.3535665

Trend: Positive

Confidence (lookup) 64.00%




S 3

tau 0.2

**Decision Matrix**

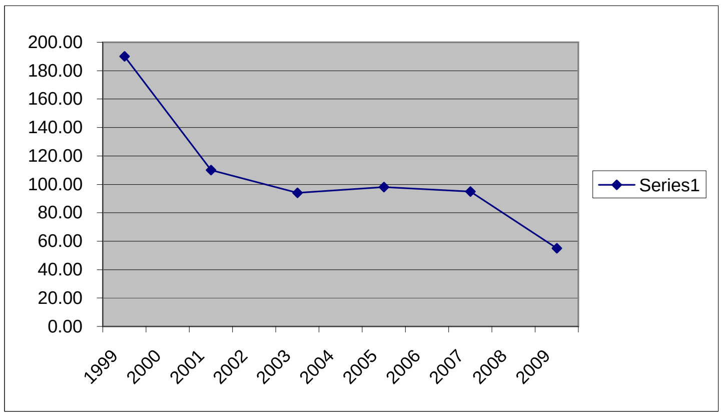
| M-K S | Confidence | COV | Trend |
|---|---|---|---|
| S > 0 | > 95% | na | Increasing |
| S > 0 | 90-95% | na | Prob. Incr. |
| S > 0 | < 90% | na | No Trend |
| S</= 0 | < 90% | >/= 1 | No Trend |
| S </= 0 | < 90% | < 1 | Stable |
| S < 0 | 90-95% | na | Prob Decr. |
| S < 0 | >95% | na | Decreasing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

**Well: 04U077**

| Date | TCE (µg/L) | Mann-Kendall Calculation: | | | | | |
|---|---|---|---|---|---|---|---|
| 6/22/1999 | 190.00 | 1 | | | | | |
| 6/8/2001 | 110.00 | 1 | -1 | | | | |
| 6/13/2003 | 94.00 | 1 | -1 | -1 | | | |
| 6/7/2005 | 98.00 | 1 | -1 | -1 | 1 | | |
| 6/12/2007 | 95.00 | 1 | -1 | -1 | 1 | -1 | |
| 6/9/2009 | 55.00 | 1 | -1 | -1 | -1 | -1 | -1 |

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

| | |
|---|---|
| Mean | 107.00 |
| STNDEV | 44.71241 |
| COV | 0.417873 |
| Trend: | Negative |
| Confidence (lookup) | 97.00% |




| | |
|---|---|
| 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 |

**Well:** **04U673**

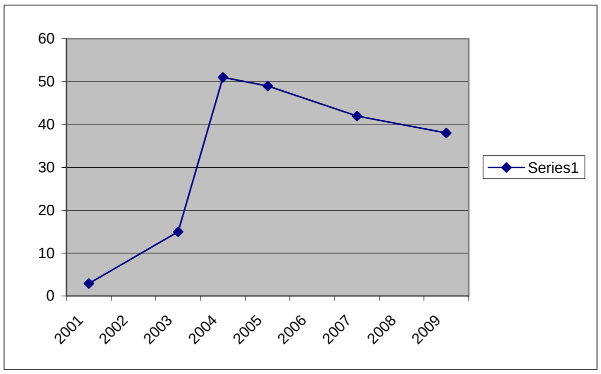
| Date | TCE (µg/L) | Mann-Kendall Calculation: | | | | | |
|---|---|---|---|---|---|---|---|
| 6/12/2001 | 2.9 | 1 | | | | | |
| 6/1/03 | 15 | 1 | 1 | | | | |
| 6/15/2004 | 51 | 1 | 1 | 1 | | | |
| 6/22/2005 | 49 | 1 | 1 | 1 | -1 | | |
| 6/21/2007 | 42 | 1 | 1 | 1 | -1 | -1 | |
| 6/18/2009 | 38 | 1 | 1 | 1 | -1 | -1 | -1 |

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

Mean 32.98
STNDEV 19.575537
COV 0.5934979

Trend: Positive

Confidence (lookup) 64.00%




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: 04U702**

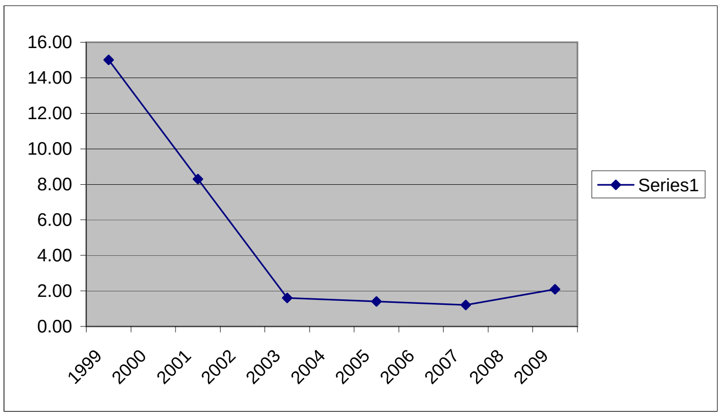
| Date | TCE (µg/L) | Mann-Kendall Calculation: | | | | | |
|---|---|---|---|---|---|---|---|
| 6/21/1999 | 15.00 | 1 | | | | | |
| 6/7/2001 | 8.30 | 1 | -1 | | | | |
| 6/16/2003 | 1.60 | 1 | -1 | -1 | | | |
| 6/8/2005 | 1.40 | 1 | -1 | -1 | -1 | | |
| 6/11/2007 | 1.20 | 1 | -1 | -1 | -1 | -1 | |
| 6/10/2009 | 2.10 | 1 | -1 | -1 | 1 | 1 | 1 |

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

Mean 4.93
STNDEV 5.625537
COV 1.140312

Trend: Negative

Confidence (lookup) 93.00%




S -9

tau -0.6

**Decision Matrix**

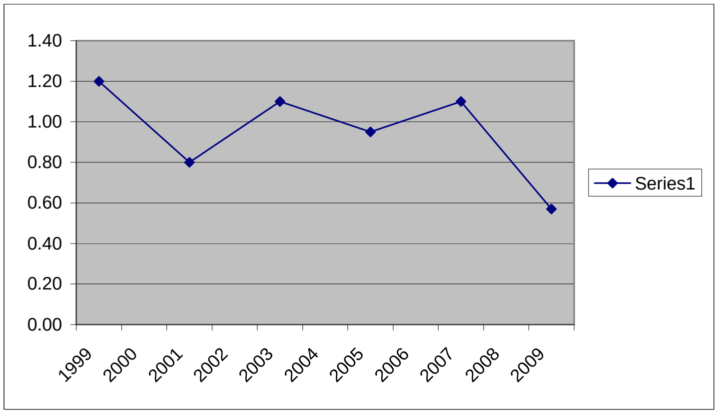
| M-K S | Confidence | COV | Trend |
|---|---|---|---|
| S > 0 | > 95% | na | Increasing |
| S > 0 | 90-95% | na | Pr. Incr. |
| S > 0 | < 90% | na | No Trend |
| S</= 0 | < 90% | >/= 1 | No Trend |
| S </= 0 | < 90% | < 1 | Stable |
| S < 0 | 90-95% | na | Pr. Decr. |
| S < 0 | >95% | na | Decreasing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

**Well:** **04U708**

| Date | TCE (µg/L) | Mann-Kendall Calculation: | | | | | |
|---|---|---|---|---|---|---|---|
| 6/23/1999 | 1.20 | 1 | | | | | |
| 6/7/2001 | 0.80 | 1 | -1 | | | | |
| 6/20/2003 | 1.10 | 1 | -1 | 1 | | | |
| 6/9/2005 | 0.95 | 1 | -1 | 1 | -1 | | |
| 6/11/2007 | 1.10 | 1 | -1 | 1 | 0 | 1 | |
| 6/3/2009 | 0.57 | 1 | -1 | -1 | -1 | -1 | -1 |

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

| | |
|---|---|
| Mean | 0.95 |
| STNDEV | 0.234236 |
| COV | 0.245702 |
| Trend: | Negative |
| Confidence (lookup) | 81.00% |




| | |
|---|---|
| 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: 04U713**

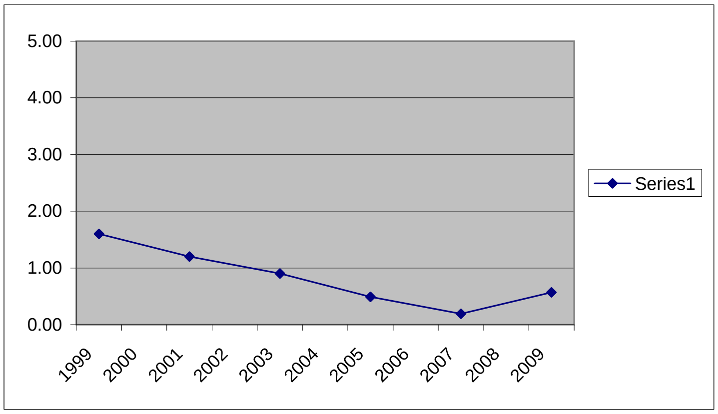
| Date | TCE (µg/L) | Mann-Kendall Calculation: | | | | | |
|---|---|---|---|---|---|---|---|
| 6/22/1999 | 1.60 | 1 | | | | | |
| 6/12/2001 | 1.20 | 1 | -1 | | | | |
| 6/12/2003 | 0.90 | 1 | -1 | -1 | | | |
| 6/9/2005 | 0.49 | 1 | -1 | -1 | -1 | | |
| 6/11/2007 | 0.19 | 1 | -1 | -1 | -1 | -1 | |
| 6/10/2009 | 0.57 | 1 | -1 | -1 | -1 | 1 | 1 |

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

Mean 0.83
STNDEV 0.515238
COV 0.624531

Trend: Negative

Confidence (lookup) 76.50%




S -11

tau -0.73333

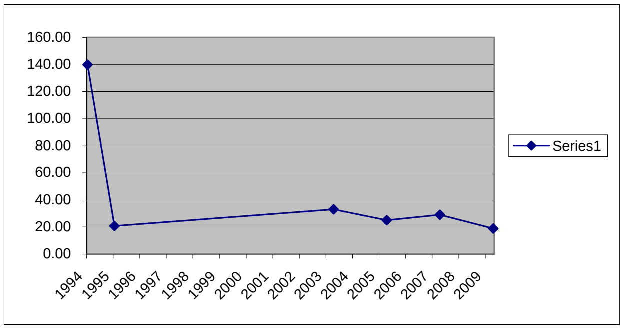
**Decision Matrix**

| 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:** **04U821**

| Date | TCE (µg/L) | Mann-Kendall Calculation: | | | | | |
|---|---|---|---|---|---|---|---|
| 3/18/1994 | 140.00 | 1 | | | | | |
| 3/15/1995 | 20.90 | 1 | -1 | | | | |
| 6/16/2003 | 33.00 | 1 | -1 | 1 | | | |
| 6/13/2005 | 25.00 | 1 | -1 | 1 | -1 | | |
| 6/13/2007 | 29.00 | 1 | -1 | 1 | -1 | 1 | |
| 6/12/2009 | 19.00 | 1 | -1 | -1 | -1 | -1 | -1 |

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




| | |
|---|---|
| Mean | 44.48 |
| STNDEV | 47.074852 |
| COV | 1.0582582 |
| Trend: | Negative |
| Confidence (lookup) | 86.00% |

| | |
|---|---|
| S | -7 |
| tau | -0.46667 |

**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**

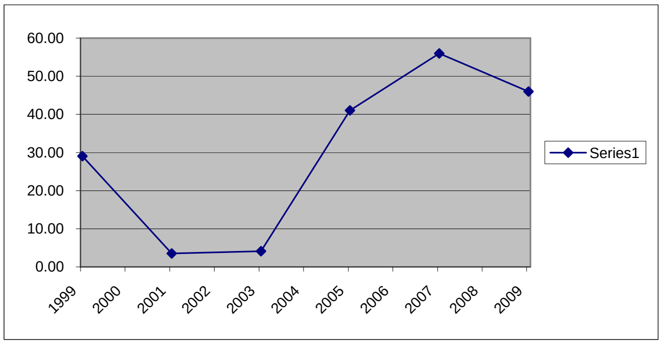
| Date | TCE (µg/L) | Mann-Kendall Calculation: | | | | | |
|---|---|---|---|---|---|---|---|
| 6/7/1999 | 29.00 | 1 | | | | | |
| 6/14/2001 | 3.5 | 1 | -1 | | | | |
| 6/1/2003 | 4.1 | 1 | -1 | 1 | | | |
| 6/23/2005 | 41 | 1 | 1 | 1 | 1 | | |
| 6/22/2007 | 56 | 1 | 1 | 1 | 1 | 1 | |
| 6/19/2009 | 46 | 1 | 1 | 1 | 1 | 1 | -1 |

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

Mean 29.93
STNDEV 22.031947
COV 0.7360338

Trend: Positive

Confidence (lookup) 93.00%




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: 04U833**

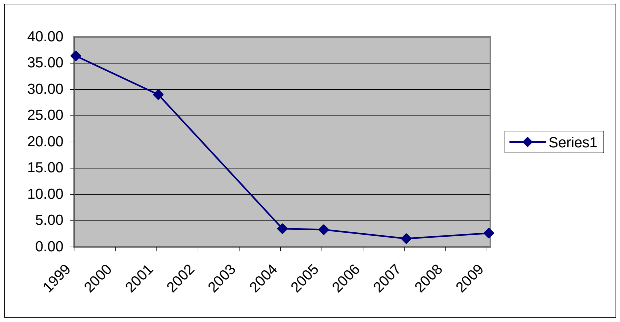
| Date | TCE (µg/L) | Mann-Kendall Calculation: | | | | | |
|---|---|---|---|---|---|---|---|
| 6/7/1999 | 36.40 | 1 | | | | | |
| 6/14/2001 | 29.00 | 1 | -1 | | | | |
| 6/18/2004 | 3.50 | 1 | -1 | -1 | | | |
| 6/9/2005 | 3.30 | 1 | -1 | -1 | -1 | | |
| 6/14/2007 | 1.60 | 1 | -1 | -1 | -1 | -1 | |
| 6/12/2009 | 2.60 | 1 | -1 | -1 | -1 | -1 | 1 |

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

Mean 12.73
STNDEV 15.656266
COV 1.2295497

Trend: Negative

Confidence (lookup) 99.00%




S -13

tau -0.86667

**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**

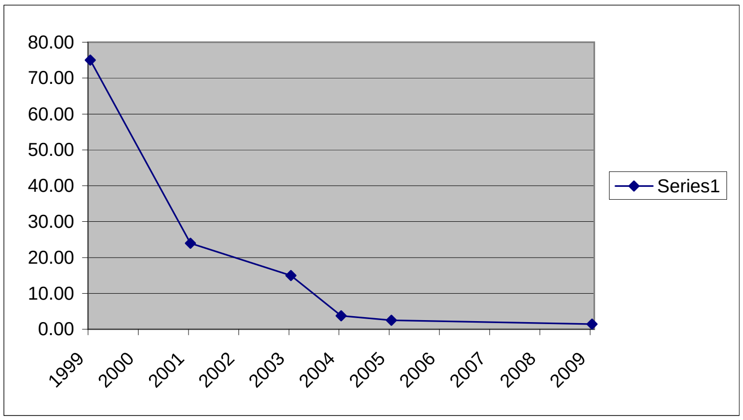
| Date | TCE (µg/L) | Mann-Kendall Calculation: | | | | |
|---|---|---|---|---|---|---|
| 6/29/1999 | 75.00 | 1 | | | | |
| 6/25/2001 | 24.00 | 1 | -1 | | | |
| 6/17/2003 | 15.00 | 1 | -1 | -1 | | |
| 6/24/2004 | 3.70 | 1 | -1 | -1 | -1 | |
| 6/21/2005 | 2.50 | 1 | -1 | -1 | -1 | -1 |
| 6/12/2009 | 1.40 | 1 | -1 | -1 | -1 | -1 | -1 |

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

Mean 20.27
STNDEV 28.22578
COV 1.392719

Trend: Negative

Confidence (lookup) 99.00%




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**

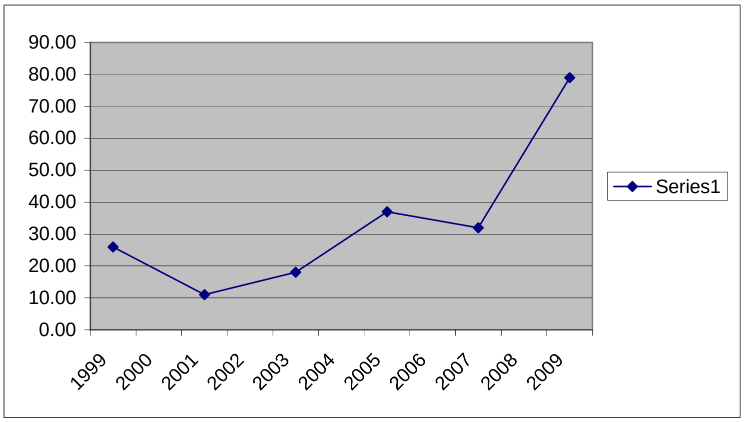
| Date | TCE (µg/L) | Mann-Kendall Calculation: | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 6/16/1999 | 26.00 | 1 | | | | | | |
| 6/20/2001 | 11.00 | 1 | -1 | | | | | |
| 6/10/2003 | 18.00 | 1 | -1 | 1 | | | | |
| 6/21/2005 | 37.00 | 1 | 1 | 1 | 1 | | | |
| 6/15/2007 | 32.00 | 1 | 1 | 1 | 1 | -1 | | 33.83 |
| 6/23/2009 | 79.00 | 1 | 1 | 1 | 1 | 1 | 1 | |

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

Mean 33.83
STNDEV 24.02846
COV 0.710201

Trend: Positive

Confidence (lookup) 93.00%




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:** **04U837**

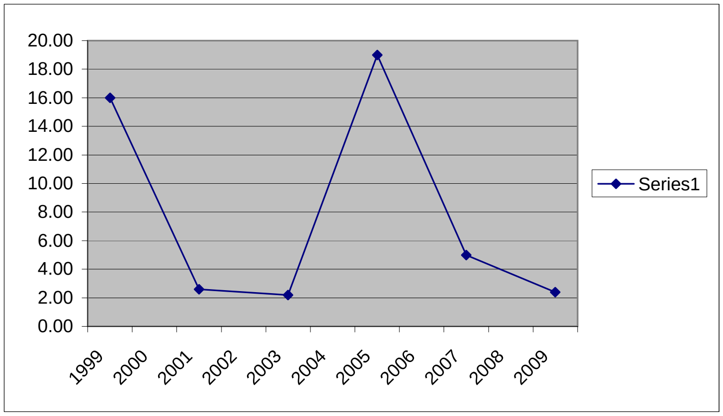
| Date | TCE (µg/L) | Mann-Kendall Calculation: | | | | | |
|---|---|---|---|---|---|---|---|
| 6/10/1999 | 16.00 | 1 | | | | | |
| 6/21/2001 | 2.60 | 1 | -1 | | | | |
| 6/10/2003 | 2.20 | 1 | -1 | -1 | | | |
| 6/15/2005 | 19.00 | 1 | 1 | 1 | 1 | | |
| 6/12/2007 | 5.00 | 1 | -1 | 1 | 1 | -1 | |
| 6/18/2009 | 2.40 | 1 | -1 | -1 | 1 | -1 | -1 |

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

Mean 7.87
STNDEV 7.590169
COV 0.964852

Trend: Negative

Confidence (lookup) 64.00%




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:** **04U838**

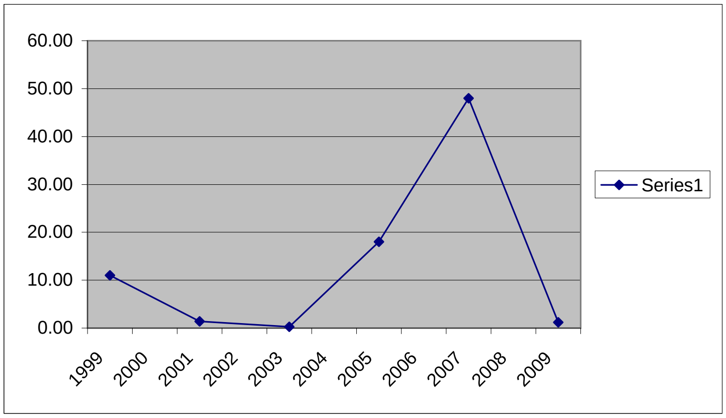
| Date | TCE (µg/L) | Mann-Kendall Calculation: | | | | | |
|---|---|---|---|---|---|---|---|
| 6/10/1999 | 11.00 | 1 | | | | | |
| 6/20/2001 | 1.40 | 1 | -1 | | | | |
| 6/9/2003 | 0.30 | 1 | -1 | -1 | | | |
| 6/7/2005 | 18.00 | 1 | 1 | 1 | 1 | | |
| 6/12/2007 | 48.00 | 1 | 1 | 1 | 1 | 1 | |
| 6/23/2009 | 1.20 | 1 | -1 | -1 | 1 | -1 | -1 |

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

Mean 13.32
STNDEV 18.37655
COV 1.379966

Trend: Positive

Confidence (lookup) 50.00%




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: 04U839**

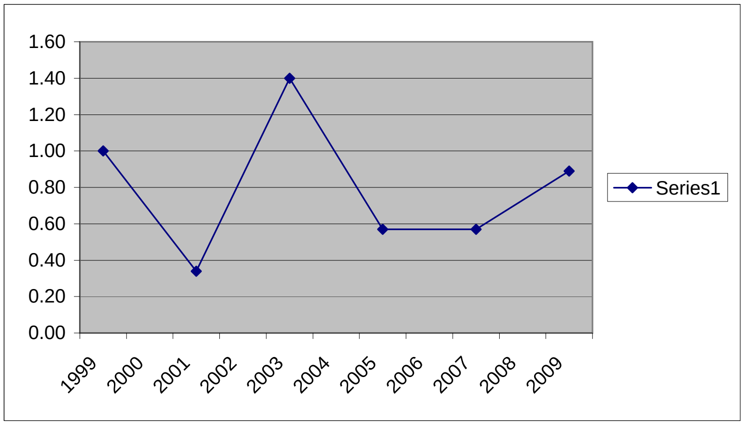
| Date | TCE (µg/L) | Mann-Kendall Calculation: | | | | | |
|---|---|---|---|---|---|---|---|
| 6/17/1999 | 1.00 | 1 | | | | | |
| 6/18/2001 | 0.34 | 1 | -1 | | | | |
| 6/6/2003 | 1.40 | 1 | 1 | 1 | | | |
| 6/7/2005 | 0.57 | 1 | -1 | 1 | -1 | | |
| 6/8/2007 | 0.57 | 1 | -1 | 1 | -1 | 0 | |
| 6/9/2009 | 0.89 | 1 | -1 | 1 | -1 | 1 | 1 |

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

Mean 0.80
STNDEV 0.380881
COV 0.479095

Trend: Zero

Confidence (lookup) 50.00%




S 0

tau 0

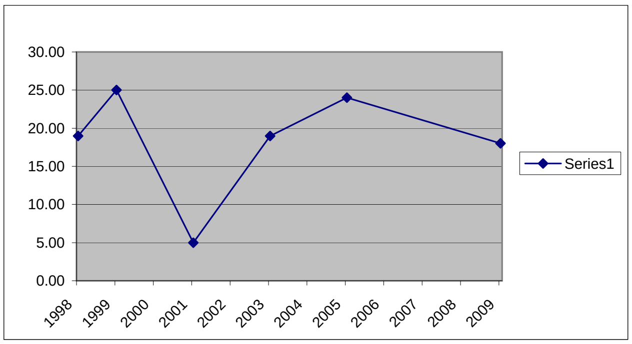
**Decision Matrix**

| 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:** **04U841**

| Date | TCE (µg/L) | Mann-Kendall Calculation: | | | | | |
|---|---|---|---|---|---|---|---|
| 6/19/1998 | 19.00 | 1 | | | | | |
| 6/14/1999 | 25.00 | 1 | 1 | | | | |
| 6/21/2001 | 5.00 | 1 | -1 | -1 | | | |
| 6/11/2003 | 19.00 | 1 | 0 | -1 | 1 | | |
| 6/9/2005 | 24.00 | 1 | 1 | -1 | 1 | 1 | |
| 6/9/2009 | 18.00 | 1 | -1 | -1 | 1 | -1 | -1 |

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




| | |
|---|---|
| Mean | 16.50 |
| STNDEV | 8.1034972 |
| COV | 0.491121 |
| Trend: | Negative |
| Confidence (lookup) | 57.00% |

| | |
|---|---|
| S | -2 |
| tau | -0.13333 |

**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**

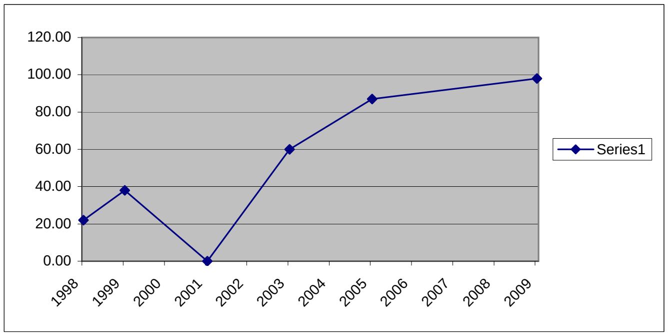
| Date | TCE (µg/L) | Mann-Kendall Calculation: | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 6/18/1998 | 22.00 | 1 | | | | | | |
| 6/14/1999 | 38.00 | 1 | 1 | | | | | |
| 6/21/2001 | 0.00 | 1 | -1 | -1 | | | | |
| 6/12/2003 | 60.00 | 1 | 1 | 1 | 1 | | | |
| 6/7/2005 | 87.00 | 1 | 1 | 1 | 1 | 1 | | |
| 6/15/2009 | 98.00 | 1 | 1 | 1 | 1 | 1 | 1 | 0 |

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

Mean 50.83
STNDEV 37.9389861
COV 0.74634071

Trend: Positive

Confidence (lookup) 97.00%




S 11

tau 0.733333

**Decision Matrix**

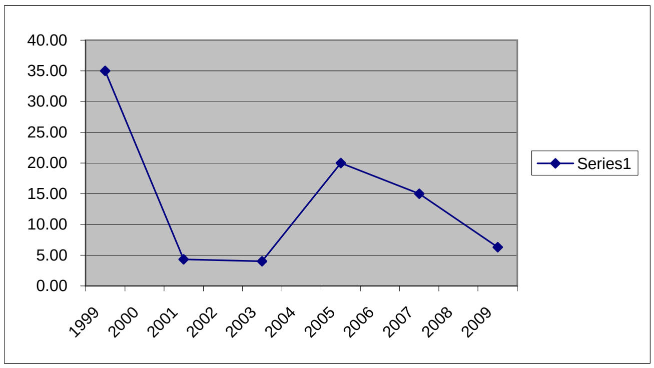
| M-K S | Confidence | COV | Trend |
|---|---|---|---|
| S > 0 | > 95% | na | Increasing |
| S > 0 | 90-95% | na | Prob. Incr. |
| S > 0 | < 90% | na | No Trend |
| S</= 0 | < 90% | >/= 1 | No Trend |
| S </= 0 | < 90% | < 1 | Stable |
| S < 0 | 90-95% | na | Prob Decr. |
| S < 0 | >95% | na | Decreasing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

**Well:** **04U845**

| Date | TCE (µg/L) | Mann-Kendall Calculation: | | | | | |
|---|---|---|---|---|---|---|---|
| 6/7/1999 | 35.00 | 1 | | | | | |
| 6/13/2001 | 4.3 | 1 | -1 | | | | |
| 6/1/2003 | 4 | 1 | -1 | -1 | | | |
| 6/22/2005 | 20 | 1 | -1 | 1 | 1 | | |
| 6/22/2007 | 15 | 1 | -1 | 1 | 1 | -1 | |
| 6/13/2009 | 6.3 | 1 | -1 | 1 | 1 | -1 | -1 |

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

| | |
|---|---|
| Mean | 14.10 |
| STNDEV | 12.093965 |
| COV | 0.857728 |
| Trend: | Negative |
| Confidence (lookup) | 64.00% |




| | |
|---|---|
| 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: 04U846**

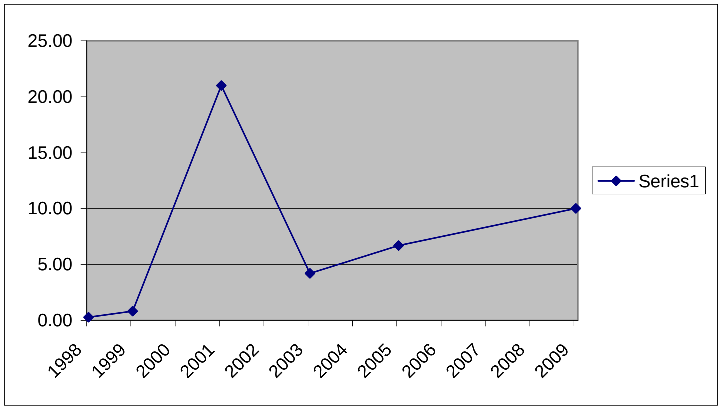
| Date | TCE (µg/L) | Mann-Kendall Calculation: | | | | | |
|---|---|---|---|---|---|---|---|
| 6/17/1998 | 0.30 | 1 | | | | | |
| 6/9/1999 | 0.83 | 1 | 1 | | | | |
| 6/15/2001 | 21.00 | 1 | 1 | 1 | | | |
| 6/9/2003 | 4.20 | 1 | 1 | 1 | -1 | | |
| 6/10/2005 | 6.70 | 1 | 1 | 1 | -1 | 1 | |
| 6/9/2009 | 10.00 | 1 | 1 | 1 | -1 | 1 | 1 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| N | | 6 | 5 | 4 | 3 | 2 | 1 | -1 | 14 |
| | sum | | 5 | 4 | -3 | 2 | 1 | 0 | 9 |
| Possibles | | 15 | | | | | | | |

Mean 7.17
STNDEV 7.6904107
COV 1.07233242

Trend: Positive

Confidence (lookup) 93.00%




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:** **04U847**

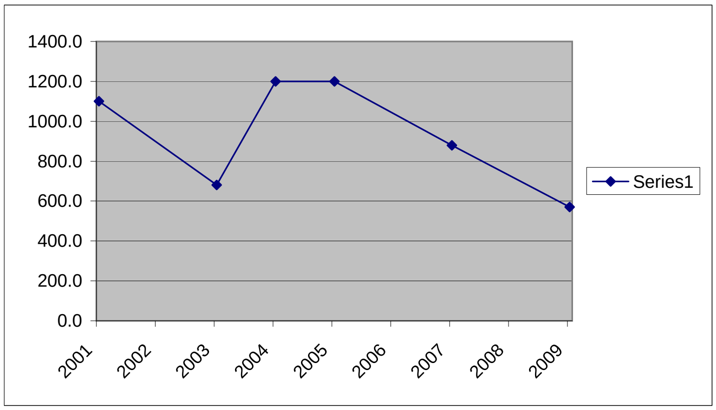
| Date | TCE (µg/L) | Mann-Kendall Calculation: | | | | | |
|---|---|---|---|---|---|---|---|
| 6/25/2001 | 1100.0 | 1 | | | | | |
| 6/17/2003 | 680.0 | 1 | -1 | | | | |
| 6/24/2004 | 1200.0 | 1 | 1 | 1 | | | |
| 6/15/2005 | 1200.0 | 1 | 1 | 1 | 0 | | |
| 6/18/2007 | 880.0 | 1 | -1 | 1 | -1 | -1 | |
| 6/19/2009 | 570.0 | 1 | -1 | -1 | -1 | -1 | -1 |

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

Mean 938.33
STNDEV 271.6186
COV 0.289469

Trend: Negative

Confidence (lookup) 70.00%




S -4

tau -0.26667

**Decision Matrix**

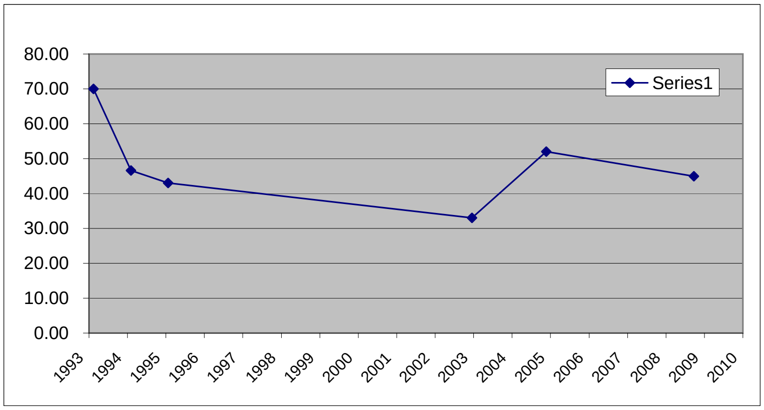
| M-K S | Confidence | COV | Trend |
|---|---|---|---|
| S > 0 | > 95% | na | Increasing |
| S > 0 | 90-95% | na | Pr. Incr. |
| S > 0 | < 90% | na | No Trend |
| S</= 0 | < 90% | >/= 1 | No Trend |
| S </= 0 | < 90% | < 1 | Stable |
| S < 0 | 90-95% | na | Pr. Decr. |
| S < 0 | >95% | na | Decreasing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

**Well:** **04U849**

| Date | TCE (µg/L) | Mann-Kendall Calculation: | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 3/17/1993 | 70.00 | 1 | | | | | | |
| 3/21/1994 | 46.60 | 1 | -1 | | | | | |
| 3/23/1995 | 43.0 | 1 | -1 | -1 | | | | |
| 6/12/2003 | 33.00 | 1 | -1 | -1 | -1 | | | |
| 6/16/2005 | 52.00 | 1 | -1 | 1 | 1 | 1 | | |
| 6/12/2009 | 45.00 | 1 | -1 | -1 | 1 | 1 | -1 | |
| N | | 6 | 5 | 4 | 3 | 2 | 1 | 15 |
| | sum | | -5 | -2 | 1 | 2 | -1 | -5 |
| Possibles | | 15 | | | | | | |

| | |
|---|---|
| S | -5 |
| tau | -0.33333 |

| | |
|---|---|
| Mean | 48.27 |
| STNDEV | 12.33315 |
| COV | 0.255521 |
| Trend: | Negative |
| Confidence (lookup) | 76.50% |




**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**

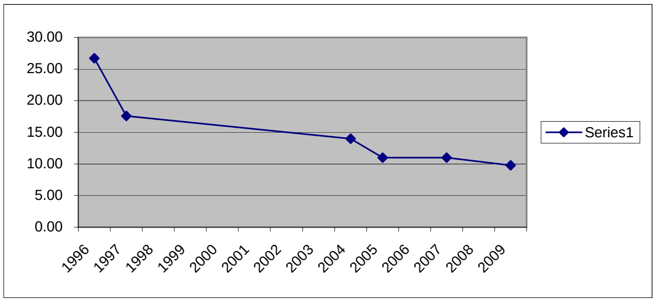
| Date | TCE (µg/L) | Mann-Kendall Calculation: | | | | | |
|---|---|---|---|---|---|---|---|
| 6/4/1996 | 26.70 | 1 | | | | | |
| 6/5/1997 | 17.60 | 1 | -1 | | | | |
| 6/16/2004 | 14.00 | 1 | -1 | -1 | | | |
| 6/23/2005 | 11.00 | 1 | -1 | -1 | -1 | | |
| 6/21/2007 | 11.00 | 1 | -1 | -1 | -1 | 0 | |
| 6/18/2009 | 9.80 | 1 | -1 | -1 | -1 | -1 | -1 |

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

Mean 15.02
STNDEV 6.3826066
COV 0.4250348

Trend: Negative

Confidence (lookup) 99.00%




S -14

tau -0.93333

**Decision Matrix**

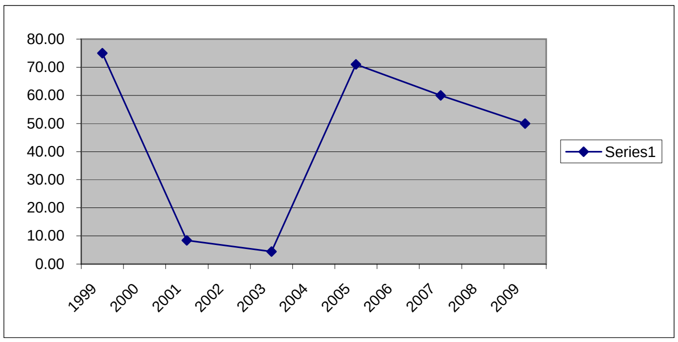
| M-K S | Confidence | COV | Trend |
|---|---|---|---|
| S > 0 | > 95% | na | Increasing |
| S > 0 | 90-95% | na | Prob. Incr. |
| S > 0 | < 90% | na | No Trend |
| S</= 0 | < 90% | >/= 1 | No Trend |
| S </= 0 | < 90% | < 1 | Stable |
| S < 0 | 90-95% | na | Prob Decr. |
| S < 0 | >95% | na | Decreasing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

**Well: 04U859**

| Date | TCE (µg/L) | Mann-Kendall Calculation: | | | | | |
|---|---|---|---|---|---|---|---|
| 6/7/1999 | 75.00 | 1 | | | | | |
| 6/13/2001 | 8.4 | 1 | -1 | | | | |
| 6/1/2003 | 4.4 | 1 | -1 | -1 | | | |
| 6/22/2005 | 71 | 1 | -1 | 1 | 1 | | |
| 6/21/2007 | 60 | 1 | -1 | 1 | 1 | -1 | |
| 6/18/2009 | 50 | 1 | -1 | 1 | 1 | -1 | -1 |

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

| | |
|---|---|
| Mean | 44.80 |
| STNDEV | 31.0279874 |
| COV | 0.692589 |
| 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 |

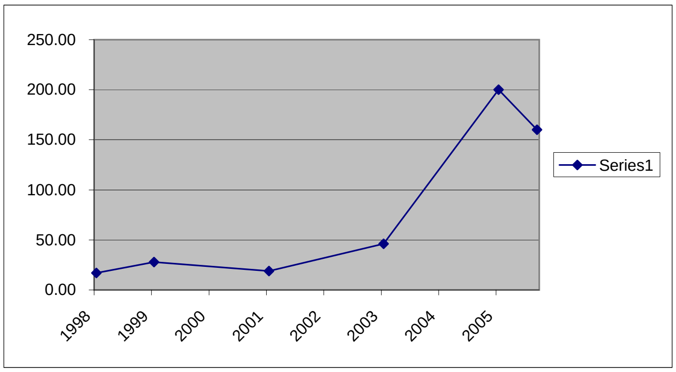
**Well:** **04U861 (abandoned)**

| Date | TCE (µg/L) | Mann-Kendall Calculation: | | | | | |
|---|---|---|---|---|---|---|---|
| 6/29/1998 | 17.10 | 1 | | | | | |
| 6/7/1999 | 28.00 | 1 | 1 | | | | |
| 6/11/2001 | 19 | 1 | 1 | -1 | | | |
| 6/1/2003 | 46 | 1 | 1 | 1 | 1 | | |
| 6/23/2005 | 200 | 1 | 1 | 1 | 1 | 1 | |
| 2/8/2006 | 160 | 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 | 78.35 |
| STNDEV | 80.400342 |
| COV | 1.026169 |
| 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**

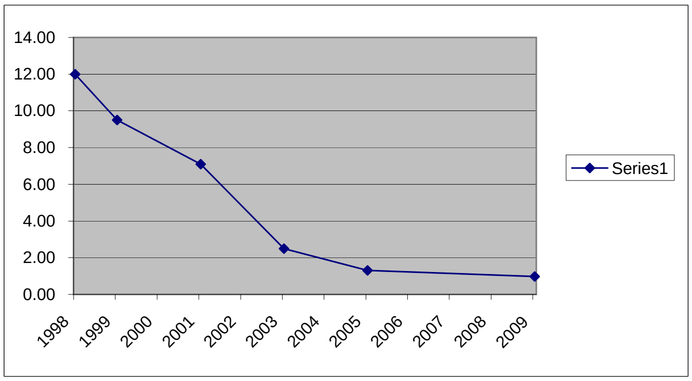
| Date | TCE (µg/L) | Mann-Kendall Calculation: | | | | | |
|---|---|---|---|---|---|---|---|
| 6/29/1998 | 12.00 | 1 | | | | | |
| 6/9/1999 | 9.5 | 1 | -1 | | | | |
| 6/19/2001 | 7.1 | 1 | -1 | -1 | | | |
| 6/12/2003 | 2.5 | 1 | -1 | -1 | -1 | | |
| 6/22/2005 | 1.3 | 1 | -1 | -1 | -1 | -1 | |
| 6/12/2009 | 0.98 | 1 | -1 | -1 | -1 | -1 | -1 |

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

| | |
|---|---|
| Mean | 5.56 |
| STNDEV | 4.6444878 |
| COV | 0.834839 |

Trend: Negative

Confidence (lookup) 99.0%




S -15

tau -1

**Decision Matrix**

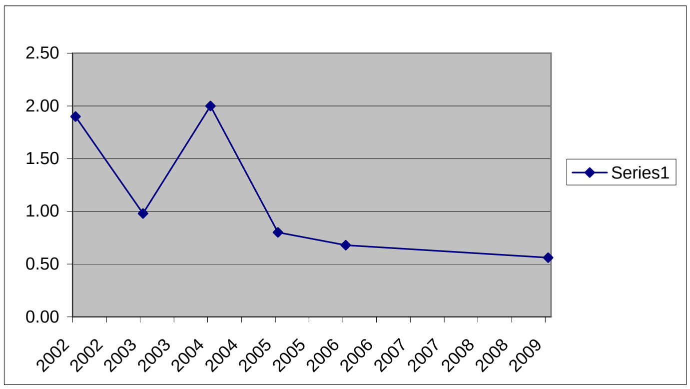
| M-K S | Confidence | COV | Trend |
|---|---|---|---|
| S > 0 | > 95% | na | Increasing |
| S > 0 | 90-95% | na | Prob. Incr. |
| S > 0 | < 90% | na | No Trend |
| S</= 0 | < 90% | >/= 1 | No Trend |
| S </= 0 | < 90% | < 1 | Stable |
| S < 0 | 90-95% | na | Prob Decr. |
| S < 0 | >95% | na | Decreasing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

**Well: 04U877**

| Date | TCE (µg/L) | Mann-Kendall Calculation: | | | | | |
|---|---|---|---|---|---|---|---|
| 6/28/2002 | 1.90 | 1 | | | | | |
| 6/13/2003 | 0.98 | 1 | -1 | | | | |
| 6/23/2004 | 2.00 | 1 | 1 | 1 | | | |
| 6/16/2005 | 0.80 | 1 | -1 | -1 | -1 | | |
| 6/6/2006 | 0.68 | 1 | -1 | -1 | -1 | -1 | |
| 6/9/2009 | 0.56 | 1 | -1 | -1 | -1 | -1 | -1 |

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

| | |
|---|---|
| Mean | 1.15 |
| STNDEV | 0.63329824 |
| COV | 0.54910252 |
| Trend: | Negative |
| Confidence (lookup) | 97.0% |




| | |
|---|---|
| S | -11 |
| tau | -0.73333 |

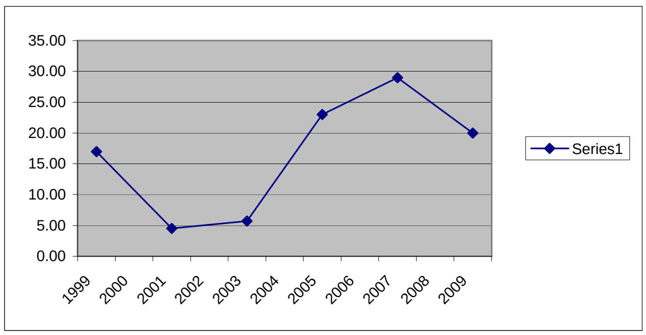
**Decision Matrix**

| 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: 04U882**

| Date | TCE (µg/L) | Mann-Kendall Calculation: | | | | | |
|---|---|---|---|---|---|---|---|
| 6/10/1999 | 17.00 | 1 | | | | | |
| 6/21/2001 | 4.50 | 1 | -1 | | | | |
| 6/11/2003 | 5.70 | 1 | -1 | 1 | | | |
| 6/17/2005 | 23.00 | 1 | 1 | 1 | 1 | | |
| 6/12/2007 | 29.00 | 1 | 1 | 1 | 1 | 1 | |
| 6/23/2009 | 20.00 | 1 | 1 | 1 | 1 | -1 | -1 |

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




Mean 16.53
STNDEV 9.7121917
COV 0.5874309

Trend: Positive

Confidence (lookup) 86.00%

S 7

tau 0.466667

**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**

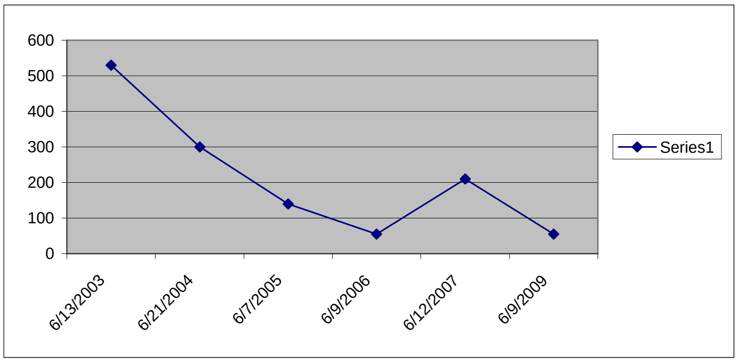
| Date | TCE (µg/L) | Mann-Kendall Calculation: | | | | | |
|---|---|---|---|---|---|---|---|
| 6/13/2003 | 530 | 1 | | | | | |
| 6/21/2004 | 300 | 1 | -1 | | | | |
| 6/7/2005 | 140 | 1 | -1 | -1 | | | |
| 6/9/2006 | 55 | 1 | -1 | -1 | -1 | | |
| 6/12/2007 | 210 | 1 | -1 | -1 | 1 | 1 | |
| 6/9/2009 | 55 | 1 | -1 | -1 | -1 | 0 | -1 |

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

| | |
|---|---|
| Mean | 215.00 |
| STNDEV | 180.7208 |
| COV | 0.840562 |

Trend: Negative

Confidence (lookup) 95.10%




S -10

tau -0.666667

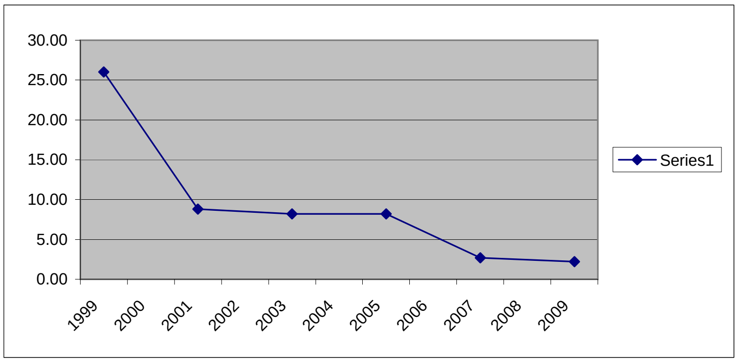
**Decision Matrix**

| 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: | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 6/21/1999 | 26.00 | | 1 | | | | | | |
| 6/7/2001 | 8.80 | | 1 | -1 | | | | | |
| 6/16/2003 | 8.20 | | 1 | -1 | -1 | | | | |
| 6/8/2005 | 8.20 | | 1 | -1 | -1 | 0 | | | |
| 6/11/2007 | 2.70 | | 1 | -1 | -1 | -1 | -1 | | |
| 6/10/2009 | 2.20 | | 1 | -1 | -1 | -1 | -1 | -1 | |
| | N | | 6 | 5 | 4 | 3 | 2 | 1 | 15 |
| | | sum | | -5 | -4 | -2 | -2 | -1 | -14 |
| | Possibles | | 15 | | | | | | |

| | |
|---|---|
| Mean | 9.35 |
| STNDEV | 8.666199 |
| COV | 0.926866 |
| Trend: | Negative |
| Confidence (lookup) | 99.00% |




| | |
|---|---|
| S | -14 |
| tau | -0.933333 |

**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**

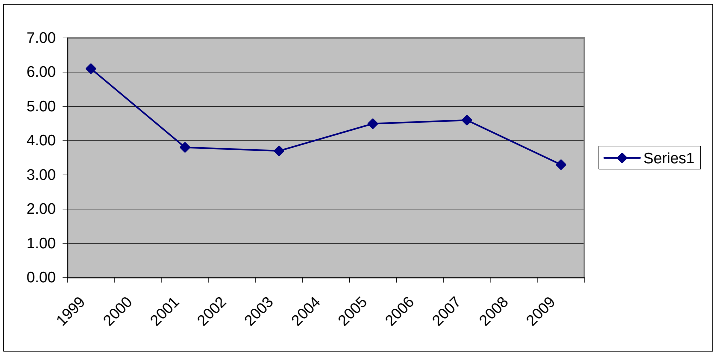
| Date | TCE (µg/L) | Mann-Kendall Calculation: | | | | | |
|---|---|---|---|---|---|---|---|
| 6/23/1999 | 6.10 | 1 | | | | | |
| 6/7/2001 | 3.80 | 1 | -1 | | | | |
| 6/12/2003 | 3.70 | 1 | -1 | -1 | | | |
| 6/9/2005 | 4.50 | 1 | -1 | 1 | 1 | | |
| 6/6/2007 | 4.60 | 1 | -1 | 1 | 1 | 1 | |
| 6/3/2009 | 3.30 | 1 | -1 | -1 | -1 | -1 | -1 |

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

Mean 4.33
STNDEV 0.99733
COV 0.230153

Trend: Negative

Confidence (lookup) 76.00%




S -5

tau -0.33333

**Decision Matrix**

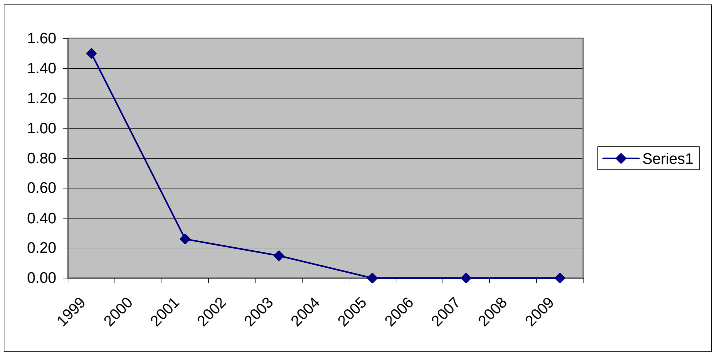
| **M-K S** | **Confidence** | **COV** | **Trend** |
|---|---|---|---|
| S > 0 | > 95% | na | Increasing |
| S > 0 | 90-95% | na | Pr. Incr. |
| S > 0 | < 90% | na | No Trend |
| S</= 0 | < 90% | >/= 1 | No Trend |
| S </= 0 | < 90% | < 1 | Stable |
| S < 0 | 90-95% | na | Pr. Decr. |
| S < 0 | >95%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

**Well: 04J713**

| Date | TCE (µg/L) | Mann-Kendall Calculation: | | | | | |
|---|---|---|---|---|---|---|---|
| 6/22/1999 | 1.50 | 1 | | | | | |
| 6/12/2001 | 0.26 | 1 | -1 | | | | |
| 6/12/2003 | 0.15 | 1 | -1 | -1 | | | |
| 6/9/2005 | 0.00 | 1 | -1 | -1 | -1 | | |
| 6/11/2007 | 0.00 | 1 | -1 | -1 | -1 | 0 | |
| 6/10/2009 | 0.00 | 1 | -1 | -1 | -1 | 0 | 0 |

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

| | |
|---|---|
| Mean | 0.32 |
| STNDEV | 0.588572 |
| COV | 1.848916 |
| Trend: | Negative |
| Confidence (lookup) | 99.00% |




| | |
|---|---|
| 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: 04J822**

| Date | TCE (µg/L) | Mann-Kendall Calculation: | | | | | |
|---|---|---|---|---|---|---|---|
| 1/11/2006 | 58.00 | 1 | | | | | |
| 6/6/2006 | 87.00 | 1 | 1 | | | | |
| 12/11/2006 | 85.00 | 1 | 1 | -1 | | | |
| 6/13/2007 | 83.00 | 1 | 1 | -1 | -1 | | |
| 6/25/2008 | 77.00 | 1 | 1 | -1 | -1 | -1 | |
| 6/16/2009 | 57.00 | 1 | -1 | -1 | -1 | -1 | -1 |

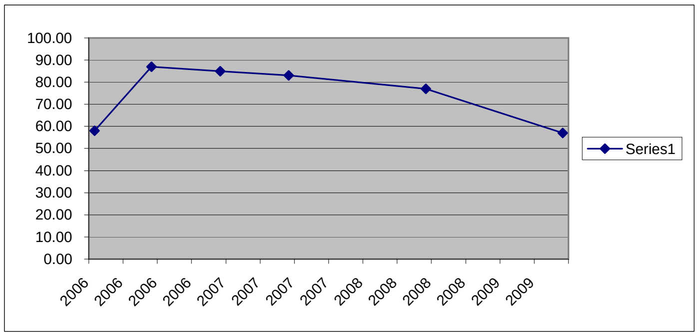
74.50

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

Mean 74.50
STNDEV 13.5904378
COV 0.18242198

Trend: Negative

Confidence (lookup) 86.00%




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: 04J834**

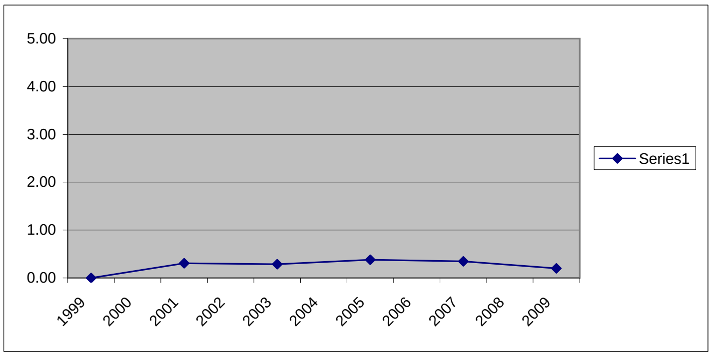
| Date | TCE (µg/L) | Mann-Kendall Calculation: | | | | | |
|---|---|---|---|---|---|---|---|
| 6/10/1999 | 0.00 | 1 | | | | | |
| 6/15/2001 | 0.31 | 1 | 1 | | | | |
| 6/9/2003 | 0.29 | 1 | 1 | -1 | | | |
| 6/8/2005 | 0.38 | 1 | 1 | 1 | 1 | | |
| 6/4/2007 | 0.35 | 1 | 1 | 1 | 1 | -1 | |
| 6/4/2009 | 0.20 | 1 | 1 | -1 | -1 | -1 | -1 |

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

Mean 0.26
STNDEV 0.139248
COV 0.546071

Trend: Positive

Confidence (lookup) 64.00%




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:** **04J836**

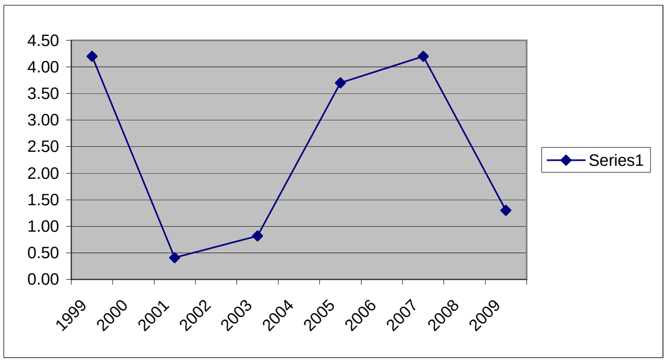
| Date | TCE (µg/L) | Mann-Kendall Calculation: | | | | | |
|---|---|---|---|---|---|---|---|
| 6/16/1999 | 4.20 | 1 | | | | | |
| 6/20/2001 | 0.41 | 1 | -1 | | | | |
| 6/10/2003 | 0.82 | 1 | -1 | 1 | | | |
| 6/21/2005 | 3.70 | 1 | -1 | 1 | 1 | | |
| 6/13/2007 | 4.20 | 1 | 0 | 1 | 1 | 1 | |
| 6/22/2009 | 1.30 | 1 | -1 | 1 | 1 | -1 | -1 |

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

Mean 2.44
STNDEV 1.779196
COV 0.729677

Trend: Positive

Confidence (lookup) 64.00%




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: 04J837**

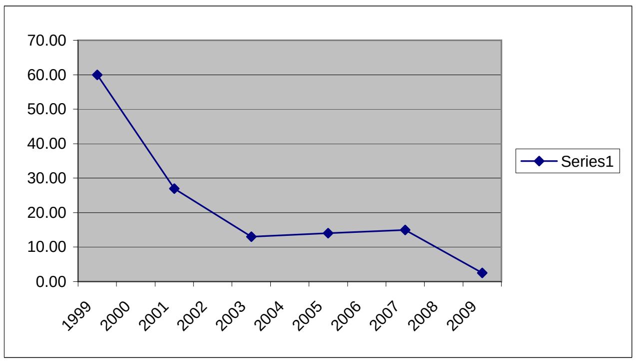
| Date | TCE (µg/L) | Mann-Kendall Calculation: | | | | | |
|---|---|---|---|---|---|---|---|
| 6/10/1999 | 60.00 | 1 | | | | | |
| 6/23/2001 | 27.00 | 1 | -1 | | | | |
| 6/16/2003 | 13.00 | 1 | -1 | -1 | | | |
| 6/20/2005 | 14.00 | 1 | -1 | -1 | 1 | | |
| 6/8/2007 | 15.00 | 1 | -1 | -1 | 1 | 1 | |
| 6/19/2009 | 2.50 | 1 | -1 | -1 | -1 | -1 | -1 |

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

Mean 21.92
STNDEV 20.21489
COV 0.922352

Trend: Negative

Confidence (lookup) 93.00%




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:** **04J838**

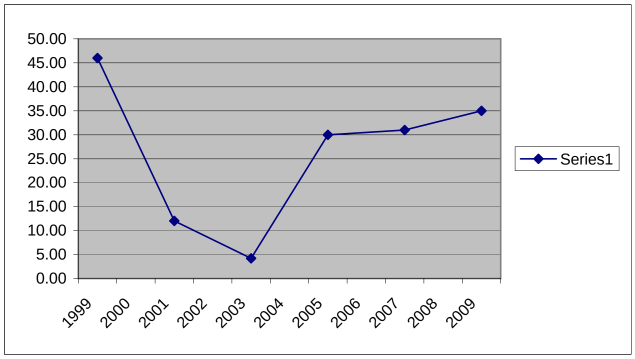
| Date | TCE (µg/L) | Mann-Kendall Calculation: | | | | | |
|---|---|---|---|---|---|---|---|
| 6/10/1999 | 46.00 | 1 | | | | | |
| 6/23/2001 | 12.00 | 1 | -1 | | | | |
| 6/9/2003 | 4.20 | 1 | -1 | -1 | | | |
| 6/17/2005 | 30.00 | 1 | -1 | 1 | 1 | | |
| 6/12/2007 | 31.00 | 1 | -1 | 1 | 1 | 1 | |
| 6/22/2009 | 35.00 | 1 | -1 | 1 | 1 | 1 | 1 |

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

Mean 26.37
STNDEV 15.44301
COV 0.585702

Trend: Positive

Confidence (lookup) 64.00%




S 3

tau 0.2

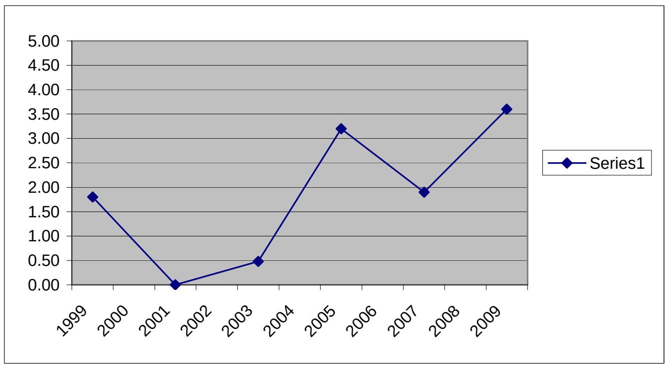
**Decision Matrix**

| 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:** **04J839**

| Date | TCE (µg/L) | Mann-Kendall Calculation: | | | | | |
|---|---|---|---|---|---|---|---|
| 6/17/1999 | 1.80 | 1 | | | | | |
| 6/18/2001 | 0.00 | 1 | -1 | | | | |
| 6/5/2003 | 0.48 | 1 | -1 | 1 | | | |
| 6/17/2005 | 3.20 | 1 | 1 | 1 | 1 | | |
| 6/8/2007 | 1.90 | 1 | 1 | 1 | 1 | -1 | |
| 6/10/2009 | 3.60 | 1 | 1 | 1 | 1 | 1 | 1 |

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




| | |
|---|---|
| S | 9 |
| tau | 0.6 |

| | |
|---|---|
| Mean | 1.83 |
| STNDEV | 1.427375 |
| COV | 0.779986 |
| Trend: | Positive |
| Confidence (lookup) | 93.00% |

**Decision Matrix**

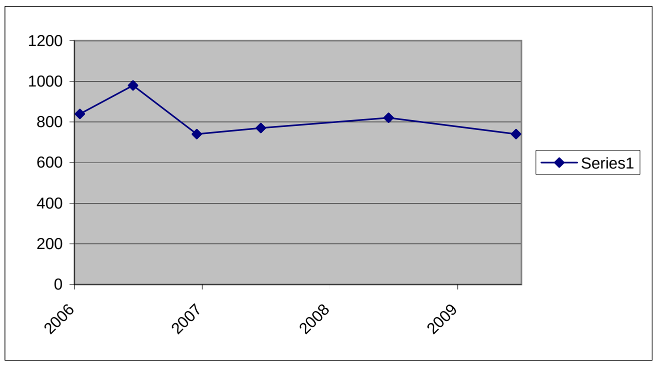
| M-K S | Confidence | COV | Trend |
|---|---|---|---|
| S > 0 | > 95% | na | Increasing |
| S > 0 | 90-95% | na | Pr. Incr. |
| S > 0 | < 90% | na | No Trend |
| S</= 0 | < 90% | >/= 1 | No Trend |
| S </= 0 | < 90% | < 1 | Stable |
| S < 0 | 90-95% | na | Pr. Decr. |
| S < 0 | >95% | na | Decreasing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

**Well:** **04J847**

| Date | TCE (µg/L) | Mann-Kendall Calculation: | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 1/11/2006 | 840 | 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 | | 815 |
| 6/9/2009 | 740 | 1 | -1 | -1 | 0 | -1 | -1 | |

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

| | |
|---|---|
| Mean | 815.00 |
| STNDEV | 90.71935 |
| COV | 0.111312 |
| Trend: | Negative |
| Confidence (lookup) | 81.00% |




| | |
|---|---|
| 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:** **04J849**

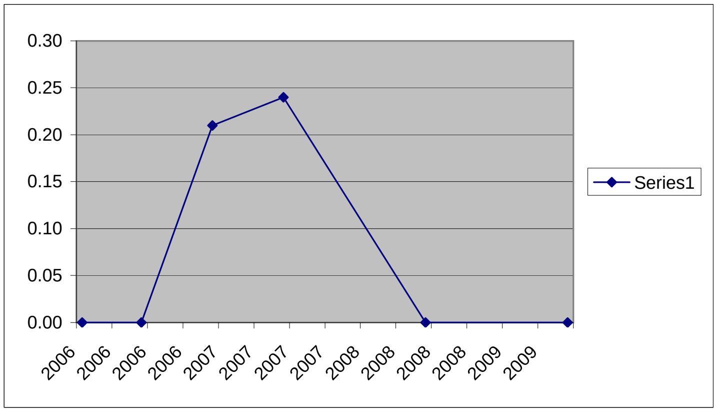
| Date | TCE (µg/L) | Mann-Kendall Calculation: | | | | | |
|---|---|---|---|---|---|---|---|
| 1/11/2006 | 0.00 | 1 | | | | | |
| 6/5/2006 | 0.00 | 1 | 0 | | | | |
| 12/11/2006 | 0.21 | 1 | 1 | 1 | | | |
| 6/12/2007 | 0.24 | 1 | 1 | 1 | 1 | | |
| 6/25/2008 | 0.00 | 1 | 0 | 0 | -1 | -1 | |
| 6/16/2009 | 0.00 | 1 | 0 | 0 | -1 | -1 | 0 |

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

Mean 0.08
STNDEV 0.116576
COV 1.554349

Trend: Positive

Confidence (lookup) 50.00%




S 1

tau 0.066667

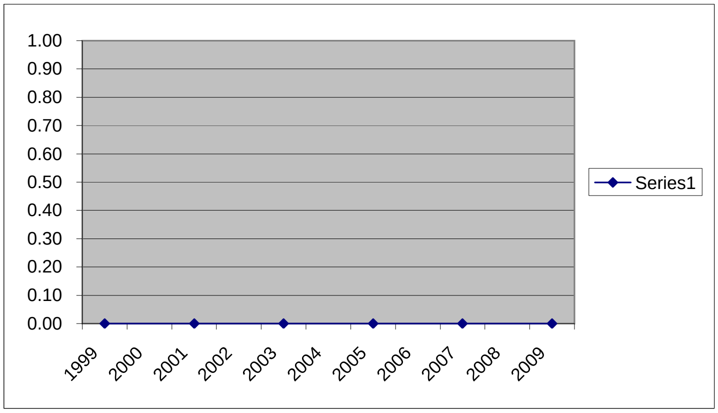
**Decision Matrix**

| 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:** **04J882**

| Date | TCE (µg/L) | Mann-Kendall Calculation: | | | | | |
|---|---|---|---|---|---|---|---|
| 6/10/1999 | 0.00 | 1 | | | | | |
| 6/15/2001 | 0.00 | 1 | 0 | | | | |
| 6/6/2003 | 0.00 | 1 | 0 | 0 | | | |
| 6/8/2005 | 0.00 | 1 | 0 | 0 | 0 | | |
| 6/6/2007 | 0.00 | 1 | 0 | 0 | 0 | 0 | |
| 6/5/2009 | 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) 43.00%

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**

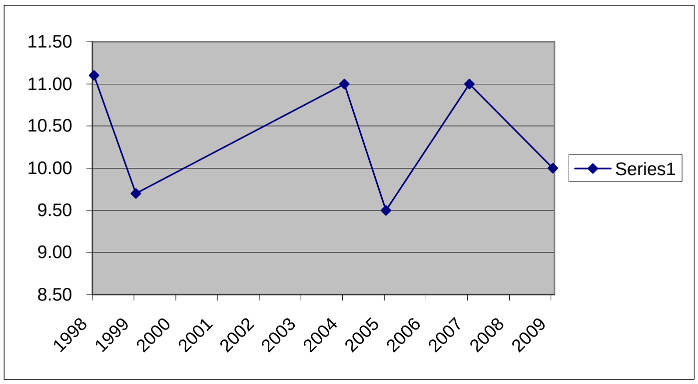
| Date | TCE (µg/L) | Mann-Kendall Calculation: | | | | | |
|---|---|---|---|---|---|---|---|
| 6/26/1998 | 11.10 | 1 | | | | | |
| 6/9/1999 | 9.70 | 1 | -1 | | | | |
| 6/23/2004 | 11.00 | 1 | -1 | 1 | | | |
| 6/6/2005 | 9.50 | 1 | -1 | -1 | -1 | | |
| 6/11/2007 | 11.00 | 1 | -1 | 1 | 0 | 1 | |
| 6/19/2009 | 10.00 | 1 | -1 | 1 | -1 | 1 | -1 |

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

Mean 10.38
STNDEV 0.7305249
COV 0.0703555

Trend: Negative

Confidence (lookup) 70.0%




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**

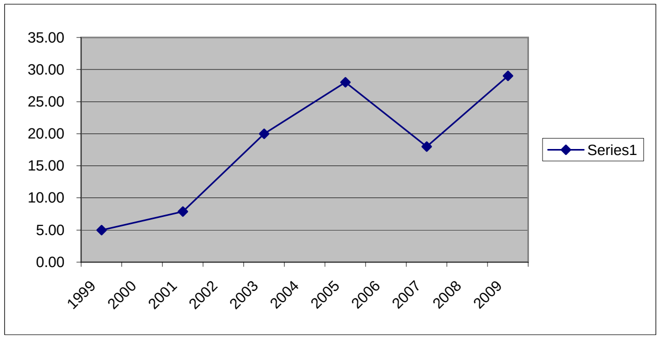
| Date | TCE (µg/L) | Mann-Kendall Calculation: | | | | | |
|---|---|---|---|---|---|---|---|
| 6/11/1999 | 5.00 | 1 | | | | | |
| 6/19/2001 | 7.9 | 1 | 1 | | | | |
| 6/11/2003 | 20 | 1 | 1 | 1 | | | |
| 6/10/2005 | 28 | 1 | 1 | 1 | 1 | | |
| 6/13/2007 | 18 | 1 | 1 | 1 | -1 | -1 | |
| 6/10/2009 | 29 | 1 | 1 | 1 | 1 | 1 | 1 |

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

Mean 17.98
STNDEV 9.960003
COV 0.553846

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:** **409550**

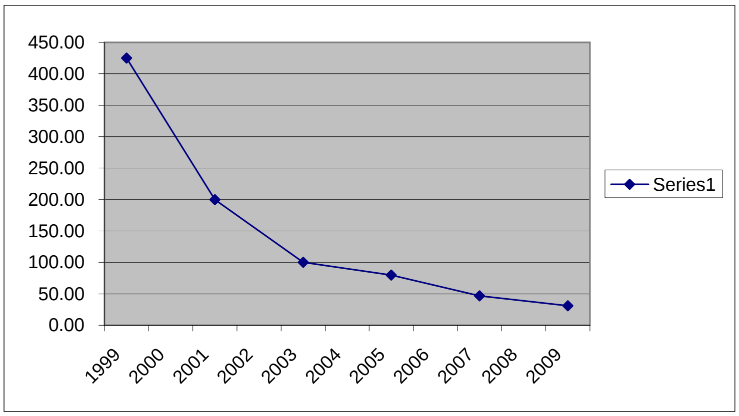
| Date | TCE (µg/L) | Mann-Kendall Calculation: | | | | | |
|---|---|---|---|---|---|---|---|
| 6/15/1999 | 425.00 | 1 | | | | | |
| 6/25/2001 | 200.00 | 1 | -1 | | | | |
| 6/13/2003 | 100.00 | 1 | -1 | -1 | | | |
| 6/14/2005 | 80.00 | 1 | -1 | -1 | -1 | | |
| 6/15/2007 | 47.00 | 1 | -1 | -1 | -1 | -1 | |
| 6/12/2009 | 31.00 | 1 | -1 | -1 | -1 | -1 | -1 |

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

Mean 147.17
STNDEV 148.4903
COV 1.008994

Trend: Negative

Confidence (lookup) 99.00%




S -15

tau -1

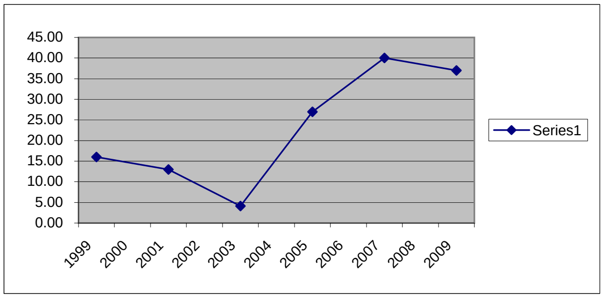
**Decision Matrix**

| 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:** **409557**

| Date | TCE (µg/L) | Mann-Kendall Calculation: | | | | | |
|---|---|---|---|---|---|---|---|
| 6/11/1999 | 16.00 | 1 | | | | | |
| 6/20/2001 | 13 | 1 | -1 | | | | |
| 6/1/2003 | 4.1 | 1 | -1 | -1 | | | |
| 6/9/2005 | 27 | 1 | 1 | 1 | 1 | | |
| 6/11/2007 | 40 | 1 | 1 | 1 | 1 | 1 | |
| 6/11/2009 | 37 | 1 | 1 | 1 | 1 | 1 | -1 |

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




| | |
|---|---|
| S | 7 |
| tau | 0.466667 |

| | |
|---|---|
| Mean | 22.85 |
| STNDEV | 14.1920753 |
| COV | 0.62109739 |
| Trend: | Positive |
| Confidence (lookup) | 86.00% |

**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**

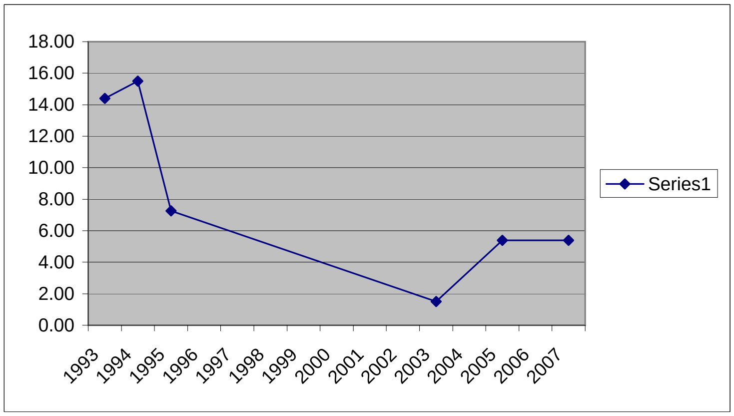
| Date | TCE (µg/L) | Mann-Kendall Calculation: | | | | | |
|---|---|---|---|---|---|---|---|
| 3/15/1993 | 14.40 | 1 | | | | | |
| 3/18/1994 | 15.50 | 1 | 1 | | | | |
| 3/20/1995 | 7.26 | 1 | -1 | -1 | | | |
| 6/13/2003 | 1.50 | 1 | -1 | -1 | -1 | | |
| 6/9/2005 | 5.40 | 1 | -1 | -1 | -1 | 1 | |
| 6/14/2007 | 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 | -0.533333 |

**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**

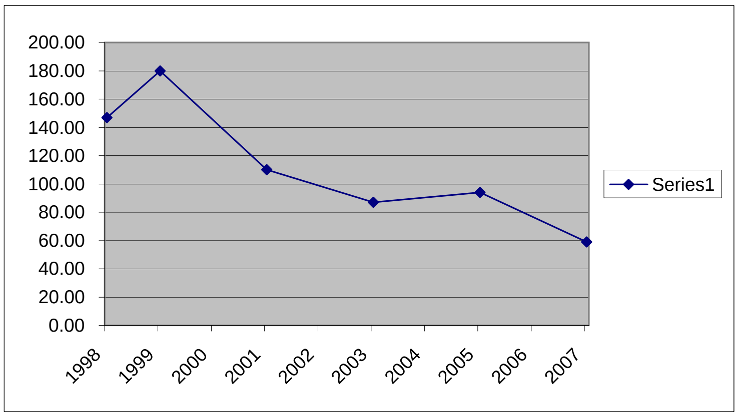
| Date | TCE (µg/L) | Mann-Kendall Calculation: | | | | | |
|---|---|---|---|---|---|---|---|
| 6/23/1998 | 147.00 | 1 | | | | | |
| 6/15/1999 | 180.00 | 1 | 1 | | | | |
| 6/23/2001 | 110.00 | 1 | -1 | -1 | | | |
| 6/13/2003 | 87.00 | 1 | -1 | -1 | -1 | | |
| 6/14/2005 | 94.00 | 1 | -1 | -1 | -1 | 1 | |
| 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 | -0.733333 |

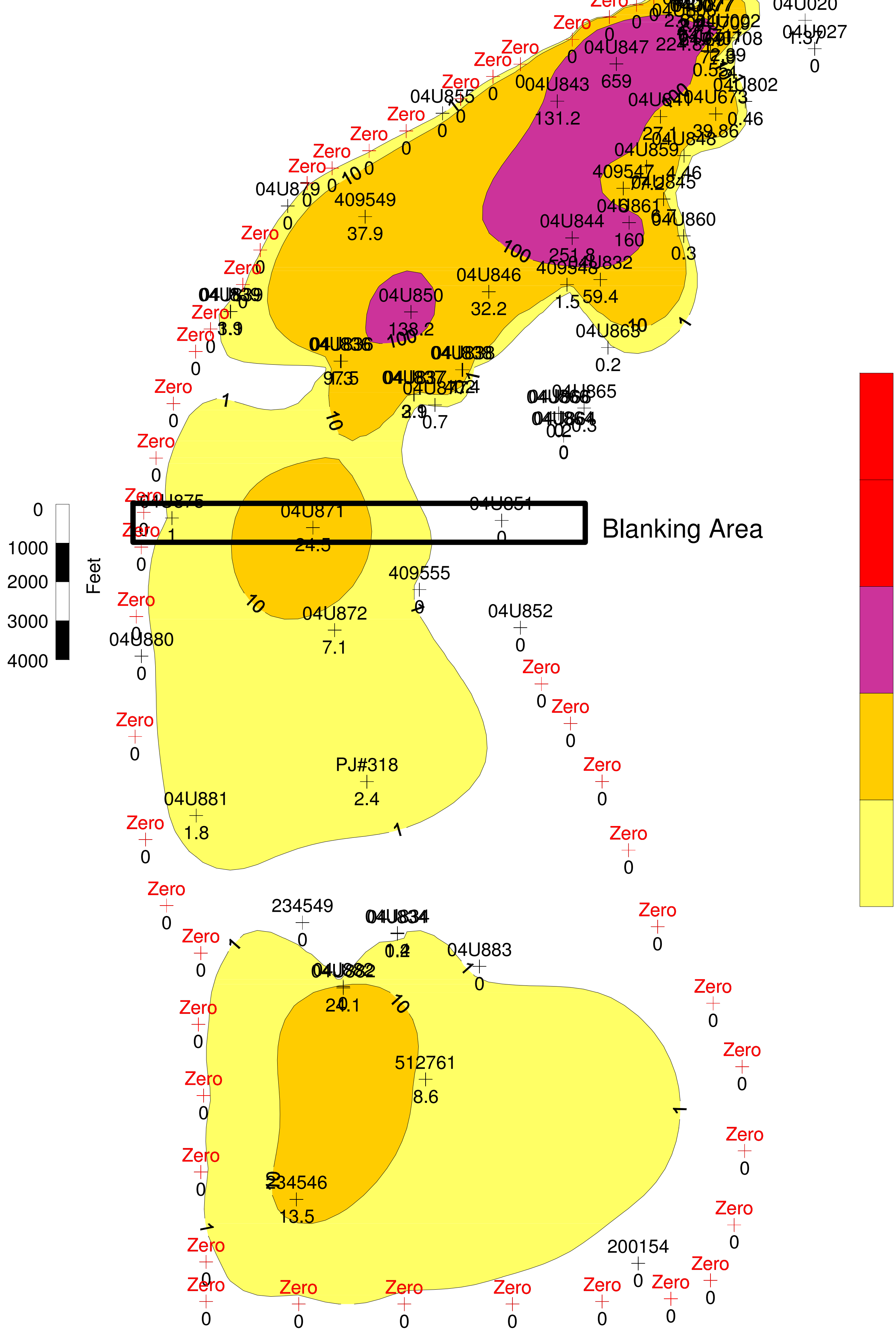
**Decision Matrix**

| 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

2009

## Total VOC Concentrations in Upper Unit 4 - 2009



## North Plume
## Total VOC Cocentrations for Surfer Plots
## FY 2009

| Well | Date | Total VOCs for Surfer |
|---|---|---|
| **04J077** | 6/9/09 | **247.9** |
| **04J702** | 6/10/09 | **2.2** |
| **04J708** | 6/3/09 | **4.0** |
| **04J713** | 6/10/09 | **0.0** |
| **04J834** | 6/4/09 | **0.2** |
| **04J836** | 6/22/09 | **1.3** |
| **04J837** | 6/19/09 | **3.1** |
| **04J838** | 6/22/09 | **40.4** |
| **04J839** | 6/10/09 | **3.9** |
| **04J864** | 10/27/04 | **0.0** |
| **04J866** | 6/17/09 | **0.0** |
| **04J882** | 6/5/09 | **0.0** |
| **04U002** | 6/3/09 | **2.4** |
| **04U020** | 6/4/09 | **1.4** |
| **04U027** | 6/4/09 | **0.0** |
| **04U077** | 6/9/09 | **61.7** |
| **04U673** | 6/18/09 | **39.9** |
| **04U701** | 6/10/09 | **4.8** |
| **04U702** | 6/10/09 | **2.1** |
| **04U709** | 6/11/09 | **77.9** |
| **04U711** | 6/11/09 | **0.6** |
| **04U713** | 6/10/09 | **0.6** |
| **04U802** | 6/11/09 | **0.5** |
| **04U806** | 6/9/09 | **224.8** |
| **04U832** | 6/19/09 | **59.4** |
| **04U833** | 6/12/09 | **2.6** |
| **04U834** | 6/12/09 | **1.4** |
| **04U836** | 6/23/09 | **97.5** |
| **04U837** | 6/18/09 | **2.9** |
| **04U838** | 6/23/09 | **1.2** |
| **04U839** | 6/9/09 | **1.1** |
| **04U841** | 6/9/09 | **27.1** |
| **04U843** | 6/15/09 | **131.2** |
| **04U844** | 6/18/09 | **251.8** |
| **04U845** | 6/17/09 | **6.7** |
| **04U846** | 6/9/09 | **32.2** |
| **04U847** | 6/19/09 | **659.0** |
| **04U848** | 6/17/09 | **4.5** |
| **04U850** | 6/15/09 | **138.2** |
| **04U851** | 6/18/09 | **0.0** |
| **04U852** | 6/24/05 | **0.0** |
| **04U855** | 6/14/07 | **0.0** |
| **04U859** | 6/18/09 | **77.2** |
| **04U860** | 6/17/09 | **0.3** |
| **04U861** | 2/8/06 | **160.0** |
| **04U863** | 6/18/09 | **0.2** |
| **04U864** | 10/27/04 | **0.0** |
| **04U865** | 6/22/05 | **0.3** |
| **04U866** | 6/22/07 | **0.2** |
| **04U871** | 6/25/09 | **24.5** |
| **04U872** | 6/24/09 | **7.1** |
| **04U875** | 6/12/09 | **1.0** |

# North Plume
# Total VOC Cocentrations for Surfer Plots
# FY 2009

| Well | Date | Total VOCs for Surfer |
|---|---|---|
| **04U877** | 6/9/09 | **0.7** |
| **04U879** | 6/5/09 | **0.0** |
| **04U880** | 6/8/09 | **0.0** |
| **04U881** | 6/17/09 | **1.8** |
| **04U882** | 6/23/09 | **24.1** |
| **04U883** | 6/8/09 | **0.0** |
| **200154** | 6/5/09 | **0.0** |
| **234546** | 6/23/09 | **13.5** |
| **234549** | June 2003 | **0.0** |
| **409547** | 6/3/09 | **6.0** |
| **409548** | 6/8/09 | **1.5** |
| **409549** | 6/10/09 | **37.9** |
| **409555** | 6/5/09 | **0.0** |
| **512761** | 6/19/09 | **8.6** |
| **PJ#318** | 6/18/09 | **2.4** |

# North Plume
# Average Total VOC Concentration Calculations
# Group 3 Blanked Area
# June 2009

| Concentration | Positive Planar Area ($m^2$) |
|---|---|
| Plume to 1 | 435388 |
| Plume to 5 | 326542 |
| Plume to 10 | 223521 |
| 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 | 108845 | 326536 |
| **5 to 10** | 7.5 | 103021 | 772659 |
| **10 to 50** | 30 | 223521 | 6705639 |
| | **Sum** | 435388 | 7804834 |

| | | |
|---|---|---|
| **Area Wtd Conc** | 18 | µg/L |

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

# North Plume
# Average Total VOC Concentration Calculations
# Group 5 Blanked Area
# June 2009

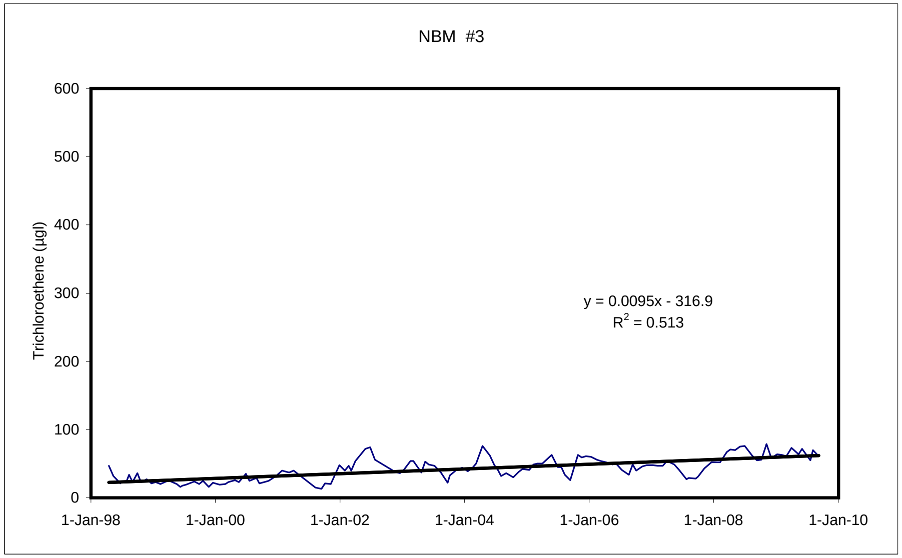
| Concentration | Positive Planar Area ($m^2$) |
|---|---|
| Plume to 1 | 24041430 |
| Plume to 5 | 13894018 |
| Plume to 10 | 9557623 |
| Plume to 50 | 4264422 |
| Plume to 100 | 2152806 |
| Plume to 200 | 550520 |
| Plume to 300 | 232270 |
| Plume to 400 | 100734 |
| Plume to 500 | 30024 |
| Plume to 600 | 0 |
| Plume to 700 | 0 |
| Plume to 800 | 0 |
| Plume to 900 | 0 |

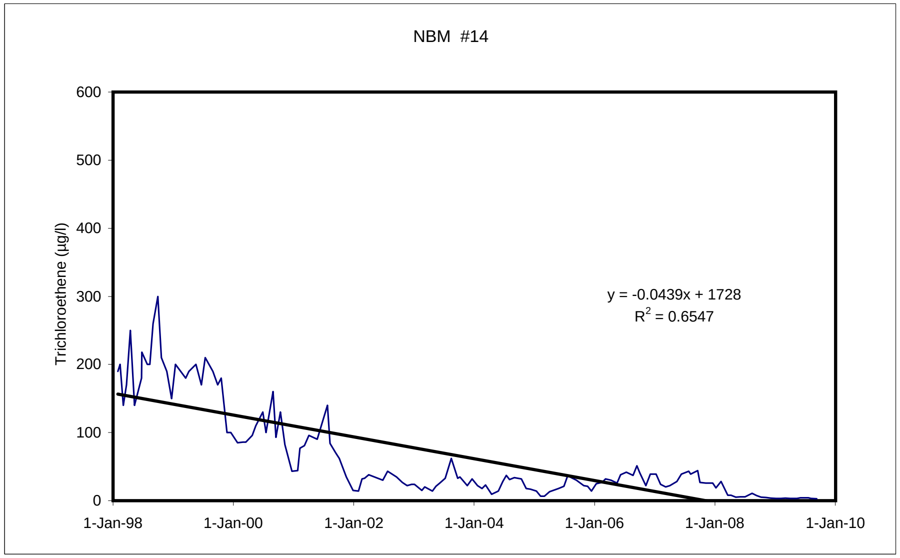
| Total VOCs (µg/L) | Avg Total VOCs (µg/L) | Area ($m^2$) | Areal Conc (µg*$m^2$/L) |
|---|---|---|---|
| **1 to 5** | 3 | 10147413 | 30442238 |
| **5 to 10** | 7.5 | 4336395 | 32522962 |
| **10 to 50** | 30 | 5293201 | 158796026 |
| **50 to 100** | 75 | 2111616 | 158371163 |
| **100 to 200** | 150 | 1602287 | 240343020 |
| **200 to 300** | 250 | 318249 | 79562350 |
| **300 to 400** | 350 | 131536 | 46037672 |
| **400 to 500** | 450 | 70710 | 31819591 |
| **500 to 600** | 550 | 30024 | 16513042 |
| **600 to 700** | 650 | 0 | 0 |
| **700 to 800** | 750 | 0 | 0 |
| **800 to 900** | 850 | 0 | 0 |
| | **Sum** | 24041430 | 794408063 |

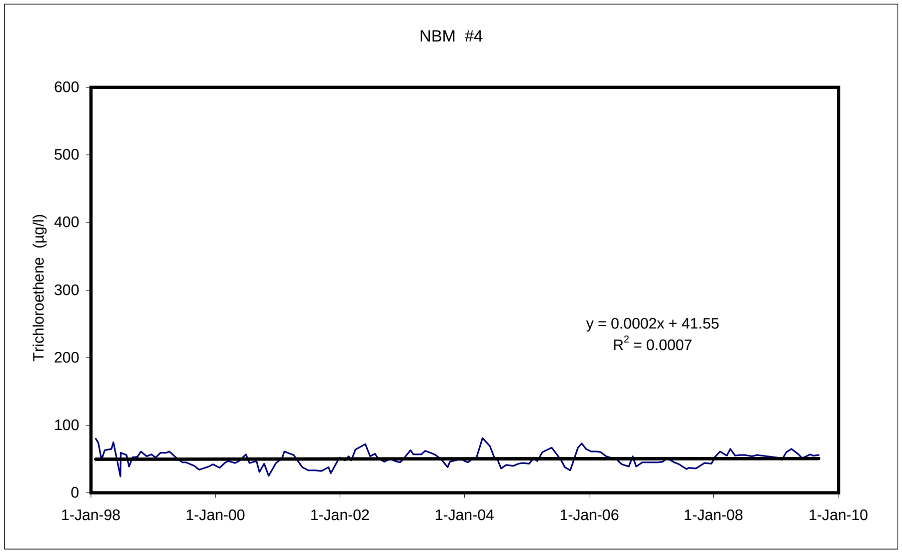
| **Area Wtd Conc** | 33 | µg/L |
|---|---|---|

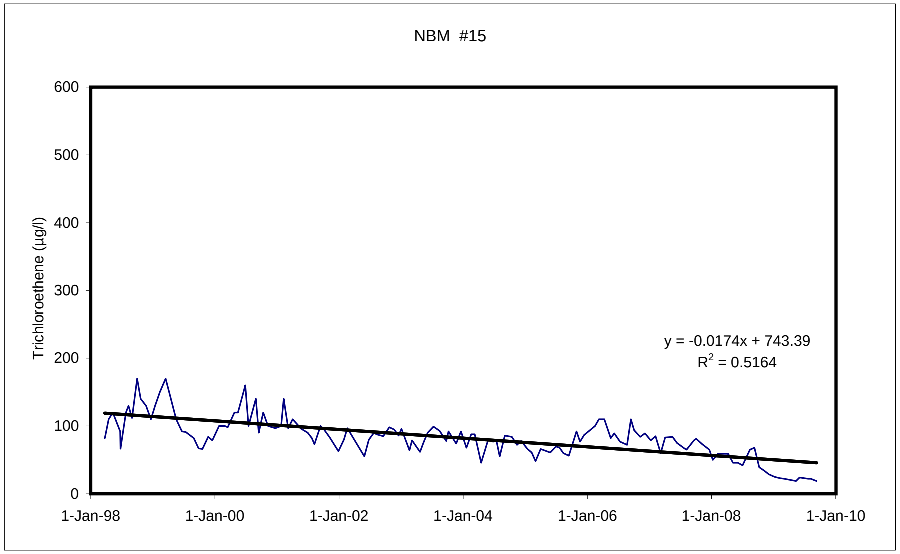
## D.2.5 Group 6 New Brighton Municipal Well Regression Analysis

# NEW BRIGHTON MUNICIPAL WELLS: Regression Analysis Since 1998: TRICHLOROETHENE

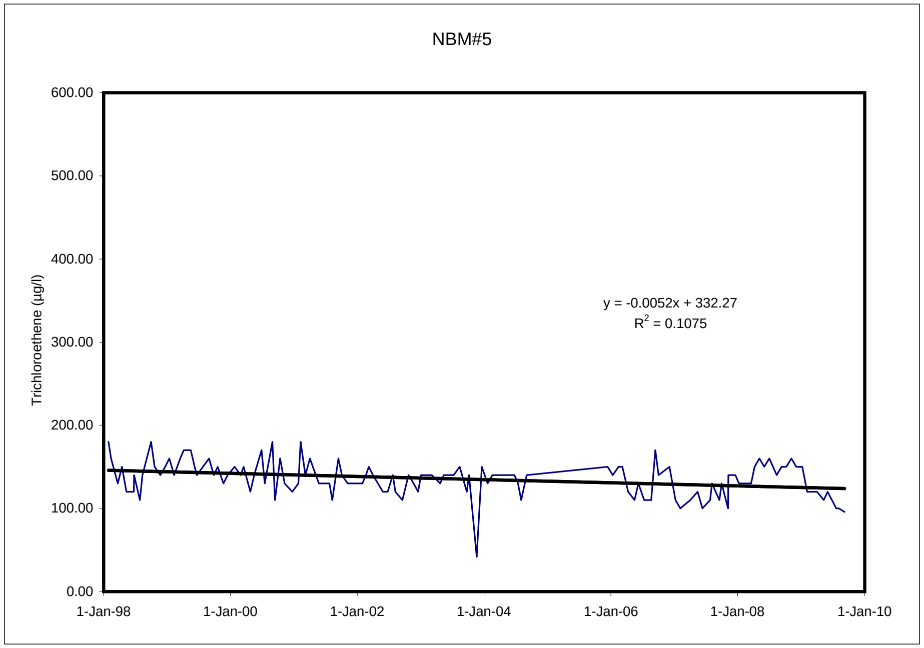


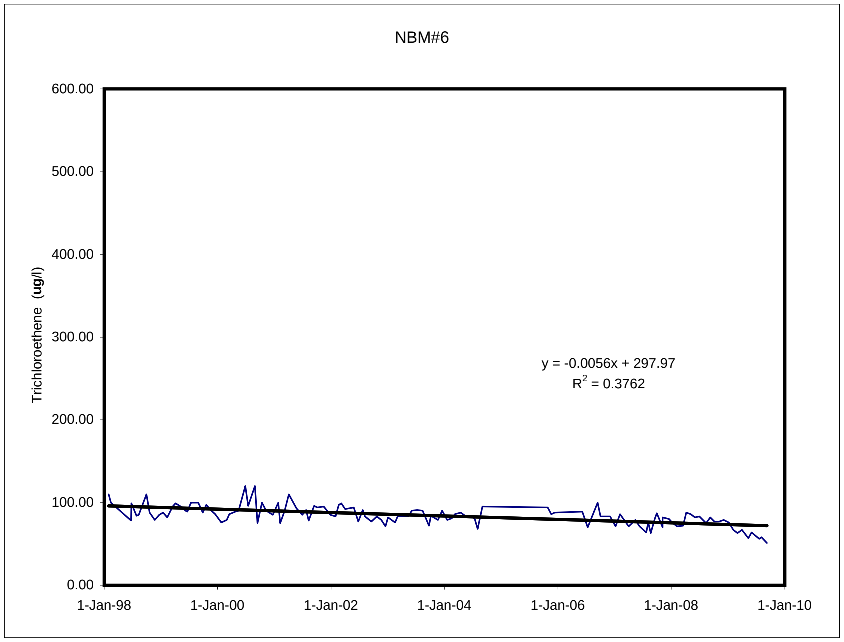



# NEW BRIGHTON MUNICIPAL WELLS:  Regression Analysis Since 1998: TRICHLOROETHENE



# D.3 Site C Analytical and Water Level Database

# APPENDIX D.3
# SITE C ANALYTICAL AND WATER LEVEL DATABASE

The Site C Analytical and Water Level Database is located on this DVD in the following Microsoft Excel file:

App D3_Site C WQ database_FY09 APRs

# Appendix E

## Well Inventory Update, FY 2009

**APPENDIX E**
**WELL INVENTORY UPDATE**

**FISCAL YEAR 2009**

## 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 2009 Update**

The updated MDH database was provided to Wenck on December 11, 2008. 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, 2007 and September 30, 2008. 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. All of the 62 newly constructed wells were monitoring wells and 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. Nine of these forty-four wells were classified into Category 6. Thirty-three of the wells were outside of the area or aquifer of concern and were classified into Category 3. Two wells could not be located during a site visit and were classified into Category 4a.

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).

Thirty-six Category 4 wells were field studied in FY 2009. This field study was accomplished through 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 as well as reclassification of some wells out of Category 4 due to new information and/or responses. Four wells were reclassified from Category 4 to Category 7 wells based on results of phone interviews and field reconnaissance. Two wells were reclassified as Category 2d based on owner responses. One well was reclassified as Category 3 based on site reconnaissance. One well was reclassified as Category 5 based on owner response and site reconnaissance. Three wells were completely removed from the database based on mapping results and/or CWI information. Two wells were added to Category 4a. A field investigation and sampling summary is included in Table E-6.

During the FY 2009 well inventory "major" sampling event Category 1a, 1b, 1c, 2a, 2b, 2c, and 4a wells were to be sampled. Through the FY 2009 well inventory update effort, sixteen wells were sampled The wells of concern that were not sampled were either found to be abandoned, non-existent, inoperable, or the well owners were not responsive to requests for access to sample. The analytical data from the FY 2009 sampling effort are summarized in Table E-2. The location of the wells sampled in FY 2009 is shown on Figure E-5.

Nine wells did not have any detections of New Brighton/Arden Hills Superfund Site contaminants and seven wells had one or more detections of these contaminants. None of the sampled wells had detections of New Brighton/Arden Hills Superfund Site contaminants above their respective OU1/OU3 cleanup levels. One sampled well was discovered to be a sand point well during site reconnaissance, and was reclassified as a Category 3 well (located at 2600 Pahl Avenue, St. Anthony).

Information contained in Tables E-3 through E-6 has been updated in the well inventory database (Filename "Well Inventory Main Database 2009", an Excel file included on this DVD).

**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 2013. Wells to be sampled in FY 2013 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 2009-FY2012 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 2009

| | | | *OU1 / OU3 COCs:* | | | | | | *Other Analytes:* | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Unique Number | Address | Sampling Date | Trichloroethene | 1,1-Dichloroethene | cis-1,2-Dichloroethene | 1,1,1-Trichloroethane | 1,1,2-Trichloroethane | 1,1-Dichloroethane | 1,1,1,2-Tetrachloroethane | 1,1,2,2-Tetrachloroethane | 1,2,3-Trichloropropane | 1,2-Dibromo-3-Chloropropane | 1,2-Dibromoethane | 1,2-Dichloroethane | 1,2-Dichloropropane | 1,3-Dichloropropane | 2-Hexanone |
| | | Cleanup Level(1) | 5 | 6 | 70 | 200 | 3 | 70 | | | | | | | | | |
| | | MDH HRL(2) | | | | | | | 70 | 2 | 40 | (Note 3) | 0.004 | 4 | 5 | (Note 3) | (Note 3) |
| --- | 2600 Pahl Ave | 6/16/09 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <5 |
| 433298 | Town & Country #2 | 6/16/09 | <1 | <1 | 5.9 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <5 |
| 200180 | Town & Country #1 | 6/16/09 | JP 0.65 | <1 | 6.0 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <5 |
| --- | 2935 Old Hwy 8 | 6/16/09 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <5 |
| --- | 2935 Old Hwy 8 D | 6/16/09 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <5 |
| 756236 | 150 26th Ave | 6/16/09 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | JP 0.16 | <1 | <1 | <5 |
| 234421 | 2151 Mustang Dr | 6/16/09 | <1 | <1 | <1 | <1 | <1 | JP 0.17 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <5 |
| 509052 | Shriners | 6/16/09 | <1 | <1 | JP 0.24 | <1 | <1 | JP 0.42 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <5 |
| S00437 | Northern Star | 6/15/09 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <5 |
| 249007 | 4453 Old Hwy 10 | 6/15/09 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <5 |
| 249007 | 4453 Old Hwy 10 D | 6/15/09 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <5 |
| S00002 | Midland Hills | 6/15/09 | JP 0.65 | JP 0.30 | 2.0 | <1 | <1 | JP 0.61 | <1 | <1 | <1 | <1 | <1 | JP 0.15 | <1 | <1 | <5 |
| 200523 | Windsor Green South | 6/15/09 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <5 |
| 200522 | Windsor Green East | 6/15/09 | <1 | <1 | <1 | <1 | <1 | JP 0.11 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <5 |
| 107405 | 4355 Old Hwy 10 | 6/15/09 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <5 |
| S00444 | Minneapolis Parks Dep't | 7/20/09 | JP 0.48 | <1 | JP 0.67 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | JP 0.31 | <1 | <1 | <5 |

# TABLE E-2

## WELL INVENTORY SAMPLING RESULTS
## Fiscal Year 2009

| Unique Number | Address | Sampling Date | *Other Analytes:* Acetone | Benzene | Bromodichloro-methane | Bromoform | Bromomethane | Carbon disulfide | Carbon tetrachloride | Chlorobenzene | Chloroethane | Chloroform | Chloromethane | cis-1,3-Dichloropropene | Dibromochloro-methane | Dibromomethane | Dichlorodifluoro-methane |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Cleanup Level[1] MDH HRL[2] | 700 | 2 | 6 | 40 | 10 | 700 | 3 | 100 | 300* | 30 | (Note 3) | 2 | 10 | (Note 3) | 1000 |
| --- | 2600 Pahl Ave | 6/16/09 | <5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 433298 | Town & Country #2 | 6/16/09 | <5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 200180 | Town & Country #1 | 6/16/09 | <5 | <1 | <1 | <1 | <1 | 62 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| --- | 2935 Old Hwy 8 | 6/16/09 | <5 | <1 | <1 | <1 | <1 | JP 0.41 UB0.34 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| --- | 2935 Old Hwy 8 D | 6/16/09 | <5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 756236 | 150 26th Ave | 6/16/09 | <5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 234421 | 2151 Mustang Dr | 6/16/09 | <5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 509052 | Shriners | 6/16/09 | <5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| S00437 | Northern Star | 6/15/09 | <5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 249007 | 4453 Old Hwy 10 | 6/15/09 | <5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 249007 | 4453 Old Hwy 10 D | 6/15/09 | <5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| S00002 | Midland Hills | 6/15/09 | <5 | JP 0.30 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 200523 | Windsor Green South | 6/15/09 | <5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 200522 | Windsor Green East | 6/15/09 | <5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 107405 | 4355 Old Hwy 10 | 6/15/09 | <5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| S00444 | Minneapolis Parks Dep't | 7/20/09 | <5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |

## TABLE E-2

## WELL INVENTORY SAMPLING RESULTS
## Fiscal Year 2009

| Unique Number | Address | Sampling Date | Ethyl benzene | Freon 11 | m,p-Xylene | Methyl ethyl ketone | Methyl isobutyl ketone | Methyl t-butyl ether | Methylene chloride | o-Xylene | Styrene | Tetrachloroethene | Toluene | trans-1,2-Dichloroethene | trans-1,3-Dichloropropene | Vinyl chloride |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | *Other Analytes:* | | | | | | | | | | | | | |
| | | Cleanup Level (1) MDH HRL (2) | 700 | 200,000 | 10,000 | 4000 | 300 | 70* | 5 | 10,000 | (Note 3) | 5 | 1000 | 100 | 2 | 0.2 |
| --- | 2600 Pahl Ave | 6/16/09 | <1 | <1 | <2 | <5 | <5 | <1 | <1 | <1 | 1.2 | <1 | JP 0.26 UB0.11 | <1 | <1 | <1 |
| 433298 | Town & Country #2 | 6/16/09 | <1 | <1 | <2 | <5 | <5 | <1 | <1 | <1 | <1 | <1 | <1 | JP 0.61 | <1 | <1 |
| 200180 | Town & Country #1 | 6/16/09 | <1 | <1 | <2 | <5 | <5 | <1 | <1 | <1 | <1 | <1 | <1 | JP 0.33 | <1 | <1 |
| --- | 2935 Old Hwy 8 | 6/16/09 | <1 | <1 | <2 | <5 | <5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| --- | 2935 Old Hwy 8 D | 6/16/09 | <1 | <1 | <2 | <5 | <5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 756236 | 150 26th Ave | 6/16/09 | <1 | <1 | <2 | <5 | <5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 234421 | 2151 Mustang Dr | 6/16/09 | <1 | <1 | <2 | <5 | <5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 509052 | Shriners | 6/16/09 | <1 | <1 | <2 | <5 | <5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| S00437 | Northern Star | 6/15/09 | <1 | <1 | <2 | <5 | <5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 249007 | 4453 Old Hwy 10 | 6/15/09 | <1 | <1 | <2 | <5 JMS65 | <5 | <1 | <1 | <1 | <1 | <1 JMS69 | <1 | <1 | <1 | <1 |
| 249007 | 4453 Old Hwy 10 D | 6/15/09 | <1 | <1 | <2 | <5 | <5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| S00002 | Midland Hills | 6/15/09 | <1 | <1 | <2 | <5 | <5 | JP 0.25 | <1 | <1 | <1 | 1.7 | <1 | <1 | <1 | JP 0.37 |
| 200523 | Windsor Green South | 6/15/09 | <1 | <1 | <2 | <5 | <5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 200522 | Windsor Green East | 6/15/09 | <1 | <1 | <2 | <5 | <5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| 107405 | 4355 Old Hwy 10 | 6/15/09 | <1 | <1 | <2 | <5 | <5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| S00444 | Minneapolis Parks Dep't | 7/20/09 | <1 | <1 | <2 | <5 | <5 | <1 | <1 | <1 | JP 0.19 | <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.

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 below the lower QC limit (the percent recovery is listed after "JS"). The sample result could be biased low.

UB The sample result was less than 5 times the level detected in a blank (the result for the blank is listed after "UB"). The sample result can be considered non detect at an elevated detection limit.

**TABLE E-3**
**CONSTRUCTED WELLS**

| Unique Number | Category | Last Name or Business Name | Street | City | Use | Depth | Date Drilled |
|---|---|---|---|---|---|---|---|
| 752812 | 6 | Remmele Engineering, Inc. | 10 Old Highway 8 | NEW BRIGHTON | Monitoring | 23 | 10/1/2007 |
| 752813 | 6 | Remmele Engineering, Inc. | 10 Old Highway 8 | NEW BRIGHTON | Monitoring | 20 | 10/1/2007 |
| 752814 | 6 | Remmele Engineering, Inc. | 10 Old Highway 8 | NEW BRIGHTON | Monitoring | 20 | 10/1/2007 |
| 752815 | 6 | Remmele Engineering, Inc. | 10 Old Highway 8 | NEW BRIGHTON | Monitoring | 22 | 10/1/2007 |
| 752816 | 6 | Remmele Engineering, Inc. | 10 Old Highway 8 | NEW BRIGHTON | Monitoring | 23 | 10/1/2007 |
| 752817 | 6 | Remmele Engineering, Inc. | 10 Old Highway 8 | NEW BRIGHTON | Monitoring | 18 | 10/1/2007 |
| 756587 | 6 | Frost | 1209 Tyler Street NE | MINNEAPOLIS | Monitoring | 24 | 8/1/2007 |
| 751345 | 6 | Ameripride Services | 700 Industrial Blvd NE | MINNEAPOLIS | Monitoring | 67 | 7/1/2007 |
| 751344 | 6 | Ameripride Services | 700 Industrial Blvd NE | MINNEAPOLIS | Monitoring | 68 | 7/1/2007 |
| 751343 | 6 | Ameripride Services | 700 Industrial Blvd NE | MINNEAPOLIS | Monitoring | 70 | 7/1/2007 |
| 751342 | 6 | Ameripride Services | 700 Industrial Blvd NE | MINNEAPOLIS | Monitoring | 72 | 7/1/2007 |
| 751341 | 6 | Ameripride Services | 700 Industrial Blvd NE | MINNEAPOLIS | Monitoring | 72 | 7/1/2007 |
| 751340 | 6 | Ameripride Services | 700 Industrial Blvd NE | MINNEAPOLIS | Monitoring | 72 | 7/1/2007 |
| 757552 | 6 | City of New Brighton | 1500 Old Highway 8 NW | NEW BRIGHTON | Monitoring | 8 | 10/1/2007 |
| 757555 | 6 | City of New Brighton | 1500 Old Highway 8 NW | NEW BRIGHTON | Monitoring | 36 | 10/1/2007 |
| 757556 | 6 | City of New Brighton | 1500 Old Highway 8 NW | NEW BRIGHTON | Monitoring | 12 | 10/1/2007 |
| 757557 | 6 | City of New Brighton | 1500 Old Highway 8 NW | NEW BRIGHTON | Monitoring | 13 | 10/1/2007 |
| 752315 | 6 | Ashland | 1400 Old Highway 8 NW | NEW BRIGHTON | Monitoring | 16 | 10/1/2007 |
| 752316 | 6 | Ashland | 1400 Old Highway 8 NW | NEW BRIGHTON | Monitoring | 14 | 10/1/2007 |
| 752317 | 6 | Ashland | 1400 Old Highway 8 NW | NEW BRIGHTON | Monitoring | 14 | 10/1/2007 |
| 752318 | 6 | Ashland | 1400 Old Highway 8 NW | NEW BRIGHTON | Monitoring | 14 | 10/1/2007 |
| 752319 | 6 | Ashland | 1400 Old Highway 8 NW | NEW BRIGHTON | Monitoring | 30 | 10/1/2007 |
| 752261 | 6 | U of M | 2525 Fourth Street SE | MINNEAPOLIS | Monitoring | 23 | 8/1/2007 |
| 752260 | 6 | U of M | 2525 Fourth Street SE | MINNEAPOLIS | Monitoring | 24 | 8/1/2007 |
| 759371 | 6 | City of Columbia Heights | 3900 University Ave NE | COLUMBIA HEIGHTS | Monitoring | 94 | 11/1/2007 |
| 759372 | 6 | City of Columbia Heights | 3900 University Ave NE | COLUMBIA HEIGHTS | Monitoring | 91 | 11/1/2007 |
| 759373 | 6 | City of Columbia Heights | 455 37th Ave NE | COLUMBIA HEIGHTS | Monitoring | 87 | 11/1/2007 |
| 759374 | 6 | City of Columbia Heights | 517 38th Ave NE | COLUMBIA HEIGHTS | Monitoring | 145 | 9/1/2007 |
| 759375 | 6 | City of Columbia Heights | 545 37th Ave NE | COLUMBIA HEIGHTS | Monitoring | 104 | 11/1/2007 |
| 759376 | 6 | City of Columbia Heights | 550 39th Ave NE | COLUMBIA HEIGHTS | Monitoring | 94 | 11/1/2007 |
| 759377 | 6 | City of Columbia Heights | 3900 Jefferson Street | COLUMBIA HEIGHTS | Monitoring | 94 | 11/1/2007 |
| 759378 | 6 | City of Columbia Heights | 38th Ave NE | COLUMBIA HEIGHTS | Monitoring | 104 | 11/1/2007 |
| 726794 | 6 | Minneapolis Public Library | 4026 26TH AVENUE S | MINNEAPOLIS | Monitoring | 38 | 9/1/2007 |
| 727254 | 6 | Alliant Techsystems, Inc. | 1500 Old Highway | NEW BRIGHTON | Monitoring | 7 | 12/1/2007 |
| 727255 | 6 | Alliant Techsystems, Inc. | 1500 Old Highway | NEW BRIGHTON | Monitoring | 7 | 12/1/2007 |
| 752830 | 6 | University Carleton | 2251 University Ave W | ST. PAUL | Monitoring | 33 | 1/1/2008 |
| 752831 | 6 | University Carleton | 2251 University Ave W | ST. PAUL | Monitoring | 37 | 1/1/2008 |
| 752832 | 6 | University Carleton | 2251 University Ave W | ST. PAUL | Monitoring | 28 | 1/1/2008 |
| 752833 | 6 | University Carleton | 2251 University Ave W | ST. PAUL | Monitoring | 30 | 1/1/2008 |
| 756595 | 6 | Ashland | 2800 Central Ave NE | MINNEAPOLIS | Monitoring | 48 | 10/1/2007 |
| 756596 | 6 | Ashland | 2800 Central Ave NE | MINNEAPOLIS | Monitoring | 48 | 11/1/2007 |
| 756597 | 6 | Ashland | 2800 Central Ave NE | MINNEAPOLIS | RC | 48 | 10/1/2007 |
| 756598 | 6 | Ashland | 2800 Central Ave NE | MINNEAPOLIS | RC | 48 | 10/1/2007 |
| 756599 | 6 | Ashland | 2800 Central Ave NE | MINNEAPOLIS | RC | 49 | 11/1/2007 |
| 737627 | 6 | CP Rail | 2800 Central Ave NE | MINNEAPOLIS | RC | 187 | 6/1/2006 |
| 759845 | 6 | Atlantic Richfield Co. | 5503 Erickson Road | MOUNDS VIEW | Monitoring | 22 | 5/1/2008 |
| 759848 | 6 | Atlantic Richfield Co. | 2280 County Road I | MOUNDS VIEW | Monitoring | 18 | 5/1/2008 |
| 759846 | 6 | Atlantic Richfield Co. | 5472 Adams Street | MOUNDS VIEW | Monitoring | 18 | 5/1/2008 |
| 759847 | 6 | Atlantic Richfield Co. | 5472 Adams Street | MOUNDS VIEW | Monitoring | 22 | 5/1/2008 |
| 752840 | 6 | Savant Properties | 812 Fourth Street SE | MINNEAPOLIS | Monitoring | 30 | 3/1/2008 |
| 752841 | 6 | Savant Properties | 816 Fourth Street SE | MINNEAPOLIS | Monitoring | 26 | 3/1/2008 |
| 752842 | 6 | Savant Properties | 811 Fourth Street SE | MINNEAPOLIS | Monitoring | 30 | 3/1/2008 |
| 757485 | 6 | Opus Northwest | 312 Ontario Street SE | MINNEAPOLIS | Monitoring | 32 | 8/1/2008 |
| 757484 | 6 | Opus Northwest | 818 Washington Ave SE | MINNEAPOLIS | Monitoring | 29 | 7/1/2008 |
| 757483 | 6 | Opus Northwest | 810 Washington Ave SE | MINNEAPOLIS | Monitoring | 32 | 8/1/2008 |
| 764188 | 6 | Capitol Hotel Group | 2407 University Ave SE | MINNEAPOLIS | Monitoring | 28 | 8/1/2008 |
| 764189 | 6 | Capitol Hotel Group | 2407 University Ave SE | MINNEAPOLIS | Monitoring | 27 | 8/1/2008 |
| 764190 | 6 | Capitol Hotel Group | 2407 University Ave SE | MINNEAPOLIS | Monitoring | 28 | 8/1/2008 |

# TABLE E-3
# CONSTRUCTED WELLS

| ***Unique Number*** | ***Category*** | ***Last Name or Business Name*** | ***Street*** | ***City*** | ***Use*** | ***Depth*** | ***Date Drilled*** |
|---|---|---|---|---|---|---|---|
| 764191 | 6 | Capitol Hotel Group | 2407 University Ave SE | MINNEAPOLIS | Monitoring | 27 | 8/1/2008 |
| 764192 | 6 | Capitol Hotel Group | 2407 University Ave SE | MINNEAPOLIS | Monitoring | 27 | 8/1/2008 |
| 764193 | 6 | Capitol Hotel Group | 2407 University Ave SE | MINNEAPOLIS | Monitoring | 27 | 8/1/2008 |
| 763293 | 6 | CBS | 2310 Kennedy Building | MINNEAPOLIS | Monitoring | 28 | 8/1/2008 |

Indicates wells that were both constructed and later sealed during FY 2008.

# TABLE E-4
# WELLS DISCLOSED THROUGH PROPERTY TRANSFER

| Unique Number | Category | Last Name or Business Name | Street | City | Use | Status | Depth | Date Drilled |
|---|---|---|---|---|---|---|---|---|
| 726803 | 6 | ~~Body Cote Thermal Processing,~~ Tankenoff | ~~940 E Henneping Ave,~~ 936 E Hennepin Ave | MINNEAPOLIS | Monitoring | In Use | 35 | 4/1/05 |
| 726804 | 6 | ~~Body Cote Thermal Processing,~~ Tankenoff | ~~941 E Henneping Ave,~~ 936 E Hennepin Ave | MINNEAPOLIS | Monitoring | In Use | 31 | 4/2/05 |
| 726805 | 6 | ~~Body Cote Thermal Processing,~~ Tankenoff | ~~942 E Henneping Ave,~~ 936 E Hennepin Ave | MINNEAPOLIS | Monitoring | In Use | 29 | 4/3/05 |
| 743482 | 6 | ~~Body Cote Thermal Processing,~~ Tankenoff | ~~900 E Henneping Ave,~~ 936 E Hennepin Ave | MINNEAPOLIS | Monitoring | In Use | 46 | 11/1/06 |
| 743483 | 6 | ~~Body Cote Thermal Processing,~~ Tankenoff | 900 E HENNEPIN | MINNEAPOLIS | Monitoring | In Use | 33 | 10/1/06 |
| 743484 | 6 | ~~Body Cote Thermal Processing,~~ Tankenoff | 900 E HENNEPIN | MINNEAPOLIS | Monitoring | In Use | 48 | 10/1/06 |
| 733248 | 6 | ~~Body Cote Thermal Processing,~~ Tankenoff | ~~900 E Henneping Ave,~~ 936 E Hennepin Ave | MINNEAPOLIS | Monitoring | In Use | 46 | 6/1/06 |
| 733247 | 6 | ~~Body Cote Thermal Processing,~~ Tankenoff | 900 E HENNEPIN | MINNEAPOLIS | Monitoring | In Use | 53 | 6/2/06 |
| 733246 | 6 | ~~Body Cote Thermal Processing,~~ Tankenoff | 900 E HENNEPIN | MINNEAPOLIS | Monitoring | In Use | 41 | 6/3/06 |
| UNKNOWN | 3 | Zhao | 1895 FAIRVIEW AVENUE N | FALCON HEIGHTS | | In Use | | |
| UNKNOWN | 3 | Berry | 3272 NEW BRIGTON ROAD | ARDEN HILLS | | In Use | | |
| UNKNOWN | 3 | Marinez | 7310 SILVER LAKE ROAD | MOUNDS VIEW | | In Use | | |
| UNKNOWN | 3 | Haake | 3032 I COUNTY ROAD | MOUNDS VIEW | | In Use | | |
| UNKNOWN | 3 | Marier | 2460 D COUNTY ROAD W | ROSEVILLE | | In Use | | |
| UNKNOWN | 3 | Thompson | 1742 HILLVIEW ROAD | SHOREVIEW | | In Use | | |
| UNKNOWN | 3 | Boone | 6715 CHANNEL ROAD NE | FRIDLEY | | In Use | | |
| UNKNOWN | 3 | Price | 1770 LAKE VALENTINE ROAD | ARDEN HILLS | | In Use | | |
| UNKNOWN | 3 | City of New Brighton | 200 FIFTH AVENUE NW | NEW BRIGHTON | | In Use | | |
| UNKNOWN | 3 | City of New Brighton | 200 FIFTH AVENUE NW | NEW BRIGHTON | | In Use | | |
| UNKNOWN | 3 | City of New Brighton | 200 FIFTH AVENUE NW | NEW BRIGHTON | | In Use | | |
| UNKNOWN | 3 | City of New Brighton | 200 FIFTH AVENUE NW | NEW BRIGHTON | | In Use | | |
| UNKNOWN | 3 | City of New Brighton | 200 FIFTH AVENUE NW | NEW BRIGHTON | | In Use | | |
| UNKNOWN | 3 | Shaq Acquision Corp. | 645 JOHNSON STREET NE | MINNEAPOLIS | | In Use | | |
| UNKNOWN | 3 | Shaq Acquision Corp. | 645 JOHNSON STREET NE | MINNEAPOLIS | | In Use | | |
| UNKNOWN | 3 | Shaq Acquision Corp. | 645 JOHNSON STREET NE | MINNEAPOLIS | | In Use | | |
| UNKNOWN | 3 | Shaq Acquision Corp. | 645 JOHNSON STREET NE | MINNEAPOLIS | | In Use | | |
| UNKNOWN | 3 | Shaq Acquision Corp. | 645 JOHNSON STREET NE | MINNEAPOLIS | | In Use | | |
| UNKNOWN | 3 | Shaq Acquision Corp. | 645 JOHNSON STREET NE | MINNEAPOLIS | | In Use | | |
| UNKNOWN | 3 | Shaq Acquision Corp. | 645 JOHNSON STREET NE | MINNEAPOLIS | | In Use | | |
| UNKNOWN | 3 | Shaq Acquision Corp. | 645 JOHNSON STREET NE | MINNEAPOLIS | | In Use | | |
| UNKNOWN | 3 | Shaq Acquision Corp. | 645 JOHNSON STREET NE | MINNEAPOLIS | | In Use | | |
| UNKNOWN | 3 | Shaq Acquision Corp. | 645 JOHNSON STREET NE | MINNEAPOLIS | | In Use | | |
| UNKNOWN | 3 | Knappenberger | 1921 GRANT ROAD | ARDEN HILLS | | In Use | | |
| UNKNOWN | 3 | Walker | 2205 LONG LAKE ROAD | NEW BRIGHTON | | In Use | | |
| UNKNOWN | 3 | Vangrootheest | 4471 10 HIGHWAY | ARDEN HILLS | | No Status Reported | | |
| UNKNOWN | 3 | MN DOT | 721 SECOND STREET SE | MINNEAPOLIS | | Not In Use | | |
| UNKNOWN | 3 | Thompson | 1742 HILLVIEW ROAD | SHOREVIEW | | Not In Use | | |
| UNKNOWN | 3 | Olson | 5754 SCHUTTA ROAD | SHOREVIEW | | Not In Use | | |
| UNKNOWN | 4a | Macdonald | 1672 14TH AVENUE NW | NEW BRIGHTON | | Not In Use | | |
| UNKNOWN | 4a | Holland | 1475 16TH STREET NW | NEW BRIGHTON | | Not In Use | | |
| UNKNOWN | 3 | New Brighton Commons, LLC | 200 FIFTH AVENUE NW | NEW BRIGHTON | | Not In Use | | |
| UNKNOWN | 3 | Shaq Acquision Corp. | 645 JOHNSON STREET NE | MINNEAPOLIS | | Not In Use | | |
| UNKNOWN | 3 | Welch | 1761 OAKWOOD DRIVE | SHOREVIEW | | Not In Use | | |
| UNKNOWN | 3 | Ziegler | 6425 DELLWOOD DRIVE NE | FRIDLEY | | Not In Use | | |

**TABLE E-5**
**SEALED WELLS**

| Unique Number | Category | Last Name or Business Name | Street | Status | Date Sealed |
|---|---|---|---|---|---|
| 505689 | 7a | BP | 2701 DELAWARE STREET SE | Sealed | 8/18/2008 |
| 517606 | ~~6,~~ 7a | U of M | 2510 FIFTH STREET S | Sealed | 9/18/2008 |
| 517607 | ~~6,~~ 7a | U of M | 2510 FIFTH STREET S | Sealed | 9/18/2008 |
| 539578 | 7a | Interplastics | 2015 BROADWAY STREET NE | Sealed | 10/31/2008 |
| 553026 | 7a | City of New Brighton | 1275 OLD HIGHWAY 8 | Sealed | 10/9/2008 |
| 553027 | 7a | City of New Brighton | 1369 OLD HIGHWAY 8 | Sealed | 10/9/2008 |
| 553029 | 7a | City of New Brighton | 1275 OLD HIGHWAY 8 | Sealed | 10/9/2008 |
| 581393 | 7a | U of M | | Sealed | 7/16/2008 |
| 592285 | 7a | MCDA | 650 25TH AVENUE SE | Sealed | 9/27/2007 |
| 598213 | ~~6,~~ 7a | Stewart Lumber Co. | ~~421 Johnson St NE,~~ 645 Johnson Street NW | ~~Unknown,~~ Sealed | 9/26/2008 |
| 628988 | 7a | City of New Brighton | 1369 OLD HIGHWAY 8 | Sealed | 10/9/2008 |
| 628989 | 7a | City of New Brighton | 1369 OLD HIGHWAY 8 | Sealed | 10/9/2008 |
| 628991 | 7a | City of New Brighton | 1369 OLD HIGHWAY 8 | Sealed | 10/9/2008 |
| 658861 | ~~6,~~ 7a | Brenntag Great Lakes, LLC | ~~Everett St,~~ 2130 Energy Park Drive | ~~Active,~~ Sealed | 3/28/2008 |
| 658862 | ~~6,~~ 7a | Brenntag Great Lakes, LLC | ~~Everett St,~~ 2130 Energy Park Drive | ~~Active,~~ Sealed | 3/28/2008 |
| 658867 | ~~6,~~ 7a | Brenntag Great Lakes, LLC | Capp Rd & Hersey St | ~~Active,~~ Sealed | 3/28/2008 |
| 658868 | ~~6,~~ 7a | Brenntag Great Lakes, LLC | ~~Capp Rd & Hersey St,~~ 2130 Energy Park Drive | ~~Active,~~ Sealed | 3/28/2008 |
| 663944 | 7a | MN PCA | 580 KASOTA AVENUE | Sealed | 11/30/2007 |
| 666479 | ~~6,~~ 7a | Brenntag Great Lakes, LLC | 2130 ENERGY PARK DRIVE | ~~Active,~~ Sealed | 4/17/2008 |
| 666480 | ~~6,~~ 7a | Brenntag Great Lakes, LLC | 2130 ENERGY PARK DRIVE | ~~Active,~~ Sealed | 3/28/2008 |
| 666481 | ~~6,~~ 7a | Brenntag Great Lakes, LLC | 2130 ENERGY PARK DRIVE | ~~Active,~~ Sealed | 3/28/2008 |
| 666482 | ~~6,~~ 7a | Brenntag Great Lakes, LLC | 2130 ENERGY PARK DRIVE | ~~Active,~~ Sealed | 4/9/2008 |
| 666483 | ~~6,~~ 7a | Brenntag Great Lakes, LLC | 2130 ENERGY PARK DRIVE | ~~Active,~~ Sealed | 3/28/2008 |
| 666485 | ~~6,~~ 7a | Brenntag Great Lakes, LLC | 2130 ENERGY PARK DRIVE | ~~Active,~~ Sealed | 3/28/2008 |
| 666486 | ~~6,~~ 7a | Brenntag Great Lakes, LLC | 2130 ENERGY PARK DRIVE | ~~Active,~~ Sealed | 4/9/2008 |
| 666487 | ~~6,~~ 7a | Brenntag Great Lakes, LLC | 2130 ENERGY PARK DRIVE | ~~Active,~~ Sealed | 3/28/2008 |
| 682732 | ~~6,~~ 7a | U of M | 545 OAK STREET SE | ~~Active,~~ Sealed | 8/8/2007 |
| 699643 | ~~6,~~ 7a | CSM | WESTGATE DRIVE | ~~Active,~~ Sealed | 6/16/2008 |
| 699644 | ~~6,~~ 7a | CSM | WESTGATE DRIVE | ~~Active,~~ Sealed | 6/16/2008 |
| 699645 | ~~6,~~ 7a | CSM | WESTGATE DRIVE | ~~Active,~~ Sealed | 6/16/2008 |
| 699646 | ~~6,~~ 7a | CSM | WESTGATE DRIVE | ~~Active,~~ Sealed | 6/16/2008 |
| 699647 | ~~6,~~ 7a | CSM | WESTGATE DRIVE | ~~Active,~~ Sealed | 6/16/2008 |
| 699648 | ~~6,~~ 7a | CSM | ~~526 Malcolm Ave SE,~~ 3171 Fifth Street | ~~Active,~~ Sealed | 6/16/2008 |
| 721690 | 7a | Minneapolis Public Library | 4026 26TH AVENUE S | Sealed | 8/14/2008 |
| 721691 | 7a | Minneapolis Public Library | 4026 26TH AVENUE S | Sealed | 8/14/2008 |
| 721692 | 7a | Minneapolis Public Library | 4026 26TH AVENUE S | Sealed | 8/14/2008 |
| 721782 | 7a | Minneapolis Public Library | 4000 28TH AVENUE S | Sealed | 8/14/2008 |
| 727216 | ~~6,~~ 7a | MN PCA | 580 KASOTA AVENUE | Sealed | 11/30/2007 |
| 752812 | ~~6,~~ 7a | Remmele Engineering | 10 OLD HIGHWAY 8 | ~~Active,~~ Sealed | 6/26/2008 |
| 752813 | ~~6,~~ 7a | Remmele Engineering | 10 OLD HIGHWAY 8 | ~~Active,~~ Sealed | 6/26/2008 |
| 752814 | ~~6,~~ 7a | Remmele Engineering | 10 OLD HIGHWAY 8 | ~~Active,~~ Sealed | 6/26/2008 |
| 752815 | ~~6,~~ 7a | Remmele Engineering | 10 OLD HIGHWAY 8 | ~~Active,~~ Sealed | 6/26/2008 |
| 752816 | ~~6,~~ 7a | Remmele Engineering | 10 OLD HIGHWAY 8 | ~~Active,~~ Sealed | 6/26/2008 |
| 752817 | ~~6,~~ 7a | Remmele Engineering | 10 OLD HIGHWAY 8 | ~~Active,~~ Sealed | 6/26/2008 |
| H0260319 | 7a | U of M | HURON BOULEVARD SE | Sealed | 7/9/2007 |
| H0260324 | 7a | CP Rail | 2900 CENTRAL AVENUE NE | Sealed | 7/17/2007 |
| H0265701 | 7a | Clover Management | 1000 D COUNTY ROAD W | Sealed | 10/16/2007 |
| H0246977 | 7a | No Owner Found | 675 VANDALIA STREET | Sealed | 3/16/2007 |
| H0259646 | 7a | Karen Werronen | 2087 FRY STREET | Sealed | 10/8/2007 |
| H0263598 | 7a | Marge Prior | 1340 MISSISSIPPI STREET | Sealed | 10/10/2007 |
| H0258147 | 7a | Dave Kuehn | 3581 RIDGEWOOD ROAD | Sealed | 10/24/2007 |
| H0266207 | 7a | Marge Prior | 1340 MISSISSIPPI STREET | Sealed | 10/23/2007 |
| H0264177 | 7a | BNSR | 2200 BLAKE AVENUE | Sealed | 7/25/2007 |
| H0262744 | 7a | Hennepin County Property Srvcs. | 1222 FOURTH STREET SE | Sealed | 10/3/2007 |
| H0252204 | 7a | City of New Brighton | 100 FIFTH AVENUE NW | Sealed | 11/12/2007 |
| H0266230 | 7a | City of New Brighton | 1400 OLD HIGHWAY 8 | Sealed | 12/5/2007 |
| H0266229 | 7a | City of New Brighton | 1400 OLD HIGHWAY 8 | Sealed | 12/5/2007 |
| H0266228 | 7a | City of New Brighton | 1400 OLD HIGHWAY 8 | Sealed | 12/5/2007 |
| H0266224 | 7a | City of New Brighton | 1400 OLD HIGHWAY 8 | Sealed | 12/5/2007 |
| H0266223 | 7a | City of New Brighton | 1400 OLD HIGHWAY 8 | Sealed | 12/5/2007 |
| 234296 | 7a | City of New Brighton | 1400 OLD HIGHWAY 8 | Sealed | 12/11/2007 |
| H0266227 | 7a | City of New Brighton | 1400 OLD HIGHWAY 8 | Sealed | 12/5/2007 |
| H0266226 | 7a | City of New Brighton | 1400 OLD HIGHWAY 8 | Sealed | 12/5/2007 |
| H0266225 | 7a | City of New Brighton | 1400 OLD HIGHWAY 8 | Sealed | 12/5/2007 |
| 409598 | ~~6,~~ 7a | ~~Trio Solvents,~~ City of New Brighton | ~~Butcher's Spur,~~ 1400 Old Hwy 8 | ~~Active,~~ Sealed | 12/5/2007 |
| 127537 | ~~2b,~~ 7a | ~~Midwest Asphalt,~~ City of New Brighton | 1400 OLD HIGHWAY 8 | ~~Active,~~ Sealed | 12/5/2007 |
| H0261837 | 7a | U of M | 2525 FOURTH STREET SE | Sealed | 6/29/2007 |
| H0266232 | 7a | Lynn Enger | 7748 KNOLLWOOD DRIVE | Sealed | 12/20/2007 |
| 726794 | ~~6,~~ 7a | Minneapolis Public Library | 4026 26TH AVENUE S | ~~Active,~~ Sealed | 8/14/2008 |
| H0263552 | 7a | U of M | 1805 FIFTH STREET E | Sealed | 8/8/2007 |
| H0266898 | 7a | Midland Grove Condos | 2220 MIDLAND GROVE ROAD | Sealed | 1/15/2008 |
| H0266202 | 7a | Vancleve Apartments East | 932 12TH AVENUE SE | Sealed | 11/8/2007 |
| H0253740 | 7a | RRLD, LLC | 4700 HIGHWAY 10 | Sealed | 7/30/2007 |
| H0253739 | 7a | RRLD, LLC | 4700 HIGHWAY 10 | Sealed | 7/23/2007 |
| H0268456 | 7a | All N Stream Partners, LLC | 309 FIFTH AVENUE NW | Sealed | 1/18/2008 |
| H0263653 | 7a | Kimes | 1740 MILLWOOD AVENUE | Sealed | 8/1/1990 |
| H0259662 | 7a | Patricia Lucas | 7517 TEMPO TERRACE NE | Sealed | 1/22/2008 |
| H0253738 | 7a | RRLD, LLC | 4700 HIGHWAY 10 | Sealed | 7/13/2007 |
| H0253737 | 7a | RRLD, LLC | 4700 HIGHWAY 10 | Sealed | 6/25/2007 |
| H0261964 | 7a | Opus Corp. | 2124 UNIVERSITY AVENUE W | Sealed | 2/8/2008 |

**TABLE E-5**
**SEALED WELLS**

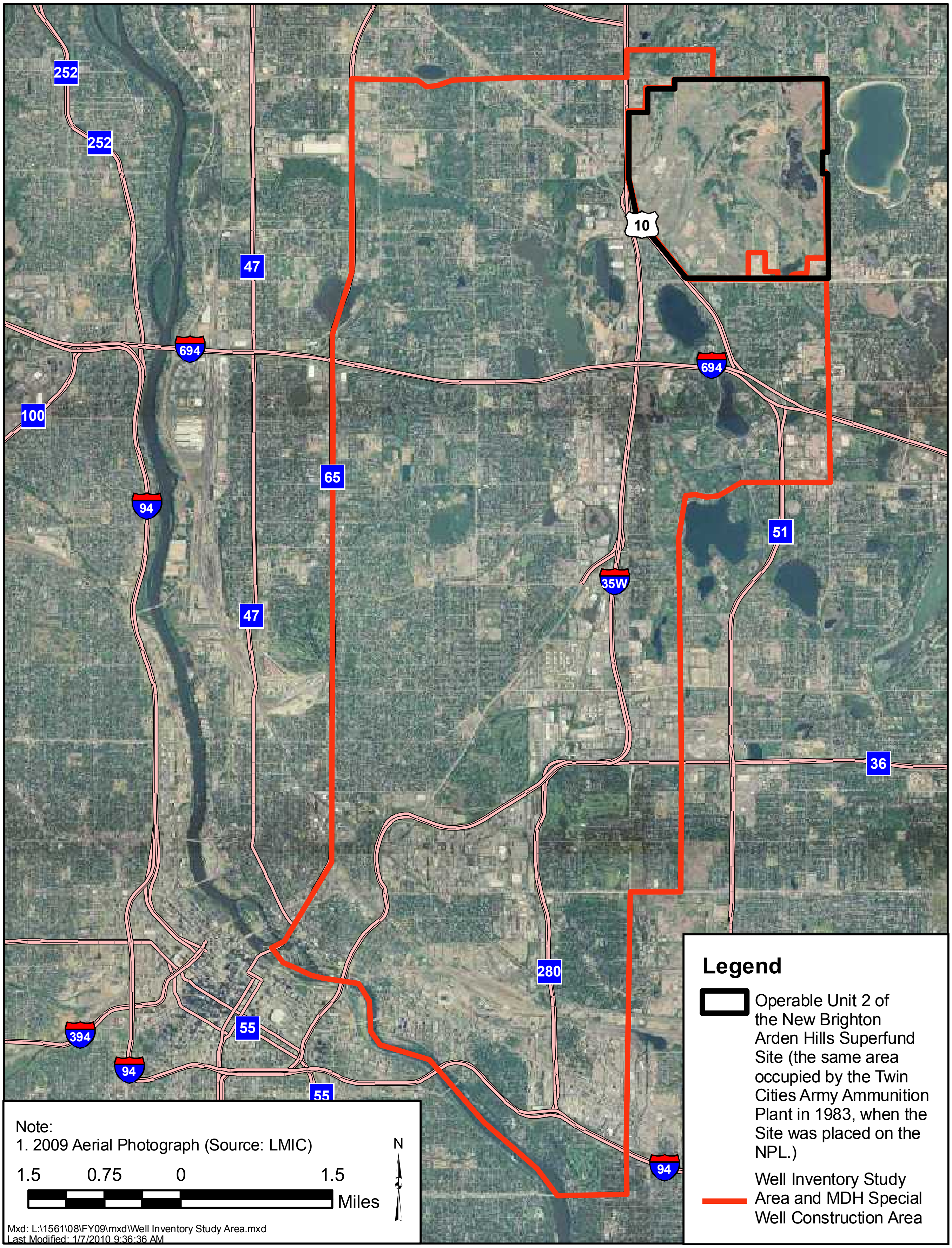
| Unique Number | Category | Last Name or Business Name | Street | Status | Date Sealed |
|---|---|---|---|---|---|
| H0253743 | 7a | Ryan Cos. | 2260 SUMMIT AVENUE | Sealed | 2/12/2008 |
| H0253744 | 7a | Ryan Cos. | 4700 HIGHWAY 10 | Sealed | 6/21/2007 |
| H0246971 | 7a | Hillcrest Development, LLLP | 950 13TH AVENUE NE | Sealed | 11/13/2006 |
| H0253579 | 7a | Bob Aten | 1987 BEACON STREET | Sealed | 3/1/2008 |
| H0259665 | 7a | Jim Carroll Estate | 2248 LAURIE ROAD W | Sealed | 2/29/2008 |
| H0253747 | 7a | United Properties, LLC | 2996 CLEVELAND AVENUE | Sealed | 3/14/2008 |
| H0267776 | 7a | Brenntag Great Lakes, LLC | 2130 ENERGY PARK DRIVE | Sealed | 3/28/2008 |
| H0267777 | 7a | Brenntag Great Lakes, LLC | 2130 ENERGY PARK DRIVE | Sealed | 3/28/2008 |
| H0262860 | 7a | Interplastics | 2015 BROADWAY STREET NE | Sealed | 12/11/2007 |
| H0262861 | 7a | Interplastics | 2015 BROADWAY STREET NE | Sealed | 12/11/2007 |
| H0262862 | 7a | Interplastics | 2015 BROADWAY STREET NE | Sealed | 12/11/2007 |
| H0262863 | 7a | Interplastics | 2015 BROADWAY STREET NE | Sealed | 12/11/2007 |
| H0262864 | 7a | Interplastics | 2015 BROADWAY STREET NE | Sealed | 12/11/2007 |
| H0262865 | 7a | Interplastics | 2015 BROADWAY STREET NE | Sealed | 12/11/2007 |
| H0262866 | 7a | Interplastics | 2015 BROADWAY STREET NE | Sealed | 12/11/2007 |
| H0267791 | 7a | Raees Chohan | 5300 CENTRAL AVENUE NE | Sealed | 4/3/2008 |
| H0268759 | 7a | Jim Ehlert | 6041 SIXTH STREET NE | Sealed | 4/1/2008 |
| H0268526 | 7a | Midwest Motor Express | 2169 MUSTANG DRIVE | Sealed | 4/10/2008 |
| 270056 | 7a | Roseville Properties | 2025 C COUNTY ROAD | Sealed | 5/5/2008 |
| H0268490 | 7a | Fedex | 2425 KENNEDY STREET NE | Sealed | 2/25/2008 |
| H0268766 | 7a | City of New Brighton | 1400 OLD HIGHWAY 8 | Sealed | 5/29/2008 |
| H0259689 | 7a | Metro Metals | 2576 DOSWELL AVENUE | Sealed | 6/12/2008 |
| 447914 | 7a | Metrol Metals | 2576 DOSWELL AVENUE | Sealed | 6/12/2008 |
| H0259690 | 7a | Curt Carbaugh | 2005 SUNNYSIDE TERRACE | Sealed | 6/16/2008 |
| H0269646 | 7a | Kumi Properties | 6071 UNIVERSITY AVENUE | Sealed | 6/27/2008 |
| H0253748 | 7a | Center Pointe Energy | 1905 BLUFF STREET | Sealed | 4/3/2008 |
| H0268525 | 7a | Resource Center of the Americas | 3012 27TH AVENUE W | Sealed | 4/9/2008 |
| H0272368 | 7a | Jane Cochiarella | 5560 ALDINE STREET | Sealed | 7/14/2008 |
| H0268794 | 7a | City of New Brighton | 1400 OLD HIGHWAY 8 | Sealed | 7/10/2008 |
| H0259697 | 7a | Jaavi Sober | 2924 NOBLE AVENUE N | Sealed | 7/14/2008 |
| H0251127 | 7a | Pat Hauer | 2255 LAURIE ROAD W | Sealed | 7/22/2008 |
| H0268057 | 7a | MN PCA | 1335 CENTRAL AVENUE NE | Sealed | 4/23/2008 |
| H0268058 | 7a | MN PCA | 1335 CENTRAL AVENUE NE | Sealed | 4/23/2008 |
| H0269246 | 7a | Whitebox Riverport | 2901 FIFTH STREET NE | Sealed | 7/16/2008 |
| H0269699 | 7a | MN DOT | | Sealed | 8/6/2008 |
| H0273505 | 7a | City of New Brighton | 1400 OLD HIGHWAY 8 | Sealed | 8/11/2008 |
| H0259714 | 7a | Greg Pallo | 2021 GLEN PAUL AVENUE | Sealed | 8/22/2008 |
| H0268012 | 7a | Beth Nelson | 2530 SILVER LAKE ROAD | Sealed | 8/22/2008 |
| H0273511 | 7a | Frances Jay | 1230 12TH AVENUE NW | Sealed | 9/2/2008 |
| H0269209 | 7a | City of New Brighton | 1200 OLD HIGHWAY 8 NW | Sealed | 4/16/2008 |
| 236122 | ~~6,~~ 7a | ~~Old Northwest Refinery,~~ City of New Brighton | 1400 OLD HIGHWAY 8 | ~~Active,~~ Sealed | 9/3/2008 |
| H0259717 | 7a | Tom Deschane | 7044 KNOLLWOOD DRIVE | Sealed | 8/27/2008 |
| H0273506 | 7a | Welch Co. | 775 VANDALIA STREET | Sealed | 7/29/2008 |
| H0273525 | 7a | Mike Kluthe | 127 SECOND AVENUE SE | Sealed | 10/6/2008 |
| H0274398 | 7a | Scheft Const. | 1892 TATUM STREET | Sealed | 9/24/2008 |
| H0273287 | 7a | Speedway Superamerica | | Sealed | 9/25/2008 |
| H0274124 | 7a | Water Supply | 2532 MILLWOOD STREET | Sealed | 10/7/2008 |
| H0273289 | 7a | Michael Frier | 2701 DELAWARE STREET SE | Sealed | 8/18/2008 |
| H0269165 | 7a | Opus Northwest, LLC | 307 OAK STREET SE | Sealed | 7/18/2008 |
| H0269164 | 7a | Opus Northwest, LLC | 313 OAK STREET SE | Sealed | 8/11/2008 |
| H0269163 | 7a | Opus Northwest, LLC | 814 WASHINGTON AVENUE SE | Sealed | 7/17/2008 |
| H0271454 | 7a | Bell Lumber and Pole Co. | 778 FIRST STREET NW | Sealed | 10/23/2008 |
| H0271453 | 7a | Bell Lumber and Pole Co. | 778 FIRST STREET NW | Sealed | 10/23/2008 |
| H0271452 | 7a | Bell Lumber and Pole Co. | 778 FIRST STREET NW | Sealed | 10/23/2008 |
| H0259732 | 7a | Henry Martin | 515 66TH AVENUE NE | Sealed | 10/20/2008 |
| 200385 | ~~3,~~ 7a | ~~Standard Spring Co,~~ MN DOT | 721 SECOND STREET SE | ~~Active,~~ Sealed | 9/19/2008 |
| H0273720 | 7a | Crown Caste USA, Inc. | 2801 37TH AVENUE NE | Sealed | 10/28/2008 |
| H0265830 | 7a | BBD Holdings, Inc. | 2010 HENNEPIN AVENUE | Sealed | 10/7/2008 |
| H0274064 | 7a | Steven Grothlon | 1501 HENNEPIN AVENUE E | Sealed | 9/8/2008 |
| H0274079 | 7a | Clark Gasson | 1000 UNIVERISTY AVENUE | Sealed | 9/26/2008 |
| H0275208 | 7a | Interplastics | 2015 BROADWAY | Sealed | 10/31/2008 |
| H0272031 | 7a | Jax Restaurant and Banquet | 1928 UNIVERSITY AVENUE NE | Sealed | 10/30/2008 |
| 200256 | 7a | Jax Restaurant and Banquet | 1928 UNIVERSITY AVENUE NE | Sealed | 10/30/2008 |
| 231878 | 7a | ~~Mengelkock Co,~~ City of New Brighton | 119 14TH STREET NW | Sealed | 3/17/2008 |
| 236512 | 7a | ~~Gordon Rendering Co,~~ City of New Brighton | ~~Butcher Allotment #1,~~ 119 14th Street NW | Sealed | 3/17/2008 |
| 517502 | 7a | ~~Mengelkock Co,~~ City of New Brighton | 119 14TH STREET NW | Sealed | 3/17/2008 |
| 517503 | 7a | ~~Mengelkock Co,~~ City of New Brighton | 119 14TH STREET NW | Sealed | 3/17/2008 |
| 517504 | 7a | ~~Mengelkock Co,~~ City of New Brighton | 119 14TH STREET NW | Sealed | 3/17/2008 |
| 726802 | ~~6,~~ 7a | ~~Body Cote Thermal Processing,~~ Tankenoff | ~~940 E Hennepin Ave,~~ 936 E Hennepin Ave | Sealed | 10/10/2008 |
| H0003793 | 7a | ~~Mogren,~~ Bhrenberg | 1745 ROSE PLACE | Sealed | 3/3/2008 |
| H0026384 | 7a | ~~Lindgren,~~ Lundgren Trust | ~~1777 Ramsey Rd,~~ 1777 Gramsie Road | Sealed | 1/17/2008 |
| H0102077 | 7a | Tankenoff | 900 HENNEPIN AVENUE E | Sealed | 10/10/2008 |
| H0118456 | 7a | ~~Body Cote Thermal Processing,~~ Tankenoff | ~~900 E Hennepin Ave,~~ 936 E Hennepin Ave | Sealed | 10/10/2008 |
| H0139155 | 7a | ~~Stewart Lumber Co.,~~ Shaq Acquistion Corp. | ~~421 Johnson St NE,~~ 645 Johnson St NE | Sealed | 4/30/2008 |
| H0156104 | 7a | ~~Johnson,~~ Opack | 1717 STANBRIDGE AVENUE | Sealed | 1/18/2008 |
| H0192299 | 7a | Becker | 1901 17TH STREET NW | Sealed | 1/18/2008 |
| H0192369 | 7a | ~~Bisset,~~ Schill | 2577 H COUNTY ROAD | Sealed | 1/16/2008 |
| H0192830 | 7a | Dougherty | 2705 ST. ANTHONY BOULEVARD | Sealed | 3/7/2008 |
| H0198147 | 7a | ~~Stewart Lumber Co.,~~ Shaq Acquistion Corp. | ~~421 Johnson St NE,~~ 645 Johnson St NE | Sealed | 4/30/2008 |
| H0198733 | 7a | ~~Scott,~~ Wappes | 2520 PAHL AVENUE | Sealed | 2/4/2008 |

**TABLE E-5**
**SEALED WELLS**

| *Unique Number* | *Category* | *Last Name or Business Name* | *Street* | *Status* | *Date Sealed* |
|---|---|---|---|---|---|
| H0216736 | 7a | City of New Brighton | 119 14TH STREET NW | Sealed | 3/17/2008 |
| H0220134 | 7a | Tankenoff | 936 E HENNEPIN AVENUE | Sealed | 10/10/2008 |
| H0241840 | 7a | ~~Gill,~~ Gillard | 2524 PAHL AVENUE NE | Sealed | 3/7/2008 |
| H0245986 | 7a | ~~Dunn,~~ Nguyen | 2911 FAIRVIEW AVENUE N | Sealed | 10/8/2007 |
| H0243689 | 7a | Spika | 699 W SEXTANT | Sealed | 3/14/2008 |
| 257072 | 7a | Ramsey County Historical Society | 2129 LARPENTEUR AVENUE W | Sealed | 1/16/2008 |
| H0242480 | 7a | Ramsey County Historical Society | 2129 LARPENTEUR AVENUE W | Sealed | 1/16/2008 |
| H0243697 | 7a | Salmanpour | 3061 SHOREWOOD LANE | Sealed | 10/5/2007 |
| H0243699 | 7a | ~~Guerrero,~~ Salmanpour | 3061 SHOREWOOD LANE | Sealed | 10/5/2007 |
| H0243698 | 7a | ~~Guerrero,~~ Salmanpour | 3061 SHOREWOOD LANE | Sealed | 10/5/2007 |
| H0253220 | 7a | ~~Brudlos,~~ Bickford | 1798 STANBRIDGE AVENUE | Sealed | 1/18/2008 |
| H0252921 | 7a | ~~Kahlhamer,~~ Schirmacher | 5837 ARTHUR STREET | Sealed | 11/5/2007 |
| H0252922 | 7a | ~~Zbikowski,~~ Loerch | 1805 SUNNYSIDE TERRACE | Sealed | 1/16/2008 |
| H0237006 | 7a | ~~Downing,~~ Sands | 5071 GREENWOOD DRIVE | Sealed | 1/18/2008 |
| H0258105 | 7a | ~~Cunninen,~~ Flint | 2661 N SHELDON ROAD | Sealed | 4/4/2008 |
| H0260192 | 7a | ~~Dillner,~~ George | 2192 ACORN ROAD | Sealed | 1/16/2008 |
| H0258119 | 7a | ~~Derauf,~~ Jorgensen | 2569 GROTTO STREET | Sealed | 3/3/2008 |
| H0261713 | 7a | ~~Nelson,~~ Brainard | 5049 WASHINGTON STREET NE | Sealed | 1/30/2008 |
| H0249531 | 7a | ~~Jocobus,~~ Larson | 6562 ANOKA STREET NE | Sealed | 2/22/2008 |
| UNKNOWN | 7a | Deeble | 1791 TATUM STREET | Sealed | 10/5/2007 |
| UNKNOWN | 7a | Carr | 1903 WALNUT STREET | Sealed | 10/8/2007 |
| UNKNOWN | 7a | Mclaughlin | 1668 MISSISSIPPI STREET NE | Sealed | 12/20/2007 |
| UNKNOWN | 7a | Ullrich | 7516 TEMPO TERRACE NE | Sealed | 1/4/2008 |
| UNKNOWN | 7a | Byrne | 1491 ONONDAGA STREET NE | Sealed | 1/11/2008 |
| UNKNOWN | 7a | | 1857 TATUM STREET | Sealed | 1/16/2008 |
| UNKNOWN | 7a | Dotzenroth | 463 DESNOYER AVENUE | Sealed | 1/16/2008 |
| UNKNOWN | 7a | Martinez | 7310 SILVER LAKE ROAD | Sealed | 1/16/2008 |
| UNKNOWN | 7a | Welch | 5620 ALDINE STREET | Sealed | 1/16/2008 |
| H0263653 | 7a | Laugen | 1740 MILLWOOD AVENUE | Sealed | 1/17/2008 |
| UNKNOWN | 7a | North | 2982 PATTON ROAD | Sealed | 1/17/2008 |
| UNKNOWN | 7a | Nelson | 5045 RAINBOW LANE | Sealed | 1/18/2008 |
| UNKNOWN | 7a | Melius | 281 FIRST STREET SE | Sealed | 1/18/2008 |
| UNKNOWN | 7a | Opack | 1717 STANBRIDGE AVENUE | Sealed | 1/18/2008 |
| UNKNOWN | 7a | Sharabi | 1953 SHARONDALE AVENUE | Sealed | 1/18/2008 |
| UNKNOWN | 7a | Fotsch | 1801 LYDIA AVENUE W | Sealed | 1/18/2008 |
| UNKNOWN | 7a | Wakem | 1568 FERNDALE AVENUE | Sealed | 1/18/2008 |
| H0251421 | 7a | Murphy Bros. Capital | 2515 RAINBOW LANE | Sealed | 7/9/2008 |
| UNKNOWN | 7a | Larson | 6562 ANOKA STREET NE | Sealed | 2/22/2008 |
| UNKNOWN | 7a | Bernstrom | 2589 ALDINE STREET | Sealed | 2/29/2008 |
| UNKNOWN | 7a | Opsahl | 2137 FAIRWAYS LANE | Sealed | 3/3/2008 |
| UNKNOWN | 7a | Leverenz | 1340 MISSISSIPPI STREET NE | Sealed | 3/11/2008 |
| UNKNOWN | 7a | Vanalst | 5567 FAIRVIEW AVENUE N | Sealed | 3/14/2008 |
| H0198148 | 7a | Shaq Acquistion Corp. | 645 JOHNSON STREET NE | Sealed | 4/30/2008 |
| UNKNOWN | 7a | Kallok | 7517 TEMPO TERRACE NE | Sealed | 5/1/2008 |
| UNKNOWN | 7a | City of New Brighton | 119 14TH STREET NW | Sealed | 3/17/2008 |
| UNKNOWN | 7a | City of New Brighton | 119 14TH STREET NW | Sealed | 3/17/2008 |
| UNKNOWN | 7a | City of New Brighton | 119 14TH STREET NW | Sealed | 3/17/2008 |
| UNKNOWN | 7a | City of New Brighton | 119 14TH STREET NW | Sealed | 3/17/2008 |
| UNKNOWN | 7a | City of New Brighton | 119 14TH STREET NW | Sealed | 3/17/2008 |
| UNKNOWN | 7a | City of New Brighton | 119 14TH STREET NW | Sealed | 3/17/2008 |
| UNKNOWN | 7a | City of New Brighton | 119 14TH STREET NW | Sealed | 3/17/2008 |
| UNKNOWN | 7a | Brock | 6041 SIXTH STREET | Sealed | 6/18/2008 |
| UNKNOWN | 7a | Dobyns | 536 11TH AVENUE NW | Sealed | 7/9/2008 |
| UNKNOWN | 7a | Alberts | 2940 SPRINGVIEW LANE | Sealed | 7/9/2008 |
| UNKNOWN | 7a | Kelly | 1733 TATUM STREET | Sealed | 7/9/2008 |
| H0256390 | 7a | | 7406 SPRING LAKE ROAD | Sealed | 10/23/2008 |
| H0259714 | 7a | Sanders | 2021 GLEN PAUL AVENUE | Sealed | 12/5/2008 |
| UNKNOWN | 7a | Grubidge | 2005 SUNNYSIDE TERRACE | Sealed | 9/5/2008 |
| UNKNOWN | 7a | Kothbauer | 5560 ALDINE STREET | Sealed | 9/5/2008 |
| UNKNOWN | 7a | Anderson | 2579 WHEELER STREET | Sealed | 9/5/2008 |
| UNKNOWN | 7a | Visaria | 2255 LAURIE ROAD W | Sealed | 9/5/2008 |
| UNKNOWN | 7a | Smith | 1659 MAPLE KNOLL DRIVE | Sealed | 9/9/2008 |
| UNKNOWN | 7a | Doneen | 1886 SHRYER AVENUE W | Sealed | 10/23/2008 |
| UNKNOWN | 7b | City of New Brighton | 119 14TH STREET NW | Sealed | 2007 or 2008 |

**TABLE E-6**
**FY 2009 FIELD INVESTIGATION AND SAMPLING SUMMARY**

| *Unique Number* | *Category* | *Last Name or Business Name* | *Street* | *City* | *Date Last Sampled* | *Status* | *Depth* | *Comments* |
|---|---|---|---|---|---|---|---|---|
| UNKNOWN | 4a | Macdonald | 1672 14TH AVENUE NW | NEW BRIGHTON | | Not in Use | | No response to letter or site visit. |
| UNKNOWN | 4a | Holland | 1475 16TH STREET NW | NEW BRIGHTON | | Not in Use | | No response to letter or site visit. |
| | 4a | Amundsen | 2816 St. Anthony Blvd | St. Anthony | | Not in Use | | No response to letter. |
| | 4a | Bryant, Jr. | 615 12th Ave NW | New Brighton | | Not in Use | | Email from Mr. Bryant 5/4/09 saying well is inoperable, does not have a functioning pump, and is not plumbed in any way to the house or outside faucets. The only reason it has not been capped is becase it is located in the basement area under a porch and cannot be accessed from outside. Well reclassified as category 2d. |
| | 4a | Burton | 2073 10th St NW | New Brighton | | Inactive | | No response to letter. |
| | 4a | City of New Brighton | 19 14th St NW | New Brighton | | Active | | Talked with Grant from City of New Brighton 5/4/09 who said that well was "removed" in 2007 or 2008. Well reclassified as category 7b. |
| | 4a | Cuddihy | 2933 Troseth Road | Roseville | | Not in Use | | No response to letter. |
| | 4a | Hermes | 2935 Old Hwy 8 | Roseville | 6/22/2005 | Active | | Sampled June 16, 2009. |
| | 4a | Olson | 4439 Old Hwy 10 | Arden Hills | | In Use | | No response to letter. |
| | 4a | McGee | 2512 27th Ave NE | St. Anthony | | Inactive | | Call from new owner (Jerry McGee) on 5/4/09 saying well was "capped" in 2005. CWI lists well # 256760 at this address, but does not show that it is sealed. Well reclassified as category 7b. |
| | 4a | Weisenberger | 2816 Silver Lake Rd | St. Anthony | | Inactive | | No response to letter. |
| | 4a | Willig | 2600 Pahl Ave | St. Anthony | | Inactive | | Sampled 6/16/09, went and looked at well in basement-it is a sand point well and therefore not screened in an aquifer of concern. Reclassified as category 3 well. |
| 249185 | 4a | Novotny | 1706 Malvern St | Lauderdale | | Unknown | | No response to letter. |
| S00295 | 4a | Alfson | 2351 Summer St | Lauderdale | | Unknown | | No response to letter. |
| | 4b | Meridian Properties Real Estate Dev., LLC. | 3700 Silver Lake Rd | St. Anthony | | Active | | Stopped by site 5/1/09, it is now a Walgreens. Spoke with store manager, he knew of no wells onsite. Reclassified as Category 5 well. |
| | 4b | New Brighton Alano Society, Inc. | | Mounds View | | Active | | Found out well has been sealed. Reclassified as category 7b well. |
| | 4b | New Brighton Alano Society, Inc. | | Mounds View | | Active | | Found out well has been sealed. Reclassified as category 7b well. |
| | 4b | Murray Heights | | | | Not in Use | | Could not locate. |
| | 4b | Ras Pac Holdings (Pacal Steel) | 2500 W County Road B | Roseville | | Inactive | | Sent letter. Received voicemail 5/20/09 from Patrick Fischer stating that "well is inoperable" and "please take us off your list." Reclassified as category 2d well. |
| 105242 | 4b | Weber, Nordeen Jr. | | | | Active | 214 | Could not locate. |
| 105271 | 4b | Nelson | | | | Active | 137 | Could not locate. |
| 126463 | 4b | B & M Construction | Nordeen Estates | | | Active | 216 | Could not locate. |
| 130000 | 4b | 550 Associates | | Arden Hills | | Inactive | | Could not locate. |
| 180922 | 4b | | | | | Active | | CWI lists #180922 as a "community supply" well located in Shakopee. Well should be deleted from database. |
| 192091 | 4b | | | Elmwood | | Active | | Mapped Elmwood- outside study area (near Moorhead). Well should be deleted from database. |
| 201192 | 4b | | | | | Active | | Could not locate. |
| 234434 | 4b | Marquart | | Arden Hills | | Unknown | | Could not locate. |
| 234532 | 4b | | | | | | | Could not locate. |
| 234537 | 4b | | | | | | | Could not locate. |
| 234545 | 4b | | | | PHASE I | | | Could not locate. |
| 234658 | 4b | | | | 6/7/1982 | | | Could not locate. |
| 234568 | 4b | Thomsen | 4 88th NE | Minneapolis | | | 200 | Mapped 88th Ave NE-location is outside Study Area and should be deleted from database. |
| 239465 | 4b | Lennox | | | | Active | 256 | Could not locate. |
| S00471 | 4b | R Komarek/Nelson-Miller Cons | | | | Inactive | | Could not locate. |
| S00551 | 4b | Tamarack Care Temp | | | 2/17/1982 | Unknown | | Could not locate. |
| S00650 | 4b | CME | | New Brighton | 6/24/1984 | | | Could not locate. |




## 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.)

Well Inventory Study Area and MDH Special Well Construction Area

Note:
1. 2009 Aerial Photograph (Source: LMIC)

1.5 0.75 0 1.5 Miles

N

Mxd: L:\1561\08\FY09\mxd\Well Inventory Study Area.mxd
Last Modified: 1/7/2010 9:36:36 AM

ANNUAL PERFORMANCE REPORT

Well Inventory Study Area

COPYRIGHT

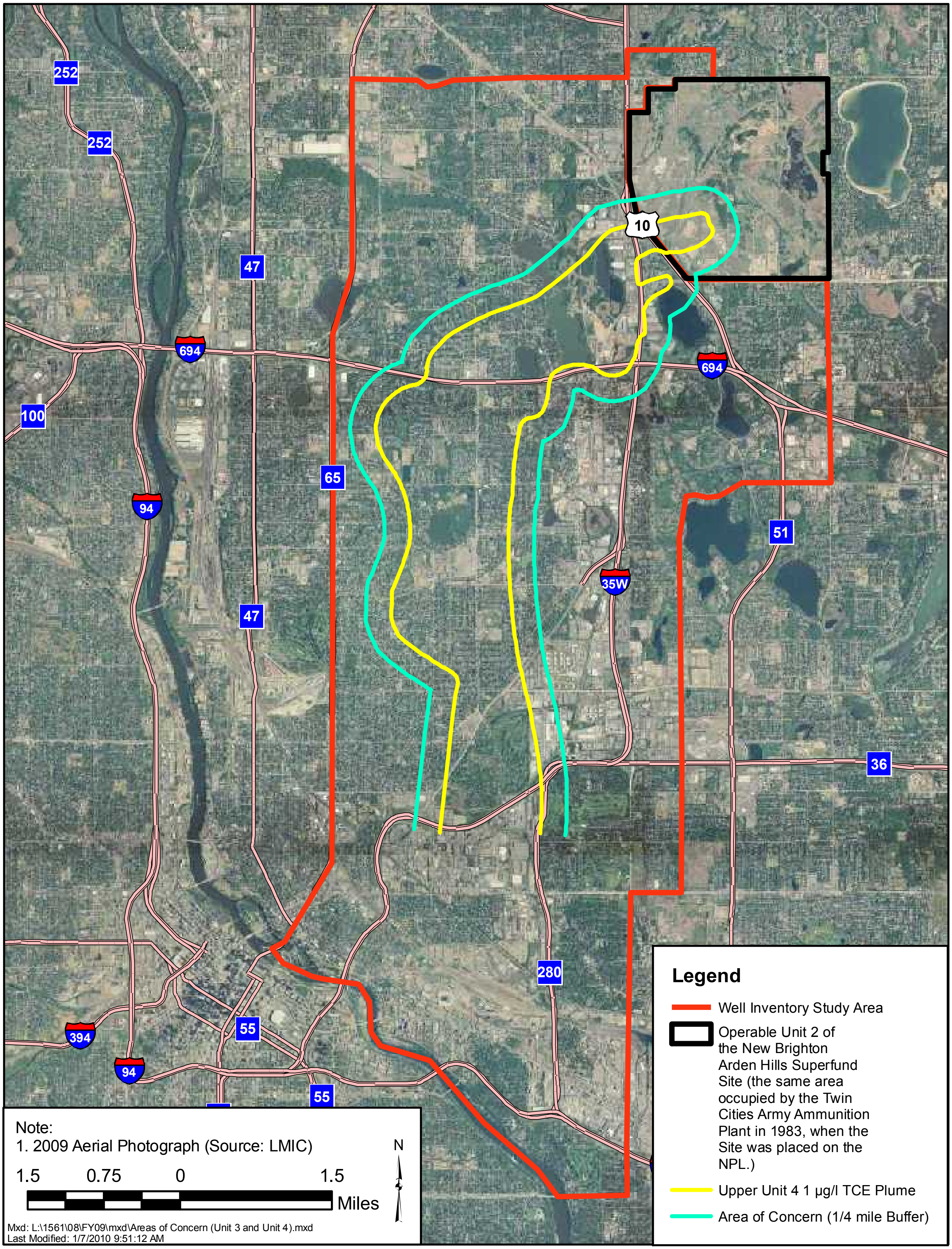
Wenck

Wenck Associates, Inc. Environmental Engineers

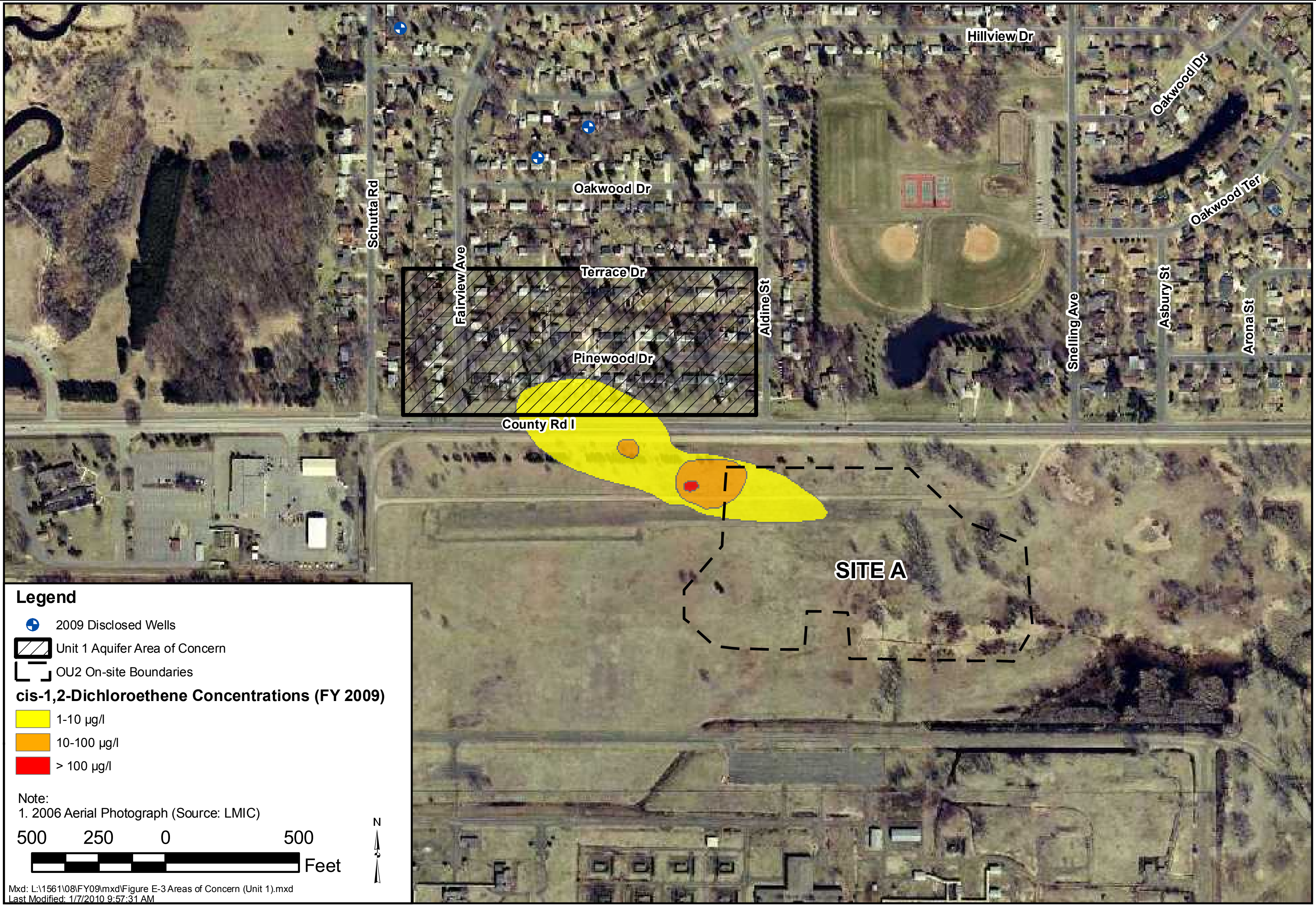
1800 Pioneer Creek Center Maple Plain, MN 55359-0429

FY 2009

Figure E-1




| ANNUAL PERFORMANCE REPORT | Wenck | FY 2009 |
|---|---|---|
| Areas of Concern (Unit 3 and Unit 4) | Wenck Associates, Inc. Environmental Engineers; 1800 Pioneer Creek Center Maple Plain, MN 55359-0429 | Figure E-2 |




ANNUAL PERFORMANCE REPORT

Area of Concern (Unit 1)

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Environmental Engineers

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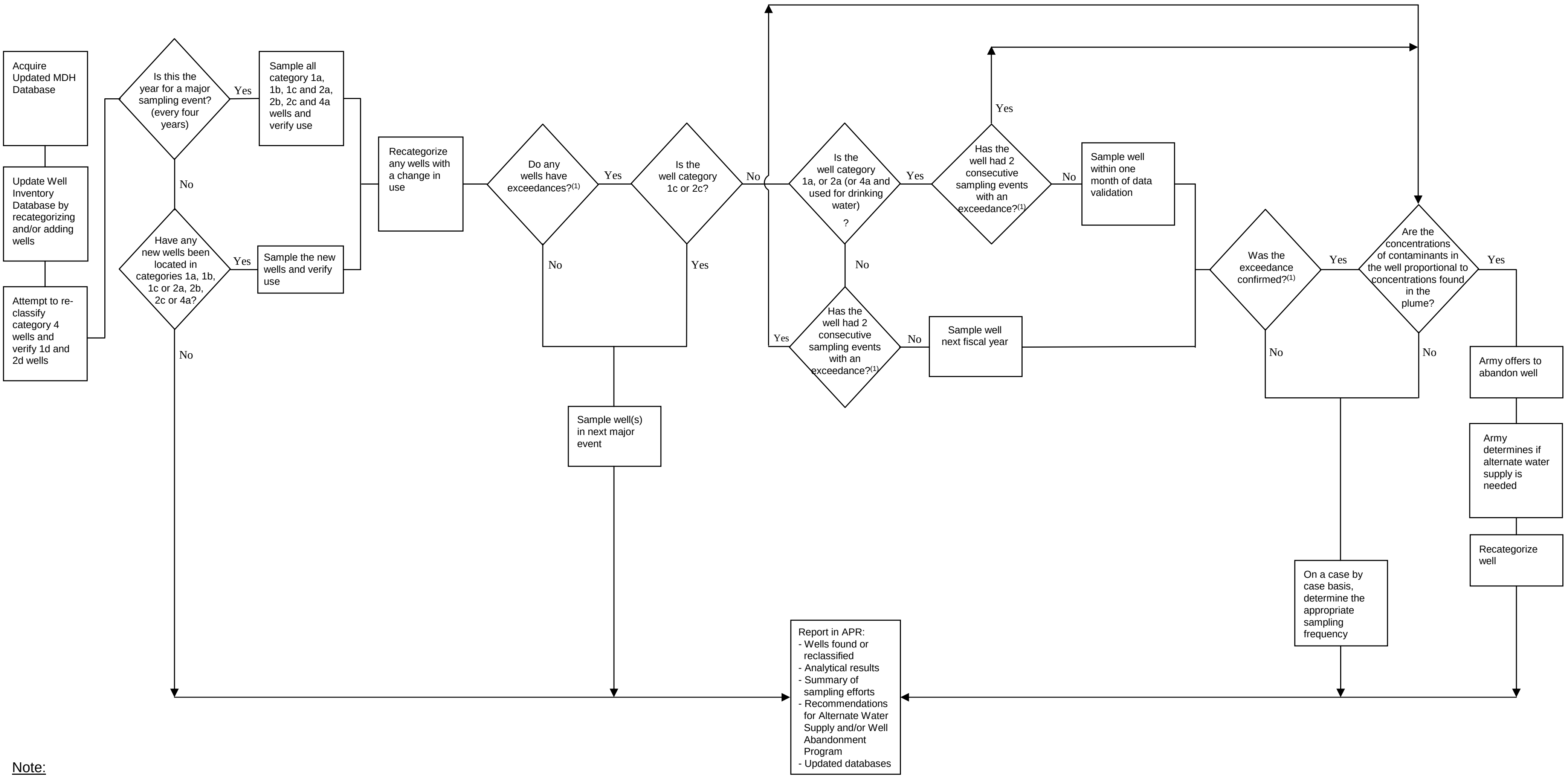
Maple Plain, MN 55359-0429

FY 2009

Figure E-3

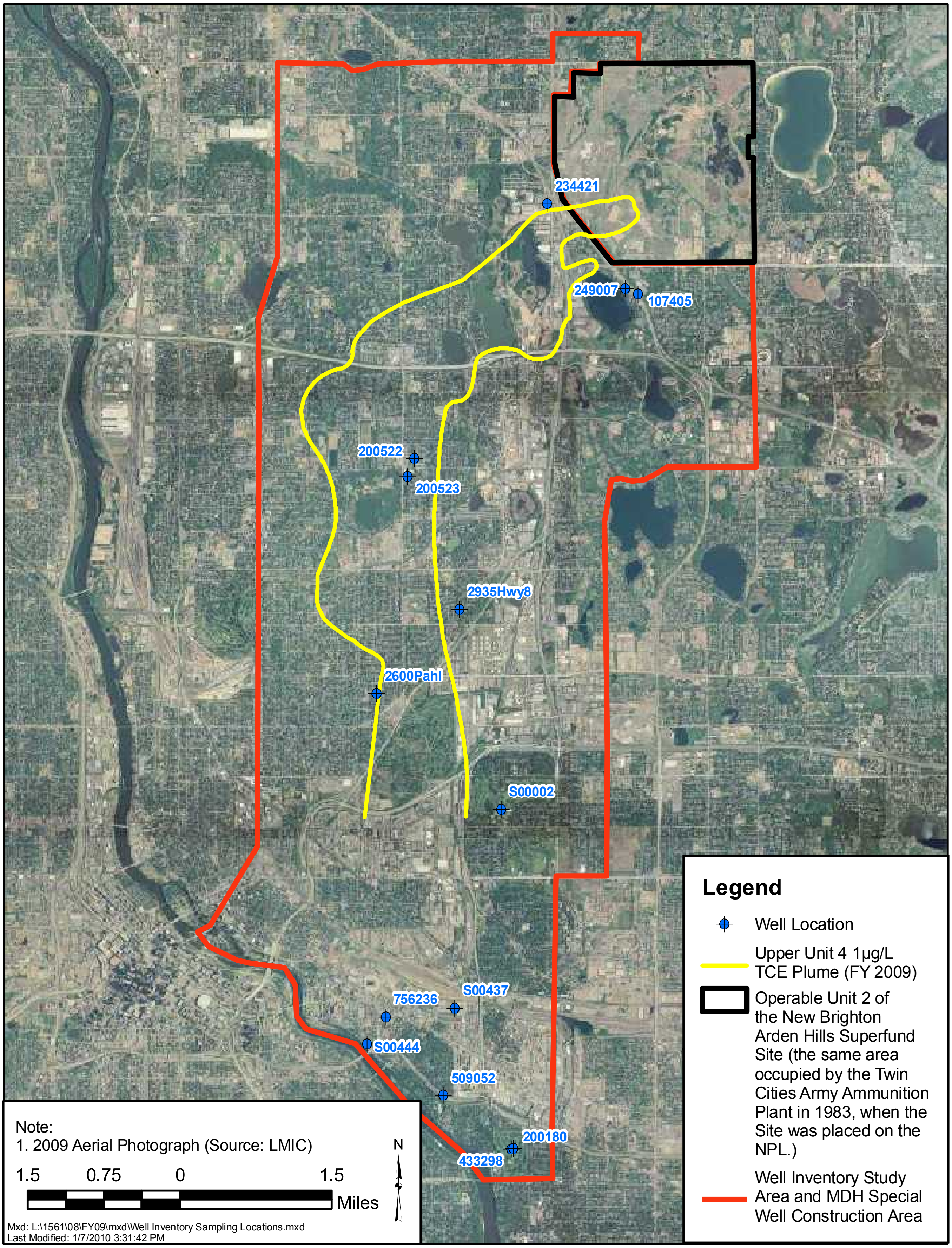
# Figure E-4

## Annual Requirements for Maintaining Well Inventory Database




Note:

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




## Legend

Well Location

Upper Unit 4 1µg/L TCE Plume (FY 2009)

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.)

Well Inventory Study Area and MDH Special Well Construction Area

Note:
1. 2009 Aerial Photograph (Source: LMIC)

1.5 0.75 0 1.5 Miles

N

Mxd: L:\1561\08\FY09\mxd\Well Inventory Sampling Locations.mxd
Last Modified: 1/7/2010 3:31:42 PM

ANNUAL PERFORMANCE REPORT

FY 2009 Well Inventory Sampling Locations



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Environmental Engineers

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Maple Plain, MN 55359-0429

FY 2009

Figure E-5

# WELL INVENTORY DATABASE

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

Well Inventory Main Database 2009.xls

# Appendix F

## Site K, TGRS, and PGRS Operational Data

# F.1 Inspection and Maintenance Activities, Fiscal Year 2009, Site K, OU2

APPENDIX F.1

INSPECTION AND MAINTENANCE ACTIVITIES
FISCAL YEAR 2009
SITE K, OU2
ARDEN HILLS, MINNESOTA

**October 2008**

1) 10/1/08 - In suspense. System default on high water alarm, reset, system restarted. Down time 24 hrs

2) 10/2/08 - In suspense. System default on high water alarm, reset, drain valve opened 1/8th turn, system restarted. Down time 24 hrs.

3) 10/17/08 - Performed monthly O&M, system down time none

4) 10/21/08 - In suspense. System OK.

5) 10/29/08 - In suspense. System OK.

**November 2008**

1) 11/10/08 - In suspense. System OK

2) 11/14/08 - Performed monthly O&M, system down time none

**December 2008**

1) 12/2/08 - In suspense. System OK

2) 12/9/08 - System shut down on high water alarm, system reset and operational

3) 12/10/08 - System shut down on high water alarm, system reset and operational

4) 12/11/08 - Troubleshoot system, reset to 11 gpm and air to 26" $H_2O$. System downtime - 14 hours

5) 12/12/08 - Performed monthly O&M, system down time none

6) 12/29/2008 - In suspense. System OK

**January 2009**

1) 1/5/09 - In suspense. System OK

2) 1/13/09 - System shut down on low building temperature. Outside temperature is -22 F; turned on space heater, removed heat stat and installed new thermostat. Restart system at 14:00 - System O.K. System down time 10 hours.

3) 1/15/09 - System shut down on high water alarm. Ice build up in discharge line cleared; space heater moved closer to discharge line. Restart system - System O.K. System down time 10 hours.

4) 1/26/09 - System shut down on high water alarm. Suspect discharge line freezing. Restart system and turn on space heater - System O.K. System down time 48 hours.

5) 1/28/09 - Increased flow rate to 10.5 gpm.

6) 1/29/2009 - Performed Monthly System O&M. High water alarm trips upon system cycling. System stays down.

APPENDIX F.1

INSPECTION AND MAINTENANCE ACTIVITIES
FISCAL YEAR 2009
SITE K, OU2
ARDEN HILLS, MINNESOTA

7) 1/30/2009 - System shut down on high water alarm. System will not restart. Float switch identified as faulty. System down time 30 hours.

**February 2009**

1) 2/2/09 - System shut down due to faulty float switch. System down time 24 hours.

2) 2/3/09 - System shut down due to faulty float switch. System down time 24 hours.

3) 2/16/09 - System shut down due to high water alarm. Reset system and restarted.

4) 2/17/09 - System shut down due to high water alarm. Cleaned discharge lines and restarted system Performed Monthly System O&M.

5) 2/23/09 - In suspense, system OK.

**March 2009**

1) 3/2/09 - System shut down at 13:35 to begin discharge line repair.

2) 3/3/09 - System restarted at 14:50. System down time 26 hours.

3) 3/6/09 - In suspense, system OK.

4) 3/10/09 - TCAAP Power outage, system down no readings.

5) 3/11/09 - Low building temperatrue due to previous days power outage; reset system- downtime 24 hours.

6) 3/16/09 - In Suspense, System OK.

7) 3/17/09 - In Suspense, System OK.

8) 3/20/09 - TCAAP Power outage, system down no readings; downtime 18 hours.

**April 2009**

1) 4/8/09 - Monthly O&M performed.

2) 4/10/09 - In Suspense, System OK.

3) 4/24/09 - System cycled 36 times on 4-23 as a result of intermitent power outages and was down until 4-27-09.

4) 4/27/09 - TCAAP Power outage resulted in tripped pump circuiut; reset, system operational. System downtime 72 hours.

**May 2009**

1) 5/18/09 - Monthly O&M performed.

2) 5/20/09 - Power outage onsite, system down.

3) 5/21/09 - No power at Site K Treatment Building, system down.

4) 5/22/09 - Power restored, system reset and restarted. Total downtime 52 hours.

APPENDIX F.1

INSPECTION AND MAINTENANCE ACTIVITIES
FISCAL YEAR 2009
SITE K, OU2
ARDEN HILLS, MINNESOTA

**June 2009**

1) 6/10/09 - In suspense, system OK

2) 6/12/09 - In suspense, system OK.

3) 6/19/09 - In suspense, system OK.

4) 6/23/09 - Low building temperature fault. Reset system and resume operation. Total downtime approximately 36 hours.

5) 6/26/09 - In suspense, system OK.

6) 6/30/09 - Monthly O&M performed. System downtime none.

**July 2009**

1) 7/9/09 - In suspense, system OK.

2) 7/16/09 - In suspense, system OK.

3) 7/31/09 - Monthly O&M performed. System downtime none.

**August 2009**

1) 8/4/09 - In suspense, system OK.

2) 8/5/09 - In suspense, system OK.

3) 8/6/09 - In suspense, system OK.

4) 8/18/09 - Low building temperature fault. System downtime approximately 48 hours.

5) 8/26/09 - Monthly O&M performed. System downtime none.

6) 8/27/09 - High water fault. System downtime approximately 23 hours.

**September 2009**

1) 9/11/09 - Monthly O&M performed. System downtime none.

2) 9/15/09 - Low building temperature fault. Troubleshoot system and determine new PLC card was needed. System downtime approximately 150 hours.

3) 9/21/09 - System resumed normal operation.

# F.2 Maintenance Activities, Fiscal Year 2009, TGRS, OU2

**APPENDIX F-2**

**MAINTENANCE ACTIVITIES**
**FISCAL YEAR 2009**
**TGRS, OU2**
**ARDEN HILLS, MINNESOTA**

**October 2008**

| | |
|---|---|
| 10/2/2009 | Treatment System; Installed a new ARV at ECV 3.<br>Down time: None. |
| 10/4/2008 | Pumphouse SC5; Shut down the pump to work on the ECV control piping.<br>Down time: 1 hour. |
| 10/7-12/2008 | Pumphouses and Treatment System; Portions of TGRS shut down as part of quarterly maintenance work.<br>Down time: 1 hour at B1 and B3; 3 hours at B8. |
| 10/15-16/2008 | Treatment System and Pumphouses; Shut down the TGRS to install check valves on the potable water line and to work on tower demister pads.<br>Down time: 1.5 hours at B1, B13 and SC2; 3.5 hours at SC5. |
| 10/18/2008 | Treatment System; Replaced a broken belt on Blower 2.<br>Down time: None. |
| 10/31/2008 | Treatment System; Installed cleaned demister pads in the tops of the towers.<br>Down time: 2 hours at B1, B13 and SC5; 1 hour at B5 and B6. |

**November 2008**

| | |
|---|---|
| 11/1/2008 | Pumphouse B8; Light flashing on PLC in Building 116; Reset PLC and observed normal operation.<br>Down time: 23 hours. |
| 11/6/2008 | Treatment System; Shutdown the Treatment System to perform monthly preventive maintenance work.<br>Down time: B1 for 2.5 hours, B13, B3, B5 and B6 for 1.5 hours each and SC2 for 4 hours. |
| 11/10/2008 | Treatment System; New pressure gauge at pump 3 and new airflow tubing at tower 1.<br>Down time: None. |
| 11/11-12/2008 | Pumphouse B8; Upon arrival to perform the daily inspection, pumphouse B8 light flashing on PLC in Building 116; Reset the PLC each day and observed normal operation.<br>Down time: 10.2 hours on 11/11 and 2.3 hours on 11/12. |

**APPENDIX F-2**

**MAINTENANCE ACTIVITIES**
**FISCAL YEAR 2009**
**TGRS, OU2**
**ARDEN HILLS, MINNESOTA**

| | |
|---|---|
| 11/12/2008 | Pumphouse B8; Lowered the pressure from 128 psi to 116 psi to decrease the flow rate.<br>Down time: None. |
| 11/15/2008 | Pumphouse B9; Chatter noise from control cabinet; Replace output card with new and normal operation observed.<br>Down time: None. |
| 11/15/2008 | Pumphouse SC4/SC5 ; Faulty I/O adapter in the control cabinet at SC4; Replace with new and SC5 lights normally on the PLC in Building 116.<br>Down time: None. |
| 11/15/2008 | Pumphouse SC3/SC2; Faulty output card and DLP in the control cabinet at SC3; Replace both with new and SC2 lights normally on the PLC in Building 116.<br>Down time: None. |
| 11/15/2008 | Pumphouse B10/B9; Install new I/O adapter and replace the DLP in B10; The B9 light on the PLC in Building 116 now lights normally.<br>Down time: None. |
| 11/18, 20, 21/2008 | Pumphouse B8; Upon arrival to perform the daily inspection, pumphouse B8 light flashing on PLC in Building 116; Reset the PLC each day and observed normal operation.<br>Down time: 20.5 hours on 11/18; 21 hours on 11/20 and 20.5 hours on 11/21. |
| 11/22/2008 | Treatment System; Fault on PDU screen, Pump 4 failed to open; Reconnected broken wire on starter coil; Normal operation observed; Well field cycled overnight.<br>Down time: 17.5 hours at B13, B3 and SC1; 9 hours at B4, B6 and B11. |
| 11/9, 26/2008 | Pumphouse SC2; Adjusted flow rate too slowly; Reset the following day and normal operation observed.<br>Down time: 3 hours on 11/9 and 5.5 hours on 11/26. |
| 11/25-30/2008 | Pumphouse SC5; Replace pump and motor with new and re-develop well with acid.<br>November down time: 150 hours. |

**December 2008**

| | |
|---|---|
| 12/1-2/2008 | Pumphouse SC5; Redevelop well with acid; Install new pump and motor.<br>Down time: 42.5 hours. |

**APPENDIX F-2**

**MAINTENANCE ACTIVITIES**
**FISCAL YEAR 2009**
**TGRS, OU2**
**ARDEN HILLS, MINNESOTA**

| | |
|---|---|
| 12/3-31/2008 | Pumphouse B8; The B8 light was flashing on the PLC almost every day upon entering Building 116 to perform the daily inspection. Also, the communication light was not lit on the corresponding I/O Scanner Module port, the low level light was lit on the control panel in the pumphouse and the pump was off. Troubleshooting work throughout the month included replacing the following equipment: water level electrode, solenoid valve and coil, microswitch, I/O adapter, input card, output card, data line protector and the water level control board, none of which solved the problem. Additional troubleshooting work is required.<br>Down time: 258 hours for the month of December. |
| 12/3/2008 | Building 116; The portable electric heater in the chlorine room was not working; Replaced with a new heater.<br>Down time: None. |
| 12/10-12/2008 | Treatment System; Periodically turned the TGRS off to perform monthly maintenance work.<br>Down time: 1 hour at B5; 2 hours at B1 and B13; 4 hours at B9 and 5.5 hours at SC2. |
| 12/15/2008 | Pumphouse SC2; Pumphouse heater does not put out warm air; Laughlin Electric on site and replaces with new.<br>Down time: None. |
| 12/17-18/2008 | Treatment System; Well field cycling; Starter wire for pump 4 was loose in motor control center cabinet; Reattached wire and observed normal operation.<br>Down time: 6.5 hours at B4 and B6; 8 hours at B11; 12.5 hours at B13 and 14.5 hours at B3. |
| 12/19/2008 | Pumphouse SC5; Flow meter was not operating despite pumping water; Removed and cleaned the meter; Observed normal meter operation.<br>Down time: None, adjusted the flow rates accordingly. |
| 12/29/2008 | Treatment System; ECV 4 will not close on command; Replaced solenoid valve and coil with new, replaced the filter and flushed the control piping; ECV 4 now closes normally.<br>Down time: None. |

**APPENDIX F-2**

**MAINTENANCE ACTIVITIES**
**FISCAL YEAR 2009**
**TGRS, OU2**
**ARDEN HILLS, MINNESOTA**

| | |
|---|---|
| 12/31/2008 | Pumphouses B8/B11; Continued troubleshooting work on the B8 shutting down problem; The data line protector in B11 has a blown resistor and B8 and B11 communications are paired together. Installed a new data line protector in the B11 pumphouse control cabinet and restarted the pump in B8; Normal operation observed, however, the communication light on the I/O scanner module in Building 116 for the B8/B11 card remains out.<br>Down time: Down time is already noted above. |

**January 2009**

| | |
|---|---|
| 1/1/2009 | Treatment System and Well Field; The daily inspection was not performed due to the New Years Day holiday.<br>Down time: None. |
| 1/5/2009 | Treatment System; ECV 4 flashing on the PDU; The valve failed to open on command; Cleaned blockage from the solenoid valve line and cycled the valve; The valve now opens normally.<br>Down time: None. |
| 1/6-7/2009 | Treatment System; ECV 4 would not close on command; Replaced closing side sections of control piping, ball valves and check valves and changed filter; ECV 4 now closes normally.<br>Down time: None. |
| 1/7-9/2009 | Programmable Logic Controller (PLC); CRA works to connect laptop computer to PLC to allow for future programming work and remote connectivity.<br>Downtime: none. |
| 1/8/2009 | Treatment System; ECV 3 failed to open on command; Well field is cycling; Flushed control piping, changed filter and adjusted opening and closing speed control valves; Cycled the valve and normal operation observed.<br>Down time: 17 hours each at B13, B3, B8, B9, B11 and SC1; 3 hours at SC5. |
| 1/10/2009 | Pumphouses B3 and B8; Turned the pumps off to perform maintenance work on the ECVs control piping.<br>Down time: 1.5 hours at each. |

**APPENDIX F-2**

**MAINTENANCE ACTIVITIES**
**FISCAL YEAR 2009**
**TGRS, OU2**
**ARDEN HILLS, MINNESOTA**

| | |
|---|---|
| 1/14/2009 | Pumphouse B1 and B13; Turned the pumps off to perform maintenance work on the ECVs control piping.<br>Down time: 1.5 hours at each. |
| 1/19-20/2009 | Pumphouse B9; The pumping rate was adjusted but too slowly; Readjusted the flow rate to the target rate.<br>Down time: 3.5 hours. |

**February 2009**

| | |
|---|---|
| 2/4-18/2009 | Pumphouse B9; Flow meter failed slowly with time; Replaced the flow meter and adjusted the daily flow rate on the spread sheet to the calibrated meter flow rate.<br>Down time: None. |
| 2/8/2009 | Pumphouse B6; Technician indicates a humming/vibrating noise coming from the pump; Shut pump off for the night and restart the next day; Only minimal humming noise observed.<br>Down time: 16 hours. |
| 2/10/2009 | Treatment System and Well Field; Power outage on TCAAP that shuts off power to the TGRS; Xcel Energy on Site; They repair the problem and power is restored; Restart the TGRS and observe normal operation.<br>Down time: 14 hours at B1, B13, B3, B5, B6, B9, B11, SC1, SC2 and SC5; 11 hours at B4 and B8. |
| 2/13/2009 | Treatment System; Reprogrammed auto dialer today including all recordings; Installed new back up battery for the Verbatim auto dialer also.<br>Down time: None. |
| 2/15/2009 | Treatment System; Call from Time Communications-TGRS Fail; ECV 1 failed to open; Changed out the operating solenoid valve, flushed the control piping and reset the speed control valves; Cycled the valve and observed normal operation.<br>Down time: None. |
| 2/17/2009 | Treatment System; Replaced the coil on the operating solenoid of ECV 3.<br>Down time: None. |

**APPENDIX F-2**

**MAINTENANCE ACTIVITIES**
**FISCAL YEAR 2009**
**TGRS, OU2**
**ARDEN HILLS, MINNESOTA**

| | |
|---|---|
| 2/17/2009 | Pumphouse B9; Flow meter not totaling properly; Replaced with new.<br>Down time: None, adjusted flow rates accordingly. |
| 2/18/2009 | Pumphouse SC2; Flow meter not totaling correctly; Replaced with new.<br>Down time: None, adjusted flow rates accordingly. |
| 2/24/2009 | Treatment System; The light for Blower 2 is not lit on the motor control center; Troubleshooting indicates a blown motor; Removed and replaced the old motor with new from inventory; Laughlin Electric performed wiring and testing of the new motor; Purchased new motor for inventory.<br>Down time: None. |

**March 2009**

| | |
|---|---|
| 3/5-8/2009 | Treatment System; Preventive Maintenance work performed; Portions of the well field cycled during maintenance activities.<br>Down time: B1 for 2.5 hours and B5 for 1 hour. |
| 3/9-10/2009 | Treatment System and Well Field; Site wide power outage due to a freezing rain storm; Xcel Energy contacted and they respond; They inspected the facility for failures but found none; They reset the main breaker and power was restored normally.<br>Down time: 22 hours at B1, B13, B3, B5, B6, B9, B11, SC1 and SC5; 19 hours at B4; 15 hours at B8 and SC2. |
| 3/20/2009 | Treatment System and Well Field; Site wide power outage due to a sleet storm; Xcel Energy contacted and responds; They repair a blown surge arrestor on a power pole near B12; Restart TGRS and normal operation observed.<br>Down time: 3 hours each at B1, B13, B3, B5, B6 and SC5; 2 hours each at B9 and SC2. |
| 3/25/2009 | Treatment System; ECV 1 fails to open; Adjust opening speed and valve responds normally.<br>Down time: B13 and B3 for 1.5 hour each. |
| 3/25-26/2009 | Pumphouse B3; Loud spraying sound coming from inside the well casing near the top of the well; T. L. Stevens contacted and they respond; Their pump pull truck gets stuck in the mud; The next morning they pull the pump; A failed O-ring at the pitless is observed; They replace with new and normal operation observed.<br>Down time: 26 hours. |

**APPENDIX F-2**

**MAINTENANCE ACTIVITIES**
**FISCAL YEAR 2009**
**TGRS, OU2**
**ARDEN HILLS, MINNESOTA**

| | |
|---|---|
| 3/25-26/2009 | Pumphouses SC2 and SC5; Power out to pumphouses; Xcel Energy contacted and they respond; Blown fuse on power pole; Restart SC2 and SC5 and they restart normally.<br>Down time: SC2 for 14 hours and SC5 for 16 hours. |
| 3/30-31/2009 | Pumphouse B13; Pump turned off to redevelop well with acid.<br>March Down time: 26 hours. |
| **April 2009** | |
| 4/1-4/2009 | Pumphouse B13; Pump turned off to redevelop the well with acid.<br>April Down time: 71 hours. |
| 4/8/2009 | Treatment System; Preventive Maintenance work performed; Installed a leak containment seal around pump 1; Added packing to pump 1 gland; Portions of the well field cycled during maintenance activities.<br>Down time: 8 hours at B13 and B8; 7 hours at B3, B4, B6, SC1 and SC5; 3 hours at B11 and SC2. |
| 4/8/2009 | Pumphouse B4; Blown submersible pump motor; Replaced with new.<br>Down time: 12.5 hours. |
| 4/8/2009 | Treatment System and Building 116; Turned off all electric room heaters and cabinet heaters.<br>Down time: None. |
| 4/15-16/2009 | Pumphouse B1; ECV closed slightly; Changed out pilot and normal operation observed.<br>Down time: 3.5 hours. |
| 4/21-25/2009 | Pumphouse SC2; Pump turned off to redevelop the well with acid.<br>Down time: 99 hours. |
| 4/23-24/2009 | Treatment System and Well Field; Xcel Energy is on Site relocating power and bypassing the Lind Power station; They increased the voltage through some of the existing lines which caused connectors to blow; Three small grass fires started from the blown connectors; The Lake Johanna Fire Department responded and extinguished the grass fires.<br>Down time: 18 hours at B1, B5, B6, B8 and B9; 20 hours at B13, B3, SC1 and SC5; 13 hours at B4 and B11. |

**APPENDIX F-2**

**MAINTENANCE ACTIVITIES**
**FISCAL YEAR 2009**
**TGRS, OU2**
**ARDEN HILLS, MINNESOTA**

| | |
|---|---|
| 4/27/2009 | Pumphouse B6; The pumping water level is 117.5 feet btoc.<br>Down time: None. |
| 4/27/2009 | Pumphouse SC5; The pumping water level is 129.5 feet btoc.<br>Down time: None. |
| 4/29/2009 | Pumphouse B11; The pumping water level is 117.3 feet btoc.<br>Down time: None. |

**May 2009**

| | |
|---|---|
| 5/1/2009 | Pumphouse B11; Shutdown the pumphouse to replace the pump and motor.<br>Down time: 2.7 hours. |
| 5/5/2009 | Pumphouses B4, B8 and B11; Opened the ECV at B11 to full open; Closed the ECV's at B4 and B8 to slow their flow rates.<br>Down time: None. |
| 5/5/2009 | Treatment System and Well Field; Performed preventive maintenance work on the treatment system.<br>Down time: 1.7 hours at B11. |
| 5/5/2009 | Treatment System; Installed a leak containment barrier around pump 2.<br>Down time: None. |
| 5/12-17/2009 | Treatment System and Well Field; System down due to reoccurring power outages; Xcel Energy on site to repair the problem; After the power was restored, wet well pump 4 did not restart causing the well field to cycle; Reset pump 4 and normal operation was observed.<br>Down time: 22 hours at B5, B9 and B11; 26.5 hours at B1 and B6; 30.5 hours at B3 and B4; 40 hours at B13, B8 and SC1; 55 hours at SC2 and 61 hours at SC5. |
| 5/19/2009 | TGRS; Five year review inspection performed.<br>Down time: None. |

**APPENDIX F-2**

**MAINTENANCE ACTIVITIES**
**FISCAL YEAR 2009**
**TGRS, OU2**
**ARDEN HILLS, MINNESOTA**

| | |
|---|---|
| 5/19-21/2009 | Well Field and Treatment System; Power outage; Xcel Energy on site to repair; After many hours of troubleshooting, Xcel locates the cause of this and previous power outages; The wind was blowing a ground lead into a blown lightning arrestor causing the power to go out; They repaired the problem and restored power to the site.<br>Down time: 35 hours at B11 and SC2; 44.5 hours at B1, B13, B3, B4, B5, B6, B8, B9, SC1 and SC5. |
| 5/25/2009 | Memorial Day Holiday; Daily inspection was not performed.<br>Down time: None. |

**June 2009**

| | |
|---|---|
| 6/4/2009 | Treatment System and Well Field; The TGRS was shut down to perform monthly maintenance work.<br>Down time: 1.5 hours at B1, B13, B5, SC1 and SC5. |
| 6/11/2009 | Building 502 Area; Graffiti (spray paint) observed on Building 502 guard shack.<br>Down time: None. |
| 6/21/2009 | Treatment System and Well Field; Power outage; Xcel Energy responds and repairs the problem.<br>Down time: 10 hours at B1, B13, B5, B6, B9, SC1 and SC5; 7 hours at B3 and B4; 3 hours at |
| 6/21-23/2009 | Pumphouse B4; Following the power outage, the pump will not start; Troubleshooting indicates the motor is pulling 63 amps which is too high but not motor lock up; T.L. Stevens on site, they pull the pitless adapter off the pitless and discharge water directly onto the ground freeing the impellars.<br>Down time: 40 hours. |
| 6/22-30/09 | Treatment System; Cellular phone for the autodialer has failed; Return to factory for servicing.<br>Down time: None. |
| 6/24/2009 | Treatment System; Installed a new airflow meter at blower 1.<br>Down time: None. |

**APPENDIX F-2**

**MAINTENANCE ACTIVITIES**
**FISCAL YEAR 2009**
**TGRS, OU2**
**ARDEN HILLS, MINNESOTA**

| | |
|---|---|
| 6/29-30/2009 | Treatment System (flow meters 1 and 2) and Pumphouses B11, B1, B13, B3, B4, B5, B8 and B9; Compared the flow rate of the existing flow meter to that of a calibrated flow meter.<br>Down time: None. |

**July 2009**

| | |
|---|---|
| 7/1/2009 | Pumphouses B6, SC2 and SC5; Checked the flow rate of the existing flow meters against a calibrated flow meter.<br>Down time: None. |
| 7/2/2009 | Pumphouses B13, B3 and B5; Changed out flow meters with new flow meters.<br>Down time: None. |
| 7/12/2009 | Pumphouse SC5; ECV closed slightly overnight slowing the flow rate.<br>Down time: 1.5 hours. |
| 7/17/2009 | Pumphouse B9; Flow meter no longer totals properly; Change out with new; New meter in at 12:15 at 13762400.<br>Down time: None. |
| 7/24-25/2009 | Pumphouse SC5; ECV closed slightly slowing the flow rate.<br>Down time: 4 hours. |
| 7/28/2009 | Pumphouse SC5; ECV closed slightly overnight slowing the flow rate.<br>Down time: 3 hours. |
| 7/31/2009 | Treatment System and Well Field; System shut down for O & M activities at the air stripping towers and 10" flow meters.<br>Down time: None. |

**August 2009**

| | |
|---|---|
| 8/1/2009 | Treatment System and Well Field; Preventive maintenance work performed on the treatment system on 7/31/2009 and down time is reflected on 8/1/2009.<br>Down time: 2.5 hours at B1 and B13; 2 hours at B5, B6 and B9. |

**APPENDIX F-2**

**MAINTENANCE ACTIVITIES**
**FISCAL YEAR 2009**
**TGRS, OU2**
**ARDEN HILLS, MINNESOTA**

| | |
|---|---|
| 8/8-9/2009 | Pumphouse SC5; Upon arrival for the daily inspection both days, the SC5 light was flashing on the PLC; Reset the PLC and SC5 restarted normally each day.<br>Down time: 27 hours. |
| 8/9-10/2009 | Pumphouse SC2; There is a blown communication card in pumphouse SC2; Replace with a new card and normal operation resumes.<br>Down time: 27 hours. |
| 8/11/2009 | Treatment System and Well Field; Shut the system off to perform preventive maintenance work.<br>Down time: 1 hour at B1 and 2 hours at B13 and B4. |
| 8/15/2009 | Pumphouse B4; The pump is off due to a blown submersible pump motor; Order and install a new motor.<br>Down time: 144 hours. |
| 8/16/2009 | Treatment System and Well Field; Blown fuse on the power pole where power enters TCAAP; Xcel Energy contacted and they respond; Power restored and the system is restarted. Normal operation resumes.<br>Down time: 15 hours at B1, B13, B3, B5, B6, B9, B11, SC1, SC2 and SC5. |
| 8/27-28/2009 | Treatment System and Well Field; Shut the treatment system and well field off to repair a leak in the 16" diameter forcemain located approximately 450 feet south of Building 116; Stevens Drilling and Environmental contracted to excavate and repair the leak; Following the repair, the system was turned on and the repair area was inspected; No further leak was observed and the excavation was backfilled.<br>Down time: 46 hours at B1, B5 and B9; 43 hours at B13, B3, B4, B6, B8, B11, SC1, SC2 and SC5. |

**September 2009**

| | |
|---|---|
| 9/1/2009 | Pumphouse SC3; Turned SC3 on today; Flow meter reading was 94031200; There is no pressure gauge on the forcemain.<br>Down time: None. |
| 9/1/2009 | Well 03U003; Collected a sample today.<br>Down time: None. |

**APPENDIX F-2**

**MAINTENANCE ACTIVITIES**
**FISCAL YEAR 2009**
**TGRS, OU2**
**ARDEN HILLS, MINNESOTA**

| | |
|---|---|
| 9/7/2009 | Treatment System and Well Field; The daily inspection was not performed today due to Labor Day.<br>Down time: None. |
| 9/15/2009 | Treatment System and Well Field; Site wide power outage reported by Mike Fix; Call to Xcel at 1135, onsite at 1215; The fusible switch in the NW corner past B12 was open (one leg); Same failure as last outage; Power restored at 1320; No call from the autodialer because the other two legs provided power to the autodialer.<br>Down time: 6.5 hours at B1, B13, B6, 03U003 and SC1; 5 hours at B3, B4, B5, B9 and SC5. |
| 9/28/2009 | Pumphouse SC5; Loss of power to the pumphouse; The fusible switch is open on the transformer pole near SC4; Called Xcel Energy and they respond; They reinstalled the fusible switch and power resumed as normal.<br>Down time: 2 hours. |
| 9/29/2009 | Pumphouse SC5; The ECV did not fully open after Xcel Energy restored power to the pumphouse.<br>Down time: 3 hours. |
| 9/30/2009 | Pumphouse SC3; Turned the pumphouse off today.<br>Down time: None. |

# F.3 Maintenance Activities by Location, Fiscal Year 2009, TGRS, OU2

**APPENDIX F-3**

**MAINTENANCE ACTIVITIES BY LOCATION**
**FISCAL YEAR 2009**
**TGRS, OU2**
**ARDEN HILLS, MINNESOTA**

**Pumphouse B1**

| | |
|---|---|
| 10/7-12/2008 | Pumphouses and Treatment System; Portions of TGRS shut down as part of quarterly maintenance work.<br>Down time: 1 hour at B1 and B3; 3 hours at B8. |
| 10/15-16/2008 | Treatment System and Pumphouses; Shut down the TGRS to install check valves on the potable water line and to work on tower demister pads.<br>Down time: 1.5 hours at B1, B13 and SC2; 3.5 hours at SC5. |
| 10/31/2008 | Treatment System; Installed cleaned demister pads in the tops of the towers.<br>Down time: 2 hours at B1, B13 and SC5; 1 hour at B5 and B6. |
| 11/6/2008 | Treatment System; Shutdown the Treatment System to perform monthly preventive maintenance work.<br>Down time: B1 for 2.5 hours, B13, B3, B5 and B6 for 1.5 hours each and SC2 for 4 hours. |
| 12/10-12/2008 | Treatment System; Periodically turned the TGRS off to perform monthly maintenance work.<br>Down time: 1 hour at B5; 2 hours at B1 and B13; 4 hours at B9 and 5.5 hours at SC2. |
| 1/1/2009 | Treatment System and Well Field; The daily inspection was not performed due to the New Years Day holiday.<br>Down time: None. |
| 1/14/2009 | Pumphouse B1 and B13; Turned the pumps off to perform maintenance work on the ECVs control piping.<br>Down time: 1.5 hours at each. |
| 2/10/2009 | Treatment System and Well Field; Power outage on TCAAP that shuts off power to the TGRS; Xcel Energy on Site; They repair the problem and power is restored; Restart the TGRS and observe normal operation.<br>Down time: 14 hours at B1, B13, B3, B5, B6, B9, B11, SC1, SC2 and SC5; 11 hours at B4 and B8. |
| 3/5-8/2009 | Treatment System; Preventive Maintenance work performed; Portions of the well field cycled during maintenance activities.<br>Down time: B1 for 2.5 hours and B5 for 1 hour. |

**APPENDIX F-3**

**MAINTENANCE ACTIVITIES BY LOCATION**
**FISCAL YEAR 2009**
**TGRS, OU2**
**ARDEN HILLS, MINNESOTA**

| | |
|---|---|
| 3/9-10/2009 | Treatment System and Well Field; Site wide power outage due to a freezing rain storm; Xcel Energy contacted and they respond; They inspected the facility for failures but found none; They reset the main breaker and power was restored normally.<br>Down time: 22 hours at B1, B13, B3, B5, B6, B9, B11, SC1 and SC5; 19 hours at B4; 15 hours at B8 and SC2. |
| 3/20/2009 | Treatment System and Well Field; Site wide power outage due to a sleet storm; Xcel Energy contacted and responds; They repair a blown surge arrestor on a power pole near B12; Restart TGRS and normal operation observed.<br>Down time: 3 hours each at B1, B13, B3, B5, B6 and SC5; 2 hours each at B9 and SC2. |
| 4/15-16/2009 | Pumphouse B1; ECV closed slightly; Changed out pilot and normal operation observed.<br>Down time: 3.5 hours. |
| 4/23-24/2009 | Treatment System and Well Field; Xcel Energy is on Site relocating power and bypassing the Lind Power station; They increased the voltage through some of the existing lines which caused connectors to blow; Three small grass fires started from the blown connectors; The Lake Johanna Fire Department responded and extinguished the grass fires.<br>Down time: 18 hours at B1, B5, B6, B8 and B9; 20 hours at B13, B3, SC1 and SC5; 13 hours at B4 and B11. |
| 5/12-17/2009 | Treatment System and Well Field; System down due to reoccurring power outages; Xcel Energy on site to repair the problem; After the power was restored, wet well pump 4 did not restart causing the well field to cycle; Reset pump 4 and normal operation was observed.<br>Down time: 22 hours at B5, B9 and B11; 26.5 hours at B1 and B6; 30.5 hours at B3 and B4; 40 hours at B13, B8 and SC1; 55 hours at SC2 and 61 hours at SC5. |
| 5/19-21/2009 | Well Field and Treatment System; Power outage; Xcel Energy on site to repair; After many hours of troubleshooting, Xcel locates the cause of this and previous power outages; The wind was blowing a ground lead into a blown lightning arrestor causing the power to go out; They repaired the problem and restored power to the site.<br>Down time: 35 hours at B11 and SC2; 44.5 hours at B1, B13, B3, B4, B5, B6, B8, B9, SC1 and SC5. |
| 5/25/2009 | Memorial Day Holiday; Daily inspection was not performed.<br>Down time: None. |
| 6/4/2009 | Treatment System and Well Field; The TGRS was shut down to perform monthly maintenance work.<br>Down time: 1.5 hours at B1, B13, B5, SC1 and SC5. |

**APPENDIX F-3**

**MAINTENANCE ACTIVITIES BY LOCATION**
**FISCAL YEAR 2009**
**TGRS, OU2**
**ARDEN HILLS, MINNESOTA**

| | |
|---|---|
| 6/21/2009 | Treatment System and Well Field; Power outage; Xcel Energy responds and repairs the problem.<br>Down time: 10 hours at B1, B13, B5, B6, B9, SC1 and SC5; 7 hours at B3 and B4; 3 hours at |
| 6/29-30/2009 | Treatment System (flow meters 1 and 2) and Pumphouses B11, B1, B13, B3, B4, B5, B8 and B9; Compared the flow rate of the existing flow meter to that of a calibrated flow meter.<br>Down time: None. |
| 8/1/2009 | Treatment System and Well Field; Preventive maintenance work performed on the treatment system on 7/31/2009 and down time is reflected on 8/1/2009.<br>Down time: 2.5 hours at B1 and B13; 2 hours at B5, B6 and B9. |
| 8/11/2009 | Treatment System and Well Field; Shut the system off to perform preventive maintenance work.<br>Down time: 1 hour at B1 and 2 hours at B13 and B4. |
| 8/16/2009 | Treatment System and Well Field; Blown fuse on the power pole where power enters TCAAP; Xcel Energy contacted and they respond; Power restored and the system is restarted. Normal operation resumes.<br>Down time: 15 hours at B1, B13, B3, B5, B6, B9, B11, SC1, SC2 and SC5. |
| 8/27-28/2009 | Treatment System and Well Field; Shut the treatment system and well field off to repair a leak in the 16" diameter forcemain located approximately 450 feet south of Building 116; Stevens Drilling and Environmental contracted to excavate and repair the leak; Following the repair, the system was turned on and the repair area was inspected; No further leak was observed and the excavation was backfilled.<br>Down time: 46 hours at B1, B5 and B9; 43 hours at B13, B3, B4, B6, B8, B11, SC1, SC2 and SC5. |
| 9/7/2009 | Treatment System and Well Field; The daily inspection was not performed today due to Labor Day.<br>Down time: None. |
| 9/15/2009 | Treatment System and Well Field; Site wide power outage reported by Mike Fix; Call to Xcel at 1135, onsite at 1215; The fusible switch in the NW corner past B12 was open (one leg); Same failure as last outage; Power restored at 1320; No call from the autodialer because the other two legs provided power to the autodialer.<br>Down time: 6.5 hours at B1, B13, B6, 03U003 and SC1; 5 hours at B3, B4, B5, B9 and SC5. |

**APPENDIX F-3**

**MAINTENANCE ACTIVITIES BY LOCATION**
**FISCAL YEAR 2009**
**TGRS, OU2**
**ARDEN HILLS, MINNESOTA**

**Pumphouse B3**

| | |
|---|---|
| 10/7-12/2008 | Pumphouses and Treatment System; Portions of TGRS shut down as part of quarterly maintenance work.<br>Down time: 1 hour at B1 and B3; 3 hours at B8. |
| 11/6/2008 | Treatment System; Shutdown the Treatment System to perform monthly preventive maintenance work.<br>Down time: B1 for 2.5 hours, B13, B3, B5 and B6 for 1.5 hours each and SC2 for 4 hours. |
| 11/22/2008 | Treatment System; Fault on PDU screen, Pump 4 failed to open; Reconnected broken wire on starter coil; Normal operation observed; Well field cycled overnight.<br>Down time: 17.5 hours at B13, B3 and SC1; 9 hours at B4, B6 and B11. |
| 12/17-18/2008 | Treatment System; Well field cycling; Starter wire for pump 4 was loose in motor control center cabinet; Reattached wire and observed normal operation.<br>Down time: 6.5 hours at B4 and B6; 8 hours at B11; 12.5 hours at B13 and 14.5 hours at B3. |
| 1/1/2009 | Treatment System and Well Field; The daily inspection was not performed due to the New Years Day holiday.<br>Down time: None. |
| 1/8/2009 | Treatment System; ECV 3 failed to open on command; Well field is cycling; Flushed control piping, changed filter and adjusted opening and closing speed control valves; Cycled the valve and normal operation observed.<br>Down time: 17 hours each at B13, B3, B8, B9, B11 and SC1; 3 hours at SC5. |
| 1/10/2009 | Pumphouses B3 and B8; Turned the pumps off to perform maintenance work on the ECVs control piping.<br>Down time: 1.5 hours at each. |
| 2/10/2009 | Treatment System and Well Field; Power outage on TCAAP that shuts off power to the TGRS; Xcel Energy on Site; They repair the problem and power is restored; Restart the TGRS and observe normal operation.<br>Down time: 14 hours at B1, B13, B3, B5, B6, B9, B11, SC1, SC2 and SC5; 11 hours at B4 and B8. |
| 3/9-10/2009 | Treatment System and Well Field; Site wide power outage due to a freezing rain storm; Xcel Energy contacted and they respond; They inspected the facility for failures but found none; They reset the main breaker and power was restored normally.<br>Down time: 22 hours at B1, B13, B3, B5, B6, B9, B11, SC1 and SC5; 19 hours at B4; 15 hours at B8 and SC2. |

**APPENDIX F-3**

**MAINTENANCE ACTIVITIES BY LOCATION**
**FISCAL YEAR 2009**
**TGRS, OU2**
**ARDEN HILLS, MINNESOTA**

| | |
|---|---|
| 3/20/2009 | Treatment System and Well Field; Site wide power outage due to a sleet storm; Xcel Energy contacted and responds; They repair a blown surge arrestor on a power pole near B12; Restart TGRS and normal operation observed.<br>Down time: 3 hours each at B1, B13, B3, B5, B6 and SC5; 2 hours each at B9 and SC2. |
| 3/25/2009 | Treatment System; ECV 1 fails to open; Adjust opening speed and valve responds normally.<br>Down time: B13 and B3 for 1.5 hour each. |
| 3/25-26/2009 | Pumphouse B3; Loud spraying sound coming from inside the well casing near the top of the well; T. L. Stevens contacted and they respond; Their pump pull truck gets stuck in the mud; The next morning they pull the pump; A failed O-ring at the pitless is observed; They replace with new and normal operation observed.<br>Down time: 26 hours. |
| 4/8/2009 | Treatment System; Preventive Maintenance work performed; Installed a leak containment seal around pump 1; Added packing to pump 1 gland; Portions of the well field cycled during maintenance activities.<br>Down time: 8 hours at B13 and B8; 7 hours at B3, B4, B6, SC1 and SC5; 3 hours at B11 and SC2. |
| 4/23-24/2009 | Treatment System and Well Field; Xcel Energy is on Site relocating power and bypassing the Lind Power station; They increased the voltage through some of the existing lines which caused connectors to blow; Three small grass fires started from the blown connectors; The Lake Johanna Fire Department responded and extinguished the grass fires.<br>Down time: 18 hours at B1, B5, B6, B8 and B9; 20 hours at B13, B3, SC1 and SC5; 13 hours at B4 and B11. |
| 5/12-17/2009 | Treatment System and Well Field; System down due to reoccurring power outages; Xcel Energy on site to repair the problem; After the power was restored, wet well pump 4 did not restart causing the well field to cycle; Reset pump 4 and normal operation was observed.<br>Down time: 22 hours at B5, B9 and B11; 26.5 hours at B1 and B6; 30.5 hours at B3 and B4; 40 hours at B13, B8 and SC1; 55 hours at SC2 and 61 hours at SC5. |
| 5/19-21/2009 | Well Field and Treatment System; Power outage; Xcel Energy on site to repair; After many hours of troubleshooting, Xcel locates the cause of this and previous power outages; The wind was blowing a ground lead into a blown lightning arrestor causing the power to go out; They repaired the problem and restored power to the site.<br>Down time: 35 hours at B11 and SC2; 44.5 hours at B1, B13, B3, B4, B5, B6, B8, B9, SC1 and SC5. |

**APPENDIX F-3**

**MAINTENANCE ACTIVITIES BY LOCATION**
**FISCAL YEAR 2009**
**TGRS, OU2**
**ARDEN HILLS, MINNESOTA**

| | |
|---|---|
| 5/25/2009 | Memorial Day Holiday; Daily inspection was not performed.<br>Down time: None. |
| 6/21/2009 | Treatment System and Well Field; Power outage; Xcel Energy responds and repairs the problem.<br>Down time: 10 hours at B1, B13, B5, B6, B9, SC1 and SC5; 7 hours at B3 and B4; 3 hours at |
| 6/29-30/2009 | Treatment System (flow meters 1 and 2) and Pumphouses B11, B1, B13, B3, B4, B5, B8 and B9; Compared the flow rate of the existing flow meter to that of a calibrated flow meter.<br>Down time: None. |
| 7/2/2009 | Pumphouses B13, B3 and B5; Changed out flow meters with new flow meters.<br>Down time: None. |
| 8/16/2009 | Treatment System and Well Field; Blown fuse on the power pole where power enters TCAAP; Xcel Energy contacted and they respond; Power restored and the system is restarted. Normal operation resumes.<br>Down time: 15 hours at B1, B13, B3, B5, B6, B9, B11, SC1, SC2 and SC5. |
| 8/27-28/2009 | Treatment System and Well Field; Shut the treatment system and well field off to repair a leak in the 16" diameter forcemain located approximately 450 feet south of Building 116; Stevens Drilling and Environmental contracted to excavate and repair the leak; Following the repair, the system was turned on and the repair area was inspected; No further leak was observed and the excavation was backfilled.<br>Down time: 46 hours at B1, B5 and B9; 43 hours at B13, B3, B4, B6, B8, B11, SC1, SC2 and SC5. |
| 9/7/2009 | Treatment System and Well Field; The daily inspection was not performed today due to Labor Day.<br>Down time: None. |
| 9/15/2009 | Treatment System and Well Field; Site wide power outage reported by Mike Fix; Call to Xcel at 1135, onsite at 1215; The fusible switch in the NW corner past B12 was open (one leg); Same failure as last outage; Power restored at 1320; No call from the autodialer because the other two legs provided power to the autodialer.<br>Down time: 6.5 hours at B1, B13, B6, 03U003 and SC1; 5 hours at B3, B4, B5, B9 and SC5. |

**APPENDIX F-3**

**MAINTENANCE ACTIVITIES BY LOCATION**
**FISCAL YEAR 2009**
**TGRS, OU2**
**ARDEN HILLS, MINNESOTA**

**Pumphouse B4**

| | |
|---|---|
| 11/22/2008 | Treatment System; Fault on PDU screen, Pump 4 failed to open; Reconnected broken wire on starter coil; Normal operation observed; Well field cycled overnight.<br>Down time: 17.5 hours at B13, B3 and SC1; 9 hours at B4, B6 and B11. |
| 12/17-18/2008 | Treatment System; Well field cycling; Starter wire for pump 4 was loose in motor control center cabinet; Reattached wire and observed normal operation.<br>Down time: 6.5 hours at B4 and B6; 8 hours at B11; 12.5 hours at B13 and 14.5 hours at B3. |
| 1/1/2009 | Treatment System and Well Field; The daily inspection was not performed due to the New Years Day holiday.<br>Down time: None. |
| 2/10/2009 | Treatment System and Well Field; Power outage on TCAAP that shuts off power to the TGRS; Xcel Energy on Site; They repair the problem and power is restored; Restart the TGRS and observe normal operation.<br>Down time: 14 hours at B1, B13, B3, B5, B6, B9, B11, SC1, SC2 and SC5; 11 hours at B4 and B8. |
| 4/8/2009 | Treatment System; Preventive Maintenance work performed; Installed a leak containment seal around pump 1; Added packing to pump 1 gland; Portions of the well field cycled during maintenance activities.<br>Down time: 8 hours at B13 and B8; 7 hours at B3, B4, B6, SC1 and SC5; 3 hours at B11 and SC2. |
| 4/8/2009 | Pumphouse B4; Blown submersible pump motor; Replaced with new.<br>Down time: 12.5 hours. |
| 4/23-24/2009 | Treatment System and Well Field; Xcel Energy is on Site relocating power and bypassing the Lind Power station; They increased the voltage through some of the existing lines which caused connectors to blow; Three small grass fires started from the blown connectors; The Lake Johanna Fire Department responded and extinguished the grass fires.<br>Down time: 18 hours at B1, B5, B6, B8 and B9; 20 hours at B13, B3, SC1 and SC5; 13 hours at B4 and B11. |
| 5/5/2009 | Pumphouses B4, B8 and B11; Opened the ECV at B11 to full open; Closed the ECV's at B4 and B8 to slow their flow rates.<br>Down time: None. |

**APPENDIX F-3**

**MAINTENANCE ACTIVITIES BY LOCATION**
**FISCAL YEAR 2009**
**TGRS, OU2**
**ARDEN HILLS, MINNESOTA**

| | |
|---|---|
| 5/12-17/2009 | Treatment System and Well Field; System down due to reoccurring power outages; Xcel Energy on site to repair the problem; After the power was restored, wet well pump 4 did not restart causing the well field to cycle; Reset pump 4 and normal operation was observed.<br>Down time: 22 hours at B5, B9 and B11; 26.5 hours at B1 and B6; 30.5 hours at B3 and B4; 40 hours at B13, B8 and SC1; 55 hours at SC2 and 61 hours at SC5. |
| 5/19-21/2009 | Well Field and Treatment System; Power outage; Xcel Energy on site to repair; After many hours of troubleshooting, Xcel locates the cause of this and previous power outages; The wind was blowing a ground lead into a blown lightning arrestor causing the power to go out; They repaired the problem and restored power to the site.<br>Down time: 35 hours at B11 and SC2; 44.5 hours at B1, B13, B3, B4, B5, B6, B8, B9, SC1 and SC5. |
| 5/25/2009 | Memorial Day Holiday; Daily inspection was not performed.<br>Down time: None. |
| 6/21/2009 | Treatment System and Well Field; Power outage; Xcel Energy responds and repairs the problem.<br>Down time: 10 hours at B1, B13, B5, B6, B9, SC1 and SC5; 7 hours at B3 and B4; 3 hours at |
| 6/21-23/2009 | Pumphouse B4; Following the power outage, the pump will not start; Troubleshooting indicates the motor is pulling 63 amps which is too high but not motor lock up; T.L. Stevens on site, they pull the pitless adapter off the pitless and discharge water directly onto the ground freeing the impellars.<br>Down time: 40 hours. |
| 6/29-30/2009 | Treatment System (flow meters 1 and 2) and Pumphouses B11, B1, B13, B3, B4, B5, B8 and B9; Compared the flow rate of the existing flow meter to that of a calibrated flow meter.<br>Down time: None. |
| 8/11/2009 | Treatment System and Well Field; Shut the system off to perform preventive maintenance work.<br>Down time: 1 hour at B1 and 2 hours at B13 and B4. |
| 8/15/2009 | Pumphouse B4; The pump is off due to a blown submersible pump motor; Order and install a new motor.<br>Down time: 144 hours. |

**APPENDIX F-3**

**MAINTENANCE ACTIVITIES BY LOCATION**
**FISCAL YEAR 2009**
**TGRS, OU2**
**ARDEN HILLS, MINNESOTA**

| | |
|---|---|
| 8/27-28/2009 | Treatment System and Well Field; Shut the treatment system and well field off to repair a leak in the 16" diameter forcemain located approximately 450 feet south of Building 116; Stevens Drilling and Environmental contracted to excavate and repair the leak; Following the repair, the system was turned on and the repair area was inspected; No further leak was observed and the excavation was backfilled.<br>Down time: 46 hours at B1, B5 and B9; 43 hours at B13, B3, B4, B6, B8, B11, SC1, SC2 and SC5. |
| 9/7/2009 | Treatment System and Well Field; The daily inspection was not performed today due to Labor Day.<br>Down time: None. |
| 9/15/2009 | Treatment System and Well Field; Site wide power outage reported by Mike Fix; Call to Xcel at 1135, onsite at 1215; The fusible switch in the NW corner past B12 was open (one leg); Same failure as last outage; Power restored at 1320; No call from the autodialer because the other two legs provided power to the autodialer.<br>Down time: 6.5 hours at B1, B13, B6, 03U003 and SC1; 5 hours at B3, B4, B5, B9 and SC5. |

**Pumphouse B5**

| | |
|---|---|
| 10/31/2008 | Treatment System; Installed cleaned demister pads in the tops of the towers.<br>Down time: 2 hours at B1, B13 and SC5; 1 hour at B5 and B6. |
| 11/6/2008 | Treatment System; Shutdown the Treatment System to perform monthly preventive maintenance work.<br>Down time: B1 for 2.5 hours, B13, B3, B5 and B6 for 1.5 hours each and SC2 for 4 hours. |
| 12/10-12/2008 | Treatment System; Periodically turned the TGRS off to perform monthly maintenance work.<br>Down time: 1 hour at B5; 2 hours at B1 and B13; 4 hours at B9 and 5.5 hours at SC2. |
| 1/1/2009 | Treatment System and Well Field; The daily inspection was not performed due to the New Years Day holiday.<br>Down time: None. |
| 2/10/2009 | Treatment System and Well Field; Power outage on TCAAP that shuts off power to the TGRS; Xcel Energy on Site; They repair the problem and power is restored; Restart the TGRS and observe normal operation.<br>Down time: 14 hours at B1, B13, B3, B5, B6, B9, B11, SC1, SC2 and SC5; 11 hours at B4 and B8. |

**APPENDIX F-3**

**MAINTENANCE ACTIVITIES BY LOCATION**
**FISCAL YEAR 2009**
**TGRS, OU2**
**ARDEN HILLS, MINNESOTA**

| | |
|---|---|
| 3/5-8/2009 | Treatment System; Preventive Maintenance work performed; Portions of the well field cycled during maintenance activities.<br>Down time: B1 for 2.5 hours and B5 for 1 hour. |
| 3/9-10/2009 | Treatment System and Well Field; Site wide power outage due to a freezing rain storm; Xcel Energy contacted and they respond; They inspected the facility for failures but found none; They reset the main breaker and power was restored normally.<br>Down time: 22 hours at B1, B13, B3, B5, B6, B9, B11, SC1 and SC5; 19 hours at B4; 15 hours at B8 and SC2. |
| 3/20/2009 | Treatment System and Well Field; Site wide power outage due to a sleet storm; Xcel Energy contacted and responds; They repair a blown surge arrestor on a power pole near B12; Restart TGRS and normal operation observed.<br>Down time: 3 hours each at B1, B13, B3, B5, B6 and SC5; 2 hours each at B9 and SC2. |
| 4/23-24/2009 | Treatment System and Well Field; Xcel Energy is on Site relocating power and bypassing the Lind Power station; They increased the voltage through some of the existing lines which caused connectors to blow; Three small grass fires started from the blown connectors; The Lake Johanna Fire Department responded and extinguished the grass fires.<br>Down time: 18 hours at B1, B5, B6, B8 and B9; 20 hours at B13, B3, SC1 and SC5; 13 hours at B4 and B11. |
| 5/12-17/2009 | Treatment System and Well Field; System down due to reoccurring power outages; Xcel Energy on site to repair the problem; After the power was restored, wet well pump 4 did not restart causing the well field to cycle; Reset pump 4 and normal operation was observed.<br>Down time: 22 hours at B5, B9 and B11; 26.5 hours at B1 and B6; 30.5 hours at B3 and B4; 40 hours at B13, B8 and SC1; 55 hours at SC2 and 61 hours at SC5. |
| 5/19-21/2009 | Well Field and Treatment System; Power outage; Xcel Energy on site to repair; After many hours of troubleshooting, Xcel locates the cause of this and previous power outages; The wind was blowing a ground lead into a blown lightning arrestor causing the power to go out; They repaired the problem and restored power to the site.<br>Down time: 35 hours at B11 and SC2; 44.5 hours at B1, B13, B3, B4, B5, B6, B8, B9, SC1 and SC5. |
| 5/25/2009 | Memorial Day Holiday; Daily inspection was not performed.<br>Down time: None. |
| 6/4/2009 | Treatment System and Well Field; The TGRS was shut down to perform monthly maintenance work.<br>Down time: 1.5 hours at B1, B13, B5, SC1 and SC5. |

**APPENDIX F-3**

**MAINTENANCE ACTIVITIES BY LOCATION**
**FISCAL YEAR 2009**
**TGRS, OU2**
**ARDEN HILLS, MINNESOTA**

| | |
|---|---|
| 6/21/2009 | Treatment System and Well Field; Power outage; Xcel Energy responds and repairs the problem.<br>Down time: 10 hours at B1, B13, B5, B6, B9, SC1 and SC5; 7 hours at B3 and B4; 3 hours at |
| 6/29-30/2009 | Treatment System (flow meters 1 and 2) and Pumphouses B11, B1, B13, B3, B4, B5, B8 and B9; Compared the flow rate of the existing flow meter to that of a calibrated flow meter.<br>Down time: None. |
| 7/2/2009 | Pumphouses B13, B3 and B5; Changed out flow meters with new flow meters.<br>Down time: None. |
| 8/1/2009 | Treatment System and Well Field; Preventive maintenance work performed on the treatment system on 7/31/2009 and down time is reflected on 8/1/2009.<br>Down time: 2.5 hours at B1 and B13; 2 hours at B5, B6 and B9. |
| 8/16/2009 | Treatment System and Well Field; Blown fuse on the power pole where power enters TCAAP; Xcel Energy contacted and they respond; Power restored and the system is restarted. Normal operation resumes.<br>Down time: 15 hours at B1, B13, B3, B5, B6, B9, B11, SC1, SC2 and SC5. |
| 8/27-28/2009 | Treatment System and Well Field; Shut the treatment system and well field off to repair a leak in the 16" diameter forcemain located approximately 450 feet south of Building 116; Stevens Drilling and Environmental contracted to excavate and repair the leak; Following the repair, the system was turned on and the repair area was inspected; No further leak was observed and the excavation was backfilled.<br>Down time: 46 hours at B1, B5 and B9; 43 hours at B13, B3, B4, B6, B8, B11, SC1, SC2 and SC5. |
| 9/7/2009 | Treatment System and Well Field; The daily inspection was not performed today due to Labor Day.<br>Down time: None. |
| 9/15/2009 | Treatment System and Well Field; Site wide power outage reported by Mike Fix; Call to Xcel at 1135, onsite at 1215; The fusible switch in the NW corner past B12 was open (one leg); Same failure as last outage; Power restored at 1320; No call from the autodialer because the other two legs provided power to the autodialer.<br>Down time: 6.5 hours at B1, B13, B6, 03U003 and SC1; 5 hours at B3, B4, B5, B9 and SC5. |

**APPENDIX F-3**

**MAINTENANCE ACTIVITIES BY LOCATION**
**FISCAL YEAR 2009**
**TGRS, OU2**
**ARDEN HILLS, MINNESOTA**

**Pumphouse B6**

| | |
|---|---|
| 10/31/2008 | Treatment System; Installed cleaned demister pads in the tops of the towers.<br>Down time: 2 hours at B1, B13 and SC5; 1 hour at B5 and B6. |
| 11/6/2008 | Treatment System; Shutdown the Treatment System to perform monthly preventive maintenance work.<br>Down time: B1 for 2.5 hours, B13, B3, B5 and B6 for 1.5 hours each and SC2 for 4 hours. |
| 12/17-18/2008 | Treatment System; Well field cycling; Starter wire for pump 4 was loose in motor control center cabinet; Reattached wire and observed normal operation.<br>Down time: 6.5 hours at B4 and B6; 8 hours at B11; 12.5 hours at B13 and 14.5 hours at B3. |
| 1/1/2009 | Treatment System and Well Field; The daily inspection was not performed due to the New Years Day holiday.<br>Down time: None. |
| 2/8/2009 | Pumphouse B6; Technician indicates a humming/vibrating noise coming from the pump; Shut pump off for the night and restart the next day; Only minimal humming noise observed.<br>Down time: 16 hours. |
| 2/10/2009 | Treatment System and Well Field; Power outage on TCAAP that shuts off power to the TGRS; Xcel Energy on Site; They repair the problem and power is restored; Restart the TGRS and observe normal operation.<br>Down time: 14 hours at B1, B13, B3, B5, B6, B9, B11, SC1, SC2 and SC5; 11 hours at B4 and B8. |
| 3/9-10/2009 | Treatment System and Well Field; Site wide power outage due to a freezing rain storm; Xcel Energy contacted and they respond; They inspected the facility for failures but found none; They reset the main breaker and power was restored normally.<br>Down time: 22 hours at B1, B13, B3, B5, B6, B9, B11, SC1 and SC5; 19 hours at B4; 15 hours at B8 and SC2. |
| 3/20/2009 | Treatment System and Well Field; Site wide power outage due to a sleet storm; Xcel Energy contacted and responds; They repair a blown surge arrestor on a power pole near B12; Restart TGRS and normal operation observed.<br>Down time: 3 hours each at B1, B13, B3, B5, B6 and SC5; 2 hours each at B9 and SC2. |

**APPENDIX F-3**

**MAINTENANCE ACTIVITIES BY LOCATION**
**FISCAL YEAR 2009**
**TGRS, OU2**
**ARDEN HILLS, MINNESOTA**

| | |
|---|---|
| 4/8/2009 | Treatment System; Preventive Maintenance work performed; Installed a leak containment seal around pump 1; Added packing to pump 1 gland; Portions of the well field cycled during maintenance activities.<br>Down time: 8 hours at B13 and B8; 7 hours at B3, B4, B6, SC1 and SC5; 3 hours at B11 and SC2. |
| 4/23-24/2009 | Treatment System and Well Field; Xcel Energy is on Site relocating power and bypassing the Lind Power station; They increased the voltage through some of the existing lines which caused connectors to blow; Three small grass fires started from the blown connectors; The Lake Johanna Fire Department responded and extinguished the grass fires.<br>Down time: 18 hours at B1, B5, B6, B8 and B9; 20 hours at B13, B3, SC1 and SC5; 13 hours at B4 and B11. |
| 4/27/2009 | Pumphouse B6; The pumping water level is 117.5 feet btoc.<br>Down time: None. |
| 5/12-17/2009 | Treatment System and Well Field; System down due to reoccurring power outages; Xcel Energy on site to repair the problem; After the power was restored, wet well pump 4 did not restart causing the well field to cycle; Reset pump 4 and normal operation was observed.<br>Down time: 22 hours at B5, B9 and B11; 26.5 hours at B1 and B6; 30.5 hours at B3 and B4; 40 hours at B13, B8 and SC1; 55 hours at SC2 and 61 hours at SC5. |
| 5/19-21/2009 | Well Field and Treatment System; Power outage; Xcel Energy on site to repair; After many hours of troubleshooting, Xcel locates the cause of this and previous power outages; The wind was blowing a ground lead into a blown lightning arrestor causing the power to go out; They repaired the problem and restored power to the site.<br>Down time: 35 hours at B11 and SC2; 44.5 hours at B1, B13, B3, B4, B5, B6, B8, B9, SC1 and SC5. |
| 5/25/2009 | Memorial Day Holiday; Daily inspection was not performed.<br>Down time: None. |
| 6/21/2009 | Treatment System and Well Field; Power outage; Xcel Energy responds and repairs the problem.<br>Down time: 10 hours at B1, B13, B5, B6, B9, SC1 and SC5; 7 hours at B3 and B4; 3 hours at |
| 7/1/2009 | Pumphouses B6, SC2 and SC5; Checked the flow rate of the existing flow meters against a calibrated flow meter.<br>Down time: None. |

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**MAINTENANCE ACTIVITIES BY LOCATION**
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**TGRS, OU2**
**ARDEN HILLS, MINNESOTA**

| | |
|---|---|
| 8/1/2009 | Treatment System and Well Field; Preventive maintenance work performed on the treatment system on 7/31/2009 and down time is reflected on 8/1/2009.<br>Down time: 2.5 hours at B1 and B13; 2 hours at B5, B6 and B9. |
| 8/16/2009 | Treatment System and Well Field; Blown fuse on the power pole where power enters TCAAP; Xcel Energy contacted and they respond; Power restored and the system is restarted. Normal operation resumes.<br>Down time: 15 hours at B1, B13, B3, B5, B6, B9, B11, SC1, SC2 and SC5. |
| 8/27-28/2009 | Treatment System and Well Field; Shut the treatment system and well field off to repair a leak in the 16" diameter forcemain located approximately 450 feet south of Building 116; Stevens Drilling and Environmental contracted to excavate and repair the leak; Following the repair, the system was turned on and the repair area was inspected; No further leak was observed and the excavation was backfilled.<br>Down time: 46 hours at B1, B5 and B9; 43 hours at B13, B3, B4, B6, B8, B11, SC1, SC2 and SC5. |
| 9/7/2009 | Treatment System and Well Field; The daily inspection was not performed today due to Labor Day.<br>Down time: None. |
| 9/15/2009 | Treatment System and Well Field; Site wide power outage reported by Mike Fix; Call to Xcel at 1135, onsite at 1215; The fusible switch in the NW corner past B12 was open (one leg); Same failure as last outage; Power restored at 1320; No call from the autodialer because the other two legs provided power to the autodialer.<br>Down time: 6.5 hours at B1, B13, B6, 03U003 and SC1; 5 hours at B3, B4, B5, B9 and SC5. |

**Pumphouse B8**

| | |
|---|---|
| 10/7-12/2008 | Pumphouses and Treatment System; Portions of TGRS shut down as part of quarterly maintenance work.<br>Down time: 1 hour at B1 and B3; 3 hours at B8. |
| 11/1/2008 | Pumphouse B8; Light flashing on PLC in Building 116; Reset PLC and observed normal operation.<br>Down time: 23 hours. |
| 11/11-12/2008 | Pumphouse B8; Upon arrival to perform the daily inspection, pumphouse B8 light flashing on PLC in Building 116; Reset the PLC each day and observed normal operation.<br>Down time: 10.2 hours on 11/11 and 2.3 hours on 11/12. |

**APPENDIX F-3**

**MAINTENANCE ACTIVITIES BY LOCATION**
**FISCAL YEAR 2009**
**TGRS, OU2**
**ARDEN HILLS, MINNESOTA**

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|---|---|
| 11/12/2008 | Pumphouse B8; Lowered the pressure from 128 psi to 116 psi to decrease the flow rate.<br>Down time: None. |
| 11/18, 20, 21/2008 | Pumphouse B8; Upon arrival to perform the daily inspection, pumphouse B8 light flashing on PLC in Building 116; Reset the PLC each day and observed normal operation.<br>Down time: 20.5 hours on 11/18; 21 hours on 11/20 and 20.5 hours on 11/21. |
| 12/3-31/2008 | Pumphouse B8; The B8 light was flashing on the PLC almost every day upon entering Building 116 to perform the daily inspection. Also, the communication light was not lit on the corresponding I/O Scanner Module port, the low level light was lit on the control panel in the pumphouse and the pump was off. Troubleshooting work throughout the month included replacing the following equipment: water level electrode, solenoid valve and coil, microswitch, I/O adapter, input card, output card, data line protector and the water level control board, none of which solved the problem. Additional troubleshooting work is required.<br>Down time: 258 hours for the month of December. |
| 12/31/2008 | Pumphouses B8/B11; Continued troubleshooting work on the B8 shutting down problem; The data line protector in B11 has a blown resistor and B8 and B11 communications are paired together. Installed a new data line protector in the B11 pumphouse control cabinet and restarted the pump in B8; Normal operation observed, however, the communication light on the I/O scanner module in Building 116 for the B8/B11 card remains out.<br>Down time: Down time is already noted above. |
| 1/1/2009 | Treatment System and Well Field; The daily inspection was not performed due to the New Years Day holiday.<br>Down time: None. |
| 1/8/2009 | Treatment System; ECV 3 failed to open on command; Well field is cycling; Flushed control piping, changed filter and adjusted opening and closing speed control valves; Cycled the valve and normal operation observed.<br>Down time: 17 hours each at B13, B3, B8, B9, B11 and SC1; 3 hours at SC5. |
| 1/10/2009 | Pumphouses B3 and B8; Turned the pumps off to perform maintenance work on the ECVs control piping.<br>Down time: 1.5 hours at each. |
| 2/10/2009 | Treatment System and Well Field; Power outage on TCAAP that shuts off power to the TGRS; Xcel Energy on Site; They repair the problem and power is restored; Restart the TGRS and observe normal operation.<br>Down time: 14 hours at B1, B13, B3, B5, B6, B9, B11, SC1, SC2 and SC5; 11 hours at B4 and B8. |

**APPENDIX F-3**

**MAINTENANCE ACTIVITIES BY LOCATION**
**FISCAL YEAR 2009**
**TGRS, OU2**
**ARDEN HILLS, MINNESOTA**

| | |
|---|---|
| 3/9-10/2009 | Treatment System and Well Field; Site wide power outage due to a freezing rain storm; Xcel Energy contacted and they respond; They inspected the facility for failures but found none; They reset the main breaker and power was restored normally.<br>Down time: 22 hours at B1, B13, B3, B5, B6, B9, B11, SC1 and SC5; 19 hours at B4; 15 hours at B8 and SC2. |
| 4/8/2009 | Treatment System; Preventive Maintenance work performed; Installed a leak containment seal around pump 1; Added packing to pump 1 gland; Portions of the well field cycled during maintenance activities.<br>Down time: 8 hours at B13 and B8; 7 hours at B3, B4, B6, SC1 and SC5; 3 hours at B11 and SC2. |
| 4/23-24/2009 | Treatment System and Well Field; Xcel Energy is on Site relocating power and bypassing the Lind Power station; They increased the voltage through some of the existing lines which caused connectors to blow; Three small grass fires started from the blown connectors; The Lake Johanna Fire Department responded and extinguished the grass fires.<br>Down time: 18 hours at B1, B5, B6, B8 and B9; 20 hours at B13, B3, SC1 and SC5; 13 hours at B4 and B11. |
| 5/5/2009 | Pumphouses B4, B8 and B11; Opened the ECV at B11 to full open; Closed the ECV's at B4 and B8 to slow their flow rates.<br>Down time: None. |
| 5/12-17/2009 | Treatment System and Well Field; System down due to reoccurring power outages; Xcel Energy on site to repair the problem; After the power was restored, wet well pump 4 did not restart causing the well field to cycle; Reset pump 4 and normal operation was observed.<br>Down time: 22 hours at B5, B9 and B11; 26.5 hours at B1 and B6; 30.5 hours at B3 and B4; 40 hours at B13, B8 and SC1; 55 hours at SC2 and 61 hours at SC5. |
| 5/19-21/2009 | Well Field and Treatment System; Power outage; Xcel Energy on site to repair; After many hours of troubleshooting, Xcel locates the cause of this and previous power outages; The wind was blowing a ground lead into a blown lightning arrestor causing the power to go out; They repaired the problem and restored power to the site.<br>Down time: 35 hours at B11 and SC2; 44.5 hours at B1, B13, B3, B4, B5, B6, B8, B9, SC1 and SC5. |
| 5/25/2009 | Memorial Day Holiday; Daily inspection was not performed.<br>Down time: None. |

**APPENDIX F-3**

**MAINTENANCE ACTIVITIES BY LOCATION**
**FISCAL YEAR 2009**
**TGRS, OU2**
**ARDEN HILLS, MINNESOTA**

| | |
|---|---|
| 6/29-30/2009 | Treatment System (flow meters 1 and 2) and Pumphouses B11, B1, B13, B3, B4, B5, B8 and B9; Compared the flow rate of the existing flow meter to that of a calibrated flow meter.<br>Down time: None. |
| 8/27-28/2009 | Treatment System and Well Field; Shut the treatment system and well field off to repair a leak in the 16" diameter forcemain located approximately 450 feet south of Building 116; Stevens Drilling and Environmental contracted to excavate and repair the leak; Following the repair, the system was turned on and the repair area was inspected; No further leak was observed and the excavation was backfilled.<br>Down time: 46 hours at B1, B5 and B9; 43 hours at B13, B3, B4, B6, B8, B11, SC1, SC2 and SC5. |
| 9/7/2009 | Treatment System and Well Field; The daily inspection was not performed today due to Labor Day.<br>Down time: None. |

**Pumphouse B9**

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|---|---|
| 11/15/2008 | Pumphouse B9; Chatter noise from control cabinet; Replace output card with new and normal operation observed.<br>Down time: None. |
| 11/15/2008 | Pumphouse B10/B9; Install new I/O adapter and replace the DLP in B10; The B9 light on the PLC in Building 116 now lights normally.<br>Down time: None. |
| 12/10-12/2008 | Treatment System; Periodically turned the TGRS off to perform monthly maintenance work.<br>Down time: 1 hour at B5; 2 hours at B1 and B13; 4 hours at B9 and 5.5 hours at SC2. |
| 1/1/2009 | Treatment System and Well Field; The daily inspection was not performed due to the New Years Day holiday.<br>Down time: None. |
| 1/8/2009 | Treatment System; ECV 3 failed to open on command; Well field is cycling; Flushed control piping, changed filter and adjusted opening and closing speed control valves; Cycled the valve and normal operation observed.<br>Down time: 17 hours each at B13, B3, B8, B9, B11 and SC1; 3 hours at SC5. |
| 1/19-20/2009 | Pumphouse B9; The pumping rate was adjusted but too slowly; Readjusted the flow rate to the target rate.<br>Down time: 3.5 hours. |

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**MAINTENANCE ACTIVITIES BY LOCATION**
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**TGRS, OU2**
**ARDEN HILLS, MINNESOTA**

2/4-18/2009 Pumphouse B9; Flow meter failed slowly with time; Replaced the flow meter and adjusted the daily flow rate on the spread sheet to the calibrated meter flow rate.
Down time: None.

2/10/2009 Treatment System and Well Field; Power outage on TCAAP that shuts off power to the TGRS; Xcel Energy on Site; They repair the problem and power is restored; Restart the TGRS and observe normal operation.
Down time: 14 hours at B1, B13, B3, B5, B6, B9, B11, SC1, SC2 and SC5; 11 hours at B4 and B8.

2/17/2009 Pumphouse B9; Flow meter not totaling properly; Replaced with new.
Down time: None, adjusted flow rates accordingly.

3/9-10/2009 Treatment System and Well Field; Site wide power outage due to a freezing rain storm; Xcel Energy contacted and they respond; They inspected the facility for failures but found none; They reset the main breaker and power was restored normally.
Down time: 22 hours at B1, B13, B3, B5, B6, B9, B11, SC1 and SC5; 19 hours at B4; 15 hours at B8 and SC2.

3/20/2009 Treatment System and Well Field; Site wide power outage due to a sleet storm; Xcel Energy contacted and responds; They repair a blown surge arrestor on a power pole near B12; Restart TGRS and normal operation observed.
Down time: 3 hours each at B1, B13, B3, B5, B6 and SC5; 2 hours each at B9 and SC2.

4/23-24/2009 Treatment System and Well Field; Xcel Energy is on Site relocating power and bypassing the Lind Power station; They increased the voltage through some of the existing lines which caused connectors to blow; Three small grass fires started from the blown connectors; The Lake Johanna Fire Department responded and extinguished the grass fires.
Down time: 18 hours at B1, B5, B6, B8 and B9; 20 hours at B13, B3, SC1 and SC5; 13 hours at B4 and B11.

5/12-17/2009 Treatment System and Well Field; System down due to reoccurring power outages; Xcel Energy on site to repair the problem; After the power was restored, wet well pump 4 did not restart causing the well field to cycle; Reset pump 4 and normal operation was observed.
Down time: 22 hours at B5, B9 and B11; 26.5 hours at B1 and B6; 30.5 hours at B3 and B4; 40 hours at B13, B8 and SC1; 55 hours at SC2 and 61 hours at SC5.

**APPENDIX F-3**

**MAINTENANCE ACTIVITIES BY LOCATION**
**FISCAL YEAR 2009**
**TGRS, OU2**
**ARDEN HILLS, MINNESOTA**

| | |
|---|---|
| 5/19-21/2009 | Well Field and Treatment System; Power outage; Xcel Energy on site to repair; After many hours of troubleshooting, Xcel locates the cause of this and previous power outages; The wind was blowing a ground lead into a blown lightning arrestor causing the power to go out; They repaired the problem and restored power to the site.<br>Down time: 35 hours at B11 and SC2; 44.5 hours at B1, B13, B3, B4, B5, B6, B8, B9, SC1 and SC5. |
| 5/25/2009 | Memorial Day Holiday; Daily inspection was not performed.<br>Down time: None. |
| 6/21/2009 | Treatment System and Well Field; Power outage; Xcel Energy responds and repairs the problem.<br>Down time: 10 hours at B1, B13, B5, B6, B9, SC1 and SC5; 7 hours at B3 and B4; 3 hours at |
| 6/29-30/2009 | Treatment System (flow meters 1 and 2) and Pumphouses B11, B1, B13, B3, B4, B5, B8 and B9; Compared the flow rate of the existing flow meter to that of a calibrated flow meter.<br>Down time: None. |
| 7/17/2009 | Pumphouse B9; Flow meter no longer totals properly; Change out with new; New meter in at 12:15 at 13762400.<br>Down time: None. |
| 8/1/2009 | Treatment System and Well Field; Preventive maintenance work performed on the treatment system on 7/31/2009 and down time is reflected on 8/1/2009.<br>Down time: 2.5 hours at B1 and B13; 2 hours at B5, B6 and B9. |
| 8/16/2009 | Treatment System and Well Field; Blown fuse on the power pole where power enters TCAAP; Xcel Energy contacted and they respond; Power restored and the system is restarted. Normal operation resumes.<br>Down time: 15 hours at B1, B13, B3, B5, B6, B9, B11, SC1, SC2 and SC5. |
| 8/27-28/2009 | Treatment System and Well Field; Shut the treatment system and well field off to repair a leak in the 16" diameter forcemain located approximately 450 feet south of Building 116; Stevens Drilling and Environmental contracted to excavate and repair the leak; Following the repair, the system was turned on and the repair area was inspected; No further leak was observed and the excavation was backfilled.<br>Down time: 46 hours at B1, B5 and B9; 43 hours at B13, B3, B4, B6, B8, B11, SC1, SC2 and SC5. |
| 9/7/2009 | Treatment System and Well Field; The daily inspection was not performed today due to Labor Day.<br>Down time: None. |

**APPENDIX F-3**

**MAINTENANCE ACTIVITIES BY LOCATION**
**FISCAL YEAR 2009**
**TGRS, OU2**
**ARDEN HILLS, MINNESOTA**

| | |
|---|---|
| 9/15/2009 | Treatment System and Well Field; Site wide power outage reported by Mike Fix; Call to Xcel at 1135, onsite at 1215; The fusible switch in the NW corner past B12 was open (one leg); Same failure as last outage; Power restored at 1320; No call from the autodialer because the other two legs provided power to the autodialer.<br>Down time: 6.5 hours at B1, B13, B6, 03U003 and SC1; 5 hours at B3, B4, B5, B9 and SC5. |

**Pumphouse B10**

| | |
|---|---|
| 11/15/2008 | Pumphouse B10/B9; Install new I/O adapter and replace the DLP in B10; The B9 light on the PLC in Building 116 now lights normally.<br>Down time: None. |

**Pumphouse B11**

| | |
|---|---|
| 11/22/2008 | Treatment System; Fault on PDU screen, Pump 4 failed to open; Reconnected broken wire on starter coil; Normal operation observed; Well field cycled overnight.<br>Down time: 17.5 hours at B13, B3 and SC1; 9 hours at B4, B6 and B11. |
| 12/17-18/2008 | Treatment System; Well field cycling; Starter wire for pump 4 was loose in motor control center cabinet; Reattached wire and observed normal operation.<br>Down time: 6.5 hours at B4 and B6; 8 hours at B11; 12.5 hours at B13 and 14.5 hours at B3. |
| 12/31/2008 | Pumphouses B8/B11; Continued troubleshooting work on the B8 shutting down problem; The data line protector in B11 has a blown resistor and B8 and B11 communications are paired together. Installed a new data line protector in the B11 pumphouse control cabinet and restarted the pump in B8; Normal operation observed, however, the communication light on the I/O scanner module in Building 116 for the B8/B11 card remains out.<br>Down time: Down time is already noted above. |
| 1/1/2009 | Treatment System and Well Field; The daily inspection was not performed due to the New Years Day holiday.<br>Down time: None. |
| 1/8/2009 | Treatment System; ECV 3 failed to open on command; Well field is cycling; Flushed control piping, changed filter and adjusted opening and closing speed control valves; Cycled the valve and normal operation observed.<br>Down time: 17 hours each at B13, B3, B8, B9, B11 and SC1; 3 hours at SC5. |

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**TGRS, OU2**
**ARDEN HILLS, MINNESOTA**

| | |
|---|---|
| 2/10/2009 | Treatment System and Well Field; Power outage on TCAAP that shuts off power to the TGRS; Xcel Energy on Site; They repair the problem and power is restored; Restart the TGRS and observe normal operation.<br>Down time: 14 hours at B1, B13, B3, B5, B6, B9, B11, SC1, SC2 and SC5; 11 hours at B4 and B8. |
| 3/9-10/2009 | Treatment System and Well Field; Site wide power outage due to a freezing rain storm; Xcel Energy contacted and they respond; They inspected the facility for failures but found none; They reset the main breaker and power was restored normally.<br>Down time: 22 hours at B1, B13, B3, B5, B6, B9, B11, SC1 and SC5; 19 hours at B4; 15 hours at B8 and SC2. |
| 4/8/2009 | Treatment System; Preventive Maintenance work performed; Installed a leak containment seal around pump 1; Added packing to pump 1 gland; Portions of the well field cycled during maintenance activities.<br>Down time: 8 hours at B13 and B8; 7 hours at B3, B4, B6, SC1 and SC5; 3 hours at B11 and SC2. |
| 4/23-24/2009 | Treatment System and Well Field; Xcel Energy is on Site relocating power and bypassing the Lind Power station; They increased the voltage through some of the existing lines which caused connectors to blow; Three small grass fires started from the blown connectors; The Lake Johanna Fire Department responded and extinguished the grass fires.<br>Down time: 18 hours at B1, B5, B6, B8 and B9; 20 hours at B13, B3, SC1 and SC5; 13 hours at B4 and B11. |
| 4/29/2009 | Pumphouse B11; The pumping water level is 117.3 feet btoc.<br>Down time: None. |
| 5/1/2009 | Pumphouse B11; Shutdown the pumphouse to replace the pump and motor.<br>Down time: 2.7 hours. |
| 5/5/2009 | Pumphouses B4, B8 and B11; Opened the ECV at B11 to full open; Closed the ECV's at B4 and B8 to slow their flow rates.<br>Down time: None. |
| 5/5/2009 | Treatment System and Well Field; Performed preventive maintenance work on the treatment system.<br>Down time: 1.7 hours at B11. |

**APPENDIX F-3**

**MAINTENANCE ACTIVITIES BY LOCATION**
**FISCAL YEAR 2009**
**TGRS, OU2**
**ARDEN HILLS, MINNESOTA**

| | |
|---|---|
| 5/12-17/2009 | Treatment System and Well Field; System down due to reoccurring power outages; Xcel Energy on site to repair the problem; After the power was restored, wet well pump 4 did not restart causing the well field to cycle; Reset pump 4 and normal operation was observed.<br>Down time: 22 hours at B5, B9 and B11; 26.5 hours at B1 and B6; 30.5 hours at B3 and B4; 40 hours at B13, B8 and SC1; 55 hours at SC2 and 61 hours at SC5. |
| 5/19-21/2009 | Well Field and Treatment System; Power outage; Xcel Energy on site to repair; After many hours of troubleshooting, Xcel locates the cause of this and previous power outages; The wind was blowing a ground lead into a blown lightning arrestor causing the power to go out; They repaired the problem and restored power to the site.<br>Down time: 35 hours at B11 and SC2; 44.5 hours at B1, B13, B3, B4, B5, B6, B8, B9, SC1 and SC5. |
| 5/25/2009 | Memorial Day Holiday; Daily inspection was not performed.<br>Down time: None. |
| 6/21/2009 | Treatment System and Well Field; Power outage; Xcel Energy responds and repairs the problem.<br>Down time: 10 hours at B1, B13, B5, B6, B9, SC1 and SC5; 7 hours at B3 and B4; 3 hours at |
| 6/29-30/2009 | Treatment System (flow meters 1 and 2) and Pumphouses B11, B1, B13, B3, B4, B5, B8 and B9; Compared the flow rate of the existing flow meter to that of a calibrated flow meter.<br>Down time: None. |
| 8/16/2009 | Treatment System and Well Field; Blown fuse on the power pole where power enters TCAAP; Xcel Energy contacted and they respond; Power restored and the system is restarted. Normal operation resumes.<br>Down time: 15 hours at B1, B13, B3, B5, B6, B9, B11, SC1, SC2 and SC5. |
| 8/27-28/2009 | Treatment System and Well Field; Shut the treatment system and well field off to repair a leak in the 16" diameter forcemain located approximately 450 feet south of Building 116; Stevens Drilling and Environmental contracted to excavate and repair the leak; Following the repair, the system was turned on and the repair area was inspected; No further leak was observed and the excavation was backfilled.<br>Down time: 46 hours at B1, B5 and B9; 43 hours at B13, B3, B4, B6, B8, B11, SC1, SC2 and SC5. |
| 9/7/2009 | Treatment System and Well Field; The daily inspection was not performed today due to Labor Day.<br>Down time: None. |

**APPENDIX F-3**

**MAINTENANCE ACTIVITIES BY LOCATION**
**FISCAL YEAR 2009**
**TGRS, OU2**
**ARDEN HILLS, MINNESOTA**

**Pumphouse B13**

| | |
|---|---|
| 10/15-16/2008 | Treatment System and Pumphouses; Shut down the TGRS to install check valves on the potable water line and to work on tower demister pads.<br>Down time: 1.5 hours at B1, B13 and SC2; 3.5 hours at SC5. |
| 10/31/2008 | Treatment System; Installed cleaned demister pads in the tops of the towers.<br>Down time: 2 hours at B1, B13 and SC5; 1 hour at B5 and B6. |
| 11/6/2008 | Treatment System; Shutdown the Treatment System to perform monthly preventive maintenance work.<br>Down time: B1 for 2.5 hours, B13, B3, B5 and B6 for 1.5 hours each and SC2 for 4 hours. |
| 11/22/2008 | Treatment System; Fault on PDU screen, Pump 4 failed to open; Reconnected broken wire on starter coil; Normal operation observed; Well field cycled overnight.<br>Down time: 17.5 hours at B13, B3 and SC1; 9 hours at B4, B6 and B11. |
| 12/10-12/2008 | Treatment System; Periodically turned the TGRS off to perform monthly maintenance work.<br>Down time: 1 hour at B5; 2 hours at B1 and B13; 4 hours at B9 and 5.5 hours at SC2. |
| 12/17-18/2008 | Treatment System; Well field cycling; Starter wire for pump 4 was loose in motor control center cabinet; Reattached wire and observed normal operation.<br>Down time: 6.5 hours at B4 and B6; 8 hours at B11; 12.5 hours at B13 and 14.5 hours at B3. |
| 1/1/2009 | Treatment System and Well Field; The daily inspection was not performed due to the New Years Day holiday.<br>Down time: None. |
| 1/8/2009 | Treatment System; ECV 3 failed to open on command; Well field is cycling; Flushed control piping, changed filter and adjusted opening and closing speed control valves; Cycled the valve and normal operation observed.<br>Down time: 17 hours each at B13, B3, B8, B9, B11 and SC1; 3 hours at SC5. |
| 1/14/2009 | Pumphouse B1 and B13; Turned the pumps off to perform maintenance work on the ECVs control piping.<br>Down time: 1.5 hours at each. |

**APPENDIX F-3**

**MAINTENANCE ACTIVITIES BY LOCATION**
**FISCAL YEAR 2009**
**TGRS, OU2**
**ARDEN HILLS, MINNESOTA**

| | |
|---|---|
| 2/10/2009 | Treatment System and Well Field; Power outage on TCAAP that shuts off power to the TGRS; Xcel Energy on Site; They repair the problem and power is restored; Restart the TGRS and observe normal operation.<br>Down time: 14 hours at B1, B13, B3, B5, B6, B9, B11, SC1, SC2 and SC5; 11 hours at B4 and B8. |
| 3/9-10/2009 | Treatment System and Well Field; Site wide power outage due to a freezing rain storm; Xcel Energy contacted and they respond; They inspected the facility for failures but found none; They reset the main breaker and power was restored normally.<br>Down time: 22 hours at B1, B13, B3, B5, B6, B9, B11, SC1 and SC5; 19 hours at B4; 15 hours at B8 and SC2. |
| 3/20/2009 | Treatment System and Well Field; Site wide power outage due to a sleet storm; Xcel Energy contacted and responds; They repair a blown surge arrestor on a power pole near B12; Restart TGRS and normal operation observed.<br>Down time: 3 hours each at B1, B13, B3, B5, B6 and SC5; 2 hours each at B9 and SC2. |
| 3/25/2009 | Treatment System; ECV 1 fails to open; Adjust opening speed and valve responds normally.<br>Down time: B13 and B3 for 1.5 hour each. |
| 3/30-31/2009 | Pumphouse B13; Pump turned off to redevelop well with acid.<br>March Down time: 26 hours. |
| 4/1-4/2009 | Pumphouse B13; Pump turned off to redevelop the well with acid.<br>April Down time: 71 hours. |
| 4/8/2009 | Treatment System; Preventive Maintenance work performed; Installed a leak containment seal around pump 1; Added packing to pump 1 gland; Portions of the well field cycled during maintenance activities.<br>Down time: 8 hours at B13 and B8; 7 hours at B3, B4, B6, SC1 and SC5; 3 hours at B11 and SC2. |
| 4/23-24/2009 | Treatment System and Well Field; Xcel Energy is on Site relocating power and bypassing the Lind Power station; They increased the voltage through some of the existing lines which caused connectors to blow; Three small grass fires started from the blown connectors; The Lake Johanna Fire Department responded and extinguished the grass fires.<br>Down time: 18 hours at B1, B5, B6, B8 and B9; 20 hours at B13, B3, SC1 and SC5; 13 hours at B4 and B11. |

**APPENDIX F-3**

**MAINTENANCE ACTIVITIES BY LOCATION**
**FISCAL YEAR 2009**
**TGRS, OU2**
**ARDEN HILLS, MINNESOTA**

| | |
|---|---|
| 5/12-17/2009 | Treatment System and Well Field; System down due to reoccurring power outages; Xcel Energy on site to repair the problem; After the power was restored, wet well pump 4 did not restart causing the well field to cycle; Reset pump 4 and normal operation was observed.<br>Down time: 22 hours at B5, B9 and B11; 26.5 hours at B1 and B6; 30.5 hours at B3 and B4; 40 hours at B13, B8 and SC1; 55 hours at SC2 and 61 hours at SC5. |
| 5/19-21/2009 | Well Field and Treatment System; Power outage; Xcel Energy on site to repair; After many hours of troubleshooting, Xcel locates the cause of this and previous power outages; The wind was blowing a ground lead into a blown lightning arrestor causing the power to go out; They repaired the problem and restored power to the site.<br>Down time: 35 hours at B11 and SC2; 44.5 hours at B1, B13, B3, B4, B5, B6, B8, B9, SC1 and SC5. |
| 5/25/2009 | Memorial Day Holiday; Daily inspection was not performed.<br>Down time: None. |
| 6/4/2009 | Treatment System and Well Field; The TGRS was shut down to perform monthly maintenance work.<br>Down time: 1.5 hours at B1, B13, B5, SC1 and SC5. |
| 6/21/2009 | Treatment System and Well Field; Power outage; Xcel Energy responds and repairs the problem.<br>Down time: 10 hours at B1, B13, B5, B6, B9, SC1 and SC5; 7 hours at B3 and B4; 3 hours at |
| 6/29-30/2009 | Treatment System (flow meters 1 and 2) and Pumphouses B11, B1, B13, B3, B4, B5, B8 and B9; Compared the flow rate of the existing flow meter to that of a calibrated flow meter.<br>Down time: None. |
| 7/2/2009 | Pumphouses B13, B3 and B5; Changed out flow meters with new flow meters.<br>Down time: None. |
| 8/1/2009 | Treatment System and Well Field; Preventive maintenance work performed on the treatment system on 7/31/2009 and down time is reflected on 8/1/2009.<br>Down time: 2.5 hours at B1 and B13; 2 hours at B5, B6 and B9. |
| 8/11/2009 | Treatment System and Well Field; Shut the system off to perform preventive maintenance work.<br>Down time: 1 hour at B1 and 2 hours at B13 and B4. |

**APPENDIX F-3**

**MAINTENANCE ACTIVITIES BY LOCATION**
**FISCAL YEAR 2009**
**TGRS, OU2**
**ARDEN HILLS, MINNESOTA**

| | |
|---|---|
| 8/16/2009 | Treatment System and Well Field; Blown fuse on the power pole where power enters TCAAP; Xcel Energy contacted and they respond; Power restored and the system is restarted. Normal operation resumes.<br>Down time: 15 hours at B1, B13, B3, B5, B6, B9, B11, SC1, SC2 and SC5. |
| 8/27-28/2009 | Treatment System and Well Field; Shut the treatment system and well field off to repair a leak in the 16" diameter forcemain located approximately 450 feet south of Building 116; Stevens Drilling and Environmental contracted to excavate and repair the leak; Following the repair, the system was turned on and the repair area was inspected; No further leak was observed and the excavation was backfilled.<br>Down time: 46 hours at B1, B5 and B9; 43 hours at B13, B3, B4, B6, B8, B11, SC1, SC2 and SC5. |
| 9/7/2009 | Treatment System and Well Field; The daily inspection was not performed today due to Labor Day.<br>Down time: None. |
| 9/15/2009 | Treatment System and Well Field; Site wide power outage reported by Mike Fix; Call to Xcel at 1135, onsite at 1215; The fusible switch in the NW corner past B12 was open (one leg); Same failure as last outage; Power restored at 1320; No call from the autodialer because the other two legs provided power to the autodialer.<br>Down time: 6.5 hours at B1, B13, B6, 03U003 and SC1; 5 hours at B3, B4, B5, B9 and SC5. |

**Well 03U003**

| | |
|---|---|
| 9/15/2009 | Treatment System and Well Field; Site wide power outage reported by Mike Fix; Call to Xcel at 1135, onsite at 1215; The fusible switch in the NW corner past B12 was open (one leg); Same failure as last outage; Power restored at 1320; No call from the autodialer because the other two legs provided power to the autodialer.<br>Down time: 6.5 hours at B1, B13, B6, 03U003 and SC1; 5 hours at B3, B4, B5, B9 and SC5. |

**Pumphouse SC1**

| | |
|---|---|
| 11/22/2008 | Treatment System; Fault on PDU screen, Pump 4 failed to open; Reconnected broken wire on starter coil; Normal operation observed; Well field cycled overnight.<br>Down time: 17.5 hours at B13, B3 and SC1; 9 hours at B4, B6 and B11. |
| 1/1/2009 | Treatment System and Well Field; The daily inspection was not performed due to the New Years Day holiday.<br>Down time: None. |

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**MAINTENANCE ACTIVITIES BY LOCATION**
**FISCAL YEAR 2009**
**TGRS, OU2**
**ARDEN HILLS, MINNESOTA**

| | |
|---|---|
| 1/8/2009 | Treatment System; ECV 3 failed to open on command; Well field is cycling; Flushed control piping, changed filter and adjusted opening and closing speed control valves; Cycled the valve and normal operation observed.<br>Down time: 17 hours each at B13, B3, B8, B9, B11 and SC1; 3 hours at SC5. |
| 2/10/2009 | Treatment System and Well Field; Power outage on TCAAP that shuts off power to the TGRS; Xcel Energy on Site; They repair the problem and power is restored; Restart the TGRS and observe normal operation.<br>Down time: 14 hours at B1, B13, B3, B5, B6, B9, B11, SC1, SC2 and SC5; 11 hours at B4 and B8. |
| 3/9-10/2009 | Treatment System and Well Field; Site wide power outage due to a freezing rain storm; Xcel Energy contacted and they respond; They inspected the facility for failures but found none; They reset the main breaker and power was restored normally.<br>Down time: 22 hours at B1, B13, B3, B5, B6, B9, B11, SC1 and SC5; 19 hours at B4; 15 hours at B8 and SC2. |
| 4/8/2009 | Treatment System; Preventive Maintenance work performed; Installed a leak containment seal around pump 1; Added packing to pump 1 gland; Portions of the well field cycled during maintenance activities.<br>Down time: 8 hours at B13 and B8; 7 hours at B3, B4, B6, SC1 and SC5; 3 hours at B11 and SC2. |
| 4/23-24/2009 | Treatment System and Well Field; Xcel Energy is on Site relocating power and bypassing the Lind Power station; They increased the voltage through some of the existing lines which caused connectors to blow; Three small grass fires started from the blown connectors; The Lake Johanna Fire Department responded and extinguished the grass fires.<br>Down time: 18 hours at B1, B5, B6, B8 and B9; 20 hours at B13, B3, SC1 and SC5; 13 hours at B4 and B11. |
| 5/12-17/2009 | Treatment System and Well Field; System down due to reoccurring power outages; Xcel Energy on site to repair the problem; After the power was restored, wet well pump 4 did not restart causing the well field to cycle; Reset pump 4 and normal operation was observed.<br>Down time: 22 hours at B5, B9 and B11; 26.5 hours at B1 and B6; 30.5 hours at B3 and B4; 40 hours at B13, B8 and SC1; 55 hours at SC2 and 61 hours at SC5. |

**APPENDIX F-3**

**MAINTENANCE ACTIVITIES BY LOCATION**
**FISCAL YEAR 2009**
**TGRS, OU2**
**ARDEN HILLS, MINNESOTA**

| | |
|---|---|
| 5/19-21/2009 | Well Field and Treatment System; Power outage; Xcel Energy on site to repair; After many hours of troubleshooting, Xcel locates the cause of this and previous power outages; The wind was blowing a ground lead into a blown lightning arrestor causing the power to go out; They repaired the problem and restored power to the site.<br>Down time: 35 hours at B11 and SC2; 44.5 hours at B1, B13, B3, B4, B5, B6, B8, B9, SC1 and SC5. |
| 5/25/2009 | Memorial Day Holiday; Daily inspection was not performed.<br>Down time: None. |
| 6/4/2009 | Treatment System and Well Field; The TGRS was shut down to perform monthly maintenance work.<br>Down time: 1.5 hours at B1, B13, B5, SC1 and SC5. |
| 6/21/2009 | Treatment System and Well Field; Power outage; Xcel Energy responds and repairs the problem.<br>Down time: 10 hours at B1, B13, B5, B6, B9, SC1 and SC5; 7 hours at B3 and B4; 3 hours at |
| 8/16/2009 | Treatment System and Well Field; Blown fuse on the power pole where power enters TCAAP; Xcel Energy contacted and they respond; Power restored and the system is restarted. Normal operation resumes.<br>Down time: 15 hours at B1, B13, B3, B5, B6, B9, B11, SC1, SC2 and SC5. |
| 8/27-28/2009 | Treatment System and Well Field; Shut the treatment system and well field off to repair a leak in the 16" diameter forcemain located approximately 450 feet south of Building 116; Stevens Drilling and Environmental contracted to excavate and repair the leak; Following the repair, the system was turned on and the repair area was inspected; No further leak was observed and the excavation was backfilled.<br>Down time: 46 hours at B1, B5 and B9; 43 hours at B13, B3, B4, B6, B8, B11, SC1, SC2 and SC5. |
| 9/7/2009 | Treatment System and Well Field; The daily inspection was not performed today due to Labor Day.<br>Down time: None. |
| 9/15/2009 | Treatment System and Well Field; Site wide power outage reported by Mike Fix; Call to Xcel at 1135, onsite at 1215; The fusible switch in the NW corner past B12 was open (one leg); Same failure as last outage; Power restored at 1320; No call from the autodialer because the other two legs provided power to the autodialer.<br>Down time: 6.5 hours at B1, B13, B6, 03U003 and SC1; 5 hours at B3, B4, B5, B9 and SC5. |

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**MAINTENANCE ACTIVITIES BY LOCATION**
**FISCAL YEAR 2009**
**TGRS, OU2**
**ARDEN HILLS, MINNESOTA**

**Pumphouse SC2**

| | |
|---|---|
| 10/15-16/2008 | Treatment System and Pumphouses; Shut down the TGRS to install check valves on the potable water line and to work on tower demister pads.<br>Down time: 1.5 hours at B1, B13 and SC2; 3.5 hours at SC5. |
| 11/6/2008 | Treatment System; Shutdown the Treatment System to perform monthly preventive maintenance work.<br>Down time: B1 for 2.5 hours, B13, B3, B5 and B6 for 1.5 hours each and SC2 for 4 hours. |
| 11/15/2008 | Pumphouse SC3/SC2; Faulty output card and DLP in the control cabinet at SC3; Replace both with new and SC2 lights normally on the PLC in Building 116.<br>Down time: None. |
| 11/9, 26/2008 | Pumphouse SC2; Adjusted flow rate too slowly; Reset the following day and normal operation observed.<br>Down time: 3 hours on 11/9 and 5.5 hours on 11/26. |
| 12/10-12/2008 | Treatment System; Periodically turned the TGRS off to perform monthly maintenance work.<br>Down time: 1 hour at B5; 2 hours at B1 and B13; 4 hours at B9 and 5.5 hours at SC2. |
| 12/15/2008 | Pumphouse SC2; Pumphouse heater does not put out warm air; Laughlin Electric on site and replaces with new.<br>Down time: None. |
| 1/1/2009 | Treatment System and Well Field; The daily inspection was not performed due to the New Years Day holiday.<br>Down time: None. |
| 2/10/2009 | Treatment System and Well Field; Power outage on TCAAP that shuts off power to the TGRS; Xcel Energy on Site; They repair the problem and power is restored; Restart the TGRS and observe normal operation.<br>Down time: 14 hours at B1, B13, B3, B5, B6, B9, B11, SC1, SC2 and SC5; 11 hours at B4 and B8. |
| 2/18/2009 | Pumphouse SC2; Flow meter not totaling correctly; Replaced with new.<br>Down time: None, adjusted flow rates accordingly. |

**APPENDIX F-3**

**MAINTENANCE ACTIVITIES BY LOCATION**
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**TGRS, OU2**
**ARDEN HILLS, MINNESOTA**

| | |
|---|---|
| 3/9-10/2009 | Treatment System and Well Field; Site wide power outage due to a freezing rain storm; Xcel Energy contacted and they respond; They inspected the facility for failures but found none; They reset the main breaker and power was restored normally.<br>Down time: 22 hours at B1, B13, B3, B5, B6, B9, B11, SC1 and SC5; 19 hours at B4; 15 hours at B8 and SC2. |
| 3/20/2009 | Treatment System and Well Field; Site wide power outage due to a sleet storm; Xcel Energy contacted and responds; They repair a blown surge arrestor on a power pole near B12; Restart TGRS and normal operation observed.<br>Down time: 3 hours each at B1, B13, B3, B5, B6 and SC5; 2 hours each at B9 and SC2. |
| 3/25-26/2009 | Pumphouses SC2 and SC5; Power out to pumphouses; Xcel Energy contacted and they respond; Blown fuse on power pole; Restart SC2 and SC5 and they restart normally.<br>Down time: SC2 for 14 hours and SC5 for 16 hours. |
| 4/8/2009 | Treatment System; Preventive Maintenance work performed; Installed a leak containment seal around pump 1; Added packing to pump 1 gland; Portions of the well field cycled during maintenance activities.<br>Down time: 8 hours at B13 and B8; 7 hours at B3, B4, B6, SC1 and SC5; 3 hours at B11 and SC2. |
| 4/21-25/2009 | Pumphouse SC2; Pump turned off to redevelop the well with acid.<br>Down time: 99 hours. |
| 5/12-17/2009 | Treatment System and Well Field; System down due to reoccurring power outages; Xcel Energy on site to repair the problem; After the power was restored, wet well pump 4 did not restart causing the well field to cycle; Reset pump 4 and normal operation was observed.<br>Down time: 22 hours at B5, B9 and B11; 26.5 hours at B1 and B6; 30.5 hours at B3 and B4; 40 hours at B13, B8 and SC1; 55 hours at SC2 and 61 hours at SC5. |
| 5/19-21/2009 | Well Field and Treatment System; Power outage; Xcel Energy on site to repair; After many hours of troubleshooting, Xcel locates the cause of this and previous power outages; The wind was blowing a ground lead into a blown lightning arrestor causing the power to go out; They repaired the problem and restored power to the site.<br>Down time: 35 hours at B11 and SC2; 44.5 hours at B1, B13, B3, B4, B5, B6, B8, B9, SC1 and SC5. |
| 5/25/2009 | Memorial Day Holiday; Daily inspection was not performed.<br>Down time: None. |

**APPENDIX F-3**

**MAINTENANCE ACTIVITIES BY LOCATION**
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**TGRS, OU2**
**ARDEN HILLS, MINNESOTA**

| | |
|---|---|
| 7/1/2009 | Pumphouses B6, SC2 and SC5; Checked the flow rate of the existing flow meters against a calibrated flow meter.<br>Down time: None. |
| 8/9-10/2009 | Pumphouse SC2; There is a blown communication card in pumphouse SC2; Replace with a new card and normal operation resumes.<br>Down time: 27 hours. |
| 8/16/2009 | Treatment System and Well Field; Blown fuse on the power pole where power enters TCAAP; Xcel Energy contacted and they respond; Power restored and the system is restarted. Normal operation resumes.<br>Down time: 15 hours at B1, B13, B3, B5, B6, B9, B11, SC1, SC2 and SC5. |
| 8/27-28/2009 | Treatment System and Well Field; Shut the treatment system and well field off to repair a leak in the 16" diameter forcemain located approximately 450 feet south of Building 116; Stevens Drilling and Environmental contracted to excavate and repair the leak; Following the repair, the system was turned on and the repair area was inspected; No further leak was observed and the excavation was backfilled.<br>Down time: 46 hours at B1, B5 and B9; 43 hours at B13, B3, B4, B6, B8, B11, SC1, SC2 and SC5. |
| 9/7/2009 | Treatment System and Well Field; The daily inspection was not performed today due to Labor Day.<br>Down time: None. |

**Pumphouse SC3**

| | |
|---|---|
| 11/15/2008 | Pumphouse SC3/SC2; Faulty output card and DLP in the control cabinet at SC3; Replace both with new and SC2 lights normally on the PLC in Building 116.<br>Down time: None. |
| 9/1/2009 | Pumphouse SC3; Turned SC3 on today; Flow meter reading was 94031200; There is no pressure gauge on the forcemain.<br>Down time: None. |
| 9/7/2009 | Treatment System and Well Field; The daily inspection was not performed today due to Labor Day.<br>Down time: None. |
| 9/30/2009 | Pumphouse SC3; Turned the pumphouse off today.<br>Down time: None. |

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**MAINTENANCE ACTIVITIES BY LOCATION**
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**ARDEN HILLS, MINNESOTA**

**Pumphouse SC4**

| | |
|---|---|
| 11/15/2008 | Pumphouse SC4/SC5 ; Faulty I/O adapter in the control cabinet at SC4; Replace with new and SC5 lights normally on the PLC in Building 116.<br>Down time: None. |

**Pumphouse SC5**

| | |
|---|---|
| 10/4/2008 | Pumphouse SC5; Shut down the pump to work on the ECV control piping.<br>Down time: 1 hour. |
| 10/15-16/2008 | Treatment System and Pumphouses; Shut down the TGRS to install check valves on the potable water line and to work on tower demister pads.<br>Down time: 1.5 hours at B1, B13 and SC2; 3.5 hours at SC5. |
| 10/31/2008 | Treatment System; Installed cleaned demister pads in the tops of the towers.<br>Down time: 2 hours at B1, B13 and SC5; 1 hour at B5 and B6. |
| 11/15/2008 | Pumphouse SC4/SC5 ; Faulty I/O adapter in the control cabinet at SC4; Replace with new and SC5 lights normally on the PLC in Building 116.<br>Down time: None. |
| 11/25-30/2008 | Pumphouse SC5; Replace pump and motor with new and re-develop well with acid.<br>November down time: 150 hours. |
| 12/1-2/2008 | Pumphouse SC5; Redevelop well with acid; Install new pump and motor.<br>Down time: 42.5 hours. |
| 12/19/2008 | Pumphouse SC5; Flow meter was not operating despite pumping water; Removed and cleaned the meter; Observed normal meter operation.<br>Down time: None, adjusted the flow rates accordingly. |
| 1/1/2009 | Treatment System and Well Field; The daily inspection was not performed due to the New Years Day holiday.<br>Down time: None. |
| 1/8/2009 | Treatment System; ECV 3 failed to open on command; Well field is cycling; Flushed control piping, changed filter and adjusted opening and closing speed control valves; Cycled the valve and normal operation observed.<br>Down time: 17 hours each at B13, B3, B8, B9, B11 and SC1; 3 hours at SC5. |

**APPENDIX F-3**

**MAINTENANCE ACTIVITIES BY LOCATION**
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**TGRS, OU2**
**ARDEN HILLS, MINNESOTA**

| | |
|---|---|
| 2/10/2009 | Treatment System and Well Field; Power outage on TCAAP that shuts off power to the TGRS; Xcel Energy on Site; They repair the problem and power is restored; Restart the TGRS and observe normal operation.<br>Down time: 14 hours at B1, B13, B3, B5, B6, B9, B11, SC1, SC2 and SC5; 11 hours at B4 and B8. |
| 3/9-10/2009 | Treatment System and Well Field; Site wide power outage due to a freezing rain storm; Xcel Energy contacted and they respond; They inspected the facility for failures but found none; They reset the main breaker and power was restored normally.<br>Down time: 22 hours at B1, B13, B3, B5, B6, B9, B11, SC1 and SC5; 19 hours at B4; 15 hours at B8 and SC2. |
| 3/20/2009 | Treatment System and Well Field; Site wide power outage due to a sleet storm; Xcel Energy contacted and responds; They repair a blown surge arrestor on a power pole near B12; Restart TGRS and normal operation observed.<br>Down time: 3 hours each at B1, B13, B3, B5, B6 and SC5; 2 hours each at B9 and SC2. |
| 3/25-26/2009 | Pumphouses SC2 and SC5; Power out to pumphouses; Xcel Energy contacted and they respond; Blown fuse on power pole; Restart SC2 and SC5 and they restart normally.<br>Down time: SC2 for 14 hours and SC5 for 16 hours. |
| 4/8/2009 | Treatment System; Preventive Maintenance work performed; Installed a leak containment seal around pump 1; Added packing to pump 1 gland; Portions of the well field cycled during maintenance activities.<br>Down time: 8 hours at B13 and B8; 7 hours at B3, B4, B6, SC1 and SC5; 3 hours at B11 and SC2. |
| 4/23-24/2009 | Treatment System and Well Field; Xcel Energy is on Site relocating power and bypassing the Lind Power station; They increased the voltage through some of the existing lines which caused connectors to blow; Three small grass fires started from the blown connectors; The Lake Johanna Fire Department responded and extinguished the grass fires.<br>Down time: 18 hours at B1, B5, B6, B8 and B9; 20 hours at B13, B3, SC1 and SC5; 13 hours at B4 and B11. |
| 4/27/2009 | Pumphouse SC5; The pumping water level is 129.5 feet btoc.<br>Down time: None. |

**APPENDIX F-3**

**MAINTENANCE ACTIVITIES BY LOCATION**
**FISCAL YEAR 2009**
**TGRS, OU2**
**ARDEN HILLS, MINNESOTA**

| | |
|---|---|
| 5/12-17/2009 | Treatment System and Well Field; System down due to reoccurring power outages; Xcel Energy on site to repair the problem; After the power was restored, wet well pump 4 did not restart causing the well field to cycle; Reset pump 4 and normal operation was observed.<br>Down time: 22 hours at B5, B9 and B11; 26.5 hours at B1 and B6; 30.5 hours at B3 and B4; 40 hours at B13, B8 and SC1; 55 hours at SC2 and 61 hours at SC5. |
| 5/19-21/2009 | Well Field and Treatment System; Power outage; Xcel Energy on site to repair; After many hours of troubleshooting, Xcel locates the cause of this and previous power outages; The wind was blowing a ground lead into a blown lightning arrestor causing the power to go out; They repaired the problem and restored power to the site.<br>Down time: 35 hours at B11 and SC2; 44.5 hours at B1, B13, B3, B4, B5, B6, B8, B9, SC1 and SC5. |
| 5/25/2009 | Memorial Day Holiday; Daily inspection was not performed.<br>Down time: None. |
| 6/4/2009 | Treatment System and Well Field; The TGRS was shut down to perform monthly maintenance work.<br>Down time: 1.5 hours at B1, B13, B5, SC1 and SC5. |
| 6/21/2009 | Treatment System and Well Field; Power outage; Xcel Energy responds and repairs the problem.<br>Down time: 10 hours at B1, B13, B5, B6, B9, SC1 and SC5; 7 hours at B3 and B4; 3 hours at |
| 7/1/2009 | Pumphouses B6, SC2 and SC5; Checked the flow rate of the existing flow meters against a calibrated flow meter.<br>Down time: None. |
| 7/12/2009 | Pumphouse SC5; ECV closed slightly overnight slowing the flow rate.<br>Down time: 1.5 hours. |
| 7/24-25/2009 | Pumphouse SC5; ECV closed slightly slowing the flow rate.<br>Down time: 4 hours. |
| 7/28/2009 | Pumphouse SC5; ECV closed slightly overnight slowing the flow rate.<br>Down time: 3 hours. |
| 8/8-9/2009 | Pumphouse SC5; Upon arrival for the daily inspection both days, the SC5 light was flashing on the PLC; Reset the PLC and SC5 restarted normally each day.<br>Down time: 27 hours. |

**APPENDIX F-3**

**MAINTENANCE ACTIVITIES BY LOCATION**
**FISCAL YEAR 2009**
**TGRS, OU2**
**ARDEN HILLS, MINNESOTA**

| | |
|---|---|
| 8/16/2009 | Treatment System and Well Field; Blown fuse on the power pole where power enters TCAAP; Xcel Energy contacted and they respond; Power restored and the system is restarted. Normal operation resumes.<br>Down time: 15 hours at B1, B13, B3, B5, B6, B9, B11, SC1, SC2 and SC5. |
| 8/27-28/2009 | Treatment System and Well Field; Shut the treatment system and well field off to repair a leak in the 16" diameter forcemain located approximately 450 feet south of Building 116; Stevens Drilling and Environmental contracted to excavate and repair the leak; Following the repair, the system was turned on and the repair area was inspected; No further leak was observed and the excavation was backfilled.<br>Down time: 46 hours at B1, B5 and B9; 43 hours at B13, B3, B4, B6, B8, B11, SC1, SC2 and SC5. |
| 9/7/2009 | Treatment System and Well Field; The daily inspection was not performed today due to Labor Day.<br>Down time: None. |
| 9/15/2009 | Treatment System and Well Field; Site wide power outage reported by Mike Fix; Call to Xcel at 1135, onsite at 1215; The fusible switch in the NW corner past B12 was open (one leg); Same failure as last outage; Power restored at 1320; No call from the autodialer because the other two legs provided power to the autodialer.<br>Down time: 6.5 hours at B1, B13, B6, 03U003 and SC1; 5 hours at B3, B4, B5, B9 and SC5. |
| 9/28/2009 | Pumphouse SC5; Loss of power to the pumphouse; The fusible switch is open on the transformer pole near SC4; Called Xcel Energy and they respond; They reinstalled the fusible switch and power resumed as normal.<br>Down time: 2 hours. |
| 9/29/2009 | Pumphouse SC5; The ECV did not fully open after Xcel Energy restored power to the pumphouse.<br>Down time: 3 hours. |

**TREATMENT SYSTEM**

| | |
|---|---|
| 10/2/2009 | Treatment System; Installed a new ARV at ECV 3.<br>Down time: None. |
| 10/7-12/2008 | Pumphouses and Treatment System; Portions of TGRS shut down as part of quarterly maintenance work.<br>Down time: 1 hour at B1 and B3; 3 hours at B8. |

**APPENDIX F-3**

**MAINTENANCE ACTIVITIES BY LOCATION**
**FISCAL YEAR 2009**
**TGRS, OU2**
**ARDEN HILLS, MINNESOTA**

| | |
|---|---|
| 10/15-16/2008 | Treatment System and Pumphouses; Shut down the TGRS to install check valves on the potable water line and to work on tower demister pads.<br>Down time: 1.5 hours at B1, B13 and SC2; 3.5 hours at SC5. |
| 10/18/2008 | Treatment System; Replaced a broken belt on Blower 2.<br>Down time: None. |
| 10/31/2008 | Treatment System; Installed cleaned demister pads in the tops of the towers.<br>Down time: 2 hours at B1, B13 and SC5; 1 hour at B5 and B6. |
| 11/6/2008 | Treatment System; Shutdown the Treatment System to perform monthly preventive maintenance work.<br>Down time: B1 for 2.5 hours, B13, B3, B5 and B6 for 1.5 hours each and SC2 for 4 hours. |
| 11/10/2008 | Treatment System; New pressure gauge at pump 3 and new airflow tubing at tower 1.<br>Down time: None. |
| 11/22/2008 | Treatment System; Fault on PDU screen, Pump 4 failed to open; Reconnected broken wire on starter coil; Normal operation observed; Well field cycled overnight.<br>Down time: 17.5 hours at B13, B3 and SC1; 9 hours at B4, B6 and B11. |
| 12/3/2008 | Building 116; The portable electric heater in the chlorine room was not working; Replaced with a new heater.<br>Down time: None. |
| 12/10-12/2008 | Treatment System; Periodically turned the TGRS off to perform monthly maintenance work.<br>Down time: 1 hour at B5; 2 hours at B1 and B13; 4 hours at B9 and 5.5 hours at SC2. |
| 12/17-18/2008 | Treatment System; Well field cycling; Starter wire for pump 4 was loose in motor control center cabinet; Reattached wire and observed normal operation.<br>Down time: 6.5 hours at B4 and B6; 8 hours at B11; 12.5 hours at B13 and 14.5 hours at B3. |
| 12/29/2008 | Treatment System; ECV 4 will not close on command; Replaced solenoid valve and coil with new, replaced the filter and flushed the control piping; ECV 4 now closes normally.<br>Down time: None. |
| 1/1/2009 | Treatment System and Well Field; The daily inspection was not performed due to the New Years Day holiday.<br>Down time: None. |

**APPENDIX F-3**

**MAINTENANCE ACTIVITIES BY LOCATION**
**FISCAL YEAR 2009**
**TGRS, OU2**
**ARDEN HILLS, MINNESOTA**

| | |
|---|---|
| 1/5/2009 | Treatment System; ECV 4 flashing on the PDU; The valve failed to open on command; Cleaned blockage from the solenoid valve line and cycled the valve; The valve now opens normally.<br>Down time: None. |
| 1/6-7/2009 | Treatment System; ECV 4 would not close on command; Replaced closing side sections of control piping, ball valves and check valves and changed filter; ECV 4 now closes normally.<br>Down time: None. |
| 1/7-9/2009 | Programmable Logic Controller (PLC); CRA works to connect laptop computer to PLC to allow for future programming work and remote connectivity.<br>Downtime: none. |
| 1/8/2009 | Treatment System; ECV 3 failed to open on command; Well field is cycling; Flushed control piping, changed filter and adjusted opening and closing speed control valves; Cycled the valve and normal operation observed.<br>Down time: 17 hours each at B13, B3, B8, B9, B11 and SC1; 3 hours at SC5. |
| 2/10/2009 | Treatment System and Well Field; Power outage on TCAAP that shuts off power to the TGRS; Xcel Energy on Site; They repair the problem and power is restored; Restart the TGRS and observe normal operation.<br>Down time: 14 hours at B1, B13, B3, B5, B6, B9, B11, SC1, SC2 and SC5; 11 hours at B4 and B8. |
| 2/13/2009 | Treatment System; Reprogrammed auto dialer today including all recordings; Installed new back up battery for the Verbatim auto dialer also.<br>Down time: None. |
| 2/15/2009 | Treatment System; Call from Time Communications-TGRS Fail; ECV 1 failed to open; Changed out the operating solenoid valve, flushed the control piping and reset the speed control valves; Cycled the valve and observed normal operation.<br>Down time: None. |
| 2/17/2009 | Treatment System; Replaced the coil on the operating solenoid of ECV 3.<br>Down time: None. |
| 2/24/2009 | Treatment System; The light for Blower 2 is not lit on the motor control center; Troubleshooting indicates a blown motor; Removed and replaced the old motor with new from inventory; Laughlin Electric performed wiring and testing of the new motor; Purchased new motor for inventory.<br>Down time: None. |

**APPENDIX F-3**

**MAINTENANCE ACTIVITIES BY LOCATION**
**FISCAL YEAR 2009**
**TGRS, OU2**
**ARDEN HILLS, MINNESOTA**

| | |
|---|---|
| 3/5-8/2009 | Treatment System; Preventive Maintenance work performed; Portions of the well field cycled during maintenance activities.<br>Down time: B1 for 2.5 hours and B5 for 1 hour. |
| 3/9-10/2009 | Treatment System and Well Field; Site wide power outage due to a freezing rain storm; Xcel Energy contacted and they respond; They inspected the facility for failures but found none; They reset the main breaker and power was restored normally.<br>Down time: 22 hours at B1, B13, B3, B5, B6, B9, B11, SC1 and SC5; 19 hours at B4; 15 hours at B8 and SC2. |
| 3/20/2009 | Treatment System and Well Field; Site wide power outage due to a sleet storm; Xcel Energy contacted and responds; They repair a blown surge arrestor on a power pole near B12; Restart TGRS and normal operation observed.<br>Down time: 3 hours each at B1, B13, B3, B5, B6 and SC5; 2 hours each at B9 and SC2. |
| 3/25/2009 | Treatment System; ECV 1 fails to open; Adjust opening speed and valve responds normally.<br>Down time: B13 and B3 for 1.5 hour each. |
| 4/8/2009 | Treatment System; Preventive Maintenance work performed; Installed a leak containment seal around pump 1; Added packing to pump 1 gland; Portions of the well field cycled during maintenance activities.<br>Down time: 8 hours at B13 and B8; 7 hours at B3, B4, B6, SC1 and SC5; 3 hours at B11 and SC2. |
| 4/8/2009 | Treatment System and Building 116; Turned off all electric room heaters and cabinet heaters.<br>Down time: None. |
| 4/23-24/2009 | Treatment System and Well Field; Xcel Energy is on Site relocating power and bypassing the Lind Power station; They increased the voltage through some of the existing lines which caused connectors to blow; Three small grass fires started from the blown connectors; The Lake Johanna Fire Department responded and extinguished the grass fires.<br>Down time: 18 hours at B1, B5, B6, B8 and B9; 20 hours at B13, B3, SC1 and SC5; 13 hours at B4 and B11. |
| 5/5/2009 | Treatment System and Well Field; Performed preventive maintenance work on the treatment system.<br>Down time: 1.7 hours at B11. |
| 5/5/2009 | Treatment System; Installed a leak containment barrier around pump 2.<br>Down time: None. |

**APPENDIX F-3**

**MAINTENANCE ACTIVITIES BY LOCATION**
**FISCAL YEAR 2009**
**TGRS, OU2**
**ARDEN HILLS, MINNESOTA**

| | |
|---|---|
| 5/12-17/2009 | Treatment System and Well Field; System down due to reoccurring power outages; Xcel Energy on site to repair the problem; After the power was restored, wet well pump 4 did not restart causing the well field to cycle; Reset pump 4 and normal operation was observed.<br>Down time: 22 hours at B5, B9 and B11; 26.5 hours at B1 and B6; 30.5 hours at B3 and B4; 40 hours at B13, B8 and SC1; 55 hours at SC2 and 61 hours at SC5. |
| 5/19/2009 | TGRS; Five year review inspection performed.<br>Down time: None. |
| 5/19-21/2009 | Well Field and Treatment System; Power outage; Xcel Energy on site to repair; After many hours of troubleshooting, Xcel locates the cause of this and previous power outages; The wind was blowing a ground lead into a blown lightning arrestor causing the power to go out; They repaired the problem and restored power to the site.<br>Down time: 35 hours at B11 and SC2; 44.5 hours at B1, B13, B3, B4, B5, B6, B8, B9, SC1 and SC5. |
| 5/25/2009 | Memorial Day Holiday; Daily inspection was not performed.<br>Down time: None. |
| 6/4/2009 | Treatment System and Well Field; The TGRS was shut down to perform monthly maintenance work.<br>Down time: 1.5 hours at B1, B13, B5, SC1 and SC5. |
| 6/21/2009 | Treatment System and Well Field; Power outage; Xcel Energy responds and repairs the problem.<br>Down time: 10 hours at B1, B13, B5, B6, B9, SC1 and SC5; 7 hours at B3 and B4; 3 hours at |
| 6/22-30/09 | Treatment System; Cellular phone for the autodialer has failed; Return to factory for servicing.<br>Down time: None. |
| 6/24/2009 | Treatment System; Installed a new airflow meter at blower 1.<br>Down time: None. |
| 6/29-30/2009 | Treatment System (flow meters 1 and 2) and Pumphouses B11, B1, B13, B3, B4, B5, B8 and B9; Compared the flow rate of the existing flow meter to that of a calibrated flow meter.<br>Down time: None. |

**APPENDIX F-3**

**MAINTENANCE ACTIVITIES BY LOCATION**
**FISCAL YEAR 2009**
**TGRS, OU2**
**ARDEN HILLS, MINNESOTA**

| | |
|---|---|
| 7/31/2009 | Treatment System and Well Field; System shut down for O & M activities at the air stripping towers and 10" flow meters.<br>Down time: None. |
| 8/1/2009 | Treatment System and Well Field; Preventive maintenance work performed on the treatment system on 7/31/2009 and down time is reflected on 8/1/2009.<br>Down time: 2.5 hours at B1 and B13; 2 hours at B5, B6 and B9. |
| 8/11/2009 | Treatment System and Well Field; Shut the system off to perform preventive maintenance work.<br>Down time: 1 hour at B1 and 2 hours at B13 and B4. |
| 8/16/2009 | Treatment System and Well Field; Blown fuse on the power pole where power enters TCAAP; Xcel Energy contacted and they respond; Power restored and the system is restarted. Normal operation resumes.<br>Down time: 15 hours at B1, B13, B3, B5, B6, B9, B11, SC1, SC2 and SC5. |
| 8/27-28/2009 | Treatment System and Well Field; Shut the treatment system and well field off to repair a leak in the 16" diameter forcemain located approximately 450 feet south of Building 116; Stevens Drilling and Environmental contracted to excavate and repair the leak; Following the repair, the system was turned on and the repair area was inspected; No further leak was observed and the excavation was backfilled.<br>Down time: 46 hours at B1, B5 and B9; 43 hours at B13, B3, B4, B6, B8, B11, SC1, SC2 and SC5. |
| 9/7/2009 | Treatment System and Well Field; The daily inspection was not performed today due to Labor Day.<br>Down time: None. |
| 9/15/2009 | Treatment System and Well Field; Site wide power outage reported by Mike Fix; Call to Xcel at 1135, onsite at 1215; The fusible switch in the NW corner past B12 was open (one leg); Same failure as last outage; Power restored at 1320; No call from the autodialer because the other two legs provided power to the autodialer.<br>Down time: 6.5 hours at B1, B13, B6, 03U003 and SC1; 5 hours at B3, B4, B5, B9 and SC5. |

**APPENDIX F-3**

**MAINTENANCE ACTIVITIES BY LOCATION**
**FISCAL YEAR 2009**
**TGRS, OU2**
**ARDEN HILLS, MINNESOTA**

**FORCEMAIN**

| | |
|---|---|
| 8/27-28/2009 | Treatment System and Well Field; Shut the treatment system and well field off to repair a leak in the 16" diameter forcemain located approximately 450 feet south of Building 116; Stevens Drilling and Environmental contracted to excavate and repair the leak; Following the repair, the system was turned on and the repair area was inspected; No further leak was observed and the excavation was backfilled.<br>Down time: 46 hours at B1, B5 and B9; 43 hours at B13, B3, B4, B6, B8, B11, SC1, SC2 and SC5. |

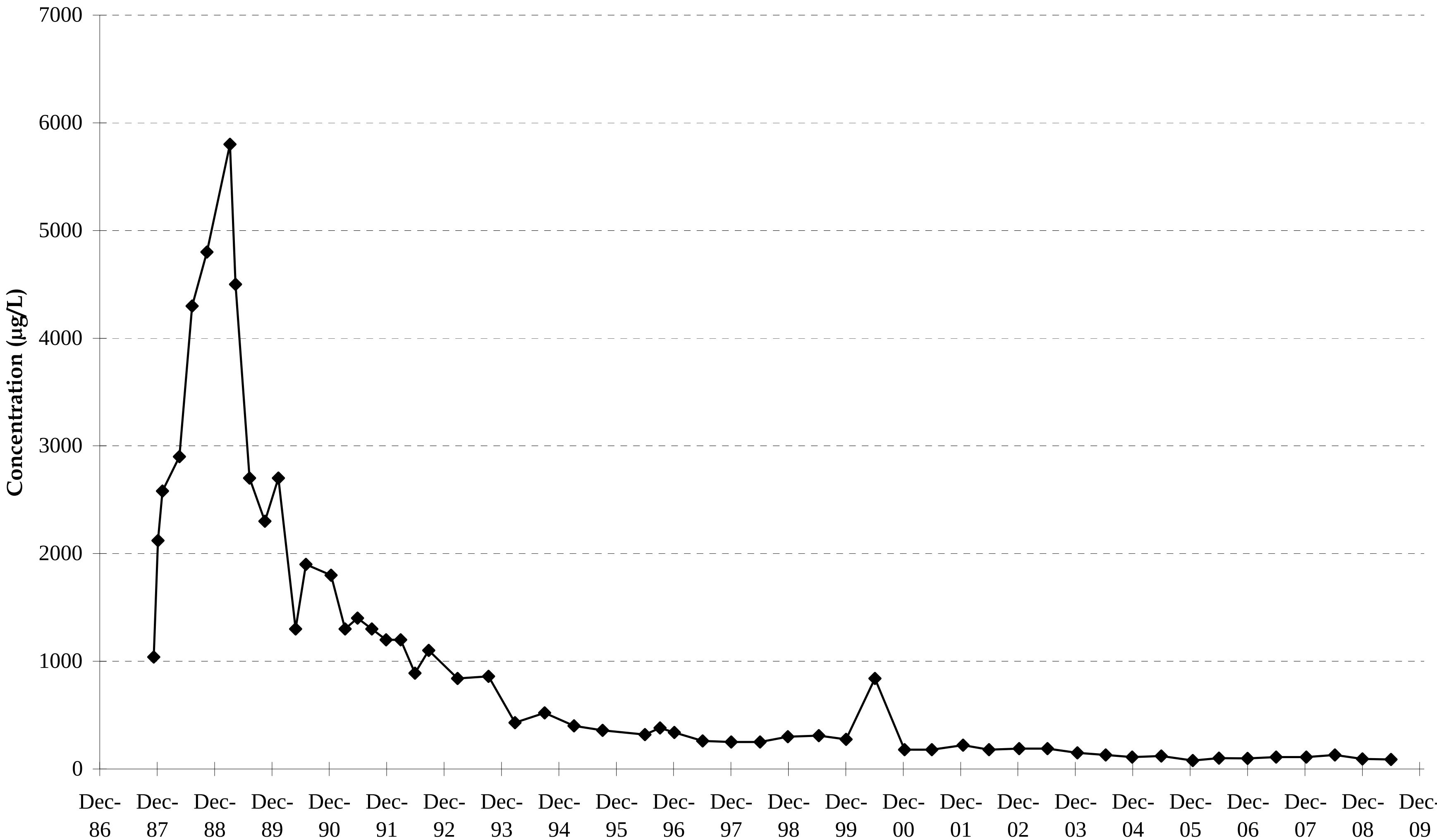
# Appendix G

## TGRS Chemical Data

# G.1 TGRS Extraction Wells – TRCLE Versus Time

**APPENDIX G-1**

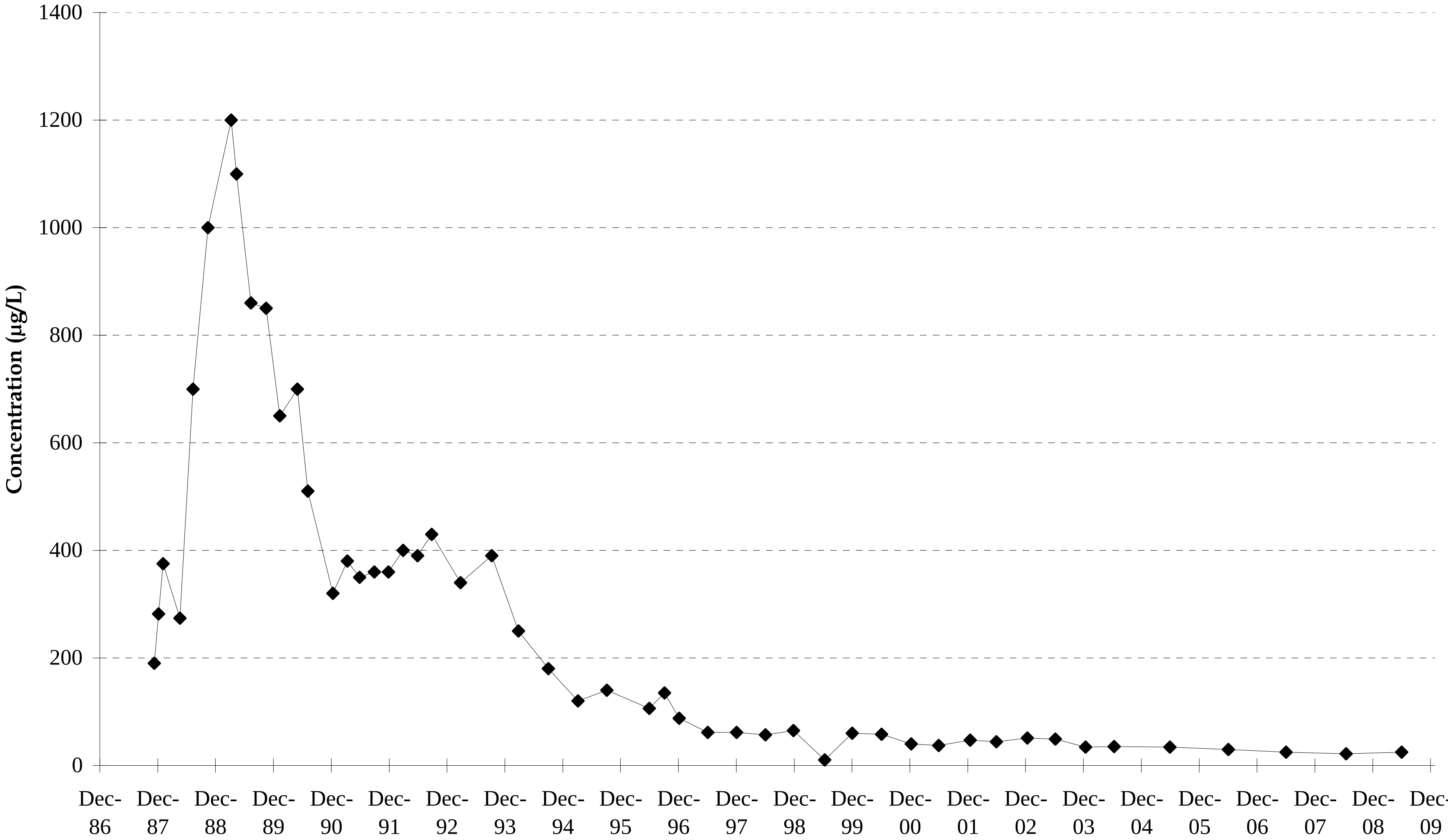
**EXTRACTION WELL B1 - TRCLE VS.TIME**




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

**APPENDIX G-1**

**EXTRACTION WELL B2 - TRCLE VS. TIME**

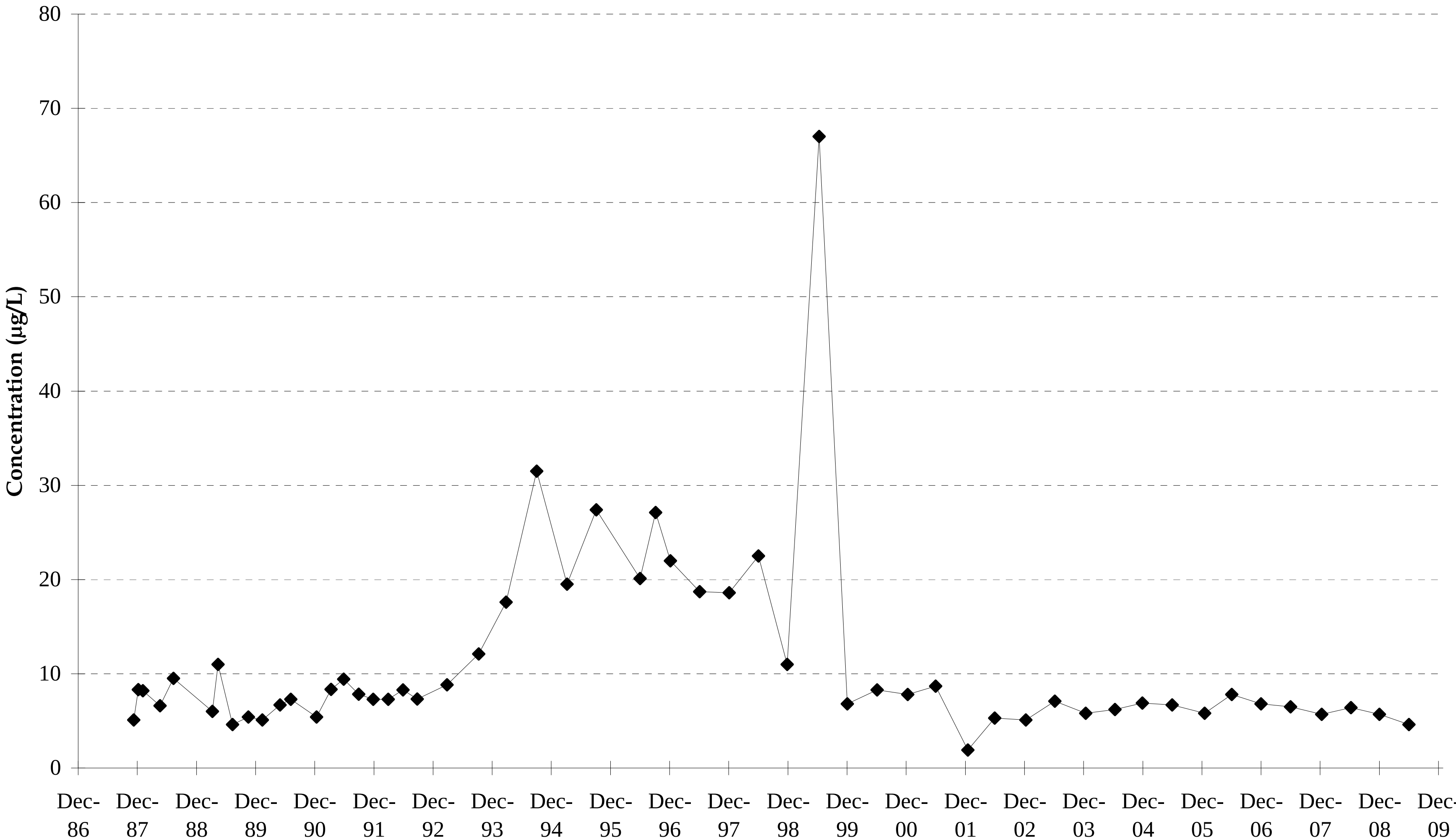



Note: Samples reporting concentrations less than the detection limit were plotted as zero.

CRA 054651 (2)

**APPENDIX G-1**

**EXTRACTION WELL B3 - TRCLE VS. TIME**

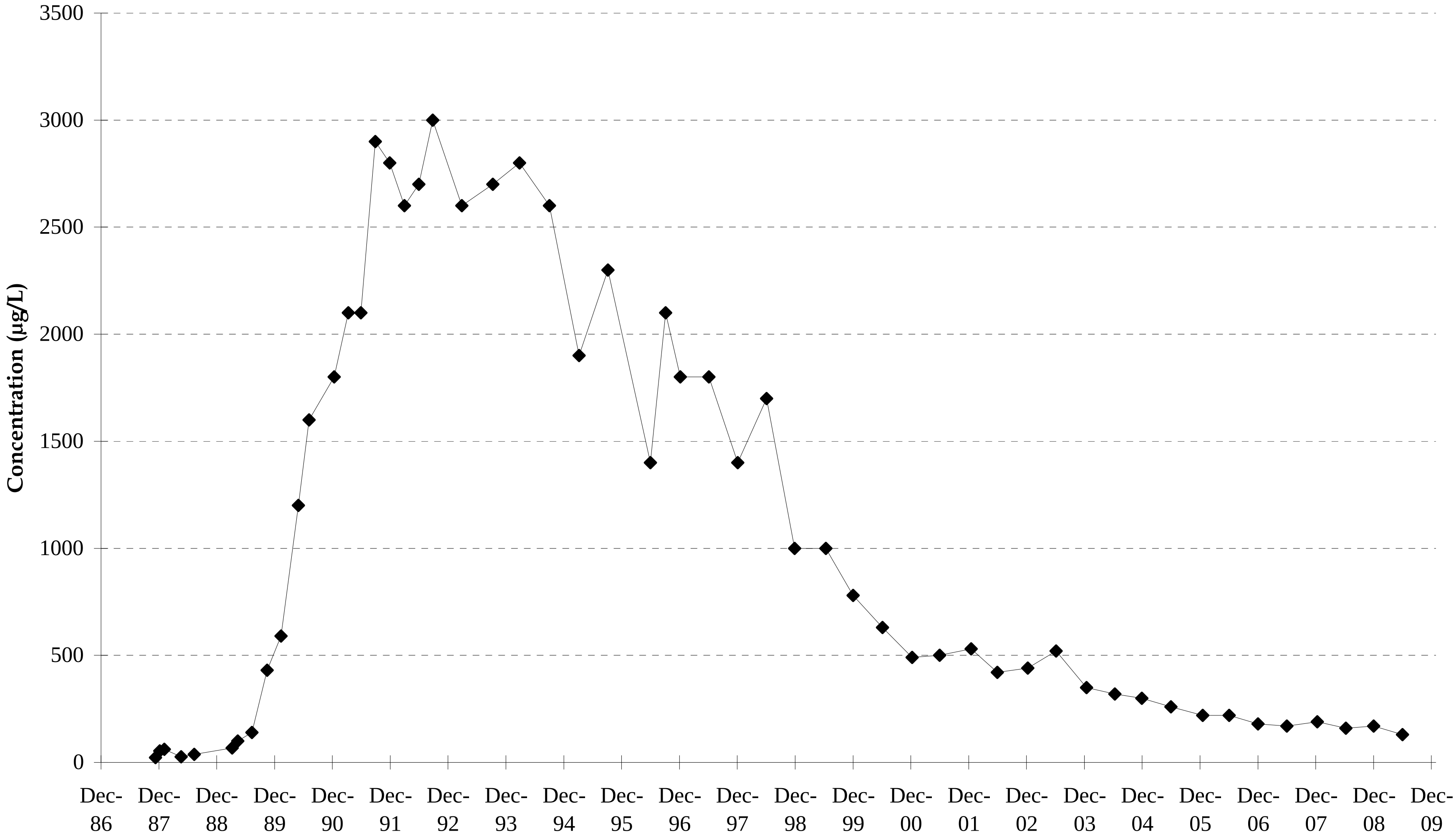



Note: Samples reporting concentrations less than the detection limit were plotted as zero.

CRA 054651 (2)

# APPENDIX G-1

## EXTRACTION WELL B4 - TRCLE VS. TIME

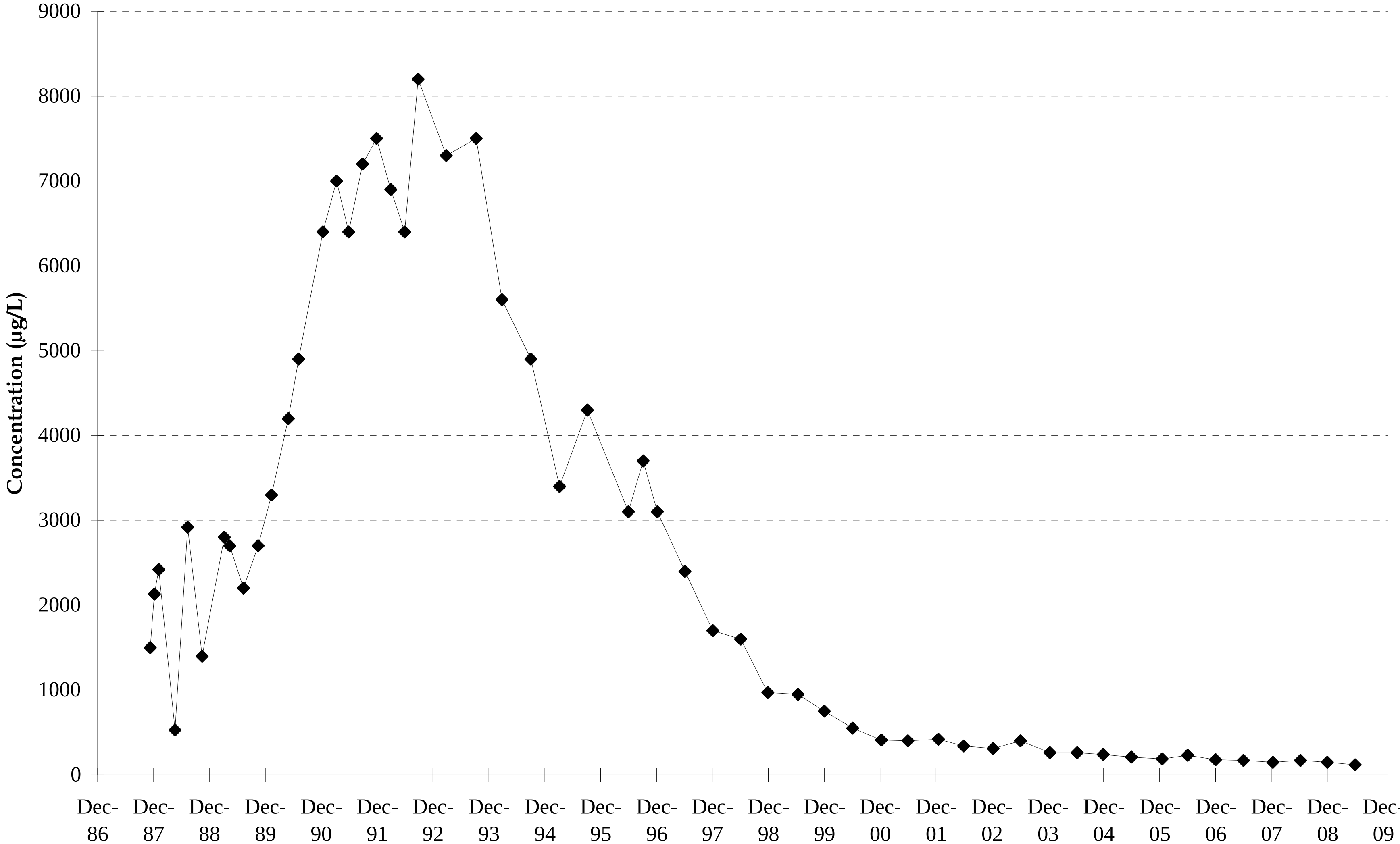



Note: Samples reporting concentrations less than the detection limit were plotted as zero.

CRA 054651 (2)

**APPENDIX G-1**

**EXTRACTION WELL B5 - TRCLE VS. TIME**

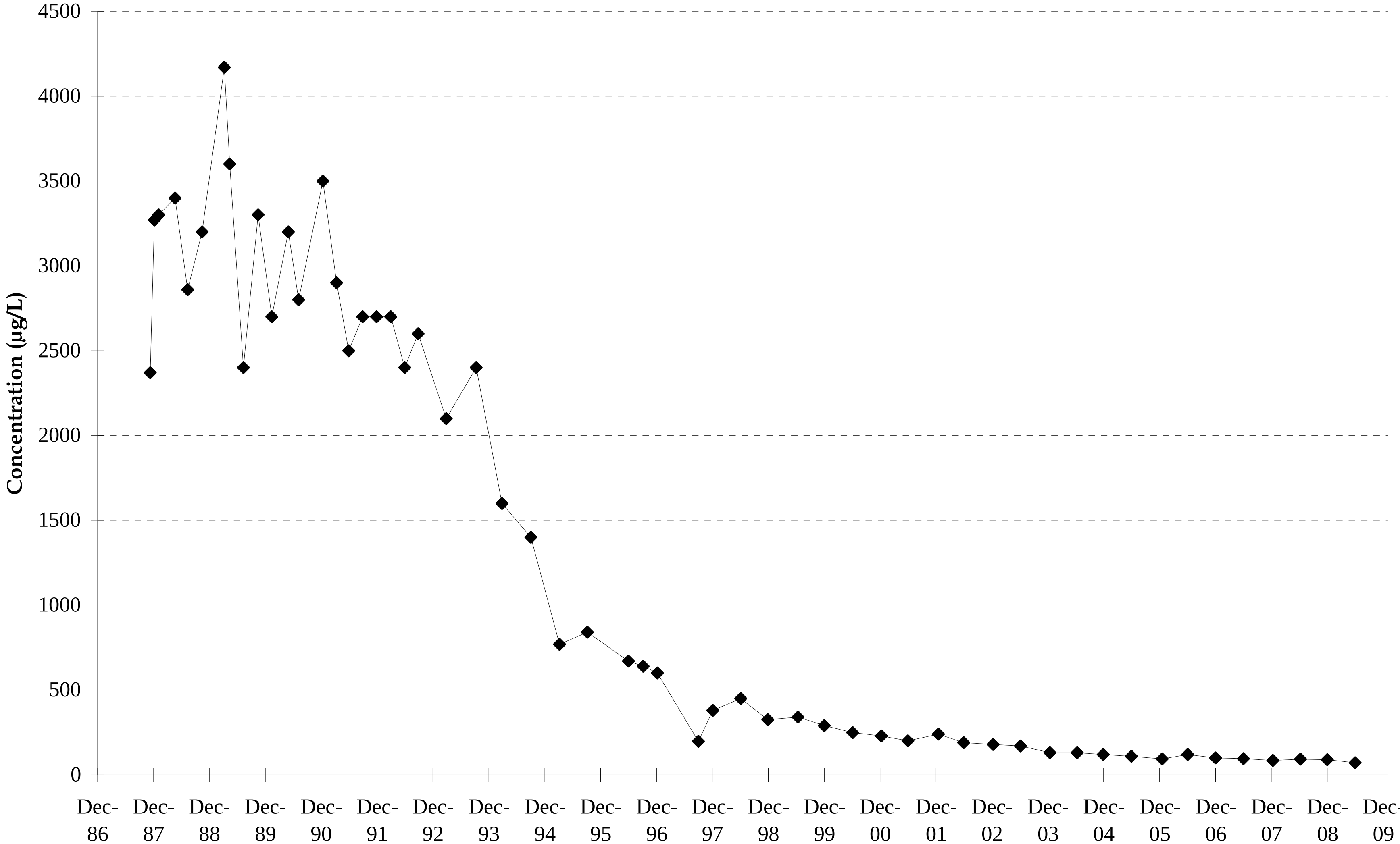



Note: Samples reporting concentrations less than the detection limit were plotted as zero.

CRA 054651 (2)

APPENDIX G-1

EXTRACTION WELL B6 - TRCLE VS. TIME

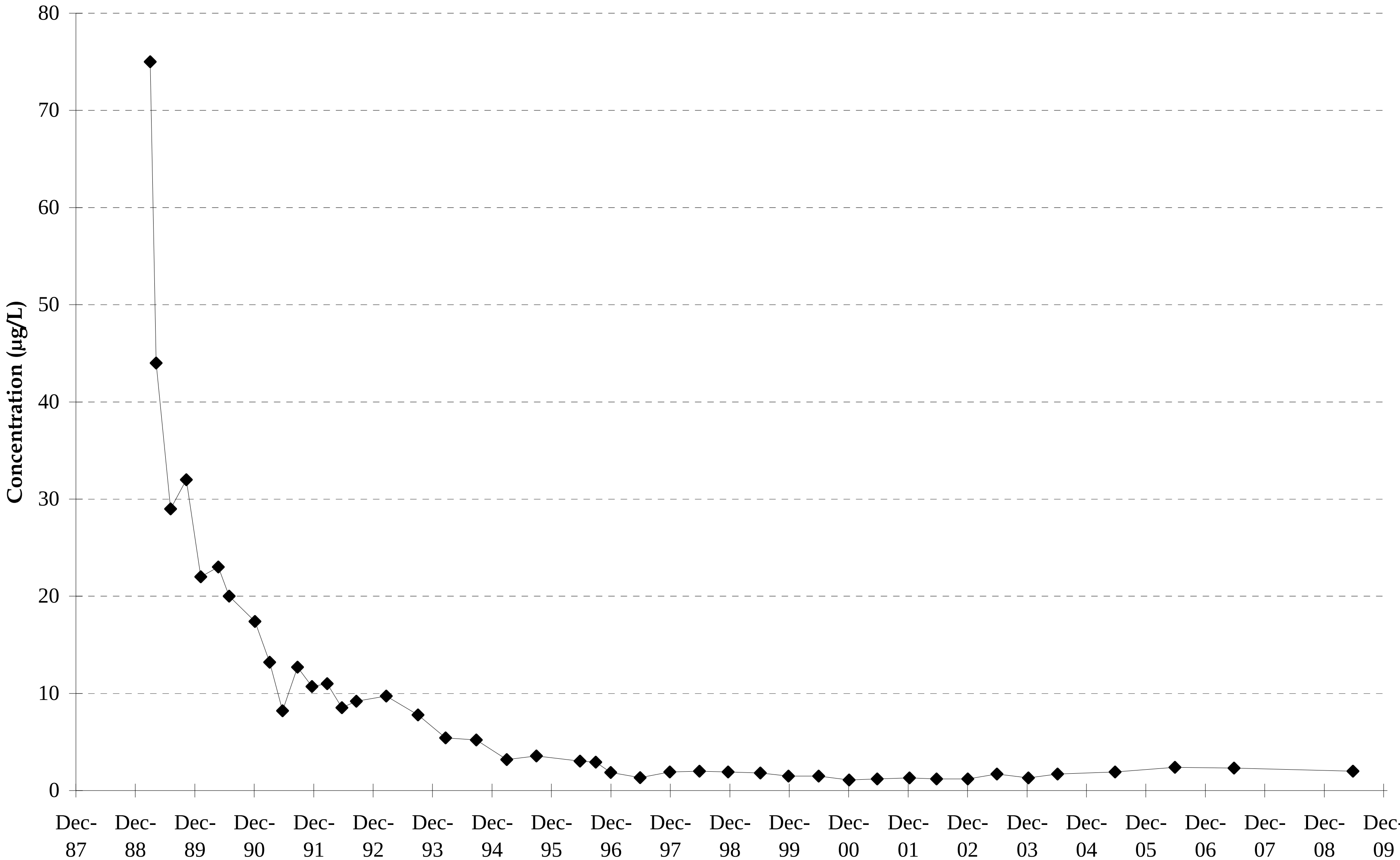



Note: Samples reporting concentrations less than the detection limit were plotted as zero.

CRA 054651 (2)

# APPENDIX G-1

## EXTRACTION WELL B7 - TRCLE VS. TIME

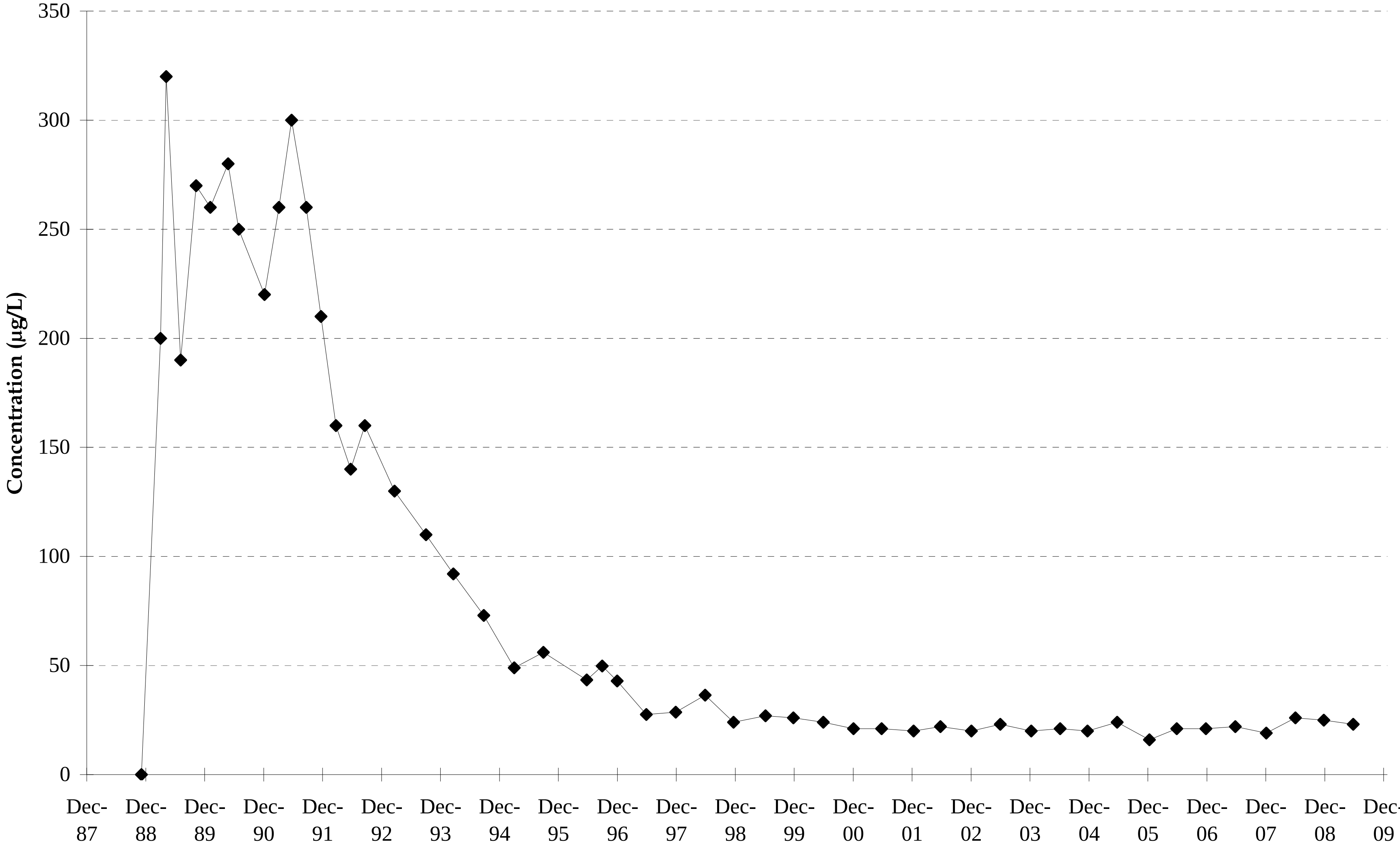



Note: Samples reporting concentrations less than the detection limit were plotted as zero.

CRA 054651 (2)

**APPENDIX G-1**

**EXTRACTION WELL B8 - TRCLE VS. TIME**

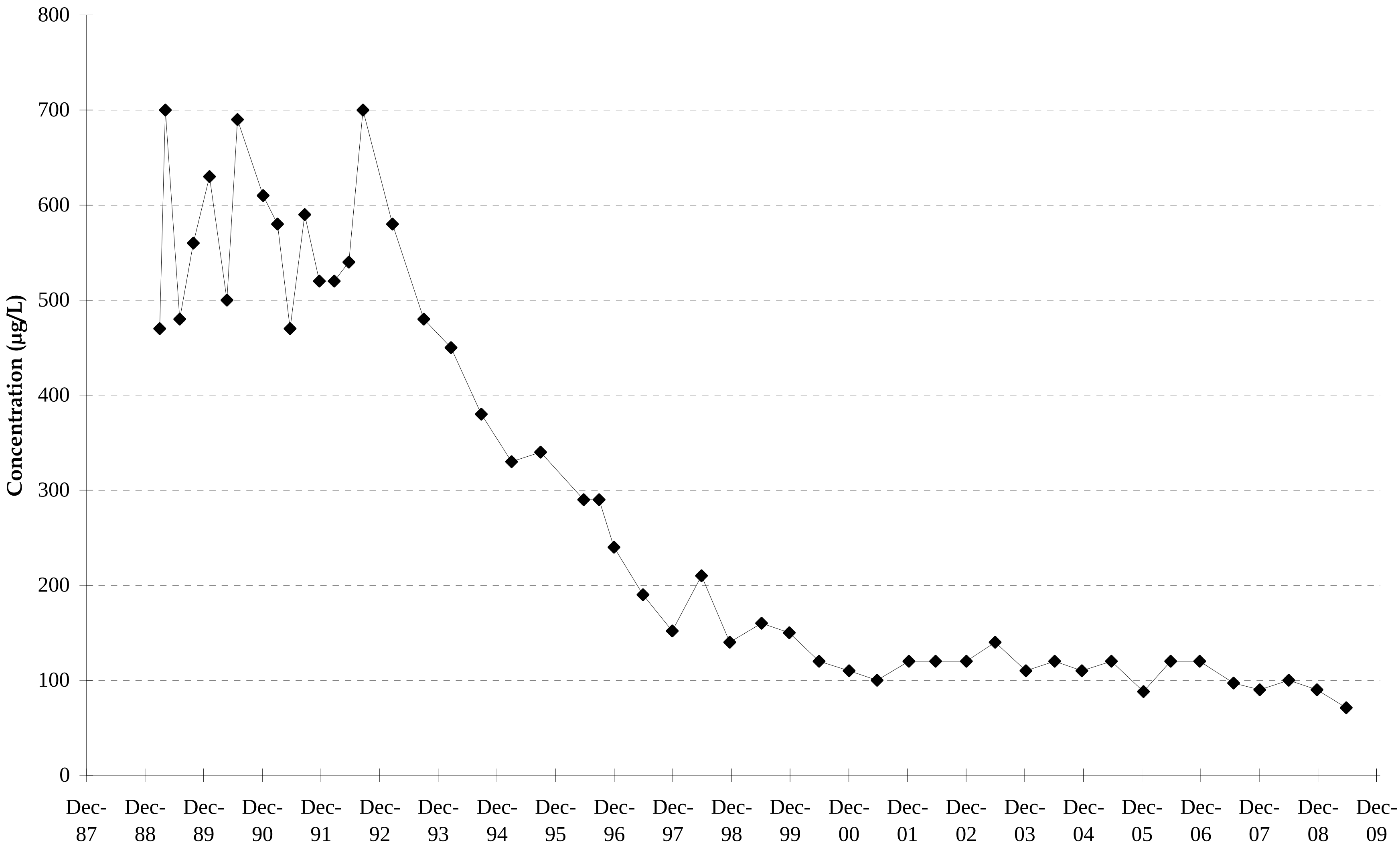



Note: Samples reporting concentrations less than the detection limit were plotted as zero.

CRA 054651 (2)

**APPENDIX G-1**

**EXTRACTION WELL B9 - TRCLE VS. TIME**

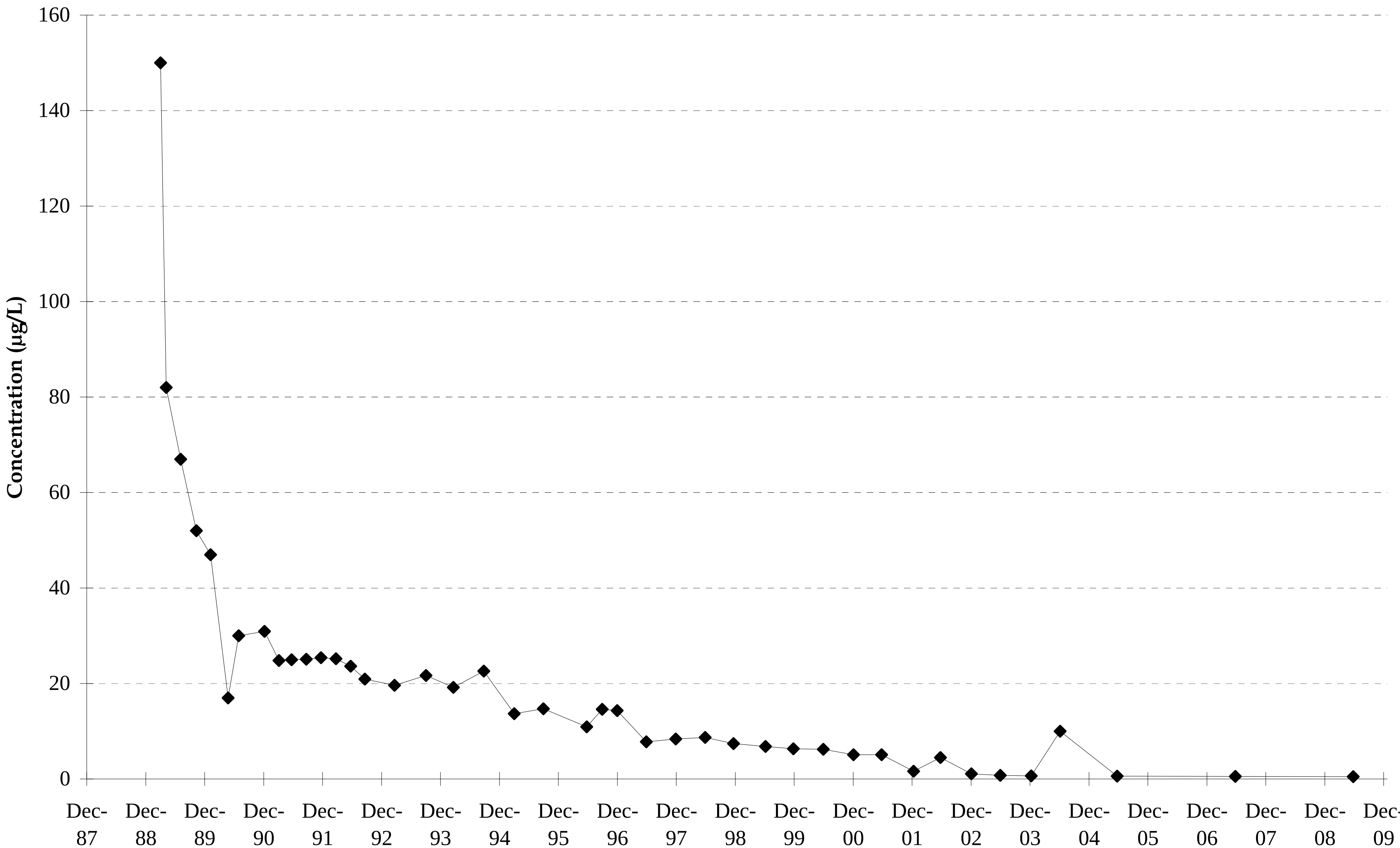



Note: Samples reporting concentrations less than the detection limit were plotted as zero.

CRA 054651 (2)

**APPENDIX G-1**

**EXTRACTION WELL B10 - TRCLE VS. TIME**

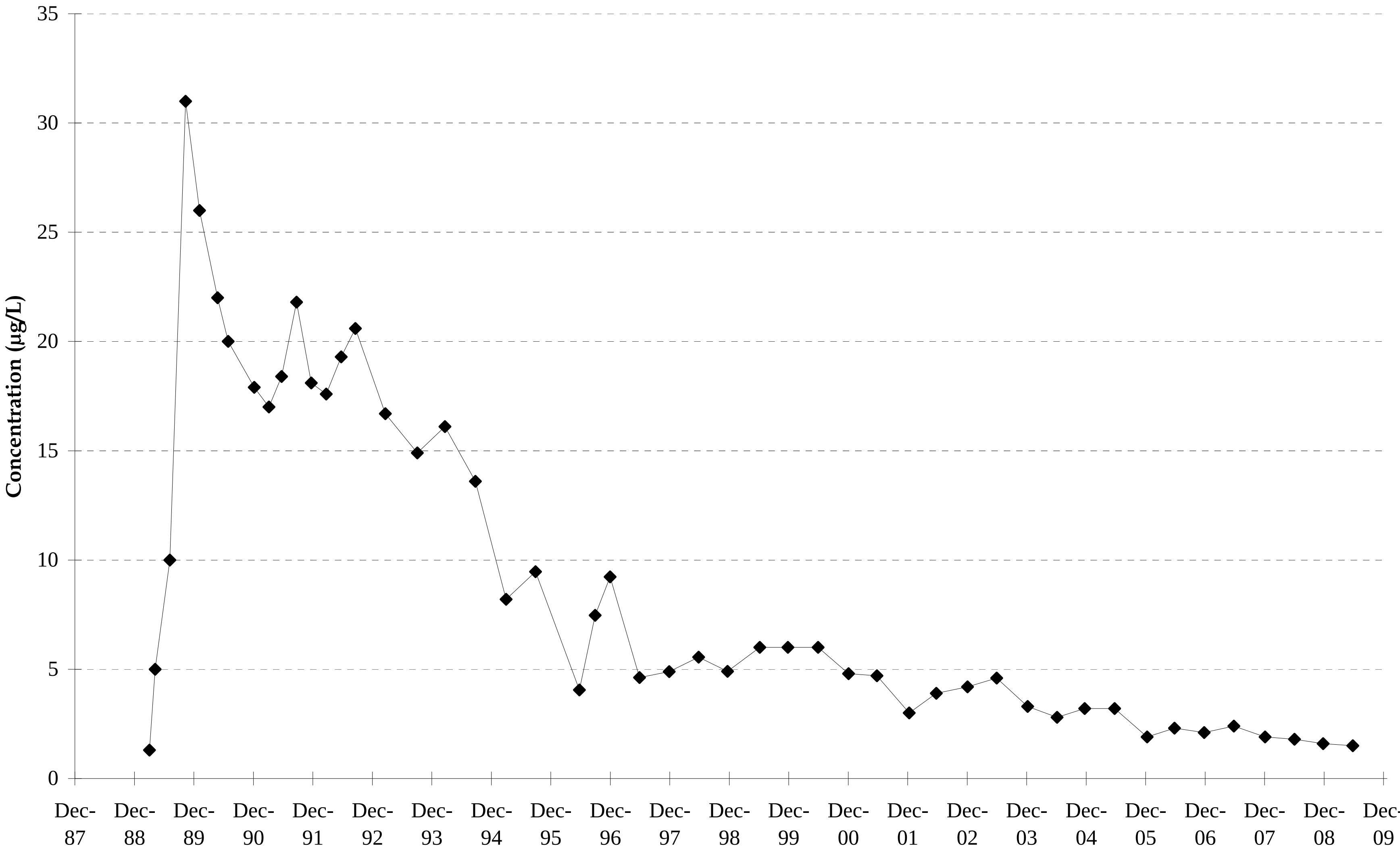



Note: Samples reporting concentrations less than the detection limit were plotted as zero.

CRA 054651 (2)

**APPENDIX G-1**

**EXTRACTION WELL B11 - TRCLE VS. TIME**

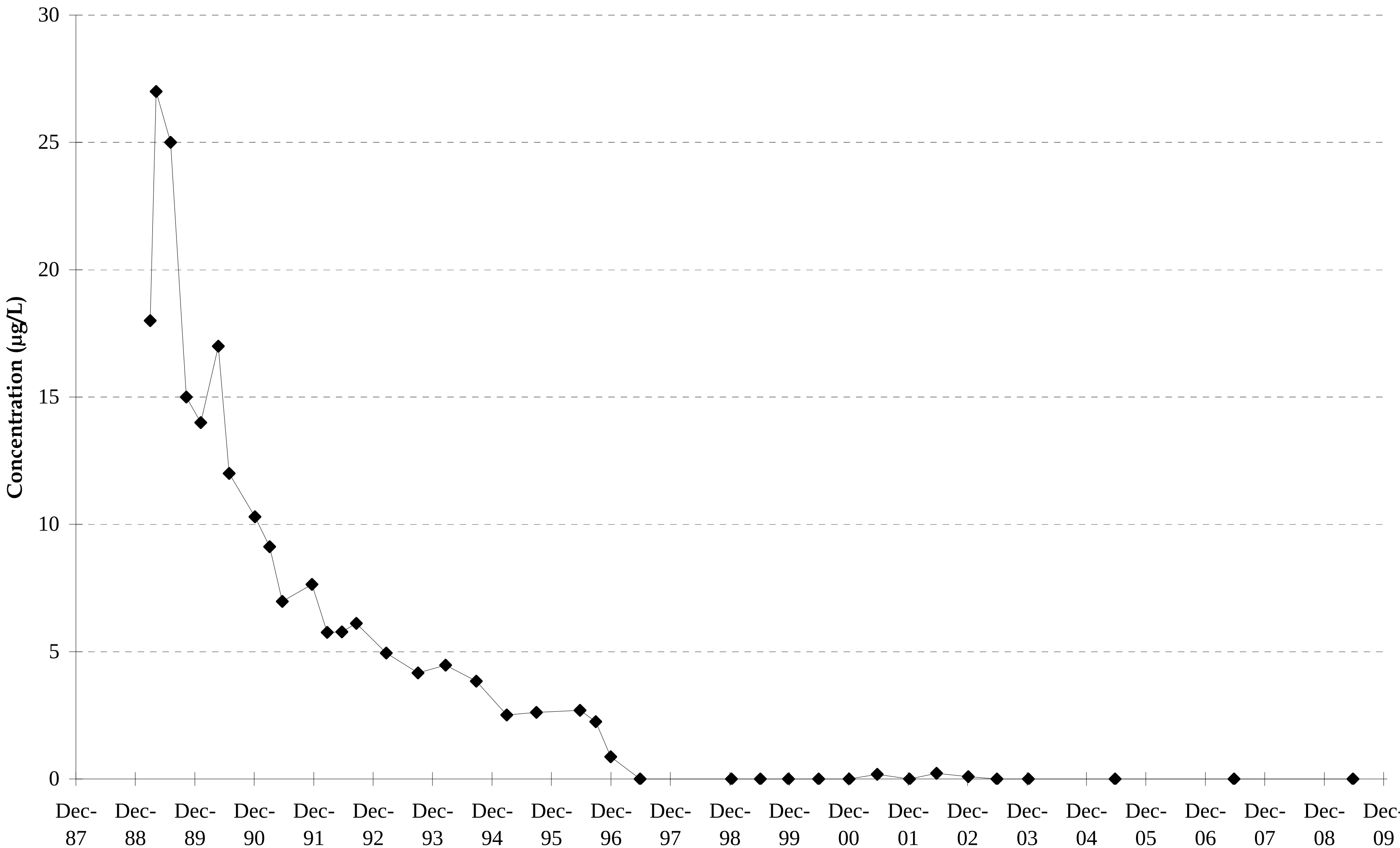



Note: Samples reporting concentrations less than the detection limit were plotted as zero.

CRA 054651 (2)

**APPENDIX G-1**

**EXTRACTION WELL B12 - TRCLE VS. TIME**

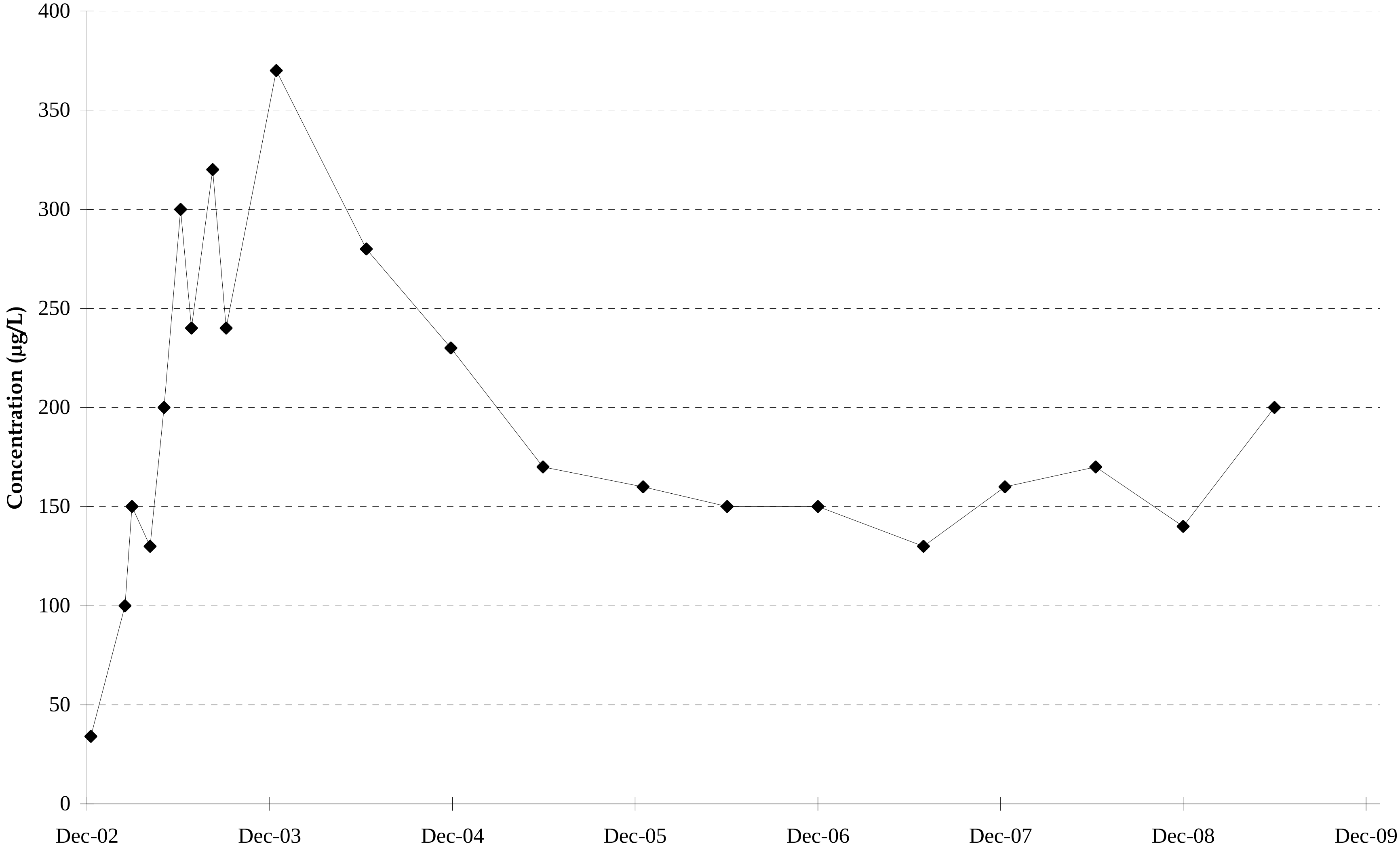



Note: Samples reporting concentrations less than the detection limit were plotted as zero.

CRA 054651 (2)

**APPENDIX G-1**

**EXTRACTION WELL B13 - TRCLE VS. TIME**

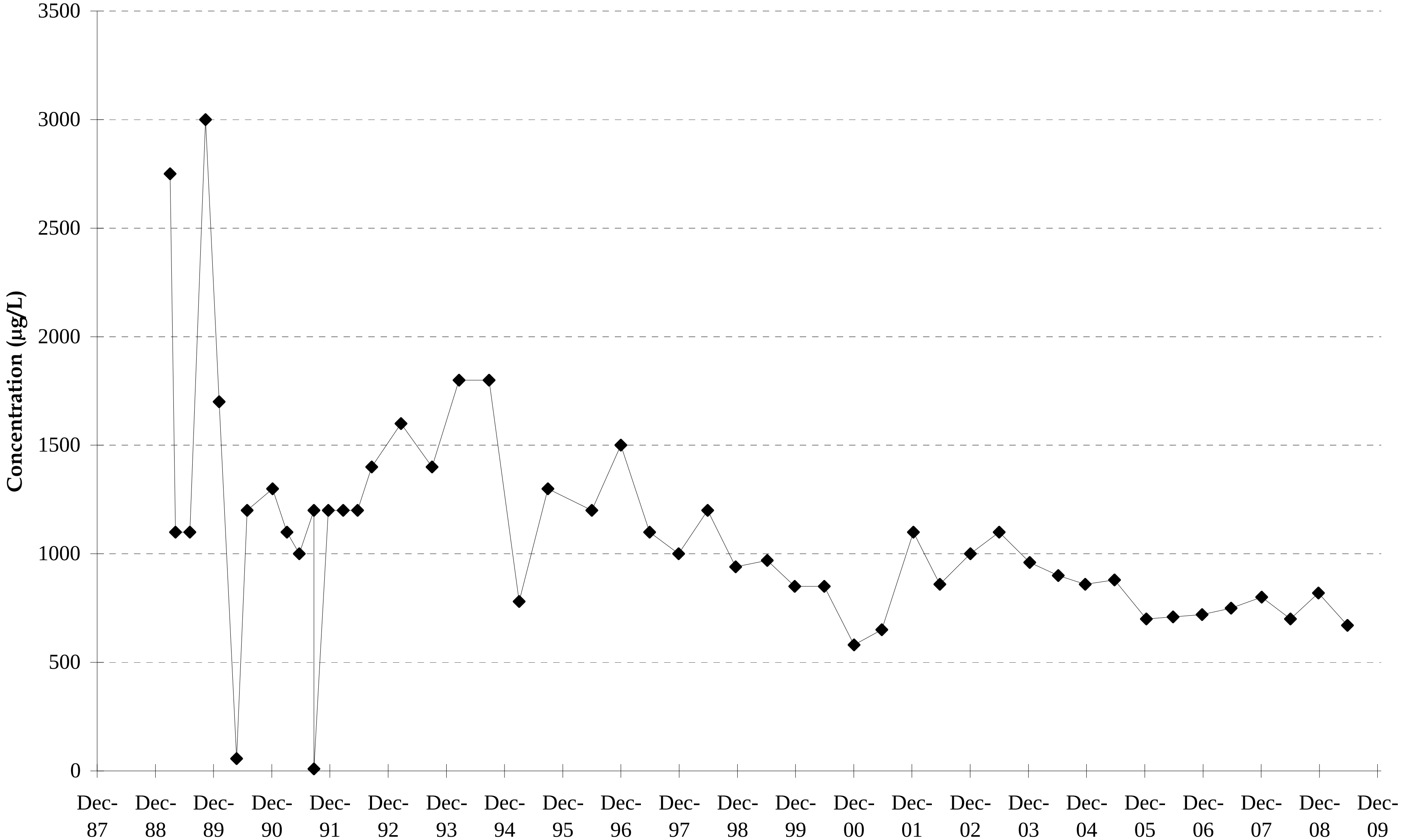



Note: Samples reporting concentrations less than the detection limit were plotted as zero.

CRA 054651 (2)

**APPENDIX G-1**

**EXTRACTION WELL SC1 - TRCLE VS. TIME**

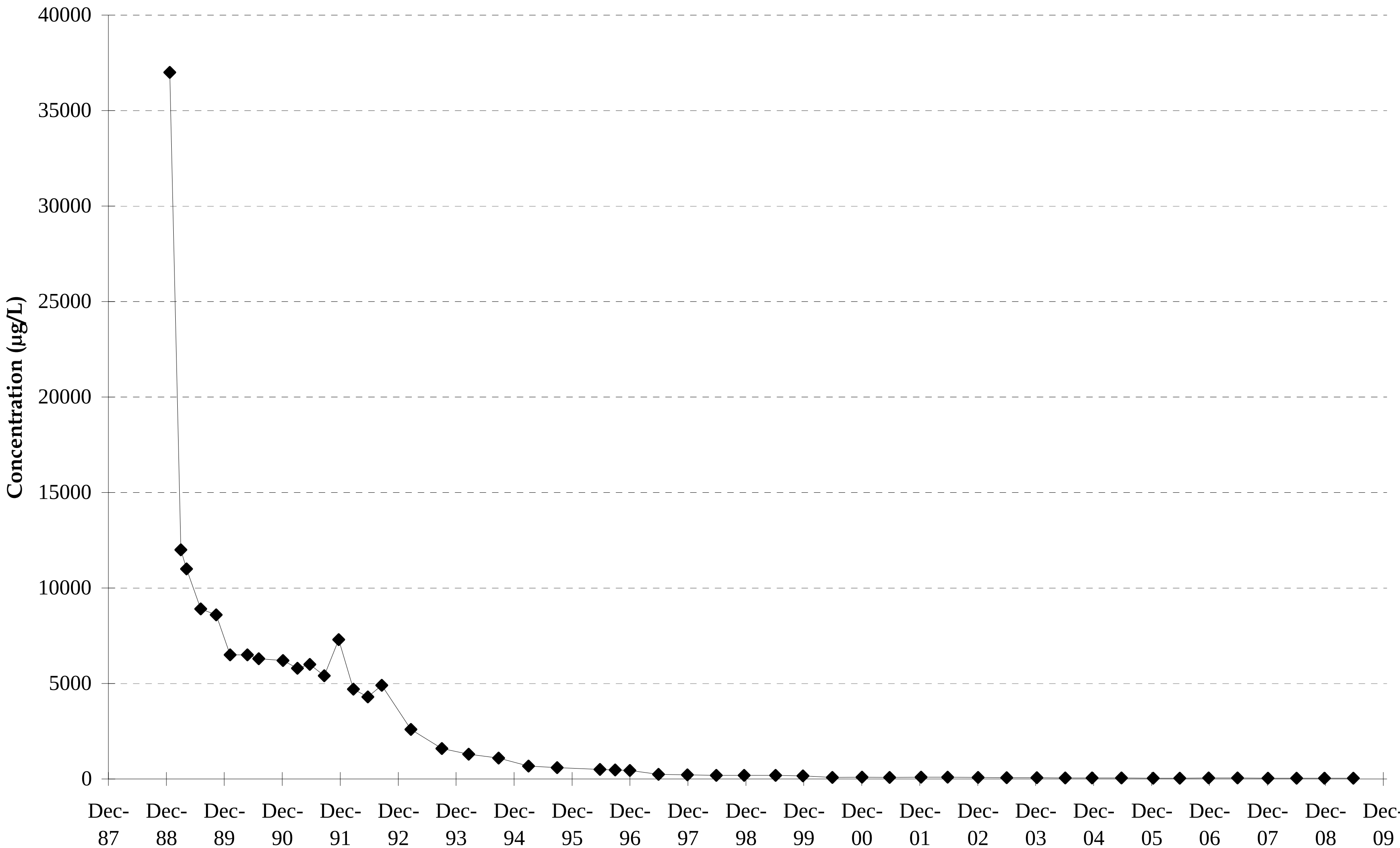



Note: Samples reporting concentrations less than the detection limit were plotted as zero.

CRA 054651 (2)

## APPENDIX G-1

## EXTRACTION WELL SC2 - TRCLE VS. TIME

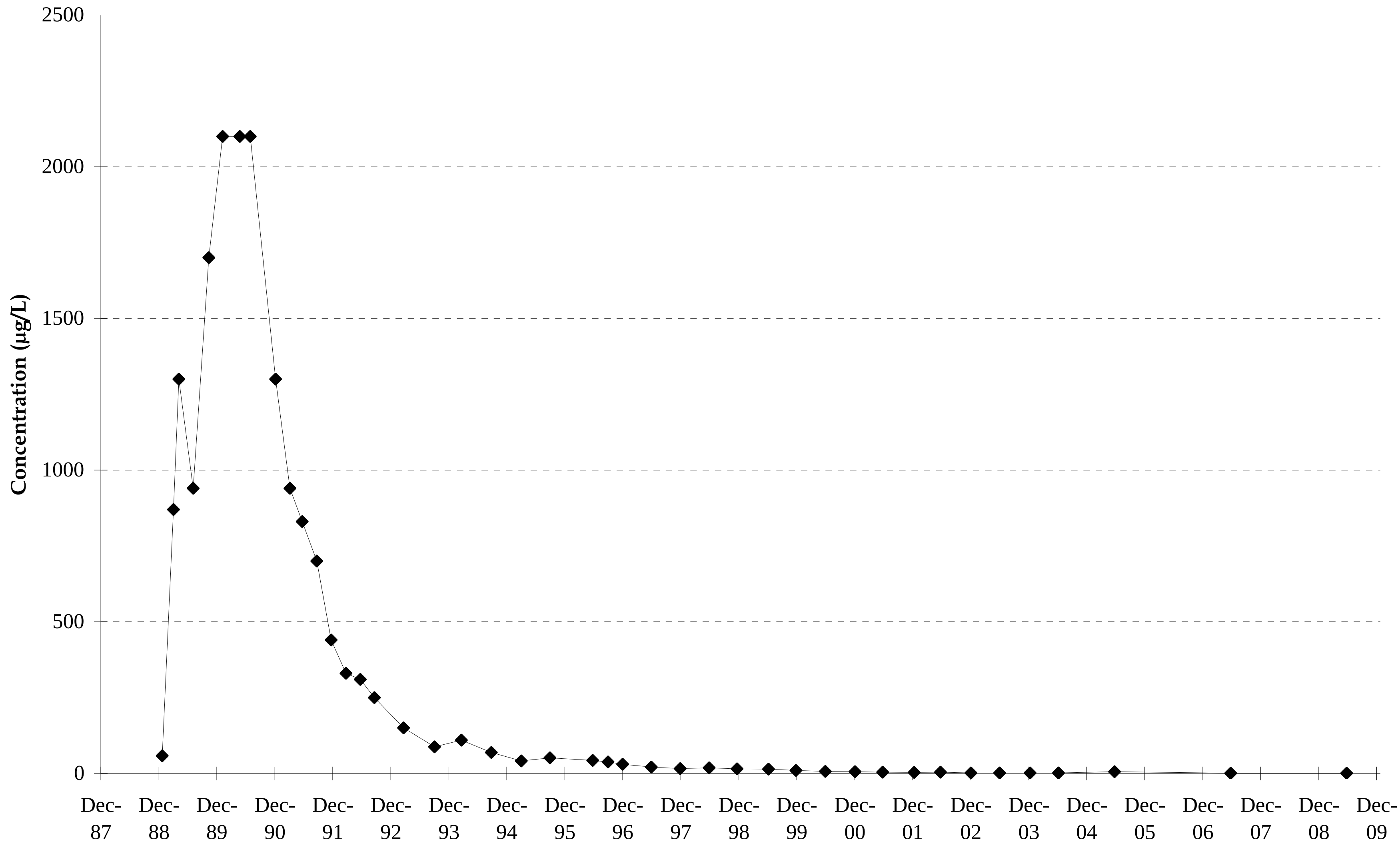



Note: Samples reporting concentrations less than the detection limit were plotted as zero.

CRA 054651 (2)

**APPENDIX G-1**

**EXTRACTION WELL SC3 - TRCLE VS. TIME**

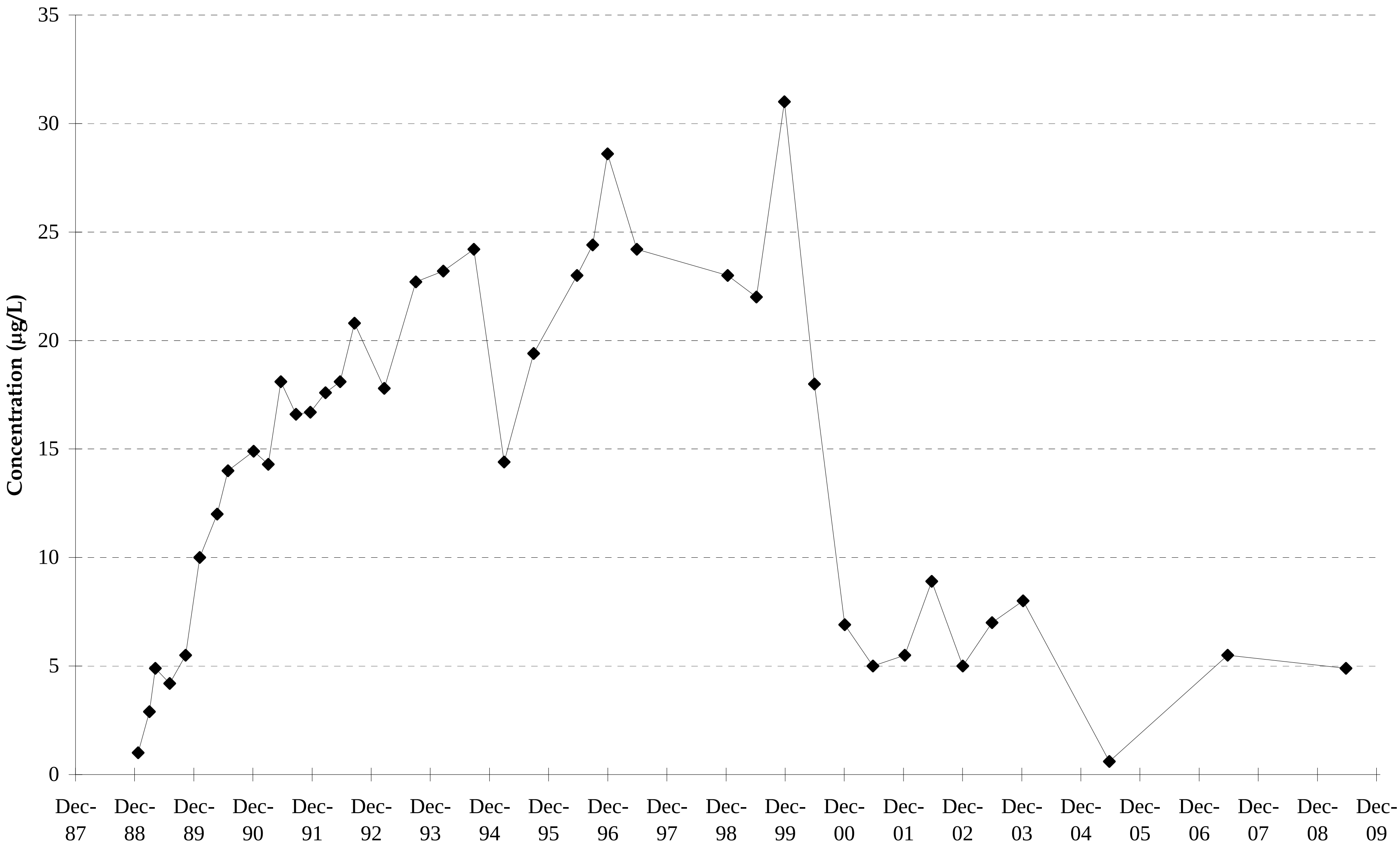



Note: Samples reporting concentrations less than the detection limit were plotted as zero.

CRA 054651 (2)

**APPENDIX G-1**

**EXTRACTION WELL SC4 - TRCLE VS. TIME**

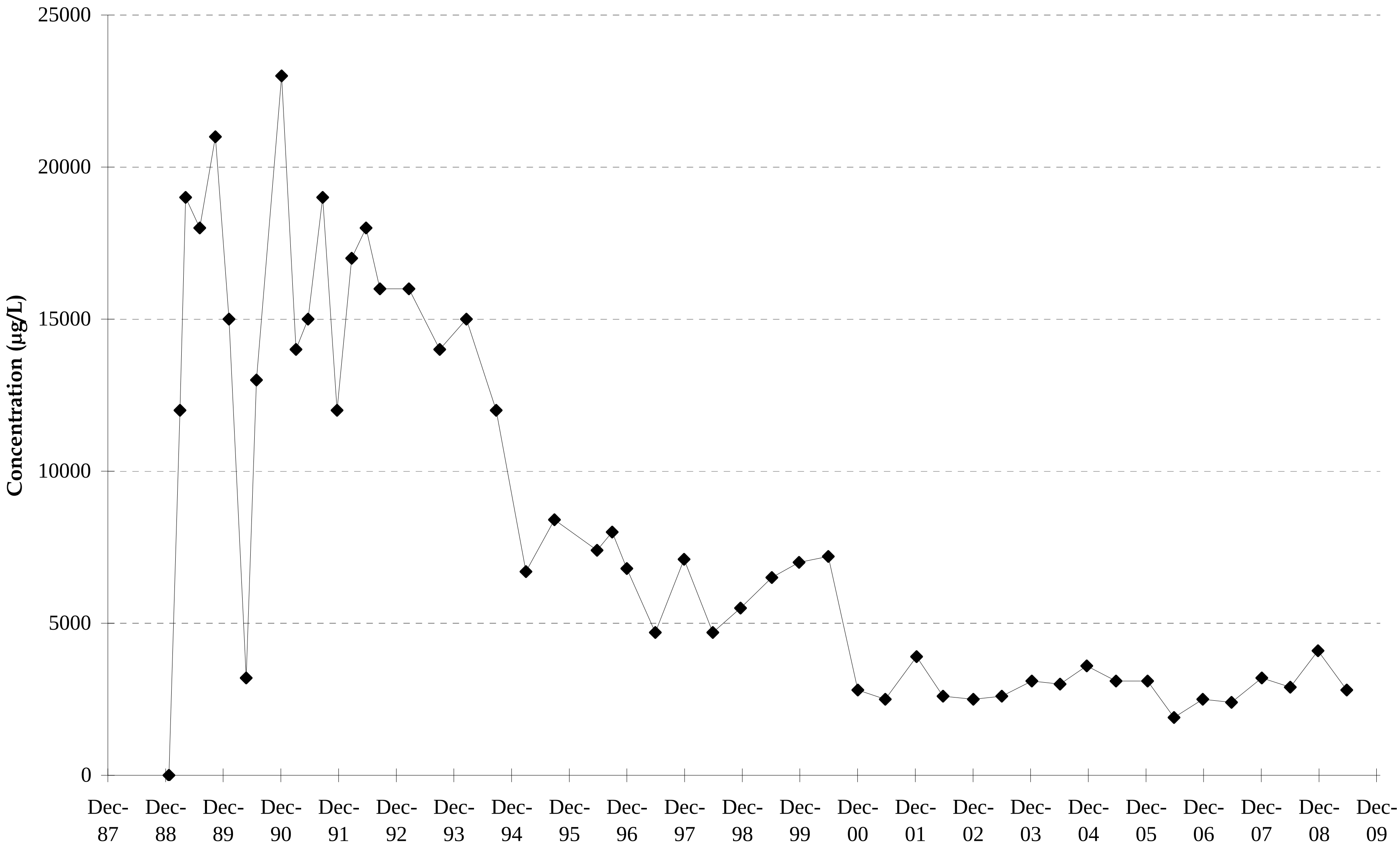



Note: Samples reporting concentrations less than the detection limit were plotted as zero.

CRA 054651 (2)

**APPENDIX G-1**

**EXTRACTION WELL SC5 - TRCLE VS. TIME**




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

CRA 054651 (2)

# G.2 Influent/Effluent Database (µg/L), Fiscal Year 2009, TGRS, OU2

**APPENDIX G-2**

**INFLUENT/EFFLUENT DATABASE (µg/L)**
**FISCAL YEAR 2009**
**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 | 10/2/08 | | < | 1 | < | 1 | < | 1 | < | 1 | < | 1 | < | 1 | 0.3 | JP |
| TGRSE | 10/2/08 | D | < | 1 | < | 1 | < | 1 | < | 1 | < | 1 | < | 1 | 0.27 | JP |
| TGRSE | 11/4/08 | | < | 1 | < | 1 | < | 1 | < | 1 | < | 1 | < | 1 | 0.28 | JP |
| TGRSE | 12/3/08 | | < | 1 | < | 1 | < | 1 | < | 1 | < | 1 | < | 1 | 0.39 | JP |
| TGRSE | 12/3/08 | D | < | 1 | < | 1 | < | 1 | < | 1 | < | 1 | < | 1 | 0.4 | JP |
| TGRSE | 1/5/09 | | < | 1 | < | 1 | < | 1 | < | 1 | < | 1 | < | 1 | 0.46 | JP |
| TGRSE | 1/5/09 | D | < | 1 | < | 1 | < | 1 | < | 1 | < | 1 | < | 1 | 0.44 | JP |
| TGRSE | 2/3/09 | | < | 1 | < | 1 | < | 1 | < | 1 | < | 1 | < | 1 | 0.31 | JP |
| TGRSE | 2/3/09 | D | < | 1 | < | 1 | < | 1 | < | 1 | < | 1 | < | 1 | 0.3 | JP |
| TGRSE | 3/3/09 | | < | 1 | < | 1 | < | 1 | < | 1 | < | 1 | < | 1 | 0.33 | JP |
| TGRSE | 4/6/09 | | < | 1 | < | 1 | < | 1 | < | 1 | < | 1 | < | 1 | 0.38 | JP |
| TGRSE | 4/6/09 | D | < | 1 | < | 1 | < | 1 | < | 1 | < | 1 | < | 1 | 0.39 | JP |
| TGRSE | 5/5/09 | | < | 1 | < | 1 | < | 1 | < | 1 | < | 1 | < | 1 | 0.4 | JP |
| TGRSE | 5/5/09 | D | < | 1 | < | 1 | < | 1 | < | 1 | < | 1 | < | 1 | 0.41 | JP |
| TGRSE | 6/3/09 | | < | 1 | < | 1 | < | 1 | < | 1 | < | 1 | < | 1 | 0.45 | JP |
| TGRSE | 6/3/09 | D | < | 1 | < | 1 | < | 1 | < | 1 | < | 1 | < | 1 | 0.43 | JP |
| TGRSE | 7/8/09 | | < | 1 | < | 1 | < | 1 | < | 1 | < | 1 | < | 1 | 0.27 | JP |
| TGRSE | 8/5/09 | | < | 1 | < | 1 | < | 1 | < | 1 | < | 1 | < | 1 | 0.38 | JP |
| TGRSE | 8/5/09 | D | < | 1 | < | 1 | < | 1 | < | 1 | < | 1 | < | 1 | 0.35 | JP |
| TGRSE | 9/1/09 | | < | 1 | < | 1 | < | 1 | < | 1 | < | 1 | < | 1 | 0.38 | JP |
| TGRSE | 9/1/09 | D | < | 1 | < | 1 | < | 1 | < | 1 | < | 1 | < | 1 | 0.28 | JP |

**APPENDIX G-2**

**INFLUENT/EFFLUENT DATABASE (µg/L)**
**FISCAL YEAR 2009**
**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 | 10/2/08 | | 36 | 4 | 4.2 | < | 1 | 3.1 | 1.5 | | 210 |
| TGRSI | 11/4/08 | | 40 | 4.2 | 4.6 | < | 1 | 2.9 | 1.4 | | 230 |
| TGRSI | 11/4/08 | D | 37 | 4.3 | 4.3 | < | 1 | 3 | 1.4 | | 240 |
| TGRSI | 12/3/08 | | 52 | 4.7 | 4.6 | < | 1 | 2.7 | 1.2 | JL134 | 250 |
| TGRSI | 1/5/09 | | 76 | 4.5 | 5.8 | < | 1 | 2.8 | 1.6 | | 260 |
| TGRSI | 2/3/09 | | 68 | 4.5 | 6.6 | < | 1 | 3 | 1.7 | | 240 |
| TGRSI | 3/3/09 | | 50 | 3.9 | 5.3 | < | 1 | 2.7 | 1.6 | | 240 |
| TGRSI | 3/3/09 | D | 51 | 3.9 | 5.7 | < | 1 | 2.7 | 1.7 | | 230 |
| TGRSI | 4/6/09 | | 55 | 4.5 | 6.4 | < | 1 | 3.1 | 1.7 | | 210 |
| TGRSI | 5/5/09 | | 53 | 4.1 | 5.5 | < | 1 | 3.3 | 1.4 | | 210 |
| TGRSI | 6/3/09 | | 39 | 3.9 | 4.6 | < | 1 | 2.9 | 1.2 | | 180 |
| TGRSI | 7/8/09 | | 38 | 4 | 4.7 | < | 1 | 3 | 1.2 | | 190 |
| TGRSI | 7/8/09 | D | 35 | 3.8 | 4.2 | < | 1 | 2.7 | 1.4 | | 180 |
| TGRSI | 8/5/09 | | 46 | 4 | 4.9 | < | 1 | 3.1 | 1.5 | | 200 |
| TGRSI | 9/1/09 | | 40 | 3.4 | 4 | < | 1 | 2.6 | 1.4 | | 190 |

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.

JL - Result is qualified as estimated due to LCS % recoveries above the upper control limit.

# Appendix H

# Operable Unit 3 Statistical Analysis

**TABLE H.1**

**MAROS DECISION MATRIX**

| *Kendall S* | *Confidence* | *Coefficient of Varience* | *Trend* |
|---|---|---|---|
| S > 0 | > 95% | NA | Definitely Increasing |
| S > 0 | 90-95% | NA | Probably Increasing |
| S > 0 | < 90% | NA | No Trend |
| S</= 0 | < 90% | >/= 1 | No Trend |
| S </= 0 | < 90% | < 1 | Stable |
| S < 0 | 90-95% | NA | Probably Decreasing |
| S < 0 | >95% | NA | Definitely Decreasing |

**TABLE H.2**

**CONFIDENCE VALUES FOR SIX DATA PAIRS**

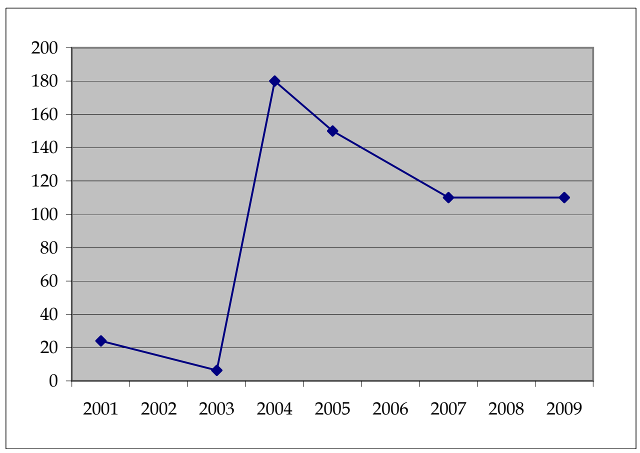
| *Kendall S* | *Confidence* |
|---|---|
| 1 | 50.00% |
| 3 | 64.00% |
| 5 | 76.50% |
| 7 | 86.40% |
| 9 | 93.20% |
| 11 | 97.20% |
| 13 | 99.17% |
| 15 | 99.86% |

**WELL 03L673**
**MANN-KENDALL STATISTICAL ANALYSIS**
**OU3 - 2009**

| Date | TCE (µg/l) | Mann-Kendall Calculation: | | | | | |
|---|---|---|---|---|---|---|---|
| 6/12/2001 | **24** | 1 | | | | | |
| 6/1/2003 | **6.3** | 1 | -1 | | | | |
| 6/1/2004 | **180** | 1 | 1 | 1 | | | |
| 6/22/2005 | **150** | 1 | 1 | 1 | -1 | | |
| 6/21/2007 | **110** | 1 | 1 | 1 | -1 | -1 | |
| 6/18/2009 | **110** | 1 | 1 | 1 | -1 | -1 | 0 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| N | 6 | 5 | 4 | 3 | 2 | 1 | 0 | | 15 |
| sum | | 3 | 4 | -3 | -2 | 0 | 0 | Kendall S | 2 |
| Possibles | 15 | | | | | | | | |
| | | | | | | | | Kendall tau | 0.13333333 |

| | |
|---|---|
| Mean | 96.72 |
| STNDEV | 68.68916703 |
| COV | 0.71021024 |
| Trend: | Positive |
| Confidence (lookup) | 57.00% |



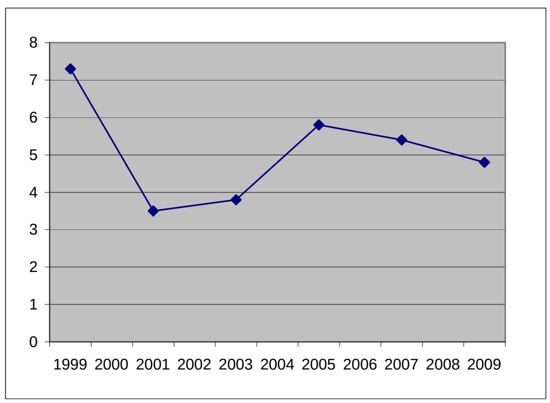

| Raw Data | Date | TCE |
|---|---|---|
| 03L673 | | |
| | 11/12/1987 | 1200 |
| | 5/2/1990 | 3200 |
| | 3/11/1991 | 2000 |
| | 3/11/1991 | 1900 |
| | 6/17/1991 | 5500 |
| | 3/12/1992 | 3900 |
| | 3/3/1993 | 2100 |
| | 3/4/1994 | 3300 |
| | 6/6/1994 | 2000 |
| | 6/6/1994 | 2000 |
| | 9/14/1994 | 1600 |
| | 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 |
| | 6/21/2007 | 110 |
| | 6/18/2009 | 110 |

**WELL 03L848**
**MANN-KENDALL STATISTICAL ANALYSIS**
**OU3 - 2009**

| Date | TCE (µg/l) | Mann-Kendall Calculation: | | | | | |
|---|---|---|---|---|---|---|---|
| 6/4/1999 | **7.3** | 1 | | | | | |
| 6/12/2001 | **3.5** | 1 | -1 | | | | |
| 6/1/2003 | **3.8** | 1 | -1 | 1 | | | |
| 6/21/2005 | **5.8** | 1 | -1 | 1 | 1 | | |
| 6/21/2007 | **5.4** | 1 | -1 | 1 | 1 | -1 | |
| 6/17/2009 | **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 | -0.06667 |

| | |
|---|---|
| Mean | 5.10 |
| STNDEV | 1.397139936 |
| COV | 0.273949007 |
| Trend: | Negative |
| Confidence (lookup) | 50.00% |



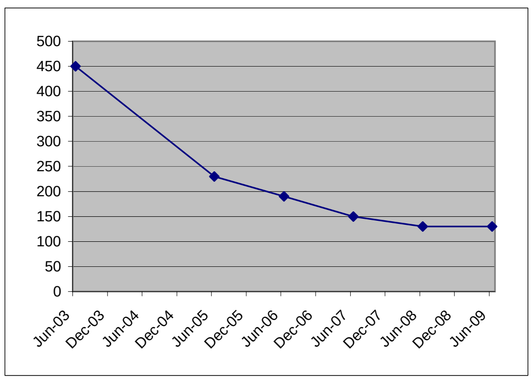

| Raw Data | Date | TCE |
|---|---|---|
| 03L848 | | |
| | 12/2/1987 | 570 |
| | 5/3/1989 | 270 |
| | 7/20/1989 | 130 |
| | 10/19/1989 | 610 |
| | 4/19/1990 | 460 |
| | 7/19/1990 | 260 |
| | 3/18/1991 | 250 |
| | 3/18/1992 | 92 |
| | 3/9/1993 | 52.9 |
| | 6/6/1994 | 27 |
| | 9/15/1994 | 27.1 |
| | 12/8/1994 | 22 |
| | 3/10/1995 | 16.6 |
| | 6/3/1996 | 11.3 |
| | 6/5/1997 | 9.34 |
| | 6/5/1997 | 8.57 |
| | 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 |
| | 6/21/2007 | 5.4 |
| | 6/21/2007 | 5.3 |
| | 6/17/2009 | 4.8 |
| | 6/17/2009 | 2.6 |

**WELL 03M848**
**MANN-KENDALL STATISTICAL ANALYSIS**
**OU3 - 2009**

| Date | TCE (µg/l) | Mann-Kendall Calculation: | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 6/1/2003 | **450** | 1 | | | | | | | Jun-03 | **450** |
| 6/21/2005 | **230** | 1 | -1 | | | | | | 6/21/2005 | **230** |
| 6/13/2006 | **190** | 1 | -1 | -1 | | | | | 6/13/2006 | **190** |
| 6/21/2007 | **150** | 1 | -1 | -1 | -1 | | | | 6/21/2007 | **150** |
| 6/18/2008 | **130** | 1 | -1 | -1 | -1 | -1 | | | 6/18/2008 | **130** |
| 6/17/2009 | **130** | 1 | -1 | -1 | -1 | -1 | 0 | | 6/17/2009 | **130** |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| N | | 6 | 5 | 4 | 3 | 2 | 1 | 0 | | 15 |
| | sum | | -5 | -4 | -3 | -2 | 0 | 0 | Kendall S | -14 |
| Possibles | | 15 | | | | | | | | |
| | | | | | | | | | Kendall tau | -0.93333 |

| | |
|---|---|
| Mean | 213.33 |
| STNDEV | 122.256561 |
| COV | 0.57307763 |
| Trend: | Negative |
| Confidence (lookup) | 99.52% |



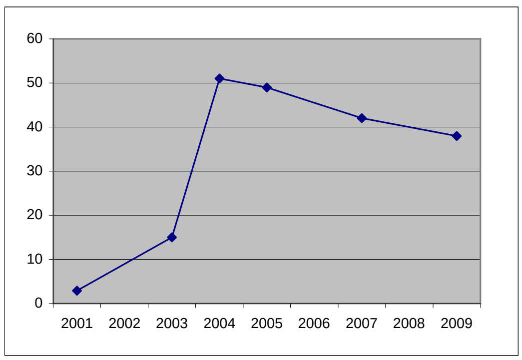

| Raw Data | Date | TCE |
|---|---|---|
| 03M848 | | |
| | 12/2/1987 | 440.00 |
| | 4/19/1990 | 190.00 |
| | 7/19/1990 | 190.00 |
| | 9/17/1990 | 330.00 |
| | 3/18/1991 | 310.00 |
| | 6/4/1991 | 730.00 |
| | 9/3/1991 | 700.00 |
| | 3/18/1992 | 640.00 |
| | 6/3/1992 | >50.10 |
| | 6/3/1992 | 570.00 |
| | 9/3/1992 | >50.10 |
| | 3/9/1993 | 1300 |
| | 3/9/1993 | 970 |
| | 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 |
| | 6/12/2001 | 370 |
| | 6/1/2003 | 450 |
| | 6/21/2005 | 230 |
| | 6/13/2006 | 190 |
| | 6/21/2007 | 150 |
| | 6/18/2008 | 130 |
| | 6/17/2009 | 130 |

**WELL 04U673**
**MANN-KENDALL STATISTICAL ANALYSIS**
**OU3 - 2009**

| Date | TCE (µg/l) | Mann-Kendall Calculation: | | | | | |
|---|---|---|---|---|---|---|---|
| 6/12/2001 | **2.9** | 1 | | | | | |
| 6/1/2003 | **15** | 1 | 1 | | | | |
| 6/1/2004 | **51** | 1 | 1 | 1 | | | |
| 6/22/2005 | **49** | 1 | 1 | 1 | -1 | | |
| 6/21/2007 | **42** | 1 | 1 | 1 | -1 | -1 | |
| 6/18/2009 | **38** | 1 | 1 | 1 | -1 | -1 | -1 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| N | | 6 | 5 | 4 | 3 | 2 | 1 | | | 15 |
| | sum | | 5 | 4 | -3 | -2 | -1 | | Kendall S | 3 |
| Possibles | | 15 | | | | | | | | |
| | | | | | | | | | Kendall tau | 0.2 |

| | |
|---|---|
| Mean | 32.98 |
| STNDEV | 19.5755375 |
| COV | 0.59349785 |
| Trend: | Positive |
| Confidence (lookup) | 64.00% |



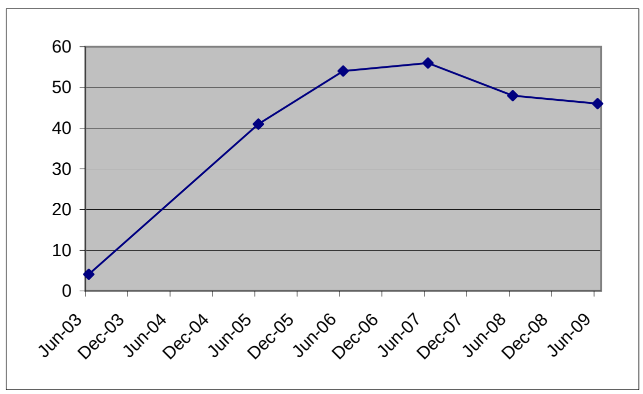

| Raw Data | Date | TCE |
|---|---|---|
| 04U673 | | |
| | 11/24/1987 | 145.0 |
| | 1/21/1988 | 580.0 |
| | 5/16/1988 | 560.0 |
| | 8/4/1988 | 253.0 |
| | 11/1/1988 | 1700.0 |
| | 5/3/1989 | 700.0 |
| | 7/21/1989 | 1200.0 |
| | 10/19/1989 | 1100.0 |
| | 5/1/1990 | 3100.0 |
| | 3/11/1991 | 990.0 |
| | 3/11/1991 | 940.0 |
| | 6/17/1991 | 410.0 |
| | 3/12/1992 | 460.0 |
| | 6/4/1992 | 430.0 |
| | 9/8/1992 | 540.0 |
| | 3/3/1993 | 280.0 |
| | 9/13/1993 | 190.0 |
| | 3/3/1994 | 270.0 |
| | 6/6/1994 | 210.0 |
| | 9/8/1994 | 170.0 |
| | 12/8/1994 | 190.0 |
| | 3/15/1995 | 160.0 |
| | 3/15/1995 | 140.0 |
| | 9/12/1995 | 260.0 |
| | 6/12/1996 | 125.0 |
| | 6/12/1997 | 60.4 |
| | 6/25/1998 | 81.9 |
| | 6/4/1999 | 74.0 |
| | 6/12/2001 | 2.9 |
| | 6/1/2003 | 15 |
| | 6/1/2004 | 51 |
| | 6/22/2005 | 49 |
| | 6/21/2007 | 42 |
| | 6/18/2009 | 38 |

**WELL 04U832**
**MANN-KENDALL STATISTICAL ANALYSIS**
**OU3 - 2009**

| Date | TCE (µg/l) | Mann-Kendall Calculation: | | | | | |
|---|---|---|---|---|---|---|---|
| 6/1/2003 | **4.10** | 1 | | | | | |
| 6/23/2005 | **41** | 1 | 1 | | | | |
| 6/13/2006 | **54** | 1 | 1 | 1 | | | |
| 6/22/2007 | **56** | 1 | 1 | 1 | 1 | | |
| 6/17/2008 | **48** | 1 | 1 | 1 | -1 | -1 | |
| 6/19/2009 | **46** | 1 | 1 | 1 | -1 | -1 | -1 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| N | | 6 | 5 | 4 | 3 | 2 | 1 | 0 | | 15 |
| | sum | | 5 | 4 | -1 | -2 | -1 | 0 | Kendall S | 5 |
| Possibles | | 15 | | | | | | | | |
| | | | | | | | | | Kendall tau | 0.333333 |

| | |
|---|---|
| Mean | 41.52 |
| STNDEV | 19.12071303 |
| COV | 0.460555111 |
| Trend: | Positive |
| Confidence (lookup) | 76.50% |




Raw Data 04U832

| Date | TCE |
|---|---|
| 11/24/1987 | 100.00 |
| 12/16/1988 | 65.00 |
| 4/25/1990 | 69.53 |
| 3/19/1991 | 47.60 |
| 3/25/1992 | 52.50 |
| 3/16/1993 | 42.00 |
| 3/16/1993 | 45.90 |
| 6/10/1994 | 49.00 |
| 9/13/1994 | 49.50 |
| 12/7/1994 | 43.30 |
| 12/7/1994 | 47.10 |
| 3/10/1995 | 56.00 |
| 6/3/1996 | 41.00 |
| 6/4/1997 | 35.20 |
| 6/25/1998 | 36.40 |
| 6/7/1999 | 29.00 |
| 6/14/2001 | 3.50 |
| 6/1/2003 | 4.10 |
| 6/23/2005 | 41 |
| 6/13/2006 | 54 |
| 6/22/2007 | 56 |
| 6/17/2008 | 48 |
| 6/19/2009 | 46 |

**WELL 04U845**
**MANN-KENDALL STATISTICAL ANALYSIS**
**OU3 - 2009**

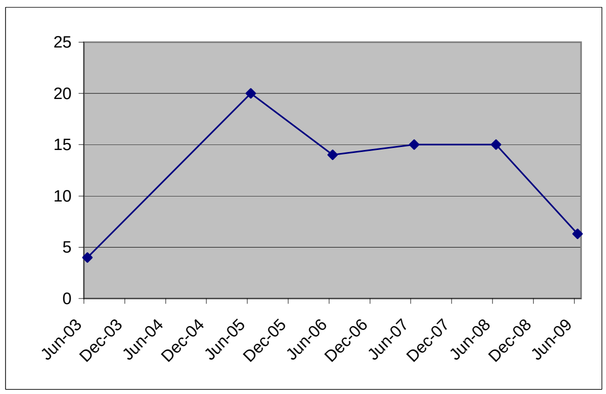
| Date | TCE (µg/l) | Mann-Kendall Calculation: | | | | | |
|---|---|---|---|---|---|---|---|
| 6/1/2003 | **4.00** | 1 | | | | | |
| 6/22/2005 | **20** | 1 | 1 | | | | |
| 6/13/2006 | **14** | 1 | 1 | -1 | | | |
| 6/22/2007 | **15** | 1 | 1 | -1 | 1 | | |
| 6/17/2008 | **15** | 1 | 1 | -1 | 1 | 0 | |
| 6/17/2009 | **6.3** | 1 | 1 | -1 | -1 | -1 | -1 |

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

| | |
|---|---|
| Mean | 12.38 |
| STNDEV | 6.02674594 |
| COV | 0.48668204 |

Trend: Zero

Confidence (lookup) 50.00%



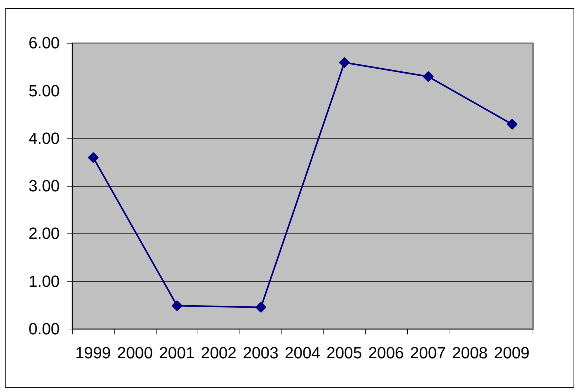

| Raw Data | Date | TCE |
|---|---|---|
| 04U845 | | |
| | 12/1/1987 | 59.00 |
| | 12/16/1988 | 155.00 |
| | 5/4/1989 | 100.00 |
| | 7/20/1989 | 160.00 |
| | 10/20/1989 | 62.00 |
| | 4/26/1990 | 38.00 |
| | 3/20/1991 | 100.00 |
| | 3/23/1992 | >50.10 |
| | 3/23/1992 | 100.00 |
| | 3/15/1993 | 84.00 |
| | 6/8/1994 | 64.00 |
| | 9/13/1994 | 70.00 |
| | 12/7/1994 | 54.00 |
| | 3/10/1995 | 39.50 |
| | 6/4/1996 | 51.20 |
| | 6/5/1997 | 30.80 |
| | 6/25/1998 | 32.90 |
| | 6/7/1999 | 35.00 |
| | 6/13/2001 | 4.30 |
| | 6/1/2003 | 4.00 |
| | 6/22/2005 | 20 |
| | 6/13/2006 | 14 |
| | 6/13/2006 | 14 |
| | 6/22/2007 | 15 |
| | 6/17/2008 | 15 |
| | 6/17/2009 | 6.3 |

**WELL 04U848**
**MANN-KENDALL STATISTICAL ANALYSIS**
**OU3 - 2009**

| Date | TCE (µg/l) | Mann-Kendall Calculation: | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 6/4/1999 | **3.60** | 1 | | | | | | |
| 6/12/2001 | **0.49** | 1 | -1 | | | | | |
| 6/1/2003 | **0.46** | 1 | -1 | -1 | | | | |
| 6/21/2005 | **5.6** | 1 | 1 | 1 | 1 | | | |
| 6/21/2007 | **5.3** | 1 | 1 | 1 | 1 | -1 | | |
| 6/17/2009 | **4.3** | 1 | 1 | 1 | 1 | -1 | -1 | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| N | | 6 | 5 | 4 | 3 | 2 | 1 | 0 | | 15 |
| | sum | | 1 | 2 | 3 | -2 | -1 | 0 | Kendall S | 3 |
| Possibles | | 15 | | | | | | | | |
| | | | | | | | | | Kendall tau | 0.2 |

| | |
|---|---|
| Mean | 3.29 |
| STNDEV | 2.295268321 |
| COV | 0.697296705 |
| Trend: | Positive |
| Confidence (lookup) | 64.00% |



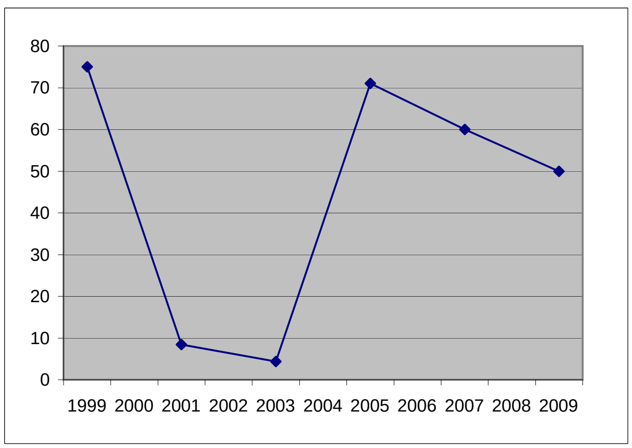

| Raw Data | Date | TCE | |
|---|---|---|---|
| 04U848 | | | |
| | 12/2/1987 | 700.00 | |
| | 8/24/1988 | 470.00 | |
| | 5/3/1989 | 150.00 | |
| | 7/20/1989 | 700.00 | |
| | 10/19/1989 | 280.00 | |
| | 4/19/1990 | 240.00 | |
| | 7/19/1990 | 140.00 | |
| | 9/17/1990 | 150.00 | |
| | 3/18/1991 | 64.00 | |
| | 3/18/1992 | 22.50 | |
| | 3/18/1992 | 23.40 | |
| | 3/10/1993 | 26.00 | |
| | 6/6/1994 | 12.20 | |
| | 9/15/1994 | 16.80 | |
| | 12/8/1994 | 15.60 | |
| | 3/10/1995 | 9.94 | |
| | 6/3/1996 | 6.15 | |
| | 6/5/1997 | 3.30 | |
| | 6/29/1998 | 4.19 | |
| | 6/4/1999 | 3.60 | |
| | 6/12/2001 | 0.49 | J |
| | 6/1/2003 | 0.46 | JP |
| | 6/21/2005 | 5.6 | |
| | 6/21/2007 | 5.3 | |
| | 6/17/2009 | 4.3 | |

**WELL 04U859**
**MANN-KENDALL STATISTICAL ANALYSIS**
**OU3 - 2009**

| Date | TCE (µg/l) | Mann-Kendall Calculation: | | | | | |
|---|---|---|---|---|---|---|---|
| 6/7/1999 | **75.00** | 1 | | | | | |
| 6/13/2001 | **8.40** | 1 | -1 | | | | |
| 6/1/2003 | **4.40** | 1 | -1 | -1 | | | |
| 6/22/2005 | **71** | 1 | -1 | 1 | 1 | | |
| 6/21/2007 | **60** | 1 | -1 | 1 | 1 | -1 | |
| 6/18/2009 | **50** | 1 | -1 | 1 | 1 | -1 | -1 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| N | | 6 | 5 | 4 | 3 | 2 | 1 | 0 | | 15 |
| | sum | | -5 | 2 | 3 | -2 | -1 | 0 | Kendall S | -3 |
| Possibles | | 15 | | | | | | | | |
| | | | | | | | | | Kendall tau | -0.2 |

| | |
|---|---|
| Mean | 44.80 |
| STNDEV | 31.02798737 |
| COV | 0.692589004 |
| Trend: | Negative |
| Confidence (lookup) | 64.00% |



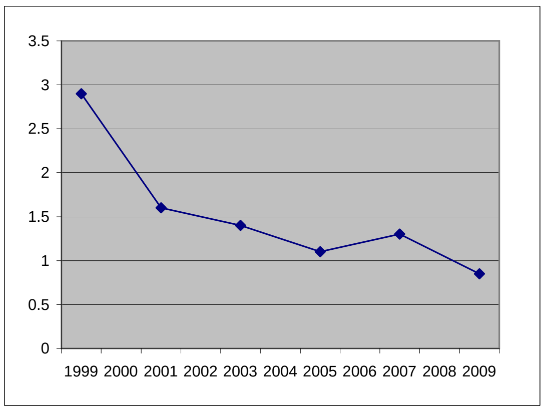

| Raw Data | Date | TCE |
|---|---|---|
| 04U859 | | |
| | 11/13/1987 | 0.30 |
| | 12/15/1988 | 8.50 |
| | 4/30/1990 | 5.59 |
| | 3/19/1991 | 5.24 |
| | 3/20/1992 | 9.29 |
| | 3/11/1993 | 40.50 |
| | 3/18/1994 | 47.00 |
| | 3/18/1994 | 49.50 |
| | 6/9/1994 | 48.90 |
| | 9/14/1994 | 64.00 |
| | 12/7/1994 | 52.50 |
| | 3/10/1995 | 43.80 |
| | 6/3/1996 | 50.80 |
| | 6/4/1997 | 31.90 |
| | 6/25/1998 | 42.00 |
| | 6/25/1998 | 46.80 |
| | 6/7/1999 | 75.00 |
| | 6/13/2001 | 8.40 |
| | 6/1/2003 | 4.40 |
| | 6/22/2005 | 71 |
| | 6/21/2007 | 60 |
| | 6/18/2009 | 50 |

**WELL 409548**
**MANN-KENDALL STATISTICAL ANALYSIS**
**OU3 - 2007**

| Date | TCE (µg/l) | Mann-Kendall Calculation: | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 6/14/1999 | **2.9** | 1 | | | | | | |
| 6/19/2001 | **1.6** | 1 | -1 | | | | | |
| 6/11/2003 | **1.4** | 1 | -1 | -1 | | | | |
| 6/8/2005 | **1.1** | 1 | -1 | -1 | -1 | | | |
| 6/12/2007 | **1.3** | 1 | -1 | -1 | -1 | 1 | | |
| 6/8/2009 | **0.85** | 1 | -1 | -1 | -1 | -1 | -1 | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| N | | 6 | 5 | 4 | 3 | 2 | 1 | 0 | | 15 |
| | sum | | -5 | -4 | -3 | 0 | -1 | 0 | Kendall S | -13 |
| Possibles | | 15 | | | | | | | | |
| | | | | | | | | | Kendall tau | -0.866667 |

| | |
|---|---|
| Mean | 1.53 |
| STNDEV | 0.72093689 |
| COV | 0.472745502 |
| Trend: | Negative |
| Confidence (lookup) | 99.17% |




| Raw Data | Date | TCE | |
|---|---|---|---|
| 409548 | | | |
| | 5/10/1989 | <0.50 | |
| | 7/20/1989 | <1.10 | |
| | 10/18/1989 | <1.10 | |
| | 4/17/1990 | 1.17 | |
| | 3/18/1991 | 0.88 | |
| | 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 | |
| | 6/8/2005 | 1.1 | |
| | 6/12/2007 | 1.3 | |
| | 6/8/2009 | 0.85 | JP |

# 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 16, 2009  Inspected By: Mike Fix (TCAAP), Dave Hamernick (Nat'l Guard), Mary Lee (Nat'l Guard), Keith Benker (Wenck)

| Sites: | A | C | D | E | G | H | I | K |
|---|---|---|---|---|---|---|---|---|
| Site is located on property controlled by: | N.G. | BRAC | N.G. | N.G. | N.G. | N.G. | BRAC | BRAC |
| Is the current land use consistent with the land use scenario upon which the soil cleanup levels were based? | Yes | Yes | Yes | Yes | Yes | Yes | Note (1) | Yes |
| Has there been any excavation or other man-made soil disturbance at the site? | No | No | No | No | No | No | No | Yes (4) |
| If excavation or soil disturbance has occurred, was prior approval given by BRAC or National Guard? | N/A | N/A | N/A | N/A | N/A | N/A | N/A | Yes |
| If excavation or soil disturbance was authorized, was the work done in accordance with the approved plan? | N/A | N/A | N/A | N/A | N/A | N/A | N/A | Yes |
| Have any new structures or facilities (including new wells) been constructed on the site? | No | No | No | No | No | No | No | No |
| If new facilities or structures were constructed, was prior approval given by BRAC or National Guard? | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| If new facilities or structures were authorized, was constuction in accordance with the approved plan? | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| If a protective soil cover is present, is adequate vegetation present throughout the soil cover area? | N/A | Yes | Yes | Yes | Yes | Yes | N/A | N/A |
| If the soil cover has a permeability requirement, is there any woody vegetation > 2" diameter present? | N/A | N/A | N/A | N/A | No | N/A | N/A | N/A |
| If a protective soil cover is present, are run-on/runoff controls in good condition (swales, berms, riprap, etc.)? | N/A | Yes | Yes | Yes | Yes | Yes | N/A | N/A |
| If a protective soil cover is present, are signs marking the edge of the soil cover present and in good condition? | N/A | Yes | Yes | Yes | Yes | Yes | N/A | N/A |
| Are there any water supply wells constructed into the portion of the aquifer with concentrations above cleanup levels? | No | No | N/A | N/A | N/A | N/A | No | No |
| Has there been any damage to or removal/modification of groundwater remediation and/or monitoring systems? | Yes (2) | Yes (3) | N/A | N/A | N/A | N/A | No | No |
| If such systems were removed or modified, was prior approval given by BRAC or National Guard? | Yes | Yes | N/A | N/A | N/A | N/A | N/A | N/A |
| If system removal/modification was authorized, was removal/modification in accordance with approved plan? | Yes | Yes | N/A | N/A | N/A | N/A | N/A | N/A |

Comments (Attach additional pages as necessary):

(1) Soil contamination is known to exist, but cleanup levels have not yet been established through a Decision Document for this site.

(3) The groundwater extraction system has been turned off with regulatory approval and placed into standby mode.

(4) In June 2009, soil remediation work was performed.

# ANNUAL SITE INSPECTION CHECKLIST FOR LAND USE CONTROLS

Operable Unit 2, New Brighton/Arden Hills Superfund Site

| Sites: | 129-3 | 129-5 | 129-15 | Grenade Range | Outdoor Firing Rng | Bldg 135 P/T Area | Bldg 535 P/T Area | Bldg 102 | Deep GW (TGRS) |
|---|---|---|---|---|---|---|---|---|---|
| Site is located on property controlled by: | N.G. | N.G. | N.G. | N.G. | N.G. | BRAC | N.G. | BRAC | BRAC/N.G. |
| Is the current land use consistent with the land use scenario upon which the soil cleanup levels were based? | Yes | Yes | Yes | Yes | Yes | Note (2) | Yes | N/A | N/A |
| Has there been any excavation or other man-made soil disturbance at the site? | No | No | No | No | No | No | No (5) | N/A | N/A |
| If excavation or soil disturbance has occurred, was prior approval given by BRAC or National Guard? | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| If excavation or soil disturbance was authorized, was the work done in accordance with the approved plan? | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Have any new structures or facilities (including new wells) been constructed on the site? | No | No | No | No | No | No | No | N/A | N/A |
| If new facilities or structures were constructed, was prior approval given by BRAC or National Guard? | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| If new facilities or structures were authorized, was constuction in accordance with the approved plan? | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| If a protective soil cover is present, is adequate vegetation present throughout the soil cover area? | N/A | N/A | Yes | N/A | Yes | N/A | N/A | N/A | N/A |
| If the soil cover has a permeability requirement, is there any woody vegetation > 2" diameter present? | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| If a protective soil cover is present, are run-on/runoff controls in good condition (swales, berms, riprap, etc.)? | N/A | N/A | Yes | N/A | Yes | N/A | N/A | N/A | N/A |
| If a protective soil cover is present, are signs marking the edge of the soil cover present and in good condition? | N/A | N/A | Yes | N/A | Yes | N/A | N/A | N/A | N/A |
| Are there any water supply wells constructed into the portion of the aquifer with concentrations above cleanup levels? | N/A | N/A | N/A | N/A | N/A | N/A | N/A | No | No |
| Has there been any damage to or removal/modification of groundwater remediation and/or monitoring systems? | N/A | N/A | N/A | N/A | N/A | N/A | N/A | No | No |
| If such systems were removed or modified, was prior approval given by BRAC or National Guard? | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| If system removal/modification was authorized, was removal/modification in accordance with approved plan? | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |

Comments (Attach additional pages as necessary):

(2) Soil contamination is known to exist, but cleanup levels have not yet been established through a Decision Document for this site. Likewise, there is no formal requirement for soil land use controls as the remedy selection has not been completed.

(5) Soil remediation is planned for August 2009.