



# **2021 Annual Monitoring Report**

**Highway 96 Site  
White Bear Township, Minnesota**

Highway 96 Site PRP Group

March 15, 2022

# Contents

<b>1.</b>	<b>Introduction</b>	<b>1</b>
1.1	Site Description	1
1.2	Project Background	1
1.3	Remedial Actions	2
1.3.1	Operable Unit 1 - Source Control	2
1.3.2	Operable Unit 2 - Groundwater Remediation	2
1.3.2.1	Groundwater Extraction System	3
1.3.2.2	Dewatering Sump	3
1.3.2.3	Groundwater Monitoring Program	3
1.3.3	Operable Unit 3 - Residential Drinking Water (East of Gilfillan Lake)	3
1.3.4	Operable Unit 4 - Residential Drinking Water (West of Gilfillan Lake)	3
1.3.4.1	New Residential Well Installations	5
1.3.4.2	Long-Term Groundwater Monitoring	5
<b>2.</b>	<b>Scope of the 2021 Annual Monitoring Report</b>	<b>6</b>
<b>3.</b>	<b>Hydrogeologic Update</b>	<b>6</b>
3.1	Geology	6
3.2	Hydrogeology	7
3.3	Groundwater Extraction System Performance Assessment	8
3.3.1	Extraction Well Network	8
3.3.1.1	List of Extraction Wells	8
3.3.1.2	Extraction Well Replacements	9
3.3.2	Extraction System Operation	10
3.3.3	VOC Removal	10
3.3.4	Hydraulic Containment	10
3.3.5	Pore Volume Exchanges	11
<b>4.</b>	<b>Groundwater Assessment</b>	<b>11</b>
4.1	Summary of Site Action Levels	11
4.1.1	Site Cleanup Goals (SCGs)	12
4.1.2	Health Risk Limits (HRLs)	12
4.2	Historical Overview of Groundwater Data	13
4.3	2021 Data Presentation	15
4.3.1	Perched Groundwater Unit	15
4.3.2	Lower Sand Aquifer	16
4.3.2.1	Compliance Monitoring Wells	16
4.3.2.2	Other Monitoring Wells	16
4.3.3	St. Peter Sandstone Aquifer	16
4.3.3.1	Compliance Monitoring Wells	17
4.3.3.2	Other Monitoring Wells	17
4.3.4	Prairie du Chien Aquifer	18
4.3.5	Residential Wells	18
<b>5.</b>	<b>Soil Cap Inspections</b>	<b>19</b>
<b>6.</b>	<b>Conclusions</b>	<b>19</b>

# Contents (cont'd)

7. Recommendations	20
8. References	20

## Table Index

Table 1.1	Monitoring Well Network
Table 1.2	Residential Well Network
Table 3.1	2021 Groundwater Elevations
Table 3.2	2021 Operation and Maintenance Activities
Table 3.3	2021 Average Monthly Groundwater Extraction Rates
Table 4.1	Historical Groundwater Sampling Events
Table 4.2	2021 Groundwater Analytical Data Detections - Perched Groundwater Unit Monitoring Wells
Table 4.3	2021 Groundwater Analytical Data Detections - Lower Sand Aquifer Monitoring Wells
Table 4.4	2021 Groundwater Analytical Data Detections - St. Peter Sandstone Aquifer Monitoring Wells
Table 4.5	2021 Groundwater Analytical Data Detections - Prairie du Chien Aquifer Monitoring Wells
Table 4.6	2021 Groundwater Analytical Data Detections - Residential Wells

## Figure Index

Figure 1.1	Site Location
Figure 1.2	Site Plan
Figure 1.3	Gas Monitoring Locations
Figure 1.4	Off-Site Groundwater Monitoring Network
Figure 1.5	Municipal Water System
Figure 3.1	Location of Cross Sections
Figure 3.2	Perched Groundwater Elevations (September 27, 2021)
Figure 3.3	Lower Sand/St. Peter Sandstone Aquifer Groundwater Elevations (September 27, 2021)
Figure 3.4	Upper St. Peter Sandstone Aquifer Groundwater Elevations (September 27, 2021)
Figure 3.5	Basal St. Peter Sandstone Aquifer Groundwater Elevations (September 27, 2021)
Figure 3.6	Prairie du Chien Aquifer Groundwater Elevations (September 27, 2021)
Figure 3.7	Historical TVOC Mass Removal
Figure 3.8	Historical TVOC Mass Removal Efficiency
Figure 3.9	Cumulative TVOC Mass Removal
Figure 3.10	Historical TVOC Concentrations Extraction Wells
Figure 3.11	Groundwater Extraction System Cross Section (2021)

## Figure Index (cont'd)

Figure 4.1	Historical TVOC Concentrations - LW3
Figure 4.2	Historical TVOC Concentrations - MW4D
Figure 4.3	Historical TVOC Concentrations - MW12D
Figure 4.4	Historical TVOC Concentrations - MW8B
Figure 4.5	Historical TVOC Concentrations - MW12B
Figure 4.6	Historical TVOC Concentrations - 11 Robb Farm Road
Figure 4.7	Historical TVOC Concentrations - 1 Lily Pond Road
Figure 4.8	Historical TVOC Concentrations - 11 Lily Pond Road
Figure 4.9	Historical TVOC Concentrations - 6 Blue Goose Road
Figure 4.10	Historical TVOC Concentrations - MW17L
Figure 4.11	TVOC Concentrations in Perched Groundwater (2021)
Figure 4.12	TVOC Concentrations in Lower Sand Aquifer (2021)
Figure 4.13	TVOC Concentrations in St. Peter Sandstone Aquifer (2021) - On-Site Monitoring Well Locations
Figure 4.14	TVOC Concentrations in St. Peter Sandstone Aquifer (2021) - Off-Site Monitoring Well Locations
Figure 4.15	TVOC Concentrations in Prairie du Chien Aquifer (2021)
Figure 4.16	TVOC Concentrations in Residential Wells (2021)
Figure 4.17	Vinyl Chloride Concentrations in Off-Site Monitoring Well Locations and Residential Wells (2021)

## Appendices

Appendix A	Geologic Cross Sections
Appendix B	Historical Groundwater Elevations
Appendix C	Annual Monitoring Well Sampling Summary
Appendix D	Documentation of Site Action Levels
Appendix E	Historical Analytical Data Summary
Appendix F	Laboratory Analytical Reports and Data Quality Assessment and Validation Memos
Appendix G	Historical Vinyl Chloride Detections Off-Site Monitoring Well Locations and Residential Wells

# 1. Introduction

This report presents the results of the 2021 groundwater sampling program conducted at the Highway 96 Site (Site) pursuant to the requirements of the Response Action Plan (RAP), dated January 1994, as amended and referenced in the Consent Order.

This report covers the monitoring period from January 1, 2021 to December 31, 2021.

## 1.1 Site Description

The Site is located in White Bear Township, Minnesota. The Site location is shown on Figure 1.1. The Site operated as a local disposal area from the 1920s until 1973. Primarily residential wastes were received and burned at the Site. Some drummed wastes were disposed at the Site in the late 1960s and early 1970s. The Site was comprised of two disposal areas, the North and South Disposal Areas, which encompassed 4.5 and 1.5 acres, respectively. A Site Plan is presented on Figure 1.2.

## 1.2 Project Background

In 1986, a study was conducted at the Site by the United States Environmental Protection Agency (USEPA), which identified groundwater contamination by volatile organic compounds (VOCs). The Minnesota Pollution Control Agency (MPCA) subsequently issued a Request for Response Action (RFRA) to three potentially responsible parties (PRPs): Whirlpool Corporation (Whirlpool), Reynolds Metals Company (Reynolds) and Red Arrow Waste Disposal Services. GHD Services Inc. (GHD) [known as Conestoga-Rovers and Associates (CRA) prior to July 1, 2015] was retained by Reynolds and Whirlpool in 1986 to assist with the implementation of the RFRA.

On behalf of Reynolds and Whirlpool, CRA conducted a Remedial Investigation and Feasibility Study (RI/FS). The RI involved a review of the waste disposal history, installation of monitoring wells, excavation of test pits within the waste, and groundwater monitoring of monitoring wells and nearby residential wells. The results of the RI were submitted to the MPCA in March 1988 (Ref. 1).

In response to the confirmation of groundwater contamination at the Site, Whirlpool and Reynolds proposed an Interim Response Action Plan (IRAP) in the RI Report (Ref. 1) involving the removal of drums found during the investigation and the installation of a groundwater extraction system.

In May 1988, the MPCA approved the RI/IRAP.

The FS involved the evaluation of remedial alternatives, which were presented in the Alternatives Analysis Report (Ref. 2) submitted to the MPCA in October 1988. The MPCA approved the Alternative Analysis Report in February 1989. Whirlpool and Reynolds continued with the FS by evaluating potential remedial alternatives. A Detailed Analysis Report (DAR) was submitted to the MPCA in April 1989 (Ref. 3). This evaluation included a proposed remedial plan for the Site. The MPCA did not comment on the DAR until June 1992 and approved the DAR with modifications in June 1994.

In 1993, Reynolds and Whirlpool conducted a groundwater investigation in North Oaks, Minnesota. The groundwater investigation provided a general definition of the groundwater flow system in the vicinity of the Site and the southeast portion of North Oaks. This investigation also delineated the extent of a remnant VOC plume. Vinyl chloride was the only VOC to exceed the Recommended Allowable Limit (RAL). The North Oaks Southeast Groundwater Investigation report was submitted to the MPCA in October 1993 (Ref. 4).

In January 1994, Whirlpool and Reynolds submitted the Phase I Response Action Plan (Ref. 5) to the MPCA. The Phase I Response Action Plan (Phase I RAP) outlined the activities required for the implementation of the final remedy at the Site. The MPCA approved the Phase I RAP with modifications by letter, dated March 1, 1994.

In May 1994, Whirlpool and Reynolds submitted the Phase II Response Action Plan (Ref. 6) to the MPCA. The Phase II Response Action Plan (Phase II RAP) provided additional construction details on the Phase I RAP and provided details on the installation of a dewatering sump and gas probes. The MPCA approved the Phase II RAP, with modifications by letter, dated October 3, 1994.

## 1.3 Remedial Actions

As a parallel activity to the RI/FS, interim remedial actions were implemented by Whirlpool and Reynolds. These actions included drum removal, groundwater extraction system installation, North Oaks groundwater investigation, and South Disposal Area investigation. The final remedy for the Site is divided into four operable units:

- Operable Unit 1 - Source Control
- Operable Unit 2 - Groundwater Remediation
- Operable Unit 3 - Residential Drinking Water (east of Gilfillan Lake)
- Operable Unit 4 - Residential Drinking Water (west of Gilfillan Lake)

### 1.3.1 Operable Unit 1 - Source Control

During 1987 and 1988, contractors for the responsible parties removed drums containing hazardous substances from the North Disposal Area (NDA). In 1993, additional drums were removed from the South Disposal Area (SDA). In 1994, waste from the NDA and SDA were screened using a backhoe to look for any remaining drums. Drums and drum-related waste identified during the screening process were removed and transported off-Site for disposal. The contractors also drained the pond located within the NDA. All the pond water was discharged to the sanitary sewer, the sediment and material from the pond bottom were screened, and drums of waste were removed. The drums were disposed at licensed facilities in the fall of 1995.

After screening the NDA and the pond, the contractors transferred all waste material from the SDA to the NDA. Tests of the soils underlying the SDA showed no residual contamination, and the SDA was backfilled with clean soil. The results of the SDA investigation were submitted to MPCA in January 1994 (Ref. 7). All waste material at the NDA, including the waste material transferred from the SDA, was compacted, graded, and capped with two feet (ft.) of clean soil and remains on the property. Since the waste areas were combined, the NDA has been referred to as the Consolidated Waste Area (CWA).

In the spring of 1995, six gas probes (GP-1 through GP-6) were installed in the CWA for methane monitoring, in accordance with the Post Closure Operation and Maintenance Plan (O&M Plan) (Ref. 8). The gas probe locations are shown on Figure 1.3.

The Source Control Operable Unit remedy was completed in the fall of 1995 and is discussed in further detail in the Remedial Action Final Report (Ref. 9). In response to the MPCA's comments to the Remedial Action Final Report, three passive methane vents (GV-1 through GV-3) were installed in the CWA in November of 1996. The gas vent locations are shown on Figure 1.3.

In accordance with the O&M Plan (Ref. 8) and MPCA-approved modifications in 2001 and 2015, gas probe monitoring was conducted on a routine basis through 2018. Historical monitoring results confirmed the presence of measurable levels of combustible gas within the CWA, but no clear Site-wide trend was observed, indicating that combustible gas concentrations are also likely attributed to the wetlands (swamp) setting. As approved by the MPCA on June 20, 2018, gas probe monitoring was discontinued following the October 2018 monitoring event. Historical gas probe monitoring results are documented in the 2018 Annual Monitoring Report.

### 1.3.2 Operable Unit 2 - Groundwater Remediation

The Groundwater Remediation Operable Unit began as an interim remedial action and consists of continued operation of the groundwater extraction system and groundwater monitoring.

### 1.3.2.1 Groundwater Extraction System

Since June 1989, a groundwater extraction system has operated at the Site. The extraction system collects groundwater from the Lower Sand and St. Peter Sandstone aquifers, effectively limits the spread of contamination, and removes contaminated groundwater. The contaminated groundwater is discharged directly to the sanitary sewer under a Metropolitan Council Environmental Services (MCES) special discharge permit.

### 1.3.2.2 Dewatering Sump

In late 1994, after the consolidation of the NDA and SDA, a dewatering sump was installed directly into and under the CWA to remove landfill leachate from the perched groundwater unit and reduce downward migration of VOCs into the Lower Sand aquifer. The extracted water was discharged directly into the sanitary sewer under a MCES special discharge permit. From 1995 to 2018, the Dewatering Sump performed as expected and removed approximately 90 pounds of VOCs from the perched groundwater unit before reaching the end of its operational life (i.e., no longer enough VOC mass for efficient removal). As approved by the MPCA on June 20, 2018, operation of the Dewatering Sump was discontinued on June 25, 2018. Historical operation of the dewatering sump is documented in the 2018 Annual Monitoring Report.

### 1.3.2.3 Groundwater Monitoring Program

#### ***On-Site Monitoring***

The on-Site groundwater-monitoring network includes 31 monitoring wells and two extraction wells. Seven of the 31 on-Site monitoring wells (MW10B, MW12B, MW12D, MW13B, MW13D, MW16B, and MW16D) are designated as compliance wells. The on-Site groundwater monitoring network is shown on Figure 1.2.

Groundwater samples are collected from on-Site extraction wells and select monitoring wells on an annual basis, as outlined in Table 1.1. Additional groundwater samples are collected from the on-Site extraction wells in accordance with the MCES discharge permit requirements.

#### ***Off-Site Monitoring***

From 1994 to 2008, the off-Site groundwater-monitoring network associated with Operable Unit 2 included residential wells and former residential wells that were converted to monitoring wells. The off-Site groundwater monitoring network is shown on Figure 1.4. As of August 2008, off-Site groundwater monitoring is conducted as part of Operable Unit 4 (see Section 1.3.4).

## 1.3.3 Operable Unit 3 - Residential Drinking Water (East of Gilfillan Lake)

In 1993, the Minnesota Department of Health (MDH) issued drinking water well advisories to 12 homes in North Oaks between the Site and Gilfillan Lake, because vinyl chloride had been detected in their wells at levels exceeding the health-based risk level that was in place in 1993. Reynolds and Whirlpool chose to address this off-Site contamination by connecting all 60 homes with private wells located on the east side of the lake to the White Bear Township municipal water system. These connections were completed in 1994. Figure 1.5 shows the area serviced by municipal water.

## 1.3.4 Operable Unit 4 - Residential Drinking Water (West of Gilfillan Lake)

From 1993 to 2004, Whirlpool/Reynolds and the MPCA monitored 51 residential wells located outside the municipal water service area on a regular basis, as part of the groundwater monitoring program for Operable Unit 2 (see Section 1.3.2.3). During a routine sampling event conducted in October 2004, low levels of vinyl chloride were detected in water samples collected from two residential well locations (12 West Shore Road and

13 West Shore Road). Residential well sampling was subsequently expanded to include an additional 31 residential well locations west of Gilfillan Lake. Since October 2004, Reynolds and Whirlpool have conducted extensive studies, under the supervision of the MPCA, to investigate the nature and extent of VOC contamination in residential wells located west of Gilfillan Lake. These studies included:

- 39 rounds of residential well sampling
- Installation of 13 new monitoring wells
- Vertical aquifer profiling (VAP) to provide vertical delineation of groundwater quality
- Installation of a test extraction well west of Gilfillan Lake in the Ski Lane Ravine
- A subsurface geophysical survey of Gilfillan Lake
- Continued monitoring at existing wells in North Oaks and at the Highway 96 Site in White Bear Township

CRA submitted various reports to MPCA that present the results of the studies listed above (Ref. 10, Ref.11, Ref. 12, Ref. 13, and Ref. 14).

In June 2007, the MPCA requested that Reynolds and Whirlpool complete a Feasibility Study (FS) to evaluate potential response actions for vinyl chloride contaminated groundwater on the west side of Gilfillan Lake. In July 2007, on behalf of Reynolds and Whirlpool, CRA submitted the FS Report (Ref. 15) to MPCA. In September 2007, MPCA provided comments on the FS Report. In October 2007, CRA provided responses to MPCA's comments on the FS Report. MPCA approved the FS Report, with modifications, in November 2007.

The MPCA used the FS Report to develop a Proposed Plan for an amendment to the 1993 Minnesota Decision Document (MDD) for the Highway 96 Site. The Proposed Plan outlined the preferred remedial alternative(s) for the area west of Gilfillan Lake (Operable Unit 4). The Proposed Plan was issued by MPCA on February 15, 2008. MPCA held a public meeting on February 26, 2008 and public comments on the Proposed Plan were accepted until March 21, 2008.

The MPCA reviewed the public comments on the Proposed Plan and prepared an amendment to the MDD and a Responsiveness Summary Document. The MDD amendment (MDD Amendment 1), which includes the Responsiveness Summary, was signed by MPCA on August 26, 2008. As outlined in MDD Amendment 1, the final MPCA-selected remedy for homes located within Operable Unit 4 of the Site includes:

- Provision of a new/deeper residential well in the Prairie du Chien aquifer for homes that are issued a well advisory by the MDH due to Listed VOCs<sup>1</sup>
- Long term groundwater monitoring
- Conditional installation and operation of a pump out system in the Ski Lane Ravine (in the event that vinyl chloride or another Listed VOC exceeds its respective health risk limit (HRL) in any of the Ski Lane Ravine monitoring wells)

As part of the long-term groundwater monitoring component associated with the MPCA-selected remedy for Operable Unit 4, MDD Amendment 1 called for installation of two or three angled monitoring wells beneath Gilfillan Lake, while noting that "obtaining access to residential property for the placement of the additional monitoring wells could be a potentially complicating factor." During the period from November 2007 through March 2009, CRA, on behalf of Reynolds and Whirlpool, made several attempts to negotiate access agreements with private property owners for installation of the angled wells. In a letter dated June 1, 2009, CRA provided MPCA with documentation of the access negotiations. Despite reasonable efforts, access for the angled well installations could not be obtained.

In a letter dated September 8, 2009, the MPCA acknowledged the attempts made by Reynolds and Whirlpool to obtain access and stated:

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<sup>1</sup> As identified on Table 1 of MPCA's MDD Amendment dated August 26, 2008 (1,1,2-trichloroethene (TCE), vinyl chloride, trans-1,2-dichloroethene, 1,1-dichloroethane, benzene, toluene, and methyl ethyl ketone).



*"...at this time, the MPCA will not require the Responsible Parties to continue their attempts to obtain access to private parties in order to install the proposed angle monitoring wells, nor will the Agency use its statutory authorities, such as condemnation, to gain access to private properties along the western shore of Gilfillan Lake for the purpose of installing the proposed angle monitoring wells."*

#### 1.3.4.1 New Residential Well Installations

As stipulated in MDD Amendment 1, the MPCA-selected remedy, for homes within Operable Unit 4 that have been issued a well advisory by the MDH due to Listed VOCs, is provision of a new/deeper residential well in the Prairie du Chien aquifer.

To date (March 2022), MDH has issued well advisories to three locations in Operable Unit 4 due to Listed VOCs: 13 West Shore Road (August 2007), 12 West Shore Road (December 2008), and 2 Heron Lane (November 2012). Whirlpool and Reynolds provided new/deeper replacement wells to each of these locations in accordance with the selected remedy. Detailed information regarding the replacement well installations is documented in Annual Monitoring Reports during the period from 2009 to 2013.

MDH has not issued any well advisories to homes within Operable Unit 4 since 2012.

#### 1.3.4.2 Long-Term Groundwater Monitoring

The long-term groundwater monitoring network associated with Operable Unit 4 includes off-Site monitoring wells installed by the responsible parties, former residential wells that were converted to monitoring wells, and active residential wells (see Figure 1.4).

##### ***Off-Site Monitoring Wells***

Eleven monitoring wells and one test extraction well have been installed off-Site to monitor groundwater conditions downgradient from the Highway 96 Site in the Glacial Drift/Lower Sand, St. Peter Sandstone, and Prairie du Chien aquifers. Groundwater samples are collected from these monitoring wells on an annual basis (see Table 1.1).

##### ***Converted Residential Monitoring Wells***

Five former residential wells located east of Gilfillan Lake were converted to monitoring wells following installation of the municipal water system in 1994 (see Section 1.3.3). One of the converted residential monitoring wells (6 Wren Lane) was abandoned in May 2000 at the request of the property owner (with MPCA approval). The remaining four converted residential monitoring wells (6 Blue Goose Road, 1 Lily Pond Road, 11 Lily Pond Road, 11 Robb Farm Road) are monitored on an annual basis (see Table 1.1).

##### ***Active Residential Wells***

From 2008 to 2019, residential well sampling was conducted in accordance with the monitoring program stipulated in MDD Amendment 1, which included 82 homes sampled on a semi-annual, annual, or biennial schedule.

Based on improved groundwater conditions reported over time (see Section 4.3.5), the MPCA determined that modifications to the sampling program were appropriate for monitoring potential long-term (chronic) exposure to low-level concentrations of VOCs in groundwater. The MPCA outlined their intended modifications in a second amendment to the MDD (MDD Amendment 2), which was issued draft for public comment on May 1, 2019. The MPCA held a public meeting on May 9, 2019 and accepted public comments through May 30, 2019.

The final version of MDD Amendment 2 was signed into effect on December 30, 2019. The modified (current) residential well monitoring program includes 28 homes that are sampled on an annual schedule and 42 homes that are sampled every five years (see Table 1.2).

## 2. Scope of the 2021 Annual Monitoring Report

The Annual Monitoring Report is prepared to report on required activities at the Site as described in the RAP, which include:

- A summary of groundwater elevation data
- A plot of the groundwater elevations for the perched groundwater system
- Groundwater elevation contours for the Lower Sand, St. Peter Sandstone, and Prairie du Chien aquifers
- A plot of total volatile organic compounds (TVOCs) with respect to time for selected wells
- A figure for each monitored groundwater unit showing TVOCs at each monitoring location
- An assessment of the monitoring parameters and sampling frequencies and recommendations for the addition or deletion of monitoring locations

## 3. Hydrogeologic Update

This section provides a hydrogeologic summary for the Site that includes 2021 groundwater elevation data and performance assessments of the extraction wells and the perched groundwater dewatering sump.

### 3.1 Geology

The near surface geology of the Site consists of unconsolidated glacial deposits overlying Paleozoic sedimentary bedrock. The topography of the Site is undulating, which is typical of a glacial terrain. The ground surface elevation ranges from 930 to 970 feet above mean sea level (AMSL).

The unconsolidated sediment is highly variable, ranging from clay to gravel size particles. This area has been defined as a complex intermixed deposit of glacial till with sandy loam and sandy clay loam (Ref. 16). The glacial deposit ranges in thickness from 50 to 150 feet.

The glacial deposits are typically underlain by the St. Peter Sandstone. However, erosional remnants of the younger Platteville Limestone and Glenwood Shale exist. The St. Peter Sandstone is classified as a white, fine to medium grained, well-sorted, silica sandstone. The St. Peter Sandstone ranges in thickness from 0 to 150 feet. A 13- to 20-foot thick shale layer separates the upper St. Peter Sandstone aquifer from the basal portion of the St. Peter Sandstone aquifer. The basal St. Peter Sandstone (Pigs Eye Member) is finer grained compared to the upper St. Peter Sandstone and is interbedded with siltstone and shale.

The St. Peter Sandstone is underlain by the Prairie du Chien Group. The Prairie du Chien Group consists of interbedded dolomitic limestone and sandstone. Regionally, the Prairie du Chien ranges in thickness from 0 to 250 feet.

Geologic cross-sections have been constructed west (A-A'), northwest (B-B'), and southwest (C-C') from the Site, through North Oaks (Appendix A). The cross-section lines are located on Figure 3.1. Geologic cross section A-A' extends from the Highway 96 Site westward across Gilfillan Lake through the Ski Lane Ravine area to the North Oaks Golf Course. Geologic cross-section B-B' extends from the Highway 96 Site northwest along Duck Pass Road on the northern shore of Gilfillan Lake. Geologic cross-section C-C' extends from the Dove Lane area (southwest of the Highway 96 Site) to the western shore of Gilfillan Lake.

## 3.2 Hydrogeology

There are four hydrostratigraphic units associated with the Site: perched groundwater, the unconsolidated glacial drift aquifer (Lower Sand aquifer), the St. Peter Sandstone aquifer, and the Prairie du Chien aquifer.

Groundwater elevations have been monitored at the Site since July 1987. A historical summary of groundwater elevations is presented in Appendix B. A summary of recent groundwater elevation measurements (collected September 27, 2021) is presented in Table 3.1.

A perched groundwater system is the uppermost water-bearing unit at the CWA. Perched groundwater units are topographically restricted and are typically associated with enclosed basins that collect surface runoff. The perched groundwater system at the CWA covers an area of approximately five acres and is likely influenced by the surface water and wetland areas located around the CWA.

Perched groundwater elevations historically have ranged from 909 feet to 945 feet AMSL. Groundwater flow within this unit is primarily downward to the Lower Sand aquifer. However, some horizontal migration does occur. September 2021 perched groundwater elevations are presented on Figure 3.2.

The Lower Sand aquifer is the uppermost aquifer across the Site. Groundwater is encountered within this unit at an approximate elevation of 900 feet AMSL. Regional groundwater flow within this unit is towards the west, except in areas affected by groundwater pumping. The hydraulic conductivity within the Lower Sand aquifer varies due to its heterogeneous nature and ranges from  $2 \times 10^{-3}$  cm/s to  $4 \times 10^{-5}$  cm/s. The average linear groundwater flow velocity is estimated to be 40 ft/yr (Ref. 4).

The St. Peter Sandstone aquifer is hydraulically connected to the overlying Lower Sand aquifer. The potentiometric surface of the St. Peter Sandstone aquifer is approximately 896 feet AMSL. Hence, a downward flow component exists between the Lower Sand and St. Peter Sandstone aquifers, under non-pumping conditions. Similar to the Lower Sand aquifer, groundwater flow within the St. Peter Sandstone aquifer is to the west, except in areas affected by groundwater pumping. In the vicinity of the Site, the average hydraulic conductivity of the upper portion of the St. Peter Sandstone aquifer is calculated at  $5 \times 10^{-3}$  cm/s. The average linear groundwater flow velocity for the upper portion of the St. Peter Sandstone aquifer in the vicinity of the Site is estimated at 80 ft/yr (Ref. 4).

September 2021 groundwater contours for the Lower Sand/St. Peter Sandstone aquifers on-Site are presented on Figure 3.3. The groundwater contours depict the hydraulic influence of the on-Site groundwater extraction system (see Section 3.3). Overall, groundwater elevations continue to reflect the heterogeneous nature of the Lower Sand aquifer. As noted on Figure 3.3, some Lower Sand aquifer monitoring locations are not used for groundwater contouring because they are screened in areas of low permeability soil (i.e., higher silt/clay content).

The St. Peter Sandstone can be divided into two stratigraphic sub-units immediately west of the Highway 96 Site: the upper St. Peter Sandstone and the basal St. Peter Sandstone. Lateral groundwater flow is towards the west for both the upper and basal portions of the St. Peter Sandstone aquifer. The basal St. Peter Sandstone aquifer has a lower permeability compared to the upper St. Peter Sandstone aquifer because it is interbedded with shale and siltstone. A 13 to 20-foot shale layer separates the upper and basal portions of the St. Peter Sandstone aquifer and acts as an aquitard.

September 2021 groundwater contours for the upper St. Peter Sandstone aquifer off-Site are presented on Figure 3.4. For the upper St. Peter aquifer, groundwater flow conditions are characterized by the St. Peter Sandstone monitoring wells at the Highway 96 Site along with off-Site monitoring wells located east of Gilfillan Lake (MW17A) and west of Gilfillan Lake (MW18A, MW19A, and MW21A).

September 2021 groundwater contours for the basal St. Peter Sandstone aquifer off-Site are presented on Figure 3.5. Groundwater flow conditions in the basal St. Peter Sandstone aquifer are characterized by off-Site monitoring wells (MW17B, MW18B, MW19B, and MW20B), converted residential monitoring wells located on the east side of Gilfillan Lake (1 Lily Pond, 11 Lily Pond, 6 Blue Goose and 11 Robb Farm Road), and two active residential wells located on the west side of Gilfillan Lake (6 West Shore Road and 38 East Oaks Road). Lateral groundwater flow in the basal St. Peter Sandstone aquifer is approximately 10 times slower than in the upper St. Peter Sandstone aquifer.

September 2021 groundwater contours for the Prairie du Chien aquifer off-Site are presented on Figure 3.6. Groundwater flow conditions in the Prairie du Chien aquifer are characterized by off-Site monitoring wells MW17L, MW18L, and MW19L. Lateral groundwater flow in the Prairie du Chien aquifer is regionally toward the west (Ref. 17). The Prairie du Chien aquifer underlies the basal St. Peter Sandstone aquifer. The Prairie du Chien has a higher hydraulic conductivity compared to the St. Peter Sandstone, which is attributed to its high fracture density. Based on single well response test data, the hydraulic conductivity of the Prairie du Chien aquifer ranges from 0.03 cm/s to 0.07 cm/s (72 ft/d to 187 ft/d) (Ref. 12), which is comparable to known published values. Applying a regional hydraulic gradient of 0.001 ft/ft and an effective porosity of 0.056 (Ref. 17), the groundwater flow velocity in the Prairie du Chien ranges from 470 to 1,220 ft/yr. This range of flow velocity is attributed to the varying degrees of fractures present in the Prairie du Chien aquifer.

## 3.3 Groundwater Extraction System Performance Assessment

Since June 1989, operation of an on-Site groundwater extraction system in the Lower Sand/St. Peter Sandstone aquifers has prevented migration of VOCs from the Site. In addition to providing hydraulic containment, the groundwater extraction system removes VOCs from the Lower Sand/St. Peter Sandstone aquifers. The extracted groundwater is discharged directly into the sanitary sewer under a MCES special discharge permit.

### 3.3.1 Extraction Well Network

#### 3.3.1.1 List of Extraction Wells

Hydraulic containment and VOC removal associated with the groundwater extraction system has been achieved through operation of the following extraction wells:

##### ***EW1***

- Installed in 1989 (Lower Sand aquifer)
- Replaced in 2005 by EW2 (see below)
- Currently used only for hydraulic monitoring

##### ***EW1A***

- Installed in 1995 (Lower Sand aquifer) to supplement EW1
- Replaced in 2010 by EW1B (see below)
- Sealed in 2021

##### ***EW1B***

- Installed in 2010 (Lower Sand aquifer) to replace EW1A
- Replaced in 2021 by EW1C (see below)
- Currently used only for hydraulic monitoring

##### ***EW1C***

- Installed in 2021 (Lower Sand aquifer) to replace EW1B
- Current/active pumping well (see Tables 3.2 and 3.3 for 2021 operation information)

##### ***EW2***

- Installed in 2005 (Upper St. Peter Sandstone aquifer) to replace EW1

- Replaced in 2021 by EW2A (see below)
- Currently used only for hydraulic monitoring

### **EW2A**

- Installed in 2021 (Upper St. Peter Sandstone aquifer) to replace EW2
- Current/active pumping well (see Tables 3.2 and 3.3 for 2021 operation information)

## **3.3.1.2 Extraction Well Replacements**

### **2005**

The gradual decline of the pumping capacity at the original extraction well (EW1) had been noted in previous annual monitoring reports. The decline of EW1 was attributed to iron fouling and possible deterioration of the well casing. The decline was expected to continue and the need for a replacement well was inevitable to maintain flexibility within the groundwater extraction system and ensure hydraulic containment. A new extraction well (EW2) was installed in September 2005 and began operation in January 2006, replacing EW1. A hydraulic response to pumping at EW2 was observed in both the Lower Sand and St. Peter Sandstone aquifers and the installation and operation of EW2 met MPCA's requirements with respect to pumping rate and effluent water quality. Installation and performance testing results were presented to MPCA in February 2006 (Ref. 11).

### **2010**

Over 15 years of operation, EW1A productivity declined due to bio-fouling of the well screen and surrounding formation. As noted in previous annual monitoring reports, numerous well rehabilitation events had been performed to address the fouling issues and re-establish productivity at EW1A. In 2009, EW1A showed minimal improvement to rehabilitation efforts. Continued groundwater extraction from the Lower Sand aquifer is needed to maintain a factor of safety in hydraulic capture and provide operational flexibility in the extraction system (i.e., avoid sole reliance on EW2). Therefore, CRA proposed to replace EW1A with a new extraction well (EW1B). In February 2010, CRA submitted a Work Plan to MPCA for installation of a new/replacement extraction well (Ref. 18). MPCA approved the Work Plan, with comments on March 10, 2010. The new extraction well (EW1B) was installed in April 2010 and began operation in May 2010, replacing EW1A. A hydraulic response to combined pumping at EW1B and EW2 was observed in both the Lower Sand and St. Peter Sandstone aquifers. Installation and performance testing results were presented to MPCA in July 2010 (Ref. 19).

### **2021**

Over 11 years of operation, EW1B productivity declined due to bio-fouling of the well screen and surrounding formation. As noted in previous annual monitoring reports, numerous well rehabilitation events had been performed to address the fouling issues and re-establish productivity at EW1B. In May 2021, EW1B showed minimal improvement to rehabilitation efforts. The increasingly poor response to well rehabilitation was an indication that well replacement would be necessary in the near future. Given site conditions/circumstances surrounding EW2 (see below), GHD recommended replacement of EW1B with a new Lower Sand Aquifer extraction well (EW1C) to maintain the factor of safety in hydraulic containment and provide long-term operational flexibility in the extraction.

Over 16 years of operation, EW2 productivity remained relatively consistent with only slight declines in specific capacity, which were resolved by routine well rehabilitation. In June 2021, a significant amount of sand entered the well casing of EW2 during routine mechanical rehabilitation. The well contractor used a downhole camera to investigate the issue and identified a corroded area (hole) inside the well casing, approximately 7 feet above the screen, rendering EW2 inoperable. GHD evaluated alternatives for restoring groundwater extraction from the St. Peter Sandstone Aquifer and recommended replacement of EW2 with a new St. Peter Sandstone Aquifer extraction well (EW2A).

In September 2021, GHD submitted a Work Plan to MPCA for replacing extraction wells EW1B and EW2 (Ref. 20). MPCA approved the Work Plan, with comments, on September 28, 2021. Former extraction well EW1A was

abandoned to create the site access necessary to install new extraction wells. The new extraction wells (EW1C and EW2A) were installed in October/November 2021 and commissioned in December 2021, replacing EW1B and EW2. A hydraulic response to combined pumping at EW1C and EW2A was observed in both the Lower Sand and St. Peter Sandstone aquifers. Installation and performance testing results were presented to MPCA in March 2022 (Ref. 21).

### 3.3.2 Extraction System Operation

Operation and maintenance activities conducted in 2021 are summarized in Table 3.2.

In 2021, EW1B/EW1C and EW2/EW2A operated at a combined average pumping rate of 14.0 gpm. The 2021 average monthly extraction rates for EW1B/EW1C and EW2/EW2A are summarized in Table 3.3.

### 3.3.3 VOC Removal

From January 1, 2021 through December 31, 2021, approximately 4.6 million gallons of groundwater were extracted by EW1B/EW1C, removing approximately 4.6 pounds of VOCs from the Lower Sand/St. Peter Sandstone aquifers. Since 1989, approximately 205 pounds of VOCs have been removed by EW1/EW1A/EW1B/EW1C.

From January 1, 2021 through December 31, 2021, approximately 2.8 million gallons of groundwater were extracted by EW2/EW2A, removing approximately 1.3 pounds of VOCs from the Lower Sand/St. Peter Sandstone aquifers. Since 2006, approximately 39 pounds of VOCs have been removed by EW2/EW2A.

Since 1989, a combined total of approximately 360 million gallons of groundwater and 244 pounds of VOCs have been removed from the Lower Sand/St. Peter Sandstone by EW1/EW1A/EW1B/EW1C and EW2/EW2A. Figure 3.7 illustrates historical VOC mass removal (per year), Figure 3.8 illustrates historical VOC removal efficiency (in pounds per million gallons), and Figure 3.9 illustrates cumulative VOC mass removal since 1989.

Figure 3.10 shows historic TVOC concentrations over time for EW1/EW1A/EW1B/EW1C and EW2/EW2A. As typically seen in groundwater extraction systems, TVOCs at EW1/EW1A declined during the initial pumping years from 1989 through 1996. From 1996 through 2005, TVOCs at EW1/EW1A remained at levels between 50 and 100 µg/L. When EW2 replaced EW1 in 2006, TVOCs at EW1A began increasing to levels between 100 µg/L and 300 µg/L. The increase in TVOC concentrations at EW1A was almost entirely due to increased 1,1,2-trichloroethene (TCE) concentrations. The increased TCE concentrations are likely attributed to a combination of delayed migration from the CWA and changes in the volume of groundwater extracted from the Lower Sand aquifer.

Delayed migration refers to the later release of VOCs to the Lower Sand aquifer. The CWA is located above a perched groundwater unit that is hydraulically isolated from the regional water table aquifer such that the downward migration of VOCs to the water table aquifer occurs through a zone of partially saturated soil. The rate of downward migration through this partially saturated zone is substantially less than under saturated soil conditions and is dependent on several variable parameters, such as moisture content, soil permeability, and pressure head. Hence, the downward migration rate and time required to reach the water table aquifer can vary both spatially and temporally underneath the CWA.

Changes in the volume of groundwater extracted from the Lower Sand aquifer (EW1A) occurred in conjunction with combined groundwater extraction from the upper St. Peter Sandstone aquifer (EW2), which began in 2006. TCE concentrations in the Lower Sand aquifer increased following commission of EW2 and as production decreased at EW1A due to bio-fouling issues (see Section 3.3.1). TCE concentrations in the Lower Sand aquifer have generally decreased since commission of EW1B in May 2010, except for increased concentrations observed in October 2011 when EW1B was temporarily shut down for repair.

### 3.3.4 Hydraulic Containment

A groundwater capture analysis was presented in CRA's July 2010 report (Ref. 19). Based on aquifer testing results referenced in the report, CRA recommended that the groundwater extraction system (EW1B and EW2) should operate at a combined pumping rate between 13 and 20 gpm to obtain a groundwater capture width of 200-300 ft and achieve

sufficient hydraulic containment to prevent migration of VOCs from the Site. Based on the 2021 combined average pumping rate of 14.0 gpm (see Table 3.3), the groundwater capture width in the Lower Sand aquifer and the upper portion of the St. Peter Sandstone aquifer was approximately 214 feet (measured at the pumping source). Groundwater elevation measurements collected on September 27, 2021 provide verification of hydraulic containment of the VOC plume (see Figure 3.3).

Groundwater analytical results also provide verification of hydraulic containment. Figure 3.11 presents a cross-section of the groundwater extraction system and depicts subsurface conditions along with 2021 groundwater sampling results for vinyl chloride. As shown on Figure 3.11, the groundwater extraction system captures contaminated groundwater from upgradient areas (e.g., as screened by monitoring wells MW4D and MW8B) and the effectiveness of the system is confirmed by low to non-detectable VOC concentrations at downgradient compliance wells and converted residential monitoring wells located east of Gilfillan Lake (see Section 4.3).

### 3.3.5 Pore Volume Exchanges

The number of pore volume exchanges since operation of the groundwater extraction system began in 1989 can be estimated based on an assumed contaminated aquifer volume. The area would encompass the CWA from EW1 to P3 in an east-west direction (500 feet) and MW1D to P4 in a north-south direction (450 feet). Assuming an aquifer thickness of 60 feet and a porosity of 30 percent, the aquifer volume would be 4,050,000 ft<sup>3</sup>, or approximately 30 million gallons. Since 1989, a combined total of approximately 360 million gallons of groundwater have been removed, which is equivalent to approximately 12 pore volume exchanges.

## 4. Groundwater Assessment

Groundwater sampling associated with the Highway 96 Site has been ongoing since 1986. A total of 84 rounds of groundwater sampling have been conducted at a combination of on-Site monitoring wells, off-Site monitoring wells, converted residential monitoring wells, and active residential wells. A summary of historical groundwater sampling events is provided in Table 4.1.

Groundwater sampling events conducted during 2021 are summarized in the following paragraphs.

### ***2021 Annual Monitoring Well Sampling Event***

During the period from September 27, 2021 through October 28, 2021, 18 on-Site monitoring wells and 15 off-Site monitoring wells (including the converted residential monitoring wells) were sampled as part of the Annual Monitoring Well Sampling Program (see Section 1.3.2.3) and as proposed in GHD's letter to the MPCA dated September 7, 2021. A sampling summary associated with the 2021 Annual Monitoring Well Sampling Event is presented in Appendix C and a discussion of the 2021 sampling results is presented in Section 4.3.

### ***October 2021 Residential Well Sampling Event***

During the period from October 6-7, 2021, 25 residential wells were sampled as part of the long-term groundwater monitoring program for Operable Unit 4 (see Section 1.3.4.2) and as proposed in GHD's letter to the MPCA dated September 7, 2021. Vinyl chloride was not detected at any of the residential well locations sampled in October 2021 (see Section 4.3.5). A complete description of the October 2021 residential well sampling event and the associated analytical results was previously submitted to the MPCA in GHD's "October 2021 Residential Well Sampling Event Data Report", dated December 7, 2021.

## 4.1 Summary of Site Action Levels

Two sets of Site action levels are used to evaluate groundwater data associated with the Highway 96 Site: Site Cleanup Goals (SCGs) and Health Risk Limits (HRLs).

## 4.1.1 Site Cleanup Goals (SCGs)

SCGs are established in Amended Table 1 of the 1993 MDD and apply to compliance monitoring wells in Operable Unit 2. The 1993 MDD originally stipulated that SCGs applied to all current and future groundwater monitoring points on the Site (defined as all wells east of Robb Farm Road). Since 1993, the list of monitoring points where SCGs apply has been modified by MPCA. The current list of Operable Unit 2 compliance monitoring wells where SCGs apply includes: MW10B, MW12B, MW12D, MW13B, MW13D, MW16B, and MW16D. The list of SCGs (Amended Table 1 of the 1993 MDD) is provided in Appendix D.1.

In May 2010, Wenck Associates (on behalf of the City of North Oaks) requested that this section of the Annual Monitoring Report include clarification provided by MPCA in a letter dated August 26, 2009 regarding the rationale for the selection of the SCG for vinyl chloride. In their letter dated August 26, 2009, the MPCA stated:

*"Groundwater cleanup levels in the original Table 1 of the October 7, 1993 MDD included the Minnesota Department of Health (MDH) Recommended Allowable Limit (RAL) for vinyl chloride of 0.1 µg/L. After submitting a Response Action Plan on January 26, 1994, the RPs took the position that the cleanup level for vinyl chloride was unattainable using a groundwater extraction/containment-type technology. On March 25, 1994, MPCA staff met with the RPs, and agreed to re-examine the cleanup level for vinyl chloride. On April 13, 1994, Whirlpool and Reynolds proposed an amended cleanup level for vinyl chloride of 2 µg/L that was based on a technical rationale (i.e., Site specific information). The technical rationale was based, in part, on the observed attenuation of 1,1-dichloroethane (1,1-DCA), another contaminant of concern at the Site, versus migration distance from the Site and on the assumption that the attenuation of vinyl chloride would parallel that of 1,1-DCA. This rationale predicted that a vinyl chloride concentration of 2 µg/L at the Site would attenuate to less than 0.03 µg/L at the west shore of Gilfillan Lake. On October 3, 1994, after several meetings and discussions with the RPs, the MPCA concluded that a cleanup level of 2 µg/L for vinyl chloride "[was] protective of human health, welfare and the environment, and [did] not allow for further degradation of the groundwater resources of the area." The MPCA agreed to change the Site cleanup level for vinyl chloride to 2 µg/L, following the execution of the Consent Order (CO). The CO, which included the MDD with amended Table 1 as Exhibit A, was executed on January 9, 1995."*

## 4.1.2 Health Risk Limits (HRLs)

HRLs apply to residential wells in Operable Unit 4, as stipulated in Table 1 of MDD Amendment 1. Operable Unit 4 is defined as residential areas without municipal water, as shown on Figure 1 of MDD Amendment 1. Excerpts from MDD Amendment 1 (including Figure 1 and Table 1) are provided in Appendix D.2.

Since MDD Amendment 1 was issued, the MDH has repealed or promulgated new HRLs for six of the seven Listed VOCs as summarized below:

- 1,1-Dichloroethane [HRL repealed in 2015]
- Benzene [2009 HRL - 2 µg/L; previous HRL - 5 µg/L]
- Toluene [2011 HRL - 200 µg/L; previous HRL - 1,000 µg/L]
- trans-1,2-Dichloroethene [2013 HRL - 40 µg/L; previous HRL - 100 µg/L]
- TCE [2015 HRL - 0.4 µg/L; previous HRL - 5 µg/L]
- Vinyl Chloride [2018 HRL – 0.2 µg/L; previous HRL 0.2 µg/L (no change)]

Since MDD Amendment 1 was issued, the MDH has issued new Health Based Guidance (HBG) in the form of Health Based Values (HBVs) or Risk Assessment Advice (RAA) for three of the seven Listed VOCs as summarized below:

- 1,1-Dichloroethane [2016 RAA - 80 µg/L; previous HRL (1993) - 70 µg/L repealed in 2015]
- Toluene [2020 HBV – 70 µg/L; current HRL (2011) – 200 µg/L]



- trans-1,2-Dichloroethene [2020 HBV - 9 µg/L; current HRL (2013) - 40 µg/L]

HBVs are developed as interim guidance until they are promulgated as new HRLs through formal rulemaking. RAAs may be based on more limited data than HRLs or may use new methodology. Where multiple HBG criteria are available, the lowest criterion is used for screening purposes.

Laboratory reporting limits are reviewed on an annual basis (and adjusted, if necessary) to ensure they remain inclusive of any new HBVs/RAAs that are issued or new HRLs that have been promulgated for Listed VOCs.

#### **Status of MDH HRL Rule Revision for Vinyl Chloride**

In a letter from CRA to MPCA dated July 26, 2007, Whirlpool and Reynolds made the commitment to include as part of the Highway 96 Site Annual Monitoring Report, a status update on the MDH HRL Rule Revision for vinyl chloride.

- The original HRL for vinyl chloride (0.2 µg/L) was established by the MDH in 1993/1994.
- In December 2004, the MDH proposed a draft revised HRL for vinyl chloride (0.08 µg/L), as part of the 2004 Draft HRL Rule Revision.
- In April 2007, the MDH withdrew the proposed draft revised HRL for vinyl chloride.
- In September 2007, the MDH recommended that the HRL for vinyl chloride be included on the list of compounds to be reviewed as part of the Draft HRL Rule Revision.
- In February 2008, MDH completed their review of the HRL for vinyl chloride and proposed that the HRL remain at 0.2 µg/L (no change).
- In July 2008, MDH posted a draft of the Proposed HRL Rule Revision and Statement of Need and Reasonableness (SONAR), a technical document explaining and supporting the revised Rules.
- In September 2008, a copy of the July 2008 Proposed HRL Rule Revision was published in the State Register.
- In October 2008, a public hearing on the July 2008 Proposed HRL Rule Revision was held before an Administrative Law Judge. The hearing was followed by a 20-day comment period (ending October 30, 2008) and a five-day rebuttal period (ending November 6, 2008).
- In April 2009, the July 2008 Proposed HRL Rule Revision was adopted (Minnesota Administrative Rules Parts 4717.7810 through 4717.7900).
- The 2009 HRL for vinyl chloride was established as 0.2 µg/L (no change).
- In March 2017, the MDH issued new HBVs for vinyl chloride. HBVs were established for multiple exposure duration categories (e.g., acute, chronic). The exposure category with the lowest HBV was cancer (0.2 µg/L) which is equal to the 2009 HRL (no change).
- In August 2018, the MDH promulgated new HRLs for vinyl chloride, replacing the previous 2009 HRL. The exposure category with the lowest HRL was cancer (0.2 µg/L) which is equal to the previous HRL (no change).

Specific information regarding the MDH HRL Rule Revision can be obtained by contacting the MDH or by visiting the MDH website:

<https://www.health.state.mn.us/communities/environment/risk/guidance/gw/table.html>

## **4.2 Historical Overview of Groundwater Data**

Groundwater analytical laboratory data are validated for quality assurance by GHD and compiled into a computer database for the purpose of data management and reporting. Groundwater data are managed according to five groundwater units/groupings:

- Perched groundwater unit
- Lower Sand aquifer
- St. Peter Sandstone aquifer
- Prairie du Chien aquifer

– Residential wells

A historical data summary, which identifies chemical concentrations of VOCs over time at each monitoring location, is presented in Appendix E. Historical VOC data for the current compliance monitoring wells (MW10B, MW12B, MW12D, MW13B, MW13D, MW16B, and MW16D) are provided in Appendix E.1. Historical VOC data for all other monitoring wells are provided in Appendix E.2. Historical VOC data for residential wells are presented in Appendix E.3.

A series of graphs showing historical TVOC concentrations for select wells representing each groundwater unit are presented on Figure 3.10 and Figures 4.1 through 4.10.

TVOC concentrations in the perched groundwater unit are represented by LW3 (Figure 4.1).

- LW3 data represent perched groundwater conditions beneath the limits of the CWA. Figure 4.1 illustrates TVOC concentrations in the perched groundwater unit decreasing from 1987 through 1991 and remaining relatively stable and less than 50 µg/L since 2001. In 2021, the TVOC concentration at LW3 was 7.41 µg/L.

TVOC concentrations in the Lower Sand aquifer are represented by MW4D (Figure 4.2), EW1/EW1A/EW1B/EW1C (Figure 3.10), and MW12D (Figure 4.3).

- MW4D data represent groundwater conditions in the Lower Sand aquifer immediately downgradient of the CWA. Figure 4.2 illustrates TVOC concentrations at MW4D decreasing from 1987 through 1991 and ranging from 50 µg/L to 500 µg/L since 1991. In 2021, the TVOC concentration at MW4D was 403.4 µg/L.
- EW1/EW1A/EW1B/EW1C data represent groundwater from the Lower Sand and St. Peter Sandstone aquifers that is captured by the extraction system. Figure 3.10 illustrates TVOC concentrations at EW1/EW1A/EW1B/EW1C (see Section 3.3).
- MW12D is a compliance well located between the extraction system and Robb Farm Road. MW12D data represent groundwater conditions in the Lower Sand aquifer immediately downgradient of the extraction system. Figure 4.3 illustrates TVOC concentrations at MW12D, which have historically remained below 3 µg/L since 1997. In October 1996, the TVOC concentration was near 400 µg/L. That sample result is considered anomalous because TVOC concentrations were not observed at or near that level prior to or after that sample date. In 2021, no VOCs were detected at MW12D.

TVOC concentrations in the St. Peter Sandstone aquifer, are represented by MW8B (Figure 4.4), EW2/EW2A (Figure 3.10), MW12B (Figure 4.5), and the four converted residential monitoring wells (Figures 4.6 through 4.9).

- MW8B is located between the CWA and the groundwater extraction system. MW8B data represent groundwater conditions in the St. Peter Sandstone aquifer immediately downgradient of the CWA. Figure 4.4 illustrates TVOC concentrations at MW8B, which have ranged from 1 µg/L to 300 µg/L since sampling began in 1987. TVOC concentrations at MW8B have remained below 100 µg/L since the commission of extraction well EW2 in January 2006. In 2021, the TVOC concentration at MW8B was 83.11 µg/L.
- EW2/EW2A data represent groundwater from the Lower Sand and St. Peter Sandstone aquifers that is captured by the extraction system. Figure 3.10 illustrates TVOC concentrations at EW2/EW2A (see Section 3.3).
- MW12B is a compliance well located between the extraction system and Robb Farm Road. MW12B data represent groundwater conditions in the St. Peter Sandstone aquifer immediately downgradient of the extraction system. Figure 4.5 illustrates TVOC concentrations at MW12B, which have historically remained below 6 µg/L since 1997. In 2021, no VOCs were detected at MW12B.
- Data from the four converted residential monitoring wells represent groundwater conditions in the St. Peter Sandstone aquifer further downgradient of the Highway 96 Site. Figure 4.6 illustrates that TVOC concentrations at 11 Robb Farm Road decreased from 1989 through 1992 and have remained relatively stable (below 10 µg/L) since 1990. In 2021, no VOCs were detected at 11 Robb Farm Road. Figure 4.7 illustrates that TVOC concentrations at 1 Lily Pond Road have fluctuated between not detected and 30 µg/L since sampling began in 1990 and have been steadily decreasing since 2009. TVOC concentrations at 1 Lily Pond Road are historically higher than the other converted residential wells, which is most likely attributed to the relative (higher) elevation of its open hole interval (see Appendix A). In 2021, the TVOC concentration at 1 Lily Pond Road was 12.9 µg/L. Figure 4.8 illustrates that TVOC concentrations at 11 Lily Pond Road have typically remained below 5 µg/L since

1996. In 2021, no VOCs were detected at 11 Lily Pond Road. Figure 4.9 illustrates that TVOC concentrations at 6 Blue Goose Road have remained below 5 µg/L since 1997. In 2021, no VOCs were detected at 6 Blue Goose Road. The overall decline of TVOC concentrations at the four converted residential monitoring well locations can be attributed to Site remediation activities and natural attenuation.

TVOC concentrations in the Prairie du Chien aquifer are represented by MW17L (Figure 4.10).

- MW17L data represent groundwater conditions in the Prairie du Chien aquifer downgradient of the Highway 96 Site. Figure 4.10 illustrates that TVOC concentrations at MW17L have remained below 10 µg/L since sampling began at this location in 2005. In 2021, no VOCs were detected at MW17L.

TVOC concentrations in each groundwater unit will continue to be evaluated through future groundwater monitoring.

## 4.3 2021 Data Presentation

Laboratory analytical reports for samples collected in 2021 are presented in Appendix F. Analytical data was reviewed by the GHD quality control/quality assurance (QA/QC) officer. Data quality assessment and validation memos are also presented in Appendix F.

Analytical results for 2021 groundwater samples collected from the perched groundwater unit, Lower Sand aquifer, St. Peter Sandstone aquifer, and Prairie du Chien aquifer monitoring wells are presented in Tables 4.2 through 4.5, respectively. Analytical results for 2021 groundwater samples collected from residential wells are presented in Table 4.6.

To illustrate the analytical results, Figures 4.11 through 4.16 show the distribution of TVOCs detected in 2021 groundwater samples collected from the perched groundwater unit, Lower Sand aquifer, St. Peter Sandstone aquifer (on-Site monitoring wells), St. Peter Sandstone aquifer (off-Site monitoring wells), Prairie du Chien aquifer, and in residential wells, respectively.

### 4.3.1 Perched Groundwater Unit

Five perched groundwater monitoring wells (LW2, LW3, MW1S, MW4U, and SUMP) were sampled in 2021. Perched groundwater well LW1 could not be sampled due to insufficient water (see Appendix C). Perched groundwater analytical results from 2021 are presented in Table 4.2 and on Figure 4.11. Historical perched groundwater VOC results are presented in Appendix E.2.

#### **Compliance Monitoring Wells**

None of the perched groundwater monitoring well locations are included in the current list of compliance wells.

#### **Other Monitoring Wells**

VOCs detected in 2021 groundwater samples collected from the perched groundwater unit include: 1,1-dichloroethane, 1,2-dichloroethane, acetone, benzene, chloroethane, cis-1,2-dichloroethene, dichlorodifluoromethane, dichlorofluoromethane, ethyl ether, trans-1,2-dichloroethene, TCE, vinyl chloride, and total xylenes. Detections of these VOCs are generally consistent with historical sampling results.

For comparison purposes, vinyl chloride was the only VOC detected in perched groundwater monitoring well samples collected in 2021 at a concentration above SCGs [*which are established for compliance wells only*]. In 2021, vinyl chloride was detected above its SCG (2 µg/L) at MW4U (4.4 µg/L). Monitoring well MW4U is located between the CWA and the groundwater extraction system and represents perched groundwater conditions immediately downgradient of the CWA.

The 2021 chloride concentrations in the perched groundwater unit ranged from 26 mg/L (MW1S) to 200 mg/L (MW4U). Chloride has historically been detected in the perched groundwater unit at concentrations below 5,000 mg/L.

## 4.3.2 Lower Sand Aquifer

Nine Lower Sand aquifer monitoring wells (EW1B, EW1C, MW1D, MW4D, MW4S, MW11D, MW12D, MW13D, and MW16D) were sampled in 2021. Lower Sand aquifer well MW10D was inaccessible and could not be sampled (see Table 1.1). Lower Sand aquifer analytical results from 2021 are presented in Table 4.3 and on Figure 4.12. Historical Lower Sand aquifer VOC results at the current compliance monitoring wells and other monitoring wells are presented in Appendix E.1 and Appendix E.2, respectively.

### 4.3.2.1 Compliance Monitoring Wells

The Lower Sand aquifer compliance wells (MW12D, MW13D, and MW16D) are located on Site, near the east side of Robb Farm Road and represent groundwater conditions in the Lower Sand aquifer immediately downgradient of the on-Site extraction system. VOCs detected in 2021 in Lower Sand aquifer compliance well samples include: 1,1-dichloroethane (1.1 µg/L at MW13D) and cis-1,2-dichloroethene (0.83 µg/L at MW13D). Similar low-level VOC detections have been observed intermittently in historical sampling results.

All 2021 VOC results from the Lower Sand aquifer compliance wells were either non-detect or below their respective SCGs.

For comparison purposes, all 2021 VOC results from the Lower Sand aquifer compliance wells were also below MDH HBGs [which are established for private drinking water supplies].

### 4.3.2.2 Other Monitoring Wells

The remaining Lower Sand aquifer monitoring wells (EW1B, EW1C, MW1D, MW4D, MW4S, MW10D, and MW11D) are located between the CWA and Robb Farm Road. VOCs detected in 2021 in the other Lower Sand aquifer monitoring well samples include: 1,1-dichloroethane, 1,1-dichloroethene, 1,2-dichloroethane, benzene, chloroethane, cis-1,2-dichloroethene, dichlorodifluoromethane, dichlorofluoromethane, tetrachloroethene, toluene, trans-1,2-dichloroethene, TCE, vinyl chloride, and total xylenes. Detections of these VOCs are generally consistent with historical sampling results.

For comparison purposes, 1,1-dichloroethane, 1,2-dichloroethane, benzene, cis-1,2-dichloroethene, TCE, and vinyl chloride were the only VOCs detected in samples collected from the other (non-compliance) Lower Sand aquifer monitoring wells in 2021 at concentrations above SCGs [which are established for compliance wells only]. In 2021, 1,1-dichloroethane was detected above its SCG (70 µg/L) at MW4D (130 µg/L), 1,2-dichloroethane was detected above its SCG (4 µg/L) at MW4D (7.9 µg/L), benzene was detected above its SCG (5 µg/L) at MW4D (5.8 µg/L), cis-1,2-dichloroethene was detected above its SCG (70 µg/L) at MW4D (71 µg/L), TCE was detected above its SCG (5 µg/L) at EW1B/EW1C (maximum concentration reported was 130 µg/L), and vinyl chloride was detected above its SCG (2 µg/L) at EW1B/EW1C (maximum concentration reported was 16 µg/L), MW4D (63 µg/L), and MW4S (6.9 µg/L). Monitoring wells MW4D and MW4S are located between the CWA and the groundwater extraction system and represent groundwater conditions in the Lower Sand aquifer immediately downgradient of the CWA, prior to capture by the extraction system. EW1B/EW1C represents groundwater from the Lower Sand and St. Peter Sandstone aquifers that is captured by the extraction system.

The 2021 chloride concentrations in the Lower Sand aquifer ranged from 30 mg/L (MW1D) to 290 mg/L (MW4D). Chloride has historically been detected in the Lower Sand aquifer at concentrations below 1,000 mg/L.

## 4.3.3 St. Peter Sandstone Aquifer

Nineteen St. Peter Sandstone aquifer monitoring wells (MW8B, MW10B, MW12B, MW13B, MW16B, MW17A, MW17B, MW18A, MW18B, MW19A, MW20B, MW21A, EW2, EW2A, EW3, and the four converted residential monitoring wells) were sampled in 2021. St. Peter Sandstone aquifer well MW19B was inaccessible and could not be sampled (see Table 1.1). St. Peter Sandstone aquifer analytical results from 2021 are presented in Table 4.4 and on Figure 4.13 (on-Site monitoring locations) and Figure 4.14 (off-Site monitoring locations). Historical St. Peter

Sandstone aquifer VOC results at the current compliance monitoring wells, and other monitoring wells are presented in Appendix E.1 and Appendix E.2, respectively.

#### 4.3.3.1 Compliance Monitoring Wells

The St. Peter Sandstone aquifer compliance wells (MW10B, MW12B, MW13B, and MW16B) are located on Site, near the east side of Robb Farm Road and represent groundwater conditions in the St. Peter Sandstone aquifer immediately downgradient of the on-Site extraction system. In 2021, no VOCs were detected in the St. Peter Sandstone aquifer compliance well samples.

#### 4.3.3.2 Other Monitoring Wells

The remaining St. Peter Sandstone aquifer monitoring wells are located both on Site and off Site.

##### ***On-Site St. Peter Sandstone Aquifer Monitoring Wells***

St. Peter Sandstone aquifer monitoring wells MW8B, EW2, and EW2A are located on Site between the CWA Robb Farm Road. VOCs detected in 2021 samples collected from MW8B and EW2/EW2A include: 1,1-dichloroethane, 1,2-dichloroethane, benzene, chloroethane, cis-1,2-dichloroethene, dichlorodifluoromethane, dichlorofluoromethane, ethylbenzene, toluene, trans-1,2-dichloroethene, TCE, vinyl chloride, and total xylenes. Detections of these VOCs are generally consistent with historical sampling results.

For comparison purposes, vinyl chloride was the only VOC detected in samples collected from the other (non-compliance) on-site St. Peter Sandstone aquifer monitoring wells in 2021 at concentrations above SCGs *[which are established for compliance wells only]*. In 2021, vinyl chloride was detected above its SCG (2 µg/L) at EW2/EW2A (maximum concentration reported was 16 µg/L) and MW8B (11 µg/L). MW8B is located between the CWA and the groundwater extraction system and represents groundwater conditions in the St. Peter Sandstone aquifer immediately downgradient of the CWA, and prior to capture by the groundwater extraction system. EW2/EW2A represents groundwater from the St. Peter Sandstone aquifer that is captured by the extraction system.

The 2021 chloride concentrations in on-Site St. Peter Sandstone aquifer monitoring wells ranged from 1.7 mg/L (MW10B) to 64 mg/L (MW8B). Chloride has historically been detected in groundwater samples from on-Site St. Peter Sandstone aquifer wells at similar concentrations.

##### ***Off-Site St. Peter Sandstone Aquifer Monitoring Wells***

St. Peter Sandstone aquifer monitoring wells MW17A, MW17B, MW18A, MW18B, MW19A, MW19B, MW20B, MW21A, EW3, and the four converted residential monitoring wells (6 Blue Goose Road, 1 Lily Pond Road, 11 Lily Pond Road, and 11 Robb Farm Road) are located off-Site between Robb Farm Road and the Ski Lane Ravine in North Oaks. VOCs detected in 2021 in the St. Peter Sandstone aquifer samples collected from off-Site monitoring locations include: 1,1-dichloroethane, dichlorodifluoromethane, dichlorofluoromethane, and vinyl chloride. Detections of these VOCs are generally consistent with historical sampling results.

For comparison purposes, no VOCs were detected in off-site St. Peter Sandstone aquifer monitoring well samples collected in 2021 at concentrations above MDH HBGs *[which are established for private drinking water supplies]*. In 2021, vinyl chloride was detected at its MDH HBG (0.2 µg/L) at MW17B. MW-17B is located between Robb Farm Road and Gilfillan Lake, in the area that was connected to municipal water in 1994 under Operable Unit 3 (see Section 1.3.3). Since 2005, the concentration of vinyl chloride in the St. Peter Sandstone aquifer on the east side of Gilfillan Lake, as represented by MW17A/MW17B, has ranged from not detected to 1.2 µg/L (see Appendix G), which is generally lower compared to historical vinyl chloride concentrations observed in the same area, as represented by sampling results from the former residential wells at 15/17/22 Gilfillan Road, which ranged from 1.8 ug/L to 2.5 µg/L in 1993 (see Appendix E). The lower vinyl chloride concentrations are attributed to Site remediation activities and natural attenuation.

The 2021 chloride concentrations in off-Site St. Peter Sandstone aquifer monitoring wells ranged from 2.2 mg/L (11 Lily Pond Road) to 95.0 J mg/L (MW17A). Chloride has historically been detected in groundwater samples from off-Site St. Peter Sandstone aquifer wells at similar concentrations.

#### 4.3.4 Prairie du Chien Aquifer

Three Prairie du Chien aquifer monitoring wells (MW17L, MW18L, and MW19L) were sampled in 2021. Prairie du Chien aquifer analytical results from 2021 are presented on Table 4.5 and Figure 4.15. Historical Prairie du Chien aquifer VOC results are presented in Appendix E.2.

##### **Compliance Monitoring Wells**

No Prairie du Chien aquifer monitoring wells are included in the current list of compliance monitoring wells.

##### **Other Monitoring Wells**

MW17L, MW18L, and MW19L are located off-Site and represent groundwater conditions in the Prairie du Chien aquifer, downgradient of the Highway 96 Site. VOCs detected in 2021 in the Prairie du Chien aquifer monitoring well samples include: 1,1-dichloroethane and toluene. Similar low-level VOC detections have been observed intermittently in historical sampling results.

For comparison purposes, all 2021 VOC results from the Prairie du Chien aquifer monitoring wells were below MDH HBGs *[which are established for private drinking water supplies]*.

Analytical results from MW17L, MW18L, and MW19L show that the Prairie du Chien aquifer continues to represent a suitable alternative water supply for the MPCA-selected remedy outlined in MDD Amendment 1 (i.e., installation of new/deeper wells for homes located in Operable Unit 4 that are issued a well advisory due to Listed VOCs).

The 2021 chloride concentrations in the Prairie du Chien aquifer ranged from 14.3 mg/L (MW17L) to 24.9 mg/L (MW18L). Chloride has historically been detected in groundwater samples from Prairie du Chien aquifer wells at similar concentrations.

#### 4.3.5 Residential Wells

Groundwater samples were collected from 25 residential well locations in 2021. Residential well analytical results from 2021 are presented in Table 4.6 and on Figure 4.16. Historical residential well VOC results are presented in Appendix E.3.

In 2021, vinyl chloride was not detected at any residential well location. The last reported detection of vinyl chloride in a residential well was in April 2014.

Figure 4.17 presents the vinyl chloride concentrations detected in off-Site monitoring well locations and residential wells in 2021. As shown on Figure 4.17, vinyl chloride was not detected at any residential well and was detected at one off-Site monitoring well location (east of Gilfillan Lake) in 2021 (see Section 4.3.3).

Residential well sampling conducted during the period from October 2004 through October 2021 of over 80 residential wells located in the southeast portion of North Oaks has shown that the number of residential wells west of Gilfillan Lake that have ever had detectable concentrations of vinyl chloride is limited to ten locations:

- 50 East Oaks Road (detected concentrations were below the HRL; last detected in April 2014.)
- 2 Heron Lane (well advisory issued by the MDH in 2012; well abandoned/replaced with a new/deeper well by the RPs.)
- 3 Heron Lane (detected concentration was below the HRL; not part of the long-term groundwater monitoring program for Operable Unit 4; at the direction of the MPCA, supplemental sampling was initiated in 2012 following the detection of vinyl chloride at 2 Heron Lane and discontinued in 2018 following six subsequent sampling events with no detections.)

- 1 Hummingbird Hill (detected concentrations were below the HRL; last detected in May 2013.)
- 2 Hummingbird Hill (detected concentrations were at or below the HRL; last detected in September 2009; well voluntarily abandoned and replaced with a new/deeper well by the RPs.)
- 10 West Shore Road (detected concentrations were below the HRL; last detected in April 2014.)
- 11 West Shore Road (detected concentrations were below the HRL; last detected in April 2014; home razed and well abandoned/replaced by the property owner in February 2020/March 2021.)
- 12 West Shore Road (well advisory issued by the MDH in December 2008; well abandoned and replaced with a new/deeper well by the RPs.)
- 13 West Shore Road (well advisory issued by the MDH in August 2007; well abandoned and replaced with a new/deeper well by the RPs.)
- 15 West Shore Road (detected concentrations were at or below the HRL; last detected in April 2014.)

Graphs of historical vinyl chloride concentrations for off-Site monitoring well locations and the above-referenced residential wells where vinyl chloride has been detected are presented in Appendix G.

VOCs detected in the residential well samples collected in 2021 include: cis-1,2-dichloroethane (0.22 J µg/L at 4 Ski Lane). Similar low-level VOC detections have been observed in historical sampling results.

All 2021 VOC results from residential wells were either non-detect or below MDH HBGs for private water supplies.

The 2021 chloride concentrations in the residential wells ranged from 5.1 mg/L (8 West Shore Road) to 137 mg/L (4 Thompson Lane). Chloride has historically been detected at similar concentrations in residential well samples.

## 5. Soil Cap Inspections

In accordance with the O&M Plan (Ref. 8) and MPCA-approved modifications on July 19, 2001, soil cap inspections were conducted on a semi-annual basis through 2014. Beginning in 2015, the frequency of soil cap inspections was reduced from semi-annually to annually, as recommended in the 2014 Annual Monitoring Report and approved by the MPCA on April 23, 2015.

The annual soil cap inspection was performed during the fourth quarter of 2021. The following items were evaluated during the inspections:

- The soil cover was inspected for detrimental erosion, settlement and stressed or overgrown vegetation
- Access roads were inspected for physical damage and obstructions
- Monitoring locations were inspected for physical damage

A record of each inspection is maintained on a checklist.

Landfill cap maintenance activities conducted in 2021 are summarized in Table 3.2. To date, the soil cover shows no indications of detrimental erosion or stressed vegetation. Minor settlement has been detected periodically and repaired by placing fill. The cap vegetation is well established and monitoring locations are in good condition.

## 6. Conclusions

Based on the information presented in this 2021 Annual Monitoring Report, the following conclusions are made:

- The groundwater extraction system (EW1B/EW1C and EW2/EW2A) is effectively providing hydraulic containment in the Lower Sand/St. Peter Sandstone aquifers and preventing contaminant migration downgradient from the

Site based on the evaluation of hydraulic conditions (i.e., groundwater elevation contours) and groundwater chemistry (i.e., analytical results at downgradient compliance wells are below SCGs).

- Groundwater samples from monitoring wells did not identify any detectable levels of vinyl chloride in wells screened in the unconsolidated Glacial Drift aquifer (Lower Sand aquifer) downgradient from the on-site extraction system.
- Groundwater samples from monitoring wells did not identify any detectable levels of vinyl chloride in wells screened in the St. Peter Sandstone aquifer west of Gilfillan Lake.
- Groundwater samples from monitoring wells did not identify any detectable levels of vinyl chloride in wells screened in the Prairie du Chien aquifer in North Oaks.
- Groundwater samples from residential wells in North Oaks did not identify any detectable levels of vinyl chloride. To date, the number of residential wells that have ever had detectable concentrations of vinyl chloride is limited to ten locations near the west shore of Gilfillan Lake: Five of the ten wells have been replaced with new/deeper residential wells by the RPs (2 Heron Lane, 2 Hummingbird Hill, 12 West Shore Road, and 13 West Shore Road - see Section 1.3.4.1) or the property owner (11 West Shore Road). Vinyl chloride concentrations at the remaining five wells (50 East Oaks Road, 3 Heron Lane, 1 Hummingbird Hill, 10 West Shore Road, and 15 West Shore Road) have never exceeded the vinyl chloride HRL (0.2 µg/L) and there have been no detections since April 2014

## 7. Recommendations

Based on the information presented in this 2021 Annual Monitoring Report, GHD recommends the following:

- Operation of the on-Site groundwater extraction system should continue in the Lower Sand/St. Peter Sandstone aquifers (via extraction wells EW1C and EW2A).
- Annual groundwater sampling of on-Site and off-Site monitoring well locations should continue.
- Residential well sampling in Operable Unit 4 should continue, as stipulated in MDD Amendment 2.
- If the MDH issues a well advisory in Operable Unit 4 due to Listed VOCs then a new residential well in the Prairie du Chien aquifer should be provided, as stipulated in MDD Amendment 1.
- Soil cap inspections should be conducted on an annual basis as approved by the MPCA on April 13, 2015. Cap maintenance should continue as needed, for the duration of operation of the groundwater extraction system.

## 8. References

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8. Conestoga-Rovers & Associates. May 1994. Post Closure Operation and Maintenance Plan.
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12. Conestoga-Rovers & Associates. February 2007. Groundwater and Residential Well Evaluation Report - North Oaks, Minnesota (February 2006 - January 2007).
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14. Conestoga-Rovers & Associates. December 2008. Completion Report - Monitoring Well Installation (MW-19A/MW-21A)
15. Conestoga-Rovers & Associates. July 2007. Feasibility Study - VOCs in Groundwater - West of Gilfillan Lake - North Oaks, Minnesota.
16. Meyer, G.N. 1985. Quaternary Geologic Map of the Minneapolis-St. Paul Urban Area, Minnesota. Minnesota Geological Survey, Miscellaneous Map Series M-54, and Scale 1:48,000.
17. Norvitch, R.F., Ross, T.G., and Brietkrietz, A. 1973. Water Resources Outlook for the Minneapolis-St. Paul Metropolitan Area, Minnesota.
18. Conestoga-Rovers & Associates. February 2010. Work Plan - Extraction Well Replacement.
19. Conestoga-Rovers & Associates. July 2010. Installation and Operation Report - Extraction Well EW1B
20. GHD Services Inc. September 2021. Work Plan – Extraction Well Replacement
21. GHD Services Inc. March 2022. Extraction Well Replacement Completion Report

# Tables

**Monitoring Well Network  
Highway 96 Site  
White Bear Township, Minnesota**

Location	Operable Unit <sup>(1)</sup>	Geographic Area <sup>(2)</sup>	Hydraulic Monitoring Frequency <sup>(3)</sup>	Sampling Frequency <sup>(3)</sup>	Analytical Parameters (Method)		
					VOCs		Chloride
					(8260)	(8260 LL)	(300.0A)
<b>Perched Groundwater Unit</b>							
LW1	OU2	Area 1	Annually	Annually	X	-	X
LW2	OU2	Area 1	Annually	Annually	X	-	X
LW3	OU2	Area 1	Annually	Annually	X	-	X
MW1S	OU2	Area 1	Annually	Annually	X	-	X
MW4U	OU2	Area 1	Annually	Annually	X	-	X
MW6S	OU2	Area 1	Annually	-	-	-	-
MW10S	OU2	Area 1	Annually	-	-	-	-
MW11S	OU2	Area 1	Annually	-	-	-	-
P1	OU2	Area 1	Annually	-	-	-	-
P2	OU2	Area 1	Annually	-	-	-	-
P3	OU2	Area 1	Annually	-	-	-	-
P4	OU2	Area 1	Annually	-	-	-	-
SUMP	OU2	Area 1	Annually	Annually	X	-	X
<b>Glacial Drift (Lower Sand) Aquifer</b>							
EW1	OU2	Area 1	Annually	-	-	-	-
EW1A	OU2	Area 1	ABD	-	-	-	-
EW1B	OU2	Area 1	Annually	-	-	-	-
EW1C *	OU2	Area 1	Annually	Annually	X	-	X
MW1D	OU2	Area 1	Annually	Annually	X	-	X
MW4D	OU2	Area 1	Annually	Annually	X	-	X
MW4S	OU2	Area 1	Annually	Annually	X	-	X
MW6D	OU2	Area 1	Annually	-	-	-	-
MW10D	OU2	Area 1	NLA	NLA	X	-	X
MW11D	OU2	Area 1	Annually	Annually	X	-	X
MW12D <sup>c</sup>	OU2	Area 1	Annually	Annually	X	-	X
MW13D <sup>c</sup>	OU2	Area 1	Annually	Annually	X	-	X
MW16D <sup>c</sup>	OU2	Area 1	Annually	Annually	X	-	X
<b>Upper St. Peter Sandstone Aquifer</b>							
EW2	OU2	Area 1	Annually	-	-	-	-
EW2A *	OU2	Area 1	Annually	Annually	X	-	X
MW7B	OU2	Area 1	Annually	-	-	-	-
MW8B	OU2	Area 1	Annually	Annually	X	-	X
MW10B <sup>c</sup>	OU2	Area 1	Annually	Annually	X	-	X
MW12B <sup>c</sup>	OU2	Area 1	Annually	Annually	X	-	X
MW13B <sup>c</sup>	OU2	Area 1	Annually	Annually	X	-	X
MW16B <sup>c</sup>	OU2	Area 1	Annually	Annually	X	-	X
MW17A	OU4	Area 3 - East	Annually	Annually	-	X	X
MW18A	OU4	Area 3 - West	Annually	Annually	-	X	X
MW19A	OU4	Area 3 - West	Annually	Annually	-	X	X
MW21A	OU4	Area 3 - West	Annually	Annually	-	X	X

**Monitoring Well Network  
Highway 96 Site  
White Bear Township, Minnesota**

Location	Operable Unit <sup>(1)</sup>	Geographic Area <sup>(2)</sup>	Hydraulic Monitoring Frequency <sup>(3)</sup>	Sampling Frequency <sup>(3)</sup>	Analytical Parameters (Method)		
					VOCs		Chloride
					(8260)	(8260 LL)	(300.0A)
<b>Basal St. Peter Sandstone Aquifer</b>							
EW3	OU4	Area 3 - West	Annually <sup>v</sup>	Annually <sup>v</sup>	-	X	X
MW17B	OU4	Area 3 - East	Annually	Annually	-	X	X
MW18B	OU4	Area 3 - West	Annually	Annually	-	X	X
MW19B	OU4	Area 3 - West	Annually	NLA	-	X	X
MW20B	OU4	Area 3 - West	Annually	Annually	-	X	X
6 Blue Goose Road <sup>#</sup>	OU4	Area 4 - East	Annually	Annually	-	X	X
1 Lily Pond Road <sup>#</sup>	OU4	Area 4 - East	Annually	Annually	-	X	X
11 Lily Pond Road <sup>#</sup>	OU4	Area 4 - East	Annually	Annually	-	X	X
11 Robb Farm Road <sup>#</sup>	OU4	Area 3 - East	Annually	Annually	-	X	X
38 East Oaks Road <sup>^</sup>	OU4	Area 4 - West	Annually <sup>v</sup>	See Table 1.2	-	See Table 1.2	
6 West Shore Road <sup>^</sup>	OU4	Area 5 - West	Annually <sup>v</sup>	See Table 1.2	-	See Table 1.2	
<b>Prairie du Chien Aquifer</b>							
MW17L	OU4	Area 3 - East	Annually	Annually	-	X	X
MW18L	OU4	Area 3 - West	Annually	Annually	-	X	X
MW19L	OU4	Area 3 - West	Annually	Annually	-	X	X

## Notes:

- (1) - As stipulated in the Minnesota Pollution Control Agency's (MPCA's) Minnesota Decision Document (MDD) for the Highway 96 Site, signed October 7, 1993, and subsequent amendments.
- (2) - See Site Figure(s)
- (3) - Conducted in October
- ABD - Abandoned
- NLA - No Longer Accessible (obstructed, as described in GHD's email to MPCA dated October 29, 2020)
- # - Converted Residential Monitoring Well
- \* - Pumping Well
- ^ - Active Residential Well
- c - Compliance Well
- v - Performed Voluntarily (no specific MPCA requirement)

**Residential Well Network  
Highway 96 Site  
White Bear Township, Minnesota**

Location	Operable Unit <sup>(1)</sup>	Geographic Area <sup>(2)</sup>	Sampling Frequency <sup>(1)(3)</sup>	Analytical Parameters (Method)	
				VOCs (8260 LL)	Chloride (300.0A)
<b>Birch Lane</b>					
1 Birch Lane	OU4	Area 5	Every Five Years <sup>(4)</sup>	X	X
2 Birch Lane	OU4	Area 5	Every Five Years <sup>(4)</sup>	X	X
3 Birch Lane	OU4	Area 5	Every Five Years <sup>(4)</sup>	X	X
<b>Buffalo Road</b>					
1 Buffalo Road	OU4	Area 3	Annually	X	X
3 Buffalo Road	OU4	Area 3	Annually	X	X
<b>Cardinal Lane</b>					
2 Cardinal Lane	OU4	Area 4	Every Five Years <sup>(4)</sup>	X	X
4 Cardinal Lane	OU4	Area 4	Every Five Years <sup>(4)</sup>	X	X
<b>Duck Pass Road</b>					
9 Duck Pass Road	OU4	Area 4	Every Five Years <sup>(4)</sup>	X	X
11 Duck Pass Road	OU4	Area 4	Every Five Years <sup>(4)</sup>	X	X
13 Duck Pass Road	OU4	Area 4	Every Five Years <sup>(4)</sup>	X	X
15 Duck Pass Road	OU4	Area 4	Every Five Years <sup>(4)</sup>	X	X
20 Duck Pass Road	OU4	Area 4	Every Five Years <sup>(4)</sup>	X	X
22 Duck Pass Road	OU4	Area 4	Every Five Years <sup>(4)</sup>	X	X
24 Duck Pass Road	OU4	Area 4	Every Five Years <sup>(4)</sup>	X	X
26 Duck Pass Road	OU4	Area 4	Every Five Years <sup>(4)</sup>	X	X
28 Duck Pass Road	OU4	Area 4	Every Five Years <sup>(4)</sup>	X	X
<b>Eagle Ridge Road</b>					
1 Eagle Ridge Road	OU4	Area 3	Annually	X	X
2 Eagle Ridge Road	OU4	Area 3	Annually	X	X
3 Eagle Ridge Road	OU4	Area 3	Annually	X	X
4 Eagle Ridge Road	OU4	Area 3	Annually	X	X
5 Eagle Ridge Road	OU4	Area 4	Every Five Years <sup>(4)</sup>	X	X
6 Eagle Ridge Road	OU4	Area 3	Annually	X	X
10 Eagle Ridge Road	OU4	Area 4	Every Five Years <sup>(4)</sup>	X	X
<b>East Oaks Road</b>					
32 East Oaks Road	OU4	Area 4	Every Five Years <sup>(4)</sup>	X	X
36 East Oaks Road	OU4	Area 4	Every Five Years <sup>(4)</sup>	X	X
38 East Oaks Road	OU4	Area 4	Every Five Years <sup>(4)</sup>	X	X
44 East Oaks Road	OU4	Area 3	Annually	X	X
50 East Oaks Road	OU4	Area 3	Annually	X	X

**Residential Well Network  
Highway 96 Site  
White Bear Township, Minnesota**

Location	Operable Unit <sup>(1)</sup>	Geographic Area <sup>(2)</sup>	Sampling Frequency <sup>(1)(3)</sup>	Analytical Parameters (Method)	
				VOCs (8260 LL)	Chloride (300.0A)
<b>Gadwall Lane</b>					
1 Gadwall Lane	OU4	Area 4	Every Five Years <sup>(4)</sup>	X	X
2 Gadwall Lane	OU4	Area 4	Every Five Years <sup>(4)</sup>	X	X
3 Gadwall Lane	OU4	Area 4	Every Five Years <sup>(4)</sup>	X	X
4 Gadwall Lane	OU4	Area 4	Every Five Years <sup>(4)</sup>	X	X
<b>Heron Lane</b>					
2 Heron Lane [New] #RP	OU4	Area 5	Every Five Years <sup>(4)</sup>	X	X
<b>Hummingbird Hill</b>					
1 Hummingbird Hill	OU4	Area 3	Annually	X	X
<b>Mallard Lane</b>					
3 Mallard Lane	OU4	Area 4	No Longer Sampled	-	-
5 Mallard Lane	OU4	Area 4	No Longer Sampled	-	-
6 Mallard Lane	OU4	Area 4	No Longer Sampled	-	-
7 Mallard Lane	OU4	Area 4	No Longer Sampled	-	-
<b>Poplar Lane</b>					
1 Poplar Lane	OU4	Area 4	Every Five Years <sup>(4)</sup>	X	X
3 Poplar Lane	OU4	Area 4	Every Five Years <sup>(4)</sup>	X	X
4 Poplar Lane	OU4	Area 4	Every Five Years <sup>(4)</sup>	X	X
6 Poplar Lane	OU4	Area 4	Every Five Years <sup>(4)</sup>	X	X
8 Poplar Lane	OU4	Area 3	Annually	X	X
<b>Quail Lane</b>					
1 Quail Lane	OU4	Area 5	Every Five Years <sup>(4)</sup>	X	X
3 Quail Lane	OU4	Area 3	Annually	X	X
<b>Robb Farm Road</b>					
1 Robb Farm Road	OU4	Area 4	No Longer Sampled	-	-
2 Robb Farm Road	OU4	Area 4	No Longer Sampled	-	-
4 Robb Farm Road	OU4	Area 4	No Longer Sampled	-	-
35 Robb Farm Road	OU4	Area 5	Every Five Years <sup>(4)</sup>	X	X
37 Robb Farm Road	OU4	Area 5	Every Five Years <sup>(4)</sup>	X	X
41 Robb Farm Road	OU4	Area 5	Every Five Years <sup>(4)</sup>	X	X
43 Robb Farm Road	OU4	Area 5	Every Five Years <sup>(4)</sup>	X	X
44 Robb Farm Road	OU4	Area 5	Every Five Years <sup>(4)</sup>	X	X
45 Robb Farm Road	OU4	Area 5	Every Five Years <sup>(4)</sup>	X	X

**Residential Well Network  
Highway 96 Site  
White Bear Township, Minnesota**

Location	Operable Unit <sup>(1)</sup>	Geographic Area <sup>(2)</sup>	Sampling Frequency <sup>(1)(3)</sup>	Analytical Parameters (Method)	
				VOCs (8260 LL)	Chloride (300.0A)
<b>Ski Lane</b>					
2 Ski Lane	OU4	Area 3	Annually	X	X
4 Ski Lane	OU4	Area 3	Annually	X	X
6 Ski Lane	OU4	Area 3	Annually	X	X
8 Ski Lane	OU4	Area 3	Annually	X	X
10 Ski Lane	OU4	Area 3	Annually	X	X
12 Ski Lane	OU4	Area 3	Annually	X	X
14 Ski Lane	OU4	Area 3	Annually	X	X
16 Ski Lane	OU4	Area 3	Annually	X	X
<b>Thompson Lane</b>					
1 Thompson Lane	OU4	Area 3	Annually	X	X
3 Thompson Lane	OU4	Area 3	Annually	X	X
4 Thompson Lane	OU4	Area 3	Annually	X	X
<b>West Shore Road</b>					
1 West Shore Road	OU4	Area 5	Every Five Years <sup>(4)</sup>	X	X
2 West Shore Road	OU4	Area 5	Every Five Years <sup>(4)</sup>	X	X
3 West Shore Road	OU4	Area 5	Every Five Years <sup>(4)</sup>	X	X
4 West Shore Road	OU4	Area 5	Every Five Years <sup>(4)</sup>	X	X
5 West Shore Road	OU4	Area 5	Every Five Years <sup>(4)</sup>	X	X
6 West Shore Road	OU4	Area 5	Every Five Years <sup>(4)</sup>	X	X
7 West Shore Road	OU4	Area 5	Every Five Years <sup>(4)</sup>	X	X
8 West Shore Road	OU4	Area 3	Annually	X	X
9 West Shore Road	OU4	Area 3	Annually	X	X
10 West Shore Road	OU4	Area 3	Annually	X	X
11 West Shore Road [New] #H	OU4	Area 3	Annually	X	X
15 West Shore Road	OU4	Area 3	Annually	X	X

## Notes:

- #H - New well installed by Homeowner (Prairie du Chien aquifer)
- #RP - Replacement well installed by Responsible Parties (Prairie du Chien aquifer)
- (1) - As stipulated in the Minnesota Pollution Control Agency's (MPCA's) Minnesota Decision Document (MDD) for the Highway 96 Site, signed 10/7/1993, and subsequent amendments signed 8/26/2008 and 12/30/2019.
- (2) - See Site Figure(s)
- (3) - Sampling events conducted in October
- (4) - Next scheduled event is in 2024

**2021 Groundwater Elevations  
Highway 96 Site  
White Bear Township, Minnesota**

Location	TOC (ft. AMSL)	September 27, 2021	
		WL (ft BTOC)	GWE (ft. AMSL)
<b>Perched Groundwater Unit</b>			
LW1	938.86	DRY	DRY
LW2	945.66	12.10	933.56
LW3	944.82	16.49	928.33
MW1S	950.65	19.80	930.85
MW4U	939.65	26.90	912.75
MW6S	948.44	21.20	927.24
MW10S	935.94	6.05	929.89
MW11S	936.34	14.03	922.31
P1	941.70	NM	NM
P2	946.11	11.53	934.58
P3	947.11	11.80	935.31
P4	948.16	13.25	934.91
SUMP	946.71	12.38	934.33
<b>Glacial Drift (Lower Sand) Aquifer</b>			
EW1	936.92	NM	NM
EW1A	938.67	ABD	ABD
EW1B * (On)	939.99	65.40	874.59
EW1C	940.66	NI	NI
MW1D	951.02	52.14	898.88
MW4D	940.48	NM	NM
MW4S	940.33	35.24	905.09
MW6D	948.15	49.08	899.07
MW10D	935.94	NM	NM
MW11D	935.40	33.13	902.27
MW12D	940.52	35.85	904.67
MW13D	937.66	37.61	900.05
MW16D	940.70	42.27	898.43
<b>Upper St. Peter Sandstone Aquifer</b>			
EW2 * (Off)	938.67	41.03	897.64
EW2A	939.34	NI	NI
MW7B	942.91	42.82	900.09
MW8B	940.91	43.12	897.79
MW10B	936.64	39.00	897.64
MW12B	939.89	42.39	897.50
MW13B	938.34	40.94	897.40
MW16B	940.71	42.70	898.01
MW17A	914.58	19.48	895.10
MW18A	925.39	34.50	890.89
MW19A	913.56	25.76	887.80
MW21A	909.03	21.01	888.02



**2021 Groundwater Elevations  
Highway 96 Site  
White Bear Township, Minnesota**

Location	TOC (ft. AMSL)	September 27, 2021	
		WL (ft BTOC)	GWE (ft. AMSL)
<b>Basal St. Peter Sandstone Aquifer</b>			
EW3	913.88	30.81	883.07
MW17B	914.50	27.84	886.66
MW18B	925.24	37.52	887.72
MW19B	913.33	NM	NM
MW20B	915.04	31.40	883.64
6 Blue Goose Road #	954.15	62.50	891.65
1 Lily Pond Road #	930.88	35.64	895.24
11 Lily Pond Road #	928.54	39.46	889.08
11 Robb Farm Road #	942.63	46.96	895.67
38 East Oaks Road ^	926.50	41.19	885.31
6 West Shore Road ^	920.20	34.03	886.17
<b>Prairie du Chien Aquifer</b>			
MW17L	914.65	29.60	885.05
MW18L	925.44	43.81	881.63
MW19L	914.18	35.06	879.12

## Notes:

ABD - Abandoned

ft. AMSL - Feet Above Mean Sea Level

ft. BTOC - Feet Below Top of Casing

GWE - Groundwater Elevation

DRY - Measured well was dry

NI - Not Installed

NM - Not Measured (inaccessible)

TOC - Top of Casing

WL - Water Level

\* - Pumping Well

- EW1B: 9.9 gpm

- EW2: OFF

# - Converted Residential Monitoring Well

^ - Active Residential Well

**2021 Operation and Maintenance Activities  
Highway 96 Site  
White Bear Township, Minnesota**

<b>Date</b>	<b>Location</b>	<b>Event</b>	<b>Remedy</b>	<b>Contractor</b>
2/24/2021	EW1B	Maintenance	Repaired leak in discharge piping.	GHD (B. Zuidema)
2/24/2021	EW1B	Operation	Increased drawdown/decreased pumping capacity observed. Routine well rehabilitation scheduled for 3/8/2021.	GHD (B. Zuidema, S. Illi)
3/4/2021	EW1B	Operation	Routine well rehabilitation delayed due to Spring Road Restrictions and rescheduled for April/May 2021.	GHD (S. Illi)
4/28/2021	EW1B, EW2	Operation	Temporarily increased pumping rate at EW2 to 15 gpm to compensate for reduced flow at EW1B (redevelopment scheduled).	GHD (B. Zuidema)
5/12/2021	EW1B	Operation	Shut down EW1B to prevent further drawdown/screen exposure.	GHD (B. Zuidema)
5/19/2021	EW1B, EW2	Operation	Conducted specific capacity checks to establish pre-well rehabilitation baseline.	GHD (B. Zuidema)
5/24/2021- 5/27/2021	EW1B	Well Rehabilitation	EW1B: Performed mechanical treatment (jet/surge/airlift); performed chemical treatment; cleaned/tested/repared pump; snaked discharge line.	GHD (S. Roste)
6/7/2021- 6/8/2021	EW2	Well Rehabilitation	EW2: Performed mechanical treatment (jet/surge/airlift). Hole in well casing identified. EW2 inoperable pending repair/replacement. Replacement scheduled for September 2021 (earliest material/contractor availability).	GHD (T. Braun)
6/16/2021	Landfill Cap, Pump House, Ski Lane Ravine	Maintenance	Trimmed around vents/probes/wells; Mowed landfill cap, around pump house, and Ski Lane Ravine.	GHD (B. Lardy, B. Zuidema)
7/21/2021	Landfill Cap	Maintenance	Trimmed around remaining vents/probes/wells and improved well labeling.	GHD (B. Zuidema)
9/27/2021- 9/28/2021	Access Pad	Maintenance	Regraded access pad.	SDE (Sub-Driller)

**2021 Operation and Maintenance Activities  
Highway 96 Site  
White Bear Township, Minnesota**

<b>Date</b>	<b>Location</b>	<b>Event</b>	<b>Remedy</b>	<b>Contractor</b>
9/28/2021	EW1A	Well Abandonment	Well abandoned to create access for new extraction wells.	SDE (Sub-Driller)
10/5/2021	Pump House	Maintenance	Remove/replace electrical componments.	PEI (Sub-Electrician)
10/6/2021- 10/8/2021	EW1C	Well Installation	Well drilling and grouting.	SDE (Sub-Driller)
10/11/2021- 10/13/2021	EW2A	Well Installation	Well drilling (attempted).	SDE (Sub-Driller)
10/14/2021	Pump House	Maintenance	Interior cleaning and painting.	GHD (S. Roste)
10/15/2021	Pump House	Maintenance	Remove/replace electrical componments.	PEI (Sub-Electrician)
10/18/2021- 10/20/2021	EW2A	Well Installation	Well drilling (attempted).	SDE (Sub-Driller)
10/22/2021	EW1C	Well Installation	Well development.	SDE (Sub-Driller)
10/28/2021- 10/29/2021	EW1C	Well Installation	Well development.	SDE (Sub-Driller)
10/29/2021	Landfill Cap	Annual Inspection	Conducted annual landfill cap inspection.	GHD (S. Roste)
11/16/2021- 11/17/2021	EW1C	Well Installation	Installed pump, trenched service lines, development, and commissioned well.	SDE (Sub-Driller) PEI (Sub-Electrician)

**2021 Operation and Maintenance Activities  
Highway 96 Site  
White Bear Township, Minnesota**

<b>Date</b>	<b>Location</b>	<b>Event</b>	<b>Remedy</b>	<b>Contractor</b>
11/18/2021- 11/24/2021	EW2A	Well Installation	Drilled and grouted well, installed pump, trenched service lines, and commissioned well.	SDE (Sub-Driller) PEI (Sub-Electrician)
11/24/2021	EW2, EW1B	Operation	Decommissioned (replaced by EW1C and EW2A).	SDE (Sub-Driller)
11/30/2021	Path	Maintenance	Repaired tire rutting (regraded and seeded).	SDE (Sub-Driller)
11/30/2021- 12/1/2021	EW1C, EW2A	Operation	Completed performance testing of new extraction wells EW1C and EW2A.	GHD (S. Roste)
12/15/2021	EW1, EW1C, EW2A	Survey	Survey TOC elevations of new extraction wells.	GHD (R.Coy)

**2021 Groundwater Extraction Rates  
Highway 96 Site  
White Bear Township, Minnesota**

Month	Average Pumping Rate		
	EW1B/EW1C (gpm)	EW2/EW2A (gpm)	Combined * (gpm)
January	9.8	9.9	19.7
February	9.4	10.3	19.8
March	8.4 <sup>(1)</sup>	11.0	19.4
April	6.2	13.2	19.4
May	2.5 <sup>(2)</sup>	11.8	14.4
June	6.6 <sup>(2)(3)</sup>	2.2 <sup>(2)(3)</sup>	8.8
July	7.8	0.0	7.8
August	8.8	0.0	8.8
September	9.7	0.0	9.7
October	9.8 <sup>(4)</sup>	0.0	9.8
November	10.4	0.0 <sup>(4)</sup>	10.5
December	14.4	5.7	20.0
<b>Annual Average</b>	<b>8.6</b>	<b>5.3</b>	<b>14.0</b>

## Notes:

\* - Combined pumping rate to be maintained between 13 and 20 gpm, as outlined in CRA's letter to MPCA dated July 9, 2010.

<sup>(1)</sup> - Well rehabilitation scheduled

<sup>(2)</sup> - Well rehabilitation conducted (see Table 3.2)

<sup>(3)</sup> - Well replacement scheduled

<sup>(4)</sup> - Well replacement conducted (see Table 3.2)

**Historical Groundwater Sampling Event Summary  
Highway 96 Site  
White Bear Township, Minnesota**

Round	Date	Sampled By	Event Description
1	January 1986	USEPA	Samples from monitoring and residential wells
2	June 1987	CRA	Samples from leachate, monitoring, and residential wells
3	January 1988	CRA	Samples from leachate, monitoring, and residential wells
4	August 1988	CRA	Samples from leachate, monitoring, and residential wells
5	March 1989	CRA	Samples from leachate, monitoring, and residential wells
6	July 1989	CRA	Samples from leachate, monitoring, and residential wells
7	October 1989	CRA	Samples from leachate, monitoring, and residential wells
8	January 1990	CRA	Samples from leachate, monitoring, and residential wells
9	May 1990	CRA	Samples from leachate, monitoring, and residential wells
10	September 1990	CRA	Samples from leachate, monitoring, and residential wells
11	December 1990	CRA	Samples from leachate, monitoring, and residential wells
12	March 1991	CRA	Samples from leachate, monitoring, and residential wells
13	June 1991	CRA	Samples from leachate, monitoring, and residential wells
14	December 1991	CRA	Samples from leachate, monitoring, and residential wells
15	May 1992	CRA	Samples from leachate, monitoring, and residential wells
16	November 1992	CRA	Samples from leachate, monitoring, and residential wells
17	May 1993	CRA	Samples from leachate, monitoring, and residential wells
18	October 1993	CRA	Samples from leachate, monitoring, and residential wells
19	January 1994	CRA	Samples from residential wells
20	April 1994	CRA	Samples from residential wells
21	May 1994	CRA	Samples from residential wells
22	August 1994	CRA	Samples from leachate and monitoring wells
23	November 1994	CRA	Samples from residential wells
24	December 1994	CRA	Samples from leachate, monitoring, and residential wells
25	May 1995	CRA	Samples from leachate, monitoring, and residential wells
26	October 1995	CRA	Samples from leachate, monitoring, and residential wells
27	May 1996	CRA	Samples from leachate and monitoring wells
28	October 1996	CRA	Samples from leachate, monitoring, and residential wells
29	May 1997	CRA	Samples from leachate and monitoring wells
30	October 1997	CRA	Samples from leachate, monitoring, and residential wells
31	May 1998	CRA	Samples from leachate and monitoring wells
32	October 1998	CRA	Samples from leachate, monitoring, and residential wells
33	Oct/Nov 1999	CRA	Samples from pilot study, leachate, monitoring, and residential wells
34	Jan/Feb 2000	CRA	Samples from compliance point wells
35	October 2000	CRA	Samples from leachate, monitoring, and residential wells
36	November 2001	CRA	Samples from leachate, monitoring, and residential wells
37	October 2002	CRA	Samples from leachate, monitoring, and residential wells
38	October 2003	CRA	Samples from leachate, monitoring, and residential wells
39	October 2004	CRA	Samples from leachate, monitoring, and residential wells
40	January 2005	CRA	Samples from residential wells
41	February 2005	CRA/MPCA	Samples from residential wells
42	March 2005	CRA/MPCA	Samples from residential wells

**Historical Groundwater Sampling Event Summary  
Highway 96 Site  
White Bear Township, Minnesota**

Round	Date	Sampled By	Event Description
43	April 2005	MPCA	Samples from residential wells
44	May 2005	CRA/MPCA	Samples from residential wells
45	June 2005	CRA/MPCA	Samples from residential wells
46	August 2005	CRA/MPCA	Samples from residential wells
47	October 2005	CRA	Samples from select monitoring wells
48	November 2005	CRA/MPCA	Samples from leachate, monitoring, and residential wells
49	December 2005	CRA	Samples from select monitoring wells
50	January 2006	CRA	Samples from select monitoring wells
51	February 2006	CRA/MPCA	Samples from residential wells
52	May 2006	CRA/MPCA	Samples from residential wells
53	October 2006	CRA/MPCA	Samples from leachate, monitoring, and residential wells
54	November 2006	CRA	Samples from select monitoring wells
55	January 2007	CRA	Samples from select monitoring wells
56	April 2007	CRA/MPCA	Samples from residential wells
57	October 2007	CRA/MPCA	Samples from leachate, monitoring, and residential wells
58	April/May 2008	CRA/MPCA	Samples from residential wells
59	September 2008	CRA	Samples from select monitoring wells
60	Oct/Nov 2008	CRA/MPCA	Samples from leachate, monitoring, and residential wells
61	April 2009	CRA/MPCA	Samples from residential wells
62	October 2009	CRA/MPCA	Samples from leachate, monitoring, and residential wells
63	April 2010	CRA/MPCA	Samples from residential wells
64	October 2010	CRA/MPCA	Samples from leachate, monitoring, and residential wells
65	April 2011	CRA/MPCA	Samples from residential wells
66	October 2011	CRA/MPCA	Samples from leachate, monitoring, and residential wells
67	April/May 2012	CRA/MPCA	Samples from residential wells
68	October 2012	CRA/MPCA	Samples from leachate, monitoring, and residential wells
69	May 2013	CRA/MPCA	Samples from residential wells
70	Sept/Oct 2013	CRA/MPCA	Samples from leachate, monitoring, and residential wells
71	April 2014	CRA/MPCA	Samples from residential wells
72	Sept/Oct 2014	CRA/MPCA	Samples from leachate, monitoring, and residential wells
73	April 2015	CRA/MPCA	Samples from residential wells
74	October 2015	GHD/MPCA	Samples from leachate, monitoring, and residential wells
75	April 2016	GHD/MPCA	Samples from residential wells
76	October 2016	GHD/MPCA	Samples from leachate, monitoring, and residential wells
77	April 2017	GHD/MPCA	Samples from residential wells
78	October 2017	GHD	Samples from leachate, monitoring, and residential wells
79	June 2018	GHD	Samples from residential wells
80	October 2018	GHD	Samples from leachate, monitoring, and residential wells
81	July 2019	GHD	Samples from residential wells
82	Oct/Nov/Dec 2019	GHD	Samples from leachate, monitoring, and residential wells
83	Oct/Nov 2020	GHD	Samples from leachate, monitoring, and residential wells
84	Sept/Oct 2021	GHD	Samples from leachate, monitoring, and residential wells

Table 4.2

2021 Groundwater Analytical Data Detections  
 Perched Groundwater Unit Monitoring Wells  
 Highway 96 Site  
 White Bear Township, Minnesota

Location	Sample ID	Analyte		Chloride mg/L	1,1-Dichloroethane µg/L	1,1-Dichloroethene µg/L	1,2-Dichloroethane µg/L	Acetone µg/L	Benzene µg/L	Chloroethane µg/L	cis-1,2-Dichloroethene µg/L	Dichlorodifluoromethane (CFC-12) µg/L	Dichlorofluoromethane µg/L
		Units	QA/QC										
		Date											
<b>On-Site Monitoring Wells</b>													
LW2	W-210928-KJ-34	09/28/2021		62	0.56 J <	1.0	0.36 J	6.5 J	2.1	< 1.0	< 0.50	< 1.0	< 1.0
LW3	W-210928-KJ-33	09/28/2021		59	0.63 J <	1.0	0.45 J	< 10	1.4	< 1.0	< 0.50	3.3	0.70 J
MW1S	W-210928-KJ-36	09/28/2021		26	< 1.0	< 1.0	< 1.0	< 10	< 1.0	< 1.0	< 0.50	< 1.0	< 1.0
MW4U	W-210928-KJ-35	09/28/2021		200	< 1.0	< 1.0	1.6	< 10	3.3	46	8.8	< 1.0	< 1.0
SUMP	W-210929-KJ-40	09/29/2021		52	< 1.0	< 1.0	0.32 J	< 10	1.1	3.2	0.83	< 1.0	< 1.0



Table 4.2

**2021 Groundwater Analytical Data Detections  
Perched Groundwater Unit Monitoring Wells  
Highway 96 Site  
White Bear Township, Minnesota**

Location	Sample ID	Analyte		Ethyl ether µg/L	Ethylbenzene µg/L	Tetrachloroethene µg/L	Toluene µg/L	trans-1,2-Dichloroethene µg/L	Trichloroethene µg/L	Vinyl chloride µg/L	Xylenes (total) µg/L	Total VOCs µg/L
		Units										
		Date	QA/QC									
<b>On-Site Monitoring Wells</b>												
LW2	W-210928-KJ-34	09/28/2021		1.0 J	< 1.0	< 1.0	< 1.0	0.68	< 1.0	< 1.0	< 1.0	11.2
LW3	W-210928-KJ-33	09/28/2021		0.93 J	< 1.0	< 1.0	< 1.0	< 0.50	< 1.0	< 1.0	< 1.0	7.41
MW1S	W-210928-KJ-36	09/28/2021		< 2.0	< 1.0	< 1.0	< 1.0	< 0.50	< 1.0	< 1.0	< 1.0	ND
MW4U	W-210928-KJ-35	09/28/2021		< 2.0	< 1.0	< 1.0	< 1.0	2.7	1.4	4.4	1.6	104.8
SUMP	W-210929-KJ-40	09/29/2021		< 2.0	< 1.0	< 1.0	< 1.0	< 0.50	< 1.0	0.80 J	< 1.0	7.85

Notes:

- < - Not detected above the noted reporting limit.
- µg/L - Micrograms per Liter
- J - Estimated
- mg/L - Milligrams per Liter
- ND - No Detections
- QA/QC - Quality Assurance/Quality Control Sample Type

Table 4.3

**2021 Groundwater Analytical Data Detections  
Lower Sand Aquifer Monitoring Wells  
Highway 96 Site  
White Bear Township, Minnesota**

Location	Sample ID	Date	QA/QC	Analyte	Chloride	1,1-Dichloroethane	1,1-Dichloroethene	1,2-Dichloroethane	Acetone	Benzene	Chloroethane	cis-1,2-Dichloroethene	Dichlorodifluoromethane (CFC-12)	Dichlorofluoromethane	
				SCG <sup>(1)</sup>	NE	70	6	4	700	5	NE	70	1000	NE	
				Units	mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
<b>On-Site Monitoring Wells</b>															
EW1B	W-210112-BZ-01	01/12/2021		NA	6.7	0.49 J	< 2.0	< 20	< 2.0	3.3	15	1.8 J	2.4		
EW1B	W-210414-BZ-001	04/14/2021		NA	5.2	0.50 J	< 1.0	< 10	0.19 J	1.9	14	1.9	2.0		
EW1B	W-210721-BZ-001	07/21/2021		NA	9.6	< 2.0	< 2.0	< 20	< 2.0	4.7	16	1.8 J	4.2		
EW1B	W-211021-SJR-01	10/21/2021		79	20	0.49 J	0.84 J	< 10	0.77 J	14	21	3.7	5.6		
EW1C	W-211201-SJR-001	12/01/2021		54	1.4	0.66 J	< 1.0	< 10	< 1.0	< 1.0	8.1	2.3	2.7		
MW1D	W-210929-KJ-43	09/29/2021		30	0.53 J	< 1.0	< 1.0	< 10	< 1.0	< 1.0	< 0.50	3.0	0.91 J		
MW4D	W-210930-KJ-31	09/30/2021		280	130	< 4.0	7.9	< 40	5.8	100	71	4.0	17		
MW4D	W-210930-KJ-37	09/30/2021	FD	290	110	< 4.0	7.8	< 40	5.0	94	55	3.2 J	15		
MW4S	W-210929-KJ-41	09/29/2021		160	13	< 1.0	1.5	< 10	2.3	36	3.5	< 1.0	< 1.0		
MW11D	W-210929-KJ-42	09/29/2021		35	< 1.0	< 1.0	< 1.0	< 10	< 1.0	< 1.0	< 0.50	< 1.0 J	< 1.0		
<b>Compliance Monitoring Wells<sup>(1)</sup></b>															
MW12D	W-210927-KJ-25	09/27/2021		49	< 1.0	< 1.0	< 1.0	< 10	< 1.0	< 1.0	< 0.50	< 1.0	< 1.0		
MW13D	W-210927-KJ-21	09/27/2021		44	0.92 J	< 1.0	< 1.0	< 10	< 1.0	< 1.0	0.83	< 1.0	< 1.0		
MW13D	W-210927-KJ-22	09/27/2021	FD	44	1.1	< 1.0	< 1.0	< 10	< 1.0	< 1.0	0.81	< 1.0	< 1.0		
MW16D	W-210928-KJ-28	09/28/2021		55	< 1.0	< 1.0	< 1.0	< 10	< 1.0	< 1.0	< 0.50	< 1.0	< 1.0		

Table 4.3

**2021 Groundwater Analytical Data Detections  
Lower Sand Aquifer Monitoring Wells  
Highway 96 Site  
White Bear Township, Minnesota**

Location	Sample ID	Analyte		Ethyl ether	Ethylbenzene	Tetrachloroethene	Toluene	trans-1,2-Dichloroethene	Trichloroethene	Vinyl chloride	Xylenes (total)	Total VOCs	
		SCG <sup>(1)</sup>		1000	700	5	1000	100	5	2	10000	NE	
		Units		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
		Date	QA/QC										
<b>On-Site Monitoring Wells</b>													
EW1B	W-210112-BZ-01	01/12/2021		< 4.0	< 2.0	0.35 J	< 2.0	3.2	60	6.4	< 2.0	99.64	
EW1B	W-210414-BZ-001	04/14/2021		< 2.0	< 1.0	0.32 J	< 1.0	4.5	79	5.1	< 1.0	114.61	
EW1B	W-210721-BZ-001	07/21/2021		< 4.0	< 2.0	< 2.0	< 2.0	3.2	47	11	< 2.0	97.5	
EW1B	W-211021-SJR-01	10/21/2021		< 2.0	< 1.0	< 1.0	2.3	3.2	49	16	0.67 J	137.57	
EW1C	W-211201-SJR-001	12/01/2021		< 2.0	< 1.0	0.51 J	< 1.0	7.3	130	0.22 J	< 1.0	153.19	
MW1D	W-210929-KJ-43	09/29/2021		< 2.0	< 1.0	< 1.0	< 1.0	< 0.50	< 1.0	< 1.0	< 1.0	4.44	
MW4D	W-210930-KJ-31	09/30/2021		< 8.0	< 4.0	< 4.0	4.7	< 2.0	< 4.0	63	< 4.0	403.4	
MW4D	W-210930-KJ-37	09/30/2021	FD	< 8.0	< 4.0	< 4.0	3.9 J	< 2.0	< 4.0	48	< 4.0	341.9	
MW4S	W-210929-KJ-41	09/29/2021		< 2.0	< 1.0	< 1.0	< 1.0	2.2	1.1	6.9	< 1.0	66.5	
MW11D	W-210929-KJ-42	09/29/2021		< 2.0	< 1.0	< 1.0	< 1.0	< 0.50	< 1.0	< 1.0	< 1.0	ND	
<b>Compliance Monitoring Wells <sup>(1)</sup></b>													
MW12D	W-210927-KJ-25	09/27/2021		< 2.0	< 1.0	< 1.0	< 1.0	< 0.50	< 1.0	< 1.0	< 1.0	ND	
MW13D	W-210927-KJ-21	09/27/2021		< 2.0	< 1.0	< 1.0	< 1.0	< 0.50	< 1.0	< 1.0	< 1.0	1.75	
MW13D	W-210927-KJ-22	09/27/2021	FD	< 2.0	< 1.0	< 1.0	< 1.0	< 0.50	< 1.0	< 1.0	< 1.0	1.91	
MW16D	W-210928-KJ-28	09/28/2021		< 2.0	< 1.0	< 1.0	< 1.0	< 0.50	< 1.0	< 1.0	< 1.0	ND	

Notes:

- (1) - Site Cleanup Goals (SCG) from Revised Table 1 of the 1993 Minnesota Decision Document (MDD)  
(SCGs only apply to Compliance Monitoring Wells)
- Shaded results exceed screening criteria, where applicable.
- < - Not detected above the noted reporting limit.
- µg/L - Micrograms per Liter
- FD - Field Duplicate
- J - Estimated
- mg/L - Milligrams per Liter
- NA - Not Analyzed
- ND - No Detections
- NE - Not Established
- QA/QC - Quality Assurance/Quality Control Sample Type

Table 4.4

**2021 Groundwater Analytical Data Detections  
St. Peter Sandstone Aquifer Monitoring Wells  
Highway 96 Site  
White Bear Township, Minnesota**

Location	Sample ID	Date	QA/QC	Analyte	Chloride	1,1-Dichloroethane	1,1-Dichloroethene	1,2-Dichloroethane	Acetone	Benzene	Chloroethane	cis-1,2-Dichloroethene	Dichlorodifluoromethane (CFC-12)	Dichlorofluoromethane	
				SCG <sup>(1)</sup>	NE	70	6	4	700	5	NE	70	1000	NE	
				Units	mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
<b>On-Site Monitoring Wells</b>															
EW2	W-210112-BZ-02	01/12/2021		NA	19	< 1.0	0.87 J	< 10	0.68 J	14	13	4.2	11		
EW2	W-210414-BZ-002	04/14/2021		NA	20	< 1.0	0.78 J	< 10	0.82 J	14	14	5.0	9.2		
EW2A	W-211201-SJR-002	12/01/2021		6.0	< 1.0	< 1.0	< 1.0	< 10	< 1.0	< 1.0	< 0.50	< 1.0	< 1.0		
MW8B	W-210930-KJ-53	09/30/2021		64	8.1	< 1.0	0.41 J	< 10	< 1.0	1.6	5.0	14	43		
<b>Compliance Monitoring Wells<sup>(1)</sup></b>															
MW10B	W-210930-KJ-54	09/30/2021		1.7	< 1.0	< 1.0	< 1.0	< 10	< 1.0	< 1.0	< 0.50	< 1.0 J	< 1.0		
MW12B	W-210927-KJ-26	09/27/2021		16	< 1.0	< 1.0	< 1.0	< 10	< 1.0	< 1.0	< 0.50	< 1.0	< 1.0		
MW13B	W-210927-KJ-23	09/27/2021		27	< 1.0	< 1.0	< 1.0	< 10	< 1.0	< 1.0	< 0.50	< 1.0	< 1.0		
MW16B	W-210928-KJ-50	09/28/2021		10	< 1.0	< 1.0	< 1.0	< 10	< 1.0	< 1.0	< 0.50	< 1.0	< 1.0		
<b>Converted Residential Monitoring Wells</b>															
6 Blue Goose Lane	W-210929-KJ-18	09/29/2021		3.2 J-	< 0.50	< 0.50	< 0.50	< 20.0	< 0.50	< 1.0	< 0.50	< 1.0	< 1.0		
1 Lily Pond Road	W-210930-KJ-51	09/30/2021		12.9 J-	7.2	< 0.50	< 0.50	< 20.0	< 0.50	< 1.0	< 0.50	3.9	1.8		
1 Lily Pond Road	W-210930-KJ-52	09/30/2021	FD	13.0 J-	6.9	< 0.50	< 0.50	< 20.0	< 0.50	< 1.0	< 0.50	3.6	1.7		
11 Lily Pond Road	W-210929-KJ-08	09/29/2021		2.2 J-	< 0.50	< 0.50	< 0.50	< 20.0	< 0.50	< 1.0	< 0.50	< 1.0	< 1.0		
11 Robb Farm Road	W-210929-KJ-19	09/29/2021		16.7 J-	0.23 J	< 0.50	< 0.50	< 20.0	< 0.50	< 1.0	< 0.50	< 1.0	< 1.0		

Table 4.4

2021 Groundwater Analytical Data Detections  
 St. Peter Sandstone Aquifer Monitoring Wells  
 Highway 96 Site  
 White Bear Township, Minnesota

Location	Sample ID	Date	QA/QC	Analyte	Chloride	1,1-Dichloroethane	1,1-Dichloroethene	1,2-Dichloroethane	Acetone	Benzene	Chloroethane	cis-1,2-Dichloroethene	Dichlorodifluoromethane (CFC-12)	Dichlorofluoromethane	
				SCG <sup>(1)</sup>	NE	70	6	4	700	5	NE	70	1000	NE	
				Units	mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
<b>Off-Site Monitoring Wells</b>															
EW3	W-211028-KJ-01	10/28/2021			8.8	< 0.50	< 0.50	< 0.50	< 20.0	< 0.50	< 1.0	< 0.50	< 1.0	< 1.0	
MW17A	W-210929-KJ-06	09/29/2021			95.0	J- < 0.50	< 0.50	< 0.50	< 20.0	< 0.50	< 1.0	< 0.50	< 1.0	< 1.0	
MW17B	W-210929-KJ-05	09/29/2021			16.3	J- < 0.50	< 0.50	< 0.50	< 20.0	< 0.50	< 1.0	< 0.50	< 1.0	< 1.0	
MW18A	W-210928-KJ-17	09/28/2021			47.8	J- < 0.50	< 0.50	< 0.50	< 20.0	< 0.50	< 1.0	< 0.50	< 1.0	< 1.0	
MW18B	W-210928-KJ-15	09/28/2021			40.4	J- < 0.50	< 0.50	< 0.50	< 20.0	< 0.50	< 1.0	< 0.50	< 1.0	< 1.0	
MW18B	W-210928-KJ-16	09/28/2021	FD		40.8	J- < 0.50	< 0.50	< 0.50	< 20.0	< 0.50	< 1.0	< 0.50	< 1.0	< 1.0	
MW19A	W-210928-KJ-09	09/28/2021			66.7	J- < 0.50	< 0.50	< 0.50	< 20.0	< 0.50	< 1.0	< 0.50	< 1.0	< 1.0	
MW20B	W-210928-KJ-04	09/28/2021			17.0	J- < 0.50	< 0.50	< 0.50	< 20.0	< 0.50	< 1.0	< 0.50	< 1.0	< 1.0	
MW21A	W-210928-KJ-12	09/28/2021			7.5	J- < 0.50	< 0.50	< 0.50	< 20.0	< 0.50	< 1.0	< 0.50	< 1.0	< 1.0	

Table 4.4

**2021 Groundwater Analytical Data Detections  
St. Peter Sandstone Aquifer Monitoring Wells  
Highway 96 Site  
White Bear Township, Minnesota**

Location	Sample ID	Analyte		Ethyl ether	Ethylbenzene	Tetrachloroethene	Toluene	trans-1,2-Dichloroethene	Trichloroethene	Vinyl chloride	Xylenes (total)	Total VOCs	
		SCG <sup>(1)</sup>		1000	700	5	1000	100	5	2	10000	NE	
		Units		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
		Date	QA/QC										
<b>On-Site Monitoring Wells</b>													
EW2	W-210112-BZ-02	01/12/2021		< 2.0	0.22 J	< 1.0	1.1	0.33 J	3.7	14	0.31 J	82.41	
EW2	W-210414-BZ-002	04/14/2021		< 2.0	0.32 J	< 1.0	1.2	0.36 J	4.6	16	0.62 J	86.9	
EW2A	W-211201-SJR-002	12/01/2021		< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	ND	
MW8B	W-210930-KJ-53	09/30/2021		< 2.0	< 1.0	< 1.0	< 1.0	< 0.50	< 1.0	11	< 1.0	83.11	
<b>Compliance Monitoring Wells<sup>(1)</sup></b>													
MW10B	W-210930-KJ-54	09/30/2021		< 2.0	< 1.0	< 1.0	< 1.0	< 0.50	< 1.0	< 1.0	< 1.0	ND	
MW12B	W-210927-KJ-26	09/27/2021		< 2.0	< 1.0	< 1.0	< 1.0	< 0.50	< 1.0	< 1.0	< 1.0	ND	
MW13B	W-210927-KJ-23	09/27/2021		< 2.0	< 1.0	< 1.0	< 1.0	< 0.50	< 1.0	< 1.0	< 1.0	ND	
MW16B	W-210928-KJ-50	09/28/2021		< 2.0	< 1.0	< 1.0	< 1.0	< 0.50	< 1.0	< 1.0	< 1.0	ND	
<b>Converted Residential Monitoring Wells</b>													
6 Blue Goose Lane	W-210929-KJ-18	09/29/2021		< 4.0	< 0.50	< 0.50	< 0.50	< 0.50	< 0.40	< 0.20	< 1.5	ND	
1 Lily Pond Road	W-210930-KJ-51	09/30/2021		< 4.0	< 0.50	< 0.50	< 0.50	< 0.50	< 0.40	< 0.20	< 1.5	12.9	
1 Lily Pond Road	W-210930-KJ-52	09/30/2021	FD	< 4.0	< 0.50	< 0.50	< 0.50	< 0.50	< 0.40	< 0.20	< 1.5	12.2	
11 Lily Pond Road	W-210929-KJ-08	09/29/2021		< 4.0	< 0.50	< 0.50	< 0.50	< 0.50	< 0.40	< 0.20	< 1.5	ND	
11 Robb Farm Road	W-210929-KJ-19	09/29/2021		< 4.0	< 0.50	< 0.50	< 0.50	< 0.50	< 0.40	< 0.20	< 1.5	0.23	

Table 4.4

**2021 Groundwater Analytical Data Detections  
St. Peter Sandstone Aquifer Monitoring Wells  
Highway 96 Site  
White Bear Township, Minnesota**

Location	Sample ID	Analyte		Ethyl ether	Ethylbenzene	Tetrachloroethene	Toluene	trans-1,2-Dichloroethene	Trichloroethene	Vinyl chloride	Xylenes (total)	Total VOCs	
		SCG <sup>(1)</sup>		1000	700	5	1000	100	5	2	10000	NE	
		Units		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
		Date	QA/QC										
<b>Off-Site Monitoring Wells</b>													
EW3	W-211028-KJ-01	10/28/2021		< 4.0	< 0.50	< 0.50	< 0.50	< 0.50	< 0.40	< 0.20	< 1.5	ND	
MW17A	W-210929-KJ-06	09/29/2021		< 4.0	< 0.50	< 0.50	< 0.50	< 0.50	< 0.40	< 0.20	< 1.5	ND	
MW17B	W-210929-KJ-05	09/29/2021		< 4.0	< 0.50	< 0.50	< 0.50	< 0.50	< 0.40	0.20	< 1.5	0.20	
MW18A	W-210928-KJ-17	09/28/2021		< 4.0	< 0.50	< 0.50	< 0.50	< 0.50	< 0.40	< 0.20	< 1.5	ND	
MW18B	W-210928-KJ-15	09/28/2021		< 4.0	< 0.50	< 0.50	< 0.50	< 0.50	< 0.40	< 0.20	< 1.5	ND	
MW18B	W-210928-KJ-16	09/28/2021	FD	< 4.0	< 0.50	< 0.50	< 0.50	< 0.50	< 0.40	< 0.20	< 1.5	ND	
MW19A	W-210928-KJ-09	09/28/2021		< 4.0	< 0.50	< 0.50	< 0.50	< 0.50	< 0.40	< 0.20	< 1.5	ND	
MW20B	W-210928-KJ-04	09/28/2021		< 4.0	< 0.50	< 0.50	< 0.50	< 0.50	< 0.40	< 0.20	< 1.5	ND	
MW21A	W-210928-KJ-12	09/28/2021		< 4.0	< 0.50	< 0.50	< 0.50	< 0.50	< 0.40	< 0.20	< 1.5	ND	

Notes:

- (1) - Site Cleanup Goals (SCG) from Revised Table 1 of the 1993 Minnesota Decision Document (MDD)  
(SCGs only apply to Compliance Monitoring Wells)
- Shaded results exceed screening criteria, where applicable.
- < - Not detected above the noted reporting limit.
- µg/L - Micrograms per Liter
- FD - Field Duplicate
- J - Estimated
- J- - Estimated - result may be biased low
- mg/L - Milligrams per Liter
- NA - Not Analyzed
- ND - No Detections
- NE - Not Established
- QA/QC - Quality Assurance/Quality Control Sample Type
- UJ - Not detected; associated reporting limit is estimated

Table 4.5

2021 Groundwater Analytical Data Detections  
 Prairie Du Chien Aquifer Monitoring Wells  
 Highway 96 Site  
 White Bear Township, Minnesota

Location	Sample ID	Analyte		Chloride mg/L	1,1-Dichloroethane µg/L	1,1-Dichloroethene µg/L	1,2-Dichloroethane µg/L	Acetone µg/L	Benzene µg/L	Chloroethane µg/L	cis-1,2-Dichloroethene µg/L	Dichlorodifluoromethane (CFC-12) µg/L	Dichlorofluoromethane µg/L
		Units	QA/QC										
		Date											
<b>Off-Site Monitoring Wells</b>													
MW17L	W-210929-KJ-32	09/29/2021		14.3	J- < 0.50	< 0.50	< 0.50	< 20.0	< 0.50	< 1.0	< 0.50	< 1.0	< 1.0
MW17L	W-210929-KJ-38	09/29/2021	FD	15.4	J- < 0.50	< 0.50	< 0.50	< 20.0	< 0.50	< 1.0	< 0.50	< 1.0	< 1.0
MW18L	W-210928-KJ-14	09/28/2021		24.9	J- 0.21 J	< 0.50	< 0.50	< 20.0	< 0.50	< 1.0	< 0.50	< 1.0	< 1.0
MW19L	W-210928-KJ-10	09/28/2021		14.4	J- < 0.50	< 0.50	< 0.50	< 20.0	< 0.50	< 1.0	< 0.50	< 1.0	< 1.0



Table 4.5

**2021 Groundwater Analytical Data Detections  
Prairie Du Chien Aquifer Monitoring Wells  
Highway 96 Site  
White Bear Township, Minnesota**

Location	Sample ID	Analyte		Ethyl ether µg/L	Ethylbenzene µg/L	Tetrachloroethene µg/L	Toluene µg/L	trans-1,2-Dichloroethene µg/L	Trichloroethene µg/L	Vinyl chloride µg/L	Xylenes (total) µg/L	Total VOCs µg/L
		Units										
		Date	QA/QC									
<b>Off-Site Monitoring Wells</b>												
MW17L	W-210929-KJ-32	09/29/2021		< 4.0	< 0.50	< 0.50	< 0.50	< 0.50	< 0.40	< 0.20	< 1.5	ND
MW17L	W-210929-KJ-38	09/29/2021	FD	< 4.0	< 0.50	< 0.50	< 0.50	< 0.50	< 0.40	< 0.20	< 1.5	ND
MW18L	W-210928-KJ-14	09/28/2021		< 4.0	< 0.50	< 0.50	< 0.50	< 0.50	< 0.40	< 0.20	< 1.5	0.21
MW19L	W-210928-KJ-10	09/28/2021		< 4.0	< 0.50	< 0.50	0.52	< 0.50	< 0.40	< 0.20	< 1.5	0.52

Notes:

- < - Not detected above the noted reporting limit.
- µg/L - Micrograms per Liter
- FD - Field Duplicate
- J - Estimated
- J- - Estimated - result may be biased low
- mg/L - Milligrams per Liter
- ND - No Detections
- QA/QC - Quality Assurance/Quality Control Sample Type

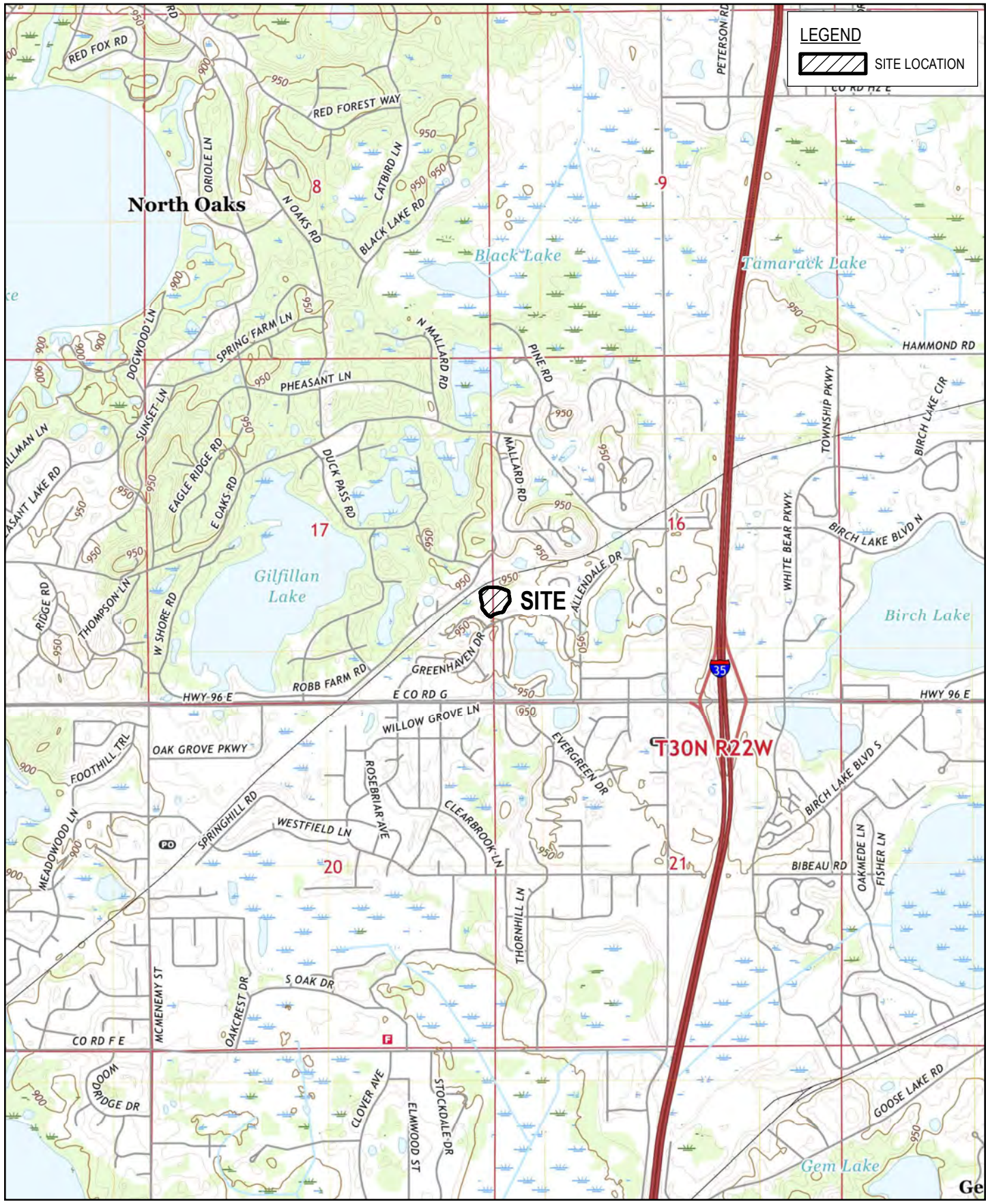
**2021 Groundwater Analytical Detections  
Residential Wells  
Highway 96 Site  
White Bear Township, Minnesota**

Location	Address	Sample ID	Analyte		Chloride	cis-1,2-Dichloroethene	Total VOCs		
			HBG Value <sup>(1)</sup>	NE				6	NE
			HBG Basis <sup>(1)</sup>	-				HRL18	-
			Units	mg/L				µg/L	µg/L
Date	QA/QC								
BUF-01	1 Buffalo Road	RW-211006-KJ-10	10/06/2021		35.5 J-	< 0.50	ND		
BUF-03	3 Buffalo Road	RW-211006-KJ-09	10/06/2021		36.8 J-	< 0.50	ND		
EAG-01	1 Eagle Ridge Road	RW-211006-KJ-17	10/06/2021		29.4 J-	< 0.50	ND		
EAG-02	2 Eagle Ridge Road	RW-211006-KJ-14	10/06/2021		38.3 J-	< 0.50	ND		
EAG-02	2 Eagle Ridge Road	RW-211006-KJ-15	10/06/2021	FD	38.6 J-	< 0.50	ND		
EAG-03	3 Eagle Ridge Road	RW-211006-KJ-13	10/06/2021		30.9 J-	< 0.50	ND		
EAG-04	4 Eagle Ridge Road	RW-211006-KJ-12	10/06/2021		29.8 J-	< 0.50	ND		
EAG-06	6 Eagle Ridge Road	RW-211006-KJ-11	10/06/2021		43.6 J-	< 0.50	ND		
EAS-44	44 East Oaks Road	RW-211006-KJ-19	10/06/2021		15.6 J-	< 0.50	ND		
EAS-50	50 East Oaks Road	RW-211006-KJ-18	10/06/2021		33.4 J-	< 0.50	ND		
POP-08	8 Poplar Lane	RW-211006-KJ-20	10/06/2021		40.7 J-	< 0.50	ND		
QUA-03	3 Quail Lane	RW-211007-KJ-31	10/07/2021		28.5	< 0.50	ND		
SKI-04	4 Ski Lane	RW-211006-KJ-01	10/06/2021		42.0 J-	0.22 J	0.22		
SKI-06	6 Ski Lane	RW-211006-KJ-02	10/06/2021		33.2 J-	< 0.50	ND		
SKI-06	6 Ski Lane	RW-211006-KJ-03	10/06/2021	FD	32.9 J-	< 0.50	ND		
SKI-08	8 Ski Lane	RW-211006-KJ-05	10/06/2021		40.2 J-	< 0.50	ND		
SKI-10	10 Ski Lane	RW-211006-KJ-06	10/06/2021		28.0 J-	< 0.50	ND		
SKI-12	12 Ski Lane	RW-211007-KJ-22	10/07/2021		59.4	< 0.50	ND		
SKI-12	12 Ski Lane	RW-211007-KJ-23	10/07/2021	FD	59.0	< 0.50	ND		
SKI-14	14 Ski Lane	RW-211006-KJ-07	10/06/2021		40.5 J-	< 0.50	ND		
SKI-16	16 Ski Lane	RW-211006-KJ-08	10/06/2021		26.5 J-	< 0.50	ND		
THO-01	1 Thompson Lane	RW-211007-KJ-28	10/07/2021		30.1	< 0.50	ND		
THO-03	3 Thompson Lane	RW-211007-KJ-30	10/07/2021		12.8	< 0.50	ND		
THO-04	4 Thompson Lane	RW-211007-KJ-29	10/07/2021		137	< 0.50	ND		
WES-08	8 West Shore Road	RW-211007-KJ-25	10/07/2021		5.1	< 0.50	ND		
WES-09	9 West Shore Road	RW-211007-KJ-26	10/07/2021		6.0	< 0.50	ND		
WES-11b	11 West Shore Road [New] <sup>#H</sup>	RW-211007-KJ-27	10/07/2021		7.1	< 0.50	ND		
WES-15	15 West Shore Road	RW-211006-KJ-21	10/06/2021		41.1	< 0.50	ND		

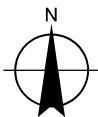
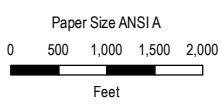
Notes:

- (1) - Health-Based Guidance (HBG) established by the Minnesota Department of Health (MDH) for private wells (where multiple values are established, the lowest value is shown)
- Shaded results exceed screening criteria, where applicable.
- <sup>#H</sup> - New well installed by Homeowner (Prairie du Chien aquifer)
- < - Not detected above the noted reporting limit.
- µg/L - Micrograms per Liter
- FD - Field Duplicate
- HRL - Health Risk Limit (## year promulgated)
- J - Estimated
- J- - Estimated - result may be biased low
- mg/L - Milligrams per Liter
- ND - No Detections
- NE - Not Established
- QA/QC - Quality Assurance/Quality Control Sample Type

# Figures



**LEGEND**  
 SITE LOCATION



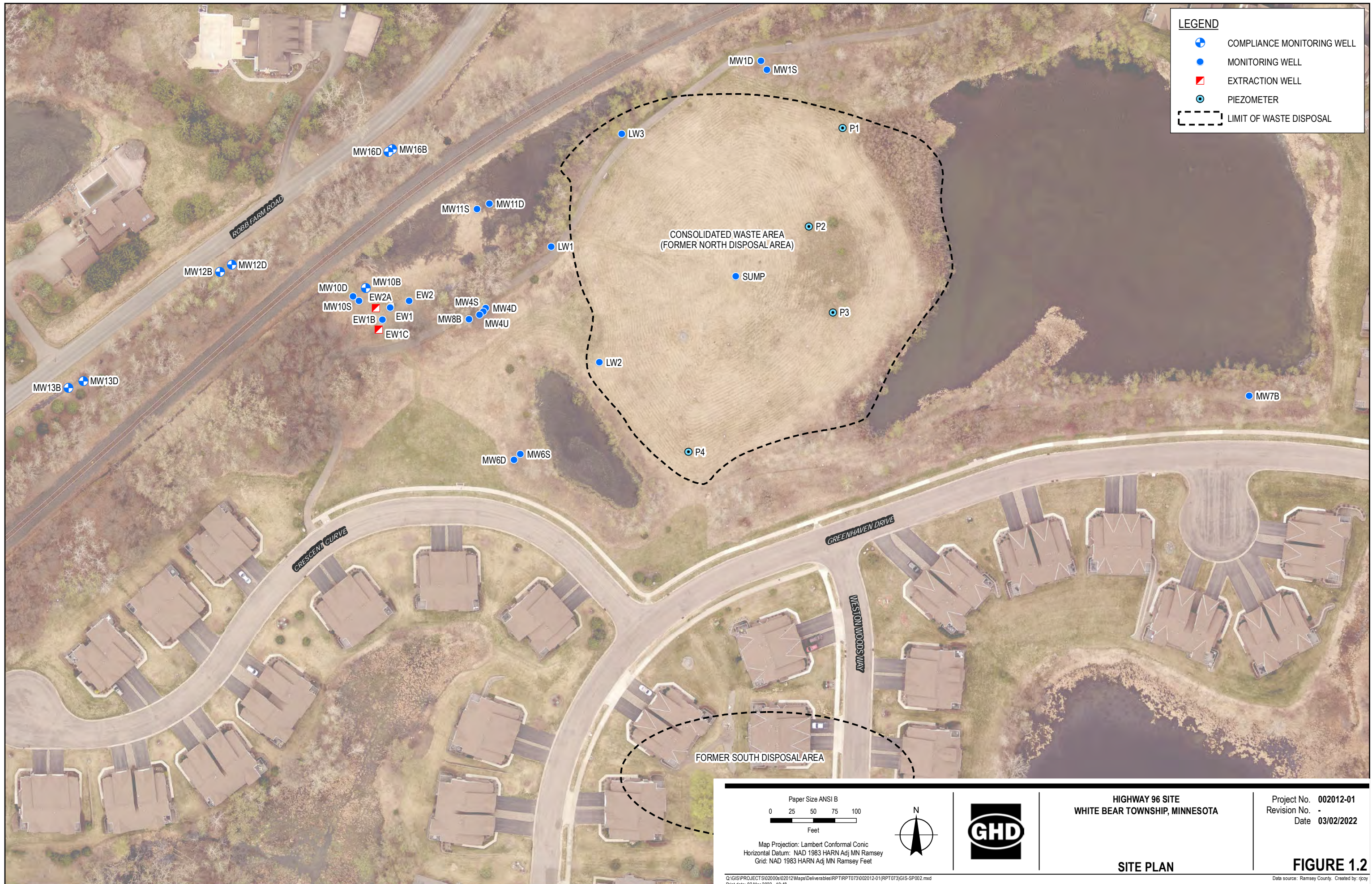
**HIGHWAY 96 SITE  
 WHITE BEAR TOWNSHIP, MINNESOTA**

Project No. 002012-01  
 Revision No. -  
 Date 02/28/2022

Map Projection: Lambert Conformal Conic  
 Horizontal Datum: NAD 1983 HARN Adj MN Ramsey  
 Grid: NAD 1983 HARN Adj MN Ramsey Feet

**SITE LOCATION**

**FIGURE 1.1**



**LEGEND**

- ⊕ COMPLIANCE MONITORING WELL
- MONITORING WELL
- ▣ EXTRACTION WELL
- ⊙ PIEZOMETER
- LIMIT OF WASTE DISPOSAL

Paper Size ANSI B

0 25 50 75 100  
Feet

Map Projection: Lambert Conformal Conic  
Horizontal Datum: NAD 1983 HARN Adj MN Ramsey  
Grid: NAD 1983 HARN Adj MN Ramsey Feet

N



**HIGHWAY 96 SITE**  
**WHITE BEAR TOWNSHIP, MINNESOTA**

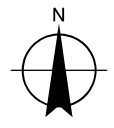
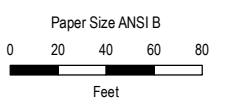
Project No. 002012-01  
Revision No. -  
Date 03/02/2022

**SITE PLAN**

**FIGURE 1.2**



LEGEND	
	GAS PROBE
	GAS VENT
	INSTALLED BY MARK OF EXCELLENCE TOWNHOMES
	INTERCEPTOR TRENCH INSTALLED BY MARK OF EXCELLENCE TOWNHOMES
	ORIGINAL LIMIT OF NORTH DISPOSAL AREA
	NEW LIMIT OF CONSOLIDATED WASTE AREA



HIGHWAY 96 SITE  
 WHITE BEAR TOWNSHIP, MINNESOTA

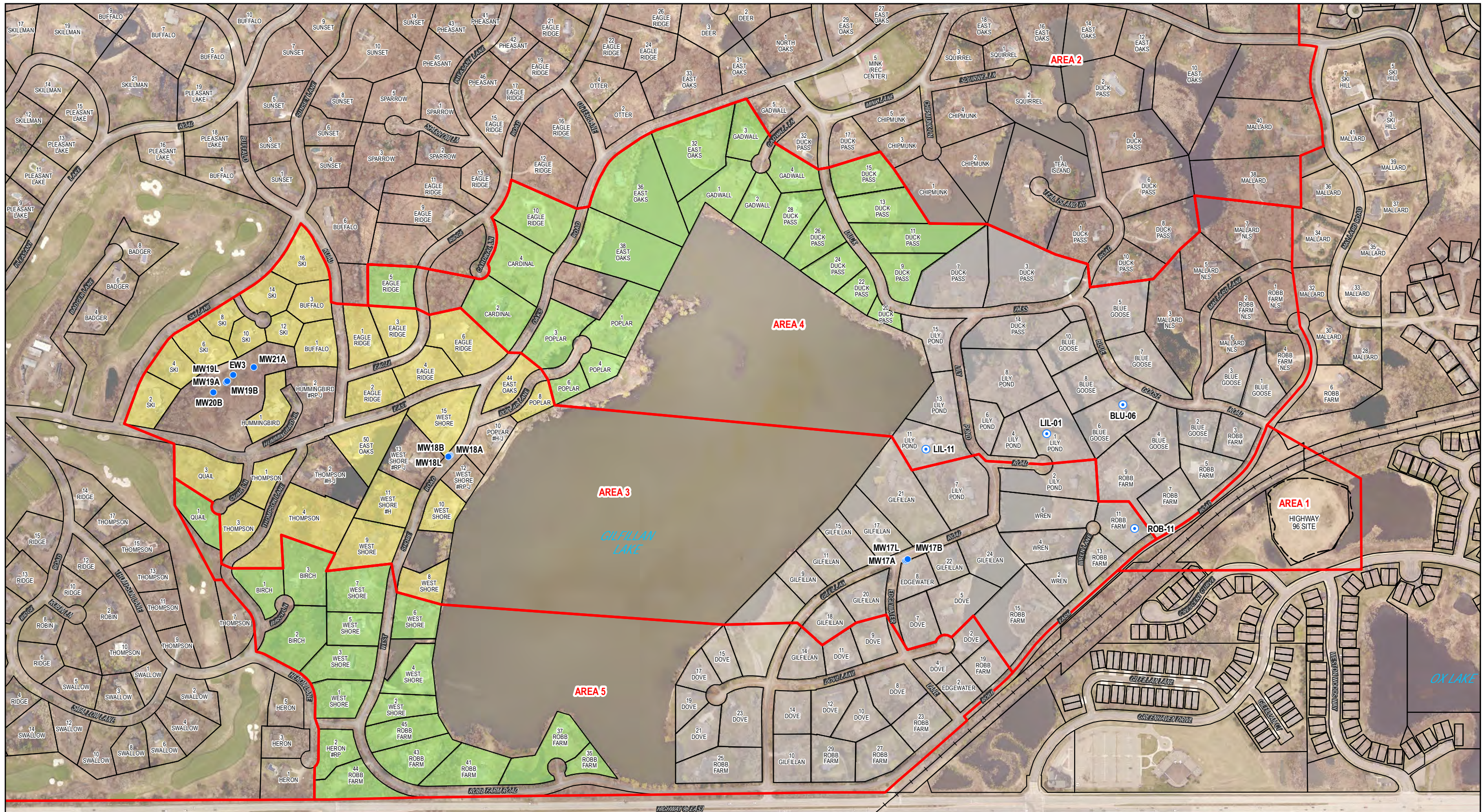
**GAS MONITORING LOCATIONS  
 CONSOLIDATED WASTE AREA**

Project No. 002012-01  
 Revision No. -  
 Date 03/01/2022

**FIGURE 1.3**

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Data source: Ramsey County. Created by: rjpy



**LEGEND**

	GEOGRAPHIC AREA		RESIDENTIAL WELL LOCATION (ANNUAL SAMPLING - OCTOBER)	#RP	REPLACEMENT WELL INSTALLED BY RPs (PRAIRIE DU CHIEN AQUIFER) [OLD WELL ABANDONED]
	MONITORING WELL LOCATION (ANNUAL SAMPLING - OCTOBER)		RESIDENTIAL WELL LOCATION (SAMPLED EVERY FIVE YEARS) [NEXT EVENT OCTOBER 2024]	#RP-J	REPLACEMENT WELL INSTALLED BY RPS (EXTENDED INTO JORDAN AQUIFER AT HOMEOWNER'S REQUEST/EXPENSE) [OLD WELL ABANDONED]
	CONVERTED RESIDENTIAL MONITORING WELL (ANNUAL SAMPLING - OCTOBER)		RESIDENTIAL WELL LOCATION (NO LONGER SAMPLED)	#H	NEW WELL INSTALLED BY HOMEOWNER (PRAIRIE DU CHIEN AQUIFER) [OLD WELL ABANDONED]
	CONNECTED TO MUNICIPAL WATER SUPPLY	NLS		#H-J	NEW WELL INSTALLED BY HOMEOWNER (JORDAN AQUIFER) [OLD WELL ABANDONED]

Paper Size ANSI B  
0 100 200 300 400 500  
Feet

Map Projection: Lambert Conformal Conic  
Horizontal Datum: NAD 1983 HARN Adj MN Ramsey  
Grid: NAD 1983 HARN Adj MN Ramsey Feet

**HIGHWAY 96 SITE**  
WHITE BEAR TOWNSHIP, MINNESOTA

**OFF-SITE GROUNDWATER  
MONITORING NETWORK**

Project No. 002012-01  
Revision No. -  
Date 03/02/2022

**FIGURE 1.4**

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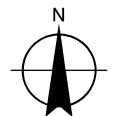
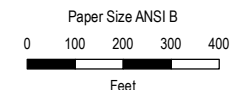
Data source: Ramsey County. Created by: rjpy



**1993/1994  
WATER SERVICE  
AREA (60 HOMES)**

**LEGEND**

- TRUNK MAIN
- SERVICE LOOP
- WATER SERVICE AREA
- LIMIT OF WASTE DISPOSAL



**HIGHWAY 96 SITE  
WHITE BEAR TOWNSHIP, MINNESOTA**

Project No. 002012-01  
Revision No. -  
Date 03/02/2022

Map Projection: Lambert Conformal Conic  
Horizontal Datum: NAD 1983 HARN Adj MN Ramsey  
Grid: NAD 1983 HARN Adj MN Ramsey Feet

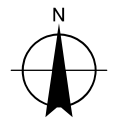
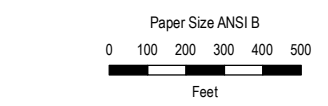
**MUNICIPAL WATER SYSTEM**

**FIGURE 1.5**

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Data source: Ramsey County. Created by: rpy





HIGHWAY 96 SITE  
WHITE BEAR TOWNSHIP, MINNESOTA

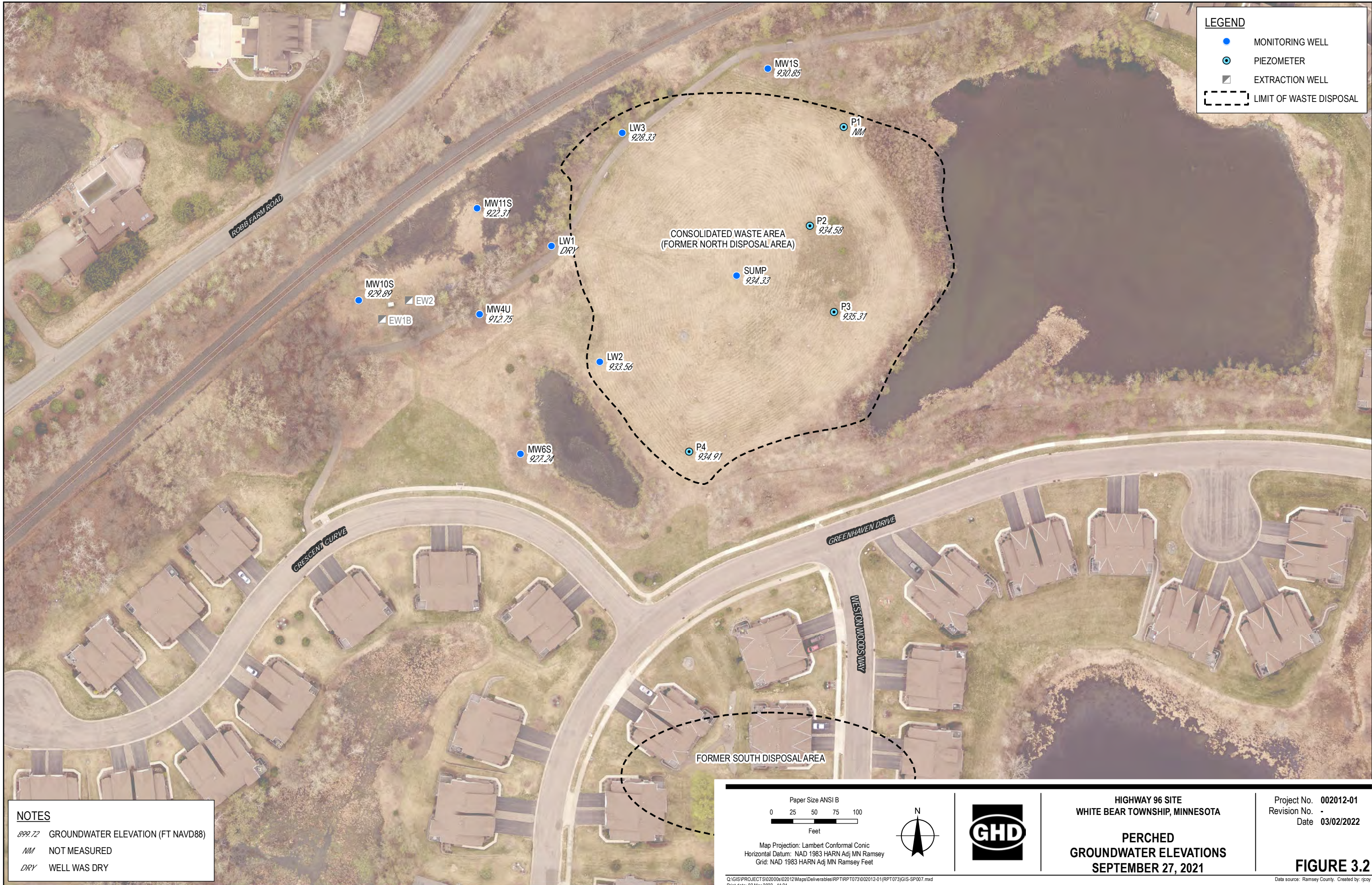
Project No. 002012-01  
Revision No. -  
Date 03/02/2022

LOCATION OF CROSS SECTIONS

FIGURE 3.1

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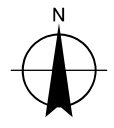
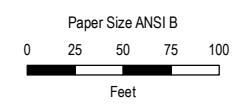


**LEGEND**

- MONITORING WELL
- ⊙ PIEZOMETER
- ▣ EXTRACTION WELL
- LIMIT OF WASTE DISPOSAL

CONSOLIDATED WASTE AREA  
(FORMER NORTH DISPOSAL AREA)

FORMER SOUTH DISPOSAL AREA



HIGHWAY 96 SITE  
WHITE BEAR TOWNSHIP, MINNESOTA

**PERCHED  
GROUNDWATER ELEVATIONS**  
SEPTEMBER 27, 2021

Project No. 002012-01  
Revision No. -  
Date 03/02/2022

**FIGURE 3.2**

**NOTES**

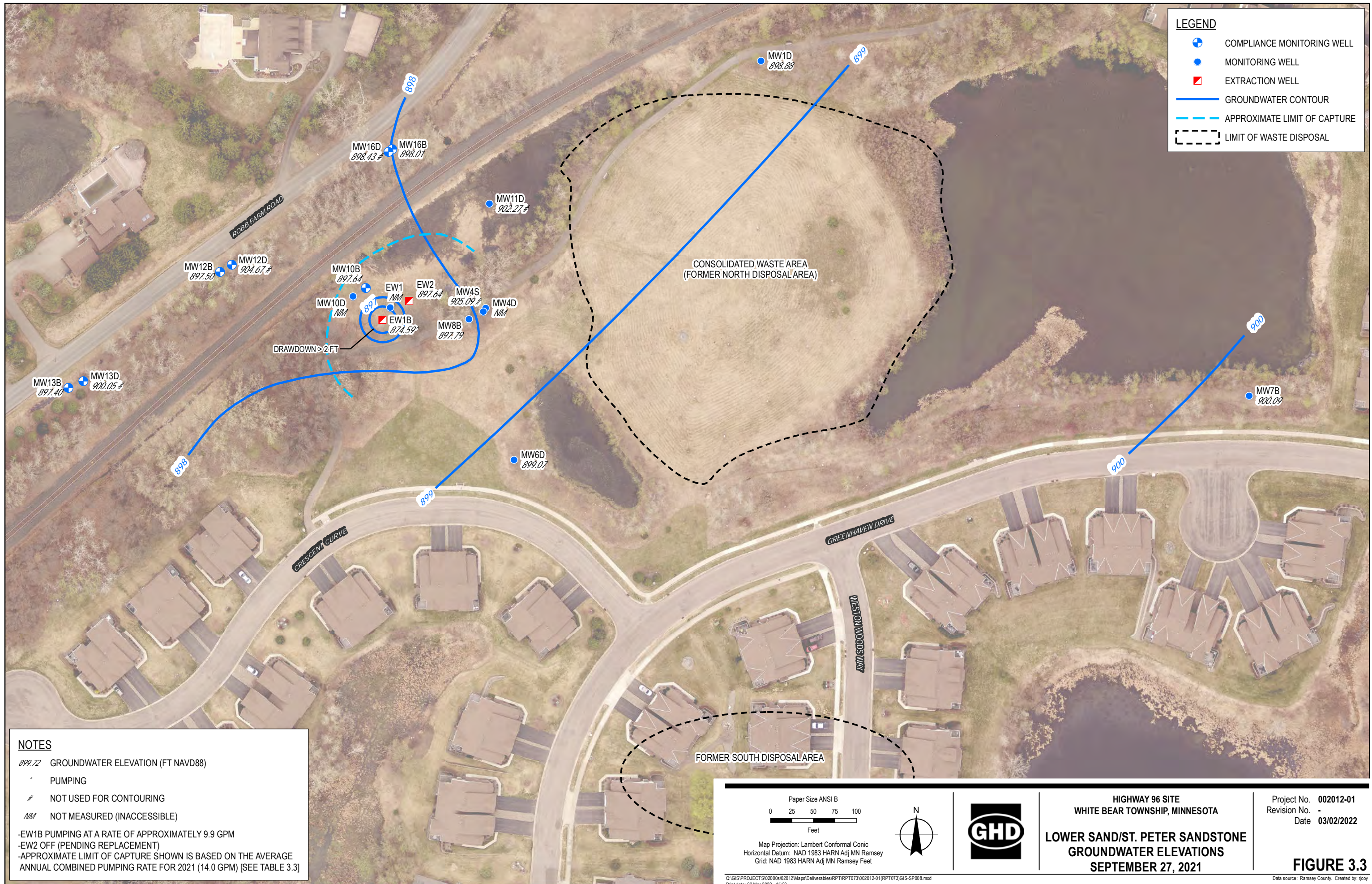
899.72 GROUNDWATER ELEVATION (FT NAVD88)

MM NOT MEASURED

DRY WELL WAS DRY

Q:\GIS\PROJECTS\020000\02012\Map\Deliverables\RPT\RPT073\02012-01\073\GIS-SP007.mxd  
Print date: 02 Mar 2022 - 11:21

Data source: Ramsey County. Created by: rjpy



**LEGEND**

- ⊕ COMPLIANCE MONITORING WELL
- MONITORING WELL
- EXTRACTION WELL
- GROUNDWATER CONTOUR
- APPROXIMATE LIMIT OF CAPTURE
- LIMIT OF WASTE DISPOSAL

**NOTES**

899.72 GROUNDWATER ELEVATION (FT NAVD88)

\* PUMPING

# NOT USED FOR CONTOURING

MM NOT MEASURED (INACCESSIBLE)

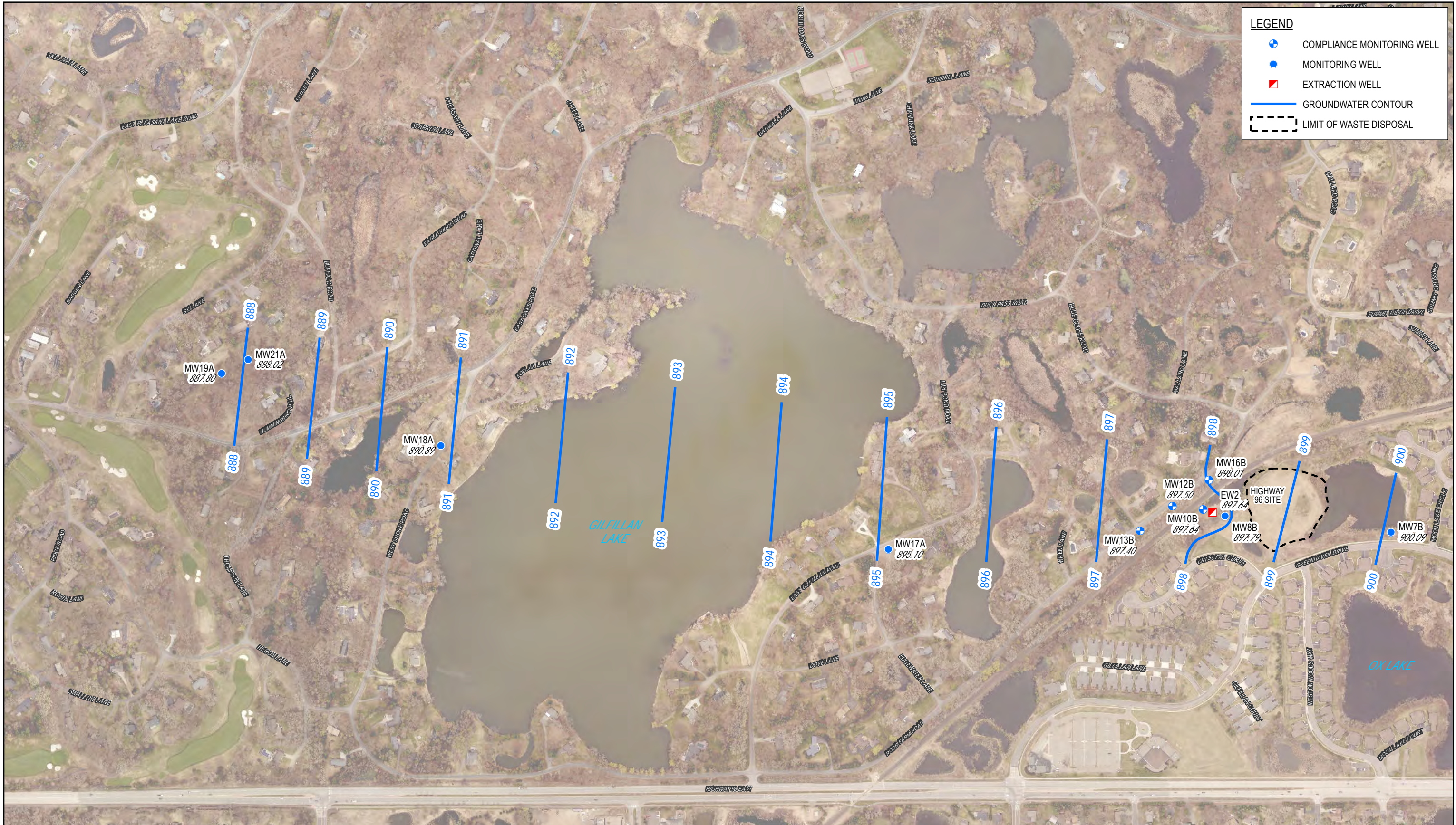
-EW1B PUMPING AT A RATE OF APPROXIMATELY 9.9 GPM

-EW2 OFF (PENDING REPLACEMENT)

-APPROXIMATE LIMIT OF CAPTURE SHOWN IS BASED ON THE AVERAGE ANNUAL COMBINED PUMPING RATE FOR 2021 (14.0 GPM) [SEE TABLE 3.3]

Paper Size ANSI B 0 25 50 75 100 Feet			<b>HIGHWAY 96 SITE</b> WHITE BEAR TOWNSHIP, MINNESOTA <b>LOWER SAND/ST. PETER SANDSTONE</b> <b>GROUNDWATER ELEVATIONS</b> SEPTEMBER 27, 2021	Project No. 002012-01 Revision No. - Date 03/02/2022
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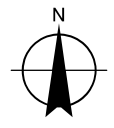
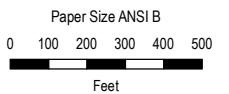
**FIGURE 3.3**



**LEGEND**

- + COMPLIANCE MONITORING WELL
- MONITORING WELL
- EXTRACTION WELL
- GROUNDWATER CONTOUR
- LIMIT OF WASTE DISPOSAL

**NOTES**  
 899.72 GROUNDWATER ELEVATION (FT NAVD88)  
 -EW2 OFF (PENDING REPLACEMENT)



Map Projection: Lambert Conformal Conic  
 Horizontal Datum: NAD 1983 HARN Adj MN Ramsey  
 Grid: NAD 1983 HARN Adj MN Ramsey Feet

**HIGHWAY 96 SITE**  
 WHITE BEAR TOWNSHIP, MINNESOTA

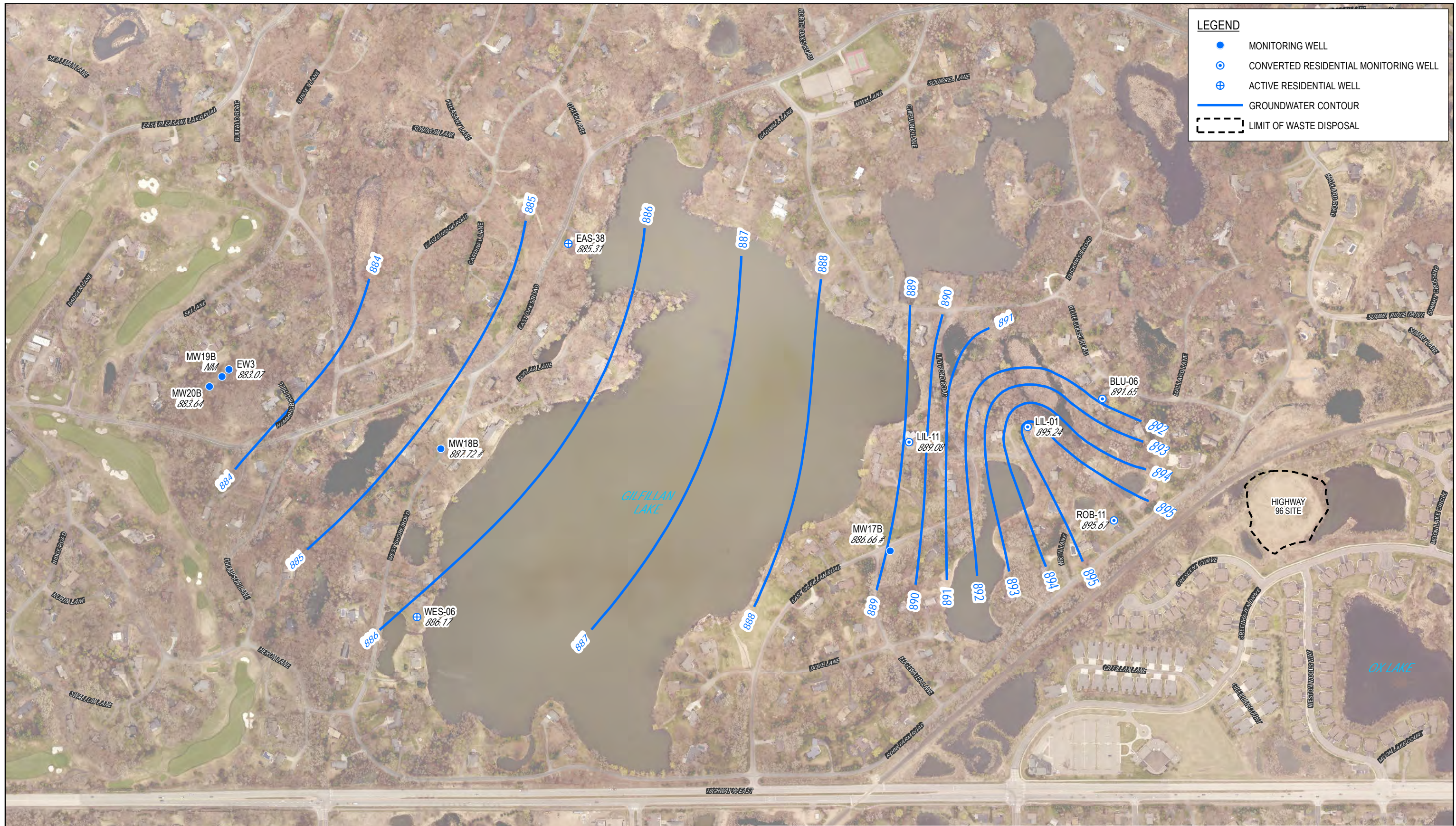
**UPPER ST. PETER SANDSTONE**  
**AQUIFER GROUNDWATER ELEVATIONS**  
 SEPTEMBER 27, 2021

Project No. 002012-01  
 Revision No. -  
 Date 03/02/2022

**FIGURE 3.4**

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Data source: Ramsey County. Created by: rjpy



**LEGEND**

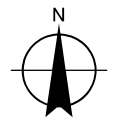
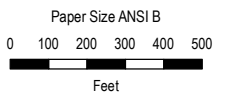
- MONITORING WELL
- ⊕ CONVERTED RESIDENTIAL MONITORING WELL
- ⊕ ACTIVE RESIDENTIAL WELL
- GROUNDWATER CONTOUR
- - - LIMIT OF WASTE DISPOSAL

**NOTES**

899.72 GROUNDWATER ELEVATION (FT NAVD88)

MM NOT MEASURED (INACCESSIBLE)

# NOT USED FOR CONTOURING



Map Projection: Lambert Conformal Conic  
 Horizontal Datum: NAD 1983 HARN Adj MN Ramsey  
 Grid: NAD 1983 HARN Adj MN Ramsey Feet

HIGHWAY 96 SITE  
 WHITE BEAR TOWNSHIP, MINNESOTA

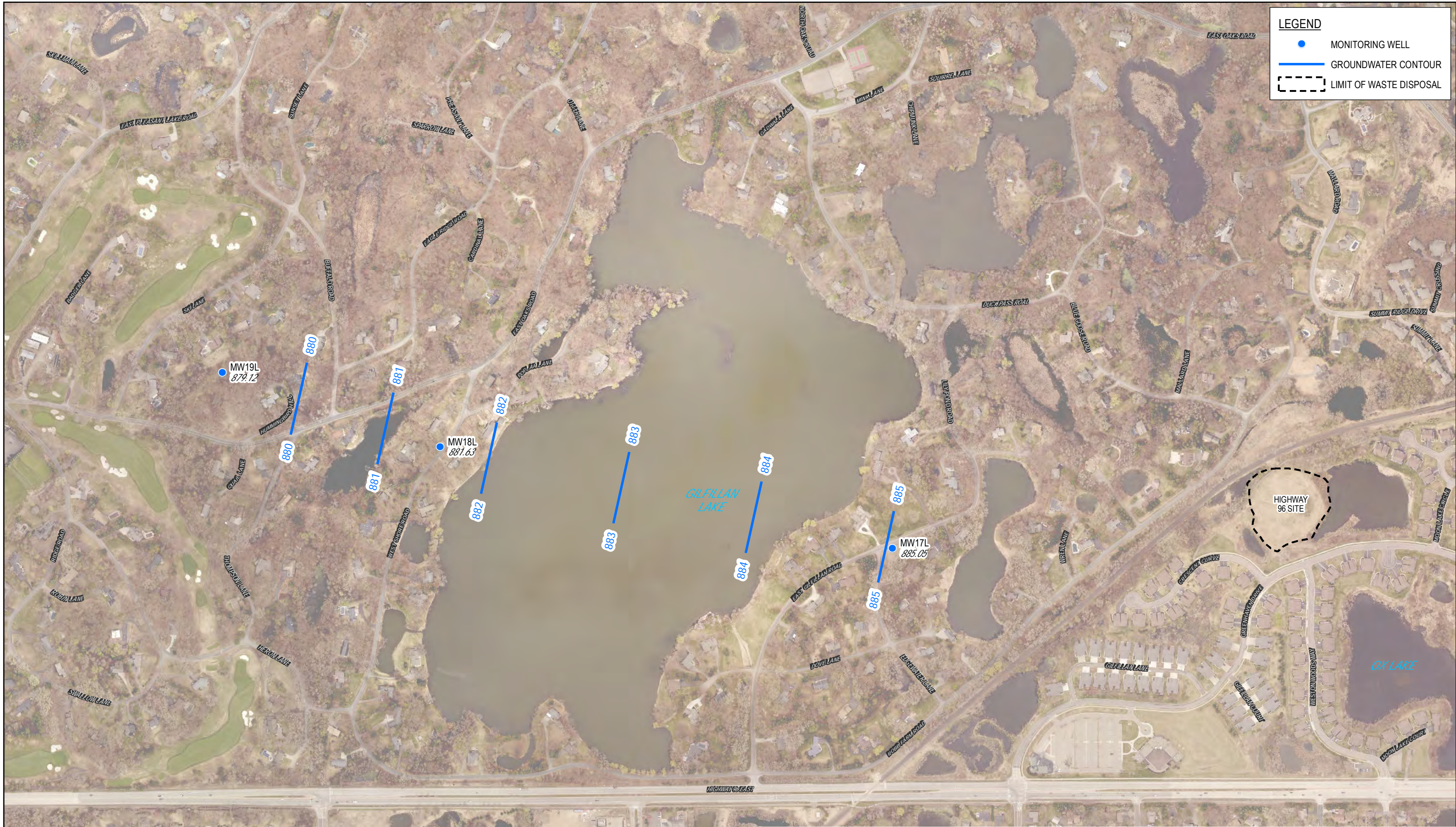
**BASAL ST. PETER SANDSTONE  
 AQUIFER GROUNDWATER ELEVATIONS**  
 SEPTEMBER 27, 2021

Project No. 002012-01  
 Revision No. -  
 Date 03/02/2022

**FIGURE 3.5**

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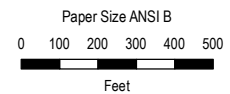
Data source: Ramsey County. Created by: rjpy



**LEGEND**

- MONITORING WELL
- GROUNDWATER CONTOUR
- LIMIT OF WASTE DISPOSAL

**NOTE**  
 899.72 GROUNDWATER ELEVATION (FT NAVD88)



Map Projection: Lambert Conformal Conic  
 Horizontal Datum: NAD 1983 HARN Adj MN Ramsey  
 Grid: NAD 1983 HARN Adj MN Ramsey Feet



**HIGHWAY 96 SITE**  
 WHITE BEAR TOWNSHIP, MINNESOTA

**PRAIRIE DU CHIEN AQUIFER**  
**GROUNDWATER ELEVATIONS**  
 SEPTEMBER 27, 2021

Project No. 002012-01  
 Revision No. -  
 Date 03/02/2022

**FIGURE 3.6**

Figure 3.7

Historical VOC Mass Removal  
Highway 96 Site  
White Bear Township, Minnesota

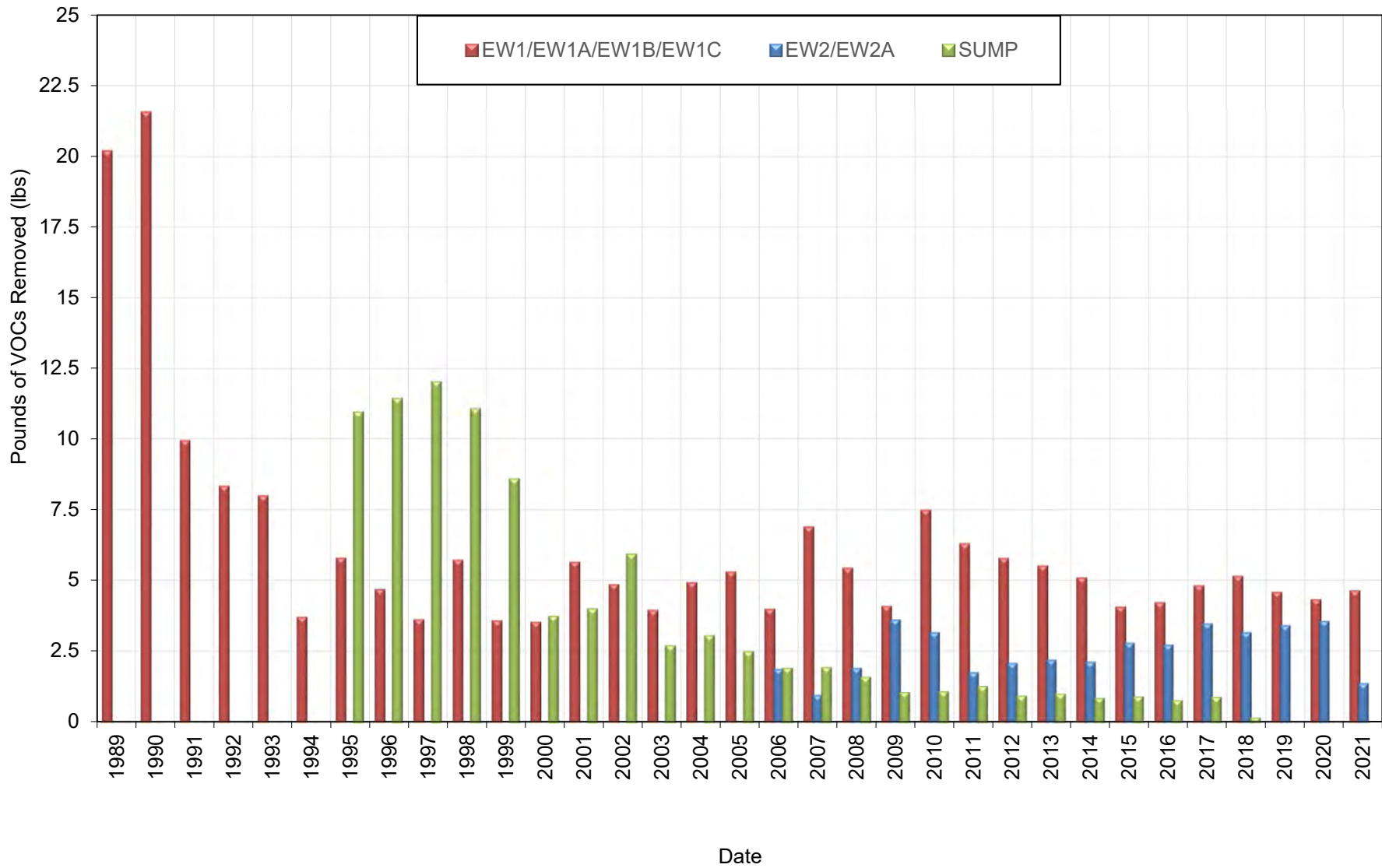
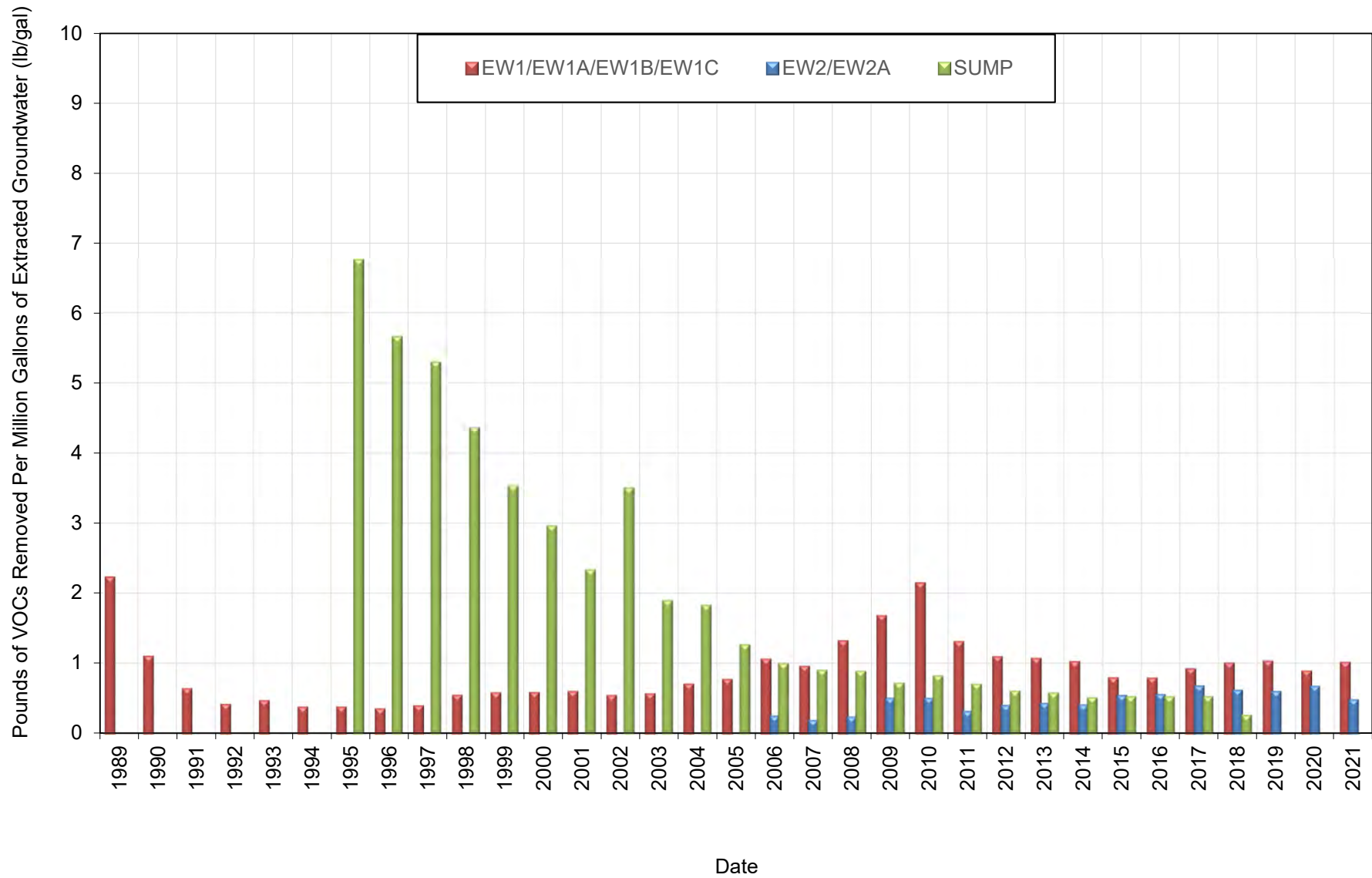


Figure 3.8

Historical VOC Mass Removal Efficiency  
Highway 96 Site  
White Bear Township, Minnesota





**Figure 3.9**  
**Cumulative VOC Mass Removal**  
**Highway 96 Site**  
**White Bear Township, Minnesota**

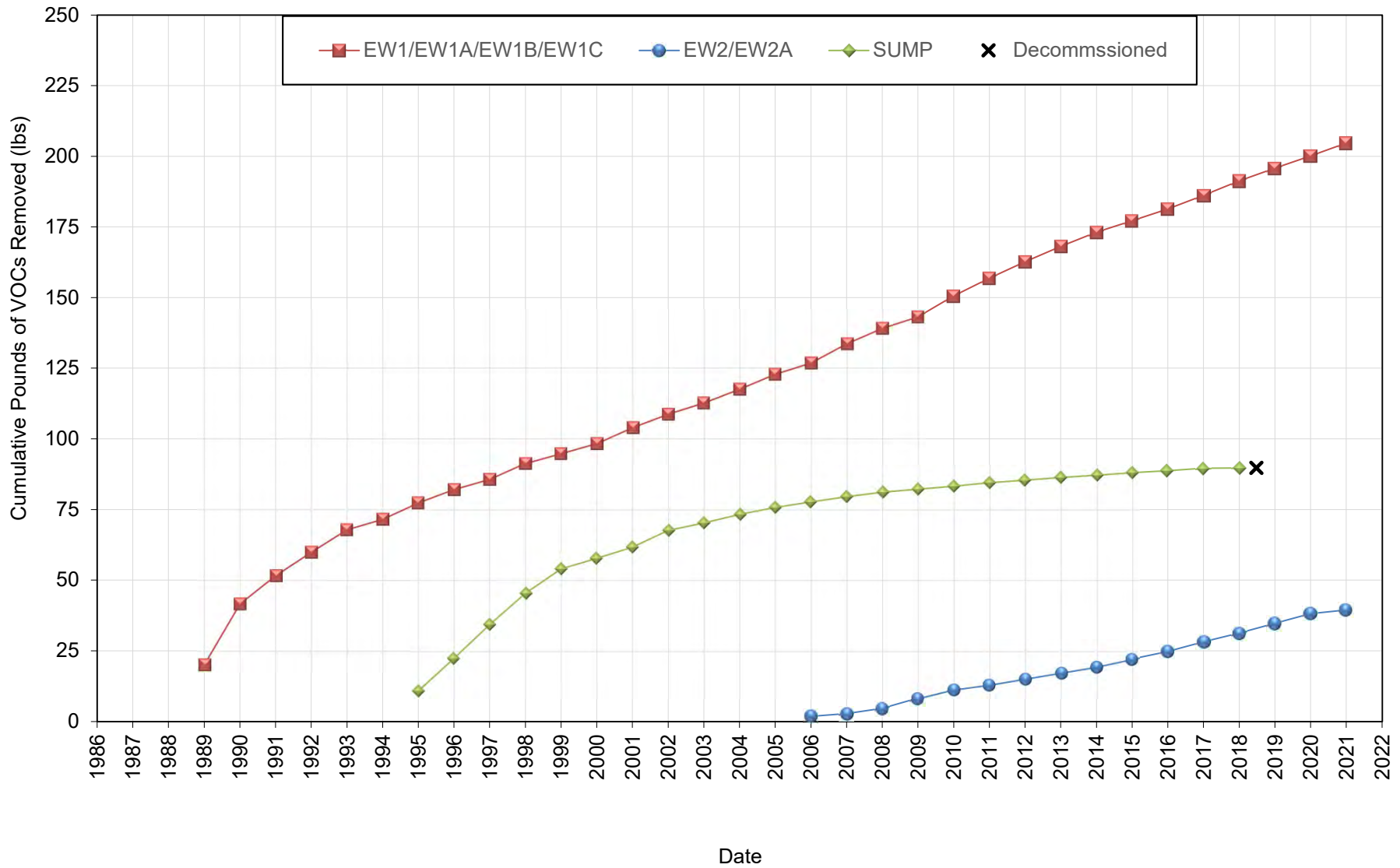
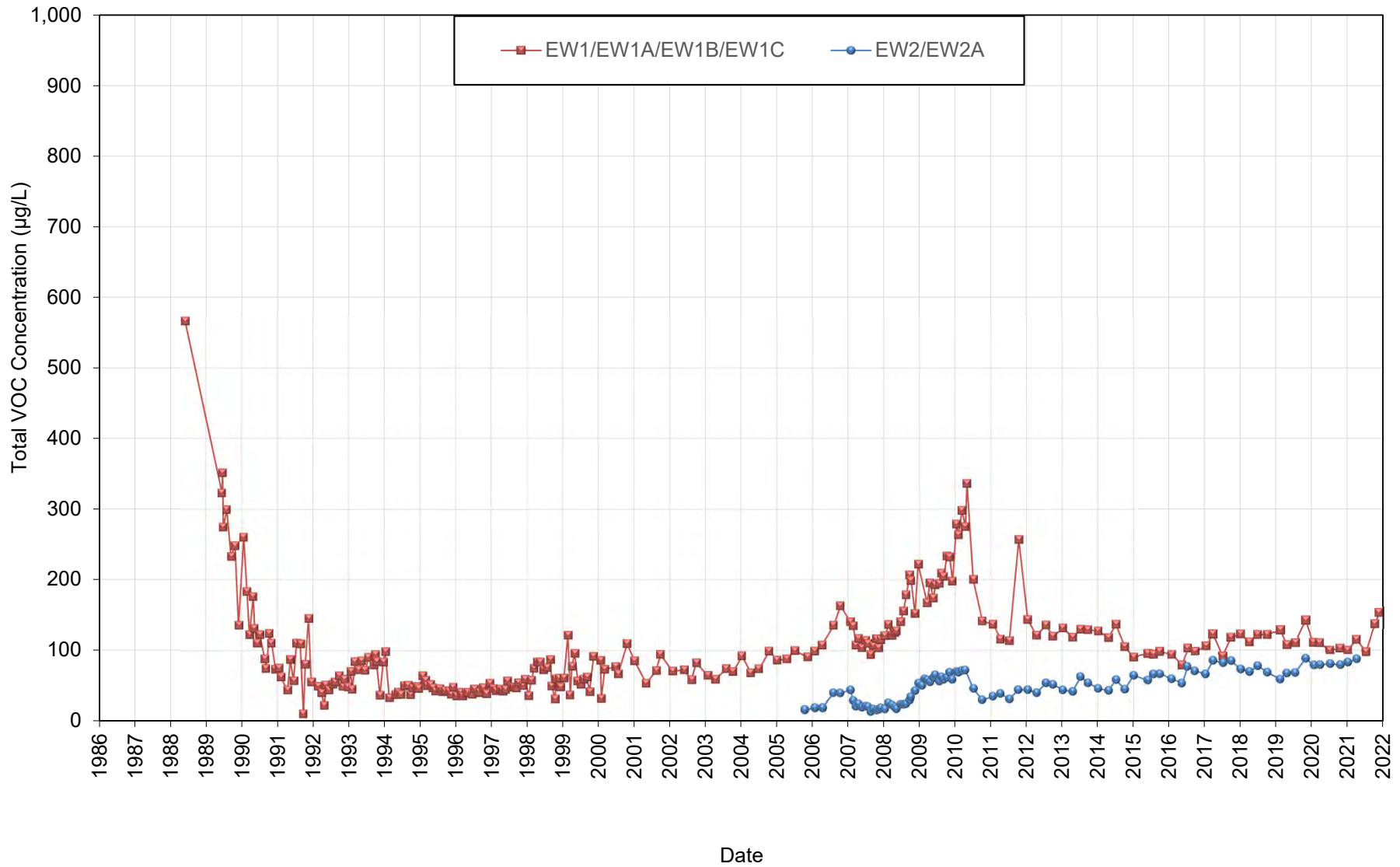
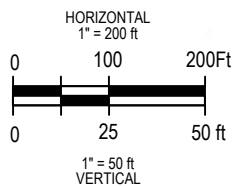
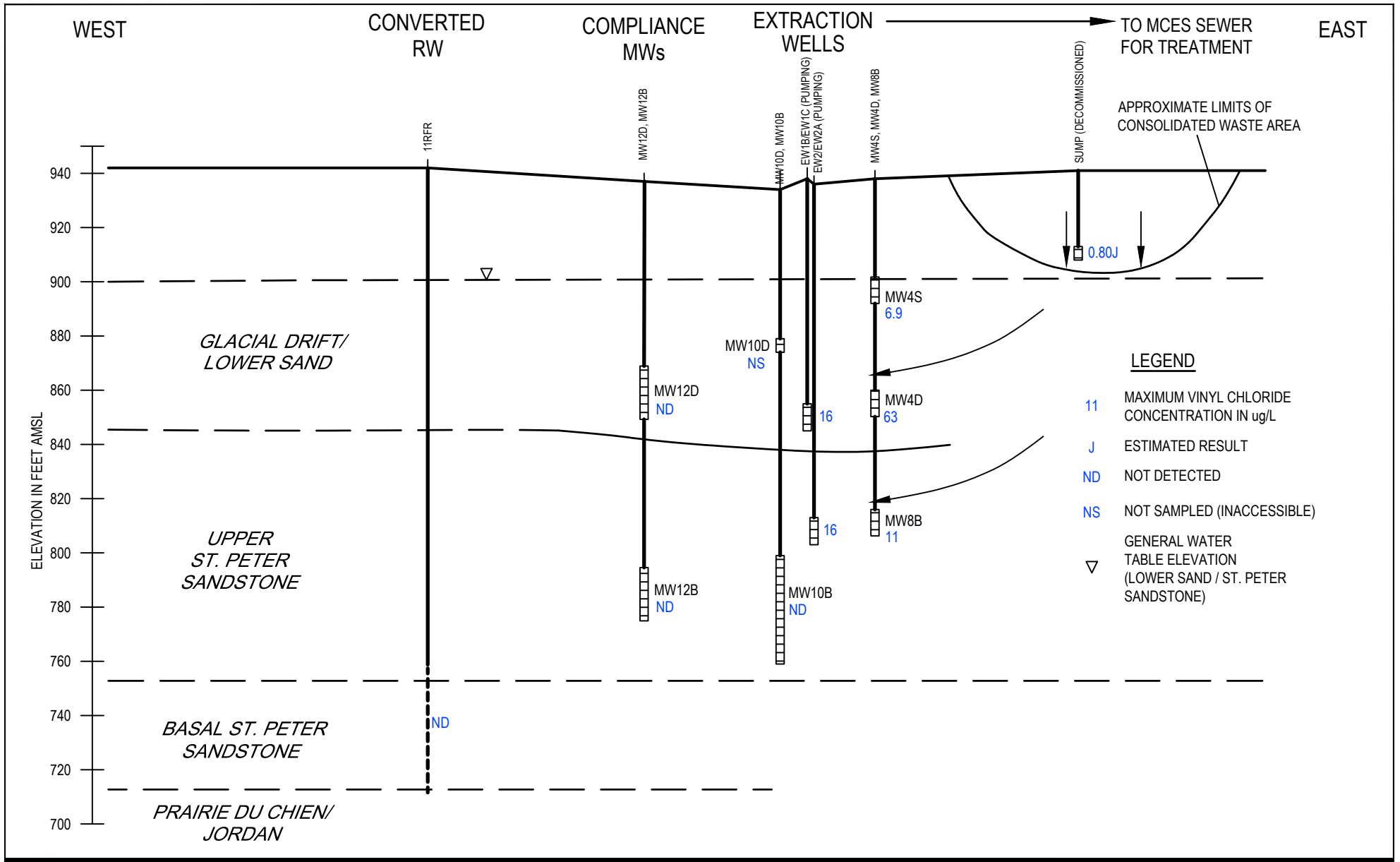


Figure 3.10

Historical Total VOC Concentrations  
EW1/EW1A/EW1B/EW1C and EW2/EW2A  
Highway 96 Site  
White Bear Township, Minnesota





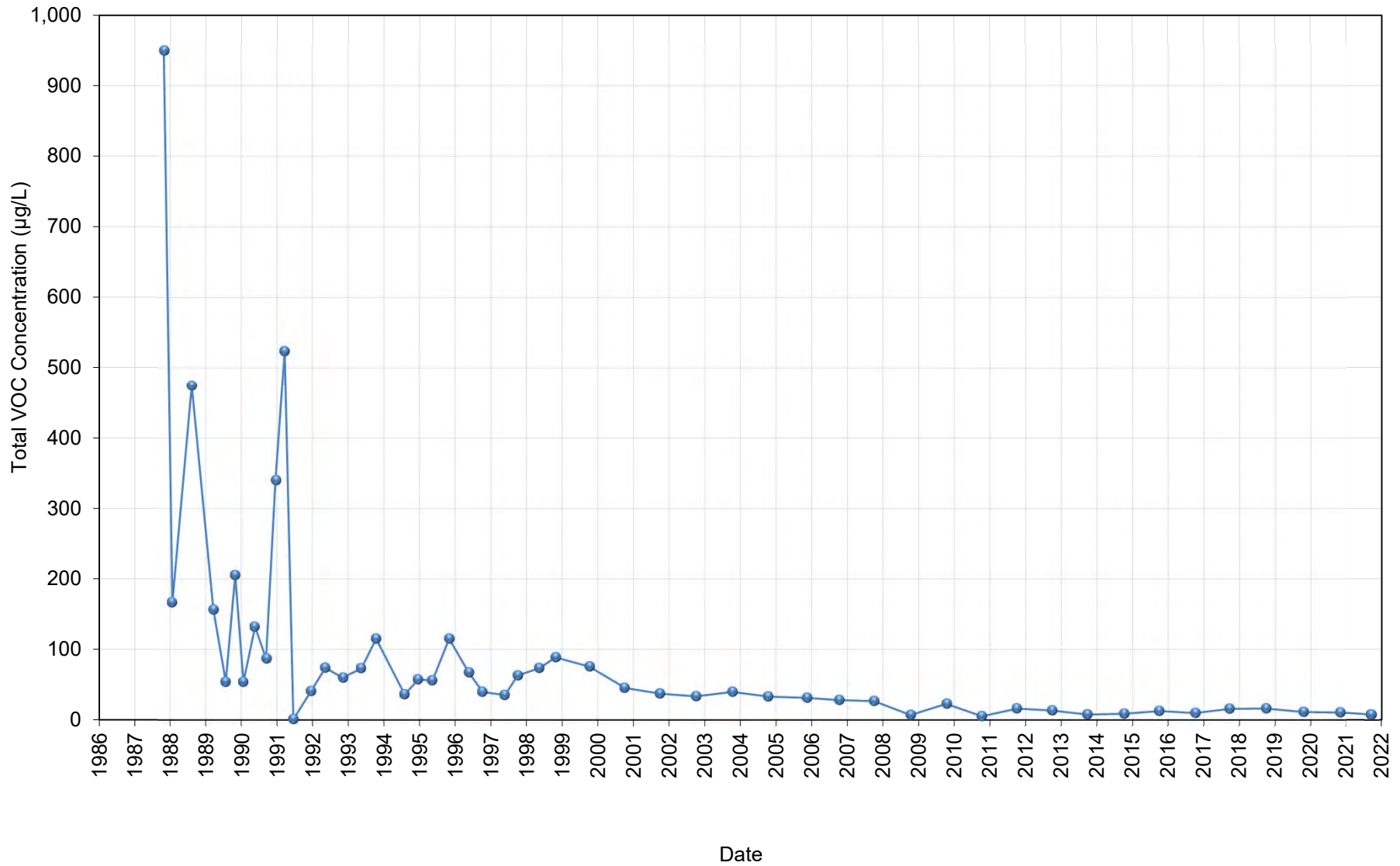
HIGHWAY 96 SITE  
WHITE BEAR TOWNSHIP, MINNESOTA

GROUNDWATER EXTRACTION  
CROSS SECTION (2021)

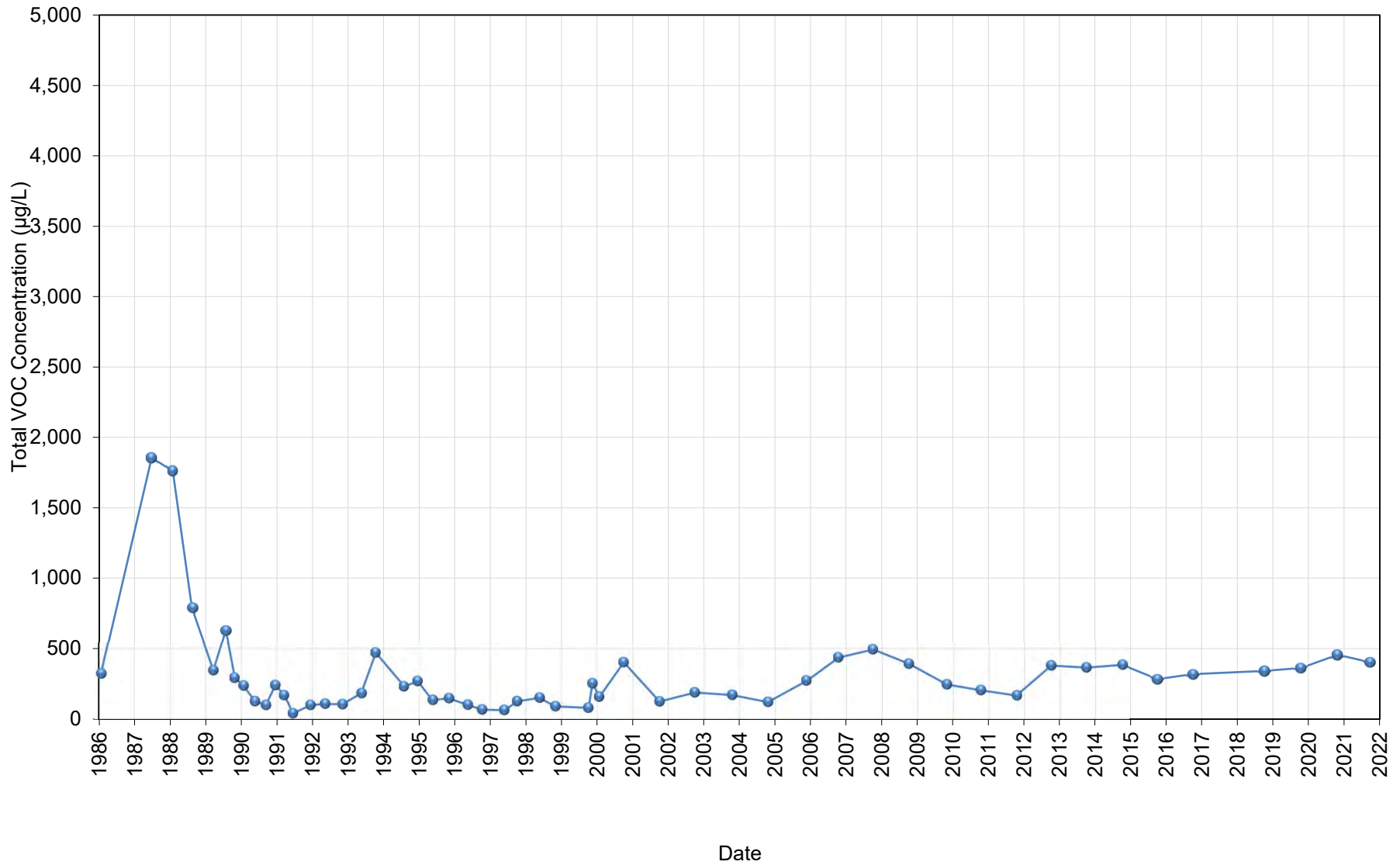
Project No. 2012  
Date February 2022

**FIGURE 3.11**

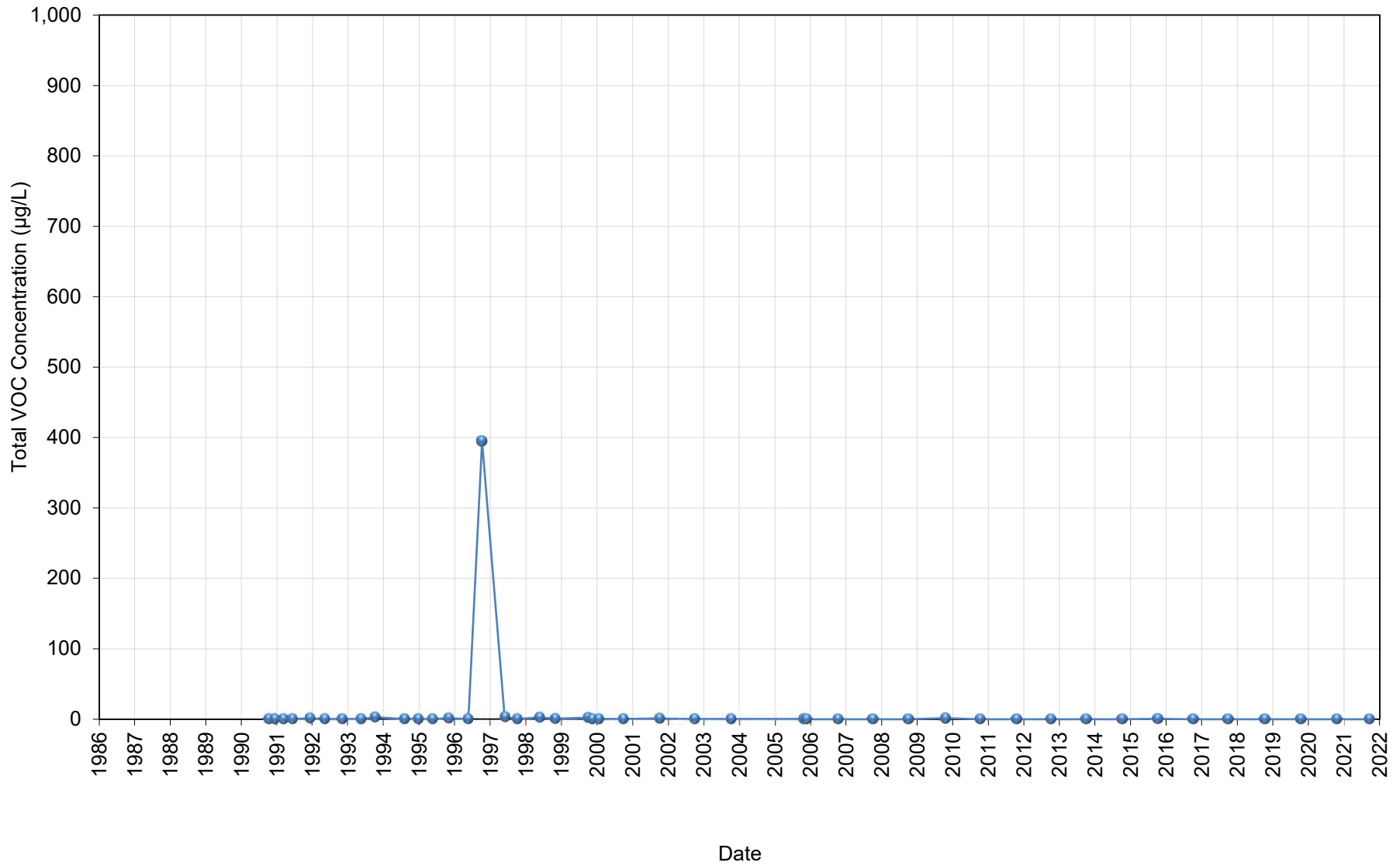
**Figure 4.1**  
**Historical Total VOC Concentrations**  
**LW3**  
**Highway 96 Site**  
**White Bear Township, Minnesota**



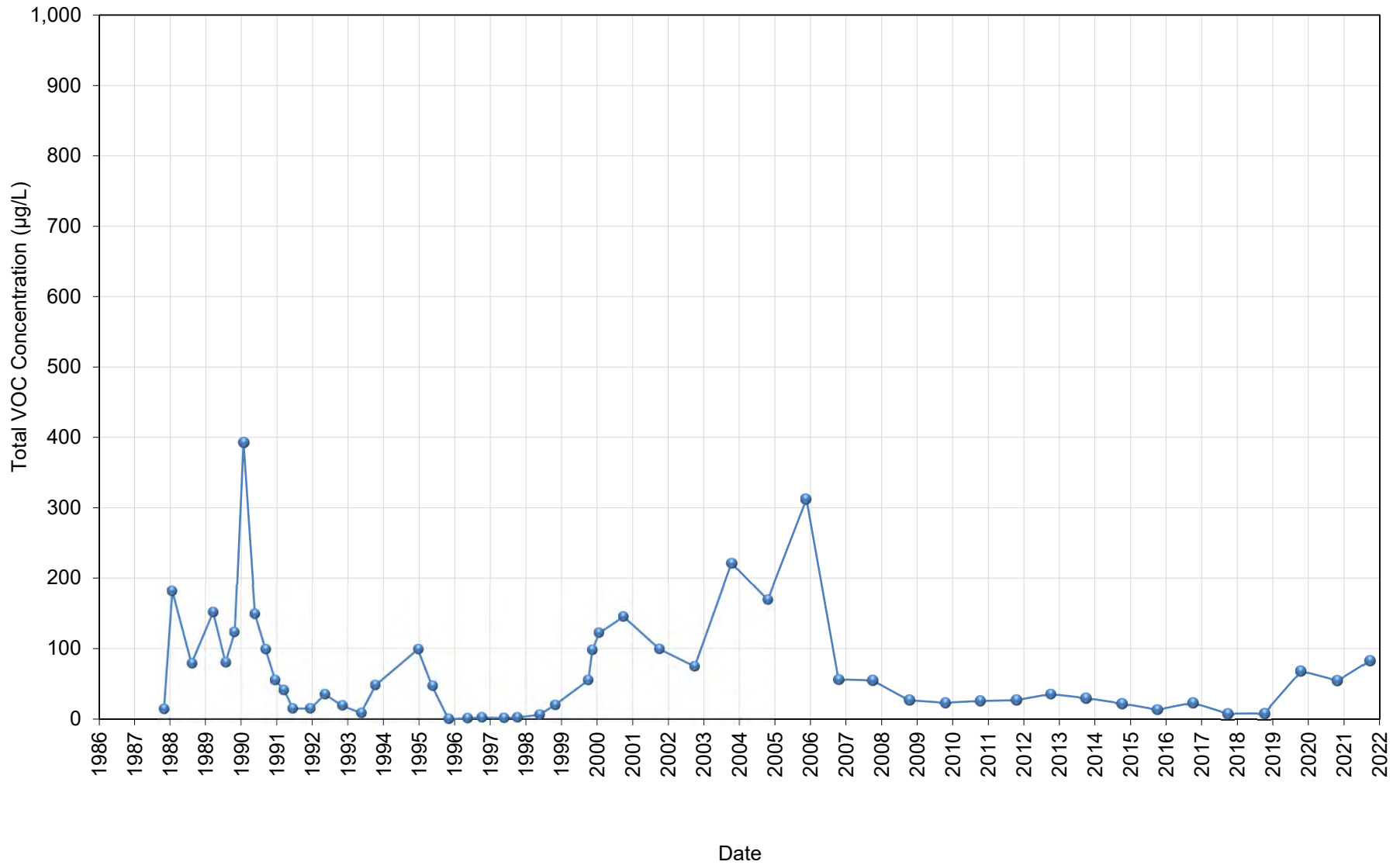
**Figure 4.2**  
**Historical Total VOC Concentrations**  
**MW4D**  
**Highway 96 Site**  
**White Bear Township, Minnesota**



**Figure 4.3**  
**Historical Total VOC Concentrations**  
**MW12D**  
**Highway 96 Site**  
**White Bear Township, Minnesota**



**Figure 4.4**  
**Historical Total VOC Concentrations**  
**MW8B**  
**Highway 96 Site**  
**White Bear Township, Minnesota**



**Figure 4.5**  
**Historical Total VOC Concentrations**  
**MW12B**  
**Highway 96 Site**  
**White Bear Township, Minnesota**

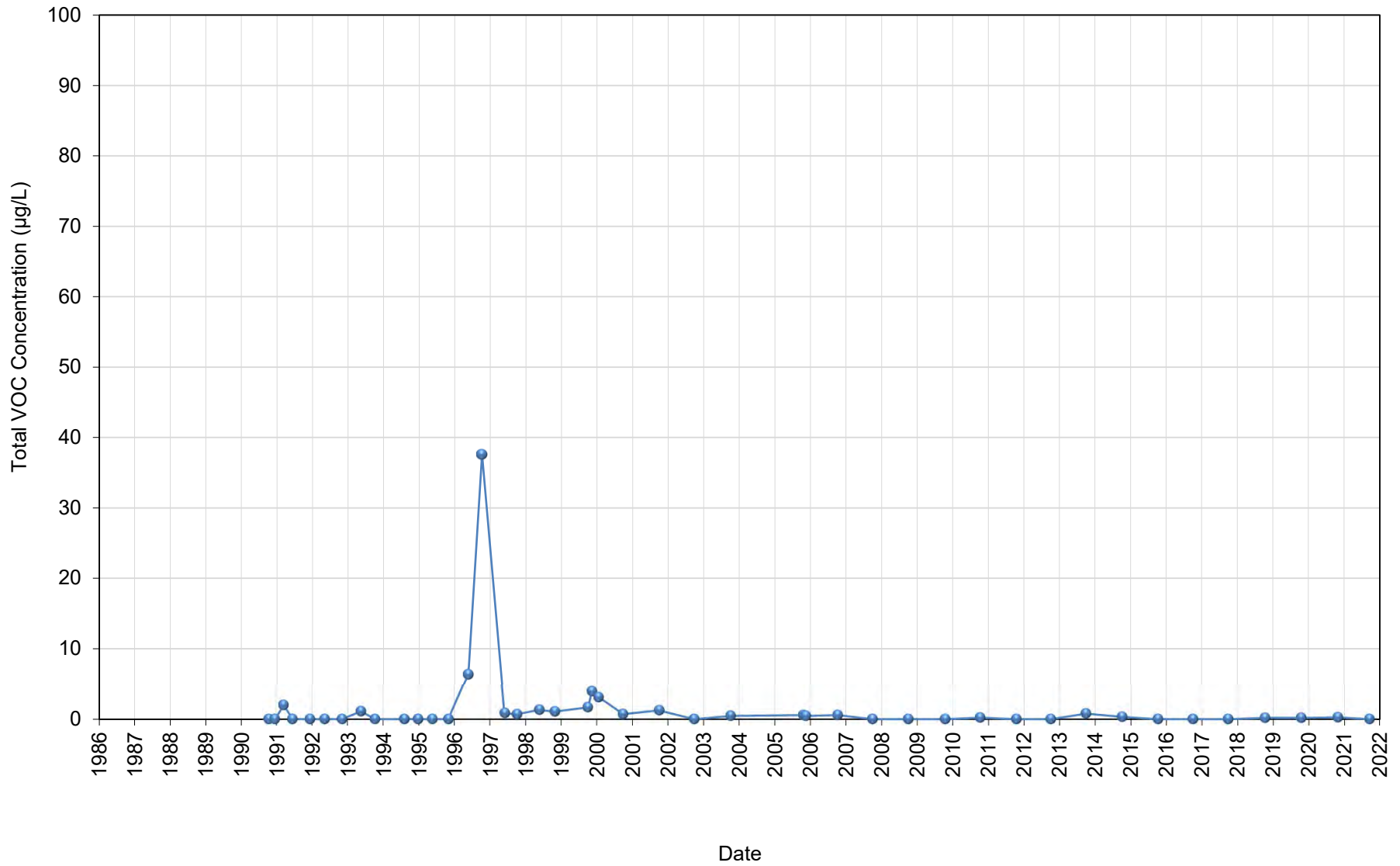




Figure 4.6

Historical Total VOC Concentrations  
11 Robb Farm Road  
Highway 96 Site  
White Bear Township, Minnesota

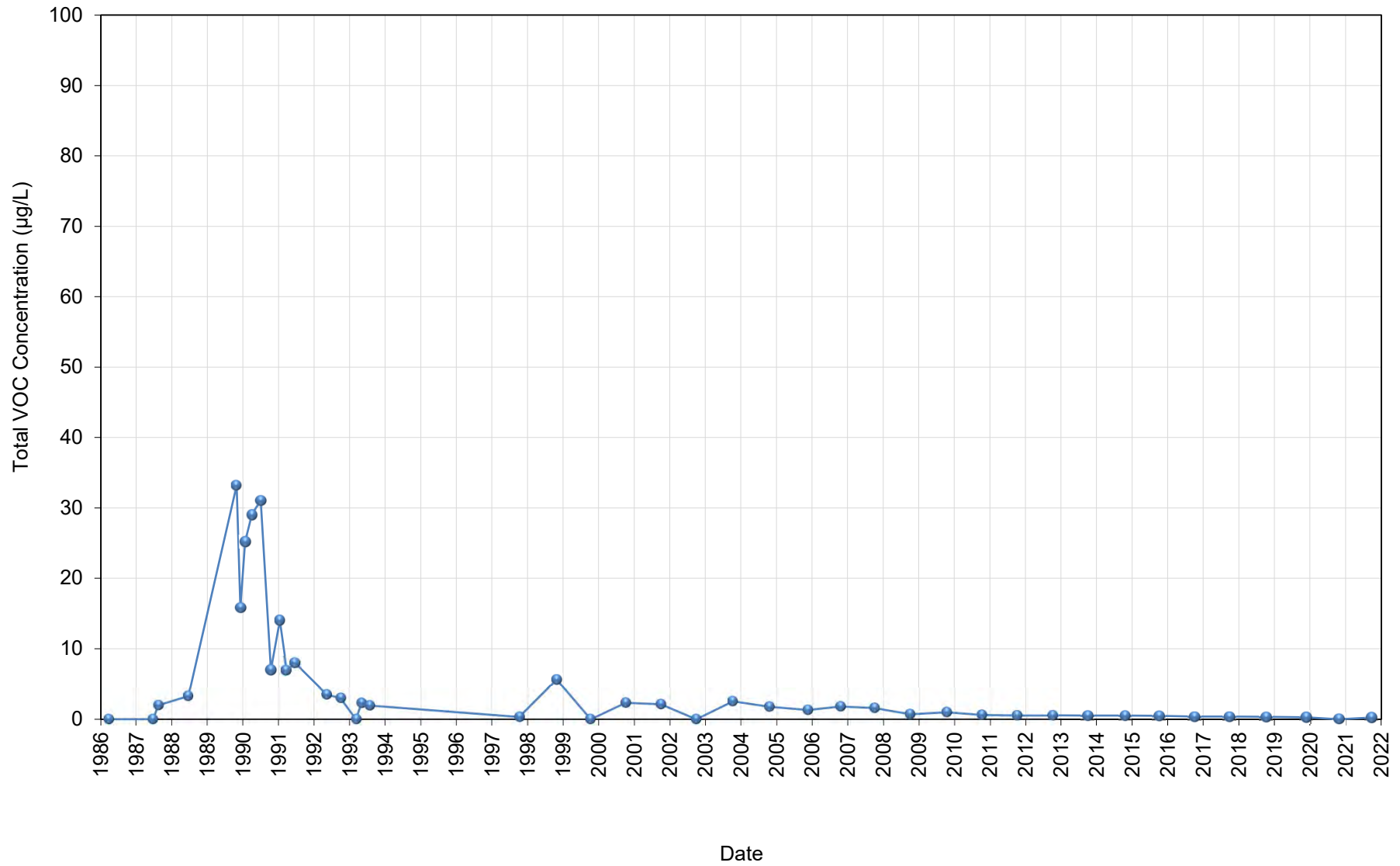


Figure 4.7

Historical Total VOC Concentrations  
1 Lily Pond Road  
Highway 96 Site  
White Bear Township, Minnesota

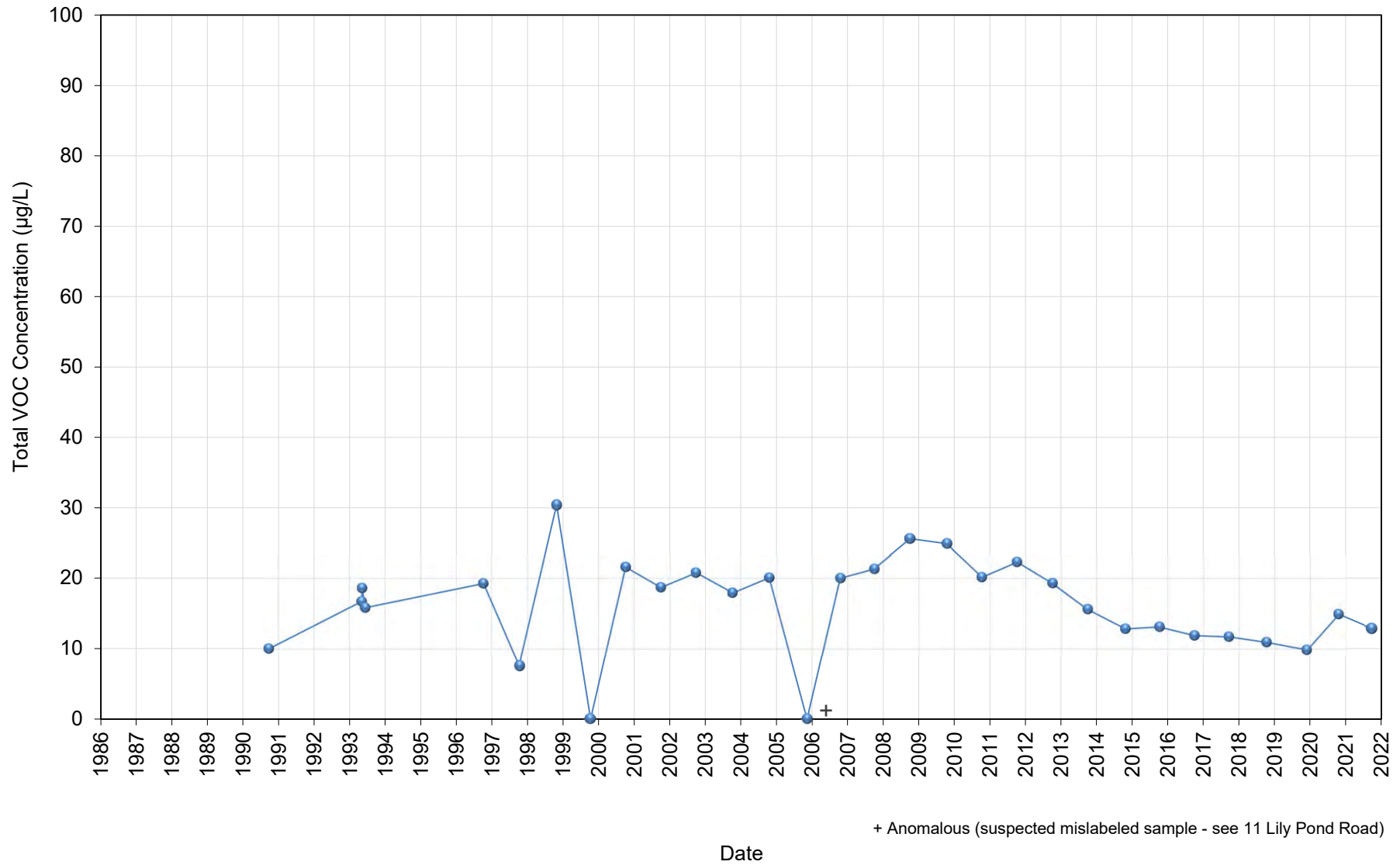


Figure 4.8

Historical Total VOC Concentrations  
11 Lily Pond Road  
Highway 96 Site  
White Bear Township, Minnesota

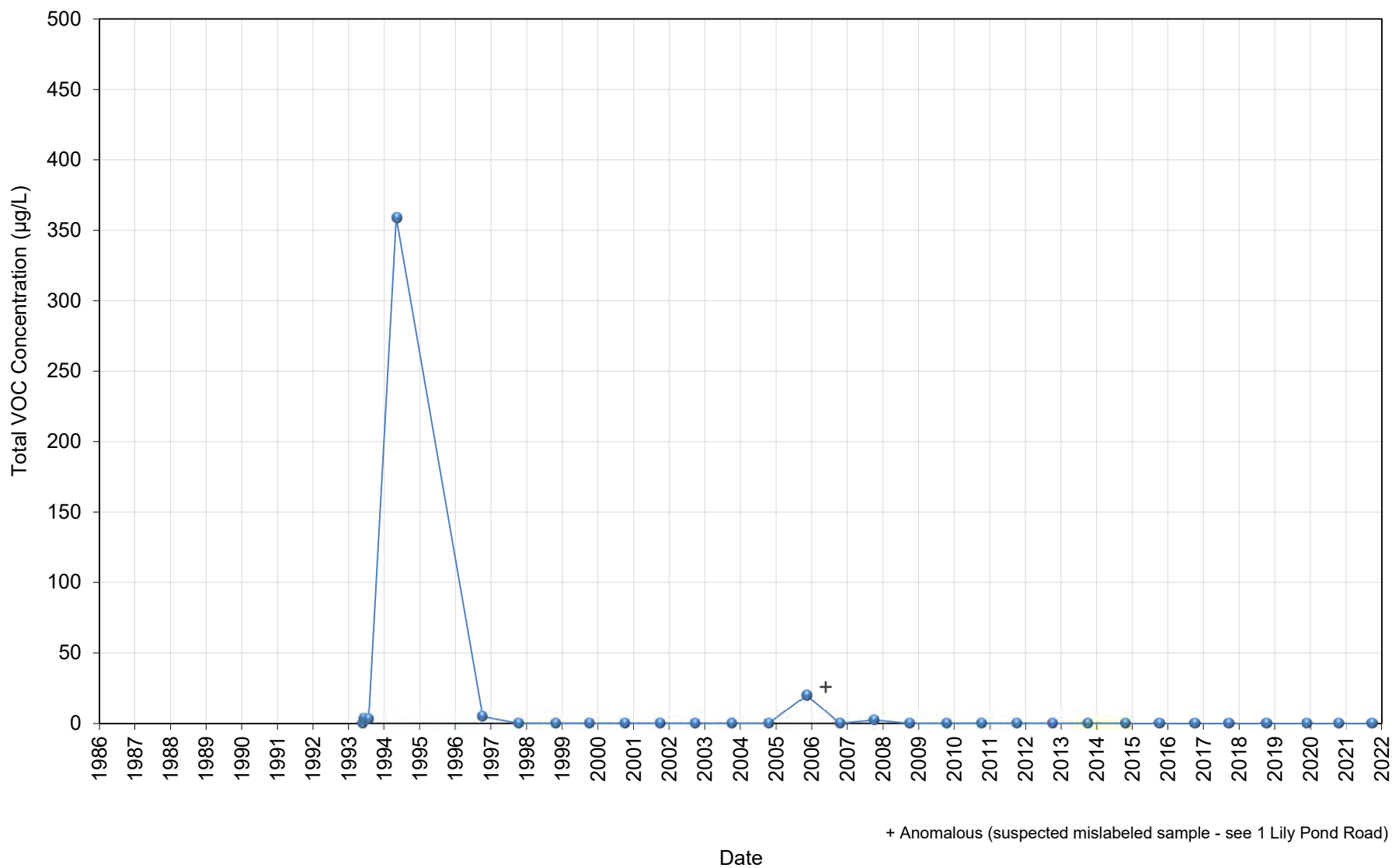
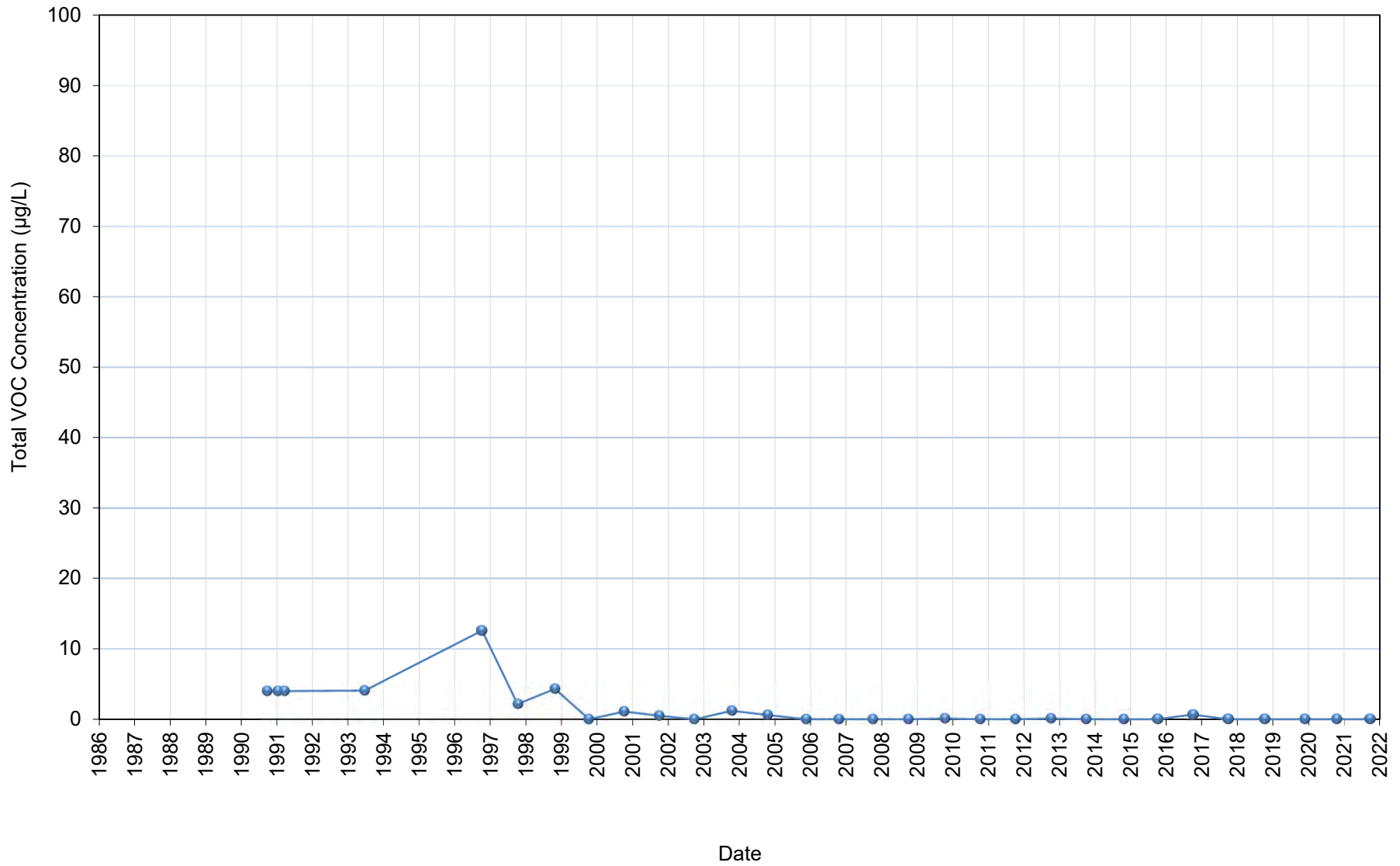
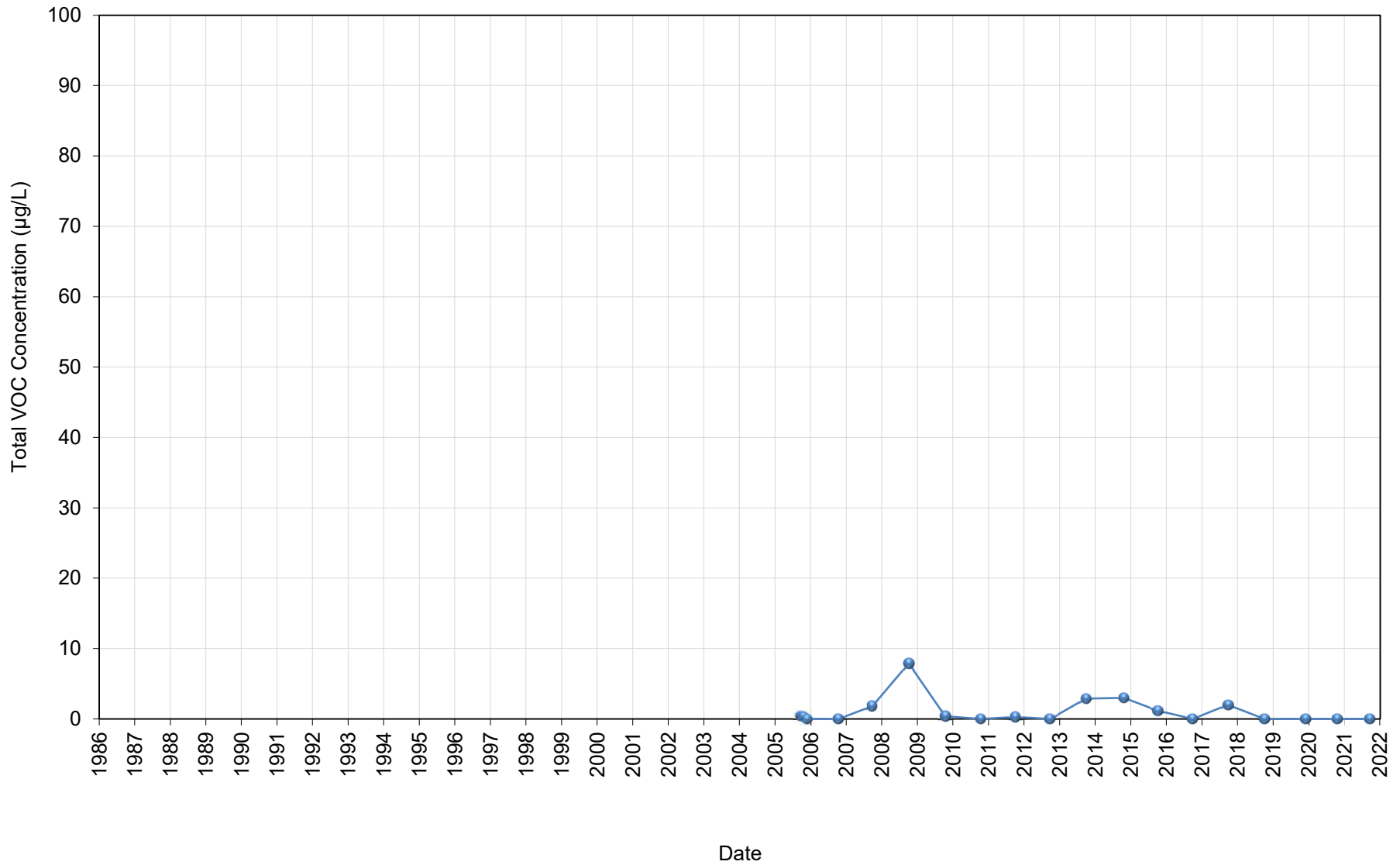


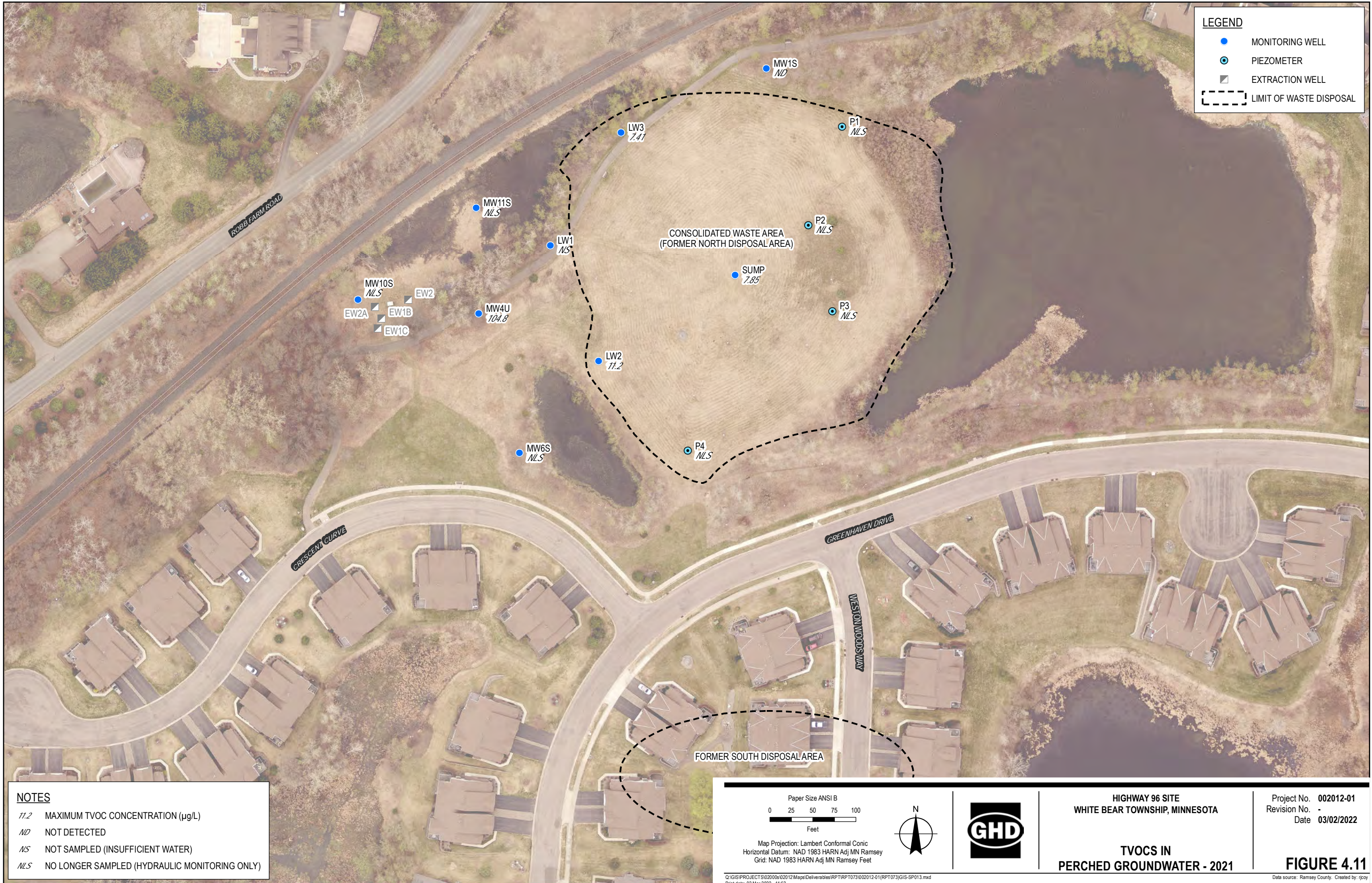
Figure 4.9

Historical Total VOC Concentrations  
6 Blue Goose Road  
Highway 96 Site  
White Bear Township, Minnesota



**Figure 4.10**  
**Historical Total VOC Concentrations**  
**MW17L**  
**Highway 96 Site**  
**White Bear Township, Minnesota**





**LEGEND**

- MONITORING WELL
- ⊙ PIEZOMETER
- ▣ EXTRACTION WELL
- LIMIT OF WASTE DISPOSAL

**NOTES**

11.2 MAXIMUM TVOC CONCENTRATION (µg/L)

ND NOT DETECTED

NLS NOT SAMPLED (INSUFFICIENT WATER)

NLS NO LONGER SAMPLED (HYDRAULIC MONITORING ONLY)

Paper Size ANSI B

0 25 50 75 100

Feet

Map Projection: Lambert Conformal Conic  
 Horizontal Datum: NAD 1983 HARN Adj MN Ramsey  
 Grid: NAD 1983 HARN Adj MN Ramsey Feet

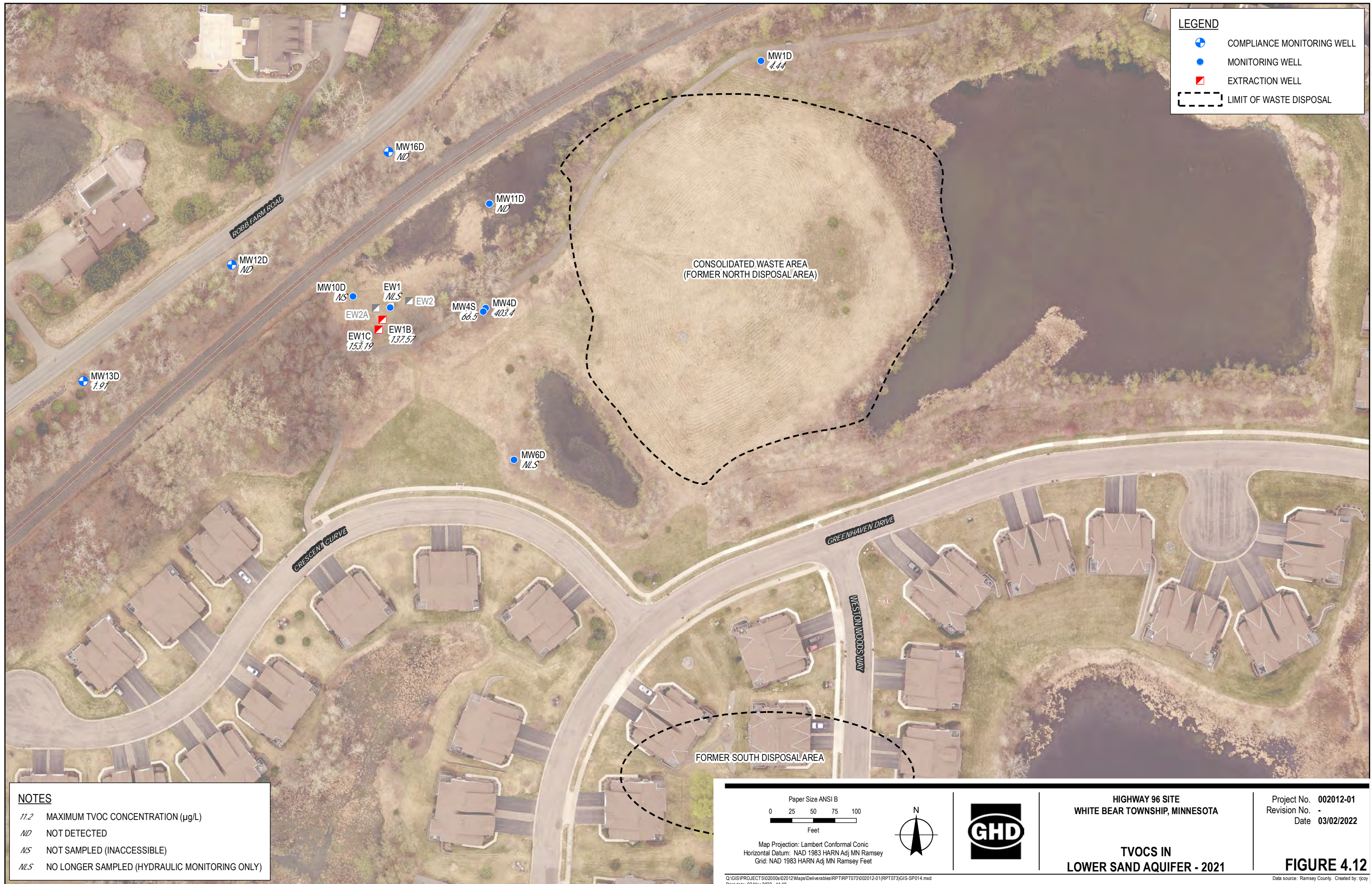


**HIGHWAY 96 SITE**  
**WHITE BEAR TOWNSHIP, MINNESOTA**

**TVOCs IN**  
**PERCHED GROUNDWATER - 2021**

Project No. 002012-01  
 Revision No. -  
 Date 03/02/2022

**FIGURE 4.11**



**LEGEND**

- ⊕ COMPLIANCE MONITORING WELL
- MONITORING WELL
- ▣ EXTRACTION WELL
- LIMIT OF WASTE DISPOSAL

**NOTES**

11.2 MAXIMUM TVOC CONCENTRATION (µg/L)

ND NOT DETECTED

NS NOT SAMPLED (INACCESSIBLE)

NLS NO LONGER SAMPLED (HYDRAULIC MONITORING ONLY)

Paper Size ANSI B

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Feet

Map Projection: Lambert Conformal Conic  
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 Grid: NAD 1983 HARN Adj MN Ramsey Feet

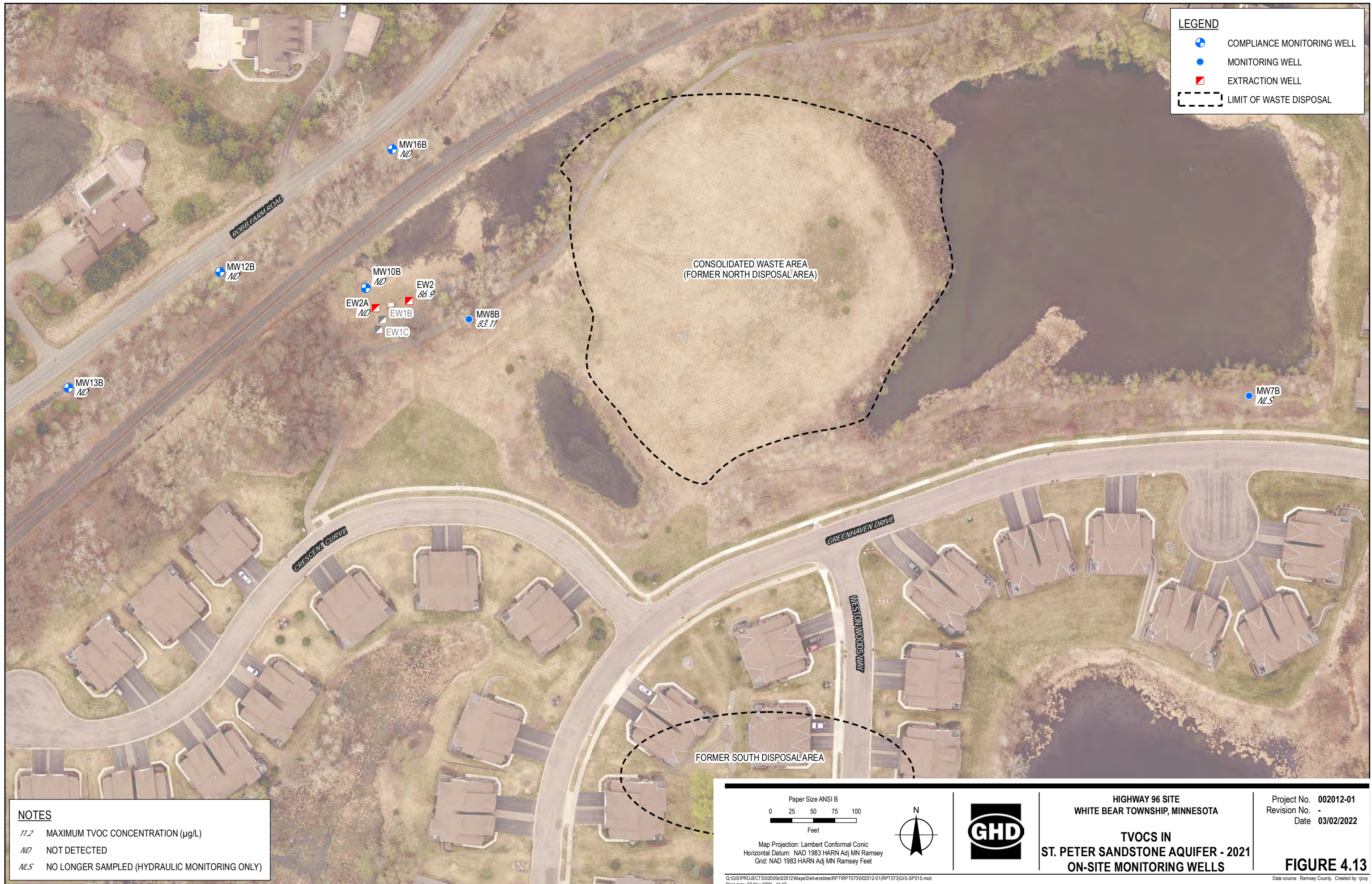


HIGHWAY 96 SITE  
 WHITE BEAR TOWNSHIP, MINNESOTA

**TVOCs IN  
 LOWER SAND AQUIFER - 2021**

Project No. 002012-01  
 Revision No. -  
 Date 03/02/2022

**FIGURE 4.12**



**LEGEND**

- ⊕ COMPLIANCE MONITORING WELL
- MONITORING WELL
- ▣ EXTRACTION WELL
- LIMIT OF WASTE DISPOSAL

**NOTES**

11.2 MAXIMUM TVOC CONCENTRATION (µg/L)

ND NOT DETECTED

NLS NO LONGER SAMPLED (HYDRAULIC MONITORING ONLY)

Paper Size ANSI B

0 25 50 75 100

Feet

Map Projection: Lambert Conformal Conic  
 Horizontal Datum: NAD 1983 HARN Adj MN Ramsey  
 Grid: NAD 1983 HARN Adj MN Ramsey Feet

N



HIGHWAY 96 SITE  
 WHITE BEAR TOWNSHIP, MINNESOTA

TVOCs IN  
 ST. PETER SANDSTONE AQUIFER - 2021  
 ON-SITE MONITORING WELLS

Project No. 002012-01  
 Revision No. -  
 Date 03/02/2022

**FIGURE 4.13**





**LEGEND**

- MONITORING WELL
- CONVERTED RESIDENTIAL MONITORING WELL
- CONNECTED TO MUNICIPAL WATER SUPPLY
- LIMIT OF WASTE DISPOSAL

**NOTES**

- 12.9 MAXIMUM TVOC CONCENTRATION (µg/L)
- ND NOT DETECTED
- NS NOT SAMPLED (INACCESSIBLE)
- 0.62 VOCs DETECTED (INCLUDING VINYL CHLORIDE)
- 10.3 VOCs DETECTED (VINYL CHLORIDE NOT DETECTED)
- ND VOCs NOT DETECTED

Paper Size ANSI B

0 100 200 300 400 500  
Feet

Map Projection: Lambert Conformal Conic  
Horizontal Datum: NAD 1983 HARN Adj MN Ramsey  
Grid: NAD 1983 HARN Adj MN Ramsey Feet



**HIGHWAY 96 SITE**  
WHITE BEAR TOWNSHIP, MINNESOTA

**TVOCs IN**  
**ST. PETER SANDSTONE AQUIFER - 2021**  
**OFF-SITE MONITORING WELLS**

Project No. 002012-01  
Revision No. -  
Date 03/02/2022

**FIGURE 4.14**



**LEGEND**

- MONITORING WELL
- CONNECTED TO MUNICIPAL WATER SUPPLY
- LIMIT OF WASTE DISPOSAL

**NOTES**

12.9	MAXIMUM TVOC CONCENTRATION (µg/L)
ND	NOT DETECTED
0.62	VOCS DETECTED (INCLUDING VINYL CHLORIDE)
10.3	VOCS DETECTED (VINYL CHLORIDE NOT DETECTED)
ND	VOCS NOT DETECTED

Paper Size ANSI B

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Feet

Map Projection: Lambert Conformal Conic  
 Horizontal Datum: NAD 1983 HARN Adj MN Ramsey  
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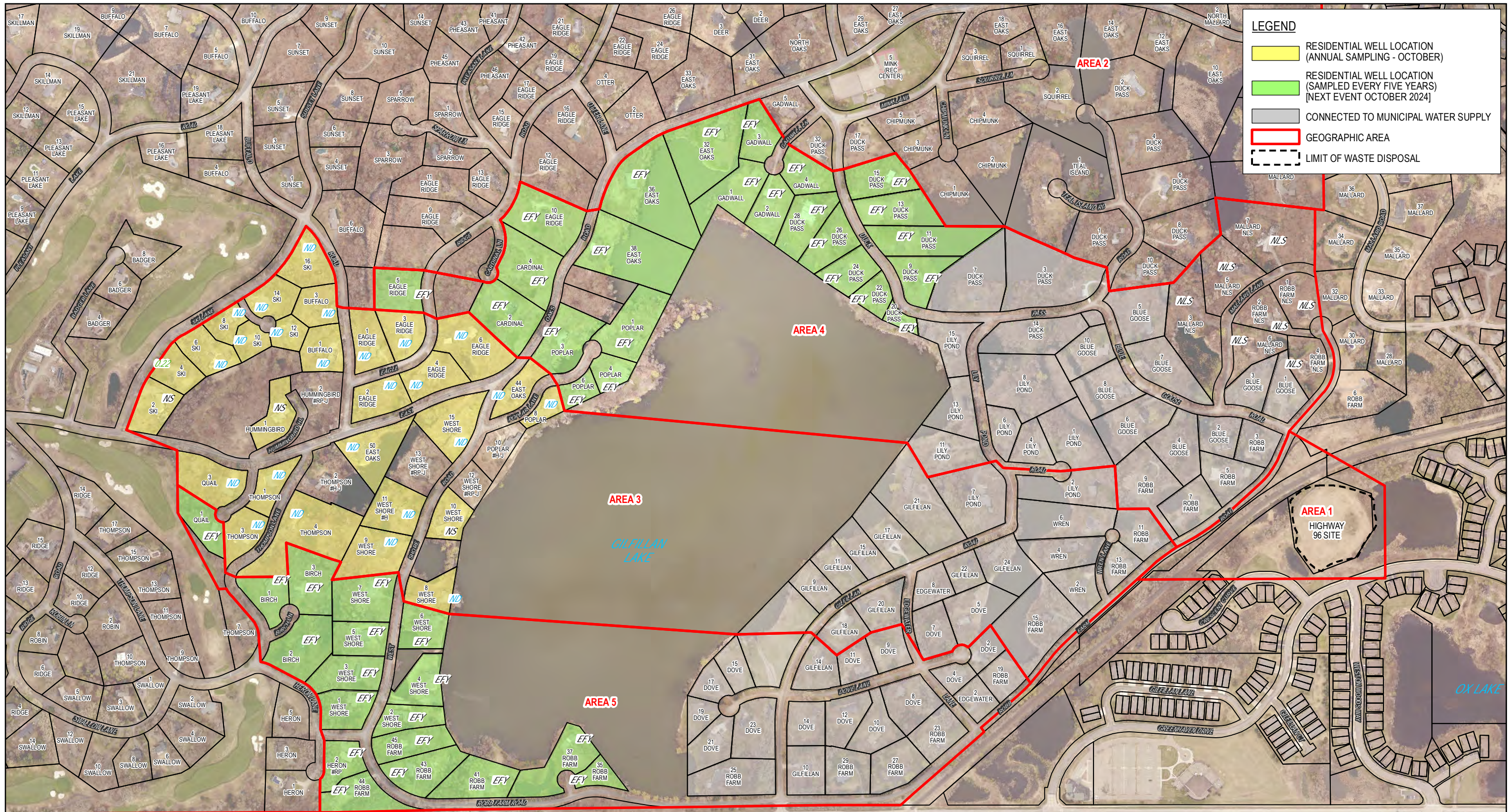
**HIGHWAY 96 SITE**  
 WHITE BEAR TOWNSHIP, MINNESOTA

**TVOCs IN**  
**PRAIRIE DU CHIEN AQUIFER - 2021**

Project No. 002012-01  
 Revision No. -  
 Date 03/01/2022

**FIGURE 4.15**

Q:\GIS\PROJECTS\020012\02012\Map\Deliverables\RPT\RP1073\02012-01\RP1073\GIS-SP017.mxd  
 Print date: 02 Mar 2022 - 17:07



**LEGEND**

- RESIDENTIAL WELL LOCATION (ANNUAL SAMPLING - OCTOBER)
- RESIDENTIAL WELL LOCATION (SAMPLED EVERY FIVE YEARS [NEXT EVENT OCTOBER 2024])
- CONNECTED TO MUNICIPAL WATER SUPPLY
- GEOGRAPHIC AREA
- LIMIT OF WASTE DISPOSAL

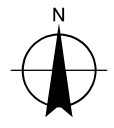
NOTES	
0.20	MAXIMUM VINYL CHLORIDE CONCENTRATION (µg/L)
ND	NOT DETECTED (< 0.063)
NS	NOT SAMPLED (INACCESSIBLE/NO RESPONSE/DECLINED/WATER OFF)
EFY	SAMPLED EVERY FIVE YEARS (NEXT EVENT 2024)
NLS	NO LONGER SAMPLED
#RP	REPLACEMENT WELL INSTALLED BY RPs (PRAIRIE DU CHIEN AQUIFER) [OLD WELL ABANDONED]
#RP-J	REPLACEMENT WELL INSTALLED BY RPs (EXTENDED INTO JORDAN AQUIFER AT HOMEOWNER'S REQUEST/EXPENSE) [OLD WELL ABANDONED]
#H	NEW WELL INSTALLED BY HOMEOWNER (PRAIRIE DU CHIEN AQUIFER) [OLD WELL ABANDONED]
#H-J	NEW WELL INSTALLED BY HOMEOWNER (JORDAN AQUIFER) [OLD WELL ABANDONED]
1.05	VOCS DETECTED (INCLUDING VINYL CHLORIDE) (DETECTION(S) IN RESIDENTIAL WELL SAMPLE ABOVE HEALTH STANDARD(S))
0.62	VOCS DETECTED (INCLUDING VINYL CHLORIDE) [ALL DETECTION(S) IN RESIDENTIAL WELL SAMPLE BELOW HEALTH STANDARD(S)]
10.3	VOCS DETECTED (VINYL CHLORIDE NOT DETECTED) [ALL DETECTION(S) IN RESIDENTIAL WELL SAMPLE BELOW HEALTH STANDARD(S)]
ND	VOCS NOT DETECTED

Paper Size ANSI B

0 100 200 300 400 500

Feet

Map Projection: Lambert Conformal Conic  
Horizontal Datum: NAD 1983 HARN Adj MN Ramsey  
Grid: NAD 1983 HARN Adj MN Ramsey Feet



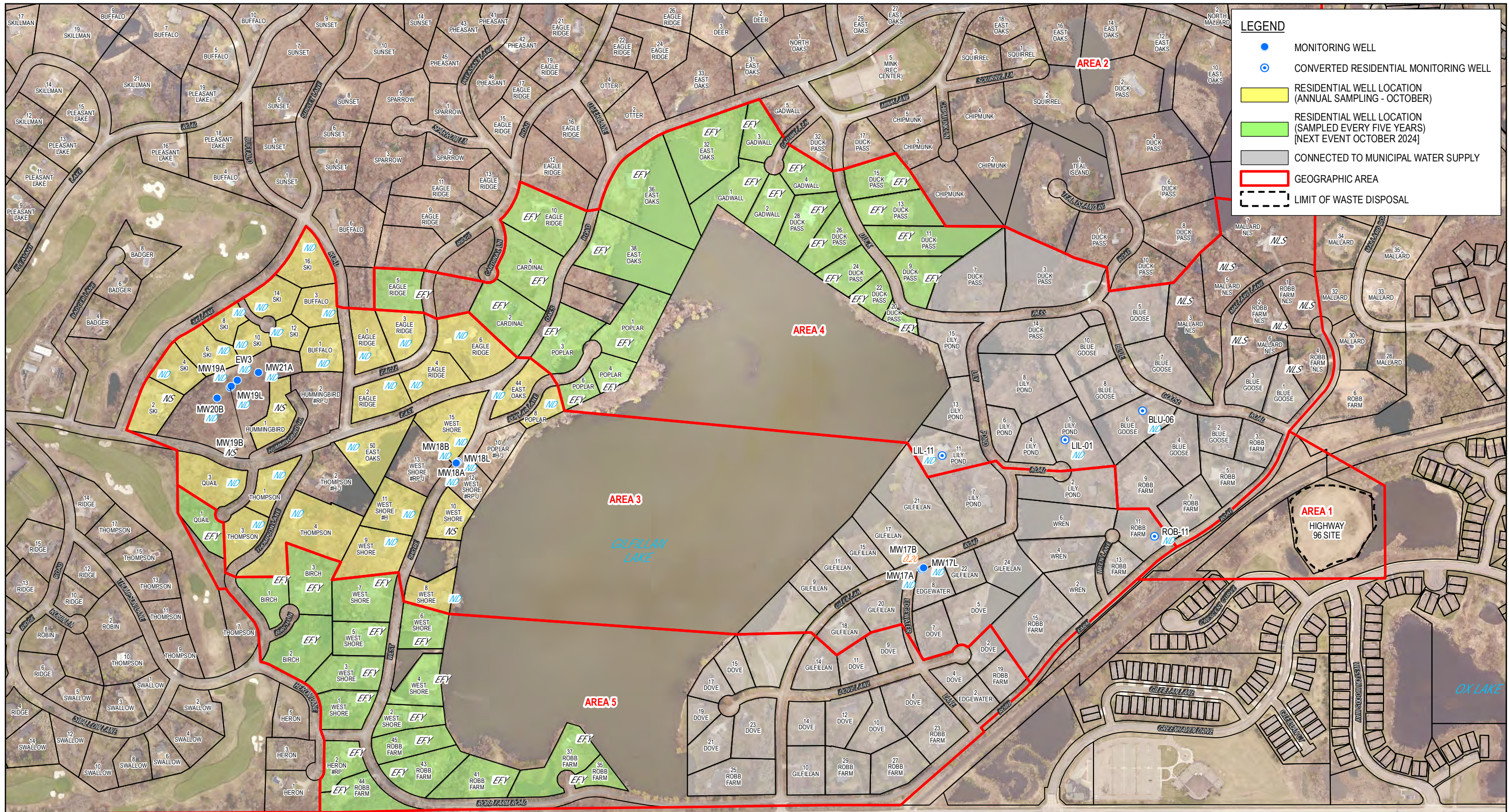
**HIGHWAY 96 SITE**  
WHITE BEAR TOWNSHIP, MINNESOTA

**TVOCs IN**  
**RESIDENTIAL WELLS - 2021**

Project No. 002012-01  
Revision No. -  
Date 03/02/2022

**FIGURE 4.16**

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Print date: 02 Mar 2022 - 16:46



**LEGEND**

- MONITORING WELL
- CONVERTED RESIDENTIAL MONITORING WELL
- RESIDENTIAL WELL LOCATION (ANNUAL SAMPLING - OCTOBER)
- RESIDENTIAL WELL LOCATION (SAMPLED EVERY FIVE YEARS) [NEXT EVENT OCTOBER 2024]
- CONNECTED TO MUNICIPAL WATER SUPPLY
- GEOGRAPHIC AREA
- LIMIT OF WASTE DISPOSAL

**NOTES**

<p>0.20 MAXIMUM VINYL CHLORIDE CONCENTRATION (µg/L)</p> <p>ND NOT DETECTED (&lt; 0.063)</p> <p>NS NOT SAMPLED (INACCESSIBLE/NO RESPONSE/DECLINED/WATER OFF)</p> <p>EFY SAMPLED EVERY FIVE YEARS (NEXT EVENT 2024)</p> <p>NLS NO LONGER SAMPLED</p>	<p>#RP REPLACEMENT WELL INSTALLED BY RPs (PRAIRIE DU CHIEN AQUIFER) [OLD WELL ABANDONED]</p> <p>#RP-J REPLACEMENT WELL INSTALLED BY RPs (EXTENDED INTO JORDAN AQUIFER AT HOMEOWNER'S REQUEST/EXPENSE) [OLD WELL ABANDONED]</p> <p>#H NEW WELL INSTALLED BY HOMEOWNER (PRAIRIE DU CHIEN AQUIFER) [OLD WELL ABANDONED]</p> <p>#H-J NEW WELL INSTALLED BY HOMEOWNER (JORDAN AQUIFER) [OLD WELL ABANDONED]</p>	<p>0.48 VINYL CHLORIDE DETECTED IN RESIDENTIAL WELL SAMPLE ABOVE HEALTH STANDARD</p> <p>0.12 VINYL CHLORIDE DETECTED</p> <p>ND VINYL CHLORIDE NOT DETECTED</p>
--	--	--

Paper Size ANSI B

0 100 200 300 400 500 Feet

Map Projection: Lambert Conformal Conic  
 Horizontal Datum: NAD 1983 HARN Adj MN Ramsey  
 Grid: NAD 1983 HARN Adj MN Ramsey Feet



**HIGHWAY 96 SITE**  
 WHITE BEAR TOWNSHIP, MINNESOTA

**VINYL CHLORIDE CONCENTRATIONS  
 IN OFF-SITE MONITORING WELLS AND  
 RESIDENTIAL WELLS - 2021**

Project No. 002012-01  
 Revision No. -  
 Date 03/02/2022

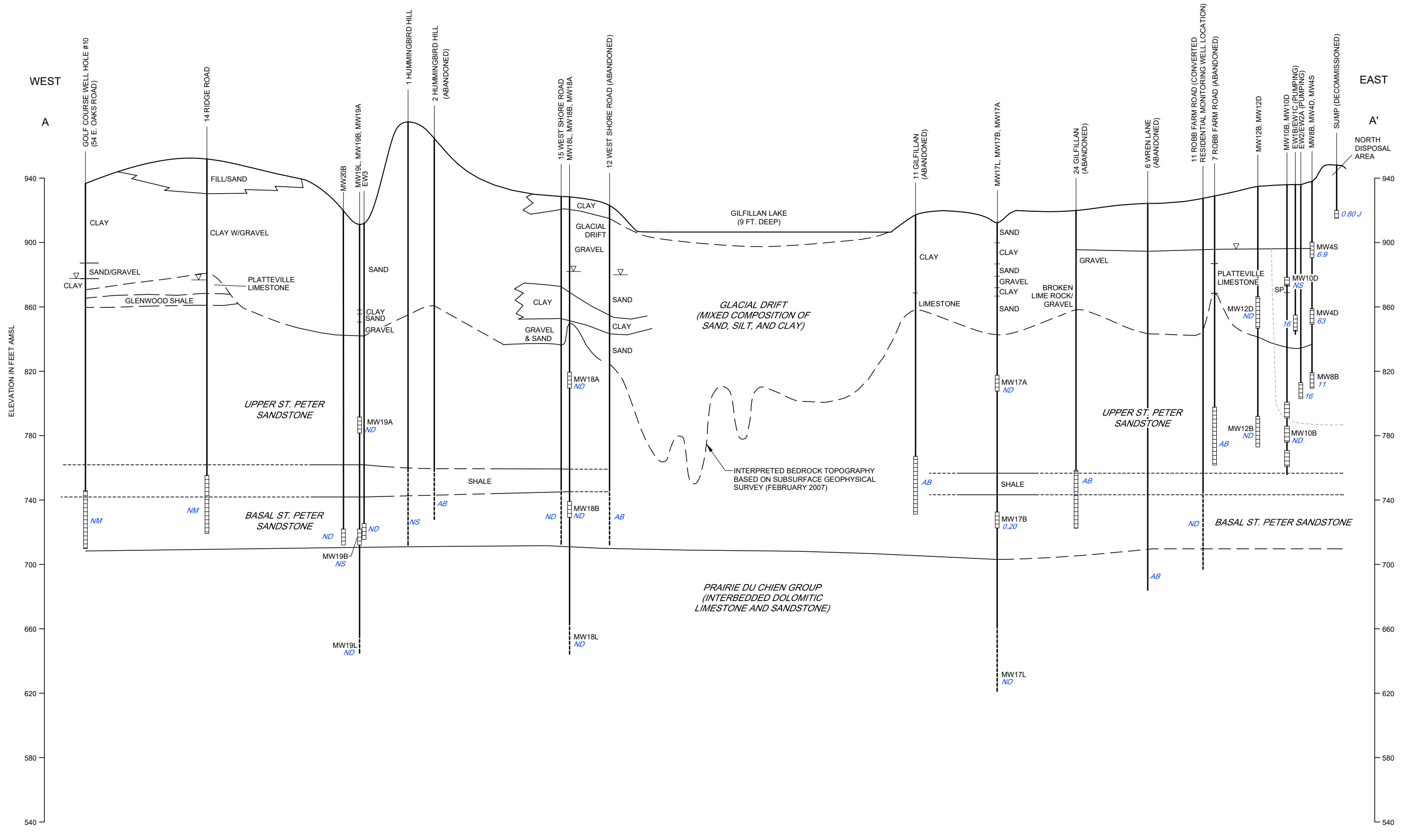
**FIGURE 4.17**

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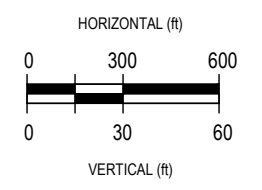
# Appendices

# **Appendix A**

## **Geologic Cross Sections**



- VINYL CHLORIDE RESULTS (2021)
- 20* MAXIMUM VINYL CHLORIDE CONCENTRATION IN  $\mu\text{g/L}$
  - J* ESTIMATED RESULT
  - ND* NOT DETECTED
  - NS* NOT SAMPLED (NO RESPONSE/DECLINED/WATER OFF/INACCESSIBLE)
  - NM* NOT MONITORED (GEOGRAPHIC AREA 2)
  - AB* ABANDONED
  - ESTIMATED EXTRACTION SYSTEM CAPTURE AREA

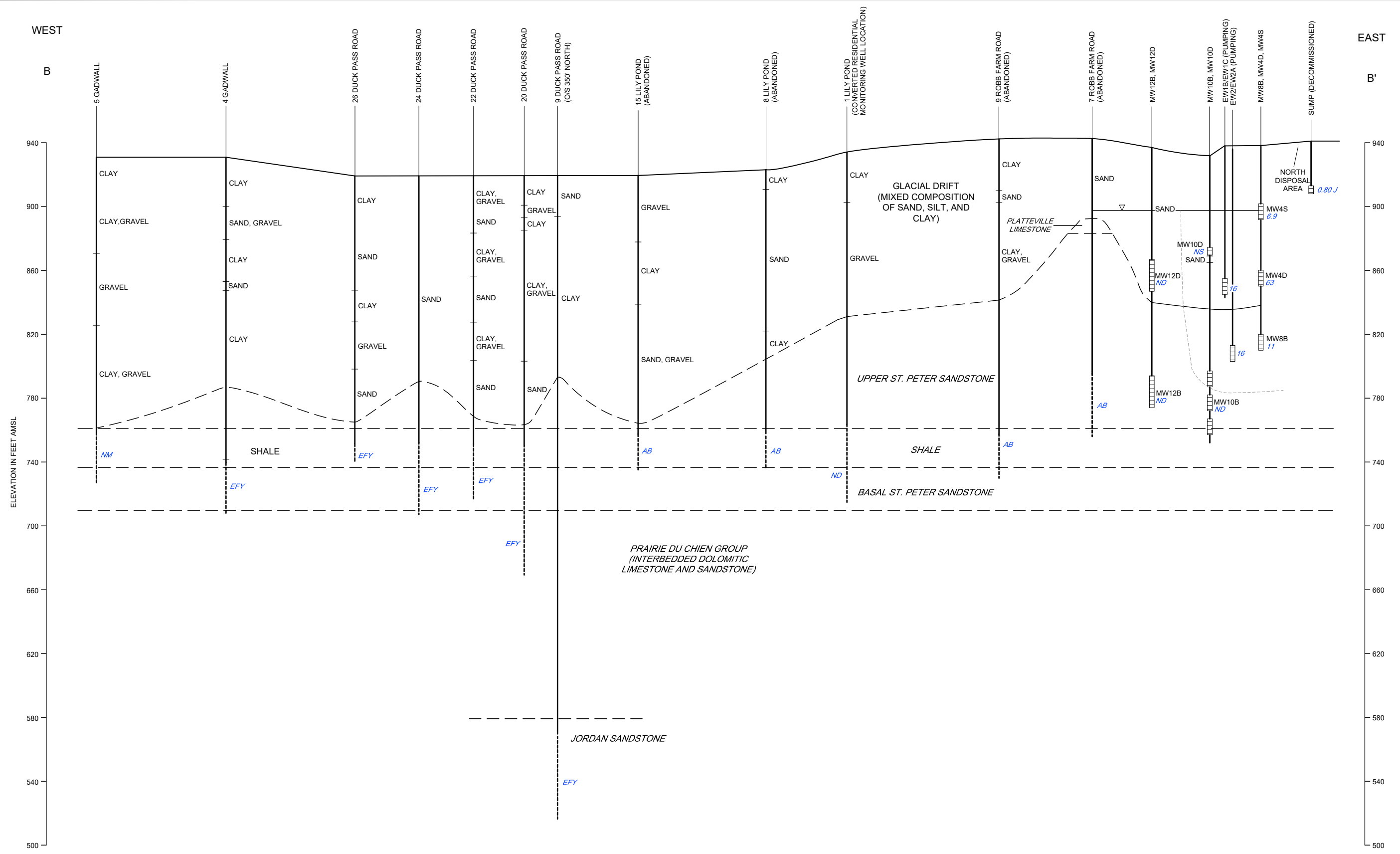


HIGHWAY 96 SITE  
 WHITE BEAR TOWNSHIP, MINNESOTA

Project No. 2012  
 Date March 2022

GEOLOGIC CROSS SECTION A-A'

FIGURE A.1



VINYL CHLORIDE RESULTS (2021)

20 MAXIMUM VINYL CHLORIDE CONCENTRATION IN ug/L

J ESTIMATED RESULT

ND NOT DETECTED

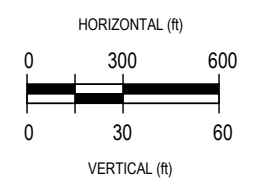
NS NOT SAMPLED (NO RESPONSE/DECLINED/WATER OFF/INACCESSIBLE)

EFY SAMPLED EVERY FIVE YEARS (NEXT EVENT 2024)

NM NOT MONITORED (GEOGRAPHIC AREA 2)

AB ABANDONED

--- ESTIMATED EXTRACTION SYSTEM CAPTURE AREA



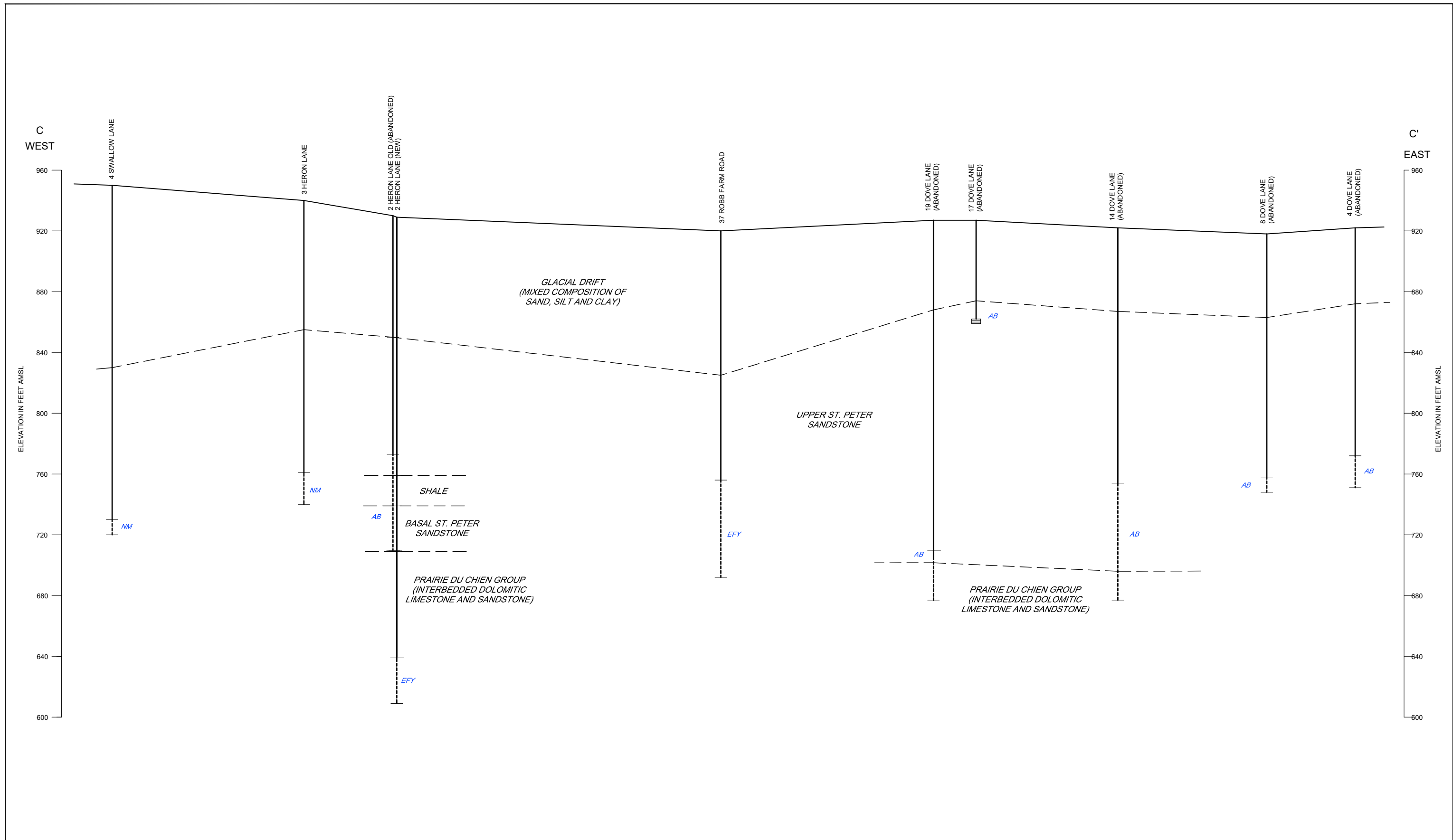
HIGHWAY 96 SITE  
WHITE BEAR TOWNSHIP, MINNESOTA

GEOLOGIC CROSS SECTION B-B'

Project No. 2012  
Date March 2022

FIGURE A.2





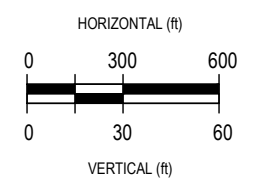
VINYL CHLORIDE RESULTS (2021)

ND NOT DETECTED

EFY SAMPLED EVERY FIVE YEARS (NEXT EVENT 2024)

NM NOT MONITORED (GEOGRAPHIC AREA 2)

AB ABANDONED



HIGHWAY 96 SITE  
WHITE BEAR TOWNSHIP, MINNESOTA

Project No. 2012  
Date March 2022

GEOLOGIC CROSS SECTION C-C'

FIGURE A.3

# **Appendix B**

## **Historical Groundwater Elevations**

Historical Summary of Groundwater Elevations  
Highway 96 Site  
White Bear Township, Minnesota

Location	TOC (ft. AMSL)	1/15/1999 (ft. AMSL)	2/26/1999 (ft. AMSL)	3/19/1999 (ft. AMSL)	4/8/1999 (ft. AMSL)	5/13/1999 (ft. AMSL)	6/9/1999 (ft. AMSL)	7/16/1999 (ft. AMSL)	8/13/1999 (ft. AMSL)	9/17/1999 (ft. AMSL)	10/1/1999 (ft. AMSL)	11/15/1999 (ft. AMSL)	12/3/1999 (ft. AMSL)	1/17/2000 (ft. AMSL)	2/22/2000 (ft. AMSL)
Perched Groundwater Unit															
LW1	938.86	926.43	928.30	928.24	932.28	934.24	931.74	929.56	928.35	929.23	928.34	926.84	926.83	926.82	926.82
LW2	945.66	929.33	929.15	929.42	DRY	931.39	932.00	931.57	931.00	930.89	930.78	929.91	929.77	929.04	928.79
LW3	944.82	928.37	928.47	928.57	930.56	934.16	933.67	931.98	930.74	931.28	930.80	929.29	929.02	928.19	927.84
MW1S	950.65	932.67	932.68	932.67	933.79	936.10	938.14	936.40	935.20	934.58	934.27	933.42	933.14	932.47	932.00
MW4U	939.65	DRY	DRY	DRY	DRY	DRY	DRY	910.19	910.62	910.47	910.49	910.14	910.09	DRY	DRY
MW6S	948.44	926.84	926.12	925.88	926.53	928.53	931.76	930.97	930.08	929.81	929.44	928.29	927.84	926.80	926.03
MW10S	935.94	922.40	924.66	928.95	930.30	931.22	929.02	930.02	928.26	930.01	928.60	929.60	928.86	922.40	919.26
MW11S	936.34	919.49	DRY	DRY	929.43	932.19	932.30	930.88	928.34	931.12	929.33	924.70	923.48	920.32	DRY
P1	941.70	934.22	934.73	935.73	937.29	939.89	937.38	936.15	935.43	935.34	935.11	934.62	934.44	933.90	933.56
P2	946.11	CAP FROZEN	926.39	926.29	927.29	926.70	926.68	926.44	926.50	926.49	926.42	926.41	926.41	NM	926.38
P3	947.11	927.35	927.30	927.29	927.30	927.51	927.42	927.42	927.45	927.45	927.40	927.37	927.36	927.30	927.28
P4	948.16	929.80	929.89	928.54	930.03	930.07	929.98	930.80	929.82	929.92	929.84	929.79	929.76	929.64	929.52
SUMP*	946.71	918.51	913.53	NM	913.08	915.24	914.98	913.80	913.50	913.60	913.44	913.55	913.47	913.90	913.49
Glacial Drift (Lower Sand) Aquifer															
EW1*	936.92	877.68	876.59	875.93	876.14	872.10	871.31	897.35	870.67	869.55	869.05	896.86	896.98	896.67	877.99
EW1A*	938.67	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	897.30	NM	NM	NM
EW1B*	939.99	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
EW1C*	940.66	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
MW1D	951.02	894.56	897.13	896.74	897.23	897.32	897.88	898.06	897.25	897.25	897.21	897.61	897.79	897.51	897.35
MW4D	940.48	896.34	895.92	895.58	896.07	896.17	896.69	897.32	896.18	896.19	896.20	896.87	897.05	896.71	896.54
MW4S	940.33	899.08	898.49	897.92	898.19	898.16	898.81	899.82	899.42	899.35	899.45	900.15	900.44	899.92	899.68
MW6D	948.15	897.26	896.84	896.49	896.86	896.91	897.47	897.97	897.28	897.20	897.22	897.77	897.89	897.54	897.44
MW10D	935.94	901.77	901.03	900.37	900.69	901.10	902.43	903.02	902.95	902.92	903.05	903.24	903.44	902.43	902.23
MW11D	935.40	900.19	899.49	899.06	899.72	900.49	901.49	902.19	902.31	901.57	901.57	901.29	901.32	900.53	900.14
MW12D	940.52	899.78	899.08	898.68	898.90	899.20	900.09	900.77	900.29	900.14	900.05	900.08	900.03	899.54	899.17
MW13D	937.66	898.45	897.88	897.44	897.90	898.11	898.13	899.46	898.63	898.52	898.51	898.58	898.64	898.21	898.05
MW16D	940.70	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
Upper St. Peter Sandstone Aquifer															
EW2*	938.67	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
EW2A*	939.34	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
MW7B	942.91	898.66	898.21	897.78	898.27	898.30	898.85	898.96	898.15	898.31	898.30	898.59	898.80	898.48	898.31
MW8B	940.91	896.22	895.81	895.47	895.99	896.04	896.59	897.20	896.05	896.08	896.07	896.76	896.89	896.64	896.24
MW10B	936.64	896.21	895.80	895.46	895.96	896.04	896.58	897.07	896.00	896.01	896.02	896.66	896.80	896.52	896.25
MW12B	939.89	896.19	895.74	895.42	895.90	895.97	896.53	895.92	895.89	895.92	895.91	896.47	896.64	896.34	896.12
MW13B	938.34	896.05	895.58	895.29	895.77	895.85	896.42	896.68	895.76	895.78	895.77	896.23	896.36	896.09	895.89
MW16B	940.71	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
MW17A	914.58	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
MW18A	925.39	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
MW19A	913.56	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
MW21A	909.03	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI

**Historical Summary of Groundwater Elevations  
Highway 96 Site  
White Bear Township, Minnesota**

Location	TOC (ft. AMSL)	1/15/1999 (ft. AMSL)	2/26/1999 (ft. AMSL)	3/19/1999 (ft. AMSL)	4/8/1999 (ft. AMSL)	5/13/1999 (ft. AMSL)	6/9/1999 (ft. AMSL)	7/16/1999 (ft. AMSL)	8/13/1999 (ft. AMSL)	9/17/1999 (ft. AMSL)	10/1/1999 (ft. AMSL)	11/15/1999 (ft. AMSL)	12/3/1999 (ft. AMSL)	1/17/2000 (ft. AMSL)	2/22/2000 (ft. AMSL)
<b>Basal St. Peter Sandstone Aquifer</b>															
EW3	913.88	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
MW17B	914.50	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
MW18B	925.24	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
MW19B	913.33	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
MW20B	915.04	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
6 Blue Goose Road #	954.15	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
1 Lily Pond Road #	930.88	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
11 Lily Pond Road #	928.54	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
11 Robb Farm Road #	942.63	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
38 East Oaks Road ^	926.50	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
6 West Shore Road ^	920.20	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
<b>Prairie du Chien Aquifer</b>															
MW17L	914.65	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
MW18L	925.44	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
MW19L	914.18	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI

**Historical Summary of Groundwater Elevations  
Highway 96 Site  
White Bear Township, Minnesota**

Location	2/28/2000 (ft. AMSL)	3/29/2000 (ft. AMSL)	4/28/2000 (ft. AMSL)	5/26/2000 (ft. AMSL)	6/28/2000 (ft. AMSL)	7/26/2000 (ft. AMSL)	8/31/2000 (ft. AMSL)	9/21/2000 (ft. AMSL)	10/2/2000 (ft. AMSL)	11/17/2000 (ft. AMSL)	12/13/2000 (ft. AMSL)	1/9/2001 (ft. AMSL)	2/28/2001 (ft. AMSL)	3/16/2001 (ft. AMSL)	4/23/2001 (ft. AMSL)
Perched Groundwater Unit															
LW1	928.33	929.15	929.52	928.26	928.31	928.33	928.20	928.05	928.28	929.79	928.33	928.21	928.17	928.66	934.86
LW2	928.73	929.00	DRY	DRY	929.86	929.59	DRY	DRY	DRY	DRY	DRY	<929.42	DRY	<929.31	932.81
LW3	928.09	929.28	930.00	929.54	930.44	929.92	928.80	929.55	929.40	930.83	930.28	929.24	928.44	928.54	937.48
MW1S	932.11	932.40	932.30	932.30	932.40	932.16	931.74	931.86	931.72	932.08	932.04	931.59	931.15	931.09	931.33
MW4U	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY	<909.32	<909.37	< 909.6	DRY
MW6S	926.20	926.06	926.12	926.21	927.68	928.00	927.45	927.34	927.21	926.86	926.83	926.44	925.79	925.53	929.51
MW10S	929.53	928.88	928.87	928.28	928.11	927.49	924.71	927.84	926.09	928.49	927.83	923.71	919.70	919.86	932.63
MW11S	918.51	922.29	921.89	920.23	923.74	923.11	919.62	925.41	923.70	923.55	921.19	918.91	<918.60	<918.6	932.68
P1	936.17	934.55	934.48	933.76	933.83	933.49	932.97	933.45	933.25	934.27	933.59	933.13	933.33	933.35	940.76
P2	926.38	926.37	926.38	926.33	926.51	NM	926.51	926.50	926.51	927.35	CAP FROZEN	926.56	CAP FROZEN	926.45	926.56
P3	927.31	927.49	927.45	927.36	927.38	927.39	927.48	927.48	927.46	930.14	929.66	929.38	929.01	928.97	931.66
P4	930.00	929.98	930.02	929.98	929.96	929.90	929.85	929.95	929.89	930.05	929.99	928.40	929.81	929.83	930.11
SUMP*	913.48	913.58	907.71	913.41	914.17	913.47	907.87	913.69	913.53	916.54	917.85	918.84	914.36	913.59	916.38
Glacial Drift (Lower Sand) Aquifer															
EW1*	877.01	867.76	867.94	881.52	882.21	883.24	884.50	894.15	894.51	884.80	884.20	883.80	884.13	883.78	883.95
EW1A*	NM	895.89	895.39	879.98	NM	NM	878.59	878.98	879.18	887.37	887.56	886.98	888.31	888.22	889.77
EW1B*	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
EW1C*	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
MW1D	897.10	896.89	896.70	896.10	896.01	895.62	895.25	895.26	895.26	895.10	895.21	895.14	895.34	895.04	896.39
MW4D	896.09	895.82	895.67	894.89	894.93	894.43	894.18	894.35	894.39	893.90	893.98	893.87	894.02	893.84	895.16
MW4S	899.20	898.46	898.19	897.43	897.28	896.81	896.39	896.25	896.40	895.93	896.01	895.91	896.01	895.73	896.63
MW6D	897.18	896.75	896.58	895.96	895.88	895.35	894.91	895.04	895.14	894.71	894.78	894.72	894.85	894.66	895.65
MW10D	901.41	894.97	900.71	900.10	900.42	900.02	899.79	899.86	900.12	899.19	899.25	899.04	898.86	898.57	899.54
MW11D	899.87	899.48	899.24	898.59	898.83	898.36	896.84	898.16	898.22	897.68	897.64	897.37	897.28	896.89	898.79
MW12D	899.12	898.57	898.40	898.04	897.91	897.60	897.19	897.14	897.20	896.68	896.76	896.67	896.51	896.32	897.22
MW13D	897.77	897.42	897.24	896.71	896.73	896.29	895.94	895.91	895.94	895.54	895.65	895.48	895.48	895.21	896.77
MW16D	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
Upper St. Peter Sandstone Aquifer															
EW2*	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
EW2A*	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
MW7B	898.12	897.89	897.76	897.21	897.09	896.76	896.39	896.30	896.33	896.16	896.29	896.24	896.40	896.10	897.34
MW8B	895.99	895.69	895.52	894.76	894.66	894.30	894.03	894.22	894.26	893.80	893.83	893.77	893.93	893.71	895.01
MW10B	895.96	901.63	895.50	894.76	894.83	894.27	894.00	894.23	894.18	893.78	893.86	893.78	893.92	893.72	895.08
MW12B	895.87	895.58	895.33	894.69	894.72	894.21	893.90	894.09	894.05	893.71	893.86	893.73	893.89	893.63	895.01
MW13B	895.66	895.42	895.18	894.58	894.54	894.05	893.73	893.90	893.84	893.59	893.68	893.62	893.73	893.52	894.93
MW16B	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
MW17A	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
MW18A	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
MW19A	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
MW21A	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI

**Historical Summary of Groundwater Elevations  
Highway 96 Site  
White Bear Township, Minnesota**

Location	2/28/2000 (ft. AMSL)	3/29/2000 (ft. AMSL)	4/28/2000 (ft. AMSL)	5/26/2000 (ft. AMSL)	6/28/2000 (ft. AMSL)	7/26/2000 (ft. AMSL)	8/31/2000 (ft. AMSL)	9/21/2000 (ft. AMSL)	10/2/2000 (ft. AMSL)	11/17/2000 (ft. AMSL)	12/13/2000 (ft. AMSL)	1/9/2001 (ft. AMSL)	2/28/2001 (ft. AMSL)	3/16/2001 (ft. AMSL)	4/23/2001 (ft. AMSL)
<b>Basal St. Peter Sandstone Aquifer</b>															
EW3	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
MW17B	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
MW18B	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
MW19B	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
MW20B	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
6 Blue Goose Road #	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
1 Lily Pond Road #	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
11 Lily Pond Road #	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
11 Robb Farm Road #	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
38 East Oaks Road ^	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
6 West Shore Road ^	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
<b>Prairie du Chien Aquifer</b>															
MW17L	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
MW18L	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
MW19L	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI

**Historical Summary of Groundwater Elevations  
Highway 96 Site  
White Bear Township, Minnesota**

Location	5/31/2001 (ft. AMSL)	8/3/2001 (ft. AMSL)	10/1/2001 (ft. AMSL)	2/7/2002 (ft. AMSL)	5/29/2002 (ft. AMSL)	8/8/2002 (ft. AMSL)	9/30/2002 (ft. AMSL)	1/6/2003 (ft. AMSL)	5/20/2003 (ft. AMSL)	9/18/2003 (ft. AMSL)	10/13/2003 (ft. AMSL)	10/18/2004 (ft. AMSL)	11/14/2005 (ft. AMSL)	10/16/2006 (ft. AMSL)	10/1/2007 (ft. AMSL)
<b>Perched Groundwater Unit</b>															
LW1	931.90	929.17	928.30	928.38	931.02	931.13	930.64	928.34	932.72	928.31	928.18	927.67	929.58	926.75	931.06
LW2	933.07	931.96	931.91	932.44	933.71	934.11	933.40	932.15	934.69	933.66	933.45	933.61	932.88	933.56	933.50
LW3	934.61	931.61	929.46	929.22	933.98	934.76	932.86	930.46	935.65	930.25	929.33	929.80	932.08	930.57	930.91
MW1S	938.72	935.66	933.36	932.05	937.84	939.37	935.46	933.59	938.26	933.23	932.40	932.74	932.97	931.85	931.03
MW4U	< 909.6	910.21	910.79	909.83	910.39	912.00	912.63	911.43	910.50	912.30	911.90	911.81	911.97	911.80	DRY
MW6S	933.62	932.57	931.05	928.07	930.01	930.06	928.62	927.03	931.48	928.96	928.62	928.90	930.05	930.11	930.99
MW10S	931.60	929.93	928.93	923.99	931.13	931.40	931.08	928.66	931.36	924.92	926.66	927.81	931.39	928.99	931.13
MW11S	932.04	930.53	923.91	918.77	932.18	932.72	932.43	928.35	932.60	925.64	923.50	924.39	931.86	928.15	931.49
P1	937.80	935.12	934.01	933.48	937.18	937.35	934.73	933.03	939.52	933.09	932.64	933.11	933.95	932.73	932.84
P2	926.78	926.75	926.72	926.54	926.72	926.70	926.62	926.55	926.20	927.56	926.52	926.56	926.53	928.02	927.04
P3	930.28	929.95	929.91	929.59	928.98	928.73	928.57	928.31	928.16	928.18	928.09	927.90	927.85	929.30	928.93
P4	DRY	DRY	DRY	DRY	DRY	930.78	930.64	930.57	930.32	930.64	930.59	930.64	930.65	930.65	930.65
SUMP*	918.96	920.97	921.86	914.84	916.27	913.96	913.61	915.61	919.49	921.30	920.14	917.31	921.92	926.35	923.60
<b>Glacial Drift (Lower Sand) Aquifer</b>															
EW1*	884.02	NM	887.18	884.26	880.00	877.62	887.66	897.35	897.42	895.95	896.11	895.60	891.88	894.36	891.64
EW1A*	890.18	888.91	889.19	894.92	880.39	880.66	877.35	875.58	870.07	859.92	858.50	860.91	857.22	856.97	865.22
EW1B*	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
EW1C*	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
MW1D	896.85	896.22	896.01	896.60	897.05	898.01	898.92	898.99	899.04	897.47	897.56	897.04	896.63	895.81	893.55
MW4D	895.71	895.00	894.78	895.46	895.72	896.80	897.89	897.96	898.02	896.46	896.96	896.06	895.58	894.64	892.30
MW4S	897.68	898.55	898.52	898.16	898.20	899.29	900.46	901.07	900.26	900.05	900.12	898.93	898.48	898.36	894.43
MW6D	896.43	896.35	896.08	896.39	896.63	897.63	898.54	898.92	898.72	897.52	897.71	897.02	896.67	896.02	893.38
MW10D	901.02	901.97	901.49	901.37	902.37	904.27	905.36	904.68	904.09	903.49	903.41	902.48	903.74	902.61	898.80
MW11D	900.03	900.25	899.39	898.93	900.53	902.09	903.27	902.90	902.84	901.49	901.30	900.66	901.56	900.50	896.83
MW12D	898.51	899.52	898.94	898.56	899.40	901.38	902.21	902.10	901.17	900.60	900.32	NO ACCESS	899.38	898.63	896.17
MW13D	898.04	898.41	897.92	897.84	899.16	900.72	901.27	900.70	901.09	899.59	899.55	NO ACCESS	898.88	897.69	895.26
MW16D	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	896.38	895.49	893.10
<b>Upper St. Peter Sandstone Aquifer</b>															
EW2*	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NM	851.37	851.76
EW2A*	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
MW7B	897.80	897.29	897.08	897.60	898.05	898.98	899.83	899.89	899.67	898.49	898.54	898.06	897.67	896.90	894.65
MW8B	895.56	894.92	894.64	895.31	895.57	896.65	897.77	897.84	897.88	896.34	896.77	895.92	895.44	894.51	892.12
MW10B	895.60	894.93	894.64	895.28	895.62	896.71	897.77	897.86	897.93	896.33	896.77	895.94	895.49	894.51	892.21
MW12B	895.53	894.84	894.60	895.21	894.90	896.68	897.70	897.80	897.87	896.24	896.35	NO ACCESS	895.42	894.46	892.18
MW13B	895.48	894.76	894.51	895.09	895.55	896.66	897.61	897.67	897.76	896.10	896.22	NO ACCESS	895.32	894.37	892.13
MW16B	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	895.84	894.94	892.59
MW17A	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	893.22	892.13	890.11
MW18A	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	885.63
MW19A	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
MW21A	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI

**Historical Summary of Groundwater Elevations  
Highway 96 Site  
White Bear Township, Minnesota**

Location	5/31/2001 (ft. AMSL)	8/3/2001 (ft. AMSL)	10/1/2001 (ft. AMSL)	2/7/2002 (ft. AMSL)	5/29/2002 (ft. AMSL)	8/8/2002 (ft. AMSL)	9/30/2002 (ft. AMSL)	1/6/2003 (ft. AMSL)	5/20/2003 (ft. AMSL)	9/18/2003 (ft. AMSL)	10/13/2003 (ft. AMSL)	10/18/2004 (ft. AMSL)	11/14/2005 (ft. AMSL)	10/16/2006 (ft. AMSL)	10/1/2007 (ft. AMSL)
<b>Basal St. Peter Sandstone Aquifer</b>															
EW3	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	877.14
MW17B	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	886.53	885.09	883.28
MW18B	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	883.73
MW19B	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	878.79	876.90
MW20B	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	876.66
6 Blue Goose Road #	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	890.85	886.20
1 Lily Pond Road #	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	892.13	884.25
11 Lily Pond Road #	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	885.73	884.20
11 Robb Farm Road #	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	892.58	890.56
38 East Oaks Road ^	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
6 West Shore Road ^	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
<b>Prairie du Chien Aquifer</b>															
MW17L	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	883.16	880.77	878.79
MW18L	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	875.54
MW19L	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	874.40	872.50



**Historical Summary of Groundwater Elevations  
Highway 96 Site  
White Bear Township, Minnesota**

Location	10/6/2008 (ft. AMSL)	12/14/2009 (ft. AMSL)	10/11/2010 (ft. AMSL)	10/10/2011 (ft. AMSL)	10/1/2012 (ft. AMSL)	9/30/2013 (ft. AMSL)	10/6/2014 (ft. AMSL)	10/5/2015 (ft. AMSL)	10/3/2016 (ft. AMSL)	9/27/2017 (ft. AMSL)	10/8/2018 (ft. AMSL)	10/24/2019 (ft. AMSL)	10/22/2020 (ft. AMSL)	9/27/2021 (ft. AMSL)
<b>Perched Groundwater Unit</b>														
LW1	927.01	DRY	929.75	928.26	927.95	928.06	932.20	931.10	932.79	929.53	933.35	934.16	926.53	DRY
LW2	932.58	932.64	931.86	932.62	931.61	931.91	933.44	938.22	934.60	933.60	935.02	938.14	938.71	933.56
LW3	928.33	929.96	930.85	930.79	928.40	928.86	933.21	937.37	934.59	932.06	934.68	935.76	929.02	928.33
MW1S	931.63	930.33	931.52	933.96	931.67	932.74	933.31	933.03	937.02	932.44	933.67	937.02	931.69	930.85
MW4U	909.88	DRY	909.86	913.36	910.24	911.11	914.40	913.81	916.57	915.03	914.99	915.96	915.55	912.75
MW6S	928.05	928.43	927.94	930.47	928.22	929.66	931.29	930.30	932.68	929.23	929.69	932.02	928.05	927.24
MW10S	DRY	927.69	929.74	928.71	919.89	920.18	930.74	931.47	932.70	930.98	931.83	932.68	929.14	929.89
MW11S	920.62	920.32	931.08	928.20	922.34	923.49	932.36	932.17	932.94	931.04	932.94	933.16	924.01	922.31
P1	932.05	932.36	932.45	933.39	931.67	932.29	933.59	933.33	935.97	932.52	934.94	938.98	932.66	NM
P2	928.40	926.68	926.57	928.47	926.62	926.62	930.77	926.78	932.77	929.35	934.69	938.85	935.27	934.58
P3	929.21	929.06	928.66	929.58	928.75	928.42	930.35	929.59	930.05	928.85	938.82	942.76	936.13	935.31
P4	930.68	930.65	DRY	930.65	930.68	930.68	930.75	930.81	930.95	931.08	936.15	939.90	935.01	934.91
SUMP*	924.91	923.21	919.71	921.48	918.52	920.58	924.75	920.81	927.25	926.89	935.76	939.44	934.44	934.33
<b>Glacial Drift (Lower Sand) Aquifer</b>														
EW1*	892.16	891.96	891.26	894.96	891.26	893.84	896.94	897.05	899.05	899.23	899.02	901.46	899.63	NM
EW1A*	861.67	871.43	891.79	895.28	892.74	894.22	897.31	897.31	899.39	899.42	899.03	901.42	899.70	ABD
EW1B*	NI	NI	888.44	894.88	889.43	891.04	893.42	892.51	887.65	890.44	884.90	877.57	880.77	874.59
EW1C*	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
MW1D	893.91	893.26	892.13	896.08	894.04	895.55	898.74	898.97	901.07	901.07	900.82	902.80	901.53	898.88
MW4D	892.45	892.17	891.93	895.06	892.91	894.39	897.53	897.71	899.99	899.92	899.59	901.79	900.30	NM
MW4S	895.39	893.51	894.58	899.26	897.09	898.27	902.57	902.08	905.57	907.63	905.18	907.41	906.44	905.09
MW6D	893.72	893.15	893.23	896.68	894.62	895.95	898.94	899.10	901.25	901.48	900.93	902.97	901.76	899.07
MW10D	899.92	897.05	898.59	903.43	900.50	901.00	904.50	904.73	908.49	908.79	NM	NM	NM	NM
MW11D	897.06	894.94	896.46	901.03	897.98	899.22	903.70	903.93	906.65	906.10	NM	908.08	905.10	902.27
MW12D	896.89	895.62	894.68	900.48	897.80	899.27	902.75	902.60	906.39	905.65	906.00	907.75	905.44	904.67
MW13D	895.88	894.35	894.10	898.87	896.35	898.28	901.56	901.27	904.07	903.28	899.79	905.43	903.18	900.05
MW16D	893.15	892.79	892.70	895.84	893.55	895.05	898.35	898.51	900.70	900.69	900.44	902.57	900.92	898.43
<b>Upper St. Peter Sandstone Aquifer</b>														
EW2*	830.76	844.88	838.11	829.96	855.39	892.30	895.08	895.02	898.46	898.76	898.76	900.91	899.31	897.64
EW2A*	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
MW7B	894.69	894.29	894.28	897.41	895.40	896.71	899.80	900.08	902.18	902.17	901.99	903.83	902.75	900.09
MW8B	892.26	892.01	891.74	892.87	892.72	894.24	897.38	897.53	899.66	899.81	899.43	901.64	900.10	897.79
MW10B	892.32	892.04	891.76	894.88	892.66	894.27	897.45	897.58	899.74	899.66	899.49	901.64	900.17	897.64
MW12B	892.28	891.95	891.71	894.82	892.68	894.20	897.41	897.57	899.71	899.64	899.47	901.61	900.15	897.50
MW13B	892.23	891.89	891.64	894.77	892.59	894.14	897.36	897.52	899.69	899.59	899.40	901.49	900.06	897.40
MW16B	892.72	892.42	892.16	895.24	893.08	894.61	897.85	898.00	900.13	900.06	900.11	902.01	900.59	898.01
MW17A	890.16	889.78	889.55	892.56	890.51	892.03	895.36	895.51	897.69	897.56	897.32	899.30	898.08	895.10
MW18A	885.88	885.39	885.21	888.49	886.64	887.96	891.15	891.31	893.46	893.81	893.14	895.43	894.19	890.89
MW19A	882.33	881.79	881.75	885.61	883.82	884.96	887.92	888.09	890.28	891.18	889.90	892.36	891.24	887.80
MW21A	882.51	882.01	881.96	885.80	884.01	885.20	887.90	888.27	890.44	891.32	890.07	892.50	891.42	888.02

**Historical Summary of Groundwater Elevations  
Highway 96 Site  
White Bear Township, Minnesota**

Location	10/6/2008 (ft. AMSL)	12/14/2009 (ft. AMSL)	10/11/2010 (ft. AMSL)	10/10/2011 (ft. AMSL)	10/1/2012 (ft. AMSL)	9/30/2013 (ft. AMSL)	10/6/2014 (ft. AMSL)	10/5/2015 (ft. AMSL)	10/3/2016 (ft. AMSL)	9/27/2017 (ft. AMSL)	10/8/2018 (ft. AMSL)	10/24/2019 (ft. AMSL)	10/22/2020 (ft. AMSL)	9/27/2021 (ft. AMSL)
Basal St. Peter Sandstone Aquifer														
EW3	877.16	878.33	877.05	879.68	877.15	879.48	882.57	882.96	885.98	885.73	885.91	888.40	887.06	883.07
MW17B	883.10	884.25	882.56	884.78	881.67	884.21	888.54	887.99	891.03	890.21	891.34	892.88	892.59	886.66
MW18B	883.83	883.58	882.06	885.05	882.39	883.85	887.92	887.43	890.43	890.44	890.17	892.31	891.46	887.72
MW19B	876.92	877.91	876.65	879.43	876.90	878.67	882.43	882.68	885.71	885.47	885.65	887.62	886.94	NM
MW20B	876.64	877.97	877.00	879.83	877.27	879.16	882.19	883.31	886.30	886.28	886.21	888.72	887.50	883.64
6 Blue Goose Road #	886.12	886.90	885.57	887.63	884.55	887.26	891.56	891.10	893.87	893.12	894.32	896.35	895.31	891.65
1 Lily Pond Road #	890.31	890.98	883.69	892.68	890.58	892.24	895.72	895.80	898.45	897.83	897.72	899.77	898.47	895.24
11 Lily Pond Road #	884.20	885.01	883.87	885.94	883.01	885.31	889.63	889.19	891.98	891.35	892.32	894.43	893.37	889.08
11 Robb Farm Road #	890.63	890.31	890.08	893.14	891.00	892.58	895.85	895.97	898.20	898.04	897.90	899.96	898.55	895.67
38 East Oaks Road ^	879.73	881.04	879.20	881.82	878.73	880.77	885.36	885.26	888.15	888.07	887.79	890.46	889.27	885.31
6 West Shore Road ^	880.62	881.12	880.01	882.80	880.18	881.85	886.03	883.46	888.60	888.42	888.67	891.05	889.47	886.17
Prairie du Chien Aquifer														
MW17L	879.27	881.31	878.52	880.70	876.63	879.25	885.18	883.38	886.99	885.37	888.17	890.21	889.46	885.05
MW18L	875.53	878.39	874.85	877.31	873.29	875.92	881.19	880.67	884.23	883.29	885.01	887.39	886.22	881.63
MW19L	872.28	875.15	872.64	875.26	871.40	873.65	878.47	878.51	882.13	880.29	882.57	885.01	883.73	879.12

## Notes:

- ft. AMSL - Feet Above Mean Sea Level
- ABD - Abandoned
- NI - Not Installed
- NM - Not Measured
- TOC - Top of Casing
- \* - Historical/Current Pumping Well
- # - Converted Residential Monitoring Well
- ^ - Active Residential Well

# **Appendix C**

## **Annual Monitoring Well Sampling Summary**

**Monitoring Well Sampling Summary**  
**September/October 2021**  
**Highway 96 Site**  
**White Bear Township, Minnesota**

Well	Sample No.	QA/QC	pH (--)	Temperature (°C)	Conductivity (mS/cm)	ORP (mV)	DO (mg/L)	Turbidity (NTU)	Comments	Analytical
BLU-06 #	W-210929-KJ-18	MS/MSD	7.58	10.73	0.655	-160	0.00	16.7	CLEAR	P1,P3
EW1B	W-211021-SJR-001	--	6.46	NM	NM	NM	NM	NM	--	P1,P2
EW2	NS	--	--	--	--	--	--	--	DAMAGED	P1,P2
EW3	W-211028-KJ-01	RB (KJ-02)	8.05	10.11	0.688	-213	0.00	17.1	CLEAR	P1,P3
LIL-01 #	W-210930-KJ-51	FD (KJ-52)	7.44	11.83	0.708	-225	0.00	10.5	CLEAR	P1,P3
LIL-11 #	W-210929-KJ-08	RB (KJ-07)	7.59	12.02	0.536	-202	0.00	12.6	CLEAR	P1,P3
LW1	NS	--	--	--	--	--	--	--	INSUF. WATER	--
LW2	W-210928-KJ-34	--	7.19	18.56	0.800	-180	0.00	21.0	CLEAR	P1,P2
LW3	W-210928-KJ-33	--	7.36	14.72	1.490	-193	0.00	10.4	CLEAR	P1,P2
MW1D	W-210929-KJ-43	--	7.65	11.39	0.697	-249	0.00	0.0	CLEAR	P1,P2
MW1S	W-210928-KJ-36	--	6.97	16.18	0.848	-130	0.00	30.1	CLEAR	P1,P2
MW4D	W-210930-KJ-31	MS/MSD; FD (KJ-37)	7.22	14.49	1.450	-179	0.00	90.5	PUMPED DRY	P1,P2
MW4S	W-210929-KJ-41	--	7.39	12.64	0.837	-228	0.00	218.0	PUMPED DRY	P1,P2
MW4U	W-210928-KJ-35	--	6.67	14.67	1.280	-115	0.00	2.1	CLEAR	P1,P2
MW8B	W-210930-KJ-53	--	7.84	11.83	0.981	-289	0.00	5.4	CLEAR	P1,P2
MW10B	W-210930-KJ-54	--	7.49	10.80	0.604	-227	0.00	2.7	CLEAR	P1,P2
MW10D	NS	--	--	--	--	--	--	--	OBSTRUCTED	--
MW11D	W-210929-KJ-42	--	7.50	15.50	0.613	-267	0.00	74.7	CLEAR	P1,P2
MW12B	W-210927-KJ-26	--	7.75	10.85	0.623	-255	0.00	23.7	CLEAR	P1,P2
MW12D	W-210927-KJ-25	RB (KJ-24)	7.10	14.29	0.901	-193	0.00	39.7	CLEAR	P1,P2
MW13B	W-210927-KJ-23	--	7.62	12.15	0.619	-249	0.00	17.8	CLEAR	P1,P2
MW13D	W-210927-KJ-21	FD (KJ-22)	8.01	12.45	0.731	-295	0.00	4.9	CLEAR	P1,P2
MW16B	W-210928-KJ-50	RB (KJ-29)	7.86	10.92	0.677	-227	0.00	7.9	CLEAR	P1,P2
MW16D	W-210928-KJ-28	RB (KJ-27)	7.19	11.61	0.708	-204	0.00	33.9	CLEAR	P1,P2
MW17A	W-210929-KJ-06	--	7.65	10.69	1.030	-227	0.00	9.1	CLEAR	P1,P3
MW17B	W-210929-KJ-05	--	8.62	16.11	0.492	-310	0.00	32.6	CLEAR	P1,P3
MW17L	W-210929-KJ-32	FD (KJ-38)	7.74	12.00	0.538	-165	0.00	73.9	CLEAR	P1,P3

**Monitoring Well Sampling Summary**  
**September/October 2021**  
**Highway 96 Site**  
**White Bear Township, Minnesota**

Well	Sample No.	QA/QC	pH (--)	Temperature (°C)	Conductivity (mS/cm)	ORP (mV)	DO (mg/L)	Turbidity (NTU)	Comments	Analytical
MW18A	W-210928-KJ-17	--	7.62	11.12	0.853	-254	0.00	12.1	CLEAR	P1,P3
MW18B	W-210928-KJ-15	FD (KJ-16)	7.68	11.15	0.774	-223	0.00	8.8	CLEAR	P1,P3
MW18L	W-210928-KJ-14	--	7.70	10.88	0.638	-194	0.00	9.9	CLEAR	P1,P3
MW19A	W-210928-KJ-09	--	7.66	10.39	0.766	-246	0.00	1.3	CLEAR	P1,P3
MW19B	NS	--	--	--	--	--	--	--	OBSTRUCTED	--
MW19L	W-210928-KJ-10	--	8.92	10.44	0.285	-407	0.00	18.3	CLEAR	P1,P3
MW20B	W-210928-KJ-04	--	7.49	10.50	0.622	-211	0.00	2.4	CLEAR	P1,P3
MW21A	W-210928-KJ-12	--	7.86	13.21	0.555	-260	0.00	27.0	CLEAR	P1,P3
ROB-11 #	W-210929-KJ-19	--	7.71	11.22	0.624	-225	0.00	42.7	CLEAR	P1,P3
SUMP	W-210929-KJ-40	RB (KJ-39)	7.00	12.16	0.663	-128	0.00	3.0	CLEAR	P1,P2

## Notes:

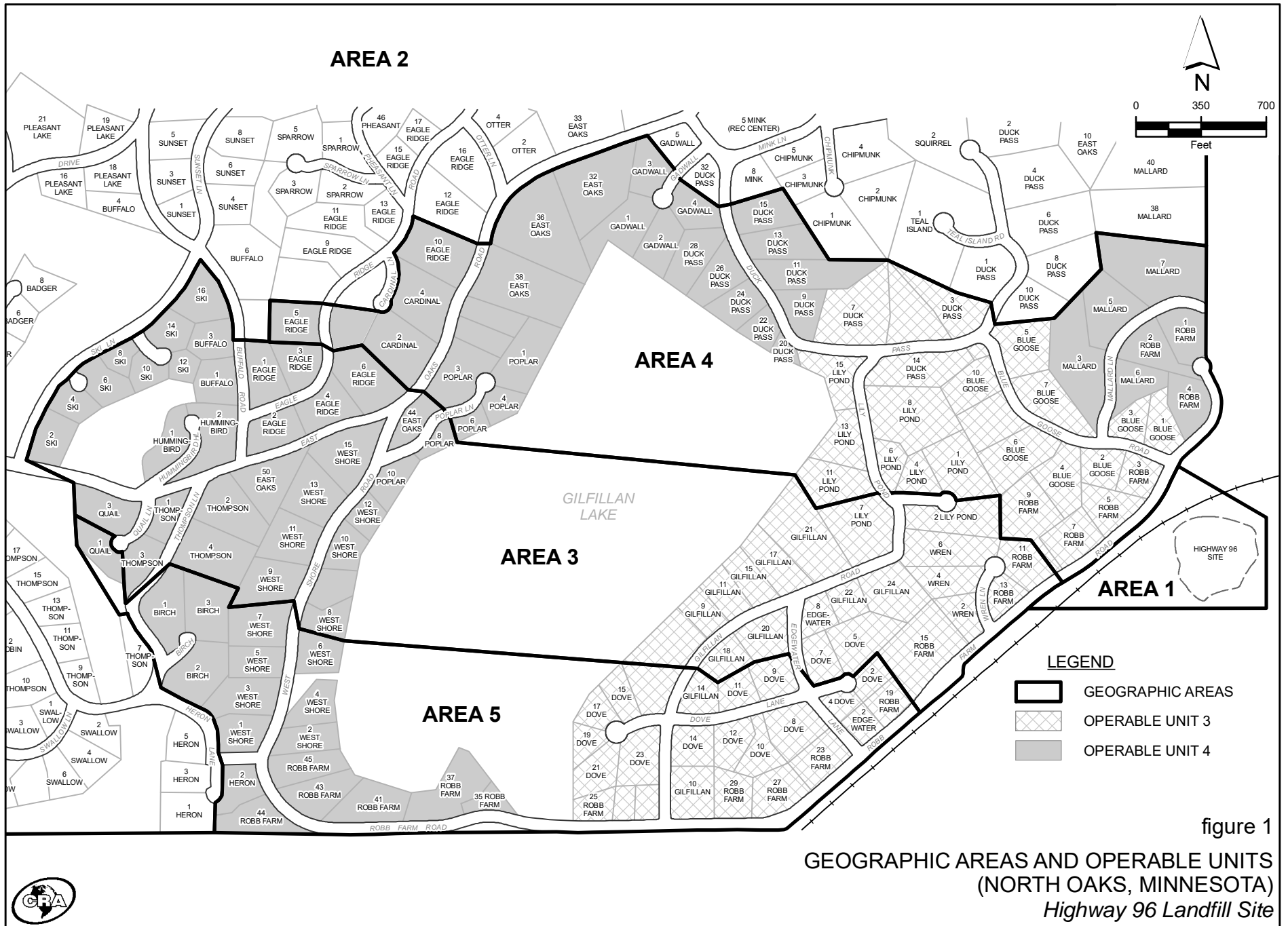
# - Converted residential monitoring well.

- DO - Dissolved Oxygen
- FD - Field Duplicate
- MM - Meter Malfunction
- mg/L - Milligrams per Liter
- mS/cm - Millisiemens per Centimeter
- MS/MSD - Matrix Spike/Matrix Spike Duplicate
- mV - Millivolts
- NM - Not Measured
- NS - Not Sampled
- NTU - Nephelometric Turbidity Units
- ORP - Oxidation Reduction Potential
- P1 - Chloride (Method 300.0A)
- P2 - Volatile Organic Compounds (VOCs) (Method 8260)
- P3 - Low-Level Volatile Organic Compounds (VOCs) (Method 8260 LL)
- QA/QC - Quality Assurance/Quality Control Sample Type
- RB - Rinsate Blank

# **Appendix D**

**Documentation of Site Action Levels**

AMENDED TABLE 1				October 10, 1994
<u>HIGHWAY 96 DUMP</u>				
GROUNDWATER CLEANUP LEVELS				
		HRL(2)	MCL(3)	LEVEL
		ug/l	ug/l	ug/l
MATRIX/COMPOUND	CARC. (1)			
<b>METALS</b>				
Barium		2000	2000	2000
Beryllium	c	0.08	1	0.08
Cadmium		4	5	4
Chromium VI		100	100	100
Chromium III		20000		20000
Copper		1000	1300	1000
Manganese		100		100
Mercury		2	2	2
Thallium		0.6	2/1	0.6
Zinc		2000	5000	2000
<b>VOLATILE ORGANICS</b>				
Acetone		700		700
Benzene	c	10	5	5
Bromodichloromethane	c	6	100	6
Bromoform	c	40	100	40
Bromomethane		10		10
Carbon Tetrachloride	c	3	5	3
Chlorobenzene		100		100
Chloroform	c	60	100	60
Dibromochloromethane		10		10
Dichlorodifluoromethane		1000		1000
1,1-Dichloroethane		70		70
1,2-Dichloroethane	c	4	5	4
1,1-Dichloroethene		6	7	6
1,2-Dichloroethene, trans		100	100	100
1,2-Dichloroethene, cis		70	70	70
1,2-Dichloropropane	c	5	5	5
1,3-Dichloropropene (cis-, trans-, mix)	c	2		2
Ethylbenzene		700	700	700
Ethyl Ether		1000		1000
Isopropylbenzene (cumene)		300		300
Methyl Ethyl Ketone (MEK, 2-butanone)		4000		4000
Methyl Isobutyl Ketone (MIBK)		300		300
Methylene Chloride (Dichloromethane)	c	50	5	5
1,1,1,2-Tetrachloroethane	c	70		70
1,1,2,2-Tetrachloroethane	c	2		2
1,1,2,2-Tetrachloroethene	c	7	5	5
Toluene		1000	1000	1000
1,2,4-Trichlorobenzene			70	70
1,1,1-Trichloroethane		600	200	200
1,1,2-Trichloroethane		3	5	3
1,1,2-Trichloroethene (TCE)	c	30	5	5
Trichlorofluoromethane		2,000		2000
1,1,2-Trichloro-1,2,2-trifluoroethane		200000		200,000
Vinyl Chloride	c	0.2	2	2*
Xylenes (total )		10000	10000	10000
<b>SEMI-VOLATILE ORGANICS</b>				
PAHs (total carcinogenic) (6)	c	0.03		0.03
<b>NOTES:</b>				
* - The clean-up level for vinyl chloride was adjusted for Site specific reasons. It is not MCL based.				
(1) Carcinogenicity - A "c" denotes a potential carcinogen.				
(2) HRL - Health Risk Limit established by the MN Department of Health.				
(3) MCL - Federal Maximum Contaminant Level				





**TABLE 1**

**Highway 96 Dump Site Ground Water Cleanup Goals**

<u>Volatile Organic Compound (VOC)</u>	<u>Cleanup Goal</u>	<u>Source</u>
1,1,2-Trichloroethene (TCE)	5 ug/l	Minnesota Department of Health, Health Risk Limit
Vinyl chloride	0.2 ug/l	“
trans-1,2-Dichloroethene (DCE)	100 ug/l	“
1,1-Dichloroethane (DCA)	70 ug/l	“
Benzene	5 ug/l	“
Toluene	1000 ug/l	“
Methyl Ethyl Ketone (MEK)	4000 ug/l	“

# Appendix E

**Historical Analytical Data Summary**

*(Available at the MPCA)*

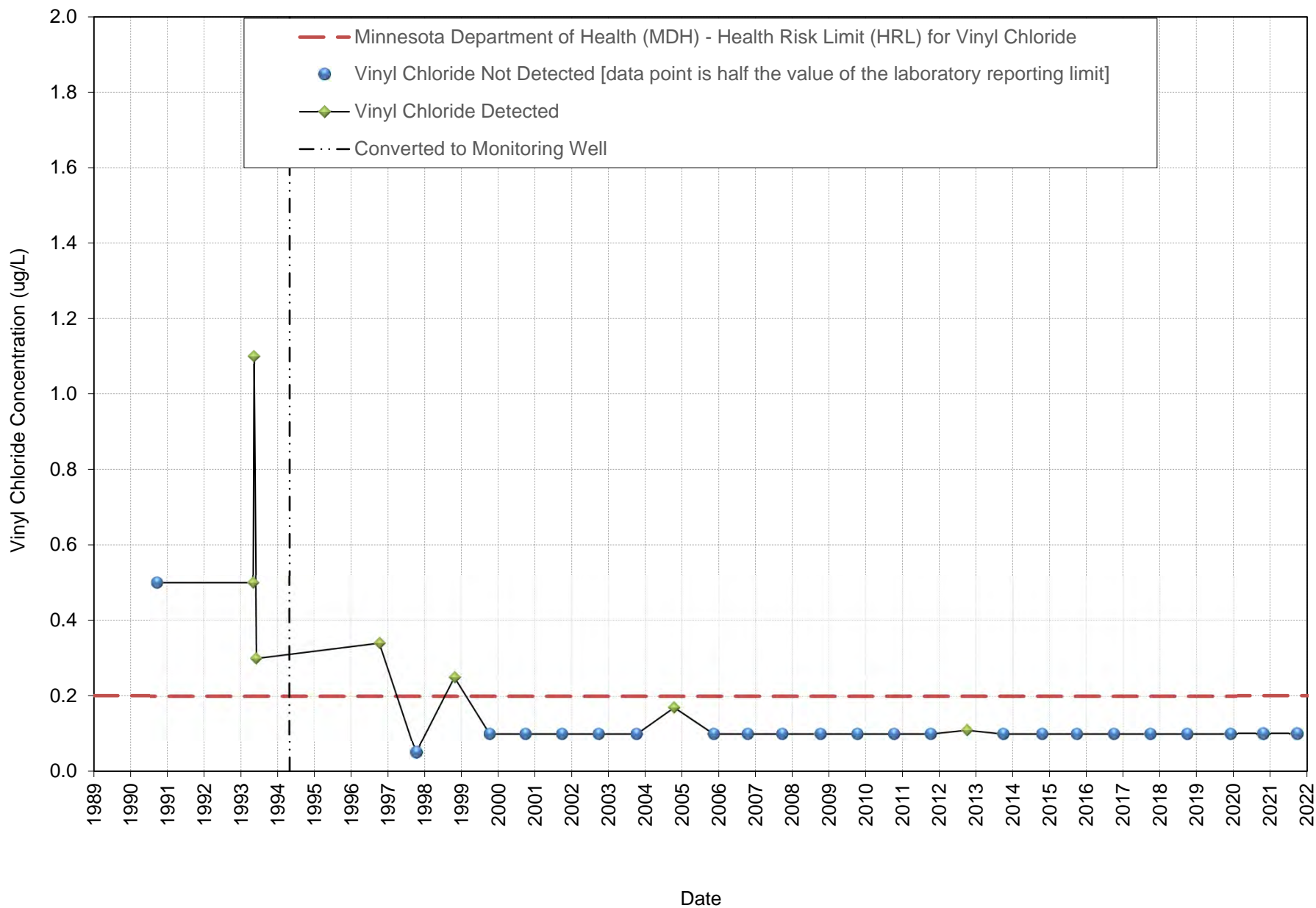
# **Appendix F**

**Laboratory Analytical Reports and Data  
Quality Assessment and Validation Memos**  
*(Available at the MPCA)*

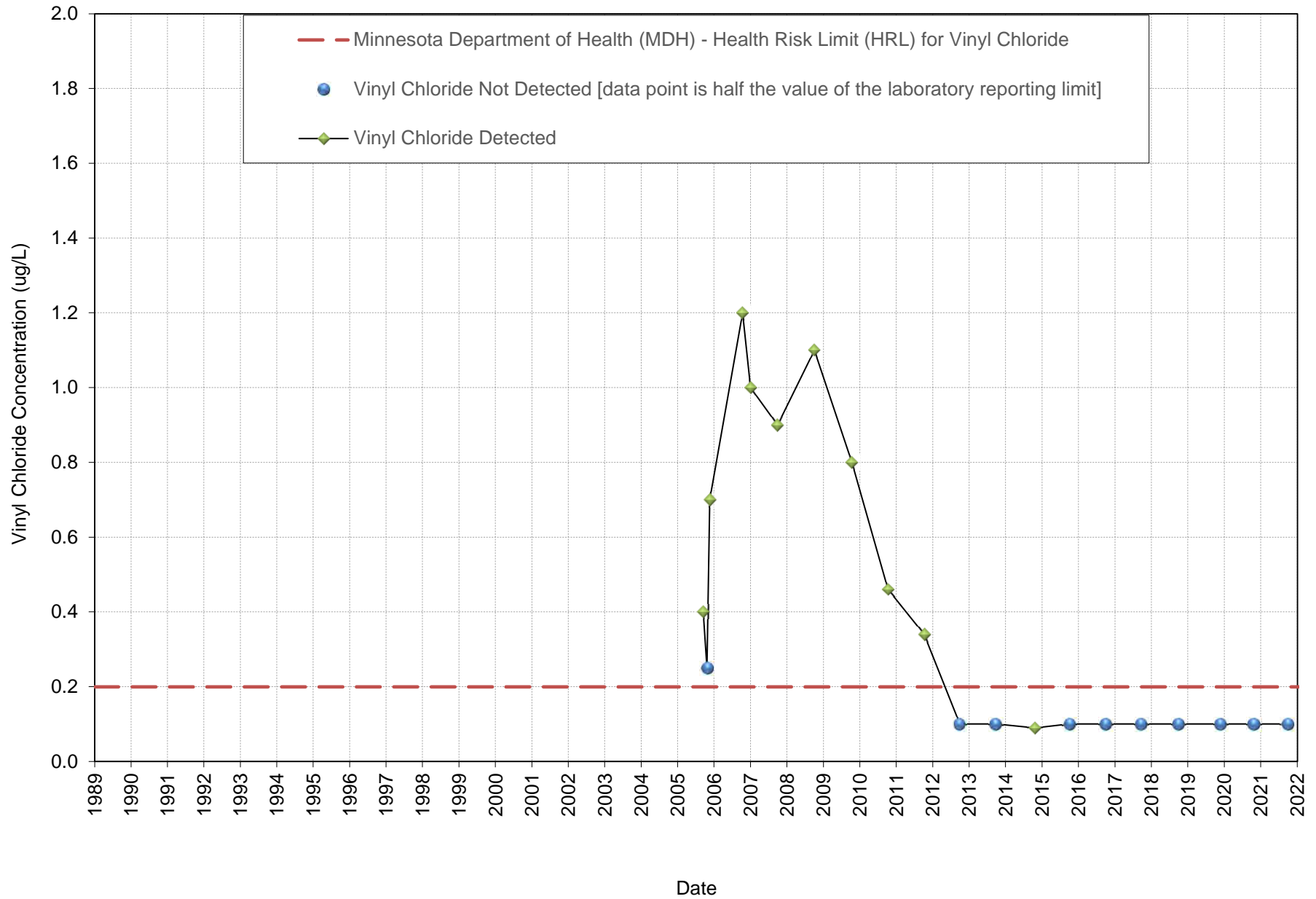
# **Appendix G**

**Historical Vinyl Chloride Detections  
Off-Site Monitoring Well Locations and  
Residential Wells**

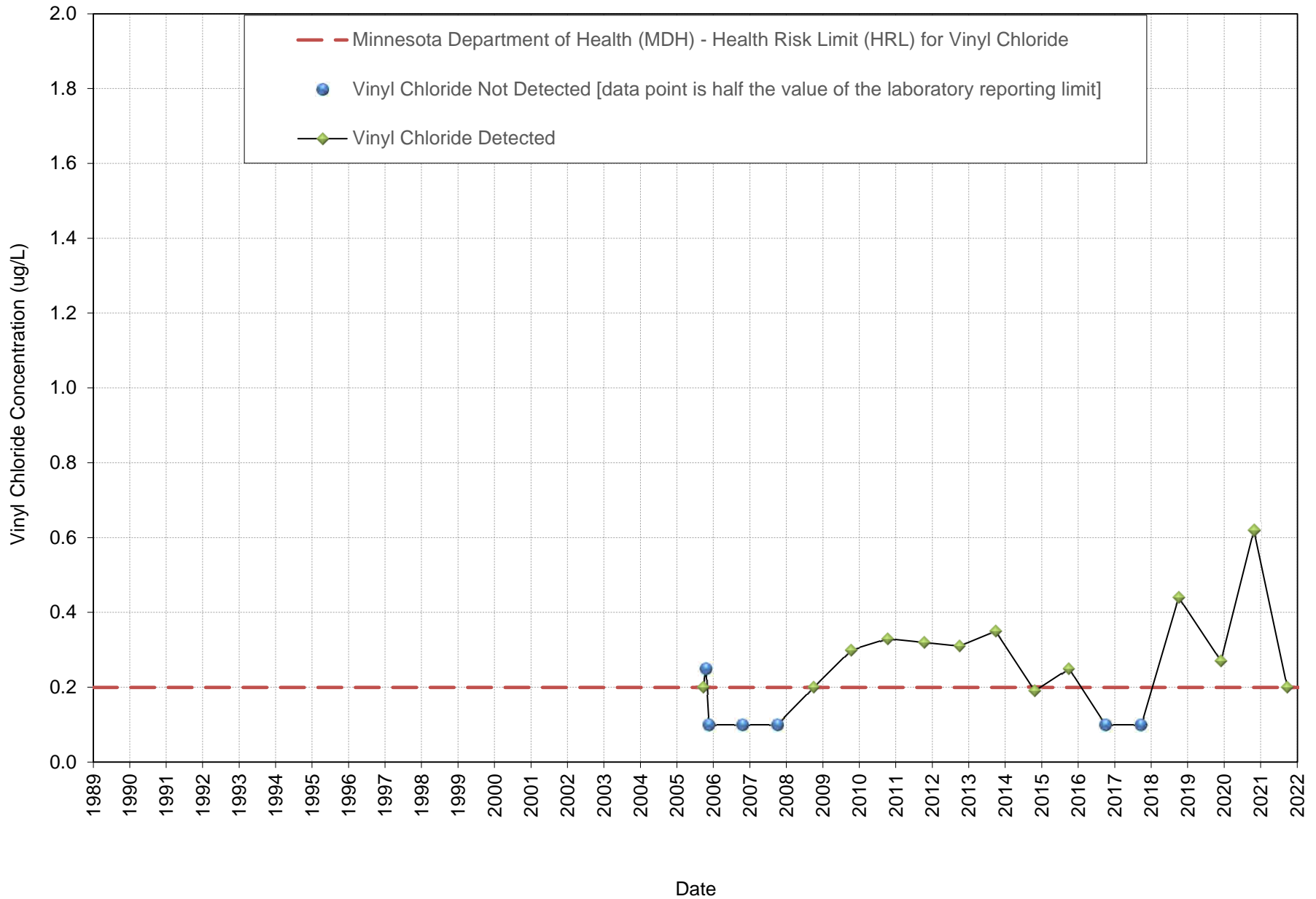
# Historical Vinyl Chloride Concentrations 1 Lily Pond Road North Oaks, Minnesota



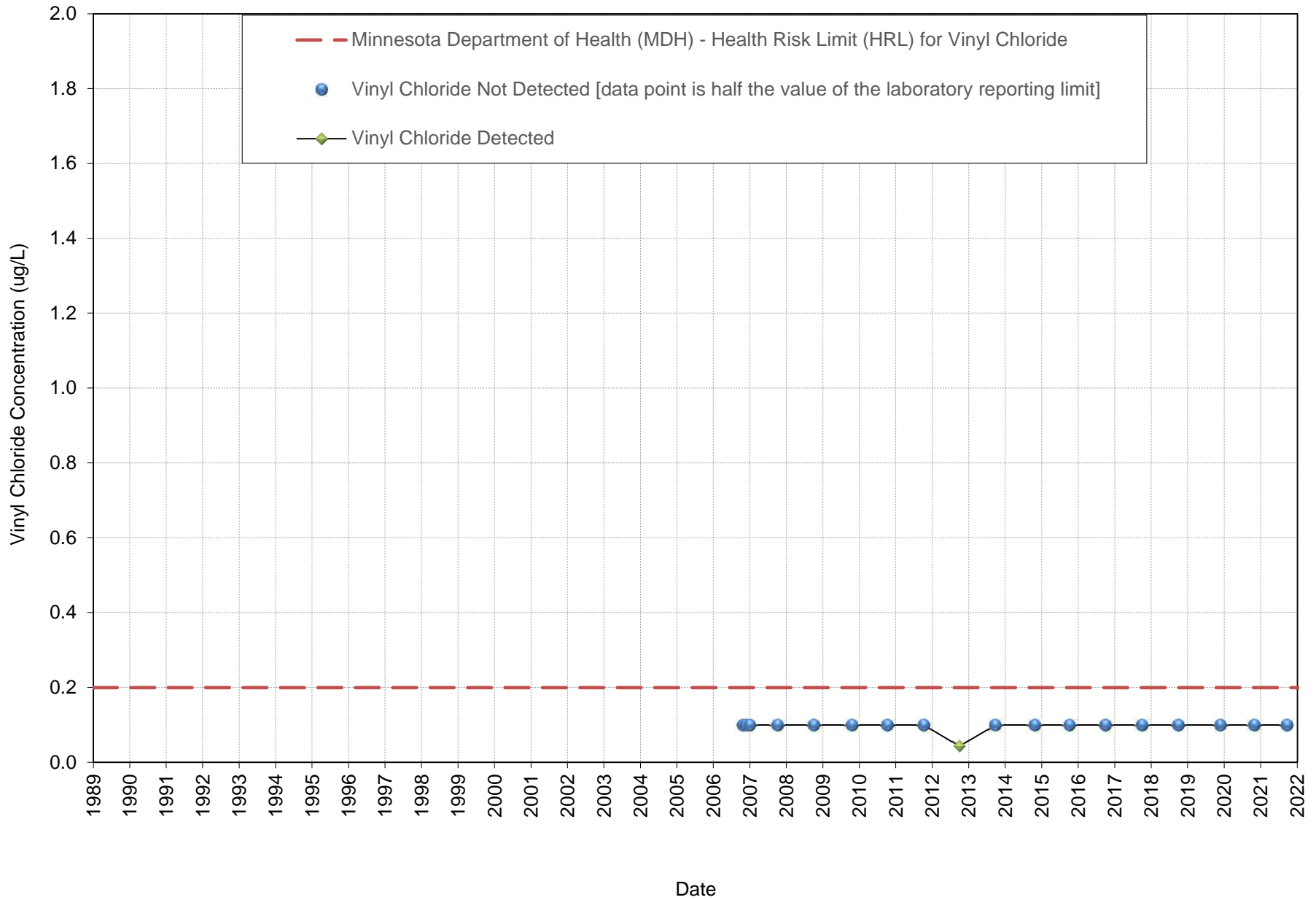
# Historical Vinyl Chloride Concentrations MW17A North Oaks, Minnesota



# Historical Vinyl Chloride Concentrations MW17B North Oaks, Minnesota

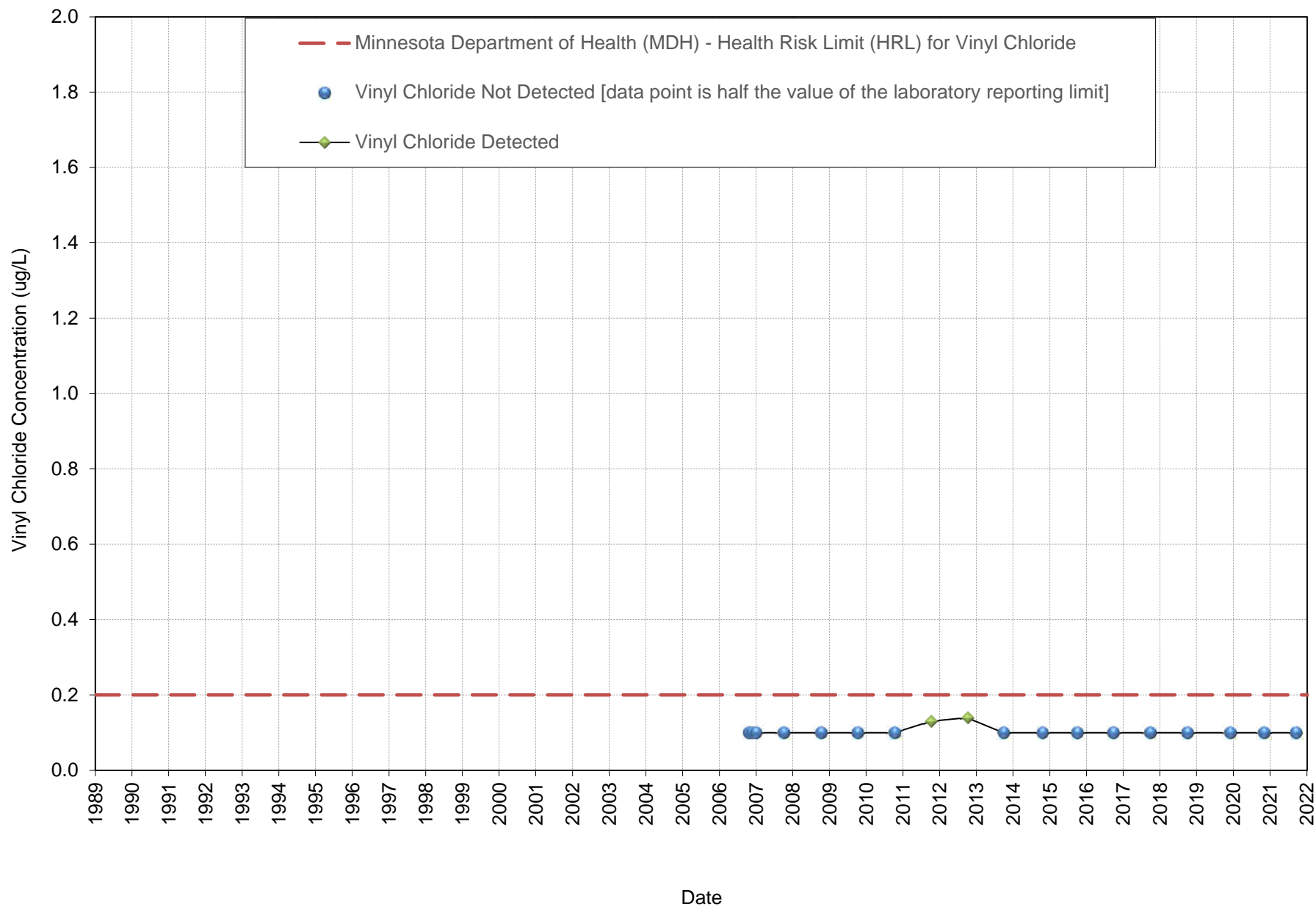


# Historical Vinyl Chloride Concentrations MW18A North Oaks, Minnesota

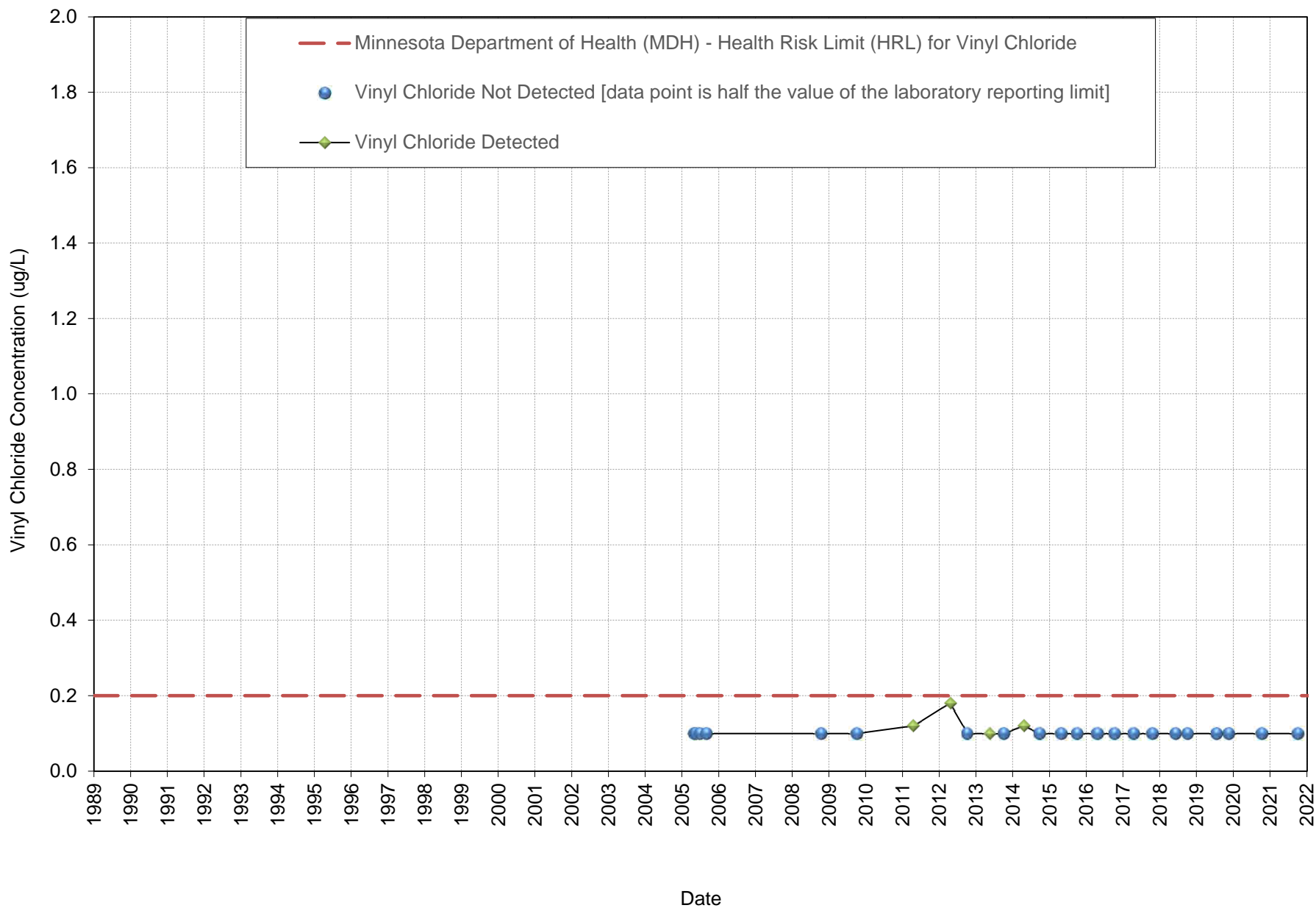




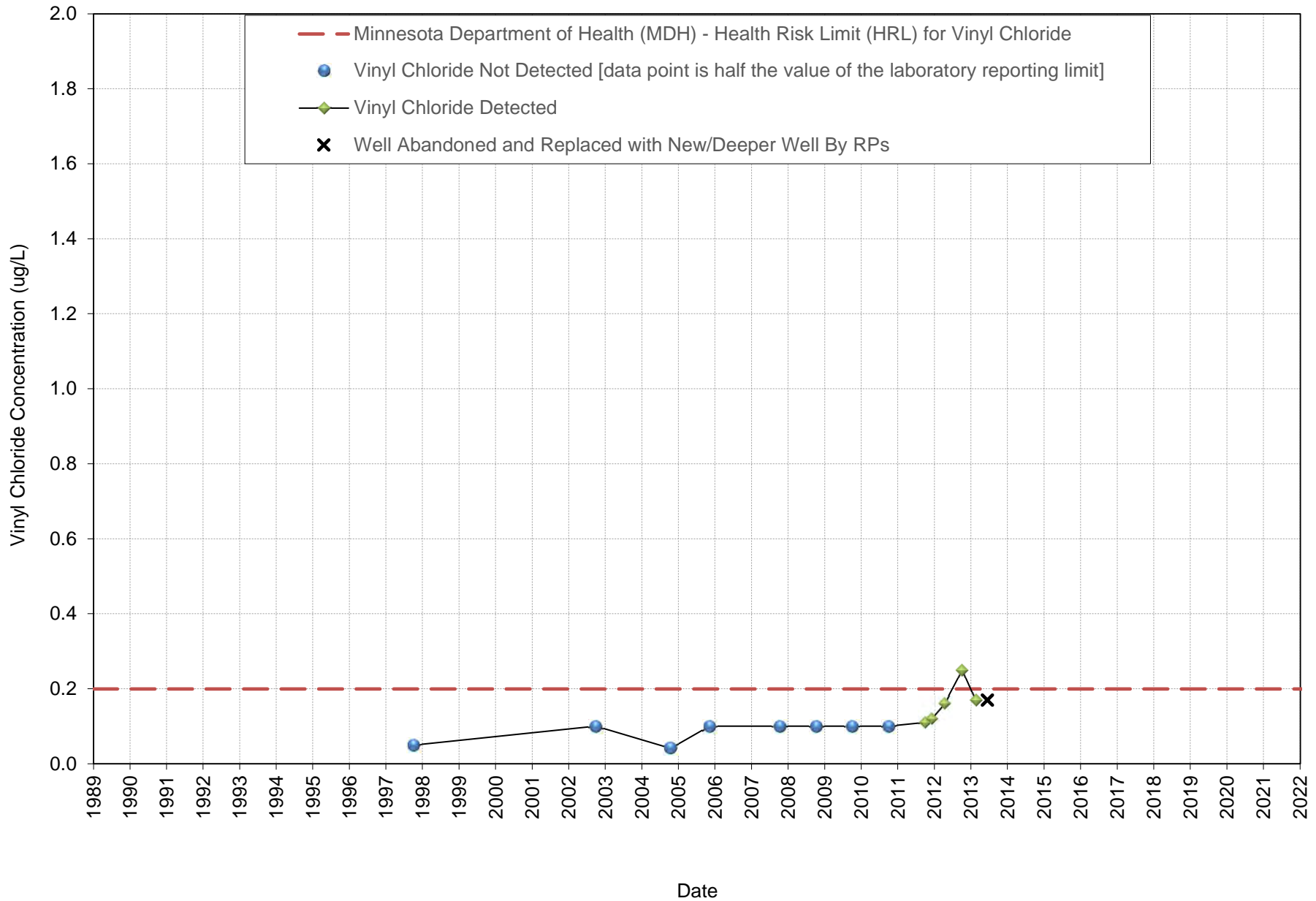
# Historical Vinyl Chloride Concentrations MW18B North Oaks, Minnesota



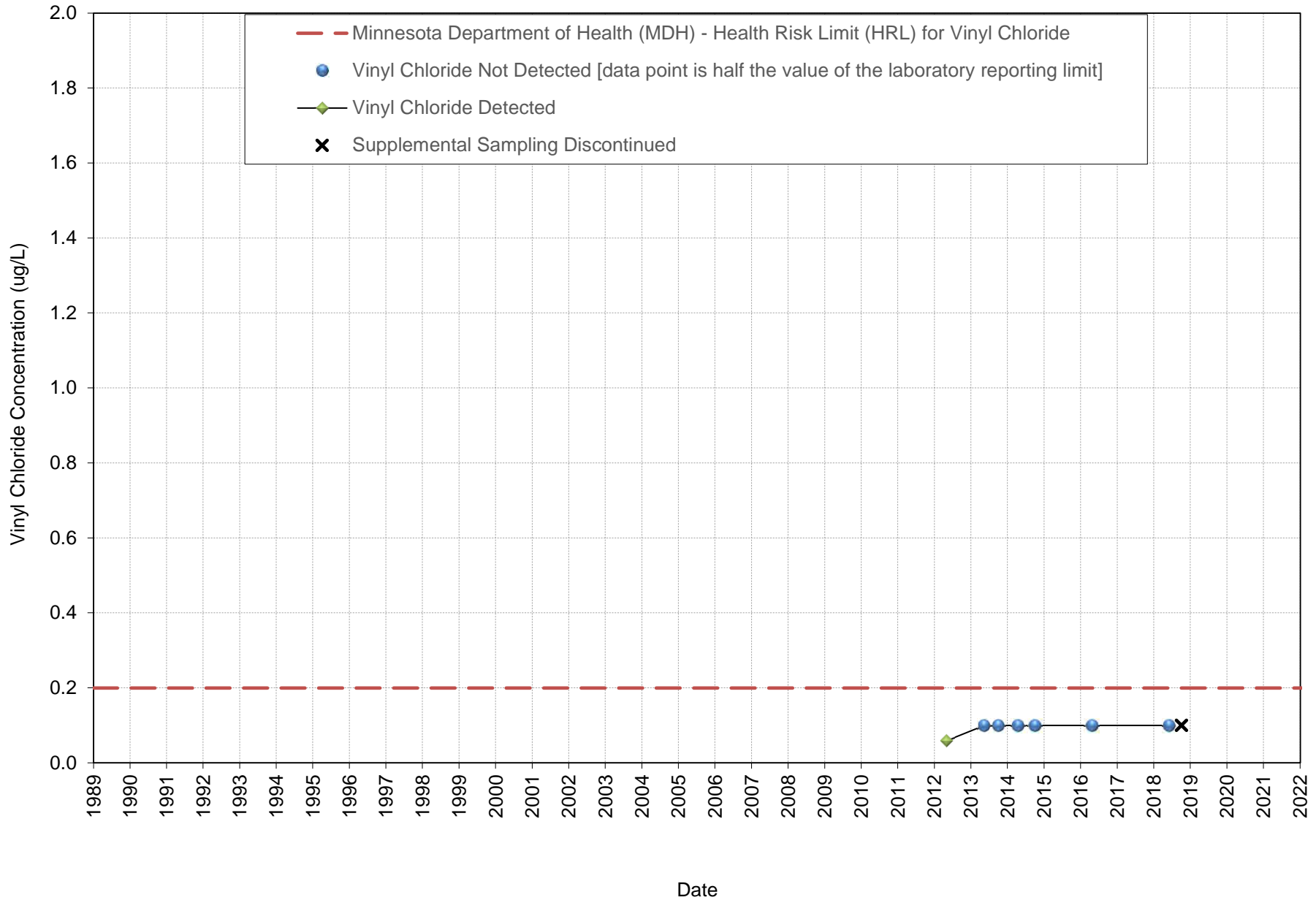
# Historical Vinyl Chloride Concentrations 50 East Oaks Road North Oaks, Minnesota



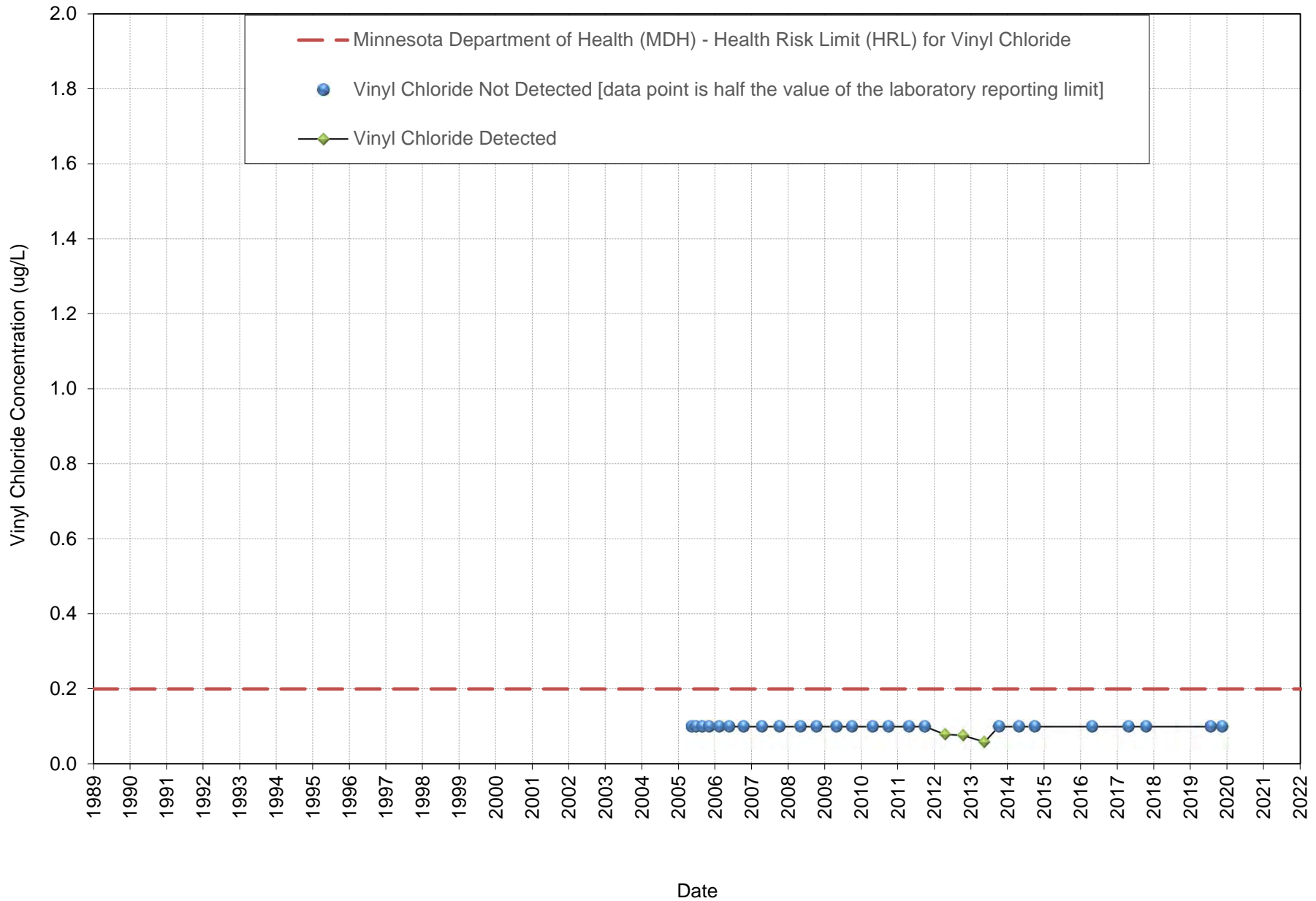
# Historical Vinyl Chloride Concentrations 2 Heron Lane (Old Well) North Oaks, Minnesota



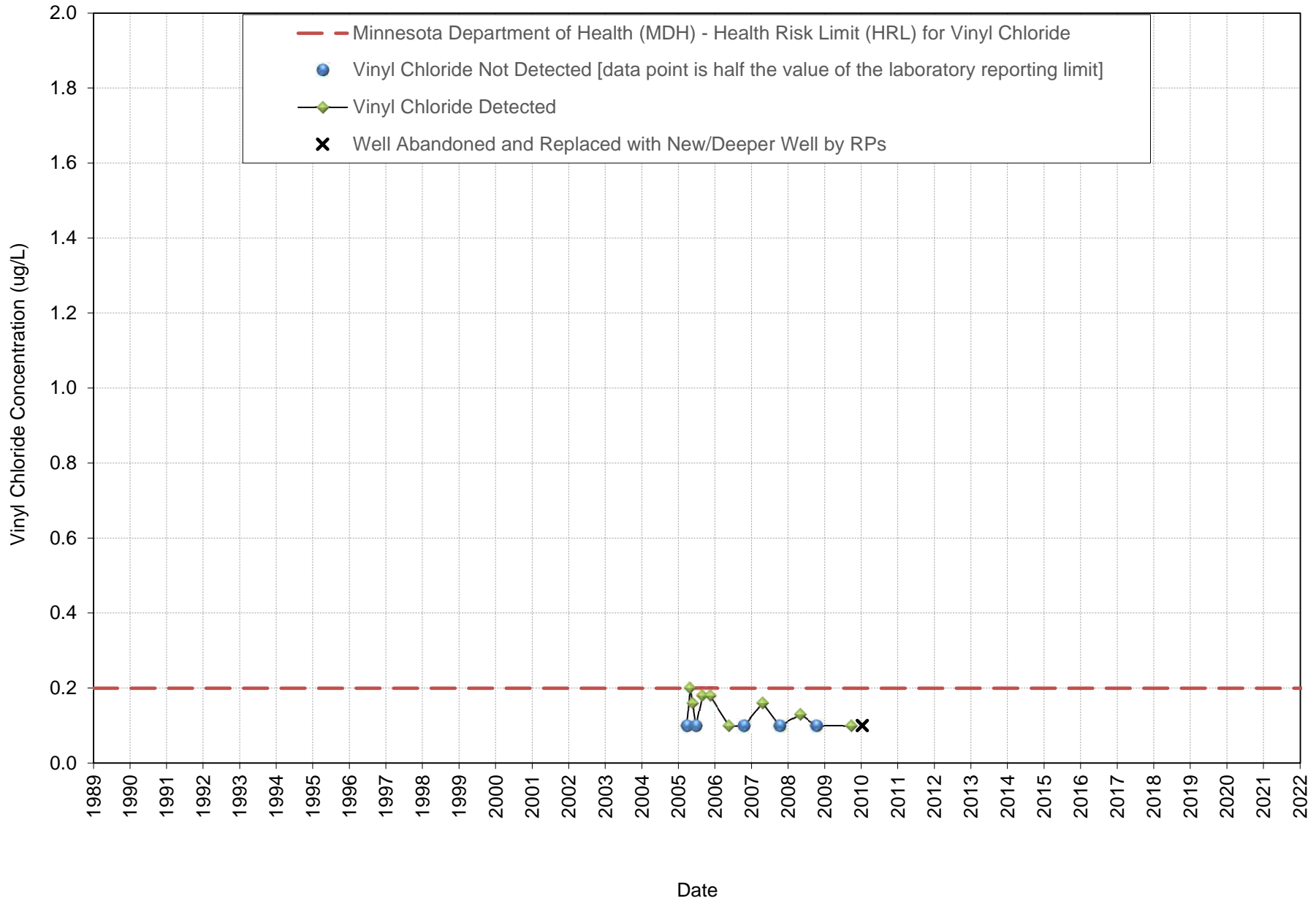
# Historical Vinyl Chloride Concentrations 3 Heron Lane North Oaks, Minnesota



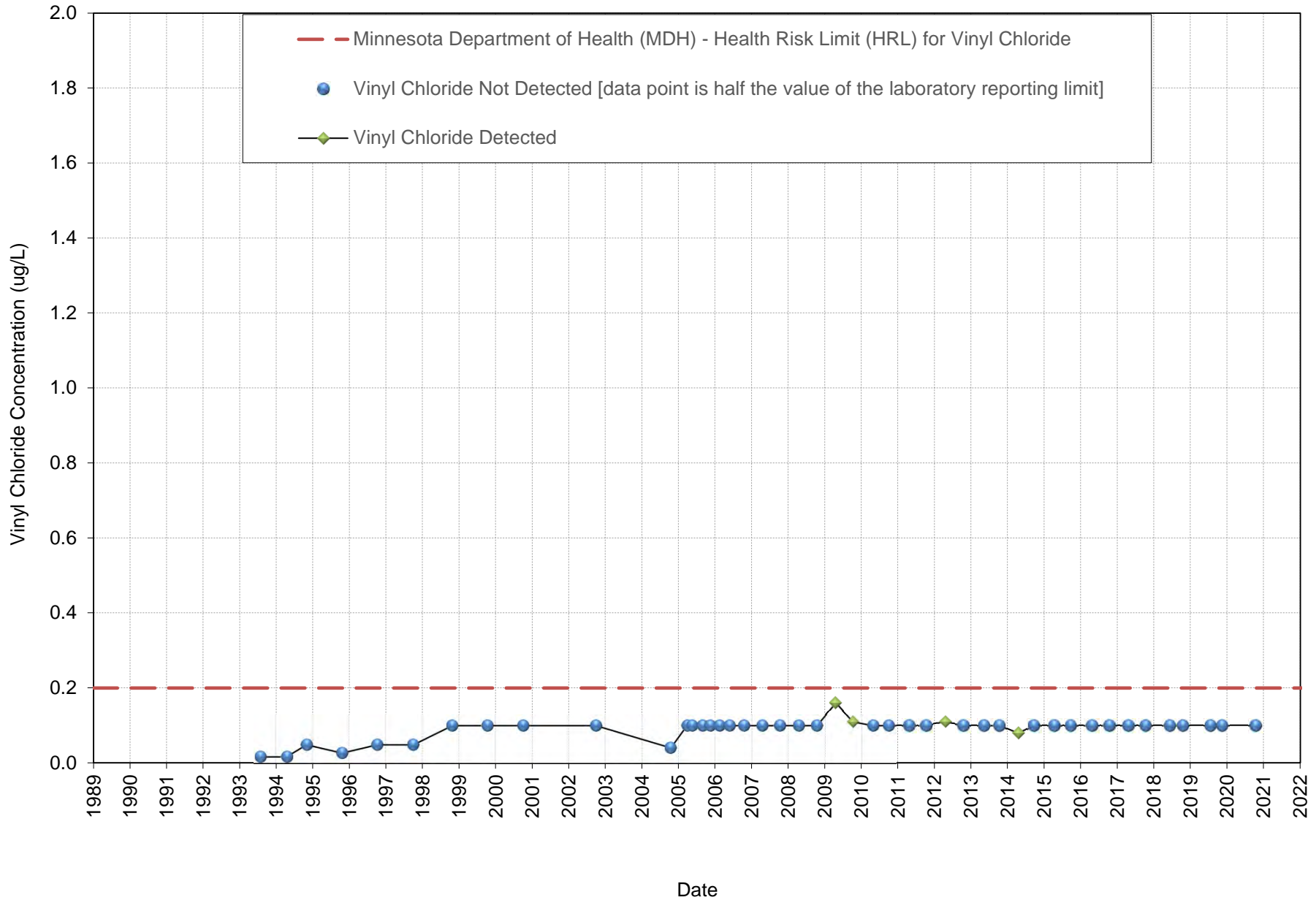
# Historical Vinyl Chloride Concentrations 1 Hummingbird Hill North Oaks, Minnesota



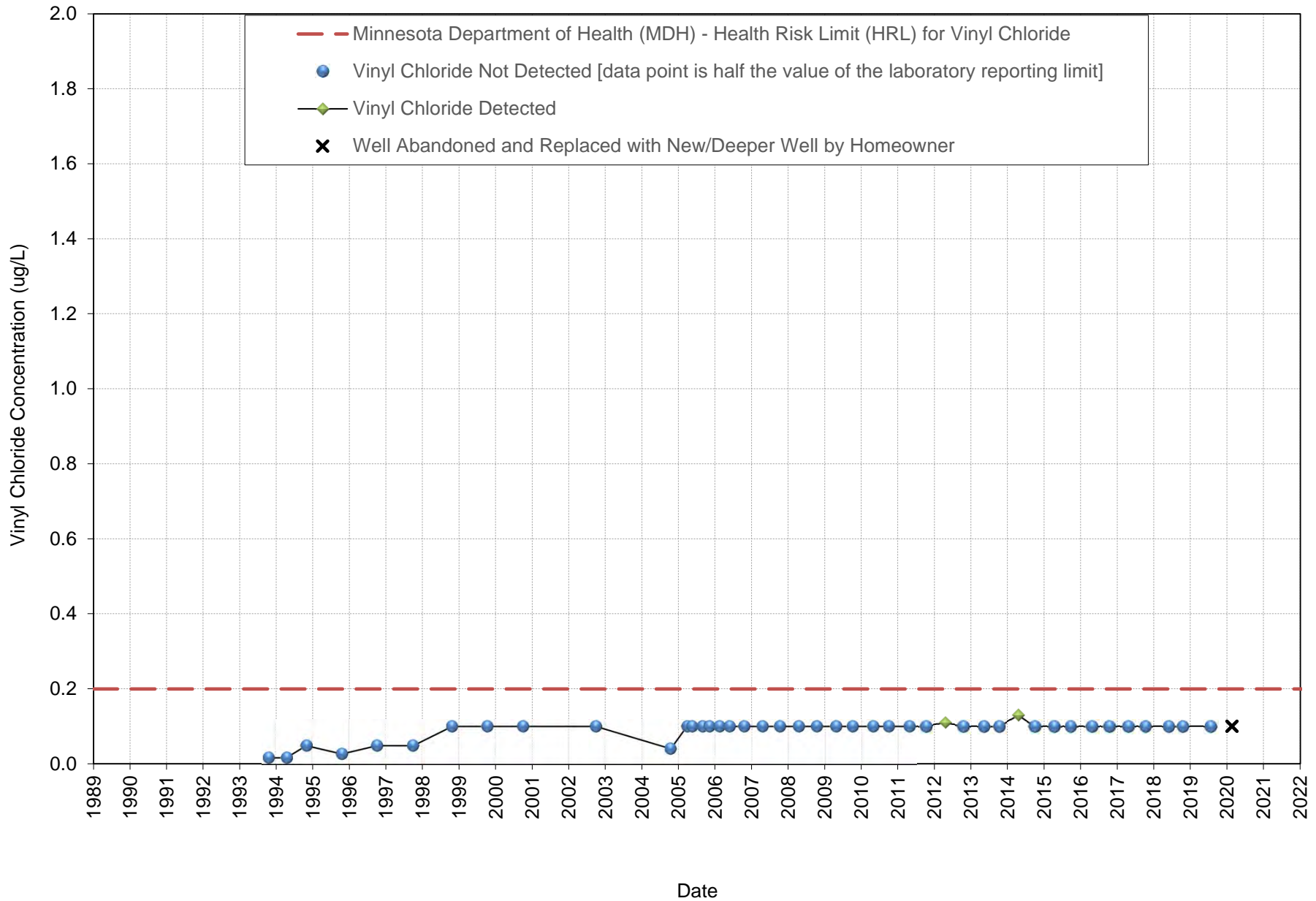
# Historical Vinyl Chloride Concentrations 2 Hummingbird Hill (Old Well) North Oaks, Minnesota



# Historical Vinyl Chloride Concentrations 10 West Shore Road North Oaks, Minnesota

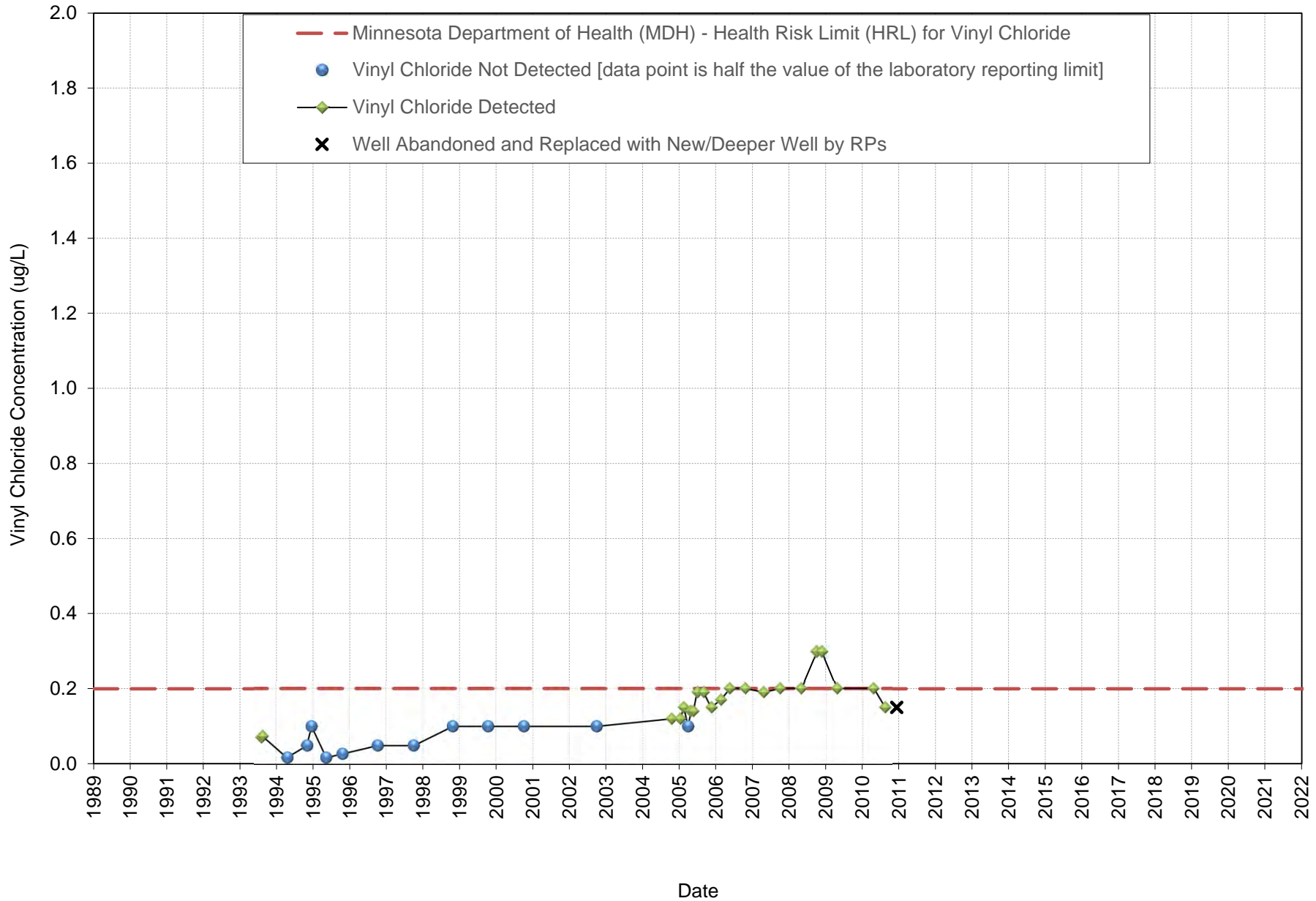


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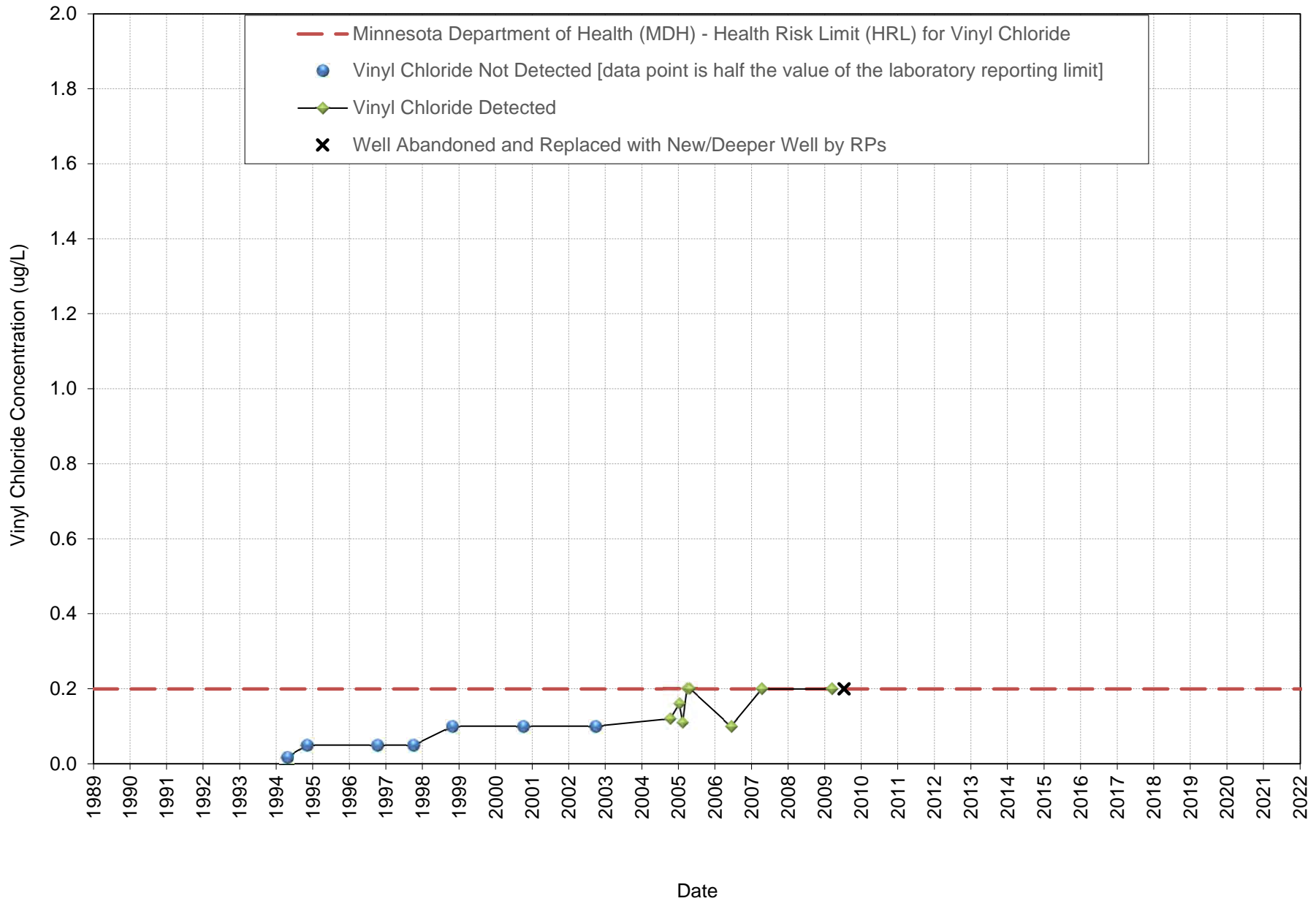




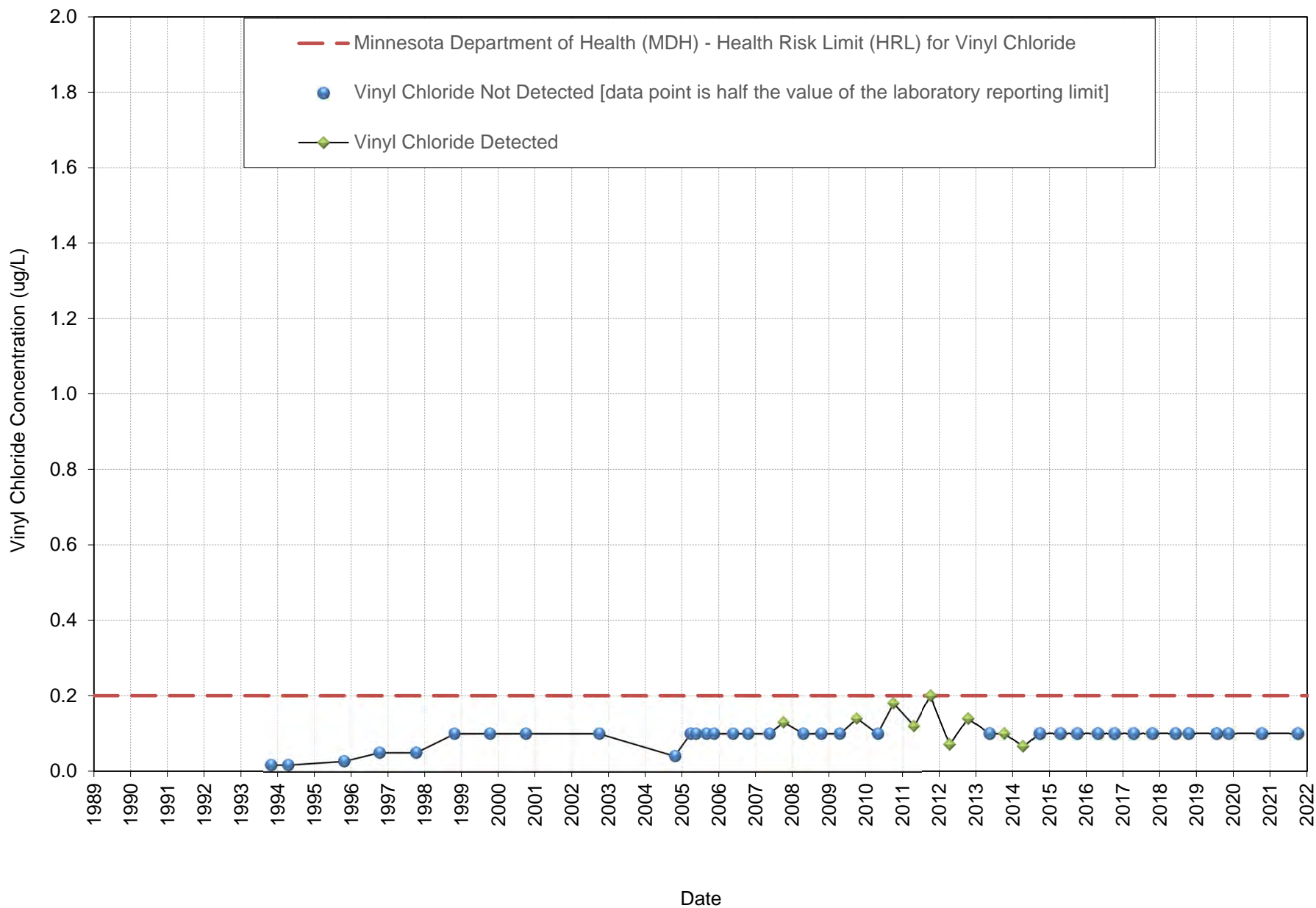
# Historical Vinyl Chloride Concentrations 12 West Shore Road (Old Well) North Oaks, Minnesota



# Historical Vinyl Chloride Concentrations 13 West Shore Road (Old Well) North Oaks, Minnesota



# Historical Vinyl Chloride Concentrations 15 West Shore Road North Oaks, Minnesota





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