Final

2017 Annual Monitoring Report

Highway 96 Site
White Bear Township, Minnesota

Highway 96 Group

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1. Introduction

This report presents the results of the 2017 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, 2017 to December 31, 2017.

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), and was 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), and 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, a total of six gas probes were installed in the CWA for methane monitoring, in accordance with the Post Closure Operation and Maintenance Plan (O&M Plan) (Ref. 8). The

installation and gas probe monitoring conducted in 1995 are discussed in further detail in the Remedial Action Final Report (Ref. 9).

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 were installed in the CWA in November of 1996 as shown on Figure 1.3. The vents were screened across the entire thickness of the waste to allow for future drawdown due to the operation of the dewatering sump.

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.

In late 1994, after the consolidation of the NDA and SDA, a dewatering sump was installed directly into and under the CWA. The dewatering sump collects leachate and discharges it to the sanitary sewer. Leachate is produced when rain and melting snow filter through the waste and dissolve chemicals from the waste. The responsible parties operate the dewatering sump to reduce the potential for degradation of the groundwater in the deeper, drinking-water aquifers.

1.3.2.2 Groundwater Monitoring Program

On-Site Monitoring

The on-Site groundwater-monitoring network includes 29 monitoring wells and 3 extraction wells screened in the perched groundwater, the unconsolidated glacial drift aquifer (Lower Sand aquifer), and the St. Peter Sandstone aquifer. 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. Additional groundwater samples are collected from the on-Site extraction wells in accordance with the MCES discharge permit requirements. Seven of the 29 on-Site monitoring wells (MW10B, MW12B, MW12D, MW13B, MW13D, MW16B, and MW16D) are designated as compliance wells.

Off-Site Monitoring

The off-Site groundwater-monitoring network includes residential wells, former residential wells that were converted to monitoring wells, and monitoring wells installed by the responsible parties. The off-Site groundwater monitoring network is shown on Figure 1.4.

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.

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). The five converted residential monitoring wells are located at 6 Blue Goose Road, 1 Lily Pond Road, 11 Lily Pond Road, 11 Robb Farm Road, and 6 Wren Lane. The converted residential monitoring well at 6 Wren Lane was abandoned in May 2000, at the request of the property owner (with MPCA approval). The four remaining converted residential monitoring wells are monitored on an annual basis.

From 1993 to 2004, Whirlpool/Reynolds and the MPCA monitored 51 residential wells located outside the municipal water service area on a regular basis. In 2005, the residential well monitoring network west of Gilfillan Lake was expanded to include an additional 31 residential well locations. The current residential well monitoring network west of Gilfillan Lake includes 77 residential wells that are monitored on a routine basis (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)

In October 2004, during routine monitoring of residential wells in North Oaks, 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). 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:

- 33 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 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, which includes the Responsiveness Summary, was signed by MPCA on August 26, 2008. As outlined in the MDD amendment, 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[1]
- 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[1] 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, the MDD Amendment 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.

[1] 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).

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

> *"…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."*

2. Scope of the 2017 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 2017 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, 2017) 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 2017 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 $2x10^{-3}$ cm/s to $4x10^{-5}$ 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 $5x10^{-3}$ 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 2017 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 (e.g., MW10D) 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 2017 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 2017 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 2017 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

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 for hydraulic monitoring (only)

EW1A

- Installed in 1995 (Lower Sand aquifer) to supplement EW1
- Replaced in 2010 by EW1B (see below)
- Currently used for hydraulic monitoring (only)

EW2

- Installed in 2005 (Upper St. Peter Sandstone aquifer) to replace EW1
- Current/active pumping well (see Tables 3.2 and 3.3 for 2017 operation information)

EW1B

- Installed in 2010 (Lower Sand aquifer) to replace EW1A
- Current/active pumping well (see Tables 3.2 and 3.3 for 2017 operation information)

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 in order 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).

After 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 reestablish 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).

EW1B and EW2 operation and maintenance activities conducted in 2017 are summarized in Table 3.2.

3.3.2 Extraction System Operation

In 2017, EW1B and EW2 operated at a combined average pumping rate of 19.8 gpm. The 2017 average monthly extraction rates for EW1B and EW2 are summarized in Table 3.3.

3.3.3 VOC Removal

From January 1, 2017 through December 31, 2017, approximately 5.2 million gallons of groundwater were extracted by EW1B, removing approximately 4.8 pounds of VOCs from the Lower Sand/St. Peter Sandstone aquifers. Since 1989, approximately 186 pounds of VOCs have been removed by EW1/EW1A/EW1B.

From January 1, 2017 through December 31, 2017, approximately 5.2 million gallons of groundwater were extracted by EW2, removing approximately 3.4 pounds of VOCs from the Lower Sand/St. Peter Sandstone aquifers. Since 2006, approximately 28 pounds of VOCs have been removed by EW2.

Since 1989, a combined total of approximately 322 million gallons of groundwater and 214 pounds of VOCs have been removed from the Lower Sand/St. Peter Sandstone by EW1/EW1A/EW1B and EW2. 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 and EW2. As typically seen in groundwater extraction systems, TVOCs declined during the initial pumping years of 1989 through 1996 at EW1/EW1A. From 1996 through 2005, TVOCs remained at levels between 50 and 100 µg/L. In 2006, TVOCs began increasing to levels between 100 µg/L and 300 µg/L. The increase in TVOC concentrations at EW1A/EW1B 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.

The total volume of groundwater extracted from the Lower Sand aquifer (EW1A/EW1B) has fluctuated 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, with the exception of increased concentrations observed in October 2011 when EW1B was temporarily shut down for repair. TCE has not been observed in monitoring locations downgradient of the extraction system.

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 2017 combined average pumping rate of 19.8 gpm (see Table 3.3), the groundwater capture width in the Lower Sand aquifer and the upper portion of the St. Peter Sandstone aquifer is approximately 300 feet (measured at the pumping source). Groundwater elevation measurements collected on September 27, 2017 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 October 2017 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 began in 1989 can be estimated based on an assumed contaminated aquifer volume. The area would encompass the CWA from EW1/EW1A/EW1B/EW2 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^3, or approximately 30 million gallons. Since 1989, a combined total of approximately 322 million gallons of groundwater have been removed, which is equivalent to approximately 10.7 pore volume exchanges.

3.4 Dewatering Sump Performance Assessment

Since July 1995, operation of the Dewatering Sump has removed VOCs from the perched groundwater unit within the CWA, which has reduced downward migration of VOCs into the Lower Sand aquifer. The extracted water is discharged directly into the sanitary sewer under a MCES special discharge permit.

In 2017, the Dewatering Sump pumped at an average rate of 3.1 gpm. The 2017 average monthly extraction rates for the Dewatering Sump are summarized in Table 3.3. Dewatering Sump operation and maintenance activities from January 2017 through December 2017 are summarized in Table 3.2.

From January 1, 2017 through December 31, 2017, approximately 1.7 million gallons of groundwater were extracted by the Dewatering Sump, removing approximately 0.9 pounds of VOCs from the perched groundwater unit. Since 1995, approximately 90 pounds of VOCs have been removed by the Dewatering Sump. 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.

The Dewatering Sump has performed as expected over its operational life. That is, the amount of VOCs removed per year has decreased over time because there was only a finite amount of VOCs in the subsurface when the system was installed and with each passing year there is a smaller amount of VOC remaining in the subsurface. This is illustrated on Figure 3.7 which shows there was many more pounds of VOCs available for removal by the sump in the early years than there has been in recent years. In terms of removal efficiency, Figures 3.8 and 3.9 show the current VOC mass removal efficiency at the Dewatering Sump (0.5 pounds per million gallons) is significantly less than the removal efficiency observed in its early years of operation (6 pounds per million gallons), which can be expected after 22 years of operation. Because the system has run its course and there is no longer enough VOCs present in the subsurface to allow for its efficient operation, Section 8 of this report includes a recommendation for discontinuing the operation of the Dewatering Sump.

The sole purpose of the Dewatering Sump is VOC mass removal from the source area (CWA). Therefore, discontinued operation of the Dewatering Sump will not affect the hydraulic containment achieved by the groundwater extraction system (EW1B and EW2), which prevents migration of VOC contamination downgradient from the Site.

4. Groundwater Assessment

Groundwater sampling associated with the Highway 96 Site has been ongoing since 1986. A total of 78 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 2017 are summarized in the following paragraphs.

April 2017 - Residential Well Sampling Event

During the period from April 27 through April 28, 2017, 22 residential wells were sampled in general accordance with the long-term monitoring program approved by the MPCA on November 7, 2007 and as proposed in GHD's letter to MPCA dated March 31, 2017. A complete description of the April 2017 residential well sampling event and the associated analytical results was previously submitted to the MPCA in GHD's "April 2017 Residential Well Data Report", dated June 26, 2017.

October 2017 - Residential Well Sampling Event

During the period from October 16 through October 25, 2017, 67 residential wells were sampled in general accordance with the long-term monitoring program approved by the Minnesota Pollution Control Agency (MPCA) on November 7, 2007 and as proposed in GHD's letter to the MPCA dated September 20, 2017. A complete description of the October 2017 residential well sampling event and the associated analytical results was previously submitted to the MPCA in GHD's "October 2017 Residential Well Data Report", dated December 8, 2017.

October 2017 - Annual Monitoring Well Sampling Event

During the period from September 27 through October 3, 2017, on-Site and off-Site monitoring wells and the converted residential monitoring wells were sampled as part of the Annual Monitoring Well Sampling Program. A technical memo that summarizes the October 2017 Annual Monitoring Well Sampling Event is presented in Appendix C.

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).

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."

Health Risk Limits (HRLs)

HRLs apply to residential wells in Operable Unit 4, as stipulated in Table 1 and Sections 2.2 and 6.0 of the 2008 MDD Amendment. Specifically, Section 2.2 of the 2008 MDD Amendment states "(the) HRL is the cleanup standard used by the MPCA for vinyl chloride for OU4". Operable Unit 4 is defined as residential areas without municipal water, as shown on Figure 1 of the 2008 MDD Amendment. The 2008 MDD Amendment (including Table 1 and Figure 1) is provided in Appendix D.2.

Since the 2008 MDD Amendment, the MDH has repealed or promulgated new HRLs for six of the seven Listed VOCs[1], as summarized below:

- Benzene [2009 HRL - 2 µg/L; previous HRL - 5 µg/L]
- Vinyl Chloride [2009 HRL – 0.2 µg/L; previous HRL 0.2 µg/L (no change)]
- 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]
- 1,1-Dichloroethane [HRL repealed in 2015]
- TCE [2015 HRL - 0.4 µg/L; previous HRL - 5 µg/L]

Since the 2008 MDD Amendment, the MDH has issued new Health Based Guidance (HBG) in the form of Health Based Values (HBVs) and Risk Assessment Advice (RAA) for two of the seven Listed VOCs[1], as summarized below:

- 1,1-Dichloroethane [2016 RAA - 80 µg/L; previous HRL (1993) - 70 µg/L repealed in 2015]
- Vinyl Chloride [2017 HBV - 0.2 µg/L; current HRL (2009) - 0.2 µg/L (no change)]

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 a semi-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.

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).

Specific information regarding the MDH HRL Rule Revision can be obtained by contacting the MDH or by visiting the MDH website: http://www.health.state.mn.us/divs/eh/risk/guidance/gw/index.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 Figures 3.10 and 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 October 2017, the TVOC concentration at LW3 was 14.61 µg/L (field duplicate result was 15.78 µg/L).

TVOC concentrations in the Lower Sand aquifer are represented by MW4D (Figure 4.2), EW1/EW1A/EW1B (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 October 2017, MW4D could not be sampled (see Section 4.3.2).
- EW1/EW1A/EW1B 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 (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 October 2017, no VOCs were detected at MW12D.

TVOC concentrations in the St. Peter Sandstone aquifer, are represented by MW8B (Figure 4.4), EW2 (Figure 3.10), MW12B (Figure 4.5), and the four converted (former) 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 over the past 20 years. In October 2017, the TVOC concentration at MW8B was 7.39 µg/L. TVOC concentrations at MW8B have decreased significantly since the commission of extraction well EW2 in January 2006.

- EW2 data represent groundwater from the Lower Sand and St. Peter Sandstone aquifers that is captured by the extraction system. EW2 was installed in September 2005 and commissioned in January 2006. Figure 3.10 illustrates TVOC concentrations at EW2, which have remained below 100 µg/L since 2005.
- 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 October 2017, 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 October 2017, the TVOC concentration at 11 Robb Farm Road was 0.35 µg/L. 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. In October 2017, the TVOC concentration at 1 Lily Pond Road was 11.7 µg/L. Figure 4.8 illustrates that TVOC concentrations at 11 Lily Pond Road have typically remained below 5 µg/L since 1996. In October 2017, 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 October 2017, no VOCs were detected at 6 Blue Goose Road. The overall decline of TVOC concentrations at the four converted residential 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 October 2017, the TVOC concentration at MW17Lwas 2.0 µg/L.

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

4.3 2017 Data Presentation

Laboratory analytical reports for samples collected in 2017 are presented in Appendix F. Analytical data quality assessment and validation of all results was conducted 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 samples collected in 2017 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 samples collected in 2017 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 2017 in 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

Six perched groundwater wells (LW1, LW2, LW3, MW1S, MW4U, and the Dewatering Sump) were sampled in 2017. Perched groundwater analytical results from 2017 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 monitoring well locations are included in the current list of compliance monitoring wells.

Other Monitoring Wells

VOCs detected in 2017 in perched groundwater samples included: 1,1-dichloroethane, 1,2-dichloroethane, acetone, benzene, chloroethane, chloroform, cis-1,2-dichloroethene, dichlorodifluoromethane, dichlorofluoromethane, ethyl ether, ethylbenzene, isopropylbenzene, 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 above its SCG in perched groundwater monitoring well samples collected in 2017. *[Note: SCGs are established for compliance wells only.]* In 2017, vinyl chloride was detected above its SCG (2 µg/L) at the Dewatering Sump (maximum concentration reported was 25 µg/L) and MW4U (10 µg/L). The Dewatering Sump is located in the center of the CWA and pumps perched groundwater out of the CWA. Monitoring well MW4U is located between the CWA and the groundwater extraction system and represents perched groundwater conditions immediately downgradient of the CWA.

The 2017 chloride concentrations in the perched groundwater unit ranged from 3.4 mg/L (LW2) to 110 mg/L (MW4U). Chloride has historically been detected in groundwater samples from perched groundwater wells at concentrations within this range.

4.3.2 Lower Sand Aquifer

Seven Lower Sand aquifer monitoring wells (EW1B, MW1D, MW4S, MW10D, MW12D, MW13D and MW16D) were sampled in 2017. One well (MW10D) purged dry before VOC sampling. Two wells (MW4D and MW11D) were unable to be sampled due to accessibility/equipment issues (see Appendix C). Lower Sand aquifer analytical results from 2017 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.

Compliance Monitoring Wells

The Lower Sand aquifer compliance monitoring wells (MW12D, MW13D, and MW16D) are located on Site, near the east side of Robb Farm Road and represent Lower Sand aquifer groundwater conditions immediately downgradient of the on-Site extraction system. VOCs detected in 2017 in Lower Sand aquifer compliance well samples included: 1,1-dichloroethane, chloroethane, and cis-1,2-dichloroethene. All 2017 analytical results from the Lower Sand aquifer compliance monitoring wells were below their respective SCGs.

Other Monitoring Wells

The remaining Lower Sand aquifer monitoring wells (EW1B, MW1D, MW4D, MW4S, MW10D, and MW11D) are also located between the CWA and Robb Farm Road. VOCs detected in 2017 in the other Lower Sand aquifer monitoring well samples included: 1,1-dichloroethane, 1,2-dichloroethane, benzene, chloroethane, cis-1,2-dichloroethene, dichlorodifluoromethane, dichlorofluoromethane, methylene chloride, trans-1,2-dichloroethene, TCE, and vinyl chloride. Detections of these VOCs are generally consistent with historical sampling results.

For comparison purposes, TCE and vinyl chloride were the only VOCs detected above their SCGs in non-compliance Lower Sand aquifer monitoring well samples collected in 2017 *[Note: SCGs are established for compliance wells only.]* In 2017, TCE was detected above its SCG (5 µg/L) at EW1B (maximum concentration reported was 79 µg/L), and vinyl chloride was detected above its SCG (2 µg/L) at MW4S (14 µg/L) and at EW1B (maximum concentration reported was 8.4 µg/L). Monitoring wells MW4S is located between the CWA and the groundwater extraction system and represents Lower Sand aquifer groundwater conditions immediately downgradient of the CWA, prior to capture by the extraction system. EW1B represents groundwater from the Lower Sand and St. Peter Sandstone aquifers that is captured by the extraction system.

The 2017 chloride concentrations in the Lower Sand aquifer ranged from 18 mg/L (MW10D) to 110 mg/L (MW4S). Chloride has historically been detected in groundwater samples from Lower Sand aquifer wells 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, MW19B, MW20B, MW21A, EW2, EW3, and the four converted residential monitoring wells) were sampled in 2017. St. Peter Sandstone aquifer analytical results from 2017 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.

Compliance Monitoring Wells

The St. Peter Sandstone aquifer compliance monitoring wells (MW10B, MW12B, MW13B, and MW16B) are located on Site, near the east side of Robb Farm Road and represent St. Peter Sandstone aquifer groundwater conditions immediately downgradient of the on-Site extraction system. VOCs detected in 2017 in the St. Peter Sandstone aquifer compliance well samples

included: dichlorodifluoromethane. All 2017 analytical results from the St. Peter Sandstone aquifer compliance monitoring wells were below their respective SCGs.

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 and EW2 are located on Site. MW8B is located between the CWA and the groundwater extraction system, and represents St. Peter Sandstone aquifer groundwater conditions immediately downgradient of the CWA and prior to capture by the groundwater extraction system. EW2 represents groundwater from the St. Peter Sandstone aquifer that is captured by the extraction system.

VOCs detected in 2017 from the St. Peter Sandstone aquifer samples collected from MW8B and EW2 included: 1,1-dichloroethane, 1,2-dichloroethane, benzene, chloroethane, cis-1,2-dichloroethene, dichlorodifluoromethane, dichlorofluoromethane, toluene, trans-1,2-dichloroethene, TCE, and vinyl chloride. Detections of these VOCs are generally consistent with historical sampling results.

For comparison purposes, vinyl chloride was the only VOC detected above its SCG in on-Site, non-compliance St. Peter Sandstone aquifer monitoring well samples collected in 2017. *[Note: SCGs are established for compliance wells only.]* In 2017, vinyl chloride was detected above its SCG (2 µg/L) at EW2 (maximum concentration reported was 13 µg/L).

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 and represent groundwater conditions in the St. Peter Sandstone aquifer, further downgradient of the Highway 96 Site.

VOCs detected in 2017 in the St. Peter Sandstone aquifer samples collected from off-Site monitoring locations included: 1,1-dichloroethane, benzene, dichlorodifluoromethane, and dichlorofluoromethane. Detections of these VOCs are generally consistent with historical sampling results.

For comparison purposes, all 2017 VOC detections were below MDH HBGs in samples collected from the off-Site St. Peter Sandstone monitoring wells. *[Note: HBGs are established for private drinking water supplies only.]*

The 2017 chloride concentrations in the St. Peter Sandstone aquifer ranged from 1.7 mg/L (MW10B) to 69.7 mg/L (MW18A). Chloride has historically been detected in groundwater samples from 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 2017. Prairie du Chien aquifer analytical results from 2017 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. In 2017, VOCs detected in the Prairie du Chien aquifer monitoring wells included: 1,1-dichloroethane and toluene. Sporadic, low-level detections of these VOCs are consistent with historical sampling results.

For comparison purposes, all 2017 VOC detections were below MDH HBGs in samples collected from the Prairie du Chien aquifer monitoring wells. *[Note: HBGs are established for private drinking water supplies only.]*

Analytical results from MW17L, MW18L, and MW19L show that the Prairie du Chien aquifer is not impacted and continues to represent a suitable alternative water supply for the MPCA-selected remedy outlined in the 2008 MDD Amendment (i.e., installation of new/deeper wells for homes located in Operable Unit 4 that are issued a well advisory due to Listed VOCs[1].)

The 2017 chloride concentrations in the Prairie du Chien aquifer ranged from 11.3 mg/L (MW17L) to 23.2 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

A total of 68 residential well locations were sampled in 2017. Residential well analytical results from 2017 are presented in Table 4.6 and on Figure 4.16. Historical residential well VOC results are presented in Appendix E.3.

In 2017, vinyl chloride was not detected at any residential well location, which marks the third consecutive year (sixth consecutive sampling event) that vinyl chloride has not been detected in a residential well sample. The last reported detection of vinyl chloride in a residential well was in April 2014.

Figure 4.17 presents the maximum vinyl chloride concentrations detected in off-Site monitoring well locations and residential wells in 2017. As shown on Figure 4.17, vinyl chloride was not detected at any residential well or off-Site monitoring well location sampled in 2017 (see Sections 4.3.3 and 4.3.4).

Residential well sampling conducted during the period from October 2004 through October 2017 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 (last detected in April 2014)
- 2 Heron Lane (last detected in February 2013; well advisory issued by MDH; well abandoned/replaced with a new/deeper well by the RPs.)
- 3 Heron Lane (last detected in May 2012)
- 1 Hummingbird Hill (last detected in May 2013)
- 2 Hummingbird Hill (last detected in September 2009; well abandoned and replaced with a new/deeper well by the RPs.)
- 10 West Shore Road (last detected in April 2014; well abandoned and replaced with a new/deeper well by the homeowner.)
- 11 West Shore Road (last detected in April 2014)
- 12 West Shore Road (last detected in August 2010; well advisory issued by MDH; well abandoned and replaced with a new/deeper well by the RPs.)
- 13 West Shore Road (last detected in March 2009; well advisory issued by the MDH; well abandoned and replaced with a new/deeper well by the RPs.)
- 15 West Shore Road (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 2017 included: 1,1-dichloroethane, 2,2-dichloropropane, cis-1,2-dichloroethene, dichlorodifluoromethane, and dichlorofluoromethane. All detected concentrations were below their respective HBGs for private water supplies.

The 2017 chloride concentrations in the residential wells ranged from not detected (15 West Shore Road) to 69.9 mg/L (43 Robb Farm Road). Chloride has historically been detected at similar concentrations in residential well samples.

4.3.5.1 New Residential Well Installations

As stipulated in the 2008 MDD amendment for the Highway 96 Site, the MPCA-selected remedy, for homes located within Operable Unit 4 of the Site that have been issued a well advisory by the MDH due to Listed VOCs[1], is provision of a new/deeper residential well in the Prairie du Chien aquifer.

To date (March 2018), MDH has only issued well advisories to three locations in Operable Unit 4 due to Listed VOCs[1]: 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. Although not required under the 2008 MDD amendment, Whirlpool and Reynolds voluntarily provided a new/deeper replacement well to 2 Hummingbird Hill, even though no MDH well advisory was issued. Detailed

information regarding the replacement well installations is documented in Annual Monitoring Reports during the period from 2009 to 2013.

No MDH well advisories have been issued to homes located within Operable Unit 4 since 2012.

4.3.5.2 Proposed Changes to Sampling Frequencies for Operable Unit 4

On November 7, 2017, GHD (on behalf of the RPs) submitted a letter to MPCA requesting modifications to the current residential well sampling frequencies associated with the long-term monitoring program for OU4. The proposed modifications outlined in GHD's November 2007 letter were based on the following factors:

- The substantial historical data set that exists for homes within OU4 (see Appendix E.3)
- Over 50% of the homes within the OU4 monitoring program have never had a detection of a Listed VOC[1]
- The only Listed VOC[1] that has been detected in OU4 at a level close to its health-based guidance established by the MDH is VC; only 10 homes within OU4 have ever had a detection of VC.
- No new VC-impacted wells have been identified in the last five years (since May 2012) and VC has not been detected at any location since April 2014.

The proposed updated sampling frequencies are appropriate for monitoring potential long-term (chronic) exposure to low-level concentrations of VOCs in groundwater, as supported by the information provided in Section 2 and Attachment A of GHD's November 2017 letter. As discussed with the MPCA on December 19, 2017, this information provides strong technical basis for modifying the current residential well sampling frequencies (see Section 8).

5. Gas Probe Monitoring

5.1 On-Site Gas Monitoring

Historical results from the gas probe monitoring program indicate the presence of measurable levels of combustible gas within the buried waste of the reconsolidated North Disposal Area. Table 5.1 presents the results of gas probe monitoring conducted using an MSA combustible gas meter from 1995 through 2001. Typical readings for other landfill sites have ranged from 0.5 to 65 percent combustible gas. As shown in Table 5.1, readings from the Highway 96 Site range from 0 to 93 percent combustible gas. This is likely an indication that all combustible gas may not be landfill related and may also be attributed in part to the wetlands (swamp) setting.

Per MPCA approval, combustible gas monitoring with an MSA meter was discontinued in 2001 and a LandTec GEM 500 portable gas meter has been used to perform combustible gas monitoring since 1999. Table 5.2 presents the historical results of gas probe monitoring using the LandTec GEM 500. The LandTec meter reads the percentage by volume of methane (CH_4), oxygen (O_2), and carbon dioxide (CO_2). Typical concentrations of these parameters recorded at other landfills sites

are: CH_4 (30 to 60%), CO_2 (20 to 50%), and O_2 (<2%). The results on Table 5.2 are generally within or below the typical concentrations.

In accordance with the O&M Plan (Ref. 8) and MPCA-approved modifications in 2001, gas probe monitoring was conducted on a semi-annual basis through 2014. Discontinuation of gas probe monitoring (beginning in 2015) was discussed with MPCA on December 10, 2013 and recommended in the 2014 Annual Monitoring Report (Ref. 20). On April 13, 2015, the MPCA requested that gas probe monitoring be conducted on an annual basis through 2018, prior to discontinuation of monitoring.

The 2017 annual gas probe monitoring event was performed during the fourth quarter of 2017, to coincide with the annual soil cap inspection (see Section 6). During the fourth quarter of 2017, the six gas probe locations shown on Figure 5.1 were monitored for combustible gas using a LandTec GEM 500. Each gas probe was also monitored for positive pressure using the Land Tec meter (accurate to 0.1 inch of H_2O). The 2017 gas probe monitoring results are presented on Table 5.2.

Figures 5.2 through 5.7 show historical combustible gas percentages for GP1 through GP6, respectively. Since combustible gas monitoring began at the Site, no clear Site-wide trend has emerged.

Pressure readings typically range between 0.0 inch of H_2O and 0.2 inches of H_2O at all locations. The lack of appreciable pressure observed at the gas probes indicates that the passive gas venting system is relieving any potential pressure build-up from combustible gas generation. However, off-cap monitoring should be conducted in nearby areas of future development prior to any construction.

5.2 MEH Gas Monitoring

MEH commenced construction activities for the Weston Woods townhome development at the Site during the spring of 2001. MEH installed 10 gas probes, and two gas interceptor trenches to prevent lateral gas migration. In July 2005, MEH installed six passive gas vents on the landfill cap in order to augment the passive gas remedy. The location of the gas probes, gas vents, and gas interceptor trench are illustrated in Figure 5.8. MEH conducted routine gas monitoring under MPCA's Voluntary Investigation and Clean-up (VIC) program (Site ID# VP14310) to evaluate the potential of lateral gas migration. MEH's gas monitoring data and migration evaluation are not included in this report.

In a letter dated January 25, 2010, the MPCA provided approval for MEH to discontinue landfill gas monitoring because methane no longer exceeded 25% of the lower explosive limit (LEL) at the landfill perimeter. The MPCA requested that MEH monitoring probes remain available for future potential monitoring until at least 2014. To date (March 2018), the MEH monitoring probes are still in place.

5.3 Soil Gas Evaluation

In 2012, a preliminary soil gas evaluation was completed during the second and third gas probe monitoring events, as proposed in CRA's email to MPCA dated June 19, 2012 and approved by MPCA on June 25, 2012. The objective of the preliminary soil gas sampling was to identify whether areas in the CWA had high concentration of VOCs, specifically vinyl chloride, in soil gas within the

vadose zone above the perched groundwater unit. The data collected from the preliminary study would be used to evaluate whether low cost supplemental remediation methods (e.g., retrofitting gas vents with solar powered blowers) would reduce the overall time frame associated with Site remediation (i.e. operation of the groundwater extraction system).

During the two soil gas screening events, all of the gas probes had at least one photo ionization detector (PID) reading greater than 1 ppm, except gas probe GP3. The maximum PID reading was 14.4 ppm (GP5). However, vinyl chloride was not detected by colorimetric detector tubes at any of the gas probe locations. Based on the lack of detectible vinyl chloride in the gas probes, no further soil gas evaluation has been conducted. As documented in a letter dated June 12, 2013, the MPCA determined that no additional gas venting is necessary at the Site.

6. 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 (Ref. 20) and approved by the MPCA on April 23, 2015.

The 2017 annual soil cap inspection was performed during the fourth quarter of 2017. 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
- Gas monitoring probes and groundwater monitoring wells were inspected for physical damage

A record of each inspection is maintained on a checklist. To date (March 2018), the cover shows no indications of detrimental erosion or stressed vegetation. Minor settlement has been detected and repaired by placing fill. The cap vegetation is well established. Gas probes and monitoring wells are in good condition.

7. Conclusions

Based on the information presented in this 2017 Annual Monitoring Report, the following conclusions are made:

1. The groundwater extraction system (EW1B and EW2) 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).
2. Operation of the Dewatering Sump is no longer efficiently removing VOC mass from the perched groundwater unit in the CWA (see Section 3.4).

3. Groundwater samples from monitoring wells show that vinyl chloride is not present in wells screened in the unconsolidated Glacial Drift aquifer (Lower Sand aquifer) in North Oaks.

4. Groundwater samples from monitoring wells did not identify any detectable levels of vinyl chloride in the St. Peter Sandstone aquifer in wells west of Gilfillan Lake.

5. Groundwater samples from monitoring wells show that vinyl chloride is not present in wells screened in the Prairie du Chien aquifer in North Oaks.

6. In 2017, ongoing residential well sampling of homes in North Oaks, west of Gilfillan Lake (Operable Unit 4) 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: 50 East Oaks Road, 2 Heron Lane, 3 Heron Lane, 1 Hummingbird Hill 2 Hummingbird Hill, 10 West Shore Road, 11 West Shore Road, 12 West Shore Road, 13 West Shore Road, and 15 West Shore Road. Five of the ten wells (2 Heron Lane, 2 Hummingbird Hill, 10 West Shore Road, 12 West Shore Road, and 13 West Shore Road) have been replaced with new/deeper residential wells (see Section 4.3.5.2). Vinyl chloride concentrations at the remaining five wells (3 Heron Lane, 1 Hummingbird Hill, 50 East Oaks Road, 11 West Shore Road, and 15 West Shore Road) have since been non-detect or remain at or below the vinyl chloride HRL (0.2 µg/L).

8. Recommendations

Based on the information presented in this 2017 Annual Monitoring Report, GHD recommends the following:

1. Operation of the on-Site groundwater extraction system should continue in the Lower Sand/St. Peter Sandstone aquifers (via extraction wells EW1B and EW2).

2. As discussed with MPCA on December 19, 2017, it is recommended that operation of the Dewatering Sump be discontinued in spring 2018 (see Section 3.4).

3. Annual groundwater sampling of on-Site and off-Site monitoring well locations should continue.

4. Residential well sampling in Operable Unit 4 should continue, in general accordance with the long-term monitoring program outlined in Alternative A2 of CRA's Feasibility Study Report (Ref. 15) (approved by MPCA on November 7, 2007) and subsequent MPCA-approved modifications. However, as discussed with MPCA on December 19, 2017, it is recommended that the current sampling frequencies be modified as outlined in GHD's November 2017 letter to MPCA (see Section 4.3.5.2).

5. The supplemental sampling of three residential wells outside the long-term monitoring program, west of 2 Heron Lane (1 Heron Lane, 3 Heron Lane, and 5 Heron Lane) should continue for one additional round in the spring of 2018, as requested by the MPCA on April 13, 2015. If the 2018 samples results remain non-detect for vinyl chloride, then these locations will no longer be sampled (as recommended in the 2014 Annual Monitoring Report) (Ref. 20).

6. If the MDH issues a well advisory in Operable Unit 4 due to Listed VOCs[1], then a new residential well in the Prairie du Chien aquifer should be provided, as stipulated in the MDD amendment for the Highway 96 Site (dated August 26, 2008).

7. As requested by the MPCA on April 13, 2015, gas probe monitoring should be conducted on an annual basis through 2018 and coincide with annual soil cap inspections, prior to discontinuation of monitoring (as recommended in the 2014 Annual Monitoring Report) (Ref. 20).

8. 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 (see Section 6.0).

9. References

1. Conestoga-Rovers & Associates. March 1988. Remedial Investigation/Interim Response Action Plan.

2. Conestoga-Rovers & Associates. October 1988. Alternatives Analysis Report.

3. Conestoga-Rovers & Associates. April 1989. Detailed Analysis Report.

4. Conestoga-Rovers & Associates. October 1993. North Oaks - Southeast Area Groundwater Investigation.

5. Conestoga-Rovers & Associates. January 1994. Response Action Plan.

6. Conestoga-Rovers & Associates. May 1994. Phase II Response Action Plan.

7. Conestoga-Rovers & Associates. January 1994. South Disposal Area Groundwater Investigation.

8. Conestoga-Rovers & Associates. May 1994. Post Closure Operation and Maintenance Plan.

9. Conestoga-Rovers & Associates. January 1995. Remedial Action Final Report.

10. Conestoga-Rovers & Associates. June 2005. Groundwater and Residential Well Evaluation Report - North Oaks, Minnesota.

11. Conestoga-Rovers & Associates. February 2006. Groundwater and Residential Well Evaluation Report - North Oaks, Minnesota (June 2005 - January 2006).

12. Conestoga-Rovers & Associates. February 2007. Groundwater and Residential Well Evaluation Report - North Oaks, Minnesota (February 2006 - January 2007).

13. Conestoga-Rovers & Associates. May 2007. Subsurface Geophysical Survey Report.

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.

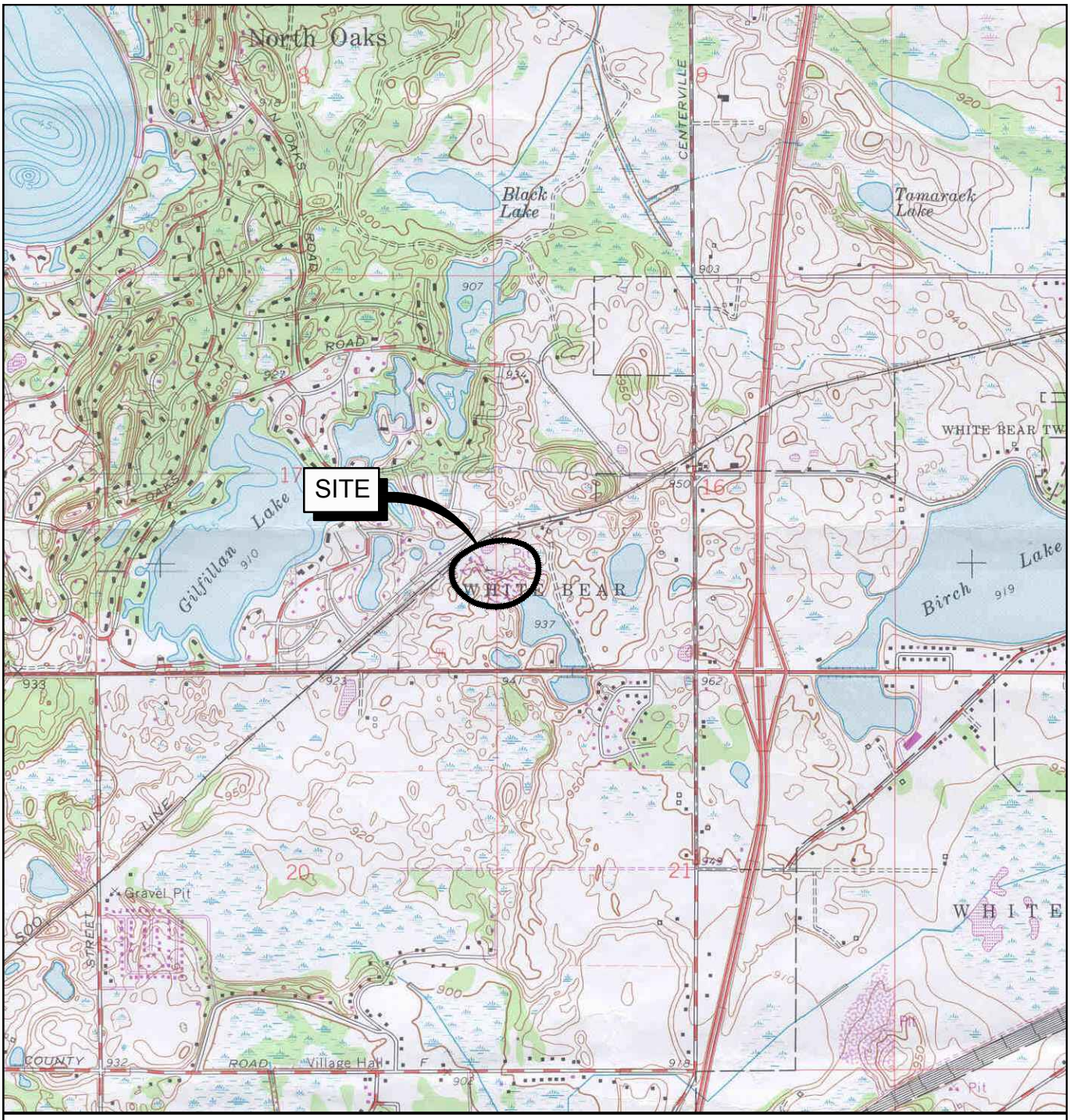
17. Norvitch, R.F., Ross, T.G., and Brietkrietz, A. 1973. Water Resources Outlook for the Minneapolis-St. Paul Metropolitan Area, Minnesota.

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. March 2015. 2014 Annual Monitoring Report, Highway 96 Site.

Figures



SOURCE: USGS 7.5 MINUTE QUAD
WHITE BEAR LAKE WEST, MINN.

N

0 1000 2000ft

figure 1.1

SITE LOCATION
HIGHWAY 96 SITE
White Bear Township, Minnesota

02012-01(068)GN-WA001 JAN 16, 2018

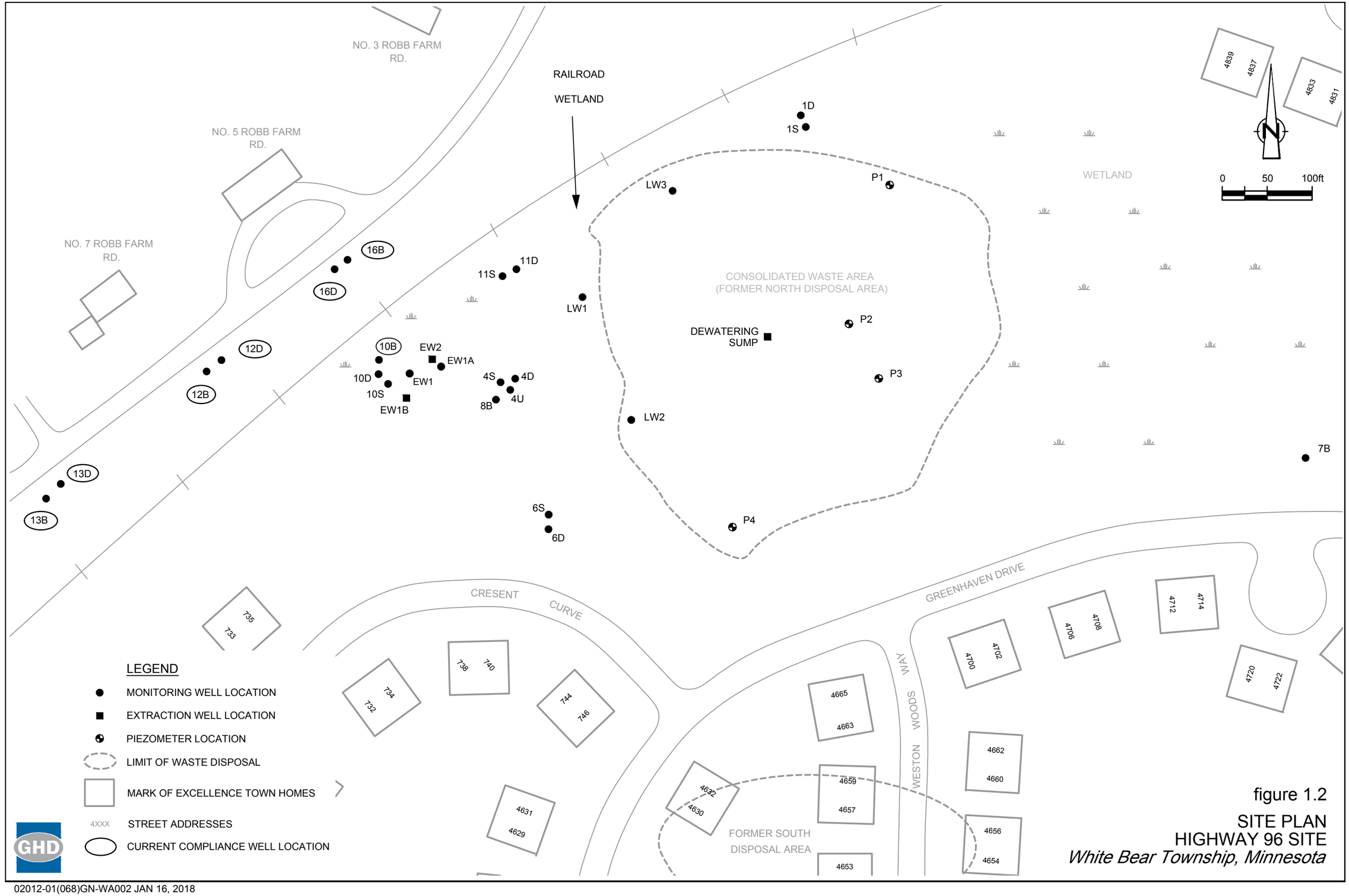


figure 1.2

SITE PLAN
HIGHWAY 96 SITE
White Bear Township, Minnesota

02012-01(068)GN-WA002 JAN 16, 2018

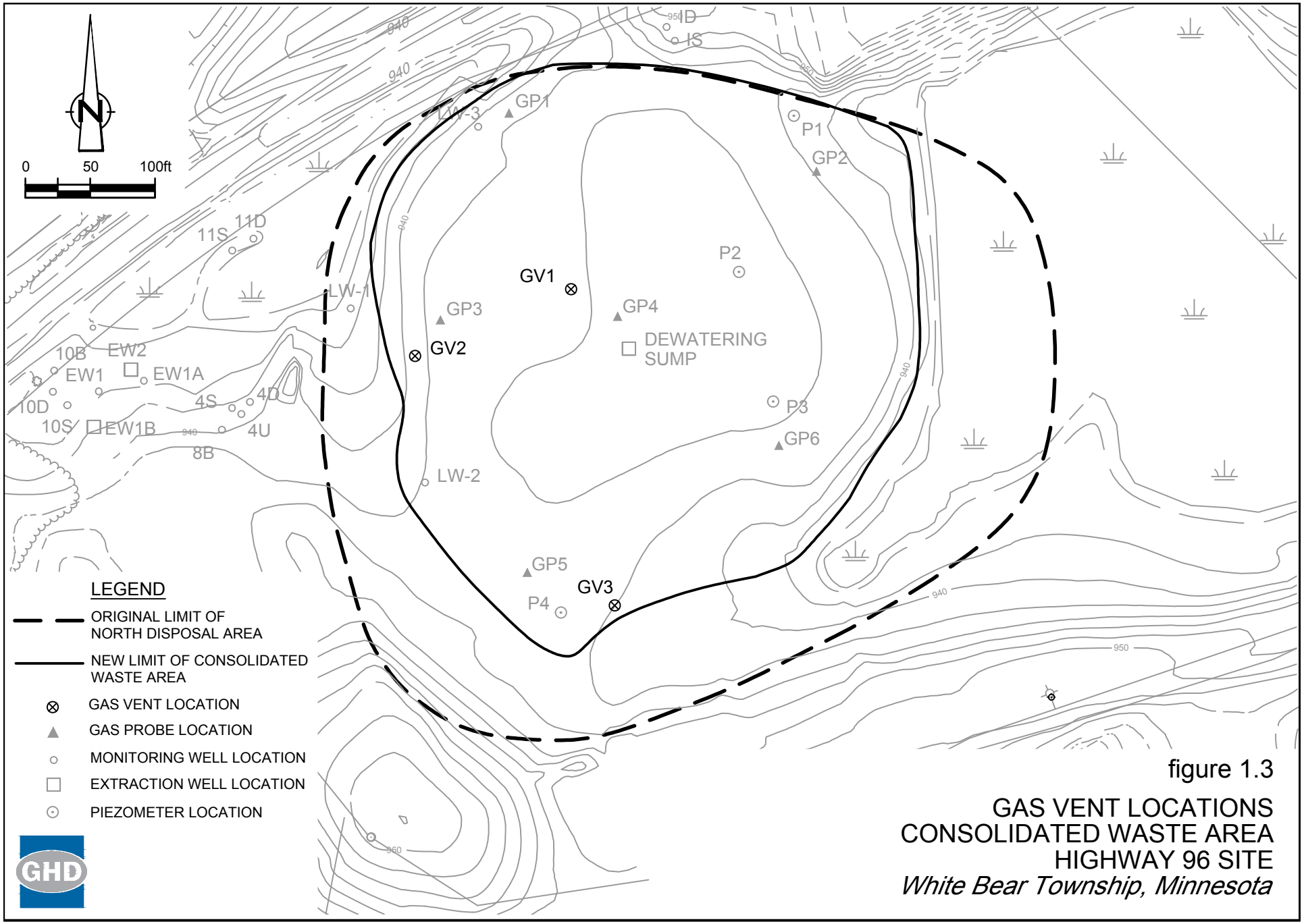


figure 1.3

GAS VENT LOCATIONS
CONSOLIDATED WASTE AREA
HIGHWAY 96 SITE
White Bear Township, Minnesota

02012-01(068)GN-WA003 JAN 16, 2018

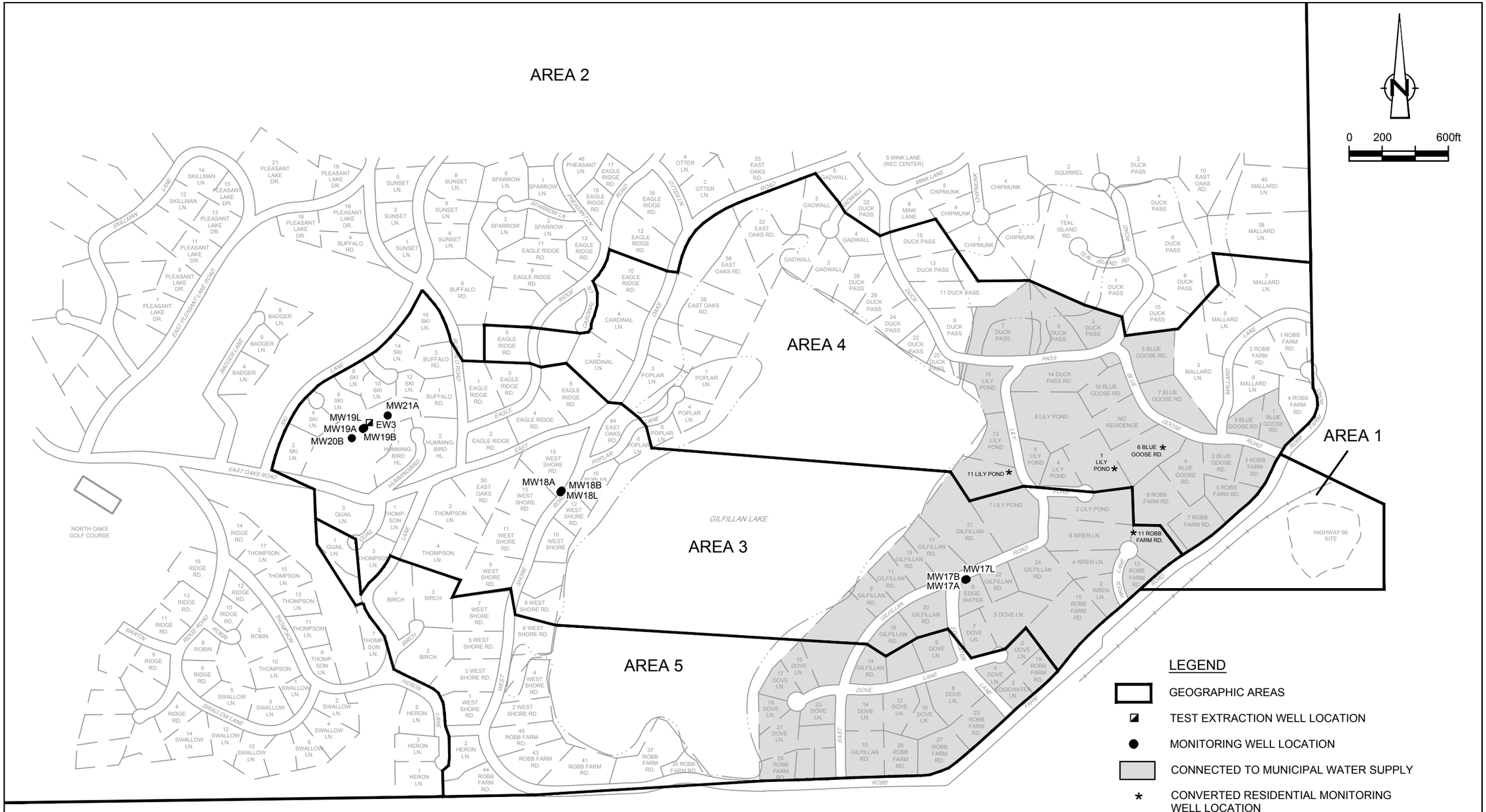


figure 1.4

OFF-SITE GROUNDWATER MONITORING NETWORK
HIGHWAY 96 SITE
White Bear Township, Minnesota

GHD

02012-01(068)GN-WA004 JAN 16, 2018

NOTE: FIGURE TAKEN FROM "REMEDIAL ACTION FINAL REPORT" CRA (1996)

figure 1.5

MUNICIPAL WATER SYSTEM
HIGHWAY 96 SITE
White Bear Township, Minnesota

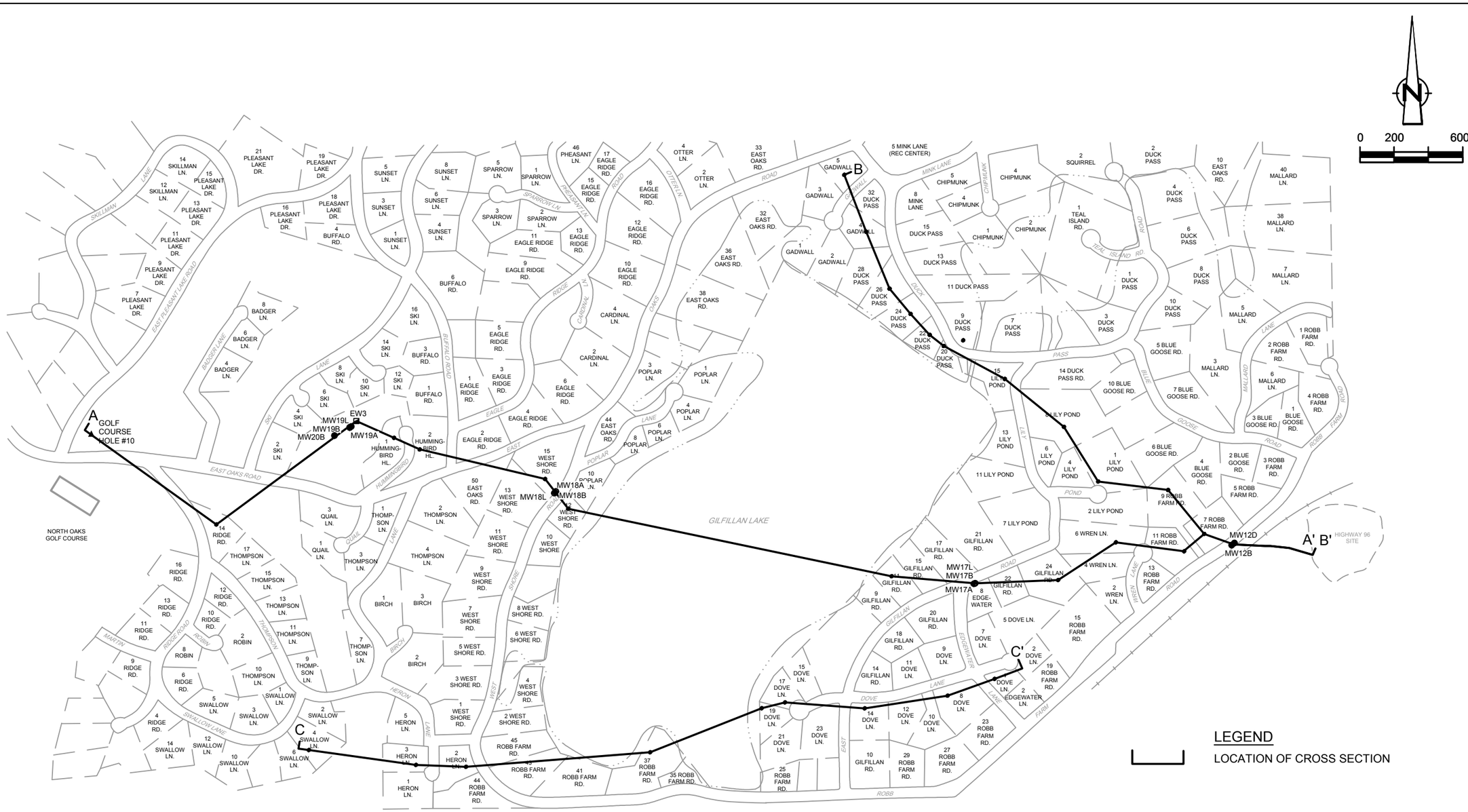


figure 3.1

LOCATION OF CROSS SECTIONS
HIGHWAY 96 SITE
White Bear Township, Minnesota

GHD

02012-01(068)GN-WA006 JAN 16, 2018

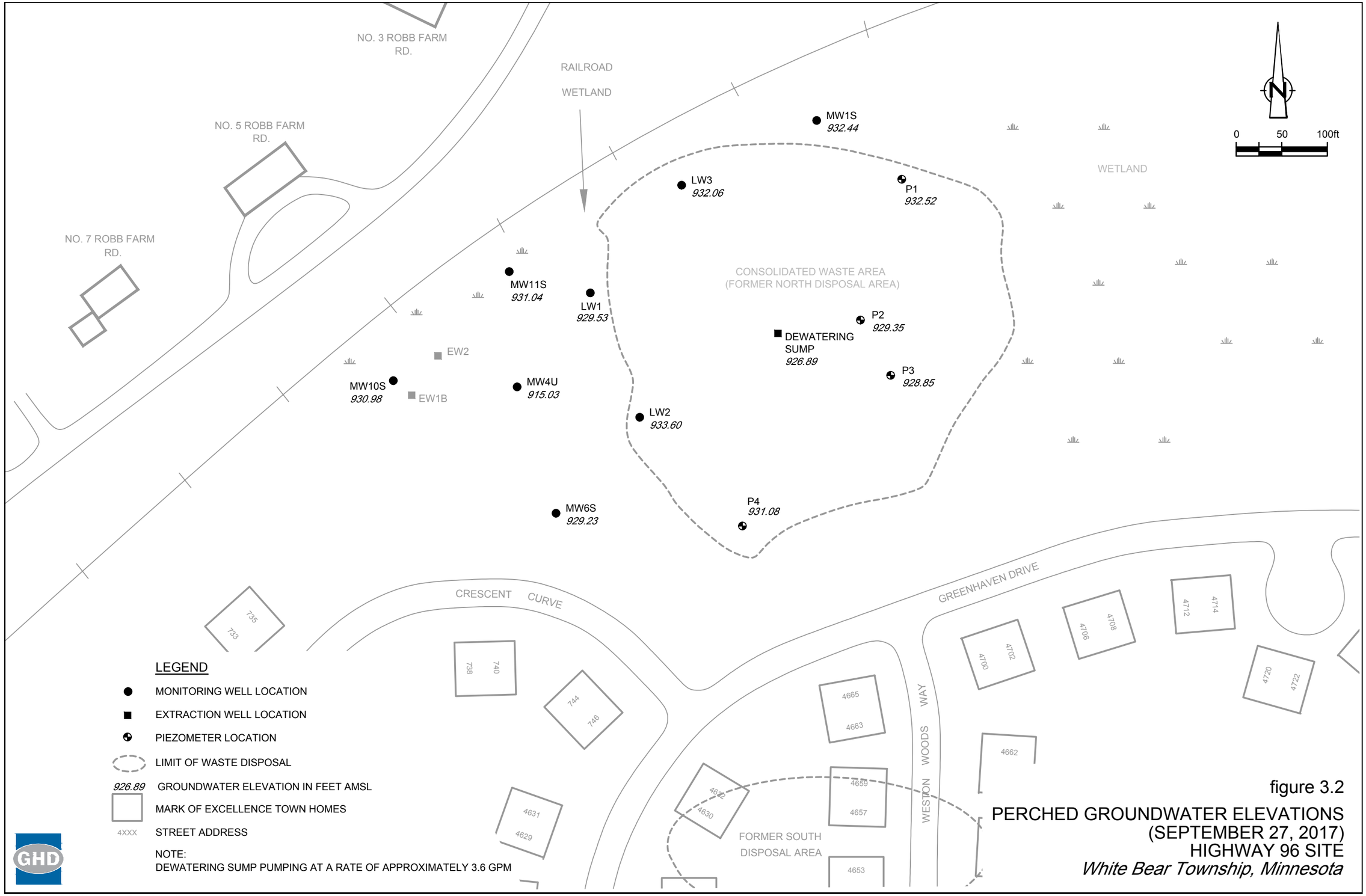
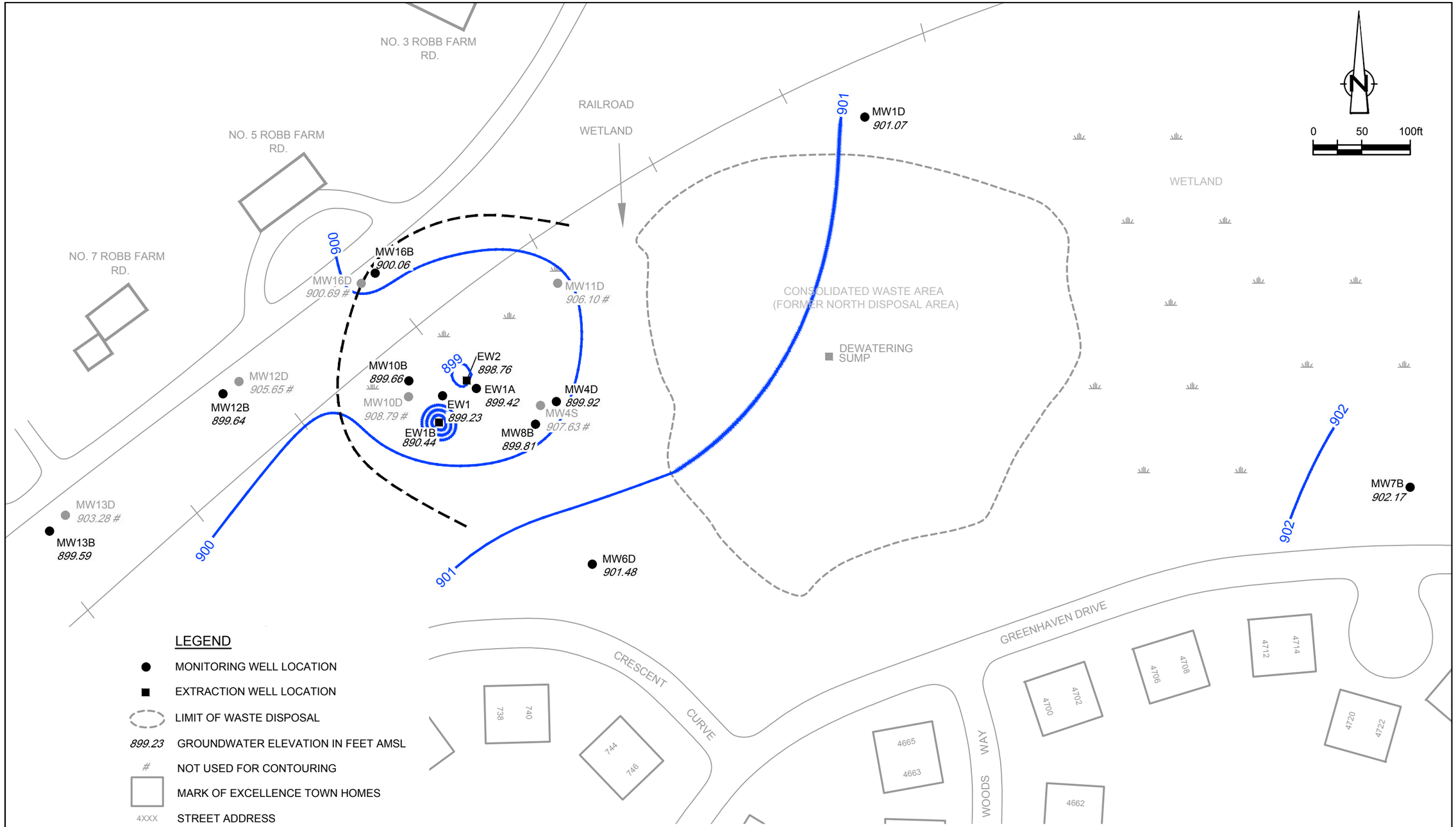


figure 3.2

PERCHED GROUNDWATER ELEVATIONS (SEPTEMBER 27, 2017) HIGHWAY 96 SITE

White Bear Township, Minnesota

02012-01(068)GN-WA007 FEB 26, 2018



LEGEND

- MONITORING WELL LOCATION
- EXTRACTION WELL LOCATION
- LIMIT OF WASTE DISPOSAL
- *899.23* GROUNDWATER ELEVATION IN FEET AMSL
- # NOT USED FOR CONTOURING
- MARK OF EXCELLENCE TOWN HOMES
- 4XXX STREET ADDRESS
- 901 GROUNDWATER CONTOUR
- APPROXIMATE LIMIT OF CAPTURE (BASED ON ANNUAL AVERAGE COMBINED PUMPING RATE)

NOTES:
-EW1B PUMPING AT A RATE OF APPROXIMATELY 10.1 GPM
-EW2 PUMPING AT A RATE OF APPROXIMATELY 10.0 GPM
-AVERAGE ANNUAL COMBINED PUMPING RATE (EW1B + EW2) FOR 2017 WAS 19.8 GPM

figure 3.3

LOWER SAND/ST. PETER SANDSTONE AQUIFER GROUNDWATER ELEVATIONS (SEPTEMBER 27, 2017) HIGHWAY 96 SITE

White Bear Township, Minnesota

02012-01(068)GN-WA008 FEB 26, 2018

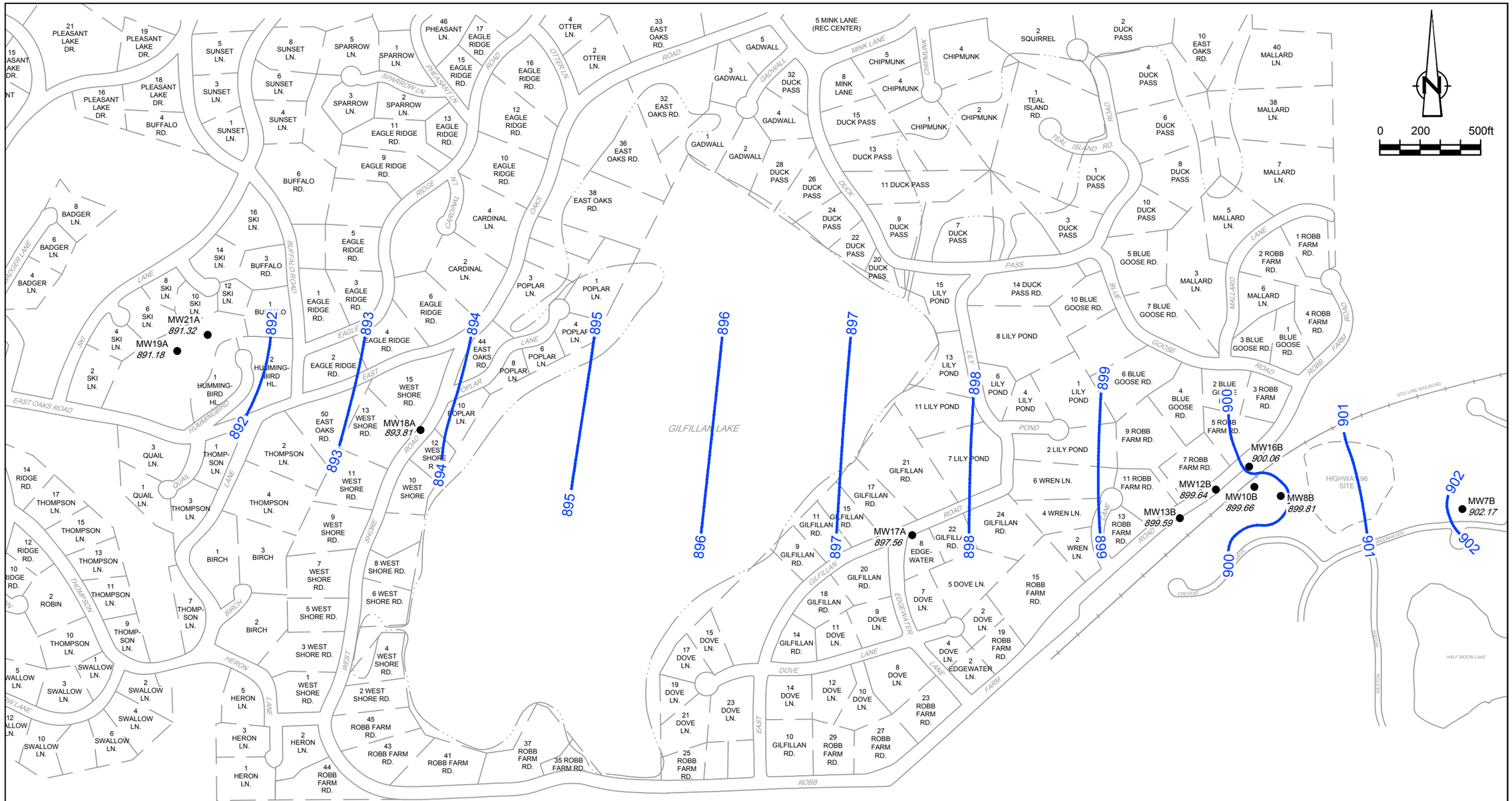
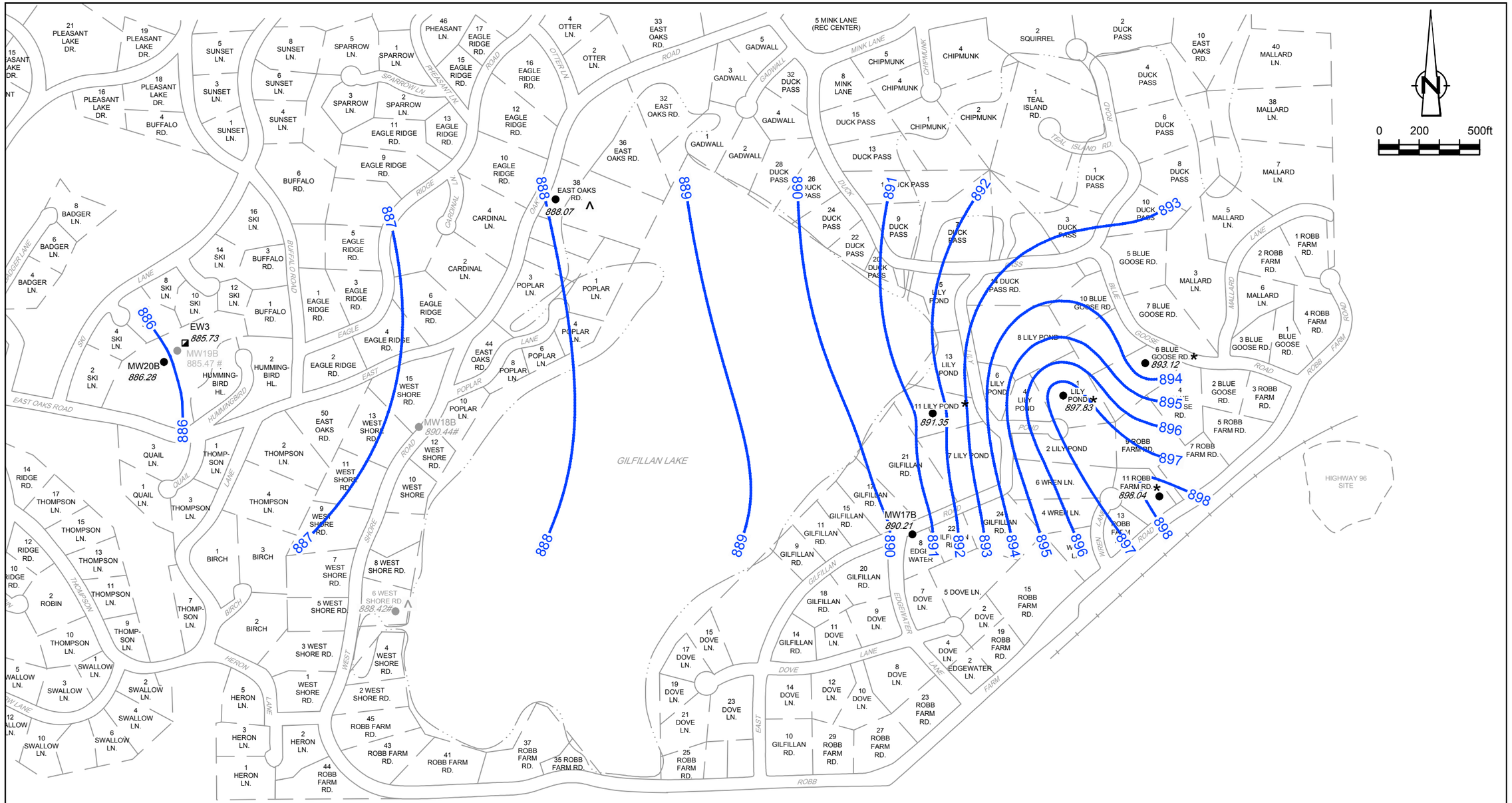


figure 3.4

UPPER ST. PETER SANDSTONE AQUIFER
GROUNDWATER ELEVATIONS (SEPTEMBER 27, 2017)
HIGHWAY 96 SITE
White Bear Township, Minnesota

GHD

02012-01(068)GN-WA009 JAN 22, 2018



LEGEND

- ◪ BASAL ST. PETER SANDSTONE TEST EXTRACTION WELL LOCATION
- ● BASAL ST. PETER SANDSTONE MONITORING WELL LOCATION
- * CONVERTED RESIDENTIAL MONITORING WELL LOCATION
- ^ ACTIVE RESIDENTIAL WELL LOCATION
- *885.73* GROUNDWATER ELEVATION IN FEET AMSL
- # NOT USED FOR CONTOURING
- 890 GROUNDWATER CONTOUR

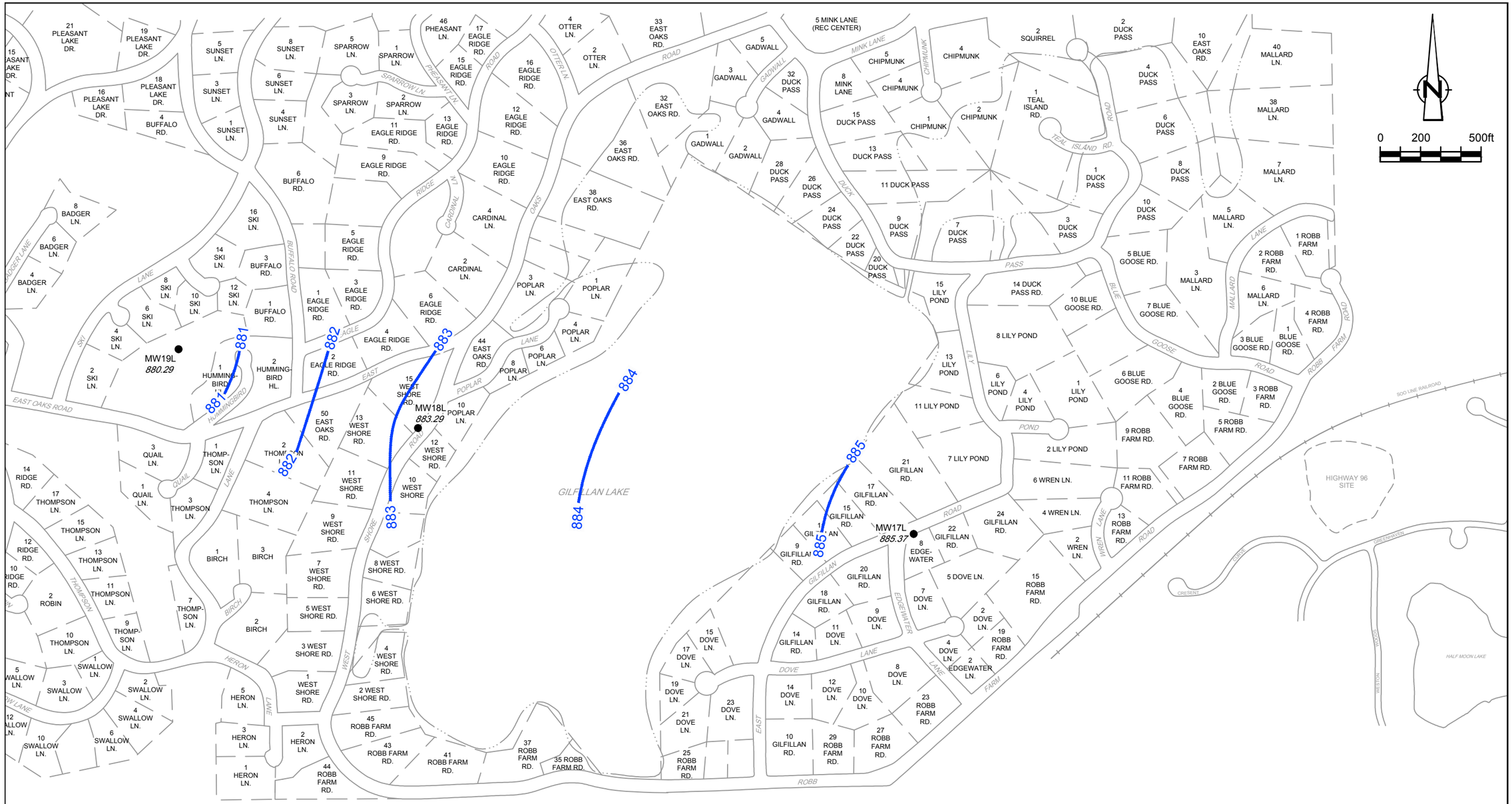
figure 3.5

BASAL ST. PETER SANDSTONE AQUIFER GROUNDWATER ELEVATIONS (SEPTEMBER 27, 2017) HIGHWAY 96 SITE

White Bear Township, Minnesota

GHD

02012-01(068)GN-WA010 JAN 22, 2018



LEGEND

- ● PRAIRIE DU CHIEN MONITORING WELL LOCATION
- *885.37* GROUNDWATER ELEVATION IN FEET AMSL
- 883 GROUNDWATER CONTOUR

figure 3.6

PRAIRIE DU CHIEN AQUIFER
GROUNDWATER ELEVATIONS (SEPTEMBER 27, 2017)
HIGHWAY 96 SITE
White Bear Township, Minnesota

02012-01(068)GN-WA011 JAN 17, 2018

Figure 3.7

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

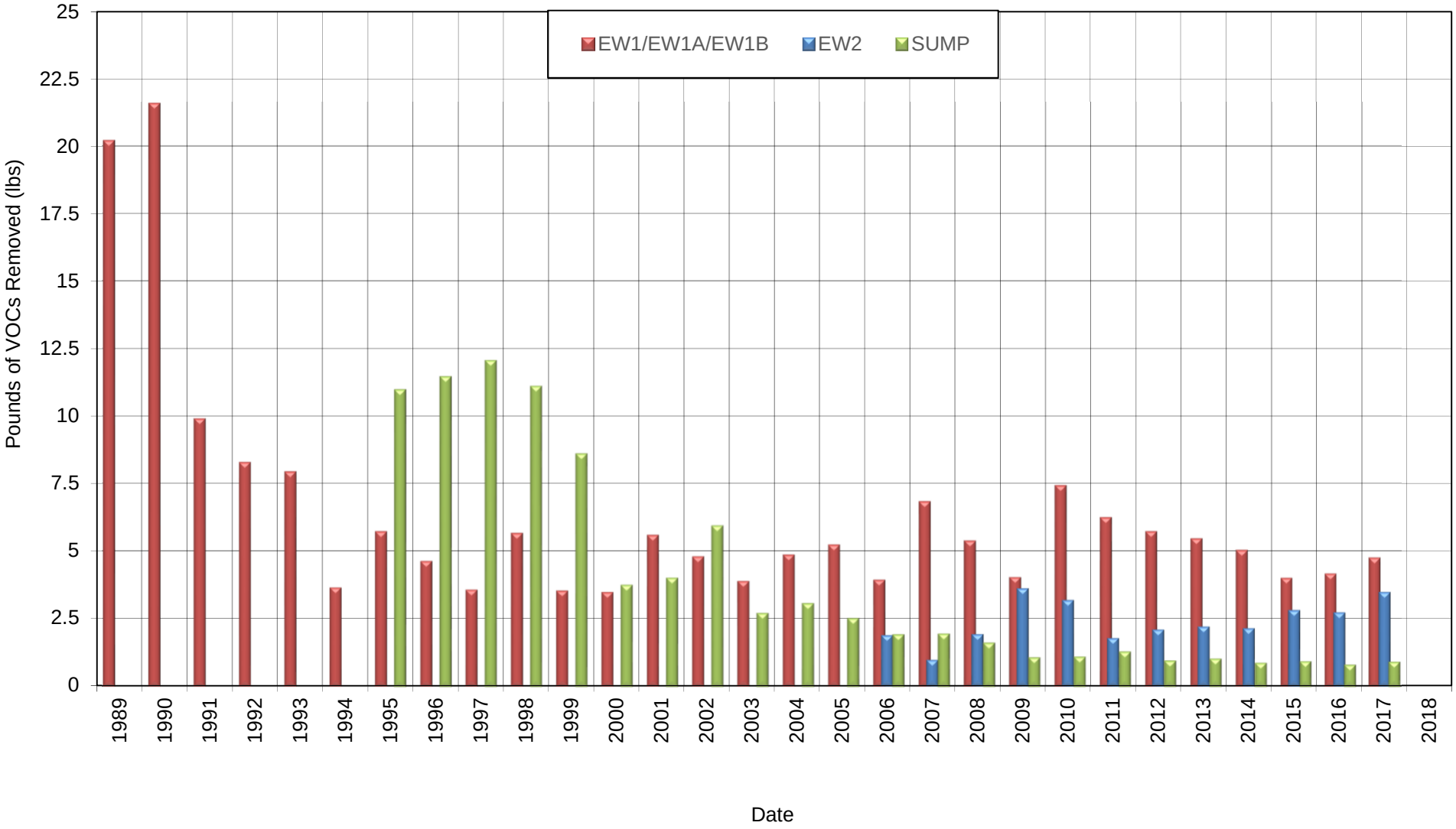


Figure 3.8

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

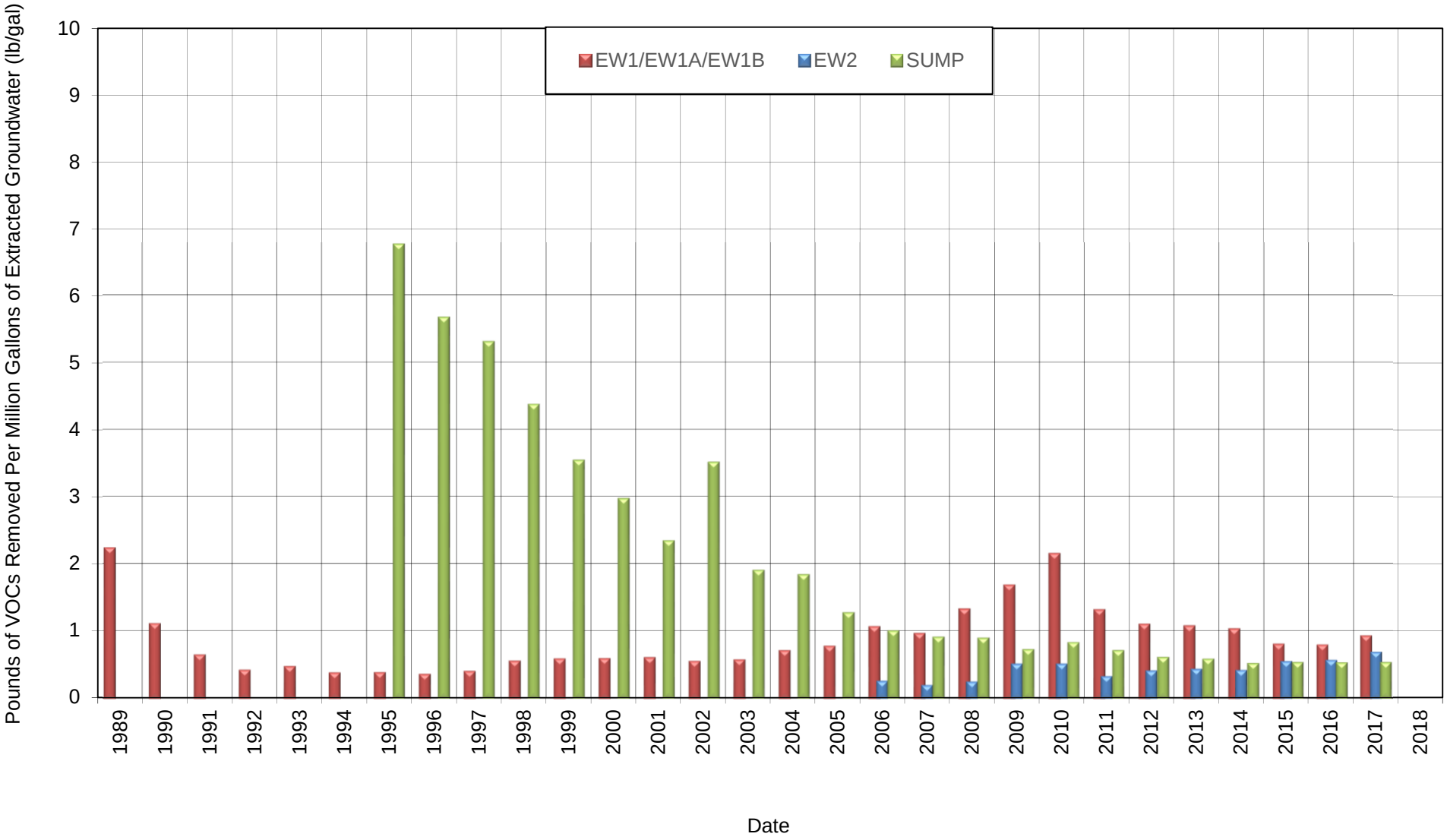


Figure 3.9

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

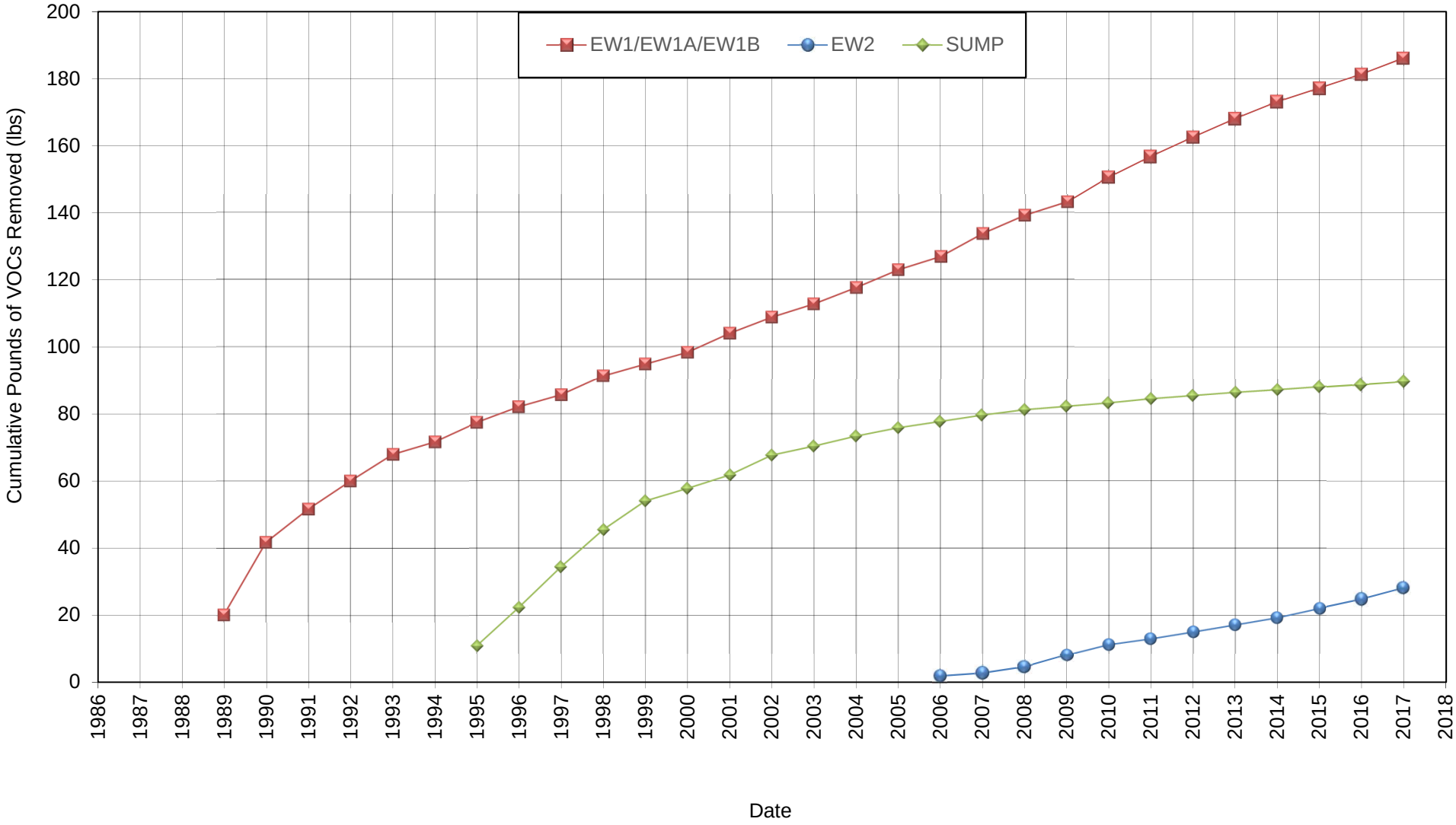
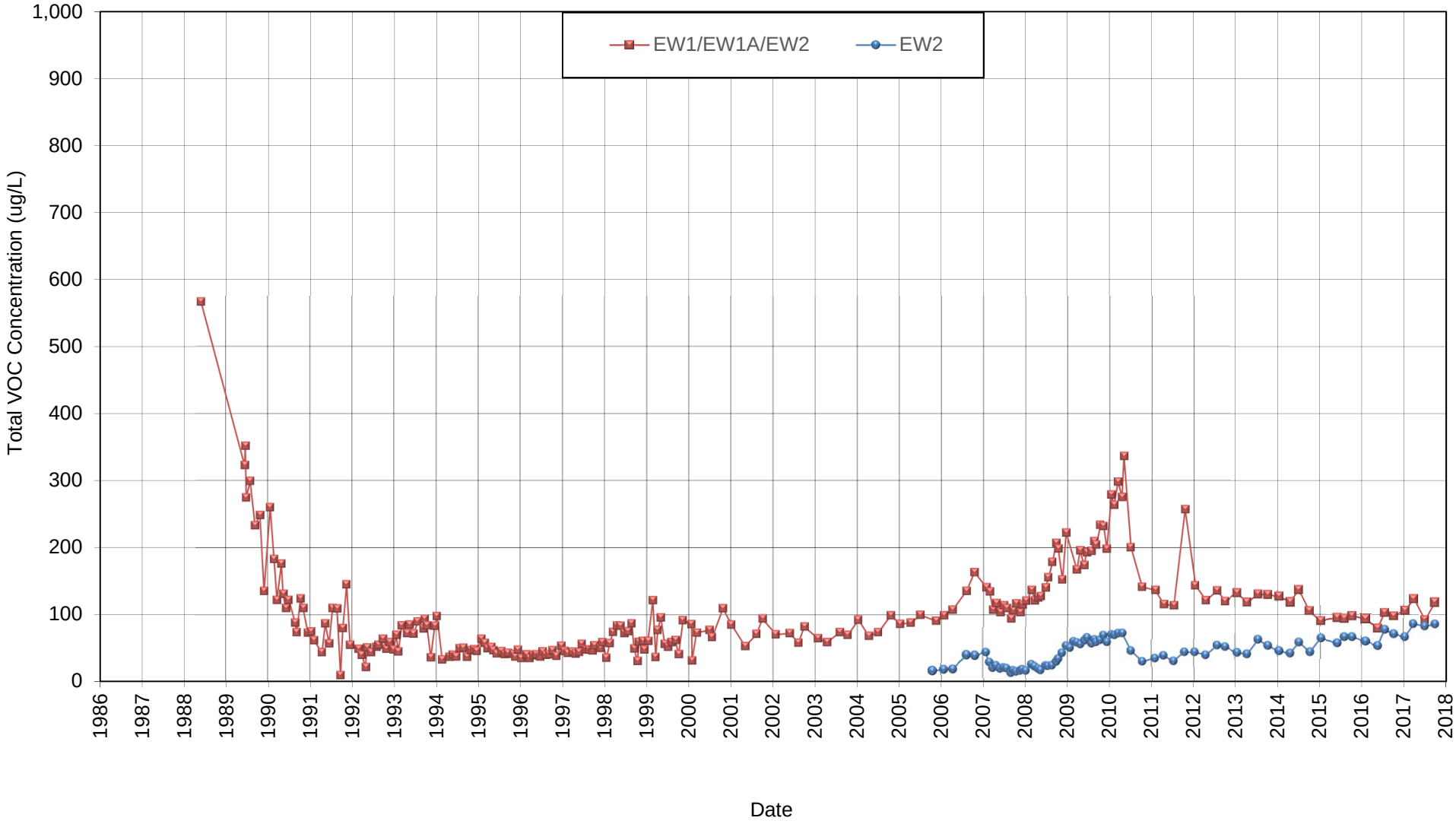


Figure 3.10

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



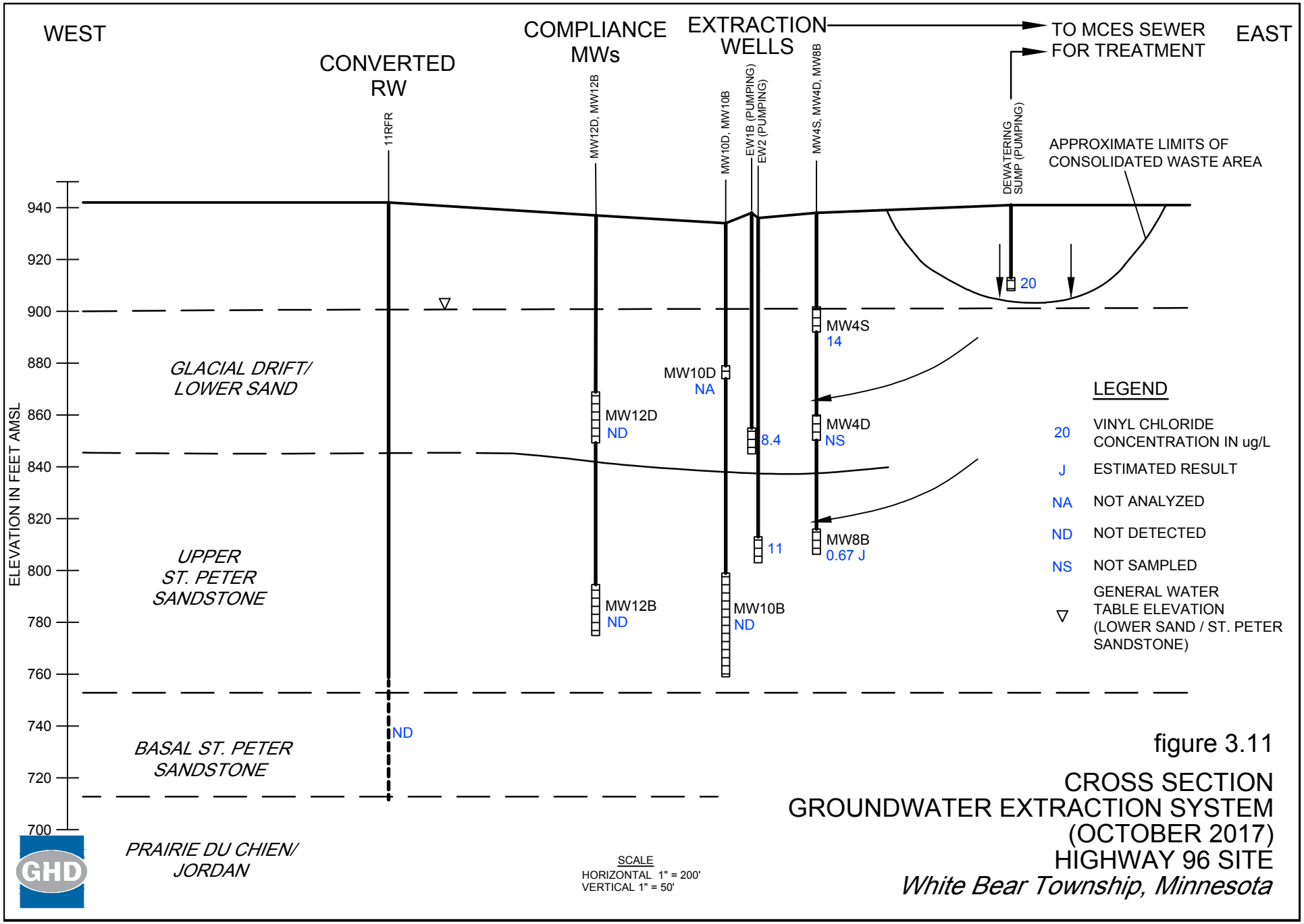


figure 3.11

CROSS SECTION GROUNDWATER EXTRACTION SYSTEM (OCTOBER 2017) HIGHWAY 96 SITE

White Bear Township, Minnesota

02012-01(068)GN-WA012 MAR 14, 2018

Figure 4.1

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

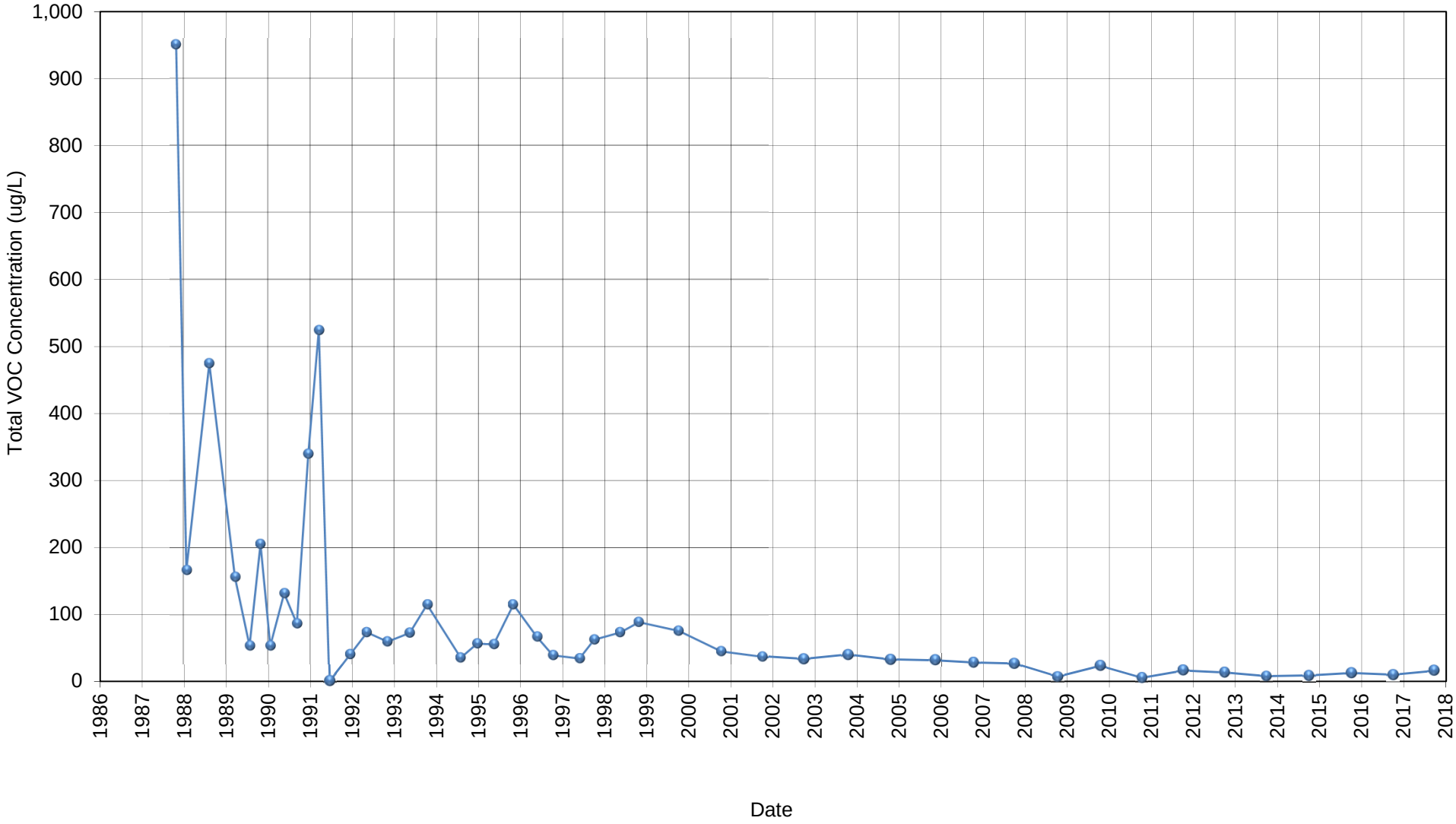


Figure 4.2

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

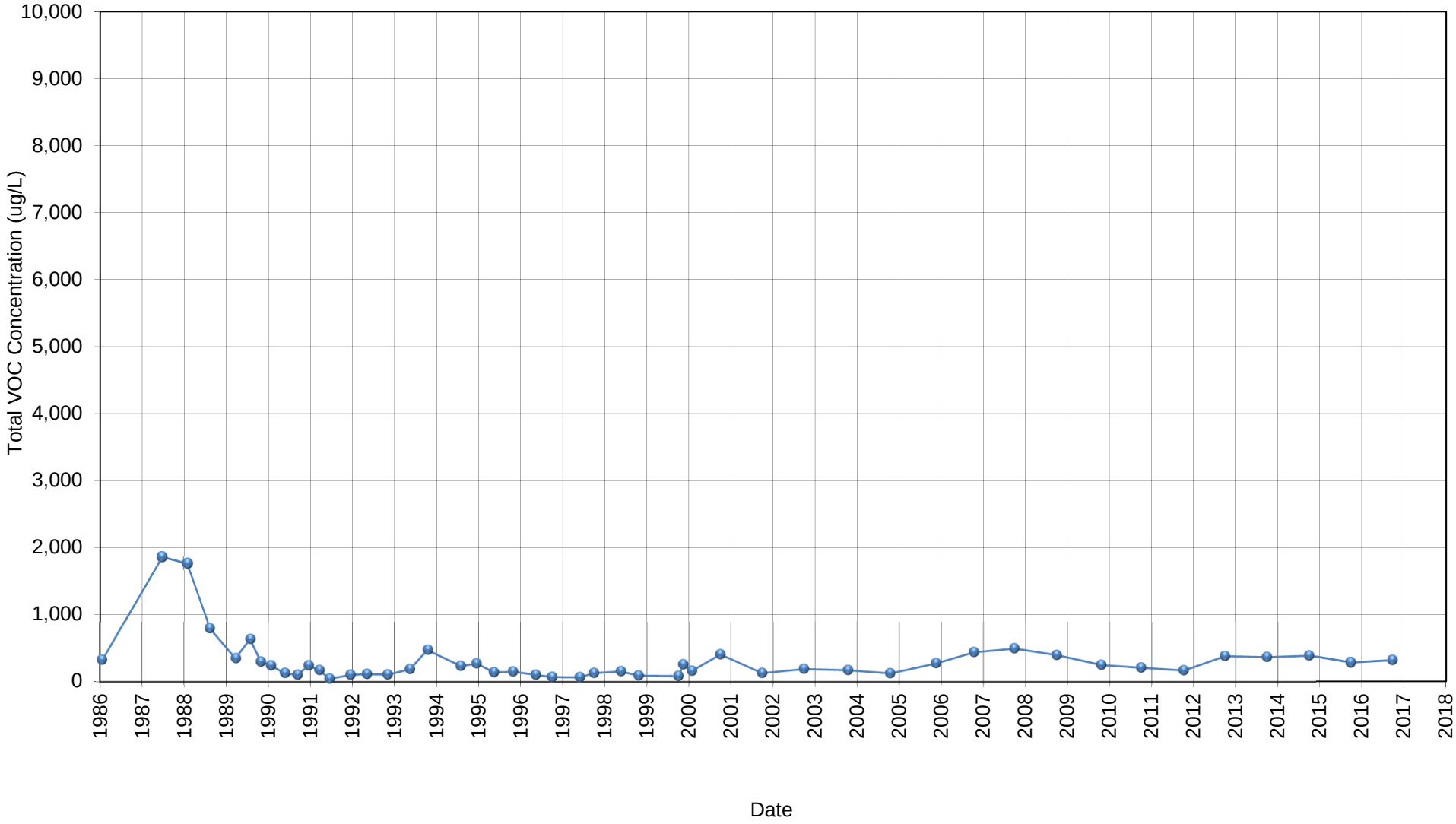


Figure 4.3

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

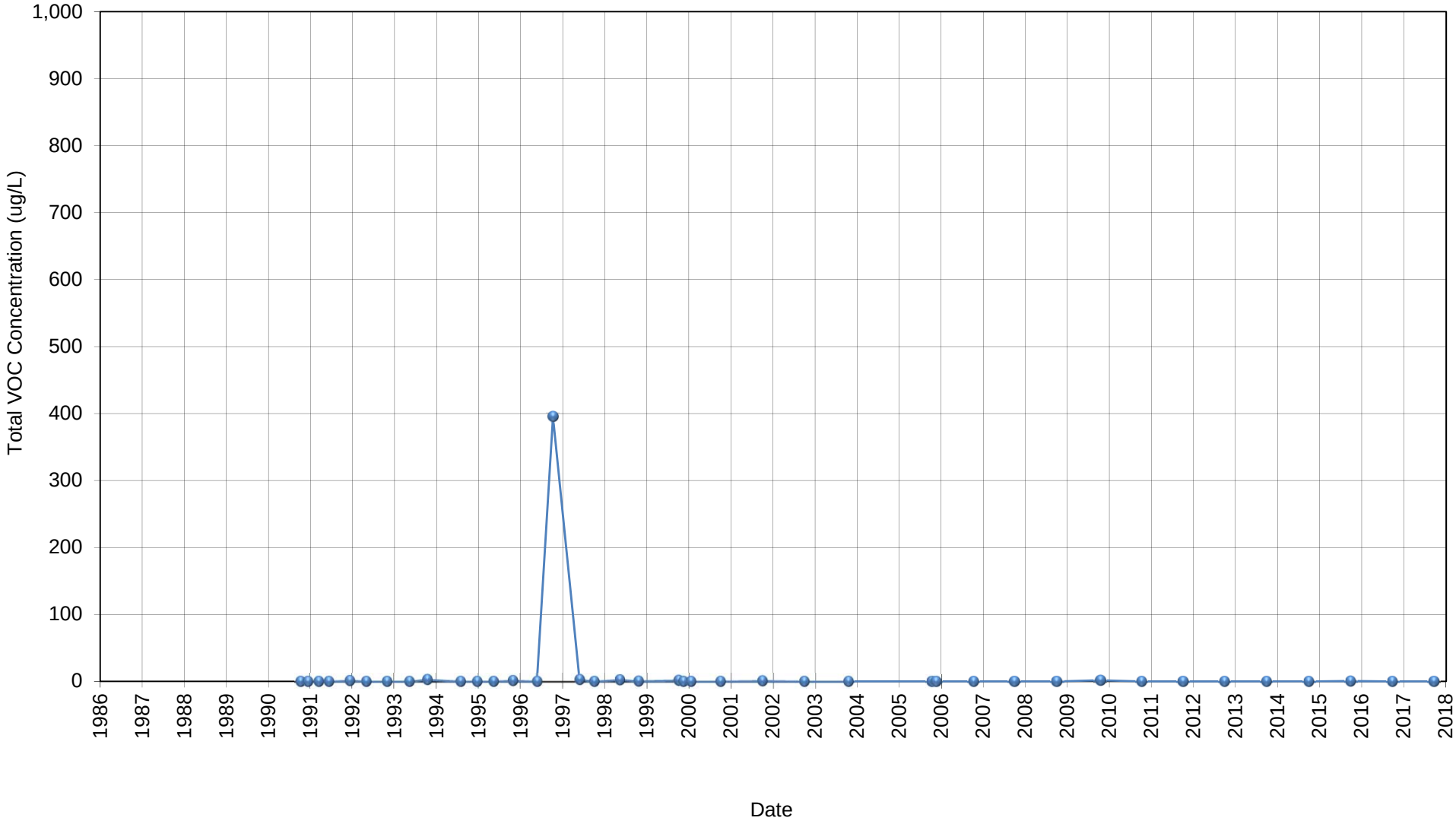


Figure 4.4

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

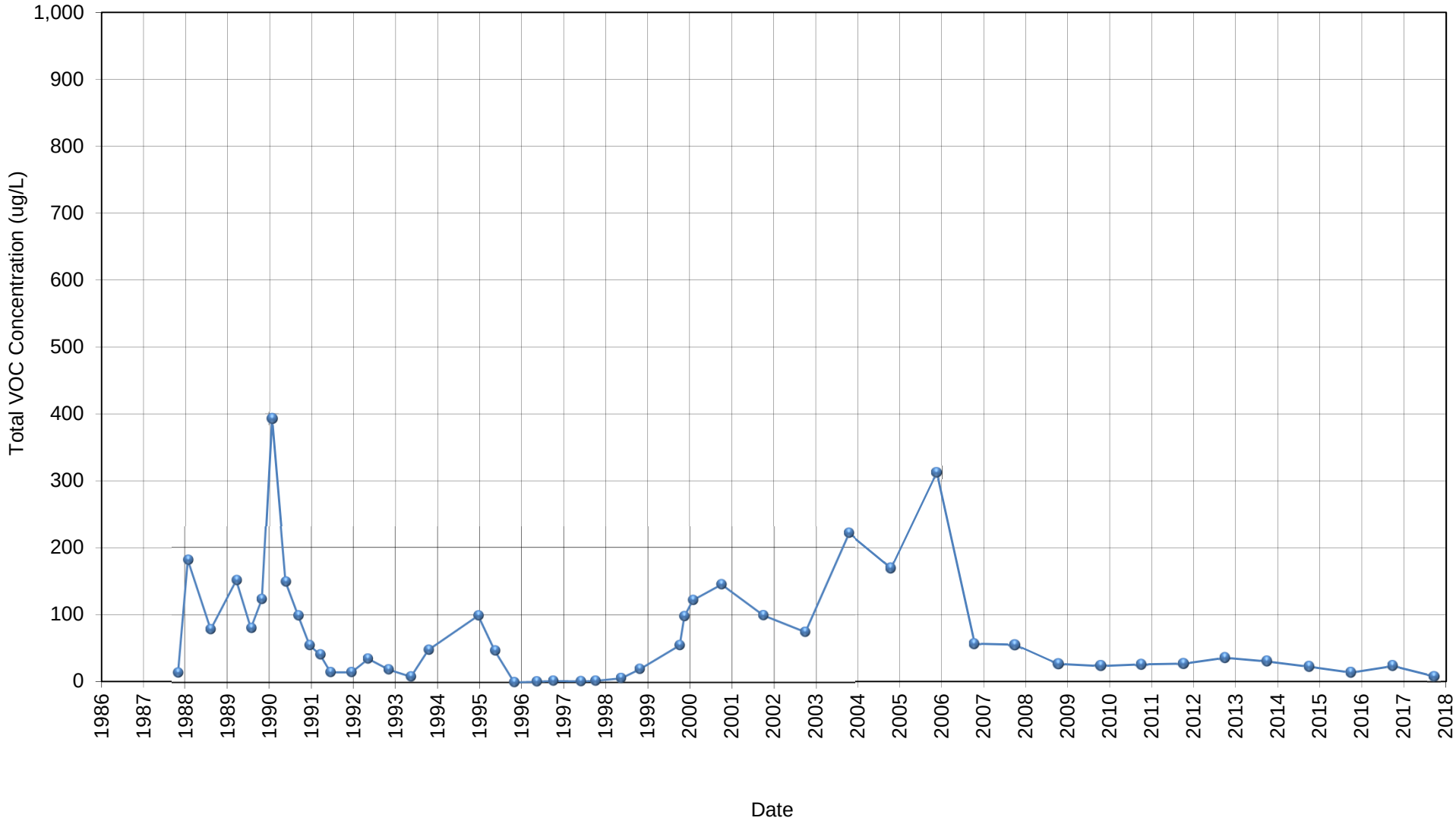


Figure 4.5

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

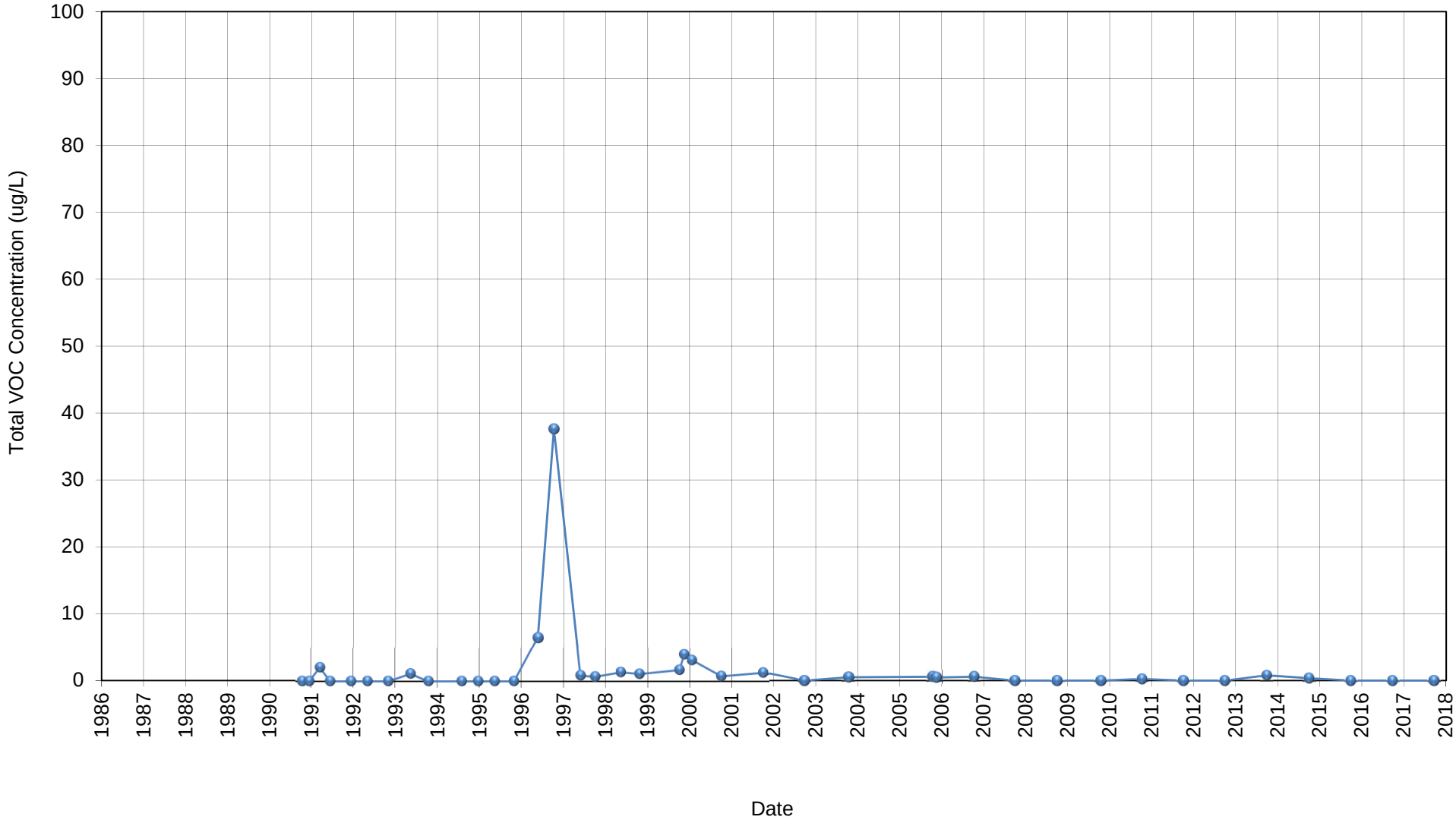


Figure 4.6

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

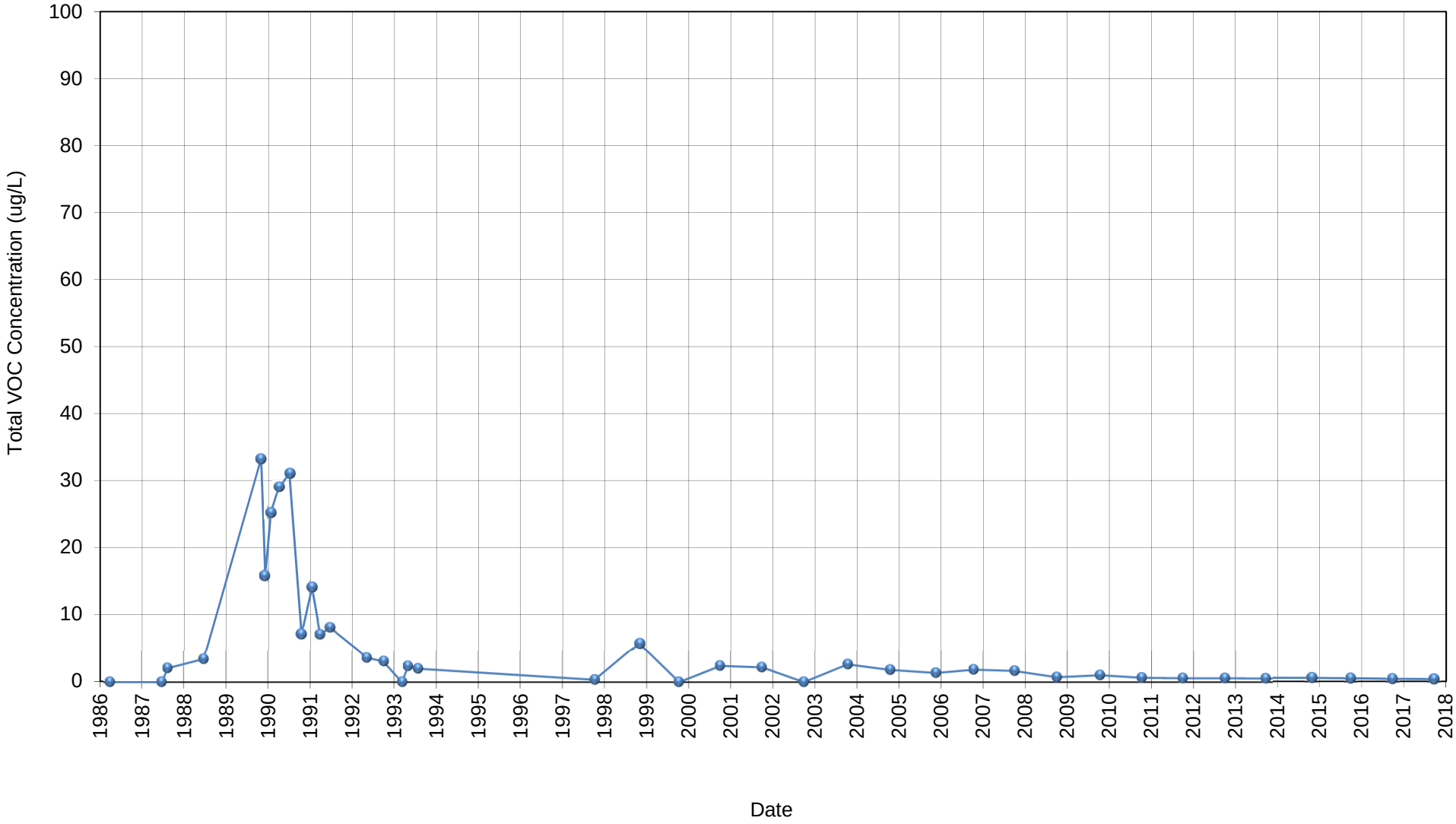
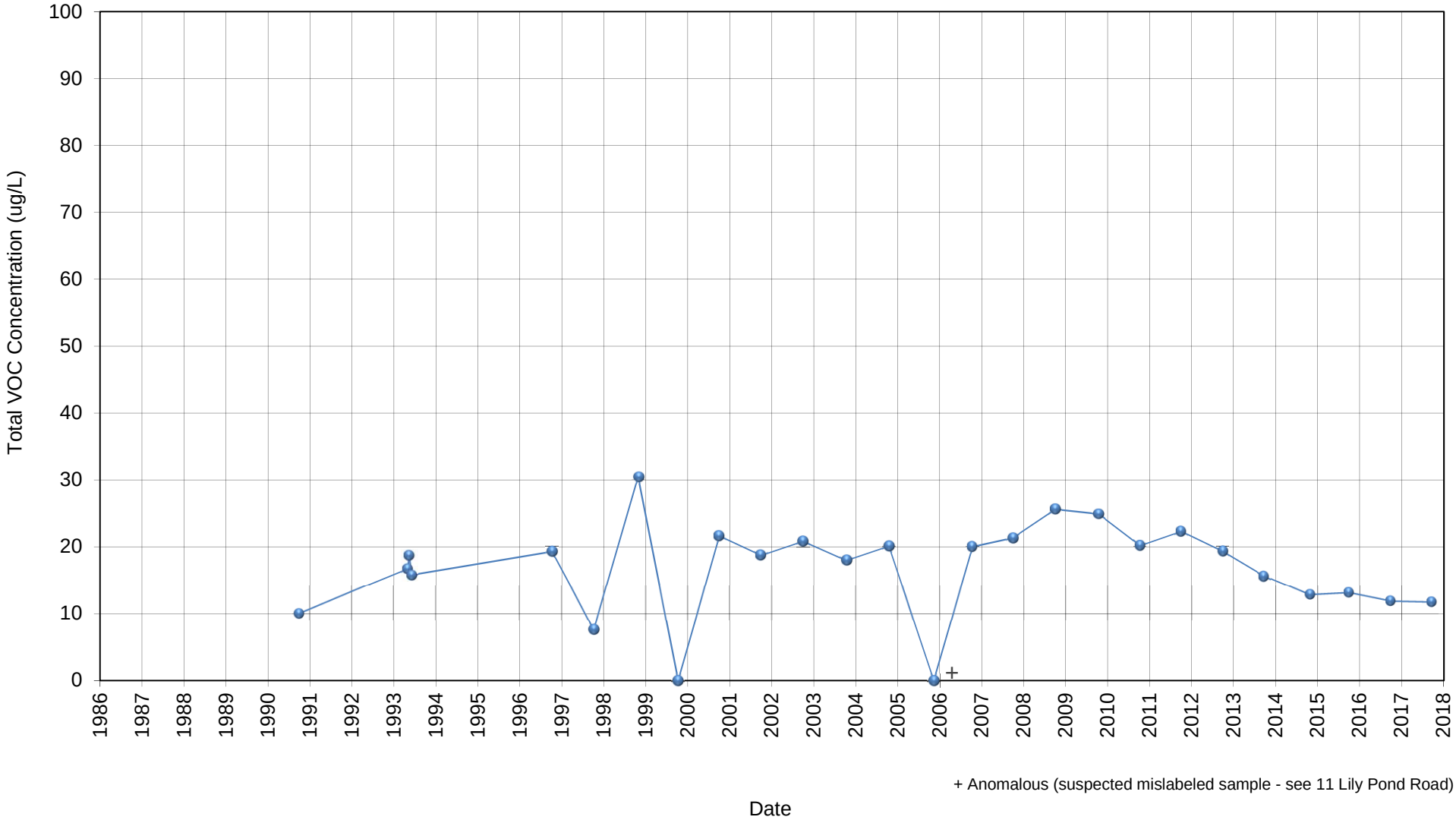


Figure 4.7

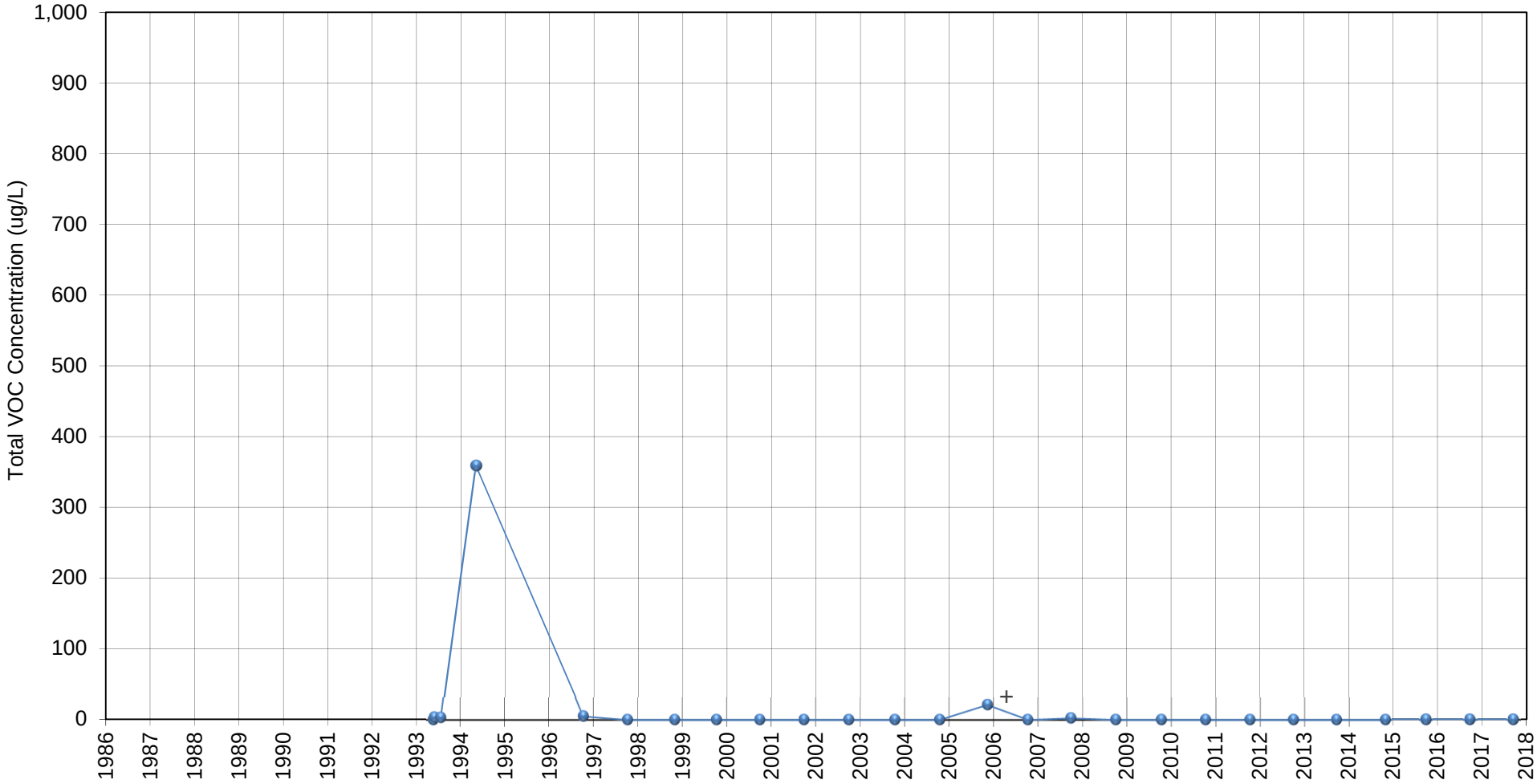
Historical Total VOC Concentrations
1 Lily Pond Road
Highway 96 Site
White Bear Township, Minnesota



+ Anomalous (suspected mislabeled sample - see 11 Lily Pond Road)

Figure 4.8

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



+ Anomalous (suspected mislabeled sample - see 1 Lily Pond Road)

Figure 4.9

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

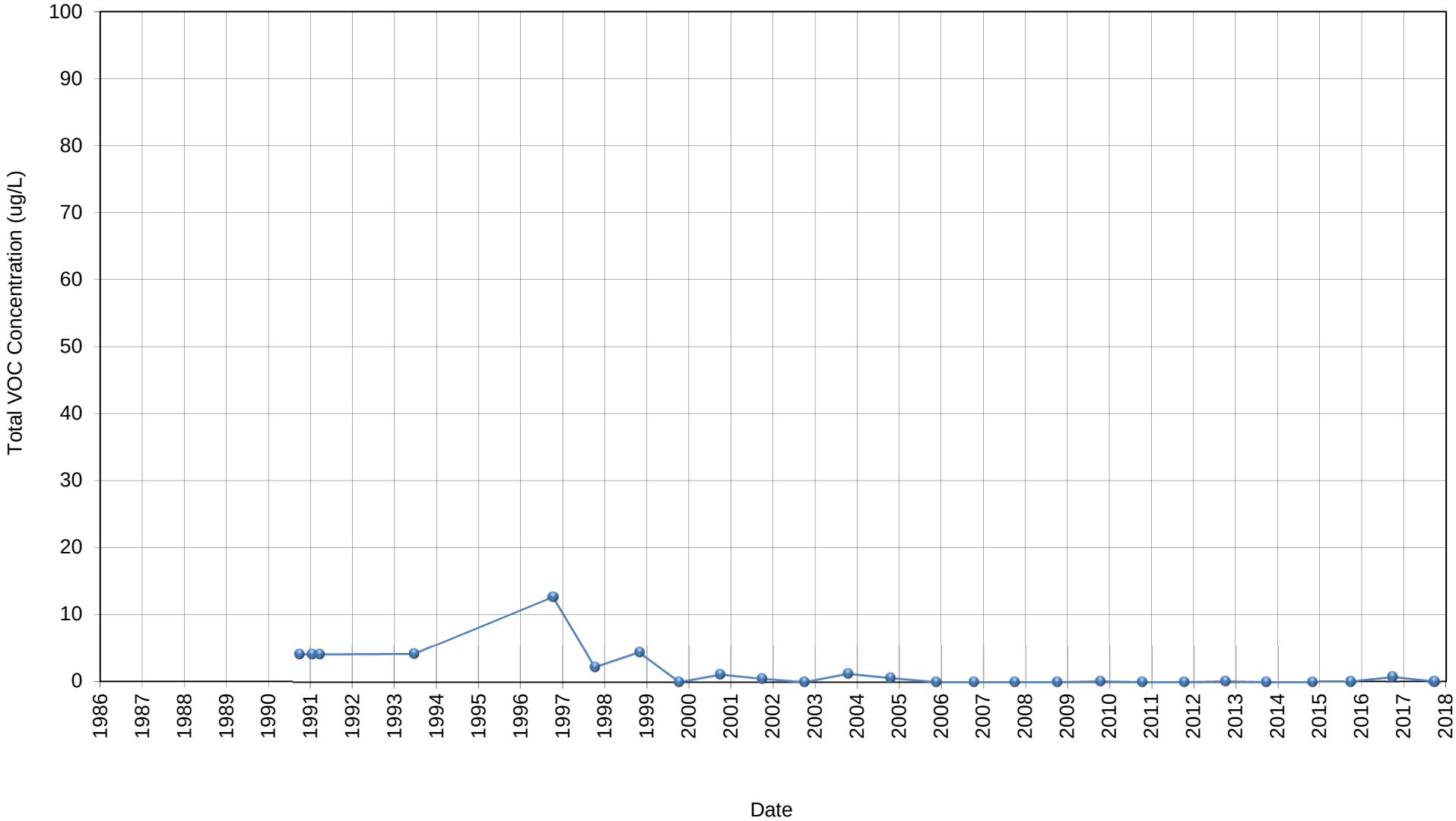
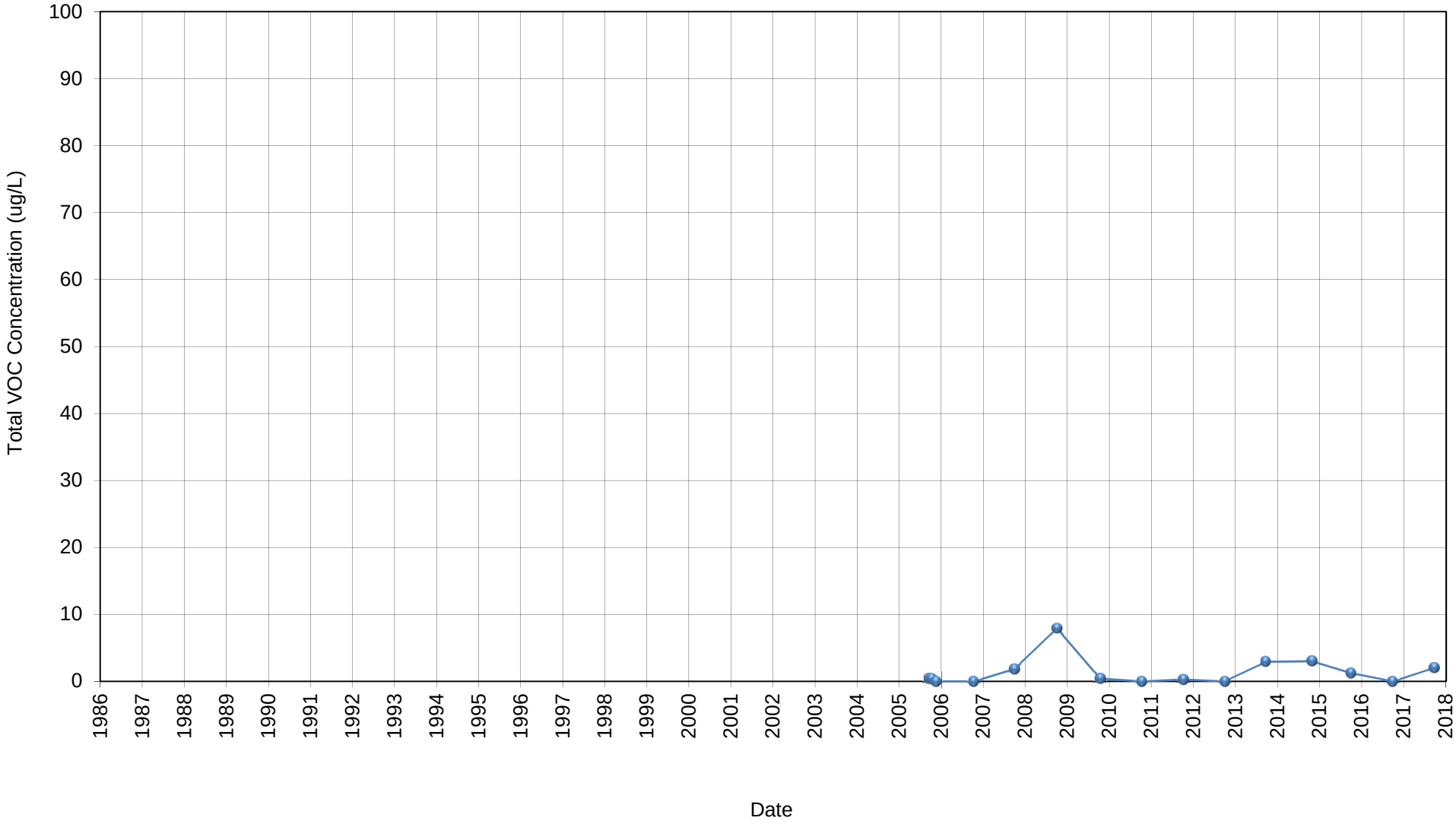


Figure 4.10

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



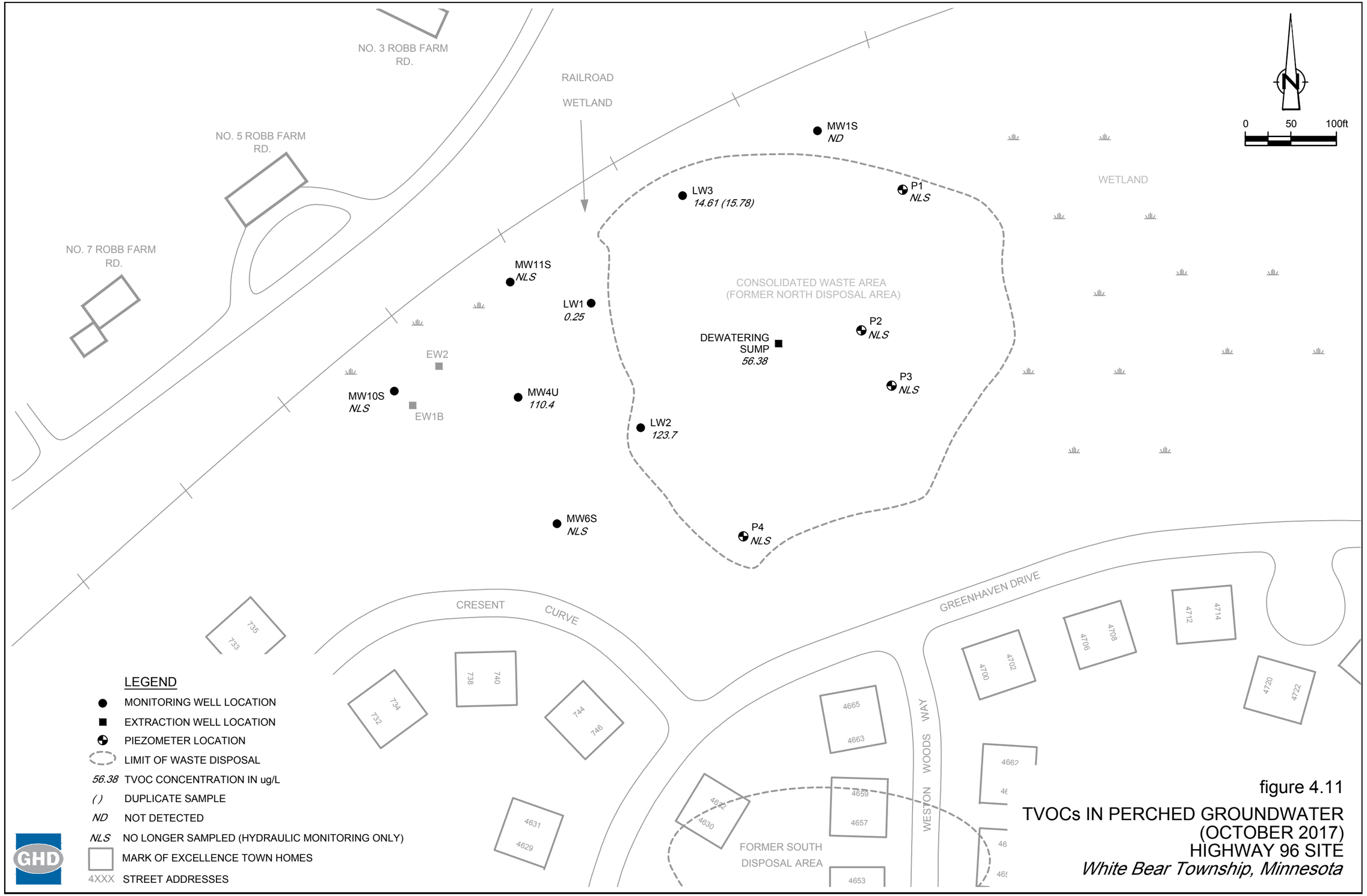


figure 4.11

TVOCs IN PERCHED GROUNDWATER (OCTOBER 2017) HIGHWAY 96 SITE

White Bear Township, Minnesota

02012-01(068)GN-WA013 MAR 14, 2018

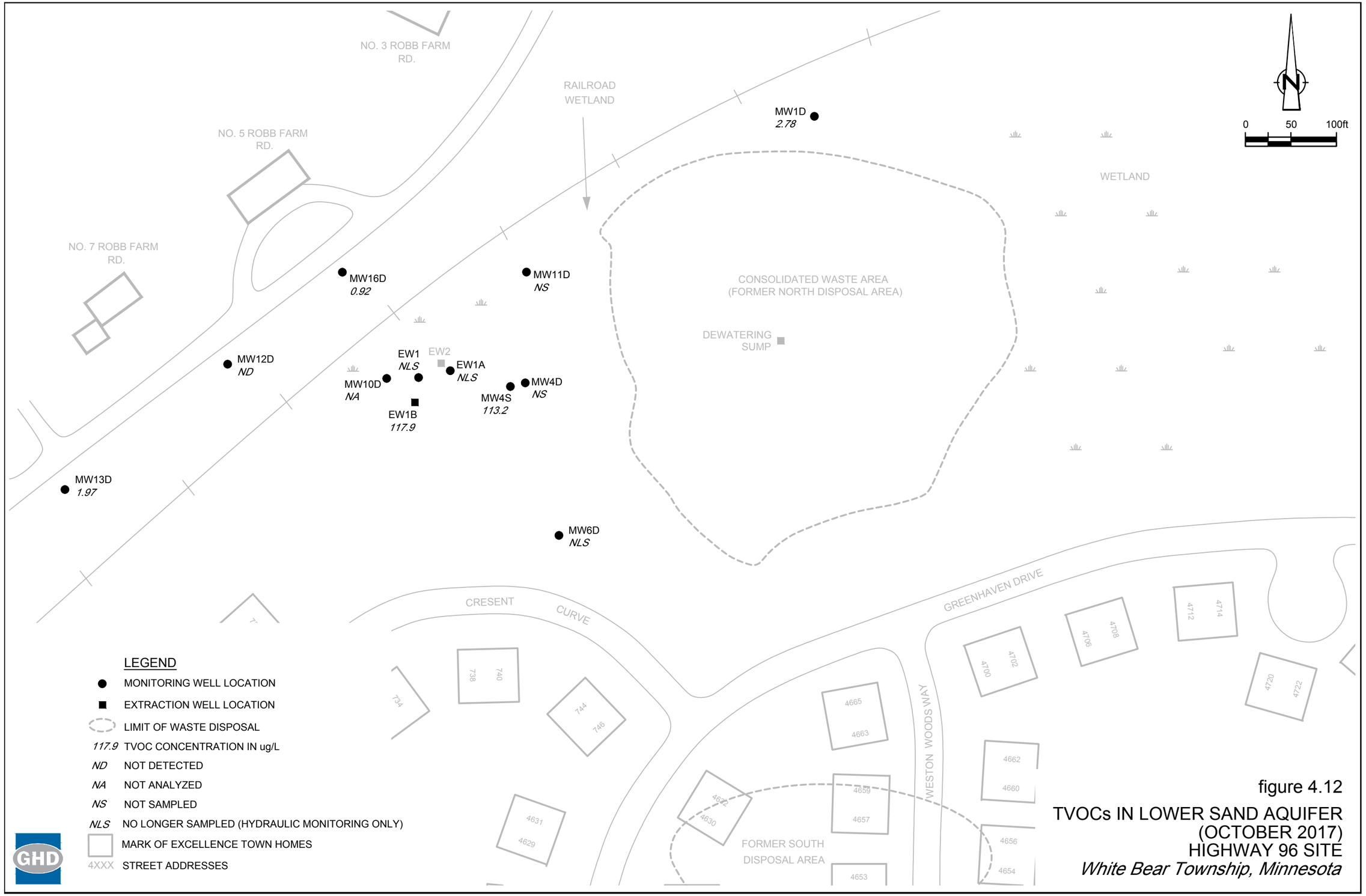


figure 4.12

TVOCs IN LOWER SAND AQUIFER
(OCTOBER 2017)
HIGHWAY 96 SITE
White Bear Township, Minnesota

02012-01(068)GN-WA014 MAR 14, 2018

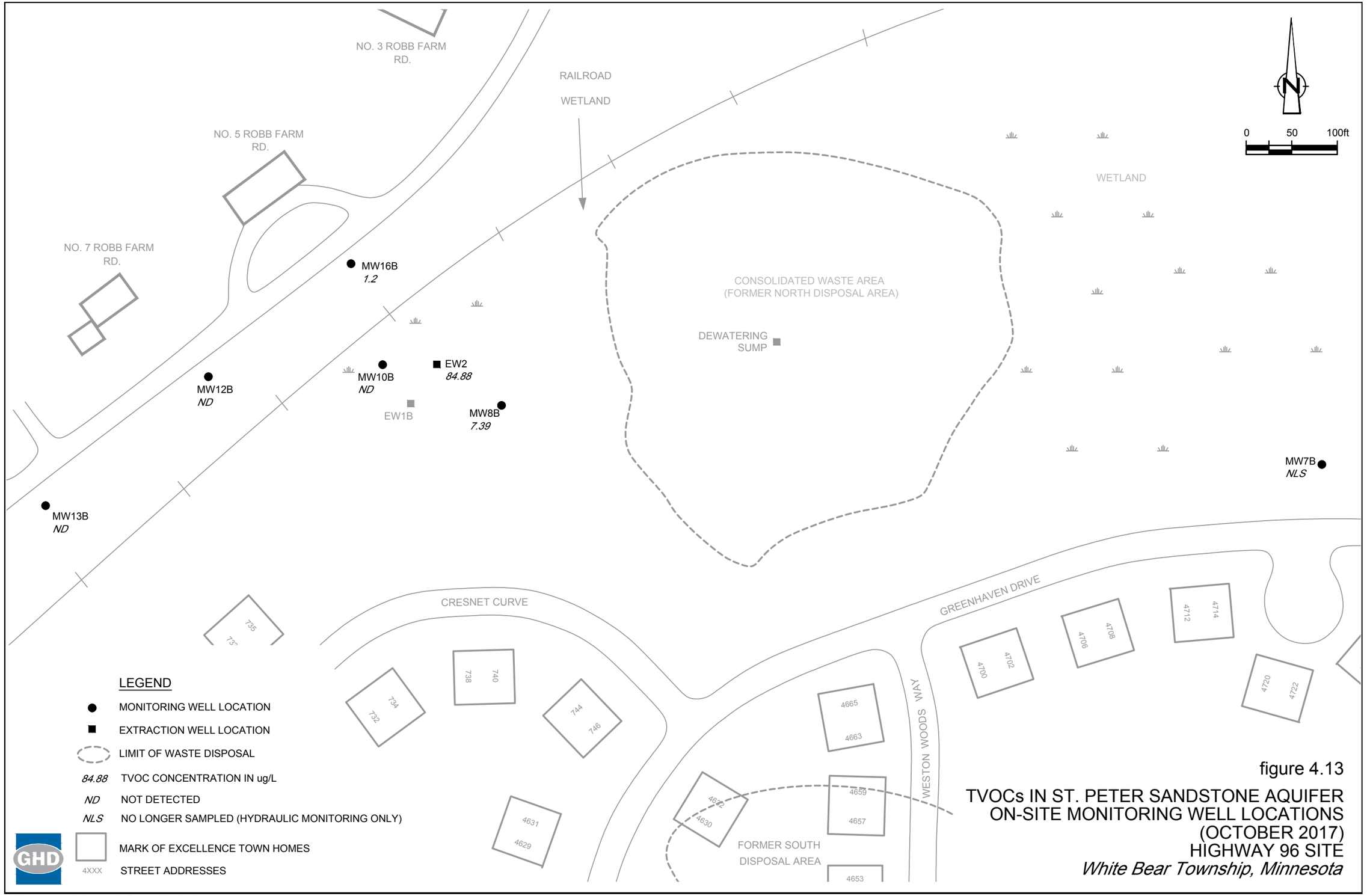
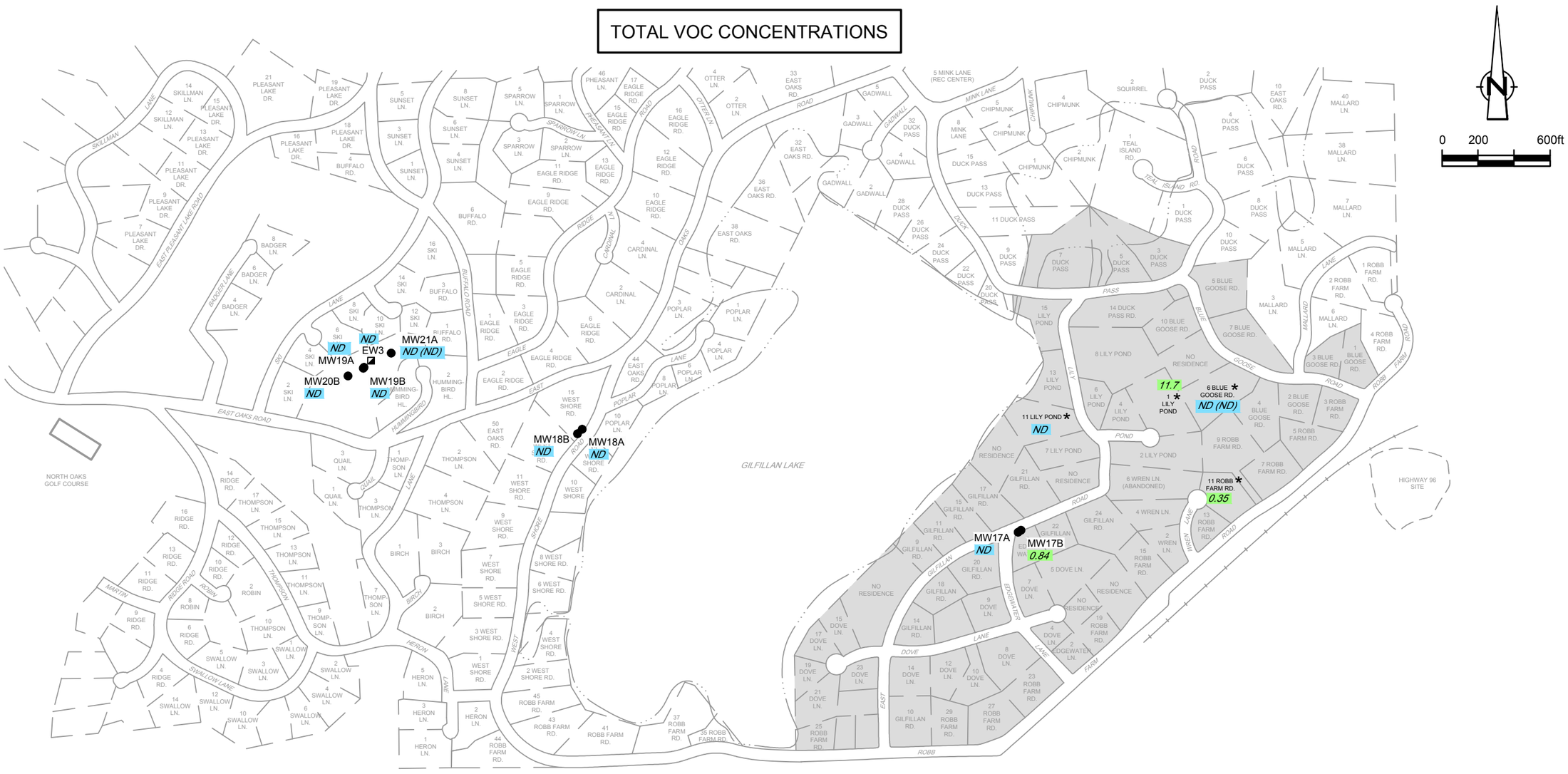


figure 4.13

TVOCs IN ST. PETER SANDSTONE AQUIFER
ON-SITE MONITORING WELL LOCATIONS
(OCTOBER 2017)
HIGHWAY 96 SITE
White Bear Township, Minnesota

02012-01(068)GN-WA015 FEB 26, 2018

TOTAL VOC CONCENTRATIONS



LEGEND

- TEST EXTRACTION WELL LOCATION
- MONITORING WELL LOCATION
- * CONVERTED RESIDENTAL MONITORING WELL LOCATION
- *11.7* TVOC CONCENTRATION IN ug/L
- *ND* NOT DETECTED
- *( )* DUPLICATE SAMPLE
- CONNECTED TO MUNICIPAL WATER SUPPLY

- VOCS DETECTED (INCLUDING VINYL CHLORIDE) [DETECTION(S) ABOVE HBG CRITERIA]
- VOCS DETECTED (INCLUDING VINYL CHLORIDE) [ALL DETECTIONS BELOW HBG CRITERIA]
- VOCS DETECTED (VINYL CHLORIDE NOT DETECTED) [ALL DETECTIONS BELOW HBG CRITERIA]
- VOCS NOT DETECTED

figure 4.14

TVOCs IN ST. PETER SANDSTONE AQUIFER
OFF-SITE MONITORING WELL LOCATIONS
(OCTOBER 2017)
HIGHWAY 96 SITE
White Bear Township, Minnesota

GHD

02012-01(068)GN-WA016 MAR 15, 2018

TOTAL VOC CONCENTRATIONS

LEGEND

- ● MONITORING WELL LOCATION
- * CONVERTED RESIDENTAL MONITORING WELL LOCATION
- *2.0* TVOC CONCENTRATION IN ug/L
- CONNECTED TO MUNICIPAL WATER SUPPLY

- VOCS DETECTED (INCLUDING VINYL CHLORIDE) [DETECTION(S) ABOVE HBG CRITERIA]
- VOCS DETECTED (INCLUDING VINYL CHLORIDE) [ALL DETECTIONS BELOW HBG CRITERIA]
- VOCS DETECTED (VINYL CHLORIDE NOT DETECTED) [ALL DETECTIONS BELOW HBG CRITERIA]
- VOCS NOT DETECTED

figure 4.15

TVOCs IN PRAIRIE DU CHIEN AQUIFER
OFF-SITE MONITORING WELL LOCATIONS
(OCTOBER 2017)
HIGHWAY 96 SITE
White Bear Township, Minnesota

GHD

02012-01(068)GN-WA017 MAR 15, 2018

TOTAL VOC CONCENTRATIONS

AREA 2

AREA 4

AREA 1

AREA 3

AREA 5

GILFILLAN LAKE

NORTH OAKS GOLF COURSE

HIGHWAY 96 SITE

0 200 600ft

LEGEND

- GEOGRAPHIC AREAS
- *1.27* — MAXIMUM TVOC CONCENTRATION IN µg/L
- * — CONVERTED RESIDENTAL MONITORING WELL LOCATION
- *ND* — NOT DETECTED
- *NS* — NOT SAMPLED (NO RESPONSE/DECLINED/WATER OFF)
- *[ ]* — NEW (DEEPER) WELL RESULT
- *#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 HOMEOWNERS EXPENSE] (OLD WELL ABANDONED)
- *#H-J* — NEW WELL INSTALLED BY HOMEOWNER [JORDAN AQUIFER] (OLD WELL ABANDONED)
- CONNECTED TO MUNICIPAL WATER SUPPLY

- VOCS DETECTED (INCLUDING VINYL CHLORIDE) [DETECTION(S) ABOVE HBG CRITERIA]
- VOCS DETECTED (INCLUDING VINYL CHLORIDE) [ALL DETECTIONS BELOW HBG CRITERIA]
- VOCS DETECTED (VINYL CHLORIDE NOT DETECTED) [ALL DETECTIONS BELOW HBG CRITERIA]
- VOCS NOT DETECTED

figure 4.16

MAXIMUM TVOC CONCENTRATIONS
IN RESIDENTIAL WELLS (APRIL/OCTOBER 2017)
HIGHWAY 96 SITE
White Bear Township, Minnesota

GHD

02012-01(068)GN-WA018 MAR 15, 2018

VINYL CHLORIDE CONCENTRATIONS

AREA 1

AREA 2

AREA 3

AREA 4

AREA 5

0 200 600ft

LEGEND

- GEOGRAPHIC AREAS
- ● MONITORING WELL LOCATION
- * CONVERTED RESIDENTAL MONITORING WELL LOCATION
- *ND* NOT DETECTED (DETECTION LIMIT 0.18 µg/L)
- *NS* NOT SAMPLED (NO RESPONSE/DECLINED/WATER OFF)
- *[ ]* NEW (DEEPER) WELL RESULT
- *#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 HOMEOWNERS EXPENSE] (OLD WELL ABANDONED)
- *#H-J* NEW WELL INSTALLED BY HOMEOWNER [JORDAN AQUIFER] (OLD WELL ABANDONED)
- CONNECTED TO MUNICIPAL WATER SUPPLY

- VINYL CHLORIDE DETECTED [ABOVE HBG CRITERIA]
- VINYL CHLORIDE DETECTED [BELOW HBG CRITERIA]
- VINYL CHLORIDE NOT DETECTED

figure 4.17

MAXIMUM VINYL CHLORIDE CONCENTRATIONS
IN OFF-SITE MONITORING WELL AND RESIDENTIAL WELL LOCATIONS
(APRIL/OCTOBER 2017)
HIGHWAY 96 SITE
White Bear Township, Minnesota

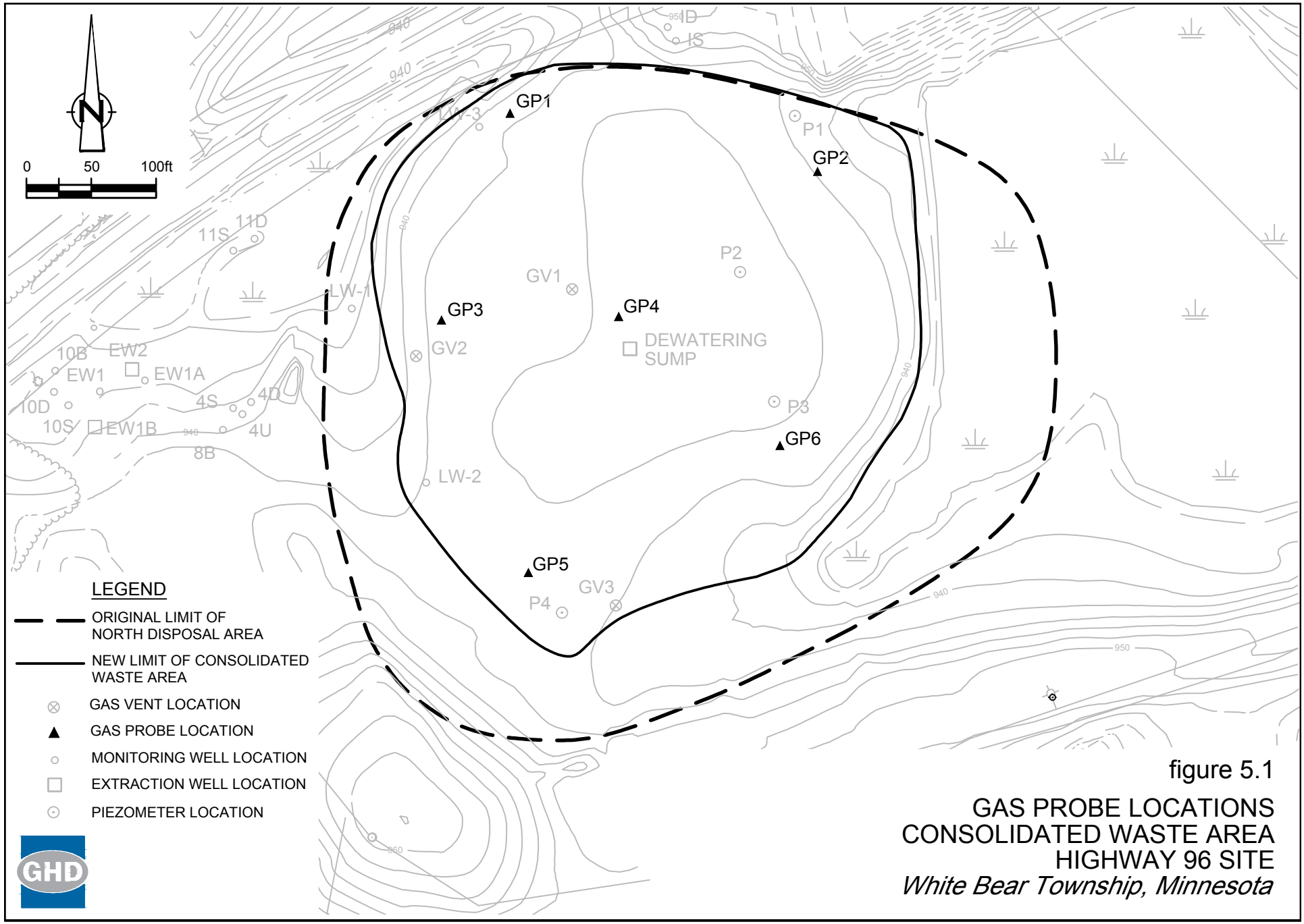


figure 5.1

GAS PROBE LOCATIONS
CONSOLIDATED WASTE AREA
HIGHWAY 96 SITE
White Bear Township, Minnesota

02012-01(068)GN-WA022 MAR 15, 2018

Figure 5.2

% Combustible Gas Concentrations
GP-1
Highway 96 Site
White Bear Township, Minnesota

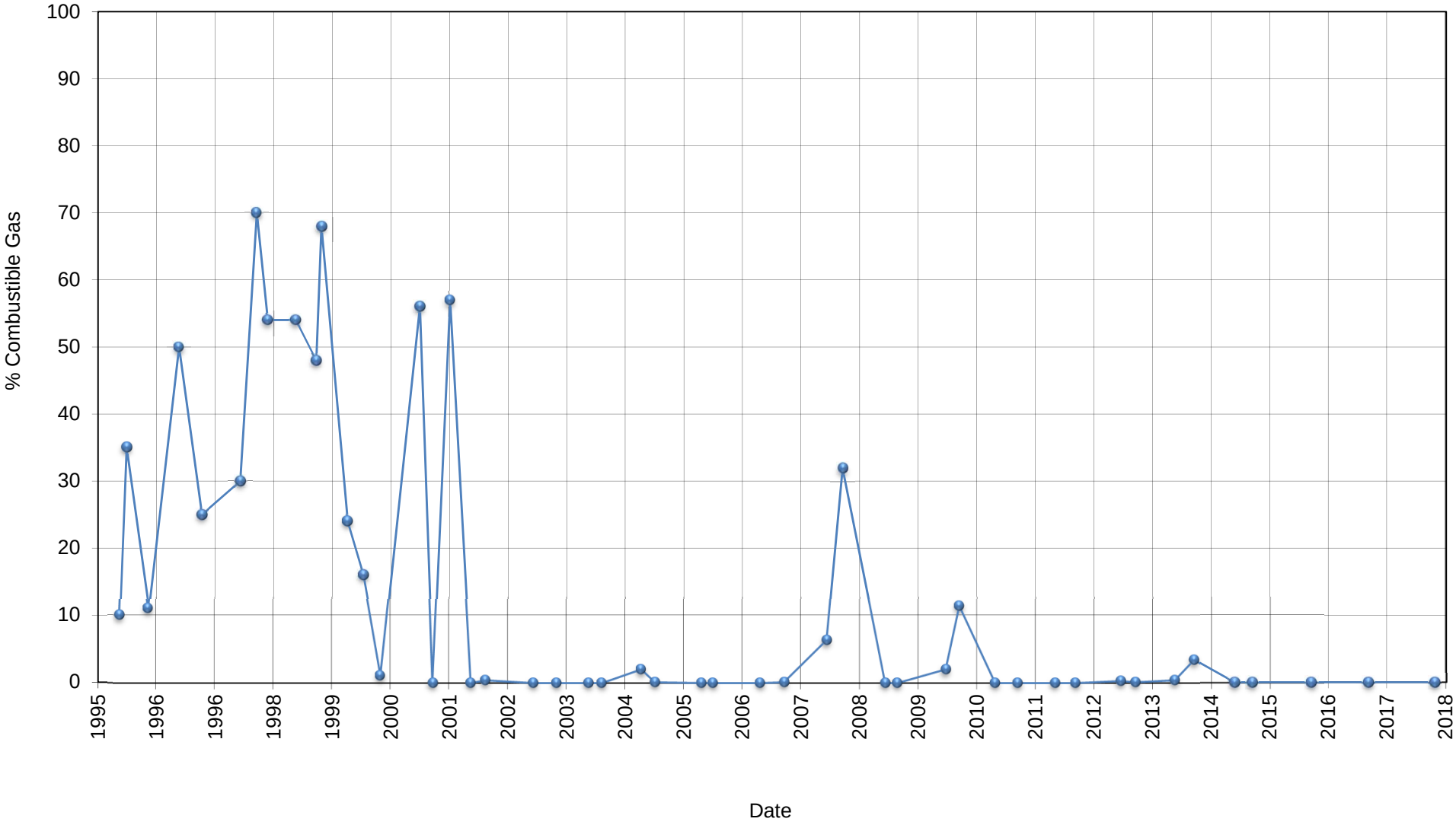


Figure 5.3

% Combustible Gas Concentrations
GP-2
Highway 96 Site
White Bear Township, Minnesota

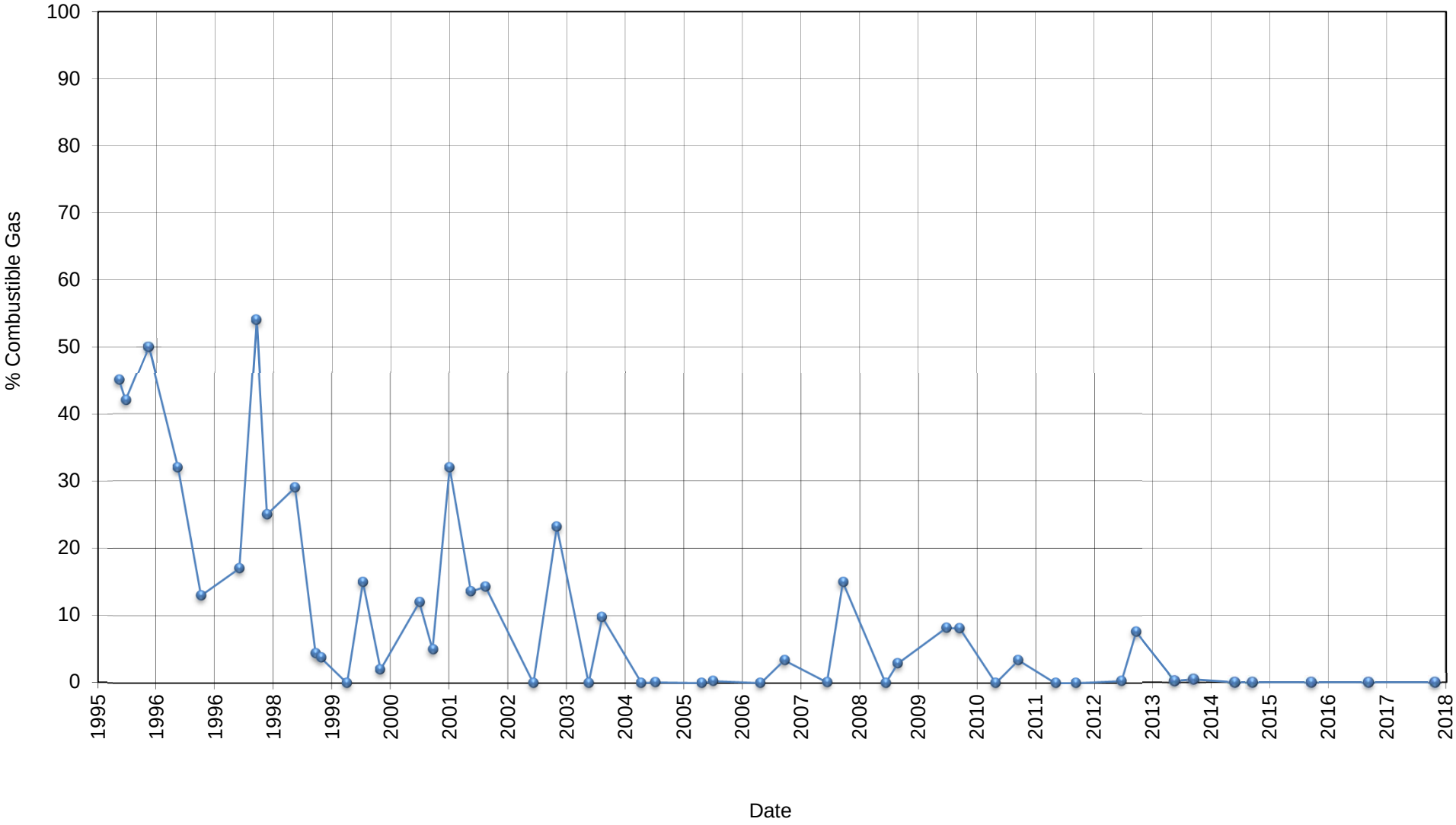


Figure 5.4

% Combustible Gas Concentrations
GP-3
Highway 96 Site
White Bear Township, Minnesota

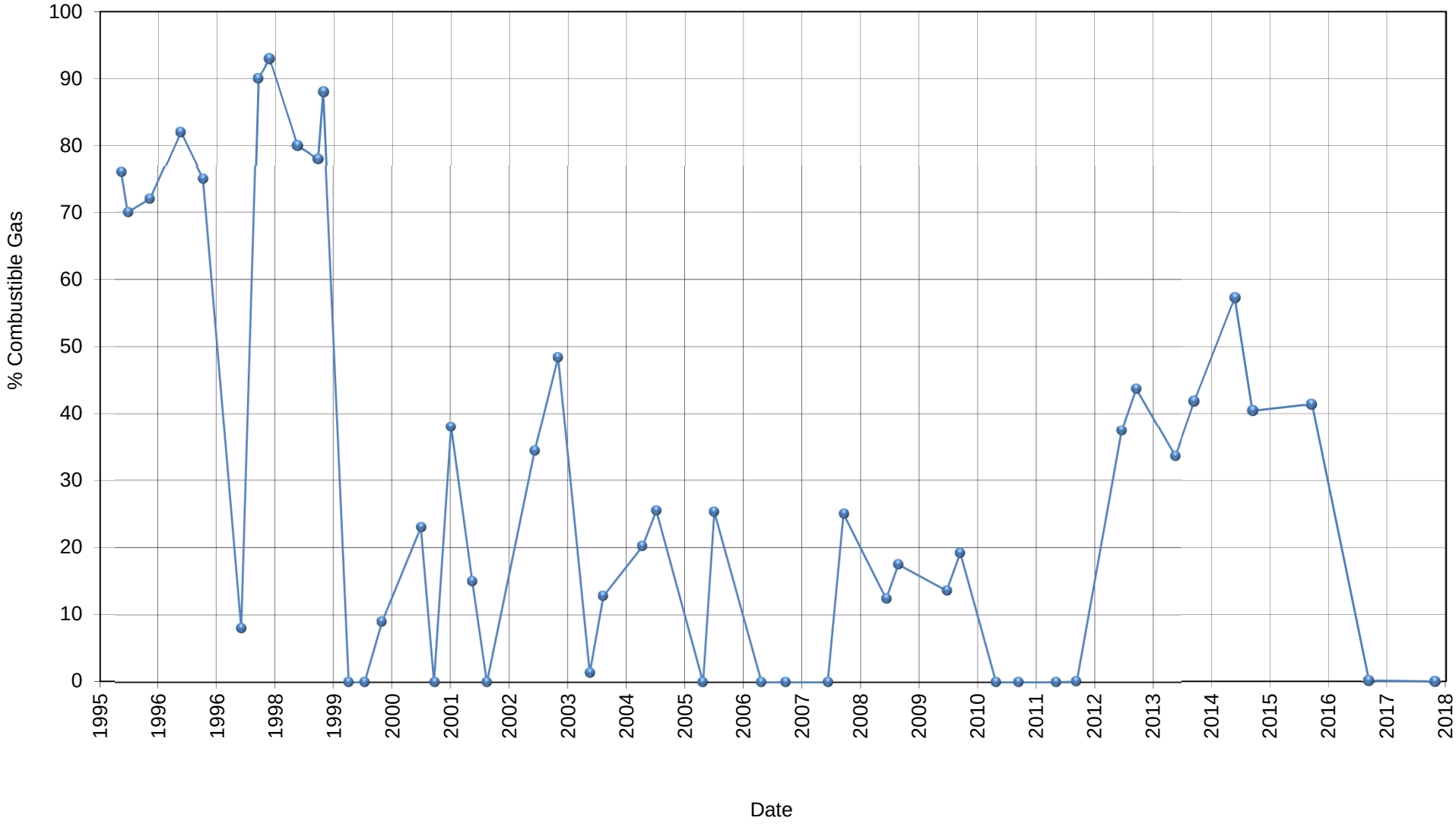


Figure 5.5

% Combustible Gas Concentrations
GP-4
Highway 96 Site
White Bear Township, Minnesota

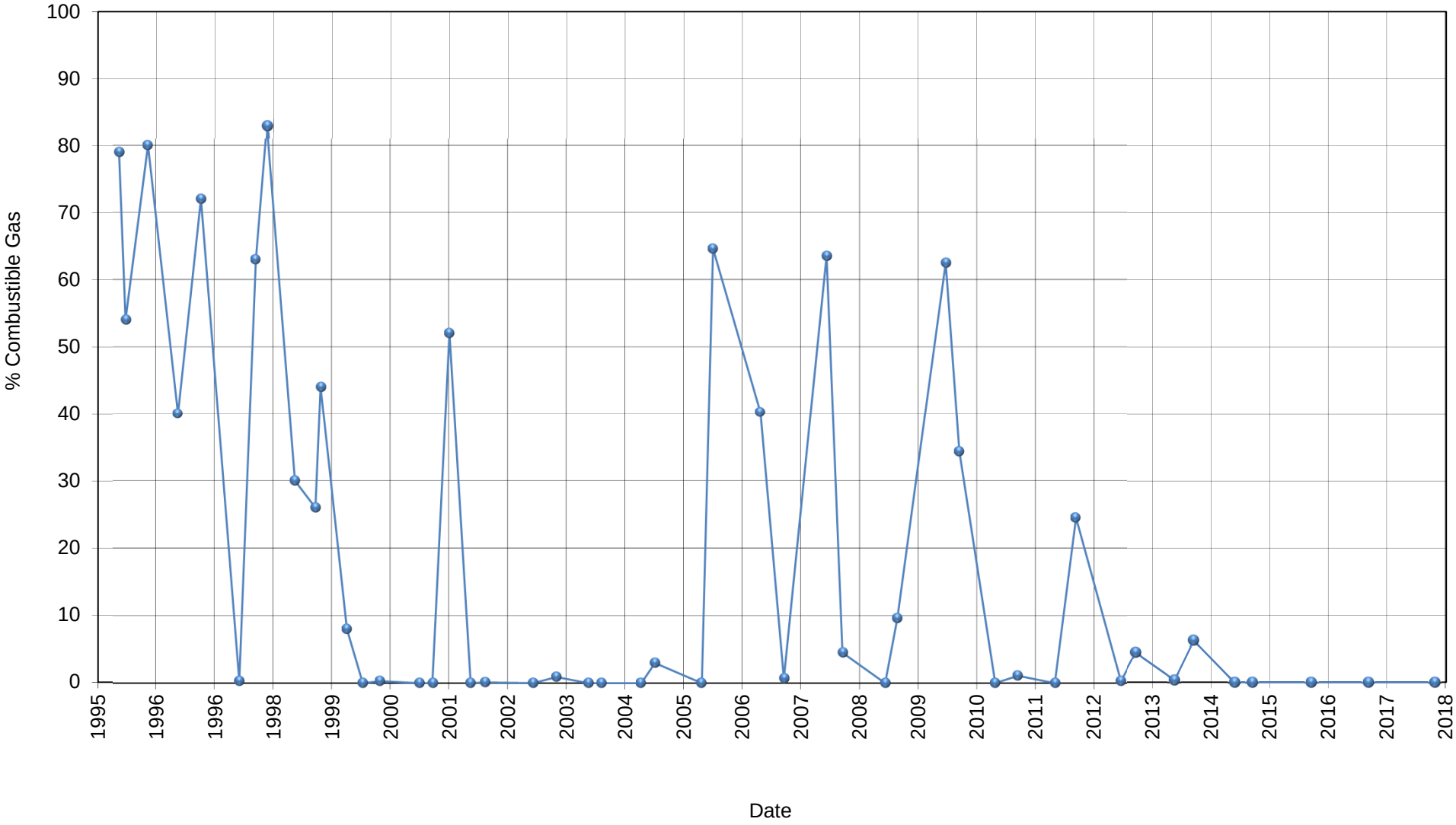


Figure 5.6

% Combustible Gas Concentrations
GP-5
Highway 96 Site
White Bear Township, Minnesota

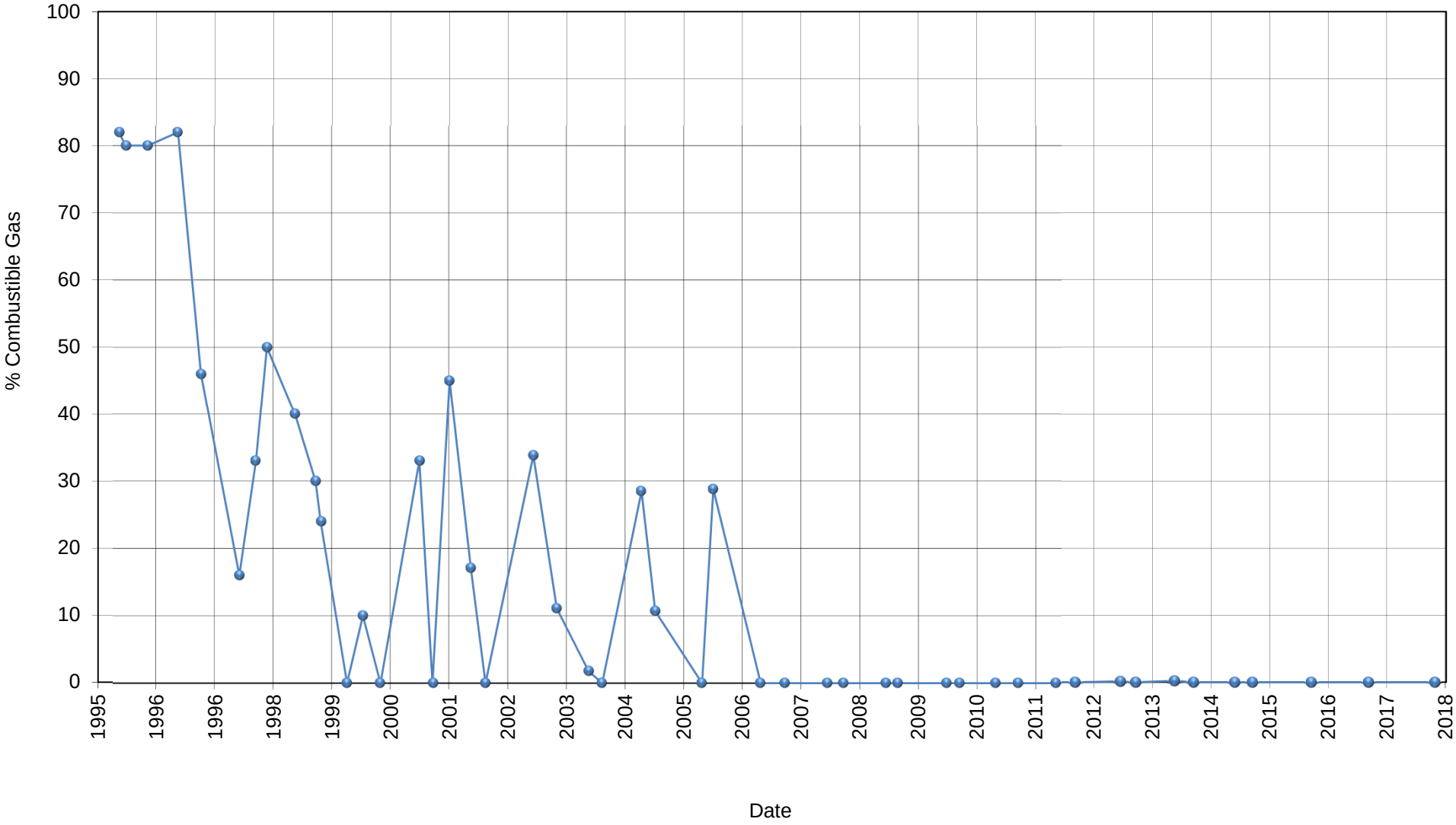
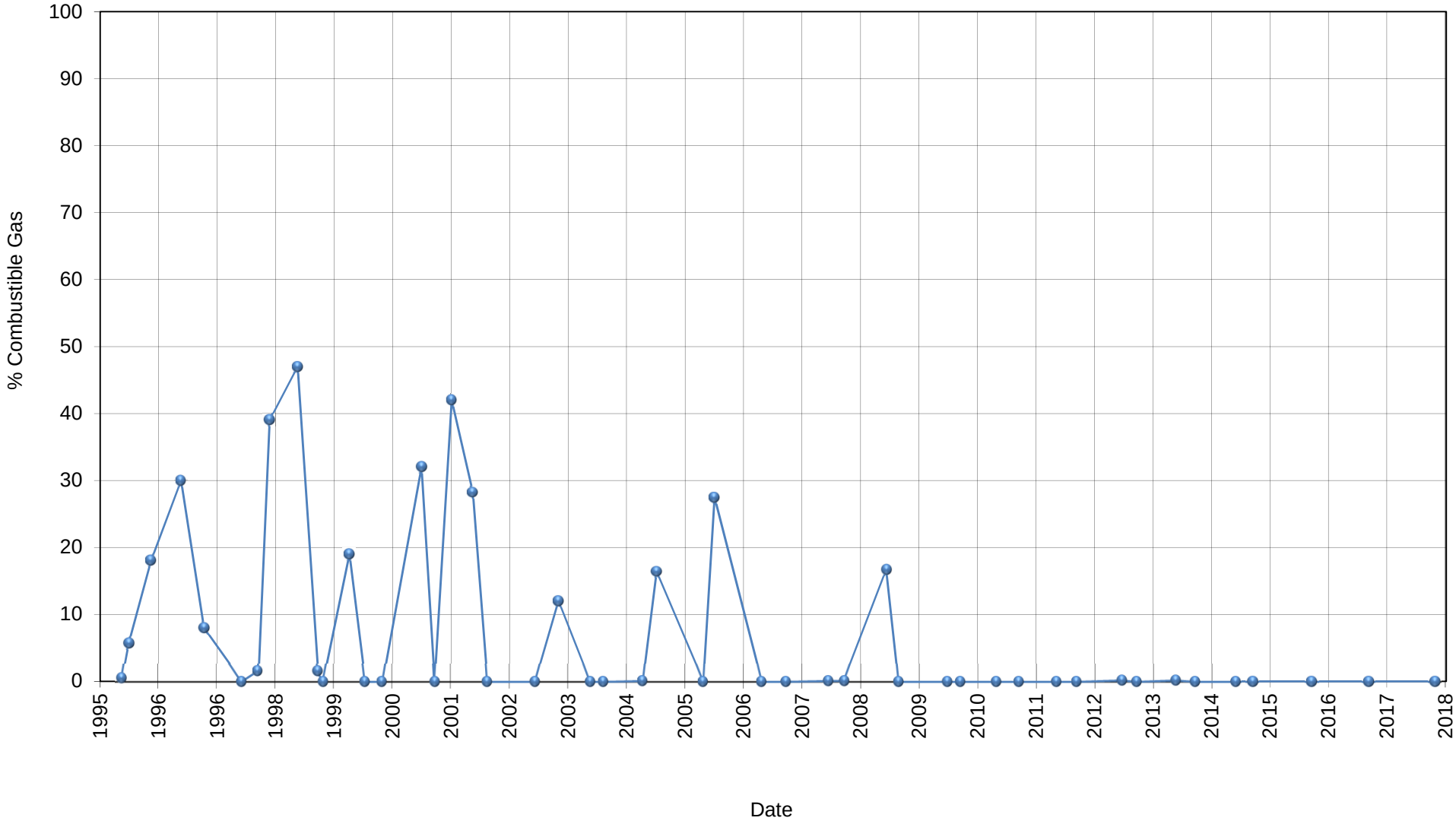


Figure 5.7

% Combustible Gas Concentrations
GP-6
Highway 96 Site
White Bear Township, Minnesota



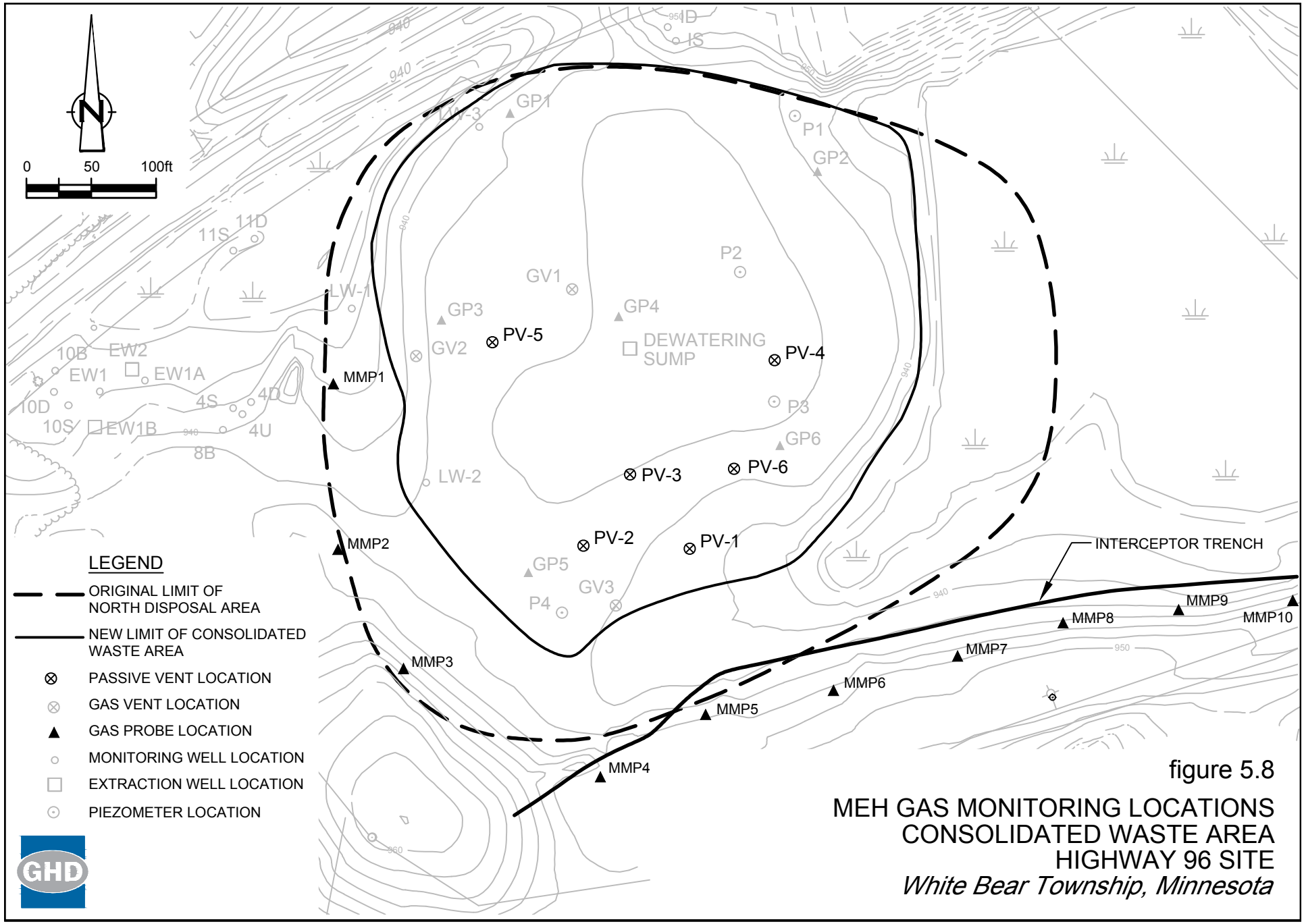


figure 5.8

MEH GAS MONITORING LOCATIONS
CONSOLIDATED WASTE AREA
HIGHWAY 96 SITE
White Bear Township, Minnesota

02012-01(068)GN-WA023 MAR 15, 2018

Tables

Table 3.1

2017 Groundwater Elevations
Highway 96 Site
White Bear Township, Minnesota

Location	TOC (ft. AMSL)	9/27/2017 WL (ft BTOC)	9/27/2017 (ft. AMSL)
Perched Groundwater Unit			
DEWATERING SUMP * (On)	946.71	19.82	926.89
LW1	938.86	9.33	929.53
LW2	945.66	12.06	933.60
LW3	944.82	12.76	932.06
MW1S	950.65	18.21	932.44
MW4U	939.65	24.62	915.03
MW6S	948.44	19.21	929.23
MW10S	935.94	4.96	930.98
MW11S	936.34	5.30	931.04
P1	941.70	9.18	932.52
P2	946.11	16.76	929.35
P3	947.11	18.26	928.85
P4	948.16	17.08	931.08
Glacial Drift (Lower Sand) Aquifer			
EW1	936.66	37.43	899.23
EW1A	938.67	39.25	899.42
EW1B * (On)	939.99	49.55	890.44
MW1D	951.02	49.95	901.07
MW4S	940.33	32.70	907.63
MW4D	940.48	40.56	899.92
MW6D	948.15	46.67	901.48
MW10D	935.94	27.15	908.79
MW11D	935.40	29.30	906.10
MW12D	940.52	34.87	905.65
MW13D	937.66	34.38	903.28
MW16D	940.70	40.01	900.69

2017 Groundwater Elevations
Highway 96 Site
White Bear Township, Minnesota

Location	TOC (ft. AMSL)	9/27/2017 WL (ft BTOC)	9/27/2017 (ft. AMSL)
Upper St. Peter Sandstone Aquifer			
EW2 * (On)	938.67	39.91	898.76
MW7B	942.91	40.74	902.17
MW8B	940.91	41.10	899.81
MW10B	936.64	36.98	899.66
MW12B	939.89	40.25	899.64
MW13B	938.34	38.75	899.59
MW16B	940.71	40.65	900.06
MW17A	914.58	17.02	897.56
MW18A	925.39	31.58	893.81
MW19A	913.56	22.38	891.18
MW21A	909.03	17.71	891.32
Basal St. Peter Sandstone Aquifer			
EW3	913.88	28.15	885.73
MW17B	914.50	24.29	890.21
MW18B	925.24	34.80	890.44
MW19B	913.33	27.86	885.47
MW20B	915.04	28.76	886.28
1 Lily Pond Road #	930.88	33.05	897.83
11 Lily Pond Road #	928.54	37.19	891.35
11 Robb Farm Road #	942.63	44.59	898.04
6 Blue Goose Road #	954.15	61.03	893.12
6 West Shore Road ^	920.20	31.78	888.42
38 East Oaks Road ^	926.25	38.18	888.07

Table 3.1

2017 Groundwater Elevations
Highway 96 Site
White Bear Township, Minnesota

Location	TOC (ft. AMSL)	9/27/2017 WL (ft BTOC)	9/27/2017 (ft. AMSL)
Prairie du Chien Aquifer			
MW17L	914.65	29.28	885.37
MW18L	925.44	42.15	883.29
MW19L	914.18	33.89	880.29

Notes:

TOC - Top of Casing
WL - Water Level
ft. AMSL - Feet Above Mean Sea Level
ft. BTOC - Feet Below Top of Casing
* - Pumping Well
- Dewatering Sump pumping at a rate of approximately 3.6 gpm
- EW1B pumping at a rate of approximately 10.1 gpm
- EW2 pumping at a rate of approximately 10.0 gpm
- Converted Residential Monitoring Well
^ - Active Residential Well

Table 3.2

Operation and Maintenance Activities
Groundwater Extraction System
January 2017 - December 2017
Highway 96 Site
White Bear Township, Minnesota

Date	Location	Event	Remedy	Contractor
01/03/2017 - 01/04/2017	Dewatering Sump	Routine Well Rehabilitation	Performed mechanical treatment (jet/airlift). Removed, cleaned, inspected, tested, and reinstalled pump. Discovered and replaced section of broken pipe.	Stevens Drilling and Environmental Services
04/12/2017 - 04/14/2017	EW-1B & EW-2	Routine Maintenance	EW-1B totalizer meter not working. Swapped EW-2 meter to EW-1B. Turned off EW-2. Installed new totalizer meter at EW-2. Turned on EW-2.	GHD (M. Barnes)
05/10/2017	Dewatering Sump	Low Pressure	Shut off pump due to low pressure. Schedule Dewatering Sump maintenance.	GHD (M. Barnes)
06/08/2017	EW-1B and EW-2	Routine Maintenance	Conducted specific capacity checks to evaluate performance.	GHD (S. Roste)
06/16/2017	Landfill Cap	Cap Mowing Gas Vent Maintenance	Conducted landfill cap inspection. Mowed landfill cap, area around meter building, and ravine near East Oaks Road. Trim around gas vents.	GHD (M. Barnes/ B. Lardy)
06/19/2017 - 06/21/2017	EW-1B and Dewatering Sump	Routine Well Rehabilitation	Performed mechanical treatment (jet/surge/airlift) (twice at each well). Chlorinated well (twice at each well). Removed, cleaned, inspected, tested, and reinstalled pump at EW-1B. Discovered and replaced damaged pump at Dewatering Sump. Dewatering Sump turned on.	Stevens Drilling and Environmental Services

Table 3.2

Operation and Maintenance Activities
Groundwater Extraction System
January 2017 - December 2017
Highway 96 Site
White Bear Township, Minnesota

Date	Location	Event	Remedy	Contractor
07/12/2017	Dewatering Sump Pump House and Landfill Cap	Routine Maintenance, Site Improvements	Replaced pressure gauge for Dewatering Sump. Sealed pump house to prevent animals/bugs from entering. Installed T-posts at 12 locations on landfill cap to mark monitoring well and gas probe locations in tall grass/snow.	GHD (M. Barnes)
08/25/2017	Landfill Cap	Cap Mowing+A4 Gas Vent Maintenance	Conducted landfill cap inspection. Mowed landfill cap, area around meter building, and ravine near East Oaks Road. Trim around gas vents.	GHD (M. Barnes/ B. Lardy)
08/30/2017	EW-2	Pipe Leak	Discovered leak in pressure gauge piping. Repaired connection.	GHD (M. Barnes)
11/02/2017	Landfill Cap	Annual Inspection	Conducted Annual landfill cap inspection.	GHD (M. Barnes)
12/05/2017 - 12/08/2017	EW-1B and EW-2	Routine Maintenance	Conducted specific capacity checks to evaluate performance.	GHD (M. Barnes)

Table 3.3

2017 Average Monthly Groundwater Extraction Rates
Highway 96 Site
White Bear Township, Minnesota

	Average Pumping Rate			
Month	**EW1B (gpm)**	**EW2 (gpm)**	**Combined* (gpm)**	**Dewatering Sump (gpm)**
January	10.0	10.0	20.0	3.1 (1)
February	9.9	9.9	19.8	4.1
March	10.3	10.0	20.3	4.0
April	10.1	8.3 (2)	18.4	3.8
May	10.0	10.0	19.9	1.0 (3)
June	9.2 (1)(4)	9.8 (4)	19.0	0.9 (3)
July	10.0	9.8	19.7	3.7
August	10.1	10.2	20.3	3.6
September	10.1	10.1	20.2	3.6
October	10.2	10.0	20.1	3.6
November	10.1	10.2	20.3	3.3
December	9.3 (4)	9.6 (4)	19.0	3.0
Annual Average	10.0	9.8	19.8	3.1

Notes:

* - Combined pumping rate of EW1B and EW2 to be maintained between 13 and 20 gpm, as outlined in CRA's letter to MPCA dated July 9, 2010.

(1) - Pump temporarily off for pump repair & routine well rehabilitation.

(2) - Flow meter failure observed during routine inspection.Meter replaced on April 14, 2017.

(3) - Sump turned off on May 10, 2017 due to low pressure. Pump replaced on June 21, 2017.

(4) - Pump temporarily off for specific capacity checks.

Table 4.1

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

Round	Date	Sampled By	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	October/November 1999	CRA	Samples from compliance point (pilot study), leachate, monitoring, and residential wells
34	January/February 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

Table 4.1

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

Round	Date	Sampled By	Description
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
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	October/November 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	September/October 2013	CRA/MPCA	Samples from leachate, monitoring, and residential wells
71	April 2014	CRA/MPCA	Samples from residential wells
72	September/October 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/MPCA	Samples from leachate, monitoring, and residential wells

Table 4.2

2017 Groundwater Analytical Data Detections
Perched Groundwater Unit Monitoring Wells
Highway 96 Site
White Bear Township, Minnesota

Location	Date		Chemical oxygen demand (COD) mg/L	Chloride mg/L	Solids, Total Suspended mg/L	1,1-Dichloroethane ug/L	1,2-Dichloroethane ug/L	Acetone ug/L	Benzene ug/L	Chloroethane ug/L	Chloroform ug/L	cis-1,2-Dichloroethene ug/L	Dichlorodifluoromethane ug/L
On-Site Monitoring Wells													
Dewatering Sump	01/18/17		NA	NA	NA	1.3	0.63 J	< 10	2.8	9.7	< 1.0	0.86	0.57 J
Dewatering Sump	04/05/17		NA	NA	NA	1.6	0.72 J	< 10	3.3	11	< 1.0	1.0	0.77 J
Dewatering Sump	07/12/17		NA	NA	NA	1.9	< 1.0	< 10	3.5	11	0.41 J	0.98	< 1.0
Dewatering Sump	10/04/17		37	NA	< 4.0	1.3	0.54 J	< 10	2.6	13	< 1.0	0.76	0.88 J
LW1	10/03/17		NA	7.0	NA	0.25 J	< 1.0	< 10	< 1.0	< 1.0	< 1.0	< 0.50	< 1.0
LW2	10/03/17		NA	3.4	NA	< 6.7	< 6.7	120	< 6.7	3.7 J	< 6.7	< 3.3	< 6.7
LW3	10/02/17		NA	32	NA	1.0	0.34 J	< 10	1.0	< 1.0	< 1.0	0.35 J	11
LW3	10/02/17	D	NA	31	NA	1.0	0.41 J	< 10	1.1	< 1.0	< 1.0	0.35 J	12
MW1S	10/03/17		NA	48	NA	< 1.0	< 1.0	< 10	< 1.0	< 1.0	< 1.0	< 0.50	< 1.0
MW4U	10/02/17		NA	110	NA	30	1.4 J	< 20	2.4	39	< 2.0	17	< 2.0

2017 Groundwater Analytical Data Detections
Perched Groundwater Unit Monitoring Wells
Highway 96 Site
White Bear Township, Minnesota

Location	Date		Dichlorofluoromethane ug/L	Ethyl ether ug/L	Ethylbenzene ug/L	Isopropylbenzene ug/L	Methylene chloride ug/L	Toluene ug/L	trans-1,2-Dichloroethene ug/L	Trichloroethene ug/L	Vinyl chloride ug/L	Xylenes, Total ug/L	Total VOCs ug/L
On-Site Monitoring Wells													
Dewatering Sump	01/18/17		< 1.0	< 2.0	11	0.80 J	< 1.0	1.4	1.3	< 1.0	22	6.6	58.96
Dewatering Sump	04/05/17		0.43 J	< 2.0	13	0.77 J	< 1.0	1.3	1.5	< 1.0	25	5.3	65.69
Dewatering Sump	07/12/17		< 1.0	< 2.0	11	0.74 J	< 1.0	1.9	1.2	< 1.0	24	7.8	64.43
Dewatering Sump	10/04/17		< 1.0	< 2.0	9.6	0.50 J	< 1.0	1.3	1.0	< 1.0	20	4.9	56.38
LW1	10/03/17		< 1.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.50	< 1.0	< 1.0	< 1.0	0.25
LW2	10/03/17		< 6.7	< 13	< 6.7	< 6.7	< 6.7	< 6.7	< 3.3	< 6.7	< 6.7	< 6.7	123.7
LW3	10/02/17		< 1.0	0.59 J	< 1.0	< 1.0	< 1.0	< 1.0	< 0.50	0.33 J	< 1.0	< 1.0	14.61
LW3	10/02/17	D	< 1.0	0.57 J	< 1.0	< 1.0	< 1.0	< 1.0	< 0.50	0.35 J	< 1.0	< 1.0	15.78
MW1S	10/03/17		< 1.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.50	< 1.0	< 1.0	< 1.0	ND
MW4U	10/02/17		< 2.0	< 4.0	1.0 J	< 2.0	< 2.0	1.1 J	2.1	2.3	10	4.1	110.4

Notes:

D - Duplicate Sample
J - Estimated
NA - Not Analyzed
ND - Not Detected

Table 4.3

2017 Groundwater Analytical Data Detections
Lower Sand Aquifer Monitoring Wells
Highway 96 Site
White Bear Township, Minnesota

Location	SCG [1] Date		Chemical oxygen demand (COD) NE mg/L	Chloride NE mg/L	Solids, Total Suspended NE mg/L	1,1-Dichloroethane 70 ug/L	1,2-Dichloroethane 4 ug/L	Acetone 700 ug/L	Benzene 5 ug/L	Chloroethane NE ug/L	Chloroform 60 ug/L	cis-1,2-Dichloroethene 70 ug/L	Dichlorodifluoromethane 1000 ug/L
On-Site Monitoring Wells													
EW1B	01/18/17		NA	NA	NA	5.8	< 3.3	< 33	< 3.3	2.7 J	< 3.3	13	1.7 J
EW1B	04/05/17		NA	NA	NA	6.7	< 3.3	< 33	< 3.3	3.3	< 3.3	16	2.6 J
EW1B	07/12/17		NA	NA	NA	7.1	< 2.0	< 20	< 2.0	0.96 J	< 2.0	13	1.9 J
EW1B	10/04/17		17	NA	25	6.7	< 3.3	< 33	< 3.3	4.5	< 3.3	16	2.1 J
MW1D	10/03/17		NA	32	NA	< 1.0	< 1.0	< 10	< 1.0	< 1.0	< 1.0	< 0.50	2.1
MW4S	10/03/17		NA	110	NA	25	1.8 J	< 50	2.4 J	56	< 5.0	12	< 5.0
MW10D	10/02/17		NA	18	NA	NA	NA	NA	NA	NA	NA	NA	NA
Compliance Monitoring Wells [1]													
MW12D	10/03/17		NA	50	NA	< 1.0	< 1.0	< 10	< 1.0	< 1.0	< 1.0	< 0.50	< 1.0
MW13D	10/03/17		NA	53	NA	1.3	< 1.0	< 10	< 1.0	< 1.0	< 1.0	0.67	< 1.0
MW16D	10/03/17		NA	50	NA	0.44 J	< 1.0	< 10	< 1.0	0.48 J	< 1.0	< 0.50	< 1.0

Table 4.3

2017 Groundwater Analytical Data Detections
Lower Sand Aquifer Monitoring Wells
Highway 96 Site
White Bear Township, Minnesota

Location	SCG [1] Date		Dichlorofluoromethane NE ug/L	Ethyl ether 1000 ug/L	Ethylbenzene 700 ug/L	Isopropylbenzene 300 ug/L	Methylene chloride 5 ug/L	Toluene 1000 ug/L	trans-1,2-Dichloroethene 100 ug/L	Trichloroethene 5 ug/L	Vinyl chloride 2 ug/L	Xylenes, Total 10000 ug/L	Total VOCs - ug/L
On-Site Monitoring Wells													
EW1B	01/18/17		1.7 J	< 6.7	< 3.3	< 3.3	< 3.3	< 3.3	< 1.7	74	6.9	< 3.3	105.8
EW1B	04/05/17		2.1 J	< 6.7	< 3.3	< 3.3	4.7	< 3.3	1.2 J	79	7.4	< 3.3	123
EW1B	07/12/17		1.7 J	< 4.0	< 2.0	< 2.0	< 2.0	< 2.0	0.93 J	59	6.8	< 2.0	91.39
EW1B	10/04/17		< 3.3	< 6.7	< 3.3	< 3.3	< 3.3	< 3.3	1.2 J	79	8.4	< 3.3	117.9
MW1D	10/03/17		0.68 J	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.50	< 1.0	< 1.0	< 1.0	2.78
MW4S	10/03/17		< 5.0	< 10	< 5.0	< 5.0	< 5.0	< 5.0	2.0 J	< 5.0	14	< 5.0	113.2
MW10D	10/02/17		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Compliance Monitoring Wells [1]													
MW12D	10/03/17		< 1.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.50	< 1.0	< 1.0	< 1.0	ND
MW13D	10/03/17		< 1.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.50	< 1.0	< 1.0	< 1.0	1.97
MW16D	10/03/17		< 1.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.50	< 1.0	< 1.0	< 1.0	0.92

Notes:

[1] - Site Cleanup Goals (SCGs) apply to compliance monitoring wells only.

Shaded results exceed SCGs, where applicable.[1]

J - Estimated
NA - Not Analyzed
ND - Not Detected
NE - Not Established

Table 4.4

2017 Groundwater Analytical Data Detections
St. Peter Sandstone Aquifer Monitoring Wells
Highway 96 Site
White Bear Township, Minnesota

Location	SCG [1] Date		Chemical oxygen demand (COD) NE mg/L	Chloride NE mg/L	Solids, Total Suspended NE mg/L	1,1-Dichloroethane 70 ug/L	1,2-Dichloroethane 4 ug/L	Acetone 700 ug/L	Benzene 5 ug/L	Chloroethane NE ug/L	Chloroform 60 ug/L	cis-1,2-Dichloroethene 70 ug/L	Dichlorodifluoromethane 1000 ug/L
On-Site Monitoring Wells													
EW2	01/18/17		NA	NA	NA	13	0.89 J	< 10	0.52 J	12	< 1.0	13	4.6
EW2	04/05/17		NA	NA	NA	18	1.0	< 10	0.68 J	15	< 1.0	15	6.7
EW2	07/12/17		NA	NA	NA	19	1.0	< 10	0.75 J	17	< 1.0	13	4.5
EW2	10/04/17		17	NA	18	16	1.0	< 10	0.68 J	21	< 1.0	13	4.7
MW8B	10/03/17		NA	25	NA	0.32 J	< 1.0	< 10	< 1.0	3.4	< 1.0	< 0.50	1.7
Compliance Monitoring Wells [1]													
MW10B	10/03/17		NA	1.7	NA	< 1.0	< 1.0	< 10	< 1.0	< 1.0	< 1.0	< 0.50	< 1.0
MW12B	10/03/17		NA	11	NA	< 1.0	< 1.0	< 10	< 1.0	< 1.0	< 1.0	< 0.50	< 1.0
MW13B	10/03/17		NA	22	NA	< 1.0	< 1.0	< 10	< 1.0	< 1.0	< 1.0	< 0.50	< 1.0
MW16B	10/02/17		NA	12	NA	< 1.0	< 1.0	< 10	< 1.0	< 1.0	< 1.0	< 0.50	1.2
Converted Residential Monitoring Wells													
6 Blue Goose Lane	09/29/17		NA	11.7	NA	< 0.50	< 0.50	< 10	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
6 Blue Goose Lane	09/29/17	D	NA	11.7	NA	< 0.50	< 0.50	< 10	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
1 Lily Pond Road	09/28/17		NA	19.2	NA	7.0	< 0.50	< 10	< 0.50	< 0.50	< 0.50	< 0.50	2.9
11 Lily Pond Road	09/28/17		NA	3.9	NA	< 0.50	< 0.50	< 10	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
11 Robb Farm Road	10/02/17		NA	18.0	NA	0.35 J	< 0.50	< 10	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50

2017 Groundwater Analytical Data Detections
St. Peter Sandstone Aquifer Monitoring Wells
Highway 96 Site
White Bear Township, Minnesota

Location	SCG [1] Date		Chemical oxygen demand (COD) NE mg/L	Chloride NE mg/L	Solids, Total Suspended NE mg/L	1,1-Dichloroethane 70 ug/L	1,2-Dichloroethane 4 ug/L	Acetone 700 ug/L	Benzene 5 ug/L	Chloroethane NE ug/L	Chloroform 60 ug/L	cis-1,2-Dichloroethene 70 ug/L	Dichlorodifluoromethane 1000 ug/L
Off-Site Monitoring Wells													
EW3	09/28/17		NA	21.4	NA	< 0.50	< 0.50	< 10	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
MW17A	09/29/17		NA	69.2	NA	< 0.50	< 0.50	< 10	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
MW17B	09/29/17		NA	28.9	NA	< 0.50	< 0.50	< 10	0.84	< 0.50	< 0.50	< 0.50	< 0.50
MW18A	10/02/17		NA	69.7	NA	< 0.50	< 0.50	< 10	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
MW18B	09/29/17		NA	14.4	NA	< 0.50	< 0.50	< 10	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
MW19A	09/29/17		NA	68.2	NA	< 0.50	< 0.50	< 10	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
MW19B	09/28/17		NA	11.7	NA	< 0.50	< 0.50	< 10	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
MW20B	09/28/17		NA	15.7	NA	< 0.50	< 0.50	< 10	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
MW21A	09/29/17		NA	8.6	NA	< 0.50	< 0.50	< 10	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
MW21A	09/29/17	D	NA	8.2	NA	< 0.50	< 0.50	< 10	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50

2017 Groundwater Analytical Data Detections
St. Peter Sandstone Aquifer Monitoring Wells
Highway 96 Site
White Bear Township, Minnesota

Location	SCG [1] Date		Dichlorofluoromethane NE ug/L	Ethyl ether 1000 ug/L	Ethylbenzene 700 ug/L	Isopropylbenzene 300 ug/L	Methylene chloride 5 ug/L	Toluene 1000 ug/L	trans-1,2-Dichloroethene 100 ug/L	Trichloroethene 5 ug/L	Vinyl chloride 2 ug/L	Xylenes, Total 10000 ug/L	Total VOCs -- ug/L
On-Site Monitoring Wells													
EW2	01/18/17		8.9	< 2.0	< 1.0	< 1.0	< 1.0	0.97 J	< 0.50	1.6	11	< 1.0	66.48
EW2	04/05/17		12	< 2.0	< 1.0	< 1.0	< 1.0	0.78 J	0.30 J	2.7	13	< 1.0	85.16
EW2	07/12/17		12	< 2.0	< 1.0	< 1.0	< 1.0	1.0	< 0.50	1.7	12	< 1.0	81.95
EW2	10/04/17		14	< 2.0	< 1.0	< 1.0	< 1.0	1.3	< 0.50	2.2	11	< 1.0	84.88
MW8B	10/03/17		1.3 J	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.50	< 1.0	0.67 J	< 1.0	7.39
Compliance Monitoring Wells [1]													
MW10B	10/03/17		< 1.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.50	< 1.0	< 1.0	< 1.0	ND
MW12B	10/03/17		< 1.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.50	< 1.0	< 1.0	< 1.0	ND
MW13B	10/03/17		< 1.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.50	< 1.0	< 1.0	< 1.0	ND
MW16B	10/02/17		< 1.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.50	< 1.0	< 1.0	< 1.0	1.2
Converted Residential Monitoring Wells													
6 Blue Goose Lane	09/29/17		< 0.50	< 0.50	< 0.50	< 0.50	< 2.5	< 0.50	< 0.50	< 0.20	< 0.20	< 1.0	ND
6 Blue Goose Lane	09/29/17	D	< 0.50	< 0.50	< 0.50	< 0.50	< 2.5	< 0.50	< 0.50	< 0.20	< 0.20	< 1.0	ND
1 Lily Pond Road	09/28/17		1.8	< 0.50	< 0.50	< 0.50	< 2.5	< 0.50	< 0.50	< 0.20	< 0.20	< 1.0	11.7
11 Lily Pond Road	09/28/17		< 0.50	< 0.50	< 0.50	< 0.50	< 2.5	< 0.50	< 0.50	< 0.20	< 0.20	< 1.0	ND
11 Robb Farm Road	10/02/17		< 0.50	< 0.50	< 0.50	< 0.50	< 2.5	< 0.50	< 0.50	< 0.20	< 0.20	< 1.0	0.35

2017 Groundwater Analytical Data Detections
St. Peter Sandstone Aquifer Monitoring Wells
Highway 96 Site
White Bear Township, Minnesota

Location	SCG (1) Date		Dichlorofluoromethane NE ug/L	Ethyl ether 1000 ug/L	Ethylbenzene 700 ug/L	Isopropylbenzene 300 ug/L	Methylene chloride 5 ug/L	Toluene 1000 ug/L	trans-1,2-Dichloroethene 100 ug/L	Trichloroethene 5 ug/L	Vinyl chloride 2 ug/L	Xylenes, Total 10000 ug/L	Total VOCs -- ug/L
Off-Site Monitoring Wells													
EW3	09/28/17		< 0.50	< 0.50	< 0.50	< 0.50	< 2.5	< 0.50	< 0.50	< 0.20	< 0.20	< 1.0	ND
MW17A	09/29/17		< 0.50	< 0.50	< 0.50	< 0.50	< 2.5	< 0.50	< 0.50	< 0.20	< 0.20	< 1.0	ND
MW17B	09/29/17		< 0.50	< 0.50	< 0.50	< 0.50	< 2.5	< 0.50	< 0.50	< 0.20	< 0.20	< 1.0	0.84
MW18A	10/02/17		< 0.50	< 0.50	< 0.50	< 0.50	< 2.5	< 0.50	< 0.50	< 0.20	< 0.20	< 1.0	ND
MW18B	09/29/17		< 0.50	< 0.50	< 0.50	< 0.50	< 2.5	< 0.50	< 0.50	< 0.20	< 0.20	< 1.0	ND
MW19A	09/29/17		< 0.50	< 0.50	< 0.50	< 0.50	< 2.5	< 0.50	< 0.50	< 0.20	< 0.20	< 1.0	ND
MW19B	09/28/17		< 0.50	< 0.50	< 0.50	< 0.50	< 2.5	< 0.50	< 0.50	< 0.20	< 0.20	< 1.0	ND
MW20B	09/28/17		< 0.50	< 0.50	< 0.50	< 0.50	< 2.5	< 0.50	< 0.50	< 0.20	< 0.20	< 1.0	ND
MW21A	09/29/17		< 0.50	< 0.50	< 0.50	< 0.50	< 2.5	< 0.50	< 0.50	< 0.20	< 0.20	< 1.0	ND
MW21A	09/29/17	D	< 0.50	< 0.50	< 0.50	< 0.50	< 2.5	< 0.50	< 0.50	< 0.20	< 0.20	< 1.0	ND

Notes:

(1) - Site Cleanup Goals (SCGs) apply to compliance monitoring wells only.

Shaded results exceed SCGs, where applicable. (1)

D - Duplicate Sample

J - Estimated

NA - Not Analyzed

ND - Not Detected

NE - Not Established

2017 Groundwater Analytical Data Detections
Prairie Du Chien Aquifer Monitoring Wells
Highway 96 Site
White Bear Township, Minnesota

Location	Date		Chemical oxygen demand (COD) mg/L	Chloride mg/L	Solids, Total Suspended mg/L	1,1-Dichloroethane ug/L	1,2-Dichloroethane ug/L	Acetone ug/L	Benzene ug/L	Chloroethane ug/L	Chloroform ug/L	cis-1,2-Dichloroethene ug/L	Dichlorodifluoromethane ug/L
Off-Site Monitoring Wells													
MW17L	09/29/17		NA	11.3	NA	< 0.50	< 0.50	< 10	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
MW18L	10/02/17		NA	23.2	NA	0.21 J	< 0.50	< 10	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
MW19L	09/28/17		NA	13.2	NA	< 0.50	< 0.50	< 10	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50

2017 Groundwater Analytical Data Detections
Prairie Du Chien Aquifer Monitoring Wells
Highway 96 Site
White Bear Township, Minnesota

Location	Date		Dichlorofluoromethane ug/L	Ethyl ether ug/L	Ethylbenzene ug/L	Isopropylbenzene ug/L	Methylene chloride ug/L	Toluene ug/L	trans-1,2-Dichloroethene ug/L	Trichloroethene ug/L	Vinyl chloride ug/L	Xylenes, Total ug/L	Total VOCs ug/L
Off-Site Monitoring Wells													
MW17L	09/29/17		< 0.50	< 0.50	< 0.50	< 0.50	< 2.5	2.0	< 0.50	< 0.20	< 0.20	< 1.0	2.0
MW18L	10/02/17		< 0.50	< 0.50	< 0.50	< 0.50	< 2.5	< 0.50	< 0.50	< 0.20	< 0.20	< 1.0	0.21
MW19L	09/28/17		< 0.50	< 0.50	< 0.50	< 0.50	< 2.5	1.4	< 0.50	< 0.20	< 0.20	< 1.0	1.4

Notes:

J - Estimated
NA - Not Analyzed

2017 Groundwater Analytical Detections
Residential Wells
Highway 96 Site
White Bear Township, Minnesota

Address	Date	QA/QC	Chloride	1,1-Dichloroethane (1,1-DCA)	2,2-Dichloropropane	cis-1,2-Dichloroethene	Dichlorodifluoromethane (CFC-12)	Dichlorofluoromethane (DCFM)	Total VOCs
MDH HBG *		Basis	NE	80	NE	6	500	20	-
			--	RAA	--	HBV	RAA	RAA	--
			mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
1 Birch Lane	10/18/2017		7.4	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	ND
1 Buffalo Road	10/19/2017		31.5	0.28 J	< 0.50	< 0.50	< 0.50	< 0.50	0.28
1 Eagle Ridge Road	4/27/2017		18.9	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	ND
1 Eagle Ridge Road	10/18/2017		19.1	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	ND
1 Eagle Ridge Road	10/18/2017	D	19.1	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	ND
1 Gadwall	10/19/2017		32.8	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	ND
1 Hummingbird Hill	4/27/2017		29.1	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	ND
1 Hummingbird Hill	10/25/2017		28.0	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	ND
1 Poplar Lane	10/17/2017		1.3	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	ND
1 Quail Lane	10/18/2017		27.0	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	ND
1 Robb Farm Road	10/19/2017		1.2	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	ND
1 Thompson Lane	4/28/2017		35.8	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	ND
1 Thompson Lane	10/19/2017		32.8	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	ND
1 West Shore Road	10/16/2017		38.6	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	ND
10 Eagle Ridge Road	10/18/2017		14.8	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	ND
10 Ski Lane	4/28/2017		30.1	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	ND
10 Ski Lane	10/18/2017		26.3	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	ND
10 West Shore Road	4/27/2017		29.9	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	ND
10 West Shore Road	10/17/2017		29.1	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	ND
11 West Shore Road	4/27/2017		34.6	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	ND
11 West Shore Road	10/17/2017		25.3	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	ND
11 West Shore Road	10/17/2017	D	25.2	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	ND
12 Ski Lane	4/28/2017		24.6	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	ND
12 Ski Lane	10/18/2017		24.6	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	ND
14 Ski Lane	4/28/2017		27.6	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	ND
14 Ski Lane	10/18/2017		39.6	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	ND
15 Duck Pass Road	10/19/2017		26.3	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	ND
15 Duck Pass Road	10/19/2017	D	26.4	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	ND
15 West Shore Road	4/27/2017		< 1.0	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	ND

2017 Groundwater Analytical Detections
Residential Wells
Highway 96 Site
White Bear Township, Minnesota

Address	Date	QA/QC	Chloride	1,1-Dichloroethane (1,1-DCA)	2,2-Dichloropropane	cis-1,2-Dichloroethene	Dichlorodifluoromethane (CFC-12)	Dichlorofluoromethane (DCFM)	Total VOCs
MDH HBG *		Basis	NE	80	NE	6	500	20	-
			--	RAA	--	HBV	RAA	RAA	--
			mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
15 West Shore Road	10/17/2017		39.2	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	ND
16 Ski Lane	4/28/2017		35.7	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	ND
16 Ski Lane	10/18/2017		26.6	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	ND
2 Birch Lane	10/18/2017		14.3	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	ND
2 Cardinal	10/16/2017		26.1	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	ND
2 Eagle Ridge Road	4/27/2017		34.6	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	ND
2 Eagle Ridge Road	10/18/2017		33.3	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	ND
2 Gadwall	10/19/2017		29.7	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	ND
2 Gadwall	10/19/2017	D	29.7	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	ND
2 West Shore Road	10/18/2017		54.0	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	ND
2 Heron Lane	10/18/2017		17.0	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	ND
20 Duck Pass Road	10/19/2017		41.4	0.79	< 0.50	< 0.50	1.0	0.57	2.36
24 Duck Pass Road	10/25/2017		7.2	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	ND
26 Duck Pass Road	10/19/2017		32.2	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	ND
28 Duck Pass Road	10/19/2017		69.2	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	ND
3 Birch Lane	10/18/2017		6.9	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	ND
3 Buffalo Road	4/27/2017		27.7	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	ND
3 Buffalo Road	4/27/2017	D	27.6	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	ND
3 Buffalo Road	10/18/2017		36.5	0.19 J	< 0.50	< 0.50	< 0.50	< 0.50	0.19
3 Eagle Ridge Road	10/18/2017		31.2	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	ND
3 Gadwall	10/19/2017		25.6	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	ND
3 Mallard Lane	10/16/2017		15.4	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	ND
3 Poplar Lane	10/17/2017		25.5	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	ND
3 Quail Lane	4/28/2017		26.0	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	ND
3 Thompson Lane	4/28/2017		26.2	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	ND
3 Thompson Lane	10/18/2017		20.7	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	ND
3 Thompson Lane	10/18/2017	D	20.7	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	ND
3 West Shore Road	10/17/2017		12.4	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	ND
32 East Oaks Road	10/18/2017		32.4	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	ND

2017 Groundwater Analytical Detections
Residential Wells
Highway 96 Site
White Bear Township, Minnesota

Address	Date	QA/QC	Chloride	1,1-Dichloroethane (1,1-DCA)	2,2-Dichloropropane	cis-1,2-Dichloroethene	Dichlorodifluoromethane (CFC-12)	Dichlorofluoromethane (DCFM)	Total VOCs
MDH HBG *		Basis	NE	80	NE	6	500	20	-
			--	RAA	--	HBV	RAA	RAA	--
			mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
35 Robb Farm Road	10/17/2017		58.6	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	ND
36 East Oaks Road	10/18/2017		23.2	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	ND
37 Robb Farm Road	10/17/2017		8.2	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	ND
37 Robb Farm Road	10/17/2017	D	8.3	< 0.50	1.0	< 0.50	< 0.50	< 0.50	1.0
38 East Oaks Road	10/25/2017		2.1	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	ND
4 Eagle Ridge Road	4/27/2017		28.6	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	ND
4 Eagle Ridge Road	10/18/2017		28.2	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	ND
4 Gadwall	10/16/2017		38.2	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	ND
4 Poplar Lane	10/17/2017		23.6	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	ND
4 West Shore Road	10/17/2017		50.8	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	ND
4 Cardinal	10/19/2017		0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	ND
41 Robb Farm Road	10/17/2017		4.2	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	ND
43 Robb Farm Road	10/17/2017		69.9	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	ND
44 East Oaks Road	4/27/2017		13.0	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	ND
44 East Oaks Road	10/17/2017		13.2	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	ND
44 Robb Farm Road	10/25/2017		28.9	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	ND
45 Robb Farm Road	10/17/2017		25.8	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	ND
5 Mallard Lane	10/19/2017		4.5	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	ND
5 West Shore Road	10/17/2017		8.4	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	ND
50 East Oaks Road	4/27/2017		32.8	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	ND
50 East Oaks Road	4/27/2017	D	33.2	0.22 J	< 0.50	0.27 J	< 0.50	< 0.50	0.49
50 East Oaks Road	10/18/2017		37.5	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	ND
6 Eagle Ridge Road	4/27/2017		52.3	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	ND
6 Eagle Ridge Road	10/18/2017		45.5	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	ND
6 Mallard Lane	10/19/2017		3.8	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	ND
6 Poplar Lane	10/17/2017		5.3	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	ND
6 Ski Lane	4/28/2017		30.0	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	ND
6 Ski Lane	10/18/2017		28.6	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	ND
6 West Shore Road	10/17/2017		6.5	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	ND

2017 Groundwater Analytical Detections
Residential Wells
Highway 96 Site
White Bear Township, Minnesota

Address	Date	QA/QC	Chloride	1,1-Dichloroethane (1,1-DCA)	2,2-Dichloropropane	cis-1,2-Dichloroethene	Dichlorodifluoromethane (CFC-12)	Dichlorofluoromethane (DCFM)	Total VOCs
MDH HBG *		Basis	NE	80	NE	6	500	20	-
			--	RAA	--	HBV	RAA	RAA	--
			mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
7 Mallard Lane	10/19/2017		11.7	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	ND
7 West Shore Road	10/19/2017		8.9	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	ND
8 Poplar Lane	4/27/2017		35.1	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	ND
8 Poplar Lane	10/17/2017		35.7	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	ND
8 Poplar Lane	10/17/2017	D	36.5	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	ND
8 Ski Lane	4/28/2017		20.4	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	ND
8 Ski Lane	10/18/2017		26.0	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	ND
8 West Shore Road	10/17/2017		5.4	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	ND
9 Duck Pass Road	10/19/2017		37.3	0.67	< 0.50	< 0.50	0.60	< 0.50	1.27
9 West Shore Road	4/27/2017		34.9	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	ND
9 West Shore Road	4/27/2017	D	35.4	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	ND
9 West Shore Road	10/17/2017		24.0	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	ND

Notes:

* - Where multiple guidance values are available, the lowest value is used for screening purposes
D - Duplicate Sample
HBG - Health-Based Guidance established by the MDH
HBV - Health Based Value
HRL - Health Risk Limit [promulgated]
J - Estimated
MDH - Minnesota Department of Health
NE - None Established
RAA - Risk Assessment Advice

Table 5.1

Historical MSA Gas Probe Monitoring Results
Highway 96 Site
White Bear Township, Minnesota

Probe	Date	Pressure (in. w.c.)	% Combustible Gas w/charcoal	% Combustible Gas w/o charcoal
GP1	05/19/1995	NM	10.0	NM
	06/29/1995	0.0	35.0	25.0
	09/06/1995	0.0	NM	16.0
	11/16/1995	NM	11.0	9.0
	05/20/1996	0.0	50.0	50.0
	08/09/1996	0.0	NM	32.0
	10/11/1996	0.0	25.0	32.0
	06/06/1997	0.0	30.0	34.0
	09/18/1997	0.0	70.0	71.0
	11/25/1997	NM	54.0	54.0
	05/18/1998	0.0	54.0	56.0
	09/23/1998	0.0	48.0	58.0
	10/26/1998	0.0	68.0	58.0
	04/08/1999	0.0	24.0	36.0
	07/16/1999	0.0	16.0	12.0
	11/02/1999	0.0	1.1	4.6
	06/30/2000	0.0[(1)]	56.0	44.0
	09/21/2000	0.0[(1)]	0.0	0.0
	01/05/2001	0.2[(1)]	57.0	54.0
GP2	05/19/1995	NM	45.0	NM
	06/29/1995	0.0	42.0	30.0
	09/06/1995	0.0	NM	48.0
	11/16/1995	NM	50.0	50.0
	05/20/1996	0.0	32.0	40.0
	08/09/1996	0.0	NM	24.0
	10/11/1996	0.0	13.0	20.0
	06/06/1997	0.0	17.0	24.0
	09/18/1997	0.0	54.0	70.0
	11/25/1997	NM	25.0	34.0
	05/18/1998	0.0	29.0	35.0
	09/23/1998	0.0	4.4	2.6
	10/26/1998	0.0	3.8	22.0
	04/08/1999	0.0	0.0	0.0
	07/16/1999	0.0	15.0	16.0
	11/02/1999	0.0	2.0	3.6
	06/30/2000	0.4[(1)]	12.0	8.0
	09/21/2000	0.0[(1)]	5.0	9.0
	01/05/2001	0.0[(1)]	32.0	32.0

Table 5.1

Historical MSA Gas Probe Monitoring Results
Highway 96 Site
White Bear Township, Minnesota

Probe	Date	Pressure (in. w.c.)	% Combustible Gas w/charcoal	% Combustible Gas w/o charcoal
GP3	05/19/1995	NM	76.0	NM
	06/29/1995	0.0	70.0	70.0
	09/06/1995	0.0	NM	78.0
	11/16/1995	NM	72.0	72.0
	05/20/1996	0.0	82.0	82.0
	08/09/1996	0.0	NM	85.0
	10/11/1996	0.0	75.0	75.0
	06/06/1997	0.0	8.0	14.0
	09/18/1997	0.0	90.0	90.0
	11/25/1997	NM	93.0	93.0
	05/18/1998	0.0	80.0	84.0
	09/23/1998	0.0	78.0	90.0
	10/26/1998	0.0	88.0	88.0
	04/08/1999	0.0	100*	110*
	07/16/1999	0.0	0.0	0.0
	11/02/1999	0.0	9.0	11.0
	06/30/2000	0.1(1)	23.0	22.0
	09/21/2000	0.0(1)	0.0	0.0
	01/05/2001	0.1(1)	38.0	36.0
GP4	05/19/1995	NM	79.0	NM
	06/29/1995	>5	54.0	40.0
	09/06/1995	>5	NM	72.0
	11/16/1995	NM	80.0	82.0
	05/20/1996	1.0	40.0	40.0
	08/09/1996	0.0	NM	28.0
	10/11/1996	0.0	72.0	74.0
	06/06/1997	0.0	0.3	0.8
	09/18/1997	0.0	63.0	78.0
	11/25/1997	NM	83.0	85.0
	05/18/1998	0.0	30.0	44.0
	09/23/1998	0.0	26.0	26.0
	10/26/1998	0.0	44.0	40.0
	04/08/1999	0.0	8.0	0.0
	07/16/1999	0.0	0.0	0.0
	11/02/1999	0.0	0.3	0.9
	06/30/2000	0.0(1)	0.0	0.0
	09/21/2000	0.1(1)	0.0	0.0
	01/05/2001	0.0(1)	52.0	56.0

Table 5.1

Historical MSA Gas Probe Monitoring Results
Highway 96 Site
White Bear Township, Minnesota

Probe	Date	Pressure (in. w.c.)	% Combustible Gas w/charcoal	% Combustible Gas w/o charcoal
GP5	05/19/1995	NM	82.0	NM
	06/29/1995	0.0	80.0	80.0
	09/06/1995	0.0	NM	88.0
	11/16/1995	NM	80.0	80.0
	05/20/1996	0.0	82.0	82.0
	08/09/1996	0.0	NM	29.0
	10/11/1996	0.0	46.0	46.0
	06/06/1997	0.0	16.0	28.0
	09/18/1997	0.0	33.0	34.0
	11/25/1997	NM	50.0	52.0
	05/18/1998	0.0	40.0	42.0
	09/23/1998	0.0	30.0	32.0
	10/26/1998	0.0	24.0	28.0
	04/08/1999	0.0	102*	140*
	07/16/1999	0.0	10.0	0.0
	11/02/1999	0.0	0.0	0.0
	06/30/2000	0.0[(1)]	33.0	32.0
	09/21/2000	0.0[(1)]	0.0	0.0
	01/05/2001	0.0[(1)]	45.0	42.0
GP6	05/19/1995	NM	0.5	NM
	06/29/1995	0.0	5.7	4.5
	09/06/1995	0.0	NM	50.0
	11/16/1995	NM	18.0	18.0
	05/20/1996	0.0	30.0	35.0
	08/09/1996	0.0	NM	0.0
	10/11/1996	0.0	8.0	9.0
	06/06/1997	0.0	0.0	0.0
	09/18/1997	0.0	1.5	1.6
	11/25/1997	NM	39.0	40.0
	05/18/1998	0.0	47.0	52.0
	09/23/1998	0.0	1.5	1.4
	10/26/1998	0.0	0.0	0.0
	04/08/1999	0.0	19.0	30.0
	07/16/1999	0.0	0.0	0.0
	11/02/1999	0.0	0.0	0.0
	06/30/2000	0.0[(1)]	32.0	30.0
	09/21/2000	0.0[(1)]	0.0	0.0
	01/05/2001	0.0[(1)]	42.0	40.0

Notes:

* Anomalous data point.
[(1)] Pressure measured with LandTec GEM 500

Table 5.2

Landtec GEM 500
Gas Probe Monitoring Results
Highway 96 Site
White Bear Township, Minnesota

		LandTec GEM 500 Readings*			
Probe	**Date**	**Pressure (in. H_2O)**	**%CH_4**	**%CO_2**	**%O_2**
GP1	11/02/99	0.0	1.3	17.6	3.5
GP1	06/30/00	0.0	46.3	13.2	5.1
GP1	09/21/00	0.0	3.6	1.4	19.3
GP1	01/05/01	0.2	62.4	12.3	2.3
GP1	05/18/01	0.0	0.0	8.1	6.8
GP1	08/17/01	0.0	0.4	12.4	1.9
GP1	06/17/02	0.0	0.0	7.3	6.0
GP1	11/04/02	0.0	0.0	4.2	14.9
GP1	05/20/03	0.0	0.0	2.5	15.2
GP1	08/13/03	0.0	0.0	18.2	1.7
GP1	04/14/04	0.0	2.0	8.5	7.3
GP1	07/08/04	0.0	0.1	6.1	12.8
GP1	04/27/05	0.0	0.0	2.5	18.9
GP1	07/06/05	0.0	0.0	13.9	7.2
GP1	04/26/06	0.0	0.0	4.6	15.0
GP1	09/20/06	0.0	0.1	8.2	7.4
GP1	06/13/07	0.0	6.3	14.0	2.5
GP1	09/20/07	0.0	31.9	11.2	8.9
GP1	06/12/08	0.0	0.0	10.4	6.5
GP1	08/26/08	0.0	0.0	3.4	16.1
GP1	06/24/09	0.0	2.0	10.5	2.8
GP1	09/17/09	0.0	11.3	4.9	12.9
GP1	04/28/10	0.0	0.0	0.4	19.7
GP1	09/17/10	0.0	0.0	1.0	19.4
GP1	05/04/11	0.0	0.0	0.6	20.4
GP1	09/14/11	0.0	0.0	2.3	18.4
GP1	06/20/12	0.0	0.3	0.2	19.4
GP1	09/19/12	0.0	0.1	1.4	18.3
GP1	05/22/13	0.0	0.4	0.8	20.3
GP1	09/18/13	0.0	3.4	2.4	17.1
GP1	05/29/14	0.1	0.0	0.2	20.1
GP1	09/17/14	0.0	0.0	0.7	20.2
GP1	09/24/15	0.0	0.0	0.9	19.7
GP1	09/14/16	0.0	0.0	0.2	20.5
GP1	11/02/17	0.0	0.0	0.4	20.6
GP2	11/02/99	0.0	6.1	14.2	1.0
GP2	06/30/00	0.4	11.0	15.6	0.0
GP2	09/21/00	0.0	10.2	15.9	1.8
GP2	01/05/01	0.0	34.7	8.7	2.5
GP2	05/18/01	0.0	13.6	6.1	6.3

Table 5.2

Landtec GEM 500
Gas Probe Monitoring Results
Highway 96 Site
White Bear Township, Minnesota

		LandTec GEM 500 Readings*			
Probe	**Date**	**Pressure (in. H_2O)**	**%CH_4**	**%CO_2**	**%O_2**
GP2	08/17/01	0.0	14.3	15.7	0.8
GP2	06/17/02	0.0	0.0	2.4	16.9
GP2	11/04/02	0.0	23.2	10.5	4.2
GP2	05/20/03	0.0	0.0	0.5	19.7
GP2	08/13/03	0.0	9.8	0.7	11.4
GP2	04/14/04	0.0	0.0	16.7	2.0
GP2	07/08/04	0.0	0.1	12.6	4.9
GP2	04/27/05	0.0	0.0	1.9	16.2
GP2	07/06/05	0.0	0.3	7.8	6.7
GP2	04/26/06	0.0	0.0	0.9	19.5
GP2	09/20/06	0.0	3.4	8.3	7.7
GP2	06/13/07	0.0	0.1	6.0	15.0
GP2	09/20/07	0.0	15.0	9.1	7.5
GP2	06/12/08	0.0	0.0	6.1	9.9
GP2	08/26/08	0.0	2.9	6.1	7.9
GP2	06/24/09	0.0	8.2	9.4	2.3
GP2	09/17/09	0.0	8.1	3.4	14.3
GP2	04/28/10	0.0	0.0	0.7	19.4
GP2	09/17/10	0.0	3.4	5.4	13.2
GP2	05/04/11	0.0	0.0	0.6	20.4
GP2	09/14/11	0.0	0.0	0.4	20.4
GP2	06/20/12	0.0	0.3	1.5	18.5
GP2	09/19/12	0.0	7.6	11.8	1.8
GP2	05/22/13	0.0	0.2	0.4	20.6
GP2	09/18/13	0.3	0.4	7.5	8.6
GP2	05/29/14	0.0	0.0	0.8	19.6
GP2	09/17/14	0.0	0.0	2.4	17.6
GP2	09/24/15	0.0	0.0	2.9	16.4
GP2	09/14/16	0.0	0.0	1.1	18.9
GP2	11/02/17	0.0	0.0	1.6	19.1
GP3	11/02/99	0.0	15.1	0.7	3.8
GP3	06/30/00	0.1	24.6	3.5	0.0
GP3	09/21/00	0.0	0.0	0.0	21.1
GP3	01/05/01	0.1	36.2	2.2	0.0
GP3	05/18/01	-0.1	15.0	3.3	0.4
GP3	08/17/01	0.0	0.0	0.0	20.4
GP3	06/17/02	0.0	34.4	2.9	0.6
GP3	11/04/02	0.0	48.4	2.4	0.2
GP3	05/20/03	0.0	1.4	0.3	19.3
GP3	08/13/03	0.0	12.8	4.4	1.4

Table 5.2

Landtec GEM 500
Gas Probe Monitoring Results
Highway 96 Site
White Bear Township, Minnesota

		LandTec GEM 500 Readings*			
Probe	**Date**	**Pressure (in. H_2O)**	**%CH_4**	**%CO_2**	**%O_2**
GP3	04/14/04	0.0	20.2	0.2	3.8
GP3	07/08/04	0.0	25.5	0.4	3.0
GP3	04/27/05	0.0	0.0	0.0	21.3
GP3	07/06/05	0.0	25.3	3.3	0.1
GP3	04/26/06	0.0	0.0	0.0	20.4
GP3	09/20/06	0.0	0.0	1.4	17.6
GP3	06/13/07	0.0	0.0	0.3	20.8
GP3	09/20/07	0.0	25.0	4.3	3.4
GP3	06/12/08	0.0	12.4	2.1	10.8
GP3	08/26/08	0.0	17.5	1.8	12.5
GP3	06/24/09	0.0	13.6	2.6	2.5
GP3	09/17/09	0.0	19.2	1.5	6.0
GP3	04/28/10	0.0	0.0	0.4	19.6
GP3	09/17/10	0.0	0.0	1.6	17.9
GP3	05/04/11	0.0	0.0	2.5	17.3
GP3	09/14/11	0.0	0.1	1.8	17.6
GP3	06/20/12	0.0	37.4	1.3	2.3
GP3	09/19/12	0.0	43.7	1.1	0.0
GP3	05/22/13	0.0	33.6	2.1	0.9
GP3	09/18/13	0.0	41.8	1.6	0.2
GP3	05/29/14	0.1	57.3	1.7	1.6
GP3	09/17/14	0.0	40.4	2.6	5.2
GP3	09/25/15	0.0	41.1	1.0	6.5
GP3	09/14/16	0.0	0.1	1.5	17.2
GP3	11/02/17	0.0	0.0	1.8	17.8
GP4	11/02/99	0.0	20.8	0.3	0.1
GP4	06/30/00	0.0	0.0	0.1	19.8
GP4	09/21/00	0.1	0.0	0.0	21.1
GP4	01/05/01	0.0	73.5	1.5	4.0
GP4	05/18/01	0.0	0.0	0.1	20.0
GP4	08/17/01	0.0	0.1	2.9	15.8
GP4	06/17/02	0.0	0.0	0.0	20.0
GP4	11/04/02	0.0	0.9	0.4	19.8
GP4	05/20/03	0.0	0.0	0.0	20.7
GP4	08/13/03	0.0	0.0	15.4	2.4
GP4	04/14/04	0.0	0.0	6.1	3.5
GP4	07/08/04	0.0	3.0	2.5	7.4
GP4	04/27/05	0.0	0.0	0.0	21.2
GP4	07/06/05	0.0	64.6	3.9	3.3
GP4	04/26/06	0.1	40.2	2.3	9.3

Table 5.2

Landtec GEM 500
Gas Probe Monitoring Results
Highway 96 Site
White Bear Township, Minnesota

		LandTec GEM 500 Readings*			
Probe	**Date**	**Pressure (in. H_2O)**	**%CH_4**	**%CO_2**	**%O_2**
GP4	09/20/06	0.0	0.7	4.8	9.9
GP4	06/13/07	0.0	63.5	3.0	0.3
GP4	09/20/07	0.0	4.5	6.7	3.7
GP4	06/12/08	0.0	0.0	0.0	20.4
GP4	08/26/08	0.0	9.6	20.7	2.8
GP4	06/24/09	0.0	62.5	1.0	0.0
GP4	09/17/09	0.0	34.3	0.9	6.6
GP4	04/28/10	0.0	0.0	0.0	20.2
GP4	09/17/10	0.0	1.1	1.4	18.6
GP4	05/04/11	0.0	0.0	0.2	20.5
GP4	09/14/11	0.0	24.5	7.9	12.9
GP4	06/20/12	0.0	0.3	0.0	20.3
GP4	09/19/12	0.0	4.4	0.8	19.0
GP4	05/22/13	0.0	0.3	0.1	20.7
GP4	09/18/13	0.0	6.2	4.6	9.5
GP4	05/29/14	0.0	0.0	0.0	21.3
GP4	09/17/14	0.0	0.0	0.0	20.3
GP4	09/24/15	0.0	0.0	0.1	20.9
GP4	09/14/16	0.2	0.0	0.0	20.5
GP4	11/02/17	0.0	0.0	0.2	20.5
GP5	11/02/99	0.0	3.6	1.0	19.0
GP5	06/30/00	0.0	36.0	5.4	0.0
GP5	09/21/00	0.0	1.4	0.3	20.5
GP5	01/05/01	0.0	43.8	3.2	0.4
GP5	05/18/01	0.0	17.1	2.1	0.4
GP5	08/17/01	0.0	0.0	1.7	15.1
GP5	06/17/02	0.0	33.8	3.0	2.7
GP5	11/04/02	0.0	11.1	1.5	1.1
GP5	05/20/03	0.0	1.8	0.0	19.3
GP5	08/13/03	0.0	0.0	15.9	1.2
GP5	04/14/04	0.0	28.5	0.2	2.9
GP5	07/08/04	0.0	10.7	1.8	4.8
GP5	04/27/05	0.1	0.0	0.0	21.2
GP5	07/06/05	0.0	28.8	3.6	0.1
GP5	04/26/06	0.0	0.0	0.2	19.9
GP5	09/20/06	0.0	0.0	0.4	20.0
GP5	06/13/07	0.0	0.0	0.1	21.2
GP5	09/20/07	0.0	0.0	0.2	20.9
GP5	06/12/08	0.0	0.0	0.0	20.4
GP5	08/26/08	0.0	0.0	1.0	18.2

Table 5.2

Landtec GEM 500
Gas Probe Monitoring Results
Highway 96 Site
White Bear Township, Minnesota

		LandTec GEM 500 Readings*			
Probe	**Date**	**Pressure (in. H_2O)**	**%CH_4**	**%CO_2**	**%O_2**
GP5	06/24/09	0.0	0.0	0.0	19.9
GP5	09/17/09	0.0	0.0	0.2	19.9
GP5	04/28/10	0.0	0.0	0.2	20.1
GP5	09/17/10	0.0	0.0	0.7	19.4
GP5	05/04/11	0.0	0.0	1.1	17.5
GP5	09/14/11	0.0	0.0	0.5	20.2
GP5	06/20/12	0.0	0.1	0.0	20.2
GP5	09/19/12	0.0	0.0	0.1	20.3
GP5	05/22/13	0.0	0.2	0.8	18.4
GP5	09/18/13	0.0	0.0	0.3	20.3
GP5	05/29/14	0.2	0.0	0.8	15.9
GP5	09/17/14	0.0	0.0	1.0	19.2
GP5	09/24/15	0.0	0.0	1.3	18.8
GP5	09/14/16	0.0	0.0	0.9	19.6
GP5	11/02/17	0.0	0.0	0.4	19.9
GP6	11/02/99	0.0	0.3	0.3	20.8
GP6	06/30/00	0.0	31.2	6.0	0.0
GP6	09/21/00	0.0	0.0	0.0	21.0
GP6	01/05/01	0.0	40.0	5.1	1.5
GP6	05/18/01	0.0	28.2	3.3	0.4
GP6	08/17/01	0.0	0.0	1.8	17.8
GP6	06/17/02	0.0	0.0	2.6	12.0
GP6	11/04/02	0.0	12.0	1.7	0.3
GP6	05/20/03	0.0	0.0	1.3	15.5
GP6	08/13/03	0.0	0.0	17.4	2.3
GP6	04/14/04	0.0	0.1	16.3	1.1
GP6	07/08/04	0.0	16.4	0.3	2.8
GP6	04/27/05	0.0	0.0	0.6	17.2
GP6	07/06/05	0.0	27.5	3.5	0.1
GP6	04/26/06	0.0	0.0	1.7	17.7
GP6	09/20/06	0.0	0.0	4.3	14.5
GP6	06/13/07	0.0	0.1	6.1	14.2
GP6	09/20/07	0.0	0.1	10.0	3.8
GP6	06/12/08	0.0	16.7	3.0	9.5
GP6	08/26/08	0.0	0.0	5.3	15.6
GP6	06/24/09	0.0	0.0	3.6	15.9
GP6	09/17/09	0.0	0.0	4.5	14.6
GP6	04/28/10	0.0	0.0	2.6	17.1
GP6	09/17/10	0.0	0.0	2.6	17.5
GP6	05/04/11	0.0	0.0	0.7	18.2
GP6	09/14/11	0.0	0.0	1.0	19.7

Table 5.2

Landtec GEM 500
Gas Probe Monitoring Results
Highway 96 Site
White Bear Township, Minnesota

		LandTec GEM 500 Readings*			
Probe	**Date**	**Pressure (in. H_2O)**	**%CH_4**	**%CO_2**	**%O_2**
GP6	06/20/12	0.0	0.2	1.2	17.7
GP6	09/19/12	0.0	0.0	0.5	20.0
GP6	05/22/13	0.0	0.2	0.2	20.5
GP6	09/18/13	0.1	0.0	3.8	14.7
GP6	05/29/14	0.1	0.0	0.3	19.0
GP6	09/17/14	0.0	0.0	3.4	16.7
GP6	09/24/15	0.0	0.0	4.5	14.8
GP6	09/14/16	0.0	0.0	3.0	15.7
GP6	11/02/17	0.0	0.0	2.7	16.4

Notes:

* - Readings captured once stabilized, after at least 60 seconds of purging.

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