WELLHEAD PROTECTION PLAN PART 2

PRINCETON PUBLIC UTILITIES
WELLHEAD PROTECTION PLAN – PART 2

June 13, 2023

Prepared for:
Princeton Public Utilities
907 1st Street
Princeton, MN 55371

WSB PROJECT NO. 019792-000

wsb

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PUBLIC WATER SUPPLY

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GENERAL INFORMATION

Unique Well Number(s): 578949, 751504, 749848
Size of Population Served by Municipal Water: 5,057 (2021)
County: Sherburne, Mille Lacs

PUBLIC WATER SUPPLY WELLS

Local Well Name	Unique Number	Aquifer	Casing Depth (ft)	Well Depth (ft)	Date Constructed
Well 7	578949	QBAA	137	169	1998
Well 8	751504	QBAA	104	139	2007
Well 9	749848	QWTA	135	160	2007

DOCUMENTATION LIST

Step	Date Performed
Part I Approval Notice Received from MDH	December 18, 2020
Scoping 2 Meeting Held (4720.5349, subp. 1)	October 12, 2021
Scoping Decision Notice Received (4720.5340, subp. 2)	October 18, 2021
Remaining Portion of Plan Submitted to Local Government Units (LGUs) (4720.5350, subp. 1 & 2)	March 10, 2023
Review Considered (4720.5350, subp. 3)	May 9, 2023
Public Hearing Conducted (4720.5350, subp. 4)	May 24, 2023
Remaining Portion WHP Plan Submitted (4720.5360, subp. 1)	June 13, 2023
Approved Review Notice Received	TBD

ACRONYM LIST

AST	Aboveground Storage Tank
BMS	Brownfield Site
CCR	Consumer Confidence Report
DWSMA	Drinking Water Supply Management Area
ERA	Emergency Response Area
HWG	Hazardous Waste Generator
HWIC	Hazardous Waste Investigative/Cleanup
ISTS	Individual Sewage Treatment System
IWMZ	Inner Wellhead Management Zone
LGU	Local Government Unit
LUST	Leaking Underground Storage Tank
MDA	Minnesota Department of Agriculture
MCL	Maximum Contaminant Level
MDH	Minnesota Department of Health
MGS	Minnesota Geological Survey
MnDNR	Minnesota Department of Natural Resources
MnDOT	Minnesota Department of Transportation
MPCA	Minnesota Pollution Control Agency
MRWA	Minnesota Rural Water Association
MWI	Minnesota Well Index
PCS	Potential Contaminant Site
PCSI	Potential Contaminant Source Inventory
PUC	Princeton Public Utilities Commission
QBAA	Quaternary Buried Confined Drift
QWTA	Quaternary Water Table Aquifer
SPL	Spills
SWCD	Soil and Water Conservation District
SWMS	Solid Waste Management Site
UST	Underground Storage Tank
WHP	Wellhead Protection
WHPA	Wellhead Protection Area
WIMN	What's In My Neighborhood
WWDS	Wastewater Disposal Site
WWTF	Wastewater Treatment Facility

EXECUTIVE SUMMARY

The Wellhead Protection Plan (the Plan) for the Princeton Public Utilities Commission (PUC) addresses the three municipal water supply wells used by PUC Wells No. 7, 8, and 9 and the associated source water aquifer (unconsolidated sand and gravel deposits also known as Quaternary Aquifer– the aquifer from which the municipal wells pump water).

Part 1 of the Plan (**Appendix C**) was originally completed by consultants TKDA and LBG, approved in January of 2011 and amended by Minnesota Department of Health (MDH) in October of 2020. The Plan (Part 1) presented: the delineation of the Wellhead Protection Areas (WHPA); the drinking water supply management area (DWSMA); and the vulnerability assessments for the system's wells and aquifers within the DWSMA. The boundaries of the WHPA/DWSMA are shown in **Figure 1, Appendix B.** Water supply wells covered by this delineation and this Part 2 Plan Amendment are listed on page 4.

The *vulnerability assessment* for the aquifers within the DWSMA was performed using available information and indicates that the vulnerability of the aquifers used by the system varies from moderate to high. The results of the aquifer vulnerability assessment determined for the PUC *what types of potential contamination sources* must be managed within the DWSMA as determined by the MDH:

- Moderate vulnerability areas – wells and tanks
- High vulnerability areas – all land uses and potential contaminant sources

This document includes the following information:

- A review of data elements identified by the MDH as applicable to the DWSMA.
- Results of an inventory of potential contaminant sources within the DWSMA.
- Review of changes, issues, problems, and opportunities related to the public water supply and the identified potential contaminant sources.
- A discussion of potential contaminant source management strategies and the goals, objectives, and action plans associated with these management strategies.
- A review of the wellhead and source water protection evaluation program and PUC's alternative water supply contingency strategy.

The goals and objectives of this Plan focus on managing potential contaminant sources within the DWSMA; reducing the potential contaminant pathways to the source water aquifer that may be provided by private wells, educating property owners and water supply users, and working with local government units..

The PUC's WHP team has identified the following goals for implementation of this Plan:

Goal 1: The PUC will work to maintain or improve the current level of water quality so that the municipal water supply will continue to meet or exceed all applicable state and federal water quality standards.

Goal 2: The PUC will work to continue to supply sufficient water quantity for system users and emergency needs.

Goal 3: The PUC will provide and promote activities that protect the source water aquifer which provides water to the municipal system. This will include increased public education of the Wellhead and Source Water Protection Program and groundwater-related issues, as well as management of the identified potential contaminant sources and conveyance mechanisms within the DWSMA.

Goal 4: The PUC will continue to collect data to support future wellhead and source water protection efforts.

Implementation of these goals will be achieved through direct management efforts within the following areas to prevent future contamination of the aquifer and increase awareness of groundwater protection:

A. Well Management
B. Public Education
C. Storage Tank Management
D. Septic Systems (ISTS)
E. Hazardous Waste Management
F. Stormwater Management Data Collection
G. Data Collection
H. Water Conservation
I. Planning and Zoning
J. Implementation
K. Evaluation

The effectiveness of the Plan must be evaluated to determine whether the implementation activities are consistent with the Plan's intent. Monitoring will be on-going, and a written evaluation of the Plan and associated activities will be conducted every two years that the Plan is in effect.

CHAPTER ONE

DATA ELEMENTS AND ASSESSMENT (4720.5200)

I. REQUIRED DATA ELEMENTS

In accordance with Minnesota Rules Chapter 4720.5200, the following data elements are considered for evaluation in a WHP Plan. Those elements required for evaluation are determined by the MDH based on the Drinking Water Supply Management Area (DWSMA) vulnerability as described in the MDH Scoping 2 Decision letter received by PUC on October 12, 2021.

A. Physical Data Elements

1. Geology

A complete description of the geologic conditions in the WHPA is provided in Part 1 of this Plan, which was completed by LBG and MDH and are included as **Appendix C.** The Part 1 of this Plan also presents existing well records and regional studies that were used to construct the geologic map with descriptions of the geology, aquifers, confining layers, recharge layers, discharge areas, and any sensitive areas.

The geology in the vicinity of the City of Princeton (City) consists of alluvium, glacial outwash, and glacial till above sandstone and crystalline bedrock. The alluvial material consists of gravel, sand, silt, and discontinuous clay. The outwash deposits are sands and gravels that vary in thickness and extent that terminate into clay till that contains sand and gravel bodies. Sandstone and bedrock are found approximately 15 to 50 meters below the ground surface. Groundwater is mostly found under confined and unconfined conditions in the sand and gravel and in the sandstone bedrock. The clay till aquitard layer provides some protection to the buried drift aquifer. There have been detections of tritium in Wells 7, 8 and 9, which evidence that surface waters are able to infiltrate the clay layer in some areas, making the system vulnerable to groundwater pollution. The extent of the relationship between the surface waters and the aquifer serving the public water supply system is uncertain; however, it appears that there is a connection between them (TKDA, 2011).

All of the PUC's wells (Wells No. 7, 8 and 9) are all completed in the buried sand and gravel aquifer (Quaternary aquifer), as shown in the well logs included in **Part 1, Appendix C** (LBG, 2010).

2. Soil Conditions

Since PUC's municipal wells and source water aquifer within the DWMSA are classified as vulnerable, surficial soil characteristics must be evaluated to determine if they could potentially apply to the Plan. Soil data and infiltration characteristics were used in the delineation of the WHPAs. An evaluation of available information from Mille Lacs and Sherburne County's soil survey was completed in 2011 as component of Princeton's previously completed WHPP Part 2. The associated maps and descriptions of the soil types for the north and south DWSMAs are provided as **Appendix F**. Both Mille Lacs and Sherburne Soil and Water Conservation Districts (SWCD) have additional information in their Plans and are available on their respective websites (LBG, 2010).

Currently, there are no highly eroding lands within the north or south DWSMAs that are causing sedimentation problems.

3. Water Resources

Since portions of Princeton's DWSMA are classified as "vulnerable", surface water resources were evaluated to their potential influence and impact to the public water supply. The boundaries and flow directions of major and minor watersheds were considered and incorporated into the groundwater model and were used to delineate the WHPA, as discussed in Part 1 (**Appendix C**).

In the north DWSMA, the Rum River is a protected waterway by the MnDNR and is a regional discharge point located on the east side of the City. As discussed in Part 1 of this report, groundwater flows easterly, towards the Rum River. The flow direction is generally downgradient from the wells located within the north DWSMA. Due to these conditions, it should not have an effect on the groundwater Princeton uses for its water supply (LBG, 2010). In addition to the Rum River, the north DWSMA does have a few wetlands located on the western boundary. The major and minor watersheds in the north DWSMA are the Rum River and County Ditch #4, respectively.

In the south DWSMA, there are no protected waterways; however, there are a few ponds and wetlands (LBG, 2010). The major and minor watersheds in the south DWSMA boundary are Rum River and County Ditch #4, respectively. Apart from of a small portion of the southwest corner of the south DWMSA is located within the Mississippi River – St. Cloud watershed.

Since there is a direct connection between surface water and the water table, the floodplains within the DWSMA are another important component to contaminant transport. The FEMA flood insurance map shows that a majority of the DWSMA is outside of the 500-year flood area. However, FEMA has designated a small area on the east side of the south DWSMA as having a 1% annual chance of flooding.

B. Land Use Data Elements

1. Land Use

It is important to determine key geographic areas for concern in managing a WHPAs to understand how land use impacts aquifer vulnerability. For example, knowledge about the location of future development or areas of redevelopment within the DWSMAs may reveal a need to closely manage the activities within those sensitive areas. Additionally, any existing land uses that currently pose a potential threat to the City's water supply need to be highlighted to increase awareness of any concerns. Since the municipal wells and the source water aquifer within the DWSMA are classified as vulnerable, current land use must be evaluated to determine if it could potentially apply to this Plan. **Figure 2, Appendix B** illustrates township, range, and section boundaries, as well as existing land uses within the DWSMA. Most of the land currently used or guided for future commercial and industrial development is situated along major transportation corridors including intersection of Highways 169 and 95.

Figure 3, Appendix B shows the DWSMAs superimposed over the zoning map for those areas within the DWSMAs as outlined in the City's 2040 Comprehensive Plan. Future land uses planned within the DWSMAs include single and two family residential, multiple family residential, general commercial business, industrial, conservation, and agricultural uses.

2. Public Utility Services

Public utilities were evaluated to determine their potential impact on the municipal drinking water supply. storm sewers, sanitary sewers, public drainage systems, public water supply, and gas and oil pipelines were considered and are included in the Part 2 Plan.

a. Transportation Routes and Corridors

The major roadways through the DWSMAs are depicted in **Figure 4, Appendix B.** These include Highway 169 and County Roads 45, 29, and 31.

b. Stormwater Conveyance System

The storm sewer system is managed and maintained by City of Princeton Public Works. The storm sewer network is located throughout the DWSMAs and is depicted in **Figure 5, Appendix B**.

c. Sanitary Sewer System

The sanitary sewer system is managed and maintained by the City of Princeton Public Works and is depicted in **Figure 6, Appendix B**. The sanitary sewer system is comprised of gravity sewers that ultimately flow towards the City's Main lift station which pumps the wastewater to the WWTF. The existing gravity sewers are predominantly vitrified clay pipe (VCP) and polyvinyl chloride (PVC) and were installed between the years1959 to 2019. The forcemain materials also include cast iron pipe (CIP) and ductile iron pipe (DIP). The older, more central portions of the City's system installed in the 1960s and early 1970s are more often composed of VCP, while the newer portions installed in the late 1970s are more often PVC. The older portions of the system with VCP are more susceptible to inflow and infiltration due to the pipe material and age, and these areas are prioritized for televising and lining.

Much of the DWSMAs are served by the City's sanitary sewer system but there are still several ISTS located within the DWSMAs as depicted in **Figure 9, Append B**. City ordinance requires connection to the municipal sewer system when available.

d. Public Water System

The watermain utilities are managed and maintained by PUC. Currently, a majority of the users within the City's boundary are connected to municipal water supply. The watermain utilities are depicted in **Figure 7, Appendix B**. The City requires all properties within the city limits that are within 150 feet of the city water system to install a suitable service connection.

e. Oil and Gas Pipelines

There is one pipeline that runs through the northern part of north DWSMA and is depicted in **Figure 8, Appendix B**. The pipeline is a natural gas line and is operated by Northern Natural Gas Co.

3. Potential Contaminant Source Inventory

Land use is closely related to the potential contaminant source inventory (PCSI) for the DWSMAs, as these contamination sites are typically related to the type and intensity of use of the property. A PCSI was completed within the DWSMA boundaries. Data was extracted from the existing databases – the Minnesota Pollution Control Agency's (MPCA) What's in My Neighborhood (WIMN), the Minnesota Department of Agriculture's (MDA) Priorities List and County Well Index (CWI) – and then was verified by aerial photography.

Data points collected from the MPCA WIMN database were first properly located through aerial photography and additional research. The list of sites was reduced by assigning the vulnerability of the DWSMA to each data point and removing those sites that did not match the criteria for the vulnerability setting. Next, potential contaminant and material codes were added to the sites, and a table and map (**Table 2, Appendix A and Figure 9, Appendix B**) were produced to display the locations and types of potential contaminants throughout the DWSMA.

Data points collected from the CWI and the MDH Well and Old Municipal Well databases were included in all vulnerability types. **Figure 7, Appendix B** includes the location of the water distribution system. **Figure 10, Appendix B** includes public and private wells within the City. A table of wells, including unique numbers, use codes, and other pertinent information is attached in **Table 3, Appendix A**. A table of sealed wells within the DWSMAs are in **Table 4, Appendix A**.

A list of unlocated wells and wells identified on the Old Municipal Well database were taken to the PUC. With the knowledge and information provided by the CWI and the PUC, the locations of many wells on this list were verified. Data for unlocated wells near the DWSMA was also evaluated. The locations of many were determined, while several wells remain unlocated, see **Table 5, Appendix A** for the remaining unlocated wells.

In addition, the MDH completed and provided survey results for the Inner Wellhead Management Zone (IWMZ) that surrounds each municipal well at a 200-foot-radius. Results of this survey remain as submitted by the MDH and are included in **Appendix D**.

Potential threats to the water supply were determined by analyzing the location of water supply wells, land use, potential contaminant sources, and the following findings are made:

- Public and Private Wells: There are 29 public and 62 private wells located within the DWSMA. Of these 91 wells, 34 are sealed and were not considered further. The 57 remaining wells are currently active.
- Unlocated Wells: In total, there are 36 unlocated wells possibly remaining within the DWSMA.
- Class V Wells: There are no known active Class V Wells within the DWSMA.
- ISTS: Shallow groundwater is highly susceptible to pollution from septic tanks. There are large areas of the DWSMA with septic systems. There are 59 suspected septic tanks.
- Hazardous Waste Sites: There are 25 Hazardous Waste Sites within the DWSMA, 9 are active and 16 are inactive.
- Leak Sites: There are 11 leaking underground storage tank sites within the DWSMA, all of which are inactive.
- Storage Tanks: There are 17 aboveground storage tank (AST) sites and 5 underground storage tank (UST) sites within the DWSMA. Of the 17 AST sites, 3 have been removed, 2 are closed, 7 are active, and 5 unknown. These sites contain(ed) chemicals, fuels, gases, oils, or waste. Of the 5 UST sites, 1 is active and 4 have been removed. These sites contain(ed) fuels, gases, or oils.
- Investigation/Cleanup Sites: There are currently 3 known investigation/cleanup sites in the DWSMA. One (1) of these sites is a Hazardous Waste Investigation/Cleanup (HWIC) site, which is inactive. There are 2 Petroleum Brownfield Sites (BMS) within the DWSMA, both are inactive.
- Solid Waste Management Site: There are 3 active solid waste management sites in the DWSMA.
- Wastewater Disposal Site: There is 1 active wastewater disposal site in the DWSMA.
- MDA Priority List: There are 2 Spill (SPL) Sites within the DWSMA involving fertilizers and unknown material, both of which are closed.
- IWMZ Results: Located within 200 feet of the municipal wells are buried sanitary sewer pipes, above ground petroleum storage tanks, and an operating well.

The activities in **Chapter 5** of this Part 2 Plan outline management activities to address the results of the PCSI.

C. Water Quantity Data Elements

1. Surface Water Quantity

Surface water quantity was analyzed as Part of the WHP Plan Part 1 (**Appendix C**) and did influence the subsequent delineation of the wellhead protection areas and were included in the groundwater model. Following the review of geologic cross sections and well logs, it does appear that surface waters are in direct connection hydraulically with the alluvial aquifer (LBG, 2010).

2. Groundwater Quantity

Groundwater quantity was analyzed as part of the WHP Plan Part 1 (**Appendix C**). The Quaternary aquifer supplies the water pumped by the PUC's three wells to meet public water demands. Summaries of the PUC's water appropriations are on file at the PUC office. No substantial changes in water use were observed between 2012 and 2021.

Groundwater levels are adequate for the volumes the PUC currently is permitted for under the groundwater appropriations program administered by the Minnesota Department of Natural Resources (MnDNR). There are currently no other high-capacity wells besides those belonging to the PUC within the DWSMAs. No well interference complaints with the PUC's wells have been documented. At this time, there appears to be sufficient groundwater quantity based upon existing pumping capacity of all wells completed in the aquifer used by the PUC.

D. Water Quality Data Elements

1. Surface Water Quality

Surface water in the vicinity of the City is in direct hydraulic connection with the subject sand and gravel aquifers. Water quality data directly from surface water was not reviewed during Part 1, however, well specific data was obtained and reviewed (LBG, 2010). It is a management goal to continue to protect the water quality of surface water resources and of the aquifer.

2. Groundwater Quality

Groundwater pumped from the unconsolidated sand and gravel deposits by the municipal wells are currently free of pathogens and disease-causing organisms. To date, none of the human-caused contaminants for which the Safe Drinking Water Act has established health-based standards is found above maximum allowable levels in the city's water supply, nor are any present at one-half of those levels (MDH, 2021). However, existing information consisting of isotopic and chemical analyses indicates that the aquifer used by the public water supply may be recharged by surface water. Tests conducted by MDH have shown trace amounts of tritium in Wells No. 7, 8, and 9 indicating there is some component of "young" water recharging the aquifer used by the Utility. To maintain MDH compliance, PUC tests water from the municipal water system for fluoride on a weekly basis. The results from these tests are presented in the PUC's annual Consumer Confidence Report (CCR), which also presents results of the annual MDH sampling from previous years. These results are posted on the City's website. A copy of the most recent CCR is included as **Appendix E**.

II. ASSESSMENT OF DATA ELEMENTS

Based on the data available for the required data elements, present and future implications of the data elements are described below for the use of the wells, quality and quantity of water supplying the public water supply wells, and the land and groundwater uses in the DWSMAs.

A. Use of Municipal Wells

The PUC currently operates three active water supply wells (Wells No. 7, 8 and 9) (**Figure 10, Appendix B**). Additional information about the municipal water supply and distribution system in general is presented in the City's Comprehensive Plan. Well construction details, well logs, and pumping rates are included in the Part 1 **(Appendix C)**.

B. Quality and Quantity of Water Supplying the Public Water Supply Wells

Part 1 of the Plan outlines the vulnerability of the public supply wells based on MnDNR geologic sensitivity ratings, casing integrity, casing depth, pumping rate, isolation distance from contaminants, and chemical and isotopic information. Well No. 7 is considered moderately vulnerable, while Wells No. 8 and 9 are considered highly vulnerable. Wells No. 7 is open to the Quaternary Buried Artesian aquifer, while Wells No. 8 and 9 are open to the Quaternary Water Table aquifer.

There are no known groundwater contamination around in the Quaternary aquifer in vicinity of the municipal wells but tritium has been detected above 1 Tritium Unit. While Tritium itself is non-toxic, it indicated a surface-groundwater connection. To understand this connection more fully, as well as the transfer of contaminants to the water source, more specific information is required. A better understanding of the connection between well water and surface water can be achieved via stable isotope analysis. Localized hydraulic conductivity and observation well data can be used to better characterize the vertical hydraulic connection and gradient between surface water and Quaternary aquifers. Opportunities and objectives to achieve these initiatives are outlined in Chapters three and five of this Plan.

Significant changes in water quantity are not anticipated over the life of this Plan. The PUC regularly withdraws water below the appropriated volume by the MnDNR. Continued water conservation measures will help maintain water use over the course of this Plan. It is not anticipated that physical, land-use, water quality, or quantity changes will greatly affect the water supplying the public water supply wells.

C. The Land and Groundwater Uses in the Drinking Water Supply Management Area

Land use and development practices have potential to impact groundwater in several ways. The existing land uses, and zoning are depicted in **Figures 2 and 3, Appendix B**. Use and storage of toxic materials, usually found in industrial and commercial uses, have the potential to spill and enter the groundwater. It is critical to locate and document where these potential contaminants exist in order to monitor those uses, provide opportunities to educate the businesses, and consider policies regarding stricter monitoring of potential new land uses. A summary of potential contaminant sources identified in the DWSMAs was provided in **Table 2, Appendix B.** Proactive management of all existing wells are of immediate concern within the vulnerable portions of the DWSMAs. Management strategies must also be developed for hazardous waste generators, public utilities infrastructure, and non-point sources of contamination in the highly vulnerable portions of each DWSMA.

The north DWSMA area is nearly fully built, and land patterns will remain relatively the same, with the exception of sporadic redevelopment opportunities. The land and groundwater use in the north DWSMA consist of developed residential uses as and is connected to the city water and sanitary services. The rural undeveloped portion of the north DWSMA located in the southwest is expected to see some additional high density residential and industrial/commercial development in the future.

The south DWSMA area is mostly developed within the city boundary and land and groundwater use consist of developed single family residential, commercial, and industrial uses. In the southern portion of the south DWMSA, currently land and groundwater uses consist of residential properties, light industry, small businesses and some agricultural and undeveloped parcels located in Baldwin Township. The Baldwin Township area of the DWSMA has been an area of both small business and residential growth. The rural undeveloped portion of the south DWSMA is expected to see high density residential and industrial development in the future.

In order for this Plan and management strategies to be effective, the PUC will need to work and communicate with City of Princeton staff and officials, Sherburne County Planning and Zoning Administration, and SWCD, Baldwin Township Board on growth and development issues that may impact the city's wells and drinking water supply. Management strategies are discussed in Chapter Five, which focus on activities that have the most potential impact on the aquifer the PUC is using for its drinking water supply. Despite the vulnerable designation of a majority of the DWSMA, non-point sources of contamination are of less immediate concern than larger potential point sources, particularly those in high vulnerability areas. Privately owned wells, particularly those that are completed in or penetrate the Quaternary aquifer will continue to be considered when developing the management strategies for the Princeton DWSMAs. Unmaintained, damaged, poorly constructed, or unused/abandoned wells could provide a direct route for contaminants to enter the Quaternary aquifer.

CHAPTER TWO

IMPACT OF CHANGES ON PUBLIC WATER SUPPLY WELLS (4720.5220)

In accordance with Minnesota Rules 4720.5220 a wellhead protection plan must identify and describe potential changes to the following that are expected within the next 10 years:

1. The physical environment
2. Land use
3. Surface water
4. Groundwater

I. POTENTIAL CHANGES IDENTIFIED

A. Physical Environment

In the north and south DWSMAs there are no significant changes to geology, soils or water resources anticipated during the 10-year time frame of this Plan.

B. Land Use

Understanding local land use is an important aspect of determining key areas of concern when managing a WHPA. Knowledge about the location of future development or areas of redevelopment within the DWSMAs may reveal a need to manage the proposed activity. Additionally, any land uses that pose a potential threat to the public water supply would need to be highlighted to increase awareness of any concerns.

A comparison of the existing and future land uses for the year 2040 indicates that some properties within the DWSMAs will remain consistent in terms of use and density, specifically in the north DWSMA. However, the density within the south DWSMA is projected to grow during the next 10 years. Some of the area within the south DWSMA is outside of city limits and is not served by the PUC water system. The PUC will need to work with Baldwin Township to ensure that the groundwater is being protected for both private Township wells and the PUC's public supply wells. There are areas of high vulnerability within the south DWSMA that are currently planned for development, which will result in higher water use on the municipal system.

C. Surface Water

No significant changes in surface water are expected in the next 10 years. However, with there being a direct hydraulic connection between surface water and the aquifer utilized by the PUC, any changes to the conditions of the adjacent surface water will most likely have an impact on the quality or quantity of the public water supply.

D. Groundwater

There are three wells supplying the water needs for the City. As presented in the City's Water Supply Plan and 2040 Comprehensive Plan, the City is not expecting a large increase in population that will be served by the public water system in the next ten years. The water usage is projected to increase by approximately 15% over the next ten years, however, the PUC does not anticipate the need for additional water supply wells to meet future demands.

II. IMPACT OF CHANGES

A. Changes Identified Above Influence of Existing Water and Land Government Programs and Regulations

The primary impacts associated with changes in physical, land use, and groundwater supply are the need to add infrastructure to accommodate increasing commercial and residential demand. In Chapter Five, a series of policies and programs are proposed to balance increased growth with infrastructure needs to mitigate the negative impact of growth and minimize potential sources of contamination to the DWSMA.

Federal and State Regulations

All tank operators and owners must comply with both federal and state regulations for underground storage tanks. At the federal level, tank operators and owners of underground storage tanks (USTs) must comply with 40 CFR Part 280-282. At the state level, operators and owners must comply with Minnesota Rules, Chapter 7150. Enforcement of state and federal regulations is the responsibility of the MPCA. The existing federal and state regulations provide adequate controls to manage underground storage tanks within the DWSMA.

If the site capacity is less than one million gallons, above ground storage tanks (ASTs) which store liquid substances that may pollute the waters of the state are regulated by Minnesota Rules, Chapter 7151. AST regulations are also enforced by the MPCA as well as state and local fire marshals. Existing regulations provide adequate controls to manage storage tanks within the DWSMA.

Federal and state regulations also regulate surface waters through the MPCA in accordance with the Wetland Conservation Act and the Municipal Separate Storm Sewer System (MS4) program. Upon new development or large expansion projects, developers and cities are required to manage stormwater runoff in a way that protects the quality and quantity of surface water. In areas with vulnerable aquifers, these policies serve the purpose of protecting groundwater as well.

Sherburne County Regulations

Sherburne County is not required to have a Subsurface Sewage Treatment Systems (SSTS) ordinance because all cities and towns within the County have ordinances that meet the requirements of Minnesota Rules Chapters 7080-7083. The County provides waste management resources including household hazardous waste, solid waste, and composting information which could potentially aid in addressing potential sources of contamination.

Sherburne County collects and maintains data related to surface water and groundwater. This information can be utilized by communities to gain a deeper understanding of the groundwater conditions in their jurisdiction. Grant funding programs for sealing unused wells are also available through the state and federal government, as well as numerous education and outreach opportunities. The well sealing grants receive funding through the Clean Water, Land, and Legacy Amendment and its continuance is dependent on that funding. In 2021, Sherburne County developed a County Solid Waste Management Plan pursuant to Minn. Stat. §115A.46. This plan guides the County's natural resource management and environmental protection programs by establishing objectives, strategies, and actions through the year 2031.

Mille Lacs County Regulations

The city of Princeton straddles the boundary between Mille Lacs County and Sherburne County. A portion of the DWSMA lies within the Mille Laces County. Like Sherburne County, Mille Lacs County is not required to have a Subsurface Sewage Treatment Systems (SSTS) ordinance because all cities and towns within the County have ordinances that meet the requirements of Minnesota Rules Chapters 7080-7083. The County provides waste management resources including household hazardous waste, solid

waste, and composting information which could potentially aid in addressing potential sources of contamination.

City of Princeton

The PUC controls water and the City controls the land use within the City through the enforcement of their Zoning Ordinances and other provisions of the City Code. The land within the DWSMA is zoned as shown in **Figure 3, Appendix B**. Current land uses found in the DWSMAs include Single Family, Multi-family, Commercial, Industrial, Institutional/Government, and Vacant.

Official controls available to the City of Princeton for regulating land use within the DWMSA include performance standards such as shoreland management regulations and wetland standards, as well as health and sanitation codes. Stormwater standards are also implemented throughout the City and within the DWSMA.

B. Administrative, Technical, and Financial Considerations

With existing cost-share programs and grant opportunities from the state and federal government, the PUC will have adequate resources available to regulate the public water supply's source water and implement the management strategies found herein. Funds to support ongoing wellhead and source water protection efforts will come from the PUC's water utility fund and MDH grants. Wellhead and source water protection activities will be evaluated on an annual basis, and any changes in the focus of the tasks will also be evaluated to determine if additional funding will be necessary to accommodate changes.

The PUC staff continue to evaluate the water distribution system and evaluate whether additional municipal wells, storage reservoirs, water treatment facilities are needed.

The PUC intends to work in conjunction with Sherburne County, Mille Lacs County, Baldwin Township, SWCD, and Rum River Watershed Partnership Board to protect surface water and source water resources as much as possible when it is beneficial and logistically feasible.

CHAPTER THREE

ISSUES, PROBLEMS, AND OPPORTUNITIES (4720.5230)

Issues, problems, and opportunities in relation to the source water aquifer, groundwater quality, and DWSMA are discussed below.

I. WATER USE AND LAND USE ISSUES, PROBLEMS, AND OPPORTUNITIES

A. Source Water Aquifer

Part 1 (**Appendix C**) determined that the WHPA and corresponding DWSMAs for the source aquifer range from moderate to high vulnerability to contamination and therefore, some locations are more likely to be affected by land use activities. Land use and zoning regulations can protect the quality of the aquifer by discouraging types of construction or activity that may cause contamination. Princeton has land use and zoning ordinances in place that could be revised in the future, if needed to address potential contaminant sites. The City has a Comprehensive Plan in place that includes policies for managing growth, approved land uses, water supplies, and wells. Policies identified in the Comprehensive Plan will help protect the City's source water aquifer. The challenge to the PUC is that portions of the DWSMAs extend beyond City limits and outside of their control. Cooperative participation in the management of the local aquifer to help assure sustainable water supplies for all users is a challenge and an opportunity.

Princeton is expected to experience growth and development within the DWSMAs but it is unlikely that additional high capacity wells will be needed or constructed through the life of this Plan. The PUC will work with the Wellhead Protection Consultant to amend this plan as required by the MDH if additional municipal wells are installed. *The ongoing collected of data has been identified as an opportunity to support future wellhead protection efforts*.

B. Groundwater Quality

Currently, groundwater pumped from the source water aquifer by the municipal wells are free of pathogens and disease-causing organisms. The PUC's water supply currently meets state and federal water quality requirements. No contaminants have been reported in water samples from the municipal wells at concentrations that exceed applicable federal health-related standards. To comply with MDH rules, the PUC adds fluoride to the water and tests water quality daily. The presence of tritium in the municipal wells is not a health risk but is an indication of the vulnerability of the aquifer. The Consumer Confidence Report (CCR) for 2021 can be found in **Appendix E.**

Water quality sampling will need to continue so that possible contamination can be identified. There are numerous private wells located within the DWSMAs that should be tested regularly, as recommended by the MDH. Coordination with the City staff, Baldwin Township, Sherburne County, Mille Lacs County, MDH, MPCA, and MnDNR to share and maintain information on wells and potential contaminants will be a challenge and an opportunity.

Education of landowners, especially those with private wells or other contaminant sources will be important in the control of contamination affecting the groundwater quality.

C. Drinking Water Supply Management Areas

Land uses found within the DWSMAs include agriculture, airport, commercial, industrial, institutional/government, parks and recreation, and residential, as well as some undeveloped areas. Potential contaminant sources identified should be monitored.

As previously mentioned, a concern for the PUC and City will be that it does not have legal capabilities to regulate activities within its DWSMAs that are outside of the City's boundaries. Some opportunities identified include:

- Continued cooperation with Baldwin Township, Sherburne County, and Mille Lacs County as well as other government entities to share information and create policies that protect the aquifers.
- Tracking and updating the list of potential contaminant sources as new information becomes available.
- Landowner education and proper well management.
- Routinely monitoring for land use and potential contaminant source changes within the Inner Wellhead Management Zone (IWMZ), a 200-foot-radius around the wells, in consideration of the State Well Code requirements.
- Placing high priority on new and existing wells and potential contaminant sources identified in the IWMZ and One Year Time of Travel Area for the implementation of best management practices.

II. Assessment of Water Use and Land Use Issues, Problems, and Opportunities

A. Issues, Problems, and Opportunities Disclosed at Public Meetings and in Written Comments

At the beginning of the WHP amendment process, the PUC sent a notification to other local government units (LGU) of its intention to amend their wellhead and source water protection efforts. After approval by the MDH, the PUC sent copies of the results of the Part 1 Plan to LGUs. The PUC was not informed of any issues, problems, or opportunities by the LGUs during that time. If any comments are received by the PUC through the development of Part 2, they will be listed here.

The PUC previously held a public information meeting on January 27, 2021 to receive comments from the general public regarding the Part 1 Amendment of the Plan. To date, the PUC has not received any comments of issues, problems, or opportunities related to the wellhead protection process.

B. Issues, Problems, and Opportunities Related to the Data Elements

Part 1 and 2 of the Plan have utilized available current local and regional information to compile and assess data elements. At a minimum, this Plan will be revised or updated every 10 years as required, and the most recent and accurate data will be utilized at that time. To support on-going wellhead protection efforts, the PUC will continue to collect data on wells, water quality, and land use within its DWSMAs. Due to limited resources to independently collect the full range of data and recreate the necessary databases, the PUC will continue to mainly rely on databases maintained by the State and County agencies to obtain and verify data, as needed.

C. Issues, Problems, and Opportunities Related to Status & Adequacy of Official Controls, Plans, and Other Local, State, and Federal Programs

Numerous controls, plans, and programs exist that may be used to achieve the wellhead protection goals identified in this Plan. State and local government units currently enforce land use ordinances, zoning laws, sewer ordinances, well permits, and groundwater-use appropriation permits. The PUC will continue to work with neighboring communities to ensure proper management of the portion of the DWSMAs that extends into their respective communities. It is anticipated that most local issues may be adequately addressed through these existing processes and the adoption of best management practices.

The wellhead protection team does not recommend any additional regulations be imposed at this time. However, the team does recommend that overall regional coordination of wellhead protection efforts be initiated.

CHAPTER FOUR

WELLHEAD PROTECTION GOALS (4720.5240)

In accordance with Minnesota Rules 4720.5240 this section must address goals for present and future water use and land use to provide a framework for determining plan objectives and related actions.

Goals outlined in this part were selected based on the information gathered and compiled from the data elements, delineations of the WHPAs and DWSMAs, results of the vulnerability assessments, results of the PCSI, expected changes in land and water uses, identified issues, problems, and opportunities, and evaluation of this information.

The public water supply is considered to be vulnerable. Therefore, the goals and objectives of this Plan will focus on managing potential contaminant sources within the DWSMA, reducing the potential contaminant pathways to the source water aquifer that may be provided by private wells, educating property owners and water supply users, and considering policies that control future siting of potential contaminants.

The PUC's WHP team has identified the following goals for implementation of this Plan:

Goal 1: The PUC will work to maintain or improve the current level of water quality so that the municipal water supply will continue to meet or exceed all applicable state and federal water quality standards.

Goal 2: The PUC will work to continue to supply sufficient water quantity for system users and emergency needs.

Goal 3: The PUC will provide and promote activities that protect the source water aquifer that provides water to the municipal system. This will include increased public awareness of the wellhead and source water protection program and groundwater-related issues, and management of the identified potential contaminant sources and conveyance mechanisms within the DWSMA.

Goal 4: The PUC will continue to collect data to support future wellhead and source water protection efforts.

CHAPTER FIVE

OBJECTIVES AND PLANS OF ACTION (4720.5250)

I. OBJECTIVES

Given the issues, problems, and opportunities discussed in Chapter Three and the goals stated in Chapter Four, the Plan delegates direct management efforts to the following areas to prevent future contamination of the aquifer and increase awareness of groundwater protection:

A. Well Management
B. Public Education
C. Storage Tank Management
D. Septic Systems (ISTS)
E. Hazardous Waste Management
F. Stormwater Management
G. Data Collection
H. Water Conservation
I. Planning and Zoning
J. Implementation
K. Evaluation

II. Plan of Action

A. Well Management

Objective A1: Take measures to promote proper sealing of abandoned, unused, unmaintained, or damaged wells.

Action A1.1: Make property owners aware of potential technical and financial resources that are available to assist them in securing grant funding for properly sealing wells.

Who:	PUC Staff
Cooperators:	Sherburne County, Mille Lacs County
Time Frame:	Annually, beginning Year 1 and ending Year 10 following the adoption of this Plan.
Estimated Cost:	$2,500 each time of notification
Goal Achieved:	Goal 3: Source water aquifer protection
How:	Use the City's website, newsletter, or direct mailings to make owners aware of well sealing cost-share programs. Provide information to realtors to pass along to property owners preparing to sell and during disclosure process

Action A1.2: Seek funds when available and feasible to locate and/or seal wells.

Who:	PUC Staff
Cooperators:	Sherburne County, Mille Lacs County, MDH, Consultant
Time Frame:	Ongoing throughout Years 1-10 of this Plan, when grant funding is available or wells are located.
Estimated Cost:	$1,000 (grant application); additional cost for sealing TBD
Goal Achieved:	Goal 3: Source water aquifer protection
How:	If any unused, unsealed wells are discovered within DWSMA, grant funding shall be sought to properly seal the well.

Objective A2: Take measures to identify properties with abandoned, unused, unmaintained, or damaged wells and potential cross connections between private wells and the City's water system

Action A2: Identify properties with potential water supply cross connections or wells that pose a hazard to the public water supply.

Who:	PUC Staff or consultant
Cooperators:	MDH, Sherburne County, Mille Lacs County, Consultant
Time Frame:	Years 3 - 5 of this Plan, or wells are located.
Estimated Cost:	$5,000 - $7,000 research effort; remaining work dependent on results
Goal Achieved:	Goal 3: Source water aquifer protection
How:	Through mapping and field investigation, as well as historical records. When possible, the list of parcels likely to have wells will be incorporated into the City Building Officials records or shared with other jurisdictions in the DWSMA. When application is made to rebuild or demolish an existing building, the records can be reviewed to determine if a well search is required.

Objective A3: Identify new high-capacity wells within the DWSMA

Action A3: The PUC will work with MnDNR and MDH to address implications of high capacity well construction or appropriation permitting changes on the City's drinking water supply or DWSMA boundary.

Who:	PUC Staff, Consultant
Cooperators:	MnDNR, MDH
Time Frame:	Ongoing, as needed.
Estimated Cost:	Varies
Goal Achieved:	Goal 2: Continue to supply sufficient water quantity for system users.
How:	The MnDNR and MDH will be contacted to inquire about any new notices on any newly proposed or constructed high-capacity wells within or near the DWSMA or any changes to existing appropriations permits for high-capacity wells. If the City or PUC receives a notice, it will work with MnDNR and MDH to determine implications for the DWSMA or the vulnerability of the aquifer. If implications are determined, the PUC will provide comment to permit application.

Objective A4: Continue to monitor water quantity and quality from the PUC's wells (existing and new) to ensure high quality.

Action A4: Examine and review the annual water quantity and quality reports to identify changes in groundwater levels, aquifer hydraulics, and concentrations of constituents.

Who:	PUC Staff
Cooperators:	Consultant, MDH
Time Frame:	Monthly – groundwater levels; When available – quality reports
Estimated Cost:	No additional cost – staff time
Goal Achieved:	Goal 1: Maintain or improve current level of water quality; Goal 2: Continue to supply sufficient water quantity.
How:	The PUC will continue to receive water quality reports, at which time the reports will be compared to previous years to evaluate trends or changes. Groundwater levels and quality shall be recorded monthly within the water supply wells. Staff will review annual water quality reports and provide summaries about changes over time. If new contaminant sources are found, the PUC will ensure wells meet isolation distance requirements.

Objective A5: Educate the public about proper well management.

Action A5: Using public events, City's website, newsletter, or other direct mailings; the PUC will provide information to the public on proper well management.

Who:	PUC and City Staff, Consultant
Cooperators:	MRWA, MDH

Time Frame:	Year 1 following the adoption of this Plan, updating biannually
Estimated Cost:	$2,500 per publishing
Goal Achieved:	Goal 3: Promote activities to raise awareness.
How:	Use the City's website, CCR, newsletter, or social media sites to provide education on proper well management by linking the MDH's Well Owner's Handbook or other pertinent information to the City's website.

Objective A6: Investigate site locations for a new PUC municipal well.

Action A6: The PUC will work with MDH and consultant to review proposed new municipal well sites to determine if the site is consistent with wellhead protection planning goals.

Who:	PUC, Consultant
Cooperators:	MDH, Consultant
Time Frame:	As needed, when new wells are planned.
Estimated Cost:	Site investigation and drilling test well costs
Goal Achieved:	Goal 2: Continue to supply sufficient water quantity.
How:	Review proposed well sites and identify any nearby potential contamination sources. If site is deemed acceptable, PUC will consider drilling a test well to evaluate the potential impact on nearby wells, pumping rates and water quality.

Objective A7: Monitor the IWMZ areas for the addition of or changes to potential contaminant sources.

Action A7: The PUC staff will assist in updating IWMZ survey form for all wells to determine if there have been additions or changes to potential contaminant sources.

Who:	PUC Staff
Cooperators:	MDH
Time Frame:	Year 5 following the adoption of this Plan.
Estimated Cost:	Varies, MDH cost and City Staff time
Goal Achieved:	Goal 1: Work to maintain or improve current water quality.
How:	The PUC will work with MDH to update the IWMZ survey every 5 years. If changes are made to the items identified in the IWMZ, the PUC will notify property owners if any well setback distances are violated and work with the property owners to address any potential contaminants identified in the IWMZ survey.

B. Public Education

Objective B1: Continue developing a public support and understanding for the WHP planning through public events and the use of websites, newsletters, and handouts.

Action B1.1: Include information about WHP and groundwater protection in the City newsletter.

Who:	PUC and City Staff
Cooperators:	MDH, MRWA, Baldwin Township
Time Frame:	Year 1 and Year 5 following the adoption of this Plan.
Estimated Cost:	$2,000 - $3,000 each mailing/posting
Goal Achieved:	Goal 3: Make information available to promote wellhead and source water protection.
How:	Identify and obtain existing educational materials available from MDH or MRWA. Write newsletter articles describing WHP and include contact information and website addresses for existing educational resources.

Action B1.2: Provide information about the WHP Plan and links to other WHP related resources on the City's website and interactive map.

Who:	PUC and City Staff, Consultant
Cooperators:	MDH, MRWA
Time Frame:	Year 5 following the adoption of this Plan.
Estimated Cost:	$1,000 - $1,500 each year of posting
Goal Achieved:	Goal 3: Make information available to promote wellhead and source water protection.
How:	Provide a summary of WHP goals and implementation. Provide links to WHP related websites including MDH, MDA, and EPA.

Objective B2: Provide information preventing leaks and proper tank maintenance to tank owners in WHP areas.

Action B2: Send reminder notices to new and old tank owners about tank regulations and the importance of early leak detection.

Who:	City Staff
Cooperators:	MDH, Fire Department, MnDOT, Baldwin Township, Sherburne County and Mille Lacs County
Time Frame:	Year 2 following the adoption of this Plan.
Estimated Cost:	$2,000 each year of postings/mailings
Goal Achieved:	Goal 3: Make information available to promote wellhead and source water protection.
How:	The PUC can assist owners on methods to use to check for leaks and how to keep records by sending out information through mailings, City's website, social media, etc. The PUC could also require the use of certified contractors for installation and removal of unregulated underground storage tanks.

Objective B3: Provide information to agricultural landowners within the DWMSA.

Action B3: Send educational information to agricultural landowners within DWSMAs about the need for proper handling and disposal of agricultural chemicals and fertilizers.

Who:	City Staff
Cooperators:	MDH, MDA, MRWA
Time Frame:	Year 3 following the adoption of this Plan.
Estimated Cost:	$1,000 - $2,000 per mailing year of postings/mailings
Goal Achieved:	Goal 3: Make information available to promote wellhead and source water protection.
How:	Through mapping, the PUC will identify agricultural landowners and provide them with educational information on proper disposal of agricultural chemicals and fertilizers and how it can help protect the City's water supply from contamination.

Objective B4: Educate emergency management officials of the importance of spills/clean-up within the DWSMA due to its sensitivity.

Action B4: Send a summary memo to the Fire Department, Sherburne Fire and Rescue, First Responders, Sherburne and Mille Lacs County Sheriff's Dept. of Emergency Managers, Minnesota Department of Transportation (MnDOT), regarding the DWSMA location, sensitivity, and importance of spill cleanup within the management area.

Who:	City Staff
Cooperators:	MDH, Sherburne and Mille Lacs County, Fire Department
Time Frame:	Year 2 following the adoption of this Plan.
Estimated Cost:	$500 - $1,000
Goal Achieved:	Goal 3: Make information available to promote wellhead and source water protection.

How:	Review and update spill response plan for transportation corridors with local management officials on the DWSMA location and importance of spill cleanup within the management areas.

C. Storage Tank Management

Objective C1: Notify owners of storage tanks located within the DWSMAs that the tank is in a source water protection area and educate owners of properties containing the storage tanks of the importance of spill prevention.

Action C1.1: Educate storage tank owners on the PUC's source water protection efforts and supply publications on proper operation and maintenance of storage tanks and make them aware of their placement within the DWSMAs

Who:	PUC and City Staff, Consultant
Cooperators:	MDH, MPCA, Consultant, Baldwin Township
Time Frame:	Within Year 3 following the adoption of this Plan.
Estimated Cost:	$2,000 - $3,000
Goal Achieved:	Goal 1: Maintain or improve the current level of water quality; Goal 3: Increase awareness of wellhead and source water protection.
How:	Send mailings or contact property owners through other means notifying them about the DWSMA delineation and the importance of spill prevention. Provide contact numbers for the appropriate government agencies to each property owner. Provide tank owners information and resources to acquire the appropriate spill clean-up materials (sorbent materials, etc.) and have these located on site.

Action C1.2: Contact and provide storage tank owners with information located within emergency response areas and make them aware of the importance of spill prevention and response.

Who:	PUC Staff, Consultant
Cooperators:	MDH, MPCA, MRWA, Consultant, Baldwin Township
Time Frame:	Within Year 5 following the adoption of this Plan.
Estimated Cost:	$2,000 - $3,000 per mailing
Goal Achieved:	Goal 1: Maintain or improve the current level of water quality; Goal 3: Increase awareness of wellhead and source water protection.
How:	Using the PCSI, PUC Staff and/or consultant will prepare a contact list of storage tank owners located within the emergency response areas. These storage tank owners will be provided information on the importance of spill prevention and response.

D. Septic System (ISTS) Management

Objective D1: Coordinate with Baldwin Township, Sherburne and Mille Lacs County to educate property owners about the need for having onsite sewage treatment systems that comply with environmental standards and other regulations.

Action D1.1: Assist both Counties efforts to educate property owners about ISTS systems and proper maintenance of them.

Who:	PUC and City Staff, Consultant
Cooperators:	Sherburne and Mille Lacs County, Baldwin Township
Time Frame:	Years 2 following the adoption of this Plan.
Estimated Cost:	$1,000 - $2,500 for mailings; Coordination with Counties Staff time.
Goals Achieved:	Goal 3: Increase awareness of wellhead and source water protection.
How:	The PUC will place information related to operation and maintenance of ISTS on their website and send mailers to ISTS owners informing them the information is available on the PUC website. The PUC will also provide assistance to Sherburne and Mille Lacs Counties if information on existing ISTS is requested.

Action D1.2: Provide information on financial opportunities to upgrade or repair on-site systems to businesses and residents in the DWSMAs.

Who:	PUC Staff
Cooperators:	Sherburne and Mille Lacs County, Baldwin Township
Time Frame:	Years 7 following the adoption of this Plan.
Estimated Cost:	Staff time.
Goals Achieved:	Goal 3: Increase awareness of wellhead and source water protection.
How:	The PUC will coordinate with county staff to place information related financial opportunities to upgrade or repair on-site systems to businesses and residents in the DWSMAs. If direct mailers are needed, the PUC will request grant funding.

E. Hazardous Waste Management

Objective E1: Educate the public and business owners on the proper disposal of hazardous waste items

Action E1.1: Support household hazardous waste collection efforts by Sherburne and Mille Lacs County

Who:	PUC and City Staff
Cooperators:	MPCA, Sherburne and Mille Lacs County
Time Frame:	Ongoing
Estimated Cost:	Staff and/or consultant time
Goals Achieved:	Goal 3: Increase awareness of wellhead and source water protection.
How:	Include information on the City's website, in the City's newsletter, distribute mailers, or include water billing inserts to encourage residents within the DWSMA, and throughout the city to participate in the either County's household hazardous waste collection day.

Action E1.2: Promote management and disposal of hazardous waste among businesses in the DWSMAs.

Who:	PUC Staff, Consultant
Cooperators:	MPCA, Sherburne and Mille Lacs County Haz. Waste Depts.
Time Frame:	Years 3 and 9 following the adoption of this plan.
Estimated Cost:	Staff and/or consultant time
Goals Achieved:	Goal 3: Increase awareness of wellhead and source water protection.
How:	Work directly with Mille Lacs and Sherburne County's Hazardous Waste Departments to notify and educate business owners about proper management and disposal of hazardous waste. For businesses located in both counties, specific information on local Information on local disposal options. Businesses will also be provided with information about the Minnesota Technical Assistance Program (MnTAP) for hazardous material management and resource recovery alternatives.

Objective E2: Encourage Owners of potential contaminant source properties with Solid Waste Management and Wastewater Disposal Sites, and Hazardous Waste Generator permits to participate in self-audit of their chemical storage and waste generation handling

Action E2: PUC staff and consultant will prepare and distribute the direct mail notice.

Who:	PUC, consultant
Cooperators:	Consultant, MDH, MnTAP
Time Frame:	Years 2 following adoption of this plan.
Estimated Cost:	$1,000 - $2,000 for each direct mail notification.
Goals Achieved:	Goal 3: Increase awareness of wellhead and source water protection.
How:	Through a direct mail contact, PUC will encourage the owners of potential contaminant source properties with solid waste management, wastewater

	disposal sites, and hazardous generator permits within the DWMSA to participate in self-audits of their waste generation and handling. The direct mail contact from the PUC will also encourage these businesses to request a site visit from the MnTAP. MnTAP helps Minnesota businesses implement industry-tailored solutions that maximize resource efficiency, prevent pollution, and reduce costs to improve public health and environment.

F. Stormwater Management

Objective F1: Educate the public on proper stormwater management, turf management, proper lawn care practices, smart salting practices, and water conservation.

Action F1.1: Provide information to the community with respect to the everyday issues regarding stormwater and lawn care.

Who:	PUC City Staff
Cooperators:	Consultant, MPCA, Watershed districts
Time Frame:	Years 4 of this Plan
Estimated Cost:	Varies
Goals Achieved:	Goal 3: Increase awareness of wellhead and source water protection
How:	Include information on the City's website, in the City's newsletter, distribute direct mailers, or include water billing inserts to educate the community on some best management practices that may be implemented.

G. Data Collection

Objective G1: Continue to cooperate with and support future data collection efforts by other agencies.

Action G1: The PUC will work with agencies to monitor the water quality in the municipal water supply wells.

Who:	PUC Staff
Cooperators:	MDH
Time Frame:	Year 6 of this Plan.
Estimated Cost:	Staff time
Goals Achieved:	Goal 4: Continue to collect data to support wellhead and source water protection.
How:	The PUC will complete the standard assessment monitoring package at the primary wells that exist at the time. MDH to provide sample bottles and cover the costs associated with the analytics. The PUC will collect the samples and ship them to MDH.

Objective G2: Continue to collect and maintain local geologic and hydrogeological data in order to improve and augment information and to provide additional data for future amendments to this plan.

Action G2.1: Monitor static and pumping levels in municipal wells.

Who:	PUC Staff
Cooperators:	MnDNR, Consultant
Time Frame:	Annually following the adoption of this plan
Estimated Cost:	Staff time
Goal Achieved:	Goal 4: Continue data collection to support future wellhead and source water protection.
How:	Conduct routine collection of groundwater levels in municipal wells, which will provide data for evaluation of groundwater elevation trends over time. This data can also be used to verify the groundwater flow field in the source water aquifer.

Action G2.2: Locate and collect geologic information from nearby wells/boreholes.

Who:	PUC Staff
Cooperators:	MDH, MnDNR, Consultant
Time Frame:	Ongoing, when funding is available
Estimated Cost:	Staff time
Goal Achieved:	Goal 4: Continue data collection to support future wellhead and source water protection.
How:	The PUC will strive to locate other wells within the DWMSA in order to collect additional geologic information. If funding permits, the PUC will consider drilling test borings in areas designated as being highly vulnerable.

Action G2.3: Conduct geophysical survey in DWSMA where subsurface information is unavailable or limited.

Who:	MnDNR, PUC Staff
Cooperators:	MDH, MnDNR
Time Frame:	Ongoing, when resources and/or funding are available
Estimated Cost:	MnDNR time
Goal Achieved:	Goal 4: Continue data collection to support future wellhead and source water protection.
How:	If funding or resources become available, the PUC will request assistance from state agencies to conduct a geophysical survey in areas within the DWMSA where subsurface information is limited.

Objective G3: Maintain up-to-date information about wells and potential contaminant sources within the DWSMA.

Action G3.1: In cooperation local government units and MDH, identify properties with potential wells within the DWSMA which locations were not verified during the creation of Part 2 of this Plan.

Who:	PUC Staff
Cooperators:	Consultant
Time Frame:	Year 4 following the adoption of this Plan.
Estimated Cost:	$4,00-$6,000
Goal Achieved:	Goal 4: Continue data collection to support future wellhead and source water protection.
How:	Through mapping and field investigation, as well as historical records. When possible, the list of parcels likely to have wells will be incorporated into the City Building Officials records or shared with other jurisdictions in the DWSMA. When the application is made to rebuild or demolish an existing building, the records can be reviewed to determine if a well search is required.

Action G3.2: In cooperation with local government units, existing state and local agencies and programs, maintain the database of wells, storage tanks, and ISTS within the DWSMA that was developed as a part of this Plan.

Who:	PUC Staff or Consultant
Cooperators:	MDH, MPCA
Time Frame:	Years 6 following the adoption of this Plan.
Estimated Cost:	$5,000-$6,000
Goal Achieved:	Goal 4: Continue data collection to support future wellhead and source water protection.
How:	An inventory of wells and potential contaminant sources was performed as part of the development of this Plan. Database will be reviewed periodically and updated as information become available.

Objective G4: Conduct stable isotope tests on all public water supply wells.

Action G4: The PUC will request that MDH conduct stable isotope testing once during the lifetime of this Plan.

Who:	PUC Staff
Cooperators:	MDH
Time Frame:	Year 7 following the adoption of this Plan.
Estimated Cost:	PUC Staff time
Goal Achieved:	Goal 1: Work to maintain or improve the current level of water quality; Goal 4: Continue to collect data to support future wellhead and water protection efforts.
How:	The PUC will request that MDH conduct Tritium or other stable isotope testing on each public water supply well during the seventh year of this Plan.

Objective G5: Maintain current information on the status of the spill, brownfields, and dump sites and any groundwater contamination associated with these sites.

Action G5: The PUC will request information from MPCA, and possibly county officials on updates on spill, brownfields, and dump sites and possible groundwater contamination.

Who:	PUC Staff
Cooperators:	MPCA, Mille Lacs and Sherburne Counties, consultant.
Time Frame:	Annually, starting after Year 2
Estimated Cost:	$500 - $1,500 for each update. Estimated costs include Staff time and consultant time
Goal Achieved:	Goal 1: Work to maintain or improve the current level of water quality; Goal 4: Continue to collect data to support future wellhead and water protection efforts.
How:	During the PCSI, locations of spill, brownfields, and dump sites where contaminant releases may or could occur were identified within the DWSMAs. PUC staff will request from MPCA updates on the status of these properties, including information on any groundwater contamination associated with these sites. Updated information will be reviewed to determine if any additional actions related to the City's water supply are warranted.

H. Water Conservation

Objective H1: Implement a community-wide water conservation program.

Action H1.1: Update conservation measures included in various plans within the City.

Who:	PUC and City Staff
Cooperators:	Consultant, MDH
Time Frame:	When applicable
Estimated Cost:	Varies for education, cost of additional activities will vary
Goals Achieved:	Goal 2: Continue to supply sufficient quantity of water to consumers.
How:	Educate the public to encourage users to voluntarily incorporate water saving habits and tools into their lifestyles, improve the existing water system's operation and maintenance procedures and incorporate costs associated with water conservation programs, adjusting water rate structure, and ensure all customers are paying for the water they use through audits, leak detection, and meter replacement or calibration as they occur or as needed.

Action H1.2: Implement water conservation measure and outreach.

Who:	PUC and City Staff
Cooperators:	Consultant, MDH
Time Frame:	Year 8 following the adoption of this plan.
Estimated Cost:	$8,000 - $10,000
Goals Achieved:	Goal 2: Continue to supply sufficient quantity of water to consumers.
How:	Encourage the public to conserve water through a variety of tools. Have information, activities, displays, kits, etc available at community events.

I. Planning and Zoning

Objective I1: Incorporate WHP initiatives into City Plans.

Action I1: The PUC and City will use this WHP Plan as a resource when updating its Comprehensive Plan, Water Supply Plan, normal zoning and planning review plans, and other relevant plans.

Who:	PUC and City Staff or Consultant
Cooperators:	MnDNR, MDH, Consultant
Time Frame:	When other plans are revised or amended
Estimated Cost:	Varies per plan
Goals Achieved:	Goal 3: Promote activities that protect the source water aquifer.
How:	WHP Initiatives will be addressed and incorporated into the City's various plan updates. Copies of this Plan will be distributed to City planning staff.

Objective I2: Eliminate or reduce the potential pollution risks to the source water aquifer and minimize the risk of altering the WHPA and DWSMA.

Action I2: Include a review of this Plan as a part of normal zoning and planning review process.

Who:	PUC, City Planning Staff and Consultant
Cooperators:	City Building Staff
Time Frame:	Ongoing
Estimated Cost:	Varies
Goals Achieved:	Goal 3: Promote activities that protect the source water aquifer.
How:	Copies of this Plan will be distributed to City Staff, and they will review this Plan and incorporate it as a part of their project planning review process.

J.Implementation

Objective J1: Track and report completed WHP activities.

Action J1: Organize and file completed WHP activities in the PUC's WHP 3-ring binder.

Who:	PUC Staff
Cooperators:	Consultant
Time Frame:	Annually following the adoption of this Plan.
Estimated Cost:	$500 each year
Goal Achieved:	Goal 4: Continue to collect data to support wellhead and source water protection.
How:	Update WHP records of completed implementation activities within the WHP 3-ring binder

K. Evaluation

Objective K1: Evaluate Plan

Action K1: Complete an evaluation report every 2.5 years.

Who:	PUC Staff
Cooperators:	Consultant
Time Frame:	Every 2.5 years following the adoption of this Plan.
Estimated Cost:	$2,500 per evaluation.
Goal Achieved:	Goal 1: Work to maintain or improve the current level of water quality; Goal 2: Work to continue to supply sufficient water quantity; Goal 3: Provide and promote activities that protect the source water aquifer.
How:	Prepare a written evaluation using the MDH WHP Program Evaluation form or a format selected by the PUC. Provide report to MDH Source Water Protection Unit.

CHAPTER SIX

EVALUATION PROGRAM (4720.5270)

The success of the Plan must be evaluated in order to determine whether the implementation activities are accomplishing the intent of the Plan. Monitoring will be ongoing, and a written evaluation of the Plan and associated activities will be conducted every two and a half years that the Plan is in effect. The evaluation activities will include the following items:

- Track the implementation of the goals, objectives, activities, and tasks discussed in Chapter Five of this Plan;
- Determine the effectiveness of specific management strategies regarding the protection of City's municipal water supply;
- Identify possible changes to these strategies which may improve their effectiveness; and
- Determine the adequacy of financial resources and staff availability to carry out the management strategies planned for each year.

The PUC will continue to coordinate with the MDH in the annual monitoring of the City's municipal water supply to determine if the management strategies presented in this Plan are having an impact on water quality. In addition, water quality problems that may still be occurring will be identified.

At the end of each evaluation period (every two and a half years) the PUC Staff will make a written report regarding progress in implementing the Plan, as well as an evaluation of the costs and benefits of the Plan activities. This report may be completed using the MDH Wellhead Protection Program Evaluation form. A copy of the report will be sent to the MDH Source Water Protection Unit in St. Paul. The PUC will also keep a copy of the report in its records. The intent of the evaluation is to compile a complete and comprehensive study of the implementation of the source management strategies for use when the PUC updates or revises this Plan. As required by the Wellhead Protection Rules, this Plan will be updated every 10 years at a minimum.

CHAPTER SEVEN

ALTERNATIVE WATER SUPPLY CONTINGENCY STRATEGY (4720.5280)

A contingency plan is put into effect to establish, provide, and keep updated certain emergency response procedures and information for the public water supply, which may become vital in the event of a partial or total loss of public water supply services as a result of a natural disaster, chemical contamination, civil disorder, or human-caused disruption.

In 2017, the PUC completed its Water Supply Plan as part of its Comprehensive Plan update. As required, the plan was submitted to the DNR Waters-Water Permit Programs for review and approval. The approved plan was adopted by the City and incorporated in the City's 2040 Comprehensive Plan. Copies of the Water Supply Plan and the 2040 Comprehensive Plan are available from the City.

Appendix A

Table 1 - Land Use

Land Use Type	Acreage
Agriculture	0.2
Single Family	106.1
Duplex/Twin	20.4
Multi-Family	6.7
Commercial	8.4
Industrial	117.6
Airport	242.4
Institutional/Government	15.3
Parks & Open Space	79.7
Right of Way	46.3
Vacant	257.1

Table 2 - Potential Contaminant Source Inventory

PCSI ID	Parcel ID	Owner Name	Address	City	Zip Code	PCS Code	Material Code	Status Code	MPCA ID	Total	DWSMA Vuln.
1	01-004-1311	Barrington Oaks North Animal Clinic	32233 124th St	Princeton	55371-3390	HWG	W000	A	MNS000153783	1	High
2	90-402-0110	Princeton Auto Center Inc	112 9th Avenue Cir S	Princeton	55371-2342	HWG	S000	A	MND022995443	1	High
3	24-557-0040	Former Maintenance Garage	232 11TH AVE S	Princeton	55371	LUST	F000	I	LS0012726	1	Mod.
4	01-004-1320	Integrity Engineering	12303 323rd Ave	Princeton	55371	HWG	S000	A	MNS000218982	1	High
5	24-161-0110	Innovative Gypsum	205 8th Ave S	Princeton	55371	SWMS	W000	A	UT0079	1	Mod.
6	16-032-0600	Dougs Auto Repair	2008 1st St	Princeton	55371	HWG	<Null>	I	WCERT1001145	1	High
7	01-419-0010	A Plus Car Care	31910 125th St	Princeton	55371	HWG	S000	I	MNR000013383	1	High
8	24-322-0420	Former Central Rivers Coop Bulk Facility	11th Ave S & 2nd St S	Princeton	55371	LUST	F000	I	LS0013415	1	Mod.
9	24-200-0080	Arnolds Printing	1201 15th Ave S	Princeton	55371-2305	HWG	<Null>	I	MNNONGEN641	1	High
10	01-423-0230	Knife River Corp N Central Princeton	31930 126th St	Princeton	55371	HWG	S000	I	MND985677855	1	High
11	24-553-0020	Princeton 2nd and 11th	1101, 1105, 1109 Second St S	Princeton	55371	PCS	BMS	I	VP17700	1	Mod.
12	01-423-0150	Becker Machine & Tool Inc - Princeton	32005 126th St	Princeton	55371	HWG	<Null>	I	MNR000042382	1	High
13	90-401-0140	Hibb's and Co	1606 10th St S	Princeton	55371-2348	AST	F000	R	TS0130594	1	Mod.
14	01-459-0125	Becker Machine & Tool Inc	12714 320th Ave	Princeton	55371-3383	HWG	<Null>	A	MNS000130591	1	High
15	24-322-0310	Abandoned Lot	10th Ave S & 2nd St S	Princeton	55371	LUST	F000	I	LS0016215	1	Mod.
16	90-413-0110	United States Distilled Products	1607 12th St S	Princeton	55371-2300	AST	C000	A	TS0123634	77	Mod.
17	90-411-0105	Kivisto Veterinary Clinic LLC	31878 126th St NW Ste 1	Princeton	55371-4591	HWG	W000	A	MNS000152611	1	High
18	24-032-2900	Hartland Co	1506 14th St S	Princeton	55371-2317	HWG	<Null>	I	MNP200000244	1	High
19	01-004-1320	Shipwreck Boat Repair	32273 124th Street NW	Princeton	55371	PCS	BMS	I	BF0001389	1	High
20	90-401-0445	Abc Refuse	1506 14th St S	Princeton	55371	UST	F000	R	TS0020255	2	Mod.
21	90-402-0107	Circle 9	106 9th Ave Cir S	Princeton	55371	UST	F000	A	TS0018858	6	High
22	16-032-0600	Klars Country Machining	9795 18th St	Princeton	55371-9801	HWG	<Null>	I	MND098278427	1	High
23	90-401-0210	Andys Auto Works	32005 126th St	Princeton	55371	HWG	<Null>	I	MND985710615	1	High
24	90-004-2301	Crystal Cabinet Works Inc	1100 Crystal Dr	Princeton	55371-3350	HWG	<Null>	A	MND006209860	1	High
25	01-419-0120	ABRA Auto Body & Glass - Princeton	32018 125th St NW	Princeton	55371-3330	HWG	W000	A	MNR000100610	1	High
26	90-407-0335	FAA	1919 12th St S	Princeton	55371-2343	AST	F000	A	TS0119731	1	Mod.
27	01-419-0010	Minnkey Inc	3220 126th St	Princeton	55371	LUST	F000	I	LS0006478	1	High
28	01-531-0205	Choppers Rods & Customs	12526 319th Ave NW	Princeton	55371	HWG	S000	I	MND985764976	1	High
29	24-032-4900	Hedstrom Truck Repair	800 Airport Rd	Princeton	55371	HWG	<Null>	I	MND982419905	1	High
30	24-553-0010	Hofman Oil	205 11th Ave S	Princeton	55371	LUST	F000	I	LS0012725	1	Mod.
31	24-033-1220	758 Princeton Laidlan Transit Inc	604 Old Highway 18 S	Princeton	55371	AST	F000	A	TS0122412	1	Mod.
32	<Null>	Princeton Oil Co	11th Ave N & 2nd St N	Princeton	55371	LUST	<Null>	I	LS0012728	1	Mod.
33	01-423-0215	Distinctive Door Designs	32010 126th St NW	Princeton	55371-3332	HWG	<Null>	A	MNS000183228	1	High
34	01-425-0010	Marvs True Value	31620 125th St	Princeton	55371	HWG	<Null>	A	MNS000212514	1	High
35	01-459-0105	AM Painting of Princeton, Inc.	32015 128th St NW	Princeton	55371-3304	HWG	<Null>	I	MNS000121673	1	High
36	16-032-0600	Allstate Leasing - Princeton	1900 1st St W	Princeton	55371	HWG	S000	I	MNR000106617	1	High
37	24-032-0800	Aaron Stevens	RR 5 Box 63	Princeton	55371-8808	HWG	<Null>	I	MND981794266	1	High
38	01-531-0110	Swantec Inc - Paint Area	31858 126th St NW	Princeton	55371-4515	HWG	<Null>	A	MNS000203802	1	High
39	24-033-1100	Public Utilities Commission	907 1st St	Princeton	55371	LUST	<Null>	I	LS0004452	1	Mod.
40	24-322-0090	Oakwood Land Development	11th Ave N & 1st St	Princeton	55371	LUST	<Null>	I	LS0012727	1	Mod.
41	90-413-0110	Paul Vincent	1800 S 12th St	Princeton	55371	UST	F000	R	TS0019196	4	Mod.
42	24-360-0200	Princeton Public Utilities Commission	907 1st St	Princeton	55371-1559	UST	F000	R	TS0053115	5	Mod.
43	90-402-0110	Princeton Auto Center Inc	112 9th Avenue Cir S	Princeton	55371-2342	AST	F000	A	TS0055207	1	High
44	90-403-0110	Sylva Corporation Inc	900 AIRPORT RD	Princeton	55371-2341	LUST	F000	I	LS0019030	1	Mod.
45	90-403-0110	Sylva Corporation Inc	900 AIRPORT RD	Princeton	55371-2341	SWMS	W000	A	PBR001218	1	Mod.
46	90-403-0110	Sylva Corporation Inc	900 AIRPORT RD	Princeton	55371-2341	AST	F000	A	TS0018909	3	Mod.
47	24-200-0080	Arnolds Printing	1201 15TH AVE S	Princeton	55371-2305	AST	W000	A	TS0054953	1	High
48	01-423-0230	Knife River Corp N Central Princeton	31930 126th St	Princeton	55371	UST	F000	R	TS0021189	1	High
49	01-423-0230	Knife River Corp N Central Princeton	31930 126th St	Princeton	55371	AST	F000	R	TS0021189	2	High
50	01-423-0150	Becker Machine & Tool Inc - Princeton	32005 126th St	Princeton	55371	LUST	F000	I	LS0016044	1	High
51	90-413-0110	United States Distilled Products	1607 12th St S	Princeton	55371-2300	AST	C000	U	TS0123634	43	Mod.
52	90-413-0110	United States Distilled Products	1607 12th St S	Princeton	55371-2300	AST	C000	C	TS0123634	4	Mod.
53	24-032-2900	Hartland Co	1506 14th St S	Princeton	55371-2317	PCS	HWIC	I	MNP200000244	1	High
54	90-004-2301	Crystal Cabinet Works Inc	1100 Crystal Dr	Princeton	55371-3350	AST	F000	A	TS0054970	1	High
55	90-004-2301	Crystal Cabinet Works Inc	1100 Crystal Dr	Princeton	55371-3350	AST	F000	U	TS0054970	1	High
56	90-004-2301	Crystal Cabinet Works Inc	1100 Crystal Dr	Princeton	55371-3350	AST	<Null>	U	TS0054970	1	High
57	90-004-2301	Crystal Cabinet Works Inc	1100 Crystal Dr	Princeton	55371-3350	SWMS	W000	A	UT0178	1	High
58	90-004-2301	Crystal Cabinet Works Inc	1100 Crystal Dr	Princeton	55371-3350	WWDS	W000	A	SIU000073	1	High
59	24-032-4900	Hedstrom Truck Repair	800 Airport Rd.	Princeton	55371	LUST	F000	I	LS0000418	1	High
60	24-322-0090	Oakwood Land Development	11th Ave N & 1st St	Princeton	55371	AST	F000	U	TS0119704	6	Mod.
61	24-360-0200	Princeton Public Utilities Commission	907 1ST ST	Princeton	55371-1559	AST	F000	R	TS0053115	1	Mod.
62	24-360-0200	Princeton Public Utilities Commission	907 1ST ST	Princeton	55371-1559	AST	F000	C	TS0053115	2	Mod.
63	24-360-0200	Princeton Public Utilities Commission	907 1ST ST	Princeton	55371-1559	AST	F000	U	TS0053115	12	Mod.
64	01-419-0010	Brads Repair	31908 125th St	Princeton	55371-3392	HWG	<Null>	I	MND982639189	1	High
65	<Null>	<Null>	907 2nd St. S	Princeton	55371	SPL	<Null>	C	94-0026	1	Mod.
66	24-550-0060	City of Princeton	212 11th Ave S	Princeton	55371	SPL	A050	C	CF-2929	1	Mod.
67	01-459-0150	A J Industries	12713 320th Ave	Princeton	55371	ISTS	<Null>	U	<Null>	1	High
68	90-411-0105	Abra Auto Body & Glass	31878 126th St. Suite 1	Princeton	55371	ISTS	<Null>	U	<Null>	1	High
69	01-418-0135	Adams, Kimberly J	12707 316th Ave	Princeton	55371	ISTS	<Null>	U	<Null>	1	High
70	01-418-0140	Adams, Kimberly J	12711 316th Ave	Princeton	55371	ISTS	<Null>	U	<Null>	1	High
71	01-419-0120	Auto Specialties - Princton	32018 125th St	Princeton	55371	ISTS	<Null>	U	<Null>	1	High
72	01-004-1311	Barrington Oaks North Animal Clinic	32233 124th St NW	Princeton	55371	ISTS	<Null>	U	<Null>	1	High
73	01-423-0150	Becker Machine & Tool Inc.	32005 126th St	Princeton	55371	ISTS	<Null>	U	<Null>	1	High
74	01-418-0115	Benik, Elinor A	31623 127th St	Princeton	55371	ISTS	<Null>	U	<Null>	1	High
75	01-418-0315	Bentz, Jesse J & Sherry C	12723 316 1/2 Ave	Princeton	55371	ISTS	<Null>	U	<Null>	1	High
76	01-423-0180	Block Technologies Inc	12536 319th Ave	Princeton	55371	ISTS	<Null>	U	<Null>	1	High
77	01-418-0320	Brander, Mark & Nancy	12733 316 1/2 Ave	Princeton	55371	ISTS	<Null>	U	<Null>	1	High
78	01-418-0220	Broda, Elmer G & Michelle M	12727 317th Ave	Princeton	55371	ISTS	<Null>	U	<Null>	1	High
79	01-423-0120	Budget Truck Rental	12535 320 1/2 Ave NW	Princeton	55371	ISTS	<Null>	U	<Null>	1	High
80	01-419-0180	David Johnson RV Rental	31908 125th St	Princeton	55371	ISTS	<Null>	U	<Null>	1	High
81	01-418-0325	Feiertag, Sandra L	12743 316 1/2 Ave	Princeton	55371	ISTS	<Null>	U	<Null>	1	High
82	01-418-0125	Hugget, Allen & Virginia	31611 127th St	Princeton	55371	ISTS	<Null>	U	<Null>	1	High
83	01-004-1315	Integrity Engineering	12303 323rd Ave	Princeton	55371	ISTS	<Null>	U	<Null>	1	High
84	01-459-0110	Integrity Automotive	32003 128th St NW	Princeton	55371	ISTS	<Null>	U	<Null>	1	High
85	01-419-0120	Jim's Auto Repair	32018 125th St	Princeton	55371	ISTS	<Null>	U	<Null>	1	High
86	01-418-0340	Johnson, James & Gwen	12724 316th Ave	Princeton	55371	ISTS	<Null>	U	<Null>	1	High
87	90-411-0105	Kivisto Veternay Clinic LLC	31878 126th St NW Suite 2	Princeton	55371	ISTS	<Null>	U	<Null>	1	High
88	01-423-0220	Knife River Corp	31930 126th St	Princeton	55371	ISTS	<Null>	U	<Null>	1	High
89	01-418-0240	Laskowski, James & Juanita	12724 316 1/2 Ave	Princeton	55371	ISTS	<Null>	U	<Null>	1	High
90	01-418-0130	Lewandoski, Dean M	31603 127th St	Princeton	55371	ISTS	<Null>	U	<Null>	1	High
91	01-418-0245	Lindau, Aaron D & Amanda J	12712 316 1/2 Ave NW	Princeton	55371	ISTS	<Null>	U	<Null>	1	High
92	90-402-0105	Marathon Gas Station	106 9th Ave Circle S	Princeton	55371	ISTS	<Null>	U	<Null>	1	High

Table 2 - Potential Contaminant Source Inventory

93	01-418-0225	McGraw, Raymond & Sandra K	12741 317th Ave NW	Princeton	55371	ISTS	<Null>	U	<Null>	1	High
94	01-531-0135	Northwoods Animal Hospital	12513 318th Ave NW	Princeton	55371	ISTS	<Null>	U	<Null>	1	High
95	01-004-3305	Olson, Glenn G & Lois A	31727 128th Ave	Princeton	55371	ISTS	<Null>	U	<Null>	1	High
96	01-418-0010	Phillipi, Thomas & Winnifred	31647 127th St	Princeton	55371	ISTS	<Null>	U	<Null>	1	High
97	90-402-0110	Princeton Auto Center	112 9th Ave Cir S	Princeton	55371	ISTS	<Null>	U	<Null>	1	High
98	01-459-0105	Pro Products Inc.	32015 128th St NW	Princeton	55371	ISTS	<Null>	U	<Null>	1	High
99	01-459-0160	Railside LLC	12739 320th Ave	Princeton	55371	ISTS	<Null>	U	<Null>	1	High
100	01-418-0230	Reed, Scott R D	12740 316 1/2 Ave	Princeton	55371	ISTS	<Null>	U	<Null>	1	High
101	01-531-0215	Rhyti Fireplace	12588 318th Ave NW	Princeton	55371	ISTS	<Null>	U	<Null>	1	High
102	90-004-1320	Shipwreck Boat Repair	32273 124th St	Princeton	55371	ISTS	<Null>	U	<Null>	1	High
103	01-418-0105	Silva, Aaron & Bianey	31633 127th St	Princeton	55371	ISTS	<Null>	U	<Null>	1	High
104	01-004-4225	Skogquist Trucking & Excavating Inc	32033 124th St	Princeton	55371	ISTS	<Null>	U	<Null>	1	High
105	01-004-3320	Snow, Donald & Ronda K	31743 128th St.	Princeton	55371	ISTS	<Null>	U	<Null>	1	High
106	01-418-0250	Soens, Wayne & Debra	31626 127th St	Princeton	55371	ISTS	<Null>	U	<Null>	1	High
107	01-586-0110	SRW Products	32020 126th St	Princeton	55371	ISTS	<Null>	U	<Null>	1	High
108	01-531-0110	Swantec, Inc	31858 126th St NW	Princeton	55371	ISTS	<Null>	U	<Null>	1	High
109	01-459-0155	Swenson Heating and Air	12723 320th Ave	Princeton	55371	ISTS	<Null>	U	<Null>	1	High
110	01-418-0120	Troseth, Kenneth E & Mary A	31617 127th St	Princeton	55371	ISTS	<Null>	U	<Null>	1	High
111	01-418-0345	Williams, Arnold & Connie	12716 316th Ave	Princeton	55371	ISTS	<Null>	U	<Null>	1	High
112	01-418-0235	Peterson, Richard & Audrey G	12724 316 1/2 Ave	Princeton	55371	ISTS	<Null>	U	<Null>	1	High
113	01-418-0160	Reierson, Gene R	12747 316th Ave	Princeton	55371	ISTS	<Null>	U	<Null>	1	High
114	01-418-0350	Parker, Bradley S & Lisa M	31608 127th St	Princeton	55371	ISTS	<Null>	U	<Null>	1	High
115	01-418-0305	Norvell, Fred A Jr	31618 127th St	Princeton	55371	ISTS	<Null>	U	<Null>	1	High
116	01-418-0150	Nori, Randall & Pauline	12727 316th Ave	Princeton	55371	ISTS	<Null>	U	<Null>	1	High
117	01-418-0330	Loija-Stone, Kimberly T	12748 316th Ave	Princeton	55371	ISTS	<Null>	U	<Null>	1	High
118	01-418-0210	Jones, Daniel & Griner	12711 317th Ave	Princeton	55371	ISTS	<Null>	U	<Null>	1	High
119	01-418-0215	Jensen, Jordan & Lois	12719 317th Ave	Princeton	55371	ISTS	<Null>	U	<Null>	1	High
120	01-418-0110	Freese, David J & Lynn M	31627 127th St	Princeton	55371	ISTS	<Null>	U	<Null>	1	High
121	01-418-0310	Bounds, Stacey	12711 316 1/2 Ave	Princeton	55371	ISTS	<Null>	U	<Null>	1	High
122	01-418-0205	Becker, Aaron E	31642 127th St NW	Princeton	55371	ISTS	<Null>	U	<Null>	1	High
123	01-418-0335	Podtburg, Olga	12736 316th Ave	Princeton	55371	ISTS	<Null>	U	<Null>	1	High
124	01-418-0155	Paulus, Mary L	12739 316th Ave	Princeton	55371	ISTS	<Null>	U	<Null>	1	High
125	01-418-0145	Papenfuss, Jeremy & Danielle	12719 316th Ave	Princeton	55371	ISTS	<Null>	U	<Null>	1	High

Table 3 - Public and Private Wells

PCSI ID	Unique Number	Well Name	Status Code	Use Code	Parcel ID	Address	City	Zip Code	PCS Code	Vulnerability
126	658501	HOMEWORK DESIGN	A	PS	01-459-0150	12713 320TH AVE NW	PRINCETON	55371	WEL	High
127	749848	PRINCETON 9	A	PC	90-414-0105	-	PRINCETON	55371	WEL	High
128	738186	CHOPPERS ROD & CUSTOM	A	DO	01-423-0190	12526 319TH AVE NW	PRINCETON	55371	WEL	High
129	143546		A	DO	01-418-0110	31627 127TH ST NW	PRINCETON	55371	WEL	High
130	703861	ARCHER, JOHN	A	DO	01-459-0130	12714 320TH AVE NW	PRINCETON	55371	WEL	High
131	601770	A M PAINTING	A	DO	01-459-0105	32015 128TH ST NW	PRINCETON	55371	WEL	High
132	126572		A	DO	01-418-0135	12707 316TH AVE NW	PRINCETON	55371	WEL	High
133	694598	RAILSIDE LLC	A	DO	01-459-0160	12739 320TH AVE NW	PRINCETON	55371	WEL	High
134	597311	G & L SALES	A	DO	01-459-0155	12723 320TH AVE NW	PRINCETON	55371	WEL	High
135	122895		A	DO	01-418-0320	12733 316 1/2 AVE NW	PRINCETON	55371	WEL	High
136	607399	PUTNAM, ROD	A	DO	01-419-0120	32018 125TH ST NW	PRINCETON	55371	WEL	High
137	750444		A	DO	01-008-1100	31646 128TH ST NW	PRINCETON	55371	WEL	Moderate
138	126823		A	DO	01-418-0010	31647 127TH ST NW	PRINCETON	55371	WEL	High
139	680572	DISTINCTIVE DOOR DESIGN	A	CO	01-423-0215	32010 126TH ST NW	PRINCETON	55371	WEL	High
140	751504	PRINCETON 8	A	PC	90-414-0105	-	PRINCETON	55371	WEL	High
141	261479	PRINCETON CARPET AND DES	A	PN	01-419-0150	31940 125TH ST NW	PRINCETON	55371	WEL	High
142	661556	WESTLING MFG	A	IR	90-403-0210	1700 12TH ST S	PRINCETON	55371	WEL	Moderate
143	261480	WQPM RADIO 1	A	PN	01-004-1325	32215 124TH ST NW	PRINCETON	55371	WEL	High
144	711191	RW BUILDERS	A	DO	90-411-0105	31878 126TH ST NW	PRINCETON	55371	WEL	High
145	165677	ANDERSON, RICHARD	A	DO	01-419-0030	-	PRINCETON	55371	WEL	High
146	225845	ODEGARD, O.J.	A	IR	01-008-1100	31646 128TH ST NW	PRINCETON	55371	WEL	Moderate
147	126821		A	DO	01-418-0125	31611 127TH ST NW	PRINCETON	55371	WEL	High
148	261477	PRINCETON RENTAL 1	A	PN	01-419-0140	32010 125TH ST NW	PRINCETON	55371	WEL	High
149	122893		A	DO	01-418-0140	12711 316TH AVE NW	PRINCETON	55371	WEL	High
150	196438	SNOW	A	DO	01-004-3320	31743 128TH ST NW	PRINCETON	55371	WEL	High
151	143545		A	DO	01-418-0105	31633 127TH ST NW	PRINCETON	55371	WEL	High
152	126579		A	DO	01-418-0130	31603 127TH ST NW	PRINCETON	55371	WEL	High
153	143351		A	DO	01-418-0105	31633 127TH ST NW	PRINCETON	55371	WEL	High
154	638482	AARON STEVENS INC.	A	DO	01-459-0145	12643 320TH AVE NW	PRINCETON	55371	WEL	High
155	470875	POFFER, BILL	A	DO	24-032-2100	1801 1ST ST	PRINCETON	55371	WEL	High
156	248307	MARVIN GEORGE BUILDERS 1	A	PP	01-425-0010	31620 125TH ST NW	PRINCETON	55371	WEL	High
157	578949	PRINCETON 7	A	PC	24-360-0190	907 1ST ST	PRINCETON	55371	WEL	Moderate
158	261483	BARRINGTON OAKS NORTH AN	A	PN	01-004-1311	32233 124TH ST NW	PRINCETON	55371	WEL	High
159	126573		A	DO	01-418-0240	12724 316 1/2 AVE NW	PRINCETON	55371	WEL	High
160	548780	SUBWAY #9413	A	PN	01-419-0110	32022 125TH ST NW	PRINCETON	55371	WEL	High
161	565070	ERICKSON ASPHALT SERVICE	A	DO	01-459-0110	32003 128TH ST NW	PRINCETON	55371	WEL	High
162	598684	PUBLIC UTILITIES COMMISS	A	TW	90-407-0335	1919 12TH ST S	PRINCETON	55371	WEL	Moderate
163	583233	BRAND, MIKE	A	PN	01-419-0160	31924 125TH ST NW	PRINCETON	55371	WEL	High
164	635856	HULTMAN, SCOTT	A	DO	01-004-4240	31913 124TH ST NW	PRINCETON	55371	WEL	High
165	143442		A	DO	01-418-0120	31617 127TH ST NW	PRINCETON	55371	WEL	High
166	771282	GALLENBERG, DENNIS & KIM	A	DO	01-004-1311	32233 124TH ST NW	PRINCETON	55371	WEL	High
167	705915	LASKOWSKI, JIM	A	DO	01-418-0240	12724 316 1/2 AVE NW	PRINCETON	55371	WEL	High
168	699148		A	DO	01-531-0135	12513 318TH AVE NW	PRINCETON	55371	WEL	High
169	704933		A	DO	01-531-0215	12588 318TH AVE NW	PRINCETON	55371	WEL	High
170	711190		A	DO	01-531-0110	31858 126TH ST NW	PRINCETON	55371	WEL	High
171	665857	GRAY, SCOTT	A	IN	01-423-0160	31969 126TH ST NW	PRINCETON	55371	WEL	High
172	699131	DISTINCTIVE DOOR DESIGN	A	DO	01-423-0215	32010 126TH ST NW	PRINCETON	55371	WEL	High
173	584466	RUST, JOHN	A	DO	01-423-0120	12535 320 1/2 AVE NW	PRINCETON	55371	WEL	High
174	763554	SMITH, KEN	A	DO	01-004-1323	32227 124TH ST NW	PRINCETON	55371	WEL	High
175	604497	STARRY, JIM	A	DO	01-004-1330	32221 124TH ST NW	PRINCETON	55371	WEL	High
176	593360	SOENS, WAYNE	A	DO	01-418-0250	31626 127TH ST NW	PRINCETON	55371	WEL	High
177	782557	INLINE PACKAGING INC.	A	IR	90-407-0340	1205 18TH AVE S	PRINCETON	55371	WEL	Moderate
178	791107	PRAIRIE RESTORATIONS	A	DO	01-008-1100	31646 128TH ST NW	PRINCETON	55371	WEL	Moderate
179	799964	BILEK, PHILOMENA	A	DO	01-004-3305	31727 128TH ST NW	PRINCETON	55371	WEL	High
180	833632	HUMPHREY, WILLIAM & LESLIE	A	CO	01-423-0120	12535 320 1/2 AVE NW	PRINCETON	55371	WEL	High
181	833953	BELL AUTO SALES	A	PS	01-004-4225	32033 124TH ST NW	PRINCETON	55371	WEL	High
182	819494	PRAIRIE RESTORATIONS	A	IR	01-005-4001	-	PRINCETON	55371	WEL	Moderate

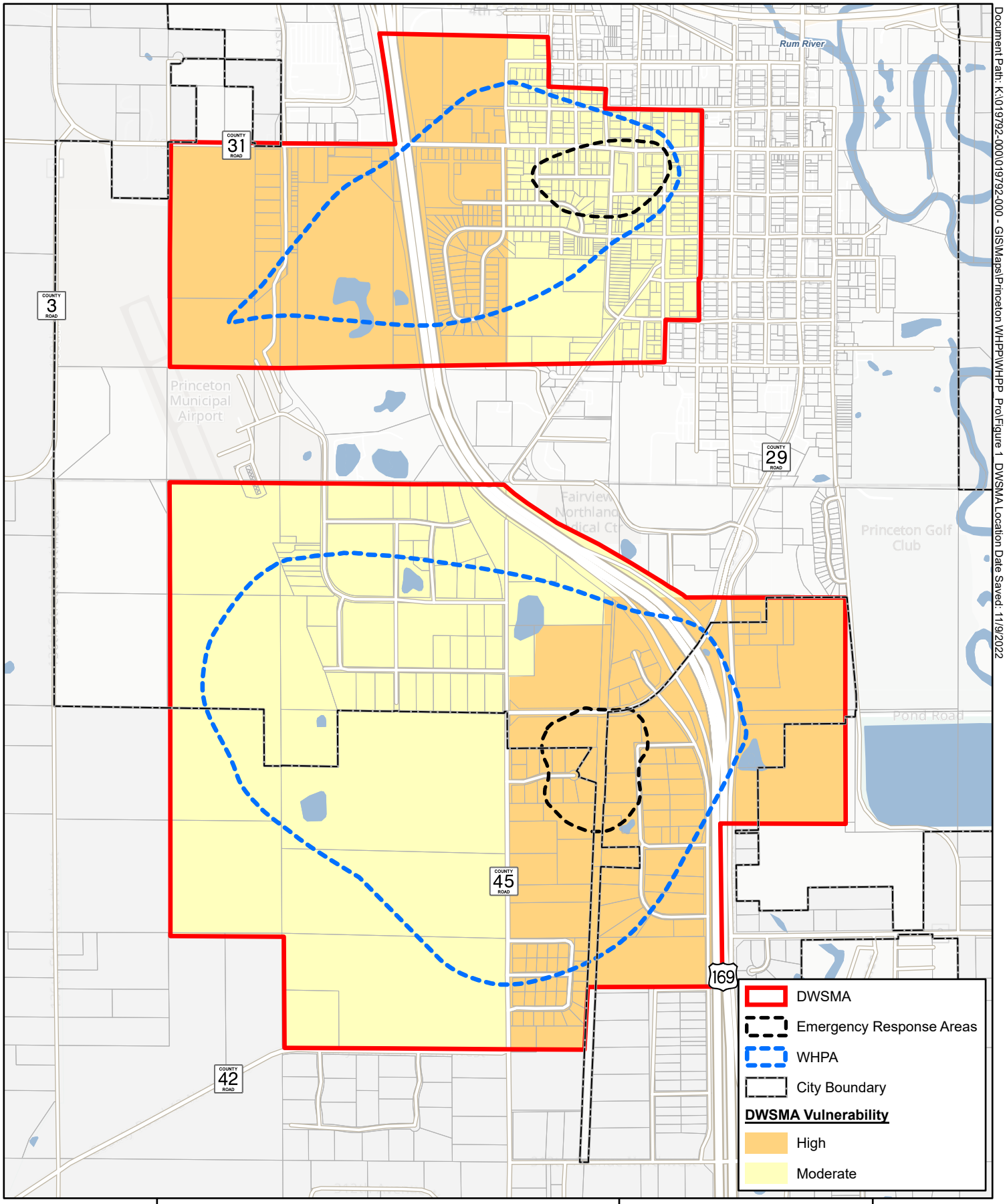
Table 4 - Sealed Wells

Unique Number	Well Name	Status Code	Use Code	Parcel ID	Address	City	Zip Code	Vulnerability
261481	SKOGQUIST TRUCKING AND E	S	PN	01-004-4225	32033 124TH ST NW	PRINCETON	55371	High
695360	DISTINCTIVE DOOR DESIGN	S	TW	01-423-0215	32010 126TH ST NW	PRINCETON	55371	High
598695	PUBLIC UTILITIES COMM.	S	AB	24-033-0210	MARK PARK	PRINCETON	55371	Moderate
328948	CITY OF PRINCETON	S	EX	24-161-0390	907 2ND ST S	PRINCETON	55371	Moderate
196437	HAUL A DOG INN	S	CO	01-004-1325	32215 124TH ST NW	PRINCETON	55371	High
598699	TW	S	TW	90-407-0335	1919 12TH ST S	PRINCETON	55371	Moderate
735034	PRINCETON TW	S	TW	90-414-0105		PRINCETON	55371	High
603685	PRINCETON TW-5	S	TW	24-360-0190	907 1ST ST	PRINCETON	55371	Moderate
329414	CITY OF PRINCETON	S	AB	90-414-0010		PRINCETON	55371	High
721792	PRINCETON TW	S	AB	24-033-0221	MARK PARK	PRINCETON	55371	Moderate
726485	MW-2	S	MW	01-423-0140	32015 126TH ST NW	PRINCETON	55371	High
726484	MW-1	S	MW	01-423-0150	32005 126TH ST NW	PRINCETON	55371	High
726486	MW-3	S	MW	01-423-0140	32015 126TH ST NW	PRINCETON	55371	High
530849	MW-2	S	MW	01-586-0110	32020 126TH ST NW	PRINCETON	55371	High
530848	MW-1	S	MW	01-586-0110	32020 126TH ST NW	PRINCETON	55371	High
530850	MW-3	S	MW	01-586-0110	32020 126TH ST NW	PRINCETON	55371	High
330909	PRINCETON BORING #2	S	EN	90-414-0105		PRINCETON	55371	High
330908	PRINCETON BORING #1	S	EN	90-414-0105		PRINCETON	55371	High
623986	MW	S	MW	24-322-0070	105 10TH AVE N	PRINCETON	55371	Moderate
623985	MW	S	MW	24-323-0050	114 11TH AVE N	PRINCETON	55371	Moderate
650810	MW-3	S	MW	24-551-0250	1101 2ND ST S	PRINCETON	55371	Moderate
650812	MW-1	S	MW	24-322-0420	DEPOT PARK	PRINCETON	55371	Moderate
623989	MW	S	MW	24-556-0040	308 11TH AVE S	PRINCETON	55371	Moderate
638439	MW-3	S	MW	24-556-0130	406 11TH AVE S	PRINCETON	55371	Moderate
638441	PETERSON, EDWARD	S	MW	24-561-0090	405 9TH AVE S	PRINCETON	55371	Moderate
660038	CITY OF PRINCETON	S	MW	24-322-0310	101 10TH AVE S	PRINCETON	55371	Moderate
544254	MW-1	S	MW	24-033-1220	604 CTY RD 18 S	PRINCETON	55371	Moderate
624037	MW	S	MW	<Null>	<Null>	PRINCETON	55371	Moderate
638440	CITY OF PRINCETON	S	MW	24-556-0160	412 11TH AVE S	PRINCETON	55371	Moderate
643354	CITY OF PRINCETON	S	MW	24-322-0420	DEPOT PARK	PRINCETON	55371	Moderate
650811	MW-2	S	MW	24-322-0420	DEPOT PARK	PRINCETON	55371	Moderate
623987	MW	S	MW	24-322-0080	101 10TH AVE N	PRINCETON	55371	Moderate
623984	MW	S	MW	24-322-0090	102 11TH AVE N	PRINCETON	55371	Moderate
623988	MW	S	MW	<Null>	<Null>	PRINCETON	55371	Moderate

Table 5 - Remaining Unlocated Wells

Unique Number	Well Name	Status Code	Use Code	Comment
181284	CONTROL DATA	A	DO	No data provided
156197	MGB 78-217	A	DO	Possible location = Pleasant Acres
122851	MARVIN GEORGE BLDRS	A	DO	Possible location = Pleasant Acres #76-2
178653	CONTROL DATA	A	DO	No data provided
178668	NELSON A. FARM	A	DO	No data provided
178687	MILLER, SPANDY	A	DO	No data provided
126564	MARVIN GEORGE BLDRS	A	DO	Possible location = Pleasant Acres
126560	MARVIN GEORGE BLDRS	A	DO	Possible location = Flower City Add.
169582	GEORGE, MARVIN	A	DO	No data provided
122896	MARVIN GEORGE BLDRS	A	DO	Possible location = Flower City Add. #75-71
122897	MARVIN GEORGE BLDRS	A	DO	Possible location = Flower City Add. #75-59
122899	MARVIN GEORGE BLDRS	A	DO	Possible location = Flower City Add. #75-72
122898	MARVIN GEORGE BLDRS	A	DO	Possible location = Flower City Add. #75-74
122900	MARVIN GEORGE BLDRS	A	DO	Possible location = Flower City Add. #75-76
192954	CONTROL DATA	A	DO	Possible location = Farm #13
161418	PRINCETON TEST WELL	I	TW	Possible location = Back of Trailer Park; Indicated as abandoned
186931	KEEN, JOHN	A	DO	Possible location = John Keen Route 3
152197	R W BUILDERS	A	DO	Notes: Drilled for R.W. Builders
442745	WILKINSON, L.J.	A	DO	Possible location = L.J. Wilkinson Rt. 5 Princeton MN 55371
275842	USGS A-329			No data provided
275843	PRINCETON		CO	No data provided
137623	MR. O.G. HANSON	A	IN	Possible location: 603 5th Ave S. Princeton, MN 55371
232397	ODEGARD,O.J.	A	IR	No data provided
473442	MW-1	A	MW	Possible location: SE of Hwy 169 and Smith Systems Rd.; See well log for drawing
473443	MW-2	A	MW	Possible location: SE of Hwy 169 and Smith Systems Rd.; See well log for drawing
496047	ISD 477 MW-1	A	MW	Possible location: 800' West of Lagrande & Smith Systems Rd.; See well log for approximate location
496048	ISD 477 MW-2	A	MW	Possible location: 800' West of Lagrande & Smith Systems Rd.; See well log for approximate location
406677		A	DO	Possible location: Deerfield
417938	GARDNER, R CONST	A	CO	No data provided
401399	GEORGE, MARV BLDRS	A	DO	No data provided
492270	SOULE, ROBERT	A	DO	Possible location: No address provided; See well log for drawing
401314	REICHLE CONST.	A	DO	Possible location: 609 Hwy 169 N, Princeton MN 55371
566697	TRUNK, EDWARD	A	DO	No data provided
580266	MW	A	MW	Sealed 07-19-96; Sealing Number = H 168973; Well log contains detailed drawings
640105	HAEHN, JEFF	A	DO	Possible location: Lot 6, Blk. 1 Fairway Add - Princeton MN
704848	PZ-8	A	PZ	Possible location: 17th Ave and 107th Ave; See well log for drawing

Appendix B



Document Path: K:\019792-000\019792-000 - GIS\Maps\Princeton WHPP\WHPP Pro\Figure 1 DWSMA Location Date Saved: 11/9/2022

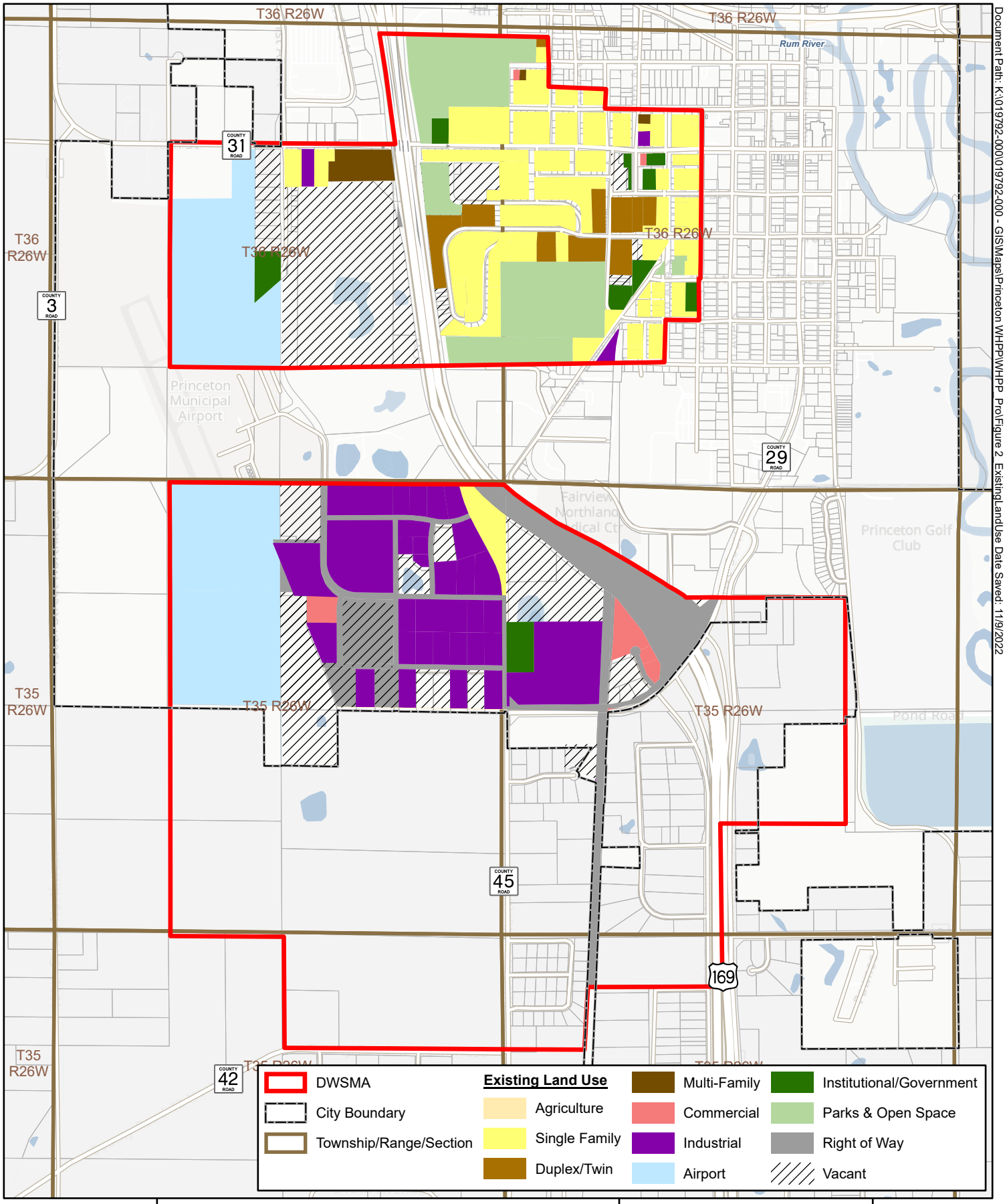
Figure 1 - DWSMA Location

Wellhead Protection Plan Part II
Princeton, MN

N

0 1,500 Feet

1 inch = 1,500 feet



Document Path: K:\019792-000\019792-000 - GIS\Maps\Princeton WHPP\WHPP Pro\Figure 2 ExistingLandUse Date Saved: 11/9/2022

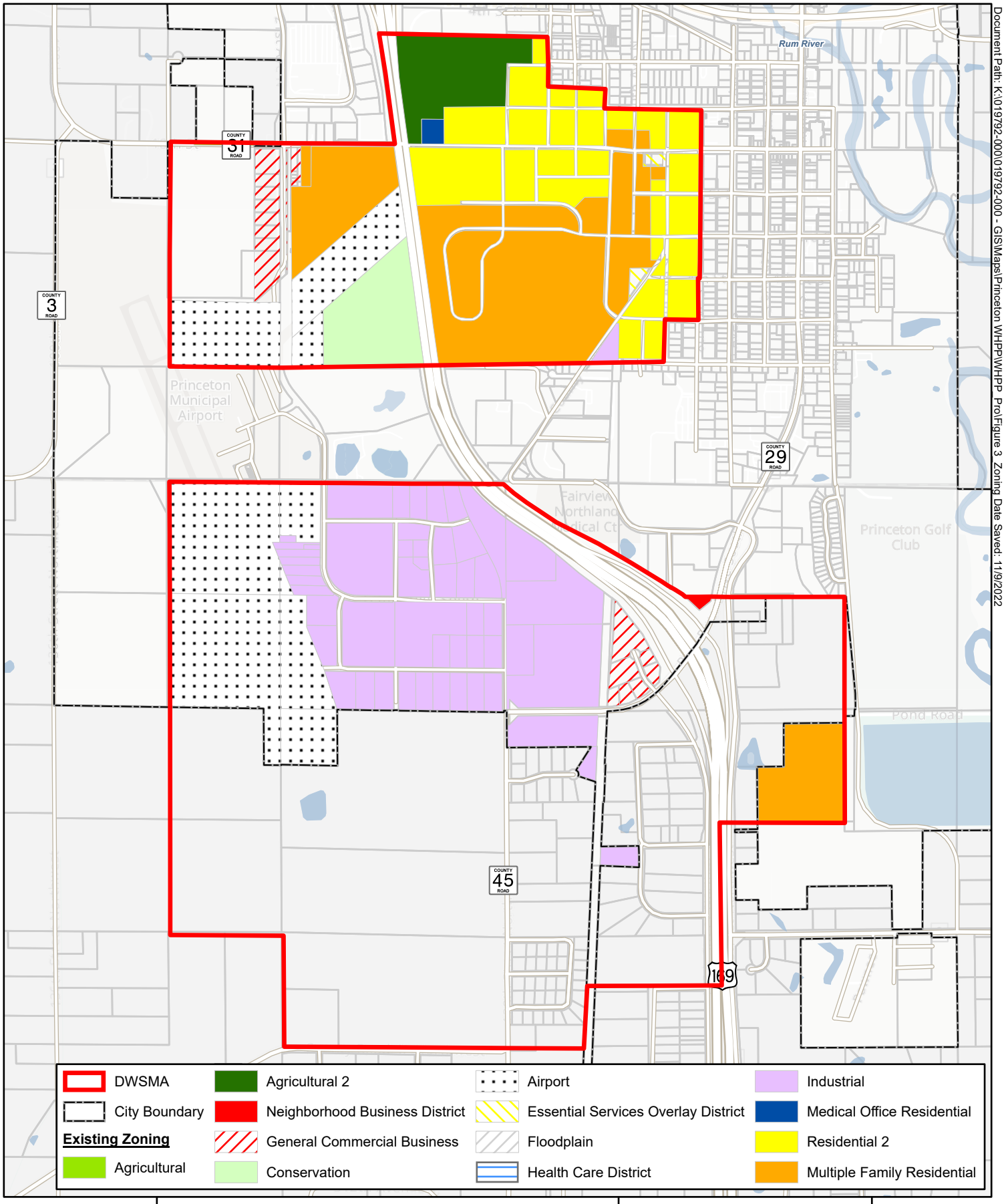
Figure 2 - Existing Land Use

Wellhead Protection Plan Part II
Princeton, MN

N

0 1,500 Feet

1 inch = 1,500 feet



Document Path: K:\019792-000\019792-000 - GIS\Maps\Princeton WHPP\WHPP Pro\Figure 3 Zoning Date Saved: 11/9/2022

City of Princeton Minnesota

Figure 3 - Existing Zoning

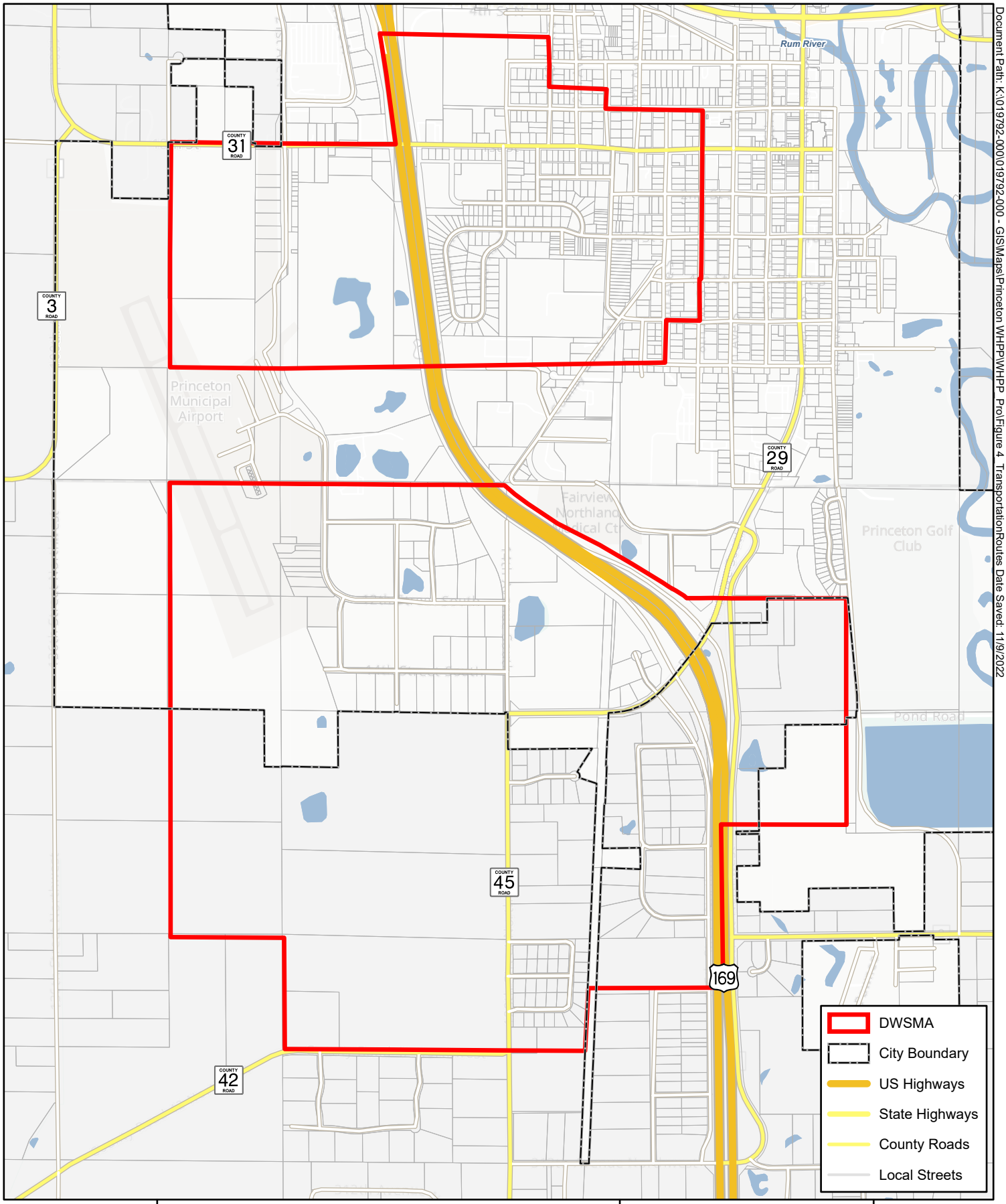
Wellhead Protection Plan Part II
Princeton, MN

N

0 1,500 Feet

1 inch = 1,500 feet

wsb



Document Path: K:\019792-000\019792-000 - GIS\Maps\Princeton WHPP\WHPP Pro\Figure 4 TransportationRoutes Date Saved: 11/9/2022

Figure 4 - Transportation Routes and Corridors

Wellhead Protection Plan Part II
Princeton, MN

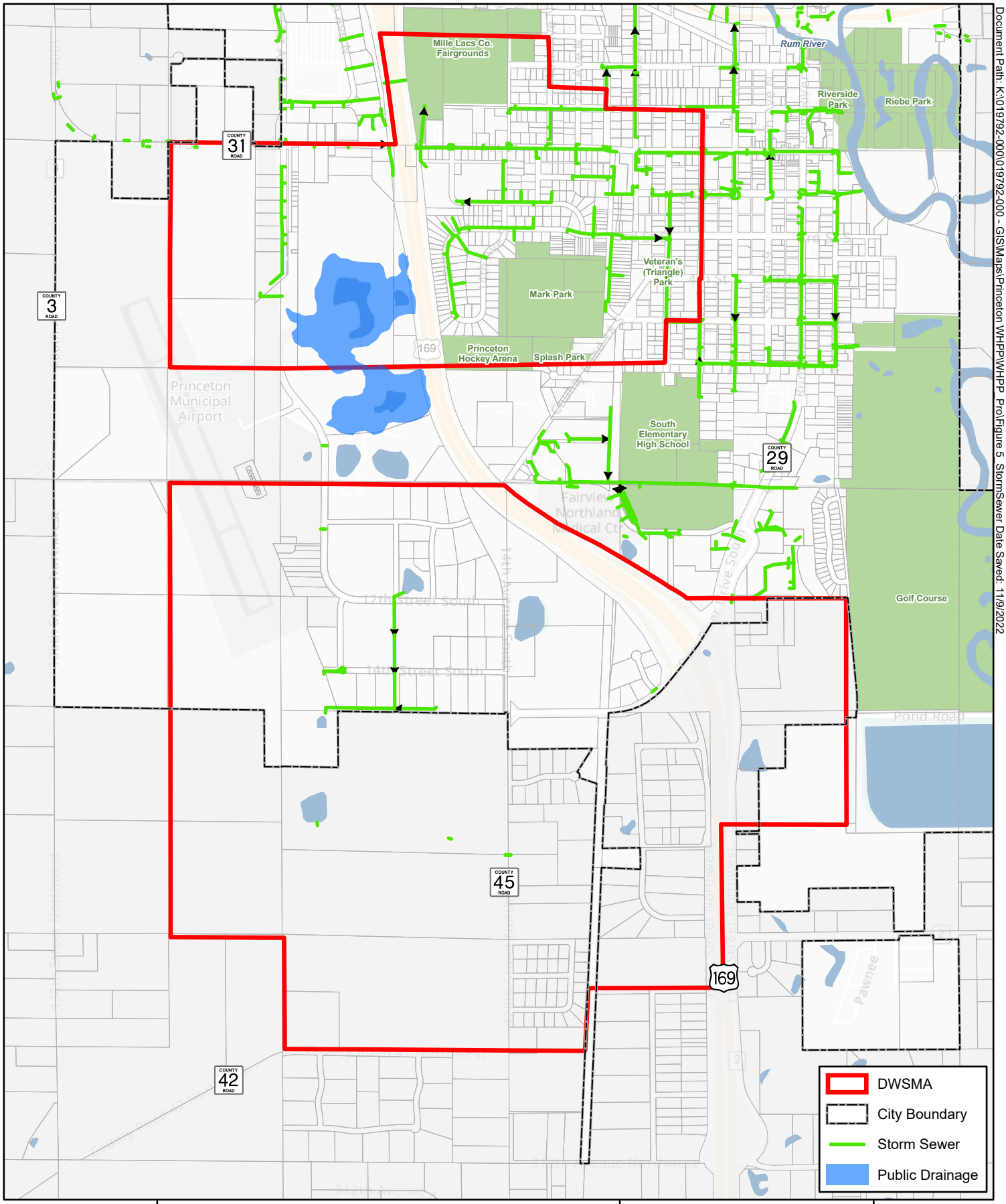
N

0 1,500 Feet

1 inch = 1,500 feet

City of PRINCETON Minnesota

wsb



Document Path: K:\019792-000\019792-000 - GIS\Maps\Princeton WHPP\WHPP Pro\Figure 5_StormSewer Date Saved: 11/9/2022

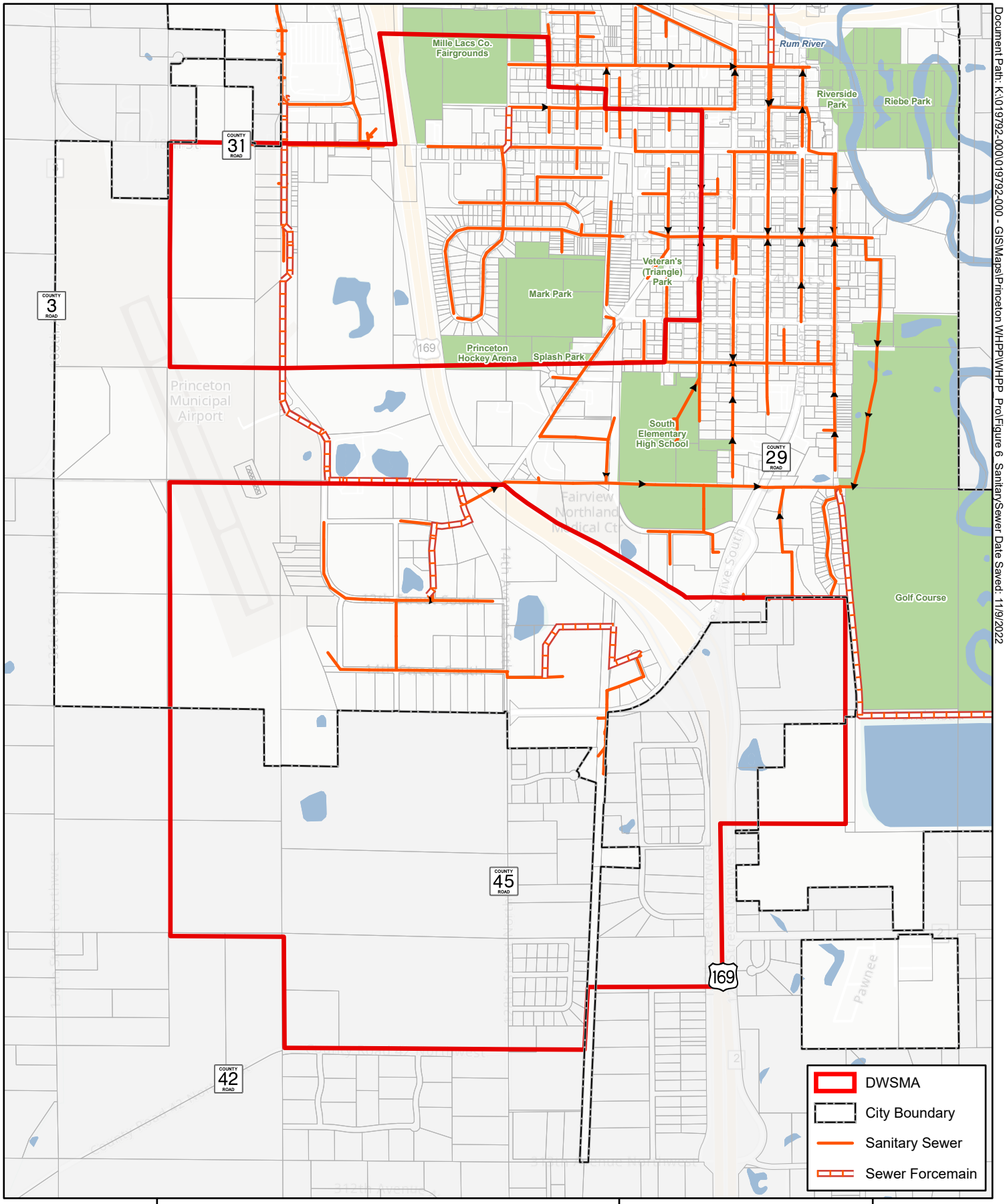
Figure 5 - Stormwater Conveyance System and Public Drainage

Wellhead Protection Plan Part II
Princeton, MN

N

0 1,500 Feet

1 inch = 1,500 feet



Document Path: K:\019792-000\019792-000 - GIS\Maps\Princeton WHPP\WHPP Pro\Figure 6_SanitarySewer Date Saved: 11/9/2022

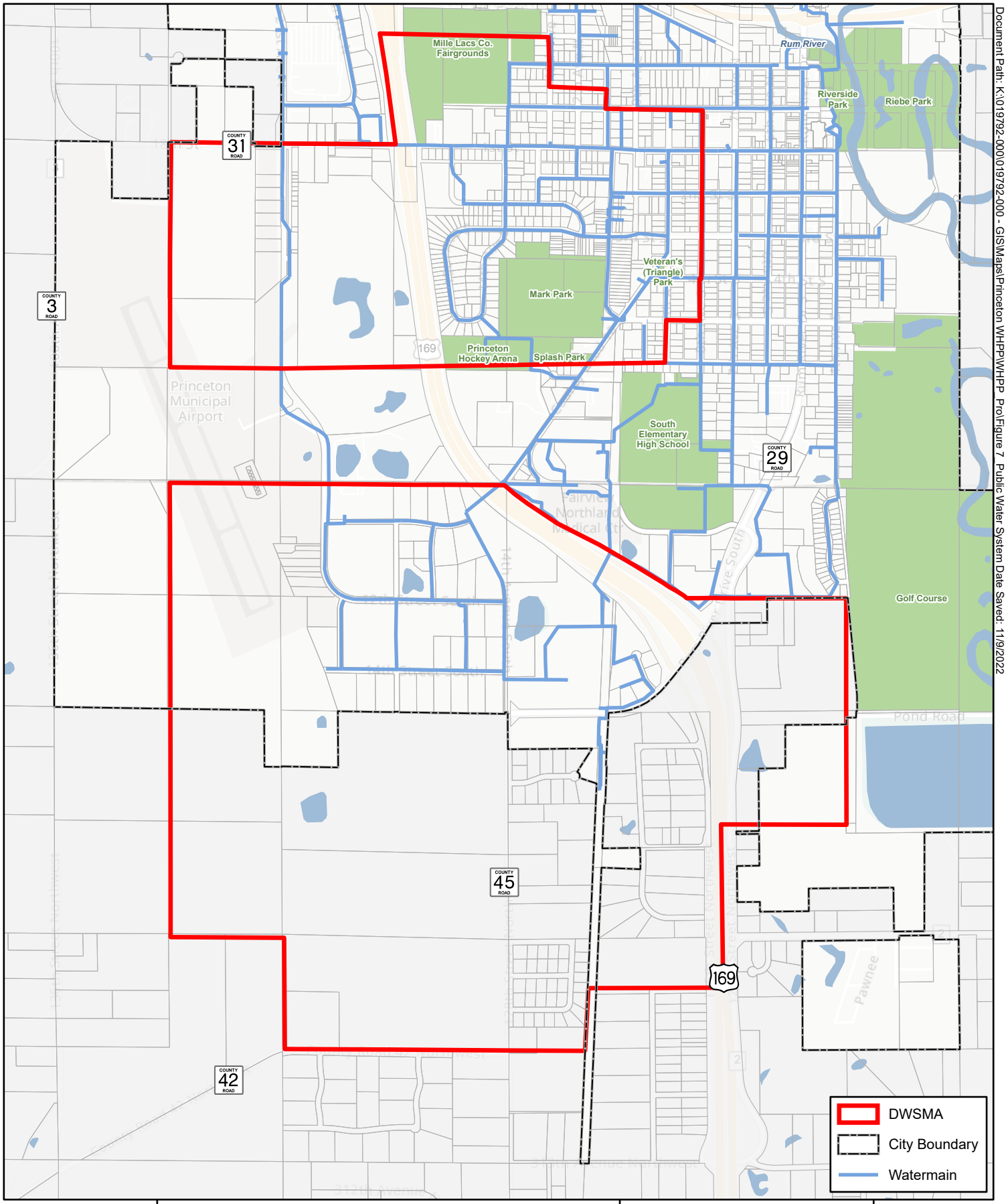
Figure 6 - Sanitary Sewer System

Wellhead Protection Plan Part II
Princeton, MN

N

0 1,500 Feet

1 inch = 1,500 feet



Document Path: K:\019792-000\019792-000 - GIS\Maps\Princeton WHPP\WHPP Pro\Figure 7 Public Water System Date Saved: 11/9/2022

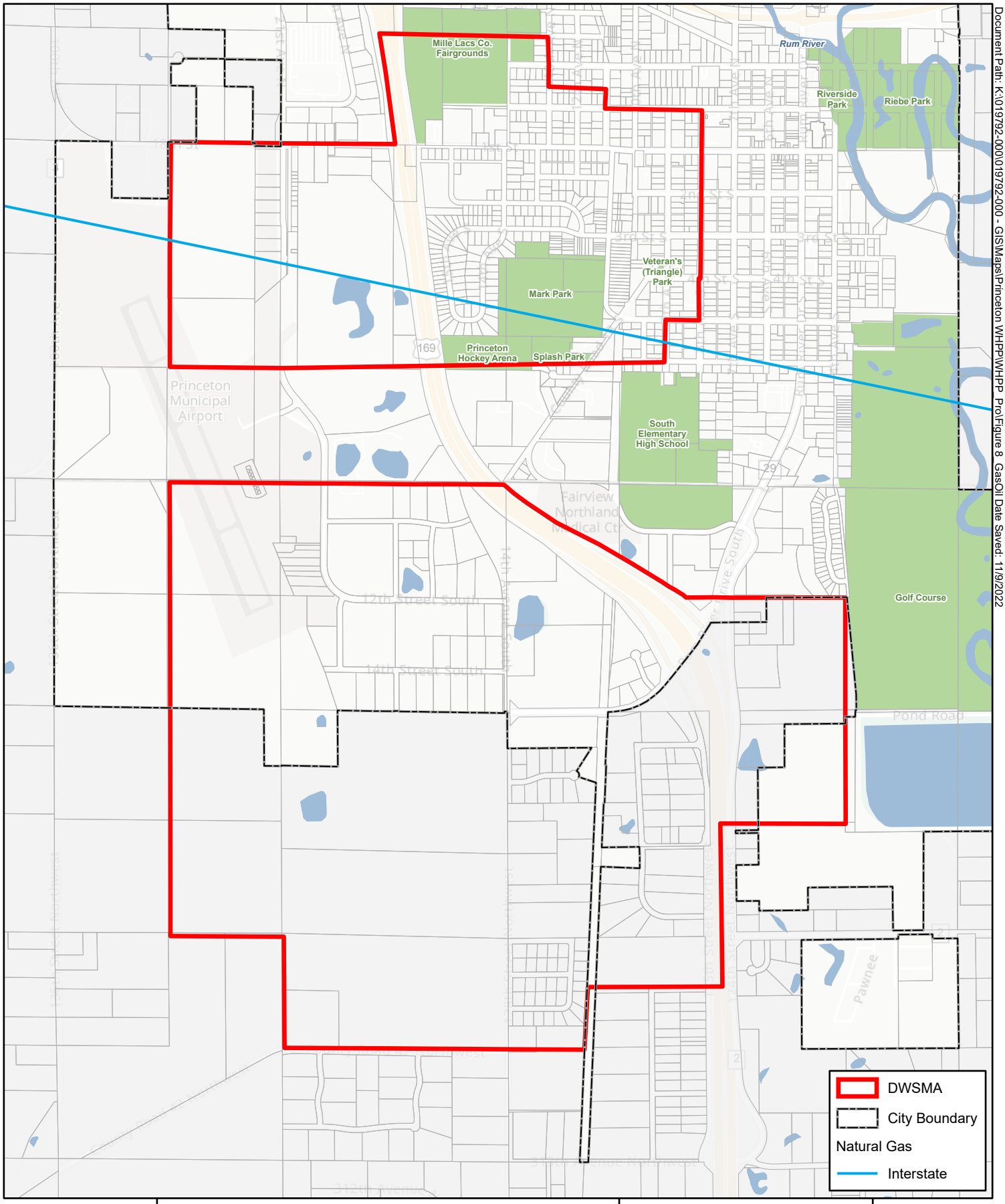
Figure 7 - Public Water System

Wellhead Protection Plan Part II
Princeton, MN

N

0 1,500 Feet

1 inch = 1,500 feet



Document Path: K:\019792-000\019792-000 - GIS\Maps\Princeton WHPP\WHPP Pro\Figure 8_GasOil Date Saved: 11/9/2022

Figure 8 - Gas and Oil Pipelines

Wellhead Protection Plan Part II
Princeton, MN

N

0 1,500 Feet

1 inch = 1,500 feet

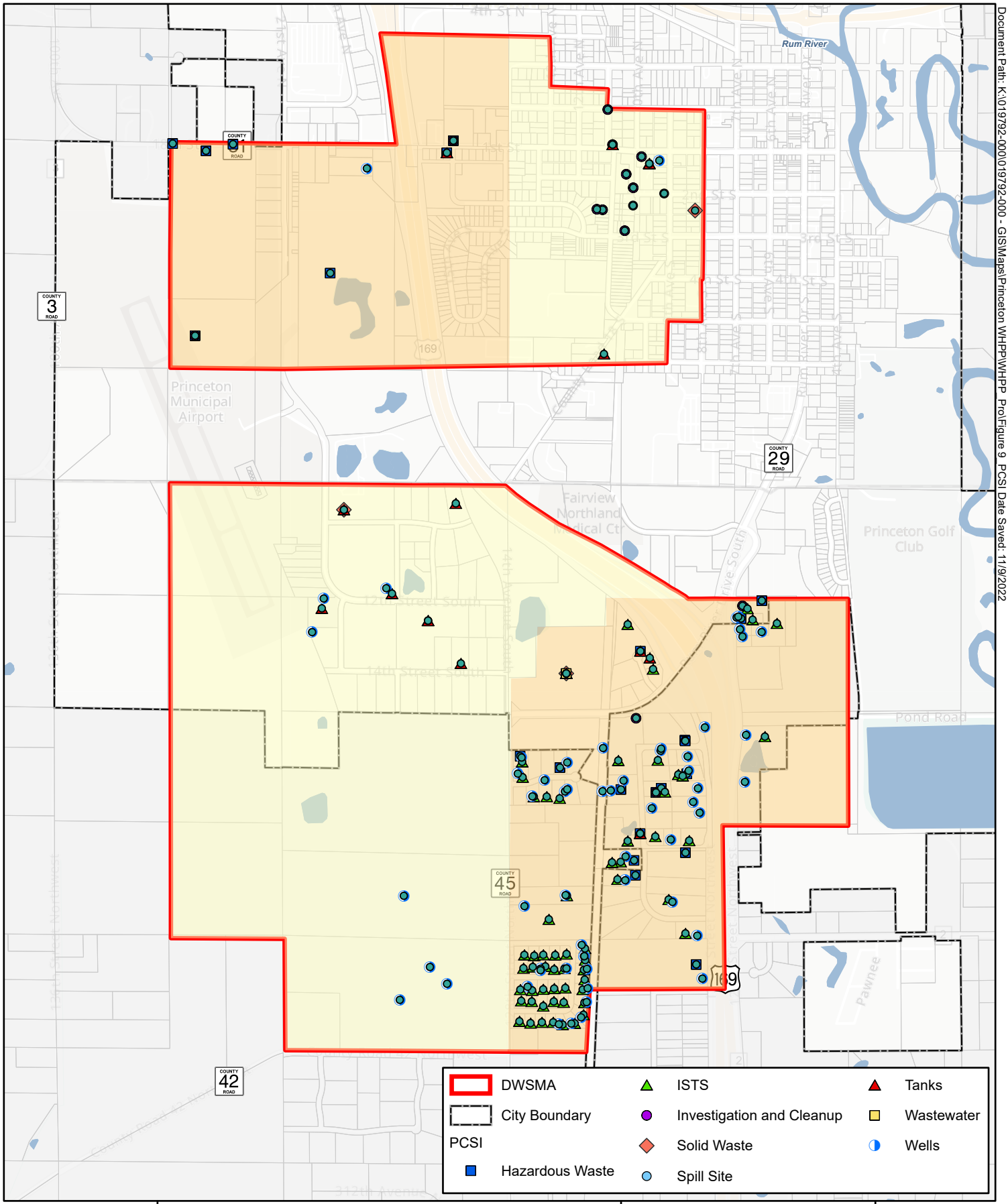


Figure 9 - Potential Contaminant Source Inventory

Wellhead Protection Plan Part II
Princeton, MN

N

0 1,500 Feet

1 inch = 1,500 feet

City of Princeton Minnesota

wsb

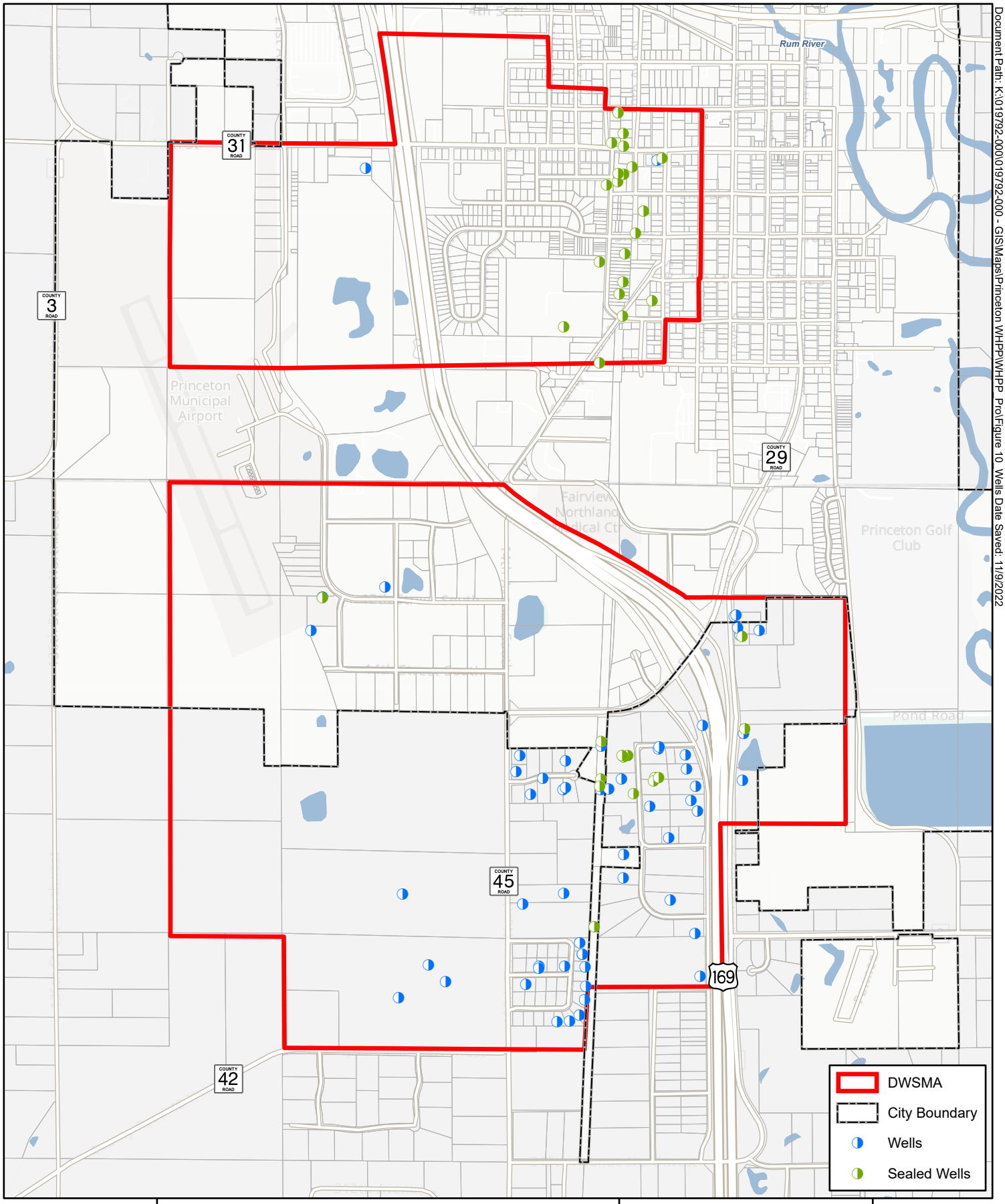


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Figure 10 - Public and Private Wells

Wellhead Protection Plan Part II
Princeton, MN

N

0 1,500 Feet

1 inch = 1,500 feet

Appendix C

Amendment to the Wellhead Protection Plan

Part I

Wellhead Protection Area Delineation
Drinking Water Supply Management Area Delineation
Well and Drinking Water Supply Management Area Vulnerability Assessments

For

Princeton Public Utilities

October 2020

DEPARTMENT OF HEALTH

CLEAN WATER LAND & LEGACY AMENDMENT

Introduction

This summary documents the amended delineation of the wellhead protection area (WHPA), drinking water supply management area (DWSMA), emergency response area (ERA), and the vulnerability assessments for the Princeton Public Utilities (PPU) drinking water supply wells and DWSMAs (PWSID 1480008). These were initially approved in January, 2011 and must now be amended as the public water supply's wellhead plan has nearly expired.

Table 1 – Water Supply Well Information

Local Well ID	Unique Number	Use/ Status	Casing Diameter (inches)	Casing Depth (feet)	Well Depth (feet)	Date Constructed/ Reconstructed	Aquifer[1]	Well Vulnerability
Well #7	578949	Primary	20 x 14	137	169	1998	QBAA	Vulnerable
Well #8	751504	Primary	18	104	139	2007	QBAA	Vulnerable
Well #9	749848	Primary	18	135	160	2007	QWTA	Vulnerable

Note: 1. QBAA: Quaternary Buried Artesian Aquifer. QWTA: Quaternary Water Table Aquifer.

Protection Area Boundaries

The amended protection area boundaries for the PPU are shown in Figure 1. Since the prior WHP Plan, Well #2 (219478) was sealed; as a result, the north DWSMA is reduced to exclude the former protection areas of Well #2. The west half of the north DWSMA is otherwise unchanged because the maximum projected volume of water pumped by Well #7 (578949) is the same as the previous plan. Similarly, the projected volume of water pumped by Wells 8 and 9 (751504 and 749848, respectively) is also the same as the previous plan. For this reason, the boundaries of the south DWSMA are only slightly refined to reflect the more recent availability of digital parcel and public land survey data. The changes to the PPU's DWSMAs are shown in Figure 2.

Except for smoothing of the polygon boundaries, the existing WHPAs for Wells 7, 8 and 9 (578949, 751504 and 749848, respectively) are determined to be adequate and are unchanged for this amendment. The ERA for Well #7 remains unchanged. However, because the locations for Wells 8 and 9 have been refined since the prior plan, there were minor revisions to the ERA boundaries for these wells with this amendment.

Vulnerability Assessments and Management Implications

The PPU wells continue to be considered vulnerable to contamination. This is primarily based on the groundwater age data showing that water from the wells is young and contains indicators of human impact (Table 2).

For the most part, the aquifer vulnerabilities remain unchanged from the prior plan, and range from moderate to high in both DWSMAs. At moderate locations, the aquifer used by the PPU wells has some geologic protection and water and contaminants may travel from the land surface to the city's aquifer within a time span of years to decades. Moderately vulnerable aquifers are prone to several types of contaminant threats, including chemical storage tanks and abandoned wells which can provide conduits for contaminants to quickly reach the city's aquifer.

The high vulnerability rating is assigned to areas where well records indicate that the protective clay-rich till layer overlying the aquifer is relatively thin. At these locations, the aquifer vulnerability is considered high because the clay layer is less than 10 feet thick. This suggests that water and contaminants may travel more quickly from the land surface to the aquifer compared to the moderate vulnerability setting. The high vulnerability area of the north DWSMA remains the same as the prior plan. However, for this amendment, the boundaries of the high vulnerability area for the south DWSMA was revised using new information from the *Sherburne County Geologic Atlas* (Berg, 2017). To be consistent with current practice, the boundaries of the high vulnerability areas were also refined using geographic features, such as parcel boundaries, public land survey data, and streets for this amendment. Highly vulnerable aquifers are prone to a wide variety of contaminants and activities occurring on the land that can pose a threat to the aquifer. The remainder of the city's wellhead protection plan will outline strategies for effectively managing potential contaminant sources within the DWSMA.

Table 2 - Isotope and Water Quality Results (Date Sampled: 03/08/2019)

Well Name (Unique Number)	Tritium[1]	Nitrate (mg/L)	Chloride/ Bromide Ratio	Chloride (mg/L)	Bromide (mg/L)	Arsenic (µg/L)
Well #7 (578949)	6.9 (Modern Age)	< 0.05	709	13.4	0.0189	3.09
Well #8 (751504)	3.9 (Modern Age)	< 0.05	715	13.8	0.0193	3.24
Well #9 (749848)	3.6 (Modern Age)	< 0.05	363	6.03	0.0166	1.5

Note: 1. Modern age reference: Lindsey et. al, 2019.

Water Quality Concerns - At present, none of the human-caused contaminants for which the Safe Drinking Water Act has established health-based standards is found above maximum allowable levels in the city's water supply, nor are any present at one-half of those levels.

Documentation

MDH rule criteria and guidelines were used to assess the adequacy of the existing delineations and vulnerability assessments and evaluate the impact of newer data. The results of this assessment showed that a full update of the Part 1 plan is not necessary and instead this brief synopsis is adequate to amend the Part 1 plan. The documentation of this assessment is available from MDH upon request.

1. **Confirm Boundaries of the High Vulnerability Areas:** The high vulnerability area of the north DWSMA was mapped using geologic information from only a couple of wells. In addition, the 80 acre area east of U.S. Hwy 169 of the south DWSMA was also mapped as high vulnerability, even though this area is located beyond the high pollution sensitivity area mapped by the MN DNR (Berg, 2017). To be conservative, the high vulnerability designations of the prior WHP Plan were maintained at these locations of the north and south DWSMAs because of limited existing subsurface information in these areas.

   Pending available resources, it is recommended that the PPU strive to locate other wells that may have geologic information, and possibly drill test borings in these high vulnerability areas to confirm the boundaries and extent. The MDH hydrologist can assist with interpreting existing well records, identifying proposed locations, and depths of test borings. In addition, surface geophysics can sometimes be useful for identifying the presence or absence of protective clay layers (i.e., aquifer confining units) overlying buried sand aquifers. The city may want to contact the MN DNR (geophysics staff, Ecological and Water Resources Division) to request their assistance with assessing whether surface geophysical survey tools would be useful in the Princeton hydrogeologic setting. In the past and pending available resources, DNR staff have had capacity to assist source water protection efforts by conducting geophysical surveys in settings where subsurface information is limited. If the city includes measures regarding this work in their amended plan, then the investigations may be eligible for funding by a Source Water Protection (SWP) grant.

2. **Water Quality Monitoring**: The standard assessment monitoring package should be analyzed during year six at any primary wells that exist at the time. MDH can provide sample bottles and cover analytical costs, pending available resources. The PPU may need to collect the samples and ship them to MDH.

Selected References

Berg, J.A. (2017), *Geologic atlas of Sherburne County, Minnesota*, Minnesota Department of Natural Resources, Division of Waters, County Atlas Series, C-32, Part B, St. Paul, Minn., 56 p., 2 plates, scale 1:100,000.

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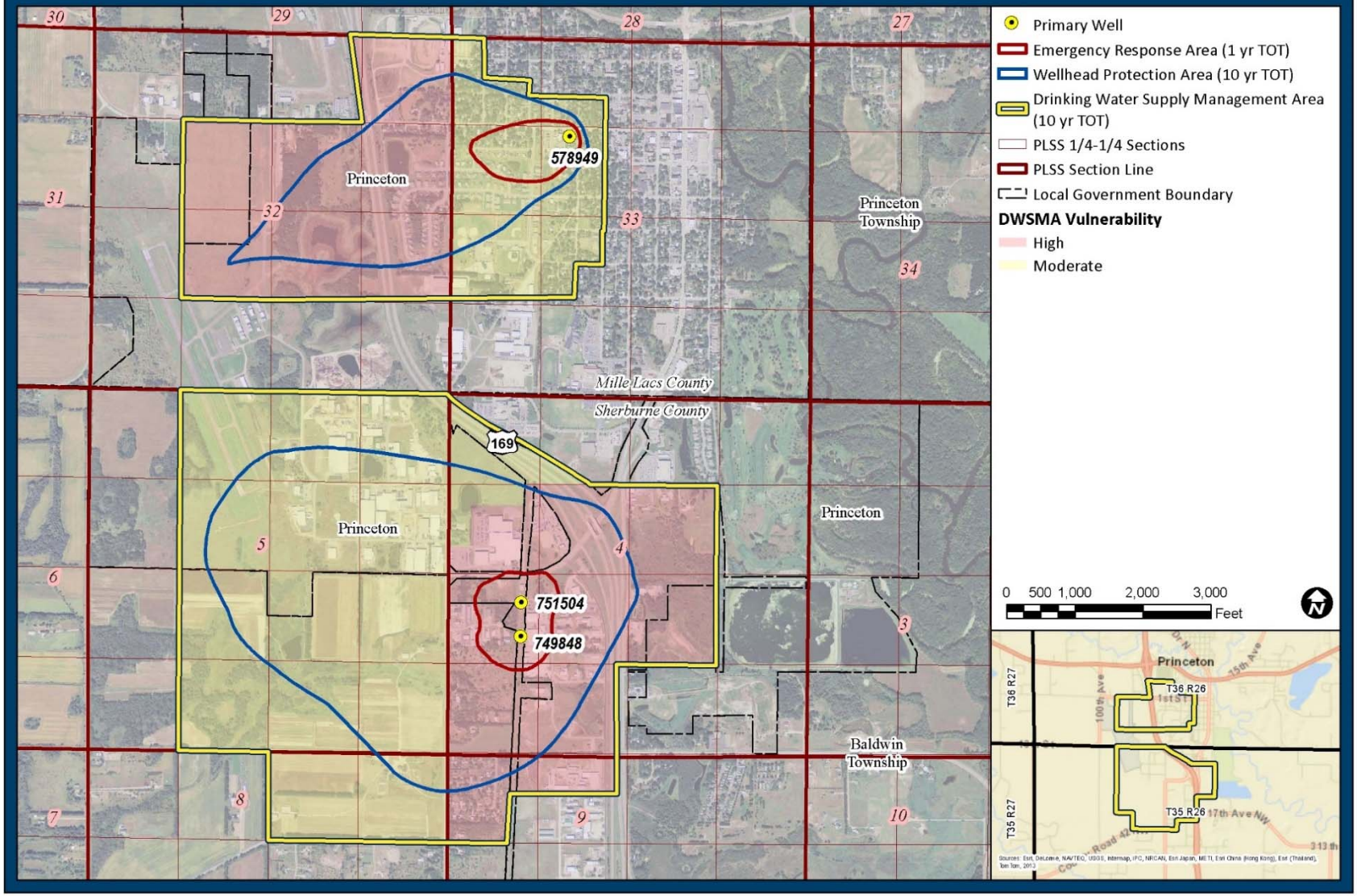
Mille Lacs & Sherburne Counties
Minnesota

Figure 1
Drinking Water Supply Management Area and Vulnerability
City of Princeton



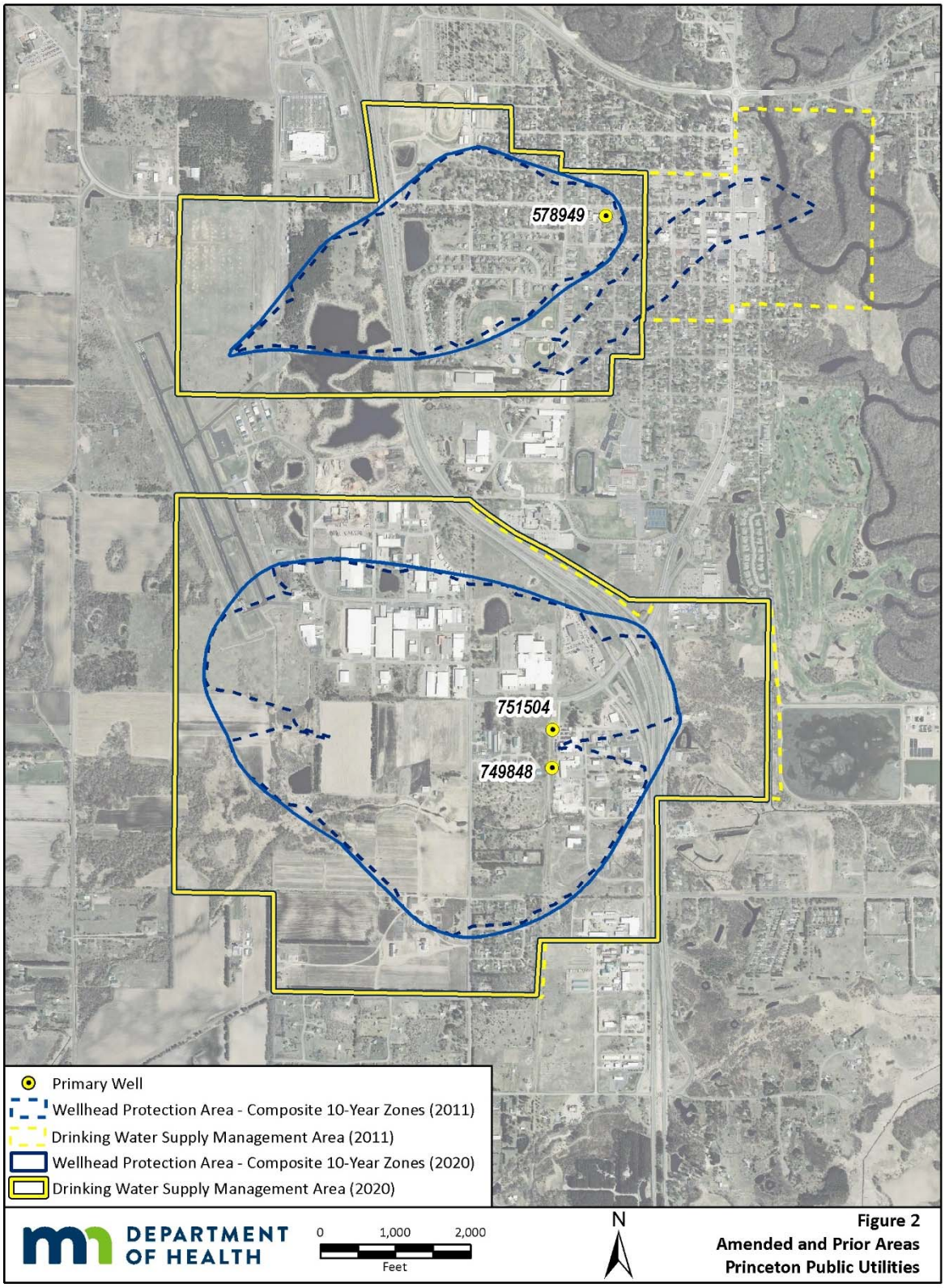


Figure 2
Amended and Prior Areas
Princeton Public Utilities

Revised

PRINCETON PUBLIC UTILITIES COMMISSION

PRINCETON, MINNESOTA

WELLHEAD PROTECTION PLAN AMENDMENT

Part 1 Amendment:

- Addition of New Wells No. 8 and 9
- Drinking Water Supply Manage Area Delineation
- Vulnerability Assessments

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Date: **October 11, 2010**
Project No. **14315.000**

WELLHEAD PROTECTION PLAN AMENDMENT
PART I
PRINCETON PUBLIC UTILITIES COMMISSION
PRINCETON, MINNESOTA

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PUBLIC WATER SUPPLY PROFILE

PUBLIC WATER SUPPLY

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GENERAL INFORMATION

UNIQUE WELL NUMBER(S) 219478, 184979, 578949, 751504, 749848

SIZE OF POPULATION SERVED 4,500

COUNTY Mille Lacs and Sherburne

DOCUMENTATION LIST

STEP	DATE PERFORMED
Date MDH Notice Given (4720.5130, subp. 3)	June 20, 2008
Manditory Completion Date (4720.5130, subp. 3)	December 2, 2011
Plan Manager Designated (4720.5300, subp. 2)	February 1, 2001
Plan Notice Sent to Local Units of Government (LUG) and MDH (4720.5300, subp. 3)	February 5, 2009
Scoping 1 Meeting Held (4720.5310, subp. 1)	September 16, 2008
Scoping Decision Notice Received (4720.5310, subp. 2)	October 10, 2008
Aquifer Test Plan (ATP) Submitted (4720.5320, subp. 1)	November 28, 2001
ATP Approval Review Notice Received From MDH (4720.5320, subp. 2)	November 28, 2001
Delineation and Vulnerability Assessment (DVA) Submitted (4720.5330, subp. 1)	October 11, 2010
DVA Approved Review Notice Received from MDH (4720.5330, subp. 2)	
WHPA and DWSMA Area Delineation and Vulnerability Assessment Submitted to LUGs (4720.5330, subp. 6)	
Public Information Meeting Held (4720.5330, subp. 7)	
Meeting with LUGs Held (4720.5300, subp. 5)	

WELLHEAD PROTECTION PLAN AMENDMENT
PART I
PRINCETON, MINNESOTA

I. EXECUTIVE SUMMARY

This Report documents the delineation of Wellhead Protection Areas (WHPA) for the drinking water supply wells operated by the Princeton Public Utilities Commission (PUC). Wellhead protection helps to prevent contaminants from entering drinking water supply wells. WHPAs have been delineated in accordance with Minnesota Rules, Parts 4720.5100 to 4720.5590, which are under the jurisdiction of the Minnesota Department of Health (MDH). Leggette, Brashears & Graham, Inc. (LBG) was contracted by TKDA to complete the groundwater flow model, the WHPA and drinking water supply management area (DWSMA) delineations, and associated well and DWSMA vulnerability assessments for this report. The WHPAs were delineated using MODFLOW (a numerical groundwater flow model) and the particle-tracking module, MODPATH. Findings in this Report are the result of collaboration between the PUC, TKDA, LBG, and the MDH.

This report is an amendment to the previous WHP report approved in 2005 to include new wells nos. 8 and 9. The previous report was also completed by TKDA and LBG.

The City of Princeton is located in the south central portion of Mille Lacs County with parts of the City extending into the northern part of Sherburne County. The geologic units of interest in the vicinity of the City and surrounding area consist of Quaternary-Aged glacial deposits that are underlain by Paleozoic-Aged bedrock. All of the PUC's wells are completed in unconsolidated sand and gravel deposits. Wells No. 2, 7, 8, and 9 are the PUC's primary use wells. Well No. 5 is no longer in use but is considered an active-emergency backup well. The PUC indicated that Well No. 2 will most likely become the active-emergency backup well and Well No. 5 would no longer be used. Wells No. 1, 3, 4, and 6 have been sealed, and were not considered in this Part 1 report.

In this area, groundwater is encountered in the Quaternary aquifer, with the flow direction being generally toward the Rum River, which serves as a local and regional hydrologic discharge point for the flow system. A model was set up by dividing the

domain into a three-dimensional, non-uniform grid with 331 rows, 300 columns, and 8 layers. The unconsolidated deposits were distilled down to four primary types: clay, silty sand, sand, and gravel. These units were defined in the model by applying four different hydraulic conductivities and were assigned in the model using a statistical method interpolating from borehole data. The base of the model was established at the top of bedrock.

The particle-tracking package, MODPATH, was used in conjunction with the calibrated flow model to create the 10-year time-of-travel pathlines necessary for delineating the WHPAs for the PUC wells.

In accordance with MDH guidance documents, the vulnerability of each PUC well was based on the following six categories: Minnesota Department of Natural Resources (DNR) geologic sensitivity rating, casing integrity, casing depth, pumping rate, isolation distance from contaminant sources, and chemical and isotopic information. As a result of this rating system, PUC Wells No. 2, 5, 7, 8, and 9 are considered vulnerable due to tritium detections, geologic sensitivity, or other detections of anthropogenic compounds. The associated vulnerability in the vicinity of the PUC wells and across the DWSMA is moderate to very high.

II. DATA ELEMENTS AND ASSESSMENT (4720.5200)

A. REQUIRED DATA ELEMENTS

1. Physical Environment Data Elements

Physical data includes natural and man-made features that may have an influence on areas surrounding the wellhead, and ultimately the well itself. Whether or not an aquifer is confined throughout the area determines the value to the WHP effort of using specific elements.

a) Precipitation. Recharge was considered in the model. More discussion on this will be included in the modeling section of this report.

b) Geology. Data gathered from well logs and regional studies were used to construct a geologic map along with descriptions of the geology including aquifers, confining layers, recharge areas, discharge areas, and any sensitive areas. Figures 1, 2, and 3 illustrate the geology in plan view and cross-section.

c) Soils. Soil characteristics influenced the subsequent delineation of the wellhead protection areas.

d) Water Resources. Water bodies, watershed areas, and their characteristics did influence the subsequent delineation of the wellhead protection areas due to their direct connection with the unconsolidated aquifers.

2. Land Use Data Elements

Regardless of whether an aquifer is confined or not, land use is always a factor in determining and managing the DWSMA around the WHPA. Unconfined aquifers, however, are particularly vulnerable to land use factors since they can enable the downward migration of groundwater.

a) Land Use. Section and quarter section boundaries, political boundaries and roads were used to establish a Drinking Water Supply Management Area (DWSMA) for the PUC wells.

b) Public Utility Services. Maps of transportation routes, storm and sanitary sewers, water supply systems, petroleum and gas pipelines, and construction and maintenance records of public water supply wells were not considered at this point to establish the DWSMA. However, this data may be considered in Part 2 report planning activities.

Well logs and pumping records were used for modeling and the vulnerability assessments.

3. Water Quantity Data Elements

Levels in lakes and streams can have an impact on an aquifer that is unconfined if there is a geologic connection between the two. From the review of geologic cross sections and select well logs, it does appear that surface waters are in direct connection hydraulically with the alluvial aquifer.

a) Surface Water Quantity. Surface water bodies did influence the subsequent delineation of the wellhead protection areas, and were included in the model.

b) Groundwater Quantity. A list of high capacity wells in the area was obtained. Table 1 lists the five PUC wells and their associated pumping rates over the last five years. Table 2 lists ten (10) other wells, besides the five PUC wells, that were identified within the model domain. These wells are also illustrated on Figure 4.

4. Water Quality Data Elements.

Water quality is an indication of aquifer vulnerability.

a) Surface Water Quality. Surface water in the vicinity of the City is in direct hydraulic connection with the subject sand and gravel aquifer. Water quality data directly from surface water was not reviewed; however, well-specific data was obtained and reviewed.

b) Groundwater Quality. Groundwater bacteriological and chemical data, both organic and inorganic, have been reviewed as part of the Vulnerability Assessment of the wells. Data was obtained from the Minnesota Department of Health and will be discussed in Section II.B.2 of this report.

B. ASSESSMENT OF DATA ELEMENTS

1. Use of the Wells

The PUC wells provide all the water for the distribution system for the City. The PUC currently has four active water supply wells (Wells No. 2, 7, 8 and 9) and one active emergency backup well (Well No. 5) located in and south of the City (Figure 1). PUC Well No. 5 was not used from 2005 to 2009. Well construction details and well logs are in Appendix I. Past and projected pumping rates are presented in Table 1.

2. Quality/Quantity of Water Supplying the Public Water Supply Wells

Water samples have been regularly obtained from the PUC wells and tested for regulated contaminants. Data summaries were obtained from the Minnesota Department of Health (MDH) for dates ranging from June 1991 to February 2010, and were inclusive of bacteria, disinfectant byproducts (DBP), inorganic compounds (IOC), nitrate, radon, radium-228, tritium, semivolatile organic compounds (SVOCs), and volatile organic compounds (VOCs).

Tritium has been detected in PUC Wells No. 7, 8, and 9, and has not been tested for in the other wells. Tritium is an indicator of vertical migration travel time and aquifer vulnerability. The presence of tritium indicates that some portion of the water entered the aquifer(s) after 1953.

The database provided by the MDH had sample results coded by “S”-source sample, “D”-distribution sample, or “E”-entry point sample. The D and E codes are generally used when a sample has been collected from a well but after some form of treatment has been applied. The source samples represent raw, untreated water. Although, the following discussion

focuses on source samples, a more detailed summary of the analytical databases is provided in Appendix II and is inclusive of the entry point and distribution sample results.

Nitrate was detected in entry point samples from Wells No. 2, 5, and 6. Some or all of the VOCs 1,2-dichloroethane, 1,1,1-trichloroethane, carbon tetrachloride, and/or ethylbenzene have been detected in Wells No. 2, 5, and 6. Data were not available for the 1991 and 1992 analytical results; although, the MDH Vulnerability Rating sheets do indicate that VOCs were detected during those years in Wells No. 2, 5, and 6. The only VOC detection after 1993 was of 1,2-dichloroethane in Well No. 2 at a concentration of 0.3 micrograms per Liter (ug/L); which, is below the MDH, Health Risk Limit of 4 ug/L for that compound.

Two SVOCs, Dalapon and Di (2-ethylhexyl) phthalate, were detected in entry point samples from Wells No. 2 and 5. Di (2-ethylhexyl) phthalate concentrations in Well No. 2 (7.5 ug/L in November 1999) and Well No. 5 (20 ug/L in May 1993) exceed the MDH HRL of 6 ug/L. However, more recent laboratory results for Wells No. 2 and 5 from February 2007 and November 1999, respectively, show that concentrations are <4 ug/L for both wells.

Much data is absent in the analytical databases including, DBP: Wells No. 8 and 9, IOC: Wells No. 7, 8, and 9, Nitrate: Wells No. 7, 8, and 9, Radon: Wells No. 7, 8, and 9, Radium-228: Wells No. 5, 7, 8, and 9, SVOCs: Wells No. 7, 8, and 9, VOCs: Wells No. 8 and 9.

Pumping records submitted to the Minnesota Department of Natural Resources were used to identify the extraction rates of the PUC wells. This data, along with past and projected pumping rates, are presented in Table 1.

3. The Land/Groundwater Uses in the DWSMA

Land and groundwater uses within the DWSMA may have effects on the aquifer used by PUC wells. The vulnerability assessment section of this report provides more detail on the subject of land use conclusions.

III. WHPA AND DWSMA DELINEATION (4720.5205)

A. BOUNDARIES, WELLHEAD PROTECTION AREA MAP

A Map of the WHPA is shown in Figure 12.

B. DOCUMENTATION

1. Physiographic and Hydrogeologic Setting

The geology of the Princeton area consists of alluvium, glacial outwash, and glacial till above sandstone and crystalline bedrock. The alluvial material consists of gravel, sand, silt, and clay found adjacent to the Rum River, which generally flows northwest to southeast through the study area. The outwash deposits are sands and gravels that vary in thickness and extent, and terminate laterally and vertically into clay till that contains discontinuous sand and gravel bodies. Cambrian sandstone and Precambrian intrusive rocks are encountered below the unconsolidated deposits at a depth of approximately 15 to 50 meters (48 to 170 feet) below ground surface.

Groundwater is encountered under confined and unconfined conditions in the sand and gravel, with minor amounts found in discontinuous sand and gravel zones within the till. Moderate to large quantities of water are found in the sandstone bedrock, and relatively insignificant quantities in the crystalline bedrock. Groundwater in the unconsolidated aquifers generally flows from topographic highs to topographic lows where it discharges to wetlands, rivers, and lakes. The PUC wells evaluated in this study obtain water from the sand and gravel aquifers as shown by the well logs in Appendix I.

Groundwater flow in the unconsolidated aquifer is generally toward the Rum River as shown by Figure 5. The map of the potentiometric surface was created from water level data obtained from the Minnesota County Well Index (CWI). Water level was interpolated with natural neighbor using ESRI's ArcGIS 3D Analyst.

All of the PUC's wells are completed in the buried sand and gravel aquifer.

2. Delineation Criteria.

The following discussion represents a summary of the five criteria for delineating the WHPA, which are specified in MR 4720.

a) Time of Travel. Pathline analysis, using a 10-year time of travel, were used when simulating groundwater movement in the aquifer which supplies all PUC wells.

b) Aquifer Transmissivity. The transmissivity (T) of an aquifer is defined as the rate at which water is transmitted through a unit width of aquifer under a hydraulic gradient. It equals the hydraulic conductivity multiplied by the aquifer thickness. The MDH assisted the PUC with a test in 2002 using Well No. 7 as the pumping well and observing drawdown in an observation well (unique #603685). The average T value was calculated as 1,068 square meters per day (m^2/day) (11,500 square feet per day [ft^2/day]) at Well No. 7. Assuming an aquifer thickness of approximately 20 m (65 ft) and the T value from Well No. 7, the hydraulic conductivity was calculated at 53 meters per day (m/d) (176.9 ft/day) for the aquifer in the vicinity of Well No. 7 (LBG, 2003). The PUC conducted tests on Wells No. 8 and 9 in 2007. LBG analyzed the data and the results are presented in Appendix III. The average T value was calculated as 336.9 (m^2/day) [3,626 (ft^2/day)] at Well No. 8 and 236.4 (m^2/day) [2,545 day (ft^2/day) at Well No. 9. Assuming an aquifer thickness of approximately 19.8 m (65 ft) and the T value from Well No. 8, the hydraulic conductivity was calculated at 17 meters per day (m/d) (55.8 ft/day) for the sand in the vicinity of Well No. 8. Assuming an aquifer thickness of approximately 30.5 m (100 ft) and the T value from Well No. 9, the hydraulic conductivity was calculated at 7.8 meters per day (m/d) (23.6 ft/day) for the silty sand in the vicinity of Well No. 9. These values would provide the range used for the buried sand and gravel aquifer in the flow model.

c) Daily Volume of Water Pumped. The daily volume selected for each well used in the WHPA was based on MR 4720.5510, subpart 4 and MDH guidelines, which states that volumes used in the WHPA delineation can be determined from either 1) the projected use of each well as a percent of the total system, or 2) the greatest annual volume of water used over the previous 5 years, whichever is greater. The latter method was used and the maximum pumping rates from 2005 to 2009 are presented in Table 1. The recent addition of City Wells No. 8 and 9 has significantly altered City's pumping scheme. Because of this the pumping rates for the model were determined by a combination of these rules. The City projects that the majority of pumping will remain shifted to Wells No. 8 and 9 leaving Well No. 7 with a diminished contribution. Therefore, while the maximum pumping rate at Well No. 7 was 217.6 MGY, with the addition of the new wells that total is highly unlikely in the future. Because of this, the projected value of 75 MGY was used for the analysis. 2009 was the first full year of pumping for Wells No. 8 and 9. Due of the lack of data, the higher flow rate of the two (108.9 MGY at Well 8) was increased slightly and applied to both wells. The total pumping rate used in the model was 3,260.3 m3/d (598 gallons per minute [gpm] or 861,280 gallons per day). This value is higher than the 2015 projected total pumping rate and significantly higher the total pumping rate in any of the 5 previous years and thus should represent a reasonable, conservative withdrawal for the flow model.

d) Hydrologic Boundaries. Hydrologic boundaries that affect the delineation criteria are:

(1) Surface water features. The Rum River is the local and regional discharge point of the flow system of interest; therefore, the River affects the direction of ground-water flow and was included in the flow model as a river boundary. Area lakes near the PUC Wells were also included as river boundaries. Long Pond and Rice Lake were used as

constant head boundaries along the west and south edges of the model domain.

(2) Geological boundaries. Well records from the CWI, as well as information from geologic maps were used in the development of the conceptual hydrogeologic model and in the vulnerability assessments.

(3) High capacity wells. LBG obtained groundwater appropriation permit data from the Minnesota Department of Natural Resources (DNR) and determined there are 10 high capacity wells other than the PUC's wells located in the model domain, whose pumping could influence groundwater flow and/or create negative boundary conditions. These wells were included in the model using their historical maximum pumping rates from the previous 5 years (2005-2009), as obtained from the DNR Water Appropriations Permit Program website (www.dnr.state.mn.us/waters/watermgmt_section/appropriations/permits.html). The high-capacity wells are illustrated on Figure 4, and summarized in Table 2.

(4) Overland Drainage. Surface runoff is directed toward local streams, wetlands and lakes.

3. Delineation Method.

The groundwater flow field was determined by using MODFLOW. Simulated heads were compared to static water levels obtained from data in the CWI. Static levels from 211 wells screened in various geologic materials were used for calibrating the ground-water flow model.

a) Groundwater Flow Models. The model used in this project was originally developed by LBG in 2003. For the purposes of this study, the model was modified using well log information to better describe the subsurface conditions. The model was also extended to the south of the original domain as the new wells may have been too

close to the original boundary. The model domain is presented on Figure 6. The model domain was divided into a three-dimensional, non-uniform grid with 331 rows, 300 columns, and 8 active layers. The model grid in the vicinity of the PUC wells is presented on Figure 7.

(1) Boundary Conditions. Modifications to the model's boundary conditions included extending the model domain south to Long Pond and removing the bedrock that was included in the original model (LBG, 2003). The base of the model is the bedrock surface as approximated from area well log information. The southwest boundary was defined as a constant-head boundary along Battle Brook extending up to Rice Lake. The eastern boundary of the model was defined using constant head conditions corresponding to a string of wetlands and ponds along the boundary along with several measured head values from wells. The Rum River and the West Branch of the Rum River are included in the model as a river boundary and a drain boundary, respectively. The heads for these features were taken from USGS maps and available GIS information. Finally, all of the high-capacity wells were redefined using the highest pumping rate for the period 2005-2009.

(2) Discretization of Aquifer Properties. Discretization of aquifer properties involves assigning initial values to each cell in the model domain. Hydraulic properties input for this model included horizontal components for hydraulic conductivity (kx and ky), vertical hydraulic conductivity (kz), specific yield (Sy), specific storage (Ss), and effective porosity (ne) (required for MODPATH to calculate linear flow velocity).

The initial hydraulic conductivities for the model were those that were defined from the pumping tests. The values for the sand and silty sand were also modified in calibrating to the

pumping test results. The porosity values are consistent for the materials.

The complex geology of the unconsolidated material was simplified for the purposes of the model by combining all of the various groups into four primary materials: clay, sand, silty sand, and gravel. A subset of well log information from the CWI was created by using only the deepest wells, those with accurate location information, and only the most representative from areas with a large number of wells. GMS, using geostatistical interpolation, was then used to create a three dimensional volume defining the various geologic units and assigning them to the eight layers in the model. This geometry was then modified in certain areas to better correlate with well log information.

Through the steady-state and transient calibration processes the optimum hydraulic conductivity values for the four primary materials were determined to be: 2.0 m/d horizontally and 0.05 m/d vertically for the clay; 20 and 10 m/d for the sand, 9 and 6 m/d for the silty sand and 300 and 200 m/d for the gravel. All of these values are reasonable for the material they describe and the sand and silty sand values are in close agreement with the results of the pumping tests at Wells No. 8 and 9 and the values are reasonable when compared to the pumping test results at Well No. 7 (53 m/d) considering it is screened in both sand and gravel.

4. Delineation Results.

a) Calibration and Uncertainty. The goal of numerical model calibration is to obtain a reasonable correlation between the simulated model results and observed field data. The calibration process was completed by running several steady-state simulations and comparing calculated heads to the measured head data at known

calibration points within the model domain. For the local model calibration, 211 well locations were used for comparison. These wells are private or municipal and are completed in the glacial deposits.

Figure 8 presents the calibration wells and simulated potentiometric contour map for steady-state conditions in the sand and gravel aquifer. Flow direction is variable, but generally flows toward the Rum River. Using the head values from the 211 calibration well locations, an error analysis on the steady-state model was performed. Figure 9 presents the transient model calibration data and model statistics. Figure 10 presents a plot of the results of the error analysis indicating that the overall RMS error for the unconsolidated sand and gravel aquifer is 1.996. The RMS error of the model is less than the estimated measurement error of the potentiometric head data and the normalized RMS error is approximately 15%. Error in the measurement data was conservatively estimated to be approximately 3.0 meters and comes from the fact that water levels can fluctuate considerably in the wells, the unknown accuracy of the actual groundwater elevation measurement, as well as the unknown accuracy of the ground surface measurement, which is often estimated from a map.

Figure 9 presents the transient calibration data. In the transient calibration, GMS was used to simulate the conditions during the pumping test at Well No. 9 with Well No. 8 and wells at Miller Pro Products and Stevens Biomatrix used as observation wells. The graphs show the actual observed data with lines 1 meter above and below the observed data. The calculated data is then plotted on top of that. It can be seen in all four plots that the calculated data are within 1 meter of the observed data and follow the profile of the drawdown reasonably closely.

The transient and steady-state calibration data (Figures 9 and 10) show a reasonably close correlation between measured and

calculated head values. While the model is based on a large amount of data, the head measurements used in the steady-state calibration are single measurements that are listed on each well record, and were collected during different seasons over several decades.

More extensive observation data collected within the same general time period and more accurate, site-specific T values throughout the model domain could improve calibration and model confidence.

A sensitivity analysis was completed as part of the modeling effort. Calibrated model values were changed and capture zones delineated to create a composite capture zone encompassing much of the variation that is eliminated by necessity though simplification. For this study the sensitivity analysis consisted of: doubling calibrated sand conductivity, halving calibrated sand conductivity. Doubling and halving calibrated clay conductivity in both the horizontal and vertical directions, decreasing the porosity of the sand by 20%, and reducing the recharge by 50%.

Defining the WHPA using the composite of the individual capture zones from the sensitivity analysis creates a final capture zone that can be considered conservative and likely to encompass the actual capture zone under a wide range of conditions.

b) WHPA Delineation. With the flow fields calibrated, a groundwater pathline analysis and sensitivity analysis were performed to delineate the capture zones and ultimately the WHPA.

The pathline analysis consisted of using MODPATH, a flowpath calculation program, to trace the 10-year capture zone for each of the wells by backtracing 20 flow paths from each well for a 10-year period (Figure 11). One- and five-year pathlines are also illustrated on Figure 11.

After both the pathline analysis and sensitivity analysis were completed, the capture zones delineated around Wells No. 5 and 7

and Wells No. 8 and 9 were merged with one another. This concatenation created final composite WHPA capture zones for use in delineating the DWSMAs (Figure 12).

A conjunctive delineation was not completed since there was only minor contribution to the model from the Rum River. Also, nearby geologic logs, hydrogeologic cross-section B-B' (Figure 3), the low geologic sensitivity at Well No. 2, and the DWSMA geologic sensitivity map (Figure 13) indicate that there is low-permeability material between grade and the source aquifer.

C. BOUNDARIES FOR THE DWSMA.

The criteria used to delineate the DWSMA (Figure 12) are based on roads and public land survey features such as sections, half sections, and quarter sections that encompass the maximum time of travel simulated as defined in MR 4720.5100. In the case of this delineation, the DWSMA encompasses the combined model-delineation WHPAs around Wells No. 2 and 7, and Wells No. 8 and 9.

IV. VULNERABILITY ASSESSMENT (4720.5210)

A. WELL VULNERABILITY

The well vulnerability assessment was conducted in accordance with the MDH guidance document, *Assessing Well Vulnerability for Wellhead Protection* (MDH, 1997). A well's vulnerability is scored based on the following six categories: DNR geologic sensitivity rating, casing integrity, casing depth, pumping rate, isolation distance from contaminant sources, and chemical and isotopic information.

The assessment of geologic sensitivity is a useful metric when estimating the relative vertical downward travel time of contaminants from grade level to the water table or source aquifer. Two geologic sensitivity methods were used to determine the sensitivity at each PUC well; Level 2 and Level 3.

A Level-2 DNR geologic sensitivity assessment was used for Wells No. 5, 8, and 9. A Level-2 assessment is generally used for shallower aquifers or aquifers with little or no low permeable units; yet, it is applicable in this case since the well logs for these PUC wells do not indicate significant confining layers. A Level-2 assessment focuses on the vadose material, the number and type of low permeable units (if present), and depth to the water table.

A Level-3 DNR geologic sensitivity assessment was used for Wells No. 2 and 7. The Level-3 DNR geologic sensitivity rating is an empirical value determined by dividing the cumulative thickness of low permeability units (e.g. clay) above the aquifer by 10 (DNR, 1991). The resulting score is termed the "L-score". A higher L-score indicates more low-permeability material above the aquifer, and therefore a lower vulnerability. A low L-score represents higher vulnerability. For example, a rating of L-1 has a higher vulnerability than L-9, because there is less low-permeability material present above the aquifer. A Level-3 assessment was conducted for PUC Wells No. 2 and 7 since the aquifer is overlain by varying thicknesses of clay. As mentioned above, points are also assigned to casing integrity and depth, pumping rate, isolation distance to contaminant sources, and chemical data, in addition to the geologic sensitivity.

Vulnerability assessment rating sheets and vulnerability scores for Wells No. 2, 5, 7, 8 and 9 are presented in Appendix IV. The vulnerability worksheets were

obtained from the MDH and reviewed by LBG. LBG suggested revising the vulnerability sheets and changes were made by MDH via email correspondence dated April 13 and 15, 2010. Per MDH guidance, any well that receives an assessment rating of 45 points or greater, has a high geologic sensitivity, has a tritium detection greater than 1 tritium units (T.U.), or has VOC detections is considered a vulnerable well. Wells No. 2 and 5 are rated as vulnerable since they had historical VOC detections. Wells No. 7, 8 and 9 had tritium detections greater than 1 T.U., which automatically makes them vulnerable.

B. DRINKING WATER SUPPLY MANAGEMENT AREA VULNERABILITY

In the proposed DWSMA, the groundwater that supplies the PUC wells is from the sand and gravel aquifer. The glacial deposits are summarized in Section II.B.1. When clay was logged with a sand or silt modifier it was not considered an effective barrier to the downward migration of contaminants from grade. Other deposits, however, do act as effective barriers where impermeable units (for example clay, hardpan, and clay and rocks) are present.

Figure 13 illustrates the geologic sensitivity for the DWSMA as determined by review of the 74 well logs across the DWSMA. Geologic logs were reviewed for each of the wells identified in the vicinity of the DWSMA. This approach of eliminated any lithologic description using sand or silt as a clay modifier resulted in a conservative estimate of the geologic sensitivity, provided a methodical approach to reviewing the CWI data. As a result, the geologic sensitivity in the vicinity of the PUC wells and across the DWSMA ranges from low to high (Figure 13).

Pursuant to MDH guidance (MDH, 1997), all geologic sensitivity ratings were automatically increased by one classification due to the presence of tritium in Wells No. 7, 8, and 9. It was assumed that tritium likely occurs in the other wells. As a result, the vulnerability in the vicinity of the PUC wells and across the DWSMA ranges from moderate to very high (Figure 14).

V. RECOMMENDATIONS

Upon completion of this Part I Report, LBG recommends that the PUC consider the following activities to further the hydrogeologic understanding of the source aquifers within the DWSMA.

1. Collect groundwater samples from PUC wells and analyze for the parameters listed as absent in Section II.B.2. Additional tritium analysis from Well No. 2 is not necessary since data exists for nearby Well No. 7.
2. Continue collecting groundwater samples for analysis of regulated contaminants and provide the data to the MDH.

VI. REFERENCES

Ericson, D.W., Lindholm, G.F., and Helgesen, J.O. 1974. Water Resources of the Rum River Watershed, East-Central Minnesota. USGS Hydrologic investigations Atlases, HA-509.

Leggette, Brashears & Graham, Inc., 2003. *Ground-Water Flow Model, City of Princeton, Minnesota, Wellhead Protection Study*. August, 2003.

Minnesota Department of Health, 1997. *Assessing Well and Aquifer Vulnerability for Wellhead Protection*. Draft document, February 1997, pp. 23.

Minnesota Department of Natural Resources, 1991. *Criteria and Guidelines for Assessing Geologic Sensitivity of Ground Water Resources in Minnesota*.

Minnesota Department of Natural Resources. *Minnesota Department of Natural Resources Appropriation Permit Program Website* (www.dnr.state.mn.us/waters/watermgmt_section/appropriations/wateruse.html)

TABLES

Table 1

Municipal Well Pumpage and Pumping Rates used in the WHPA Delineation
Part I Wellhead Protection Plan
Princeton, Mille Lacs and Sherburne Counties, Minnesota

Well	Unique ID Number	Aquifer	Casing Depth (feet)	Well Depth (feet)	Past Use (MGY)					Maximum Volume Pumped Over Previous Five Years (MGY)	Projected Volume to be Pumped in 2015 (MGY)	Projected value used in the WHPA delineation analysis (MGY)	Projected value used in the WHPA delineation analysis (m3/d)
					2009	2008	2007	2006	2005				
2	219478	QBAA	142	162	0	0	15.9	15.2	19.4	**19.4**	0	19.9	201.2
5	184979	QBAA	110	150	0	0	0	0	0	**0.0**	0	0	0.0
7	578949	QBAA	137	169	23.8	121.1	213	217.6	200.4	**217.6**	75	75	777.7
8	751504	QBAA	104	139	108.9	43	0	0	0	**108.9**	87.5	110	1140.7
9	749848	QWTA	135	160	60.9	35.8	0	0	0	**60.9**	87.5	110	1140.7
Totals					193.6	199.9	228.9	232.8	219.8	**406.8**	250.0	314.9	**3260.3**

Notes:
*: Projected use is the maximum annual pumping volume between 2005 and 2009.
QBAA: Quaternary Buried Artesian Aquifer
QWTA: Quaternary Water Table Aquifer
MGY: Million gallons per year
m^3/day: cubic meters per day
Maximum annual pumping volume for the municipal system for the past five years.
Projected annual and daily pumping volume for the municipal system.

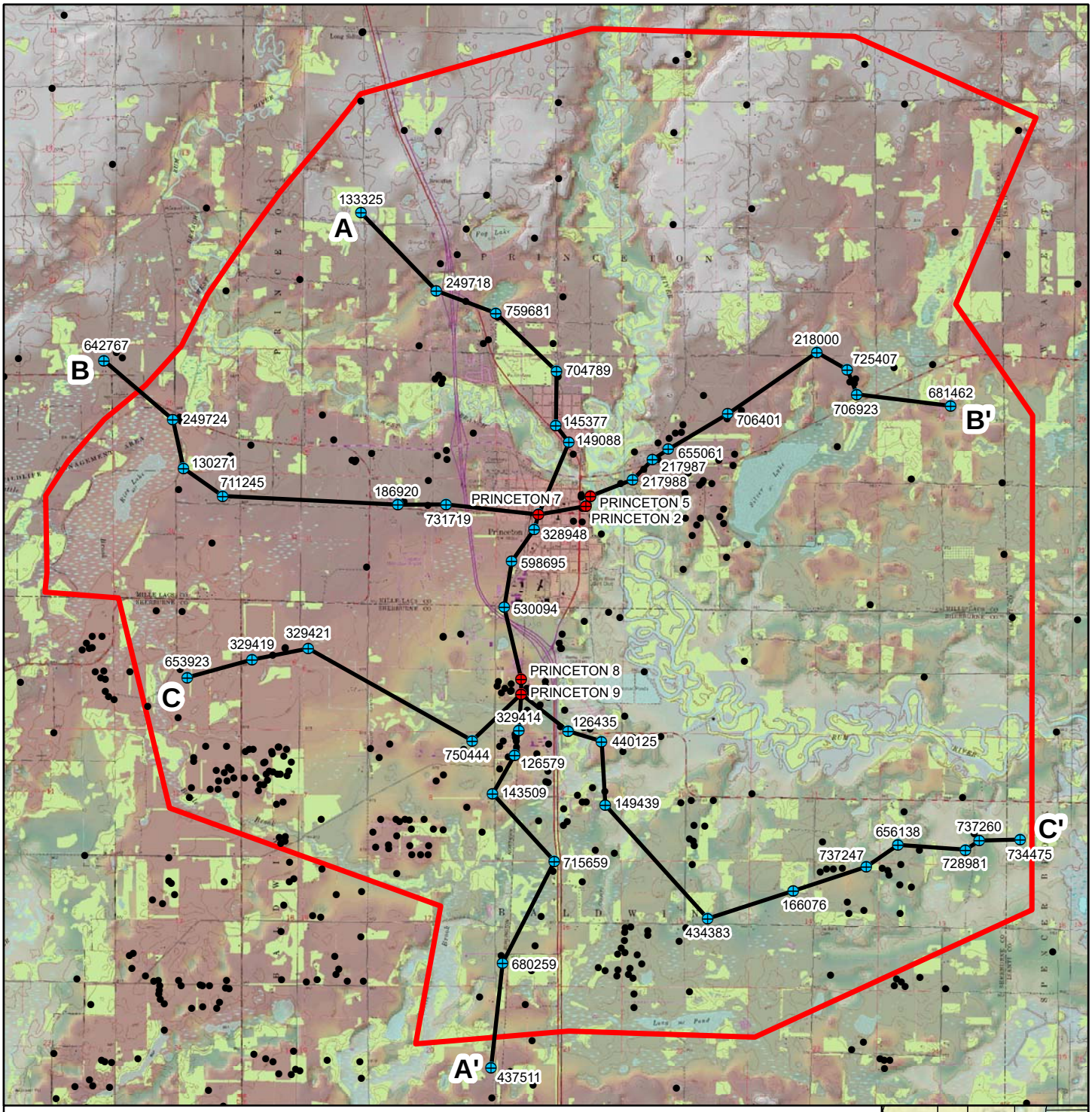
Table 2

Appropriation Permit Wells in Model Domain
Part I Wellhead Protection Plan
Princeton, Mille Lacs and Sherburne Counties, Minnesota

MN CWI Unique Well ID	Coordinates		Pumping Rate (2005-2009 Maximum)	Pumping Rate (2005-2009 Maximum)
	Easting	Northing	MGY	m3/d
407444	451298	5049192	29.2	303
413525	452229	5049470	49.8	516
442743	455162	5048910	1.29	13
451776	455190	5045511	25.2	261
632453	454578	5047721	3.51	36
689568	451367	5044571	35.1	364
689585	450156	5044808	24.7	256
689619	450957	5044793	36	373
753193	454800	5045049	2.6	27
N/A*	451566	5045584	15.5	161

Notes:
- Well pumping rates were downloaded from the MN DNR Water Appropriation Permit Program website. The five-year maximum rate was calculated from 2005 to 2009 data for the above listed wells.
- Coordinates are UTM, Zone 15, NAD83, and are from the appropriations database.
MGY: Million gallons per year
m^3/day: cubic meters per day
MN CWI: Minnesota County Well Index
*: MN CWI Unique ID not available. This well corresponds to Permit No. 1963-0427.

FIGURES



Source: USGS 7.5-Minute Quadrangles. Stillwater 1:250,000, 30-meter digitial elevation model. MN County Well Index.

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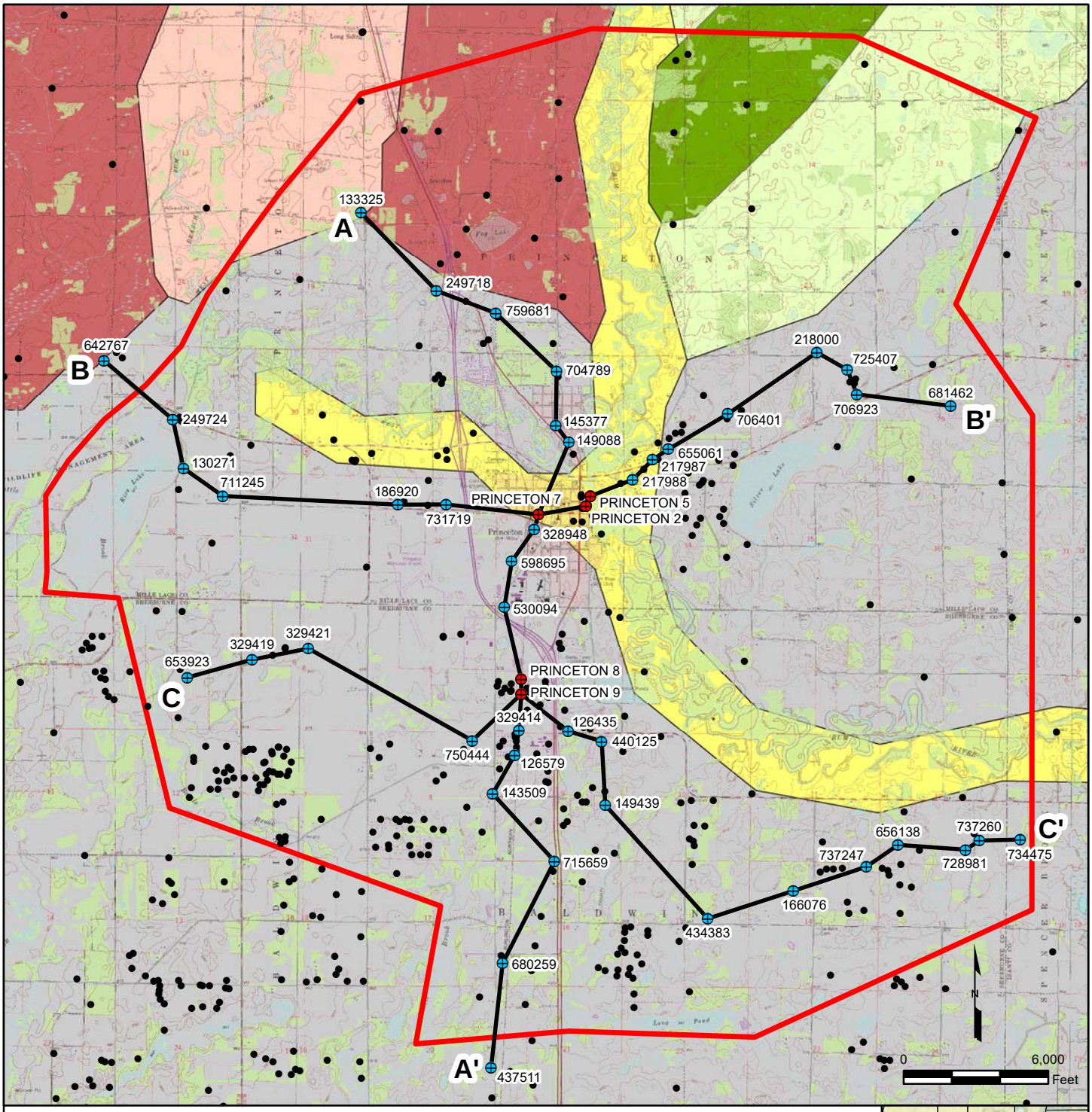
CITY OF PRINCETON

PRINCETON, MINNESOTA

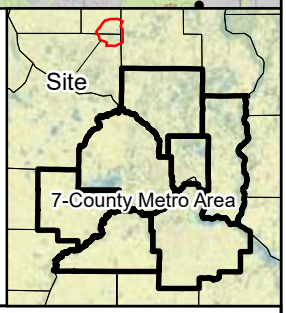
SITE LOCATION MAP AND
HYDROGEOLOGIC CROSS-SECTION LOCATIONS

FILE:	G3PRNWHP01G.MXD	DATE:	03/30/2010	FIGURE:	1



City Well
MN CWI Well Used in Cross Section
MN CWI Well Not Used in Cross Section
Hydrogeologic Cross-Section Line
Model Domain

Quaternary Geology
- DO: Outwash (Des Moines)
- DPE: End Moraine (Des Moines Lobe - Pine City Moraine)
- DPG: Ground Moraine (Des Moines Lobe - Pine City Moraine)
- HAL: Alluvium (Holocene)
- SO: Outwash (Superior)
- SSG: Ground Moraine (Superior Lobe - Mille Lacs Highland Moraine)



Source: USGS 7.5-Minute Quadrangles. Quaternary Geology coverage, Map S-1 (1982). MN County Well Index.

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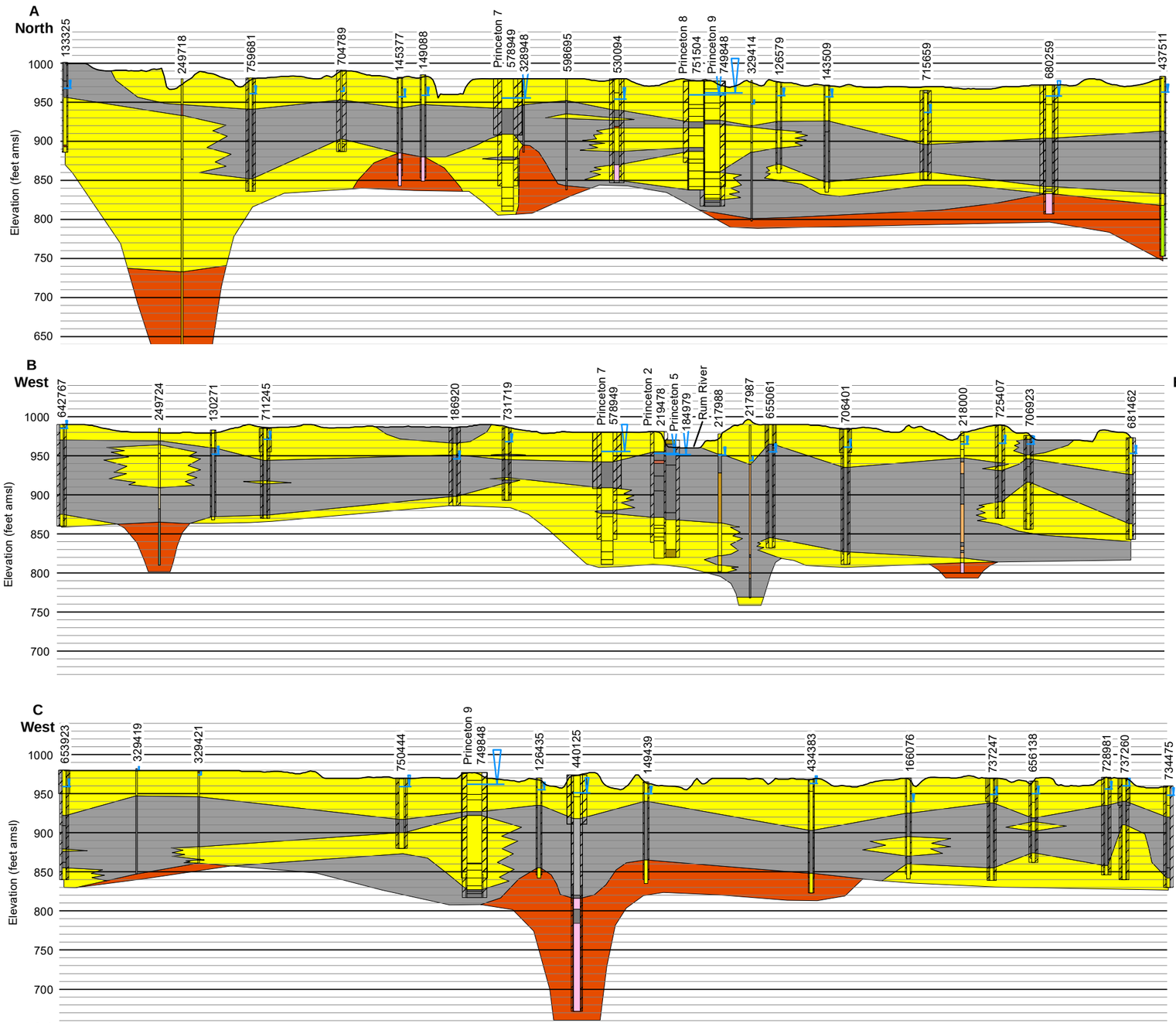
CITY OF PRINCETON
PRINCETON, MINNESOTA

QUATERNARY GEOLOGY MAP AND
HYDROGEOLOGIC CROSS-SECTION LOCATIONS

FILE:	G3PRNWHP01H.MXD	DATE:	03/30/2010	FIGURE:	2



Lithology

- Clay
- Sand
- Bedrock

Note: Unique Well ID #126579 on A-A' was raised by approximately 25 feet to match grade.

Sources: MN CWI, and grade elevation extracted from the Minnesota 30-meter digital elevation model (http://deli.dnr.state.mn.us/).

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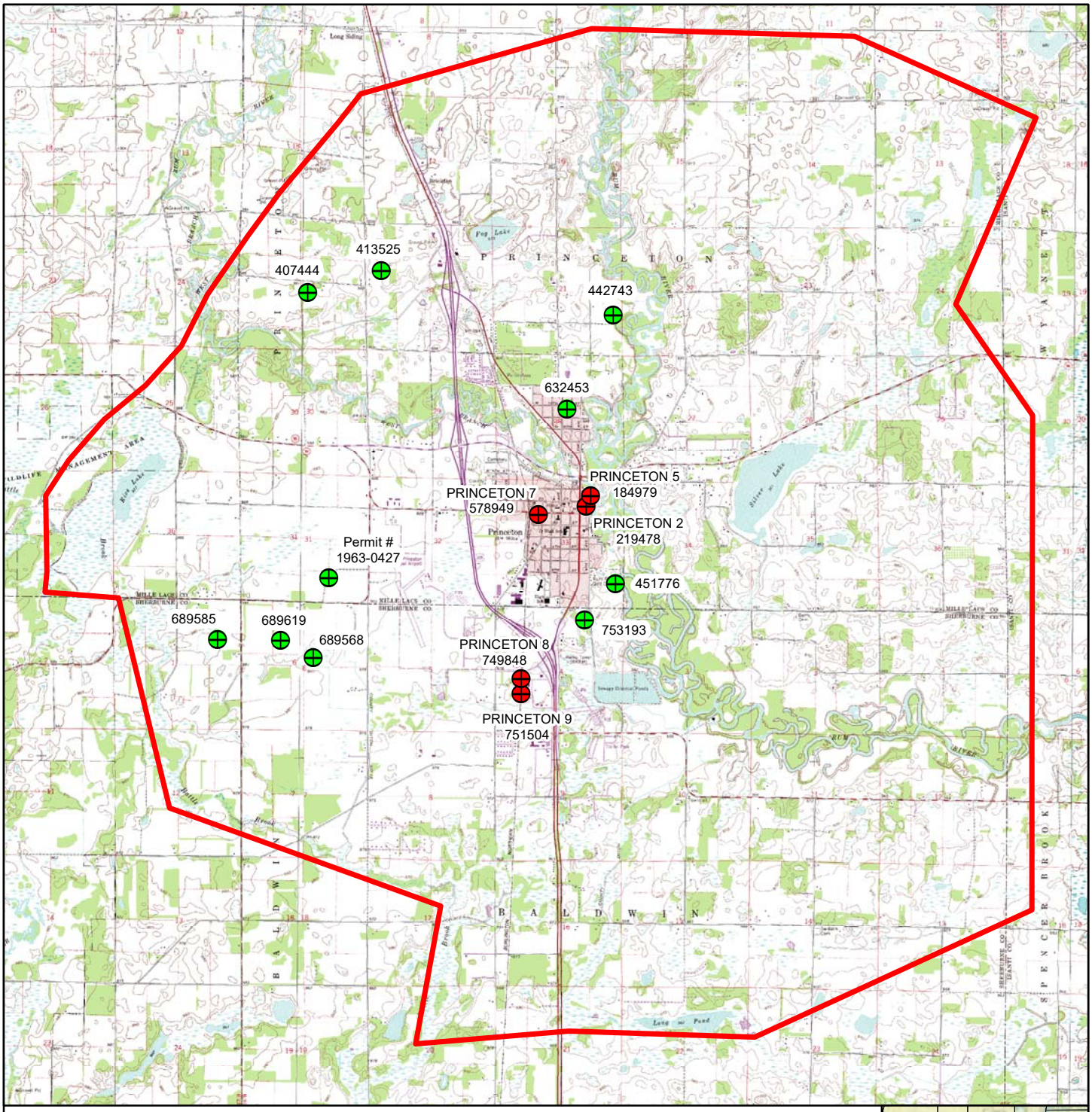
CITY OF PRINCETON

PRINCETON, MINNESOTA

HYDROGEOLOGIC CROSS-SECTIONS A-A', B-B', AND C-C'

FILE:	G3PRNWHP01I.MXD	DATE:	03/30/2010	FIGURE:	3



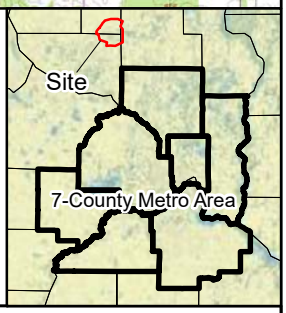
City Well

High-Capacity Well Used in Groundwater Flow Model

Model Domain

N

0 6,000 Feet



Source: USGS 7.5-Minute Quadrangles. MN County Well Index.

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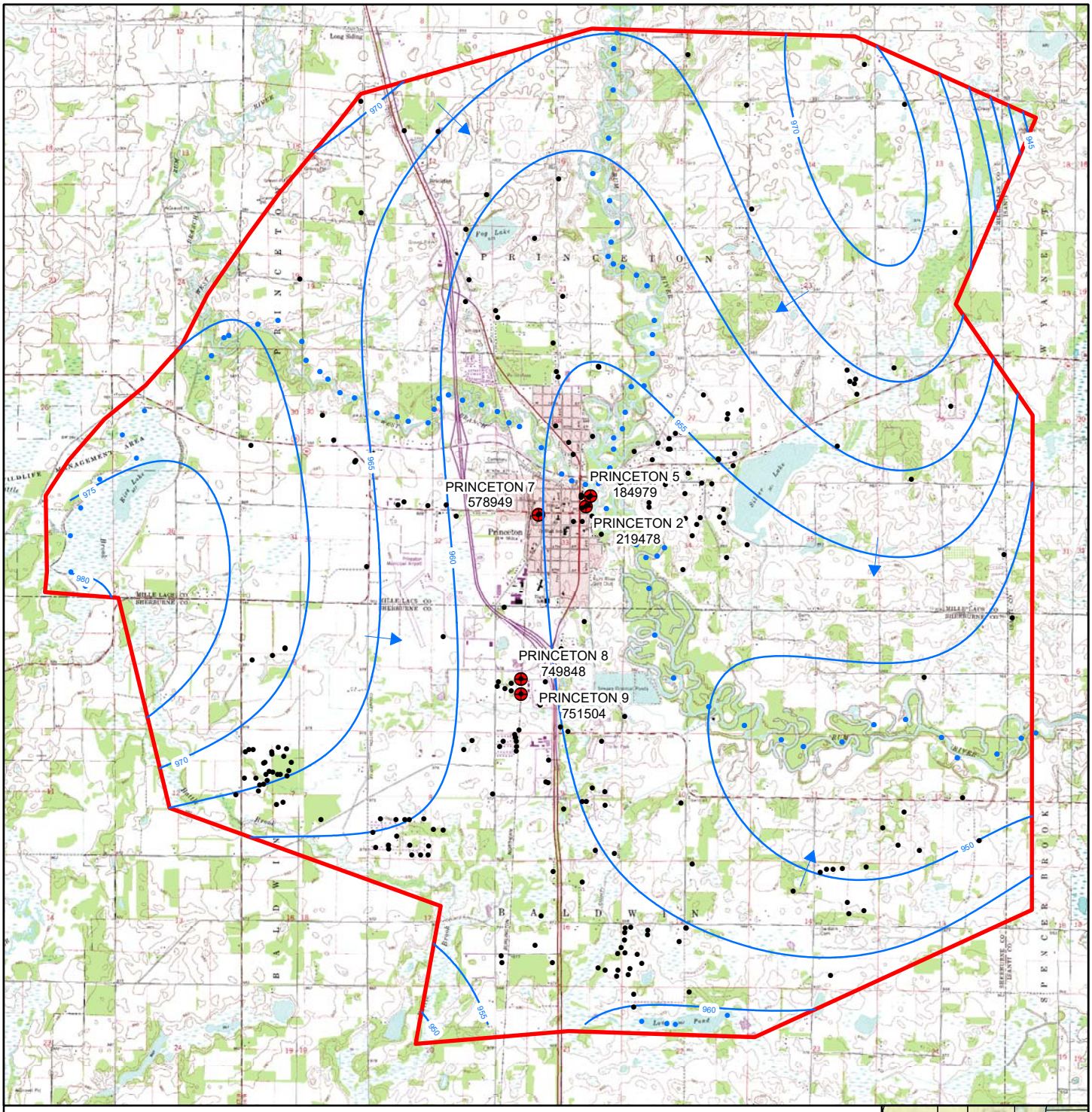
CITY OF PRINCETON

PRINCETON, MINNESOTA

LOCATION OF CITY AND SURROUNDING HIGH-CAPACITY WELLS USED IN THE GROUNDWATER FLOW MODEL

FILE:	G3PRNWHP01J.MXD	DATE:	04/21/2010	FIGURE:	4



Source: USGS 7.5-Minute Quadrangles. MN County Well Index. Contours delineated using a 12th order polynomial trend in ArcGIS.

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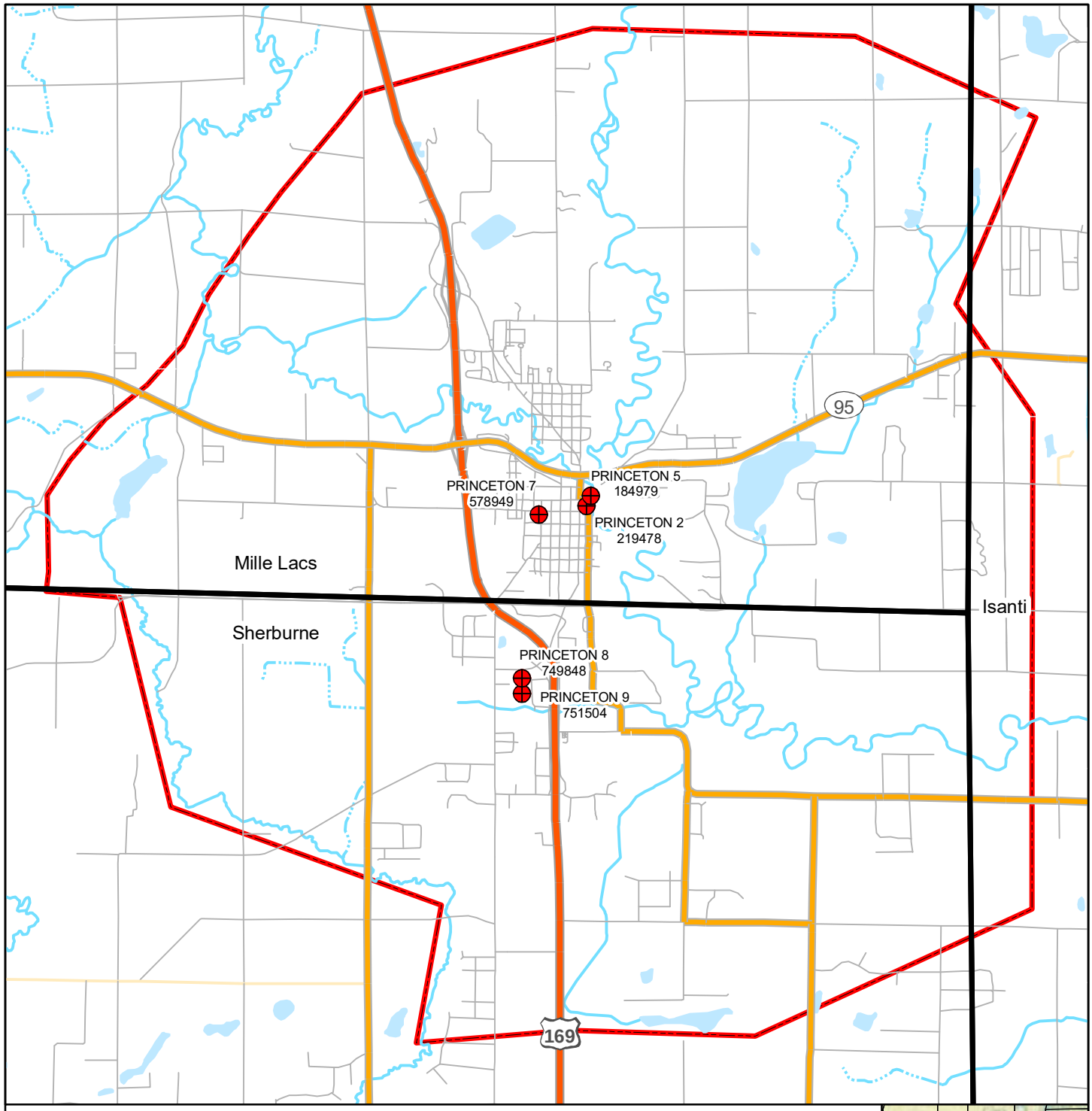
CITY OF PRINCETON

PRINCETON, MINNESOTA

QUATERNARY POTENTIOMETRIC SURFACE MAP

FILE:	G3PRNWHP01L.MXD	DATE:	04/21/2010	FIGURE:	5

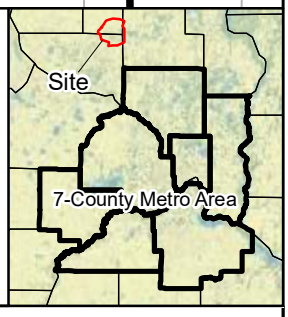


City Well

Model Domain

N

0 6,000 Feet



Source: ESRI ArcGIS StreetMap North America. MN County Well Index.

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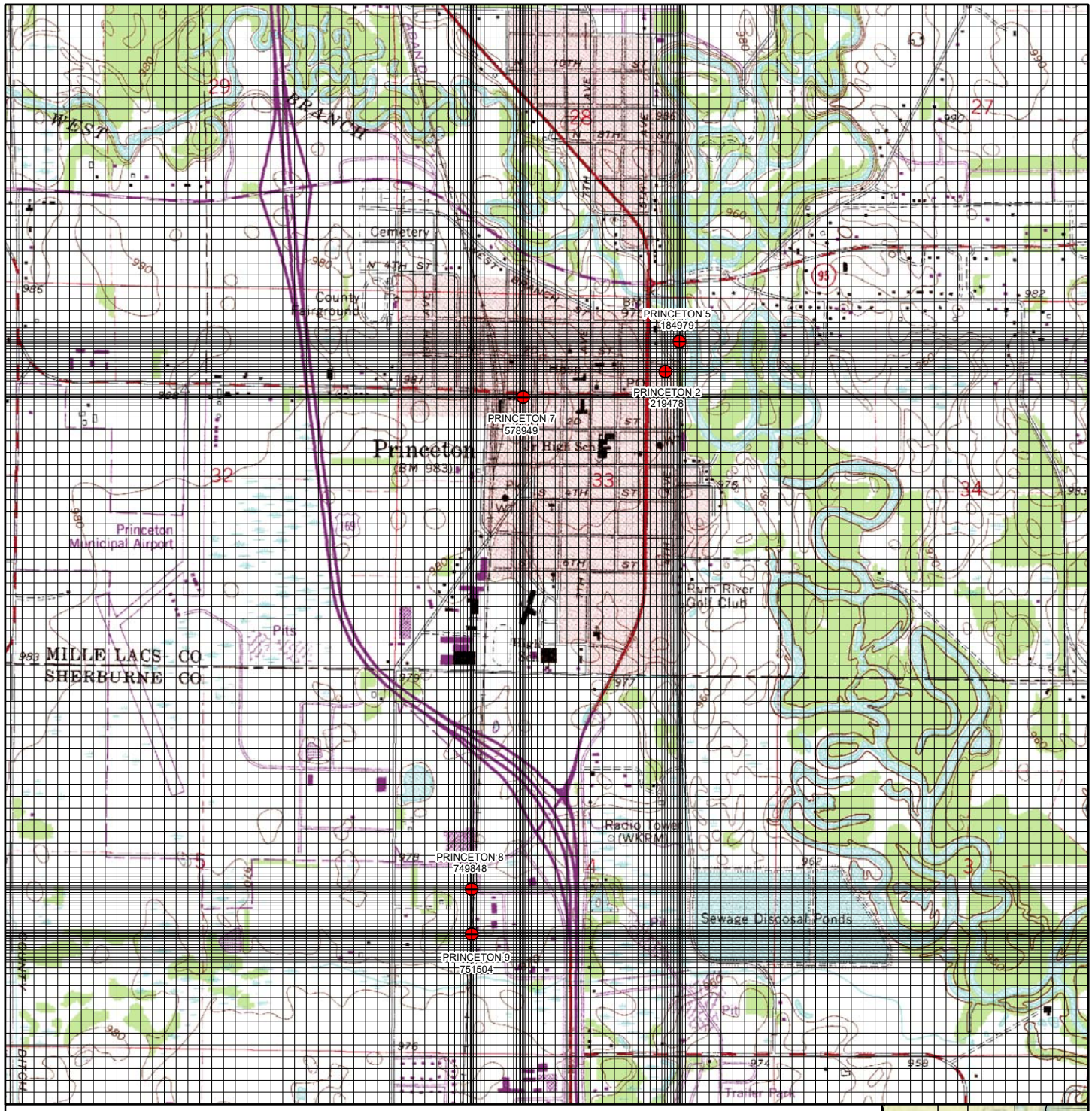
CITY OF PRINCETON

PRINCETON, MINNESOTA

MODEL DOMAIN

FILE:	G3PRNWHP01K.MXD	DATE:	04/07/2010	FIGURE:	6



Source: USGS 7.5-Minute Quadrangles. MN County Well Index.

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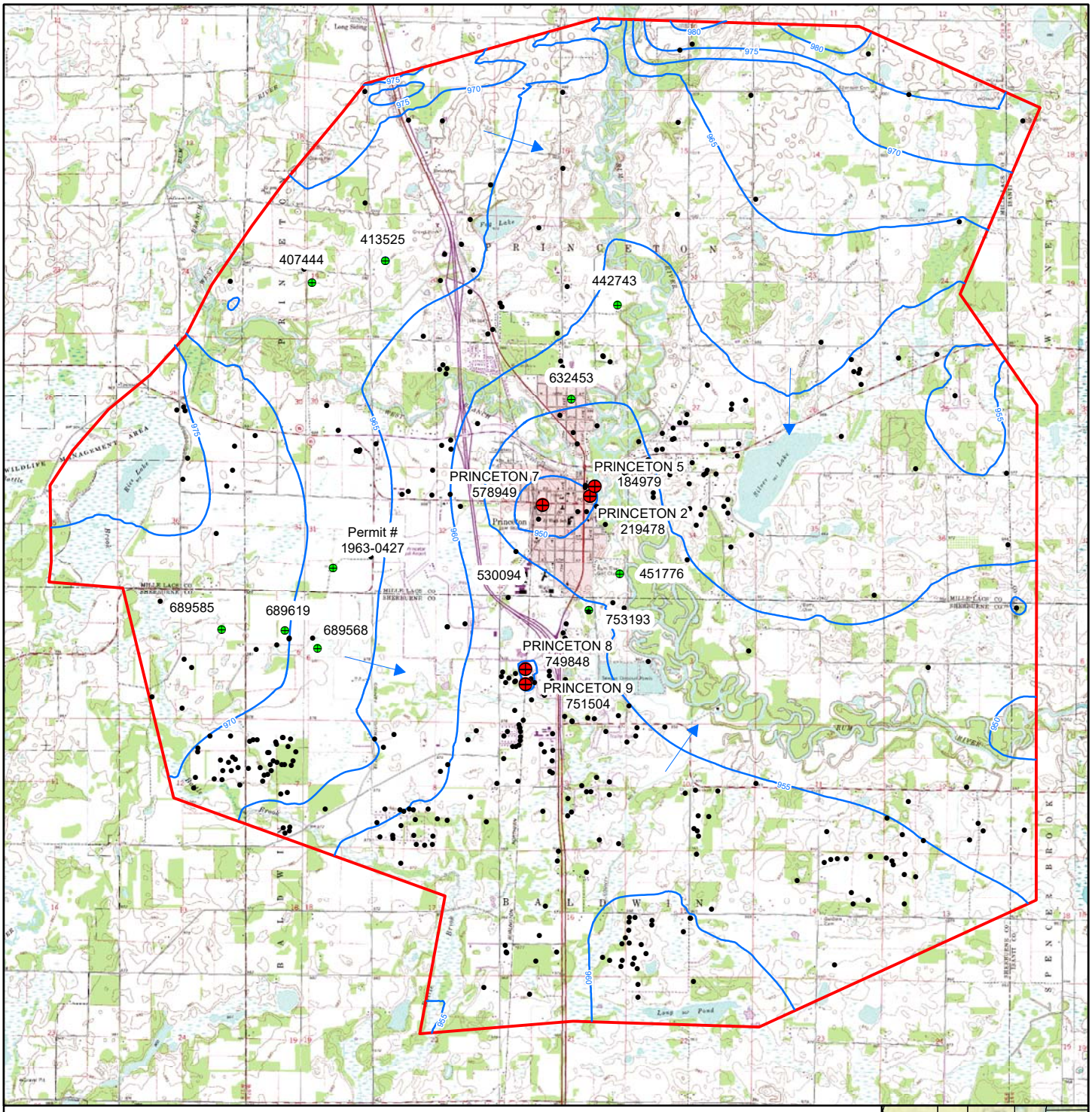
CITY OF PRINCETON

PRINCETON, MINNESOTA

MODEL GRID IN VICINITY OF CITY WELLS

FILE:	G3PRNWHP01N.MXD	DATE:	04/21/2010	FIGURE:	7



Source: USGS 7.5-Minute Quadrangles. MN County Well Index.

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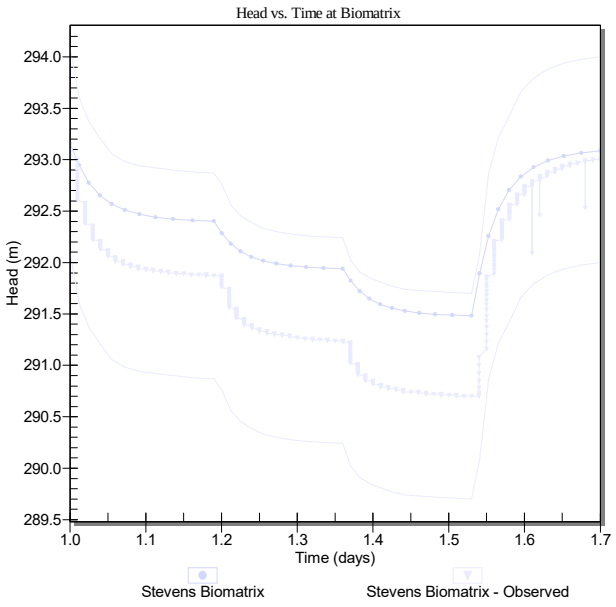
CITY OF PRINCETON

PRINCETON, MINNESOTA

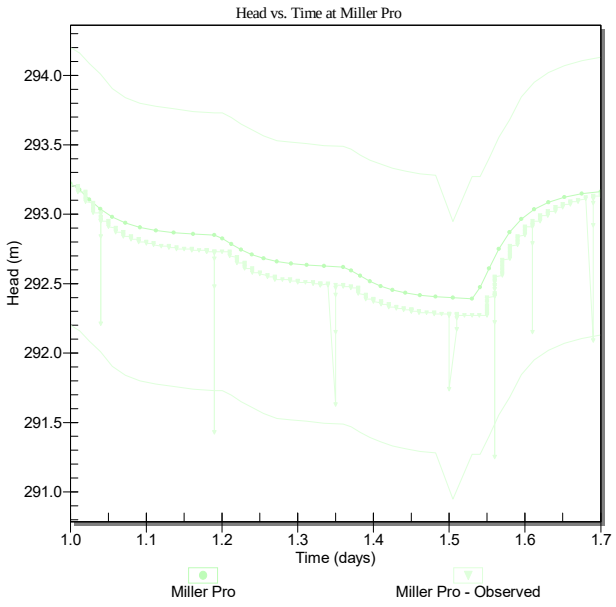
SIMULATED GROUNDWATER EQUIPOTENTIAL CONTOURS AND CALIBRATION WELL LOCATIONS

FILE: G3PRNWHP01O.MXD	DATE: 04/12/2010	FIGURE: 8

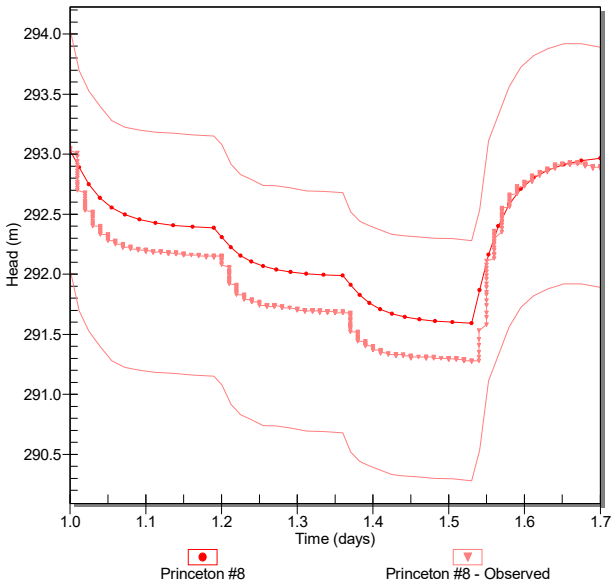
Biomatrix
Time Series



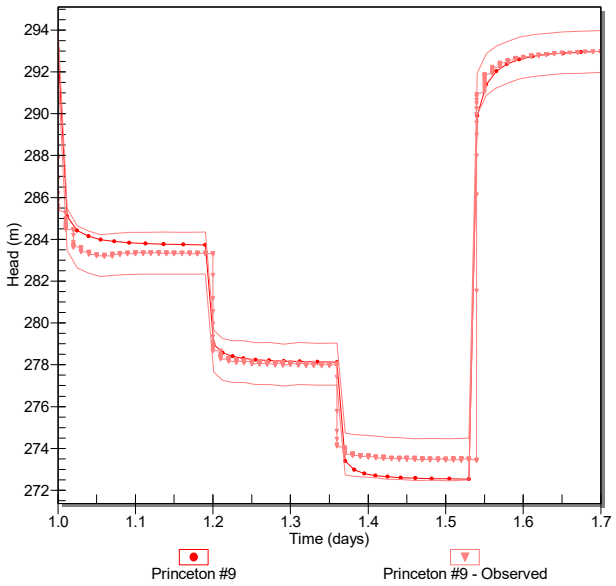
Miller Pro
Time Series



Princeton 8
Time Series



Princeton 9
Time Series



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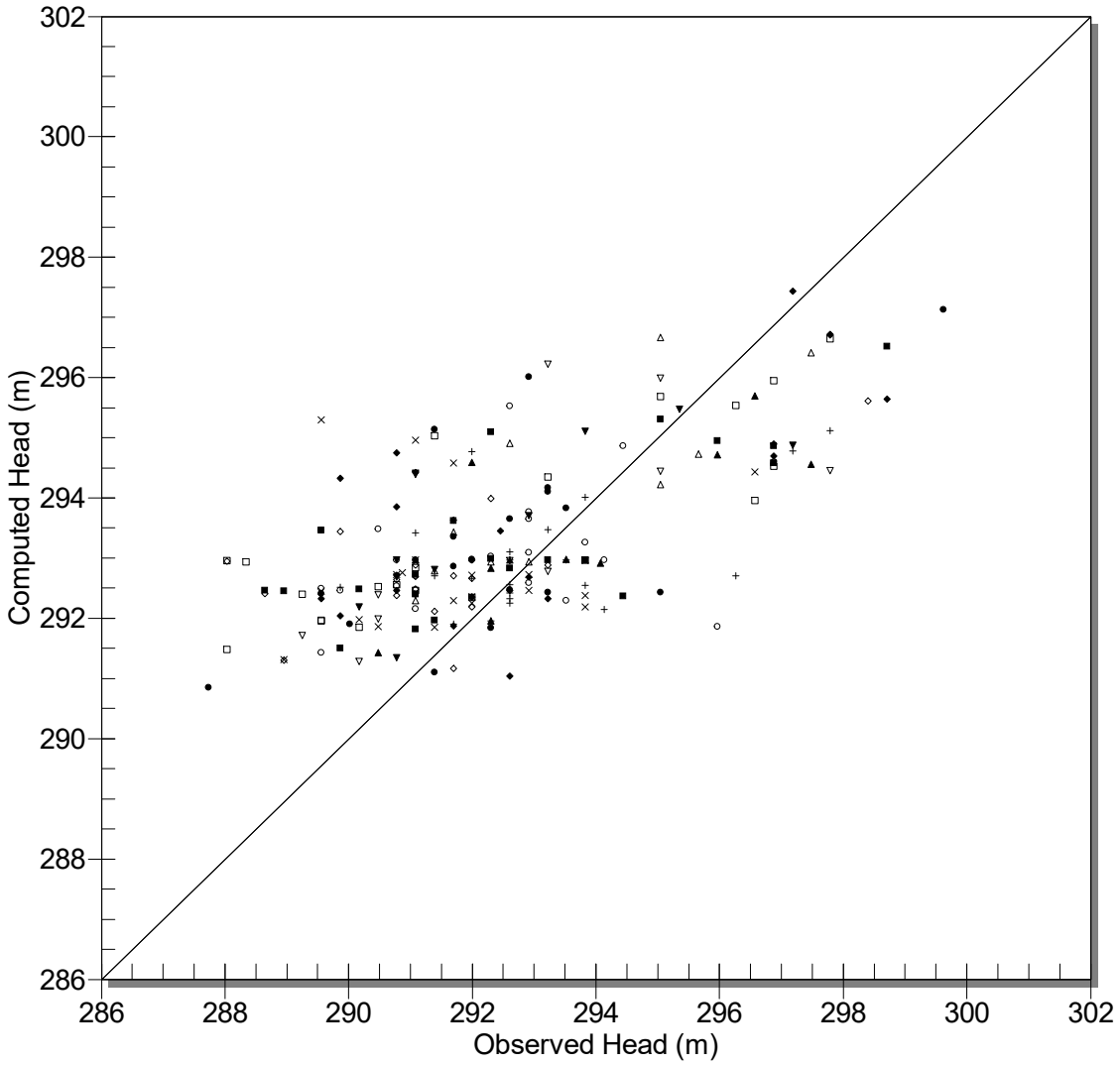
CITY OF PRINCETON
PRINCETON, MINNESOTA

TRANSIENT MODEL CALIBRATION DATA

FILE: G3PRNWHP01P.MXD	DATE: 04/21/2010	FIGURE: 9

Computed vs. Observed Values

Head



Error Summary

Head

Mean Error:	0.780
Mean Abs. Error:	1.628
Root Mean Sq. Error:	1.996

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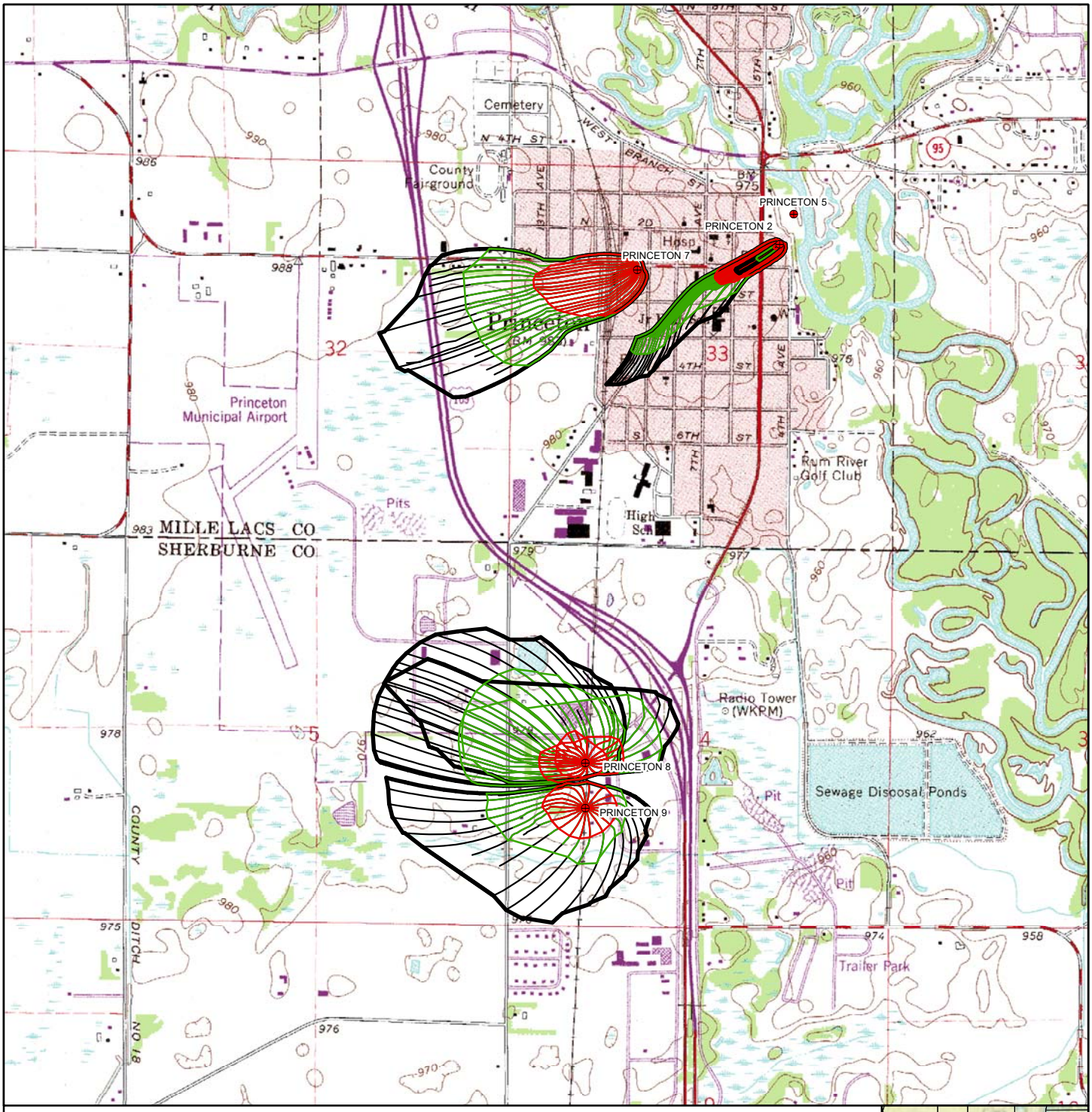
CITY OF PRINCETON
PRINCETON, MINNESOTA

STEADY-STATE MODEL CALIBRATION DATA AND MODEL STATISTICS

FILE:	DATE:	FIGURE:
G3PRNWHP01Q.MXD	04/21/2010	10



City Well

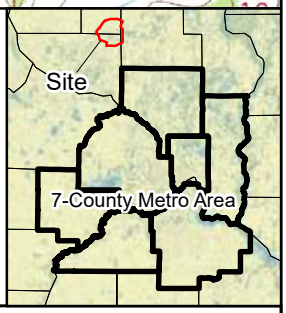
1-Year Time-of-Travel Pathlines / WHPA

5-Year Time-of-Travel Pathlines / WHPA

10-Year Time-of-Travel Pathlines / WHPA

N

0 2,000 Feet



Source: USGS 7.5-Minute Quadrangles. MN County Well Index.

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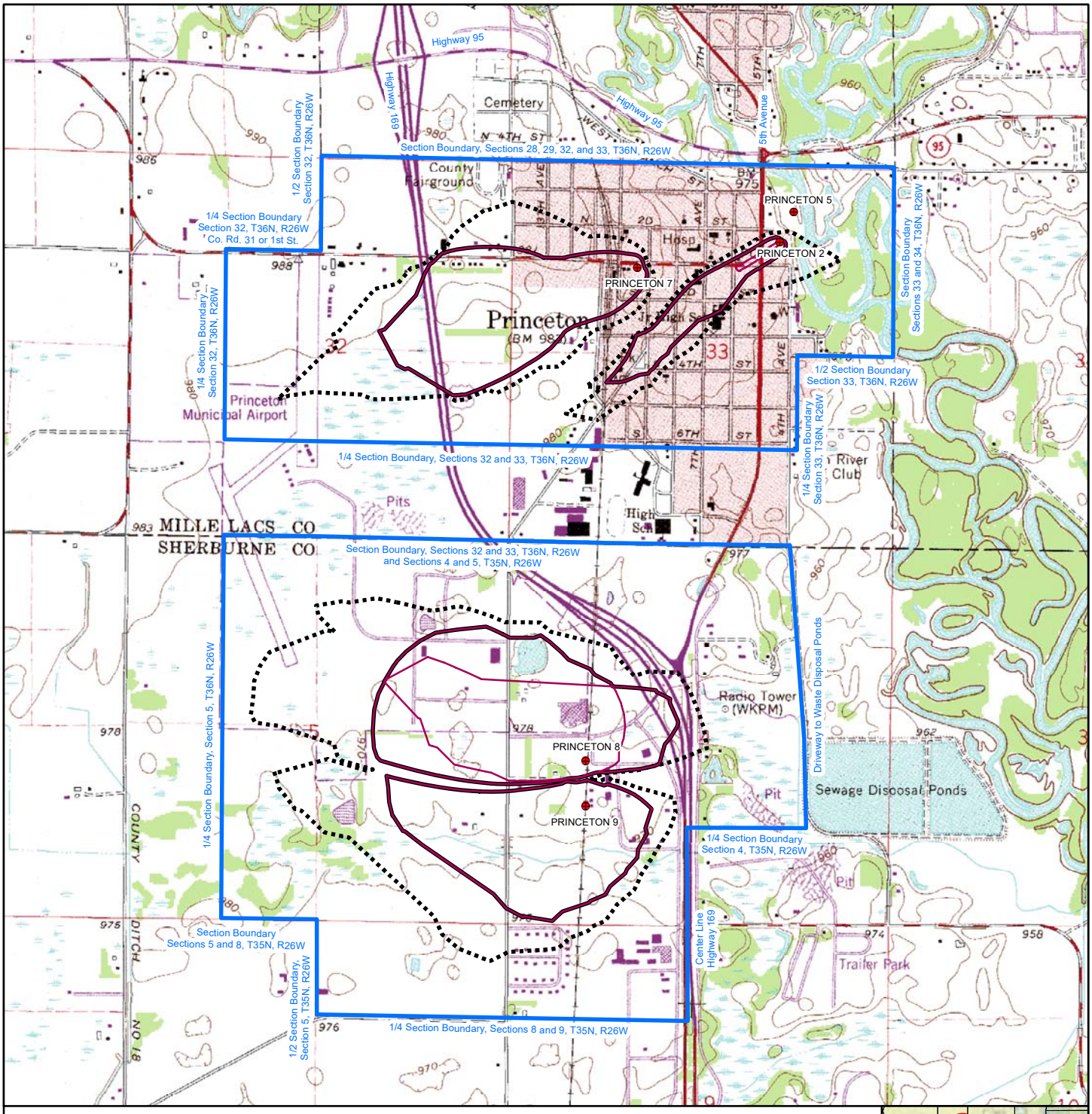
CITY OF PRINCETON

PRINCETON, MINNESOTA

1, 5, AND 10-YEAR TIMES-OF-TRAVEL PATHLINES AND WELLHEAD PROTECTION AREA BOUNDARIES

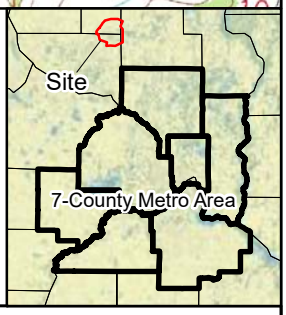
FILE: G3PRNWHP01U.MXD	DATE: 10/04/2010	FIGURE: 11



- City Well
- MN CWI Well
- Combined WHPA (Steady-State Model)
- Composite WHPA (Sensitivity Analysis)
- DWSMA

N

0 2,000 Feet



Source: USGS 7.5-Minute Quadrangles. MN County Well Index.

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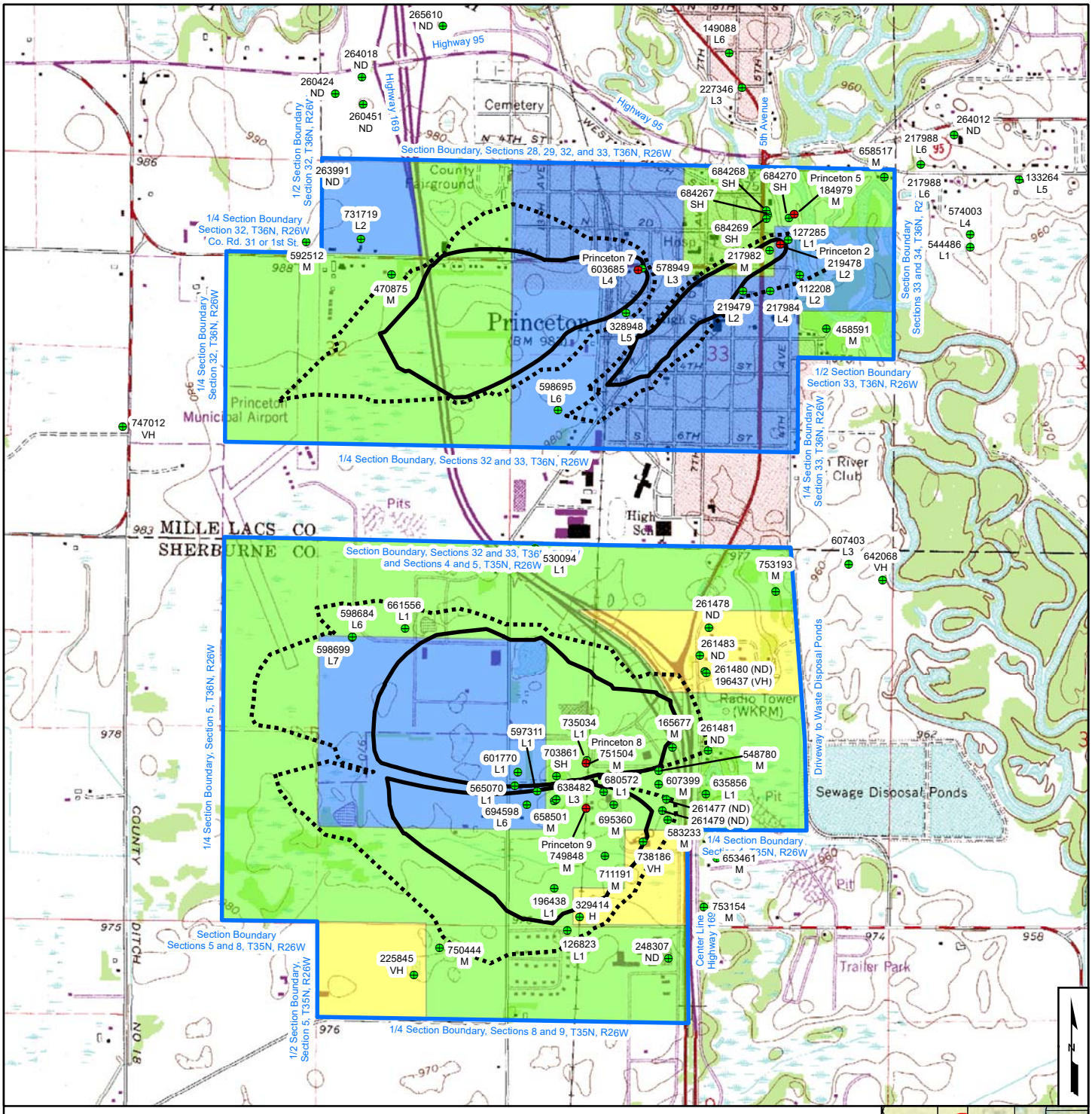
CITY OF PRINCETON

PRINCETON, MINNESOTA

DWSMA DELINEATION

FILE:	G3PRNWHP01V.MXD	DATE:	10/04/2010	FIGURE:	12



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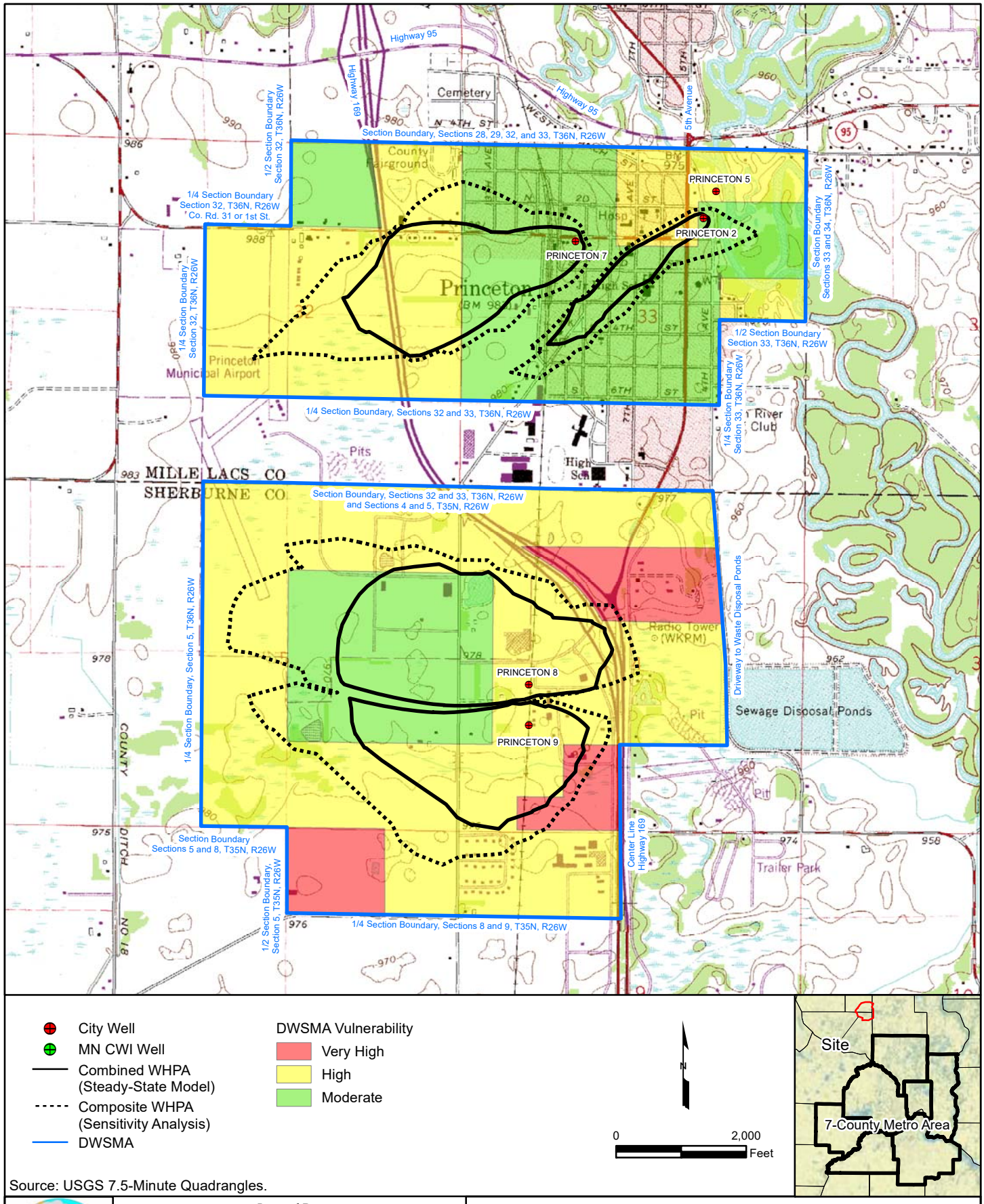
CITY OF PRINCETON
PRINCETON, MINNESOTA

DWSMA GEOLOGIC SENSITIVITY ASSESSMENT

FILE:	G3PRNWHP01W.MXD	DATE:	10/04/2010	FIGURE:	13



Source: USGS 7.5-Minute Quadrangles.

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CITY OF PRINCETON
PRINCETON, MINNESOTA

DWSMA VULNERABILITY ASSESSMENT

FILE:	G3PRNWHP01X.MXD	DATE:	10/04/2010	FIGURE:	14

APPENDIX I

Municipal Well Logs

Minnesota Unique Well No.

219478

County Mille Lacs
Quad Princeton
Quad ID 154D

MINNESOTA DEPARTMENT OF HEALTH

WELL AND BORING RECORD

Minnesota Statutes Chapter 103I

Entry Date 04/13/1988
Update Date 06/23/2005
Received Date

Well Name PRINCETON 2

Township Range Dir Section Subsections Elevation: 981 ft. (7.5 minute topographic map (+/- 5 feet))

36 26 W 33 ABDCAC Elevation Method

Well Depth	Depth Completed	Date Well Completed
162 ft.	162 ft.	00/00/1948

Drilling Method --

Well Address

PRINCETON MN

Drilling Fluid --

Well Hydrofractured? ☐ Yes ☐ No
From Ft. to Ft.

Use Community Supply PWS ID 1480008 Source S02

Casing Type Joint No Information Drive Shoe? ☐ Yes ☐ No Above/Below ft.

Casing Diameter 12 in. to 142 ft. **Weight** lbs./ft. **Hole Diameter**

Open Hole from ft. to ft.

Screen YES Make Type

Diameter	Slot/Gauze	Length	Set Between
0		0	142 ft. and 162 ft.

Geological Material	Color	Hardness	From	To
SAND			0	26
CLAY	BLUE		26	28
CLAY & ROCKS	YELLOW		28	37
BOULDERS			37	41
CLAY-SAND & HARDPAN			41	57
CLAY & HARDPAN			57	76
CLAY-SAND & ROCKS			76	110
FINE DIRTY SAND			110	120
CLEAN COARSE TO FINE SAND			120	124
CLEAN COARSE GRAVEL & SAND			124	130
MEDIUM COARSE SAND & GRAVEL			130	135
FINE GRAVEL & STONES			135	140
GRAVEL			140	162

Static Water Level
28 ft. from Land surface Date Measured 00/00/1948

PUMPING LEVEL (below land surface)
30 ft. after hrs. pumping 400 g.p.m.

Well Head Completion
Pitless adapter manufacturer Model
☐ Casing Protection ☐ 12 in. above grade
☐ At-grade (Environmental Wells and Borings ONLY)

NO REMARKS

Grouting Information Well Grouted? ☐ Yes ☐ No

Located by: Minnesota Geological Survey
Method: Digitization (Screen) - Map (1:24,000)
Unique Number Verification: N/A
Input Date: 02/22/2001
System: *UTM - Nad83, Zone15, Meters* X: 454816 Y: 5046493

Nearest Known Source of Contamination
_feet _direction _type
Well disinfected upon completion? ☐ Yes ☐ No

Pump ☐ Not Installed Date Installed
Manufacturer's name Model number ___ HP _ Volts
Length of drop Pipe _ft. Capacity _g.p.m Type Material

Abandoned Wells Does property have any not in use and not sealed well(s)? ☐ Yes ☐ No

Variance Was a variance granted from the MDH for this well? ☐ Yes ☐ No

First Bedrock
Last Strat Gravel (+larger)
Aquifer Quat. Buried Artes. Aquifer
Depth to Bedrock ft.

Well Contractor Certification

Mccarthy Well Co.	27022	MCCARTHY WELL
License Business Name	Lic. Or Reg. No.	Name of Driller

County Well Index Online Report 219478 Printed 4/8/2010
HE-01205-07

Minnesota Unique Well No.

184979

County Mille Lacs
Quad Princeton
Quad ID 154D

MINNESOTA DEPARTMENT OF HEALTH

WELL AND BORING RECORD

Minnesota Statutes Chapter 103I

Entry Date 10/10/1991
Update Date 07/20/2005
Received Date

Well Name PRINCETON 5

Township Range Dir Section Subsections Elevation 970 ft.

36 26 W 33 ABADAC Elevation Method 7.5 minute topographic map (+/- 5 feet)

Well Depth	Depth Completed	Date Well Completed
150 ft.	150 ft.	07/21/1982

Drilling Method Cable Tool

Well Address

PRINCETON MN 55371

Geological Material	Color	Hardness	From	To
NO RECORD			0	5
SANDY CLAY	GRAY		5	32
SANDY CLAY	BROWN		32	93
SANDY CLAY	GRAY		93	102
FINE DIRTY SAND	BROWN		102	120
SAND			120	140
NO RECORD			140	150

Drilling Fluid --

Well Hydrofractured? ☐ Yes ☐ No
From Ft. to Ft.

Use Community Supply PWS ID 1480008 Source S05

Casing Type Steel (black or low carbon) Joint Welded Drive Shoe? ☑
Yes ☐ No Above/Below ft.

Casing Diameter	Weight	Hole Diameter
12 in. to 110 ft.	lbs./ft.	

Open Hole from ft. to ft.

Screen YES Make JOHNSON Type stainless steel

Diameter	Slot/Gauze	Length	Set Between
12	40		110 ft. and 150 ft.

Static Water Level
18.5 ft. from Land surface Date Measured 07/14/1982

PUMPING LEVEL (below land surface)
64.8 ft. after 12 hrs. pumping 550 g.p.m.

Well Head Completion
Pitless adapter manufacturer Model
☐ Casing Protection ☑ 12 in. above grade
☐ At-grade (Environmental Wells and Borings ONLY)

REMARKS
M.G.S. NO. 2187.

Located by: Minnesota Geological Survey
Method: Digitization (Screen) - Map (1:12,000)

Unique Number Verification: Information from owner
Input Date: 02/01/2001

System: *UTM - Nad83, Zone15, Meters*
X: 454875 Y: 5046619

Grouting Information Well Grouted? ☑ Yes ☐ No

Grout Material: Neat Cement from to ft.

Nearest Known Source of Contamination
_feet _direction _type

Well disinfected upon completion? ☑ Yes ☐ No

Pump ☐ Not Installed Date Installed
Manufacturer's name Model number ___ HP _ Volts
Length of drop Pipe _ft. Capacity _g.p.m Type Material

Abandoned Wells Does property have any not in use and not sealed well(s)? ☐
Yes ☐ No

Variance Was a variance granted from the MDH for this well? ☐ Yes ☐ No

Cuttings Yes
First Bedrock
Last Strat Unknown deposit type
Aquifer Quat. Buried Artes. Aquifer
Depth to Bedrock ft.

Well Contractor Certification

Thein Well Co. Clara City	12013	THEIN, S.
License Business Name	Lic. Or Reg. No.	Name of Driller

County Well Index Online Report

184979

Printed 4/8/2010
HE-01205-07

Minnesota Unique Well No.

578949

County Mille Lacs
Quad Princeton
Quad ID 154D

MINNESOTA DEPARTMENT OF HEALTH

WELL AND BORING RECORD

Minnesota Statutes Chapter 103I

Entry Date 04/20/1999
Update Date 07/20/2005
Received Date

Well Name PRINCETON 7

Township Range Dir Section Subsections Elevation 980 ft.

36 26 W 33 BDBA Elevation Method Calc from DEM (USGS 7.5 min or equiv.)

Well Depth	Depth Completed	Date Well Completed
169 ft.	169 ft.	06/02/1998

Drilling Method Cable Tool

Well Address
907 1ST ST
PRINCETON MN 55371

Drilling Fluid Bentonite

Well Hydrofractured? ☐ Yes ☐ No
From Ft. to Ft.

Use Community Supply PWS ID 1480008 Source S08

Casing Type Joint No Information Drive Shoe? ☐ Yes ☐ No Above/Below ft.

Geological Material	Color	Hardness	From	To
FINE SAND	BROWN	SOFT	0	25
SAND & GRAVEL	BROWN	SOFT	25	38
CLAY & ROCKS	BROWN	SOFT	38	71
SAND & GRAVEL/ROCKS	BROWN	HARD	71	100
CLAY & ROCK	BROWN	HARD	100	104
SAND & GRAVEL	BROWN	HARD	104	108
FINE SAND	BROWN	SOFT	108	139
GRAVEL/ ROCKS	BROWN	SOFT	139	153
COARSE SAND	BROWN	SOFT	153	163
ROCKS? GRAVEL	BROWN	SOFT	163	169

Casing Diameter	Weight	Hole Diameter
20 in. to 72 ft.	78.6 lbs./ft.	20 in. to 72 ft.
14 in. to 137 ft.	54.6 lbs./ft.	

Open Hole from ft. to ft.

Screen YES Make JOHNSON Type stainless steel

Diameter	Slot/Gauze	Length	Set Between
8	65	40	129 ft. and 169 ft.

Static Water Level
24.5 ft. from Land surface Date Measured 05/21/1998

PUMPING LEVEL (below land surface)
46 ft. after 8 hrs. pumping 900 g.p.m.

Well Head Completion
Pitless adapter manufacturer Model
☐ Casing Protection ☐ 12 in. above grade
☐ At-grade (Environmental Wells and Borings ONLY)

NO REMARKS

Grouting Information Well Grouted? ☑ Yes ☐ No

Grout Material: from 0 to 120 ft. 2.5

Located by: Minnesota Department of Health
Method: Digitization (Screen) - Map (1:24,000)
Unique Number Verification: N/A
Input Date: 04/25/2005
System: *UTM - Nad83, Zone15, Meters*
X: 454216 Y: 5046385

Nearest Known Source of Contamination
_feet _direction _type
Well disinfected upon completion? ☐ Yes ☐ No

Pump ☑ Not Installed Date Installed
Manufacturer's name GOULD Model number 121CHC-3 HP 50 Volts 480
Length of drop Pipe 100 ft. Capacity 75 g.p.m Type Material Steel (black or low carbon)

Abandoned Wells Does property have any not in use and not sealed well(s)? ☐ Yes ☐ No

Variance Was a variance granted from the MDH for this well? ☐ Yes ☐ No

First Bedrock
Last Strat
Aquifer Quat. Buried Artes. Aquifer
Depth to Bedrock ft.

Well Contractor Certification

Renner E.H. Well	71015	COX, A.
License Business Name	Lic. Or Reg. No.	Name of Driller

County Well Index Online Report 578949 Printed 4/8/2010
HE-01205-07

Minnesota Unique Well No.

751504

County Sherburne
Quad Princeton
Quad ID 154D

MINNESOTA DEPARTMENT OF HEALTH

WELL AND BORING RECORD

Minnesota Statutes Chapter 103I

Entry Date 06/18/2007
Update Date 03/09/2009
Received Date 09/06/2007

Well Name PRINCETON 8

Township Range Dir Section Subsections Elevation 977 ft.

35 26 W 4 CBADBA Elevation Method 7.5 minute topographic map (+/- 5 feet)

Well Depth	Depth Completed	Date Well Completed
139 ft.	139 ft.	06/00/2007

Drilling Method Dual Rotary

Well Address

PRINCETON MN 55371

Geological Material	Color	Hardness	From	To
SAND	BROWN	SOFT	0	30
MEDIUM SAND, GRAVEL	BROWN	SOFT	30	35
COARSE SAND/GRAVEL	BROWN	SOFT	35	45
SAND	GRAY	SOFT	45	52
SAND/GRAVEL/CLAY	GRAY	MEDIUM	52	60
SAND	DK. BRN	SOFT	60	70
SILTY SAND	DK. BRN	SOFT	70	85
SILT, CLAY, ROCK	DK. BRN	MEDIUM	85	90
MEDIUM SAND & GRAVEL	GRAY	SOFT	90	100
MEDIUM SAND	GRAY	SOFT	100	105
COARSE SAND, GRAVEL, ROCK	GRAY	MEDIUM	105	115
MEDIUM SAND	GRAY	SOFT	115	125
MEDIUM TO COARSE SAND & GRAVEL	GRAY	SOFT	125	135
COARSE SAND & GRAVEL	GRAY	SOFT	135	139
CLAY	BROWN	MED-HRD	139	139

Drilling Fluid
Water

Well Hydrofractured? ☐ Yes ☑ No
From Ft. to Ft.

Use Community Supply PWS ID Source

Casing Type Steel (black or low carbon) Joint Welded Drive Shoe? ☑
Yes ☐ No Above/Below ft.

Casing Diameter	Weight	Hole Diameter
18 in. to 104 ft.	70.59 lbs./ft.	18 in. to 98.6 ft.
		11 in. to 139 ft.

Open Hole from ft. to ft.

Screen YES Make JOHNSON Type stainless steel

Diameter	Slot/Gauze	Length	Set Between
12	10	40.5	98.6 ft. and 139 ft.

Static Water Level
17.5 ft. from Land surface Date Measured 06/09/2007

PUMPING LEVEL (below land surface)
90.6 ft. after 24 hrs. pumping 740 g.p.m.

Well Head Completion
Pitless adapter manufacturer Model
☐ Casing Protection ☑ 12 in. above grade
☐ At-grade (Environmental Wells and Borings ONLY)

REMARKS
M.G.S. NO. 4700.

Located by: Minnesota Department of Health Method: GPS SA Off (averaged)
Unique Number Verification: N/A Input Date: 05/25/2007
System: *UTM - Nad83, Zone15, Meters* X: 453998 Y: 5044307

Grouting Information Well Grouted? ☐ Yes ☑ No

Nearest Known Source of Contamination
350 feet E direction Septic tank/drain field type
Well disinfected upon completion? ☑ Yes ☐ No

Pump ☐ Not Installed Date Installed
Manufacturer's name Model number ___ HP _ Volts
Length of drop Pipe _ft. Capacity _g.p.m Type Material

Abandoned Wells Does property have any not in use and not sealed well(s)? ☑
Yes ☐ No

Variance Was a variance granted from the MDH for this well? ☐ Yes ☑ No

Borehole Geophysics Yes
First Bedrock
Last Strat Clay-brown
Aquifer Quat. Buried Artes. Aquifer
Depth to Bedrock ft.

Well Contractor Certification

Mark J Traut Wells, Inc.	1404	FEIA, E.
License Business Name	Lic. Or Reg. No.	Name of Driller

County Well Index Online Report

751504

Printed 4/7/2010
HE-01205-07

Minnesota Unique Well No.

749848

County Sherburne
Quad Princeton
Quad ID 154D

MINNESOTA DEPARTMENT OF HEALTH

WELL AND BORING RECORD

Minnesota Statutes Chapter 103I

Entry Date 07/23/2007
Update Date 12/05/2008
Received Date 09/06/2007

Well Name PRINCETON 9

Township Range Dir Section Subsections Elevation 977 ft.

35 26 W 4 CBDDBB Elevation Method 7.5 minute topographic map (+/- 5 feet)

Well Depth	Depth Completed	Date Well Completed
160 ft.	160 ft.	08/01/2007

Drilling Method Dual Rotary

Well Address

PRINCETON MN 55371

Drilling Fluid Water

Well Hydrofractured? ☐ Yes ☑ No
From Ft. to Ft.

Use Community Supply PWS ID Source

Geological Material	Color	Hardness	From	To
FINE SILTY SAND	BROWN	SOFT	0	10
FINE SAND	BROWN	SOFT	10	15
FINE SAND, FEW STONES	BROWN	SOFT	15	28
GRAVEL, SAND, FEW ROCKS	BROWN	SOFT	28	35
FINE TO MED. SAND	BROWN	SOFT	35	50
SAND, CLAY LENSES	GRAY	SOFT	50	55
SILTY FINE SAND	BROWN	SOFT	55	116
CLAY	BROWN	MEDIUM	116	117
FINE SILTY SAND	BROWN	SOFT	117	125
FINE SAND	BROWN	SOFT	125	135
FINE SAND, ROCK LAYERS	BROWN	SOFT	135	145
FINE TO MED SAND, GRAVEL, ROCK LAY	BROWN	SOFT	145	150
FINE TO MED SAND, GRAVEL ROCK/CLAY	BROWN	SOFT	150	152
FINE SAND, CLAY, ROCK/GRAVEL LAYER	BROWN	SOFT	152	155
CLAY	BROWN	MEDIUM	155	160

Casing Type Steel (black or low carbon) Joint Welded Drive Shoe? ☑
Yes ☐ No Above/Below ft.

Casing Diameter	Weight	Hole Diameter
18 in. to 135 ft.	70.59 lbs./ft.	18 in. to 135 ft.
		17.25 in. to 160 ft.

Open Hole from ft. to ft.

Screen YES Make JOHNSON Type stainless steel

Diameter	Slot/Gauze	Length	Set Between
12	10	5	130 ft. and 135 ft.
12	30	25	135 ft. and 160 ft.

Static Water Level
15 ft. from Land surface Date Measured 08/01/2007

PUMPING LEVEL (below land surface)
ft. after hrs. pumping g.p.m.

Well Head Completion
Pitless adapter manufacturer Model
☐ Casing Protection ☑ 12 in. above grade
☐ At-grade (Environmental Wells and Borings ONLY)

REMARKS
DRILLERS: ED & BUTCH G.

Grouting Information Well Grouted? ☐ Yes ☑ No

Located by: Minnesota Department of Health
Method: GPS SA Off (averaged)
Unique Number Verification: N/A
Input Date: 05/29/2007
System: *UTM - Nad83, Zone15, Meters*
X: 453998 Y: 5044116

Nearest Known Source of Contamination
400 feet North East direction Septic tank/drain field type
Well disinfected upon completion? ☐ Yes ☐ No

Pump ☐ Not Installed Date Installed
Manufacturer's name Model number ___ HP _ Volts
Length of drop Pipe _ft. Capacity _g.p.m Type Material

Abandoned Wells Does property have any not in use and not sealed well(s)? ☑
Yes ☐ No

Variance Was a variance granted from the MDH for this well? ☐ Yes ☑ No

First Bedrock
Last Strat Clay-brown
Aquifer Quat. Water Table Aquifer
Depth to Bedrock ft.

Well Contractor Certification

Mark J Traut Wells, Inc.	1404	SEE REMARKS
License Business Name	Lic. Or Reg. No.	Name of Driller

County Well Index Online Report

749848

Printed 4/7/2010
HE-01205-07

APPENDIX II

Princeton-MDH Water Chemistry Summary

Appendix II
Princeton-MDH Water Chemistry Summary

Only Compounds that had detections are listed below for the currently active Wells 2, 5, 7, 8, and 9.

The Summary below is inclusive of distribution and entry point (after some treatment) data and not just the source data. Per Gail Haglund, MDH, April 14, 2010, the codes for the data in the sample_point_id column in each data table are as follows,

- D##: distribution sample
- E##: entry point sample (has had some treatment and is not directly from well)
- S##: source sample (this is directly from the well before any treatment

Bacteria (Question emailed to Gail Haglund 4/6/2010)

- Well 2: Absent (most recent sample 3/30/2006) (Entry sample)
- Well 5: Present (10/16/2001) (Distribution sample) – most recent sample Absent (3/30/2006) (Entry point sample)
- Well 7: Absent (most recent sample 3/10/2009) (Source sample)
- Well 8: Absent (only sample 3/10/2009) (Source sample)
- Well 9: Absent (only sample 3/10/2009) (Source sample)
-

Disinfectant Biproducts (DBP) or Total Trihalomethanes (TTHM) were analyzed in groundwater samples collected from Wells 2, 5, and 7. The Minnesota Department of Health (MDH) Health Risk Limit (HRL) is listed next to the parameter name.

- Bromodichloromethane (HRL 6 ug/L)
  - Well 2: <0.2 ug/L (4/27/2007) (only Source sample)
  - Well 5: 2.7 ug/L (6/11/1999) – most recent <0.2 ug/L (8/16/1999) (Entry point sample)
  - Well 7: <0.2 ug/L (8/15/2000) (only Source sample)
  - Well 8: no sample results
  - Well 9: no sample results
- Chlorodibromomethane (HRL 10 ug/L)
  - Well 2: <0.5 ug/L (4/27/2007) (only Source sample)
  - Well 5: 1.4 ug/L (6/11/1999) – most recent <0.5 ug/L (8/16/1999) (Entry point sample)
  - Well 7: <0.5 ug/L (8/15/2000) (Source sample)
  - Well 8: no sample results
  - Well 9: no sample results
- Chloroform (HRL 30 ug/L)
  - Well 2: <0.1 ug/L (4/27/2007) (only Source sample)
  - Well 5: 4.1 ug/L (6/11/1999) – most recent <0.1 ug/L (8/16/1999) (Entry point sample)
  - Well 7: <0.1 ug/L (8/15/2000) (only Source sample)
  - Well 8: no sample results
  - Well 9: no sample results

Inorganic Compounds (IOC) were monitored in groundwater samples collected from Wells 2 and 5. The Minnesota Department of Health (MDH) Health Risk Limit (HRL) is listed next to the parameter name.

- Arsenic (no HRL)
    - Well 2: 5.8 ug/L (4/29/1997) – most recent 3.3 ug/L (11/1/2006) (Entry point sample)
    - Well 5: 2.4 ug/L (7/21/1993) – most recent 2 ug/L (8/16/1999) (Entry point sample)
    - Well 7: no sample results
    - Well 8: no sample results
    - Well 9: no sample results
- Barium (HRL 2,000 ug/L)
    - Well 2: 95.6 ug/L (11/1/2006) – most recent and maximum (Entry point sample)
    - Well 5: 57 ug/L (8/1/1995) – only result (Entry point sample)
    - Well 7: no sample results
    - Well 8: no sample results
    - Well 9: no sample results
- Mercury (no HRL)
    - Well 2: 0.02 ug/L (8/1/1995) – most recent <0.01 ug/L (11/1/2006) (Entry point sample)
    - Well 5: 0.01 ug/L (8/1/1995) – only result (Entry point sample)
    - Well 7: no sample results
    - Well 8: no sample results
    - Well 9: no sample results

Radon or Radium-228 was detected in groundwater samples collected from Wells 2 and 5. The Minnesota Department of Health (MDH) Health Risk Limit (HRL) is listed next to the parameter name.

- Radon (no HRL)
    - Well 2: 1990 pCi/L (2/1/2005) – most recent 1400 pCi/L (10/31/2005) (Entry point sample)
    - Well 5: 262 pCi/L (8/16/1999) – only sample (Entry point sample)
    - Well 7: no sample results
    - Well 8: no sample results
    - Well 9: no sample results
- Radium-228 (no HRL)
    - Well 2: 1.3 pCi/L (9/9/2008) – only sample (Entry point sample)
    - Well 5: no sample results
    - Well 7: no sample results
    - Well 8: no sample results
    - Well 9: no sample results

Nitrate + Nitrite Nitrogen, Total was detected in groundwater samples collected from Wells 2 and 5. The Minnesota Department of Health (MDH) Health Risk Limit (HRL) is listed next to the parameter name.

- Nitrate + Nitrite Nitrogen, Total (HRL 10,000 ug/L)
    - Well 2: 0.72 mg/L (5/4/2005) – most recent <0.05 mg/L (4/8/2009) (Entry point sample)
    - Well 5: 0.11 mg/L (9/10/1998) – most recent <0.05 mg/L (4/8/2009) (Entry point sample)
    - Well 7: no sample results
    - Well 8: no sample results
    - Well 9: no sample results

Semivolatile Organic Compounds (SVOCs) were detected in groundwater samples collected from Wells 2 and 5. The Minnesota Department of Health (MDH) Health Risk Limit (HRL) is listed next to the parameter name.

- Dalapon (no HRL)
    - Well 2: 2.24 ug/L (2/25/1993) – most recent <0.5 ug/L (2/22/2007) (Entry point sample)
    - Well 5: 1.57 ug/L (2/25/1993) – most recent <0.5 ug/L (11/18/1999) (Entry point sample)
    - Well 7: no sample results
    - Well 8: no sample results
    - Well 9: no sample results
- Di(2-ethylhexyl) phthalate (HRL 6 ug/L)
    - Well 2: 7.5 ug/L (11/18/1999) – most recent <4 ug/L (2/22/2007) (Entry point sample)
    - Well 5: 20 ug/L (5/19/1993) – most recent <4 ug/L (11/18/1999) (Entry point sample)
    - Well 7: no sample results
    - Well 8: no sample results
    - Well 9: no sample results

Volatile Organic Compounds (VOCs) were detected in groundwater samples collected from Wells 2 and 5. The Minnesota Department of Health (MDH) Health Risk Limit (HRL) is listed next to the parameter name.

- 1,2-Dichloroethane (HRL 4 ug/L)
    - Well 2: 0.3 ug/L (4/27/2007) (Source sample)
        - most recent 0.6 ug/L (9/27/2007) (Entry point sample)
    - Well 5: 0.6 ug/L (8/1/1995) – most recent 0.4 ug/L (8/16/1999) (Entry point sample)
    - Well 7: <0.2 ug/L (only sample 8/15/2000) (Source sample)
    - Well 8: no sample results
    - Well 9: no sample results

APPENDIX III

Aquifer Testing Results

MEMORANDUM

TO: FILE

FROM: DAVE HUME

SUBJECT: AQUIFER PUMPING TEST ANALYSIS

DATE: MAY 2010

RE: CITY OF PRINCETON, MN - PART I WHP PLAN

The following presents the results of the aquifer pumping tests analysis completed by Leggette, Brashears & Graham, Inc. (LBG) for the City of Princeton (City). The objective of the analysis was to better characterize the groundwater system in the vicinity of the City's new well field under pumping conditions and to determine the transmissivity (T) of the aquifer utilized by City Wells No. 8 and 9. Determining T is one of the criteria required by the Minnesota Department of Health (MDH) for delineating the wellhead protection (WHP) area.

Background

The tests were conducted by SEH, Inc. in August 2007as part of the new well field development project that included the installation and testing of Wells No. 8 and 9. The locations of Wells No. 8 and 9, and the observation well network are shown on Figure III-1. The tests were conducted as step-rate tests and summarized in the following table:

Test	Wells Pumped	Dates	Step/Rate (gpm)	Analyzed by LBG
1	No. 9	8/20-21/07	1/250 2/400 3/550	yes
2	No. 8	8/22-24/07	1/400 2/600 3/800 4/650 to 1050	yes
3	No. 8	8/24-27/07	1/650	no
	No. 9		1/710-900	

Test 1 and Test 2 were selected by LBG for analyses since these tests included a single pumping well and several observation wells. Test 3 included both wells pumping and was completed at the end of Tests 1 and 2 to meet the requirements of the Department of Natural Resources, Division of Water. The purpose of Test 3 was to evaluate potential well interference and the cumulative impact on the aquifer as results of pumping both wells at the City's required demand. The DNR memorandum summarizing the testing is in Attachment III-1.

The pumping and observation well network for Test 1 and Test 2 are summarized in the following table, and the well logs are in Attachment III-2

Well	Purpose	Screened Interval (ft)	Total Depth (ft)
No. 8	Pumping / Observation	99-139	143
No. 9	Pumping / Observation	130-160	160
TW-8	Pumping	99-139	143
Stephens	Pumping	91-95	95
Miller Pro	Pumping	84-89	89

Hydrogeology

The conceptual geology in the vicinity of the test area is shown in cross section on Figure III-2. The aquifers that supply groundwater to the City of Princeton wells consist of alluvial and glacial outwash sands and gravels that are separated in places by discontinuous layers of silt, clay and glacial till. These fine-grained layers which are present at various depths and thicknesses in the vicinity of Well Nos. 8 and separate the deeper aquifer where the City wells are screened. These characteristics create leaky confined aquifer conditions, which are shown by the flattening or departure of later drawdown data below the Theis curve.

Results

Aquifer parameters were determined by analyzing the drawdown versus time data using Aqtesolv for Windows Pro (Aqtesolv) (ver. 4.5). Based on the qualitative analysis of the drawdown responses, the conceptual model, and the required assumptions being met, several solutions were applied to each data set. These included:

- Theis (1935) and Cooper-Jacob (1946) solutions for a confined aquifer were applied to the step-rate test data, and the Theis (1935) recovery solution was applied to the recovery data. The drawdown analyses was completed on the portion of the data prior to leakage;
- The Hantush-Jacob (1955) solution was used for a leaky confined aquifer solution; and,
- The Papadopulos and Cooper (1967) method was applied used to represent a fully penetrating, well with wellbore storage in a homogeneous, isotropic confined aquifer.

The results of the quantitative analyses are presented in Attachment III-3 for Test 1 and Attachment III-4 for Test 2. For Test 1(well no. 9 pumping), T values ranged from approximately 2,000 to 6,000 feet squared per day [ft^2/day]) with a geometric mean of 3,626 ft^2/day. Storativity (S) values ranged from 10^{-5} to 10^{-4}. For Test 2, T values ranged from approximately 1,400 to 5,600 ft^2/day with a geometric mean of 2, 545 ft^2/day. Storativity (S) values were 10^{-4}.

References

Cooper, H.H. and C.E. Jacob, 1946. A generalized graphical method for evaluating formation constants and summarizing well field history, Am. Geophys. Union Trans., vol. 27, pp. 526-534.

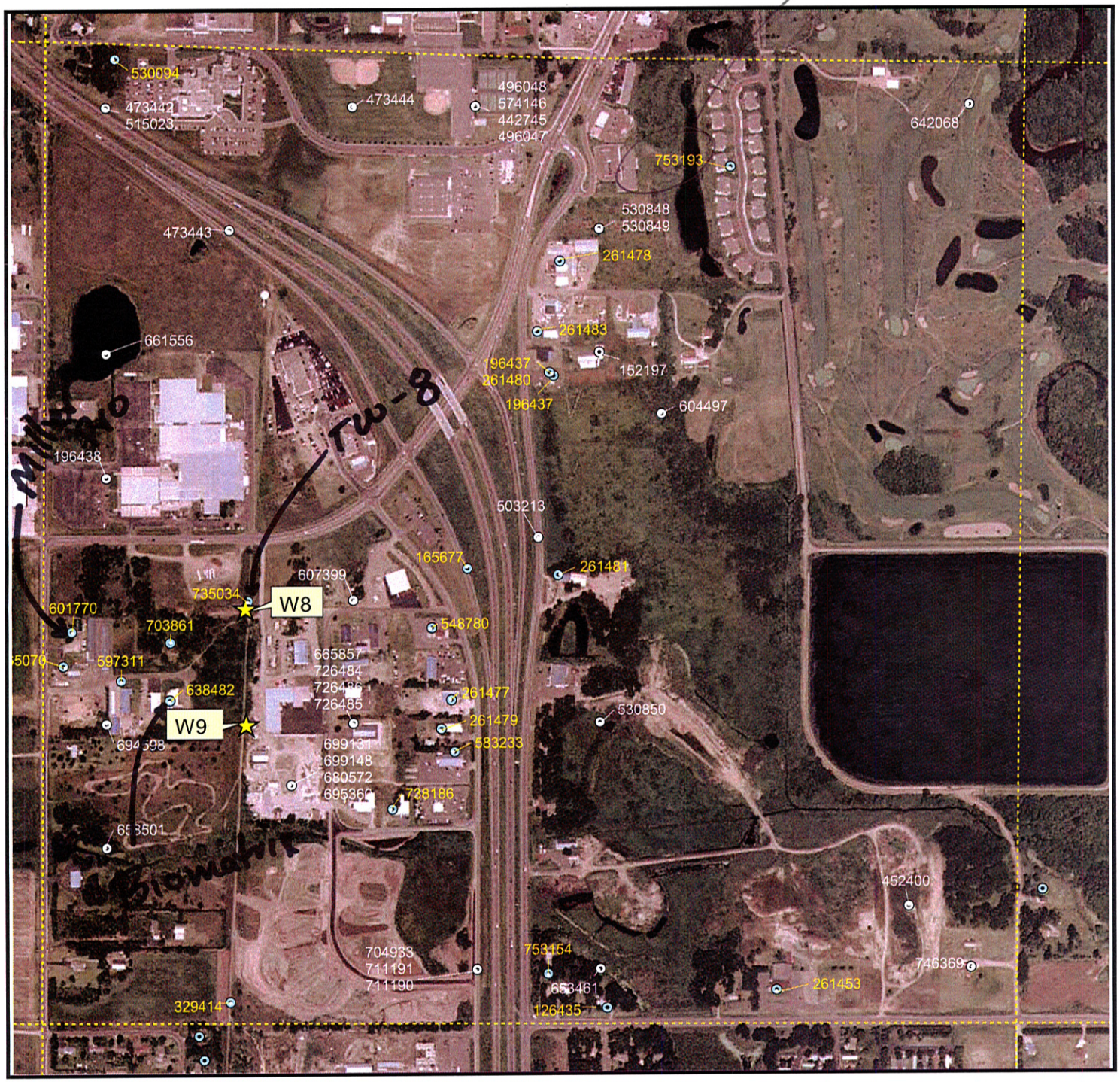
Hantush, M.S. and C.E. Jacob, 1955. Non-steady radial flow in an infinite leaky aquifer, Am. Geophys. Union Trans., vol. 36, pp. 95-100.

Papadopulos, I.S. and H.H. Cooper, 1967. Drawdown in a well of large diameter, Water Resources Research, vol. 3, no. 1, pp. 241-244.

Theis, C.V., 1935. The relation between the lowering of the piezometric surface and the rate and duration of discharge of a well using groundwater storage, Am. Geophys. Union Trans., vol. 16, pp. 519-524.

FIGURES

Fairway Ponds



Field Locating Wells
Section 4 (T35 R26W)
Princeton Wellhead Plan Amendment

Fig. III-1

Locations of Pumping and Observation wells (Aug 2007 Aquifer Pumping Test)

Explanation

- Princeton PUC Wells
- Located Wells
- Unlocated Wells

N

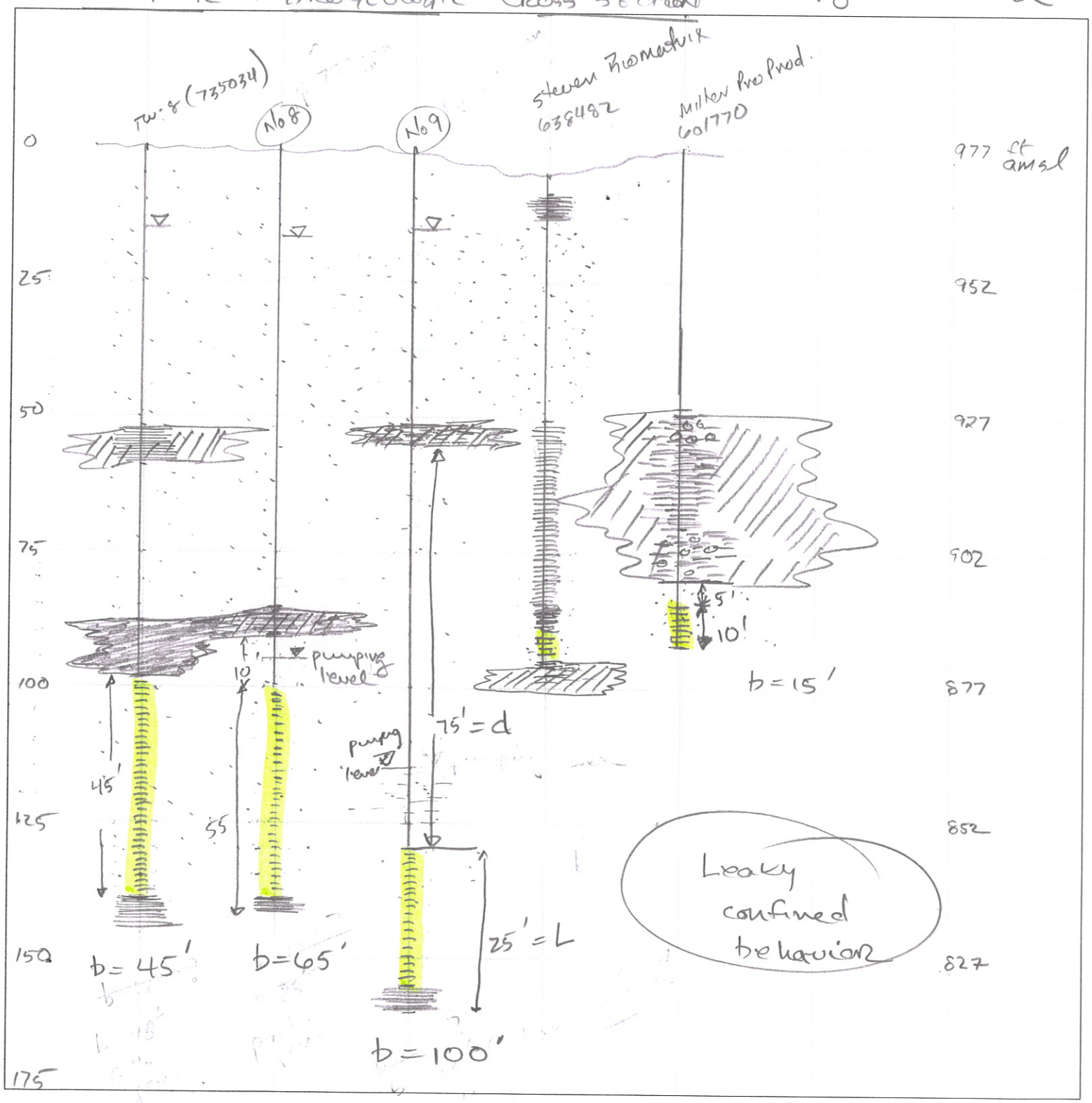
200 0 200 400 600 Feet

MDH September 10, 2008

LEGGETTE, BRASHEARS & GRAHAM, INC.
Professional Ground-Water Consultants

JOB Princeton WHP
SHEET NO. 1 OF 1
CALCULATED BY DBH DATE
CHECKED BY DATE
SCALE

Conceptual Hydrogeologic Cross Section - Figure III-2



ATTACHMENT III-1

DNR WATERS MEMORANDUM

LBG

DEPARTMENT: DNR Waters

STATE OF MINNESOTA

Office Memorandum

DATE: October 24, 2007

TO: Tim Crocker

FROM: Evan Drivas

PHONE: (651) 259-5664

SUBJECT: Princeton Aquifer Test

Introduction

Princeton drilled municipal wells 8 (unique number 751504) and 9 (unique number 749848) were drilled on the south side of the city (T35N, R26W Section 4) to supply a new water treatment plant. An aquifer test was conducted to determine the yield of the wells and evaluate well interference potential.

Discussion

Production wells 8 and 9 were drilled to the base of a bedrock valley that was eroded through Mt. Simon sandstone. Land surface elevation is approximately 977 feet mean sea level. The static water level is approximately 960 ft msl. The aquifer at the well sites is semi-confined by 5 foot clay lenses. The production wells were drilled to the base of the aquifer, with screened intervals between elevations 878 to 838 ft msl and 847 to 817 ft msl. The aquifer is confined at the majority of other wells in the area.

leaky aquifer

Production wells 8 and 9, test well TW-8, Stephens Biomatrix's well, Knife River concrete plant well, Miller Pro Product's well, and Northwoods Animal Hospital's well were monitored with transducers for the test (see attachment for well locations). A step drawdown test was started with production well 8 on August 22 at 8 a.m. A constant rate test with wells 8 and 9 pumped at 730 gallons per minute per well started August 24 at 2 p.m. The well 9 pumping rate was increased to 930 gallons per minute on August 25 at noon. The two well test continued at a combined pumping rate of 1660 gallons per minute until August 27 at 11 a.m.

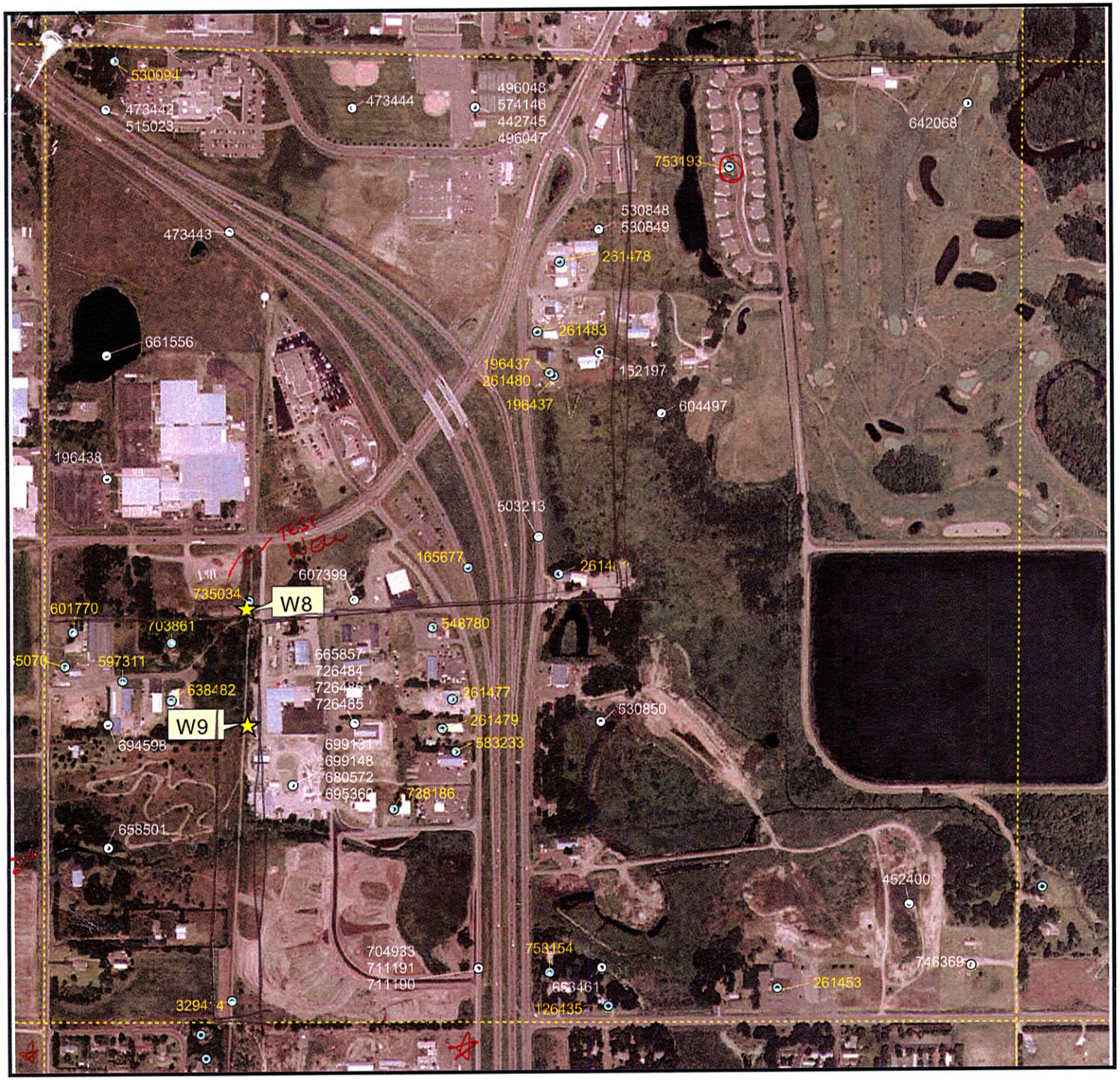
Water level drawdown stabilized at approximately 90 feet below land surface in production well 8, which is 8 feet above the top of the screen. Water level drawdown stabilized at approximately 115 feet in production well 9, which is 15 feet above the top of the screen. Production well and test well data plots are attached. Water level drawdown was 34 feet at 35 feet, 15 feet at 500 feet, 7.5 feet at 1000 feet, and negligible at 1500 feet. The water level in the Knife River concrete plant well was not affected during the test.

The yield of the source aquifer appears to be adequate for a combined pumping rate of approximately 1400 gallons per minute from Princeton wells 8 and 9. I could find not find any neighboring wells that require pump lowering before the new wells go on-line.

I recommend a permit requirement for monthly measurement of test well 8 (unique number 735034). Knife River concrete probably needs an appropriation permit, and numerous commercial wells in the area could need a permit.

Please contact me with any questions.

C: Dale Homuth Jeanette Leete Laurel Reeves



Field Locating Wells
Section 4 (T35 R26W)
Princeton Wellhead Plan Amendment

Explanation

- Princeton PUC Wells
- Located Wells
- Unlocated Wells

N

200 0 200 400 600 Feet

MDH September 10, 2008

ATTACHMENT III-2

PUMPING WELL AND OBSERVATION WELL LOGS

No. 8

Minnesota Unique Well No.
751504

County Sherburne
Quad Princeton
Quad ID 154D

MINNESOTA DEPARTMENT OF HEALTH
WELL AND BORING RECORD
Minnesota Statutes Chapter 103I

Entry Date 06/18/2007
Update Date 03/09/2009
Received Date 09/06/2007

Well Name PRINCETON 8
Township Range Dir Section Subsections Elevation 977 ft.
35 26 W 4 CBADBA **Elevation Method** 7.5 minute topographic map (+/- 5 feet)

Well Depth	Depth Completed	Date Well Completed
139 ft.	139 ft.	06/00/2007

Drilling Method Dual Rotary

Well Address
PRINCETON MN 55371

Drilling Fluid Water
Well Hydrofractured? ☐ Yes ☑ No From Ft. to Ft.
Use Community Supply **PWS ID** **Source**

Geological Material	Color	Hardness	From	To
SAND	BROWN	SOFT	0	30
MEDIUM SAND, GRAVEL	BROWN	SOFT	30	35
COARSE SAND/GRAVEL	BROWN	SOFT	35	45
SAND	GRAY	SOFT	45	52
SAND/GRAVEL/CLAY	GRAY	MEDIUM	52	60
SAND	DK. BRN	SOFT	60	70
SILTY,SAND	DK. BRN	SOFT	70	85
SILT; CLAY, ROCK	DK. BRN	MEDIUM	85	90
MEDIUM SAND & GRAVEL	GRAY	SOFT	90	100
MEDIUM SAND	GRAY	SOFT	100	105
COARSE SAND, GRAVEL, ROCK	GRAY	MEDIUM	105	115
MEDIUM SAND	GRAY	SOFT	115	125
MEDIUM TO COARSE SAND & GRAVEL	GRAY	SOFT	125	135
COARSE SAND & GRAVEL	GRAY	SOFT	135	139
CLAY	BROWN	MED-HRD	139	139

Casing Type Steel (black or low carbon) **Joint** Welded **Drive Shoe?** ☑
Yes ☐ No **Above/Below** ft.

Casing Diameter	Weight	Hole Diameter
18 in. to 104 ft.	70.59 lbs./ft.	18 in. to 98.6 ft.
		11 in. to 139 ft.

Open Hole from ft. to ft.

Screen YES **Make** JOHNSON **Type** stainless steel

Diameter	Slot/Gauze	Length	Set Between
12	10	40.5	98.6 ft. and 139 ft.

Static Water Level
17.5 ft. from Land surface Date Measured 06/09/2007

PUMPING LEVEL (below land surface)
90.6 ft. after 24 hrs. pumping 740 g.p.m.

Well Head Completion
Pitless adapter manufacturer Model
☐ Casing Protection ☑ 12 in. above grade
☐ At-grade (Environmental Wells and Borings ONLY)

REMARKS
M.G.S. NO. 4700.

Located by: Minnesota Department of Health **Method:** GPS SA Off (averaged)
Unique Number Verification: N/A **Input Date:** 05/25/2007
System: *UTM - Nad83, Zone15, Meters* X: 453998 Y: 5044307

Grouting Information Well Grouted? ☐ Yes ☑ No

Nearest Known Source of Contamination
350 feet E direction Septic tank/drain field type
Well disinfected upon completion? ☑ Yes ☐ No

Pump ☐ Not Installed Date Installed
Manufacturer's name Model number HP Volts
Length of drop Pipe ft. Capacity g.p.m Type Material

Abandoned Wells Does property have any not in use and not sealed well(s)? ☑
Yes ☐ No

Variance Was a variance granted from the MDH for this well? ☐ Yes ☑ No

Borehole Geophysics Yes
First Bedrock
Last Strat Clay-brown
Aquifer Quat. Buried Artes. Aquifer
Depth to Bedrock ft.

Well Contractor Certification

License Business Name	Lic. Or Reg. No.	Name of Driller
Mark J Traut Wells, Inc.	1404	FEIA, E.

County Well Index Online Report **751504** Printed 5/27/2009
HE-01205-07

No. 9

MINNESOTA DEPARTMENT OF HEALTH

WELL AND BORING RECORD

Minnesota Statutes Chapter 103I

Minnesota Unique Well No. **749848**

County Sherburne
Quad Princeton
Quad ID 154D

Entry Date 07/23/2007
Update Date 12/05/2008
Received Date 09/06/2007

Well Name PRINCETON 9

Township Range Dir Section Subsections Elevation 977 ft. 7.5 minute topographic map (+/- 5 feet)

35 26 W 4 CBDDBB **Elevation Method**

Well Depth	Depth Completed	Date Well Completed
160 ft.	160 ft.	08/01/2007

Drilling Method Dual Rotary

Well Address

PRINCETON MN 55371

Drilling Fluid Water

Well Hydrofractured? ☐ Yes ☑ No From Ft. to Ft.

Use Community Supply **PWS ID** **Source**

Geological Material	Color	Hardness	From	To
FINE SILTY SAND	BROWN	SOFT	0	10
FINE SAND	BROWN	SOFT	10	15
FINE SAND, FEW STONES	BROWN	SOFT	15	28
GRAVEL, SAND, FEW ROCKS	BROWN	SOFT	28	35
FINE TO MED. SAND	BROWN	SOFT	35	50
SAND, CLAY LENSES	GRAY	SOFT	50	55
SILTY FINE SAND	BROWN	SOFT	55	116
CLAY	BROWN	MEDIUM	116	117
FINE SILTY SAND	BROWN	SOFT	117	125
FINE SAND	BROWN	SOFT	125	135
FINE SAND, ROCK LAYERS	BROWN	SOFT	135	145
FINE TO MED SAND, GRAVEL, ROCK LAY	BROWN	SOFT	145	150
FINE TO MED SAND, GRAVEL ROCK/CLAY	BROWN	SOFT	150	152
FINE SAND, CLAY, ROCK/GRAVEL LAYER	BROWN	SOFT	152	155
CLAY	BROWN	MEDIUM	155	160

Casing Type Steel (black or low carbon) **Joint** Welded **Drive Shoe?** ☑ Yes ☐ No **Above/Below** ft.

Casing Diameter	Weight	Hole Diameter
18 in. to 135 ft.	70.59 lbs./ft.	18 in. to 135 ft.
		17.25 in. to 160 ft.

Open Hole from ft. to ft.

Screen YES **Make** JOHNSON **Type** stainless steel

Diameter	Slot/Gauze	Length	Set Between
12	10	5	130 ft. and 135 ft.
12	30	25	135 ft. and 160 ft.

Static Water Level
15 ft. from Land surface Date Measured 08/01/2007

PUMPING LEVEL (below land surface)
ft. after hrs. pumping g.p.m.

Well Head Completion
Pitless adapter manufacturer Model
☐ Casing Protection ☑ 12 in. above grade
☐ At-grade (Environmental Wells and Borings ONLY)

REMARKS
DRILLERS: ED & BUTCH G.

Located by: Minnesota Department of Health **Method:** GPS SA Off (averaged)
Unique Number Verification: N/A **Input Date:** 05/29/2007
System: *UTM - Nad83, Zone15, Meters* X: 453998 Y: 5044116

Grouting Information Well Grouted? ☐ Yes ☑ No

Nearest Known Source of Contamination
400 feet North East direction Septic tank/drain field type
Well disinfected upon completion? ☐ Yes ☐ No

Pump ☐ Not Installed Date Installed
Manufacturer's name Model number HP Volts
Length of drop Pipe ft. Capacity g.p.m Type Material

Abandoned Wells Does property have any not in use and not sealed well(s)? ☑ Yes ☐ No

Variance Was a variance granted from the MDH for this well? ☐ Yes ☑ No

Well Contractor Certification

Mark J Traut Wells, Inc.	1404	SEE REMARKS
License Business Name	Lic. Or Reg. No.	Name of Driller

First Bedrock
Last Strat Clay-brown
Aquifer Quat. Water Table Aquifer
Depth to Bedrock ft.

County Well Index Online Report **749848** Printed 5/27/2009
HE-01205-07

TW-8

Minnesota Unique Well No. **735034**

County Sherburne
Quad Princeton
Quad ID 154D

MINNESOTA DEPARTMENT OF HEALTH
WELL AND BORING RECORD
Minnesota Statutes Chapter 103I

Entry Date
Update Date 09/21/2007
Received Date 11/29/2005

Well Name PRINCETON TW 8
Township Range Dir Section Subsections Elevation 977 ft.
35 26 W 4 CBADBA **Elevation Method** 7.5 minute topographic map (+/- 5 feet)

Well Depth	Depth Completed	Date Well Completed
143 ft.	139 ft.	11/09/2005

Drilling Method Non-specified Rotary

Well Address
RUM RIVER DR
PRINCETON MN 55371

Geological Material	Color	Hardness	From	To
SAND	BROWN	SOFT	0	35
SAND & GRAVEL	BROWN	SOFT	35	52
CLAY	GRAY	MEDIUM	52	58
SAND	BROWN	SOFT	58	80
CLAY & ROCKS	BROWN	MEDIUM	80	99
SAND & GRAVEL	BROWN	SOFT	99	139
CLAY	BROWN	MEDIUM	139	143
CLAY (RED/WHT/BLK)	VARIED	HARD	143	143

static estimate 15'

aq thick 124

139-15

Drilling Fluid Bentonite
Well Hydrofractured? ☐ Yes ☑ No
From Ft. to Ft.

Use Test well

Casing Type Steel (black or low carbon) **Joint** No Information **Drive Shoe?** ☐ Yes ☑ No **Above/Below** ft.

Casing Diameter	Weight	Hole Diameter
6 in. to 99 ft.	18.97 lbs./ft.	10 in. to 143 ft.

r = .417

Open Hole from ft. to ft.

Screen YES **Make** JOHNSON **Type** stainless steel

Diameter	Slot/Gauze	Length	Set Between
6	30	40	99 ft. and 139 ft.

15-99 40 screen

Static Water Level
ft. from Date Measured

PUMPING LEVEL (below land surface)
139 ft. after 8 hrs. pumping 300 g.p.m.

Well Head Completion
Pitless adapter manufacturer Model
☐ Casing Protection ☑ 12 in. above grade
☐ At-grade (Environmental Wells and Borings ONLY)

REMARKS
DRILLERS: ROBBIE TERRES, PHIL RATKE & ROY NIES.

Located by: Minnesota Department of Health **Method:** GPS SA Off (averaged)
Unique Number Verification: N/A **Input Date:** 04/13/2007
System: *UTM - Nad83, Zone15, Meters* **X:** 454001 **Y:** 5044318

Grouting Information Well Grouted? ☑ Yes ☐ No

Grout Material: High solids bentonite from to 60 ft. 19 bags

Nearest Known Source of Contamination
_feet _direction _type
Well disinfected upon completion? ☑ Yes ☐ No

Pump ☐ Not Installed Date Installed
Manufacturer's name Model number __ HP _ Volts
Length of drop Pipe _ft. Capacity _g.p.m Type Material

Abandoned Wells Does property have any not in use and not sealed well(s)? ☐ Yes ☑ No

Variance Was a variance granted from the MDH for this well? ☐ Yes ☑ No

First Bedrock
Last Strat Clay
Aquifer Quat. Buried Artes. Aquifer
Depth to Bedrock ft.

Well Contractor Certification

Traut, Mark J. Wells	73646	ROB/PHIL/ROY
License Business Name	Lic. Or Reg. No.	Name of Driller

County Well Index Online Report **735034** Printed 5/27/2009 HE-01205-07

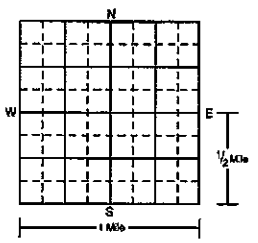
Stephens Bromatrix

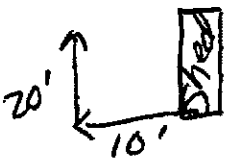
MINNESOTA DEPARTMENT OF HEALTH
WELL AND BORING RECORD
Minnesota Statutes Chapter 1031

MINNESOTA UNIQUE WELL NO. **638482**

WELL LOCATION
County Name: Sherburne
Township Name: Baldwin | Township No.: 35 | Range No.: 26 | Section No.: 4 | Fraction: NW¼
House Number, Street Name, City, and Zip Code of Well Location: 12643 - 320th Ave NW, Princeton
or Fire Number:

Show exact location of well in section grid with "X". Sketch map of well location. Showing property lines, roads and buildings.





PROPERTY OWNER'S NAME: Aaron Stevens Inc.
Property owner's mailing address if different than well location address indicated above.
6297 Aspen Rd
Princeton MN 55371

WELL OWNER'S NAME: same as above
Well owner's mailing address if different than property owner's address indicated above.
same as above

Static test
91-19=
ag thick on pump well

GEOLOGICAL MATERIALS	COLOR	HARDNESS OF MATERIAL	FROM	TO
fine Sand	Brn		0	8
Clay	Brn		8	12
fine Sand	Brn		12	51
Clay	Brn		51	88
Sand	Brn		88	95
Clay	Brn		95	97

Use a second sheet, if needed

REMARKS, ELEVATION, SOURCE OF DATA, etc.

JAN 2000 RECEIVED WELL MGT.

MINN. DEPT. OF HEALTH COPY 638482

WELL DEPTH (completed): 95 ft. | Date Work Completed: 11/22/99

DRILLING METHOD: ☐ Cable Tool ☐ Driven ☐ Dug ☐ Auger ☒ Rotary ☐ Jetted ☐ _____

DRILLING FLUID: Bentonite | WELL HYDROFRACTURED? ☐ YES ☒ NO FROM _____ ft. to _____ ft.

USE: ☒ Domestic ☐ Irrigation ☐ Environ. Bore Hole ☐ Monitoring ☐ Community PWS ☐ Noncommunity PWS ☐ Dewatering ☐ Heating/Cooling ☐ Industry/Commercial ☐ Remedial ☐ _____

CASING: ☐ Steel ☒ Plastic | Drive Shoe? ☐ Yes ☒ No | ☐ Threaded ☐ Welded ☐ _____

HOLE DIAM.

CASING DIAMETER		WEIGHT		HOLE DIAM.	
4 in. to 91 ft.		_____ lbs./ft.		7 7/8 in. to 95 ft.	
_____ in. to _____ ft.		_____ lbs./ft.		_____ in. to _____ ft.	
_____ in. to _____ ft.		_____ lbs./ft.		_____ in. to _____ ft.	

SCREEN: Make Johnson | Type SS | Diam. 4" Tel | Slot/Gauze 15 | Length 4' | Set between 91 ft. and 95 ft. FITTINGS: _____
OPEN HOLE: from _____ ft. to _____ ft.

STATIC WATER LEVEL: 19 ft. ☒ below ☐ above land surface Date measured 11/22/99

PUMPING LEVEL (below land surface): 95 ft. after 1 hrs. pumping 45 g.p.m.

WELL HEAD COMPLETION: ☒ Pitless adapter manufacturer Maas Model 4J1 | ☐ Casing Protection _____ ☒ 12 in. above grade | ☐ At-grade (Environmental Wells and Borings ONLY)

GROUTING INFORMATION: Well grouted? ☒ Yes ☐ No
Grout Material ☐ Neat cement ☐ Bentonite ☐ Concrete ☒ High Solids Bentonite
from 0 to 40 ft. 6 ☐ yds. ☒ bags
from 40 to 81 ft. cuttings ☐ yds. ☐ bags
from _____ to _____ ft. _____ ☐ yds. ☐ bags

NEAREST KNOWN SOURCE OF CONTAMINATION: 55 feet N direction septic type
Well disinfected upon completion? ☒ Yes ☐ No

PUMP: ☐ Not installed Date installed 12-1-99
Manufacturer's name Aermotor
Model number A12B50 HP ½ Volts 230
Length of drop pipe 60' 1" PVC ft. Capacity 12 g.p.m.
Type: ☒ Submersible ☐ L.S. Turbine ☐ Reciprocating ☐ Jet ☐ 42T

ABANDONED WELLS: Does property have any not in use and not sealed well(s)? ☐ Yes ☒ No

VARIANCE: Was a variance granted from the MDH for this well? ☐ Yes ☒ No TN# _____

WELL CONTRACTOR CERTIFICATION
This well was drilled under my supervision and in accordance with Minnesota Rules, Chapter 4725. The information contained in this report is true to the best of my knowledge.

Mark J. Traut Wells, Inc. 71536
Licensee Business Name *Lic. or Reg. No.*
Mark J. Traut 12/8/99
Authorized Representative Signature *Date*
Perry & Kris
Name of Driller *Date*

HE-01205-07 (Rev. 2/99)

Qty 95'-2"

Unique No. 00638482

County Name Sherburne

MINNESOTA DEPARTMENT OF HEALTH

WELL AND BORING RECORD

Minnesota Statutes Chapter 1031

Update Date 2005/03/11

Entry Date 2000/06/13

Township Name	Township	Range	Dir	Section	Subsection
	35	26	W	4	B

Well Depth	Depth Completed	Date Well Completed
97 ft.	95 ft.	1999/11/22

Well Name AARON STEVENS INC.

Drilling Method Non-specified Rotary

Well Owner's Name AARON STEVENS INC.
12643 320TH NW AV
PRINCETON MN

Drilling Fluid: Bentonite

Well Hydrofractured? ☐ Yes ☑ No
From ft. to ft.

Contact's Name AARON STEVENS INC.
6297 ASPEN RD
PRINCETON MN 55371

Use Domestic

Casing — Drive Shoe? ☐ Yes ☑ N

Hole Diameter: in. to 95 ft

Casing Diameter: 4 in. to 91 ft — Weight(lbs/ft)

GEOLOGICAL MATERIAL	COLOR	HARDNESS	FROM	TO
FINE SAND	BROW		0	8
CLAY	BROW		8	12
FINE SAND	BROW		12	51
CLAY	BROW		51	88
SAND	BROW		88	95
CLAY	BROW		95	97

Screen Y — Open Hole From ft. to ft.

Make JOHNSON Type L

Diameter	Slot	Length	Set	Fitting
4	15	4	91 ft. to 95 ft	

Static Water Level 19 ft. from Land surface Date 1999/11/22

PUMPING LEVEL (below land surface)
95 ft. after 1 hrs. pumping 45 g.p.m.

Well Head Completion
Pitless adapter mfr MAASS Model 4J1
Casing Protection ☑ 12 in. above grade
☐ At-grade(Environmental Wells and Borings ONLY)

Grouting Information Well grouted? ☑ Yes ☐ No

Material	From	To (ft.)	Amount(yds/bags)	
B	0	40	6	S
C	40	81		

Nearest Known Source of Contamination
55 ft. direction N type SDF
Well disinfected upon completion? ☑ Yes ☐ No

Pump ☐ Not Installed Date Installed
Mfr name AERMOTOR
Model A12B50 HP 0.5 Volts 230
Drop Pipe Length 60 ft. Capacity 12 g.p.m
Type S

Any not in use and not sealed well(s) on property? ☐ Yes ☑ No

Was a variance granted from the MDH for this Well? ☐ Yes ☑ No

USGS Quad: Princeton Elevation 980
Aquifer: Alt Id:

Well CONTRACTOR CERTIFICATION Lic. Or Reg. No. 71536
License Business Name
Name of Driller

Report Copy

HE-01205-06 (Rev. 9/96)

Miller Pro Products

10/30/97

MINNESOTA DEPARTMENT OF HEALTH
WELL AND BORING RECORD
Minnesota Statutes Chapter 1031

MINNESOTA UNIQUE WELL NO. 601770

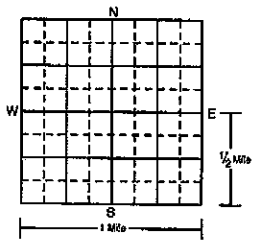
WELL LOCATION

County Name: Sherburne

Township Name	Township No.	Range No.	Section No.	Fraction
Baldwin	35N	26W	4	NW ¼ NW ¼ SW ¼

House Number, Street Name, City, and Zip Code of Well Location or Fire Number: 32015 128th Street Princeton, MN

Show exact location of well in section grid with "X". Sketch map of well location. Showing property lines, roads and buildings.



PROPERTY OWNER'S NAME: A M Painting

Property owner's mailing address if different than well location address indicated above.

P.O. Box 176
Princton, MN 55371

WELL OWNER'S NAME:

Well owner's mailing address if different than property owner's address indicated above.

GEOLOGICAL MATERIALS	COLOR	HARDNESS OF MATERIAL	FROM	TO
Sand	Brown	Soft	0	48
Clay & Gravel	Grey	Soft	48	57
Clay	Brown	Med	57	71
Rocks	Grey	Hard	71	74
Clay & Rocks	Grey	Med	74	82
Gravel	Brown	Soft	82	89

Use a second sheet if needed

REMARKS, ELEVATION, SOURCE OF DATA, etc.

OCT 1997 RECEIVED WELL MGT.

MINN. DEPT. OF HEALTH COPY 601770

WELL DEPTH (completed): 89' ft. Date Work Completed: 9/30/97

DRILLING METHOD: ☐ Cable Tool ☐ Driven ☐ Dug ☐ Auger ☒ Rotary ☐ Jetted ☐ _____

DRILLING FLUID: Bentonite

WELL HYDROFRACTURED? ☐ YES ☒ NO FROM _____ ft. to _____ ft.

USE: ☒ Domestic ☐ Irrigation ☐ Test Well ☐ Monitoring ☐ Community PWS ☐ Noncommunity PWS ☐ Dewatering ☐ Heating/Cooling ☐ Industry/Commercial ☐ Remedial ☐ _____

CASING: ☐ Steel ☒ Plastic Drive Shoe? ☐ Yes ☒ No ☐ Threaded ☐ Welded ☐ _____

HOLE DIAM.

CASING DIAMETER		WEIGHT		HOLE DIAM.	
4 in. to 84 ft.		1.9 lbs./ft.		6¼ in. to 89 ft.	
_____ in. to _____ ft.		_____ lbs./ft.		_____ in. to _____ ft.	
_____ in. to _____ ft.		_____ lbs./ft.		_____ in. to _____ ft.	

SCREEN: Make Johnson Type Stainless Steel Diam. 2" Slot/Gauze 12 Length 5' Set between 84 ft. and 89 ft. FITTINGS: BP SEAL

OPEN HOLE from _____ ft. to _____ ft.

STATIC WATER LEVEL: 15 ft. ☒ below ☐ above land surface Date measured 9/30/97

PUMPING LEVEL (below land surface): 84 ft. after 2 hrs. pumping 50 g.p.m.

WELL HEAD COMPLETION: ☒ Pitless adapter manufacturer Monitor Model 1"Bulldog ☐ Casing Protection _____ ☒ 12 in. above grade ☐ At-grade (Environmental Wells and Borings ONLY)

GROUTING INFORMATION: Well grouted? ☒ Yes ☐ No

Grout Material ☐ Neat cement ☐ Bentonite ☐ Concrete ☒ High Solids Bentonite

cuttings from 0 to 30 ft. .17 ☒ yds. ☐ bags
from 30 to 84 ft. _____ ☐ yds. ☐ bags
from _____ to _____ ft. _____ ☐ yds. ☐ bags

NEAREST KNOWN SOURCE OF CONTAMINATION: 25 feet NE direction Tested Line type

Well disinfected upon completion? ☒ Yes ☐ No

PUMP: ☐ Not Installed Date installed 10/8/97

Manufacturer's name: Aermotor

Model number T12-50 HP 1/2 Volts 230

Length of drop pipe 40'1"PVC ft. Capacity 10 g.p.m.

Type: ☒ Submersible ☐ L.S. Turbine ☐ Reciprocating ☐ Jet ☐ _____

ABANDONED WELLS: Does property have any not in use and not sealed well(s)? ☐ Yes ☒ No

VARIANCE: Was a variance granted from the MDH for this well? ☐ Yes ☒ No

WELL CONTRACTOR CERTIFICATION

This well was drilled under my supervision and in accordance with Minnesota Rules, Chapter 4725. The information contained in this report is true to the best of my knowledge.

McAlpine Bros., Inc. 27270
Licensee Business Name *Lic. or Reg. No.*

Authorized Representative Signature 10/8/97 *Date*

Gregg Goodin 9/30/97
Name of Driller *Date*

HE-01205-06 (Rev. 9/96)

Unique No. 00601770

County Name Sherburne

MINNESOTA DEPARTMENT OF HEALTH

WELL AND BORING RECORD

Minnesota Statutes Chapter 1031

Update Date 2005/01/06

Entry Date 1998/07/06

Township Name	Township	Range	Dir	Section	Subsection
	35	26	W	4	CBB

Well Depth 89 ft. | Depth Completed 89 ft. | Date Well Completed 1997/09/30

Well Name A M PAINTING

Drilling Method Non-specified Rotary

Well Owner's Name AM PAINTING
32015 128TH ST
PRINCETON MN 55371

Contact's Name
P.O.BOX 176
PRINCETON MN 55371

Drilling Fluid: Bentonite

Well Hydrofractured? ☐ Yes ☑ No
From ft. to ft.

Use Domestic

Casing — Drive Shoe? ☐ Yes ☑ N

Hole Diameter: in. to 89 ft

Casing Diameter: 4 in. to 84 ft — Weight(lbs/ft): 1.9

GEOLOGICAL MATERIAL	COLOR	HARDNESS	FROM	TO
SAND	BROW	SOFT	0	49
CLAY & GRAVEL	GRAY	SOFT	49	57
CLAY	BROW	MEDIUM	57	71
ROCKS	GRAY	HARD	71	74
CLAY & ROCKS	GRAY	MEDIUM	74	82
GRAVEL	BROW	SOFT	82	89

P.o Products

Screen Y — Open Hole From ft. to ft.

Make JOHNSON — Type L

Diameter	Slot	Length	Set	Fitting
2	12	5	84 ft. to 89 ft	

Static Water Level 15 ft. from Land surface — Date 1997/09/30

PUMPING LEVEL (below land surface)
84 ft. after 2 hrs. pumping 50 g.p.m.

Well Head Completion
Pitless adapter mfr MONITOR — Model BULLDOG
Casing Protection ☑ 12 in. above grade
☐ At-grade(Environmental Wells and Borings ONLY)

Grouting Information — Well grouted? ☑ Yes ☐ No

Material	From	To (ft.)	Amount(yds/bags)	
H	0	30	0.17	Y
C	30	84		

Nearest Known Source of Contamination
25 ft. direction NE type SDF
Well disinfected upon completion? ☑ Yes ☐ No

Pump ☐ Not Installed — Date Installed
Mfr name AERMOTOR
Model T12-50 — HP 0.5 — Volts 230
Drop Pipe Length 40 ft. — Capacity 10 g.p.m
Type S

Any not in use and not sealed well(s) on property? ☐ Yes ☑ No

Was a variance granted from the MDH for this Well? ☐ Yes ☑ No

USGS Quad: Princeton — Elevation 976
Aquifer: — Alt Id:

Well CONTRACTOR CERTIFICATION Lic. Or Reg. No. 27270
License Business Name
Name of Driller GOODIN, G.

Report Copy

HE-01205-06 (Rev. 9/96)

ATTACHMENT III-3

TEST 1 (WELL NO. 9)
STEP-RATE TEST DATA
QUALITATIVE ANALYSIS

JOB Riverdale pad
SHEET NO. ___ OF ___
CALCULATED BY DJH DATE 2/21/10
CHECKED BY ___ DATE ___
SCALE ___

LEGGETTE, BRASHEARS & GRAHAM, INC.
Professional Ground-Water Consultants

#9 Test Pumping Test (Test 1)

ob well	Distance to Pumping well (ft)	T (gal/day)	S	method
#9 pumping well	0.5	3475	–	Theis (confined)
		3218	–	Theis – (Recovery)
		2195	–	Hantush-Jacob (Leaky)
#8	627	2315	1.5×10^{-4}	Theis (confined)
		4129	–	Theis (recovery)
		1952	1.2×10^{-4}	Hantush-Jacob (Leaky)
TW-8	665	2045	1.4×10^{-4}	Theis (confined)
		2162	1.2×10^{-4}	Hantush-Jacob (Leaky)
stephens	432	2108	2.0×10^{-4}	Theis (confined)
		3220	–	Theis (recovery)
		1467	1.8×10^{-4}	Hantush-Jacob (Leaky)
Miller Pro	1067	2153	1.8×10^{-4}	Theis (confined)
		5603	–	Theis (recovery)
		1968	1.6×10^{-4}	Hantush-Jacob (Leaky)

start: 8/20/2007 7:45 P.M.
End: 8/21/2007 8:35 A.M.

rates:	250 gpm	8/20	7:45 p.m.	to 8/21	12:25 a.m.
	400 gpm	8/21	12:26 a.m.	to 8/21	4:26 a.m.
	550 gpm	8/21	4:27 a.m.	to 8/21	8:30 a.m.

2545 = GEOMEAN

b = 100'

Test 1
#9 Pumping

PROJECT: PRINCETON
Test By: DON S. & BRIAN T.

Well #: 9 - Step
Uniq # 749848
Date: 8/20/2007
Job #: 307935
Meter Reading Beginning: 89471600
Meter Reading Ending: 89852000

Well Information:

Length of Casing		Hp of Pump	
Length of Screen		Model of Pump	
Total Well Depth		Specific Capacity	
Static Water Level	16.84	Take Readings From Top of Casing 2' above grade	
Well Capacity		GPM @	PWL	G.P.F.D.D.

*Notes:

per transducer data Test Start = 7:42

Date	Time	AM	PM	GPM	PWL	Sand/Gal	Comments
1/2/2001	12:34	X	X	123	12'3"	4" c/g	This is a sample
8/20/2007	7:45		X	250			
	7:48		X		38.6	T	
	7:55		X		43.4	T	
	8:00		X	207	44.95	T	
	8:10		X	250			Turned Up
	8:15		X		47.55	T	
	8:30		X		48.35	T	
	8:45		X		48.75	T	
	9:00		X		49.1	T	
	9:30		X		49.0	T	
	9:45		X		48.85	T	
8/21/07	12:25	X			48.75	T	
?	12:26	X		400	62.52	T	
	12:36	X			63.74	T	
	12:39	X			64.04	T	
	12:43	X			64.64	T	
	12:53	X			65.25	T	
	1:15	X			65.69	T	
	4:22	X			66.3	T	

transducer data 1 hr off.

Use this test. No. 8 was before pumping.

The data stated above is representative of the time spent pumping at the capacities stated. Deviation from either time spent pumping or both could change the outcome if these results.

NOTE: On RECOVERY need: 5-1 minute checks
5-5 minute checks
2-30 minute checks
1-per hour as needed

PROJECT: PRINCETON
Test By: DON S. & BRIAN T.

Well #: 9 - Step Uniq #
Date: Job #:
Meter Reading Beginning:
Meter Reading Ending:

Well Information:

Length of Casing		Hp of Pump	
Length of Screen		Model of Pump	
Total Well Depth		Specific Capacity	
Static Water Level		Take Readings From Top of Casing 2' above grade	
Well Capacity	GPM @	PWL	G.P.F.D.D.

*Notes:

0 Page 2 of 3

Date	Time	AM	PM	GPM	PWL	Sand/Gal	Comments
1/2/2001	12:34	X	X	123	12'3"	4" c/g	This is a sample
8/20/2007	4:27	X		550	76.95	T	
21?	4:29	X		550	78.77	T	
	4:31	X		550	79.25	T	
	4:32	X		550	79.48	T	
	4:34	X		550	79.7	T	
	4:55	X		550	80.5	T	
	5:20	X		550	80.75	T	
	7:45	X		550	81.15	T	
	8:10	X		550	81.1	T	
	8:30	X				SHUT DOWN	
	8:33	X			32.9	RECOVERY	
	8:35	X			28.62		
	10:25				17.8		
	12:00				17.1		

The data stated above is representative of the time spent pumping at the capacities stated. Deviation from either time spent pumping or both could change the outcome if these results.

NOTE: On RECOVERY need: 5-1 minute checks
5-5 minute checks
2-30 minute checks
1-per hour as needed

PROJECT:	PRINCETON	Well #	9	Uniq #	749829
Test By:	DON S. & BRIAN T.	Date:	8/23/2007	Job #:	307891
		Meter Reading Beginning:		-	
		Meter Reading Ending:		-	

Well Information:

Length of Casing	135		Hp of Pump	75	
Length of Screen	30		Model of Pump	8T-75-750	
Total Well Depth	160		Specific Capacity	-	
Static Water Level	16.84		Take Readings From Top of Casing 2' above		
Well Capacity	932	GPM @	115.52	PWL	9.44

*Notes:

Date	Time	AM	PM	GPM	PWL	Sand/Gal	
1/2/2001	12:34	X	X	123	12'3"	4" c/g	
8/23/2007	7:11	X			25		
	8:15	X			25		
	9:15	X	Pulled transducer - Replace Pump				
	11:15	X		Reinstall transducer			
8/24/2007	2:25	X			23.50		
	2:30	X		Start Up of well #9			
			Well 8 still running				
	2:30	X					89852000
	2:31	X	Shut Down - High Amps?				
	6:30	X	Pulled transducer - Replace pump				
	8:20	X	Reinstall transducer - Parts Run				
	11:42	X	Pulled Transducer				
	1:22		X	Reinstalled Transducer			
	1:35	START/STOP SEVERAL TIMES					89854000
	1:57		X	START UP			
	2:00		X	700			89855900
	2:13		X	861			89867100
	2:19		X				89871600
	2:21		X	850			89873300

Test

Do Not Use Test. 9 No. 8 + No. 9 Pumping

The data stated above is representative of the time spent pumping at the capacities stated. Deviation from either time spent pumping or both could change the outcome if these results.

NOTE: On RECOVERY need: 5-1 minute checks
5-5 minute checks
2-30 minute checks
1-per hour as needed

PROJECT: PRINCETON
Test By: DON S. & BRIAN T.

Well #: 9 Uniq # 749829
Date: 8/23/2007 Job #: 307891
Meter Reading Beginning: -
Meter Reading Ending: -

Well Information:

Length of Casing	135	Hp of Pump	75	
Length of Screen	30	Model of Pump	8T-75-750	
Total Well Depth	160	Specific Capacity	-	
Static Water Level	16.84	Take Readings From Top of Casing 2' above grade		
Well Capacity	932 GPM @	115.52 PWL	9.44	G.P.F.D.D.

*Notes:

Date	Time	AM	PM	GPM	PWL	Sand/Gal	Comments
1/2/2001	12:34	X	X	123	12'3"	4" c/g	This is a sample
8/24/2007	2:24		X				89875350
	2:29		X	750			89879100
	2:36		X				89884600
	2:39		X	716			89886750
	4:50		X		93.8		
	8:11		X		94.4		
	6:10		X		94.8		
8/25/2007	6:11	X					90567150
	6:17	X		733			90571550
	11:15	X					TURNED VALVE UP
	11:19	X					90792850
	11:21	X		930			90797500
	11:27	X			109.3		
	11:33	X	SHUT DOWN				
	11:36	X	START UP				
	12:01		X				90826750
	12:04		X	900			90829450
	12:07		X		108.80		
	1:29		X	SHUT DOWN			Filters
	1:34		X		START UP		

The data stated above is representative of the time spent pumping at the capacities stated. Deviation from either time spent pumping or both could change the outcome if these results.

NOTE: On RECOVERY need: 5-1 minute checks
5-5 minute checks
2-30 minute checks
1-per hour as needed

PROJECT: PRINCETON
Test By: DON S. & BRIAN T.

Well #: 9 Uniq # 749829
Date: 8/23/2007 Job #: 307891
Meter Reading Beginning: -
Meter Reading Ending: -

Well Information:

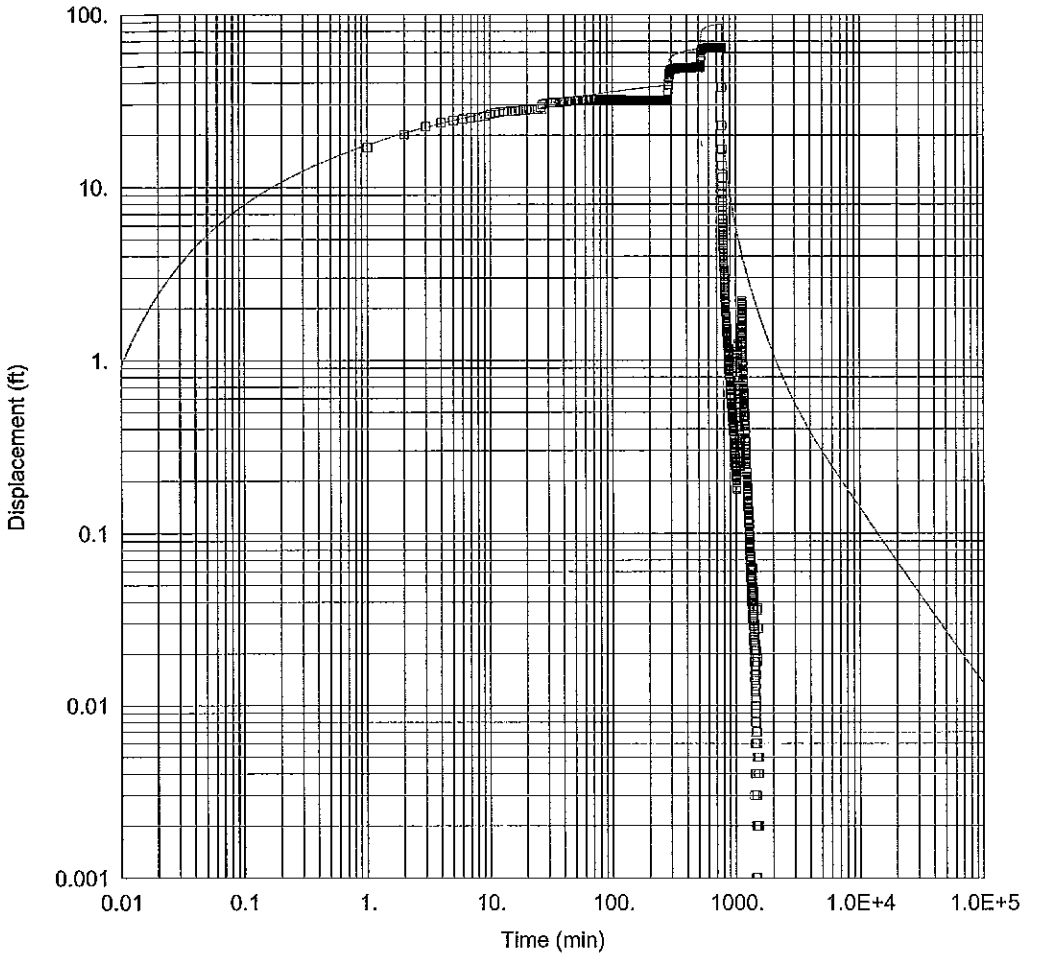
Length of Casing	135		Hp of Pump	75	
Length of Screen	30		Model of Pump	8T-75-750	
Total Well Depth	160		Specific Capacity	-	
Static Water Level	16.84		Take Readings From Top of Casing 2' above grade		
Well Capacity	932	GPM @	115.52	PWL	9.44 G.P.F.D.D.

*Notes:

Date	Time	AM	PM	GPM	PWL	Sand/Gal	Comments
1/2/2001	12:34	X	X	123	12'3"	4" c/g	This is a sample
8/25/2007	1:36		X				90908400
	1:39		X	960			90911250
	2:03		X				90932150
	2:04		X		114.7		
	2:06		X	933		T	90934950/9.5 GPFPD
	8:34		X	938	115.9	T	91299000
8/26/2007	12:03	X		937	115.8	T	91494850
	6:03	X		939	115.9	T	91832850
	8:39	X		937	116	T	91979000
	12:06		X	936	115.63	T	92172700
	1:33		X	932	115.5	T	92253800
	7:25		X		115.52	T	
8/27/2007	7:00		X		SHUT DOWN		

The data stated above is representative of the time spent pumping at the capacities stated. Deviation from either time spent pumping or both could change the outcome if these results.

NOTE: On RECOVERY need: 5-1 minute checks
5-5 minute checks
2-30 minute checks
1-per hour as needed



PRINCETON #9 PUMPING - PRINCETON #9 OBSERVING

Data Set: S:\...\#9 test (#9 ob well) theis early (FINAL).aqt
Date: 02/12/10 Time: 12:48:40

PROJECT INFORMATION

Company: PRNWHP
Client: PRNWHP
Location: Princeton, MN
Test Well: Princeton #9
Test Date: August 2007

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
Princeton #9	2729890	1257639

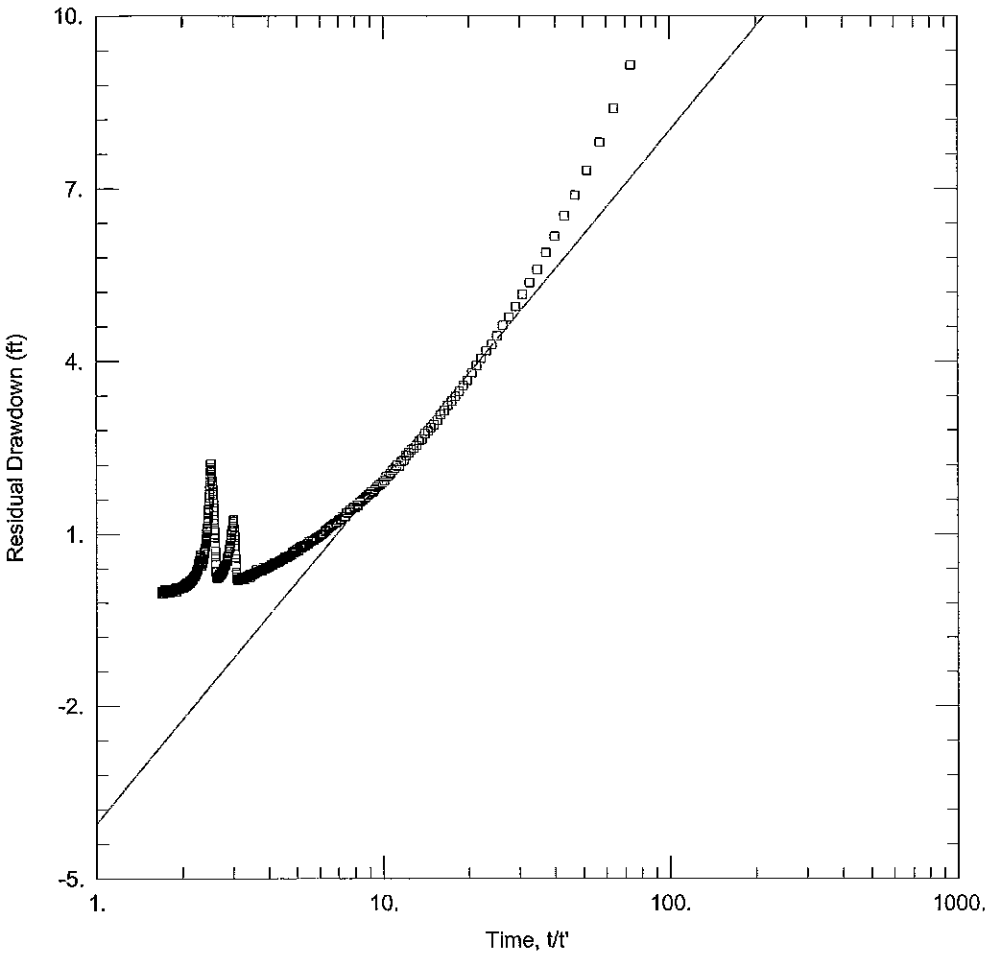
Observation Wells

Well Name	X (ft)	Y (ft)
▫ Princeton #9	2729890	1257639

SOLUTION

Aquifer Model: Confined
Solution Method: Theis

T = 3474.6 ft^2/day
S = 0.19
Kz/Kr = 0.1
b = 100. ft



PRINCETON #9 PUMPING - PRINCETON #9 OBSERVING

Data Set: S:\...\#9 test (#9 ob well) Theis recovery (FINAL).aqt
Date: 02/12/10 Time: 12:48:03

PROJECT INFORMATION

Company: PRNWHP
Client: PRNWHP
Location: Princeton, MN
Test Well: Princeton #9
Test Date: August 2007

AQUIFER DATA

Saturated Thickness: 100. ft Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
Princeton #9	2729890	1257639

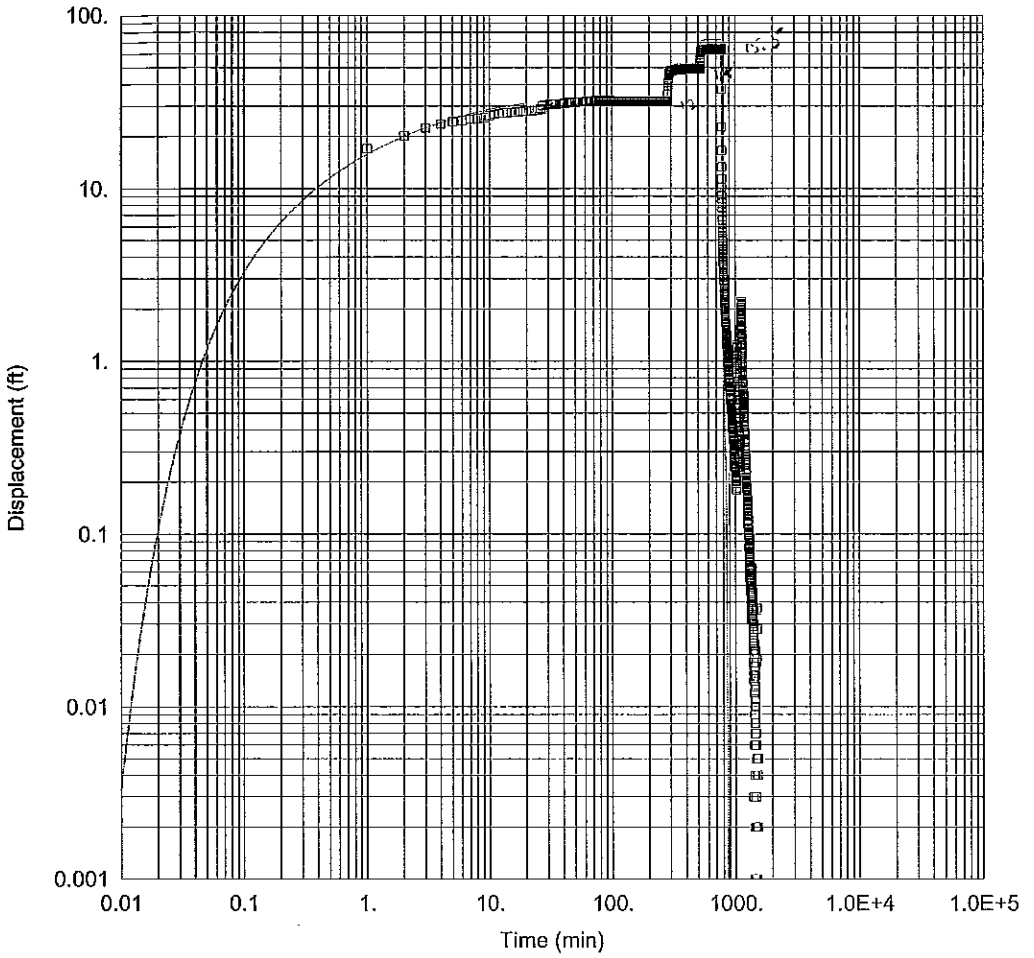
Observation Wells

Well Name	X (ft)	Y (ft)
Princeton #9	2729890	1257639

SOLUTION

Aquifer Model: Confined Solution Method: Theis (Recovery)

T = 3218.8 ft^2/day S/S' = 4.705



PRINCETON #9 PUMPING - PRINCETON #9 OBSERVING

Data Set: S:\...\#9 test (#9 ob well) hantush leaky (FINAL).aqt
Date: 02/12/10 Time: 12:50:53

PROJECT INFORMATION

Company: PRNWHP
Client: PRNWHP
Location: Princeton, MN
Test Well: Princeton #9
Test Date: August 2007

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
Princeton #9	2729890	1257639

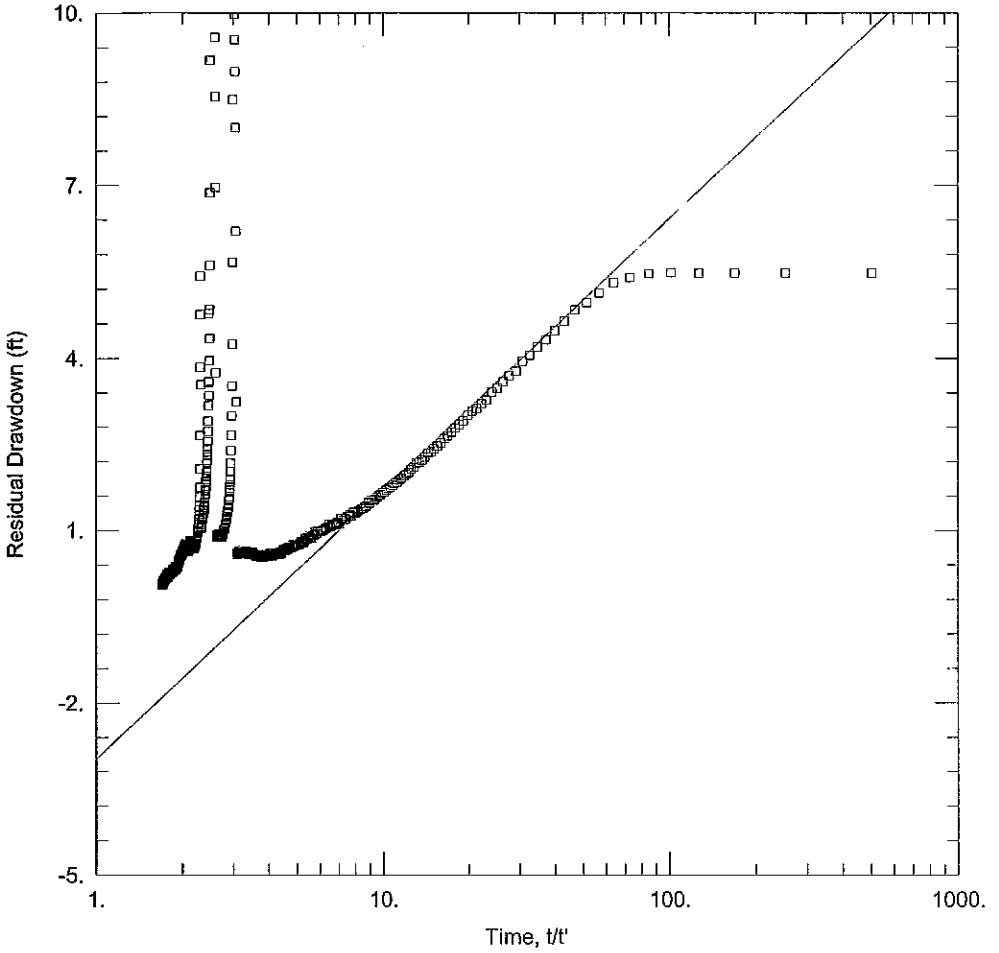
Observation Wells

Well Name	X (ft)	Y (ft)
▫ Princeton #9	2729890	1257639

SOLUTION

Aquifer Model: Leaky
Solution Method: Hantush-Jacob

T = 2195.3 ft^2/day
S = 0.6761
r/B = 0.1
Kz/Kr = 0.1
b = 100. ft



PRINCETON #9 PUMPING - PRINCETON TW-8 OBSERVING

Data Set: S:\...\#9 test (TW-8) theis rcvy (FINAL).aqt
Date: 02/12/10 Time: 12:47:03

PROJECT INFORMATION

Company: PRNWHP
Client: PRNWHP
Location: Princeton, MN
Test Well: Princeton #9
Test Date: August 2007

AQUIFER DATA

Saturated Thickness: 100. ft Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
Princeton #9	2729890	1257639

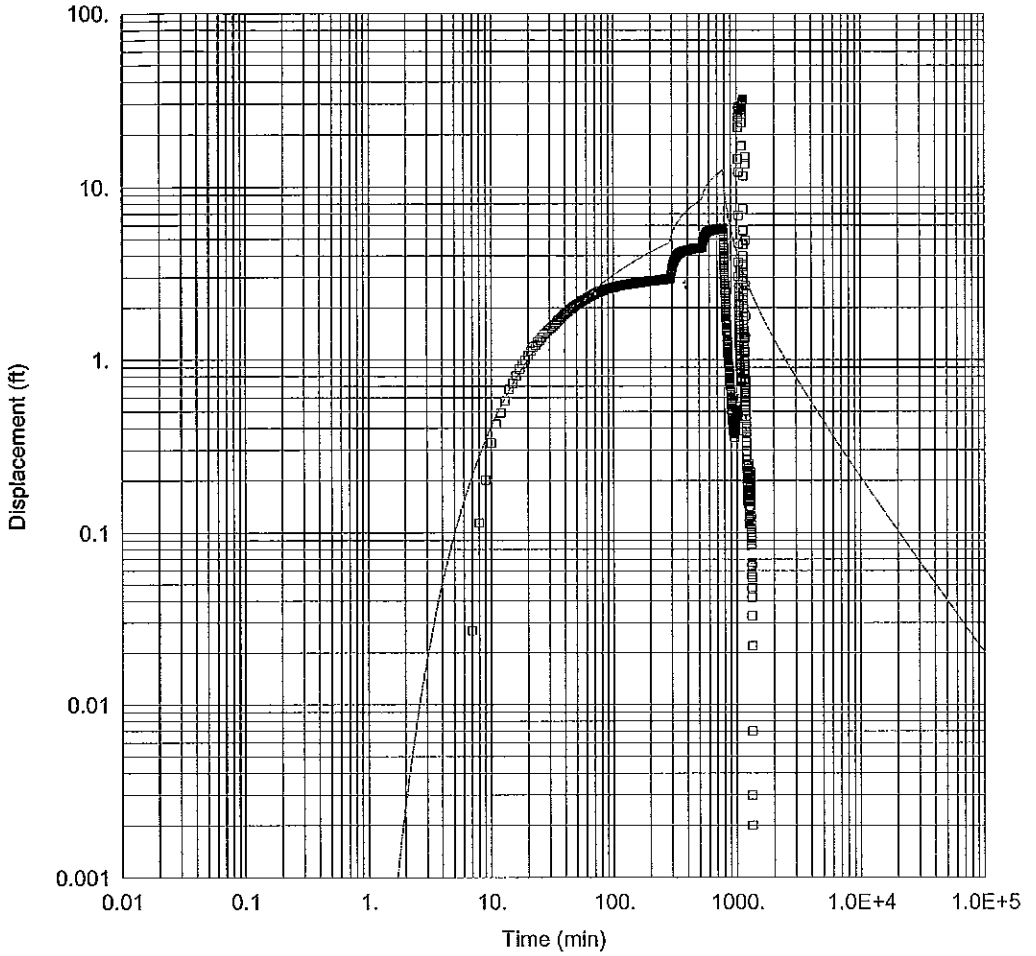
Observation Wells

Well Name	X (ft)	Y (ft)
▫ Princeton TW-8	2729892	1258304

SOLUTION

Aquifer Model: Confined Solution Method: Theis (Recovery)

T = 4129.9 ft^2/day S/S' = 4.31



PRINCETON #9 PUMPING - PRINCETON #8 OBSERVING

Data Set: S:\...\# 9 test (#8 ob well) theis (FINAL).aqt
Date: 02/12/10 Time: 12:51:02

PROJECT INFORMATION

Company: PRNWHP
Client: PRNWHP
Location: Princeton, MN
Test Well: Princeton #9
Test Date: August 2007

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
Princeton #9	2729890	1257639

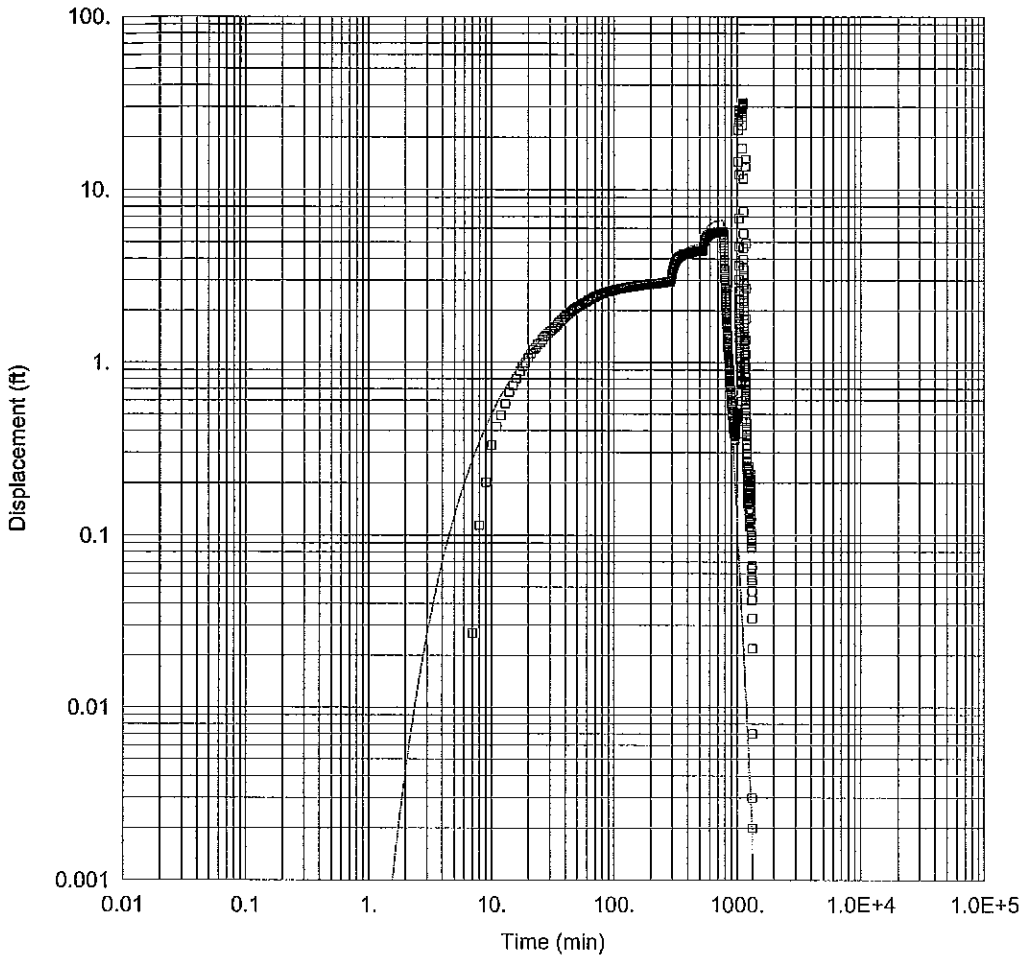
Observation Wells

Well Name	X (ft)	Y (ft)
▫ Princeton #8	2729882	1258266

SOLUTION

Aquifer Model: Confined
Solution Method: Theis

T = 2315.2 ft^2/day
S = 0.0001514
Kz/Kr = 0.1
b = 100. ft



PRINCETON #9 PUMPING - PRINCETON #8 OBSERVING

Data Set: S:\...\# 9 test (#8 ob well) hantush leaky (FINAL).aqt
Date: 02/12/10 Time: 12:46:48

PROJECT INFORMATION

Company: PRNWHP
Client: PRNWHP
Location: Princeton, MN
Test Well: Princeton #9
Test Date: August 2007

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
Princeton #9	2729890	1257639

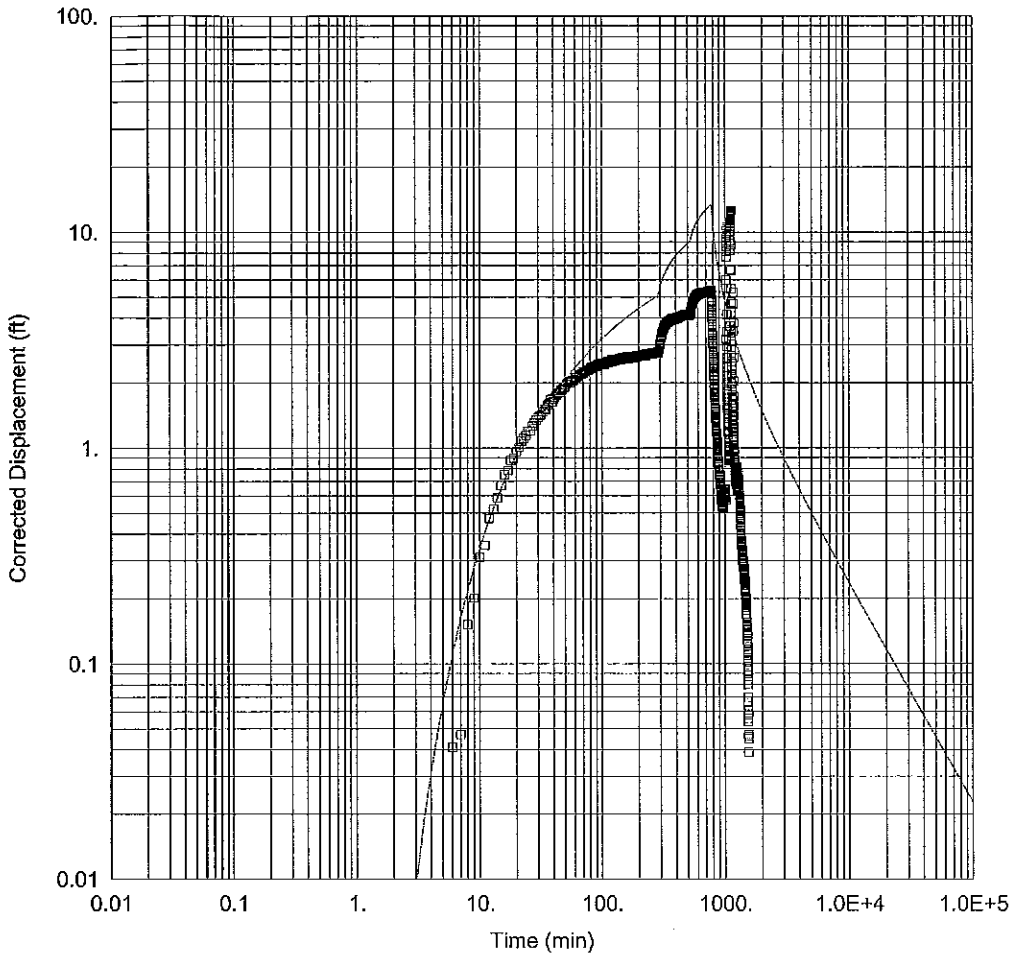
Observation Wells

Well Name	X (ft)	Y (ft)
▫ Princeton #8	2729882	1258266

SOLUTION

Aquifer Model: Leaky
Solution Method: Hantush-Jacob

T = 1952.1 ft^2/day
S = 0.0001203
r/B = 0.6
Kz/Kr = 0.1
b = 100. ft



PRINCETON #9 PUMPING - PRINCETON TW-8 OBSERVING

Data Set: S:\...\#9 test (TW-8) theis early (FINAL).aqt
Date: 02/12/10 Time: 12:47:10

PROJECT INFORMATION

Company: PRNWHP
Client: PRNWHP
Location: Princeton, MN
Test Well: Princeton #9
Test Date: August 2007

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
Princeton #9	2729890	1257639

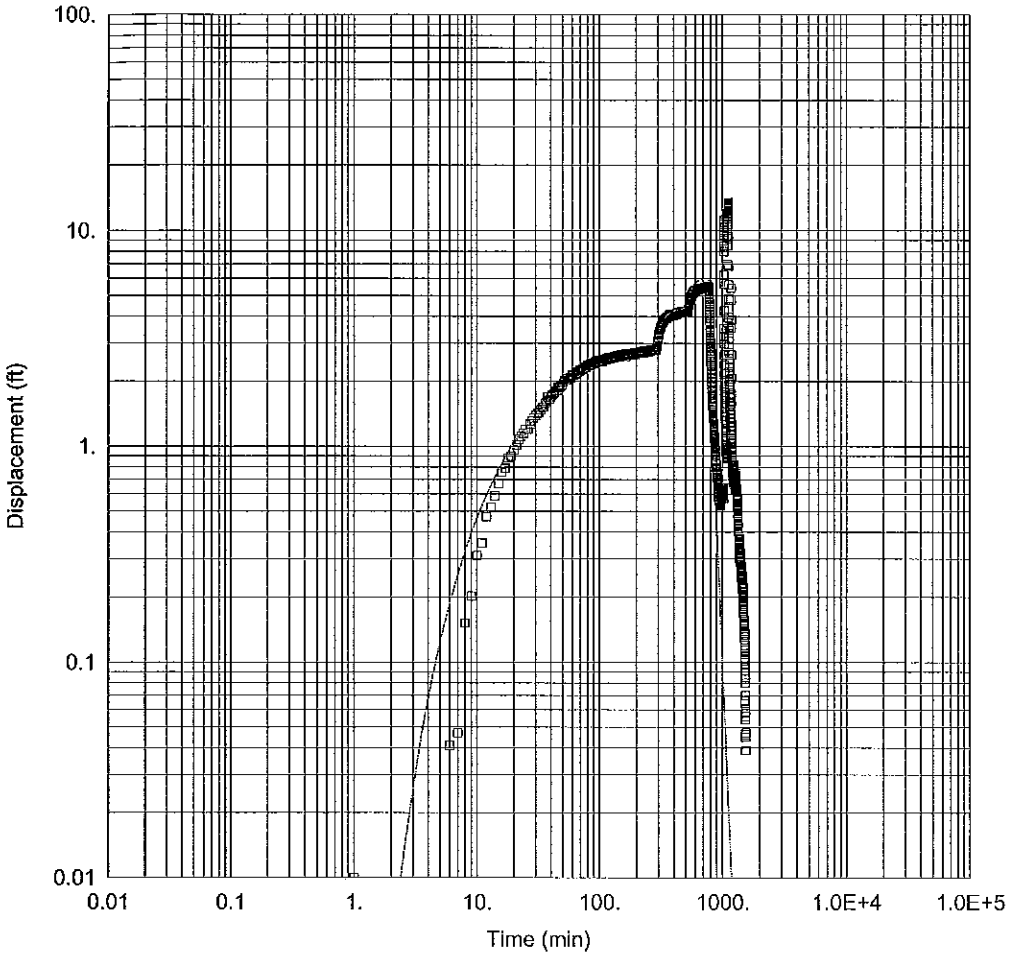
Observation Wells

Well Name	X (ft)	Y (ft)
▫ Princeton TW-8	2729892	1258304

SOLUTION

Aquifer Model: Unconfined
Solution Method: Theis

T = 2045.9 ft^2/day
S = 0.0001421
Kz/Kr = 0.1
b = 100. ft



PRINCETON #9 PUMPING - PRINCETON TW-8 OBSERVING

Data Set: S:\...\#9 test (TW-8) hantush leaky (FINAL).aqt
Date: 02/12/10 Time: 12:47:21

PROJECT INFORMATION

Company: PRNWHP
Client: PRNWHP
Location: Princeton, MN
Test Well: Princeton #9
Test Date: August 2007

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
Princeton #9	2729890	1257639

Observation Wells

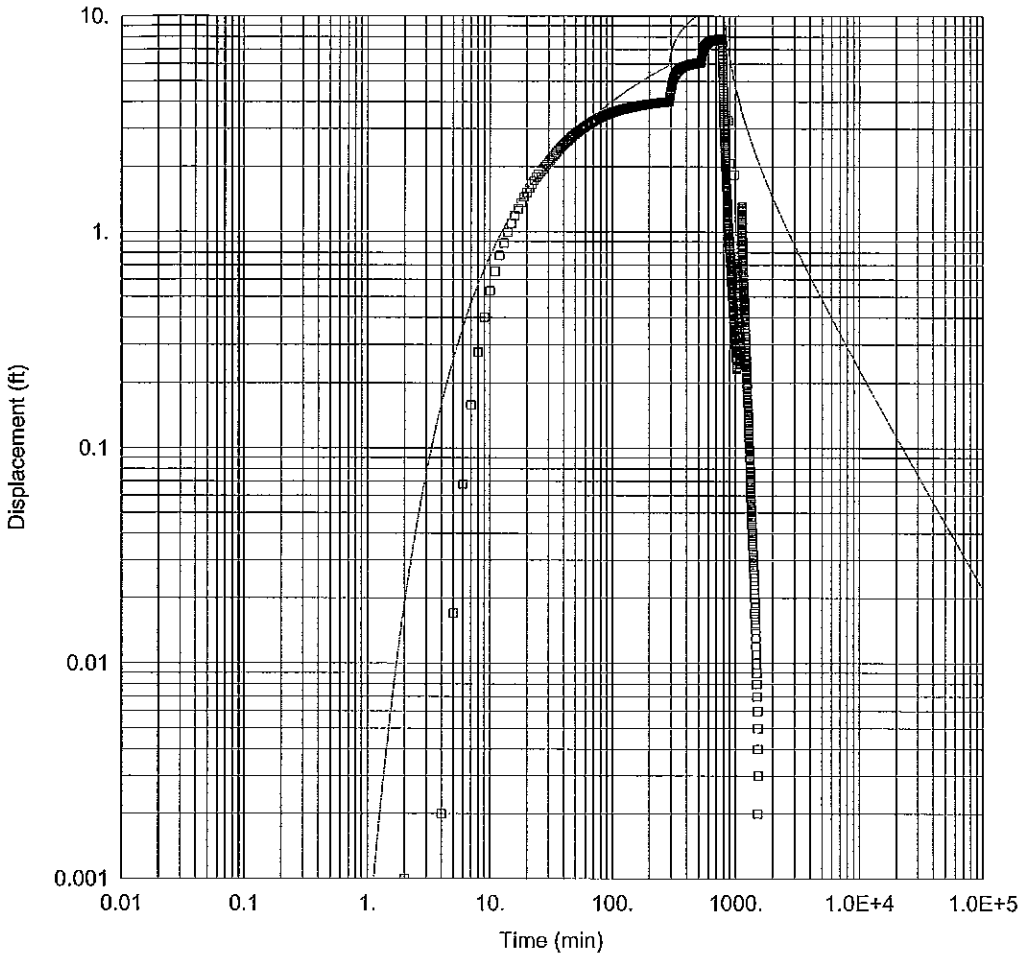
Well Name	X (ft)	Y (ft)
▫ Princeton TW-8	2729892	1258304

SOLUTION

Aquifer Model: Leaky
Solution Method: Hantush-Jacob

T = 2162.5 ft^2/day
r/B = 0.6
b = 100. ft

S = 0.0001156
Kz/Kr = 0.1



PRINCETON #9 PUMPING - STEPHENS 638482 OBSERVING

Data Set: S:\...\#9 test (Stephens) theis early (FINAL).aqt
Date: 02/22/10 Time: 13:50:16

PROJECT INFORMATION

Company: PRNWHP
Client: PRNWHP
Location: Princeton, MN
Test Well: Princeton #9
Test Date: August 2007

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
Princeton #9	2729890	1257639

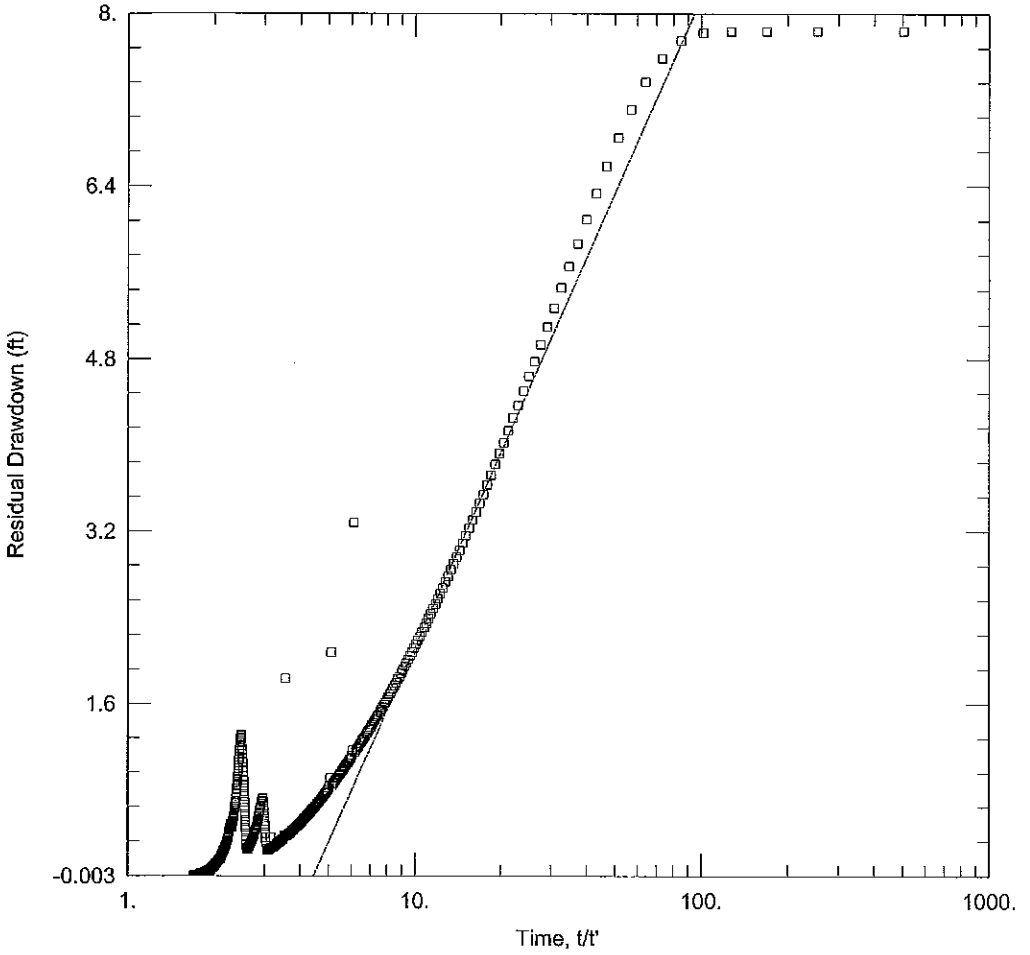
Observation Wells

Well Name	X (ft)	Y (ft)
Stephens 638482	2729476	1257763

SOLUTION

Aquifer Model: Confined
Solution Method: Theis

T = 2107.9 ft^2/day
S = 0.0001987
Kz/Kr = 0.1
b = 100. ft



PRINCETON #9 PUMPING - STEPHENS 638482 OBSERVING

Data Set: S:\...\#9 test (Stephens) Theis recovery (FINAL).aqt
Date: 02/22/10 Time: 13:05:53

PROJECT INFORMATION

Company: PRNWHP
Client: PRNWHP
Location: Princeton, MN
Test Well: Princeton #9
Test Date: August 2007

AQUIFER DATA

Saturated Thickness: 100. ft Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
Princeton #9	2729890	1257639

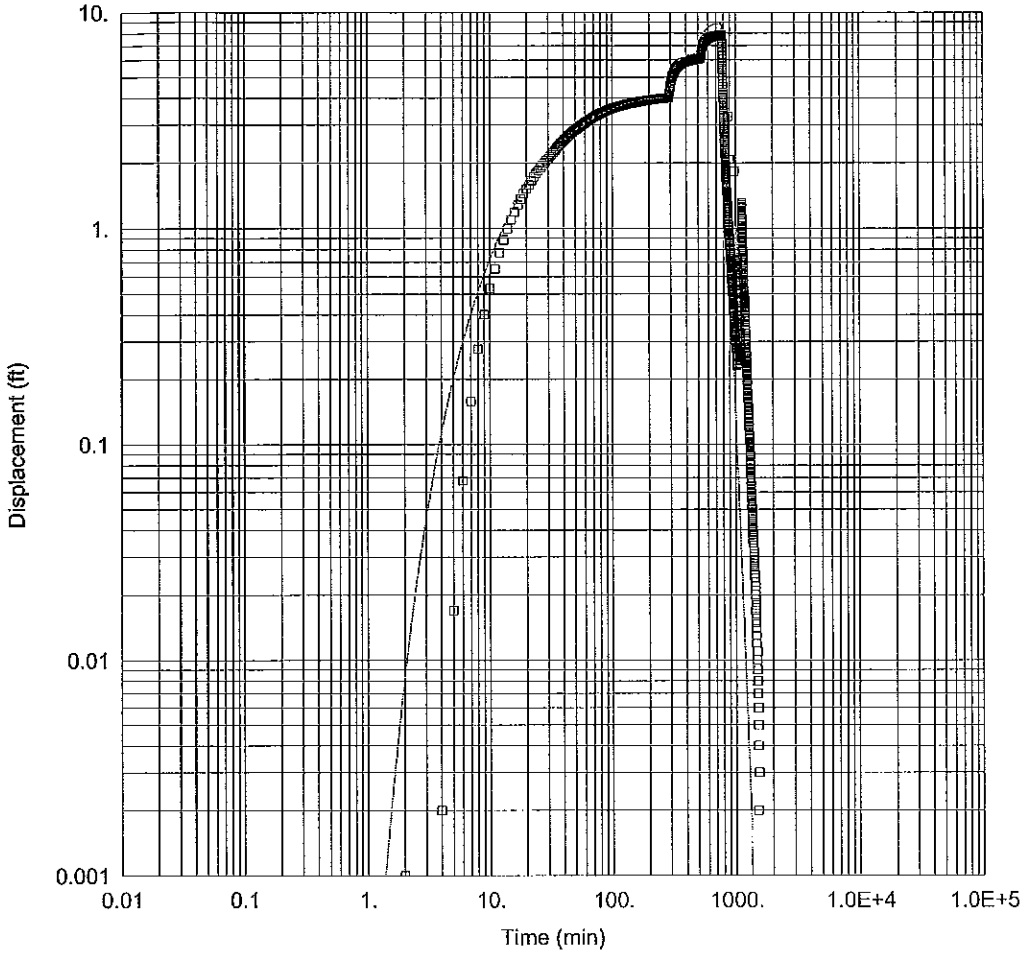
Observation Wells

Well Name	X (ft)	Y (ft)
▫ Stephens 638482	2729476	1257763

SOLUTION

Aquifer Model: Confined Solution Method: Theis (Recovery)

T = 3220. ft^2/day S/S' = 4.458



PRINCETON #9 PUMPING - STEPHENS 638482 OBSERVING

Data Set: S:\...\#9 test (Stephens) hantush leaky (FINAL).aqt
Date: 02/12/10 Time: 12:47:39

PROJECT INFORMATION

Company: PRNWHP
Client: PRNWHP
Location: Princeton, MN
Test Well: Princeton #9
Test Date: August 2007

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
Princeton #9	2729890	1257639

Observation Wells

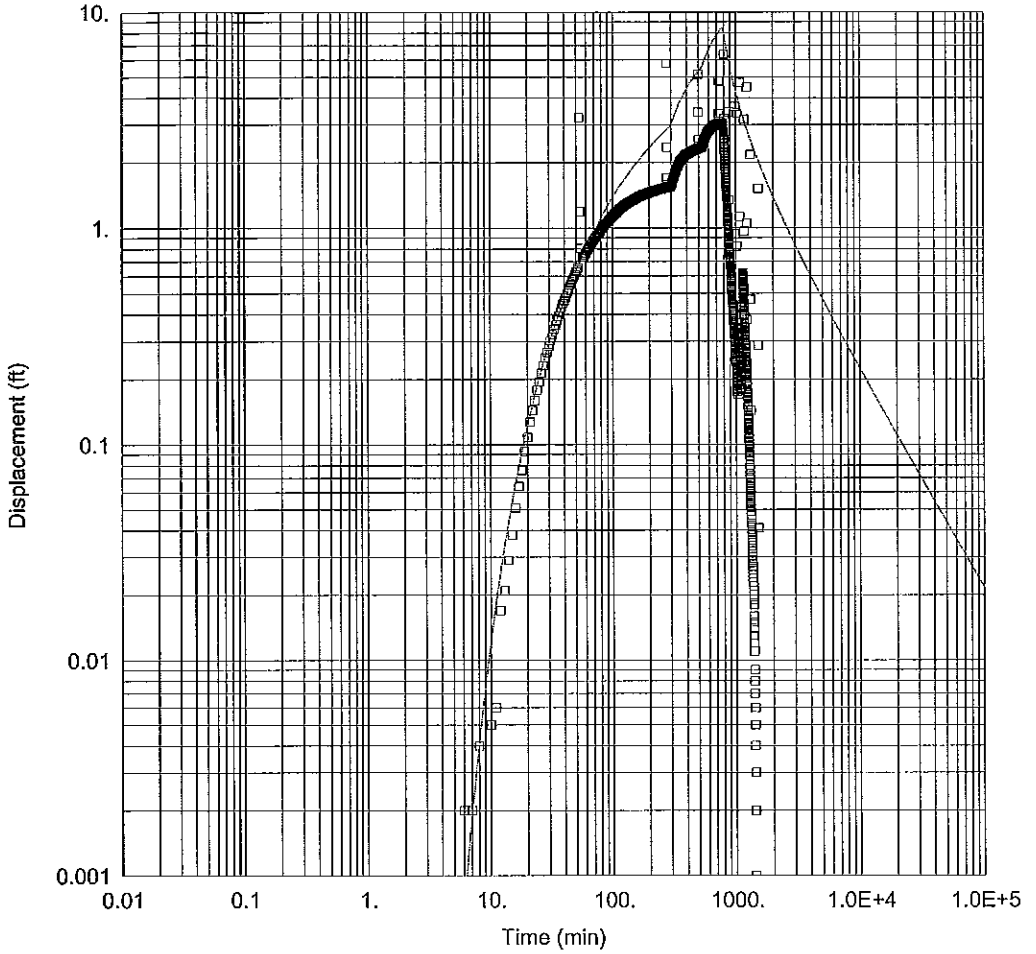
Well Name	X (ft)	Y (ft)
▫ Stephens 638482	2729476	1257763

SOLUTION

Aquifer Model: Leaky
Solution Method: Hantush-Jacob

T = 1467. ft^2/day
r/B = 0.6
b = 100. ft

S = 0.0001796
Kz/Kr = 0.1



PRINCETON #9 PUMPING - MILLER PRO PRODUCTS 601770 OBSERVING

Data Set: S:\...\#9 test (Miller) theis early (FINAL).aqt
Date: 02/12/10 Time: 12:47:51

PROJECT INFORMATION

Company: PRNWHP
Client: PRNWHP
Location: Princeton, MN
Test Well: Princeton #9
Test Date: August 2007

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
Princeton #9	2729890	1257639

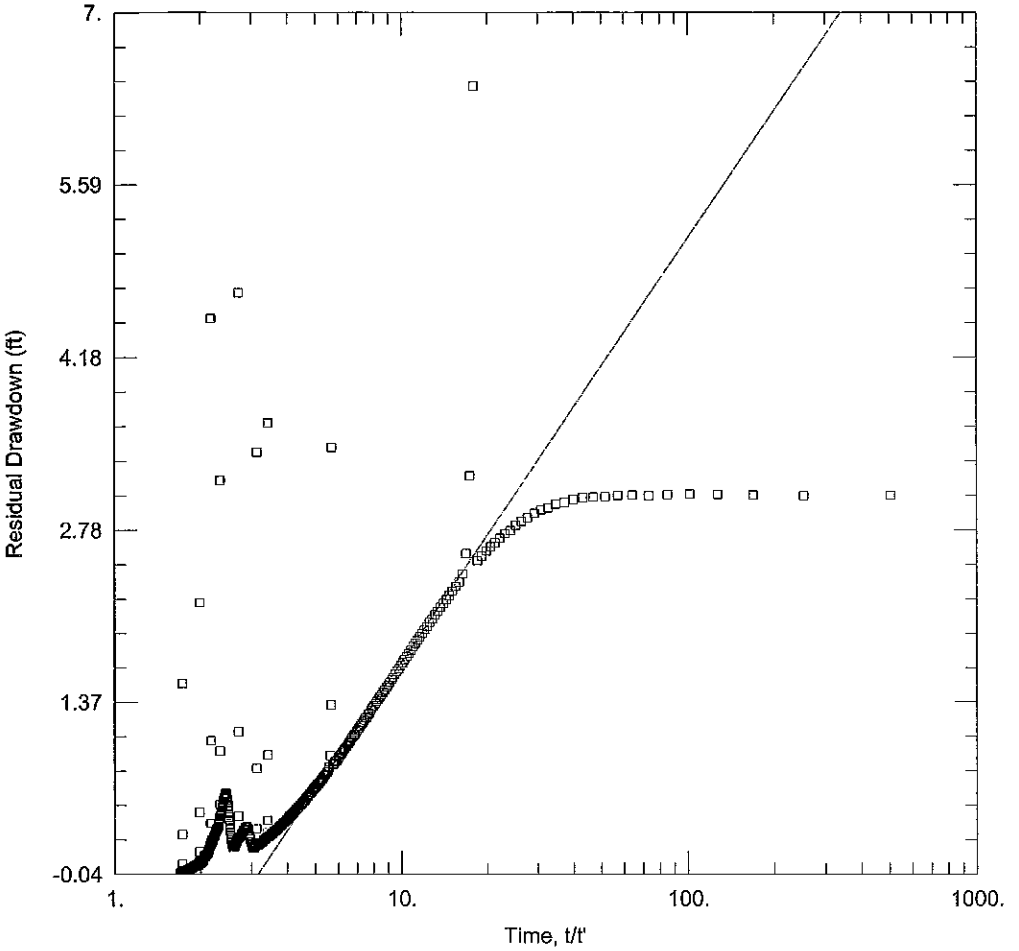
Observation Wells

Well Name	X (ft)	Y (ft)
▫ Miller Pro Products 601770	2728943	1258131

SOLUTION

Aquifer Model: Confined
Solution Method: Theis

T = 2153.3 ft^2/day
S = 0.0001843
Kz/Kr = 0.1
b = 100. ft



PRINCETON #9 PUMPING - MILLER PRO PRODUCTS 601770 OBSERVING

Data Set: S:\...\#9 test (Miller) theis recovery (FINAL).aqt
Date: 02/12/10 Time: 12:47:44

PROJECT INFORMATION

Company: PRNWHP
Client: PRNWHP
Location: Princeton, MN
Test Well: Princeton #9
Test Date: August 2007

AQUIFER DATA

Saturated Thickness: 100. ft Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
Princeton #9	2729890	1257639

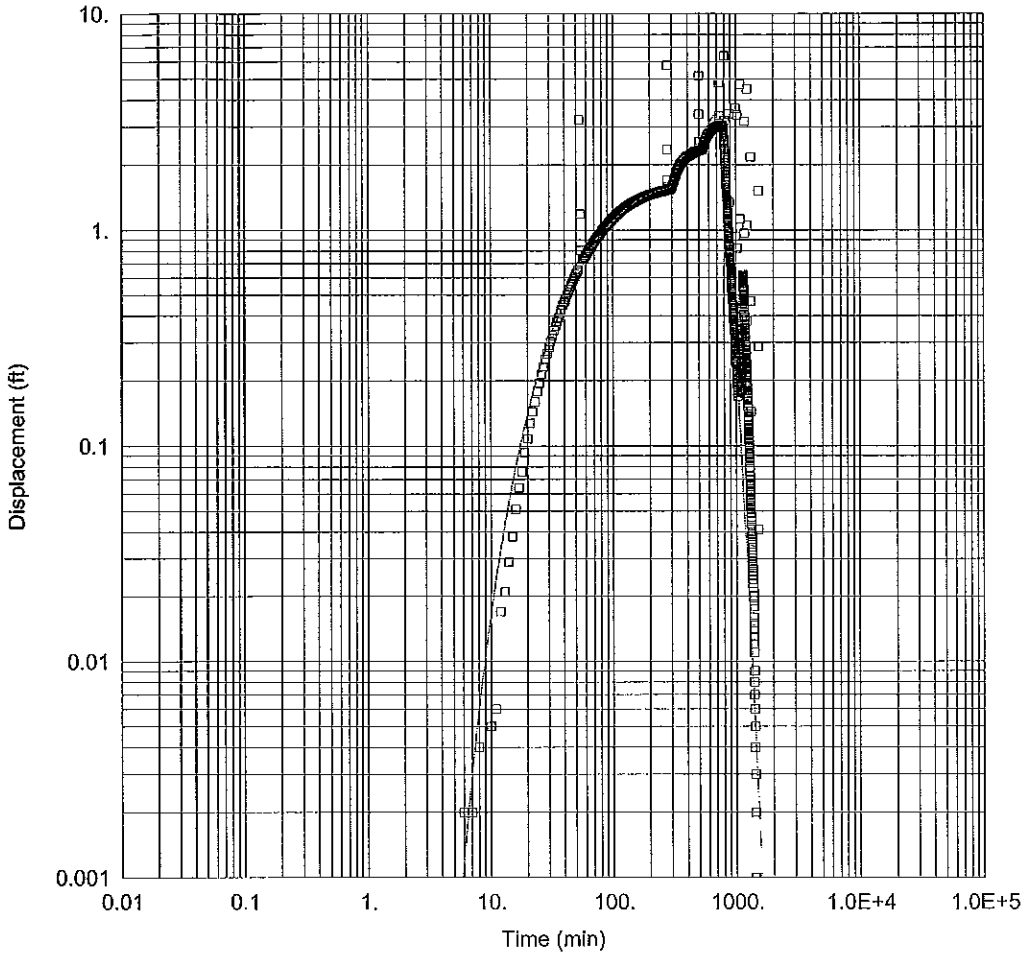
Observation Wells

Well Name	X (ft)	Y (ft)
Miller Pro Products 601770	2728943	1258131

SOLUTION

Aquifer Model: Confined Solution Method: Theis (Recovery)

T = 5603.7 ft^2/day S/S' = 3.243



PRINCETON #9 PUMPING - MILLER PRO PRODUCTS 601770 OBSERVING

Data Set: S:\...\#9 test (Miller) hantush leaky (FINAL).aqt
Date: 02/12/10 Time: 12:47:57

PROJECT INFORMATION

Company: PRNWHP
Client: PRNWHP
Location: Princeton, MN
Test Well: Princeton #9
Test Date: August 2007

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
Princeton #9	2729890	1257639

Observation Wells

Well Name	X (ft)	Y (ft)
Miller Pro Products 601770	2728943	1258131

SOLUTION

Aquifer Model: Leaky
Solution Method: Hantush-Jacob

T = 1968.9 ft^2/day
S = 0.0001575
r/B = 1.
Kz/Kr = 0.1
b = 100. ft

ATTACHMENT III-4

TEST 2 (WELL NO. 8)
STEP-RATE TEST DATA
QUALITATIVE ANALYSIS

JOB Princeton MN
SHEET NO. ____ OF ____
CALCULATED BY TJH DATE 2/22/10
CHECKED BY ____ DATE ____
SCALE ____

LEGGETTE, BRASHEARS & GRAHAM, INC.
Professional Ground-Water Consultants

#8 Pumping Test (TEST 2)

Ob well	Distance to Pumping well (ft)	T (ft²/day)	S	Method
#8 pumping well	0.5	1947 4031 4107	– – –	Hantush-Jacob (Leaky) Papadopulos-Cooper (confined) Cooper-Jacob (confined)
#9	627	6142 4022	9.5×10^{-5} 1.0×10^{-4}	Theis (confined) Hantush-Jacob (Leaky)
TW-8	~ 40	2904 2216 2927	2.7×10^{-4} 5.9×10^{-4} 2.9×10^{-4}	Cooper-Jacob (confined) Hantush-Jacob (Leaky) Theis (confined)
stephens	~ 630	3602 4789	2.7×10^{-4} 2.9×10^{-4}	Hantush-Jacob (Leaky) Theis (confined)
Miller Pro	~ 980	4108 4749	3.1×10^{-4} 3.7×10^{-4}	Hantush-Jacob (Leaky) Theis (confined)
		3626	= GEOMEAN	

Start: 8/22/07 1:15 p.m.
End: 8/24/07 2:00 p.m.

rates
- 400 gpm 8/22 1:15 p.m. to 8/22 5:17 p.m.
- 600 gpm 8/22 5:18 p.m. to 8/22 9:18 p.m.
- 800 gpm 8/22 9:20 p.m. to 8/23 2:45 a.m.
- 1050 to 860 gpm 8/23 2:46 a.m. to 8/23 12:12 a.m.
- 750 gpm 8/23 12:13 p.m. to 8/24 2:25 a.m.

b = 65'

ENTERED IN DATABASE
BY/DATE
CHECKED BY RES
DATE 5/28/07

PROJECT: PRINCETON
Test By: DON S. & BRIAN T.

Well # 8 Uniq # 751504
Date: 8/21/2007 Job #: 307935
Meter Reading Beginning: 75378000
Meter Reading Ending: -

Well Information:

Length of Casing	104		Hp of Pump	125	
Length of Screen	30		Model of Pump	10T-90	
Total Well Depth	139		Specific Capacity	-	
Static Water Level	20.2		Take Readings From Top of Casing 2' above grade		
Well Capacity	740	GPM @	90.6	PWL	10.5 G.P.F.D.D.

*Notes:

Page 1 of 6

Date	Time	AM	PM	GPM	PWL	Sand/Gal	Comments
1/2/2001	12:34	X	X	123	12'3"	4" c/g	This is a sample
8/21/2007	12:45		X	400			
	12:53		X		48.1		
	12:55		X	SHUT DOWN - LINE PROBLEM			
	2:00		X	400	START UP		
	2:05		SHUT DOWN - MOTOR ISSUE				
START & STOP SEVERAL TIMES TO CHECK MOTOR CONDITION							
8/22/2007	8:15	X	PULLED TRANSDUCER				
	12:30		X	REINSTALLED			
	1:15		X	400	START UP		
	1:18		X		44.8		
	1:55		X		48.43		
	2:50		X		49.0		
	3:34		X		49.2		75435900
	3:35			416			
	4:30		X		49.33	T	
	5:05		X		49.4	T	
	5:17			380			75475000
	5:18			600			

Table 1 Use before No. 9 was pumping

The data stated above is representative of the time spent pumping at the capacities stated. Deviation from either time spent pumping or both could change the outcome if these results.

NOTE: On RECOVERY need: 5-1 minute checks
5-5 minute checks
2-30 minute checks
1-per hour as needed

5/26/2009 2:19 PM LR

PROJECT: PRINCETON
Test By: DON S. & BRIAN T.

Well #: 8 Uniq # 751504
Date: 8/21/2007 Job #: 307935
Meter Reading Beginning:
Meter Reading Ending:

Well Information:

Length of Casing	104		Hp of Pump	125	
Length of Screen	30		Model of Pump	10T-90	
Total Well Depth	139		Specific Capacity	-	
Static Water Level	20.2		Take Readings From Top of Casing 2' above grade		
Well Capacity	740	GPM @	90.6	PWL	10.5 G.P.F.D.D.

*Notes:

Date	Time	AM	PM	GPM	PWL	Sand/Gal	Comments
1/2/2001	12:34	X	X	123	12'3"	4" c/g	This is a sample
8/22/2007	5:23		X	600	67.9	T	
	5:55		X	600	70.3	T	
	6:45		X	600	70.9	T	
	7:45		X	600	71.2	T	
	8:50		X	600	71.38	T	
	9:15		X	600	71.43	T	
	9:18			600	SHUT DOWN		Filters
	9:20			800	START UP		
	10:00			800	SHUT DOWN		Hand Pump
	10:20			800	START UP		
	10:25		X	800	85.9	T	
	10:45		X	800	86.6	T	
	10:55		X	800	86.77	T	
	11:00		X	800	86.98	T	
	11:05		X	800	87.15	T	
	11:10		X	800	87.28	T	
	11:15		X	800	87.3	T	
	11:25		X	800	87.38	T	
	11:30		X	800	87.42	T	
	11:40		X	800	87.53	T	

The data stated above is representative of the time spent pumping at the capacities stated. Deviation from either time spent pumping or both could change the outcome if these results.

NOTE: On RECOVERY need: 5-1 minute checks
5-5 minute checks
2-30 minute checks
1-per hour as needed

PROJECT: PRINCETON
Test By: DON S. & BRIAN T.

Well #: 8 Uniq # 751504
Date: 8/21/2007 Job #: 307935
Meter Reading Beginning:
Meter Reading Ending: -

Well Information:

Length of Casing	104	Hp of Pump	125
Length of Screen	30	Model of Pump	10T-90
Total Well Depth	139	Specific Capacity	-
Static Water Level	20.2	Take Readings From Top of Casing 2' above grade	
Well Capacity	740 GPM @	90.6 PWL	10.5 G.P.F.D.D.

*Notes:

Date	Time	AM	PM	GPM	PWL	Sand/Gal	Comments
1/2/2001	12:34	X	X	123	12'3"	4" c/g	This is a sample
8/22/2007	11:50		X	800	87.54	T	
8/23/2007	12:00	X		800	87.62	T	
	12:15	X		800	87.71	T	
	1:30	X		800	87.9	T	
	2:30	X		800	87.97	T	
	2:45	X		1050	95		drawdown went below 95', had to back down
	2:57	X		950	94.4	T	
	2:59	X		950	94.25	T	
	3:03	X			94.2	T	
	3:08	X			94.23	T	
	3:16	X			94.31	T	
	3:20	X		960	94.4	T	759170
	3:45	X		960	94.5	T	759410
	4:20	X			94.56	T	759721
	4:30	X			94.65	T	759811 (cranked valve a little more)
	5:03	X		920	95.00	T	760115
	6:30	X		920	95.12	T	760915
	7:00	X			95.33	T	
	7:44	X		877			761564

The data stated above is representative of the time spent pumping at the capacities stated. Deviation from either time spent pumping or both could change the outcome if these results.

NOTE: On RECOVERY need: 5-1 minute checks
5-5 minute checks
2-30 minute checks
1-per hour as needed

PROJECT: PRINCETON
Test By: DON S. & BRIAN T.

Well #: 8
Date: 8/21/2007
Meter Reading Beginning:
Meter Reading Ending: -

Uniq # 751504
Job #: 307935

Well Information:

Length of Casing	104		Hp of Pump	125	
Length of Screen	30		Model of Pump	10T-90	
Total Well Depth	139		Specific Capacity	-	
Static Water Level	20.2		Take Readings From Top of Casing 2' above grade		
Well Capacity	740	GPM @	90.6	PWL	10.5 G.P.F.D.D.

*Notes:

Date	Time	AM	PM	GPM	PWL	Sand/Gal	Comments
1/2/2001	12:34	X	X	123	12'3"	4" c/g	This is a sample
8/23/2007	8:45	X			93.8		Turned up
	10:55	X			96		Turned down
	11:00	X					76334200
	12:12	X		861			76396200
	1:23		X		91.3		
	7:30		X				76775550
	7:32		X				76775550
	7:33		X	650			76776200
	7:35		X				76777750
	7:36		X	750			76778500
	8:13		X	785	83.75		76807550
	8:21	SHUT VALVE A LITTLE					
	8:23		X	744			76814800
	8:31		X	744	82.8		76820750
	8:51		X	760	82.8		76835950
	8:55	SHUT VALVE A LITTLE					
	8:56		X	755			76839750
	9:06		X	755	82.25		76847300
	9:26		X	752.5	82.00		76862350
	9:46		X	752.5	81.9		76877400

The data stated above is representative of the time spent pumping at the capacities stated. Deviation from either time spent pumping or both could change the outcome if these results.

NOTE: On RECOVERY need: 5-1 minute checks
5-5 minute checks
2-30 minute checks
1-per hour as needed

PROJECT: PRINCETON
Test By: DON S. & BRIAN T.

Well #: 8 Uniq # 751504
Date: 8/21/2007 Job #: 307935
Meter Reading Beginning:
Meter Reading Ending: -

Well Information:

Length of Casing	104	Hp of Pump	125
Length of Screen	30	Model of Pump	10T-90
Total Well Depth	139	Specific Capacity	-
Static Water Level	20.2	Take Readings From Top of Casing 2' above grade	
Well Capacity	740 GPM @	90.6 PWL	10.5 G.P.F.D.D.

*Notes:

Date	Time	AM	PM	GPM	PWL	Sand/Gal	Comments
1/2/2001	12:34	X	X	123	12'3"	4" c/g	This is a sample
8/23/2007	10:06		X	750	81.9		76892400
	10:26		X	750	81.9		76907400
8/24/2007	12:00	X		752.7	82.1		76978150
	2:00	X		753	82.1		77068550 well No. 9 begins pumping @ ~ 2:25 a.m. 8/24/07
	3:00	X		752	82.1		77113650
	6:00	X		757	82.1		77249900
	7:58	X		748	82		77338150
	10:24	X		752	82		77447900
	4:44		X		85.9		
	8:26		X		87.3		
8/25/07	6:35	X			87.5		78344800
	640	X		740			78348500
	11:15	X		Turned #9 valve up			
	11:22	X			87.5		
	1:46		X				78662700
	1:58		X	683			78670900
	2:00		X				
							opened valve slightly

The data stated above is representative of the time spent pumping at the capacities stated. Deviation from either time spent pumping or both could change the outcome if these results.

NOTE: On RECOVERY need: 5-1 minute checks
5-5 minute checks
2-30 minute checks
1-per hour as needed

PROJECT: PRINCETON
Test By: DON S. & BRIAN T.

Well #: 8 Uniq # 751504
Date: 8/21/2007 Job #: 307935
Meter Reading Beginning:
Meter Reading Ending: -

Well Information:

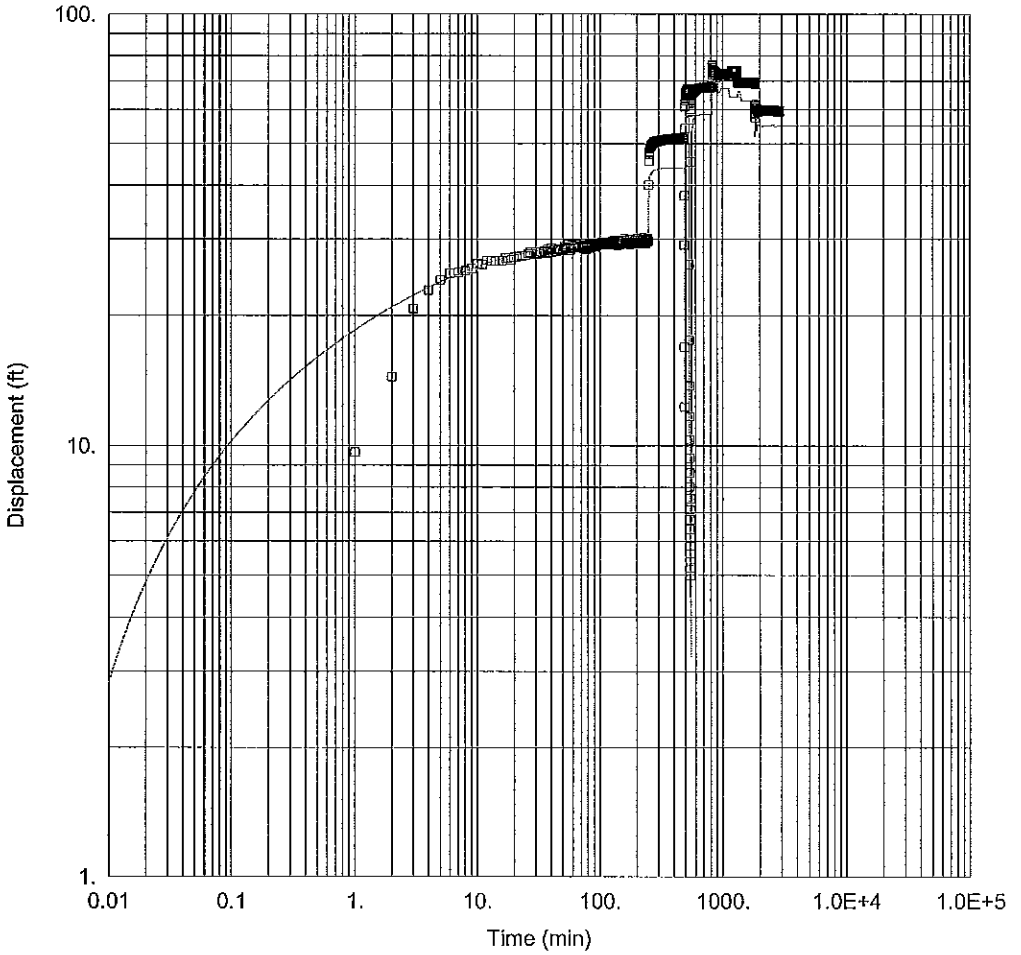
Length of Casing	104		Hp of Pump	125	
Length of Screen	30		Model of Pump	10T-90	
Total Well Depth	139		Specific Capacity	-	
Static Water Level	20.2		Take Readings From Top of Casing 2' above grade		
Well Capacity	740	GPM @	90.6	PWL	10.5 G.P.F.D.D.

*Notes:

Date	Time	AM	PM	GPM	PWL	Sand/Gal	Comments
1/2/2001	12:34	X	X	123	12'3"	4" c/g	This is a sample
8/25/2007	2:11		X				78680050
	2:16		X		89.8	T	
	2:17		X	758			78684600/10.89 GPFPP
	8:16		X	754	90.7	T	78955400
8/26/2007	12:16	X		754.5	90.8		79136500
	6:20	X		754	90.8	T	79411050
	8:46	X		754	90.8	T	79521200
	11:56	X		757	90.6	T	79665000
	1:23		X	741	90.6	T	79729450
	7:40		X		90.6		
8/27/2007	7:00		X	SHUT DOWN			

The data stated above is representative of the time spent pumping at the capacities stated. Deviation from either time spent pumping or both could change the outcome if these results.

NOTE: On RECOVERY need: 5-1 minute checks
5-5 minute checks
2-30 minute checks
1-per hour as needed



PRINCETON #8 PUMPING - PRINCETON #8 OBSERVING

Data Set: S:\...\#8 (# 8 ob well) hantush leaky (FINAL).aqt
Date: 02/22/10 Time: 13:39:44

PROJECT INFORMATION

Company: PRNWHP
Client: PRNWHP
Location: Princeton, MN
Test Well: Princeton #8
Test Date: August 2007

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
Princeton #8	2729882	1258266

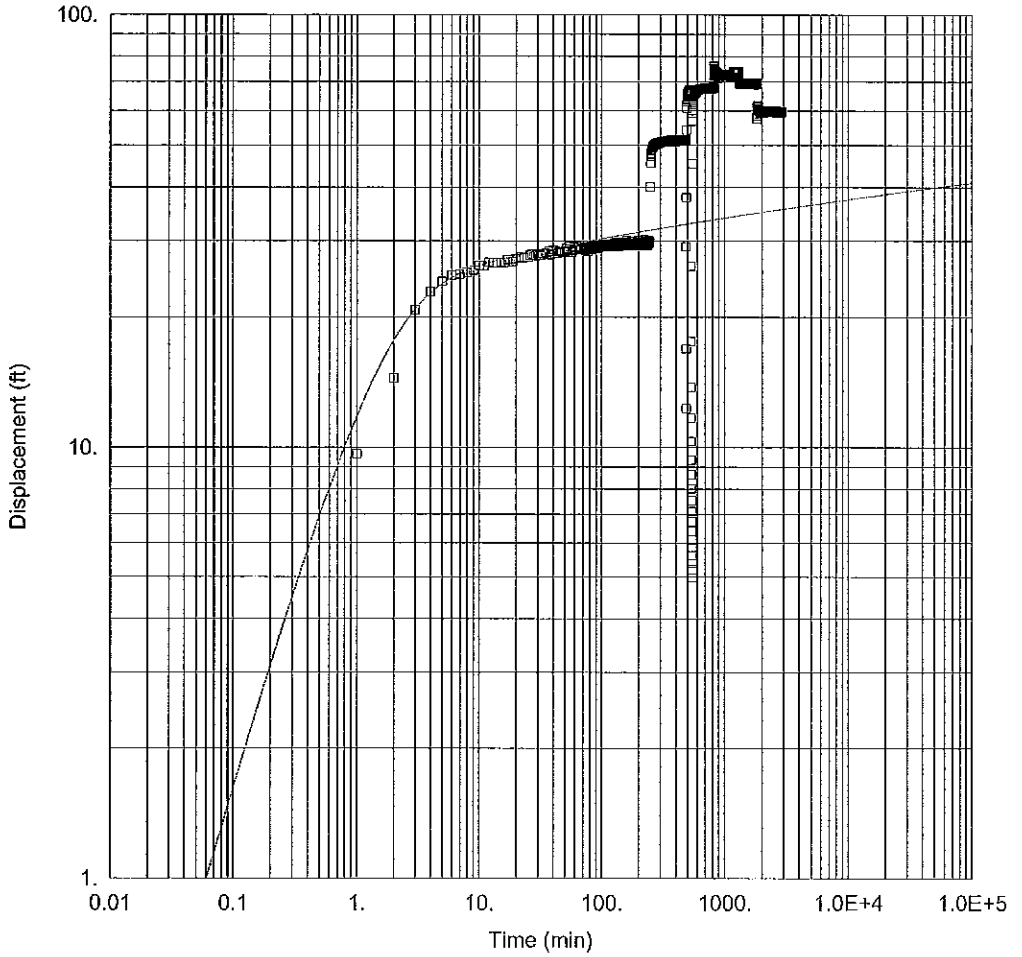
Observation Wells

Well Name	X (ft)	Y (ft)
▫ Princeton #8	2729882	1258266

SOLUTION

Aquifer Model: Leaky
Solution Method: Hantush-Jacob

T = 1947.5 ft^2/day
S = 0.03822
r/B = 0.02
Kz/Kr = 0.1
b = 65. ft



PRINCETON #8 PUMPING - PRINCETON #8 OBSERVING

Data Set: S:\...\#8 (# 8 ob well) pop-cooper (FINAL).aqt
Date: 02/22/10 Time: 13:39:57

PROJECT INFORMATION

Company: PRNWHP
Client: PRNWHP
Location: Princeton, MN
Test Well: Princeton #8
Test Date: August 2007

AQUIFER DATA

Saturated Thickness: 65. ft Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
Princeton #8	2729882	1258266

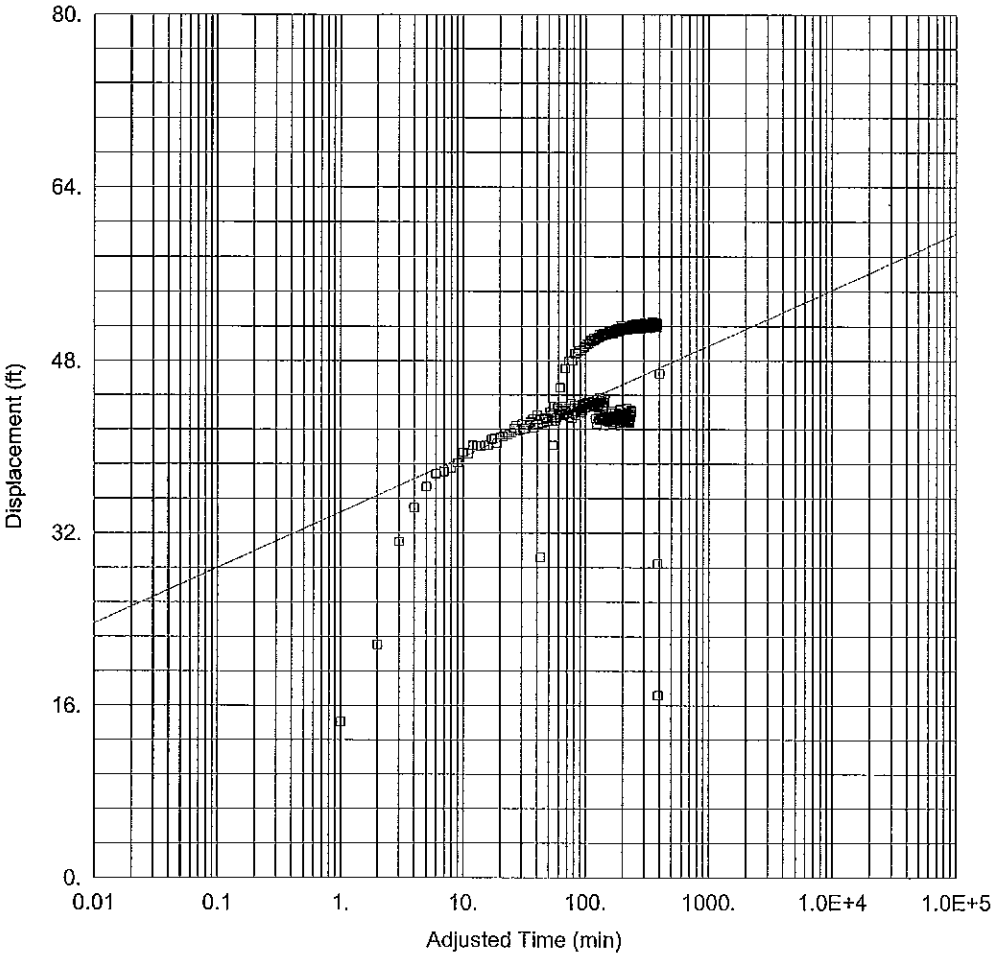
Observation Wells

Well Name	X (ft)	Y (ft)
▫ Princeton #8	2729882	1258266

SOLUTION

Aquifer Model: Confined Solution Method: Papadopulos-Cooper

T = 4031.7 ft^2/day S = 0.01259
r(w) = 0.01 ft r(c) = 1. ft



PRINCETON #8 PUMPING - PRINCETON #8 OBSERVING

Data Set: S:\...\#8 (# 8 ob well) cooper-jacob (FINAL).aqt
Date: 02/22/10 Time: 13:39:29

PROJECT INFORMATION

Company: PRNWHP
Client: PRNWHP
Location: Princeton, MN
Test Well: Princeton #8
Test Date: August 2007

AQUIFER DATA

Saturated Thickness: 65. ft Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
Princeton #8	2729882	1258266

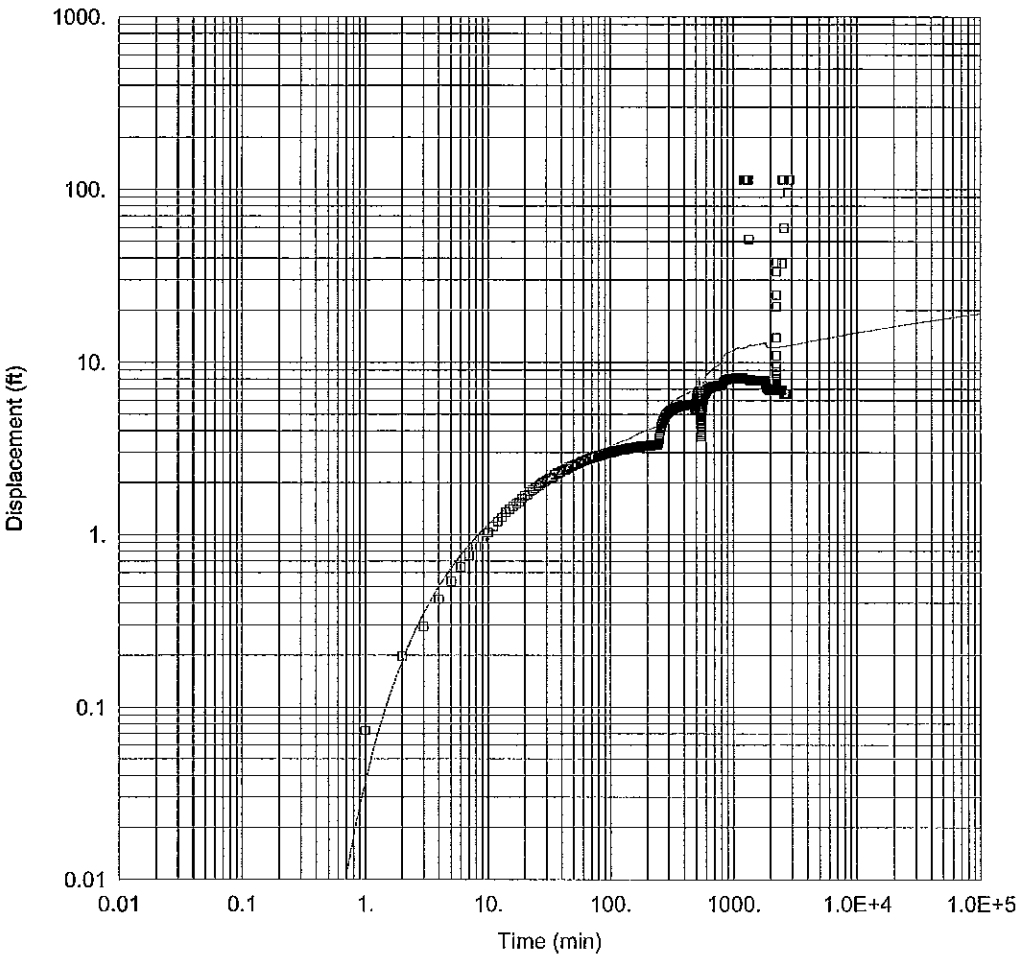
Observation Wells

Well Name	X (ft)	Y (ft)
Princeton #8	2729882	1258266

SOLUTION

Aquifer Model: Confined Solution Method: Cooper-Jacob

T = 4106.9 ft^2/day S = 3.239E-6



PRINCETON #8 PUMPING - PRINCETON #9 OBSERVING

Data Set: S:\...\#8 (# 9 ob well) theis (FINAL).aqt
Date: 02/22/10 Time: 14:03:50

PROJECT INFORMATION

Company: PRNWHP
Client: PRNWHP
Location: Princeton, MN
Test Well: Princeton #8
Test Date: August 2007

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
Princeton #8	2729882	1258266

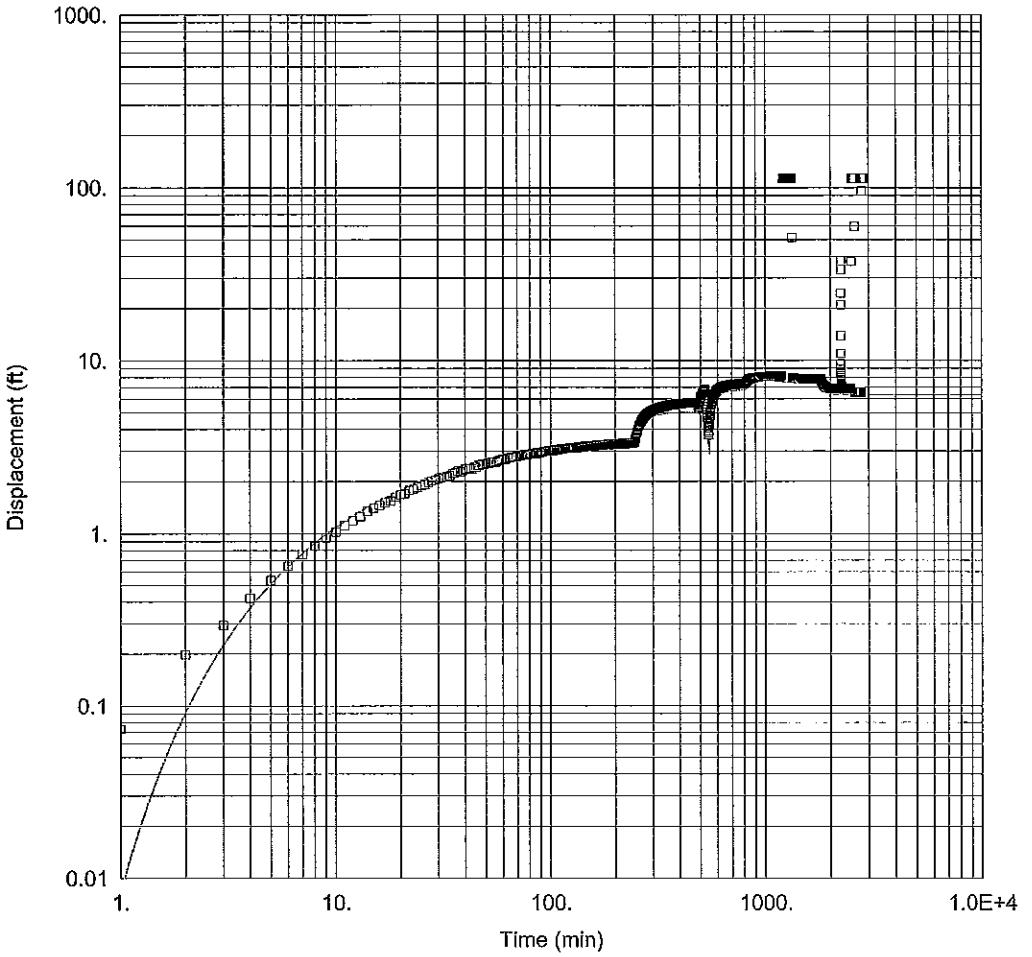
Observation Wells

Well Name	X (ft)	Y (ft)
▫ Princeton #9	2729890	1257639

SOLUTION

Aquifer Model: Confined
Solution Method: Theis

T = 6114.2 ft^2/day
S = 9.545E-5
Kz/Kr = 0.1
b = 65. ft



PRINCETON #8 PUMPING - PRINCETON #9 OBSERVING

Data Set: S:\...\#8 (# 9 ob well) hantush leaky (FINAL).aqt
Date: 02/22/10 Time: 13:57:14

PROJECT INFORMATION

Company: PRNWHP
Client: PRNWHP
Location: Princeton, MN
Test Well: Princeton #8
Test Date: August 2007

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
Princeton #8	2729882	1258266

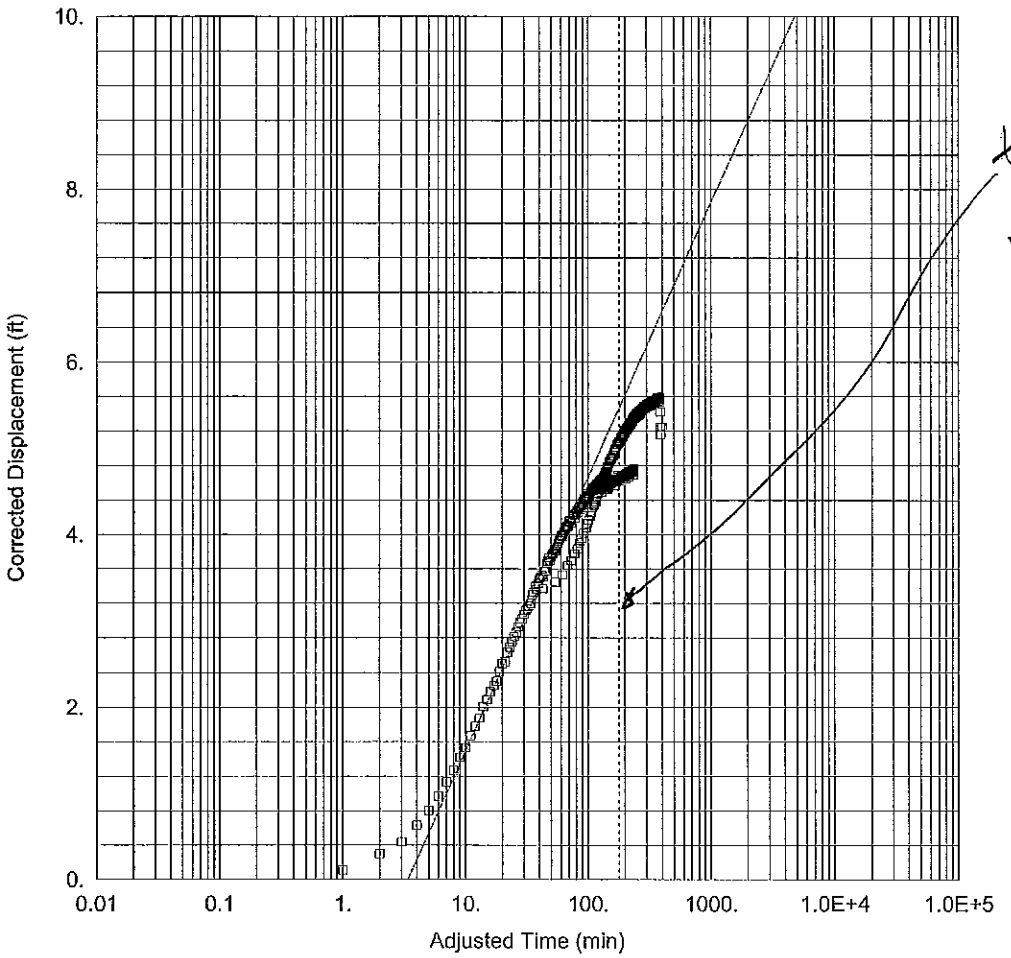
Observation Wells

Well Name	X (ft)	Y (ft)
▫ Princeton #9	2729890	1257639

SOLUTION

Aquifer Model: Leaky
Solution Method: Hantush-Jacob

T = 4022.3 ft^2/day
S = 0.0001049
r/B = 0.4
Kz/Kr = 0.1
b = 65. ft



PRINCETON #8 PUMPING - PRINCETON #9 OBSERVING

Data Set: S:\...\#8 (# 9 ob well) cooper-jacob (FINAL).aqt
Date: 02/22/10 Time: 13:40:36

PROJECT INFORMATION

Company: PRNWHP
Client: PRNWHP
Location: Princeton, MN
Test Well: Princeton #8
Test Date: August 2007

AQUIFER DATA

Saturated Thickness: 100. ft Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
Princeton #8	2729882	1258266

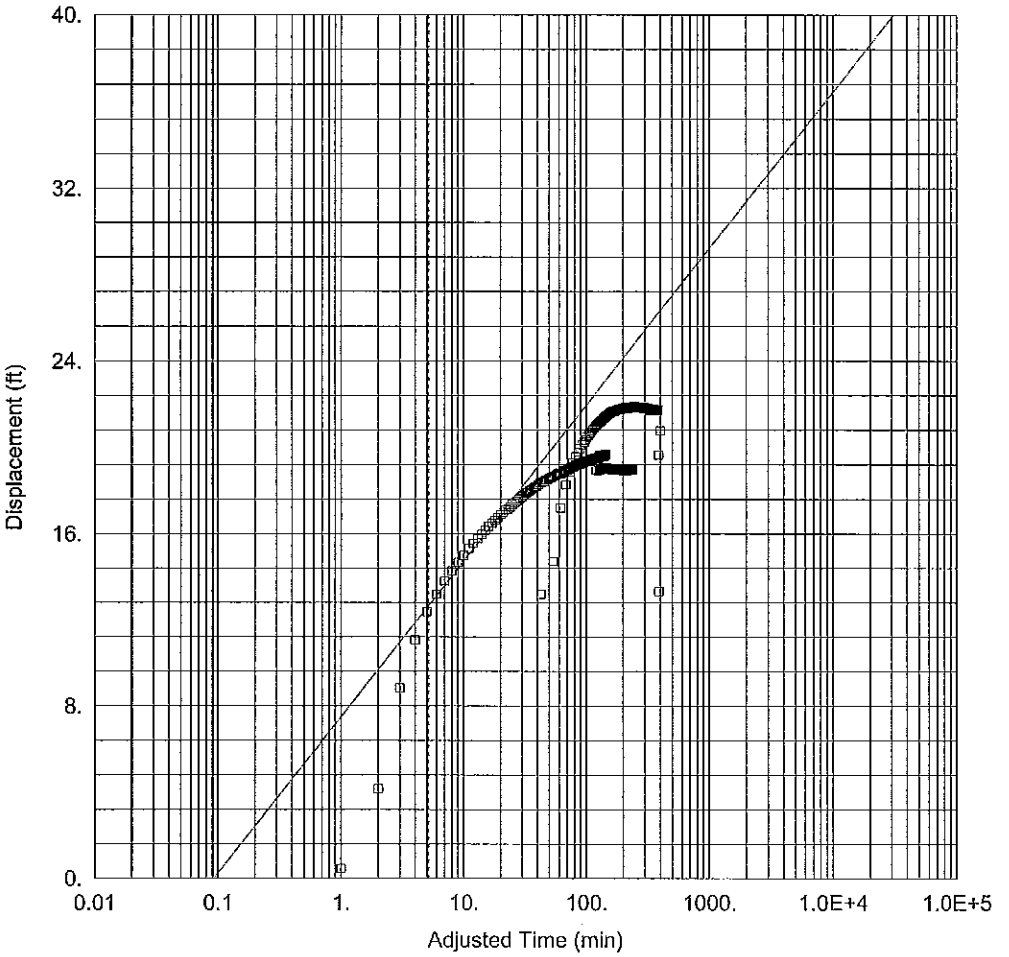
Observation Wells

Well Name	X (ft)	Y (ft)
▫ Princeton #9	2729890	1257639

SOLUTION

Aquifer Model: Unconfined Solution Method: Cooper-Jacob

T = 6670.1 ft^2/day S = 8.939E-5



used

PRINCETON #8 PUMPING - PRINCETON TW-8 OBSERVING

Data Set: S:\...\#8 (TW-8 ob well) copper-jacob (FINAL).aqt
Date: 02/22/10 Time: 14:16:14

PROJECT INFORMATION

Company: PRNWHP
Client: PRNWHP
Location: Princeton, MN
Test Well: Princeton #8
Test Date: August 2007

AQUIFER DATA

Saturated Thickness: 65. ft Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
Princeton #8	2729882	1258266

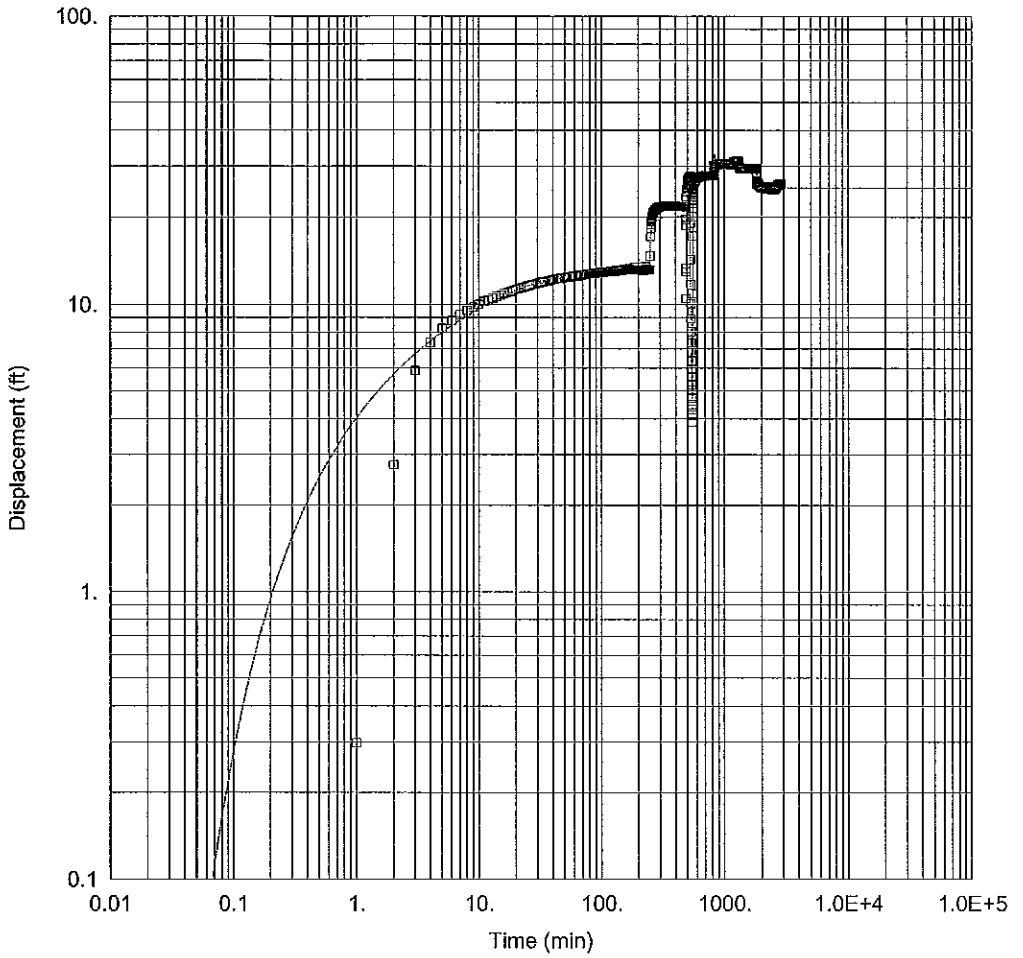
Observation Wells

Well Name	X (ft)	Y (ft)
▫ Princeton TW-8	2729892	1258304

SOLUTION

Aquifer Model: Confined Solution Method: Cooper-Jacob

T = 2924.4 ft^2/day S = 0.0002723



PRINCETON #8 PUMPING - PRINCETON TW-8 OBSERVING

Data Set: S:\...\#8 (TW-8 ob well) hantush leaky (FINAL).aqt
Date: 02/22/10 Time: 14:21:31

PROJECT INFORMATION

Company: PRNWHP
Client: PRNWHP
Location: Princeton, MN
Test Well: Princeton #8
Test Date: August 2007

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
Princeton #8	2729882	1258266

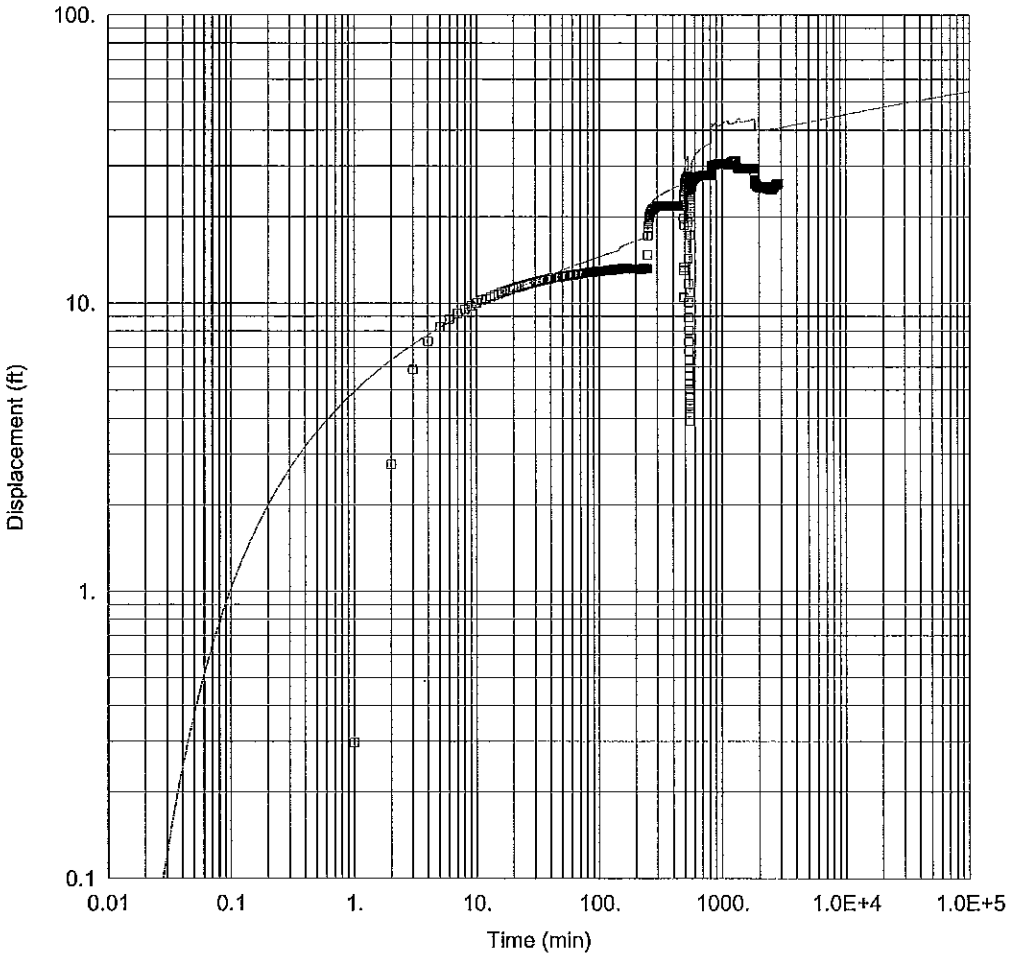
Observation Wells

Well Name	X (ft)	Y (ft)
▫ Princeton TW-8	2729892	1258304

SOLUTION

Aquifer Model: Leaky
Solution Method: Hantush-Jacob

T = 2216.2 ft^2/day
S = 0.000594
r/B = 0.1
Kz/Kr = 0.1
b = 65. ft



PRINCETON #8 PUMPING - PRINCETON TW-8 OBSERVING

Data Set: S:\...\#8 (TW-8 ob well) theis (FINAL).aqt
Date: 02/22/10 Time: 14:24:18

PROJECT INFORMATION

Company: PRNWHP
Client: PRNWHP
Location: Princeton, MN
Test Well: Princeton #8
Test Date: August 2007

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
Princeton #8	2729882	1258266

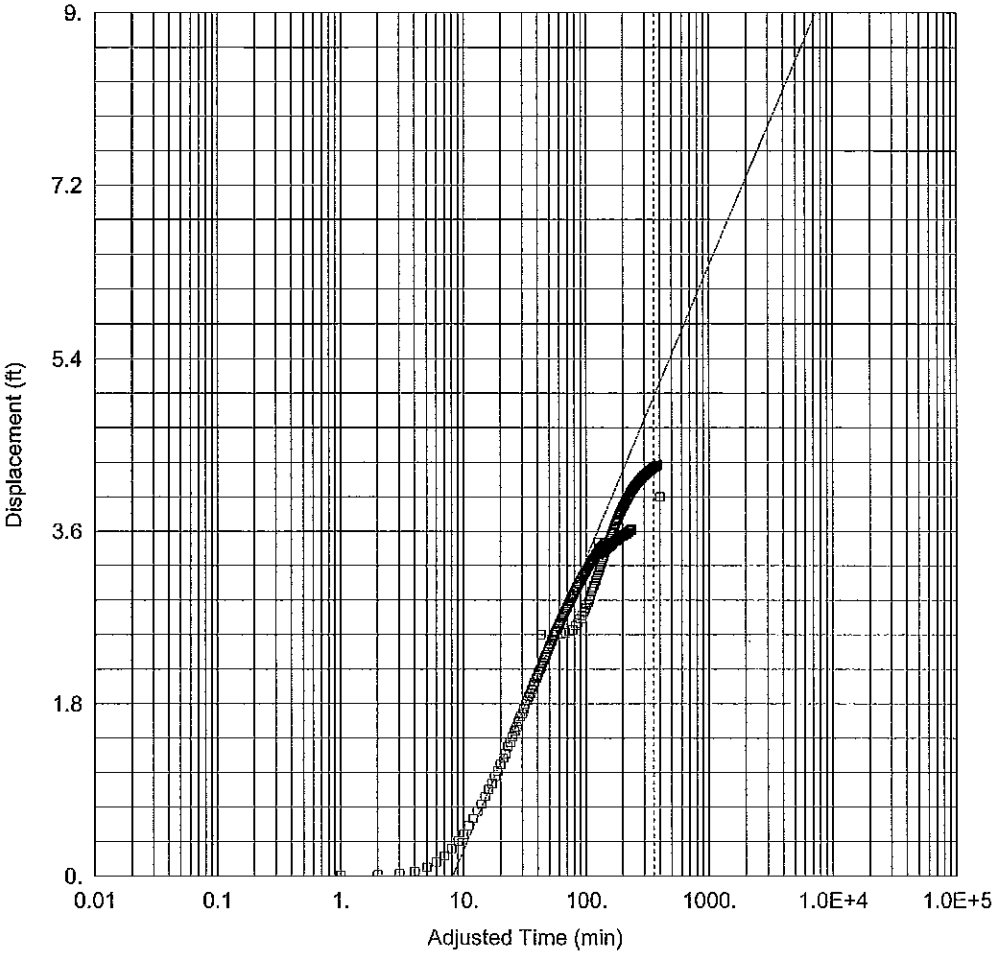
Observation Wells

Well Name	X (ft)	Y (ft)
▫ Princeton TW-8	2729892	1258304

SOLUTION

Aquifer Model: Confined
Solution Method: Theis

T = 2927.1 ft^2/day
S = 0.0002952
Kz/Kr = 0.1
b = 65. ft



not valid

PRINCETON #8 PUMPING - PRINCETON STEPHENS 638482 OBSERVING

Data Set: S:\...\# 8 (Stephens) cooper-jacob (FINAL).aqt
Date: 02/22/10 Time: 14:29:54

PROJECT INFORMATION

Company: PRNWHP
Client: PRNWHP
Location: Princeton, MN
Test Well: Princeton #8
Test Date: August 2007

AQUIFER DATA

Saturated Thickness: 65. ft Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
Princeton #8	2729882	1258266

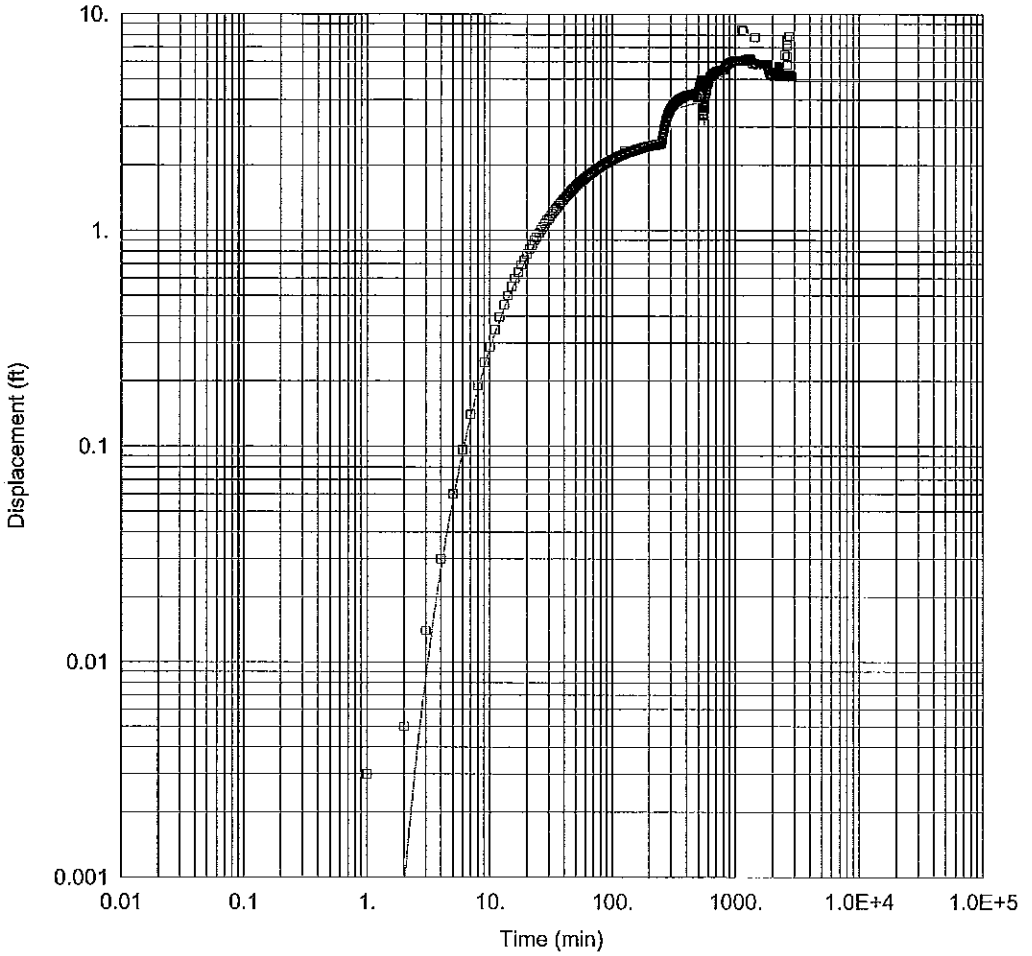
Observation Wells

Well Name	X (ft)	Y (ft)
Princeton Stephens 6384	2729476	1257763

SOLUTION

Aquifer Model: Confined Solution Method: Cooper-Jacob

T = 6942.4 ft^2/day S = 0.0002119



PRINCETON #8 PUMPING - PRINCETON STEPHENS 638482 OBSERVING

Data Set: S:\...\# 8 (Stephens) hantush leaky (FINAL).aqt
Date: 02/22/10 Time: 14:30:42

PROJECT INFORMATION

Company: PRNWHP
Client: PRNWHP
Location: Princeton, MN
Test Well: Princeton #8
Test Date: August 2007

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
Princeton #8	2729882	1258266

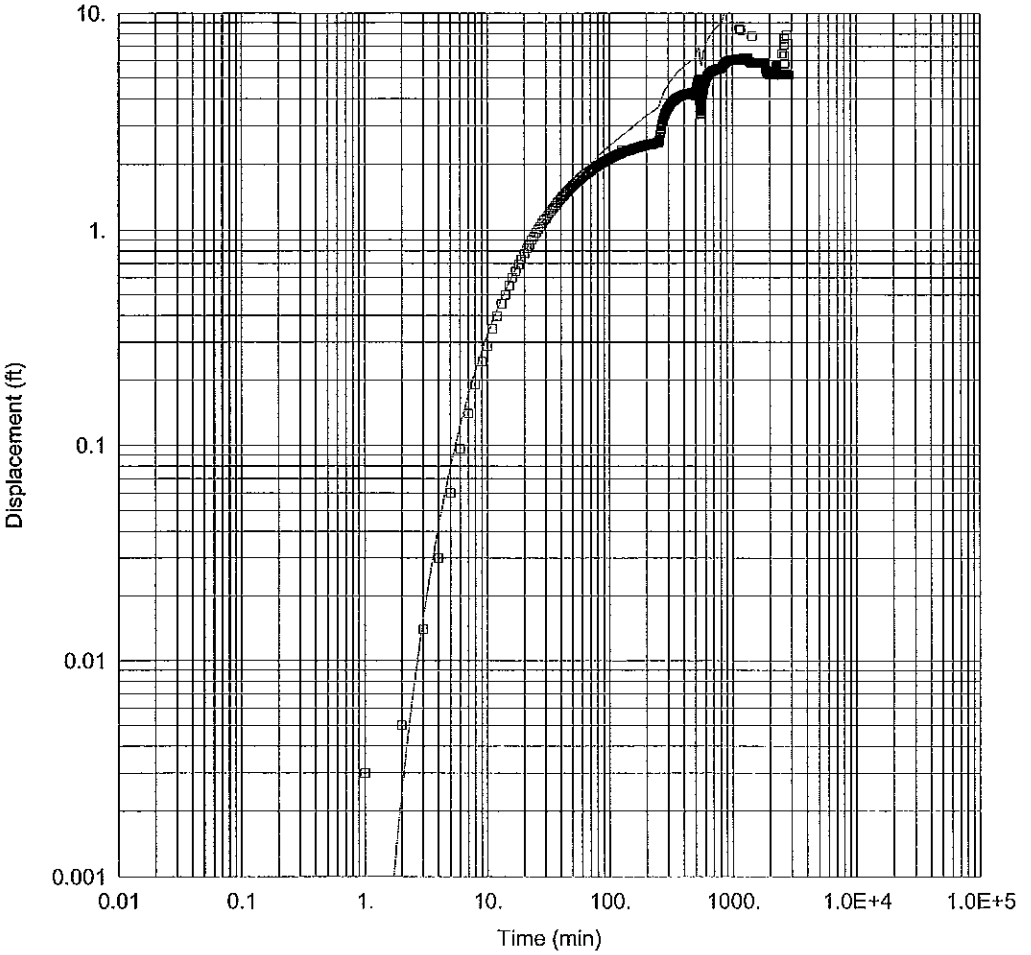
Observation Wells

Well Name	X (ft)	Y (ft)
▫ Princeton Stephens 6384	2729476	1257763

SOLUTION

Aquifer Model: Leaky
Solution Method: Hantush-Jacob

T = 3661.5 ft^2/day
S = 0.0002739
r/B = 0.6
Kz/Kr = 0.1
b = 65. ft



PRINCETON #8 PUMPING - PRINCETON STEPHENS 638482 OBSERVING

Data Set: S:\...\# 8 (Stephens) theis early (FINAL).aqt
Date: 02/22/10 Time: 14:31:02

PROJECT INFORMATION

Company: PRNWHP
Client: PRNWHP
Location: Princeton, MN
Test Well: Princeton #8
Test Date: August 2007

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
Princeton #8	2729882	1258266

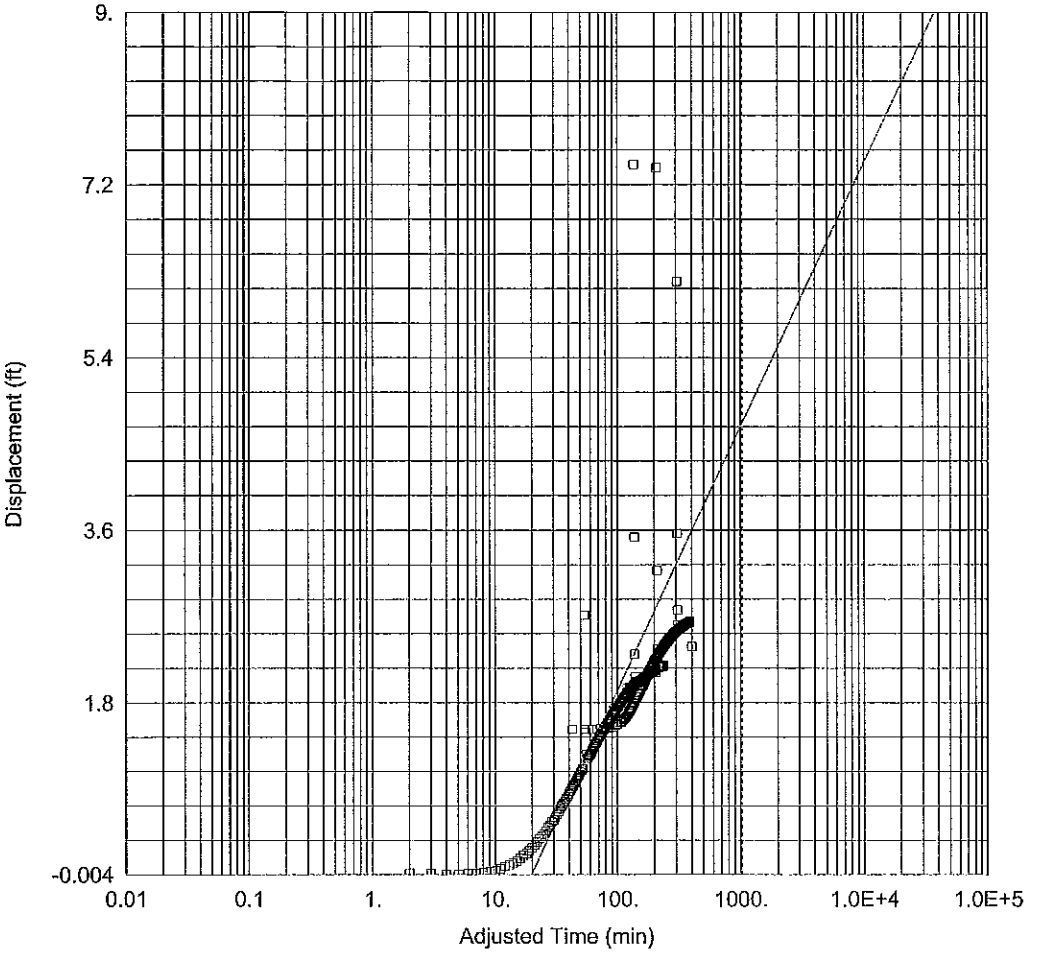
Observation Wells

Well Name	X (ft)	Y (ft)
▫ Princeton Stephens 6384	2729476	1257763

SOLUTION

Aquifer Model: Confined
Solution Method: Theis

T = 4789.9 ft^2/day
S = 0.0002908
Kz/Kr = 0.1
b = 65. ft



not used

PRINCETON #8 PUMPING - PRINCETON MILLER PRO 601770 OBSERVING

Data Set: S:\...\# 8 (miller) cooper jacob (FINAL).aqt
Date: 02/22/10 Time: 14:25:55

PROJECT INFORMATION

Company: PRNWHP
Client: PRNWHP
Location: Princeton, MN
Test Well: Princeton #8
Test Date: August 2007

AQUIFER DATA

Saturated Thickness: 65. ft Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
Princeton #8	2729882	1258266

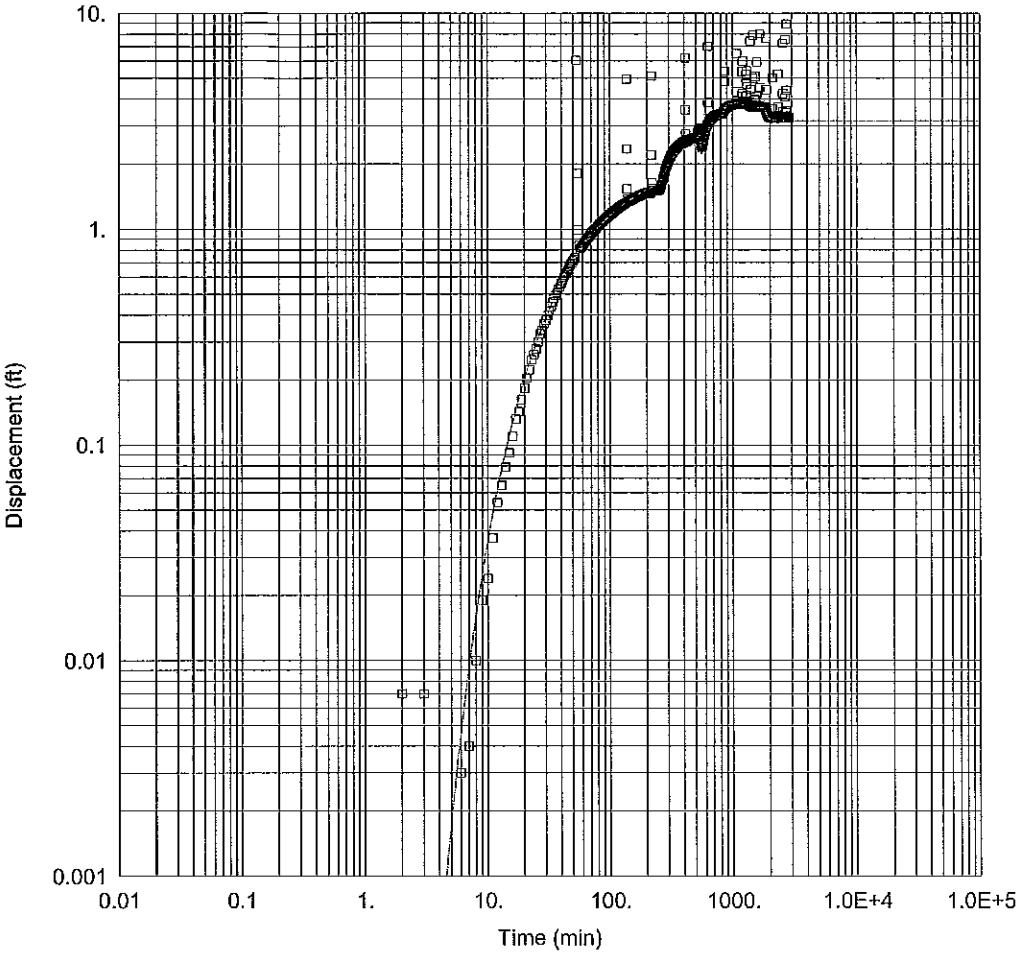
Observation Wells

Well Name	X (ft)	Y (ft)
▫ Princeton Miller Pro 601770	2728943	1258131

SOLUTION

Aquifer Model: Confined Solution Method: Cooper-Jacob

T = 7693.8 ft^2/day S = 0.0002653



PRINCETON #8 PUMPING - PRINCETON MILLER PRO 601770 OBSERVING

Data Set: S:\...\# 8 (miller) hantush leaky (FINAL).aqt
Date: 02/22/10 Time: 14:26:26

PROJECT INFORMATION

Company: PRNWHP
Client: PRNWHP
Location: Princeton, MN
Test Well: Princeton #8
Test Date: August 2007

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
Princeton #8	2729882	1258266

Observation Wells

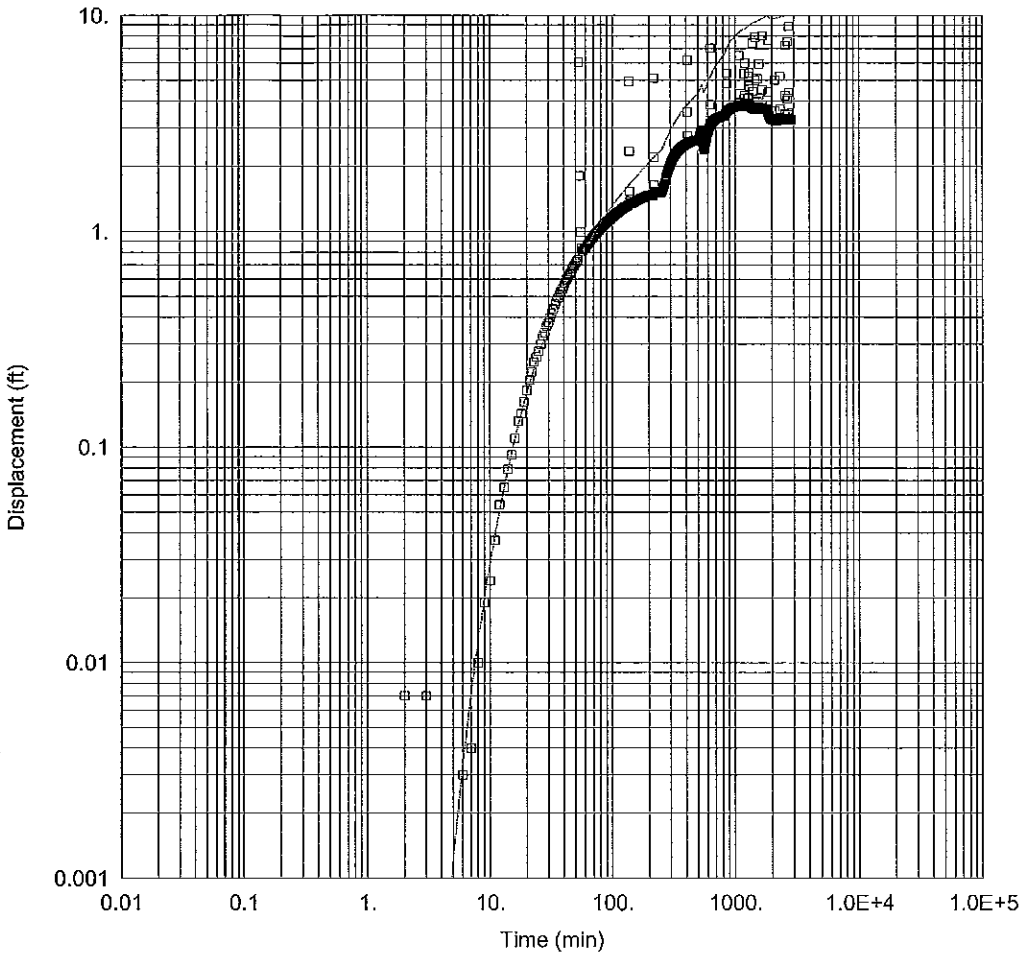
Well Name	X (ft)	Y (ft)
▫ Princeton Miller Pro 6017	7(2728943	1258131

SOLUTION

Aquifer Model: Leaky
Solution Method: Hantush-Jacob

T = 4108.3 ft^2/day
r/B = 0.8
b = 65. ft

S = 0.0003143
Kz/Kr = 0.1



PRINCETON #8 PUMPING - PRINCETON MILLER PRO 601770 OBSERVING

Data Set: S:\...\# 8 (miller) theis early (FINAL).aqt
Date: 02/22/10 Time: 14:27:36

PROJECT INFORMATION

Company: PRNWHP
Client: PRNWHP
Location: Princeton, MN
Test Well: Princeton #8
Test Date: August 2007

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
Princeton #8	2729882	1258266

Observation Wells

Well Name	X (ft)	Y (ft)
▫ Princeton Miller Pro 6017	7(2728943	1258131

SOLUTION

Aquifer Model: Confined
Solution Method: Theis

T = 4749.2 ft^2/day
S = 0.0003772
Kz/Kr = 0.1
b = 65. ft

APPENDIX IV

Well Vulnerability Sheets

625 Robert St. N. St. Paul MN 55155
P.O. Box 64975 St. Paul MN 55164 - 0975

MINNESOTA DEPARTMENT OF HEALTH
SECTION OF DRINKING WATER PROTECTION
SWP Vulnerability Rating

PWSID: 1480008 TIER: 1
SYSTEM NAME: Princeton WHP RANK:
WELL NAME: Well #2 UNIQUE WELL #: 00219478

COUNTY: Mille Lacs TOWNSHIP NUMBER: 36 RANGE: 26 W SECTION: 33 QUARTERS: ABDCAC

CRITERIA		DESCRIPTION		POINTS
Aquifer Name(s)	:	Quaternary Buried Artesian		
DNR Geologic Sensitivity Rating	:	Low		20
L Score	:	2		
Geologic Data From	:	Well Record		
Year Constructed	:	1948		
Construction Method	:	Cable Tool/Bored		0
Casing Depth	:	142		10
Well Depth	:	162		
Casing grouted into borehole?		Unknown		0
Cement grout between casings?		Not applicable		0
All casings extend to land surface?		Yes		0
Gravel - packed casings?		No		0
Wood or masonry casing?		No		0
Holes or cracks in casing?		Unknown		0
Isolation distance violations?				0
Pumping Rate	:	255		5
Pathogen Detected?				0
Surface Water Characteristics?				0
Maximum nitrate detected	:	.72 05/04/2005		0
Maximum tritium detected	:	Unknown		0
Non-THMS VOCs detected?		1,2-Dichloroethane	11/01/1991	VULNERABLE
		1,1,1-Trichloroethane	11/01/1991	
		Carbon tetrachloride	01/29/1992	
Pesticides detected?				0
Carbon 14 age	:	Unknown		0
Wellhead Protection Score	:			35
Wellhead Protection Vulnerability Rating	:			VULNERABLE
Vulnerability Overridden	:			

COMMENTS

1,2-DCA also detected 4/27/2007.
1,1,1-TCA and Carbon Tetrachloride were non-detect 4/27/2007.

625 Robert St. N. St. Paul MN 55155
P.O. Box 64975 St. Paul MN 55164 - 0975

MINNESOTA DEPARTMENT OF HEALTH
SECTION OF DRINKING WATER PROTECTION
SWP Vulnerability Rating

PWSID: 1480008 TIER: 1
SYSTEM NAME: Princeton WHP RANK:
WELL NAME: Well #5 UNIQUE WELL #: 00184979

COUNTY: Mille Lacs TOWNSHIP NUMBER: 36 RANGE: 26 W SECTION: 33 QUARTERS: ABADAC

CRITERIA		DESCRIPTION		POINTS
Aquifer Name(s)	:	Quaternary Buried Artesian		
DNR Geologic Sensitivity Rating	:	Medium		25
L Score	:	0		
Geologic Data From	:	Well Record		
Year Constructed	:	1982		
Construction Method	:	Cable Tool/Bored		0
Casing Depth	:	110		10
Well Depth	:	150		
Casing grouted into borehole?		Yes		0
Cement grout between casings?		Not applicable		0
All casings extend to land surface?		Yes		0
Gravel - packed casings?		No		0
Wood or masonry casing?		No		0
Holes or cracks in casing?		Unknown		0
Isolation distance violations?				0
Pumping Rate	:	375		5
Pathogen Detected?				0
Surface Water Characteristics?				0
Maximum nitrate detected	:	.11 09/10/1998		0
Maximum tritium detected	:	Unknown		0
Non-THMS VOCs detected?		1,2-Dichloroethane	01/22/1992	VULNERABLE
Pesticides detected?				0
Carbon 14 age	:	Unknown		0
Wellhead Protection Score	:			40
Wellhead Protection Vulnerability Rating	:			VULNERABLE

Vulnerability Overridden :

COMMENTS

625 Robert St. N. St. Paul MN 55155
P.O. Box 64975 St. Paul MN 55164 - 0975

MINNESOTA DEPARTMENT OF HEALTH
SECTION OF DRINKING WATER PROTECTION
SWP Vulnerability Rating

PWSID: 1480008 TIER: 1
SYSTEM NAME: Princeton WHP RANK:
WELL NAME: Well #7 UNIQUE WELL #: 00578949

COUNTY: Mille Lacs TOWNSHIP NUMBER: 36 RANGE: 26 W SECTION: 33 QUARTERS: BDBA

CRITERIA		DESCRIPTION	POINTS
Aquifer Name(s)	:	Quaternary Buried Artesian	
DNR Geologic Sensitivity Rating	:	Low	20
L Score	:	3	
Geologic Data From	:	Well Record	
Year Constructed	:	1998	
Construction Method	:	Cable Tool/Bored	0
Casing Depth	:	129	10
Well Depth	:	169	
Casing grouted into borehole?		Yes	0
Cement grout between casings?		Yes	0
All casings extend to land surface?		Yes	0
Gravel - packed casings?		No	0
Wood or masonry casing?		No	0
Holes or cracks in casing?		Unknown	0
Isolation distance violations?			0
Pumping Rate	:	750	10
Pathogen Detected?			0
Surface Water Characteristics?			0
Maximum nitrate detected	:	<.05 08/04/2004	0
Maximum tritium detected	:	18.8 08/15/2000	VULNERABLE
Non-THMS VOCs detected?			0
Pesticides detected?			0
Carbon 14 age	:	Unknown	0
Wellhead Protection Score	:		40
Wellhead Protection Vulnerability Rating	:		VULNERABLE
Vulnerability Overridden	:		

COMMENTS

625 Robert St. N. St. Paul MN 55155
P.O. Box 64975 St. Paul MN 55164 - 0975

MINNESOTA DEPARTMENT OF HEALTH
SECTION OF DRINKING WATER PROTECTION
SWP Vulnerability Rating

PWSID: 1480008 TIER: 1
SYSTEM NAME: Princeton WHP RANK:
WELL NAME: Well #8 UNIQUE WELL #: 00751504

COUNTY: Mille Lacs TOWNSHIP NUMBER: 35 RANGE: 26 W SECTION: 4 QUARTERS: CBADBA

CRITERIA		DESCRIPTION	POINTS
Aquifer Name(s)	:	Quaternary Buried Artesian	
DNR Geologic Sensitivity Rating	:	High	0
L Score	:	0	
Geologic Data From	:	Well Record	
Year Constructed	:	2007	
Construction Method	:	Rotary/Drilled	0
Casing Depth	:	104	10
Well Depth	:	139	
Casing grouted into borehole?		Not applicable	0
Cement grout between casings?		Not applicable	0
All casings extend to land surface?		Yes	0
Gravel - packed casings?		Not applicable	0
Wood or masonry casing?		No	0
Holes or cracks in casing?		No	0
Isolation distance violations?			0
Pumping Rate	:	750	10
Pathogen Detected?			0
Surface Water Characteristics?			0
Maximum nitrate detected	:	Unknown	0
Maximum tritium detected	:	16.1 09/23/2008	VULNERABLE
Non-THMS VOCs detected?			0
Pesticides detected?			0
Carbon 14 age	:	Unknown	0
Wellhead Protection Score	:		20
Wellhead Protection Vulnerability Rating	:		VULNERABLE
Vulnerability Overridden	:		

COMMENTS

625 Robert St. N. St. Paul MN 55155
P.O. Box 64975 St. Paul MN 55164 - 0975

MINNESOTA DEPARTMENT OF HEALTH
SECTION OF DRINKING WATER PROTECTION
SWP Vulnerability Rating

PWSID: 1480008 TIER: 1
SYSTEM NAME: Princeton WHP RANK:
WELL NAME: Well #9 UNIQUE WELL #: 00749848

COUNTY: Mille Lacs TOWNSHIP NUMBER: 35 RANGE: 26 W SECTION: 4 QUARTERS: CBDDBB

CRITERIA		DESCRIPTION	POINTS
Aquifer Name(s)	:	Quaternary Buried Unconfined	
DNR Geologic Sensitivity Rating	:	High	0
L Score	:	0	
Geologic Data From	:	Well Record	
Year Constructed	:	2007	
Construction Method	:	Rotary/Drilled	0
Casing Depth	:	135	10
Well Depth	:	160	
Casing grouted into borehole?		Unknown	5
Cement grout between casings?		Not applicable	0
All casings extend to land surface?		Yes	0
Gravel - packed casings?		Not applicable	0
Wood or masonry casing?		No	0
Holes or cracks in casing?		No	0
Isolation distance violations?			0
Pumping Rate	:	750	10
Pathogen Detected?			0
Surface Water Characteristics?			0
Maximum nitrate detected	:	Unknown	0
Maximum tritium detected	:	15.8 09/23/2008	VULNERABLE
Non-THMS VOCs detected?			0
Pesticides detected?			0
Carbon 14 age	:	Unknown	0
Wellhead Protection Score	:		25
Wellhead Protection Vulnerability Rating	:		VULNERABLE

Vulnerability Overridden :

COMMENTS

Appendix D

Environmental Health Division
Drinking Water Protection Section
P.O. Box 64975
St. Paul, Minnesota 55164-0975

INNER WELLHEAD MANAGEMENT ZONE (IWMZ) - POTENTIAL CONTAMINANT SOURCE INVENTORY (PCSI) REPORT

PUBLIC WATER SYSTEM INFORMATION

PWS ID	1480008 **COMMUNITY**
NAME	Princeton
ADDRESS	Princeton Public Utilities Commission, 907 First Street, P.O. Box 218, Princeton, MN 55371

FACILITY (WELL) INFORMATION

NAME	Well #7
SAMPLE POINT ID	S08
UNIQUE WELL NO.	578949
COUNTY	Mille Lacs

IS THERE A WELL LOG OR ADDITIONAL CONSTRUCTION INFORMATION AVAILABLE?

☐ **YES** (Please attach a copy)
☐ **NO** ☐ **UNDETERMINED**

PWS ID / SAMPLE POINT ID	1480008 S08	**UNIQUE WELL NO.**	578949

PCSI CODE	ACTUAL OR POTENTIAL CONTAMINATION SOURCE	ISOLATION DISTANCES (FEET)				LOCATION	
		Minimum Distances		Sensitive Well[1]	Within 200 Ft. Y / N / U	Dist. from Well	Est. (?)
		Community	Non-community				
Agricultural Related							
*AC1	Agricultural chemical buried piping	50	50		N		
*AC2	Agricultural chemical multiple tanks or containers for residential retail sale or use, no single tank or container exceeding, but aggregate volume exceeding 56 gal. or 100 lbs. dry weight	50	50		N		
ACP	Agricultural chemical tank or container with 25 gal. or more or 100 lbs. or more dry weight, or equipment filling or cleaning area without safeguards	150	150		N		
ACS	Agricultural chemical storage or equipment filling or cleaning area with safeguards	100	100		N		
ACR	Agricultural chemical storage or equipment filling or cleaning area with safeguards and roofed	50	50		N		
ADW	Agricultural drainage well[2] (Class V well - illegal[3])	50	50		N		
AAT	Anhydrous ammonia tank (stationary tank)	50	50		N		
AB1	Animal building, feedlot, confinement area, or kennel, 0.1 to 1.0 animal unit (stockyard)	50	20	100/40	N		
AB2	Animal building or poultry building, including a horse riding area, more than 1.0 animal unit	50	50	100	N		
ABS	Animal burial area, more than 1.0 animal unit	50	50		N		
FWP	Animal feeding or watering area within a pasture, more than 1.0 animal unit	50	50	100	N		
AF1	Animal feedlot, unroofed, 300 or more animal units (stockyard)	100	100	200	N		
AF2	Animal feedlot, more than 1.0, but less than 300 animal units (stockyard)	50	50	100	N		
AMA	Animal manure application	use discretion	use discretion		N		
REN	Animal rendering plant	50	50		N		
MS1	Manure (liquid) storage basin or lagoon, unpermitted or noncertified	300	300	600	N		
MS2	Manure (liquid) storage basin or lagoon, approved earthen liner	150	150	300	N		
MS3	Manure (liquid) storage basin or lagoon, approved concrete or composite liner	100	100	200	N		
MS4	Manure (solid) storage area, not covered with a roof	100	100	200	N		
OSC	Open storage for crops	use discretion	use discretion		N		
SSTS Related							
AA1	Absorption area of a soil dispersal system, average flow greater than 10,000 gal./day	300	300	600	N		
AA2	Absorption area of a soil dispersal system serving a facility handling infectious or pathological wastes, average flow 10,000 gal./day or less	150	150	300	N		
AA3	Absorption area of a soil dispersal system, average flow 10,000 gal./day or less	50	50	100	N		
AA4	Absorption area of a soil dispersal system serving multiple family residences or a non-residential facility and has the capacity to serve 20 or more persons per day (Class V well)[2]	50/300/150[4]	50/300/150[4]	100/600/300[4]	N		
CSP	Cesspool	75	75	150	N		
AGG	Dry well, leaching pit, seepage pit	75	75	150	N		
*FD1	Floor drain, grate, or trough connected to a buried sewer	50	50		N		
*FD2	Floor drain, grate, or trough if buried sewer is air-tested, approved materials, serving one building, or two or less single-family residences	50	20		N		

PWS ID / SAMPLE POINT ID	1480008 S08	UNIQUE WELL NO.	578949

PCSI CODE	ACTUAL OR POTENTIAL CONTAMINATION SOURCE	ISOLATION DISTANCES (FEET)				LOCATION	
		Minimum Distances		Sensitive Well[1]	Within 200 Ft. Y / N / U	Dist. from Well	Est. (?)
		Community	Non-community				
*GW1	Gray-water dispersal area	50	50	100	N		
LC1	Large capacity cesspools (Class V well - illegal)[2]	75	75	150	N		
MVW	Motor vehicle waste disposal (Class V well - illegal)[2]	illegal	illegal		N		
PR1	Privy, nonportable	50	50	100	N		
PR2	Portable (privy) or toilet	50	20		N		
*SF1	Watertight sand filter; peat filter; or constructed wetland	50	50		N		
SET	Septic tank	50	50		N		
HTK	Sewage holding tank, watertight	50	50		N		
SS1	Sewage sump capacity 100 gal. or more	50	50		N		
SS2	Sewage sump capacity less than 100 gal., tested, conforming to rule	50	20		N		
*ST1	Sewage treatment device, watertight	50	50		N		
SB1	Sewer, buried, approved materials, tested, serving one building, or two or less single-family residences	50	20		Y	120	N
SB1	Sewer, buried, approved materials, tested, serving one building, or two or less single-family residences	50	20		Y	105	N
SB1	Sewer, buried, approved materials, tested, serving one building, or two or less single-family residences	50	20		Y	150	N
SB1	Sewer, buried, approved materials, tested, serving one building, or two or less single-family residences	50	20		Y	118	N
SB1	Sewer, buried, approved materials, tested, serving one building, or two or less single-family residences	50	20		Y	190	N
SB2	Sewer, buried, collector, municipal, serving a facility handling infectious or pathological wastes, open-jointed or unapproved materials	50	50		N		
*WB1	Water treatment backwash holding basin, reclaim basin, or surge tank with a direct sewer connection	50	50		N		
*WB2	Water treatment backwash holding basin, reclaim basin, or surge tank with a backflow protected sewer connection	20	20		N		
Land Application							
SPT	Land spreading area for sewage, septage, or sludge	50	50	100	N		
Solid Waste Related							
COS	Commercial compost site	50	50		N		
CD1	Construction or demolition debris disposal area	50	50	100	N		
*HW1	Household solid waste disposal area, single residence	50	50	100	N		
LF1	Landfill, permitted demolition debris, dump, or mixed municipal solid waste from multiple persons	300	300	600	N		
SVY	Scrap yard	50	50		N		
SWT	Solid waste transfer station	50	50		N		
Storm Water Related							
SD1	Storm water drain pipe, 8 inches or greater in diameter	50	20		N		
SWI	Storm water drainage well[2] (Class V well - illegal[3])	50	50		N		
SM1	Storm water pond greater than 5000 gal.	50	35		N		
Wells and Borings							
*EB1	Elevator boring, not conforming to rule	50	50		N		
*EB2	Elevator boring, conforming to rule	20	20		N		
MON	Monitoring well	record dist.	record dist.		N		
WEL	Operating well	record dist.	record dist.		N		
UUW	Unused, unsealed well or boring	50	50		N		
General							
*CR1	Cistern or reservoir, buried, nonpressurized water supply	20	20		N		
PLM	Contaminant plume	50	50		N		
*CW1	Cooling water pond, industrial	50	50	100	N		
DC1	Deicing chemicals, bulk road	50	50	100	N		
*ET1	Electrical transformer storage area, oil-filled	50	50		Y	53	N
*ET1	Electrical transformer storage area, oil-filled	50	50		Y	60	N
*ET1	Electrical transformer storage area, oil-filled	50	50		Y	64	N
*ET1	Electrical transformer storage area, oil-filled	50	50		Y	39	N
GRV	Grave or mausoleum	50	50		N		
GP1	Gravel pocket or French drain for clear water drainage only	20	20		N		
*HS1	Hazardous substance buried piping	50	50		N		

PWS ID / SAMPLE POINT ID	1480008 S08	UNIQUE WELL NO.	578949

PCSI CODE	ACTUAL OR POTENTIAL CONTAMINATION SOURCE	ISOLATION DISTANCES (FEET)				LOCATION	
		Minimum Distances		Sensitive Well[1]	Within 200 Ft. Y / N / U	Dist. from Well	Est. (?)
		Community	Non-community				
HS2	Hazardous substance tank or container, above ground or underground, 56 gal. or more, or 100 lbs. or more dry weight, without safeguards	150	150		N		
HS3	Hazardous substance tank or container, above ground or underground, 56 gal. or more, or 100 lbs. or more dry weight with safeguards	100	100		N		
HS4	Hazardous substance multiple storage tanks or containers for residential retail sale or use, no single tank or container exceeding 56 gal. or 100 lbs., but aggregate volume exceeding	50	50		N		
HWF	Highest water or flood level	50	N/A		N		
*HG1	Horizontal ground source closed loop heat exchanger buried piping	50	50		N		
*HG2	Horizontal ground source closed loop heat exchanger buried piping and horizontal piping, approved materials and heat transfer fluid	50	10		N		
IWD	Industrial waste disposal well (Class V well)[2]	illegal[3]	illegal[3]		N		
IWS	Interceptor, including a flammable waste or sediment	50	50		N		
OH1	Ordinary high water level of a stream, river, pond, lake, reservoir, or drainage ditch (holds water six months or more)	50	35		N		
*PP1	Petroleum buried piping	50	50		N		
*PP2	Petroleum or crude oil pipeline to a refinery or distribution center	100	100		N		
PT1	Petroleum tank or container, 1100 gal. or more, without safeguards	150	150		N		
PT2	Petroleum tank or container, 1100 gal. or more, with safeguards	100	100		N		
PT3	Petroleum tank or container, buried, between 56 and 1100 gal.	50	50		N		
PT4	Petroleum tank or container, not buried, between 56 and 1100 gal.	50[5]	20		N		
PU1	Pit or unfilled space more than four feet in depth	20	20		N		
PC1	Pollutant or contaminant that may drain into the soil	50	50	100	N		
SP1	Swimming pool, in-ground	20	20		N		
*VH1	Vertical heat exchanger, horizontal piping conforming to rule	50	10		N		
*VH2	Vertical heat exchanger (vertical) piping, conforming to rule	50	35		N		
*WR1	Wastewater rapid infiltration basin, municipal or industrial	300	300	600	N		
*WA1	Wastewater spray irrigation area, municipal or industrial	150	150	300	N		
*WS1	Wastewater stabilization pond, industrial	150	150	300	N		
*WS2	Wastewater stabilization pond, municipal, 500 or more gal./acre/day of leakage	300	300	600	N		
*WS3	Wastewater stabilization pond, municipal, less than 500 gal./acre/day of leakage	150	150	300	N		
*WT1	Wastewater treatment unit tanks, vessels and components (Package plant)	100	100		N		
*WT2	Water treatment backwash disposal area	50	50	100	N		
Additional Sources (If there is more than one source listed above, please indicate here).							
Potential Contamination Sources and Codes Based on Previous Versions of this Form							
	none found within 200' of this well.						

PWS ID / SAMPLE POINT ID	1480008 S08	UNIQUE WELL NO.	578949

PCSI CODE	ACTUAL OR POTENTIAL CONTAMINATION SOURCE	ISOLATION DISTANCES (FEET)				LOCATION	
		Minimum Distances		Sensitive Well[1]	Within 200 Ft. Y / N / U	Dist. from Well	Est. (?)
		Community	Non-community				

* New potential contaminant source.

[1] A sensitive well has less than 50 feet of watertight casing, and which is not cased below a confining layer or confining materials of at least 10' in thickness.

[2] These sources, known as Class V underground injection wells, are regulated by the federal U.S. Environmental Protection Agency.

[3] These sources are classified as illegal by Minnesota Rules, Chapter 4725.

[4] Isolation distance is determined by average flow per day or if a facility handles infectious or pathological wastes.

[5] A community public water-supply well must be a minimum of 50 feet from a petroleum tank or container, unless the tank or container is used for emergency pumping and is located in a room or building separate from the community well; and is of double-wall construction with leak detection between walls; or is protected with secondary containment.

This form is based on the new isolation distances in Minnesota Rules, Chapter 4725, related to wells and borings adopted August 4, 2008, and Minnesota Rules, Chapter 4720, related to wellhead protection.

PWS ID / SAMPLE POINT ID	1480008 S08	UNIQUE WELL NO.	578949

SETBACK DISTANCES	All potential contaminant sources must be noted on sketch.

Record the distance and approximate compass bearing of each potential contaminant source from the well, and identify the source using the "Source Code". Unlabeled points on the map are unsealed wells.

	Y	N	N/A
Were the isolation distances maintained for the new sources of contamination?	X		
Is the system monitoring existing nonconforming sources of contamination?			X

Reminder Question: Were the wellhead protection measure(s) implemented?

INSPECTOR	Breth, Katie	DATE	10 - 17 - 2022

PWS ID / SAMPLE POINT ID	1480008 S08	UNIQUE WELL NO.	578949

RECOMMENDED WELLHEAD PROTECTION (WHP) MEASURES	WHP MEASURE IMPLEMENTED? Y or N	DATE VERIFIED

COMMENTS

Backwash water tank is buried north of Well # 7 / pumphouse building approximately 10 - 12 feet. Princeton Public Utilities has Pwr. Plant and diesel tanks for back-up generators south of well # 7. All items have considerable containment devices in place to prevent contamination.

For further information, please contact:

Minnesota Department of Health
Drinking Water Protection Section
Source Water Protection Unit
P.O. Box 64975
St. Paul, Minnesota 55164-0975

Section Receptionist: 651-201-4700
Division TDD: 651-201-5797 or MN Relay Service @ 1-800-627-3529 and ask for 651-201-5000

Environmental Health Division
Drinking Water Protection Section
P.O. Box 64975
St. Paul, Minnesota 55164-0975

INNER WELLHEAD MANAGEMENT ZONE (IWMZ) - POTENTIAL CONTAMINANT SOURCE INVENTORY (PCSI) REPORT

PUBLIC WATER SYSTEM INFORMATION

PWS ID	1480008 **COMMUNITY**
NAME	Princeton
ADDRESS	Princeton Public Utilities Commission, 907 First Street, P.O. Box 218, Princeton, MN 55371

FACILITY (WELL) INFORMATION

NAME	Well #8
SAMPLE POINT ID	S09
UNIQUE WELL NO.	751504
COUNTY	Sherburne

IS THERE A WELL LOG OR ADDITIONAL CONSTRUCTION INFORMATION AVAILABLE?

☐ **YES** (Please attach a copy)
☐ **NO** ☐ **UNDETERMINED**

PWS ID / SAMPLE POINT ID	1480008 S09	**UNIQUE WELL NO.**	751504

PCSI CODE	ACTUAL OR POTENTIAL CONTAMINATION SOURCE	ISOLATION DISTANCES (FEET)				LOCATION	
		Minimum Distances		Sensitive Well[1]	Within 200 Ft. Y / N / U	Dist. from Well	Est. (?)
		Community	Non-community				
Agricultural Related							
*AC1	Agricultural chemical buried piping	50	50		N		
*AC2	Agricultural chemical multiple tanks or containers for residential retail sale or use, no single tank or container exceeding, but aggregate volume exceeding 56 gal. or 100 lbs. dry weight	50	50		N		
ACP	Agricultural chemical tank or container with 25 gal. or more or 100 lbs. or more dry weight, or equipment filling or cleaning area without safeguards	150	150		N		
ACS	Agricultural chemical storage or equipment filling or cleaning area with safeguards	100	100		N		
ACR	Agricultural chemical storage or equipment filling or cleaning area with safeguards and roofed	50	50		N		
ADW	Agricultural drainage well[2] (Class V well - illegal[3])	50	50		N		
AAT	Anhydrous ammonia tank (stationary tank)	50	50		N		
AB1	Animal building, feedlot, confinement area, or kennel, 0.1 to 1.0 animal unit (stockyard)	50	20	100/40	N		
AB2	Animal building or poultry building, including a horse riding area, more than 1.0 animal unit	50	50	100	N		
ABS	Animal burial area, more than 1.0 animal unit	50	50		N		
FWP	Animal feeding or watering area within a pasture, more than 1.0 animal unit	50	50	100	N		
AF1	Animal feedlot, unroofed, 300 or more animal units (stockyard)	100	100	200	N		
AF2	Animal feedlot, more than 1.0, but less than 300 animal units (stockyard)	50	50	100	N		
AMA	Animal manure application	use discretion	use discretion		N		
REN	Animal rendering plant	50	50		N		
MS1	Manure (liquid) storage basin or lagoon, unpermitted or noncertified	300	300	600	N		
MS2	Manure (liquid) storage basin or lagoon, approved earthen liner	150	150	300	N		
MS3	Manure (liquid) storage basin or lagoon, approved concrete or composite liner	100	100	200	N		
MS4	Manure (solid) storage area, not covered with a roof	100	100	200	N		
OSC	Open storage for crops	use discretion	use discretion		N		
SSTS Related							
AA1	Absorption area of a soil dispersal system, average flow greater than 10,000 gal./day	300	300	600	N		
AA2	Absorption area of a soil dispersal system serving a facility handling infectious or pathological wastes, average flow 10,000 gal./day or less	150	150	300	N		
AA3	Absorption area of a soil dispersal system, average flow 10,000 gal./day or less	50	50	100	N		
AA4	Absorption area of a soil dispersal system serving multiple family residences or a non-residential facility and has the capacity to serve 20 or more persons per day (Class V well)[2]	50/300/150[4]	50/300/150[4]	100/600/300[4]	N		
CSP	Cesspool	75	75	150	N		
AGG	Dry well, leaching pit, seepage pit	75	75	150	N		
*FD1	Floor drain, grate, or trough connected to a buried sewer	50	50		N		
*FD2	Floor drain, grate, or trough if buried sewer is air-tested, approved materials, serving one building, or two or less single-family residences	50	20		N		

PWS ID / SAMPLE POINT ID	1480008 S09	UNIQUE WELL NO.	751504

PCSI CODE	ACTUAL OR POTENTIAL CONTAMINATION SOURCE	ISOLATION DISTANCES (FEET)				LOCATION	
		Minimum Distances		Sensitive Well[1]	Within 200 Ft. Y / N / U	Dist. from Well	Est. (?)
		Community	Non-community				
*GW1	Gray-water dispersal area	50	50	100	N		
LC1	Large capacity cesspools (Class V well - illegal)[2]	75	75	150	N		
MVW	Motor vehicle waste disposal (Class V well - illegal)[2]	illegal	illegal		N		
PR1	Privy, nonportable	50	50	100	N		
PR2	Portable (privy) or toilet	50	20		N		
*SF1	Watertight sand filter; peat filter; or constructed wetland	50	50		N		
SET	Septic tank	50	50		N		
HTK	Sewage holding tank, watertight	50	50		N		
SS1	Sewage sump capacity 100 gal. or more	50	50		N		
SS2	Sewage sump capacity less than 100 gal., tested, conforming to rule	50	20		N		
*ST1	Sewage treatment device, watertight	50	50		N		
SB1	Sewer, buried, approved materials, tested, serving one building, or two or less single-family residences	50	20		Y	135	N
SB1	Sewer, buried, approved materials, tested, serving one building, or two or less single-family residences	50	20		Y	70	N
SB2	Sewer, buried, collector, municipal, serving a facility handling infectious or pathological wastes, open-jointed or unapproved materials	50	50		N		
*WB1	Water treatment backwash holding basin, reclaim basin, or surge tank with a direct sewer connection	50	50		N		
*WB2	Water treatment backwash holding basin, reclaim basin, or surge tank with a backflow protected sewer connection	20	20		N		
Land Application							
SPT	Land spreading area for sewage, septage, or sludge	50	50	100	N		
Solid Waste Related							
COS	Commercial compost site	50	50		N		
CD1	Construction or demolition debris disposal area	50	50	100	N		
*HW1	Household solid waste disposal area, single residence	50	50	100	N		
LF1	Landfill, permitted demolition debris, dump, or mixed municipal solid waste from multiple persons	300	300	600	N		
SVY	Scrap yard	50	50		N		
SWT	Solid waste transfer station	50	50		N		
Storm Water Related							
SD1	Storm water drain pipe, 8 inches or greater in diameter	50	20		N		
SWI	Storm water drainage well[2] (Class V well - illegal[3])	50	50		N		
SM1	Storm water pond greater than 5000 gal.	50	35		N		
Wells and Borings							
*EB1	Elevator boring, not conforming to rule	50	50		N		
*EB2	Elevator boring, conforming to rule	20	20		N		
MON	Monitoring well	record dist.	record dist.		N		
WEL	Operating well	record dist.	record dist.		N		
UUW	Unused, unsealed well or boring	50	50		N		
General							
*CR1	Cistern or reservoir, buried, nonpressurized water supply	20	20		N		
PLM	Contaminant plume	50	50		N		
*CW1	Cooling water pond, industrial	50	50	100	N		
DC1	Deicing chemicals, bulk road	50	50	100	N		
*ET1	Electrical transformer storage area, oil-filled	50	50		N		
GRV	Grave or mausoleum	50	50		N		
GP1	Gravel pocket or French drain for clear water drainage only	20	20		N		
*HS1	Hazardous substance buried piping	50	50		N		
HS2	Hazardous substance tank or container, above ground or underground, 56 gal. or more, or 100 lbs. or more dry weight, without safeguards	150	150		N		
HS3	Hazardous substance tank or container, above ground or underground, 56 gal. or more, or 100 lbs. or more dry weight with safeguards	100	100		N		
HS4	Hazardous substance multiple storage tanks or containers for residential retail sale or use, no single tank or container exceeding 56 gal. or 100 lbs., but aggregate volume exceeding	50	50		N		
HWF	Highest water or flood level	50	N/A		N		
*HG1	Horizontal ground source closed loop heat exchanger buried piping	50	50		N		

PWS ID / SAMPLE POINT ID	1480008 S09	UNIQUE WELL NO.	751504

PCSI CODE	ACTUAL OR POTENTIAL CONTAMINATION SOURCE	ISOLATION DISTANCES (FEET)				LOCATION	
		Minimum Distances		Sensitive Well[1]	Within 200 Ft. Y / N / U	Dist. from Well	Est. (?)
		Community	Non-community				
*HG2	Horizontal ground source closed loop heat exchanger buried piping and horizontal piping, approved materials and heat transfer fluid	50	10		N		
IWD	Industrial waste disposal well (Class V well)[2]	illegal[3]	illegal[3]		N		
IWS	Interceptor, including a flammable waste or sediment	50	50		N		
OH1	Ordinary high water level of a stream, river, pond, lake, reservoir, or drainage ditch (holds water six months or more)	50	35		N		
*PP1	Petroleum buried piping	50	50		N		
*PP2	Petroleum or crude oil pipeline to a refinery or distribution center	100	100		N		
PT1	Petroleum tank or container, 1100 gal. or more, without safeguards	150	150		N		
PT2	Petroleum tank or container, 1100 gal. or more, with safeguards	100	100		N		
PT3	Petroleum tank or container, buried, between 56 and 1100 gal.	50	50		N		
PT4	Petroleum tank or container, not buried, between 56 and 1100 gal.	50[5]	20		N		
PU1	Pit or unfilled space more than four feet in depth	20	20		N		
PC1	Pollutant or contaminant that may drain into the soil	50	50	100	N		
SP1	Swimming pool, in-ground	20	20		N		
*VH1	Vertical heat exchanger, horizontal piping conforming to rule	50	10		N		
*VH2	Vertical heat exchanger (vertical) piping, conforming to rule	50	35		N		
*WR1	Wastewater rapid infiltration basin, municipal or industrial	300	300	600	N		
*WA1	Wastewater spray irrigation area, municipal or industrial	150	150	300	N		
*WS1	Wastewater stabilization pond, industrial	150	150	300	N		
*WS2	Wastewater stabilization pond, municipal, 500 or more gal./acre/day of leakage	300	300	600	N		
*WS3	Wastewater stabilization pond, municipal, less than 500 gal./acre/day of leakage	150	150	300	N		
*WT1	Wastewater treatment unit tanks, vessels and components (Package plant)	100	100		N		
*WT2	Water treatment backwash disposal area	50	50	100	N		
Additional Sources (If there is more than one source listed above, please indicate here).							
Potential Contamination Sources and Codes Based on Previous Versions of this Form							
	none found within 200' of this well.						

* New potential contaminant source.

[1] A sensitive well has less than 50 feet of watertight casing, and which is not cased below a confining layer or confining materials of at least 10' in thickness.

[2] These sources, known as Class V underground injection wells, are regulated by the federal U.S. Environmental Protection Agency.

[3] These sources are classified as illegal by Minnesota Rules, Chapter 4725.

[4] Isolation distance is determined by average flow per day or if a facility handles infectious or pathological wastes.

[5] A community public water-supply well must be a minimum of 50 feet from a petroleum tank or container, unless the tank or container is used for emergency pumping and is located in a room or building separate from the community well; and is of double-wall construction with leak detection between walls; or is protected with secondary containment.

This form is based on the new isolation distances in Minnesota Rules, Chapter 4725, related to wells and borings adopted August 4, 2008, and Minnesota Rules, Chapter 4720, related to wellhead protection.

PWS ID / SAMPLE POINT ID	1480008 S09	UNIQUE WELL NO.	751504

SETBACK DISTANCES	All potential contaminant sources must be noted on sketch.

Record the distance and approximate compass bearing of each potential contaminant source from the well, and identify the source using the "Source Code". Unlabeled points on the map are unsealed wells.

	Y	N	N/A
Were the isolation distances maintained for the new sources of contamination?	X		
Is the system monitoring existing nonconforming sources of contamination?	X		

Reminder Question: Were the wellhead protection measure(s) implemented?

INSPECTOR	Breth, Katie	DATE	10 - 17 - 2022

PWS ID / SAMPLE POINT ID	1480008 S09	UNIQUE WELL NO.	751504

RECOMMENDED WELLHEAD PROTECTION (WHP) MEASURES	WHP MEASURE IMPLEMENTED? Y or N	DATE VERIFIED

COMMENTS

Manufacturing business with outside storage yard lot is located SE of Well # 8. Business should be reminded about spills and management of lot near well. Business is not on city sewer services.

For further information, please contact:

Minnesota Department of Health
Drinking Water Protection Section
Source Water Protection Unit
P.O. Box 64975
St. Paul, Minnesota 55164-0975

Section Receptionist: 651-201-4700
Division TDD: 651-201-5797 or MN Relay Service @ 1-800-627-3529 and ask for 651-201-5000

Environmental Health Division
Drinking Water Protection Section
P.O. Box 64975
St. Paul, Minnesota 55164-0975

INNER WELLHEAD MANAGEMENT ZONE (IWMZ) - POTENTIAL CONTAMINANT SOURCE INVENTORY (PCSI) REPORT

PUBLIC WATER SYSTEM INFORMATION

PWS ID	1480008 **COMMUNITY**
NAME	Princeton
ADDRESS	Princeton Public Utilities Commission, 907 First Street, P.O. Box 218, Princeton, MN 55371

FACILITY (WELL) INFORMATION

NAME	Well #9
SAMPLE POINT ID	S10
UNIQUE WELL NO.	749848
COUNTY	Sherburne

IS THERE A WELL LOG OR ADDITIONAL CONSTRUCTION INFORMATION AVAILABLE?

☐ **YES** (Please attach a copy)
☐ **NO** ☐ **UNDETERMINED**

PWS ID / SAMPLE POINT ID	1480008 S10	**UNIQUE WELL NO.**	749848

PCSI CODE	ACTUAL OR POTENTIAL CONTAMINATION SOURCE	ISOLATION DISTANCES (FEET)				LOCATION	
		Minimum Distances		Sensitive Well[1]	Within 200 Ft. Y / N / U	Dist. from Well	Est. (?)
		Community	Non-community				
Agricultural Related							
*AC1	Agricultural chemical buried piping	50	50		N		
*AC2	Agricultural chemical multiple tanks or containers for residential retail sale or use, no single tank or container exceeding, but aggregate volume exceeding 56 gal. or 100 lbs. dry weight	50	50		N		
ACP	Agricultural chemical tank or container with 25 gal. or more or 100 lbs. or more dry weight, or equipment filling or cleaning area without safeguards	150	150		N		
ACS	Agricultural chemical storage or equipment filling or cleaning area with safeguards	100	100		N		
ACR	Agricultural chemical storage or equipment filling or cleaning area with safeguards and roofed	50	50		N		
ADW	Agricultural drainage well[2] (Class V well - illegal[3])	50	50		N		
AAT	Anhydrous ammonia tank (stationary tank)	50	50		N		
AB1	Animal building, feedlot, confinement area, or kennel, 0.1 to 1.0 animal unit (stockyard)	50	20	100/40	N		
AB2	Animal building or poultry building, including a horse riding area, more than 1.0 animal unit	50	50	100	N		
ABS	Animal burial area, more than 1.0 animal unit	50	50		N		
FWP	Animal feeding or watering area within a pasture, more than 1.0 animal unit	50	50	100	N		
AF1	Animal feedlot, unroofed, 300 or more animal units (stockyard)	100	100	200	N		
AF2	Animal feedlot, more than 1.0, but less than 300 animal units (stockyard)	50	50	100	N		
AMA	Animal manure application	use discretion	use discretion		N		
REN	Animal rendering plant	50	50		N		
MS1	Manure (liquid) storage basin or lagoon, unpermitted or noncertified	300	300	600	N		
MS2	Manure (liquid) storage basin or lagoon, approved earthen liner	150	150	300	N		
MS3	Manure (liquid) storage basin or lagoon, approved concrete or composite liner	100	100	200	N		
MS4	Manure (solid) storage area, not covered with a roof	100	100	200	N		
OSC	Open storage for crops	use discretion	use discretion		N		
SSTS Related							
AA1	Absorption area of a soil dispersal system, average flow greater than 10,000 gal./day	300	300	600	N		
AA2	Absorption area of a soil dispersal system serving a facility handling infectious or pathological wastes, average flow 10,000 gal./day or less	150	150	300	N		
AA3	Absorption area of a soil dispersal system, average flow 10,000 gal./day or less	50	50	100	N		
AA4	Absorption area of a soil dispersal system serving multiple family residences or a non-residential facility and has the capacity to serve 20 or more persons per day (Class V well)[2]	50/300/150[4]	50/300/150[4]	100/600/300[4]	N		
CSP	Cesspool	75	75	150	N		
AGG	Dry well, leaching pit, seepage pit	75	75	150	N		
*FD1	Floor drain, grate, or trough connected to a buried sewer	50	50		N		
*FD2	Floor drain, grate, or trough if buried sewer is air-tested, approved materials, serving one building, or two or less single-family residences	50	20		N		

PWS ID / SAMPLE POINT ID	1480008 S10	UNIQUE WELL NO.	749848

PCSI CODE	ACTUAL OR POTENTIAL CONTAMINATION SOURCE	ISOLATION DISTANCES (FEET)				LOCATION	
		Minimum Distances		Sensitive Well[1]	Within 200 Ft. Y / N / U	Dist. from Well	Est. (?)
		Community	Non-community				
*GW1	Gray-water dispersal area	50	50	100	N		
LC1	Large capacity cesspools (Class V well - illegal)[2]	75	75	150	N		
MVW	Motor vehicle waste disposal (Class V well - illegal)[2]	illegal	illegal		N		
PR1	Privy, nonportable	50	50	100	N		
PR2	Portable (privy) or toilet	50	20		N		
*SF1	Watertight sand filter; peat filter; or constructed wetland	50	50		N		
SET	Septic tank	50	50		N		
HTK	Sewage holding tank, watertight	50	50		N		
SS1	Sewage sump capacity 100 gal. or more	50	50		N		
SS2	Sewage sump capacity less than 100 gal., tested, conforming to rule	50	20		N		
*ST1	Sewage treatment device, watertight	50	50		N		
SB1	Sewer, buried, approved materials, tested, serving one building, or two or less single-family residences	50	20		Y	45	N
SB2	Sewer, buried, collector, municipal, serving a facility handling infectious or pathological wastes, open-jointed or unapproved materials	50	50		N		
*WB1	Water treatment backwash holding basin, reclaim basin, or surge tank with a direct sewer connection	50	50		N		
*WB2	Water treatment backwash holding basin, reclaim basin, or surge tank with a backflow protected sewer connection	20	20		N		
Land Application							
SPT	Land spreading area for sewage, septage, or sludge	50	50	100	N		
Solid Waste Related							
COS	Commercial compost site	50	50		N		
CD1	Construction or demolition debris disposal area	50	50	100	N		
*HW1	Household solid waste disposal area, single residence	50	50	100	N		
LF1	Landfill, permitted demolition debris, dump, or mixed municipal solid waste from multiple persons	300	300	600	N		
SVY	Scrap yard	50	50		N		
SWT	Solid waste transfer station	50	50		N		
Storm Water Related							
SD1	Storm water drain pipe, 8 inches or greater in diameter	50	20		N		
SWI	Storm water drainage well[2] (Class V well - illegal[3])	50	50		N		
SM1	Storm water pond greater than 5000 gal.	50	35		N		
Wells and Borings							
*EB1	Elevator boring, not conforming to rule	50	50		N		
*EB2	Elevator boring, conforming to rule	20	20		N		
MON	Monitoring well	record dist.	record dist.		N		
WEL	Operating well	record dist.	record dist.		Y	96	
UUW	Unused, unsealed well or boring	50	50		N		
General							
*CR1	Cistern or reservoir, buried, nonpressurized water supply	20	20		N		
PLM	Contaminant plume	50	50		N		
*CW1	Cooling water pond, industrial	50	50	100	N		
DC1	Deicing chemicals, bulk road	50	50	100	N		
*ET1	Electrical transformer storage area, oil-filled	50	50		N		
GRV	Grave or mausoleum	50	50		N		
GP1	Gravel pocket or French drain for clear water drainage only	20	20		N		
*HS1	Hazardous substance buried piping	50	50		N		
HS2	Hazardous substance tank or container, above ground or underground, 56 gal. or more, or 100 lbs. or more dry weight, without safeguards	150	150		N		
HS3	Hazardous substance tank or container, above ground or underground, 56 gal. or more, or 100 lbs. or more dry weight with safeguards	100	100		N		
HS4	Hazardous substance multiple storage tanks or containers for residential retail sale or use, no single tank or container exceeding 56 gal. or 100 lbs., but aggregate volume exceeding	50	50		N		
HWF	Highest water or flood level	50	N/A		N		
*HG1	Horizontal ground source closed loop heat exchanger buried piping	50	50		N		
*HG2	Horizontal ground source closed loop heat exchanger buried piping and horizontal piping, approved materials and heat transfer fluid	50	10		N		

PWS ID / SAMPLE POINT ID	1480008 S10	UNIQUE WELL NO.	749848

PCSI CODE	ACTUAL OR POTENTIAL CONTAMINATION SOURCE	ISOLATION DISTANCES (FEET)				LOCATION	
		Minimum Distances		Sensitive Well[1]	Within 200 Ft. Y / N / U	Dist. from Well	Est. (?)
		Community	Non-community				
IWD	Industrial waste disposal well (Class V well)[2]	illegal[3]	illegal[3]		N		
IWS	Interceptor, including a flammable waste or sediment	50	50		N		
OH1	Ordinary high water level of a stream, river, pond, lake, reservoir, or drainage ditch (holds water six months or more)	50	35		N		
*PP1	Petroleum buried piping	50	50		N		
*PP2	Petroleum or crude oil pipeline to a refinery or distribution center	100	100		N		
PT1	Petroleum tank or container, 1100 gal. or more, without safeguards	150	150		N		
PT2	Petroleum tank or container, 1100 gal. or more, with safeguards	100	100		N		
PT3	Petroleum tank or container, buried, between 56 and 1100 gal.	50	50		N		
PT4	Petroleum tank or container, not buried, between 56 and 1100 gal.	50[5]	20		N		
PU1	Pit or unfilled space more than four feet in depth	20	20		N		
PC1	Pollutant or contaminant that may drain into the soil	50	50	100	N		
SP1	Swimming pool, in-ground	20	20		N		
*VH1	Vertical heat exchanger, horizontal piping conforming to rule	50	10		N		
*VH2	Vertical heat exchanger (vertical) piping, conforming to rule	50	35		N		
*WR1	Wastewater rapid infiltration basin, municipal or industrial	300	300	600	N		
*WA1	Wastewater spray irrigation area, municipal or industrial	150	150	300	N		
*WS1	Wastewater stabilization pond, industrial	150	150	300	N		
*WS2	Wastewater stabilization pond, municipal, 500 or more gal./acre/day of leakage	300	300	600	N		
*WS3	Wastewater stabilization pond, municipal, less than 500 gal./acre/day of leakage	150	150	300	N		
*WT1	Wastewater treatment unit tanks, vessels and components (Package plant)	100	100		N		
*WT2	Water treatment backwash disposal area	50	50	100	N		
Additional Sources (If there is more than one source listed above, please indicate here).							
Potential Contamination Sources and Codes Based on Previous Versions of this Form							
	none found within 200' of this well.						

* New potential contaminant source.

[1] A sensitive well has less than 50 feet of watertight casing, and which is not cased below a confining layer or confining materials of at least 10' in thickness.

[2] These sources, known as Class V underground injection wells, are regulated by the federal U.S. Environmental Protection Agency.

[3] These sources are classified as illegal by Minnesota Rules, Chapter 4725.

[4] Isolation distance is determined by average flow per day or if a facility handles infectious or pathological wastes.

[5] A community public water-supply well must be a minimum of 50 feet from a petroleum tank or container, unless the tank or container is used for emergency pumping and is located in a room or building separate from the community well; and is of double-wall construction with leak detection between walls; or is protected with secondary containment.

This form is based on the new isolation distances in Minnesota Rules, Chapter 4725, related to wells and borings adopted August 4, 2008, and Minnesota Rules, Chapter 4720, related to wellhead protection.

PWS ID / SAMPLE POINT ID	1480008 S10	UNIQUE WELL NO.	749848

SETBACK DISTANCES	All potential contaminant sources must be noted on sketch.

Record the distance and approximate compass bearing of each potential contaminant source from the well, and identify the source using the "Source Code". Unlabeled points on the map are unsealed wells.

	Y	N	N/A
Were the isolation distances maintained for the new sources of contamination?			X
Is the system monitoring existing nonconforming sources of contamination?			X

Reminder Question: Were the wellhead protection measure(s) implemented?

INSPECTOR	Breth, Katie	DATE	10 - 17 - 2022

PWS ID / SAMPLE POINT ID	1480008 S10	UNIQUE WELL NO.	749848

RECOMMENDED WELLHEAD PROTECTION (WHP) MEASURES	WHP MEASURE IMPLEMENTED? Y or N	DATE VERIFIED

COMMENTS

Three manufacturing businesses NE, NW and SE of PWS Well. Businesses should be reminded of spills and site best management practices. Businesses are not connected City Sewer, but septics are not within the IWMZ.

For further information, please contact:

Minnesota Department of Health
Drinking Water Protection Section
Source Water Protection Unit
P.O. Box 64975
St. Paul, Minnesota 55164-0975

Section Receptionist: 651-201-4700
Division TDD: 651-201-5797 or MN Relay Service @ 1-800-627-3529 and ask for 651-201-5000

Appendix E

Princeton 2021 Drinking Water Report

Making Safe Drinking Water

Your drinking water comes from a groundwater source: three wells ranging from 139 to 169 feet deep, that draw water from the Quaternary Buried Artesian and Quaternary Water Table aquifers.

Princeton works hard to provide you with safe and reliable drinking water that meets federal and state water quality requirements. The purpose of this report is to provide you with information on your drinking water and how to protect our precious water resources.

Contact Scott Schmit, Water Superintendent, at (763) 389-2252 or SSchmit@PrincetonUtilities.com if you have questions about Princeton's drinking water. You can also ask for information about how you can take part in decisions that may affect water quality.

The U.S. Environmental Protection Agency sets safe drinking water standards. These standards limit the amounts of specific contaminants allowed in drinking water. This ensures that tap water is safe to drink for most people. The U.S. Food and Drug Administration regulates the amount of certain contaminants in bottled water. Bottled water must provide the same public health protection as public tap water.

Drinking water, including bottled water, may reasonably be expected to contain at least small amounts of some contaminants. The presence of contaminants does not necessarily indicate that water poses a health risk. More information about contaminants and potential health effects can be obtained by calling the Environmental Protection Agency's Safe Drinking Water Hotline at 1-800-426-4791.

Princeton Monitoring Results

This report contains our monitoring results from January 1 to December 31, 2021.

We work with the Minnesota Department of Health to test drinking water for more than 100 contaminants. It is not unusual to detect contaminants in small amounts. No water supply is ever completely free of contaminants. Drinking water standards protect Minnesotans from substances that may be harmful to their health.

Learn more by visiting the Minnesota Department of Health's webpage Basics of Monitoring and testing of Drinking Water in Minnesota (https://www.health.state.mn.us/communities/environment/water/factsheet/sampling.html).

How to Read the Water Quality Data Tables

The tables below show the contaminants we found last year or the most recent time we sampled for that contaminant. They also show the levels of those contaminants and the Environmental Protection Agency's limits. Substances that we tested for but did not find are not included in the tables.

We sample for some contaminants less than once a year because their levels in water are not expected to change from year to year. If we found any of these contaminants the last time we sampled for them, we included them in the tables below with the detection date.

We may have done additional monitoring for contaminants that are not included in the Safe Drinking Water Act. To request a copy of these results, call the Minnesota Department of Health at 651-201-4700 between 8:00 a.m. and 4:30 p.m., Monday through Friday.

Some contaminants are monitored regularly throughout the year, and rolling (or moving) annual averages are used to manage compliance. Because of this averaging, there are times where the Range of Detected Test Results for the calendar year is lower than the Highest Average or Highest Single Test Result, because it occurred in the previous calendar year.

Definitions

- **AL (Action Level)**: The concentration of a contaminant which, if exceeded, triggers treatment or other requirements which a water system must follow.
- **EPA:** Environmental Protection Agency
- **MCL (Maximum contaminant level)**: The highest level of a contaminant that is allowed in drinking water. MCLs are set as close to the MCLGs as feasible using the best available treatment technology.
- **MCLG (Maximum contaminant level goal)**: The level of a contaminant in drinking water below which there is no known or expected risk to health. MCLGs allow for a margin of safety.
- **MRDL (Maximum residual disinfectant level):** The highest level of a disinfectant allowed in drinking water. There is convincing evidence that addition of a disinfectant is necessary for control of microbial contaminants.
- **MRDLG (Maximum residual disinfectant level goal)**: The level of a drinking water disinfectant below which there is no known or expected risk to health. MRDLGs do not reflect the benefits of the use of disinfectants to control microbial contaminants.
- **N/A (Not applicable)**: Does not apply.
- **ppb (parts per billion)**: One part per billion in water is like one drop in one billion drops of water, or about one drop in a swimming pool. ppb is the same as micrograms per liter (μg/l).
- **ppm (parts per million)**: One part per million is like one drop in one million drops of water, or about one cup in a swimming pool. ppm is the same as milligrams per liter (mg/l).
- **PWSID**: Public water system identification.

Monitoring Results – Regulated Substances

LEAD AND COPPER – Tested at customer taps.

Contaminant (Date, if sampled in previous year)	**EPA's Ideal Goal** (MCLG)	**EPA's Action Level**	**90% of Results Were Less Than**	**Number of Homes with High Levels**	**Violation**	**Typical Sources**
Lead (08/23/19)	0 ppb	90% of homes less than 15 ppb	1.8 ppb	0 out of 20	NO	Corrosion of household plumbing.
Copper (08/23/19)	0 ppm	90% of homes less than 1.3 ppm	0.32 ppm	0 out of 20	NO	Corrosion of household plumbing.

CONTAMINANTS RELATED TO DISINFECTION – Tested in drinking water.

Substance (Date, if sampled in previous year)	**EPA's Ideal Goal** (MCLG or MRDLG)	**EPA's Limit** (MCL or MRDL)	**Highest Average or Highest Single Test Result**	**Range of Detected Test Results**	**Violation**	**Typical Sources**
Total Trihalomethanes (TTHMs)	N/A	80 ppb	19.4 ppb	N/A	NO	By-product of drinking water disinfection.
Total Haloacetic Acids (HAA)	N/A	60 ppb	12.5 ppb	N/A	NO	By-product of drinking water disinfection.
Total Chlorine	4.0 ppm	4.0 ppm	0.66 ppm	0.34 - 0.84 ppm	NO	Water additive used to control microbes.

Total HAA refers to HAA5

OTHER SUBSTANCES – Tested in drinking water.						
Substance (Date, if sampled in previous year)	**EPA's Ideal Goal** (MCLG)	**EPA's Limit** (MCL)	**Highest Average or Highest Single Test Result**	**Range of Detected Test Results**	**Violation**	**Typical Sources**
Fluoride	4.0 ppm	4.0 ppm	0.65 ppm	0.52 - 0.75 ppm	NO	Erosion of natural deposits; Water additive to promote strong teeth.

Potential Health Effects and Corrective Actions (If Applicable)

Fluoride: If your drinking water fluoride levels are below the optimal concentration range of 0.5 to 0.9 ppm, please talk with your dentist about how you can protect your teeth and your family's teeth from tooth decay and cavities. For more information, visit: MDH Drinking Water Fluoridation (https://www.health.state.mn.us/communities/environment/water/com/fluoride.html). Fluoride is nature's cavity fighter, with small amounts present naturally in many drinking water sources. There is an overwhelming weight of credible, peer-reviewed, scientific evidence that fluoridation reduces tooth decay and cavities in children and adults, even when there is availability of fluoride from other sources, such as fluoride toothpaste and mouth rinses. Since studies show that optimal fluoride levels in drinking water benefit public health, municipal community water systems adjust the level of fluoride in the water to an optimal concentration between 0.5 to 0.9 parts per million (ppm) to protect your teeth. Fluoride levels below 2.0 ppm are not expected to increase the risk of a cosmetic condition known as enamel fluorosis.

Monitoring Results – Unregulated Substances

In addition to testing drinking water for contaminants regulated under the Safe Drinking Water Act, we sometimes also monitor for contaminants that are not regulated. Unregulated contaminants do not have legal limits for drinking water.

Detection alone of a regulated or unregulated contaminant should not cause concern. The meaning of a detection should be determined considering current health effects information. We are often still learning about the health effects, so this information can change over time.

The following table shows the unregulated contaminants we detected last year, as well as human-health based guidance values for comparison, where available. The comparison values are based only on potential health impacts and do not consider our ability to measure contaminants at very low concentrations or the cost and technology of prevention and/or treatment. They may be set at levels that are costly, challenging, or impossible for water systems to meet (for example, large-scale treatment technology may not exist for a given contaminant).

A person drinking water with a contaminant at or below the comparison value would be at little or no risk for harmful health effects. If the level of a contaminant is above the comparison value, people of a certain age or with special health conditions - like a fetus, infants, children, elderly, and people with impaired immunity – may need to take extra precautions. Because these contaminants are unregulated, EPA and MDH require no particular action based on detection of an unregulated contaminant. We are notifying you of the unregulated contaminants we have detected as a public education opportunity.

- More information is available on MDH's A-Z List of Contaminants in Water (https://www.health.state.mn.us/communities/environment/water/contaminants/index.html) and Fourth Unregulated Contaminant Monitoring Rule (UCMR 4) (https://www.health.state.mn.us/communities/environment/water/com/ucmr4.html).

UNREGULATED CONTAMINANTS – Tested in drinking water.

Contaminant	Comparison Value	Highest Average Result or Highest Single Test Result	Range of Detected Test Results
Sodium*	20 ppm	7.52 ppm	N/A
Sulfate	500 ppm	7.86 ppm	N/A

*Note that home water softening can increase the level of sodium in your water.

Some People Are More Vulnerable to Contaminants in Drinking Water

Some people may be more vulnerable to contaminants in drinking water than the general population. Immuno-compromised persons such as persons with cancer undergoing chemotherapy, persons who have undergone organ transplants, people with HIV/AIDS or other immune system disorders, some elderly, and infants can be particularly at risk from infections. The developing fetus and therefore pregnant women may also be more vulnerable to contaminants in drinking water. These people or their caregivers should

seek advice about drinking water from their health care providers. EPA/Centers for Disease Control (CDC) guidelines on appropriate means to lessen the risk of infection by *Cryptosporidium* and other microbial contaminants are available from the Safe Drinking Water Hotline at 1-800-426-4791.

Learn More about Your Drinking Water

Drinking Water Sources

Minnesota's primary drinking water sources are groundwater and surface water. Groundwater is the water found in aquifers beneath the surface of the land. Groundwater supplies 75 percent of Minnesota's drinking water. Surface water is the water in lakes, rivers, and streams above the surface of the land. Surface water supplies 25 percent of Minnesota's drinking water.

Contaminants can get in drinking water sources from the natural environment and from people's daily activities. There are five main types of contaminants in drinking water sources.

- **Microbial contaminants,** such as viruses, bacteria, and parasites. Sources include sewage treatment plants, septic systems, agricultural livestock operations, pets, and wildlife.
- **Inorganic contaminants** include salts and metals from natural sources (e.g. rock and soil), oil and gas production, mining and farming operations, urban stormwater runoff, and wastewater discharges.
- **Pesticides and herbicides** are chemicals used to reduce or kill unwanted plants and pests. Sources include agriculture, urban stormwater runoff, and commercial and residential properties.
- **Organic chemical contaminants** include synthetic and volatile organic compounds. Sources include industrial processes and petroleum production, gas stations, urban stormwater runoff, and septic systems.
- **Radioactive contaminants** such as radium, thorium, and uranium isotopes come from natural sources (e.g. radon gas from soils and rock), mining operations, and oil and gas production.

The Minnesota Department of Health provides information about your drinking water source(s) in a source water assessment, including:

- How Princeton is protecting your drinking water source(s);
- Nearby threats to your drinking water sources;
- How easily water and pollution can move from the surface of the land into drinking water sources, based on natural geology and the way wells are constructed.

Find your source water assessment at Source Water Assessments (https://www.health.state.mn.us/communities/environment/water/swp/swa) or call 651-201-4700 between 8:00 a.m. and 4:30 p.m., Monday through Friday.

Lead in Drinking Water

You may be in contact with lead through paint, water, dust, soil, food, hobbies, or your job. Coming in contact with lead can cause serious health problems for everyone. There is no safe level of lead. Babies, children under six years, and pregnant women are at the highest risk.

Lead is rarely in a drinking water source, but it can get in your drinking water as it passes through lead service lines and your household plumbing system. Princeton is responsible for providing high quality drinking water, but it cannot control the plumbing materials used in private buildings.

Read below to learn how you can protect yourself from lead in drinking water.

1. **Let the water run** for 30-60 seconds before using it for drinking or cooking if the water has not been turned on in over six hours. If you have a lead service line, you may need to let the water run longer. A service line is the underground pipe that brings water from the main water pipe under the street to your home.
    - You can find out if you have a lead service line by contacting your public water system, or you can check by following the steps at: https://www.mprnews.org/story/2016/06/24/npr-find-lead-pipes-in-your-home
    - The only way to know if lead has been reduced by letting it run is to check with a test. If letting the water run does not reduce lead, consider other options to reduce your exposure.
2. **Use cold water** for drinking, making food, and making baby formula. Hot water releases more lead from pipes than cold water.
3. **Test your water.** In most cases, letting the water run and using cold water for drinking and cooking should keep lead levels low in your drinking water. If you are still concerned about lead, arrange with a laboratory to test your tap water. Testing your water is important if young children or pregnant women drink your tap water.
    - Contact a Minnesota Department of Health accredited laboratory to get a sample container and instructions on how to submit a sample:
      Environmental Laboratory Accreditation Program
      (https://eldo.web.health.state.mn.us/public/accreditedlabs/labsearch.seam)
      The Minnesota Department of Health can help you understand your test results.
4. **Treat your water** if a test shows your water has high levels of lead after you let the water run.
    - Read about water treatment units:
      Point-of-Use Water Treatment Units for Lead Reduction
      (https://www.health.state.mn.us/communities/environment/water/factsheet/poulead.html)

Learn more:

- Visit Lead in Drinking Water
  (https://www.health.state.mn.us/communities/environment/water/contaminants/lead.html)
- Visit Basic Information about Lead in Drinking Water (http://www.epa.gov/safewater/lead)
- Call the EPA Safe Drinking Water Hotline at 1-800-426-4791.To learn about how to reduce your contact with lead from sources other than your drinking water, visit Common Sources (https://www.health.state.mn.us/communities/environment/lead/fs/common.html).

Appendix F

United States Department of Agriculture

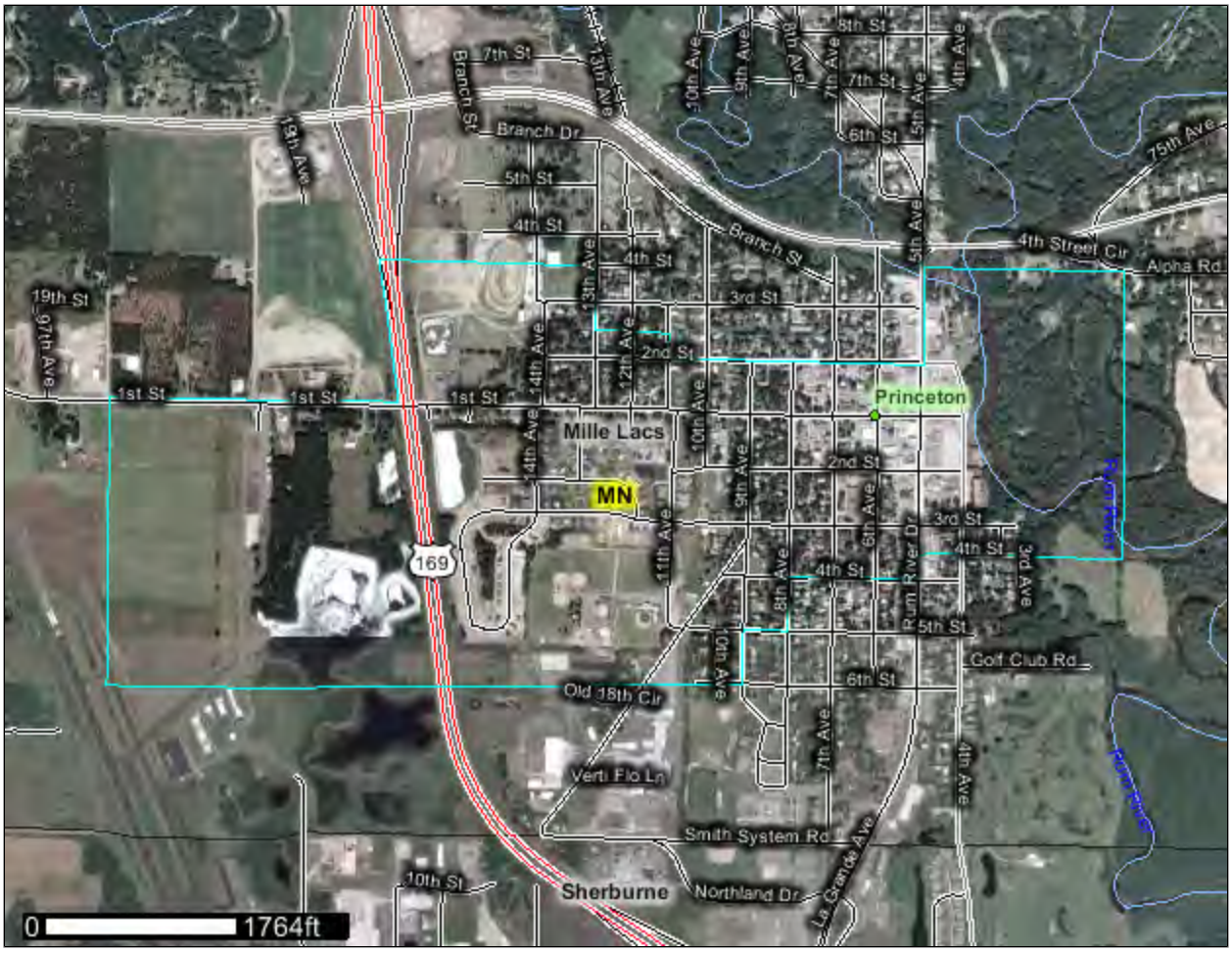
NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Mille Lacs County, Minnesota

Princeton North DWSMA Soils Map



October 10, 2011

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://soils.usda.gov/sqi/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (http://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://soils.usda.gov/contact/state_offices/).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Soil Data Mart Web site or the NRCS Web Soil Survey. The Soil Data Mart is the data storage site for the official soil survey information.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means

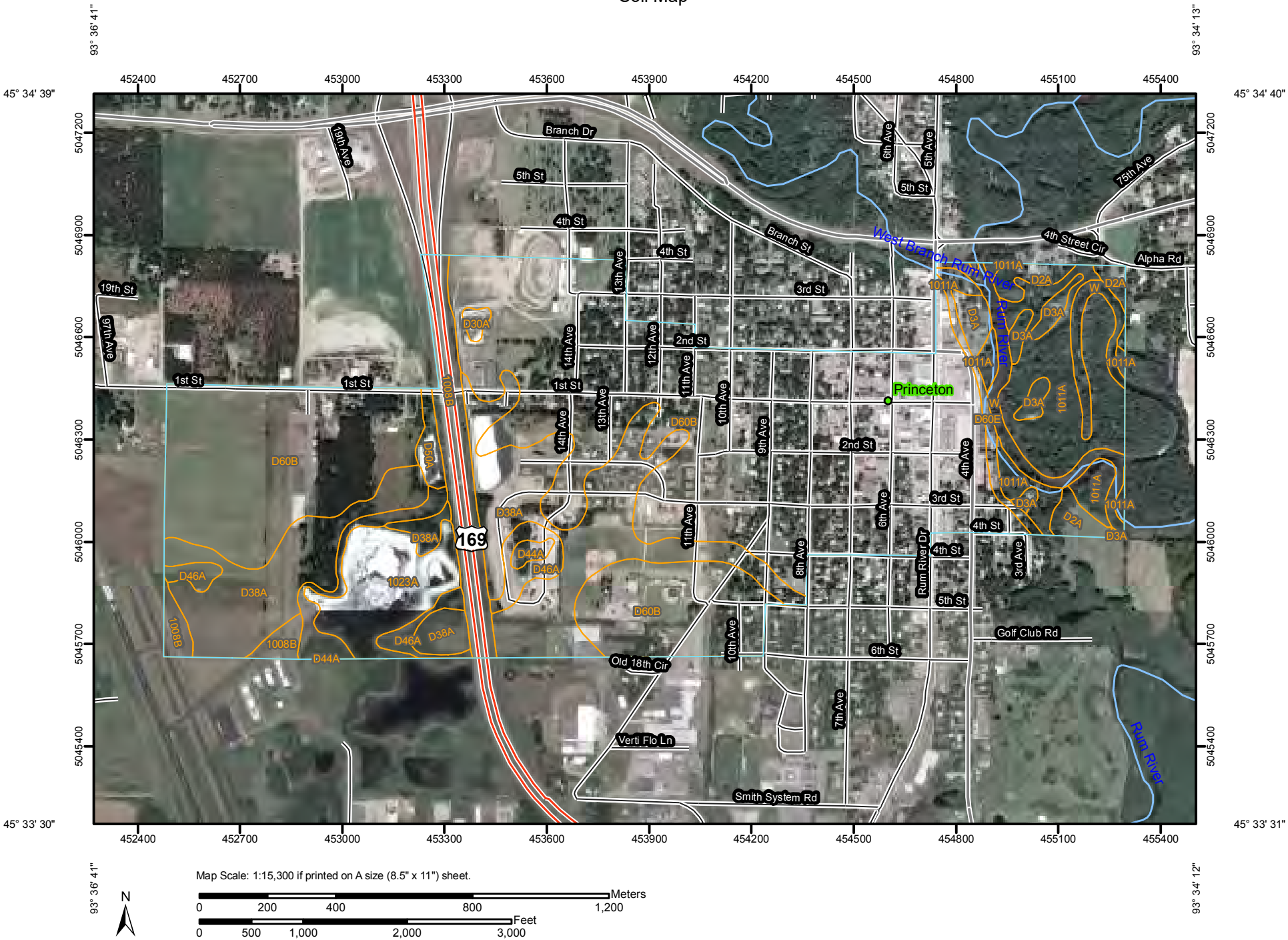
for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

Contents

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map



MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Units

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other

Special Line Features
- Gully
- Short Steep Slope
- Other

Political Features
- Cities

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

MAP INFORMATION

Map Scale: 1:15,300 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:12,000.

Please rely on the bar scale on each map sheet for accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 15N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Mille Lacs County, Minnesota
Survey Area Data: Version 5, Dec 14, 2009

Date(s) aerial images were photographed: 7/18/2003

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Mille Lacs County, Minnesota (MN095)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
1008B	Udipsamments (cut and fill land)	28.5	4.7%
1011A	Fordum-Winterfield complex, 0 to 2 percent slopes, frequently flooded	46.1	7.7%
1023A	Seelyeville and Markey soils, ponded, 0 to 1 percent slopes	25.8	4.3%
D2A	Elkriver fine sandy loam, 0 to 2 percent slopes, rarely flooded	9.4	1.6%
D3A	Elkriver fine sandy loam, 0 to 2 percent slopes, occasionally flooded	9.7	1.6%
D30A	Seelyeville and Markey soils, depressional, 0 to 1 percent slopes	1.4	0.2%
D38A	Cantlin loamy fine sand, 0 to 3 percent slopes	102.0	16.9%
D44A	Isanti loamy fine sand, 0 to 2 percent slopes	9.9	1.6%
D46A	Lino loamy fine sand, 0 to 2 percent slopes	11.9	2.0%
D50A	Isanti fine sandy loam, depressional, 0 to 1 percent slopes	3.7	0.6%
D60B	Zimmerman fine sand, 3 to 6 percent slopes	332.5	55.2%
D60E	Zimmerman fine sand, 12 to 30 percent slopes	4.8	0.8%
W	Water	16.3	2.7%
Totals for Area of Interest		**602.0**	**100.0%**

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Sherburne County, Minnesota

Princeton South DWSMA Soils Map

October 10, 2011

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

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Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Soil Data Mart Web site or the NRCS Web Soil Survey. The Soil Data Mart is the data storage site for the official soil survey information.

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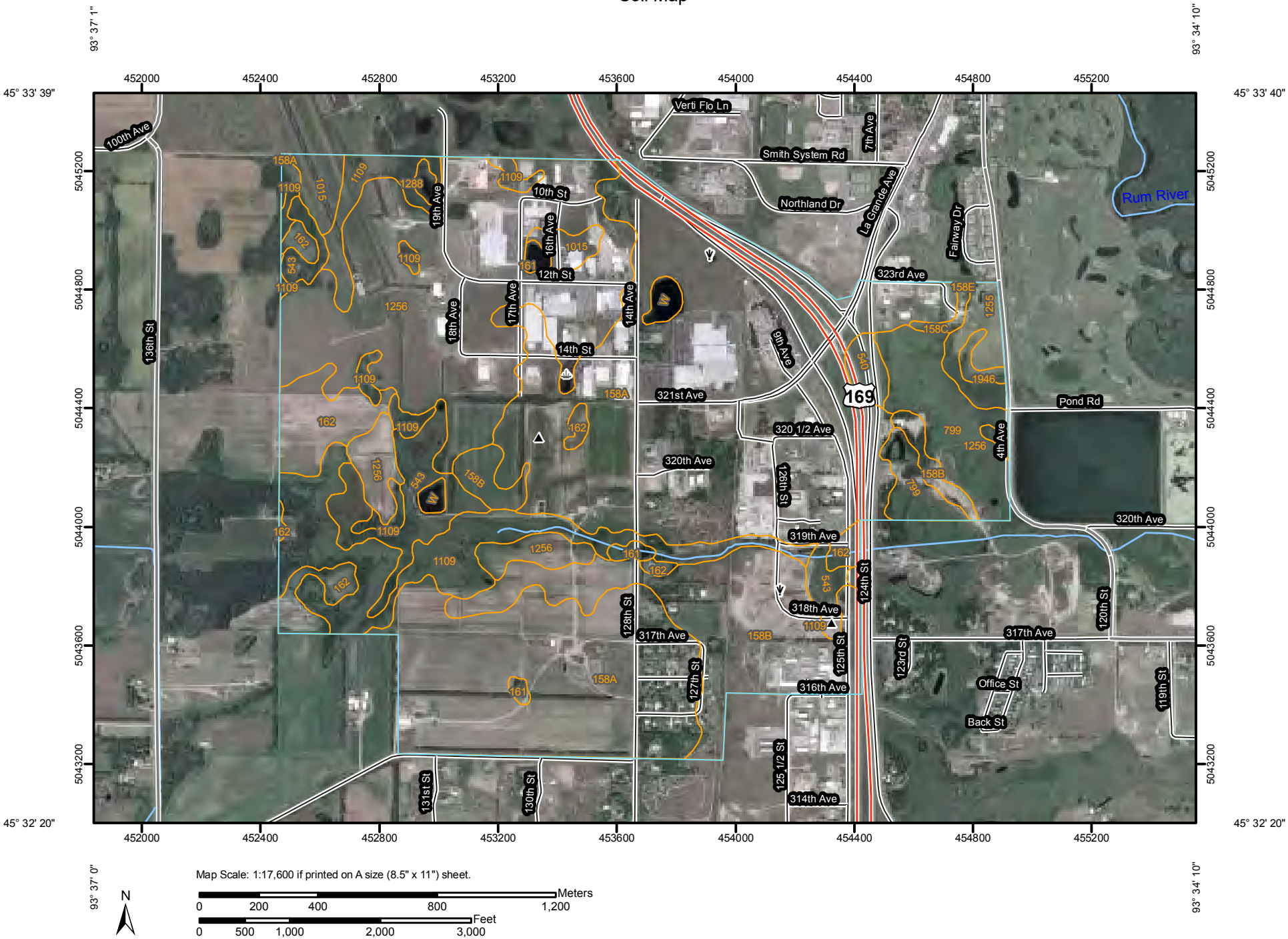
Contents

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map



MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Units

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other

Special Line Features
- Gully
- Short Steep Slope
- Other

Political Features
- Cities

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

MAP INFORMATION

Map Scale: 1:17,600 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:15,840.

Please rely on the bar scale on each map sheet for accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 15N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Sherburne County, Minnesota
Survey Area Data: Version 8, Dec 15, 2009

Date(s) aerial images were photographed: 7/18/2003

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Sherburne County, Minnesota (MN141)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
158A	Zimmerman fine sand, 0 to 3 percent slopes	405.8	42.3%
158B	Zimmerman fine sand, 3 to 6 percent slopes	98.5	10.3%
158C	Zimmerman fine sand, 6 to 12 percent slopes	2.3	0.2%
158E	Zimmerman fine sand, 12 to 25 percent slopes	0.3	0.0%
161	Isanti fine sandy loam, depressional, 0 to 1 percent slopes	5.2	0.5%
162	Lino loamy fine sand, 0 to 2 percent slopes	38.0	4.0%
540	Seelyeville muck, 0 to 1 percent slopes	6.4	0.7%
543	Markey muck, 0 to 1 percent slopes	35.3	3.7%
799	Seelyeville and Bowstring soils, 0 to 1 percent slopes, frequently flooded	46.7	4.9%
1015	Udipsamments, cut and fill land	13.8	1.4%
1109	Isanti loamy fine sand, 0 to 2 percent slopes	91.5	9.5%
1255	Elkriver fine sandy loam, 0 to 2 percent slopes, occasionally flooded	12.9	1.3%
1256	Cantlin loamy fine sand, 0 to 3 percent slopes	191.2	19.9%
1288	Seelyeville-Markey complex, ponded, 0 to 1 percent slopes	1.8	0.2%
1946	Fordum-Winterfield complex, 0 to 2 percent slopes, frequently flooded	3.0	0.3%
W	Water	5.7	0.6%
Totals for Area of Interest		**958.4**	**100.0%**

Appendix G

Wellhead Protection Action Item Descriptions	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	Ongoing	As Needed
A. Well Management												
Action A.1.1: Make property owners aware of potential technical and financial resources that are available to assist them in securing grant funding for properly sealing wells	x									x		
Action A.1.2: Seek funds when available and feasible to locate and/or seal wells.											x	
Action A.2: Identify properties with potential water supply cross connections or wells that pose a hazard to the public water supply.			x									
Action A.3: The PUC will work with MnDNR and MDH to address implications of high capacity well construction or appropriation permitting changes on the City's drinking water supply or DWSMA boundary.											x	
Action A.4: Examine and review the annual water quantity and quality reports to identify changes in groundwater levels, aquifer hydraulics, and concentrations of constituents.											x	
Action A.5: Using public events, City's website, newsletter, or other direct mailings; the PUC will provide information to the public on proper well management.	x											
Action A.6: The PUC will work with MDH and consultant to review proposed new municipal well sites to determine if the site is consistent with wellhead protection planning goals.												x
Action A.7: The PUC staff will assist in updating IWMZ survey form for all wells to determine if there have been additions or changes to potential contaminant sources.					x							
B. Public Education												
Action B1.1: Include information about WHP and groundwater protection in the City newsletter	x				x							
Action B1.2: Provide information about the WHP Plan and links to other WHP related resources on the City's website and interactive map.					x							
Action B2: Send reminder notices to new and old tank owners about tank regulations and the importance of early leak detection.		x										
Action B3: Send educational information to agricultural landowners within DWSMAs about the need for proper handling and disposal of agricultural chemicals and fertilizers.			x									
Action B4: Send a summary memo to the Fire Department, Sherburne Fire and Rescue, First Responders, Sherburne and Mille Lacs County Sheriff's Dept. of Emergency Managers, Minnesota Department of Transportation (MnDOT), regarding the DWSMA location, sensitivity, and importance of spill cleanup within the management area.		x										
C. Storage Tank Management												
Action C1.1: Educate storage tank owners on the PUC's source water protection efforts and supply publications on proper operation and maintenance of storage tanks and make them aware of their placement within the DWSMAs			x									
Action C1.2: Contact and provide storage tank owners with information located within emergency response areas and make them aware of the importance of spill prevention and response.					x							
D. Septic Systems (ISTS) Management												
Action D1.1: Assist both Counties efforts to educate property owners about ISTS systems and proper maintenance of them.		x										
Action D1.2: Provide information on financial opportunities to upgrade or repair on-site systems to businesses and residents in the DWSMAs.							x					
E. Hazardous Waste Mangement												
Action E1.1: Support household hazardous waste collection efforts by Sherburne and Mille Lacs County											x	
Action E1.2: Promote management and disposal of hazardous waste among businesses in the DWSMAs.									x			
Action E2: PUC staff and consultant will prepare and distribute the direct mail notice.		x										
F. Stormwater Management												

Action F1.1: Provide information to the community with respect to the everyday issues regarding stormwater and lawn care.				x								
G. Data Collection												
Action G1: The PUC will work with agencies to monitor the water quality in the municipal water supply wells.						x						
Action G2.1: Monitor static and pumping levels in municipal wells.											x	
Action G2.2: Locate and collect geologic information from nearby wells/boreholes.											x	
Action G2.3: Conduct geophysical survey in DWSMA where subsurface information is unavailable or limited.											x	
Action G3.1: In cooperation local government units and MDH, identify properties with potential wells within the DWSMA which locations were not verified during the creation of Part 2 of this Plan.				x								
Action G3.2: In cooperation with local government units, existing state and local agencies and programs, maintain the database of wells, storage tanks, and ISTS within the DWSMA that was developed as a part of this Plan.						x						
Action G4: The PUC will request that MDH conduct stable isotope testing once during the lifetime of this Plan.							x					
Action G5: The PUC will request information from MPCA, and possibly county officials on updates on spill, brownfields, and dump sites and possible groundwater contamination.												
H. Water Conservation												
Action H1.1: Update conservation measures included in various plans within the City.												x
Action H1.2: Implement water conservation measure and outreach.								x				
I. Planning and Zoning												
Action I1: The PUC and City will use this WHP Plan as a resource when updating its Comprehensive Plan, Water Supply Plan, normal zoning and planning review plans, and other relevant plans.												x
Action I2: Include a review of this Plan as a part of normal zoning and planning review process.												x
J. Implementation												
Action J1: Organize and file completed WHP activities in the PUC's WHP 3-ring binder.											x	
K. Evaluation												
Action K1: Complete an evaluation report every 2.5 years.											x	