

WELLHEAD PROTECTION PLAN



**FOR THE CITY OF
NORTH MANKATO, MINNESOTA**

September 2017

Forward

This document presents the wellhead protection (WHP) plan for the City of North Mankato that will help provide for an adequate and safe drinking water supply for community residents. It contains the following components:

- Assessment of the data elements used to prepare the plan;
- Delineation of the wellhead protection area;
- Delineation of the drinking water supply management area;
- Assessments of well and drinking water supply management area vulnerability;
- Impact of land and water use changes on the public water supply well(s) used by the water supplier;
- Issues, problems, and opportunities affecting the well(s), well water, and the drinking water supply management area;
- Wellhead protection goals for this plan;
- Objectives and plan of action for achieving the wellhead protection goals;
- Evaluation program for assessing the effectiveness of this plan; and
- Contingency strategy to address an interruption of the water supply.

Water Supply Wells Included in This Plan

Unique Number	Well Number	Use/Status ¹
209823	5	P
209821	6	P
112207	7	P
415943	8	P

¹P = Primary Water Supply Well

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Glossary of Terms and Acronyms

Data Element. A specific type of information required by the Minnesota Department of Health to prepare a wellhead protection plan.

Drinking Water Supply Management Area (DWSMA). The surface and subsurface areas surrounding a public water supply well, including the wellhead protection area, that must be managed by the entity identified in the wellhead protection plan. (Minnesota Rules, part 4720.5100, subpart 13). This area is delineated using identifiable landmarks that reflect the scientifically calculated wellhead protection area boundaries as closely as possible.

Emergency Response Area (ERA). The part of the wellhead protection area that is defined by a one-year time of travel within the aquifer that is used by the public water supply well (Minnesota Rules part 4720.5250, subpart 3). It is used to set priorities for managing potential contamination sources within the DWSMA.

Emergency Standby Well. A well that is pumped by a public water supply system only during emergencies, such as when an adequate water supply cannot be achieved because one or more primary or seasonal water supply Wells cannot be used.

Inner Wellhead Management Zone (IWMZ). The land that is within 200 feet of a public water supply well (Minnesota Rules, part 4720.5100, subpart 19). The City of North Mankato must manage the IWMZ to help protect it from sources of pathogen or chemical contamination that may cause an acute health effect.

Primary Water Supply Well. A well that is regularly pumped by a public water supply system to provide drinking water.

Vulnerability. Refers to the likelihood that one or more contaminants of human origin may enter either 1) a water supply well that is used by the City of North Mankato or 2) an aquifer that is a source of public drinking water.

WHP. Wellhead Protection

WHP Area (WHPA). The surface and subsurface area surrounding a well or well field that supplies a public water system, through which contaminants are likely to move toward and reach the well or well field (Minnesota Statutes, part 103I.005, subdivision 24).

WHP Plan Goal. An overall outcome of implementing the WHP plan, e.g., providing for a safe and adequate drinking water supply.

WHP Measure. A method adopted and implemented by a City of North Mankato to prevent contamination of a public water supply, and approved by the Minnesota Department of Health under Minnesota Rules, parts 4720.5100 to 4720.5590.

WHP Plan Objective. A capability needed to achieve one or more WHP goals, e.g., implementing WHP measures to address high priority potential contamination sources within 5 years.

Acronyms

DNR – Minnesota Department of Natural Resources

EPA – United States Environmental Protection Agency

NCPS – Nicollet County Property Services

MDH – Minnesota Department of Health

MRWA – Minnesota Rural Water Association

SWCD – Nicollet County Soil and Water Conservation District



Figure 1A - North Mankato Lower DWSMA Boundaries and DWSMA Vulnerability

North Mankato NW Drinking Water Supply Management Area (DWSMA) MN-00866 - Low Vulnerability

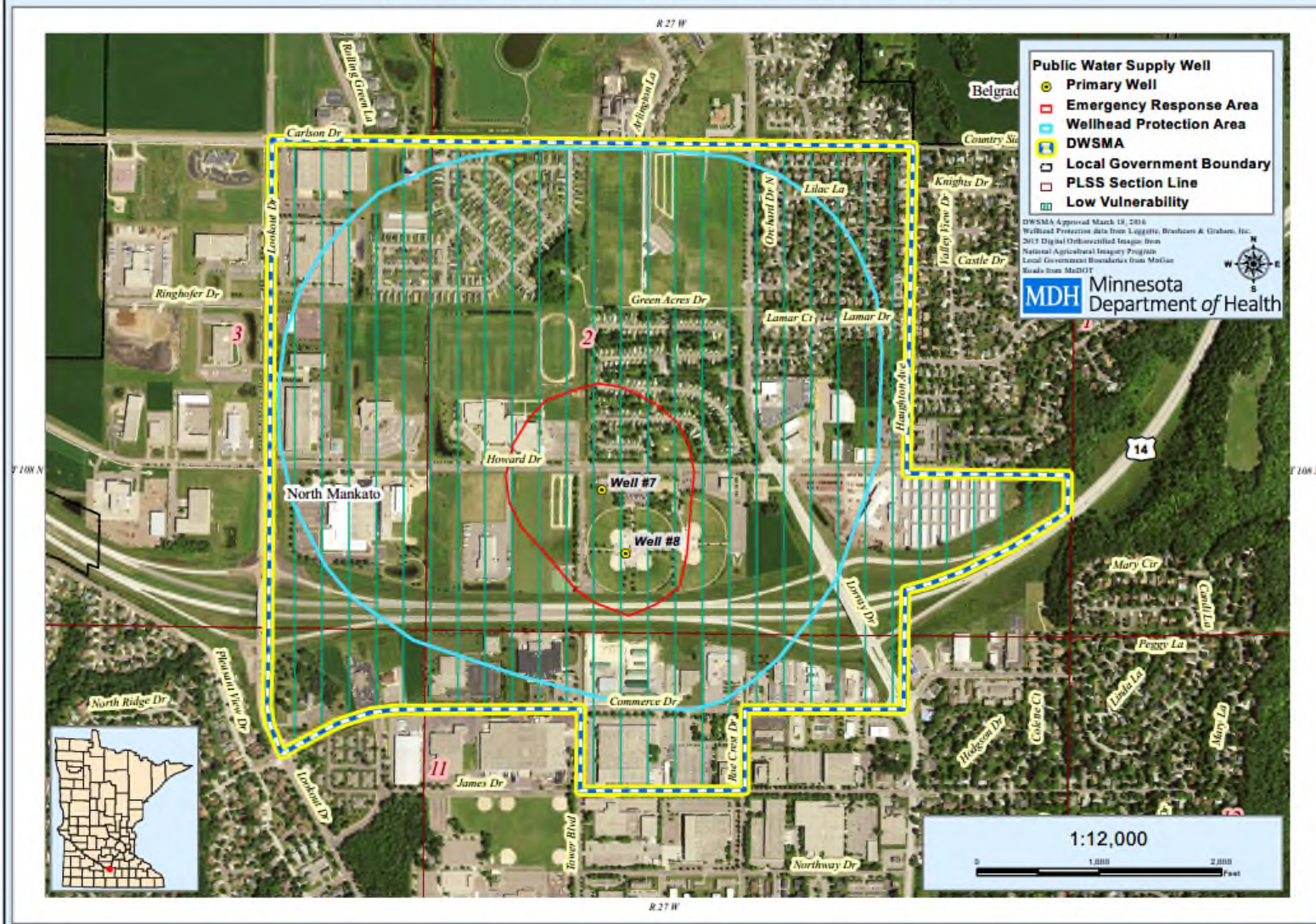


Figure 1B - North Mankato Upper DWSMA Boundaries and DWSMA Vulnerability

Chapter 1 - Introduction

1.1 Background

The wellhead protection (WHP) plan for the City of North Mankato was prepared by the North Mankato Public Works Department in cooperation with the Minnesota Department of Health (MDH). It contains specific actions that the city will take to fulfill WHP requirements that are specified under Minnesota Rules, part 4720.5100 to 4720.5590. Also, the support that Minnesota state agencies, federal agencies, Nicollet County, and others will provide is presented to identify their roles in protecting the city's drinking water supply. The plan is effective for 10 years after the approval date specified by MDH and the city is responsible for implementing its WHP plan of action, as described in Table 8 of this report. Furthermore, the city will evaluate the status of plan implementation at least every two-and-one-half years to identify whether its WHP plan is being implemented on schedule.

1.2 Plan Appendices

Much of the technical information that was used to prepare this plan is contained in the appendices but is summarized in the main body of this plan. In particular:

- Appendix I contains documents and discussion regarding the data elements used for this plan.
- Appendix II contains the first part of the plan, consisting of the delineation of the wellhead protection area (WHPA), the two drinking water supply management areas (DWSMA), and the vulnerability assessments for the public water supply wells and the two DWSMAs. This part of the plan is summarized in Chapter 3.
- Appendix III contains the inventory of potential contamination sources. This inventory is discussed in Chapter 4 in terms of assigning risk to the city's water supply and is also discussed in Chapter 6, relating to issues, problems or opportunities.
- Appendix IV contains supporting documents.

Chapter 2 - Identification and Assessment of the Data Elements Used to Prepare the Plan

The data elements that are included in this plan were used to 1) delineate the WHPAs and the DWSMAs and to assess DWSMA and well vulnerability and 2) document the need for the WHP measures that will be implemented to help protect the city's water supply from potential sources of contamination. The city met with representatives from MDH on two occasions to discuss data elements that are specified in Minnesota Rules, part 4720.5400, for preparing a WHP plan.

The first scoping meeting, held on August 27, 2014 addressed the data elements that were needed to support the delineation of the WHPA, the DWSMA, and the well and DWSMA vulnerability assessments. The second scoping meeting, held on May 3, 2016 discussed the data elements required to 1) identify potential risks to the public water supply and 2) develop effective management strategies to protect the public water supply in relation to well and DWSMA vulnerability. The results of each meeting were communicated to the city by MDH through a formal scoping decision notice and are presented in Appendix I.

Each data element is required to be assessed for its impact on 1) the use of the public water supply well, 2) delineation of the WHPA, 3) the quality and quantity of water supplying the public water supply wells, and 4) land and groundwater uses within the DWSMA. Presented in Appendix I is information about the availability of information regarding data element and the results of assessing each data element relative to the overall impact each data element may have on the four items listed above.

The availability of the information relating to each data element that is used in this plan was assessed by the Minnesota Department of Health and the City of North Mankato. During the assessment process the City of North Mankato and Minnesota Department of Health 1) reviewed the completeness of the information available relating to each data element that is used in this plan and 2) determined if a data element is considered an issue, concern or opportunity that the City of North Mankato can address in this plan.

The data elements specified by the MDH relating to the **physical environment** used in the development of the WHP plan are considered sufficient to provide an adequate assessment. No concerns or issues have been identified with these data elements. The assessment of the data elements specified by MDH relating to **land use** identified issues or concerns regarding the long-term management of the DWSMA. The following items summarize these land use issues that will be addressed in Chapter 9 of this WHP plan:

- Land use changes are not anticipated within the DWSMA.
- North Mankato's population is stable and the primary wells can meet demand.

Finally, the data elements specified by the MDH relating to **water quantity and quality** used in the development of the WHP plan are considered sufficient to provide an adequate assessment. Ground water quality and quantity information is 1) used during the WHPA delineation and water well and DWSMA vulnerability process and 2) assessed to determine the influence land uses may have on the city water wells (Appendix I).

Actions that are needed to address identified issues, concerns or opportunities as a result of the data element assessment process are included in the plan of action (Chapter 9). Not all of the data elements listed in the WHP rule had to be addressed in the WHP plan because of the nonvulnerable nature of the city's source of drinking water.

Chapter 3 - Delineation of the Wellhead Protection Area, Drinking Water Supply Management Area and Vulnerability Assessments

A detailed description of the process used for 1) delineating the two WHPAs and DWSMAs, and 2) preparing the vulnerability assessment of the city water supply wells and DWSMA is presented in Appendix II. The City of North Mankato contracted with Bolton & Menk, Inc. who in turn hired Leggette, Brashears & Graham, Inc. has licensed geoscientist by the State of Minnesota on staff to complete the delineations and vulnerability assessments.

A new Well #9 (809695) was constructed and put on line after this WHP process was begun; consequently, this well was not included in this plan as per MDH direction.

3.1 WHPA and DWSMA Delineation

Figures 1A and 1B shows the boundaries of the WHPA and the DWSMA for each DWSMA. The WHPAs were delineated using computer simulations of groundwater movement to generate the underground capture zone for city Well 5 (209823), Well 6 (209821), Well 7 (112207) and Well 8 (415943).

The DWSMA boundaries were defined for the City of North Mankato using the following features: Center lines of streets or roads and public land survey coordinates.

3.2 Well Vulnerability Assessment

The construction and water quality obtained from the primary wells used by the City of North Mankato is included in the assessment of well vulnerability. The vulnerability of the city wells is considered low because they are constructed so that the wells are adequately sealed into the borehole and do not pump water that contains human-caused contaminants.

3.3 DWSMA Vulnerability Assessment

The low vulnerability assigned to the two DWSMAs (Figure 1A and 1B) was determined using geologic maps and reports and groundwater chemistry information which indicate that the aquifer exhibits a low sensitivity throughout the DWSMA.

Chapter 4 – Inventory of Potential Contamination Sources, Establishing Priorities and Assigning Risk to Potential Contamination Sources

The types of potential contamination sources that may exist within the DWSMA were derived from the information collected to satisfy the data element requirements (Chapter 2). The impact assigned to each data element as part of the assessment process (Appendix I) was used to assess the types of potential contamination sources that may present a risk to the city's drinking water supply. The low vulnerability assessment for the DWSMA indicates that, generally, only wells, other types of boreholes or excavations that may reach the aquifer and certain types of Environmental Protection Agency Class V wells are likely to impact the city wells.

4.1 Conducting the Potential Contaminant Sources Inventory

As a start point in the inventory process, the MDH provided the City of North Mankato with well information from the Minnesota Well Index and other data bases. These data sources included wells with known locations, unknown locations, well sealing records and property disclosure documents that were shown on a GIS-based map and then systematically reviewed by the wellhead protection team to determine if any of the documented wells were located within the two North Mankato DWSMAs. Available historical photos were also reviewed by city and Nicollet County staff and a local well driller for information about possible well locations. Finally, the WHP team reviewed municipal well files provided by the MDH (Appendix III) to determine 1) the location

of any unused city wells within the DWSMA or municipal boundaries, and 2) what the current status (active, sealed or unknown) of any unused city wells may be.

4.2 Contaminants of Concern

None of the human-caused contaminants regulated under the federal Safe Drinking Water Act have been detected at levels indicating that the well itself serves to draw contaminants into the aquifer as a result of pumping.

4.3 Inventory Results and Risk Assessment

Maps and a table describing the types and locations of potential contaminant sources (e.g. wells) located within the DWSMAs is presented in Appendix III.

A summary of the results for the inner well management zone (IWMZ) potential contaminant source inventory (PCSI) for the primary and emergency standby city wells is listed in Table 1. Table 2 presents the PCSI results for the remainder of the DWSMA. The priority assigned to each type of potential contamination source addresses 1) the number inventoried, 2) its proximity to a city well, 3) the capability of local geologic conditions to absorb a contaminant, 4) the effectiveness of existing regulatory controls, 5) the time required for the City of North Mankato to obtain cooperation from governmental agencies that regulate it, and 6) the administrative, legal, technical, and financial resources needed. A **high (H)** risk potential implies that the potential source type has the greatest likelihood to negatively impact the city's water supply and should receive highest priority for management. A **low (L)** risk potential implies that a lower priority for implementing management measures is assigned.

Table 1
Potential Contamination Sources and Assigned Risk
For the IWMZ for Primary Wells

Well ID	Source Type	Total	Level of Risk
City Well #5 (209823)	Sanitary sewers, Storm water pipes, petroleum tank (56-1100 gal)	8	Low
City Well #6 (209821)	Sanitary sewers, Storm water pipes.	7	Low
City Well #7 (112207)	Sanitary sewer, Petroleum tank (>1100 gal), Sanitary sewers, water treatment backwash basin	6	Low
City Well #8 (415943)	Sanitary sewer, Storm water pipes	3	Low

In summary, Well #5 has one storm water pipe; Well #7 has one petroleum tank >1100 gallons; and, Well #8 has two storm water pipes that do not meet or exceed state well code setback requirements. The IWMZ potential contaminant source inventory conducted by the MDH is in Appendix III which provides more information regarding the types of potential contaminants and locations in relation to each city well. Because of the low geologic vulnerability of the DWSMA

these potential contaminant sources generally pose a low level of risk to the aquifer used by the city.

Table 2
Potential Contamination Sources and Assigned Risk
For the Remainder of the DWSMA

Potential Source Type	Total Number	Number Within Emergency Response Area and Level of Risk		Number Within Remainder of the DWSMA and Level of Risk	
Municipal well	5	0	-	1	L
Municipal well, unsealed	1	1	H	-	-
Unknown well, private	3	0	-	3	H

Within the DWSMA, in addition to the five city wells, there is one unused, unsealed city well and three private wells that are listed by the MDH's Minnesota Well Index (MWI) as 'located' wells. Because the three private wells are listed in the MWI as being 'located' the wells are required by MDH to be included in the potential contaminant source inventory. Nevertheless, the MWI does not provide any details regarding well construction, ownership or specific location of these three wells. City staff contacted Nicollet County staff, retired city staff and a local well driller in attempts to gather location and/or well status information about the three wells without success. Because of the absence of verifiable information regarding the status of these three private wells and the unused municipal well, all four wells are ranked as a high priority to determine status of these wells and potential sealing if locations and status is determined. Following is additional information regarding located wells within the DWSMA.

- An abandoned deep, city-owned well (Old Well #1 – no unique number assigned) is likely located at the original site of the water treatment plant near current Well #6. There are no records available about the construction of this well or if it may have been sealed in the past. This potential contaminant source located within the Emergency Response Area for Well #6 is considered a high priority to confirm the location and status of the well and seal if determined to be unsealed.
- Wells numbered 1000009043, 1000009044 and 1000009045 were assigned these numbers as part of a MDH – county program to locate and label wells within participating counties. These three wells are shown as being located in the Upper DWSMA; reviewing historical aerial photos, these wells may have been associated with farm sites that no longer exist. Assistance from MDH will be requested to determine the status of these wells.
- In the Upper DWSMA, MDH records indicate nine (9) wells have been sealed and in the Lower DWSMA, seventeen (17) wells have been properly sealed. The sealed wells include residential wells, municipal wells and monitoring wells. Appendix C has a table and map of sealed wells generated from MDH records.
- There are no known EPA - classified Class V wells within the DWSMA.
- There are no Sanborn fire insurance maps available for the city of North Mankato.

Chapter 5 - Impact of Land and Water Use Changes on the Public Water Supply Well

The city estimates that the following changes to the physical environment, land use, surface water, and groundwater may occur over the 10-year period that the WHP plan is in effect (Table 3). This is needed to determine whether new potential sources of contamination may be introduced in the future and to identify future actions for addressing these anticipated sources. Land and water use changes may introduce new contamination sources or result in changes to groundwater use and quality. The anticipated changes may occur within the jurisdictional authority of the city, although some may not. Table 3 describes the anticipated changes to the physical environment, land use, and surface water or groundwater in relationship to the 1) influence that existing governmental land and water programs and regulations may have on the anticipated change, and 2) administrative, technical, and financial considerations of the City of North Mankato and property owners within the DWSMAs.

Table 3 – Expected Land and Water Use Changes

Expected Change (Physical Environment, Land Use, Surface Water, Groundwater)	Impact of the Expected Change On the Source Water Aquifer	Influence of Existing Government Programs and Regulations on the Expected Change	Administrative, Technical, and Financial Considerations Due to the Expected Change
Physical Environment: No major change of the physical environment within the DWSMA is anticipated.	No impact anticipated.	No changes, therefore, existing programs or regulations are adequate.	No additional administrative, technical or financial considerations required.
Land Use: 1) No change in current land use within the Lower DWSMA is anticipated. However, the Upper DWSMA will likely experience long-term growth with associated greater water demands. 2) City may explore development of new city ordinances or policies addressing wells, water use and distribution requirements.	1) No impact anticipated in the short term. Pumping rates may increase in wells serving the Upper DWSMA in future years. 2) Land use planning that includes groundwater protection measures in the area surrounding the two DWSMAs can benefit the city's source water supply. Measures could address sealing of abandoned wells and/or reducing the potential of new wells being drilled within the municipal boundaries.	1) No rapid changes to current land uses anticipated, therefore, existing programs or regulations are adequate. 2) The city or county currently have no local ordinances in place addressing wells within the two DWSMAs or within city boundaries. This could change if the city reviews existing rules or policies for adequacy in addressing drinking water supply and distribution. Adoption of new regulations or policies addressing wells and public water supply may be an outcome of a review process.	1) No additional administrative, technical or financial considerations required. 2a) Within the city, any revisions to land use ordinances to further protect the public water supply would have to comply with all applicable state rules and regulations. 2b) The city may require technical assistance in developing new land use or water use related ordinances.
Surface Water:	Not Applicable	Not Applicable	Not Applicable
Groundwater: The city does not anticipate an increase in water use in the Lower DWSMA area, but demand in the Upper DWSMA area is likely to rise as industrial, commercial and residential uses expand.	No change expected in demand in the short term. However, water usage in the Upper DWSMA is expected to slowly increase over time which may result in increased pumping rates or additional wells in the future to meet demand.	No changes in water use anticipated in the short term. Therefore, existing programs or regulations are adequate to address permitting and construction to improve water supply infrastructure.	City Council will consider technical needs and funding options prior to implementing any plan to update public water infrastructure. No additional administrative considerations required because overall water demand not likely to change in the short term.

Chapter 6 - Issues, Problems, and Opportunities

6.1 Identification of Issues, Problems and Opportunities

The City of North Mankato has identified water and land use issues, problems and opportunities related to 1) the aquifer used by the city water supply well, 2) the quality of the well water, or 3) land or water use within the DWSMA. The city assessed 1) input from public meetings and written comments it received, 2) the data elements identified by MDH during the scoping meetings, and 3) the status and adequacy of the city's official controls and plans on land and water uses, in addition to those of local, state, and federal government programs.

The results of this effort are presented in Table 4, which defines the nature and magnitude of contaminant source management issues in the city's DWSMA. Identifying issues, problems and opportunities, including resource needs, enables the city to 1) take advantage of opportunities that may be available to make effective use of existing resources, 2) set meaningful priorities for source management and 3) solicit support for implementing specific source management strategies.

Table 4 - Issues, Problems, and Opportunities

Issue Identified	Impacted Feature	Problem Associated with the Identified Issue	Opportunity Associated with the Identified Issue	Adequacy of Existing Controls to Address the Issue
There may be unidentified, unused, unlocated or poorly maintained wells within the two DWSMAs.	These types of wells could potentially impact water quality within the aquifer used by the city or private wells within the DWSMAs.	Unused/unsealed or poorly maintained wells may provide a direct route for contaminants to reach an aquifer the city uses for water supply.	The City can work with the MDH and NCPS to continue to inventory and prioritize wells within or near the two DWSMAs. City can apply for a MDH-SWP grant for assistance in locating and sealing wells that are determined to be abandoned or unused within the two DWSMAs.	City doesn't have any local controls to track existing wells, new wells or unused or abandoned wells. Therefore, the city will need to work with citizens, MDH and county to locate wells and promote the proper sealing of any abandoned or unused wells located within the two DWSMAs.
The Lower DWSMA boundaries are within multiple jurisdictions: Blue Earth County and the City of Mankato. Also, the City of Mankato's West DWSMA boundary overlaps the Lower DWSMA (See PCSI map in Appendix III)	Aquifers, Well Water Quantity, Well Water Quality, Lower DWSMA	The City of North Mankato will need to rely on the City of Mankato to administer land use controls and regulate potential contaminant sources in the area of the Lower DWSMA outside the City of North Mankato's jurisdiction.	City of North Mankato could enter into a joint planning effort with the City of Mankato to manage potential contaminant sources (wells) in those areas of overlap of each city's DWSMAs within the other city's jurisdiction.	Each city regulates land uses within their own city limits. The two cities could collaborate in a review of existing land use controls for adequacy in protecting each of the cities' water supply.

Table 4 - Issues, Problems, and Opportunities – Continued

Issue Identified	Impacted Feature	Problem Associated with the Identified Issue	Opportunity Associated with the Identified Issue	Adequacy of Existing Controls to Address the Issue
The city has limited staff and financial resources to implement the wellhead protection plan.	DWSMA	With limited resources implementing the WHP plan could be a challenge for the City of North Mankato.	The city could partner with the City of Mankato, Nicollet county and state agencies that may have regulatory authority or programs to assist the city in WHP implementation.	A MDH-SWP grant program is available to a public water supplier with an approved WHP plan to implement the WHP plan.
Any new high capacity well(s) constructed within or near the two DWSMAs may alter WHPA boundaries and/or provide a pathway for pollutants to enter the aquifer.	Aquifer, DWSMA and potentially water well quantity and quality.	A large capacity well could potentially impact the city's municipal water supply wells' ability to supply water. City doesn't have any local controls regarding use or placement of a new high capacity well or pumping rates which may influence the capture area of the city well.	The city will need to work closely with the MDH-SWP, DNR-Waters, City of Mankato and county to identify any new high capacity wells which may be drilled within or near either DWSMA. MDH & DNR can assist city in determining if a new high capacity well may influence the capture area of city wells.	Current state law and rules requires all wells to be constructed according to state well construction codes and setbacks. DNR & MDH consider quantity of water being requested and potential impact on a DWSMA prior to permitting.
The city does not have any official controls or land use policies in place to control the placement or usage of new wells within the two DWSMAs or city.	Aquifer, DWSMA and water well quantity and quality.	A property owner could potentially drill a new water well within the city limits or DWSMA without city review or approval. Current land use categories typically do not consider potential impact on groundwater.	The city could adopt official controls or revise existing rules to control the placement or use of new wells within the city. City could use a land use planner to develop or update the city land use plan or zoning ordinance to address: impacts of land use on the aquifers used by the city and, use and placement of wells in city. City can apply for a MDH-SWP grant to assist in developing official controls regarding all types of wells within the two DWSMAs and/or entire city.	City of North Mankato does address private water supply systems and specifically prohibits cross connections between private wells and the public distribution system and can restrict public water supply usage if necessary. City does not address high capacity wells or the placement of new wells within city limits. MDH has authority to require well sealing.
Monitoring regional use of the Mt. Simon aquifer.	Aquifer and potentially water well quantity	Access to the Mt. Simon aquifer could be limited in the future to assure sustainable use of the aquifer for the public.	Continue to participate in a DNR-led cooperative work group of Mt. Simon aquifer users.	State of Minnesota (DNR) has the authority to control groundwater appropriations from the Mt. Simon or other aquifers.
North Mankato's "Well #1" has been out of service since about 1947 but remains unsealed.	Aquifer in Lower DWSMA. Potentially well water quality.	Unused/unsealed or poorly maintained wells may provide a direct route for contaminants to reach an aquifer the city uses for water supply.	City can apply for MDH for assistance in locating Well #1 and request grants to seal the well once the location in the Lower DWSMA is verified.	City council has administrative controls to address this issue. MDH has authority to require well sealing.

Table 4 - Issues, Problems, and Opportunities – Continued

Issue Identified	Impacted Feature	Problem Associated with the Identified Issue	Opportunity Associated with the Identified Issue	Adequacy of Existing Controls to Address the Issue
Conducting an aquifer test of a city well located in the Lower DWSMA would provide better modeling data for future WHP amendment.	Aquifer, Lower DWSMA, water well quantity	Determination of Lower WHPA and DWSMA was based on data from a Mankato city well with different construction properties.	An aquifer test conducted by MDH staff would produce more localized data that would be used for future WHP amendments.	MDH would provide the instruments and staff to coordinate an aquifer test with North Mankato staff at no cost to the city.
Class V drainage wells may be present within the two DWSMAs.	Aquifer, water well quality and DWSMA.	Auto/truck repair-related businesses within the DWSMAs with a Class V drainage well may allow oil, grease and other auto-related pollutants to infiltrate into the soil and/or aquifer.	City can provide the public and owners of such businesses with educational materials regarding Class V drainage wells.	City could adopt an ordinance to control the use of Class V wells within the city limits. Federal EPA rules ban Class V drainage wells associated with auto/truck-related businesses in all WHP areas.
It is important to educate the citizens within the two DWSMAs and newly-elected city officials and other local or state agencies about the City's WHP program.	Aquifer, water well quality and quantity and DWSMA	Periodic turnover in elected officials and staff from various agencies can be a challenge to maintain continuity and momentum in future WHP plan implementation efforts.	City staff can work with MDH SWP or MRWA staff to provide WHP-related information to elected officials, citizens and other local or state technical staff. This keeps decision-makers informed of the importance and need for effective WHP plan implementation as they relate to the city's drinking water supply.	City can formally request assistance from MDH, MRWA or Nicollet County PS to develop appropriate educational materials related to WHP.

6.2 Comments Received

There have been several occasions for local governments, state agencies, and the general public to identify issues and comment on the city's WHP plan. At the beginning of the planning process, local units of government were notified that the city was going to develop its WHP plan and were given the opportunity to identify issues and comment. A public information meeting was held to review the results of the delineation of the wellhead protection areas, DWSMAs, and the vulnerability assessments. A public hearing was held before the completed WHP plan was sent to MDH for state agency review and approval.

Chapter 7 - Existing Authority and Support Provided by Local, State, and Federal Governments

In addition to its own controls, the City of North Mankato will rely upon partnerships formed with local units of government, state agencies, and federal agencies with regulatory controls or resource management programs in place to help implement its WHP plan. The level of support that a local, state, and federal agency can provide depends on its legal authority, as well as the resources available to local governments.

7.1 Existing Controls and Programs of the City of North Mankato

Table 5 lists the legal controls and/or programs that the city has identified to support the management of potential contamination sources within the DWSMAs.

Table 5 - Controls and Programs of the City of North Mankato

Type of Control	Program Description
<ol style="list-style-type: none">1. City zoning2. State building code3. Chapter 52 – Water Services<ul style="list-style-type: none">• Cross connections and backflow prevention• Water service hookup• Private water supplies4. Conservation rate water and sewer billing5. DNR Water Supply Plan	<ol style="list-style-type: none">1. Requires land uses within city to comply with city ordinance to control and direct city development and offset potential environmental risk to the city’s water supply that may be posed by a specific land use.2. Requires building permits to assure setbacks to water and sewer lines are met; plumbing and electrical inspections.3. Reduce potential for contamination of drinking water supply.4. Single water use rates tied to sewer rates promote water conservation leakage, service charges, hook-up requirements, water rates and restricted hours for sprinkling.5. Addresses droughts and water emergencies, contribute to maintaining aquifer levels and reduces potential well interference or water use conflicts.

7.2 Local Government Controls and Programs

Table 6 lists departments or programs within Nicollet County that may be able to assist the city with issues relating to potential contamination sources that 1) have been inventoried or 2) may result from changes in land and water use within the DWSMAs.

Table 6 - Local Agency Controls and Programs

Government Unit	Name of Control/Program	Program Description
Nicollet County Property Services	<ol style="list-style-type: none">1. Water Planning Management2. County Zoning Ordinance3. Comprehensive Land Use Plan	<ol style="list-style-type: none">1. Identifying & assessing priority water resource concerns.2. County controls all land uses in township areas; Construction permits required.3. Guides development in townships within Blue Earth County.
Nicollet County SWCD	State Cost Share	Funds available for well sealing within DWSMAs.

7.3 State Agency and Federal Agency Support

MDH will serve as the contact for enlisting the support of other state agencies on a case-by-case basis regarding technical or regulatory support that may be applied to the management of potential contamination sources. Participation by other state agencies and the federal government is based on legal authority granted to them and resource availability. Furthermore, MDH 1) administers state regulations that affect specific potential sources of contamination and 2) can provide technical assistance to property owners to comply with these regulations.

Table 7 identifies the specific regulatory programs or technical assistance that state and federal agencies may provide to the City of North Mankato to support implementation of the WHP plan. It is likely that other opportunities for assistance may be available over the 10-year period that the plan is in effect due to changes in legal authority or increases in funding granted to state and federal agencies. Therefore, the table references opportunities available when the city's WHP plan was first approved by MDH.

Table 7- State and Federal Agency Controls and Programs

Government Unit	Type of Program	Program Description
MDH	State Well Code (Minnesota Rules, Chapter 4725)	MDH has authority over the construction of new wells and the sealing of wells. MDH staff in the Well Management Program offer technical assistance for enforcing well construction codes, maintaining setback distances for certain contamination sources, and well sealing.
MDH	WHP	MDH has staff that will help the city identify technical or financial support that other governmental agencies can provide to assist with managing potential contamination sources. MDH administers SWP grant program.
DNR	Water appropriation permitting (Minnesota Rules, Chapter 6115)	DNR can require that anyone requesting an increase in existing permitted water appropriations, or to pump groundwater, must address concerns regarding the impacts to drinking water if these concerns are included in a WHP plan.
U.S. EPA	40 Code of Federal Regulations 144, Subpart G	Automatic closure of Class 5 automotive waste disposal wells in WHPA; inventory of all Class V wells.

7.4 Support Provided by Nonprofit Organizations

The City of North Mankato will request assistance from the Nicollet County Public Services, the City of Mankato, the Minnesota Rural Water Association and other established organizations to assist in the implementation of their WHP plan.

Chapter 8 - Goals

Goals define the overall purpose for the WHP plan, as well as the end points for implementing objectives and their corresponding actions. The WHP team identified the following goals after considering the impacts that 1) changing land and water uses have presented to drinking water quality over time and 2) future changes that need to be addressed to protect the community's drinking water:

- **Maintain a safe and adequate drinking water supply for community residents which meet all state and federal drinking water standards.**
- **Increase awareness among public officials, land owners and the general public about the importance of WHP in protecting the public drinking water supply.**
- **Support ongoing data collection efforts to enhance future WHP activities.**

Chapter 9 - Objectives and Plan of Action

Objectives provide the focus for ensuring that the goals of the WHP plan are met and that priority is given to specific actions that support multiple outcomes of plan implementation. Both the objectives and the wellhead protection measures (actions) that support them are based on assessing 1) the data elements (Chapter 2), 2) the potential contaminant source inventory (Chapter 4), 3) the impacts that changes in land and water use present (Chapter 5) and 4) issues, problems, and opportunities referenced to administrative, financial, and technical considerations (Chapter 6).

9.1 Objectives

The following objectives have been identified to support the goals of the WHP plan for the City of North Mankato:

1. Communicate with public about wells and wellhead protection.
2. Utilize community comprehensive planning to protect drinking water.
3. Manage wells that are owned or operated by the community.
4. Provide guidance to private well owners to properly manage wells.
5. Collect, monitor and evaluate data necessary to support WHP Plan implementation.

9.2 Establishing Priorities

WHP measures reflect the administrative, financial, and technical requirements needed to address the risk to water quality or quantity presented by each type of potential contamination source. Not all of these measures can be implemented at the same time, so the WHP team assigned a priority to each. A number of factors must be considered when WHP action items are selected and prioritized (part 4720.5250, subpart 3):

- Contamination of the public water supply wells by substances that exceed federal drinking water standards.
- Quantifiable levels of contamination resulting from human activity.
- The location of potential contaminant sources relative to the wells.

- The number of each potential contaminant source identified and the nature of the potential contaminant associated with each source.
- The capability of the geologic material to absorb a contaminant.
- The effectiveness of existing controls.
- The time needed to acquire cooperation from other agencies and cooperators.
- The resources needed, i.e., staff, money, time, legal, and technical resources.

9.3 WHP Measures and Action Plan

Based upon these factors, the WHP team has identified WHP measures that will be implemented by the city over the 10-year period that its WHP plan is in effect. The objective that each measure supports is noted as well as 1) the lead party and any cooperators, 2) the anticipated cost for implementing the measure and 3) the year or years in which it will be implemented.

The following categories are used to further clarify the focus that each WHP measure provides, in addition to helping organize the measures listed in the action plan:

- Education and Outreach
- Well and Contaminant Source Management
- Land Use Planning
- WHP Coordination, Evaluation and Reporting
- Monitoring, Data Collection and Assessment
- Contingency Planning

Table 8 lists each measure that will be implemented over the 10-year period that the city's WHP plan is in effect, including the priority assigned to each measure. Unless otherwise specified, all efforts to implement identified measures listed in Table 8 must be summarized by the eighth year after WHP approval to coincide with the beginning of the formal process to amend this current version of the WHP plan.

Table 8 - WHP Plan of Action

Public Education and Outreach - Implementation Action Items													
Action	Priority	Description	Objective Addressed	Cooperators	Cost	Implementation Time Frame							
						2018	2019	2020	2021	2022	2023	2024	2025
Action 1	Low	<u>WHP & Drinking Water Protection Education</u> Measure: Select wellhead protection public education items from the MN Rural Water Association source water protection website and post on the city's website.	1, 4	City, MRWA	\$50	•		•		•		•	•
Action 2	High	<u>Well Education</u> Measure: Provide information to public utilizing the city's website regarding unused or unsealed wells and options for managing wells by 1) properly sealing unused wells or, 2) return unused wells to operating condition.	1, 4	City, MDH, MRWA, NCPS	\$50	•		•		•		•	•
Action 3	Low	Measure: Provide public with educational materials regarding Class V wells.			\$25		•					•	
Action 4	Low	<u>Water Use Management</u> Measure: Educate the public regarding water conservation practices to reduce water use.	1,2,3	City, MRWA	\$25	•		•		•		•	•
Evaluation and Reporting – Implementation Action Items													
Action	Priority	Description	Objective Addressed	Cooperators	Cost	Implementation Time Frame							
						2018	2019	2020	2021	2022	2023	2024	2025
Action 5	Medium	<u>Implementation, Tracking and Reporting Activities</u> Measure: Maintain a “WHP folder” that contains date and documentation of WHP activities you have completed.	5	City	Staff Time	On Going							
Action 6	High	<u>WHP Program Evaluation Plan Reporting:</u> Measure: Complete an Evaluation Report every 2.5 years that evaluates the “progress of plan of action and the impact of any contaminant release on the aquifer supplying the public water supply well” MN WHP Rule 4720.5270.	5	City	Staff Time			•		•		•	

Table 8 - WHP Plan of Action – Continued

Well and Contaminant Source Management - Implementation Action Items															
Action	Priority	Description	Objective Addressed	Cooperators	Cost	Implementation Time Frame									
						2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Action 7	Medium	<u>High Capacity Well Management</u> Measure: If a new appropriation permit or high capacity well is being proposed in or within 2.0 miles of either DWSMA, or within the area of influence as determined by the MnDNR, cooperate with the DNR and MDH hydrologists as requested to help assess any potential impacts on the public water supply well or aquifer used. If impacts are identified, cooperatively work with the high capacity well owner, DNR and MDH hydrologist to identify options to resolve any potential impacts.	1, 4, 5	City, NCPS, MDH DNR	Staff Time	On An As-Needed Basis									
Action 8	High	<u>Private and Public Well Management</u> Measure: Request technical assistance from the City of Mankato, Nicollet County, MDH or other state agencies to identify and verify location of any unused, unsealed or improperly sealed wells within either DWSMA deemed to be a risk to the aquifer used by city.	1, 4, 5	City, City of Mankato, NCPS, MDH	Staff Time		•	•							
Action 9	High	Measure: Request technical assistance from MDH to locate North Mankato city well #1in the Lower DWSMA.		City, MDH	Staff Time		•	•							
Action 10	High	Measure: Request technical assistance from MDH-Well Management Section to determine status and locations of three wells listed in MWI as being ‘located’ within the Upper DWSMA; well numbers: 1000009043, 1000009044 and 1000009045.		City, MDH	Staff Time	•									
Action 11	High	Measure: Apply for MDH grants to seal unused, unsealed or improperly sealed private or public wells located in either DWSMA deemed to be a risk to the aquifers used by city. The fulfillment of this measure is contingent upon availability of funding.		City, MDH, MRWA	Staff Time	On An As-Needed Basis									
Action 12	Low	<u>Class V Wells</u> Measure: Work with MDH Planner to identify any potential Class V wells in the two DWSMAs.	1, 4, 5	City, MDH, USEPA	Staff Time	On An As Needed Basis									
Action 13	Low	Measure: If a Class V Well is identified, work with MDH-SWP Planner to provide the property owner with information to contact the EPA regarding the requirements of Class V wells.		City, MDH, USEPA	Staff Time	On An As Needed Basis									
Action 14	High	<u>Municipal Well Management Practices:</u> Measure: Monitor setbacks for all new potential sources of contamination within the IWMZ of all primary and emergency standby wells.	1, 3, 5	City	Staff Time	On Going Basis									
Action 15	High	Measure: Request assistance from the MDH to review and update the IWMZ survey form for all city wells every 5 years.	3	City, MDH	Staff Time					•				•	

Well and Contaminant Source Management - Implementation Action Items															
Action	Priority	Description	Objective Addressed	Cooperators	Cost	Implementation Time Frame									
						2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Action 16	High	Measure: Implement WHP measures identified on current and future IWMZ Inventory forms.	3, 5	City, MDH	Staff Time	On Going									
Land Use Planning															
Action	Priority	Description	Objective Addressed	Cooperators	Cost	Implementation Time Frame									
						2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Action 17	Medium	<u>General Land Use & Water Resource Planning:</u> Measure: Send the Nicollet County Water Plan Coordinator a copy of the state approved North Mankato WHP plan.	1, 2	City, NCPS, City of Mankato	Staff Time	•									
Action 18	Medium	Measure: Request the inclusion of DWSMA map and identified WHP issues (Chapter 6) when the Nicollet County water management plan or comprehensive land use plan is revised.				•									
Action 19	Medium	Measure: Request to be notified by all jurisdictions with planning and zoning authority about land use permits or zoning changes near either DWSMA which may impact the public water supply wells and aquifer.				•									
Action 20	Low	Measure: Consider coordination with the City Engineer to identify and recommend changes to city policies, plans or controls that can be made to help protect the City of North Mankato public water supply wells and aquifers used by those wells. Fulfillment of this measure is contingent upon receiving MDH grant funding.	1,2, 3	City						•					

Table 8 - WHP Plan of Action - Continued

Monitoring and Data Collection – Implementation Action Items												
Action	Priority	Description	Objective Addressed	Cooperators	Cost	Implementation Time Frame						
						2018	2019	2020	2021	2022	2023	2024
Action 21	Medium	Measure: Request assistance from the City of Mankato and Nicollet County PS to verify the locations of new wells that have been constructed within two-miles of the applicable DWSMA since 2017.	5	City, MDH, NCPS, City of Mankato	Staff Time							•
Action 22	Medium	Measure: Request assistance from the City of Mankato and the MDH to provide copies of records (if available) of wells added or sealed since 2017 within either DWSMA.										•
Action 23	High	Measure: Work with MDH hydrologist to schedule and conduct an aquifer test on one of the city’s multi-aquifer wells.	3,5	City, MDH	Staff Time					•		
Action 24	High	Measure: Continue monitoring Mt. Simon aquifer wells as per DNR working group protocols.	3, 5	City, DNR	Staff Time +\$1000/yr.	As required by Work Group						
Action 25	Medium	Measure: Work with MDH to conduct tritium sampling on select well(s) prior to the next amendment.	3, 5	City, MDH	Staff Time					•		
Action 26	Medium	Measure: Review and update as needed the potential contaminant source well inventory (spreadsheet and map) every 2 ½ years for existing wells, new wells and/or sealed wells that are identified in either DWSMA.	1, 3, 5	City	Staff Time			•			•	
Contingency Planning												
Action	Priority	Description	Objective Addressed	Cooperator(s)	Cost	Implementation Time Frame						
						2018	2019	2020	2021	2022	2023	2024
Action 27	Low	Measure: Update the Part 2 – Emergency Preparedness Procedures portion of the DNR Water Supply Plan on an as-needed basis or prior to amending this WHP plan, whichever comes first.	1, 3, 5	City	Staff Time							•

9.4 Commitments from Cooperators

The agencies listed in Table 9 manage various programs that may provide technical and in some instances financial assistance to support the City of North Mankato with implementing the WHP measures in which they are identified.

Table 9 - Cooperating Agencies List

Agency Name and Measure Number	Agency Name and Measure Number
MDH – 2,3, 7-13, 15, 16, 21, 22, 25	Nicollet County PS – 2, 3, 7, 8, 17-19, 21, 22
MRWA – 1-4, 11	US EPA – 12, 13
DNR – 7, 24	City of Mankato – 8, 17-19, 21, 22

Chapter 10 - Evaluation Program

Evaluation is used to support plan implementation and is required under Minnesota Rules, part 4720.5270 prior to amending the city's WHP plan. Plan evaluation is specified under Objective 5 (Chapter 9.1) and provides the mechanism for determining whether WHP action items are achieving the intended result or whether they need to be modified to address changing administrative, technical, or financial resource conditions within the DWSMA. The city has identified the following procedures that it will use to evaluate the success with implementing its WHP plan.

1. The WHP team will meet, at a minimum, every two-and-one-half years to assess the status of plan implementation and to identify issues that impact the implementation of action steps throughout the DWSMA;
2. The city will prepare a written report that documents how it has assessed plan implementation and the action items that were carried out. The report will be presented to MDH at the first scoping meeting held with the city to begin amending the WHP plan.

Chapter 11 - Contingency Strategy

The WHP plan includes a contingency strategy that addresses disruption of the water supply caused by either contamination or mechanical failure. The city has a contingency water supply plan in effect that was approved by the Minnesota Department of Natural Resources in 2017 and fulfills the contingency planning requirements for wellhead protection. A copy of this plan is available for public review during regular business hours at the City of North Mankato Public Works office and is referenced in this section. Appendix IV contains the DNR approval letter.

APPENDICES

Appendix I: Identification and Assessment of Data Elements Used to Prepare the Plan

Appendix II: Wellhead Protection, Part 1 WHPA and DWSMA Delineation and Vulnerability Assessment

Appendix III: Inventory of Potential Contamination Sources

Appendix IV: Supporting Documents

Appendix I

Assessment of Data Elements

- 1. Scoping Decision Notice and Letter No. 1**
- 2. Scoping Decision Notice No. 2**
- 3. Assessment of Data Elements, including:**
 - DWSMA Land Cover Map and Table**
 - City of North Mankato Comprehensive Plan and Map**
 - City of North Mankato Zoning Map**
 - Nicollet County Comprehensive Plan and Map**
 - Nicollet County (Belgrade Township) Zoning Map**
 - Nicollet County Comprehensive Water Plan addressing groundwater management**
 - 2016 City of North Mankato Consumer Confidence Report**



COPY

Protecting, maintaining and improving the health of all Minnesotans

September 26, 2014

Mr. Duane Rader, Water Superintendent
1001 Belgrade Avenue
P.O. Box 2055
North Mankato, Minnesota 56002

Dear Mr. Rader

Subject: Scoping Decision Notice No. 1 for the City of North Mankato, PWSID 1520005

This letter provides notice of the results of the Scoping 1 meeting held with you and Rudy Kleist (city of North Mankato, David Hume (Leggette, Brashears & Graham, Inc.), Herman Dharmarajah (Bolton & Menk) and Karen Voz and me (Minnesota Department of Health) on August 27, 2014, regarding wellhead protection planning. During the meeting, we discussed the preparation of Part I of a Wellhead Protection Plan that will document the 1) delineation of a wellhead protection area, 2) delineation of a drinking water supply management area, and 3) assessments of well and aquifer vulnerability related to these areas for the primary water supply wells that are used by North Mankato. The wellhead protection area is the surface and subsurface area surrounding your public water supply wells through which contaminants are likely to move and affect your drinking water supply. The drinking water supply management area is the area delineated using identifiable landmarks that reflect the wellhead protection area boundaries as closely as possible.

It is our understanding that the city also has a well (Well 5 – Unique No. 209823) that it retains for emergency standby use. The city must manage an inner wellhead management zone that is defined by a 200-foot radius around each emergency standby well.

According to the state wellhead protection rule, the city will have until September 15, 2017, to complete its entire Wellhead Protection Plan, Part I and Part II. As we discussed, the rule describes the criteria used for determining the time period for completion of the Wellhead Protection Plan (Minnesota Rules, part 4720.5130). The Minnesota Department of Health (MDH) highly recommends that half of the time allotted be dedicated to completing Part II of the plan.

It is our understanding that you will be contracting a consultant to prepare the delineations and vulnerability assessments for the city. MDH has a draft Request for Proposal (RFP) that can be used to help select a consultant that has experience in wellhead protection planning and, in particular, with preparing a Part I report. Please contact me at the phone number below if you want to discuss using the draft RFP.

Mr. Duane Rader
Page 2
September 26, 2014

At our meeting, we discussed rule requirements and the types of information needed to prepare the Part I report. The Wellhead Protection Plan must be prepared in accordance with Minnesota Rules, parts 4720.5100 to 4720.5590. General wellhead protection requirements and criteria for delineating the wellhead protection area and data reporting are presented in Minnesota Rules, parts 4720.5500 to 4720.5510.

The enclosed Scoping Decision Notice No. 1 formally identifies the information that the city must provide to MDH to meet rule requirements for preparing Part I of the Wellhead Protection Plan. The wellhead rule refers to the existing information required for wellhead planning as data elements. Much of this information is available in the public domain, as described in the Scoping Decision Notice No. 1 form. You only need to provide the information that is not in the public domain and, therefore, not available to MDH. The Scoping Decision Notice No. 1 form also 1) lists the Minnesota unique well number and well construction for each well that will be included in the Wellhead Protection Plan [Table 1]; 2) lists the pumping volumes for each well [Table 2; and 3) includes a map of the well locations. An inner wellhead management zone (IWMZ), which is the area within a 200-foot radius around the well, serves as the wellhead protection area for emergency wells. A summary of the information that the city needs to provide is included at the end of the Scoping Decision Notice No. 1 form.

After we have had an opportunity to review the information listed in the Scoping Decision Notice No. 1 that you will be providing to MDH, we would appreciate the opportunity to again meet with you and select the appropriate method for delineating your wellhead protection area. We also will discuss how you can become involved in the preparation of the Part I report.

After your consultant has had an opportunity to develop a conceptual model of the local hydrogeologic setting, we would like to meet with your consultant to discuss the proposed delineation approach. This pre-delineation meeting may be accomplished by a conference call if 1) MDH approves, and 2) the consultant provides figures for the discussion beforehand.

Prior to finalizing the wellhead protection area boundaries, we highly recommend that we informally review preliminary model results and assess whether any changes are needed to meet rule requirements. Model input and solution files should be submitted in electronic form. The same applies to geographical data, such as the wellhead protection area and drinking water supply management area. When geographic data are submitted electronically, ArcInfo export or ArcView shapefile formats are preferred. It will greatly accelerate our review if these geographic data use the 1983 North American Datum (NAD83), Universal Transverse Mercator, Zone 15 North (UTM, Z15N) projection, with meter distance units. Other datum and projection systems are acceptable as long as they are documented. Specific questions regarding electronic geographic data can be directed to Michael Baker, Source Water Protection Unit, at 651/201-4651.

Mr. Duane Rader
Page 3
September 26, 2014

Finally, it is our understanding that you will serve officially as the wellhead protection manager on behalf of the city. You are responsible for providing written notice to local units of government of the city's intent to develop the Wellhead Protection Plan, as required by the wellhead protection rule (part 4720.5300, subpart 3). A copy of this notice should be forwarded to MDH and must include a list of the city wells, their unique well numbers, and contact information for you as wellhead protection manager. Karen Voz, your Source Water Protection Unit Planner, can provide you with some examples of the notification of intent that other communities have used. Please contact her at 320-223-7322.

In closing, we look forward to working with you on completion of your Wellhead Protection Plan. If you have any questions regarding our comments, please contact me at 651/201-4658 or at john.woodside@state.mn.us.

Sincerely,



John Woodside, Hydrologist
Source Water Protection Unit
Environmental Health Division
P.O. Box 64975
St. Paul, Minnesota 55164-0975

JSW:ds-b

Enclosures: Scoping Decision Notice No. 1; Summary of Data Requested; Table 1 - Public Water Supply Well Information; Table 2 - Annual Volume of Water Pumped From PWS Wells;
Map of Well Locations

cc: Karen Voz, Planner, Source Water Protection Unit, St. Cloud District Office
Rudy Kleist, City of North Mankato
David Hume, Leggette, Brashears & Graham, Inc.
Herman Dharmarajah, Bolton & Menk

April 22, 2015

Mr. Duane Rader, Water Superintendent
City of North Mankato
P.O. Box 2055
North Mankato, Minnesota 56002-2055

Dear Mr. Rader:

**Subject: Amendment to the Scoping Decision Notice No. 1 for City of North Mankato –
PWSID 1520005 - for Well 5 (209823)**

This letter provides notice of the results of an amended Scoping 1 meeting I held with Duane Rader (city of North Mankato) over the phone on March 30, 2015, regarding wellhead protection planning. The scoping is being amended to include the additional public water supply Well 5 (209823). During the meeting, we discussed the preparation of Part I of a Wellhead Protection Plan that will document the 1) delineation of a wellhead protection area, 2) delineation of a drinking water supply management area, and 3) assessments of the well and aquifer vulnerability related to these areas for the public water supply.

According to the state wellhead protection rule, North Mankato will have until September 15, 2017, to complete its entire Wellhead Protection Plan, Part I and Part II, for Well 5 (209823). This is the same completion date as your other public water supply wells, given on September 26, 2014, Scoping Decision Notice No. 1 sent to you. It is our understanding that you have contracted a consultant to prepare the delineations and vulnerability assessments for North Mankato for amending the Wellhead Protection Plan.

During our conversation, we discussed rule requirements and the types of information needed to prepare the Part I report. As in the September 26, 2014, decision notice, the Wellhead Protection Plan must be prepared in accordance with Minnesota Rules, parts 4720.5100 to 4720.5590. General wellhead protection requirements and criteria for delineating the wellhead protection area and data reporting are presented in Minnesota Rules, parts 4720.5500 to 4720.5510.

The enclosed Scoping Decision Notice No. 1 formally identifies the information North Mankato must provide to the Minnesota Department of Health (MDH) to meet rule requirements for preparing Part I of the Wellhead Protection Plan for Well 5 (209823). The wellhead rule refers to the existing information required for wellhead planning as data elements. Much of this information is available in the public domain, as described in the Scoping Decision Notice No. 1 form. You only need to provide the information that is not in the public domain and, therefore, not available to MDH. The Scoping Decision Notice No. 1 form also 1) lists the Minnesota unique well number and well construction for Well 5 [209823 - Table 1]; 2) lists the pumping volumes for the well [Table 2]; 3) includes a table of high-capacity wells that may influence the delineation; and 4) includes a map of the well location. A summary of the information that the city needs to provide is included at the end of the Scoping Decision Notice No. 1 form.

Mr. Duane Rader
Page 2
April 22, 2015

As with the other public water supply wells, once the delineations are completed, and prior to finalizing the wellhead protection area boundaries, we highly recommend that we informally review preliminary model results and assess whether any changes are needed to meet rule requirements. Model input and solution files should be submitted in electronic form. The same applies to geographical data, such as the wellhead protection area and drinking water supply management area. When geographic data are submitted electronically, ArcInfo export or ArcView shapefile formats are preferred. It will greatly accelerate our review if these geographic data use the 1983 North American Datum (NAD83), Universal Transverse Mercator, Zone 15 North (UTM, Z15N) projection, with meter distance units. Other datum and projection systems are acceptable as long as they are documented. Specific questions regarding electronic geographic data can be directed to Michael Baker, Source Water Protection Unit, at 651/201-4651.

Finally, it is our understanding that you are serving officially as the wellhead protection manager on behalf of North Mankato for this well also. It is our understanding that you provided written notice on September 27, 2014, to local units of government of the city's intent to develop the Wellhead Protection Plan, as required by the wellhead protection rule (part 4720.5300, subpart 3). You will need to provide an amended notice of intent to the local units of government for Well 5 (209823) also, and send verification to MDH.

In closing, we thank you for your cooperation in completing this amendment to your Wellhead Protection Plan. Karen Voz, your MDH Planner, and I look forward to working with you. If you have any questions regarding our comments, please contact Karen at 320/223-7322 or me at 651/201-4658.

Sincerely,

John Woodside, Hydrologist
Source Water Protection Unit
Environmental Health Division
P.O. Box 64975
St. Paul, Minnesota 55164-0975

JWS:ds-b

Enclosures: Scoping Decision Notice No. 1 Form; Summary of Data Requested; Table 1 - Public Water Supply Well Information; Table 2 - Annual Volume of Water Pumped From PWS Well; Table 3 - Permitted High-Capacity Wells; Map of Well Location

cc: Karen S. Voz, Planner, St. Cloud District Office
Amy L. Lynch, Engineer, Mankato District Office

SCOPING DECISION NOTICE No. 1

The purpose for the first Scoping Meeting, as required by Minnesota Rules, part 4720.5310, is to discuss the information necessary for preparing the Part I Report of a Wellhead Protection Plan. The Part I Report identifies the area that provides the source of drinking water for the public water supply (PWS) so that the PWS can develop land use or management practices to protect their groundwater resource from contamination. Specifically, the Part I Report documents the delineation of the wellhead protection area (WHPA), the delineation of the drinking water supply management area (DWSMA), and assesses the vulnerability of the PWS wells and DWSMA.

The wellhead rule (Minnesota Rules, part 4720.5310) refers to the information required for wellhead planning as data elements. This form lists the data elements that are stated in Minnesota Rules, part 4750.5400. The Minnesota Department of Health (MDH) uses this form to designate which data elements are needed to prepare the Part I Report, based on the hydrogeological setting, vulnerability of the wells, and aquifer information known at the time of the Scoping 1 Meeting.

Name of Public Water Supply		Date	
North Mankato (PWSID = 1520005)		April 22, 2015	
Name of the Wellhead Protection Manager			
Duane Rader, Water Superintendent			
Address	City	Zip	
1001 P.O. Box 2055	North Mankato	56002	
Unique Well Numbers			Phone
209823 (Well 5), 209821 (Well 6), 112207 (Well 7), 415943 (Well 8)			507/625-3382

Instructions for Completing the Scoping No. 1 Form

N	D	V	S	N = If this box is checked with an "X," this data element is NOT necessary for the Part I Report of your Wellhead Protection Plan. This data element may be identified later at the Scoping 2 Meeting and used for the Part 2 Report. Please go to the next data element.
X				

N	D	V	S	D = If this box is checked with an "X," the preparer of the Part I Report is required to use this information for the DELINEATION of the WHPA or the DWSMA. If there is no check in the "S" box, this information is available in the public domain or is on file at MDH.
	X			

N	D	V	S	V = If this box is checked with an "X," the preparer of the Part I Report is required to use this information for the VULNERABILITY assessment of the PWS well(s) or the DWSMA. If there is no check in the "S" box, this information is available in the public domain or is on file at MDH.
		X		

N	D	V	S	S = If this box is checked with an "X," the PWS must SUBMIT the information to the MDH.
			X	

DATA ELEMENTS ABOUT THE PHYSICAL ENVIRONMENT

A. PRECIPITATION				
N	D	V	S	A.1: An existing map or list of local precipitation gauging stations.
X				
Technical Assistance Comments:				
N	D	V	S	A.2: An existing table showing the average monthly and annual precipitation, in inches, for the preceding five years.
X				
Technical Assistance Comments:				
B. GEOLOGY				
N	D	V	S	B.1: An existing geologic map and a description of the geology, including aquifers, confining layers, recharge areas, discharge areas, sensitive areas as defined in Minnesota Statutes, section 103H.005, subdivision 13, and groundwater flow characteristics.
	X	X	X	
Technical Assistance Comments: Information of this type is required to characterize the geologic and hydrogeologic setting of the PWS well field(s). This information is used to define aquifer geometry, location and magnitude of the recharge and discharge areas, and groundwater flow information. Aquifer tests or alternatives listed in MN Rules, part 4720.5510, subpart 6, can be used to help characterize flow in the aquifer. Reference all information used to develop the conceptual model of the geologic setting and submit to MDH only the information that is not available in the public domain.				
N	D	V	S	B.2: Existing records of the geologic materials penetrated by wells, borings, exploration test holes, or excavations, including those submitted to the department.
	X	X	X	
Technical Assistance Comments: Information of this type may be useful to refine the understanding of the geologic and hydrogeologic setting on a local basis. Submit only if the PWS or city has information of test drilling or site investigations conducted by the city that is not available in the public domain.				
N	D	V	S	B.3: Existing borehole geophysical records from wells, borings, and exploration test holes.
	X	X	X	
Technical Assistance Comments: Information from geophysical records may provide additional information about aquifer thickness, well construction, and water level information at a local scale. Submit only if the information is not available in the public domain.				
N	D	V	S	B.4: Existing surface geophysical studies.
	X	X	X	
Technical Assistance Comments: Information from geophysical studies may be useful to refine the understanding of the geology on a local basis. Submit only if the information is not available in the public domain.				
C. SOILS				
N	D	V	S	C.1: Existing maps of the soils and a description of soil infiltration characteristics.
X				
Technical Assistance Comments:				
N	D	V	S	C.2: A description or an existing map of known eroding lands that are causing sedimentation problems.
X				
Technical Assistance Comments:				

D. WATER RESOURCES				
N	D	V	S	D.1: An existing map of the boundaries and flow directions of major watershed units and minor watershed units.
X				
Technical Assistance Comments:				
N	D	V	S	D.2: An existing map and a list of public waters as defined in Minnesota Statutes, section 103G.005, subdivision 15, and public drainage ditches.
X				
Technical Assistance Comments:				
N	D	V	S	D.3: The shoreland classifications of the public waters listed under sub-item (2), pursuant to part 6120.3000 and Minnesota Statutes, sections 103F.201 to 103F.221.
X				
Technical Assistance Comments:				
N	D	V	S	D.4: An existing map of wetlands regulated under Chapter 8420 and Minnesota Statutes, section 103G.221 to 103G.2373.
X				
Technical Assistance Comments:				
N	D	V	S	D.5: An existing map showing those areas delineated as floodplain by existing local ordinances.
X				
Technical Assistance Comments:				

DATA ELEMENTS ABOUT THE LAND USE

E. LAND USE				
N	D	V	S	E.1: An existing map of parcel boundaries.
	X		X	
Technical Assistance Comments: This information may be helpful in delineating the DWSMA, if available. If this information is provided, identification numbers must be provided for each parcel. An electronic format for the map is preferable.				
N	D	V	S	E.2: An existing map of political boundaries.
	X		X	
Technical Assistance Comments: Please provide this information if the boundaries have been updated/changed. This information may help delineate the DWSMA. An electronic format for the map is preferable.				
N	D	V	S	E.3: An existing map of public land surveys, including township, range, and section.
	X			
Technical Assistance Comments: This information is available in the public domain and may be used to delineate the DWSMA.				
N	D	V	S	E.4: A map and an inventory of the current and historical agricultural, residential, commercial, industrial, recreational, and institutional land uses and potential contaminant sources.
X				
Technical Assistance Comments:				
N	D	V	S	E.5: An existing, comprehensive land-use map.
X				
Technical Assistance Comments:				
N	D	V	S	E.6: Existing zoning map.
X				
Technical Assistance Comments:				

F. PUBLIC UTILITY SERVICES

N	D	V	S	F.1: An existing map of transportation routes or corridors.
	X			
Technical Assistance Comments: This information is available in the public domain and may be used to delineate the DWSMA.				
N	D	V	S	F.2: An existing map of storm sewers, sanitary sewers, and the public water supply systems.
X				
Technical Assistance Comments:				
N	D	V	S	F.3: An existing map of gas and oil pipelines used by gas and oil suppliers.
X				
Technical Assistance Comments:				
N	D	V	S	F.4: An existing map or list of public drainage systems.
X				
Technical Assistance Comments:				
N	D	V	S	F.5: An existing record of construction, maintenance, and use of the public water supply well(s) and other wells within the drinking water supply management area.
	X	X	X	
Technical Assistance Comments: If the information is different than that on file with MDH, please provide 1) the pumping rates for the current and previous years, and the projected annual pumping rates for the next five years for each well in the PWS; and 2) well record(s) for the PWS well(s). Information about the PWS well(s) may affect the vulnerability assessment due to rehabilitation/reconstruction of a well or changes in pumping rates.				

DATA ELEMENTS ABOUT WATER QUANTITY

G. SURFACE WATER QUANTITY

N	D	V	S	G.1: An existing description of high, mean, and low flows on streams.
X				
Technical Assistance Comments:				
N	D	V	S	G.2: An existing list of lakes where the state has established ordinary high water marks.
X				
Technical Assistance Comments:				
N	D	V	S	G.3: An existing list of permitted withdrawals from lakes and streams, including source, use, and amounts withdrawn.
X				
Technical Assistance Comments:				
N	D	V	S	G.4: An existing list of lakes and streams for which state protected levels or flows have been established.
X				
Technical Assistance Comments:				
N	D	V	S	G.5: An existing description of known water-use conflicts, including those caused by groundwater pumping.
X				
Technical Assistance Comments:				

H. GROUNDWATER QUANTITY				
N	D	V	S	H.1: An existing list of wells covered by state appropriation permits, including amounts of water appropriated, type of use, and aquifer source.
	X	X	X	
Technical Assistance Comments: Please submit this information for wells that are not permitted by the DNR because this information may be useful in identifying the hydrologic boundary conditions that could affect the size and shape of the WHPA boundaries.				
N	D	V	S	H.2: An existing description of known well interference problems and water-use conflicts.
	X	X	X	
Technical Assistance Comments: Please notify MDH of well interference problems of which the PWS is aware. Interference problems with other wells, if present, likely indicate a hydrologic boundary that would need to be considered in making the WHPA delineation.				
N	D	V	S	H.3: An existing list of state environmental boreholes, including unique well number, aquifer measured, years of record, and average monthly levels.
	X	X	X	
Technical Assistance Comments: Only submit monthly water level measurements (with unique well numbers and dates) if this information is not available in the public domain.				

DATA ELEMENTS ABOUT WATER QUALITY

I. SURFACE WATER QUALITY				
N	D	V	S	I.1: An existing map or list of the state water quality management classification for each stream and lake.
X				
Technical Assistance Comments:				
N	D	V	S	I.2: An existing summary of lake and stream water quality monitoring data, including: 1. bacteriological contamination indicators; 4. sedimentation; 2. inorganic chemicals; 5. dissolved oxygen; and 3. organic chemicals; 6. excessive growth or deficiency of aquatic plants.
X				
Technical Assistance Comments:				

J. GROUNDWATER QUALITY

N	D	V	S	J.1: An existing summary of water quality data, including: 1) bacteriological contamination indicators; 2) inorganic chemicals; and 3) organic chemicals.
	X	X	X	
Technical Assistance Comments: Submit if the PWS has information that is not available in the public domain, because the information may help explain groundwater flow paths.				
N	D	V	S	J.2: An existing list of water chemistry and isotopic data from wells, springs, or other groundwater sampling points.
	X	X	X	
Technical Assistance Comments: Submit if the PWS has information that is not available in the public domain, because the information may help explain groundwater flow paths.				
N	D	V	S	J.3: An existing report of groundwater tracer studies.
	X	X	X	
Technical Assistance Comments: Submit if the PWS has information that is not available in the public domain, because the information may help explain groundwater flow paths.				
N	D	V	S	J.4: An existing site study and well water analysis of known areas of groundwater contamination.
		X	X	
Technical Assistance Comments: Submit if the PWS has information on contaminant sources not available in the public domain, because these reports may contain additional geologic or hydrogeologic information.				
N	D	V	S	J.5: An existing property audit identifying contamination.
X				
Technical Assistance Comments:				
N	D	V	S	J.6: An existing report to the Minnesota Department of Agriculture and the Minnesota Pollution Control Agency of contaminant spills and releases.
	X	X		
Technical Assistance Comments: Notify MDH of reports on spills or contaminant releases that are on file with the PWS or city but are not in the public domain. These reports do not need to be submitted but the MDH staff would like to review the reports.				

Summary of Data Request

Specific Data to be Provided to MDH by PWS

As discussed during the first Scoping Meeting on August 27, 2014, the public water supply (PWS) will provide the following information for Part I of their Wellhead Protection Plan to the Minnesota Department of Health. The number of the data element that refers to the information needed to prepare the Part I Report is listed in the parenthesis at the end of each request.

- 1) Municipal well information: Use Tables 1 and 2, the well records for the PWS wells, and a map showing the locations of all the PWS wells, to review the accuracy of 1) all PWS well construction, 2) well locations, and 3) pumping information. (F.5)

Table 1 lists well use and construction for each of the PWS wells. Have you reconstructed any wells? Are there well records for reconstructed wells?

The enclosed map shows the locations of the primary public water supply wells and the emergency backup well. Please let us know if you feel the wells are not correctly located. These locations must be used to delineate your wellhead protection areas.

Table 2 shows the available pumping information and indicates what information the PWS needs to provide for the delineation of the capture zone. Please provide 1) the pumping data for 2012 and 2013 that was sent to the Minnesota Department of Natural Resources, 2) whether this rate was measured or estimated, and 3) the projected annual pumping amounts for the next five years.

- 2) Provide a copy of any aquifer test or specific capacity information for the PWS wells that was obtained during well construction, maintenance, or repair. (B.1)
- 3) Is there an existing map of parcel and/or political boundaries that could be used for defining the Drinking Water Supply Management Area (DWSMA)? If you wish to use parcel lines, please provide the parcel identification number for each parcel boundary along with the map. Have the city boundaries changed? If the city boundaries have changed, please provide the new boundaries. The boundaries of the DWSMA may be larger if political boundaries are used instead of the parcel boundaries. (E.1 and E.2)
- 4) Are there other private well records, soil boring reports, geophysical studies, or water level measurements in your files that MDH staff did not identify at the scoping meeting and that would be available for MDH staff to review and copy? (B.2, B.3, B.4, and H.3)
- 5) Identify reports that you have on file relating to leaks/contamination sites that may be a concern to your drinking water supply that MDH may review and copy. (J.4)
- 6) Do your files contain water chemistry data, such as bacteria, virus, inorganic, organic, or isotopic results from wells or other groundwater sampling points, that is not currently available to MDH that MDH may review and copy? (J.1 and J.2)
- 7) Identify reports that you have in your files relating to groundwater tracer studies that have been conducted. (J.3)
- 8) Provide information about other high-capacity wells in your area that may not be permitted and are not listed on the attached Table 3. (H.1)
- 9) Please describe any conflicts over water use that the PWS has been involved with, such as 1) private wells that went dry (or well interference) or 2) springs or wetlands that were affected. Was the Department of Natural Resources involved in resolving the conflict? (G.5 and H.2)

**Table 1 - Public Water Supply Well Information
North Mankato, Minnesota**

Local Well Name	Unique Number	Use/ Status¹	Casing Diameter (inches)	Casing Depth (feet)	Well Depth (feet)	Date Constructed/ Reconstructed	Well Vulnerability	Aquifer
Well 5	209823	P	16 x 12	285	687	May 1958	Not Vulnerable	MTPL - Multiple
Well 6	209821	P	24 x 20	265	681	Feb 1959	Not Vulnerable	MTPL - Multiple
Well 7	112207	P	24 x 20	416	860	7/21/1975	Not Vulnerable	MTPL - Multiple
Well 8	415943	P	30 x 24 x 18	614.1	845	2/17/1986	Not Vulnerable	CMTS - Mt.Simon

Note: 1. Primary (P) Well

**Table 2 - Annual Volume of Water Pumped from PWS Wells
(Millions of Gallons)**

Well Name/ Number	Unique No.	2009	2010	2011	2012	2013	Projected* 2018
Well 5	209823	667,700	246,700	1,271,500	1,408,400	1,516,600	
Well 6	209821	129,517,000	122,603,000	123,719,000	135,467,000	123,719,000	
Well 7	112207	198,135,000	281,489,000	189,022,000	201,508,000	189,022,000	
Well 8	415943	172,307,000	62,871,000	154,056,077	195,592,000	154,056,077	

Source: DNR State Water Use Database System.

* Data to be provided by the city.

Table 3
Permitted High-Capacity Wells Within 2 Miles of Located PWS Wells in North Mankato

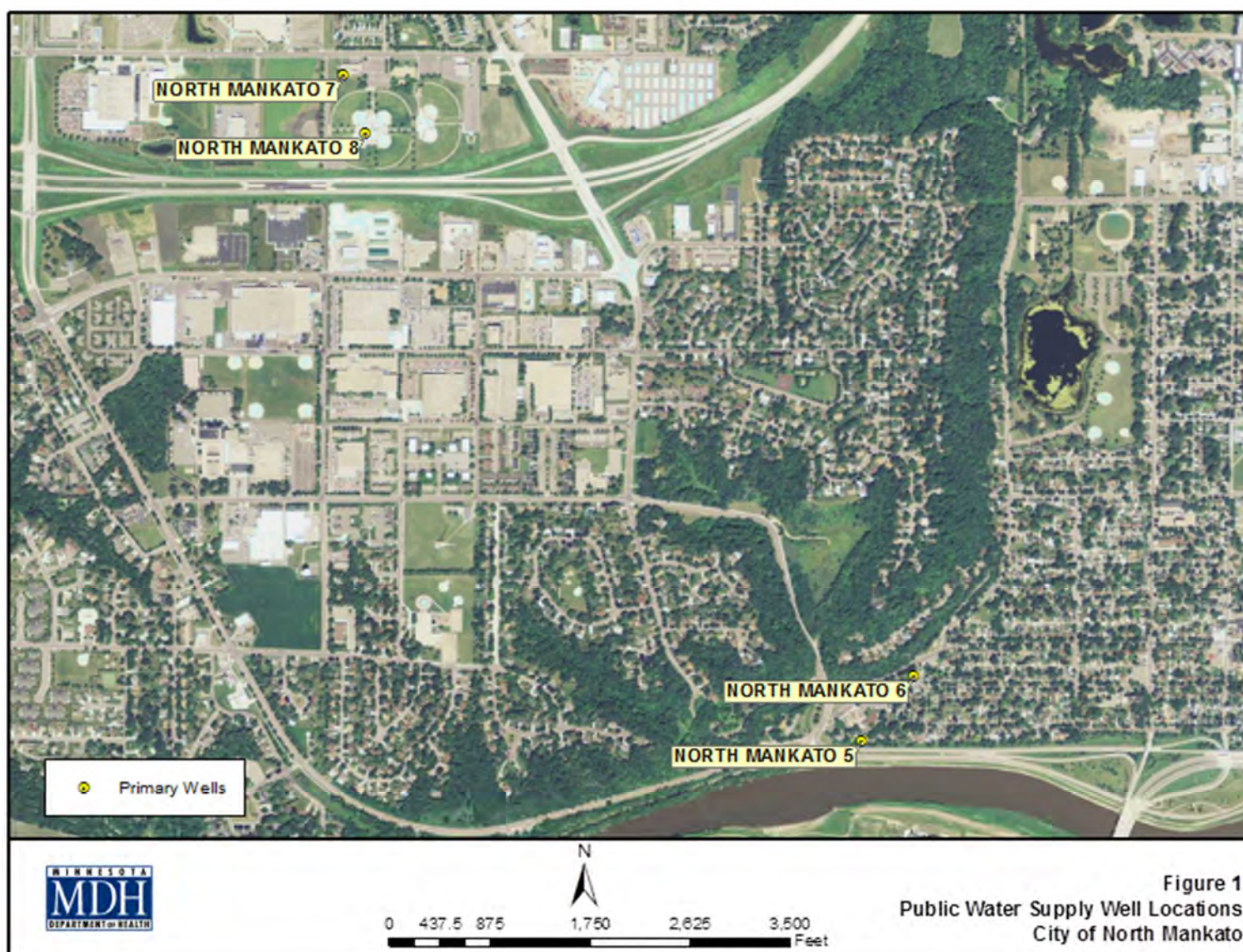
Unique Number	Well Name	DNR Permit Number	Aquifer	Use	Annual Volume of Water Pumped*	Daily Volume (cubic meters)
209828	CENEX HARVEST STATES COOPERATIVE	1987-4120	CFRNCMTS	Agricultural Processing	1302.3	13506
683899	MANKATO, CITY OF	1970-1412	QWTA	Municipal Waterworks	643.5	6674
209830	MANKATO, CITY OF	1970-1412	QWTA	Municipal Waterworks	597.8	6200
458567	MANKATO, CITY OF	1970-1412	CECRCMTS	Municipal Waterworks	406.6	4217
524744	WIS-PAK OF MANKATO INC	1971-0313	CMTS	Agricultural Processing	108.2	1122
686257	MANKATO, CITY OF	1970-1412	CMTS	Municipal Waterworks	97.6	1012
763073	MINNESOTA QUARRIES INC	2000-4105	CFIG	Sand and Gravel Washing	23.8	247
191916	SOUTH BEND TOWNSHIP	1985-4076	CMTS	Municipal Waterworks	12.9	134
242883	HILLCREST HEALTH CARE	1990-4282	CFIG	Private Waterworks	4.6	48
255277	MINNESOTA QUARRIES INC	2000-4105	No Record	Sand and Gravel Washing	2.6	27
209395	MANKATO, CITY OF	1970-1412	CSTLCMTS	Municipal Waterworks	0.8	8

* = Expressed as millions of gallons. Source year = 2011.

Source: MN Dep't. of Natural Resources Division of Waters - State Water Use Data System (SWUDS)

GIS Data Source: SWP.swuds_cwi_2011

Map of Well Locations





COPY

May 17, 2016

Protecting, maintaining and improving the health of all Minnesotans

Mr. Duane Rader, Water Superintendent
City of North Mankato
P.O. Box 2055
North Mankato, Minnesota 56003-2055

Dear Mr. Rader:

Subject: Scoping 2 Decision Notice and Meeting Summary – City of North Mankato – PWSID 1520005

This letter provides notice of the results of a scoping meeting held with you, Terry Bovee (consultant), and me on May 3, 2016, at North Mankato Public Works regarding wellhead protection (WHP) planning. During the meeting, we discussed the data elements that must be compiled and assessed to prepare the part of the WHP plan related to the management of potential contaminants in the approved drinking water supply management area. The enclosed Scoping 2 Decision Notice lists the data elements discussed at the meeting. The data elements must be compiled and assessed in terms of their present and future implications on the 1) use of the well(s), 2) quality and quantity of water supplying the public water supply wells(s), and 3) land and groundwater uses in the drinking water supply management areas. We also discussed a summary of planning issues that were identified during the Part I WHP Plan development process which should be considered for inclusion in your Part II WHP Plan.

The city of North Mankato has met the requirements to distribute copies of the first part of the WHP plan to local units of government and hold an informational meeting for the public. The city of North Mankato will have until September 1, 2017, to complete its WHP plan.

If a data element is marked on the enclosed notice as a data element that must be used and it does not exist, it is helpful if your plan notes this. MDH understands a consultant will be working with you to develop a draft of the remainder of the WHP plan. I will be contacting you to review the progress of the development of Part II of your plan. I will be contacting you to review the progress of the development of Part II of your plan. If you have any questions regarding the enclosed notice, contact me by email at karen.s.voz@state.mn.us or by phone at (320) 223-7322.

Sincerely,

Karen S. Voz, Principal Planner
Source Water Protection Unit
Environmental Health Division
St. Cloud District Office
3333 West Division Street, Suite #212
St. Cloud, Minnesota 56301-4557

KSV:ds-b

Enclosures

cc: Ms. Amy Lynch, MDH Engineer, Mankato District Office

Mr. Terry Bovee, Consultant

Mr. John Harrenstein, City Administrator, City of North Mankato

General Information: 651-201-5000 • Toll-free: 888-345-0823 • www.health.state.mn.us

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SCOPING 2 DECISION NOTICE

Low Vulnerability DWSMA

Remainder of the Wellhead Protection Plan

Name of Public Water Supply:		Date:
City of North Mankato PWSID 1520005		May 17, 2016
Name of the Wellhead Protection Manager:		
Mr. Duane Rader, Water Superintendent		
Address:	City:	Zip:
P.O. Box 2055	North Mankato	56003-2055
Unique Well Numbers:		Phone:
209823 (Well 5), 209821 (Well 6), 112207 (Well 7), 415943 (Well 8)		(507) 625-4141

Instructions for Completing the Scoping 2 Form

N	R	S	N = Not required. If this box is checked, this data element is NOT necessary for your wellhead protection plan because it is not needed or it has been included in the first scoping decision notice. Please go to the next data element.
X			

N	R	S	R = Required for the remainder of the plan. If this box is checked, this data MUST be used for the "remainder of the plan."
	X		

N	R	S	S = Submit to MDH. If this box is checked, this data element MUST be included in your wellhead protection plan and submitted to MDH. If there is NO check mark in the "S" box but there is an "X" in the "R" box, this data element MUST be included in your plan, but should NOT be submitted to MDH. This box will only be checked if MDH does not have access to this data element. This will help to reduce the cost by reducing the amount of paper and time to reproduce the data element.
		X	

DATA ELEMENTS ABOUT THE PHYSICAL ENVIRONMENT

PRECIPITATION			
N	R	S	An existing map or list of local precipitation gauging stations.
X			
Technical Assistance Comments:			
N	R	S	An existing table showing the average monthly and annual precipitation in inches for the preceding five years.
X			
Technical Assistance Comments:			
GEOLOGY			
N	R	S	An existing geologic map and a description of the geology, including aquifers, confining layers, recharge areas, discharge areas, sensitive areas as defined in Minnesota Statutes, section 103H.005, subdivision 13, and groundwater flow characteristics.
	X		
Technical Assistance Comments: The management of all the Drinking Water Supply Management Area(s) must reflect what is known about these data elements.			
N	R	S	Existing records of the geologic materials penetrated by wells, borings, exploration test holes, or excavations, including those submitted to the department.
	X		
Technical Assistance Comments: The management of all the Drinking Water Supply Management Area(s) must reflect what is known about these data elements.			
N	R	S	Existing borehole geophysical records from wells, borings, and exploration test holes.
	X		
Technical Assistance Comments: The management of all the Drinking Water Supply Management Area(s) must reflect what is known about these data elements.			
N	R	S	Existing surface geophysical studies.
	X		
Technical Assistance Comments: The management of all the Drinking Water Supply Management Area(s) must reflect what is known about these data elements.			
SOILS			
N	R	S	Existing maps of the soils and a description of soil infiltration characteristics.
X			
Technical Assistance Comments:			
N	R	S	A description or an existing map of known eroding lands that are causing sedimentation problems.
X			
Technical Assistance Comments:			

WATER RESOURCES			
N	R	S	An existing map of the boundaries and flow directions of major watershed units and minor watershed units.
X			
Technical Assistance Comments:			
N	R	S	An existing map and a list of public waters as defined in Minnesota Statutes, section 103G.005, subdivision 15, and public drainage ditches.
X			
Technical Assistance Comments:			
N	R	S	The shoreland classifications of the public waters listed under subitem (2), pursuant to part 6120.3000 and Minnesota Statutes, sections 103F.201 to 103F.221.
X			
Technical Assistance Comments:			
N	R	S	An existing map of wetlands regulated under chapter 8420 and Minnesota Statutes, section 103G.221 to 103G.2373.
X			
Technical Assistance Comments:			
N	R	S	An existing map showing those areas delineated as floodplain by existing local ordinances.
X			
Technical Assistance Comments:			

DATA ELEMENTS ABOUT THE LAND USE

LAND USE			
N	R	S	An existing map of parcel boundaries.
	X	X	
Technical Assistance Comments: The management of all the Drinking Water Supply Management Area(s) must reflect what is known about this data element.			
N	R	S	An existing map of political boundaries.
	X	X	
Technical Assistance Comments: The management of all the Drinking Water Supply Management Area(s) must reflect what is known about this data element.			
N	R	S	An existing map of public land surveys including township, range, and section.
	X		
Technical Assistance Comments: The management of all the Drinking Water Supply Management Area(s) must reflect what is known about this data element.			

N	R	S	A map and an inventory of the current and historical agricultural, residential, commercial, industrial, recreational, and institutional land uses and potential contaminant sources.
	X	X	
Technical Assistance Comments: The inventory, mapping, and management of land uses and potential sources of contamination for all the Drinking Water Supply Management Area(s) must reflect what is known about these data elements, as follows: <u>Low Vulnerability</u> 1) All potential contaminant sources as listed on the attachment [inventory wells <i>with screens or open intervals between the elevations of 700 to 450 (feet, MSL) for the Tunnel City – Wonewoc (CTCW) Aquifer and 400 to 345 (feet, MSL) for the Mt. Simon (CMST) Aquifer</i>] and wells of undocumented or unknown depths for the potential contaminant source inventory]; 2) a land use/land cover map and table; and 3) an inventory of the Inner Wellhead Management Zone (IWMZ). As a starting point, MDH will provide a land cover map and table from federal data bases. This data set must be used unless an alternative electronic data set that is more current and detailed is available. Management strategies must be developed for all land uses and potential sources of contamination.			
N	R	S	An existing comprehensive land-use map.
	X	X	
Technical Assistance Comments: The management of all the Drinking Water Supply Management Area(s) must reflect what is known about this data element. Include any urban fringe planning areas.			
N	R	S	Existing zoning map.
	X	X	
Technical Assistance Comments: The management of all the Drinking Water Supply Management Area(s) must reflect what is known about this data element.			
PUBLIC UTILITY SERVICES			
N	R	S	An existing map of transportation routes or corridors.
X			
Technical Assistance Comments:			
N	R	S	An existing map of storm sewers, sanitary sewers, and public water supply systems.
X			
Technical Assistance Comments:			
N	R	S	An existing map of the gas and oil pipelines used by gas and oil suppliers.
X			
Technical Assistance Comments:			

N	R	S	An existing map or list of public drainage systems.
X			
Technical Assistance Comments:			
N	R	S	An existing record of construction, maintenance, and use of the public water supply well(s) and other wells within the drinking water supply management area.
	X		
Technical Assistance Comments: The management of all the Drinking Water Supply Management Area(s) must reflect what is known about these data elements.			

DATA ELEMENTS ABOUT WATER QUANTITY

SURFACE WATER QUANTITY			
N	R	S	An existing description of high, mean, and low flows on streams.
X			
Technical Assistance Comments:			
N	R	S	An existing list of lakes where the state has established ordinary high water marks.
X			
Technical Assistance Comments:			
N	R	S	An existing list of permitted withdrawals from lakes and streams, including source, use, and amounts withdrawn.
X			
Technical Assistance Comments:			
N	R	S	An existing list of lakes and streams for which state protected levels or flows have been established.
X			
Technical Assistance Comments:			
N	R	S	An existing description of known water-use conflicts, including those caused by groundwater pumping.
X			
Technical Assistance Comments:			
GROUNDWATER QUANTITY			
N	R	S	An existing list of wells covered by state appropriation permits, including amounts of water appropriated, type of use, and aquifer source.
	X		
Technical Assistance Comments: The management of all the Drinking Water Supply Management Area(s) must reflect what is known about these data elements.			
N	R	S	An existing description of known well interference problems and water use conflicts.
	X	X	
Technical Assistance Comments: The management of all the Drinking Water Supply Management Area(s) must reflect what is known about these data elements.			

N	R	S	An existing list of state environmental bore holes, including unique well number, aquifer measured, years of record, and average monthly levels.
	X		
Technical Assistance Comments: The management of all the Drinking Water Supply Management Area(s) must reflect what is known about this data element.			

DATA ELEMENTS ABOUT WATER QUALITY

SURFACE WATER QUALITY			
N	R	S	An existing map or list of the state water quality management classification for each stream and lake.
X			
Technical Assistance Comments:			
N	R	S	An existing summary of lake and stream water quality monitoring data, including: 1. bacteriological contamination indicators; 4. sedimentation; 2. inorganic chemicals; 5. dissolved oxygen; and 3. organic chemicals; 6. excessive growth or deficiency of aquatic plants.
X			
Technical Assistance Comments:			
GROUNDWATER QUALITY			
N	R	S	An existing summary of water quality data, including: 1. bacteriological contamination indicators; 2. inorganic chemicals; and 3. organic chemicals.
	X		
Technical Assistance Comments: The management of all the Drinking Water Supply Management Area(s) must reflect what is known about these data elements.			
N	R	S	An existing list of water chemistry and isotopic data from wells, springs, or other groundwater sampling points.
	X		
Technical Assistance Comments: The management of all the Drinking Water Supply Management Area(s) must reflect what is known about these data elements.			
N	R	S	An existing report of groundwater tracer studies.
	X		
Technical Assistance Comments: The management of all the Drinking Water Supply Management Area(s) must reflect what is known about this data element.			
N	R	S	An existing site study and well water analysis of known areas of groundwater contamination.
X			
Technical Assistance Comments:			

N	R	S	An existing property audit identifying contamination.
X			
Technical Assistance Comments:			
N	R	S	An existing report to the Minnesota Department of Agriculture and the Minnesota Pollution Control Agency of contaminant spills and releases.
X			
Technical Assistance Comments:			

Scoping 2 Meeting Wellhead Protection (WHP) Planning Issues Summary

Drinking Water Protection Issues Identified to Date:

- None

Water Quality Detections and Implications:

- None

Old Municipal Well Information:

- The Minnesota Department of Health has compiled historical information for use in the planning process.
- A copy was provide to the WHP manager.

Sanborn Maps:

- ☐ Sanborn Maps are available for this area
- ☒ Sanborn Maps are not available for this area.

Recommended WHP Measures:

Aquifer Testing: For this WHPA delineation, the transmissivity of North Mankato's aquifers were estimated from an aquifer test conducted in a similar geologic setting in the nearby town of Mankato. However, the Minnesota River, a major hydrologic divide, separates the wellfields of North Mankato and Mankato. Additionally, the North Mankato wells are multi-aquifer wells, and aquifer test results from other wells may not be completely transferrable. It would be better if more localized data could be used for future amendments of North Mankato's WHP plan.

With assistance from MDH hydrologist, the city should investigate the possibility of conducting an aquifer test using the city's wells.

Other:

- None

This document is intended to be a summary of issues identified to date and is **not intended to replace the required data elements identified in the Scoping 2 Decision Notice** nor is it intended to be an exhaustive list of all potential drinking water issues.

Scoping 2 Decision Notice Attachment
Potential Contaminant Source Inventory Requirements

Low Vulnerable DWSMA

The following current and historical potential contaminant sources and related codes and activity status and related codes are required to be included in the potential contaminant source inventory. All potential contaminant sources must be assigned an activity status and related code using state program descriptors or local knowledge.

<u>Potential Contaminant Sources (PCS)</u>	<u>PCS Codes</u>
Large Capacity Cesspool (potential Class V)	CVLCC
Large Capacity Waste Water Disposal Site (potential Class V)	CVWWD
Motor Vehicle Waste Disposal Well (potential Class V)	CVMVW
Wells	WEL

Activity Status; Codes; and Descriptions

Status	Code	Description
Active	A	PCS is operative or in use. Examples: Animal feedlot is active. Well is in use or has maintenance permit.
Closed	C	PCS is inactive and is not open from a regulatory viewpoint. Example: Leaking storage tank site or landfill is closed.
Inactive	I	PCS is present but not currently active. Examples: Gravel pit is inactive. Well is un-used.
Removed	R	PCS has been removed. Example: Underground storage tank has been removed.
Unknown	U	Activity status of the PCS is not known definitely or has not been evaluated. Examples: Class V site status unknown. Well is thought to be sealed, but no official sealing record has been identified.

ASSESSMENT OF THE DATA ELEMENTS USED TO PREPARE THE NORTH MANKATO WHP PLAN

The data elements listed in the Minnesota Department of Health Scoping 1 and 2 Letter and Notice were identified by the MDH to be used in the WHP plan and were specified in the scoping decision notices that were presented to the Public Water Supplier (Appendix I for Scoping 2 documents and appendix II for Scoping 1 documents). The selection of a data element for inclusion in the plan is based on 1) the hydrogeological setting and 2) vulnerability of the wells used by the Public Water Supplier, and 3) vulnerability of the DWSMA known at the time that each scoping meeting was held. Each data element is assessed for its impact on 1) the use of the public water supply well, 2) delineation of the WHPA, 3) the quality and quantity of water supplying the public water supply well, and 4) land and groundwater uses within the DWSMA.

Physical Environment

Precipitation information was not required because of the hydraulically confined aquifer used by the city of North Mankato.

Geologic information was obtained from 1) existing maps, reports, and studies that are listed in the References section of the Part 1 report, and 2) the records of wells, test borings, and well sealing records that are on file at the MDH and stored in the County Well Index (CWI) database. Soil data was not required because of the hydraulically confined aquifer used by the city of North Mankato.

Geologic information was used to determine 1) the extent and composition of the aquifers used by the city wells, 2) the vulnerability of the aquifer at the location of each well used by the Public Water Supplier, and 3) the vulnerability of the DWSMAs (see Appendix II). Geologic information affects the delineation of the WHPA because it is used to address the aquifer transmissivity and hydrologic boundaries delineation criteria. Second, geologic information provides insight into the pathways that recharging water takes to enter the aquifer, which impacts 1) the use of the well, and 2) the quality and quantity of water that is pumped. Finally, it is the principle information that is used to assess DWSMA vulnerability, which impacts land- and groundwater-uses within the DWSMA.

Water resources information was not required because of the hydraulically confined aquifer used by the city of North Mankato.

Land Use

Land use information was obtained from various sources relating to existing parcel boundaries, political boundaries, public land survey coordinates, comprehensive land-use, and zoning. Figures 1 and 2 in the North Mankato Wellhead Protection Plan contains political boundaries and public land survey coordinates. Parcel boundary information is in a geographic information system (GIS) format and has been included with other GIS materials submitted to the MDH. Land cover data, comprehensive planning and zoning information is included at the end of this Appendix.

Appendix III contains a map and inventory of current and historical agricultural, residential, commercial, industrial, recreational, and institutional land uses and potential contamination sources and parcel identification data.

Center-lines of highways, streets or roads and public land survey coordinates were used in defining DWSMA boundaries. DWSMA boundaries impact land and groundwater uses because they define where the WHP plan will be implemented. They have no direct impact on 1) the use of the public water supply well, 2) delineation of the WHP area, and 3) the quantity and quality of the well water used by the public water supply.

The comprehensive land use and zoning maps affect land and water use within the DWSMA because they provide a basis for limiting future land uses that may be incompatible with ordinances or planning goals. As such, they may be used for denying new potential contamination sources or imposing performance standards that affect the use of existing or new public water supply wells and the quantity and quality of the well water used by the Public Water Supplier. The land surrounding the two North Mankato DWSMAS is mostly zoned for residential or commercial, which because of the hydraulically confined aquifer used by the city of North Mankato, does not impact the aquifer. The city of North Mankato has a zoning ordinance and map, state building code and a cross connection policy. The city also has a recently updated comprehensive land use plan. The comprehensive plan map and the zoning map for the city and Nicollet County is included in this Appendix.

The information contained in Appendix III provides the basis for defining the types of potential contamination sources that may or do impact the quantity and quality of the well water used by the public water supply. The priorities that are assigned to the WHP action steps that are specified in the plan are based on the information contained in Appendix II. As a result, these actions steps affect the future use of the public water supply well and land and groundwater uses within the two DWSMAs. Groundwater use was included to meet the hydrologic boundary and water use criteria for delineating the WHPAs.

Information about public utility services includes maps of 1) transportation routes and corridors, 2) storm sewers, sanitary sewers, the public water supply distribution system, 3) gas and oil pipelines, and 4) public drainage systems was not required because of the hydraulically confined aquifer used by the city of North Mankato.

Record of the construction and maintenance of the public water supply wells is presented in Table 1 and their use is presented in Table 5 of the Part 1 report found in Appendix II. Demand on the four wells serving as the primary source of drinking water determines how often they are pumped. This affects the delineation of its WHPA because pumping amount is a delineation criterion. Only the city's four primary wells listed in the Part 1 report are modeled to determine the one and ten year capture areas that are used to establish priorities for managing potential contamination sources within the DWSMA. The construction and maintenance of a public water supply well affect the well vulnerability assessment and the focus of the potential contamination source inventory. Sealing an improperly constructed or maintained well may be a priority action step for protecting other wells because such wells may become conduits for contamination to enter the aquifer.

Water Quantity Information

Water Quantity Information was obtained for groundwater resources. Water Quantity Information was not required for surface water resources because of the hydraulically confined aquifer used by the city of North Mankato.

The DNR is the principle source of water quantity information although studies and reports that are available from other state and federal agencies or from the Public Water Supplier are described in the References section of this report. Water quantity information affects the 1) delineation of the WHPA because the pumping amounts are used to calculate the daily well discharge which is a WHPA delineation criterion, 2) use of the public water supply well because a maximum annual amount for the public water supply system is specified under the DNR appropriations permit, and 3) land and water use within the DWSMA because pumping may impact whether other wells or existing land uses may cause contamination of the aquifer or contamination to move toward the public water supply well. It may indirectly affect the future quantity and quality of the water from the public water supply well.

A list of wells covered by state appropriations permits, including the amounts of water appropriated, type of use, and aquifer source were assessed as follows. The Public Water Supplier provided the information describing pumping for water supply over the previous 5 years and the projected pumping for the first five years of plan implementation (Part 1, Table 5). The city of North Mankato's primary wells (#5, #6, #7 and #8) and twenty three other high-capacity wells (Table 6 in the Part 1 report, Appendix II) are included in the Part 1 analysis.

There are no known well interference problems and water use conflicts within the city of North Mankato's DWSMAs. Well interference and water use conflicts are used (if they exist) to delineate the WHPA because they document hydrologic boundaries that must be included. Also, they indicate areas where aquifer recharge is insufficient to meet pumping demands and this condition 1) limits groundwater use in the DWSMAs and 2) may impact land uses such as agricultural irrigation or industry that rely on high capacity wells.

A search was conducted for environmental bore holes, including the unique number, aquifer measured, years of record, and average monthly levels from the observation well networks that are maintained by the DNR and the U.S. Geological Survey. This information is used to delineate the WHPA by providing information that helps to define aquifer recharge and the distribution of hydraulic head. It may have an indirect influence on water use within the DWSMAs because the water level data can be used to document seasonal or long-term impacts that pumping has on the aquifer supplying the public water supply well. This information has no impact on the quality the water supplying the public water supply well and land and groundwater uses within the DWSMAs. There were no environmental bore holes listed.

Water Quality Information

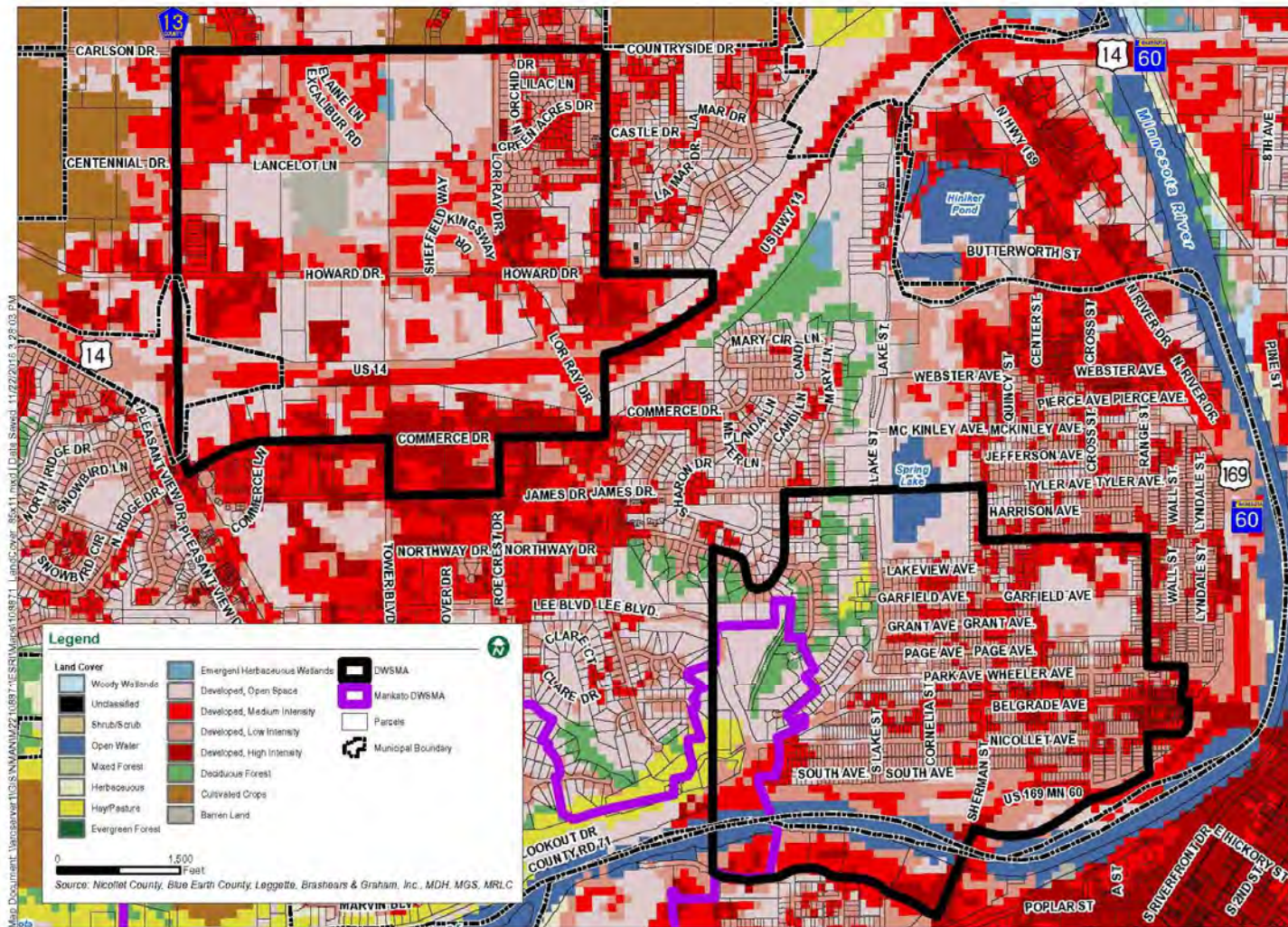
Groundwater quality information was obtained from the Public Water Supply Program and Well Management Program at MDH, the Public Water Supplier and from reports and studies that are listed in the references section of the Part 1 report (Appendix II). Surface water quality information was not required because of the hydraulically confined aquifer used by the city of North Mankato.

Information that summarizes groundwater quality is used to assess the pathways that recharge takes to the aquifer and this may impact the selection of methods that are used to delineate the WHPA and to assess well and DWSMA vulnerability. The presence of human-made contaminants is used to 1) calibrate a groundwater flow model by providing a means of checking travel time distance from the source of a contaminant to a public water supply well and 2) assess the vulnerability of the well and the DWSMA. The presence of naturally occurring contaminants is used to assess the extent that the source water aquifer is isolated from surface water recharge. The presence of either human-made or naturally occurring contaminants may influence pumping of the public water supply well because pumping may impact the rate at which contamination may be moving into the aquifer. Also, the level of contamination may require that the water be treated for potable use or that the contaminated water be blended with other water to reduce contaminant levels to drinking water standards.

The presence of human-made contaminants is used to identify potential sources of the contamination that should receive a high priority for inventory and for supporting the priority that is assigned to objectives and actions in the plan that manage these sources. This affects the focus of land and water use management practices within the DWSMAs. The 2016 City of North Mankato Consumer Confidence Report is included in this Appendix. No contaminants were detected at levels that violated federal drinking water standards.

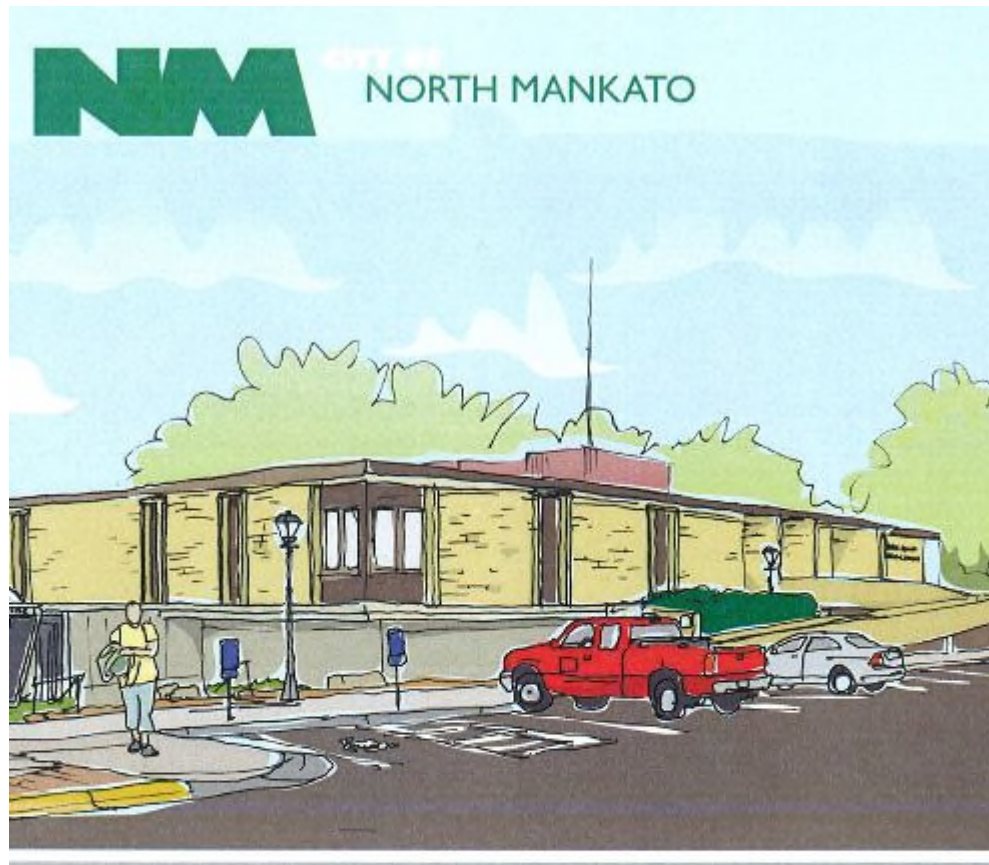
Water chemistry and isotopic data from wells, springs, or other groundwater sampling points and reports of groundwater tracer studies is used to determine the 1) time needed for surface water or precipitation to travel from the surface to the source water aquifer and 2) degree to which the source water aquifer is impacted by recharge from surface water features. This assessment affects the delineation of the WHPA because it helps define the degree of hydraulic confinement and whether a surface water feature comprises a hydraulic boundary that must be included. Also, this information is used to determine the sustainability of the aquifer and any surface water features that may be impacted by increased pumping within the DWSMA. No human-caused contaminants have been detected at elevated levels in samples from the wells, indicating the water in the aquifer has not been affected by activities on the land surface. Also, tritium results for water samples from the wells indicate that less than 0.8 tritium units were present; indicating the water in the aquifer has not been affected by recent recharge.

Site studies and water quality analyses of known areas of groundwater contamination, property audit results, reports of contamination spills and releases by the Minnesota Pollution Control Agency and Minnesota Department of Agriculture provide basic information that is used to determine the extent that groundwater quality may already be impaired by previous land- and groundwater-use practices. This information is used to assess the vulnerability of the wells and the two DWSMAs, which affects 1) the scope, and direction of the inventory of potential contamination sources and 2) the resulting priorities that are assigned to objectives and actions for managing land and groundwater uses within the DWSMAs. Also, the hydrogeologic information contained in the reports is used to refine the understanding of local groundwater conditions that affects the delineation of the WHPAs. There are no known areas of contamination within the aquifer used by the city of North Mankato.



Land Cover in North Mankato DWSMAs	
Upper DWSMA Land Cover	Acres
Barren Land	14.69
Developed, High Intensity	70.00
Developed, Low Intensity	149.09
Developed, Medium Intensity	205.29
Developed, Open Space	158.78
Emergent Herbaceous Wetlands	1.78
Total	599.63
Lower DWSMA Land Cover	
Acres	
Deciduous Forest	23.89
Developed, High Intensity	24.09
Developed, Low Intensity	181.81
Developed, Medium Intensity	108.41
Developed, Open Space	111.90
Hay/Pasture	7.42
Open Water	32.95
Total	490.46

North Mankato Land Cover and Table for Upper and Lower DWSMAs



Comprehensive Plan

March, 2015

Excerpts from North Mankato Comprehensive Plan.

To review the entire document, contact North Mankato City Hall.

Comprehensive Plan

The City of North Mankato City Council adopted the Comprehensive Plan on March 2, 2015.

Comprehensive Plan

Chapter 1: Introduction

Chapter 2: Vision

Chapter 3: Land Use

Chapter 4: Housing

Chapter 5: Economic Development

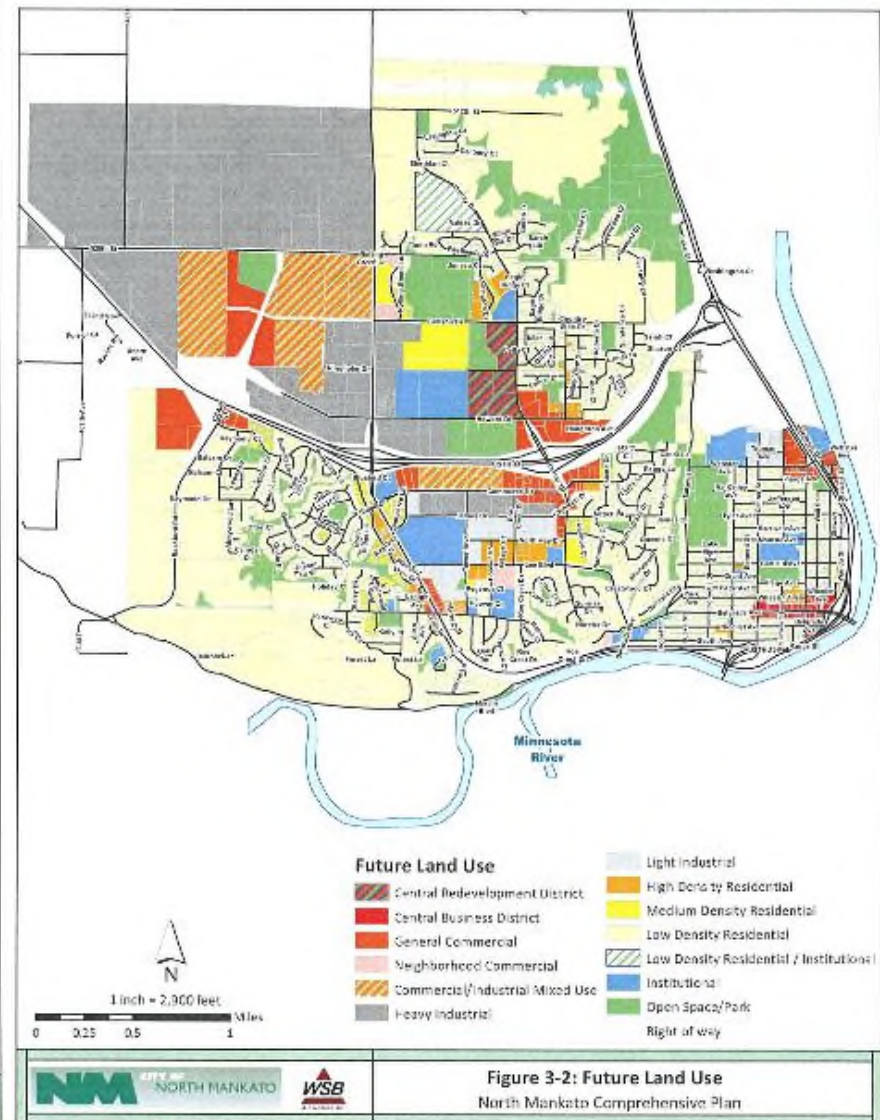
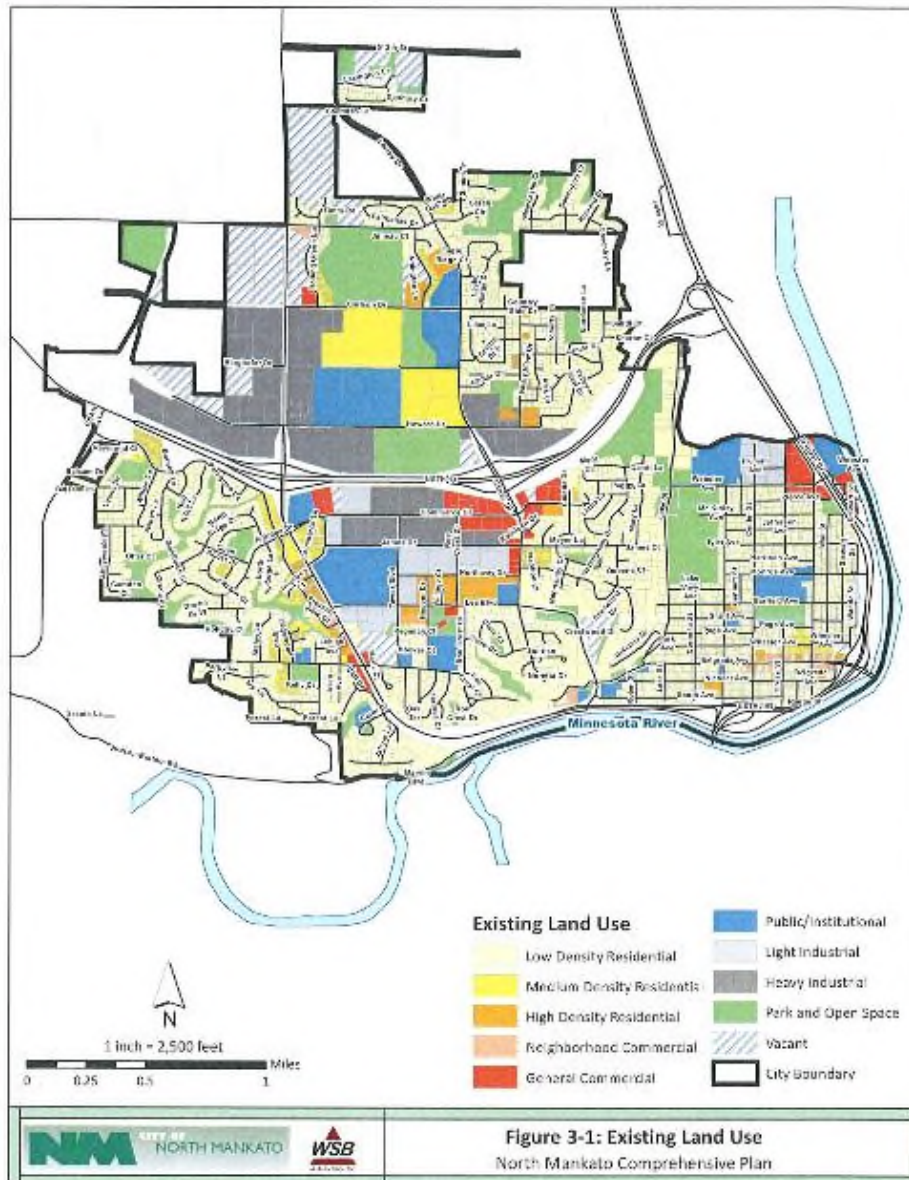
Chapter 6: Transportation

Chapter 7: Utilities

Chapter 8: Parks, Trails, and Recreation

Chapter 9: Downtown Redevelopment

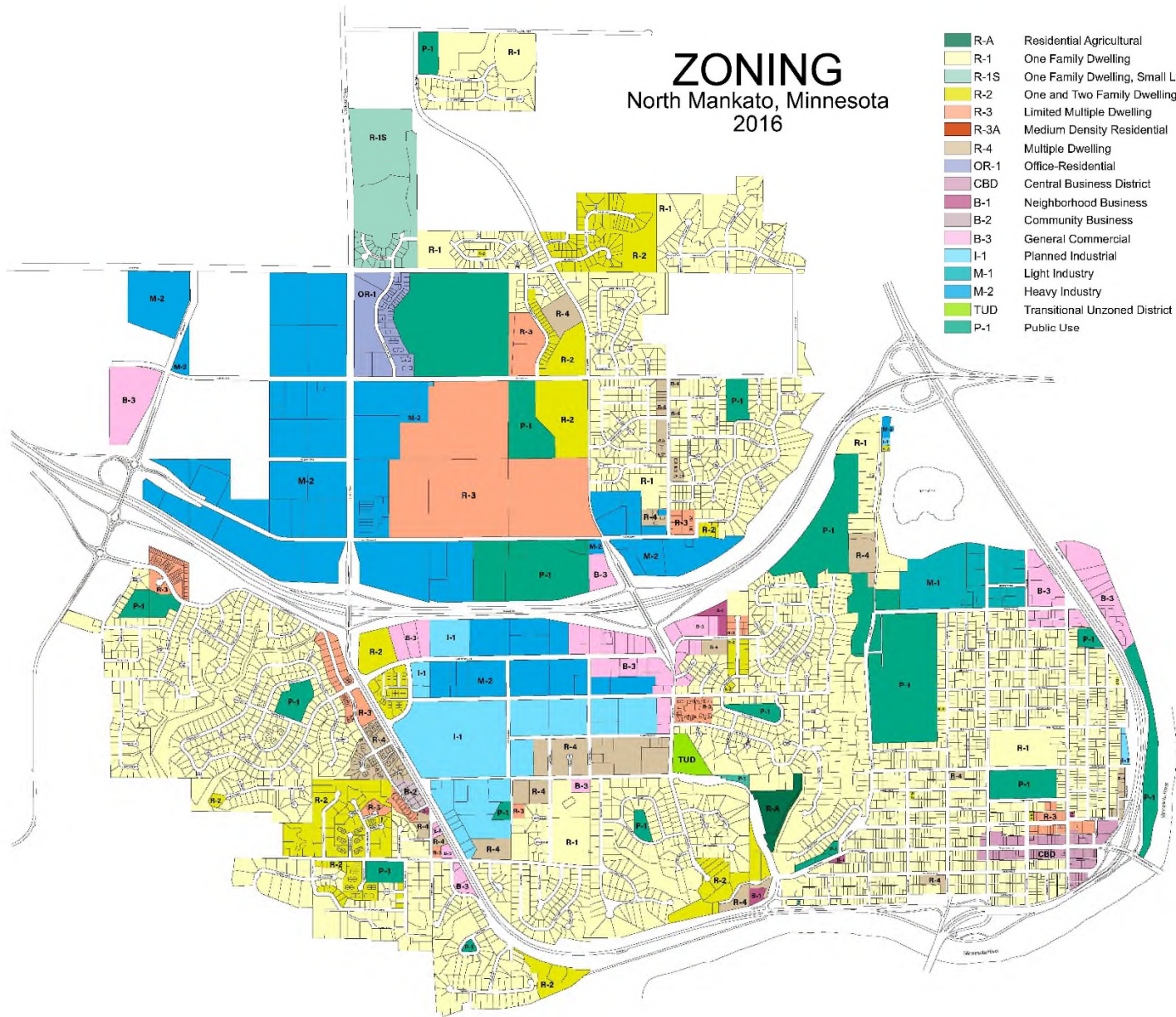
Chapter 10: Community Design



North Mankato Existing and Future Land Use Maps

ZONING

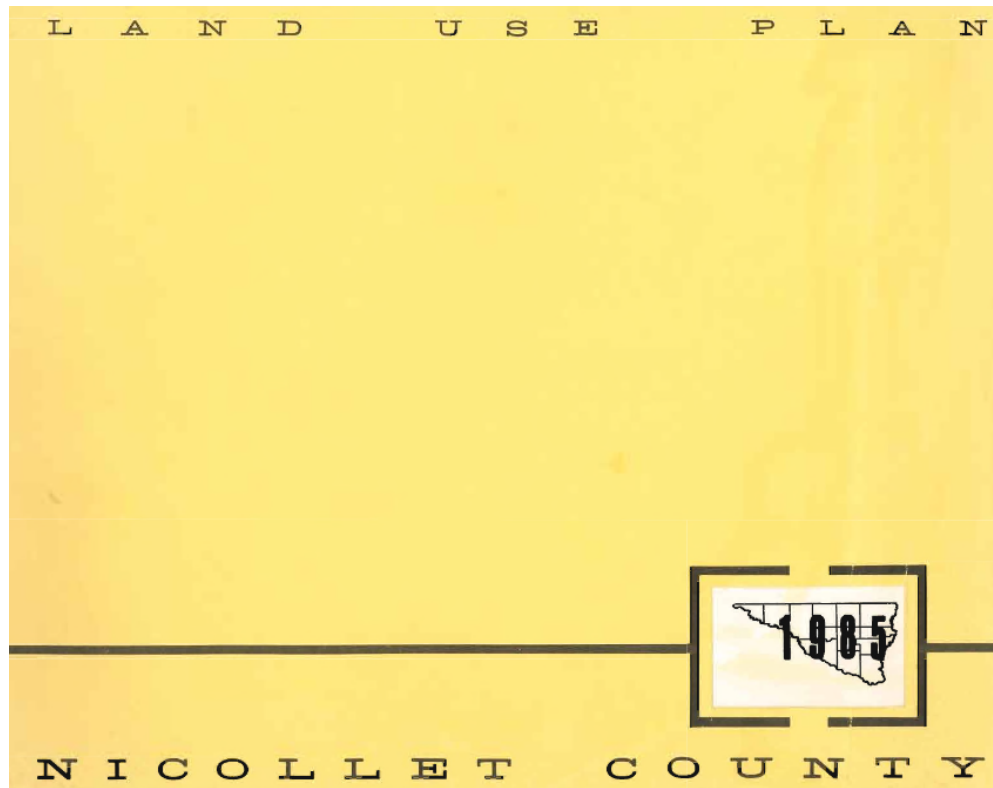
North Mankato, Minnesota 2016



City of North Mankato Zoning Map

Excerpts from the Nicollet County Land Use Plan, 1985

<http://www.co.nicollet.mn.us/DocumentCenter/Home/View/432>



city of NORTH MANKATO existing land use

LEGEND

COMMERCIAL	[Symbol]
INDUSTRIAL	[Symbol]
RESIDENTIAL - SINGLE FAMILY DWELLING	[Symbol]
RESIDENTIAL - MULTIFAMILY DWELLING	[Symbol]
PUBLIC	[Symbol]
CHURCHES	[Symbol]
SCHOOLS	[Symbol]

THE INFORMATION ON THIS MAP WAS PROVIDED BY THE
CITY OF NORTH MANKATO, MINNESOTA. THE CITY ENGINEERING DEPARTMENT
BASED MAP PREPARED BY THE CITY ENGINEERING DEPARTMENT

NORTH
NASON-LAW-WEHRMAN & KNIGHT, INC.
COMMUNITY PLANNING
CONSULTANTS
MINNEAPOLIS, MINNESOTA

Map 8

POLICY, PRINCIPLES, AND GOALS

POLICY

The following are broad statements of policy, indicating the scope of the planning program, the levels of responsibility of public bodies concerned with physical development in the County, and the County's general approach to planning:

- o The County should utilize and assist the townships in solving common planning problems. County-township interaction can and should be a two-way process to mutual benefit.
- o The County should assist and cooperate actively with the municipalities in solving urban planning problems. Although land areas within the incorporated communities are the responsibility of the municipalities themselves, the surrounding areas -- which often have urbanization problems -- are a County responsibility. Where possible, such urban development should be annexed to the municipality. County controls over urban fringe areas, therefore, should be structured to reflect desirable standards for community development.
- o The County should work actively and cooperatively with all government levels and public agencies to find satisfactory solutions to planning problems within their respective scopes of responsibility.
- o While the planning program is expected to furnish primary guidance to public officials, the planning program is for the benefit of the citizens of the County, and all approved plans and studies shall be public information available to the citizens for guidance in their private plans.

GENERAL GOALS

Before a plan is created it is well to carefully consider and define what one expects to accomplish with such a plan. The following general goals were adopted for the Nicollet County Plan:

- o Conservation of the resources of the County.

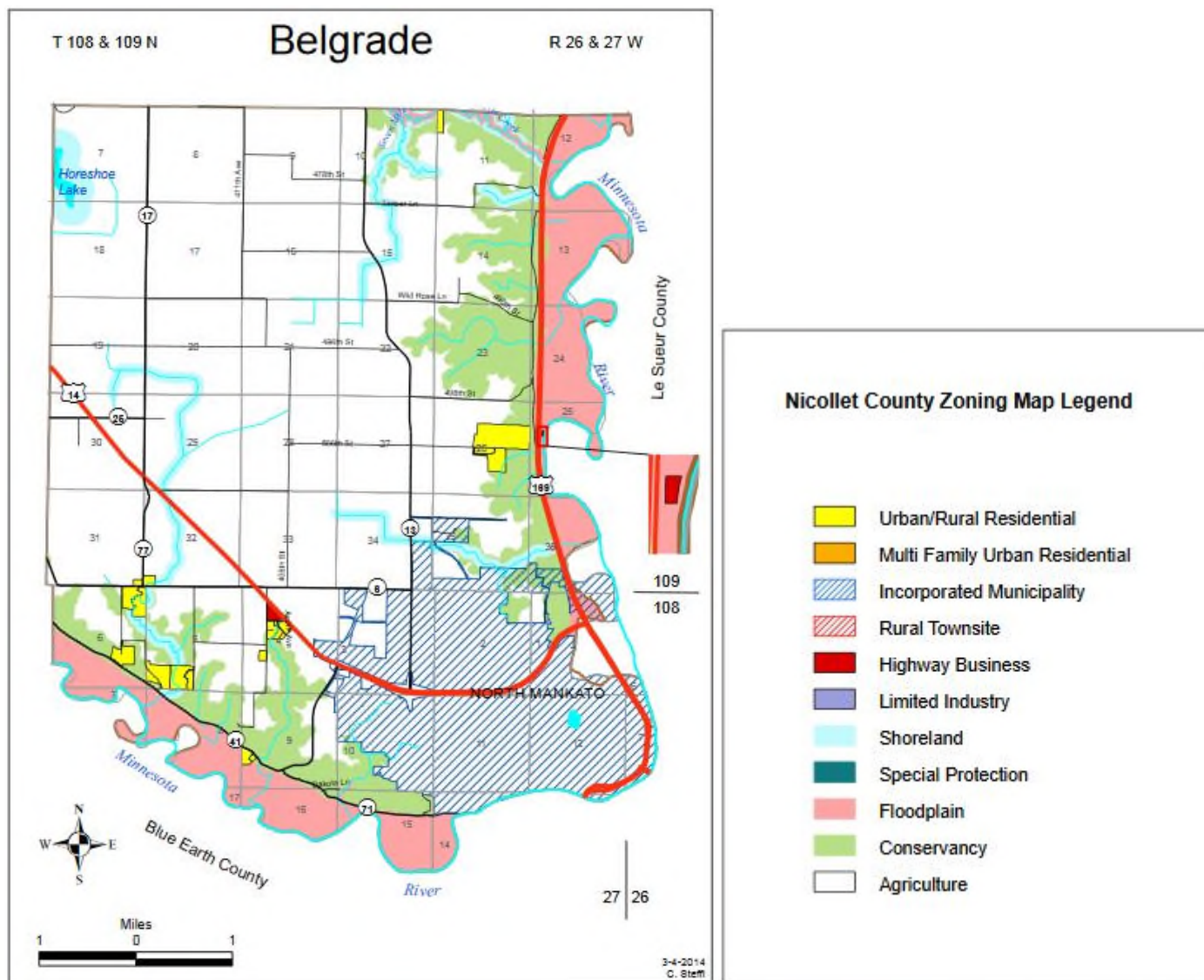
Belgrade Township

The natural physical character of this township is quite uniform except for the bluff and flood plain along the Minnesota River. The uplands are almost entirely devoid of wooded areas or marshes. A portion of a small lake lies within the northwest limits of the township.

The principal development influence on the land use pattern in this township is the proximity to the Mankato urban area. This includes the city of North Mankato and the transportation routes which are a part of the urban complex. The two principal elements of the latter are U.S. Highway 169 and U.S. Highway 14. There are also a number of other secondary roads which feed into this area or which tie into the primary routes and are, therefore, a part of the total transportation network which focuses upon the greater Mankato urban area. Because it is situated in proximity to the largest urban community in the region, the land use characteristics in Belgrade Township are, and will no doubt continue to be, the most dynamic of any township in the County.

There is some industrial and commercial development along roads to the north of the City of North Mankato, but a part of this industrial area lies within Blue Earth County. Even though this property is west of the Minnesota River it belongs in Blue Earth County because the course of the River has changed. For the most part, however, urban development in rural areas of Belgrade Township has consisted of residential development. The township contains 146 farmsteads and 77 non-farm units.

Thus, about 35% of the homes in rural areas of the township are related to urban employment in the Mankato area. Map 5b shows that these are scattered north of North Mankato, along County Highway 73 and U.S. Highway 169, and west of North Mankato along County Highway 71 and between County Highway 71 and Trunk Highway 14.



Nicollet County (Belgrade Township) Zoning Map

Excerpts from the
**NICOLLET COUNTY LOCAL WATER MANAGEMENT PLAN
2013 AMENDMENT**

<http://www.co.nicollet.mn.us/DocumentCenter/Home/View/385>

DESCRIPTION OF PRIORITY CONCERNS TO BE ADDRESSED BY THE LWM PLAN

The Priority Concerns listed below were selected by the Water Plan Task Force members, after carefully reviewing submitted concerns and comments and refined after discussions. While the assessment of priority concerns utilized the best available information, this LWM Plan rests on data and analyses contained in previous editions of the LWM Plan.

Priority Concern 4: Groundwater

Nicollet County is 100% dependent on groundwater for its drinking water, either through individual wells, municipal supply or rural water systems. The groundwater concern will be addressed to assure long - term quality and quantity of groundwater supplies, with a priority for wellhead protection areas and areas not currently served by public/community systems.

GOALS AND OBJECTIVES TO ADDRESS PRIORITY CONCERNS

Priority Concern 4: Groundwater

Groundwater is the main source for drinking water in Nicollet County. High quality drinking water is necessary for both community health and economic well - being. Protecting the sources of drinking water is a goal for the water plan by working with municipalities and individuals to prevent groundwater contamination.

Nicollet County is an area of intensive agriculture with areas of geology that make it susceptible to groundwater contamination. Past studies have shown that some groundwater sources have been contaminated within the County. Human activities including urban and industrial development and waste water treatment have the potential to affect both private and public water sources.

Most areas of the County have shown the possibility of developing adequate ground water supplies for farm and domestic use. Planning for future development and gaining an understanding of the groundwater resources will help ensure that the resource is protected.

GOAL – Ensure a safe and adequate supply of groundwater.

Objective 1 - Well Water Testing

Objective 2 - Encourage Wellhead (Ground and Surface Water) Protection from Contamination

Objective 3 - Encourage Proper Sealing of Unused or Abandoned Wells

Objective 4 - Education

City of North Mankato
2016 Drinking Water Report

The City of North Mankato is issuing the results of monitoring done on its drinking water for the period from January 1 to December 31, 2016. The purpose of this report is to advance consumers' understanding of drinking water and heighten awareness of the need to protect precious water resources.

Source of Water

The City of North Mankato provides drinking water to its residents from a groundwater source: five wells ranging from 681 to 860 feet deep, that draw water from the Multiple and Mt. Simon aquifers.

The Minnesota Department of Health has made a determination as to how vulnerable our systems' source(s) of water may be to future contamination incidents. If you wish to obtain the entire source water assessment regarding your drinking water, please call 651-201-4700 or 1-800-818-9318 (and press 5) during normal business hours. Also, you can view it on line at www.health.state.mn.us/divs/eh/water/swp/swa.

Call 507-625-4141 if you have questions about the City of North Mankato drinking water or would like information about opportunities for public participation in decisions that may affect the quality of the water.

Results of Monitoring

No contaminants were detected at levels that violated federal drinking water standards. However, some contaminants were detected in trace amounts that were below legal limits. The table that follows shows the contaminants that were detected in trace amounts last year. (Some contaminants are sampled less frequently than once a year; as a result, not all contaminants were sampled for in 2016. If any of these contaminants were detected the last time they were sampled for, they are included in the table along with the date that the detection occurred.)

Key to abbreviations:

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.

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.

MRDL — Maximum Residual Disinfectant Level.

MRDLG — Maximum Residual Disinfectant Level Goal.

AL — Action Level: The concentration of a contaminant which, if exceeded, triggers treatment or other requirement which a water system must follow.

90th Percentile Level — This is the value obtained after disregarding 10 percent of the samples taken that had the highest levels. (For example, in a situation in which 10 samples were taken, the 90th percentile level is

CONSUMER CONFIDENCE REPORT

PWSID: 1520005

determined by disregarding the highest result, which represents 10 percent of the samples.) Note: In situations in which only 5 samples are taken, the average of the two with the highest levels is taken to determine the 90th percentile level.

pCi/l — PicoCuries per liter (a measure of radioactivity).

ppm — Parts per million, which can also be expressed as milligrams per liter (mg/l).

ppb — Parts per billion, which can also be expressed as micrograms per liter (µg/l).

N/A — Not Applicable (does not apply).

Contaminant (units)	MCLG	MCL	Level Found		Typical Source of Contaminant
			Range (2016)	Average /Result*	
Alpha Emitters (pCi/l)	0	15.4	N/A	6.3	Erosion of natural deposits.
Combined Radium (pCi/l)	0	5.4	N/A	3.7	Erosion of natural deposits.
Fluoride (ppm)	4	4	.66-.8	.91	State of Minnesota requires all municipal water systems to add fluoride to the drinking water to promote strong teeth; Erosion of natural deposits; Discharge from fertilizer and aluminum factories.
Haloacetic Acids (HAA5) (ppb)	0	60	2.3-7.7	7.7	By-product of drinking water disinfection.
Nitrate (as Nitrogen) (ppm)	10.4	10.4	.82-1.4	1.4	Runoff from fertilizer use; Leaching from septic tanks, sewage; Erosion of natural deposits.
TTHM (Total trihalomethanes) (ppb)	0	80	26-27.2	27.2	By-product of drinking water disinfection.

*This is the value used to determine compliance with federal standards. It sometimes is the highest value detected and sometimes is an average of all the detected values. If it is an average, it may contain sampling results from the previous year.

Contaminant (units)	MRDLG	MRDL	****	*****	Typical Source of Contaminant
Chlorine (ppm)	4	4	.2-1.5	1.11	Water additive used to control microbes.

****Highest and Lowest Monthly Average.

*****Highest Quarterly Average.

CONSUMER CONFIDENCE REPORT

PWSID: 1520005

Contaminant (units)	MCLG	AL	90% Level	# sites over AL	Typical Source of Contaminant
Copper (ppm)	1.3	1.3	.61	0 out of 30	Corrosion of household plumbing systems; Erosion of natural deposits.
Lead (ppb)	0	15	2.8	0 out of 30	Corrosion of household plumbing systems; Erosion of natural deposits.

If present, elevated levels of lead can cause serious health problems, especially for pregnant women and young children. Lead in drinking water is primarily from materials and components associated with service lines and home plumbing. City of North Mankato is responsible for providing high quality drinking water, but cannot control the variety of materials used in plumbing components. When your water has been sitting for several hours, you can minimize the potential for lead exposure by flushing your tap for 30 seconds to 2 minutes before using water for drinking or cooking. If you are concerned about lead in your water, you may wish to have your water tested. Information on lead in drinking water, testing methods, and steps you can take to minimize exposure is available from the Safe Drinking Water Hotline or at <http://www.epa.gov/safewater/lead>.

Monitoring may have been done for additional contaminants that do not have MCLs established for them and are not required to be monitored under the Safe Drinking Water Act. Results may be available by calling 651-201-4700 or 1-800-818-9318 during normal business hours.

Compliance with National Primary Drinking Water Regulations

The sources of drinking water (both tap water and bottled water) include rivers, lakes, streams, ponds, reservoirs, springs, and wells. As water travels over the surface of the land or through the ground, it dissolves naturally-occurring minerals and, in some cases, radioactive material, and can pick up substances resulting from the presence of animals or from human activity.

Contaminants that may be present in source water include:

Microbial contaminants, such as viruses and bacteria, which may come from sewage treatment plants, septic systems, agricultural livestock operations, and wildlife.

Inorganic contaminants, such as salts and metals, which can be naturally-occurring or result from urban stormwater runoff, industrial or domestic wastewater discharges, oil and gas production, mining, or farming.

Pesticides and herbicides, which may come from a variety of sources such as agriculture, urban stormwater runoff, and residential uses.

Organic chemical contaminants, including synthetic and volatile organic chemicals, which are by-products of industrial processes and petroleum production, and can also come from gas stations, urban stormwater runoff, and septic systems.

Radioactive contaminants, which can be naturally-occurring or be the result of oil and gas production and mining activities.

In order to ensure that tap water is safe to drink, the U. S. Environmental Protection Agency (EPA) prescribes regulations which limit the amount of certain contaminants in water provided by public water systems. Food and Drug Administration regulations establish limits for contaminants in bottled water which must provide the same protection for public health.

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

CONSUMER CONFIDENCE REPORT

PWSID: 1520005

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.

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. These people should seek advice about drinking water from their health care providers. EPA/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.

Appendix II

Part 1

Wellhead Protection Area Delineations, Drinking Water Supply Management Area Delineations, and Well and Drinking Water Supply Management Area Vulnerability Assessments

**for
City of North Mankato**

Wellhead Protection Plan

Part 1

Delineation of Wellhead Protection Area, Drinking Water Supply Management Area, and Drinking Water Supply Management Area Vulnerability Assessment

March 2016

Prepared for

The City of North Mankato

by

Leggette, Brashears & Graham, Inc.

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Glossary of Terms

Data Element. A specific type of information required by the Minnesota Department of Health to prepare a Wellhead Protection Plan.

Drinking Water Supply Management Area (DWSMA). The area delineated using identifiable land marks that reflects the scientifically calculated wellhead protection area boundaries as closely as possible (Minnesota Rules, part 4720.5100, subpart 13).

Drinking Water Supply Management Area Vulnerability. An assessment of the likelihood that the aquifer within the DWSMA is subject to impact from land and water uses within the wellhead protection area. It is based upon criteria that are specified under Minnesota Rules, part 4720.5210, subpart 3.

Emergency Response Area (ERA). The part of the wellhead protection area that is defined by a one-year time of travel within the aquifer that is used by the public water supply well (Minnesota Rules, part 4720.5250, subpart 3). It is used to set priorities for managing potential contamination sources within the DWSMA.

Inner Wellhead Management Zone (IWMZ). The land that is within 200 feet of a public water supply well (Minnesota Rules, part 4720.5100, subpart 19). The public water supplier must manage the IWMZ to help protect it from sources of pathogen or chemical contamination that may cause an acute health effect.

Wellhead Protection (WHP). A method of preventing well contamination by effectively managing potential contamination sources in all or a portion of the well's recharge area.

Wellhead Protection Area (WHPA). The surface and subsurface area surrounding a well or well field that supplies a public water system, through which contaminants are likely to move toward and reach the well or well field (Minnesota Statutes, part 103I.005, subdivision 24).

Well Vulnerability. An assessment of the likelihood that a well is at risk to human-caused contamination, either due to its construction or indicated by criteria that are specified under Minnesota Rules, part 4720.5550, subpart 2.

Acronyms

ATP - Aquifer Test Plan

CFR - Calculated Fixed Radius

CWI - County Well Index

DNR - Minnesota Department of Natural Resources

EPA - United States Environmental Protection Agency

FSA - Farm Security Administration

MDA - Minnesota Department of Agriculture

MDH - Minnesota Department of Health

MGS - Minnesota Geological Survey

MnDOT - Minnesota Department of Transportation

MnGEO - Minnesota Geospatial Information Office

MPARS – Minnesota DNR Permitting and Reporting System

MPCA - Minnesota Pollution Control Agency

NRCS - Natural Resource Conservation Service

SWCD - Soil and Water Conservation District

UGE - Upgradient Extensions

UMN - University of Minnesota

USDA - United States Department of Agriculture

USGS - United States Geological Survey

1. Introduction

Leggette, Brashears and Graham, Inc. (LBG) has developed this Part 1 of the Wellhead Protection (WHP) Plan for the City of North Mankato (City) (public water supply identification number 1520005). The work was performed in accordance with the Minnesota Wellhead Protection Rule (MR), parts 4720.5100 to 4720.5590.

The results of the development of this amended WHP Plan are presented in the text below, on Tables 1 through 7 and Figures 1 through 12, which are listed in the Table of Contents.

This report presents delineations of the wellhead protection areas (WHPAs) and drinking water supply management areas (DWSMAs), and the vulnerability assessments for the public water supply wells and DWSMAs. Figure 10 shows the boundaries of the WHPAs and the DWSMAs. These are based on WHPAs that are defined by a 10-year time of travel. Figure 10 also shows the emergency response areas (ERAs), which are defined by a 1-year time of travel.

This report also lists the technical information that was used to prepare this portion of the WHP Plan in accordance with the MR. Information pertaining to the Aquifer Test Plan (ATP) and the well vulnerability sheets can be obtained from the Minnesota Department of Health (MDH).

The City Wells included in the WHP Plan are listed in Table 1.

Table 1 - Water Supply Well Information for the City of North Mankato

Local Well Name	Unique Number	Type	Casing Diameter (inches)	Casing Depth (feet)	Well Depth (feet)	Date Constructed/ Reconstructed	Well Vulnerability	Aquifer
Well No. 5	209823	Primary	16 x 12	285	687	1958	Non-Vulnerable	Wonewoc Mt. Simon
Well No. 6	209821	Primary	24 x 20	265	681	1959	Non-Vulnerable	Wonewoc Mt. Simon
Well No. 7	112207	Primary	24 x 20	416	860	1975	Non-Vulnerable	Tunnel City Wonewoc Mt. Simon
Well No. 8	415943	Primary	30 x 24 x 18	614.1	845	1986	Non-Vulnerable	Mt. Simon

2. Assessment of the Data Elements

Table 2 presents the assessment of the data elements as outlined in the MDH's scoping letter relative to the present and future implications of planning items that are specified in MR, part 4720.5210.

Table 2 - Assessment of Data Elements

Data Element	Present and Future Implications				Data Source
	Use of the Well (s)	Delineation Criteria	Quality and Quantity of Well Water	Land and Groundwater Use in DWSMA	
Precipitation					
Geology					
Maps and geologic descriptions	M	H	H	H	MGS, DNR, USGS
Subsurface data	M	H	H	H	MGS, MDH, MPCA, USGS
Borehole geophysics					None available
Surface geophysics					None available
Soils					
Maps and soil descriptions					
Eroding lands					
Water Resources					
Watershed units					
List of public waters					
Shoreland classifications					
Wetlands map					
Floodplain map					
Land Use					
Parcel boundaries map	L	H	L	L	Nicollet, Blue Earth County Data
Political boundaries map	L	H	L	L	County GIS Data
Public Land Survey map	L	H	L	L	ESRI Data
Land use map and inventory					
Comprehensive land use map					
Zoning map					
Public Utility Services					
Transportation routes and corridors	L	H	L	L	ESRI Data
Storm/sanitary sewers and PWS system map					
Oil and gas pipelines map					
Public drainage systems map or list					
Records of well construction, maintenance, and use	H	H	H	H	City, CWI
Surface Water Quantity					
Stream flow data					
Ordinary high water mark data					
Permitted withdrawals					

Data Element	Present and Future Implications				Data Source
	Use of the Well (s)	Delineation Criteria	Quality and Quantity of Well Water	Land and Groundwater Use in DWSMA	
Protected levels/flows					
Water use conflicts					
Groundwater Quantity					
Permitted withdrawals	H	H	H	H	DNR
Groundwater use conflicts					None Identified
Water levels	H	H	H	H	DNR, MPCA, MDH, City
Surface Water Quality					
Stream and lake water quality management classification					
Monitoring data summary					
Groundwater Quality					
Monitoring data	H	H	H	H	MPCA, MDH
Isotopic data	H	H	H	H	MDH
Tracer studies					None available
Contamination site data	M	M	M	M	MPCA, MDA
Property audit data from contamination sites					
MPCA and MDA spills/release reports					MPCA

Definitions Used for Assessing Data Elements:

High (H) – The element has a direct impact.

Moderate (M) – The element has an indirect or marginal impact.

Low (L) – The element has little if any impact.

Shaded – The element was not required by MDH for preparing the WHP Part 1 Plan.

3. General Descriptions

3.1 Description of the Water Supply System

The City obtains its drinking water supply from four primary wells, City Wells No. 5 through 8. The wells are shown on Figure 1 and Table 1 summarizes information regarding them.

3.2 Description of the Hydrogeologic Setting

The City of North Mankato is located in southern Nicollet County, north and west of the Minnesota River and the City of Mankato. Four City Wells, two locations with two wells each, supply the community with all of its water.

Well logs and the Geologic Atlases of Nicollet, Le Sueur, and Blue Earth County, Minnesota from the Minnesota Geological Survey (MGS) were used to supplement any studies that were available. A summary of the hydrologic conditions at the City Wells is presented in Tables 3a and 3b.

The most significant feature in the North Mankato area is the Minnesota River valley that appears to be the primary discharge feature for groundwater in the region. This valley cuts west to east south of the City and then turns north and borders the east side of the City. The rest of the geology in the vicinity of the City is as follows:

- a) Glacial Drift overlies the bedrock throughout the North Mankato area;
- b) The Prairie du Chien Group is encountered as the surficial bedrock east of the City and the Minnesota River with a small area of it under the western half of the City, west of Lor Ray Dr. and east of Belgrade Township Rd. 191, south of Timm Rd., and north of the Minnesota River
- c) Jordan Sandstone is encountered as the surficial bedrock in the area of the City as islands between buried valleys where it was eroded away. East of the City, across the Minnesota River, Jordan Sandstone is more prevalent and the bed gets thicker as the base of the unit dips to the east. The dip of the bedrock layers in the area is approximately 0.5 degrees to the east;
- d) The St. Lawrence formation is a confining unit underlying the Jordan and overlaying the Tunnel City Group (Tunnel City). In the North Mankato area the St. Lawrence is approximately 60 feet thick near the City Wells and is found throughout the City with the exception of a narrow buried valley where it is absent that starts approximately 1 mile east of City Wells No. 5 and 6 and extends north along the Minnesota River. This layer is considered an aquitard and likely separates the flow to the City Wells from flow in shallower aquifers;
- e) The Tunnel City is the next water bearing unit. Usually, this sandstone does not yield much water. The layer extends throughout the North Mankato area ranging in thicknesses from approximately 125 to over 160 feet. City Well No. 7 is open to this aquifer;
- f) Wonewoc Sandstone also extends throughout the North Mankato area ranging in thickness from approximately 50 to 70 feet. Generally, this layer is a useful source of water, and is utilized by Wells No. 5, 6, and 7;
- g) The Eau Claire Formation is a confining unit between the Wonewoc and the Mt Simon Sandstone. This unit is approximately 100 ft thick in the area of the City Wells;
- h) Mt. Simon Sandstone (Mt. Simon) is a principal source of water for the City of North Mankato. Its thickness in the North Mankato area exceeds 200 ft. City Well No.8 indicates a thickness of 225 feet and is the only well that reaches a lower aquifer unit, the Hinkley/Fond du Lac Sandstone. All four City Wells are completed in the Mt. Simon with City Well No. 8 open solely to the Mt. Simon; and,

- i) The Hinkley/Fond du Lac Sandstone underlies the Mt. Simon Sandstone and is over 800 feet thick in the North Mankato area (Mossler, 2012).

Table 3a - Description of the Local Hydrogeologic Setting for the Tunnel City/Wonewoc Aquifer

Tunnel City / Wonewoc (CTCW)	Aquifer Material	Sandstone	City Well Logs
	Primary Porosity	0.2	Typical of aquifer material.
	Aquifer Thickness	189 - 229 feet	City Well Logs (CTCW)
	Stratigraphic Top Elevation	654 - 689 ft-amsl	City Well Logs
	Stratigraphic Bottom Elevation	463 - 477 ft-amsl	City Well Logs
	Hydraulic Confinement	Confined	City Well Logs
	Transmissivity (T)	Reference Value 693.6 ft ² /day	Specific capacity data analysis of wells in the North Mankato area yielded conductivity values with a geometric mean of 3.4 ft/day for the combined Tunnel City/Wonewoc Aquifer. Multiplying these values by the average thickness the aquifer at the North Mankato Wells (204 ft) produced the reference value.
	Hydraulic Conductivity (K)	Reference Value : 11 ft/day	See above.
	Groundwater Flow Field	Flow to the south-southwest toward the Minnesota River and areas of pumping in the City of Mankato. Hydraulic Gradient is variable	Measured from model results. Flow near Well No. 7 is generally radial towards the well with flow at Wells No. 5 and 6 coming from the northeast.

Table 3b - Description of the Local Hydrogeologic Setting for the Mt. Simon Aquifer

Mt. Simon (CMTS)	Aquifer Material	Sandstone	City Well Logs
	Primary Porosity	0.2	Typical of aquifer material.
	Aquifer Thickness	230 - 367 ft	City Well Logs*
	Stratigraphic Top Elevation	355 - 387 ft-amsl	City Well Logs
	Stratigraphic Bottom Elevation	91 - 152 ft-amsl	City Well Logs*
	Hydraulic Confinement	Confined	City Well Logs
	Transmissivity (T)	Reference Value/Range 2,151 ft ² /day (1,185 – 4,740 ft ² /day)	The reference value for the transmissivity of the Mt. Simon Aquifer was determined from pumping tests at Mankato Well No. 16 (686257) and the range is the reference value approximately halved and doubled.
	Hydraulic Conductivity (K)	Reference Value/Range 7.6 ft/day (3.3 – 16.4 ft/day)	See above.
	Groundwater Flow Field	Flow to the south-southwest toward the Minnesota River and areas of pumping in the City of Mankato. Hydraulic Gradient is variable	Measured from model results. Flow near Wells No. 7 and 8 is generally radial towards the wells with flow at Wells No. 5 and 6 coming from the northeast.

*Aquifer may be thicker as base of well logs do not indicate a change in aquifer

4. Delineation of the Wellhead Protection Area

4.1 Delineation Criteria

The boundaries of the WHPAs for the City are shown in Figure 7. Table 4 provides descriptions of how the delineation criteria that are specified under MR, part 4720.5510 were included in the model.

Table 4 - Description of WHPA Delineation Criteria

Criterion	Descriptor	How the Criterion was Addressed
Flow Boundary	Minnesota and Blue Earth Rivers, local streams and lakes	The rivers and lakes provide boundary conditions within the regional model north of the City. They are included in the model and help set the local groundwater flow.
Flow Boundary	Other High-Capacity Wells (Table 6)	The pumping amounts were determined based on the averaged 2010-2014 pumped volumes. The pumping amounts of these high-capacity wells were included in the methods used for the delineation.
Daily Volume of Water Pumped	See Table 5	Pumping information was obtained from the Minnesota Department of Natural Resources Appropriations Permit 1975-4230. The annual pumped volumes were converted to a daily volume pumped by a well.
Groundwater Flow Field	See Figures 6 and 7	The model calibration process addressed the relationship between the calculated versus observed groundwater flow field.
Aquifer Transmissivity	Reference Value 693.6 ft ² /day – CTCW 2,151 ft ² /day - CMTS	See Tables 3a and 3b.
Time of Travel	10 years	The public water supplier selected a 10-year time of travel.

Information provided by the City and from the Minnesota Department of Natural Resources (DNR) Permitting and Reporting System (MPARS) database was used to identify the maximum volume of water pumped annually by each well over the previous five-year period. The volumes pumped from the wells over previous five years and the rates used in the delineation are summarized in Table 6. The exception is at Well No. 5 as it had anomalously low pumping relative to the other three wells and pumping increased approximately 35-fold over the previous 5 years. Therefore, to be conservative relative to potential pumping increases at this well, a value equal to approximately 10 percent of the total pumping (62 MGY, 642.3 m³/d) was used for the delineation. The average volume pumped by the City is increasing; however, the projected value in 2025 is less than 600 MGY. The total volume used in the model, illustrated in Table 6 (674.6 MGY, 6,989 m³/d), is approximately 23% greater than the highest single-year demand over the period of record (548.9 MGY in 2014) and higher than the projected value, indicating a conservative delineation volume. The daily volume of discharge used as an input parameter in the model was calculated by dividing the annual withdrawal volume by 365 days.

Table 5 - Annual Volume of Water Discharged from Water Supply Wells

Well Name	Unique Number	Total Annual Withdrawal (million gallons/year[MGY])					Maximum Withdrawal 2010 - 2014 (MGY)	Daily Withdrawal used in WHP Plan (m3/d)
		2010	2011	2012	2013	2014		
Well No. 5	209823	0.25	1.3	1.4	1.5	8.9	8.9	642.3*
Well No. 6	209821	122.6	123.7	135.5	124.4	104.3	135.5	1403.8
Well No. 7	112207	281.5	189	201.5	195.8	266.2	281.5	2916.3
Well No. 8	415943	62.9	154.1	195.6	188.9	169.5	195.6	2026.4
Totals		467.25	468.1	534	510.6	548.9	621.5	6989

- Source: MPARS, Permit Number 1975-4230.

* Well No. 5 was Assigned 10% of the total of the maximum withdrawal rates.

Table 6 - Other Permitted High-Capacity Wells within Model Area

Unique Number	Well Name	Aquifer	DNR Permit Number	Use	Annual Withdrawal (MGY)
209387	School Sisters of Notre Dame	CJDN/CTCW	1975-4191	Commercial Water Supply	0.1
209391	Mankato, City Of	CSTLCMTS	1970-1412	Public Water Supply	1.32
614146	Winkler, Cathy	CTCW	2013-1025	Aquaculture	1.9
255278	Coughlan Quarries, LLC	CTCW	2000-4105	Sand and Gravel Washing	2.18
255277	Coughlan Quarries, LLC		2000-4105	Sand and Gravel Washing	2.68
242883	Hillcrest Health Care Center	CFIG	1990-4282	Private Water Supply	4.28
209395	Mankato, City Of	CSTL/CMTS	1970-1412	Public Water Supply	4.36
652870	Bohks, Kyle	CSTL/CTCW	1990-4079	Golf Course Irrigation	4.48
423362	Vetter Stone Company	CJDN	1975-4178	Mine Processing	6.32
209388	School Sisters of Notre Dame	CJDN/CTCW	1975-4191	Commercial Water Supply	7.76
191916	South Bend Township	CMTS	1985-4076	Public Water Supply	13.32
763073	Coughlan Quarries, LLC	CTCW	2000-4105	Sand and Gravel Washing	20.38
209379	Vetter Stone Company	CJDN	1975-4178	Mine Processing	21.16
n/a	Mankato Golf Club	OPDC/CTCW	1990-4076	Golf Course Irrigation	22.86
471830	North Links Ltd Partnership	CMTS	1992-4133	Golf Course Irrigation	23.78
624305	Vetter Stone Company	CTCW	1975-4178	Mine Processing	29.3
159550	Mount Kato Ski Area	CSTL/CECR	1979-4056	Snow/Ice Making	32.86
524744	Wis-Pak of Mankato Inc	CMTS	1971-0313	Agricultural Processing	103.04
686257	Mankato, City Of	CMTS	1970-1412	Public Water Supply	333.48
458567	Mankato, City Of	CECR/CMTS	1970-1412	Public Water Supply	358.08
209830	Mankato, City Of	QWTA	1970-1412	Public Water Supply	499.08
683899	Mankato, City Of	QWTA	1970-1412	Public Water Supply	626.8
209828	Cenex Harvest States Cooperative	CFRN/CMTS	1987-4120	Agricultural Processing	1348.54

- Source: MPARS

4.2 Method Used to Delineate the Wellhead Protection Area

Figure 10 shows the WHPAs delineated for the City Wells using the results of the porous media modeling delineations. The WHPAs are a composite of all the areas identified using methods described in this report that potentially contribute recharge to the aquifers used by the City Wells within a 10-year time of travel.

4.2.1. Porous Media Delineations

The porous media delineation of the WHPAs for the City Wells was completed by creating a finite difference flow model using MODFLOW-NWT. MODFLOW-NWT is a 3D, cell-centered, finite difference, saturated flow model developed by the USGS (Niswonger, et. al., 2011).

The model domain was divided into a three-dimensional, non-uniform grid. The model uses approximately 370 rows and 350 columns, but not all of the cells are active. The model has 8 layers. Finer grid spacing was applied in the model with telescopic mesh refinement used in the area of the City Wells. This grid spacing (2 m in the area of the wells) provides better definition in the area of the flow field where simulating the influence of pumping from the wells is critical.

There are eight layers in the model to represent the geological units described in Section 3.2. The top elevation of layer 1 was defined by USGS 10-meter digital elevation data. The bottoms of each of the layers were defined by interpolation of approximate layer bottom elevation from geologic maps of the area and well log information.

Boundary conditions within the model were created using the river package to represent the rivers and lakes. Constant head boundaries were added to represent the groundwater surface on the northwest and south east edges of the model. The boundaries were defined using heads measured in wells near the them as well as approximated heads from local hydrogeologic atlas information. These boundaries are approximately parallel to the Minnesota River at a distance of between 6 and 11 miles. The northern and western bounds of the model are no-flow boundaries coinciding with flow toward the Minnesota River

The size of the domain and the general flow-field characteristics of the model were based on preliminary modeling, information from the City of Mankato Wellhead Protection Plan, and data from local geologic and hydrogeologic atlases.

In addition to the previously mentioned information, the following data were incorporated in the refined model:

- The pumping rates from Table 5 were assigned to the City Wells.
- The pumping rates from Table 6 were assigned to high-capacity wells located within the model boundary.

A set of 36 particles was launched from each cell containing a well for a ten year time-of-travel using MODPATH, a flowpath calculation program. A porosity of 20 percent was used for the aquifers, as generally suggested by the MDH.

As part of the uncertainty analysis, further groundwater pathline analyses, each consisting of 36 pathlines for a 10-year time-of-travel, were performed to delineate the 1-, 5- and 10-year capture zones and ultimately the WHPA.

The resulting WHPA boundaries (Figure 10) are a composite of the 10-year capture zones calculated using this model for the base case parameters and the parameter values used in the uncertainty analysis that is discussed in the following section. The model input files are available upon request from the MDH.

4.3 Results of Model Calibration and Sensitivity Analysis

The goal of numerical model calibration is to obtain a reasonable correlation between the simulated model results and observed field data. The calibration process is generally completed by running a series of steady-state simulations (simulations where the flow magnitude and direction are constant with time), comparing calculated heads to the measured heads at wells within the model domain while changing the model parameters until the best match between the two is achieved. After a model is reasonably calibrated a sensitivity analysis is used to determine the impact that changes to an input parameter have on the output of the model. In areas where there is a great deal of uncertainty in the physical parameters, either as a consequence of lack of data or based on the uncertainty associated with the interpretation of available data (i.e. pumping test analyses), a number of models are generally run to observe the effect on the model results over the range of potential values for each of the significant parameters. While none of the individual capture zones delineated as part of this analysis should be considered the “correct” one, it is assumed that the actual capture zone is encompassed by the resulting concatenation of analysis zones.

4.3.1. Calibration

The calibration plot, showing measured versus simulated hydraulic head values for model layers 5, 6, and 8, corresponding to the Tunnel City Group, Wonewoc, and Mt. Simon Aquifers, respectively, is illustrated on Figure 8. The plot shows that the simulated values and measured head values generally compare quite favorably and have a normalized root mean squared (NRMS) error of approximately 8 percent. Plots of the calibration for the individual aquifers show similar results.

More extensive and current observation data collected within the same general time period and more accurate, site-specific transmissivity values throughout the model domain would improve calibration and model confidence. More data on the heads and flow direction in the Mt. Simon aquifer would also improve confidence in the model.

The groundwater flow field and hydraulic heads in the area of the City for Layers 6 and 8 of the calibrated model, representing the Tunnel City/Wonewoc and Mt. Simon Aquifers, respectively, are shown on Figures 6 and 7. The flow directions agree with other studies conducted in the area and measured heads in local wells. The 1-, 5-, and 10-year capture zones, predicted using the calibrated model, are shown on Figure 9. However, due to the potential variability associated with the physical characteristics of the aquifer; a sensitivity/uncertainty analysis was completed as part of the modeling effort.

4.3.2. Sensitivity Analysis

Sensitivity is the amount of change in model results caused by the variation of a particular input parameter. For example, changing the hydraulic conductivity of an area can change the calculated head

values in and around the area of the modified model as compared to the heads in the unmodified model. Because of the relative simplicity of the area of interest in this model, the size and orientation of the modeled capture zone may be sensitive to any of the input parameters:

The **pumping rate** determines the volume of the aquifer that donates water to the well. Increasing the pumping rate will expand the capture zone, for a given thickness, and decreasing it will make the capture zone smaller.

- **Results** – The pumping rate for each well was defined by Minnesota Rules and therefore is not a variable for consideration in this analysis. There are other high-capacity wells in the vicinity of the City Wells that have a significant effect on the capture zones; however they do not alter the production of the City Wells and appear to have consistent use and are therefore unlikely to change the capture zones of the City Wells in the near future.

The **direction of groundwater flow** and gradient can often be variable and change significantly with changing conditions such as fluctuations in local surface water elevations or the pumping rates in local wells

- **Results** – The regional flow direction and gradient were determined through the modeling process and closely resemble the flow direction and gradient determined through mathematical analysis of the measured heads in the area. Based on the regional observation data, the characteristics of the flow field and the use of the aquifers of interest there is not likely to be a significant change to the flow field.

The **horizontal hydraulic conductivity** influences the size and shape of the capture zone. A change in the hydraulic conductivity of the aquifer will alter the location of the capture zones. Most conductivity estimates combine the Wonewoc with the Tunnel City Group; however, there is a significant layer of shale that forms the base of the Tunnel City Group. This layer may effectively separate the Tunnel City and Wonewoc Aquifers; however, they are treated as a single aquifer for the purposes of this study.

- **Results** - Data from a pumping test recorded at City of Mankato Well No. 16 indicate the hydraulic conductivity of the Mt. Simon Aquifer to be approximately 7.6 ft/d (2.3 m/d), which agrees well with other results and estimates for the area. Using drawdown data from wells completed in the Tunnel City and Wonewoc Aquifers in the North Mankato area, the combined conductivity of these aquifers was estimated to be 11 ft/d (3.4 m/d).

Because there is uncertainty associated with the conductivity values for the bedrock aquifers, an uncertainty analysis was conducted where the conductivities for the Mt. Simon were approximately reduced by half and doubled (3.3 to 16.4 ft/d [1 to 5 m/d]) and the range for the combined Tunnel City/Wonewoc (3 to 41 ft/d [.9 to 12.5 m/d]) aquifer was determined using the specific capacity data from wells in the area completed in the these aquifer units.

The aquifer **thickness** and **porosity** influence the size and shape of the capture zone by limiting the water-bearing volume within a given area of aquifer. Decreasing or increasing either thickness or porosity forces a proportional decrease or increase in the areal extent of the capture zone.

- **Results** – The thicknesses of the aquifers in the model closely approximates the actual thicknesses measured from the well logs. Any difference between the actual transmissivity of

the aquifers and the modeled transmissivity is addressed in the uncertainty analysis. The porosity value in the model for the both the Mt. Simon and Wonewoc is 0.20. The thickness and porosity of the aquifers, being relatively consistent in the area of the wells, are not considered variables for this study.

4.4 Addressing Model Uncertainty

Using computer models to simulate groundwater flow always requires that simplifying assumptions be made. Local geology can be highly variable and information from well logs and pumping tests indicates that this is likely the case near the City Wells. Unfortunately, existing information is not detailed enough to define this degree of variability and interpretation of log and test data is often inconsistent. For models of the scale used in this study, the information and computational ability does not exist to precisely delineate the WHPA. To account for this, a number of models are run to examine the various potential WHPAs for the wells, given the range of the input data mentioned previously.

MODFLOW models were used to delineate the capture zones for the aquifers that supply water to the City Wells. As described previously, the hydraulic conductivity was the single variable identified that could cause the greatest change in the WHPAs for the City Wells. Because the range of conductivities determined through different tests at different locations throughout the area show significant variation, uncertainty was represented by increasing and decreasing the conductivity of the aquifers through a reasonable range of values. The range of hydraulic conductivity determined from testing and data is summarized in Tables 3a and 3b and the values used for each of the runs in the uncertainty analysis are presented in Table 7.

Table 7– Hydraulic Conductivity Values Used in Uncertainty Analysis

Simulation	Tunnel City/Wonewoc Conductivity (ft/d)	Tunnel City/Wonewoc Conductivity (m/d)	Mt. Simon Conductivity (ft/d)	Mt Simon Conductivity (m/d)
Base Model	11	3.4	7.6	2.3
Uncert-1	11	3.4	3.3	1
Uncert-2	11	3.4	16.4	5
Uncert-3	3	0.9	7.6	2.3
Uncert-4	41	12.6	7.6	2.3
Uncert-5	3	0.9	3.3	1
Uncert-6	3	0.9	16.4	5
Uncert-7	41	12.6	3.3	1
Uncert-8	41	12.6	16.4	5

Capture areas were delineated for the assessed range of aquifer conductivities for a time-of-travel period of 10 years and are shown on Figure 10 as the 10-Year Composite Capture Zone. Nine model runs were required to include all possible input parameters. The WHPAs for the City wells consist of a composite of the porous media aquifer delineations for the different input parameters used in the uncertainty analysis.

5. Delineation of the Drinking Water Supply Management Area

The boundaries of the DWSMA were defined by LBG and the public water supplier using roads and Public Land Survey System coordinates (Figure 10).

Because surface water is not hydraulically connected to the aquifers near the City wells, due to the presence of the St. Lawrence confining unit, a conjunctive delineation was not necessary.

6. Vulnerability Assessments

The Part 1 WHP Plan includes the vulnerability assessments for the public water supply well and DWSMA. These vulnerability assessments are used to help define potential contamination sources within the DWSMA and to select appropriate measures for reducing the risk that they present to the public water supply.

6.1 Assessment of Well Sensitivity

Review of site-specific data from the CWI, which are represented graphically in cross section on Figures 3 and 4, indicates that significant amounts of low permeability material overlies the Tunnel City/Wonewoc and Mt. Simon aquifers across the majority of both DWSMA boundaries. As a result, the areas inside the Wells No. 5 and 6 and Wells No. 7 and 8 DWSMAs are both characterized by low geologic sensitivity.

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. A Level-3 DNR geologic sensitivity assessment was used for the City Wells. The Level-3 DNR geologic sensitivity rating is an empirical value determined by dividing the cumulative thickness of low permeability units 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 since the aquifers are 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.

A Level-3 assessment was also conducted for all CWI wells located in the vicinity of the DWSMA delineation. The geologic sensitivity “L-scores” were calculated by LBG using an MDH Geographic Information System tool that utilizes lithology information from the MN CWI. Figure 11 illustrates the geologic sensitivity for the DWSMA as determined by mapping L-scores from the well logs across and adjacent to the DWSMA. Geologic sensitivity near the City Wells and across the DWSMAs is low.

6.2 Assessment of Well Vulnerability

The well vulnerability assessment was conducted in accordance with the MDH guidance document, Assessing Well Vulnerability for Wellhead Protection (MDH, 1997). The vulnerability of a well 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.

Vulnerability assessment rating sheets and vulnerability scores for Wells No. 5 through 8 were obtained from the MDH and reviewed by LBG. All wells are considered not vulnerable based on the variables mentioned above.

6.3 Assessment of the Drinking Water Supply Management Area Vulnerability

Once the geologic sensitivity was determined for wells in the DWSMA and vulnerability ratings were determined for the City Wells, the vulnerability ratings for the DWSMA could be determined. Since tritium has not been detected above 1 Tritium Unit (T.U), the vulnerability rating in the vicinity of the City Wells and across the DWSMA remained the same as the geologic sensitivity rating, which is low (Figure 12).

7. Recommendations

Upon completion of this Part 1 WHP Plan amendment, the following recommendations are provided for the City to consider for better understanding the hydrogeologic conditions of the source aquifers and refinement of future WHPA delineations.

- Other water well owners in the vicinity of City Wells No. 5 and 6, particularly the City of Mankato, should be contacted to determine if there are any plans to change their current pumping schemes in the foreseeable future as any significant changes could affect the direction of flow, particularly in the area of Wells No. 5 and 6.
- Continue collecting groundwater samples for analysis of regulated contaminants and provide the data to the MDH.
- Aquifer Testing: For this WHPA delineation, the transmissivity of North Mankato's aquifers were estimated from an aquifer test conducted in a similar geologic setting in the nearby town of Mankato. However, the Minnesota River, a major hydrologic divide, separates the wellfields of North Mankato and Mankato. Additionally, the North Mankato wells are multi-aquifer wells, and aquifer test results from other wells may not be completely transferrable. It would be better if more localized data could be used for future amendments of North Mankato's WHP plan. With assistance from the MDH hydrologist, the city should investigate the possibility of conducting an aquifer test using the city's wells.

8. References

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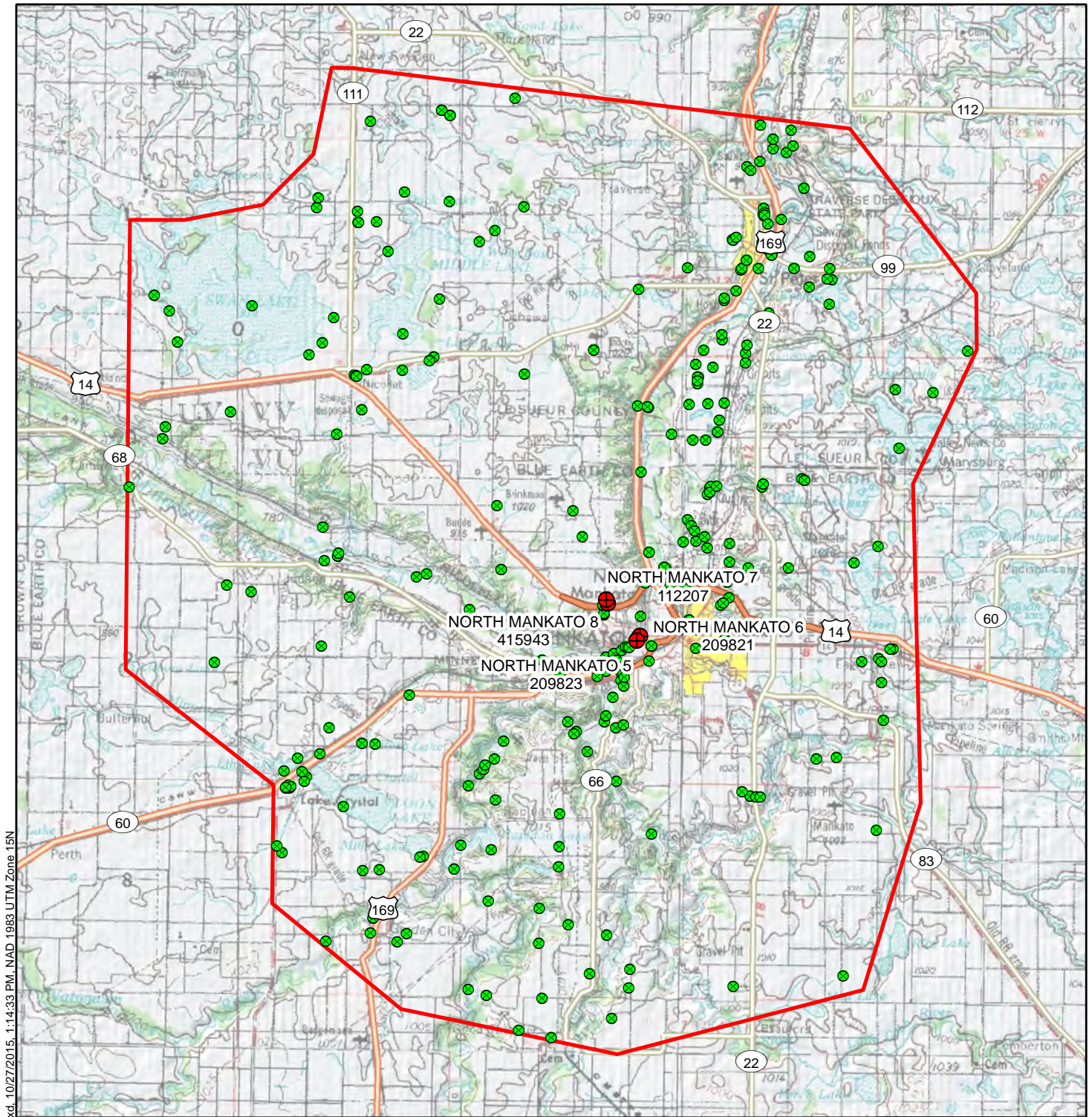
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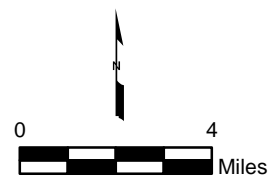
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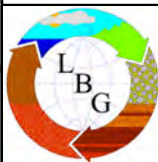
Figures



- City Well Location
- High Capacity Well
- Local Model Boundary



Source: National Geographic Society, i-cubed. Minnesota County Well Index (CWI).



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NORTH MANKATO, MINNESOTA

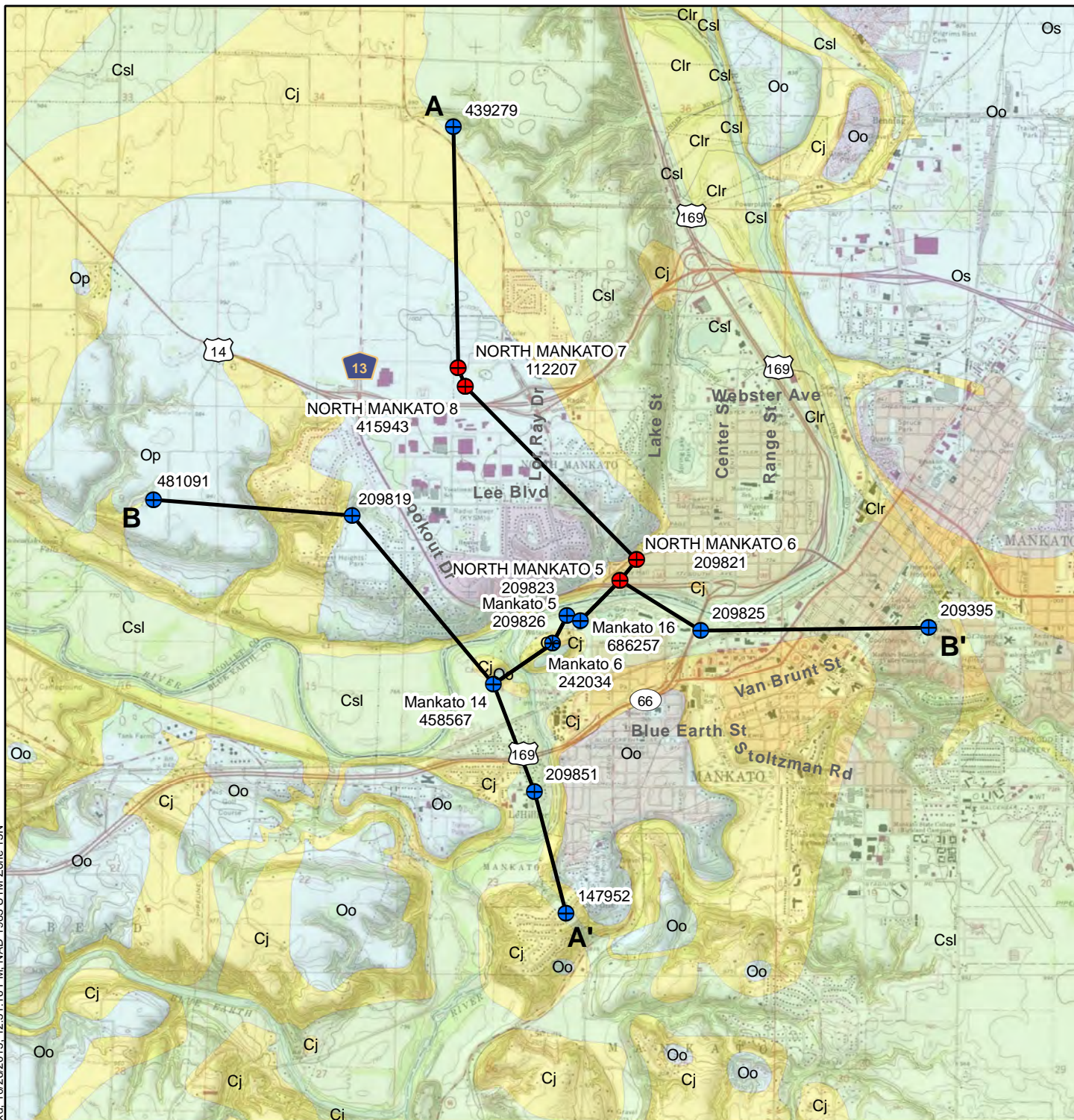
SITE LOCATION, HIGH CAPACITY WELLS AND LOCAL MODEL BOUNDARY

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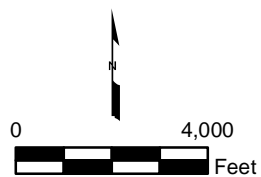
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FIGURE: 1

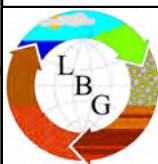
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- City Well Location
- CWI Well on Hydrogeologic Cross Section
- Hydrogeologic Cross Section Location
- Op Prairie du Chien Group (Also "Os" and "Oo")
- Cj Jordan Sandstone
- Csl St. Lawrence Formation



Source: National Geographic Society, i-cubed. Minnesota County Well Index (CWI). MN DNR Blue Earth and Nicollet Counties Hydrogeologic Atlas, 2011.



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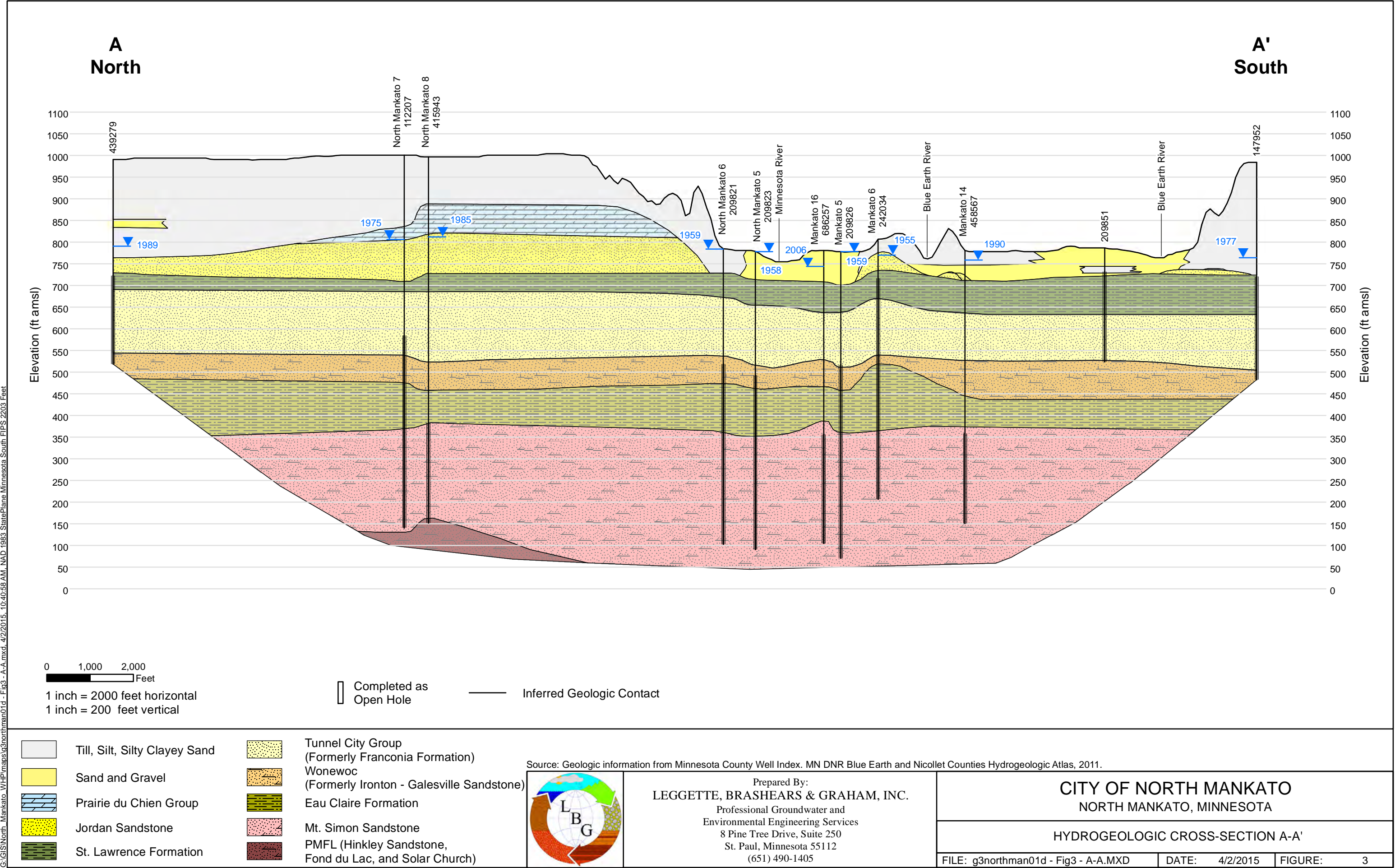
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HYDROGEOLOGIC CROSS SECTIONS AND BEDROCK GEOLOGY

FILE: g3northman01g - Fig2.MXD

DATE: 10/26/2015

FIGURE: 2



G:\GIS\North_Mankato_WHP\maps\g3northman01d - Fig3 - A-A.mxd, 4/2/2015, 10:40:58 AM, NAD 1983 StatePlane Minnesota South FIPS 2203 Feet

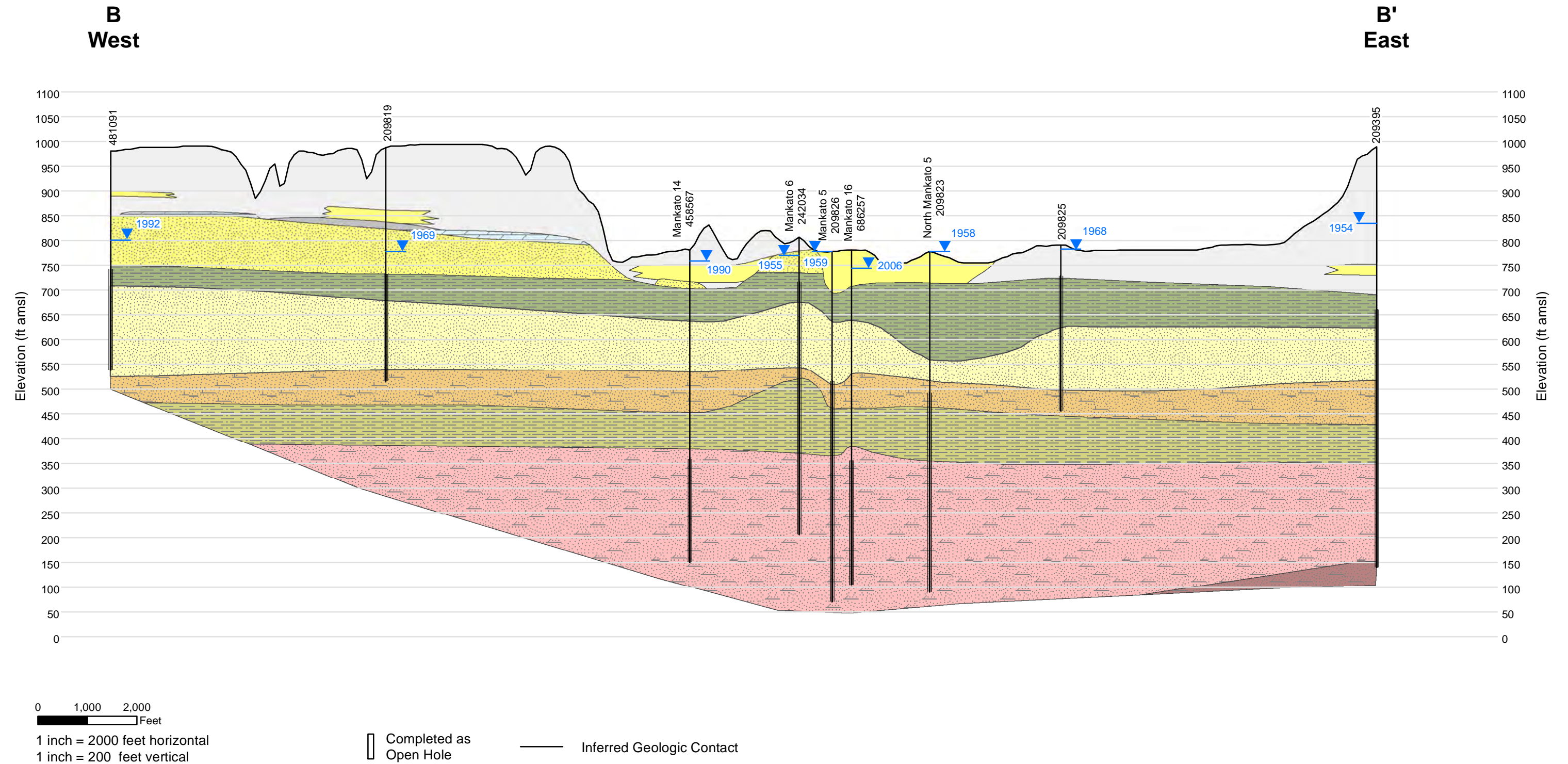
Source: Geologic information from Minnesota County Well Index. MN DNR Blue Earth and Nicollet Counties Hydrogeologic Atlas, 2011.



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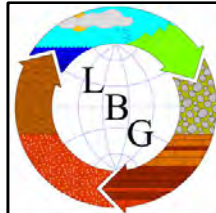
CITY OF NORTH MANKATO NORTH MANKATO, MINNESOTA		
HYDROGEOLOGIC CROSS-SECTION A-A'		
FILE: g3northman01d - Fig3 - A-A.MXD	DATE: 4/2/2015	FIGURE: 3

G:\GIS\North_Mankato_WHP\maps\g3northman01e - Fig 4 - B-B.mxd, 10/28/2015, 12:36:52 PM, NAD 1983 StatePlane Minnesota South FIPS 2203 Feet



	Till, Silt, Silty Clayey Sand		Tunnel City Group (Formerly Franconia Formation)
	Sand and Gravel		Wonewoc (Formerly Ironston - Galesville Sandstone)
	Cretaceous		Eau Claire Formation
	Prairie du Chien Group		Mt. Simon Sandstone
	Jordan Sandstone		PMFL (Hinkley Sandstone, Fond du Lac, and Solar Church)
	St. Lawrence Formation		

Source: Geologic information from Minnesota County Well Index. MN DNR Blue Earth and Nicollet Counties Hydrogeologic Atlas, 2011.

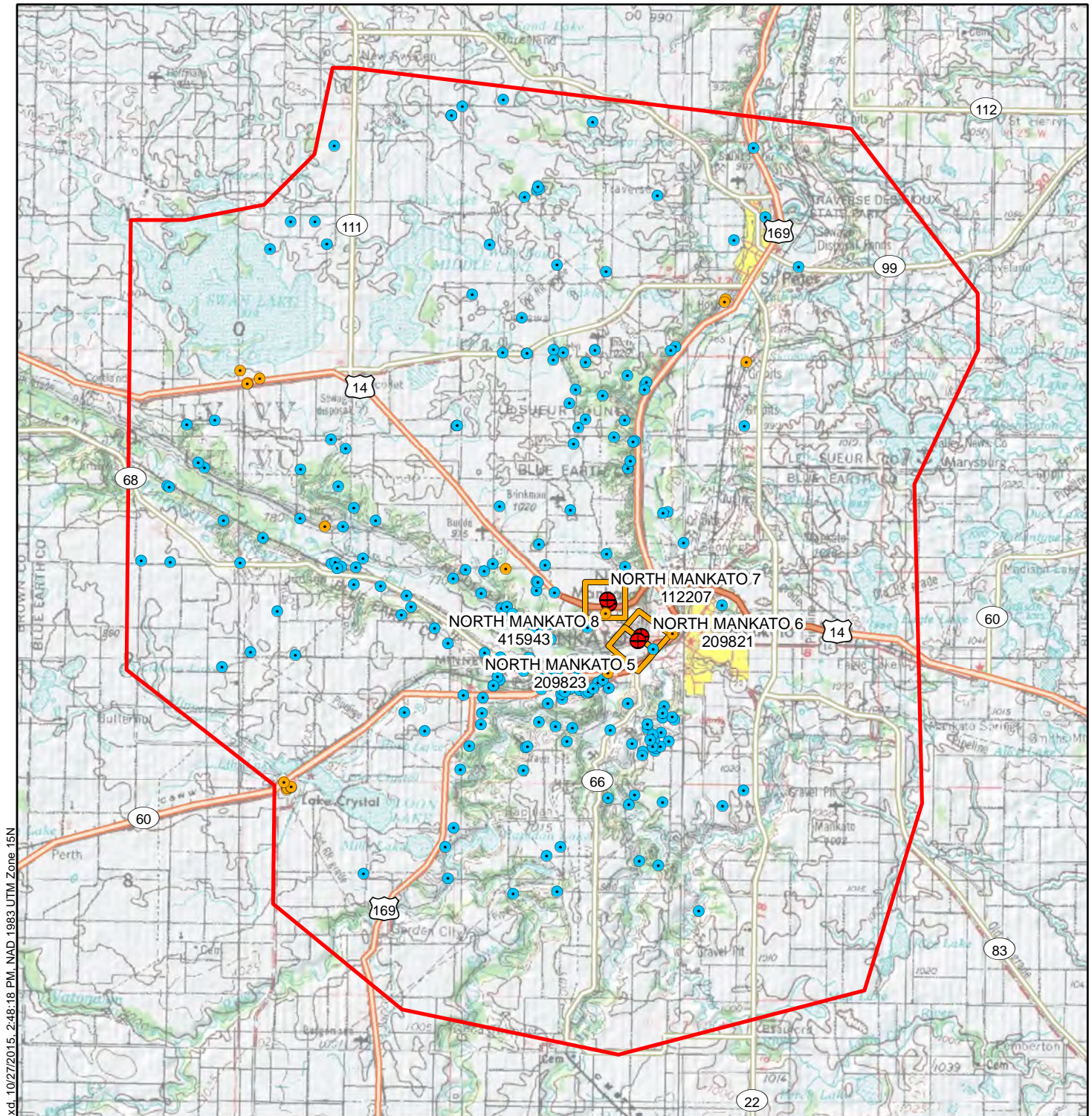


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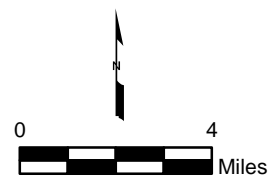
CITY OF NORTH MANKATO
NORTH MANKATO, MINNESOTA

HYDROGEOLOGIC CROSS-SECTION B-B'

FILE: g3northman01e - Fig 4 - B-B.MXD DATE: 10/28/2015 FIGURE: 4



- City Well Location
- Calibration Point (Mt. Simon Well)
- Calibration Point (Tunnel City or Wonewoc Well)
- Modification Area
- Local Model Domain



Source: National Geographic Society, i-cubed. Minnesota County Well Index (CWI).



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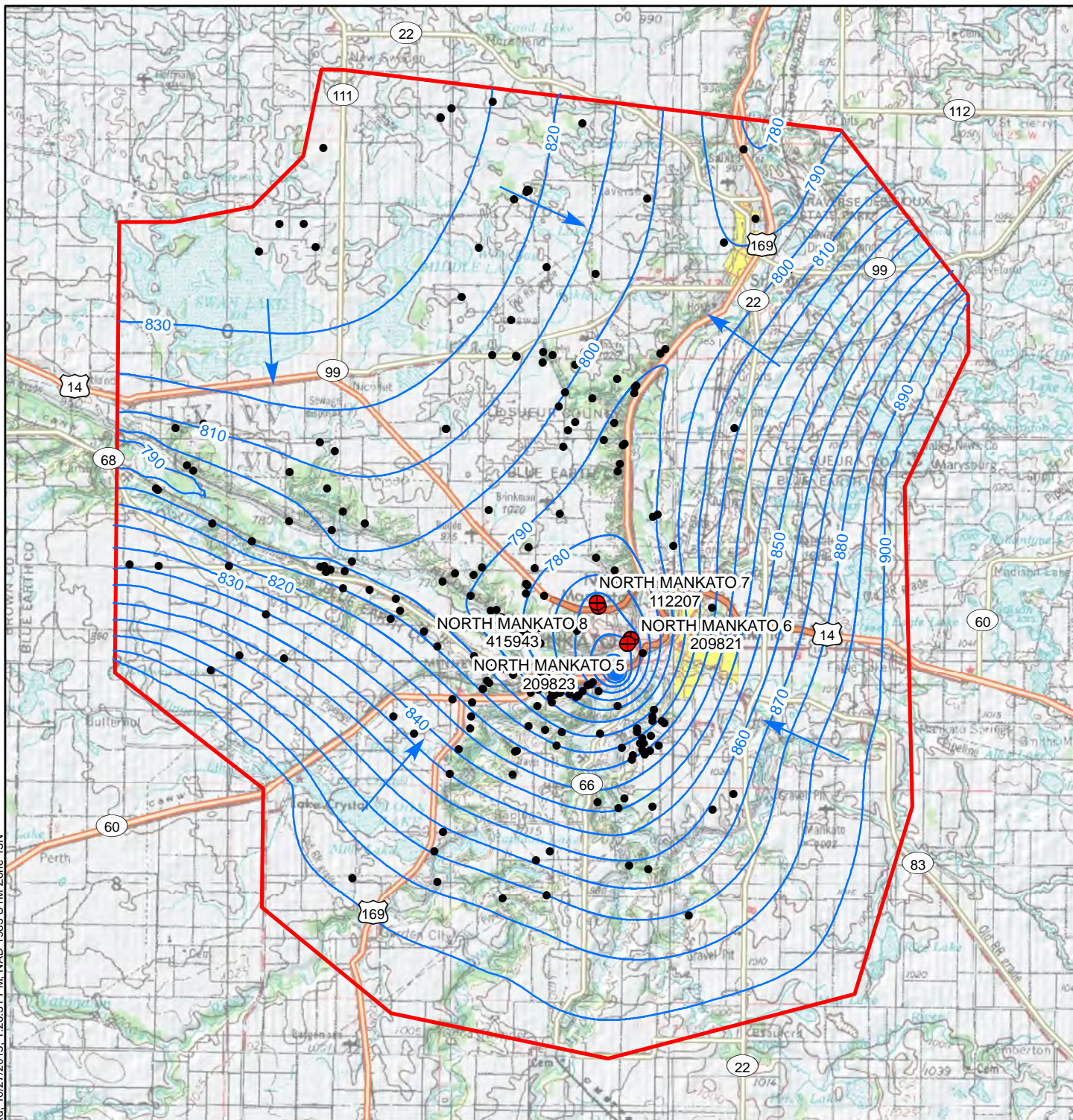
LOCAL MODEL BOUNDARY, CALIBRATION POINTS, AND MODIFICATION AREAS

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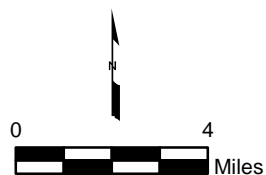
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FIGURE: 5

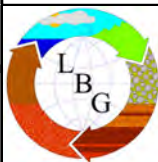
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- City Well Location
- Tunnel City and Wonewoc Aquifer Well Location
- Groundwater Elevation Contour (ft amsl)
- Groundwater Flow Direction
- Local Model Domain



Source: National Geographic Society, i-cubed. Minnesota County Well Index (CWI).



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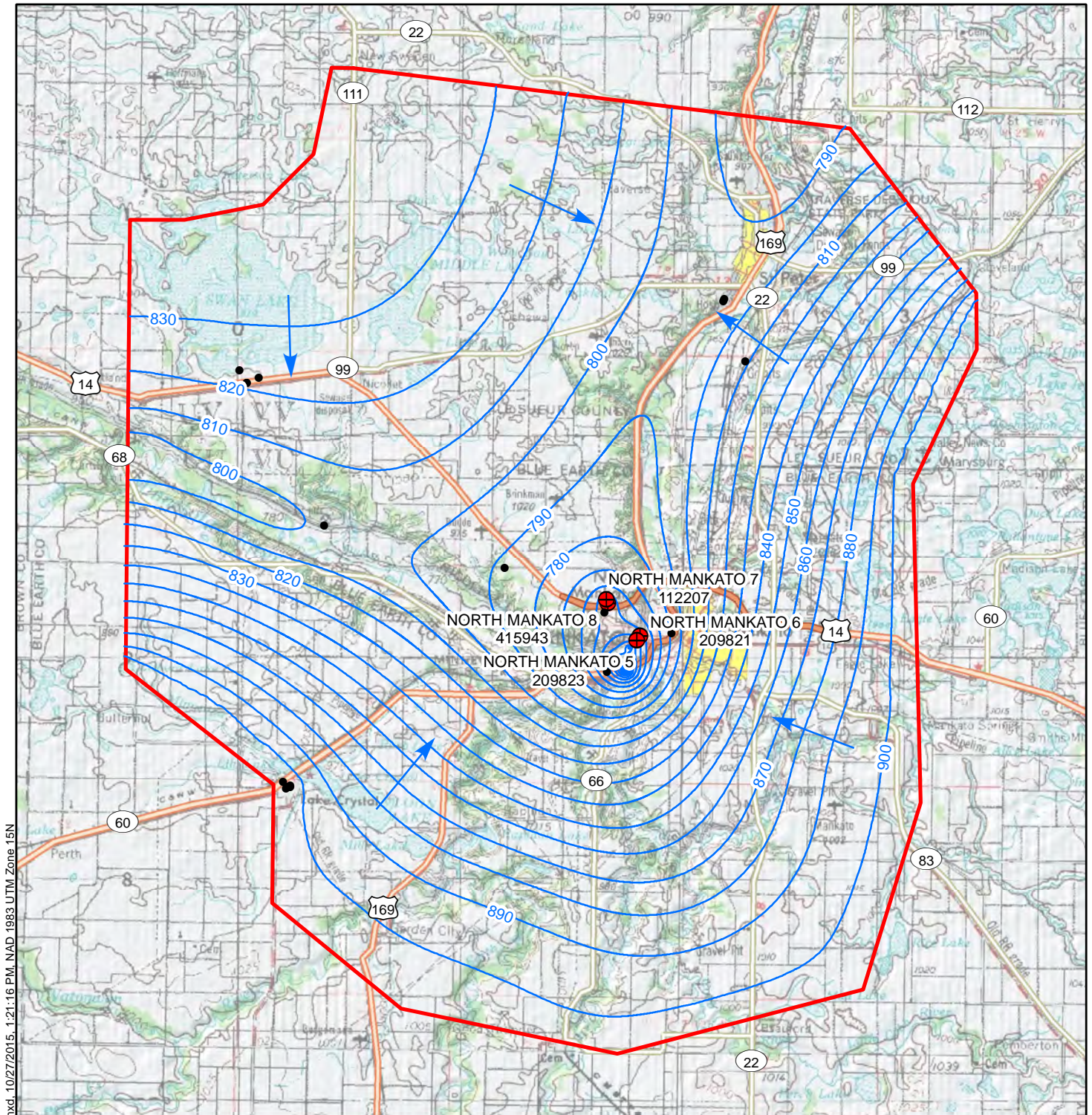
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**SIMULATED EQUIPOTENTIAL CONTOURS TUNNEL CITY
AND WONEWOC AQUIFER**

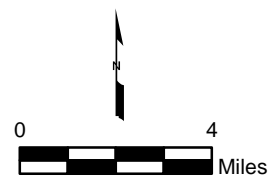
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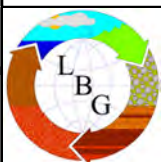
FIGURE: 6



- City Well Location
- Mt. Simon Aquifer Well Location
- Groundwater Elevation Contour (ft amsl)
- Groundwater Flow Direction
- Local Model Domain



Source: National Geographic Society, i-cubed. Minnesota County Well Index (CWI).



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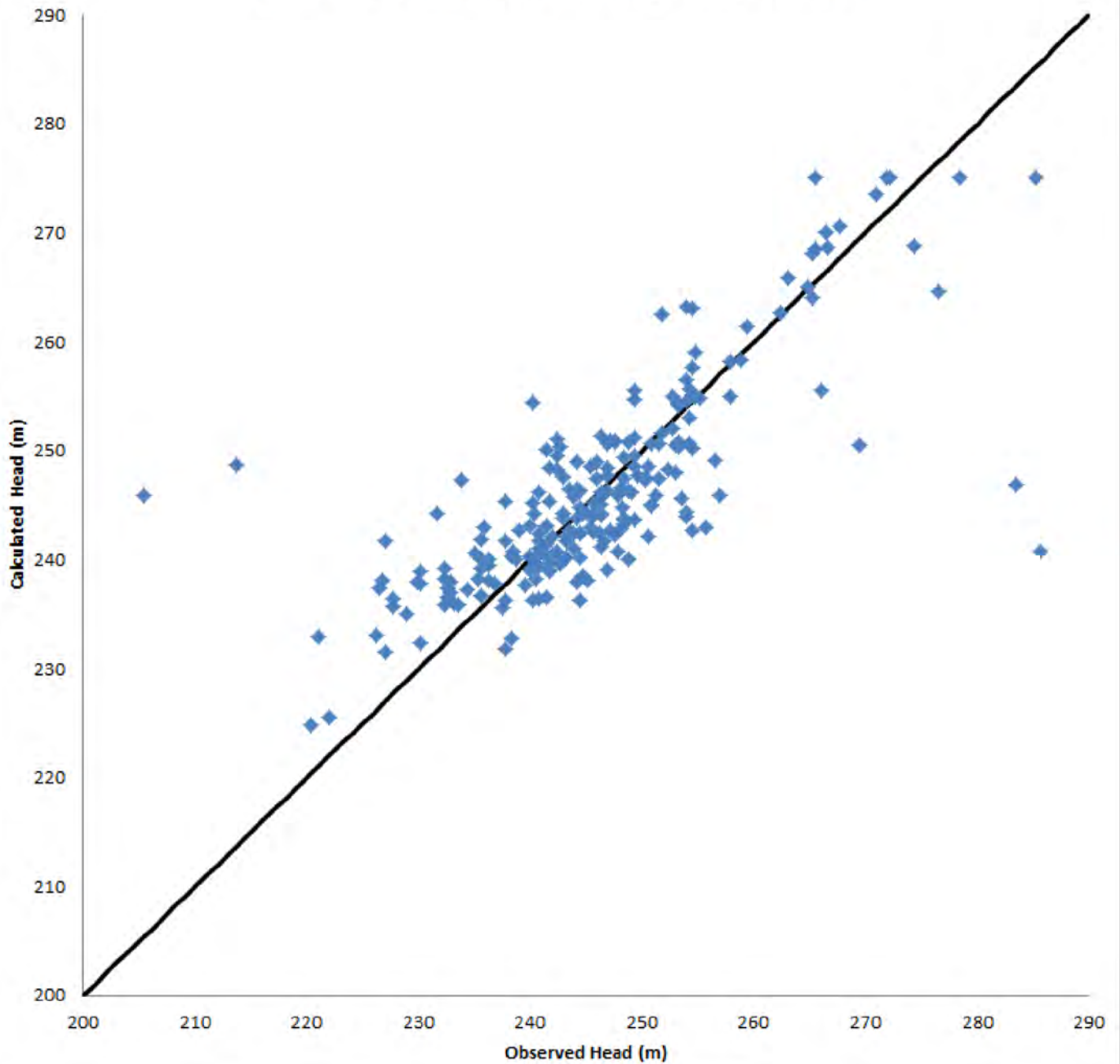
SIMULATED EQUIPOTENTIAL CONTOURS MT. SIMON AQUIFER

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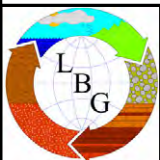
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FIGURE: 7

Computed vs. Observed Values Hydraulic Head in Model Layers 5,6 and 8



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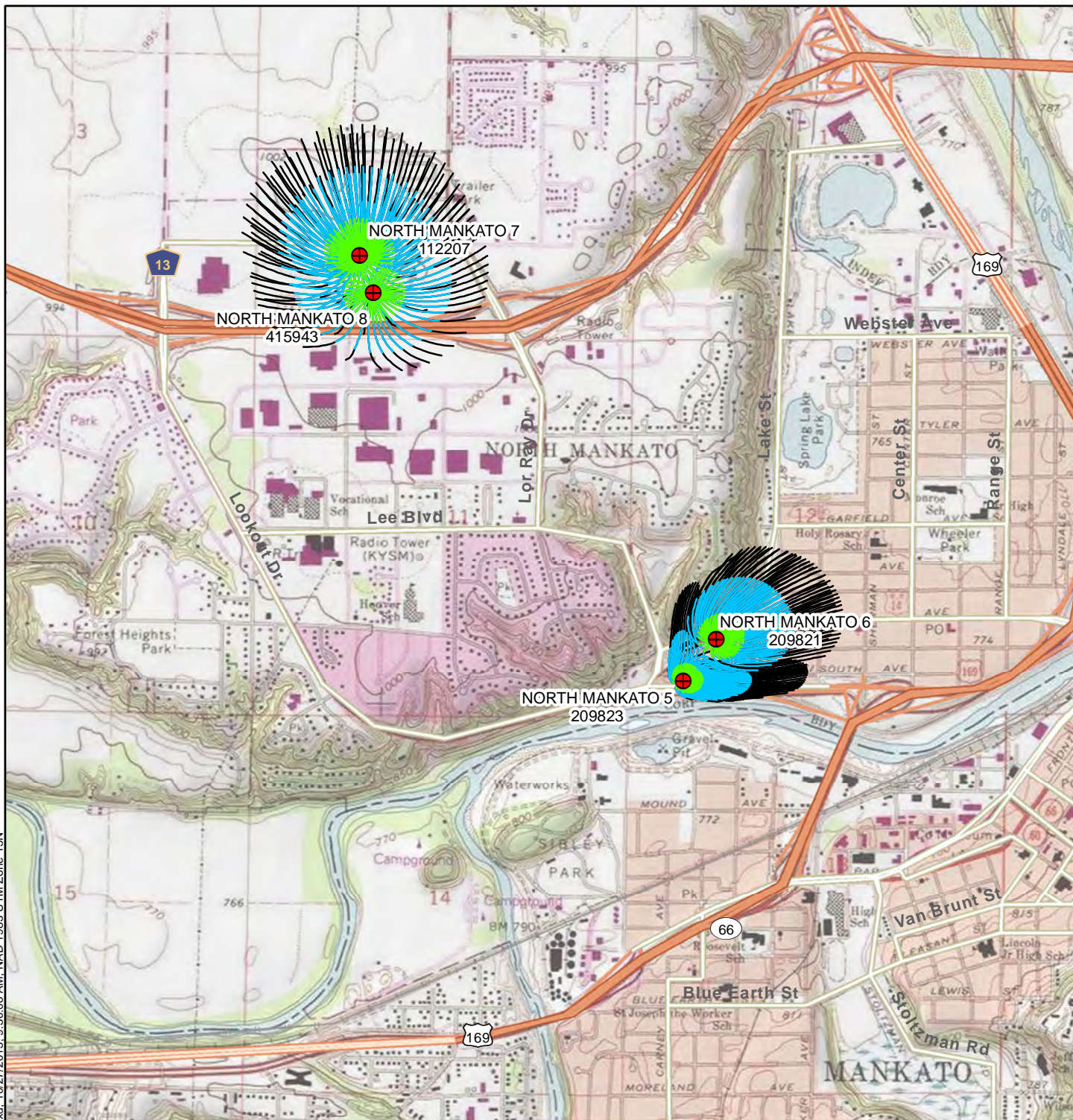


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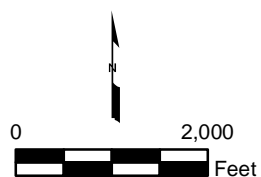
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MODEL CALIBRATION - ALL LAYERS

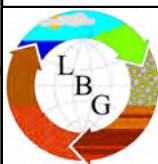
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- City Well Location
- 1-Year Flowpaths (Tunnel City, Wonewoc, and Mt. Simon Aquifer)
- 5-Year Flowpaths (Tunnel City, Wonewoc, and Mt. Simon Aquifer)
- 10-Year Flowpaths (Tunnel City, Wonewoc, and Mt. Simon Aquifer)



Source: National Geographic Society, i-cubed. Minnesota County Well Index (CWI).



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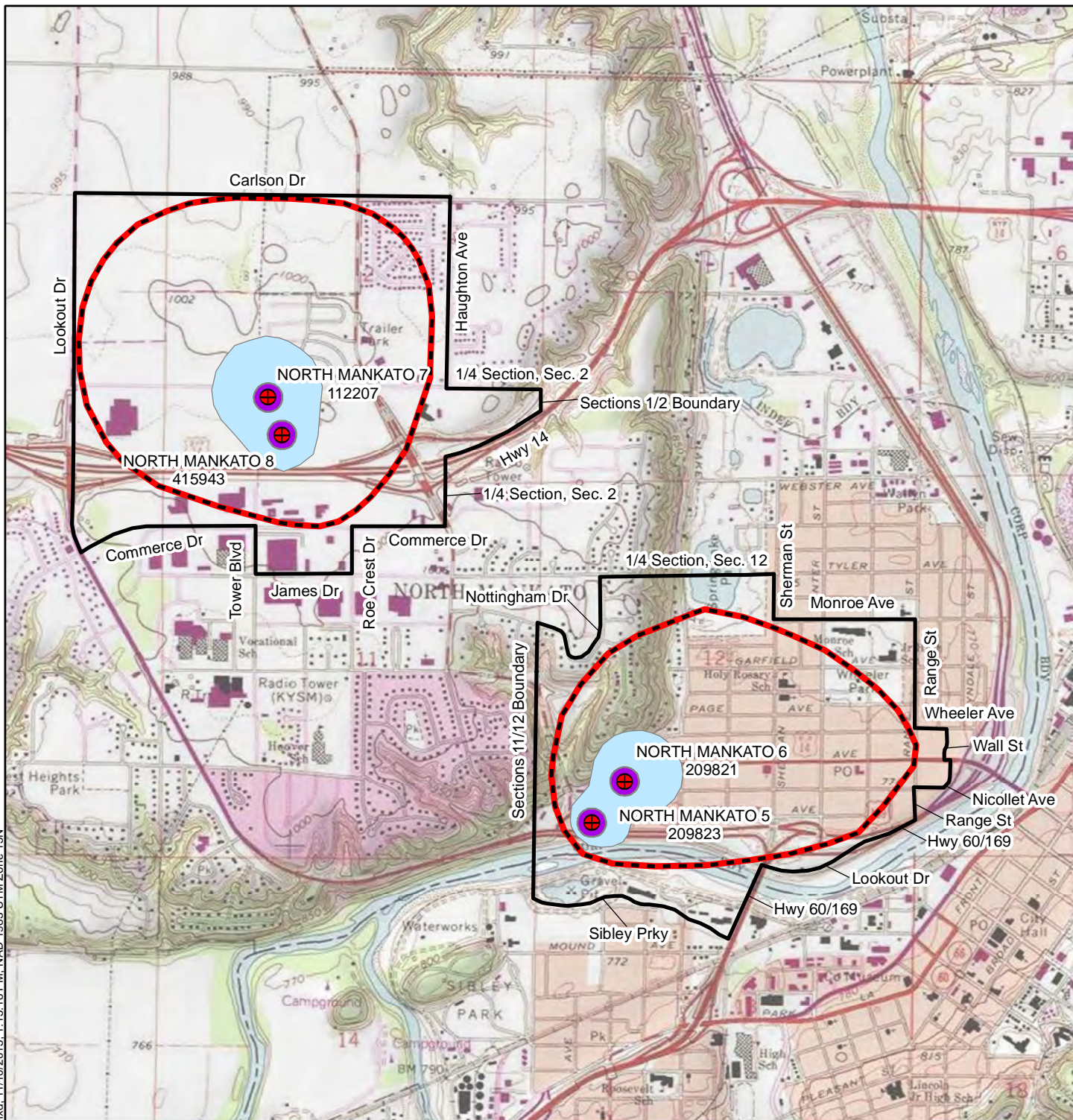
NORTH MANKATO NORTH MANKATO, MINNESOTA







1-, 5-, AND 10-YEAR FLOW PATHS FOR CALIBRATED MODEL

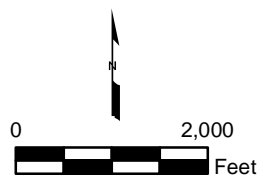
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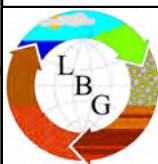
FIGURE: 9



-  City Well Location
-  10-Year Composite Capture Zone (porous flow)
-  Combined Wellhead Protection Area
-  Drinking Water Supply Management Area
-  Emergency Response Area (1-yr time of travel)
-  IWMZ (Inner Wellhead Management Zone)



Source: National Geographic Society, i-cubed. Minnesota County Well Index (CWI).



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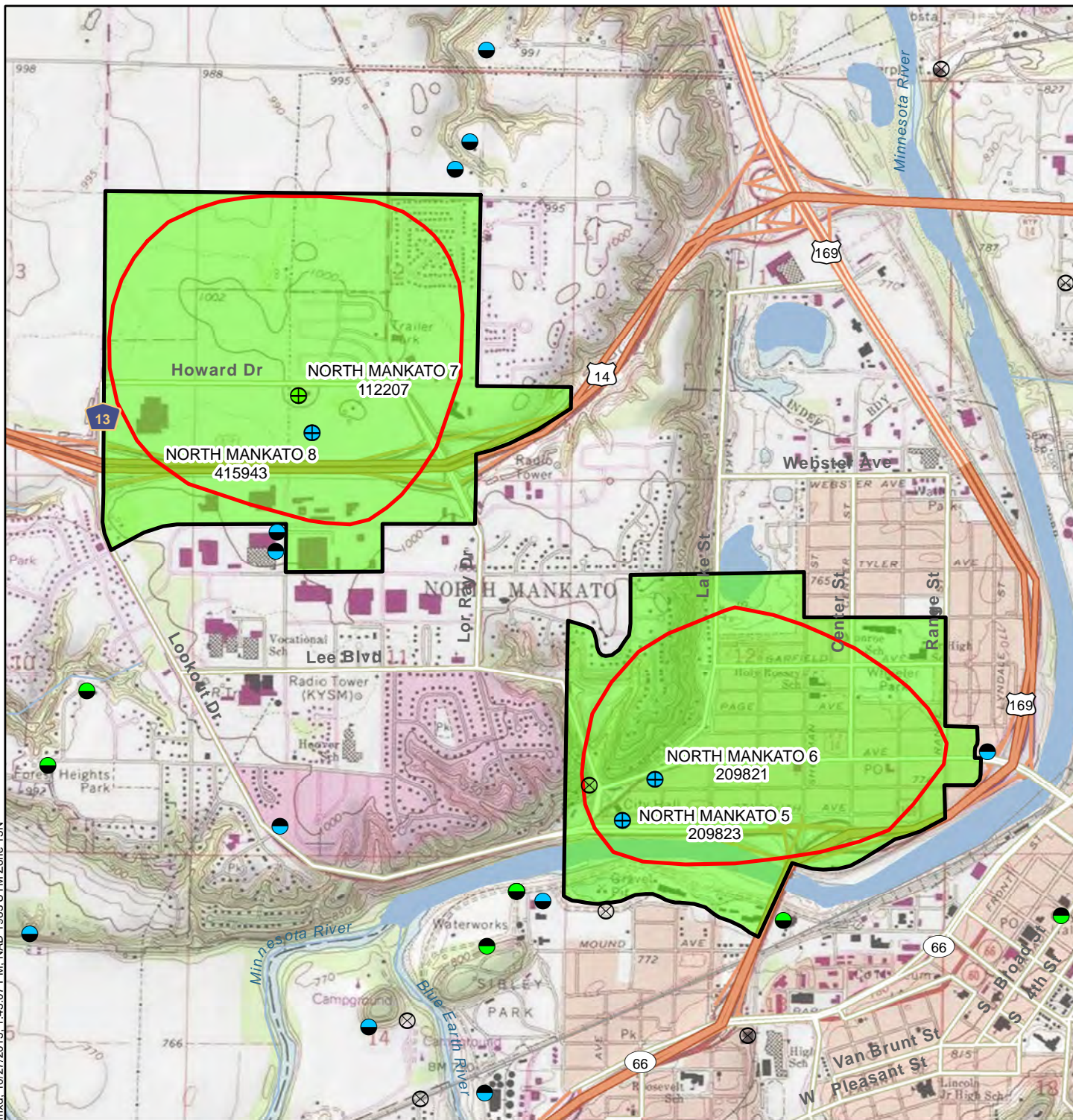
COMBINED WELLHEAD PROTECTION AREA BOUNDARIES AND DRINKING WATER SUPPLY MANAGEMENT AREAS

FILE: g3northman011 - Fig10.MXD

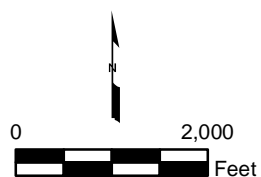
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FIGURE: 10

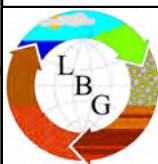
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- ⊕ City Well
 - ⊗ Insufficient Data
 - Domestic Well
 - Combined Wellhead Protection Area
 - Drinking Water Supply Management Area
- Geologic Sensitivity**
- Very High Sensitivity
 - High Sensitivity
 - Moderate Sensitivity
 - Low Sensitivity (L-Score: 1-3)
 - Low Sensitivity (L-Score: 4-7)
 - Very Low Sensitivity (L-Score: 8-11)
 - Very Low Sensitivity (L-Score: >11)



Source: National Geographic Society, i-cubed. Minnesota County Well Index (CWI).



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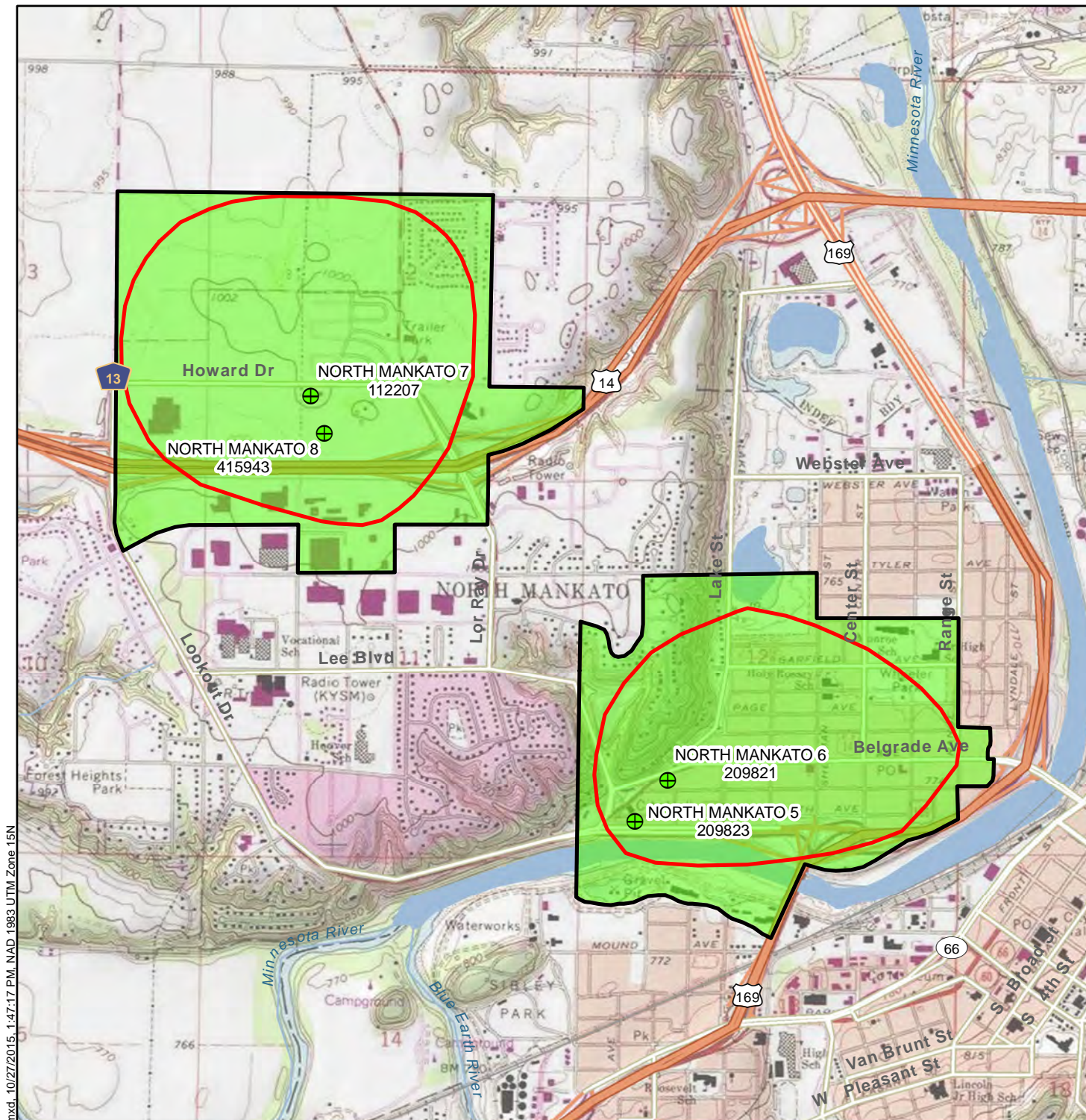
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DRINKING WATER SUPPLY MANAGEMENT AREA
GEOLOGIC SENSITIVITY ASSESSMENT

FILE: g3northman01m - Fig11.MXD

DATE: 10/27/2015

FIGURE: 11

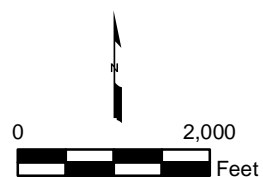


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- ⊕ City Well
- Combined Wellhead Protection Area
- Drinking Water Supply Management Area

DWSMA Vulnerability

- Very High
- High
- Moderate
- Low



Source: National Geographic Society, i-cubed. Minnesota County Well Index (CWI).



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**DRINKING WATER SUPPLY MANAGEMENT AREA
 VULNERABILITY ASSESSMENT**

FILE: g3northman01n - Fig12.MXD

DATE: 10/27/2015

FIGURE: 12

Appendix III

Inventory of Potential Contamination Sources

- 1. Map and Table of Potential Contaminant Sources in North Mankato DWSMAs**
- 2. Inner Well Management Zone Forms for Primary Wells**
- 3. Minnesota Department of Health Public Water Supply Well Inventory**

The Minnesota Department of Health Water Supply Inventory (aka The Old Municipal Well file) exhibit provides information on those public water supply wells the city of North Mankato 1) currently use for primary and emergency sources in flow, 2) public water supply wells that have been removed from flow and 3) unverified wells that provide information about wells whose existence has not yet been confirmed.

These records indicating current and past well the city of North Mankato have owned or used can be useful in locating these old wells and developing a prioritization process to locating and sealing abandoned wells. Only the first four pages of this 89 page report is included in this Appendix. The complete report is on file with the city of North Mankato Public Works, Water Department Superintendent.

- 4. Sealed Wells Within DWSMA**

A map and table of well sealing records determined to have been located within the two DWSMAs.

Note: There are no Sanborn Fire Insurance maps available for the city of North Mankato.

**1. Map and Table of Potential Contaminant Sources in North Mankato
DWSMAs**

City of North Mankato Potential Contaminant Source Inventory

Page 1 of 2



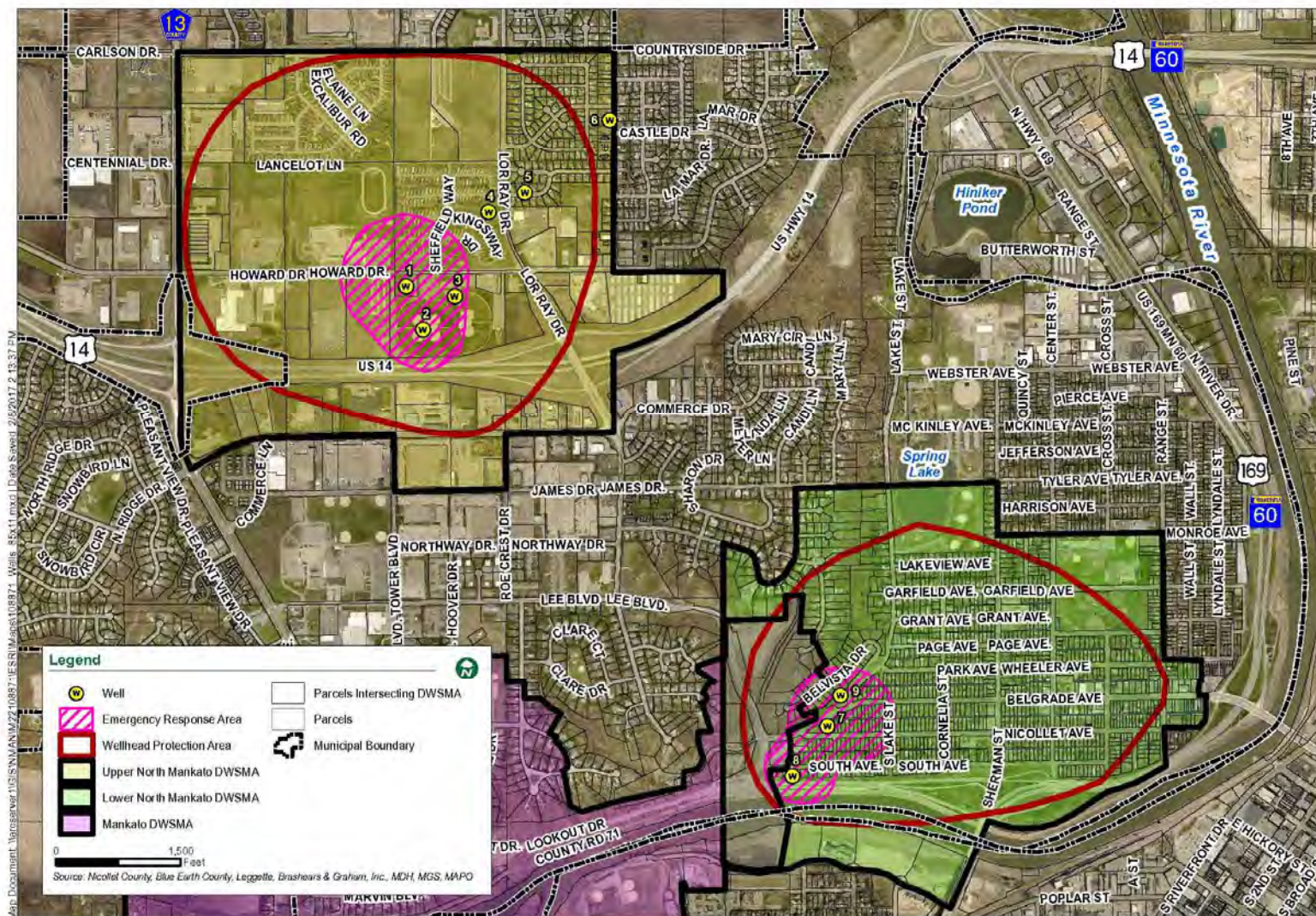
Wellhead Protection Plan
City of North Mankato

PCSI

February 2017



**BOLTON
& MENK**
Real People. Real Solutions.



City of North Mankato Potential Contaminant Source Inventory
Page 2 of 2

PCSI_ID	PIN	FAC_NAME	ADDRESS	CITY	ZIP5_CODE	PCS_C	STATUS	MAT_C	PROGRAM_ID	TOTAL	COMMENT
1	18.490.0030	City of No. Mankato	1001 Belgrade Ave	No. Mankato	56003	WEL	A		112207	1	City Well #7; upper DWSMA
2	18.490.0010	City of No. Mankato	1001 Belgrade Ave	No. Mankato	56003	WEL	A		415943	1	City Well #8; upper DWSMA
3	18.490.0010	City of No. Mankato	1001 Belgrade Ave	No. Mankato	56003	WEL	A		809695	1	City Well #9; upper DWSMA
4	unknown					WEL	U		1000009044	1	MDH - MWI location given as S2,T108N, R27W, upper DWSMA; no other records at state or county.
5	unknown					WEL	U		1000009043	1	MDH - MWI location given as S2,T108N, R27W, upper DWSMA; no other records at state or county.
6	unknown					WEL	U		1000009045	1	MDH - MWI location given as S2,T108N, R27W, upper DWSMA; no other records at state or county.
7	18.012.3430	City of No. Mankato	1001 Belgrade Ave	No. Mankato	56003	WEL	A		209821	1	City Well #6; Lower DWSMA
8	18.644.0260	City of No. Mankato	1001 Belgrade Ave	No. Mankato	56003	WEL	A		209823	1	City Well #5; Lower DWSMA
9	18.661.0450	City of No. Mankato	1001 Belgrade Ave	No. Mankato	56003	WEL	U		0	1	North Mankato's Old Well #1; abandoned; no sealing record; Lower DWSMA

2. Inner Well Management Zone Forms for Primary Wells

INNER WELLHEAD MANAGEMENT ZONE (IWMZ) - POTENTIAL CONTAMINANT SOURCE INVENTORY (PCSI) REPORT

PUBLIC WATER SYSTEM INFORMATION

PWS ID	1520005	COMMUNITY
NAME	North Mankato	
ADDRESS	Water Superintendent, North Mankato City Hall, 1001 Belgrade Avenue, P.O. Box 2055, North Mankato, MN 560022055	

FACILITY (WELL) INFORMATION

NAME	Well #5	IS THERE A WELL LOG OR ADDITIONAL CONSTRUCTION INFORMATION AVAILABLE? <input type="checkbox"/> YES (Please attach a copy) <input type="checkbox"/> NO <input type="checkbox"/> UNDETERMINED
FACILITY ID	S01	
UNIQUE WELL NO.	209823	
COUNTY	Nicollet	

PWS ID / FACILITY ID	1520005 S01	UNIQUE WELL NO.	209823
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PCSI CODE	ACTUAL OR POTENTIAL CONTAMINATION SOURCE	ISOLATION DISTANCES (FEET)				LOCATION	
		Minimum Distances		Sensitive Well¹	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 well² (Class V well - illegal³)	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	50/300/150⁴	50/300/150⁴	100/600/300⁴	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		
*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		

PWS ID / FACILITY ID	1520005 S01	UNIQUE WELL NO.	209823
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PCSI CODE	ACTUAL OR POTENTIAL CONTAMINATION SOURCE	ISOLATION DISTANCES (FEET)				LOCATION	
		Minimum Distances		Sensitive Well¹	Within 200 Ft. Y / N / U	Dist. from Well	Est. (?)
		Community	Non-community				
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		N		
SB2	Sewer, buried, collector, municipal, serving a facility handling infectious or pathological wastes, open-jointed or unapproved materials	50	50		Y	140	N
SB2	Sewer, buried, collector, municipal, serving a facility handling infectious or pathological wastes, open-jointed or unapproved materials	50	50		Y	130	N
SB2	Sewer, buried, collector, municipal, serving a facility handling infectious or pathological wastes, open-jointed or unapproved materials	50	50		Y	110	N
SB2	Sewer, buried, collector, municipal, serving a facility handling infectious or pathological wastes, open-jointed or unapproved materials	50	50		Y	112	N
SB2	Sewer, buried, collector, municipal, serving a facility handling infectious or pathological wastes, open-jointed or unapproved materials	50	50		Y	95	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		
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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		Y	25	N
SD1	Storm water drain pipe, 8 inches or greater in diameter	50	20		Y	107	N
SWI	Storm water drainage well² (Class V well - illegal³)	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		

PWS ID / FACILITY ID	1520005 S01	UNIQUE WELL NO.	209823
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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				
*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		Y	188	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.						
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* 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 / FACILITY ID

1520005 S01

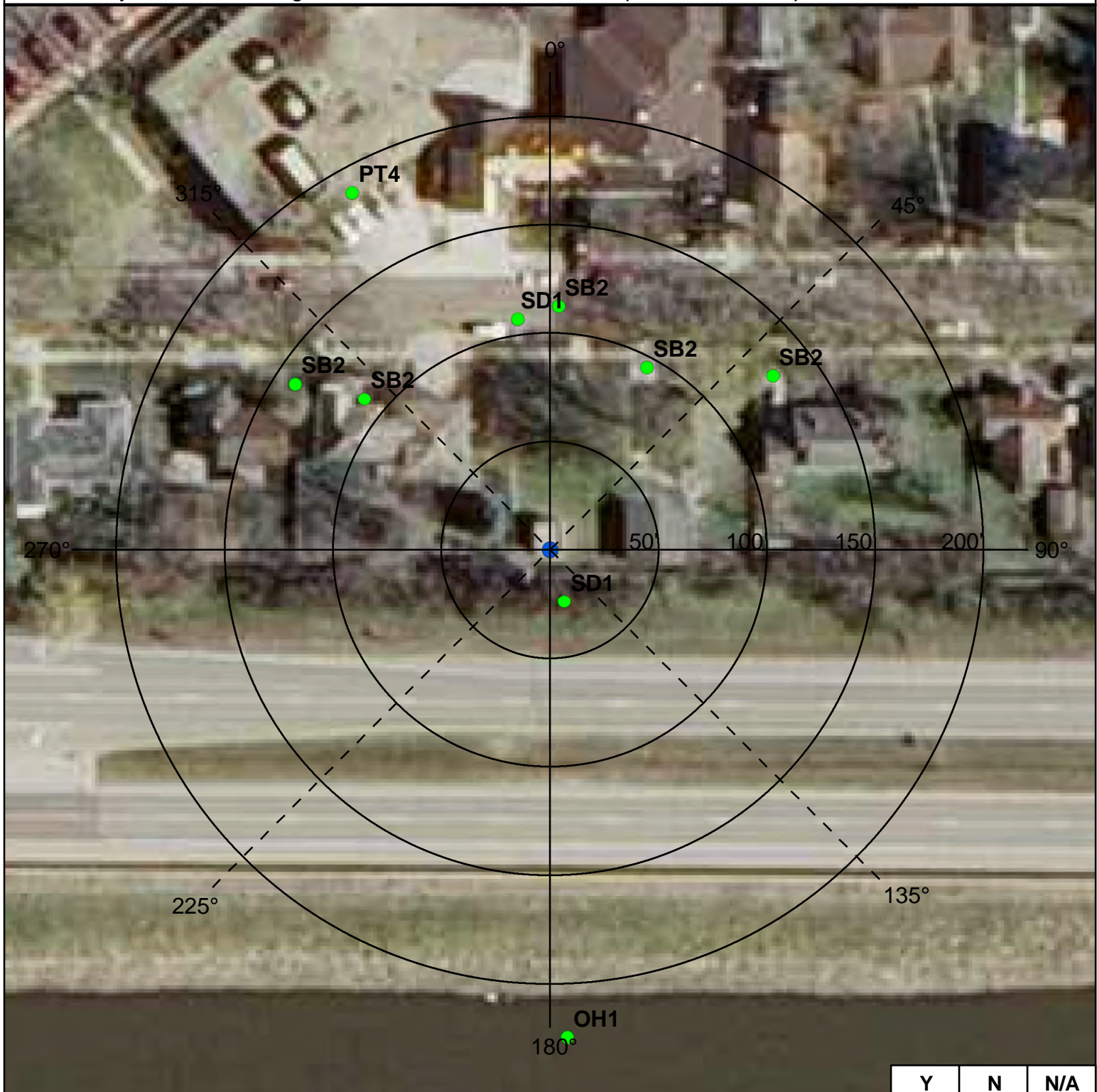
UNIQUE WELL NO.

209823

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?

Is the system monitoring existing nonconforming sources of contamination?

Reminder Question: Were the wellhead protection measure(s) implemented?

INSPECTOR

Voz, Karen (SWP)

DATE

8 - 25 - 2016

PWS ID / FACILITY ID	1520005 S01	UNIQUE WELL NO.	209823
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RECOMMENDED WELLHEAD PROTECTION (WHP) MEASURES	WHP MEASURE IMPLEMENTED? Y or N	DATE VERIFIED
Secondary containment, such as earthen or concrete barriers, should be provided for above ground storage tanks to contain spills or leaks.		
The stormwater pipe should be managed to insure optimal performance. Information on stormwater management can be found on the Minnesota Pollution Control Agency website.		

COMMENTS

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

INNER WELLHEAD MANAGEMENT ZONE (IWMZ) - POTENTIAL CONTAMINANT SOURCE INVENTORY (PCSI) REPORT

PUBLIC WATER SYSTEM INFORMATION

PWS ID	1520005	COMMUNITY
NAME	North Mankato	
ADDRESS	Water Superintendent, North Mankato City Hall, 1001 Belgrade Avenue, P.O. Box 2055, North Mankato, MN 560022055	

FACILITY (WELL) INFORMATION

NAME	Well #6	IS THERE A WELL LOG OR ADDITIONAL CONSTRUCTION INFORMATION AVAILABLE? <input type="checkbox"/> YES (Please attach a copy) <input type="checkbox"/> NO <input type="checkbox"/> UNDETERMINED
FACILITY ID	S02	
UNIQUE WELL NO.	209821	
COUNTY	Nicollet	

PWS ID / FACILITY ID	1520005 S02	UNIQUE WELL NO.	209821
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PCSI CODE	ACTUAL OR POTENTIAL CONTAMINATION SOURCE	ISOLATION DISTANCES (FEET)			LOCATION	
		Minimum Distances		Sensitive Well¹	Within 200 Ft. Y / N / U	Dist. from Well
		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 well² (Class V well - illegal³)	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	50/300/150⁴	50/300/150⁴	100/600/300⁴	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	
*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	

PWS ID / FACILITY ID	1520005 S02	UNIQUE WELL NO.	209821
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PCSI CODE	ACTUAL OR POTENTIAL CONTAMINATION SOURCE	ISOLATION DISTANCES (FEET)				LOCATION	
		Minimum Distances		Sensitive Well¹	Within 200 Ft. Y / N / U	Dist. from Well	Est. (?)
		Community	Non-community				
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	59	N
SB2	Sewer, buried, collector, municipal, serving a facility handling infectious or pathological wastes, open-jointed or unapproved materials	50	50		Y	122	N
SB2	Sewer, buried, collector, municipal, serving a facility handling infectious or pathological wastes, open-jointed or unapproved materials	50	50		Y	130	N
*WB1	Water treatment backwash holding basin, reclaim basin, or surge tank with a direct sewer connection	50	50		Y	47	N
*WB1	Water treatment backwash holding basin, reclaim basin, or surge tank with a direct sewer connection	50	50		Y	47	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		Y	132	N
SD1	Storm water drain pipe, 8 inches or greater in diameter	50	20		Y	73	N
SWI	Storm water drainage well² (Class V well - illegal³)	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		
*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	illegal³	illegal³		N		

PCSI CODE	ACTUAL OR POTENTIAL CONTAMINATION SOURCE	ISOLATION DISTANCES (FEET)				LOCATION	
		Minimum Distances		Sensitive Well¹	Within 200 Ft. Y / N / U	Dist. from Well	Est. (?)
		Community	Non-community				
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		

[illegible]

	none found within 200' of this well.						
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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.

3

PWS ID / FACILITY ID

1520005 S02

UNIQUE WELL NO.

209821

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?

Is the system monitoring existing nonconforming sources of contamination?

Reminder Question: Were the wellhead protection measure(s) implemented?

INSPECTOR

Voz, Karen (SWP)

DATE

8 - 25 - 2016

PWS ID / FACILITY ID	1520005 S02	UNIQUE WELL NO.	209821
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RECOMMENDED WELLHEAD PROTECTION (WHP) MEASURES	WHP MEASURE IMPLEMENTED? Y or N	DATE VERIFIED
The stormwater pipe should be managed to insure optimal performance. Information on stormwater management can be found on the Minnesota Pollution Control Agency website.		

COMMENTS
<div></div>

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

INNER WELLHEAD MANAGEMENT ZONE (IWMZ) -
POTENTIAL CONTAMINANT SOURCE INVENTORY (PCSI) REPORT

PUBLIC WATER SYSTEM INFORMATION

PWS ID	1520005	COMMUNITY
NAME	North Mankato	
ADDRESS	Water Superintendent, North Mankato City Hall, 1001 Belgrade Avenue, P.O. Box 2055, North Mankato, MN 560022055	

FACILITY (WELL) INFORMATION

NAME	Well #7	IS THERE A WELL LOG OR ADDITIONAL CONSTRUCTION INFORMATION AVAILABLE?
FACILITY ID	S03	<input type="checkbox"/> YES (Please attach a copy)
UNIQUE WELL NO.	112207	<input type="checkbox"/> NO <input type="checkbox"/> UNDETERMINED
COUNTY	Nicollet	

PWS ID / FACILITY ID	1520005 S03	UNIQUE WELL NO.	112207
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PCSI CODE	ACTUAL OR POTENTIAL CONTAMINATION SOURCE	ISOLATION DISTANCES (FEET)				LOCATION	
		Minimum Distances		Sensitive Well¹	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 well² (Class V well - illegal³)	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	50/300/150⁴	50/300/150⁴	100/600/300⁴	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		
*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		

PWS ID / FACILITY ID	1520005 S03	UNIQUE WELL NO.	112207
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PCSI CODE	ACTUAL OR POTENTIAL CONTAMINATION SOURCE	ISOLATION DISTANCES (FEET)				LOCATION	
		Minimum Distances		Sensitive Well¹	Within 200 Ft. Y / N / U	Dist. from Well	Est. (?)
		Community	Non-community				
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		N		
SB2	Sewer, buried, collector, municipal, serving a facility handling infectious or pathological wastes, open-jointed or unapproved materials	50	50		Y	200	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		Y	175	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		Y	135	N
SD1	Storm water drain pipe, 8 inches or greater in diameter	50	20		Y	120	N
SWI	Storm water drainage well² (Class V well - illegal³)	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		
*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	illegal³	illegal³		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		

PWS ID / FACILITY ID

1520005 S03

UNIQUE WELL NO.

112207

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
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Were the isolation distances maintained for the new sources of contamination?			
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Is the system monitoring existing nonconforming sources of contamination?			
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Reminder Question: Were the wellhead protection measure(s) implemented?			
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INSPECTOR

Voz, Karen (SWP)

DATE

8 - 25 - 2016

PWS ID / FACILITY ID	1520005 S03	UNIQUE WELL NO.	112207
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RECOMMENDED WELLHEAD PROTECTION (WHP) MEASURES	WHP MEASURE IMPLEMENTED? Y or N	DATE VERIFIED

COMMENTS
<div></div>

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

INNER WELLHEAD MANAGEMENT ZONE (IWMZ) -
POTENTIAL CONTAMINANT SOURCE INVENTORY (PCSI) REPORT

PUBLIC WATER SYSTEM INFORMATION

PWS ID	1520005	COMMUNITY
NAME	North Mankato	
ADDRESS	Water Superintendent, North Mankato City Hall, 1001 Belgrade Avenue, P.O. Box 2055, North Mankato, MN 560022055	

FACILITY (WELL) INFORMATION

NAME	Well #8	IS THERE A WELL LOG OR ADDITIONAL CONSTRUCTION INFORMATION AVAILABLE?
FACILITY ID	S04	<input type="checkbox"/> YES (Please attach a copy)
UNIQUE WELL NO.	415943	<input type="checkbox"/> NO <input type="checkbox"/> UNDETERMINED
COUNTY	Nicollet	

PWS ID / FACILITY ID	1520005 S04	UNIQUE WELL NO.	415943
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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		
*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		

PWS ID / FACILITY ID	1520005 S04	UNIQUE WELL NO.	415943
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PCSI CODE	ACTUAL OR POTENTIAL CONTAMINATION SOURCE	ISOLATION DISTANCES (FEET)				LOCATION	
		Minimum Distances		Sensitive Well¹	Within 200 Ft. Y / N / U	Dist. from Well	Est. (?)
		Community	Non-community				
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		N		
SB2	Sewer, buried, collector, municipal, serving a facility handling infectious or pathological wastes, open-jointed or unapproved materials	50	50		Y	78	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		Y	30	N
SD1	Storm water drain pipe, 8 inches or greater in diameter	50	20		Y	49	N
SWI	Storm water drainage well² (Class V well - illegal³)	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		
*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	illegal³	illegal³		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		

PWS ID / FACILITY ID

1520005 S04

UNIQUE WELL NO.

415943

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?

Is the system monitoring existing nonconforming sources of contamination?

Reminder Question: Were the wellhead protection measure(s) implemented?

INSPECTOR

Voz, Karen (SWP)

DATE

8 - 25 - 2016

PWS ID / FACILITY ID	1520005 S04	UNIQUE WELL NO.	415943
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RECOMMENDED WELLHEAD PROTECTION (WHP) MEASURES	WHP MEASURE IMPLEMENTED? Y or N	DATE VERIFIED
The stormwater pond should be managed to insure optimal performance. Information on stormwater management can be found on the Minnesota Pollution Control Agency website.		

COMMENTS
<div></div>

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

3. Minnesota Department of Health Public Water Supply Well Inventory



Minnesota Department of Health

Environmental Health in Minnesota

MDH Public Water Supply Sources Report

PWSID: **1520005**

PWS Name: **North Mankato**

PWS Type: **Community**

PWS Status: **Active**

Public Water Supply Sources: Information from MNDWIS and CWI (sorted by Sample Point ID)

Source Type Codes: **GW** = Ground water; **SW** = Surface water; **GUI** = Ground water under influence

Location Source: **MGS** = digitized by the MN Geological Survey; * indicates incomplete records

O* = duplicate in Unverified Well Data; **R*** = duplicate in MNDWIS PWS Sources Removed from Flow; **S*** = duplicate in MNDWIS PWS Sources in Flow;

MNDWIS PWS SOURCES IN FLOW														
Source Info							MNDWIS Data				CWI Data			
Sample Point ID	Name	Type	Availability	Status	Well No. (link to Well Log(s))	Location Info (link to Map)	Drill Year	Depth (in feet)	Case Depth (in feet)	Case Diam. (in inches)	Drill Date	Depth Completed (in feet)	Case Depth (in feet)	Case Diam. (in inches)
S01	Well #5	GW	Emergency	Active	209823 O*	03/16/1993 (M. Sweers)	1958	680	285	12	05-00-1958	687.00	285.00	12.00
S02	Well #6	GW	Primary	Active	209821 O*	03/16/1993 (M. Sweers)	1959	687	275	20	02-00-1959	681.00	265.00	20.00
S03	Well #7	GW	Primary	Active	112207 O*	02/07/2001 (B. Bloomgren)	1975	860	416	20	07-21-1975	860.00	416.00	20.00
S04	Well #8	GW	Primary	Active	415943 O*	03/16/1993 (M. Sweers)	1986	845	614	18	02-17-1986	845.00	614.10	18.00

MNDWIS and CWI data value discrepancies in preceding tables are shown in **RED** (0 or null values excepted).

Unverified Wells

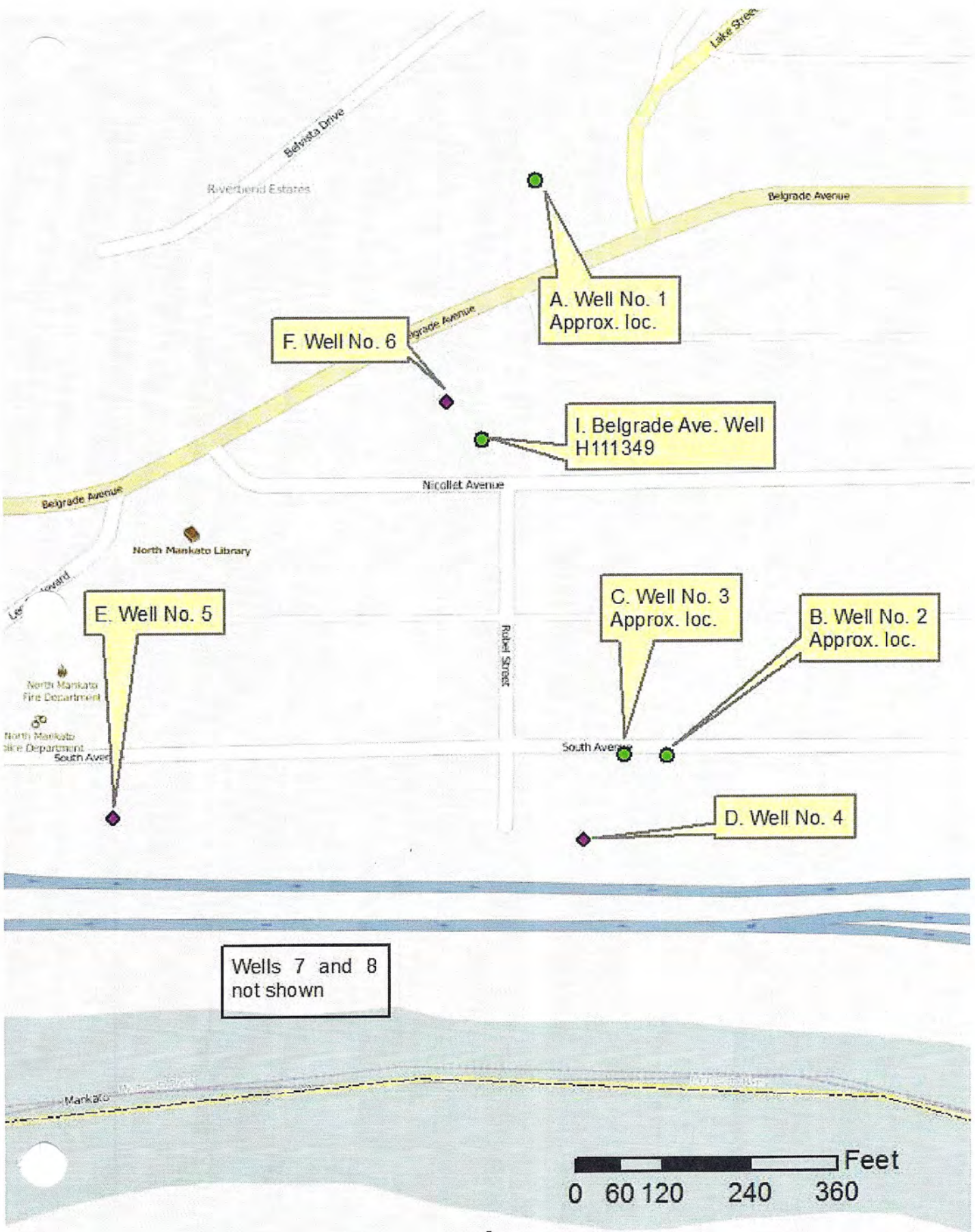
The following tables show information on wells whose existence (or previous existence) has not yet been confirmed.

UNVERIFIED Well Data													
Well Search Reference	Name(s)	Unique Well Number	Drilled Depth (ft.)	Completed Depth (ft.)	Depth Cased (ft.)	Casing Diameter (in.)	Year Constructed	Construction Type	Year Out of Service	Sealing Record?	Year Sealed	Location Info	Comments
A	Well No. 1		350.0	350.0		10.0	Before 1926	Cable Tool/Bored	1947			Near old pump station on W side of city. W of Lake St. on N side of Belgrave Ave.	Ref.: 1926 MDH San. Rpt. Orig. 325' deep. What was in "old pump stn."? Might have been prior well prior or water supply from river. 1942: 350' deep.
B	Well No. 2	H46953	60.0	60.0		6.0	Before 1926	Cable Tool/Bored	1953	Y	1994	Near Minnesota R.	Ref.: 1926 MDH San. Rpt. H46953.

UNVERIFIED Well Data													
Well Search Reference	Name(s)	Unique Well Number	Drilled Depth (ft.)	Completed Depth (ft.)	Depth Cased (ft.)	Casing Diameter (in.)	Year Constructed	Construction Type	Year Out of Service	Sealing Record?	Year Sealed	Location Info	Comments
C	Well No. 3	<u>H46954</u>	60.0	60.0		6.0	Before 1926	Cable Tool/Bored	1953	Y	1994	Near Minnesota R.	Ref.: 1926 MDH San. Rpt. H46954.
D	Well No. 4; H46955	<u>209824</u>	68.0	68.0	46.0	12.0	1936	Cable Tool/Bored		Y	1994	At South Ave. on Lots 9 & 10 of Henry Roberts Addn.	Ref.: 1942 MDH San. Rpt. 16' scrn. Orig. depth was 55', w/12" csg. to 39'. H46955.
E	Well No. 5	<u>209823 S*</u>	680.0	680.0	285.0	12.0	Before 1948	Cable Tool/Bored				At South Ave. on Lot 40 of Menton's Addn.	Ref.: 1948 MDH San. Rpt. 16" x 12". Orig. drld. by K.M. Brown Co. 1948 to 78', w/20" csg. 1958-Well deepened to 680'.
F	Well No. 6	<u>209821 S*</u>	687.0	687.0	275.0	20.0	1959	Cable Tool/Bored					Ref.: 1960 MDH San. Rpt. 24" x 20" well. MGS City Well File note: orig. drilled by McCarthy Well Co. in 1958, depth 680', w/16" csg. to 95' & 12" liner to 285'. Same well?
G	Well No. 7	<u>112207 S*</u>	865.0	865.0	290.0	20.0	1976	Cable Tool/Bored					Ref.: 1978 MDH San. Rpt.
H	Well No. 8	<u>415943 S*</u>	845.0	845.0	614.0	18.0	1986	Cable Tool/Bored					Ref.: 1987 MDH San. Rpt.
I	Belgrade Ave. Well	<u>H111349</u>	210.0	210.0	120.0	4.0	1975			Y	1997	"Well Location: 1001 Belgrade Blvd." Same as city offices? See map drawn on sealing record.	Ref.: MDH WELLS database. H111349. Former residential well or test well?
Databases Searched					Remarks								
County Well Index (1-mile radius); MDH DWP Microfiche; MDH 1988-2002 Muni Well Inventory; Lakesnwoods.com; Biennial Report of					This Unverified Municipal Well Inventory is as complete and thorough as possible, given available documentation. However, MDH Planners and Hydros, as well as City representatives should feel free to add or subtract from this report as necessary. NORTH								

UNVERIFIED Well Data													
Well Search Reference	Name(s)	Unique Well Number	Drilled Depth (ft.)	Completed Depth (ft.)	Depth Cased (ft.)	Casing Diameter (in.)	Year Constructed	Construction Type	Year Out of Service	Sealing Record?	Year Sealed	Location Info	Comments
													<p>the MN State Dairy and Food Commissioner-1907; Minnesota Geological Survey City Well File Folders; MGS Bulletin (22, 27, 31, or 32); MNBrew.com (breweries); MDH DWP MNDWIS; Past and Present MN Railroad Stations; Sanborn Fire Insurance Maps; MDH WELLS</p> <p>MANKATO, in Belgrade Township, is a city on the Minnesota River, opposite to the city of Mankato, Blue Earth County. It was originally platted in 1857 with two ferry landings connecting to Mankato; a bridge between the communities was built in 1898. It was incorporated as a village and separated from the township in 1898. Sanborn historical maps for 1900, 1908, 1914, 1924, & 1948 were reviewed for municipal and private wells. A well was shown at the Mankato Brick & Tile Co. on the 1924 Sanborn. A creamery is shown in the 1948 Sanborn map, on Belgrade Ave. at Ball or B Street. No mention of a railroad depot was reported. The 1944 MGS Bulletin 31 mentions a 1928 water analysis from a "400-foot deep" city well; A on this list. Depth of this 350 ft. well was likely rounded up to 400 ft. A map from MGS City Well file shows locations of Wells 1 through 6. Well sealing records were found for Wells No. 2, 3, & 4, but not for Well No. 1. Also, which well does sealing record H111349 match? It was 4-inch diameter and 210 ft. deep. Was it a city well, test well, or residential?</p>
Unverified Well Data Compiled By: Geoffery Nash Compiled Date: 1/21/2014 8:25:33 AM													

Source: MN Dep't. of Health - 1/21/2014



4. Sealed Wells in the City of North Mankato DWSMAs

Sealed Wells in the City of North Mankato DWSMAs



Wellhead Protection Plan
City of North Mankato

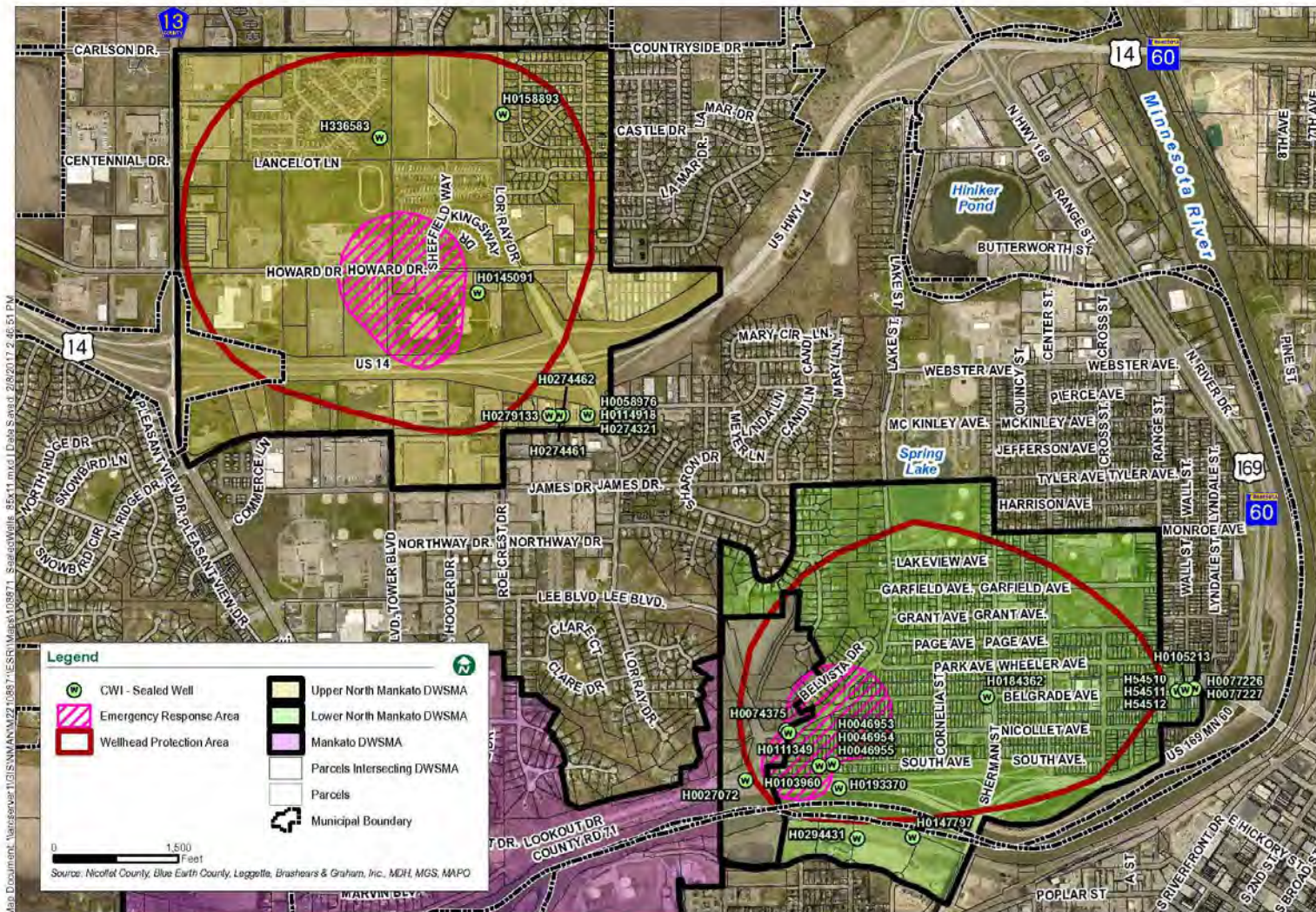
PCSI

February 2017



BOLTON & MENK

Real People. Real Solutions.



**Sealed wells that have been determined to be located within the two DWSMAs.
Well sealing data is provided by the MDH.**

UNIQUE	SEAL_ID	NAME	SEAL_DEP	NOTES	DWSMA_LOC
532326	H54511	Coastal Mart, Inc.	15	MW	Lower DWSMA
532327	H54510	Coastal Mart, Inc.	15	MW	Lower DWSMA
532328	H54512	Coastal Mart, Inc.	15	MW	Lower DWSMA
	H0027072	Olinger, Dave	70		Lower DWSMA
	H0046953	North Mankato, City Of	50	MUNICIPAL WELL #2	Lower DWSMA
	H0046954	North Mankato, City Of	50	MUNICIPAL WELL #3	Lower DWSMA
209824	H0046955	North Mankato, City Of	71	MUNICIPAL WELL #4	Lower DWSMA
	H0058976	Budget Oil Company	20	6 EBH: GEOPROBES 200-1 THRU 200-6	Upper DWSMA
	H0074375	Adams, Beulah	400	DOMESTIC	Lower DWSMA
	H0077226	North Mankato, City Of	578	Old Marigold site, near 169 & Belgrade	Lower DWSMA
	H0077227	North Mankato, City Of	310	Old Marigold site, near 169 & Belgrade	Lower DWSMA
	H0114918	Budget Oil Company	9	GEOPROBE	Upper DWSMA
	H0111349	North Mankato, City Of	210	EMERGENCY WS LOCATED BY CITY HALL	Lower DWSMA
	H0105213	Budget Oil Company	12	6 EBH: GEOPROBES 608-1 THRU 608-6 @ 12'	Lower DWSMA
	H0103960	Marti, Myrtle	59	WS	Lower DWSMA
	H0147797	North Star Concrete	20	TEMP WELL AT NE CORNER OF POPLAR AND MOUND	Lower DWSMA
	H0145091	North Mankato, City Of	237	SOUTH OF HOWARD DRIVE.	Upper DWSMA
	H0158893	Tauer, Dale	285		Upper DWSMA
	H0184362	Pluto, Barb	16		Lower DWSMA
	H0193370	Lund, A. F.	246		Lower DWSMA
	H0274462	Northwest Investments Of Lacrosse	21	TEMP MW	Upper DWSMA
	H0274461	Northwest Investments Of Lacrosse	21	TEMP MW	Upper DWSMA
	H0274321	Oasis Market	36	TEMP GEOPROBE	Upper DWSMA
	H0279133	Haugem, Pamela	32	TEMP MW	Upper DWSMA
	H0294431	I And S Group	10	2 TEMP MWS	Lower DWSMA
	H336583	Camelot Park	216	Old Drummer farm site, NW of Camelot Park	Upper DWSMA

Appendix IV

Supporting Documents

- 1. From North Mankato Code: Chapter 52 – Water Service**
- 2. DNR Water Supply Plan Approval Letter**

CHAPTER 52: WATER SERVICE

Section

- [52.01](#) Connection with city water system
- [52.02](#) Deficiency of water and shutting off water
- [52.03](#) Repair of service line
- [52.04](#) Abandoned services penalties
- [52.05](#) Water service lines
- [52.06](#) Private water supplies
- [52.07](#) Water meters
- [52.08](#) Restricted hours for sprinkling
- [52.09](#) Private fire hose connections
- [52.10](#) Opening hydrants
- [52.11](#) Obstructing and screening of fire hydrants
- [52.12](#) Single service and multiple units metered separately for water

§ 52.01 CONNECTION WITH CITY WATER SYSTEM.

(A) *Mandatory connection with water main.*

(1) *General rule.* The owner of a building constructed for human occupancy abutting on or adjacent to any street or other right-of-way in which a water main is located shall be required, at the owner's expense, to immediately install a suitable service connection to such water main in accordance with the provisions of this chapter once the water main becomes operational. Upon connection to the municipal system, the property owner shall abandon and seal all wells pursuant to applicable rules.

(2) *Annexed lands.* In the case where such a building has been annexed into the city, then the owner shall be required to make such a service connection within 1 year after the date of annexation or within 90 days of the date the water main becomes operational, whichever is later. However, if such owner's private water supply requires repairs or other maintenance to meet state codes and standards which exceeds \$1500, then such owner shall immediately connect with the city water system. Furthermore, a building constructed after the date of annexation shall not be subject to the above time limitations and the owner shall be required to immediately connect to such water main.

(3) *Unsafe private water system.* If a building, annexed or otherwise, is serviced by a private water supply which, upon inspection, reveals that the water is unsafe for human consumption, then the owner of such building shall immediately connect with the city water system.

(B) *Failure to connect.* If water service connections are not made pursuant to this section, an official 30 day notice shall be served upon the property owner instructing that such connections are to be made in accordance with this chapter. If the owner fails to make such connection, following the expiration of such 30 days, then the city may provide for the connection to such water system and may charge such cost against the property as a special assessment. If the property owner fails to grant access to such building for the purpose of making such connection, the city may seek an appropriate court order compelling that such connection be made. The actual expenses incurred by the city in obtaining such court order, including legal fees, shall be added to the cost to be charged against the property as a special assessment.

(C) *Private water systems.* All private water supply systems shall be designed, constructed, maintained and updated so as to be in full accordance with all applicable federal, state, county or city standards and regulations during all times when the water from such systems is used for human consumption. The owners of such private water systems shall provide for access to the

same for purposes of inspection. If a private water system is found not to be in accordance with such regulations or standards, then water from such system shall not be utilized for human consumption.

(Am. Ord. 88, passed 5-18-1987; Am. Ord. 48, 4th Series, passed 1-22-2013)

§ 52.02 DEFICIENCY OF WATER AND SHUTTING OFF WATER.

(A) The city is not liable for any deficiency or failure in the supply of water to customers whether occasioned by shutting the water off for the purpose of making repairs or connections or by any other cause whatever. In case of fire, or alarm of fire, water may be shut off temporarily to certain areas of the city in order to insure an adequate supply of water for fire fighting. In making repairs or construction of new works, water may be shut off at any time and kept off so long as may be necessary.

(B) The city shall be held harmless in case of problems arising from shutting off water, changing meter, and the like.

(1975 Code, § 3.70, Subd. 1)

§ 52.03 REPAIR OF SERVICE LINE.

(A) It is the responsibility of the consumer or owner to maintain the service pipe from the main into the house or other building. In case of failure upon the part of any consumer or owner to repair any leak occurring in his or her service pipe within 24 hours after oral or written notice has been given the owner or occupant of the premises, the water may be shut off and will not be turned on until a reconnection charge has been paid and the water service has been repaired. When the waste of water is great or when damage is likely to result from the leak, the water supply will be turned off if the repair is not undertaken immediately.

(B) *Water usage credit for repair of frozen service line.*

(1) All credits are subject to the approval of the Public Works Director.

(2) The total amount of any credit shall be approved by the Finance Director.

(3) To receive a credit for excess use of water as a result of a frozen water line, a customer shall submit proof that work has been completed to open a frozen water service line.

(4) All claims a frozen water line has occurred shall be verified by a city employee designated by the Public Works Director.

(5) Any credit issued shall only apply for charges during the at-risk period as determined by the Public Works Director not to exceed 4 months.

(6) Total gallons credited shall not reduce total water consumption to less than the comparable period average for that property, or a comparable property.

(7) Gallons credited per day may not exceed 300.

(8) Credits may only be given for 2 consecutive years.

(1975 Code, § 3.70, Subd. 2) (Am. Ord. 56, 4th series, passed 3-17-2014)

§ 52.04 ABANDONED SERVICE PENALTIES.

All service installations connected to the water system that have been abandoned or, for any reason, have become useless for further service shall be disconnected at the main by means of a solid sleeve repair clamp or other city approved device. The owner of the premises, served by this service, shall pay the cost of the disconnection. When new buildings are erected on the site of old ones, and it is desired to replace the old water service, a new permit shall be taken out and the regular tapping charge shall be made as if this were a new service. It is unlawful for any person to cause or allow any service pipe to be hammered or squeezed together at the ends to stop the flow of water, or to save expense in properly removing such pipe from the main. Also,

such improper disposition thereof shall be corrected by the city and the cost incurred shall be borne by the person causing or allowing such work to be performed.

(1975 Code, § 3.70, Subd. 3)

§ 52.05 WATER SERVICE LINES.

(A) Water service lines refer to the water line servicing or having the potential to service a parcel of land. This includes, but is not limited to, any apparatus used to connect to the public water supply, including tees, saddles, and corporations. The service line shall not be laid less than 7 feet below grade and shall be installed and maintained in accordance with the Minnesota State Plumbing Code. One-inch diameter shall be the minimum size water service line allowed. The water service line from the structure to the city main shall be the property owner's responsibility to repair and maintain.

(B) Flared fitting and joints must have a pipe joint compound applied to the back side of the flare as well as the front side and the tube must be reamed to the full bore of the tube.

(C) Heavy duty compression fittings meeting AWWA standards may also be used. The tube they are installed on must be reamed to the full bore of the tube.

(D) A tracer wire shall be installed on all non-conductive water lines when installing a new water service or modifying an existing water line. Tracer wires shall conform to the following requirements:

(1) Twelve gauge minimum solid copper wire coated for underground use. The coating shall be blue in color.

(2) The tracer wire shall be laid in the trench alongside the water line. If splicing is necessary, a direct bury connection is required.

(3) The tracer wire shall daylight at the point of entry at the foundation of the building through PVC conduit and a blank box as a future contact point to locate the service line.

(4) Tracer wire shall be installed on new water main installations in a manner approved by the city.

(5) Tracer wire shall be tested for continuity. If the tracer wire is found to be not continuous, it must be repaired or replaced.

(1975 Code, § 3.70, Subd. 4) (Am. Ord. 17, 4th series, passed 1-17-2008; Am. Ord. 30, 4th series, passed 1-4-2010; Am. Ord. 63, 4th series, passed 1-5-2015)

§ 52.06 PRIVATE WATER SUPPLIES.

No water pipe of the city water system shall be connected with any pump, well, pipe, tank or any device that is connected with any other source of water supply and when such are found, the city shall notify the owner or occupant to disconnect the same and, if not immediately done, the city water shall be turned off. Before any new connections to the city system are permitted, the city shall ascertain that no cross-connections will exist when the new connection is made. When a building is connected to "City Water" the private water supply may be used only for such purposes as the city may allow.

(1975 Code, § 3.70, Subd. 5)

§ 52.07 WATER METERS.

As part of the new construction of any new residential, commercial or industrial building, the use of 2 water meters is required. One water meter shall meter the inside water usage and 1 water meter shall meter the outside water usage. The outside meter shall meter water that is not being returned to the city sanitary sewer system. The meters become the property of the property owner who is responsible for all repair and maintenance.

(Ord. 30, 4th series, passed 1-4-2010)

§ 52.08 RESTRICTED HOURS FOR SPRINKLING.

Whenever the city shall determine that a shortage of water threatens the city, it may limit the times and hours during which water may be used from the city water system for lawn and garden sprinkling, irrigation, car washing, air conditioning, and other uses, or either or any of them. It is unlawful for any water consumer to cause or permit water to be used in violation of such determination after public announcement thereof has been made through the news media specifically indicating the restrictions thereof.

(1975 Code, § 3.70, Subd. 6) Penalty, see § [10.99](#)

§ 52.09 PRIVATE FIRE HOSE CONNECTIONS.

Owners of structures with self-contained fire protection systems may apply for and obtain permission to connect the street mains with hydrants, large pipes, and hose couplings, for use in case of fire only, at their own installation expense and at such rates as the Council may adopt by resolution as herein provided.

(1975 Code, § 3.70, Subd. 7)

§ 52.10 OPENING HYDRANTS.

It is unlawful for any person, other than members of the Fire Department or other person duly authorized by the city, in pursuance of lawful purpose, to open any fire hydrant or attempt to draw water from the same or in any manner interfere therewith. It is also unlawful for any person so authorized to deliver or suffer to be delivered to any other person any hydrant key or wrench, except for the purposes strictly pertaining to their lawful use.

(1975 Code, § 3.70, Subd. 8) Penalty, see § [10.99](#)

§ 52.11 OBSTRUCTING AND SCREENING OF FIRE HYDRANTS.

(A) No property owner or tenant shall plant any shrub, tree or other cultivar or construct any landscape structure that serves to screen any fire hydrant from view or to limit access to the fire hydrant for maintenance or fire suppression use.

(B) Upon written notice, a property owner shall have 10 calendar days to remove any screening that the Public Works Director has determined to be unlawful. Such determinations are made at the sole discretion of the city.

§ 52.12 SINGLE SERVICE AND MULTIPLE UNITS METERED SEPARATELY FOR WATER.

The termination of the main water line may be on any floor of the building, as long as it terminates 12 inches above the floor with the main building valve immediately installed. At this juncture, in order to individually meter each unit, a manifold must be installed with individual valves and supplies to each unit. Meters may be installed at this juncture or in individual units with shut-off valves to each unit.

The manifold shall be in an area not controlled by the individual tenants.

(Ord. 34, 4th Series, passed 1-18-11)

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Minnesota Department of Natural Resources

DNR ECOLOGICAL & WATER RESOURCES

21371 State Highway 15

New Ulm, MN 56073



March 2, 2017

City of North Mankato
Duane Rader, Water Superintendent
1001 Belgrade Avenue; P.O. Box 2055
North Mankato, MN 56002-2055

Dear Mr. Rader:

RE: Water Supply Plan Approval, City of North Mankato, Nicollet County

Our office has completed the review of your water supply plan for the public water supply authorized under DNR Water Appropriation Permit No. 1975-4230. I am pleased to advise you that in accordance with Minnesota Statutes, Section 103G.291, Subdivision 3, and on behalf of the Commissioner of the Department of Natural Resources, I hereby **approve your water supply plan**. We encourage cities to complete the attached "Certificate of Adoption" form. Please upload the form to the Minnesota DNR Permitting and Reporting System (MPARS) as soon as the city officially adopts the plan.

The DNR and Minnesota Rural Water Association encourage the city to educate its customers on how they can reduce household water use. As mentioned at the water supply planning workshops, the DNR will be contacting you periodically regarding the progress the city has made on their water conservation goals. We encourage you to keep records of your success.

Thank you for your efforts in planning for the future of the City of North Mankato water supply and for conserving the water resources of the State of Minnesota. If you have any questions or need additional assistance with the city's water appropriation permit, please contact Area Hydrologist Garry Bennett at (320) 234-2550, ext. 230 or garry.bennett@state.mn.us.

Best regards,
DNR-ECOLOGICAL & WATER RESOURCES

A handwritten signature in blue ink, appearing to read "Robert Collett".

Robert Collett
Regional Manager

e-copy: Carmelita Nelson, DNR Ecological & Water Resources
Garry Bennett, DNR Ecological & Water Resources
Kevin Ostermann, Nicollet County SWCD
Minnesota Permitting and Reporting System (MPARS)

**CERTIFICATION OF ADOPTION
WATER SUPPLY PLAN**

City or Water System Name: North Mankato

Name of Person Authorized to Sign

Certification on Behalf of the System: Mark Dehen

Title: Mayor

Address: 1001 Belgrade Avenue, North Mankato, MN 56003

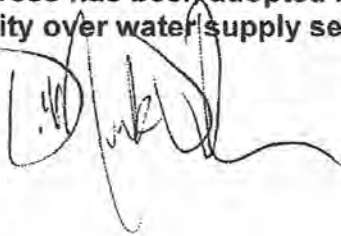
Telephone: 507-625-4141

Fax: 507-625-4151

E-mail: markdehen@northmankato.com

I certify that the Water Supply Plan approved by the Department of Natural Resources has been adopted by the city council or utility board that has authority over water supply services.

Signed:



Date: 3/20/17