South/Southwest Big Kandiyohi Lake Community

Community Assessment Report

Lake Lillian, Minnesota

Stantec

Prepared for:
Kandiyohi County
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Willmar, MN 56201

Prepared by:
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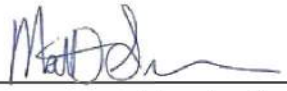
Reviewed by: 
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1.0 PROFESSIONAL CERTIFICATION

I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision and that I am a certified MPCA Designer under the laws of the state of Minnesota.

Signature/Date: _____ April 1, 2026
Name: Eric M. Blasing Date
Registration: Certification Number: C7582

2.0 INTRODUCTION

The South/Southwest Big Kandiyohi Lake community (Project) is located along the south and southwest shoreline of Big Kandiyohi Lake in Fahlun Township, Kandiyohi County, Minnesota (Figure 1). The community is unsewered, and residential wastewater needs are met by individual subsurface sewage treatment systems (ISTS)[1]. Residents are served water by a combination of individual and shared water supply wells. Stantec Consulting Services Inc. (Stantec) was retained to assess the probable compliance status of existing ISTS, and to evaluate alternatives for viable long-term wastewater treatment infrastructure.

This Community Assessment Report (CAR) was made possible through a Small Community Wastewater Treatment Program Technical Assistance Grant from the Minnesota Public Facilities Authority (PFA). These grants are available to small unsewered communities and used to analyze possible solutions to wastewater problems associated with noncompliant ISTS. Small Community Wastewater Treatment Program Technical Assistance grants are designed to help communities develop the technical, managerial, and financial capacity necessary to build, operate, and maintain new subsurface sewage treatment systems (SSTS). This report would not have been possible without the generous assistance of Kandiyohi County, the Big Kandiyohi Lake Association, the Minnesota Pollution Control Agency (MPCA), and the PFA.

The Project area contains 103 properties, as shown in Figure 1, including 102 residential and one commercial. The study area was selected based on adjacency to lakeshore, lot density, lot size, lot constraints, and expected ISTS status as these are the primary factors in considering a community wastewater solution. Individual property details and findings can be found within the parcel data spreadsheet in Appendix A.

2.1 PREVIOUS INVESTIGATIONS

An Unsewered Area Needs Documentation[2] assessment was completed by Kandiyohi County and Stantec as part of the CAR funding application. Information gathered in the Unsewered Area Needs Documentation was reviewed and incorporated into the findings of this report.

2.2 REPORT PURPOSE

This report serves as a planning document for possible long-term wastewater infrastructure solutions for the Project. The CAR is intended to present probable existing ISTS status and determine if the

[1] ISTS are defined in Minnesota Rule Chapter 7080 as a type of SSTS that treats and disperses wastewater via the soil. “ISTS” refers generally to a home septic system.

[2] Unsewered Area Needs Documentation is a form created by the MPCA for unsewered communities when applying for funding. The form provides a preliminary status of existing ISTS conditions within the community.

community is best served in the future by ISTS, a shared community system, or connection to a regional municipal wastewater treatment facility (WWTF).

2.3 WORK PERFORMED

An assessment of existing ISTS conditions was executed to determine a project baseline for analysis. Included in this assessment was a review of Kandiyohi County ISTS permit records, consultation with county staff, and field investigations to determine likely ISTS compliance status within the community. The analysis also evaluated potential future wastewater treatment options to serve the Project. Useful background information regarding some ISTS specifics (i.e., drainfield trench vs. mound) produced by the University of Minnesota Onsite Sewage Treatment Program (OSTP)[3] is found in Appendix B.

A typical CAR investigation includes the development of potential community wastewater collection and treatment options. These options are based on areas of highest need due to low ISTS compliance, likely replacement ISTS type, and/or significant lot constraints. See Section 4 for further discussion.

[3] The University of Minnesota OSTP provides technical training and continuing education for individuals who design, inspect, install, and maintain ISTS in Minnesota. Additional homeowner information regarding ISTS can be found at their website: http://septic.umn.edu/

3.0 EXISTING CONDITIONS

This section summarizes existing ISTS conditions within the Project area. The ISTS identified on evaluated properties include pressure beds, trenches, at-grades, mounds, cesspool/drywells (CP/DW), and holding tanks. A determination of likely ISTS compliance status was made for each property. In addition, a determination was made as to what the likely future ISTS would be to serve the property, based on soil conditions and existing site constraints.

3.1 METHODS

Fieldwork was completed in the fall of 2025 and included site visits to each participating property to locate water supply wells, wastewater tanks, and soil dispersal systems. Soil borings were conducted as needed, and ISTS were evaluated to determine their likely compliance status. An assessment was also made regarding the most likely option for each property's replacement ISTS.

Prior to the commencement of fieldwork, Kandiyohi County provided available ISTS permit files, design and inspection records for the properties, and Geographic Information System (GIS) shape files of property boundaries. In addition, homeowner surveys were collected for participating properties to gain further knowledge of existing ISTS, parcel occupancy status, bedroom count, water supply, and dwelling water-use appliances. Information gleaned from records and homeowner surveys was incorporated into the parcel data spreadsheet (Appendix A) and used in the assessment.

Of the 103 properties, 41 agreed to participate in an onsite property assessment. Stantec was able to access all participating properties to complete a site assessment with the intent of documenting likely ISTS compliance and evaluating future ISTS options. Stantec used existing permit records, soil survey data, and completed soil borings as needed to evaluate soils throughout the Project area.

Likely ISTS compliance status for the 62 properties that did not allow a site visit was determined by permit review, visual assessment from the public right-of-way or adjacent property, soil conditions observed on neighboring properties, and professional judgement.

3.2 FINDINGS

This section summarizes existing conditions of ISTS in the Project area. A determination of likely ISTS compliance status was made along with likely future ISTS to serve the properties.

3.2.1 Drinking Water Source

Property drinking water sources include individual and shared water supply wells (Figure 2) as there is no community public water supply system. Note, not all water supply wells were located during fieldwork, as gathering locations on non-participating properties was not possible. Therefore, Figure 2 does not illustrate an inclusive exhibit of water supply wells for the Project area. Also included in Figure 2 are the 100-year flood zone areas.

Drinking water supply wells are typically described as either deep (greater than 50 feet of watertight casing) or shallow (less than 50 feet of watertight casing). Depth and location of wells must be considered when determining ISTS setback requirements. New ISTS drainfield components must meet a 50-foot setback from a standard deep well and a 100-foot setback from a shallow well. For shared community

collection system pressure sewer force main, a 50-foot setback applies. The Minnesota Department of Health governs water supply well setbacks and potential variances.

3.2.2 Parcel Type

Table 3-1 summarizes parcel types in the Project area. Data is from homeowner surveys, property tax parcel data records, and fieldwork observations. Of the 103 Project properties, 85 (83%) are seasonal and 18 (17%) are occupied year-round.

For estimating wastewater design flows, Minnesota Rules Chapter 7080 classifies homes as Type I, II, III, or IV dwellings based on structure size and number of water-use appliances. Essentially, the smaller the structure and the fewer water-use appliances, the lower the flow volumes to expect. A Type I classification would assign the highest flows and Type IV, the lowest. This information was known from ISTS permit files, property tax parcel data records, and homeowner surveys, and is included in Appendix A.

Table 3-1: Parcel Type

Parcel Type	Number	Percentage
Residential	102	99%
Commercial	1	1%
Total	**103**	**100%**

3.2.3 ISTS Type

Table 3-2 summarizes ISTS types in the Project area.

Table 3-2: ISTS Type

ISTS Type	Number	Percentage
Trenches	5	5%
Pressure Bed	2	2%
At-Grade	1	1%
Mound	26	25%
CP/DW	8	8%
Holding Tank	58	56%
No System	3	3%
Total	**103**	**100%**

3.2.4 ISTS Compliance Status

While evaluating each parcel, the likely ISTS compliance status was determined based on Minnesota Rules Chapter 7080 and Kandiyohi County SSTS ordinance. Noncompliant ISTS fall into one of two categories including failure to protect groundwater (FTPG) or imminent threat to public health or safety (ITPHS).

- FTPG criteria include:
  - Less than 36-inches of vertical separation between the bottom of the soil dispersal system and a limiting condition such as seasonally high groundwater, hardpan, or bedrock.
  - Non-watertight tanks (includes CP/DWs and outhouse systems).
  - Not meeting reporting requirements of an operating permit. Operating permits within Kandiyohi County are issued for ISTS with secondary pretreatment, non-standard systems, and systems designed to treat over 5,000 gallons per day.

- ITPHS criteria include:
  - Sewage backing up into the dwelling.
  - Untreated sewage discharging to the ground surface or surface waters.
  - Treated effluent surfacing on the ground surface from the soil dispersal system.
  - An ISTS in an unsafe condition (dangerous/missing tank riser covers, exposed wiring, unsound tank, etc.).
  - Any other condition deemed by an inspector to be a threat to human health or safety.

Table 3-3 summarizes likely ISTS compliance status within the Project. Likely compliance status is based on Kandiyohi County permit information, soils data, information provided by property owners, and onsite field assessments. The reasons for noncompliant ISTS status were:

- The use of outdated CP/DW systems; CP/DWs are not allowed under current state code.
- Subsurface trench or pressure bed systems lacking adequate vertical separation from seasonally high groundwater.
- Properties with unsound tanks, or with outdoor showers or sinks not connected to an ISTS, triggering an ITPHS.

Table 3-3: Likely ISTS Compliance Status

Status	Number	Percentage
Compliant	80	78%
Noncompliant ITPHS	5	5%
Noncompliant FTPG	15	15%
No System	3	2%
Total	**103**	**100%**

See Figure 3 and the parcel data spreadsheet in Appendix A for parcel-specific likely compliance status.

3.2.5 ISTS Age

Age is a factor in determining the overall health of a community's ISTS infrastructure. The typical ISTS lifespan is approximately 25 to 40 years under normal use and with proper maintenance. Over time, ISTS components can degrade, the distribution rock or sand/soil surface interface can plug, and soil beneath the soil dispersal system can eventually lose capacity to treat pollutants.

Waste strength, flow volume, and system maintenance are fundamental factors in how long an ISTS functions, but eventually all ISTS need to be replaced. Table 3-4 summarizes ISTS age ranges within the Project area. System ages were based on Kandiyohi County records and homeowner surveys. Fifteen properties lacked County records or homeowner survey information, thus ISTS ages are unknown. ISTS lacking County records were likely either installed without a permit or installed prior to County recordkeeping. Figure 4 provides a visual representation of current ISTS ages within the Project area.

Table 3-4: ISTS Age (as of 2026)

System Age	Number	Percentage
< 10	13	13%
10 – 19	31	30%
20 – 29	32	31%
30 – 39	8	8%
40+	1	1%
Unknown	15	15%
No System	3	2%
Total	**103**	**100%**

3.2.6 Summary

Of the 103 ISTS within the Project, 80 (78%) are compliant and thus are not in need of immediate replacement. Of the 20 noncompliant ISTS, five are ITPHS, seven lack sufficient vertical separation to groundwater, and eight are likely a CP/DW system. A CP/DW is basically a buried vessel with no bottom or with walls that allow wastewater to seep directly into the soil and/or groundwater. Cesspool/drywell systems are outdated, do not protect groundwater, and are no longer allowed to be installed in Minnesota.

4.0 ALTERNATIVES

When considering alternatives for long term wastewater infrastructure, three components are evaluated:

- Collection: the means wastewater generated from individual dwellings is conveyed to the wastewater treatment system.
- Treatment: settlement of solids, removal of pathogens, and reduction of nutrients in primary, secondary, and tertiary processes.
- Effluent dispersal: final distribution of treated effluent to surface waters, the ground surface, or subsurface soils.

When a series of homes are connected to a decentralized wastewater treatment system, it is commonly referred to as a community cluster system. Cluster system ownership, operation, and management occur through a municipality, the formation of a special purpose district, or through private ownership. For this report, the assumption was made that any community cluster system would fall under the ownership of Kandiyohi County as a subordinate service district (District). This would qualify the Project for public funding opportunities. A system developed privately is not eligible for public financing and can present legal challenges as it relates to land ownership, system maintenance, and fee collection.

The City of Lake Lillian and Blomkest-Svea stabilization pond systems are nearby, however, wastewater from the Project would put each WWTF over their treatment capacity and thus regionalizing is not viable. Therefore, feasible wastewater alternatives for the Project include the installation of ISTS to serve each dwelling, private ISTS excluding holding tanks (likely future holding tank properties served by a community cluster SSTS), and a shared community cluster SSTS serving the Project. These alternatives are evaluated within the following section.

4.1 ALTERNATIVES ANALYSIS

The following alternatives have been evaluated for long-term wastewater treatment infrastructure to serve properties within the Project:

- Alternative 1: Private ISTS for all properties
- Alternative 2: Community cluster midsized subsurface sewage treatment system (MSTS)
- Alternative 3: Community cluster large subsurface sewage treatment system (LSTS)

Table 4-1 includes the estimated wastewater design flow for the alternatives and the associated permit that would apply.

Table 4-1: Wastewater Design Flow and Permit Type

Alternative	No. of Properties	SSTS Type	Wastewater Design Flow (gpd)*	Permit Type**
Alternative 1: Private ISTS	103	ISTS	Varies per property	Kandiyohi County ISTS
Alternative 2: Community Cluster MSTS***	42 61	ISTS MSTS	Varies per property 9,950	Kandiyohi County ISTS Kandiyohi County MSTS
Alternative 3: Community Cluster LSTS****	3 100	ISTS LSTS	Varies per property 16,680	Kandiyohi County ISTS State Disposal System (SDS)

*Permit flow is not the actual flow observed but rather is a prescribed design flow. The design flow considers an allowed reduction in per-dwelling flow estimates for community cluster systems with over 10 dwellings and includes infiltration and inflow for the collection system.
**Permit type required for ISTS assumes that the individual property owners are the ISTS owners/managers. The SDS permit required for the shared community cluster LSTS assumes Kandiyohi County is the owner.
***Community cluster MSTS serving the 61 properties whose likely only future ISTS option is a holding tank. Remaining properties would continue utilizing private ISTS as they currently do.
****Due to their distant proximity to most of the Project service area, the three far western properties (Parcel IDs: 16-031-0095, 16-032-0060, and 16-032-0030) would be served by their own ISTS.

Per Minnesota Rule 7081.0120, a daily wastewater flow was estimated for Alternative 2 and Alternative 3 using a formula specified in the rule. The formula calculates a design flow based on each dwelling's classification and the total number of dwellings included. Typically, the actual daily wastewater flow observed is less than the estimated design flow as a safety factor is incorporated. Also included is the collection system infiltration and inflow (I/I), as specified in Minnesota Rule 7081.0120. See Appendix C for wastewater design flow calculation details.

The wastewater design flow dictates permitting authority, the level of pretreatment required, and other permitting requirements as summarized in the following classifications:

- A SSTS designed with a wastewater flow less than 5,000 gpd is considered an ISTS and would be permitted by Kandiyohi County. These systems have the least restrictive design and permitting requirements.
- A SSTS designed with a wastewater flow between 5,000 gpd and 10,000 gpd is considered an MSTS and would be permitted by Kandiyohi County. These systems have greater design and permitting requirements compared to an ISTS and require an operating permit with greater oversight.
- A SSTS with a wastewater design flow greater than 10,000 gpd is permitted through the MPCA SDS program. These systems require enhanced pretreatment with nitrogen limits at the end-of-pipe (prior to soil dispersal) and/or within groundwater monitoring wells. These systems are considered LSTS.

4.1.1 Alternative 1: Private ISTS

The private ISTS alternative would require individual property owners to be responsible for the installation, management, operation, and maintenance of their ISTS. Therefore, operation and

maintenance of ISTS would continue as is currently practiced. System upgrades, operation, and maintenance costs would be paid by the property owner with no public funding. Future decisions would be made by the property owner and a county-issued ISTS permit would be required for each property.

Advantages of private ISTS ownership can include lower permitting requirements and lower overall costs for installation, operation, and maintenance unless the ISTS is a holding tank. Disadvantages include management by individuals rather than the community, loss of yard space, potential for inadequate maintenance, and potential impacts to property values compared to a property connected to a public wastewater system.

4.1.1.1 Future ISTS Upgrades

As stated in Section 3.2.4, 20% of ISTS within the Project are likely noncompliant. This accounts for some type of potential imminent ISTS upgrade at 20 properties. However, all properties need an ISTS upgrade at some point in the future based on their limited life expectancy. The typical life expectancy for a properly installed and maintained ISTS is 25 to 40 years. However, this varies significantly depending on wastewater strength, water use patterns, construction, operation, and maintenance.

The ISTS type needed at upgrade is significant as it directly influences the initial capital, operation, and maintenance costs. Minnesota Rules parts 7080.2200 – 7080.2400 define ISTS type including the following:

- Type I: Standard systems including subsurface or above-grade soil dispersal systems on undisturbed soils. Type I systems meet all technical sizing, design, and construction requirements, have suitable soils, and can meet all setbacks.
- Type II: Holding tanks, privies, and systems in floodplains.
- Type III: Non-standard systems that deviate from Type I code requirements that are constructed on soil which is difficult, disturbed, or contains seasonally high groundwater. Type III systems can include intentionally undersized soil dispersal systems due to inadequate area. These systems use flow restrictions that limits the daily effluent discharged to the soil dispersal system.
- Type IV: Commonly referred to as “performance” systems. Type IV systems include secondary pretreatment by means of an aerobic treatment unit or media filter prior to soil dispersal. These pretreatment technologies introduce air either mechanically or passively which encourages aerobic bacterial growth and reduces loadings such as biochemical oxygen demand (BOD) and total suspended solids (TSS). Adding secondary pretreatment allows treated effluent to be loaded to the soil at a higher rate, which will reduce the overall size of the soil dispersal system. Type IV systems can also include tertiary treatment technologies which reduce pathogenic bacteria (fecal coliform used as the indicator). This allows treated effluent to be dispersed with reduced vertical separation from the bottom of the soil dispersal system distribution media to the limiting condition. Type IV systems are more expensive to design, construct, operate, and maintain.

Appendix A and Figure 5 summarize each property’s most likely future ISTS based on the lot size, soil conditions, SSTS design requirements, and current land use. For a property that does not have suitable

space for a soil dispersal system due to site improvements, setbacks, and/or the food zone, the future ISTS would likely be a holding tank. Whether a Type III or Type IV system is used to address various site constraints is up to the homeowner, the ISTS designer, and the permitting authority. There are advantages and disadvantages to each. For this report, properties with challenging soils or limited room for a soil dispersal system are classified as needing either a Type III or Type IV system. Table 4-2 and Table 4-3 summarize likely future ISTS for noncompliant properties and all Project properties, respectively.

Table 4-2: Future ISTS for Noncompliant Properties

ISTS Type	Number	Percentage
Type I	6	30%
Type II	8	40%
Type III or Type IV	6	30%
Total	**20**	**100%**

Table 4-3: Future ISTS for All Properties

ISTS Type	Number	Percentage
Type I	12	12%
Type II	61	59%
Type III or Type IV	30	29%
Total	**103**	**100%**

Of the 103 evaluated properties, only 12 properties (12%) have adequate area for a standard Type I ISTS, while 91 (88%) do not. Those properties would likely be served by a Type II holding tank or a Type III or Type IV ISTS. Of the 20 likely noncompliant properties, six (30%) have adequate area for a Type I ISTS while 14 (70%) do not.

4.1.1.2 Private ISTS Summary

The following points summarize the private ISTS alternative:

- Advantages:
    - Construction, operation, and maintenance costs are based on need and strictly dependent upon the individual property. The community does not share overall costs.
    - Less overall capital costs when compared to a community system.
    - Local groundwater recharge.

- Disadvantages:
    - Less freedom on yard usage.
    - Individuals may choose to forgo proper operation and maintenance practices leading to poor ISTS performance, failure, or an imminent threat to public health.
    - Potential lower property values when compared to a community cluster system.
    - Grant funding is not available to reduce capital costs for the ISTS only option.

4.1.2 Alternative 2: Community Cluster MSTS

Alternative 2 would include a publicly-owned community cluster system serving the 61 constrained properties whose likely only future ISTS option is a holding tank. Remaining properties would continue utilizing private ISTS as they currently do. The community cluster system would include collection, treatment, and an above-grade mound soil dispersal system. Due to the estimated wastewater design flow, the cluster system would be considered a MSTS. The following section evaluates a community cluster MSTS to serve the holding tank properties.

4.1.2.1 Collection System

Four common collection systems are available to convey wastewater which include the following:

- Conventional gravity
    - A conventional gravity collection system includes a building sewer on each property that conveys raw sewage to a large diameter ($\geq$ 8-inch diameter) sewer main. Manholes are required every 400 feet or major directional change along the sewer route and lift stations may be needed depending upon topography.
- Septic tank effluent gravity (STEG)
    - STEG systems include a septic tank on each property from which settled wastewater or effluent flows into common small diameter gravity piping.
- Septic tank effluent pump (STEP)
    - STEP systems include a septic tank on each property from which effluent is pumped into a common small diameter pressure force main.
- Grinder pump low pressure sewer
    - Grinder pump low pressure sewer collection systems include a basin on each property with a grinder pump that macerates raw sewage and discharges into common small diameter pressure force main. See Appendix D for a grinder station detail.

Based on topography, lot size, reduced land disturbance, and construction costs, the grinder pump low pressure sewer collection system would be the most feasible and cost-effective to serve the Project area.

A grinder pump low pressure sewer system utilizes grinder pumps at each home. Grinder pumps work collectively to convey sewage to the treatment site. A small footprint is required at each connection, as the grinder pump is housed in a cylindrical 24-inch diameter vault. These systems require electrical

power, air release valves, cleanouts, and large septic tanks at a centralized location for primary treatment to occur.

Utilizing a pressurized grinder system significantly reduces potential I/I into the collection system. Flexible high-density polyethylene (HDPE) piping is installed using directional drilling equipment instead of open cut excavation, which leads to less clearing, grubbing, and overall site disturbance. Sewage flows full and under pressure in the force main. Therefore, piping does not have to maintain a constant grade and can follow topography. Because the piping remains full, it must maintain proper bury depth for frost protection and incorporate insulation where needed.

Operation and maintenance tasks include performing routine system inspections and responding to emergency situations. Such circumstances include broken or obstructed piping, power outages, or pump failures. Also, the centralized settling tank(s) would accumulate solids over time and require monitoring and periodic pumping.

The design of a pressure collection system incorporates calculations of inline pressures and flow velocities that will be encountered compared to the number of pumps running simultaneously. The flow velocity must be maintained at or above two feet per second to ensure proper solids scouring within the piping.

An advantage of using grinder stations is that they do not require a septic tank on the property. Therefore, they require less area for construction and site disturbance is minimized. Grinder stations are typically installed using smaller construction equipment which is important on small lots with space constraints due to structures, trees, or other physical impediments. A well-maintained grinder pump could last 15 to 25 years depending on proper care, use, and regular inspections.

4.1.2.2 Wastewater Treatment System

The wastewater treatment system would provide primary and secondary treatment prior to being dispersed to the soil. The system would include pretreatment components designed to treat wastewater constituents and lower pollutants before soil dispersal.

A treatment site has not been selected as land was not available to be evaluated during fieldwork. However, a potential treatment location along 147th Avenue SE is shown in Figure 6. The site appears to have suitable topography and soil and is adjacent to the Project area. This location is shown for conceptual purposes to illustrate the scale of land purchase needed for a cluster system. The owner has not been contacted, and it is unknown if the land would be available. If a community cluster MSTS is selected, this area would need to be further evaluated to ensure the site and soil can accommodate the system.

According to the Natural Resources Conservation Service (NRCS) Web Soil Survey, soils within this area primarily includes Nicollet clay loam, featuring moderately well-structured clay loam extending to poorly-structured loam with depth. The USDA NRCS soil series description can be found in Appendix E. Nicollet

soils are very deep, somewhat poorly-drained, and formed on glacial till plains and moraines. Periodically saturated soils are predominant with seasonally high groundwater occurring approximately 18 – 24 inches below the ground surface. Based on the desktop analysis, these soils could accommodate an above-grade soil dispersal system that would maintain a minimum vertical separation to seasonally high groundwater of 36-inches.

A grinder pump low presser sewer collection system would convey raw sewage to the treatment site which would include buried precast concrete tanks, an aerobic treatment unit (ATU), dose tank, pumps, a mound soil dispersal system, controls, and other associated appurtenances. A gravel drive would provide access.

Per MSTS requirements (Minnesota Rule 7081.0270), the mound soil dispersal system would be designed to accommodate 100% of the design flow and an additional 100% reserve area would be set aside for potential future replacement use. The proposed mound soil loading rate, rock bed loading rate, and contour loading rate are 0.6 gpd/ft^2, 1.2 gpd/ft^2, and 12 gpd/ft, respectively. These values may vary based on a full site assessment and soil investigation.

Based on these loading rates, approximately 830 lineal feet of mound would be required. It is envisioned six mound cells would be constructed. The actual number of cells and their dimensions would vary depending upon actual site characteristics. Figure 6 shows the treatment site location but does not represent a final design or imply landowner consent to sell the property. The estimated treatment site area shown is 10 acres.

Each mound cell would receive aerobically treated effluent on a timed basis from a dedicated pump within the dose tank. The pumps would alternate throughout the day and the total number of doses to the mound system would depend upon the actual wastewater flow volume. Effluent would be distributed evenly within the rock bed via pressure laterals and would infiltrate vertically through the bed into the clean mound sand. Once through the sand, treated effluent would infiltrate into the native soil.

An automated control panel would govern system operations and be equipped with remote telemetry. This feature would allow real-time remote access to detailed operations data, the ability for the operator to change setpoint values, and alarm condition notification.

The community cluster MSTS would require operation and maintenance responsibilities, and a Kandiyohi County operating permit would be issued. Typical tasks include monitoring and logging wastewater flows, inspecting pumps and blowers, inspecting grinder stations, field flushing pressure distribution laterals, rotating mound cells, checking treatment tanks for solids accumulation, sampling, reporting, and monitoring treatment processes. Accumulated tank solids would be pumped periodically and hauled to an approved facility for disposal.

See Section 5 for a cost analysis including construction, operation, and maintenance estimates.

4.1.2.3 Community Cluster MSTS Summary

The following points summarize the community cluster MSTS alternative:

- Advantages:
    - Low-interest rate loans and grant programs available for design and construction costs of the community cluster MSTS.
    - Allows for more usable land area on properties served by the community cluster MSTS.
    - Routine operation and maintenance activities completed by a certified service provider/operator for the community cluster MSTS.
    - Removes all holding tanks from the Project area.
    - Local groundwater recharge.
- Disadvantages:
    - Land acquisition can be difficult for the community cluster MSTS. Currently, there is no agreement or discussion with landowners.
    - High estimated construction costs for the community cluster MSTS serving the holding tank properties, making grant programs a requirement for affordability.
    - Potential local opposition.

4.1.3 Alternative 3: Community Cluster LSTS

The community cluster LSTS alternative would serve all of the properties along 147th Street NE and would include collection, treatment, and an above-grade mound soil dispersal system. Due to an estimated wastewater design flow greater than 10,000 gpd, the system would be considered an LSTS and permitted by the MPCA. The three parcels at the west end of the CAR area would pursue their own private ISTS replacement as needed. The following section evaluates a community cluster LSTS

4.1.3.1 Collection System

The grinder pump low pressure sewer system, previously described, would best serve the community cluster LSTS alternative. See Section 4.1.2.1 for details.

4.1.3.2 Wastewater Treatment System

The wastewater treatment system would provide primary, secondary, and tertiary treatment prior to being dispersed to the soil. The system would include pretreatment components designed to treat wastewater constituents and treat total nitrogen to less than 10 mg/L end-of-pipe, as would be required by the MPCA SDS permit.

The treatment site previously described would also serve the community cluster LSTS. See Section 4.1.2.2 for details.

A grinder pump low presser sewer collection system would convey raw sewage to the treatment site which would include buried precast concrete tanks, ATUs, a denitrification unit, dose tank, pumps, controls, a mound soil dispersal system, and other associated appurtenances. A control building would be located adjacent to the treatment tanks that would house the control panel, electrical distribution panel, chemical feed equipment, blowers, and be equipped with a generator for backup power. A gravel drive would provide access, and the entire site would include perimeter fencing.

Per LSTS requirements, the mound soil dispersal system would be constructed to accommodate 150% of the design flow and an additional 50% reserve area would be set aside for potential future replacement use. The proposed mound soil loading rate, rock bed loading rate, and contour loading rate are 0.6 gpd/ft^2, 1.2 gpd/ft^2, and 12 gpd/ft, respectively. These values may vary based on a full site assessment and soil investigation.

Based on these loading rates, 2,100 lineal feet of mound would be required. It is envisioned sixteen mound cells would be constructed. The actual number of cells and their dimensions would vary depending upon actual site characteristics. Figure 7 shows the treatment site location but does not represent a final design or imply landowner consent to sell the property. The estimated treatment site area shown is 20 acres.

Each mound cell would receive treated effluent on a timed basis from a dedicated pump within the dose tank. The pumps would alternate throughout the day and the total number of doses to the mound system would depend upon the actual wastewater flow volume. Effluent would be distributed evenly within the rock bed via pressure laterals and would infiltrate vertically through the bed into the clean mound sand. Once through the sand, treated effluent would infiltrate into the native soil.

An automated control panel would govern system operations and be equipped with remote telemetry. This feature would allow real-time remote access to detailed operations data, the ability for the operator to change setpoint values, and alarm condition notification.

The community cluster LSTS requires routine operation and maintenance responsibilities. Typical tasks include monitoring and logging wastewater flows, inspecting pumps and blowers, inspecting grinder stations, field flushing pressure distribution laterals, rotating mound cells, checking treatment tanks for solids accumulation, sampling, reporting, and monitoring treatment processes. Accumulated tank solids would be pumped periodically and hauled to an approved facility for disposal.

See Section 5 for a cost analysis including construction, operation, and maintenance estimates.

4.1.3.3 Community Cluster LSTS Summary

The following points summarize the community cluster LSTS alternative:

- Advantages:
    - Low-interest rate loans and grant programs available for design and construction costs.
    - Potential property value increase compared to private ISTS.

  - Allows for more usable land area on properties.
  - Routine operation and maintenance activities completed by a certified service provider/operator.
  - Local groundwater recharge.

- Disadvantages:

  - Land acquisition in close proximity can be difficult. Currently, there is no agreement or discussion with landowners.
  - Highest estimated construction cost, making grant programs a requirement for affordability.
  - High operation, maintenance, and replacement costs.
  - Potential local opposition.

5.0 OPINION OF PROBABLE COST ANALYSIS

Several alternatives have been evaluated to improve existing wastewater infrastructure within the Project including private ISTS replacement, community cluster MSTS, and a community cluster LSTS. The following section includes an opinion of probable cost analysis of these alternatives including capital, operation, maintenance, and replacement (OM&R) costs. A 20-year present worth and financing analysis have also been completed. For equal comparison of alternatives and to prevent average costs from being skewed, costs associated with the Big Kandiyohi Lake County Park West have been excluded and are stand-alone. Therefore, total estimated costs were divided by 102 connections.

5.1 OPINION OF PROBABLE CONSTRUCTION COST ESTIMATE

Table 5-1 provides estimated construction costs to privately replace ISTS within the Project. The replacement ISTS would include Type I mounds, Type II holding tanks, and Type III or IV systems.

Table 5-1: Private ISTS Opinion of Probable Construction Cost Estimate

New ISTS Type	Number	Estimated Cost per ISTS	Estimated Construction Cost
Type I	11	$30,000	$330,000*
Type II	61	$7,500	$457,500
Type III or Type IV	30	$35,000	$1,050,000
Construction Cost Subtotal			$1,837,500
Contingency			$183,750
Total Estimated Construction Cost			$2,021,250
Estimated Construction Cost per Connection			$19,825

* Excludes the $180,000 estimated Type I ISTS mound replacement cost for the Big Kandiyohi Lake County Park West.

Table 5-2 provides estimated construction costs to replace all future likely holding tanks with a publicly owned community cluster MSTS. The remaining 42 properties within the Project would be served by private replacement of ISTS including Type I mounds and Type III or IV systems. Note, the estimated community cluster MSTS construction costs do not include reductions from potential grant funding programs.

The community cluster system includes a grinder pump low pressure sewer collection system and a MSTS consisting of primary and secondary treatment prior to being dispersed to a mound soil dispersal system. See Appendix F for a detailed cost estimate.

Table 5-2: Community Cluster MSTS Opinion of Probable Construction Cost Estimate

New ISTS Type	Number	Estimated Cost per ISTS	Estimated Construction Cost
Type I Mound	11	$30,000	$330,000*
Type III or Type IV	30	$35,000	$1,050,000
Cluster MSTS	61	N/A	$3,957,000
Construction Cost Subtotal			$5,337,000
Contingency			$533,700
Engineering Services (Cluster MSTS)			$594,000
Legal & Administrative (Cluster MSTS)			$40,000
Total Estimated Construction Cost			$6,504,700
Estimated Construction Cost per Connection**			$63,800

* Excludes the $180,000 estimated Type I ISTS mound replacement cost for the Big Kandiyohi Lake County Park West.
**The estimated construction cost per connection for the 61 properties served by the MSTS only (without the 41 ISTS) is $81,750.

Table 5-3 summarizes estimated construction costs for a community cluster LSTS to serve the Project area. Note, these estimated construction costs do not include reductions from potential grant funding programs. The community cluster system includes a grinder pump low pressure sewer collection system and LSTS consisting of primary, secondary, and tertiary treatment prior to being dispersed to a mound soil dispersal system. See Appendix F for a detailed cost estimate.

Table 5-3: Community Cluster LSTS Opinion of Probable Construction Cost Estimate

Collection System	Treatment System*	Contingency	Engineering Services**	Legal & Admin.**	Total Estimated Construction Cost	Estimated Construction Cost per Connection
$4,042,000	$4,132,000	$817,400	$1,218,000	$82,000	$10,291,400	$100,900

*Includes a $60,000 estimated Type I ISTS mound replacement cost for the two far western properties (Parcel IDs: 16-031-0095 and 16-032-0030). Excludes the $180,000 estimated Type I ISTS mound replacement cost for the Big Kandiyohi Lake County Park West.
**Engineering services and legal & administrative fees are for the LSTS only.

5.2 OPERATION, MAINTENANCE, AND REPLACEMENT COSTS

When comparing wastewater treatment alternatives, OM&R costs must be included in the evaluation. Annual OM&R for ISTS vary greatly depending on type. Holding tanks have the highest OM&R costs due to pumping, which can be thousands per year depending upon water usage. Type I and Type III or IV ISTS have much less OM&R costs than holding tanks and have been estimated at approximately $400 and $1,000 per year, respectively. Replacement costs are for short-lived assets such as pumps, blowers, and controls. Each replacement cost is calculated based on the component cost spread over its estimated life.

For purposes of this study, it was assumed that dwellings served by holding tanks would generate one-third of their respective wastewater design flow, and seasonal properties would occupy the dwelling

for 60 days during the summer months. Also, for Alternative 2 and Alternative 3, it was assumed that three-quarters and one-quarter of the established wastewater design flow would be generated from the properties during the summer and winter months, respectively. The winter wastewater flow estimate was chosen because of the low number of year-round dwellings, based on property tax parcel data records.

Table 5-4 provides estimated annual OM&R costs for each alternative without costs associated with the Big Kandiyohi Lake County Park West. For the equal comparison of alternatives, total costs were shared by the remaining 102 connections. Annual OM&R costs for Alternative 1 was the highest due to holding tank pumping costs. Annual OM&R costs for Alternative 2 and Alternative 3 includes costs associated with electricity to operate pumps and blowers, equipment replacement fund, service provider/operator fees, laboratory costs, and others for the community cluster systems.

Table 5-4: Estimated Annual Operation, Maintenance, & Replacement Costs

	Alternative 1: Private ISTS	Alternative 2: Community Cluster MSTS	Alternative 3: Community Cluster LSTS
Total Annual OM&R Costs	$148,620	$76,500	$112,600
Estimated Annual OM&R Costs per Connection	$1,460	$750	$1,105
Estimated Monthly OM&R Costs per Connection	$122	$63	$92

5.3 PRESENT WORTH ANALYSIS

A present worth analysis allows a direct comparison of alternatives by converting future costs into present-day dollar amounts. Future expenditures on capital replacement, operations, and maintenance are converted by using financial calculation formulas, an assumed 20-year timeframe, and a discount rate. The discount rate is generally described as the difference between the available rate of return on an investment and the average inflation rate. A discount rate of 2.2% was utilized in the analysis taken from the United States Office of Management and Budget Discount Rates for Benefit-Cost Analysis OMB Circular No. A-94. After converting future expenditures into a present worth value, these costs are added to estimated capital construction costs and used in alternative comparison.

Annual costs for Alternative 2 and Alternative 3 include OM&R and debt service on loans taken out for design and construction. Capital construction costs, not covered by grant funding, would be paid for by a low-interest loan available through the PFA. Each connection would be responsible for their equal share of the debt service, which would be included in annual property tax statements. If desired, the property owner could pay their share as a lump sum to avoid interest charges.

Table 5-6 summarizes the present worth and financing analysis. For Alternative 2 and Alternative 3, it was assumed the project would obtain an 80% grant from the PFA. The alternatives could pursue funding through the Small Community Wastewater Treatment Program, Point Source Implementation Grant Program, and/or the Water Infrastructure Fund. The remaining costs would be covered by a 20-year, 2.9% loan (current rate per PFA). Grant eligibility is based on affordability, total project construction costs, project priority list (PPL) ranking, funding reserves, median household income, and other factors. Note, it is not certain the project would receive a grant but based on experience, there is opportunity. To equally compare the alternatives, it was assumed private ISTS would be financed by loans of the same length

and interest rate. The total estimated costs are without costs associated with the Big Kandiyohi Lake County Park West. For the equal comparison of alternatives, total costs were shared by the remaining 102 connections

Table 5-5: Present Worth and Financing Analysis

	Alternative 1: Private ISTS	Alternative 2: Community Cluster MSTS	Alternative 3: Community Cluster LSTS
Present Worth Analysis			
Total Estimated Probable Construction Cost	$2,021,250	$6,505,000	$10,292,000
Grant Funding Reduction to Capital Construction Cost	$0	$3,989,600	$8,180,800
Final Total Estimated Probable Construction Cost	$2,021,250	$2,515,400	$2,111,200
Final Total Estimated Probable Construction Cost per Connection	$19,816	$24,661	$20,698
Annual OM&R Present Worth	$2,384,000	$1,228,000	$1,807,000
Total Estimated Present Worth	$4,405,250	$3,743,400	$3,918,200
Financing Analysis			
Estimated Loan Amount	$2,021,250	$2,515,400	$2,111,200
Annual Loan Payment (20-year, 2.9% Interest)	$134,700	$167,600	$140,600
Annual OM&R Costs	$148,620	$76,500	$115,100
Total Estimated Annual Costs (OM&R and Loan Payment)	$283,320	$244,100	$255,700
Estimated Annual Costs per Connection	$2,780	$2,400	$2,510
Estimated Monthly Costs per Connection	$232	$200	$209

6.0 SUMMARY AND RECOMMENDATIONS

The CAR investigation estimated the likely compliance status for existing ISTS in the Project and provides a direct comparison of alternatives for long-term wastewater treatment infrastructure. The following is a summary of findings:

- The majority of existing ISTS (55%) are greater than 20 years old or of unknown age.
- Eighty properties (78%) are likely to have a compliant ISTS.
- Likely future ISTS to serve the properties include 12 Type I (12%), 61 Type II (59%), and 30 Type III or Type IV (29%).
- The alternatives evaluated for long-term wastewater treatment infrastructure include Alternative 1: Private ISTS, Alternative 2: Community Cluster MSTS, and Alternative 3: Community Cluster LSTS.
- Estimated opinion of probable construction costs for the alternatives are:
    - Alternative 1: $2,021,250 ($19,825 per connection)
    - Alternative 2 (before grant funding reduction): $6,505,000 ($63,800 per connection)
    - Alternative 2 (after grant funding reduction): $2,515,400 ($24,660 per connection)
    - Alternative 3 (before grant funding reduction): $10,292,000 ($100,900 per connection)
    - Alternative 3 (after grant funding reduction): $2,111,200 ($20,700 per connection)
- Estimated present worth values for the alternatives are:
    - Alternative 1: $4,405,250
    - Alternative 2: $3,743,400
    - Alternative 3: $3,918,200
- Estimated annual costs per connection including potential grant funding, low-interest loan principal forgiveness, and OM&R costs for the alternatives are:
    - Alternative 1: $2,780 ($232 per month)
    - Alternative 2: $2,400 ($200 per month)
    - Alternative 3: $2,510 ($209 per month)

6.1 RECOMMENDATIONS

This CAR provides information that will assist in making informed decisions on the next steps to take as alternatives are reviewed. It is our recommendation that the following be considered:

- If project stakeholders value the lowest capital cost (without grant funding reduction), existing dwellings should continue using private ISTS. The ISTS should be upgraded, as needed.
- If project stakeholders desire a community solution, then a publicly owned community cluster system should be pursued . Further considerations for this alternative include:
    - Explore construction financing grant opportunities and work with PFA and Stantec for assistance.
    - Explore the creation of a subordinate service district which would allow Kandiyohi County a means to effectively provide and finance wastewater services for the Project.
    - Investigate the opportunity of acquiring land (Parcel ID: 16-034-0010) for the MSTS at the location shown in Figure 6.

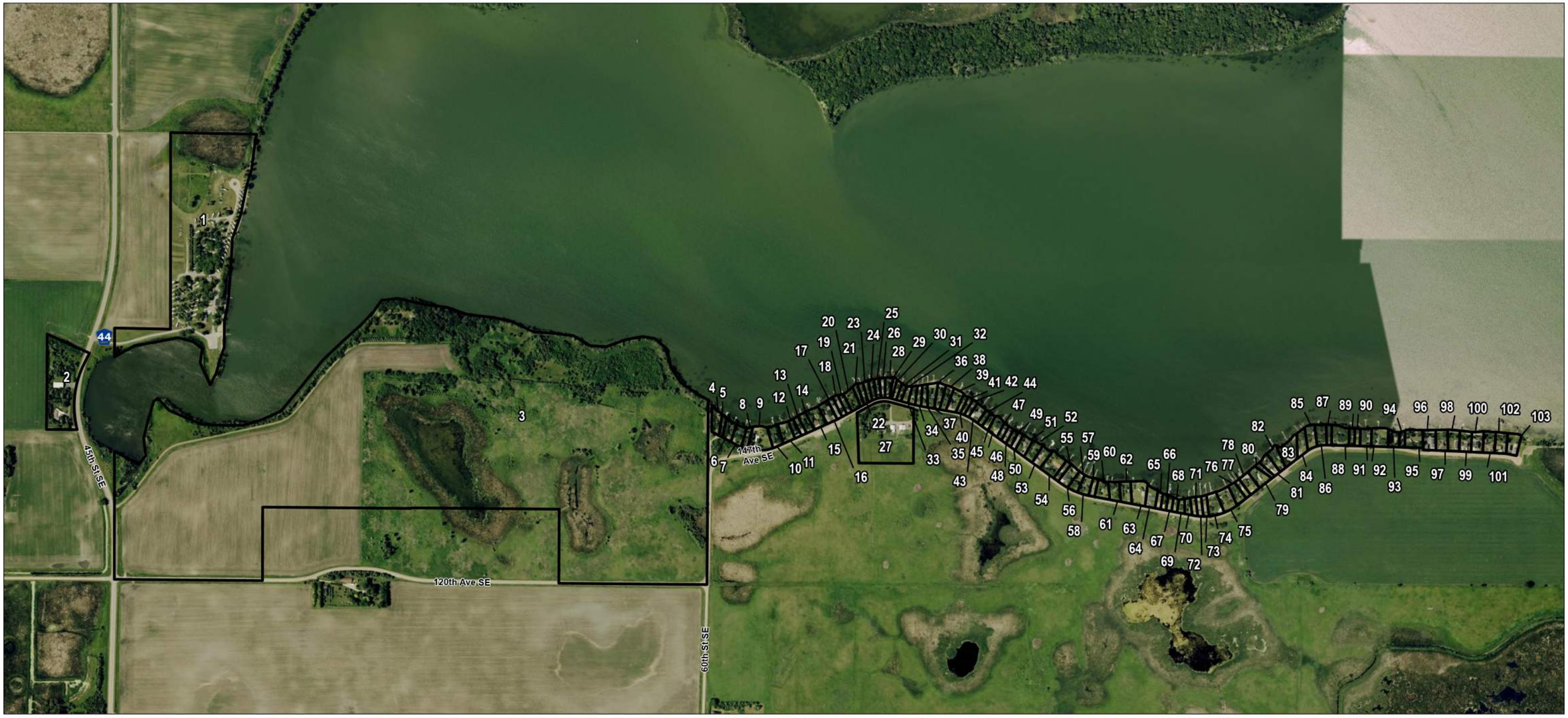
6.2 NEXT STEPS

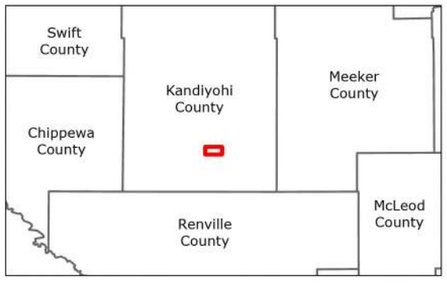
Kandiyohi County will continue to enforce MN Rules Chapter 7080 SSTS regulations and the county ordinance. Noncompliant ISTS will require upgrades and homeowners will be responsible for ensuring their ISTS remain in compliance.

The following actions should be taken by Project stakeholders based on selecting a community solution:

- Determine the desire of property owners within the Project area to pursue a community solution.
- If a community cluster system is desirable, explore construction financing grant opportunities, creation of a subordinate service district, and land acquisition as described in Section 6.1.

FIGURES





Legend

Study Area Parcels

0 450 900 Feet

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N

Stantec

Project Location
Fahlun Twp., Kandiyohi Co., MN

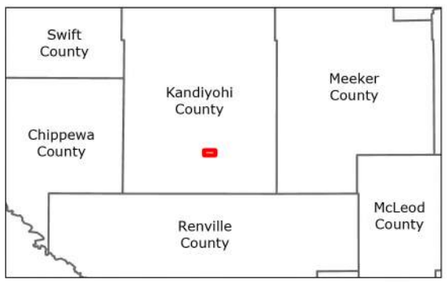
Prepared by ARH on 2026-04-01

Client/Project
227708357
Kandiyohi County, MN
South/Southwest Big Kandiyohi Lake Community
Community Assessment Report

Figure No.
1

Title
Project Area

Notes
1. Coordinate System: NAD 1983 HARN Adj MN Kandiyohi Feet
2. Data Sources: Kandiyohi Co., Stantec, USDA
3. Background: 2023 USDA NAIP Imagery



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1. Coordinate System: NAD 1983 HARN Adj MN Kandiyohi Feet
2. Data Sources: Kandiyohi Co., Stantec, UMN CWI, USDA
3. Background: 2023 USDA NAIP Imagery

Legend
- Study Area Parcels
- FEMA 1% Annual Floodplain
- Deep Well 50 ft Setback Buffer
- Shallow Well 100 ft Setback Buffer
- Deep Well*
- Shallow Well*
- County Well Index - Verified Well Location

*Water supply wells only located on parcels that granted permission to access the property

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N

Stantec

Project Location
Fahlun Twp., Kandiyohi Co., MN

Prepared by ARH on 2026-04-01

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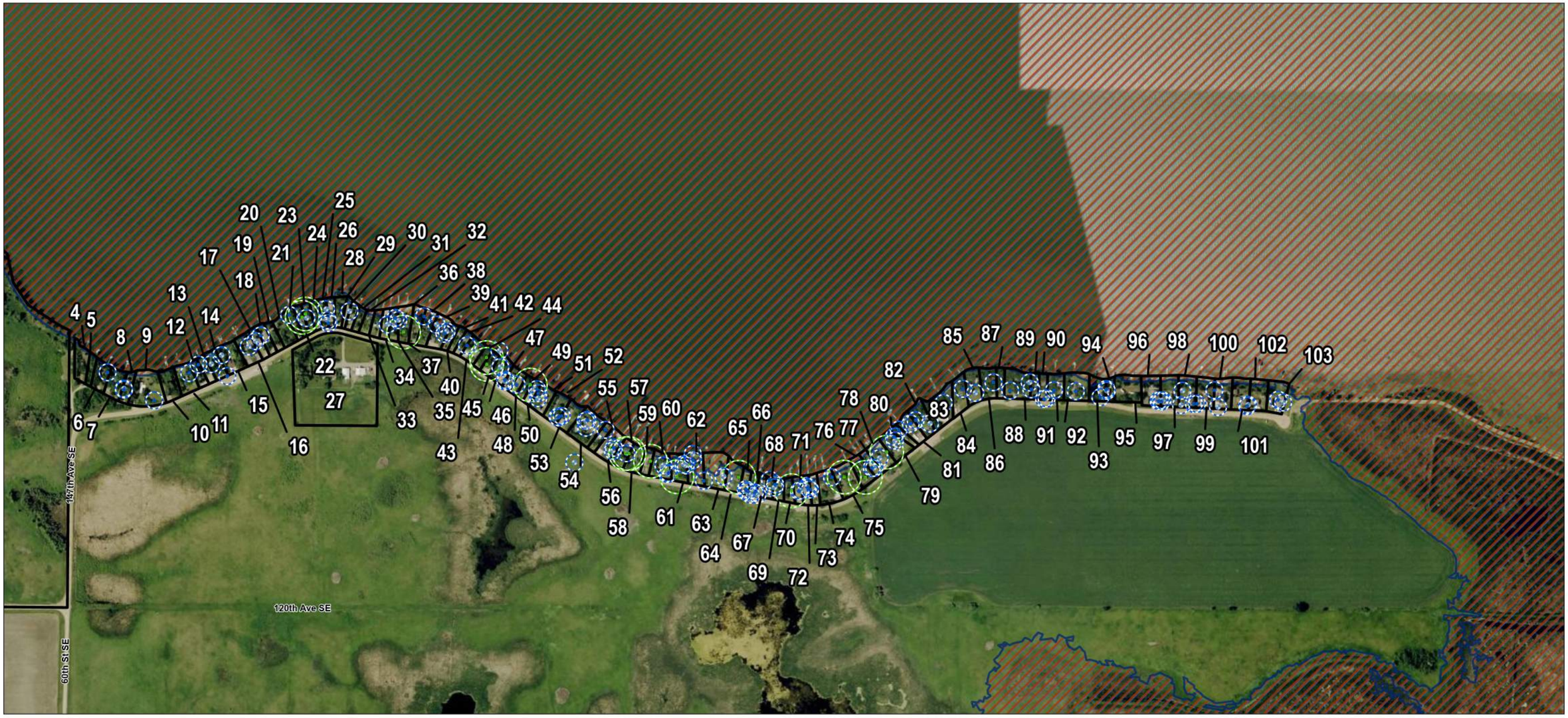
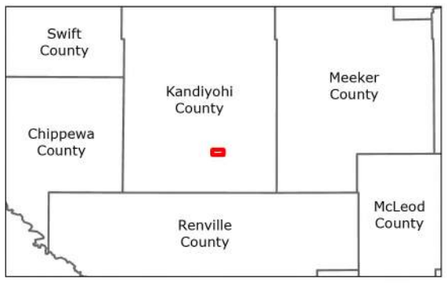
Kandiyohi County, MN
South/Southwest Big Kandiyohi Lake Community
Community Assessment Report

Figure No.
2A

Title
Water Supply Well Locations





Notes
1. Coordinate System: NAD 1983 HARN Adj MN Kandiyohi Feet
2. Data Sources: Kandiyohi Co., Stantec, UMN CWI, USDA
3. Background: 2023 USDA NAIP Imagery

Legend

- Study Area Parcels
- FEMA 1% Annual Floodplain
- Deep Well 50 ft Setback Buffer
- Shallow Well 100 ft Setback Buffer
- Deep Well*
- Shallow Well*
- County Well Index - Verified Well Location

*Water supply wells only located on parcels that granted permission to access the property

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(At original document size of 11x17)
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Stantec

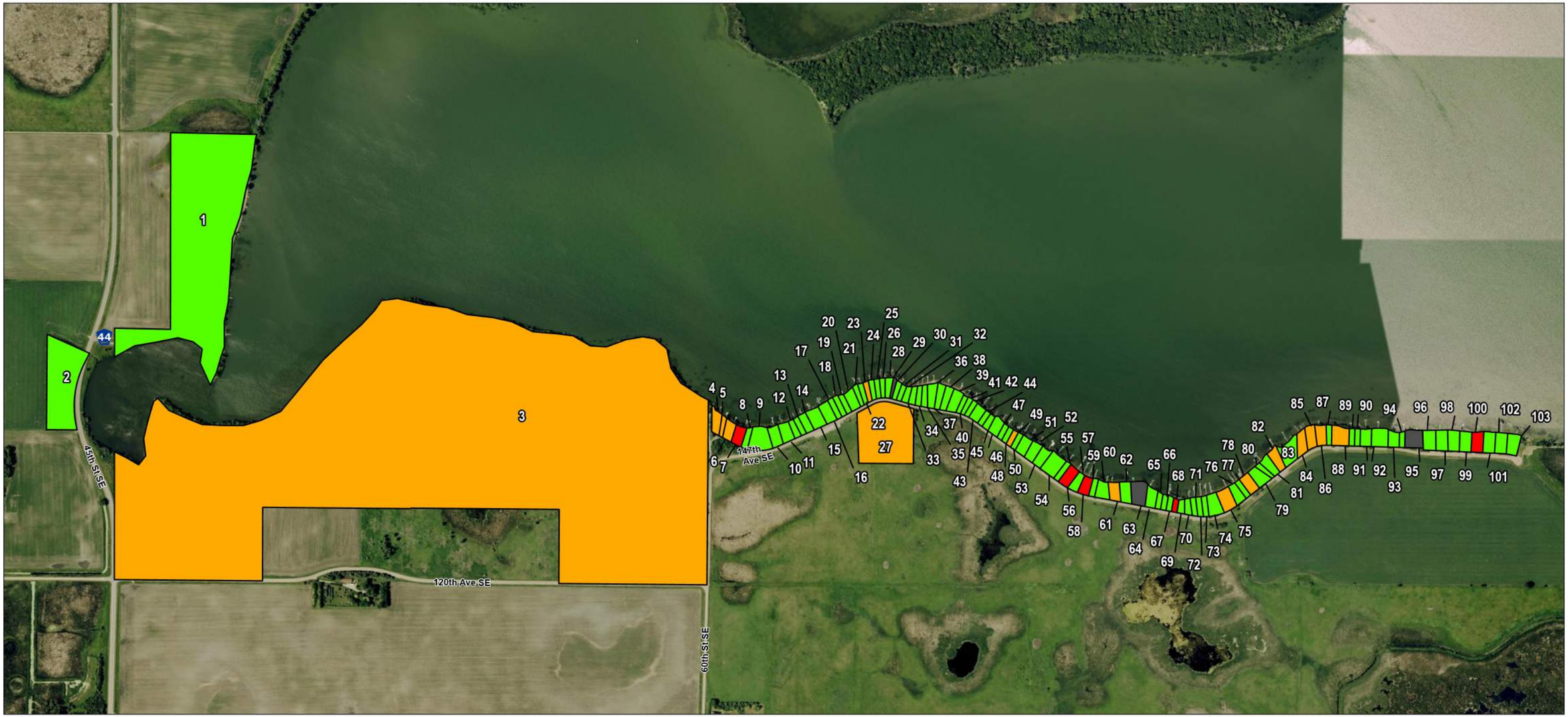
Project Location
Fahlun Twp., Kandiyohi Co., MN

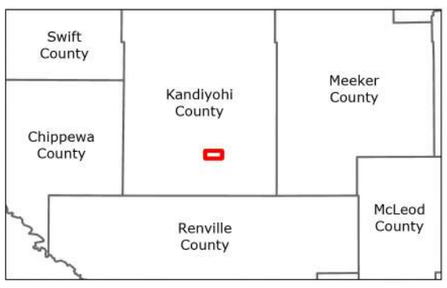
Prepared by ARH on 2026-04-01

Client/Project 227708357
Kandiyohi County, MN
South/Southwest Big Kandiyohi Lake Community
Community Assessment Report

Figure No.
2B

Title
Water Supply Well Locations





Legend

- Study Area Parcels

Likely ISTS Compliance Status

- No System
- Compliant
- Failure to Protect Groundwater (FTPG)
- Imminent Threat to Public Health or Safety (ITPHS)

0 450 900 Feet
(At original document size of 11x17)
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N

Notes

1. Coordinate System: NAD 1983 HARN Adj MN Kandiyohi Feet
2. Data Sources: Kandiyohi Co., Stantec, USDA
3. Background: 2023 USDA NAIP Imagery

Stantec

Project Location
Fahlun Twp., Kandiyohi Co., MN

Prepared by ARH on 2026-04-01

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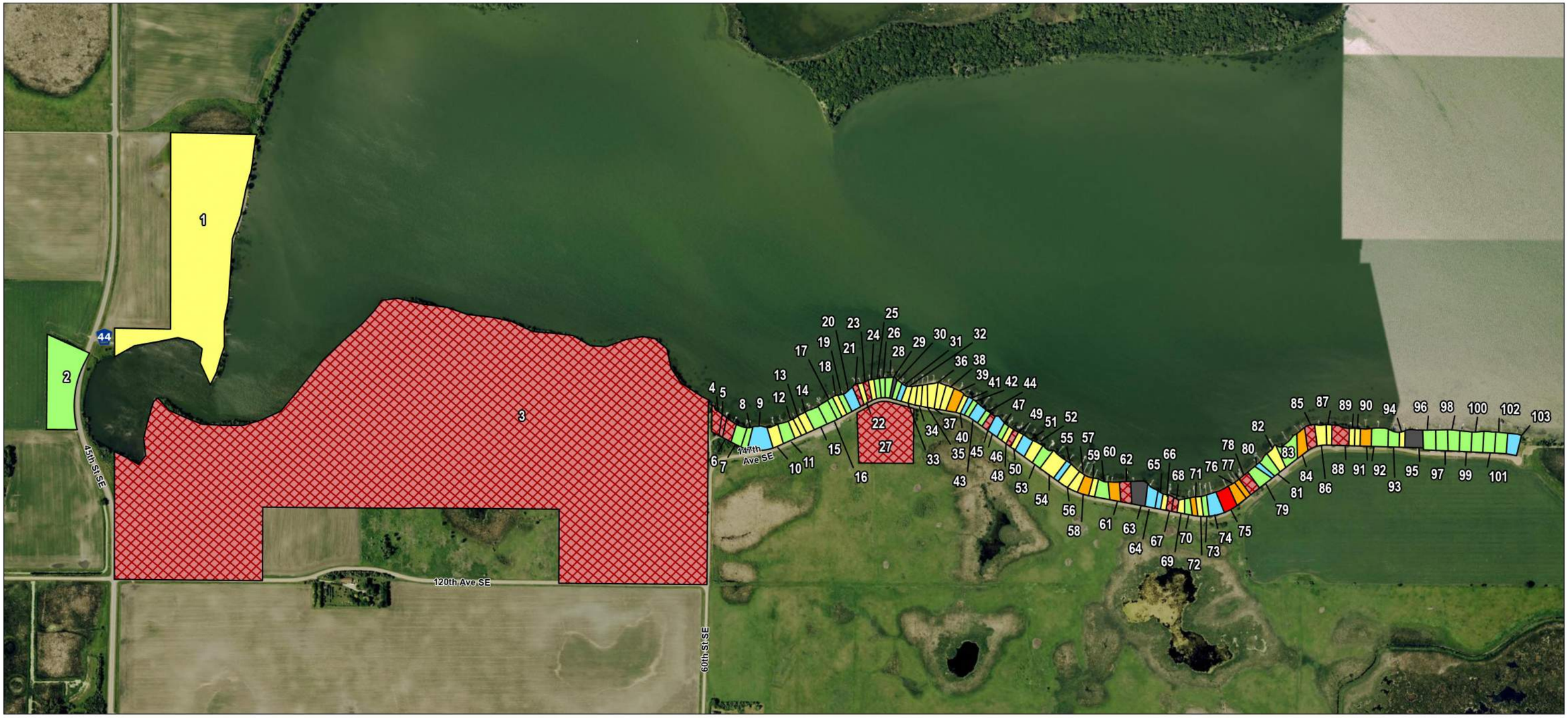
Kandiyohi County, MN
South/Southwest Big Kandiyohi Lake Community
Community Assessment Report

227708357

Figure No.
3

Title
Likely ISTS Compliance Status



Legend

- Study Area Parcels

SSTS Age

- Unknown
- <10 Years
- 10-19 Years
- 20-29 Years
- 30-39 Years
- 40+ Years
- No System

Notes

1. Coordinate System: NAD 1983 HARN Adj MN Kandiyohi Feet
2. Data Sources: Kandiyohi Co., Stantec, USDA
3. Background: 2023 USDA NAIP Imagery

0 450 900 Feet

(At original document size of 11x17)
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Project Location
Fahlun Twp., Kandiyohi Co., MN

Prepared by ARH on 2026-04-01

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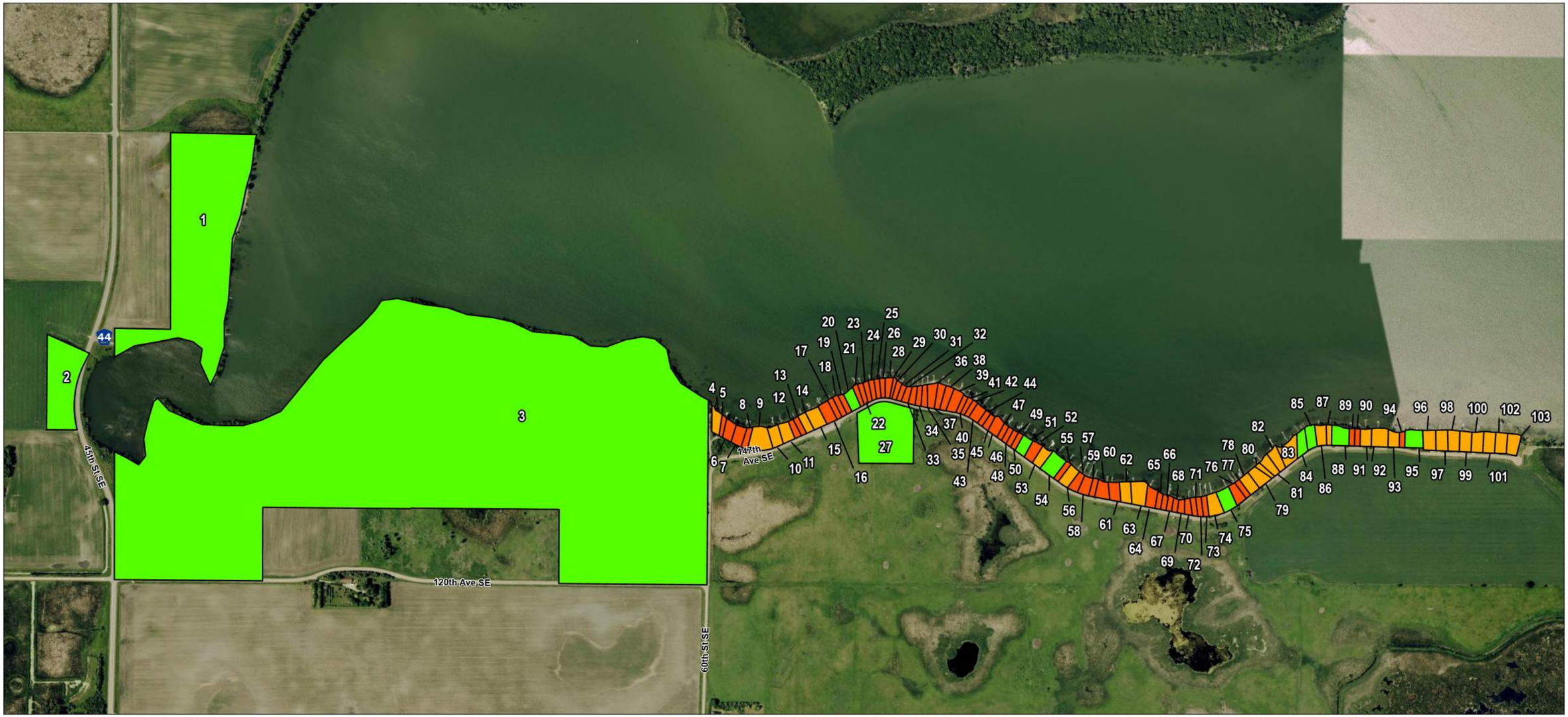
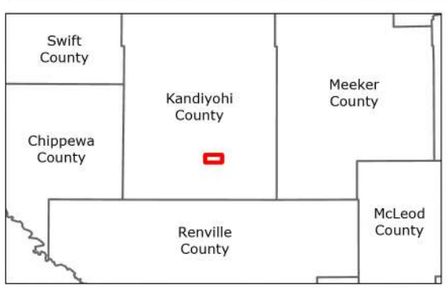
Kandiyohi County, MN
South/Southwest Big Kandiyohi Lake Community Community Assessment Report

227708357

Figure No.
4

Title
ISTS Age (as of 2026)





Legend

- Study Area Parcels

Likely Future ISTS

- Type I
- Type II
- Type III/IV

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(At original document size of 11x17)
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Stantec

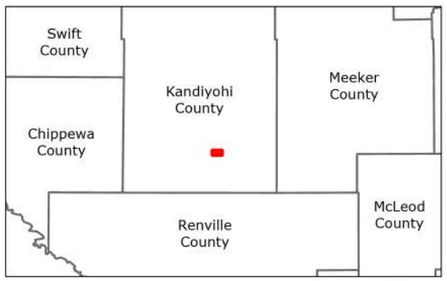
Project Location Prepared by ARH on 2026-04-01
Fahlun Twp., Kandiyohi Co., MN

Client/Project 227708357
Kandiyohi County, MN
South/Southwest Big Kandiyohi Lake Community Community Assessment Report

Figure No.
5

Title
Likely Future ISTS for All Properties

Notes
1. Coordinate System: NAD 1983 HARN Adj MN Kandiyohi Feet
2. Data Sources: Kandiyohi Co., Stantec, USDA
3. Background: 2023 USDA NAIP Imagery



Legend

- Study Area Parcels
- Wastewater Treatment Site
- Parcel Connected to MSTS
- Collection System Pressure Sewer Force Main

0 250 500 Feet
(At original document size of 11x17)
1:6,000

N

Notes
1. Coordinate System: NAD 1983 HARN Adj MN Kandiyohi Feet
2. Data Sources: Kandiyohi Co., Stantec, USDA
3. Background: 2023 USDA NAIP Imagery

Stantec

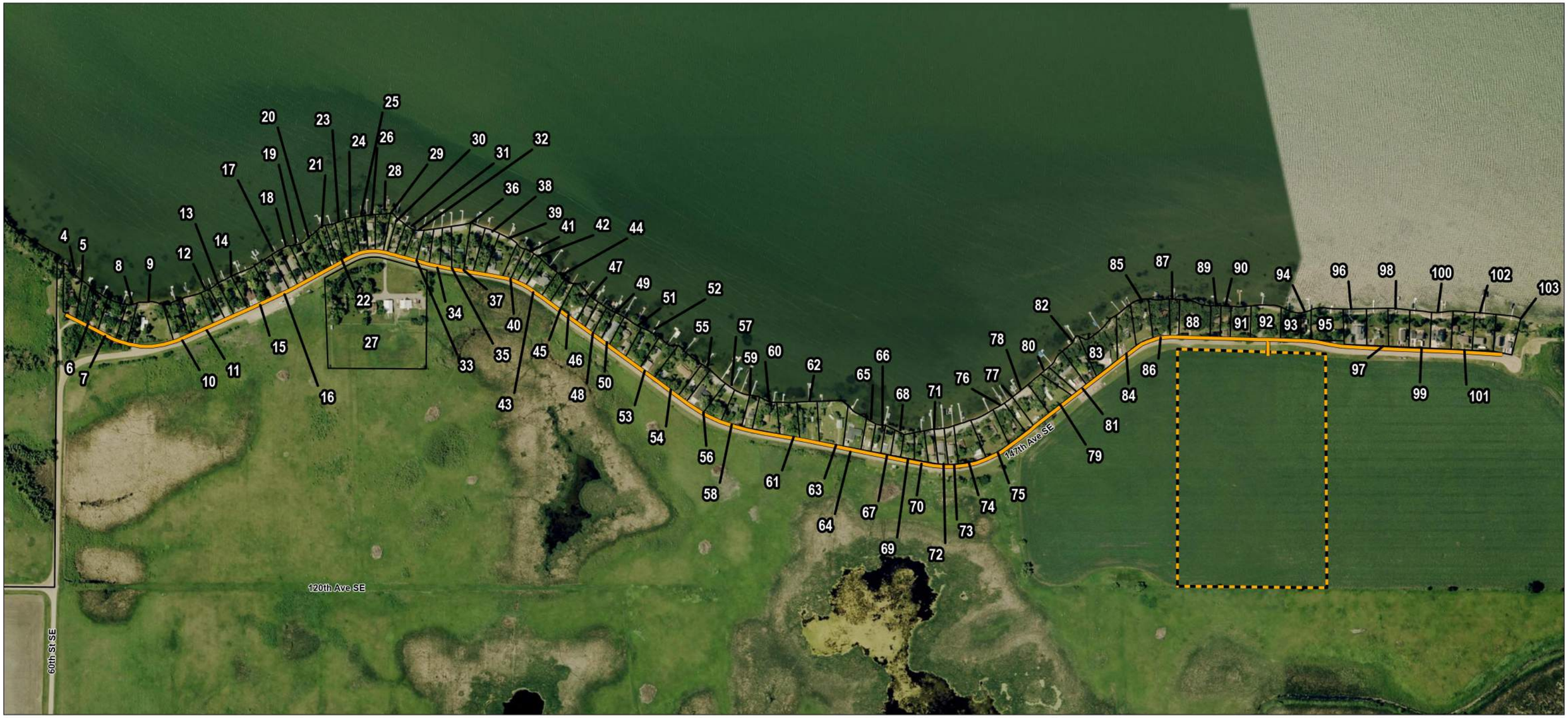
Project Location
Fahlun Twp., Kandiyohi Co., MN

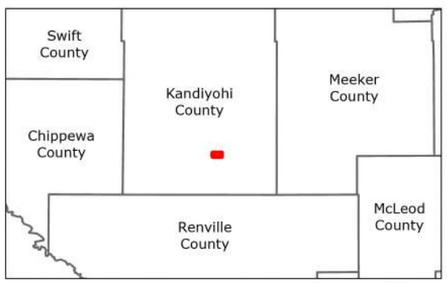
Prepared by ARH on 2026-04-01

Client/Project 227708357
Kandiyohi County, MN
South/Southwest Big Kandiyohi Lake Community
Community Assessment Report

Figure No.
6

Title
Community Cluster MSTS Concept





Legend

- Study Area Parcels
- Wastewater Treatment Site
- Collection System Pressure Sewer Force Main

0 250 500 Feet
(At original document size of 11x17)
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N

Notes
1. Coordinate System: NAD 1983 HARN Adj MN Kandiyohi Feet
2. Data Sources: Kandiyohi Co., Stantec, USDA
3. Background: 2023 USDA NAIP Imagery

Stantec

Project Location
Fahlun Twp., Kandiyohi Co., MN

Prepared by ARH on 2026-04-01

Client/Project 227708357
Kandiyohi County, MN
South/Southwest Big Kandiyohi Lake Community
Community Assessment Report

Figure No.
7

Title
Community Cluster LSTS Concept

APPENDIX A

Parcel Data Spreadsheet

South/Southwest Big Kandiyohi Lake Community Assessment Report

Parcel Data Spreadsheet

				ISTS Information								Compliance Information					Likely Future ISTS				
												Likely Compliance status									
														Noncompliant							
CAR MAP ID#	Parcel ID	Address	Property Type: Commercial, Residential, or Other (No Dwelling or Vacant)	County Permit on File	Property Use	Year Installed	ISTS Age as of 2026	System Type	Number of Bedrooms*	MPCA Dwelling Classification	Estimated Design Flow	Compliant (X if Yes)	Certificate of Compliance Date	ITPHS (X if Yes)	Failure to Protect Groundwater (X if Yes)	VS = lack of vertical separation SD = surface discharge CP/DW = cesspool/drywell SA = safety threat (type of threat)	Type 1 (Standard Type & Size)	Type 2 (Holding Tank)	Type 3 or 4 (Poor Soils, Undersized, or Rip & Replace)	Estimated New ISTS Replacement Cost	Estimated Annual Operation, Maintenance, & Replacement Costs
1	16-032-0060	14391 45th Street	Commercial	Yes	Seasonal	1998	28	Mound	N/A	N/A	3,600	X					X			$180,000	$2,500
2	16-031-0095	14608 45th Street	Residential	No	Year-Round	2010	16	Mound	4	I	600	X					X			$30,000	$400
3	16-032-0030	14801 45th Street	Residential	No	Seasonal	Unknown	Unknown	CP/DW	2	II	225				X	CP/DW	X			$30,000	$400
4	16-450-0910	6022 147th Avenue	Residential	No	Seasonal	Unknown	Unknown	At-grade	2	II	225		2017		X	VS			X	$35,000	$1,000
5	16-450-0900	6044 147th Avenue	Residential	No	Seasonal	Unknown	Unknown	CP/DW	1	II	225				X	CP/DW		X		$7,500	$900
6	16-450-0890	6064 147th Avenue	Residential	No	Seasonal	Unknown	Unknown	CP/DW	2	II	225				X	CP/DW		X		$7,500	$900
7	16-450-0870	6104 147th Avenue	Residential	Yes	Seasonal	2011	15	Holding Tank	3	II	300			X		SD (Outdoor Shower)		X		$7,500	$1,190
8	16-450-0860	6124 147th Avenue	Residential	Yes	Seasonal	2011	15	Holding Tank	3	II	300	X						X		$7,500	$1,190
9	16-450-0840	6144 147th Avenue	Residential	No	Seasonal	2019	7	Mound	3	I	450	X	2025						X	$35,000	$1,000
10	16-450-0820	6164 147th Avenue	Residential	No	Year-Round	1999	27	Mound	2	II	225	X							X	$35,000	$1,000
11	16-450-0810	6184 147th Avenue	Residential	Yes	Seasonal	2015	11	Mound	3	I	450	X							X	$35,000	$1,000
12	16-450-0800	6204 147th Avenue	Residential	No	Seasonal	1997	29	Holding Tank	3	II	300	X	2025					X		$7,500	$1,190
13	16-450-0790	6224 147th Avenue	Residential	Yes	Seasonal	1998	28	Holding Tank	2	II	225	X						X		$7,500	$900
14	16-450-0780	6244 147th Avenue	Residential	No	Seasonal	2002	24	Mound	2	II	225	X							X	$35,000	$1,000
15	16-450-0760	6282 147th Avenue	Residential	No	Year-Round	2009	17	Pressure Bed	4	I	600	X	2015						X	$35,000	$1,000

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Parcel Data Spreadsheet

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16	16-450-0750	6302 147th Avenue	Residential	No	Year-Round	2014	12	Mound	3	II	300	X	2020					X		$7,500	$7,230
17	16-450-0730	6342 147th Avenue	Residential	No	Year-Round	2011	15	Holding Tank	2	II	225	X						X		$7,500	$5,430
18	16-450-0720	6364 147th Avenue	Residential	Yes	Year-Round	2005	21	Holding Tank	2	II	225	X						X		$7,500	$5,430
19	16-450-0710	6380 147th Avenue	Residential	Yes	Seasonal	2009	17	Holding Tank	3	II	300	X	2019					X		$7,500	$1,190
20	16-450-0700	6400 147th Avenue	Residential	No	Seasonal	2021	5	Mound	2	I	300	X					X			$30,000	$400
21	16-450-0690	6420 147th Avenue	Residential	No	Seasonal	Unknown	Unknown	Holding Tank	2	II	225	X						X		$7,500	$900
22	16-450-0680	6444 147th Avenue	Residential	Yes	Seasonal	2005	21	Holding Tank	2	II	225	X						X		$7,500	$900
23	16-450-0675	6460 147th Avenue	Residential	No	Seasonal	Unknown	Unknown	CP/DW	1	II	225				X	CP/DW		X		$7,500	$900
24	16-450-0670	6482 147th Avenue	Residential	No	Seasonal	2005	21	Holding Tank	2	II	225	X	2021					X		$7,500	$900
25	16-450-0660	6502 147th Avenue	Residential	No	Year-Round	2008	18	Holding Tank	3	II	300	X	2020					X		$7,500	$7,230
26	16-450-0650	6522 147th Avenue	Residential	No	Seasonal	2016	10	Holding Tank	2	II	225	X						X		$7,500	$900
27	16-033-0012	6531 147th Avenue	Residential	No	Year-Round	Unknown	Unknown	CP/DW	2	II	225				X	CP/DW	X			$30,000	$400
28	16-450-0640	6526 147th Avenue	Residential	No	Seasonal	2009	17	Holding Tank	3	II	300	X						X		$7,500	$1,190
29	16-450-0630	6530 147th Avenue	Residential	No	Seasonal	N/A	N/A	No System	1	III	180							X		$7,500	$720
30	16-450-0620	6580 147th Avenue	Residential	Yes	Seasonal	2012	14	Holding Tank	3	II	300	X						X		$7,500	$1,190

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31	16-450-0610	6598 147th Avenue	Residential	No	Seasonal	2018	8	Holding Tank	1	I	300	X						X		$7,500	$1,190
32	16-450-0600	6618 147th Avenue	Residential	No	Seasonal	2003	23	Holding Tank	2	II	225	X						X		$7,500	$900
33	16-450-0590	6640 147th Avenue	Residential	Yes	Seasonal	2003	23	Holding Tank	3	II	300	X	2024					X		$7,500	$1,190
34	16-450-0580	6660 147th Avenue	Residential	No	Seasonal	2003	23	Holding Tank	2	II	225	X						X		$7,500	$900
35	16-450-0570	6680 147th Avenue	Residential	Yes	Seasonal	2002	24	Holding Tank	2	II	225	X						X		$7,500	$900
36	16-450-0560	6700 147th Avenue	Residential	Yes	Seasonal	2004	22	Holding Tank	3	II	300	X						X		$7,500	$1,190
37	16-450-0550	6720 147th Avenue	Residential	No	Seasonal	1997	29	Holding Tank	2	II	225	X	2017					X		$7,500	$900
38	16-450-0540	6740 147th Avenue	Residential	No	Seasonal	2000	26	Holding Tank	2	II	225	X	2014					X		$7,500	$900
39	16-450-0530	6760 147th Avenue	Residential	Yes	Seasonal	1994	32	Holding Tank	3	II	300	X	2015					X		$7,500	$1,190
40	16-450-0510	6780 147th Avenue	Residential	No	Seasonal	2001	25	Holding Tank	2	II	225	X						X		$7,500	$900
41	16-450-0500	6800 147th Avenue	Residential	No	Seasonal	2017	9	Holding Tank	2	II	225	X						X		$7,500	$900
42	16-450-0490	6820 147th Avenue	Residential	No	Seasonal	2007	19	Holding Tank	3	II	300	X						X		$7,500	$1,190
43	16-450-0480	6842 147th Avenue	Residential	Yes	Year-Round	2020	6	Holding Tank	2	II	225	X						X		$7,500	$5,430
44	16-450-0470	6862 147th Avenue	Residential	Yes	Seasonal	2014	12	Holding Tank	2	II	225	X	2022					X		$7,500	$900
45	16-450-0465	6882 147th Avenue	Residential	No	Seasonal	Unknown	Unknown	Holding Tank	2	II	225	X	2017					X		$7,500	$900

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46	16-450-0460 & 16-450-0450	6904 147th Avenue	Residential	No	Seasonal	2020	6	Holding Tank	2	I	300	X	2015					X		$7,500	$1,190
47	16-450-0440	6942 147th Avenue	Residential	No	Seasonal	2008	18	Holding Tank	3	II	300	X						X		$7,500	$1,190
48	16-450-0430	6962 147th Avenue	Residential	Yes	Year-Round	2006	20	Holding Tank	3	I	450	X						X		$7,500	$10,850
49	16-450-0420	6980 147th Avenue	Residential	No	Seasonal	Unknown	Unknown	CP/DW	3	II	300				X	CP/DW		X		$7,500	$1,190
50	16-450-0410	6998 147th Avenue	Residential	Yes	Seasonal	1997	29	Mound	2	III	180	X	2015					X		$7,500	$720
51	16-450-0390	7030 147th Avenue	Residential	No	Seasonal	2020	6	Holding Tank	3	II	300	X	2025				X			$30,000	$400
52	16-450-0370	7040 147th Avenue	Residential	No	Seasonal	1997	29	Mound	3	III	218	X	2022					X		$7,500	$870
53	16-450-0350	7070 147th Avenue	Residential	Yes	Seasonal	2011	15	Mound	2	I	300	X	2021						X	$35,000	$1,000
54	16-450-0340	7080 147th Avenue	Residential	No	Seasonal	2005	21	Mound	2	I	300	X	2020				X			$30,000	$400
55	16-450-0330	7100 147th Avenue	Residential	No	Seasonal	2022	4	Holding Tank	3	II	300	X						X		$7,500	$1,190
56	16-450-0320	7120 147th Avenue	Residential	Yes	Year-Round	2002	24	Holding Tank	2	I	300		2021	X		SD (Outdoor Shower)			X	$35,000	$1,000
57	16-450-0310	7140 147th Avenue	Residential	Yes	Seasonal	2001	25	Holding Tank	3	I	450	X						X		$7,500	$1,790
58	16-450-0300	7160 147th Avenue	Residential	Yes	Seasonal	1995	31	Holding Tank	3	II	300			X		SA (Cracked Tank)		X		$7,500	$1,190
59	16-450-0290	7180 147th Avenue	Residential	Yes	Seasonal	1999	27	Holding Tank	2	II	225	X	2015					X		$7,500	$900
60	16-450-0280	7200 147th Avenue	Residential	Yes	Seasonal	2010	16	Holding Tank	4	II	375	X	2022					X		$7,500	$1,490

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61	16-450-0260	7232 147th Avenue	Residential	No	Seasonal	1994	32	Trenches	3	II	300				X	VS		X		$7,500	$1,190
62	16-450-0255	7240 147th Avenue	Residential	No	Seasonal	Unknown	Unknown	Mound	2	I	300	X							X	$35,000	$1,000
63	16-450-0240	7280 147th Avenue	Residential	No	Seasonal	N/A	N/A	No System	3	I	450								X	$35,000	$1,000
64	16-450-0210	7308 147th Avenue	Residential	Yes	Seasonal	2023	3	Holding Tank	3	II	300	X						X		$7,500	$1,190
65	16-450-0200	7328 147th Avenue	Residential	Yes	Seasonal	2017	9	Holding Tank	2	II	225	X						X		$7,500	$900
66	16-450-0190	7340 147th Avenue	Residential	No	Seasonal	2000	26	Holding Tank	4	II	375	X	2005					X		$7,500	$1,490
67	16-450-0180	7360 147th Avenue	Residential	Yes	Seasonal	Unknown	Unknown	Holding Tank	3	II	300	X	2016					X		$7,500	$1,190
68	16-450-0170	7380 147th Avenue	Residential	Yes	Seasonal	Unknown	Unknown	Mound	3	II	300		2006	X		SD (Outdoor Sink) SA (Unsafe Tank Lid)		X		$7,500	$1,190
69	16-450-0160	7400 147th Avenue	Residential	Yes	Seasonal	1999	27	Holding Tank	3	II	300	X	2023					X		$7,500	$1,190
70	16-450-0150	7420 147th Avenue	Residential	Yes	Seasonal	2010	16	Holding Tank	2	II	225	X	2021					X		$7,500	$900
71	16-450-0140	7540 147th Avenue	Residential	Yes	Year-Round	1996	30	Holding Tank	2	II	225	X	2021					X		$7,500	$5,430
72	16-450-0130	7560 147th Avenue	Residential	No	Year-Round	2006	20	Holding Tank	3	I	450	X	2021					X		$7,500	$10,850
73	16-450-0125	7580 147th Avenue	Residential	Yes	Seasonal	2011	15	Holding Tank	3	II	300	X						X		$7,500	$1,190
74	16-450-0110	7600 147th Avenue	Residential	No	Seasonal	2023	3	Holding Tank	3	I	450	X							X	$35,000	$1,000
75	16-450-0090	7630 147th Avenue	Residential	No	Seasonal	1975	51	Trenches	2	II	225		1998		X	VS	X			$30,000	$400

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76	16-450-0080	7640 147th Avenue	Residential	Yes	Seasonal	1991	35	Holding Tank	3	II	300	X						X		$7,500	$1,190
77	16-450-0070	7660 147th Avenue	Residential	No	Seasonal	1994	32	Holding Tank	2	II	225	X	2021					X		$7,500	$900
78	16-450-0060	7680 147th Avenue	Residential	Yes	Seasonal	Unknown	Unknown	Trenches	3	II	300				X	VS			X	$35,000	$1,000
79	16-450-0050	7700 147th Avenue	Residential	Yes	Seasonal	2008	18	Holding Tank	3	II	300	X	2006						X	$35,000	$1,000
80	16-450-0040	7720 147th Avenue	Residential	Yes	Seasonal	2021	5	Holding Tank	3	II	300	X	2020						X	$35,000	$1,000
81	16-450-0030	7740 147th Avenue	Residential	No	Seasonal	2009	17	Holding Tank	3	II	300	X							X	$35,000	$1,000
82	16-450-0020	7760 147th Avenue	Residential	No	Year-Round	2004	22	Pressure Bed	3	I	450		2021		X	VS			X	$35,000	$1,000
83	16-450-0010	7770 147th Avenue	Residential	Yes	Seasonal	2007	19	Mound	2	I	300	X	2014						X	$35,000	$1,000
84	16-600-0230	7810 147th Avenue	Residential	No	Seasonal	1991	35	Trenches	2	II	225				X	VS	X			$30,000	$400
85	16-600-0200	7828 147th Avenue	Residential	No	Seasonal	Unknown	Unknown	CP/DW	1	III	180				X	CP/DW	X			$30,000	$400
86	16-600-0180	7852 147th Avenue	Residential	Yes	Seasonal	1999	27	Trenches	2	I	300				X	VS			X	$35,000	$1,000
87	16-600-0170	7858 147th Avenue	Residential	No	Seasonal	2002	24	Mound	2	I	300	X	2022						X	$35,000	$1,000
88	16-600-0140	7868 147th Avenue	Residential	No	Seasonal	Unknown	Unknown	CP/DW	2	II	225				X	CP/DW	X			$30,000	$400
89	16-600-0130	7878 147th Avenue	Residential	Yes	Seasonal	2005	21	Holding Tank	2	II	225	X						X		$7,500	$900
90	16-600-0120	7888 147th Avenue	Residential	No	Seasonal	1998	28	Holding Tank	3	II	300	X	2020					X		$7,500	$1,190

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91	16-600-0100	7898 147th Avenue	Residential	No	Seasonal	1996	30	Mound	3	II	300	X	2024						X	$35,000	$1,000
92	16-600-0090	7902 147th Avenue	Residential	No	Seasonal	2009	17	Mound	3	I	450	X							X	$35,000	$1,000
93	16-600-0050	7918 147th Avenue	Residential	No	Seasonal	2012	14	Holding Tank	3	II	300	X							X	$35,000	$1,000
94	16-600-0040	7930 147th Avenue	Residential	Yes	Seasonal	2004	22	Holding Tank	2	II	225	X	2019					X		$7,500	$900
95	16-600-0010	7942 147th Avenue	Residential	No	Seasonal	N/A	N/A	No System	3	I	450						X			$30,000	$400
96	16-700-0010	7964 147th Avenue	Residential	Yes	Year-Round	2013	13	Mound	4	I	600	X	2021						X	$35,000	$1,000
97	16-700-0020	7982 147th Avenue	Residential	Yes	Seasonal	2010	16	Mound	2	I	300	X							X	$35,000	$1,000
98	16-700-0030	7998 147th Avenue	Residential	Yes	Year-Round	2012	14	Mound	2	I	300	X	2022						X	$35,000	$1,000
99	16-700-0040	8010 147th Avenue	Residential	No	Seasonal	2013	13	Mound	3	I	450	X	2024						X	$35,000	$1,000
100	16-700-0050	8026 147th Avenue	Residential	Yes	Year-Round	2014	12	Mound	3	I	450		2023	X		SD (Outdoor Shower)			X	$35,000	$1,000
101	16-700-0060	8042 147th Avenue	Residential	No	Seasonal	2012	14	Mound	3	I	450	X							X	$35,000	$1,000
102	16-700-0070	8054 147th Avenue	Residential	No	Seasonal	2012	14	Mound	3	I	450	X							X	$35,000	$1,000
103	16-700-0080	8068 147th Avenue	Residential	No	Year-Round	2017	9	Mound	2	I	300	X							X	$35,000	$1,000

* If there was no permit or homeowner survey, bedroom count was based off dwelling size and comparing to neighboring structures.

APPENDIX B

ISTS Information

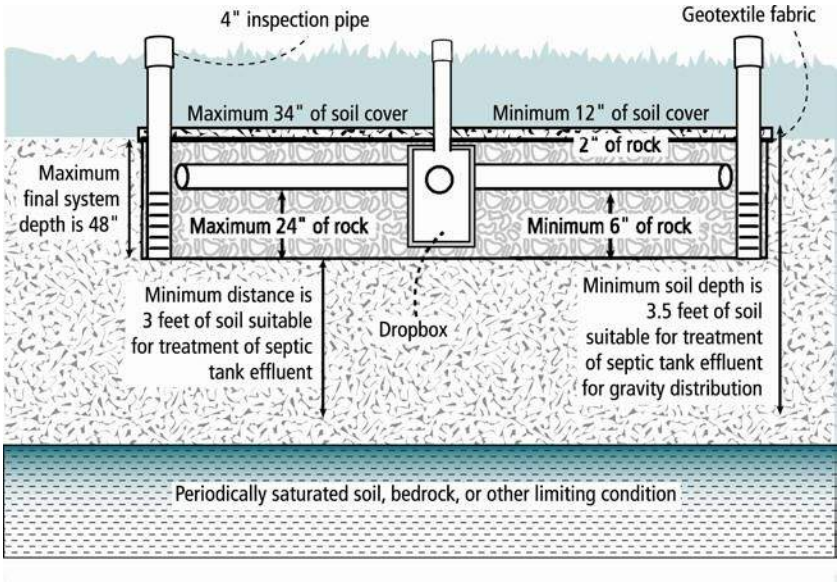
Below-Grade Systems

Below-grade systems are constructed in original soil with distribution of effluent occurring below the soil surface. With below grade systems the soil treatment area is designed and installed such that the infiltrative surface is below the original ground elevation and a final cover of topsoil stabilizes the completed installation, supports vegetative growth, and sheds runoff. It is the underlying soil that treats the many harmful components in the effluent before it reaches surface or ground waters. The two types of below-grade soil treatment systems commonly used are trenches and seepage beds.

Trenches have better oxygen transfer then beds and are recommended whenever the site conditions allow although seepage beds are often more attractive due to reduced land area requirements. In addition, the cost and time of construction, trenches are preferred because they have greater infiltrative surface for the same bottom area, and less damage typically occurs to the infiltrative surface during construction (Otis et al, 1977).

The figure below shows minimum depths and separation requirements for trenches or seepage beds. For systems without pretreatment, at least three feet of soil suitable for treatment should be located below the bottom of the distribution media. The minimum depth of distribution media is six inches, followed by a minimum soil cover of twelve inches, so that the total distance from the periodically saturated or other limiting condition to the final grade is approximately 4.5 feet. Note that this total could be made up of 3.5 feet of original soil and one foot of soil (7080.2150, Subp. 3) over the distribution media of the system.

Figure 1 - Trench and Bed Depth



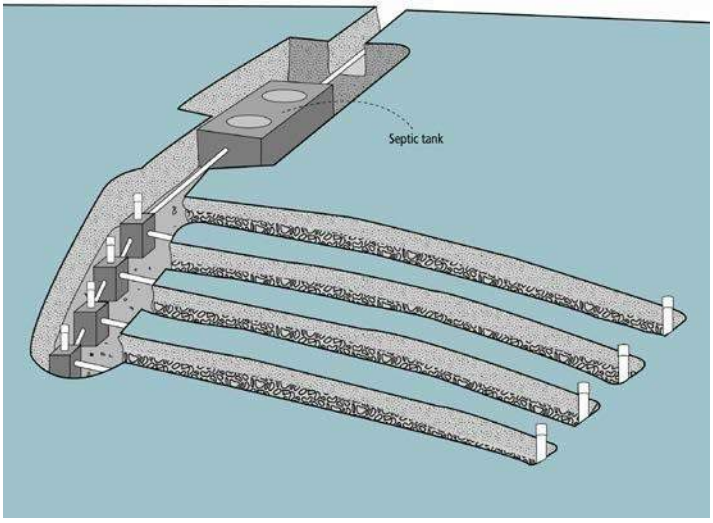
From MN Rules 7080.2260 Subp. 3. If the distribution media in a trench or a bed is in contact with soil texture group 2 through 4 (medium sand, fine sand, coarse and medium loamy sand) pressure distribution must be used.

Below-Grade Systems: Specifications

Trenches

The trench is the most common of the soil treatment systems. **According to MN Rules Chapter 7080.1100, Subp. 89 a trench is defined as a soil treatment and dispersal system, the absorption width of which is 36 inches or less.** Trenches are narrower than they are wide, no wider than three feet, and are laid out along the contours of the soil. A typical trench is constructed by making a level excavation 18 to 36 inches wide.The method of distributing the septic tank effluent can be either pressure or gravity. There are a number of different configurations by which the trenches can be connected with each other and with the septic tank: parallel, serial, and continual. A typical trench is constructed by making a level excavation 18 to 36 inches wide. A typical layout for a trench system is shown in Figure 2.

Figure 2 - Typical Trench Layout



The soil around and beneath the trench must be neither too coarse nor too fine. A coarse soil may not adequately filter pathogens, and a fine soil may be too tight to allow water to pass through. Soils with percolation rates between 0.1 and 60 mpi or soils with a listed loading rate on Table IX in Chapter 7080.2150 are suitable for treating sewage using a Type I below-grade design. **Trench media must never be placed in contact with soils having a percolation rate faster than 0.1 mpi or soil type 1 or slower than 60 mpi. For soils with percolation rates faster than 0.1 mpi and between 61 and 120 mpi, Type I below-grade systems may not be used (7080.2150, Subp. 3).**

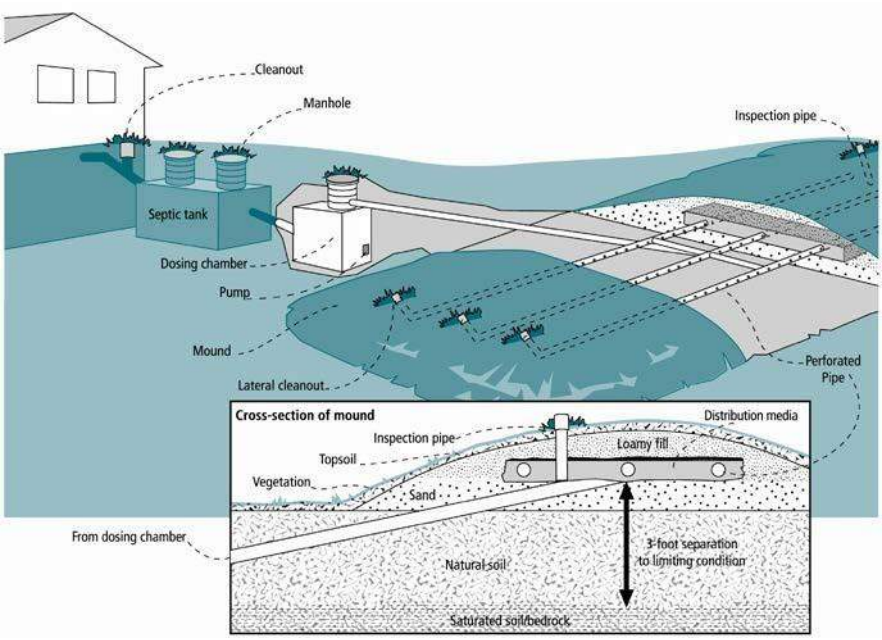
The trench soil treatment system consists of distribution media, covered with a minimum of 12 inches of soil and a close-growing and vigorous vegetation. Many trench systems utilize a pipe and gravel distribution system where effluent passes through the pipe and is stored within the media until it can be absorbed into the soil. Partial treatment is achieved as effluent passes through the biomat. The biomat also distributes effluent across the soil surfaces and maintains aerobic conditions outside the trench.

Mound Systems

Mound systems are defined in Chapter 7080.1100, Subp. 50, as “a soil treatment and dispersal system designed and installed such that all of the infiltrative surface is installed above grade, using clean sand between the bottom of the infiltrative surface and the original ground elevation, utilizing pressure distribution and capped with suitable soil material to stabilize the surface and encourage vegetative growth.”

A sewage treatment mound is nothing more than a seepage bed elevated by clean sand fill to provide adequate separation between where sewage effluent is applied and a limiting soil layer as shown in the figure below. Mounds were developed in the early 1970s to overcome soil and site conditions, which limit the use of trenches and beds (Converse et al., 1977). Limiting conditions include high water tables, shallow soil depth to bedrock, slowly permeable soil, or soil too coarse for treatment.

Figure 1 - Mound System and Components



A mound system is a two-stage process involving both effluent treatment and dispersal. Treatment is accomplished predominately by physical and biochemical processes within the clean sand material and native soil. The physical characteristics of the influent wastewater, influent loading rate temperature, and the nature of the receiving fill material and in situ soil affect these processes.

Physical entrapment, increased retention time, and conversion of pollutants in the effluent are important treatment objectives accomplished under unsaturated conditions. Pathogens contained in the effluent are eventually deactivated through filtering, retention, and adsorption by the fill material. In addition, many pollutants are converted to other chemical forms by oxidation processes.

The mound system addresses high water table conditions by elevating the infiltration bed to achieve the needed vertical separation. By using uniform distribution and adequate vertical separation in the selected sand media, vertical unsaturated flow is maintained, thus ensuring the maximum treatment permitted by this technology. On sites with slowly permeable soils, the mound system helps assure a known level of effluent treatment before effluent is discharged to the native soil. These soils are subject to severe damage from smearing and compaction, especially during the construction of conventional systems, which drastically reduces the permeability of the soil by destroying water-moving

pores and channels. As a result these sites present a high potential for site and soil interface damage in addition to the need for large soil treatment systems to provide adequate infiltration area. For these sites, mound systems provide the following advantages:

- The mound effluent enters the more permeable natural topsoil over a larger area where it can move laterally until absorbed by the less permeable subsoil.
- The bio-mat that develops at the bottom of the media/sand infiltration area will not clog the filter media as readily as it would the less permeable natural soil.
- The infiltration area within the filter media is much smaller than it would be if placed in the more slowly permeable subsoil, yet the total mound area is probably larger than it would be for a conventional soil treatment system, if one could be used.

Mound systems are used primarily in shallow soils overlying a restrictive layer or elevated groundwater table. The shallower the soil, the more attention must be paid to transporting the treated effluent away from the point of application. Fifteen mound systems in Wisconsin were found to have a total nitrogen reduction of at least 55% from the pretreatment effluent to mound toe effluent (Blasing and Converse, 2004). Sufficient numbers of mounds have been installed in Minnesota and elsewhere to prove that the mound treatment system is a Type I technology. There are more than 50,000 single-family mounds successfully treating sewage in Minnesota.

Dispersal is primarily affected by the depth of the unsaturated receiving soils, their hydraulic conductivity, land slope, and the area available for dispersal. The mound consists of sand material, an absorption bed, and cover material. Effluent is dispersed into the absorption bed, where it flows through the fill material and undergoes biological, chemical, and physical treatment. It then passes into the underlying soil for further treatment and dispersal to the environment. Clean sand (defined by state rule) is required for mounds to effectively treat and disperse effluent.

Cover material consists of material that provides erosion protection, a barrier to excess precipitation infiltration, and allows gas exchange. The native soil serves, in combination with the fill, as treatment media, and it also disperses the treated effluent.

APPENDIX C

Wastewater Flow Calculation

South/Southwest Big Kandiyohi Lake Community
Alternative 2: Community Cluster MSTS
Wastewater Design Flow
(MN Rules 7080.1850, 7081.0120, 7081.0140)

CAR Map ID#	Address	Parcel ID#	# Bedroom	Dwelling Classification*	Flow (gpd)	Reduction Factor	Wastewater Flow (gpd)
5	6044 147th Avenue	16-450-0900	1	II	225	0.45	101
6	6064 147th Avenue	16-450-0890	2	II	225	0.45	101
7	6104 147th Avenue	16-450-0870	3	II	300	1.00	300
8	6124 147th Avenue	16-450-0860	3	II	300	1.00	300
12	6204 147th Avenue	16-450-0800	3	II	300	1.00	300
13	6224 147th Avenue	16-450-0790	2	II	225	0.45	101
16	6302 147th Avenue	16-450-0750	3	II	300	0.45	135
17	6342 147th Avenue	16-450-0730	2	II	225	0.45	101
18	6364 147th Avenue	16-450-0720	2	II	225	0.45	101
19	6380 147th Avenue	16-450-0710	3	II	300	0.45	135
21	6420 147th Avenue	16-450-0690	2	II	225	0.45	101
22	6444 147th Avenue	16-450-0680	2	II	225	0.45	101
23	6460 147th Avenue	16-450-0675	1	II	225	0.45	101
24	6482 147th Avenue	16-450-0670	2	II	225	0.45	101
25	6502 147th Avenue	16-450-0660	3	II	300	0.45	135
26	6522 147th Avenue	16-450-0650	2	II	225	0.45	101
28	6526 147th Avenue	16-450-0640	3	II	300	0.45	135
29	6530 147th Avenue	16-450-0630	1	III	180	0.45	81
30	6580 147th Avenue	16-450-0620	3	II	300	0.45	135
31	6598 147th Avenue	16-450-0610	1	I	300	1.00	300
32	6618 147th Avenue	16-450-0600	2	II	225	0.45	101
33	6640 147th Avenue	16-450-0590	3	II	300	0.45	135
34	6660 147th Avenue	16-450-0580	2	II	225	0.45	101
35	6680 147th Avenue	16-450-0570	2	II	225	0.45	101
36	6700 147th Avenue	16-450-0560	3	II	300	0.45	135
37	6720 147th Avenue	16-450-0550	2	II	225	0.45	101
38	6740 147th Avenue	16-450-0540	2	II	225	0.45	101
39	6760 147th Avenue	16-450-0530	3	II	300	0.45	135
40	6780 147th Avenue	16-450-0510	2	II	225	0.45	101
41	6800 147th Avenue	16-450-0500	2	II	225	0.45	101
42	6820 147th Avenue	16-450-0490	3	II	300	0.45	135
43	6842 147th Avenue	16-450-0480	2	II	225	0.45	101
44	6862 147th Avenue	16-450-0470	2	II	225	0.45	101
45	6882 147th Avenue	16-450-0465	2	II	225	0.45	101
46	6904 147th Avenue	)-0460 & 16-45(	2	I	300	1.00	300
47	6942 147th Avenue	16-450-0440	3	II	300	0.45	135
48	6962 147th Avenue	16-450-0430	3	I	450	1.00	450
49	6980 147th Avenue	16-450-0420	3	II	300	0.45	135
50	6998 147th Avenue	16-450-0410	2	III	180	0.45	81
52	7040 147th Avenue	16-450-0370	3	III	218	0.45	98
55	7100 147th Avenue	16-450-0330	3	II	300	0.45	135
57	7140 147th Avenue	16-450-0310	3	I	450	1.00	450
58	7160 147th Avenue	16-450-0300	3	II	300	0.45	135
59	7180 147th Avenue	16-450-0290	2	II	225	0.45	101
60	7200 147th Avenue	16-450-0280	4	II	375	1.00	375
61	7232 147th Avenue	16-450-0260	3	II	300	0.45	135
64	7308 147th Avenue	16-450-0210	3	II	300	0.45	135

CAR Map ID#	Address	Parcel ID#	# Bedroom	Dwelling Classification*	Flow (gpd)	Reduction Factor	Wastewater Flow (gpd)
65	7328 147th Avenue	16-450-0200	2	II	225	0.45	101
66	7340 147th Avenue	16-450-0190	4	II	375	1.00	375
67	7360 147th Avenue	16-450-0180	3	II	300	0.45	135
68	7380 147th Avenue	16-450-0170	3	II	300	0.45	135
69	7400 147th Avenue	16-450-0160	3	II	300	0.45	135
70	7420 147th Avenue	16-450-0150	2	II	225	0.45	101
71	7540 147th Avenue	16-450-0140	2	II	225	0.45	101
72	7560 147th Avenue	16-450-0130	3	I	450	1.00	450
73	7580 147th Avenue	16-450-0125	3	II	300	0.45	135
76	7640 147th Avenue	16-450-0080	3	II	300	0.45	135
77	7660 147th Avenue	16-450-0070	2	II	225	0.45	101
89	7878 147th Avenue	16-600-0130	2	II	225	0.45	101
90	7888 147th Avenue	16-600-0120	3	II	300	0.45	135
94	7930 147th Avenue	16-600-0040	2	II	225	0.45	101

*MN Rule 7080 Classification per SSTS permit data, homeowner survey, and/or Kandiyohi County GIS parcel data

Total Average Dry Weather (ADW) Flow, gpd:		9,430
Collection system forcemain length (mile)	1.3	
Pipe diameter, inch	2	
Infiltration/Inflow (200 gpd/in. dia./mi), gpd:		520
Total Average Wet Weather (AWW) Flow, gpd:		**9,950**

South/Southwest Big Kandiyohi Lake Community
Alternative 3: Community Cluster LSTS
Wastewater Design Flow
(MN Rules 7080.1850, 7081.0120, 7081.0140)

CAR Map ID#	Address	Parcel ID#	# Bedroom	Dwelling Classification*	Flow (gpd)	Reduction Factor	Wastewater Flow (gpd)
4	6022 147th Avenue	16-450-0910	2	II	225	0.45	101
5	6044 147th Avenue	16-450-0900	1	II	225	0.45	101
6	6064 147th Avenue	16-450-0890	2	II	225	0.45	101
7	6104 147th Avenue	16-450-0870	3	II	300	0.45	135
8	6124 147th Avenue	16-450-0860	3	II	300	0.45	135
9	6144 147th Avenue	16-450-0840	3	I	450	0.45	203
10	6164 147th Avenue	16-450-0820	2	II	225	0.45	101
11	6184 147th Avenue	16-450-0810	3	I	450	0.45	203
12	6204 147th Avenue	16-450-0800	3	II	300	0.45	135
13	6224 147th Avenue	16-450-0790	2	II	225	0.45	101
14	6244 147th Avenue	16-450-0780	2	II	225	0.45	101
15	6282 147th Avenue	16-450-0760	4	I	600	1.00	600
16	6302 147th Avenue	16-450-0750	3	II	300	0.45	135
17	6342 147th Avenue	16-450-0730	2	II	225	0.45	101
18	6364 147th Avenue	16-450-0720	2	II	225	0.45	101
19	6380 147th Avenue	16-450-0710	3	II	300	0.45	135
20	6400 147th Avenue	16-450-0700	2	I	300	0.45	135
21	6420 147th Avenue	16-450-0690	2	II	225	0.45	101
22	6444 147th Avenue	16-450-0680	2	II	225	0.45	101
23	6460 147th Avenue	16-450-0675	1	II	225	0.45	101
24	6482 147th Avenue	16-450-0670	2	II	225	0.45	101
25	6502 147th Avenue	16-450-0660	3	II	300	0.45	135
26	6522 147th Avenue	16-450-0650	2	II	225	0.45	101
27	6531 147th Avenue	16-033-0012	2	II	225	0.45	101
28	6526 147th Avenue	16-450-0640	3	II	300	0.45	135
29	6530 147th Avenue	16-450-0630	1	III	180	0.45	81
30	6580 147th Avenue	16-450-0620	3	II	300	0.45	135
31	6598 147th Avenue	16-450-0610	1	I	300	0.45	135
32	6618 147th Avenue	16-450-0600	2	II	225	0.45	101
33	6640 147th Avenue	16-450-0590	3	II	300	0.45	135
34	6660 147th Avenue	16-450-0580	2	II	225	0.45	101
35	6680 147th Avenue	16-450-0570	2	II	225	0.45	101
36	6700 147th Avenue	16-450-0560	3	II	300	0.45	135
37	6720 147th Avenue	16-450-0550	2	II	225	0.45	101
38	6740 147th Avenue	16-450-0540	2	II	225	0.45	101
39	6760 147th Avenue	16-450-0530	3	II	300	0.45	135
40	6780 147th Avenue	16-450-0510	2	II	225	0.45	101
41	6800 147th Avenue	16-450-0500	2	II	225	0.45	101
42	6820 147th Avenue	16-450-0490	3	II	300	0.45	135
43	6842 147th Avenue	16-450-0480	2	II	225	0.45	101
44	6862 147th Avenue	16-450-0470	2	II	225	0.45	101
45	6882 147th Avenue	16-450-0465	2	II	225	0.45	101
46	6904 147th Avenue	)-0460 & 16-45(	2	I	300	0.45	135
47	6942 147th Avenue	16-450-0440	3	II	300	0.45	135
48	6962 147th Avenue	16-450-0430	3	I	450	1.00	450
49	6980 147th Avenue	16-450-0420	3	II	300	0.45	135

CAR Map ID#	Address	Parcel ID#	# Bedroom	Dwelling Classification*	Flow (gpd)	Reduction Factor	Wastewater Flow (gpd)
50	6998 147th Avenue	16-450-0410	2	III	180	0.45	81
51	7030 147th Avenue	16-450-0390	3	II	300	0.45	135
52	7040 147th Avenue	16-450-0370	3	III	218	0.45	98
53	7070 147th Avenue	16-450-0350	2	I	300	0.45	135
54	7080 147th Avenue	16-450-0340	2	I	300	0.45	135
55	7100 147th Avenue	16-450-0330	3	II	300	0.45	135
56	7120 147th Avenue	16-450-0320	2	I	300	0.45	135
57	7140 147th Avenue	16-450-0310	3	I	450	1.00	450
58	7160 147th Avenue	16-450-0300	3	II	300	0.45	135
59	7180 147th Avenue	16-450-0290	2	II	225	0.45	101
60	7200 147th Avenue	16-450-0280	4	II	375	0.45	169
61	7232 147th Avenue	16-450-0260	3	II	300	0.45	135
62	7240 147th Avenue	16-450-0255	2	I	300	0.45	135
63	7280 147th Avenue	16-450-0240	3	I	450	1.00	450
64	7308 147th Avenue	16-450-0210	3	II	300	0.45	135
65	7328 147th Avenue	16-450-0200	2	II	225	0.45	101
66	7340 147th Avenue	16-450-0190	4	II	375	0.45	169
67	7360 147th Avenue	16-450-0180	3	II	300	0.45	135
68	7380 147th Avenue	16-450-0170	3	II	300	0.45	135
69	7400 147th Avenue	16-450-0160	3	II	300	0.45	135
70	7420 147th Avenue	16-450-0150	2	II	225	0.45	101
71	7540 147th Avenue	16-450-0140	2	II	225	0.45	101
72	7560 147th Avenue	16-450-0130	3	I	450	0.45	203
73	7580 147th Avenue	16-450-0125	3	II	300	0.45	135
74	7600 147th Avenue	16-450-0110	3	I	450	1.00	450
75	7630 147th Avenue	16-450-0090	2	II	225	0.45	101
76	7640 147th Avenue	16-450-0080	3	II	300	0.45	135
77	7660 147th Avenue	16-450-0070	2	II	225	0.45	101
78	7680 147th Avenue	16-450-0060	3	II	300	0.45	135
79	7700 147th Avenue	16-450-0050	3	II	300	0.45	135
80	7720 147th Avenue	16-450-0040	3	II	300	0.45	135
81	7740 147th Avenue	16-450-0030	3	II	300	0.45	135
82	7760 147th Avenue	16-450-0020	3	I	450	1.00	450
83	7770 147th Avenue	16-450-0010	2	I	300	0.45	135
84	7810 147th Avenue	16-600-0230	2	II	225	0.45	101
85	7828 147th Avenue	16-600-0200	1	III	180	0.45	81
86	7852 147th Avenue	16-600-0180	2	I	300	0.45	135
87	7858 147th Avenue	16-600-0170	2	I	300	0.45	135
88	7868 147th Avenue	16-600-0140	2	II	225	0.45	101
89	7878 147th Avenue	16-600-0130	2	II	225	0.45	101
90	7888 147th Avenue	16-600-0120	3	II	300	0.45	135
91	7898 147th Avenue	16-600-0100	3	II	300	0.45	135
92	7902 147th Avenue	16-600-0090	3	I	450	1.00	450
93	7918 147th Avenue	16-600-0050	3	I	300	0.45	135
94	7930 147th Avenue	16-600-0040	2	II	225	0.45	101
95	7942 147th Avenue	16-600-0010	3	I	450	1.00	450

CAR Map ID#	Address	Parcel ID#	# Bedroom	Dwelling Classification*	Flow (gpd)	Reduction Factor	Wastewater Flow (gpd)
96	7964 147th Avenue	16-700-0010	4	I	600	1.00	600
97	7982 147th Avenue	16-700-0020	2	I	300	0.45	135
98	7998 147th Avenue	16-700-0030	2	I	300	0.45	135
99	8010 147th Avenue	16-700-0040	3	I	450	1.00	450
100	8026 147th Avenue	16-700-0050	3	I	450	0.45	203
101	8042 147th Avenue	16-700-0060	3	I	450	0.45	203
102	8054 147th Avenue	16-700-0070	3	I	450	0.45	203
103	8068 147th Avenue	16-700-0080	2	I	300	0.45	135

*MN Rule 7080 Classification per SSTS permit data, homeowner survey, and/or Kandiyohi County GIS parcel data

Total Average Dry Weather (ADW) Flow, gpd:		16,080
Collection system forcemain length (mile)	1.5	
Pipe diameter, inch	2	
Infiltration/Inflow (200 gpd/in. dia./mi), gpd:		600
Total Average Wet Weather (AWW) Flow, gpd:		**16,680**

APPENDIX D

Grinder Station Detail

PENTAIR

HYDROMATIC®
SEWAGE GRINDER PUMPS AND PACKAGES

WWW.HYDROMATIC.COM

Submersible Grinder Pumps

2 HP Submersible Grinders

Hydromatic® 2 HP grinder pumps offer a proven method of reducing residential waste into a fine slurry for ideal transfer to a variety of sewage treatment operations.

Centrifugal Grinders

Our centrifugal grinders use an exclusive dual-cutter design that prevents clogging, binding and roping in a wide range of operating conditions. These cutters cut waste twice to reduce it to an even finer slurry. The first cut is performed by the radial cutter; the second by the axial cutter that recuts the waste in a perpendicular direction to the radial cutters. Centrifugal grinders offer a number of semi-open vortex impeller diameters to generate dependable performance over a wide range of flow and head conditions.

Semi-Positive Displacement Grinders

Semi-positive displacement grinders feature a progressing cavity design with a Buna-N stator for extended durability in the high head conditions required by low pressure sewer systems.

Non-Submersible Grinders

Non-submersible grinder pumps offer the same reliable service that comes with a submersible grinder pump. Our exclusive dual cutters reduce waste into a fine slurry for ideal transfer to a variety of sewage treatment applications. Available with either cast iron or navy M bronze pump ends, these pumps provide the service you need when your application doesn't require a submersible pump.

2 HP Grinder Packages

Hydromatic 2 HP grinder packages provide the superior quality of Hydromatic grinder pumps combined with the highest quality fittings and controls. A control panel specifically designed to optimize pump performance, packaged all together in a durable UV-resistant basin, make for quick and easy installation.

TL-Pro System

Liftout rail system for centrifugal grinders provides ease of installation and removal of the pump. The TL-Pro system uses a cast iron discharge elbow with integrated ball check valve, and is available with spark-proof rails for hazardous locations.

Available with:

- HPGR200
- HPG(X)200
- HGRS200

TL-Pro liftout valve with integral ball check valve.

TG-Pro System

Flexible piping system with slip-fit discharge connection provides ease of installation and removal for all 2 HP grinders. Pumps include a stainless steel stand.

Available with:

- HPD200
- HPG200
- HPGR200
- HGRS200

Heavy-duty 1¼" flexible pipe and easy slip-fit connection allows for quick installations and servicing.

TH-Pro System

Factory assembled discharge piping with single union ball valve disconnect eliminates installation errors and reduces installation time dramatically.

Available with:

- HPD200 and HPGR200

Ball valve with union disconnect allows easy removal of the pump and piping.

Innovative solid state control panel with hand-contact sensor to control the alarm functions and integrated alarm light and buzzer. The control panel includes on-board pumping system diagnostics with pump run time counter and pump cycle counter.

Submersible Grinder Pumps

TL-Pro and TG-Pro

Using an exclusive control circuit board built to maximize the performance of Hydromatic 2 HP grinder pumps, the Novus 1000 Plus Series control panel is an integral part of the 2 HP grinder package. Standard features include lockable latches, sub-door, raised back panel, flashing red alarm light, electronic horn and "Touch-to-Silence" pad in a NEMA 4X enclosure.

Standard Features and Benefits

- 24" fiberglass basin
- UV-resistant basin and lid
- Brass shut-off valve
- Built-in anti-siphon protection
- NEMA 6 JBox
- Weighted float switches
- Slip-fit connection ball check valve
- Pressure-relief valve (HPD200 models only)

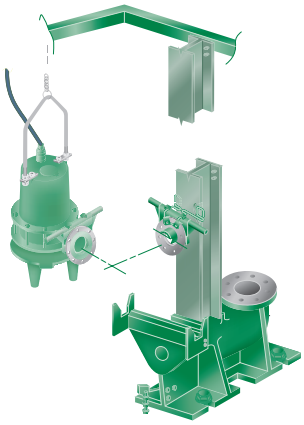
3, 5 & 7.5 HP Submersible Grinders

When your waste removal needs exceed the capabilities of the residentially designed 2 HP submersible grinders, Hydromatic offers a complete line of 3, 5 & 7.5 HP submersible grinder pumps with a variety of high flow and high head conditions. These grinders use the exclusive dual cutter grinder system and have dual seals for added motor protection and are available for Class I and Class II hazardous locations.

Hydromatic 3, 5 & 7.5 HP grinder packages combine the quality of Hydromatic grinder pumps with our exclusive Novus Series of control panels. Available with a variety of material and NEMA-rating enclosures, Novus Series control panels use state-of-the-art digital controllers to optimize operation of your simplex, duplex or triplex grinder system.

PR Rail System

Non-corrosive lift-out rail system designed for horizontal discharge pumps (HPGFH/HPGHH) feature a reliable connection/disconnection system, including a diaphragm gasket, for sealing to the discharge elbow. The system will accept 3" flow.



Submersible Grinder Guide

		Single Seal			Dual Seal			Hazardous Location		
		HGRS200	HPGR200	HPD200	HPG200	HPGH / HPGHH	HPGF / HPGFH	HPG(X)200	HPGH(X) / HPGHH(X)	HPGF(X) / HPGFH(X)
Cord Entry: Sealed for maximum protection from wicking and water seepage into the motor housing.	Compression Fitting	X	X	X	X	X	X	X	X	X
	Epoxy Barrier				X	X	X	X	X	X
	O-Rings				X	X	X	X	X	X
	Connection Box								X	X
Bearings: Heavy-duty ball bearings, upper (radial) and lower (thrust), are continuously lubricated by oil to ensure long service life.		X	X	X	X	X	X	X	X	X
Motor: Oil-filled motor provides superior cooling and permanent lubrication of bearings, low maintenance and extended service life. Electrical design combines the advantages of high torque output with optimum running efficiency engineered specifically for grinder operation.	Single Phase: Start capacitors for maximum starting torque. Motor windings contain automatic thermal overload protection.	2 HP 230V 60 Hz 3450 RPM	2 HP 230V 60 Hz/50 Hz 3450/2900 RPM	2 HP 230V 60 Hz/50 Hz 1750/1460 RPM	2 HP 200/230V 60 Hz/50 Hz 3450/2900 RPM	3 & 5 HP 200/230V 60 Hz/50 Hz 3450/2900 RPM	3 & 5 HP 200/230V 60 Hz/50 Hz 1750/1460 RPM	2 HP 200/230V 60 Hz/50 Hz 3450/2900 RPM	3 & 5 HP 200/230V 60 Hz/50 Hz 3450/2900 RPM	3 & 5 HP 200/230V 60 Hz/50 Hz 1750/1460 RPM
	Three Phase				2 HP 200/230/460/575V 60 Hz/50 Hz 3450/2900 RPM	3, 5, 7½ HP 200/230/460/575V 60 Hz/50 Hz 3450/2900 RPM	3, 5, 7½ HP 200/230/460/575V 60 Hz/50 Hz 1750/1460 RPM	2 HP 200/230/460/575V 60 Hz/50 Hz 3450/2900 RPM	3, 5, 7½ HP 200/230/460/575V 60 Hz/50 Hz 3450/2900 RPM	3, 5, 7½ HP 200/230/460/575V 60 Hz/50 Hz 1750/1460 RPM
Stator Bolts: Stator is secured to the motor housing by means of stator bolts which ensures ease of maintenance if the need ever arises.		X	X	X	X	X	X	X	X	X
Shaft: Stainless steel shaft to eliminate corrosion and fatigue for longer pump life. Minimized shaft overhang decreases deflection and increases bearing and seal life.		X	X	X	X	X	X	X	X	X
Seals: Mechanical seal constructed with a ceramic stationary face and a carbon rotating face. Field-proven for long service life.	Single Seal	X	X	X	X	X	X	X	X	X
	Dual Seal: Maximum moisture protection for the motor.				X	X	X	X	X	X
Moisture Probes: Electrical sensors to detect the presence of moisture in the seal chamber before it damages the motor.	Single Probe				X	X	X			
	Two Probes: Redundant protection from moisture intrusion							X	X	X
Cutters: Reduce solids to the smallest particle size, thereby greatly reducing clogging, roping or binding.	High efficiency cutter	X		X						
	Exclusive dual cutter design		X		X	X	X	X	X	X
Discharge	1¼" NPT vertical discharge	X	X	X	X			X		
	2" NPT vertical discharge					X	X		X	X
	3" 125 lb. horizontal flange					X	X		X	X
Impeller: Multi-vane, semi-open impeller precludes material buildup around shaft and seal.	Valox® with insert	X	X		X	X	X			
	Cast bronze				X			X	X	X
Progressing Cavity: Semi-positive displacement feed system designed specifically for LPS applications. 300 Series stainless steel single lobe rotor and Buna-N double helix stator for extended life.				X						

PENTAIR

740 EAST 9TH STREET,
ASHLAND, OHIO 44805
WWW.HYDROMATIC.COM

269 TRILLIUM DRIVE, KITCHENER,
ONTARIO, CANADA N2G 4W5
WWW.HYDROMATIC.COM

APPENDIX E

Soil Information

Map Scale: 1:2,150 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 30 60 120 180

Feet: 0 100 200 400 600

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 15N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features

- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Kandiyohi County, Minnesota
Survey Area Data: Version 24, Sep 10, 2025

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jun 29, 2023—Sep 13, 2023

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
130A	Nicollet silty clay loam, 0 to 2 percent slopes	1.1	4.4%
130B	Nicollet clay loam, 2 to 5 percent slopes	20.7	87.2%
981	Canisteo-Harps loams	2.0	8.3%
Totals for Area of Interest		**23.8**	**100.0%**

LOCATION NICOLLET MN+IA

Established Series
Rev. TCJ-AGG
05/2011

NICOLLET SERIES

The Nicollet series consists of very deep, somewhat poorly drained soils that formed in calcareous loamy glacial till on till plains and moraines. Slopes range from 0 to 5 percent. Mean annual air temperature is about 9 degrees C (48 degrees F). Mean annual precipitation is about 660 mm (28 inches).

TAXONOMIC CLASS: Fine-loamy, mixed, superactive, mesic Aquic Hapludolls

TYPICAL PEDON: Nicollet clay loam on a 2 percent plane slope in a cultivated field. (Colors are for moist soil unless otherwise stated.)

Ap--0 to 25 cm (0 to 10 inches); black (10YR 2/1) clay loam; weak fine subangular blocky structure; friable; about 2 percent gravel; slightly acid; abrupt smooth boundary. [18 to 28 cm (7 to 12 inches thick)]

A--25 to 43 cm (10 to 17 inches); very dark gray (10YR 3/1) clay loam; moderate fine subangular blocky structure; friable; about 5 percent gravel; common black (10YR 2/1) worm casts; slightly acid; gradual irregular boundary. [8 to 38 cm (3 to 15 inches thick)]

Bw--43 to 53 cm (17 to 21 inches); dark grayish brown (10YR 4/2) clay loam; moderate fine subangular blocky structure; friable; common very dark gray (10YR 3/1) worm casts; about 5 percent gravel; moderately acid; clear smooth boundary.

Bg1--53 to 74 cm (21 to 29 inches); dark grayish brown (2.5Y 4/2) clay loam; moderate fine prismatic structure parting to moderate fine subangular blocky; friable; few very dark gray (10YR 3/1) worm casts; about 5 percent gravel; common fine distinct olive brown (2.5Y 4/4) Fe concentrations; moderately acid; abrupt wavy boundary.

Bg2--74 to 84 cm (29 to 33 inches); dark grayish brown (2.5Y 4/2) clay loam; weak medium prismatic structure parting to moderate fine and medium subangular blocky; friable; few very dark gray (10YR 3/1) worm casts; about 5 percent gravel; few fine faint grayish brown (2.5Y 5/2) Fe depletions and a few fine distinct light olive brown (2.5Y 5/4) and prominent brown (7.5YR 5/4) Fe concentrations; slightly acid; abrupt wavy boundary. [Combined thickness of the B horizon is 15 to 51 cm (6 to 20 inches.)

BCg--84 to 91 cm (33 to 36 inches); grayish brown (2.5Y 5/2) clay loam; weak fine and medium subangular blocky structure; friable; few very dark gray (10YR 3/1) worm casts; about 5 percent gravel; many fine distinct light olive brown (2.5Y 5/4) Fe concentrations; slightly effervescent in parts; slightly alkaline; abrupt wavy boundary.[0 to 20 cm (0 to 8 inches thick)]

BCkg--91 to 152 cm (36 to 60 inches); grayish brown (2.5Y 5/2) loam; massive in place breaking to angular fragments with greater horizontal than vertical dimensions; friable; about 5 percent gravel; common lime masses; many fine distinct light olive brown (2.5Y 5/4) and few fine prominent yellowish brown (10YR 5/8) Fe concentrations; few black (N 2/0) Fe-Mn concretions; strongly effervescent; slightly alkaline.

TYPE LOCATION: Martin County, Minnesota; about 1.5 miles northeast of Sherburn; 384 m (1,260 feet) north and 30 m (100 feet) east of the southwest corner of sec. 5, T. 102 N., R. 32 W.; USGS Sherburn, MN

quadrangle; Lat. 43 degrees 39 minutes 50 seconds N., Long. 94 degrees 42 minutes 43 seconds W. NAD 27.

RANGE IN CHARACTERISTICS: Depth to free carbonates ranges from 51 to 122 cm (20 to 48 inches). The mollic epipedon is 25 to 61 cm (10 to 24 inches) thick. Rock fragments of mixed lithology are 1 to 8 percent throughout. The 25 to 102 cm (10 to 40 inch) series control section averages between 24 to 35 percent clay and 20 to 35 percent fine sand and coarser.
The A horizon has value of 2 or 3, and chroma of 1 or 2. It is loam, clay loam, or silty clay loam. It is moderately acid to neutral.

The upper part of the B horizon has hue of 10YR or 2.5Y, value of 3 or 4, and chroma of 2 to 4. The lower part of the B horizon has value of 4 or 5, and chroma of 2 to 4. When matrix chroma is 3 or 4, low chroma mottles are present or the layer is less than 6 inches thick. The B horizon is dominantly clay loam, but loam and silty clay loam are within the range. It is moderately acid to neutral in the upper part and slightly acid to slightly alkaline in the lower part.

The BC or C horizon has hue of 2.5Y or 5Y, value of 5 or 6, and chroma of 2 to 4. It is slightly alkaline or moderately alkaline. The moderately fine substratum phase has textures of loam or clay loam. It has 20 to 30 percent clay and less than 45 percent total sand. The moderately coarse substratum phase has textures of loam, fine sandy loam or sandy loam. It has 12 to 22 percent clay and more than 40 percent total sand.

COMPETING SERIES: These are the Arkton, Crippin, Floyd, Fostoria, Kensett, Merton, Ottosen, Readlyn, Snider, and Wilmonton soils. Arkton and Crippin soils have free lime within 51 cm (20 inches)of the surface, and average more the 35 percent fine sand or coarser in the series control section. Fostoria soils have less than 1 percent rock fragments throughout the series control section. Merton, Ottosen and Snider soils have less than 1 percent course fragments in the upper part of the profile. Kensett soils have a lithic contact at 51 to 61 cm (20 to 24 inches). Readlyn soils are strongly acid or very strongly acid and have less than 1 percent rock fragments in the upper part of the series control section. Wilmonton soils are slightly to strongly alkaline and have secondary carbonates in the upper part of the series control section.

GEOGRAPHIC SETTING: Nicollet soils have slightly convex or plane slopes. They are on till plains, ground moraines, and terminal moraines. Their slopes range from 0 to 5 percent. They formed in friable, calcareous loam and clay loam glacial till of Late Wisconsinan age. The climate is humid continental with warm summers and cold winters. Mean annual air temperature ranges from 7 to 10 degrees C (45 to 50 degrees F). Mean annual precipitation ranges from 660 to 813 mm (26 to 32 inches). Frost free days range from 155 to 200. Elevation is 244 to 479 m (800 to 1,570 feet) above sea level.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Canisteo, Clarion, Glencoe, Okoboji, Storden, Swanlake, and Webster soils which are members of a hydrosequence with Nicollet soils. The well drained Clarion, Storden and Swanlake soils are generally on the more convex slopes and higher in the landscape. Poorly drained Canisteo and Webster soils are on broad nearly level areas. Very poorly drained Glencoe and Okoboji soils are in depressions and swales.

DRAINAGE AND SATURATED HYDRAULIC CONDUCTIVITY: Somewhat poorly drained. Saturated hydraulic conductivity, measured in micrometers per second, is 4.23 to 14.11 (.6 to 2 inches per hour). Runoff is low. Seasonal high saturation occurs at depths as high as 46 cm (1.5 feet), typically during the months of March through June in normal years.

USE AND VEGETATION: Mostly cultivated to corn and soybeans. Native vegetation is tall grass prairie.

DISTRIBUTION AND EXTENT: MLRA-103. South-central Minnesota and north-central Iowa. This soil is extensive.

MLRA SOIL SURVEY REGIONAL OFFICE (MO) RESPONSIBLE: St. Paul, Minnesota

SERIES ESTABLISHED: Nicollet County, Minnesota, 1949.

REMARKS: Diagnostic horizons and features recognized in this pedon are: mollic epipedon - the zone from the surface to 43 cm (17 inches) (Ap and A); cambic horizon - the zone from 43 to 91 cm (17 to 36 inches) (Bw, Bg1, Bg2, and BCkg); aquic subgroup - color below the mollic epipedon.

ADDITIONAL DATA: Refer to Minnesota Agricultural Experiment Station Central File Code Nos. 57, 58, 164, and 628 for results of some laboratory analyses of representative pedons of this series.

National Cooperative Soil Survey
U.S.A.

APPENDIX F

Cost Analysis

Probable Construction Cost Estimate
Alternative 2: Community Cluster MSTS
South/Southwest Big Kandiyohi Lake Community

Item No.	Item	Quantity	Unit	Unit Cost	Total Cost
	Collection System				
1	Mobilization and Demobilization	1	LS	$ 144,900	$ 144,900
2	Septic Tank Abandonment	61	EA	$ 1,500	$ 91,500
3	Grinder Station and Controls	61	EA	$ 20,000	$ 1,220,000
4	Grinder Electrical Installation	61	EA	$ 1,000	$ 61,000
5	Building Sanitary Sewer Cleanout	61	EA	$ 300	$ 18,300
6	4" Gravity Building Sanitary Sewer	2,440	LF	$ 50	$ 122,000
7	Pressure Sewer	6,900	LF	$ 30	$ 207,000
8	Pressure Sewer Lateral	4,575	LF	$ 35	$ 160,125
9	Air/Vacuum Release Valve and Manhole	2	EA	$ 12,500	$ 25,000
10	Isolation Valve	3	EA	$ 4,000	$ 12,000
11	Pressure Sewer Cleanout	7	EA	$ 4,500	$ 31,500
12	2" Curb Stops	61	EA	$ 3,000	$ 183,000
13	Washed Stone	700	CY	$ 50	$ 35,000
14	Select Granular	700	CY	$ 50	$ 35,000
15	Insulation (4")	1,100	SY	$ 50	$ 55,000
16	Property Site Restoration	61	EA	$ 2,000	$ 122,000
17	Asphaltic Pavement Patch	80	SY	$ 100	$ 8,000
18	Class V Gravel Roadway Patch	900	SY	$ 17.50	$ 15,750
19	Silt Fence	2,500	LF	$ 5	$ 12,500
				Collection Subtotal:	**$ 2,560,000**
	Treatment System				
20	Mobilization and Demobilization	1	LS	$ 71,000	$ 71,000
21	Septic Tank #1	20,000	GAL	$ 5.50	$ 110,000
22	Septic Tank #2	20,000	GAL	$ 5.50	$ 110,000
23	Equalization Tank	12,000	GAL	$ 5.50	$ 66,000
24	ATU Tank	12,000	GAL	$ 5.50	$ 66,000
25	Dose Tank	12,000	GAL	$ 5.50	$ 66,000
26	Aluminum Access Hatch	7	EA	$ 2,000	$ 14,000
27	Tank Riser Pipe	50	LF	$ 200	$ 10,000
28	Tank Riser/tank Adapter	16	EA	$ 200	$ 3,200
29	Riser Fiberglass Lid	16	EA	$ 400	$ 6,400
30	Effluent Screen	2	EA	$ 1,000	$ 2,000
31	Submersible Effluent Pump	10	EA	$ 3,000	$ 30,000
32	Pump Guide Rails & Discharge Piping	10	EA	$ 3,000	$ 30,000
33	Control Panel	1	LS	$ 50,000	$ 50,000
34	Float Switch Sensors	8	EA	$ 1,000	$ 8,000
35	Aerobic Treatment Unit	1	EA	$ 75,000	$ 75,000
36	Mound Soil Dispersal System	830	LF	$ 325	$ 269,750
37	Yard Piping	1,500	LF	$ 45	$ 67,500
38	Tank Insulation	360	SY	$ 50	$ 18,000
39	Gravel Access Road	150	LF	$ 75	$ 11,250
40	Culvert	1	LS	$ 2,500	$ 2,500
41	Site Restoration	5	ACRE	$ 15,000	$ 75,000

Item No.	Item	Quantity	Unit	Unit Cost	Total Cost
42	Silt Fence	1,500	LF	$ 5	$ 7,500
43	Rock Construction Entrance	1	LS	$ 2,500	$ 2,500
44	Electrical Service	1	LS	$ 25,000	$ 25,000
45	Electrical Component Installation Costs	1	LS	$ 50,000	$ 50,000
46	Land	10	ACRE	$ 15,000	$ 150,000

Treatment Subtotal:	**$ 1,397,000**
Collection & Treatment Subtotal:	**$ 3,957,000**
Contingency:	**$ 396,000**
Engineering Services:	**$ 594,000**
Legal & Administrative:	**$ 40,000**
Total Probable Construction Cost Estimate:	**$ 4,987,000**

Annual Operation, Maintenance, & Replacement Cost Estimate
Alternative 2: Community Cluster MSTS
South/Southwest Big Kandiyohi Lake Community

Collection System	Estimated Cost	Notes
Service Provider	$3,000	24 hrs./year @125/hr
Miscellaneous Repairs/Service	$2,500	
Electricity		
Grinder Pumps & Controls	$0	To be paid for by private property owner
Equipment Replacement	$18,900	
Collection Subtotal:	**$24,400**	

Treatment System	Estimated Cost	Notes
Service Provider	$3,000	24 hrs./year @125/hr
Property Insurance	$1,200	$100/month
Miscellaneous Repairs/Service	$2,500	
Septage Hauling/Disposal	$1,000	$0.20/gallon, 10,000 gallons every 2 years
Mowing/Snow Removal	$2,500	
Laboratory	$250	
Telemetry	$600	$50/month
Electricity		
Pumps, Blowers, & Controls	$4,400	
Equipment Replacement	$2,200	
Treatment Subtotal:	**$17,700**	
Total Annual OM&R Costs:	**$42,100**	

Probable Construction Cost Estimate
Alternative 3: Community Cluster LSTS
South/Southwest Big Kandiyohi Lake Community

Item No.	Item	Quantity	Unit	Unit Cost	Total Cost
	Collection System				
1	Mobilization and Demobilization	1	LS	$ 228,800	$ 228,800
2	Septic Tank Abandonment	100	EA	$ 1,500	$ 150,000
3	Grinder Station and Controls	100	EA	$ 20,000	$ 2,000,000
4	Grinder Electrical Installation	100	EA	$ 1,000	$ 100,000
5	Building Sanitary Sewer Cleanout	100	EA	$ 300	$ 30,000
6	4" Gravity Building Sanitary Sewer	4,000	LF	$ 50	$ 200,000
7	Pressure Sewer	7,800	LF	$ 30	$ 234,000
8	Pressure Sewer Lateral	7,500	LF	$ 35	$ 262,500
9	Air/Vacuum Release Valve and Manhole	2	EA	$ 12,500	$ 25,000
10	Isolation Valve	3	EA	$ 4,000	$ 12,000
11	Pressure Sewer Cleanout	8	EA	$ 4,500	$ 36,000
12	2" Curb Stops	100	EA	$ 3,000	$ 300,000
13	Washed Stone	1,065	CY	$ 50	$ 53,250
14	Select Granular	1,065	CY	$ 50	$ 53,250
15	Insulation (4")	1,780	SY	$ 50	$ 89,000
16	Property Site Restoration	100	EA	$ 2,000	$ 200,000
17	Asphaltic Roadway Patch	160	SY	$ 100	$ 16,000
18	Class V Gravel Roadway Patch	1,800	SY	$ 17.50	$ 31,500
19	Silt Fence	4,000	LF	$ 5	$ 20,000
				Collection Subtotal:	**$ 4,042,000**
	Treatment System				
20	Mobilization and Demobilization	1	LS	$ 214,000	$ 214,000
21	Septic Tank #1	40,000	GAL	$ 5.50	$ 220,000
22	Septic Tank #2	30,000	GAL	$ 5.50	$ 165,000
23	Equalization Tank	20,000	GAL	$ 5.50	$ 110,000
24	ATU Tank	50,000	GAL	$ 5.50	$ 275,000
25	Denitrification Dose Tank	6,000	GAL	$ 5.50	$ 33,000
26	Denitrification Treatment Tank	12,500	GAL	$ 5.50	$ 68,750
27	Polishing ATU Tank	12,500	GAL	$ 5.50	$ 68,750
28	Dose Tank	12,000	GAL	$ 5.50	$ 66,000
29	Aluminum Access Hatch	20	EA	$ 2,000	$ 40,000
30	Tank Riser Pipe	150	LF	$ 200	$ 30,000
31	Tank Riser/tank Adapter	50	EA	$ 200	$ 10,000
32	Riser Fiberglass Lid	50	EA	$ 400	$ 20,000
33	Effluent Screen	3	EA	$ 1,000	$ 3,000
34	Submersible Effluent Pump	24	EA	$ 3,000	$ 72,000
35	Pump Guide Rails & Discharge Piping	24	EA	$ 3,000	$ 72,000
36	Control Panel	1	LS	$ 100,000	$ 100,000
37	Float Switch Sensors	12	EA	$ 1,000	$ 12,000
38	Aerobic Treatment Unit	2	EA	$ 75,000	$ 150,000
39	Nitrification Treatment Unit	2	EA	$ 75,000	$ 150,000
40	Denitrification Treatment Unit	1	EA	$ 60,000	$ 60,000
41	Polishing Aerobic Treatment Unit	1	EA	$ 75,000	$ 75,000
42	Sludge Receiving Manhole	1	LS	$ 30,000	$ 30,000
43	Chemical Feed Equipment	1	LS	$ 35,000	$ 35,000

Item No.	Item	Quantity	Unit	Unit Cost	Total Cost
44	Magnetic Flow Meter Manhole	1	LS	$ 60,000	$ 60,000
45	Control Building	1	LS	$ 175,000	$ 175,000
46	Control Building Furnishings	1	LS	$ 12,500	$ 12,500
47	Mound Soil Dispersal System	2,100	LF	$ 325	$ 682,500
48	Yard Piping	3,500	LF	$ 45	$ 157,500
49	Tank Insulation	800	SY	$ 50	$ 40,000
50	Gravel Access Road	150	LF	$ 75	$ 11,250
51	Culvert	1	LS	$ 2,500	$ 2,500
52	Perimeter Fence	3,800	LF	$ 20	$ 76,000
53	Site Restoration	10	ACRE	$ 15,000	$ 150,000
54	Silt Fence	2,500	LF	$ 5	$ 12,500
55	Rock Construction Entrance	1	LS	$ 2,500	$ 2,500
56	Electrical Service	1	LS	$ 35,000	$ 35,000
57	Backup Generator	1	LS	$ 100,000	$ 100,000
58	Electrical Component Installation Costs	1	LS	$ 175,000	$ 175,000
59	Land	20	ACRE	$ 15,000	$ 300,000

Treatment Subtotal:	**$ 4,072,000**
Collection & Treatment Subtotal:	**$ 8,114,000**
Contingency:	**$ 812,000**
Engineering Services:	**$ 1,218,000**
Legal & Administrative:	**$ 82,000**
Total Probable Construction Cost Estimate:	**$ 10,226,000**

Annual Operation, Maintenance, & Replacement Cost Estimate
Alternative 3: Community Cluster LSTS
South/Southwest Big Kandiyohi Lake Community

Collection System	Estimated Cost	Notes
Wastewater Operator	-	Provided below
Miscellaneous Repairs/Service	$2,500	
Electricity		
Grinder Pumps & Controls	$0	To be paid for by private property owner
Equipment Replacement	$30,900	
Collection Subtotal:	**$33,400**	

Treatment System	Estimated Cost	Notes
Service Provider	$30,000	$2,500/month for third party Service Provider
Property Insurance	$1,200	$100/month
Administration	$900	1 hr./month @ $75/hr.
MPCA Permit	$250	New permit $1,250 every 5 years
Miscellaneous Repairs/Service	$2,500	
Septage Hauling/Disposal	$2,000	$0.20/gallon, 20,000 gallons every 2 years
Mowing/Snow Removal	$2,500	
Laboratory	$7,500	
Chemical	$6,100	
Telemetry	$600	$50/month
Electricity		
Pumps, Blowers, & Controls	$18,600	
Equipment Replacement	$6,200	
Treatment Subtotal:	**$78,400**	
Total Annual OM&R Costs:	**$111,800**	

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