Western Lake Superior Sanitary District
Comprehensive Wastewater Services Master Plan
June 2016

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Comprehensive Wastewater Services Plan
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Table of Contents

MASTER PLAN EXECUTIVE SUMMARY .......................................................................................... 3
SECTION 1: INTRODUCTION ........................................................................................................ 7
SECTION 2: PLAN GOALS ............................................................................................................. 13
SECTION 3: LAND USE AND DEMOGRAPHICS ......................................................................... 19
SECTION 4: ENVIRONMENTAL CHARACTERISTICS .................................................................... 37
SECTION 5: WLSSD SERVICE AREAS AND UNSEWERED AREAS ............................................. 49
SECTION 6: PROCESS AND FACILITY ANALYSIS ..................................................................... 63
SECTION 7: REGULATORY COMPLIANCE AND SCIENTIFIC FOCUSES ................................. 105
SECTION 8: PLAN RECOMMENDATIONS ..................................................................................... 111
SECTION 9: PLAN ADMINISTRATION .......................................................................................... 115
LITERATURE REVIEW .................................................................................................................. 117

List of Tables

Table 3-1, WLSSD Population Trends (1980-2010) ........................................................................ 30
Table 3-2, WLSSD Population Density .......................................................................................... 31
Table 3-3, Population Projections 2010 - 2040 ............................................................................ 34
Table 3-4, Average Household Size Change 2000 – 2010 .............................................................. 35
Table 5-1, WLSSD Service Areas (square miles) ......................................................................... 49
Table 5-2, WLSSD Sewered and Unsewered Population ................................................................. 50
Table 6-1, WLSSD Flow and Loading Projections 2016-2036 ......................................................... 66
Table 6-2, Summary of WLSSD Capacity and Design Parameters ............................................... 68
Table 6-3, ADWF, Level of Service and Peak Flow by Metering Location ..................................... 73
Table 6-4, Model Predicted Results for Existing and Future Conditions During a 10-year Flow Event ........................................................................................................................................... 84
Table 6-5, Pump Station Capacities and Capacity Ratios – Existing Conditions ............................. 85
Table 6-6, Pump Station Capacities and Capacity Ratios – Future Conditions ............................... 86
Table 6-7, Model Predicted Overflow Points and Volumes – Existing Conditions .......................... 88
Table 6-8, Model Predicted Overflow Points and Volumes – Future Conditions ............................ 89
Table 6-9, Model Predicted Overflow Points and Volumes for the 10-year Flow Event .................. 90
Table 6-10, Model Predicted use of Storage Facilities and summary of Eliminated Overflow Points ........................................................................................................................................... 91
Table 6-11, WLSSD Pump Stations ............................................................................................... 94
Table 6-12, 10-year Capital Improvement Plan for Pump Stations .................................................... 100
Table 6-13, 10-year Capital Improvement Plan for Gravity Interceptors ........................................ 101
List of Figures

Figure 1-1, WLSSD Location Map........................................................................................................... 7
Figure 1-2, Legislative Boundaries Map .................................................................................................... 8
Figure 3-1, Land Cover Map..................................................................................................................... 21
Figure 3-2, Population Density Map ......................................................................................................... 32
Figure 3-3, Population Distribution Map .................................................................................................... 33
Figure 4-1, Dominant Soils Map................................................................................................................ 29
Figure 4-2, Area Watersheds ...................................................................................................................... 43
Figure 4-3, Normal Annual Precipitation ................................................................................................... 47
Figure 4-4, Normal Winter Precipitation .................................................................................................... 48
Figure 4-5, Normal Spring Precipitation .................................................................................................... 48
Figure 4-6, Normal Summer Precipitation .................................................................................................. 48
Figure 4-7, Normal Fall Precipitation ......................................................................................................... 48
Figure 5-1, Existing WLSSD Collection System ....................................................................................... 51
Figure 5-2, Urban Services Boundary Map ............................................................................................... 55
Figure 6-1, WLSSD Existing Facilities Schematic .................................................................................... 64
Figure 6-2, WLSSD Modeled Service Basins ............................................................................................ 69
Figure 6-3, Municipal Peak Flow Standards ............................................................................................. 71
Figure 6-4, Pipe Capacity – 10 Year Design Flow Event (Pump Side) ......................................................... 75
Figure 6-5, Pipe Capacity – 10 Year Design Flow Event (Gravity Side) .................................................... 75
Figure 6-6, Pipe Surcharging – 10 Year Design Flow Event (Pump Side) .................................................. 76
Figure 6-7, Pipe Surcharging – 10 Year Design Flow Event (Gravity Side) ............................................. 76
Figure 6-8, Pipe and Pump Station Capacity Ratios (Pump Side) ............................................................... 78
Figure 6-9, Pipe and Pump Station Capacity Ratios (Gravity Side) ........................................................... 78
Figure 6-10, Modeled Service Basins and Future Service Areas ............................................................... 80
Figure 6-11, Future Conditions Pipe Capacity – 10 Year Design Flow Event (Pump Side) ....................... 81
Figure 6-12, Future Conditions Pipe Capacity – 10 Year Design Flow Event (Gravity Side) .................... 81
Figure 6-13, Future Conditions Pipe Surcharging – 10 Year Design Flow Event (Pump Side) ............... 82
Figure 6-14, Future Conditions Pipe Surcharging – 10 Year Design Flow Event (Gravity Side) .............. 82
Figure 6-15, Future Conditions Pipe and Pump Station Capacity Ratios (Pump Side) ............................ 83
Figure 6-16, Future Conditions Pipe and Pump Station Capacity Ratios (Gravity Side) ......................... 83
Figure 6-17, Condition Criticality Matrix Example .................................................................................... 98

Appendices (Enclosed CD)

A. Collection System Model Update (Brown & Caldwell, November, 2015)
B. Collection System Future Conditions Evaluation (Brown & Caldwell, August 2015)
C. Hermantown Interceptor AMP (CDM Smith, December 2014)
D. Hermantown and East Interceptor Storage Facilities Schematic
E. WLSSD Pump Stations Summary
F. WLSSD Pump Station Improvements since 2010 Master Plan
G. WLSSD Pump Station Recommended Improvements
H. 2016 – 2025 Capital Improvement Program
I. 10-Year Capital Improvement Summaries
Executive Summary

This document provides an update to the 2010 Comprehensive Wastewater Services Master Plan. This is a timely and energetic project entailing a wide variety of water resource, socioeconomic, and engineering issues for a vast area covering approximately 530 square miles.

The Plan quickly and efficiently identifies key issues and provides an action plan directly tied to pertinent WLSSD goals and policies.

A great deal of data and information has been utilized in formulating a useful and beneficial Comprehensive Plan. Many subject areas are covered quite extensively. Others will require further analysis by the District as important environmental and land use planning issues are discussed and acted upon. The Plan includes the following main sections:

I. Introduction and Background
II. Plan Goals
III. Land Use and Demographics
IV. Environmental Characteristics
V. Service Areas and Unsewered Areas
VI. Process and Facility Analysis
VII. Regulatory Compliance and Scientific Focuses
VIII. Plan Recommendations

The content of the document centers on the main mission of the WLSSD to provide a Plan that is environmentally sensitive to key water quality and wastewater collection needs. At the same time the Plan also provides a basis for current and future cost effective planning, consistent with local and regional planning guidelines.

Summary of Plan Recommendations

The following recommendations have been developed through the master planning process. The recommendations are summarized below and discussed in further detail in Sections 6 and 7 of this document.

8.1 Provide support for development of subsurface sanitary sewage treatment systems (SSTS) and/or decentralized collection systems in unsewered areas and areas of concern of WLSSD.

District should continue to work in an advisory capacity with all parties from the land owners affected to the community leaders and other educational and regulatory agencies striving to find the best solution available.

8.2 Manage WLSSD Urban Services Boundary to represent the changing development visions within local communities

It is recommended that the Urban Services Boundary (USB) be adopted as proposed to meet the future needs of the region and that this recommendation become effective upon acceptance of this Plan by the WLSSD Board of Directors and will remain in effect until the Board takes action to cancel or amend the recommendation.
Based again on consultation with local communities, review of local comprehensive land use plans, and a detailed capacity and condition assessment of the WLSSD collection system, the USB defines areas of urban density development, beyond which public utilities such as sanitary sewers should not be extended. Establishment of the boundary ensures controlled expansion of local sewer systems consistent with local comprehensive plans as well as the goals and policies of the District Comprehensive Plan and Capital Improvements Program.

8.3 **Expand the scope of the WLSSD Planning Assistance Grant Program and better define eligibility requirements.**

It is recommended that and the current planning assistance grant program be maintained to support local planning efforts to address problems in unsewered areas of the District. In addition to planning support for unsewered areas, the grant program should be expanded to include such items as development of collection system inventory, GIS data development, and I &I and FOG assessments/studies. Requirements regarding local match, application form, requirements, reporting, deliverables, etc. should be reassessed.

8.4 **Regional Comprehensive Planning Review and Approval**

It is recommended WLSSD continue its policy whereby all member communities are required to adopt and maintain a local Comprehensive Plan. Moreover, all revisions or updates of community plans, specifically in regard to utilities, will require review and approval by the WLSSD Board.

8.5 **Capital Improvements Program/Asset Management**

WLSSD will continue its commitment to maintaining the capacity and effectiveness of the treatment and conveyance facilities through adoption of the recommendations in its Capital Improvement Program. The specific Capital Improvement recommendations resulting from the condition assessments for pump stations and gravity interceptors are highlighted in Section 6 of this document.

8.6 **Geographic Information Systems (GIS)**

WLSSD will develop a coordinated regional GIS data source related to wastewater infrastructure and water quality management and continue to build and maintain a comprehensive GIS database for all WLSSD infrastructure and programs to support District long-range planning and capital budgeting as well as region wide planning efforts.

8.7 **Conveyance System Management Standards**

It is recommended that WLSSD develop and publish conveyance system management standards that include policies and procedures accepting, processing and inspecting direct/service connections to the WLSSD system when necessary, facility ownership/metering and design and construction standards for WLSSD constructed facilities.
8.8 Implement Conveyance System Capacity Management/CMOM Program

Continue to fulfill the components of the WLSSD CMOM in order to ensure capacity of the conveyance system for current and future flows by working collaboratively with municipalities on implementing I & I and FOG reduction programs and through the WLSSD seasonal meter program and the community meter loan program.

8.9 Energy

The WLSSD has joined the Better Buildings, Better Plants Program through the Department of Energy with a goal of reducing overall energy consumption by 25% over the period of 2016 – 2025. Key focus areas include the full utilization of the biogas produced in the wastewater treatment into electricity and/or building heat through upgrades to boilers, gas conditioning and the installation of engine generators, the reduction of overall energy consumption through upgrades and efficiency improvements in WLSSD equipment, buildings and processes and the reduction in fuel consumption through the use of more fuel efficient vehicles.
Section 1: Introduction

1.1 Location and Planning Area

The Western Lake Superior Sanitary District (“WLSSD” or “the District”) is located in northeastern Minnesota at the western tip of Lake Superior (Figure 1-1). The WLSSD area covers approximately 530 square miles in northeastern Carlton County and southeastern St. Louis County.

Figure 1-1, WLSSD Location Map
Within the WLSSD legislative boundaries are eight cities and nine townships including the cities of Duluth, Cloquet, Hermantown, Proctor, Scanlon, Rice Lake, Carlton and Wrenshall along with the townships of Silver Brook, Thomson, Twin Lakes, Canosia, Duluth, Grand Lake, Lakewood, Midway and Solway.

The District also serves the Village of Oliver in Wisconsin and the Knife River Larsmont Sanitary District (KRLSD) along the north shore of Lake Superior, neither of which is within the WLSSD legislative boundaries. WLSSD also accepts hauled liquid waste from throughout the region in addition to household septic tank waste.

Figure 1-2, WLSSD Legislative Boundaries
1.2 WLSSD Authority

The WLSSD was created in 1971 by the Minnesota Legislature as a special purpose subdivision of the State to address problems with water pollution, and collection and disposal of sewage. Minnesota Statutes, Chapter 458D, outlines the framework by which the District is governed, the powers and duties of its Board and officers, taxing authority, cost sharing and planning responsibilities. The statute charged the District with the responsibility of improving and protecting the waters of the St. Louis River basin area.

In 1974, additional legislation was passed which gave the District the added responsibility of solid waste management. The District’s enabling legislation as well as subsequent state legislative action such as SCORE (Select Committee on Resources and the Environment) gave the WLSSD broad powers for planning for wastewater treatment and solid waste, acquisition of existing facilities, construction of new facilities, and the authority to operate facilities and set rates for such services. Within this framework, the District has initiated programs for the abatement of pollutant discharges. Such measures included construction of an advanced regional wastewater treatment plant and wastewater conveyance facilities, supported by ongoing water quality monitoring and facility planning programs.

1.3 WLSSD Mission and Vision Statements

**WLSSD Mission Statement**

The mission of the Western Lake Superior Sanitary District (WLSSD) is to plan and provide for the effective and economical collection and treatment of wastewater and to ensure responsible solid waste management through effective planning and oversight, education and customer services in order to:

- Protect public health and safety;
- Preserve and ensure the best use of waters, land, and natural resources;
- Prevent, control and abate water and solid waste pollution,

...thereby protecting the St. Louis River basin and Lake Superior.

These services will be performed in a manner that exceeds state and federal environmental regulations and with a focus on pollution prevention, waste and toxicity reduction, beneficial reuse and recycling.
WLSSD Vision Statement

The WLSSD will be a leader in effective waste management, continuously evolving to reflect the changing needs of its constituents and stakeholders from local to international levels. This will be achieved through effective long-range planning.

WLSSD’s services will be delivered in a cost-effective manner, providing value to its users and ensuring the long-term financial viability of District operations.

WLSSD will consistently meet or exceed all permit standards. WLSSD will be proactive in seeking and implementing innovative environmental protection strategies that allow the organization to continue as an international leader, especially by pioneering preventive approaches and technologies.

Facilities and equipment will be maintained to a standard of excellence.

Resources to determine effective treatment and disposal options will be available to all within the District.

WLSSD will provide programs that help educate the community and maintain effective relations so that its efforts are viewed as assets to the overall well-being of the neighborhoods it serves.

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WLSSD will be a place where all employees are proud to come to work and express that pride both inside and outside the organization.

District employees will work together to achieve the WLSSD vision by focusing on continuous improvement at individual, process and organizational levels. To achieve the vision for its customers, the District will emphasize training and development, team work, effective communication and conflict resolution, diversity and mutual respect.
1.4 Basis for Comprehensive Plan

The planning authority and sewage treatment responsibilities of WLSSD are a key element to achievement of water quality goals and pollution control. Legislation requires that the District Board prepare and adopt “…a comprehensive plan for the collection, treatment and disposal of sewage in all or a designated part of the District through a system of interceptors and treatment works. [. . .] The Plan shall take into account the preservation and best and most economic use of water and other natural resources in the area; the preservation, use and potential for use of lands adjoining waters to the state to be used for the disposal of sewage; and the impact such a disposal system will have on present and future land use in the area affected thereby.” This Comprehensive Plan is directed toward that goal.

The purpose and need for a Comprehensive Plan is evident when the relationships between water resources, economic growth, population expansion and/or shifts, and environmental preservation are considered. A guideline outlining such relationships between the “natural” and “built” environments is important now and in the future. An effective Comprehensive Plan plays an important role in defining these issues.

The WLSSD Board adopted its first comprehensive plan/program statement on October 4, 1972. Subsequent revisions were made reflecting the changing character and challenges facing the District. Certainly there have been significant changes over the past 43 years in terms of land use patterns, population growth, environmental issues and priorities. New environmental guidelines are also continually changing on both state and federal levels. The Plan was last revised in 2010.

Similar to previous plans, this document serves as a guide to future water quality planning, capital budgeting and facility management for the District. Integral parts of the Plan include goals and policies covering a wide variety of statutory responsibilities and coordination efforts with local, state, and federal governments. Much like its predecessors, this plan recognizes the significant changes facing the District as it relates to population growth, land use patterns and environmental guidelines.

1.5 Planning Approach

The general approach of the planning process is to evaluate current and expected future conditions and prepare effective goals and policies for water quality management, Asset Management and a Capital Improvement Planning (CIP) for the WLSSD now and for the future. This comprehensive planning process has involved extensive data collection, analysis, and discussions related to important issues facing the District today and in the near future.

The Comprehensive Plan addresses the following key areas:

- Planning goals
- Land-use and demographics
- Environmental characteristics
- WLSSD service areas and unsewered areas
- Conveyance system analysis
- Regulatory compliance and scientific focuses
- Plan recommendations
- Plan administration
1.6 Plan Objective

The objective of the revision of the Comprehensive Plan is to develop guidelines which accurately reflect current and future issues and needs. Further, the intent of the Plan is to focus all basic information and planning data into a single document, which describes existing conditions of the wastewater conveyance system, specifies planning goals/objectives, and recommends policies and actions which support future wastewater management needs of the WLSSD region.

Appropriate use of water resources and enforcement of water quality protection can be ensured through strong policies and prudent program implementation. Implementation of such a program requires the cooperation of the two counties, eight cities and ten townships which comprise the WLSSD area as well as a wide variety of commercial and industrial interests, state and local regulatory agencies and environmental groups.
Section 2: Plan Goals

The goals of the Comprehensive Plan provide for future development and growth, in effect “shaping” future development, while minimizing surface water and ground water problems and enhancing the environment. The goals are consistent with state and federal mandates while meeting the more specific and changing needs of the region.

Goal: A goal is a vision toward which water management efforts are directed. This section of the plan identifies five goals for water resources planning and management functions.

Policy: Each goal has several corresponding policies. A policy is a governing principle that provides the means for achieving established goals.

The goals and policies are ultimately developed into specific action items for major topics of the Comprehensive Plan.

Major Topic:
Section 2.1: Regional Planning and Development

Goal: Collaborate with, and provide guidance to, appropriate agencies and citizen groups in their planning efforts to ensure coordination and compatibility with the WLSSD Comprehensive Wastewater Services Master Plan.

1. Ensure adequate planning related to local sewer systems throughout the District by providing communities, industries, and local governmental units (LGUs) with guidelines and technical assistance as appropriate to ensure that water quality is maintained or improved and that regional goals and considerations are factored into local plans.

2. Promote consistency in wastewater planning and related land use policies between LGUs.

3. Participate and provide technical and financial assistance as appropriate in the evaluation and application of alternative wastewater collection and treatment systems for those areas where connection to the WLSSD sewer connection system is neither feasible nor cost effective.

4. Support plans for development of new or expanded public sewer utilities or services that are consistent with local comprehensive plans. If such utility extensions are deemed the best wastewater collection/treatment alternative, developments should be phased in such a way that promotes orderly development.

5. Encourage development generated by new sewer and water services to locate in or adjacent to already developed areas to promote system efficiency, compact densities and orderly development. These areas should be located within the District’s Urban Service Boundary.
6. Continue to evaluate new and emerging wastewater treatment and conveyance system technologies, for the purpose of maintaining the highest level of wastewater treatment that is both economically and technically feasible.

7. Coordinate and provide technical assistance to local agencies in the planning of all treatment systems within the District so that they constitute a coordinated sewage disposal system. Priority should be given to existing developed areas where immediate public health issues and/or water pollution is a concern.

8. Support the development of a coordinated regional Geographic Information System (GIS) related to wastewater infrastructure and water quality management.

Major Topic: Section 2.2: WLSSD Facilities and Services

**Goal:** Provide cost effective and environmentally sound wastewater collection and treatment facilities, in accordance with Minnesota State Statute 458D.05, which provides for “the preservation and best and most economic use of the water and other natural resources in the area.”

1. Maintain a strategic planning process which identifies capacity, cost and reliability priorities for the wastewater treatment and conveyance system to ensure that the District is able to provide cost effective conveyance and treatment services while maintaining or improving its treatment capabilities.

2. Ensure that all new sewer extensions within the District are reviewed prior to a permit issuance. Ensure that clear and consistent criteria are developed in regard to the conditions these extensions must meet for approval (e.g., area identified in local comprehensive plans, located within the WLSSD Urban Services Boundary, etc.)

3. Ensure continued compliance with regulations concerning discharges into District treatment facilities, compatible with federal and state regulations, as well as local conditions (WLSSD Model Ordinance Regulating the use of Public and Private Sewers, WLSSD Ordinance Establishing Standards for Reduction of Inflow and Infiltration, WLSSD Ordinance Establishing Standards for Fats, Oils and Grease Reduction, Industrial Pretreatment Ordinance, CMOM, Capacity Allocation System).

4. Restrict infiltration and inflow (I&I) into the sewer system through water conservation education, sound operating procedures, proper design and construction practices, maintenance of existing facilities, and strict enforcement by all municipal and industrial sources.

5. Reduce inflow and infiltration across the entire WLSSD system by providing leadership, education, monitoring, policy development and enforcement in order to prevent the release of untreated sewage to the Lower St. Louis River and Lake Superior.
Major Topic:
Section 2.3: Regulatory Responsibility and Water Quality Management

**Goal:** Maintain WLSSD’s responsibility for managing water quality within the District while recognizing and cooperating with the regulatory authority of other local, state, tribal, and federal entities.

1. Maintain and implement this plan and all subsequent amendments consistent with the requirements of appropriate regulatory agencies.

2. Recognize the responsibility of Carlton and St. Louis counties, the Fond du Lac Band of Lake Superior Chippewa, the Minnesota Pollution Control Agency, the Environmental Protection Agency and local municipalities for establishment and implementation of a local program for water resource management and land-use planning, and foster sound working relationships to ensure coordination of efforts.

3. Collaborate on programs, research and policy development led by the regulatory community and government agencies that focus on TMDL development for the St. Louis River, delisting the lower St. Louis River AOC, restoring the habitats and the beneficial uses of the lower St. Louis River.

4. Equitably enforce applicable state and federal pollution control guidelines.

5. Ensure consistency with District goals by requiring local governmental units (LGUs) obtain District review and comment during the development of local comprehensive water quality plans and land use plans and through the review of all related permit requests affecting water quality within the District.

6. Support river, stream and lake monitoring which aid in determining compliance with water quality standards and/or provide information as to needed water quality improvements and opportunities.

   Reduce pollution from nonpoint sources through the development and implementation of pollution prevention policies and education programs for homeowners and businesses.

7. Coordinate a program between the District, Carlton and St. Louis counties, the Minnesota Pollution Control Agency and others as appropriate to identify and evaluate best available solutions to failing individual sewage treatment systems.

8. Maintain and share ongoing water quality and wastewater operating data.

Major Topic:
Section 2.4: Finance

**Goal:** Finance projects by means that are equitable to all customers.

1. Develop and implement financial policies and practices consistent with the District enabling legislation and other applicable state and federal requirements.
2. Develop and maintain capital improvement plans based upon strategic priorities and ensure that each project undergoes a rigorous technical and financial review to ensure it meets the long-term needs of the District and its users.

3. Pursue all available grants, loans and other alternative funding sources to fund wastewater system improvement projects consistent with Plan recommendations.

4. Support efforts by member communities to secure outside funding assistance of local collection system projects to those consistent with WLSSD facility plans and capital improvement projects.

5. Call upon the resources and assistance of the state and federal governments for financial support of water quality initiatives

Major Topic:
Section 2.5: Public Participation, Information and Education

Goal: Increase public participation and knowledge in regional wastewater and water quality management.

1. Effectively utilize a variety of media—including newsletter, radio, television, internet, and newspaper—to present and encourage discussion of water quality and water conservation issues affecting the District and its residents.

2. Support existing and future education programs directed at the preservation and improvement of water quality within the lower St. Louis River basin.

Major Topic:
Section 2.6: Energy Management

Goal: Improve energy efficiency continuously by establishing and implementing an effective energy management and conservation program that supports modern technological capabilities and customer satisfaction, provides a safe and comfortable work environment, while complying with all permit requirements and maintaining effective operations by:

1. Offsetting rate increases with energy reduction improvements

2. Dedicating resources to identifying and evaluating energy reduction opportunities

3. throughout District facilities and comply with energy conservation requirements mandated by state/local government

4. Establishing energy management program responsibility within the WLSSD organization.
5. Incorporating energy management and conservation practices into applicable District policies such as purchasing and personnel

6. Promoting and emphasizing energy conservation best practices at a staff level by

7. Encouraging efficient use of resources through training and education efforts and discussions at the work team level

8. Evaluating and implementing practices to conserve energy beyond direct consumption. (i.e. energy consumption for manufacturing, transportation, etc.)

9. Working toward utilizing 100% of waste energy and available infrastructure at WLSSD facilities

10. Evaluating WLSSD’s carbon footprint in anticipation of carbon credit opportunities

11. Incorporating energy management/conservation in public education programs

**Goal:** Collaborate with governmental agencies, utility companies or other organizations on energy conservation opportunities. Actively seek out available funding sources and grants for projects that focus on energy reduction efforts or utilizing renewable energy sources by:

1. Support further development of internal and external energy-efficient technologies

2. Work to establish partnerships to implement or pilot the use of alternative or renewable energy sources at WLSSD facilities

3. Secure adequate and reliable energy supplies at the most advantageous rates, and implement contingency plans to protect operations from energy supply interruptions

**Goal:** Establish funding sources dedicated to implementing energy reduction improvements.

1. Establish standing capital budget item for energy reduction improvements

2. Incorporate energy evaluation as part of long term vehicle replacement plan and individual vehicle purchases

3. Incorporate energy efficiency, conservation and state of the art energy reduction technologies in all new installations, modifications and replacements to existing process and facility designs.

4. Support and/or adopt State and National energy efficiency policies/standards/goals
Section 3: Land Use and Demographics

Section 3.1: Comprehensive Land Use Planning

The land use planning authority in relationship to WLSSD is clearly set forth in Minnesota State Statutes, Chapter 458D, Subsection 458D.05. Under this authority the District requires that “each local governmental unit.....shall adopt a similar comprehensive plan and program for the collection, treatment, and disposal of sewage for which the local government unit is responsible ...”

All member communities have maintained and adopted comprehensive plans since the mid-1970s, including identification of future wastewater management needs. Some plans have been updated more often than others. WLSSD Staff has worked to insure that the needs of local cities and townships are accurately represented in this Plan.

Future modifications or revisions of local plans which affect the WLSSD Plan will require review and approval by the WLSSD Board. Since beginning operations in the 1970s, local sewer extension requests have systematically been reviewed by the WLSSD to determine consistency of planned land uses and utility expansions with local and regional land use plans.

Section 3.2: Community Land Use and Plans

The land use and demographic features of the eight cities and nine townships within the WLSSD area illustrate a primary concentrated urban area in Duluth and parts of Hermantown and a smaller center to the west along I-35 in Cloquet. Scattered urban density development has also occurred adjacent to inland lakes such as Pike Lake, Grand Lake, Caribou Lake and Chub Lake and along the shore of Lake Superior in Duluth and Lakewood townships. The urban development pattern of the WLSSD area is a result of early settlement, historical growth and current economic conditions within the region. Besides being influenced directly by the Lake Superior basin and associated environmental issues, the region is also characterized by the wide variety of rural and urban development patterns found within its jurisdictional boundaries. Waterways, transportation corridors, natural green belts, and commercial development continue to influence community growth patterns and shape land use and demographic features.

Growth in the WLSSD area can be described as linear. The City of Duluth, as the major metropolitan area, stretches northeast-southwest along the north shore of Lake Superior and has urban land uses and local infrastructure needs. Development activity has historically spread to outlying suburban areas and along transportation corridors extending to the north, south, and west of the city.

The land use and demographic picture for the WLSSD area indicates a shift in population distribution and development to outlying suburban areas of Duluth and rural areas of adjoining communities (City of Rice Lake, Canosia Township, Grand Lake Township, and surrounding townships to the north). Considerable development has taken place in the City of Hermantown, with higher density growth continuing in the eastern half of the City. Concentrated pockets of residential development are found around Pike Lake, Caribou Lake, Chub Lake, and the Grand Lake areas. More concentrated residential and commercial development is also found along the north shore of Lake Superior.
A large percentage of the high-growth areas in the WLSSD area are rural in nature and served by individual sewage treatment systems. Emerging issues are also found in the surrounding communities experiencing growth around suburban lakes and other unsewered areas that are attracting rapid growth.

As noted, the primary urban centers for the region are the cities of Duluth, Hermantown and Cloquet. Figure 3-1 on the following page depicts the various land use and land cover classification within the District. Also of note is significant growth in the second tier of townships surrounding the city of Duluth where lake frontage and rural character within commuting distance attract residential development.
Current and future land use information for the WLSSD region was reviewed as part of the development of the Comprehensive Plan. In addition, all existing comprehensive plans, land use plans, water quality plans and other associated planning documents presently in place throughout the region were reviewed by District staff. Current land use trends show residential development extending from Duluth west to outlying suburban areas, bordering communities and adjoining townships. Key development areas include the City of Hermantown, and portions of the City of Rice Lake and Twin Lakes, Canosia and Grand Lake townships.

As a result of a creation of the Duluth North Shore Sanitary District (DNSSD) and the Knife River Larsmont Sanitary District (KRLSD) which provide sewer service along the North Shore between Duluth and Knife River a North Shore Land Use Plan was developed to address growth in an area from Lester River in Duluth to Two Harbors. The Duluth North Shore Sanitary District and Lake County commissioned the North Shore Land Use Plan to address the land use issues and local development priorities in light of the potential for new development opportunities along the North Shore.

The shift in residential development from central Duluth to outlying suburban and rural areas shows a land use pattern typical of large metropolitan communities. Residential, commercial, and industrial development interests follow major corridor routes with open, available land areas found in outlying suburban locations. Also, rural, low-density development typically occurs in areas removed from urban services.

Commercial and industrial land uses in the WLSSD area are mainly confined to urban areas and transportation corridors related to Duluth and Cloquet. Commercial strip development is located in association to these transportation areas and is not specifically restricted to corporate limit boundaries. A linear development pattern is found to a great degree along Highway 53 west of Duluth, as well as along the north-south Interstate 35 corridor, Highway 61 along the North Shore and Highway 33 north through the city of Cloquet.

Other communities within the WLSSD area show a more concentrated development pattern based on corporate limits and public services. Following is a brief discussion of key land use activities in member communities.

**Section 3.2.1: St. Louis County Communities**

**City of Proctor**
The City of Proctor has had a stable population over the past 50 years, with a peak population of 3,180 in 1980. The population of Proctor is concentrated in the central part of the community, while the northern and southern portions remain relatively rural. Economic development efforts within Proctor are focused in the downtown area and along the Interstate 35 corridor. The City of Proctor recently completed the Kirkus Street construction project which created a direct east-west connection in the southern half of Proctor and opened up a largely undeveloped section of the City for potential future residential development.

The area around the intersection of Interstate 35 and Boundary Avenue has developed into a highway commercial node with the additions of a fast food restaurant, a gas station/convenience store and a hotel. Additional commercial development is possible in this area. In 2013, the City of Proctor annexed a 67.5 acre portion of neighboring Midway Township along Interstate 35 which has been identified by the City as a potential area for expansion of water and wastewater utilities to facilitate additional commercial development.

The City of Proctor last updated its comprehensive plan in July 2010.
Midway Township
Midway Township is a primarily rural community immediately adjacent to the cities of Hermantown, Proctor and Duluth. Population within the Township has gradually declined since 1970.

The majority of the town is rural residential in nature with some agricultural uses. Midway Park is portion of the Township immediately adjacent to the City of Proctor with more urban densities and is served by public sewer and water. Midway Township has an agreement with the City of Proctor for the maintenance of the Midway Park sewer area along with billing for residents connected to the utilities in this area. The Township intends to limit utility services within the Midway Park area to the current served area.

Sanitary sewer service is provided to a number of parcels in the Midway Road/Becks Road area. The Township is currently in the planning stages of developing a wastewater collection system that would serve additional properties on Midway Road north of Interstate 35 and south of the Interstate on Becks Road. The extension of utilities in these areas will address existing issues with on-site treatment systems and will not be used as a tool to increase the density of development.

An Orderly Annexation Agreement was reached with the City of Duluth in 2014 to annex 2,500 acres of mainly Duluth owned land south of the Interstate 35 corridor.

Midway Township updated its comprehensive plan in 2015.

Solway Township
Solway Township is located in the southern portion of St. Louis County, adjacent to Hermantown, Proctor and west of the City of Duluth. The Township has experienced small population growth over the past 30 years.

Large portions of the Township are forest covered and nearly one-third of the Township is wetland. The soils in Solway Township have issues with permeability and/or high water tables, which present severe limitations to build dwellings with basements in lower areas.

Solway Township has no immediate plans for adding sewer service to any portion of the Township in the next 5-10 years. The dominant land use in the Township is large-lot rural residential. The highest levels of residential development can be found in the eastern part of the township and along Morris Thomas Road, paralleling the southern border. In addition, the northeast corner of Solway Township contains several more densely populated residential subdivisions.

Solway Township does not have a large amount of commercial or industrial development. Commercially zoned land accounts for about 120 acres of Solway Township and lies mainly between U.S. Highway 2 and Old Highway 2. Highway 194 is an option for commercial development with good road access.

The Solway Township Comprehensive Plan was most recently revised March 2001.

City of Hermantown
The City of Hermantown updated its 1976 Comprehensive Plan in August 2001. Land use projections did not change significantly as a result of the plan update. Property east of the Ugstad road is a high-density area (1/2 to 1-acre lots); west of the Ugstad road is lower density. Hermantown’s current population growth averages approximately 35 new homes per year. Most of the larger sewer extensions have been intended to serve existing development; however, new development is occurring within the interiors of main roadways where new
sewer extensions have been constructed. There is potential for secondary retail development remaining behind existing principal retailers along the Highway 53 corridor.

In July of 2014, the City of Hermantown adopted a “Small Area Planning Guide” aimed at researching neighborhoods and/or portions of the City with similar issues. Small area plans provide recommendations for economic development, land use, housing, transportation, parks and recreation, environmental preservation, community heritage and other topics. These small area plans will serve as a complement to the 2001 Hermantown Comprehensive Plan. Areas identified for further study include: the Adolph Neighborhood Small Area Plan in 2014, Gateway Commercial Corridor in 2015, Housing Opportunity Areas in 2016, Airport Commerce in 2017 and Small Economic Activity Centers in 2018.

**Canosia Township**

Canosia Township is located within St. Louis County immediately adjacent to the cities of Duluth and Hermantown. Since 1980, Canosia Township has seen population growth of 38.2-percent, which is one of the fastest growing areas within the WLSSD area. The northern portion of Canosia Township is characterized by low density rural residential or undeveloped land. The areas around Pike Lake and Caribou Lake have more dense residential development. Since the majority of lakeshore on these lakes is currently developed, most new development on these lakes would likely be additions to existing homes or the redevelopment of seasonal cabins or traditional mobile homes into year-round homes. There is also the potential for additional second-tier lake development in some areas around Pike and Caribou Lake.

The “Four Corners” area at the intersection of Highway 53 and Midway Road is the primary commercial district within the Township and serves both local and through traffic. An area identified within the Township as an area of future growth and development is the North Airport Development area along Stebner Road. Water and sewer service would be needed in this area if any future development were to occur. In addition, Canosia Township supports continuing to looking at wastewater treatment concepts to address issues with on-site treatment systems on Caribou Lake.

In 2000, Canosia and Grand Lake townships completed building a wastewater collection system and created the Pike Lake Area Wastewater Collection System (PLAWCS) to sewer an area with identified water quality and health concerns.

Canosia Township updated its comprehensive plan in 2015.

**Grand Lake Township**

Grand Lake Township updated its comprehensive plan in 2000. The township plan projects the growth of approximately 700 people in the next 20 years adding about 265 new households. This growth will be sporadic and dependent on changing economic conditions, but on average, 13 new households per year. What this could mean to WLSSD is additional environmental pressures on surrounding Pike, Caribou and Grand lakes as the expected growth will likely focus on shoreland areas. The only area in Grand Lake that is presently sewered is the westerly half of Pike Lake.

In 2015, construction has started to build a decentralized wastewater collection system for the residents of Birch Point located on the North West side of Caribou Lake. In total there are 34 homes in the project area.

**City of Rice Lake**

The City of Rice Lake is located in southern St. Louis County directly north of the City of Duluth. Once primarily a rural area, the City is now a transition area between the urban area around Duluth and rural St. Louis County.
The southernmost part of the City generally has the highest density of development, with densities continuing to decrease to the north.

Over the past 30 years, the City of Rice Lake has seen a steady increase in population, nearly six-percent in this time. Besides vacant land, single-family homes are the most dominant land use feature in the City. Residential land south of Martin Road is zoned urban residential and contains smaller average sized lots with a higher density throughout. North of Martin Road is considered rural residential and contains larger lot sizes extending to 160 acres.

Since there is such an abundance of vacant land (41%) throughout the City, the opportunity for future development of residential land use is very promising. Recent expansion has occurred in the urban residential zone along Charles Road while several new roads have been constructed throughout the rural residential zones.

Most of the homes in the City have subsurface sewage treatment systems (SSTS). The majority of properties located in the southeast portion of the City are served by a centralized sewer system. The City recently completed the construction of additional sewer utilities along West Calvary Road has connect individual single family homes formerly with on-site treatment systems to the wastewater collection system.

Commercial uses occupy approximately two-percent of City land. The majority of commercial sites are in the western half of the City along Rice Lake Road. Existing commercial sites are also located along busier roads in the City including Howard Gnesen, Arnold, and East Calvary roads. The City of Rice Lake has identified the Rice Lake Road as a focus area for future commercial growth and areas on East Calvary Road and Martin roads for future industrial activities.

The City of Rice Lake last amended its Comprehensive Plan in January 2007 when it was still a township.

City of Duluth
The City of Duluth completed an update of its comprehensive plan in 2006 and is currently in the process of creating a new comprehensive plan as of the date of this document. Consulting with City Staff it was identified that a majority of future development within the City of Duluth will be in-fill in within existing areas of the City and re-development of existing sites. One such re-development site is the location of the former U.S. Steel mill in Gary New Duluth where future industrial uses could locate. Other recently completed redevelopment projects include the Pier B development adjacent to Bayfront Park, Maurices corporate offices in the downtown area, the Blue Stone Lofts and Blue Stone Flats housing and retail development adjacent to University of Minnesota-Duluth and Harbor Bay Development along London Road and 23rd Avenue East. Further commercial and light industrial uses are anticipated to infill around the Duluth International Airport and within the existing Airport Industrial Park. Additional residential development areas have been identified along Kenwood Avenue and Arrowhead Roads and also the Grand Avenue Estates near Morgan Park.

The population of Duluth has been stable for the past decade. The total population of Duluth was estimated at 86,239 in the 2008 – 2012 American Community Survey. The number of housing units has also remained relatively consistent since the 1980’s.

There are approximately 15,400 acres within the City of Duluth (36%) that are undeveloped, including both public and private ownership. According to the City of Duluth Comprehensive Plan, the City’s preference for future development is infill, redevelopment, and neighborhood extensions.
Duluth Township
Duluth Township completed a comprehensive plan update in August 2002. New housing has occurred throughout the Township. All new housing promotes the rural character of the Township and sustainable development practices. Residential developments include a broader mix of homes and some multi-unit, larger parcel developments. Commercial and industrial developments within the Township have experienced some growth, but only in a limited and well managed way. New commercial services exist that serve the basic needs of residents and are located in commercial districts along Scenic Highway 61. The 2002 comprehensive plan discourages development that changes the density as currently zoned and encourages the preservation or protection of areas unsuitable for development due to environmental, economic, or community constraints. Along the North Shore Corridor of Duluth Township there is existing sewer service. The comprehensive plan recommends that the current development density and mix of housing lot sizes, housing types, and amenities are maintained. The plan also seeks to limit development in the North Shore Corridor that puts at risk the engineered carrying capacity of community or regional infrastructure.

Lakewood Township
Lakewood Township adopted a revised comprehensive land use plan in August 2008. There are relatively large areas of undeveloped private properties in the Township. How these numerous, relatively undeveloped properties are developed will be an emerging issue for the Township. The primary land use in Lakewood Township is single-family residences located primarily along roads. Approximately 1000 acres of the Township are in a density class greater than 4.8 acres. Sixty acres are in developments less than one acre. There is currently one area zoned for commercial use. There are two areas in the Township where residential development occurs in higher densities than the majority of the Township. These areas are located in the southeast and southwest corners of the Township. These areas continue to experience increasing development pressure.

A very small portion of Lakewood Township is served by municipal sanitary sewer in the Duluth North Shore Sanitary District (DNSSD). Septic systems are a major environmental issue, but advancements in technology and education in maintenance have helped reduce pollution from these sources. New technology with wastewater collection systems makes the concept of public sewer an option. Although very expensive, options such as small diameter pressure mains have been installed in many rural areas. There are also clustered systems that may be a viable alternative. There are a number of parcels that are unacceptable for on-site treatment due to the proximity of ground water and/or surface water.

Section 3.2.2: Carlton County Communities
According to the Carlton County Community Based Comprehensive Plan, last updated in 2002, most future development in the County is anticipated to occur in the northeastern part of the County in proximity to the Interstate 35 and Highway 33 corridors. This growth will primarily be residential, with commercial development occurring directly adjacent to the highway corridors. Individual city and township strategic planning will be necessary to deal with increased development pressures throughout the County.

The Economic Development Office of Carlton County currently reports six major industrial, commercial or residential developments within the County including the Cloquet Business Park, United Development of Cloquet, Esko Industrial/Business Park, Moose Lake Retail Park, Esko Town Center, and the Carlton County Commercial Development.
Western Lake Superior Sanitary District
COMPREHENSIVE WASTEWATER SERVICES PLAN

With regard to wastewater treatment, the County Plan promotes cluster, rather than strip, commercial
development and encourages the development of commercial and industrial areas on sites accessible to public
utility systems. For areas not accessible to public utilities, the County supports evaluating the feasibility of
providing sewer services to fully developed lakeshore areas within the county with significant septic system
failure rates and exploring funding possibilities for this purpose. This includes identifying areas of high
groundwater sensitivity and areas where septic system failure is likely to occur. The County Plan also
encourages educating the public about on-site sewage treatment regulations and the use of alternative systems,
enforcing on-site sewage treatment requirements and update as needed in accordance with the Carlton County
Water Plan and provide technical assistance and information about low interest loan programs that assist
landowners in upgrading their systems.

City of Cloquet
The City of Cloquet depicts a stable, freestanding community not specifically tied to the growth patterns of the
City of Duluth. Development is confined to existing City limits and service areas. Rural density patterns are found
in the balance of Cloquet. Over the past ten years the City of Cloquet has extended utilities north along Highway
33 to serve the 120 acre business park (with 80 developable acres). Presently, the business park has two
tenants. The City has also indicated that a significant area surrounding the business park could be developed
into residential uses over the next 20 years. Another area of interest is an area designated as Commercial-
Industrial Reserve north of I-35. The City has included a map of “Phased Public Sewer and Water Extension and
Staged Urban Growth” within their 2007-2027 Comprehensive Plan.

City of Carlton
Effective in January 2015, the cities of Carlton and Thomson consolidated to create a larger City of Carlton. The
cities of Carlton and Thomson had not experienced significant growth in the last several years, with the City of
Carlton experiencing a population decrease over the past 20 years.

The City of Carlton has a mix of existing housing including single family homes, apartments and assisted living.
The City still has some developable land within the core of the community. Currently water and sanitary service
cover all but the rural portion of the City. Commercial development within Carlton is primarily located in the
downtown area with some light industrial activities on the outskirts of the City.

The City of Carlton has identified a number of areas as focal points for housing development areas. These
include a four block area on the west side of First Street, a section of land south of Dalles Avenue, the South
Terrace Neighborhood, and an area east of Thomson Road. Another potential site identified for apartments or
townhomes exists along Third Street, north of Cedar Avenue. The landscape in Carlton limits development in
some locations with the presence of wetlands and rock.

The cities of Carlton and Thomson located within Carlton County have not experienced significant growth in the
last several years. In fact the City of Carlton has seen its population decrease over the past 20 years. In 2008
the City of Carlton constructed a new water tower.

Silver Brook and Twin Lakes Townships
The townships of Silver Brook and Twin Lakes have seen an increase in population of nearly 15-percent each. It
is projected that both of these townships will continue to see significant growth. Most important to the District
will be the projected growth in Twin Lakes Township as it continues to plan for sewering more of its community
north of Highway 210 and a larger development south and east of the Olsonville area along I-35 and Hwy 61. In
2006 the Black Bear Casino expanded its footprint with the construction of a new larger casino and additional
hotel and banquet hall space among other things. There have been recent discussions about a possible future annexation of Twin Lakes Township by the City of Carlton.

**Fond du Lac Reservation**

The Fond du Lac Reservation Land Use and Management Plan was adopted in January of 1998. The plan indicates that there is not a significant amount of population growth predicted or planned in the next 5-10 years. Primarily there are three distinctive “neighborhoods” – Brookston, Cloquet and Sawyer – with no single central focal point. The area roughly a half-mile to the west, south and east of the intersection of Big Lake and University roads is the institutional core of the Fond du Lac Reservation. It contains the tribal center, Ojibwe School, clinic and other tribal offices and service buildings. This area depicts the most westerly expansion of sanitary sewer from the City of Cloquet system.

The Big Lake Sanitary District is located within Perch Lake Township, Sawyer Township, and within the exterior boundaries of the Fond du Lac Indian Reservation. Currently wastewater treatment within the Sanitary District consists of individual sewage treatment systems (ISTS) for each home or business, including conventional systems (septic tank with drainfield or holding tank), mound systems, or privies. Studies completed by Indian Health Services on tribal properties indicate that many of these existing systems are failing or “non-compliant”.

As a result of the studies mentioned above, The Big Lake Area Sanitary District was officially formed in January 2007 in accordance with Minn. Stat. §§ 115.18 to 115.37. Recent studies into all the available wastewater treatment options for the estimated 350 residential properties located around and adjacent to Big Lake and the area between the lake and the City of Cloquet has shown that the best available option would be to study connection to and treatment of the wastewater by WLSSD. Studies continue today looking into the best way to make such a connection to WLSSD, whether it is a direct connection or a connection via the City of Cloquet collection system.

**City of Scanlon**

The City of Scanlon has also seen some new commercial development along the southeast portion of the city with another 35 potential acres zoned for commercial development. According to the U.S. Census data from 2010, the City of Scanlon has seen moderate increase in population growth. Surrounding economic development in the communities of Cloquet and Duluth, which serve as working hubs, likely contributed to this growth. Currently Scanlon has approximately 100 acres of undeveloped residential land available. Scanlon updated its Comprehensive Plan in 2015.

Scanlon will utilize a systematic short-range planning process to continue to provide adequate infrastructure and maintenance for city structures, parks, trails, water, sanitary, and storm sewer systems, roads, and other public facilities to sustain future growth.

In 2015 the residents of the City of Scanlon initiated a petition requesting that the State of Minnesota explore the benefits of a merger between Cloquet and Scanlon. The Scanlon City Council voted to move forward with the preliminary merger study in 2015.

**Thomson Township (Esko)**

Thomson Township has seen significant growth over the past 20 years with expected growth to continue at its present pace. Most recently the Township has prepared land along I-35 between Esko and Scanlon as its industrial/business park. Water for fire protection and sanitary sewer infrastructure has already been extended to this property. The Township has also platted land adjacent to I-35 just east of County Highway 1. This area is
designated for Highway Commercial uses and is referred to as the Town Center development area. Thomson Township last updated its Comprehensive Plan in 1999.

City of Wrenshall
The City of Wrenshall has remained relatively stable over the past 10 years. The potential for growth within the city limits is great but expected to happen at a much more gradual pace than some other areas within the District. Like Carlton, Wrenshall recently built a new water tower in 1997-98.

Section 3.3: Population and Demographics

The demographic data used in this report was primarily collected utilizing resources available from the U.S. Census Bureau and the Minnesota State Demographer’s Office. In addition, local comprehensive plans as well as the Duluth-Superior Metropolitan Interstate Council (MIC) Long Range Transportation Plan were used as references for demographic trends and projections.

An historical analysis of the WLSSD area finds that long-range trends showed a peak in Duluth and immediate surrounding area population in the 1960s. It was during this period that Duluth reached its highest population of 106,884 with more than 45-percent of the total St. Louis County population. However, since that time Duluth has experienced a decline in population. The 2010 census figures for the City of Duluth show a population of 86,265, or 43-percent of the St. Louis County population and 63-percent of the WLSSD population. The State Demographer’s estimated projections to the year 2030 show slight increases in the City of Duluth population, reversing the slow decline experienced during the 1970s and 1980s.

Population data for the WLSSD area show three-percent increase in total District population between 2000 and 2010. Overall, the Carlton County portion of WLSSD increased over 10-percent between 2000 and 2010 while the St. Louis County portion of WLSSD increased by two-percent. Table 3-1 shows the percentage of population change between 2000 and 2010 for all District communities. The overall “shift” in population to suburban and nearby rural areas is indicative of demographic trends experienced throughout northeastern Minnesota. Historic data and economic fluctuations found population movement to more concentrated neighborhoods in Duluth urban areas. However, over the last 15-20 years a change in population is noted from these areas to nearby second tier suburban tracts and rural locations. Isolated development and population shifts are also noted around area lakes (e.g., Pike Lake, Caribou Lake, Grand Lake, Chub Lake) and along the North Shore of Lake Superior. A population map and population distribution map based on the 2010 Census can be found on pages 32 and 33.

The analysis of forecasted trends for the WLSSD area finds that the “shift” in population to suburban and rural areas around Duluth will continue. Of note is a significant forecasted rise in population in the cities of Hermantown, Rice Lake and Wrenshall and the township areas of Canosia, Grand Lake, Duluth, Lakewood, Thomson, Twin Lakes and Silver Brook. The largest percentage increase in the last 10 years has been in the Twin Lakes and Silver Brook townships. This is important to the District in that the majority of these areas are not currently served by public sewer utility services.
### Table 3-1, WLSSD Area Population Trends 1980 - 2010

<table>
<thead>
<tr>
<th>Area</th>
<th>1980</th>
<th>1990</th>
<th>% Change</th>
<th>2000</th>
<th>% Change</th>
<th>2010</th>
<th>% Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>St. Louis County Total</td>
<td>222,229</td>
<td>198,213</td>
<td>-10.8%</td>
<td>200,528</td>
<td>1.2%</td>
<td>200,226</td>
<td>-0.2%</td>
</tr>
<tr>
<td>St. Louis County (WLSSD)</td>
<td>116,944</td>
<td>109,841</td>
<td>-6.1%</td>
<td>113,033</td>
<td>2.9%</td>
<td>115,242</td>
<td>2.0%</td>
</tr>
<tr>
<td>Duluth</td>
<td>92,811</td>
<td>85,493</td>
<td>-7.9%</td>
<td>86,918</td>
<td>1.7%</td>
<td>86,265</td>
<td>-0.8%</td>
</tr>
<tr>
<td>Hermantown</td>
<td>6,759</td>
<td>6,761</td>
<td>0.0%</td>
<td>7,448</td>
<td>10.2%</td>
<td>9,414</td>
<td>26.4%</td>
</tr>
<tr>
<td>Proctor</td>
<td>3,180</td>
<td>2,974</td>
<td>-6.5%</td>
<td>2,852</td>
<td>-4.1%</td>
<td>3,057</td>
<td>7.2%</td>
</tr>
<tr>
<td>Rice Lake</td>
<td>3,861</td>
<td>3,883</td>
<td>0.6%</td>
<td>4,139</td>
<td>6.6%</td>
<td>4,095</td>
<td>-1.1%</td>
</tr>
<tr>
<td>Grand Lake Twp.</td>
<td>2,166</td>
<td>2,355</td>
<td>8.7%</td>
<td>2,621</td>
<td>11.3%</td>
<td>2,779</td>
<td>6.0%</td>
</tr>
<tr>
<td>Lakewood Twp.</td>
<td>1,680</td>
<td>1,799</td>
<td>7.1%</td>
<td>2,013</td>
<td>11.9%</td>
<td>2,190</td>
<td>6.0%</td>
</tr>
<tr>
<td>Canosia Twp.</td>
<td>1,562</td>
<td>1,743</td>
<td>11.6%</td>
<td>1,998</td>
<td>14.6%</td>
<td>2,158</td>
<td>8.0%</td>
</tr>
<tr>
<td>Solway Twp.</td>
<td>1,665</td>
<td>1,722</td>
<td>6.4%</td>
<td>1,842</td>
<td>4.0%</td>
<td>1,944</td>
<td>5.5%</td>
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<tr>
<td>Duluth Twp.</td>
<td>1,604</td>
<td>1,561</td>
<td>-2.7%</td>
<td>1,723</td>
<td>10.4%</td>
<td>1,941</td>
<td>12.7%</td>
</tr>
<tr>
<td>Midway Twp.</td>
<td>1,656</td>
<td>1,500</td>
<td>-9.4%</td>
<td>1,479</td>
<td>-1.4%</td>
<td>1,399</td>
<td>-5.4%</td>
</tr>
<tr>
<td>Carlton County Total</td>
<td>29,936</td>
<td>29,259</td>
<td>-2.3%</td>
<td>31,671</td>
<td>8.2%</td>
<td>35,386</td>
<td>11.7%</td>
</tr>
<tr>
<td>Carlton County (WLSSD)</td>
<td>19,647</td>
<td>19,292</td>
<td>-1.8%</td>
<td>20,192</td>
<td>4.7%</td>
<td>22,294</td>
<td>10.4%</td>
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<tr>
<td>Cloquet</td>
<td>11,142</td>
<td>10,885</td>
<td>-2.3%</td>
<td>11,201</td>
<td>0.3%</td>
<td>12,124</td>
<td>8.2%</td>
</tr>
<tr>
<td>Carlton</td>
<td>862</td>
<td>923</td>
<td>7.1%</td>
<td>810</td>
<td>-12.2%</td>
<td>862</td>
<td>6.4%</td>
</tr>
<tr>
<td>Scanlon</td>
<td>1,050</td>
<td>878</td>
<td>-16.3%</td>
<td>838</td>
<td>-4.6%</td>
<td>991</td>
<td>18.3%</td>
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<tr>
<td>Wrenshall</td>
<td>333</td>
<td>296</td>
<td>-11.1%</td>
<td>308</td>
<td>4.1%</td>
<td>399</td>
<td>29.5%</td>
</tr>
<tr>
<td>Thomson**</td>
<td>152</td>
<td>132</td>
<td>-13.1%</td>
<td>153</td>
<td>15.9%</td>
<td>159</td>
<td>3.9%</td>
</tr>
<tr>
<td>Thomson Twp.</td>
<td>3,962</td>
<td>3,970</td>
<td>0.0%</td>
<td>4,361</td>
<td>9.8%</td>
<td>5,003</td>
<td>14.6%</td>
</tr>
<tr>
<td>Twin Lakes Twp.</td>
<td>1,595</td>
<td>1,673</td>
<td>4.9%</td>
<td>1,912</td>
<td>14.3%</td>
<td>2,108</td>
<td>10.3%</td>
</tr>
<tr>
<td>Silver Brook Twp.</td>
<td>551</td>
<td>535</td>
<td>-2.9%</td>
<td>609</td>
<td>13.8%</td>
<td>648</td>
<td>6.4%</td>
</tr>
<tr>
<td>TOTAL WLSSD AREA</td>
<td>136,591</td>
<td>129,133</td>
<td>-5.5%</td>
<td>133,225</td>
<td>3.2%</td>
<td>137,536</td>
<td>3.2%</td>
</tr>
</tbody>
</table>

Source: United States Census Bureau

**Merged with City of Carlton in 2015**
## Table 3-2, WLSSD Area Population Density

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>St. Louis County (WLSSD)</td>
<td>398.8</td>
<td>113,033</td>
<td>283.4</td>
<td>115,242</td>
<td>289.0</td>
<td>5.6</td>
</tr>
<tr>
<td>Duluth</td>
<td>87.4</td>
<td>86,918</td>
<td>994.5</td>
<td>86,265</td>
<td>987.0</td>
<td>-7.5</td>
</tr>
<tr>
<td>Hermantown</td>
<td>34.4</td>
<td>7,448</td>
<td>216.5</td>
<td>9,414</td>
<td>273.7</td>
<td>57.2</td>
</tr>
<tr>
<td>Proctor</td>
<td>3.0</td>
<td>2,852</td>
<td>950.7</td>
<td>3,057</td>
<td>1019.0</td>
<td>68.3</td>
</tr>
<tr>
<td>Rice Lake</td>
<td>33.5</td>
<td>4,139</td>
<td>123.6</td>
<td>4,095</td>
<td>122.2</td>
<td>-1.4</td>
</tr>
<tr>
<td>Grand Lake Twp.</td>
<td>71.5</td>
<td>2,621</td>
<td>36.7</td>
<td>2,779</td>
<td>38.9</td>
<td>2.2</td>
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<tr>
<td>Lakewood Twp.</td>
<td>27.8</td>
<td>2,013</td>
<td>72.4</td>
<td>2,190</td>
<td>78.8</td>
<td>6.4</td>
</tr>
<tr>
<td>Canosia Twp.</td>
<td>35.7</td>
<td>1,998</td>
<td>56.0</td>
<td>2,158</td>
<td>60.4</td>
<td>4.4</td>
</tr>
<tr>
<td>Solway Twp.</td>
<td>35.7</td>
<td>1,842</td>
<td>51.6</td>
<td>1,944</td>
<td>54.5</td>
<td>2.9</td>
</tr>
<tr>
<td>Duluth Twp.</td>
<td>51.8</td>
<td>1,723</td>
<td>33.3</td>
<td>1,941</td>
<td>37.5</td>
<td>4.2</td>
</tr>
<tr>
<td>Midway Twp.</td>
<td>18.0</td>
<td>1,479</td>
<td>82.2</td>
<td>1,399</td>
<td>77.7</td>
<td>-4.5</td>
</tr>
<tr>
<td>Carlton County (WLSSD)</td>
<td>147.4</td>
<td>20,192</td>
<td>135.0</td>
<td>22,294</td>
<td>149.0</td>
<td>14.0</td>
</tr>
<tr>
<td>Cloquet</td>
<td>35.9</td>
<td>11,201</td>
<td>312.0</td>
<td>12,124</td>
<td>337.7</td>
<td>25.7</td>
</tr>
<tr>
<td>Carlton</td>
<td>2.3</td>
<td>810</td>
<td>352.2</td>
<td>862</td>
<td>374.8</td>
<td>22.6</td>
</tr>
<tr>
<td>Scanlon</td>
<td>0.8</td>
<td>838</td>
<td>1047.5</td>
<td>991</td>
<td>1238.8</td>
<td>191.3</td>
</tr>
<tr>
<td>Wrenshall</td>
<td>1.5</td>
<td>308</td>
<td>205.3</td>
<td>399</td>
<td>266.0</td>
<td>60.7</td>
</tr>
<tr>
<td>Thomson**</td>
<td>2.2</td>
<td>153</td>
<td>69.5</td>
<td>159</td>
<td>72.3</td>
<td>2.8</td>
</tr>
<tr>
<td>Thomson Twp.</td>
<td>39.9</td>
<td>4,361</td>
<td>109.3</td>
<td>5,003</td>
<td>125.4</td>
<td>16.1</td>
</tr>
<tr>
<td>Twin Lakes Twp.</td>
<td>46.9</td>
<td>1,912</td>
<td>40.8</td>
<td>2,108</td>
<td>44.9</td>
<td>4.1</td>
</tr>
<tr>
<td>Silver Brook Twp.</td>
<td>17.9</td>
<td>609</td>
<td>34.0</td>
<td>648</td>
<td>36.2</td>
<td>2.2</td>
</tr>
<tr>
<td><strong>TOTAL WLSSD AREA</strong></td>
<td><strong>546.2</strong></td>
<td><strong>133,225</strong></td>
<td><strong>242.8</strong></td>
<td><strong>137,536</strong></td>
<td><strong>250.6</strong></td>
<td><strong>7.8</strong></td>
</tr>
</tbody>
</table>

*Source: United States Census Bureau*

**Merged with City of Carlton in 2015**
### Table 3-3, WLSSD Area Population Projections 2010 to 2040

<table>
<thead>
<tr>
<th>Area</th>
<th>2010 Actual</th>
<th>2020 Projection</th>
<th>2030 Projection</th>
<th>2040 Projection</th>
</tr>
</thead>
<tbody>
<tr>
<td>St. Louis County (WLSSD)</td>
<td>115,242</td>
<td>117,830</td>
<td>120,482</td>
<td>123,301</td>
</tr>
<tr>
<td>Duluth</td>
<td>86,265</td>
<td>86,616</td>
<td>86,966</td>
<td>87,318</td>
</tr>
<tr>
<td>Hermantown</td>
<td>9,414</td>
<td>10,559</td>
<td>11,705</td>
<td>12,950</td>
</tr>
<tr>
<td>Proctor</td>
<td>3,057</td>
<td>3,132</td>
<td>3,208</td>
<td>3,283</td>
</tr>
<tr>
<td>Rice Lake</td>
<td>4,095</td>
<td>4,347</td>
<td>4,615</td>
<td>4,900</td>
</tr>
<tr>
<td>Grand Lake Twp.</td>
<td>2,779</td>
<td>2,950</td>
<td>3,132</td>
<td>3,325</td>
</tr>
<tr>
<td>Lakewood Twp.</td>
<td>2,190</td>
<td>2,325</td>
<td>2,468</td>
<td>2,620</td>
</tr>
<tr>
<td>Canosia Twp.</td>
<td>2,158</td>
<td>2,291</td>
<td>2,432</td>
<td>2,582</td>
</tr>
<tr>
<td>Solway Twp.</td>
<td>1,944</td>
<td>2,064</td>
<td>2,191</td>
<td>2,326</td>
</tr>
<tr>
<td>Duluth Twp.</td>
<td>1,941</td>
<td>2,061</td>
<td>2,188</td>
<td>2,323</td>
</tr>
<tr>
<td>Midway Twp.</td>
<td>1,399</td>
<td>1,485</td>
<td>1,577</td>
<td>1,674</td>
</tr>
<tr>
<td>Carlton County (WLSSD)</td>
<td>22,294</td>
<td>24,143</td>
<td>25,074</td>
<td>25,415</td>
</tr>
<tr>
<td>Cloquet</td>
<td>12,124</td>
<td>13,224</td>
<td>13,734</td>
<td>13,921</td>
</tr>
<tr>
<td>Carlton</td>
<td>862</td>
<td>940</td>
<td>976</td>
<td>990</td>
</tr>
<tr>
<td>Scanlon</td>
<td>991</td>
<td>1,081</td>
<td>1,123</td>
<td>1,138</td>
</tr>
<tr>
<td>Wrenshall</td>
<td>399</td>
<td>435</td>
<td>452</td>
<td>458</td>
</tr>
<tr>
<td>Thomson</td>
<td>159</td>
<td></td>
<td>Merged w/ City of Carlton in 2015</td>
<td></td>
</tr>
<tr>
<td>Thomson Twp.</td>
<td>5,003</td>
<td>5,457</td>
<td>5,667</td>
<td>5,744</td>
</tr>
<tr>
<td>Twin Lakes Twp.</td>
<td>2,108</td>
<td>2,299</td>
<td>2,388</td>
<td>2,420</td>
</tr>
<tr>
<td>Silver Brook Twp.</td>
<td>648</td>
<td>707</td>
<td>734</td>
<td>744</td>
</tr>
<tr>
<td><strong>TOTAL WLSSD AREA</strong></td>
<td><strong>137,536</strong></td>
<td><strong>141,973</strong></td>
<td><strong>145,556</strong></td>
<td><strong>148,716</strong></td>
</tr>
</tbody>
</table>

*Sources: United States Census Bureau, MN State Demographer’s Office, MIC Duluth-Superior Long Range Transportation Plan*
Table 3-4, WLSSD Area Average Household Sizes 2000 to 2010

<table>
<thead>
<tr>
<th>Area</th>
<th>2000 Average Household Size</th>
<th>2010 Average Household Size</th>
<th>2000 – 2010 Change (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>St. Louis County (WLSSD)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Duluth</td>
<td>2.26</td>
<td>2.23</td>
<td>-1.3%</td>
</tr>
<tr>
<td>Hermantown</td>
<td>2.67</td>
<td>2.55</td>
<td>-4.5%</td>
</tr>
<tr>
<td>Proctor</td>
<td>2.38</td>
<td>2.34</td>
<td>-1.7%</td>
</tr>
<tr>
<td>Rice Lake</td>
<td>2.77</td>
<td>2.54</td>
<td>-8.3%</td>
</tr>
<tr>
<td>Grand Lake Twp.</td>
<td>2.66</td>
<td>2.52</td>
<td>-5.3%</td>
</tr>
<tr>
<td>Lakewood Twp.</td>
<td>2.84</td>
<td>2.74</td>
<td>-3.5%</td>
</tr>
<tr>
<td>Canosia Twp.</td>
<td>2.66</td>
<td>2.58</td>
<td>-3.0%</td>
</tr>
<tr>
<td>Solway Twp.</td>
<td>2.74</td>
<td>2.57</td>
<td>-6.2%</td>
</tr>
<tr>
<td>Duluth Twp.</td>
<td>2.58</td>
<td>2.59</td>
<td>0.4%</td>
</tr>
<tr>
<td>Midway Twp.</td>
<td>2.66</td>
<td>2.56</td>
<td>-3.8%</td>
</tr>
<tr>
<td><strong>Carlton County (WLSSD)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cloquet</td>
<td>2.42</td>
<td>2.44</td>
<td>0.1%</td>
</tr>
<tr>
<td>Carlton</td>
<td>2.65</td>
<td>2.56</td>
<td>-3.3%</td>
</tr>
<tr>
<td>Scanlon</td>
<td>2.30</td>
<td>2.33</td>
<td>1.3%</td>
</tr>
<tr>
<td>Wrenshall</td>
<td>2.77</td>
<td>2.59</td>
<td>-6.5%</td>
</tr>
<tr>
<td>Thomson**</td>
<td>2.39</td>
<td>2.18</td>
<td>-8.8%</td>
</tr>
<tr>
<td>Thomson Twp.</td>
<td>2.86</td>
<td>2.74</td>
<td>-4.2%</td>
</tr>
<tr>
<td>Twin Lakes Twp.</td>
<td>2.84</td>
<td>2.68</td>
<td>-5.6%</td>
</tr>
<tr>
<td>Silver Brook Twp.</td>
<td>2.91</td>
<td>2.66</td>
<td>-8.6%</td>
</tr>
<tr>
<td><strong>TOTAL WLSSD AREA</strong></td>
<td><strong>2.51</strong></td>
<td><strong>2.48</strong></td>
<td><strong>-1.2%</strong></td>
</tr>
</tbody>
</table>

Sources: United States Census Bureau, MN State Demographer’s Office
**Merged with City of Carlton in 2015**
Section 4: Environmental Characteristics

The natural resources of the District represent constraints to development and limitations to conventional individual sewage treatment systems. The natural resources not only help shape the land use patterns, but also dictate the level of management activity necessary to meet the goals and policies of this plan. Recognizing natural resources constraints is a key step in providing an adequate level of protection of the sensitive environments of the District.

The environmental character of the WLSSD area is defined largely by Lake Superior, inland forests, and open agricultural land. Geologic land forms and variable soil characteristics continue to dominate natural and constructed environments along the Lake Superior shoreline and bluff areas. Farther inland, hardwood and coniferous forest areas provide vegetative wildlife habitat. Wetlands and lakes are also identified throughout the region with associated soil, vegetative and wildlife features. Farm areas with associated crops and livestock further make up the environmental character of the region.

Section 4.1: Bedrock Geology

Bedrock geology is one of many natural features that affect future development patterns, water quality and the suitability of available wastewater management alternatives.


According to the Carlton County Water Plan 2014 update, surficial and near-surficial bedrock in certain areas of the county cause other water resource problems. These areas of shallow bedrock can cause groundwater to move quickly along the joints and fractures rather than slowly by inter-granular flow. Three of the bedrock aquifers present in Carlton County, the Proterozoic, Metasedimentary, Keweenawan Volcanics, and Precambrian Undifferentiated, have this characteristic. Shallow bedrock occurs in a band in Carlton County from the northeast to the southwest central townships, and in the southeast corner. Bedrock wells in these areas are susceptible to contamination from the land surface.

Section 4.2: Soils

The present landscape in the WLSSD service area is primarily a result of the Pleistocene glaciation, which produced a variety of erosional and depositional landforms. Glacial deposits are evident in the form of moraines, eskers, outwash deposits and glacial lake sediments. All these features are relatively young, geologically, with none older than 25,000 years, and some as young as 12,000 years.

Glacial sediment is generally composed of two basic types: till and outwash. Till is a mixture of sizes from boulders to clay, deposited directly by the ice. Outwash is mainly sand and gravel transported and deposited by meltwater streams.

A significant portion of the WLSSD is covered by ground moraine till. In addition, an end moraine known as the Highland Moraine was formed along the northwest margin of the Superior lobe during the Automba phase. The Thomson moraine, an end moraine formed during the Nickerson phase, is found in Carlton County. Materials deposited in moraines may be complicated mixtures of different glacial sediments. In the study area, they are
mainly tills consisting of unsorted and unstratified mixtures of clay, silt, sand, gravel and boulders, intermixed in places with bouldery to sandy outwash.

Glacial lake deposits also cover a significant portion of the area. These sediments were deposited on top of earlier glacial deposits and on bedrock. These lacustrine deposits originally formed a flat to gently sloping, relatively smooth surface. In most areas, the lake plain has been eroded and deeply dissected by stream valleys. The glacial lake sediments are predominantly stratified clay with lesser amounts of silt, sand and boulders. Abandoned shorelines and beach zones contain sandy and gravelly materials transported and sorted by wave and current action. These deposits can be found along the highest shoreline of Glacial Lake Duluth and along subsequent lower stages of the lake. The gravel pits that can be found at or near the abandoned shoreline mark these zones.

Outwash consists of well-sorted and stratified sand and gravel deposits. These meltwater stream deposits are generally found in the form of deltas or fans. Some of these deposits, such as in the Cloquet area, are outwash fans from streams flowing out of the margin of the glacial ice. In other areas, the outwash deltas were formed from streams entering and discharging into Glacial Lake Duluth.

The soils within the Lake Superior watershed formed as a result of the weathering of unconsolidated materials derived from very deep to shallow glacial and organic deposits. This material has been subjected to climate and organisms as conditioned by relief over the last 14,000 years. The relative proportions of soil types vary dramatically within the Lake Superior watershed mostly due to the depth to bedrock, slope gradient, geologic parent material and landscape position. The following narrative is based on major soil groupings within the subwatersheds. Figure 4-1 on the following page depicts the dominant soil classification within the District.

The major soils within the St. Louis River watershed are very deep, nearly level to sloping, on loamy glacial till moraines and nearly level silty glacial lake plains and nearly level muck and peat in bogs. They are well and moderately well drained on summits and side slopes, somewhat poorly and poorly drained on flat areas and very poorly drained in depressions and bogs. Natural fertility is moderately high-to-high. The potential for surface erosion on steeper areas is high. Minor soils are located on sandy glacial outwash plains.

The major soils within the Cloquet River watershed are very deep, nearly level to sloping, on sandy glacial outwash plains. They are somewhat excessively to moderately well drained on summits and side slopes, somewhat poorly drained on flat areas and poorly or very poorly drained in depressions. Natural fertility is low to moderate. The potential for surface erosion on steeper areas is moderately high. Minor soils area on dense-loamy glacial till moraines and drumlins on the borders of the outwash plains. Other minor soils are muck and peat in bogs.

The major soils within the Lake Superior (south) and (north) watersheds above 1,000 feet elevation, are very deep to shallow over bedrock, nearly level to extremely steep, on gravelly-loamy glacial till moraines. They are well to moderately well drained on summits and side slopes, somewhat poorly and poorly drained on flat areas and poorly or very poorly drained in depressions. Natural fertility is low to moderately high. The potential for surface erosion on steeper areas is high. Below 1,000 feet elevation, the major soils area very deep to shallow over bedrock, nearly level to steep, on clayey glacial till moraines. They are well to moderately well drained on summits and sides slopes, somewhat poorly and poorly drained on flat areas and poorly or very poorly drained in depressions. Natural fertility is high. The potential for surface erosion and soil slumping on steeper areas is high. Minor soils are on sandy glacial outwash terraces adjacent to major streams. Other minor soils are mucks and peat in bogs.
Section 4.3: Topography
Given its geologic history, topography is one of the major natural resources related constraints that exist within the District. Steep slopes not only add considerable difficulties and cost for development, but also represent areas of high risk from erosion. Topography varies considerably from the shores of Lake Superior inland along the areas adjacent to the St. Louis River.

Figure 4-2 illustrates the major three watersheds of the District: the Lake Superior Watershed to the northeast; the Upper St. Louis River Watershed to the northwest; and the Lower St. Louis River Watershed to the south. The amended June 24, 2015 St. Louis County Water Plan shows that portion of the Upper St. Louis River Watershed lying generally north of a line drawn across the south end of Wild Rice Lake Reservoir and Grand Lake and just north of Pike Lake to be part of the Cloquet River Watershed.

The general relief within the District varies considerably. Slopes rise sharply from Lake Superior and the St. Louis River, transitioning into a more gently rolling topography. Relief within the St. Louis River watershed varies from 50 feet to 550 feet.

Topographic descriptions as they relate to the soil landscape units are included in the soil portion of this section of the report.

Section 4.4: Wetlands
The majority of wetland resources within the District occur in the northwest and southwestern areas. The areas surrounding Grand Lake, Pike Lake and Wild Rice Lake Reservoir in St. Louis County, and Twin Lakes Area of Carlton County in particular, have vast wetland resources.

Wetlands not only represent a physical constraint to development but they also require protection from pollutant discharges, whether from surface sources or groundwater influences. Residents need to be aware of the limitations represented by wetlands. Additionally, it should be recognized wetland protection responsibilities are shouldered by a matrix of wetland regulations.

The U.S. Army Corps of Engineers through Section 404 of the Clean Water Act has regulatory (permitting) responsibilities over waters of the United States, encompassing wetlands, lakes and streams. The regulatory (permitting) focus for wetlands is on filling or draining of wetlands. Preliminary wetland identification is made using the National Wetland Inventory (NWI) mapping system, which illustrates wetland extent and type as determined from infrared photography, on a USGS quadrangle scale map. The NWI maps are on file with the Corps of Engineers, the area Minnesota Board of Water and Soil Resources office and Carlton and St. Louis County.

The Minnesota DNR, through its Protected Waters and Wetlands Program has designated over 50 wetlands within the District as protected. Generally, any activity adjacent to the wetlands, which is below the ordinary high water level of the wetland, is subject to a protected waters permit. DNR protected waters maps are on file at the local DNR offices.

In 1991, the Minnesota Legislature passed into law the Wetland Conservation Act (WCA). The purpose of the WCA is to achieve no net loss in the quantity, quality and biological diversity of Minnesota’s existing wetlands. The WCA overlaps the regulatory authority of the Corps of Engineers, but goes beyond protecting wetlands through a permitting process, which applies to all wetland resources meeting the federal definition of wetland.
Implementation of the WCA and its certification of exemption provisions is the responsibility of Carlton and St. Louis counties.

All of Carlton County including Fond du Lac is mapped according to the National Wetlands Inventory System. The detailed set of NWI maps is available for viewing in the Carlton County Planning and Zoning Office, SWCD/NRCS office, DNR or MPCA offices.

**Section 4.5: Water Resources**

Area-wide water resources can be divided in two general categories; surface water resources and groundwater resources. Lake Superior, the St. Louis River and St. Louis Bay are the major surface water resources. Many smaller tributary rivers, lakes and streams comprise the minor surface water resources within WLSSD boundaries.

The WLSSD area has significant water resources in the form of lakes, rivers and streams. Protection of these resources represents a major constraint to development. The need for the extension of public facilities or implementation of effective SSTS technology is based on the need to protect these resources. Individual county water plans (Carlton County, 2014 and St. Louis County, 2015) are the means by which water quality conditions are addressed in a comprehensive manner. The District is part of the county solution, however counties have been given the statutory authority to develop and implement plans to protect and enhance surface and groundwater resources. In addition, the MPCA Lake Superior Basin Plan of 2004 addresses water quality conditions in a comprehensive manner.

**Section 4.5.1: Surface Waters**

Major influences within the WLSSD boundaries are watersheds associated with the St. Louis River and Lake Superior basins. These watersheds consist of the Upper St. Louis River Watershed, Lower St. Louis River Watershed, Cloquet River Watershed, Nemadji River Watershed, and the Lake Superior Watershed (Figure 4-2). Local tributaries and associated drainage patterns within these watersheds are important factors influencing water quality and future utility services for future suburban and rural development.

In addition to Lake Superior, the surface waters within District boundaries consist of lakes, bogs, rivers and streams. The largest lakes/reservoirs include Wild Rice Lake (reservoir), Grand Lake, Caribou Lake, Pike Lake and part of Fish Lake (reservoir) in St. Louis County; and Thomson Reservoir, Chub Lake and Hay Lake in Carlton County. There are numerous rivers and streams in the District, with the major river being the St. Louis River, which drain into Lake Superior and are protected watercourses under the Minnesota Department of Natural Resources (MN DNR) protected waters designation.

The most dramatic recovery in the quality of surface water has occurred in that portion of the St. Louis River downstream from Cloquet since startup of the WLSSD regional wastewater treatment facility in 1978. In general, the quality of surface waters is good. However, there remain some isolated areas of poorer water quality in the more densely developed and unsewered areas of the District.

In addition, several reaches of the St. Louis River are currently considered impaired by some toxic substances including mercury and several organic chemicals. This situation is the result of past practices of many historical river-front businesses and industries and other historical local and atmospheric sources of contamination. Two significantly contaminated historical industrial sites (Interlake-Duluth Tar
and U.S. Steel) are currently in the process of being cleaned-up and there are broader planning and clean-up efforts underway for other toxics-related impairments that exist in the river.

Under Minnesota Rules Chapter 7050, the state legislature established standards for the protection of the quality of waters in the state. The rules and classifications are used to determine what type of protection a specific or given water feature should receive. Additionally, the Fond du Lac Reservation, which straddles the Carlton and St. Louis County lines, has promulgated and adopted tribal water quality standards for the many lakes, streams and wetlands of the reservation.

**Section 4.5.2: Groundwater**

Groundwater wells throughout the District draw from water in unconsolidated glacial deposits or bedrock. In general, the Fond du Lac Formation/Hinckley Sandstone is the best source of groundwater. Water from other rock types (e.g., Thomson Formation, Duluth Gabbro and North Shore Volcanic Group) can range from good to poor quality.

Wells with the best yields are located in sand and gravel zones in glacial drift, interflow horizons in the North Shore Volcanic Group and the Fond du Lac Formation/ Hinckley Sandstone.

The regional groundwater flow is to the east-southeast toward Lake Superior. Locally, movement is toward rivers, such as the St. Louis River and its tributaries. In the Nemadji Basin on the other hand, flow is from the basin divide with the St. Louis to the Nemadji River and its tributaries.

In general, the quality of the groundwater within the WLSSD is good. The waters from the aquifers contain calcium, magnesium and bicarbonate ions; however, saline water containing sodium chloride and sulfates is found in some bedrock aquifers. The highly variable quality of the water from bedrock wells, particularly in the volcanic rocks, is due to the presence of different minerals, as well as the length of time the water is in the rock.
Section 4.5.3: Suburban Lakes and Streams

"Suburban lakes" in both counties are subject to continuing threats of water quality degradation from shoreland development. Recreation is a very important use of the surface waters in the District. Many of the lakes in St. Louis and Carlton counties are highly populated with seasonal or year-round homes.

Lake Associations have been formed for several of lakes in the area. These citizen groups strive to maintain and improve water quality in the lake, educate both members and nonmembers about water quality issues, and obtain funding to address water quality and education issues in their watershed.

Lakes receive both point and nonpoint sources of pollution. Lakes are also deposition areas for pollutants from the atmosphere. Known atmospheric problems including acid rain (attributed to sulfur compounds from burning fossil fuels) and nitrate, dioxins, mercury, and other contaminants, have been detected in lakes and rivers in the District (Carlton County, 2009). The MPCA does administer a number of programs dealing with surface water quality assessment and assistance, including the Citizen Lake Monitoring Program, Clean Lakes Program, Clean Water Partnership, Lake Assessment Program, Routine Water Quality Monitoring, and Toxic Substance Control Program. Shoreland protection measures (e.g., Shoreland Zoning and Best Management Practices) have been implemented for most lakes and streams in St. Louis and Carlton counties.

The indications given by the MPCA survey list of impacted waters show a concern for the surface water quality (Carlton County, 2009). Concern has been registered about individual septic system contamination on area lakes. Degradation of the water quality in these lakes will continue if sources of the problems are not identified and corrected. The problem is definitely a public health and ecological concern. Additionally, the problem is a concern to economic growth and tourism because the area relies heavily on the surface water quality and tourism industry for the county’s standard of living (Carlton County, 2009). Therefore, the issue has economic as well as water quality implications.

Erosion, sedimentation, and runoff of soil, fertilizers, and pesticides from crop pasture, urban (turf) and forest lands is a problem that will increase as the regional population and development increases. The St. Louis County Comprehensive Water Management Plan (2015) identified that shoreland areas will continue to be in high demand for development. Some areas will experience multi-tier development, which will further alter the landscape and cause increased impacts to these sensitive areas. As human use increases within the watersheds, the impacts to the water bodies intensify.

The long term impacts of improperly functioning on-site sewage systems, excessive fertilization, and urban-source runoff are beginning to show in the suburban lake areas around the major population centers. Increased peak flows and stream temperature increases have resulted from man-made hydrologic changes to watersheds such as forest-type change, roads, and many types of impervious surfaces. The peak flow increases have caused increased bank erosion resulting in increased sedimentation, turbidity, habitat loss, and increased dredging in the harbor. Temperature increases in local streams threaten the numerous trout populations in the District.

Within the District, the issues relate more to dealing with existing problems than preventing future problems (WLSSD, 1976). Many of the prime suburban lakes have already developed to the state where there is little, if any, prime developable land remaining. In most cases development occurred prior to the enactment of shoreline setback and structure spacing criteria. Improperly located and spaced structures
leads to improperly located wastewater disposal systems. Since poor soils and/or high groundwater tables typify shoreline areas, the danger of contamination is magnified.

Section 4.5.4: The St. Louis River
The St. Louis River, the largest U.S. tributary to Lake Superior, drains 3,634 square miles, entering the southwestern corner of the lake between Duluth, Minnesota, and Superior, Wisconsin. The river flows 179 miles through three distinct areas: coarse soils, glacial till and outwash deposits at its headwaters; a deep, narrow gorge at Jay Cooke State Park; and red clay deposits in its lower reaches. As it approaches Duluth and Superior, it becomes a 12,000-acre freshwater estuary. The upper estuary has wilderness-like areas, while the lower estuary is characterized by urban development, an industrial harbor and a major port. The lower estuary includes St. Louis Bay, Superior Bay, Allouez Bay and the lower Nemadji River.

In the late 1980s, the St. Louis River was designated as one of 42 Areas of Concern (AOC) on the Great Lakes due to pollution problems. These problems were addressed by the St. Louis River System Remedial Action Plan (RAP), which focused primarily on the 39 miles of the St. Louis River below Cloquet, Minnesota.

The RAP process began in 1989 as a collaborative effort between the Minnesota Pollution Control Agency (MPCA) and the Wisconsin Department of Natural Resources (WDNR). At that time, the agencies created a Citizens Advisory Committee (CAC). In 1996, the agencies helped launch the CAC as the Citizens Action Committee - an independent, non-profit organization. In June 1997, the CAC hired its first executive director and opened an office. The CAC has recently re-organized to become the St. Louis River Alliance.

The RAP’s document (identification of problems) was published in 1992, and was highly praised by the International Joint Commission (IJC). A progress report containing 43 recommendations was published in 1995. The CAC most recently was named the St. Louis River Alliance and continues its commitment to facilitating remaining recommendations. The SLRA also acts as a facilitator of issues and coordinator of projects benefiting the St. Louis River estuary.

The WLSSD has long participated in a comprehensive monitoring program for the St. Louis River. An extensive database was created through a monthly sampling program, which began in the early 1970’s. Water qualities were tracked at several established sampling locations from Brookston to the St. Louis Bay. This program was essential to the early identification of changes in the quality of this resource. Focused sampling continues at strategic locations along the St. Louis River.

Continued growth in seasonal developments, tourism and visitor infrastructure could further impact the St. Louis River and other sensitive surface waters of the District. The Water Plans for both Carlton and St. Louis Counties identify “hotspots” where water quality concerns need to be addressed. The counties will have to work closely with the District, MN DNR, MPCA, citizens and elected officials to insure that changing development standards address the types of pollutants that are impacting water quality today.
Section 4.5.6: Lake Superior (Great Lakes Initiative)

In 1995, the Environmental Protection Agency (EPA) and the Great Lakes states agreed to a comprehensive plan to restore the health of the Great Lakes. The Final Water Quality Guidance for the Great Lakes System, also known as the Great Lakes Initiative. The Guidance consists of water quality criteria for 29 pollutants to protect aquatic life, wildlife, and human health, and detailed methodologies to develop criteria for additional pollutants; implementation procedures to develop more consistent, enforceable water quality-based effluent limits in discharge permits, as well as total maximum daily loads of pollutants that can be allowed to reach the Lakes and their tributaries from all sources; and anti-degradation policies and procedures.

Under the Clean Water Act, the States of Illinois, Indiana, Michigan, Minnesota, New York, Ohio, Pennsylvania, and Wisconsin must adopt provisions into their water quality standards and NPDES permit programs within two years (by March 23, 1997) that are consistent with the Guidance, or EPA will promulgate the provisions for them. The Guidance for the Great Lakes System will help establish consistent, enforceable, long-term protection from all types of pollutants, but will place short-term emphasis on the types of long-lasting pollutants that accumulate in the food web and pose a threat to the Great Lakes System. The Guidance includes minimum water quality criteria, anti-degradation policies, and implementation procedures that provide a coordinated ecosystem approach for addressing existing and possible pollutant problems and improves consistency in water quality standards and permitting procedures in the Great Lakes System. In addition, the Guidance provisions help establish consistent goals or minimum requirements for Remedial Action Plans (RAPs) and Lakewide Management Plans (LaMPs) that are critical to the success of international multi-media efforts to protect and restore the Great Lakes ecosystem.

Section 4.6: Climate

The climate of the WLSSD area is classified as a continental climate regime characterized by wide variations in temperature. Temperatures can range from highs near 100 degrees Fahrenheit in the summer months to lows of minus 45 degrees Fahrenheit during the winter months. The normal daily maximum temperature annually is 48.7 degrees Fahrenheit.

Average annual precipitation in the District area ranges from 29 to 31 inches. August 1972 is on record for the highest monthly precipitation total with 10.31 inches during the month. Because the District area is so large (530 square miles), there can be rain events in one portion of the District that are significant while other portions of the District receive little or no precipitation. This variation can cause difficulty in determining how the collection system will respond one rain event to the next and the variability complicates using hydraulic modeling tools to predict system performance. Figures 5 through 8 on the following page show normal precipitation across the State of Minnesota for each season.

The WLSSD area typically averages approximately 60 to 70 inches of snowfall per year. The median seasonal snowfall is 70 inches. Snowmelt each spring can result in inflow and infiltration issues, especially through manholes in located in ditches or other low-lying areas.
Figure 4-3
Normal Precipitation Annual (1981-2010)

State Climatology Office
DNR Division of Ecological and Water Resources
August 2012
Section 5: WLSSD Service Areas

The WLSSD service area covers 530 square miles encompassing two counties, seven cities and ten townships. Much of this area, however, is not served directly by a public sewer utility system. From a geographic perspective, only 12-percent (62.0 square miles) of the total WLSSD service area is actually served by public sewers. Another 5-percent (26.7 square miles) of the WLSSD area has been identified in local plans as areas where future sanitary sewer service is possible within the next 10-20 years. Table 5-1 below summarizes the total sewered and future sewered areas within WLSSD. Each service area is discussed in further detail later in this section.

Table 5-1, WLSSD Service Areas (Square Miles)

<table>
<thead>
<tr>
<th>Status</th>
<th>In WLSSD (Sq. Mi.)</th>
<th>Percent of WLSSD Area</th>
<th>Outside WLSSD (Sq. Mi.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sewered Areas</td>
<td>62.0</td>
<td>11.7%</td>
<td>1.7</td>
</tr>
<tr>
<td>Potential Future Sewer Areas</td>
<td>26.7</td>
<td>5.0%</td>
<td>2.5</td>
</tr>
<tr>
<td>Areas of Concern</td>
<td>2.4</td>
<td>0.4%</td>
<td>0.6</td>
</tr>
<tr>
<td>Unsewered/No Current Plans</td>
<td>438.9</td>
<td>82.9%</td>
<td>---</td>
</tr>
</tbody>
</table>

Table 5-2 on the following page illustrates the total population within WLSSD communities and the distribution between sewered and unsewered areas. Unsewered areas are dependent upon some form of SSTS for wastewater management. The population data in the table reflects 2010 Census data. The estimated sewered and unsewered population estimates were obtained by reviewing Census block data, community plans and meetings with local units of government.

Approximately 21-percent of the population within the WLSSD area is not served by a public sewer system. This percentage is below the estimated 27-percent of the State of Minnesota population that is unsewered as stated by the MPCA.
### Table 5-2, WLSSD Sewered and Unsewered Population

<table>
<thead>
<tr>
<th>Community</th>
<th>2010 Population</th>
<th>Estimated Sewered Population</th>
<th>Estimated Unsewered Population</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CARLTON COUNTY</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>City of Carlton</td>
<td>862</td>
<td>712</td>
<td>150</td>
</tr>
<tr>
<td>City of Cloquet</td>
<td>12,124</td>
<td>9,122</td>
<td>3,002</td>
</tr>
<tr>
<td>City of Scanlon</td>
<td>991</td>
<td>972</td>
<td>19</td>
</tr>
<tr>
<td>Silver Brook Township</td>
<td>648</td>
<td>0</td>
<td>648</td>
</tr>
<tr>
<td>City of Thomson (merged w/ Carlton in '15)</td>
<td>159</td>
<td>158</td>
<td>1</td>
</tr>
<tr>
<td>Thomson Township</td>
<td>5,003</td>
<td>1,913</td>
<td>3,090</td>
</tr>
<tr>
<td>Twin Lakes Township</td>
<td>2,108</td>
<td>114</td>
<td>1,994</td>
</tr>
<tr>
<td>City of Wrenshall</td>
<td>399</td>
<td>351</td>
<td>48</td>
</tr>
<tr>
<td><strong>Carlton County WLSSD Subtotal:</strong></td>
<td><strong>22,294</strong></td>
<td><strong>13,184</strong></td>
<td><strong>9,110</strong></td>
</tr>
<tr>
<td><strong>Percent of WLSSD - Carlton County:</strong></td>
<td></td>
<td><strong>59.1%</strong></td>
<td><strong>40.9%</strong></td>
</tr>
<tr>
<td><strong>ST. LOUIS COUNTY</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Canosia Township</td>
<td>2,158</td>
<td>653</td>
<td>1,505</td>
</tr>
<tr>
<td>Duluth Township</td>
<td>1,941</td>
<td>537</td>
<td>1,404</td>
</tr>
<tr>
<td>City of Duluth</td>
<td>86,265</td>
<td>84,157</td>
<td>2,108</td>
</tr>
<tr>
<td>Grand Lake Township</td>
<td>2,779</td>
<td>333</td>
<td>2,446</td>
</tr>
<tr>
<td>City of Hermantown</td>
<td>9,414</td>
<td>5,657</td>
<td>3,757</td>
</tr>
<tr>
<td>Lakewood Township</td>
<td>2,190</td>
<td>75</td>
<td>2,115</td>
</tr>
<tr>
<td>Midway Township</td>
<td>1,399</td>
<td>254</td>
<td>1,145</td>
</tr>
<tr>
<td>City of Proctor</td>
<td>3,057</td>
<td>2,824</td>
<td>233</td>
</tr>
<tr>
<td>City of Rice Lake</td>
<td>4,095</td>
<td>750</td>
<td>3,345</td>
</tr>
<tr>
<td>Solway Township</td>
<td>1,944</td>
<td>0</td>
<td>1,944</td>
</tr>
<tr>
<td><strong>St. Louis County WLSSD Subtotal:</strong></td>
<td><strong>115,242</strong></td>
<td><strong>95,240</strong></td>
<td><strong>20,002</strong></td>
</tr>
<tr>
<td><strong>Percent of WLSSD - St. Louis County:</strong></td>
<td></td>
<td><strong>82.6%</strong></td>
<td><strong>17.7%</strong></td>
</tr>
<tr>
<td><strong>OUTSIDE WLSSD LEGISLATIVE BOUNDARIES</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oliver</td>
<td>399</td>
<td>189</td>
<td>210</td>
</tr>
<tr>
<td>KRLSD</td>
<td>222</td>
<td>200</td>
<td>22</td>
</tr>
<tr>
<td><strong>TOTAL WLSSD SERVICE AREA</strong></td>
<td><strong>138,157</strong></td>
<td><strong>108,813</strong></td>
<td><strong>29,344</strong></td>
</tr>
<tr>
<td><strong>Percent of WLSSD Total</strong></td>
<td></td>
<td><strong>78.8%</strong></td>
<td><strong>21.2%</strong></td>
</tr>
</tbody>
</table>

*Estimates calculated by using 2010 Census figures, local plans, and discussion with community leaders.*
Section 5.1: Existing Sewered Areas

Sewered areas are defined as the areas that are currently served by publicly owned sanitary sewers. The WLSSD Collection System consists of pumping stations, metering stations, interceptors and force mains involved in the transmission of municipal and industrial wastewater to the Wastewater Treatment Plant (WWTP) located in Duluth.

Within this area WLSSD operates eighteen (18) pump stations. The dry-weather volumes handled by the pumping stations range from 50,000 gallons per day to 25 million gallons per day (MGD). Approximately seventy-six (76) miles of sewage interceptors and force mains (piping) are maintained by WLSSD within its Collection System.

Figure 5-1 on the following page shows a map of the existing WLSSD system of interceptors and pump stations.
Section 5.2: Future Service Areas/Urban Services Boundary

During the Comprehensive Planning process, District communities identified through their local comprehensive plans, areas where additional urban growth is likely to occur during the next 10-20 years. Urban growth would be characterized by higher density development served by public utilities such as sewer. Communities also identified those areas that are expected to retain more of their rural characteristics.

After consulting with each community within the District, the “Urban Services Boundary” originally developed during the 2003 update of the Wastewater Quality Master Plan, was revised to reflect community plans. The purpose of the urban services boundary is to show the approximate location which public utilities, such as sanitary sewer, are appropriate for extension. Areas outside this boundary should be protected from urban sprawl or unorganized growth. Establishment of this boundary insures controlled expansion of local sewer systems consistent with local Comprehensive Plans as well as the goals and policies of the WLSSD Plan and Capital Improvement Programs.

The location of this boundary will be evaluated again at the end of the planning period or at other times deemed necessary by the District Board. Requests to expand the boundary would be evaluated on a case-by-case basis and at a minimum would need to be consistent with local comprehensive plans.

Figure 5-2 shows the map depicting the WLSSD Urban Services Areas. These areas are defined as follows:

- **Urban Services Area** – Within this area are the approximate locations which public utilities such as sanitary sewer are appropriate for expansion. Areas outside this boundary should be protected from urban sprawl or unorganized growth.

- **Sewered Area** – Areas currently served by publicly owned sanitary sewers. Wastewater is treated at the WLSSD regional treatment facility located in Duluth.

- **Pending Sewer Area** – These areas show locations where extending wastewater service is in the planning stages at the time of this Comprehensive Plan revision.

- **Future Sewer Areas** – These areas depict locations where communities have identified in their community plans as areas where sewer could likely be extended in either the short or long-term.

- **Areas of Concern** – Areas within or just beyond the 530 square mile statutory boundaries of the WLSSD which due to existing development densities and/or known wastewater management problems may require further investigation during the planning period. These areas are typically located around lakes and rivers that have small lots containing seasonal and/or year round homes and limited options for expanding, replacing or improving either their homes or subsurface sewage treatment systems (SSTS). Additionally, these areas would include areas zoned to accommodate large industrial or commercial uses.

The areas within the District boundaries will have priority in receiving technical assistance from the District in the evaluation of current problems and potential solutions. For areas outside of WLSSD boundaries, District staff may be available to provide support such as technical assistance or educational resources as time and funding allows.
Figure 5-2
WLSSD Urban Services Boundary
Section 5.3: Subsurface Sewage Treatment Systems (SSTS)

Subsurface Sewage Treatment Systems are commonly known as septic systems. They are soil-based treatment systems used by homes and businesses which are not connected to municipal sewer. SSTS were formerly called Individual Sewage Treatment Systems (ISTS). While the terminology has changed to reflect changes in the septic system industry, a septic system is still a combination of tanks or other treatment devices providing initial treatment of sewage which ultimately discharging the sewage into the soil for final treatment. As with large wastewater facilities, SSTS need to be properly designed, installed, regulated and maintained.

SSTS treat sewage through a combination of biological, physical and chemical processes. They are designed to account for the daily wastewater flow, the type of distribution system (gravity or pressure), soil conditions of the site, and need the development of a biological layer (a biomass) for proper wastewater treatment. When properly designed, constructed and maintained they provide a high degree of sewage treatment and are a proven method of controlling the negative environmental effects of untreated sewage.

One decentralized community/cluster system presently exists within the boundaries of the WLSSD. This system is located on Grand Lake in Grand Lake Township and consists of 10-12 residential dwellings contributing wastewater to a community wetland treatment system. Another such decentralized collection system that is currently in the construction phase is the Birch Point area of Caribou Lake in Grand Lake Township. This system will involve the collection of wastewater from 30-35 residential households. It is of great importance that these systems be managed by an agency with the capabilities and technical expertise to effectively manage larger collection systems.
Section 5.3.1: Responsible Units

State of Minnesota

Minnesota Rules, Chapter 7080-7083 (Subsurface Sewage Treatment System Standards or SSTS) administered by the Minnesota Pollution Control Agency (MPCA) provide technical standards and guidance for the siting, design and construction of on-site systems. Minnesota Statutes, Chapter 103F requires counties and municipalities to adopt and enforce these standards within designated floodplain, shoreland and wild and scenic river areas. Outside the designated areas, Chapter 7080-7083 rules act only as a guidance document to counties and municipalities.

The 1995 legislation, known as the ISTS Act, has been codified as Minn. Stat. §§ 115.55 and 115.56. The Act has been amended in recent years, with major changes in 1996, 2008 and again in 2011. The purpose of this legislative activity was to address the serious problems associated with failing ISTS. The law has brought increased attention and regulation to a problem of which many citizens and community leaders were previously unaware.

Counties, Municipalities, and Towns

The St. Louis County Environmental Services Department is responsible for managing information and permits for SSTS in the County along with administering the provisions of the St. Louis County Subsurface Sewage Treatment (SSTS) Ordinance known as Ordinance 61 (adopted February 2014). There is a loan program available to help residents repair and replace failing or non-conforming systems. The county continues working to reduce the number of failing septic systems through its SSTS ordinance, which requires that property ownership cannot be transferred unless certain specific conditions are met.

Within St. Louis County, municipalities and townships with individual zoning authority can make use of County staff for approval of new SSTS systems and rehabilitations. The County also conducts SSTS approvals, inspections and enforcement in the remaining rural townships within the WLSSD service area.

St. Louis County has identified areas with wastewater treatment problems that have a high number of poorly performing systems resulting from factors such as inadequately-sized lots, poor soils and/or high water tables. In some locations, the density of structures overwhelms the landscape. This is especially true for lake communities as year round use increases. It is estimated there are between 30,000-35,000 subsurface septic systems in St. Louis County.

As discussed in the St. Louis County Water Plan 2010-2020, Coordination between land use permitting and on-site sewage treatment decisions have been improved. For example, a three-bedroom home is now the standard used to determine whether or not a lot has sufficient room to accommodate an on-site sewage treatment system. Municipal sewer lines have been extended into areas that had previously been identified as “problem areas,” including Pike Lake and along the North Shore. “Problem areas” are those areas with poor (e.g. clay) soils, high water tables, and areas that are densely developed with small lots.

A number of areas with identified waste water treatment problems within the WLSSD service area include the Caribou Lake and Grand Lake areas and the Claymore Street area in the City of Duluth and the “Elde’s Corner” area in Midway Township.
The Carlton County Planning and Zoning Department administers the Individual Sewage Treatment Systems Ordinance (Ordinance #30) (adopted January 1, 2010) in all areas of the County, with the exception of the cities of Wright and Jay Cooke State Park. Carlton County permits and inspects all new installations, replacements and repairs of systems.

The current Carlton County Ordinance #30 requires system compliance inspections at point of sale or with application submittal for properties within the Shoreland Management Overlay Districts of the County.

The Carlton County Comprehensive Local Water Plan that was updated in 2014 recommends developing a cooperative effort with landowners, such as through a lake association, to inventory SSTS for compliance and funding for replacement of failing systems. The Plan also recommends approval of county wide point-of-sale compliance inspections of all existing septic systems. Finally, the County Water Plan support wastewater collection and treatment facility projects, such as the Big Lake Sanitary District.

Western Lake Superior Sanitary District

The enabling statute of the WLSSD, Chapter 458D is quite specific to the purposes of this regional government unit. Section 458D.01 established a sanitary board to be “assigned the responsibility of carrying on a continuous long range program of planning with respect thereto and given the authority to take over, acquire, construct, better administer, operate and maintain any and all interceptors and treatment works needed for the collection, treatment and disposal of sewage and solid waste in such area, as well as local sanitary sewer facilities over which the Board agrees to assume responsibility at the request of any local government unit.”

The statute does not mention subsurface sewage treatment system authority as an intended purpose for the District. In the absence of specific authority, it is potentially problematic to assume such where none explicitly exists. Thus there could be administrative risks to the District with such assumption.

On the other hand, there is an indirect role for the District in SSTS authority from a planning perspective. Section 458D.05 states that the Board shall prepare and adopt a comprehensive plan for “the collection, treatment and disposal of sewage in all or a designated part of the District through a system of interceptors and treatment works...etc.”

The collection of sewage is generally accepted as a role for local government. Sewage collection system need is often driven by the following:

- Comprehensive land use planning which dictates development densities requiring such service;
- Existing development with failing SSTS which can sometimes be more cost effectively replaced with a collection system; and
- Environmental conditions which do not allow for effective installation, operation or design life of SSTS.

The transport of sewage through an interceptor and its treatment may either be a local or regional responsibility. In this case, the WLSSD has been given the authority for transport and treatment through Chapter 458D. The issue of land use and comprehensive planning as discussed elsewhere in the plan provides an indirect role for the District in SSTS authority. This occurs when a local government requests...
the transport of sewage anticipated from an existing or future collection system versus continuing with the construction or maintenance of subsurface sewage treatment systems.

Section 5.3.2: Constraints
Previous WLSSD Comprehensive Water Quality Management Plans discussed the construction and operation of subsurface sewage treatment systems.

Significant portions of Carlton County contain soils that have severe limitations for SSTS. Specifically, Thomson Township contains soil types, which are well-drained, but have slow water percolation rates. Therefore, sewage treatment systems may become hydraulically overloaded and fail to function properly.

The North Shore area of Lake Superior has variable conditions for soil thickness with ledge rock often outcropping. Experience has found that a site-specific soils survey is required at the time of an SSTS suitability determination. However, this is often too late for the landowner to discover that the site may have an SSTS limitation.

It is apparent that soils characteristics are a limiting factor for the location of subsurface sewage treatment systems in a significant portion the WLSSD area.

Section 5.3.3: Inspection and Monitoring Needs
Long-term protection of the environment requires that inspection and monitoring of SSTS continue by the responsible local government unit particularly in those areas most susceptible to contamination (e.g., shoreland zones). Inspection should continue to be the primary responsibility of local government (county and city). Inspection procedures and requirements have become more definitive over the years, as the MPCA has moved forward with rule amendments.

Monitoring needs refer to field and administrative actions, which can be implemented to address how well the SSTS program is administered by local government.

Section 5.3.4: Inspection and Monitoring Needs
The WLSSD Comprehensive Plan contemplates that in certain areas management of wastewater generated from a home or business would continue to utilize on-site systems. In these areas, systems continue to be managed by the user, with County oversight (St. Louis or Carlton), under rules established by the Legislature and the Minnesota Pollution Control Agency (MPCA). Costs of construction, maintenance, and operation are typically the responsibility of the property owner.

The WLSSD has periodically been asked to investigate the role of managing decentralized collection/cluster systems within its boundaries. It should be noted that when WLSSD was created, Minnesota Statutes 458D charged the District with the broad responsibility of improving and protecting waters of the St. Louis River Basin area. With this in mind, and also realizing the direction the State of Minnesota is heading when evaluating and placing priority for funding wastewater projects on decentralized options rather than centralized collection, the District should not rule out a future management role of these types of systems (existing and future).
In certain communities, poor soil conditions, high population densities, small lot sizes or persistent failures of on-site systems have made continued management by the home or business owner a less than desirable alternative. Often the only solutions recommended in these areas have been to connect to a centralized sewer system for ultimate treatment either at WLSSD or at a decentralized treatment site. An option available that stands between publicly owned collection systems and individually owned on-site systems are managed on-site systems.

A system of managed on-site treatment systems could entail different levels of control, but in each case it would mean that the property owner would give up some or all control of the on-site treatment system in exchange for management by a third party. The third party could be the local unit of government (i.e., township, city, county, WLSSD) or an entity similar to the Pike Lake Area Wastewater Collection System (PLAWCS) or the Duluth North Shore Sanitary District (DNSSD). In exchange for the third party having control of the on-site system, the property owner would receive services on their system, and payment for such services would be collected in a way that all property owners could benefit equitably from being part of the managed on-site system area.

Section 5.3.5: On-Site System Management Models

On-site system management could come in various levels of control beyond the direct control of the property owner. The following decentralized wastewater management models, from the least comprehensive to the most comprehensive, are shown below as described by the Environmental Protection Agency (EPA).

- **Homeowner Awareness Model**
  This model is well suited to areas of low environmental sensitivity where sites are suitable for conventional onsite systems. In this case, systems are sited and constructed on prescribed criteria and the homeowner is provided with maintenance reminders. This system is relatively easy to implement, however there is often times no compliance mechanism in place.

- **Maintenance Contract Model**
  This model is best suited for areas with low to moderate environmental sensitivity where sites are marginally suitable for conventional onsite systems due to small lots, shallow soils or low-permeability soils. They are often times found in small cluster systems. Under the Maintenance Contract Model there is a lower risk of treatment system malfunctions, however, like the Homeowner Awareness Model there is some degree of difficulty tracking and enforcing compliance due to the reliance on the owner or contractor to report a lapse in services.

- **Operating Permit Model**
  A typical application of this model is found in areas of moderate environmental sensitivity where sites are marginally suitable for conventional onsite systems due to small lots, shallow solids or low permeability soils. This system uses regular compliance monitoring reports and non-compliant systems are identified and corrective actions are required.

- **Responsible Management Entity (RME) Operation**
  This model is best suited for areas of moderate to high environmental sensitivity where reliable and sustainable system management is required. This application is frequently found in cluster systems. Operations and maintenance responsibility is transferred from the system owner to a professional
management entity that holds the operating permit. Typically there is one permit for each group of systems. The RME must have the approval of the property owner for repairs which could result in a conflict if performance problems are identified by the RME and not corrected by the property owner.

- **Responsible Management Entity (RME) Ownership Model**
  This management model is typically found in areas of greatest environmental sensitivity, where reliable management is required. This includes sole source aquifers, wellhead or source water protection zones, critical aquatic habitats, and outstanding value resource waters. This is the preferred management model for cluster systems serving multiple properties under different ownership. The model provides the greatest protection of environmental resources and homeowner investment and also removes the potential conflicts between the user and the RME as discussed in the previous model. This system offers a high level of oversight if system problems occur.
Section 6: PROCESS AND FACILITY ANALYSIS

Section 6.1: Existing Facilities

From a geographic perspective, only 12-percent (63.65 square miles) of the total 530 square-mile WLSSD service area is served by public sewers. Another 6-percent (32.06 square miles) of the WLSSD area has been identified in local plans as areas where future sanitary sewer service is possible in the next 10-20 years.

The more concentrated and urban areas receive wastewater service, connected to the regional treatment plant through a 76.5-mile network of interceptors and forcemain sewers. Nineteen pumping stations are necessary to move wastewater from as far away as Wrenshall and Jay Cooke State Park. The three largest stations are located in Cloquet, Scanlon and Knowlton Creek. More recent extensions have brought service to the Black Bear Casino, the Village of Oliver, the North Shore, Pike Lake and the Fond du Lac neighborhood of Duluth. The WLSSD regional treatment plant is located at 2626 Courtland Street in Duluth and is designed to treat an average wet weather flow of 48.4 million gallons per day.

The municipal customers of the WLSSD include portions of the cities of Duluth, Cloquet, Hermantown, Proctor, Rice Lake, Carlton, Scanlon and Wrenshall; the townships of Thomson (Esko), Twin Lakes, Canosia, Duluth, Lakewood, Grand Lake and Midway, and the Village of Oliver in Wisconsin. Portions of the north shore of Lake Superior as far north as Knife River are also served. The largest industrial customers of the WLSSD include SAPPI Fine Paper, United States Gypsum, Verso, and Specialty Minerals.

There is an important relationship between land use/demographics and future wastewater utility systems. Future potential service areas reflect development and population growth requiring public utility services through interceptor extensions and, in some cases, new interceptors. Severe limitations for conventional SSTs in portions of the District further defines the need for the extension of public services to identified growth areas.

Extension of public services is dependent on more than just projected development patterns. Four areas that impact the decision to expand service areas and facilities include plant capacity, interceptor capacity, inflow and infiltration and local planning objectives.

Section 6.2 below highlights key findings of the 2001 WLSSD Effluent Quality Master Plan. The other two areas, interceptor capacity and inflow and infiltration will be discussed in much more detail in the collection system evaluation part of this master planning effort found in Section 6.3.

Section 6.2: Wastewater Treatment Plant Capacity

The wastewater treatment plant began operations in September of 1978 and was operated near design capacity at startup. However, the trend from 1979 through 1985 was one of reduced loadings from the industrial users (WLSSD, 1992). This trend was caused by both a general economic decline and efforts by industry to reduce their discharges. This produced considerable excess capacity in the system, which was available for industrial expansion (WLSSD, 1992).

Between 1985 and 1987, loadings increased slightly as the area economy strengthened. In 1988, loadings increased significantly due to the startup of the Lake Superior Paper Company (now Verso) paper mill in Duluth.
The objectives for the 2001 WLSSD Effluent Quality Plan included a review and evaluation for the existing liquid stream wastewater treatment facilities, a revised assessment of the wastewater treatment plant capacity, identification of opportunities for optimization of the current facilities, and an evaluation to comprehensively address current and future requirements to protect the water quality of the St. Louis River and Lake Superior. The figure below presents a schematic of the facilities evaluated during the planning process of the Effluent Quality Plan.

**Figure 6-1, WLSSD Existing Facilities Schematic**

**Section 6.2.1: Baseline Flows and Loads**

WLSSD updated projections of total flow and mass loading to the wastewater treatment facility over a 20-year planning period as of early 2016. The historical operating data used to establish year 2016 baseline flows and loadings included the following daily average values from time periods spanning January 2012 through December 2012 and May 2014 through December 2015:
Operating data from January 2013 through April 2014 were excluded from the analysis supporting the updated flow and loading projections; loadings from the largest industrial user during this period were identified by the District as not representative of current or repeatable conditions based on knowledge of the industrial user’s operations.

Mass loading numbers listed for the baseline (2016) conditions are based on daily mass loading of each parameter, calculated using the flow and concentrations measurements listed above. Maximum month loadings and maximum week loadings are based on running averages of daily loadings over continuous 30-day and 7-day periods, respectively.

Projected growth over a 20-year period is based on an update to the WLSSD collection system model in 2015, which included an estimate of 6 percent total growth in municipal flows and loads over a 30-year period. Monthly billing record data indicate that municipal wastewater accounts for approximately 40 percent of total flow and 20 percent of total loading, on average, to the collection system. Therefore, the projection basis is summarized as follows:

- Municipal growth at 6% over 30 years at a linear growth rate
- No growth in flow and loading from industrial users
- Growth in flow at 1.6% over 20 years at a linear growth rate
- Growth in mass loading at 0.8% over 20 years at a linear growth rate
- Continuation of historically observed peaking factors consistent with the 2016 baseline

The resulting flow and loading projections are summarized in Table 6-1 on the following page.
**Table 6-1, Flow and Loading Projections 2016 - 2036**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>2016</th>
<th>2026</th>
<th>2036</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Flow (mgd)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Annual Average</td>
<td>36.8</td>
<td>37.1</td>
<td>37.4</td>
</tr>
<tr>
<td>Max Month</td>
<td>58.5</td>
<td>58.9</td>
<td>59.4</td>
</tr>
<tr>
<td>Max Week</td>
<td>81.0</td>
<td>81.6</td>
<td>82.3</td>
</tr>
<tr>
<td>Max Day</td>
<td>146.4</td>
<td>147.6</td>
<td>148.7</td>
</tr>
<tr>
<td><strong>BOD Load (lb/d)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Annual Average</td>
<td>76,763</td>
<td>77,070</td>
<td>77,377</td>
</tr>
<tr>
<td>Max Month</td>
<td>101,251</td>
<td>101,656</td>
<td>102,061</td>
</tr>
<tr>
<td>Max Week</td>
<td>110,994</td>
<td>111,438</td>
<td>111,882</td>
</tr>
<tr>
<td>Max Day</td>
<td>148,674</td>
<td>149,269</td>
<td>149,863</td>
</tr>
<tr>
<td><strong>TSS Load (lb/d)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Annual Average</td>
<td>62,057</td>
<td>62,305</td>
<td>62,553</td>
</tr>
<tr>
<td>Max Month</td>
<td>84,099</td>
<td>84,435</td>
<td>84,771</td>
</tr>
<tr>
<td>Max Week</td>
<td>115,653</td>
<td>116,116</td>
<td>116,578</td>
</tr>
<tr>
<td>Max Day</td>
<td>179,490</td>
<td>180,208</td>
<td>180,926</td>
</tr>
<tr>
<td><strong>Phosphorus (lb/d)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Annual Average</td>
<td>771</td>
<td>774</td>
<td>777</td>
</tr>
<tr>
<td>Max Month</td>
<td>940</td>
<td>944</td>
<td>948</td>
</tr>
<tr>
<td>Max Week</td>
<td>1,148</td>
<td>1,153</td>
<td>1,157</td>
</tr>
<tr>
<td>Max Day</td>
<td>1,269</td>
<td>1,274</td>
<td>1,279</td>
</tr>
</tbody>
</table>

A previous 2001 Effluent Quality Plan discussed in the previous section, provided an evaluation of the WLSSD wastewater treatment plant capacity relative to flows and loadings projected at the time of the study. The District is currently evaluating strategies to address the aging high purity oxygen (HPO) generation system at the facility. The updated flow and loading projections will support decision making in the HPO system planning effort.

**Section 6.3: Conveyance System Capacity**

A collection system model was developed as part of the 2003 Comprehensive Wastewater Services Master Plan as a tool to evaluate capacity of the WLSSD collection system. The collection system model consists of two model components: wastewater flow generation (hydrologic) model which is used to simulate wastewater and inflow and infiltration flows entering the collection system, and a hydraulic model which simulates the results of the generated flow within the collection system. The development of the collection system model in 2002 used CAPE (Capacity Assurance Planning Environment) for the hydrologic model and SewerCat for the hydraulic model.

The collection system model was updated in 2009 and 2014. The model components consist of CAPE for the hydrologic model component and MIKE URBAN for the hydraulic model component for future WLSSD modeling. The MIKE URBAN model represents a state-of-the-art tool WLSSD can use for planning and design of existing and future facilities. The collection system model updates include extensive calibration updates based on additional years of flow and rain data and incorporation of recent collection system improvements.
Wastewater flow is comprised of base sanitary flow and inflow and infiltration. Base sanitary flow represents flow intentionally discharged to the sewer system. It consists of domestic flow from residential properties, flow from commercial establishments, and flow from industries. Inflow and infiltration is “clearwater” that is not intended to enter the sewer system. Inflow and infiltration reaches the system through defects in pipes and manholes and clearwater connections to the sewer system, such as connected foundation footing drains. Inflow and infiltration is heavily influenced by precipitation. Therefore, an analysis of a sewer system must be made for conditions that reflect the influence of precipitation.

It has been generally accepted, through discussions with the Minnesota Pollution Control Agency (MPCA) that the design level for basic components of the WLSSD collection system is that which will convey a design flow from a 25-year, one-hour rainfall event. Deriving a design flow event from a 25-year one-hour rainfall event is problematic because a rainfall event does not take into account antecedent conditions; however, an analysis was done which generally related the 25-year, one-hour rainfall event to be approximately equivalent to the 10-year flow event. Based on this correlation, the 10-year flow event was used for evaluation of capacity and flow conditions throughout the collection system. Table 6-3 on the following page summarizes the parameters discussed in this plan and how they are applied to capacity analysis.

The collection system model was calibrated using most recent available monitored wastewater flow and rain data. The calibration for most locations in the collection system represents a very large database of information that provides a high level of confidence in the calibrated model. Each hydraulic model update expands on the data used for calibration of the collection system model.
### Table 6-2, Summary of WLSSD Capacity and Design Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Definition</th>
<th>Use</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Level of Service – Peak Flow (LOS)</strong></td>
<td>The peak allowable flow that a municipality may discharge to the WLSSD sewage collection system.</td>
<td>The primary design basis for sizing interceptor sewers and pump stations.</td>
<td>Level of Service and Municipal Peak Flow Standards were adopted by the WLSSD Board of Directors in 2003. The 2003 Comprehensive Wastewater Services Master Plan defines and presents the rationale for the Level of Service – Peak Flow philosophy.</td>
</tr>
<tr>
<td><strong>Capacity Allocation – Peak Flow (CAPF)</strong></td>
<td>The peak allowable flow that an industrial user may discharge to the WLSSD sewage collection system.</td>
<td>Used in conjunction with Level of Service Peak Flow as the primary basis for sizing interceptor sewers and pump stations.</td>
<td>Every 5 years a capacity allocation agreement is executed with each user. A peak flow rate is established within the Capacity Allocation Agreement.</td>
</tr>
<tr>
<td><strong>Design Rainfall Event</strong></td>
<td>A rainfall event selected for design purposes. Typically generated based on historical rainfall data.</td>
<td>The primary parameter used to generate design flow events. Used historically as the primary means for benchmarking sewer system performance during rainfall events.</td>
<td></td>
</tr>
<tr>
<td><strong>Design Flow Event</strong></td>
<td>Developed by simulating a design rainfall event through a calibrated flow generation and hydraulic model. The recurrence interval for the design flow event is based on modeling runs that are generated from historical rainfall events followed by a statistical analysis.</td>
<td>The flow generation and hydraulic model is essentially used to predict sewer flows for given storm events. The result is a design flow event. For this reason, the design flow event becomes the key parameter for most engineering design exercises related to interceptor pump station and storage tank sizing.</td>
<td>Appendix B of 2003 WLSSD’s Wastewater Services Master Plan provides a summary of the flow generation and hydraulic model output that was developed for the purpose of generating design flow events. Because a calibrated flow generation and hydraulic model is unique to each sanitary sewer system, the resulting design flow events and recurrence intervals are unique to the specified sanitary sewer system being evaluated.</td>
</tr>
<tr>
<td><strong>25-year 1-hour Rainfall Event</strong></td>
<td>An isolated storm event with a duration of 1-hour and recurrence interval of 25 years.</td>
<td>The reference rainfall event for purposes of I&amp;I reduction. Municipal and Industrial users are required to restrict flows below their peak flow limitations (LOS or CAPF) during this reference event.</td>
<td>Bulletin 71 – Rainfall Frequency Atlas of the Midwest by Floyd A. Huff and James R. Angel (1992), defines the magnitude of the 25-year 1-hour event. When the reference rainfall event is simulated through WLSSD’s calibrated flow generation and hydraulic model, a design flow event with a recurrence interval of 10-years results. For this reason, the 25-year 1-hour storm event and the 10-year design flow event are used interchangeably by WLSSD.</td>
</tr>
<tr>
<td><strong>10-year Design Flow Event</strong></td>
<td>A design flow event with a 10-year recurrence interval.</td>
<td>Used interchangeably by WLSSD with the 25-year 1-hour rainfall event as the reference event for purposes of I&amp;I reduction and system design.</td>
<td></td>
</tr>
</tbody>
</table>
The system was evaluated under both existing and future conditions. Existing conditions were based on actual, recent flow conditions. Future conditions were based on flows adjusted for population and employment projected to the year 2040. The future condition scenario does not include any assumptions for continued reductions resulting from the ongoing City of Duluth inflow and infiltration reduction program (footing drain disconnections, lateral linings, etc.). This program is expected to continue to reduce inflow and infiltration to the sewer system, however reductions are not included in the model update as a variable. This is a conservative approach in that there may be fewer capacity constraints under future conditions than those identified because actual, future peak flows may be less than those used in this evaluation.

A comprehensive description of the collection system model and details of the hydraulic capacity evaluation for existing and future conditions are presented in Appendices A and B. The results are summarized in the following narrative. Figure 6-2 shows the WLSSD Collection System Basins used in the hydraulic model. Areas highlighted yellow are monitored by permanent flow metering systems. Areas highlighted in green are monitoring with temporary flow metering units.

**Figure 6-2, WLSSD Collection System Model Basins**
Section 6.3.1: Capacity Measures

The parameters used to assess the capacity of pipes in the WLSSD conveyance system include the following:

Average Velocity
Average velocity is a measure of how fast wastewater is moving through the sewer system. Extremely high velocities can damage the pipe. Velocities that are too low can result in deposition of sediment in the sewers, which reduces the sewer capacity. Acceptable velocities under dry weather flow conditions are in the range of 2 – 10 feet per second (fps).

Percent of Full Pipe Capacity
This is a measure of the peak flow in the sewer relative to the amount of flow the sewer can convey when it is just full. A value of 100 percent indicates the pipe is just flowing full. A value greater than 100 percent indicates the pipe is being surcharged. Surcharging is a condition when the water level rises above the crown of the pipe in the adjacent manholes providing a larger driving head to push more flow through the pipe. Gravity sewers are generally designed to flow without surcharging. However, some degree of surcharging can usually be tolerated for short durations that may occur during the peak portion of wet weather flow events.

Surcharge Height
Surcharge height is a measure of how high water rises in a manhole above the crown of the adjacent pipe. A surcharge height of 1 – 2 feet is generally acceptable for short durations under wet weather conditions. Higher surcharge values may be tolerated depending on site-specific conditions.

Level of Service
The amount of capacity to be provided to a municipality by the WLSSD is defined as the Level of Service (LOS). The assessment completed as part of the 2003 Comprehensive Wastewater Services Master Plan established an appropriate LOS for the WLSSD to provide to its municipal users based on the wet weather peaking factor curves shown in Figure 6-3. The assessment concluded that the proposed wet weather peaking factor curve is a reasonable standard for sizing conveyance system components for wet weather flow and that it is generally more cost effective to reduce peak flows by inflow and infiltration removal in collection systems with peaking factors above 8 to 10 than to provide additional conveyance and treatment capacity. A comprehensive view of the collection system capacity based on this accepted LOS shows that the capacity of the pumped side and gravity side of the collection system are in balance with the hydraulic capacity of the wastewater treatment plant (see Figure 27, Comprehensive Wastewater Services Master Plan - 2003). The LOS concept was implemented when the Plan was adopted by the WLSSD Board of Directors in 2003. The LOS concept has since been incorporated into the capacity allocation system, inflow and infiltration ordinance and is used as a design parameter when evaluating capacity needs for infrastructure improvements.

When evaluating a design for rehabilitation or new installation of collection system components, the design wet weather peaking factor curve is referenced which is two times the dry weather peaking factor curve.
**Figure 6-3, WLSSD Municipal Peak Flow Standards**

The Municipal Peak Flow Standard defines the allowable peak flow from a municipal customer, based on the municipal dry weather flow and peaking factors. The large industrial component of the WLSSD wastewater flow tends to skew this type of evaluation in comparison to systems with mostly municipal wastewater.

The industrial peak flow allocation is based on agreements between the WLSSD and the individual industries. The remaining capacity is available to municipal customers. Determination of the Municipal Peak Flow Standard is determined by subtracting out the system capacity allocated to industrial flow and the average industrial flow. The resulting parameter, referred to as the capacity ratio (CR), is defined as follows:

\[
\text{Capacity Ratio} = \frac{\text{Facility Capacity Available for Municipal Flow}}{\text{Average Municipal Flow}}
\]

\[
\text{Capacity Ratio} = \frac{\text{Total Facility Capacity} - \text{Industrial Peak Flow Allocation}}{\text{Total Average Flow} - \text{Average Industrial Flow Allocation}}
\]

The facility capacity for municipal flow is defined as the total facility capacity minus the peak flow allocation for industrial flow. For pipes, the total capacity is based on either the full pipe gravity flow...
capacity, or the surcharge capacity in those areas where surcharging can be accommodated. The average municipal flow is the total average flow minus the average industrial flow allocation.

The capacity ratio should be greater than the peaking factor defined by the Design Peak Flow Ratio for the Municipal Peak Flow Standard, as this represents the physical measurement of the capacity available to the municipal customer.

Firm capacity of a pump station is generally defined as the station capacity available with the largest pump unit out of service. Standards for the WLSSD collection system are keyed to the capacity ratio provided for each sewershed. Detailed discussion of the development and calculation of the capacity ratio can be found in the 2003 Master Plan document.

Consistent with the approach followed for previous WLSSD Comprehensive Plans, the failure of a pump station to meet the target capacity ratio based on firm capacity will not trigger a capital improvement to increase the firm capacity as long as the target capacity ratio is being met based on total capacity. However, when major pump station renovations are undertaken to address aging or obsolete equipment, the firm capacity of the pump station would be increased to meet the target capacity ratio based on firm capacity.

Table 6-4 on the following pages summarizes the peak flow values by customers. The values are based on model predicted flows for a 10-year flow event generated by each customer without regard to available sewer or pump station capacities. When the existing condition 10-year flow event peak flow exceeds the allowable peak flow, it is anticipated the municipality will have a Municipal Peak Flow Standard violation in the event of a 10-year flow event. These municipalities are bolded in Table 6-4.
Table 6-3, Average Dry Weather Flow, Allowable Peak Flow and Modeled 1-year Peak Flow by Flow Metering Location

<table>
<thead>
<tr>
<th>Metering Location</th>
<th>Average Dry Weather Flow (ADWF) (MGD); Municipal portion only – Model data</th>
<th>Level of Service - Allowable Peak Flow (2015)*</th>
<th>Existing Conditions: 10-year Flow Event Peak Flow (MGD)</th>
<th>Future Conditions: 10-year Flow Event Peak Flow (MGD)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bayview Heights</td>
<td>0.178</td>
<td>1.49</td>
<td>2.3</td>
<td>2.8</td>
<td></td>
</tr>
<tr>
<td>Carlton</td>
<td>0.092</td>
<td>0.8</td>
<td>2.3</td>
<td>2.4</td>
<td></td>
</tr>
<tr>
<td>Cloquet 22nd St.</td>
<td>0.125</td>
<td>0.91</td>
<td>0.8</td>
<td>0.8</td>
<td>11.7% decrease in LOS over 5 years</td>
</tr>
<tr>
<td>Cloquet Metering Station</td>
<td>0.697</td>
<td>5.8</td>
<td>3.9</td>
<td>4.5</td>
<td></td>
</tr>
<tr>
<td>Duluth North Shore Sanitary District</td>
<td>0.055</td>
<td>0.24</td>
<td>1.1</td>
<td>1.2</td>
<td>Storage Tank 31.4% decrease in LOS over 5 years</td>
</tr>
<tr>
<td>Endion</td>
<td>0.976</td>
<td>9.08</td>
<td>26.2</td>
<td>26.3</td>
<td>Storage tank</td>
</tr>
<tr>
<td>Esko</td>
<td>0.099</td>
<td>0.71</td>
<td>1.5</td>
<td>1.6</td>
<td>Growth community</td>
</tr>
<tr>
<td>Gary/Fond du Lac</td>
<td>0.204</td>
<td>1.71</td>
<td>3</td>
<td>3</td>
<td>Storage Tank</td>
</tr>
<tr>
<td>Heilberg Road (Thomson Township)</td>
<td>0.004</td>
<td>0.03</td>
<td>0.2</td>
<td>0.2</td>
<td></td>
</tr>
<tr>
<td>Hermantown</td>
<td>0.29</td>
<td>2.18</td>
<td>2.7</td>
<td>3.1</td>
<td>Growth community</td>
</tr>
<tr>
<td>Jay Cooke</td>
<td>0.002</td>
<td>0.01</td>
<td>0.2</td>
<td>0.2</td>
<td>75% decrease in LOS over 5 years due to removal of service to Oldenburg point</td>
</tr>
<tr>
<td>Lakeside/Dodge (City of Duluth)</td>
<td>0.373</td>
<td>2.58</td>
<td>7.7</td>
<td>7.7</td>
<td>Storage Tank</td>
</tr>
<tr>
<td>Landfill (MPCA)/Ridgeview RD</td>
<td>0.022</td>
<td>0.18</td>
<td>0.03</td>
<td>0.1</td>
<td>Can turn off leachate flow; large reduction in flow after landfill closed in 2010 resulting in decrease of LOS by 50%</td>
</tr>
<tr>
<td>Larson Road (Thomson Township)</td>
<td>0.017</td>
<td>0.14</td>
<td>0.1</td>
<td>0.2</td>
<td></td>
</tr>
<tr>
<td>Oliver (Oliver, WI)</td>
<td>0.017</td>
<td>0.1</td>
<td>0.2</td>
<td>0.2</td>
<td></td>
</tr>
<tr>
<td>Oneota</td>
<td>0.383</td>
<td>4.31</td>
<td>11</td>
<td>11.0</td>
<td></td>
</tr>
<tr>
<td>Pike Lake</td>
<td>0.7</td>
<td>0.45</td>
<td>0.7</td>
<td>0.8</td>
<td>Growth Community</td>
</tr>
<tr>
<td>Polk</td>
<td>0.355</td>
<td>2.68</td>
<td>8.6</td>
<td>8.6</td>
<td>Storage Tank</td>
</tr>
<tr>
<td>Proctor</td>
<td>0.233</td>
<td>1.96</td>
<td>2.5</td>
<td>2.6</td>
<td></td>
</tr>
<tr>
<td>Railroad St.</td>
<td>0.039</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td></td>
</tr>
<tr>
<td>Rice Lake</td>
<td>0.027</td>
<td>0.23</td>
<td>0.4</td>
<td>0.5</td>
<td></td>
</tr>
<tr>
<td>Scanlon Metering Station</td>
<td>0.085</td>
<td>1.62</td>
<td>1.4</td>
<td>1.4</td>
<td>Growth community</td>
</tr>
<tr>
<td>Thomson</td>
<td>0.006</td>
<td>0.06</td>
<td>0.3</td>
<td>0.4</td>
<td>25% decrease in LOS over 5 years</td>
</tr>
<tr>
<td>Twin Lakes</td>
<td>0.068</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>Growth community</td>
</tr>
<tr>
<td>Wrenshall/Silverbrook</td>
<td>0.016</td>
<td>0.13</td>
<td>0.3</td>
<td>0.4</td>
<td></td>
</tr>
</tbody>
</table>

*Level of Service is based on the Average Dry Weather Flow for the previous 5 years of data: In 2014 the level of service calculation was revised to use the average dry weather flow average over the previous 5 years. This allows for level of service changes to be moderated and more consistent for municipalities.
The evaluation of the WLSSD conveyance system shows that the municipal level of service is exceeded at several locations under extreme wet weather flows for both current and future conditions. Municipalities with additional inflow and infiltration (I and I) opportunities to reduce flows include Duluth, Carlton, Duluth North Shore, Esko, Hermantown, Jay Cooke, Oliver, Proctor, Rice Lake, Pike Lake, Thomson and Wrenshall/Silverbrook. This indicates that these areas have additional work to do on I&I reduction activities.

Growth communities identified have increased their dry weather flow and thus their Level of Service since 2009. These communities include Esko, Hermantown, Knife River Larsmont Sanitary District, Pike Lake, Scanlon and Twin Lakes. Most of these communities exceed the 10 year flow event for both existing and future conditions. It will be particularly important to continue monitoring flows from these areas to ensure capacity is available and that I&I reduction plans are sufficient.

Section 6.3.2: Capacity Evaluation – Current Conditions

A hydraulic capacity evaluation was performed as part of the planning process to assess system capacity of the gravity portion of the WLSSD interceptor system and pump stations and identify hydraulic restrictions in the collection system based on the 10 year flow event.

Figures 6-4 and 6-5 on the following page depict the results of the evaluation. These figures show the percent of full capacity for each modeled pipe segment. It is a measure of peak flow in the sewer relative to the amount of flow the sewer can convey when it is full, based on full pipe capacity using Manning’s equation.
In addition to the pipe capacity, surcharge height was also identified and summarized in Figures 6-6 and 6-7.
The above figures summarize the capacity and surcharging of the system relative to the design flow event. These figures indicate at some locations, peak flows in pipes are greater than 100-percent of pipe capacity and surcharging can be expected to occur in portions of the interceptor system under peak wet weather conditions. It is important to note, that a pipe indicated to be over 100-percent of full pipe capacity does not necessarily indicate a problematic situation or overflow conditions. This information must be used in combination with observed conditions, model assumptions, surcharge tolerance and other factors to provide a full assessment. Individual locations highlighted in these figures can be further evaluated using the hydraulic model in order to determine surcharge tolerance and potential overflow locations.

While velocities in most pipes are within a reasonable range, some pipe velocities exceed 10 fps. These are pipes with sleep slopes. High velocities at these locations are unavoidable because of the steep terrain in which the pipes were built. These pipe reaches should be regularly inspected and closely monitored for evidence of erosion of the pipe material.

Capacity ratios were computed for each interceptor segment. Capacity ratios shown in Figures 6-8 and 6-9 are based on either the full pipe capacity or the capacity that can be achieved with surcharging, where surcharge can be accommodated. In general, the system has the capacity to meet the Municipal Peak Flow Standard for existing flow conditions.

The 10-year design flow events show greater than 120-percent of pipe capacity is used in areas of the Scanlon, Proctor, West, Hermantown, East, Woodland and Lakeside Interceptors. Areas of pipe surcharging greater than two-feet occur on the Proctor, West, Hermantown, East, Pike Lake and Lakeside interceptors. These surcharges and pipe capacity use are generally tolerated, however, must continue to be measured and monitored. The temporary flow metering program assists in collecting data to improve and validate the modeling results.
The interceptor segments that do not meet the target values for current conditions are pipe segments located on the Hermantown Interceptor and the downstream portion of the West Interceptor.

In 2010, the Minnesota Department of Transportation (MnDOT) completed a project which addressed storm water management in the Miller Creek area. This project reduced wet weather flow to the Hermantown Interceptor. Population and employment growth continues in the areas served by the Hermantown Interceptor. The entire Hermantown Interceptor was evaluated by CDM Smith to determine capital improvement needs through 2060 flow estimates. A number of alternatives were evaluated to upsize the pipes to accommodate future flows from this growing area. Sections of the pipeline located near Miller Creek will be realigned to improve access and aid construction. The full evaluation can be found in Appendix C.

The West Interceptor area of concern are manholes WE029, WE023, WE020 and WE017 upstream of the wastewater treatment plant. The model shows that the volume of flow causes surcharging as the pipe floods from the treatment plant back up the West Interceptor causing potential overflows at manholes with lower rim elevations. The City of Duluth lift stations 16 and 17 connect to the West Interceptor upstream of this area and sources of inflow and infiltration in the tributaries continue to be addressed by the City of Duluth by using Cured in Place Pipe Lining. It is expected continued reduction of I and I in this area will be seen in future flow metering data.

The West Interceptor has a very shallow slope and therefore average velocity in the pipe is very low. The consequences of this are sediment deposition and increased maintenance attention. A pipe sag has been identified in the area of the predicted overflows on the West Interceptor which increases the need for maintenance in this area and potential sediment buildup would increase the risk of overflow, however, this is not the reason for the hydraulic overload condition identified. WLSSD has established a pipe cleaning schedule of once every two years in order to ensure continued pipe capacity is maximized in this area. Additionally, upstream pipe rehabilitation will assist in reducing Inflow and Infiltration to this area.

If pipes are replaced in the future to accommodate future growth, they should be sized to meet the target capacity ratio.
Section 6.3.3: Capacity Evaluation – Future Conditions

The quantity of wastewater generated in the WLSSD service area is expected to increase as a result of both growth within existing sewered areas and the development of new sewered areas that will become part of the WLSSD service area in the future. The existing and future WLSSD service areas are shown in Figure 6-10. Possible future areas of sewer service are highlighted in pink. The results of the capacity evaluation for future conditions are similar to those for current conditions and can be viewed in the following Figures 6-11 through 6-16.

Figure 6-10, WLSSD Existing Model Basins with Future Service Areas
Western Lake Superior Sanitary District
COMPREHENSIVE WASTEWATER SERVICES PLAN

Figure 6-11
Future Conditions
Pipe Capacity - 10 Year Design Flow Event

Legend
- WWTP
- Pump Stations
- Force Main
- Modeled Interceptors
  Pipe Capacity - 10 yr Event
  - 0 to 60%
  - 60 to 100%
  - 100 to 120%
  - Greater than 120%

Figure 6-12
Future Conditions
Pipe Capacity - 10 Year Design Flow Event

Legend
- WWTP
- Pump Stations
- Force Main
- Modeled Interceptors
  Pipe Capacity - 10 yr Event
  - 0 to 60%
  - 60 to 100%
  - 100 to 120%
  - Greater than 120%
Figure 6-13,
Future Conditions Pipe Surcharging - 10 Year Design Flow Event

Figure 6-14,
Future Conditions Pipe Surcharging - 10 Year Design Flow Event
Figure 6-15,
Future Conditions
Pipe and Pump Station Capacity Ratios
Based on a combination of gravity and surcharge

Figure 6-16,
Future Conditions
Pipe and Pump Station Capacity Ratios
Based on a combination of gravity and surcharge
Section 6.3.4: Capacity Evaluation – Pump Stations

Peak flows at each pump station and their respective capacities are summarized in Table 6-5. Capacities are exceeded for the design flow event at several of the pump stations. Storage basins are located at the Gary, Endion, Lakeside, Polk Street and Pike Lake Pump Stations to store peak flows.

The Carlton, Thomson and Oneota Pump Stations do not meet the model predicted 10-year flow capacity for existing conditions. These stations do not have storage capacity.

Table 6-4, Pump Station Capacity and Model Predicted Results for Existing and Future Conditions During a 10-year Flow Event

<table>
<thead>
<tr>
<th>Pump Station</th>
<th>Total Station Capacity (MGD)</th>
<th>Existing Conditions: 10-year Flow Event</th>
<th>Future Conditions: 10-year Flow Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowlton Creek</td>
<td>49.0</td>
<td>43.7</td>
<td>46.6</td>
</tr>
<tr>
<td>Scanlon</td>
<td>46.0</td>
<td>31.6</td>
<td>34.0</td>
</tr>
<tr>
<td>Cloquet</td>
<td>36.0</td>
<td>26.7</td>
<td>28.3</td>
</tr>
<tr>
<td>Bristol Street</td>
<td>11.0</td>
<td>5.4</td>
<td>5.4</td>
</tr>
<tr>
<td>Polk Street</td>
<td>6.4</td>
<td>8.5</td>
<td>8.5</td>
</tr>
<tr>
<td>Gary</td>
<td>1.5</td>
<td>3.2</td>
<td>3.2</td>
</tr>
<tr>
<td>Esko</td>
<td>1.6</td>
<td>1.5</td>
<td>1.6</td>
</tr>
<tr>
<td>Carlton</td>
<td>2.9</td>
<td>3.2</td>
<td>3.7</td>
</tr>
<tr>
<td>Twin Lakes</td>
<td>1.2</td>
<td>0.38</td>
<td>0.63</td>
</tr>
<tr>
<td>Thomson</td>
<td>0.4</td>
<td>0.44</td>
<td>0.44</td>
</tr>
<tr>
<td>Jay Cooke</td>
<td>0.34</td>
<td>0.17</td>
<td>0.17</td>
</tr>
<tr>
<td>Silver Brook</td>
<td>1.4</td>
<td>0.32</td>
<td>0.4</td>
</tr>
<tr>
<td>Wrenshall</td>
<td>0.4</td>
<td>0.34</td>
<td>0.4</td>
</tr>
<tr>
<td>Endion</td>
<td>16</td>
<td>25.9</td>
<td>27.7</td>
</tr>
<tr>
<td>Lakeside LS45 (Dodge – City of Duluth)</td>
<td>3.2*</td>
<td>7.7</td>
<td>7.7</td>
</tr>
<tr>
<td>Railroad Street</td>
<td>1.7</td>
<td>0.56</td>
<td>0.56</td>
</tr>
<tr>
<td>Oneota Street</td>
<td>10.8</td>
<td>11.6</td>
<td>11.8</td>
</tr>
<tr>
<td>Pike Lake</td>
<td>0.34</td>
<td>0.53</td>
<td>1.2</td>
</tr>
<tr>
<td>Ridgeview Road</td>
<td>0.7</td>
<td>0.03</td>
<td>0.7</td>
</tr>
</tbody>
</table>

*The model uses LS45’s peak capacity with one pump operating (3.2 MGD or 2,200 GPM). Total capacity with two pumps is 3.7 MGD or 2,600 GPM, but is a manual mode of operation.

Table 6-6 lists the WLSSD stations, their firm and total capacities, and a comparison of the firm capacity ratio and the target capacity ratio as defined for the WLSSD system. Firm capacity of a pump station is generally defined as the station capacity available with the largest pump unit out of service. It is noted that the firm capacity ratio for several of the stations falls short of the target capacity – these are shown in bold font.

As a way of addressing the deficiency in installed capacity of the three largest pump stations, WLSSD keeps a spare pump unit for the Knowlton Creek and Scanlon pump stations in stock, ready for immediate replacement in the event of a failure. Planned major retrofit of these stations should include a detailed analysis of the condition of the pumps prior to any upgrades or other changes in station capacity.
The Oneota Street Pump Station was designed to provide the required peak flow using firm capacity – two of the three installed pumps. The reductions of infiltration and inflow by the City of Duluth upstream of this station have reduced the likelihood of hydraulic problems downstream in the West Interceptor. Monitoring of this station after high flow events should continue in order to determine downstream and upstream effects in the system.

It should also be noted that the Gary Pump Station does not meet its target capacity ratio even when the station total capacity is considered. This station was replaced in 2010 and has a firm capacity of 1.3 MGD and total capacity of 1.5 MGD. In addition, peak flows to this pump station are attenuated by the adjacent storage basin; thus, it is not necessary for the pump station to meet the target capacity ratio. The Pike Lake pump station is also below the target capacity ratio using both firm and total capacity. A storage tank was installed in 2011 to remedy the capacity concerns of the current conditions.

Increases in future flow will result in some WLSSD interceptors and pump stations having capacity ratios that do not meet the target level of service as shown in Table 6-7. Growth in the system needs to be monitored and upgrades of facilities made to meet the target level of service when flows dictate. Facilities with capacity ratios less than the target values are not recommended for upgrade immediately if they are not causing capacity problems. However, when these facilities are upgraded either to accommodate future growth or to address condition concerns, they should be upgraded to meet the target capacity ratios based on future flow conditions and firm capacities.

**Table 6-5, Pump Station Capacities and Capacity Ratios – Existing Conditions**

<table>
<thead>
<tr>
<th>Pump Station</th>
<th>Total Capacity (MGD)</th>
<th>Firm Capacity (MGD)</th>
<th>Total Capacity Ratio</th>
<th>Firm Capacity Ratio&lt;sup&gt;1&lt;/sup&gt;</th>
<th>Target Capacity Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowlton Creek</td>
<td>48.9</td>
<td>40.3</td>
<td>7.9</td>
<td>5</td>
<td>6.4</td>
</tr>
<tr>
<td>Scanlon</td>
<td>45.9</td>
<td>31.7</td>
<td>18.4</td>
<td>5.5</td>
<td>7.0</td>
</tr>
<tr>
<td>Cloquet</td>
<td>36.0</td>
<td>27.1</td>
<td>14.8</td>
<td>2</td>
<td>7.2</td>
</tr>
<tr>
<td>Endion</td>
<td>16.0</td>
<td>10.0</td>
<td>11.4</td>
<td>7.1</td>
<td>6.7</td>
</tr>
<tr>
<td>Bristol Street (LSPI)&lt;sup&gt;2&lt;/sup&gt;</td>
<td>11.0</td>
<td>8.8</td>
<td>N/A&lt;sup&gt;3&lt;/sup&gt;</td>
<td>N/A&lt;sup&gt;3&lt;/sup&gt;</td>
<td>N/A&lt;sup&gt;3&lt;/sup&gt;</td>
</tr>
<tr>
<td>Oneota Street (PS-12)&lt;sup&gt;2&lt;/sup&gt;</td>
<td>10.8</td>
<td>8.3</td>
<td>19.3</td>
<td>14.8</td>
<td>7.5</td>
</tr>
<tr>
<td>Polk Street</td>
<td>6.4</td>
<td>6.4</td>
<td>18</td>
<td>14.8</td>
<td>7.8</td>
</tr>
<tr>
<td>Carlton</td>
<td>2.9</td>
<td>2.3</td>
<td>15.3</td>
<td>12.1</td>
<td>8.0</td>
</tr>
<tr>
<td>Railroad Street (PS-8)&lt;sup&gt;2&lt;/sup&gt;</td>
<td>1.7</td>
<td>1.2</td>
<td>34.4</td>
<td>21.5</td>
<td>8.0</td>
</tr>
<tr>
<td>Gary</td>
<td>1.5</td>
<td>1.3</td>
<td>6.8</td>
<td>5.9</td>
<td>8.0</td>
</tr>
<tr>
<td>Esko</td>
<td>1.6</td>
<td>1.2</td>
<td>16.2</td>
<td>12.1</td>
<td>8.0</td>
</tr>
<tr>
<td>Silver Brook</td>
<td>1.4</td>
<td>0.94</td>
<td>84.9</td>
<td>57</td>
<td>8.0</td>
</tr>
<tr>
<td>Twin Lakes</td>
<td>1.2</td>
<td>1.1</td>
<td>17.6</td>
<td>16.2</td>
<td>8.0</td>
</tr>
<tr>
<td>Ridgeview</td>
<td>0.75</td>
<td>0.69</td>
<td>34.1</td>
<td>31.4</td>
<td>8.0</td>
</tr>
<tr>
<td>Thomson</td>
<td>0.4</td>
<td>0.26</td>
<td>29.9</td>
<td>19.4</td>
<td>8.0</td>
</tr>
<tr>
<td>Wrenshall</td>
<td>0.4</td>
<td>0.26</td>
<td>24.3</td>
<td>15.8</td>
<td>8.0</td>
</tr>
<tr>
<td>Pike Lake</td>
<td>0.34</td>
<td>0.34</td>
<td>4.9</td>
<td>4.9</td>
<td>8.0</td>
</tr>
<tr>
<td>Jay Cooke</td>
<td>0.34</td>
<td>0.29</td>
<td>68</td>
<td>58</td>
<td>8.0</td>
</tr>
</tbody>
</table>

1. Firm Capacity Ratios shown in **bold** font are less than the target Capacity Ratio
2. Historical Pump Station Name
3. Station only receives industrial flow
4. The Pike Lake PS has storage available to attenuate the current peak flows. It does not account for potential future flows.
A detailed capacity verification was not performed for the Master Plan Update at any of the pump stations. As was the case in 2003 and 2009, pumps are generally performing as designed, evidenced by the analyses performed for the recent collection system modeling work. Significant capacity deficiencies are noted at a few of the stations, most of which have onsite storage capacity available to attenuate flows. The Carlton, Wrenshall, Ridgeview and Pike Lake pump stations will need to be upgraded or storage provided to manage future flows if growth continues as planned. The use of storage tanks at Endion, Dodge Street (LS45) and Gary must be monitored to ensure they meet capacity requirements of future flows.

Continued I&I reduction is needed upstream of the Thomson and Carlton pump stations to ensure continued capacity.

### Table 6-6, Pump Station Capacities and Capacity Ratios – Future Conditions

<table>
<thead>
<tr>
<th>Pump Station</th>
<th>Total Capacity (MGD)</th>
<th>Firm Capacity (MGD)</th>
<th>Total Capacity Ratio</th>
<th>Firm Capacity Ratio¹</th>
<th>Target Capacity Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowlton Creek</td>
<td>48.9</td>
<td>40.3</td>
<td>7.1</td>
<td>4.4</td>
<td>6.4</td>
</tr>
<tr>
<td>Scanlon</td>
<td>45.9</td>
<td>31.7</td>
<td>11.0</td>
<td>3.3</td>
<td>7.0</td>
</tr>
<tr>
<td>Cloquet</td>
<td>36.0</td>
<td>27.1</td>
<td>9.4</td>
<td>1.3</td>
<td>7.2</td>
</tr>
<tr>
<td>Bristol Street (LSPI)²</td>
<td>11.0</td>
<td>8.8</td>
<td>N/A³</td>
<td>N/A³</td>
<td>N/A³</td>
</tr>
<tr>
<td>Endion</td>
<td>16.0</td>
<td>10.0</td>
<td>11.1</td>
<td>6.9</td>
<td>6.7</td>
</tr>
<tr>
<td>Oneota Street (PS-12)²</td>
<td>10.8</td>
<td>8.3</td>
<td>15.0</td>
<td>11.5</td>
<td>7.5</td>
</tr>
<tr>
<td>Polk Street</td>
<td>6.4</td>
<td>6.4</td>
<td>17.6</td>
<td>10.2</td>
<td>7.8</td>
</tr>
<tr>
<td>Carlton</td>
<td>2.9</td>
<td>2.3</td>
<td>9.3</td>
<td>7.4</td>
<td>8.0</td>
</tr>
<tr>
<td>Railroad Street (PS-8)²</td>
<td>1.7</td>
<td>1.2</td>
<td>32.7</td>
<td>20.5</td>
<td>8.0</td>
</tr>
<tr>
<td>Esko</td>
<td>1.6</td>
<td>1.2</td>
<td>11.3</td>
<td>8.4</td>
<td>8.0</td>
</tr>
<tr>
<td>Gary</td>
<td>1.5</td>
<td>1.3</td>
<td>6.6</td>
<td>5.7</td>
<td>8.0</td>
</tr>
<tr>
<td>Pike Lake²</td>
<td>1.5</td>
<td>1.0</td>
<td>1.8</td>
<td>1.8</td>
<td>8.0</td>
</tr>
<tr>
<td>Silver Brook</td>
<td>1.4</td>
<td>0.94</td>
<td>42.1</td>
<td>28.3</td>
<td>8.0</td>
</tr>
<tr>
<td>Twin Lakes</td>
<td>1.2</td>
<td>1.1</td>
<td>9.4</td>
<td>8.6</td>
<td>8.0</td>
</tr>
<tr>
<td>Ridgeview Road</td>
<td>0.75</td>
<td>0.69</td>
<td>5.2</td>
<td>4.7</td>
<td>8.0</td>
</tr>
<tr>
<td>Thomson</td>
<td>0.40</td>
<td>0.26</td>
<td>25.3</td>
<td>16.4</td>
<td>8.0</td>
</tr>
<tr>
<td>Wrenshall</td>
<td>0.4</td>
<td>0.26</td>
<td>12.0</td>
<td>7.8</td>
<td>8.0</td>
</tr>
<tr>
<td>Jay Cooke</td>
<td>0.34</td>
<td>0.29</td>
<td>67.6</td>
<td>57.7</td>
<td>8.0</td>
</tr>
</tbody>
</table>

1. Firm Capacity Ratios shown in **bold** font are less than the target Capacity Ratio
2. **Historical Pump Station Name**
3. **Station only receives industrial flow**
4. **The Pike Lake PS has storage available to attenuate the current peak flows. It does not account for potential future flows.**

### Section 6.3.5: System Overflows

The occurrence of peak wet weather wastewater flows that exceed the capacities of the pipes and pump stations may result in overflows through either dedicated bypass pipes or manholes.

The main areas in the WLSSD interceptor system that historically experienced persistent overflows and were recognized locations in the Consent Decree have all been addressed. The Consent Decree was terminated in June, 2015. WLSSD continues to utilize the hydraulic model to determine areas of
concern for hydraulic issues. Table 6-8 describes model predicted overflow volumes at locations where overflows are expected for the 10 year flow event using the 2009 and 2014 model results under existing conditions. Much of the improvement noted is a result of the work done by both WLSSD and the City of Duluth to address the points identified in the Consent Decree. This work included miles of interceptor rehabilitation, primarily cured in place pipe lining, and construction of numerous storage basins to contain wet weather flows.

Table 6-8 lists the model predicted overflow volumes at locations where overflows are expected for the 10 year flow event under existing flow conditions. The model updates included the storage tank capacities and updated flow data from 2009 to 2014. The amounts of predicted overflows are greatly reduced, however, some areas are still identified as at risk. These include the following:

- Lakeside Interceptor (Manholes LS030 – LS035)
- West Interceptor (Manholes WE023 – WE029)
- Hermantown Interceptor (Manholes HT003 – HT006 and HT058 – HT063)
- Pike Lake Interceptor (PL0008)

Table 6-9 describes the model predicted overflow volumes at locations where overflows are expected for the 10 year flow event using the 2009 and 2014 model results under future flow conditions. Future conditions adjust for population and employment growth to the year 2040. These areas include:

- Lakeside Interceptor (Manholes LS030 – LS035)
- West Interceptor (Manholes WE023 – WE029)
- Hermantown Interceptor (Manholes HT003 – HT006 and HT058 – HT063 and HT091 – HT096)
- Pike Lake Interceptor (PL0008 – PL0017)
- Rice Lake Interceptor (RL001 – RL014)

While it is expected further reduction of inflow and infiltration will occur as a result of ongoing City of Duluth efforts, the data was not adjusted to account for this.
Table 6-8, Model Predicted Overflow Points and Volumes from 2009 to 2014 for Existing Conditions: 10-Year Flow Event

<table>
<thead>
<tr>
<th>Location</th>
<th>2009 Predicted Overflow (MG)</th>
<th>2015 Predicted Overflow (MG)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lakeside Manholes</td>
<td>LS001, LS016 – LS039 3.5 MGD</td>
<td>LS030-LS035 0.02 MGD</td>
</tr>
<tr>
<td>Hermantown and Rice Lake</td>
<td>HT004, HT026-HT032, HT055-HT060 1.56 MGD Hermantown HT090-102 0.03 MGD</td>
<td>HT003-HT006, HT058-HT063 0.04 MGD RL001 – RL014 and HT091-HT096 0.01 MGD</td>
</tr>
<tr>
<td>West</td>
<td>WE017 – WE029 0.28 MGD</td>
<td>WE023 – WE029 0.03 MGD</td>
</tr>
<tr>
<td>Scanlon Div. D</td>
<td>D018-D137 0.08 MGD</td>
<td>0 MGD</td>
</tr>
<tr>
<td>Cloquet</td>
<td>F000SC, F000_CQ 0.02 MGD</td>
<td>0 MGD</td>
</tr>
<tr>
<td>Proctor</td>
<td>PR005-PR015, PR041-PR051 0.32 MGD</td>
<td>0 MGD</td>
</tr>
<tr>
<td>Woodland</td>
<td>WL011-WL012, WL056-WL061, WL069-WL080, WL089-WL099 0.14 MGD</td>
<td>0 MGD</td>
</tr>
<tr>
<td>Pike Lake</td>
<td>0 MGD</td>
<td>PL008 0.003 MGD (assumes weir plate removed)</td>
</tr>
<tr>
<td>Polk ST</td>
<td>PO008-PO014 0.6 MGD</td>
<td>0 MGD – 20% basin used</td>
</tr>
<tr>
<td>Endion</td>
<td>8.84 MGD</td>
<td>0 MGD – 95% Phase 1 and 50% Phase 2 basin used</td>
</tr>
<tr>
<td>Fitger’s Overflow</td>
<td>3.25 MGD</td>
<td>0 MGD – 10% Canal Park Basin used</td>
</tr>
<tr>
<td>East Interceptor</td>
<td>EA018, EA036-EA045 0.76 MGD</td>
<td>0 MGD – 10% Canal Park Basin used</td>
</tr>
<tr>
<td>Lakeside 45 (Dodge St.)</td>
<td>0 MGD at pump station</td>
<td>0 MGD – 70% of basin used</td>
</tr>
<tr>
<td></td>
<td>3.5 MGD in downstream manholes</td>
<td></td>
</tr>
</tbody>
</table>
Table 6-8, Model Predicted Overflow Points and Volumes from 2009 to 2014 for Future Conditions: 10-Year Flow Event

<table>
<thead>
<tr>
<th>Location</th>
<th>2009 Predicted Overflow (MG)</th>
<th>2015 Predicted Overflow (MG)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lakeside Manholes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lakeside Manholes</td>
<td>LS001, LS016 – LS039</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3.54 MGD</td>
<td>LS030-LS035</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.03 MGD</td>
</tr>
<tr>
<td>Hermantown and Rice Lake</td>
<td>HT004, HT026-HT032, HT055-HT060, HT090-102</td>
<td>HT003 – HT006, HT058 – HT063, HT091 – HT096</td>
</tr>
<tr>
<td></td>
<td>2.13 MGD</td>
<td>0.11 MGD</td>
</tr>
<tr>
<td></td>
<td></td>
<td>RL001 – RL014</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.10 MGD</td>
</tr>
<tr>
<td>West</td>
<td>WE017 – WE029</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.32 MGD</td>
<td>WE023 – WE029</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.04 MGD</td>
</tr>
<tr>
<td>Pike Lake</td>
<td>0 MGD</td>
<td>PL008 – PL017</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.17 MGD</td>
</tr>
<tr>
<td></td>
<td></td>
<td>95% basin used</td>
</tr>
<tr>
<td>Bayview Heights</td>
<td>BV103-104</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.11 MGD</td>
<td></td>
</tr>
<tr>
<td>Scanlon Div. D</td>
<td>D018-D137</td>
<td>0 MGD</td>
</tr>
<tr>
<td></td>
<td>0.42 MGD</td>
<td></td>
</tr>
<tr>
<td>Cloquet</td>
<td>F000SC, F000_CQ</td>
<td>0 MGD</td>
</tr>
<tr>
<td></td>
<td>0.05 MGD</td>
<td></td>
</tr>
<tr>
<td>Proctor</td>
<td>PR005-PR015, PR041-PR051</td>
<td>0 MGD</td>
</tr>
<tr>
<td></td>
<td>0.32 MGD</td>
<td></td>
</tr>
<tr>
<td>Esko</td>
<td>E006T2</td>
<td>0 MGD</td>
</tr>
<tr>
<td></td>
<td>0.003 MGD</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.15 MGD</td>
<td></td>
</tr>
<tr>
<td>Polk ST</td>
<td>PO008-PO014</td>
<td>0 MGD – 20% basin used</td>
</tr>
<tr>
<td></td>
<td>0.62 MGD</td>
<td></td>
</tr>
<tr>
<td>Endion</td>
<td>9.90 MGD</td>
<td>0 MGD – 95% Phase 1 and 50% Phase 2 basin used</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0 MGD – 55% Canal Park Basin used</td>
</tr>
<tr>
<td>Fitger’s Overflow</td>
<td>3.54 MGD</td>
<td>0 MGD – 55% Canal Park Basin used</td>
</tr>
<tr>
<td>East Interceptor</td>
<td>EA018, EA036-EA045</td>
<td>0 MGD – 55% Canal Park Basin used</td>
</tr>
<tr>
<td></td>
<td>0.88 MGD</td>
<td></td>
</tr>
<tr>
<td></td>
<td>EA008</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.01 MGD</td>
<td></td>
</tr>
<tr>
<td>Gary PS Storage Basin</td>
<td>0 MGD</td>
<td>0 MGD – 10% basin used</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lakeside 45 (Dodge St.)</td>
<td>0 MGD at pump station</td>
<td>0 MGD – 70% of basin used</td>
</tr>
<tr>
<td></td>
<td>3.67 MGD in downstream manholes</td>
<td></td>
</tr>
</tbody>
</table>
Table 6-10 directly compares the 2014 model predicted overflow volumes for current flow and future flow conditions. The results of any increases in overflow compared with historical summaries are not necessarily a reflection of a worsening of collection system performance, but rather an updated assessment based on the use of a more state-of-the-art set of tools, as well as more recent flow data that allow an improved characterization of the collection system’s performance. Table 6-11 shows the overflows noted in past comprehensive plans that have been eliminated and the amount of storage facilities being utilized.

Table 6-9, Model Predicted Overflow Points and Volumes for the 10-year Flow Event using Existing and Future Conditions

<table>
<thead>
<tr>
<th>Area</th>
<th>Manhole Range</th>
<th>Current Condition Overflow Volume: 10-year Flow Event (MG)</th>
<th>Future Condition Overflow Volume: 10-year Flow Event (MG)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pike Lake Interceptor</td>
<td>PL008</td>
<td>0.003</td>
<td>2.17</td>
<td>PL008 – PL017 have significant surcharge and ~ 95% of the basin is used for future flows.</td>
</tr>
<tr>
<td>Lakeside Interceptor manholes</td>
<td>LS030-LS035</td>
<td>0.02</td>
<td>0.03</td>
<td>Low manholes</td>
</tr>
<tr>
<td>Hermantown Interceptor manholes</td>
<td>HT003-HT006; HT058-HT063</td>
<td>0.06</td>
<td>0.11</td>
<td>Addressed in Joint Work Plan to be submitted before July 3, 2010. Overflow mitigation required by Consent Decree by September 30, 2010.</td>
</tr>
<tr>
<td>Rice Lake</td>
<td>RL001 – RL014 HT091-HT096</td>
<td>0.01</td>
<td>0.10</td>
<td></td>
</tr>
<tr>
<td>West Interceptor manholes</td>
<td>WE023 – WE029</td>
<td>0.02</td>
<td>0.04</td>
<td>Addressed in Joint Work Plan to be submitted before July 3, 2010. Overflow mitigation required by Consent Decree by December 31, 2016.</td>
</tr>
</tbody>
</table>
### Table 6-10, Model Predicted use of Storage Facilities and summary of Eliminated Overflow Points for the 10-year Flow Event using Existing and Future Conditions

<table>
<thead>
<tr>
<th>Area</th>
<th>Manhole Range</th>
<th>Current Condition Overflow Volume: 10-year Flow Event (MG)</th>
<th>Future Condition Overflow Volume: 10-year Flow Event (MG)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polk overflow &amp; manholes</td>
<td></td>
<td>0</td>
<td>0</td>
<td>1.0 MG storage tank used at 20% for existing and future flows</td>
</tr>
<tr>
<td>Dodge overflow (City of Duluth Asset)</td>
<td></td>
<td>0</td>
<td>0</td>
<td>70% of basin used for existing and future flows</td>
</tr>
<tr>
<td>Endion overflow</td>
<td></td>
<td>0</td>
<td>0</td>
<td>4 MG of storage available; 95% of Phase 1 (1 MG used) and 50% of Phase 2 (3 MG) used for existing and future conditions</td>
</tr>
<tr>
<td>Fitger’s overflow and East Interceptor Manholes</td>
<td></td>
<td>0</td>
<td>0</td>
<td>8.3 MG storage tank at Canal Park to accommodate the overflow from Fitger’s and MH EA018; 10% of capacity used for existing conditions; 55% used for future conditions</td>
</tr>
<tr>
<td>Gary Pump Station Storage Basin</td>
<td>Storage Basin</td>
<td>0</td>
<td>0</td>
<td>Approx. 10% of basin used for future flows</td>
</tr>
<tr>
<td>Division D manholes</td>
<td>D010, D050; D052</td>
<td>0</td>
<td>0</td>
<td>Overflow eliminated</td>
</tr>
<tr>
<td>Esko Manhole</td>
<td>E006T2</td>
<td>0</td>
<td>0</td>
<td>Overflow eliminated</td>
</tr>
<tr>
<td>Division F manholes</td>
<td>F000_SC, F000_CQ</td>
<td>0</td>
<td>0</td>
<td>Overflow eliminated</td>
</tr>
<tr>
<td>Proctor manholes</td>
<td>PR005 - PR015</td>
<td>0</td>
<td>0</td>
<td>Overflow eliminated</td>
</tr>
<tr>
<td>Bayview Manholes</td>
<td>BV103-104</td>
<td>0</td>
<td>0</td>
<td>Overflow eliminated</td>
</tr>
</tbody>
</table>

### Section 6.3.6: Storage Basins

Overflows from the WLSSD system can be mitigated by one or a combination of the following actions:

- Increase system conveyance and treatment capacity
- Provide storage to attenuate peak flows
- Reduce peak flows tributary to the system
Mitigation of the expected overflows can be addressed by providing storage, reducing peak wet weather flows, or a combination of both actions. A balance between the amount of capacity provided by storage and the peak flows discharged to the system must be achieved to optimize performance of the system.

Several facilities have been constructed by the City of Duluth and the WLSSD in recent years to reduce overflows. In order to mitigate peak flows from areas throughout the WLSSD service area, a number of storage basins have been used and constructed. Available storage is described below and shown on the drawing in Appendix D (East and Lakeside Interceptors Storage Facilities Schematic).

**East Interceptor/Fitger’s Area**
Historical overflows have occurred during wet weather events at manholes located at 3rd Avenue East and Superior and 5th Avenue East and Superior, which is next to the Fitger’s Brewery Complex. An 8.3 million gallon storage tank (LS-6) was constructed at Canal Park by the City of Duluth to accommodate the overflow from Fitger’s and manhole EA018.

**Lakeside Interceptor/Endion Pump Station Area**
A one million gallon storage tank (LS-50) was constructed at the Endion Pump Station in 2007. A 3.0 million gallon storage tank (LS-51) was constructed in 2011 and is also located just upstream of the Endion Pump Station.

**Polk Street Pump Station**
A 1.0 million gallon storage tank at the Polk Street Pump Station was completed in 2011. The pump station was rebuilt and sized with a firm capacity of 6.4 Million Gallons per Day.

**Dodge Street Pump Station**
A 1.9 million gallon storage tank (LS-45) was constructed in 2005 and is owned and operated by the City of Duluth. The City of Duluth increased pumping capacity in order to drain the storage basin faster following use in order to optimize use during successive wet weather events. The pumps are controlled by the level in the upstream interceptor and in the downstream storage basins to prevent overflows.

**Gary Pump Station**
A 1.63 million gallon wastewater storage facility is used to attenuate peak flows from the Gary Duluth area.

**Pike Lake Pump Station**
A 100,000 gallon wastewater storage facility is used to attenuate peak flows from the Pike Lake Pump Station.

**Duluth North Shore Sanitary District Pump Station**
A 300,000 gallon wastewater storage facility is used to attenuate peak flows from the Duluth North Shore Sanitary District Facility. The pump station stores flow based on the wet well level and flow at the Endion Pump Station.

**Knife River Sanitary District Pump Station**
A 100,000 gallon wastewater storage facility is used to attenuate peak flows from the Knife River Sanitary District Pump Station. The pump station stores flow based on the wet well level and flow at the Endion Pump Station.
Section 6.4: Asset Management

Section 6.4.1: Pump Station Condition Assessment

A summary of the WLSSD pump stations, age, locations and classifications is shown in Table 6-12. Additional information such as capacity and power source on each station can be found in Appendix E.

Table 6-11, WLSSD Pump Stations

<table>
<thead>
<tr>
<th>Station</th>
<th>Address</th>
<th>Classification¹</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowlton Creek</td>
<td>8500 Bayhill Dr, Duluth MN 55807</td>
<td>Major</td>
<td>1975; 2006</td>
</tr>
<tr>
<td>Scanlon</td>
<td>3209 Hwy 61, Scanlon MN 55720</td>
<td>Major</td>
<td>1975, 2009</td>
</tr>
<tr>
<td>Cloquet</td>
<td>2201 AVE B, Cloquet MN 55720</td>
<td>Major</td>
<td>1976</td>
</tr>
<tr>
<td>Bristol Street</td>
<td>4920 Recycle Way, Duluth MN 55807</td>
<td>Major</td>
<td>1986</td>
</tr>
<tr>
<td>Endion</td>
<td>505 S 18th AVE E, Duluth MN 55812</td>
<td>Major</td>
<td>1988</td>
</tr>
<tr>
<td>Oneota Street</td>
<td>4826 Oneota ST, Duluth MN 55807</td>
<td>Minor</td>
<td>2008</td>
</tr>
<tr>
<td>Railroad Street</td>
<td>1116 Railroad ST, Duluth MN 55802</td>
<td>Minor</td>
<td>2005</td>
</tr>
<tr>
<td>Esko</td>
<td>52 West Riverside RD, Esko MN 55733</td>
<td>Minor</td>
<td>1960 (orig.) 1976</td>
</tr>
<tr>
<td>Polk Street</td>
<td>110 Central AVE S, Duluth MN 55807</td>
<td>Submersible</td>
<td>2011</td>
</tr>
<tr>
<td>Gary</td>
<td>499 95th AVE W, Gary MN 56545</td>
<td>Submersible</td>
<td>1975 (orig.),</td>
</tr>
<tr>
<td>Twin Lakes</td>
<td>1465 Komoko RD, Twin Lakes Twp MN 55718</td>
<td>Submersible</td>
<td>1993</td>
</tr>
<tr>
<td>Ridgeview Road</td>
<td>4537 Ridgeview RD, Duluth, MN 55803</td>
<td>Submersible</td>
<td>2008</td>
</tr>
<tr>
<td>Wrenshall</td>
<td>207 Pioneer DR, Wrenshall MN 55797</td>
<td>Submersible</td>
<td>1995</td>
</tr>
<tr>
<td>Pike Lake</td>
<td>5489 Miller Trunk Hwy, Hermantown MN 55811</td>
<td>Submersible</td>
<td>2001</td>
</tr>
<tr>
<td>Thomson</td>
<td>110 Vermillion ST, Thomson MN 55718</td>
<td>Prefabricated</td>
<td>1975</td>
</tr>
<tr>
<td>Carlton</td>
<td>305 N 6th ST, Carlton MN 55718</td>
<td>Prefabricated</td>
<td>1975</td>
</tr>
<tr>
<td>Silver Brook</td>
<td>12 Broadway, Wrenshall MN 55797</td>
<td>Prefabricated</td>
<td>1975</td>
</tr>
<tr>
<td>Jay Cooke</td>
<td>500 Hwy 210, Carlton MN 55718</td>
<td>Prefabricated</td>
<td>1975</td>
</tr>
</tbody>
</table>

¹ Major – total pumping capacity from 11 to 49 MGD; constructed during or after original WLSSD development in 1976; cast concrete wet well/dry well configurations and brick faced structures
Prefabricated – total pumping capacity ranges from 0.34 to 2.9 MGD; constructed during or after original collection system in 1976; pre-cast concrete wet well, fabricated steel dry well and precast concrete super-structure
Minor – total pumping capacity ranges from 1.6 to 10.8 MGD per station; constructed prior to formation of sanitary district; cast concrete wet well/dry well configuration
Submersible – total pumping capacity ranges from 0.40 to 6.4 MGD; Constructed over last 10-20 years; precast wet wells and meter vaults.

Significant pump station improvements completed since the 2009 Master Plan include:

- Reconstruction of the Polk Street and Gary Pump Stations.
- Evaluation and improvements to debris handling at Scanlon, Cloquet, Knowlton and Endion pump stations.
- Installation of storage capacity at Polk Street, Pike Lake and East end of collection system
- Replacement of damaged impeller at Knowlton Creek Pump Station
- Replacement of Esko Pump Station (in progress)
- Installation of Cloquet pump station dimminutor lifting beam
- Rehabilitation of primary biofilter at Scanlon and Knowlton Creek Pump Stations
The condition of each of the WLSSD pump stations was evaluated and discussed with collection operations, maintenance and electrical personnel to determine capital needs. Results of these workshops are summarized in Appendices F and G attached to this report.

- Appendix F details notable improvements completed since 2010 to debris handling, pumping, mechanical, electrical technology, odor and safety at each of the pump stations. In addition to this list, numerous additional preventative maintenance activities are ongoing at each of the pump stations.
- Appendix G lists recommendations for improvements to be performed or evaluated at each of the WLSSD Pump Stations.

Additional information on previous inspections, evaluation and detailed recommendations for maintenance and capital improvements are outlined in the Pump Station Condition Assessment report completed by Brown and Caldwell dated September, 2009, which can be found in the 2009 Comprehensive Plan Update.

In addition, WLSSD’s prefabricated pump stations were evaluated in 2006 by Brown and Caldwell, Inc. and recommendations made in the report titled, “Prefabricated Pump Station Capital Improvement Planning”. Recommendations completed include the following:

1. Reconstruction of the Polk Street Pump Station
2. Rehabilitation of the Gary Pump Station
3. Cathodic protection installed at Carlton and Thomson Pump Stations
4. Confined Space Entry and Fall protection procedures reviewed

Recommendations from this report that remain to be completed include:

1. Replace Jay Cooke Pump Station
2. Upgrade Wrenshall Pump Station
3. Eliminate Silver Brook pump station

**Section 6.4.2: Pump Station Condition Assessment – Key Recommendations**

Some recommendations from the “Prefabricated Pump Station Capital Improvement Planning” still remain to be completed. These include replacement of the Jay Cooke pump station and elimination of the Silver Brook pump station. Elimination of Silver Brook will require an upgrade to the pumps at the Wrenshall pump station. This work is scheduled to be completed in 2016. Replacement of the Jay Cooke station is scheduled for 2021. This delay is possible due to the decreased flow resulting from the removal of pipe after the 2012 flood, as well as additional safety measures to address confined space entries and fall protection at the station.

The Esko Pump station is currently being reconstructed and is planned to be operational in early 2016.

Additional capital projects include evaluation of the Knowlton Creek, Scanlon and Cloquet pump stations in 2021, design in 2024 and rehabilitation starting in 2025.

The most significant recommendations resulting from the updated Pump Station Condition Assessment are listed below and are detailed in Table 6-13 in the next section:
- Evaluate electrical infrastructure at Cloquet, Knowlton, Scanlon and Bristol Pump Stations and develop schedule for motor rebuilds, VFD backup and station replacement.
- Conduct structural condition assessment of the Carlton, Cloquet and Scanlon Pump stations.
- Replace entry doors on the Railroad and Endion Pump Stations.
- Paint existing generators at Bristol, Carlton, Pike Lake and Twin Lakes; Paint dry well piping and mechanical at Endion Pump station.
- Investigate replacement of check valves at Pike Lake and valve operational status at other pump stations.
- Evaluate cathodic protection at the Thomson and Carlton pump stations to ensure continued protection to these stations.
- Complete other miscellaneous maintenance improvement projects identified in Appendix G.

Additional recommendations for maintenance, operational improvement and smaller capital improvement projects are discussed and outlined in Appendix G.

**Section 6.4.3: Gravity Interceptor Condition Assessment – Key Recommendations**

In 2008, WLSSD retained Camp, Dresser and McKee, Inc. (CDM) to develop a computerized asset management system to maintain condition information on the interceptors in the collection system. As part of development of the asset management system, closed circuit television (CCTV) inspection data were reviewed, and each condition defect was given a score according to a standard ranking system. Criticality criteria for each interceptor segment were also developed and ranked. The condition assessment also incorporates information obtained from maintenance inspections and odor complaints. A decision-tree tool then prioritizes maintenance and capital improvement needs within a matrix, which compares condition and criticality scores. The decision-tree tool allows for the development of alternatives and prioritization of rehabilitation or replacement projects for the collection system. The asset management system will assist WLSSD to effectively and efficiently prioritize maintenance, rehabilitation or replacement work in the collection system.

The approach summarized above, enables WLSSD to perform a comprehensive interceptor assessment and evaluation, from which it can develop a 10-year CIP that is based on a detailed review and analysis of each interceptor’s condition and criticality.

The Pipeline Assessment and Certification Program (PACP) coding standardizes the CCTV inspections and thus allows for a rating to be assigned to each defect. Both structural defects and operation/maintenance issues can be observed and graded based on severity. The quantity and percent of pipe affected by each PACP-rated defect can be easily tabulated using the software.

A condition rating is assigned a “quick score” based on the worst PACP grade; i.e. the higher the quick score, the worse the condition. The quick scores are then divided into three levels of severity based on the probability of failure. This information is mapped and then used in a condition-criticality matrix. This Matrix is updated when inspections are complete (via the decision-tree tool and matrix tool).
The software allows WLSSD to catalog the information and visualize the system using ArcGIS mapping software. The following maps aid in determining priorities:

- Map of the CCTV inspection status
- Map of manholes with limited access for CCTV
- Pipe Age
- Pipe Material
- Odor complaints
- PACP results

These maps provide a big-picture view of the system components. The details are used in the decision tree to prioritize specific areas in need of cleaning/inspection.

In summary, the following components are used in the Interceptor Asset Management Program to develop the Capital Improvement Program (CIP):

1. Criticality – Each pipe segment is issued a value for criticality based on the severity or consequence of failure. Categories of assessment include public safety, financial impact, human and environmental exposure, proximity to sensitive waters and impact to service. An overall criticality score is assigned to each pipe segment based on present parameters and scoring.
2. Condition – Each pipe’s physical condition is inspected using CCTV and each segment is coded using the PACP coding method. Each defect is scored based on the severity and each pipe is assigned a condition score based on the most severe defect present.
3. Condition/Criticality Matrix – A matrix of condition and criticality scores is developed which highlights pipes that may require additional capital improvements or maintenance actions.
4. Other data – Other data such as odor reports, access issues, Level of Service adequacy and surcharging are reviewed.
5. Project Development – Projects are developed using the condition, criticality scores, matrix rating and other data. Once summarized, the pipes are assigned a recommended type of repair, based on the defects. Then they are evaluated on an interceptor-by-interceptor basis. Capital projects are developed based on condition, criticality, type of project and proximity to other defected pipes.
6. Prioritize Projects – Projects are prioritized based on defects, condition, criticality, and other data.
7. Project Costs – project costs are developed for each capital project, based on estimates developed using actual construction cost information.
8. Develop a CIP – The data is used to develop a 10-year CIP.

Figure 6-17 shows the Condition-Criticality Matrix from the 2015 Interceptor Asset Management Plan. The number located in each box represents the number of pipes that are in each category. The Figure highlights a section of the Hermantown Interceptor.
The Interceptor Asset Management Report, dated May 7, 2011 contains the 2011 – 2020 Capital Improvement Program and 2011 – 2015 Inspection and Maintenance Program as identified in the 2011 Interceptor Asset Management Review. This document contains information on program development, cost estimate assumptions, asset management programs and supporting documentation. Each year, the plans are updated and adjusted based on changes in condition, criticality and schedules. It is the intent that the summary document is updated in its entirety every 5 years.

The current ten-year Capital Improvement Program (CIP) and Interceptor Maintenance Plan (IMP) are located in Appendix I. Planning-level costs for the CIP indicate a ten-year cost of $68,122,000 with annual expenditures averaging $6,812,000. Planning-level costs for the IMP indicate a five-year cost of $1,506,000 with annual expenditures averaging $301,000.

Key recommendations for management of the WLSSD interceptors include the following:

- Maintain the Interceptor Asset Management Program and associated manuals, on an ongoing basis, in order to develop the annual budget for capital projects and operation and maintenance.
Western Lake Superior Sanitary District
COMPREHENSIVE WASTEWATER SERVICES PLAN

- Complete gravity interceptor rehabilitation and replacement projects in accordance with the asset management program.

- Implement interceptor and maintenance program as outlined in the CIP and IMP in Appendix I.

- Develop an inspection/assessment program for force mains and manholes and incorporate into interceptor asset management program.

- Update the IAMP Decision Tools to incorporate new PACP standards (Version 7) and software updates. Update base files associated with the hydraulic model update and geodatabase files (ArcGIS updates).
Section 6.5: Capital Improvement Program

Capital improvement recommendations for pump stations and gravity interceptors are summarized in Tables 6-13 and 6-14 on the following pages. These tables detail the costs and implementation timelines for the 10-year capital planning period. These tables are used to develop and maintain the District’s annual 10-year Capital Improvement Plan.

Table 6-12, 10-year Capital Improvement Plan for Pump Stations (2015 Dollars)

<table>
<thead>
<tr>
<th>Project</th>
<th>Capital Cost</th>
<th>Implementation Year</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Knowlton Creek Pump Station</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Facilities Plan/Detailed Inspection</td>
<td>$75,000</td>
<td>2021</td>
</tr>
<tr>
<td>Design Upgrades</td>
<td>$1,444,000</td>
<td>2025</td>
</tr>
<tr>
<td><strong>Scanlon Pump Station</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lifting Beam Improvements</td>
<td>$70,000</td>
<td>2016</td>
</tr>
<tr>
<td>Facilities Plan/Detailed Inspection</td>
<td>75,000</td>
<td>2021</td>
</tr>
<tr>
<td>Design Upgrades</td>
<td>$1,278,000</td>
<td>2024</td>
</tr>
<tr>
<td>Major Rehabilitation</td>
<td>$13,241,000</td>
<td>2025</td>
</tr>
<tr>
<td><strong>Cloquet Pump Station</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Facilities Plan/Detailed Inspection</td>
<td>$75,000</td>
<td>2021</td>
</tr>
<tr>
<td><strong>Wrenshall Pump Station</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Upgrade Wrenshall/Abandon Silver Brook</td>
<td>$498,000</td>
<td>2016</td>
</tr>
<tr>
<td><strong>Jay Cooke Pump Station</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Replace Pump Station</td>
<td>$1,245,000</td>
<td>2021</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>$18,001,000</td>
<td></td>
</tr>
</tbody>
</table>

**Knowlton Creek, Scanlon and Cloquet Pump Stations**
Major rehabilitation of the largest three pump stations is planned to begin in 2025. In order to prepare for this, a facilities plan and detailed inspection will occur in approximately 2021 and design will take place starting a year prior to the rehabilitation. The inspections will assist in determining the final design and order of completion.

**Wrenshall and Silver Brook Pump Stations**
In 2016, the Wrenshall Pump Station will be upgraded in order to eliminate the Silver Brook Pump Station. The upgrade will consist of new pumps, controls and flow metering systems. The Silver Brook pump station will be demolished once the Wrenshall system is upgraded.

**Jay Cooke Pump Station**
The Jay Cooke Pump Station is scheduled for replacement in 2021 with a submersible pumping station.
### Table 6-13, 10-year Capital Improvement Plan for Interceptors (2015 Dollars)

<table>
<thead>
<tr>
<th>Project</th>
<th>Capital Cost</th>
<th>Implementation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cloquet Interceptor</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CIPP Lining, Point Repairs</td>
<td>$ 452,000</td>
<td>2017</td>
</tr>
<tr>
<td><strong>East Interceptor</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>East Interceptor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Point Repair EA019</td>
<td>$ 244,000</td>
<td>2017</td>
</tr>
<tr>
<td><strong>Hermantown Interceptor</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Preliminary Design</td>
<td>$ 150,000</td>
<td>2016</td>
</tr>
<tr>
<td>Design Pipe Replacement</td>
<td>$ 1,456,000</td>
<td>2017</td>
</tr>
<tr>
<td>Replace Pipes HT103-070</td>
<td>$10,492,000</td>
<td>2018</td>
</tr>
<tr>
<td>Design Pipe Replacement</td>
<td>$ 1,406,000</td>
<td>2017</td>
</tr>
<tr>
<td>Replace Pipes HT069-040</td>
<td>$ 9,449,000</td>
<td>2019</td>
</tr>
<tr>
<td>Design Pipe Replacement</td>
<td>$ 675,000</td>
<td>2017</td>
</tr>
<tr>
<td>Replace Pipes HT038-021</td>
<td>$ 4,328,000</td>
<td>2020</td>
</tr>
<tr>
<td>Design Pipe Replacement</td>
<td>$ 759,000</td>
<td>2017</td>
</tr>
<tr>
<td>Replace Pipes HT020-00C</td>
<td>$ 5,527,000</td>
<td>2023</td>
</tr>
<tr>
<td><strong>Jay Cooke Interceptor</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Point Repair West H027, H024</td>
<td>$ 104,000</td>
<td>2017</td>
</tr>
<tr>
<td><strong>Lakeside Interceptor</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CIPP LS034 – LS041</td>
<td>$ 298,000</td>
<td>2016</td>
</tr>
<tr>
<td><strong>Nopeming Interceptor</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Point Repairs K008, K004; replace K002</td>
<td>$ 279,000</td>
<td>2021</td>
</tr>
<tr>
<td><strong>Proctor Interceptor</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Replace PR015-006;</td>
<td>$ 1,068,000</td>
<td>2024</td>
</tr>
<tr>
<td><strong>Railroad Interceptor</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Replace RR003 - R001</td>
<td>$ 385,000</td>
<td>2017</td>
</tr>
<tr>
<td><strong>Rice Lake Interceptor</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Design Engineering</td>
<td>$ 172,000</td>
<td>2016</td>
</tr>
<tr>
<td>CIPP RL015 – RL001</td>
<td>$1,194,000</td>
<td>2017</td>
</tr>
<tr>
<td><strong>Scanlon Interceptor</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Design Phase 4</td>
<td>$1,105,000</td>
<td>2016</td>
</tr>
<tr>
<td>Phase 4: CIPP D068-D054</td>
<td>$ 7,395,000</td>
<td>2016</td>
</tr>
<tr>
<td>Design Phase 5</td>
<td>$ 1,205,000</td>
<td>2020</td>
</tr>
<tr>
<td>Phase 5: CIPP D047-D024</td>
<td>$ 8,383,000</td>
<td>2021</td>
</tr>
<tr>
<td>Design Phase 6</td>
<td>$ 1,276,000</td>
<td>2021</td>
</tr>
<tr>
<td>Phase 6: CIPP D023-D001</td>
<td>$ 8,884,000</td>
<td>2022</td>
</tr>
<tr>
<td><strong>Silver Brook Interceptor</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Point Repair H003; Replace H004</td>
<td>$ 62,000</td>
<td>2017</td>
</tr>
<tr>
<td><strong>West Interceptor</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>West Interceptor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Point Repair, WE039, WE028, WE018, WE017</td>
<td>$ 270,000</td>
<td>2017</td>
</tr>
<tr>
<td><strong>Woodland Interceptor</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Joint Repair, CIPP Lining</td>
<td>$1,104,000</td>
<td>2017</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>$ 68,122,000</td>
<td></td>
</tr>
</tbody>
</table>

**Cloquet Interceptor**
The Cloquet Interceptor contains a longitudinal crack and infiltration requiring repair in pipe sections F057, F056 and F051. CIPP lining and point repairs will be done to correct the pipe defects. This project is scheduled for 2017 and will cost approximately $452,000.
**East Interceptor**
The City of Duluth will be reconstructing Superior Street which contains a portion of the East Interceptor (EA020-EA017). CIPP lining and point repairs will be done to correct the pipe defects as part of the reconstruction project. This project is scheduled for 2017 and will cost approximately $244,000.

**Hermantown Interceptor**
The Hermantown Interceptor has hydraulic capacity and condition concerns throughout the entire length. It serves a growing area of the District and requires upsizing in order to meet Level of Service into the future. A preliminary design is scheduled for 2016. The project will consist of 4 phases and will replace the entire interceptor. Entire cost of the project will be approximately $34 Million.

**Jay Cooke Interceptor**
The Jay Cooke Interceptor contains infiltration requiring repair. Point repairs will be done to correct the pipe defects. This project is scheduled for 2017 and will cost approximately $104,000.

**Lakeside Interceptor**
The Lakeside Interceptor contains root intrusions and infiltration defects requiring repair. CIPP lining and point repairs will be done to correct the pipe defects. This project is scheduled for 2016 and will cost approximately $298,000, part of which is planned to be funded through the US Army Corp of Engineers.

**Nopeming Interceptor**
The Nopeming Interceptor contains a deformed, broken pipe and infiltration requiring repair. Pipe replacement and point repairs will be done to correct the pipe defects. This project is scheduled for 2021 and will cost approximately $279,000.

**Proctor Interceptor**
The Proctor Interceptor will have hydraulic capacity issues requiring replacement of pipes PR015 to PR006 with larger pipe to meet capacity needs and level of service. This project is scheduled for 2024 and will cost approximately $1,068,000.

**Railroad Interceptor**
The Railroad Interceptor contains a section of deformed pipe and sagged pipe requiring repair. Replacement of the pipe will be scheduled when plans for the use of the former Georgia Pacific plant are anticipated. This project is tentatively scheduled for 2017 and will cost approximately $385,000.

**Rice Lake Interceptor**
The Rice Lake Interceptor contains a number of infiltration defects requiring repair. CIPP lining and point repairs will be done to correct the pipe defects. This will help reduce flow in the downstream Hermantown Interceptor. This project is scheduled for 2017 and will cost approximately $1,366,000.

**Scanlon Interceptor**
The Scanlon Interceptor has weld failures at many of its pipe joints, which result in lining failure and reduced pipe wall thickness due to corrosion. CIPP lining will be done to correct the pipe defects. Three more phases of rehabilitation exist. Phase 4 is scheduled in 2016, with Phase 5 and 6 from 2020 to 2022. The remaining cost will be approximately $28 Million.
Silver Brook Interceptor
The Silver Brook Interceptor contains an offset joint and infiltration runner requiring repair. Pipe replacement and point repair are scheduled for 2017 and will cost approximately $62,000.

West Interceptor
The West Interceptor contains pipe defects and infiltration requiring repair. Point repairs are scheduled for 2017 and will cost approximately $270,000.

Woodland Interceptor
The Woodland Interceptor contains pipe defects and infiltration requiring repair. CIPP lining and point repairs will be done to correct the pipe defects. This project is scheduled for 2017 and will cost approximately $1,104,000.

ADDITIONAL CAPITAL IMPROVEMENT PROJECTS:

In addition to the pump station and interceptor plans, assessment and improvements are planned for the forcemain and manholes in the system.

Forcemain Improvements
Sections of the Knowlton Creek Forcemain will be evaluated using non-destructive tests. Continued evaluation of WLSSD forcemains is budgeted for 2019 in the amount of $100,000 and is planned on a three year frequency.

The Scanlon Forcemain river crossing valves will require additional evaluation and possible replacement within the next 10 years.

Manhole Improvements
The Asset Management program routinely inspects manholes for their condition. Manhole data will be used to prioritize rehabilitation activities. A manhole rehabilitation program is planned to be developed and used to schedule approximately $100,000 in additional improvements in 2019.

Interceptor Asset Management Plan Update
The WLSSD Interceptor Asset Management Plan utilizes a number of software components including PipeTech, ArcGIS and Windows. It is the intent to review the program, software and integration routinely to ensure continued use with software updates and new Pipe Assessment Certification Program (PACP) versions. An update has been scheduled for 2016 and will cost approximately $100,000. The program will be assessed and the asset management tools will be updated.

Section 6.6: Plan to Maintain System Capacity

The capacity analysis performed by Brown and Caldwell as part of updating the hydraulic model for existing and future conditions was discussed in Sections 6.3.2 to 6.3.5. The results indicated that the system generally has adequate capacity to meet the Municipal Peak Flow Standard. Exceptions include the Hermantown Interceptor and the Carlton and Pike Lake pump stations. The Hermantown Interceptor is planned for a major replacement (refer to Appendix C for details). The Carlton, Wrenshall,
Ridgeview and Pike Lake pump stations will need to be upgraded or storage provided to manage future flows if growth continues as planned. Carlton is currently undergoing rehabilitation of its sewer system to reduce Inflow and Infiltration. Future flows will be monitored to determine the impact of this work on capacity. The capacity projections at the Carlton and Thomson pump station should be aided by the reduction in flow at the Jay Cooke Pump Station. The use of storage tanks at Endion, Dodge Street (LS45) and Gary must be monitored to ensure they meet capacity requirements of future flows.

The future flow conditions utilized in the hydraulic model are based on individual community’s predictions for what will occur. The capacity of WLSSD interceptors and pump stations will continue to need to be monitored, and upgrades of facilities made, in order to meet the target level of service when development and flows dictate.

Several tools are in place to insure system capacity is available when it is needed. Following is a list and a brief discussion regarding how each contributes to the plan to maintain system capacity:

- **Updated Planning and Capacity Allocation System** – The Comprehensive Wastewater Services Master Plan will be reviewed and updated on an approximate five year interval coincident with the Capacity Allocation System renewal cycle. This will insure that current community and industrial growth projections are known and incorporated into the WLSSD capital improvement program.

- **Capital Improvement Program** – Condition is the primary driver for improvements of a wastewater collection system with aging infrastructure, however, current and future capacity needs are evaluated as part of design of each capital improvement project. The hydraulic model assists in determining the improvement needs and the downstream impact of interceptor improvements. In portions of the system such as the Hermantown Interceptor, where capacity is a nearer term driver for improvement, a more detailed capacity evaluation will be performed to develop capital improvement priorities in this area.

- **Capacity, Management, Operations and Maintenance (CMOM) Program** – The CMOM program incorporates procedures for internal communication regarding keeping the hydraulic model up to date, and a cycle of continuous communication regarding new information from temporary flow metering activities, sewer extension activities, and capital improvement activities.

- **Inflow and Infiltration Ordinance** – An inflow and infiltration ordinance was adopted in October 2008 that supports the plan to maintain system capacity by insuring that communities within the WLSSD are continuing to reduce inflow and infiltration from entering the system which potentially uses system capacity which could be used for future growth. Updates to the ordinance are ongoing.
Section 7: REGULATORY COMPLIANCE AND SCIENTIFIC FOCUSES

Section 7.1: Mercury

The US Environmental Protection Agency (USEPA) Great Lakes Water Quality Initiative (GLI) led to the Final Water Quality Guidance for the Great Lakes System, which was finalized on March 23, 1995 (60 Federal Register, 15366-15425). The Clean Water Act required the Great Lakes States to adopt the Guidance provisions into their water quality standards and NPDES permit programs. The Guidance specified numeric criteria for selected pollutants to protect aquatic life, wildlife, and human health from bioaccumulative chemicals of concern (BCCs). Mercury is among the BCCs. The derivation of the wildlife-based criteria is summarized in Great Lakes Water Quality Initiative Criteria Documents for Protection of Wildlife (EPA/820/B-95/008).

The Minnesota Pollution Control Agency (MPCA) adopted water quality standards based on GLI in Minn. R. ch. 7052, along with the wildlife-based criteria in 1998. As shown in Minn. R. 7052.0100, for chronic standards values were derived to protect aquatic life, human health, and fish-eating wildlife; the most stringent chronic standard was then adopted as the applicable standard. The EPA wildlife-based criteria for mercury — 1.3 ng/L (1300 pg/L) — was more stringent than the values calculated to protect human consumers of fish (1.53 ng/L) and aquatic life (3,400 ng/L) and is therefore applied as the applicable chronic standard.

The basis for the MPCA wildlife-based chronic standards were the USEPA GLI criteria documents. The USEPA calculated chronic criterion for mammalian wildlife using mink and otter. The geometric mean for the mink and otter was 2.4 ng/L. The document then calculated a mercury chronic criterion for avian wildlife, based on the belted kingfisher, herring gull, and bald eagle. The geometric mean for the three avian species 1.3 ng/L. Because the avian wildlife value was more restrictive it was selected as the final criterion. The calculation of wildlife-based chronic criteria or standards involved determining values for body weight, water ingestion rate, food ingestion rate, and bioaccumulation factor, as well as a combined uncertainty factor of six. A list of documents, including the criteria document and the more detailed technical support document are at: https://www.epa.gov/gliclearinghouse/great-lakes-initiative-technical-support-documents.

WLSSD is a pioneer and leader in mercury source identification and reduction as evidenced by Regulatory agencies referencing its Blueprint for Mercury Elimination; e.g., https://archive.epa.gov/greatlakes/p2/web/pdf/blueprint.pdf https://www.pca.state.mn.us/sites/default/files/wq-wwtp7-14.doc.

WLSSD will be implementing an agency-approved Mercury Minimization Plan (MMP) over the next five years, beginning in 2016. The MMP has the following key components and timelines:

Step 1 – 2016 and 2017; Pollution Prevention

Step 2 – 2017 and 2018; Optimizing Wastewater Treatment Performance

Step 3 – 2018 and 2019; Testing Mercury Reduction Technologies
WLSSD is confident that thorough and successful completion of the MMP’s three steps will lead to achievement of its most important goal, which is to achieve consistent compliance with the GLI-based mercury limits within the next NPDES/SDS permit cycle; i.e. 2016 through 2020.

Section 7.2: Effluent Disinfection

The effluent limit for fecal coliform bacteria is a state (MN) imposed discharge restriction; see Minn R. 7053.0215, subp. 1. There are drinking water intakes within 25 miles of the treated effluent discharge (the City of Duluth’s drinking water intake, and the City of Superior’s (WI) drinking water intake). Monitoring data collected at the drinking water intakes, as per the NPDES/SDS Permit requirements applicable to WLSSD have shown that there have been no exceedences of the fecal coliform threshold at any of the drinking water intakes when disinfection is not occurring; i.e. November through March.

In March of 2008, the new *Escherichia coli* (E.coli) water quality standard of 126 orgs/100 ml as a calendar-month geometric mean from April through October of each year, became effective (Minn. R. 7050.0222), replacing the previous Fecal Coliform standard of 200 orgs/100 ml as a calendar month geometric mean. However, Minnesota has retained the fecal coliform effluent limit in NPDES/SDS domestic permits. E.coli monitoring was added to the NPDES/SDS permit requirements applicable to WLSSD as an additional measure of disinfection efficacy. This was done because of the knowledge that *Klebsiella* sp. bacteria, known to be present in pulp and paper mills, can interfere with the fecal coliform testing method, and lead to falsely high fecal coliform results.

WLSSD’s effluent must now be in compliance with not one (fecal coliform) but two (E.coli added) numeric limits for bacteria; for the next five-year NPDES/SDS permit cycle starting in 2016. WLSSD is the first, and currently the only, wastewater treatment facility in MN to face this two-fold permit compliance challenge for effluent disinfection.

Section 7.3: Nutrients

The *Minnesota Nutrient Reduction Strategy* (NRS) will guide the state in reducing excess nutrients in waters so that in-state and downstream water quality goals are ultimately met. The NRS includes nutrient reduction goals and milestones at several levels. For individual water bodies in Minnesota, state water quality standards define the goals.

The current Phosphorus Rule and Strategy has, and will continue, to address phosphorus reductions in wastewater. The adoption of river eutrophication standards in 2014 is expected to result in additional wastewater phosphorus reductions in certain watersheds.

The history of phosphorus management at wastewater treatment facilities in Minnesota starting in 2000 is an example of a successful program to reduce a pollutant of concern. Several steps used in the successful Phosphorus Strategy (MPCA 2000) are also proposed for nitrogen:

- Influent and effluent nitrogen monitoring at wastewater treatment facilities
- Nitrogen management plans for wastewater treatment facilities
- Nitrogen effluent limits
- Add nitrogen removal capacity with facility upgrade
Point source to nonpoint source trading

A key reference for the text above was the Executive Summary of the *Minnesota Nutrient Reduction Strategy* - [https://www.pca.state.mn.us/water/nutrient-reduction-strategy](https://www.pca.state.mn.us/water/nutrient-reduction-strategy)

For the upcoming NPDES/SDS permit cycle (2016-2020) WLSSD will have to meet a mass-based phosphorus limit, which is a substantial change from the long-standing concentration based limit. WLSSD will also be routinely monitoring nitrogen-based parameters (e.g. ammonia, nitrate plus nitrite, Kjeldahl nitrogen) as per the frequency specified in the NPDES/SDS permit. These monitoring data can be used by the MPCA to quantitatively evaluate the need for numeric limit(s) on nitrogen-based parameters applicable to WLSSD in the future.

**Section 7.3: Salty Discharges (including sulfate)**

Wastewater from some process streams contains high concentrations of chlorides, sulfates, salinity, and dissolved minerals. For simplicity, they are often referred to as “salty discharges”. Sources associated with high salt concentrations include: municipal or industrial water softening processes using concentrating treatment technologies (e.g., reverse osmosis, ion exchange, membrane filtration, etc.); food processing using density-based (saline) sorting; and, beverage, ethanol, biofuels, meat jerky or cheese production, and animal rendering industries.

The Minnesota Pollution Control Agency (MPCA) currently has limited information about concentrations of these parameters in discharges for most National Pollutant Discharge Elimination System (NPDES) permitted facilities. Available data indicates concentrations of some minerals in reject waste streams, even those that are discharged to a Publicly Owned Treatment Work (POTW), may be high enough to result in exceedances of water quality standards in the receiving water. A few POTWS have even had whole effluent toxicity test results that seem to indicate excessive salt concentrations. To address this, the MPCA began in 2009 to add monitoring for “salty” parameters to NPDES permits as they come up for reissuance or as new permits are issued.

A key reference for the text above was “Salty Discharge” Monitoring At NPDES/SDS Permitted Facilities - [https://www.pca.state.mn.us/sites/default/files/wq-wwprm2-05.pdf](https://www.pca.state.mn.us/sites/default/files/wq-wwprm2-05.pdf)

During the next NPDES/SDS permit cycle, WLSSD will be routinely monitoring chloride as per the frequency specified in the permit. These monitoring data can be used by the MPCA to quantitatively evaluate the need for a numeric limit on “salty discharges”, applicable to WLSSD in the future.

Minnesota adopted a sulfate standard to protect wild rice in 1973 based on past studies showing that wild rice was found primarily in low sulfate waters. For the past several years, the MPCA, researchers, and many varied individuals and organizations have been engaged in gathering data and developing a basis for revising this standard. The Minnesota Legislature provided funding in 2011 for a study to gather additional information about the effects of sulfate and other substances on the growth of wild rice in the Legacy Amendment Bill. The legislation included a $1.5 million appropriation to implement a wild rice research plan and contract with scientific experts to conduct the study. The MPCA is now moving from this research and rule-development phase into the administrative rulemaking process to amend the wild rice sulfate standard.

The Minnesota Legislature provided funding in 2011 for a study to gather additional information about the effects of sulfate and other substances on the growth of wild rice in the Legacy Amendment Bill. The legislation included a $1.5 million appropriation to implement a wild rice research plan and contract with scientific experts to conduct the study. The MPCA contracted with the University of Minnesota to conduct several research projects as part of this study. The MPCA also established a study Advisory Committee, which includes representation from WLSSD.
A key reference for the text above was Sulfate standard to protect wild rice – https://www.pca.state.mn.us/water/sulfate-standard-protect-wild-rice

During the next NPDES/SDS permit cycle, WLSSD will be routinely monitoring sulfate as per the frequency specified in the permit. These monitoring data can be used by the MPCA to quantitatively evaluate the need for a numeric limit on sulfate, applicable to WLSSD in the future.

Section 7.3: Novel Substances

Recent studies of Minnesota’s waters show that a wide variety of unregulated chemicals, such as pharmaceuticals, fragrances, fire retardants, and insecticides, are ending up in lakes and rivers. Many of these substances have properties that can interfere with the functioning of hormones in animals and people. Some mimic the effects of hormones in animals and negatively impact growth and development. These endocrine-active compounds are not acutely toxic at the levels normally found in the environment, but over time can impact organisms at very low concentrations. Sources of these chemicals to waters include wastewater discharges, runoff from animal agriculture, and air pollution. The MPCA has developed methods to help characterize adverse effects of these chemicals on aquatic life; see Minnesota’s Aquatic Life Screening Values -- https://www.pca.state.mn.us/sites/default/files/wq-cec2-01.pdf.

WLSSD has collaborated with the U.S. EPA on research projects focusing on Novel Substances. These research collaboration efforts have yielded three publications in a peer-reviewed scientific journal; specifically:


WLSSD will continue to be receptive to collaborating on and supporting hypothesis-driven research projects, which are founded on principles of objective, technically sound science, and that have the potential to benefit WLSSD and its customers.

Section 7.4: Inflow and Infiltration

Inflow means water other than wastewater that enters a sewer system from sources such as roof leaders, foundation drains, yard drains, manhole covers, cross connections between storm sewers and sanitary sewers, catch basins, storm water runoff and other drainage structures.
Infiltration means water other than wastewater that enters the sewer system from the ground through defective pipe, pipe joints, and manholes. Inflow and Infiltration (I/I) is a part of every collection system and must be taken into account in the determination of an appropriate design flow of a wastewater treatment plant. During substantial rainfall events, isolated periods of extensive snow/ice melt, or during combinations of rainfall and melting the WLSSD waste treatment plant can experience influent flows that exceed its design wet-weather flow capacity (i.e. 48 MGD) by as much as three-fold.

WLSSD has an enforceable I/I Ordinance; see:

The WLSSD I/I Ordinance will serve as an effective tool to mitigate the I/I problems that continue to challenge the WLSSD wastewater treatment plant’s wet-weather flow capacity. The Ordinance has already proven it effectiveness as evidenced by the early (2015 vs. 2016) and complete termination of a Consent Decree, which listed WLSSD as a co-defendant; see:

**Section 7.5: Underground Storage Tanks**

WLSSD has multiple underground storage tanks (USTs) that must comply with MPCA requirements listed in regulations specific for UST’s; see: https://www.pca.state.mn.us/waste/underground-storage-tank-systems.

Aspects of that UST-specific regulation that are most applicable to WLSSD’s include:

- Corrosion protection for tanks and piping
- Internal lining inspections
- Cathodic protection systems
- Release detection for tanks

Certification is necessary to officially assess compliance with several of these aspects. WLSSD utilizes external resources that have the proper certifications to assure that official compliance assessments are performed.

**Section 7.5: Co-Digestion**

WLSSD is moving forward with plans to anaerobically co-digest feed stocks with high caloric content with its (currently) anaerobically digested sludge. The Biosolids produced from anaerobic co-digestion must continue to meet all regulatory compliance aspects specified in the NPDES/SDS permit, which must be at least as (but can be more) restrictive than those specified by the U.S. EPA; see:

WLSSD is also permitted to land apply Biosolids in the State of Wisconsin. Therefore, the Biosolids produced from anaerobic co-digestion must continue to meet all regulatory compliance aspects specified in the WI DNR permit.
Section 7.6: Air Quality

In synchrony with the above mentioned co-digestion plan, WLSSD is advancing plans to generate heat and electricity from the biogas generated by the co-digestion process. In the 2016 legislative session, WLSSD is requesting $8.1 million in funding for the “Combined Heat and Power Energy Project.” This project includes the installation of two 825-kilowatt generators and equipment to generate electricity with biogas, produced in the wastewater treatment process, and to capture and reuse heat from the process.

WLSSD’s Air Quality permit was re-issued in 2012 as a Title V source, which at that time positioned WLSSD to be “over permitted”. However, WLSSD desired the Title V level of permitting because its plans for the near-future Combined Heat and Power Energy Project. This facilitated a straight-forward amendment of the permit in 2014 to regulate the additional emissions specific to the Combined Heat and Power Energy Project. The heating component of the project will be fully functional in 2016; thus far, all permit-required Air Quality submittals have been completed on time. These submittals include various one-time notifications/updates on new emission units, both prior to their installation and in regards to their first use of fuel(s). Once the new emission units are performance-tested and fully operational, routine reporting on fuel use and emission output will prevail.
Section 8: PLAN RECOMMENDATIONS

8.1 Management of subsurface sanitary sewage treatment systems (SSTS) and/or decentralized collection systems in unsewered areas and areas of concern

As discussed in depth in Section 5, this plan recommends that the District continue to recognize the problems facing member communities in unsewered areas utilizing individual sanitary sewage treatment systems and decentralized collection systems. The Plan recommends that the District continue to work in an advisory capacity with all parties from the land owners affected to the community leaders and other educational and regulatory agencies striving to find the best solution available.

8.2 Revision of Urban Services Boundary

It is recommended that the urban services boundary (USB) be adopted as proposed to meet the future needs of the region and that this recommendation become effective upon acceptance of this Plan by the WLSSD Board of Directors and will remain in effect until the Board takes action to cancel or amend the recommendation.

Based again on consultation with local communities, review of local comprehensive land use plans, and a detailed capacity and condition assessment of the WLSSD collection system, the USB defines areas of urban density development, beyond which public utilities such as sanitary sewers should not be extended. Establishment of the boundary ensures controlled expansion of local sewer systems consistent with local comprehensive plans as well as the goals and policies of the District Comprehensive Plan and Capital Improvements Program.

8.3 Expand Scope of Planning Assistance Grant Program

It is recommended that the Planning Assistance Grant Program continue to be made available to assist local planning efforts addressing problems in unsewered areas of the District and also be expanded to include other wastewater related topics including inflow and infiltration (I & I) and fats, oils and grease (FOG) assessments, development of collection system inventories, GIS projects, etc. During this planning period the grant program application will be modified and include requirements for matching funds, project reporting and deliverables.

The District has supported local communities in the evaluation of wastewater management and water quality problems since its creation in the early 1970s. Support has come in the form of technical assistance from District staff or financial support toward planning or engineering processes.

Recognizing that member communities will continue to address wastewater and water quality problems, the WLSSD Board established a fund that supports development of a process to be used to support such planning efforts.
8.4 Regional Comprehensive Planning Review and Approval

The WLSSD enabling legislation recognizes the importance of a coordinated planning effort to insure successful operations of the regional system and effective management of water quality in the lower St. Louis River basin. Effective communication of member community and industry needs is essential to development and implementation of District planning goals.

The District should continue its policy whereby all member communities are required to adopt and maintain a local Comprehensive Plan. Moreover, all revisions or updates of community plans, specifically in regard to utilities, will require review and approval by the WLSSD Board.

8.5 Capital Improvements Program/Asset Management

WLSSD will continue its commitment to maintaining the capacity and effectiveness of the treatment and conveyance facilities through adoption of the recommendations in its Capital Improvement Program. The specific Capital Improvement recommendations resulting from the condition assessments for pump stations and gravity interceptors are highlighted in Section 6.5 of this report and are further discussed in the document appendices.

8.6 Geographic Information Systems (GIS)

WLSSD will develop a coordinated regional GIS data source related to wastewater infrastructure and water quality management and continue to build and maintain a comprehensive GIS database for all WLSSD infrastructure and programs to support District long-range planning and capital budgeting as well as region wide planning efforts.

Specific GIS initiatives to develop and build upon include asset management tools, capacity availability fee (CAF) and sewer extension administration, and documentation of WLSSD easements, odor monitoring and tracking at District facilities, and permitting of sites in the WLSSD biosolids land application program.

8.7 Conveyance System Management Standards

It is recommended that WLSSD develop and publish conveyance system management standards that include policies and procedures accepting, processing and inspecting direct/service connections to the WLSSD system when necessary, facility ownership/metering and design and construction standards for WLSSD constructed facilities. Complete annual review of asset ownership and identify possible transfers.

8.8 Implement Conveyance System Capacity Management/CMOM Program

Continue to fulfill the components of the WLSSD CMOM in order to ensure capacity of the conveyance system for current and future flows by working collaboratively with municipalities on implementing I & I and FOG reduction programs and through the WLSSD seasonal meter program and the community meter loan program.
Components of this include:

- Update the Comprehensive Master Plan every five to ten years.
- Maintain the Interceptor Asset Management Program and associated manuals on an ongoing basis in order to develop the annual budget for capital projects and operation and maintenance.
- Assess the condition of WLSSD’s pump stations during Master Planning Activities or sooner as warranted.
- Utilize and update the hydraulic model. Utilize the modeling tools to determine priority projects and on-going modeling for I/I sources and capacity management.
- Maintain the Online Operations and Maintenance Manual.
- Maintain and evaluate the Fats, Oils and Grease program.
- Perform an update of GIS information and maintain the Collection System Map Book.
- Further develop program to document and query manhole inspections and conditions.

8.9 Energy

The WLSSD will control costs and reduce its overall carbon footprint by reducing overall energy consumption by 25% over the next ten years. The activities undertaken to accomplish this are specified in the WLSSD Energy Master Plan.

Key components include:

- Update the WLSSD Energy Master Plan every five to ten years.
- Complete installation of engine generators and gas conditioning to allow biogas to be collected and used to produce electricity for use in wastewater treatment.
- Eliminate the flaring of biogas by using it in engine generators for electrical production and/or in the biogas boilers for building and process heat.
- Implement the direct introduction of wastes with a high biogas-generating potential into the existing anaerobic digesters. This will significantly increase biogas production for use in engine generators, and consequently increase electricity generation - moving the WLSSD wastewater plant toward 100% electrical self-generation.
- Develop a district-wide energy team to provide education, strategy and measurement of energy use and energy reduction to facilitate the active involvement of all employees in our efforts to reduce energy consumption.
- Update the district-wide vehicle fleet to the most fuel efficient vehicles suitable for the purpose needed.
Section 9: PLAN ADMINISTRATION

9.1 REGULATORY CONTROLS

The land use planning authority in relationship to the WLSSD is clearly set forth in Minnesota State Statutes, Chapter 458D, Subsection 458D.05. Under this authority the District requires that local plans be submitted for review and approval in relation to the collection, treatment, and disposal of sewage for which the local government unit is responsible. Such local planning efforts are to be in compliance with the WLSSD Board's goals and policies and in relation to the District's planning efforts. Updated plans for many townships and cities within the District are timely and needed in relation to the WLSSD Comprehensive Plan.

9.2 AMENDMENT PROCEDURES

The WLSSD Comprehensive Plan intends to extend through the year 2020. For the plan to remain dynamic, an avenue must be available to implement new information, ideas, methods, standards and management practices. Amendment proposals can be requested any time by any person or persons either residing or having business within the District.

Request for Amendment: A written request for plan amendment is submitted to the WLSSD staff. The request shall outline the need for the amendment as well as additional materials that the WLSSD will need to consider before making its decision.

Staff Review: A decision is made as to the validity of the request. Three options exist; 1) reject the amendment, 2) accept the amendment as a minor issue, with minor issues collectively added to the plan at a later date, 3) accept the amendment as a major issue, with major issues requiring an immediate amendment. In acting on an amendment request, staff shall recommend to WLSSD Board whether or not a public hearing is warranted.

Board Consideration: The amendment and the need for a public hearing shall be considered at a regular or special WLSSD Board meeting. Staff recommendations should also be considered before decisions on appropriate action(s) are made.

Public Hearing: This step allows the public input based on the public sentiment. The WLSSD Board and staff shall determine when the public hearing should occur in the process.

Board Adoption: Final action on an amendment is WLSSD Board adoption. However, prior to the adoption, an additional public hearing should be held.

9.3 PLAN REVIEW

A brief annual report should be made by WLSSD Planning and Technical Services staff summarizing development changes, capital improvements and other water management-related issues that have occurred over the past year. The review should also include an update on available funding sources for water resource issues.
The plan will remain in effect through 2020 or until revised. The plan should then be reviewed for consistency with current water resources management methods and Comprehensive Plans. At this time, all annual reports and past amendments can be added to the document. Depending on the significance of changes, a new printing of the plan may be appropriate.
The following references were utilized in the preparation of this document:

3. Carlton County, Community-Based Comprehensive Plan, April 2001
5. St. Louis County Comprehensive Water Management Plan 2010-2020
7. City of Scanlon Comprehensive Plan, 2015
8. Canosia Township Comprehensive Land Use Plan, 2014
9. City of Thomson, Comprehensive Plan, 1976
10. City of Cloquet, Comprehensive Plan, 2007-2027
15. City of Proctor Comprehensive Plan, 2008
16. Town of Lakewood Comprehensive Land Use Plan, August 2008
17. Fond du Lac Reservation Land Use and Management Plan, Jan 1998
19. Duluth Township Comprehensive Plan, August 21, 2002
21. UMD-Campus Master Plan Update 2000
22. Solway Township Comprehensive Land Use Plan, March 2001
23. Minnesota Statutes, Chapter 458D Local Sanitary Districts - Western Lake Superior
24. Minnesota State Demographics Office, Census of Population and Housing, 2010
25. St. Louis County, Zoning Ordinance, 1994
26. City of Duluth, Comprehensive Land Use Plan, 2006
28. Western Lake Superior Sanitary District (WLSSD), Inflow and Infiltration Reduction Project