2021-2030 Watershed Management Plan

Clearwater River
WATERSHED DISTRICT
Promote | Protect | Preserve

COMPREHENSIVE WATERSHED MANAGEMENT PLAN
2021-2030

Approved by the Minnesota Board of Water and Soil Resources
March 24, 2021

Adopted by the CRWD Board of Managers April 17, 2021

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This Plan was created under direct supervision of the District's Board of Managers, Administrator, and Senior Advisor. It was prepared by Resilience Resources, LLC.

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ACKNOWLEDGEMENTS

State and Local Partners
Board of Water and Soil Resources Minnesota Pollution Control Agency Minnesota Department of Natural Resources Meeker County and Meeker County SWCD Stearns County and Stearns County SWCD Wright County and Wright County SWCD District Cities and Townships District Lake Associations and Homeowners Associations Special Thanks to former Manager Kathy Jonsrud

CLEAN WATER LAND & LEGACY AMENDMENT	**Clean Water, Land and Legacy Amendment Projects include:** • Kimball Phase I, Phase II Stormwater Retrofits • Cedar Lake Restoration Projects • Watkins Stormwater Project

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Executive Summary

The Comprehensive Watershed Management Plan (Plan) describes how the Clearwater River Watershed District (District) will manage activities in the watershed from the years 2021 through 2030. The Plan describes the natural resources and core activities of the watershed, the issues and goals that the District will focus on for the next ten years, and the implementation strategies and subwatershed activities which will be used to meet those goals. This Executive Summary provides an overview of the Plan.

The District was formed April 9, 1975, by order of the Minnesota Water Resources Board, acting under authority of Chapter 112, MSA (the Minnesota Watershed Act). Residents noticed a decrease in the clarity of the area lakes and streams, an increase in the number of rough fish (bullheads and carp), and an increase in the number of algae blooms. The District was the first founded with a mission to protect and improve water quality. Most other Districts were formed to control flooding and expanded their scopes to include water quality.

Land use in the 158.8 square mile watershed is emblematic of central Minnesota's economic and recreational heritage: Rich agricultural lands concentrated in the upper, western portion of the watershed with high value recreational lakes and rivers in the central and lower watershed. The District is 18% water and 57% working agricultural lands. It is located about 40 miles northwest of the Twin Cities Metropolitan Area in Stearns, Wright, and Meeker Counties in Central Minnesota. The watershed encompasses the Cities of Clearwater, Annandale, Kimball, South Haven and Watkins, as well as numerous townships, and includes 19 lakes, 98 miles of the Clearwater River and tributary creeks and over 7,700 acres of wetlands.

The mission of the Clearwater River Watershed District is to promote, preserve and protect water and natural resources within the boundaries of the district in order to maintain property values, recreational opportunities, and quality of life as authorized by Minnesota State Statute 103D.

The substantial successes of the Clearwater River Watershed District to date have come through projects and programs accomplished with landowners and partners. This organization:

- respects landowners, local, state, and federal government partners.
- benefits individuals and the community by promoting, preserving, and protecting water and natural resources.
- supports stakeholders in cultivating resilient systems around soil, water, and infrastructure to benefit water and natural resources.

Achieving our goals has always required the coordination and cooperation of many. To that end, our focus is on the people and institutional relationships in the District and on developing strategies that benefit the greater good. This does not reflect an unwillingness to make unpopular decisions sometimes required to achieve our goals, but when we do so, we do it in service of our stakeholders in a fiscally responsible manner, for the greater good.

At the time of the District's establishment in 1975, water clarity was low and aquatic recreation was impaired. The figure below shows graphically the distribution of water clarity in the District when water quality data was first measured in advance of the District's 1980s Project.

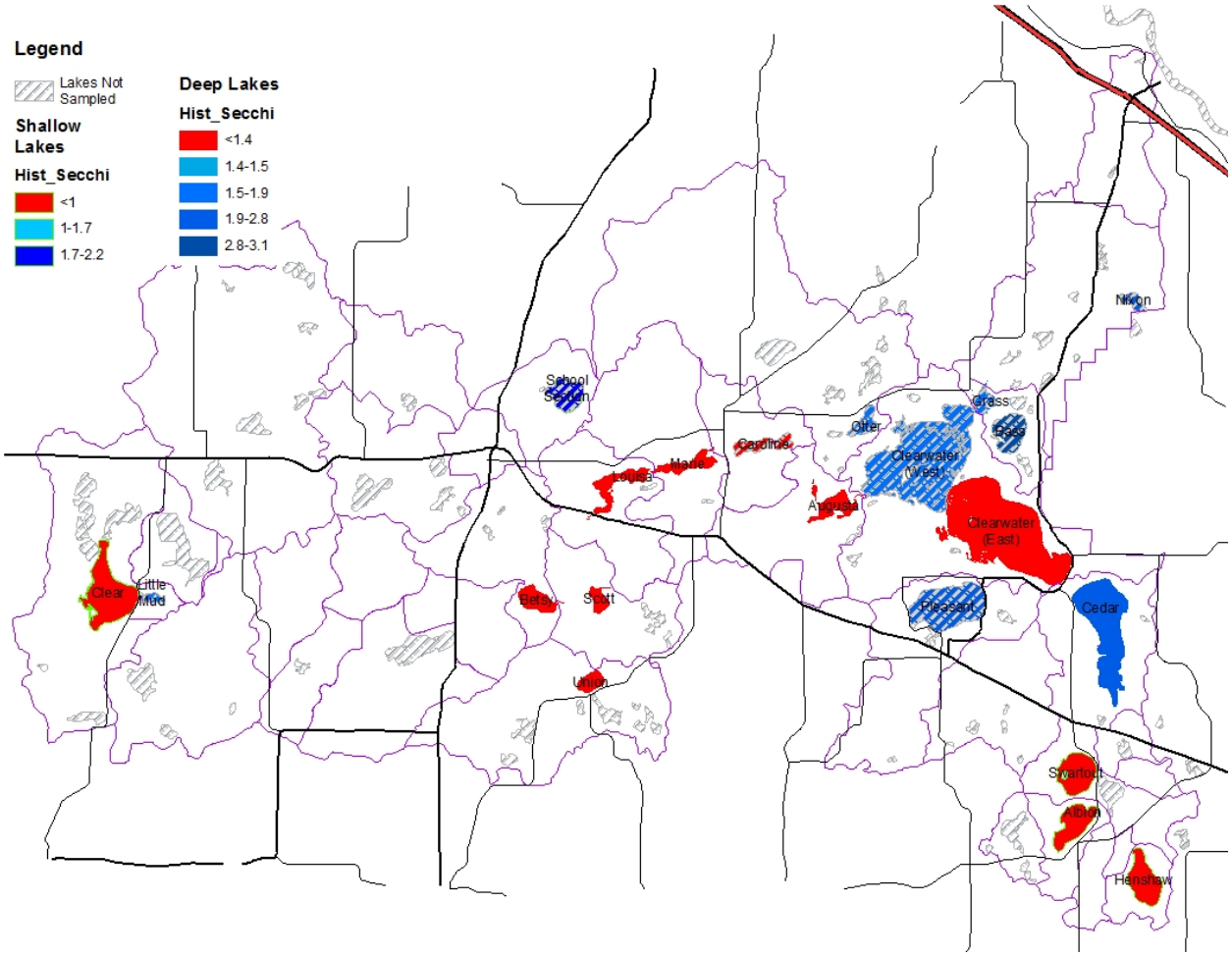


Figure E.1 Water Clarity Prior to District Projects

The 1980's Project, with its Total Maximum Daily Load (TMDL) style combination of setting target nutrient load reductions and achieving them through projects and programs, brought

significant improvements in water quality to District lakes in the late 1980's and early 1990's. An intensive period of hydrologic, hydraulic and water quality monitoring in the District provided data for the 2003 MPCA Watershed Wide TMDL studies. Implementing the District's 2009 TMDL Plan brought Lake Betsy Phosphorus levels in the upper watershed from a 10-year summer average of 269 ug/L (1998-2007, TMDL Study), down to a low of 92 ug/L in 2017 and a 10-year average of 140 ug/L (2010-2019).

Owing to District projects and programs, in full cooperation and coordination with local partners, often funded in part by state and federal partners, water clarity meets state standards in most District lakes as shown in the figure below. While nutrient, sediment, dissolved oxygen, *E. coli*, aquatic life and recreation impairments persist, ***the District and partners have made measurable improvements in water quality***.

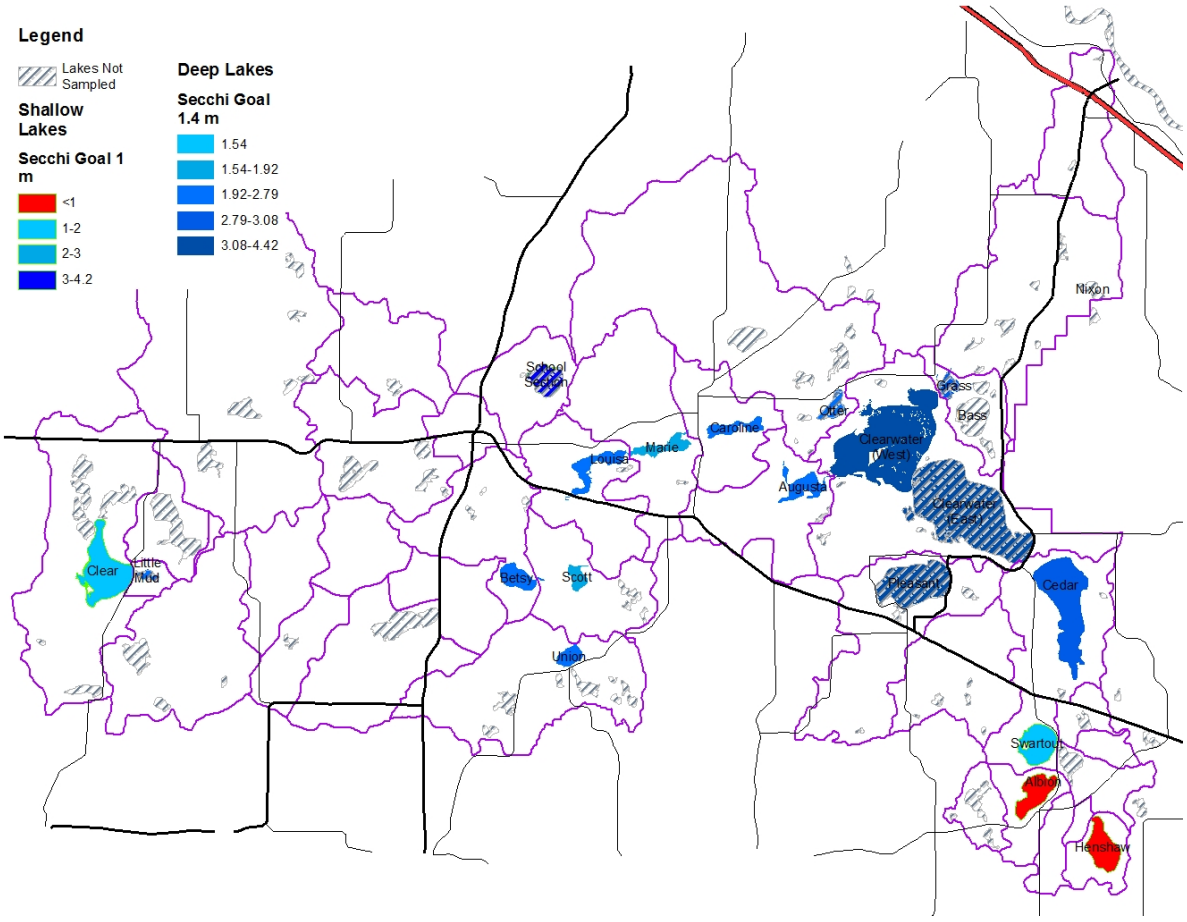


Figure E.2 2019 Water Clarity Resulting from District Projects

In the coming 10 years, the District will continue with the policies and practices that have yielded measurable improvements in water quality. This plan expands the District's focus on natural resource protection and restoration and accommodates a changing climate.

Priority Issues

The District identified priority issues of equal and critical importance through a stakeholder process and analysis of the available data, set goals, and identified strategies to meet them. Priority issues in the District are summarized below and presented in more detail in Section 2 of this plan:

Priority Issue 1: Threatened and Impaired Surface Water Quality and Natural Resources

The Clearwater River Watershed District is one of the few Minnesota watershed districts founded to improve water quality. Our long history of studies, data collection, projects and programs have historically focused on achieving nutrient load reduction to recreational lakes, reducing in stream and upland erosion, and rough fish management. As science and our understanding of the issues and their drivers evolve, our planning and implementation expands and evolves. The most recently completed plan cycle included capital projects to:

- Continue the work done under previous plans to protect and restore lake water quality and recreational uses of District lakes and streams through watershed nutrient and sediment load reduction
- Combat low oxygen and restore habitat in the Clearwater River and tributary streams, with special focus on District trout streams
- Reduce internal nutrient cycling (the release of phosphorus) from lakes and wetlands to downstream waters and the corresponding oxygen demand from wetlands impairing habitat in downstream waters
- Manage rough fish populations where they threaten water quality
- Reduce watershed loads of bacteria and sediment
- Protect and restore native habitat for in lake, emergent, and terrestrial project areas.

Strategies:

While studies, projects and programs implemented in the next 10 years will continue to focus on the drivers of surface water impairments that threaten recreational uses; this plan expands work on overall health for all water and natural resources.

- Oxygen demand and the release of biologically available nutrients from lake bottoms and wetlands continues to be a primary driver of multiple impairments issues in the watershed. The tools for addressing this issue are limited due to the science and limited application. Existing projects like iron enhanced sand filters and other filtration systems can be maintenance intensive. As one of the first Minnesota Districts to recognize this issue and use filtration, and hydrologic restoration to address the transport of soluble P, the District will continue to pioneer field methods to combat the issue as it is necessary to achieve our goals.

Projects to target this loading are underway for several district lakes already and will continue. These lakes include Clear Lake, Lake Betsy, Lakes Louisa & Marie, Lake Augusta, Pleasant Lake, and Swartout Lake. This list may expand as more data is collected.

- In-stream, shoreland and upland erosion in the watershed threatens habitat in lakes, rivers and wetlands, reduces the productivity in agricultural lands, creates difficulties for townships and municipalities managing infrastructure, and impairs recreation. The District will:
    - Implement a program, in partnership with the local DNR, which will offer education and technical resources to shoreline landowners for lakes, streams and wetlands to reduce erosion and excess sediment and nutrient transport. Include county and SWCD staff as they are willing and able to provide resources.
    - Update stormwater management plans for cities and draft new ones for townships to reduce erosion and cultivate resilience in stormwater management in urbanized and residential areas.
    - Continue to implement projects identified in a 319-funded District study completed in 2016 to reduce sediment and bacteria load in the upper watershed.
        - Several projects were completed with individual landowners, some are in progress. The District will continue to work with landowners in these high priority areas.
        - Continue to work with County and State transportation engineers to incorporate stormwater management and erosion reduction into projects. Meeker County reconstructed County Road 17 during 2019, the District offered technical support to add erosion control and alternative design to reduce erosion in our high priority areas.
- Robust annual collection of water quality, hydrology, hydrologic and climate data will continue to support the development of projects and programs. Hydrologic, hydraulic and watershed load modeling that supports design and implementation and prioritization of projects and programs will continue.
- Protection and restoration of the District's three trout streams will continue and be a priority in this planning cycle.
    - Phase I and II of the Kimball Stormwater Retrofits targeted infiltration of excess stormwater, stormwater capture and reuse to protect Willow Creek, a trout stream near the City.
    - The District will work with partners to secure grant funding to reduce sediment loads and stormwater runoff to Thiel Creek.

    - The District will continue to collect data in all three trout streams (Thiel, Willow and Fairhaven) to identify needs for protection and restoration and implement programs and projects.
- Agriculture continues to be the largest single land use in the District. Reducing nutrient and sediment loads from these lands continues to be the largest lever the District must pull to continue to demonstrate measurable improvements to water and natural resources. The District will expand programs to support resilience in soils, water quality, and habitat protection. For example:
    - Expand the District's award-winning Targeted Fertilizer Application program from just the upper watershed (the target of the previous plan), to the entire district.
    - The District will continue to support alternative tile intakes through cost share,
    - Initiate the "odd piece program" which will offer cost share incentives to install perpetual cover and/or native habitat on oddly shaped, hard to farm, highly erodible lands near surface waters.
    - Support SWCD efforts to promote cover crops and other practices to promote resilience in soil, water, and natural resources.
    - Continue to pursue unique partnerships with public and private entities to expand project uptake and keep costs low, for example, local Co-Ops engaged in the Targeted Fertilizer Program to enroll new program participants.
- Look for retrofit opportunities for projects installed in the 1980's to improve efficiency and achieve newer District goals. Two priority treatment systems include:
    - Annandale Wetland Treatment System
    - Watkins Wetland Treatment System

Priority Issue 2: Climate Change

Precipitation has changed both in frequency and intensity since the last plan implementation period. Temperature changes further impact water chemistry and biology.

Projects and programs to achieve District goals are designed based on an understanding of the drivers of both healthy ecosystems and impairments to those ecosystems. As precipitation and temperature change, design standards and best practices will also change. While new stressors may emerge, new opportunities are also possible. Recording precipitation, lake levels and stream flow at a limited number of individual stations does not capture the spatial and temporal variation in precipitation or the hydrologic response. Expanded precipitation, lake level and flow monitoring and

evaluation of data collected will be critical to understanding the hydraulic response to changing precipitation patterns.

Measuring and quantifying the hydrologic response to precipitation is the basis of good design and implementation. Hydrologic and hydraulic data needs are greater, as is the need to understand how changing temperature will impact water and natural resource management. All projects and programs will be designed and maintained for climate resilience with water and natural resources, flood prevention, stormwater management and infrastructure in mind.

Strategies:

- Expanded Monitoring- monitoring and data collection around precipitation and hydrology will be expanded. Additional Citizen Precipitation Recorders will be recruited, and additional evaluation of data collected by local, state and federal partners will be considered.
- Resilience-based design – Promote Infrastructure design that better handles the more intense storms that climate change causes. Project and program design shall be based on recent climate data and standards. While using Atlas 14 precipitation frequency estimates are the recommended standard of care now for developing design targets, that may change during the timeframe of plan implementation. Evaluate design criteria and adjust as needed. This evaluation process includes not only design standards and normal precipitation, but also evolving needs related to how water and natural resources interact with infrastructure and soils.
- Expanded Analysis – every two years, the following will be evaluated and updated based on the newest best practices around climate change:
    - Monitoring and data collection practices
    - Density and location of monitoring stations
    - Design standards
    - Best practices and programs for agricultural cost share
    - Best practices around supporting entities managing stormwater in urban and residential areas
    - Operation and maintenance of current district projects
    - Data analysis and reporting
- Expanded Modeling – Hydrologic and hydraulic modeling will be updated and expanded to better support design, operation, maintenance and planning. Models are currently and will continue to be updated on a 5-year basis or as needed for specific projects or programs, unless recommendations change.
- Communications – Discuss climate resilience with landowners, local, state and federal partners as well as residents to identify their needs and determine the District's role in meeting them.

Priority Issue 3: Localized Flooding and Navigation Obstructions

Localized flooding that threatens property is sometimes an issue in the District. The District has addressed this in partnership with area residents and in collaboration with DNR and other regulatory stakeholders. The District operates and maintains two lake outlets which were petitioned by residents for flood control. Localized flooding in urban or rural areas can also present issues. Several District lakes also have large bogs which sometimes break lose and can impair navigation and cause flooding.

Strategies:

- Continue to inspect, operate, and maintain District projects related to flood management like the School Section and Pleasant Lake Outlets. These outlets will be operated in accordance with DNR permits.
- The District will serve as a technical support and fiscal agent and partner to residents and partner with federal, state, and local regulatory partners that address and manage flooding such as the bog control project for Lake Augusta.
- The District will look for opportunities to support townships, cities and counties in stormwater studies in high priority areas where other water and natural resource goals might be achieved with additional technical support or funding.

Priority Issue 4: Aquatic Invasive and Nuisance Species Management

Aquatic invasive and nuisance species management continues to be an issue of primary concern for residents and stakeholders in the District. In 1993 the District initiated its first AIS management program to manage and treat Eurasian Water Milfoil in Clearwater Lake. As the needs and science around AIS and nuisance species management continue to evolve, the District has shifted from species specific projects to more general AIS and nuisance species projects. Several of the original petitioned AIS species specific projects have been changed to more general plans for AIS and nuisance species early detection, mapping, and management plans.

Currently AIS and nuisance aquatic species management plans exist for the following lakes:

- Bass Lake
- Cedar Lake
- Clearwater Lake
- Lake Augusta
- Chain of Lakes (Louisa & Marie)
- Clear Lake (self-administered)

The District's model is to respond specifically to the needs of the landowners and serve as a fiscal agent for projects initiated by resident petition under 103D process for establishing projects initiated by petition. The District adopted standards around AIS and nuisance management Projects for Lake Associations to follow and serves as both a technical support and a fiscal agent for these Projects.

Locally driven support of aquatic invasive and nuisance species management within the District, conducted in full cooperation and coordination with state and local partners.

Strategies:

- Continue to serve as a technical support and fiscal agent to local residents and partner with federal, state, and local regulatory partners, landowners and lake associations to manage AIS and aquatic nuisance species. This includes staff and Board training and participation in educational seminars from time to time on AIS and nuisance aquatic species management.

Priority Issue 5: Sustainable Administration and Funding

Financing for sustainable operation, administration, operation and maintenance of District Core Functions, and capital projects and programs is critical to achieving District goals and performing core functions.

Strategies:

- Plan and provide for adequate staffing and professional services
- Provide for project and program funding and administration
- Provide for infrastructure and equipment funding
- Continue board training, staff training if necessary, and funding for qualified consultants
- Continue to apply for and administer grants
- Seek alternative sources of funding

Priority Issue 6: Operation and Maintenance

The District has constructed many capital projects. Operation and maintenance are both priority issues and a core function for the District. The age of projects, shifting climate, and emerging issues necessitate ongoing evaluation of operation and maintenance for all District projects.

Legacy projects, new projects, and the four community wastewater systems the District is tasked with operating and maintaining all require funding, experienced contractors and staff.

Strategies:

- Conduct a regular inspection program to identify maintenance and operational needs.
- Evaluate, every two years at least, projects and programs that require operation and maintenance to identify opportunities for adjustments to better serve local needs around water and natural resource goals, infrastructure needs and climate resilience.
- Adequately fund operation and maintenance and maintain projects in accordance with regulatory requirements.

District Core Functions

Sustainable Administration + Financing

- Plan and provide for adequate staffing and professional services
- Provide for project and program funding and administration
- Provide for infrastructure and equipment funding
- Continue to apply for and administer grants
- Seek alternative sources of funding

Monitoring + Studies

- Sound data collection is the source of good decisions for the District
- Continue to implement Foundational Monitoring Program to track trends in target water bodies
- Conduct Special Studies and Feasibility Studies to identify the drivers of the District issues, prioritize and implement solutions
- Quantify impacts on and benefits for groundwater resources as they relate to projects and programs to meet surface water quality goals

Operation + Maintenance

- Operate and maintain flood management projects like lake outlets
- Operate and maintain Legacy Projects and New Projects
- Maintain a high level of service and regulatory compliance for community Sewer Systems
- Conduct a robust inspection program for District projects with maintenance if necessary

Capital Projects + Programs

- Identify and implement existing and new projects and programs to address District Issues and achieve District goals
- Periodically evaluate existing projects for opportunities to achieve additional goals or address issues

Education + Outreach

- Support stakeholders and enhance partnerships
- Engage with landowners, in person when possible, District Wide
- Convene special stakeholder groups to target specific issues
- Engage with regulatory stakeholders and partners at federal, state and local level
- Develop electronic collateral and outreach for the purpose of education and engagement

Other Programs

- The District has and will continue to participate proactively in state and federal programs including TMDL studies, OWOP, WRAPS

Watershed wide plan summary table

Upper Clearwater River 07010203 Clear Lake to Upstream of Lake Betsy							Implementation Schedule									
Waterbody	**ID**	**County**	**Parameter**	**Impairment Driver**	**Strategy**	**Budget**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
Kingston Wetland	47-0312-00	Meeker	Phosphorus, Sediment	Watershed load, legacy wetland export of Soluble P and oxygen demand	319 funded project completed in 2017, reduce watershed loads, maintain project and manage water levels and coordinate with DNR. Project maintenance will continue.	$25,000	x	x	x	x	x	x	x	x	x	x
Little Mud Lake	47-0096	Meeker	Phosphorus	Watershed loads	reduce watershed loads. No projects identified specifically for Little Mud, though watershed load reductions targeting Little Mud's watershed will yield load reductions for the lake.											
County Ditch 20	738 AQL	Meeker	Aquatic Life-Impaired	Watershed loads, impaired habitat	Reduce watershed loads and maintain channel stability, augment drainage authority work to improve water quality where possible. Work with City of Watkins on stormwater management.	$123,000			x	x						
County Ditch 44	550 AQL, Fishes and Inverts	Meeker	Aquatic Life-Impaired	Watershed loads, impaired habitat	Reduce watershed loads and maintain channel stability, augment drainage authority work to improve water quality where possible.	$146,000					x	x				
Clearwater River, CD 44 to Lake Betsy	549, AQL, AQR, DO & FC Approved	Meeker	Aquatic Life/Aquatic Recreation, DO, FC (Sediment/ bacteria/ nutrients)	Oxygen demand from Kingston Wetland, limited re-aeration	Reduce watershed loads and maintain channel stability. Construct channel stability projects in main channel, and tributaries. Conduct channel morphometry study.	$210,000							x	x		
Clear Lake	47-0095	Meeker	Phosphorus	Soluable P loading from northern wetland complex	Manage soluable P loading to the lake via main tributaries. Manage watershed export of P. Continue rough fish management.	$375,000	x	x								

Middle Clearwater River 070102030202 Lakes Betsy through Augusta and the Clearwater River							Implementation Schedule									
Waterbody	**ID**	**County**	**Parameter**	**Impairment Driver**	**Strategy**	**Budget**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
Marie Lake	73-0014	Stearns/ Wright	Total Phosphorus	Upstream, internal and watershed loads	Manage watershed sediment and nutrient loads	$175,000	x	x	x	x	x					
Lake Louisa	86-0282	Stearns/ Wright	Total Phosphorus	Upstream, internal and watershed loads	Manage watershed sediment and nutrient loads	$175,000	x	x	x	x	x					
Union Lake	86-0298	Meeker/ Wright	Total Phosphorus	Upstream, internal and watershed loads	Manage watershed nutrient loads	$25,000						x	x			
Scott Lake	86-0297	Meeker/ Wright	Total Phosphorus	Upstream, internal and watershed loads	Manage watershed nutrient loads	$25,000						x	x			
School Section Lake	73-0035	Stearns	NA	NA	Ongoing operation of outlet and required monitoring, continue to reduce nutrient loads to lake. Seek permit modification.	$30,000										
Thiel Creek (headwaters to Thiel, and Thiel to Lake Marie Class 1B, 2Ag, 3B Trout Stream)	556, 619	Stearns	Nutrients, *E. coli*, temperature, sediment & morphometry (AQR)	Climate change, land use in the watershed.	Reduce sediment and chloride loads, conduct stream survey to assess habitat and channel morphometry. Projects on riparian roadways and steep slopes to mitigate high temperature, sediment laden stormwater from entering creek directly. Develop projects and programs to improve water quality and habitat.	$150,000		x	x							
Fairhaven Creek (headwaters to Lake Marie)	565	Stearns	Nutrients, temperature, sediment & morphometry	Watershed Loads	Reduce sediment and chloride loads, conduct stream survey to assess habitat and channel morphometry. Develop projects and programs to improve water quality and habitat.	$125,000		x		x						

Middle Clearwater River 070102030202 Lakes Betsy through Augusta and the Clearwater River							Implementation Schedule									
Waterbody	**ID**	**County**	**Parameter**	**Impairment Driver**	**Strategy**	**Budget**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
Clearwater River: Caroline to Augusta		Stearns	Nutrients, soluble P export, hydrology, sediment & morphometry		Evaluate soluble P export through data collection and analysis. Identify capital projects/programs to mitigate.	$375,000		x	x	x						
Clearwater River: Lake Betsy to Scott Lake	715	Stearns	Nutrients, hydrology, sediment & morphometry		Evaluate soluble P export through data collection and analysis. Identify capital projects/ programs to mitigate. Identify opportunities to reduce rough fish populations	$350,000				x	x	x				
Clearwater River Scott Lake to Lake Louisa	717	Stearns	Nutrients, soluble P export, hydrology, sediment & morphometry AQR Fisheries/ Invertebrates	Upper watershed and internal wetland loading	Evaluate soluble P export through data collection and analysis. Identify capital projects/ programs to mitigate.	$159,000			x	x						
Willow Creek 1B, 2Ag, 3B (Trout Stream), Headwaters to Betsy	515	Meeker	Nutrients, hydrology, temperature, sediment & morphometry		Reduce sediment and chloride loads, conduct stream survey to assess habitat and channel morphometry. Develop projects and programs to improve water quality and habitat.	$210,000							x	x		
Betsy Lake	47-0042	Meeker	Total Phosphorus	Upper watershed and internal loads	Reduce upstream and internal phosphorus loads	$95,000	x	x	x	x						
					Manage rough fish populations	$45,000		x	x			x	x		x	x
Caroline Lake	86-0281	Stearns/ Meeker/ Wright	Total Phosphorus	Upper watershed and internal loads	Manage upstream and internal phosphorus loads	$126,000							x	x	x	
Augusta Lake	86-0284	Stearns/ Meeker/ Wright	Total Phosphorus		Manage internal phosphorus, manage upland wetland soluble P export, manage upland erosion. AIS Project support and Bog Project support	$225,000	x	x	x							

Clearwater Lake – Clearwater River 070102030203 Three Mile Creek							Implementation Schedule									
Waterbody	**ID**	**County**	**Parameter**	**Impairment Driver**	**Strategy**	**Budget**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
Otter Lake	73-0015	Stearns	Total Phosphorus	NA	Monitor, adjust as needed. No projects identified, though some budget is included in the event of an AIS need.	$5,000										
Three Mile Creek	545, 571, 564	Stearns	Aquatic Life	NA	Additional stressor assessment work needed; likely stressors are due to land use in watershed.	$5,000										x

Clearwater Lake – Clearwater River 070102030204 Clearwater – Cedar – Pleasant Lakes							Implementation Schedule									
Waterbody	**ID**	**County**	**Parameter**	**Impairment Driver**	**Strategy**	**Budget**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
Swartout Lake	86-0208	Wright	Total Phosphorus	Hydrologic disturbance, tributary wetland and internal loads	Manage Internal Phosphorus, manage bird populations to reduce loading, rough fish management, vegetative management, reduce watershed loads	$125,000	x	x	x	x	x	x	x	x	x	x
Albion Lake	86-0212	Wright	Total Phosphorus	Hydrologic disturbance, tributary wetland and internal loads	Rough fish and vegetative management	$15,000	x	x	x	x	x	x	x	x	x	x
Henshaw Lake	86-0213	Wright	Total Phosphorus	Hydrologic disturbance, tributary wetland and internal loads	Manage internal phosphorus, rough fish and vegetation	$35,000	x	x	x	x	x	x	x	x	x	x
Cedar Lake	86-0227	Wright	Total Phosphorus		Ongoing maintenance and operation of Cedar Lake Restoration Project as well as AIS project support	$450,000	x	x	x	x						
Pleasant Lake	86-0251	Wright	Total Phosphorus		Continue lake outlet operation	$15,000						x	x	x		
Clearwater Lake	86-0252	Wright	Total Phosphorus		Watershed and upland water load reductions. AIS support.	$175,000			x	x	x					

Lower Clearwater River 070102030205							Implementation Schedule									
Waterbody	**ID**	**Area**	**Parameter**	**Impairment Driver**	**Strategy**	**Budget**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2028**	**2030**
Clearwater River: Clearwater Lake to Mississippi	511	Stearns/ Wright	Dissolved Oxygen		Nitrogen Load reduction, re-aeration, channel morphology restoration	$35,000									x	x
Weigand Lake	86-0242	Wright	Total Phosphorus		Monitor, adjust as needed	$9,000										
Nixon Lake	86-0238	Wright	Total Phosphorus		Monitor, adjust as needed	$9,000										
Grass Lake	86-0243	Wright	Total Phosphorus		Monitor, adjust as needed	$9,000										
Bass Lake	86-0234	Wright	Total Phosphorus		Continued support of Bass AIS Project, monitor, adjust as needed	$9,000										

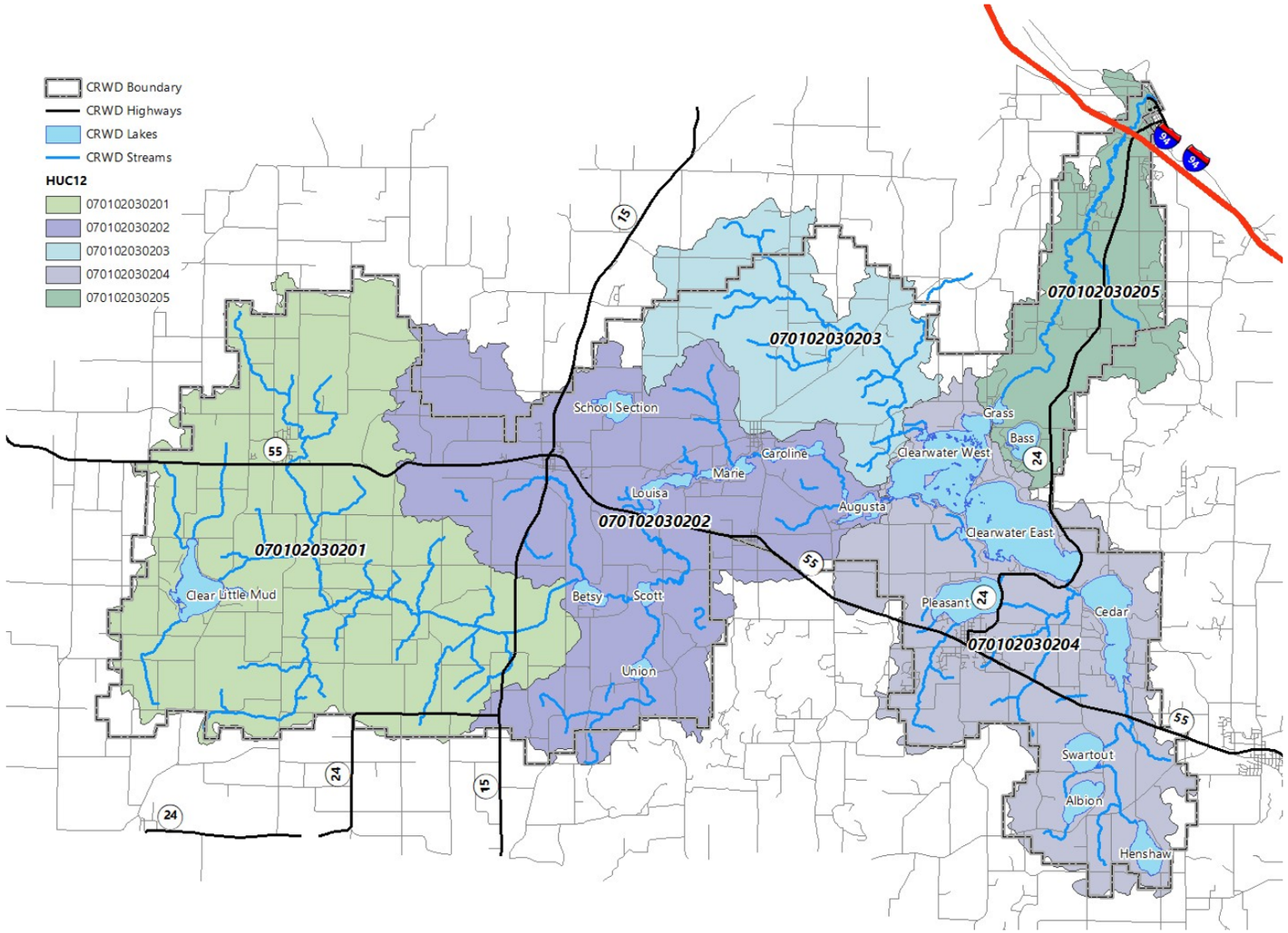


Figure E.3 CRWD Map with HUC 12 Identification

The Plan is divided up into an Executive Summary, 6 main chapters and contains 4 appendices. The sections and appendices are listed below:

1. Introduction & Background
2. Priority Issues, Goals, and Implementation Strategies
3. District Core Activities
4. Priority Resources and Sub-watershed Activities
5. Plan Implementation and Roles
6. Amendments to the Plan

Appendix A: Project History
Appendix B: Land and Natural Resources Inventory and Assessment
Appendix C: Acronyms and Definitions
Appendix D: 2020 Monitoring Plan

During implementation of the most recent 10-year comprehensive plan, annual planning sessions were key to set the direction for the year ahead. The result of these annual planning sessions resulted in measurable progress towards goals. During that planning period, the District collected additional data and implemented studies which deepened and expanded it's understanding of issues. Science and tools available for implementation expanded. Climate also changed. These changes will continue. This plan is meant to be a guide to set the direction each year.

1.0 Introduction & Background

1.1 Mission

Mission: The mission of the Clearwater River Watershed District is to promote, preserve and protect water and natural resources within the boundaries of the district in order to maintain property values, recreational opportunities, and quality of life as authorized by Minnesota State Statute 103D.

1.2 Guiding Principles for Executing the Comprehensive Plan

The substantial successes of the Clearwater River Watershed District to date have come through projects and programs accomplished with landowners and partners. This organization:

- ***respects landowners, local, state and federal government partners.***
- ***benefits individuals and the community by promoting, preserving and protecting water and natural resources.***
- ***supports our stakeholders in cultivating resilient systems around soil, water and infrastructure to benefit water and natural resources.***

Achieving our goals has always required the coordination and cooperation of many. To that end, our focus is on the people and institutional relationships in the District and on developing strategies that benefit the greater good. This does not reflect an unwillingness to make unpopular decisions sometimes required to achieve our goals, but when we do so, we do it in service of our stakeholders in a fiscally responsible manner, for the greater good.

1.3 A Brief History of Planning and Implementation

The Clearwater River Watershed District (District) was established as a unit of local government on April 9, 1975, by order of the Minnesota Water Resources Board, acting under authority of Chapter 112, MSA (the Minnesota Watershed Act).

The District was formed in response to residents noticing a decrease in the clarity of the area lakes and streams, an increase in the number of rough fish (bullheads and carp), and an increase in the growth of algae blooms. The District was the first founded with a mission to protect and improve water quality. Most other Districts were formed to control flooding and expanded their scopes to include water quality. There are three main chapters in the District's history:

- 1980-1993: Chain of Lakes Project
- 1993-2003: Maintenance, Monitoring, Stakeholder Engagement, Community Wastewater

- 2003-2020: TMDL & Implementation, Cedar Lake

1980-1993: Chain of Lakes Project

The Clearwater River Chain of Lakes Project was undertaken cooperatively by the District, the USEPA, the MPCA and other agencies with the purpose of improving water quality in Clearwater Lake and several smaller District Lakes. Most of the funding came from state and federal grants with a small local match. With a final budget of $4.3 million, and project and program implementation spanning between 1980 and 1993, it was one of the largest projects in the Clean Lakes Programs.

Lake water quality dramatically improved in Lakes Betsy, Scott, Louisa, Marie (which includes the Mill Pond), Caroline, Augusta, Clearwater, and Grass.

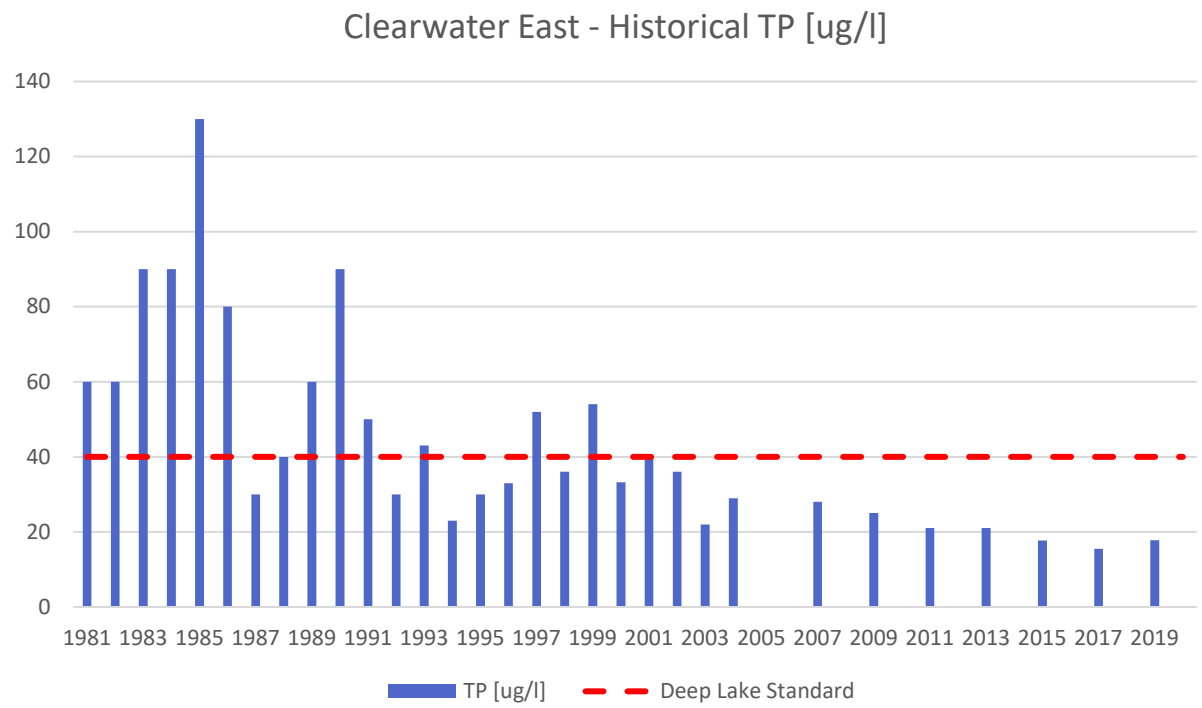


Figure 1: Example of improving water quality in East Clearwater Lake

The projects constructed include:

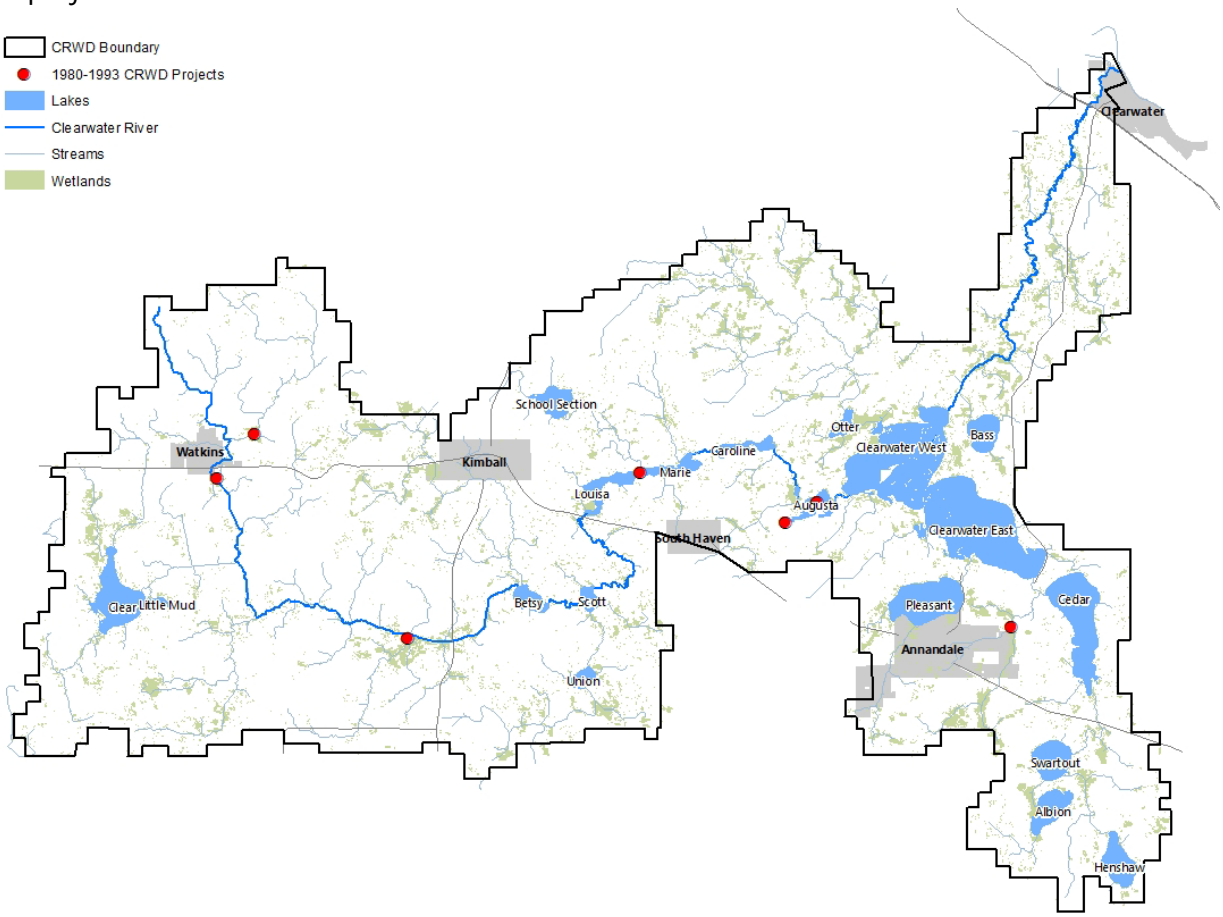


Figure 2: 1980-1993 Chain of Lakes Project

- Annandale Wetland Treatment System
- Kingston Wetland Treatment System
- Lake Augusta Aeration Project
- Lake Augusta Erosion Control Project
- 1980 Monitoring Program
- Non-Point Source Pollution Abatement Tri County Conservation Project (TCCP)
- Upper Lakes Aeration and Mechanical Fish Removal
- Watkins Wetland Isolation Project
- Watkins Wetland Treatment System
- Replacement Projects for Aerators

1993-2003: Maintenance, Monitoring, Stakeholder Engagement, Community Wastewater

District operations during this time focused on its comprehensive monitoring program, operation and maintenance of the projects constructed before 1993, and work with local partners and landowners on agricultural programs. Increasing pressure for residential and

recreational development on non-conforming lots sparked the county to assign the District the duties of fiscal management, operation, and maintenance for 4 small community sewer wastewater systems which serve 129 homes throughout the District.
Projects and programs during this time include:

- On-going rough fish management
- Agricultural BMPs with landowners
- Operation and maintenance of District projects
- Construction and operation of 4 Community Wastewater Systems
- District funded 4 municipal stormwater studies for cities in the District
- Expanded data analysis and stakeholder outreach through publication of Lake Report Cards, newsletters, and in person outreach
- Established and implemented a comprehensive annual monitoring program. Data collected during the time served as the foundation for the next phase of implementation and water quality improvements

2003-2020: TMDL & Implementation, Cedar Lake

The MPCA established water quality standards under the Clean Water Act to ensure designated uses of lakes and streams were protected. They published the State's first 303d impaired waters list in 1994 and expanded the list significantly in 1998 and 2002. Lake Louisa was the first District water to be included on the 303d impaired waters list in 2002. It was, and remains, impaired for excess nutrients.

In 2003, the recent 10-year data set collected through the District's comprehensive water quality monitoring program showed many lakes were impaired for nutrients and some rivers and streams were impaired for dissolved oxygen, excess sediment, and bacteria.

The District sought an MPCA grant to conduct the State's first watershed-wide Total Maximum Daily Load (TMDL) study of impaired waters. After conducting large-scale water quality studies funded by the MPCA in the watershed between 2003 and 2007, the District's TMDL Implementation Plan was approved by the EPA in 2009.

The District's last 10-year Comprehensive Plan was then updated early to incorporate the TMDL Implementation Plan activities. Following that update, the District was eligible for and secured a total of close to $2.5 million in state and federal grants to implement the projects and programs identified therein.

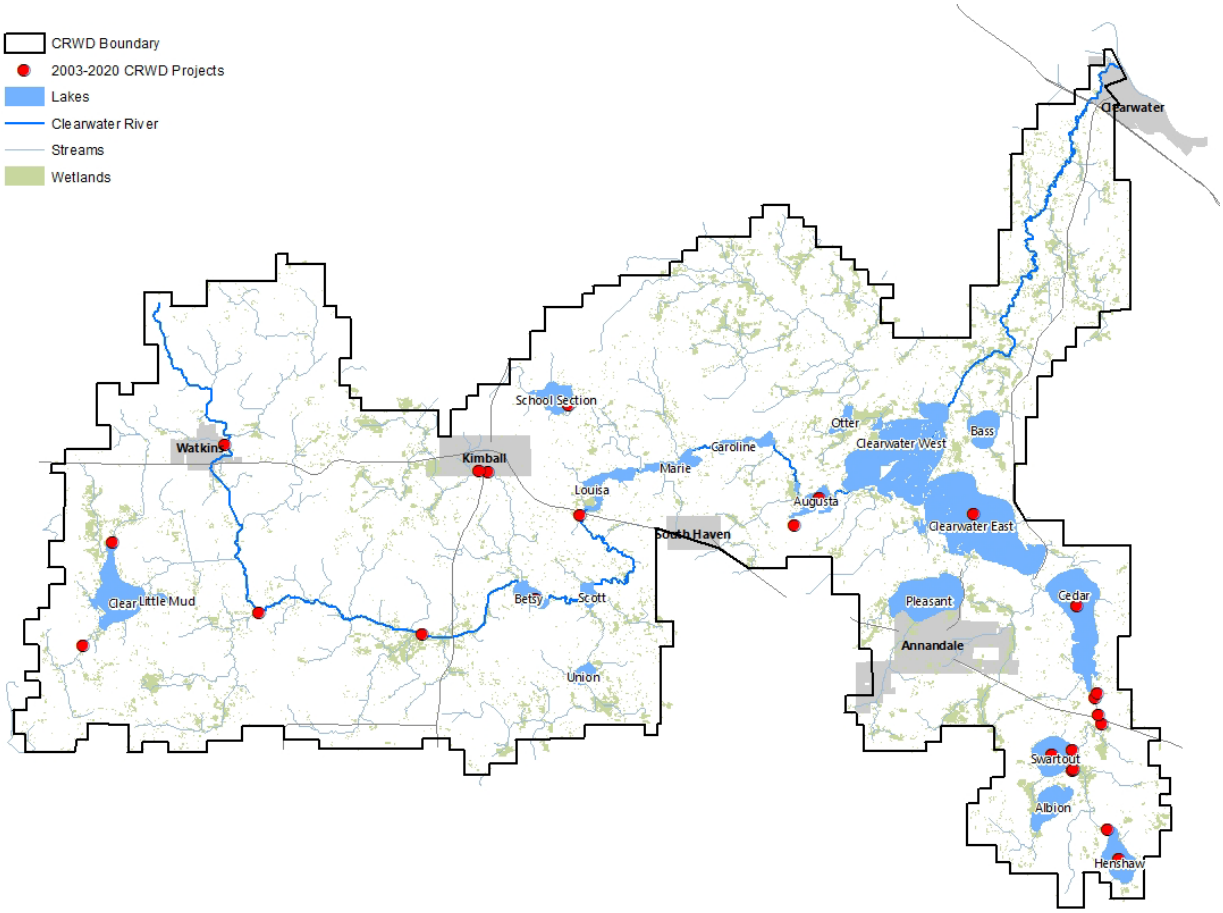


Figure 3: 2003-2020 CRWD Projects

Projects and programs implemented during this time funded through a combination of local and grant funds include:

- Segner Pond retention and limestone filtration for soluble P removal (local funds)
- Rough Fish management in Cedar Lake Subwatershed (local funds)
- Variable Rate Targeted Fertilizer Program (Federal 319 funds plus local match)
- Alternative Tile Intake Program (Federal 319 funds plus local match)
- Bacteria and Sediment Load Reduction Implementation – Upper Watershed (Federal 319 funds plus local match)
- Hayable Buffer and Soybean Buffer Programs (local funds)
- Highway 55 Project (BWSR grant plus local match)
- Swartout Iron Enhanced Sand Filter (BWSR grant plus local match)
- Watkins Area Stormwater Filtration System (BWSR grant plus local match)
- Kingston Wetland Restoration (Federal 319 grant plus local match)
- Kimball Area Stormwater Retrofit, Capture, and Reuse – Phases I & II (BWSR grant plus local match)
- Nitrogen Mitigation System, Clearwater Harbor and Hidden River (PFA grant, local match)
- Repair of School Section Outlet (local funds)
- Repair of Pleasant Lake Outlet (local funds)
- Augusta Erosion Control Project repair (local funds)
- Clearwater River Stabilization (state conservation fund grant plus local match)

Post implementation water quality data shows measurable and significant improvement in water quality in the District's lakes and streams as the result of the investment in the Clearwater River Watershed District. The dots in Figure 4 represent the mean TP results in lakes sampled in 2019. Red dots indicate means that do not meet TP standards.

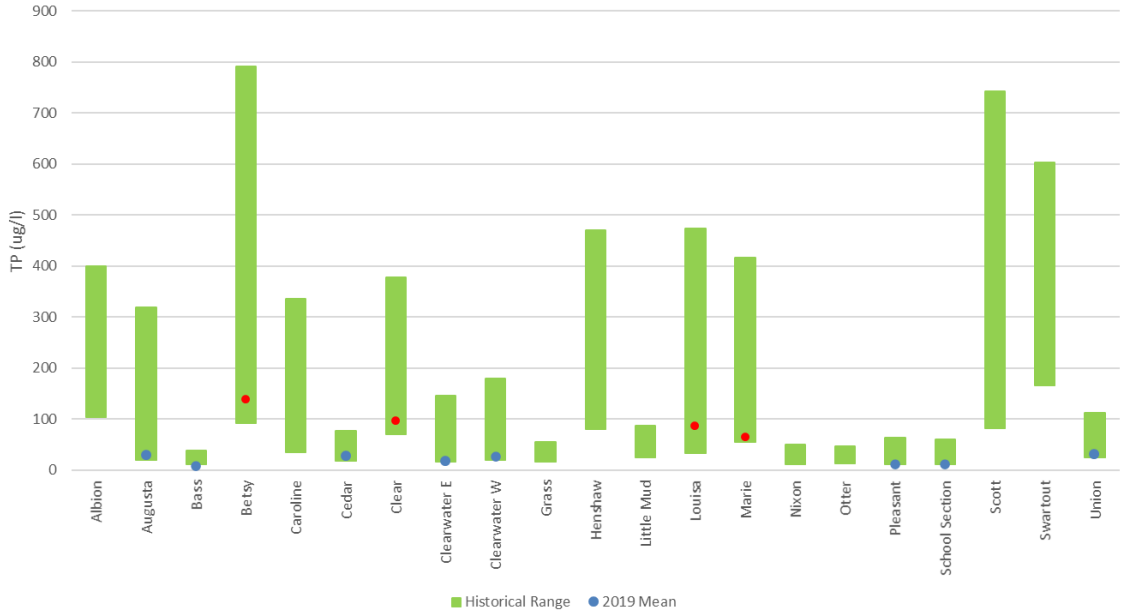


Figure 4: Total Phosphorus Historical Range and 2019 Mean in District Lakes

Table 1: Water quality improvement figures

Lake	Avg TP (ug/L) 1980-2009	Avg TP (ug/L) 2010-2019	Avg Chl a (ug/L) 1980-2009	Avg Chl a (ug/L) 2010-2019
Albion	205	147	121	79
Augusta	84	41	26	13
Bass	19	11	3	3
Betsy	341	140	45	30
Caroline	109	73	33	25
Cedar	35	24	11	8
Clear	191	121	73	57
Clearwater E	50	19	16	5
Clearwater W	52	25	19	11
Henshaw	244	102	137	67
Little Mud	63	26	15	5
Louisa	158	95	49	19
Marie	149	86	57	28
Pleasant	28	22	10	9
School Section	31	14	8	3
Scott	260	130	70	40
Swartout	332	304	288	53
Union	46	40	17	12

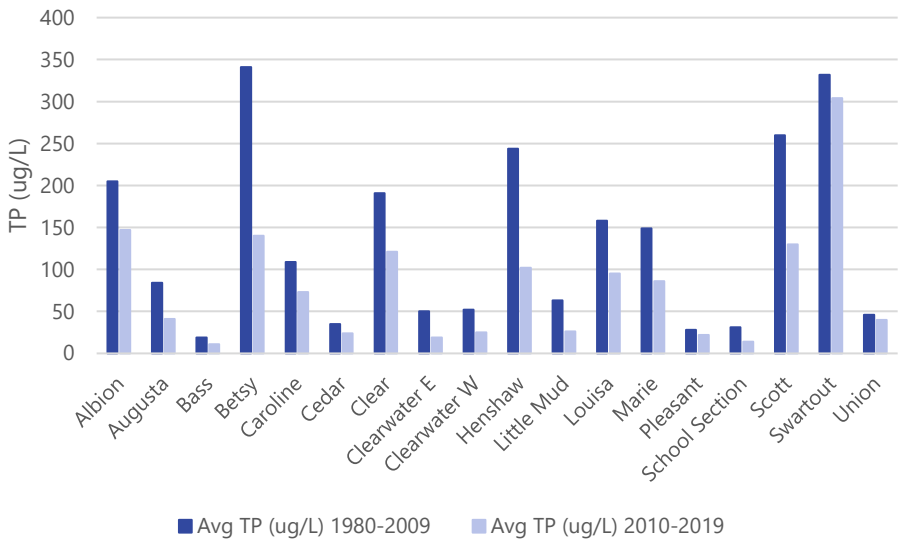


Figure 5: TP improvements during last generation Plan

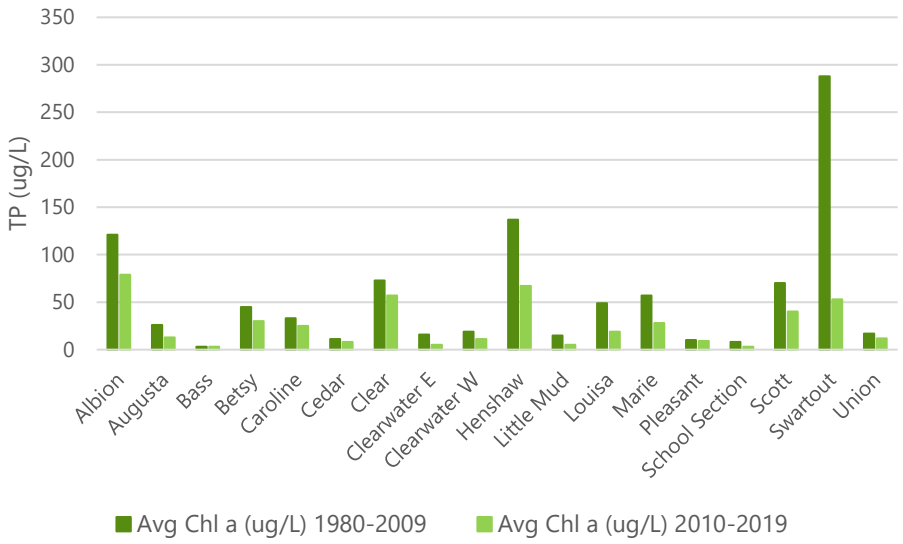


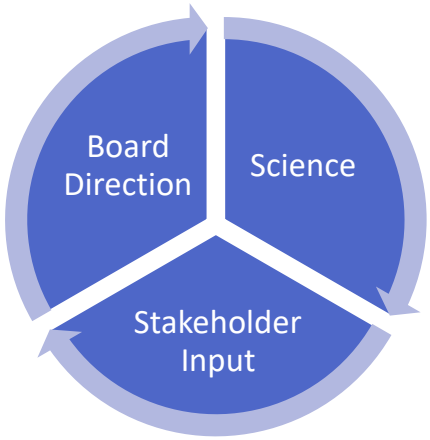
Figure 6: Chl-a improvements during last generation Plan

1.4 Planning Process

The process of planning and stakeholder engagement included three key elements:

1. Science: Through evaluation of water quality data, hydrologic data, water quality and hydrologic modeling results we can begin to understand both the drivers of impairments as well as develop cost effective solutions.

2. Stakeholder Input: The District's stakeholders include local, state and federal government partners, lake associations, not for profit groups focused on resource protection, and landowners.



- Board of Managers and Staff Meetings: Updating the 10- year comprehensive plan started in 2018. The Board of Managers and staff conducted several discussions and workshops to identify priority issues and develop the goals and strategies to address them. Formal annual Planning Meetings were conducted March 21, 2018; March 27, 2019; and March 11, 2020. An additional workshop was conducted September 10, 2020.
- CAC Meetings: The District's Citizen Advisory Committee (CAC) is critical to supporting the stakeholder process. In addition to attending annual planning sessions, and other meetings with planning on the agenda, they provide information and feedback to the Board. They also reviewed and commented on the draft plan.

- Contacts with state and local regulatory stakeholders: The Board of Managers and staff regularly communicate with state and local regulatory partners to discuss both short and long-term planning.
- Local Civic Expos: Board members have staffed a CRWD booth at two local civic expos. This is completed annually (Expos were cancelled in 2020 due to COVID). A survey was conducted at the 2019 Expo. Results are incorporated into this plan.
- Web, Social and Print Media: The District updated its web site in 2020 and engaged more deeply with a social media audience to draw input and engagement.

3. Board Direction: The Board of Managers takes the science-based recommendations of the staff and stakeholder recommendations to develop the priority issues and goals for the District. Discussions on budgeting, schedules and feasibility inform their decisions.

1.5 Plan Organization & Use

The Plan is divided up into an Executive Summary, 6 main chapters and contains 4 appendices. The sections and appendices are listed below:

1. Introduction & Background
2. Priority Issues, Goals, and Implementation Strategies
3. District Core Activities
4. Priority Resources and Sub-watershed Activities
5. Plan Implementation and Roles
6. Amendments to the Plan

Appendix A: Project History
Appendix B: Land and Natural Resources Inventory and Assessment
Appendix C: Acronyms and Definitions
Appendix D: 2020 Monitoring Plan

During implementation of the most recent 10-year comprehensive plan, annual planning sessions were key to set the direction for the year ahead. The result of these annual planning sessions resulted in measurable progress towards goals. During that planning period, the District collected additional data and implemented studies which deepened and expanded it's understanding of issues. Science and tools available for implementation expanded. Climate also changed. These changes will continue. This plan is meant to be a guide to set the direction each year.

2.0 Priority Issues, Goals, and Implementation Strategy

Priority Issue 1: Threatened and Impaired Surface Water Quality and Natural Resources

Impaired surface waters refer to those waterbodies which have been included on the Minnesota Pollution Control Agency (MPCA)'s Section 303d Impaired Waters List. A Total Maximum Daily Load (TMDL) study and implementation plan has been completed which provides guidance towards actions that can be taken by CRWD and its partners to restore many of the impaired water bodies in the District. Threatened surface waters and natural resources are those where land use, development or recreational pressure is likely to degrade the resource below reference conditions or standards.

CRWD plans to focus efforts in the first few years of the Plan on selected lakes to ascertain the best projects to improve water quality. These actions are described in more detail within the goals and strategies in the Plan.

Since the last planning cycle, water and natural resource managers have shifted from a focus on the chemical properties of the surface water (for example, nutrient concentrations) to a broader definition of resource management within a watershed. Indicators of aquatic and terrestrial biotic integrity are now regularly assessed, and management goals established. The broadening can include fisheries, macroinvertebrates, emergent vegetation and submerged macrophytes, and aquatic invasive (or nuisance) species.

Goal 1-1: Work to delist all waters within CRWD currently on the 303d Impaired Waters list and show measurable in-lake nutrient reductions in priority impaired waters within the first 5 years of Plan implementation.

Strategy 1-1-1: Implement projects and programs on priority lakes which may include but are not limited to Clear Lake, Lake Augusta, Lakes Louisa and Marie, as well as Lake Betsy, Swartout, Albion and Henshaw Lakes.

Strategy 1-1-2: For lakes and streams which studies indicate internal loading or wetland loading as a driver of impairment or a threat to water quality, complete or update internal load management feasibility study to identify projects with the best potential for nutrient reduction. In the cases which internal or wetland load is identified as a driver of an impairment or a threat to water quality, work to minimize the impact of soluble phosphorus and oxygen demand export from wetlands to downstream waters. Pursue partnerships to assist with funding, monitoring, maintenance, or other activities. Restoration of mitigation sites may be considered. Projects may include but are not limited to adsorption filters, hydrologic restorations (ie Kingston Wetland), and additive treatments.

Strategy 1-1-3: Use an annual evaluation process to organize funding, along with technical and staff resources in line with the implementation schedule. Identify gaps in funding, technical and staff resources and set a plan to fill those gaps.

Goal 1-2: Demonstrate stable or improving water quality trends in all CRWD lakes and streams by 2030 and provide protection for high value water and natural resources. This goal has been met over the last 10 years and we aim to continue that trend.

Strategy 1-2-1: Conduct an annual monitoring program that tracks trends in the waters CRWD manages. Report data annually to the Minnesota Pollution Control Agency's (MPCA) database and create an annual monitoring report which will be available on CRWD website. Annually evaluate monitoring program and adjust the program as necessary and incorporate data and analysis into decision making and into Annual Report.

Strategy 1-2-2: Continually evaluate for new contaminants, adding chloride evaluation in 2020, and considering other emerging contaminants and their impact on water and natural resources.

Goal 1-3: Engage citizens, stakeholders and partners through education and involvement opportunities.

Strategy 1-3-1: Build on existing and pursue new partnerships with governmental entities and diverse stakeholders to maximize effectiveness and eliminate gaps in water and natural resource protection. Do so by prioritizing regular and proactive communication with partners and stakeholders.

Strategy 1-3-2: Use effective marketing techniques, including social media, recognition of successes, and regular, timely communications. The annual report, website, digital collateral, and other communications will use a cohesive narrative behind the successes achieved by the CRWD.

Strategy 1-3-3: Be a resource to residents, business owners, and developers by providing an easy to use website, responsive staff and useful educational collateral.

Strategy 1-3-4: Implement sub-watershed-based outreach events, press releases, and social media communication.

Strategy 1-3-5: Maintain existing program partnership targeting school age children through schools, or other entities.

Strategy 1-3-6: Focus on in person communication where possible and safe.

Goal 1-4: The District has unique abilities and authorities around funding and implementation. To the maximum extent, leverage these to support advancement of programs that support landowners, local, state and federal stakeholders, industry, agriculture and development in establishing sustainable management practices to cultivate resilience around infrastructure and land use that support the District's water and natural resource goals.

Strategy 1-4-1: Expand existing agricultural programs: targeted fertilizer application program, the District's cost share program, various buffer and perpetual vegetative cover programs.
Strategy 1-4-2: Actively and on an annual basis identify new programs for agricultural, residential and urban landscapes. This can be done with continued engagement with these stakeholders to identify their needs, issues, plans and available resources.
Strategy 1-4-3: Expand cost shares for alternative tile intake program.
Strategy 1-4-4: Actively engage with county, SWCD, BWSR, DNR, and MPCA and other partners to leverage multiple funding sources to implement projects and programs to cost effectively further the Districts water and natural resource goals.
Strategy 1-4-5: Support local townships, municipalities and lake associations with studies, data, communications content which supports the District's water and natural resource goals. For example, the District undertook stormwater studies for Kimball, Annandale, and Watkins in the late 1990's. These studies have been the groundwork not only to engage stakeholders, but also for implementation of significant projects that had measurable improvements in water quality and flood reduction.
Strategy 1-4-6: Establish and or support a variety of soil and land conservation programs to promote resilience, either in partnership with other stakeholders or through District programs.
Strategy 1-4-7: Establish a program to promote perpetual vegetative cover and or native plantings on irregularly shaped or marginal cropland prioritizing land on highly erodible soils riparian to surface waters.
Strategy 1-4-8: Provide opportunities for broader input from residents about problems observed in the watershed (such as a resident informing the District of erosion occurring on the north side of Lakes Louisa and Marie during a regular Board meeting).

Goal 1-5: Provide for additional natural resource data collection and analysis to set appropriate targets for natural resource management.

Strategy 1-5-1: Avoid overlap with existing efforts by other stakeholders through regular and proactive communication and coordination of efforts with state, federal and local resource managers.
Strategy 1-5-2: Coordinate with DNR to collect meaningful data on fish populations and macrophytes in lakes and quantify the impacts of rough fish management.
Strategy 1-5-3: Water clarity in several district lakes has improved measurably. Fisheries and aquatic plant populations in these lakes have shifted, in part due to water clarity improvements. Initiate discussions on improving surface water clarity with fisheries management stakeholders.
Strategy 1-5-4: Continue with rough fish migration barriers, physical removal and investigate alternatives for management of populations detrimental to water quality and recreation.

Strategy 1-5-5: Publish shallow lake management plans for key shallow lakes targeted for restoration and protection. Some lakes targeted for early restoration include but are not limited to Clear, Swartout, Albion and Henshaw.

Strategy 1-5-6: Measure water quality, soil characteristics, hydrology and habitat in key wetlands to manage soluble phosphorus export from wetlands and protect their function and values. Wetlands are a key hydrologic and habitat feature. The typical management paradigm is to assign nutrient load reductions to wetlands: Decreased flow velocity and increased residence time in wetlands allows settling of particulate matter and assimilation of particulate bound total phosphorus. However, wetlands can also cycle nutrients, releasing biologically available phosphorus during anoxic periods. Anoxic periods when biologically available phosphorus is exported generally correlate with the recreational fishing and swimming season. The impacts of these soluble phosphorus releases drive public perceptions of recreational impairments. Direct measurement of upstream and downstream water quality of several wetlands within the district show soluble phosphorus export in excess of phosphorus loads which can be assimilated by downstream waters if they are to meet their 303d nutrient goals. Exports of biologically available phosphorus from wetlands contributes to algal blooms in downstream lakes, lake nutrient impairment, and biotic impairment for excess nutrients, and low oxygen in streams.

Strategy 1-5-7: Measure elements of stream health, stability, and biotic integrity. Riparian land use, water quality, stream morphology, hydrology and vegetative community contribute to stream health. Collecting data on these will support projects to stabilize stream banks, reduce erosion, reduce flooding, and improve habitat. Water quality will require adequate data and understanding of the systems.

Strategy 1-5-8: Continue to measure and report water quality trends in deep lakes in terms of in lake water quality and quantification of nutrient loads.

Priority Issue 2: Climate Change

Goal 2-1: Consider the changes in climate normals reported by the NWS and observed in the District in implementation of all District strategies, projects, and programs.

Strategy 2-1-1: Collect and report additional hydrologic and hydraulic data including precipitation, stream flow and lake levels throughout the District.

Strategy 2-1-2: Design projects and programs using up to date precipitation and temperature normal and best available data and design standards. When fiscally and scientifically prudent, update existing projects due to changes in climate normals. We will evaluate those opportunities annually within the context of the Operations and Maintenance Reports and the Monitoring Report.

Strategy 2-1-3: Periodically evaluate the water and natural resource needs within the district through the lens of cultivating resilience around climate change and its impact on precipitation, hydrology, channel stabilization, macrophyte and fisheries populations,

infrastructure, land use, and needs of the residents. Report findings in annual update for BWSR.

Strategy 2-1-4: Periodically update the watershed models for the District to support design with new climate normal.

Priority Issue 3: Localized Flooding and Navigation Obstructions

Goal 3-1: Minimize flood damage to private and public property within CRWD.

Strategy 3-1-1: Communicate regularly with local partners and residents to assess what is needed to address new flooding concerns and support floodplain management in accordance with city, state, and federal regulations.

Strategy 3-1-2: In the event that localized flooding crosses legal boundaries of other entities but is within the watershed, CRWD may collect hydrologic and hydraulic (H&H) data to support partners modeling efforts which address flooding and water quality issues. Limit modeling support to only those instances where CRWD can use its unique abilities and authorities to address its priority issues.

Strategy 3-1-3: Support floodplain management in accordance with municipal, state, and federal regulations.

Strategy 3-1-4: Continue to operate and maintain district projects that impact water levels in accordance with permits and water quality benefits.

Strategy 3-1-5: Use cost share programs and technical support to encourage local partners with land use authority to promote resilience around infrastructure and stormwater management that reduces negative impacts on water and natural resources.

Goal 3-2: In cases where biological/ vegetative (bogs) obstructions cause barriers to navigation or potential flooding, CRWD will look for opportunities to reduce navigation/flooding obstructions as they align with the priorities of the CRWD Plan implementation.

Strategy 3-2-1: Continue to operate as fiscal agent for existing bog management projects.

Goal 3-3: Support other LGUs and partners in navigation management.

Strategy 3-3-1: Where appropriate, CRWD may act as a partner and fiscal agent to lake associations or other interest groups to manage biological/ vegetative navigation obstructions/ potential drivers of flooding.

Priority Issue 4: Aquatic Invasive and Nuisance Species Management

Goal 4-1: In cases where AIS management/ nuisance species management overlaps with water quality improvement efforts, especially in shallow lakes (for example rough fish management), CRWD will look for opportunities to improve water quality as they align with the priorities of the CRWD Plan implementation.

Strategy 4-1-1: Implement rough fish management (such as harvesting, fish migration barriers, etc.) where applicable.

Goal 4-2: Support other LGUs and partners in AIS management.

Strategy 4-2-1: Where appropriate, CRWD may act as a partner and fiscal agent to lake associations or other interest groups to manage AIS.

Strategy 4-2-2: Where appropriate, CRWD may partner with other agencies or lake associations to provide education on AIS. These partnerships will be described and approved by the Board and each opportunity will be evaluated to ensure consistency with CRWD's priorities, goals, strategies, and statutory responsibilities.

Priority Issue 5: Sustainable Administration and Funding

Goal 5-1: Provide for sustainable administration and funding for projects, programs and core activities to support addressing the CRWD priority issues, core functions and subwatershed plans.

Strategy 5-1-1: Secure adequate funding to implement the Districts projects and programs and provide for sustainable administration through levy and use of unique abilities and authorities under Minnesota state statute 103D.

Strategy 5-1-2: Seek and secure partnerships with other state, federal and local government units, civic groups, lake associations, not for profit and private groups to advance funding availability and implementation of District projects, programs, and administration to further District goals.

Priority Issue 6: Operation and Maintenance

Goal 6-1: Provide for sustainable operation, administration, and funding for District capital projects. Because of the substantial number of projects constructed by the District, and their age as well as shifting climate, and emerging issues, ongoing evaluation of operation and maintenance activities is necessary. Operation and maintenance are both priority issues and core functions of the District.

Strategy 6-1-1: Maintain optimal functionality of existing capital projects through annual inspection, routine operation, and maintenance.

Strategy 6-1-2: Periodically evaluate function of capital projects with respect to new technology, new data collected and new or emerging issues.

Strategy 6-1-3: Update the District's project operations and maintenance manual every 5 years.

Goal 6-2: Provide for sustainable operation, administration, and funding for each of the Districts Small Sanitary Sewer Systems: Rest-A-While Shores, Clear Water Harbor, Hidden River, Wandering Ponds.

Strategy 6-2-1: Maintain community wastewater system operation within permit requirements with a high level of service for residents at the lowest costs possible with consideration for long term costs for maintenance and ultimate replacement of the systems.

3.0 CRWD Core Activities

Minnesota Statutes Chapter 103D lists the general purposes of a watershed district: To conserve the natural resources of the state by land use planning, flood control and other conservation practices by using sound scientific principles for the protection of public health and welfare and the provident use of the natural resources.

To achieve the goals in this plan, the District will undertake sustainable administration, monitoring, education and outreach, and operate, inspect and maintain existing projects. This section describes how each of the core activities will be focused over the life of this plan.

Sustainable Administration + Financing

- Plan and provide for adequate staffing and professional services
- Provide for project and program funding and administration
- Provide for infrastructure and equipment funding
- Continue to apply for and administer grants
- Seek alternative sources of funding

Monitoring + Studies

- Sound data collection is the source of good decisions for the District
- Continue to implement Foundational Monitoring Program to track trends in target water bodies
- Conduct Special Studies and Feasibility Studies to identify the drivers of the District issues, prioritize and implement solutions
- Where appropriate, engage in evaluation and management of groundwater resources as they relate to surface water quality goals

Operation + Maintenance

- Operate and maintain flood management projects like lake outlets
- Operate and maintain Legacy Projects and New Projects
- Maintain a high level of service and regulatory compliance for community Sewer Systems
- Conduct a robust inspection program for District projects with maintenance if necessary

Capital Projects + Programs

- Identify and implement existing and new projects and programs to address District Issues and achieve District goals.
- Evaluate existing projects every 3-5 years for opportunities to achieve additional goals or address issues

Education + Outreach

- Support stakeholders and enhance partnerships
- Engage with landowners, in person when possible, District Wide
- Convene special stakeholder groups to target specific issues
- Engage with regulatory stakeholders and partners at federal, state, and local level

Other Programs

- The District has and will continue to participate proactively in state and federal programs including TMDL studies, OWOP, WRAPS

3.1 Sustainable Administration and Financing

Sustainable administration and financing are both priorities for the District. They support all core functions and they facilitate achieving our water and natural resource goals.

Key elements of sustainable administration and financing are listed below and described here or in other sections of this report:

- Administrative oversight of District's Core Functions, plan implementation, and financial, legal and statutory obligations by staff, consultants and Board.
- Training, continuity and engagement of staff and Board Members.
- Adequate data and studies to drive decisions.
- Technology and tools:
    - Monitoring Equipment
    - Software
    - Data Storage

A long history and broad portfolio of capital projects and programs requires a longer outlook to maintain the progress made in prior years and continue on the path to protect and improve water and natural resources. Continuity and engagement of staff and strong Board members leads to rich institutional knowledge of project history, local knowledge and the trust of the stakeholders all of which are key to project and program implementation.

The District also adopts aggressive plans to achieve local water and natural resource goals. Sustainable administration supports plan implementation and measurable results.

The District will continue to leverage 103D for establishing priority Projects as well as locally driven Projects and programs. Aggressive grant seeking is also necessary to bring in funding for projects and programs which cannot be fully funded locally. The District also actively seeks to partner and support federal, state and local regulatory stakeholders on project and program implementation to maximize the impact of these organizations. Robust communications and outreach are needed to facilitate this.

Further, the District continues to look for new sources of funding, new partnerships and creative ways to support water and natural resource protection and improvement, and to cultivate resilience within the District around water, soil and natural resource and infrastructure management.

3.2 Monitoring and Studies

The District will continue to operate a robust annual data collection and analysis program to support assessment of progress towards goals by taking a broad-based approach of assessing water quality conditions. The District will monitor water quality in lakes and streams, measure

and monitor watershed hydrology and runoff. The District may monitor or assess indicators of biotic integrity, fish, invertebrate or aquatic macrophyte populations.

The program prioritizes routine, baseline monitoring by District staff and partners, and may conduct periodic special monitoring or studies to support specific management goals. Stable funding for the monitoring program is provided by the general fund and specific Project funding as well as grants when available.

In addition to the baseline monitoring and special studies undertaken, priorities will be expanded during this planning period to add climate and hydrologic data, specifically precipitation, stream flow and runoff. Appendix D is a recent monitoring plan for the District. These are updated annually at the District's annual planning session in March.

3.3 Capital Project Operation & Maintenance

The District has constructed several capital projects since its establishment (Appendix A contains a description of each District project and a mapped project location). Many projects constructed in the 1980s and 1990s require significant maintenance due to their age, changing climate, or changes in the way we understand and manage natural resources.

Many new projects are operationally intensive or maintenance intensive such as fish migration barriers, lake outlets, nutrient filtration systems, and small community sanitary sewer systems. Ongoing data collection and annual inspection are key to effective operation and maintenance. Local contractors have provided cost effective operation and maintenance for some projects.

The District will evaluate the effectiveness of projects and adjust the design, construction, operation, or maintenance of key projects to achieve District goals, as needed. Funding of project maintenance and operations is provided for in MN Statutes 103D.631. Grants may be pursued when projects reach their useful life cycle and require more than typical maintenance.

3.4 Capital Projects & Program Implementation

The District identifies and prioritizes projects and programs to meet goals through our process of:

- maintaining a robust baseline water quality, hydrologic and hydraulic data collection program.
- consulting with partner agencies on their collection and analysis of habitat and natural resource data.
- regular data analysis and reporting.
- stakeholder input and priorities.
- coordination and collaboration with our local, state, and federal partners.
- quantification of project benefits relative to costs.

- considering the impact of climate change.
- prioritizing projects that cultivate resilience in the natural and built environment with respect to water and natural resources and soil health.

Once a need is identified, conducting additional Feasibility Studies may also be necessary to support development prioritization and implementation of projects and programs.
Water quality, hydrologic and hydraulic, as well as natural resource data show specific areas of focus for capital projects and programs that will provide the most cost-efficient load reductions based on drivers of impairments and threats to surface water quality and natural resources:

- Reduce export of soluble P and oxygen demand from wetlands
    - Clear Lake North Wetland
    - Lake Augusta upstream wetland
    - Clearwater River Upstream Wetlands for Louisa and Marie
    - Watkins wetlands
    - Cedar Lake subwatershed wetlands
    - Assessment of other wetland complexes
- Stabilization projects and programs to reduce erosion and sedimentation in streams lakes and wetlands. Projects can be in stream, lake shoreland or upland.
- Upland programs to prevent nutrient, sediment and bacteria transport to downstream waters and promote healthy soils, habitat, and strong yields for agricultural lands.
- Restoration and protection projects for high value resources such as the District's three trout streams.
- Legacy project retrofits.

Specific target projects and programs and implementation areas are identified in the subwatershed plans in Section 4 of this report. Annually, the District reviews progress towards subwatershed plans and adjusts course as needed. From time to time, new projects opportunities that meet District goals emerge. These are considered on an annual basis.

Capital Projects: Some key high priority projects are listed below and described in more detail in the subwatershed plans:

- Clear Lake North Watershed Load Reduction, the final remaining project not completed from the District's previous comprehensive plan.
- Lake Augusta Restoration.
- Thiel Creek Restoration/ Protection.
- Upper Clearwater River and Tributary Assessment and stabilization projects
- Annandale Wetland Treatment System Restoration.
- Watkins (south) Wetland Treatment System Restoration and Watkins Isolation Unit Restoration.
- Upland and gully erosion reduction, Chain of Lakes.
- Upper Watershed TSS/ Bacteria project implementation.

Capital Programs: Through the planning, data evaluation and public input process, the District has the following key elements of capital programs:

- The District will give special consideration to projects and programs that conserve nutrients and can provide a cost benefit for producers or are cost neutral.
- The District will work with staff, an appropriate TAC, the AC, county and SWCD staff, producers, co-ops, and crop consultants to:
    - Identify barriers to participation in existing programs and identify strategies to overcome the barriers.
    - Evaluate progress of created/ongoing programs annually.

Examples of the types of programs the District has and will include are described below; this is not an exhaustive list:

- *Perpetual vegetative buffer:* Landowners often cite the limitations on haying buffers in the CRP program as an impediment to their participation. While prohibiting haying may benefit wildlife, it is the maintenance of continuous vegetative cover that provides the bulk of the water quality benefits. The District program provides CRP-like incentives for buffers that could be hayed if a consistent vegetative cover was maintained. This may allow for expansion of perpetual vegetative cover in high priority areas to improve water quality.
- *Variable Rate Fertilizer Application:* The District will continue the cost share program to promote soil nutrient testing with variable rate fertilizer application. Most producers currently apply fertilizer at a constant rate across a given field. Soil tests show that the nutrient deficit varies considerably even within a single field. Gridded soil testing, funded all or in part by cost-share, shows more precisely where fertilizer is needed. Participants are not allowed to apply manure or fertilizer more than what soil tests indicate, as necessary.
- *Stormwater Support*: Stormwater from developed and residential areas of cities and townships can be a source of sediment nutrients in the District. When cities, townships and counties implement infrastructure or development projects on public properties, limited funding can impact the amount of stormwater management provided by these programs. The District has supported municipalities with technical evaluations for stormwater management opportunities and offered costs. Cities, counties and townships can approach the District early in a development/ re-development project and discuss stormwater opportunities and obtain technical assistance, design assistance, and cost share funds to enhance water quality beyond current regulatory requirements.
- *Odd Parcel Program:* Larger track farming equipment can make smaller, oddly shaped parcels difficult to farm. The District will identify oddly shaped parcels in high priory areas for perpetual cover grants.

- *Shoreland Education Program:* Partner with state and local government to provide education, outreach, and technical assistance for riparian shoreland residents of lakes, streams, and wetlands to prevent erosion.
- *Identify Other Opportunities:* The District will maintain staff and consultants necessary to develop and administer the programs and activities to meet water quality goals.

3.5 Education and Outreach

The previous generation of the District's Plan listed future actions the District would take such as maintaining an active website, participating in community fairs, and developing brochures.

The District created a website in the early 2000s. It was redeveloped in 2007 and again in 2019. The website is used to communicate about all things happening in the District. Board meeting agendas, minutes, public notices, District reports, project and program information can all be found on the website and is regularly updated.

The District created social media accounts through Facebook and Twitter in 2014 and developed a StoryMap with GIS in 2018 to create a District-wide outreach tool. The StoryMap will be refreshed in 2021 and updated annually.

One of the key elements for education and outreach in the District has always been building relationships through face to face proactive communication whenever possible, with residents, lake associations, county and SWCD staff as well as other federal, state and local regulatory partners. It is essential this practice continues so that foundational relationships are strong in advance of when partners need to collaborate for projects and programs.

The channels and frequency of communication varies, depending on specific needs at the time.

Table 2: Communication Plan Rubric

Stakeholder/ Communication Channel	In Person	Phone Call	Email	Direct Mailing	Editorial / Press Release	Website	Social Media
Elementary Fairs	Fund annual Environmental Education Days						
Lake Associations	Attend annual meetings	2 per year to lake assn president	Monthly board agenda	Notifications as required	Provide collateral for newsletters	Provide collateral for newsletters	Provide timely information throughout the year
CRWD Advisory Committee	Convene and attend 3 meetings per year.	As needed	Monthly board agenda and check ins	Notifications as required			
Lake Associations with active projects	Attend annual meetings, 1 additional visit per year	2 per year to lake assn president	Semi-annual budget updates and check ins	Notifications as required	Provide collateral for newsletters	Provide collateral for newsletters	
Counties and SWCDs	Participate in meetings and partner in projects and grants	Quarterly & as needed communicate proactively	Monthly Board Packets	Notifications as required			
LGUs	Participate in community fairs and expos	Annual	Monthly Board Packets	Notifications as required			
Ag Community	Meet in person when possible and necessary						Provide timely information throughout the year
BWSR	Attend meetings; partner through projects and grants	As needed	Send monthly Board agenda and minutes; Annual reports	Notifications as required		Promotion of Clean Water Legacy projects quarterly	Promotion of Clean Water Legacy projects quarterly

Stakeholder/ Communication Channel	In Person	Phone Call	Email	Direct Mailing	Editorial / Press Release	Website	Social Media
MPCA	Attend meetings; partner through projects and grants		Send monthly Board agenda and minutes	Notifications as required			
DNR	Attend meetings; partner through projects and grants	As needed for specific permits	Send monthly Board agenda and minutes	Notifications as required			
Federal Partners	As necessary for project development	As necessary for project development	As necessary for project development	Notifications as required			
All residents	As necessary to respond to questions	As necessary to respond to questions	As necessary to respond to questions	Notifications as required	2 press releases per year		
Sanitary Sewer Residents	2 per year site visits, as necessary	Quarterly check in with HOA lead		Quarterly Billings			
Upper Mississippi TAC	As necessary	As necessary	As necessary				
Residents – Shoreland				Annual mailings regarding projects and programs		Provide timely information throughout the year	Provide timely information throughout the year
Residents – Non-Shoreland				Annual mailings regarding projects and programs		Provide timely information throughout the year	Provide timely information throughout the year

3.6 Other Programs (OWOP, WRAPS, TMDL, other)

Load allocation for many of the District's 303 listed impaired waters were set through studies the District undertook in partnership with the MPCA in 2003. The Studies were approved in 2007, an implementation plan was approved in 2009.

The District is part of the Upper Mississippi River Watershed (HUC 07010203). The TAC for which has coordinated on TMDLs, the first round of WRAPs, and preliminarily on the OWOP process. The group is currently engaged in the second round of WRAPs and planning for OWOP. District staff will participate in these processes as they are deemed appropriate by the larger TAC.

Published TMDLs for the District are available on the MPCA's web site.

As new programs and initiatives are developed, the District will continue to be a strong partner in watershed health.

4.0 Priority Resources and Sub-watershed Plans

4.1 Priority Resources

This is a resource-based plan, broken into subwatersheds for implementation. Activities are identified and prioritized around specific resources and resource goals as prioritized by stakeholder input and validated by data.

The types of resources and general goals for each around them are summarized below.

Lakes	Protect and improve water quality and habitat. All District lakes meet state water quality and natural resource standards.
Streams	Protect and restore rivers, tributaries and trout streams. District streams meet state standards for water quality and natural resources.
Wetlands	Evaluate the role of wetlands in soluble P transport and oxygen demand and mitigate impacts. Protect and restore wetlands for habitat and hydrologic benefits and to protect downstream waters.
Soils	Implement programs to support resilience in soil health and soil conservation and reduce erosion.
Groundwater	Consider and quantify impacts on and benefits to groundwater of projects and programs.
Infrastructure	Stormwater conveyance, drainage, natural resource recreational infrastructure, as well as restoration project infrastructure are key resources in the District. Climate change dictates the need to consider long term stewardship and system lifecycles during management of water and natural resources and look for multiple benefits, and opportunities during implementation.

4.2 14-Digit HUC Sub-watershed 1-Page Plans

The subwatershed specific plans are summarized and tabulated. The watershed is broken into 5 12-digit HUCs for implementation purposes:

UPPER CLEARWATER RIVER- CLEAR LAKE TO LAKE BETSY

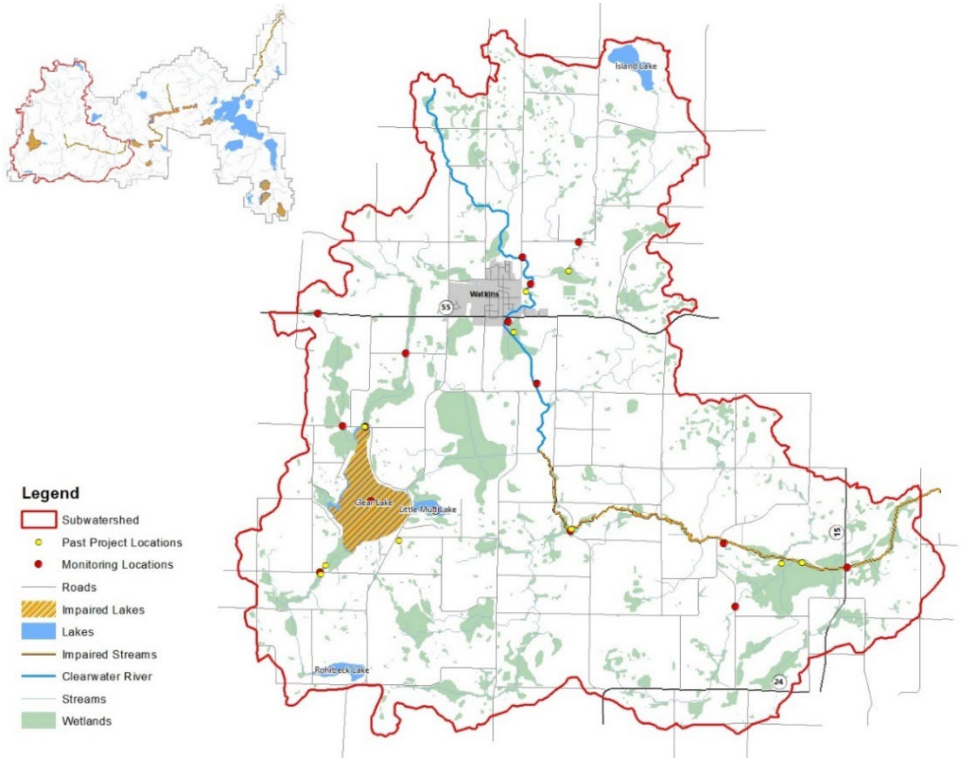


Figure 7: Subwatershed 30201

Priority Resources	Clear Lake, Clearwater River, County Ditches 44 and 20, Kingston Wetland
Impairments	Excess nutrients, sediment, bacteria, dissolved oxygen
Impairment Drivers	Wetland nutrient cycling, watershed runoff.
Monitoring	Maintain baseline sites, monitor for project design needs around wetland nutrient export
Projects	Clear Lake Restoration, Upper Clearwater River Stabilization, CD 20 & CD 44 restoration/ load reduction, Watkins Project restorations and retrofits.
Programs	Field-based BMPs
Implementation Schedule	0-5 years
Potential Partners	Clear Lake Residents, Meeker County, DNR, USFWS, Cities and Townships
Education and Outreach	School program through SRWD, field days, continue outreach through Co-ops. Lake association coordination and collateral development for newsletters.

MIDDLE CLEARWATER RIVER- LAKE BETSY THROUGH AUGUSTA, CLEARWATER RIVER

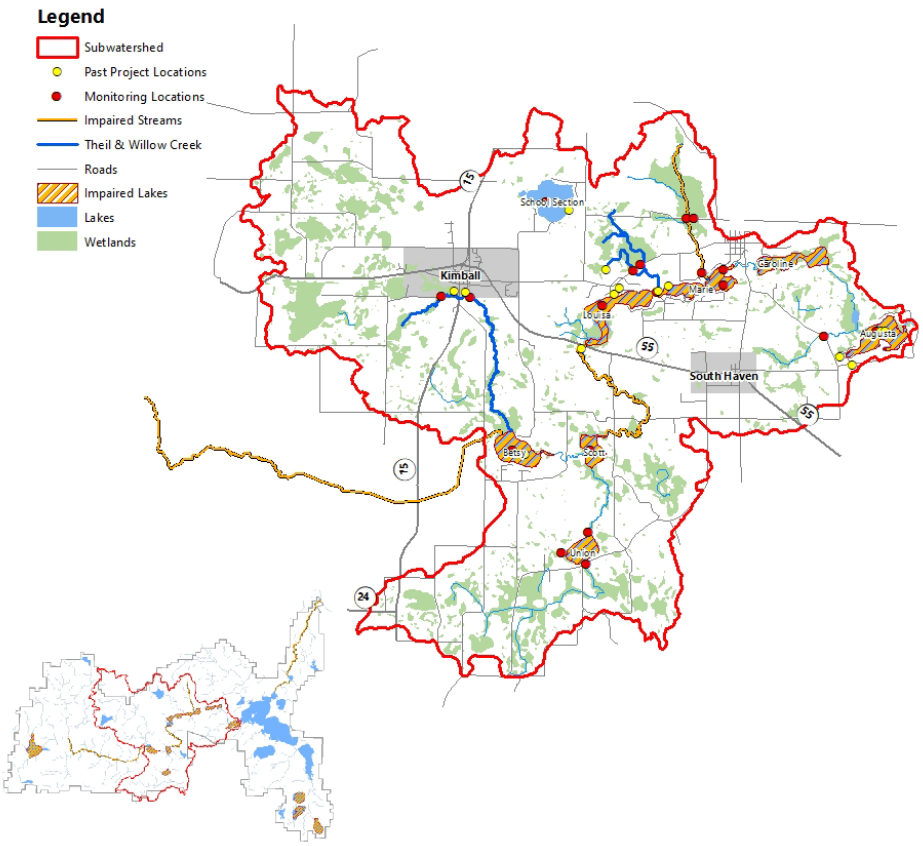


Figure 8: Subwatershed 30202

Priority Resources	Lakes Betsy, Scott, Louisa, Marie, Union, School Section, Caroline, and Augusta; Thiel Creek, Fairhaven Creek, Clearwater River
Impairments	Excess nutrients, aquatic life
Impairment Drivers	Upstream lakes and streams, internal loading, wetland loading, watershed runoff, rough fish.
Monitoring	Maintain baseline efforts, project specific monitoring for Lake Augusta, Lake Louisa and Lake Marie. Rough fish management. Expand monitoring on Thiel and Fairhaven Creeks for restoration and protection efforts.
Projects	Thiel and Fairhaven Creeks restoration and protection, Lakes Louisa and Marie restoration, erosion control projects. Protect and improve Willow Creek.
Programs	Shoreland erosion mitigation outreach, field based BMPs
Implementation Schedule	0-5 years
Potential Partners	Lake association, municipalities, counties
Education and Outreach	Lake association coordination and collateral development for newsletters. School age programs.

THREE MILE CREEK

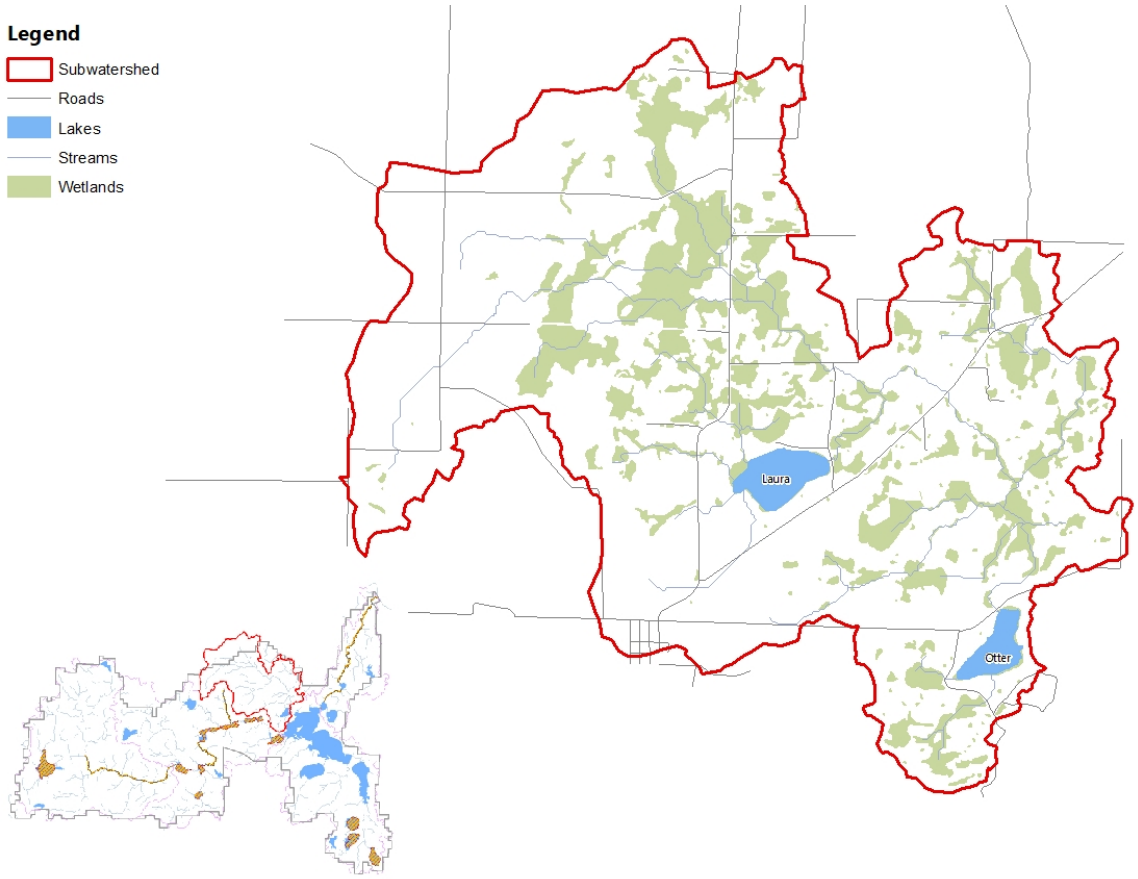


Figure 9: Subwatershed 30203

Priority Resources	Otter Lake, Three Mile Creek
Impairments	None
Impairment Drivers	NA
Monitoring	Minimal
Projects	None identified
Programs	Field based BMPs
Implementation Schedule	8-10 years
Potential Partners	Counties, townships
Education and Outreach	School age outreach.

CLEARWATER- CEDAR -PLEASANT

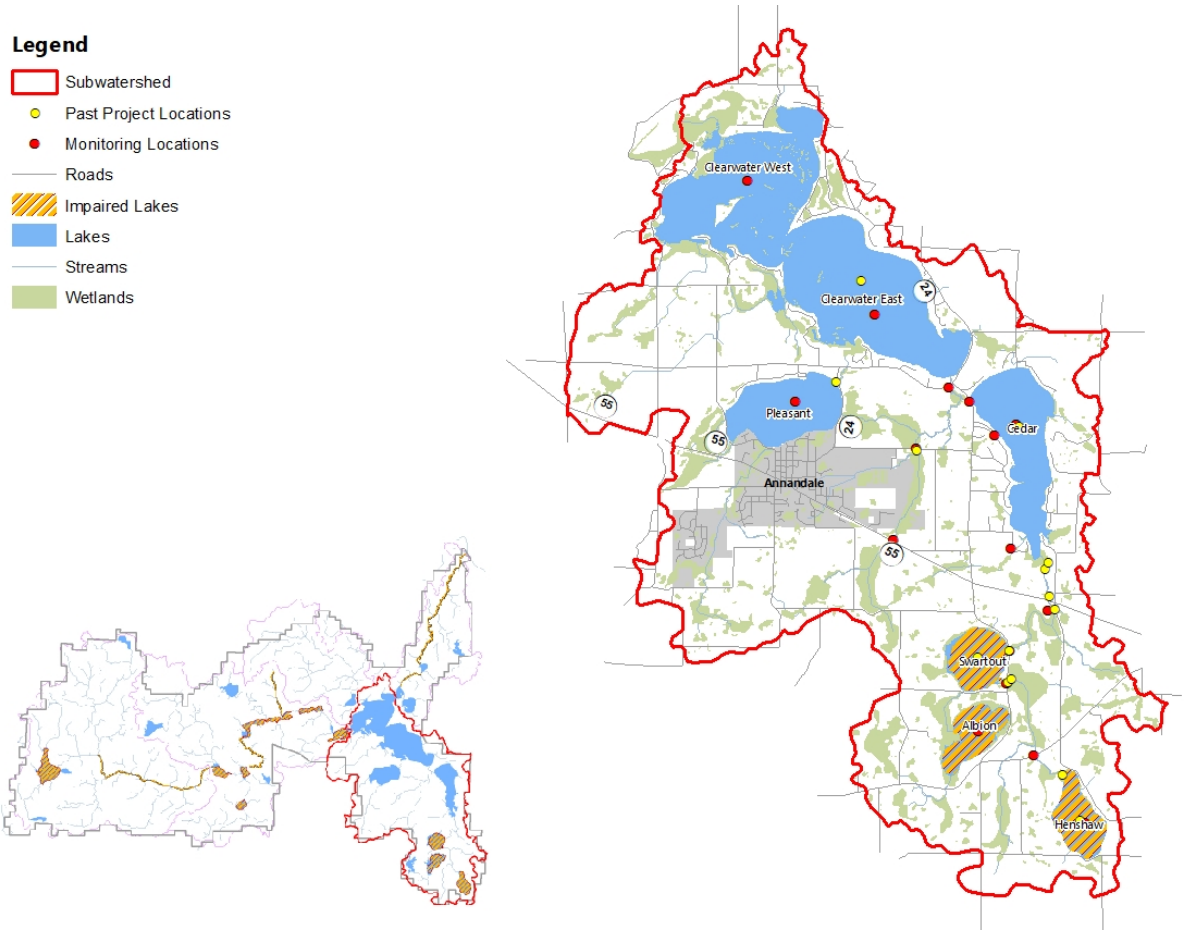


Figure 10: Subwatershed 30204

Priority Resources	Lakes Henshaw, Albion, Swartout, Pleasant, Cedar, Clearwater East, Clearwater West, Clearwater River
Impairments	Excess nutrients
Impairment Drivers	Internal loading, wetland nutrient cycling, rough fish, watershed loading
Monitoring	Baseline and project specific
Projects	On-going rough fish management, shallow lakes management plans, additional restoration projects, legacy project restorations
Programs	Field based BMPs
Implementation Schedule	0-10 years
Potential Partners	County, townships, Annandale, DNR
Education and Outreach	School age and lake association coordination and collateral development for newsletters, ag community and LGUs

LOWER CLEARWATER RIVER

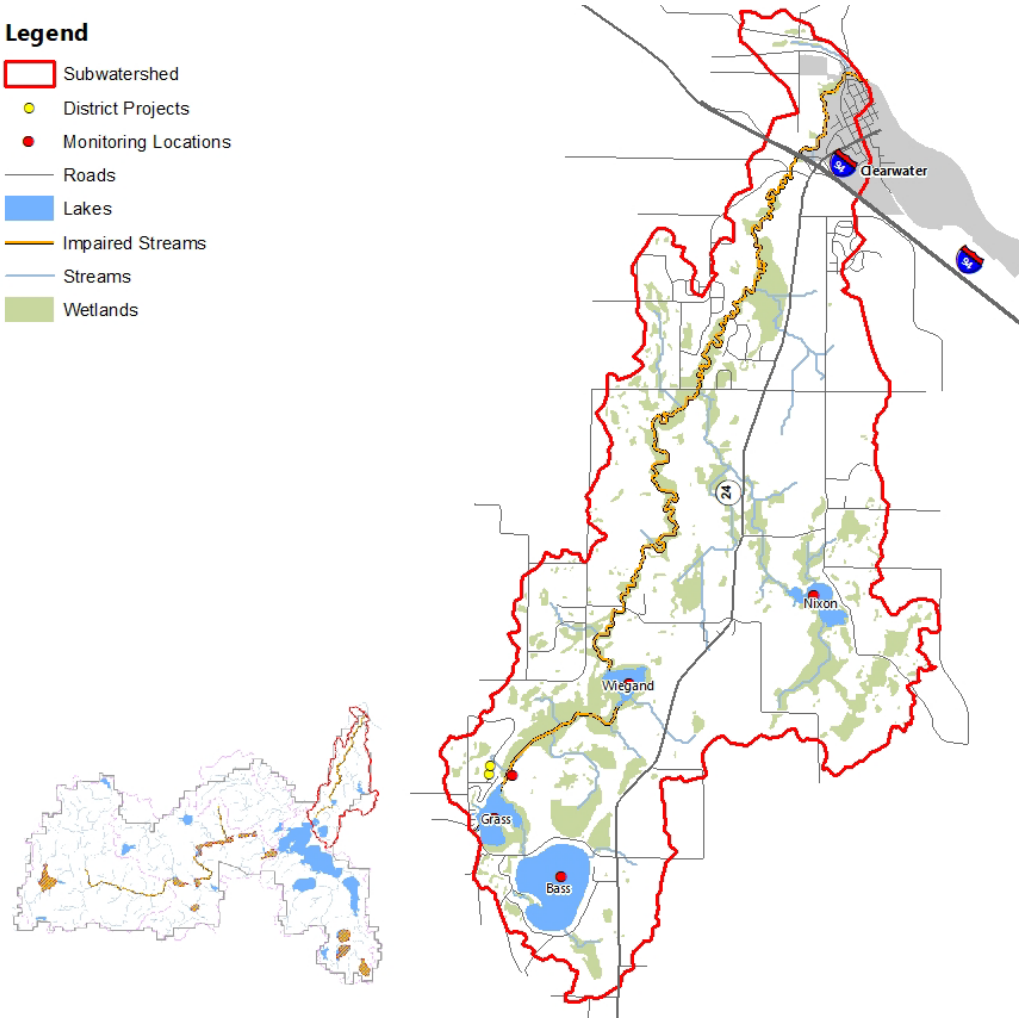


Figure 11: Subwatershed 30205

Priority Resources	Bass Lake, Grass Lake, Clearwater River
Impairments	Aquatic life, fisheries bio, and dissolved oxygen
Impairment Drivers	Low gradient stream, wetland loading
Monitoring	Baseline
Projects	Stream restoration
Programs	Field based BMPs
Implementation Schedule	5-10 years
Potential Partners	County, township, lake association
Education and Outreach	School age, lake associations, ag community, LGUs

5.0 Plan Implementation & Roles

The District prioritizes partnerships and collaborative projects and programs. The following is a listing of partners and roles and the impacts of this plan on them:

- SCWDs: The District may, from time to time, provide additional direct cost share or technical support for projects which align with District priorities. The District will coordinate closely with SWCD to offer support.
- Counties: The District will communicate regularly with county staff to provide updates or partner on projects.
- Lake Associations: Several lake associations have petitioned the District for Projects where the District serves as the fiscal agent and drafts project guidelines. These projects consist of AIS or Bog management projects. The District will continue to support lake associations on these projects and other protection and restoration efforts.
- Cities/ Townships: The District will coordinate and communicate with cities and townships to offer support in cultivating resilient stormwater management and from time to time may provide technical support or direct cost share. Where source water protection overlaps with surface water and natural resources goals, these projects may be prioritized. Source water protection areas exist in the cities of Annandale, Clearwater, and Kimball.

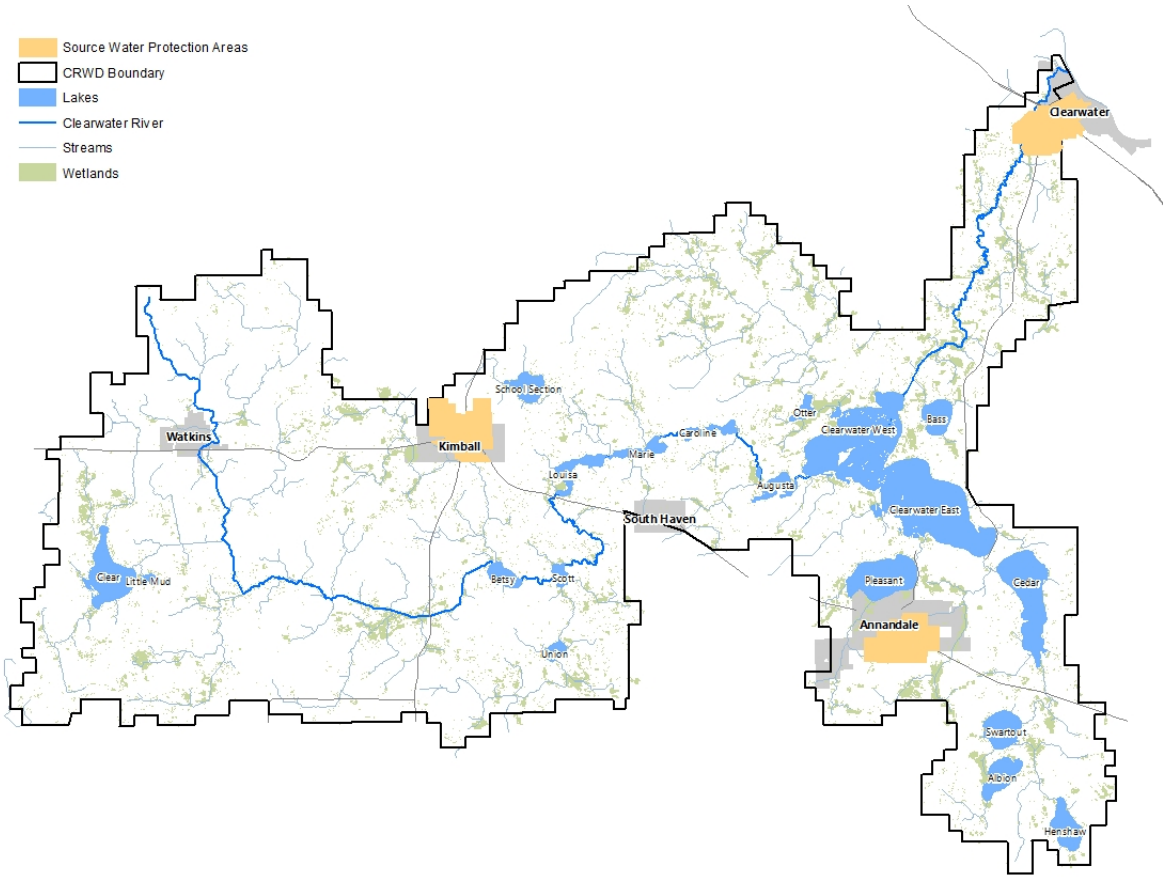


Figure 12: CRWD Source Water Protection Areas

- State & Federal Agency Partners: Coordinate with state and federal partners on projects. Review and process permits needed for project implementation or maintenance. These partners may be asked from time to time to participate in TAC/ Regulatory Advisory projects during project development.

6.0 Using and Amending this Plan

This Plan provides direction to CRWD for management activities through the year 2030. The Board may initiate amendments to the Plan at any time based on new requirements, policies, programs, or practices.

The Plan provides preliminary estimates of costs for subwatershed projects and programs outside of core functions, administration, and monitoring through 2030. The Board will annually review core activities and subwatershed implementation activities which may result in future minor or major Plan amendments. The Board may choose to respond to changes in watershed conditions, to improve or clarify language, or to provide more specificity for projects and programs.

Specific goals within this plan call for more detailed, in depth periodic reviews with respect to plan elements which may include:

- Climate Change
- Operation & Maintenance
- Emerging Issues
- Design Standards
- Monitoring Plans/ Data
- Finances and Administration

These detailed reviews will be conducted every three years and will be conducted in more detail than the annual planning.

The managers may initiate an amendment of a watershed management plan or revised watershed management plan by submitting a petition with the proposed amendment to the board of the Board of Water and Soil Resources. The BWSR board must give notice and hold a hearing on the amendment in the same manner as for the watershed management plan. After the hearing, the BWSR board may, by order, approve or prescribe changes in the amendment. The amendment becomes part of the watershed management plan after approval by the BWSR board. The BWSR board must send the order and approved amendment to the entities that receive an approved watershed management plan under section 103D.401, subdivision 5.

APPENDIX A: History of Projects in the Clearwater River Watershed District

(www.lakenwoods.com, n.d.)

History of Projects in CRWD

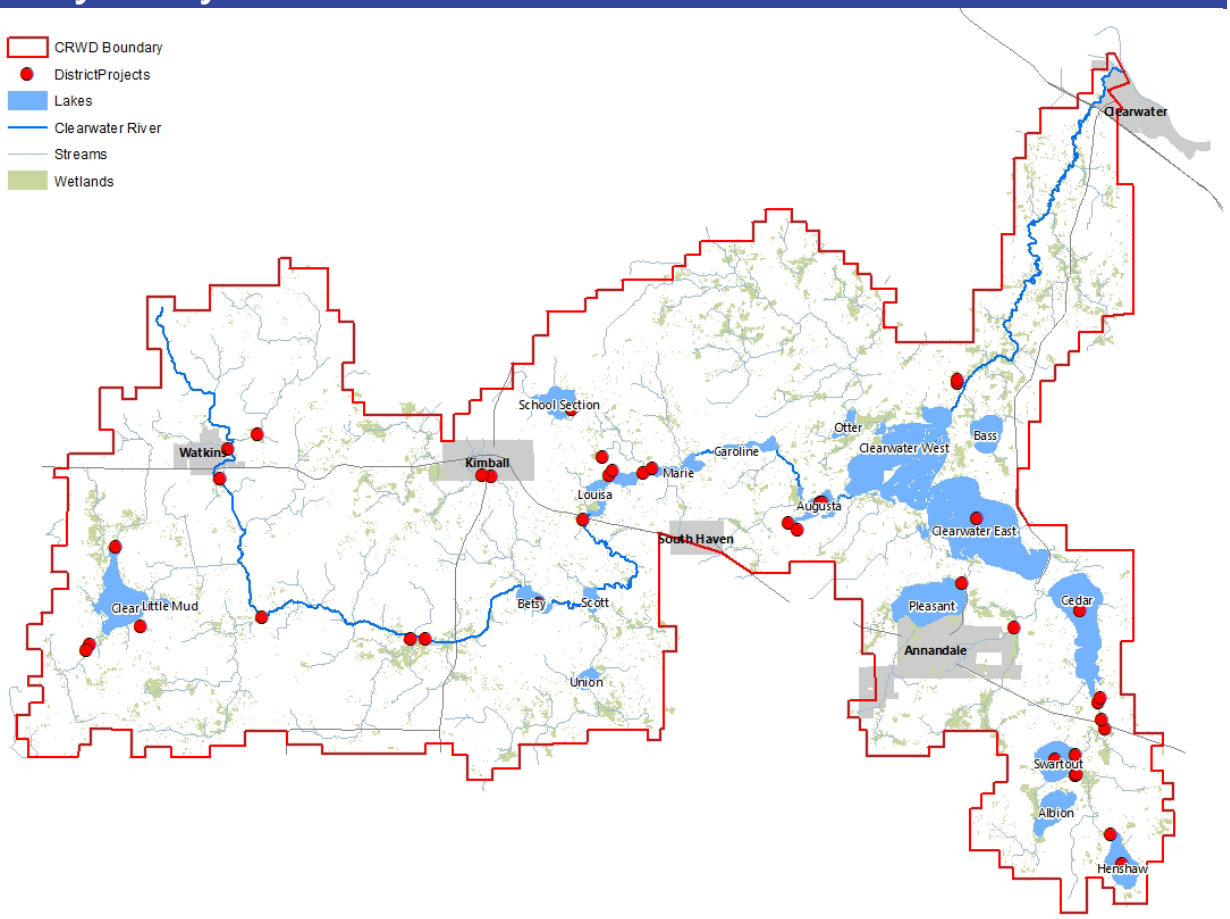


Figure A- 1: CRWD Projects Map

1980's Clearwater River Chain of Lakes Restoration Project

The Clearwater River Chain of Lakes Restoration Project is a series of lake and watershed restoration measures, which included monitoring, modeling, projects and programs, undertaken to improve the water quality of the Clearwater River Chain of Lakes and the Clearwater River. Clearwater Lake, Grass Lake, Lake Augusta, Lake Caroline Millpond, Lake Marie, Lake Louisa, Scott Lake and Lake Betsy and the Clearwater River each saw measurable improvements from the project as a whole. Individual project elements included:

Watkins Isolation Project & Watkins Wetland Treatment System

Wetlands are natural traps for phosphorus and other nutrients that promote over-abundant algae in lakes. Forcing the inflowing water to spread over the whole wetland (rather than following a channel) when flows are moderate or low can increase settling and nutrient sequestration. This is the principle of the three wetland treatment systems that form the backbone of the lake restoration project and the Watkins Wetland Treatment System.

Because wetlands are natural traps for phosphorus, they can grow overloaded with nutrients and sediments can, from time to time, consume oxygen in the water column needed to support aquatic life as well as discharge soluble phosphorus. This was the case in the Watkins Isolation Project, where the overloaded wetland was isolated from streamflow to reduce downstream loads.

County Ditch 20 Wetland Treatment System

The County Ditch 20 Wetland Treatment System contains approximately 40 acres of wetlands that are served by a diversion structure and two channels. A total of approximately 7,000 feet of diversion channels distributes the contaminated runoff over the wetland. The approximate expense of this project is $200,000 and it was completed in late 1984. This wetland system removes approximately 1,000 pounds of phosphorus annually.

Kingston Wetland Treatment System

The Kingston Wetland Treatment System is the major facility of the project and contains nearly 300 acres of wetland. Over 19,000 feet of diversion channels have been constructed, with more than 150 distribution pipes installed along the length of the channel. The construction cost of this project was approximately $394,000 and it was completed in 1985. The system removed 5,600 pounds of phosphorus annually.

Annandale Wetland Treatment System

The Annandale Wetland Treatment System consists of approximately 40 acres of wetlands in two locations, with 4,600 feet of diversion ditches. The approximate construction expense of this project is $120,000 and it was completed in late 1984, with an approximate phosphorus removal capacity of 750 pounds per year.

Lake Augusta Erosion Control Project

The Lake Augusta Erosion Control Project was completed in 1982 at a cost of approximately $133,000. This project alleviates a serious erosion problem into Lake Augusta and has an estimated phosphorus removal capacity of 40 pounds per year by impounding water on a field, and then dropping it down to the bottom of the ravine to avoid overland flow and associated erosion. The project was repaired in 2017.

Non-Point Source Pollution Abatement Project

The Non-Point Source Pollution Abatement Project was added to the Restoration in 1985 and was later extended to 1993. This project aimed to institute farming practices that will protect the public from water quality degradation while at the same time reducing soil loss, lowering farm operating costs and increasing profits. The infrastructure developed to implement this was the Tri-County Conservation Project (TCCP), composed of the

Steams, Meeker and Wright Soil and Water Conservation Districts, along with CRWD. To demonstrate conservation tillage practices, a no-till drill was purchased. Also, tillage demonstration plots have been used. A local farmer's group was formed to provide grassroots input on implementing conservation practices through the project. Critical erosion and nutrient export areas were identified using a computer model. Runoff and groundwater monitoring - including pesticide impacts - was conducted. The project with a budget of some $1.5 million, worked through cooperation among individual farmers, the agri-business community, the TCCP member districts, Minnesota Pollution Control Agency, Board of Water and Soil Resources, Agricultural Extension Service, U.S. Soil Conservation Service, Environmental Protection Agency and others.

Lake Augusta Hypolimnetic Aeration System

The Lake Augusta Hypolimnetic Aeration System was installed in Lake Augusta during 1985 at an approximate cost of $262,000. In addition to assuring increased fisheries, the system removed an estimated 280 pounds of phosphorus annually while operational by maintaining near-bottom oxygen and thereby suppressing phosphorus release from the sediments. This system has been removed. The phosphorus removed by this aeration system has been replaced by other project elements.

Upper Lakes Aeration and Mechanical Fish Removal Project

The Upper Lakes Aeration and Mechanical Fish Removal Project include the hypolimnetic aeration of Lakes Louisa and Marie. These aerators were installed in 1985-1986. In addition, mechanical removal of rough fish (carp, bullhead, etc.) was performed on Lake Betsy, Scott Lake, Union Lake, Lake Louisa, Millpond and Lake Marie during the fall of 1984 and the spring and fall of 1985-1988. Being bottom feeders, rough fish mix large amounts of nutrients into the water from the sediments. The estimated cost of this project is $285,000 and it removes an estimated 1,800 pounds of phosphorus annually. This system has been removed. The phosphorus removal by this system will be replaced by wetland treatment systems.

Monitoring Program

From 1981 through 1992 a monitoring program including lake and stream water quality, stream flows and precipitation (beginning in 1983) was part of the lake restoration project. The monitoring program helped bring about important modifications including the addition of the Upper Watkins Wetland Isolation and the Nonpoint Source Pollution Abatement Projects. The Upper Watkins Wetland Isolation Project was added to the project in 1983. Formerly, untreated Wastewater from a cheese plant discharged into the Upper Watkins Wetland. This transformed the wetland from a nutrient trap (its natural state) into a nutrient source - in fact, the largest nutrient source in the entire watershed. The project diverts runoff and channel flow around the edge of the wetland and includes more than 11,000 feet of isolation dikes and channels, plus

overflow structures; and ditch crossings. The estimated expense of this project is $460,000 and it was completed in late 1984. It has resulted in a phosphorus load reduction of approximately 30,000 pounds annually.

Pleasant Lake Outlet

The outlet from Pleasant Lake was reconstructed to increase the outflow capacity in order to alleviate excessively high lake levels there. The project, initiated by local petition, was completed in early 1985 at an approximate cost of $48,000. The outlet was repaired in 2019.

School Section Lake Outlet

To alleviate flooding of homes and farmland, an outlet was constructed from School Section Lake in late 1984. The lake has no natural outlet, and it rose seven feet during 1983-1984, mainly because of a rising water table. The cost of the outlet was approximately $255,000. The outlet was repaired in 2018 at a cost of $101,000.

Augusta-Clearwater-Grass Lake Bog Control Project

After two years of very high water that caused severe floating bog problems in these lakes, necessitating several emergency bog removal projects, a bog control project was set up with the cooperation of the lake property owners involved. That project includes acquisition and improvement of access areas for bog removal and the funding and process for removal of floating bogs deemed harmful. Estimated cost for the project is $17,000. It was initiated in the summer of 1985.

Clearwater Lake Eurasian Water Milfoil Control Project (replaced by the Clearwater Lake AIS Project)

Eurasian Water Milfoil (EWM) was discovered in Clearwater Lake in 1989. For several years, the Clearwater Lake Property Owners chemically treated (under state permit) the identified EWM areas of the lake. In 1993, the CRWD initiated this project to help the EWM control effort through funding for chemical (2,4-D) purchase and incidental costs, with the property owners continuing to provide volunteer labor for the application. The estimated project cost is $148,000 for the years 1994-1998. This project was subsumed by the Clearwater Lake AIS Project and all funds were transferred to that project in 2020.

Clearwater Lake AIS Project

Between 1994 and 2019 the Clearwater Lake Eurasian Water Milfoil project funded the treatment of EWM in Clearwater Lake. The Clearwater Lake Property Owners petitioned the District in 2018 to implement a broader project which included not only treatment of EWM but also early

detection and treatment of all AIS. Treatment regimen now also includes treatment of Curlyleaf Pondweed. The new project was initiated in 2019.

Lake Augusta AIS Project

In response to the infestation of Eurasian Watermilfoil in Lake Augusta, the CRWD undertook the Lake Augusta Milfoil Treatment Project to control Eurasian Watermilfoil in Lake Augusta. The District acts as fiscal agent for this project. Treatment of Eurasian Watermilfoil is carried out by the Lake Augusta Association under the guidance and direction of the Minnesota Department of Natural Resources.

In 2013, the Board of Managers of the District was petitioned by Lake Augusta Residents to amend the Lake Augusta Eurasian Watermilfoil Project to an Aquatic Invasive Species (AIS) control Project. On March 12, 2014, after preparation of a Technical and Cost Specifications Report, and upon review by the Board, a public hearing was held to amend the project. That same day, the Board moved to amend the project, allowing for the control of all aquatic invasive species under this project. The new title for this project is Lake Augusta Aquatic Invasive Species (AIS) Project #01-2.

City of Kimball Phase I & Phase II Stormwater Retrofit

CRWD constructed two phases of stormwater projects in the City of Kimball, MN to provide stormwater treatment and reduce flooding. CRWD received a $738,750 2012 BWSR Grant for the Kimball Stormwater Phase II Project. Construction was completed in 2014. The project provides for pretreatment and infiltration of city stormwater to promote baseflow to a nearby trout stream. Stormwater capture and secondary re-use designed into Phase II of the project which benefits the trout stream as well as recreational opportunities within the city park and the City's clean drinking water supply.

Bass Lake AIS Project

The Bass Lake Association of Wright County (BLAWC) petitioned the CRWD in October 2018 to establish a project for the detection, control, and management of AIS. The group had been treating the lake for Curly Leaf Pondweed under the supervision and direction of the MN Department of Natural Resources (MNDNR).

The CRWD produced an Engineer's Report to analyze the options for implementing this project with different budgets for the BLAWC to consider. The project was approved to move forward at the December 2019 CRWD Board Meeting.

Watkins Stormwater Project

The CRWD secured a Clean Water Fund Grant of $351,906 from MN Board of Water and Soil Resources, through the Clean Water, Land, and Legacy Amendment in April 2015 to finalize design and construct the Watkins Stormwater Project.

This project targeted a 796 pound annual phosphorus reduction by treating runoff from a 6,500 acre urban and agricultural drainage area north of Watkins, Minnesota which drains to County Ditch 20 and the Clearwater River. The project treats runoff from about 60% of the drainage area to the DO and bacteria impaired Clearwater River, and about 15% of the drainage area to nutrient impaired Lake Betsy.

Two offline filtration/ settling basins were constructed to remove sediment and nutrients from ditched flow. The CRWD had previously purchased the land and developed the project. The project represents a 10% reduction of the non-point source phosphorus load to Lake Betsy, while nutrient load reduction will improve improving water quality in the Clearwater River and other upstream lakes.

Henshaw Lake Outlet Repair: 2020

The road around the corrugated metal pipe (CMP) culvert outlet of Henshaw Lake was eroding, and the pipe was corroded. The District partnered with Albion Township to replace the outlet to ensure the elevation was preserved, and the carp migration barriers were replaced.

Cedar Lake Project, #06-01

The Clearwater River Watershed District was petitioned by the Cedar Lake Conservation Club on July 12, 2006 to develop and implement measures designed to reduce the phosphorous loading and carp population in Cedar Lake. Based on several years of monitoring, historical data, and the input of affected property owners, the Cedar, Albion, Swartout, Henshaw Project #06-1 (CASH P#06-1) was created.

This project was amended by Board action in 2013 to implement the Cedar Lake Watershed Protection and Improvement Project. Follow the links to the right and below to learn more about the project and subsequent amendments.

- Segner Pond- An in line soluble phosphorus filtration system.
- Highway 55 Project- An in line soluble phosphorus filtration system.
- Rough Fish Migration Barriers and Physical Removal.
- Swartout iron enhanced sand filter (IESF).

Clearwater River/ Kingston Wetland Restoration

The Kingston Wetland Project was originally constructed back in the mid-1980s to provide treatment of the Clearwater River as part of the 1980's Clearwater River Chain of Lakes Restoration Project. As part of the District's TMDL Implementation efforts, the Kingston Wetland

Feasibility Study and Restoration Project was designed and implemented to extend the original project's useful life and provide on-going water quality benefits to downstream waters. The restoration project seeks to:

- Address a dissolved oxygen (DO) impairment in this section of the Clearwater River
- Restore natural ecology and hydrology in the wetland and river
- Maintain the wetland's particular phosphorus treatment capacity while addressing the exportation of soluble phosphorus from the wetland during low-flow conditions

The District secured a Section 319 Nonpoint Source Management Fund grant for $404,000. The project was constructed in late winter - early spring of 2013. Major project components include: a restored low-flow meandered channel, a rock riffle pool, and a limestone filter berm.

Results of Project:

- DO: Pre-restoration 59% of samples collected at all times of day violated the DO standard. Post-restoration only 27% of samples violated DO standards.
- Total Phosphorus (TP): Pre-restoration (2001-2012) avg TP concentration at monitoring station below Kingston Wetland Complex was 308 ug/L. Post-restoration (2013-current) was 199 ug/L (arithmetic mean). TP load reductions are estimated to be 1,955 lbs. annually.
- Soluble Phosphorus (OP): Pre-restoration (2001-2012) avg OP concentration at monitoring station below Kingston Wetland Complex was 156 ug/L. Post-restoration (2013-current) was 100 ug/L (arithmetic mean).
- Hilsenhoff Biotic Index (HBI) scores, which is used to track ecological functions, greatly improved in the Clearwater River post-restoration as compared to pre-restoration (8.26 in 2012, 6.08 in 2014). Over the same time period, percentage of intolerant macroinvertebrates species increasing from 0.00% to 1.59% of total sampled, pollution tolerant species decreased from 35.22% to 18.73%, and super-tolerant species decreased from 55.66% to 6.03%. (For comparison, HBI scores from other low gradient streams in MN ranged from 5.8 to 8.8; the best achievable goal for the Clearwater River in this section is 5.8).
- Approximately 6,100 lineal feet of the Clearwater River's channel was restored to a meandering low-flow channel from its previously-ditch state. During high flows, the river accesses the wetland complex via an existing diversion channel around the edge of the wetland, along with overtopping the low-flow channel. This maintains the particulate phosphorus capacity, while addressing the sediment oxygen demand in the wetland during low-flow conditions that was a large driver of the dissolved oxygen impairment in the Clearwater River below the wetland.
- A limestone filter berm was installed at the outlet of the wetland to remove soluble phosphorus during low flow conditions.

Clear Lake Restoration 2004- present

At the upstream end of the Watershed District, Clear Lake is the first lake is tributary to the Clearwater River. Improving water quality in Clear Lake has always been a priority for the District and for lake shore residents and the greater community. There is a long history of community engagement in restoration of this lake:

- Poor water quality in Clear Lake prompted the property owners around Clear Lake to file a petition in 1987 with the District to correct the problem. A diagnostic and feasibility study was needed to investigate causes of the lake's problems and determine appropriate remedial action. Toward this end the District applied for a Clean Water Partnership state grant in 1988, but no grant was offered. Nevertheless, the property owners with volunteer labor and limited financial support from the District and Meeker County undertook a scaled-down study and restoration efforts including converting from septic systems to regional wastewater treatment.
- 2009 TMDL study identifies additional loading sources (plan to assess internal loading)
- 2009 CRWD 10-year plan updated to include project on north side of Clear Lake to address Soluble Phosphorus.
- 2012 Internal Load Study identifies external nutrient sources.
- 2012 Clear Lake South Project to address external soluble phosphorus loading from watershed wetlands.
- 2013 Preliminary feasibility completed to retrofit north weir with filter- lack of property owner interest & flat terrain limited.
- 2017 Updated Lake Response Model for Clear Lake to assess the need for internal load management relative to other District lakes.
- 2009-2018 programs targeting nutrient & sediment load reductions from agricultural land use.
- 2018 Continued Partnership with CLPO to secure grant funding to collect additional data to partition loads between watershed sources, and wetland sources.

As part of the District's efforts to increase the water quality in this lake, programs in the upper watershed were augmented by two capital projects:

- **Clear Lake North Notch Weir:** , A V-Notch Weir was installed on the northern tributary to the lake, near the public access. The purpose of this weir is to temporarily impound water during rain events over a 24-36 hour period. By doing so, this allows any water-born sediment a chance to settle out of the water column before entering Clear Lake. The project reduces phosphorus loading to Clear Lake by 575 lbs. annually and provides wetland restoration benefits to 50 acres of drained wetlands.

There is a planned expansion of this project during the next planning cycle to incorporate soluble P removal from the influent area.

Clear Lake South Notch Weir and Iron Enhanced Sand Filter: A Notch Weir was installed on the southern tributary (County Ditch No. 44) to the lake, along 355th Street. The purpose of this weir is to temporarily impound water during rain events over a 24-48 hour period. By doing so,

this allows nutrients to settle and filter before entering Clear Lake. An easement for this project was secured in 2011. The project was constructed in 2012, and monitoring of its effectiveness continues. The project is estimated to provide 588 lbs. per year of phosphorus reduction.

Targeted Fertilizer Application Project

The District secured a Federal 319 grant in 2012 which funded soil tests for priority fields on a 2.2 acre grid across up to 16,000 acres of critical cropland to determine the proper amount of fertilizer to be applied to each section of the field. The applicator used the results of the soil tests and GPS technology to apply the precise amount of fertilizer in each grid of the fields. A 10% average reduction in fertilizer application rates was obtained on test plots in the area as part of a successful small-scale pilot program started in 2009.

Priority crop land were those fields located in the upper watershed that drains to Clear Lake and Lake Betsy, which exports a significant phosphorus load to downstream lakes and those in sensitive areas for agricultural runoff, based on proximity to water bodies, slope, and soil type. These criteria were specifically in line with the CRWDs approved TMDL Implementation Plan.

The program was successful and local coops promoted the practice throughout and outside the boundaries of the District. The program was expanded to cover the entire watershed in 2020 with updated criteria and cost share.

Alternative Intake Pilot Project

Between 2015 and 2018, CRWD partnered with farmers and contractors to install the alternative intakes in priority lands to provide the highest cost/ benefit. Priority crop lands were those fields located in the upper watershed that drains to Clear Lake and Lake Betsy. This area exports a significant phosphorus load to downstream lakes and those in sensitive areas from agricultural runoff, based on proximity to water bodies, slope, and soil type. These criteria are specifically in line with the CRWDs approved TMDL Implementation Plan. The CRWD worked with contractors to recruit participants. A federal 319 grant funded installation of the alternative tile inlets.

Upper Watershed TSS and Bacteria Projects Phase I & II

In 2015 District staff and engineer updated an existing bacteria and TSS source inventory through a desktop survey and field reconnaissance. The project goal was to identify and prioritize project locations to reduce sediment and bacteria loading to the Clearwater River which is impaired for bacteria and sediment. Participants were recruited as high priority projects were identified. Projects were prioritized for preliminary design based on their potential for load reduction to the Clearwater River. The project was funded through an MPCA Clean Water Partnership grant.

Clearwater River Restoration, Conservation Corps

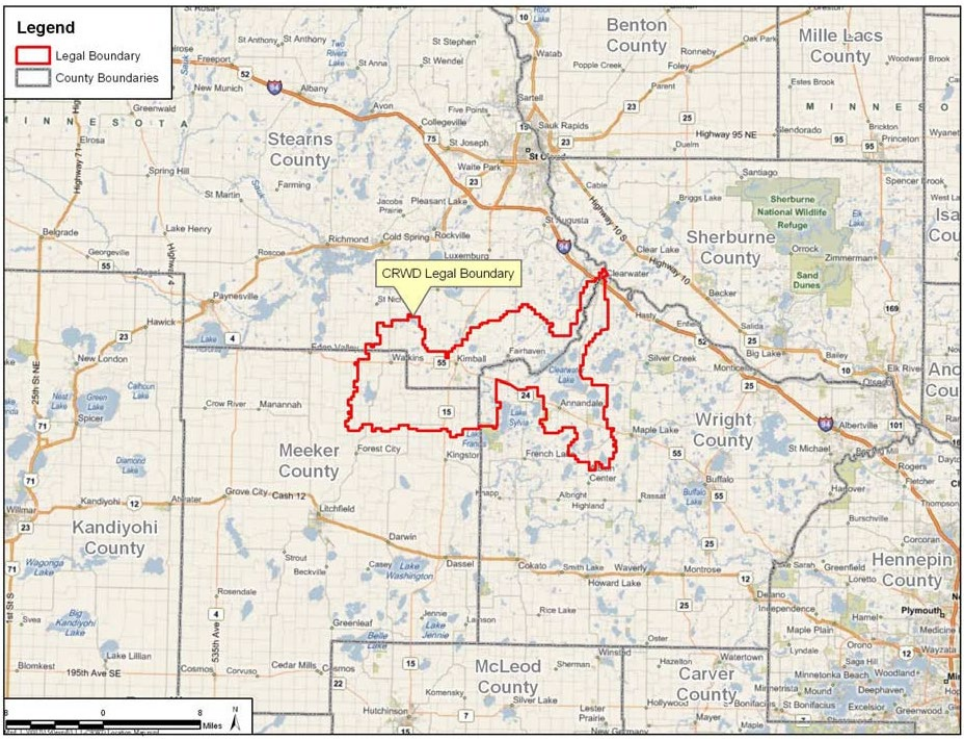
This project entailed evaluating and prioritizing restoration sites along the River upstream of Lake Betsy. On-site native materials to provide toe protection. Selective canopy thinning

allowed understory vegetation to further stabilize channel banks. This project was ongoing as labor was available.

APPENDIX B: Land and Natural Resources Inventory and Assessment

Clearwater River

WATERSHED AREA



The watershed, with its 7,336 acres of lake basins, has its eastern boundary located about 40 miles northwest of the west edge of the Twin Cities Metropolitan Area.

Figure B- 1: CRWD Location

The District is situated generally in northeastern Meeker County, southeastern Stearns County and northern Wright County. The area of the District is 158.8 square miles; 46.1 square miles in Meeker County; 54.2 square miles are in Stearns County, and 58.5 square miles are in Wright County. The District extends 22½ miles from east to west and 16½ miles from north to south:

The watershed of the Sauk River is adjacent to the west end and to the west part of the north side of the Clearwater River Watershed District. Adjacent to the south side of the Clearwater River Watershed District is the watershed of the North Fork of the Crow River. For the most part, the watersheds of Fish Creek and Silver Creek, Plum Creek and Johnson Creek which are small drainage areas also border the Clearwater River Watershed.

The Clearwater River Watershed District encompasses the entire drainage area of the Clearwater River. It includes portions of Meeker, Stearns and Wright Counties in 'Central Minnesota and the municipalities of Watkins, Kimball and Annandale, as well as all or parts of various townships.

The lakes through which the Clearwater River flows are divided into an Upper and Lower Chain by the Fair Haven dam. The Upper Chain includes Lakes Betsy (Betty), Union, Scott, Louisa, Marie. The Lower Chain includes Lakes Caroline, Augusta, Clearwater, Grass and Wiegand. Other major lakes in the District are: Clear Lake, Willow Lake, School Section Lake, Pleasant lake, Cedar Lake, Bass Lake, Swartout Lake, Albion Lake and Otter Lake.

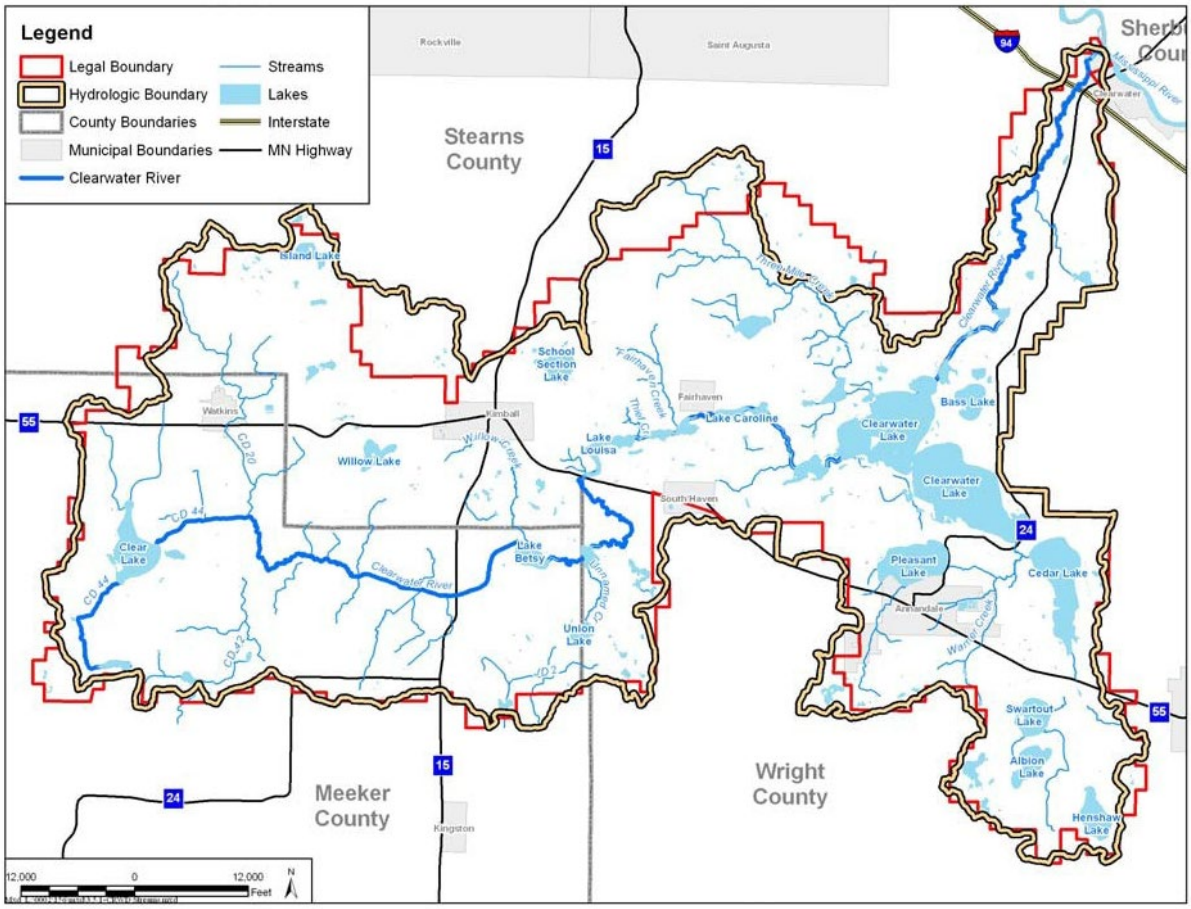


Figure B- 2: Water Resources within CRWD

The Clearwater River begins southwest of Watkins and is joined by a tributary known as County Ditch 20 as it meanders south, then east; where it enters the Upper Chain of Lakes. It flows north and under State Highway 55 between Kimball and South Haven, then the general direction of flow through the chain is east, then northeast out of Clearwater Lake, through Grass and Wiegand Lakes, and on into the mighty Mississippi at the City of Clearwater.

The following political units are located totally or in part within the boundary of the CRWD: Wright County, Stearns County, Meeker County, City of Watkins, City of Kimball, City of South Haven, City of Annandale, Lynden Township, Fair Haven Township, Forest Prairie Township, Maine Prairie Township, Kingston Township, Corinna Township, Luxemburg Township, and Southside Township.

TOPOGRAPHY

General

The topography of the area is dominated by rolling glacial moraines. The western portion of the watershed is composed of morainal hills, which have a high clay content. The area to the east is flatter and consists of sandier outwash and less clay. The elevation of the area ranges from 1220 feet in the west to 940 feet at the Mississippi River.

The headwaters of the Clearwater River is located in Meeker County at an elevation of about 1,160 feet, and the flow is generally northeasterly and easterly to Clearwater Lake, thence northeasterly to its outlet into the Mississippi River at the City of Clearwater. The river is about 39 miles long with a channel gradient of about 10 feet per mile between Clear Lake and Betsy (Betty) Lake in Meeker County. From Betsy (Betty) Lake to the outlet into the Mississippi River, the channel has a gradient of about 3.8 feet per mile.

Clearwater River

Land Use

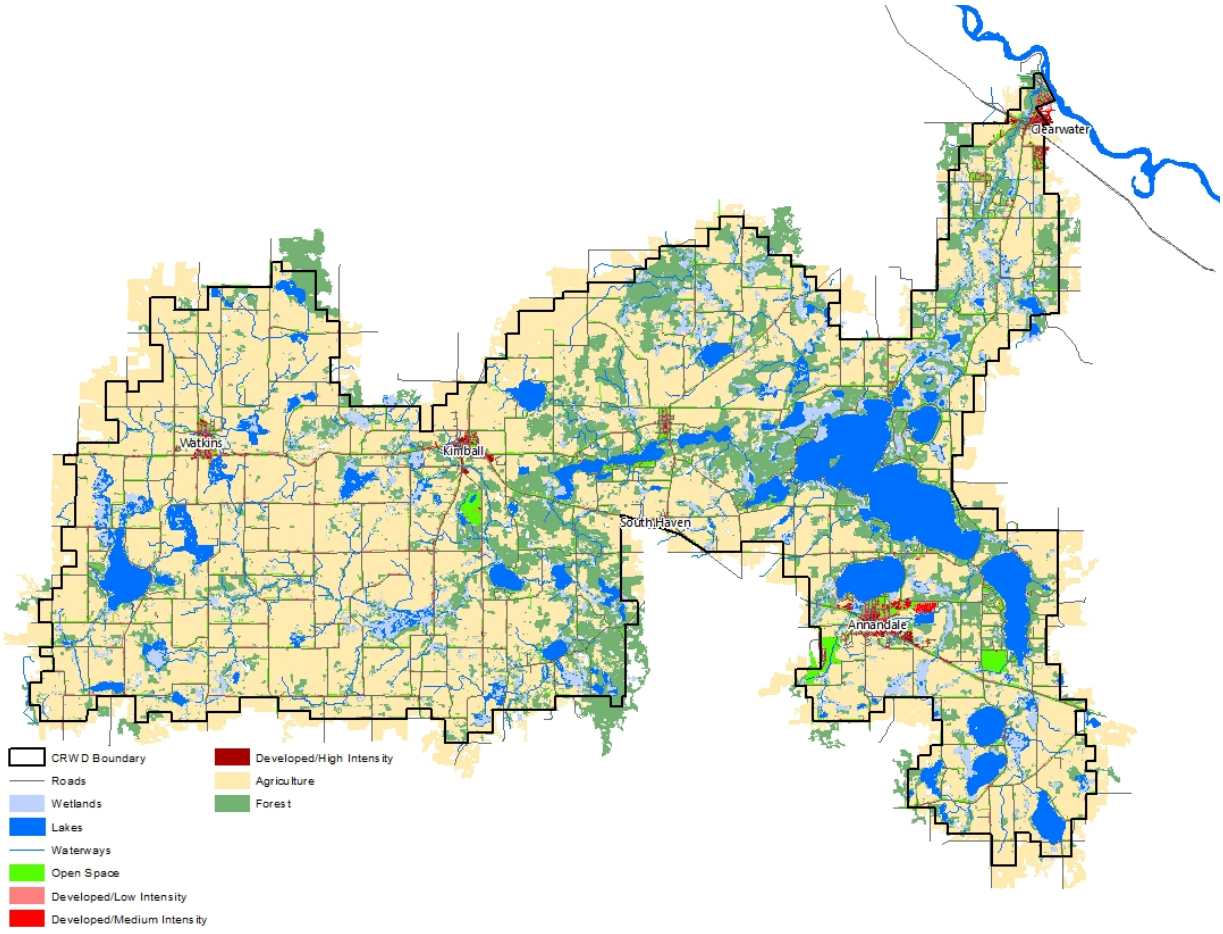
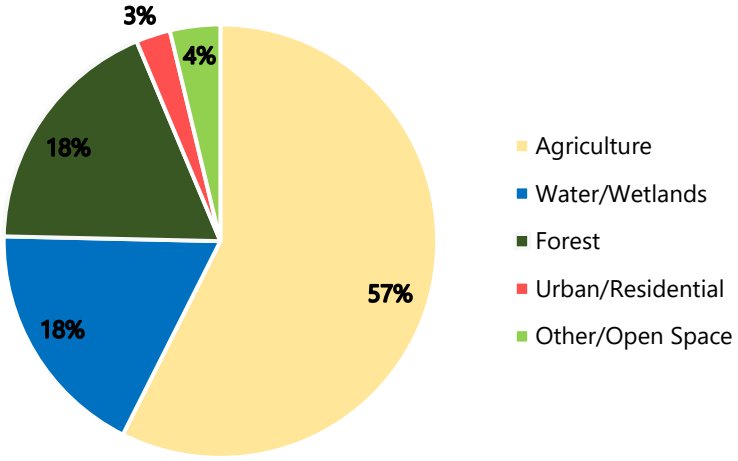


Figure B- 3: Land Use within CRWD

In very general demographic and geographic terms, the CRWD can be divided into two diverse areas. The eastern portion of the district is primarily urban/recreational in nature with scattered agricultural use. The western area is predominantly agricultural, consisting of cash crop, dairy, beef, hog, and turkey operations.



Streams and Local Drainage

There are five principal tributaries of the Clearwater River: County Ditch 20, which passes through Watkins; Willow Creek, which passes through Kimball; an unnamed creek from Union Lake; Three Mile Creek, which enters Clearwater Lake; and Warner Creek, which also flows into Clearwater Lake. Minor tributaries are Fairhaven Creek and an unnamed creek one mile West of Fairhaven, both trout streams, and Thiel Creek, which flows into Lake Marie. Much of the river has little or no flow at times. Baseflow in the river I sometimes low, leading to low or no flow in portions of the river. During the summer months and tributaries are often dry. This is a trend that has persisted through the monitoring period which began in the 1980s.

DITCHES WITHIN THE WATERSHED DISTRICT

Table B- 1: Ditches within CRWD

Name	County	Location	Comment
CD 20-Part	Meeker	Forest Prairie Twp	Outlet from Clear Lake to Clearwater River
CD 20-Part	Meeker	Forest Prairie Twp	Northeast part of twp
CD 42-	Meeker	Forest Prairie Twp	Southeast part of twp
CD 44-	Meeker	Forest Prairie Twp	Southwest part of twp
CD 46-	Meeker	Kingston Twp	In part of Clearwater River
JD 2-	Meeker-Wright	Kingston-Southside Twp	South of Union Lake Wright

Geology

The watershed lies in the Alexandria Moraine area. The great belt of lake-dotted moraine extending northward in an arc through west central Minnesota is the Alexandria moraine complex - a complex because it is 10-20 miles broad, is interrupted by extensive areas of outwash, and contains the drifts of two different ice lobes. The bulk of the moraine is believed to have been produced at the terminus of the Wadena lobe, concurrent with formation of the Wadena drumlin field. Later, during the last phase of the Wisconsin Ice Stage, the moraine was subsequently overridden from the west by the Des Moines lobe.

Soils

The CRWD consists of course- textured soils in the eastern area to fine-textured soils in the western area. Geologic events occurring during the Early Proterozoic eon (2,500-1,600 million years) and Early and Middle Archean eon (over 3,000 million years) established the bedrock structure of CRWD. Glacial events during the Late-Wisconsin period as early as 10,000 years ago have provided the surficial structure of CRWD. Combined, these geologic characteristics provide insight into the functional aspects of the land and allow informed land use decisions to be made based on the opportunities and constraints of the physical landscape. Geologic information is particularly important in determining groundwater susceptibility to contamination and for identifying potential mineral extract opportunities.

The underlying bedrock geology of the CRWD consists primarily of metamorphic rocks; granite and gneiss that are overlain by weathered metamorphic rocks and sedimentary rocks; and shale and siltstones. While some of these formations may be visible as outcrops at various points of the CRWD, the majority of bedrock is overlain by 50 to 150 feet of glacial outwash and till. Two

hundred fifty to 450 feet of glacial outwash and till overlie bedrock in the southwestern portion of the CRWD.

The oldest bedrock (2.6 billion years) consists of three gneiss groups (Undivided, Richmond and Sartell) and is located primarily in the northern and western portions of the CRWD. The next oldest bedrock formations (1.7 billion years) consist of the various granite formations concentrated in the CRWD.

The majority of bedrock in CRWD, now overlain by glacial till, was at one time exposed. This exposed bedrock underwent weathering, resulting in the mantling of weathered and kaolinite rock over bedrock. Another layer of sedimentary rock (siltstone and shale) was overlain as a result of rising seas.

Together, the above geologic events provide the foundation of the bedrock complex within CRWD. Glacial events further shaped the geology of the CRWD.

While many glacial events have occurred during the last 2 million years, the most visible surficial geologic formations took form in the last glaciation of the Late-Wisconsin period, approximately 20,000 years ago. The Wisconsin glaciation consisted of multiple advances and retreats of the Laurentide ice sheet. The Rainy Lobe; the Superior Lobe and the Des Moines Lobe of this ice sheet crossed paths frequently and carved the landscape of the CRWD that is visible today. These events deposited primarily glacial outwash in CRWD. These deposits provide the CRWD with an abundance of prime agricultural land and highly productive agricultural soils.

Associated with all glacial activity and providing many of the distinct features of the CRWD glacial landscape are the glacial moraine features. A series of these moraines were formed by the activity of the Rainy and Superior Lobes. the St. Croix Moraine, while heavily weathered, provides CRWD with its rolling hills and landforms.

Topography of CRWD was formed as a result of glacial events, the formation of the bedrock foundation and the process of erosion. The topography of CRWD ranges from rolling hills in the eastern part of CRWD to flat in the western part.

The Natural Resource Conservation Service (NRCS) has identified numerous soil classifications in CRWD. The majority of these soils provide a good foundation for agricultural activities, the principal land use in CRWD.

Lester-Hayden Association

The Lester-Hayden soil association occupies rolling slopes and depressions. The soils formed in calcareous, gray colored loam glacial till.

Lester soils make up about 35 percent of the association and these well drained soils occupy gently sloping and rolling slopes.

Hayden soils make up about 30 percent of the association. These well drained soils occupy the steeper slopes near lakes and streams. The Lester-Hayden association is well suited to intensive cropping. Dairying predominates, with some cash grain farming of corn and soybeans. The low wet bogs and meadows are used for pasture and wild hay. Wooded pastures and woodlots are common.

Estherville-Hubbard Association

The Estherville-Hubbard soil association consists of nearly level and undulating slopes on plains and terraces that border the Mississippi, Clearwater and Sauk Rivers. These dark colored soils formed in one to two feet of loamy material above calcareous grayish colored sands and gravels.

Estherville soils make up about 50 percent of this association. These somewhat excessively drained soils occupy nearly level and undulating slopes with occasional steep escarpments between terraces.

Hubbard soils occupy nearly level to very steep slopes and make up about 30 percent of the association.

The Estherville-Hubbard association is mainly used as cropland with many small areas of oak and aspen scattered about. Fairly dense strands of hardwoods are in areas near Clearwater Lake. Most farms are growing cash grain crops of corn and soybeans. These soils are well suited to irrigation and it overcomes the major obstacles to crop production. Wind erosion is a problem where the soil is cultivated. The soils in this association are a good source of sand and gravel and some commercial pits are operating here. These soils have few limitations for most urban and recreational purposes, but steep slopes may severely limit their use for these purposes.

Burnsville-Hayden Association

This is a distinctive soil association, which occupies very steep, rough, and irregular topography. The light-colored soils formed in calcareous, gray colored, moderately coarse textured drift and loam glacial till.

Burnsville soils occupy hilly to steep slopes that form about 60 percent of this association. They also occur as a complex with Hayden soils. Burnsville soils are somewhat excessively drained.

Hayden soils make up about 20 percent of this association. These well drained soils occupy sloping to steep irregular slopes.

The Burnsville-Hayden soil association is partly used as cropland with some in pasture or woodland. Cropland areas typically occur on the less sloping land. The slopes on the uplands severely limit the use of this association for most urban, recreational, and agricultural purposes.

Hayden-Peat-Marsh Association

The topography of this area is strongly rolling to hilly moraine with short, uneven slopes. The soils are light to moderately dark colored and medium textured. They formed under mixed northern hardwoods from limey, clay loam glacial till. Available moisture supplying capacity and

natural fertility are moderate. Most of the soils are well drained, but large areas of very poorly drained soils occur in the depressions.

Sheet erosion is severe throughout the area and gully erosion is also a serious problem.

Emmert-Flak Association

It occupies rugged hills, steep slopes, and marshy depressions. The light-colored soils formed from noncalcareous, brown colored glacial drift.

Emmert soils occur on rolling to very steep slopes and comprise about 50 percent of the association. They also occur as a complex with Flak soils and are excessively drained.

Flak soils make up about 40 percent of the association. These well drained soils occupy sloping and rolling slopes that are usually somewhat less sloping than the Emmert soils.

Dairy farming predominates and corn, oats, and alfalfa are the principal crops grown. Many lakes are present in the association to provide quality recreation. Several gravel pits are located in the area, which provide high quality aggregates. Limiting factors for urban development are mainly the problems associated with steep slopes.

Hayden-Lester-Peat Association

The Hayden-Lester-Peat soil association occupies strongly rolling and hilly areas. The mineral soils formed in calcareous, gray colored loam glacial till. The peaty soils formed in organic materials that vary in thickness and generally are underlain by loamy material.

Hayden soils make up about 60 percent of the association. These well drained soils occupy some of the roughest land and consist of strongly rolling and hilly slopes. Hayden soils are suited to intensive cropping. Features affecting non-farm uses include moderate shrink-swell potential and high susceptibility to frost action.

Lester soils make up about 20 percent of the association. These well drained soils occupy gently sloping and rolling slopes. Lester soils are well suited to intensive cropping. Features affecting non-farm uses include moderate shrink-swell potential and high susceptibility to frost action.

Peaty soils make up about 10 percent of the association. These very poorly drained organic soils occupy depressions. They vary in depth and generally are underlain by loamy material. Most of the peat is quite raw but in areas that have been drained and cultivated, the peat is more decomposed. Artificial drainage is needed before this soil can be used for growing crops. Large amounts of fertilizer are needed.

Summer frosts are a hazard. Features affecting non-farm uses include high water table, low bearing value, low shear strength and compacted permeability, high shrink-swell potential, and high susceptibility to frost action.

Minor soils occupy about 10 percent of this association and include the poorly drained Cordova and Webster soils and the very poorly drained Glencoe soils. Steep slopes and wet soils with lack of drainage outlets present problems for urban development.

Dairy farming predominates with corn, small grains, and hay grown on the less sloping soils. Wooded pastures and woodlots are common. The low wet bogs and meadows are used for pasture and wild hay.

Lester-LeSueur-Cordova Association

The Lester-LeSueur-Cordova soil association occupied nearly level and gently sloping areas. These dark colored soils formed in calcareous, gray colored loam glacial till. Lester soils make up about 40 percent of the association. These well drained soils occupy gently sloping slightly higher areas than the LeSueur soils. Lester soils are well suited to intensive cropping. Features affecting non-farm uses include moderate shrink-swell potential and high susceptibility to frost action.

LeSueur soils make up about 30 percent of the association. They are moderately well drained and occupy nearly level and gently sloping lower lying areas than the Lester soils. LeSueur soils are well suited to intensive cropping. Features affecting non-farm uses include a slightly wet condition during periods of high rainfall because of its topographic position. Other features include moderate shrink-swell potential and high susceptibility to frost action.

Cordova soils make up about 20 percent of the association, are poorly drained, and occupy nearly level areas. They are well suited for use as cropland if artificially drained or as pasture. The normally high seasonal water table and susceptibility to frost heave severely limits these soils when used for urban and recreational purposes.

Minor soils nearby are Glencoe and peaty soils and others that make up about 10 percent of the association.

The Lester-LeSueur-Cordova association is well suited and used for intensive cropping. Cash grain farming predominates with corn and soybeans being the main crops grown. Excess water can be removed with surface ditches and tile drains but for urban and recreational uses, wetness remains a limiting factor.

Climate

Temperature at St. Cloud has ranged from a low of 40 degrees below zero in 1951 to a high of 103 degrees above zero in 1947. The normal annual precipitation at St. Cloud is about 26.8 inches and has ranged from a minimum of 14.64 inches in 1910 to a maximum of 41.01 inches in 1897.

As part of the Clearwater Chain of Lakes Restoration Project, precipitation and river tributary flow monitoring were initiated in 1981. Precipitation is measured at four precipitation sampling stations distributed throughout the District as shown on Figure 1 and stream flow measurements are taken at 19 locations throughout the District. Area Weighted average precipitation during 1981-1999 was 29.47 inches. The watershed experienced a wet cycle from 1983 to 1986. Precipitation during 1987 was the lowest since 1981 and one of the driest since 1910. Two storms have been considered as a flash flood according to the State climatological office. These occurred on June 21, 1983, when a maximum of nearly 12 inches occurred in Watkins and on September 8 and 9, 1985 when 9.2 inches were recorded in western Sherburne County. The precipitation by year within the district is shown in the following table and for the period of 1981 through 2001.

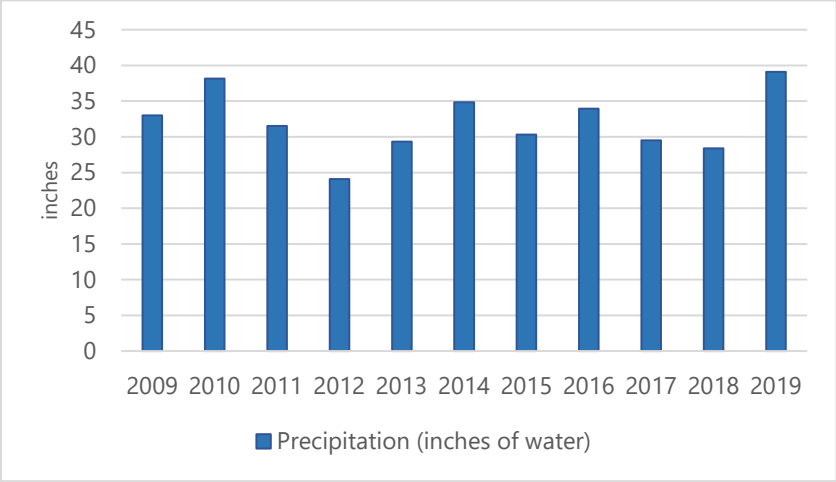


Figure B- 4: Precipitation in CRWD - Source: MN State Climatology Office

1981-2001 WHOLE-WATERSHED RUNOFF
Runoff (inches)
Measured at Clearwater Lake Outlet (CR10.5)

1981	**1982**	**1983**	**1984**	**1985**	**1986**	**1987**	**1988**	**1989**	**1990**
3.6	6.8	17.4	13.3	12.0	16.0	1.4	0.7	3.0	11.7
1991	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**
20.7	12.9	15.5	9.0	8.8	4.8	6.3	5.5	3.9	1.0
2001	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
2.8	7.6	6.5	2.8	8.6	4.2	3.0	2.0	7.6	13.1
2011	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**Mean**		
18.8	5.6	3.9	8.1	6.0	7.6	5.1	7.7		

The impact of the high runoff has been an increase the District's pollutant loading to its waters and delay the response of remedial restoration measures.

Water Supply and Use

Clearwater River Flow Data

Mean normal stream flow at the inlet to Clearwater Lake is 31.07 cfs with normalized flows as high as 85.20 during the month of April.

The U.S. Army Corps of Engineers estimated the discharges for the Clearwater River and elevations for specified lakes were determined using the HEC-1 Flood Hydrograph Package. The entire watershed above the mouth at the Mississippi River was modeled. Thirteen (13) subbasins, nine (9) reservoir routings and eleven (11) combining units were used.

The model was calibrated to an U.S. Geological Survey peak discharge estimate based on a discharge measurement made on the Clearwater River upstream of the State Highway 55 bridge following the June 21, 1983 storm. This site is just upstream of the inlet to Lake Louisa. A discharge of 2,150 cfs was recorded on June 23, 1983 and is believed to be within 0.2 feet of the peak stage with an estimated peak discharge of 2,610 cfs. This storm produced an average rainfall over the watershed of 9.19 inches.

Selected Lake Elevations and Discharges from HEC-1 Model for the 10-, 50-, 100- and 500-Year Events for Various Locations in the Clearwater River Basin are shown below.

Table B- 2: Discharge Predictions within CRWD

Recurrence interval years	Lake Louisa Inlet Hwy 55 Discharge cfs ft	Fairhaven Dam Fairhaven, MN Elev Discharge		Lake Caroline Outlet Elev Discharge		Bridge Below Weigand Lake Elev Discharge		Mouth Clearwater River Discharge cfs ft
		NGVD ft	cfs ft	NGVD ft	cfs ft	NVGD ft	cfs ft	
10	610	1007.75	640	993.70	670	990.91	730	740
50	1010	1008.47	1070	995.15	1110	992.09	1280	1310
100	1190	1008.79	1280	995.70	1320	992.62	1530	1560
500	1790	1009.66	1940	997.20	2020	994.21	2290	2340

Source: U.S. Army Corps of Engineers, Interim Hydrology Report

Groundwater

The watershed lies almost entirely in glacial drift over igneous and metamorphic rocks. Thickness of the drift averages 200 feet. In glacial drift aquifers, specific capacity of small yield wells (less than 30 gpm) averages 1.31 gpm per foot of drawdown.

Locally, groundwater is discharged to small streams and lakes. Most recharge is from snowmelt in the spring, although excessive precipitation in the summer or fall can result in high water levels. Extreme high-water levels in 1972, 1984-1986, and 2019 are attributed to record-breaking rainfall.

Regional groundwater movement in the glacial drift is from upland areas toward the Mississippi and Clearwater rivers.

An area of surficial outwash lying a short distance to the north of Clearwater River and north of Kimball has soils of low water-holding capacity and is the primary area in the watershed with a probability of future irrigation development.

A situation developed in School Section Lake during 1984, which resulted from the heavy rainstorms beginning in the summer of 1983. School Section Lake is a land-locked lake in southeastern Stearns County, just north of Kimball. The lake level increased approximately seven feet, which caused 14 houses and cabins around the lake to be flooded. The lakeshore owners petitioned the Clearwater River Watershed District to install an outlet and the outlet was completed in September 1984. The Minnesota Department of Natural Resources completed a study in January 1986 evaluating the relationship of lake to the groundwater system. It is apparent that lake-groundwater interaction is a major factor in developing lake water budgets.

Lakes

LAKES IN THE WATERSHED DISTRICT

Table B- 3: Lakes within CRWD

County	Name	Acres
Meeker	Betsy	153.66
	Clear	529.07
	Little Mud	37.37
	Rohrbeck	62.67
	Round	33.65
Stearns	Carter	31.25
	Island	80.74
	Laura	139.86
	Lynden	15.74
	Marie	145.81
	Otter	91.75
	School Section	201.02
	Swamp	22.68
	Willow	155.51
Wright	Albion	249.04
	Caroline	135.16
	Cedar	790.31
	Cornell	28.55
	Grass	71.47
	Helmbrecht Pond	8.45
	Henshaw	272.38
	Little John	47.63
	Mead	15.27
	Nixon	59.57
	Pleasant	597.00
	Swartout	292.87
	Unnamed (Goble)	12.07
	Unnamed (Hidden)	7.90
Wright & Meeker	Scott	82.70
	Union	92.94
Wright & Stearns	Augusta	187.12
	Bass	222.47
	Clearwater East	1660.12
	Clearwater West	1498.15
	Edward	100.34
	Louisa	189.43
	Wiegand	42.45
Total Lake Acres		**8364.17**

Recreational Water Use

All lakes in the watershed are used for recreational purposes, and there is intensive use of certain of the recreational lakes.

Waste Treatment Systems

Municipal

The cities of Kimball, Watkins and Annandale have all upgraded their waste treatment plants to include spray irrigation of the treated effluent.

The city of Watkins treatment system is located on the north edge of the District, and in fact; the spray sites are located outside the District. Thus, there is no discharge from this system to the Clearwater River.

The Kimball waste treatment system is located east of Kimball and, again, there is no point discharge from this system. However, runoff from this system would eventually reach Lake Louisa, which is part of the Clearwater River.

The Annandale waste treatment system includes spray irrigation sites east of Annandale near Warner Creek. Again, there are no point discharges from this system. However, runoff from the spray fields could enter Clearwater Lake via the Warner Creek.

The cities of South Haven and Fairhaven do not have public sewage disposal systems and the residents utilize private sewage systems.

Industrial

The only industry in the District that discharged to a stream was the Mid-America Dairyman's Association facility located in Watkins. This facility was engaged in the manufacture of cheese products. This facility closed in mid-1986.

The Upper Watkins Wetland Isolation Project (Number 81-7) was completed in 1985 to capture and retain large quantities of nutrients, which had previously been discharged to this wetland. The facility had attempted several treatment systems to meet the requirements of their NPDES permit before closing.

Various institutional contributors are connected to the municipal sewage treatments systems in multiple cities, including the public schools in each of the cities, laundromats, senior citizen homes, trailer parks and other such contributors.

Economy

Population

Population census from 1980 to 2010, along with the population estimates from 2019 of the townships and cities partially or wholly within the District are given in the following table:

Table B- 4: Population within CRWD

Township or City	County	1980 Census	2000 Census	2010 Census	2019 (estimate)	Change (2010-2019)	% Change (2010-2019)
Albion Twp	Wright	1,127	1,146	1,255	1,326	71	5%
Annandale City	Wright	1,568	2,684	3,228	3,517	289	8%
Clearwater City	Wright	379	858	1,735	1,818	83	5%
Clearwater Twp	Wright	1,153	1,368	1,306	1,390	84	6%
Corinna Twp	Wright	1,831	2,457	2,322	2,466	144	6%
Fairhaven Twp	Stearns	1,102	1,458	1,507	1,612	105	7%
Forest City Twp	Meeker	661	666	653	656	3	0%
Forest Prairie Twp	Meeker	920	869	972	980	8	1%
French Lake Twp	Wright	936	1,130	1,172	1,249	77	6%
Kimball City	Stearns	651	635	762	798	36	5%
Kingston Twp	Meeker	971	1,266	1,256	1,262	6	0%
Luxemburg Twp	Stearns	912	689	637	688	51	7%
Lynden Twp	Stearns	1,389	1,919	1,938	2,076	138	7%
Maine Prairie Twp	Stearns	1,518	1,686	1,887	2,009	122	6%
South Haven City	Wright	205	204	187	193	6	3%
Southside Twp	Wright	1,475	1,576	1,521	1,618	97	6%
Watkins City	Meeker	757	880	962	953	(9)	-1%
TOTALS		**17,555**	**21,491**	**23,300**	**24,611**	**1,311**	**5%**

In several instances, only a small part of a township in the above list is within the area. The cities of Annandale, Kimball and South Haven are entirely within the area, but the city of Clearwater is only partly within the area. Since in most instances the census units tabulated in the population list are partly outside of the area, the population of the area is less than the total given above. The total estimated population (2019) of the District is 17,228.

Population is greater per square mile in the eastern area with an expected 8-10% increase in growth over the next 10-year period. The western area population will likely remain somewhat constant or decrease slightly.

Agriculture

The small family farm predominates in the District, with no major trend visible towards corporate operation. In Wright County there is a steady shift towards cash grain production and away from dairy farming. As the metropolitan area expands northwestward, there is a growing trend toward working in the city and managing the farm as a secondary source of income. In the Stearns and Meeker portions of the District, dairying predominates.

Cash grain crops are corn, soybeans, oats, and wheat, with more and more wheat replacing oats in areas of intensive grain production as world market demand increases for this commodity.

Irrigation is emerging as an agricultural practice north of the Clearwater River, near Kimball. A large area of soils of low water-holding capacity in the vicinity of Kimball indicates the potential for future irrigation development.

Industry

Industrial development in the District is agriculturally oriented with some light manufacturing.

Transportation

Interstate Highway No. 94 and State Highway No. 55 pass or enter the District generally from east to west providing quick, ready access to the lakes from the Twin Cities. State Highways Nos. 15 and 24 pass through the District generally from north to south. The Soo Line Railroad provides rail transportation from Twin City terminals to points west. Facilities are provided for bus and private aircraft transportation within and near the District.

Property Valuation

The 2020 total taxable market value of the District is $16,168,181. Lakeshore property contributes significantly to the tax base of the communities.

Recreation and Tourism

There is one resort within the District. There are four seasonal camps, which are resort type facilities to aid those with mental and physical disabilities, and a scout camp. They are Camp Courage on Cedar Lake; Camp Friendship on Clearwater Lake; Camp Challenge on Swart-Watts Lake; and Camp Heritage on Lake Caroline. The total recreational tourism of the District is difficult to assess; however, it should be fair to state that considering the permanent and seasonal residents, their families and friends, the tourists availing themselves of the resort, the individuals utilizing the four camps, the state and privately owned public accesses, the individuals availing themselves of the facilities of the District would measure in the tens of thousands annually.

APPENDIX C: Acronyms & Definitions

Acronyms

AC – Agricultural Conservation
AIS - Aquatic Invasive Species
Atlas 14 – Current Precipitation Frequency Estimates
BMP – Best Management Practice
CAC - Citizen Advisory Committee
cfs - cubic feet per second
Chl-a - Chlorophyll- a
CIP - Capital Improvements Plan
CRP – Conservation Reserve Program
DNR - Minnesota Department of Natural Resources
DO - Dissolved Oxygen
EPA - Environmental Protection Agency
EQuIS - Environmental Quality Information System (MPCA water quality data)
H+H - Hydrologic and Hydraulic
IBI - Index of Biotic Integrity
JPA - Joint Powers Agreement
LA - Load Allocation
LCCMR - Legislative-Citizen Commission on Minnesota Resources
LGU - Local Government Unit
LWMP - Local Water Management Plan
MDA - Minnesota Department of Agriculture
µg/ L - Micrograms per liter (ppb)
mg/L - Milligrams per liter (ppm)
MIDS - Minimal Impact Design Standards
MNDOT - Minnesota Department of Transportation
MnRAM - Minnesota Routine Assessment Methodology (for evaluating wetland functions)
MPCA - Minnesota Pollution Control Agency
NTU - Nephelometric Turbidity Units
NWI - National Wetland Inventory
NWS - National Weather Service
OP - Orthophosphorus
OWOP- One Water One Plan
Plan - Watershed Management Plan
ppb - parts per billion (ug/L)
ppm - parts per million(mg/L)
QA/QC - Quality Assurance/Quality Control
SLMP - Sustainable Lake Management Plans
SRP - Soluble Reactive Phosphorus
SWAG - Surface Water Assessment Grant
SWCD – Soil and Water Conservation District
SWPPP - Storm Water Pollution Prevention Program
TAC - Technical Advisory Committee
TMDL - Total Maximum Daily Load
TP - Total Phosphors
TSS - Total Suspended Solids
USEPA - United States Environmental Protection Agency
USGS - United States Geological Survey
WCA - Wetland Conservation Act
WLA - Waste Load Allocation
WRAPS - Watershed Restoration and Protection Plan

Definitions

Aquatic Invasive Species (AIS) – non-native species such as zebra mussels and Eurasian watermilfoil

Atlas 14 – The National Weather Service Hydrometeorological Design Studies Center has released NOAA Atlas 14, Volume 8. The Atlas provides precipitation frequency estimates for many of the Midwestern states, including Minnesota. Analyses of the historical frequency of heavy rainfall events are of importance to engineers and others involved in designing and operating infrastructure such as culverts and stormwater runoff ponds.

Best Management Practice – Practices on land- either agricultural fields, animal agriculture areas or in developed areas- that are determined to be effective and practicable means of preventing or reducing the amount of pollution generated by non-point sources to a level compatible with water and natural resource goals.

Chlorophyll-a (Chl-a) – Chl-a is a green pigment in algae. Measuring Chl-a concentration gives an indication of how abundant algae are in a waterbody.

Dissolved Oxygen (DO) - The concentration of molecular oxygen (O2) dissolved in water. The DO level represents one of the most important measurements of water quality and is a critical indicator of a water body's ability to support healthy ecosystems. Levels above 5 mg/L are considered optimal, and most fish cannot survive for prolonged periods at levels below 3 mg/L. Microbial communities in water use oxygen to breakdown organic materials, such as animal waste products and decomposing algae and other vegetation. Low levels of dissolved oxygen can be a sign that too much organic material is in a water body.

EQuIS - a repository for water quality, biological, and physical data and is used by state environmental agencies, EPA and other federal agencies, universities, private citizens, and many others. The MPCA uses the information entered into the database to determine the quality of the state's water bodies. If water quality standards are not met, the water body will designated as impaired and will need to have a TMDL study conducted.

Eutrophication – The aging process by which lakes are fertilized with nutrients. Natural eutrophication will gradually change the character of a lake. Human activities can accelerate the process.

Index of Biotic Integrity (IBI) – n index of biological integrity (IBI) can help scientists measure the health of water creatures, diagnose the type of stressors damaging a water body, define management approaches to protect and restore the water's biological communities and evaluate how effective protection and restoration activities are.

Impaired Waters – The Clean Water Act requires states to publish, every two years, a list of streams and lakes that are not meeting their designated uses because of excess pollutants. The list, known as the 303(d) list, is based on violations of water quality standards.

Secchi Disk – a round, white, metal disk that is used to determine water clarity. It is lowered into the water until it is not visible. The depth is recorded, and then the disk is raised until it is visible. The mean value of the two readings gives the clarity.

Secchi Disk Transparency (SDT) - the term used in describing the results of a Secchi reading expressed in feet or meters.

Surface Water Assessment Grant (SWAG) - Grant awarded by the PCA to help fund surface water monitoring

Total Maximum Daily Load (TMDL) – Calculation of the maximum amount of a pollutant that a waterbody can receive and still meet water quality standards and an allocation of that amount to the pollutant's source.

Total Phosphorus (TP) – A nutrient essential to the growth of organisms and is commonly the limiting factor in the primary productivity of surface water bodies. Total phosphorus includes the amount of phosphorus in solution (reactive) and in particle form. Agricultural drainage, wastewater, and certain industrial discharges are typical sources of phosphorus, and can contribute to the eutrophication of surface water bodies.

Total Suspended Solids (TSS) – Very small particles remaining dispersed in a liquid due to turbulent mixing that can create turbid or cloudy conditions. A measure of the material suspended in water in mg/l. Total suspended solids (TSS) cause: a) interference with light penetration, b) buildup of sediment and c) potential reduction in aquatic habitat. Solids also carry nutrients that cause algal blooms and other toxic pollutants that are harmful to fish. Clay, silt, and sand from soils, phytoplankton (suspended algae), bits of decaying vegetation, industrial wastes, and sewage are common suspended solids.

Turbidity – a water quality parameter that refers to how clear the water is. It is an indicator of the concentration of suspended solids in the water. Excessive sedimentation in streams and rivers is a major source of surface water pollution in the United States. Polluted waters are commonly turbid. Turbidity is expressed in NTU (Nephelometric Turbidity Units).

APPENDIX D: 2020 Monitoring Plan & Water Level Monitoring Status

Source: Derek Desens - Sunset on Mill Pond – Marie Lake

Resilience
RESOURCES LLC

TO: BOARD OF MANAGERS

FROM: DISTRICT ENGINEER

DATE: 1/30/2020

SUBJECT: PROPOSED 2020 WATER QUALITY MONITORING PROGRAM

Introduction

The Clearwater River Watershed District has conducted an annual water quality monitoring program at select locations throughout the watershed since 1981 in an effort to assess District progress towards water quality goals, track long-term water quality trends, and evaluate effectiveness of existing water quality improvement projects and programs. The proposed 2020 program is in line with previous efforts however has pulled back in some areas to reduce scope.

Baseline Monitoring: Lakes

The recommended 2020 lake monitoring includes the 3 monitoring sites covered by the SWAG grant for 2020, remaining work not completed in 2019, and the regularly scheduled lakes for sampling. A total of 13 lakes will be monitored or standard parameters (Table 2).

- Lakes sampled monthly May – September (Parameters: temperature and dissolved oxygen profiles, Secchi depth, Chlorophyll-A, total phosphorus surface samples).
- Aquatic vegetation survey schedule (by others) is shown in Table 4.

SWAG Monitoring: Lakes

To complete our 2019 SWAG requirements, we will need to collect the following:

Marie – TP, Chl-A in September 2020
Louisa – TP, Chl-A in September 2020
All 2019 lakes – Chloride & Hardness in August 2020
Clearwater East, Clearwater West, and Cedar – duplicate samples in July 2020
Clearwater East and Clearwater West – Sulfate in June

2020 SWAG lakes are Clearwater East, Clearwater West, and Cedar

Lake	Parameters	Months
All Lakes	TP, Chl-A Secchi Conductance, Temp, pH, DO, Rec Suitability and Appearance	M, J, J, A, S
All 2019 SWAG Lakes	Chloride & Hardness (CaCO3)	August
Clearwater East Clearwater West Cedar	Duplicate Samples	July
Clearwater East Clearwater West	Sulfate	June

Baseline monitoring: Streams

The recommended 2020 stream monitoring includes the 9 streams shown in Table 5 (no water quality sample at 10.5).

- All streams will be monitored monthly April to October (Parameters include: temperature, dissolved oxygen, pH, specific conductance and flow, ortho-phosphorus, total phosphorus and total suspended solids).
- Continuous water level monitoring will be recorded using pressure transducers at stations CR28.2, CR16.7 (Fairhaven Dam) CR10.5, CD 20-1.0, SSW04 (Illsley Ave), Theil Creek and School Section Lake.
- Telemetry + Continuous Water Level Grass Lake Dam, Theil Creek at CR 40
- Visual monitoring at 5 fish migration barrier sites in Cedar Lake Subwatersheds.

Special Monitoring:

Clear Lake Special- Coring + Bench Test

Samples and analysis to determine wetland release rates and dosing rates. Three cores with chemistry, release rate studies and dosing calcs are proposed.

If dosing rates are favorable, conduct vegetative and invertebrate surveys on bench test wetland area and northern wetland for pre-dosing evaluation. Conduct dosing, monitor and conduct post dosing vegetative and invertebrate sampling (workplan for this phase is still in progress pending feedback from DNR).

Lake Augusta Special- Upstream Sampling + Sediment Analysis

Collect surface water quality samples to characterize wetland loading to Augusta. A combination of additional TP/ OP samples in western tributary channel.

Collect wetland sediment cores to characterize TP content and release rates in the wetland.

Stream Chloride Monitoring:

Proposed grab samples at 15 stream sites 3x/ year.

Table 1: Proposed 2020 Water Quality Monitoring Cost & Fund Allocation

Category	Sites	Lab	Labor	Expenses	Total	Note
Lake Monitoring	13	$3,298.46	$ 9,100.00	$1,600.00	$13,998	<- SWAG
Stream Regular Monitoring	9	$3,041.50	$ 7,000.00	$2,450.00	$12,492	
Stream Chloride Monitoring	15	$ 675.84	$ 750.00	$ 50.00	$ 1,475.84	
Augusta - Supplemental Channel	3	$ 429.00	$ 625.00	$ -	$ 1,054.00	
Augusta - Supplemental Sediment	1	$4,200.00	$ 1,000.00	$ 120.00	$ 5,320.00	
Clear - Supplemental	1	$5,600	$ 600.00	$ 120.00	$ 6,320.00	<-$5000 grant
Continuous Water Level Monitoring + Telemetry	8		$2,800	$300	$3,100	
Camera Install	5		$2,800	$1,325	$4,125	
Lake Level Gauge Install	10		$2,625	$450	$3,075	
Rain Gauge Readers	6		$1,675	$500	$2,175	
Reporting, Lab Coordination, Submittals					$23,375	
SUBTOTALS		$6,339.96	$28,975.00	$6,915.00	$76,510	
10% contingency					$7,651	
				TOTAL	$84,161	
				District Cost:	$60,766	

Funding Source	Cost
General [100]	$26,306.31
Chain of Lakes [210]	$28,936.94
Project #06-01 [215]	$5,918.92
SSL #17-1	$4,603.60
SWAG	$ 18,395.00
	$84,161

Table 2: Baseline lake monitoring for CRWD lakes

STATIONS	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Clearwater East^*	X	X		X		X		X		X		X~	X~		X		X
Clearwater West^*		X	X		X		X		X		X	X~	X~	X		X	
Augusta^*		X	X	X	X	X	X	X	X	X	X	X~	X	X	X	X	X
Caroline*	X	X	X	X	X	X	X	X	X		X		X			X	
Marie^*	X	X	X	X	X	X	X	X	X	X	X	X~		X		X	
Louisa^*		X	X	X	X	X	X	X	X	X	X	X~		X		x	
Scott*	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X
Betsy*		X	X	X	X	X	X	X	X	X	X	X~	X	X	X	X	X
Clear	X	X	X	X	X	X	X	X	X	X	X	X~	X	X	X	X	X
Cedar^#	X	X	X	X	X	X	X	X	X	X	X	X~	X~	X		X	
Albion#	X	X	X	X	X	X	X	X	X	X	X		X		X		
Swartout#	X	X	X	X	X	X	X	X	X	X	X		X		X		
Henshaw#	X	X	X	X	X	X	X	X	X	X	X		X		X		
Bass	X	X		X		X			X			X			X		
Grass*	X	X		X		X		X									
Little Mud		X			X			X					X				X
Nixon	X	X		X		X			X					X	X		
Otter		X			X			X					X		X		
Pleasant	X	X	X		X		X		X			X				X	
School Section		X		X		X		X				X				X	
Union	X	X	X	X	X	X	X	X	X	X	X	X~		X			X
Wiegand*!		X															
TOTALS	14	22	14	17	16	17	14	17	16	12	13	12	13				

NOTES

^ denotes a lake that has a CRWD AIS Project

* denotes a lake that falls under the 1980 Project

# denotes a lake that falls under Project #06-1

~ SWAG Funding

! Wiegand lake sampling was discontinued in favor of stream sampling at Nordell Bridge downstream; that event will be tracked in separate schedule going forward

Table 3: Lake sediment surveying for CRWD lakes

STATIONS	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Clearwater East^*																	
Clearwater West^*																	
Augusta^*			X										X				
Caroline*														X			
Marie^*!											X						
Louisa^*!											X						
Scott*			X														
Betsy*		X												X			
Clear		X											X				
Cedar^#																	
Albion#																	
Swartout#										X							
Henshaw#																	
Bass																	
Grass*																	
Little Mud																	
Nixon																	
Otter																	
Pleasant																	
School Section																	
Union															X		
Wiegand*																	
TOTALS	0	2	2	0	0	0	0	0	0	1	2	0	2	2	2	0	0

NOTES

^ denotes a lake that has a CRWD AIS Project

* denotes a lake that falls under the 1980 Project

# denotes a lake that falls under Project #06-1

! These lakes had surveys completed in 2006

~ denotes outside entity plans to complete (ex. MNDNR, MPCA, lake association)

Table 4: Proposed Long-Term Lake Assessments: Indices of Biological Integrity (Vegetation/ Fisheries Surveying)

STATIONS	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Clearwater East^*	F!						F+	PI+, F!		PI+,D+~	D+~	D+~	PI+,D+~	D+~	D+~	PI+,D+~
Clearwater West^*								PI+		PI+,D+~	D+~	D+~	PI+,D+~	D+~	D+~	PI+,D+~
Augusta^*							F+		PI+,D+~	D+~	D+~	PI+,D+~	D+~	D+~	PI+,D+~	D+~
Caroline*							F+						PI			
Marie^*!							F+			PI+,D+~	D+~	D+~	PI+,D+~	D+~	D+~	PI+,D+~
Louisa^*!							F+			PI+,D+~	D+~	D+~	PI+,D+~	D+~	D+~	PI+,D+~
Scott*													PI			
Betsy*					F+		V			PI, F+			PI			
Clear					V+	F+				PI, F+			PI			
Cedar^#							F+	PI+	PI+,D+~	D+~	D+~	PI+,D+~	D+~	D+~	PI+,D+~	D+~
Albion#				V+		PI	PI	PI			PI			PI		
Swartout#			PI	PI	PI	PI, V+	PI	PI			PI			PI		
Henshaw#						PI, V+	PI				PI			PI		
Bass								V+		F+						PI
Grass*							F+									PI
Little Mud									PI+							
Nixon							V+									PI
Otter				F+, V+											PI	
Pleasant										F+					PI	
School Section	F+, F!			V+											PI	
Union					F+			V+	PI	F+			PI			
Wiegand*																
TOTAL (by CRWD)	0	0	1	1	1	3	3	2	1	2	3	0	2	3	3	3

NOTES F stands for standard fisheries survey, PI stands for point-intercept survey, D stands for AIS delineation, V stands for vegetation survey

^ denotes a lake that has a CRWD AIS Project

* denotes a lake that falls under the 1980 Project

# denotes a lake that falls under Project #06-1

! Fish IBI assessment and/or targeted survey was performed by MNDNR

+ denotes outside entity performed (ex. MNDNR, lake association)

~ denotes will be completed under CRWD AIS Project Policy

Table 5: Baseline stream monitoring for CRWD streams

STATIONS	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
SCE01~!	X	X	X	X	X	X	X	X									
SHE01*!	X	X	X	X	X	X	X	X									
SSW01*!	X	X	X	X	X	X	X	X									
SSW02*#	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	
SSW04*	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
CR7.0 (Nordell Br)					X			X									
CD10.5	X	X	X	X	X	X	X	X	X	X	X	Stage + Telemetry	Stage + Telemetry	X	X	X	X
CR28.2^	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
CR29.0^				X	X	X	X	X	X	X	X		X	X	X	X	X
CLN			X		X	X	X	X	X	X	X	X	X	X	X	X	X
CLS#			X		X	X	X	X	X	X	X		X	X	X	X	X
CD20-1.0^		X				X	X	X	X	X	X	X	X	X	X	X	X
CD20-2.2^						X	X	X	X			X					X
LAWT									X								X
ULST									X							X	
ULWT									X							X	
WS1^#										X	X		X	X	X		
WC2.5^					X	X	X	X				X			X		
WC3.0^					X	X	X	X				X			X		
WR0.2	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
TOTALS	8	9	10	9	14	15	15	16	13	10	10	9	10	10	13	11	10

NOTES ^denotes a site that falls under the 1980 Project *denotes a site that falls under Project #06-1

*denotes outside entity plans to complete (ex. MNDNR, MPCA, lake association)

Table 6: Baseline 2020 Monitoring Schedule- at a glance

Category	2020 Schedule	Station	Parameters
Lakes:	Once per month, May- Sept. Note: lake sampling to be completed by September 15	SWAG: Clearwater (East + West), Cedar, Regular: Augusta, Caroline, Scott, Betsy, Clear, Swartout, Albion, Henshaw, Little Mud, Nixon	*Field: Secchi depth, DO and temperature profiles. *Lab: surface samples for total phosphorus, and chlorophyll-a. *Additional parameters for SWAG grant in 2020 and Augusta.
Streams:	Monthly April-November	*CLN, WR0.2, WC 2.5, WC 3.0 (General Fund) *CD20-1.0, CR28.2, (Chain of Lakes O&M Fund) *SSW04 (Project #06-1 O&M)	Field: DO, temperature, conductivity, pH Lab: total phosphorus, ortho phosphorus, TSS
	Continuous WSEL: April-October	*CR10.5 & CR16.7 (FHD) (General Fund) *CR28.2, (Chain of Lakes O&M Fund) *SSW04 (Project #06-1 O&M) *School Section Lake, TC1 (Project #17-1 Capital Fund)	*Place pressure transducers after ice-out, check throughout year, pull in October *TC1 will also have stream field parameters taken whenever they are checked
Lake Levels	Weekly	Administrator recruitment	Level
Precipitation:	Daily	Multiple in watershed	Rain gauge stations (6)
Note: any approved supplements are added to the schedule at field staff's discretion.			

CLEARWATER RIVER WATERSHED DISTRICT RECREATIONAL LAKES - WATER LEVEL MONITORING STATUS									
Lake Name	**DNR Lake ID**	**Size (acres)**	**Depth (ft)**	**# of DNR Lake Level Readings and date range**	**Outlet Description**	**Flood issues**	**Comments**	**Monitoring Need**	**Who should monitor?**
Albion	86021200	251	9	**3**: 1999-2001	Ice ridge overflow at south end - drains to Swartout	Only Farmland affected		Low	CRWD
Augusta	86028400	187	82	**386**: 1991 to 2018	Natural River channel to Clearwater Lake- Grass Lake dam controls	Significant: Many low homes affected in 1986 Flood	Levels should be slightly above Grass Lake Levels at most times of year; Gage reader added in 2020.	High (but tied to Grass)	CRWD
Bass	86023400	222	34	**431**: 1951 to 2020	2 outlets: primary on S side and drains to Clearwater via a small ditch	Several low homes on south side	DNR gage reader until 2017	Medium	DNR
Betsy (Betty)	47004200	154	29	**0**	Clearwater River natural channel to Scott Lake	Unknown: Possibly some low cabins		Medium	CRWD
Caroline	86028100	135	45	**0**	Clearwater River natural channel to Augusta Lake	None known		Low	N.A.
Cedar	86022700	790	108	**210**: 1941 to 2020	Medium sized Dam in CSAH 6 at SW side - drains to Clearwater	None known	DNR gage reader in 2019	Medium	DNR
Clear	47009500	529	18	**755**: 1990 to 2019	Culvert under 657th ave? - headwaters of Clearwater River	Unknown: Possibly some low cabins	DNR gage reader in 2019	High	DNR
Clearwater	86025200	3158	73	**430**: 1932 to 2018 (only 2 readings in past 3 years)	DNR owned Dam at north end of Grass Lake	Significant: Many low homes affected in 1986 Flood	Restriction caused by CR 144 Bridge between Grass and Clearwater can cause higher levels on Clearwater Lake	High (but can use Grass)	CRWD
Grass	86024300	71	35	**478**: 1939 to 2018 (only 2 readings in past 3 years)	DNR owned Dam at north end of Grass Lake	Significant: Many low homes affected in 1986 Flood	Bogs at dam increase flooding potential	High	CRWD
Henshaw	86021300	272	8	**1:** 1 in 2019	Culvert at Twp Road at N end of Lake	None known	Problems with debris clogging outlet	High	CRWD
Little Mud	47009600	37	42	**2**: 1999 and 2001	Channel at NW side of lake ?	None known		Low	N.A.
Louisa	86028200	189	44	**1** reading in 1990	Fairhaven Dam on Marie Lake	No significant problems known	Tied to Marie Levels	Low	N.A.
Marie	73001400	146	36	**306**: 1961 to 2020	Fairhaven Dam on Marie Lake	Some low cabins on south side of lake	Gage reader added in 2020.	High	CRWD
Nixon	86023800	60	67	**1** in 1975	Natural flowage at NW side of Lake - flows to Clearwater River	None known		Low	N.A.
Otter	73001500	92	51	**0**	Channel to Clearwater lake -Controlled by Grass Lake dam	None known		Low	N.A.
Pleasant	86025100	597	74	**119**: 1949 to 2011	CRWD owned structure at NE side of lake -drains to Clearwater	A few lower homes are affected	CRWD required to monitor lake levels. Gage reader added in 2020.	High	CRWD
School Section	73003500	193	12	**284**: 1967 to 2020	CRWD owned structure at SE side of lake -drains to Theil Creek	Several cabins destroyed in 1986- mostly sewers affected now	CRWD required to monitor lake levels. Gage reader added in 2020.	High	CRWD
Scott	86029700	80	23	**0**	Clearwater River channel at NE side of lake - drains to Louisa	None known		Low	N.A.
Swartout	86020800	171	12	**613**: 1941 to 1999	Small dam in CSAH 6 at E side of lake - drains to Cedar	Some low cabins affected in past	Problems with debris clogging outlet	High	CRWD
Union	86029800	93	35	**1** in 1994	Overflow area at north end of lake	None known		Low	N.A.
Wiegand	86024200	42	24	**1** in 1983	Clearwater River channel at N side of lake - Drains to Mississippi River	None known	Problem with floating bogs at outlet in past	Low	N.A.