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

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History of Projects in CRWD

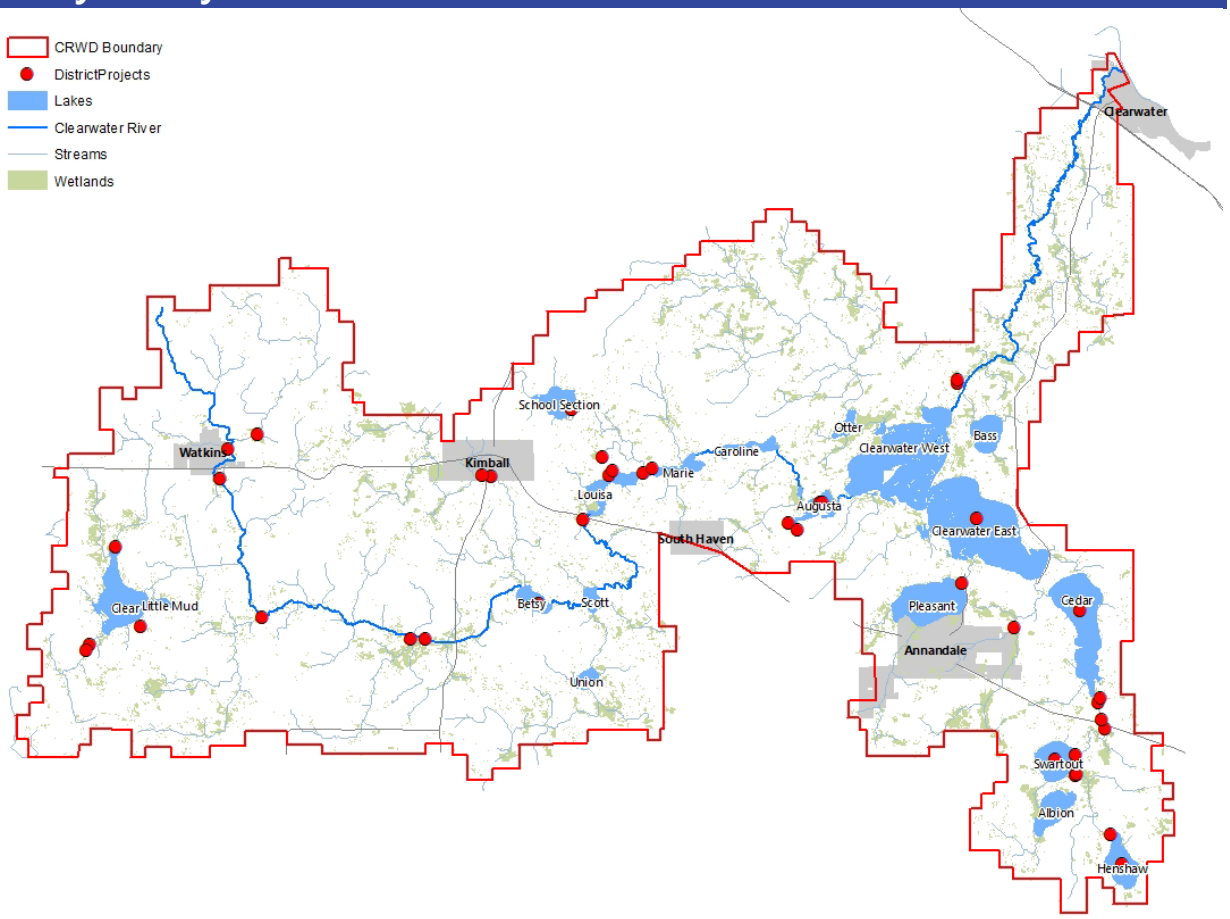

Figure A- 1: CRWD Projects Map

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.