3.0 WATER RESOURCES

3.1 MAJOR STREAMS AND TRIBUTARIES

The Red Lake River originates at the dam at the outlet of Lower Red Lake and flows in a westerly direction approximately 196 river miles to its confluence with the Red River of the North at East Grand Forks (Figure 13).

There are two main tributaries to Red Lake River. One is Thief River, which drains the northern part of the RLWD. This watershed is approximately 1,090 square miles in size. Thief River joins the Red Lake River at Thief River Falls. The second tributary is the Clearwater River, which drains the area south of the Red Lake River. There are about 1,347 square miles in this watershed. Clearwater River empties into Red Lake River at Red Lake Falls. The Lost, Hill and Poplar rivers are minor tributaries to the Clearwater River. The Grand Marais Creek is another significant stream in the RLWD, but it outlets into the Red River of the North, north of East Grand Forks. The Grand Marais Creek subwatershed consists of approximately 317 square miles and is almost entirely agricultural in nature.

There are a number of tributaries of the Upper and Lower Red lakes. These include: Battle Creek, Blackduck River, Cormorant River, Dorrigans Creek, Mud River, Shotley Brook, Tamarac River and several smaller streams.

There are wide variations in the flow of the Red Lake River and its tributaries. The peak periods occur in April and May, depending on the spring breakup and snow melt, and again in May, June or July when heavy spring or summer rains occur. A low flow period generally occurs in the late summer or early fall because of low precipitation. During the winter months, when the rivers and lakes are frozen over, another low flow occurs (Figure 14).

Figure 13
Major Streams and Tributaries Map

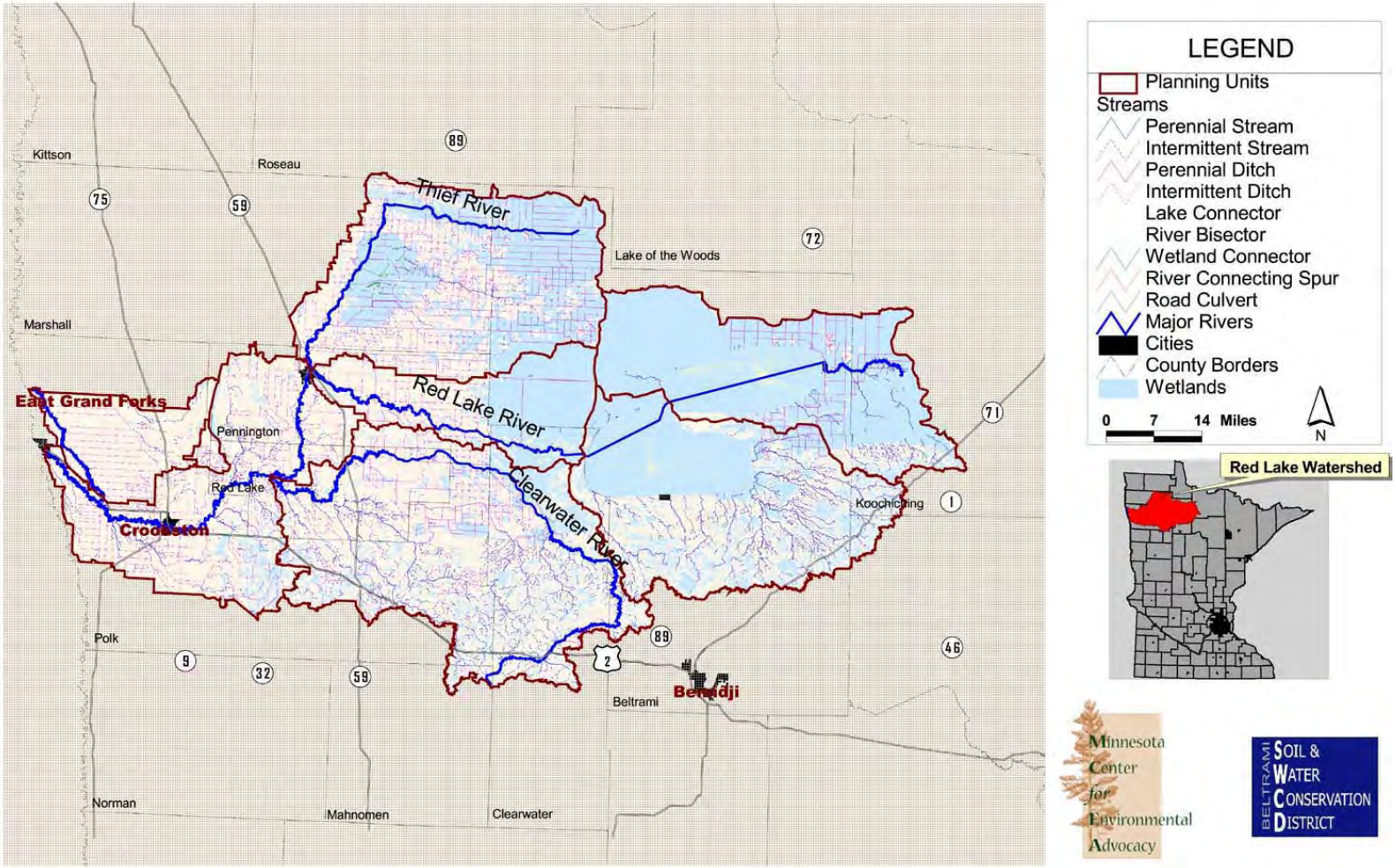
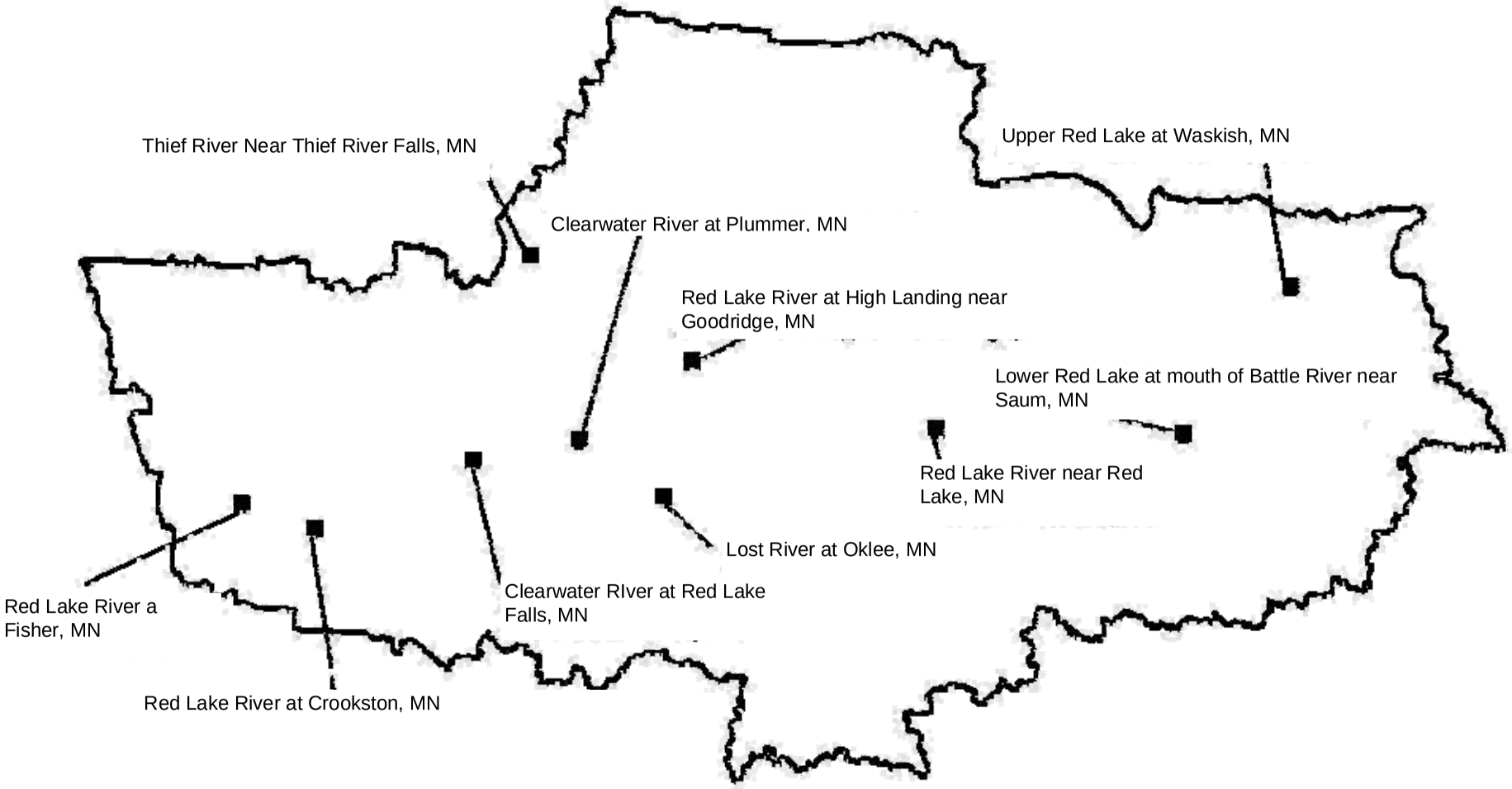


Figure 14
Stream Gages Site Location Map



3.2 LAKES

The largest lakes are the Upper and Lower Red lakes, which comprise an area of 265,040 acres. Lower Red Lake and 60 percent of Upper Red Lake are within the Red Lake Reservation and are fished, for subsistence and commercial purposes, solely by members of the Red Lake Band of Chippewa Indians.

The remainder of Upper Red Lake lies outside of the Reservation and is managed by the Minnesota DNR. A cooperative effort between the Red Lake Band of Chippewa Indians and the MnDNR is currently underway to restore the walleye fishery in the Red Lakes, which collapsed in the mid-1990's.

There are numerous smaller lakes in the RLWD, such as Badger, Cable, Cameron, Cross, Puposky, Poplar, Turtle, Whitefish and many others. Blackduck Lake and Balm Lake have favorable shorelines with sand bottoms. Pine, Clearwater and Maple lakes have a mixture of sand and muck bottoms. Maple Lake is located close to Crookston, East Grand Forks and Grand Forks in Polk County.

Total lake area in the RLWD is estimated at 314,800 acres. There are approximately 190 smaller lakes, most of which are in the moraine area south of the Upper and Lower Red lakes.

3.2.1 Wetlands

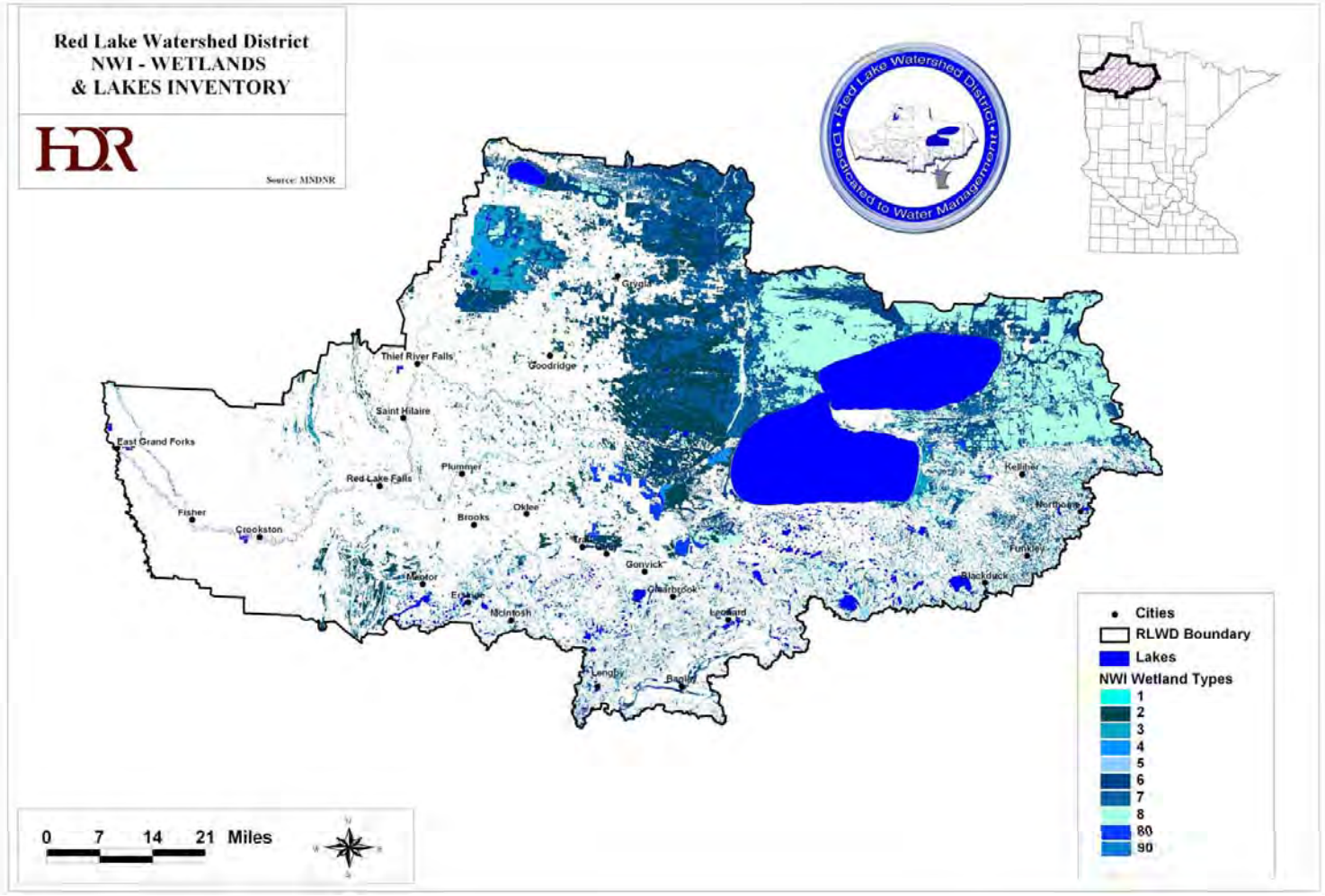
There are 1,541,147 acres of wetlands in the RLWD based upon the National Wetlands Inventory (NWI). They are broken down by type and acreage as follows:

Table 4
Wetlands in the Red Lake Watershed District

WETLAND TYPE – NWI	ACREAGE
Type 1	12,275
Type 2	253,003
Type 3	93,441
Type 4	11,593
Type 5	331,617
Type 6	310,176
Type 7	201,124
Type 8	327,919

Figure 15 shows the locations of existing wetlands within the RLWD.

Figure 15
National Wetlands Inventory Map



3.2.2 Drainage Systems

The cumulative affects of drainage are the focus of much discussion and debate. Section 6.0 addresses FDR principles and the role that drainage plays in the overall approach to water management. Legal drainage ditches have been constructed in the watershed since about 1870. Figure 3 shows most of the public ditch systems placed in a grid-like fashion across mainly the western portion of the RLWD. There are 271 miles of legal ditches managed by the RLWD. Most of the existing ditch systems were established during the first quarter of the 1900's. They provide local relief from soil wetness conditions and minor flooding problems. Inadequate drainage based on today's design standards and problems with existing legal and natural drainage systems is a major water management concern. The generally flat topography and predominantly heavy soils of this area do not afford natural drainage adequate for efficient production of agricultural crops. However, when drained, the soils are highly productive. The RLWD has obtained Minnesota Board of Water and Soil Resources (BWSR) challenge grant funds to update the RLWD ditch inventory with better mapping and identification of benefited areas (Figure 16).

3.2.3 Water Management Structures

The Red Lake outlet was constructed by the USACE. The project consists of a flood control dam at the outlet of Lower Red Lake. The project provides 1 million acre-feet (ac-ft) of flood control storage. Figure 17 depicts the water management projects within the boundaries of the RLWD. Some of these projects, such as the Kiwosay, are managed for purposes other than flood control. Appendix 4 details specific project information.

The RLWD is a partner in over 23 different water retention facilities of varying size and purpose. These projects have significant cumulative NRE values associated with land use that is inherent with water management facilities.

Figure 16
Legal Ditches Map

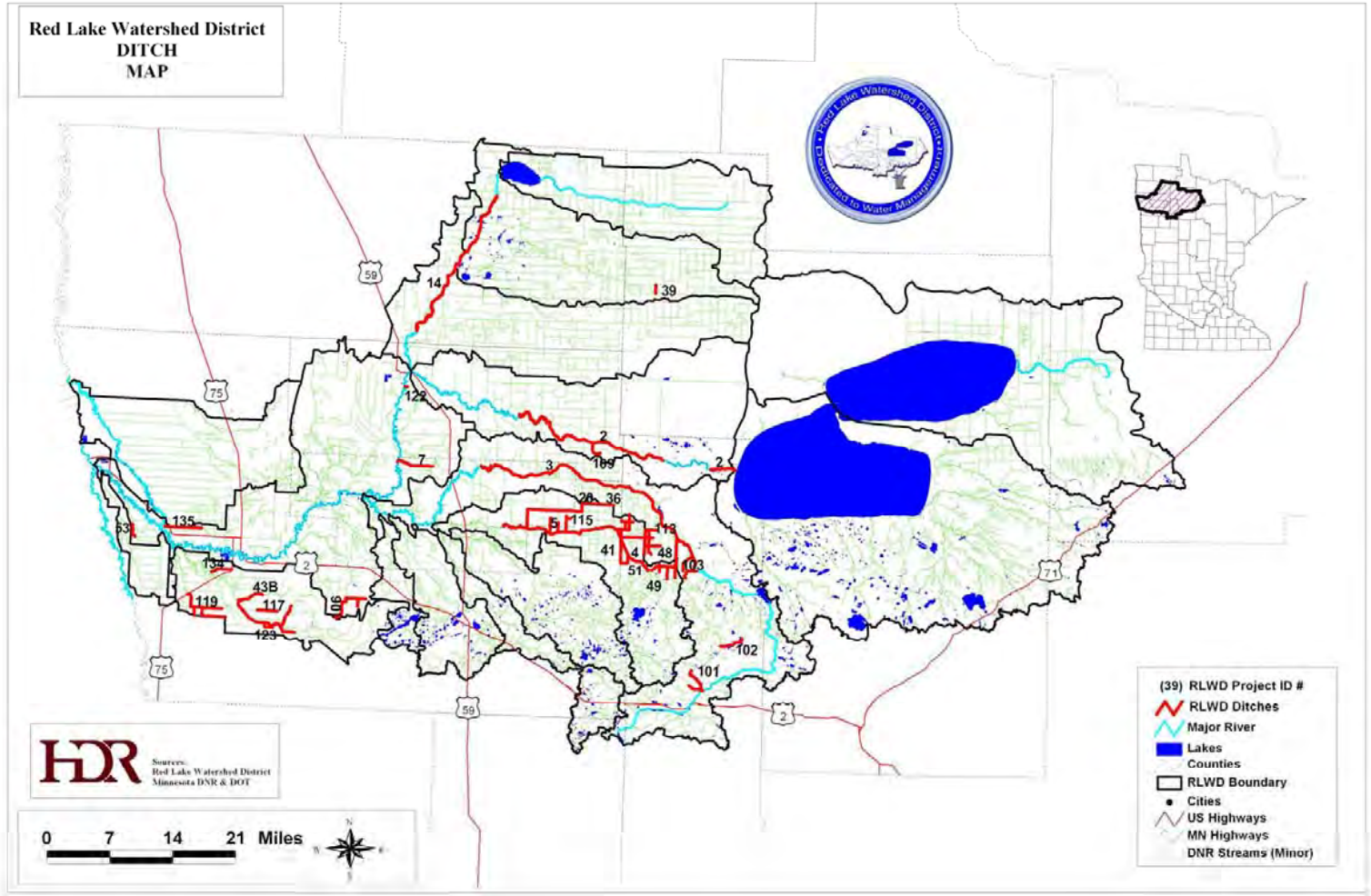
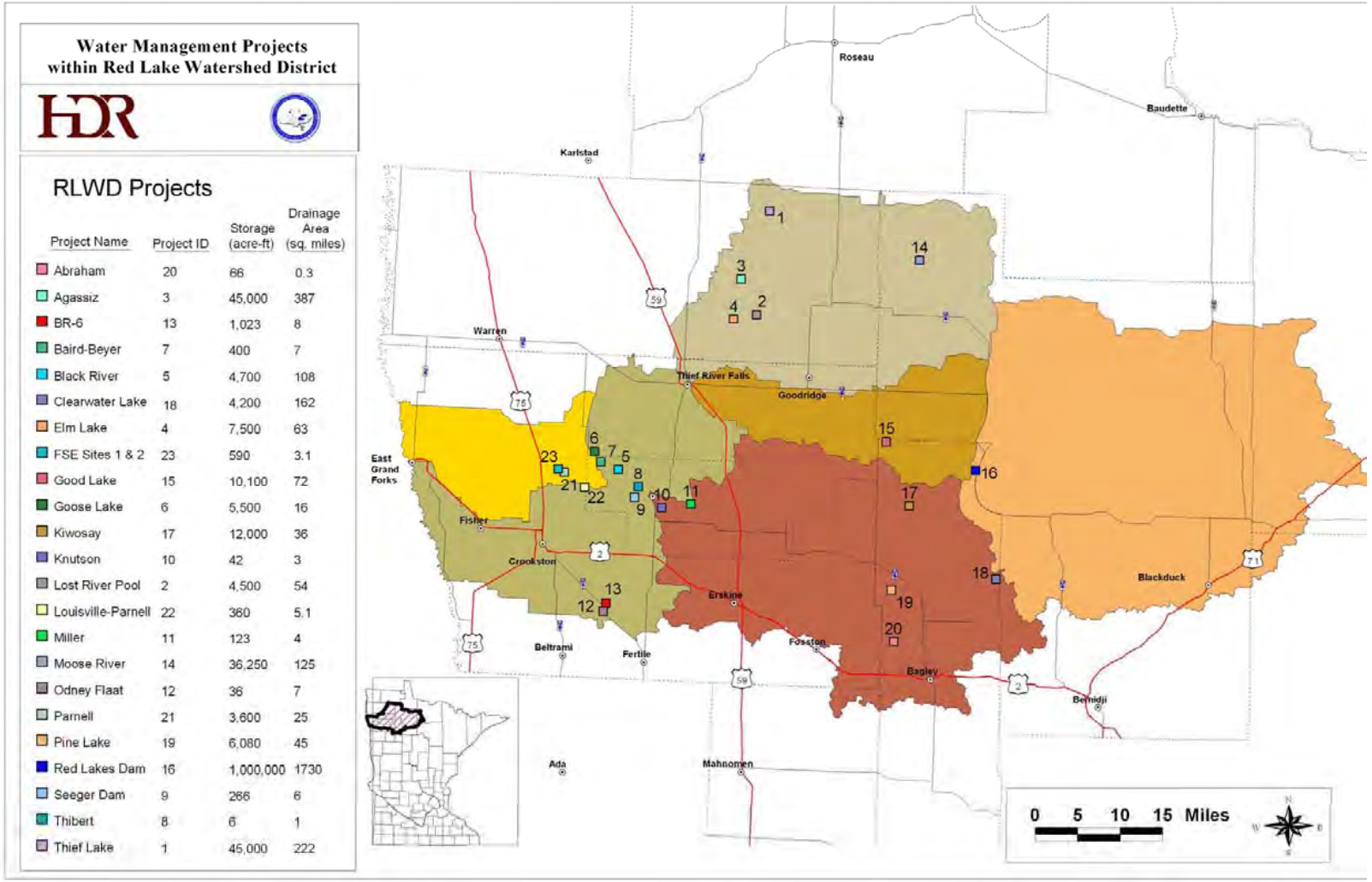


Figure 17
Water Management Projects



3.3 WATER SUPPLY

Groundwater aquifers in the glacial drift and underlying fractured bedrock surface are an important source of water supply for small communities, farms and ranch populations. Large industries, such as power generating plants, sugar and potato processing plants, rely on the rivers for their water supply.

In the eastern two-thirds of the watershed, adequate water can be obtained from wells less than 150 feet deep. In the western part of the RLWD, well depths may exceed 300 feet and may be drawing groundwater from the sand and gravel glacial till deposits or the Precambrian bedrock surface.

The four largest cities in the RLWD are Thief River Falls, Crookston, East Grand Forks and Red Lake Falls. Thief River Falls and East Grand Forks obtain their water from the Red Lake River. The intake for the City of Thief River Falls is downstream of the confluence of the Thief River. The City of Grand Forks, North Dakota, also uses the Red Lake River as a drinking water source. Crookston has recently completed drilling two new wells in addition to their four existing wells. The six wells are located in two separate well fields. Crookston wells range in depth from 56 feet to 164 feet. Red Lake Falls has two deep wells (303 and 307 feet). The remaining towns and villages have from one to three wells, depending on population and local industry. Wells depths vary 56-307 feet deep throughout the watershed district. More detailed information on the public water supplies can be found in the source water assessment for each system provided by the Minnesota Department of Health (MDH).

There is relatively little recharge of underground aquifers from the average annual precipitation of 22 inches. Evapotranspiration results in a loss of approximately 19.4 inches, and the remaining 2.6 inches are lost in runoff.

3.3.1 Drinking Water

The smaller communities and farm population obtain their water supply from wells. This water is usually of good quality and suitable for domestic and livestock needs. The MDH tests all public water supplies systems for a variety of constituents. The testing is completed on "finished" water after any treatment processes.

The two communities of Thief River Falls and East Grand Forks obtain their water exclusively from the Red Lake River. It is necessary to filter and disinfect all river water used for municipal and industrial purposes. During high spring runoff, water purification problems are increased. Both communities participated in preparing a source water assessment and included the

following as issues of importance: naturally occurring organics, sediment, micro-organisms and turbidity.

3.3.2 Water Use

3.3.2.1 Surface Water and Groundwater

Based on information provided by the MnDNR, there are hundreds of permitted surface water and groundwater appropriation installations within the watershed. Figure 18 shows the MnDNR permitted active water use locations.

3.3.2.2 Inventory of Public Water Suppliers

Based on information provided by the MDH, there are 17 municipal water suppliers within the RLWD. Four of the cities within the RLWD (Thief River Falls, East Grand Forks, Crookston and Red Lake Falls) are required by law to have a MnDNR Water Supply and Emergency Conservation Plan.

In addition, each community already has or will be preparing a wellhead protection plan. Wellhead protection planning includes delineating a capture zone for each public water supply well and managing potential contaminant sources within that designated wellhead protection area. Communities with completed plans in the RLWD include: Red Lake Falls, Oklee and St. Hilaire. Communities where plans are underway include: Crookston, Bagley and Blackduck. Other communities in the RLWD will develop plans in the future.

3.3.3 Water Quality Monitoring Plan

The RLWD's Water Quality Project has been ongoing since 1984. The RLWD's commitment to this project reflects the heightened awareness and increased concern for water quality from the public and agencies alike. Fifty-five sites located throughout the RLWD were sampled seasonally, beginning in 1984. Sampling was reduced to 30 sites in 1990. The RLWD currently monitors over 30 sites four times per year. Sampling sites are located in all major subwatersheds within the RLWD. Although a core set of long-term monitoring sites [i.e. those sites associated with U.S. Geologic Survey (USGS) gauges] will continue to be monitored, some site locations may be adapted to changing project needs and assessment strategies. The RLWD long-term monitoring program collects data for dissolved oxygen, water temperature, conductivity, pH, total phosphorus, orthophosphorus, total suspended solids (TSS), total dissolved solids, total Kjeldahl nitrogen, ammonia nitrogen, nitrates and nitrites, fecal coliform and chemical oxygen demand. Water quality samples will be analyzed for Escherichia (E.) coli bacteria from May of 2005 forward due to impending MPCA standards for this parameter. Also beginning in 2005, long-term monitoring program samples will no longer be analyzed for chemical oxygen demand (Figure 19).

Figure 18
Water Use

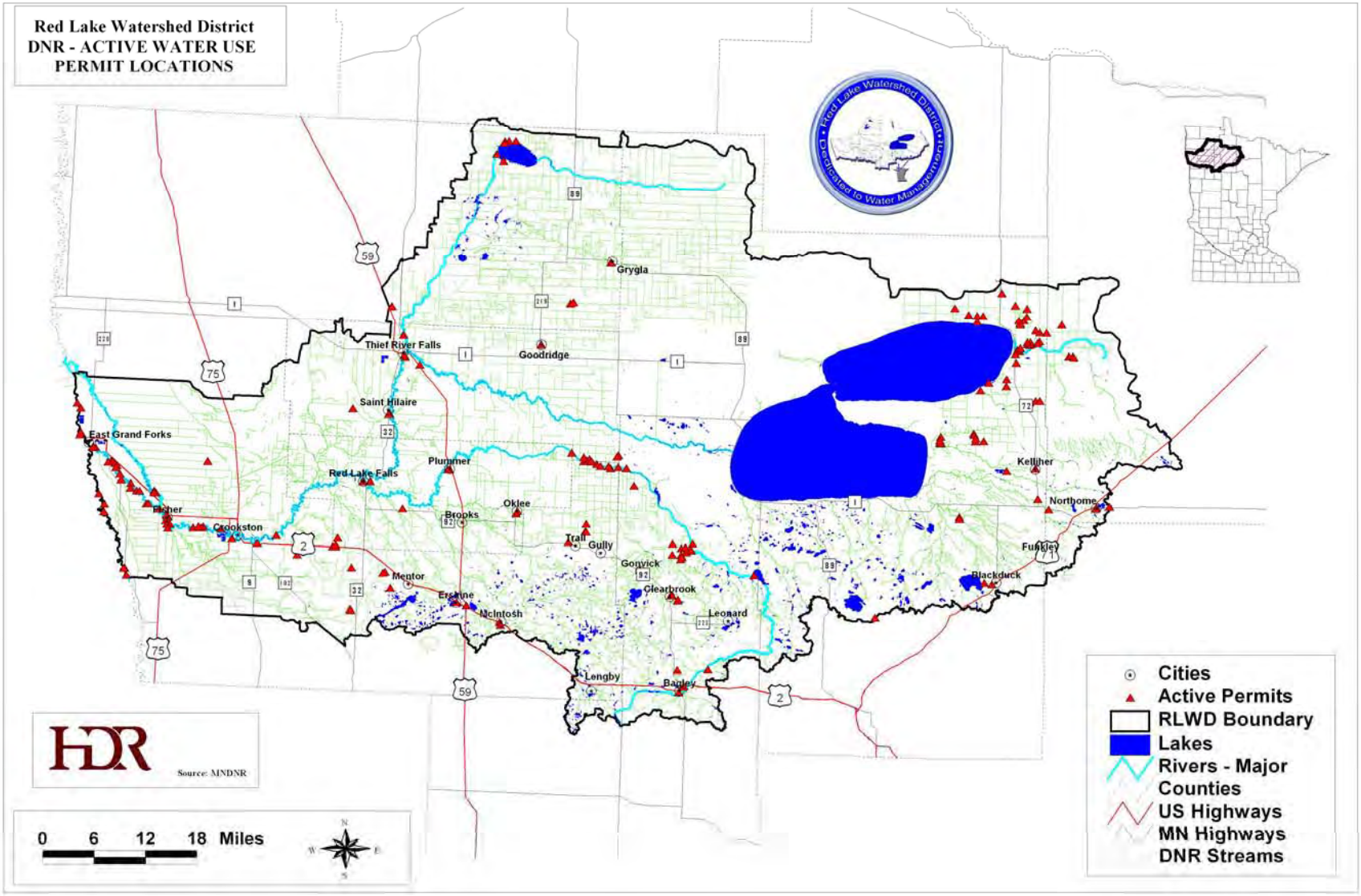
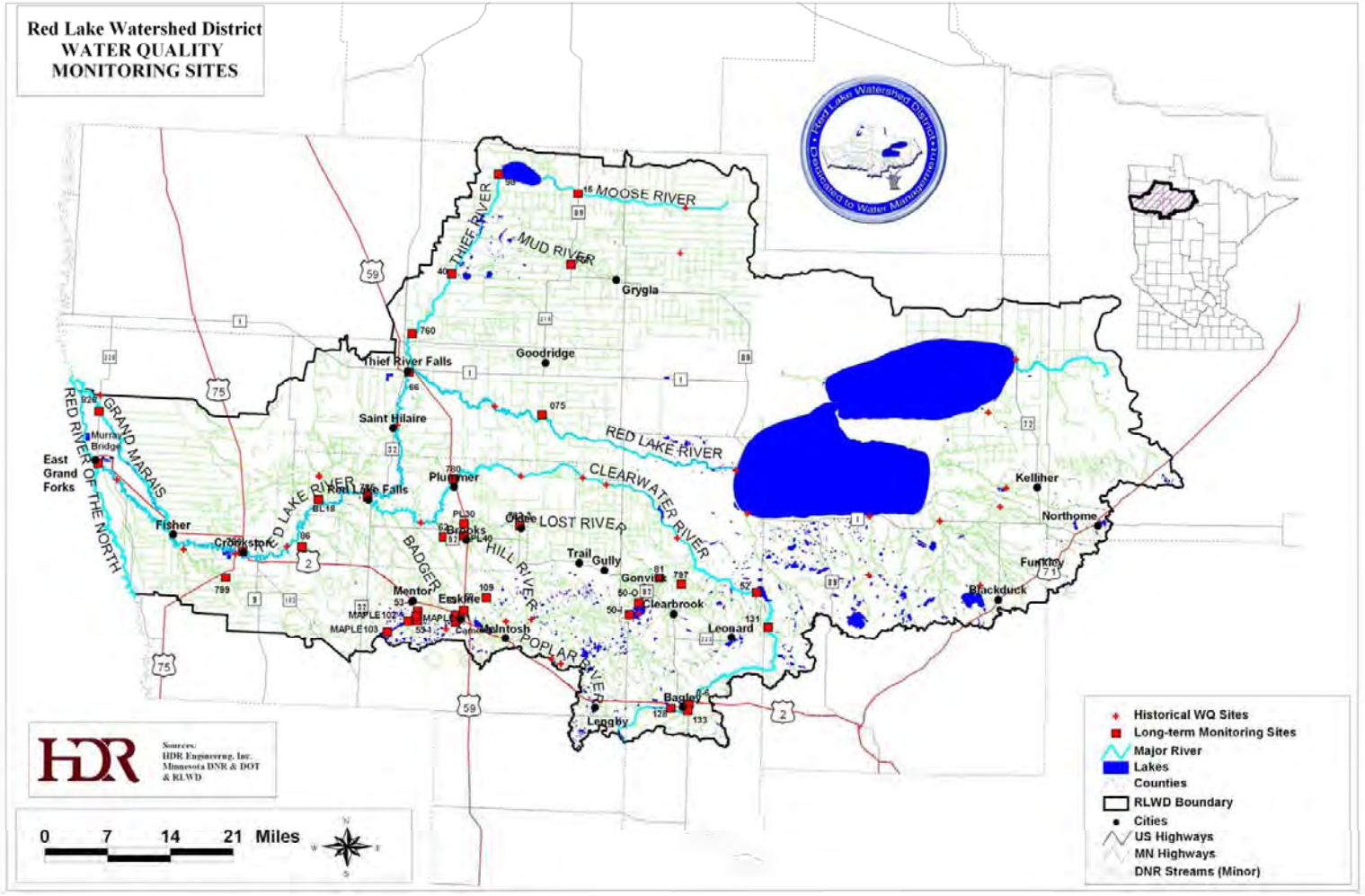


Figure 19
Water Quality Monitoring Sites



The RLWD long-term monitoring program is undergoing changes that will increase its efficiency and the usability of the data collected without greatly increasing costs. Data will be collected on a schedule that is more suitable for assessments. Data will regularly be entered into the Environmental Protection Agency's (EPA) national water quality database STORET. Analysis for two parameters for which data is not used may be discontinued. Site location will continue to be based on the locations of USGS gauges, position within a watershed, project locations, locations of other agencies' monitoring sites and the locations of impaired reaches. Flow measurements will be collected at sites that lack rating curves. The RLWD has spent an average of $41,000 per year on its water quality program since it began. The amount spent varies each year, based upon the amount of time spent on other water quality projects.

Water quality varies throughout the RLWD. The Red Lakes subwatershed, Upper Red Lake River subwatershed and the Upper Clearwater River subwatershed, in the eastern part of the RLWD, are characterized by good water quality. Some streams within these areas have even seen improvement in recent years. As the rivers travel further west into the Red River Valley, however, they encounter lower gradients, increased drainage and channelization. These factors and others negatively affect water quality and biotic integrity. The Thief River, which joins the Red Lake River from the north, has relatively good water quality during normal flow conditions, particularly during summer months. However, during bank-full flows as well as low-flow situations, water quality can become impaired. Dissolved oxygen levels plummet, while total dissolved solids and conductivity levels increase during winter occurrences of low-flow. TSS and phosphorus levels greatly increase during occurrences of high flow, whether this high flow is from runoff, the release of water from Agassiz NWR, or both. On the Lower Red Lake River and on Grand Marais Creek, high turbidity and TSS levels are a regular occurrence. A summary of water quality findings, including impaired waters as identified by the MPCA, is found in Appendix 6 and Appendix 7.

3.3.3.1 Outstanding Resource Value Waters

According to Minnesota Rules Chapter 7050.0180, there are seven calcareous fens classified as Outstanding Value Resource Waters (OVRW) within the RLWD. The ORVWs are listed as follows:

Calcareous Fens

Clearwater County:

(1) Clearbrook fen, 61 (T.149, R.37, S.17)

Pennington County:

(2) Sanders east fen, 65 (T.153, R.44, S.7)
(3) Sanders east fen, 74 (T.153, R.44, S.7)
(4) Sanders fen, 64 (T.153, R.44, S.18, 19)

Polk County:

(5) Tympanuchus prairie fen, 26 (T.149, R.45, S.17)
(6) Tympanuchus prairie fen, 38 (T.149, R.45, S.16)
(7) Gully fen (T.150, R.39W, S.14)

In addition, the Pembina Trail Reserve in Polk County is classified as an ORVW.

3.3.3.2 Rare and Endangered Species

The RLWD has the MnDNR Natural Heritage Program listing and maps of rare and endangered species on file. The RLWD will review this information prior to implementation of watershed projects to avoid adverse impacts.

3.3.4 Inventory of Municipal Wastewater Treatment Systems

The wastewater treatment facilities in the RLWD appear in Table 5.

Table 5
RLWD Wastewater Treatment Facilities

Facility Name	ID Number	County	Watershed Name	Facility flow (mgd)
Bagley WWTP	MN0022691	Clearwater	Clearwater River	0.14
Clearbrook WWTP	MN0020931	Clearwater	Clearwater River	0.125
Erskine WWTP	MN0022527	Polk	Clearwater River	0.101
Gonvick WWTP	MN0020541	Clearwater	Clearwater River	0.1
McIntosh WWTP	MNG580031	Polk	Clearwater River	0.105
Oklee WWTP	MNG580038	Red Lake	Clearwater River	0.058
Plummer WWTP	MN0024520	Red Lake	Clearwater River	0.037
7 Clans Casino Stabilization Ponds	MN0063452	Pennington	Red Lake River	0.0135
American Crystal Sugar - Crookston	MN0001929	Polk	Red Lake River	5
American Crystal Sugar - E Grand Forks	MN0001937	Polk	Red Lake River	10
Crookston WWTP	MN0021423	Polk	Red Lake River	1.4
Fisher WWTP	MN0023426	Polk	Red Lake River	0.0375
Goodridge WWTP	MNG580022	Pennington	Red Lake River	0.026
Red Lake Falls WWTP	MN0020613	Red Lake	Red Lake River	0.16
St Hilaire WWTP	MN0024741	Pennington	Red Lake River	0.025
Thief River Falls Power Plant	MNG250058	Pennington	Red Lake River	0.002
Thief River Falls Regional Airport	MN0044415	Pennington	Red Lake River	0.00675
Thief River Falls WWTP	MN0021431	Pennington	Red Lake River	2.14
East Grand Forks WWTP	MN0021814	Polk	Red River of the North - Grand Marais	1.4
Oslo WWTP	MN0024431	Marshall	Red River of the North - Grand Marais	0.102
Grygla WWTP	MN0040771	Marshall	Thief River	0.032
Blackduck WWTP	MN0052302	Beltrami	Upper and Lower Red Lakes	0.1255
Kelliher WWTP	MNG580068	Beltrami	Upper and Lower Red Lakes	0.0365

3.3.5 Relationship to Existing Water Management Plans and Programs

The Managers recognize the importance of having a comprehensive plan that both captures local vision and is inclusive of the goals and objectives of other natural resources agencies. During the planning process, members of the MPCA, MnDNR, USFWS, USACE, County Water Planners, SWCDs, County Commissioners and others were invited to participate in the planning process. These individuals were asked to provide input to the RLWD's planning process on the goals, policies and objectives of the following plan areas:

- County Water Management Plans
- Soil and Water Conservation District Plans
- Natural Resources Agency Plans
- Other Local Government Water Management Plans
- MPCA Regional Groundwater Plan

The RLWD provided numerous opportunities for the respective agencies to provide review and comment on the RLWD's Overall Plan. Where possible, the RLWD will try to provide opportunities for the various resource agencies to implement their programs when the RLWD is implementing a FDR project. These partnership opportunities will be facilitated through the mediation process and the established project teams (PTs).

In addition to the input the various agencies had in the development of the overall watershed plan, each agency administers programs that impact water resources management. The programs with the greatest potential to impact water resources management by the RLWD are summarized in Table 6. The agencies should be contacted directly for a complete program description.

The Flood Damage Reduction Mediation Agreement of 1998 was developed and intended to be the framework for a collaborative approach to implement both FDR and natural areas protection and enhancement in the Red River Basin on chronic, flood-prone areas identified by local watershed organizations.

3.3.6 Groundwater Quality

The role of the RLWD in this area will be to review data gathered by other agencies and data compiled by the RLWD. New water quality information in the RLWD is being accumulated by the MDH, MPCA, USGS, MnDNR and the SWCD with their analysis of public water supplies. The RLWD will strive for coordination of a groundwater data management program. The

RLWD's role will involve an annual review of the data gathered by other agencies during the current year and assisting industry and agriculture people in siting new facilities. The aforementioned activities are not intended to supersede the authority or responsibility of other agencies, but to deal with locally sensitive projects before they are extensively developed.

Table 6
Programs that Impact Water Resources Management

AGENCY	PROGRAM	SYNOPSIS
MnDNR	Land Use Management (shoreland, flood plain)	State-wide land use management standards, implemented by cities and counties. Impact setback, density, ISTS, water quality, etc.
MnDNR	Protected Waters and Wetlands Permitting Program	Issues permits for activities that alter course, current or cross-section of protected waters. Coordinated with other local, state and federal permits.
MPCA	Total Maximum Daily Loads	Data collection, monitoring and analysis. Will result in capitol projects to improve water quality. Opportunity for partnership with RLWD.
MPCA	NPDES Program	Permitting program for construction and land disturbing activities. Self monitoring program for implementation of BMPs to reduce erosion and sedimentation.
BWSR	Wetland Conservation Act	State wetland protection program designed to protect wetlands not regulated by MnDNR or USACE. Coordinated with other local, state and federal actions.
BWSR	Grant and funding programs [Conservation reserve enhancement program (CREP), Wetland Reserve Program]	Programs to idle sensitive agricultural lands and restore wetlands and associated habitat to improve water quality.
USACE	Section 401 and 10 Permits	Water resources permitting programs that regulated fill and excavation in waters of the U.S. and navigable waters. Coordinated with local and state efforts.

3.3.7 Annual Report on Water Quality

An annual water quality report will be prepared by the RLWD staff for the RLWD annual report. A biannual comprehensive water quality report will also be produced beginning in 2004. This report will include the statistical analysis and water quality modeling conducted using RLWD long-term monitoring data. Without this type of accounting and compilation of data, it is unlikely the abatement plan would be dynamic and adaptable. The report will summarize, specifically, the five major areas of the abatement plan, the planning for the subsequent years and will describe changes needed to fine tune the Overall Plan, based on the data and conclusions of the previous year's work. Reports will also be produced for any special water quality projects, including intensive monitoring, erosion control projects and any studies conducted by the RLWD. Copies of all reports are available at the RLWD office and posted on the RLWD website (www.redlakewatershed.org).

Some of the data analysis conducted for this report includes the creation of histograms and time series plots using Microsoft Excel, data censoring by simple substitution and the calculation of annual loads by the Flux modeling program. Comparisons are made among sites based on mean concentrations, EPA standards and minimally impacted values. Water quality data is interpreted for the identification of problems, impacts, trends and patterns. The RLWD water quality program will produce biannual comprehensive reports of results from its long-term monitoring program. Additional information on water quality is found in Appendix 7.

3.3.8 Impaired Waters and Total Maximum Daily Loads

The MPCA is the state agency responsible for protecting Minnesota's water quality. Every two years an updated list of impaired streams and lakes is published. This list can be found on the MPCA website at http://www.pca.state.mn.us/water/tmdl/index.html.

There are a number of rivers, streams and lakes within the RLWD that are listed on the MPCA Clean Water Act Section 303(d) List of Impaired Waters. Most of these impairments are discussed within the subwatershed sections of this Overall Plan (Section 7.0). These "impaired" waters do no meet water quality standards and pose risks to people, aquatic life and recreation. They contain too much sediment, bacteria, mercury, phosphorus and other contaminants. There will need to be a continued effort from local, state and federal interests to meet the challenge of addressing these impaired waters. Appendix 6 is included as an example for development of total maximum daily loads (TMDLs) in the Red River Basin.

3.3.9 Water Quality Improvement Projects

In addition to monitoring water quality, the RLWD will pursue the implementation of projects that will improve water quality, habitat and provide other natural resource enhancements. Studying the rivers and lakes is essential for understanding the locations and sources of water quality problems. However, studies and monitoring programs should be balanced with implementation of projects that will actually create improvements in water quality, habitat, etc. The Clearwater Nonpoint Study and other studies have recommended various projects for improving and protecting water quality. Cost-share funding through state, federal and non-profit grants will be sought for these projects. These projects could include streambank stabilization, grade stabilization, riparian buffer, wetland restoration, public education, stream restoration and Best Management Practice (BMP) implementation projects. Special studies (by the RLWD as well as other agencies) and the RLWD long-term monitoring program will be used to target priority areas and needs for water quality improvement project implementation.