KANABEC COUNTY WATER PLAN 2006 - 2016

KANABEC COUNTY

COMPREHENSIVE LOCAL WATER PLAN

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Teresa Bearce	**Environmental Services Director**
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EXECUTION SUMMARY

The Kanabec County Comprehensive Local Water Plan update was coordinated with the assistance of a committee of eight members. Information obtained through the scoping document process dictated priority concerns for the county.

KANABEC COUNTY WATER PLAN ACCOMPLISHMENTS 2001 - 2006

Since approval of the current Kanabec County Comprehensive Local Water Plan, the following items have been funded. Several of these are on-going items that will continue to be addressed in this updating of the plan.

Education and Information

The Kanabec SWCD and the NRCS have worked with local schools to establish a water quality education program called "River Watch". The program is conducted each spring and fall and includes Mora and Ogilvie schools.

From 2002 through 2006, the Water Plan Committee hosted a booth at the Mora Area Home Show showing projects assisted through the water plan program.

In 2005 and 2006, the Water Plan Committee hosted a booth at the Kanabec County Fair. This reached a more diverse group of people then the Home Show.

Inventory and Mapping

In 2005, the Water Plan Committee started funding the county ditch inventory. This ongoing mapping of the ditches will help access the county ditches for future water projects.
Water Plan funds have been used to assist with the completion of a soil survey for Kanabec County. In 2005, the survey was completed. This is the first detailed soil survey of Kanabec County.

During 2000, septic system compliance inspections were completed for several residences around Lewis Lake. Water Plan funds were used to complete the inspections. By 2001, all participants made the required repairs or replacements.

Land and Water Treatment

Feedlot Improvements – Water Plan funds have been used to provide technical assistance for feedlot improvements. This has been ongoing and will continue throughout the upcoming years.

Manure Management Plans – Water Plan funds have been used to provide technical assistance for manure management plans. This includes calculating application rates to best protect water quality and provide proper crop nutrients. Additional manure management plans are underway and will continue in the upcoming years.

Shoreline Erosion Control – Water Plan funds have been used to provide technical assistance and cost sharing for development and installation of shoreline erosion control plans. The emphasis on natural vegetative buffers will be ongoing through the upcoming years.

Water Monitoring and Data Collection

In 2005 a joint project involving MPCA, SWCD, Kanabec County Environmental Services and the neighboring county of Mille Lacs, started to access the TMDL for the Groundhouse River within the Counties. This will be ongoing and could apply to other waters in the county.

Well testing for families with new babies is another project, where Water Plan money has been used. This on-going program is a valuable tool in preventing health risks to newborn infants. This will be ongoing throughout the upcoming years.

The monitoring of lakes within Kanabec County has also been established using Water Plan funds. Water samples are collected on area lakes from April through September. Samples are tested for levels of nitrates, phosphorous, and chlorophyll. This will continue.

The Kanabec County Water Plan identified priority concerns to the water quality of the area. These concerns and goals have been discussed in the plan.

The Water Plan Committee will coordinate regularly. A detailed plan of action will be prepared annually to adequately fund and assign responsibility for completing the necessary priority items to achieve the desired goal. This will provide some flexibility and allow for better management of funds and personnel to achieve the plan's goals. See location map.

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I. INTRODUCTION

A. AUTHORITY

The authority to prepare comprehensive local water plans was granted to counties in 1986 when the Minnesota Legislature passed the Comprehensive Local Water Management Act. The legislature recognized the need to manage the State's surface and ground waters in a comprehensive manner and determined that water resource planning should occur at the county level as local residents are in the position to recognize problems and identify and carry out needed actions to effectively address local water resource issues.

B. PURPOSE OF PLAN

The purpose of Kanabec County's Comprehensive Local Water Plan is:

- To identify existing and potential challenges or opportunities for the protection, management, and development of water resources and related land resources in Kanabec County and the Snake River Watershed.
- To develop and implement an action plan to promote sound water management decisions, and
- To achieve effective environmental protection of Kanabec County's water and land resources.

Based on the understanding of existing conditions, county officials can then decide:

- What water resources are necessary and desired for future growth and development;
- And determine a course of action to achieve and maintain the quality of life desired in Kanabec County.

Kanabec County recognized that counties must develop their own local plan for managing water resources. If not, they will eventually lose the opportunity to make intelligent, local choices that anticipate or prevent water resource problems in the future.

Kanabec County also recognizes that a well-developed comprehensive water plan can also integrate local initiatives with existing state and federal water related programs and funding sources. This integration also allows more effective management of all programs developed for the protection of water resources and the general environment.

C. SCOPE OF PLAN

This comprehensive local water plan addresses the physical, surface water, ground water and related land resources. The plan utilizes existing data and local public input.

Discussion within the plan addresses primarily water quality. Although water quantity is also addressed, quality is a more prominent problem within Kanabec County.

D. PLANNING PROCESS

The Kanabec County Board of Commissioners passed a resolution on June 13, 1990, to engage in this water planning process and enter into an agreement with the Minnesota Board of Water and Soil Resources. On August 24th, 2005, the Kanabec County Board of Commissioners passed a resolution, indicating their intent to update the 2001 plan. The Kanabec County Board of Commissioners delegated the task of coordinating water planning to the Kanabec County Water Plan Administrator. In addition, the Water Planning Committee was charged with the task of updating the comprehensive local water plan for Kanabec County.

II. INVENTORY AND ASSESSMENTS

A. GENERAL PHYSICAL ENVIRONMENT

PRECIPITATION

Precipitation is measured and recorded by rainfall observers of the Minnesota Climatological Network. Administered by the Soil and Water Conservation District Observers are required to record daily precipitation readings, which are submitted to the Kanabec SWCD on a monthly basis. Rainfall records developed by the rainfall observers are entered into a statewide database, which provides information on precipitation amounts and precipitation patterns.

Currently, there are 10 official rainfall observers located throughout Kanabec County.
Figure 1 indicates the location of the rainfall observers in Kanabec County.

The following is the yearly total averages across the County since the last County Water Plan update in 2001:

Year	Inches
2005	33”
2004	32”
2003	27”
2002	37”
2001	34”

Annual reports of statewide precipitation records are sent to each SWCD and rainfall observer.

GEOLOGY

Kanabec County has two primary aquifers, a surficial sand-plain aquifer and a bedrock sandstone aquifer (Mount Simon-Hinckley). The location of the surficial sand-plain aquifer is shown on Figure 2 and the bedrock sandstone aquifer is shown on Figure 3.

The sand-plain aquifer is the aquifer of greater importance in managing water resources due to its large quantity of water, potential for development, and susceptibility to contamination. It is composed of outwash and well sorted sand

and gravel deposited during the retreat of the glaciers. The underlying bedrock material consists of sandstone, which may be thousands of feet thick and igneous rock.

Sand-plain Aquifer - The sand-plain aquifer is unconfined and has a saturated thickness ranging from 0 to 90 feet, averaging 30 feet. Most water levels are less than 20 feet below the land surface. Depth to water is usually greater in areas of higher altitude, with water levels at or near the land surface in most of the stream valleys.

Theoretical well yields from the sand-plain aquifer range from 100 gallon per minute (GPM) to 1500 gpm with an average of approximately 300 gpm. Infiltration of precipitation and snowmelt is the primary source of recharge of the sand-plain aquifer. Ground water discharges are primarily through evapotranspiration, leakage to streams, and pumpage.

Extensive sand-plain aquifers in northern Carlton, northern and southern Pine and southern Kanabec Counties are connected by elongated outwash filled valleys eroded in the till.

Bedrock Aquifer - The bedrock geology consists of the Hinckley sandstone and the Fond Du Lac formation. There is little data pertaining to the Mount Simon-Hinckley aquifer in Kanabec County. Depth to the sandstone formation generally ranges from 0 to 100 feet below the land surface. The sandstones generally are highly fractured and loosely cemented, providing for storage of large quantities of water.

The surficial geology in the non-sand-plain areas consists of till, which is an unsorted mixture of rock, silt, and clay. Till yields low quantities of water. The bedrock west of the Mt. Simon-Hinckley Aquifer consists of granite, which may yield small amounts of water adequate for domestic wells. Areas of granite bedrock overlain by till have the lowest potential for ground-water yield in the County.

Aquifer Confinement - Test drilling indicated that the sand-plain aquifer overlies the sandstone aquifer in several areas. In almost every location the aquifers are separated by a confining layer of till. However, test drilling near Quamba indicates that no confining layer separates the aquifers. Outwash also may be in direct contact with the sandstone aquifers near outcrops of sandstone. In areas where the sand-plain aquifer overlies the sandstone aquifers, water level data suggests downward movement of water and recharge to the underlying sandstone aquifer.

Ground Water Flow - Ground water flow is predominantly north to south, draining to the Ann, Groundhouse, Knife, and Snake Rivers. In the southern part of the County, flow is generally west to east following the Groundhouse and Snake River valleys.

Ground water elevation (above sea level) and flow direction is shown on Figure 4.

SOIL SURVEY, SOILS MAP, AND INFILTRATION CHARACTERISTICS

Kanabec County soil mapping has been completed. This information has been valuable for a number of uses such as: conservation planning, engineering designs, road building projects, plant recommendations, water table depth, wetland determinations, septic system suitability, building construction, land subdivision, waste utilization, forest management, physical and chemical properties and other uses.

Kanabec County has six major soil associations. The General Soil Map for Kanabec County is shown as Figure 5A. The characteristics of the soil associations are described below.

1. MILACA-RONNEBY ASSOCIATION - Nearly level to gently sloping, well and somewhat poorly drained soils that have dense reddish fine sandy loam subsoil.

2. DALBO-BRICKTON ASSOCIATION - Nearly level, moderately well drained and somewhat poorly to poorly drained soils that have calcareous substratum.

3. OMEGA-NEMADJI ASSOCIATION - Nearly level to gently sloping, somewhat poorly drained soils that have sand sub-soils.

4. ROSHOLT-ONAMIA ASSOCIATION - Nearly level to gently sloping, well-drained soils that have loamy subsoil and gravely sand substratum.

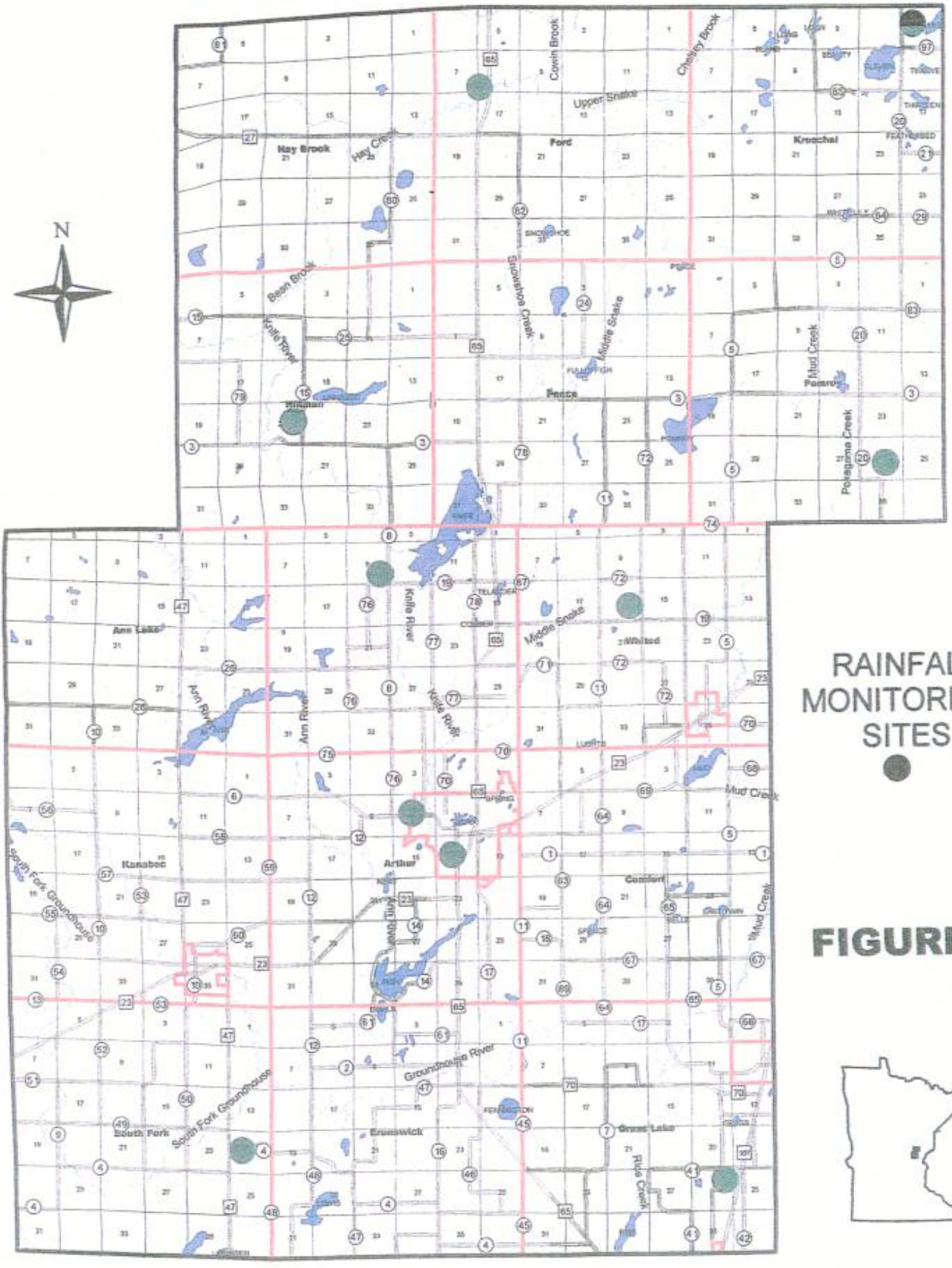
5. GREENWOOD-LOXLEY-BESEMAN ASSOCIATION - Nearly level, very poorly peat and muck soils.

6. Alluvial soils that flood.

These soil associations correlate reasonably with the Land Management Information Center (LMIC) soil landscape unit map as shown on Figure 6. The soils in the county are predominately sands and loams, with some peat and alluvial soils.

Soil permeability ranges from .2 inches per hour (in./hr.) to greater than 5 in./hr. As shown on Figure 7. Low permeability rates (less than 2.5in./hr.) occur over .6% of the County in the Dalbo-Brickton Soil Association, north of Grasston. Seventy-two percent of the County falls under medium and variable permeability (.25 in./hr. - 5 in./hr.). This permeability is associated primarily with the Milaca-Ronneby Soil Association, which are the loamy soils. Fifteen percent of the county falls under high permeability (greater than 2.5"/hr.). This permeability is associated with Omega-Nemadji and Rosholt-Onamia Association which have gravely and/or sandy sub-soils.

COUNTY OF KANABEC



RAINFALL MONITORING SITES

FIGURE 1

COUNTY OF KANABEC

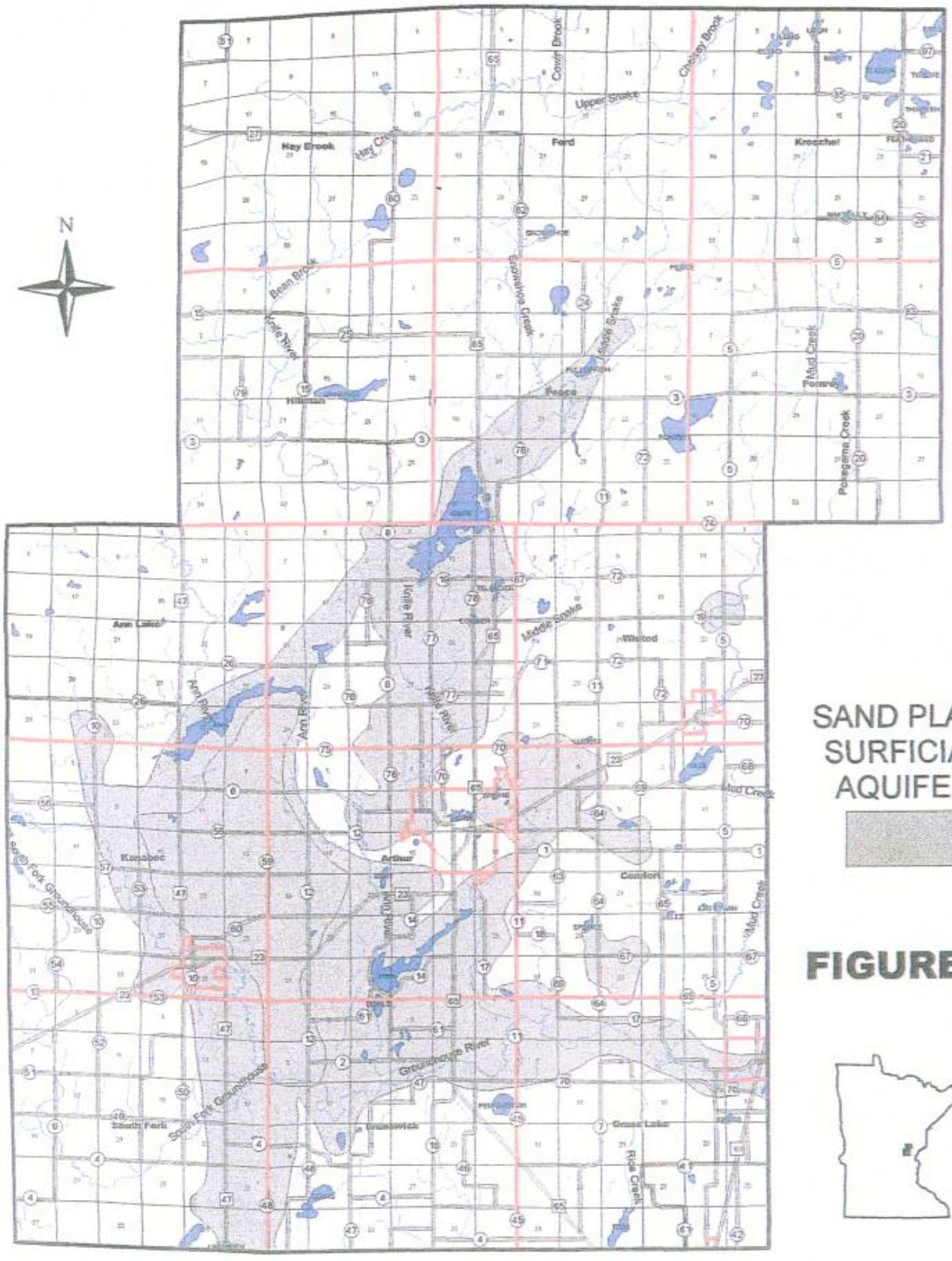
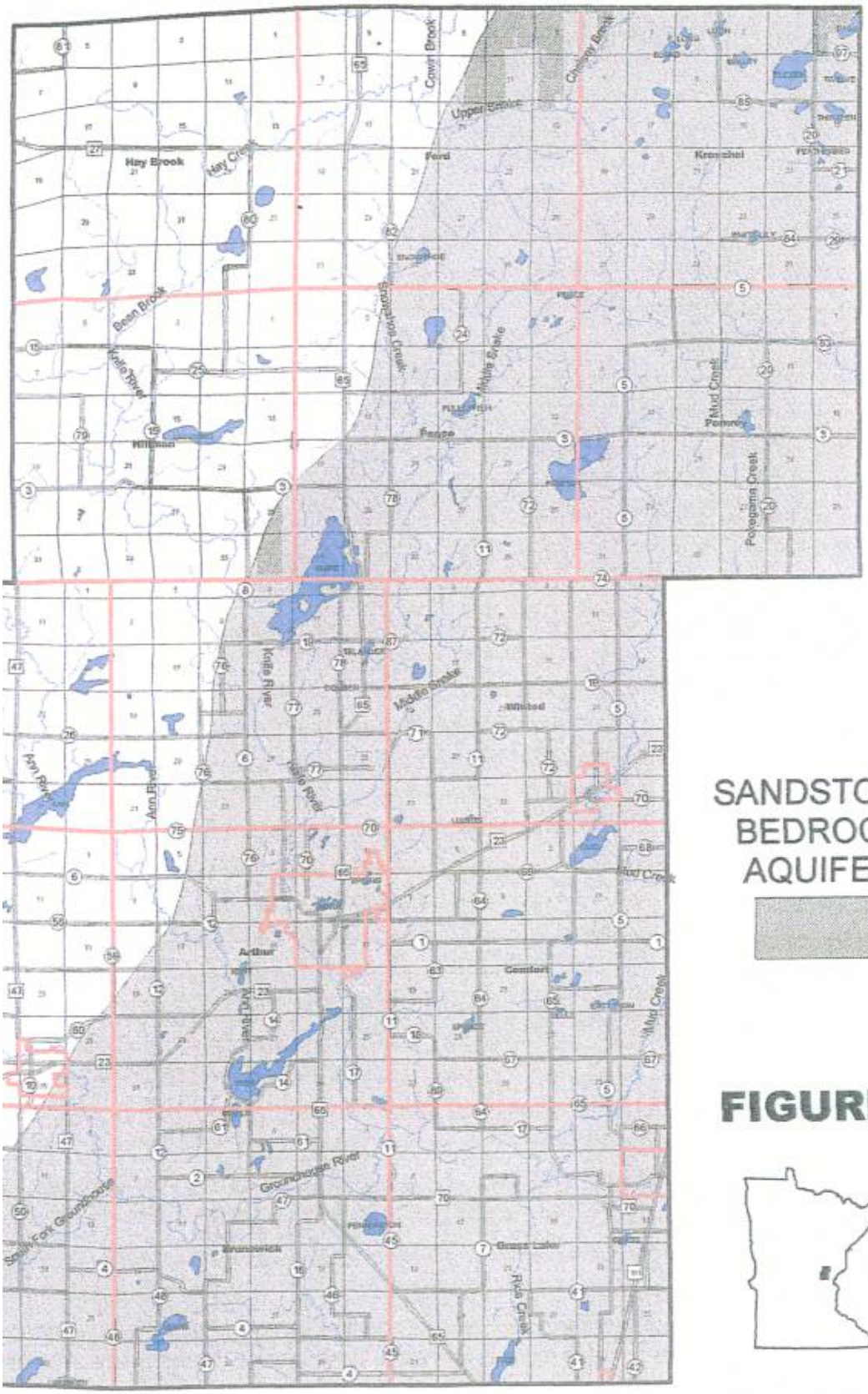


FIGURE 2

COUNTY OF KANABEC



SANDSTONE BEDROCK AQUIFER

FIGURE 3

COUNTY OF KANABEC

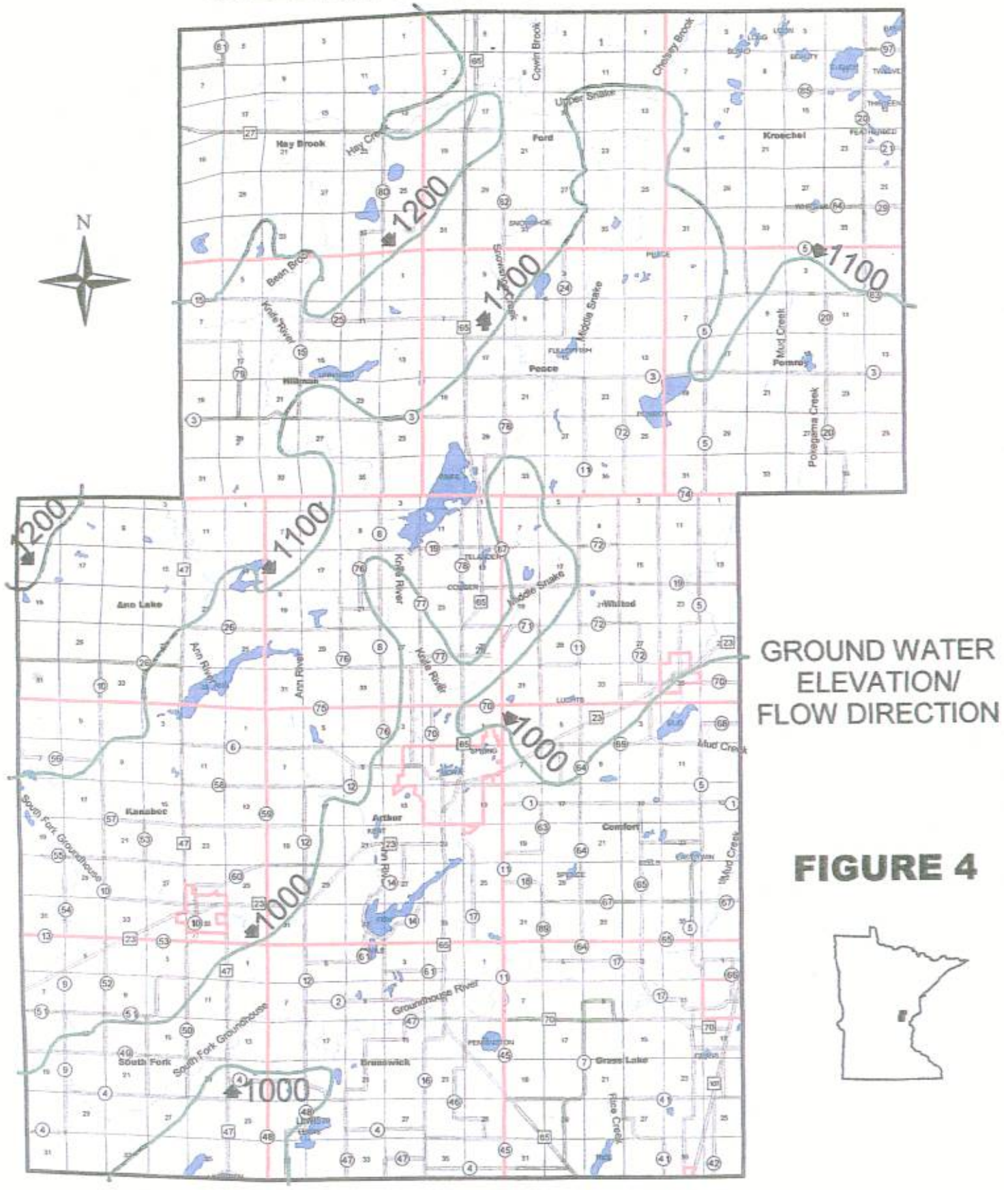


FIGURE 4

COUNTY OF KANABEC

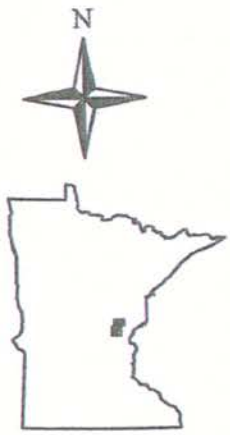
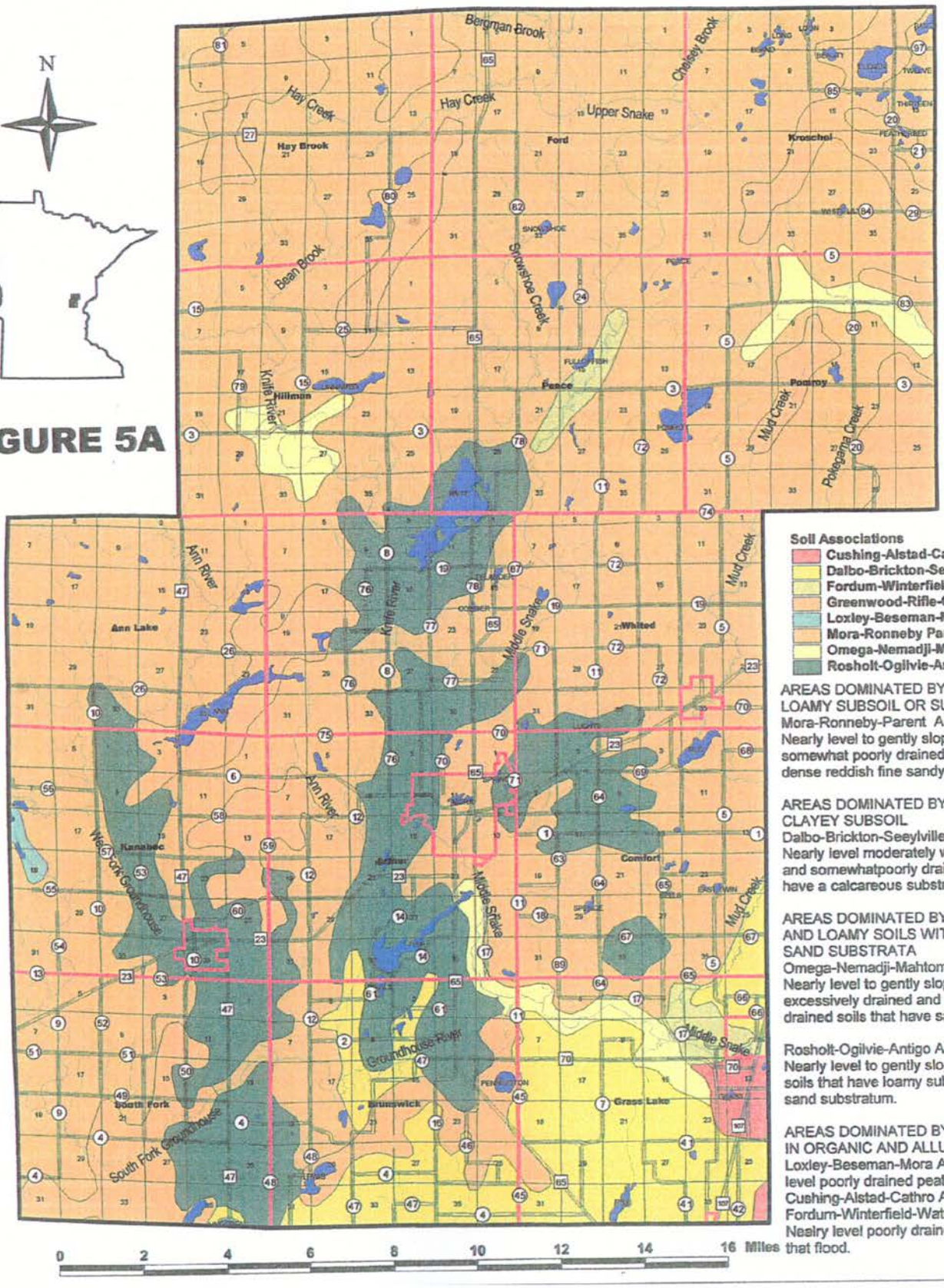


FIGURE 5A



Soil Associations

- Cushing-Alstad-Cathro
- Dalbo-Brickton-Seelyville
- Fordum-Winterfield-Water
- Greenwood-Rifle-Cathro
- Loxley-Beseman-Mora
- Mora-Ronneby Parent
- Omega-Nemadji-Mahtomedi
- Rosholt-Ogilvie-Antigo

AREAS DOMINATED BY SOILS WITH LOAMY SUBSOIL OR SUBSTRATUM
Mora-Ronneby-Parent Association
Nearly level to gently sloping, well and somewhat poorly drained soils that have dense reddish fine sandy loam subsoil.

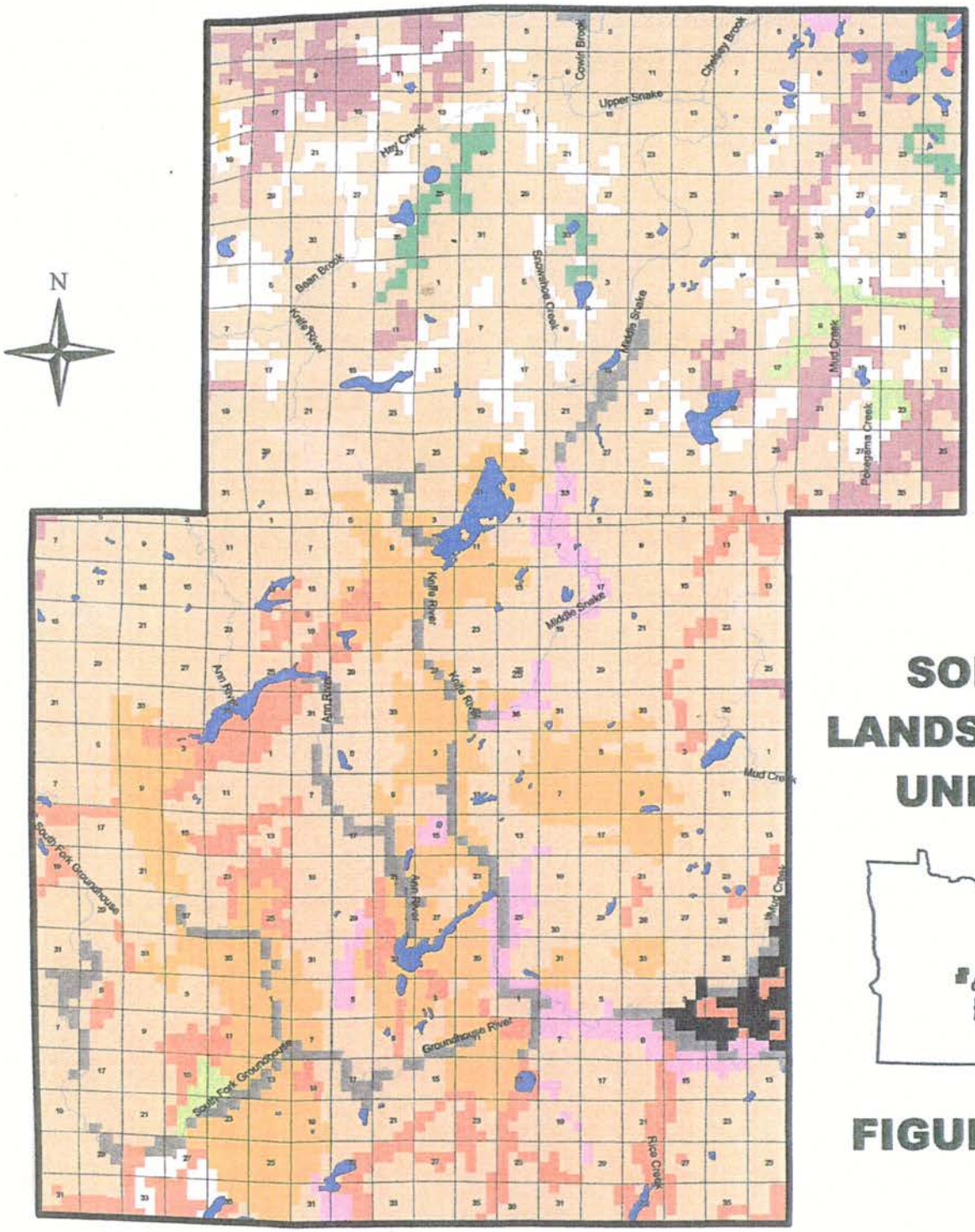
AREAS DOMINATED BY SOILS WITH CLAYEY SUBSOIL
Dalbo-Brickton-Seelyville Association
Nearly level moderately well drained and somewhatpoorly drained soils that have a calcareous substratum.

AREAS DOMINATED BY SANDY SOILS AND LOAMY SOILS WITH GRAVELY-SAND SUBSTRATA
Omega-Nemadji-Mahtomedi Association
Nearly level to gently sloping, somewhat excessively drained and somewhat poorly drained soils that have sand substratum.

Rosholt-Ogilvie-Antigo Association
Nearly level to gently sloping well drained soils that have loamy subsoil and gravely sand substratum.

AREAS DOMINATED BY SOILS FORMED IN ORGANIC AND ALLUVIAL MATERIAL
Loxley-Beseman-Mora Association Nearly level poorly drained peat and muck soils.
Cushing-Alstad-Cathro Association and Fordum-Winterfield-Water Association, Nealry level poorly drained alluvial soils that flood.

COUNTY OF KANABEC



SOIL LANDSCAPE UNITS

FIGURE 6

	Count	Percent	Acres	Legend
2	10	0.1	400	WWWW (WATER)
3	5352	63.0	214080	LLWL
4	204	2.4	8160	SSWL
5	549	6.5	21960	PEAT
8	69	0.8	2760	SLPL
10	530	6.2	21200	LLPL
16	55	0.6	2200	SSPL
18	375	4.4	15000	MPMP (NON-ACID PEAT)
19	6	0.1	240	APAP (ACID PEAT)
20	251	3.0	10040	AAAA (ALLUVIAL PEAT)
22	968	11.4	38920	SLWL
31	51	0.6	2040	CLPL
42	76	0.9	3040	LPLP PEAT OVER LOAM

9 0 9 18 Miles

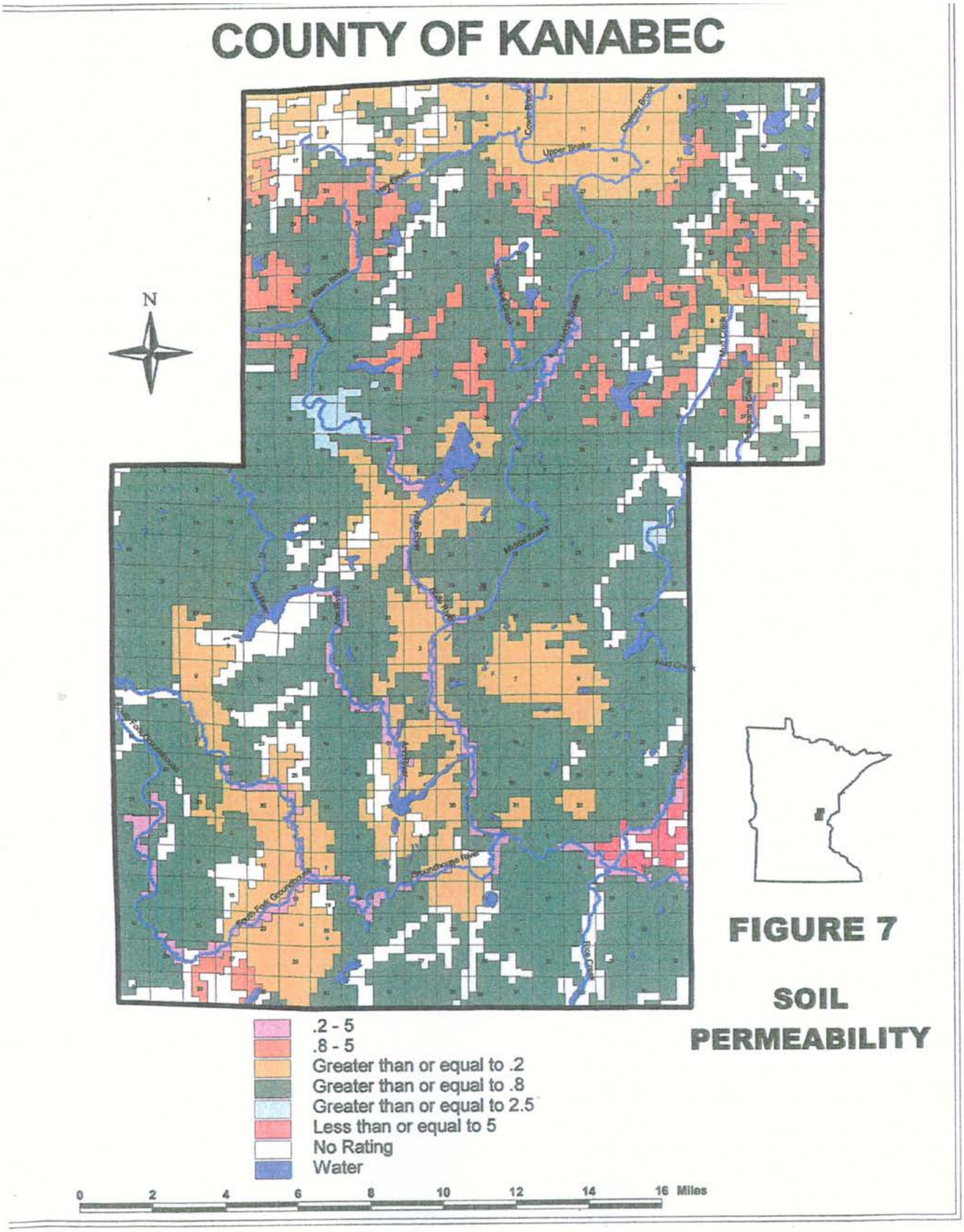


FIGURE 7

SOIL PERMEABILITY

EROSIO

EROSION PRONE SOILS

Current data on erosion prone soils is limited to information provided by the Land Management Information Center (LMIC). High priority areas for water erosion are, as defined by LMIC, either shoreland with a potential soil loss between the soil loss tolerance "T" (the allowable loss of a particular soil, or the rate at which soil will regenerate itself) and "2T' (two times the allowable or regeneration rate), or any land with a potential soil loss less tolerance greater than 2T. According to the LMIC, .3% (1040 acres) of the County has a high potential for shoreland erosion and .4% (1520 acres) has a high potential for eroding greater then 2T. The majority of these areas are associated with Rosholt-Onamia and Milaca-Ronneby soil associations. See Figure 8 for locations of erosion prone soils.

WATERSHEDS

Kanabec County has three major watersheds within the boundary of the County. They are the Rum River, Snake River, and Kettle River watersheds. Figure 9 shows the boundaries of the three major watersheds and 63 minor watersheds, and the direction of flow for each minor watershed. The general surface water flow is north to south in the northern part of the County and west to east in the south. Knowing the direction of surface water flow will help locate possible pollution sources as well as downstream water bodies which would be affected by the source.

Below is a list of each major watershed, sub-watersheds, and minor watersheds described by topographic relief.

SNAKE RIVER MAJOR WATERSHED

Snake River sub-watershed

The Snake River sub-watershed, which includes the upper, middle, and lower Snake River, is the largest group of sub-watersheds in the basin encompassing 273,301 acres or 43 % of the total Snake River Watershed. The Snake River originates in Aitkin County and flows for a total of 101.3 miles before entering the St. Croix River east of Pine City. The upper Snake River sub-watershed is characterized by areas of steep slopes which can be up to 25%, its relatively low percentage of cultivated land, and its exceptionally high numbers of state-listed rare and endangered wetland plant and animal species. Due to the upper Snake River's susceptibility to erosion and high number of rare and endangered plant and animal species, it is listed as a high priority and should be maintained and protected through the use of wise land stewardship practices. The middle and lower Snake River sub-watersheds have flatter slopes but more intense land uses, much higher percentages of cultivated land, and slightly lower percentage of rare and endangered plant and animal species. The middle and lower Snake River sub-watershed are listed as high priority minor watersheds due to their relatively high intensity land-uses and high number of rare and endangered plant and animal species, and should be a target area for implementation of appropriate best management practices (Figures 8A-C).

Hay Creek (36018)- The watershed is fairly flat with slopes of 2-5%. Along the southern part of the watershed is the Hay Creek. As it nears the Snake River, the slopes increase to 12.5-15%.

Bergman Brook (36016)- This is a flat watershed with slopes of 2-5% in the west. Along the southern border of Bergman Brook where it enters Kanabec County, the slopes increase to 5-8%.
Cowman's Brook (36011) - The only area of any significant slope is adjacent to the Cowman's Brook where slopes are 10-15%. The remaining areas are relatively flat with slopes of only 3-5%.

Snake River (36015) - The watershed is flat in the north part with slopes of 3-5%. Near the Snake River the terrain turns very steep with slopes of 15-20%.

Chelsey Brook (36014) - The watershed is generally flat on the west side with slopes on only 4-5%. The slopes become 12.5-15% near Chelsey Brook.

Snake River (36033) - The upper end of the watershed is very hilly with slopes of 20%. There are some marsh inclusions throughout the area. Along the Snake River in the Bean Dam Wildlife Management Area the slopes are very steep with ridges from 15-25% slope.

Creek to Snake River (36037) - The north, east and south sides of the watershed are relatively flat with slopes of 4-5%. Near the Snake River the slopes increase to about 7-10%. There are many small hills with small wetlands.

To Snowshoe Brook (36035) - The watershed has a flat terrain with areas of 5-7%.

Snowshoe Brook (36032) - The western area of the watershed is flat and marshy with slopes of 2-4%. The creek from Snowshoe Lake has slopes of 15-20%. The slopes along the Snowshoe Brook increase to 25%. As the Brook nears Lake Full of Fish the slopes increase to 20-25%. The eastern half of the watershed is flat and marshy with slopes of 2-4%.

Snake River (36036) - In the northern part of the watershed along the river the slopes are about 5-7%. Further south the slopes become 10-13%. There are several locations in the Blackberry Acres residential subdivision where the slopes are up to 25%.

To Snake River (36039) - The topography around Pomroy Lake is very flat with 2-4% slopes which is a characteristic of minor watershed.

Snake River (36045) - The north and west side of the watershed has flat slopes of 2-4%. Along the east side of the river there are slopes of 12.5-25%. On the west side the slopes are 5-12%. The area flattens to 5-6% slope as it gets to its confluence with the Knife River.

Snake River (36049) - Areas in the north are flat with slopes of only 2-4%. There are some areas of 15% slope along a tributary which flows into the Snake River north of Mora. Along the Snake River and where the Knife River joins it, there are slopes of 10-15% along the east side. As the river nears Mora, there are slopes of 25% on the east side and slopes of 7.5-13% along the west side. As the river continues south the slopes decrease to about 10-15%. The remaining areas around the river are very flat with slopes of only 3-4%.

Spring Brook (36050) - The north half of this watershed is very flat with slopes of 2-5% with many depressional areas. As the brook nears the Snake River, the slopes increase to 10-15% along the river.

Spence Brook (36063) - The entire watershed is fairly flat with slopes of only 2-4%.

Snake River (36055) - The northern part of the watershed has slopes of 10-15% just south of the confluence of the Ann River. The remaining watershed is fairly flat with slopes of only 4-5%.

Rice Creek (36060)- The watershed is very flat with slopes of only 3-4%.

Snake River (36064 and 36061)- Both of the watersheds are very flat as the River leaves Kanabec County, having slopes of only 3-4%.

KNIFE RIVER sub-watershed

The Knife River sub-watershed is approximately 69,052 acres in size and comprises 11 percent of the total Snake River Watershed. The origin of the Knife River is found in Mille Lacs County near Wahkon. For a distance of 27 miles, the Knife River flows southeasterly until it joins the Snake River near Mora. The width of the Knife River varies from 35 to 70 feet with 1 to 2 foot depths, but extremes of 150 foot width and 12 foot depth also exist. The Knife River sub-watershed has a relatively high percentage of land susceptible to flooding, which indicates that the majority of the sub-watershed is environmental sensitive to changes in land-use. In addition, the Knife River sub-watershed also drains into Knife Lake, which is one of the eight major lakes in the entire basin that is economically and recreationally important to the surrounding area. For these reasons the Knife River sub-watershed is listed as a high priority area and should be the focus of implementation efforts to protect and improve its water quality.

Creek to Knife River (36021) - The northern half of the watershed is very flat and marshy. The slopes average about 3%. As the creek nears the Knife River the slopes increase to 12-15% on both sides of the creek.
Creek to Knife River (36019) - The watershed is on the Mille Lacs- Kanabec County line, and is relatively flat with 4-5% slopes.

Creek to Creek to Knife River (36031)- The east half of the area is generally flat and marshy with slopes of 2-4%. The southern areas have 13-15% slopes. The remaining terrain is flat.

Knife River (36020)- The northern area of the watershed is very flat with slopes less than 3%. Along the Knife River, the slopes increase to 12-15%.

Knife River (36022) - Near the Mille Lacs and Kanabec County line, the topography is flat with slopes of 2-5%. Along a small tributary which flows into the Knife River from the north, the slopes are steeper, from 6-8%. As it joins the Knife River, the slopes increase to 15-20% along the river. The slopes along the Knife River before Bean Brook are steep ranging from 15-20%. These slopes continue at 12.5% as the river reaches Knife Lake.

Bean Brook (36034) - The watershed generally has a 5-7% slope with areas of 15% slope surrounding the marsh of Bachman Dam.

Creek to Knife River (36044) - The northern half of the watershed is fairly flat with slopes of 3-5%. Near the Knife River, the slopes increase to 7-10%.

Knife Lake (36038) - North of Knife Lake the topography is fairly flat with slopes of 3-5%. On the west side of the lake the slopes increase to 7-12%. South of the lake to the confluence of the Snake River, the slopes remain at about 7% on the west bank of the river.

Ann River sub-watershed

The Ann River sub-watershed is 53,968 acres in size or 8 percent of the total Snake River Watershed. The Ann River originates in Mille Lacs County and flows for 21 miles, through Ann and Fish Lakes. Ann and Fish Lakes are two of the eight major lakes in the Snake River Watershed based on their economic and recreational value to the area. The land-use varies highly throughout this sub-watershed with 30.1 percent of the land being developed around Fish Lake. For these reasons the Ann River sub-watershed is given a high priority ranking for the implementation of best management practices.

Little Ann River (36023) - The watershed is in the Mille Lacs Wildlife Management Area and is flat and swampy. As it nears DeWitt Pool, the slopes increase to 5-7%.

To Little Ann River (36028) - The watershed is in the Mille Lacs Wildlife Management Area and is flat and swampy. As it nears the Little Ann River, the slopes increase to 7-8%.

Little Ann River (36043) - The watershed is generally flat in the north with slopes of 4-5%. As the river nears Mackey Brook and continues to the Little Ann River, the slopes increase to about 7%.

Camp Creek (36042) - The northern half of the watershed has a large area of wetlands with slopes of 4-6%. As the creek nears Ann Lake, the slopes increase to 10-12%.

Ann River (36048) - The far north areas in the watershed has large wetlands with slopes of 4-7%. Around Ann Lake the slopes are steep ranging from 15-25%, except on the southeast portion of the lake, where there is a large marsh. South of the lake and south of Spring Brook, the slopes decrease to 4-6%. West of the brook the slopes increase greatly to 20-25%. The area around the Ann Lake Dam has a 7-10% slope. North of County Road 6 there are several locations of 15-20% slope. South of County Road 6 there are rolling hills with slopes of 7-10%. East of the Ann River (before it crosses Hwy 23) there are areas of 20% slope. Areas away from the river are flat with slopes of only 2-4%. The river slopes are to 12-15%. South of Hwy 23, the slopes continue at 15-20%.

Fish Lake (36054) - The west side of the watershed has slopes of 12-15%. Along the shores of Fish Lake (except the west side at the Tosher Creek confluence), the slopes range from 15-20%. South of the lake, the topography is generally rolling hills with slopes of 7-10%.

Groundhouse River sub-watershed

The Groundhouse River sub-watershed is 88,998 acres and encompasses 14 percent of the Snake River Watershed. A total of four branches of the Groundhouse River originates in Mille Lacs County south of Ogilvie. The Groundhouse joins the Snake River near Brunswick and flows a total of 29 miles. The width of the mainstream of the river ranges between 35 and 40 feet, with an average depth of 1 to 2 feet. Forest cover is found in the upper portion of the Groundhouse River, but the lower reach of the Groundhouse River has some of the highest percentages of developed land in the entire Snake River Watershed, and is predominately used for various forms of Agriculture including forage, pasture and grain production. Water quality data from the Southfork of the Groundhouse River indicates poor water quality compared to the rest of the Snake River Watershed, for these reasons, the Groundhouse River sub-watershed is listed as a high priority and should be targeted for the implementation of appropriate best management practices.

Creek to Groundhouse River (36021) - The watershed has a flat topography of no greater than 5%.

Groundhouse River (36026) - The watershed has steep ridges of 15-20% which follow the Groundhouse River.

Southfork of Groundhouse River (36029) - The watershed is heavily farmed. The slopes are relatively flat with slope ranging from 4-5%. Along the western edge of the watershed there are areas of 6-8% slope along the Southfork of the Groundhouse River. There are several ditches and streams throughout this watershed, surrounded by wetlands.

Groundhouse River (36062) - The watershed is very flat with slopes averaging around 2%.

Ditch to Groundhouse River (36053) - The watershed is very flat with slopes of 3-4%. The ditch drains wetlands south to the Groundhouse River.

Southfork of Groundhouse River (36058) - The watershed is very flat with 0-2% slopes. As it nears the Groundhouse, the slopes increase to 5-7%.

Ditch To Southfork of Groundhouse River (36052) - The watershed is a very flat watershed and has slopes of 2-4% with several wetlands.

Groundhouse River (36059) - In the areas along the Groundhouse River where the Southfork joins, the slopes are very steep and may be up to 25% in some areas. As the river continues east, the slopes decrease to 20%. West of Erickson Lake there are many rolling hills with slopes of 10-15%. The remainder of the watershed is flat with slopes of less than 5%. The only area of significant slope is along the river where it meets the Snake River, where the slope is 7-10%.

Mud Creek sub-watershed

The Mud Creek sub-watershed has an area of 48,804 acres and is approximately 8 percent of the total Snake River Watershed. Mud Creek originates southeast of Pomroy Lake and flows 23 miles in a southeasterly direction until it joins the Snake River near Grasston. Mud Creek is relatively developed with flat slopes and has a low percentage of wetlands. Mud Creek flows through Quamba (Mud) Lake, which is one of the eight recreationally, and economically important lakes to the Snake River Watershed. For these reasons, the Mud Creek sub-watershed is listed as a high priority area and should be targeted for implementation of best management practices.

Mud Creek (36040) - The watershed is flat and marshy with slopes less than 3%. There are few hills in the north with slopes of 5-7%.

To Mud Creek (36046) - The watershed is a very flat and marshy area, with slopes averaging only 3%.

Mud Creek (36051) - The watershed is very flat and marshy. The only area of any slope is south of Quamba Lake, where the slope increases to 5-8%.

Unnamed watershed (36056) - The watershed is flat with an average slope of only 3%.

Mud Creek (36057) - The areas of the Twin Lakes are the only areas of significant slope within the watershed. East of the lakes, the slope is about 7-10%. The remaining watershed is flat with slopes of 4-6%.

Pokegama sub-watershed

The Pokegama Creek sub-watershed is 50,661 acres in size and comprises 8 percent of the Snake River Watershed. Pokegama Creek originates northwest of Brook Park and flows 19 miles southeasterly before entering the Snake River through Pokegama Lake. Pokegama Lake is the largest lake basin (in terms of volume) in the Snake River Watershed. The Pokegama Creek watershed is very flat and has a high percentage of land susceptible to flooding as well as a relatively high percentage of developed land in its watershed. For these reasons, the Pokegama Creek sub-watershed is listed as a high priority and should be the focus of implementation of appropriate management practices.

Pokegama Creek (36047) - The watershed is very flat with an average slope of only 3%.

East Pokegama Creek (36041) - The watershed is very flat and swampy with an average slope of only 3%.

RUM RIVER MAJOR WATERSHED

Malone Creek (21003) - The watershed is very flat and marshy as it drains into Mile Lacs Lake.

Bogus Brook (21032) - The watershed is heavily farmed with a flat terrain of 0-2% slope.

Lory Lake & Creek to Ties Creek (21061) - The watershed is relatively flat with slopes of 4-6%. At the south end of Lewis Lake the slopes increase to 8-10%.

Ties Creek (21062) - This watershed is a heavily farmed area. It consists of ditches and wetlands and has an average slope of 4%.

KETTLE RIVER WATERSHED

Little Pine Creek (35037) - The watershed is flat and marshy with slopes of only 2-4%. Near the Aitkin County border north of Beauty Lake, the slopes increase to 8-10%.

South Branch of Grindstone River (35038) - Around Lake Five and Long Lakes the topography is very diverse with slopes ranging from 10-25%. Further south it flattens off to marsh land and bogs. It has few rolling hills with slopes of only 2-5% in the southern areas.

North Branch of Grindstone River (35040) - The watershed includes Lake Thirteen and is very flat with slopes of only 3-5%.

West Branch of Grindstone River (35039) - This watershed is flat and marshy with slopes of only 2-4%.

There are 3 major watersheds within Kanabec County: Snake River, Rum River, and Kettle River. The Snake River consists of 92% of the county. The Rum River consists of 2.5% and the Kettle River 5.5% of the county. Land use varies from watershed to watershed. The Rum River is mainly agricultural in use. The Snake River has both agricultural and forested. The Kettle River is mainly forested in use.

Priorities within the three watersheds vary with land use. Due to the majority of the county lying in the Snake River Watershed, it is the highest priority of concern. The Rum River watershed would be second due to the heavy agricultural use. The Kettle River watershed would be third.

PROTECTED WATERS

The DNR has designated certain waters in the State as protected waters under M.S. 103G.201. A state (DNR) permit is required for any change in their course, current, or cross-section. The underlying philosophy is that the state not only has an interest in protecting the amount of water contained in these lakes, marshes and streams, but also has an interest in protecting the container (i.e., lake, marsh, or stream) which confines these waters.

Protected waters include all of the following:

1. All water basins assigned a shoreland management classification, except wetlands less than 80 acres classified as natural environment lakes.

2. All water which have been determined to be public waters or navigable waters by a court of law.

3. All meandered lakes, except those which have been legally drained.

4. All water basins previously designated by the Commissioner of Natural Resources for specific management purposes such as trout lakes or game lakes.

5. All water basins previously designated as scientific and natural areas.

6. All water basins located within and totally surrounded by publicly owned lands.

7. All water basins where the State of Minnesota or the federal government holds title to any of the beds or shores, unless the owner declares that the water is not necessary for the purpose of public ownership.

8. All water basins where there is a publicly owned and controlled access which is intended to provide for public access to the water basin.

9. All natural and altered natural watercourses with a total drainage area greater than two square miles and all designated trout streams regardless of the size of their drainage area.

Any work done below the ordinary high water mark (OHWL) of protected waters and wetlands requires a permit from the DNR. Generally, alternatives should be considered which avoid or minimize impacts to protected waters, but if the impacts are unavoidable, particularly to wetlands, they must be mitigated in accordance with state laws and regulations. Typical examples of projects requiring a permit include: draining, filling, dredging, channelizing, construction of dams, harbors or permanent offshore structures, placement of bridges and culverts, and marinas.

COUNTY OF KANABEC

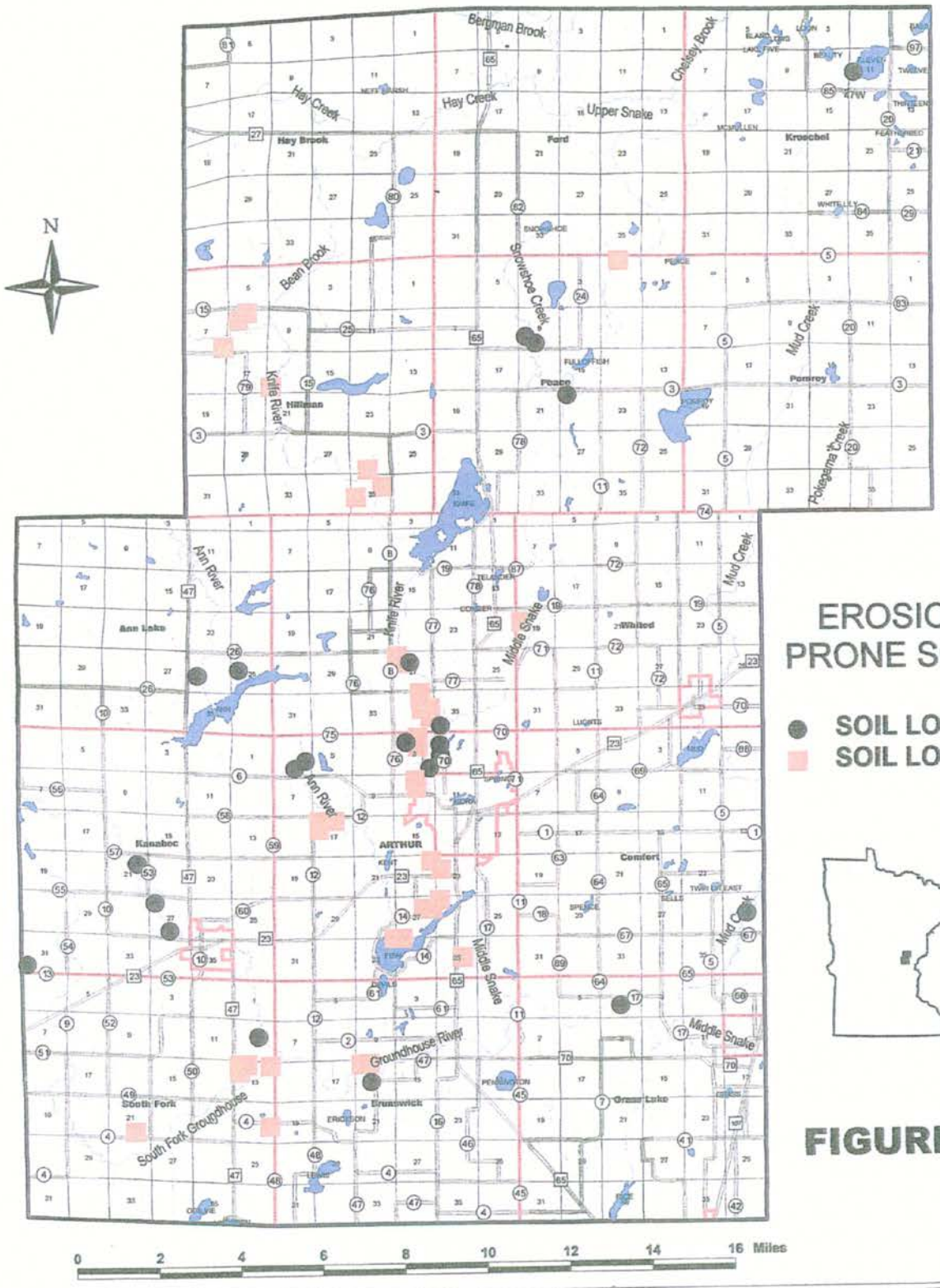


FIGURE 8

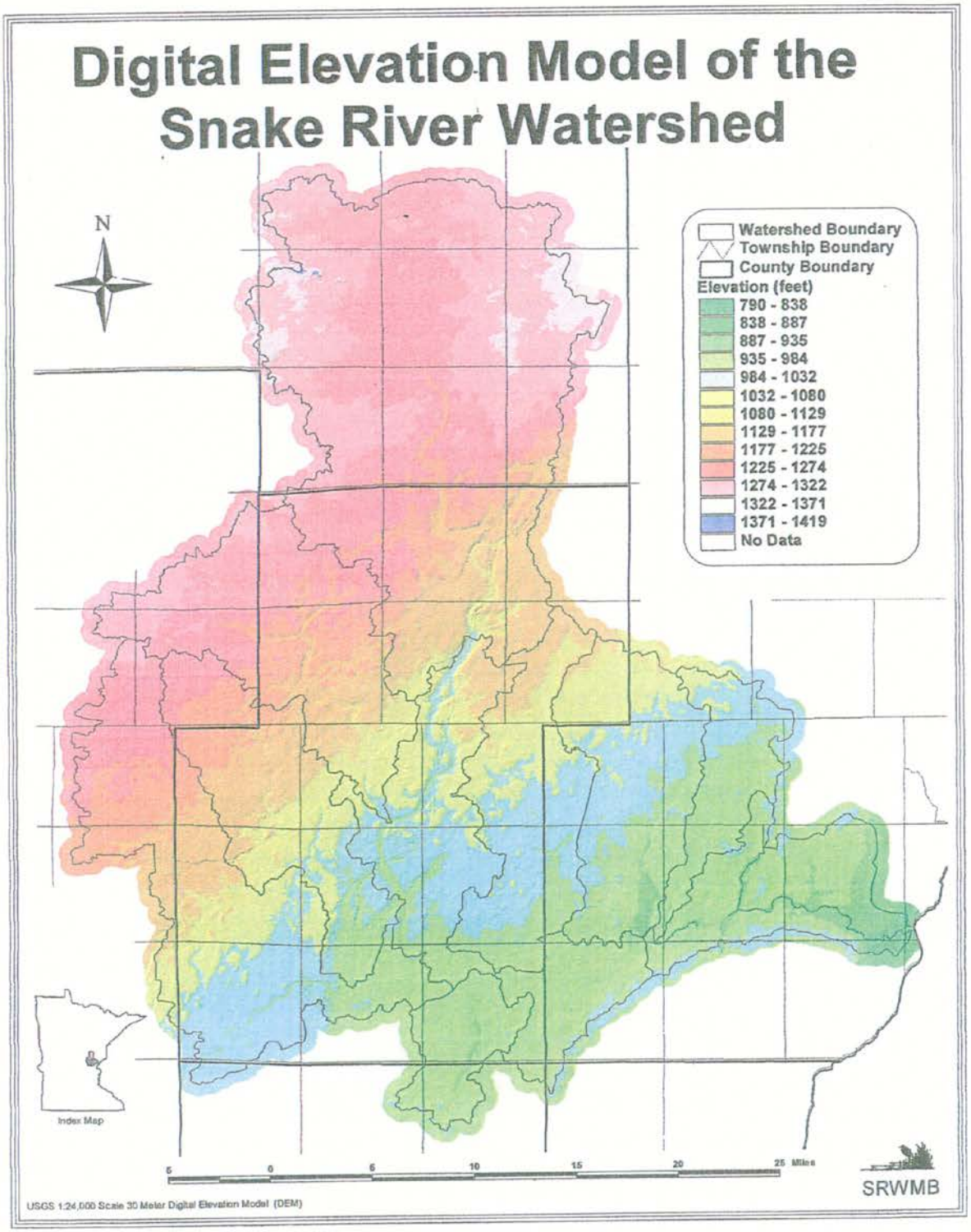

Digital Elevation Model of the Snake River Watershed
N
Watershed Boundary
Township Boundary
County Boundary
Elevation (feet)
790 - 838
838 - 887
887 - 935
935 - 984
984 - 1032
1032 - 1080
1080 - 1129
1129 - 1177
1177 - 1225
1225 - 1274
1274 - 1322
1322 - 1371
1371 - 1419
No Data
Index Map
5 0 5 10 15 20 25 Miles
SRWMB
USGS 1:24,000 Scale 30 Meter Digital Elevation Model (DEM)

FIGURE 8A

Percent of Slope in the Snake River Watershed

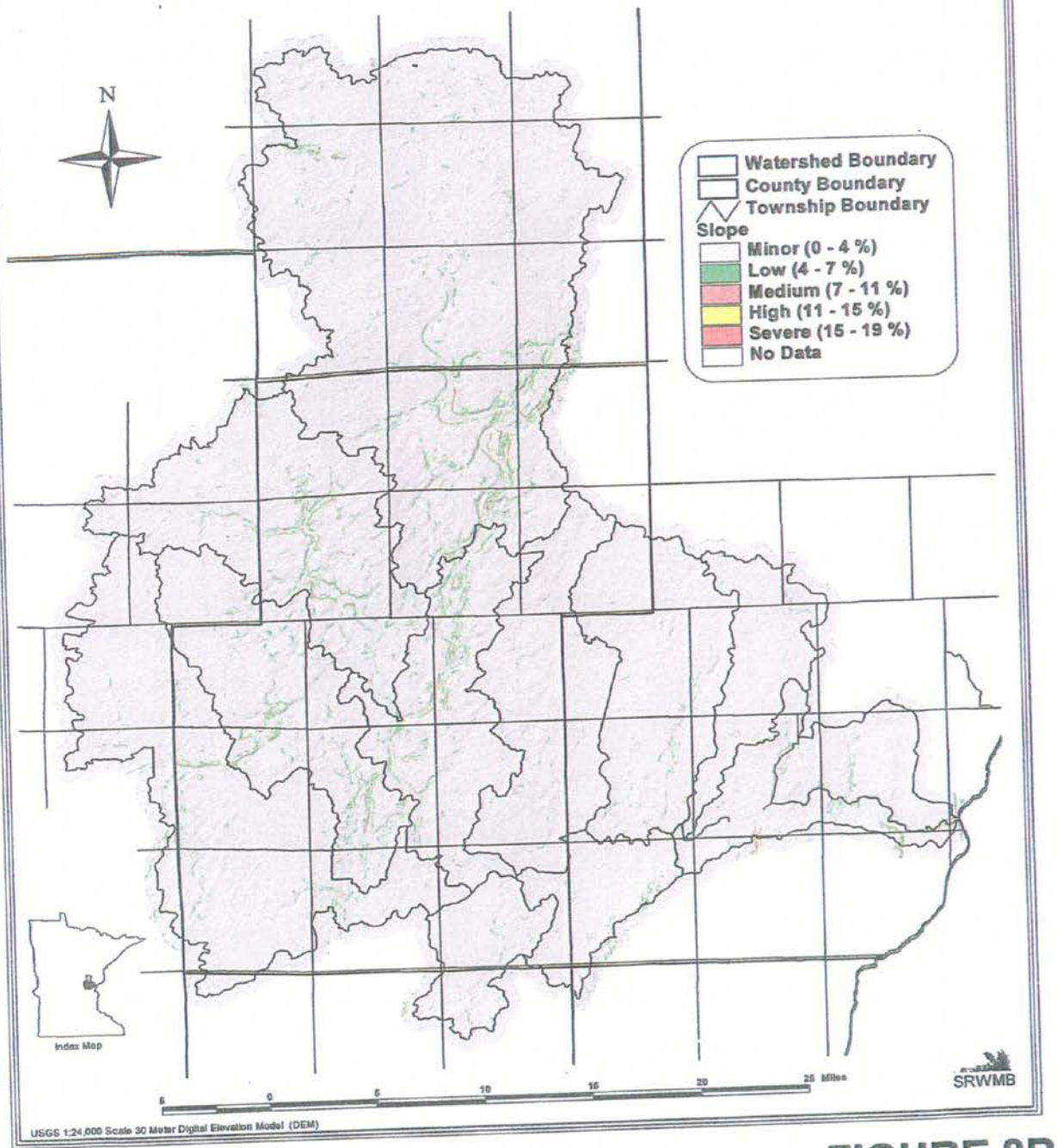


FIGURE 8B

1990's Landuse inThe Snake River Watershed

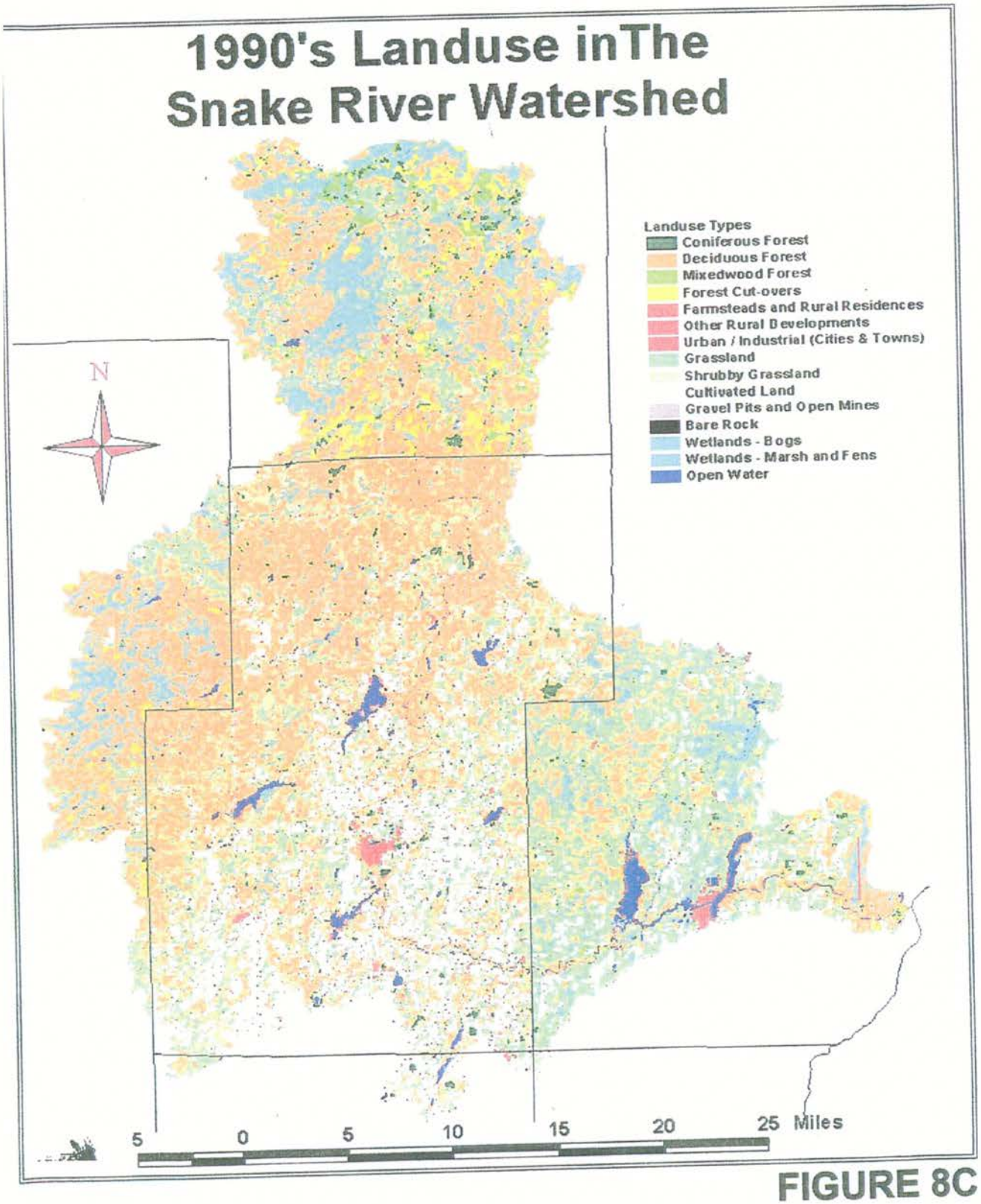


FIGURE 8C

According to the federal Clean Water Act, private citizens, and federal, state, and local agencies who want to discharge dredged or fill material into US waters, including all wetlands, must obtain a Section 404 permit from the US Army Corps of Engineers and a Section 401 water quality certification from the Minnesota Pollution Control Agency. The Section 401 permit must be obtained first. Some activities requiring both permits include construction of boat ramps, riprap, placing fill in a wetland, building in a wetland, dams or dikes, stream channelization and stream diversion.

Exemptions from Section 404 for the discharge of dredged or fill materials include farming activities; emergency reconstruction of levees, dikes or dams; construction or maintenance of farm ponds; construction and maintenance of farm roads; forest roads; or temporary roads for moving mining equipment.

The Minnesota Wetland Conservation Act of 1991 generally prohibits the draining or filling of wetlands unless they are replaced.

Figure 10 shows all protected waters in the County. Each protected water is number coded to a list maintained by DNR. A larger scale map is on file with the County Auditor or available from the DNR. Below is a list of all protected waters within the County.

LIST OF PROTECTED WATERS IN KANABEC COUNTY

Lake	ID#	Type	Acres
Eleven	1	5	320
Beauty	2	5	64
Lake Five	3	5	46
Twelve	4	5	26
Thirteen	5	5	53
Featherbed	6	4	38
McMullen	7	4	14
White Lily	8	5	32
Pomroy	9	5	267
Peace	10	4	33
Rice	11	4	172
Unnamed	12	4	11
Grass Lake	13	4	40
Unnamed	14	4	30
Quamba	15	5	249
Spence	16	4	55
Unnamed	17	4	35
Sells	18	4	64
Twin/East	19	5	27
Doughnut	20	4	20
Luchts	21	4	46
Unnamed	22	4	14
Unnamed	23	4	12
Full of Fish	24	5	85
Pocket Knife	25	5	28
Snowshoe	26	5	45
Spring	27	5	142
Knife	28	5	1127

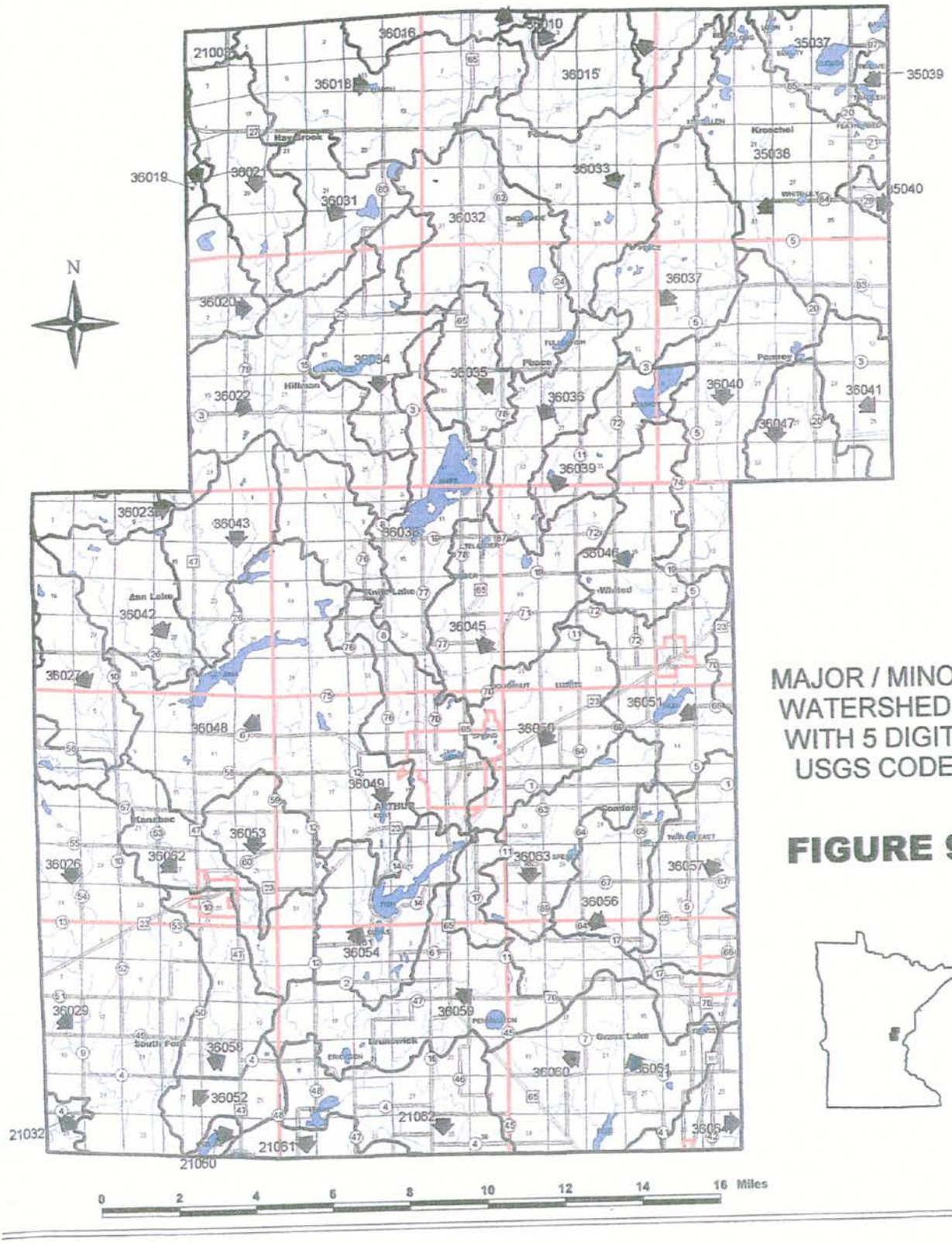
Unnamed	29	4	21
Pennington	30	5	132
Erickson	31	4	68
Lewis	32	5	215
Devils	33	5	121
Mora	34	5	63
Kent	35	4	34
Fish	36	5	440
Telander	37	5	36
Conger	38	5	18
Ann	40	5	363
Ogilvie	41	3	85
Unnamed	42	5	45
Long	44	5	50
Unnamed	45	4	10
Unnamed	46	3	30
Unnamed	45	4	10
Unnamed	46	3	30
Unnamed	47	4	15
Unnamed	48	4	10
Unnamed	49	4	10
Unnamed	50	3	12
Unnamed	51	4	12
Unnamed	52	4	40
Unnamed	53	4	15
Unnamed	54	4	15
Unnamed	55	3	50
Unnamed	56	3	35
Unnamed	57	4	10
Unnamed	58	4	12
Unnamed	60	3	12
Unnamed	61	3	30
Unnamed	63	3	10
Unnamed	64	4	20
Unnamed	65	3	15
Unnamed	66	3	12
Unnamed	67	4	10
Jeff Marsh	68	5	141
Unnamed	69	3	10
Unnamed	70	5	45
Unnamed	71	4	15
Unnamed	72	3	20
Unnamed	75	4	11
Unnamed	76	3	30
Unnamed	77	4	11
Unnamed	78	4	10
Unnamed	79	3	56
Unnamed	80	4	16
Unnamed	81	3	10

Unnamed	82	3	11
Unnamed	83	4	24
Unnamed	84	4	10
Unnamed	85	3	15
Unnamed	88	4	70
Unnamed	91	4	10
Unnamed	93	3	12
Unnamed	94	3	110
Unnamed	96	4	15
Unnamed	97	3	29
Unnamed	98	3	18
Unnamed	99	3	14
Unnamed	100	3	17
Unnamed	101	4	14
Unnamed	104	3	10
Unnamed	106	3	18
Unnamed	107	5	12
Unnamed	108	3	12
Unnamed	109	5	58
Unnamed	110	4	21
Unnamed	111	4	22
Unnamed	112	3	12
Unnamed	113	5	10
Unnamed	114	3	10
Unnamed	115	4	12
Unnamed	116	5	3
Unnamed	117	3	3
Unnamed	118	4	13
Unnamed	120	5	23
Unnamed	121	3	14
			6170

Kanabec County has 105 DNR Protected waters, totaling approximately 6,200 acres. The table below indicates the size of bodies of water in Kanabec County.

Size	**# of waters**
<25 acres	56
26-50 acres	25
51-100 acres	11
101-200 acres	6
201-300 acres	3
301-400 acres	2
401-500 acres	1
>501 acres	1
	105

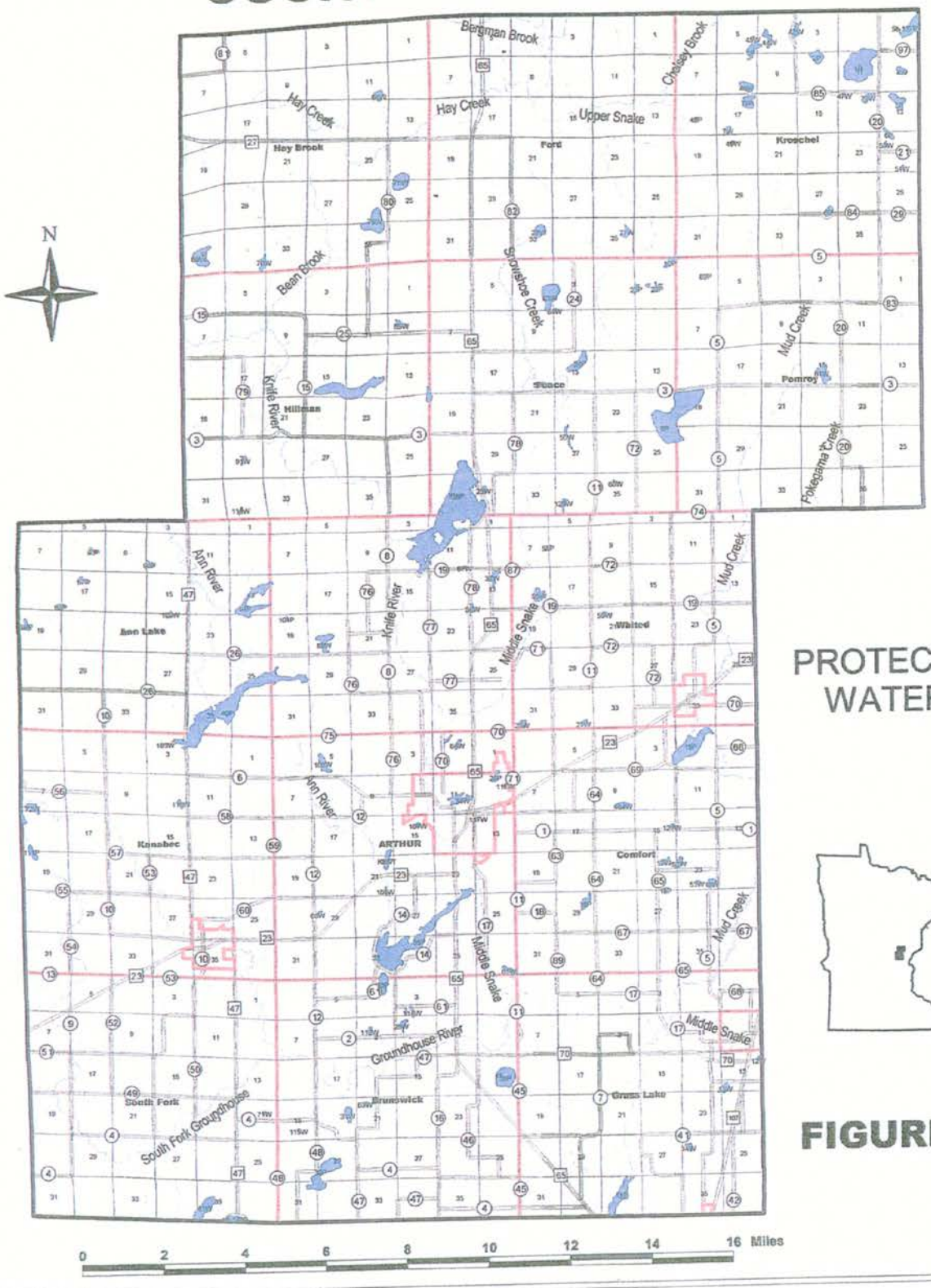
COUNTY OF KANABEC



MAJOR / MINOR WATERSHEDS WITH 5 DIGIT USGS CODE

FIGURE 9

COUNTY OF KANABEC



PROTECTED WATERS

FIGURE 10

PUBLIC DITCHES

In Kanabec County there are 12 public ditch systems totaling 87.3 miles. Five ditches are administered by neighboring counties. Figure 11 shows all public and judicial ditches. The newest ditch system is Judicial Ditch #6 (Pine/Isanti) which was completed in 1941.

PLANNED DRAWDOWNS OF CONTROLLED OUTLETS

Kanabec County has numerous structures throughout the County. Presently, there are no plans for draw downs on any existing outlets.

CONTROL STRUCTURES AND DAMS

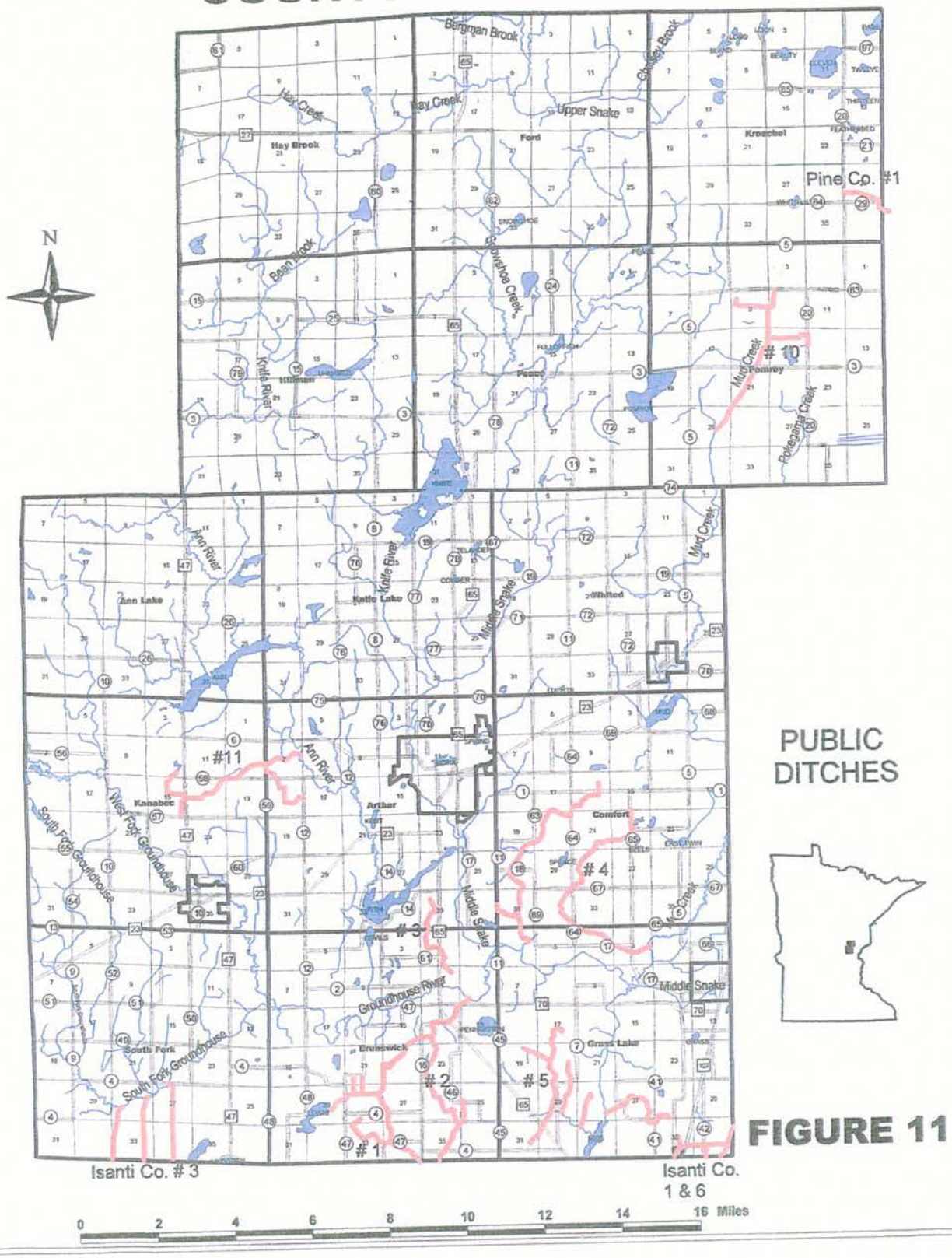
There are several control structures and dams within Kanabec County. The Knife Lake Dam is classified as a Hazard 2 Dam by the DNR. All other dams in Kanabec County are Hazard 3.

Figure 12 indicates the location of these control structures and dams. The following is a list of Dams in Kanabec County.

Name	Owner
Chesley Brook	State - Wildlife
Forshier Pool	Private Ownership
Gus Herwig	Private Ownership
Forshier Group Farm Pool	Private Ownership
Bergstadt Dam	Private Ownership
Bachman Dam	Private Ownership

Name	Owner
Richards Pond	Private Ownership
Carda Impoundment	Private Ownership
Lake Albert	Private Ownership
Blowers Dam	Private Ownership
Knife Lake	State
Ann Lake	State
Mud Lake	State
Pomroy Lake	County & State
Ann River	State
Ernest Linder Wildlife Pond	Private Ownership
Rum River State Forest	State
Rum River State Forest	State
Rum River State Forest	State

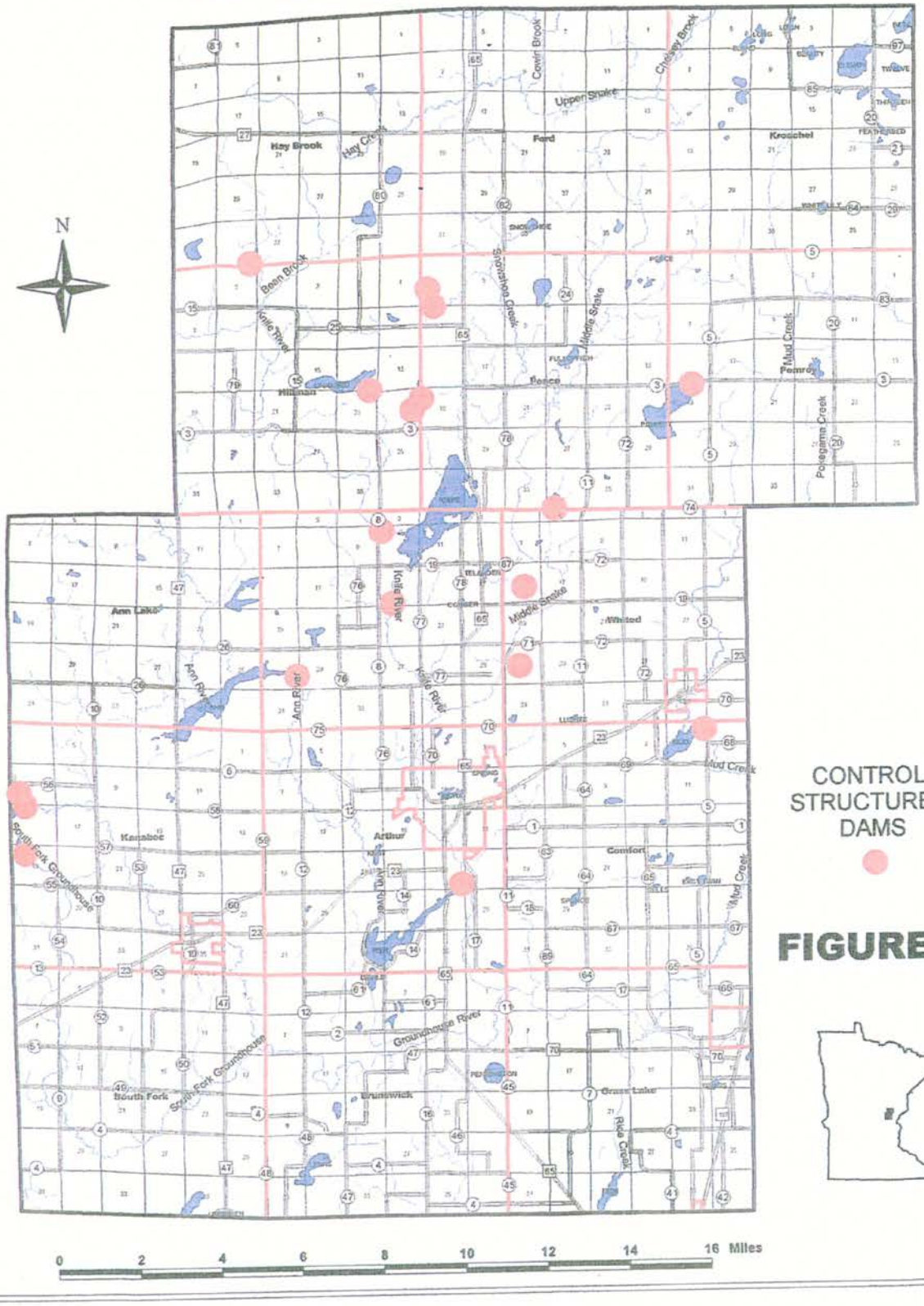
COUNTY OF KANABEC



PUBLIC DITCHES

FIGURE 11

COUNTY OF KANABEC



CONTROL STRUCTURES, DAMS

FIGURE 12

ORIGINAL VEGETATION

The original vegetation of Kanabec County is shown on Figure 13. The information is taken from "The Natural Vegetation of Minnesota at the Time of the Public Land Survey: 1847-1907". Below is a key to Figure 13.

Boreal Hardwood - Conifer Forest - Aspen, Birch, Balsam Fir, White Spruce and White Cedar

Floodplain Forest - Silver Maple, Elm, Cottonwood, and Willow

Great Lakes Pine Forest - White Pine, Red Pine, Paper Birch and Aspen

Maple-Basswood Forest - Elm, Basswood, Sugar Maple, Red Oak, and White Oak

Northern Hardwood Forests - Sugar Maple, Yellow Birch, Basswood, and occasional White Pine

Oak Woodland and Brushland - Bur Oak, Pin Oak, Aspen, Hazel Thickets and Prairie Openings

Peatland - Sedgefen, Black Spruce, Sphagnum Bog, White Cedar, Black Ash Swamp

In the early 1900's approximately 80% of Kanabec County was forested. Presently, the amount of forested land is about 45%, nearly half of what it was 80 years ago. Much of the southern part of the County was covered formerly with Maple-Basswood forests. Many of those forested areas are gone due to extensive logging and is now agricultural land. The northern half of the county is still heavily forested; however, much of the original vegetation has disappeared due to logging. The regrowth has been mainly Aspen.

Kanabec County has lost nearly half of its' forested areas, in the last 80 years. In those areas where regrowth has occurred, much of the original vegetation is gone. These issues are being addressed in the East Central Landscape Forest Resources Plan.

GENERAL TOPOGRAPHY

Figure 14 indicates the general topography in relationship to the minor watersheds of Kanabec County. This topography information is based on the minor watershed maps determined by the US Geological Survey 7.5 minute watershed topographic maps.

According to Figure 14, Kanabec County has a fair amount of steep land with a greater than 18% slope. These slopes are most numerous in the heavily forested northern regions and along major rivers, particularly the upper Snake, upper Knife, and upper Groundhouse Rivers. These areas of high slope usually taper off to 6-18%, including the Knife River and the Snake River.

LAND USE

The table below indicates the percentage and acreage of existing land use, determined by LMIC, based on dominant land use of 40 acre cells (Figure 14B).

USE	ACRES (1969)	% (1969)	ACRES (Known as of 2000)	% (As of 2000)

Forested	166,160	48.9	144,948	42.5	(13)
Cultivated	52,040	15.3	69,483	20.4	34
Water	4,120	1.2	6,341	1.9	54
Marsh (wetland)	9,160	2.7	18,955	5.6	107
Urban Res/Non-Res.	4,240	1.3	6,432	1.9	52
Hayland/Pasture	104,120	30.6	67,933	19.9	(35)
Brushland	unknown	unknown	26,563	7.8	
Mining	unknown	unknown	540	.2	
Total	339,840	100	341,195	100%	

The northern half of Kanabec County is predominately forested. The southern half of the County is mostly in agricultural use, either cultivated or in pasture. Areas with significant development include the cities of Mora, Ogilvie, Quamba, Grasston, and around Fish Lake, Ann Lake, Knife Lake, Lewis Lake, and Quamba Lake.

PUBLIC WATER SUPPLY/ SEWER SYSTEMS

Within Kanabec County only the municipalities of Mora and Ogilvie have public water supplies. Figure 15 & 17 displays the areas in the cities which are served with public water supplies. Mora, Grasston, and Ogilvie have public sanitary sewer systems. Figure 16 & 18 displays the location of these services. Mora is the only city in the county which is serviced by storm sewers.

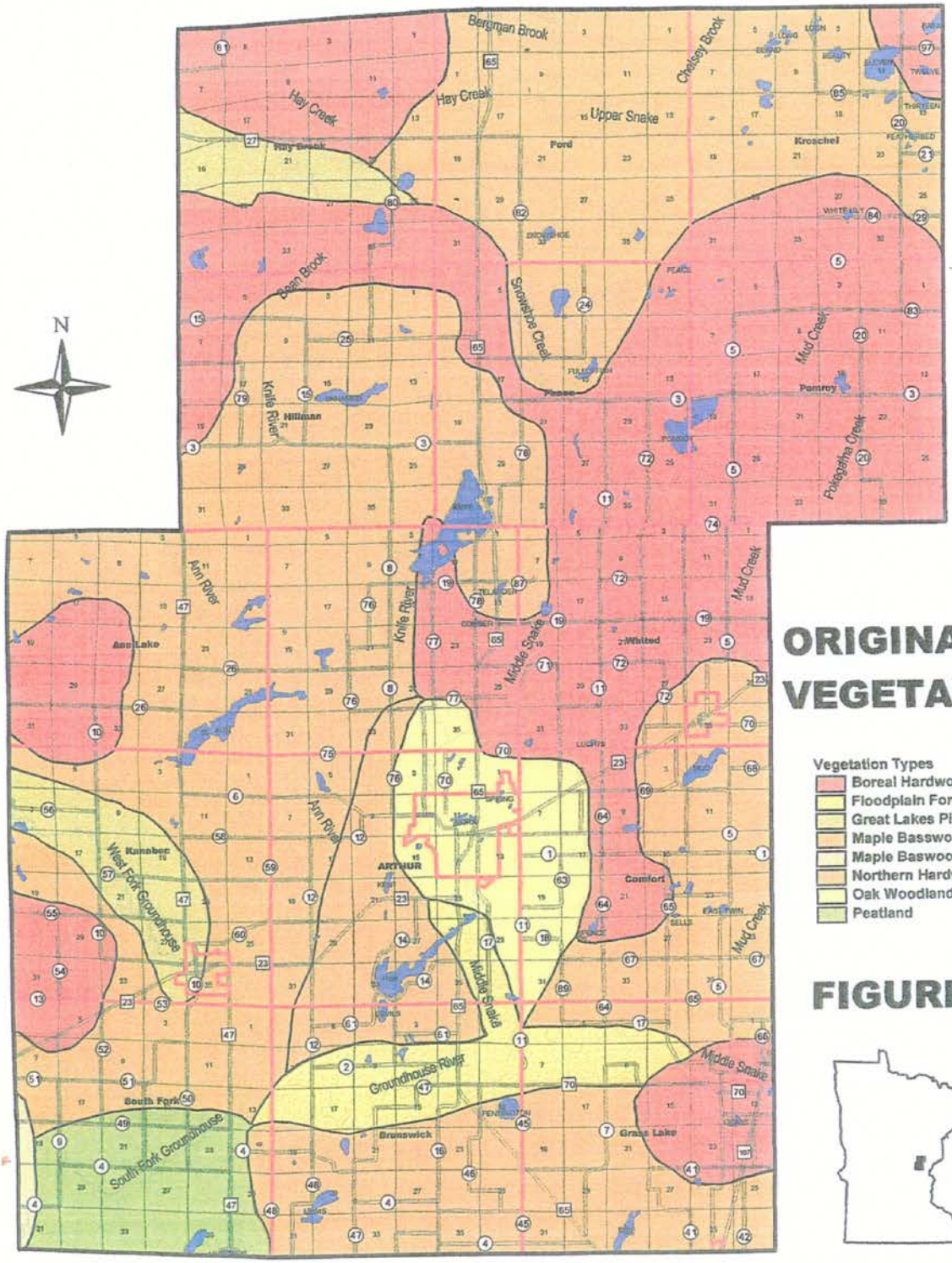
Rules have recently gone into effect which establish regulations and require storm water discharge permits in certain cases. There are two types of permits - municipal and industrial storm water permits. No municipal permits are required in Kanabec County as municipalities are not subject to the permit unless they have a population of at least 100,000 persons.

Smaller cities, counties, and school districts with storm water discharges associated with industrial activity may be required to apply for industrial storm water permits. Activities which require a permit include facilities with contaminated storm water discharges; facilities were certain minerals are exposed to storm water, solid and hazardous waste facilities, and where construction activity disturbs one or more acres.

The City of Mora's storm water system has approximately nine outlets that flow directly into Lake Mora and five outlets that flow directly into the Snake River. None of these flows are monitored for surface water quality before they enter the surface waters. The DNR strongly encourage municipalities to establish holding ponds as a means of treating storm water.

At time of publication, the cities of Quamba and Mora are involved in a joint project along with local state and federal agencies to establish city sewer within the city of Quamba. No completion date is known at this time.

COUNTY OF KANABEC

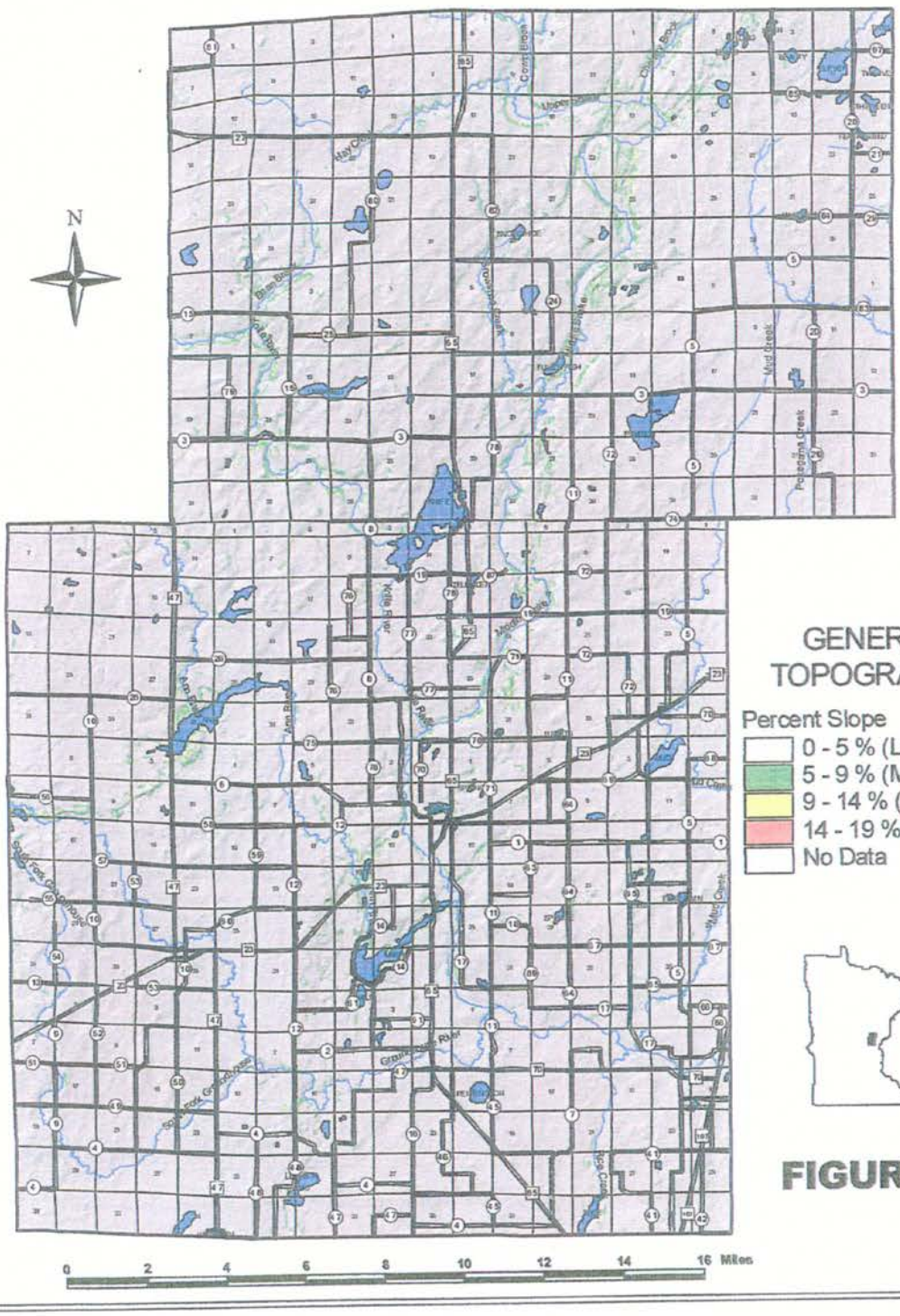


ORIGINAL VEGETATION

Vegetation Types
- Boreal Hardwood Forest
- Floodplain Forest
- Great Lakes Pine Forest
- Maple Basswood
- Maple Baswood
- Northern Hardwood Forest
- Oak Woodland Brushland
- Peatland

FIGURE 13

COUNTY OF KANABEC



GENERAL TOPOGRAPHY

Percent Slope

- 0 - 5 % (Low)
- 5 - 9 % (Medium)
- 9 - 14 % (High)
- 14 - 19 % (Severe)
- No Data

FIGURE 14

COUNTY OF KANABEC

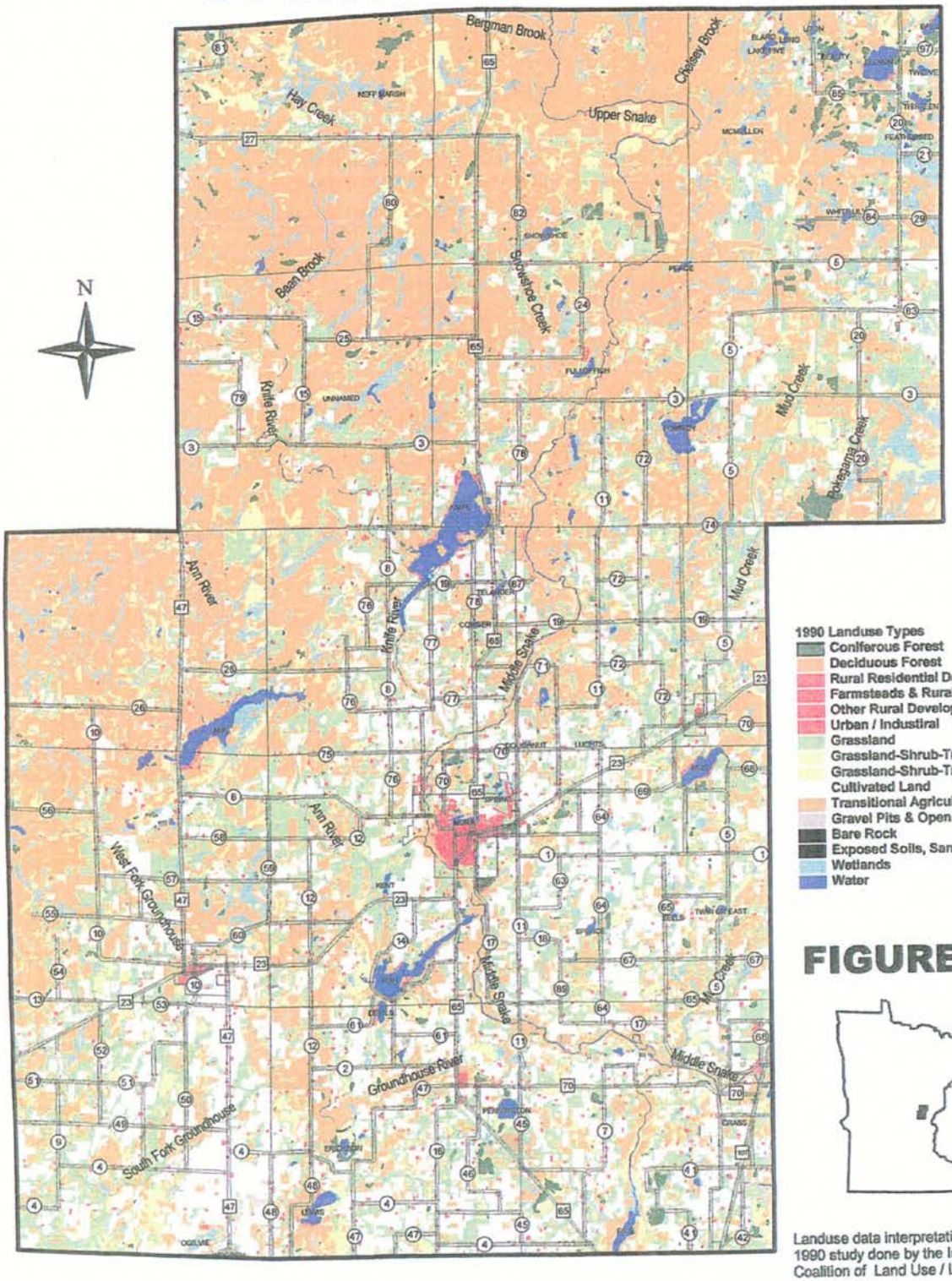


FIGURE 14B

Landuse data interpretation based on the 1990 study done by the International Coalition of Land Use / Land Cover.

LAND OWNERSHIP

The table below displays the quantity of land in different ownership's in the County. The acreage's and percentages are based on LMIC data.

Owner	Acres	Percent
Private	280,533	89%
County	10,678	3%
State	23,659	8%
Federal	535	0%
	315,405	100%

Eighty-nine percent of the land in the county is privately owned. The remaining 11% is public land.

POPULATION CHARACTERISTICS

Population distribution, density, and growth rates are an important consideration within the water planning process because of the interrelationship of people and water. The presence of a population places demands on the water resources for domestic, industrial, and recreational uses. The activities of this population and its use of water can significantly impact the resource. Conversely, the presence of water resources greatly influences population patterns as evidenced by residential development near lakes and rivers.

This section provides an overview of the total population, population distribution, population density, and population growth rates for Kanabec County. This information will provide an indication of the demand and impact of the population on water resources. The population distribution and density trends may also indicate future water resource management issues.

Total Population, Distribution, Density

The historic and present population, population density, and growth rates of Kanabec County, townships, and municipalities are shown below.

TOWNSHIP/CITY	1970	1980	1990	2000	90-00 % Change	2000 Density (Person/Sq.M)
Ann Lake Twp.	193	226	264	377	42.8	12.1
Arthur Twp.	957	1435	1533	1905	24.2	52.9
Brunswick Twp.	765	978	1107	1263	14	35.08
Comfort Twp.	569	756	819	931	13.6	25.8
Ford Twp.	131	137	150	177	18	4.9
Grass Lake Twp.	769	944	888	928	4.5	25.7
Haybrook Twp.	108	206	165	218	32.1	6
Hillman Twp.	233	311	335	384	14.6	10.6
Kanabec Twp.				853		23.6
Knife Lake Twp.	557	727	825	1049	27.1	33.8
Kroschel Twp.	216		188	218	15.9	6
Peace Twp.	386	485	609	963	58.1	26.75
Pomroy Twp.	281	342	321	390	21.4	10.8
Southfork Twp.	526	568	614	662	7.8	18.3
Whited Twp.	449	616	693	808	16.5	26
Grasston City	132	123	119	105	(11.7)	
Mora City	2582	2890	2905	3193	9.9	
Ogilvie City	384	423	510	474	(7)	
Quamba City	114	22	124	98	(20.9)	
KANABEC COUNTY	9,775	12,161	12,802	14,996	17.1	28.7

Kanabec County's population in 2000 totals 14,996 persons. A total of 3,870 persons or 26 percent of the population is located within the four municipalities. The remaining 11,126 persons, or 74 percent, reside in the rural, unincorporated areas of Kanabec County.

The population is unevenly distributed throughout the County. The overall density of Kanabec County is 28.7 persons per square mile. The most densely populated portion of the County (not including Mora) is the Arthur Township area with a density of 52.9 persons per square mile. The most sparsely populated area of Kanabec County is the northern portion, which has a density of 5 to 6 persons per square mile.

Population Growth

Kanabec County has experienced a modest overall growth rate. The growth rate over the last ten year was 17.1 percent, which was higher than the State's rate of 12.4 percent.

The population growth rates vary greatly between minor civil divisions within the County. The fastest growing areas since 1990 are: Peace Township (58.1%) and Ann Lake Township (42.8%), which is probably attributable to lake related development. These municipalities lost population: Grasston (-11.7%), Ogilvie (-7%), and Quamba (-20.9%).

The of population and density growth throughout Kanabec County are shown in Figure A.

ECONOMIC CHARACTERISTICS

The economic characteristics of an area can greatly influence the utilization of and impact on water resources. For example, both agricultural and tourism based economies may depend heavily on local water resources, yet the use of the resource and impact on it will differ greatly. The following data is an attempt to provide insight into the economic characteristics and trends of Kanabec County.

The table below (Figure B) identifies several sources of employment for Kanabec County, the # of employees for each source in 1995 and 1999, and the percentage of gain or loss from each source between these years.

SOURCE	1995	1999	% of Change
Forestry, fishing, hunting, agriculture	3,362	3,441	2.3
Construction	194	185	(4.6)
Manufacturing	770	709	(8)
Wholesale/retail, administrative support	1277	837	(34.5)
Finance, insurance, real estate	120	125	4
Other services/service related	932	1205	22.6

The major change in income sources from 1995 to 1999 was the shift from wholesale/ retail to other services and service related jobs.

EXPECTED CHANGES TO ENVIRONMENT, LAND USE AND DEVELOPMENT

Population: There is no indication that the recent growth rate of Kanabec County (14.6%) will change in the immediate future. However, a majority of the growth since 1980 has been in the unserviced, unincorporated areas of the County. The County has been experiencing out-migration.

Plans, Controls: Previously, the townships within the County have developed comprehensive plans and adopted land use controls, resulting in a total of twelve of the County's fifteen townships having controls. Seven of these townships have instituted density zoning provisions to limit the density and amount of development which can occur.

Land Use: There is not specific data available on changes in land use. It is known that the number of farms, farm employment and farm income have decreased within recent years. The economic base of Kanabec County is shifting to non-farm employment with the greatest increase in the services sector. This economic trend will result in fewer farms and more non-farm residences.

Public Facilities, Services

There are no expected major changes to roads, public utility extensions, regulation or other factors which will significantly impact water resources.

In summary, the changes in land use and the recent out-migration to lakes and rivers are trends which may result in a possible need for further monitoring of water resources in the County.

B. WATER SURFACE - QUANTITY

HIGH, MEAN, AND LOW FLOWS IN STREAMS

The table below shows the annual volumes (in inches of runoff after evaporation) for dry, normal, and wet conditions for Kanabec County's three major watersheds and Knife River.

Name	Dry	Normal	Wet
Rum River	4.4	6.4	9.0
Snake River	5.5	7.1	11.1
Kettle River	7.0	8.1	12.1
Knife River	2.25	8.12	17.97

There is one USGS gauging station in Kanabec County. The station is located on the Knife River, north of Mora on County Road 77, approximately 3/4 mile north of the confluence with the Snake River. The average discharge is 61.0 cubic feet per second. This station has been established for 16 years.

ORDINARY HIGH WATER LEVELS

The Ordinary High Water Level (OHWL) is a state delineated line of equal elevation surrounding a lake basin which defines where the lake bed ends and where the upland begins. The OHWL location serves as the point of reference for certain property and water rights. Shoreland management ordinances establish land use restrictions within certain distances landward from the OHWL. The DNR also uses the OHWL for determining whether permits are needed for work done on protected waters or wetlands.

The following table lists the lakes and the determined OHWL's.

Lake Name (lake #)	Township	Elevation
Eleven (33-1)	Kroschel	1114.4
Fish (33-36)	Arthur	950.2
Knife (33-28)	Knife Lake & Peace	1045.8
Ann (33-40)	Ann Lake & Kanabec	1043.5
Mora (33-34)	Arthur	983.4
Pomroy (33-9)	Peace & Pomroy	1099.2
Quamba (33-15)	Whited	998.2
Loon (33-42)	Kroschel	1138.8
Lewis (33-32)	Brunswick	970.1

The larger, developed lakes in the County have established OHWL's. On lakes without OHWL's, the County Environmental Services Office determines the OHWL by locating where the vegetative cover changes from aquatic (hydrophytic) to terrestrial.

PERMITTED WITHDRAWALS FROM LAKES AND STREAMS

The DNR issues water appropriation permits for water withdrawals from lakes and streams of 1 million gallons per year (mgy). The table below lists the name of the permit holders, location, and permitted pumpage in 2004.

Name	Location	Permitted Pumpage (mgy)
Bauerly Bros. Inc.	Grass Lake, Sect 9	30.0
Thoeny Farms	Southfork, Sect 24	92.0
Mora Country Club	Comfort, Sect 7	12.0
Springbrook Golf Course	Comfort, Sect 7	22.0
City of Mora	Arthur, Sect 11	200.0
Jans Car Wash	Arthur, Sect 14	1.5
Lloyd Carda	Kanabec, Sect 10	28.5
City of Ogilvie	Kanabec, Sect 35	22.0
Blum Sand & Gravel	Knife Lake, Sec 12	12.0

WATER USE CONFLICTS

There are some water use conflicts involving jet ski users, fisherman, and recreational boaters, in Kanabec County, according to the DNR and local sources. There have always been concerns over the cattle utilizing stream areas.

On May 17, 2001, Kanabec County enacted Ordinance #21 to control surface water use on Knife Lake.
On April 13, 2005, Kanabec County enacted Ordinance #28 to control surface water use on Ann Lake.

C. SURFACE WATER - QUALITY

WATER QUALITY CLASSIFICATIONS

A system of classifying waters by water quality management is established in M.S. 115.03, M.S. 1154.11 and Minnesota Pollution Control Agency Rules Chapter 7050. The waters of the state, both surface and ground water, are classified based on considerations of best usage in the interest of the public. Waters are grouped into one or more of the seven classifications and conditions described below.

Numerical water quality standards have been established for each classification which prescribes the qualities or properties of the waters that are necessary for the designated public uses and benefits. These minimum quality standards are used in determining limitations for the discharge of waters to the receiving waters. When the standard of a water body exceeds those of its classification, it is considered an indication of a polluted condition. Classification descriptions:

1 - Domestic Consumption The quality of Class 1 waters of the state shall be suitable for drinking. All ground waters, and certain specifically ally designated surface waters are Class 1 waters. These waters must meet both the primary (maximum contaminant levels) and secondary drinking water standards issued by the U.S. EPA.

2 -Aquatic life and recreation The quality of Class 2 surface waters shall be suitable for the growth and propagation of a healthy community of aquatic plants and animals and their habitats, and for aquatic recreation of all kinds, including swimming. Fish from Class 2 waters should be safe for human consumption, and aquatic organisms should be safe for consumption by wildlife. Class 2 waters are further divided into four subclasses listed below.

Class 2A - Trout waters. These waters shall be suitable for the maintenance of a healthy community of coldwater fish. The MPCA uses the DNR list of trout lakes and streams to define Class 2A waters. This class of surface waters is also protected as a source of drinking water.

Class 2B - These waters shall be suitable for maintenance of a healthy community of cool or warm water sport fish, associated aquatic life, and their habitats. Most lakes, streams, and rivers in the state are Class 2B waters.

Class 2Bd - These waters are the subgroup of Class 2B waters that are also protected for drinking.

Class 2C - Class 2C waters are usually small streams that provide a more limited habitat for game fish populations. However, with very few exceptions, the same standards that apply to Class 2B water also apply to Class 2C waters.

Class 2D - These waters are wetlands and they are protected for the propagation and maintenance of a healthy community of aquatic and terrestrial species indigenous to wetlands, and their habitats. Wetlands shall be suitable for boating and other forms of aquatic recreation for which the wetland may be usable. Most Class 2B standards apply to wetlands.

3 - Industrial Consumption - The quality of Class 3 waters shall be such as to permit their use with or without chemical treatment for most industrial purposes, except food processing.

4 - Agriculture and Wildlife - Class 4 waters of the state shall be such as to permit their use for irrigation without significant damage or adverse effects upon any crops or vegetation, including truck garden crops; and for use by livestock and wildlife for watering without inhibition or injurious effects. Class 4 wetlands (4C) are also protected for erosion control, groundwater recharge, low flow augmentation, and storm water retention.

5 - Aesthetic Enjoyment and Navigation The quality of Class 5 waters of the state shall be such as to be suitable for aesthetic enjoyment of scenery, to avoid any interference with navigation or damaging effects on property.

6 - All Other Uses Which May Be Beneficial - The uses to be protected in Class 6 waters may be under other jurisdictions and in other areas which the waters of the state are tributary and may include any or all of the above uses, plus any other possible beneficial uses. No numerical standards are associated with the Class 6 use.

7 - Limited resource value waters - The quality of Class 7 waters of the state shall be such as to protect aesthetic qualities, secondary body contact use, and groundwater use as a potable water supply. Class 7 waters do not provide enough water or suitable habitat for aquatic life and recreation and are not protected for this use.

All surface waters in Kanabec County are classified as 2B, 3B, 4A, 4B, 5 & 6; with the exception of the Southfork of the Groundhouse River which is classified as 2C, and Hay Creek in the northern part of the County, which is classified as 1B, 2Bd, and 3B.

In general, the waters of Kanabec County are suitable as fisheries for sport fishes and for recreation, industrial consumption, agricultural uses including irrigation and livestock use, aesthetic enjoyment, navigation, and fire prevention.

Hay Creek in northern Kanabec County is of especially high quality and may be used as a source of drinking water with approved disinfection. This water body is protected as a source of drinking water.

The Southfork of the Groundhouse River in southwestern Kanabec County has been classified of a lower quality and use as to include the propagation and maintenance of rough fish species. This is being addressed with the start of the TMDL in 2005.

WATER QUALITY MONITORING

Surface water quality monitoring in Kanabec County has been limited to a few water bodies and has been done infrequently, with the exception of Knife Lake. Water quality monitoring since the initial water plan in 1992, has been completed by: MPCA and A.W. Research Laboratories on Fish Lake; US Geological Survey in the Snake River Watershed; City of Mora on the Snake River and the Snake River watershed Management Board throughout the Snake River Watershed.

Average summer water quality characteristics for lakes in Kanabec County can be classified in two ecoregions: Northern Lakes and Forests, and North Central Hardwood Forests. The boundary between these two regions is north of Ann Lake and through the Knife River watershed heading east. Parameters for the two ecoregions are recommended by the MPCA as follows:

Parameter	Northern Lakes & Forests	North Central Hardwood Forest
Total Phosphorus (mg/l)	.014 - .017	.023 - .050
Secchi Disk (feet)	8 – 15	4.9 – 10.5
Chlorophyll-a (mg/l)	<10	5 – 22
Nitrate + Nitrate (mg/l)	<.01	<.01
Total Suspended Solids (mg/l)	<1 – 2	2 – 6

Monitoring has been done throughout the county. Reports of the data are available at the Kanabec SWCD office.

TROPHIC STATUS INDEX (TSI)

One of the most useful measures of a lake's water quality is its trophic status. Following is a brief description of this concept and the type of data considered in this measurement.

"The "trophy" of a lake is the rate at which organic matter is supplied by or to the lake. The effects of organic input are generally expressed on a scale from nutrient poor to nutrient rich. Nutrient poor oligotrophic lakes are often characterized by low rates of organic input and low production, while for nutrient rich or eutrophic lakes, the input of nutrients and resulting production is generally relatively high.

In common usage, trophic refers to open water, the area of the lake in which primary production is dominated by phytoplankton, e.g., algae. Sampling necessary for classification according to trophic status is normally carried out in this area. When determining trophic status, three special cases must be kept in mind: brown water lakes colored by organic matter from the watershed; bog lakes receiving input primarily from littoral vegetation; and shallow, highly eutrophic lakes dominated by littoral vegetation. Conditions in these lakes may not be reflected by trophic state indices and, therefore, must be considered separately.

Lake trophic status models categorize lakes on a scale ranging from oligotrophic to eutrophic. The scale used indicates water quality conditions in a lake based on factors pertaining to the eutrophication process. The trophic scale typically indicates how increases in the concentration of phosphorous influences chlorophyll-a concentration, which is a direct measure of lake productivity. Chlorophyll-a and total phosphorous are also related to transparency, the ability of the

lake water to transmit light. This relationship makes possible the substitution of Secchi disc transparency as a measurement of water quality."

(Source: Lake Development, 1987; DNR)

The classifications for trophic levels are oligotrophic, mesotrophic, eutrophic, and hypereutrophic. An oligotrophic lake has the lowest level of nutrients - it is clear and deep, with very little algae. Lakes which are considered oligotrophic have a numerical value of ≤40. Mesotrophic lakes have higher nutrient concentrations than oligotrophic lakes, but the water is still relatively clear. Algae is noticeable in a mesotrophic lake. Lakes which are considered mesotrophic have a numerical value of 41-50. An eutrophic value of 51-65. Hypereutrophic lakes display the highest nutrient concentrations and the most algae. The water from these lakes is often characterized as "green," and can have a strong odor. Lakes which are hypereutrophic have a value >65.

The following table indicates the trophic level and trophic status index (TSI) for lakes in Kanabec County.

Lake	Trophic Level	TSI#	Swimmable Use	Priority
Five	Mesotropic	47	Fully swimmable	Low
Pomroy	Eutrophic	57	Fully, but threatened	Medium
Lewis	Mesotrophic	57	Fully swimmable	Low
Devils	Mesotrophic	45	Fully swimmable	Low
Eleven	Eutrophic	60	Fully, but threatened	Medium
Featherbed	Eutrophic	57	Fully, but threatened	Medium
Full of Fish	Eutrophic	59	Partial	Medium
Beauty	Eutrophic	60	Partial	Medium
Quamba (Mud)	Hypereutrophic	68.3	No swimming	high
Spence	Hypereutrophic	70	No swimming	high
Sells	Eutrophic	65	No swimming	high
Spring	Hypereutrophic	69	No swimming	high
Knife	Hypereutrophic	77	No Swimming	high
Fish	Hypereutrophic	72	No swimming	high
Ann	Hypereutrophic	71	No swimming	high

(Source: Minnesota Lake Water Quality Assessment Data Base (1970-1995): Summer Mean Water Quality and Trophic Status & Snake River Watershed Lake Monitoring TSI Summary, 2000.)

Nearly all of the lakes in Kanabec County are eutrophic or hypereutrophic. The major lakes in Kanabec County, with the exception of Lake Five (Bland Lake), have a relatively high nutrient content and a heavy algal growth. Six lakes are categorized as eutrophic and an additional six are classified as hypereutrophic.

AQUATIC VEGETATION

Within the past few years there has been permitted herbicide treatments for purple loosestrife and curly-leaf pondweed in Knife Lake and adjacent waters. Ann Lake and Fish Lake have had permitted herbicide treatments for curly-leaf algae.

There has been an extensive attempt to re-establish bulrushes along the shores of Knife Lake. Bulrushes have been planted to minimize wave action and thus erosion of the shoreland. The bulrushes also serve to improve fish habitat and act as sources of nutrients in the water.

FISH KILLS

The MN DNR Fisheries Division classifies the majority of lakes in Kanabec County as warmwater game fish (walleye, northern pike, largemouth bass, panfish) lakes. Warmwater lakes by nature are generally shallow and moderately to heavily vegetated. These characteristics coupled with warmwater produce highly productive lakes, which naturally experience moderate algae blooms. Decaying vegetation during the winter can deplete oxygen levels and produce partial fish kills. Algae blooms and partial fish kills are common and natural to Kanabec County lakes.

D. GROUND WATER – QUANTITY & QUALITY

GROUND WATER APPROPRIATION PERMITS

The DNR requires that appropriation permits be issued for wells which pump 1 million gallons per year (mgy). Appropriation permits issued in Kanabec County for the year 1999 are shown in the following table.

Name of Permit Holder	Location	Permitted Pumpage (mgy)
Bremix Concrete Co.	Brunswick Twp, Sect 20	40.0
Thoeny Farms	Southfork Twp, Sect 24	92.0
Thoeny Farms	Southfork Twp, Sect 24	92.0
Springbrook Golf Course	Comfort Twp, Sect 7	22.0
City of Mora	Arthur Twp, Sect 11	200.0
City of Mora	Arthur Twp, Sect 11	200.0
City of Mora	Arthur Twp, Sect 11	200.0
City of Mora	Arthur Twp, Sect 14	200.0
Jans Car Wash	Arthur Twp, Sect 14	1.5
Holiday Companies	Arthur Twp, Sect 14	5.3
City of Ogilvie	Kanabec Twp, Sect 35	22.0

The five municipal wells, which supply the public water for Mora and Ogilvie, draw their water from a buried aquifer. The remaining six permitted wells are located in the sand-plain aquifer.

STATE OBSERVATION WELLS

Currently there are three groundwater observation wells being monitored in Kanabec County, by the Kanabec SWCD, in cooperation with the DNR, Division of Waters. The wells are measured to evaluate ground water fluctuations over a period of time. The three current wells that are being monitored are well #33012, #33005, and #33009 (See Figure 20, indicating the well locations). Data is no longer collected for well #'s 33000 and 33011, due to inaccessibility and well sealing.

The current wells being monitored are all located in near surface, unconfined, water table aquifers. This means they are located in sands and gravel layers beneath the ground surface with no limiting barriers above these layers.

All water level readings are measured from ground surface.

The current wells being measured are at the following total depth:

Well # 33012 17' depth
Well # 33005 47' depth
Well # 33009 21.5' depth

WELL HEAD PROTECTION

Wellhead protection is a method of preventing contamination of a public water supply well by managing potential contaminant sources in the area which contributes water to a public water supply well. All public water suppliers are required to manage an inner-wellhead management zone, a 20-foot radius surrounding a public water supply. In addition, owners and operators of such wells must prepare a wellhead protection plan.

E. SPECIAL LAND USES

SPECIAL GEOLOGICAL CONDITIONS

A sand-plain surficial aquifer is located in the south central portion of Kanabec County as shown on Figure 2. The presence of this aquifer was confirmed by a study done by the US Geological Survey, which was sponsored by the Onanegozie RC&D and DNR. This aquifer was determined by local soil maps, several hundred driller's logs, aerial photographs, and lithologic descriptions of 750 augured test holes.

The sand-plain aquifer area has a high potential for ground water contamination, according to Eric Porcher of the MPCA Division of Water Quality. Areas of highest ground water contamination susceptibility are those typically composed of:

-Aquifer Material: sand & gravel, sandstone
-Recharge Potential: moderate to high
-Soil Materials: generally sandy soils
-Vadose Zone Materials: sand & gravel, sandstone

Aquifer material - refers to the aquifer nearest the land surface. Aquifer materials are composed of consolidated or unconsolidated materials such as sand, gravel, and porous or fractured bedrock, which yield sufficient quantities of water for use. When a contaminant reaches the water table or aquifer, the rate, direction, and path length that it will travel is controlled by the saturated media.

Kanabec County has a moderate to high rating for hydraulic conductivity aquifer materials because of the high presence of sand & gravel and sandstone.

Recharge potential - is the relative potential for precipitation to penetrate the ground surface. Water recharging an aquifer may transport a contaminant vertically to an aquifer.

Kanabec County has a low recharge potential throughout the County; however in the southern half there is a higher presence of moderate to high recharge potential.

Soils materials - have a significant impact on the amount of water which infiltrates and consequently the rate at which a contaminant moves vertically towards the saturated zone or groundwater. The ability of a soil to restrict the flow of water is controlled by its texture (grain size) and the amount of clay present.

Within Kanabec County the majority of the soil (98%) is classified as a sandy loam with the remaining 15% classified as sand and gravel.

SEDIMENTATION PROBLEMS

Documented data on the extent and severity of eroding lands and associated sedimentation problems does not exist for Kanabec County. The data that is presented in this section is based on visual observations of SWCD and NRCS staff and local residents, who notify the SWCD of erosion problems on their land. Figure 22 indicates areas of known erosion and sedimentation.

In recent years, the SWCD has had a growing concern from shore land owners, regarding erosion problems. The SWCD along with other conservation agency partners, such as NRCS IMPACK 6 and Joint Powers Board, provides conservation assistance to landowners for these types of projects. Prioritizing, planning, surveying, and designing erosion control practices are a major part of their programs.

The majority of erosion control problems reported have come from lakeshore property owners. These areas include the Snake River, Groundhouse River, Knife Lake, Knife River, Fish Lake, Lewis Lake, and Quamba Lake. Other areas reported have been on cropland areas in the southern half of the County. Sedimentation problems may also be problems created by construction projects. The projects may be short term but the sedimentation problems created can have a long term impact.

Current erosion and sedimentation is shown by the darkened areas on the attached referenced map.

HAZARDOUS WASTE GENERATORS

Minnesota Hazardous Waste Rules (Chapter 7045) state that any person (or company), by site, whose act or process produces hazardous waste is a generator. Hazardous waste is controlled from the time it is produced until final treatment or disposal. Persons, who produce, store, treat, or dispose of hazardous wastes must get a permit from the MPCA. Persons who violate Minnesota's hazardous waste laws may receive fines and/or imprisonment and may be required to pay for any environmental damages caused by failure to follow the laws and rules.

There are three classifications of generators:

Very Small Quantity Generators VSQG's	Generates fewer than 100 kg of waste per month (less than 2 drums).
Small Quantity Generators SQG's	Generates between 100 kg and 1000 kg of waste per month (about 2 to 4 drums).
Large Quantity Generators LQG's	Generates more than 1000 kg of waste per month (more than 4 drums).

Depending on the size of generator, the person or business has several storage limits and requirements. The limits of storage time prior to shipping are:

VSQG - 180 days after 1000 kg has been accumulated;
SQG - 180 days after the waste was first put into the container(accumulation start date).
LQG - 90 days after accumulation start date unless storage facility permit is obtained.

All generators must inspect storage areas weekly and keep accurate records of the inspections. All storage areas must meet certain requirements governing the storage of chemicals, stacking of drums and storage area size.

According to the MPCA, Kanabec County has 46 hazardous waste generators located within the municipalities and in rural areas.

HOUSEHOLD HAZARDOUS WASTE

Kanabec County's Household Hazardous Waste collection day is on a Saturday in May at the East Central Solid Waste Facility. This program began in 1997 and continues.

MINNESOTA SUPERFUND LIST

The Superfund Program identifies, investigates, and determines appropriate cleanup plans for abandoned or uncontrolled hazardous waste sites where a release or potential release of a hazardous substance poses a risk to human health or the environment.

Kanabec County does not have any hazardous waste sites at this time.

STORAGE TANKS

Underground Storage Tanks

The MPCA regulates most underground storage tanks (UST's) of greater than 110 gallons capacity. Consumptive-use heating oil UST's and not-for-resale motor fuel UST's located at a residence or farms are regulated only if they are greater than 1,100 gallons capacity. All UST's regulated by the MPCA which were not properly closed before January 1, 1974 should have been registered with the MPCA by June 1, 1986 or within 30 days of completion of installation, whichever is later. UST's containing fertilizers, herbicides or pesticides are regulated by the Dept. of Agriculture. UST's containing hazardous waste are subject to hazardous waste rules and regulations.

The MPCA inspects UST's during the installation and removal process and also conducts inspections of facilities which have active UST's to ensure that the UST owner/operator is in compliance with UST rules and regulations.

UST's (tanks and piping) which are subject to leak detection requirements and which were installed before December 22, 1988 were required to implement an appropriate leak detection method during the four year period between December 22, 1989 and December 22, 1993, depending upon the age of the UST. Such UST's installed after this date were required to implement an appropriate method of leak detection at the time of installation.

UST's (tanks and piping) installed on or after August 1, 1985 which are subject to corrosion protection requirements were required to have corrosion protection at the time of installation. Such UST's installed before this date are required to be upgraded for corrosion protection by December 22, 1998 or be properly closed by this date.

UST's installed on or December 22, 1988 and which are subject to spill containment and overfill prevention requirements were required to have such equipment at the time of installation. Such UST's installed before this date are required to be upgraded for spill containment and overfill prevention or be properly closed by this date.

MPCA also has requirements regarding the installation and the removal of underground storage tanks that became effective August 1, 1992. The contractor installing the tanks must be certified by the MPCA. Proper installation must be followed according to the manufacture's instructions. And finally, a 30 day notification to the MPCA is required. There are some additional requirements of installation depending on the type of substances to be placed in the tanks.

Required methods for removal of tanks are as follows:

The MPCA must be notified.
The contractor removing the tanks must be certified by the MPCA.
A site assessment must be conducted during tank removal, which included soil and/or water samples if there is no evidence of contamination.
If the site is contaminated, arrangements must be made for cleanup.
MPCA must be contacted within 24 hours if contamination is suspected.
A suitable location for storing contaminated soil must be approved by the MPCA.
Recycling of the tank's liquid contents must be done.
30 day notification to the MPCA is required.

Above Ground Storage Tanks

MN Statue 116.48 states that all above ground tanks (AGST) over 1100 gallons for farm and residential uses must be registered with the Minnesota Pollution Control Agency (MPCA). All commercial tanks and tanks containing petroleum and chemical must be registered with MPCA.

According to MN Statue 116.48 part 71000.0010-7100.0090, **ALL** tanks which contain petroleum, chemical and food must have a secondary containment. The secondary containment must be 100% the size of the tank with 6 inches of freeboard.

The Minnesota Department of Agriculture (MDA) regulates AGST that are used for fertilizers and pesticides. Pesticide tanks must have a secondary containment of 125% of the size of the tank and fertilizer tanks must have a secondary containment of 100% of the size of the tank.

PERMITTED DISCHARGES

The following is a list of MPCA permitted discharges in Kanabec County.

City	Receiving Water	Systems
Mora	Snake River	Sewerage
Ogilvie	Groundhouse River	Sewerage
Grasston	Snake River	Sewerage

All of the permitted discharges are municipal wastewater treatment facilities, Mora and Ogilvie have recently upgraded their facilities to meet existing and near future wastewater treatment needs. Grasston's facility has a treatment capacity which far exceeds the present demand as the facility was designed for a local industry which is now closed.

ABANDONED WELLS

There is no count of abandoned wells in Kanabec County.

Minnesota Statues, effective July 1, 1990, requires that people who buy real estate in Minnesota be informed about any wells on the property, whether the wells are being used or not. The law applies to all types of water wells, including drive-point wells, drilled wells, dug wells, monitoring wells, dewatering wells and groundwater thermal exchange systems.
The law was passed to assist with the problem posed by abandoned wells. Abandoned wells can be a significant threat to public health and the environment. They can provide a path for surface contamination to reach the ground water, creating a potential threat to the quality of the drinking water.

MDH estimates that there are anywhere from 400,000 to 1.2 million unsealed, abandoned wells in the State. Many of these wells have been left open or are in a serious state of disrepair, creating a potential health and safety hazard for adults, children, pets and livestock.

Property owners are legally responsible for all wells whether the well is currently in use or not in use. Property owners must seal the well or obtain a maintenance permit for wells that are not currently operable or disconnected from power. These unused wells must be properly maintained so they do not endanger health or safety, or contaminate the ground water. The permits are available from the Minnesota Department of Health (MDH) for a fee of $50 a year. Maintenance permits are not transferable.

There are many wells in the State where only the top of the pipe was plugged. This type of sealing does not provide protection to the ground water since contaminated surficial ground water could enter the well through rust holes or joints in the pipe, allowing for the contamination of the ground water source.

FEEDLOTS

According to Minnesota Rule Chapter 7020 an animal feedlot is a lot or building or combination of lots and buildings intended for the confined feeding, breeding, raising, or holding of animals and specifically designed as a confinement area in which manure may accumulate, or where the concentration of animals is such that a vegetative cover cannot be maintained within the enclosure. For purposes of these parts, open lots used for the feeding and rearing of poultry (poultry ranges) shall be considered to be animal feedlots. Pastures shall not be considered animal feedlots under these parts.

The Minnesota Pollution Control Agency (MPCA) requires that an owner of a proposed or existing animal feedlot apply for a permit when:

a) An animal feedlot capable of holding 50 or more animal lots or a manure storage area capable of holding the manure produced by 50 or more animal units; and

b) An animal feedlot capable of holding ten or more and fewer than 50 animal units or a manure storage area capable of holding the manure produced by ten or more and fewer than 50 animal units that is located within shore land.

In October, 2000, a major revision of the feed lot rules went into effect. The goals for the feed lot rules are registration of all feedlots capable of holding 50 animal units or more (10 in shore land). Focus on animal feed lots and manure storage areas that have the greatest potential for environmental impact.

F. RELATED LAND RESOURCES

WETLANDS

Wetlands provide many benefits for water quality and the environment. Wetlands provide filters for sediment and nutrients, they attenuate flood flows, modify water quality, and support fish and wildlife. They may also serve as interconnections between surface water and ground water. Because of these benefits, they are regulated through the Minnesota Wetland Conservation Act.

National Wetland Inventory

National Wetland Inventories (NWI) are developed by the US Fish and Wildlife Service (USFWS). Kanabec County has a completed inventory available at the SWCD office and Environmental Services Department. NWI's identify additional wetlands that are not identified in the DNR Protected Waters Inventory (PWI).

Figure 24 shows an example of the NWI.

Army Corp of Engineers

Permits are required for projects like dredging, placing structures in navigable waters of the United States, or placing dredged or fill material in any waters or wetlands. Two laws regulate this type of work: Section 10 deals with the work in navigable waters, and Section 404 deals with placing dredges or fill material in any waters or wetlands.

Navigable waters in Kanabec County which would be regulated by the Army Corps of Engineers (COE) include: Snake River, Knife River, Ann River, and the Groundhouse River.

The COE has several different review processes, depending on the nature of the work to be done. Large projects require a full public interest review. Examples of these projects are new marinas or harbors in navigable waters, large dredging projects, highway projects through wetlands or waters, fill in wetlands to turn them into upland, or large drainage projects.

The COE regulates many more wetland and water areas than does the MNDNR. The COE regulates every wetland type and has jurisdiction over virtually every wetland and water body in Minnesota.

MN Protected Wetlands

Certain wetlands have been identified as protected wetlands under Minnesota Statutes 103G.201 and are subject to the regulations and permitting previously described in the Protected Waters section.

The State of Minnesota bases its program of wetland protection on the classification system presented in Wetlands of the United States, United States Department of the Interior, Fish and Wildlife Circular No.39, 1971 edition. All wetland types 1 through 8 exist in Kanabec County. Below is a description of the types of wetlands as determined by the US Fish and Wildlife Service.

TYPE 1: Seasonally flooded basins or flats. Soil is covered with water or is waterlogged during variable seasonal periods but usually is well-drained during much of the growing season. Vegetation varies greatly according to season and duration of flooding: from bottom-land hardwoods to herbaceous growths.

TYPE 2: Inland fresh meadows. Soil is usually without standing water during most of the growing season but is waterlogged within at least a few inches of the surface. Vegetation includes grasses, sedges, rushes and various broad-leaved plants. Meadows may fill shallow basins, sloughs, or farmland sags, that may border shallow marshes on the landward side.

TYPE 3: Inland shallow fresh marshes. Soil is usually waterlogged early during the growing season and is often covered with as much as 6 inches or more of water. Vegetation includes grasses, brushes, spike rushes, cattails, arrowheads, pickerelweed and smartweeds. These marshes may nearly fill shallow lake basins or sloughs, or may border deep marshes on landward side, also common as seep areas on irrigated lands.

TYPE 4: Inland deep fresh marshes. Soil is usually covered with 6 inches to 3 feet or more of water during the growing season. Vegetation includes cattails, reeds, bulrushes, spike-rushes, and wild rice. In open areas; pondweeds, naiads, coontail, water milfoils, waterweeds, duckweeds, water-lilies or spatterdocks may occur. These deep marshes may completely fill shallow lake basins, potholes, limestone sinks and sloughs, or they may border open water in such depressions.

TYPE 5: Inland open fresh water. Shallow ponds and reservoirs are included in this type. Water is usually less than 10 feet deep and fringed by border of emergent vegetation similar to open areas of Type 4.

TYPE 6: Shrubs swamps. Soil is usually waterlogged during growing season and is often covered with as much as 6 inches of water. Vegetation of shrub swamps includes alders, willows, buttonbush, dogwoods, and swamp-privet that occur mostly along sluggish streams and occasionally on flood plains.

TYPE 7: Wooded swamps. Soil is waterlogged at least to within a few inches of the surface during growing season and is often covered with as much as 1 foot of water and occur mostly along sluggish streams, flood plains, flat uplands and in shallow basins. Trees associated with wooded swamps include tamarack, arborvitae, black spruce, balsam, red maple and black ash. Northern evergreen swamps usually have a thick ground cover of mosses. Deciduous swamps frequently support beds of duckweeds, and smartweeds.

TYPE 8: Bogs. Soil associated with bogs is usually waterlogged and supports a spongy covering of mosses and occur mostly in shallow basins, on flat uplands and along sluggish streams. Vegetation is woody or herbaceous or both. Typical plants are heath shrubs, sphagnum moss, and sedges. In the North, leather-leaf, labrador-tea, cranberries, carex and cotton grass are often present. Scattered, often stunted, black spruce and tamarack may occur.

Wetland Conservation Act

The Wetland Conservation Act (WCA) of 1991 was enacted by the state legislature to protect the quantity and quality of wetlands in Minnesota. The mission of WCA is no-net loss of wetland area and value. Counties in Minnesota are divided into 3 categories based upon their remaining percentage of pre-settlement wetlands. WCA is administered by the Kanabec County Environmental Services Department. Wetland activities planned must first go through sequencing which involves consideration of avoidance, mitigation of impacts and finally replacement of wetland area. Possible exemptions to the law are also considered for each

activity. Due to its complexity and potential future amendments, no attempt to address the law in detail will be made in this plan.

WCA does provide for an exemption from property tax if the wetland is located in high priority areas. This program is called the Wetland Preservation Area. Currently, the wetlands in Kanabec County that are addressed to be a high priority are all wetlands throughout the county.

United States Department of Agriculture

The USDA farm programs have become increasingly protective of wetlands. The 1985 Farm Bill made persons ineligible to participate in farm programs if a landowner converted a wetland and planted a commodity crop in its place. The Natural Resources Conservation Service is the responsible agency for identifying wetlands in an agricultural field. The 1990 Farm Bill was more restrictive and made a person ineligible to participate in farm programs if a landowner converts a wetland regardless if no commodity crop was planted on the wetland.

The NWI does provide an indication of the approximate number of drained wetlands. According to the National Wetland Inventory most of the drainage of wetlands has taken place in the southern half of the County. The main reasons wetlands have been drained throughout the County is for agricultural uses, residential and commercial development, and highway construction.

LOCAL PLANS AND OFFICIAL CONTROLS

Land uses and development activity affect water resources. For this reason, the State rules for the preparation of comprehensive local water plans require the submission of any existing water and related land resources plans and official controls. Existing water and related land resources plans must be fully utilized in preparing the comprehensive water plan.

This correlation between local plans and controls and the local comprehensive water plan continues after the preparation and adoption of the plan. The Water Planning Act states that local unit of government shall amend existing water and related land resource plans and official controls as necessary to conform them to the applicable, approved comprehensive water plan.

It is therefore important to evaluate local plans to determine what types of plans and controls exist, their consistency throughout the hydrologic system, and their effectiveness in addressing existing and potential problems.

Existing Plans and Controls
Existing local plans and controls related to and evaluated in this water planning process are:

Kanabec Co. Shorelands Management Ordinance No.5
Kanabec Co. Flood Plain Ordinance No.9
Kanabec Co. Subdivision Regulations No.4
Kanabec Co. Individual Sewer System Ordinance No.6
Kanabec Co. Knife Lake Archeological Sites Ordinance No.12
Comprehensive Land Use Plan No. 22
Solid Waste Ordinance No. 14
Surface Use of Knife Lake No. 21
Surface Use of Ann Lake No. 28
Township and Municipal comprehensive plans
Township and Municipal Zoning Ordinances

Shorelands Management

The Minnesota Shorelands Management Act requires local government to manage development activities and land use within 1000 feet of lakes and 300 feet of rivers. The state has established minimum shore land standards addressing issues including land use, lot area and width, building and sewer setbacks, vegetation alteration, grading and filling, on-site sewers.

SHORELAND ZONING CLASSIFICATIONS

Lake	Lake ID#	Zoning Classification
Lewis Lake	32	Recreational Development
Eleven	1	Recreational Development
Beauty	2	Natural Environment
Five	3	Natural Environment
Twelve	4	Natural Environment
Thirteen	5	Natural Environment
Featherbed	6	Natural Environment
White Lily	8	Natural Environment
Pomroy	9	Recreational Development
Peace	10	Natural Environment
Rice	11	Natural Environment
Grass	13	Natural Environment
Unnamed	14	Natural Environment
Quamba	15	Recreational Development
Spence	16	Natural Environment
Unnamed	17	Natural Environment
Sells	18	Natural Environment
Twin	19	Natural Environment
Luchts	21	Natural Environment
Full of Fish	24	Natural Environment
Pocket Knife	25	Natural Environment
Snowshoe	26	Natural Environment
Spring	27	Recreational Development
Knife	28	Recreational Development
Pennington	30	Natural Environment
Erickson	31	Natural Environment
Devils	33	Recreational Development
Mora	34	General Development
Kent	35	Natural Environment
Fish	36	Recreational Development
Telander	37	Natural Environment
Ann	40	Recreational Development

Shore Land Zoning

Natural Environment - lakes are generally small, often shallow lakes within limited capacities for assimilating the impacts of development and recreational use. They often have adjacent lands with substantial constraints for development such as high water tables, exposed bedrock, and unsuitable soils. These lakes, particularly in rural areas, usually do not have much existing development or recreational use.

Recreational Development - lakes are generally medium-sized lakes of varying depths and shapes with a variety of landform, soil, and groundwater situations on the lands around them. They often are characterized by moderate levels of recreational use and existing development. Development consists mainly of seasonal and year-round residences and recreationally-oriented commercial uses. Many of these lakes have capacities for accommodating additional development and use.

General Development - lakes are generally large, deep lakes or lakes or varying sizes and depths with high levels and mixes of existing development. These lakes often are extensively used for recreation and, except for the very large lake, are heavily developed around the shore. Second and third tiers of development are fairly common. The larger examples in this class can accommodate additional development and use.

Kanabec County

Kanabec County Shore land Ordinance No.5 was originally instituted as the county-wide shore land management ordinance in the early 1970's in response to the Shore land Management Act. The County adopted an updated shore land ordinance, which went into effect February 1, 1992 to comply with the revised statewide shore land standards which went into effect on July 3, 1989, which is periodically updated as required.

The Kanabec County Shoreland Management Ordinance No.5 applies to all unincorporated shore lands within the county and has been adopted by the Townships. Arthur Township administers the shoreland regulations within their Township.

The cities of Mora, Ogilvie and Grasston administer shoreland regulations within the cooperate boundaries of their cities.

Flood Plain Management

Minnesota Statutes, Chapter 103E delegates the responsibility to local government units to adopt regulations designed to minimize flood losses. Kanabec County, Arthur Township, the City of Mora, and the City of Ogilvie administer flood plain ordinances within the County.

Kanabec County

The Flood Plain Management Ordinance No.9 applies to the Snake River from Co. Rd. 24 in Peace Township to the Pine County boundary, excluding the incorporated areas of the cities of Mora and Grasston and Arthur Township.

An engineering study completed in 1978 delineated the floodway, flood fringe (100 year flood boundary) and the 500 year flood boundary. The Flood Plain Management Ordinance regulations are based on the engineered map.

The ordinance limits use within the designated floodway district to those of low flood damage potential, including agricultural uses, parking and loading areas, recreational uses and residential lawns. Uses shall not obstruct flood flows or increase flood elevation. Structural development is allowed in the flood fringe district; however, they must be elevated on fill in order that the lowest floor is at or above the regulatory flood protection elevation (one foot above the 100 year flood elevation).

The ordinance has been approved by the Minnesota Department of Natural resources and the Federal Emergency Management Agency, thereby qualifying property owners within the flood plain district to be eligible for flood insurance.

Arthur Township

Arthur Township has chosen to adopt and administer their own flood plain management regulations for areas adjacent to the Snake River and Fish Lake. The Township ordinance is based on the same engineering study as the County's ordinance and the ordinances are similarly structured.

City of Mora

The City of Mora has enacted and administers flood plain management provisions for designated flood plain areas within the corporate limits of Mora. The ordinance is structured like the Kanabec County's and Arthur Township's ordinances, providing for consistent flood plain management throughout the County.

City of Ogilvie

The City of Ogilvie has adopted and administers flood plain regulations to regulate development within the designated flood plain of the Groundhouse River.

County Subdivision Regulations

Kanabec County's subdivision platting ordinance presently in effect was adopted on August 28, 1985. Subdivision Platting Ordinance No.4 regulates the subdivision of land and the laying out of streets, alleys and other public grounds.

The area of jurisdiction of the ordinance is the unincorporated area of the County, where townships have not enacted subdivision controls within their respective jurisdictions.
The subdivision ordinance generally applies to the division of a tract of land into two or more lots or parcels of less than five acres with a lot width of less than 300 feet and less than 300 feet minimum frontage on an existing public road, or any division of a parcel where a new road is required. Provisions exist within the subdivision platting ordinance which regulates land development activities in ways that ground and surface water can be impacted.

Kanabec County Individual Sewer System Ordinance

On February 11, 1998, Kanabec County repealed Individual Sewer System Ordinance No. 6 and Ordained Sewage and Waste Water Ordinance No.6, which is the adoption of Minnesota Rules Chapter 7080, with the addition of Subdivision 3 of Ordinance No.6, which states that all new and upgraded sewage treatment systems for individual dwellings shall be sized for Type I dwellings. Kanabec County permits and regulates individual sewage treatment systems through its Sewage and Waste Water Treatment Ordinance No.6. The ordinance applies to all systems in the unincorporated area, including shore lands, of the County except for Arthur Township, which has adopted and enforces its own regulations, which comply with Chapter 7080.

The 7080 regulations include standards for determining the feasibility of an individual sewage treatment system, appropriate design in view of the treatment needs and site characteristics, system location, system maintenance and alternative systems.

To assist in achieving compliance with the current Sewage and Waste Water Treatment standards and to protect the quality of surface waters, Kanabec County requires that individual sewage treatment systems be certified as being in compliance prior to the conveyance of property located in shore land areas.

Kanabec County Waste Tire Ordinance

Kanabec County adopted an ordinance regulating waste tires within the unincorporated area of county on September 1, 1988. The ordinance prohibits storing, processing, or disposing of tires or a tire-derived product without obtaining a Waste Tire Facility Permit from the Minnesota Waste Management Board and Kanabec County.

Knife Lake Archeological Sites Ordinance

Kanabec County Ordinance No.12 designates publicly owned islands and the Indian mound burial grounds on Knife Lake as archeological sites and subject to certain regulations.

The primary purpose of the ordinance is to protect archeological sites by establishing how the water related lands can be used. The ordinance prohibits any removal or damage to vegetation, placement of objects or materials, or disturbance of the ground.

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Township Comprehensive Plans and Official Controls

Within Kanabec County, comprehensive planning and zoning, with the exception of the septic, shoreland and designated flood plain areas (except in Arthur Township), is conducted at the township level. Of the 15 townships located within the County, 13 have adopted township-wide Arthur Township has adopted and administers shoreland, and septic ordinances, in addition to a general zoning ordinance. Ford, and Ann Lake have not instituted township zoning at this time, however, Ford Township is in the process of implementing a zoning ordinances.

When analyzing the individual township ordinances, there is much similarity in the types of land uses allowed and activities regulated throughout the County. The greatest difference between the township ordinances relates to the density of residential development. The following table attempts to summarize the individual ordinances in order to understand the type and density of development allowed throughout the County.

TOWNSHIP ZONING SUMMARY

Township/District/Uses	Density/Lot Size	General Provisions Related to Water Resources
ARTHUR		
Agric – Open District		Mining – conditional use
Agric		
Resident	2 ac.	Land reclamation-erosion control
Rural-Resident District		
Resident	1 ac.	Refuse-public health safety
General Business District		
Comm	5000 sq ft	Public water alt. – DNR permit
Highway Business District		
Comm	5000 sq ft	
Limited Industrial District		
Industrial	5 ac.	
BRUNSWICK		
Agric – Open District		Mining – conditional use
Agric		
Resident	3 per qtr/qtr 2 ac.	Storage/disposal of materials
Comm – Industrial District	2 ac.	No pollution
Comm		
Industrial		No pollution of water resources
		Land reclam – no erosion
		Public water at. – DNR permit
COMFORT		
Farm – Resident District		Mining – conditional use
Agric		
Resident	1 per qtr/qtr 20 ac.	Bulk/ext. storage – cond. Use
Comm (c.u.)		if pollution potential
Industrial (c.u.)		
		Drainage – prevent flooding, erosion
		Land reclam – cond. Use
GRASS LAKE		
Farm – Resident District		Bulk/ext. storage – cond. Use
Agric		if pollution potential
Resident	5 ac.	
Comm		Drainage – prevent flooding erosion
Industrial		Land reclam – cond. Use

HAYBROOK

Farm – Resident District		
Argric		
Resident	**2 per qtr/qtr 20 ac.**	
Comm.		
Industrial		

HILLMAN

Farm – Resident District		**Mining – conditional use**
Agric		
Resident	**2 per qtr/qtr 1 ac.**	
Comm (c.u.)		
Industrial (c.u.)		

KANABEC

Agric District		**Mining – conditional use**
Agric District		
Resident	**2 ac.**	**Storage/disposal of materials**
Agric – Resident District		**no pollution**
Agric		
Resident	**2 ac.**	**No pollution of water resources**
Highway/Business		
Agric		**Land reclam – no erosion**
Resident	**2 ac.**	
Comm		**Public water alt. – DNR permit**
Industrial		

KNIFE LAKE

Agric – Open District		**Mining – conditional use**
Agric		
Resident	**2 ac. On existing road**	**Storage/disposal of materials**
Agric – Resident District	**2 ac. On existing road**	**no pollution**
Agric		
Resident		**No pollution of water resources**
Comm (c.u.)		
Industrial (c.u.)		**Land reclam – no erosion**
		Public water alt. – DNR permit

KROSCHEL

Agric – Open District		**Mining – conditional use**
Agric – Open District		
Resident	**2 per qtr/qtr 20 ac.**	**Land relcam – no erosion**
Comm (c.u.)		
Industrial (c.u.)		**Public water alt. –DNR permit**

PEACE*

Agric – Open District		**Mining – conditional use**
Agric		
Resident		**Storage/disposal of materials**
Agric –Resident District		**no pollution**
Agric		
Resident	**10 ac.**	**No pollution of water resources**
Comm (c.u.)	**5 ac.**	
Industrial (c.u.)		**Land reclam – no erosion**
		Public water alt. – DNR permit

POMROY

Agric – Open District		**Mining – conditional use**
Agric		
Resident	**2 per qtr/qtr 2.5 ac.**	**Public water alt. – DNR permit**
Comm (c.u.)		

SOUTHFORK*

Agric – Open District		**Mining – conditional use**
Agric		
Resident	**3 per qtr/qtr 5 ac.**	

WHITED*

Agric – Open District		**Mining - conditional use**
Agric		
Resident	**5 ac. On existing road**	**Storage/disposal of materials**
Agric – Residential District	**5 ac.**	
Agric		**No pollution of water resources**
Resident		
Comm (c.u.)		**Land reclam – no erosion**
Industrial (c.u.)		
		Public water alt. – DNR permit

The following is a general characterization of the township ordinances:

Agricultural Uses - The primary land uses provided for throughout the county is agricultural uses, open uses such as forestry and recreation, and residential.

Residential Uses - Residential density is controlled through density requirements, access requirements and lot size.

Commercial and industrial Uses - Commercial and industrial uses are limited in the unincorporated areas by being allowed only in specific districts or by a conditional use permits.

Protection of Water Resources - All of the township ordinances contain special or general provisions which relate to the protection of water resources. Nearly all of the township ordinances regulate the storage or disposal of materials as to not result in pollution, or a conditional use permit is required if there is some potential for pollution. Land reclamation (grading and filling) is regulated in nearly all townships through a conditional use permit or regulations to prevent erosion. Several ordinances prohibit any activities which pollute water resources. Many of the ordinances include a provision for the alteration of protected waters, which serve as a reminder that permits are required from the Department of Natural Resources for activities occurring within protected waters. All of the townships require a conditional use permit for mining activities which allow them to control factors including operations, drainage, and site reclamation.

Municipal Plans and Official Controls

When analyzing the impact of urban areas on water resources, the level and method by which public services, i.e. water, sanitary sewer, storm sewer, are provided is often more relevant than land use or density. An overview of these services is provided in another section identifying municipal services and utilities.

City of Mora

The City of Mora has an adopted comprehensive plan, zoning ordinance, and subdivision regulations. As previously described, the City also has shoreland and flood plain regulations in effect.

The City's comprehensive plan and zoning ordinance allows for residential, commercial, and industrial land uses at an urban density. Commercial areas are designated in the downtown area along T.H. 65, industry is to be located in the northeast area of the City, and the remaining area is for residential development at various densities.

Residential development is allowed on one acre lots if an on-site sewage treatment system can be installed to meet the minimum Minnesota Pollution Control Agency standards. However, it is the policy of the City to require development to be served by the central system, if feasible.

Standards exist within the ordinance requiring that no matter is to be discharged across a lot or percolate into the subsoil to the extent to be detectable or endanger public health or safety. Waste materials are not to be washed into the public storm or sanitary sewer without a permit from the city.

The Subdivision Regulations also provide for some protection of water resources. No development will be allowed in areas of potential flooding. Erosion and sedimentation control plans are required for developments on slopes. Central water and sewer services are to be utilized when available to the site. Adequate drainage systems shall be required and approved. The regulations allow for denial of development in consideration of natural features including water courses.

City of Ogilvie

The City of Ogilvie has adopted a zoning ordinance and subdivision regulations. The zoning ordinance allows for commercial uses in the downtown area and along T.H.23. Industrial uses are allowed in the northern part of the City. The area on both sides of the Groundhouse River which is subject to flooding is designated as a conservation area where building development are not allowed.

The subdivision regulations include provisions which have a direct and indirect relation to water resources. Development proposals must have plans for erosion and sediment control and the review of development proposals shall take flooding, erosion potential and sewer feasibility into consideration.

City of Grasston

The City of Grasston initiated comprehensive plan and zoning ordinance for the City. The plan and ordinance establish land uses, lot sizes and other general regulations pertaining to development activities.

WATER-BASED RECREATIONAL LAND

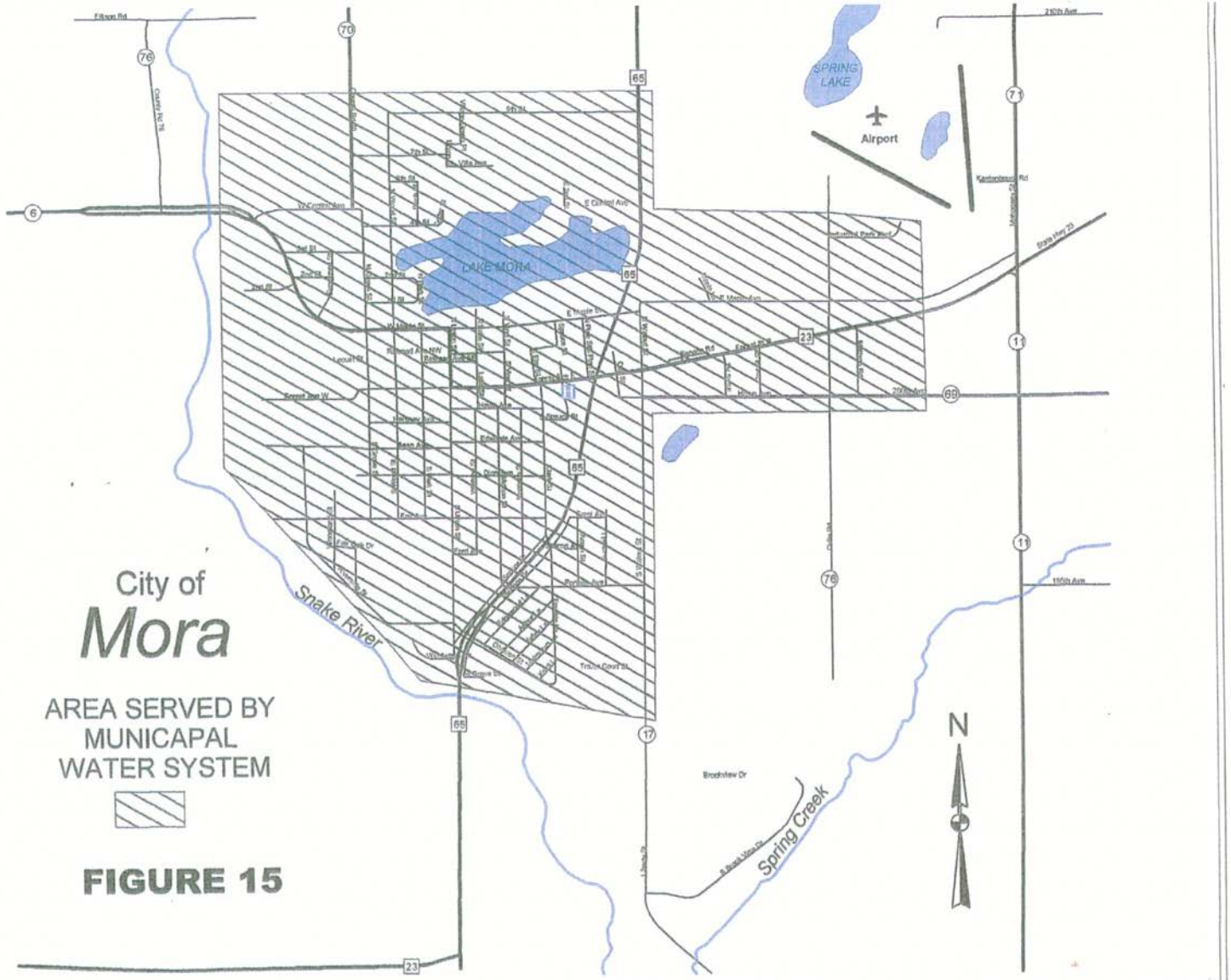
According to the DNR's MN Statewide Comprehensive Outdoor Recreation Plan, 1984-1989, Kanabec County has two state forest trails within the Snake River State Forest and the Rum River State Forest.

The Snake River is a state designated canoeing and boating river. This means that the State maintains three public assesses along the river. Due to the extraordinary qualities of the river, it was once considered for inclusion into the Minnesota Wild and Scenic Rivers Program.

Kanabec County has seven lakes that have a medium to high recreational use. They are Knife, Fish, Ann, Pomroy, Quamba, Lewis, and Eleven. These lakes all have at least one public access maintained by the DNR or MN DOT. Recreational use consists of fishing (summer and winter), swimming, water skiing, etc.

Kanabec County has a diversity of resources. With its close proximity to the Twin Cities metropolitan area, it has the potential for high recreational use.

Fishing is popular in Kanabec County. Many years ago, Knife Lake had undergone a reclamation project to restore gamefish populations. Several other lakes are experiencing declining water quality and fish habitat.


City of
Mora
AREA SERVED BY
MUNICAPAL
WATER SYSTEM
FIGURE 15
LAKE MORA
SPRING LAKE
Airport
Snake River
Spring Creek
N

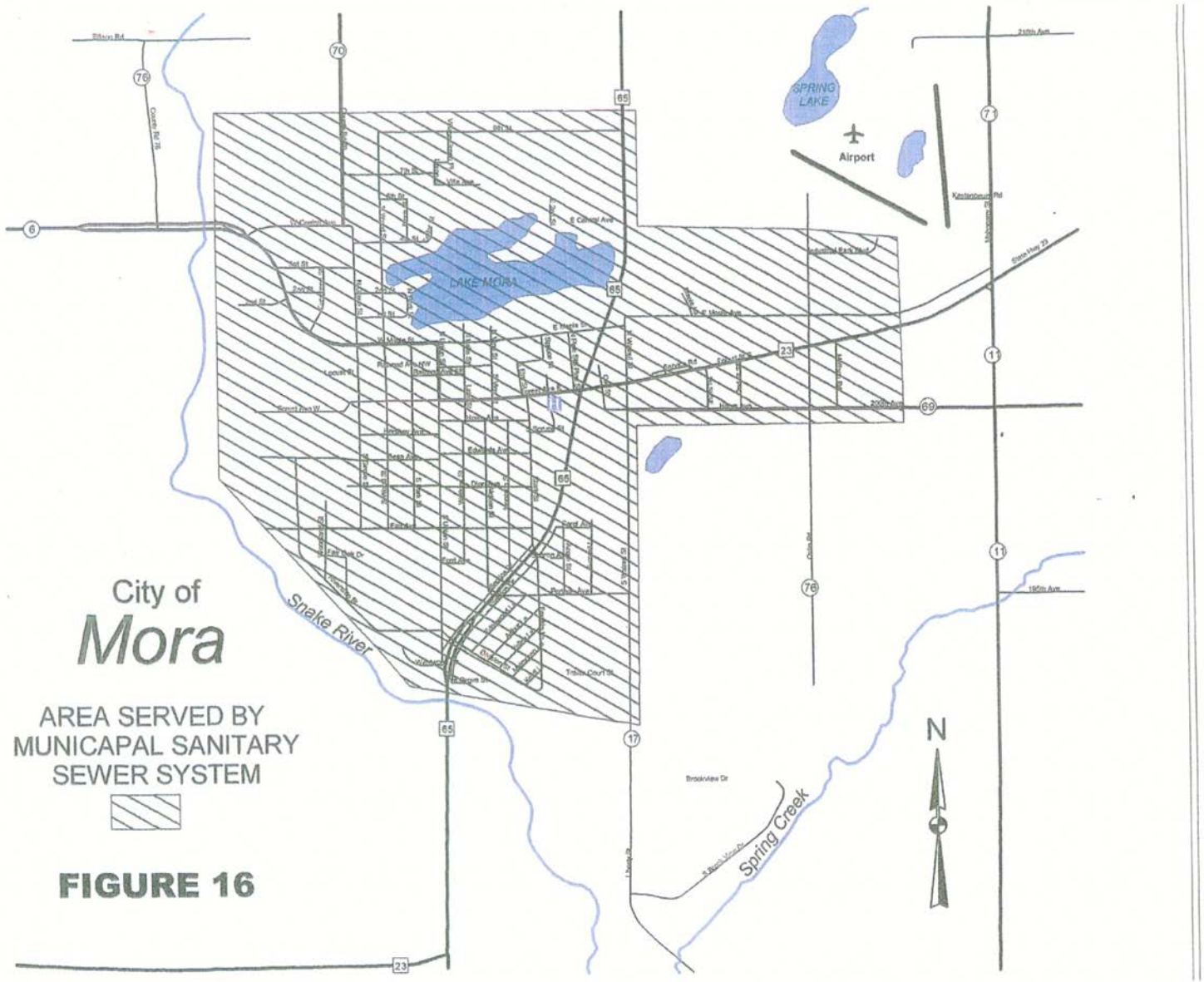

SPRING LAKE
Airport
LAKE MORA
Snake River
Spring Creek
N
City of
Mora
AREA SERVED BY
MUNICAPAL SANITARY
SEWER SYSTEM

FIGURE 16

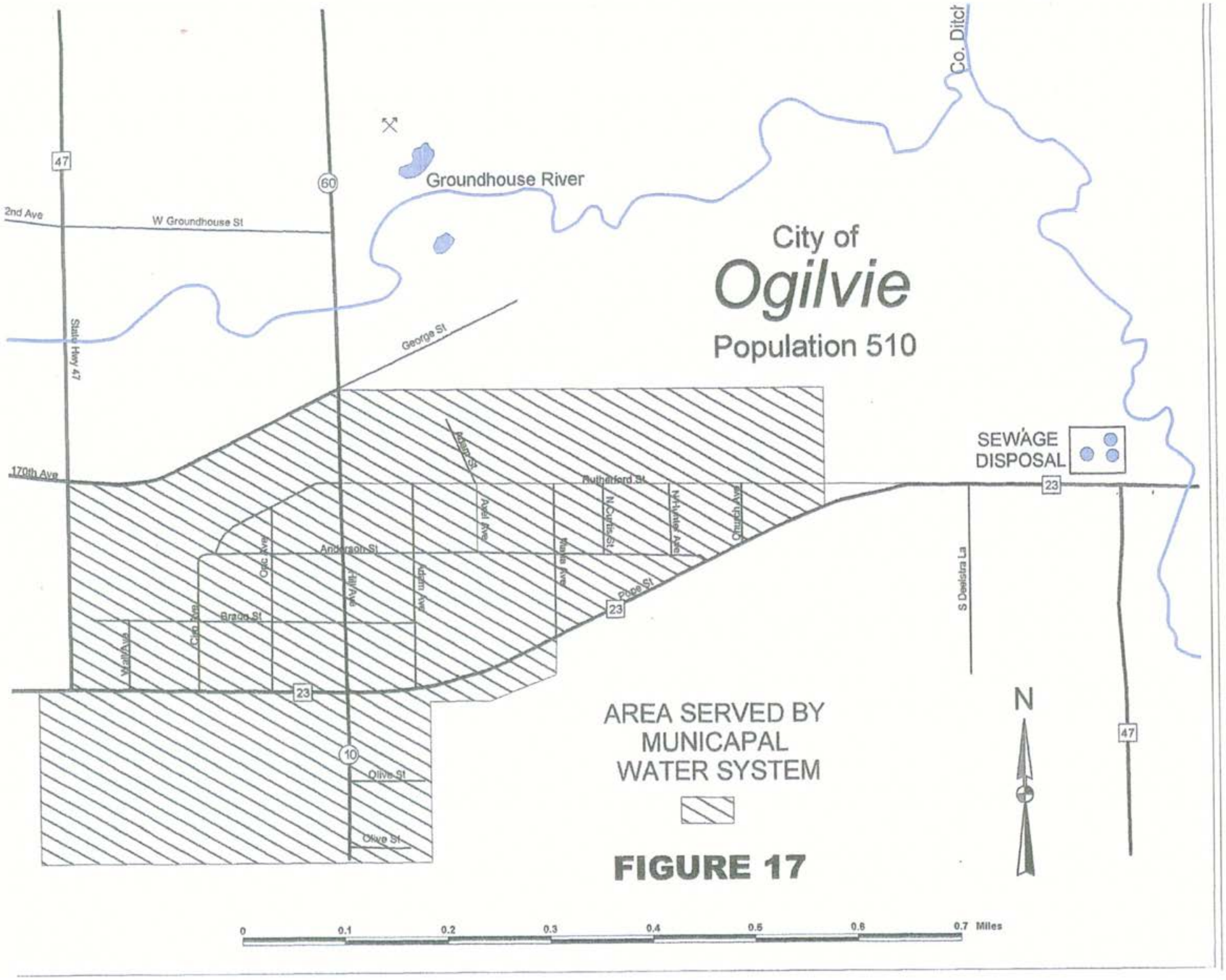
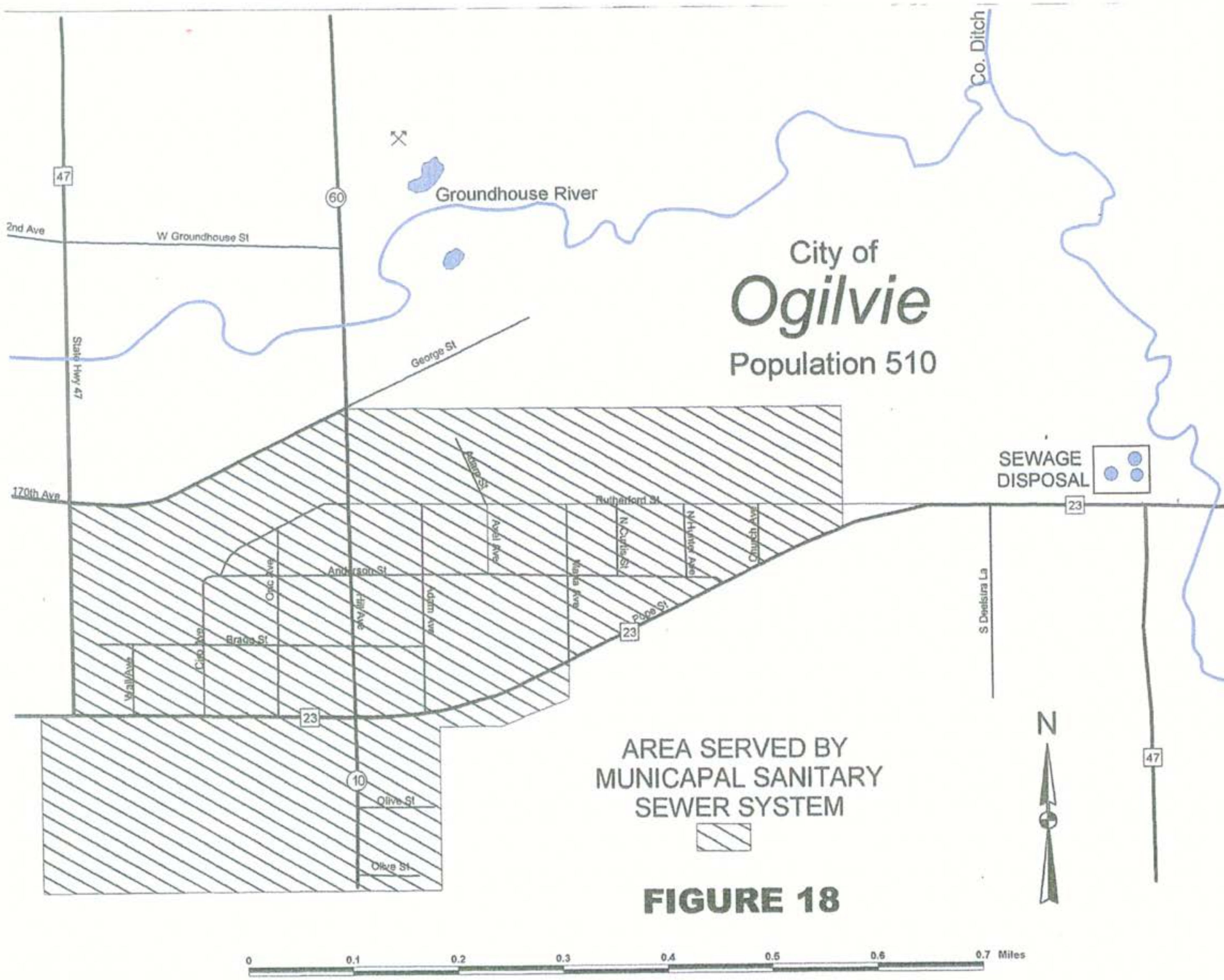

City of
Ogilvie
Population 510
Groundhouse River
2nd Ave
W Groundhouse St
State Hwy 47
George St
170th Ave
Rutherford St
Anderson St
Pope St
Olive St
S Deelstra La
SEWAGE
DISPOSAL
AREA SERVED BY
MUNICAPAL
WATER SYSTEM
N
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7 Miles

FIGURE 17



City of
Ogilvie
Population 510
Groundhouse River
Co. Ditch
SEWAGE
DISPOSAL
AREA SERVED BY
MUNICAPAL SANITARY
SEWER SYSTEM
N
2nd Ave
W Groundhouse St
State Hwy 47
170th Ave
George St
Rutherford St
Anderson St
Brady St
Pine St
S Deelstra La
Olive St
47
60
23
10
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7 Miles

FIGURE 18

Approximately 50 percent of Kanabec County is forested. Kanabec County has a very large population of wild game. Deer, bear, and grouse hunting is high in the county. The majority of the recreation activity in the county is fishing, hunting, snowmobiles, cross country skiers, hikers, etc.

FISH AND WILDLIFE HABITAT

Wildlife Areas

Kanabec County has eleven wildlife management areas (WMA) which are administered through the DNR. These are listed below.

Ann Lake WMA	1614 acres
Bean Dam WMA	240 acres
Lake Five WMA	280 acres
Gravel Pit WMA	11 acres
Hay Snake WMA	240 acres
Mille Lacs WMA	5645 acres
Rice Creek WMA	636.4 acres
Tosher Creek WMA	363 acres
Whited WMA	173 acres
Wire Tree WMA	40 acres
Kroschel WMA	210 acres

There are no written management plans on the management units with the exception of the Mille Lacs Wildlife Area. A copy of the plan is available at the SWCD office.

One of the DNR's concerns regarding the wildlife management areas is human population and its effect on wildlife areas. Land adjacent to wildlife areas may be subdivided. There are two subdivisions bordering wildlife areas at this time in the County. Subdivision developments can lead to trespassing problems and can affect water quality and public use of the area.

The DNR is also concerned about wetlands and other wildlife habitat, much of which is on private land. Degradation of these areas through development, drainage, siltation, and other human activities decreases the value of these habitats for wildlife. Private lands play an important role in providing wildlife habitat in the county.

The DNR also conducts various surveys on wildlife and fisheries habitats.

Fish Habitat

The fisheries ecological and management classifications for Kanabec County lakes are:

Lake	Ecological	Management
Eleven	Centrarchid	Centrarchid
Five	Centrarchid	Centrarchid
Thirteen	Centrarchid	Centrarchid
Pomroy	Centrarchid	Centrarchid
Quamba (Mud)	Centrarchid	Centrarchid
Full of Fish	Centrarchid	Centrarchid
Snoeshow	Bullhead	Warm-water Gamefish
Spring	Bullhead	Regular Winterkill
Knife	Centrarchid-walleye	Walleye- Centrarchid
Pennington	Bullhead	Warm-water gamefish
Lewis	Centrarchid	Centrarchid
Devils	Centrarchid	Centrarchid
Mora	Roughfish-Gamefish	Warm-water Gamefish
Fish	Centrarchid	Centrarchid
Ann	Centrarchid	Walleye- Centrarchid

Ecological Classification:

Centrarchid-Walleye – Medium to large sized, usually lakes consisting of many ecologically different bays or sections, some being natural walleye habitat, others more suitable for panfish species. May also have substantial bullhead and/or carp and buffalo populations.

Centrarchid – Medium and small sized, weedy, fertile, hardwater lakes, usually no large open areas. May also contain moderate to substantial populations of carp, and/or buffalo and/or bullheads.

Roughfish-Gamefish – Fertile lakes in southern and central Minnesota, characterized by relatively large rough-fish populations. Many may occasionally winter-kill.

Bullhead – Shallow lakes, in which frequent winter-kills promote the dominance of bullheads.

Management Classifications:

Walleye- Centrarchid – This type of management is designed to furnish a walleye fishery of moderate size, without displacing largemouth or smallmouth bass or panfish populations.

Centrarchid – Specify as largemouth or smallmouth bass since physical characteristics of the lakes managed will differ depending on the species. In addition to bass and panfish, considerable attention is usually given to the northern pike.

Gamefish – This classification is designed to cover those lakes in southern and central Minnesota where roughfish removal and stocking or rescued fish are common management procedures. They include lakes which occasionally winter-kill where management is aimed at building up a desirable fish population in as short time as possible.

Regular winter-kill – Management of lakes in this classification is usually confined to rescue work and/or walleye fry stocking. Fishing is of the boom or bust type.

A majority of the lakes in Kanabec County are warmwater gamefish (walleye, northern pike, largemouth bass, panfish) lakes. Management of these lakes include surveying the physical and biological characteristics every 5 to 10 years, and stocking of gamefish. Warmwater lakes by nature are generally shallow and moderately to heavily vegetated. These characteristics, coupled with warm water produce highly productive lakes which naturally experience moderate algae blooms. Decaying vegetation during the winter can deplete oxygen levels and produce partial fish kills. Algae blooms and partial winter kills are common and natural to some Kanabec County lakes.

The Ann and Knife Rivers are the two important streams managed in Kanabec County. Natural reproduction of game (walleye, northern pike, smallmouth bass), and nongame fish occur in the rivers. Management includes periodic stocking of walleye into both rivers.

Knife Lake was treated with rotenone in the Fall of 1989. The goal of the project was to eliminate the carp population. Carp quickly overpopulated the lake by gaining access through a temporary dam. Carp are effective at recycling nutrients from the lake sediments into the water column, helping to produce algae blooms. Since the treatment, water clarity has improved and severity of blooms may decrease.

The Minnesota DNR is in the process of identifying several watershed management projects. Watershed management is seen as an effective long term management plan aimed at improving water quality, outdoor recreation, and sustainable agriculture. The watershed projects will be considered by local, county, state, and federal agencies as well as private organizations.

UNIQUE FEATURES AND SCENIC AREAS

Kanabec County has several rare and endangered plants and animals. Below they are listed by their State and Federal status designations:

PLANTS	FEDERAL	STATE
Carex woodii; Wood's Sedge		SPC
Najas Gracillima, Slender Naiad *Potamogeton*		SPC
Bicupulatus, Snailseed Pondweed *Potageton Vaseyi,*		END
Vasey's Pondweed *Decodon Verticillatus,*		SPC
Waterwillow *Botrychium Lanceolatum,* Triangle		SPC
Monnwort		THR
POA Paludigena, Bog Bluegrass		THR
Juglans Cinerea, Butternut		SPC
Botrychium Minganense, Mingan Monnwort		SPC
ANIMALS		
Ichthyomyzon Gagei, Southern Brook Lamprey		SPC
Perina Evides, Gilt Darter		SPC
Haleiaeetus luscocephalus; Bald Eagle	THR	SPC
Emydoidea Blandingii, Blanding's Turtle		THR
Acipenser Fulvescens, Lake Sturgeon		SPC
Buteo Lineatus, Red-shouldered Hawk		SPC

SPC- Special Concern
THR- Threatened
END - Endangered

EXPECTED CHANGES TO SURFACE WATER, GROUND WATER, AND RELATED LAND RESOURCES

Surface Water Resources

Seasonal development will continue to result in pressure to the surface water resources. Much of the riparian lands of the recreational lakes have already been developed. Second tier development is common around the larger lakes. Additional second tier development can be expected where it does not presently exist. It is expected that the rivers will experience an increase in development since river frontage represents the only undeveloped shoreland available. The potential for significant water quality impacts will continue without effective zoning.

Seasonal residential use on lakes results in numerous impacts to lake resources. Residential developments usually involve lawns, which leads to the use of fertilizers, herbicides, and mowing to the water's edge, giving the potential for runoff containing nutrients and chemicals to surface waters. Impervious surfaces associated with the development around lakes and rivers adds to surface water runoff and related problems. Education should be directed to riparian owners regarding lawn care practices and the problems resulting from runoff of herbicides and fertilizers.

Surface use of lakes continue to increase, while major conflict or over-use does not presently exist. Conflicts between surface water users are now occurring; jet skies, water skiing, fishing, pleasure boating, swimming, wildlife nesting, shoreline development. These issues may need to be monitored at some point in the future.

Certain changes have occurred or are occurring which should be considered positive for surface water quality. There are fewer feedlots and livestock within the shoreland areas. Marginal lands are less likely to be put to agricultural uses due to wetland regulation, CRP and RIM programs, and the general downturn in farming.

Ground Water Resources

There are no expected changes to ground water quality or quantity. The most significant activity related to ground water will be efforts to determine its present quality through monitoring.

There is no significant change expected in the usage of ground water for agricultural and industrial purposes. The supply of ground water should be sufficient for the foreseeable future.

Known areas of potential ground water pollution, such as the sanitary landfill are being tested or monitored.

Related Land Resources

Changes occurring related to land resources include a reduction in agricultural activities, the limitation and regulation of development through township zoning and recently updated ordinance for shorelands and floodplains. The development of river shoreland is expected since lakeshore land is nearly all developed. Additional rural non-farm residential development is expected in response to the decline in agriculture and economic shift to non-farm employment and income.

There is a trend to increase regulation of land resources within the County. Wetland regulation, a solid waste ordinance, and more townships enacting zoning is indicative of the increasing public concern for the protection of water resources.

III. Priority Concerns

In response to the physical, environmental, and economic characteristics of Kanabec County, specific data related to surface water, ground water, and related lands and issues identified by the public and the Water Plan Committee, the following issues have been identified as priority concerns.

The priorities and concerns established in the Kanabec County scoping document will establish guidelines for the Water Plan Committee and help to meet goals to achieve protection for the waters of Kanabec County. This will be done by reviewing plans and proposals brought before the Water Plan Committee and referring projects to appropriate federal, state and local agencies for assistance.

Kanabec County is in the process of establishing a TMDL for the South Fork of the Groundhouse River located within the Snake River Watershed. This is a joint effort with Minnesota Pollution Control Agency, Kanabec County Soil and Water Conservation District, Mille Lacs County Soil and Water Conservation District, Snake River Watershed and Kanabec County Environmental Services Department. With the completion of the TMDL, data will be available to address water concerns in that location. This process would be applied to other areas within Kanabec County to continue to address water quality and determine appropriate corrective actions.

The Kanabec County Water Plan Committee, through the scoping document process, updated the Kanabec County Water Plan with goals to address the priority concerns stated in the scoping document. Agencies will be identified to achieve the goals.

After reviewing all submitted concerns, the Water Plan Committee chose the following concerns and obtainable goals:

Priority Concern 1:

The protection of shore lands and tributaries from erosion, sedimentation and nutrient loading -

- Surface Water Quality as it relates to development adjacent to riparian areas.
- Cropland sedimentation and erosion control.
- Feedlot runoff of excess nutrients to surface waters.
- Nutrient management planning to control excess application of nutrients to cropland.
- Livestock Exclusion from surface water areas.
- Grazing Management near surface waters.
- Storm water Runoff – controls for urban areas.
- Construction site – sedimentation and erosion control measures.
- Other runoff from impervious areas including residual oils, gas and solvents from vehicles.
- Runoff controls to wetlands and surface waters as result of timber harvest.

Priority Concern 2:

Drainage Ditch Maintenance -

- Maintain existing drainage ditches (including judicial ditches) where possible and feasible, for
  agricultural purposes.

- Maintain ditch systems on new road projects. Example Hwy 47 Road Improvement Project resulted in excess runoff onto farm fields and private properties.

Priority Concern 3:

Ground water concerns –

- Homes with new babies/nitrate level in drinking water
- Unsealed abandoned wells
- Septic contamination from non-compliant systems

Priority Concern 4:

Ground and Surface Water –

- Emergency spill contamination
- Hazardous waste
- Solid waste

Priority Concern 1 Goal:

The protection of shorelands and tributaries from erosion sedimentation and nutrient loading- This will be addressed through on-going "Best Management Practices" established through forestry, shoreland, agriculture and SWCD plan development impact can be addressed through county and state regulations with shoreland regulations and MPCA storm water regulations.

This will be an ongoing process for the Kanabec County Environmental Services Department, Kanabec Soil and Water Conservation District and the MPCA and various state agencies.

Priority Concern 2 Goal:

Drainage Ditch Maintenance –
Kanabec County Highway Department has started an inventory of the ditches, within the County. Establishing existing ditches will set the ground work for the maintenance, abandonment and any future ditch projects. This project is being funded in part by the Water Plan Fund.

Priority Concern 3 Goal:

Ground Water Concerns –
Kanabec County Water plan has and will continue funding for well testing of homes with new babies. This helps to address issues and concerns for nitrates Kanabec County through the County septic ordinance will continue to bring no-compliant shoreland septic systems into compliance. Kanabec County SWCD through funding for well sealing will continue to provide for the sealing of wells.

Priority Concern 4 Goal:

Ground & Surface Water –
Kanabec County sponsors a county household hazardous waste day and a county clean-up day. Both will continue in an effort to protect ground and surface waters from contamination. Through the solid waste plan, for Kanabec County, the education and promotion of recycling and disposing of solid waste properly will continue to reduce water contamination.

V. SNAKE RIVER WATERSHED

Location, Size -
The Snake River Watershed is one of eighty one (81) major watershed in Minnesota, covering 986 square miles in parts of Aitkin, Chisago, Isanti, Kanabec, Mille Lacs, and Pine counties. The table below shows the area within each county.

County	Area in Square Miles	% of Total Area in County
Kanabec County	479.7	48.7
Aitkin	201.5	20.4
Pine	199.5	20.2
Mille Lacs	88.1	9.0
Isanti	15.3	1.6
Chisago	1.4	.1
TOTAL	985.5	100%

Since nearly all of Kanabec County is considered within the Snake River watershed, nearly every priority concern of this plan applies to the Snake River Watershed and should be considered as an action to be carried out within the watershed.

There are certain actions related to the Snake River watershed which Kanabec County is proposing to be common actions of all the watershed counties and to be carried out in a joint or coordinated manner. These actions can be more effective if carried out in a coordinated or joint manner rather than carried out individually.
This is true of the water quality monitoring outlined in the SRWMB water monitoring plan.

The four major counties within the watershed have formed a joint powers agreement to coordinate the water plans of Aitkin, Mille Lacs, and Pine Counties. This coordinating body has developed and coordinates the Snake River watershed plan. These plans have been amended into the individual county plans.

The Snake River Watershed Management Board consists of one commissioner from each of the four counties. This board has all administrative and project approval authority. The SRWMB has one full-time coordinator that reports to the Board. There is a Citizens Advisory Committee consisting of one SWCD supervisor, one lake association member, and one private citizen from each of the four counties. There is also a Technical Advisory Committee, which consists of one technician from each SWCD office in the four counties.

The SRWMB funding source will be extremely helpful for the landowners throughout the watershed in improving the water quality.

The Snake River Watershed Management Board, SRWMB, adopted a long term Water Quality Monitoring Plan 1998 – 2008. This was adopted and implemented by the Board in 1988, this is a long term monitoring plan. Data has been collected, with analysis, yearly. The data will be run through models to further develop the information's usability. Attempts have been made to collect and standardize historic data collected by various agencies in the past, to give us a long term look. The large amount of data that has been collected and submitted is being reviewed, time permitting. Kanabec County through its Comprehensive Water Plan has developed an additional lake monitoring program and reimburses the SRWMB for part of its sampling program in Kanabec County. Pine and Aitkin Counties also participate in the long term sampling program.

The SRWMB and the Minnesota Pollution Control Agency (MPCA) have just completed an intensive one year sampling project on the Groundhouse River to do a Total Maximum Daily Load (TMDL) study. This sampling project not only included collecting water samples, but also flow data, biological data and analysis of stressors. The TMDL study on the Groundhouse River will result in a project implementation plan to address the identified impairments. The SRWMB and MPCA are looking at completing work plans to start TMDL studies on all of the Impaired Waters in the watershed. The Minnesota Department of Natural Resources (DNR), Division of Fisheries is completing detailed stream analysis on each stream in the Watershed. The Minnesota Pollution Control Agency staff is physically reviewing each stream for impairments and stressors.

The Snake River Watershed Management Board has also approved an expansion of our monitoring program to include the recruitment of Volunteer Stream and Lake Monitors to give us more people looking at each stream and lake. The SRWMB will work with each volunteer with training and reimbursement of the initial application costs to MPCA. The SRWMB is also working with School Districts to set up additional monitoring programs for students.

SNAKE RIVER WATERSHED MANAGEMENT BOARD

WATER QUALITY MONITORING PROGRAM

1998 - 2008

IMPLEMENTATION MONITORING AND EVALUATION

Evaluation is considered to be a major component of the implementation plan. Its purpose is to help us understand how effective our programs and actions are at achieving Project goals. In order to do this, it is necessary to use several evaluation methods or tools that are designed to measure different variables from different perspectives. To evaluate the project, sampling data will be collected to measure changes in water quality, statistics will be kept on land use changes, attitudes of watershed residents will be assessed, and specific implementation programs will be periodically reviewed and assessed. This comprehensive approach will provide a variety of assessments about project effectiveness in terms of water quality impacts, land use changes, citizen attitudes, and program delivery. Information gathered will be used as a guide for future program adjustments. In addition, a tracking system will be used to document new BMP's in the watershed.

Water Quality Monitoring

The Phase II monitoring plan will be a continuation of the Snake River Watershed Long Term Monitoring program. The purpose of the water quality/quantity monitoring program is to collect necessary data for the calibration of FLUX and BATHTUB models. Models can help with evaluating historical and future water quality trends or improvements. The hydrologic and nutrient flux among the lakes, the Snake River and internal loading will be determined. Samples will be collected from the lakes and tributary sites. Figure 5 shows stream grab sample stations. Data will be collected at grab sample stations during spring melt and storm event conditions. Grab sample stations have been placed in strategic locations throughout the watershed to characterize localized conditions. Sampling at stream locations will occur most frequently during the spring runoff period (Table 3.01).

Table 1.04 Stream Site Selection and Description

BC-1
Bear Creek near McGrath, MN Aitkin County: T43N, R23W, section 5, Bear Creek and Co. Rd. 9 Latitude: 46°14'24" Longitude: 93°16'12"

PS-8
Pokegama Creek at CR 14 near Beroun, MN Pine County: T39N, R22W, section 1, north section line, NE, NW Latitude: 45°54'00" Longitude: 93°01'48"

SR-2
Snake River near McGrath, MN Aitkin County: T43N, R23W, section 10, near SW corner, Snake River and Hwy 18 Latitude: 46°13'12" Longitude: 93°14'24"

SR-8
Knife River near Mora, MN Kanabec County: T40N, R24W, section 27, southeast corner, Knife River and Co. Rd. 77 Latitude: 45°55'12" Longitude: 93°18'36"

SR-9
Snake River near Mora, MN Kanabec County: T39N, R24W, section 14, Snake River and Hwy 65 Latitude: 45°51'36" Longitude: 93°18'00"

SR-11
Ann River near Mora, MN Kanabec County: T39N, R24W, section 17, north section line, Ann River and Co. Rd. 12 Latitude: 45°52'48" Longitude: 93°21'36"

SR-16
Mud Creek near Grasston, MN Kanabec County: T38N, R23W, section 2, northeast corner, Mud Creek and Co. Rd. 5 Latitude: 45°48'36" Longitude: 93°10'12"

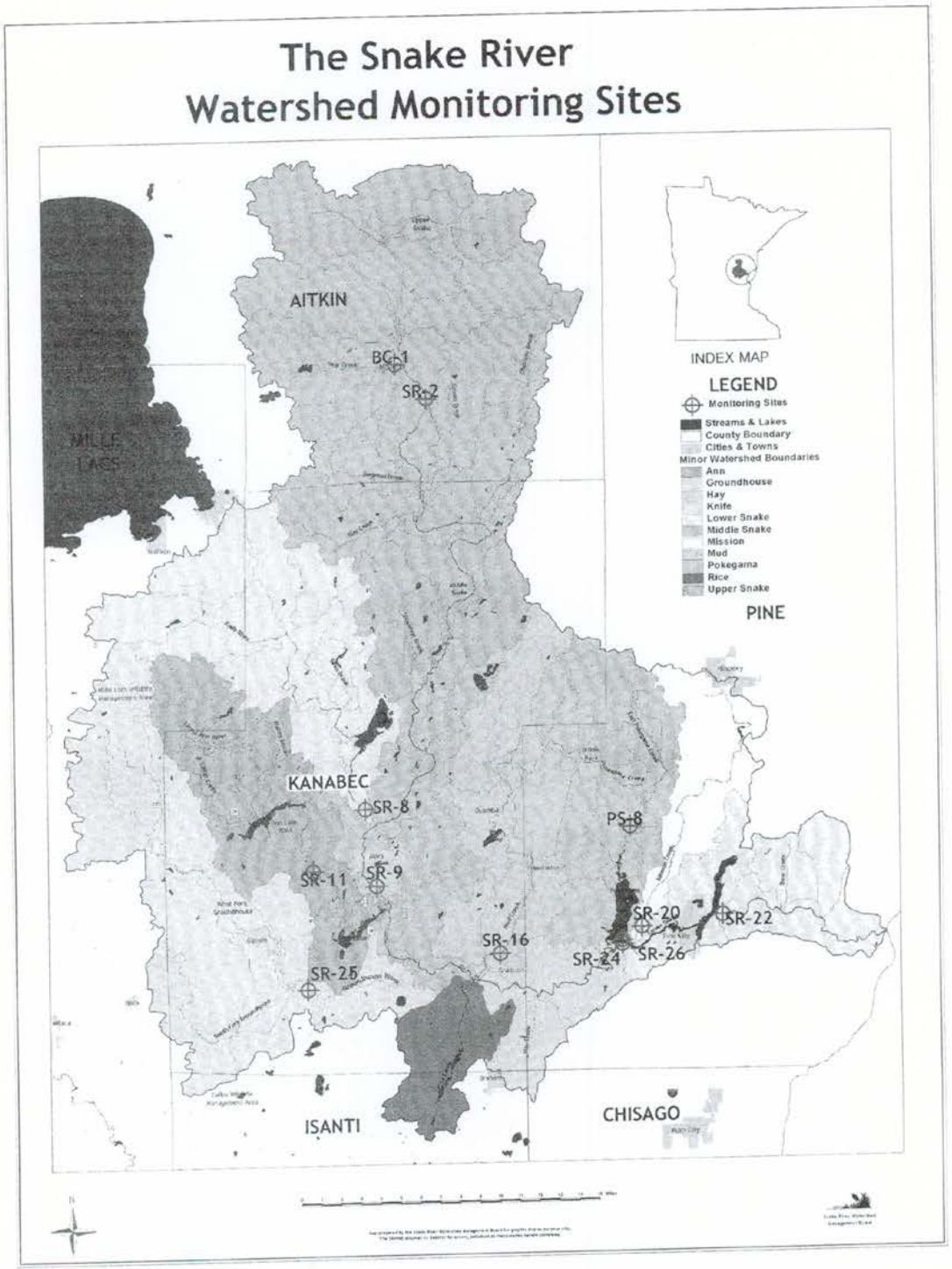
SR-20
Mission Creek near Pine City, MN Pine County: T39N, R21W, section 30, south section line Latitude: 45°49'48" Longitude: 93°01'12"

SR-22
Snake River at outlet of Cross Lake near Pine City, MN Pine County: T39N, R21W, section 27, Snake River below Cross Lake dam Latitude: 45°50'24" Longitude: 93°56'24"

SR-24
Snake River west of Pokegama Lake near Pine City, MN Pine County: T39N, R22W, section 36, Snake River and Hwy 7 (258' wide bridge) Latitude: 45°49'12" Longitude: 93°02'24"

SR-25
Groundhouse River near Mora, MN Kanabec County: T38N, R24W, section 8, southwest corner, Groundhouse River and Co. Rd. 12 Latitude: 45°47'24" Longitude: 93°22'12"

SR-26
Pokegama Lake SE in/outflow near Pine City, MN Pine County: T39N, R22W, section 36, Pokegama Lake outlet and Hwy 53 Latitude: 45°49'12" Longitude: 93°02'24"



Lake Monitoring

Parameters analyzed once per month	Chloride	Fecal Coliform Bacteria		

Continuous monitoring stations are presently at sites SR-8, SR-22, SR-24, SR-26 and PS-8. Stilling wells will be installed at sites SR-16 and BC-1. Ultrasound equipment will be installed at SR-2, SR-9, SR-11, SR-20 and SR-25. The equipment used at all locations shall consist of a data logger and sensor to establish stream depth. Staff gages will be installed at all twelve stream locations. SWCD staff and project volunteers will download data loggers monthly. Ten flow measurements will be taken at different gage depths at each stream location. Flow information will be used to establish rating curves for discharge (cfs) versus staff gage height (ft).

WATERSHED ASSESSMENT

Hydrologic Monitoring Data

SRWMB, with assistance from the MPCA, will be responsible for developing the hydrologic and nutrient budgets for the lake. Hydrologic budgets will be computed for the system utilizing direct hydrologic measurements and modeling techniques. Nutrient budgets will be determined by direct computation of field measurements and the FLUX model. Water quality modeling will be performed using the U.S. Army Corps of Engineer software BATHTUB. The BATHTUB model will be used as a diagnostic and predictive tool in evaluating the water and nutrient budgets of the lakes.

Annual hydrologic budget and annual pollutant budgets for phosphorus and suspended solids entering the Snake River Watershed will be calculated. This information will be used to identify the key components of pollutant loading to the lake and development of the restoration and management plan for the Snake River.

Estimate of Water and Pollutant Loads from Sub-watersheds

Preparation of pollutant budgets is a critical component of any watershed study. These budgets are used to quantify inputs of nutrients and sediments at various locations in the watershed. Data generated in this task will be used with management information to select and rank restoration measures. Watershed analysis conducted will be used to develop detailed nutrient and sediment budgets for the Snake River. This approach provides predictive capability for changes compared with management strategies.

Prioritization, and Selection of Priority Management Areas

The approach of combining in lake techniques for immediate relief from existing problems and watershed management techniques for long-term water quality improvements should provide a flexible means of managing the Snake River Watershed. Ideas will be requested from county, state and federal

agencies to ensure consistency with regional planning and watershed management objectives. This approach has shown to be cost-effective, accepted by the public and regulatory agencies, technically feasible, and environmentally sound.

Field Monitoring

Field instruments will be examined regularly to minimize failure and reduce down time. Field test equipment includes a YSI Dissolved Oxygen/Temperature Meter; a YSI portable conductivity meter; and a YSI portable pH meter. Both the dissolved oxygen and conductivity meters will be calibrated before each use. Field measurements will be conducted at each of the sites on a monthly basis before samples are collected and data from these measurements will be incorporated into the Snake River Water Quality Database. Current readings for tributaries will be taken using an AA Current Meter with a 6' wading rod. Periodic readings will be taken at each site with a reading at near zero flow and at high flow.

Discharge Ratings

Stream flow at each of the watershed monitoring sites will be projected through the development of a stage-discharge relationship curve. Initial rating curves were developed by the Department of Natural Resources and will be updated by the MPCA and SRWMB annually. SWCD and SRWMB staff will take a minimum of three flow readings at monitoring site. Development and use of a stage-discharge relationship requires measurement of stage, datum, channel dimensions, water velocity and discharge as specified in the Minnesota Pollution Control Agency (MPCA) Quality Control Manual.

Water Sample Analysis

A state certified water-testing lab will do laboratory analysis of all parameters from 1998-2007. All laboratory tests done by ERA Laboratories Duluth, MN, will follow the methods and procedures reported in their procedure manual. Parameters to be tested for include total suspended solids (TSS), total suspended volatile solids (SVS), total phosphorus (TP), soluble phosphorus (P-PO4), nitrate-nitrogen (N-NO2 + NO3), Kjeldahl nitrogen, total organic nitrogen, and chloride. Samples will be shipped to ERA Laboratories in a sealed cooler. Chain of custody for each sample will followed at all times, and signed off on when custody is transferred. Samples will be transported in ice filled coolers, and be analyzed within 48 hours of sample collection.

QA/QC

All laboratory tests done by ERA laboratories will follow the methods and procedures reported in their procedure manual.

Data processing procedures will follow the MPCA Quality Control Manual and be recorded on field analysis report forms. Statistical analysis will be computed by use of computer software, such as FLUX.

The overall quality assurance object for this project is to provide for all reasonable actions to prevent erroneous data from being produced. Clear and accurate reporting of all data will be strived for at every opportunity. In the event that errors do occur, they will be identified and corrected. Suspect data will not be utilized as a basis for conclusions and subsequent actions.

BMP and Program Evaluation

Several evaluation methods, in addition to the monitoring program discussed above, are necessary to measure Project success. Methods used in the implementation plan have been selected to evaluate different components and outcomes of the plan in different ways.

A best management practice (BMP) tracking system will be used to measure BMP adoption rates within priority management areas. Information contained in this system will include records of initial contacts with landowners or operators; the status of each BMP from initial sign-up to construction; and the potential sediment and nutrient reduction obtained as a result of the BMP. This information will be entered into the watershed GIS system maintained by the SRWMB.

A questionnaire will be administered to a random sample of watershed residents at the onset of the implementation program. This survey will measure attitudes and opinions about the Snake River, and identify issues of greatest concern to watershed residents. A follow-up questionnaire will be administered three to four years later to measure shifts in attitudes, opinions, and perceptions about the Snake River.

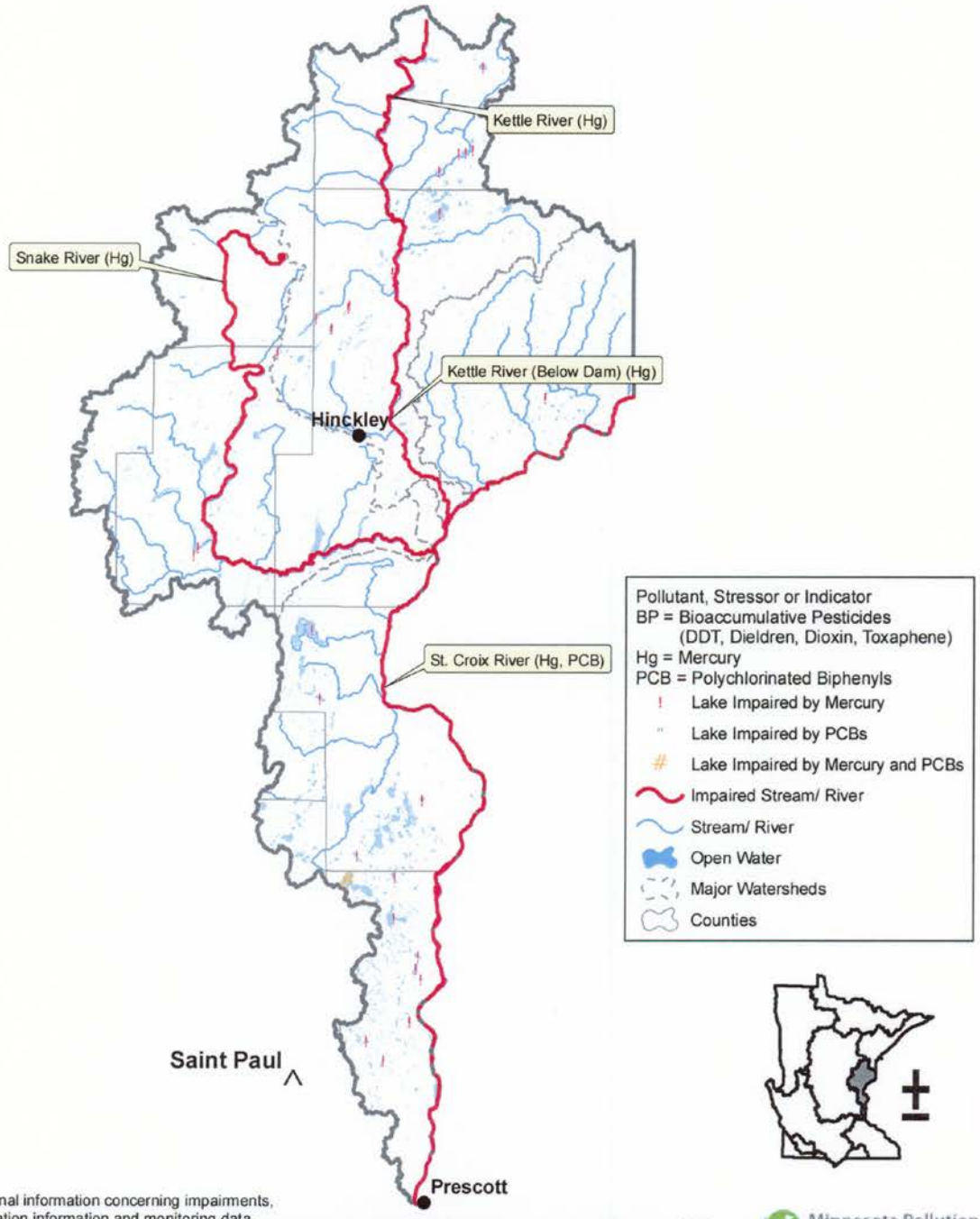
The Department of Natural Resources (DNR) has conducted many biological surveys and habitat assessments for many of the Lakes and Streams located in the Snake River Watershed. Some of the first biological surveys conducted in the Snake River Watershed were done in 1964 and 1966. These surveys provide a historical record of existing conditions before the implementation of conservation activities in the Snake River Watershed. Sites for fish sampling and habitat evaluation were selected to be representative of given stream reaches, or were chosen to evaluate impacts of potential pollution sources or the impact of tributary streams on the fish community.
As part of the Snake River Enhancement Project a stream survey will be done on the Snake River as well as Lake Surveys for Knife, Fish, Ann, Pokegama, and Cross Lakes in the summer of 2005. Information gathered from these surveys will help assess historical and current changes in fish populations and habitat

conditions. The 2005 surveys will be instrumental in evaluating the effects of Project activities that reduce soil erosion and nutrient loading as they relate to improving spawning and rearing habitat for species of game fish in the Snake River.

Program evaluation tools will be developed to evaluate other key activities within each program element of the implementation plan. For example, an evaluation of watershed assessment teams will be undertaken to determine how effective they are at meeting their intended purpose. Events and tours will be evaluated shortly after their completion, and evaluations will be made of investments in each media area. Program evaluations will be ongoing and will help guide decisions throughout the course of the Project.

St. Croix River Basin: Bioaccumulative Toxics

2006 Impaired Waters Requiring a TMDL (per Section 303 (d) Clean Water Act)

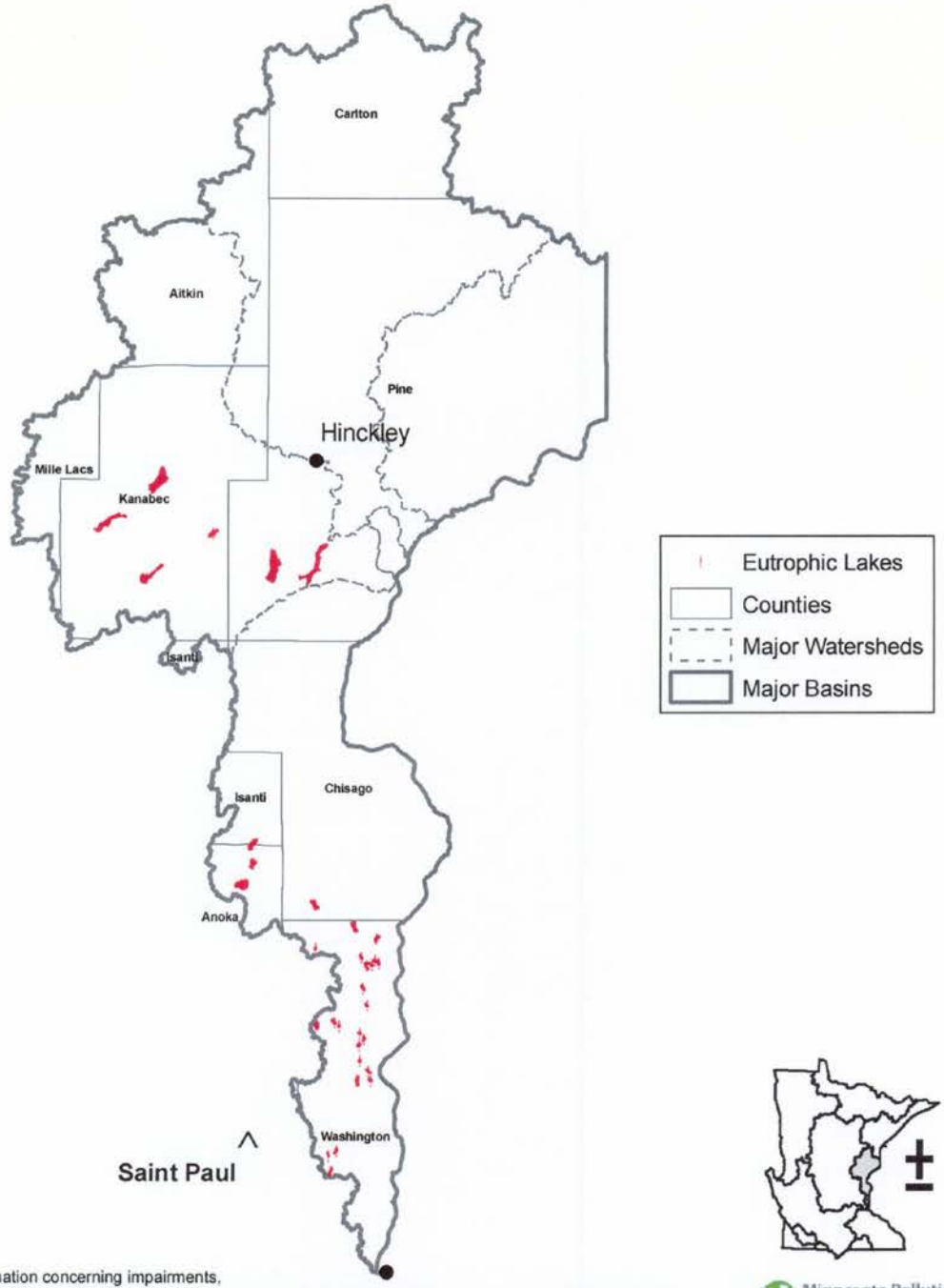


For additional information concerning impairments, such as station information and monitoring data, see the MPCA Environmental Data Access System. http://www.pca.state.mn.us/data/edaWater

Minnesota Pollution Control Agency
June, 2006

St. Croix River Basin: Eutrophic Lakes

2006 Impaired Waters Requiring a TMDL (per Section 303 (d) Clean Water Act)

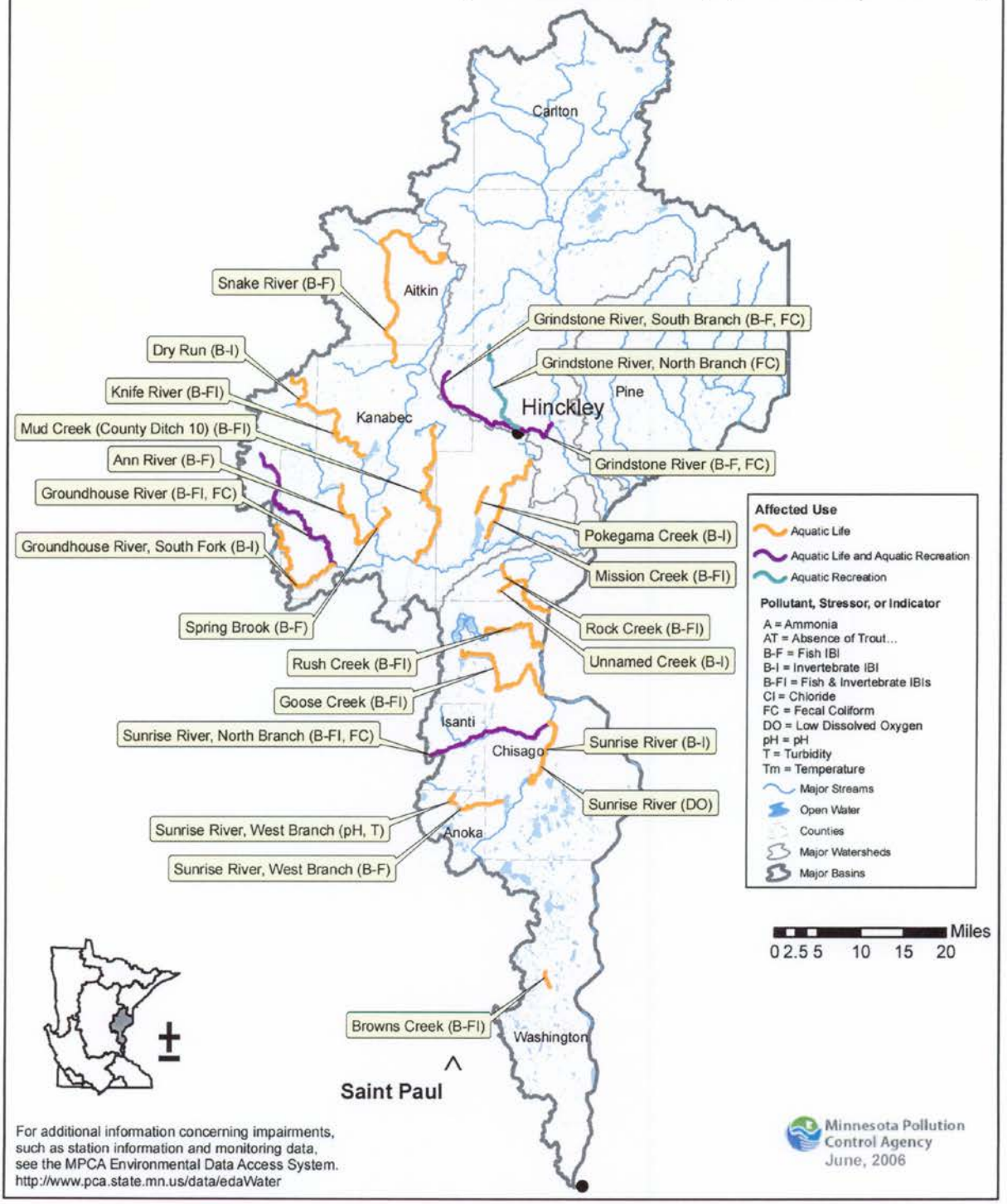


For additional information concerning impairments, such as station information and monitoring data, see the MPCA Environmental Data Access System. http://www.pca.state.mn.us/data/edaWater

Minnesota Pollution Control Agency
June, 2006

St. Croix River Basin: Conventional Parameters

2006 Impaired Waters Requiring a TMDL (per Section 303 (d) Clean Water Act)



For additional information concerning impairments, such as station information and monitoring data, see the MPCA Environmental Data Access System. http://www.pca.state.mn.us/data/edaWater

Minnesota Pollution Control Agency
June, 2006

VII. CONFLICT RESOLUTION

CONFLICTS WITH EXISTING OR PROPOSED PLANS OF CONTIGUOUS COUNTIES, OR LOCAL UNITS OF GOVERNMENT.

At this time, there are not known conflicts between the Kanabec County Comprehensive Water Plan, and plans of local units of government or other counties. If conflicts should arise in the future, they will be addressed in an informal or formal resolution process.

Informal Resolution Process

The County or other local unit of government may request a meeting with the chair of the Board of Water and Soil Resources to informally resolve the following disputes: to determine the meaning of any provision of Minnesota Statutes Chapter 103B; to resolve conflicts between any two comprehensive water plans; or to settle any other dispute relating to a comprehensive water plan. The informal resolution process is as follows:

1. A meeting with the chairman of the State Board of Water and Soil Resources may be requested in writing by any of the involved parties.

2. The nature of the provision or omission causing the conflict must be described, whether it is in the comprehensive water plan, local plan, or other control. All parties in the conflict must be identified.

3. The chair shall acknowledge the request in writing, and request a meeting of all parties. If requests for a meeting does not satisfy the parties, or if there is no response from one of the other parties, the chair shall make a reasonable effort to obtain the information needed for resolution in another manner.

4. The chair shall establish the meeting time and place, and inform all parties in writing. A local unit of government may be represented by any person or persons of its choosing, subject to control of the chair. The chair may consider any relevant and reasonable evidence or argument by local unit of government in reaching a resolution.

5. The decision of the chair may be announced at the meeting, or made later. In any case, the decision shall be submitted in writing to all parties, and will be effective 60 days following the decision of the chair.

6. A petition may be filed within that time pursuant to Minnesota Statues, Section 103B.25, Subdivision 3, for a contested case hearing under that section.

Formal Resolution Process

A county or other local unit of government may petition for a contested case hearing if: the interpretation and implementation of a comprehensive plan is challenged by a local unit of government aggrieved by the plan; if two or more counties disagree about the apportionment of the costs of a projects implemented in a comprehensive plan; or if a county and another local unit government disagree about a change in a local water and related land resources plan or official control recommended by the county under Statute 103B. The process for a formal resolution of a conflict is as follows:

1. A petition must be filed within 60 days after the date of adoption or approval of the disputed ordinance, or the date a local unit of government receives a recommendation of the County Board under Section 103B.12. The petition must be made in writing, addressed to the state board, and include the following: the names, phone numbers, and addresses of the parties or their representatives involved in the petition; a request for a hearing; a statement of the allegations or issues to be determined by the hearing; and proof of service of a copy of the petition on all other involved local units of government.

2. The petition is considered filed with the State Board when it is received by the Board. The Board shall acknowledge receipt of the petition in writing.

3. Within 5 days of the receipt of the petition, the State Board shall file a request for the assignment of an administrative law judge.

4. Hearings are governed by the contested case procedure of Minnesota Statutes, Chapter 14. The Board shall not be considered a party to the hearing for the purpose of apportioning the fees of the Office of Administrative Hearings and for transcript fees.

5. Following the hearings and the report of the administrative law judge, the BWSR must make a final decision on the issue. All parties will be informed of the decision in writing.

6. A decision of the Board may be appealed to the court of appeals.

VIII. BIBLIOGRAPHY

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WATERSHEDS

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PROTECTED WATERS.

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