INVENTORY of RESOURCES
(Kanabec County Water Plan)
Appendix B

This inventory to the Water Plan contains many general summaries of the natural resources within Kanabec County such as lake statuses, groundwater sources, topography, soils, original vegetation and wildlife habitat. Also included is data on population, ordinances, dams, floodplains and shoreland management.

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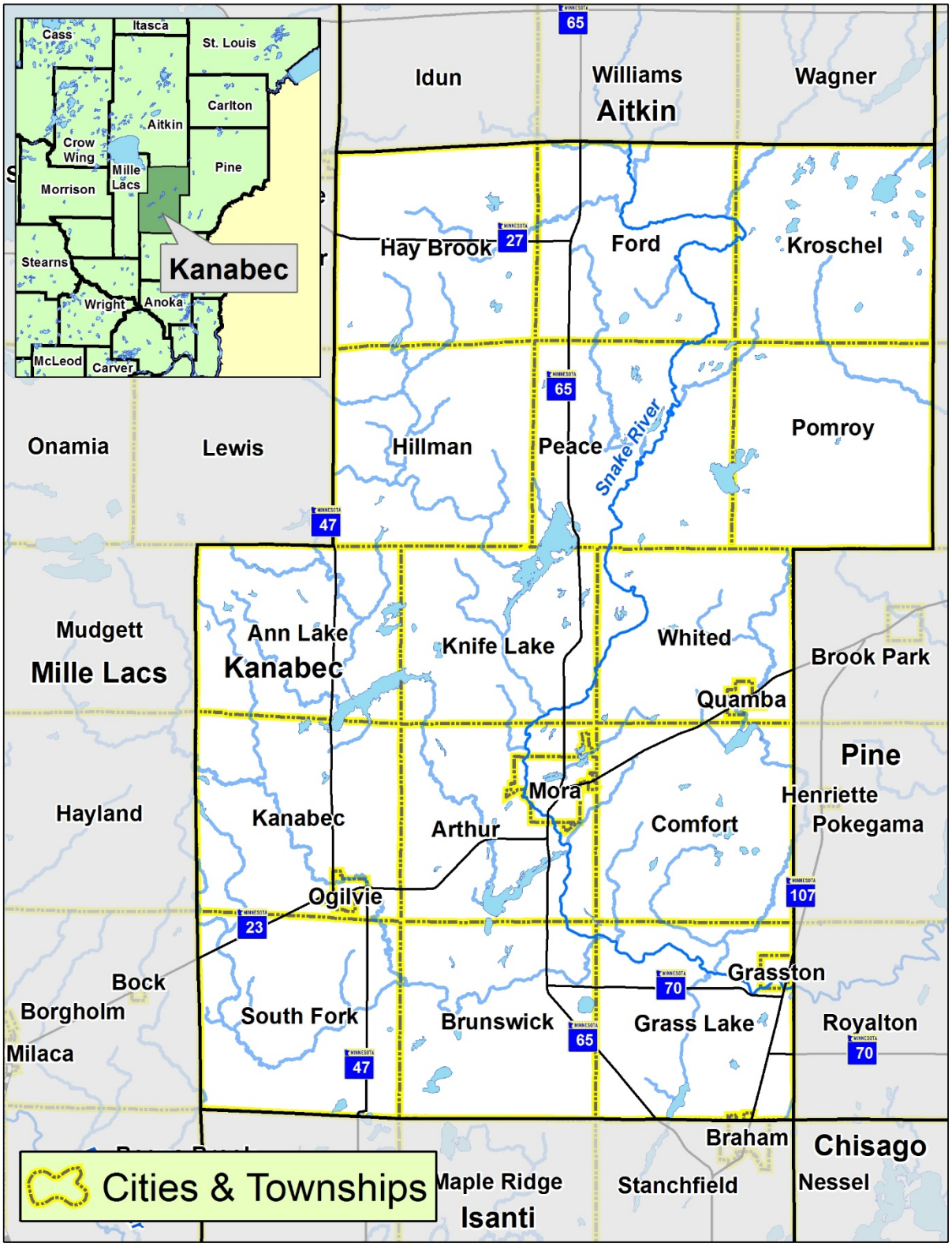
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Cities & Townships

INVENTORY - WATER PLAN

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.

Flood Plain Management Ordinance No.9
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.

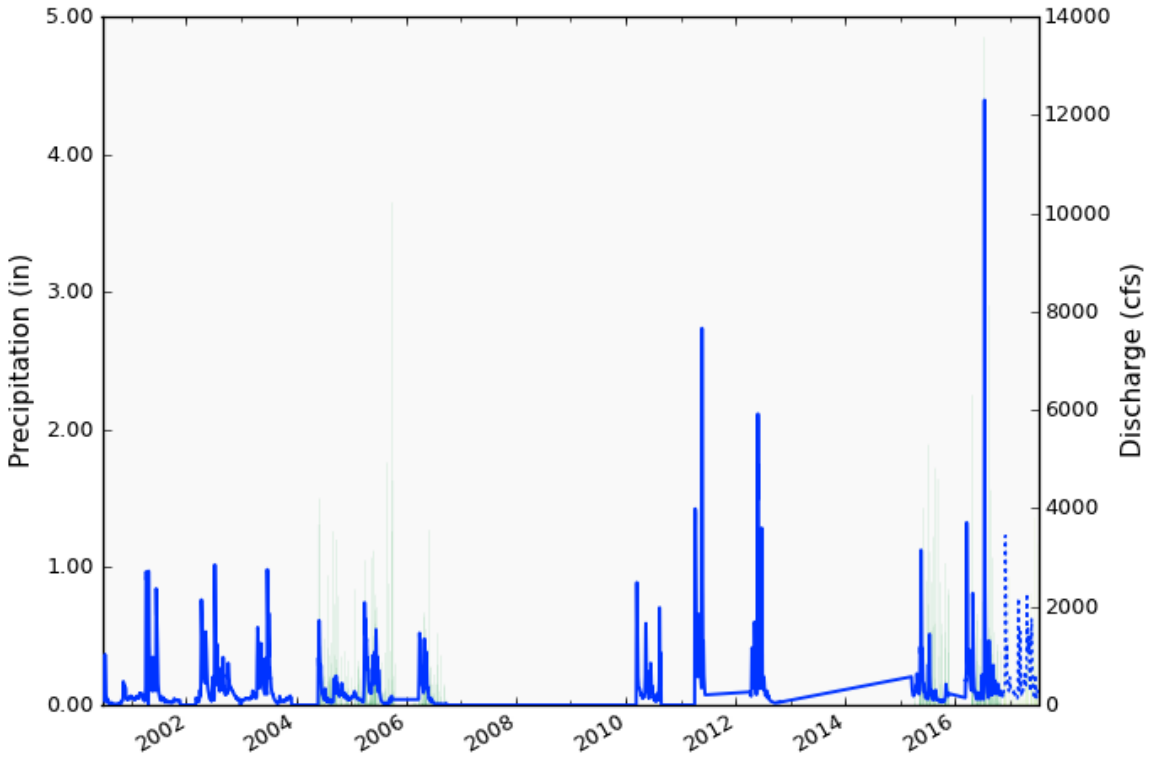
PRECIPITATION

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. 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.



Precipitation Discharge Table

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 gaging 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.

Dams & Control Structures

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

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

GROUND WATER:

AQUIFERS

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.

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 Kanabec SWCD usually have funds available for sealing abandoned wells. Generally a few wells are sealed each year with assistance from the SWCD.

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.

Observation Wells - State

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 . 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

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.

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.

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

SPECIAL GEOLOGICAL CONDITIONS

A sand-plain surficial aquifer is located in the south central portion of Kanabec County. 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. Hydraulic conductivity is described as the ease with which water can move through pore space or fractures. It depends on the intrinsic permeability of the material. The high presence of sand & gravel and sandstone for Kanabec County means water moves at a higher rate than expected compared to areas with denser geologic materials.

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. Generally speaking the larger the spore space between soil particles the faster the infiltration rate of runoff water through the soil profile. Soil particles in order of the largest pore space are gravel, sand, silt and clay. A pure loam soil contains equal parts sand, silt and clay.

HAZARDOUS WASTE

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.

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.

LAKES:

WATER RECREATION

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.

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.

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 'trophic state' 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 $\leq$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.

ORDINANCES:

Sewer System Ordinance - Individual

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.

Township Comprehensive Plans

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, 14 have adopted township-wide Arthur Township has adopted and administers shoreland, and septic ordinances, in addition to a general zoning ordinance. Ann Lake has not instituted township zoning at this time.

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 ORDINANCES

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

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.

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.

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

POPULATION:

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.

Population – Distribution & Density

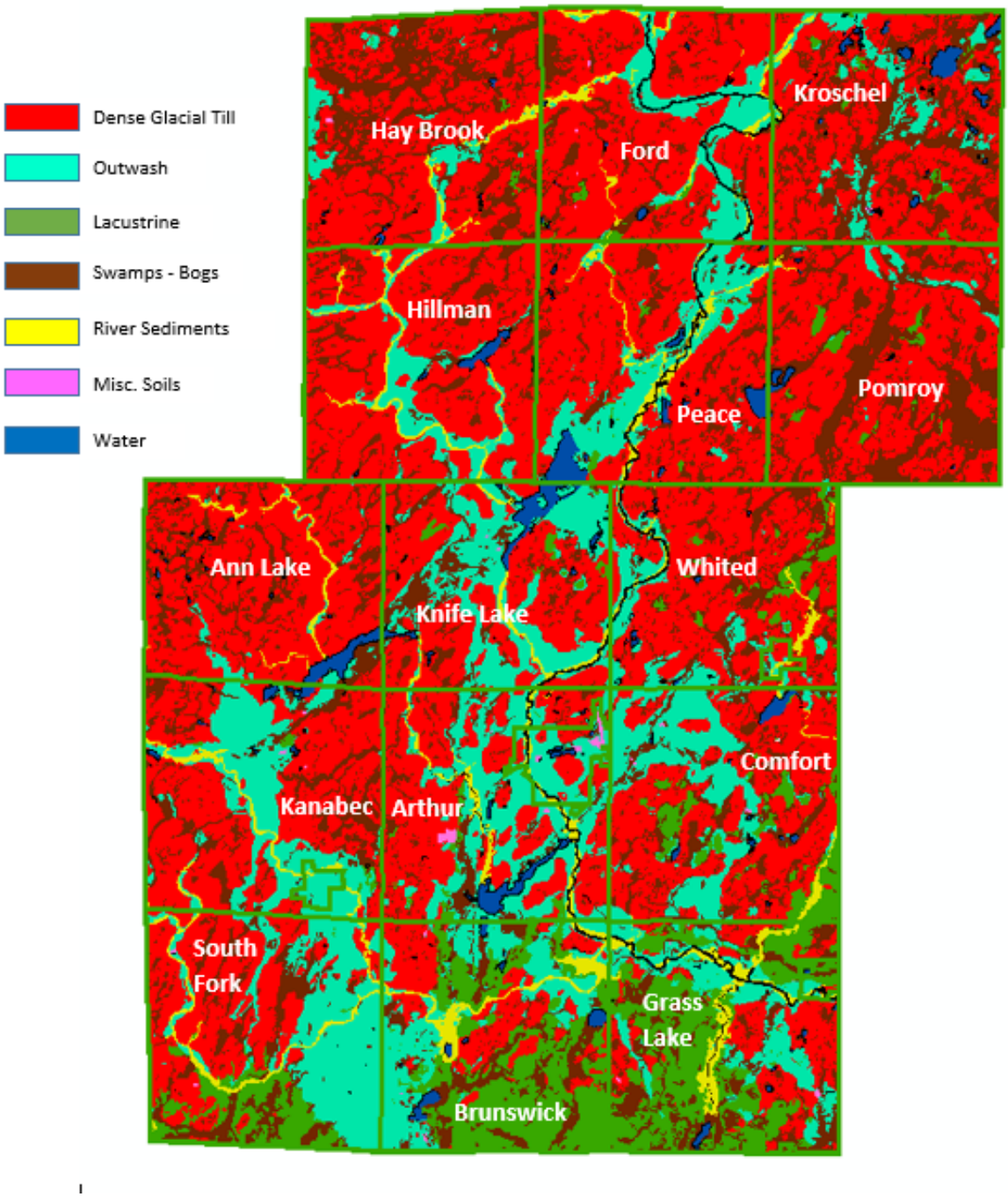
The historic and present population, population density, and growth rates of Kanabec County, townships, and municipalities are shown below.

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.

General Soils Map – Kanabec County



SOILS

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.

Soil Descriptions:

Dense Glacial Till: Brennyville-Mora-Cebana Association

Setting: Landform: Moraines Slope range: 0 to 30 percent

Composition
Extent of map unit in the County and similar soils: 51 percent

Soil Properties and Qualities: Dense till between 40 – 60 inches

Soil Associations – Described Individually:
Brennyville
Drainage class: Somewhat poorly drained
Parent material: Till
Surface texture: Silt loam
Mora
Drainage class: Somewhat poorly drained
Parent material: Till
Surface texture: Fine sandy loam
Cebana
Drainage class: Poorly drained
Parent material: Till
Surface texture: Silt loam

Swamps – Bogs: Seelyeville – Cathro Association

Setting: Landform: Moraines, Outwash plains, Lake plains Slope range: 0 to 1 percent

Composition
Extent of map unit in the County and similar soils: 16 percent

Soil Properties and Qualities: Decomposing organic matter greater than 5 feet or having loamy subsoil

Soil Associations – Described Individually:
Seelyville
Drainage class: Very poorly drained
Parent material: Organic matter
Surface texture: Muck
Cathro
Drainage class: Very poorly drained
Parent material: Organic matter over loamy material
Surface texture: Muck

River Sediments: Bowstring – Fluvaquents Association

Setting: Landform: Flood plains Slope range: 0 to 1 percent

Composition
Extent of map unit in the County and similar soils: 3 percent

Soil Properties and Qualities: Decomposing organic matter with stratified silt loam to gravelly coarse sand

Soil Associations – Described Individually:
Bowstring
Drainage class: Very poorly drained
Parent material: Organic matter with stratified sediments
Surface texture: Muck
Fluvaquents
Drainage class: Very poorly drained
Parent material: Stratified silt loam to gravels and sands
Surface texture: Mucky silt loam

Lacustrine (Lake Plain): Grasston – Longsiding - Foglake Association

Setting: Landform: Lake plains Slope range: 0 to 12 percent

Composition
Extent of map unit in the County and similar soils: 7 percent

Soil Properties and Qualities: Glaciolascustrine clays, silts, and very fine sands

Soil Associations – Described Individually:
Grasston
Drainage class: Moderately well drained
Parent material: Lacustrine
Surface texture: Silt loam
Longsiding
Drainage class: Somewhat poorly drained
Parent material: Lacustrine
Surface texture: Silt loam
Foglake
Drainage class: Poorly drained
Parent material: Lacustrine
Surface texture: Silt loam

Outwash Plains: Antigo – Chetek - Ossmer Association

Setting: Landform: Outwash plains and stream terraces Slope range: 0 to 8 percent

Composition
Extent of map unit in the County and similar soils: 23 percent

Soil Properties and Qualities: Loamy and silty mantles range from 0 to 30 inches over sands and gravels

Soil Associations – Described Individually:
Antigo
Drainage class: Moderately well drained
Parent material: Silt mantle over outwash
Surface texture: Silt loam
Chetek
Drainage class: Somewhat excessively drained
Parent material: Loamy mantle over outwash
Surface texture: Fine sandy loam

Ossmer
Drainage class: Somewhat poorly drained
Parent material: Silt mantle over outwash
Surface texture: Silt loam

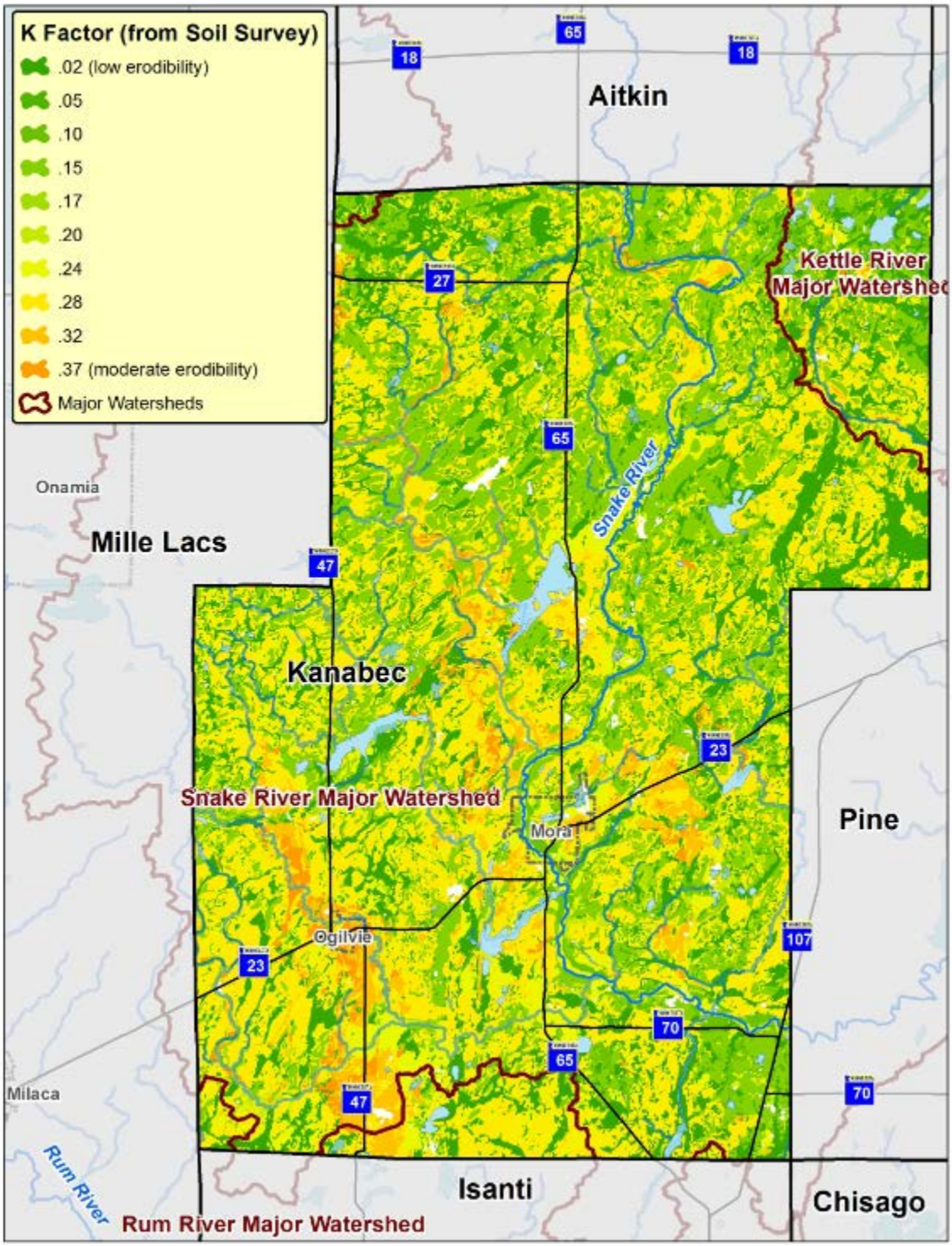
Misc. Soils (Cut and Fill lands): Udipsamments – Udorthents Association

Setting: Landform: Moraines, Outwash plains, Lake plains Slope range: 0 to 6 percent

Composition
Extent of map unit in the County and similar soils: Less than 1 percent

Soil Properties and Qualities: Highly variable soil conditions reflecting fill material or soil scrape areas

Soil Associations – Described Individually:
Udipsamments
Drainage class: Excessively drained
Parent material: Variable sandy material
Surface texture: Various sandy textures
Udiorthents
Drainage class: Well drained
Parent material: Variable loamy material
Surface texture: Variable silty loam to clay loam


K Factor (from Soil Survey)
.02 (low erodibility)
.05
.10
.15
.17
.20
.24
.28
.32
.37 (moderate erodibility)
Major Watersheds
Aitkin
Kettle River
Major Watershed
Onamia
Mille Lacs
Snake River
Kanabec
Snake River Major Watershed
Mora
Pine
Ogilvie
Milaca
Rum River
Isanti
Chisago
Rum River Major Watershed
18
65
27
47
23
107
70

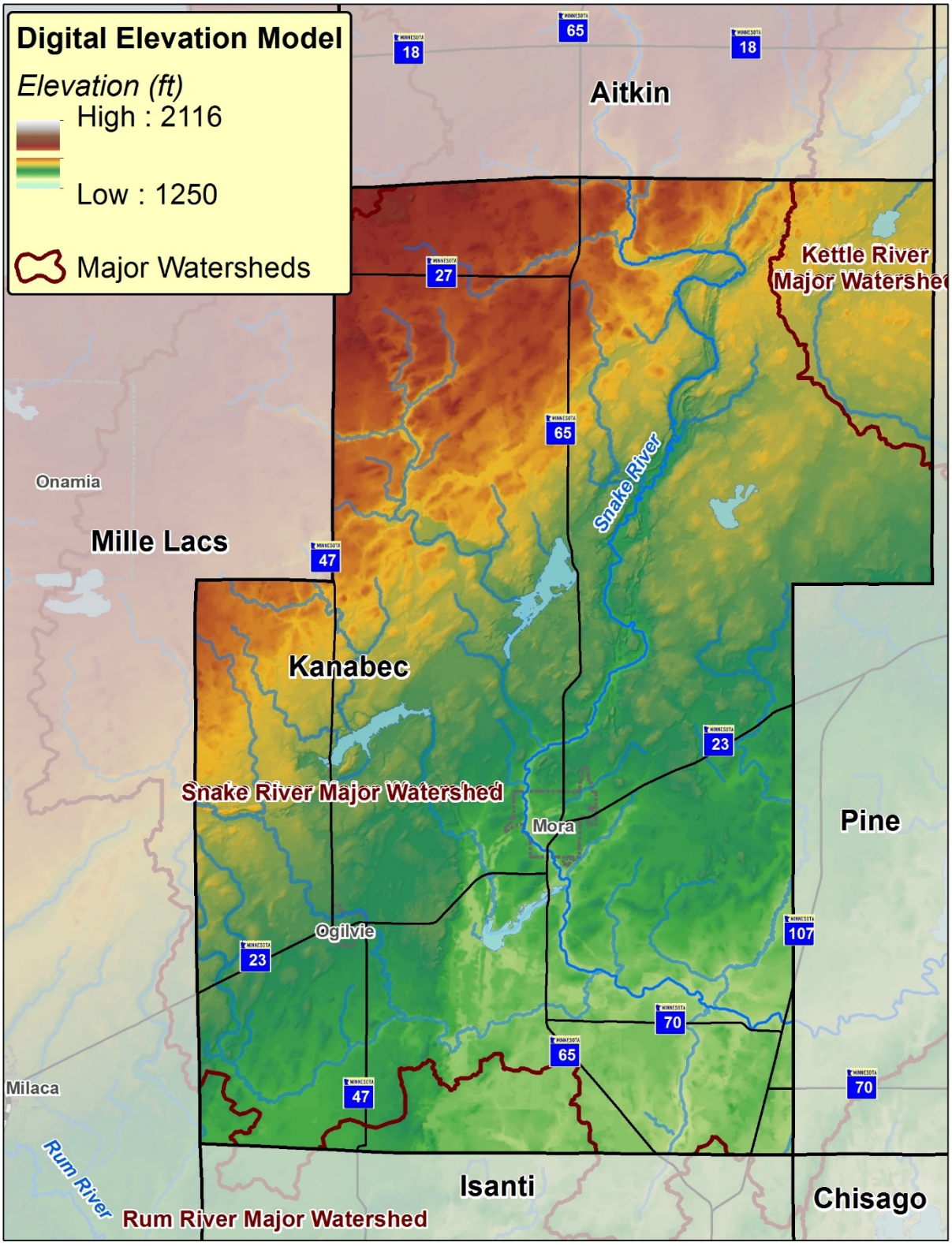
Erosion Prone Soils

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 than 2T. The majority of these areas are associated with Rosholt-Onamia and Milaca-Ronneby soil associations.

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.


Digital Elevation Model
Elevation (ft)
High : 2116
Low : 1250
Major Watersheds
Aitkin
Kettle River
Major Watershed
Onamia
Mille Lacs
Snake River
Kanabec
Snake River Major Watershed
Mora
Pine
Ogilvie
Milaca
Rum River
Isanti
Chisago
Rum River Major Watershed
65
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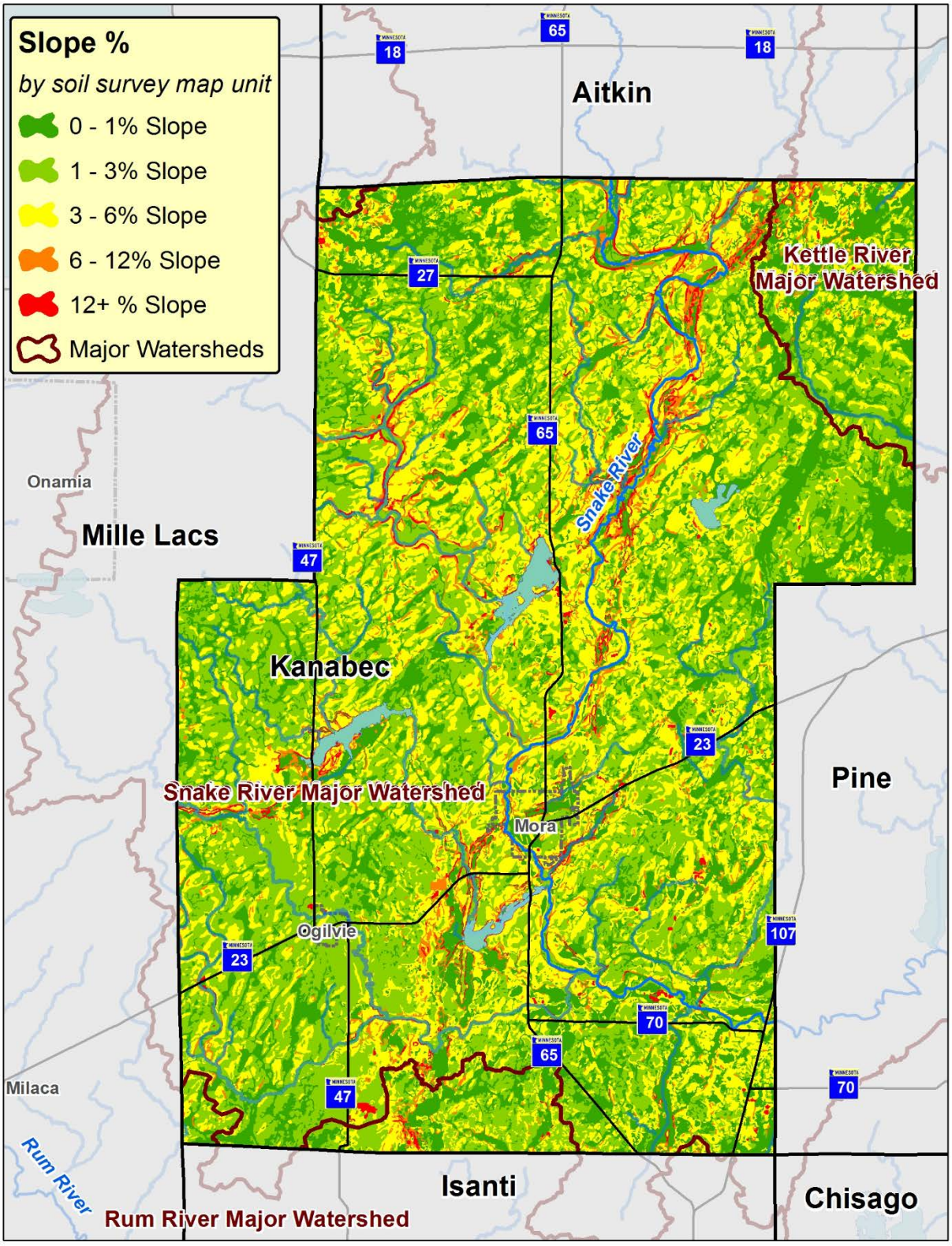
Slope %
by soil survey map unit
0 - 1% Slope
1 - 3% Slope
3 - 6% Slope
6 - 12% Slope
12+ % Slope
Major Watersheds
Aitkin
Kettle River
Major Watershed
Onamia
Mille Lacs
Snake River
Kanabec
Snake River Major Watershed
Mora
Pine
Ogilvie
Milaca
Rum River
Isanti
Chisago
Rum River Major Watershed
18
65
27
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23
107
70

VEGETATION – ORIGINAL

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

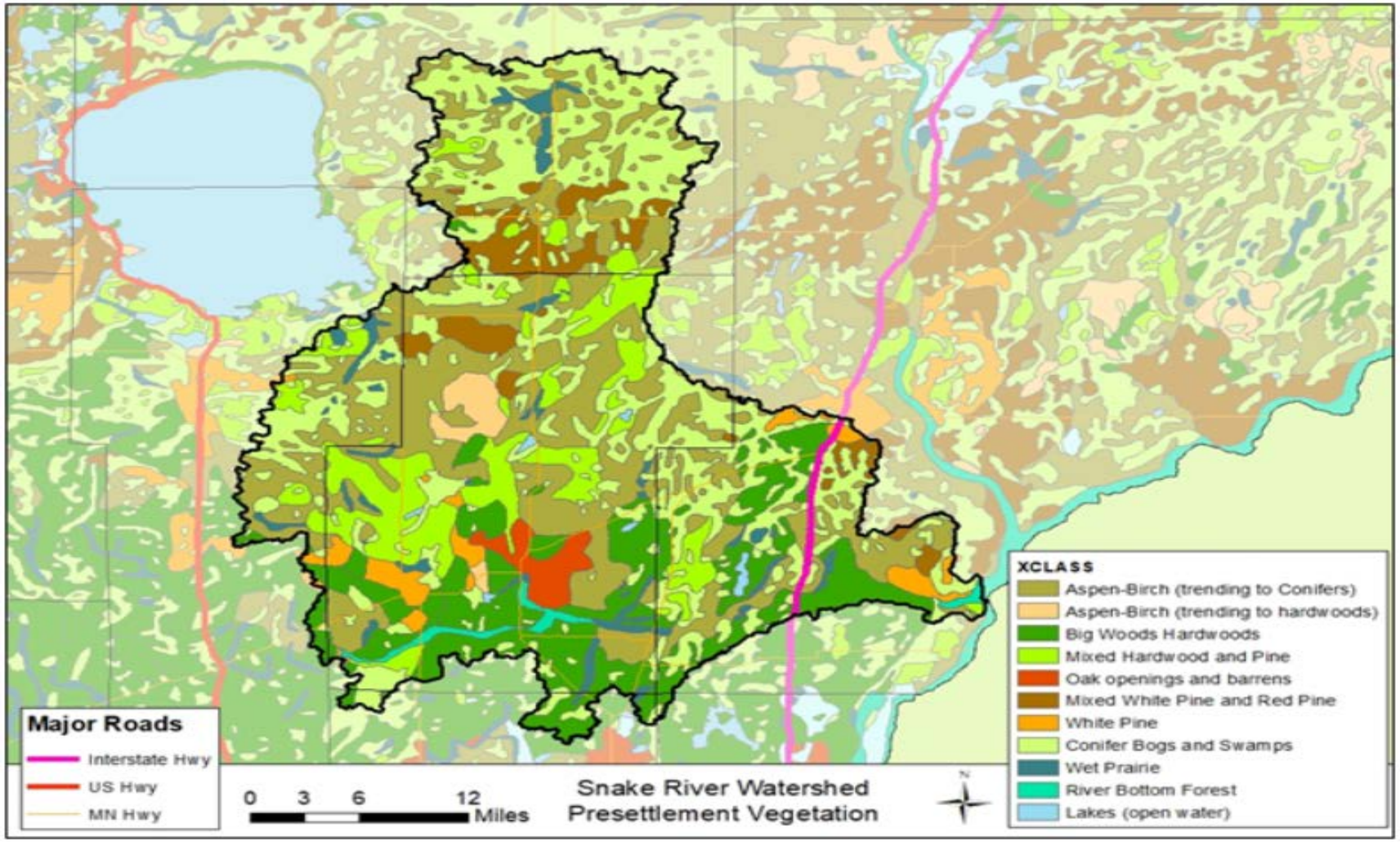
Northern Hardwood Forests - Sugar Maple, Yellow Birch, Basswood, and occasional White Pine

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.



Pre-settlement land cover based on Marshner's interpretation of the Public Land Survey.

WATERS RESOURCES

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.

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.

Protected Waters List

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

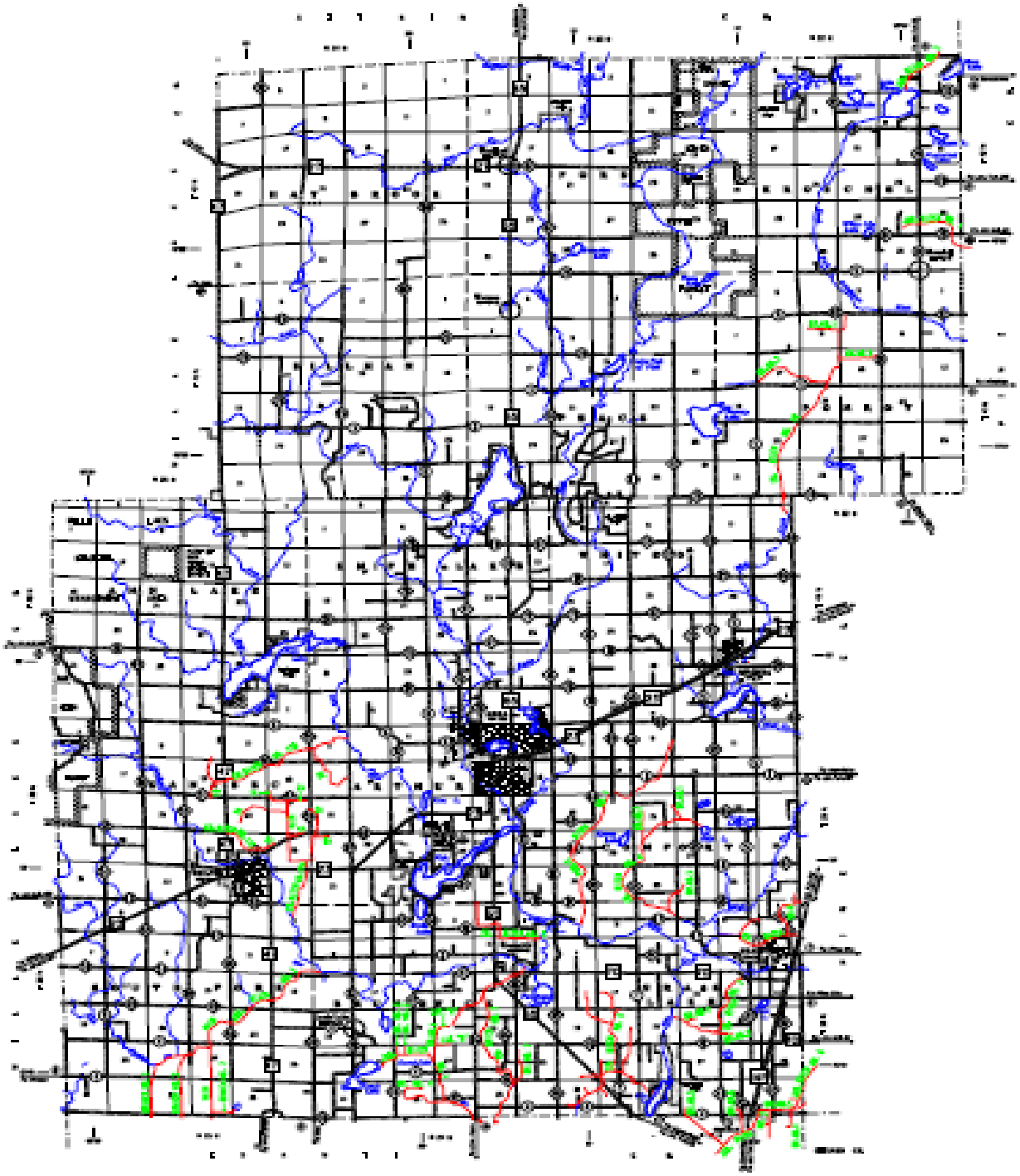
Unnamed	58	4	12
Unnamed	60	3	12
Unnamed	61	3	30
Unnamed	63	3	10
Unnamed	64	4	20
Unnamed	65	3	15
Unnamed	66	3	12
Unnamed	67	4	10
Jeff Marsh	68	5	141
Unnamed	69	3	10
Unnamed	70	5	45
Unnamed	71	4	15
Unnamed	72	3	20
Unnamed	75	4	11
Unnamed	76	3	30
Unnamed	77	4	11
Unnamed	78	4	10
Unnamed	79	3	56
Unnamed	80	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** (Lakes)	
<25 acres	56	
26-50 acres	25	
51-100 acres	11	
101-200 acres	6	(Rice, Spring, Jeff Marsh, Pennington, Devils, Unnamed-ID94)
201-300 acres	3	(Pomroy, Quamba, Lewis)
301-400 acres	2	(Anne, Eleven)
401-500 acres	1	(Fish)
>501 acres	1	(Knife Lake)
	105	

Public Ditches



Legend: Public Ditches: Public Waters:

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.

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.

SUB-WATERSHEDS:

Snake River Sub-Watersheds

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

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.

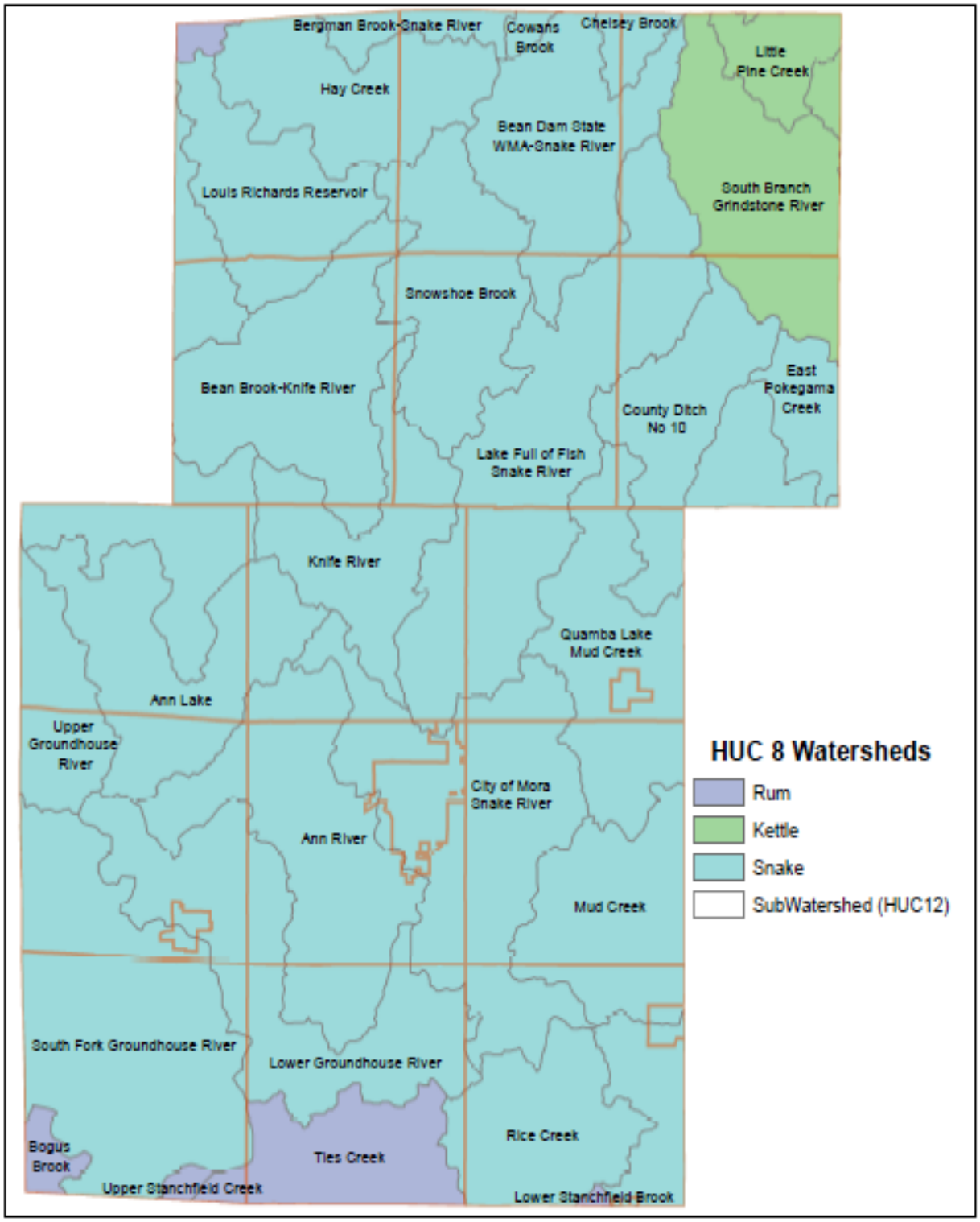
Spence Brook (36063) - The entire watershed is fairly flat with slopes of only 2-4%.

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%.

Kanabec County Sub-Watersheds



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%.

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).

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.

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 provide protection of wetlands within agricultural fields. 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 of a commodity crop planted on the wetland.

The National Wetland Inventory provides an indication of the approximate number of drained wetlands. According to the National Wetland Inventory most of the drained wetlands have occurred 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.

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.

WILDLIFE HABITAT

Wildlife Manabement 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.

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.

Plant & Animal Species of Concern

Kanabec County has several species of concern, threatened and endangered plants and animals. Below they are listed by the States' status designations. None of these species have a Federal status designation.

Common name	Scientific name	Group	State status
Mudpuppy	Necturus maculosus	amphibian	special concern
Cerulean Warbler	Setophaga cerulea	bird	special concern
Red-shouldered Hawk	Buteo lineatus	bird	special concern
Trumpeter Swan	Cygnus buccinator	bird	special concern
Yellow Rail	Coturnicops noveboracensis	bird	special concern
Pugnose Shiner	Notropis anogenus	fish	threatened
Lake Sturgeon	Acipenser fulvescens	fish	special concern
Southern Brook Lamprey	Ichthyomyzon gagei	fish	special concern
Least Darter	Etheostoma microperca	fish	special concern
Gilt Darter	Percina evides	fish	special concern
A Caddisfly	Limnephilus secludens	insect	endangered
Caped Leafhopper	Macrosteles clavatus	insect	special concern
Big Brown Bat	Eptesicus fuscus	mammal	special concern
Little Brown Myotis	Myotis lucifugus	mammal	special concern
Creek Heelsplitter	Lasmigona compressa	mussel	special concern
Purple Wartyback	Cyclonaias tuberculata	mussel	endangered
Elktoe	Alasmidonta marginata	mussel	threatened
Round Pigtoe	Pleurobema sintoxia	mussel	special concern
Fluted-shell	Lasmigona costata	mussel	threatened
Spike	Elliptio dilatata	mussel	threatened
Mucket	Actinonaias ligamentina	mussel	threatened
Black Sandshell	Ligumia recta	mussel	special concern
Blanding's Turtle	Emydoidea blandingii	reptile	threatened
Narrow Triangle Moonwort	Botrychium lanceolatum ssp. angustisegmentum	vascular plant	threatened
Lance-leaf Violet	Viola lanceolata var. lanceolata	vascular plant	threatened
Lapland Buttercup	Ranunculus lapponicus	vascular plant	special concern

Common name	Scientific name	Group	State status
A Bristle-berry	Rubus stipulatus	vascular plant	endangered
Robbins' Spikerush	Eleocharis robbinsii	vascular plant	threatened
Least Moonwort	Botrychium simplex	vascular plant	special concern
Slender Naiad	Najas gracillima	vascular plant	special concern
Snailseed Pondweed	Potamogeton bicupulatus	vascular plant	endangered
Bog Bluegrass	Poa paludigena	vascular plant	threatened
Mingan Moonwort	Botrychium minganense	vascular plant	special concern
Swamp Blackberry	Rubus semisetosus	vascular plant	threatened
Butternut	Juglans cinerea	vascular plant	endangered
Vermont Bristle-berry	Rubus vermontanus	vascular plant	special concern
Water-willow	Decodon verticillatus var. laevigatus	vascular plant	special concern
Discoid Beggarticks	Bidens discoidea	vascular plant	special concern

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