NATURAL RESOURCES

Natural and physical features/attributes of the City of Osakis are simultaneously a bountiful resource and a factor limiting development/redevelopment. Natural Resources in and around Osakis provide the foundation for maintaining a healthy environment, high quality of life and growing sustainably. Osakis's natural resources are one of its greatest assets. Preserving and improving on natural resources will not only continue to provide a base for recreation, but will also help to support the local economy by providing high quality resources from which to draw. Because of increasing affluence and people's growing desire to vacation and reside in areas such as Osakis with high scenic amenities, it is imperative that Osakis plan for the protection of its natural resources.

Within Chapter 3 of this plan (Demographic Trends and Assumptions), it is noted that Osakis is projected to increase 37% in population throughout the course of the next two decades. Much of this growth can be attributed to Osakis's natural amenities. Efforts should be directed toward wetlands and water resources, soils and geology, topography and drainage, wildlife and rare species, natural scenery, forests, prairies, and native plant communities. The concept of sustainable development should provide direction. Sustainable development can be seen as *"development that maintains or enhances economic opportunity and community well-being while protecting and restoring the natural environment upon which people and economies depend. Sustainable development meets the needs of the present without compromising the ability of future generations to meet their own needs."* (Minnesota Legislature, 1996.) The perspective of sustainability calls upon us to invest our time and energy in efforts which simultaneously strengthen the environmental, economic and social dimensions of any issue.

This Chapter provides background information on the City of Osakis's physical profile that is intended to assist in guiding growth and preserving natural resources. This chapter includes:

1. A Physical Profile including information on area, climate, topography, waters, watershed, groundwater, vegetation, rare species and soil conditions;

2. Natural Resource Objectives; and

3. Natural Resource Policies/Recommendations.

I. PHYSICAL SETTING

A. Size

The 2000 Census identifies 2.13 square miles of land area with Osakis of which 2.01 is square miles of land and 0.12 square miles is water. Since the 2000 Census the City has not acquired any additional land through annexation.

B. Climate

The climate of Osakis and surrounding Central Minnesota region is characterized by warm, humid summers with severe local storms and occasional tornadoes. The winter seasons are generally cold and relatively dry. The average 30 year annual precipitation for the years 1961 to 1990 has been 27 to 28 inches of water based on data from the State Climatology Office, Division of Waters, Minnesota Department of Natural Resources. Nearly two thirds of Minnesota's annual precipitation falls during the growing season of May through September or 17 to 18 inches of precipitation. The normal precipitation during the months of April through October has been 22 to 23 inches. During late December, January, and early February, temperatures frequently remain below zero. Frost in Minnesota takes place as early as September and ends as late as May. Soil freeze occurs in Minnesota during the late fall and early winter months.

II. LAND RESOURCES

A. Ecologic Framework

Figure 4-1
Minnesota Ecological Regions

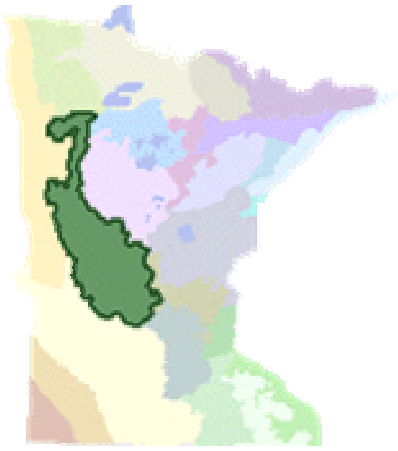
Source: MNDNR

Minnesota includes three of North America's ecological regions or biomes which represent major climate zones which converge: prairie parkland, deciduous forest and coniferous forest. The Ecological Classification System (ECS) is a nationwide system developed to manage natural resources on a sustainable basis. This system integrates climatic, geologic, hydrologic, topographic, soil and vegetation data. Osakis is included within the Eastern Broadleaf Forest province. This province bridges the transition zone between prairie to the west and true forest to the east. Major landforms include lake plains, outwash plains, end moraines, ground moraines, and drumlin fields.

Sections within this province are further defined by the origin of glacial deposits, regional elevation, distribution of plants and regional climate. Minnesota has 10 sub-ecological sections and Osakis lies within the Minnesota and NE Iowa Morainal division. The Alexandria Moraine Complex forms the western and southern boundary of this subsection. The eastern boundary was developed using general landform boundaries and the separation of northern hardwoods presettlement vegetation and dominantly coniferous or aspen-birch presettlement vegetation.

Steep slopes, high hills and lakes formed in glacial end moraines and outwash plains characterize this subsection. Presettlement vegetation included maple-basswood forests interspersed by oak savannas, tallgrass prairies, and oak forests. Much of this region is currently farmed. Tourism is predominant around the lakes.

Figure 4-2
Alexandria Moraine Complex
(Hardwood Hills)



Source: MNDNR

B. Topography and Drainage

Map 4-1 illustrates topography within the City of Osakis. The area features gentle fluctuations in elevation from about 1,330 to 1,380 feet above sea level. Mild variations in the City's topography allow for a diverse array of development possibilities and options. A topographical survey indicates Osakis's terrain is generally flat and conducive to urban development, however, some area of steep slope exist along Lake Osakis, specifically near the Osage Park area and Cemetery. These areas generally are of unique value to the community and function best if allowed to exist in a natural state or exist with limitation on development such that they will not be urbanized or irrevocably altered.

C. Soils

Many of the environmental decisions about using a resource are based on the kind of soil and the ability of the soil to support that resource use. The characteristics of the soils in the Osakis area are examined in order to make proper decisions on the use of the land and to protect the natural environment. Existing soils in the City have been principally responsible for the area's overall development pattern and may impose limitations or increased sensitivity to future urban development/redevelopment.

An illustration of soils (Map 4-2) within the City of Osakis is included on the following page and is reflective of USGS datum. Soil surveys provided by USGS provide information about erosion rates, depth to groundwater, surface and subsurface (to 5 feet) soil texture, engineering interpretations and suitability for activities such as private sewage treatment, building limitations, and nonmetallic mining sites to name few. This information is invaluable in making water and land resource management decisions. Soils with identical or near identical profiles are grouped into a soil series, normally named for a geographical feature where it was first described. Each series has the same characteristics, regardless of where it is subsequently found. Soil associations, which are described on a general county soils map, are a distinct pattern of soil series in defined proportions. Soil association maps provide an overview of the soils at a county level. These maps can help identify where high runoff or erosion could be expected, or where areas of high or low agricultural potential are likely to be located. These maps are not adequate for detailed planning and site selection of structures or roads. There are two general soil associations in Osakis area, Waukon-Gonvick and Ves-Roliss-Normania.

The Douglas and Todd County Soil Surveys reveals most surface soils within the City consist of loam with surface soils of black loam and subsoils of brown sandy to clay loam which are, by nature, relatively level, poorly and moderately drained. Runoff, erosion and wetness are the main limitations in use and management concerns.

Table 4-1 reflects data included in the Douglas and Todd County Soil Surveys as illustrated on the "General Soils Map" for each respective County.

Table 4-1
General Soil Associations – City of Osakis

Soil Association	Characteristics
Ves-Roliss-Normania (Todd County)	Nearly level to sloping, well drained, poorly drained, and moderately well drained, loamy soils on ground moraines and till plains.
Waukon-Gonvick (Douglas County)	Well drained and moderately well drained, nearly level to hilly soils formed in loamy glacial till.

D. Vegetation and Rare Species

As of the adoption of the Comprehensive Plan, the Department of Natural Resources had not published a biological survey and respective map. Information related to vegetation and rare species should be included in the Comprehensive Plan as it becomes available.

III. SURFACE WATER RESOURCES

A. Watershed

The term 'watershed' refers to the entire physical area or basin drained by a distinct stream or riverine system. Gravity and topography are the two major factors that define a watershed. Watersheds help

review authorities to evaluate the quality and quantity of local water resources. Osakis is contained within the Sauk River Watershed District (SRWD). A map of the SRWD (Map 4-3) is located on the following page. The SRWD extends from the Mississippi River near St. Cloud into the eastern portions of Douglas County to within three miles of Alexandria. The watershed, like the Sauk River, extends in a northwest to southeast direction. The overall watershed is about 75 miles in length with some areas being up to 20 to 30 miles in width.

According to data from the Minnesota Land Management Information Center (LMIC), the Sauk River watershed covers over 667,000 acres or approximately 1,041 square miles across portions of five counties. The portions of counties contained within by the watershed include southeastern Douglas County, northeastern Pope County, southwestern Todd County, northern Meeker County, and the center third of Stearns County. A small portion of the watershed (six acres) is contained within Morrison County.

The SRWD has implemented an Overall Comprehensive Plan which states, "It is the mission of the Sauk River Watershed District to apply our unique abilities and authorities in ways that protect and enhance our watershed's resources for today and tomorrow".

The City requires proposed development maintain compliance with Minnesota Pollution Control Agency standards and local stormwater/erosion control ordinances/procedures.

B. Lakes, Rivers and Streams

Approximately six percent of the City's total land area is comprised of surface waters. Map 4-4 located on the following page is reflective of the public water inventory and national wetland inventory for areas within the City of Osakis. The map illustrates surface water resources. Major surface water features within the City include Lake Osakis, Faille Lake, and Stevens Lake. In addition several protected wetlands exist within and in close proximity to the corporate limits. Surface waters classified by the Minnesota Department of Natural Resources (MNDNR) are subject to shoreland regulations.

Clearly, the Osakis area lakes are an important resource to the community, arguably the centerpiece of the community. Lakes in the City support a high quality of life for area residents and provide thousands of people with a range of recreational opportunities and economic gains.

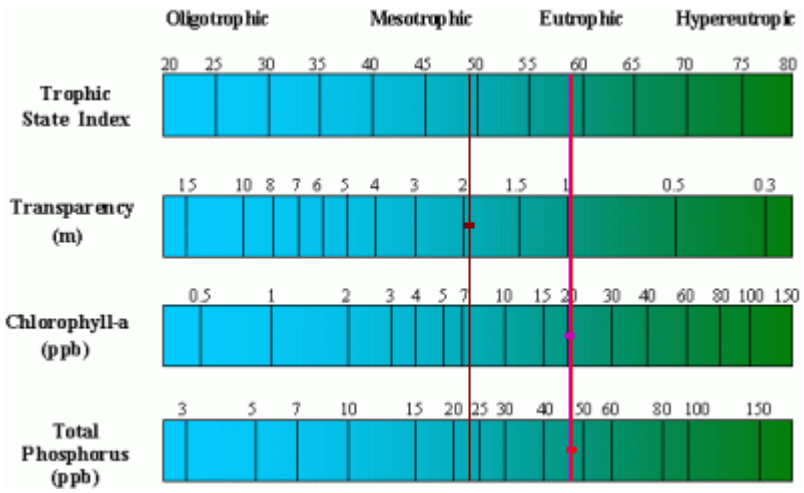
The most notable of the waterbodies within the City is Lake Osakis. Lake Osakis has been a popular destination for decades. The MNDNR has compiled extensive data on Lake Osakis including: lake surveys, lake depth maps, lake water quality data and lake water clarity data (from the Pollution Control Agency), satellite-based water clarity information (from the University of Minnesota), lake notes and fish consumption advice (from the Department of Health). Lake Osakis was **not** included on the MNDNR, Division of Ecological Services *Notice of Waters Identified and Designated as Infested Waters* list published in March of 2005 which cites those lakes infested with Eurasian water milfoil, spiny water flea, zebra mussels, ruffe, white perch or round goby. Lakes Faille and Stevens do not have this detailed information, however, estimated data on Lake Faille including water chemistry is available from the SRWD.

The Clean Water Act requires states to publish, every two years, an updated list of streams and lakes that are not meeting their designated uses because of excess pollutants. The list, known as the 303(d) list, is based on violations of water quality standards and is organized by river basin. A TMDL study identifies both point and nonpoint sources of each pollutant that fails to meet water quality standards. Water quality sampling and computer modeling determine how much each pollutant source must reduce its contribution to assure the water quality standard is met. Rivers and streams may have several TMDLs, each one determining the limit for a different pollutant. The Minnesota Pollution Control Agency (MPCA) is the state agency responsible for protecting Minnesota's water quality. Lake Osakis is included on the most recent TMDL list which was approved in 2004. The

affected use was aquatic recreation and the excess pollutant noted was excess nutrients. According the MPCA, Lake Faille is proposed to be on the 2006 TMDL list.

According to the SRWD, Osakis Lake (DNR Lake ID number: 77-0215) is considered a non-flowage lake since it a headwater basin and becomes the starting point for the Sauk River. The land area draining to Osakis Lake, or its lakeshed, covers 84,881 acres. With the surface area of the lake is 6,788 acres, the lakeshed to lake surface area is 12.5:1. It is the 40th largest lake in the State. Over the past 30 to 40 years the lake has experienced decreased water quality and increased growth in aquatic vegetation. A diagnostic study in 1993 concluded that without corrective actions further degradation of the water resource would occur.

Figure 4-3
Lake Osakis Tropic State Index (TSI)
Carson



Source: MNDNR

As illustrated in Figure 4-3, Lake Osakis is a degraded water body with and overall Trophic status of Eeutrophic with TSI ratings as follows: Total Phosphorus: 59, Chlorophyll-a: 59 and Secchi Disk: 49.

Carlson's Trophic State Index (TSI), discussed in Figure 4-2 below is a common means for characterizing a lake's trophic state (overall health) and associating Secchi, chlorophyll-*a*, and phosphorus measurements. The term "trophic status" refers to the level of productivity in a lake as measured by phosphorous content, algae abundance, and depth of light penetration. The index below shows levels of trophic status.

Table 4-2
Carlson's Trophic State Index

TSI < 30	Classical Oligotrophy: Clear water, oxygen throughout the year in the hypolimnion, salmonid fisheries in deep lakes.
TSI 30 - 40	Deeper lakes still exhibit classical oligotrophy, but some shallower lakes will become anoxic in the hypolimnion during the summer.
TSI 40 - 50	Water moderately clear, but increasing probability of anoxia in hypolimnion during summer.

TSI 50 - 60 Lower boundary of classical eutrophy: Decreased transparency, anoxic hypolimnia during the summer, macrophyte problems evident, warm-water fisheries only.

TSI 60 - 70 Dominance of blue-green algae, algal scums probable, extensive macrophyte problems.

TSI 70 - 80 Heavy algal blooms possible throughout the summer, dense macrophyte beds, but extent limited by light penetration. Often would be classified as hypereutrophic.

TSI > 80 Algal scums, summer fish kills, few macrophytes, dominance of rough fish

The shoreline within the City along Lake Osakis has been almost entirely developed with homes, cabins and resorts, creating the potential to negatively impact the Lake. Development on lakeshores has been shown to increase nutrient levels and increase shoreline erosion which lead to an increase in algae blooms and suspended solids, thereby decreasing water clarity and degrading habitat. Efforts should be made to monitor development related activities the contribute most to degradation of the lake(s) which include removing aquatic and terrestrial vegetation along the shore, increasing impervious surfaces, nitrogen and phosphorus fertilizers, using rip-rap and other harmful landscaping practices and compacting the soils.

C. Wetlands

Wetlands have historically been regarded as obstacles to development rather than areas of intrinsic value. However, it is now generally accepted that wetlands are valuable for storing essential surface waters, stabilizing surface waters to minimize the danger of droughts of floods and supporting wildlife habitat. Wetlands are also the primary method of recharging aquifers ensuring a continued water supply. Wetlands cleanse and purify surface water by removing nutrients and other contaminants from storm water runoff.

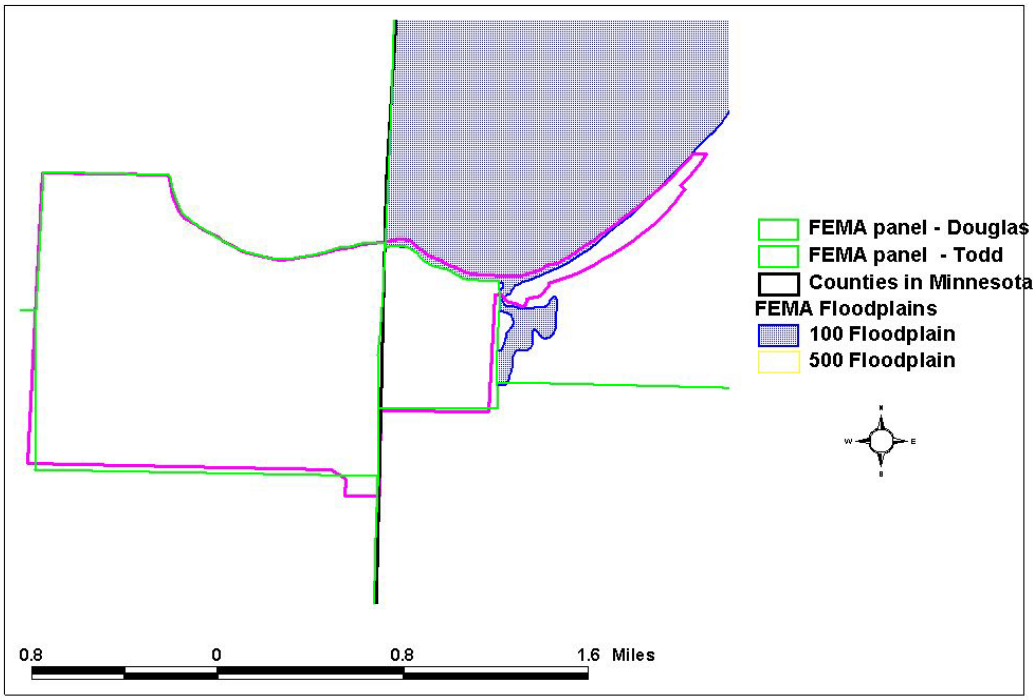
Wetlands are also illustrated on Map 4-4. The source for these data is the National Wetland Inventory (NWI). Wetlands represent approximately 6% of the surface in the study area.

The Army Corps of Engineers and the Department of Natural Resources are ultimately responsible for the overall protection of wetland, however, the Douglas County Soil and Water District is the local governmental unit responsible for implementing wetland protection measures and administers the Wetland Conservation Act (WCA) on behalf of the City.

D. Flood Plains

Until recently, the City did not have any areas designated as Floodplain and consequently is not enrolled in the National Flood Insurance Program (NFIP). However, in 1995 the City annexed a portion of Gordon Township within Todd County that included areas of FEMA Floodplain. These areas are illustrated on Figure 4-4. This situation creates potential issues for the City and homeowners within the annexed territory. If a property owner in that mapped floodplain tries to get a federally-backed mortgage (most mortgage types), or refinance, etc., they would not be able to since they would be required to buy flood insurance and are not able to since the City is not enrolled in the NFIP. As this area develops or as homes are sold, problems are likely to arise as a result. The City should investigate enrollment into the NFIP and adopt regulations for these areas.

Figure 4-4
City of Osakis (current boundary vs. FEMA floodplain)



Throughout the remainder of the City are areas which have encountered flooding and the City has taken corrective actions through structural engineering to alleviate flooding potential, however, flood prone areas still exist within the community.

In 1969, the Minnesota Legislature enacted the State Flood Plain Management Act (Minnesota Statutes, Chapter 103F). This Act stresses the need for a comprehensive approach to solving flood problems by emphasizing nonstructural measures, such as floodplain zoning regulations, flood insurance, floodproofing and flood warning and response planning. By law, Minnesota floodprone communities are required to: 1) adopt floodplain management regulations when adequate technical information is available to identity floodplain areas, and 2) to enroll and maintain eligibility in the NFIP so that people may insure themselves from future losses through the purchase of flood insurance. The Department of Natural Resources (DNR) is the state agency with the overall responsibility for implementation of the State Flood Plain Management Act.

E. Water Control Structures

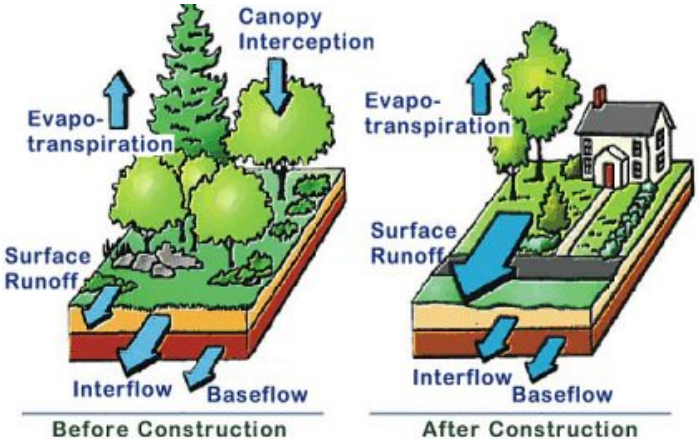
Osakis Lake includes a water control structure which is maintained by Todd County. The MN DNR provides dam safety oversight. In addition to this water control structure and others within the Sauk River Watershed, there are hundreds, perhaps thousands of culverts and box channels that control the flow of surface water throughout the District. These facilities are maintained by the cities, townships and county governments as well as by the Minnesota Department of Transportation (MNDOT).

The presence of culverts, bridges and other water controls structures has a significant influence on flood control. The City has not undertaken a comprehensive inventory of their respective flow control structures and facilities.

F. Local Hydrologic Cycle

Groundwater and surface water are both part of the "hydrologic cycle". Development has a profound influence on the quality of waters. To start, development dramatically alters the local hydrologic cycle (see Figure 4-5 below). The hydrology of a site changes during the initial clearing and grading that occur during construction. Trees, meadow grasses, and agricultural crops that intercept and absorb rainfall are removed and natural depressions that temporarily pond water are graded to a uniform slope. Cleared and graded sites erode, are often severely compacted, and can no longer prevent rainfall from being rapidly converted into stormwater runoff.

Figure 4-5
Local Hydrologic Cycle



Source: MNDNR

The situation worsens after construction. Roof tops, roads, parking lots, driveways and other impervious surfaces no longer allow rainfall to soak into the ground. Consequently, most rainfall is converted directly to runoff. The increase in stormwater can be too much for the existing natural drainage system to handle. As a result, the natural drainage system is often altered to rapidly collect runoff and quickly convey it away (using curb and gutter, enclosed storm sewers, and lined channels). The stormwater runoff is subsequently discharged to downstream waters.

Water Quality is affected by the accumulation of trash, oil and rubber from cars, fertilizers and pesticides applied to lawns, sediment from bare or poorly vegetated ground and other pollutants entering streams, rivers and the Lakes. Inflow of sediment can cloud water, blocking sunlight from submerged plants. Sediment also settles to the bottom of streams, clogging the gravel beds used by fish for laying their eggs. Nutrients, such as phosphorus and nitrogen, from fertilizers enter the water and promote unusually rapid algae growth. As this algae dies, its decomposition reduces or eliminates oxygen needed by fish, shellfish, and other aquatic life for survival.

IV. GROUND WATER RESOURCES

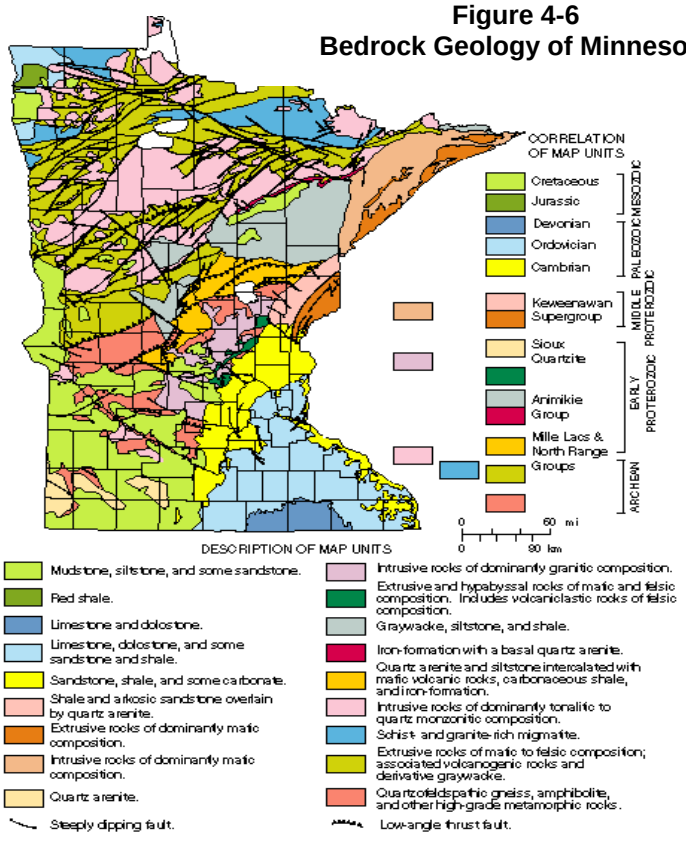
A. Geologic Framework

Subsurface geology and groundwater are important considerations for all communities as they are the source of potable (i.e. drinkable) water. Hydrogeology is the study of the interrelation of subsurface geology and water. Because the consequences of human actions and forces at work above ground have a direct impact upon our ground water resources it is important to consider hydrogeologic resources.

As shown in Figure 4-6, geologic conditions very greatly in different parts of Minnesota. The Sauk River Watershed District Overall Comprehensive Plan includes the following summary of geologic resources:

"Sauk River watershed is underlain by relatively simple layers of rock and sediment. Metamorphic and crystalline basement rocks are overlain by weathered rocks and sediment that are in turn overlain by glacial deposits. The stacking of geologic layers reflects the order in which they were formed. The basement rocks were formed over 1.7 billion years ago. The weathered rocks and sediments were deposited on top of the basement rock from 140 to 65 million years ago. Most of the glacial deposits were deposited over these formations during the Quaternary period less than one million years ago. Over the last two million years, there have been approximately 20 large-scale southward advances of the Laurentide Ice Sheet. These major glacial advances have been grouped into four stratigraphic units inlcuding the Nebraskan, Kansan, Illinoisan and Wisconsinian (listed in order of age from earliest to latest). The most recent advance, the Wisconsinian, has made the most impacts on the watershed in terms of glacial deposits and surface features. The Sauk River watershed is located in a region where glaciers advanced at least four times during the 60,000 years of the Wisconsin glaciation. Many of the hills and plains that make up the existing landscapes in the watershed are the result of several substages of the Wisconsin glaciation with the last advance occurring over 9,500 years ago."

Figure 4-6
Bedrock Geology of Minnesota



Source: Minnesota Geological Survey

Hydro geologic conditions also determine how sensitive ground water may be to contamination by chemicals and pollutants introduced at ground level. Sensitivity to pollution is described in terms of the length of time it takes for a drop of water to cycle from absorption into the ground to discharge (removal) from an aquifer. The pollution sensitivity of an aquifer is assumed to be inversely proportional to the time of travel: shorter cycle times may indicate a higher sensitivity, longer cycle times may represent a greater

travel time and increased geologic protection. Contaminants are assumed to travel at the same rate as water.

There are four pollution sensitivity categories: Very High, High, Moderate, and Low. The pollution sensitivity of an aquifer is assumed to be inversely proportional to the time of travel. Very High sensitivity indicates that water moving downward from the surface may reach the ground-water system within hours to months leaving little time to respond to and prevent aquifer contamination. Low sensitivity where it takes decades to centuries for the cycle to be complete may allow enough time for a surface contamination source to be investigated and corrected before serious ground-water pollution develops. It is important to note higher pollution sensitivity categories do not mean water quality has been or will be degraded and low sensitivity does not guarantee that ground water is or will remain uncontaminated. Osakis's soil properties do not contribute to a high pollution sensitivity category as the soil properties are loam over loam. The loam is a balanced mixture of salt, sand and clay.

The Minnesota Pollution Control Agency reports 17 confirmed instances of leaking underground storage tanks (LUST) within the City over the past 15 years. Most files on the sites have been closed as of the drafting of this Plan. The sites are identified in the following table.

TABLE 4-3
LEAKING UNDERGROUND STORAGE TANK SITES

Site and MPCA ID#	Address	Release Discovered Date	Product Released	Leak Site Complete Site Closure Date	Contaminated Soils Remaining/Offsite Contamination
The Landing (FDIC) (821)	NE Corner Lake Osakis – CO Rd 10	November 1988	Gasoline, Type Unknown	April 1997	S/No
Community Memorial Home (7408)	410 W Main Street	August 1989	Diesel	March 1996	No/Unknown
Food n Fuel (2301)	Old Hwy 27	February 1990	Gasoline, Unleaded	--	Yes/Yes
Deluxe Oil Co (2651)	Hwy 27 W	March 1990	Diesel	June 1994	No/Unknown
Fishermens Corner (2606)	11 Nokomis Street	June 1990	Gasoline, Regular	August 1992	Yes/Unknown
Osakis Creamery Association (4633)	114 W Main Street	September 1991	Diesel	December 1992	Yes/No
Deluxe Oil Co (4859)	216 Nokomis Street	November 1991	Gasoline, Unleaded	June 1995	Yes/Unknown
Independent School Dist 213 (5472)	500 1st Avenue	July 1992	Fuel Oil, 1&2	January 1994	No/Unknown
Fertilizer Plant (6197)	4001 State Hwy 127 SE	April 1993	Gasoline, Type Unknown	November 1993	No/Unknown
Blacks Resort (6825)	1202 E Lake Street	September 1993	Gasoline, Type Unknown	September 1994	Yes/Unknown
Fishermens Corner (11009)	11 Nokomis W	October 1997	Gasoline, Type Unknown	December 2000	Yes/Unknown
Jim & Betty's Park (11414)	2270 E Lake Street	May 1998	Gasoline, Type Unknown	June 1998	Yes/No

Food N Fuel Inc. (11575)	300 Nokomis Street W	July 1998	Gasoline, Type Unknown	January 1999	Yes/No
Ironwood Resort (12127)	4490 Smith Lake Road SE	November 1998	Gasoline, Regular	November 1999	S/Unknown
George Residence (12721)	RR 3 PO Box 66	June 1999	Gasoline, Regular	November 1999	S/Unknown
Randalls Phillips 66 (12798)	201Nokomis Street SE	July 1999	Diesel	April 2002	Yes/Yes
Osakis Ready Mix (13563)	207 2nd Ave E	August 2000	Diesel	April 2002	Yes/Unknown

Source: MN Pollution Control Agency, 2005

Osakis draws its groundwater from a groundwater source with two wells ranging from 114 to 129 feet deep which draw from the Quaternary Buried Artesian aquifer. The Minnesota Department of Health determined in 2004 that the Osakis source of groundwater was not particularly susceptible to contamination. Studies during that year show that no contaminants were detected at levels that violated federal drinking water standards, however, some contaminants were detected in trace amounts that were below the legal limits. Chemically, the City's water is a calcium-magnesium bicarbonate type with high iron and manganese concentrations. The groundwater is chemically suitable for most purposes; however, hardness is a problem in some areas.

The City of Osakis has adopted the first phase of a Wellhead Protection Plan. The purpose of a Wellhead Protection Plan is to ensure the current and future safety of the City's drinking water supply. A map of the wellhead protection area follows on the subsequent page as Map 4-5.

V. AIR, NOISE AND LIGHT POLLUTION

The air quality is also an important and sometimes forgotten issue of importance for communities; air pollution is increasingly a regional and global problem. Pollutants can blow in from cities hundreds of miles away. An air toxic monitoring study was completed by the MPCA (Alexandria test site) from 1996 to 1997 and measured 73 air toxics. The average concentrations of the air toxics were compared to health benchmarks. Overall the Alexandria test site rated healthy quality of air. The only compounds which exceeded benchmarks in Alexandria were carbon tetrachloride and formaldehyde which are each contributor to cancer. Most production of carbon tetrachloride was banned in 1997 and levels have been decreasing since. A representative of MPCA[1] indicated that levels of carbon tetrachloride would be expected to be below the 1997 reading. Formaldehyde was above benchmarks at all locations Statewide and continue to be at all monitoring locations. Protection and encouragement of trees within the community can aid in maintaining high air quality.

Residents overwhelming indicated that they wished to retain the small town atmosphere of the community. They value the peace and tranquility of City and the Lake. Visual pollution from light and noise pollution detract from the small town atmosphere. Lighting should not detract from the views of the lake at night and blinking, flashing and bright lights are a nuisance and can easily be controlled through modern advances in lighting which reduce glare and concentrate lighting on-site. Not only can good lighting design and devices control light pollution, they also are more cost efficient and energy efficient. Furthermore, commercial and industrial lighting should not detract from residential uses. Noise ordinances can ensure that noises do not cause nuisances to residents as well.

[1] *(Kari Schwerin Palmer, Environmental Outcomes, MPCA, personal communication, July 2005)*

VII. ARCHEOLOGICAL RESOURCES

The history of a City helps a community define its sense of "place". Historic patterns of development, to a large measure, dictate where a community will grow in the future. History also gives us a window to view the lives of our forbearers and a mirror to reflect their images in our own endeavors.

As time progresses, Osakis may faces the loss of more and more of one of its truly non-renewable resources. These resources are the archaeological and historic sites that give the City's modern day residents a tie to the past. Many of these cultural resources are being purposefully demolished or destroyed while others face the natural elements and slowly erode away, some without any knowledge. One threat to these resources is that their significance, or even their existence, is largely unknown. Development, redevelopment, or failure to maintain these sites can diminish or destroy historic and archaeological resources. However, widespread knowledge of archaeological sites can increase the likelihood that they will be disturbed or vandalized. Encroaching development and modernization require the need for preservation of archaeologically and historically significant sites. Because the known, or suspected, historic resources may have no significant relationship to current or likely future uses or activities in Osakis, it is questionable if they will play a role in determining or affecting the City's character. However, State guidelines call for municipalities to review construction or other ground disturbing activity within prehistoric archaeological sensitive and historic sensitive areas.

Osakis lies within the Central Lakes Deciduous Archeological Region of the State and also in an area where there is a medium to high probability of archeological site existence. Site potential is based upon statistical relationships between known sites and environmental factors. Information obtained from the Office of the State Archaeologist (OSA), State Historic Preservation Office (SHPO), and MnDOT indicate the presence of some archaeological sites, however, locations have not been verified and are rather schematic. Areas along the eastern portion of Lake Osakis may warrant review and appropriate coordination with the State Historic Preservation Office (SHPO) as to area sensitivity. For further reference, data is available in the records of SHPO.

VIII. DEVELOPMENT CONSTRAINTS

A review of several natural features has been reviewed in this chapter. It should be noted that several of the natural features identified in this chapter, including but not limited to lakes, soils, wetlands, flood prone areas, potential archeological sites and regionally significant ecological areas, will present constraints to future development. Several of these significant natural features/areas exist in the proposed growth area of the City. Following as Map 4-6 is a map illustrating potential constraints to development. The boundaries on the map are a compilation of floodplain areas, National Wetland Inventory areas, areas of steep slope (based upon Douglas and Todd County Soil Surveys) and DNR Public Waters Inventory data. Field verification was not done to determine wetland existence. It should be noted that further review of these and sites identified is required prior to development. This map is intended to provide a general overview.

IX. NATURAL RESOURCES OBJECTIVES AND RECOMMENDATIONS

Objective: To the extent possible establish a balance between promoting, protecting, enhancing and preserving natural and physical features (including, but not limited to, woodlands, wetlands, soils, steep slopes, surface waters, groundwater) while managing requests for development and redevelopment.

Policy/Recommendations:

1. Encourage efforts to preserve wildlife species including preservation of natural habitat areas and pre-settlement (native) vegetative communities where feasible.
2. Encourage the use of natural resource data/studies for planning and review of development and redevelopment such as soils, topography, groundwater etc.

3. Develop a policy ensuring compliance with approved subdivision grading/drainage plans are maintained. Compliance checks/certifications upon site grading completion, at the time of building permit issuance and immediately prior to issuance of a certificate of occupancy should be considered.
4. Carefully regulate development in areas adjacent to shorelands, wetlands and floodprone areas to preserve these as attractive amenities.
5. Encourage development to conform to the natural limitations presented by topography, soils or other natural conditions.
6. Identify and protect significant scenic areas, open spaces, historic or archaeological sites. Emphasize proper management of open space areas in order to preserve trees, wildlife, pre-settlement (native) landscape communities, floodplain, water quality and similar environmentally sensitive features.

Objective: Protect the quality and use of surface water through support and coordination with the SRWD, County SWCD's, Lake Associations and state and federal agencies.

Policy/Recommendations:

1. Encourage and promote land use practices to protect and improve surface water resources.
2. Require appropriate erosion controls during construction and enforce through a developer's agreement and onsite inspections.
3. Establish a priority listing of water areas to monitor surface water quality and quantity.
4. Complete a detailed inventory of stormwater infrastructure along with other information to develop a hydrologic flow model for management purposes.
5. Evaluate the impact of stormwater runoff on surface water in the City and respective growth areas and determine and develop a Citywide Surface Water Management Plan or proactive implementation of watershed management tools developed by the SRWD, as amended or updated.
6. Enforce existing regulations and develop programs and new regulations where necessary to protect surface water.
7. Support the coordination of planning and implementation efforts between the SRWD, Lake Associations, County Soil and Water Conservation Districts and Land & Resource Management Offices as well as state and federal agencies.

Objective: Protect and preserve groundwater supply and quality through support and coordination with the SRWD, County SWCD's, Lake Associations and state and federal agencies.

Policy/Recommendations:

1. Protect ground resource from contamination through the development and implementation of a Wellhead Protection Plan and other programs.
2. Identify geologically sensitive areas in the City and define the limits and recharge areas of aquifers.
3. Map areas of Leaking Underground Tanks.

Objective: Protect air quality in the City to comply with MPCA standards.

Policy/Recommendations:

1. Review performance standards within the Zoning Ordinance to ensure that they adequately control dust and wind erosion related to land use and development activities.

Objective: Preserve the environment as a sustainable resource to insure both present and future generations a good quality of life.

Policy/Recommendations:

1. Coordinate plans and work with all agencies responsible for the protection and restoration of our environment.
2. Administer and support the state environmental review program (EAW, EIS).
3. Initiate plans to correct any and all abuses and preserve areas critical to the City's way of life (Lake Osakis).
4. Develop an enforcement program that properly enforces the City's regulations including stormwater violations.
5. Encourage tree planting on private property within the City and investigate the adoption of a tree preservation and replacement ordinance as a part of the Zoning Ordinance to protect valuable trees in areas which will be developed in the future.
6. Examine specific requirements for environmental protection that may be incorporated into the City's Subdivision regulations such as identification of subdivision landscaping standards and identification of existing trees of a substantial size as part of the preliminary plat required data.
7. Participate in the National Flood Insurance Program and adopt Floodplain regulations.

Objective: Educate the community about its natural resource assets and encourage them to think about their use and impact on the natural resources of the community and greater areas.

Policy/Recommendations:

1. Maintain a current list of persons to contact at various local, state and federal agencies which are responsible for protecting the environment.
2. Distribute new information relating to environmental regulations to all policy makers and elected officials as it becomes available.
3. Promote environmental stewardship including reducing, recovering and recycling waste materials.
4. Maintain data that reflects the economic benefits of clean water to the local economy.
5. Attend annual meetings of lake associations and the SRWD to share information on surface water issues and to gain better insights on surface water issues.
6. Update and/or develop streamlined City permitting procedures including but not limited applications, checklists, fees, and inspections.
7. Provide developers and owners with technical assistance in applying Best Management Practices for stormwater management on road and land development projects.
8. Seek opportunities, such as conferences and publications to learn about emerging issues regarding the environment and provide training for elected and appointed officials to assist them in dealing with the complexities of environmental issues.

Objective: Every effort shall be made to identify and protect prehistoric and historic sites which meet national, state, or local criteria for historic designation from destruction or harmful alteration.

Policy/Recommendations:

1. SHPO should be referred to for all land use proposals where a possible impact to a historic or archaeological site has been identified.
2. Applicants with land use proposals that contain areas identified as being archaeologically sensitive should be required to conduct an investigation of the area's archaeological significance. The scale and location of the proposal will determine if such an investigation will be required.