Chapter Two:
Natural Resources

Chapter Two profiles one of Litchfield's greatest assets, its diverse natural resource-base. Information presented in this chapter includes climate, topography, original vegetation, geology, soils, surface water resources, and aquifers. As the City plans for future growth and development, it will be imperative to take into account the impact placed on these natural resources in an effort to prevent the loss of the many benefits they provide to the community.

Climate

The City of Litchfield is located in the continental climate zone, characterized by a wide range of weather patterns between seasons. During the winter months, cold, dry continental polar air dominates the region. Hot, dry continental air masses from the desert southwest, along with warm, moist maritime tropical air masses that originate over the Gulf of Mexico, are common during the summer months. The spring and fall months serve as transition periods between summer and winter, comprised of alternating intrusions of air from various sources. The average annual high temperature for the City is 52.3°F, while the average annual low temperature is 32.5°F. The mean total annual precipitation for Litchfield is 28.6 inches. Approximately 21 inches or 75 percent of the total annual precipitation falls in the summer months as rainfall. Average annual snowfall for the area is approximately 40 inches.

Presettlement Vegetation

The Minnesota Department of Natural Resources (DNR) has inventoried the original vegetation of the State by analyzing the detailed maps and records of early surveyors (circa 1895). The Litchfield area served as a transition between forest and prairie vegetative communities prior to settlement. A large area of forested land, known as the "Big Woods", was found just north and west of the City. Deciduous trees including aspen, oak, maple, basswood, and hickory were common in this area. Areas south and west of the City were dominated by prairie vegetation. Big bluestem and Indian grass occupied the deep soils of the moist uplands, while little bluestem and side oats grama covered the thin soils of the dry uplands. In general, bluejoint, prairie cordgrass, rushes, and sedges dominated the lowland areas and wetlands. Today, most of the presettlement vegetative communities of the area have been severely fragmented or lost due to development and agriculture.

Geology

Litchfield is underlain with rocks and geologic deposits of pre-Cambrian age (older than 500 million years), Cretaceous age (65 to 130 million years), and Quaternary age (Pleistocene, 1.8 million years to the present). The pre-Cambrian rocks are a complex of crystalline granite and mica schist that represent the bedrock of the region. These were originally magmas, of igneous origin, having been intruded into the earth's crust about 2 billion years ago. Their upper surface has weathered to a soft kaolinitic clay that is white where it overlies granite and grayish-green where it overlies schist. Well and boring records complied by the Minnesota Department of Health (MDH) indicate bedrock at approximately 400 feet.

In some locations sedimentary rocks of Cretaceous age are encountered as a relatively thin layer of less than 100 feet thick overlaying the granite. These rocks are generally soft blue or black shales interbedded with poorly consolidated, loosely cemented siltstone and sandstone. The blue clay and white quartz sands were deposited during the period when the Cretaceous sea covered much of the western interior of the North American continent. A well drilled in section 14 of Litchfield Township encountered sandstone at a depth of 340 feet.

A mantle of glacial drift of Quaternary age overlies the bedrock of the region. The drift was deposited during the pre-Wisconsin (more than 35,000 years ago) and Wisconsin (20,000 to 11,000 years ago) glaciations. It consists largely of till, an unstratified, unsorted mixture ranging from fine-grained sand to boulders imbedded in a silt-clay matrix and stratified sand and gravel of glacial outwash or ice-contact origin.

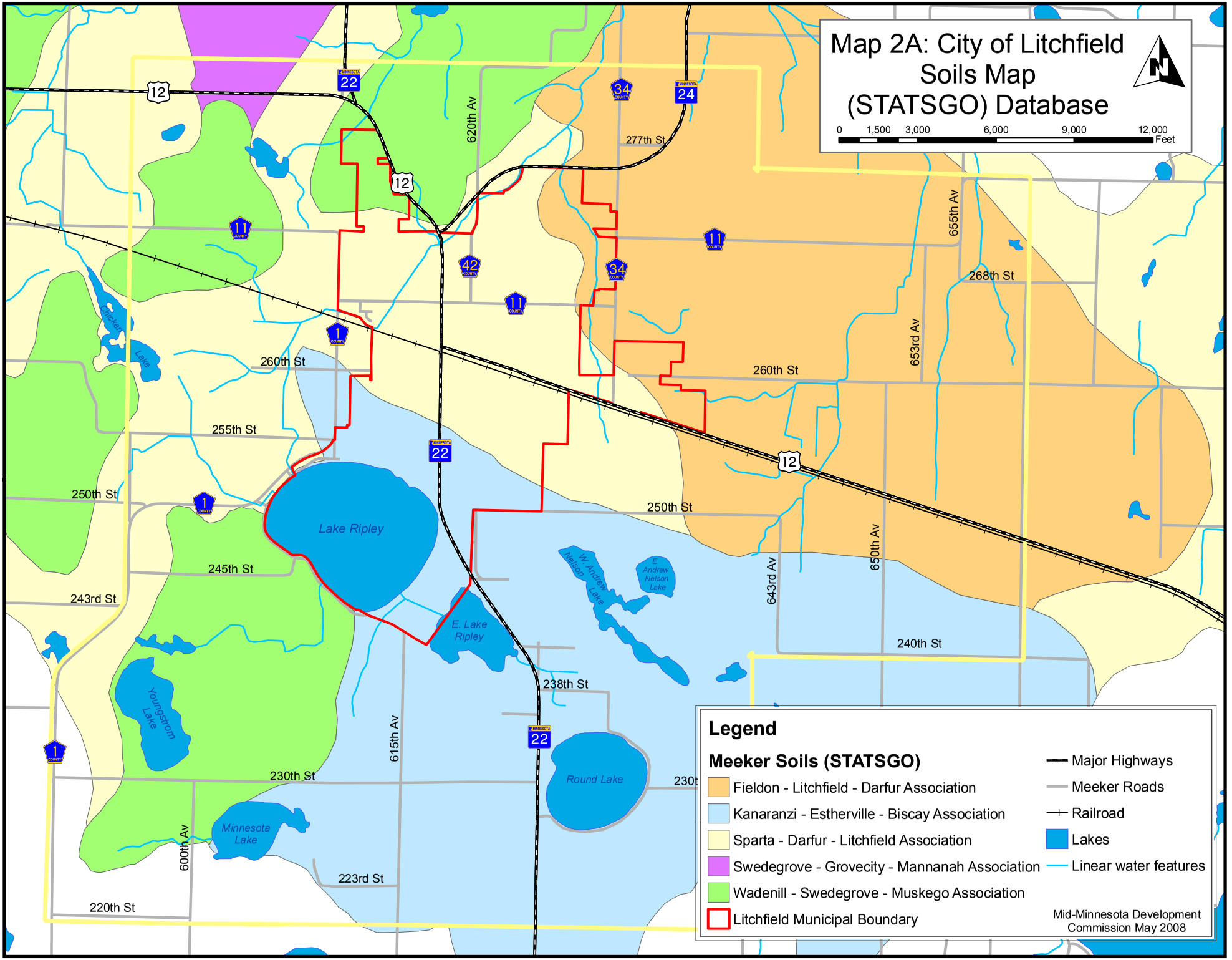
Soils

Soils develop from the breakdown of unconsolidated parent material, intermixed with plant and animal remains. Their formation is an extremely long process, taking place over hundreds to thousands of years. The soils of the watershed developed from glacial drift materials that were deposited during the last glaciation. Besides parent material, factors influential in soil genesis include climate, organisms, topography, and time.

The United States Department of Agriculture (USDA) has prepared a soil survey for all of Meeker County. The information contained in this survey is extremely important because it describes the characteristics associated with each soil type and what kinds of land-use activities are acceptable. For Litchfield, some of the most important characteristics will be drainage, water table, and suitability for building construction. A map of the soil map units in the Litchfield area is presented in Map 2A. It should be noted that soil surveys are not meant to be extremely accurate, but rather used as a guide. If the exact location of a soil with certain characteristics is needed, a sample from the site will need to be taken and analyzed. To view this information for a particular soil map unit, please obtain a copy of the USDA Soil Survey from the Meeker County Soil and Water Conservation District.

Aquifers

Aquifers are defined as water-bearing porous soil or rock strata that yield significant amounts of water to wells. The two principal aquifers types present in the Litchfield area are surficial-drift aquifers and buried-drift aquifers. Surficial-drift aquifers are localized and made up of sand or gravel deposits located at or near the surface. These aquifers are generally unconfined and have well depths ranging from 30-240 feet deep, with yields ranging from 25-500 gallons per minute. The water of these aquifers is generally of good quality, with high concentrations of iron and manganese present in some areas. Nitrate contamination is also a significant concern. Buried-drift aquifers are comprised of sand or gravel deposits, but because of repeated glaciation, are confined beneath layers of silt and clay. Well depths in these aquifers range from 80-500 feet deep, with yields of approximately 25-500 gallons per minute. Water from these aquifers generally contains high concentration of iron, manganese, sulfate, and chloride.


Map 2A: City of Litchfield
Soils Map
(STATSGO) Database
0 1,500 3,000 6,000 9,000 12,000 Feet
N
12
22
24
34
11
42
1
620th Av
277th St
655th Av
268th St
653rd Av
260th St
255th St
250th St
245th St
243rd St
650th Av
643rd Av
240th St
238th St
615th Av
230th St
600th Av
223rd St
220th St
Lake Ripley
E. Lake Ripley
W. Andrew Nelson Lake
E. Andrew Nelson Lake
Youngstrom Lake
Minnesota Lake
Round Lake
Chicken Lake
Legend
Meeker Soils (STATSGO)
Fieldon - Litchfield - Darfur Association
Kanaranzi - Estherville - Biscay Association
Sparta - Darfur - Litchfield Association
Swedegrove - Grovecity - Mannanah Association
Wadenill - Swedegrove - Muskego Association
Litchfield Municipal Boundary
Major Highways
Meeker Roads
Railroad
Lakes
Linear water features
Mid-Minnesota Development Commission May 2008

Wellhead Protection Areas

The City of Litchfield has four primary water supply wells. These wells are located in Section 11 of Litchfield Township. The water produced from these wells meets State and Federal drinking water standards. In an effort to safeguard these water supplies from contamination, the City is involved in a wellhead protection program with the MDH. There are two steps in the wellhead protection planning process: 1) delineation of the wellhead protection area (WHPA) and drinking water supply management area (DWSMA) and 2) creation of a wellhead protection (WHP) plan. The WHPA is defined as the recharge area of the well and is delineated based upon five criteria: time of travel, aquifer transmissivity, flow boundaries, daily volume of water pumped, and groundwater flow field. The DWSMA is the geographic area, including the WHPA, which is managed and protected in the WHP plan. The WHP plan identifies specific goals, objectives, and actions that the City can implement to protect its water supplies. Both of these steps have been completed for Litchfield. Map 2B displays Litchfield's WHPA and DWSMA. As a result of the creation of the WHP plan, the City's Public Works Department has installed signage and has developed an outreach program with the Wagner Elementary School. In addition, the City has appointed a committee to oversee wellhead protection efforts.

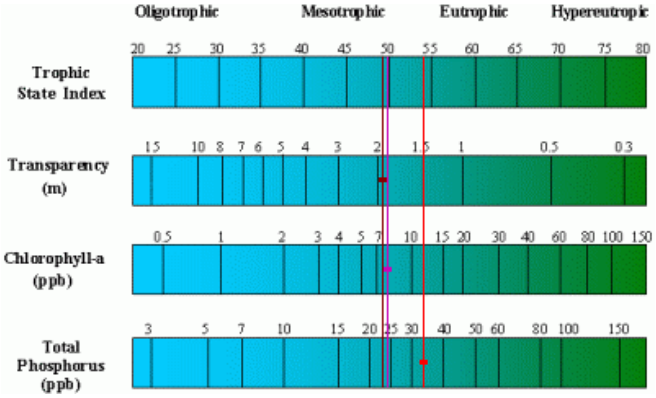
Surface Water Resources

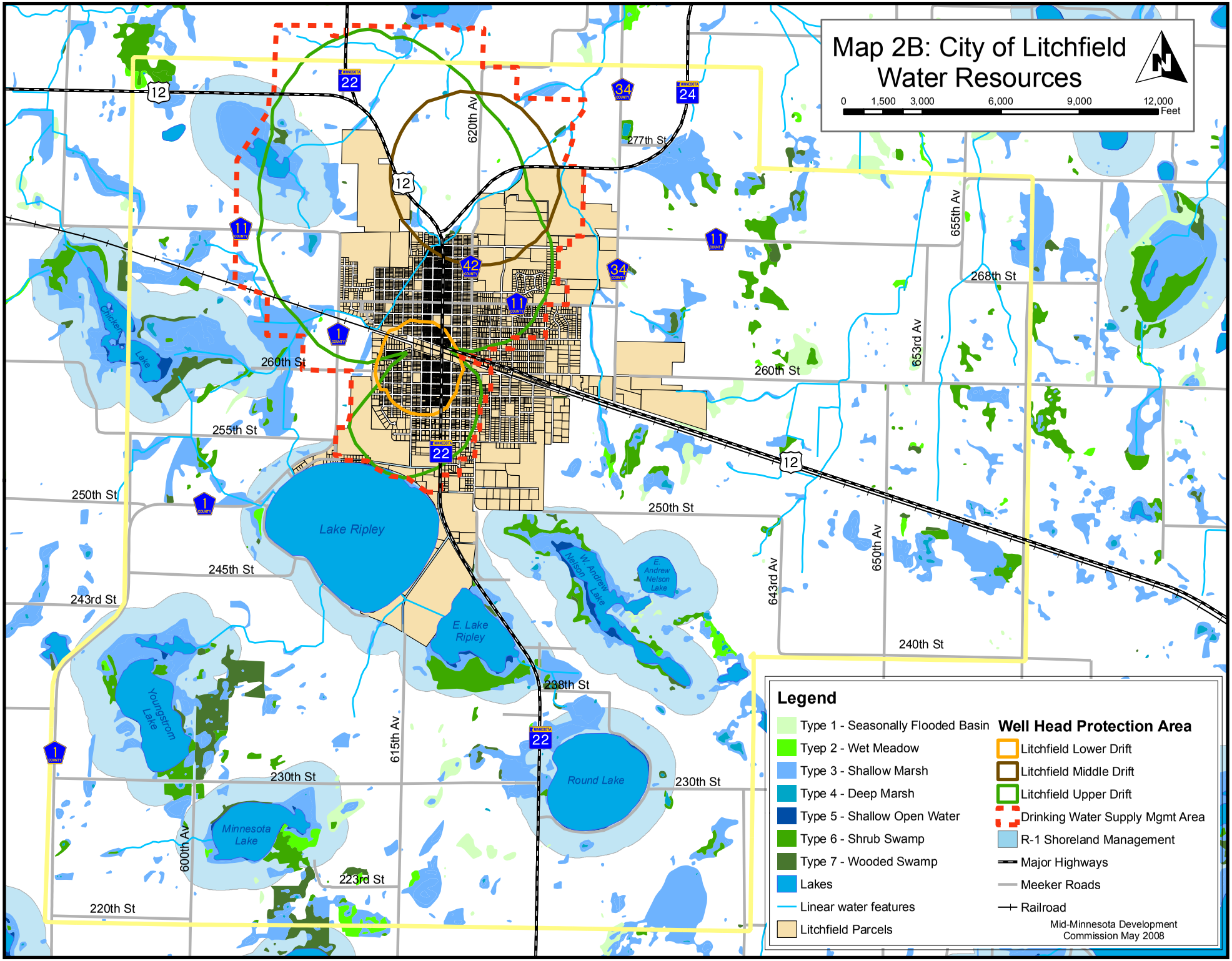
Litchfield is located within the North Fork of the Crow River Watershed, which is part of the Upper Mississippi River Watershed. Jewett Creek, the lone outlet of Lake Ripley, runs through the western edge of the City and connects with the North Fork of the Crow River near Forest City. Map 2B displays the City's surface water resources, which include Lake Ripley, Jewett Creek, and numerous wetlands. The following provides an overview of each of these resources.

Lake Ripley

Lake Ripley is located in the southwestern portion of the City. The basin encompasses approximately 558 acres and is quite shallow, with a mean depth of 10 feet and a maximum depth of 18 feet. The DNR has classified the lake as general development; a significant portion of its lakeshore is developed with residential housing. The City of Litchfield has adopted a shoreland ordinance to regulate lot size and structural setbacks on the lake. The lake has had a heavy cultural influence from the City of Litchfield over the past century. In the early 1900s, tourists from as far away as the East Coast and Florida traveled to Litchfield to enjoy the pristine water of Lake Ripley. Today, the water quality of the lake is average, but is improving thanks to the efforts of the Lake Ripley Improvement Association. According to Figure 2A, the lake is classified between mesotrophic and eutrophic (meaning nutrient rich), with an average transparency of 6.9 feet. Lake Ripley is infested with Eurasian watermilfoil and curlyleaf pondweed, both of which are non-native, invasive species.

Figure 2A
Lake Ripley Water Quality Summary




Map 2B: City of Litchfield
Water Resources
0 1,500 3,000 6,000 9,000 12,000
Feet
N
12
22
24
34
42
11
1
620th Av
277th St
655th Av
268th St
653rd Av
260th St
255th St
250th St
650th Av
643rd Av
245th St
243rd St
240th St
238th St
615th Av
230th St
600th Av
223rd St
220th St
Chicken Lake
Lake Ripley
E. Lake Ripley
W. Andrew Nelson Lake
E. Andrew Nelson Lake
Youngstrom Lake
Minnesota Lake
Round Lake
Legend
Type 1 - Seasonally Flooded Basin
Tyep 2 - Wet Meadow
Type 3 - Shallow Marsh
Type 4 - Deep Marsh
Type 5 - Shallow Open Water
Type 6 - Shrub Swamp
Type 7 - Wooded Swamp
Lakes
Linear water features
Litchfield Parcels
Well Head Protection Area
Litchfield Lower Drift
Litchfield Middle Drift
Litchfield Upper Drift
Drinking Water Supply Mgmt Area
R-1 Shoreland Management
Major Highways
Meeker Roads
Railroad
Mid-Minnesota Development Commission May 2008

Eurasian watermilfoil *(Myriophyllum spicatum)*

Eurasian watermilfoil was accidentally introduced to North America from Europe. Spread westward into inland lakes primarily by boats and waterbirds, it reached Midwestern states between the 1950s and 1980s. In nutrient-rich lakes it can form thick underwater stands of tangled stems and vast mats of vegetation at the water's surface. In shallow areas the plant can interfere with water recreation such as boating, fishing, and swimming. The plant's floating canopy can also crowd out important native water plants.

A key factor in the plant's success is its ability to reproduce through stem fragmentation and runners. A single segment of stem and leaves can take root and form a new colony. Fragments clinging to boats and trailers can spread the plant from lake to lake. The mechanical clearing of aquatic plants for beaches, docks, and landings creates thousands of new stem fragments. Removing native vegetation creates perfect habitat for invading Eurasian watermilfoil.

Eurasian watermilfoil has difficulty becoming established in lakes with well established populations of native plants. In some lakes the plant appears to coexist with native flora and has little impact on fish and other aquatic animals.

Adapted from the Minnesota DNR - www.dnr.state.mn.us

Eurasian watermilfoil typically has 12 to 21 pairs of leaflets. The native northern watermilfoil, with which it is often confused, usually has 5 to 9 pairs. *Drawing courtesy Bell Museum of Natural History.*

Several studies have been completed in recent decades to research the water quality issues of Lake Ripley. In 1986, the Minnesota Pollution Control Agency (MPCA) completed a Lake Assessment Program (LAP) study to assess the overall health of the lake. Water quality data was collected and analyzed as part of the study. The study concluded that a large improvement in the water quality of the Lake Ripley was not likely to result without a significant reduction in the amount of phosphorus entering the lake. Sources of phosphorus specifically mentioned included groundwater inputs from septic systems, agricultural runoff, urban runoff, and wetland drainage. Best management practices (BMPs) were prescribed to reduce nutrient loading to the lake and its tributaries.

A Phase 1 Clean Lakes Program Diagnostic Study was completed on Lake Ripley from June 1987 to September 1993. As part of the study, local stakeholders, including Meeker County and the City of Litchfield, worked in cooperation with the MPCA to collect data and information on the lake and its watershed. The study identified phosphorus loading as a priority issue. Noted sources of phosphorus included failing septic systems around Lake Ripley and runoff from nearby feedlots. Like the aforementioned LAP study, the diagnostic study prescribed BMPs to reduce phosphorus loading.

Lake Ripley represents a valuable recreational resource for the City of Litchfield and the surrounding region. The Jaycee Park is located on the east shore of the lake and offers a swimming area, playground equipment, and a public boat launch. West Ripley County Park is found on the west side of the lake and offers a picnic shelter, playground equipment, volleyball courts, horseshoe courts, a fishing pier, and a public boat launch. There is also a four-mile paved path that circles the lake. This is a popular destination for walkers, joggers, bikers, and in-line skaters.

In 2000, the DNR conducted a fishery survey on Lake Ripley. The survey involved an assessment of fish populations with standard lake survey gillnets and trapnets. Common fish species documented during the survey work included Black Bullhead, Black Crappie, Bluegill, Brown Bullhead, Common Carp, Largemouth Bass, Northern Pike, Pumpkinseed Sunfish, Walleye, Yellow Bullhead, and Yellow Perch. Fish were analyzed for length and average weight. The results of the surveys were then compared to the normal range of characteristics of fish caught in lakes with similar physical and chemical makeup. Overall, the fish populations were within or above the normal range of characteristics for similar lake types.

Jewett Creek

The water quality of Jewett Creek is adversely influenced by Lake Ripley and drainage systems. In fact, the stream was recently included on the Environmental Protection Agency's Section 303(d) List of Impaired Waters. This list is based upon violations of State water quality standards. Minnesota's statewide water quality standards are specified in Minn. Rules Chapter 7050. For each pollutant that causes a lake or stream to fail to meet State water quality standards, the Clean Water Act requires the State to conduct a Total Maximum Daily Load (TMDL) study, which identifies all point and nonpoint sources. Water quality sampling and computer modeling determine how much each pollutant source must reduce its contributions to assure the standard is met. Table 2A lists the four impairments of Jewett Creek and the expected start and completion dates of associated TMDLs.

Table 2A
Jewett Creek Water Quality Impairments
~ 2008 EPA Section 303(d) List ~

Reach	Description	Affected Use	Pollutant	TMDL	
				Start	End
Jewett Creek (County Ditches 19, 18, & 17)	Headwaters (Lk Ripley) to N Fk Crow R	Aquatic life	Ammonia	2005	2008
Jewett Creek (County Ditches 19, 18, & 17)	Headwaters (Lk Ripley) to N Fk Crow R	Aquatic life	Fish IBI	2006	2012
Jewett Creek (County Ditches 19, 18, & 17)	Headwaters (Lk Ripley) to N Fk Crow R	Aquatic life	Invertebrate IBI	2006	2012
Jewett Creek (County Ditches 19, 18, & 17)	Headwaters (Lk Ripley) to N Fk Crow R	Aquatic life	Low Oxygen	2005	2008

Wetlands

Wetlands are low depressions in the landscape covered with shallow and sometimes intermittent water. Wetlands are also commonly referred to as marshes, swamps, potholes, sloughs, shallow lakes, and ponds. While often considered to be marginal land, wetlands serve many functions in the natural ecosystem. In addition to providing habitat to thousands of species of flora and fauna, they provide numerous other benefits including natural water filtration, floodwater attenuation, aquifer recharge, and opportunities for recreation and aesthetic appreciation. Wetlands are classified according to their depth of water, total area, and seasonal life span.

Wetlands are regulated and protected under numerous federal and state laws. Those that are regulated and protected under the State of Minnesota's Public Waters Inventory include all Types 3, 4, and 5 wetlands that are ten or more acres in size in unincorporated areas or two and one half or more acres in size in incorporated areas. Any work done below the ordinary high water mark of public waters requires a permit from the Minnesota DNR. For additional information concerning applicable wetland laws and regulations, please contact the Meeker County Soil and Water Conservation District or Minnesota DNR.

Map 2B details the wetland resources of the City of Litchfield and surrounding area, as derived from the U.S. Fish and Wildlife Service's National Wetlands Inventory. Notice the large number of Type 3 and greater wetlands that are found in the immediate area. As the City expands, it may be desirable to utilize these wetlands as natural areas, which can be viewed from walking trails, picnic areas or bike paths.

Floodplains

Historically, development has occurred in floodplains adjacent to waterways and lakes. In order to protect existing property and structures within these areas, Federal and State governments have enacted laws governing floodplains. The DNR and the Federal Insurance Administration, under the Federal Emergency Management Agency (FEMA), are responsible for regulating and defining areas of flood hazard, known as the 100-year floodplain. The State of Minnesota, under the Floodplain Management Act, requires local units of government to adopt a floodplain ordinance compliant with minimum State and Federal standards. Local enforcement is generally through the city or county zoning official and the regional DNR hydrologist.

Map 2B identifies the FEMA 100-year floodplain for the City and surrounding area. Notice that the entire designated floodplain is found along Jewett Creek and adjacent to Lake Ripley. Flooding in these areas is generally minimal, except during heavy rainfall events and rapid snowmelt in the spring.