2.0 Inventory and Condition Assessment

This section documents existing conditions and resource characteristics within the Elm Creek watersheds. Where the Second Generation Watershed Management Plan included a detailed inventory of conditions, that data is not repeated here. A summary of that information is provided for context, with new or updated information presented in more detail.

The Physical Environment subsection describes the watershed's physical setting, geology and geomorphology, soils, and water resources. The Biological Environment subsection describes vegetation, biodiversity and native communities, unique features, and the biology of lakes and streams. The subsection Human Environment describes land use and growth patterns, recreational resources, and potential environmental hazards. The lakes, streams, and wetlands in the watershed are described in the Water Resources section.

2.1 WATERSHED PHYSICAL ENVIRONMENT

2.1.1 Location

The Elm Creek watershed covers just over 130 square miles in northwestern Hennepin County. There are six municipalities with land in the watershed (Figure 1.1 (page 1-1), Table 2.1).

Table 2.1. Cities in the Elm Creek watershed.

Cities	Area (sq mi)
Champlin	3.08
Corcoran	36.06
Dayton	25.17
Maple Grove	26.32
Medina	9.34
Plymouth	4.44
Rogers	26.20
Total	130.61

2.1.2 Topography and Drainage

The drainage pattern in the watershed is typical of a glaciated morainic area- gently rolling with low, round-top hills and numerous small wetlands in low areas. There are four primary landforms found in the watershed, each distinguished by varying patterns of glacial drift. Thinly spread drift formed till plains. The southern edge of the watershed is located within the Lonsdale-Lerdal Till Region, with characteristic low hills and depressions and clayey soils.

The central area of the watershed is located in the Waconia-Waseca Moraine or Emmons-Faribault Moraine. These landforms are similar, but the Waconia-Waseca landform is often dominated by loamy-silty soils and the Emmons-Faribault by silty-clayey soils. Moraines are formed from glacial till

dumped at the edges of glaciers creating belts of hills. Numerous rugged hills or "knobs" and deep irregular depressions called "kettles" dominate morainic landforms. Kettles are formed when isolated blocks of ice melted, often creating lakes, ponds, and wetlands. These depression areas tend to be poorly drained.

The Mississippi Valley Outwash Plain runs along the Crow and Mississippi Rivers. An outwash plain forms when glacial meltwater dropped sorted and stratified materials. When blocks of glacial ice melt they may form small shallow lakes. Landforms undulate and roll in gentle terraces and bottom lands.

Additional detail on the geologic history of the watershed can be found in the 2003 Elm Creek Watershed Management Plan and in the Hennepin County Geologic Atlas (Balaban 1989).

Four streams drain most of the watershed: Elm Creek and three tributaries: Rush Creek, North Fork Rush Creek, and Diamond Creek. Elm Creek discharges into the Mississippi River just downstream of the Champlin Mill Pond. The northwestern part of the watershed drains through small channels and ditches to the Crow River and a small portion of the north drains directly to the Mississippi River. Figure 2.1 shows the major watershed drainage features, including subwatershed boundaries, lakes, and streams.

2.1.3 Climate

The climate is predominately continental. Sitting close to the middle of North America, the weather in the watershed can vary widely and rapidly. Both temperature and precipitation can change abruptly. Table 2.2 shows the watershed's temperature normals, or averages, for the last 30 years.

Table 2.2. Temperature normals in °F for the Elm Creek watershed.

Twin Cities (1981-2010)													
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Annual**
Maximum	23.7	28.9	41.3	57.8	69.4	78.8	83.4	80.5	71.7	58.0	41.2	27.1	55.3
Minimum	7.5	12.8	24.3	37.2	48.9	58.8	64.1	61.8	52.4	39.7	26.2	12.3	37.3
Mean	15.6	20.8	32.8	47.5	59.1	68.8	73.8	71.2	62.0	48.9	33.7	19.7	46.3
Crystal Airport (1981-2010)													
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Annual**
Maximum	23.8	29.1	41.6	57.8	70.0	79.1	83.4	82.5	72.0	58.8	41.5	27.3	55.7
Minimum	6.7	11.5	22.6	35.7	46.9	57.2	62.0	60.1	50.4	37.9	24.9	11.7	35.8
Mean	15.2	20.3	32.1	46.8	58.4	68.2	72.7	71.3	61.2	48.4	33.2	19.5	45.7

Source: Minnesota State Climatology Office and National Climatic Data Center.

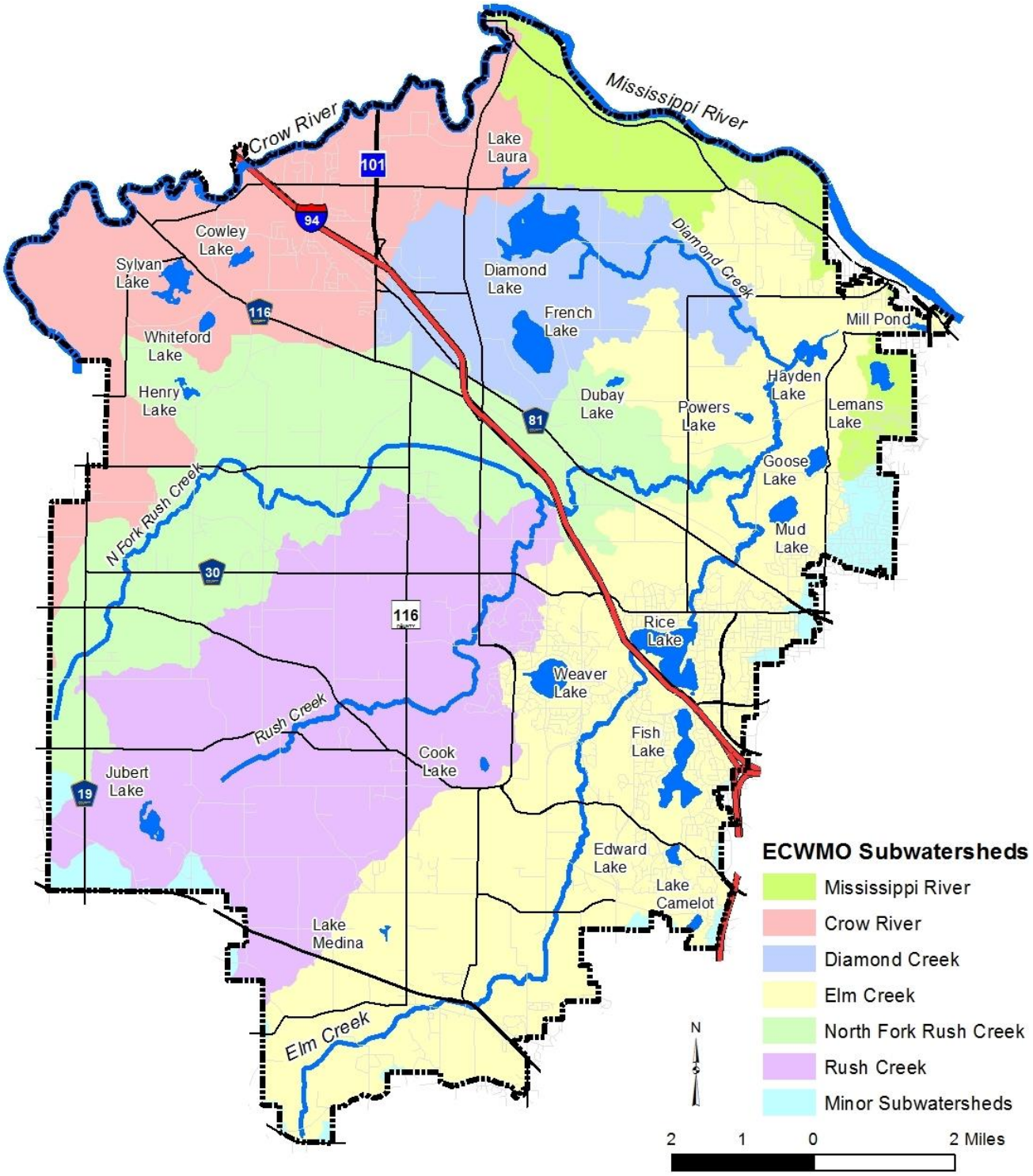

Figure 2.1. Elm Creek watershed drainage system.
Source: Minnesota DNR.

In a normal year, around 30 inches of precipitation falls on the watershed. Table 2.3 shows the watershed's precipitation normals. Winter snowfall averages about 40 inches, which is about 15 inches less than the Twin Cities receives annually. Snow generally stays on the ground from mid-December to early March. Snow and rainfall data for the watershed is obtained at weather stations in Minneapolis and Rockford.

Table 2.3. Precipitation normals in inches for the Elm Creek watershed.

Twin Cities (1981-2010)													
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Annual**
Precipitation	0.90	0.76	1.89	2.65	3.36	4.25	4.04	4.29	3.07	2.43	1.76	1.15	30.57
Snow	11.7	8.5	10.8	2.8	0	0	0	0	0	0.6	8.9	12.2	55.5
Rockford (1981-2010)													
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Annual**
Precipitation	0.92	0.86	1.55	2.67	3.36	4.44	3.84	4.00	3.44	2.37	1.71	1.08	29.46
Snow	7.2	6.8	7.8	3.0	0	0	0	0	0	0.3	7.0	10.8	39.9

Source: National Oceanic and Atmospheric Administration (NOAA) National Weather Service.

2.1.4 Soils

Most of the watershed is located within the Grantsburg Loamy Till Plain. The glacial till is interspersed with pockets of silt, sand, and gravel, mantled with patches of clayey, silty, or sandy sediments (Kennedy and Lueth 1976.) Perched water tables are common in these landscape units.

Soil texture is generally loamy or sandy with scattered organic or marsh soils areas. These soils have moderate to minimum infiltration rates ranging from 0.15 to 0.30 inches per hour when thoroughly wetted. Wind erodibility is also generally low to moderate. Highly to moderately permeable soils dominate the watershed (Figure 2.2). Soil hydrologic group characteristics are detailed in Table 2.4.

The soils information in Figure 2.2 is provided for use in describing the general characteristics of the major soil associations for summary purposes. The Hennepin County Soil Survey or site soil borings should be consulted for site-specific information.

2.1.5 Geology and Geomorphology

The bedrock underlying the watershed is generally St. Lawrence and Franconia Formation sandstone and shale 100 to 250 feet below the surface. A dendritic network of 200-400 foot deep bedrock valleys carved down to the Eau Claire Formation underlies the watershed, and many of the area's lakes and wetlands resulted from melting iceblocks deposited in or carried to these valleys. The surficial geology of the watershed is generally loamy glacial till, with sand and gravel outwash deposits along the Crow River, and Middle Terrace sand and gravelly sand deposits along the Mississippi (Balaban 1989).

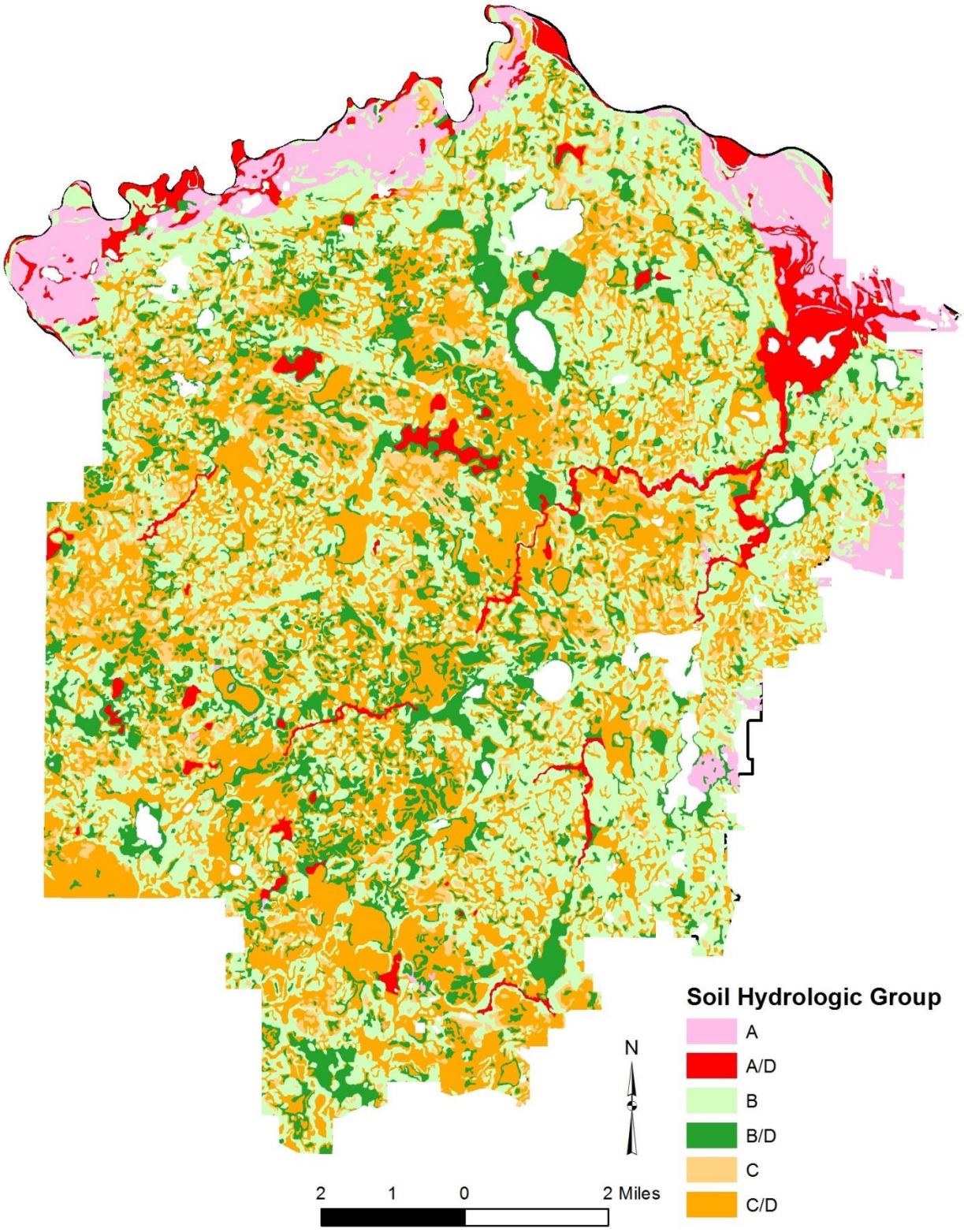

Figure 2.2. Soils by Hydrologic Soil Group classification.
Source: USDA NRCS SSURGO.

Table 2.4. Soil characteristics and infiltration rates by Hydrologic Soils Group (HSG).

HSG	Infiltration Rate/Hour	Texture	Unified Soil Classification System
A	1.63"	Gravel, sandy gravel and silt gravels	GW – well graded gravels, sandy gravels GPO – Gap-graded or uniform gravels, sandy gravels GM – Silty gravels, silty sandy gravels SW – Well-graded, gravelly sands
	0.8	Sand, loamy sand or sandy loam	SP – Gap-graded or uniform sands, gravelly sands
B	0.45	Silt loam	SM – Silty sands, silty gravelly sands
	0.3	Loam	MH – Micaceous silts, diatomaceous silts, volcanic ash
C	0.2	Sandy clay loam	ML – Silts, very fine sand, silty or clayey fine sands
D	0.06	Clay loam, silty clay loam, sandy clay, silty clay or clay	GC – Clayey gravels, clayey sandy gravels SC – Clayey sands, clayey gravelly sands CL – Low plasticity clays, sandy or silty clays OL – Organic silts and clays of low plasticity CH – Highly plastic clays and sandy clays OH – Organic silts and clays of high plasticity

Source: Minnesota Stormwater Manual.

Four major geomorphic regions are found in the watershed: the Lonsdale-Lerdal Till Region along the southwest border of the watershed; the Waconia-Waseca Moraine in the central part of the watershed; the Emmons-Faribault Moraine in the north; and Mississippi Valley Outwash along the Crow and Mississippi Rivers (University of Minnesota 1975).

There are a series of glacial eskars - long, narrow ridges of sand and gravel deposited by a glacial stream running below a melting glacial lobe – in the vicinity of Elm Creek Park Reserve. One eskar runs north-northeast along the west side of Powers Lake to near the intersection of Pineview Lane and 129th Avenue North. Another runs from Territorial Road along the west side of Mud Lake to the south side of Hayden Lake. A third runs north-northeast along the east side of Mud Lake and Goose Lake and the west side of Lemans Lake.

2.2 WATERSHED BIOLOGICAL ENVIRONMENT

2.2.1 Vegetation

Prior to settlement by the Europeans in the mid-19th century, vegetation in the watershed was primarily Big Woods, dominated by maple-basswood forest and punctuated by patches of wet prairie (Figure 2.3). The eastern edge of the watershed was a transition zone from the oak savanna/prairie landscape to the east. The Minnesota Biological Survey (MBS) has identified locations in the watershed with intact native plant communities, and those with biodiversity significance (see Figure 2.4). Native plant communities are a group of native plants that interact with each other and the surrounding environment in ways not greatly altered by humans or by introduced plant or animal species. Table 2.5 details the native plant community types that have been identified in the watershed. Many of these are located in the Elm Creek and Crow-Hassan Park Reserves.

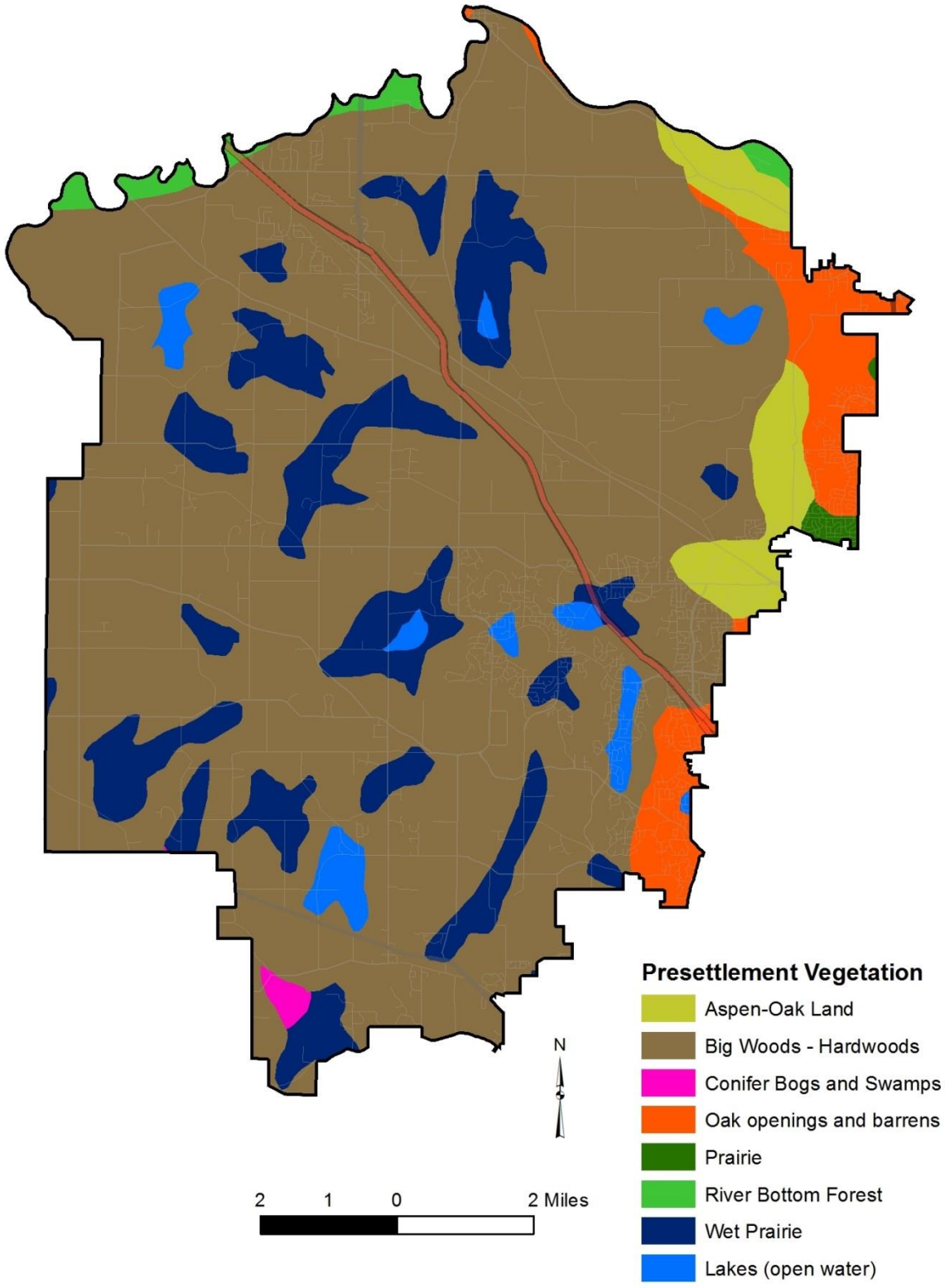

Figure 2.3. Presettlement vegetation in the Elm Creek watershed.
Source: Minnesota DNR.

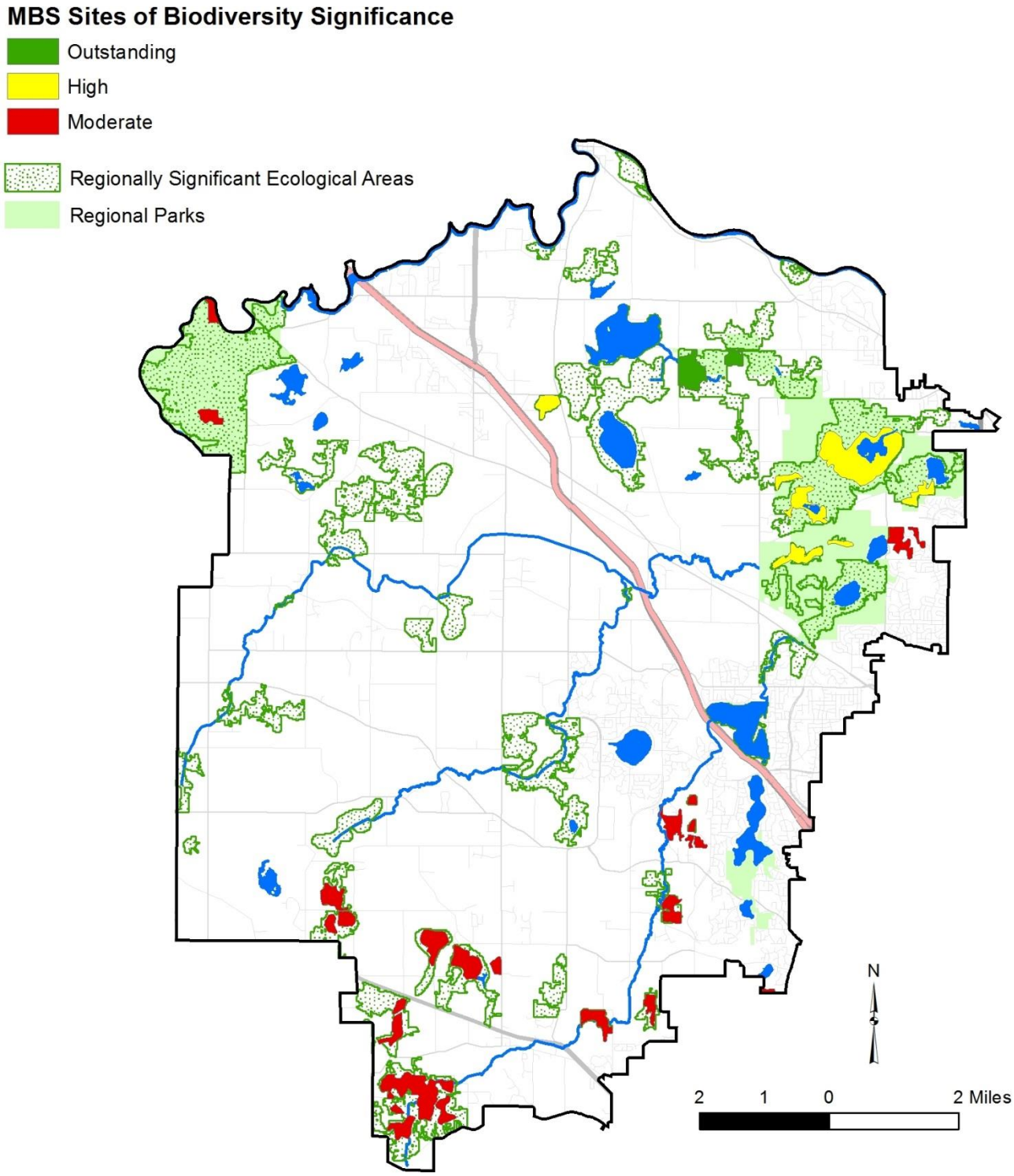

Figure 2.4. Sites of ecological diversity in the Elm Creek watershed.
Source: Minnesota DNR.

Table 2.5. Native plant community types observed in the Elm Creek watershed.

Community Type	Last Observed
Black Ash Swamp	1995
Lowland Hardwood Forest	1996
Mixed Hardwood Swamp	1995
Wet Meadow	1996
Shrub Swamp Seepage Subtype	1996
Oak Forest (Big Woods)–Mesic Subtype	1995
Floodplain Forest Silver Maple Subtype	1998
Maple-Basswood Forest (Big Woods)	1995
Tamarack Swamp Minerotrophic Subtype	1995

Note: Current as of 2013. Not based on a comprehensive survey of the state or watershed. Absence of observation does not mean other species or community types are not present.
Source: Natural Heritage and Nongame Research Program of the Division of Ecological and Water Resources, Minnesota Department of Natural Resources (DNR).

Rare, Threatened, and Endangered Species. The DNR Natural Heritage and Nongame Research Program maintains a database of observations of rare plant and animal species compiled from historical records from museum collections and published information supplemented with data from years of field work. Table 2.6 shows the rare plant species listed in that database as being observed recently or at some time in the past within the watershed.

Table 2.6. Rare plant species observed in the Elm Creek watershed.

Scientific Name	Name	Last Observed	Federal Status	State Status
Panax quinquefolius	American Ginseng	1997	None	Special Concern

Note: Current as of 2013. Not based on a comprehensive survey of the state or watershed. Absence of observation does not mean other species are not present. Some species may have multiple observations.
Source: Natural Heritage and Nongame Research Program of the Division of Ecological and Water Resources, Minnesota Department of Natural Resources (DNR).

2.2.2 Fish and Wildlife

Lakes. Fishing is possible on many of the lakes in the Elm Creek watershed, with many having a public access and several a DNR fishing pier or shore access. Mill Pond and Boundary Creek Park Ponds are included in the DNR's Fishing in the Neighborhood (FIN) program, which provides education and programming to encourage and support youth fishing. Weaver Lake and the FIN lakes have been stocked with fish by the DNR (Table 2.7.) The Elm Creek Commission has not conducted any fish surveys on the lakes in the watershed. The DNR Lakefinder website may be consulted to find the latest fish survey information for each lake.

Table 2.7. DNR fish stocking in lakes in the Elm Creek watershed, 2003-2013.

Lake	Year(s) Stocked	Fish Stocked
Boundary Creek Ponds	2011-2012	Bluegill, Black Crappie
Mill Pond	2003 - 2012	Bluegill, Black Crappie
Weaver	2006	Tiger Muskie

Source: Minnesota DNR.

Streams. Elm Creek and its tributaries Diamond, Rush, and South Fork Rush Creeks are listed as Impaired Waters for biotic integrity. Minnesota uses an Index of Biotic Integrity (IBI) to assess the fish and macroinvertebrate communities in streams. The IBI evaluates and integrates multiple attributes of the aquatic community, or "metrics," to evaluate a complex biological system. Each metric is based upon a structural (e.g., species composition) or functional (e.g., feeding habits) aspect of the aquatic community that changes in a predictable way in response to human disturbance. Fish and macroinvertebrate IBIs are expressed as a score that ranges from 0-100, with 100 being the best score possible. A stream's biota is considered to be impaired when the IBI for fish or macroinvertebrates falls below the threshold established for that category of stream. Table 2.8 and Figure 2.5 and Figure 2.6 show the Index of Biotic Integrity scores used to evaluate these streams for biotic impairment.

A Stressor Identification Study ("Stressor ID") (Lehr 2015) is part of the WRAPS report completed for the watershed. That study evaluated the possible factors, or stressors, causing the impairments and identified those that are most likely affecting the fish and macroinvertebrate communities.

Table 2.8. Index of Biotic Integrity listing criteria and relevant data.

Stream	Reach	Site ID	Fish IBI		Macroinvertebrate IBI	
			Score	Threshold	Score	Threshold
Diamond Cr	French Lk to Unnamed Lk	99UM085	1	40	n/a	n/a
Diamond Cr	French Lk to Unnamed Lk	10UM008	19	40	46.8	46.8
Rush Cr	Headwaters to Elm Cr	07UM097	24	40	15.0	46.8
					5.7	46.8
Rush Cr	Headwaters to Elm Cr	99UM081	34	40	42.6	46.8
Rush Cr	Headwaters to Elm Cr	99UM081	26	40		
Rush Cr	S Fork (Unnamed Ditch to CD 16)	10UM013	1	40	31.4	46.8
Rush Cr	S Fork (Unnamed Lake to Rush Cr)	10UM011	20	40	31.3	46.8
Rush Cr	S Fork (Unnamed Lake to Rush Cr)	10UM014	1	40	37.9	46.8
Elm Cr	Headwaters to Mouth	10UM034	1	40	32.9	46.8
Elm Cr	Headwaters to Mouth	10UM035	6	40	45.6	46.8
Elm Cr	Headwaters to Mouth	10UM035	3	40		
Elm Cr	Headwaters to Mouth	10UM009	19	40	29.0	
Elm Cr	Headwaters to Mouth	97UM002	19	50	n/a	n/a
Elm Cr	Headwaters to Mouth	97UM002	29	50		
Elm Cr	Headwaters to Mouth	97UM002	35	50		
Elm Cr	Headwaters to Mouth	99UM082	28	50	n/a	n/a
Elm Cr	Headwaters to Mouth	00UM085	26	50	65.1	46.8
Elm Cr	Headwaters to Mouth	10EM167	24	50	45.1	46.8

Source: Elm Creek Stressor ID study (Lehr 2015).

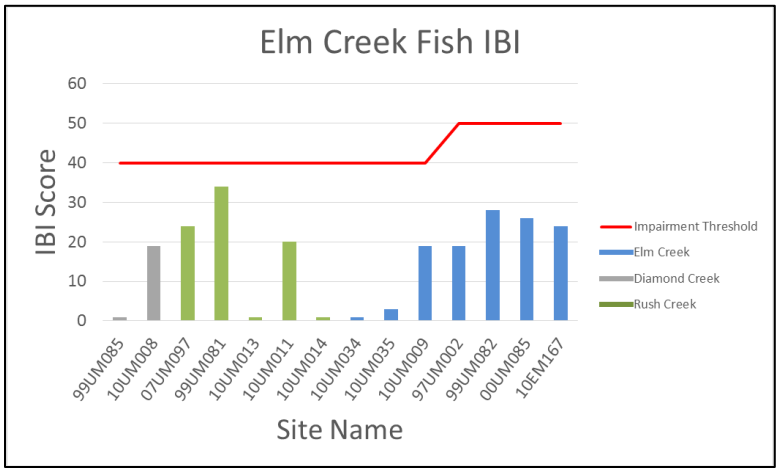

Figure 2.5. Fish IBI scores compared to the impairment threshold.
Source: Elm Creek Stressor ID study (Lehr 2015).

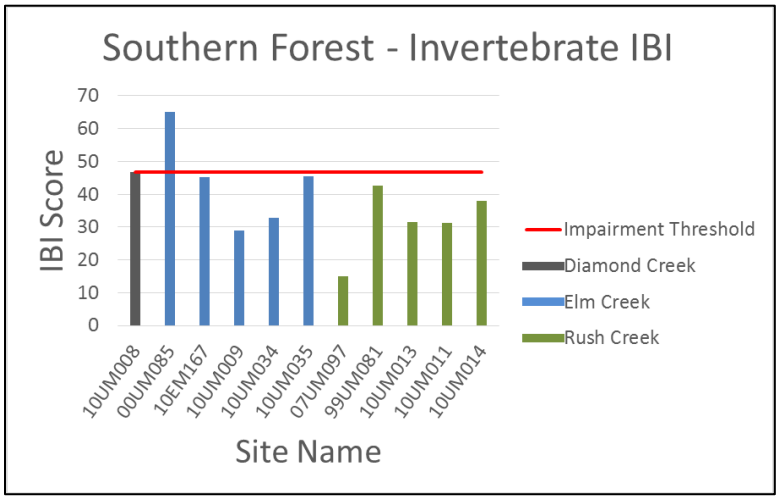

Figure 2.6. Macroinvertebrate IBI scores compared to the impairment threshold.
Source: Elm Creek Stressor ID study (Lehr 2015).

Rare, Threatened, and Endangered Species. The DNR Natural Heritage and Nongame Research Program maintains a database of observations of rare plant and animal species compiled from historical records from museum collections and published information supplemented with data from years of field work. Table 2.9 shows the rare fish and wildlife species listed in that database as being observed recently or at some time in the past within the watershed. Many of these observations were within one of the regional park reserves in the watershed.

Table 2.9. Rare animal species observed in the Elm Creek watershed.

Scientific Name	Name	Last Observed	Federal Status	State Status
Ammodramus henslowii	Henslow's sparrow	1997	None	Endangered
Bartramia longicauda	Upland sandpiper	1983	None	Watchlist
Botaurus lentiginosus	American bittern	1992	None	Watchlist

Scientific Name	Name	Last Observed	Federal Status	State Status
Cygnus buccinator	Trumpeter Swan	2011	None	Special Concern
Empidonax virescens	Acadian flycatcher	1997	None	Special Concern
Emydoidea blandingii	Blanding's Turtle	2008	None	Threatened
Gallinula galeata	Common gallinule	1991	None	Special Concern
Haliaeetus leucocephalus	Bald eagle	1998	None	Watchlist
Lanius ludovicianus	Loggerhead shrike	1994	None	Endangered
Notropis anogenus	Pugnose shiner	1948	None	Threatened
Pituophis catenifer	Gopher snake	1992	None	Special concern
Ligumia recta	Black sandshell	2007	None	Special concern

Note: Current as of 2013. Not based on a comprehensive survey of the state or the watershed. Absence of observation does not mean other species are not present. Some species may have multiple observations.
Source: Natural Heritage and Nongame Research Program of the Division of Ecological and Water Resources, Minnesota Department of Natural Resources (DNR).

Aquatic Invasive Species. Three lakes in the watershed have been determined by the Department of Natural Resources (DNR) to be infested with Eurasian watermilfoil, an invasive exotic plant species: Rice Lake, Weaver Lake, and Fish Lake.

2.2.3 Unique Features and Scenic Areas

The Elm Creek Watershed has many natural areas, water resources, and local parks. Three Rivers Park District operates three regional facilities: Fish Lake, Elm Creek and Crow-Hassan Regional Park Reserves. At Fish Lake Regional Park, swimming, boating, paddling, and ice fishing are popular activities, along with hiking and biking and picnicking.

The 4,900 acre Elm Creek Regional Park Reserve features picnic grounds, a large creative play area, a swimming pond, a winter sports area, and an extensive bicycle/pedestrian trail system that allows users to view the park's lakes, wetlands, and Elm and Rush Creeks. The Eastman Nature Center in Elm Creek Park features quiet reading and observation rooms, large classrooms, a professional exhibit area with wildlife watching, and outdoor learning facilities such as display gardens, a floating boardwalk, pond observation blind, amphitheater, orienteering courses, and demonstrative plantings for wildlife.

Crow-Hassan Regional Park Reserve is operated as a nature reserve, with limited facilities but extensive hiking, cross country skiing, and horse riding trails, and several campgrounds along the Crow River. The Reserves are also home to many of the rare and endangered species and special habitats described above.

Those regional park facilities are shown on Figure 2.7, which also shows boat ramps, fishing beaches, and fishing piers. Local or private access to the lakes, streams and rivers are not shown on this figure.

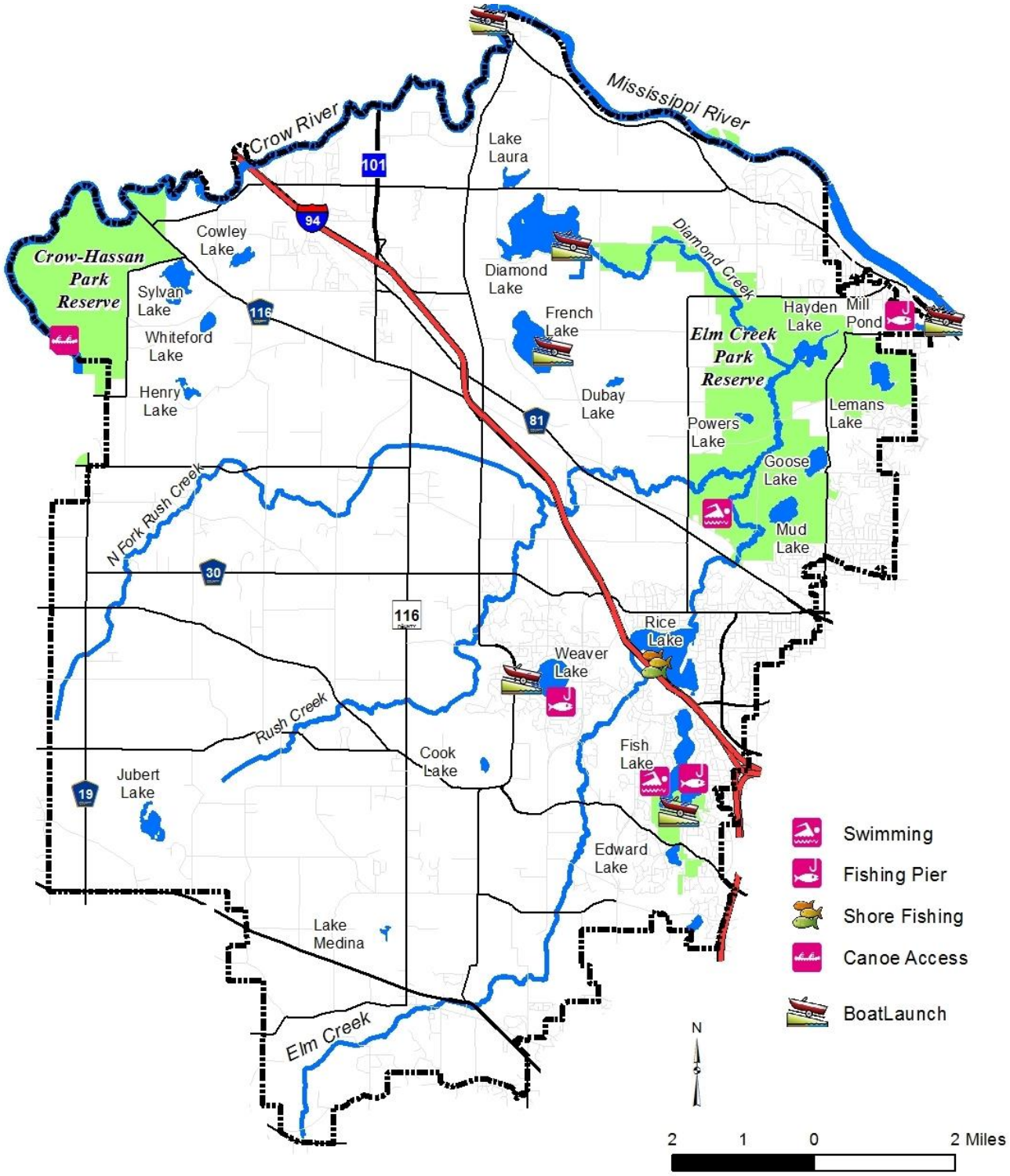

Figure 2.7. Water-based recreation in the Elm Creek watershed.
Source: Minnesota DNR.

2.3 WATERSHED HUMAN ENVIRONMENT

The notes of the Public Land Survey conducted in 1856 describe the townships of the watershed as being 'extremely timbered,' generally level, and with many lakes and marshes. The first known settler of European descent arrived in the Dayton area in 1851, settling on the site of a French fur trading post. Other claims followed, mostly along the Mississippi and Crow Rivers and near the lakes. In 1854 the first hotel in Dayton was erected near the confluence of the Crow and Mississippi Rivers, the post office was established in 1855, and in 1856 a mill was built just downstream of the Crow. A church followed in 1857 and a school in 1859, the year the village was organized. Territorial Road was authorized by the Territorial Legislature in 1855, fueling growth in the area, and the hamlet of Hassan was organized in 1869.

The area now known as Corcoran drew settlers as early as 1855. P.B. Corcoran was one of the earliest settlers, and was variously the school teacher, shop keeper, and post master. The town was organized at his house in 1858. Louis Gervais and Pierre Bottineau arrived in 1851 and staked their claims in what is now Maple Grove. At least two sawmills were operated in early Maple Grove: one on Elm Creek north of today's County Road 30, and one on Rice Lake. The watershed remained primarily agricultural until the mid-20th century (Rogers-Hassen, Dayton, and Maple Grove Historical Societies; City of Corcoran).

2.3.1 Current Land Use

The predominant land use in the watersheds is Agriculture (Table 2.10), followed by Undeveloped, a category which includes undevelopable wetlands and grasslands in addition to lands that are currently vacant and developable. Only about a quarter of the watershed is developed, clustered in the eastern part of the watershed, and along the I-94 corridor. About half the watershed is located within the Municipal Urban Services Area (MUSA), although most of the area draining through Rush Creek and North Fork Rush Creek lies outside the MUSA. The 2010 Census population of the watershed is approximately 93,000 persons in 33,600 households.

Table 2.10. 2010 land use in the Elm Creek watershed.

Land Use	Elm Creek	
	Area (acres)	%
Agricultural	25,634	31.0
Undeveloped	21,821	26.4
Single Family	15,584	18.8
Park, Recreational, or Preserve	10,317	12.5
Open Water	3,167	3.8
Industrial and Utility	1,440	1.7
Golf Course	1,297	1.6
Institutional	1,044	1.3
Commercial	1,001	1.2
Farmstead	896	1.1

Land Use	Elm Creek	
	Area (acres)	%
Railway and Highway	251	0.3
Multifamily	159	0.2
Extractive	76	0.1
Mixed Use (Commercial/Residential)	33	<0.1
Total	82,720	100

Source: Metropolitan Council.

2.3.2 Current Land Cover

The Minnesota Land Cover Classification System (MLCCS) is a tool to systematically categorize areas in terms of land cover rather than land use. It is especially useful for natural resource managers as it is a hierarchical system of classification that allows users to graphically depict high-level general classifications or detailed specific plant species. Figure 2.9 shows the high-level general classification of land cover types in the watershed.

2.3.3 Future Land Use

Areas of projected urban growth are shown in Figure 2.10. This data was compiled by the Metropolitan Council from cities' most recent Comprehensive Plans, and represents cities' expected 2020 land use. Significant growth and development is expected in Corcoran, Medina, Dayton and Rogers, along major transportation corridors and within the 2020 MUSA.

2.3.4 Potential Environmental Hazards

Groundwater connections, hazardous waste, leaking above- and below-ground storage tanks, and feedlots can be potential sources of surface and groundwater contamination. The MPCA maintains a current on-line mapping tool with information about air quality, hazardous waste, remediation, solid waste, tanks and leaks, and water quality. This tool is available at www.pca.state.mn.us/udgx680.

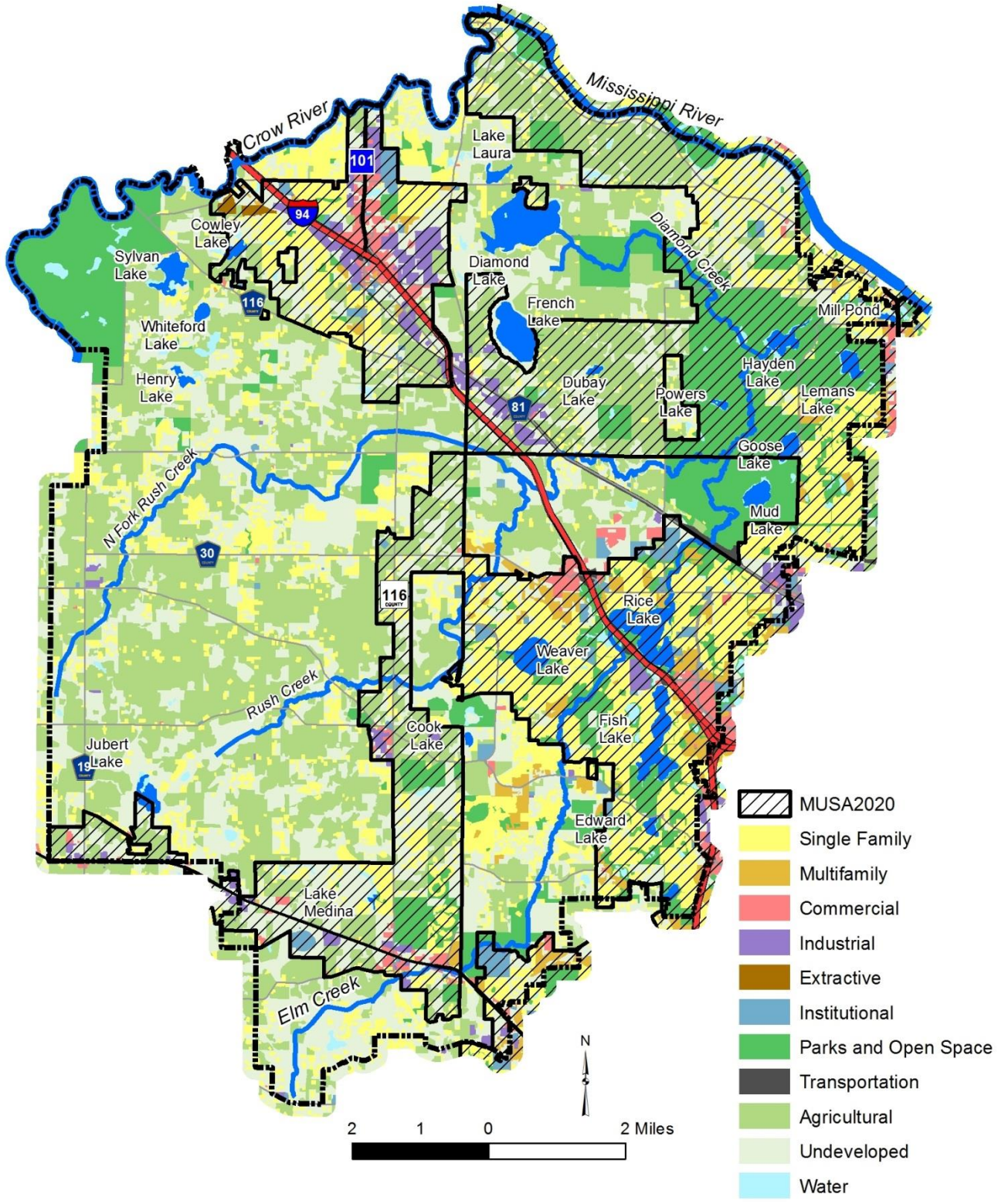

Figure 2.8. 2010 land use in the Elm Creek watershed.
Source: Metropolitan Council.

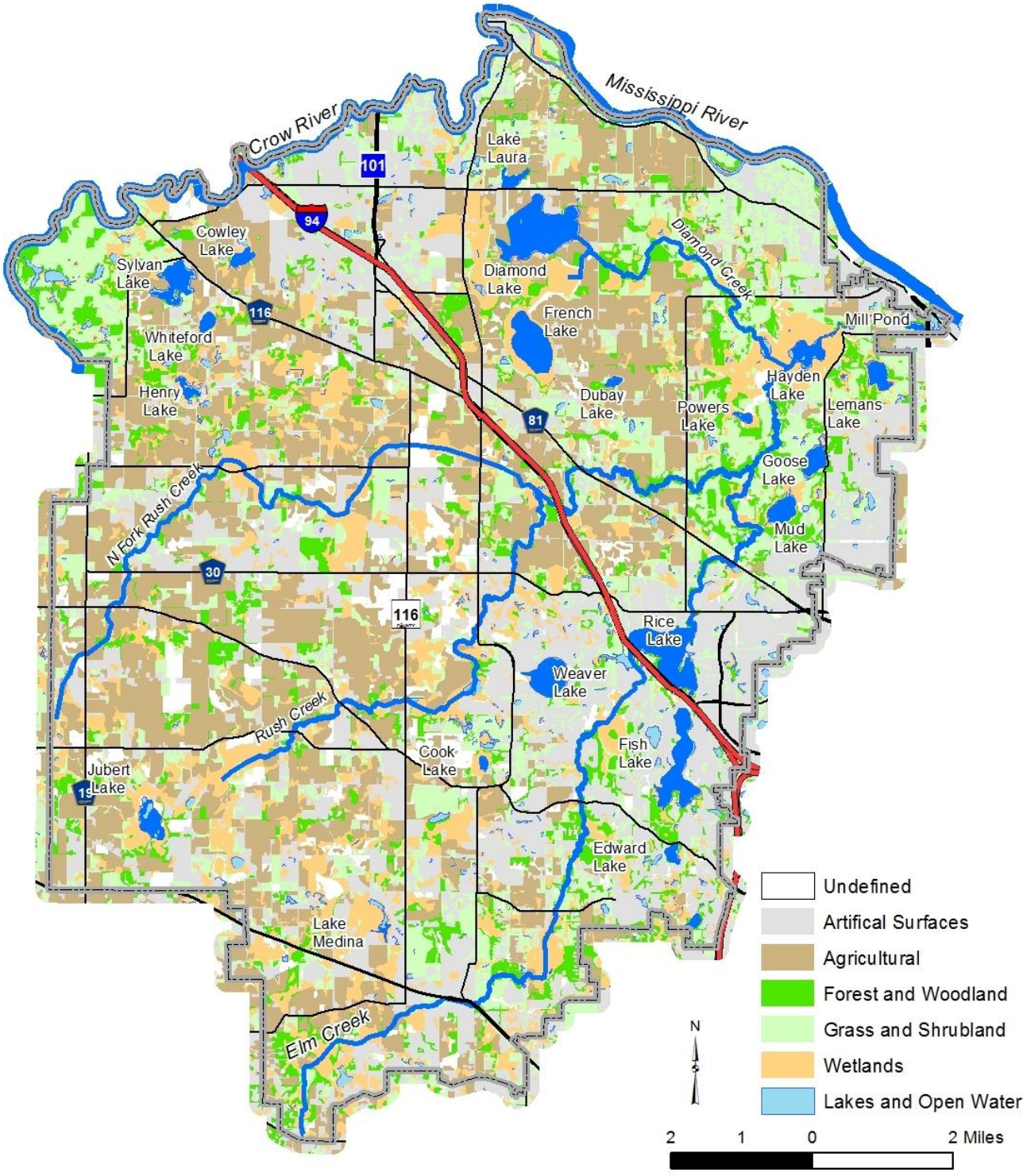

Figure 2.9. MLCCS land cover classification of the Elm Creek watershed.
Source: Minnesota DNR.

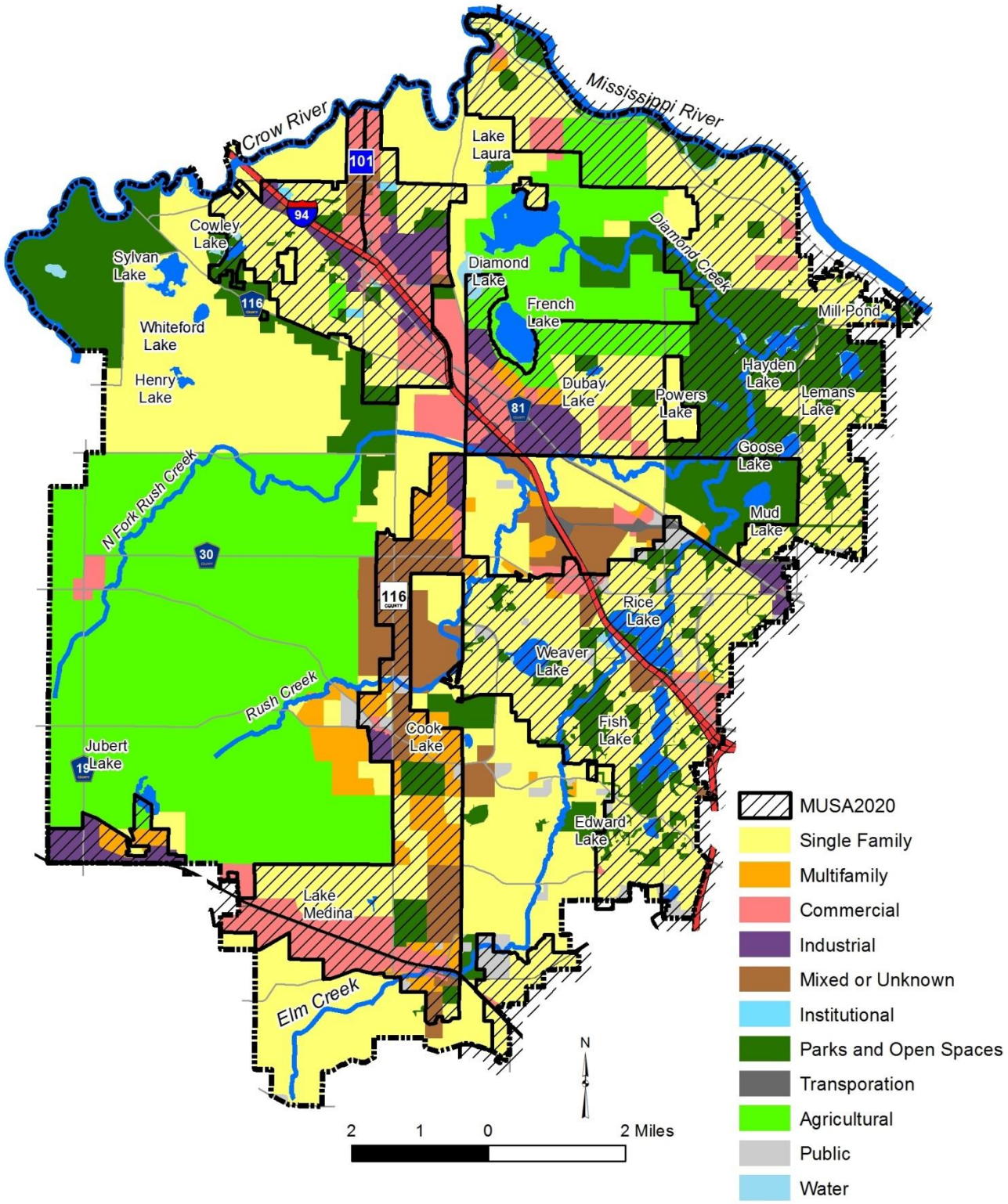

Figure 2.10. Planned 2020 land use in the Elm Creek watershed.
Source: Metropolitan Council.

2.4 WATERSHED WATER RESOURCES

2.4.1 Lakes

There are 22 lakes in the Elm Creek watershed; two - French and Medina - are considered by the MPCA to be wetlands. The lakes in the watershed are shown on Figure 2.11. Minnesota's standards for lake water quality vary depending on the depth classification of the lake (Table 2.11). Shallow lakes are less than 15 feet deep, or 80% or more of the lake area supports rooted aquatic plants. The DNR lake number and shoreland classification, lake morphometry, and water quality data are shown in Table 2.12. Lake water quality trends are shown in Appendix B. More information can be found at the DNR's LakeFinder website: www.dnr.state.mn.us/lakefind/index.html.

Table 2.11. Water quality standards for lakes in the North Central Hardwood Forest Ecoregion.

Parameters	Shallow Lakes	Deep Lakes
Total Phosphorus (TP) (µg/L)	≤60	≤40
Chlorophyll-*a* (chl-a) (µg/L)	≤20	≤14
Secchi Depth transparency (SD) (meters)	≥1.0	≥1.4

Table 2.12. Characteristics of lakes in the Elm Creek watershed, 2004-2013.

Lake	Location	DNR ID#	Surface Area (ac)	Max Depth (ft)	Depth Class	DNR Class	Summer Average			Years of Data
							TP (µg/L)	Chl-a (µg/L)	SD (m)	
Camelot	Plymouth	27-0099-00	22	n/a	n/a	NE	76	11	1.1	2
Cook	Maple Grove	27-0120-00	13	n/a	Shallow	NE	n/a	n/a	n/a	0
Cowley	Rogers	27-0169-00	47	7	Shallow	NE*	626	57	0.6	3
Diamond	Dayton	27-0125-00	406	8	Shallow	RD	170	68	0.8	9
Dubay	Dayton	27-0129-00	15	n/a	Shallow	NE	n/a	n/a	n/a	0
Edward	Maple Grove	27-0121-00	28	n/a	n/a	RD	n/a	n/a	n/a	0
Fish	Maple Grove	27-0118-00	238	48	Deep	RD	47	26	1.3	10
French	Maple Grove	27-0127-00	217	6	Shallow	RD	214	152	0.5	8
Goose	Dayton	27-0122-00	59	6	Shallow	NE	175	111	0.3	2
Hayden	Dayton	27-0128-00	93	n/a	Shallow	NE	n/a	n/a	n/a	0
Henry	Rogers	27-0175-00	44	5	Shallow	RD*	162	41	0.8	7
Jubert	Corcoran	27-0165-00	64	41	Deep	NE	n/a	n/a	n/a	0
Laura	Dayton	27-0123-00	35	n/a	Shallow	NE	n/a	n/a	n/a	0
Lemans	Champlin	27-0066-00	60	n/a	Shallow	NE	n/a	n/a	n/a	0
Medina	Medina	27-0146-00	8	n/a	Shallow	NE	n/a	n/a	n/a	0
Mill Pond	Champlin	27-0061-00	34	11	Shallow	NE	276	8	2.0	5
Mud	Maple Grove	27-0112-00	73	n/a	n/a	NE	67	16	1.3	2
Powers	Dayton	27-0130-00	15	n/a	Shallow	NE	n/a	n/a	n/a	0
Rice	Maple Grove	27-0116-01	314	11.5	Deep	RD	322	95	0.8	6
West Rice	Maple Grove	27-0116-02	32	11	Shallow		218	26	1.4	2
Sylvan	Rogers	27-0171-00	110	10	Shallow	NE*	447	28	1.7	1
Weaver	Maple Grove	27-0117-00	152	57	Deep	RD	33	13	2.6	10
Whiteford	Rogers	27-0172-00	30	n/a	n/a	NE*	n/a	n/a	n/a	0

Sources: Minnesota DNR, MPCA EQuIS, Elm Creek WRAPS. *City's Shoreland Classification
NE = Natural Environment; RD = Recreational Development (Shoreland Management Classification)

Impaired Lakes. Five lakes in the watershed do not meet state nutrient standards and have been designated by the MPCA and USEPA as Impaired Waters. A Watershed Restoration and Protection Strategies (WRAPS) study was begun in 2009 to conduct additional monitoring and develop TMDLs for the nutrient-impaired lakes as well as protection strategies for the lakes that currently meet water quality standards. Those two studies will be complete in 2015. Two lakes are impaired for mercury in fish tissue, and TMDLs for those impairments were included in the statewide 2007 mercury TMDL. The WRAPS study found that the water quality in Sylvan and Goose Lakes does not meet state standards and those lakes will likely be added to the 2016 Impaired Waters list. More information can be found in the Elm Creek Watershed TMDL (Brasch 2015).

Table 2.13. Draft 2014 303(d) List impaired lakes in the Elm Creek watershed.

Lake	DNR Lake #	Affected Use	Pollutant	TMDL/WRAPS Process
Fish Lake	27-0118-00	Aquatic consumption Aquatic recreation	Mercury FT[1] Nutrients	TMDL Approved 2007 WRAPS Project
Weaver Lake	27-0117-00	Aquatic consumption	Mercury FT	TMDL Approved 2007
Diamond Lake	27-0125-00	Aquatic recreation	Nutrients	WRAPS Project
Cowley Lake	27-0169-00	Aquatic recreation	Nutrients	WRAPS Project
Rice Lake	27-0116-01	Aquatic recreation	Nutrients	WRAPS Project
Lake Henry	27-0175-00	Aquatic recreation	Nutrients	WRAPS Project
Sylvan Lake	27-0171-00	Not yet listed impaired	Nutrients	WRAPS Project
Goose Lake	27-0122-00	Not yet listed impaired	Nutrients	WRAPS Project

Source: MPCA.

2.4.2 Streams

Elm Creek drains the eastern portion of the watershed, flowing northeast from its headwaters in Medina to its confluence with the Mississippi River in Champlin, and through Rice Lake in Maple Grove (Figure 2.11). Rush Creek and the North Fork of Rush Creek drain the center of the watershed. The North Fork joins the main stem just upstream of I-94, and the main stem joins Elm Creek in the Elm Creek Park Reserve. Diamond Creek flows out of Diamond Lake, joining Elm Creek just upstream of Hayden Lake. In the northwest, several small channels drain directly to the Crow River, and a small area in Dayton flows directly to the Mississippi River.

Table 2.14. Stream characteristics in the Elm Creek watershed.

Elm Creek Watershed	
Stream	**Length (mi)**
Elm Creek	21.08
Diamond Creek	5.69
Rush Creek	9.10
North Fork Rush Creek	16.92

Stream Conditions. Water quality data at the USGS monitoring site in Elm Creek Park is available from 2008-2013. Additional monitoring at other sites along Elm Creek and the other major streams in the watershed has been completed for the WRAPS study and for general assessment purposes. As noted in Table 2.15 below, the four major streams exceed state water quality standards for *E. coli* bacteria. Other impairments include low dissolved oxygen and excess chloride. Data on stream conditions and trends is detailed in the TMDL. Summary data can be found in Appendix B.

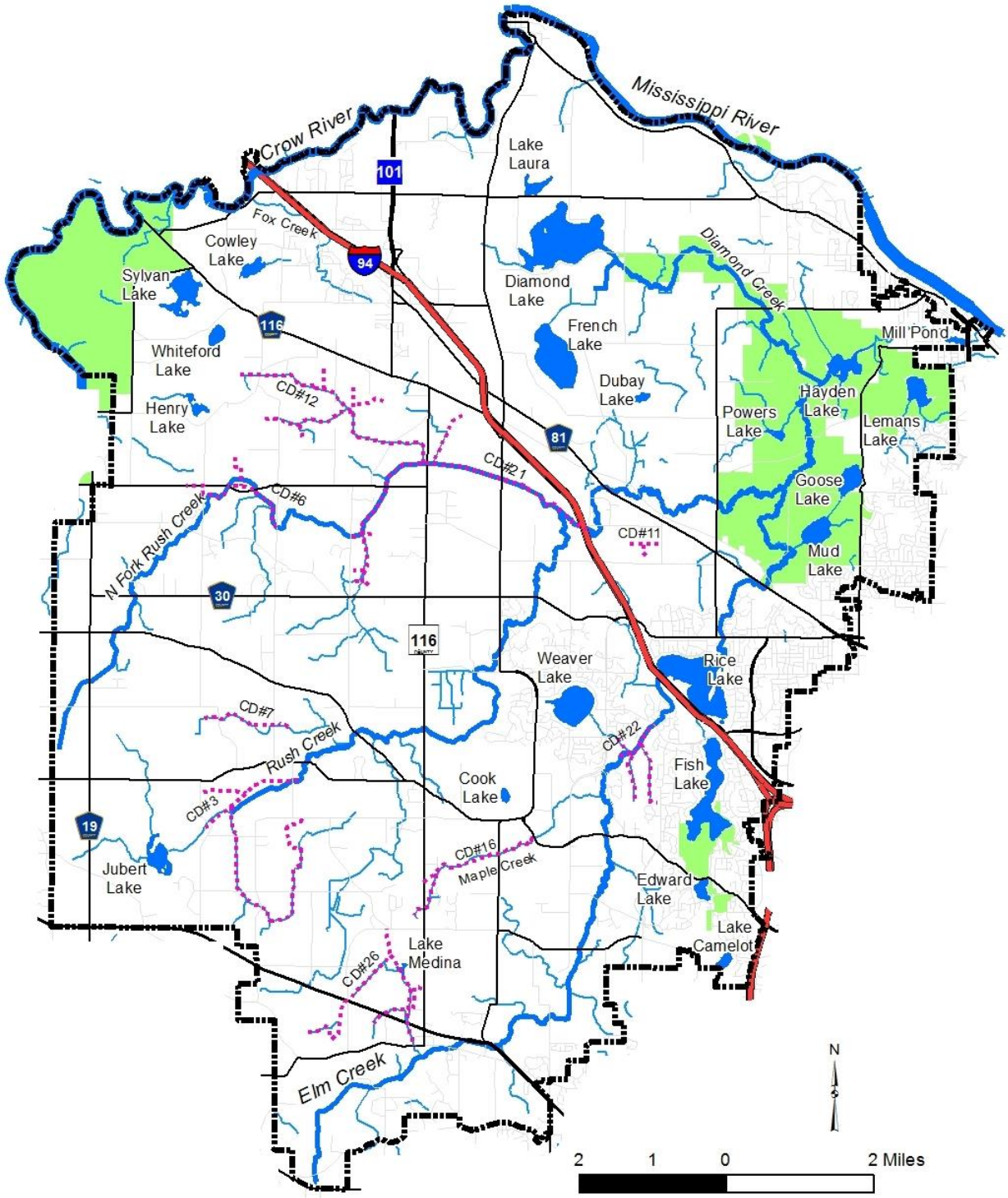

Figure 2.11. Major lakes, streams and ditches in the Elm Creek watershed.
Source: Minnesota DNR. Ditches: Hennepin County Environment and Energy.

Impaired Streams. Diamond, Rush, North Fork Rush, and Elm Creeks and the Crow River have been designated by the Minnesota Pollution Control Agency (MPCA) and Environmental Protection Agency (EPA) as Impaired Waters, and are listed on the state's draft 2014 303(d) list for not meeting water quality standards as shown in Table 2.15. More information about these impairments can be found in the Elm Creek Watershed TMDL (MPCA 2015). A WRAPS study will be complete in 2015 and will address the bacteria, DO, and biotic impairments in the four creeks. A TMDL for two of the impairments on the Crow was completed in 2013, with the other impairments addressed in the Crow River WRAPS completed in 2015.

Table 2.15. Draft 2014 303(d) List impaired streams in the Elm Creek watershed drainage area.

Stream	Stream AUID #	Affected Use	Pollutant	TMDL/WRAPS Process
Diamond Cr	07010206-525	Aquatic life/ Aquatic recreation	*E. coli,* DO, M-IBI[1], F-IBI[1]	WRAPS Project
Rush Creek	07010206-732	Aquatic life/ Aquatic recreation	*E. coli,* M-IBI, F-IBI, chloride	WRAPS Project
Rush Creek	07010206-760	Aquatic life	M-IBI, F-IBI	WRAPS Project
North Fork Rush Creek	07010206-528	Aquatic life/ Aquatic recreation	*E. coli,* DO, M-IBI, F-IBI	WRAPS Project
Elm Creek	07010206-508	Aquatic life/ Aquatic recreation	*E. coli,* DO, M-IBI, F-IBI, chloride	WRAPS Project
Crow River	07010204-502	Aquatic life/ Aquatic recreation	TMDL: Fecal coliform, turbidity WRAPS: DO, F-IBI, M-IBI	TMDL Approved 2013 WRAPS Approved 2015
Mississippi R	09010206-567	Aquatic life	Mercury FT[2], PCB FT[2]	Approved

[1] Index of Biotic Integrity. A measure of the quantity and quality of aquatic life. M-IBI denotes macroinvertebrate impairment and F-IBI denotes fish impairment.
[2] "FT" means fish tissue.
Source: MPCA.

The Elm Creek watershed member cities will be impacted by several regional TMDLs. The Elm Creek watershed is excluded from the draft Upper Mississippi Bacteria TMDL because the WRAPS study is being completed as a stand-alone project. The watershed will be impacted by the South Metro Mississippi Turbidity TMDL. Finally, the MPCA is currently preparing a Twin Cities Metro Chloride Management Plan which will serve as a metro-wide TMDL for all chloride-impaired waters.

2.4.3 Ditches

There are several county ditches in the watershed (Figure 2.11). Parts of the North Fork Rush Creek are under the ditch authority of Hennepin County as County Ditch (CD) #21 and CD #6. CD #12 is an extensive system with multiple branches tributary to the North Fork. Part of the upper reaches of Rush Creek and several laterals are CD #3, and a short segment of Elm Creek is CD #22. CD #7, CD #16, CD #26, and CD #11 are ditch systems not directly connected to one of the primary stream systems in the watershed.

2.4.4 Wetlands

The US Fish and Wildlife Service (FWS) compiled wetland maps from aerial photo interpretation as part of the National Wetland Inventory (NWI) (Figure 2.12). Wetland scientists use two common

classification schemes to identify wetland type – the FWS's "Circular 39" system, and a replacement system developed by Cowardin et al., commonly referred to as the Cowardin system. The Circular 39 system was originally developed to classify wetlands for waterfowl habitat purposes. Eight of the Circular 39 freshwater wetland types are found in Minnesota. The Cowardin scheme is a hierarchical classification based on landscape position, substrate, flooding regime, and vegetation. While the Cowardin scheme has been officially adopted by the FWS and other agencies, the Circular 39 system is still commonly used because of its simplicity and ease of use.

The original NWI was developed in the 1980s. The DNR is updating the NWI using remote sensing imagery; the East-Central region of Minnesota, including Hennepin County, was reevaluated using 2010 and 2011 imagery. According to the updated NWI, wetlands, including lakes, cover about 21 percent of the watershed's surface (Table 2.16.) A delineation of wetland boundaries is required to be completed any time development or other impacts may occur near or in a wetland.

Table 2.16. NWI wetland area by type for Elm Creek watershed.

Circular 39 Type	Acres	Percent
1 - Seasonally Flooded	6,911	8.3
2 - Wet Meadow	75	0.1
3 - Shallow Marsh	5,739	6.9
4 - Deep Marsh	666	0.8
5 - Shallow Open Water	2,838	3.4
6 - Shrub Swamp	757	0.9
7 - Wooded Swamp	99	0.1
8 - Bogs	4	<0.1
80 - Mun. and Indus. Activities	18	<0.1
90 - Riverine	465	0.6
98 - Uplands	66,018	79.0
Grand Total	83,590	100

Cowardin Type	Acres	Percent
Emergent (EM)	10,947	13.1
Unconsolidated Bottom (UB)	3,120	3.7
Forested (FO)	1,880	2.2
Aquatic Bed (AB)	867	1.0
Scrub-Shrub (SS)	757	0.9
Unconsolidated Shore (US)	1	<0.1
Upland	66,018	79.0
Grand Total	83,590	100

Source: Minnesota DNR, 2013 Update East-Central Minnesota.

2.4.5 Public Waters

State Statutes classify certain waterbodies as Waters of the State and the DNR maintains maps and lists on the Public Waters Inventory (PWI). Public Waters wetlands include all type 3, type 4, and type 5 wetlands (as defined in U.S. Fish and Wildlife Service Circular No. 39, 1971) that are 10 acres or more in size in unincorporated areas or 2.5 acres or more in size in incorporated areas. Public watercourses are defined as natural and altered watercourses with a total drainage area greater than two square miles or natural and altered watercourses designated by the DNR commissioner as trout streams. Work within waterbodies designated on the PWI is regulated by the DNR. Public waters wetlands and watercourses are listed in the tables below and shown on Figure 2.13. Public Waters basins, wetlands, and watercourses are listed in Appendix F.

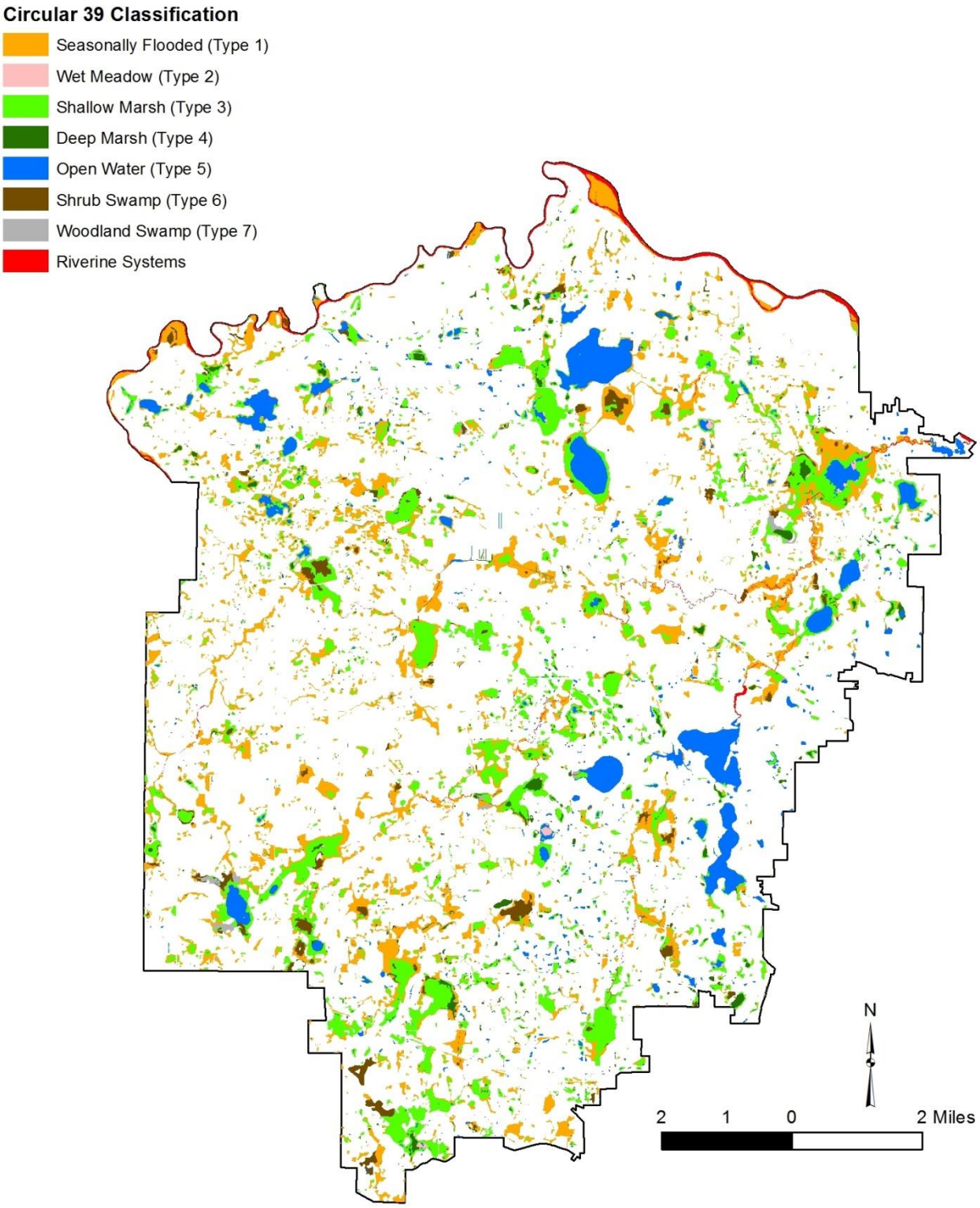

Figure 2.12. National Wetlands Inventory wetlands in Elm Creek.
Source: Minnesota DNR, 2013 Update East-Central Minnesota.

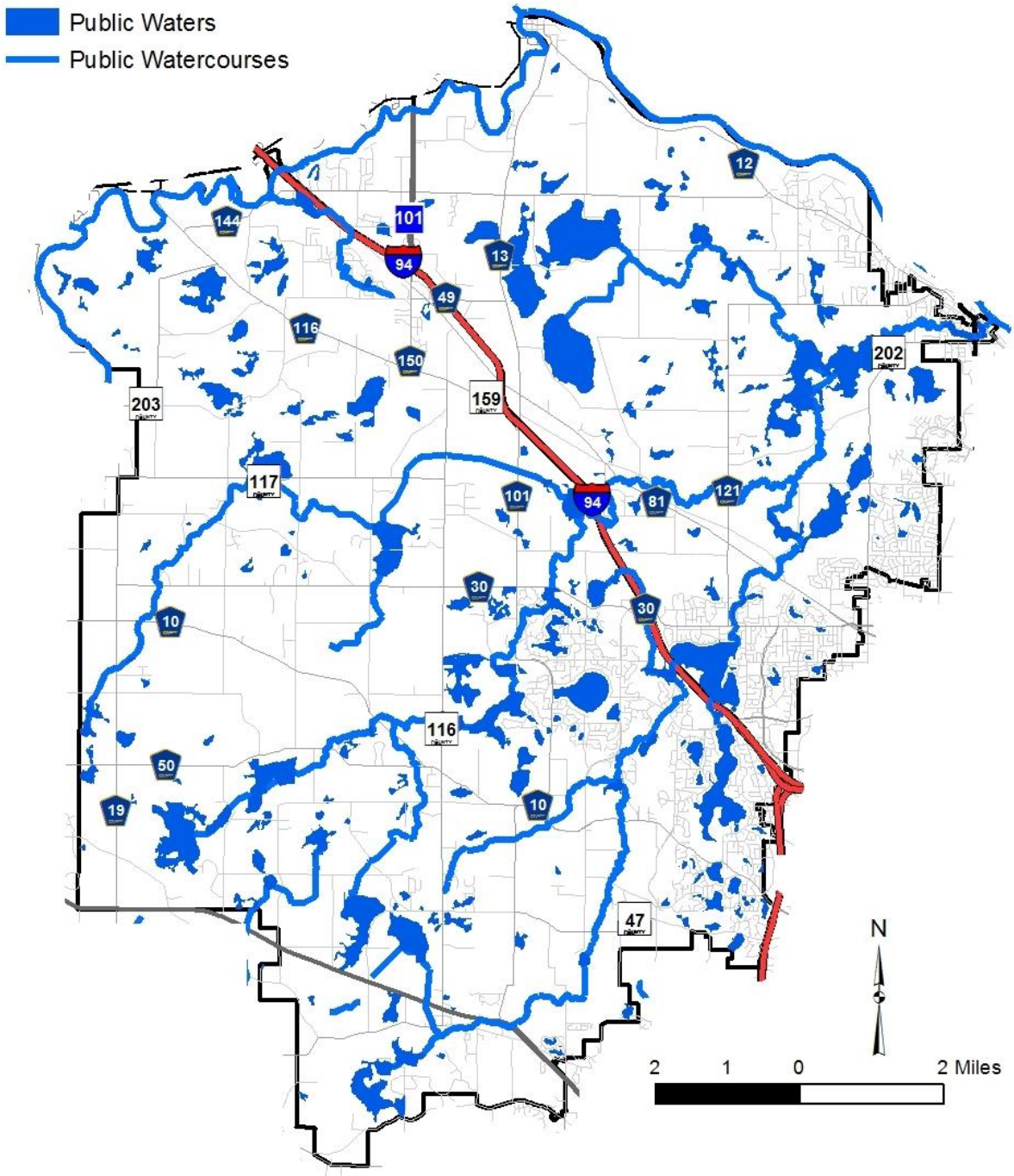

Figure 2.13. Public Waters in the Elm Creek watershed.
Source: Minnesota DNR

2.4.6 Floodplain

Flooding effects may range from personal nuisance to property damage or loss to injury or death. Floodplain areas flood most often and severely. Land use regulations define the floodplain as the area covered by the flood that has a one percent chance of occurring each year, also known as the

100-year flood. The floodplain is divided into two zoning districts: the floodway and flood fringe. The floodway includes the river channel and nearby land areas which must remain open to discharge the 100-year flood. The flood fringe, while in the flood plain, lies outside the floodway. Regulations usually allow development in the flood fringe but require flood-proofing or raising to the legal flood protection elevation.

In 1968, Congress created the National Flood Insurance Program (NFIP) to make flood insurance available to property owners at federally subsidized rates. The NFIP required communities to adopt local laws to protect lives and future development from flooding. The Federal Emergency Management Agency (FEMA) first must formally notify a community that it has special flood hazard areas (SFHA) before it can join the NFIP. FEMA notifies communities by issuing a Flood Hazard Boundary Map (FHBM). This map shows the approximate boundaries of the community's 100-year flood plain. Each participating community has a Flood Insurance Study (FIS). Each of the communities in Elm Creek has a Flood Insurance Study, which can be viewed at the respective City Hall or through Hennepin County Environmental Services. Figure 2.14 shows the approximate 100-year and 500-year floodplain in the watersheds.

2.4.7 Groundwater

Much of the watershed is underlain by loamy and clayey glacial till, and groundwater is less vulnerable to contamination because the unsorted sediment with grains of different sizes is more closely packed together with less void space than sediments comprised of particles of more uniform size. However, the Crow River corridor is underlain with sand, loamy sand, and gravel outwash and is considered to be very highly sensitive to potential pollution. Wetlands and areas near wetlands and lakes are moderately susceptible to contamination due to the proximity to the water table.

Most of the cities obtain their municipal water supplies from the deep Franconia-Ironton-Galesville aquifer, although a few wells draw from more shallow quaternary formations. The Franconia formation is comprised of fine grained sandstone and shale while the Ironton-Galesville sandstones are fine to medium grained sandstone with interbedded shale. Corcoran does not operate a municipal water system. Property owners rely on private wells for potable water. A large development currently under construction in Corcoran will be supplied with municipal water purchased from the city of Maple Grove. The water supply for Plymouth is located outside the Elm Creek watershed.

The cities that obtain their water from groundwater have completed Wellhead Protection Studies. These studies model groundwater flow and identify areas that should be specially managed to reduce the risk of contamination of groundwater (see Figure 2.15). Emergency Response Areas show where immediate action should be taken to clean up spills of contaminants to protect groundwater.

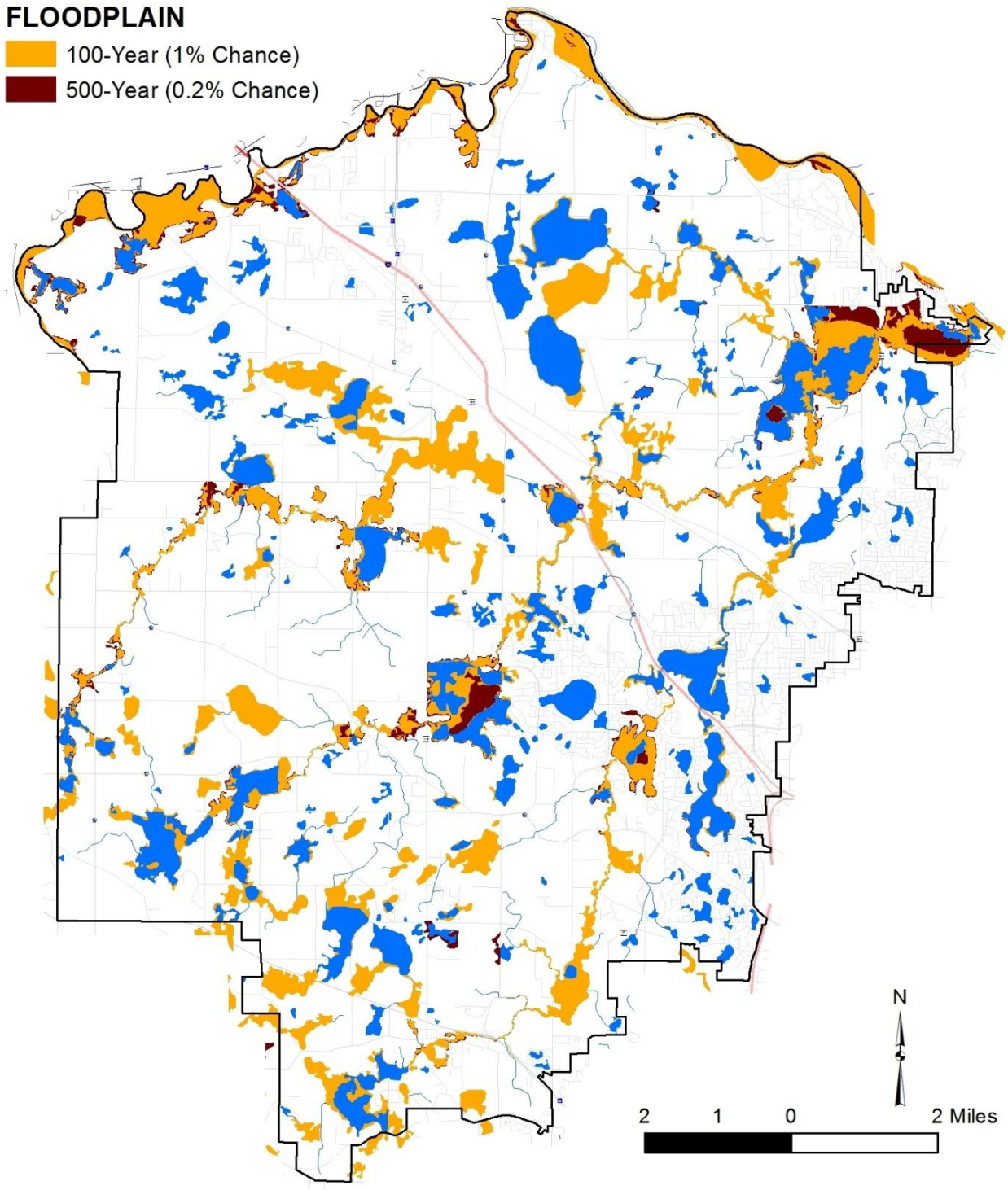

Figure 2.14. Floodplain in the Elm Creek watershed.
Source: Minnesota DNR.

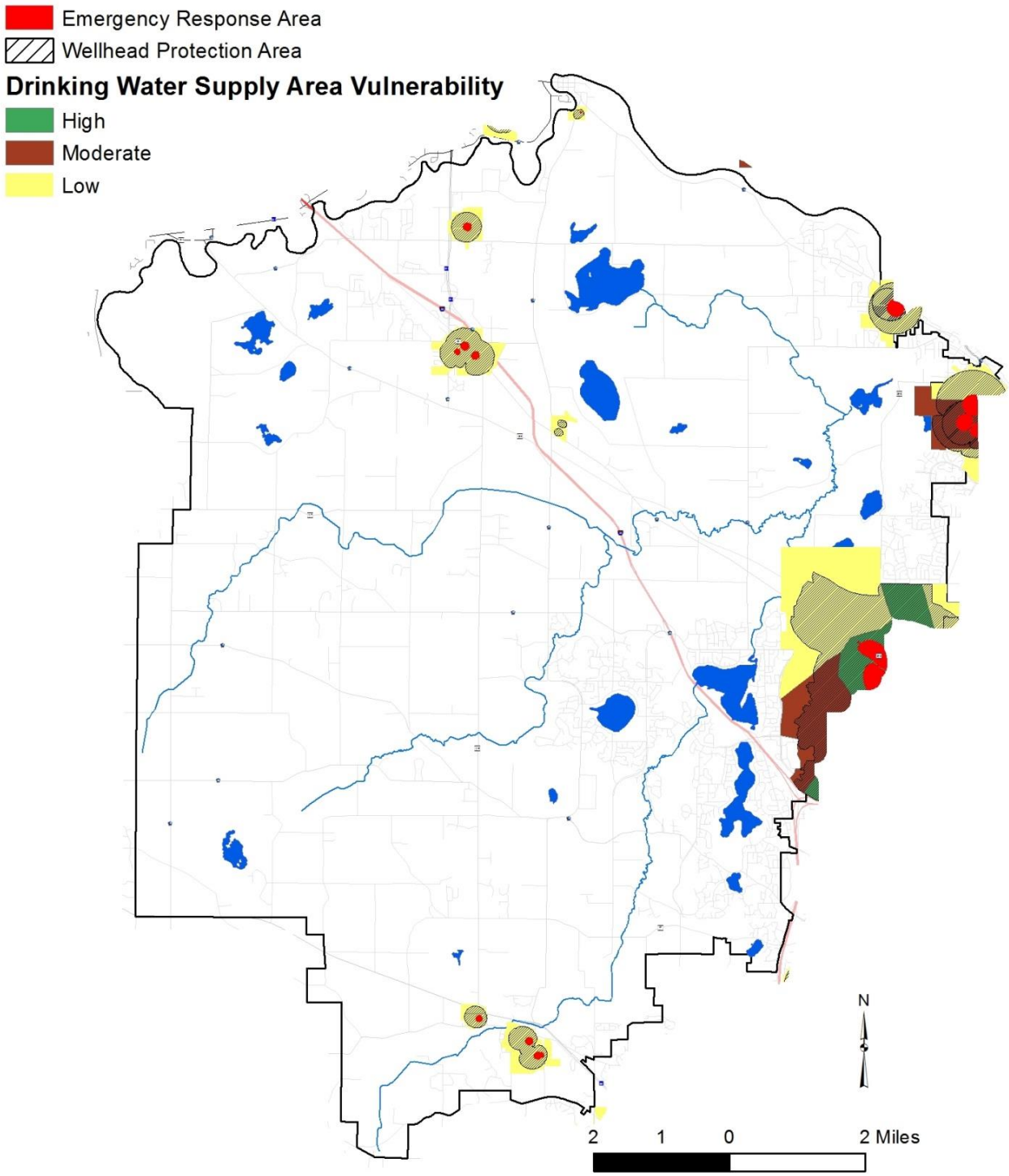

Figure 2.15. Drinking Water Wellhead Protection Areas.
Source: Minnesota Department of Health.