# LMMM ILF Service Area Compensation Planning Framework

## Watershed Based Approach to Wetland Compensatory Mitigation

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# THANK YOU + ACKNOWLEDGEMENTS


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# 1. INTRODUCTION

This Compensation Planning Framework (CPF) provides documentation for a watershed-based approach to compensatory wetland mitigation in the western portion of the Lower Mississippi River, the Minnesota River, and the Missouri River Bank Service Areas, also referred to as Bank Service Areas (BSAs) 8 West, 9, and 10, as part of the Minnesota In-Lieu Fee Program (ILF). These BSAs were combined and are being treated as one for the purpose of this CPF due to the similar geology and land use. In addition, BSAs 8 West and 10 are too small for statistical analysis on their own. It should also be noted that only the western portion of BSA 8 is included in this CPF due to the major differences in the geographic location, geology, hydrogeomorphology, and land use between the western and eastern portions of the BSA. The eastern portion of BSA 8 is covered in a different report and referred to as ILF Service Area 8E (SA 8E). The CPF documents baseline conditions and prioritizes compensatory wetland mitigation on a major watershed scale by using statewide data sources, as well as local and regional planning efforts which are readily available to the public.

The CPF is a report which analyzes baseline conditions and develops a prioritization methodology for the siting of replacement sites as a requirement for the ILF Program. As required by both the Federal Mitigation Rule and the Minnesota Wetland Conservation Act (WCA), the CPF must designate areas of high priority for wetland replacement. These are areas of the state where preservation, enhancement, restoration, or creation of wetlands have high public value (Rodacker & Smith, 2018). Initially, the ILF will be focused on credit generation for the Local Government Road Wetland Replacement Program (LGRWRP) which is administered by the Minnesota Board of Water and Soil Resources (BWSR). A list of acronyms and their meanings can be referenced in Appendix A.

# 2. GEOGRAPHIC SERVICE AREA

## Service Area Overview

This CPF focuses on three BSAs within southwestern Minnesota including the Lower Mississippi West (BSA 8W), Minnesota River (BSA 9), and Missouri River (BSA 10). The Lower Mississippi West (BSA 8W) and Minnesota River Basin (BSA 9) span the area within the state of Minnesota with Hydrologic Unit Codes (HUC) of 0710 and 0702, respectively. The Missouri River Basin (BSA 10) covers area across portions of HUC 1017 and 1023 within the state of Minnesota. The BSAs were combined within this report, as mentioned before, and will be referred to collectively as the Lower Mississippi, Minnesota, and Missouri ILF Service Area (LMMM SA). The LMMM SA spans approximately 16.4 million acres across 38 counties. The boundary of the LMMM SA ranges from the cities of Fergus Falls in the north to Worthington in the south. A “C” shaped line from Eagan to Mankato to Albert Lea comprises the eastern border, while the western border is the state line (Figure B-1). According to the National Land Cover Database (NLCD), in 2019 land cover in the LMMM SA was primarily agriculture. Cultivated crops covers approximately 77% of the SA, along with hay and pasture covering 4% (Table 2-1). Only about 5% of the LMMM SA is developed. Land cover of water resources include emergent herbaceous wetlands (5%) and open water (3%). The land use across remaining areas comprises 6% total and includes forest, grassland, woody

wetlands, barren land, and shrub/scrub. The LMMM SA contains 19 major watersheds (HUC 8) including the Blue Earth River (Major Watershed number 30; HUC8 ID 07020009), Chippewa River (26; 07020005), Cottonwood River (29; 07020008), Des Moines River – Headwaters (51; 07100001), East Fork Des Moines River (53; 07100003), Lac qui Parle River (24; 07020003), Le Sueur River (32; 07020011), Little Sioux River (84; 10230003), Lower Big Sioux River (82; 10170203), Lower Des Moines River (52; 07100002), Lower Minnesota River (33; 07020012), Minnesota River – Headwaters (22; 07020001), Minnesota River – Mankato (28; 07020007), Minnesota River – Yellow Medicine River/Hawk Creek (25; 07020004), Pomme de Terre River (23; 07020002), Redwood River (27; 07020006), Rock River (83; 10170204), Upper Big Sioux River (81; 10170202), and Watonwan River (31; 07020010) watersheds. The major watersheds are shown in Figure B-1 and described in the following paragraphs.

**Table 2-1. Current Land Cover from the National Land Cover Database**

| Landcover (NLCD 2019) | Percent Area |
|---|---|
| Cultivated Crops | 77% |
| Developed | 5% |
| Emergent Herbaceous Wetlands | 5% |
| Pasture/Hay | 4% |
| Open Water | 3% |
| Deciduous Forest | 2% |
| Grassland/Herbaceous | 2% |
| Woody Wetlands | 1% |
| Mixed Forest | 0.3% |
| Barren Land | 0.1% |
| Shrub/Scrub | 0.03% |
| Evergreen Forest | 0.02% |

Land cover data from the National Land Cover Database (NLCD) for the LMMM SA.

## Ecological Classification

The ecological classification system used in this study was developed jointly by the Minnesota Department of Natural Resources (MnDNR) and the United States Forest Service (USFS). This system is used to classify areas with similar ecological characteristics. It is set up in tiers which become successively smaller and more unique. Provinces are the broadest tier and are defined by major climate zones, native vegetation, and biomes. There are four provinces present in Minnesota but only two of those provinces intersect with the LMMM SA: Eastern Broadleaf Forest and Prairie Parkland. Within the provinces are sections, which are defined by the origin of glacial deposits, regional elevation, distribution of plants and regional climate. In Minnesota there are 10 sections but only three are present in the LMMM SA. Each section is then broken down further into subsections. Subsections are defined by the glacial deposition processes, surface bedrock formations, local climate, topographic relief,

and the distribution of plants (Cleland et al., 1997). There are 26 total subsections in Minnesota, nine of the subsections are represented within the LMMM SA. Maps of the provinces, and subsections can be found in Figure B-2. Each province and subsection are described in more detail below. The acreage of each province, section and subsection within each major watershed can be found in Table 2-2. This will be helpful for decision makers because it allows them to consider ecological patterns and identify areas with similar management opportunities.

### EASTERN BROADLEAF FOREST PROVINCE

The Eastern Broadleaf Forest province extends over 11% (approximately 1.3 million acres) of the LMMM SA. Outside of the LMMM SA and Minnesota, this province spans most states in the Midwest. It is a transition zone between the semi-arid prairies in southwest United States and the semi-humid mixed conifer-hardwood forests to the north and into Canada. During the last glaciation, glaciers covered the northern section of the Eastern Broadleaf Forest Province in Minnesota. After receding, the glaciers left a thick layer of glacial drift which can be the cause of poor drainage and is highly erodible (MnDNR, n.d.-b). There are five subsections within the LMMM SA.

#### *Anoka Sand Plain Subsection*

This subsection has unique characteristics that date back to the last glaciation. There is evidence that it was once covered in glacial meltwater which formed lakes and laid down numerous layers of sand. Broad sandy plains are distinctive of this subsection. At one point there were active dunes which have now become stabilized by vegetation and an increase of surface water. The majority of the Anoka Sand Plain is located within the Middle Mississippi watershed, but a small portion (19,802 acres) is located within the LMMM SA. Wetlands in this subsection are found on the poorly drained soils along the Mississippi River, as well as in the depressions on the sand plain where drainage is limited, and organic matter has accumulated. The small section located in the LMMM SA is in the Lower Minnesota River major watershed within the Twin Cities metro region (MnDNR, n.d.-a).

#### *Big Woods*

Deciduous forest, rolling hills, and thick deposits of gray limey glacial till are characteristics of the Big Woods subsection. This is the third largest subsection within the LMMM SA, spanning nearly 900,000 acres along the Minnesota River valley leading into the Twin Cities metro region. Four major watersheds including the Blue Earth River, Le Sueur River, Lower Minnesota River, and Minnesota River – Mankato watersheds have land within the Big Woods subsection. The deciduous forest exists on the intersection between tallgrass prairie to the west, oak savanna to the south and east, and mixed forest atop outwash plain to the north. Red oak, sugar maple, basswood, and elm were historically the dominant tree species. The drainage network is undeveloped, with abundant large, groundwater-fed lakes and wetlands peppered throughout the subsection. In present day, most of this subsection is in agricultural production, with approximately 10-15% of the upland forest and wetlands remaining (MnDNR, 2024a).

*Hardwood Hills Subsection*

The Hardwood Hills subsection is characterized by steep slopes, high hills, and lakes which formed in glacial end moraines and outwash plains. It was once dominated by conifers and aspen-birch forests. The northern portion of this subsection intersects with the northwestern tip of the LMMM SA. The 225,909 acres of the subsection within the LMMM SA extend across two major watersheds including the Chippewa River and the Pomme de Terre River major watersheds. The northern portion of the Hardwood Hills subsection is a mix of wetlands, lakes, forests, and cultivated crops. Wetlands in this subsection formed in the poorly drained potholes and remnant features of glaciation (MnDNR, n.d.-c).

*Oak Savanna Subsection*

The Oak Savanna subsection covers approximately 125,000 acres along the eastern edge of the LMMM SA. Nearly all of those acres are within the Le Sueur River watershed, with the exception of 500 acres located in the Lower Minnesota River watershed. The Oak Savanna subsection represents a geological transition point between prairie to the south and west, and forest to the north. The rolling moraines of this subsection somewhat limited fire disturbance enough for oak trees and other fire-resistant woody species to exist, while not limiting fire enough to protect forest from developing. Loess soil sits atop end moraine ridges, while alfisol soils dominate the low laying regions. There is a well-developed drainage network, with streams snaking through dissected ravines. The vegetation was a mosaic of savanna, prairie, forest, and wetlands prior to settlement, but present day most of the region is in agricultural production (MnDNR, 2024d).

*St. Paul – Baldwin Plains and Moraines Subsection*

One of the smaller ecological subsections within the LMMM SA, the St. Paul – Baldwin Plains and Moraines subsection covers approximately 50,000 acres within the northeast corner of the Lower Minnesota River watershed. Rolling moraines and outwash plains are characteristic of this subsection, which extends from the Twin Cities metro region to the St. Croix and further into Wisconsin. The Mississippi River bisects this subsection, historically contributing to the well-developed floodplain. The pre-settlement vegetation was a mosaic of predominantly oak savanna with pockets of prairie and maple-basswood forest. The locations of these plant communities were largely influenced by topography and frequency of disturbance. Most of the lakes within this subsection are located on top of moraines, with wetlands located adjacent to floodplains. In the present day, urbanization from the Twin Cities metro region has highly impacted this ecological subsection, greatly altering vegetation community types and hydrology (MnDNR, 2024e).

PRAIRIE PARKLAND PROVINCE

The Prairie Parkland Province covers nearly 89% of the LMMM SA, spanning close to 10.4 million acres. Outside of the SA, the Prairie Parkland Province extends northwest into Canada, west into North and South Dakota, and south into Iowa, Nebraska, Kansas, Oklahoma, and Missouri. This province has less precipitation and higher temperatures than the other provinces in Minnesota. Prairies and grasslands were the dominate vegetation before European settlement. The thick layer of glacial drift left by the Des Moines lobe as well as the natural development of prairie soils rich in organic matter, provide incredibly fertile soil for agriculture. One of the most

distinct characteristics of this province is the Minnesota River, which formed from extreme erosion and downcutting when Glacial Lake Agassiz was dramatically drained. This province is home to prairie pothole wetlands. These wetlands formed in the uneven landscape left by the receding Des Moines Lobe. They are not well connected via surface water, leading to wetlands with variable hydrology and groundwater connections. They are extremely important for both the flora and fauna of the area (MnDNR, n.d.-e). There are four subsections within the LMMM SA.

*Coteau Moraines Subsection*

The Coteau Moraines subsection covers approximately 2 million acres within the LMMM SA. It is the second largest ecological subsection within the SA, covering 17% of acres across a region, oriented northwest to southeast, in the southwestern portion of the LMMM SA. Fourteen of the nineteen major watersheds intersect with the Coteau Moraines subsection including Blue Earth River, Cottonwood River, Des Moines River – Headwaters, East Fork Des Moines River, Lac Qui Parle River, Little Sioux River, Lower Big Sioux River, Lower Des Moines River, Minnesota River – Mankato, Minnesota River – Yellow Medicine River/Hawk Creek, Redwood River, Rock River, Upper Big Sioux River, and Watonwan River major watersheds. The Coteau Moraines subsection is characterized by increasing deposits of loess over glacial till. The boundaries of the subsection align with a high glacial landform where glacial till was deposited. Steep escarpments along the northeast border are visible by looking at the watercourse network – most of this subsection drains through the Minnesota River Prairie subsection to the Minnesota River. There are two units within the subsection. The outer Coteau consists of a poorly developed drainage network with relatively more lakes and wetlands compared to the middle Coteau unit, where easily eroded loess allowed for a more developed drainage network. Overall, this subsection consisted predominantly of tallgrass prairie, with wet prairies and forests located only along stream corridors. Now, agriculture dominates this region (MnDNR, 2024b).

*Inner Coteau Subsection*

The Inner Coteau Subsection is in the southwestern corner of the LMMM SA and spans approximately 780,000 acres within the SA. The boundaries are delineated by the highest elevation of the coteau complex in Minnesota, which consisted of large deposits of glacial till. Beyond Minnesota, the coteau complex extends into South Dakota and Iowa. A well-developed drainage network extends through this rolling moraine landscape, where areas of easily eroded loess soil was eroded over time. Much of this subsection drains southwest to the Missouri River system. There are very few lakes located within this subsection. Tallgrass prairie historically dominated this section, but now has been replaced with agriculture (MnDNR, 2024c). Six major watersheds have acres within the Inner Coteau subsection including the Des Moines River – Headwaters, Lower Big Sioux River, Minnesota River – Yellow Medicine River/Hawk Creek, Redwood River, Rock River, and Upper Big Sioux River watersheds.

*Minnesota River Prairie Subsection*

Taking up the largest amount of area within the LMMM SA is the Minnesota River Prairie Subsection. This subsection covers over 7.5 million acres, spanning 65% of the entire SA. Fifteen of the nineteen major watersheds within the LMMM SA contain some amount of the Minnesota River Prairie subsection, ranging from

the entirety of the Minnesota River – Headwaters watershed to less than 0.5% of the Des Moines River – Headwaters watershed. The Minnesota River Prairie subsection generally has gently rolling hills, except for the area around the Minnesota River which has steep bluffs. The subsection is covered in a very thick layer of glacial drift which leads to soils that are well to moderately well drained loams. Wetlands in this area are generally prairie pothole wetlands. As far as surface water is concerned, these wetlands are considered disconnected. The drainage network is poorly developed due to the relatively young age of the landscape. Agriculture is the dominate land use in this subsection (MnDNR, n.d.-d).

*Red River Prairie Subsection*

The Red River Prairie subsection covers a small sliver of the LMMM SA along the very northern tip next to Fergus Falls, MN. It is fully contained within the Pomme de Terre River watershed within the LMMM SA and spans approximately 18,000 acres. Contiguous tallgrass prairie growing on top of lacustrine till from Glacial Lake Agassiz is characteristic of this subsection. The area is largely flat with some gently rolling hills. Pockets of poorly drained clay deposits resulted in the prairie-pothole topography, with wet prairies and meadows located in shallow depressions across the landscape. Nearly all of these wetlands have been ditched and drained to support agriculture. Spring flooding in this subsection is common (MnDNR, n.d.-f).

| Table 2-2. Area (Acres) of Ecological Subsections Broken Down by Each Major Watershed within SA 1 | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Province:** | **Eastern Broadleaf Forest Province** | | | | | **Prairie Parkland Province** | | | | |
| **Section:** | **Minnesota + NE Iowa Morainal** | | | | | **North Central Glaciated Plains** | | | **Red River Valley** | |
| **Subsection:** | **Anoka Sand Plain** | **Big Woods** | **Hardwood Hills** | **Oak Savanna** | **St. Paul – Baldwin Plains** | **Coteau Moraines** | **Inner Coteau** | **Minnesota River Prairie** | **Red River Prairie** | **Total** |
| Blue Earth River | - | 512 | - | - | - | 4,899 | - | 771,832 | - | **777,243** |
| Chippewa River | - | - | 99,329 | - | - | - | - | 1,230,823 | - | **1,330,153** |
| Cottonwood River | - | - | - | - | - | 316,098 | - | 524,687 | - | **840,785** |
| Des Moines River - Headwaters | - | - | - | - | - | 795,944 | 64 | 2,591 | - | **798,598** |
| East Fork Des Moines River | - | - | - | - | - | 227 | - | 129,198 | - | **129,425** |
| Lac qui Parle River | - | - | - | - | - | 106,379 | - | 380,593 | - | **486,972** |
| Le Sueur River | - | 73,875 | - | 124,491 | - | - | - | 512,749 | - | **711,116** |
| Little Sioux River | - | - | - | - | - | 205,753 | - | - | - | **205,753** |
| Lower Big Sioux River | - | - | - | - | - | 5,643 | 321,086 | - | - | **326,729** |
| Lower Des Moines River | - | - | - | - | - | 36,080 | - | 19,653 | - | **55,733** |
| Lower Minnesota River | 19,802 | 719,946 | - | 542 | 48,934 | - | - | 385,129 | - | **1,174,353** |
| Minnesota River - Headwaters | - | - | - | - | - | - | - | 501,739 | - | **501,739** |
| Minnesota River - Mankato | - | 95,959 | - | - | - | 1,446 | - | 764,481 | - | **861,886** |
| Minnesota River - Yellow Medicine River/Hawk Creek | - | - | - | - | - | 194,814 | 738 | 1,137,223 | - | **1,332,775** |
| Pomme de Terre River | - | - | 126,579 | - | - | - | - | 415,900 | 17,754 | **560,233** |
| Redwood River | - | - | - | - | - | 205,729 | 1,504 | 240,299 | - | **447,533** |
| Rock River | - | - | - | - | - | 152,318 | 429,790 | - | - | **582,108** |
| Upper Big Sioux River | - | - | - | - | - | 3,011 | 23,448 | - | - | **26,459** |
| Watonwan River | - | - | - | - | - | 16,976 | - | 541,989 | - | **558,965** |
| **LMMM SA Total** | **19,802** | **890,292** | **225,909** | **125,033** | **48,934** | **2,045,317** | **776,630** | **7,558,885** | **17,754** | **11,708,557** |

## Major Watershed Descriptions

The purpose of each major watershed description is to provide context for future decisions about wetland mitigation site selection. Nearly half of the watersheds in the LMMM SA extend outside of the Minnesota state boundary on the west and south sides. In these cases, the descriptions give a broad context of the overall watershed, followed by watershed details specific to the SA.

Data used to fill out the watershed descriptions is plentiful and publicly available. Reports that were used include: Watershed Restoration and Protection Strategy Reports (WRAPS) from the Minnesota Pollution Control Agency (MPCA), Watershed Health Assessment Framework (WHAF) from the MnDNR, county local water management plans, and One Watershed One Plan documents, when available. Mapping resources used were provided from various state agencies through the Minnesota Geospatial Commons. Other resources used in the descriptions are watershed specific and listed when appropriate. For descriptions of the ecological classifications see section 2-B.

### BLUE EARTH RIVER

The Blue Earth River major watershed (HUC 07020009) is part of the Lower Minnesota River Basin. This watershed is located along the southeast border of the LMMM SA and extends into north-central Iowa. The watershed covers more than 1,500 square-miles, of which about 1,200 square-miles is within Minnesota, including Faribault, Blue Earth, Cottonwood, Freeborn, Jackson, Martin, and Watonwan counties. This watershed is centered on the Blue Earth River, which begins in north Iowa, and flows north toward the Minnesota River.

According to the Blue Earth Watershed Context Report, within the LMMM SA, the watershed is rural with most areas having a density of fewer than 10 people per square-mile (MnDNR, 2017c). The total population is about 32,000, with most of the population concentrated in communities such as Blue Earth, Fairmont, Mankato (southwestern side), Trimont, and Winnebago. I-90 runs east-west through the south part of the watershed, and US-169 runs north-south through the center of the watershed.

Soils in the watershed are formed from glacial till plains and moraines and have high percentages of silt and clay. The watershed is flat and about 90% of the watershed has a slope of 5% or less. About 57% the watershed is mapped as having soils that formed under hydric conditions (mostly wet prairie), but only about 4% of the watershed is currently mapped as wetland. Other current landcover in the watershed include cultivated crops (about 83%) and developed land (about 8%). Crops in the watershed are predominately corn and soybeans.

According to National Wetland Inventory (NWI) data, 60% of existing wetlands are freshwater emergent, 30% are forested, 5% are scrub-shrub and 4% are unconsolidated bottom. Freshwater emergent wetlands within the watershed are found as riparian areas along watercourses, and depressional wetlands are scattered throughout the landscape. Forested and scrub-shrub wetlands within the watershed are located primarily in riparian areas along the Blue Earth River and its major tributaries.

More than 99% of the watershed is within the Minnesota River Prairie ecological subsection, with the west edge falling within the Coteau Moraines subsection, and the north edge within the Big Woods subsection. According

to the Blue Earth River Climate Summary for Watersheds Report, watershed precipitation ranges from 31 to 34 inches annually ((MnDNR, 2019b). Average rainfall increases from west to east and about 70% of the rainfall occurs in the spring and summer. Average annual rainfall in this area is increasing, with the most recent 30-year average showing a nearly 3-inch increase compared to historical records.

### CHIPPEWA RIVER

The Chippewa River major watershed (HUC 07020005) is part of the Minnesota River Basin. This watershed is located along the northern border of the LMMM SA. This watershed covers about 2,080 square-miles and includes Chippewa, Douglas, Grant, Kandiyohi, Ottertail, Pope, Stevens, and Swift counties. The Chippewa River begins in north Douglas County and then flows south until it joins the Minnesota River in the city of Montevideo.

According to the Chippewa River Watershed Context Report, the watershed is predominantly rural with most areas having a density of fewer than 10 people per square-mile (MnDNR, 2017d). The watershed population is about 32,500, with most of the population concentrated in the communities of Benson, Evansville, Glenwood, Hancock, Kerkhoven, Montevideo (west side), and Starbuck. I-94 crosses the north side of the watershed, and US-12 crosses the south side of the watershed.

Soils in the watershed are formed from glacial moraines, till plains, lake plains and sand plains. As a result, soil composition in this watershed is quite variable. Silts and clays are common in the center of the watershed, while sandy soils are common within the Clontarf Lake Plain (southwest area of the watershed) and the Bellgrade Sand Plain (east side of the watershed). While much of the watershed is flat (slopes of 3% or less), there are some areas of rolling hills along the east side of the watershed, with slopes as steep as 15%. About 40% of the watershed soils were formed under hydric conditions (mostly wet prairie), but only about 10% of the watershed is currently mapped as wetland. Other current land covers in the watershed include cultivated crops (about 65%), pasture/hay (about 8%), water (about 6%), forest (about 4%), and developed land (about 5%). Crops are primarily corn and soybeans, with smaller areas of small grains, perennials, and sugar beets.

According to NWI data, 79% of existing wetlands are freshwater emergent, 8% are forested, 5% are scrub-shrub, and 9% are unconsolidated bottom. Most emergent wetlands in the watershed are depressional wetlands located within rolling terrain in Douglas, Pope, and Kandiyohi counties. In comparison, the west side of the watershed is more intensely cultivated, and many emergent wetlands are either farmed or are limited to the edges of rivers and watercourses. The forested/scrub-shrub wetlands are widely scattered throughout the watershed with concentrations along streams and rivers.

More than 92% of the watershed is within the Minnesota River Prairie ecological subsection, with the north area falling within the Hardwood Hills subsection. According to the Chippewa River Climate Summary for Watersheds Report, watershed precipitation ranges from 26 to 28 inches annually (MnDNR, 2019c). Average rainfall increases from northwest to southeast and about 70% of the rainfall occurs in the spring and summer. Average annual rainfall in this area is increasing, with the most recent 30-year average showing a nearly 2-inch increase compared to historical records.

### COTTONWOOD RIVER

The Cottonwood River major watershed (HUC 07020008) is part of the Minnesota River Basin. This watershed is in the center of the LMMM SA. This watershed covers more than 1,300 square-miles and includes five Minnesota counties (Brown, Cottonwood, Lyon, Murray, and Redwood). The Redwood River begins near the community of Balaton, in Lyon County, and flows east until it joins the Minnesota River near New Ulm.

According to the Cottonwood River Watershed Context Report, the watershed is predominantly rural with most areas having a density of fewer than 10 people per square-mile (MnDNR, 2017e). The watershed population is about 29,000, with most of the population concentrated in communities located along US-14 (Lamberton, New Ulm, Sleepy Eye, Springfield, Tracy, and Walnut Grove). The watershed also includes the far south side of the city of Marshall.

Soils in the watershed are mainly glacial till plains and glacial moraines. These soils are an even mix of sand, silt, and clay. A small area near Jeffers is mapped as Darfur Bedrock Hills, which includes bedrock at or near the surface.

The watershed is flat and most of the watershed has a slope of 3% or less. However, a few areas along rivers do exceed 10% slope. Elevation drops more than 800 feet (generally from southwest to northeast) over about 70 miles. Nearly half of the watershed is mapped as having soils that formed under hydric conditions, but only about 4% is currently mapped as wetland. About 85% of the watershed is used for cultivated crops (primarily corn and soybeans) and 6% has been developed. Only 1% is mapped as forest.

According to NWI data, 76% of existing wetlands are freshwater emergent, 17% are forested, 2% are scrub shrub, and 4% are unconsolidated bottom. NWI mapped wetlands are generally restricted to the edges of rivers and watercourses, with concentrations of wetlands along the Cottonwood River.

About 62% of the watershed is within the Minnesota River Prairie ecological subsection, with the most western area falling within the Coteau Moraines subsection. According to the Cottonwood River Climate Summary for Watersheds Report, watershed precipitation ranges from 28 to 30 inches annually (MnDNR, 2019d). Average rainfall increases from northwest to southeast and about 72% of the rainfall occurs in the spring and summer. Average annual rainfall in this area is increasing, with the most recent 30-year average showing a 1-inch increase compared to historical records.

### DES MOINES RIVER – HEADWATERS

The Des Moines River – Headwaters major watershed (HUC 07100001) is part of the Lower Mississippi River Basin. This watershed is in the southwest corner of the LMMM SA. This watershed covers about 1,250 square-miles and includes six Minnesota counties (Cottonwood, Jackson, Lyon, Murray, Nobles, and Pipestone). The Des Moines River begins in Lyon County and joins the Mississippi River in the far southeast corner of Iowa.

According to the Des Moines River – Headwaters Context Report, the watershed is predominantly rural with most areas having a density of fewer than 10 people per square-mile (MnDNR, 2017f). The watershed population is

about 30,000, with most of the population concentrated in communities such as Fulda, Jackson, Lakefield, Slayton, Windom, and Worthington (north side). US-59 runs north-south through the center of the watershed.

Soils in the watershed are mainly formed from glacial moraines and till plains. The far west side of the watershed includes Buffalo Ridge, which creates a drainage divide between the Mississippi and Missouri Rivers. Silt, sand, and clay tend to be evenly distributed within this watershed, with some of the sandiest soils occurring near the Des Moines River.

The watershed is very flat with most areas having a slope of 3% or less. Elevation in the watershed drops about 600 feet (generally from northwest to southeast) over about 60 miles. While more than 40% of the watershed is mapped as having soils that formed under hydric conditions, only about 6% is currently mapped as wetland. About 80% of the watershed is used for cultivated crops (primarily corn and soybeans), about 6% is pasture/grassland and about 6% has been developed.

According to NWI data, 85% of existing wetlands are freshwater emergent, 5% are forested, 3% are scrub shrub, and 5% are unconsolidated bottom. Most of these NWI mapped wetlands are restricted to the edges of rivers and watercourses.

More than 99% of the watershed is within the Coteau Moraines ecological subsection, with the most eastern edge falling within the Minnesota River Prairie subsection. According to the Des Moines River – Headwaters Climate Summary for Watersheds Report, watershed precipitation ranges from 29 to 30 inches annually (MnDNR, 2019e). Average rainfall increases from northwest to southeast and about 70% of the rainfall occurs in the spring and summer. Average annual rainfall in this area is increasing, with the most recent 30-year average showing a more than 2-inch increase compared to historical records.

### EAST FORK DES MOINES RIVER

The East Fork Des Moines River major watershed (HUC 07100003) is part of the Lower Mississippi River Basin. This watershed is located along the south-central border of the LMMM SA and extends outside of the LMMM SA into north-central Iowa. This watershed covers about 1,300 square-miles, and about 200 square-miles of the watershed is in the LMMM SA. In Minnesota (Jackson and Martin counties), this watershed forms the headwaters of the East Fork of the Des Moines River. The East Fork eventually joins the West Fork of the Des Moines River near Dakota City, Iowa about 15 miles north of Fort Dodge, Iowa.

According to the East Fork Des Moines River Watershed Context Report, in the LMMM SA, the watershed is predominantly rural with most areas having a density of fewer than 10 people per square-mile (MnDNR, 2017h). The watershed population is about 3,000, with about a third of the population residing in the city of Sherburn. I-90 runs east-west through the north side of the watershed.

Soils in the watershed are formed from a glacial till plain. Soils are an even mix of silt, sand, and clay, with pockets of sand along the East Fork of the Des Moines River.

The watershed is flat with most areas having a slope of 3% or less. Elevation drops about 200 feet (generally from northwest to southeast) over about 20 miles. More than 60% of the watershed is mapped as having soils

that formed under hydric conditions, but only about 3% is currently mapped as wetland. About 85% of the watershed is used for cultivated crops (corn and soybeans), and about 6% has been developed.

According to NWI data, 80% of existing wetlands are freshwater emergent, 13% are forested, 3% are scrub shrub, and 3% are unconsolidated bottom. Most of these NWI mapped wetlands are associated with the shallow lake systems in the southeast side of the watershed.

More than 99% of the watershed is within the Minnesota River Prairie ecological subsection, with the west edge falling within the Coteau Moraines subsection. According to the East Fork Des Moines River Climate Summary for Watersheds Report, watershed precipitation is about 31 inches annually and about 70% of the rainfall occurs in the spring and summer (MnDNR, 2017h). Average annual rainfall in this area is increasing, with the most recent 30-year average showing a nearly 2-inch increase compared to historical records.

### LAC QUI PARLE RIVER

The Lac qui Parle River major watershed (HUC 07020003) is part of the Minnesota River Basin. This watershed is located along the west border of the LMMM SA and extends outside of the LMMM SA into northeast South Dakota. This watershed covers about 1,100 square-miles and about 760 square-miles of the watershed is in the LMMM SA. This watershed includes the Lac qui Parle River and its West Branch. These rivers flow northeast and join near the city of Dawson. From there, the Lac qui Parle River continues northeast to its confluence with the Minnesota River in Lac qui Parle state park.

According to the Lac qui Parle Watershed Context Report, In the LMMM SA, the watershed is rural with most areas having a density of fewer than 10 people per square-mile (MnDNR, 2017i). The watershed population is about 9,500, with most of the population concentrated in the communities of Canby, Dawson, and Madison. US-212 (east-west) and US-75 (north-south) intersect near the center of the watershed.

Soils in the watershed are formed from glacial moraines, till plains, and lake plains. While silts, sands, and clays are evenly mixed in the majority of the watershed, areas with high clay and high sand percentages occur throughout the watershed.

Most of the watershed has less than 5% slope, but the overall terrain is rolling, particularly along the west side.. Elevation drops more than 800 feet across the watershed, with about 500 feet of elevation change occurring in the southwest side (within the Coteau Moraines subsection). More than 40% of the watershed is mapped as having soils that formed under hydric conditions, but only about 8% is currently mapped as wetland. About 75% of the watershed is used for cultivated crops (primarily corn and soybeans), about 10% is pasture/grassland and about 5% has been developed. Most of the pasture/grassland is located within the Coteau Moraines subsection, to the west of Canby.

According to NWI data, 87% of existing wetlands are freshwater emergent, 8% are forested, 2% are scrub shrub, and 3% are unconsolidated bottom. Most of these NWI mapped wetlands are restricted to the edges of rivers, watercourses and drainageways.

About 78% of the watershed is within the Minnesota River Prairie ecological subsection and the southwestern corner is within the Coteau Moraines subsection. According to the Lac qui Parle River Climate Summary for Watersheds Report, watershed precipitation ranges from 26 to 27 inches annually (MnDNR, 2019f). Average rainfall increases from north to south and about 69% of the rainfall occurs in the spring and summer. Average annual rainfall in this area is increasing, with the most recent 30-year average showing a 2-inch increase compared to historical records.

### LE SUEUR RIVER

The Le Sueur River major watershed (HUC 07020011) is part of the Minnesota River Basin. This watershed is located along the east border of the LMMM SA. This watershed covers about 1,100 square-miles and includes parts of five Minnesota counties (Blue Earth, Faribault, Freeborn, Steele, and Waseca). The Le Sueur River, Cobb River and Maple River flow through the watershed. These rivers generally flow northwest and join just south of the city of Mankato. From there, the Le Sueur River continues north for about 5 miles until it enters the Blue Earth River.

According to the Le Sueur River Watershed Context Report, the watershed is rural with most areas having a density of fewer than 10 people per square-mile (MnDNR, 2017j). The total watershed population is about 34,000, with most of the population concentrated in communities of Eagle Lake, Janesville, Madison Lake, Mapleton, New Richland, Mankato (east side), Waseca (west side), and Wells. US-14 runs east-west through the north side of the watershed.

Soils in the watershed are formed primarily from glacial moraines, with a small area of glacial till plains occurring along the south boundary. Soils in the west half of the watershed are silts and clays and the east half tends to be an even mix of silts, sands, and clays.

The watershed is flat with most areas having a slope of 5% or less. There are some areas of rolling hills in the east side of the watershed. Slopes of 10% of greater occur along rivers to the south of Mankato. Elevation in the watershed drops about 400 feet (generally from southeast to northwest) over about 40 miles. More than 60% of the watershed is mapped as having soils that formed under hydric conditions, but only about 6% is currently mapped as wetland. About 83% of the watershed is used for cultivated crops (primarily corn and soybeans), about 4% is pasture/grassland and about 7% has been developed.

According to NWI data, 72% of existing wetlands are freshwater emergent, 20% are forested, 4% are scrub shrub, and 3% are unconsolidated bottom. NWI mapped emergent wetlands widely scattered throughout the watershed, with concentrations along rivers and in areas with more rolling terrain. Forested/scrub-shrub wetlands are typically located in the riparian areas of rivers and watercourses.

About 72% of the watershed is within the Minnesota River Prairie ecological subsection, 18% in the Oak Savanna subsection, and 10% in the Big Woods subsection. According to the Le Sueur River Climate Summary for Watersheds Report, watershed precipitation ranges from 32 to 35 inches annually (MnDNR, 2019g). Average rainfall increases from northwest to southeast and about 70% of the rainfall occurs in the spring and summer.

Average annual rainfall in this area is increasing, with the most recent 30-year average showing a nearly 4-inch increase compared to historical records.

### LITTLE SIOUX RIVER

The Little Sioux River major watershed (HUC 10230003) is part of the Missouri River basin. This watershed is located along the southern border of the LMMM SA and extends outside of the LMMM SA into northwest Iowa. This watershed covers nearly 3,000 square-miles and about 320 square-miles of the watershed is in the LMMM SA. In Minnesota (Jackson and Nobles counties) this watershed forms the headwaters of the Little Sioux River and the Ocheyedan River, which both flow south. The Little Sioux and Ocheyedan join in Spencer, Iowa and from there, the Little Sioux continues south to the Missouri River, just north of Omaha, Nebraska.

According to the Little Sioux River Watershed Context Report, in the LMMM SA, the watershed is predominantly rural with most areas having a density of fewer than 10 people per square-mile (MnDNR, 2017k). The watershed population is about 8,000, with most of the population concentrated in the city of Worthington (south side). I-90 runs east-west through the north side of the watershed and US-59 runs north-south along the west side of the watershed.

Soils in the watershed are formed from glacial moraines and till plains, with a small area of Buffalo Ridge in the southwest corner. Soil composition in this watershed is quite variable with higher percentages of silts and clays in the center of the watershed.

Nearly the entire watershed has a slope of 5% or less. Elevation in the watershed drops about 300 feet (generally from north to south) over about 15 miles. More than 45% of the watershed is mapped as having soils that formed under hydric conditions, but only about 5% is currently mapped as wetland. About 83% of the watershed is used for cultivated crops (primarily corn and soybeans), about 4% is pasture/grassland and about 6% has been developed.

According to NWI data, 88% of existing wetlands are freshwater emergent, 2% are forested, 3% are scrub shrub, and 6% are unconsolidated bottom. Most of these NWI mapped wetlands are located along shallow lakes and in river riparian areas.

The entire watershed is within the Coteau Moraines ecological subsection. According to the Little Sioux River Climate Summary for Watersheds Report, Watershed precipitation is about 30 inches annually (MnDNR, 2019h). About 70% of the rainfall occurs in the spring and summer. Average annual rainfall in this area is increasing, with the most recent 30-year average showing a 2-inch increase compared to historical records.

### LOWER BIG SIOUX RIVER

The Lower Big Sioux River watershed (HUC 10170203) is part of the Missouri River Basin. This watershed is located along the southwest border of the LMMM SA and extends into Iowa and South Dakota. While this watershed covers nearly 3,500 square-miles, only about 500 square-miles is in the LMMM SA. In Minnesota, this watershed includes Lincoln, Pipestone, and Rock counties. While the Big Sioux River does not flow through

the LMMM SA, the LMMM SA does include several tributaries to the Big Sioux River (Beaver Creek, Split Rock Creek, and Pipestone Creek).

According to the Lower Big Sioux River Watershed Context Report, in the LMMM SA, the watershed is predominantly rural with most areas having a density of fewer than 10 people per square-mile (MnDNR, 2017b). The watershed population is about 8,500 with about half of the population residing in the city of Pipestone. I-90 runs east-west through the south corner of the watershed, and US-75 runs north-south through the north part of the watershed.

Soils in the watershed are formed from till plains and from the Blue Mounds and Buffalo Ridge formations, which includes rock outcrops of Sioux Quartzite. Soils in this watershed are high in silt and clay, especially in the south half of the watershed.

Much of the watershed is hilly with most areas having slopes between 3% and 10%. Elevation in the watershed drops about 600 feet (generally from northeast to southwest) over about 40 miles. About 20% of the watershed is mapped as having soils that formed under hydric conditions, but only about 5% is currently mapped as wetland. About 77% of the watershed is used for cultivated crops (primarily corn and soybeans), about 15% is pasture/grassland and about 6% has been developed.

According to NWI data, 95% of existing wetlands are freshwater emergent, 1% are forested, 1% are scrub shrub, and 3% are unconsolidated bottom. Nearly all of these NWI mapped wetlands are restricted to the edges of streams and drainageways.

About 98% of the watershed is within the Inner Coteau ecological subsection, with the northeast edge falling within the Coteau Moraines subsection. According to the Lower Big Sioux River Climate Summary for Watersheds Report, watershed precipitation is about 28 inches annually and about 70% of the rainfall occurs in the spring and summer (MnDNR, 2019i). Average annual rainfall in this area is increasing, with the most recent 30-year average showing a more than 2-inch increase compared to historical records.

### LOWER DES MOINES RIVER

The Lower Des Moines River major watershed (HUC 07100002) is part of the Lower Mississippi River Basin. This watershed is located along the south-central border of the LMMM SA and extends outside of the LMMM SA into Iowa. While this watershed covers about 1,100 square-miles, less than 100 square-miles of this watershed is in the LMMM SA. In Minnesota, this watershed includes Jackson and Martin counties.

According to the Lower Des Moines Watershed Context Report, in the LMMM SA, the watershed is almost entirely rural (MnDNR, 2017g). The watershed population is only about 800. The southeast corner of Jackson is the only incorporated area in this watershed. US-71 runs north-south through the center of the watershed.

Soils in the watershed are formed from glacial moraines and till plains. Soil composition in this watershed is an even mix of silt, sand, and clay, although high percentages of silts and clays are present in the west half of the watershed.

Much of the watershed is flat (3% or less) with steeper areas (up to 10%) occurring adjacent to the Des Moines River. Elevation across the watershed drops about 200 feet from the edges of the watershed toward the Des Moines River. Nearly 50% of the watershed is mapped as having soils that formed under hydric conditions, but only about 2% is currently mapped as wetland. About 86% of the watershed is used for cultivated crops (primarily corn and soybeans), about 5% is pasture/grassland and about 5% has been developed.

According to NWI data, 58% of existing wetlands are freshwater emergent, 28% are forested, 4% are scrub shrub, and 9% are unconsolidated bottom. Nearly all of these NWI mapped wetlands are located along the Des Moines River.

About 65% of the watershed is within the Coteau Moraines ecological subsection (west side) and the east side is within the Minnesota River Prairie subsection. According to the Lower Des Moines River Climate Summary for Watersheds Report, watershed precipitation is about 30 inches annually and about 70% of the rainfall occurs in the spring and summer (MnDNR, 2017a). Average annual rainfall in this area is increasing, with the most recent 30-year average showing a nearly 2-inch increase compared to historical records.

### LOWER MINNESOTA RIVER

The Lower Minnesota River major watershed (HUC 07020012) is part of the Minnesota River Basin. This watershed is located along the east boundary of the LMMM SA, and it includes part of the southwest Twin Cities metro area. This watershed covers about 1,800 square-miles and includes 10 Minnesota counties (Carver, Dakota, Hennepin, Le Sueur, McLeod, Nicollet, Renville, Rice, Scott, and Sibley). This watershed is centered on the reach of the Minnesota River that flows northeast from St Peter to its confluence with the Mississippi River in Minneapolis/St Paul. There are numerous tributaries to the Minnesota River within this watershed, including the Rush River and Credit River.

According to the Lower Minnesota River Watershed Context Report, when compared to the rest of the LMMM SA, population density in this watershed is high (MnDNR, 2017n). More than 600,000 people live within this watershed. Twin Cities metro communities in the watershed include Apple Valley, Burnsville, Bloomington, Chanhassen, Chaska, Deep Haven, Eagan, Eden Prairie, Edina, Hopkins, Inver Grove Heights, Lakeville, Mendota Heights, Minnetonka, Prior Lake, Richfield, Rosemount, Savage, Shakopee, and Shorewood. Outside of the metro, larger communities include Arlington, Belle Plaine, Cologne, Gaylord, Jordan, Le Center, Le Sueur, Lonsdale Montgomery, New Prague, Norwood Young America, Waconia, and Winthrop. I-494, I-35W, and I-35E run through the most populated metro areas. US highways US-169 and US-212 also cross the east half of the watershed.

Soils in the watershed are formed from glacial moraines, till plains, and alluvial plains. Soils along the Minnesota River tend to be quite sandy, while the rest of the watershed tend to be a more even distribution of silt, sand, and clay. This watershed also has occasional areas of bedrock near the Minnesota River.

While much of the watershed is quite flat (less than 3%) there are localized areas of rolling hills. Additionally, there are steep slopes transitioning to the Minnesota River, with some slopes exceeding 10%. Elevation in the watershed drops about 400 feet across the watershed, and generally slopes towards the Minnesota River. There

is a steep transition adjacent to the Minnesota River with some areas dropping more than 200 feet in elevation in about a quarter of a mile.

About 50% of the watershed is mapped as having soils that formed under hydric conditions, but only about 10% is currently mapped as wetland. About 56% of the watershed is used for cultivated crops (primarily corn and soybeans), about 11% is pasture/grassland and about 16% has been developed and about 7% if forest.

According to NWI data, 67% of existing wetlands are freshwater emergent, 19% are forested, 6% are scrub shrub, and 5% are unconsolidated bottom. According to NWI data, emergent wetlands are scattered throughout the watershed and forests/scrub shrub wetlands are concentrated along the Minnesota River.

The majority of the watershed falls within the Big Woods and Minnesota River Prairie ecological subsections and the east edge includes small areas of the St. Paul-Baldwin Plains and the Anoka Sand Plain subsections. According to the Lower Minnesota River Climate Summary for Watersheds Report, watershed precipitation ranges from 30 to 33 inches annually (MnDNR, 2019j). Average rainfall increases from west to east and about 70% of the rainfall occurs in the spring and summer. Average annual rainfall in this area is increasing, with the most recent 30-year average showing a more than 2-inch increase compared to historical records.

### MINNESOTA RIVER – HEADWATERS

The Minnesota River – Headwaters major watershed (HUC 07020001) is part of the Minnesota River Basin. This watershed is located along the northwestern border of the LMMM SA and extends outside of the LMMM SA into South Dakota. The east half of this watershed (about 800 acres) is in the LMMM SA and includes four Minnesota counties (Bigstone, Lac qui Parle, Stevens, and Swift). This watershed includes the upper reach of the Minnesota River from Browns Valley, Minnesota southeast to Lac qui Parle state park. Notable lakes on the Minnesota River include Bigstone Lake (between Browns Valley and Ortonville), Marsh Lake (near the confluence of the Pomme de Terre River), and Lac qui Parle Lake (upstream of Lac qui Parle state park). This watershed also includes the Yellow Bank River. This river flows through the southwest corner of the watershed and then joins the Minnesota River in the Bigstone River National Wildlife Refuge, near the city of Odessa.

According to the Minnesota River – Headwaters Watershed Context Report, in the LMMM SA, the watershed is rural with most areas having a density of fewer than 10 people per square-mile (MnDNR, 2017l). The watershed population is less than 7,000. The city of Ortonville, which is located at the intersection of US-75 and US-12, is the largest incorporated area within the watershed.

Soils in the watershed are formed from glacial moraines, till plains, lake plains, and alluvial plains. Soil composition in the watershed is highly variable, particularly in the alluvial and lake plains where soils range from almost pure sand to almost pure silt and clay. Localized areas of bedrock also occur near the Minnesota River.

Elevations in the watershed are varied, ranging from flat, to rolling hills, to grades of more than 10% along Big Stone Lake and the Minnesota River. However, the overall elevation change is minimal, with only about a 200 foot range of elevation within the watershed. Nearly 40% of the watershed is mapped as having soils that formed under hydric conditions, but only about 13% is currently mapped as wetland. About 65% of the watershed is

used for cultivated crops (primarily corn, soybeans, and a small area of grains), about 8% is pasture/grassland, 8 percent is water, and about 5% has been developed.

According to NWI data, 85% of existing wetlands are freshwater emergent, 4% are forested, 3% are scrub shrub, and 7% are unconsolidated bottom. NWI maps an expansive area of emergent wetlands near Big Stone National Wildlife Refuge, and as scattered depressional wetlands throughout the landscape. Forested wetlands are typically limited to the riparian areas of the Minnesota River.

All of the watershed is within the Minnesota River Prairie ecological subsection. According to the Minnesota River – Headwaters Climate Summary for Watersheds Report, watershed precipitation ranges from 25 to 36 inches annually (MnDNR, 2019a). About 70% of the rainfall occurs in the spring and summer. Average annual rainfall in this area is increasing, with the most recent 30-year average showing a nearly 2-inch increase compared to historical records.

### MINNESOTA RIVER – MANKATO

The Minnesota River – Mankato major watershed (HUC 07020007) is part of the Minnesota River Basin. This watershed is located along the east-central boundary of the LMMM SA. This watershed covers more than 1,300 square-miles and includes nine Minnesota counties (Blue Earth, Brown, Cottonwood, Le Sueur, Nicollet, Redwood, Renville, Sibley, and Watonwan). The Minnesota River – Mankato watershed branches into two sections that are centered on the Minnesota River and the Little Cottonwood River.

According to the Minnesota River – Mankato Watershed Context Report, the overall character of this watershed is rural, with the notable exception of the cities of Mankato, New Ulm, Redwood Falls, and St Peter contributing to a watershed population of about 95,000 residents (MnDNR, 2017m). Fairfax, Lake Crystal, and Nicollet are also population centers within the watershed. US highways in the watershed include US-169 and US-14.

Soils in the watershed are formed from glacial till plains. Other areas include alluvial plains along the Minnesota River, and an area of bedrock located to the east of the community of Jeffers. Soil composition in the watershed is an even mix of silt, sand, and clay, although there are some pockets of sandy soils along the Minnesota River, and in the southwest lobe of the watershed.

Generally, the watershed is quite flat (less than 3%) with the exception of the slopes to the Minnesota River, and the headwaters of the Little Cottonwood River. While the watershed has an elevation range of more than 600 feet, the majority of the watershed is within an elevation range of 200 feet.

More than 55% of the watershed is mapped as having soils that formed under hydric conditions, but only about 7% is currently mapped as wetland. About 76% of the watershed is used for cultivated crops (primarily corn and soybeans), about 3% is pasture/grassland, 4% is water, and about 7% has been developed.

According to NWI data, 58% of existing wetlands are freshwater emergent, 25% are forested, 13% are scrub shrub, and 3% are unconsolidated bottom. The NWI mapped emergent wetlands are concentrated along a series of lakes near the city of Nicollet and in a lakes area to the southeast of St Peter. Nearly all of the forested/scrub shrub wetlands are located in riparian areas along the Minnesota River.

About 90% of the watershed is mapped as the Minnesota River Prairie ecological subsection, and the area east of the Minnesota River is mapped as part of the Big Woods subsection. According to the Minnesota River – Mankato Climate Summary for Watersheds Report, watershed precipitation ranges from 29 to 32 inches annually (MnDNR, 2019k). Average rainfall increases from northwest to southeast and about 70% of the rainfall occurs in the spring and summer. Average annual rainfall in this area is increasing, with the most recent 30-year average showing a nearly 2-inch increase compared to historical records.

### MINNESOTA RIVER – YELLOW MEDICINE RIVER/HAWK CREEK

The Minnesota River – Yellow Medicine River/Hawk Creek major watershed (HUC 07020004) is part of the Minnesota River Basin. This watershed spans the west side of the LMMM SA. This watershed covers more than 2,000 square-miles and includes eight Minnesota counties (Chippewa, Kandiyohi, Lac qui Parle, Lincoln, Lyon, Redwood, Renville, and Yellow Medicine). This watershed includes the reach of the Minnesota River between Lac qui Parle state park and Redwood Falls. The southwest part of the watershed includes the Yellow Medicine River and its tributaries. The northwest part of the watershed includes Hawk Creek and its tributaries.

According to the Minnesota River – Yellow Medicine River Context Report, this watershed is rural, but does include some major population centers (MnDNR, 2017o). The watershed population is about 45,000. Willmar and Montevideo are the largest cities in the watershed. Other population centers include Bird Island, Clara City, Cottonwood, Granite Falls, Minneota, Olivia, and Renville. US highways in the watershed include US-12, US-212, US-59, US-71, and US-75.

Soils in the watershed are formed from glacial moraines, till plains, lake plains, alluvial plains and a small area of the Buffalo Ridge formation. Soil composition in this watershed is variable. Areas near rivers and near the city of Willmar tend to have more sandy soils. The Tracy Till Plain (in northeast Lincoln County) has a high percentage of clay. Areas of bedrock (at or near the surface) are also scattered along the Minnesota River.

Most of the watershed is very flat with most areas having a slope of 3% or less. Exceptions to this are the southwest lobe of the watershed (which drops about 500 feet over 20 miles); the slopes to the Minnesota River (which drops about 150 feet); and the Willmar area (which has rolling hills). About 46% of the watershed is mapped as having soils that formed under hydric conditions, but only about 5% is currently mapped as wetland. About 80% of the watershed is used for cultivated crops (primarily corn and soybeans), about 6% is pasture/grassland and about 6% has been developed.

According to NWI data, 75% of existing wetlands are freshwater emergent, 14% are forested, 5% are scrub shrub, and 5% are unconsolidated bottom. Concentrations of NWI mapped wetlands occur in near the east and west sides of the watershed and along the Minnesota River.

About 85% of the watershed is within the Minnesota River Prairie ecological subsection, with the west area falling within the Coteau Moraines subsection. According to the Minnesota River – Yellow Medicine River Climate Summary for Watersheds Report, watershed precipitation ranges from 27 to 29 inches annually (MnDNR, 2019l). Average rainfall increases from west to east and about 70% of the rainfall occurs in the spring and

summer. Average annual rainfall in this area is increasing, with the most recent 30-year average showing a more than 2-inch increase compared to historical records.

### POMME DE TERRE RIVER

The Pomme de Terre River major watershed (HUC 07020002) is part of the Minnesota River Basin. This watershed is located along the northwest border of the LMMM SA. This watershed covers nearly 900 square-miles and includes six Minnesota counties (Bigstone, Douglas, Grant, Otter Tail, Pope, Stevens, and Swift). The Pomme de Terre River begins in Otter Tail County and flows south until it joins the Minnesota River (Marsh Lake) near the city of Appleton.

According to the Pomme de Terre River Context Report, this watershed is rural with most areas having a density of fewer than 10 people per square-mile (MnDNR, 2017p). The watershed population is about 15,000, with more than a third of the population living in Appleton and Morris. I-94 crossed the north part of the watershed. US-59 runs north-south through the center of the watershed and US-12 crosses the south side of the watershed.

Soils in the watershed are formed from glacial moraines, till plains, and alluvial plains. Most soils in this watershed contain high percentages of silt and clay. Pockets of sandy soil occur along the Pomme de Terre River and in an area located to northeast of I-94.

Most of the south part of the watershed is flat with most areas having a slope of 3% or less. North of the community of Barrett, the landscape transitions to rolling hills, with numerous wetlands and shallow lakes. About 33% of the watershed is mapped as having soils that formed under hydric conditions and about 10% is currently mapped as wetland. About 63% of the watershed is used for cultivated crops (corn, soybeans, and some small grains), about 11% is pasture/grassland 5% is forest, and about 6% has been developed.

According to NWI data, 77% of existing wetlands are freshwater emergent, 6% are forested, 3% are scrub shrub, and 13% are unconsolidated bottom. These NWI wetlands are evenly distributed throughout the watershed.

About 74% of the watershed is within the Minnesota River Prairie ecological subsection, 22% within the Hardwood Hills subsection and 3% within the Red River Prairie subsection. According to the Pomme de Terre River Climate Summary for Watersheds Report, watershed precipitation is about 26 inches annually and about 70% of the rainfall occurs in the spring and summer (MnDNR, 2019m). Average annual rainfall in this area is increasing, with the most recent 30-year average showing a nearly 2-inch increase compared to historical records.

### REDWOOD RIVER

The Redwood River major watershed (HUC 07020006) is part of the Minnesota River Basin. This watershed is located within the southwest corner of the LMMM SA. This watershed covers about 700 square-miles and includes six Minnesota counties (Murray, Lincoln, Lyon, Pipestone, Redwood, and Yellow Medicine). The Redwood River begins in Pipestone County and flows northeast until it joins the Minnesota River near the city of Redwood Falls.

According to the Redwood River Context Report, the watershed is rural with most areas having a density of fewer than 10 people per square-mile (MnDNR, 2017q). Larger communities within the watershed include Lake Benton, Marshall, Redwood Falls, and Tyler. The watershed population is about 24,000. US-59 runs north-south through the center of the watershed and US-14/US-75 intersects in Lake Benton along the west side of the watershed.

Soils in the watershed are formed from glacial moraines, till plains, lake plains and the Buffalo Ridge formation. Soils in the east half of the watershed tend to be high in organic matter and soils in the west half tend to have higher percentages of silt and clay.

Elevation in the west half of the watershed drops nearly 900 feet (southwest to northeast) between the communities of Lake Benton and Marshall. In contrast, the east half of the watershed is flat, with only about a 200-foot change in elevation over about 30 miles. About 45% of the watershed is mapped as having soils that formed under hydric conditions, but only about 5% is currently mapped as wetland. About 78% of the watershed is used for cultivated crops (primarily corn and soybeans), about 9% is pasture/grassland and about 6% has been developed.

According to NWI data, 83% of existing wetlands are freshwater emergent, 9% are forested, 3% are scrub shrub, and 4% are unconsolidated bottom. The NWI mapped wetlands are concentrated in the west half of the watershed, and along the Redwood River.

About 54% of the watershed is within the Minnesota River Prairie ecological subsection and 46% is in the Coteau Moraines subsection. According to the Redwood River Climate Summary for Watersheds Report, watershed precipitation is about 28 inches annually and about 70% of the rainfall occurs in the spring and summer (MnDNR, 2019n). Average annual rainfall in this area is increasing, with the most recent 30-year average showing a more than 2-inch increase compared to historical records.

### ROCK RIVER

The Rock River major watershed (HUC 10170204) is part of the Missouri River Basin. This watershed is located along the southwest corner of the LMMM SA and extends outside of the LMMM SA into Iowa. This watershed covers more than 1,600 square-miles and about 900 square-miles of this watershed is in the LMMM SA. In Minnesota, this watershed includes Murray, Nobles, Pipestone and Rock counties. The Rock River and Little Rock River flow south through the watershed, and eventually join in northwest Iowa. From there, the Rock River continues southwest to the confluence with the Big Sioux River at the South Dakota/Iowa border.

According to the Rock River Context Report, in the LMMM SA, the watershed is rural with most areas having a density of fewer than 10 people per square-mile (MnDNR, 2017r). The watershed population is about 17,000, with nearly half of the population residing in the communities of Adrian, Edgerton, and Luverne. I-90 (east-west) and US-75 (north-south) intersect near the city of Luverne.

Soils in the watershed are formed from glacial moraines, till plains, and alluvial plains. The Buffalo Ridge formation runs along the east boundary, and the Blue Mounds formation (which includes bedrock at or near the

surface) is located along the west-central boundary. Soil composition in this watershed is variable with silts and clays more common in the southwest.

Slopes in this watershed form a strong dendritic pattern, with streams and drainageways carving steep slopes that lead to the Rock River. About 27% of the watershed is mapped as having soils that formed under hydric conditions, but only about 5% is currently mapped as wetland. About 81% of the watershed is used for cultivated crops (primarily corn and soybeans), about 11% is pasture/grassland and about 6% has been developed.

According to NWI data, 92% of existing wetlands are freshwater emergent, 3% are forested, 1% are scrub shrub, and 3% are unconsolidated bottom. Nearly all of the NWI mapped wetlands are located along the edges of rivers and drainageways.

All of watershed is within the Coteau ecological subsections (74% in the Inner Coteau and 26% in the Coteau Moraines). According to the Rock River Climate Summary for Watersheds Report, watershed precipitation ranges from 28 to 29 inches annually and about 70% of the rainfall occurs in the spring and summer (MnDNR, 2019o). Average annual rainfall in this area is increasing, with the most recent 30-year average showing a 1.5-inch increase compared to historical records.

#### UPPER BIG SIOUX RIVER

The Upper Big Sioux River major watershed (HUC 10170202) is part of the Missouri River Basin. This watershed is located along the west border of the LMMM SA and extends outside of the LMMM SA into South Dakota. Only about 40 square-miles of this approximately 2,100 square-mile watershed is located within the LMMM SA. One Minnesota county (Lincoln County) is included in this watershed. Medary Creek (a tributary to the Big Sioux River) is the only named watercourse in this part of the watershed.

According to the Upper Big Sioux River Context Report, in the LMMM SA, the watershed is entirely rural. The watershed population is only 130 people. There are no incorporated areas in this area. Utility scale wind turbines are common in this area. US-14 runs east-west across the south part of this watershed.

Soils in the watershed originate from glacial till plains and the Buffalo Ridge formation. Soils in this watershed are silts and clays with areas of higher organic matter near streams and drainageways.

Slopes in this watershed form a dendritic pattern, with streams and drainageways carving steep slopes that lead to Medary Creek. About 10% of the watershed is mapped as having soils that formed under hydric conditions and about 8% is currently mapped as wetland. About 60% of the watershed is used for cultivated crops (primarily corn and soybeans), about 34% is pasture/grassland and about 4% has been developed. Utility scale wind turbines are also common within this watershed.

According to NWI data, 95% of existing wetlands are freshwater emergent, 1% are forested, 1% are scrub shrub, and 3% are unconsolidated bottom. Nearly all of these NWI mapped wetlands are located along the edges of watercourses and drainageways.

All of the watershed is within the Coteau ecological subsections (89% in the Inner Coteau and 11% in the Coteau Moraines). According to the Upper Big Sioux River Climate Summary for Watersheds Report, watershed

precipitation is about 28 inches annually and about 70% of the rainfall occurs in the spring and summer (MnDNR, 2019p). Average annual rainfall in this area is increasing, with the most recent 30-year average showing a more than 3-inch increase compared to historical records.

### WATONWAN RIVER

The Watonwan River major watershed (HUC 07020010) is part of the Minnesota River Basin. This watershed is located within the south-central part of the LMMM SA. This watershed covers nearly 900 square-miles and includes parts of six Minnesota counties (Blue Earth, Brown, Cottonwood, Jackson, Martin, and Watonwan). The Watonwan River (and its north and south forks) generally flows east until it reaches the Blue Earth River near Garden City.

According to the Watonwan River Context Report, the watershed is rural with most areas having a density of fewer than 10 people per square-mile (MnDNR, 2017s). The watershed population is about 18,000, with population centers including Madelia, Mountain Lake, St James, and Truman. US-169 runs north-south along the east side of the watershed and US-71 runs north-south along the west side.

Soils in the watershed are formed from glacial moraines and till plains, with an area of sand plain on the east side of the watershed and a small area of the Darfur Bedrock Hills formation on the west side of the watershed. Soil composition in the west half of the watershed is an even mix of silts, sands and clays. The east half includes large areas of sand, and large areas of silt. Bedrock occurs along the northwest side of the watershed, near the community of Darfur.

While the watershed is generally flat (slopes of 3% or less), there are some areas of rolling terrain in the west half of the watershed. More than 55% of the watershed is mapped as having soils that formed under hydric conditions, but only about 4% is currently mapped as wetland. About 87% of the watershed is used for cultivated crops (primarily corn and soybeans), about 2% is pasture/grassland and about 6% has been developed.

According to NWI data, 70% of existing wetlands are freshwater emergent, 22% are forested, 3% are scrub shrub, and 5% are unconsolidated bottom. While emergent wetlands are widely scattered throughout the watershed, forested/scrub shrub wetlands are limited to the edges of rivers and watercourses.

About 97% of the watershed is within the Minnesota River Prairie ecological subsection, with the most western edge falling within the Coteau Moraines subsection. According to the Watonwan River Climate Summary for Watersheds Report, watershed precipitation ranges from 30 to 32 inches annually and about 70% of the rainfall occurs in the spring and summer (MnDNR, 2019q). Average annual rainfall in this area is increasing, with the most recent 30-year average showing a more than 2-inch increase compared to historical records.

# 3. BASELINE CONDITIONS

The baseline conditions section analyzes and describes the current conditions of water resources across the LMMM SA. All the data analyzed is readily available to the public. Additional information about the land use, vegetation cover, and permitting history is included to add a greater understanding of current conditions and to

further inform the prioritization process. Maps for the geographic service area and the baseline conditions are located in Appendix B.

## Pre-settlement vegetation

The Historic Vegetation Model (VEGMOD) developed by the Minnesota Department of Transportation (MnDOT) was summarized to gain insight into the distribution of vegetation prior to the significant changes resulting from European settlement (pre-settlement). VEGMOD was developed to represent the vegetation present at the time of the Public Land Survey (1848-1907) across Minnesota. The model is based on statistical analysis of interpreted data which includes surveyor's observations and modern terrain and soils data (MnDOT, 2019). A summary of the vegetative cover grouped by vegetative class is provided in **Error! Reference source not found.**. Unclassified data was excluded from the analysis.

Results from the VEGMOD data (Figure B-3) reflect the ecological classification subsections for each of the major watersheds. This includes prairie, pothole wetlands, and shallow lakes across the vast majority of the LMMM SA. As the Minnesota River moves east to meet the Mississippi River, the river valley transitions from prairie-pothole to big woods deciduous forest, comprised predominantly with maple and basswood. These communities exist in a greatly altered state today, with nearly all native prairie and pothole wetland area reduced to support agriculture.

| Table 3-1. Summary of Pre-Settlement Vegetation for the LMMM SA | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Category** | **Water** | **Wetland** | | **Forest** | | | | | **Prairie** | | | |
| **Major Watershed** | **Surface Water** | **Seasonally Wet** | **Permanently Wet** | **Coniferous Forest** | **Coniferous Woodland** | **Mixed Coniferous-Deciduous Forest** | **Deciduous Forest** | **Deciduous Woodland** | **Prairie** | **Bush-Prairie** | **Coniferous Savanna** | **Deciduous Savanna** |
| Blue Earth River | 2% | 3% | 7% | - | - | - | 1% | - | 86% | - | - | < 1% |
| Chippewa River | 6% | 2% | 7% | - | - | - | 2% | 1% | 81% | - | - | 1% |
| Cottonwood River | 1% | 1% | 7% | - | - | - | < 1% | - | 91% | - | - | < 1% |
| Des Moines River - Headwaters | 4% | 1% | 4% | - | - | - | < 1% | - | 91% | - | - | - |
| East Fork Des Moines River | 5% | 1% | 8% | - | - | - | - | - | 85% | - | - | < 1% |
| Lac qui Parle River | 1% | 1% | 3% | - | - | - | < 1% | - | 95% | - | - | - |
| Le Sueur River | 3% | 7% | 8% | - | - | - | 11% | < 1% | 68% | - | - | 2% |
| Little Sioux River | 5% | 1% | 6% | - | - | - | - | - | 88% | - | - | - |
| Lower Big Sioux River | < 1% | 1% | < 1% | - | - | - | < 1% | - | 99% | - | - | - |
| Lower Des Moines River | 1% | 1% | 6% | - | - | - | < 1% | - | 92% | - | - | < 1% |
| Lower Minnesota River | 4% | 9% | 15% | - | - | - | 42% | < 1% | 27% | - | - | 3% |
| Minnesota River - Headwaters | 5% | 7% | 3% | - | - | - | < 1% | - | 85% | - | - | - |
| Minnesota River - Mankato | 4% | 6% | 11% | - | - | - | 12% | < 1% | 67% | - | - | < 1% |
| Minnesota River - Yellow Medicine River/Hawk Creek | 2% | 2% | 8% | - | - | - | < 1% | - | 88% | - | - | < 1% |
| Pomme de Terre River | 9% | 2% | 7% | - | - | - | 4% | 1% | 75% | < 1% | - | 2% |
| Redwood River | 3% | 1% | 6% | - | - | - | < 1% | - | 89% | - | - | - |
| Rock River | < 1% | 1% | 1% | - | - | - | - | - | 98% | - | - | - |
| Upper Big Sioux River | - | < 1% | - | - | - | - | < 1% | - | 100% | - | - | - |
| Watonwan River | 2% | 2% | 5% | - | - | - | < 1% | - | 91% | - | - | < 1% |
| **Category Total** | **3%** | **10%** | | **7%** | | | | | **80%** | | | |
| **LMMM SA Total** | **3%** | **3%** | **7%** | **-** | **-** | **-** | **6%** | **< 1%** | **79%** | **-** | **-** | **1%** |

## Wetlands

The current extent of wetlands in the LMMM SA is based on the 2019 update of the Minnesota National Wetland Inventory (NWI) provided by the MnDNR (Kloiber et al., 2019). The LMMM SA has approximately 800,000 acres of palustrine wetlands (Figure B-4). Riverine and Lacustrine wetlands were not included in this analysis because they are commonly associated with non-wetland deepwater habitat in the Cowardin classification system. Approximately 7% of the LMMM SA is palustrine wetlands, which is lower than the statewide percentage of 20%. Emergent wetlands make up the vast majority of wetlands within the LMMM SA (615,184 acres; 76% of wetlands). Forested wetlands are second, comprising just over 100,000 acres and 12% of wetlands. Unconsolidated bottom and shrub-scrub are the least abundant type of wetlands, spanning 47,945 acres (6%) and 35,134 acres (4%), respectively. Aquatic bed and unconsolidated shore combine to cover 8,565 acres, just over 1% of all wetlands.

The northern major watersheds have the highest percentages of wetland acres across the watershed, with the Minnesota River – Headwaters having the highest (13%) and Chippewa River and Pomme de Terre River watersheds each with 10% acres of wetlands. The Lower Minnesota River watershed also has 10% acres of wetlands. In contrast, the Lower Des Moines River and East Fork Des Moines River along the Iowa border have the least amount of wetland acres, 2% and 3%, respectively. The remaining watersheds range from 4% to 8% wetlands. Table 3-2 includes exact numbers and a comparison between the LMMM SA and statewide.

**Table 3-2. Acres of Wetland**

| Major Watershed | Watershed Acres | Palustrine | | | | | Total Wetland Acres | Percent Watershed Wetland |
|---|---|---|---|---|---|---|---|---|
| | | Emergent | Forested | Scrub-Shrub | Unconsolidated Bottom | AB+US* | | |
| Blue Earth River | 777,243 | 20,076 | 9,913 | 1,597 | 1,212 | 297 | 33,095 | 4% |
| Chippewa River | 1,330,153 | 106,065 | 10,275 | 5,087 | 12,367 | 1,155 | 134,949 | 10% |
| Cottonwood River | 840,785 | 26,336 | 5,668 | 745 | 1,430 | 217 | 34,398 | 4% |
| Des Moines River - Headwaters | 798,598 | 42,650 | 2,451 | 1,486 | 2,391 | 683 | 49,660 | 6% |
| East Fork Des Moines River | 129,425 | 3,108 | 489 | 123 | 133 | 34 | 3,888 | 3% |
| Lac qui Parle River | 487,024 | 34,627 | 3,056 | 652 | 1,300 | 194 | 39,829 | 8% |
| Le Sueur River | 711,116 | 28,524 | 8,026 | 1,431 | 1,373 | 516 | 39,871 | 6% |
| Little Sioux River | 205,754 | 8,659 | 191 | 242 | 562 | 207 | 9,861 | 5% |

| Major Watershed | Watershed Acres | Palustrine | | | | | Total Wetland Acres | Percent Watershed Wetland |
|---|---|---|---|---|---|---|---|---|
| | | Emergent | Forested | Scrub-Shrub | Unconsolidated Bottom | AB+US* | | |
| Lower Big Sioux River | 326,852 | 16,254 | 123 | 134 | 564 | 5 | 17,081 | 5% |
| Lower Des Moines River | 55,733 | 655 | 319 | 41 | 103 | 7 | 1,125 | 2% |
| Lower Minnesota River | 1,174,353 | 75,708 | 21,111 | 7,345 | 5,882 | 2,683 | 112,729 | 10% |
| Minnesota River - Headwaters | 501,741 | 56,522 | 2,511 | 2,127 | 4,586 | 463 | 66,210 | 13% |
| Minnesota River - Mankato | 861,886 | 36,479 | 15,958 | 7,955 | 2,081 | 592 | 63,064 | 7% |
| Minnesota River - Yellow Medicine River/Hawk Creek | 1,332,775 | 52,193 | 9,602 | 3,103 | 3,581 | 545 | 69,025 | 5% |
| Pomme de Terre River | 560,233 | 41,460 | 2,994 | 1,522 | 7,171 | 580 | 53,727 | 10% |
| Redwood River | 447,533 | 20,860 | 2,294 | 647 | 1,107 | 122 | 25,030 | 6% |
| Rock River | 582,108 | 29,103 | 941 | 359 | 1,109 | 38 | 31,550 | 5% |
| Upper Big Sioux River | 26,459 | 1,940 | 14 | 21 | 67 | 1 | 2,043 | 8% |
| Watonwan River | 558,965 | 13,960 | 4,445 | 516 | 926 | 226 | 20,073 | 4% |
| **LMMM SA Total** | **11,708,735** | **615,184** | **100,379** | **35,134** | **47,945** | **8,565** | **807,207** | **7%** |
| **Statewide** | **55,643,000** | **3,497,216** | **4,017,805** | **3,272,710** | **228,021** | **63,816** | **11,079,568** | **20%** |

Data from the Minnesota NWI (2019 update)
*Aquatic Bed and Unconsolidated Shore

## Lakes

According to the MnDNR Hydrography data, the LMMM SA has approximately 304,000 acres of lakes (Figure B-5). About 3% of the LMMM SA is lakes. Over half of all lake area within the LMMM SA is concentrated across 3 major watersheds. In the north, the Chippewa River watershed has approximately 75,000 acres of lakes (6% of major watershed area) and the Pomme de Terre River has approximately 47,000 acres of lakes (8% of major watershed area). Moving south, the Lower Minnesota River has approximately 34,000 acres of lakes (3%). In contrast, 2 major watersheds in the south (Lower Des Moines River and Upper Big Sioux River) have less than 100 acres of lakes each and another 2 major watersheds (Lower Big Sioux River and Rock River) have less than

1,000 acres of lakes each. In these 4 major watersheds the lake area comprises less than 1% of their major watershed area. The area of lakes in all watersheds can be found in Table 3-3.

Four of the five largest lakes in the LMMM SA are located in the northern region, including Minnewaska Lake (8,050 acres, Chippewa River watershed), Big Stone Lake (6,152 acres, Minnesota River – Headwaters watershed), Marsh Lake (4,462 acres, Minnesota River - Headwaters watershed), and Christina Lake (3,971 acres, Pomme de Terre River watershed). The largest lake, Swan Lake, is located further south, within the Minnesota River – Mankato watershed, and spans 8,884 acres.

**Table 3-3. Summary of Lake Area (Acres) for the LMMM SA**

| Major Watershed | Watershed Acres | Lake Acres[1] | Lake Area % |
|---|---|---|---|
| Blue Earth River | 777,243 | 11,167 | 1% |
| Chippewa River | 1,330,153 | 74,861 | 6% |
| Cottonwood River | 840,785 | 5,576 | 1% |
| Des Moines River - Headwaters | 798,598 | 20,407 | 3% |
| East Fork Des Moines River | 129,425 | 4,262 | 3% |
| Lac qui Parle River | 487,024 | 4,174 | 1% |
| Le Sueur River | 711,116 | 14,859 | 2% |
| Little Sioux River | 205,754 | 7,744 | 4% |
| Lower Big Sioux River | 326,852 | 450 | < 1% |
| Lower Des Moines River | 55,733 | 37 | < 1% |
| Lower Minnesota River | 1,174,353 | 34,317 | 3% |
| Minnesota River - Headwaters | 501,741 | 26,409 | 5% |
| Minnesota River - Mankato | 861,886 | 20,195 | 2% |
| Minnesota River - Yellow Medicine River/Hawk Creek | 1,332,775 | 17,613 | 1% |
| Pomme de Terre River | 560,233 | 47,317 | 8% |
| Redwood River | 447,533 | 6,734 | 2% |
| Rock River | 582,108 | 877 | < 1% |
| Upper Big Sioux River | 26,459 | 45 | < 1% |
| Watonwan River | 558,965 | 6,996 | 1% |
| **LMMM SA Total** | **11,708,735** | **304,042** | **3%** |

[1]Data from MnDNR Hydrography- Lakes and Open Water

## Watercourses

The MnDNR Rivers and Streams dataset was used to conduct an inventory of all watercourses within each major watershed. This dataset is part of the National Hydrography Dataset (NHD) provided by the United States Geological Survey (USGS). The length of mapped watercourses, categorized by channel type (ditched or natural) and flow regime (unknown, intermittent, or perennial), is provided in **Error! Reference source not found.**. A measure of watercourse density (the number of stream miles per square mile of watershed) for each major watershed was calculated to assess variability of the tributary network throughout the LMMM SA. The majority

of watercourses within the LMMM SA are characterized as natural-intermittent (55%) with an average watercourse density of 1.3 miles of watercourse per square mile of watershed (Figure B-6). The Minnesota River – Yellow Medicine River/Hawk Creek watershed has the highest number of miles of watercourses (2,926 miles), with the majority in the drainage ditch category. The major watersheds in the southwestern corner of the state have the highest watercourse density. These include the Upper and Lower Big Sioux River and the Rock River watersheds, with watercourse densities of 2.2, 2.4 and 2.2 respectively.

**Table 3-4. Summary of Watercourses (Miles) for the LMMM SA**

| Major Watershed | Drainage Ditch | Natural-Unknown Flow Regime | Natural-Intermittent | Natural-Perennial | Total | *Watercourse Density |
|---|---|---|---|---|---|---|
| Blue Earth River | 323 | 132 | 337 | 389 | **1,182** | **1.0** |
| Chippewa River | 1 | 160 | 1,520 | 411 | **2,092** | **1.0** |
| Cottonwood River | 133 | 110 | 1,292 | 416 | **1,951** | **1.5** |
| Des Moines River - Headwaters | 272 | 87 | 908 | 315 | **1,582** | **1.3** |
| East Fork Des Moines River | 62 | 3 | 73 | 23 | **161** | **0.8** |
| Lac qui Parle River | 364 | 57 | 693 | 306 | **1,421** | **1.9** |
| Le Sueur River | 283 | 15 | 505 | 390 | **1,193** | **1.1** |
| Little Sioux River | 74 | 10 | 215 | 27 | **327** | **1.0** |
| Lower Big Sioux River | 24 | 35 | 1,034 | 115 | **1,208** | **2.4** |
| Lower Des Moines River | 30 | 15 | 77 | 8 | **130** | **1.5** |
| Lower Minnesota River | 830 | 134 | 825 | 451 | **2,240** | **1.2** |
| Minnesota River - Headwaters | 2 | 54 | 555 | 122 | **734** | **0.9** |
| Minnesota River - Mankato | 639 | 154 | 465 | 276 | **1,533** | **1.1** |
| Minnesota River - Yellow Medicine River/Hawk Creek | 1,283 | 148 | 1,125 | 370 | **2,926** | **1.4** |
| Pomme de Terre River | - | 61 | 592 | 97 | **750** | **0.9** |
| Redwood River | 295 | 29 | 442 | 148 | **914** | **1.3** |
| Rock River | 71 | 88 | 1,543 | 269 | **1,972** | **2.2** |
| Upper Big Sioux River | - | 3 | 81 | 7 | **92** | **2.2** |
| Watonwan River | 101 | 49 | 593 | 334 | **1,077** | **1.2** |
| **LMMM SA Total** | **4,787** | **1,345** | **12,874** | **4,476** | **23,484** | **1.3** |

*Watercourse Density is the number of stream miles per square mile of watershed

## Altered Watercourses

An inventory of altered watercourses statewide was completed via a joint project with MPCA and the Minnesota Geospatial Information Office (MnGEO). The inventory analyzed historic aerial photos, current aerial photos, and LiDAR data to determine watercourses that have been altered. Watercourses were sectioned into four categories: altered, impounded, natural, and no definable channel. An altered watercourse is a naturally occurring stream, river, or an artificially constructed canal or ditch whose habitat has been compromised through hydrologic alteration. Streams whose flow has been dammed are categorized as impounded. Natural watercourses are

those that have little to no human influence. The no definable channel category includes flowlines from the NHD that no longer appear on the aerial imagery or LiDAR hillshade (MnGEO, 2013).

SA wide, most of the watercourses are categorized as altered (Figure B-7). Of the altered watercourses, the Minnesota River – Yellow Medicine River/Hawk Creek watershed has the most (1,788 miles) followed by the Lower Minnesota River watershed (1,568 miles). Watersheds with relatively high amounts of no definable channels include the Des Moines River – Headwaters (465 miles), Chippewa River watershed (597 miles), and Lac qui Parle River (395 miles). Compared to ditching, impoundments do not impact watercourses nearly as much across the LMMM SA (less than 1% watercourse miles are impounded). Exact length of altered watercourses for each watershed can be found in **Error! Reference source not found.**.

**Table 3-5. Summary of Altered Watercourses (Miles) in the LMMM SA**

| Major Watershed | Altered | Impoundment | Natural | No Definable Channel |
|---|---|---|---|---|
| Blue Earth River | 695 | < 1 | 368 | 122 |
| Chippewa River | 1,201 | 4 | 291 | 597 |
| Cottonwood River | 805 | 16 | 764 | 368 |
| Des Moines River - Headwaters | 621 | 14 | 483 | 465 |
| East Fork Des Moines River | 96 | - | 25 | 40 |
| Lac qui Parle River | 608 | 7 | 413 | 395 |
| Le Sueur River | 733 | 1 | 359 | 102 |
| Little Sioux River | 225 | 1 | 42 | 59 |
| Lower Big Sioux River | 489 | 3 | 504 | 212 |
| Lower Des Moines River | 88 | 1 | 28 | 12 |
| Lower Minnesota River | 1,568 | 6 | 491 | 272 |
| Minnesota River - Headwaters | 357 | 39 | 224 | 115 |
| Minnesota River - Mankato | 799 | < 1 | 537 | 215 |
| Minnesota River - Yellow Medicine River/Hawk Creek | 1,788 | 8 | 637 | 495 |
| Pomme de Terre River | 479 | 2 | 156 | 115 |
| Redwood River | 486 | 2 | 361 | 65 |
| Rock River | 1,012 | 5 | 683 | 271 |
| Upper Big Sioux River | 32 | < 1 | 49 | 10 |
| Watonwan River | 595 | 3 | 246 | 235 |
| **LMMM SA Total** | **12,676** | **112** | **6,659** | **4,164** |
| Data from the MPCA Altered Watercourses Project updated in 2019 | | | | |

## Water Quality

Water quality in the LMMM SA was assessed using the MPCA's 303(d) impaired waters list. Data for lakes, streams, and wetlands were updated in 2022. Not all impairments are pertinent to wetland restoration and protection, therefore a subset of the impairments were chosen. The impairments included in this report are dissolved oxygen (DO), fishes bioassessments, aquatic macroinvertebrate bioassessments, nitrate, nutrients

and eutrophication biological indicators, turbidity, and total suspended solids (TSS). Lakes and streams that were assessed and located partially or wholly within tribal lands are included in this analysis. Across the LMMM SA, 671 lakes were assessed, and 218 lakes were found to be impaired (Figure B-8). Of the impaired lakes, one (1) lake was located partially on tribal land. The Blue Earth River watershed had the highest percentage of its lakes impaired (54%), while the Lower Minnesota River had the highest number of impaired lakes (57). Lac Qui Parle River had the lowest percentage of its lakes impaired (5%). **Error! Reference source not found.** includes assessed and impaired lake area and percentage for each watershed.

In addition to evaluating the number of impaired waterbodies, lakes and streams that are nearly impaired or barely impaired (nearly/barely) for one or more impairments were also evaluated. The MPCA identifies nearly/barely waterbodies by analyzing water quality data to determine what waterbodies are close to the impairment thresholds. This information is helpful to establish more context for impaired waterbodies as well as identify waterbodies that aren't included in the impairment analysis but are nearing impairment thresholds. An important consideration when evaluating nearly/barely waterbodies is that these categorizations are based on the waterbody's designated use classification (i.e. aquatic life and aquatic recreation), not specific parameters, so it is possible for a stream to be impaired for one aquatic life parameter (i.e. dissolved oxygen) but also be listed as nearly impaired for aquatic life due to another parameter (TSS, nutrients and eutrophication biological indicators, etc.) nearing the threshold. There are five lakes in the LMMM SA that are nearly impaired, four lakes within the Lower Minnesota River watershed and one lake in the Pomme de Terre River watershed. The four lakes in the Lower Minnesota River watershed include Lower Prior Lake (987 acres) and Bavaria Lake (187 acres) which are currently listed as impaired for Aquatic Life (fish bioassessments) and are nearly impaired for Aquatic Recreation (nutrients), and Crystal Lake (291 acres) and Orchard Lake (296 acres) which are nearly impaired for Aquatic Life standards (fish bioassessment). Sewell Lake (369 acres) in the Pomme de Terre River watershed is nearly impaired for Aquatic Life standards (fish bioassessment). Several watersheds did not have any lakes assessed, including the Lower Des Moines, Rock River, and Upper Big Sioux River.

**Table 3-6. Assessed and Impaired Lakes**

| Major Watershed | Assessed | | Impaired | | % Impaired Based on Lake Count |
|---|---|---|---|---|---|
| | Acres | Count | Acres | Count | |
| Blue Earth River | 7,272 | 26 | 5,140 | 14 | 54% |
| Chippewa River | 45,068 | 123 | 29,083 | 46 | 37% |
| Cottonwood River | 3,560 | 28 | 1,250 | 7 | 25% |
| Des Moines River - Headwaters | 20,255 | 50 | 15,642 | 20 | 40% |
| East Fork Des Moines River | 4,908 | 10 | 3,452 | 4 | 40% |
| Lac qui Parle River | 2,583 | 20 | 1,530 | 1 | 5% |
| Le Sueur River | 13,298 | 23 | 7,535 | 6 | 26% |
| Little Sioux River | 12,459 | 18 | 4,429 | 9 | 50% |
| Lower Big Sioux River | 93 | 1 | - | - | - |
| Lower Des Moines River | - | - | - | - | - |

| Major Watershed | Assessed | | Impaired | | % Impaired Based on Lake Count |
|---|---|---|---|---|---|
| | Acres | Count | Acres | Count | |
| Lower Minnesota River | 21,365 | 174 | 15,173 | 57 | 33% |
| Minnesota River - Headwaters | 24,879 | 19 | 17,764 | 5 | 26% |
| Minnesota River - Mankato | 17,018 | 29 | 4,478 | 9 | 31% |
| Minnesota River - Yellow Medicine River/Hawk Creek | 12,096 | 52 | 5,632 | 14 | 27% |
| Pomme de Terre River | 29,253 | 56 | 8,803 | 10 | 18% |
| Redwood River | 5,331 | 18 | 4,492 | 8 | 44% |
| Rock River | - | - | - | - | - |
| Upper Big Sioux River | - | - | - | - | - |
| Watonwan River | 5,640 | 24 | 3,360 | 8 | 33% |
| **LMMM SA Total** | **225,078** | **671** | **127,762** | **218** | **32%** |
| Data includes lakes wholly and partially on tribal lands | | | | | |

Regarding streams, there were 1,278 individual stream reaches assessed across the LMMM SA and 693 of those reaches were found to be impaired (54% impaired; Figure B-9). There were no impaired stream reaches on tribal land. Five watersheds had less than half of their stream reaches impaired (Pomme de Terre River, 31%; Chippewa River, 35%; Lower Minnesota River, 44%; East Fork Des Moines River, 45%; and Cottonwood River, 48%), while all other watersheds had more than half their stream reaches impaired. The Lower Big Sioux River had the highest percentage of stream reaches impaired (81%), discounting the Upper Big Sioux River watershed, which only had one reach assessed and it was impaired (100%). The Minnesota River - Yellow Medicine River/Hawk Creek watershed had the most miles of streams assessed (1,009 miles) and 51% of reaches were impaired.

In addition to evaluating the number of impaired waterbodies, lakes and streams that are nearly impaired or barely impaired (nearly/barely) for one or more impairments were also evaluated. The MPCA identifies nearly/barely waterbodies by analyzing water quality data to determine what waterbodies are close to the impairment thresholds. This information is helpful to establish more context for impaired waterbodies as well as identify waterbodies that aren't included in the impairment analysis but are nearing impairment thresholds. An important consideration when evaluating nearly/barely waterbodies is that these categorizations are based on the waterbody's designated use classification (i.e. aquatic life and aquatic recreation), not specific parameters, so it is possible for a stream to be impaired for one aquatic life parameter (i.e. dissolved oxygen) but also be listed as nearly impaired for aquatic life due to another parameter (TSS, nutrients and eutrophication biological indicators, etc.) nearing the threshold. There are three stream reaches in LMMM that are nearly/barely impaired. A 2.2-mile reach of Eagle Creek within the Lower Minnesota River watershed is nearly impaired for one or more Aquatic Life standards (DO, TSS, eutrophication, fish bioassessment, macroinvertebrate bioassessment). JD 9 within the Le Sueur River watershed is currently listed as impaired for macroinvertebrate bioassessments with one or more of the remaining Aquatic Life standards identified as

being barely impaired within the 1.3-mile reach. Also, an 18.6-mile reach of the Pomme de Terre River is barely impaired for another Aquatic Life standard in addition to fish bioassessment. See **Error! Reference source not found.** for all assessed and impaired stream miles and percentages in each watershed. There are 33 lakes in LMMM that are nearly/barely impaired. See Table 3-8 for a summary of these lakes, the major watershed they are within, and their nearly/barely designation.

**Table 3-7. Assessed and Impaired Streams**

| Major Watershed | Assessed | | Impaired | | % Impaired Based on Stream Count |
|---|---|---|---|---|---|
| | Miles | Count* | Miles | Count* | |
| Blue Earth River | 620 | 87 | 463 | 58 | 67% |
| Chippewa River | 691 | 147 | 381 | 52 | 35% |
| Cottonwood River | 595 | 77 | 433 | 37 | 48% |
| Des Moines River - Headwaters | 485 | 78 | 371 | 50 | 64% |
| East Fork Des Moines River | 55 | 11 | 38 | 5 | 45% |
| Lac qui Parle River | 403 | 41 | 341 | 28 | 68% |
| Le Sueur River | 528 | 89 | 417 | 52 | 58% |
| Little Sioux River | 112 | 25 | 70 | 15 | 60% |
| Lower Big Sioux River | 222 | 32 | 210 | 26 | 81% |
| Lower Des Moines River | 29 | 8 | 25 | 6 | 75% |
| Lower Minnesota River | 865 | 190 | 551 | 83 | 44% |
| Minnesota River - Headwaters | 275 | 29 | 158 | 22 | 76% |
| Minnesota River - Mankato | 660 | 112 | 449 | 59 | 53% |
| Minnesota River - Yellow Medicine River/Hawk Creek | 1,009 | 159 | 631 | 81 | 51% |
| Pomme de Terre River | 223 | 42 | 118 | 13 | 31% |
| Redwood River | 335 | 42 | 267 | 27 | 64% |
| Rock River | 446 | 67 | 397 | 46 | 69% |
| Upper Big Sioux River | 14 | 1 | 14 | 1 | 100% |
| Watonwan River | 377 | 41 | 349 | 32 | 78% |
| **LMMM SA Total** | **7,945** | **1,278** | **5,683** | **693** | **54%** |

*Count is the number of stream reaches not individual streams
Data includes streams wholly and partially on tribal lands

**Table 3-8. Nearly/Barely Waterbodies**

| Major Watershed | Lake ID | Lake Name | Lake Area (acres) | Nearly/Barely |
|---|---|---|---|---|
| Blue Earth River | 46-0031-00 | Hall | 548.1 | Nearly |
| | 46-0012-00 | Imogene | 185.6 | Nearly |
| | 46-0014-01 | Willmert (main bay) | 335.4 | Barely |
| | 46-0109-00 | Fox | 951.0 | Nearly |

| Major Watershed | Lake ID | Lake Name | Lake Area (acres) | Nearly/Barely |
|---|---|---|---|---|
| Chippewa River | 61-0066-00 | Leven | 282.0 | Barely |
| | 34-0359-00 | Sunburg | 298.2 | Barely |
| | 61-0183-00 | Pike | 243.7 | Nearly |
| | 21-0264-00 | Stowe | 377.1 | Barely |
| | 61-0180-00 | Emily | 2316.3 | Nearly |
| | 76-0086-00 | Hassel | 609.0 | Nearly |
| Cottonwood River | 80-1290-00 | Wellner-Hageman Reservoir | 74.9 | Barely |
| Des Moines River - Headwaters | 51-0046-00 | Shetek | 3462.2 | Nearly |
| | 51-0043-00 | Fox | 172.1 | Nearly |
| | 17-0024-00 | String | 336.2 | Nearly |
| | 17-0013-00 | Wolf | 60.7 | Barely |
| Little Sioux River | 32-0022-00 | Clear | 434.2 | Nearly |
| Lower Minnesota River | 19-0076-00 | McDonough | 18.1 | Barely |
| | 19-0066-00 | Carlson | 12.0 | Nearly |
| | 19-0064-00 | Unnamed (Holz) | 6.8 | Nearly |
| | 10-0084-00 | Burandt | 96.7 | Nearly |
| | 10-0019-00 | Bavaria | 166.5 | Barely |
| | 10-0007-00 | Lucy | 87.5 | Nearly |
| | 10-0002-00 | Riley | 296.2 | Nearly |
| | 70-0120-01 | Thole | 118.5 | Nearly |
| | 70-0021-00 | Markley | 16.3 | Barely |
| Minnesota River - Mankato | 70-0470-00 | George | 88.2 | Nearly |
| Minnesota River - Yellow Medicine River | 34-0246-00 | East Solomon | 657.7 | Nearly |
| | 34-0186-00 | Swan | 229.1 | Nearly |
| | 41-0067-00 | Perch | 246.1 | Nearly |
| Pomme de Terre River | 56-0379-00 | North Turtle | 1773.2 | Barely |
| | 75-0075-00 | Perkins | 518.3 | Nearly |
| Redwood River | 42-0002-00 | School Grove | 348.7 | Nearly |
| Watonwan River | 83-0056-00 | Butterfield | 53.6 | Barely |

## Land Cover

The 2019 National Land Cover Dataset (NLCD) was used to analyze the current land cover across the LMMM SA. There are 20 land cover classifications in the NLCD but a simplified list of classes was used for this study. The simplified classifications include *Agriculture, Barren, Developed, Forest, Grassland, Water*, and *Wetlands*. Table 3-99 includes the landcover classification breakdown within each individual watershed.

Most of the land cover in the LMMM SA is classified as *Agriculture* (81%). *Wetlands* and *Developed* land are tied for the second highest land cover at 6% each. Although the wetland area as mapped in the NWI and the NLCD are similar (7% and 6% respectively), the difference is a result of different mapping methods, scales, and

accuracy. On a watershed level, over half of the major watersheds have at least 85% of land classified as *Agriculture*. None of those watersheds have more than 5% wetland coverage. Three watersheds including the Lower Minnesota River, Minnesota River – Headwaters, and Pomme de Terre River, have substantially lower *Agriculture* land coverage (72% or less). The Lower Minnesota river has 66% of land classified as *Agriculture* and 17% as *Developed*, because it spans a portion of the Twin Cities metro. In the northern region of the LMMM SA, the Minnesota River – Headwaters has the most land classified as *Wetland* (14%) and an additional 8% of land classified as *Water*. The Pomme de Terre River has 8% of land classified as *Wetland* and 9% as *Water* (Table 33-9 and Figure B-10).

**Table 3-9. Land Cover Percentage of Each Watershed in 2019**

| Major Watershed | Agriculture | Barren | Developed | Forest | Grassland | Water | Wetlands |
|---|---|---|---|---|---|---|---|
| Blue Earth River | 87% | < 1% | 6% | 1% | 1% | 2% | 4% |
| Chippewa River | 77% | < 1% | 4% | 4% | 1% | 6% | 8% |
| Cottonwood River | 89% | < 1% | 5% | 1% | 1% | 1% | 4% |
| Des Moines River - Headwaters | 84% | < 1% | 5% | 1% | 3% | 3% | 4% |
| East Fork Des Moines River | 88% | < 1% | 5% | 1% | 1% | 3% | 3% |
| Lac qui Parle River | 84% | < 1% | 4% | 1% | 1% | 1% | 8% |
| Le Sueur River | 85% | < 1% | 6% | 2% | 1% | 2% | 5% |
| Little Sioux River | 85% | < 1% | 5% | 1% | 1% | 4% | 4% |
| Lower Big Sioux River | 88% | < 1% | 5% | < 1% | 6% | < 1% | 1% |
| Lower Des Moines River | 88% | < 1% | 4% | 3% | 4% | < 1% | 1% |
| Lower Minnesota River | 66% | < 1% | 17% | 7% | < 1% | 3% | 6% |
| Minnesota River - Headwaters | 72% | < 1% | 4% | 1% | 1% | 8% | 14% |
| Minnesota River - Mankato | 79% | < 1% | 7% | 5% | 1% | 2% | 7% |
| Minnesota River - Yellow Medicine River/Hawk Creek | 85% | < 1% | 5% | 2% | 1% | 2% | 5% |
| Pomme de Terre River | 70% | < 1% | 5% | 5% | 2% | 9% | 8% |
| Redwood River | 83% | < 1% | 6% | 1% | 4% | 2% | 4% |
| Rock River | 88% | < 1% | 5% | < 1% | 5% | < 1% | 2% |
| Upper Big Sioux River | 74% | < 1% | 4% | < 1% | 20% | < 1% | 1% |
| Watonwan River | 88% | < 1% | 5% | 1% | < 1% | 1% | 4% |
| **LMMM SA Total** | **81%** | **< 1%** | **6%** | **3%** | **2%** | **3%** | **6%** |

Data from the National Land Cover Database. Categories simplified based on 2019 NLCD categories

## Perennial Cover

In addition to analyzing land cover, perennial cover was evaluated using the 2019 NLCD. Of the seven classes, *Forest*, *Grassland*, and *Wetlands* were categorized as *Perennial*. *Agriculture*, *Barren*, and *Developed* were classified as *Non-Perennial*. *Water* and any uncategorized data were omitted from the analysis. As can be seen in Figure B-11 and Table 3-10, Non-perennial cover dominants the LMMM SA. 85% of land (9.8 million acres)

across the SA is in Non-perennial coverage. At the major watershed scale, the Minnesota River – Yellow Medicine River/Hawk Creek has the most acres in Non-perennial coverage (1.2 million acres; 89% land area) while the Little Sioux River and Blue Earth River watersheds have the highest percentage of acres in Non-perennial cover (93% each). The Chippewa River watershed has the most acres in Perennial coverage (280,000 acres, 22% land area). The Upper Big Sioux has the highest percentage of the watershed area in Perennial cover (26%), but it is the smallest watershed (approximately 26,000 acres).

**Table 3-10. Acres of Perennial and Non-Perennial Cover in 2019**

| Major Watershed | Perennial | Non-Perennial | Total |
|---|---|---|---|
| Blue Earth River | 55,697 | 708,689 | **764,386** |
| Chippewa River | 279,015 | 973,147 | **1,252,162** |
| Cottonwood River | 71,559 | 762,637 | **834,196** |
| Des Moines River - Headwaters | 85,235 | 691,183 | **776,419** |
| East Fork Des Moines River | 6,228 | 119,062 | **125,290** |
| Lac qui Parle River | 82,092 | 399,776 | **481,868** |
| Le Sueur River | 63,980 | 632,797 | **696,777** |
| Little Sioux River | 14,172 | 184,260 | **198,432** |
| Lower Big Sioux River | 46,991 | 279,421 | **326,413** |
| Lower Des Moines River | 4,637 | 50,824 | **55,461** |
| Lower Minnesota River | 240,213 | 898,761 | **1,138,974** |
| Minnesota River - Headwaters | 108,082 | 355,349 | **463,431** |
| Minnesota River - Mankato | 117,848 | 724,002 | **841,850** |
| Minnesota River - Yellow Medicine River/Hawk Creek | 150,135 | 1,162,441 | **1,312,576** |
| Pomme de Terre River | 122,249 | 386,178 | **508,427** |
| Redwood River | 55,977 | 383,932 | **439,910** |
| Rock River | 63,468 | 517,614 | **581,082** |
| Upper Big Sioux River | 6,854 | 19,586 | **26,440** |
| Watonwan River | 33,473 | 517,879 | **551,352** |
| **LMMM SA Total** | **1,607,903** | **9,767,539** | **11,375,443** |

Based on the 2019 NLCD.

## Areas of Biodiversity Significance

To assess sensitive plant communities and rare species, the Biodiversity Significance Rank provided by the Minnesota Biological Survey was used. This dataset was developed over 30 years. Initial surveys were conducted starting in the 1990's to inventory and map Minnesota's native plant communities. Sites were selected on a county basis using aerial photos to identify locations where native plant communities would be present. As a result, not all potential areas of biodiversity significance were chosen, and it is likely some boundaries within mapped areas have shifted over time.

Within the survey, ranks were given to each site based on the presence of rare species populations, the size and condition of native plant communities, and the proximity of the site to different land uses (MnDNR, 2022). One

of four ranks was assigned to each site: *Outstanding*, *High*, *Moderate*, and *Below*. Sites ranked as *Outstanding* typically have the most numerous occurrences and best examples of the rarest species and contain the most intact rare native plant communities. Sites ranked as *High* have medium occurrences of rare species and are good examples of high quality rare native plant communities. Sites ranked as *Moderate* contain some rare species and have moderately disturbed native plant communities. These sites have very good potential for recovery of native plant communities. Sites ranked as *Below* lack rare species and native plant communities. However, these sites may still be important for local conservation efforts and may benefit native plants and animals. They have high potential for restoration of native habitat (MnDNR, 2022).

Within the LMMM SA, approximately 615,000 acres (5% of the total area of the SA) were surveyed for biodiversity significance (Figure B-12). The majority of sites (2% of the total area of the SA, 47% of surveyed area) were ranked as *Moderate* across the SA. Two thirds of the major watersheds had most of their sites ranked as *Moderate*. Exceptions included the Cottonwood River, Des Moines River – Headwaters, Minnesota River – Headwaters, Redwood River, and Watonwan River watersheds, which had most of their sites ranked as *Below*. The East Fork Des Moines River had most acres ranked as *High*, although only 1% of the watershed was surveyed. Twelve watersheds had 5% or less area ranked for biodiversity significance, and nearly remaining watersheds had 10% or less area ranked. Exceptions included the Minnesota River – Headwaters watershed with 12% and the Upper Big Sioux River watershed with 22%. Acres and percentages for each watershed and SA can be found in Table 3-11.

**Table 3-11. Acres of Areas of Biodiversity Significance and Rank**

| Major Watershed | Below | | Moderate | | High | | Outstanding | | Grand Total | |
|---|---|---|---|---|---|---|---|---|---|---|
| Blue Earth River | 7,755 | 1% | 14,720 | 2% | 1,388 | < 1% | 691 | < 1% | **24,553** | **3%** |
| Chippewa River | 22,218 | 2% | 32,679 | 2% | 9,089 | 1% | 2,649 | < 1% | **66,634** | **5%** |
| Cottonwood River | 13,768 | 2% | 13,766 | 2% | 1,341 | < 1% | 890 | < 1% | **29,765** | **4%** |
| Des Moines River - Headwaters | 21,011 | 3% | 19,457 | 2% | 1,714 | < 1% | 2,198 | < 1% | **44,380** | **6%** |
| East Fork Des Moines River | 419 | < 1% | 292 | < 1% | 481 | < 1% | - | - | **1,192** | **1%** |
| Lac qui Parle River | 13,496 | 3% | 13,958 | 3% | 4,259 | 1% | 1,709 | < 1% | **33,422** | **7%** |
| Le Sueur River | 8,610 | 1% | 8,858 | 1% | 2,441 | < 1% | - | - | **19,910** | **3%** |
| Little Sioux River | 1,300 | 1% | 5,054 | 2% | 651 | < 1% | - | - | **7,005** | **3%** |
| Lower Big Sioux River | 9,163 | 3% | 13,526 | 4% | 3,869 | 1% | 2,802 | 1% | **29,361** | **9%** |
| Lower Des Moines River | 19 | < 1% | 1,375 | 2% | 45 | < 1% | - | - | **1,439** | **3%** |
| Lower Minnesota River | 16,176 | 1% | 25,919 | 2% | 16,944 | 1% | 2,752 | < 1% | **61,791** | **5%** |
| Minnesota River - Headwaters | 20,084 | 4% | 19,896 | 4% | 11,858 | 2% | 5,986 | 1% | **57,824** | **12%** |
| Minnesota River - Mankato | 9,148 | 1% | 20,390 | 2% | 18,914 | 2% | 3,791 | < 1% | **52,242** | **6%** |
| Minnesota River - Yellow Medicine River/Hawk Creek | 23,940 | 2% | 31,707 | 2% | 8,353 | 1% | 893 | < 1% | **64,893** | **5%** |
| Pomme de Terre River | 5,725 | 1% | 12,677 | 2% | 2,251 | < 1% | 59 | < 1% | **20,712** | **4%** |
| Redwood River | 14,991 | 3% | 9,048 | 2% | 1,005 | < 1% | 1,117 | < 1% | **26,161** | **6%** |
| Rock River | 10,054 | 2% | 32,168 | 6% | 4,200 | 1% | 2,893 | < 1% | **49,315** | **8%** |

| Major Watershed | Below | | Moderate | | High | | Outstanding | | Grand Total | |
|---|---|---|---|---|---|---|---|---|---|---|
| Upper Big Sioux River | 775 | 3% | 3,960 | 15% | 179 | 1% | 959 | 4% | **5,874** | **22%** |
| Watonwan River | 8,724 | 2% | 7,804 | 1% | 2,141 | < 1% | - | - | **18,669** | **3%** |
| **LMMM SA Total** | **207,377** | **2%** | **287,252** | **2%** | **91,123** | **1%** | **29,388** | **< 1%** | **615,140** | **5%** |
| Data updated 2021 | | | | | | | | | | |

## Prairie Conservation Plan

The Minnesota Prairie Conservation Plan (Prairie Plan) was used to assess current and future prairie-pothole habitat areas on the landscape (Minnesota Prairie Plan Working Group, 2018). This 25-year strategy aims to protect and restore critically endangered prairie habitat for plant and wildlife species. The second version of the Prairie Plan, published in 2018, includes measurable goals for grassland and wetland acres within several zones that would support mobile wildlife species, maintain current acres of prairie, and improve habitat within the surrounding agricultural landscape for species adapted to live in the agricultural countryside. Within the Prairie Plan dataset, there are three categories of land use. Core areas represent areas on the landscape that currently retain some features of a functioning prairie landscape. Strategic habitat complexes represent areas where future grassland and wetland habitat is needed to provide habitat steppingstones from one core area to the next. Corridor area represents a six-mile-wide corridor running nearly the entire length of Minnesota, connecting all core areas and strategic habitat complexes to each other. There is a goal of 10 percent grassland and wetland habitat for each square mile within the corridor areas to allow for habitat connectivity.

Across the LMMM SA, approximately 2 million acres are within the core areas, strategic habitat complexes, or corridor (Figure B-13). Based on the Prairie Plan, approximately 9% of the land area is planned to be used as grassland or wetland habitat by 2033. The Minnesota River – Headwaters watershed currently has the most acres of prairie (152,096 acres) and will have the second highest percentage of prairie over time (33%). The Des Moines River – Headwaters and Chippewa River watersheds have the most opportunity for grassland and wetland restoration, with 49,716 acres and 45,061 acres located within strategic habitat complexes. Eight of the major watersheds have over 50,000 acres within the corridor including Chippewa River, Cottonwood River, Des Moines River – Headwaters, Lac Qui Parle River, Minnesota River – Headwaters, Minnesota River – Yellow Medicine River/Hawk Creek, Pomme de Terre River, and Rock River, representing a need for many small areas of restoration and protection evenly dispersed throughout the corridor. Four watersheds on the east side of the LMMM SA are significantly less impacted by the prairie plan, including Blue Earth River, East Fork Des Moines River, Le Sueur River, and Lower Minnesota River watersheds. Table 3-12 includes the acres of present and planned prairie habitat based in the Prairie Plan within each individual watershed.

**Table 3-12. Acres of Present and Planned Prairie Habitat**

| Major Watershed | Watershed | Core Areas (Present) | Strategic Habitat Complexes (Planned) | Corridor (Planned) | % Prairie* |
|---|---|---|---|---|---|
| Blue Earth River | 777,240 | 730 | - | - | < 0.5 % |

| Major Watershed | Watershed | Core Areas (Present) | Strategic Habitat Complexes (Planned) | Corridor (Planned) | % Prairie* |
|---|---|---|---|---|---|
| Chippewa River | 1,330,147 | 147,791 | 45,061 | 249,968 | 16% |
| Cottonwood River | 840,782 | 29,183 | 25,753 | 119,915 | 8% |
| Des Moines River - Headwaters | 798,595 | 69,122 | 49,716 | 51,502 | 16% |
| East Fork Des Moines River | 129,425 | 8 | - | - | < 0.5 % |
| Lac qui Parle River | 487,022 | 69,140 | - | 69,212 | 16% |
| Le Sueur River | 711,113 | - | - | - | - |
| Little Sioux River | 205,753 | - | 11,387 | 27,363 | 7% |
| Lower Big Sioux River | 326,851 | 46,495 | - | 46,338 | 16% |
| Lower Des Moines River | 55,733 | 10,529 | - | 1,213 | 19% |
| Lower Minnesota River | 1,174,348 | - | 27 | - | < 0.5 % |
| Minnesota River - Headwaters | 501,739 | 152,096 | 6,896 | 84,653 | 33% |
| Minnesota River - Mankato | 861,882 | 57,006 | 23,811 | 12,880 | 10% |
| Minnesota River - Yellow Medicine River/Hawk Creek | 1,332,769 | 93,724 | 6,802 | 73,731 | 8% |
| Pomme de Terre River | 560,231 | 31,337 | 19,747 | 81,952 | 11% |
| Redwood River | 447,531 | 36,468 | 3,350 | 40,563 | 10% |
| Rock River | 582,106 | 45,530 | 11,403 | 81,632 | 11% |
| Upper Big Sioux River | 26,459 | 12,058 | - | - | 46% |
| Watonwan River | 558,963 | 7,005 | - | 20,716 | 2% |
| **LMMM SA Total** | **11,708,689** | **808,224** | **203,952** | **961,639** | **9%** |
| *Percent Prairie is the core areas plus strategic habitat complexes plus ten percent of the corridor acreage divided by watershed acreage. | | | | | |

## Sensitive Groundwater Area

Groundwater is an important resource in the LMMM SA; therefore, it is important to assess sensitivity to threats. Wetlands play an important role in surface water infiltration, aquifer recharge, and chemical transfer. That role depends on the wetland hydrology and the surrounding geology. The potential threats to groundwater were assessed using the Pollution Sensitivity of Near-Surface Materials dataset provided by the MnDNR. This data is a subset of the County Geologic Atlas, specifically Part B – Groundwater/Hydrogeology. Water chemistry provides information about water movement, infiltration rates, and the relative age of groundwater. Using chemicals like tritium, Carbon-14, Chloride, and Nitrate, among others, researchers can calculate the transmission time (MnDNR, 2021). This dataset estimates that transmission time of water through the top 10-feet of from the land surface (three feet of soil and seven feet of surficial geology).

The LMMM SA, as a whole, tends to have low or very low pollution sensitivity (Table 3-13 and Figure B-14). There are distinct areas of moderate and high sensitivity along the major rivers, like the Minnesota River, in the southwestern corner of the state, and the northwestern portion of the SA (specifically the Pomme de Terre and Chippewa River watersheds). The southwestern corner of the state including the Lower Big Sioux River, Rock

River, and Cottonwood River watersheds has pockets of bedrock. The Watonwan River watershed has a range of sensitivity including bedrock and karst. Along the Minnesota River watersheds, the sensitivity ranges but there is a significant amount of high sensitivity, karst, and bedrock. This is due to alluvium and channel formation from historic and modern rivers and flooding. The high sensitivity areas in the Chippewa River and the Lower Minnesota River watersheds tends to be very sandy. Areas of low or very low sensitivity along the western Minnesota boundary and extending into the Cottonwood River and Minnesota River – Yellow Medicine River/Hawk Creek watersheds tends to have clay or clay loam at the surface. As one travels east across the SA the surficial geology changes to mostly loams and therefore the sensitivity changes to low instead of very low. The loams and clay loam are glacial till which has low transmissivity rates but are still important for groundwater transport and wetland morphology.

**Table 3-13. Summary of Sensitive Groundwater Areas (acres)**

| Major Watershed | Bedrock at or near surface | Karst | High | Moderate | Low | Very Low | Ultra Low | Water |
|---|---|---|---|---|---|---|---|---|
| Blue Earth River | - | 904 | 7,270 | 28,111 | 566,142 | 162,787 | - | 11,916 |
| Chippewa River | - | - | 98,806 | 168,124 | 649,437 | 323,065 | - | 90,715 |
| Cottonwood River | 14,100 | - | 156 | 94,958 | 379,348 | 344,864 | - | 7,355 |
| Des Moines River - Headwaters | - | - | 13,839 | 60,784 | 164,785 | 535,257 | - | 23,930 |
| East Fork Des Moines River | - | - | - | - | 123,329 | 474 | - | 4,548 |
| Lac qui Parle River | - | - | 13 | 67,551 | 250,519 | 162,035 | - | 6,846 |
| Le Sueur River | - | 1,628 | 9,895 | 26,033 | 398,210 | 255,634 | - | 19,713 |
| Little Sioux River | - | - | 3,476 | 1,664 | 56,490 | 135,282 | - | 8,628 |
| Lower Big Sioux River | 17,299 | - | - | 57,563 | 106,651 | 144,950 | - | 308 |
| Lower Des Moines River | - | - | 1,574 | - | 52,383 | | - | 29 |
| Lower Minnesota River | 137 | 13,722 | 74,495 | 80,211 | 825,483 | 108,568 | - | 71,732 |
| Minnesota River - Headwaters | 5,283 | - | 24,037 | 54,645 | 77,725 | 304,737 | 51 | 35,186 |
| Minnesota River - Mankato | 9,608 | 8,297 | 30,402 | 47,872 | 665,628 | 76,645 | - | 23,432 |
| Minnesota River - Yellow Medicine River/Hawk Creek | 5,413 | - | 28,588 | 71,718 | 597,996 | 608,009 | - | 21,045 |
| Pomme de Terre River | - | - | 51,596 | 22,300 | 71,973 | 363,597 | - | 50,764 |
| Redwood River | 95 | - | 22 | 52,799 | 200,238 | 186,417 | - | 7,960 |
| Rock River | 6,506 | - | - | 111,919 | 90,892 | 371,868 | - | 867 |
| Upper Big Sioux River | - | - | - | 3,445 | 2,046 | 20,935 | - | 12 |
| Watonwan River | 8,318 | 12 | 12,519 | 43,083 | 449,294 | 37,727 | - | 8,010 |
| **LMMM SA Total** | **66,761** | **24,563** | **356,686** | **992,780** | **5,728,571** | **4,142,849** | **51** | **392,996** |

Data from the MnDNR Minnesota Hydrogeologic Atlas, updated in 2018.

## RIM, PWP, and CREP Easements

Conservation easements are a mechanism that is used to improve water quality, reduce soil erosion, reduce phosphorus and nitrogen loading, improve wildlife habitat, decrease flooding, and protect and restore wetlands (MnGEO, 2024). Minnesota has several easement programs but for the purpose of this report, only three programs were assessed. These include Reinvest in Minnesota (RIM) Reserve, Permanent Wetlands Preserve Program (PWP), and the Conservation Reserve Enhancement Program (CREP). The RIM program restores marginal and environmentally sensitive agricultural land with the goal of protecting soil and water quality and supporting fish and wildlife habitat. The program currently focuses on permanent wetland restoration, adjacent native grassland wildlife habitat complexes, and permanent riparian buffers (BWSR, 2024b). The PWP program intends to protect at-risk wetlands and landowners receive rental payments as compensation. Eligible wetland types include seasonally flooded basins, fresh wet meadows, shallow marshes, and shrub carr (Helland, 2005). Lastly, CREP is a combination of RIM and Conservation Reserve Program (CRP). This program protects sensitive agricultural land and can include buffer strips, wetland restorations, and well-head protection areas. This program is only available for counties in southern Minnesota and enrolls land in CRP for 14 to 15 years and establishes a permanent conservation easement on the same land through MN's RIM (BWSR, 2024a).

Overall, the LMMM SA has approximately 65,000 acres of RIM, 126,000 acres of CREP, and 5,000 acres of PWP (Table 3-14 and Figure B-15). The Minnesota River – Yellow Medicine/Hawk Creek watershed has the most acres in both RIM and CREP. Minnesota River – Mankato has the most acres in PWP. The Upper Big Sioux River watershed has the least number of acres in RIM and no (zero) acres in both CREP and PWP. The Lower Des Moines River has the least number of acres, but more than zero acres, in CREP. The East Fork of the Des Moines River watershed has the least number of acres, but also more than zero acres, in PWP.

**Table 3-14. Summary of RIM, CREP, and PWP Areas (acres)**

| Major Watershed | RIM* | CREP** | PWP*** |
|---|---|---|---|
| Blue Earth River | 1,849 | 8,246 | 161 |
| Chippewa River | 8,064 | 17,529 | 389 |
| Cottonwood River | 4,508 | 14,639 | 311 |
| Des Moines River - Headwaters | 6,539 | 4,860 | 817 |
| East Fork Des Moines River | 695 | 548 | 6 |
| Lac qui Parle River | 1,399 | 8,797 | 50 |
| Le Sueur River | 2,707 | 7,818 | 72 |
| Little Sioux River | 559 | 962 | 125 |
| Lower Big Sioux River | 520 | 204 | 179 |
| Lower Des Moines River | 362 | 165 | - |
| Lower Minnesota River | 5,814 | 3,953 | 608 |
| Minnesota River - Headwaters | 2,083 | 3,325 | 72 |
| Minnesota River - Mankato | 7,492 | 10,922 | 1,016 |
| Minnesota River - Yellow Medicine River/Hawk Creek | 11,304 | 24,855 | 977 |

| Major Watershed | RIM* | CREP** | PWP*** |
|---|---|---|---|
| Pomme de Terre River | 3,700 | 2,737 | 104 |
| Redwood River | 3,437 | 5,816 | 209 |
| Rock River | 2,082 | 2,376 | 170 |
| Upper Big Sioux River | 81 | - | - |
| Watonwan River | 1,930 | 7,875 | 213 |
| **LMMM SA Total** | **65,125** | **125,627** | **5,481** |
| Data from BWSR, updated in 2023.<br>*RIM is the Reinvest in Minnesota program<br>**CREP is the Conservation Reserve Easement Program<br>***PWP is the Permanent Wetlands Preserve program | | | |

## Permitting Analysis

Permits issued under the U.S. Army Corps of Engineers (USACE) Regulatory Program were reviewed for the four-year period between January 2017 and December 2021. This review focused on authorized impacts to wetlands (e.g., filling or draining) that resulted in a permanent loss of the resource.

**Error! Reference source not found.**15 provides a summary of authorized wetland impacts between 2017 and 2021. It is important to note that this information provides only a subset of wetland impacts over this period. For example, the placement of fill material into a wetland for residential development would be included in this summary. However, the placement of fill material into a wetland for a temporary road, which would be restored to its preexisting condition at a later time, would not be included in this summary. Lastly, the USACE does not regulate impacts to all wetlands. Certain wetlands that are considered isolated are not regulated by the USACE and would not be included in this summary.

Considering these caveats, the Lower Minnesota River watershed experienced the greatest amount of wetland impacts over this period. This appears reasonable as this major watershed includes portions of the southern Minneapolis/St. Paul metropolitan region. The remaining watersheds have significantly less impacts as impacts are generally correlated with the level of development.

**Table 3-15. Acres of Permitted Wetland Impact**

| Major Watershed | Acres of Impact |
|---|---|
| Blue Earth River | 1.0 |
| Chippewa River | 28.5 |
| Cottonwood River | 1.3 |
| Des Moines River - Headwaters | - |
| East Fork Des Moines River | - |
| Lac qui Parle River | 12.2 |
| Le Sueur River | 6.7 |
| Little Sioux River | - |
| Lower Big Sioux River | 0.2 |

| Major Watershed | Acres of Impact |
|---|---|
| Lower Des Moines River | - |
| Lower Minnesota River | 50.4 |
| Minnesota River - Headwaters | 5.0 |
| Minnesota River - Mankato | 20.5 |
| Minnesota River - Yellow Medicine River/Hawk Creek | 12.2 |
| Pomme de Terre River | 8.8 |
| Redwood River | 3.3 |
| Rock River | 4.4 |
| Upper Big Sioux River* | - |
| Watonwan River | 2.7 |
| **LMMM SA Total** | **157.2** |
| Data from 2017 to 2021 provided by the U.S. Army Corps of Engineers *Data for Upper Big Sioux watershed is included with the Lower Big Sioux watershed because the data does not distinguish between the two major watersheds. | |

# 4. CUMULATIVE IMPACT ANALYSIS

## Wetland Loss

Wetland loss was analyzed for the entire LMMM SA. To quantify wetland loss, the historic extent of wetlands was compared to the current extent. The historic extent of wetlands are wetlands that existed prior to European Settlement (from here on referred to as pre-settlement wetlands). To estimate pre-settlement wetlands, a combination of hydric soil data map unit (DMU) ratings and current wetlands extent was used. Hydric soils, as defined by the United States Department of Agriculture (USDA), are soils that have been formed under conditions of saturation, flooding, and ponding, long enough during the growing season to develop anaerobic conditions in the upper part. Soil DMUs mapped with a hydric rating of 66% and above were used in combination with Palustrine class wetlands from the NWI to estimate the areal coverage of pre-settlement wetlands. Soil mapping processes for hydric soils underestimates the actual extent of wetlands, therefore the assumption was made that wetlands that exist today outside the mapped hydric soils also existed pre-settlement. Using this method, there were approximately 4.9 million acres of wetland in the LMMM SA prior to European settlement. Compared to the current extent of wetlands (808,000 acres), there has been a 84% loss. The greatest loss has occurred in the Lower Des Moines River watershed with 96% of the wetlands lost. The Upper Big Sioux River watershed has experienced the least amount of wetland loss with only 20%. Table 4-1 summarizes the total wetland loss for the LMMM SA by watershed and the entire area.

Another approach to quantify the area of pre-settlement wetlands was conducted by Anderson & Craig (1984) by analyzing soil maps provided by the Minnesota Soil Atlas for the entire state. They selected soils that were either peat or wet mineral soils and assumed that these represent areas where pre-settlement wetlands once

existed. Wet mineral soils are soils mapped as poorly drained mineral soils. They found that there were 18.4 million acres of pre-settlement wetlands across the state. Within the LMMM SA they found approximately 3.7 million acres of pre-settlement wetlands. Compared to the extent of wetlands at the time of publishing in 1984 (99,000 acres), there was a 97% loss in wetland acreage. See Table 4-2 for detailed numbers for each watershed.

Tables 4-1 and 4-2 show the percent lost in the LMMM SA from Anderson & Craig (1984) is 97% and the percent lost based on hydric soils and the current NWI is 84%. The most likely reasons for this difference are mapping methodologies and the level of accuracy of each method.

**Table 4-1. Wetland Loss Based on Hydric Soils and NWI**

| Major Watershed | Pre-settlement Acres | Current Acres* | Wetland Loss (acres) | Percent Lost |
|---|---|---|---|---|
| Blue Earth River | 428,634 | 33,480 | 395,154 | 92% |
| Chippewa River | 420,876 | 135,119 | 285,757 | 68% |
| Cottonwood River | 387,504 | 34,493 | 353,011 | 91% |
| Des Moines River - Headwaters | 306,558 | 49,535 | 257,023 | 84% |
| East Fork Des Moines River | 74,888 | 3,935 | 70,952 | 95% |
| Lac qui Parle River | 217,421 | 40,140 | 177,280 | 82% |
| Le Sueur River | 415,574 | 40,072 | 375,502 | 90% |
| Little Sioux River | 85,913 | 9,904 | 76,008 | 88% |
| Lower Big Sioux River | 57,559 | 17,021 | 40,538 | 70% |
| Lower Des Moines River | 25,857 | 1,109 | 24,748 | 96% |
| Lower Minnesota River | 556,816 | 112,708 | 444,108 | 80% |
| Minnesota River - Headwaters | 151,502 | 66,231 | 85,271 | 56% |
| Minnesota River - Mankato | 472,316 | 62,799 | 409,516 | 87% |
| Minnesota River - Yellow Medicine River/Hawk Creek | 595,127 | 69,284 | 525,843 | 88% |
| Pomme de Terre River | 118,534 | 53,752 | 64,782 | 55% |
| Redwood River | 193,694 | 24,711 | 168,983 | 87% |
| Rock River | 160,682 | 31,627 | 129,055 | 80% |
| Upper Big Sioux River | 2,577 | 2,066 | 511 | 20% |
| Watonwan River | 298,362 | 20,284 | 278,078 | 93% |
| **LMMM SA Total** | **4,970,393** | **808,271** | **4,162,121** | **84%** |

*Based on the NWI, includes only Palustrine class wetlands

| Table 4-2. Wetland Loss Based on Anderson & Craig (1984) | | | |
|---|---|---|---|
| **Major Watershed** | **Pre-settlement Acres** | **Acres as of 1984** | **Percent Lost** |
| Blue Earth River | 372,592 | 4,063 | 99% |
| Chippewa River | 396,675 | 30,198 | 92% |
| Cottonwood River | 230,558 | 1,865 | 99% |
| Des Moines River - Headwaters | 143,301 | 1,753 | 99% |
| East Fork Des Moines River | 48,211 | 341 | 99% |
| Lac qui Parle River | 149,501 | 1,670 | 99% |
| Le Sueur River | 355,491 | 8,638 | 98% |
| Little Sioux River | 63,979 | 651 | 99% |
| Lower Big Sioux River | 14,078 | 75 | 99% |
| Lower Des Moines River | 18,445 | 221 | 99% |
| Lower Minnesota River | 398,527 | 17,350 | 96% |
| Minnesota River - Headwaters | 190,052 | 3,043 | 98% |
| Minnesota River - Mankato | 378,167 | 6,508 | 98% |
| Minnesota River - Yellow Medicine River/Hawk Creek | 426,577 | 8,846 | 98% |
| Pomme de Terre River | 117,005 | 10,583 | 91% |
| Redwood River | 98,749 | 940 | 99% |
| Rock River | 82,917 | 383 | 100% |
| Upper Big Sioux River | 3,013 | 75 | 98% |
| Watonwan River | 201,003 | 2,036 | 99% |
| **LMMM SA Total** | **3,688,841** | **99,240** | **97%** |
| The county data presented in Anderson & Craig (1984) was processed so that numbers could be summarized by watershed. It was assumed that wetland coverage was equal across the county. | | | |

## Banking Analysis

Since passage of the Clean Water Act in 1972 and WCA in 1991, most wetland impacts are regulated by one or both programs and may require mitigation to offset the functions lost as a result of the authorized impacts. Today, credits obtained from wetland mitigation banks are the primary source of mitigation for these impacts. Project-specific mitigation is also an agency accepted option, provided the site meets regulatory and technical eligibility requirements. To assess how wetland banking credits are being used to offset wetland impacts in the LMMM SA, an analysis of wetland banking activity and the current credit inventory in the standard (private) market MnDOT, and LGRWRP accounts was completed. Banking activity was evaluated by compiling annual credit withdrawals for wetland banks located in the LMMM SA. The analysis utilized annual reports obtained from the State of Minnesota wetland banking database from 2018 through 2022. Credit inventory in the standard market in the LMMM SA was assessed using information from the BWSR Available Wetland Credit listing which displays credits available for purchase based on feedback from the account holders. Since the LMMM SA is a

combination of three separate BSAs, which are different banking markets, the analysis was broken down for each BSA. Only accounts located in the western portion of 8 are included in this analysis.

Table 4-3 provides a summary of wetland credits withdrawn in each BSA in Minnesota for the period of 2018 through 2022. The withdrawal numbers include transactions for MnDOT, LGRWRP, and standard accounts. Transactions associated with the agricultural wetland bank are not included in the table. As shown, BSA 9 is the fourth most active BSA in Minnesota generating an average annual credit demand of 82 credits during the period of analysis. BSA 8W and BSA 10 are the least active BSAs in the state, generating an average annual credit demand of 10 and 7 credits respectively. BSA 9 accounts for approximately 13% of the credits withdrawn statewide each year. Whereas BSAs 8W and 10 account for only 2% and 1% respectively.

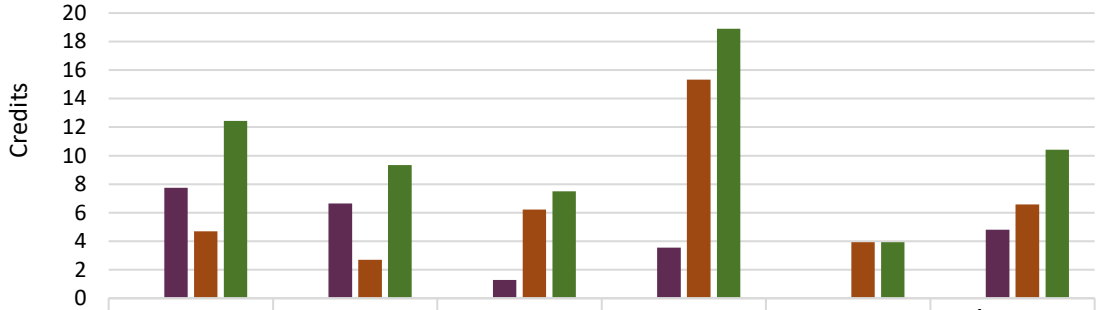
Withdrawal data was further analyzed to determine the individual type contributions (MnDOT, LGRWRP, and standard) for each year. The results of this analysis are summarized in Figures 4-1, 4-2, and 4-3. Not surprisingly, transactions from standard bank accounts represent most of the credit withdrawal activity in all three BSAs, followed by the LGRWRP and then MnDOT. In BSA 9 LGRWRP is a significant amount of the withdrawal activity, a close second after the standard bank.

**Table 4-3. Wetland Credits Withdrawn by Bank Service Areas 2018-2022[1]**

| BSA/SA | | 2018 | 2019 | 2020 | 2021 | 2022 | Total | Average |
|---|---|---|---|---|---|---|---|---|
| 1 | | 30 | 15 | 141 | 340 | 119 | **645** | 129 |
| 2 | | 8 | 18 | 31 | 25 | 10 | **91** | 18 |
| 3 | | 18 | 38 | 81 | 94 | 88 | **319** | 64 |
| 4 | | 10 | 24 | 53 | 106 | 17 | **210** | 42 |
| 5 | | 22 | 52 | 199 | 136 | 127 | **536** | 107 |
| 6 | | 24 | 38 | 23 | 26 | 4 | **115** | 23 |
| 7 | | 120 | 121 | 122 | 155 | 142 | **660** | 132 |
| SA 8E | | 14 | 43 | 37 | 63 | 23 | **180** | 36 |
| LMMM SA | *8W* | *12* | *9* | *8* | *19* | *4* | ***52*** | *10* |
| | *9* | *66* | *57* | *66* | *135* | *88* | ***411*** | *82* |
| | *10* | *0.5* | *7* | *5* | *0.2* | *23* | ***36*** | *7* |
| | Total | 78.5 | 73 | 79 | 154.2 | 115 | **499** | 99 |
| **Total** | | **325** | **421** | **765** | **1099** | **645** | **3255** | **651** |

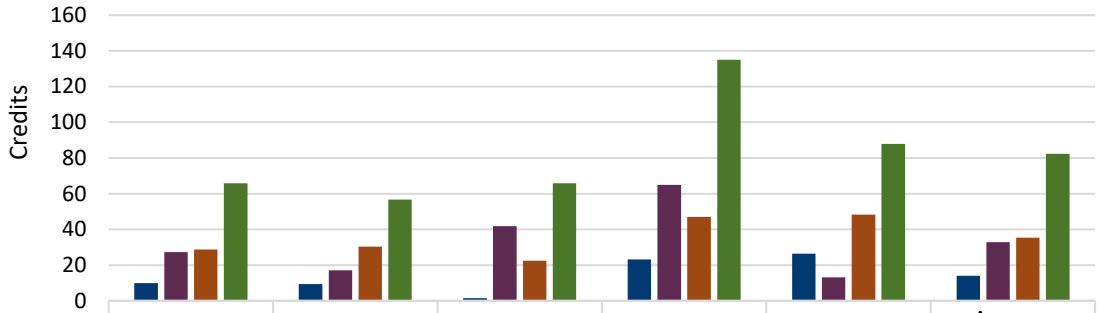
[1] Excludes withdrawals from agricultural wetland bank accounts

**Figure 4-1**
**BSA 8W Wetland Credit Withdrawals**
**by Account Type 2018-2022**



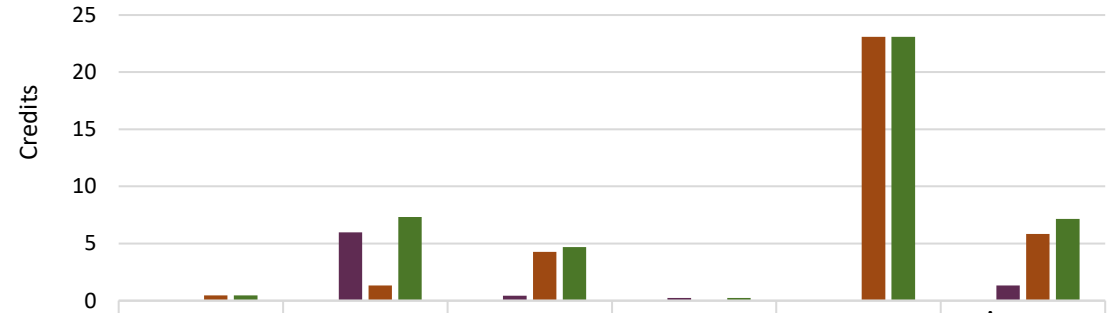

| | 2018 | 2019 | 2020 | 2021 | 2022 | Average Annual |
|---|---|---|---|---|---|---|
| MnDOT | 0 | 0 | 0 | 0 | 0 | 0.0000 |
| Road Program | 7.742 | 6.6403 | 1.2797 | 3.56 | | 4.8055 |
| Standard | 4.6926 | 2.7 | 6.2228 | 15.3295 | 3.9365 | 6.5763 |
| Total | 12.4346 | 9.3403 | 7.5025 | 18.8895 | 3.9365 | 10.4207 |

**Figure 4-2**
**BSA 9 Wetland Credit Withdrawals**
**by Account Type 2018-2022**




| | 2018 | 2019 | 2020 | 2021 | 2022 | Average Annual |
|---|---|---|---|---|---|---|
| MnDOT | 9.9195 | 9.2835 | 1.56 | 23.143 | 26.364 | 14.0540 |
| Road Program | 27.2356 | 17.1557 | 41.7751 | 64.8544 | 13.2185 | 32.8479 |
| Standard | 28.7106 | 30.297 | 22.4625 | 46.9933 | 48.3021 | 35.3531 |
| Total | 65.8657 | 56.7362 | 65.7976 | 134.9907 | 87.8846 | 82.2550 |

**Figure 4-3**
**BSA 10 Wetland Credit Withdrawals by Account Type 2018-2022**




| | 2018 | 2019 | 2020 | 2021 | 2022 | Average Annual |
|---|---|---|---|---|---|---|
| MnDOT | 0 | 0 | 0 | 0 | 0 | 0.0000 |
| Road Program | 0 | 5.98 | 0.44 | 0.23 | 0 | 1.3300 |
| Standard | 0.46 | 1.3376 | 4.26 | 0 | 23.099 | 5.8313 |
| Total | 0.4600 | 7.3176 | 4.7000 | 0.2300 | 23.0990 | 7.1613 |

CURRENT STATUS

Standard wetland bank ledger information in the LMMM SA was compiled and reviewed to provide a snapshot of the number of credits currently available. This analysis focused on credits that were deposited into Minnesota wetland banks as of December 2023 and listed for sale on the BWSR Available Wetland Credit listing. This analysis does not include credits from MnDOT or the LGRWRP (the status of credits associated with these state programs is addressed later in this section). The total number of credits listed for public sale in BSA 9 is 234.5609 credits spread amongst 32 banks. In BSA 10 there are 18.6009 credits listed for public sale within one account. There are no credits listed for public sale in BSA 8W. It is unknown what amount of the credit inventory is under contract and thus not available to future permittees to satisfy mitigation requirements. BSA 9 has a substantial supply of publicly available wetland credits with at least a 6- year supply based on the average annual demand for standard credits calculated in Figure 4-2. BSA 8W has no supply of credits and BSA 10 only has a 3-year supply.

BSA 8W has one LGRWRP bank with 4.7925 credits available. This bank will meet LGRWRP demand for one year. There are no active MnDOT banks in BSA 8W. MnDOT and LGRWRP credit balances in BSA 9 are sufficient to meet expected demand for at least the next two to four years. MnDOT presently has a balance of 65.4769 credits across 15 accounts that will meet their program demand for at least the next four years based on the five-year annual average calculated for this analysis. The LGRWRP has an approximate two-year supply of credits with a total available balance of 15.7060 credits. BSA 10 does not currently have MnDOT or LGRWRP credits available. Although the MnDOT demand is zero and the LGRWRP demand is 1.33 credits per year. However, this is not unusual because the agencies have recognized in rule and policy that impacts in BSA 10 can be replaced in BSA 9 or the Des Moines River watershed portion of BSA 8 (BSA 8W) without an increase in the mitigation

ratio. This is in response to the relatively small geographic area of BSA 10 in Minnesota and the difficulty associated with finding economically viable mitigation sites in such a small market.

# 5. WATERSHED TRENDS AND THREATS

## Trends in Wetland Quantity and Quality

Minnesota has adopted a policy goal to achieve a no-net-loss in quantity and quality of wetlands across the state. This is achieved through many regulatory and non-regulatory programs, including WCA. Since 2006, the MPCA and MnDNR have completed routine surveys to assess the status and trends in quantity and quality of wetlands across the state of Minnesota.

The MnDNR is responsible for quantifying the status and trends of wetland quantity across Minnesota. Using remote sensing data, three surveys have been completed: a baseline was established in 2006, the first iteration was in 2009, and the second iteration in 2012.

A three-year study was completed from 2006-2008, to establish a baseline in wetland quantity in Minnesota. It was found that there are 10.62 million acres of wetland across the state. The Prairie Parkland Region in southwestern Minnesota and the Paleozoic Plateau in southeastern Minnesota have considerably less wetlands than central and northern portions of the state. Forested wetland was the most widespread type, covering approximately 4.4 million acres. Emergent wetlands were the next most abundant with 3.1 million acres (Kloiber, 2010).

Between the first (2009) and second (2012) iterations there was a net increase of area that changed from upland to wetland. There was some change from wetland to upland which was due to human intervention. A high proportion of the changes in wetland type and area happened on agricultural land (Kloiber & Norris, 2017). It should be noted that the increase in wetland acreage was primarily in unconsolidated bottom type wetlands. It was also found that conversions between wetland types were primarily from emergent wetlands to cultivated or unconsolidated bottom wetlands.

The MPCA is responsible for assessing the status and trends in wetland quality in Minnesota. This is done by completing two surveys, the Depressional Wetland Quality Assessment (DWQA) and the Minnesota Wetland Condition Assessment (MWCA). The DWQA focuses on vegetation, macroinvertebrates, and water quality for depressional wetlands. It has undergone three iterations in 2007, 2012, and 2017. The MWCA, which covers a broader spectrum of wetlands, was first completed in 2011 to determine a baseline for wetland vegetation quality and to begin quantifying potential human impacts associated with degraded conditions (Minnesota Pollution Control Agency, 2015). It was repeated in 2016 to establish trends.

In 2011, the MWCA baseline survey found that Minnesota has relatively high-quality wetlands, but it is regionally specific. There are more wetlands in northern Minnesota than southern Minnesota which causes the data to be weighted towards the condition of the northern region. About 49% of Minnesota wetlands are in exceptional condition. These wetlands are predominately located in the north-central and northeastern portions of the state.

As for the western and southern portions of the state, most wetlands are in fair or poor condition. The baseline survey also found that Minnesota's wetlands, as a whole, are exposed to a low level of stressors, but this is also regionally specific. The northern portions of the state experience low pressure from stressors, but the southern and western regions experience high pressure, specifically from non-native invasive plants (Minnesota Pollution Control Agency, 2015). Wetlands in the LMMM SA experience high pressure from stressors and are generally lower quality wetlands.

The results from the first iteration of the MWCA in 2016 found that Minnesota's wetland vegetation continues to be high quality. The results are similar to the baseline with the exception of a statistically significant 3% decrease of wetlands in poor condition. Vegetation quality still varied by region with the north having higher quality and less stressors, and the south and west having lower quality and more impact from stressors. In the western and southern portions of the state there was a statistically significant increase in the number of fair condition wetlands and a corresponding decrease in poor condition wetlands (Bourdaghs et al., 2019). Wetland vegetation quality in the LMMM SA has largely stayed the same since the first baseline assessment in 2011.

The LMMM SA falls within the study region for the DWQA. In 2017, it was found that 58% of plant communities in depressional wetland basins were in fair condition, 25% in poor condition, and 4% in good condition. The most recent iteration for the DWQA changed the vegetation quality methods and therefore cannot be compared to previous data. Based on the relative stability of aquatic macroinvertebrate community condition of the past surveys, there seems to be no significant change in the quality of depressional wetlands and ponds (Genet et al., 2019).

In addition to these routine studies that establish trends in wetland quantity and quality, BWSR also completed a study assessing wetland quality within depressional wetlands with the intention of refining restoration requirements and strategies on wetland banks ((Strojny, 2020). Using the Floristic Quality Assessment as a measure of wetland condition, wetlands that were restored with differing intensities were compared. The restoration intensities included were intensively restored, passively restored, and naturally occurring wetlands. It was found that fresh wet meadows that were actively managed for vegetation tended to have higher quality vegetation. This trend was not observed in shallow marsh or shallow open water communities. Overall, the quality of the wetlands aligned with the MPCA Statues and Trends reports for southern Minnesota.

In summary, the vegetation quality of wetlands in Minnesota is high. The southern region tends to have lower quality because there is more pressure from stressors. These stressors are both human intervention and non-native invasive species. As far as areal extent, Minnesota has actually seen an increase in wetlands. It is important to note that there have been many conversions from emergent wetlands to deep-water habitats and ponds. The LMMM SA reflects the regional trends in both wetland quality and extent, with more extensive high-quality wetlands in the north and lesser quality, smaller wetlands in the south.

## Description of Threats

Wetlands across Minnesota are under threat from many different stressors. In the LMMM SA, wetlands are threated specifically by the loss of hydrologic storage, pollution, and invasive vegetation. These threats are based

on the conditions established in the Baseline Conditions section as well as conversations with stakeholders. It is important to recognize current and future threats, as well as the impact threats have on prioritizing areas for wetland restoration and protection.

### LOSS OF HYDROLOGIC STORAGE

The loss of hydrologic storage can be seen through many of the baseline conditions explored above, specifically altered watercourses, perennial cover, and wetland loss. Hydrologic storage is the ability of the landscape to hold water, permanently or temporarily, mainly in lakes, wetlands, and rivers. Storage on the landscape is important for the flood mitigation and water quality (Mitsch & Gosselink, 2015). According to the NWI, the Chippewa River, Pomme de Terre, and Lower Minnesota River watersheds have the most loss in hydrologic storage due to the number of ditched wetlands (wetland with a "d" modifier). In addition, The Lower Des Moines River and East Fork of the Des Moine River watersheds have the most wetland loss and area in agriculture. Across the SA watersheds are experiencing loss in hydrologic storage through land uses and drained wetlands.

In addition to the data within this report illuminating the loss of hydrologic storage across the SA, the USACE also recently completed a study which came to a similar conclusion. The Minnesota River Basin Interagency Study (USACE, 2020) used several hydrologic models and environmental benefits analyses to determine the impact of basin-wide land use change and implementation of Best Management Practices. The results were intended to help understand water, sediment, nitrogen, and phosphorus transport in several scenarios including historic, existing, and probable future conditions. It was found that "[…] the most critical needs are for actions to store water on the landscape using BMPs, build soil health, and stabilize ravine erosion. Water storage BMPs include temporary storage basins, managed drainage outlets, grass waterways and buffers, and edge-of-field treatment wetlands. Cover crops and reduced tillage will help improve soil health, which is critical to increase soil organic matter and retain water on the landscape."

### THREAT OF POLLUTION

According to the WHAF from the MnDNR, the LMMM SA generally has the worst water quality in Minnesota, the most agriculture and the most non-point sources of pollution. The threat from pollution is a real and active issue in this area of the State. According to the NLCD, 80% of the LMMM SA is agriculture and 6% is developed. Most of Minnesota cities are located in the LMMM SA and are growing. Both agriculture and urbanization introduce new pollutants to the landscape and also decrease the hydrologic storage and the ability of water to filter through soil before entering groundwater aquifers. Water quality tends to decrease with an increase in agriculture and development pressure. In addition, wetland macro-invertebrates are sensitive to pollution which can lead to a decrease in their population and diversity.

### INVASIVE SPECIES

Invasive species are a serious problem for the future of our wetlands and can cause economic and ecological harm. Invasive species like Cattails (*Typha angustifolia*), Reed Canary Grass (*Phalaris arundinacea*), Purple Loosestrife (*Lythrum salicaria*), and Emerald Ash Borer (*Agrilus planipennis*) put native species in Minnesota, and specifically in the LMMM SA, at risk. Invasive species can crowd out native plants and limit sunlight. They

can hinder water flow and reduce wildlife habitat. The impact that invasive species have on wetlands in the LMMM SA includes changes in hydrology from dense root systems, lowered biological diversity due to outcompeting invasive species, and loss of native canopy cover from invasive pests.

# 6. STAKEHOLDER INVOLVEMENT

Stakeholders are a crucial part of the CPF development process and were included via virtual meetings. The first meeting took place in March 2023, to introduce the ILF and CPF development process to the stakeholders. A summary of the baseline conditions was presented to gather feedback from stakeholders so metrics could be tailored to the LMMM SA. Stakeholders invited to participate included: Soil and Water Conservation Districts, Cities, Counties, Watershed Districts, Watershed Management Organizations, BWSR, MnDNR, MnDOT, MPCA, USACE, EPA, Lower Sioux-Dakota, and Shakopee Mdewakaton Dakota. Those that attended included individuals from Soil and Water Conservation Districts, Cities, Counties, Watershed Districts, MPCA, BWSR, and the MnDNR. Discussions during the meeting highlighted public drainage information and flood-prone areas. Data for these categories is not comprehensive across the entire SA area, therefore these will not be added as baseline conditions. During the meeting stakeholders identified two additional baseline conditions that have sufficient data to be incorporated in the report. Sensitive groundwater areas and current RIM and CREP easement areas will be included in the report as baseline conditions. A list of attendees and the material presented is provided in Appendix C-1.

The second stakeholder meeting took place in August 2023. This meeting reviewed the updated baseline conditions and presented the two conditions, sensitive groundwater areas and current RIM and CREP easement areas, which were added based on the first meeting. USACE permitting data was also presented as it had been added following the first stakeholder meeting, although it was not a result of stakeholder feedback. The cumulative impact analysis as well as the LMMM SA trends and threats assessment were also presented. The main focus of the meeting was presenting prioritization criteria for restoration and soliciting feedback from stakeholders. A draft list of the criteria and a preliminary map of prioritized catchments were introduced. The invite list was the same as the first meeting. Those that attended included individuals from Soil and Water Conservation Districts, Counties, Cities, Watershed Districts, MnDNR, MnDOT, and BWSR. Areas and threats specifically mentioned in local plans were discussed but no additional information was requested to be added. A list of the attendees and the material presented is provided in Appendix C-2.

The third and final stakeholder meeting took place in December 2023. The purpose of the meeting was to present the prioritization process and final results. A brief refresher of the purpose of the report, the baseline conditions, cumulative impact analysis, and SA trends and threats was also given. The invite list was the same as the previous two meetings. Those that attended included individuals from Counties, Soil and Water Conservation Districts, and BWSR. There were no comments provided on the meeting materials. A list of the attendees and the material presented is provided in Appendix C-3.

# 7. PRIORITIZATION METHODS FOR SELECTING AND IMPLEMENTING MITIGATION ACTIVITIES

The geographic scale used to identify priority areas for wetland mitigation in this plan is the MnDNR Level 8 catchments. The MnDNR has defined Level 8 catchments to be "the smallest delineated and digitized drainage area mapped by the MnDNR Watershed Delineation Project." The catchment scale was selected for two primary reasons. First, the prioritization process can be conducted at a finer scale which allows for more specific identification of areas where wetland mitigation may benefit watershed health. At the same time, the number of catchments in the LMMM SA is not excessive and the process can be completed in a reasonable amount of time with meaningful results. Second, the MnDNR has developed large amounts of watershed data at the catchment level that can be easily accessed to support the prioritization process which reduces the time associated with the GIS-based analyses.

The LMMM SA is made up of 2,458 catchments distributed across the nineteen major watersheds as follows: Blue Earth River has 127 catchments, Chippewa River has 534 catchments, Cottonwood River has 136 catchments, Des Moines River – Headwaters has 137 catchments, East Fork Des Moines River has 23 catchments, Lac Qui Parle has 86 catchments, Le Sueur River has 115 catchments, Little Sioux River has 47 catchments, Lower Big Sioux River has 51 catchments, Lower Des Moines River has 9 catchments, Lower Minnesota River has 266 catchments, Minnesota River – Headwaters has 83 catchments, Minnesota River – Mankato has 142 catchments, Minnesota River – Yellow Medicine River/Hawk Creek has 198 catchments, Pomme de Terre River has 260 catchments, Redwood River has 66 catchments, Rock River has 82 catchments, Upper Big Sioux River has 6 catchments, and Watonwan River has 90 catchments (Figure 7-1).

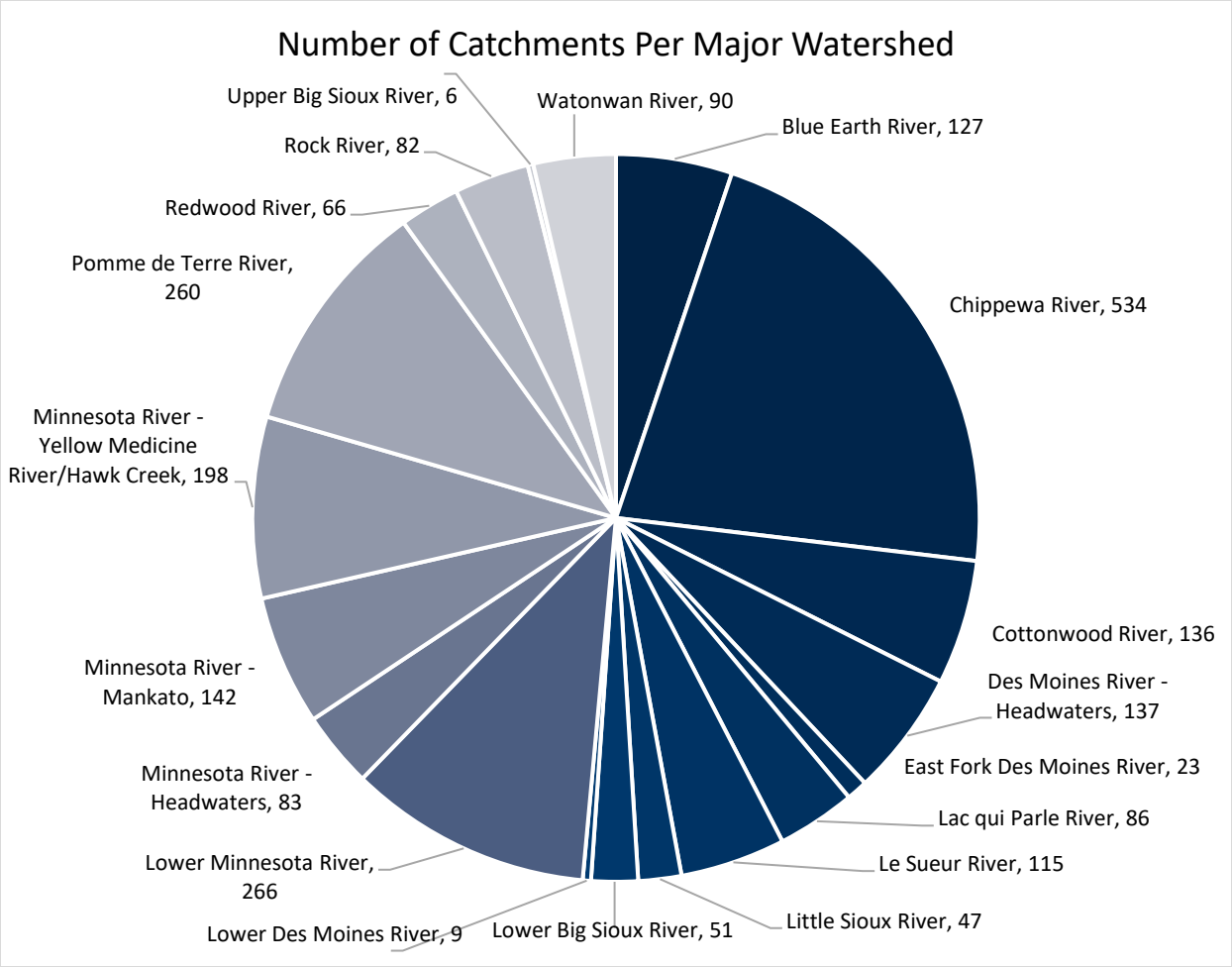



**Figure 7-1. Chart showing the number of catchments within each major watershed.**

## Criteria Selection

Criteria for catchment prioritization were selected by stakeholders attending the second stakeholder meeting. BWSR and ISG staff served as facilitators of the discussion and selection process by suggesting criteria for restoration and then seeking stakeholder input. After the meeting, each criterion was evaluated for availability and suitability of GIS-based data. A list and description of the restoration criteria can be seen in Table 7-1.

### RESTORATION CRITERIA

A total of 11 different criteria were selected for restoration prioritization. They include *Altered Streams, Drained Wetlands, Flooding, Ground Water Pollution, Lake and River Impairments, Lake Phosphorus Sensitivity (LPSS), Local Plans, Perennial Cover, Prairie Plan, Wetland Loss, and WRAPS Stream Priorities*. The specific criterion and description of data used can be found in Table 7-1.

**Table 7-1. Restoration Criteria and Description of Data**

| Criterion | Description |
|---|---|
| Altered Streams | This is a ratio of total stream miles classified by the MPCA altered watercourses project as *Impounded* and *Altered* to the total miles of watercourses. Lakes and *No-definable Channel* classification were removed due to the nature of the SA and duplicate mapped features. |
| Drained Wetlands | The total area of wetlands, relative to catchment area, that have a "d" modifier in the National Wetland Inventory. |
| Flooding | Catchments with greater acreage within the FEMA 100-year floodplain were prioritized. |
| Ground Water Pollution | This is based on the near-surface pollution sensitivity dataset from the WHAF. It is a measure of the travel time it takes for water to infiltrate to a depth of 10 feet. Areas of high sensitivity were prioritized. |
| Impairments | A combination of lake and river impairments as mapped by the MPCA impaired waters project (updated 2020) and the WHAF water quality non-point source score. Areas with both high number of impairments and non-point sources were prioritized. This criterion aligns with the USACE Minnesota River Basin Interagency Study (2020). |
| Lakes of Phosphorus Sensitivity Significance (LPSS) | Lakes of Phosphorus Sensitivity Significance (LPSS) presents a ranked list of priority lakes based on sensitivity to additional phosphorus loading. Catchments with more area of LPSS lakes were prioritized. |
| Local Plans | These are areas specifically called out in One Watershed One Plan reports and WRAPS reports for wetland restoration. Scores were assigned as follows: 10: specific geographies and wetland restoration actions called out in the plan, 7: wetland restoration is called out as a priority in multiple spots with details given related to BMPs and entities participating but less specifics, 4: wetland restoration generally mentioned as important but there are few specifics, and 1: wetland restoration is not mentioned at all. |
| Perennial Cover | *Perennial* cover as mapped in the National Land Cover Database, which includes *forest*, *grassland*, and *wetland*. Areas of low amounts of *perennial* cover relative to catchment area were prioritized. |
| Prairie Plan | This criterion includes areas called out within the Prairie Plan, including core areas, corridors, and corridor complexes. It was only applied within major watersheds that had area included the Prairie Plan. |
| Wetland Loss | Areas that have experienced high amounts of wetland loss, relative to catchment area, since European Settlement. This data was produced for this report. Details can be found in the Cumulative Impact Assessment. |
| WRAPS Stream Protection Priorities | Streams that currently support biological communities are a priority for protection. Catchments with more stream miles of priority protection streams will be prioritized for wetland restorations to protect streams from potential of future degradation. |
| | |

## Development of Criterion Maps

GIS transformation of spatially explicit data characterizing each criterion were normalized through a reclassification process to generate maps that captured the potential for a catchment to improve watershed health through wetland restoration. The geoprocessing for each criterion followed a straightforward and repeatable process (Figure 7-2).

First, GIS data representing each criterion was obtained and associated with each catchment in the LMMM SA. If a catchment value had not been assigned (GIS data obtained from the WHAF typically had predetermined criterion scores for each catchment), a value was calculated for each catchment using raw data. For example, the number of ditched wetlands was determined by dividing the area of NWI wetlands with a "d" modifier by the total area of the catchment and multiplying the result by 100.

The resulting criterion scores were then normalized from 0 to 100 for each major watershed by dividing each catchment criteria value by the highest value in that major watershed. The normalized results were then classified into ten classes using the natural breaks tool in ArcGIS in an ascending order of priority (Reclassify step in Figure 7-2). In other words, low scores are catchments with lower potential for wetland mitigation to improve watershed health and high scores represent areas that would have a higher potential to improve watershed health for restoration.

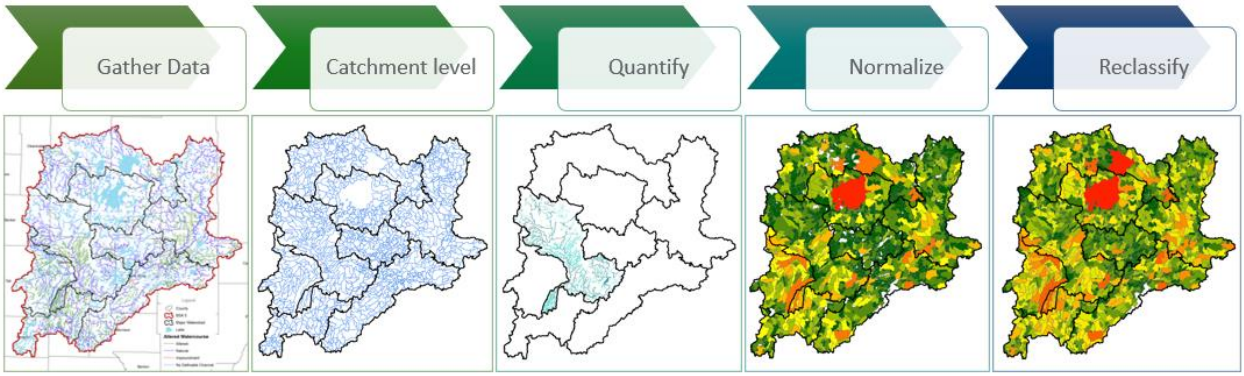



**Figure 7-2. Data transformation process.**

The process described above and in Figure 7-2 was used for all criteria except local plans. For this criterion specific scores were given to each catchment based on the data. The process and scoring can be found in Table 7-1.

## Weighting Derived from Stakeholder Input

Stakeholders were offered the opportunity to weight criteria based on the perceived value within their work area. A simple survey via Survey123 was sent out and the stakeholders had three weeks to respond. Within the survey, stakeholders were asked to rank the criteria from most important to least important. There were 26 responses to the survey. The results of the survey are shown in Table 7-3. The rank of the criteria determined the weight it would receive in the final prioritization.

Weighting was calculated by using the rank sum methodology. Once the rank was assigned by stakeholders the associated weight was multiplied by the criterion score for each catchment. All of the weighted criterion scores were summed together to get the final prioritization score. Catchments with higher scores were prioritized more for restoration. Unweighted results for restoration can be seen in Figure D-1. The weighted results for restoration can be seen in Figure D-2.

| Table 7-2. Restoration Ranks Assigned by Stakeholders and Resulting Weights | | |
|---|---|---|
| **Rank** | **Criterion** | **Weight** |
| 1 | Drained Wetlands | 0.1547 |
| 2 | Local Plans | 0.1401 |
| 3 | Wetland Loss | 0.1300 |
| 4 | Altered Streams | 0.1198 |
| 5 | Impairments | 0.0998 |
| 6 | Flooding | 0.0853 |
| 7 | Groundwater Pollution | 0.0751 |
| 8 | Perennial Cover | 0.0649 |
| 9 | WRAPS | 0.0547 |
| 10 | LPSS | 0.0456 |
| 11 | Prairie Plan | 0.0300 |
| | | |

## Designation of Priority Catchments

The analyses completed to this point separated catchments within each major watershed based on their expected potential to benefit watershed health through wetland restoration activities. The next step in the process was to take these results and identify the prioritized catchments for wetland mitigation projects. This required finding a breakpoint in the prioritization outputs that balanced the need for sufficient wetland mitigation opportunities with maximizing benefits to the watershed. For example, designating only a small number of catchments as high priority areas may not result in enough opportunities for projects when a search is initiated through a selection process. Similarly, identifying a large number of catchments as high priority areas may decrease the potential benefits to the watershed because the value of the prioritization process is diluted. To this purpose, catchments that had prioritization scores in the 80$^{th}$ percentile and above were run through an opportunity filter, to be described later, and considered prioritized. It should be noted that the 80$^{th}$ percentile was determined by the number of catchments, not the area. This methodology differed from other CPF reports because using the top third prioritized 60% of the BSA area which prioritized too large of an area.

In addition to establishing a breakpoint, the prioritized catchments were run through an opportunity filter to preemptively remove catchments that have little to no opportunity for project establishment. The opportunity filter considered amount of wetland loss in each respective catchment. The breakpoint or threshold for this filter was determined for the entire SA by evaluating the data and applying professional judgement. Using wetland loss, any catchment with zero percent of loss were removed. Any catchments that were prioritized and then removed due to the filter, were replaced with a catchment with the next highest prioritization score. This was done so that the total number of catchments within the 80$^{th}$ percentile and above remained the same for each watershed.

For the LMMM SA, all catchments with prioritization scores in the 80th percentile and above within the score distribution for each major watershed that also passed the opportunity filter were identified as a high priority area for wetland restoration. Using this method, a total of 498 catchments (5,063,468 acres of the LMMM SA) were prioritized. A table showing the number of catchments prioritized for restoration by major watershed can be seen in Table 7-5 and Figure D-3 shows a map of the prioritized catchments.

The major watershed with the largest area prioritized was the Chippewa River watershed with 760,272 acres. The major watershed with the least prioritized area was the Upper Big Sioux River watershed, with 13,128 acres. Maps for individual watersheds showing the prioritized catchments can be seen in Figures D-4 through D-23. Table 7-5 lists the acres prioritized for each watershed as well as the percent of the total SA area.

**Table 7-3. Number and Area of Catchments Prioritized for Each Watershed**

| Major Watershed | Number of Catchments | Acres | Percent of SA Area |
|---|---|---|---|
| Blue Earth River | 26 | 333,719 | 3% |
| Chippewa River | 107 | 760,272 | 6% |
| Cottonwood River | 28 | 338,421 | 3% |
| Des Moines River - Headwaters | 28 | 311,960 | 3% |
| East Fork Des Moines River | 5 | 67,395 | 1% |
| Lac qui Parle River | 18 | 231,378 | 2% |
| Le Sueur River | 23 | 261,697 | 2% |
| Little Sioux River | 10 | 81,434 | 1% |
| Lower Big Sioux River | 11 | 116,051 | 1% |
| Lower Des Moines River | 2 | 33,367 | 0.3% |
| Lower Minnesota River | 52 | 492,396 | 4% |
| Minnesota River - Headwaters | 17 | 238,898 | 2% |
| Minnesota River - Mankato | 29 | 343,698 | 3% |
| Minnesota River - Yellow Medicine River/Hawk Creek | 40 | 491,876 | 4% |
| Pomme de Terre River | 52 | 324,239 | 3% |
| Redwood River | 13 | 173,011 | 1% |
| Rock River | 17 | 237,640 | 2% |
| Upper Big Sioux River | 2 | 13,128 | 0.1% |
| Watonwan River | 18 | 213,888 | 2% |
| **LMMM SA Total** | **498** | **5,064,468** | **43%** |

# 8. CONCLUSION

This CPF report established baseline conditions, analyzed wetland trends and threats, gathered stakeholder input, and prioritized catchments for wetland restoration within the LMMM SA. The prioritized catchments have high public value and identify areas where wetland restoration efforts are expected to provide the greatest

benefit to watershed health. The primary use of the CPF is determining the preferred location of future compensatory wetland mitigation sites for the ILF program. In addition, due to the SA specific data and local input used in prioritization, the CPF can be helpful in guiding the location of private (standard) bank establishment. The CPF can also be used for establishing or updating other watershed based planning documents or selecting non-regulatory restoration projects. Data used within this CPF will be periodically updated and can be requested from BWSR.

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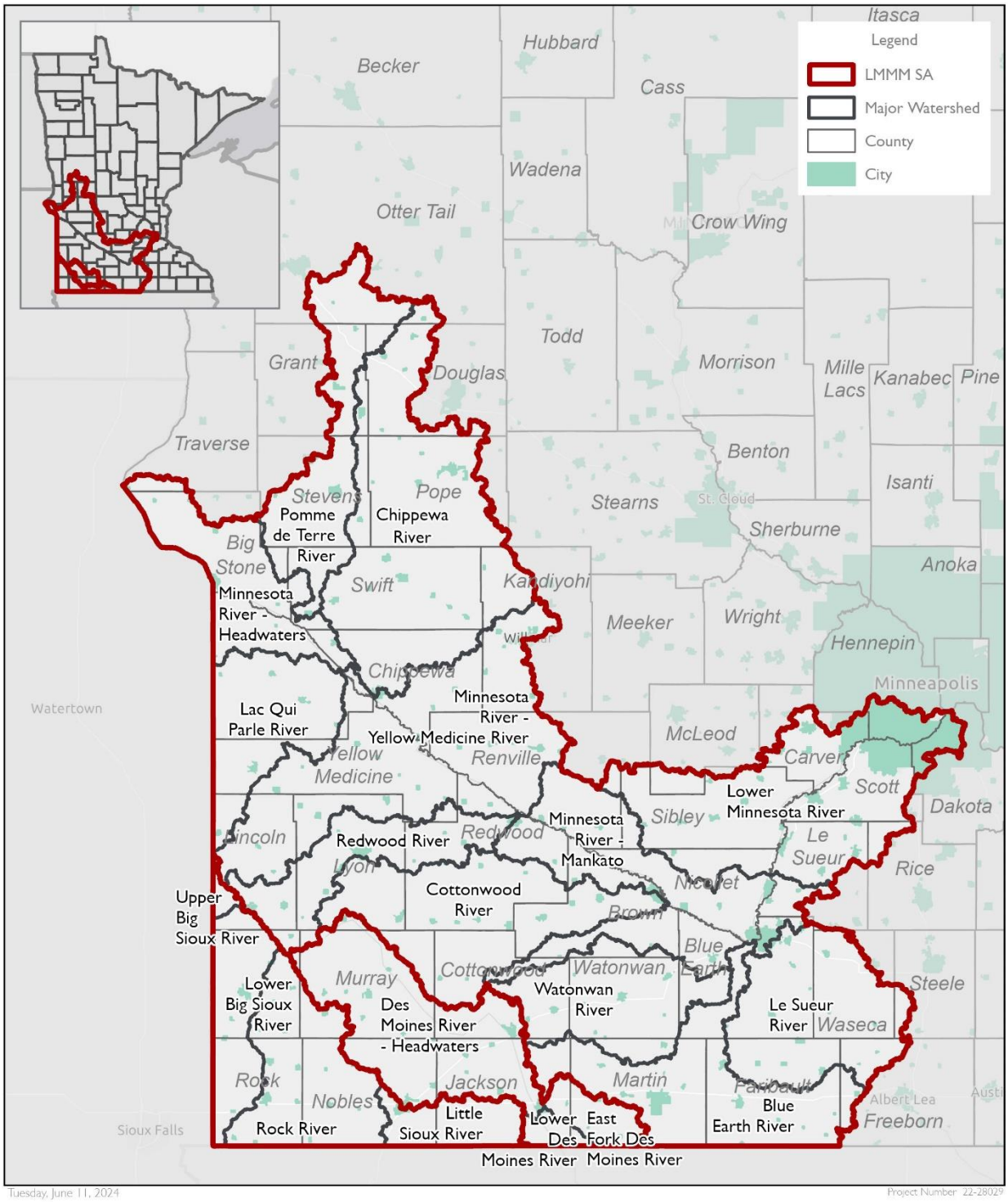
# Appendix A: Acronyms

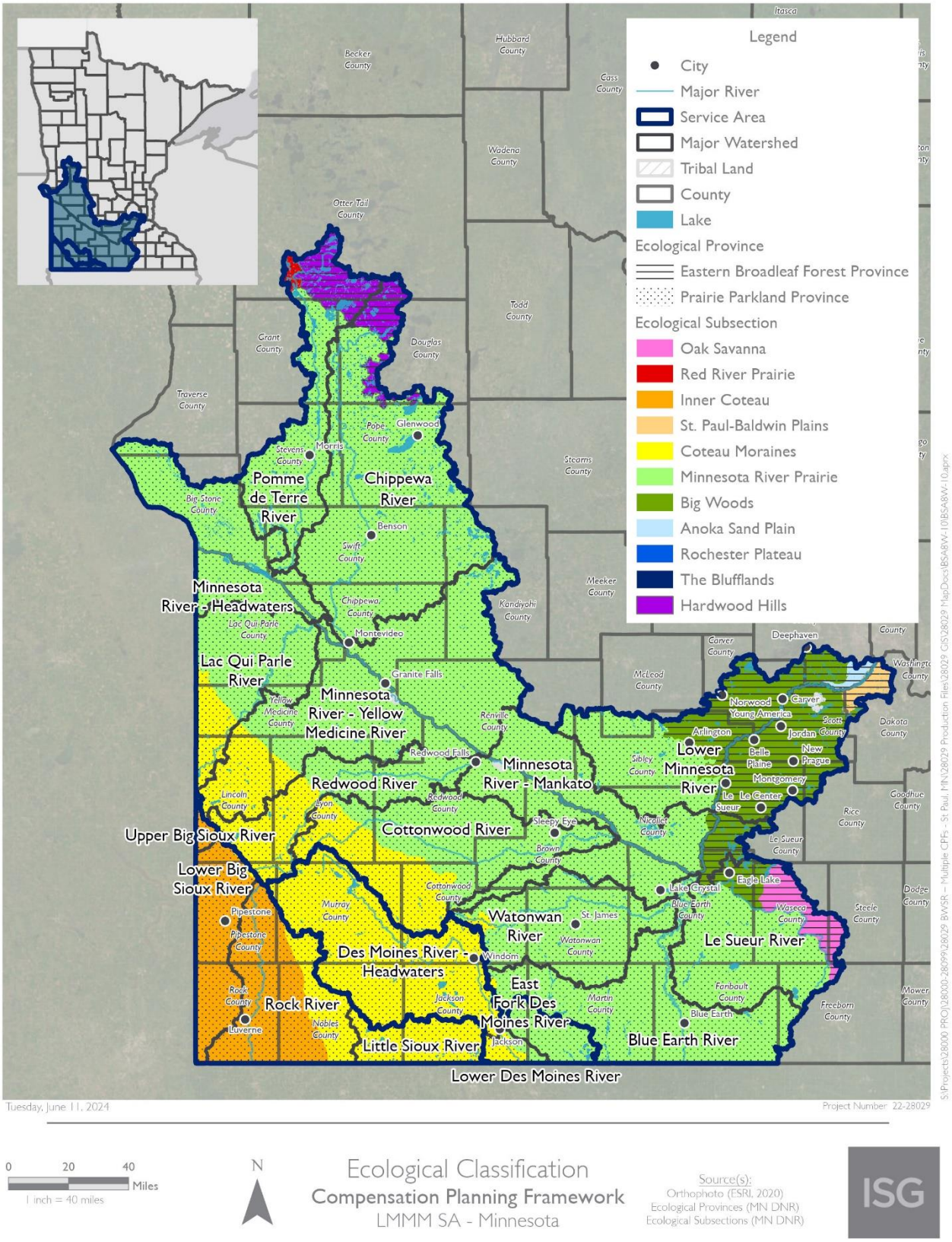
| Acronym | Full Name |
|---|---|
| 1W1P | One Watershed One Plan |
| BMP | Best Management Practice |
| BSA | Bank Service Area |
| BWSR | Minnesota Board of Water and Soil Resources |
| CPF | Compensation Planning Framework |
| CREP | Conservation Reserve Enhancement Program |
| DMU | Data Map Unit |
| DO | Dissolved Oxygen |
| DWQA | Depressional Wetland Quality Assessment |
| EPA | Environmental Pollution Agency |
| FEMA | Federal Emergency Management Agency |
| GIS | Global Information Systems |
| HUC | Hydrologic Unit Code |
| ILF | In-Lieu Fee Program |
| JD | Juridictional Ditch |
| LGRWRP | Local Government Road Wetland Replacement Program |
| LMMM | Lower Minnesota, Missouri and Mississippi (BSAs 8W, 9, and 10) |
| LiDAR | Light Detection and Ranging- remote sensing method for measuring elevations |
| LPSS | Lakes of Phosphorus Sensitivity Significance |
| MBS | Minnesota Biological Survey |
| MnDNR | Minnesota Department of Natural Resources |
| MnDOT | Minnesota Department of Transportation |
| MnGEO | Minnesota Geospatial Information Office |
| MPCA | Minnesota Pollution Control Agency |
| MWCA | Minnesota Wetland Condition Assessment |
| NHD | National Hydrography Dataset |
| NLCD | National Land Cover Database |
| NWI | National Wetlands Inventory- specifically for Minnesota |
| PWP | Permanent Wetland Preserve program |
| RIM | ReInvest In Minnesota |
| SNA | Scientific Natural Area |
| SWCD | Soil Water Conservation District |
| TSS | Total Suspended Solids |
| USACE | United State Army Corps of Engineers |
| USDA | Unites States Department of Agriculture |
| USFS | United States Forest Service |
| USGS | United States Geological Survey |
| VEGMOD | Historic Vegetation Model |
| WCA | Wetland Conservation Act |
| WHAF | Watershed Health Assessment Framework |
| WRAPS | Watershed Restoration and Protection Strategy Report |

# Appendix B: Baseline Condition Maps

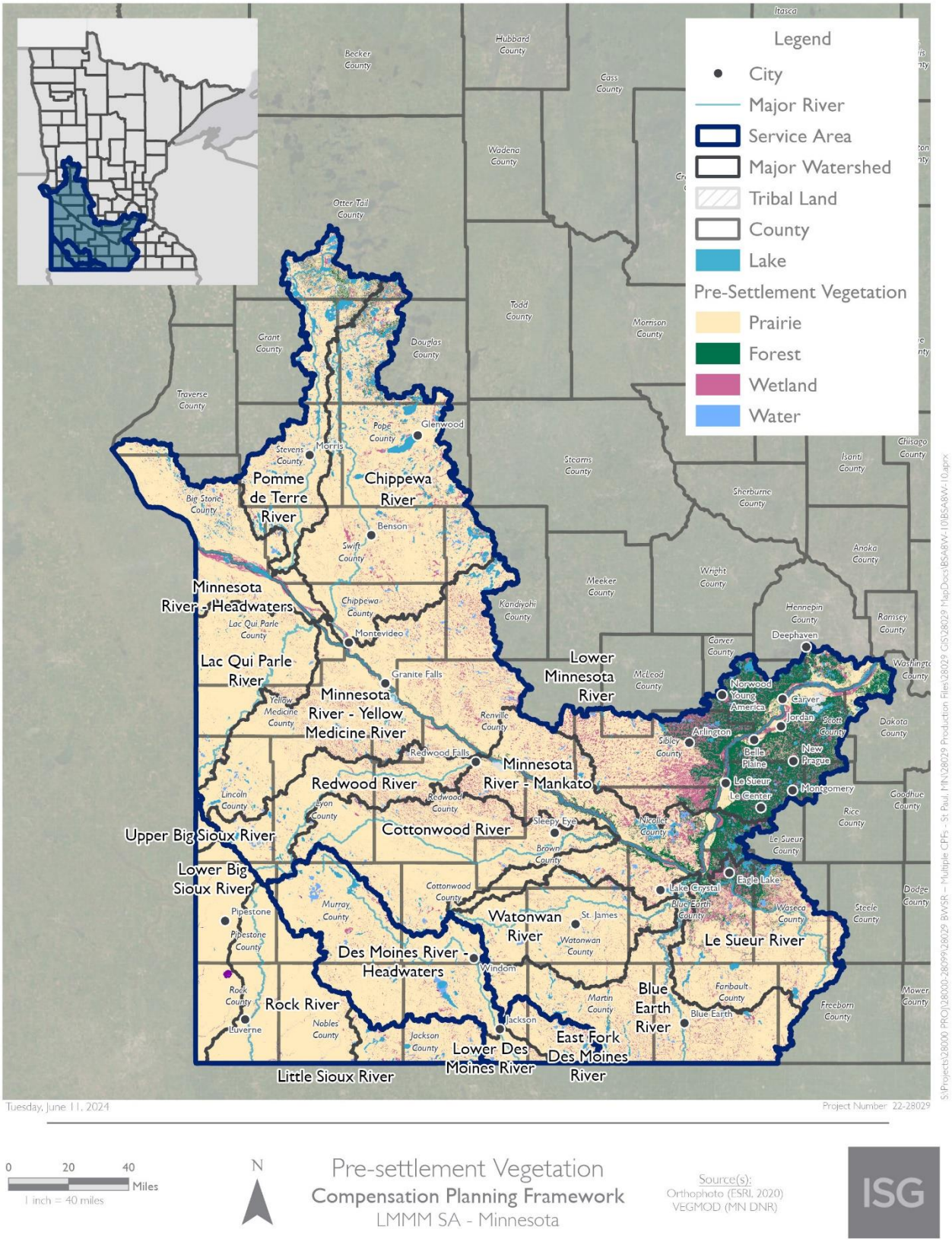
## Figure B-1. Project Location



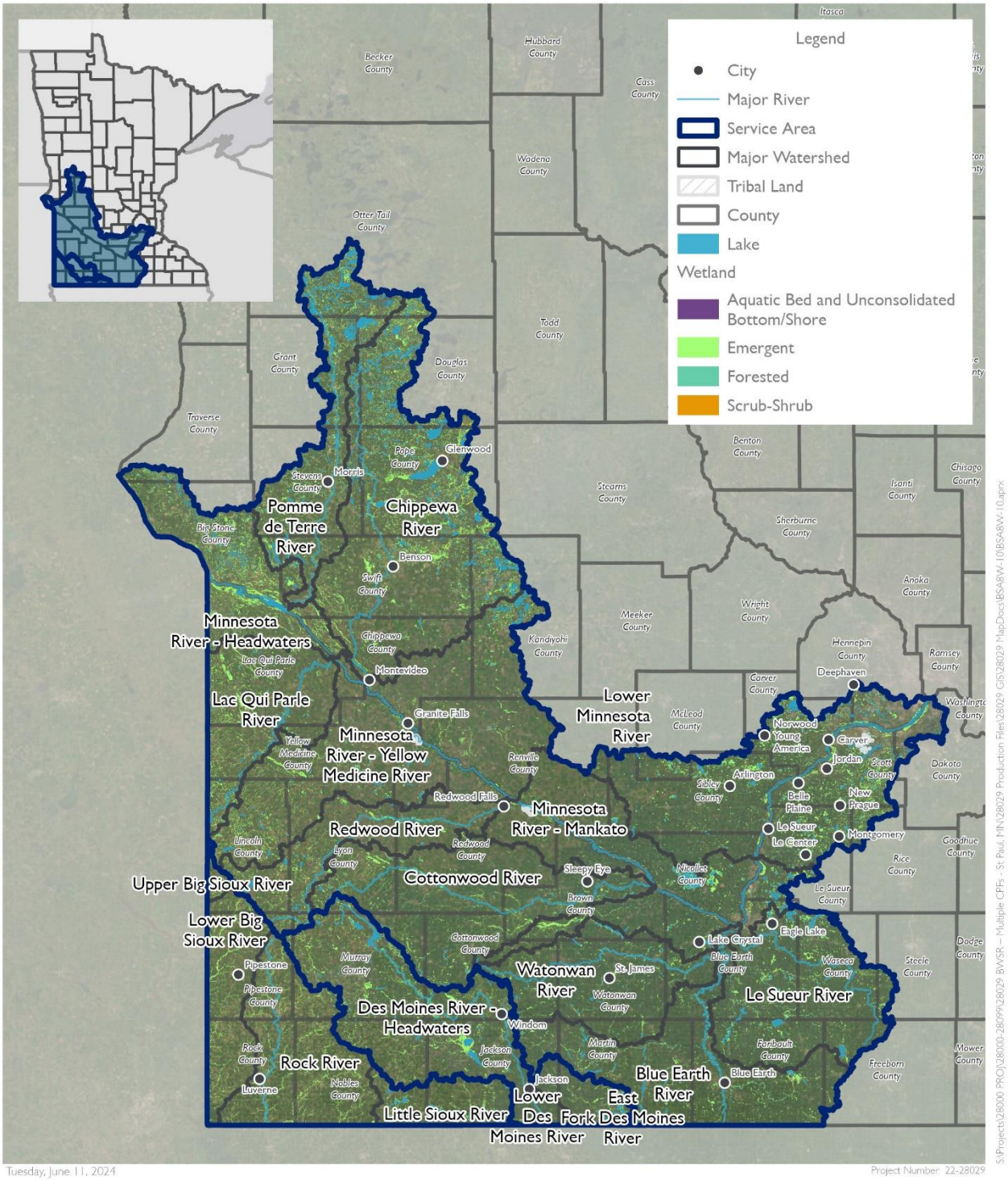
## Figure B-2. Ecological Classification



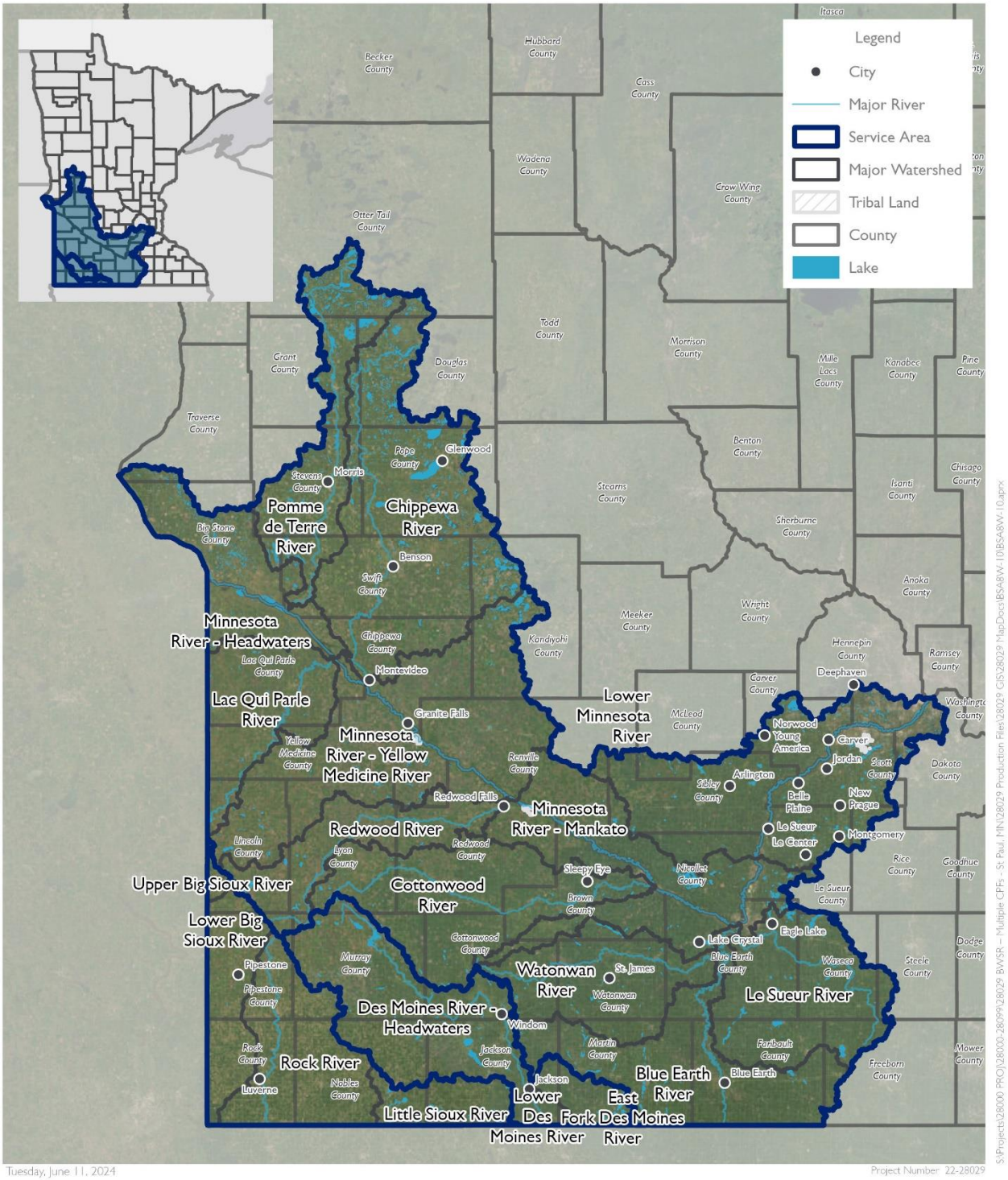
## Figure B-3. Pre-settlement Vegetation



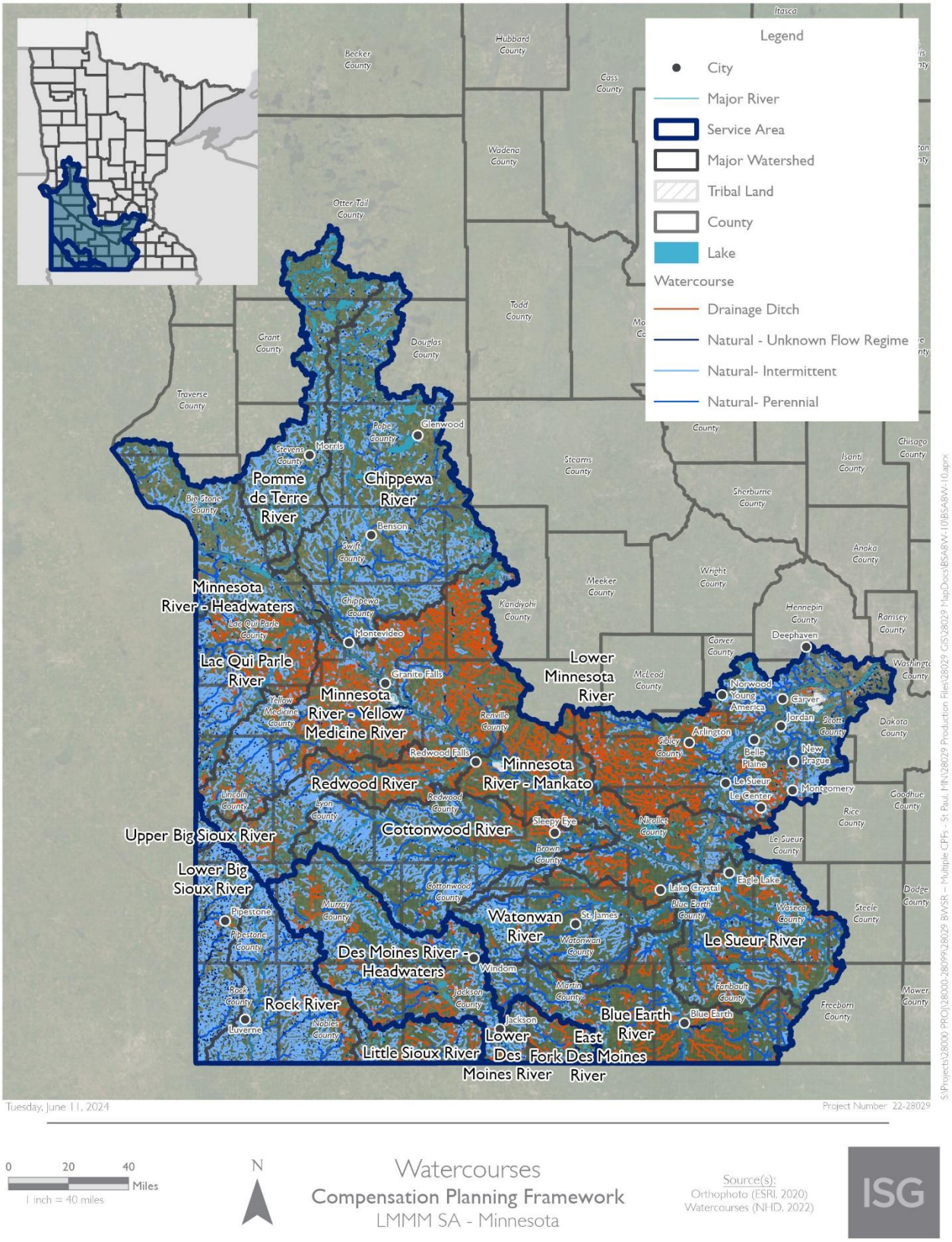
## Figure B-4. Wetlands



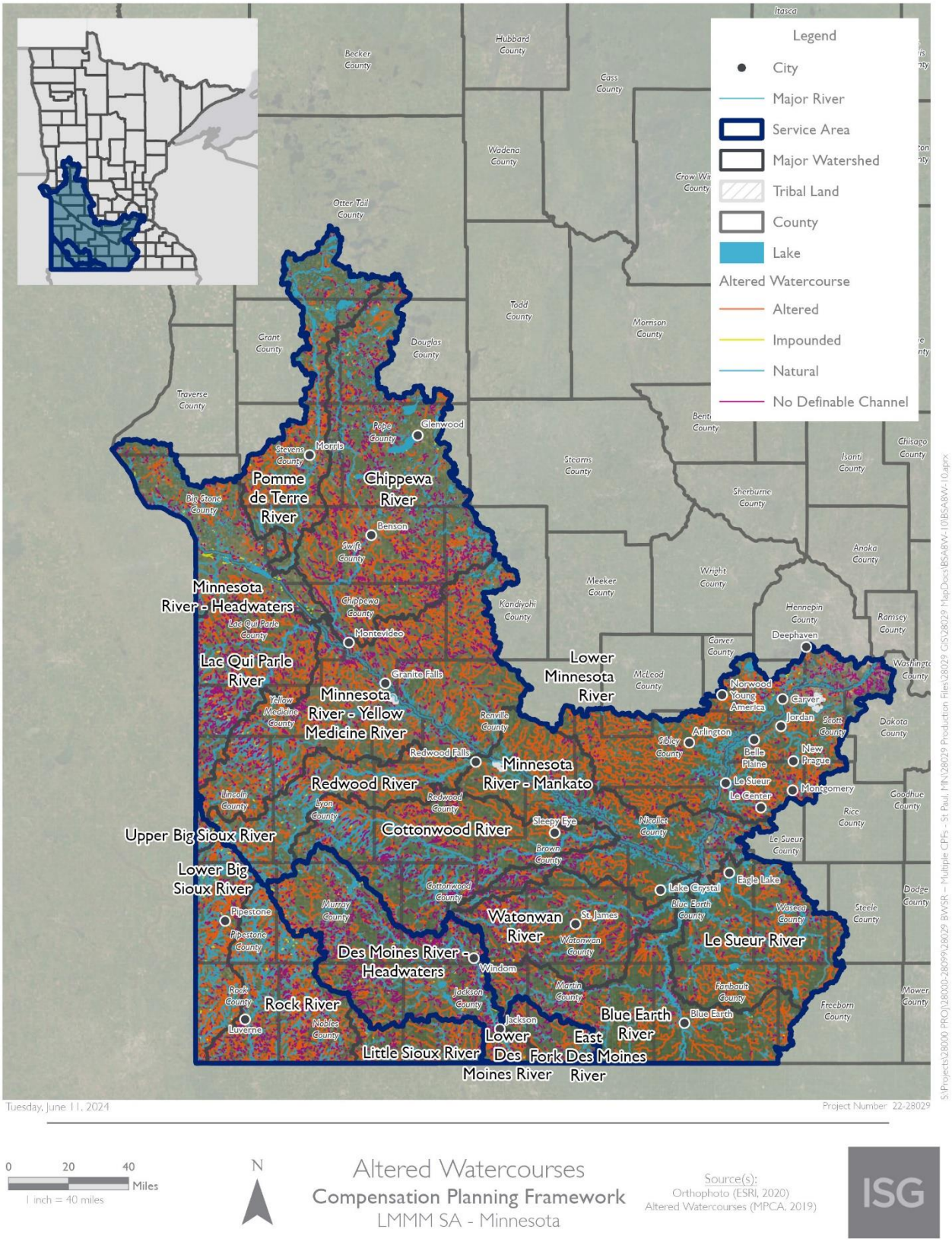
## Figure B-5. Lakes



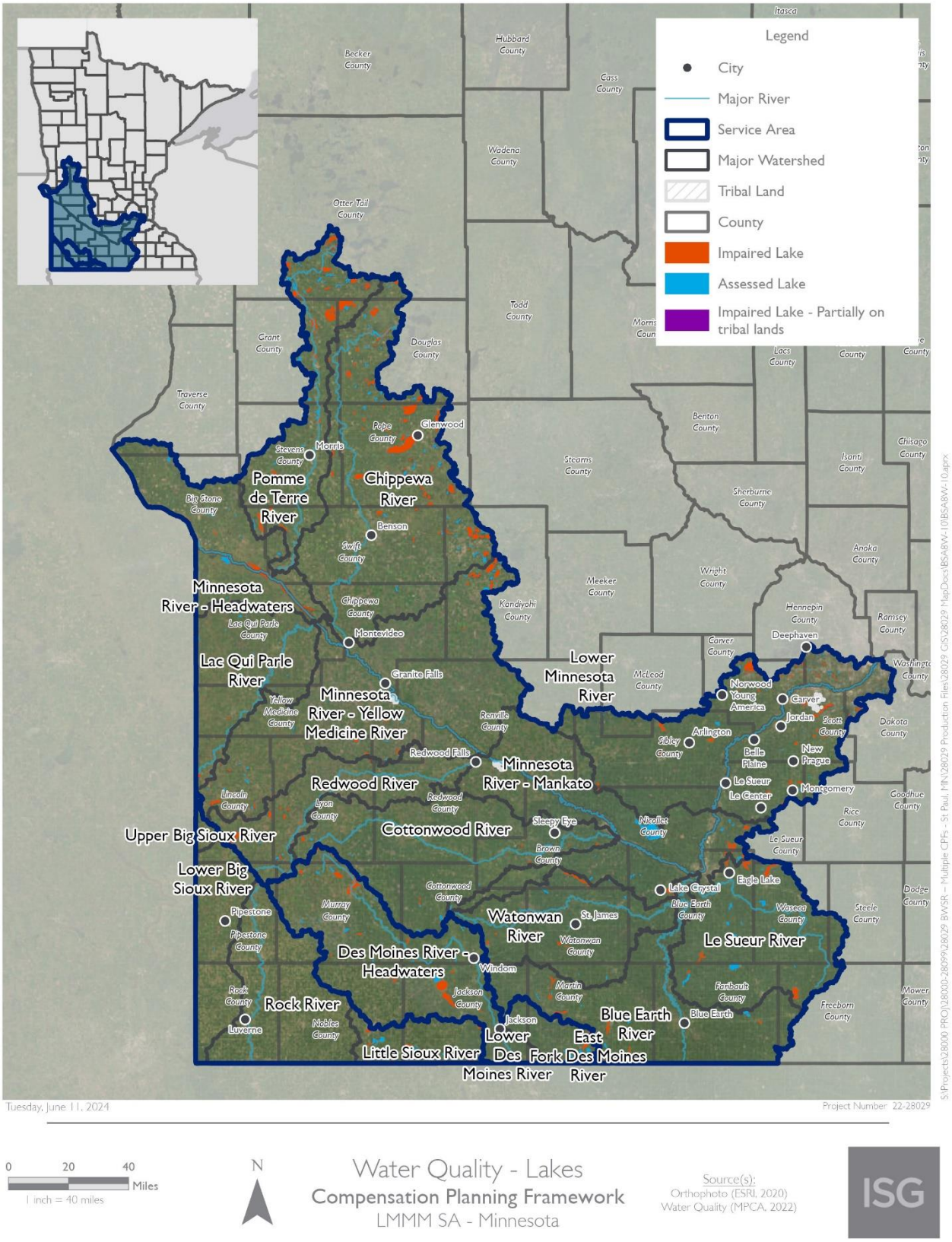
## Figure B-6. Watercourses



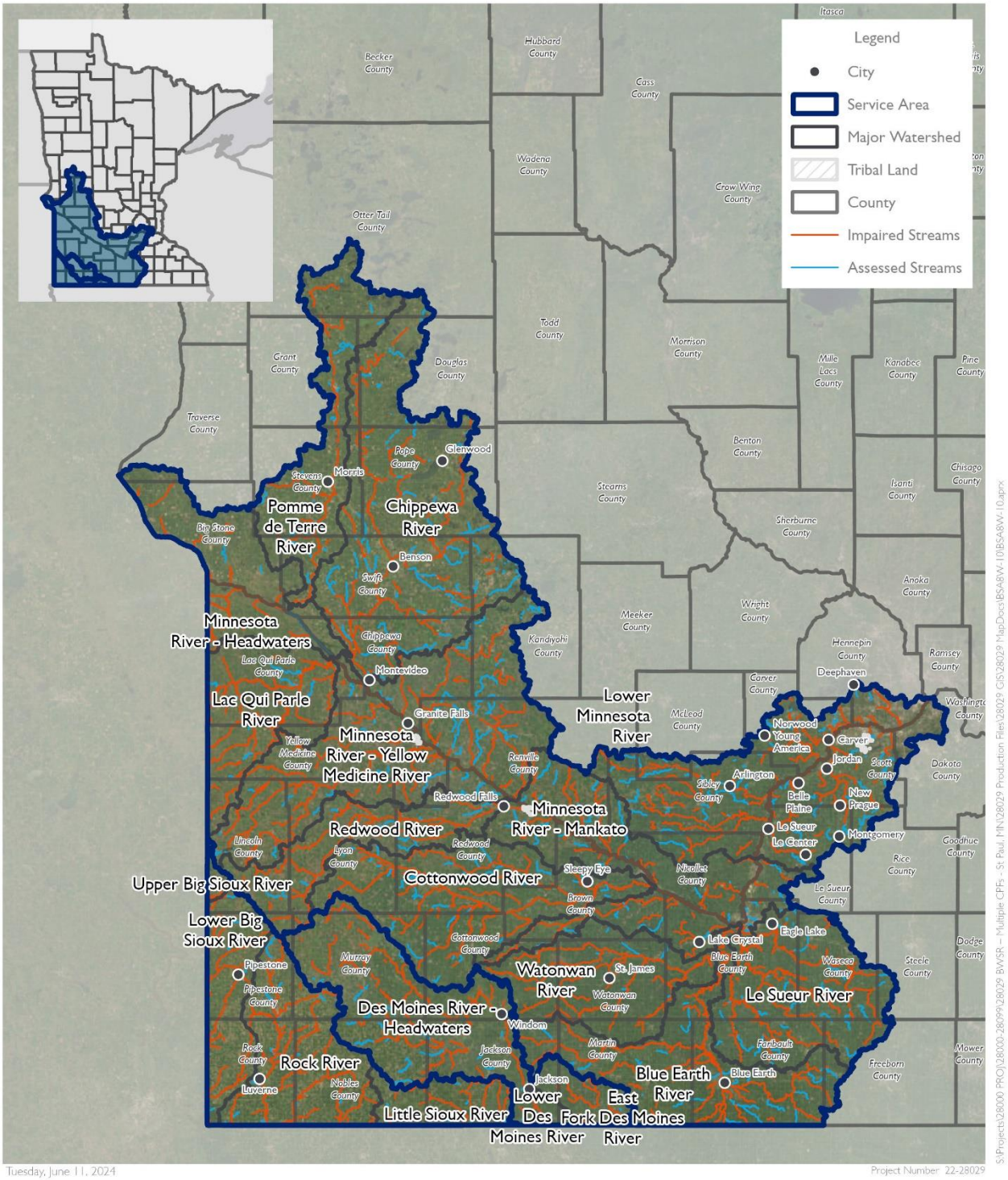
## Figure B-7. Altered Watercourses



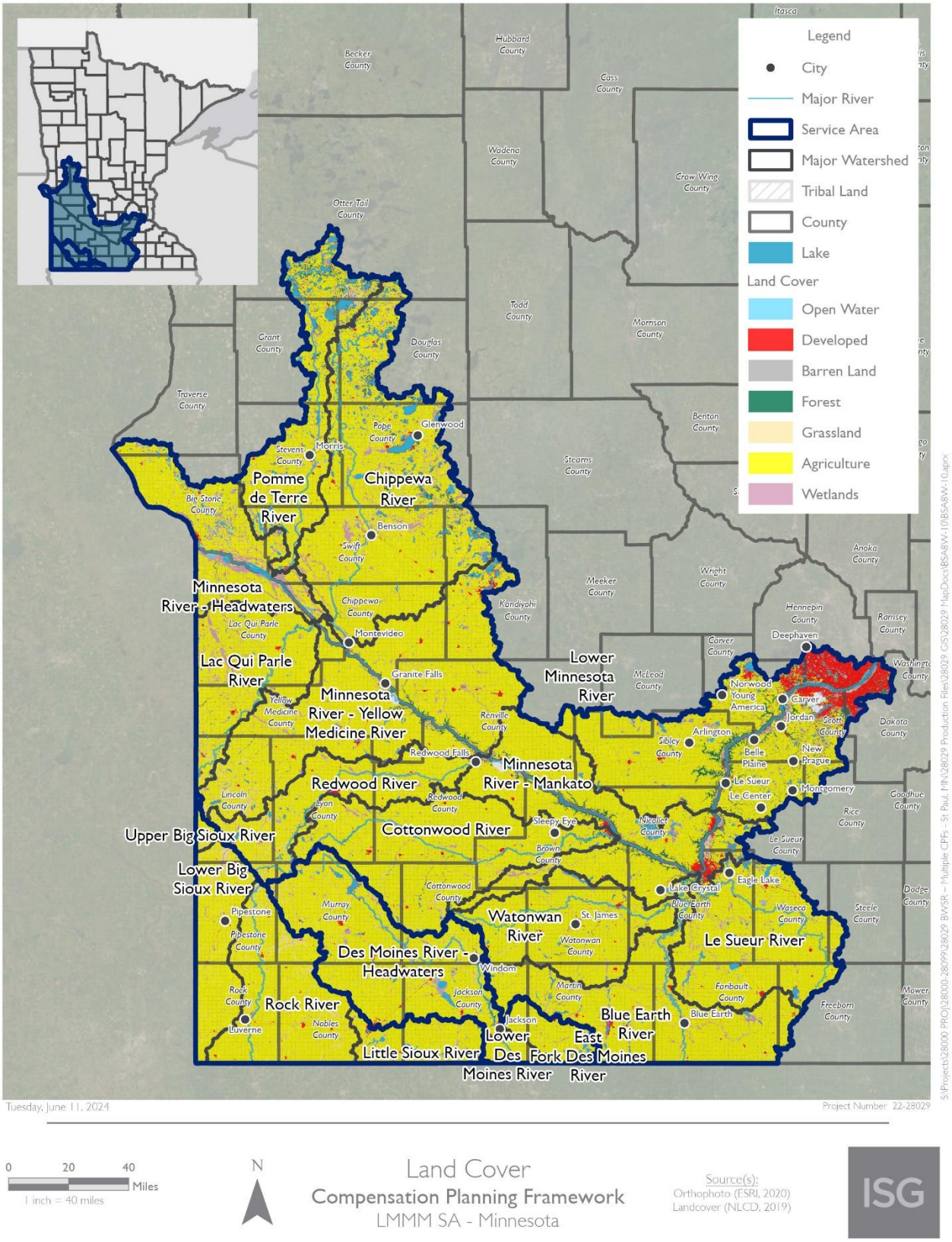
## Figure B-8. Water Quality- Lakes



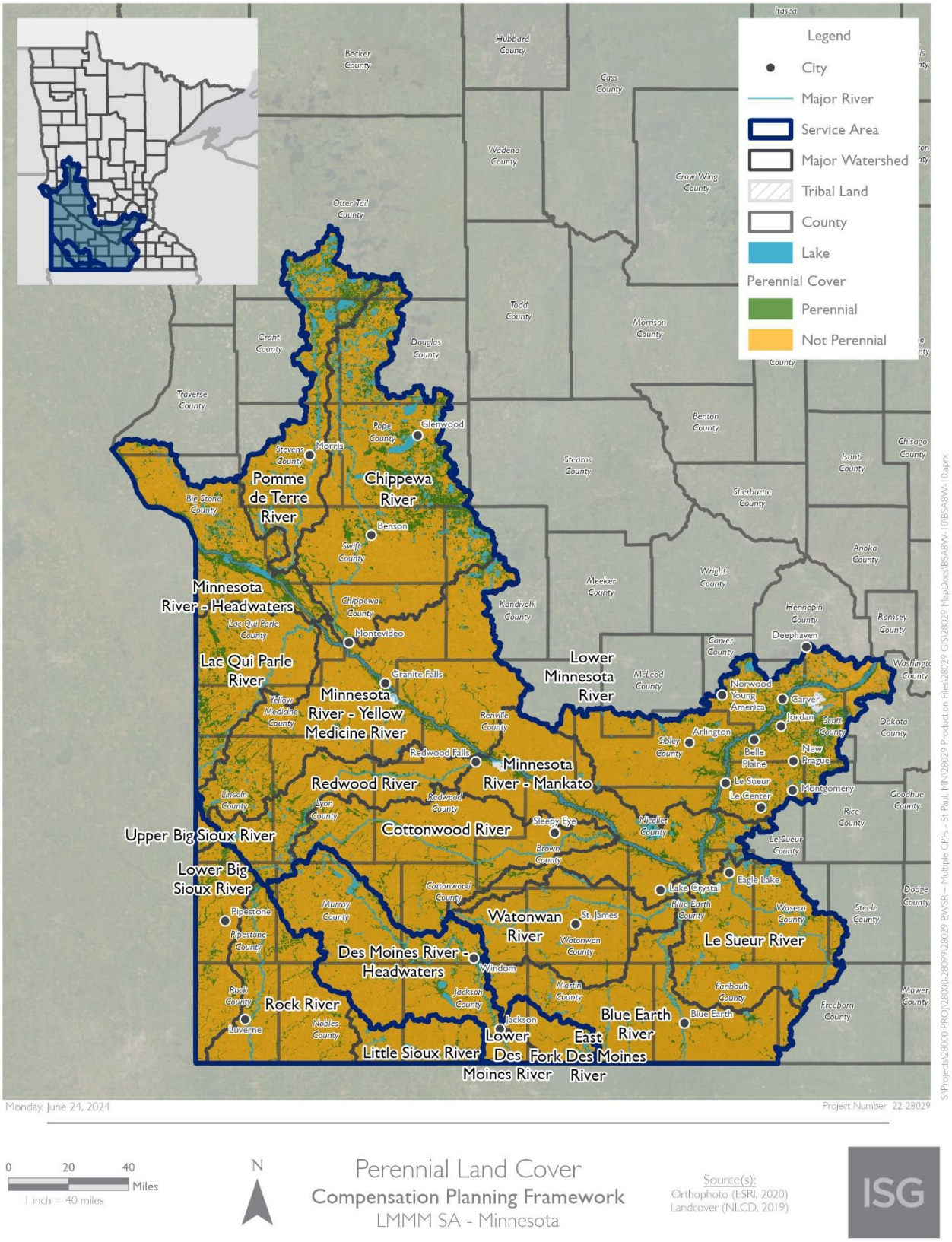
## Figure B-9. Water Quality- Streams



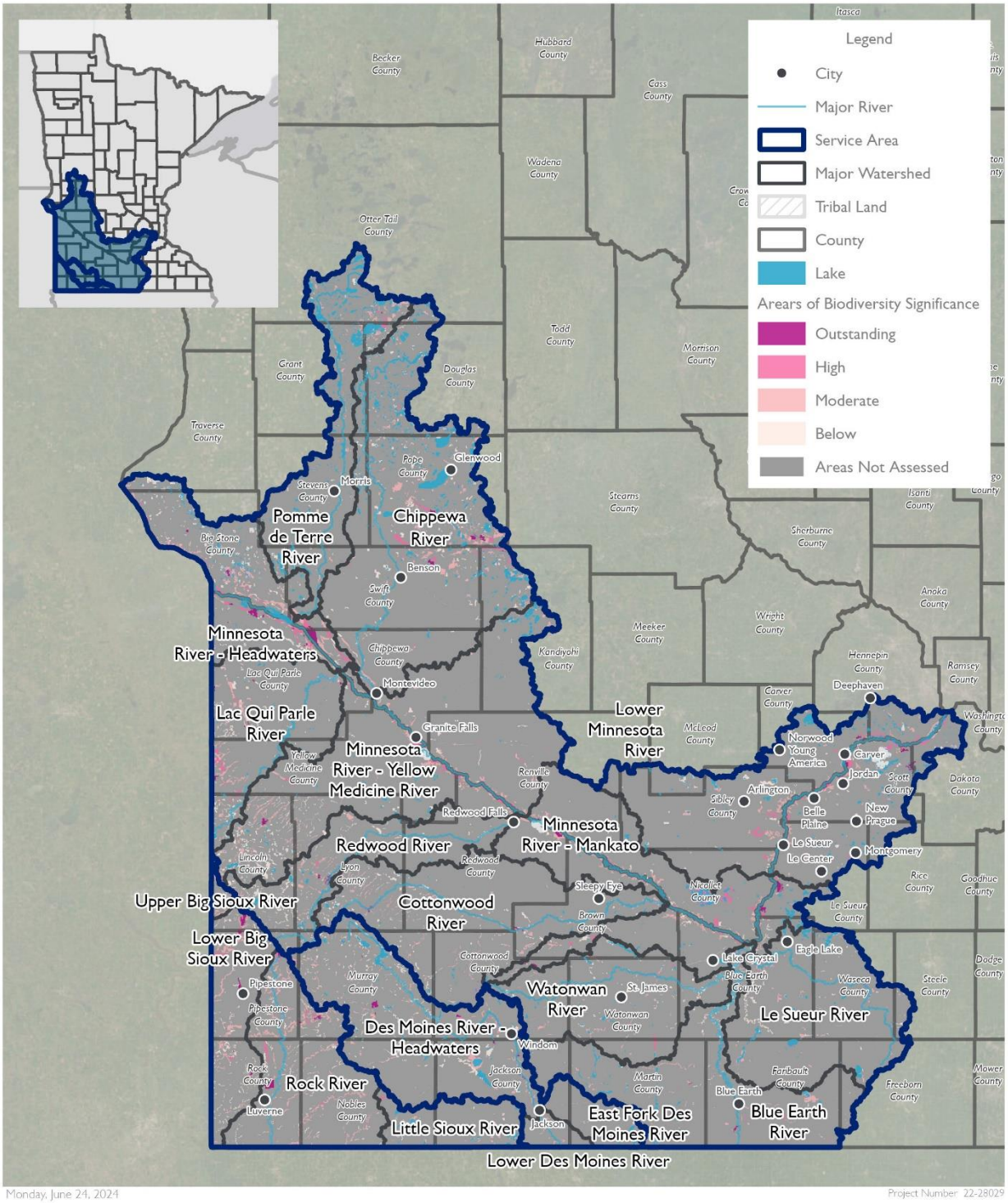
## Figure B-10. Land Cover



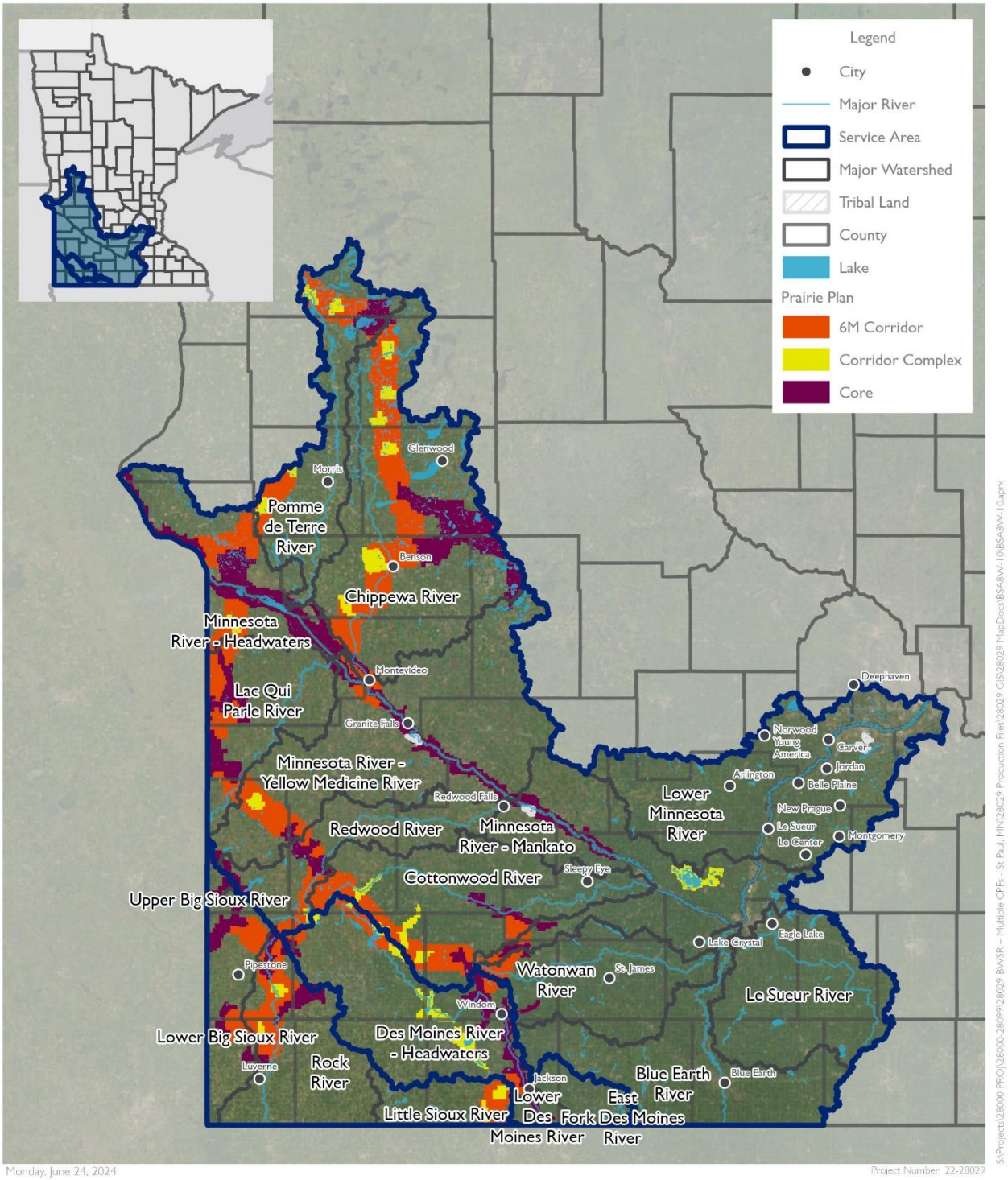
## Figure B-11. Perennial Land Cover



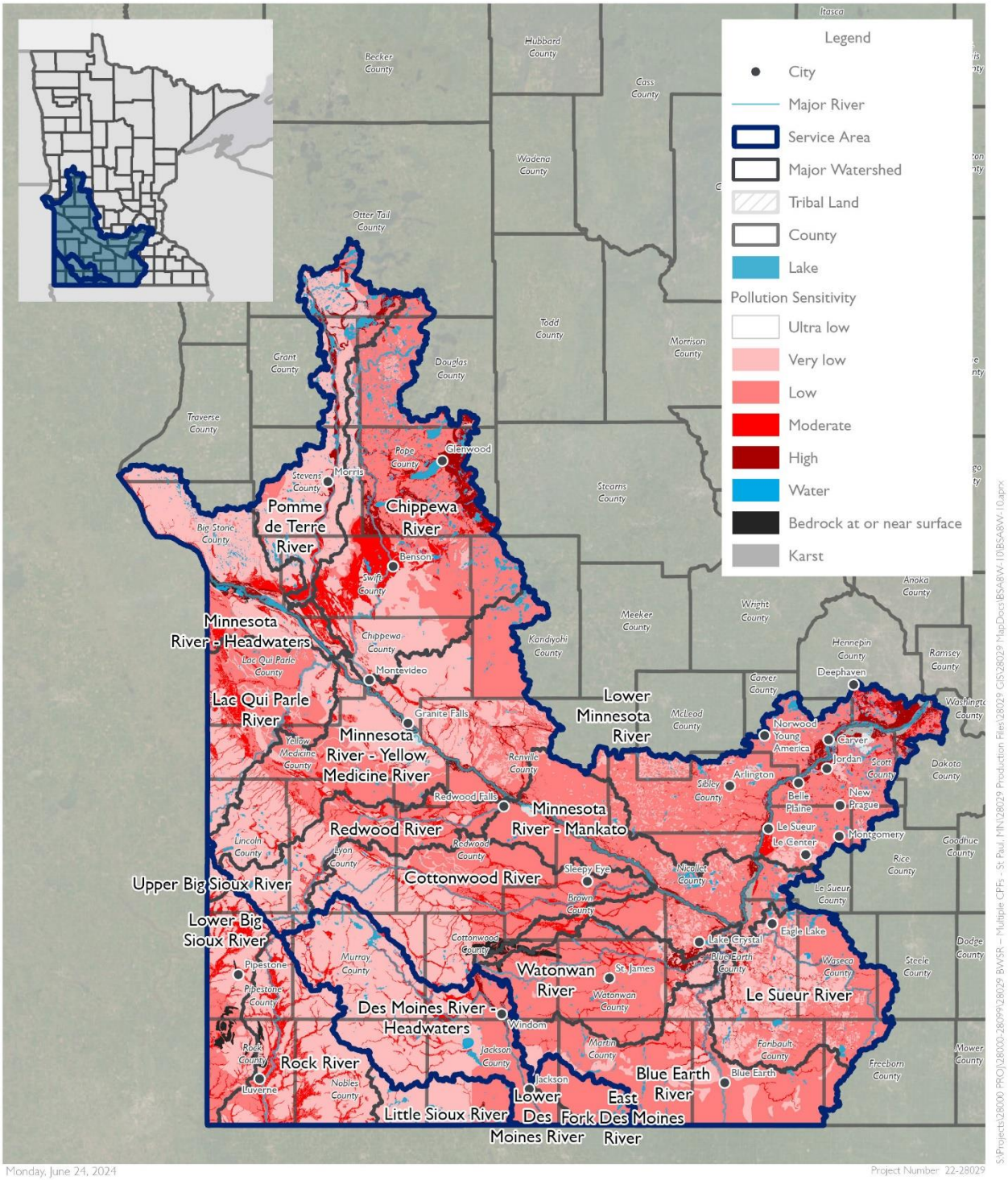
## Figure B-12. Areas of Biodiversity Significance



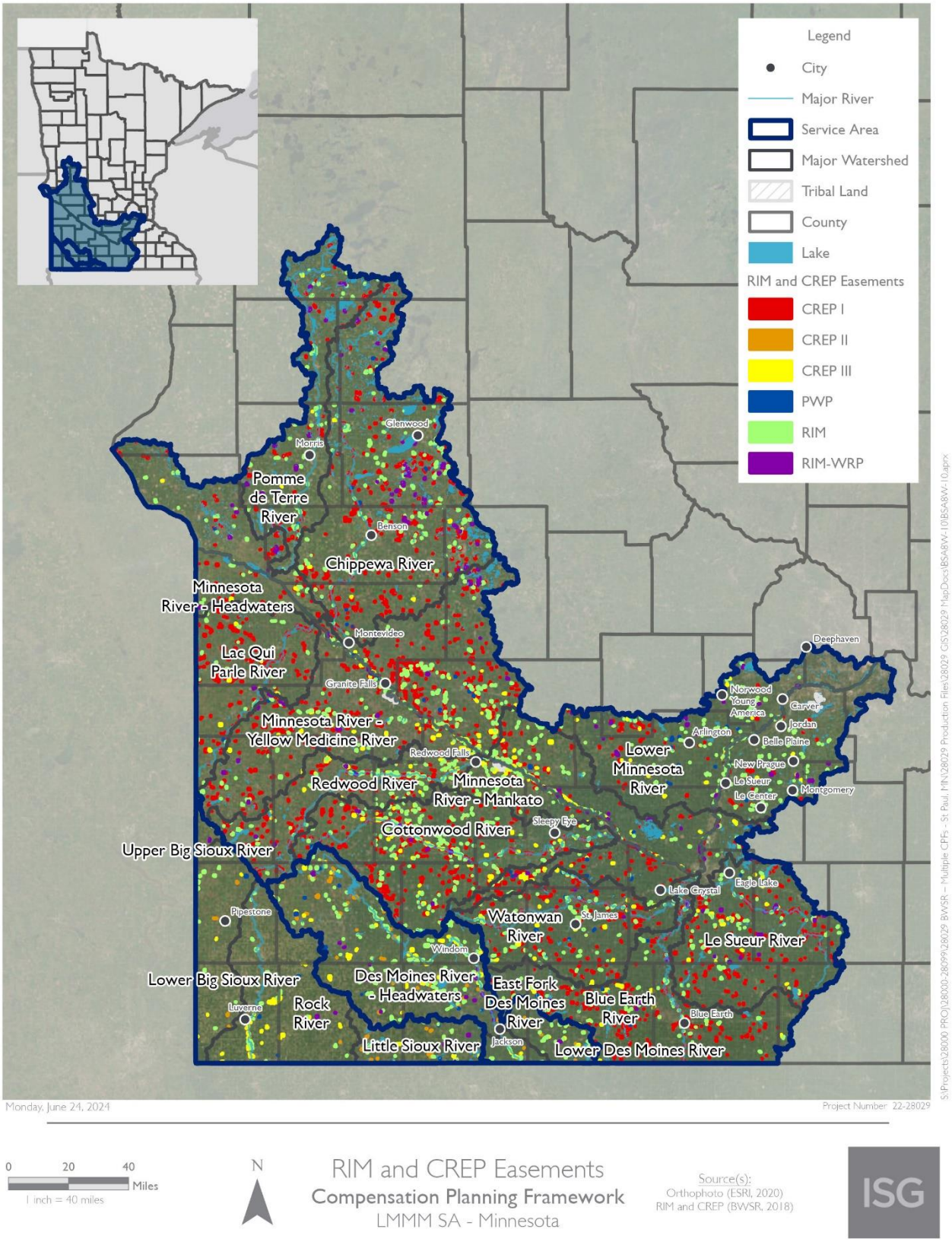
## Figure B-13. Prairie Plan- Priaire Areas



## Figure B-14. Sensitive Groundwater Areas



## Figure B-15. RIM, PWP, and CREP Easements



# Appendix C: Stakeholder Meeting Attendees and Presentations

# C-1. Meeting 1- March 2023 Stakeholder Meeting List of Attendees

| First Name | Last Name | Email | Organization |
|---|---|---|---|
| Alyssa | Core | alyssa.core@state.mn.us | BWSR |
| Amber | Doschadis | amber@umrwd.org | Upper Minnesota River WD |
| Amy | Timm | Amy.timm@state.mn.us | MPCA WPM |
| Andy | Albertsen | andy.albertsen@mn.nacdnet.net | SWCD - Swift |
| Ben | Rosburg | benjamin.rosburg@co.nicollet.mn.us | Nicollet |
| Brad | Wozney | brad.wozney@state.mn.us | BWSR |
| Cade | Steffenson | cade.steffenson@state.mn.us | BWSR |
| Carrie | Schultz | carrie.schultz@co.watonwan.mn.us | SWCD - Watonwan |
| Steve | Christopher | steve.christopher@state.mn.us | BWSR BC |
| Dale | Sterzinger | dale.sterzinger@mndistrict.org | SWCD - Lincoln |
| Dan | Donayre | dan.donayre@bolton-menk.com | City of Springfield |
| Dane | Lynch | Dane.Lynch@blueearthcountymn.gov | Blue Earth County |
| Darren | Wilke | darren.wilke@co.big-stone.mn.us | Big Stone County |
| David | Bucklin | David.Bucklin@co.cottonwood.mn.us | Cottonwood SWCD |
| Doug | Bos | doug.bos@co.rock.mn.us | Rock County |
| Dustin | Benes | dustin.martinswcd@gmail.com | Martin SWCD |
| Emily | Dick | edick@plslwd.org | Prior Lake - Spring Lake Watershed District |
| Holly | Bushman | hbushman@co.le-sueur.mn.us | Le Sueur County |
| Hannah | Neusch | hneusch@fairmont.org | City of Fairmont |
| Jack | Bushman | jack.bushman@sibleyswcd.org | Sibley SWCD |
| Jason | Beckler | jason.beckler@state.mn.us | BWSR BC |
| Joel | Asp | jasp@sehinc.com | City of Sartell |
| Jed | Chestnut | jed.chesnut@state.mn.us | BWSR |
| Jennie | Skancke | jennie.skancke@state.mn.us | IRT (DNR) |
| John | Hansel | john.hansel@state.mn.us | BWSR |
| John | Shea | john.shea@state.mn.us | BWSR BC |
| Kay | Gross | kay.gross@co.cottonwood.mn.us | SWCD - Cottonwood |
| Kristen | Larson | klarson@co.carver.mn.us | Carver WMO |
| Kyle | Krier | kyle.krier@pcmn.us | SWCD - Pipestone |
| Kyle | Richter | kyler@renvilleswcd.org | Renville SWCD |
| Mark | Zabel | mark.zabel@co.dakota.mn.us | Dakota County |

| First Name | Last Name | Email | Organization |
|---|---|---|---|
| Matt | Solemsaas | matt.solemsaas@stevensswcd.org | SWCD - Stevens |
| Mitchell | Enderson | mitchell.enderson@lqpco.com | Lac qui Parle- Yellow Bank WD |
| Rebecca | Bedhun | rbeduhn@sehinc.com | City of New Germany |
| Anne | Sawyer | anne.sawyer@state.mn.us | BWSR BC |
| Shane | Johnson | shane.johnson@co.faribault.mn.us | SWCD - Faribault |
| Tyler | Cowing | tcowing@fairmont.org | City of Fairmont |
| Terry | Jeffery | tjeffery@rpbcwd.org | Riley-Purgatory-Bluff Creek WD |
| Tom | Warner | tom.warner@swcd.chippewa.mn | SWCD - Chippewa |
| Zach | Bothun | zach.bothun@swcd.chippewa.mn | Chippewa SWCD |

# C-1. Meeting 1- March 2023 Stakeholder Meeting Presentation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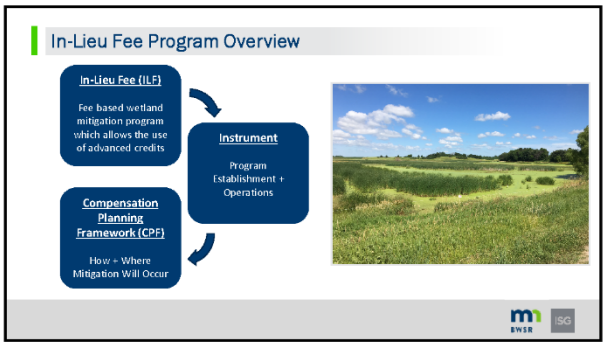


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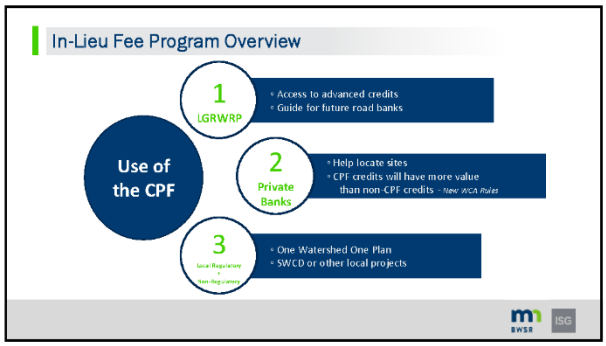


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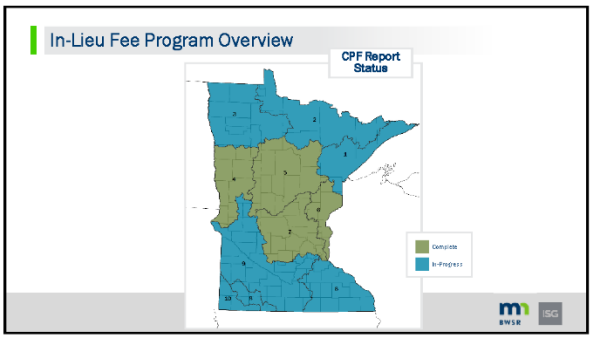
In-Lieu Fee Program Overview
CPF Report Status
Complete
In-Progress

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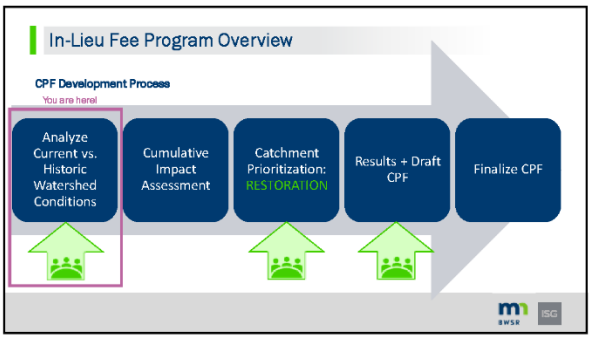
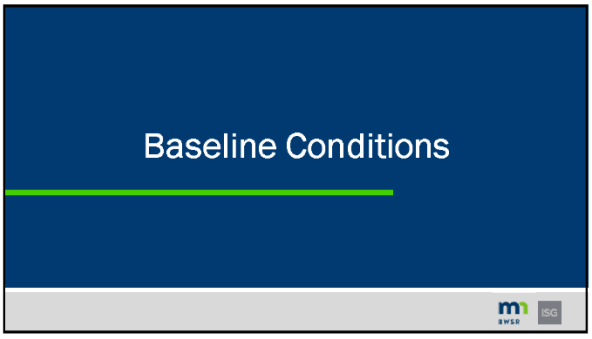

In-Lieu Fee Program Overview
CPF Development Process
You are here!
Analyze Current vs. Historic Watershed Conditions
Cumulative Impact Assessment
Catchment Prioritization: RESTORATION
Results + Draft CPF
Finalize CPF

8


In-Lieu Fee Program Overview
Key CPF Development Component
Stakeholder Input
Nothing replaces local knowledge
Input on appropriate data sources
State + Local
Leads us through local plans
Identifies the most important watershed goals

9


Baseline Conditions

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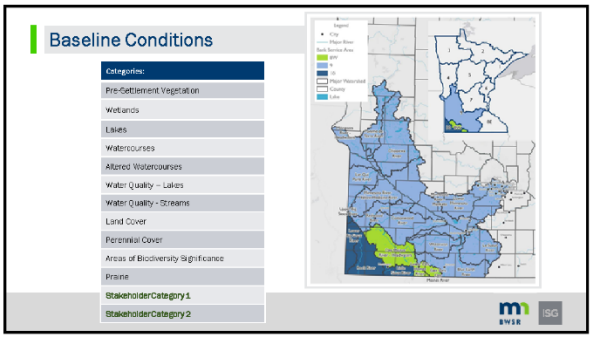
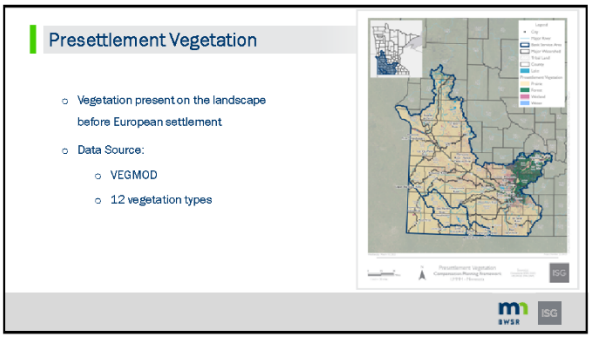
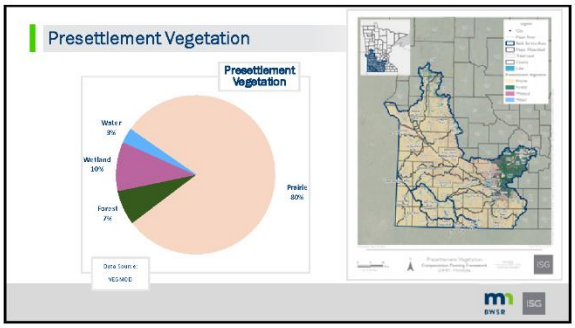

Baseline Conditions
Categories:
Pre-Settlement Vegetation
Wetlands
Lakes
Watercourses
Altered Watercourses
Water Quality – Lakes
Water Quality - Streams
Land Cover
Perennial Cover
Areas of Biodiversity Significance
Prairie
StakeholderCategory1
StakeholderCategory2

11


Presettlement Vegetation
Vegetation present on the landscape before European settlement
Data Source:
VEGMOD
12 vegetation types

12

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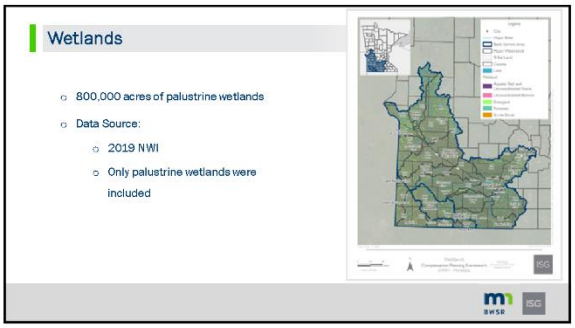


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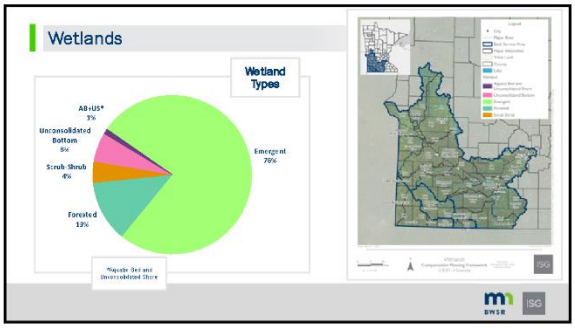


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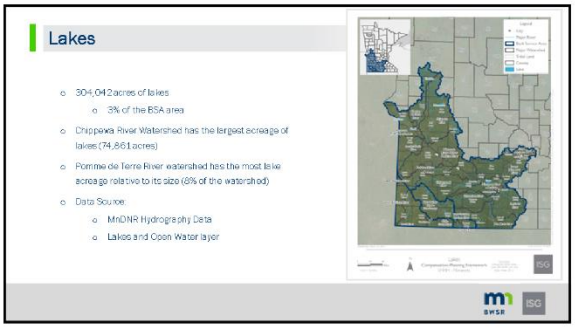


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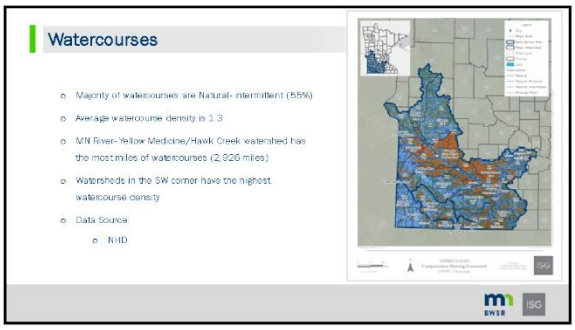


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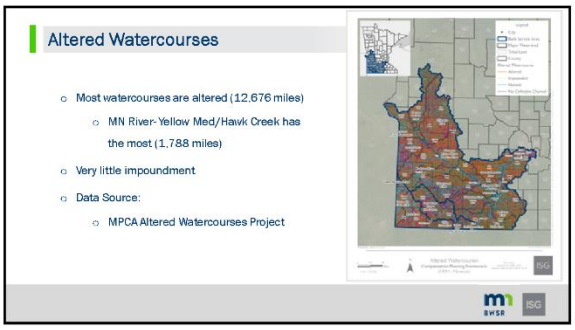


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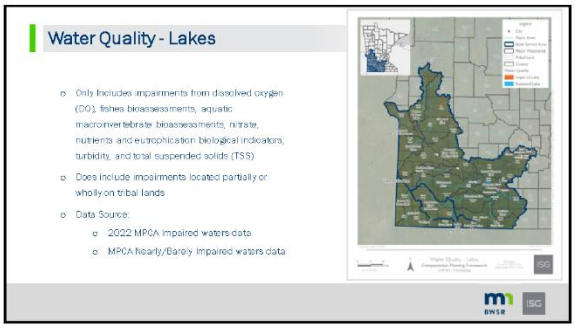


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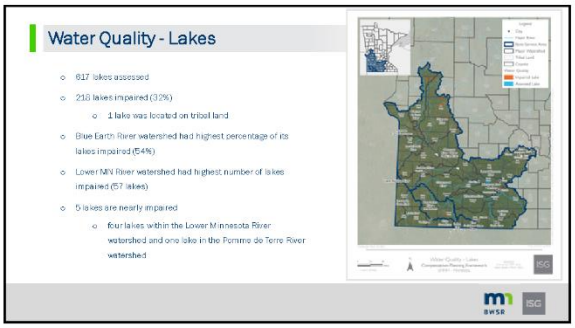


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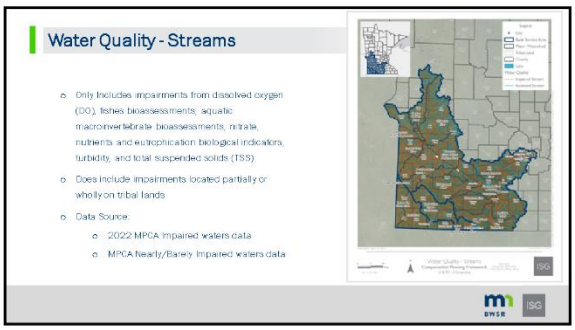


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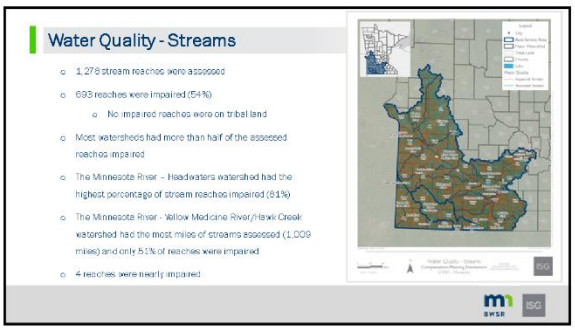


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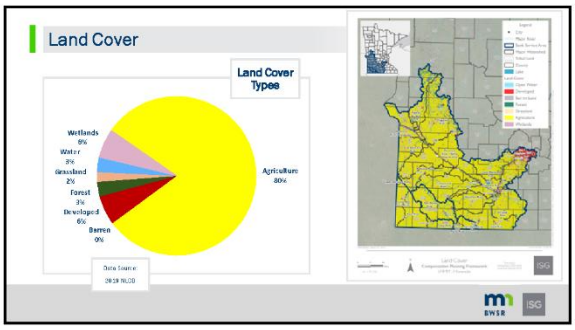


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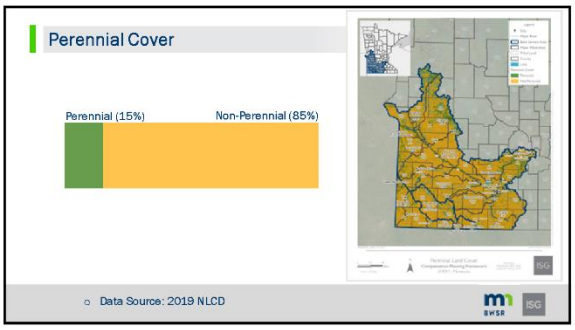


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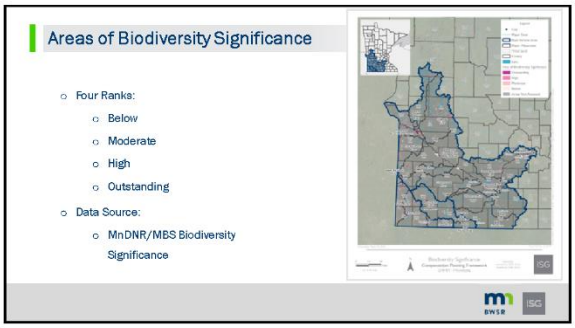


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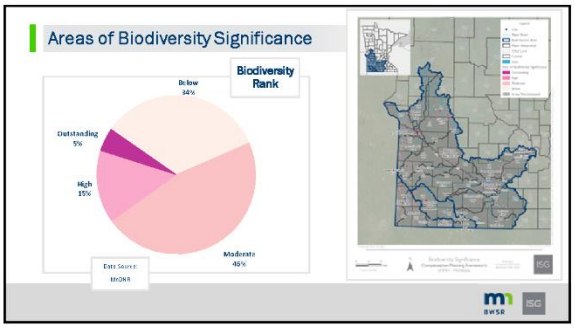


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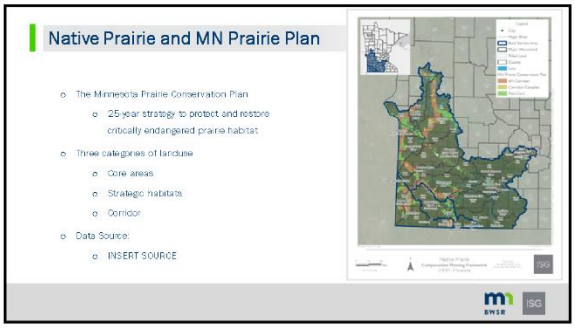


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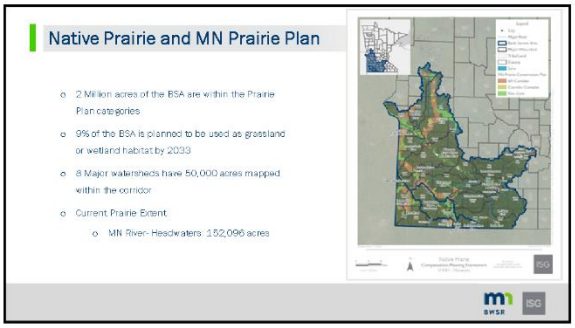


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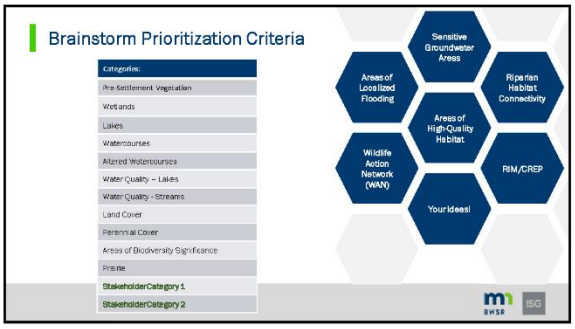


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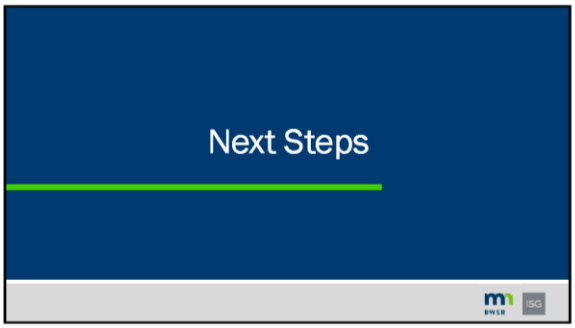
Next Steps

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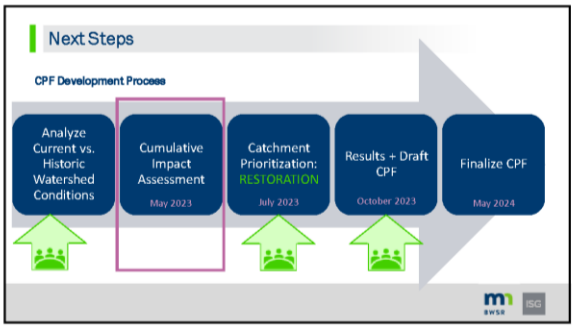
Next Steps
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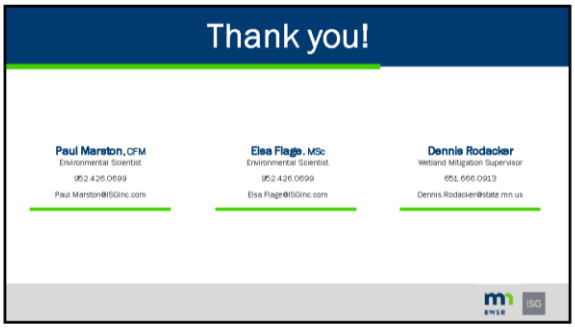
May 2023
Catchment Prioritization: RESTORATION
July 2023
Results + Draft CPF
October 2023
Finalize CPF
May 2024

32


Thank you!
Paul Marston, CFM
Environmental Scientist
952.426.0699
Paul.Marston@ISGinc.com
Elsa Flage, MSc
Environmental Scientist
952.426.0699
Elsa.Flage@ISGinc.com
Dennis Rodacker
Wetland Mitigation Supervisor
651.666.0913
Dennis.Rodacker@state.mn.us

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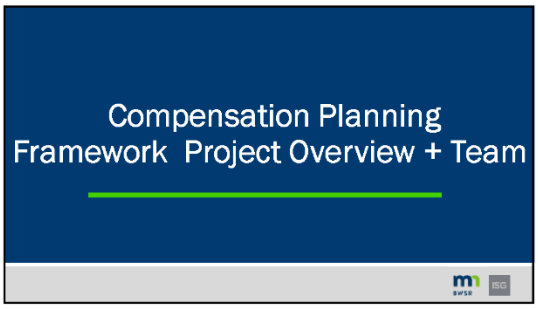
## C-2. Meeting 2- August 2023 Stakeholder Meeting List of Attendees

| First Name | Last Name | Email | Organization |
|---|---|---|---|
| Amber | Doschadis | amber@umrwd.org | Upper Minnesota River WD |
| Andy | Albertsen | andy.albertsen@mn.nacdnet.net | SWCD - Swift |
| Ben | Rosburg | benjamin.rosburg@co.nicollet.mn.us | Nicollet |
| Brayden | Anderson | brayden.anderson@co.ym.mn.gov | Yellow Medicine |
| Cade | Steffenson | cade.steffenson@state.mn.us | BWSR |
| Dan | Donayre | dan.donayre@bolton-menk.com | City of Springfield |
| Dane | Lynch | Dane.Lynch@blueearthcountymn.gov | Blue Earth County |
| Nichole | DeWeese | deweese.nichole@epa.gov | EPA |
| Doug | Bos | doug.bos@co.rock.mn.us | Rock County |
| Douglas | Goodrich | douglas.goodrich@state.mn.us | BWSR BC |
| Dustin | Benes | dustin.martinswcd@gmail.com | Martin SWCD |
| Jack | Bushman | jack.bushman@sibleyswcd.org | Sibley SWCD |
| Jarrett | Spitzack | jarett.spitzack@riceswcd.org | Rice SWCD |
| Jed | Chestnut | jed.chesnut@state.mn.us | BWSR |
| Jennifer | Kaminskie | jennifer.kaminskie@stearnscountymn.gov | Stearns County |
| Joni | Giese | jgiese@plslwd.org | Prior Lake-Spring Lake WD |
| John | Smyth | john.smyth@stantec.com | City of Waseca |
| Jenna | Olson | jolson@cityofeagan.com | City of Eagan |
| Jonah | Olson | jonah.olson@wot.mnswcd.org | West Otter Tail SWCD |
| Kristen | Larson | klarson@co.carver.mn.us | Carver WMO |
| Kyle | Krier | kyle.krier@pcmn.us | SWCD - Pipestone |
| Kyle | Richter | kyler@renvilleswcd.org | Renville SWCD |
| Luke | Olson | lukeolson@co.lyon.mn.us | Lyon |
| Mark | Hiles | mark.hiles@state.mn.us | BWSR |
| Michael | Schultz | mschultz@co.le-sueur.mn.us | SWCD - Le Sueur |
| Rebecca | Novak | rebecca.novak@state.mn.us | MnDOT |
| Sydney | DePrenger | sdeprenger@mankatomn.gov | Mankato |
| Stacey | Lijewski | stacey.lijewski@hennepin.us | Hennepin Conservation District |
| Steve | Christopher | steve.christopher@state.mn.us | BWSR BC |
| Tom | Kresko | tom.kresko@state.mn.us | DNR Hydrologist |

# C-2. Meeting 2- August 2023 Stakeholder Meeting Presentation


1

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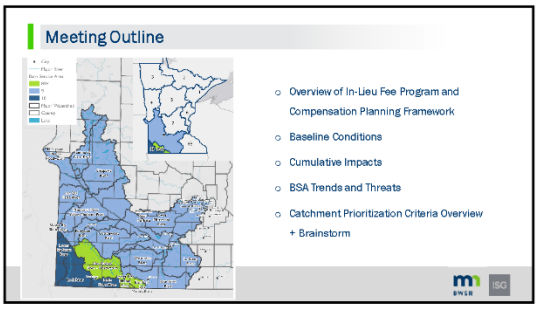


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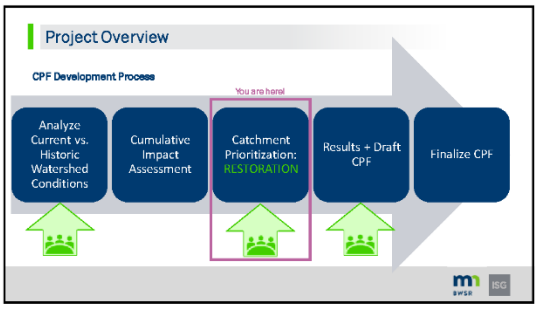


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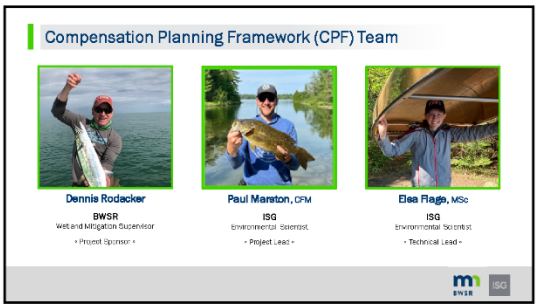


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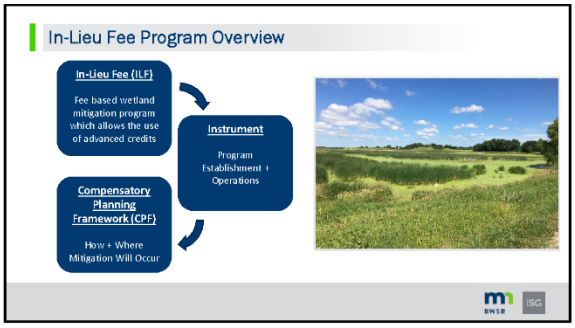
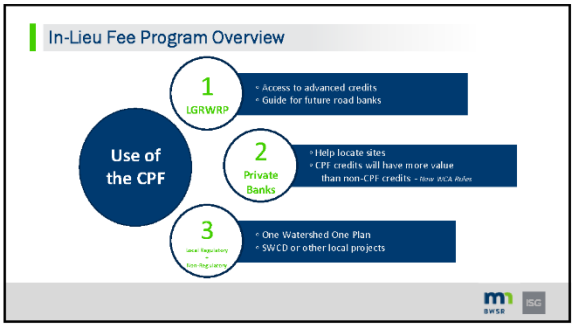
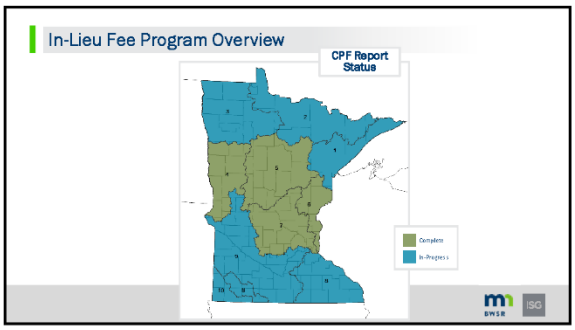

In-Lieu Fee Program Overview
In-Lieu Fee (ILF)
Fee based wetland mitigation program which allows the use of advanced credits
Instrument
Program Establishment + Operations
Compensatory Planning Framework (CPF)
How + Where Mitigation Will Occur

7


In-Lieu Fee Program Overview
1
LGRWRP
Access to advanced credits
Guide for future road banks
Use of the CPF
2
Private Banks
Help locate sites
CPF credits will have more value than non-CPF credits
3
One Watershed One Plan
SWCD or other local projects

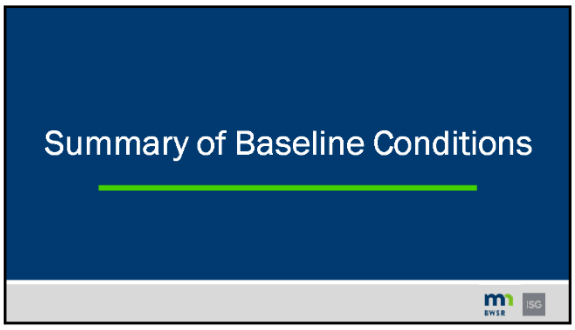
8


In-Lieu Fee Program Overview
CPF Report Status

9


In-Lieu Fee Program Overview
Key CPF Development Component
Stakeholder Input
Nothing replaces local knowledge
Input on appropriate data sources
State + Local
Leads us through local plans
Identifies the most important watershed goals

10


Summary of Baseline Conditions

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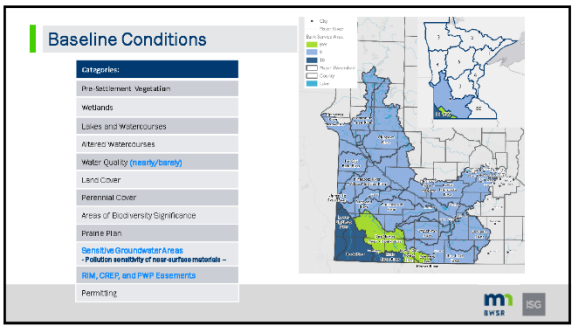
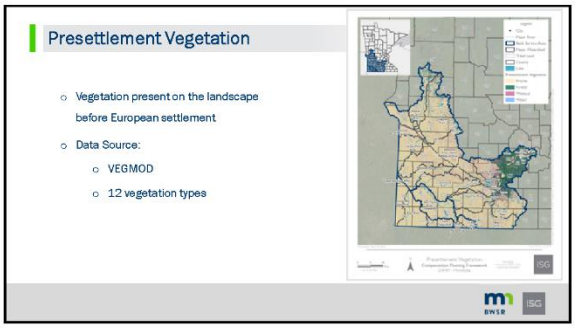

Baseline Conditions
Categories:
Pre-Settlement Vegetation
Wetlands
Lakes and Watercourses
Altered Watercourses
Water Quality (nearly/barely)
Land Cover
Perennial Cover
Areas of Biodiversity Significance
Prairie Plan
Sensitive Groundwater Areas
- Pollution sensitivity of near-surface materials -
RIM, CREP, and PWP Easements
Permitting

12

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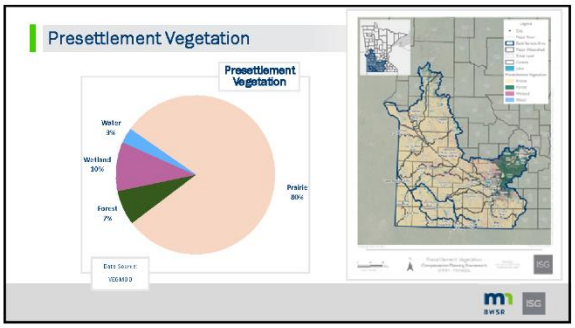


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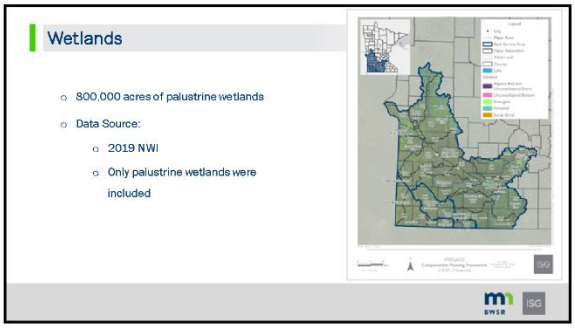


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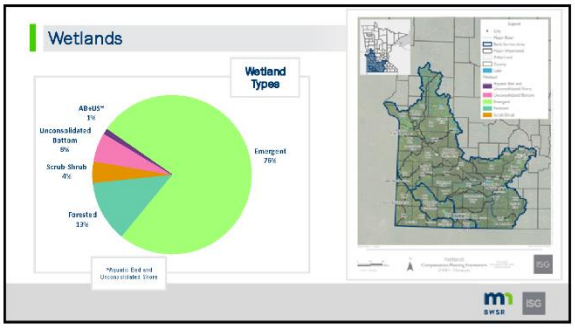


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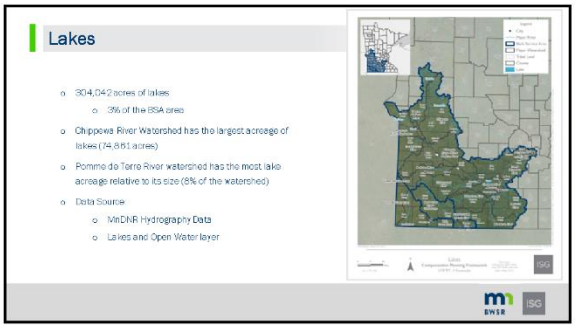


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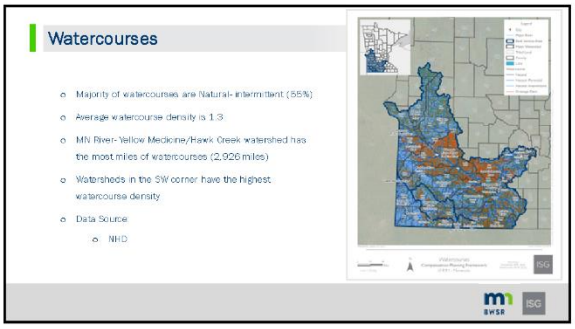


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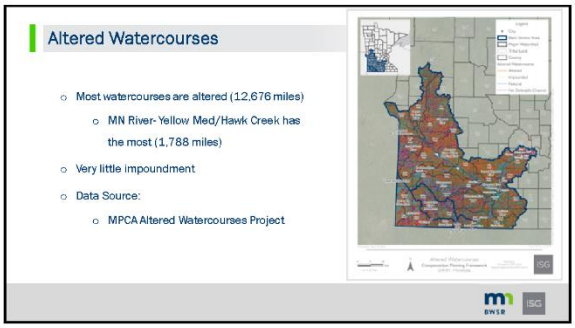


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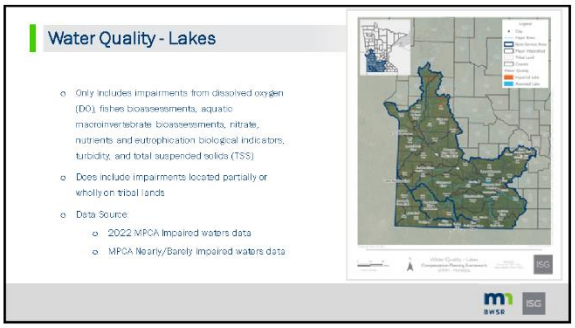


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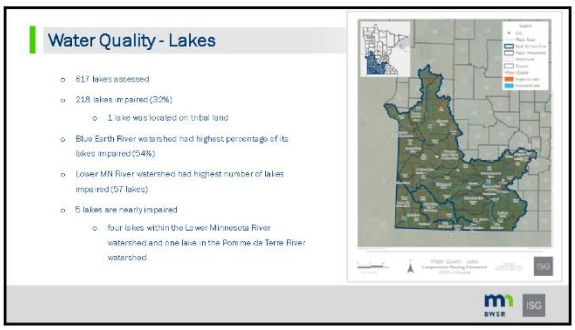


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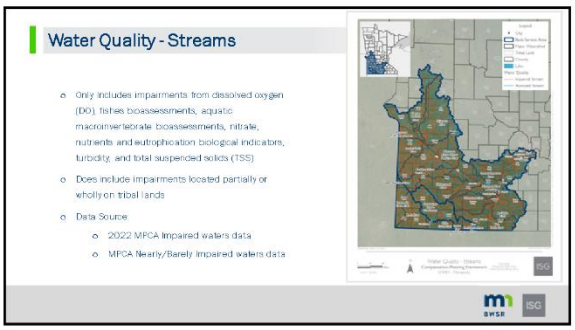


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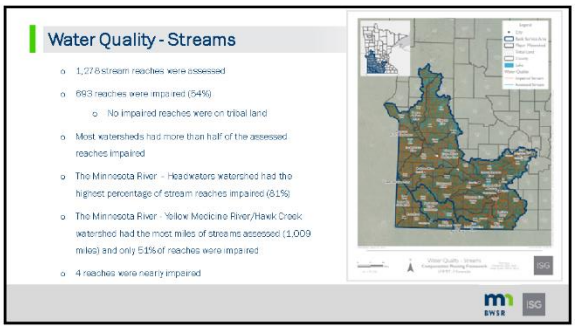


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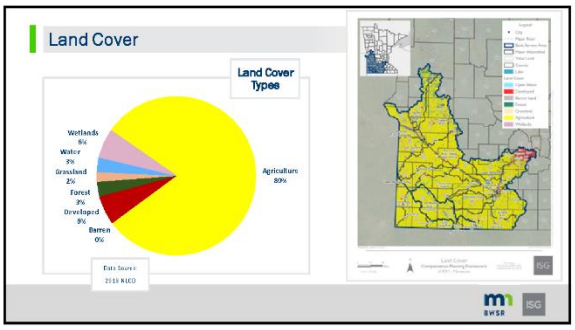


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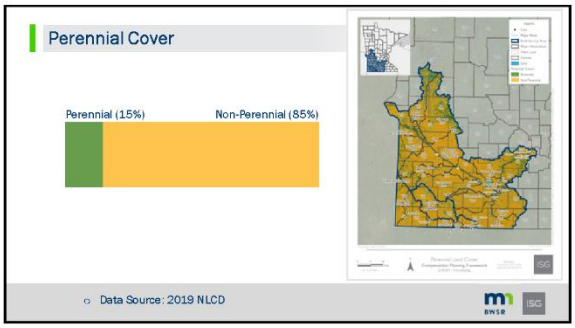


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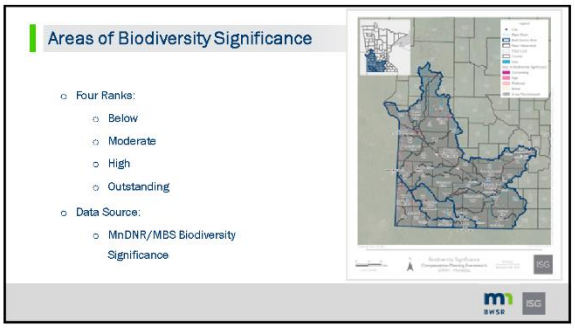


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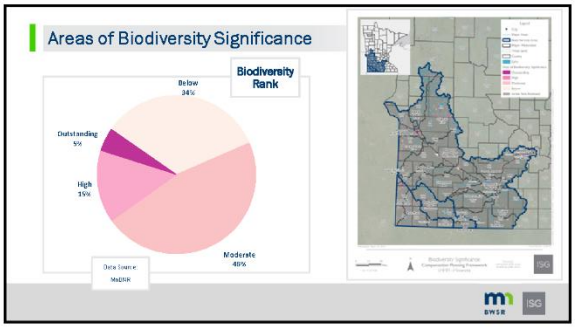


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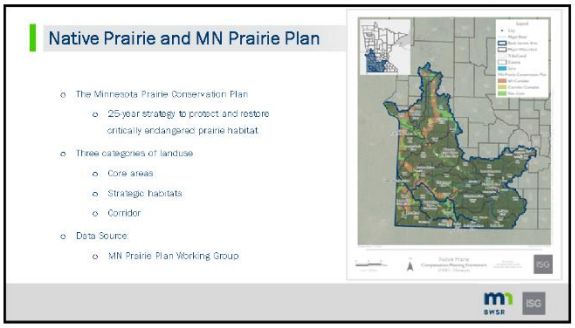


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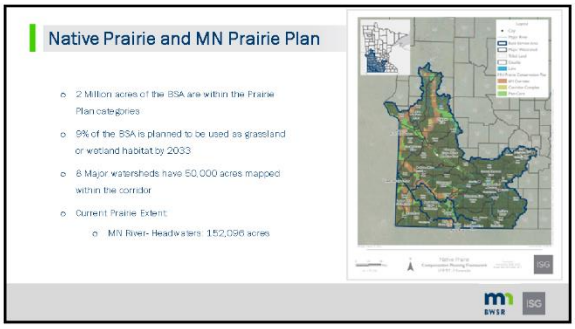


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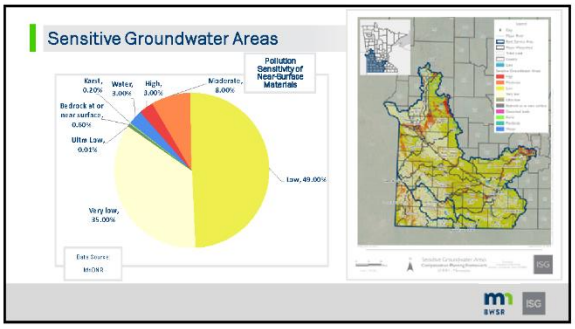


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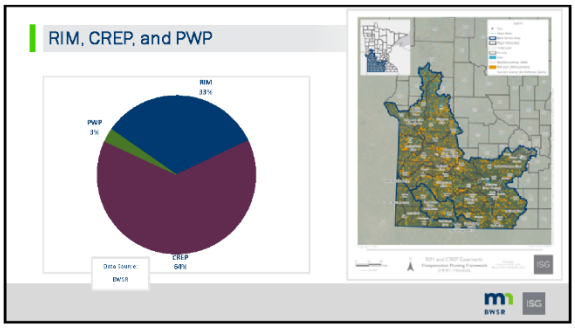


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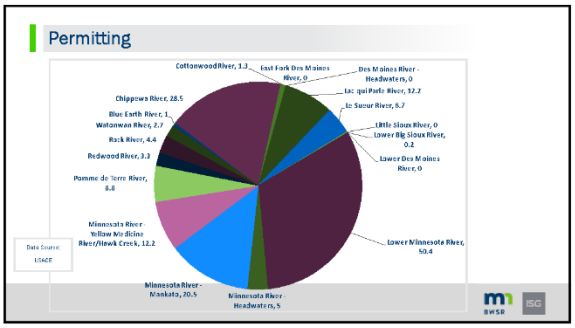


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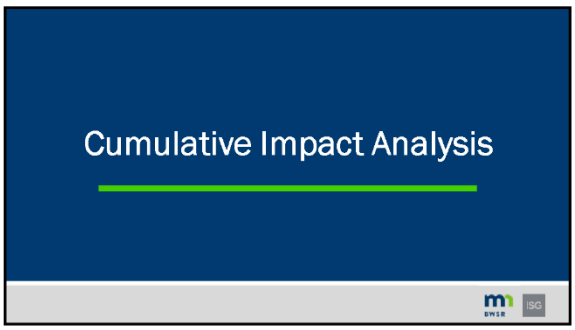


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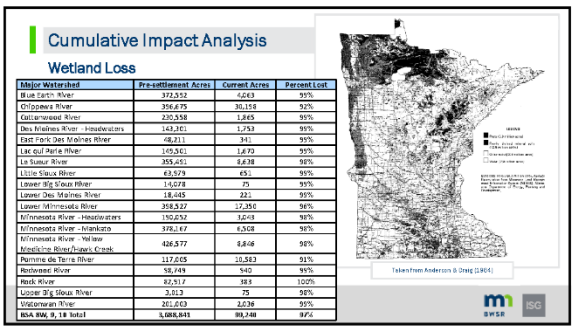


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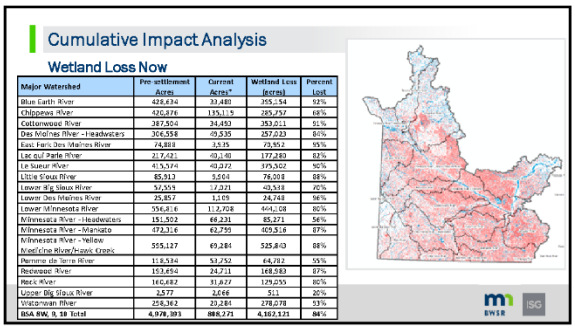


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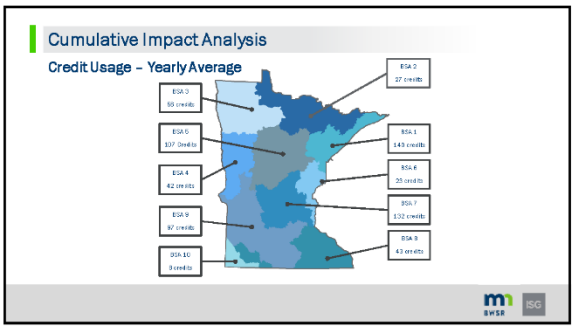


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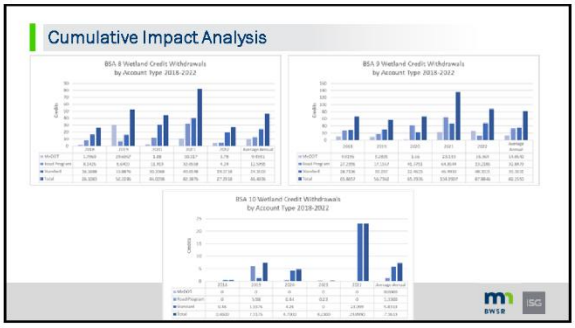


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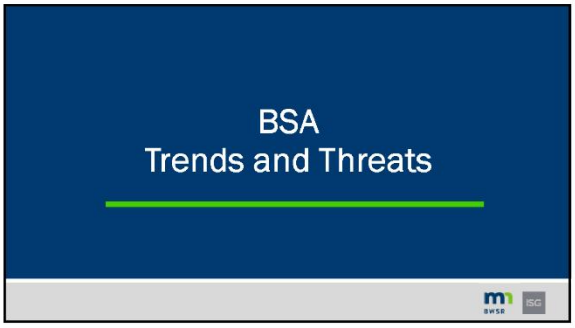


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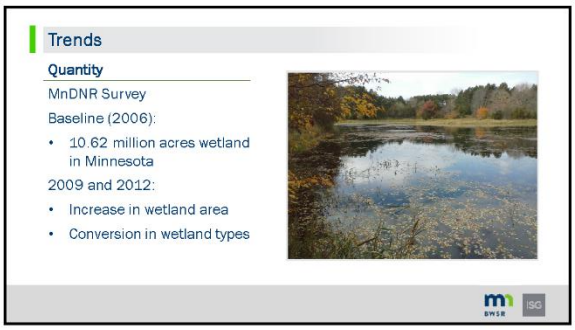


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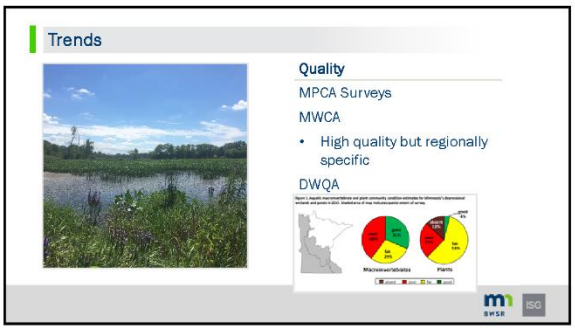


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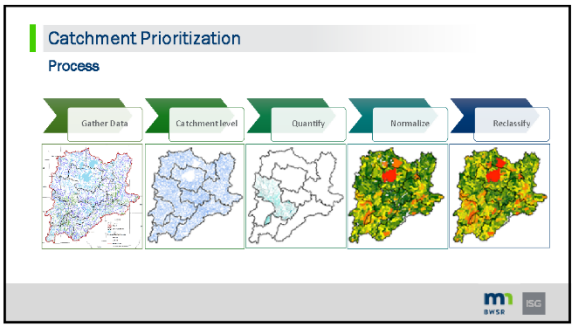


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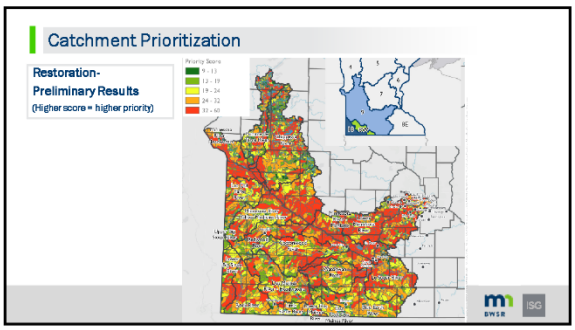


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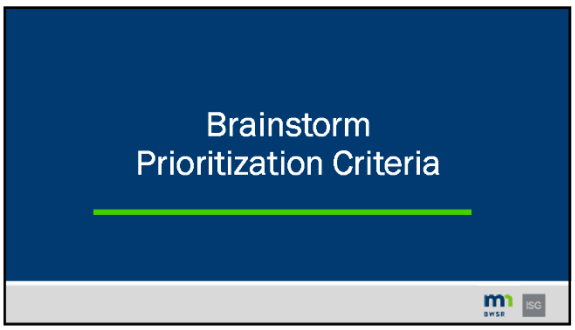


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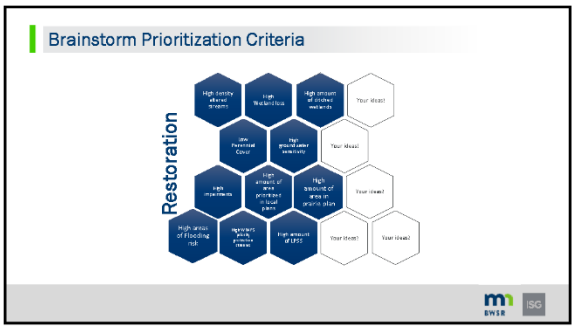


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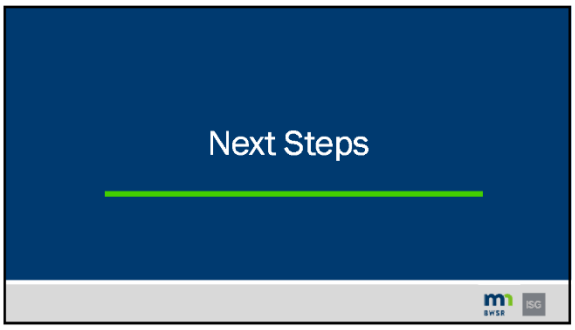


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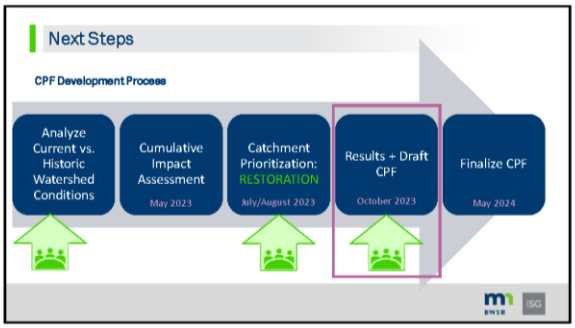
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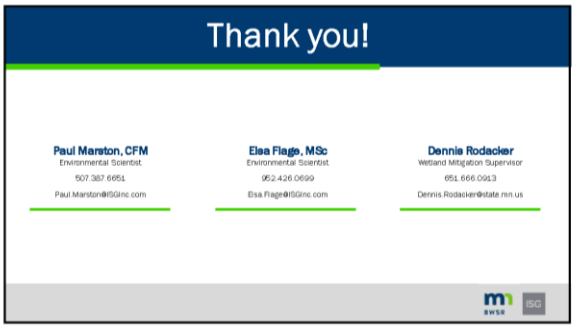
October 2023
Finalize CPF
May 2024

49


Thank you!
Paul Marston, CFM
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50

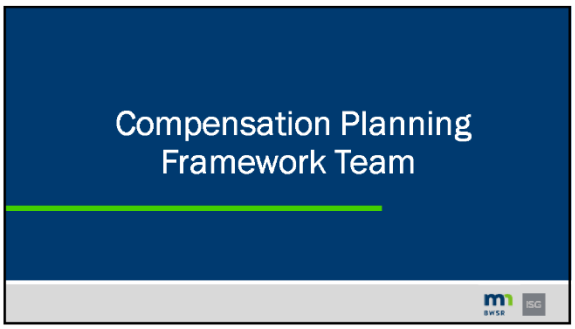
## C-3. Meeting 3- December 2023 Stakeholder Meeting List of Attendees

| First Name | Last Name | Email | Organization |
|---|---|---|---|
| Jeremy | Benson | jeremy.benson@mnswcd.org | Kittson SWCD |
| Amber | Doschadis | amber@umrwd.org | Upper Minnesota River WD |
| Ann | Messerschmidt | amesserschmidt@lakevillemn.gov | City of Lakeville |
| Blake | Giles | blakegiles@co.lyon.mn.us | Lyon County |
| Brayden | Anderson | brayden.anderson@co.ym.mn.gov | Yellow Medicine |
| Brian | Montroy | brian.montroy@state.mn.us | MnDNR |
| Cade | Steffenson | cade.steffenson@state.mn.us | BWSR |
| Dan | Donayre | dan.donayre@bolton-menk.com | City of Springfield |
| Dane | Lynch | Dane.Lynch@blueearthcountymn.gov | Blue Earth County |
| Darren | Wilke | darren.wilke@co.big-stone.mn.us | Big Stone County |
| Doug | Bos | doug.bos@co.rock.mn.us | Rock County |
| Dustin | Benes | dustin.martinswcd@gmail.com | Martin SWCD |
| Jack | Bushman | jack.bushman@sibleyswcd.org | Sibley SWCD |
| Jarrett | Spitzack | jarett.spitzack@riceswcd.org | Rice SWCD |
| Jason | Beckler | jason.beckler@state.mn.us | BWSR BC |
| Jesse | Carlson | jcarlson@cityofsavage.com | City of Savage |
| Jed | Chestnut | jed.chesnut@state.mn.us | BWSR |
| Joni | Giese | jgiese@plslwd.org | Prior Lake-Spring Lake WD |
| John | Ryther | jryther@ci.albertlea.mn.us | City of Albert Lea |
| Joe | Seidl | jseidl@chanhassenmn.gov | City of Chanhassen |
| Kenny | Famakinwa | kenny.famakinwa@co.nicollet.mn.us | Nicollet County |
| Kristen | Larson | klarson@co.carver.mn.us | Carver WMO |
| Kyle | Krier | kyle.krier@pcmn.us | SWCD - Pipestone |
| Kyle | Richter | kyler@renvilleswcd.org | Renville SWCD |
| Linda | Loomis | naiadconsulting@gmail.com | Lower MN River WD |
| Mark | Schaetzke | marks.swcd@wasecacounty.gov | Waseca SWCD |
| Rachel | Crownhart | rachel.crownhart@shakopeedakota.org | Shakopee Mdewakanton Sioux Community |
| Samantha | Berger | samantha.berger@applevalleymn.gov | City of Apple Valley |
| Anne | Sawyer | anne.sawyer@state.mn.us | BWSR BC |

| | | | |
|---|---|---|---|
| Stacey | Lijewski | stacey.lijewski@hennepin.us | Hennepin Conservation District |
| Troy | Kuphal | tkuphal@scottswcd.org | Scott SWCD |
| Zach | Dickhausen | zdickhausen@rpbcwd.org | Riley Purgatory Bluff Creek Watershed District |

# C-3. Meeting 3- December 2023 Stakeholder Meeting Presentation


1

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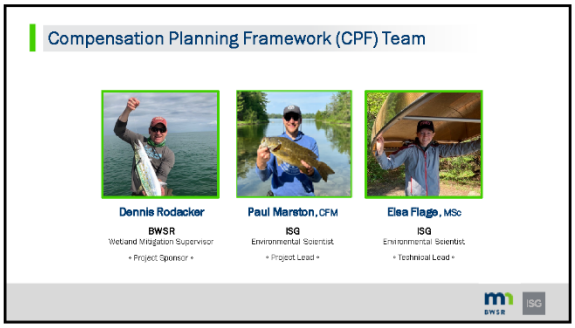


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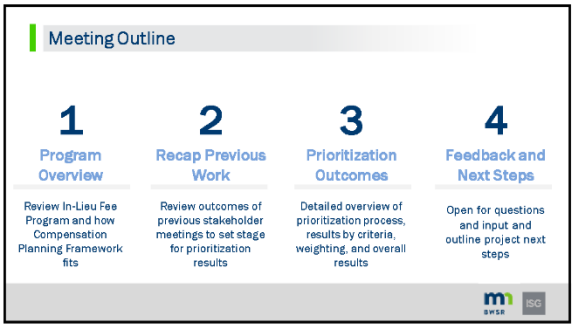


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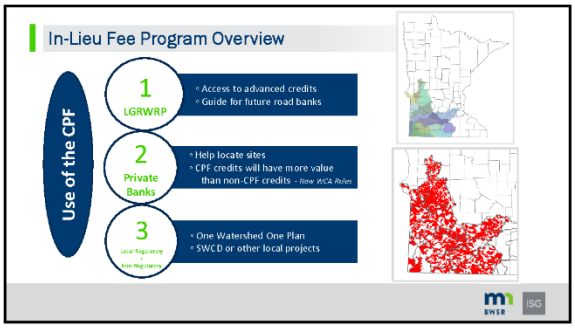


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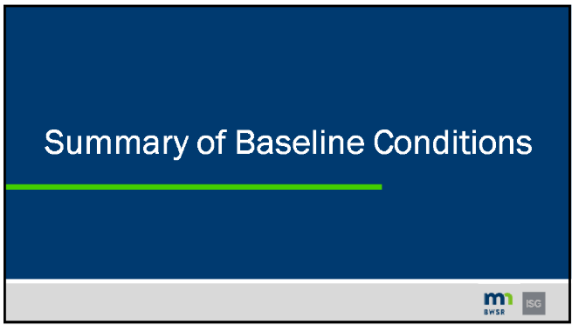


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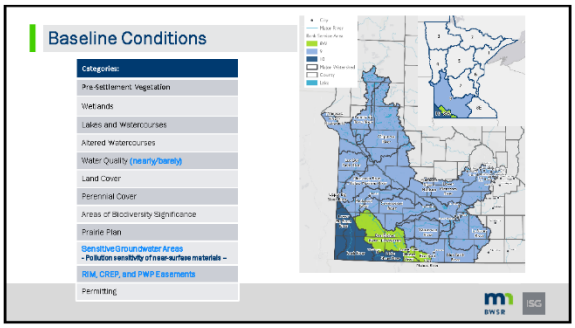
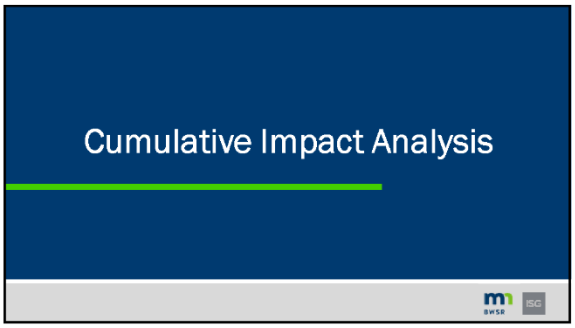
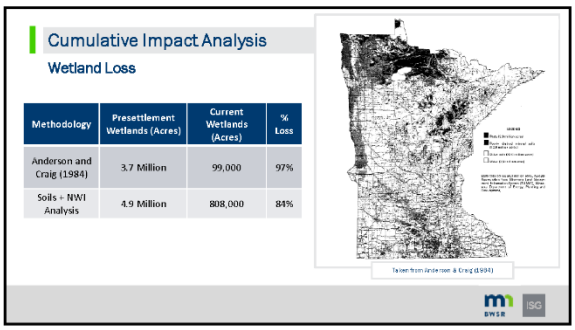

Baseline Conditions
Categories:
Pre-Settlement Vegetation
Wetlands
Lakes and Watercourses
Altered Watercourses
Water Quality (nearly/barely)
Land Cover
Perennial Cover
Areas of Biodiversity Significance
Prairie Plan
Sensitive Groundwater Areas
– Pollution sensitivity of near-surface materials –
RIM, CREP, and PWP Easements
Permitting

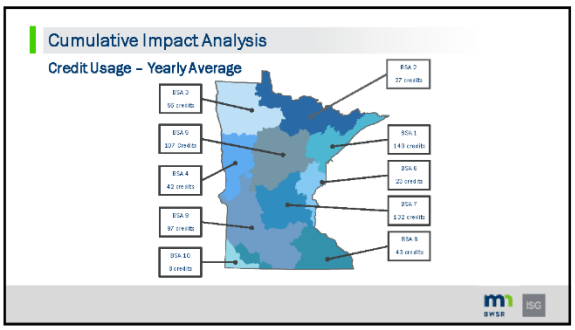
7


Cumulative Impact Analysis

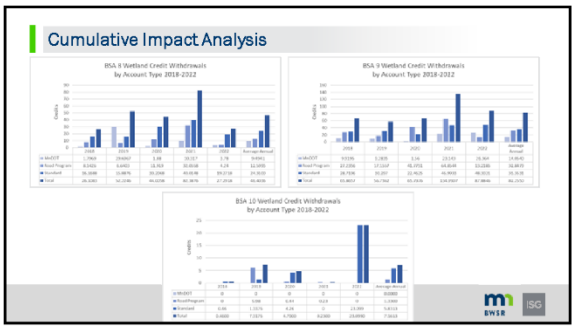
8


Cumulative Impact Analysis
Wetland Loss
Methodology
Presettlement Wetlands (Acres)
Current Wetlands (Acres)
% Loss
Anderson and Craig (1984)
3.7 Million
99,000
97%
Soils + NWI Analysis
4.9 Million
808,000
84%

9


Cumulative Impact Analysis
Credit Usage – Yearly Average

10


Cumulative Impact Analysis

11


BSA
Trends and Threats

12

## Trends

**Quantity**

MnDNR Survey

Baseline (2006):

- 10.62 million acres wetland in Minnesota

2009 and 2012:

- Increase in wetland area
- Conversion in wetland types

13

## Trends

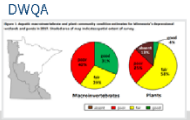
**Quality**

MPCA Surveys

MWCA

- High quality but regionally specific

DWQA



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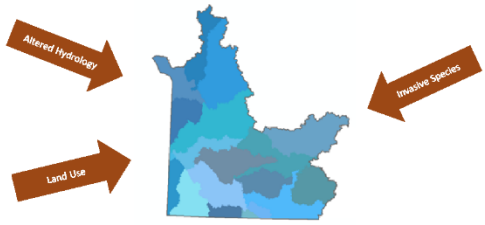
## Threats

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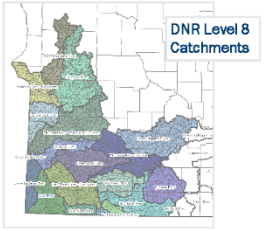
## Catchment Prioritization

16

## Catchment Prioritization

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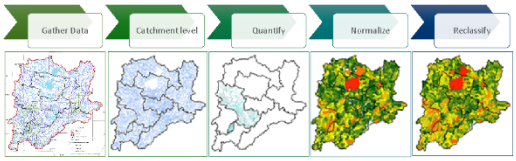
## Catchment Prioritization

**Data Analysis**

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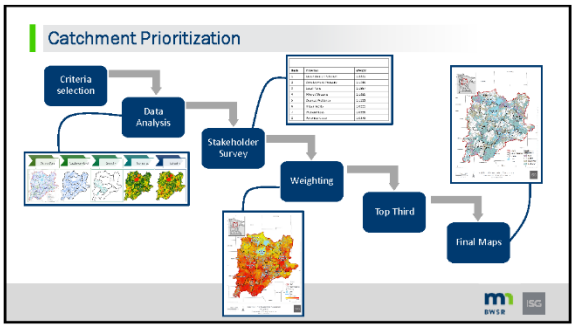


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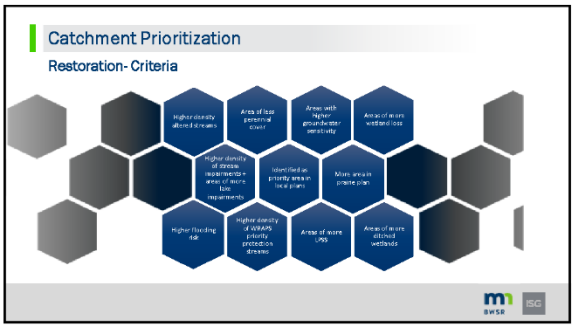


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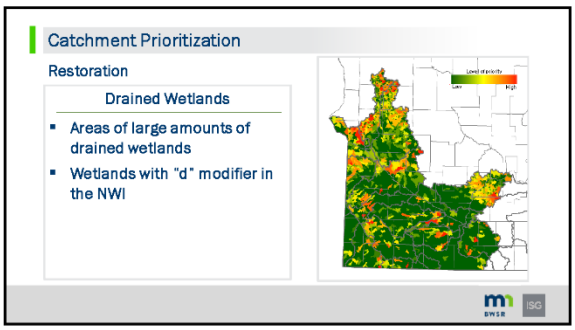


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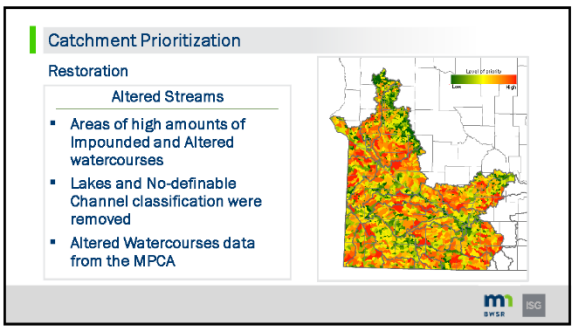


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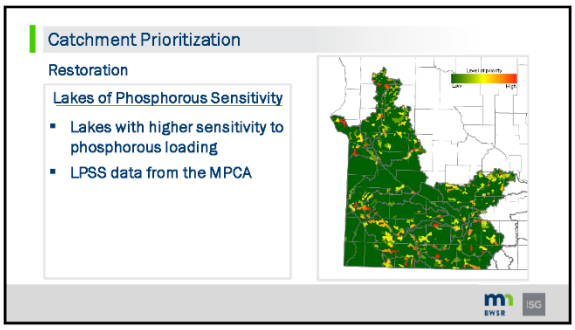


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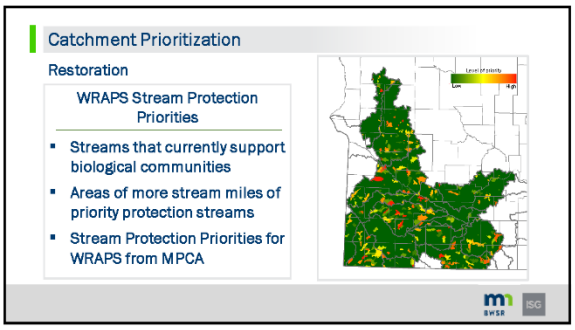


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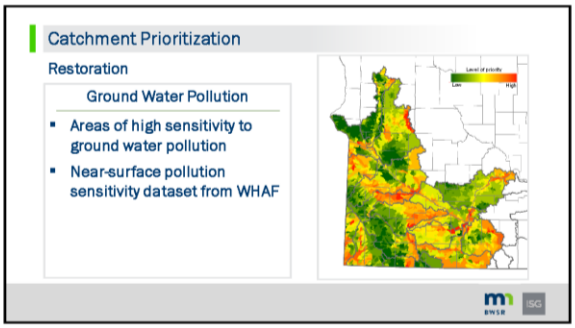


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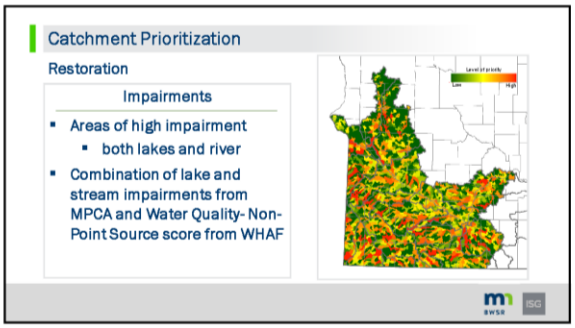


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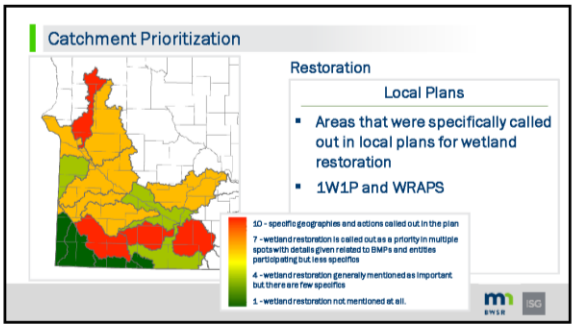


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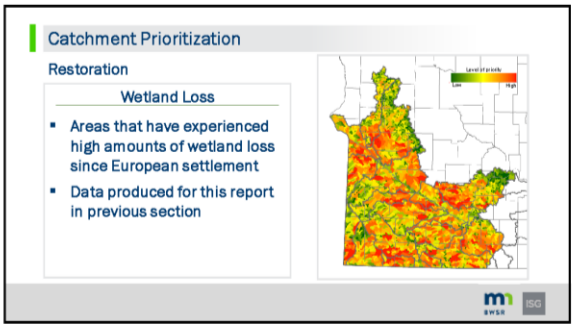


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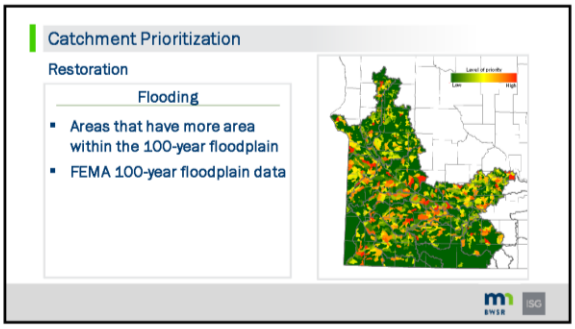


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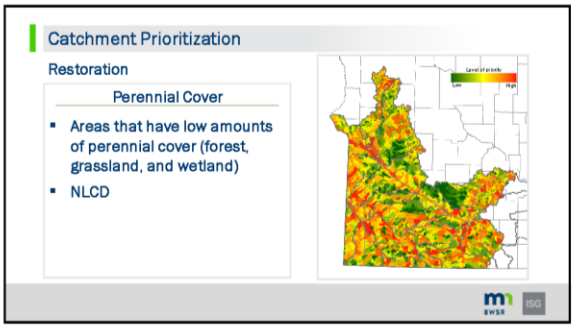


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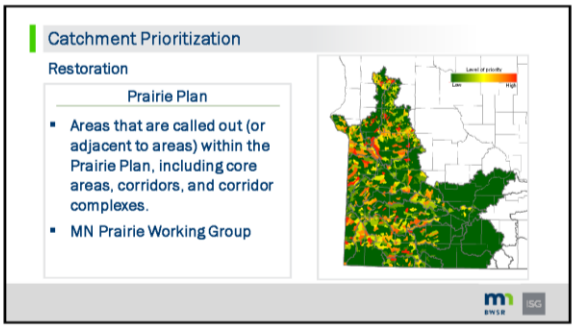


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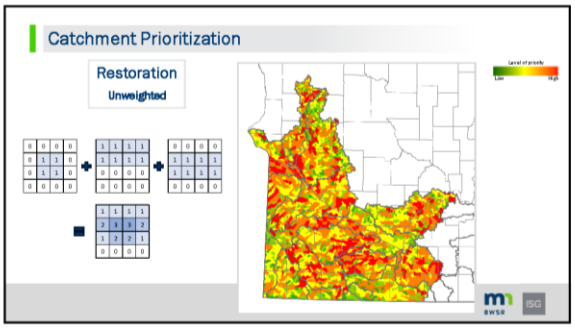


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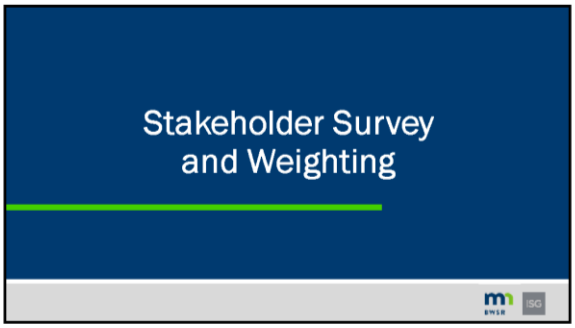


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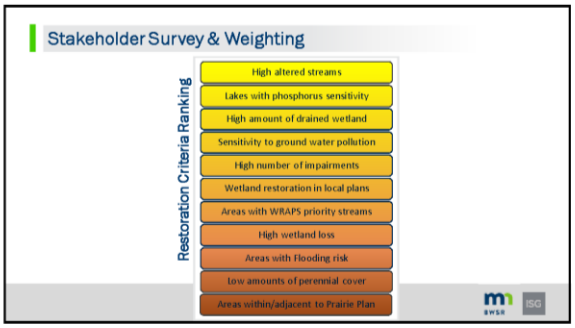


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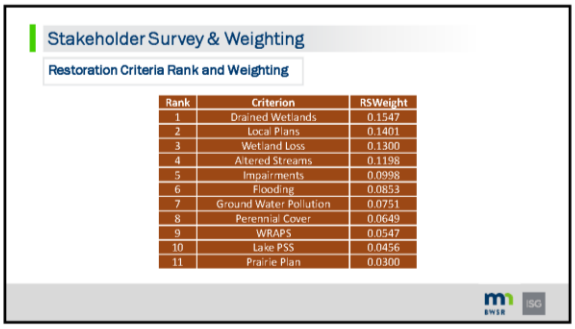
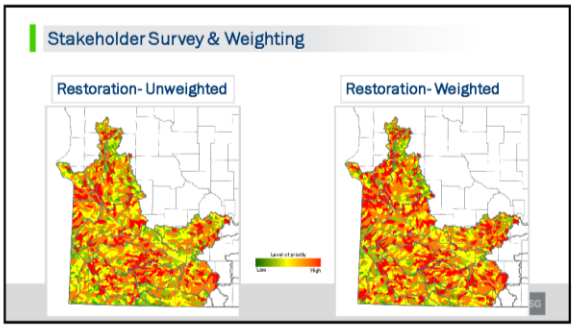



| Rank | Criterion | RSWeight |
|---|---|---|
| 1 | Drained Wetlands | 0.1547 |
| 2 | Local Plans | 0.1401 |
| 3 | Wetland Loss | 0.1300 |
| 4 | Altered Streams | 0.1198 |
| 5 | Impairments | 0.0998 |
| 6 | Flooding | 0.0853 |
| 7 | Ground Water Pollution | 0.0751 |
| 8 | Perennial Cover | 0.0649 |
| 9 | WRAPS | 0.0547 |
| 10 | Lake PSS | 0.0456 |
| 11 | Prairie Plan | 0.0300 |

35

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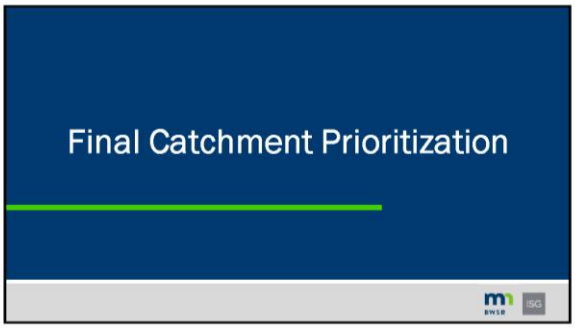


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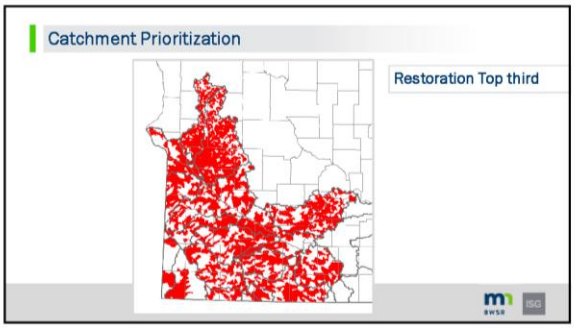


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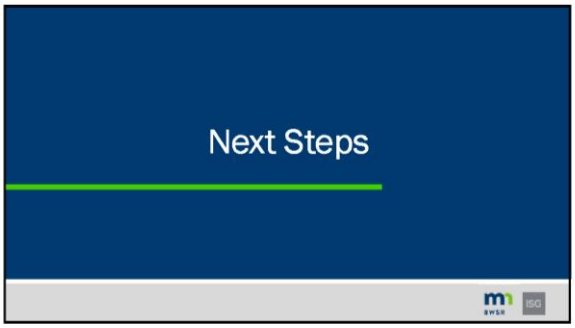


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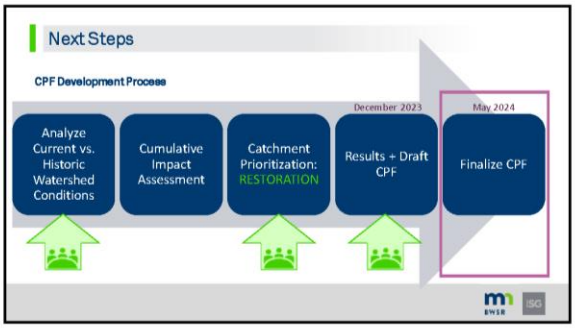


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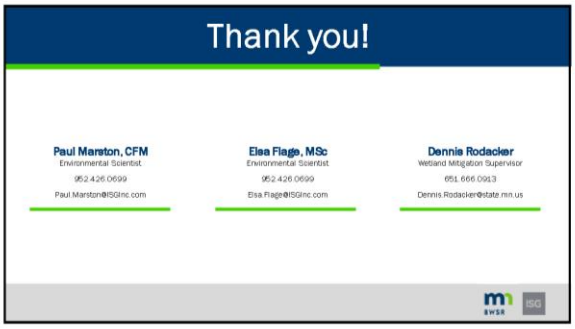
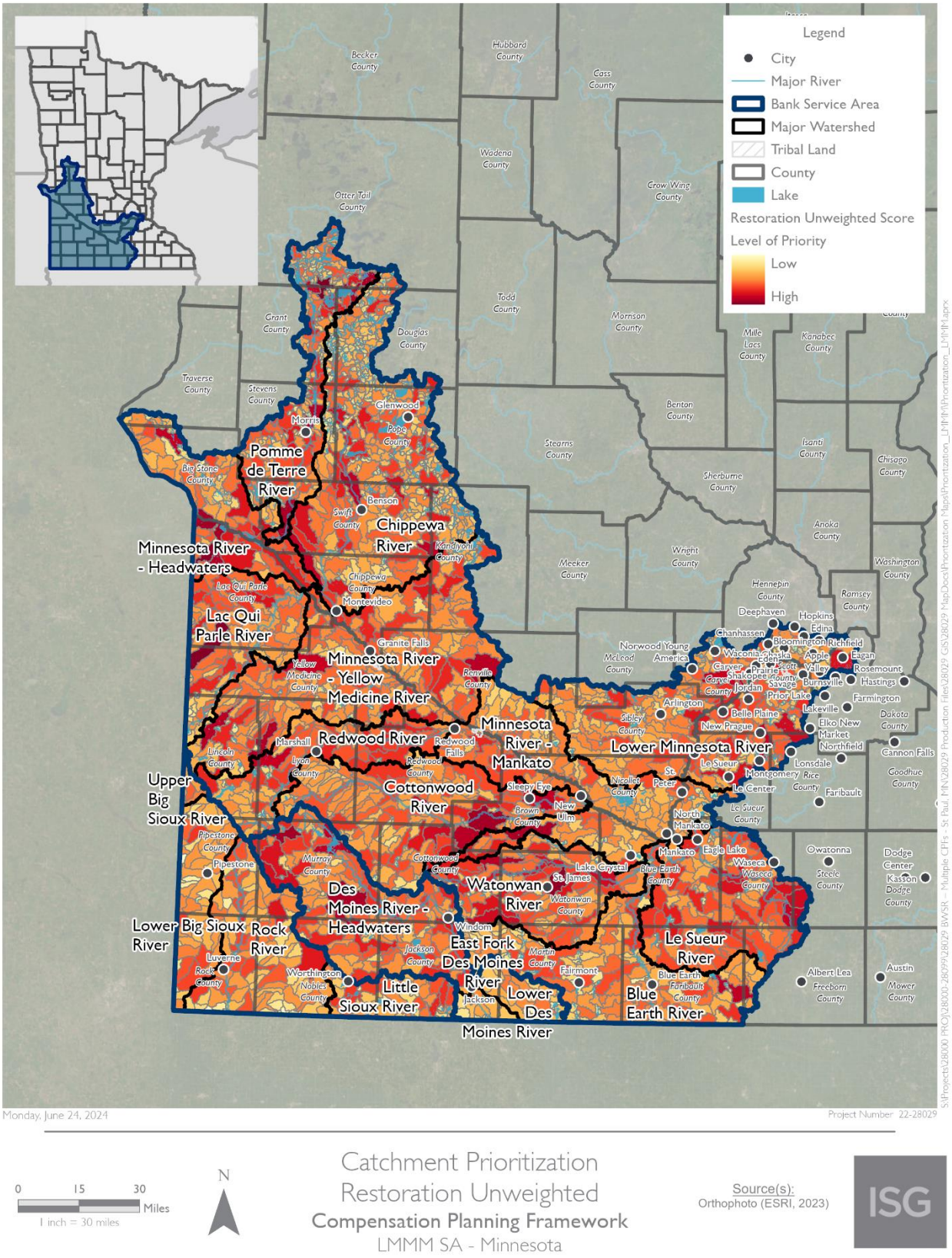


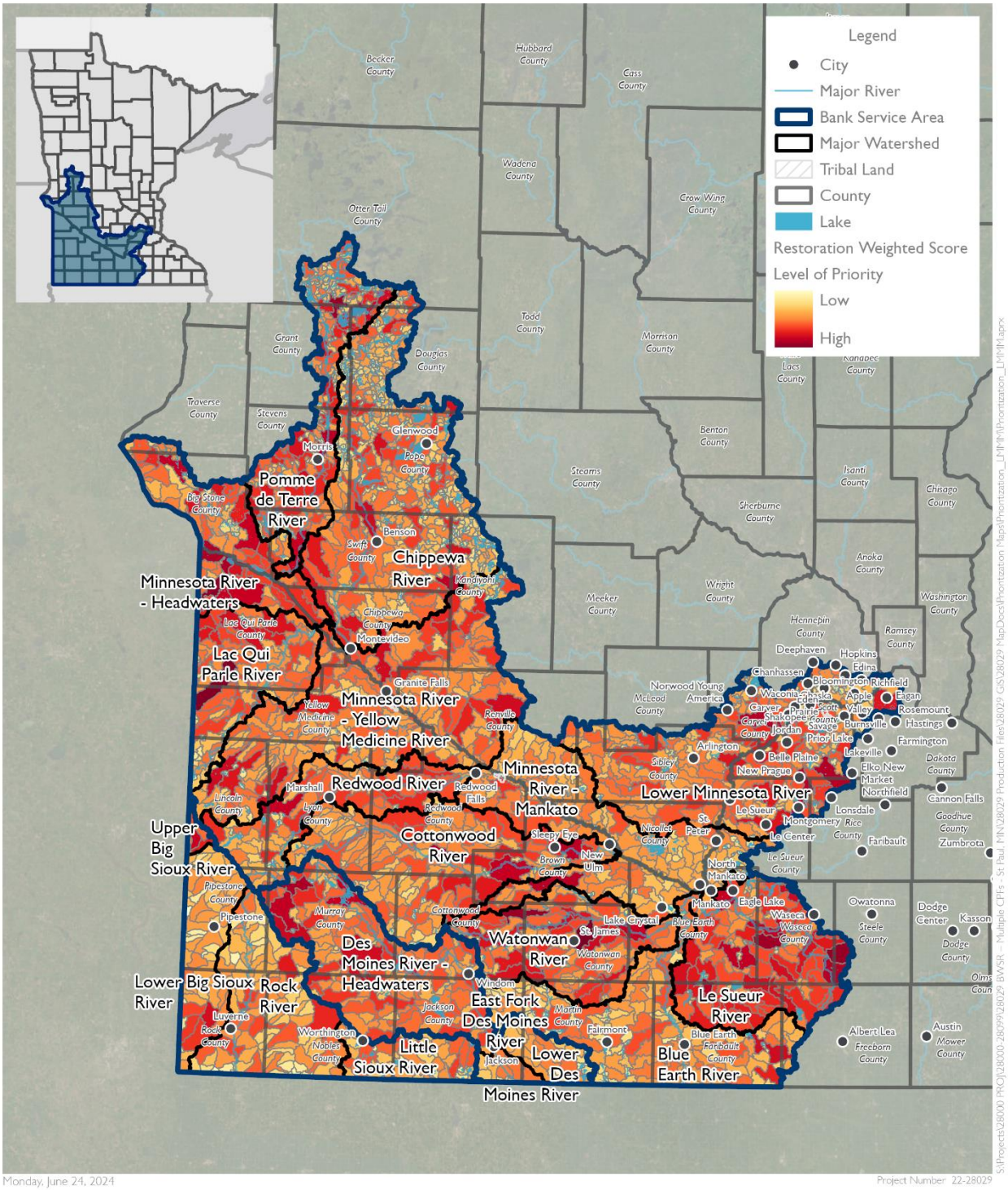

42

# Appendix D: Catchment Prioritization Maps

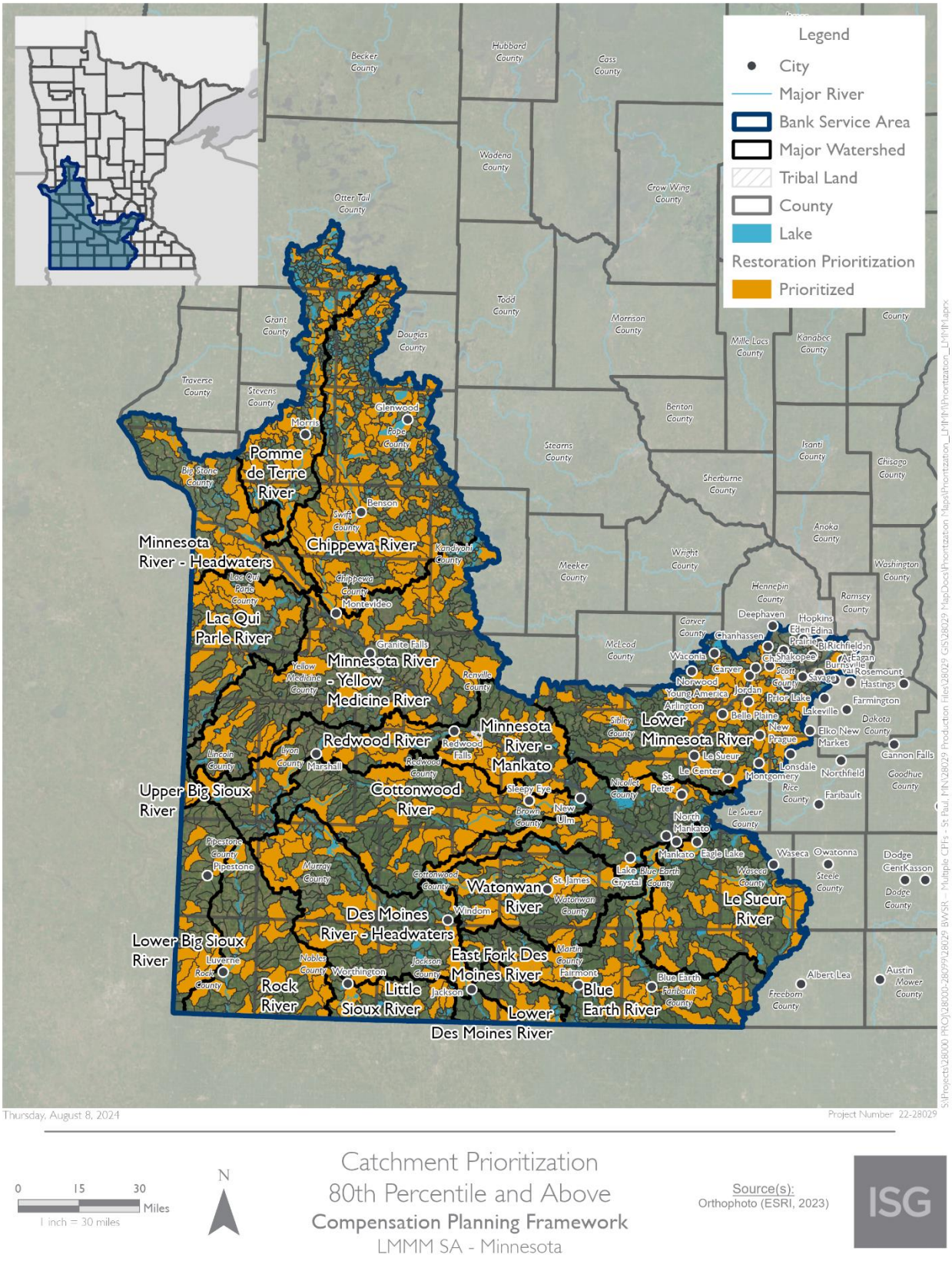
## Figure D-1. Unweighted Restoration Catchment Prioritization



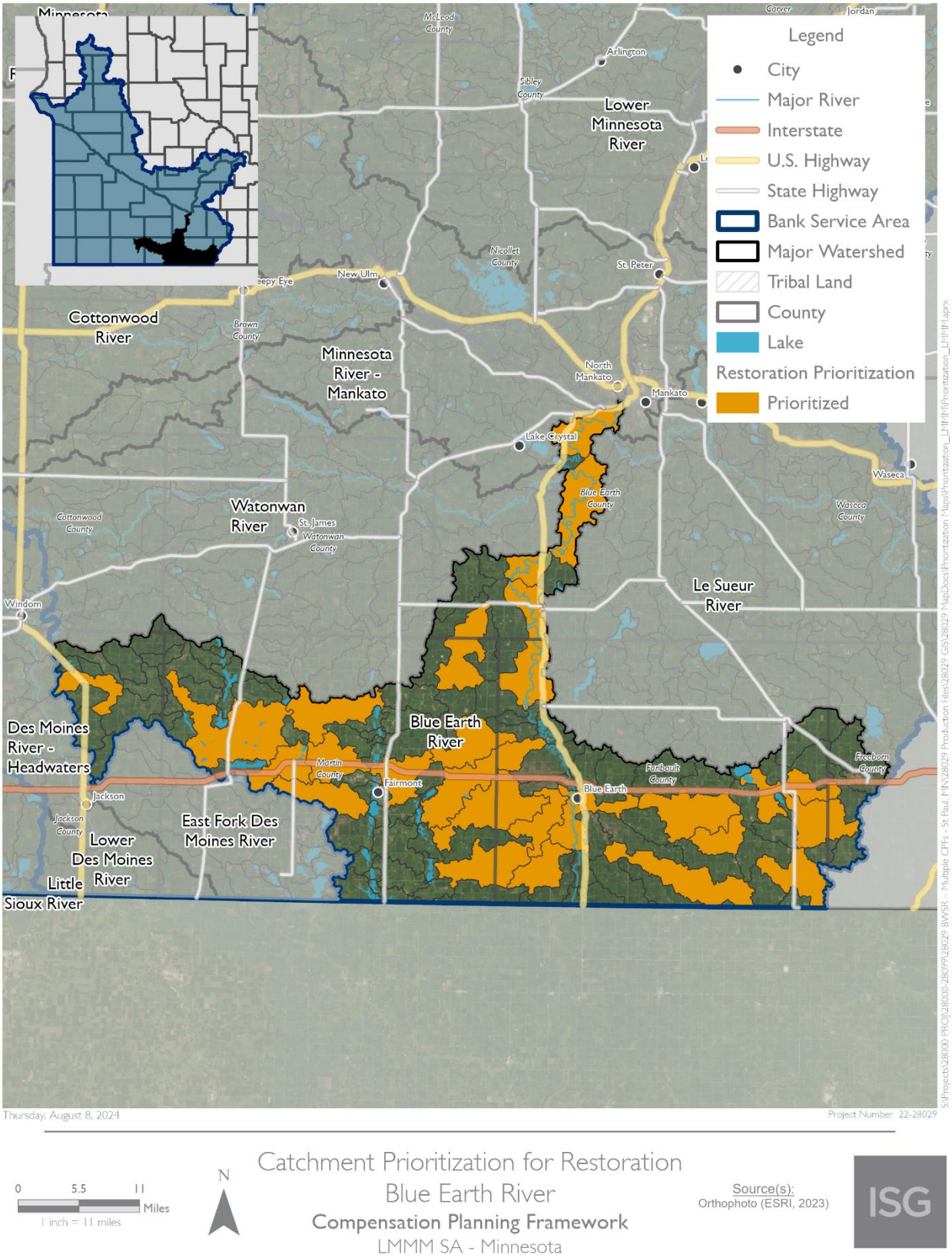
## Figure D-2. Weighted Restoration Catchment Prioritization



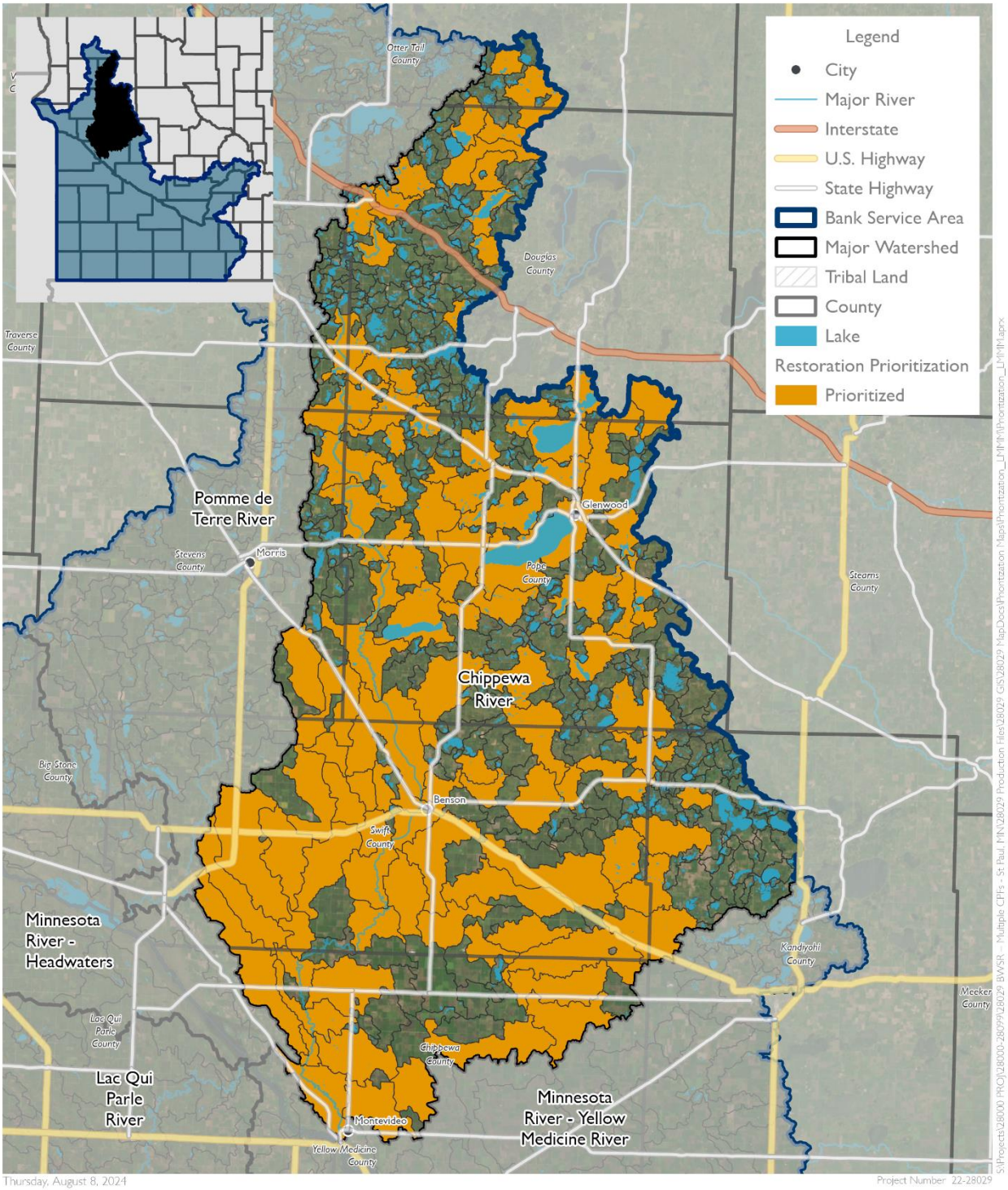
## Figure D-3. Final Restoration Catchment Prioritization



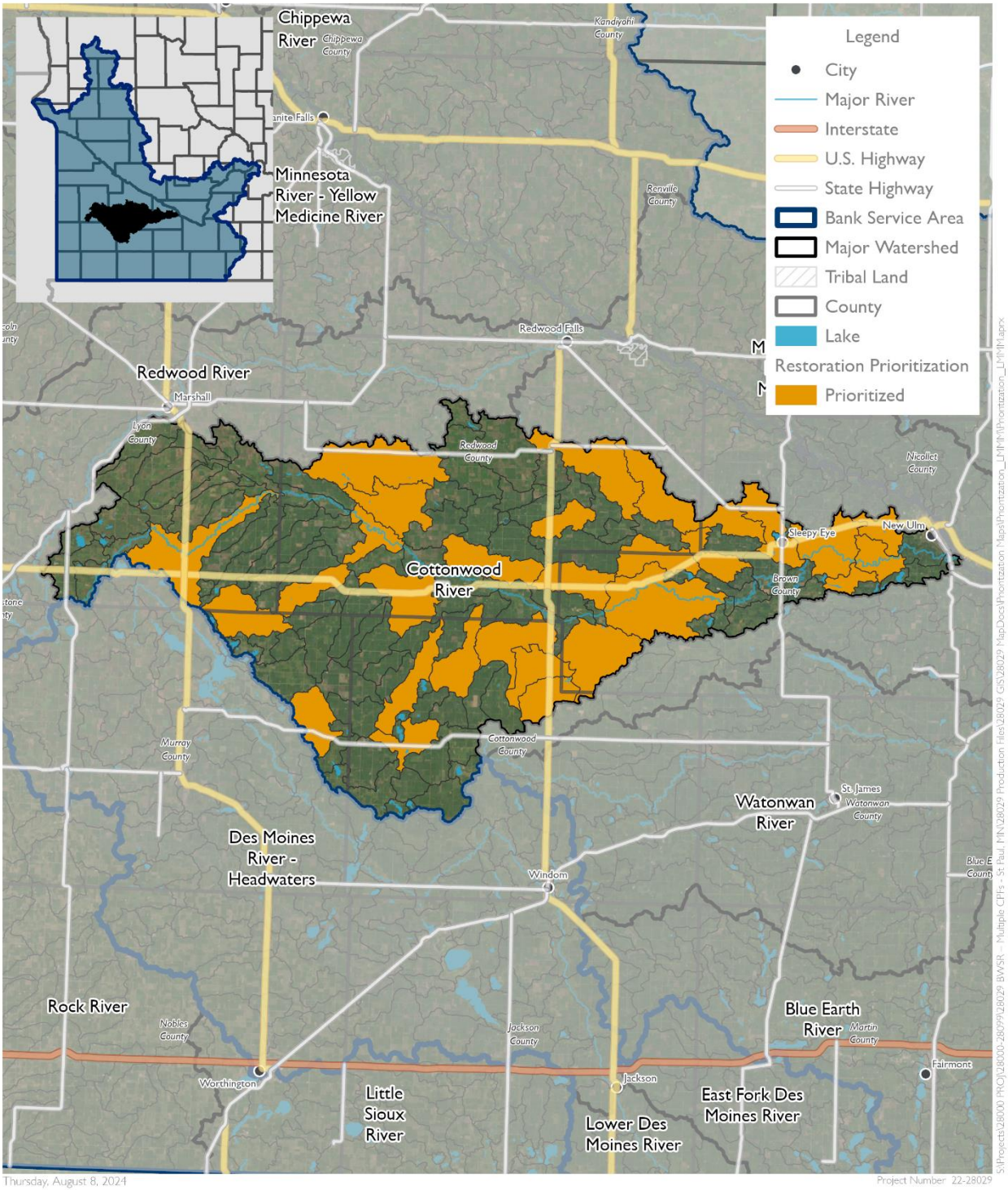
## Figure D-4. Final Restoration Catchment Prioritization – Blue Earth River Watershed



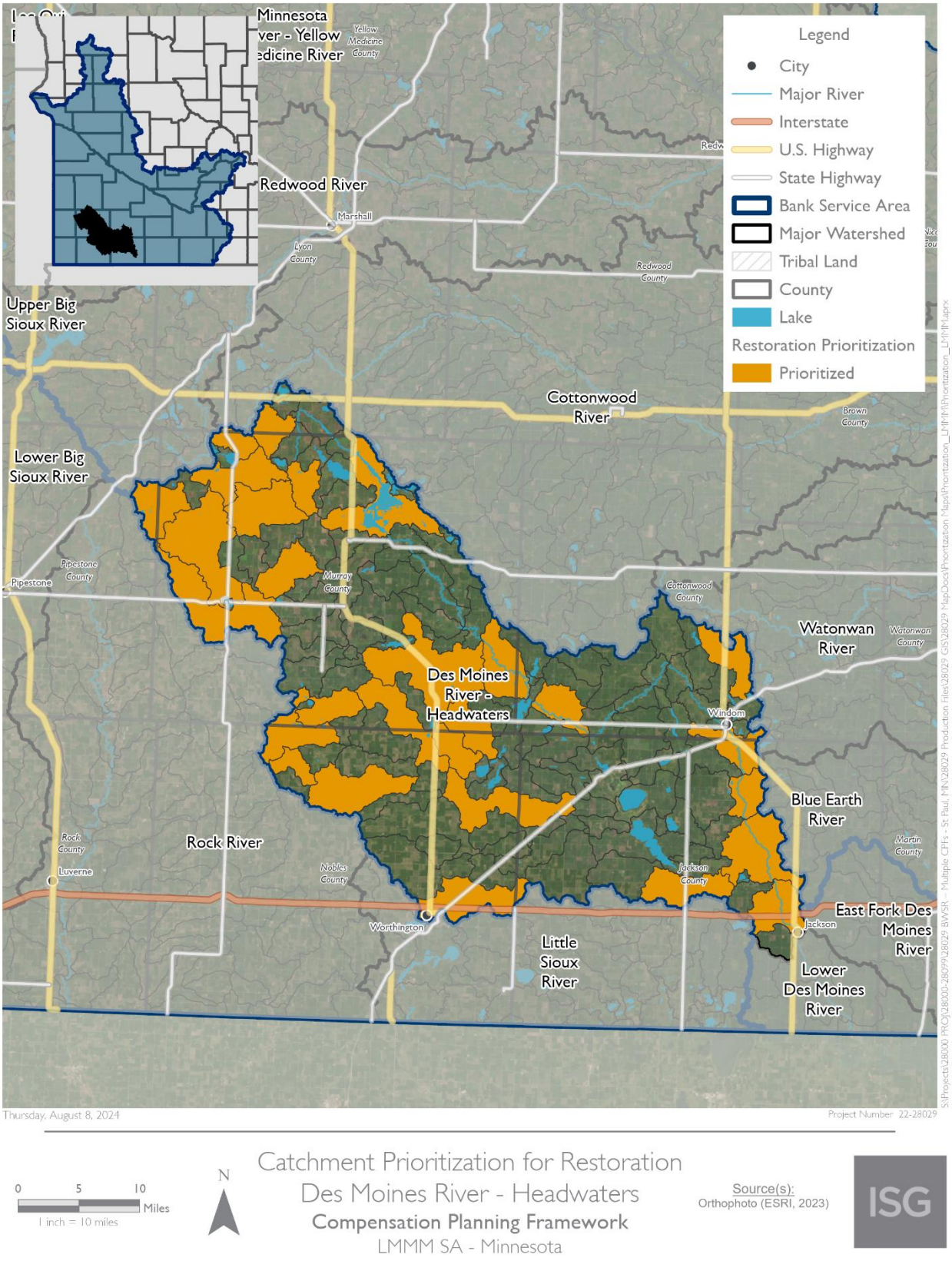
## Figure D-4. Final Restoration Catchment Prioritization – Chippewa River Watershed



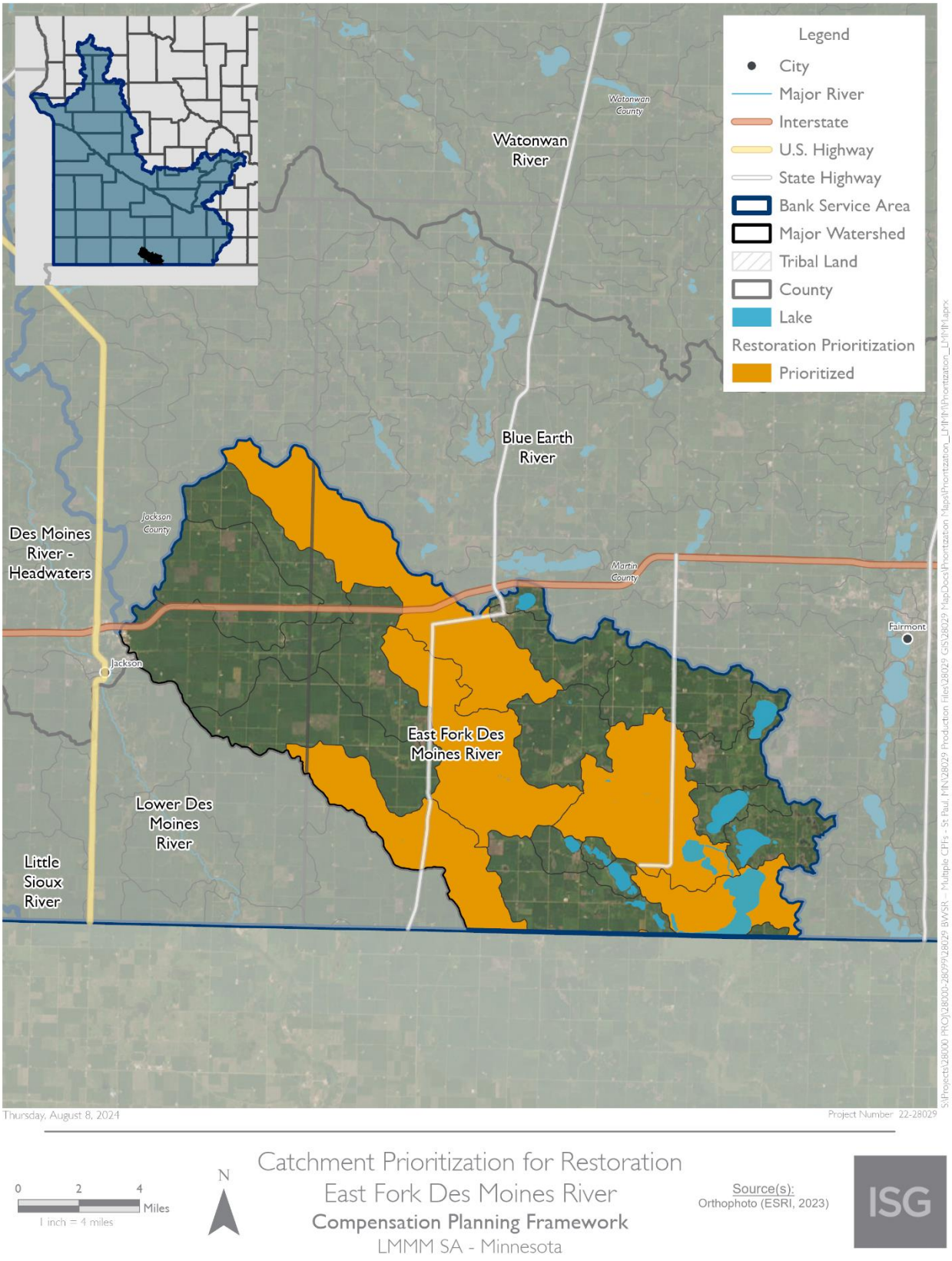
## Figure D-6. Final Restoration Catchment Prioritization – Cottonwood River Watershed



## Figure D-7. Final Restoration Catchment Prioritization – Des Moines River – Headwaters Watershed



## Figure D-8. Final Restoration Catchment Prioritization – East fork Des Moines River Watershed




0 2 4 Miles
1 inch = 4 miles

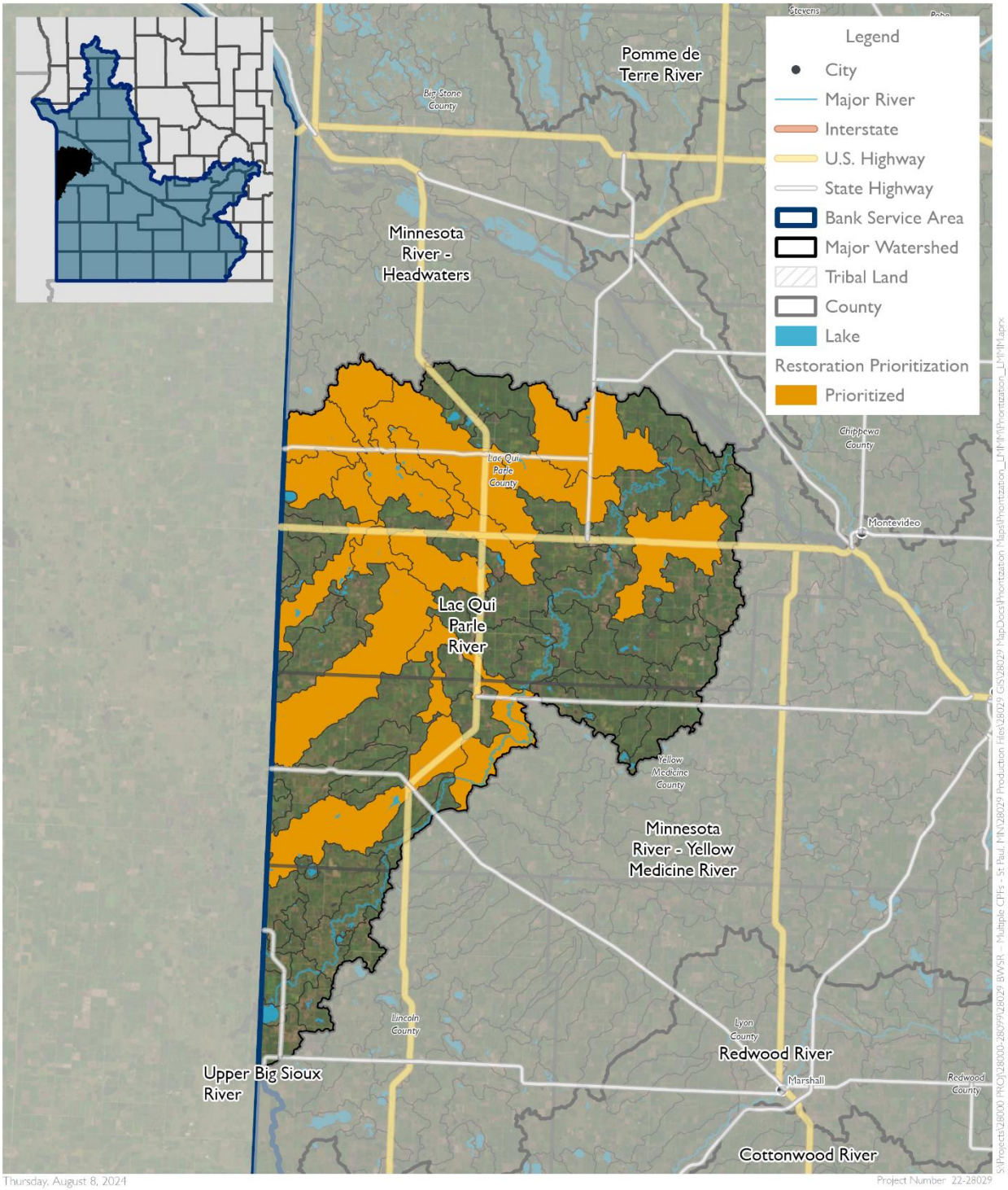
N

Catchment Prioritization for Restoration
East Fork Des Moines River
Compensation Planning Framework
LMMM SA - Minnesota

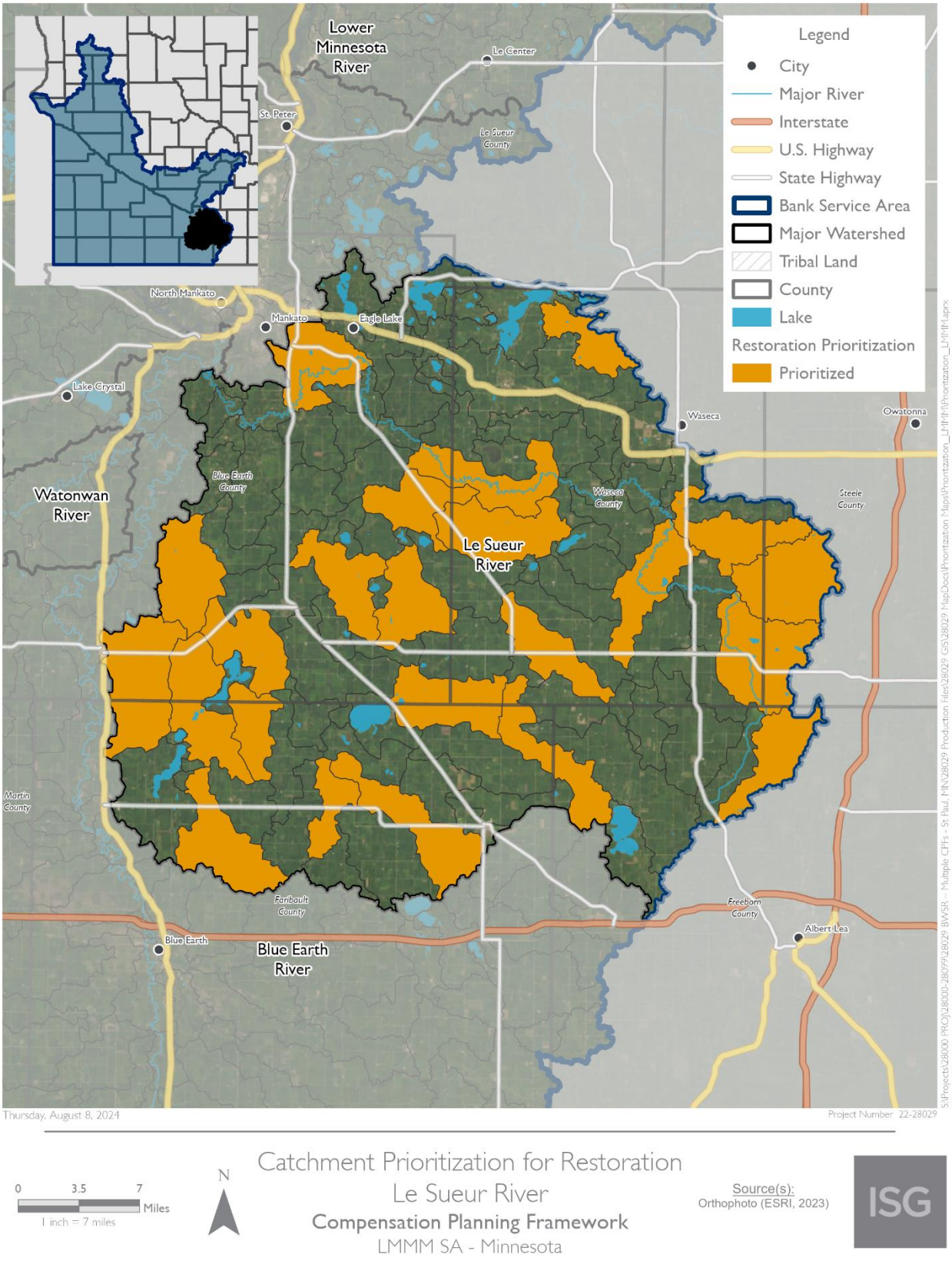
Source(s):
Orthophoto (ESRI, 2023)

ISG

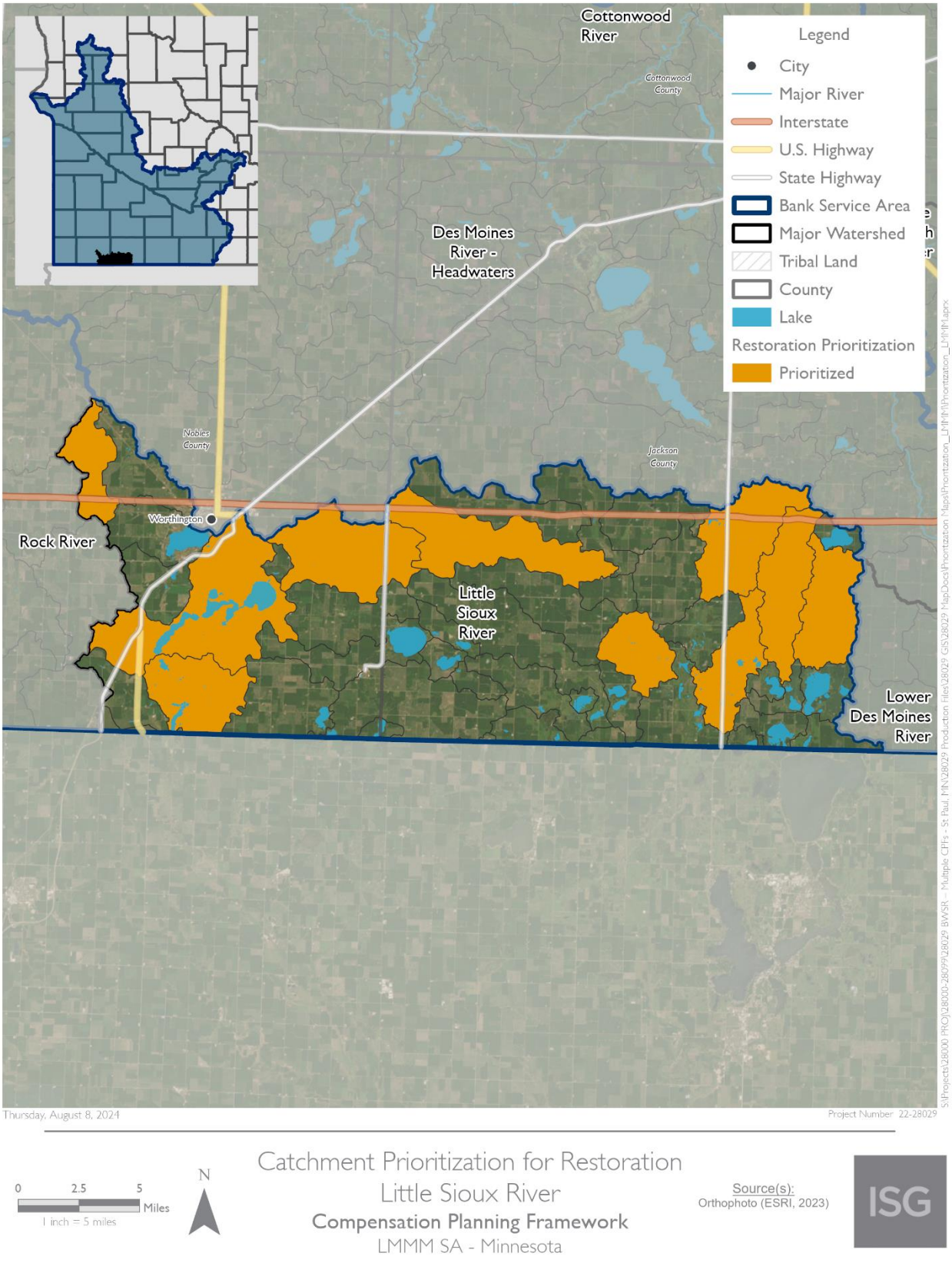
## Figure D-9. Final Restoration Catchment Prioritization – Lac Qui Parle River Watershed



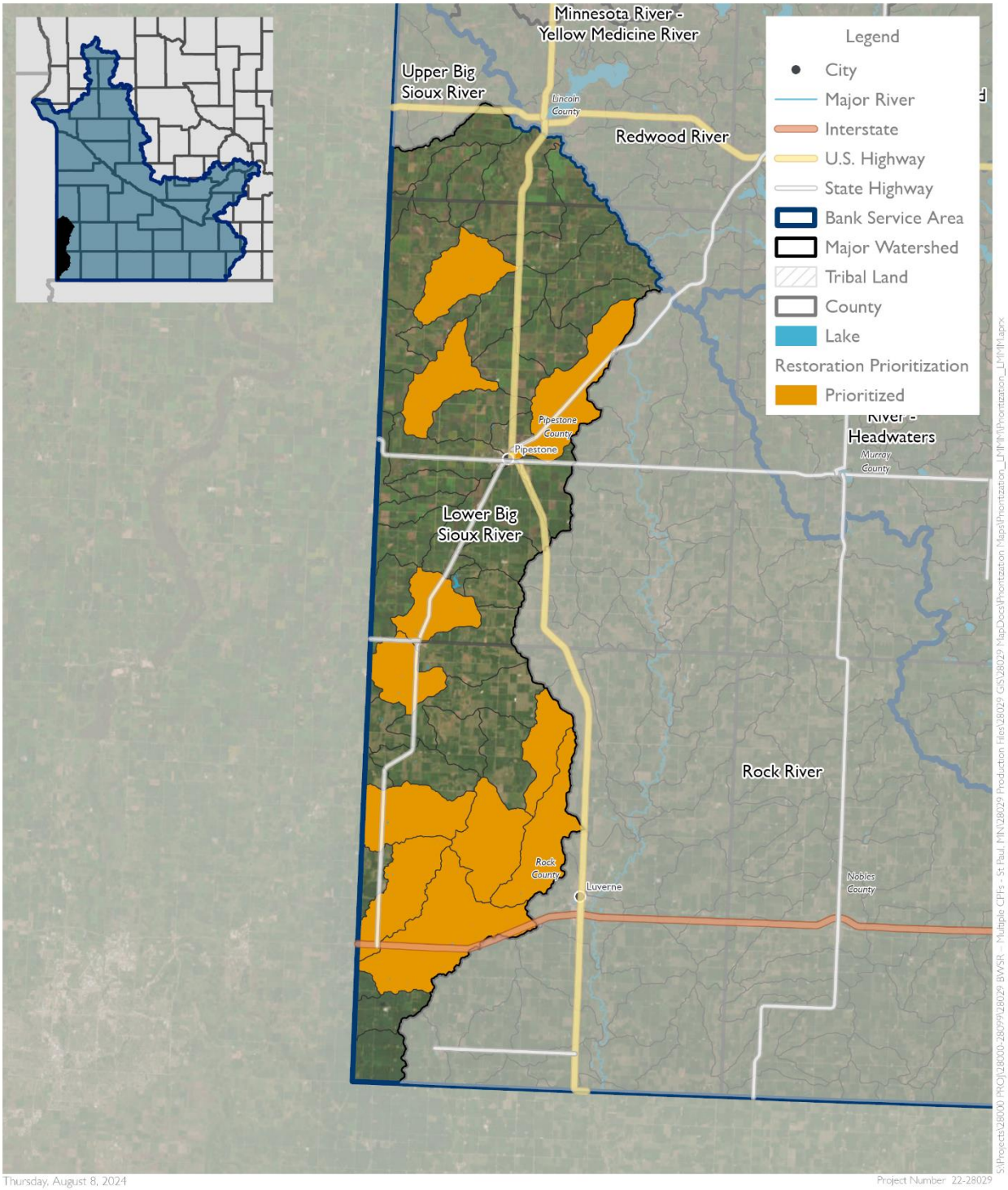
## Figure D-10. Final Restoration Catchment Prioritization – Le Sueur River Watershed



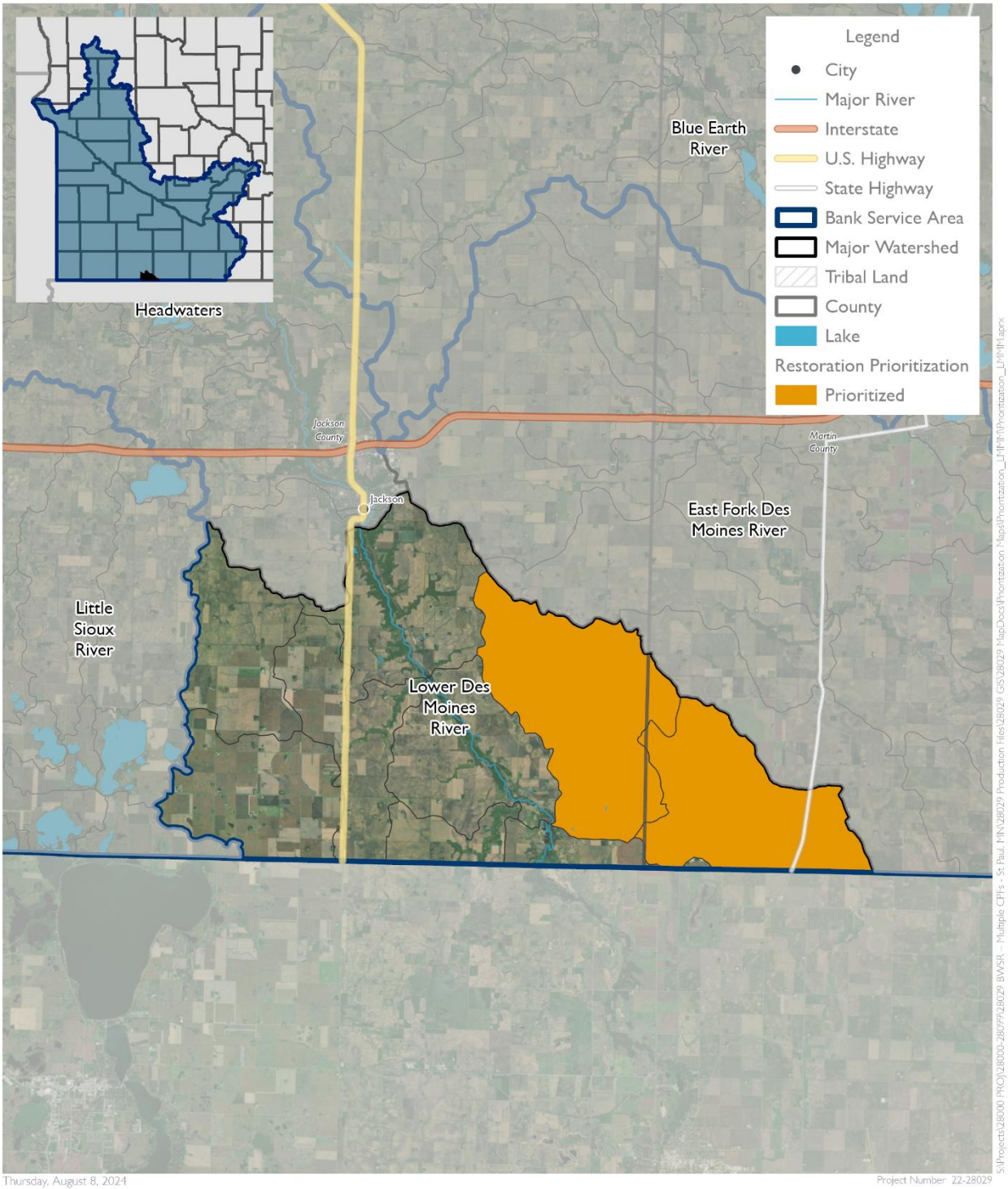
## Figure D-11. Final Restoration Catchment Prioritization – Little Sioux River Watershed



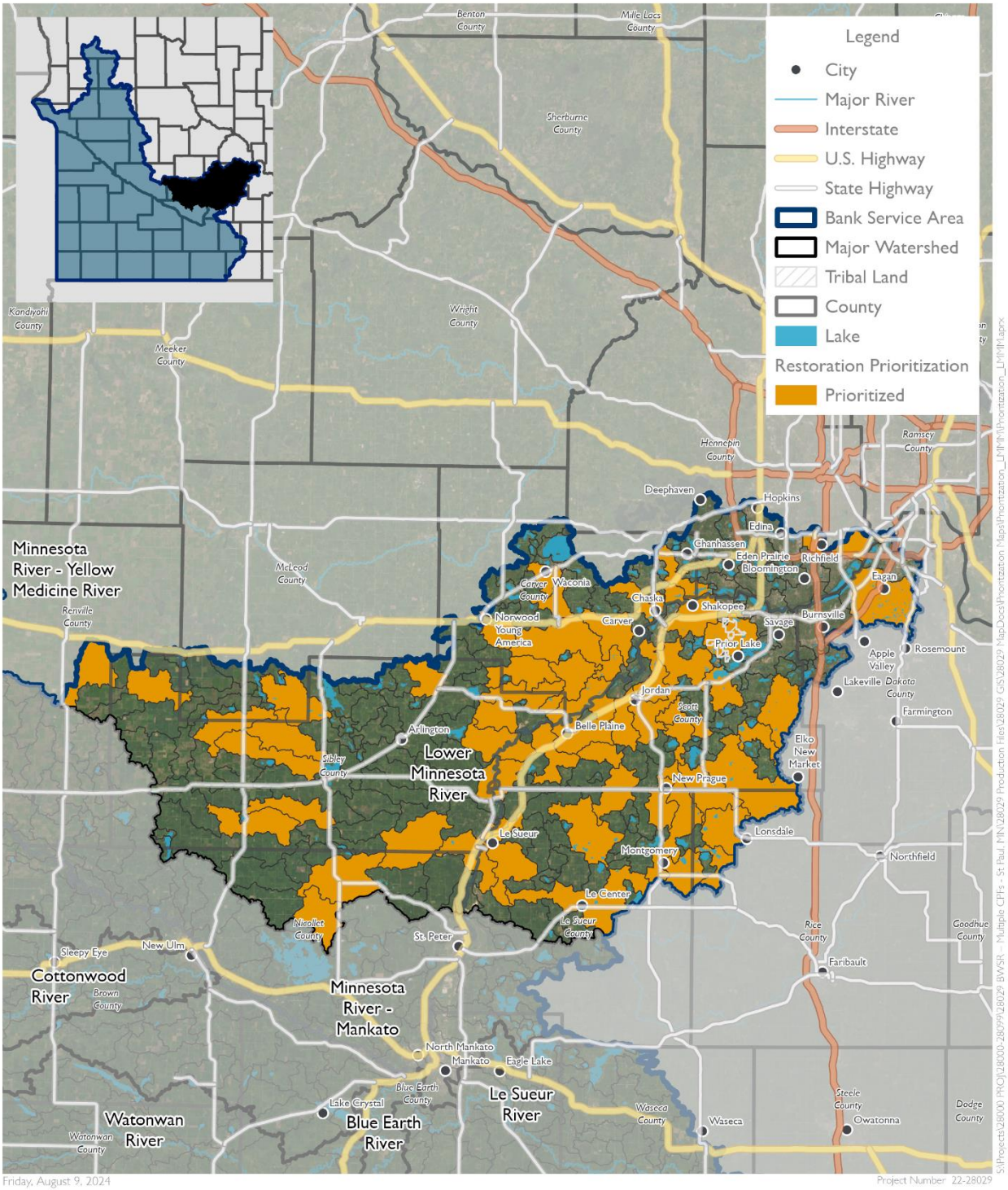
## Figure D-12. Final Restoration Catchment Prioritization – Lower Big Sioux River Watershed



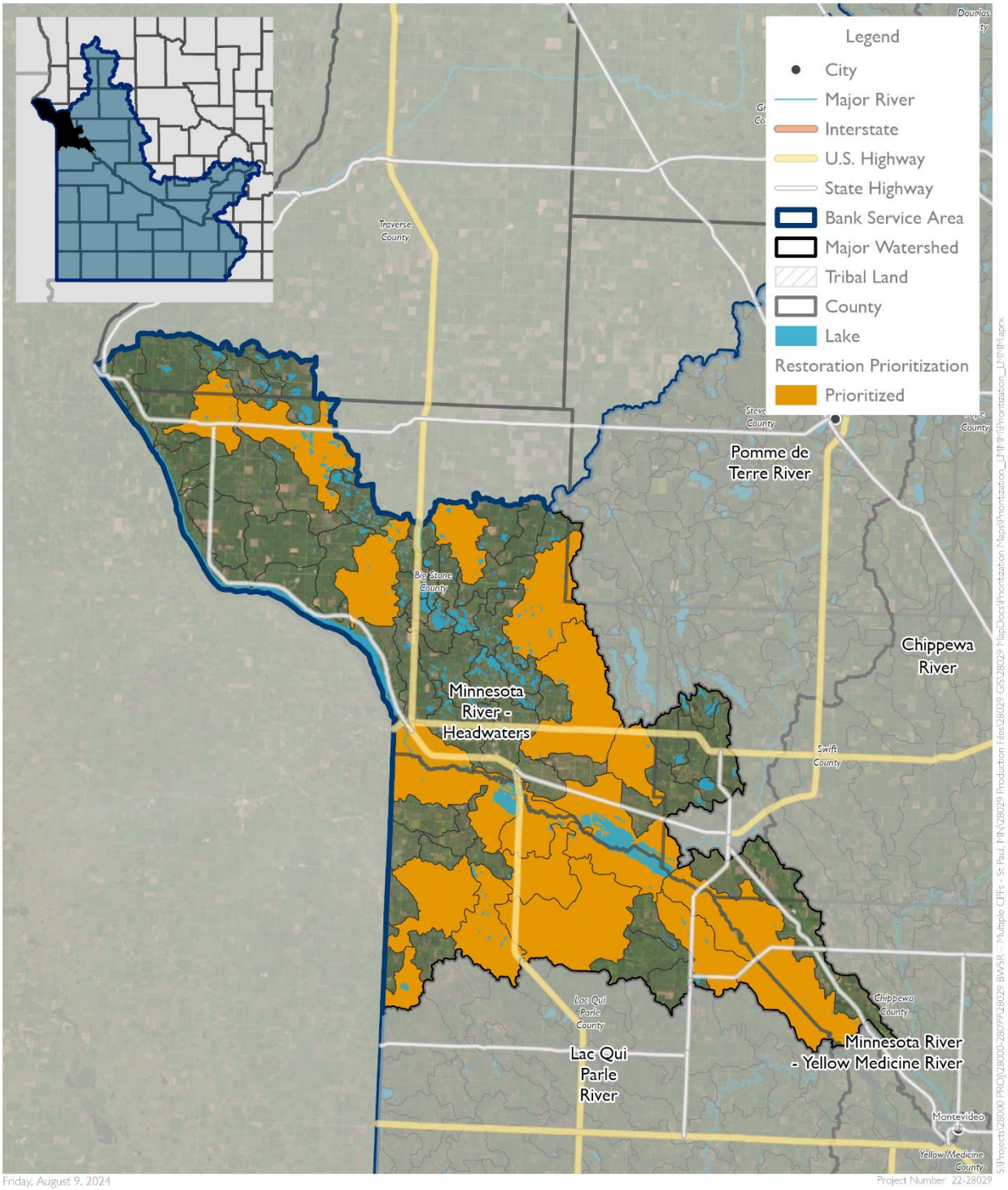
## Figure D-13. Final Restoration Catchment Prioritization – Lower Des Moines River Watershed



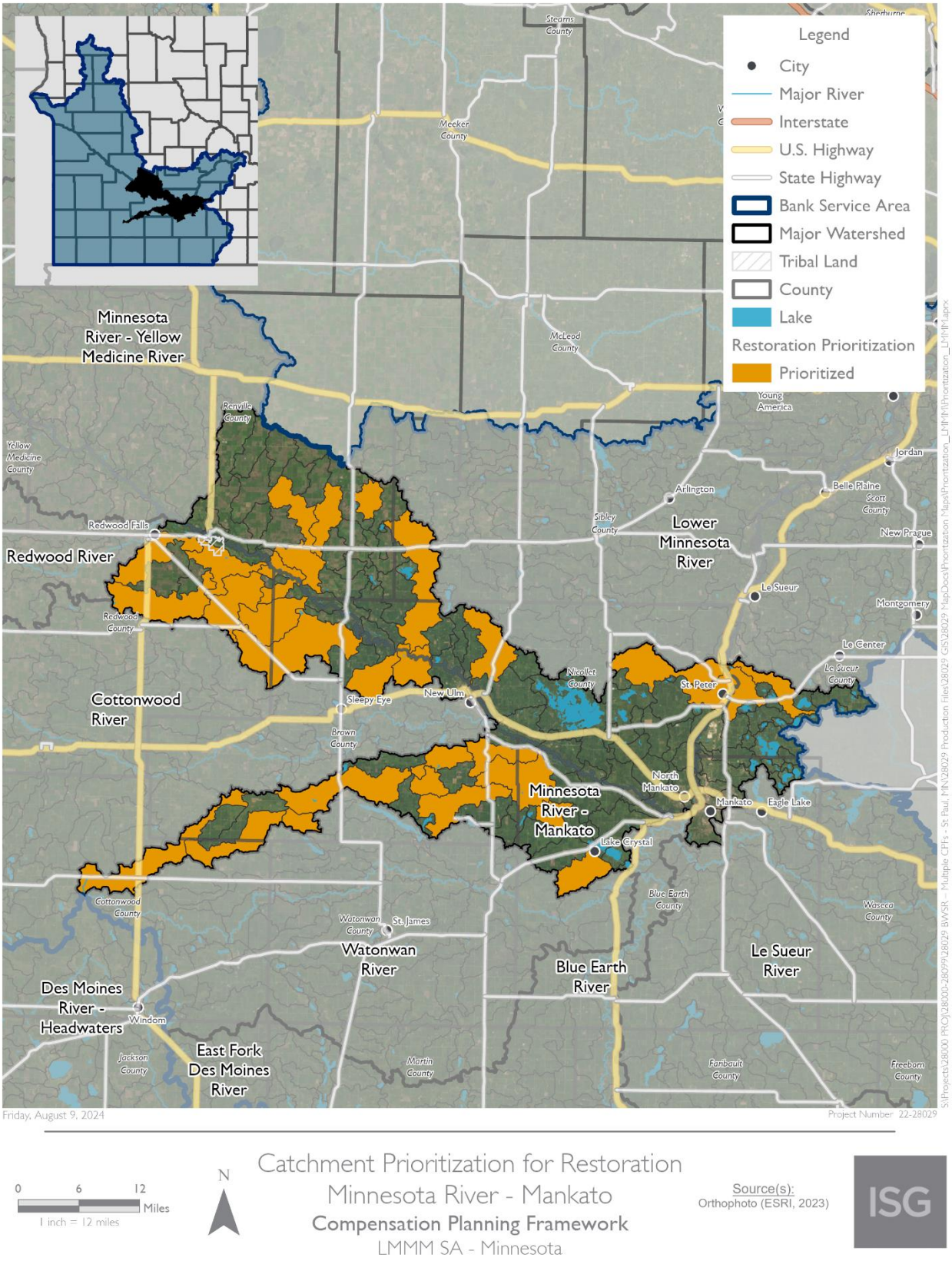
## Figure D-14. Final Restoration Catchment Prioritization – Lower Minnesota River Watershed



## Figure D-15. Final Restoration Catchment Prioritization – Minnesota River – Headwaters Watershed



## Figure D-16. Final Restoration Catchment Prioritization – Minnesota River – Mankato Watershed




0 6 12 Miles
1 inch = 12 miles

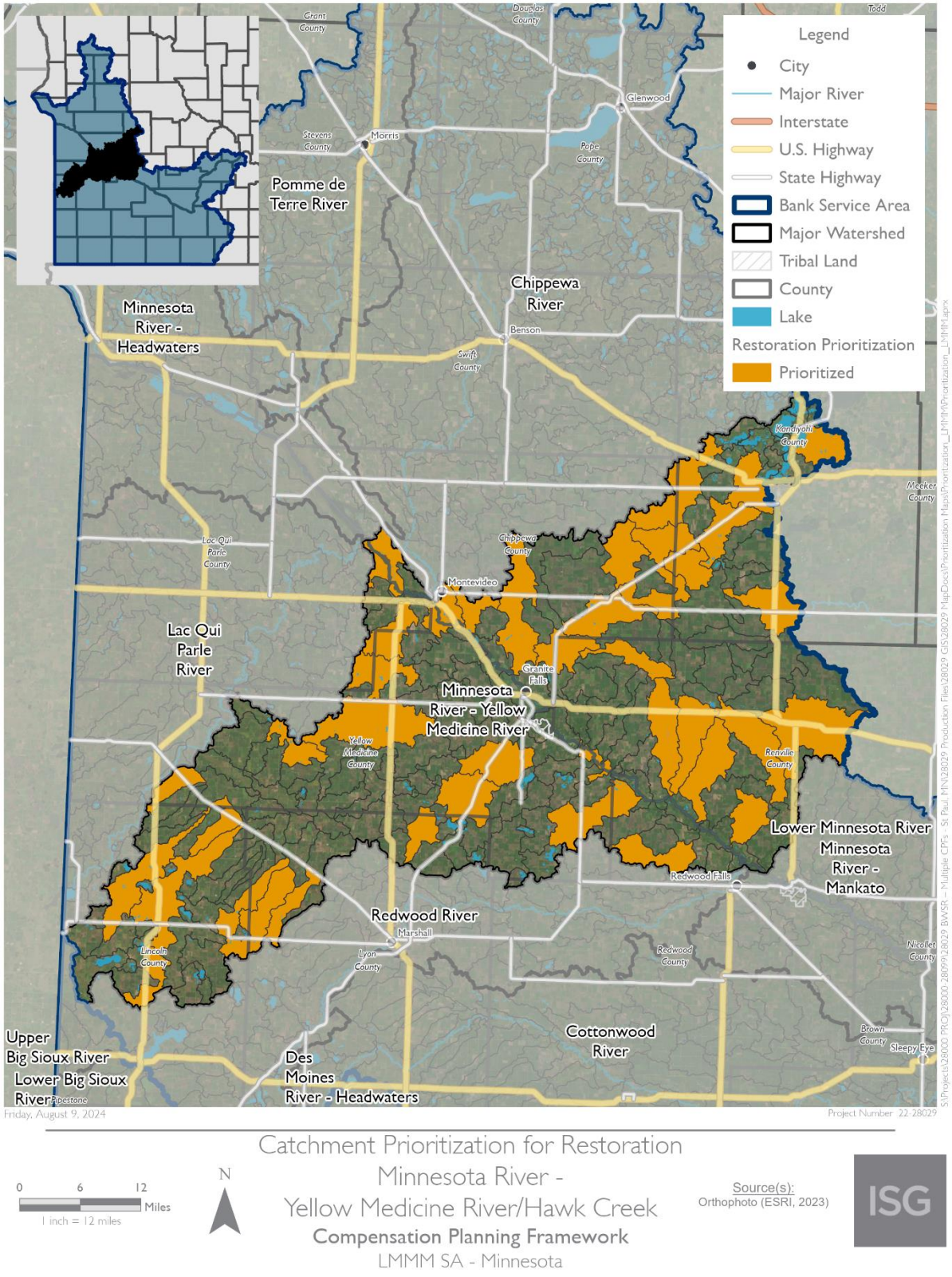
N

Catchment Prioritization for Restoration
Minnesota River - Mankato
**Compensation Planning Framework**
LMMM SA - Minnesota

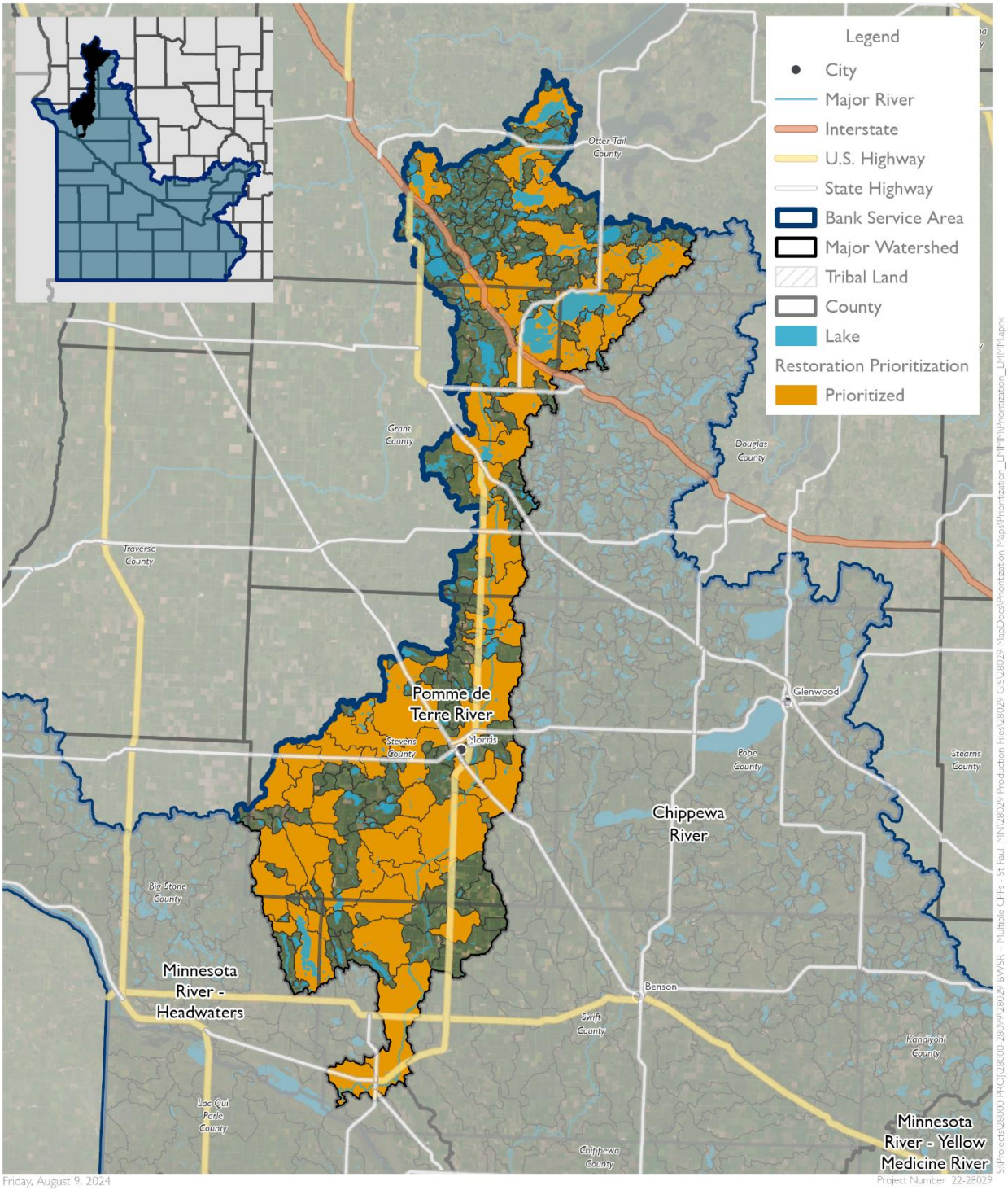
Source(s):
Orthophoto (ESRI, 2023)

ISG

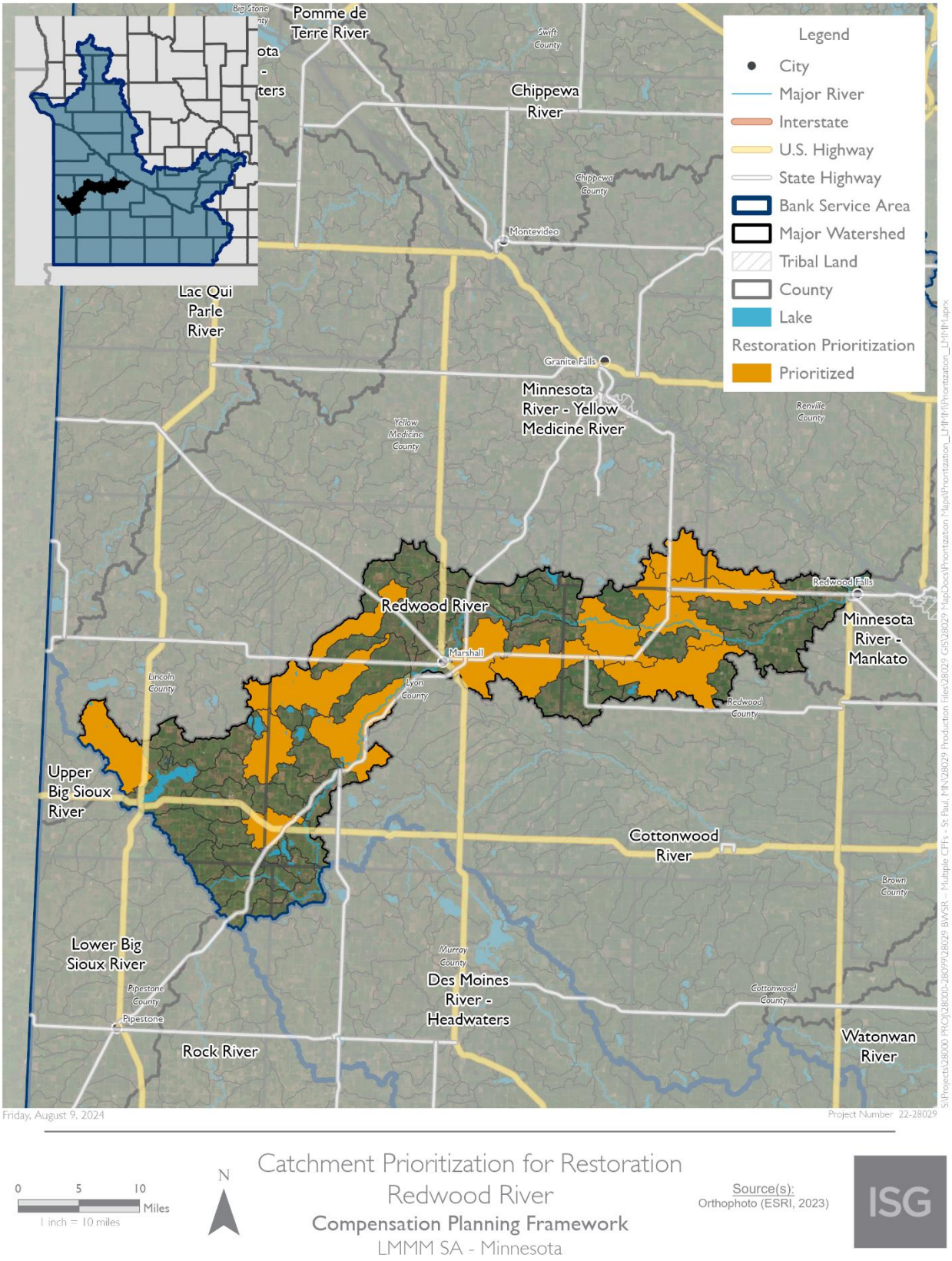
## Figure D-17. Final Restoration Catchment Prioritization – Minnesota River – Yellow Medicine/Hawk Creek Watershed



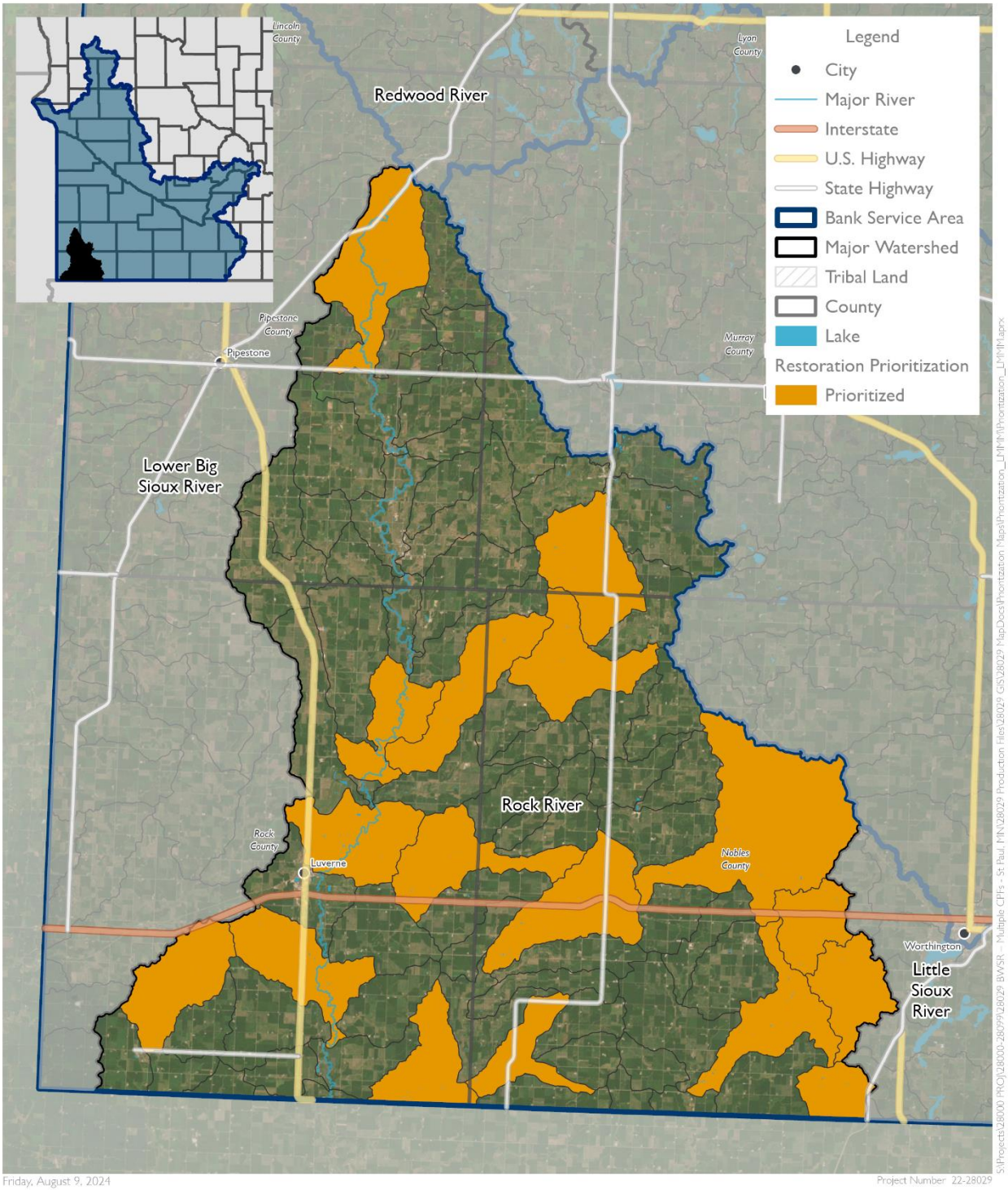
## Figure D-18. Final Restoration Catchment Prioritization – Pomme de Terre River Watershed



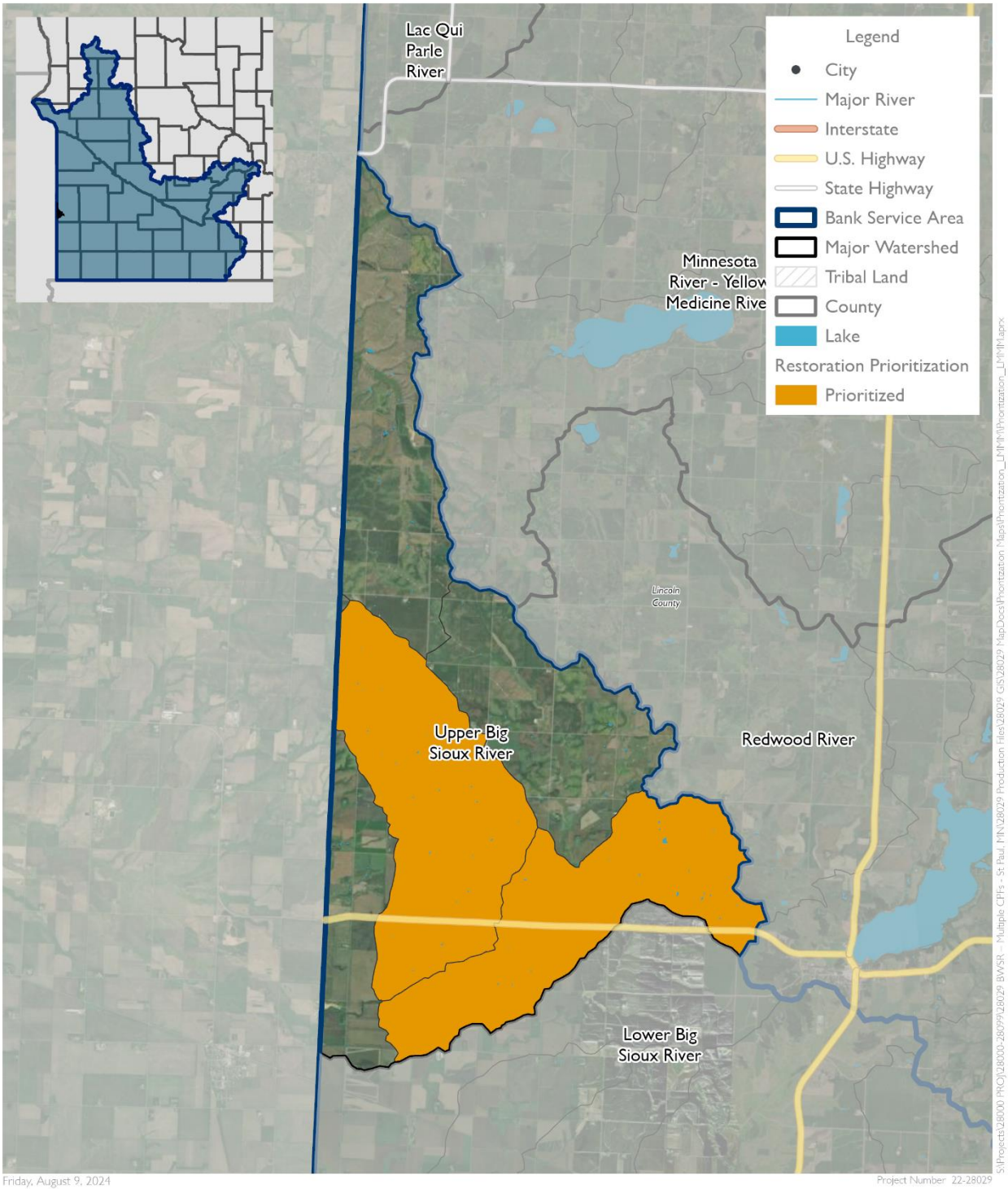
## Figure D-19. Final Restoration Catchment Prioritization – Redwood River Watershed



## Figure D-20. Final Restoration Catchment Prioritization – Rock River Watershed



## Figure D-22. Final Restoration Catchment Prioritization – Upper Big Sioux River Watershed



## Figure D-23. Final Restoration Catchment Prioritization – Watonwan River Watershed