



# Bank Service Area 6 Compensation Planning Framework

## Watershed Based Approach to Wetland Compensatory Mitigation

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## 1. INTRODUCTION

This Compensation Planning Framework (CPF) provides documentation for a watershed-based approach to compensatory wetland mitigation in the St. Croix Watershed in Minnesota, also referred to as Bank Service Area (BSA) 6, as part of the Minnesota In-Lieu Fee Program (ILF). 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

### ILF Service Area Overview

State and Federal wetland regulatory agencies have divided Minnesota into ten BSAs for the purpose of locating compensatory mitigation. These BSAs are watershed-based areas generally consistent with the four-digit U.S. Geological Survey HUC codified in the district's mitigation policy and Minnesota Wetland Conservation Act (WCA) rules.<sup>1</sup> In the event that BWSR and the Corps agree to modify BSA boundaries in the future, the ILF instrument and any affected CPFs would be modified to adhere to these program changes.

The focus of this CPF is BSA 6, which is the portion of the St. Croix River basin (HUC 0703) that lies within Minnesota. Most of the St. Croix River watershed is located north and east of the Twin Cities metropolitan area except for a relatively narrow portion as it approaches the confluence with the Mississippi River approximately 20-miles southeast of St. Paul, Minnesota at the border city of Prescott, Wisconsin. Although the St. Croix River watershed extends into the western portion of Wisconsin this CPF focuses exclusively on the areas within Minnesota (Figure B-1).

According to the National Land Cover Database (NLCD), in 2011 land cover in BSA 6 was primarily deciduous forests (31% of the BSA area). Cultivated crops cover approximately 9% of BSA 6, along with hay and pasture covering 16% (Table 2-1). About 6% of BSA 6 is developed. Land cover of water resources include wooded wetlands (17%), emergent herbaceous wetlands (10%), and open water (3%). The land use across remaining areas comprises 7% total and includes mixed forest, grassland, barren land, evergreen forest and shrub/scrub.

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<sup>1</sup> The agencies have subdivided several of the 4-digit HUCs in Minnesota and made other adjustments to BSA boundaries in the southern half of the state to more effectively manage the siting of mitigation in Minnesota.

To provide a more manageable and meaningful analysis, the majority of the information in this CPF is provided at the 8-digit HUC scale (also referred to as a “major watershed” in Minnesota). This level of analysis takes into account the difference in land use from north to south as well as the quality and quantity of aquatic resources present. The major watersheds in BSA 6 include, from north to south, the Upper St. Croix (HUC ID: 07030001), Kettle River (07030003), Snake River (07030004), and the Lower St. Croix (07030005). The Lower St. Croix is referred to as the Stillwater watershed in the remainder of this CPF. The major watersheds are shown in Figure B-1 and described in the following paragraphs.

<b>Table 2-1. Current Land Cover from the National Land Cover Database for BSA 6</b>	
<b>Landcover (NLCD 2011)</b>	<b>Percent Area</b>
Cultivated Crops	9.3%
Developed	5.5%
Emergent Herbaceous Wetlands	10.6%
Pasture/Hay	16.0%
Open Water	3.2%
Deciduous Forest	31.1%
Grassland/Herbaceous	2.3%
Woody Wetlands	17.4%
Mixed Forest	0.6%
Barren Land	0.0%
Shrub/Scrub	2.9%
Evergreen Forest	1.6%
Land cover data from the National Land Cover Database (NLCD) for BSA 6.	

## 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 and two of those provinces intersect BSA 6: Eastern Broadleaf Forest and Laurentian Mixed Forest.

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 and five are present in BSA 6. 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, six of the subsections are represented within BSA 6. 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 13% (approximately 295,000 acres) of the BSA 6. Outside of the BSA 6 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 two subsections of the Eastern Broadleaf Forest Province within BSA 6.

##### *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. About 130,000 acres of the Anoka Sand Plain is located within BSA 6, all within the Stillwater watershed. Wetlands in this subsection are often found in depressions on the sand plain where drainage is limited, and organic matter has accumulated (MnDNR, n.d.-a).

##### *St. Paul-Baldwin Plains and Moraines Subsection*

The St. Paul – Baldwin Plains and Moraines subsection covers approximately 165,000 acres within BSA 6, all within the Stillwater 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, 2024).

#### LAURENTIAN MIXED FOREST PROVINCE

The Laurentian Mixed Forest province covers 87% (approximately 1.95 million acres). This province has broad areas of conifer forest, mixed hardwoods and conifer forest, and conifer bogs and swamps. A unique characteristic of this landscape is the thin layer of glacial deposit which overlays bedrock. This leads to a landscape that is rugged, rocky, and has many lakes. Wetlands in this province appear in poorly drained depressions which accumulate organic matter (MnDNR, n.d.-c). There are four subsections of the Laurentian Mixed Forest Province within BSA 6.

### *North Shore Highlands Subsection*

The North Shore Highlands Subsection covers about 29,000 acres within BSA 6. This subsection occurs at the far northern edge of BSA 6. There is a very thin layer of glacial drift over the entire subsection. Bedrock is exposed across most of the area. Soils are clayey with some sandy loams and loams. Wetlands are not as extensive in this subsection but are still present. Streams and small lakes tend to be numerous (MnDNR, n.d.-e).

### *St. Louis Moraines Subsection*

The St. Louis Moraines Subsection covers about 86,000 acres within BSA 6. This subsection occurs at the far northern edge of BSA 6. This subsection is heavily forested and has many lakes and wetlands. There is substantial glacial drift which is very thick. The majority of the soils in this subsection are loamy. The remaining soils are excessively well-drained sand with minor amounts of poorly drained soil. Although the soils are mostly well-drained, there are a large number of lakes, rivers, and wetlands because the drainage network is poorly developed. Wetlands are scattered throughout the subsection and include both forested and emergent wetlands (MnDNR, n.d.-g).

### *Mille Lacs Uplands Subsection*

The Mille Lacs Uplands subsection covers approximately 1.85 million acres across all four watersheds in BSA 6. The major landforms in this subsection are ground moraines and drumlin fields. Soils are mostly loamy but are underlain by dense glacial till. This glacial till only allows for a small amount of water movement throughout the soil profile. The drainage pathways are young and undeveloped, resulting in many rivers and wetlands. Wetlands in this subsection occur as peatlands in the depressions between drumlin ridges (MnDNR, n.d.-d).

### *St. Croix Moraine Subsection*

The St. Croix Moraine subsection is relatively small and covers about 3,000 acres of the Lower St. Croix River – Stillwater watershed. This subsection is a narrow zone along the west side of the St. Croix River that generally extends from Interstate Park (near the city of Taylors Falls) north to Wild River State Park. This area includes steep slopes to the St. Croix River. The MnDNR's ecological classification system indicates that the information describing this subsection is being revised (MnDNR, n.d.-f).

Table 2-2. Area (Acres) of Ecological Subsections Broken Down by Each Major Watershed within BSA 6							
Province:	Eastern Broadleaf Forest Province		Laurentian Mixed Forest Province				Total
Section:	Minnesota + NE Iowa Morainal		Northern Superior Uplands	Northern Minnesota Drift + Lake Plains	Western Superior Uplands	Southern Superior Uplands	
Subsection:	Anoka Sand Plain	St. Paul – Baldwin Plains	North Shore Highlands	St. Louis Moraines	Mille Lacs Uplands	St. Croix Moraine	
Kettle River			29,379	86,095	557,450		<b>672,924</b>
Stillwater					643,542		<b>643,542</b>
Snake River	130,894	165,007			286,886	2,948	<b>585,735</b>
Upper St. Croix River					347,719		<b>347,719</b>
<b>BSA 6 Total</b>	<b>130,894</b>	<b>165,007</b>	<b>29,379</b>	<b>86,095</b>	<b>1,835,597</b>	<b>2,948</b>	<b>2,249,920</b>

## Major Watershed Descriptions

The purpose of each major watershed description is to provide context for future decisions about wetland mitigation site selection. There are four major watersheds included in BSA 6, and one of these watersheds (Upper St. Croix River) extends outside of BSA 6 into Wisconsin. For the Upper St. Croix River, this report describes the resources of the watershed located within BSA 6.

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 (1W1P) documents, where available. Mapping resources used were obtained 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 the previous section.

### KETTLE RIVER

The Kettle River major watershed (HUC 07030003) is located in the north half of BSA 6 and generally centered on the Kettle River. The Kettle River begins near the north edge of the watershed and joins the St Croix River near St Croix State Park. The watershed covers more than 1,050 square miles, and includes part of four counties: Aitkin, Carlton, Kanabec, and Pine<sup>2</sup>.

According to the Kettle River Watershed Context Report, this watershed is generally rural with an average population density of about 20 people per square mile (MnDNR 2017a). The total population is about 22,000 and most of the communities are located along the I-35 corridor. Larger communities in this watershed include Barnum, Hinckley, Moose Lake, and Sandstone.

Soils in the watershed are formed from glacial till plains, drumlins, moraines, and sand plains. Terraces have also formed near the St Croix River. Soil texture in the watershed is variable but tends to include sandy uplands and organic lowlands. The east side of the watershed includes an area of karst geology. Terrain within the watershed is variable with a mix of rolling hills (up to 15% slope) and wet low areas. Slopes range from 0 to approximately 12% with over three quarters of the land area having a slope of less than 3%. There is about 600 feet of elevation change across the watershed. About 36% of the watershed is mapped as having soils that formed under hydric conditions and most of this wet area is still present. Landcover is dominated by forest, wetlands and pasture/hay. Only about 4% of the watershed is in cultivated crop production.

According to data from the National Wetlands Inventory (NWI), wetlands cover 220,581 acres approximately 33% of the total 672,924 acre area of the Kettle River watershed.

Most (83%) of the watershed is within the Mille Lacs Uplands subsection, with the north edge falling within the St. Louis Moraines, and North Shore Highlands subsections. According to the Kettle River Climate Summary for

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<sup>2</sup> County level soil data was unavailable for Pine County, which covers approximately 40% of the BSA. The only soils data available for Pine County is the States Soil Geographic Database STATSGO, which is a general soil map at a scale with significant limitations for this study

Watersheds report, watershed precipitation ranges from 30 to 31 inches annually (MnDNR, 2019a). About 66% 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 about a 2-inch increase compared to historical records.

#### LOWER ST. CROIX RIVER-STILLWATER

The Lower St Croix River-Stillwater (Stillwater) major watershed (HUC 07030005) is located in the southern half of BSA 6 and follows the Minnesota state boundary. The watershed covers more than 900 square miles, and includes part of six counties: Anoka, Chisago, Isanti, Pine, Ramsey, and Washington.

According to the Stillwater Watershed Context Report, this watershed has numerous communities with an average population density of about 175 people per square mile (MnDNR, 2017b). The total population is about 160,000, which includes Afton, Bayport, Baytown, Chisago City, Cottage Grove, East Bethel, Forest Lake, Grant, Harris, Lake Elmo, Lake St. Croix Beach, Lakeland, Lindstrom, Linwood, Mahtomedi, Marine on St. Croix, North Branch, Oak Park Heights, Oakdale, Pine City, Rush City, Scandia, Shafer, Stacy, Stillwater, Taylors Falls, Woodbury, and Wyoming. I-35 runs through the north half of the watershed and US 8 connects Forest Lake with Chisago City, Lindstrom and Taylors Falls. I-94 also crosses the watershed between Lakeland and Lake Elmo.

Soils in the watershed are formed from glacial lake plains and moraines. Terraces have also formed near the St. Croix River. Soils in the watershed are sandy, with variable areas that include silt and clay. The south third of the watershed includes areas of karst geology. Terrain within the watershed is relatively level, with the exception steep bluffs along the St. Croix River. There is about 400 feet of elevation change across the watershed, with areas along the St. Croix River dropping more than 200 feet. About 35% of the watershed is mapped as having soils that formed under hydric conditions, and about 23% of the watershed is currently mapped as wetland. Landcover is dominated by forest, pasture/hay, cultivated crops, and wetlands. About 25% of the watershed is in cultivated crop production (mostly corn and soybeans), and about 10% of the watershed is developed.

According to data from the NWI, wetlands cover 102,844 acres, approximately 18% of the total 585,735-acre area of the Stillwater watershed. About half of the watershed is in the Mille Lacs Uplands subsection, the remaining falls within the St. Paul – Baldwin Plains and the Anoka Sand Plain subsections. According to the Lower St. Croix River Climate Summary for Watersheds report, watershed precipitation ranges from 31 to 33 inches annually (MnDNR, 2019b). About 68% of the rainfall occurs in the spring and summer. Average annual rainfall in the area is increasing, with the most recent 30-year average showing about a 2-inch increase compared to historical records.

#### SNAKE RIVER

The Snake River major watershed (HUC 07030004) is located in the center of BSA 6 and extends from just east of Mille Lacs Lake and joins the St. Croix River to the east of Pine City. The watershed covers more than 1,000 square miles, and includes part of six counties: Aitkin, Chisago, Isanti, Kanabec, Mille Lacs, and Pine.

According to the Snake River (St. Croix) Watershed Context Report, this watershed is fairly rural with average population density of about 30 people per square mile (MnDNR, 2017a). The total population is about 30,000.

Larger communities in this watershed include Brunswick, Hinckley, Mora, Ogilvie, and Pine City. I-35 crosses the east side of the watershed.

Soils in the watershed are formed from glacial till plains, drumlins, and moraines. Large areas of peatlands have also developed in Aikin County. Soils in the watershed area are very sandy and are mixed with silt. Terrain within the watershed is fairly level, with some local terrain associated with drumlins and moraines. There is about 500 feet of elevation change across the watershed. About 43% of the watershed is mapped as having soils that formed under hydric conditions, and about 30% of the watershed is currently mapped as wetland. Landcover is dominated by forest, pasture/hay, and wetlands. About 10% of the watershed is in cultivated crop production (mostly corn and soybeans), and about 4% of the watershed is developed.

According to data from the NWI, wetlands cover 217,478 acres, approximately 34% of the total 643,542-acre area of the Snake River watershed. The entire watershed is within the Mille Lacs Uplands subsection. According to the Snake River (St. Croix) Climate Summary for Watersheds report, watershed precipitation ranges from 30 to 31 inches annually (MnDNR, 2019c). About 67% of the rainfall occurs in the spring and summer. Average rainfall in the area is increasing, with the most recent 30-year average showing about a 2-inch increase compared to historical records.

#### UPPER ST. CROIX RIVER

The Upper St. Croix River major watershed (HUC 07030001) is located on the northeast side of BSA 6 and extends outside of the BSA into northwest Wisconsin. The entire watershed covers more than 2,000 square miles, with about 550 square miles within BSA 6.

According to the St. Croix River – Upper Watershed Context Report, this watershed is very rural with average population density of about 5 people per square mile (MnDNR, 2017c). The total population is about 3,000. Askov is this only incorporated city in this area. There are no interstates or US highways within this watershed.

Soils in the watershed area are very sandy and were formed primarily from glacial moraines, with smaller areas of till plain, sand plain, and St. Croix River terraces. Terrain within the watershed generally consists of small hills and large pockets of level lowlands. There is about 500 feet of elevation change across the watershed, and about a 100-foot change in elevation along the St. Croix River. A large area of karst geology is present along the northwest side of the watershed. About 41% of the watershed is mapped as having soils that formed under hydric conditions, and about 33% of the watershed is currently mapped as wetland. Landcover is dominated by forest and wetlands, with a small area of pasture/hay. Only about 2% of the watershed is developed.

According to data from the NWI, wetlands cover 111,908 acres, approximately 32% of the total 347,719-acre area of the Upper St. Croix River watershed. The entire watershed is within the Mille Lacs Uplands subsection. According to the Upper St. Croix River Climate Summary for Watersheds report, annual watershed precipitation is about 31 inches (MnDNR, 2019d). About 66% of the rainfall occurs in the spring and summer. Average rainfall in the area is increasing, with the most recent 30-year average showing a 1-to-2-inch increase compared to historical records.

### **3. BASELINE CONDITIONS**

The baseline condition section of this CPF is intended to satisfy the requirement in 33 CFR 332. 8(c)(2)(iv) for an analysis of current aquatic resource conditions in the service area. The approach utilized in this document includes an analysis of wetlands, lakes, streams, and water quality using readily available information compiled by state and federal agencies. We have also included information on land use, vegetation cover, and permitting history has also been included to give a well-rounded understanding of the current aquatic resource conditions. These data also provide some insight on trends and potential future conditions throughout the watershed.

#### **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 Table 3-1. 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. Pre-settlement data indicates that the southern half of BSA 6 was generally a mix of prairie, wet prairie, and deciduous forest (oak and aspen). The northern half was a mix of swamps, conifer bogs, coniferous forests, aspen, and birch.

Table 3-1. Summary of Pre-Settlement Vegetation for the BSA 6

Category	Water			Wetland		Forest				Prairie			
	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	
<b>Major Watershed</b>													
Kettle River	2%	2%	46%	9%	0%	11%	27%	0%	0%	0%	0%	2%	
Stillwater	7%	2%	20%	1%	0%	0%	35%	1%	4%	0%	0%	30%	
Snake River	2%	2%	38%	5%	0%	7%	46%	0%	0%	0%	0%	1%	
Upper St. Croix River	1%	2%	52%	8%	0%	7%	27%	0%	1%	0%	0%	3%	
<b>Category Total</b>	3%	40%		47%					10%				
<b>BSA 6 Total</b>	3%	2%	38%	6%	0%	6%	35%	0%	1%	0%	0%	9%	

## Wetlands

The current extent of wetlands in BSA 6 is based on the 1980-1986 National Wetland Inventory (NWI) provided by the MnDNR. BSA 6 has approximately 652,812 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 29% of the BSA 6 is palustrine wetlands, which is higher than the statewide percentage of 20%. Emergent wetlands make up the majority of wetlands within BSA 6 (217,456 acres; 35% of wetlands). Forested wetlands are second, comprising just over 216,000 acres and 34% of wetlands. Shrub-scrub wetlands are a close third with 209,982 acres (33%). Unconsolidated bottom, Aquatic bed, and Unconsolidated Shore are the least abundant types of wetlands, spanning a combined 9,184 acres (1.5%).

Within the watersheds, the Upper St. Croix River, Snake, and Kettle major watersheds are approximately one third wetlands while the Stillwater major watershed is 18% wetland. The three northernmost watersheds also have more forested and scrub shrub wetlands than the Stillwater watershed. Table 3-2 includes exact numbers and a comparison between BSA 6 and statewide.

Table 3-2. Acres of Wetland								
Major Watershed	Watershed Acres	Palustrine					Total Wetland Acres	Percent Watershed Wetland
		Emergent	Forested	Scrub-Shrub	UB*	AB+US**		
Kettle River	672,924	41,544	94,165	83,118	1,742	13	220,581	33%
Stillwater	585,735	54,133	24,153	19,964	4,496	98	102,844	18%
Snake River	643,542	96,520	55,372	63,403	2,179	5	217,478	34%
Upper St. Croix River	347,719	25,259	42,500	43,498	646	5	111,908	32%
<b>BSA 6 Total</b>	<b>2,249,920</b>	<b>217,456</b>	<b>216,190</b>	<b>209,982</b>	<b>9,064</b>	<b>121</b>	<b>652,812</b>	<b>29%</b>
<b>Statewide</b>	<b>55,643,000</b>	<b>3,497,216</b>	<b>4,017,805</b>	<b>3,272,710</b>	<b>228,021</b>	<b>63,816</b>	<b>11,079,568</b>	<b>20%</b>

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

The condition of wetlands in BSA 6 was assessed by examining one factor that has a pronounced effect on wetland quality throughout Minnesota, the hydrologic alteration via drainage. Since drainage tile maps are not publicly available, the analysis was focused on the presence of drainage ditches. To determine the acreage of ditched wetlands within BSA 6, wetlands with the “d” (ditched) modifier in the NWI were identified and summed for each watershed. While this likely underestimates the number of wetlands affected by drainage (because tile drainage is not represented and because of the age of the NWI data used for the analysis) it provides a baseline for understanding where wetland functions have been impacted by hydrologic alteration throughout the BSA. The catchments that have the greatest area of wetlands affected by drainage, and potentially, the greatest functional loss as a result, are in the northern region of the Stillwater and southeastern region of the Snake River watersheds. A summary of the ditched wetlands acreage is shown in Table 3-3.

Table 3-3. Summary of Ditched Wetlands by Watershed for BSA 6			
Watershed	Wetland (acres)	Ditched Wetlands (acres)	Percent Ditched Wetlands
Upper St. Croix River	111,908	4,344	3.9%
Snake	186,050	34,206	18.4%
Kettle	220,582	11,909	5.4%
Stillwater	102,844	31,696	30.85
<b>BSA</b>	<b>621,384</b>	<b>82,155</b>	<b>13.2%</b>

### Lakes

According to the MnDNR Hydrography data (Lakes and Open Water data), BSA 6 has approximately 62,000 acres of lakes and more than half of this acreage is in the Lower St. Croix River – Stillwater major watershed (Figure B-5). About 3% of BSA 6 is lakes. The area of lakes in all watersheds can be found in Table 3-4.

There are at least nine lakes in BSA 6 that are more than 1,000 acres. Six of these large lakes are located in the Stillwater major watershed (Big Marine, Coon, East Rush, Forest, Green, and West Rush), two are in the Snake River major watershed (Knife and Pokegama) and one is in the Kettle River major watershed (Sturgeon).

Major Watershed	Watershed Acres	Lake Acres <sup>1</sup>	Lake Area %
Kettle River	672,924	12,330	2%
Stillwater	585,735	38,163	7%
Snake River	643,542	9,571	<1%
Upper St. Croix River	347,719	2,152	<1%
<b>BSA 6 Total</b>	<b>2,249,920</b>	<b>62,216</b>	<b>3%</b>
<sup>1</sup> 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 Table 3-5. 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 BSA 6. The majority of watercourses within BSA 6 are characterized as natural-perennial (35%) with an average watercourse density of 1.1 miles of watercourse per square mile of watershed (Figure B-6). The Kettle River watershed has the highest number of miles of watercourses (1,132 miles), with the majority in the Natural-Intermittent category. The Lower St. Croix River – Stillwater major watershed has the highest watercourse density at 1.2.

Major Watershed	Drainage Ditch	Natural-Unknown Flow Regime	Natural-Intermittent	Natural-Perennial	Total	*Watercourse Density
Kettle River	135	206	397	395	<b>1,132</b>	<b>1.1</b>
Stillwater	163	266	398	260	<b>1,087</b>	<b>1.2</b>
Snake River	210	200	326	296	<b>1,032</b>	<b>1.0</b>
Upper St. Croix River	3	71	98	376	<b>548</b>	<b>1.0</b>
<b>BSA 6 Total</b>	<b>511</b>	<b>744</b>	<b>1,218</b>	<b>1,327</b>	<b>3,800</b>	<b>1.1</b>
*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 placed 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).

Across BSA 6, most of the watercourses are categorized as altered (Figure B-7). Of the altered watercourses, the Lower St. Croix - Stillwater watershed has the most (443 miles) followed by the Snake River watershed (365 miles). The miles of altered watercourses for each watershed can be found in Table 3-6.

<b>Major Watershed</b>	<b>Altered</b>	<b>Impoundment</b>	<b>Natural</b>	<b>No Definable Channel</b>
Kettle River	257	14	708	153
Stillwater	443	10	359	270
Snake River	365	55	503	111
Upper St. Croix River	71	4	434	40
<b>BSA 6 Total</b>	<b>1,136</b>	<b>84</b>	<b>2,005</b>	<b>574</b>

Data from the MPCA Altered Watercourses Project updated in 2019

The Upper St. Croix River and Kettle River watersheds have a higher ratio of natural to altered streams and a small amount affected by impoundments. The Snake River major watershed contains a higher number of altered watercourses than the Upper St. Croix River and Kettle as well as the most watercourse length affected by impoundments. Finally, the Stillwater major watershed has more mapped altered water courses than natural ones and also a dramatically higher number of watercourses where there is no definable channel. There is a clear north-south trend in BSA 6 with respect to the extent of altered courses with a much greater occurrence of alteration in the southern major watersheds of BSA 6 relative to the northern ones. Comparing the percent of altered watercourses per total stream miles in each watershed and statewide shows that the Upper St. Croix River and Kettle River major watersheds are below the state average at 13% and 23% respectively. The Snake major watershed (35%) is just below the 39% state average while the Stillwater is just above the state average at 41%. The average for the entire BSA is 30%, which is also below the state average.

## Water Quality

Water quality in BSA 6 was assessed using the MPCA's 303(d) impaired waters list. Data for lakes, streams, and wetlands were assessed based upon 2016 impairment listings. Impairment listings for all impairment

parameters were included in the analysis summarized within this analysis. Lakes and streams that were assessed and located partially or wholly within tribal lands are included in this analysis.

Across BSA 6, 169 lakes were assessed, and 57 lakes were found to be impaired (Figure B-8). None of these impaired lakes are located on tribal land. The Snake River watershed had the highest percentage of its lakes impaired (67%), while the Stillwater watershed had the highest number of impaired lakes (64). The Kettle River watershed had 14 impaired lakes, and the Upper St Croix River watershed had one impaired lake. Table 3-7 includes assessed and impaired lake area and percentage for each watershed.

Major Watershed	Assessed		Impaired		% Impaired Based on Lake Count
	Acres	Count	Acres	Count	
Kettle River	7,256	27	5,422	14	52%
Stillwater	27,614	131	26,772	64	49%
Snake River	5,587	9	5,105	6	67%
Upper St. Croix River	116	2	73	1	50%
<b>BSA 6 Total</b>	<b>40,573</b>	<b>169</b>	<b>37,372</b>	<b>57</b>	<b>34%</b>
Data includes lakes wholly and partially on tribal lands					

Regarding streams, there were 275 individual stream reaches assessed across BSA 6 and 92 of those reaches were found to be impaired (33% impaired; Figure B-9). The Stillwater watershed had the greatest number and miles of impaired stream reaches. The Upper St. Croix River watershed had the least number and miles of impaired stream reaches. See Table 3-8 for all assessed and impaired stream miles and percentages in each watershed.

Major Watershed	Assessed		Impaired		% Impaired Based on Stream Count
	Miles	Count*	Miles	Count*	
Kettle River	293	41	118	17	41%
Stillwater	438	131	275	42	32%
Snake River	426	77	259	23	30%
Upper St. Croix River	69	26	55	10	38%
<b>BSA 6 Total</b>	<b>1426</b>	<b>275</b>	<b>707</b>	<b>92</b>	<b>33%</b>
*Count is the number of stream reaches not individual streams					
Data includes streams wholly and partially on tribal lands					

## Land Cover

The 2011 National Land Cover Dataset (NLCD) was used to analyze the current land cover across BSA 6. 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 3-9 includes the landcover classification breakdown within each individual watershed.

The majority of land cover in BSA 6 is classified as *forests* (33%) with the second highest category being *wetlands* at 28% (Table 3-9). Although the wetland area as mapped in the NWI and the NLCD are similar (29% and 28% of BSA 6 respectively), the difference is a result of different mapping methods, scales, and accuracy. On the watershed level, *Forest* is the highest land cover in the Snake River and Upper St. Croix River watershed while, for the Stillwater and Kettle River watershed *Agriculture* and *Wetlands* are the dominant land cover respectively (Figure B-10).

Major Watershed	Agriculture	Barren	Developed	Forest	Grassland	Water	Wetlands
Kettle River	4.5%	0.01%	1.2%	10.1%	1.8%	0.8%	11.5%
Stillwater	11.5%	0.01%	2.8%	5.5%	1.4%	1.7%	3.1%
Snake River	7.9%	0.01%	1.2%	10.1%	1.2%	0.5%	7.7%
Upper St. Croix River	1.4%	0.01%	0.3%	7.5%	0.8%	0.2%	5.3%
<b>BSA 6 Total</b>	<b>25.3%</b>	<b>0.04%</b>	<b>5.5%</b>	<b>33.2%</b>	<b>5.2%</b>	<b>3.2%</b>	<b>27.5%</b>

Data from the National Land Cover Database. Categories simplified based on 2011 NLCD categories

## Perennial Cover

In addition to analyzing land cover, perennial cover was evaluated using the 2011 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, about 18% of land (1.8 million acres) across BSA 6 is in non-perennial coverage. 8.2 million acres are in *Perennial* cover compared to 1.8 million acres in *non-perennial* cover. Perennial cover ranges from 33% in the Stillwater watershed to greater than 85% in the Snake River, Kettle and Upper St. Croix River watersheds.

Major Watershed	Perennial	Non-Perennial	Total
Kettle River	2,755,830	270,000	<b>3,025,830</b>
Stillwater	1,575,123	1,056,996	<b>2,632,119</b>
Snake River	2,480,306	412,680	<b>2,892,986</b>
Upper St. Croix River	1,481,205	83,030	<b>1,564,235</b>
<b>BSA 6 Total</b>	<b>8,292,464</b>	<b>1,822,706</b>	

Based on the 2011 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).

A large amount of BSA 6 has been surveyed for biodiversity significance, especially in the north half of the BSA (Figure B-12). Most of the mapped biodiversity areas in BSA are ranked as *Moderate*, *High*, or *Outstanding* quality. Acres and percentages for each watershed in BSA 6 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	
Kettle River	38,877.62	3.3%	322,616.2	27.3%	83,508.34	7.1%	33,561.38	2.8%	<b>478,563.5</b>	<b>40.5%</b>
Stillwater	8,040.24	0.7%	32,983.06	2.8%	15,269.11	1.3%	42,492.91	3.6%	<b>98,785.32</b>	<b>8.4%</b>
Snake River	54,105.37	4.6%	131,186.8	11.1%	99,903.13	8.5%	29,102.09	2.5%	<b>314,297.4</b>	<b>26.6%</b>
Upper St. Croix River	3,675.3	0.3%	176,205	14.9%	50,123.02	4.3%	58,971.15	5.0%	<b>288,974.5</b>	<b>24.5%</b>
<b>BSA 6 Total</b>	<b>104,698.53</b>	<b>8.9%</b>	<b>662,991.06</b>	<b>56.2%</b>	<b>248,803.6</b>	<b>21.1%</b>	<b>164,127.53</b>	<b>13.9%</b>	<b>1,180,620.72</b>	
Data updated 2021										

## Sensitive Species and Plant Communities

Sensitive species and plant communities are those that have been recognized by natural resource management agencies as unique to a geographic area or have been determined to be in decline. These types of resources present both opportunities and constraints for CPF development because watershed scale planning can benefit these species/communities where the goals of the CPF line up with the needs of a particular species or habitat. Information on the presence of federally recognized sensitive species was obtained from the U.S. Fish and Wildlife Service's Environmental Conservation Online System reports for the counties in BSA 6 (Table 3-12). State listed sensitive species information (endangered, threatened, special concern, and those in greatest need

of conservation) was obtained from the DNR's Native Plant Community (NPC) map and Conservation status rank information.

Table 3-12. Federally Listed Threatened and Endangered Species Identified in BSA 6			
Species	Status	Location in BSA 6	Habitat
Canada lynx ( <i>Lynx canadensis</i> )	Threatened (fed)	Carlton, Pine	Northern forested areas
Gray wolf ( <i>Canis lupus</i> )	Threatened (fed)	Carlton, Pine	Northern forested areas
Northern long-eared bat ( <i>Myotis septentrionalis</i> )	Threatened (fed)	Throughout BSA 6	Hibernates in caves and mines – swarming in surrounding wooded areas in autumn. Roosts and forages in upland forests during spring and summer.
Rusty patched bumble bee ( <i>Bombus affinis</i> )	Endangered (fed)	Chisago, Washington	Grasslands with flowering plants from April through October, underground and abandoned rodent cavities or clumps of grasses above ground as nesting sites, and undisturbed soil for hibernating queens to overwinter.
Higgins eye pearl mussel ( <i>Lampsilis higginsii</i> )	Endangered (fed)	Chisago, Washington	Mississippi and St. Croix Rivers
Snuffbox ( <i>Epioblasma triquetra</i> )	Endangered (fed)	Chisago, Washington	St. Croix River
Spectaclecase ( <i>Cumberlandia monodonta</i> )	Endangered (fed)	Chisago, Pine, Washington	Mississippi and St. Croix Rivers
Winged mapleleaf ( <i>Quadrula fragosa</i> )	Endangered (fed)	Chisago, Washington	Mississippi and St. Croix Rivers

Outside of the mussel species that are found in the St. Croix River, none of the federally identified species are associated primarily with aquatic resources and are not likely to be found in wetlands or in areas associated with wetland restoration projects. Canada lynx, gray wolf, and northern long-eared bat may utilize wetlands (particularly forested wetlands) at times during the year, but these species are most typically found in upland habitats.

Identification of sensitive plant communities was based on Minnesota's Native Plant Community Classification (Version 2.0). The classification is hierarchical and based strongly on plant species composition developed through an analysis of extensive field data collected from forests, prairies, wetlands, and other habitats. The NPC types and subtypes recognized in Minnesota have been assigned conservation status ranks (S-ranks) that reflect the risk of elimination of the community from Minnesota.

There are five ranks:

S1 = critically imperiled

S2 = imperiled

S3 = vulnerable to extirpation

S4 = apparently secure; uncommon but not rare

S5 = secure, common, widespread, and abundant

A range in rank (for example, S1S2) indicates there is uncertainty in conservation status but it falls within a given range. Possible S-ranks (for example, S1 or S2) are listed for NPC subtypes based on the S-rank of the NPC type.

These ranks are determined using methodology developed by the conservation organization NatureServe and its member natural heritage programs in North America. S-ranks were assigned to Minnesota's NPC types and subtypes based on information compiled by DNR plant ecologists on: 1) geographic range or extent; 2) area of range occupied; 3) number of occurrences; 4) number of good occurrences, or percent area of occurrences with good viability and ecological integrity; 5) environmental specificity; 6) long-term trend; 7) short-term trend; 8) scope and severity of major threats; and 9) intrinsic vulnerability.

The analysis of NPC types for this CPF focused on the subtypes assigned a ranking of S3, S2, or S1. There are 37,853 acres of native plant communities that have been assigned one of these conservation status ranks in BSA 6. The Stillwater watershed has the most total acres designated (14,971 acres) followed by the Upper St. Croix (10,735 acres), Snake River (6,779 acres), and the Kettle River (5,368 acres). The Stillwater watershed also had the largest amount of wetland NPCs designated S1, S2, or S3 with 8,797 acres attributable primarily to the *Black Ash - Yellow Birch - Red Maple - Basswood Swamp* (WFn55b), *Black Ash - (Red Maple) Seepage Swamp* (WFs57a), and *Southern Tamarack Swamp* (FPs63a). As observed with other BSA characteristics there is a north/south gradient with respect to the types of NPCs identified in BSA 6 and their distribution. Several of the NPCs identified in the Stillwater major watershed are at the northern edge of their range and are not found in the more northern major watersheds in BSA 6.

Of the eighteen NPCs identified as either S1, S2, or S3 only one has a designation containing S1, the *Black Ash - (Red Maple) Seepage Swamp* (WFs57a) with a designation of S1S2. This plant community is found throughout the BSA but is most common in the Stillwater major watershed. It occurs on strongly rolling to steeply dissected terrain where there is sufficient relief for groundwater to upwell or discharge laterally in springs or broad zones. Most often these seepage areas are present on level alluvial terraces below steep slopes with exposed bedrock aquifers; less often, they develop in regions of deep glacial drift where groundwater flows through highly permeable aquifers and emerges at the ground surface. In all settings, springheads and rivulets with continuously flowing cold groundwater are evident. A summary of the wetland NPCs with S1, S2, or S3 rankings is provided in Table 3-13. Figure B-13 shows the location of these areas.

**Table 3-13. Native Plant Community Summary for Wetland Subtypes**

<b>Native Plant Community</b>	<b>S-rank</b>	<b>Upper St. Croix River</b>	<b>Kettle</b>	<b>Snake</b>	<b>Stillwater</b>
APn91b - Graminoid Poor Fen (Basin)	S3	-	180.0	17.1	-
FFn57a - Black Ash - Silver Maple Terrace Forest	S3	373.1	426.7	802.0	-
FFn67a - Silver Maple - (Sensitive Fern) Floodplain Forest	S3	382.7	65.8	149.1	233.3
FPn72a - Rich Tamarack Swamp (East central)	S3	164.3	282.1	1,111.0	-
MRn83a - Cattail - Sedge Marsh (Northern)	S2	-	-	54.8	-
WFn55b - Black Ash - Yellow Birch - Red Maple - Basswood Swamp (East central)	S3	1,554.0	221.0	2,431.2	4,057.5
WFs57a - Black Ash - (Red Maple) Seepage Swamp	S1S2	122.6	20.3	35.6	1,358.0
OPn91b - Graminoid Rich Fen (Water Track)	S2 or S3	-	82.2	-	-
WFn74a - Alder - (Red Currant - Meadow-Rue) Swamp	S3	265.8	167.8	-	-
WMs83a - Seepage Meadow/Carr	S3	-	4.2	-	5.7
WFn53b - Lowland White Cedar Forest (Northern)	S3	30.6	-	-	-
APn90b - Graminoid Bog	S2 or S3 or S4	-	-	-	4.7
FFs59c - Elm - Ash - Basswood Terrace Forest	S2	-	-	-	77.1
FFs68a - Silver Maple - (Virginia Creeper) Floodplain Forest	S3	-	-	-	882.6
FPs63a - Tamarack Swamp (Southern)	S3	-	-	-	2,037.4
MRn93b - Spikerush - Bur Reed Marsh (Northern)	S2	-	-	-	126.9
WMs83a1 - Seepage Meadow/Carr, Tussock Sedge Subtype	S3	-	-	-	11.2
WPs54b - Wet Prairie (Southern)	S2	-	-	-	2.2
<b>TOTAL ACRES WITH S1, S2, or S3 RANKING (WETLAND and UPLAND)</b>		<b>10,735.1</b>	<b>5,368.0</b>	<b>6,778.7</b>	<b>14,971.2</b>
<b>TOTAL WETLAND ACRES WITH S1, S2, or S3 RANKING</b>		<b>2,893.0</b>	<b>1,450.1</b>	<b>4,600.8</b>	<b>8,796.7</b>
WETLAND ACRES AS S1		0	0	0	0
WETLAND ACRES AS S1S2		122.6	20.3	35.6	1,358.0
WETLAND ACRES AS S2		0	0	54.8	206.2
WETLAND ACRES AS S2 OR S3		0	82.2	0	0
WETLAND ACRES AS S3		2,770.4	1,347.6	4,510.4	7,227.8
WETLAND ACRES AS S2 OR S3 OR S4		0	0	0	4.7

## Permitting Analysis

Permits issued under the U.S. Army Corps of Engineers (USACE) St. Paul District Clean Water Act Section 404 permitting program for a five-year period (2011-2016) was reviewed. This review focused on determining the work types that most commonly result in regulated impacts to aquatic resources and identifying permit intensity per major watershed. The review also assessed the number of impacts authorized by Corps' permits during this period. The work type categories in the Corps' permitting data were variable with a high number of classes representing similar types of work. For ease of analysis and illustration, the types were consolidated into eight

major types that include: *transportation, structures, bank stabilization, mitigation, mining, energy generation, dredging, and development*. From 2011-2016, 205 permit actions were processed within BSA 6 (Table 3-14).

<b>Work Type</b>	<b>Permit Amount</b>
Transportation	85
Structure	57
Bank Stabilization	15
Mitigation	15
Mining	3
Energy Generation	4
Dredging	3
Development	23
<b>Total</b>	<b>205</b>

Since permit activity is often closely correlated with population density and transportation infrastructure, the permit data was plotted with these two data sets (Figure B-14). The areas of highest population density in BSA 6 are home to the majority of the permitting actions. The Stillwater watershed, with the highest population density and the most miles of major roadways, has the highest number of permit actions (96) which amounts to 47% of the total number of permits issued during this time period. The Kettle River had the second most permit actions (64), or 31% of the total. Permit actions were clustered primarily around the cities of Moose Lake and Sandstone where Interstate 35 intersects with major county arterial roads. The Snake and Upper St. Croix River watersheds show lesser amounts of permit activity concentrated near major roadways and cities (Figure B-14).

Permit location and impact data for BSA 6 was also analyzed at the catchment scale to provide more detailed information regarding the location and degree of regulated impacts (Figures B-15 & B-16). The Stillwater watershed's southern region has the highest number of permits and impact. The Snake River watershed does not have any catchments with a high concentration of permit actions, however, there are several where impact amounts are at the higher end of the scale for BSA 6. In the north portion of BSA 6, the concentration of permits in the Moose Lake area translated into higher amounts of impact relative to other catchments. Very few impacts were authorized by Section 404 permits in the Upper St. Croix River watershed Table 3-15.

<b>Table 3-15. Acres of Permitted Wetland Impact</b>	
<b>Major Watershed</b>	<b>Acres of Impact</b>
Kettle River	20784
Stillwater	14.385
Snake River	21.048
Upper St. Croix River	0.065
<b>BSA 6 Total</b>	<b>20,819.498</b>
Data from 2017 to 2021 provided by the U.S. Army Corps of Engineers	

### Summary of Baseline Conditions

The baseline condition assessment revealed a significant difference in the quantity and quality of aquatic resources generally following a north to south gradient. In the north, both upland and aquatic resources are more intact, there is less anthropogenic disturbance, less fragmentation and higher quality resources (assuming that resource quality can be inferred from watershed landscape scale assessments of water quality, number of ditched wetlands, and land use patterns). In the central portion of the watershed, forested lands give way to cropped land and pasture along with more concentrated developed areas around transportation corridors. The degree of disturbance evidenced by ditched wetlands and altered courses is significantly greater in the southern Kettle River major watershed and the Snake River major watershed. The southernmost major watershed in BSA 6, the Stillwater, is the most degraded of the four and shows the adverse effects of being located on the northeastern edge of the Twin Cities metropolitan area. The Stillwater major watershed showed more evidence of impact than the other major watersheds in every factor evaluated in the baseline condition assessment. However, it still contains a significant number of aquatic resources with respect to lakes, watercourses, and the extent of wetlands remaining.

## 4. CUMULATIVE IMPACT ANALYSIS

### Wetland Loss

One of the most frequently utilized metrics for assessing watershed health is the amount of loss or degradation of aquatic resources over a specified period of time. Most often these analyses are conducted with the baseline condition established as the time of European settlement or slightly thereafter depending on the availability of information. With respect to wetlands, this type of analysis is frequently accomplished by comparing the extent of hydric soils in the watershed to the most current wetland mapping available. Unfortunately, this method is not accurate for the St. Croix watershed because the county level soils data for Pine County, which is 40% of the BSA, is not complete. Without the county level data, a less refined state level data set must be used which increases the uncertainty associated with this analysis, particularly for major watersheds that include large portions of Pine County (Upper St. Croix River, Kettle, and Snake). The analysis was completed by first estimating

<b>Watershed</b>	<b>Watershed Size (acres)</b>	<b>Hydric Soils (acres)</b>	<b>Wetland Loss (acres)</b>	<b>Wetland Loss (%)</b>
Upper St. Croix River	347,719	108,384	60,945	56.2
Snake River	643,542	215,118	77,081	35.8
Kettle River	672,924	171,643	45,496	26.5
Stillwater	585,735	145,966	68,771	47.1
<b>BSA</b>	<b>2,249,920</b>	<b>641,111</b>	<b>252,293</b>	<b>39.4</b>

the pre-settlement extent of wetlands by selecting soil map unit polygons that had an 80% or greater hydric soil rating if using the county level data or if identified as hydric for the state level data. Next, the current extent of wetlands in the BSA was estimated by using the palustrine class from the 1980-1986 NWI. The two datasets were then combined using GIS and the overlap between the NWI and the mapped soil polygons was identified and eliminated. The remaining soil polygons were then identified as areas of wetland loss and saved as a unique file. The results of this analysis are provided in Table 4-1.

The effects of the state level soil data are clearly evident in Table 4-1. The Upper St. Croix River watershed, which has been shown to be the least disturbed and generally most intact watershed based on the factors examined in this CPF, shows the highest amount of wetland loss at 56.2%. Based on agency experience and familiarity with this area, we are confident this number greatly overestimates the amount of loss in this watershed. Since the Upper St. Croix River watershed is located entirely within Pine County these results are not unexpected. The results for the Kettle River watershed are also likely skewed towards more loss than actually has occurred since 53% of this watershed is located in Pine County. The estimates for the Snake and Stillwater watersheds are more in line with what was expected based on agency experience although there is most likely a measurable influence from the soils data on the result for the Snake River watershed.

In light of the obvious shortcomings of the wetland loss estimate, other sources of information were reviewed to further assess the degree to which wetlands have been removed from the landscape in BSA 6. In 1984, the University of Minnesota Center for Urban and Regional Affairs published a document that estimated the pre-settlement and, at the time, current extent of wetlands in each county of the state (referred to as the Anderson and Craig report) (Anderson & Craig, 1984). This report was used to establish the pre-settlement areas that are incorporated into certain operational aspects of the Minnesota Wetland Conservation Act. Although the report is nearly thirty-five years old, it does provide meaningful information about the extent of wetlands in this BSA at the time the report was authored. The wetland loss data in the report was provided on a county basis which then required some manipulation to present on a watershed basis. To accomplish this, the area within each major watershed was broken down by county and the amount of pre-settlement and current wetland acres in these areas was derived based on the information in Anderson and Craig report. This required an assumption that the pre-settlement and current wetlands reported in Anderson and Craig were uniformly distributed across each county, which is likely not the case. The results of this analysis are provided in Table 4-2.

<b>Table 4-2. Calculated Wetland Loss Using Anderson and Craig 1985 for BSA 6</b>				
<b>Watershed</b>	<b>Watershed Size (acres)</b>	<b>Pre-settlement Wetlands (acres)</b>	<b>Wetland Loss (acres)</b>	<b>Wetland Loss (%)</b>
Upper St. Croix River	347,719	116,668	9,241	8
Snake River	643,542	196,017	20,026	10
Kettle River	672,924	215,835	16,998	8
Stillwater	585,735	107,916	33,527	31
<b>BSA</b>	<b>2,249,920</b>	<b>636,436</b>	<b>79,792</b>	<b>13</b>

The loss analysis based on the Anderson and Craig report suggests that overall, the BSA has experienced approximately 13% loss of wetland acreage from the pre-settlement period through approximately 1980. The highest losses within a major watershed were in the Stillwater watershed, which is what is expected based on the population density and degree of landscape alteration in that area. This assessment also suggests that the watersheds that are located the furthest north, the Upper St. Croix River and Kettle River watersheds, have the least amount of loss which is also what is expected based on the other data evaluated in this CPF.

The loss calculations in Table 4-1 are very different from those in Table 4-2. Each has limitations based on the source(s) of the data and assumptions that were made in order to produce an estimate. Since cumulative loss is an important consideration in assessing watershed health and for strategic siting of mitigation sites additional analyses were conducted to attempt to substantiate, to some degree, one of the wetland loss estimates.

Wetland loss generally correlates well with the amount of landscape disturbance from urban development and conversion to agricultural use, in particular row cropping. Table 4-3 presents the results of the wetland loss assessments in the context of land cover. The fifteen cover classes in the 2011 NLCD were consolidated into the five categories shown in the table to differentiate between land uses that could result in wetland loss and those typically do not. The categories generally associated with activities that result in wetland loss are shaded gray for illustration purposes. Assuming the correlation between land use type and wetland loss is valid, the data in the table supports the loss estimates based on Anderson and Craig over those obtained from the estimate relying on soil mapping and the NWI. The increase in wetland loss between watersheds in Anderson and Craig moves in the same direction as the increase in the amount of land classified as developed or in agricultural use. Therefore, these estimates appear to be a more reliable although it has to be understood that the data from which it was obtained is dated and would not be an accurate assessment of actual wetland loss based on watershed conditions in 2018. However, the land use cover data does support a conclusion that wetland loss in BSA 6 is highest in the Stillwater watershed, decreases to some degree in the Snake watershed, and is even less in the Kettle and Upper St. Croix River watersheds.

Table 4-3. Wetland Loss Determinations and Land Cover Classifications for BSA 6							
Watershed	Wetland Loss Method		Land Cover Classification				
	Hydric Soils/NWI	Anderson and Craig	Water	Development	Forest	Wetland	Agriculture
Upper St. Croix River	56.2	8	1.2	2.1	48.5	39.3	8.9
Kettle	26.5	8	2.7	4.1	33.9	44.3	15
Snake	35.8	10	1.8	4.2	35.3	31.1	27.7
Stillwater	47.1	31	6.5	10.6	21.2	17.3	44.4

## Banking Analysis

As part of the CPF development, BWSR conducted an analysis of wetland banking in BSA 6 to assess how this form of wetland replacement was being used to offset wetland impacts authorized under WCA and Section 404. The analysis relied on data obtained from the State of Minnesota Wetland Bank from 1996 through 2017 primarily through the processing of wetland bank transactions. The analysis is conducted at a fairly coarse scale because of limitations associated with data collected during the approximate 20-year period of record.<sup>3</sup> However, even at a coarse scale, the analysis is useful in understanding how wetland banking has been operating in BSA 6 as a means of informing decisions about how and where to locate wetland mitigation sites in the future.

### CURRENT STATUS

From the date the wetland banking program was created in 1996 to the present day, seventeen wetland banks have been established in BSA 6. Together, these banks have resulted in a deposit of 796.4 wetland credits. They are generally concentrated near the metro area with 15 of the 17 located in the Stillwater Watershed and the remaining two located in the southern portion of the Snake River Watershed. The wetland banks located in BSA 6 are summarized in Table 4-4.

Table 4-4. Approved Wetland Banks in BSA 6								
Name	Type	Major	County	Year Established <sup>1</sup>	Size	Status	CWA <sup>2</sup>	WCA
Sandager 1	Private	Stillwater	Chisago	1995	1.5	Sold out	N	Y
Sandager 2	Private	Stillwater	Chisago	1997	13.6	Active	Y	Y
Swenson	Private	Stillwater	Washington	2000	8.8	Sold out	N	Y
Palme	Private	Stillwater	Isanti	2001	21.2	Sold out	N	Y
Goertz	Private	Stillwater	Chisago	2002	37.5	Sold out	N	Y
White	Private	Stillwater	Washington	2003	1.01	Active	N	Y
Brown's Creek	LGRWRP	Stillwater	Washington	2004	10.26	Sold out	N	Y
Nelson	LGRWRP	Snake	Kanabec	2004	148.4	Sold out	Y	Y
Bald Eagle	Private	Stillwater	Washington	2006	2.76	Active	Y	Y

<sup>3</sup> A comparison by type of impacted wetlands and replacement wetlands could not be completed because of limitations associated with the data collected by the regulatory agencies.

Table 4-4. Approved Wetland Banks in BSA 6								
Name	Type	Major	County	Year Established <sup>1</sup>	Size	Status	CWA <sup>2</sup>	WCA
Strandlund 1	Private	Stillwater	Anoka	2007	16.08	Sold out	Y	Y
Mold Family Trust	Private	Stillwater	Chisago	2007	50	Active	Y	Y
Pryor	Private	Stillwater	Chisago	2007	56.1	Active	Y	Y
Holmstrom	Private	Stillwater	Chisago	2008	9.11	Active	Y	Y
Janet Johnson	LGRWRP	Stillwater	Chisago	2008	298.6	Active	Y	Y
Strandlund 2	Private	Stillwater	Anoka	2012	15	Active	Y	Y
South Fork	Private	Snake	Kanabec	2013	78.28	Active	Y	Y
Wildflower Shores	Private	Stillwater	Washington	2016	11.034	Active	N	Y

<sup>1</sup> – Based on first deposit of credits into the MWB.  
<sup>2</sup> – “Y” indicates that at least some of the credits from the bank were federally approved.

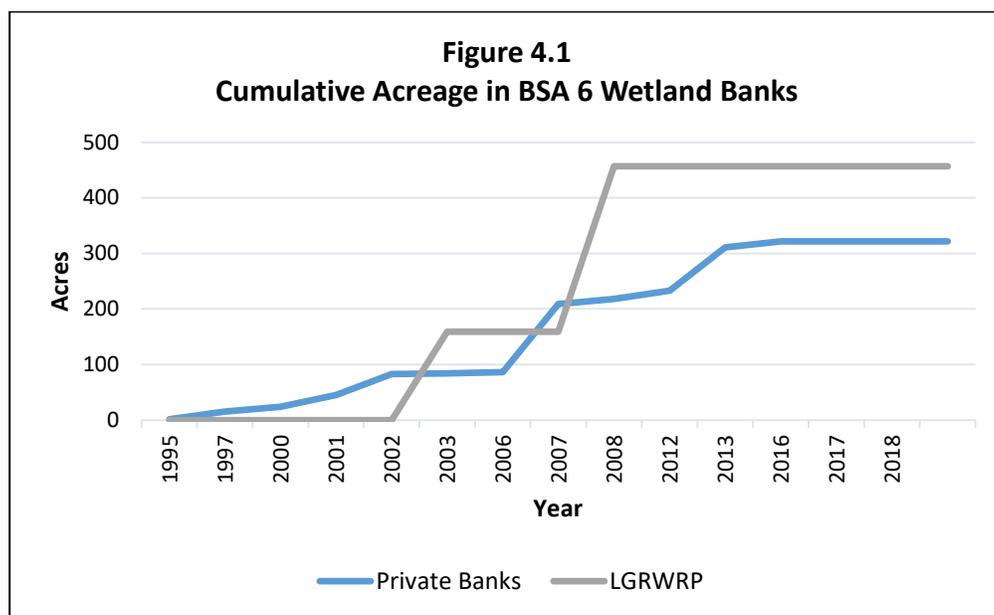
As of April 2020, the balance of wetland credits in BSA 6 was 79.4, which includes 36.3 federally approved credits and 43.1 state only approved credits. The total amount of federally approved credits includes 3.8 credits in LGRWRP accounts and 17.7 credits that have been purchased and placed in a transfer account but have not yet applied towards a mitigation requirement. Removing these credits from the pool of federally approved credits leaves approximately 14.8 federally approved credits that are potentially available for sale on the private banking market. The majority of these credits are associated with the South Fork Bank in Kanabec County (14.2 credits). The 14.8 federally approved credits are spread amongst five different banks and include the following types: shallow marsh, sedge meadow, deep marsh, open bog, hardwood swamp, fresh (wet) meadow, shrub-carr, wet to wet mesic prairie, and upland buffer. The most abundant wetland credit type is fresh (wet) meadow which accounts for approximately 92% of the available federally approved credits.

The 3.8 federally approved credits in LGRWRP accounts in BSA 6 are associated with the Janet Johnson bank in Chisago County. This total includes 1.34 fresh (wet) meadow credits and 2.42 deep marsh credits. There are currently no LGRWRP wetland bank sites in BSA 6 that are anticipated to have additional credit deposits nor are there any potential LGRWRP wetland bank sites in development that would to the credit totals within the next two years.

#### CREDIT GENERATION AND USE

Credit generation in BSA 6 was assessed by examining the cumulative acreage in wetland banks for both private banking and the LGRWRP. Acreage was used in lieu of credits because of the differences between state and federal crediting and the difficulty with obtaining information on credits from the early years of the wetland banking program. However, information on credit amounts is provided in this assessment whenever possible. The assessment focuses primarily on the preceding ten-year period since activities within this timeframe will have the greatest effect on wetland banking today. The preceding ten years is also the standard BWSR uses for determining average annual demand for the LGRWRP and is thus consistent with analyses currently in place. As shown by the gray line in Figure 4.1, wetland bank acres have not been added to the LGRWRP since 2007 when the Janet Johnson bank was approved. With respect to credit generation, the most recent deposit of credits for the LGRWRP was made in late 2014 with the final deposit for the Janet Johnson bank. The number of credits

generated for the LGRWRP program in BSA 6 has not changed since that time. For private banking, approximately 113.4 acres have been added to the total for private banks in BSA 6 since 2008. The additional acreage comes from four banks. Assuming each of these banks achieves their full performance level and the maximum number of projected credits are approved for deposits this would generate approximately 62.9 credits consisting of 54.1 credits approved under both the CWA and WCA and 8.8 credits approved only under WCA (some of these credits have already been released). Thus, over this ten-year period approximately 5.4 federally approved credits have been generated each year. This figure is expected to decline in future years because no private banks have been established since 2013 and the number of credits released from existing banks is not expected to be enough to sustain this average.



Data from the MWB also was used to assess the degree to which impacts that occurred in BSA 6 were offset with wetland credits from banks located within the BSA. This analysis relied on data from the MWB database that was submitted on transaction forms as part of the WCA replacement approval process. The data represents the number of credits withdrawn from bank accounts located in BSA 6 in order to satisfy a mitigation requirement and does not take into consideration project specific mitigation. This data should not be considered an estimate of the total acreage of wetland impacts since it represents credits that were derived using replacement ratios (the acreage will almost always be less than or equal to the credits withdrawn because ratios are applied to impact acreages to determine the mitigation requirement). In cases where the impact location was not specified in the database the impact acreage was identified as “unknown” but was represented in the summary. Information that would allow a comparison between impacted wetland type and credit type is not available in the MWB database and is therefore not addressed in this analysis. The data was broken down into LGRWRP activities and non-LGRWRP activities to identify any significant differences between the BWSR administered program and private banking. The results of this analysis are summarized in Table 4-5.

**Table 4-5. Source of Wetland Bank Credit Used as Mitigation for Impacts in BSA 6**

Activity Type	1	2	3	4	5	6	7	8	9	10	Unknown	Total	% In Place <sup>1</sup>
LGRWRP	39.7	0.8	39.8	0.5	38.9	129.6	21.6	6.1	2.5	0	23.4	302.9	42.7
Non-LGRWRP	0	0	5.3	0.2	10.5	63.8	21.3	0.7	16.5	0	7.6	125.9	50.7
Combined	39.7	0.8	45.1	0.7	49.4	193.4	42.9	6.8	19	0	31	428.8	45.1

<sup>1</sup> – In place refers to impacts in BSA 6 that were mitigated in BSA 6.

Table 4-5 shows that, with respect to wetland bank activity, the in-place requirement is being met in BSA 6 less than half the time for LGRWRP activities and approximately half the time for non-LGRWRP activities. Because of the higher number of credits used for LGRWRP impacts the combined rate on in-place replacement from wetland banking is only 45.1% which indicates that there is a fairly significant number of wetlands impacts that are being mitigated outside of BSA 6. This is not unexpected given the low or non-existent credit balances for both private banking and the LGRWRP. For those impacts where credits were obtained from outside of BSA 6, adjacent BSAs that are part of the Mississippi River basin (BSAs 5, 7, and 8) were used 38.4% of the time (66.6 credits) for LGRWRP credits and 52.3% of the time (32.5 credits) for non-LGRWRP impacts. The LGRWRP utilized credits from outside the Mississippi River basin for roughly a quarter (26.7%) of the total credits used and 46.6% of the credits obtained from outside of BSA 6. Non-LGRWRP projects utilized credits from outside the Mississippi River basin much less frequently: 4.4% of the total credits used and 8.9% of the total from outside BSA 6.

#### SUMMARY

The analysis of wetland banking data identified several important facts that will be factored into development of the CPF for BSA 6. First, both the LGRWRP and private banking are experiencing a shortage of available wetland bank credits that will carry into the future based on the current balances and lack of proposed banks. Second, the banks that have been constructed to date are concentrated in the southern, more populated/developed areas of the St. Croix River watershed (Snake and Stillwater major watersheds) which is where aquatic resources are more degraded and where most of the permitting activity is taking place. Third, approximately half of the wetland bank credits used for mitigation for impacts occurring within the watershed have come from outside of the BSA.

## 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. BSA 6 saw similar trends with the rest of the state, with a net increase of wetland but primarily through wetland type conversion.

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. None of BSA 6 is within the study area of the DWQA. 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 BSA 6 experience medium pressure from stressors and are generally fair to higher 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 in wetlands in poor condition. Vegetation quality is 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 (Bourdagh et al., 2019). Wetland vegetation quality in BSA 6 has largely stayed the same since the first baseline assessment in 2011.

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. BSA 6 reflects the regional trends in both wetland quality and extent, with extensive fair and high-quality wetlands across the entirety of the BSA.

## Description of Threats

Wetlands across Minnesota are under threat from many different stressors. In BSA 6, wetlands are threatened specifically by the loss of hydrologic storage, population growth and urbanization, water quality impairments and wetland credit shortages. These threats are based on familiarity with the BSA implementing WCA, the conditions established in the Baseline Conditions section, conversations with stakeholders and published reports and other information. 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 ability of wetlands and streams to store water on the landscape has been significantly altered by wetland loss, ditch construction and stream alterations in many areas of the BSA. Changing the capacity of these natural systems results in increased peak flows, lower base flows, and increased nutrient and sediment concentrations in streams, rivers, and lakes (Mitsch & Gosselink, 2015) which, in turn, degrades water quality.

The loss of hydrologic storage metric in the WHAF Health Scores was used to assess the degree to which hydrologic storage has been impacted in each catchment in BSA 6. The WHAF loss of hydrologic storage index combines two underlying metrics that represent two ways in which hydrologic storage has changed: the current extent of wetlands relative to the historic extent and the length of altered or straightened streams relative to the total length of stream. Each of these metrics is calculated as a ratio that is then multiplied by 100 to calculate an index score that ranges from 0 to 100. A score of 0 represents the worst condition, a score of 100 represent the best condition. The two metrics were averaged to create a combined index score for hydrologic storage at the catchment scale. The scores range from 0 (all historic storage converted and/or all streams altered) to 100 (all historic storage present and/or all streams are natural). The Loss of Hydrologic Storage Index scores for BSA 6 are provided in Figure B-17.

From this WHAF health score, it is evident that the most impacted catchments are located in the northern Stillwater and southern Snake watersheds. Many of these catchments have index scores in the 30 – 50 range which indicates that the hydrologic storage capability in these areas has been significantly reduced.

The results of this analysis are consistent with other measures of watershed health including the amount of impaired aquatic resources within the watershed. The two most degraded watersheds are the Snake and Stillwater with more than 500-miles of impaired streams. Conversely, the Upper St. Croix and Kettle have less than 160 impaired miles combined. The data for impaired lakes shows a similar pattern in BSA 6 with more than half the lakes in the Snake and Stillwater listed as impaired. The Kettle River watershed also has a high degree of impairment but it does not appear to track with the lost hydrologic storage metric in the WHAF. The loss of hydrological storage remains a stressor in the Upper St. Croix and Kettle, but just to a lesser degree.

#### POPULATION GROWTH AND URBANIZATION

Each major watershed in BSA 6 experienced an increase in population during the period 2000 – 2010 based on United States census data. The increase in population ranged from 6% in the Upper St. Croix River to 16% in the Stillwater with the Kettle and Snake River seeing 12% and 11% growth respectively. Continued population growth is expected in this part of Minnesota particularly in areas that are closest to the Twin Cities metropolitan area (the Stillwater and Snake River watersheds). On the landscape, population growth results in loss of perennial cover, artificial drainage, fragmentation of habitats, and an increase in impervious surfaces. As formally natural areas are converted to agriculture or urban land uses the landscape's ability to filter and store water is reduced which correlates to increased storm water runoff and loading of pollutants into receiving waters.

As an indicator of urbanization and potential high threat areas, the phosphorus stress layer developed by the MPCA was used to predict anthropogenic stress on water quality in the form of phosphorus inputs across the landscape. The phosphorus stress tool combines the GIS data inputs for land cover (open development, low density development, medium density development, high density development, pasture, crops, and barren land), distance to roads, distance to feedlots, and population block density into a single stress score. High levels of stress could suggest an increased need for functioning wetlands, whereas low levels of stress could predict areas to maintain wetlands. The phosphorus stress analysis for BSA 6 is provided in Figure B-18.

There is a significant increase in phosphorus stress in the southern portion of the BSA, which correlates to the land cover illustrated in Figure B-10. Results are similar to wetland loss and altered streams with the Stillwater and lower portion of the Snake having the most risk of contamination. This risk manifests itself in terms of the increased impaired stream miles, and acres of impaired lakes. The northern watersheds show some localized phosphorus stress but overall is significantly lower than the southern watersheds.

#### WATER QUALITY IMPAIRMENTS

As discussed in the Baseline Condition section of this CPF, BSA 6 has numerous documented water quality impairments that affect use of the aquatic resources in the watershed and the flora and fauna that depend on them. Restoring the affected waters to a higher quality condition and reversing the trends that led to the impairments is a challenging task. The recognition of this in the form of completed and ongoing TMDLs is positive for the watershed but in the face of increasing population and the resulting land use changes, water quality impairments remain a threat not only in this watershed but in the downstream receiving waters.

## SHORTAGE OF WETLAND BANK CREDITS

At its core, the watershed approach to wetland mitigation seeks to maintain and improve the quality and quantity of wetlands in a watershed through strategic selection of mitigation sites. One method used to achieve this goal is wetland banking where credits are generated in advance of impacts at locations approved by regulatory agencies. The credits stem from activities that have met rigorous performance standards established for the bank site. Using these credits to offset impacts that occur within the watershed addresses the quality component of the watershed approach. The quantity aspect is addressed through ratios used to determine the amount required to offset the impact as well as through a robust supply of credits in the watershed. As discussed previously in this CPF, BSA 6 has a shortage of wetland credits that hinders progress toward full implementation of the watershed approach. Currently, there are a total of 79.4 credits available for purchase of which 14.8 are federally approved and available to the public for purchase. Similarly, the LGRWRP has a balance of 3.8 federally approved credits that could be used to offset authorized impacts. Using an average annual demand of 13 credits for the LGRWRP in BSA 6 and 7.4 for non-LGRWRP impacts we estimate that the current supply for the LGRWRP would be exhausted within a year's time while credits available to the public would be exhausted within two years. When these supplies are gone, credits will need to be obtained from other BSAs in order to satisfy mitigation requirements unless project-specific mitigation is a viable option for applicants. Assuming bank credits would be used, over a three-year period the amount of wetland impact that would be replaced with credits from outside BSA 6 would be 42.6 acres assuming a 1:1 replacement ratio. Compounding the credit shortage issue is the fact that there are no wetland banks currently in development in BSA 6 which makes it more of a long-term issue easily extending beyond the three-year timeframe used in this estimate.

## 6. STAKEHOLDER INVOLVEMENT

BWSR initiated a stakeholder involvement process as part of the BSA 6 CPF development in February of 2017. A meeting was held with stakeholders in the watershed to familiarize them with the ILF concept, review and approval process, and the development of the CPF. Attendees at the meeting included staff from the soil and water conservation districts, counties, watershed districts, and the St. Croix River Association. The importance of stakeholder input to CPF development and the prioritization of watershed needs was emphasized during that initial meeting.

A second stakeholder meeting was held in January 2018, to update the stakeholders on development of the CPF and to solicit their input on the watershed condition assessment and the site selection process. BWSR staff provided an overview of the baseline condition summary prepared in support of the BSA 6 CPF and presented the condition assessment that provides a relative comparison of the state of aquatic resources in each major watershed in the BSA. The stakeholders had no specific concerns or comments on the condition assessment. Following the presentation on existing conditions, BWSR staff solicited input from the stakeholders on criteria that would be useful when identifying and prioritizing potential wetland restoration sites. The stakeholders provided fifteen criteria that could be used in the process. The input from the stakeholders was evaluated by

BWSR staff and factored into the catchment identification and prioritization process addressed in the next section of this CPF. A list of attendees and the material presented is provided in Appendix C.

## **7. PRIORITIZATION METHODS FOR SELECTING AND IMPLEMENTING MITIGATION ACTIVITIES**

### **Statement of Aquatic Resource Goals and Objectives**

The primary objective of Minnesota's (ILF) program is to provide high-quality and sustainable mitigation to offset the loss of aquatic resource functions resulting from authorized impacts. This goal will be achieved through strategic site selection based on a watershed approach that incorporates stakeholder input, ensuring that the mitigation efforts are both effective and inclusive. One of the key goals of the ILF program is to reverse the trend of wetland mitigation export and improve watershed health by targeting and pursuing high-quality wetland mitigation opportunities. By focusing on these high-quality opportunities, the program aims to enhance the overall health and functionality of the watershed, ensuring that the ecological benefits are maximized. Another objective is to provide public value by replacing impacts from smaller individual projects with larger mitigation sites that have greater ecological value. An approach that ensures that the mitigation sites are more effective in providing ecological benefits, thereby offering greater value to the public.

The program also aims to identify and design sites that, to the greatest extent practicable, represent pre-settlement conditions with respect to hydrology and vegetation. By striving to restore these sites to their pre-settlement conditions, the program seeks to create more natural and sustainable ecosystems that can better support a diverse range of species and ecological functions. Establishing priorities between the major watersheds based on the condition assessment and input from watershed stakeholders is another critical goal of the ILF program. By considering the current conditions of the watersheds and the input from stakeholders, the program can ensure that the most pressing needs are addressed first, thereby maximizing the effectiveness of the mitigation efforts. Finally, the program aims to identify priority areas for mitigation projects within each major watershed based on the condition assessment and input from watershed stakeholders. Ensuring that the mitigation efforts are focused on the areas that need it the most, thereby providing the greatest ecological benefits.

### **Prioritization Strategy**

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 BSA 6 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.

BSA 6 is made up of 368 unique catchments distributed across the 4 major watersheds as follows Kettle River has 100 catchments, Snake River has 89 catchments, Upper St. Croix has 39 catchments, and Stillwater has 140 catchments (Figure D-3).

### Criteria Selection

Criteria for catchment prioritization were selected through information obtained from stakeholders at two workshops in 2017 and 2018 and from BWSR staff with experience in watershed planning and wetland mitigation siting. Input was also obtained from the Corps of Engineers and other members of the Interagency Review Team during their review of the ILF prospectus. After the meeting, each criterion was evaluated for availability and suitability of GIS-based data. A criterion was selected if it met the following three qualities; 1) It represents a watershed health characteristic that affects or can be affected by the presence/absence of wetlands, 2) it represents a watershed characteristic that is generally present throughout the BSA which allows for comparison between and amongst catchments with sufficient variation for comparisons, 3) GIS data at the catchment level was publicly available for the criterion. A list and description of the restoration criteria can be seen in Table 7-1.

#### RESTORATION CRITERIA

A total of 12 different criteria were selected for restoration prioritization. They include Areas with High Soil Erosion Potential, Areas with Low Amounts of Perennial Cover, Areas with Poor Habitat Connectivity, Areas with More Degraded Wetlands (Ditched Wetlands), Areas with More Altered Watercourses, Areas with Higher Amounts of Impaired Streams, Areas with Higher Amounts of Impaired Lakes, Areas with Approved TMDL Implementation Plans, Areas Identified as Priorities for Wetland Restoration in Other Watershed/Regional Plans, Areas with High Permitting Frequency Based on Previous 5 Years Data, Areas Where There are High Value Habitats and/or Threatened or Endangered Species Associated with Wetland or Aquatic Flora and Fauna and Catchments Containing Groundwater Recharge Areas as Designated in State and Local Plans. 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
Areas With High Soil Erosion Potential	The areas with high soil erosion potential from the Minnesota Department of Natural Resources Watershed Health Assessment Framework (WHAF). The index score combines the inherent erodibility of a soil type (known as K-factor); with the position of the soil on the landscape (slope) to rank each catchment by its erosion potential.
Areas With Low Amounts of Perennial Cover	Perennial cover was considered to be any land cover not identified as developed or in any form of agricultural use based on the 2011 National Land Cover Data. Hay and pasture were considered to be perennial cover. The amount of land with perennial cover was divided by the total catchment area and then multiplied by 100 to create the final ratio.

Table 7-1. Restoration Criteria and Description of Data	
Criterion	Description
Areas With Poor Habitat Connectivity	The Riparian Connectivity Index in the WHAF compares the amount of cropped or developed land cover to the amount of open land in the riparian area. The percentage of agricultural and developed land relative to the total riparian area was calculated and scored. Scores range from 0 (all lands within 200 meters of streams or in floodplains are in annual cropland or urban cover) to 100 (all lands are neither urban nor annual agriculture).
Areas With More Degraded Wetlands (Ditched Wetlands)	The acreage of ditched wetlands in each catchment was determined using the “d” modifier in the NWI. The ditched wetland score was determined by dividing the area of ditched wetlands by the total area of wetlands in the catchment and multiplying the result by 100.
Areas With More Altered Watercourses	The altered watercourse score measures the proportion of streams and rivers that have been altered within each catchment watershed (Minnesota Pollution Control’s Altered Watercourses Project). This score is the ratio of the length of altered watercourses in the catchment to the total length of watercourses present. The score is the inverse of the percentage.
Areas With Higher Amounts of Impaired Streams	Using the MPCA’s Water Quality Assessment Database (2016) a ratio of impaired stream length to total stream length was calculated and multiplied by 100 for each catchment.
Areas With Higher Amounts of Impaired Lakes	Using the MPCA’s Water Quality Assessment Database (2016) a ratio of impaired lake area to total lake area was calculated and multiplied by 100.
Areas With Approved TMDL Implementation Plans	Risk values were calculated as a three-meter grid that covers the entire state. For each cell, an individual score represents the risk of phosphorus mobilization from that location. The average of the grid cell values intersecting each catchment watershed were used to create a score for that catchment.
Areas Identified as Priorities for Wetland Restoration in Other Watershed/Regional Plans	Reviewing these plans and, where determined appropriate, including these efforts in the prioritization process acknowledges other planning efforts and increases the potential for wetland mitigation siting to provide greater watershed benefits.
Areas With High Permitting Frequency Based on Previous 5 Years Data	The analysis was the number of permits per catchment divided by the area of wetlands in the catchment using data was provided by the U.S. Army Corps of Engineers Section 404 permit database from 2011 to 2016.
Areas Where There Are High Value Habitats and/or Threatened or Endangered Species Associated with Wetland or Aquatic Flora and Fauna	Using information from the MNDNR 2015-2025 Wildlife Action Plan a ratio of the high and medium high scored areas to total area was calculated for each catchment.
Catchments Containing Groundwater Recharge Areas as Designated in State and Local Plans	The pollution sensitivity of near-surface materials index from the WHAF was used to represent this criterion. The index score is an area weighted average for each catchment’s rate of infiltration based on properties of the soil and surficial geology.

## Development of Criterion Maps

GIS transformation of spatially explicit data characterizing each criterion was 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 7-1).

First, GIS data representing each criterion was obtained and associated with each catchment in BSA 6. 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 7-1). 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.

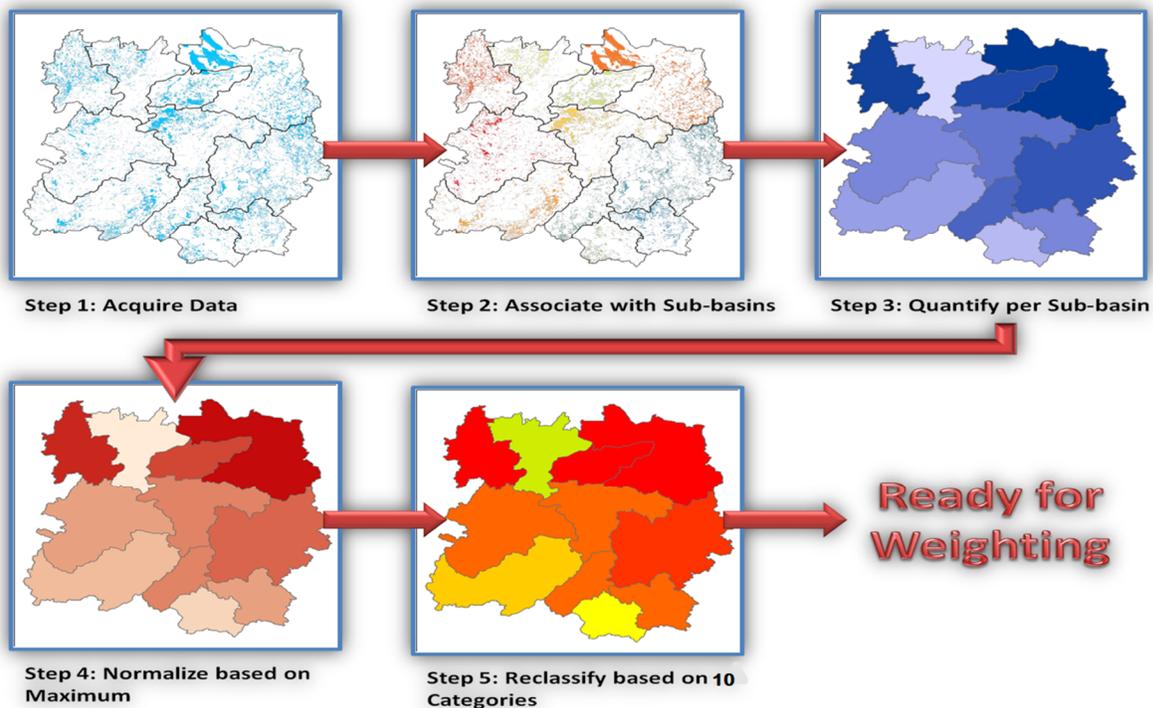


Figure 7-1. Data transformation process.

The process described above and in Figure 7-1 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 7-2.

### **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 SurveyMonkey was sent out and used to gauge the stakeholder perceptions of value of each criterion in relation to another. Twenty-two separate stakeholders were invited to participate in the elicitation process. There were twelve responses (55% response rate) to the survey. The results were used as weighting factors in the catchment prioritization. The preferences were polled in two separate fashions: a straight ranking of the criteria and a pair-wise comparison of the criteria. The results of the survey are shown in Table 7-2.

Weighting for each catchment was calculated using the MCDA pairwise comparison weights from Table 7-2 based on a straightforward algorithm:

$$V_i = \sum_j w_j c_{ij}$$

Where  $V_i$  is the prioritization score for the  $i$ th catchment which is equal to the sum of the values of the  $i$ th catchment criteria ( $c_{ij}$ , where  $j = 1, 2, 3 \dots 12$ ) multiplied by their normalized weights ( $w_j$ ). The summed prioritization score was used to generate a map displaying the comparative preference for siting wetland mitigation within each catchment based on these inputs. Maps of the weighted outputs for each major watershed are provided in Appendix D.

**Table 7-2. Restoration Ranks Assigned by Stakeholders and Resulting Weights**

Criterion	MCD Pairwise Weighting <sup>1</sup>	Rank	Straight Average <sup>2</sup>	Rank
Areas with more degraded wetlands (ditched wetlands) (C4)	0.124	1	4.67	1
Areas with higher amounts of impaired lakes (C7)	0.113	2	4.67	1
Areas with higher amounts of impaired streams (C6)	0.111	3	4.89	3
Areas identified as priorities for wetland restoration in other watershed/regional plans (C9)	0.109	4	5.89	4
Areas where there are high value habitats and/or threatened or endangered species associated with wetland or aquatic flora and fauna (C11)	0.087	5	6.56	7
Areas with low amounts of perennial cover (C2)	0.076	6	7.00	8
Areas containing groundwater recharge areas as designated in state and local plans (C12)	0.074	7	8.00	10
Areas with more altered watercourses (C5)	0.072	8	6.22	6
Areas with approved TMDL implementation plans (C8)	0.070	9	7.33	9
Areas with high soil erosion potential (C1)	0.070	9	6.11	5
Areas with high permitting frequency based on previous 5 years data (C10)	0.057	11	8.00	10
Areas with poor habitat connectivity (C3)	0.037	12	8.67	12

<sup>1</sup> – Results of the MCDA pairwise comparisons using responses from seven stakeholders.  
<sup>2</sup> – Average priority ranking based on responses from nine stakeholders.

## 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 use the catchment prioritization scores to identify the catchments that will be targeted for wetland mitigation projects when there is a need to generate credits for the ILFP (repayment of advanced credits). 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 with weighted prioritization scores in the top third of the distribution for their respective major watershed were identified as a high priority area. In addition, if the total acreage of restorable wetlands for the top third of the catchments within a major watershed was less than 33% of the total acreage of restorable wetlands for that major watershed then additional catchments were added as high priority areas, based on their

weighted prioritization scores, until the total acreage of restorable wetlands reached 33% of the total restorable wetlands for that major watershed. The acreage of restorable wetlands was obtained from the RWI and was used as an estimate of the number of restorable wetlands in each catchment. It was not treated as an absolute and catchments were not removed as high priority areas if the RWI identified few or no restorable wetlands

Using this method, a total of 130 catchments (892,028 acres (1,394 square miles) of BSA 6 were prioritized: 41 in the Kettle River watershed, 29 in the Snake River watershed, 13 in the Upper St. Croix watershed, and 47 in the Stillwater watershed. Eight additional catchments were included in the Kettle River watershed in order to meet the requirement that 33% of the total acreage of restorable wetlands be included in high priority areas. The number of prioritized catchments for restoration by major watersheds can be seen in Table 7-3.

Major Watershed	Catchments			Restorable Wetlands		Weighted Scores		
	Number Prioritized	Prioritized Area <sup>1</sup> (acres)	Prioritized Acres (% of total)	Prioritized <sup>2</sup> (acres)	Major Watershed (% of total)	Range	Avg	Median
Upper St. Croix River	13/39	135,057	39	1,997	42	77.9 -100	86.8	85.2
Snake	29/89	239,410	37	12,599	49	77.6 - 100	84.4	83.4
Kettle	41/100	230,238	34	3,242	36	77.2 - 100	86.1	84.6
Stillwater	47/140	287,323	49	9,426	55	55.2 - 100	74.7	72.8

Notes:  
<sup>1</sup> – Prioritized area is the total land area within each major watershed.  
<sup>2</sup> – Prioritized acres based on the RWI.

The prioritization process resulted in consistent results for the Upper St. Croix River, Snake, and Kettle major watersheds with respect to range, average, and median weighted scores for the prioritized catchments. In addition, for each of these major watersheds the selected catchments all had weighted scores greater than 77 with an average between 84 and 86 which supports the decision to designate the top 33% of the catchments as high priority for wetland mitigation since there was not a significant drop off in weighted scores within the top third of the catchments. The Stillwater major watershed is an outlier with respect to the range, average, and median weighted scores. It also had the largest percentage of prioritized acres and restorable wetlands (based on the RWI). This is likely attributable to the higher number of catchments in this major watershed combined with a smaller average size relative to the other major watersheds and the decision in this CPF to base prioritization on a percentage of the catchments evaluated. The figures D-4 through D-7. shows prioritized catchments in each major watershed.

## Long-term Protection and Management

Each wetland bank site that becomes part of the ILF Program will be required to have an establishment, maintenance, and management plan to achieve the identified goals of the project. The management strategies

will be specific to the project and will include standard, recognized strategies such as those identified in the Minnesota Wetland Restoration Guide (BWSR online guide, 2012). All project sites will have long-term protection through the recording and enforcement of a perpetual conservation easement. After an initial establishment and maintenance period (typically 5 years), the easement will be periodically monitored by BWSR staff to ensure compliance. BWSR began collecting a stewardship fee in 2017 to fund these long-term easement compliance and monitoring activities which ensure that the inspection program will be funded into the future. As stipulated in the easement, the landowner is ultimately responsible for maintenance of the project site in concert with the approved mitigation plan and conservation easement. However, in the past BWSR has also played a role in making sure that long-term management issues are satisfactorily addressed on LGRWRP wetland bank sites.

## Evaluation Strategy

BWSR has considerable experience managing the LGRWRP which includes monitoring budgets, site development activities, and credit balances. Evaluation of the CPF will be integrated into the annual program review activities that are currently part of the overall program management. Because we intend for the CPFs to be used to influence wetland banking site selection as well as ILF site selection we fully expect that these documents will be reviewed on a regular basis and periodically updated. Potential reasons for revisiting the goals and objectives of the CPF could include completion of local watershed plans that address management of aquatic resources, identification of wetland mitigation priority areas by a WCA local government unit, and feedback on the prioritization strategy from implementation activities. We anticipate that an initial review of the goals and objectives of the BSA 6 CPF will be conducted three years after the first advanced credits are sold, which provides enough time for the prioritization strategy to be implemented and evaluated.

## 8. CONCLUSION

This CPF report established baseline conditions, analyzed wetland trends and threats, gathered stakeholder input, and prioritized catchments for wetland restoration within BSA 6. 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 BSA 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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<https://upperwapsi.org/plan/about-the-watershed/soils/>

# Appendix A: Acronyms



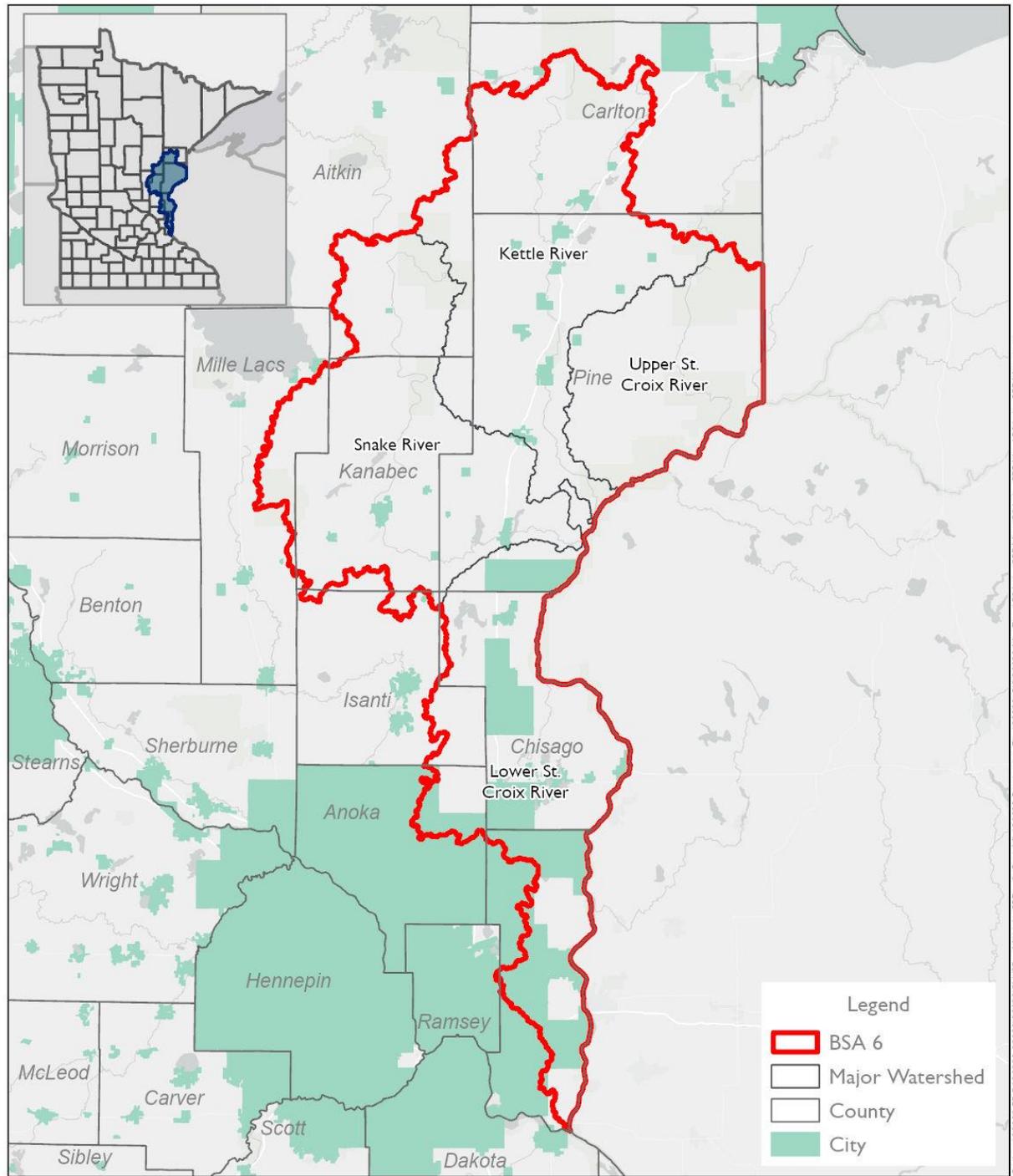
<b>Acronym</b>	<b>Full Name</b>
1W1P	One Watershed One Plan
AB	Aquatic Bed wetland type
BMP	Best Management Practice
BSA	Bank Service Area
BWSR	Minnesota Board of Water and Soil Resources
CPF	Compensation Planning Framework
CWMP	Comprehensive Watershed Management Plan
CREP	Conservation Reserve Enhancement Program
DMU	Data Map Unit
DO	Dissolved Oxygen
DWQA	Depressional Wetland Quality Assessment
EPA	Environmental Protection Agency
FEMA	Federal Emergency Management Agency
GIS	Geographic Information System
GW	Groundwater
HUC	Hydrologic Unit Code
ID	Identifier
ILF	In-Lieu Fee Program
JD	Jurisdictional Ditch
LGRWRP	Local Government Road Wetland Replacement Program
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
SA	In-Lieu-Fee Service Area
SGCN	Species of Greatest Conservation Need
SNA	Scientific and Natural Area
SWCD	Soil and 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

Bank Service Area 6 Compensation Planning Framework

USGS	United States Geological Survey
VEGMOD	Historical Vegetation Model
WCA	Wetland Conservation Act
WHAF	Watershed Health Assessment Framework
WMA	Wildlife Management Area
WRAPS	Watershed Restoration and Protection Strategy Report

# Appendix B: Baseline Condition Maps

**Figure B-1. Project Location**



Monday, March 3, 2025

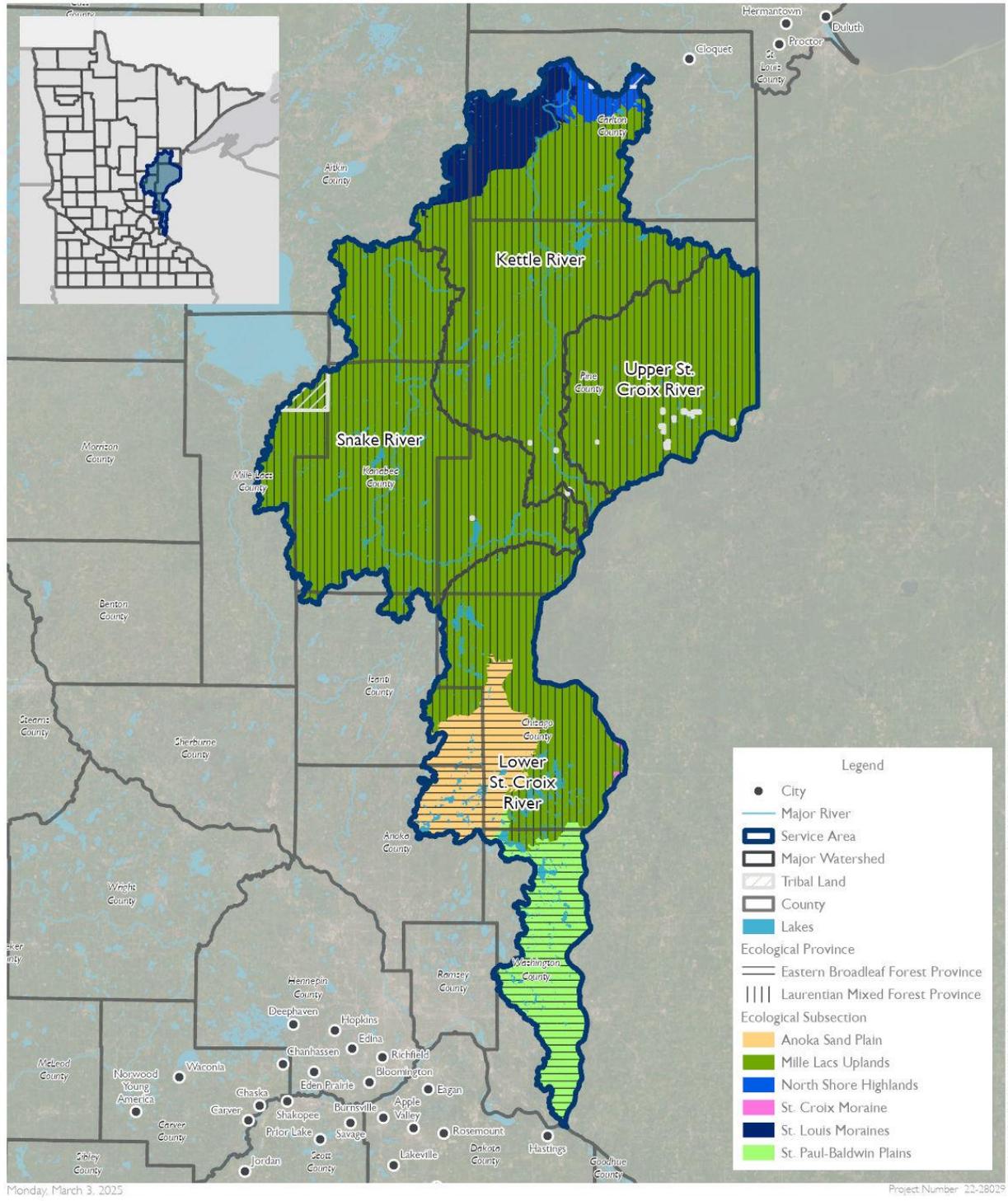
Project Number 22-28029



Project Location  
Compensation Planning Framework  
BSA 6 - Minnesota



**Figure B-2. Ecological Classification**

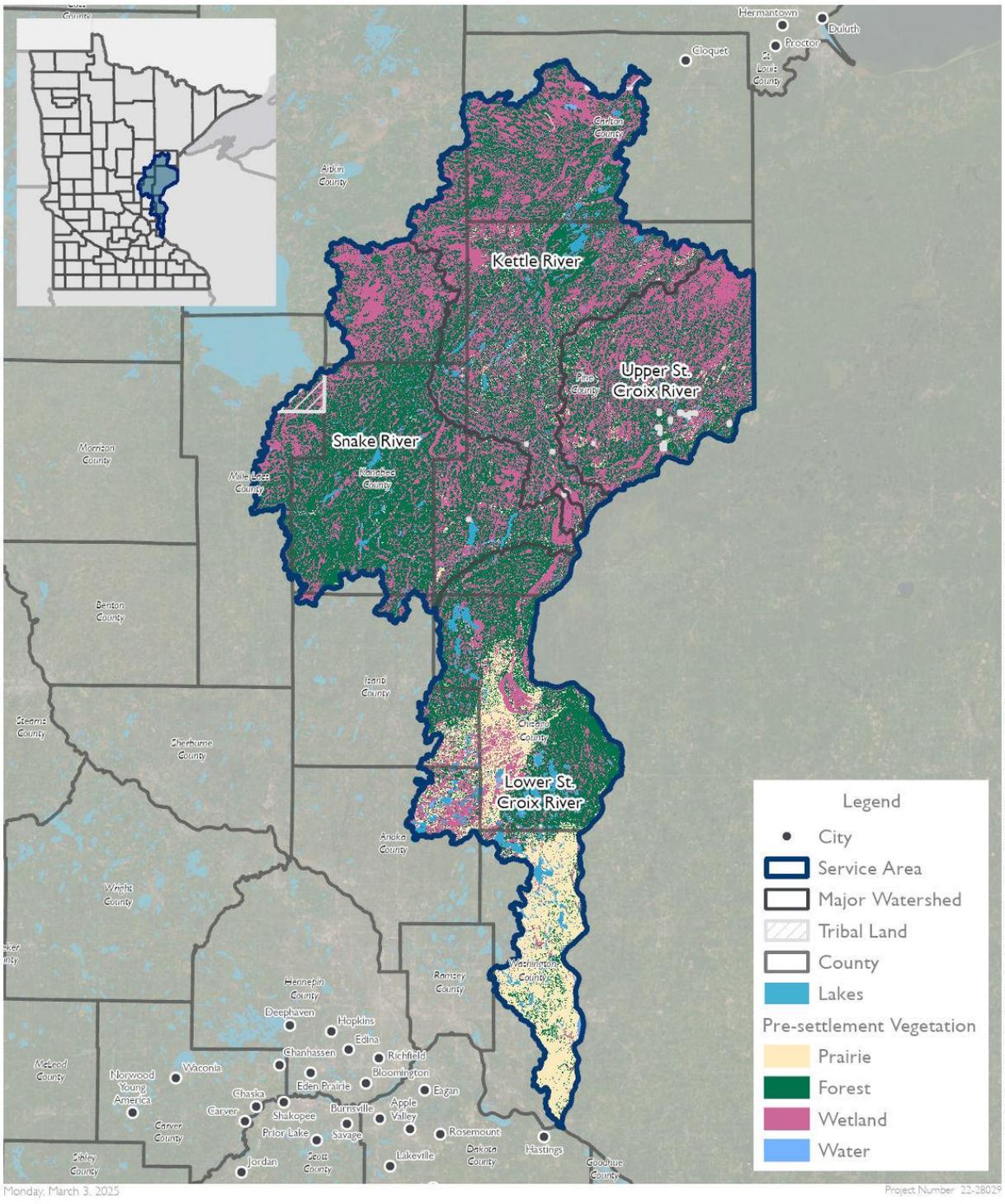


Ecological Classification  
 Compensation Planning Framework  
 BSA 6 - Minnesota

Source(s)  
 Orthophoto (ESRI, 2023)  
 Ecological Provinces (MN DNR)  
 Ecological Subsections (MN DNR)



Bank Service Area 6 Compensation Planning Framework  
**Figure B-3. Pre-settlement Vegetation**

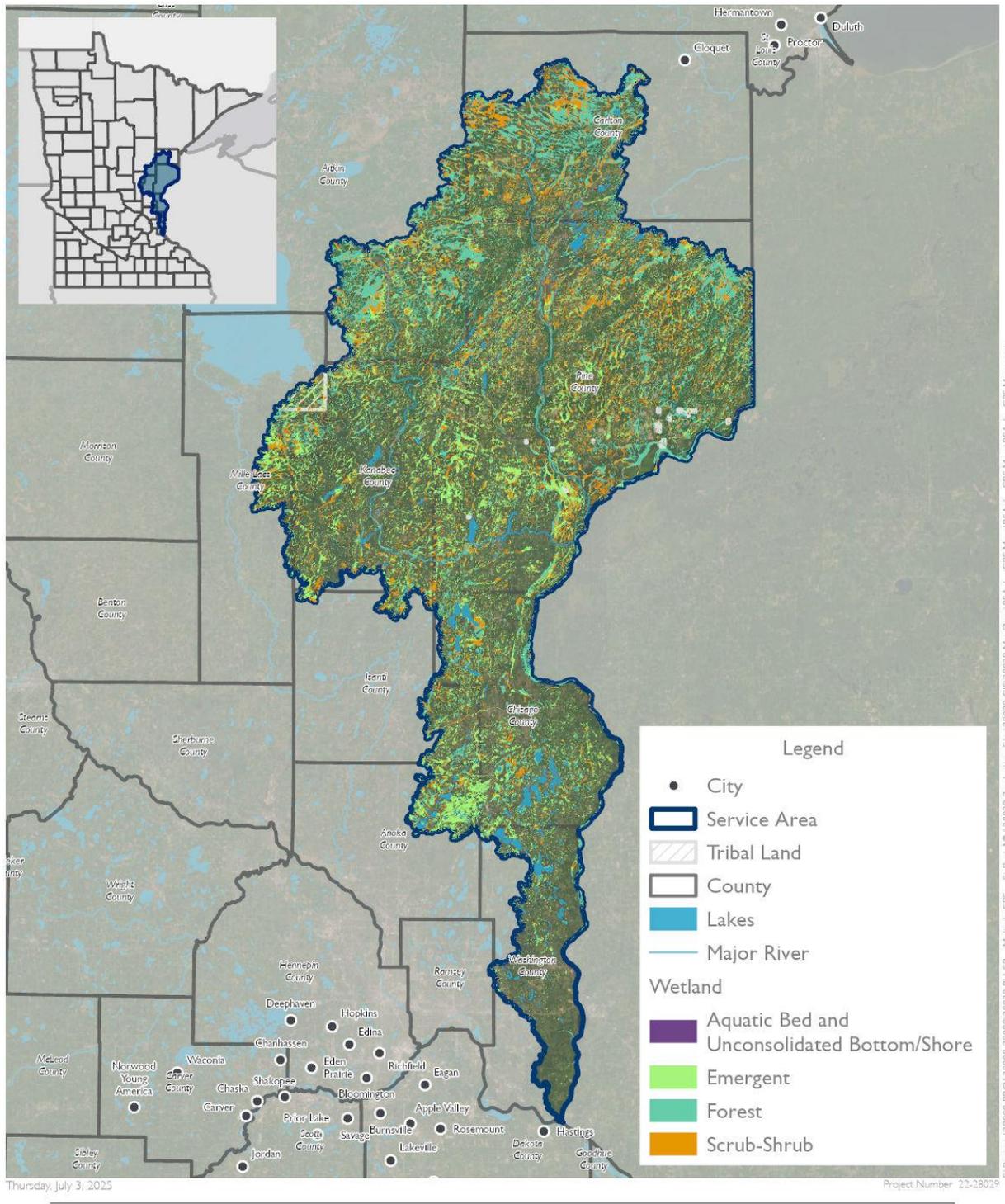


Pre-settlement Vegetation  
 Compensation Planning Framework  
 BSA 6 - Minnesota

Source(s):  
 Orthophoto (ESRI, 2023)  
 VEGMOD (MnDOT)



**Figure B-4. Wetlands**

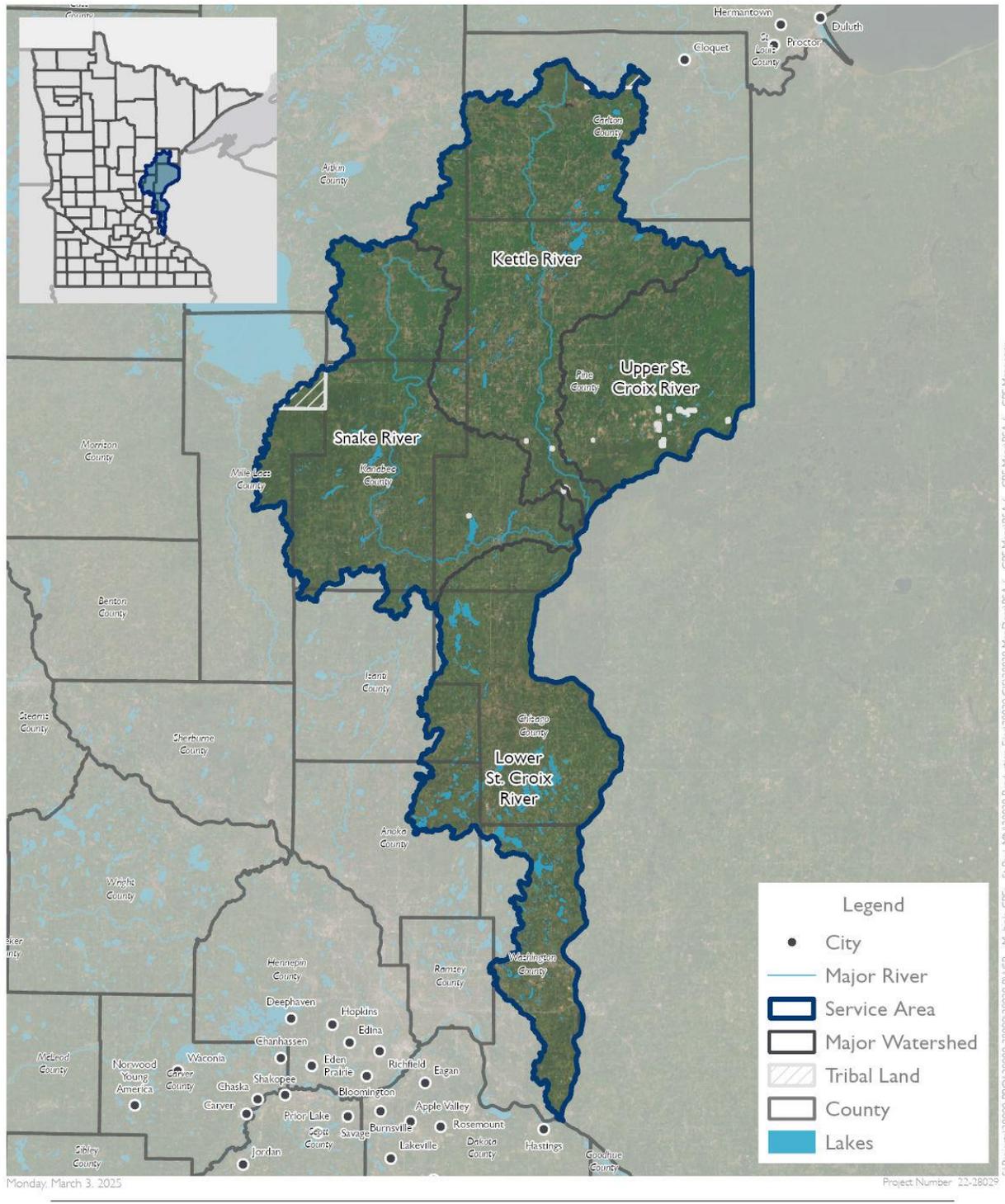


Wetlands  
Compensation Planning Framework  
BSA 6 - Minnesota

Source(s):  
Orthophoto (ESRI, 2023)  
Wetlands (NWI)



**Figure B-5. Lakes**

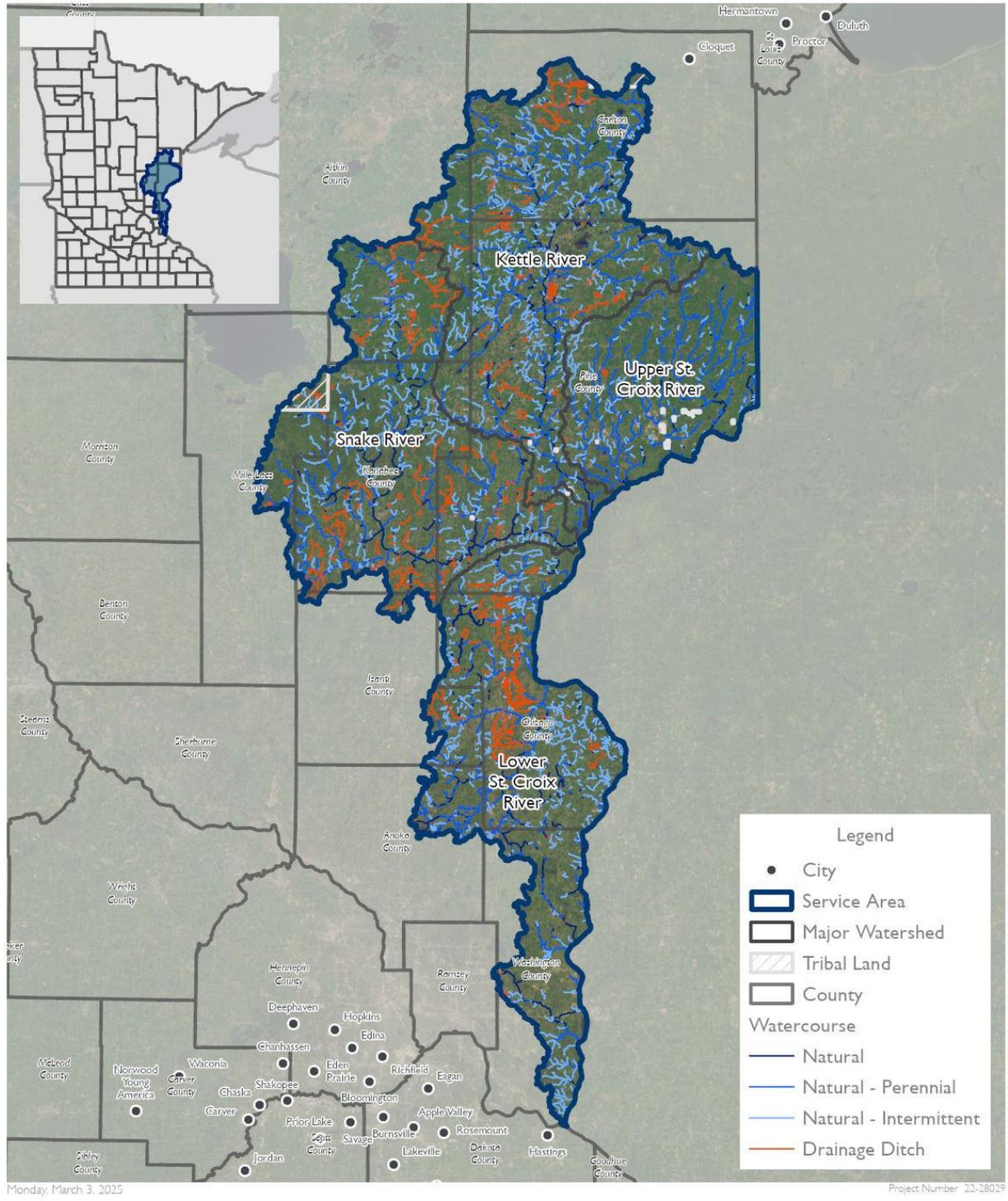


Lakes  
 Compensation Planning Framework  
 BSA 6 - Minnesota

Source(s):  
 Orthophoto (ESRI, 2023)  
 Lakes (MN DNR Lakes and  
 Open Water, 2012)



**Figure B-6. Watercourses**

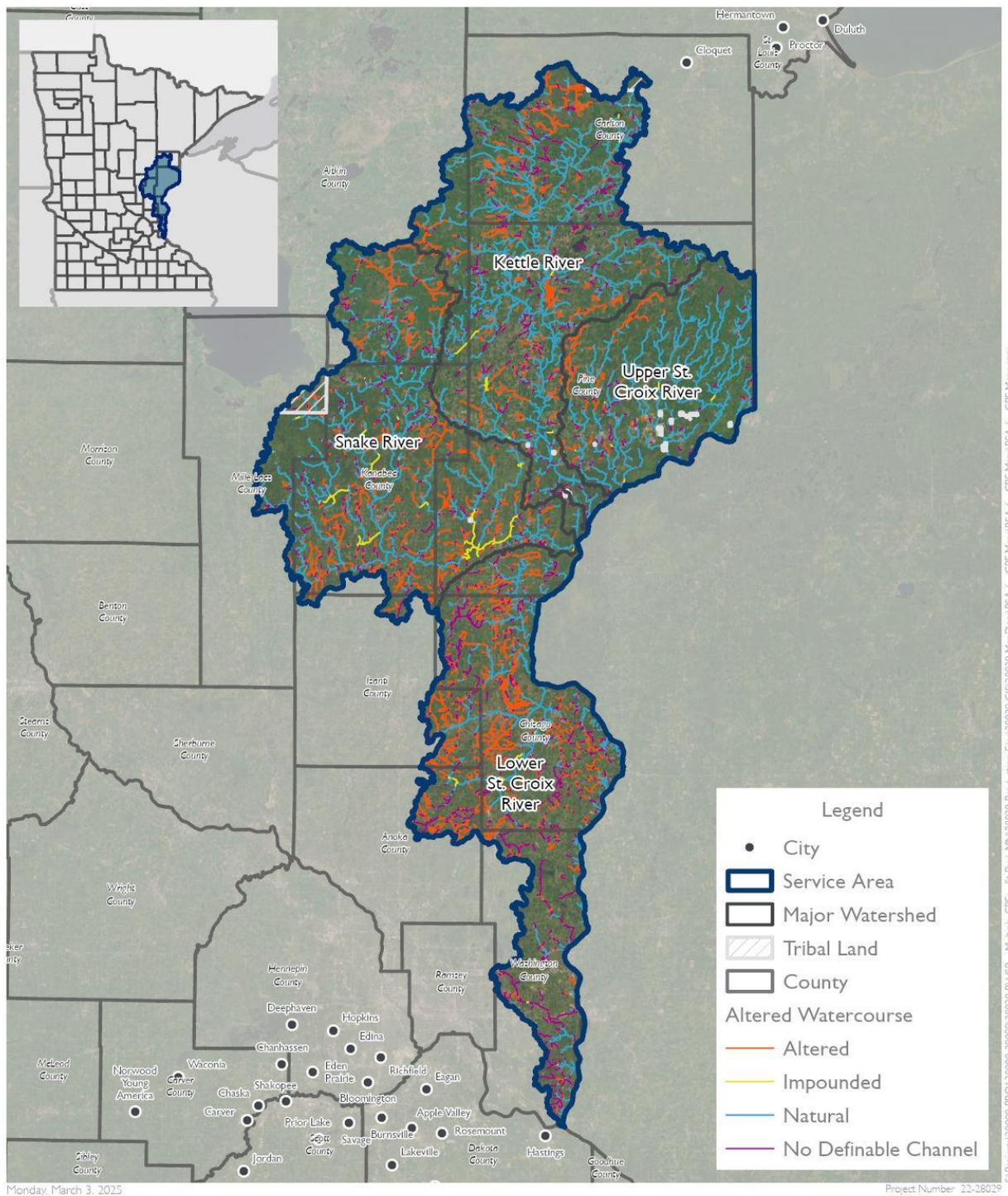


Watercourses  
Compensation Planning Framework  
BSA 6- Minnesota

Source(s):  
Orthophoto (ESRI, 2023)  
Watercourses (NHD, 2022)



**Figure B-7. Altered Watercourses**

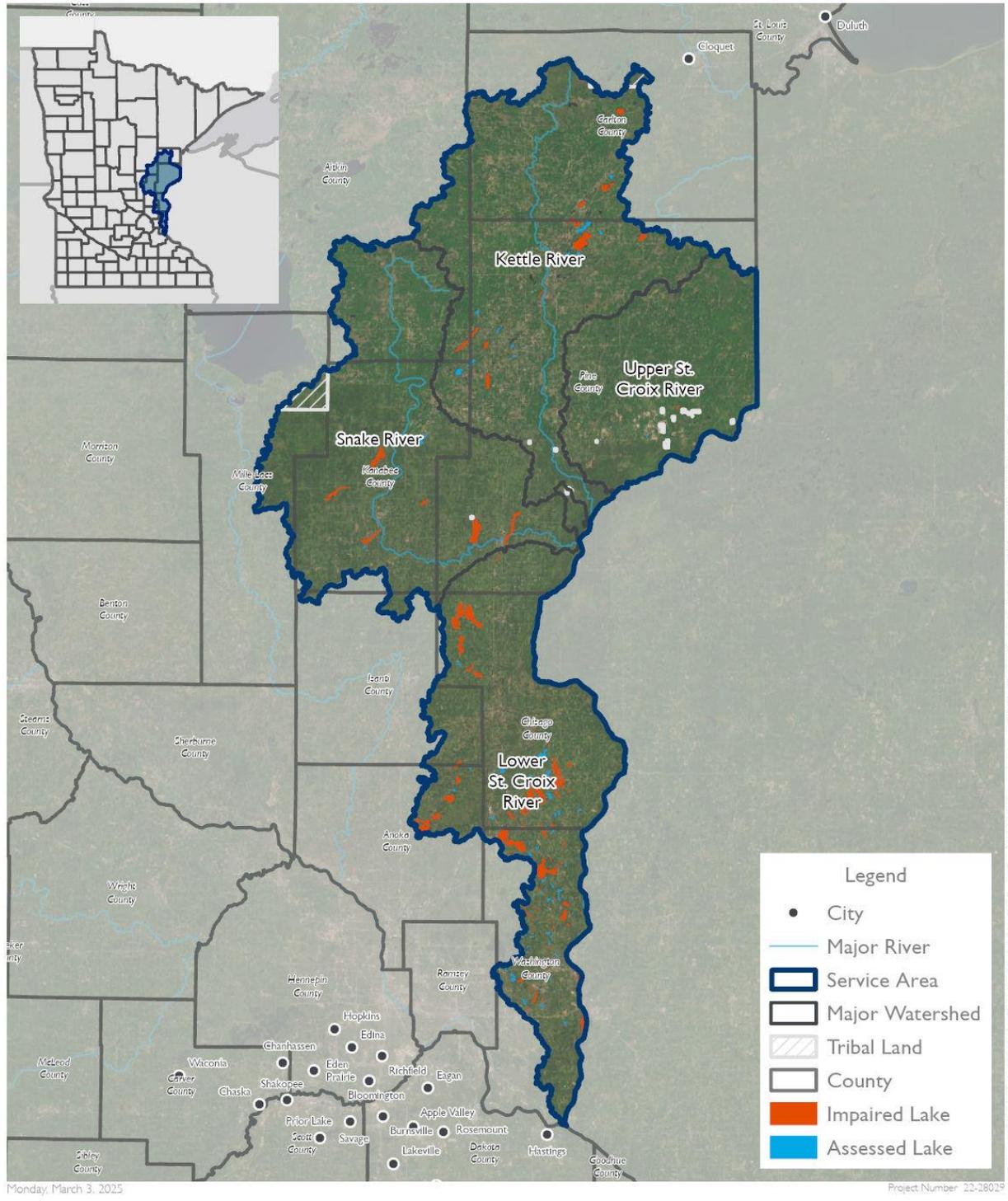


Altered Watercourses  
 Compensation Planning Framework  
 BSA 6 - Minnesota

Source(s):  
 Orthophoto (ESRI, 2023)  
 Altered Watercourses (MPCA, 2019)



**Figure B-8. Water Quality- Lakes**

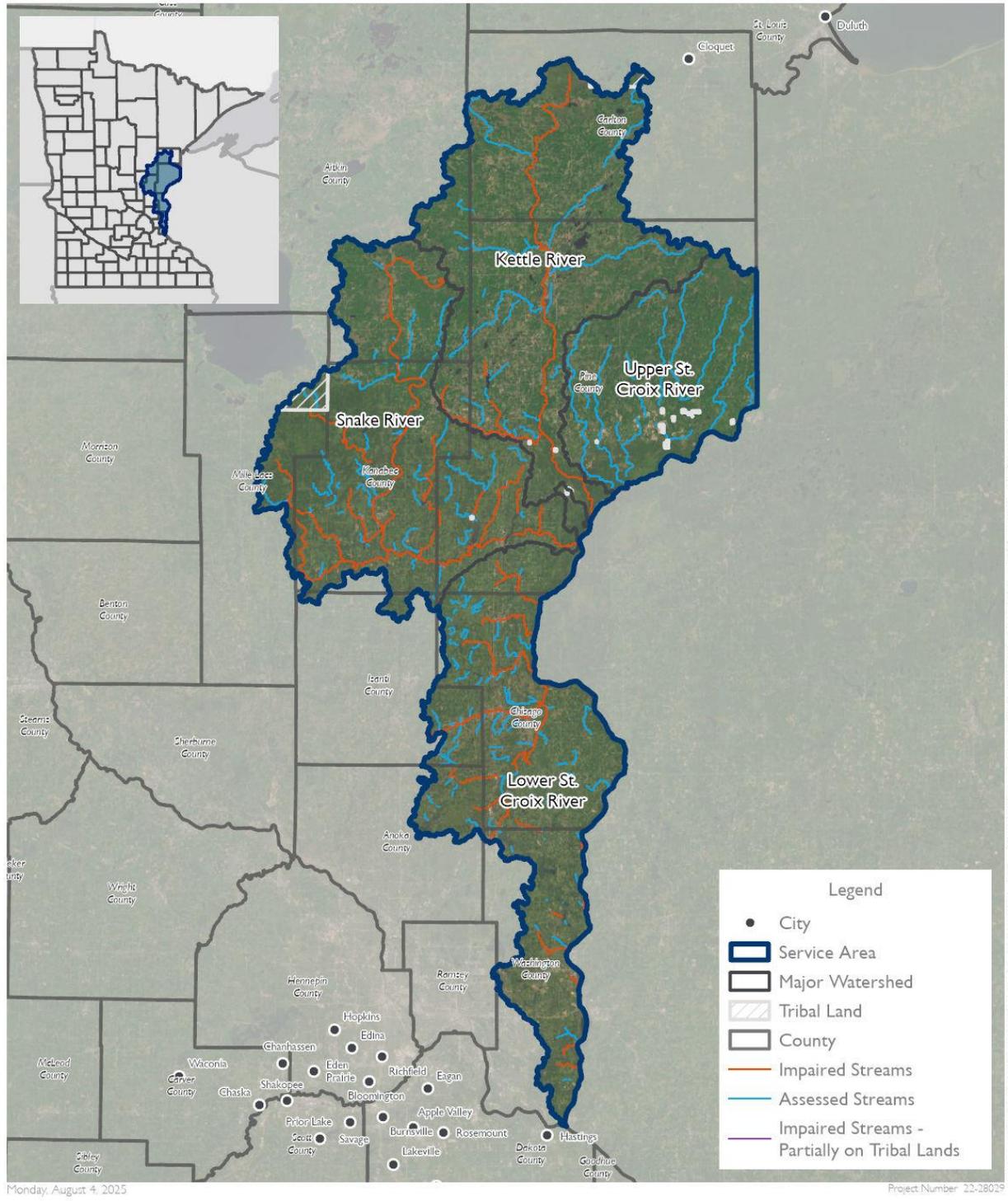


Water Quality - Lakes  
Compensation Planning Framework  
BSA 6 - Minnesota

Source(s):  
Orthophoto (ESRI, 2023)  
Water Quality (MPCA, 2022)



**Figure B-9. Water Quality- Streams**



0 8 16 Miles

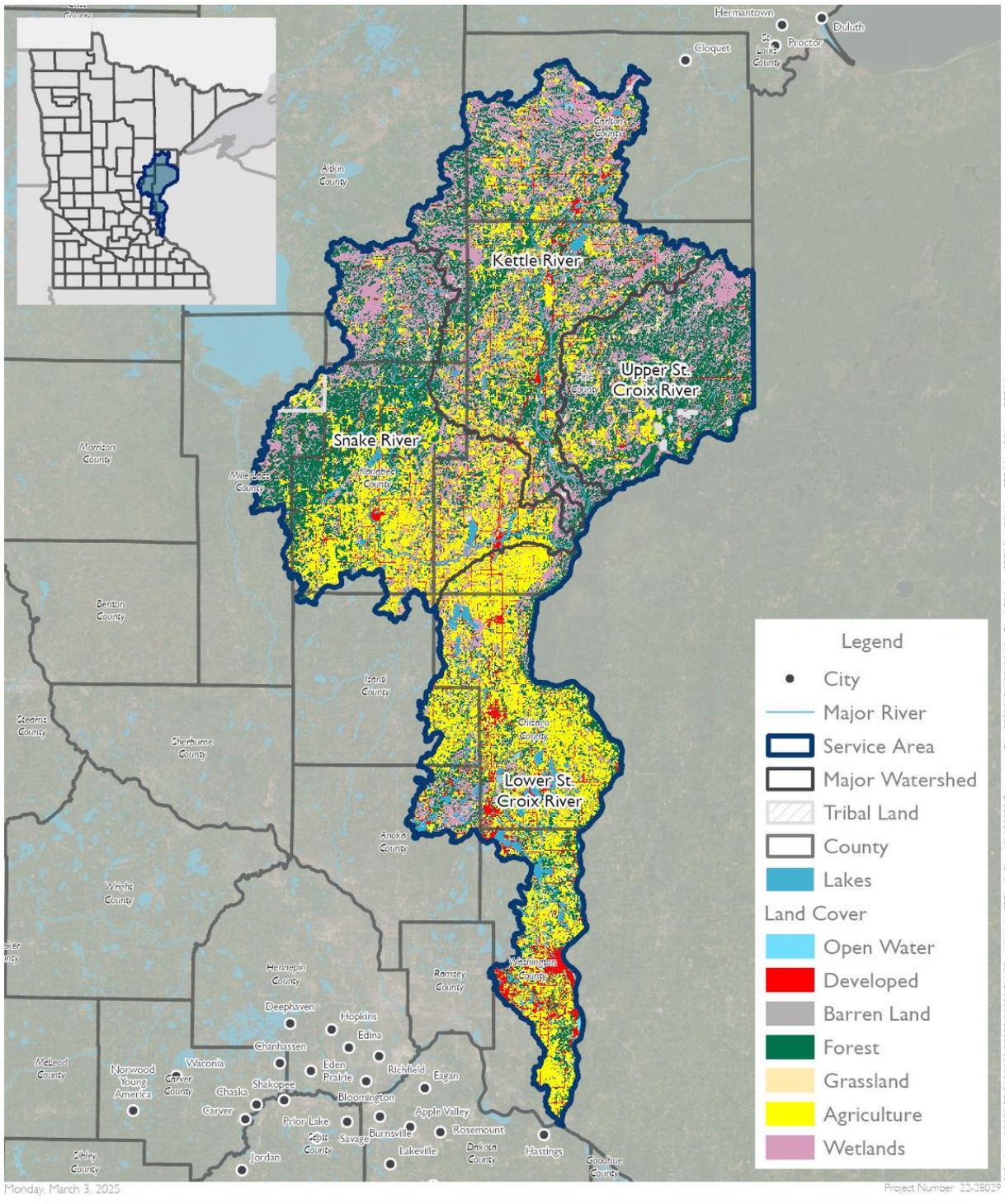
1 inch = 16 miles

N

Water Quality - Streams  
Compensation Planning Framework  
BSA 6 - Minnesota

Source(s):  
Orthophoto (ESRI, 2023)  
Water Quality (MPCA, 2022)

**Figure B-10. Land Cover**

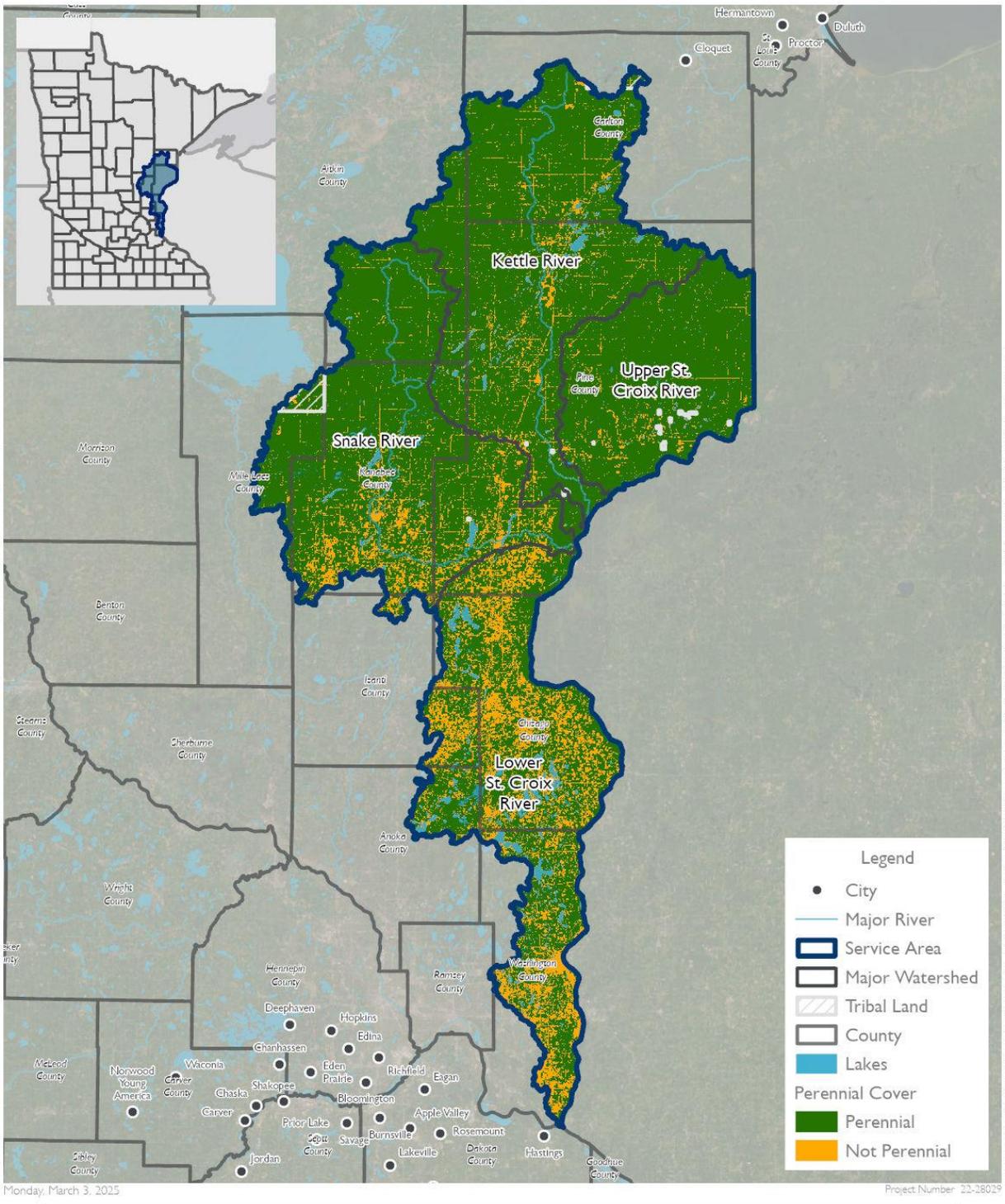


Land Cover  
 Compensation Planning Framework  
 BSA 6 - Minnesota

Source(s):  
 Orthophoto (ESRI, 2023)  
 Landcover (NLCD, 2019)



**Figure B-11. Perennial Land Cover**

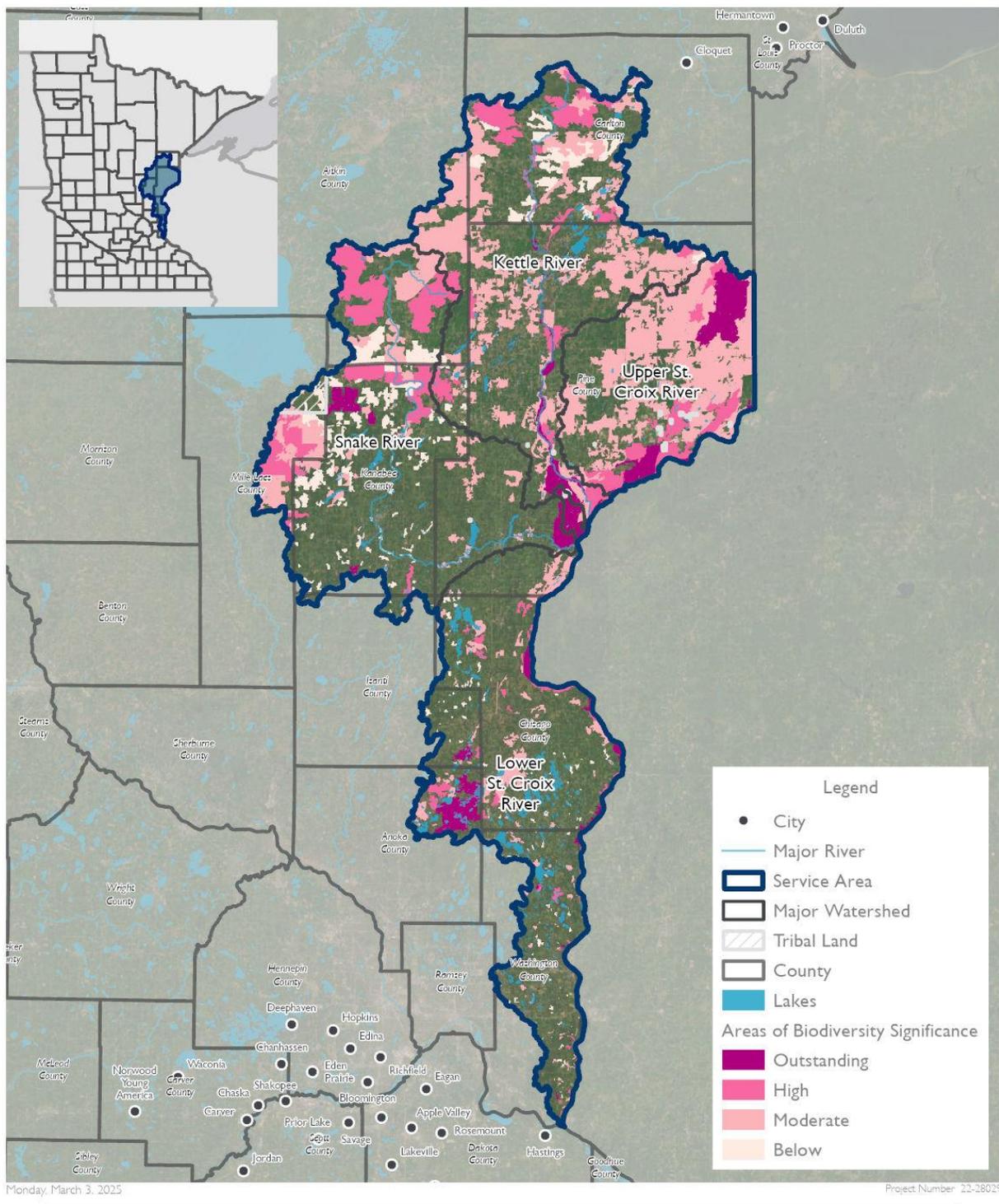


Perennial Land Cover  
 Compensation Planning Framework  
 BSA 6 - Minnesota

Source(s):  
 Orthophoto (ESRI, 2023)  
 Landcover (NLCD, 2019)



Bank Service Area 6 Compensation Planning Framework  
**Figure B-12. Areas of Biodiversity Significance**

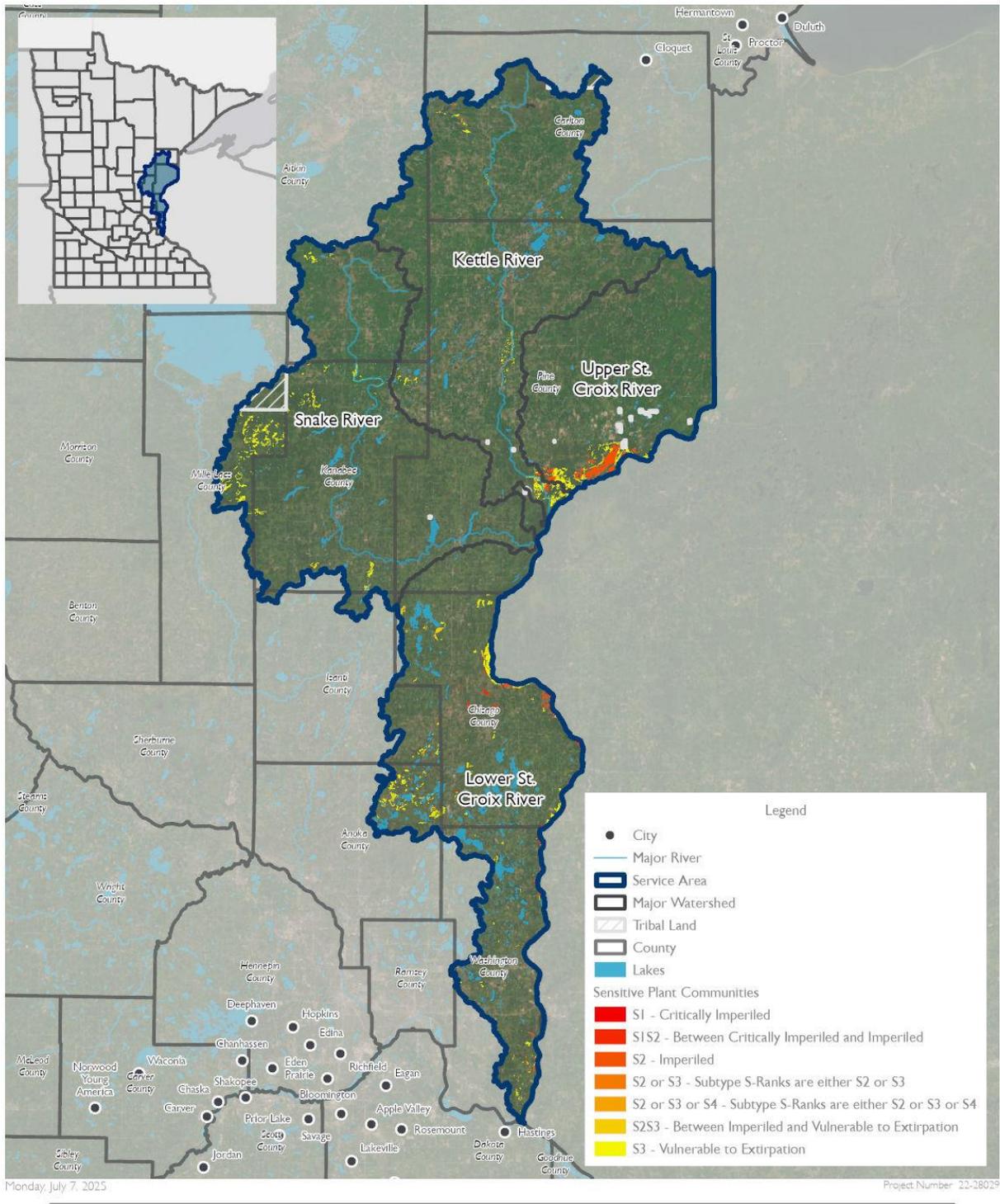


Biodiversity Significance  
 Compensation Planning Framework  
 BSA 6 - Minnesota

Source(s):  
 Orthophoto (ESRI, 2023)  
 Biodiversity (MBS, 2022)



**Figure B-13. Sensitive Species and Plant Communities**

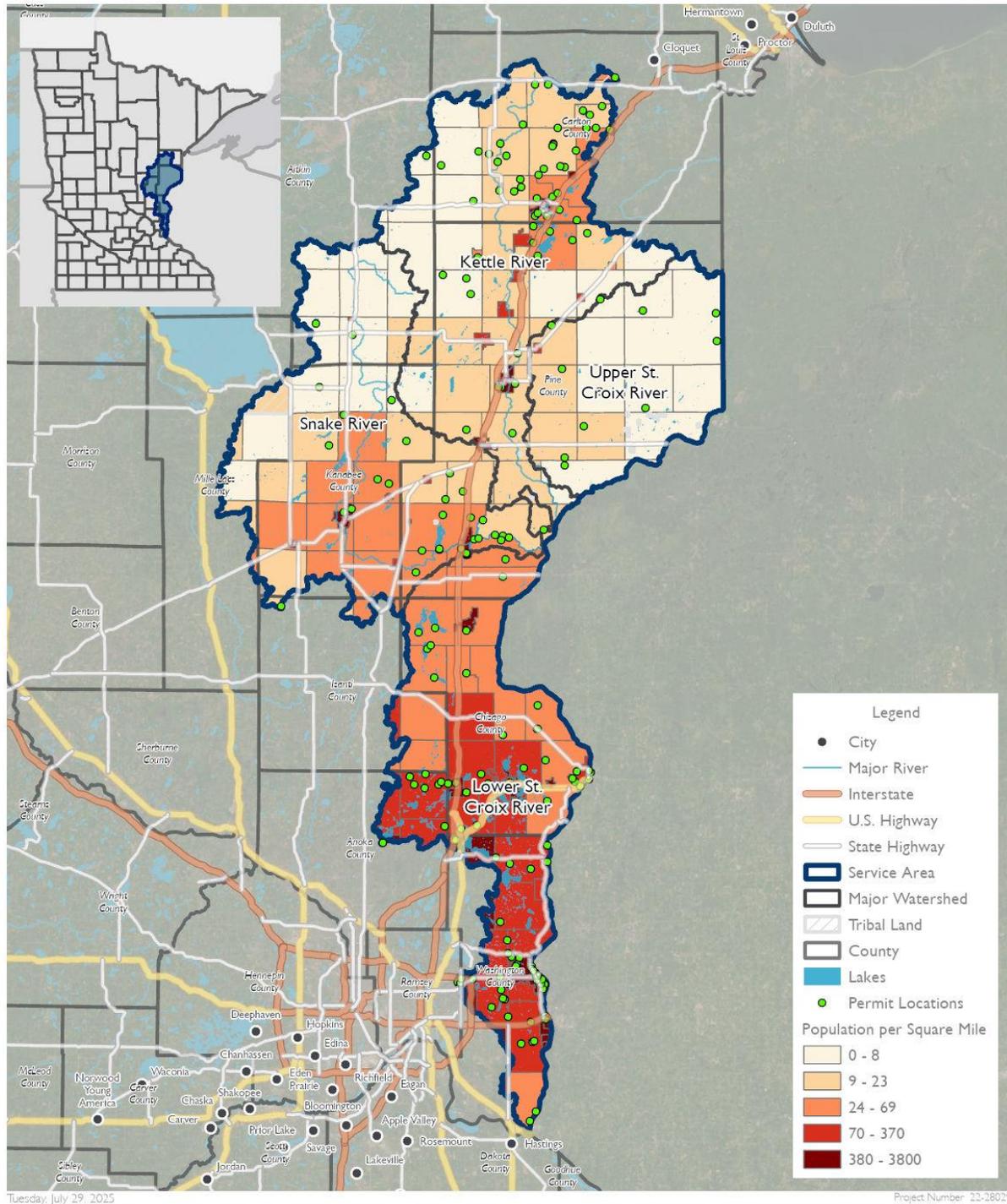


Sensitive Species and  
Plant Communities  
Compensation Planning Framework  
BSA 6 - Minnesota

Source(s):  
Orthophoto (ESRI 2023)



Bank Service Area 6 Compensation Planning Framework  
**Figure B-14. Permit Locations and Populations**

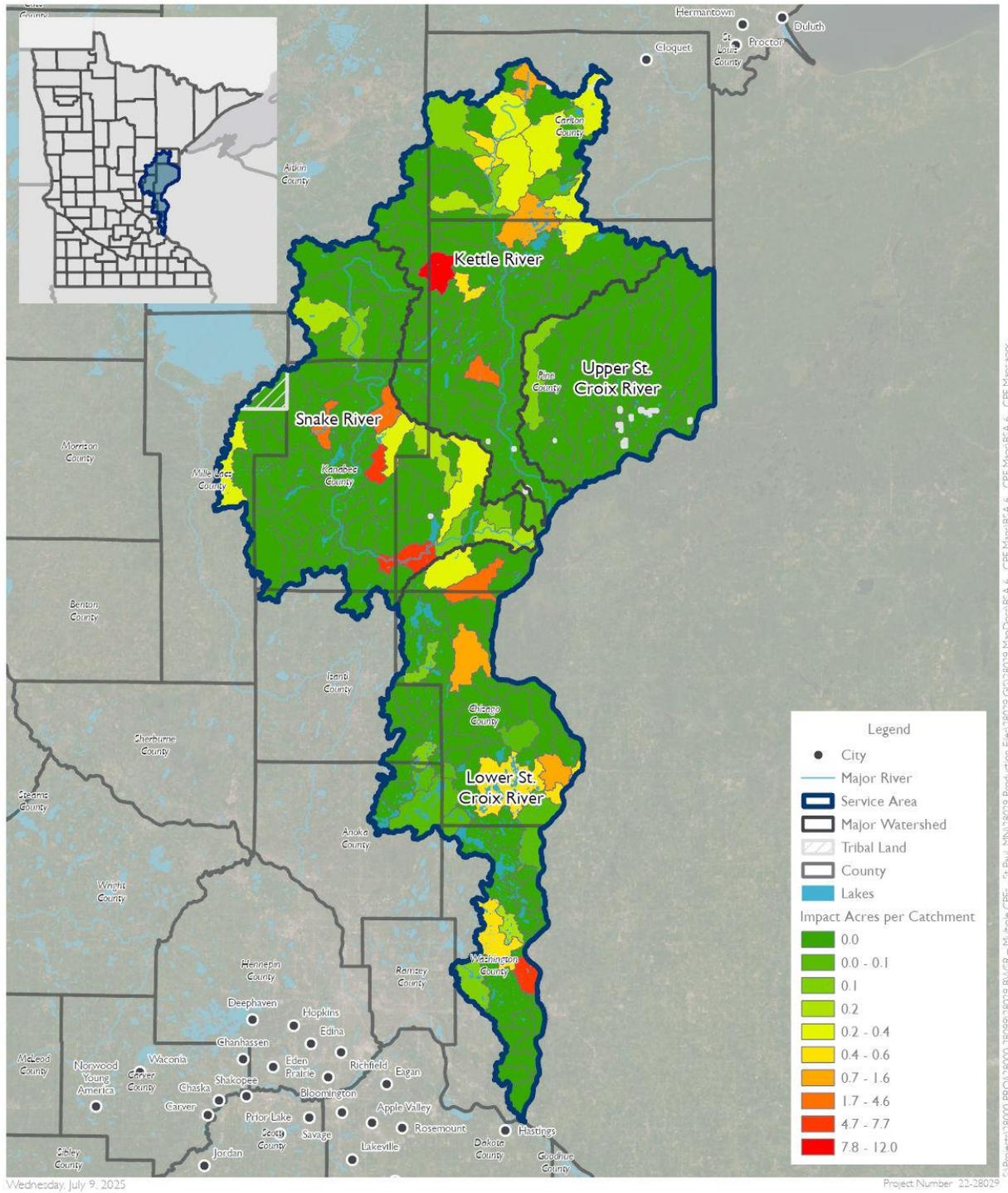


CWA Permit Locations  
 and Population  
 Compensation Planning Framework  
 BSA 6 - Minnesota

Source(s):  
 Orthophoto (ESRI 2023)



Bank Service Area 6 Compensation Planning Framework  
**Figure B-15. Section 404 Impacts**



Wednesday, July 9, 2025

Project Number 22-28029

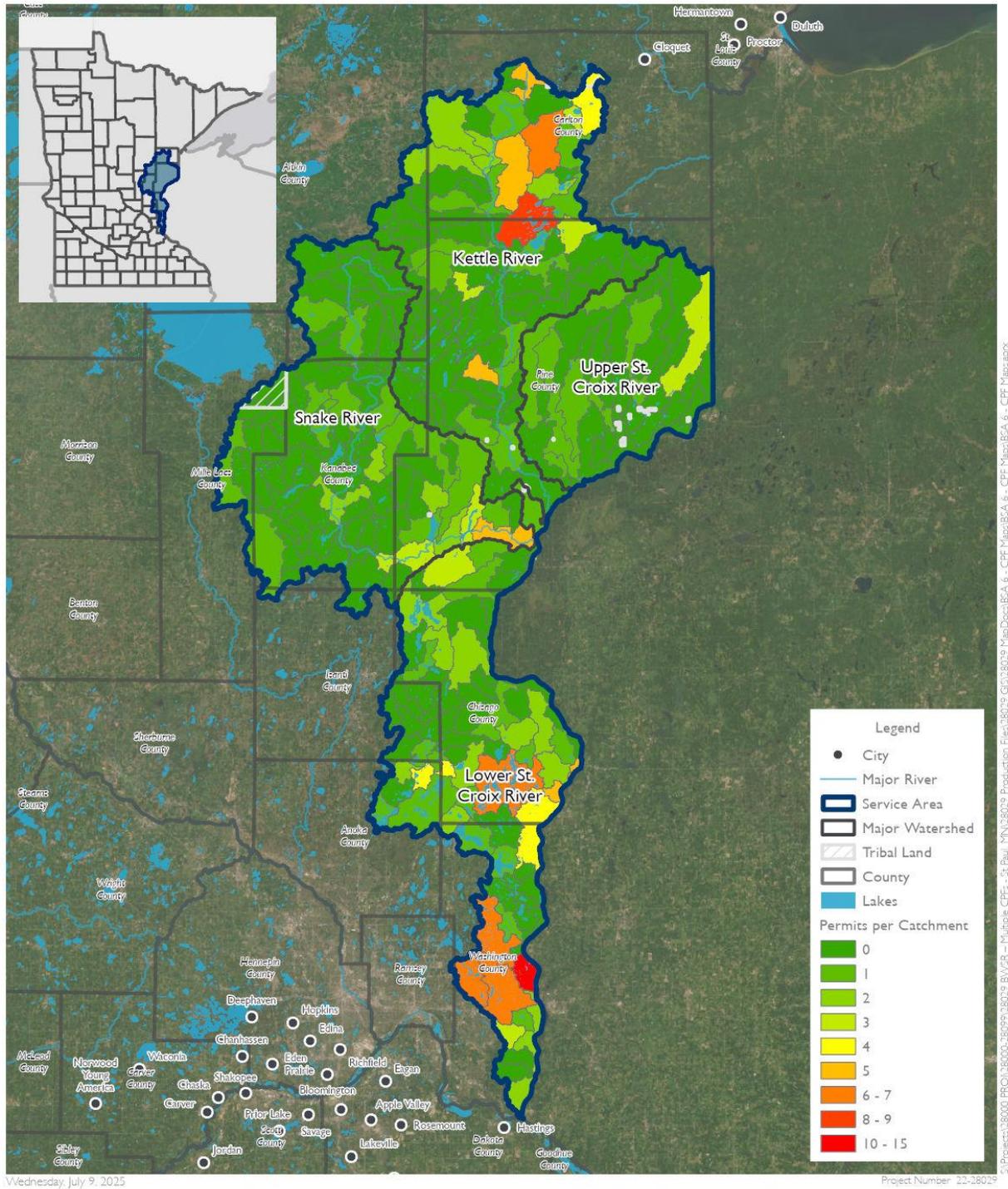


Section 404 Impacts  
 by Catchment  
 Compensation Planning Framework  
 BSA 6 - Minnesota

Source(s):  
 Orthophoto (ESRI 2023)



**Figure B-16. Permit Density**

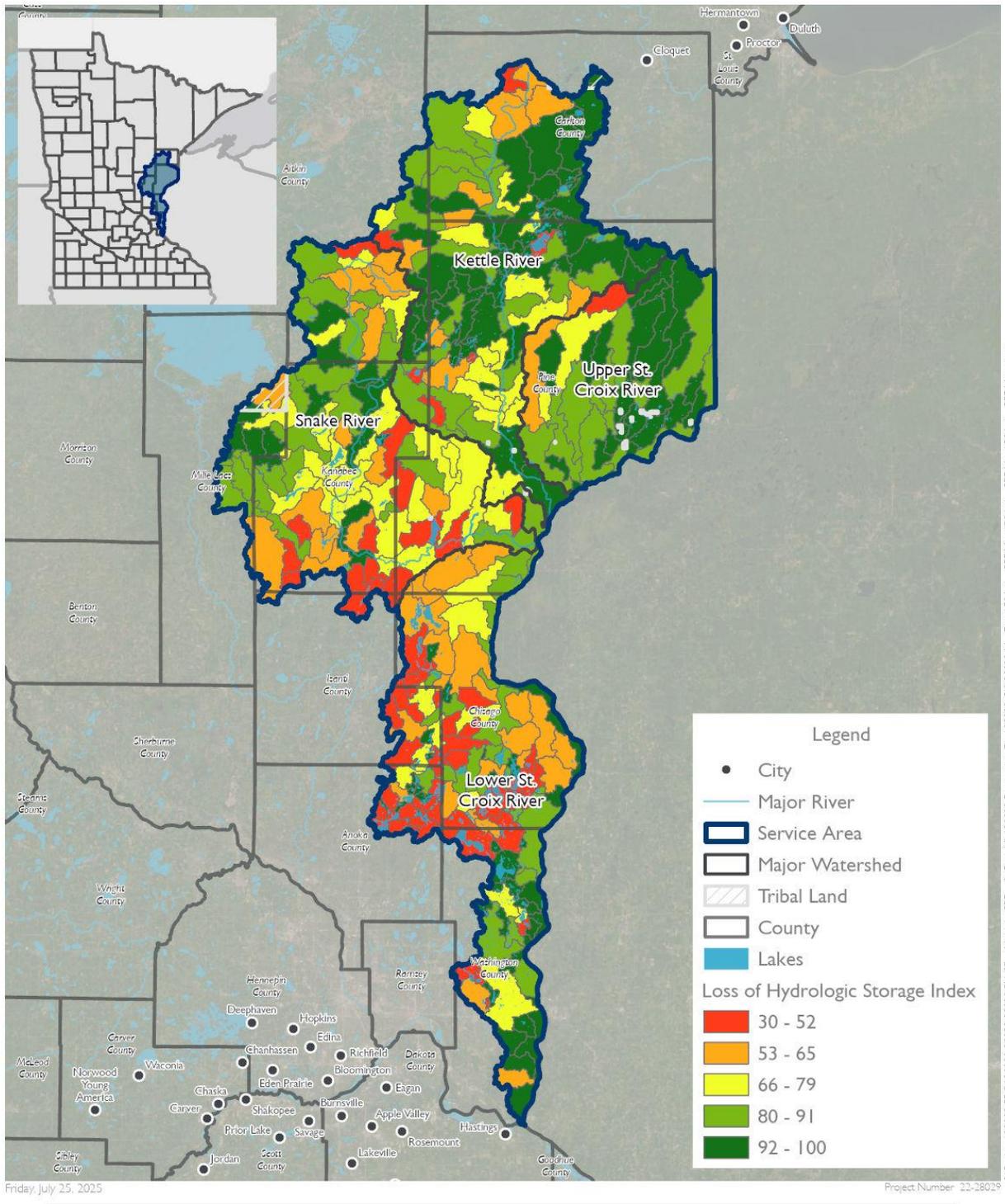


Permit Density by Catchment  
 Compensation Planning Framework  
 BSA 6 - Minnesota

Source(s):  
 Orthophoto (ESRI, 2023)



**Figure B-17. Loss of Hydrologic Storage**

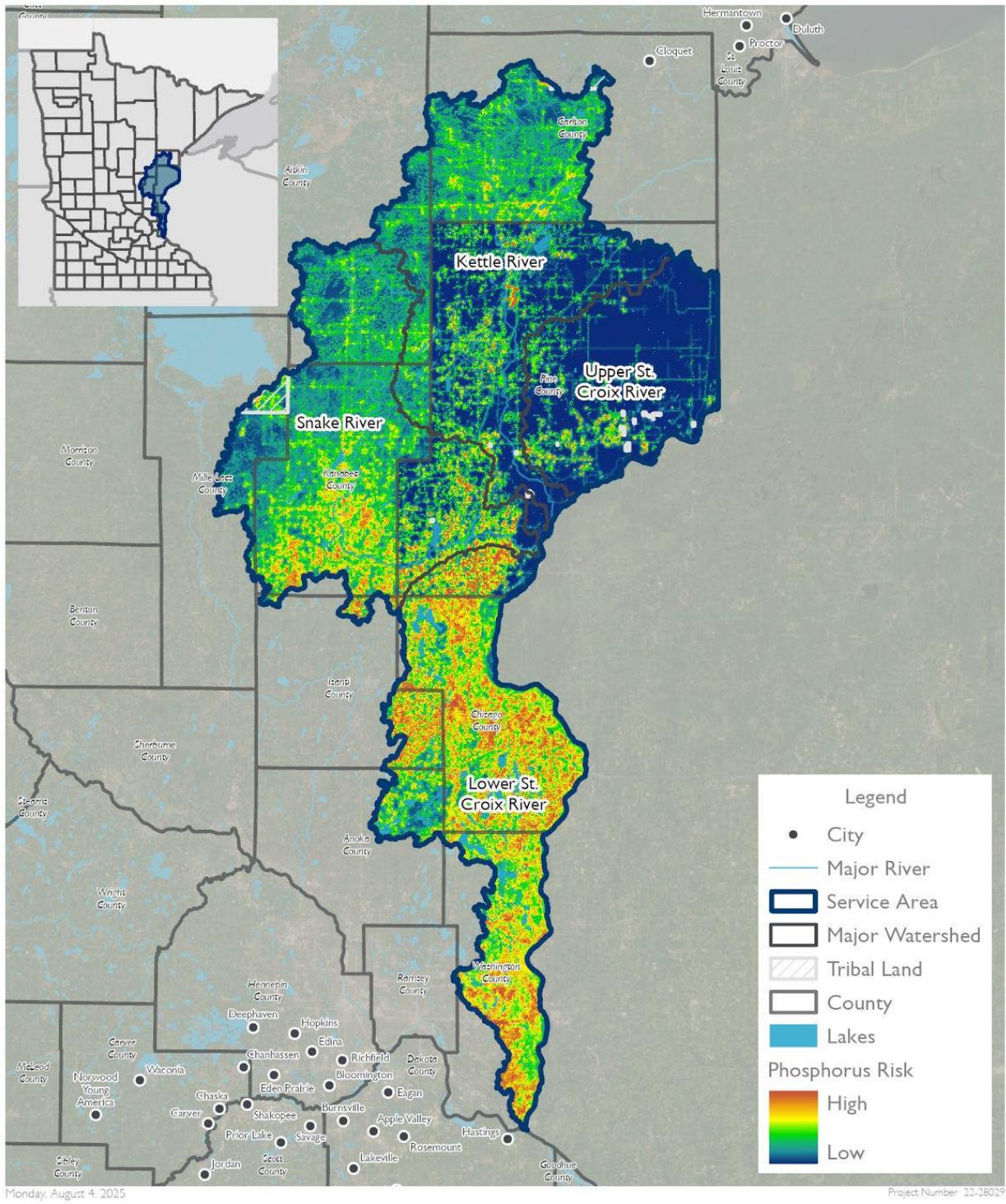


Loss of Hydrologic Storage Index  
 Compensation Planning Framework  
 BSA 6 - Minnesota

Source(s):  
 Orthophoto (ESRI, 2023)



**Figure B-18. Phosphorus Risk**



Phosphorus Risk  
 Compensation Planning Framework  
 BSA 6 - Minnesota

Source(s):  
 Orthophoto (ESRI, 2023)  
 Phosphorus Stress (DRUM, 2014)



# Appendix C: Stakeholder Meeting Attendees and Presentations



## C-1. Meeting 1- February 2017 Stakeholder Meeting List of Attendees

Organization	Name	Email	Present at 2/18/17 Meeting
Washington SWCD	Jay Riggs	<a href="mailto:jay.riggs@mnwcd.org">jay.riggs@mnwcd.org</a>	Yes
Chisago SWCD	Craig Mell & Cassey	<a href="mailto:craig.mell@mn.nacdnet.net">craig.mell@mn.nacdnet.net</a>	Yes
Knabec SWCD	Deanna Pomije	<a href="mailto:deanna.pomije@mn.nacdnet.net">deanna.pomije@mn.nacdnet.net</a>	Yes
Pine SWCD	Robin Poppe	<a href="mailto:robin.poppe@co.pine.mn.us">robin.poppe@co.pine.mn.us</a>	No
Carlton SWCD	Laura Christianson	<a href="mailto:lchristensen@carltonswcd.org">lchristensen@carltonswcd.org</a>	Yes
Isanti SWCD	Todd Kulaf	<a href="mailto:todd.kulaf@mn.nacdnet.net">todd.kulaf@mn.nacdnet.net</a>	No
Mille Lacs SWCD	Susan Shaw	<a href="mailto:susan.shaw@co.mille-lacs.mn.us">susan.shaw@co.mille-lacs.mn.us</a>	Yes
Aikin SWCD	Steve Hughs	<a href="mailto:hughes.aitkinswcd@gmail.com">hughes.aitkinswcd@gmail.com</a>	No
Anoka SWCD	Becky Wozney	<a href="mailto:becky.wozney@anokaswcd.org">becky.wozney@anokaswcd.org</a>	Yes
Comfort Lake Forest Lake WD	Mike Kinny	<a href="mailto:michael.kinney@clflwd.org">michael.kinney@clflwd.org</a>	No
Sunrise WMO	Jamie Shurbon	<a href="mailto:jamie.schurbon@anokaswcd.org">jamie.schurbon@anokaswcd.org</a>	No
Chisago Lake LID	Susanna Wilson	<a href="mailto:susanna.wilson@chisagocounty.us">susanna.wilson@chisagocounty.us</a>	No
Carnelian Marine St. Croix WD	Jim Shaver	NA	No
Browns Creek WD	Karen Kill	<a href="mailto:karen.kill@mnwcd.org">karen.kill@mnwcd.org</a>	No
Valley Branch WD	John Hanson	<a href="mailto:jhanson@barr.com">jhanson@barr.com</a>	Yes
South Washington WD	Matt Moore	<a href="mailto:mmoore@ci.woodbury.mn.us">mmoore@ci.woodbury.mn.us</a>	Yes
Middle St. Croix WMO	Mike Isensee	<a href="mailto:misensee@mnwcd.org">misensee@mnwcd.org</a>	No
St. Croix River Association	Deb Ryun	<a href="mailto:debryun@scramail.com">debryun@scramail.com</a>	Yes
St. Croix River Association	Monica Zachay	<a href="mailto:monicaz@scramail.com">monicaz@scramail.com</a>	Yes
St. Croix River Association	Natalie Warren	<a href="mailto:nataliew@scramail.com">nataliew@scramail.com</a>	No
Chisago County Environmental	Jeff Fertig	<a href="mailto:jafertig@co.chisago.mn.us">jafertig@co.chisago.mn.us</a>	No

# C-1. Meeting 1- February 2017 Stakeholder Meeting Presentation



## What is an ILF Program

- Fee based wetland mitigation program based on a watershed approach

## ILF Approval Process

Based in Federal Rule  
Federal approval necessary no State approval process

Agreement: between Corps and Sponsor to allow Sale of Advance Credits  
Pre Approved plan on how mitigation will occur

## ILF and Banks

Advanced vs Released Credits  
Advanced are like Loan  
Released or on the landscape

Non Profits or Government Agencies Only  
Removed the drive for profit  
Outcome driven= better mitigation

Watershed approach selection of projects  
Banks are opportunity based

## Current State of Mitigation

6.6 Credits Remaining

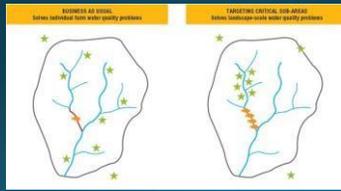
## Two Components of ILF Program

Instrument  
Program Establishment and Operation  
Costs and Fees of Credits  
Accounting Procedures  
Long Term Management  
Land Protection  
Reporting

Compensatory Planning Framework (CPF)  
How and Where Mitigation Will Occur

# Compensatory Planning Framework (CPF)

Prioritizes Wetland Restoration to Meet Watershed Goals



# CPF Development Process



## Stakeholder Input

Federal Rule Requires Stakeholder Input  
Nothing replaces local knowledge

Input on Appropriate Data Sources (State and Local)

Lead Us Through Your Local Plans

ID Your Most Important Watershed Goals



## CPF Development

Initial Analysis using GIS to Determine  
Wetland Loss  
Changes in Perennial Cover  
Changes in Land use  
Changes in Hydrologic Storage  
???



Identify Sources of Impairment and Threats  
Wide ranging in St. Croix Basin  
Agriculture  
TMDL's Vs Loss of Habitat

## CPF Development Initial Data Sources

Watershed Health Assessment Framework  
<http://arcgis.dnr.state.mn.us/ewr/whaf/Explore/#>

Web site that provides a comprehensive overview of the ecological health of Minnesota's watersheds

Provides:

- Watershed Report Card
- Ecological Context Report
- Downloadable GIS Data on Watersheds and Catchments

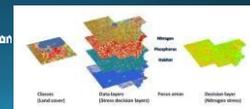
## CPF Development Initial Data Sources

Restorable Wetland Prioritization Tool  
<http://www.mnwetlandrestore.org/>  
MNRWI

Predicts likely locations for restorable wetlands using 30 Meter DEM resolution  
Locates stressed areas in need of water quality and habitat improvement  
Prioritizing areas that are most likely to result in high functioning sustainable wetlands  
Refines output based on your priorities

Provides

- Downloadable GIS data at the 30 meter pixel resolution
- Focus on Nitrogen, Phosphorus, Habitat



## CPF Development Share and Present Data



1. Present Analysis of Data
  - Maps
  - Tabular data
  - Our thoughts on threats
  - Our Thoughts on Goals
2. Solicit Information from you
  - What local data you may have
  - What you perceive as threats
  - Your watershed goals



## Final Step in CPF Development



## Use of CPF



### Road Program Access to Advance Credits

- Prevent closure of program in service areas
- Guide for future road banks
- Can act as an economic catalyst to share credits with private sector needs

### Private Commercial Banks

- Bankers and use CPF to locate potential bank sites
- CPF credits will have more value than non CPF credits (New WCA Rules)
- Will grandfather existing banks

## Use of CPF



### Non Regulatory Conservation Groups

- BWSR RIM
- LREP

### Watershed District Plans and Projects

- Direct project location for regulatory and non regulatory uses

### SWCD Projects

- Work with county or landowners to develop more effective projects

## Time Line

Prospectus	March 2017
Second Stakeholder meeting	?
Draft Instrument	?
Final Instrument	?

## Goal of Next Meeting



1. Present Analysis of Data
  - Maps
  - Tabular data
  - Our thoughts on threats
  - Our Thoughts on Goals
2. Solicit Information from you
  - What local data you may have
  - What you perceive as threats
  - Your watershed goals

## C-2. Meeting 2- January 22, 2018 Stakeholder Meeting List of Attendees

Organization	Name	Email	Present at 1/22/18 Meeting
Washington SWCD	Jay Riggs	<a href="mailto:jay.riggs@mnwcd.org">jay.riggs@mnwcd.org</a>	No
Chisago SWCD	Craig Mell & Cassey	<a href="mailto:craig.mell@mn.nacdnet.net">craig.mell@mn.nacdnet.net</a>	Yes
Knabec SWCD	Deanna Pomije	<a href="mailto:deanna.pomije@mn.nacdnet.net">deanna.pomije@mn.nacdnet.net</a>	No
Pine SWCD	Robin Poppe	<a href="mailto:robin.poppe@co.pine.mn.us">robin.poppe@co.pine.mn.us</a>	No
Carlton SWCD	Laura Christianson	<a href="mailto:lchristensen@carltonswcd.org">lchristensen@carltonswcd.org</a>	Yes
Isanti SWCD	Todd Kulaf	<a href="mailto:todd.kulaf@mn.nacdnet.net">todd.kulaf@mn.nacdnet.net</a>	Yes
Mille Lacs SWCD	Suasan Shaw	<a href="mailto:susan.shaw@co.mille-lacs.mn.us">susan.shaw@co.mille-lacs.mn.us</a>	No
Aikin SWCD	Steve Hughs	<a href="mailto:hughes.aitkinswcd@gmail.com">hughes.aitkinswcd@gmail.com</a>	No
Anoka SWCD	Becky Wozney	<a href="mailto:becky.wozney@anokaswcd.org">becky.wozney@anokaswcd.org</a>	Yes
Comfort Lake Forest Lake WD	Mike Kinny	<a href="mailto:michael.kinney@clflwd.org">michael.kinney@clflwd.org</a>	No
Sunrise WMO	Jamie Shurbon	<a href="mailto:jamie.schurbon@anokaswcd.org">jamie.schurbon@anokaswcd.org</a>	No
Chisago Lake LID	Susanna Wilson	<a href="mailto:susanna.wilson@chisagocounty.us">susanna.wilson@chisagocounty.us</a>	No
Carnelian Marine St. Croix WD	Jim Shaver	NA	No
Browns Creek WD	Karen Kill	<a href="mailto:karen.kill@mnwcd.org">karen.kill@mnwcd.org</a>	No
Valley Branch WD	John Hanson	<a href="mailto:jhanson@barr.com">jhanson@barr.com</a>	Yes
South Washington WD	Matt Moore	<a href="mailto:mmoore@ci.woodbury.mn.us">mmoore@ci.woodbury.mn.us</a>	No
Middle St. Croix WMO	Mike Isensee	<a href="mailto:misensee@mnwcd.org">misensee@mnwcd.org</a>	No
St. Croix River Association	Deb Ryun	<a href="mailto:debryun@scramail.com">debryun@scramail.com</a>	No
St. Croix River Association	Monica Zachay	<a href="mailto:monicaz@scramail.com">monicaz@scramail.com</a>	No
St. Croix River Association	Natalie Warren	<a href="mailto:nataliew@scramail.com">nataliew@scramail.com</a>	No
Chisago County Environmental	Jeff Fertig	<a href="mailto:jafertig@co.chisago.mn.us">jafertig@co.chisago.mn.us</a>	No

## C-2. Meeting 2- January 22, 2018 Stakeholder Meeting Presentation



### What is an ILF Program

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- Agreement: between Corps and Sponsor to allow Sale of Advance Credits  
Pre Approved plan on how mitigation will occur

### ILF and Banks

- Advanced vs Released Credits  
Advanced are like Loan  
Released or on the landscape
- Non Profits or Government Agencies Only  
Removed the drive for profit  
Outcome driven= better mitigation
- Watershed approach selection of projects  
Banks are opportunity based

### Current State of Mitigation

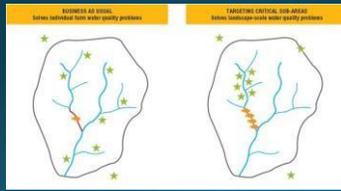
6.6 Credits Remaining

### Two Components of ILF Program

- Instrument
  - Program Establishment and Operation
  - Costs and Fees of Credits
  - Accounting Procedures
  - Long Term Management
  - Land Protection
  - Reporting
- Compensatory Planning Framework (CPF);  
How and Where Mitigation Will Occur

# Compensatory Planning Framework (CPF)

Prioritizes Wetland Restoration to Meet Watershed Goals



# CPF Development Process



## Stakeholder Input

Federal Rule Requires Stakeholder Input  
Nothing replaces local knowledge

Input on Appropriate Data Sources (State and Local)

Lead Us Through Your Local Plans

ID Your Most Important Watershed Goals



## CPF Development

Initial Analysis using GIS to Determine  
Wetland Loss  
Changes in Perennial Cover  
Changes in Land use  
Changes in Hydrologic Storage  
???



Identify Sources of Impairment and Threats  
Wide ranging in St. Croix Basin  
Ag vs Development  
TMDL's vs Loss of Habitat

## CPF Development Initial Data Sources

Watershed Health Assessment Framework  
<http://arcgis.dnr.state.mn.us/ewr/whaf/Explore/#>

Web site that provides a comprehensive overview of the ecological health of Minnesota's watersheds

Provides:

- Watershed Report Card
- Ecological Context Report
- Downloadable GIS Data on Watersheds and Catchments

## CPF Development Initial Data Sources

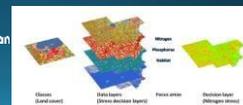
Restorable Wetland Prioritization Tool  
<http://www.mnwetlandrestore.org/>

MINRWI

Predicts likely locations for restorable wetlands using 30 Meter DEM resolution  
Locates stressed areas in need of water quality and habitat improvement  
Prioritizing areas that are most likely to result in high functioning sustainable wetlands  
Refines output based on your priorities

Provides

- Downloadable GIS data at the 30 meter pixel resolution
- Focus on Nitrogen, Phosphorus, Habitat



## CPF Development Share and Present Data



1. **Present Analysis of Data**
  - Maps
  - Tabular data
  - Our thoughts on threats
  - Our Thoughts on Goals
2. **Solicit Information from you**
  - What local data you may have
  - What you perceive as threats
  - Your watershed goals



## Final Step in CPF Development



### Goals

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_

### PRIORITiES

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_



## Use of CPF



**Road Program Access to Advance Credits**

- Prevent closure of program in service areas
- Guide for future road banks
- Can act as an economic catalyst to share credits with private sector needs

**Private Commercial Banks**

- Bankers and use CPF to locate potential bank sites
- CPF credits will have more value than non CPF credits (New WCA Rules)
- Will grandfather existing banks

## Use of CPF



**Non Regulatory Conservation Groups**

- BWSR RIM
- LREP

**Watershed District Plans and Projects**

- Direct project location for regulatory and non regulatory uses

**SWCD Projects**

- Work with county or landowners to develop more effective projects

## Time Line

Prospectus	March 2017
Second Stakeholder meeting	?
Draft Instrument	?
Final Instrument	?

## Goal of Next Meeting

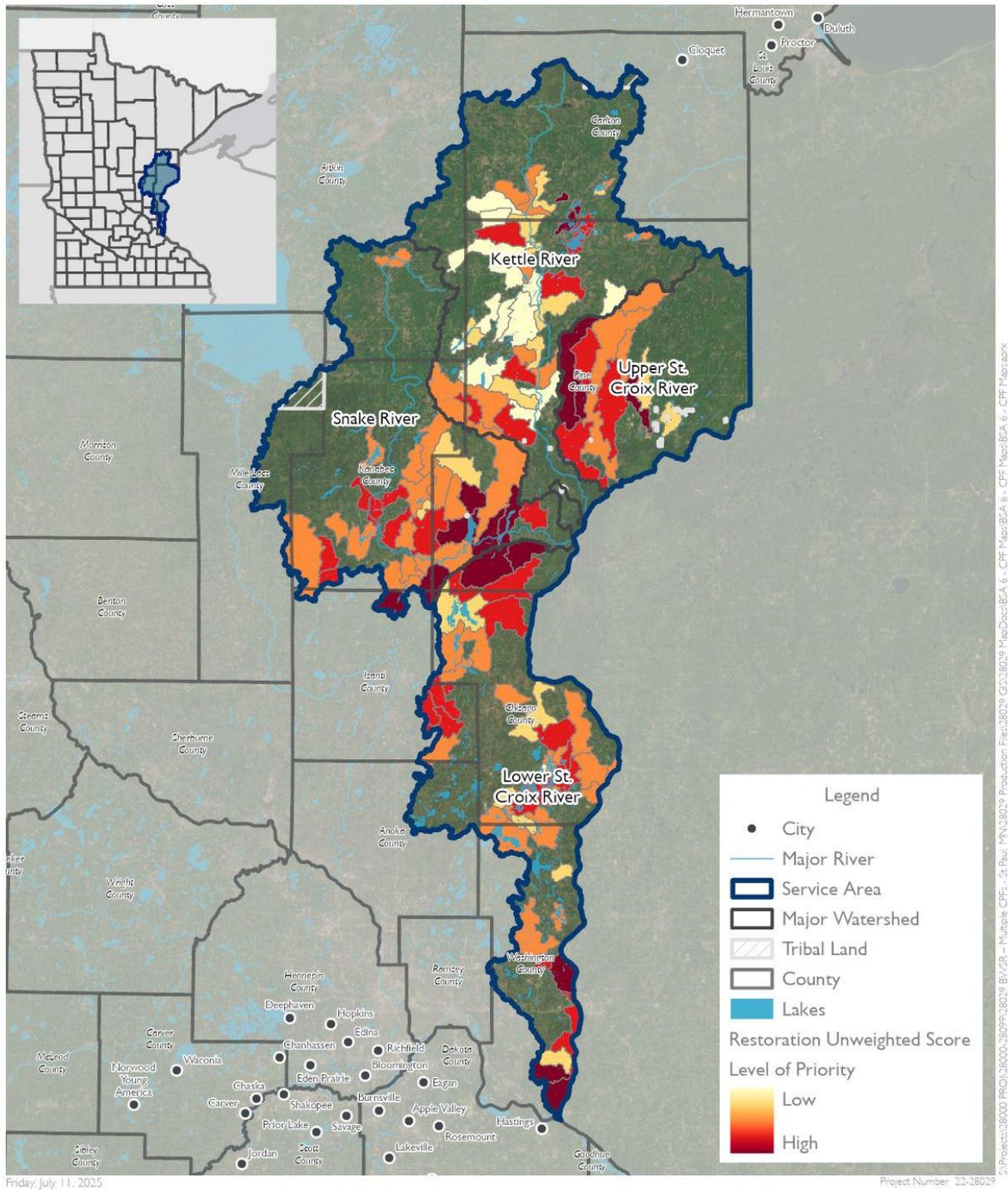


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# Appendix D: Catchment Prioritization Maps



**Figure D-1. Unweighted Restoration Catchment Prioritization**

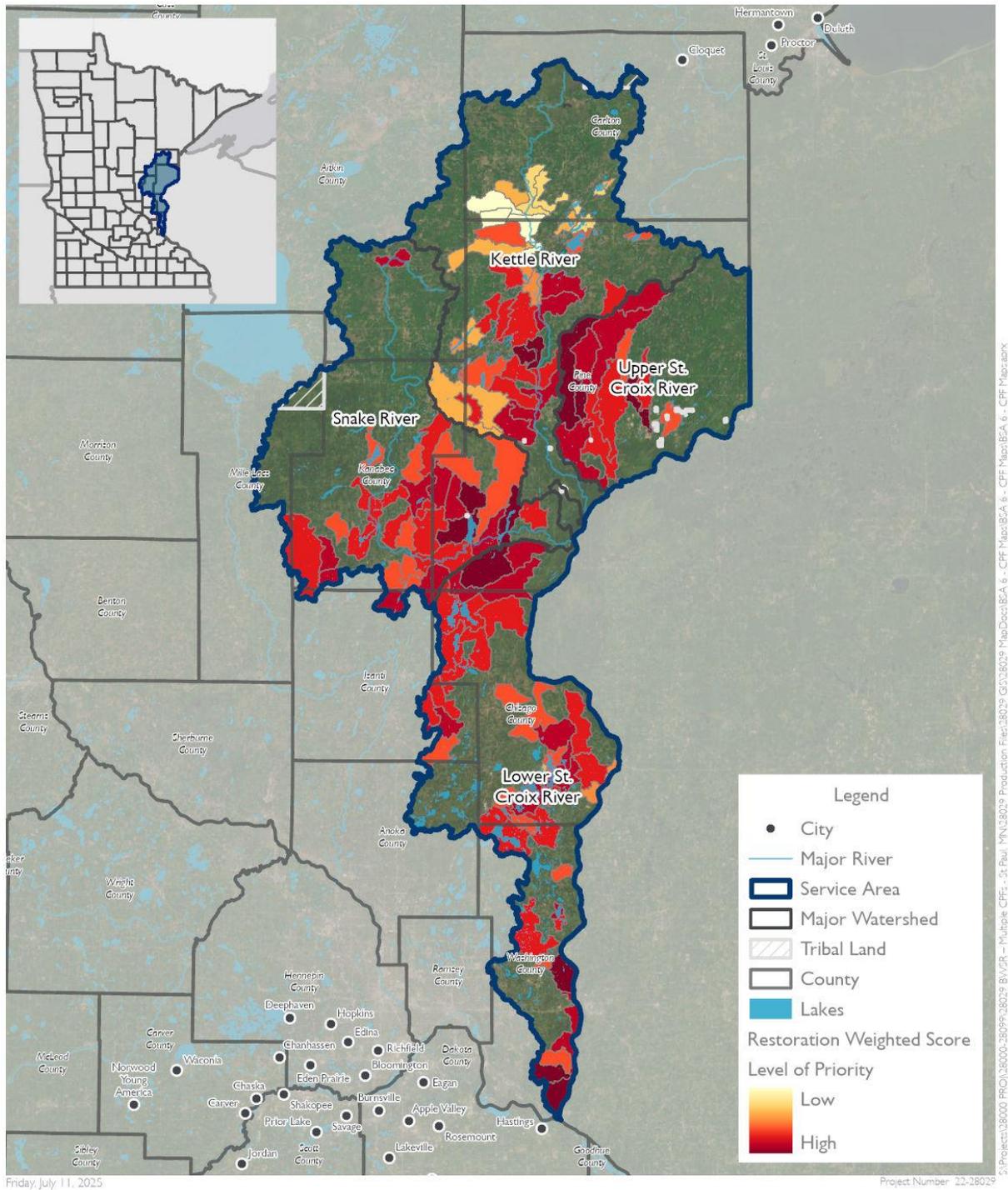


Catchment Prioritization  
 Restoration Unweighted  
 Compensation Planning Framework  
 BSA 6 - Minnesota

Source(s):  
 Orthophoto (ESRI, 2023)



**Figure D-2. Weighted Restoration Catchment Prioritization**

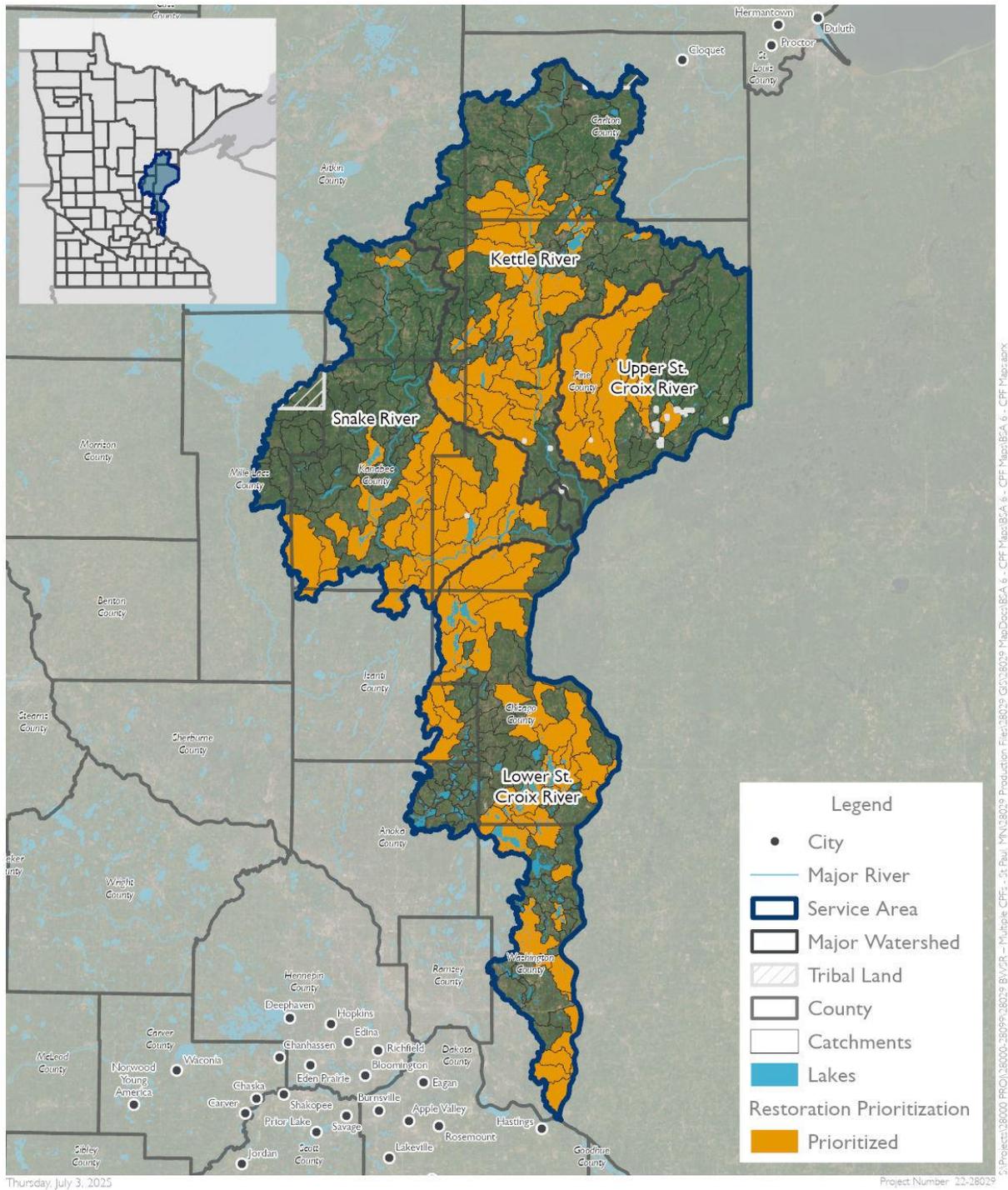


Catchment Prioritization  
 Restoration Weighted  
 Compensation Planning Framework  
 BSA 6 - Minnesota

Source(s):  
 Orthophoto (ESRI, 2023)



**Figure D-3. Final Restoration Catchment Prioritization**

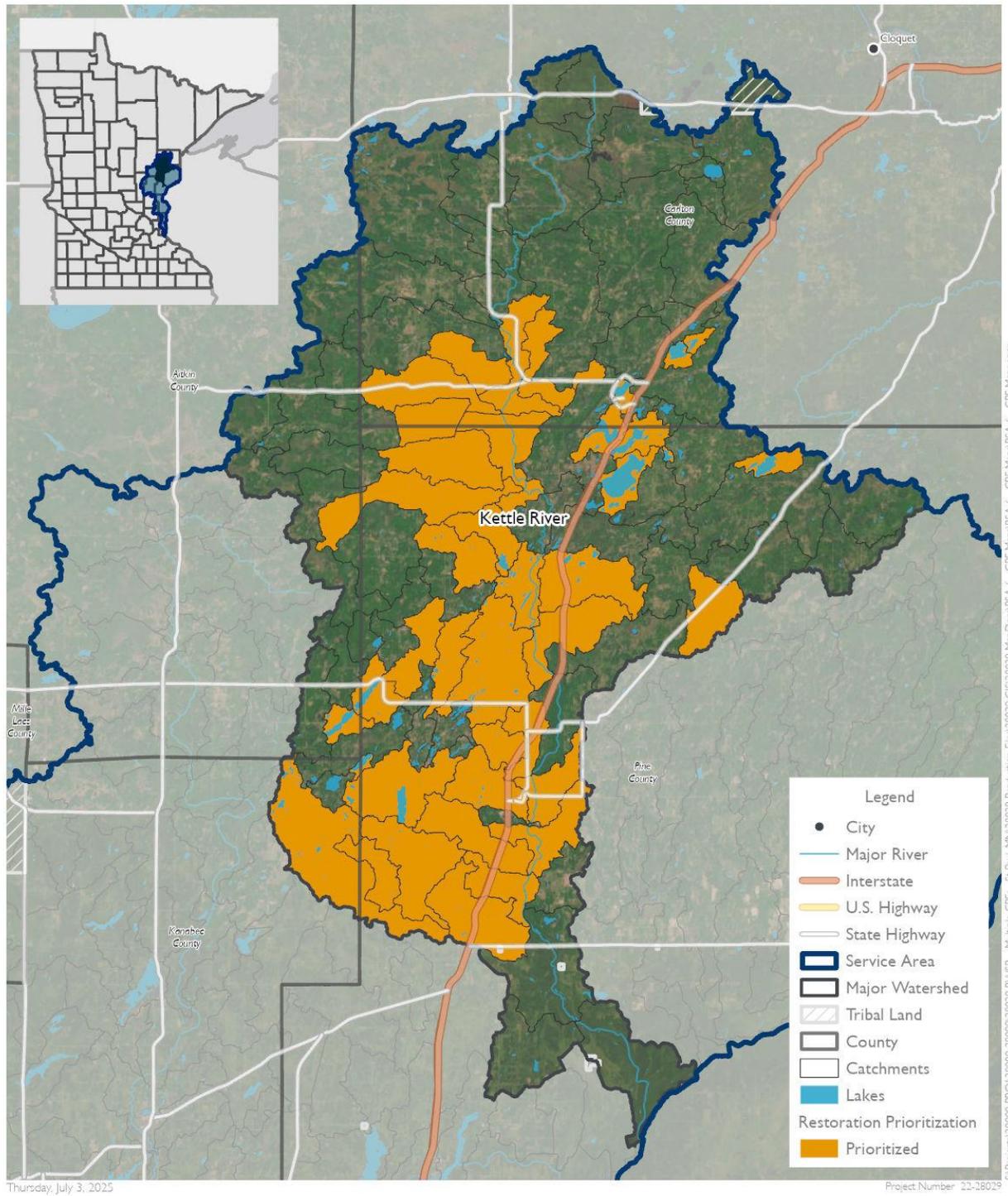


Catchment Prioritization  
 Restoration Top Third  
 Compensation Planning Framework  
 BSA 6 - Minnesota

Source(s):  
 Orthophoto (ESRI, 2023)



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

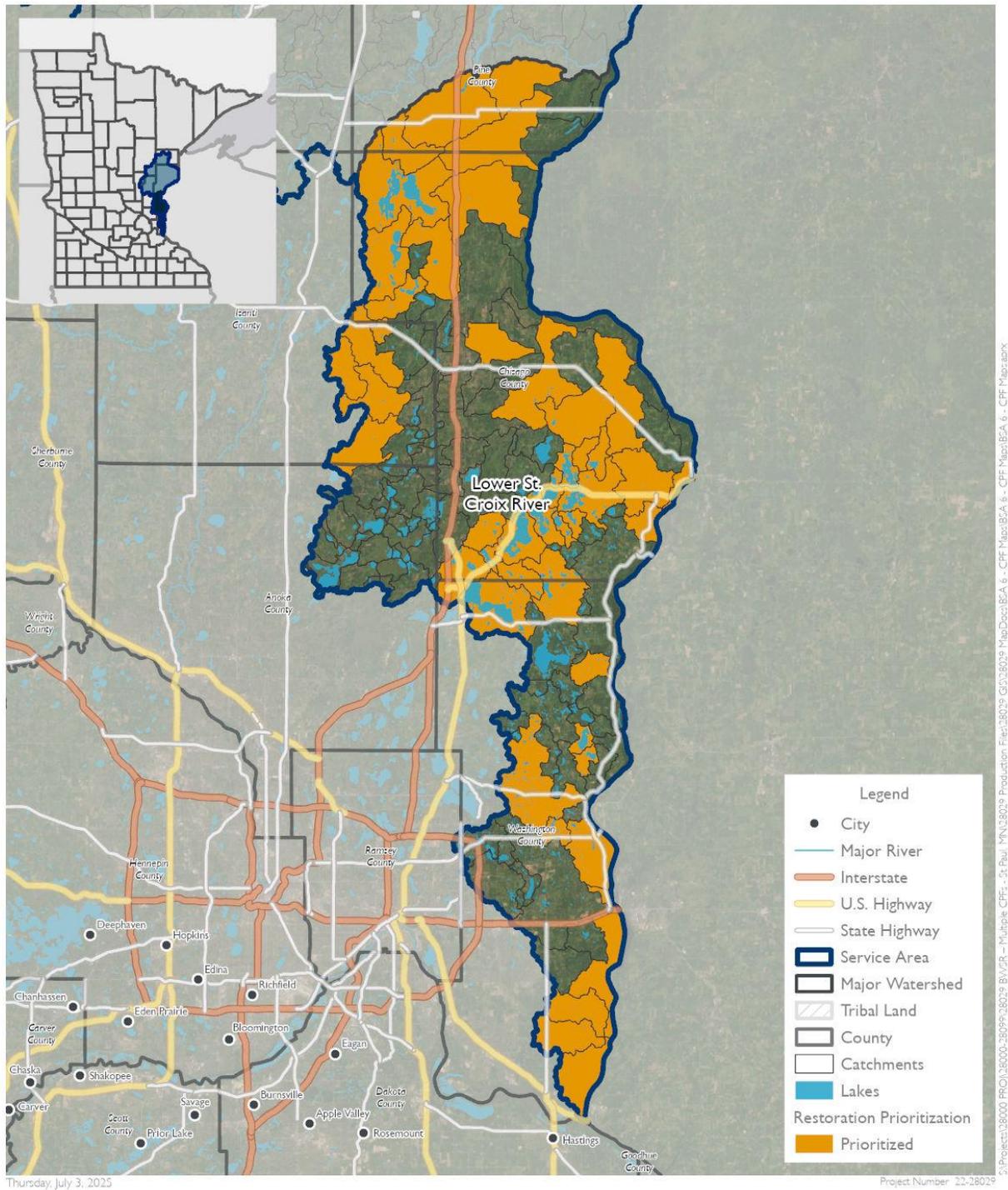


Catchment Prioritization for Restoration  
Kettle River  
Compensation Planning Framework  
BSA 6 - Minnesota

Source(s):  
Orthophoto (ESRI, 2023)



**Figure D-5. Final Restoration Catchment Prioritization – Lower St. Croix River-Stillwater Watershed**

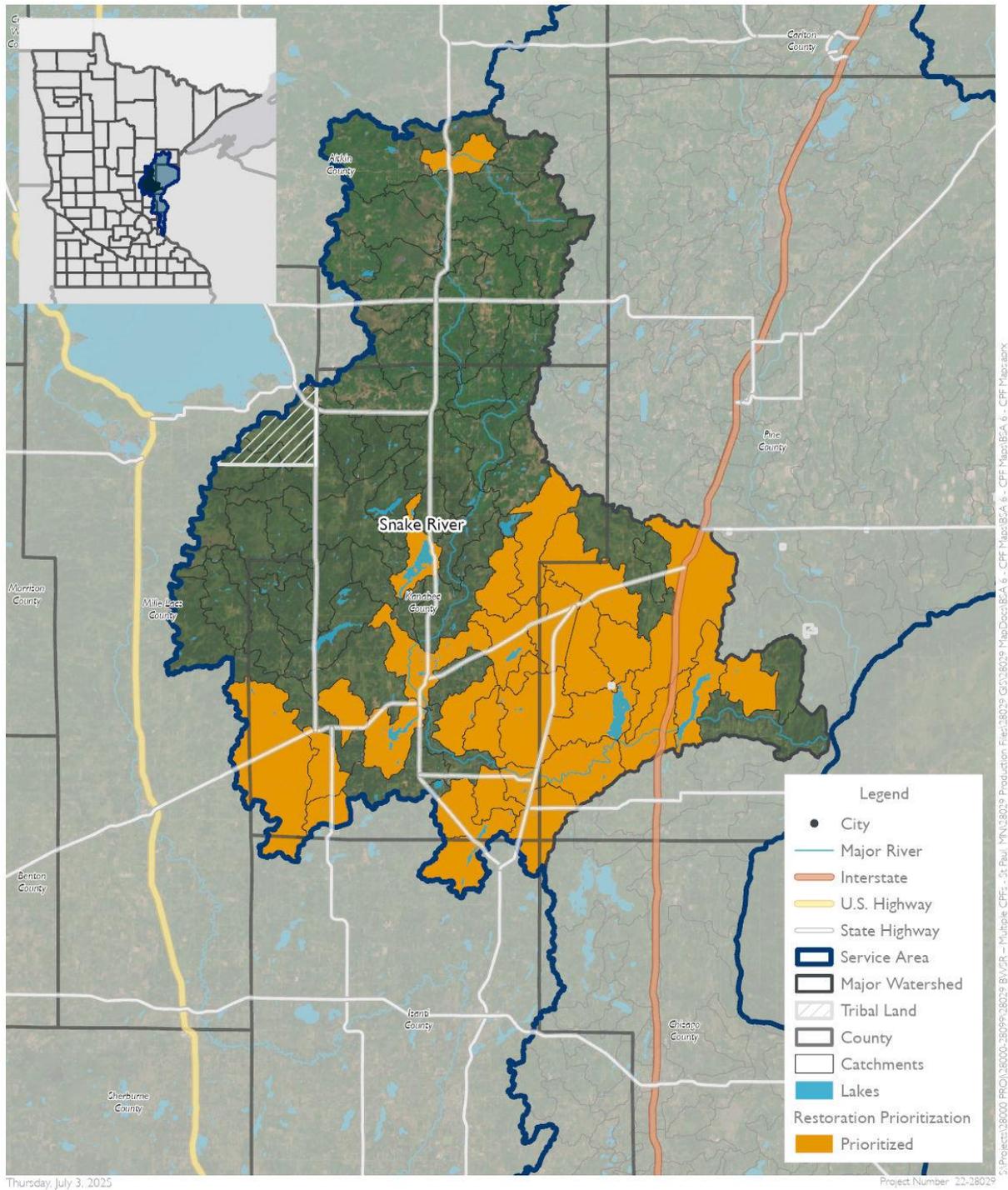


Catchment Prioritization for Restoration  
 Lower St. Croix River  
 Compensation Planning Framework  
 BSA 6 - Minnesota

Source(s):  
 Orthophoto (ESRI, 2023)



**Figure D-6. Final Restoration Catchment Prioritization – Snake River Watershed**

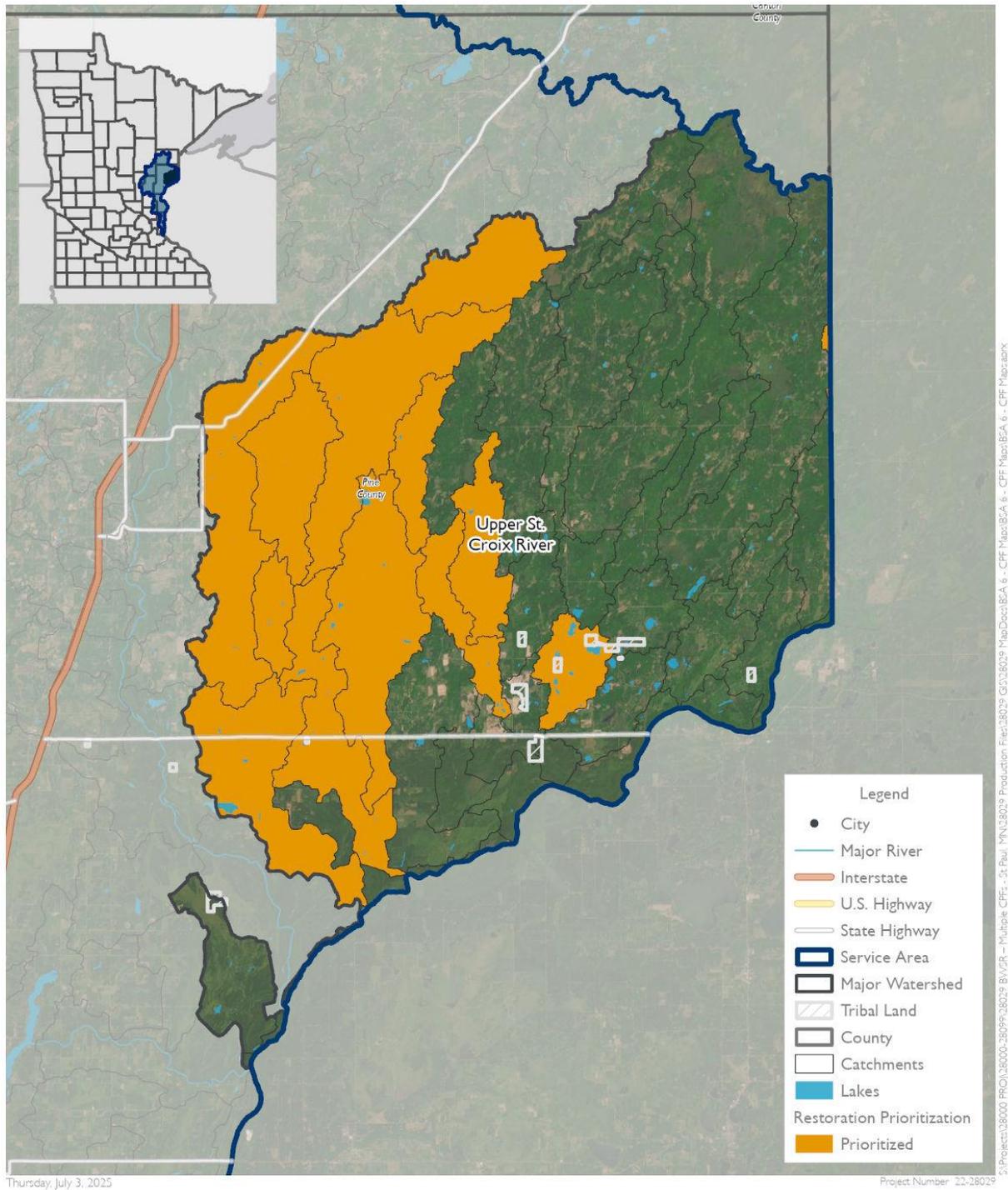


Catchment Prioritization for Restoration  
 Snake River - St. Croix  
 Compensation Planning Framework  
 BSA 6 - Minnesota

Source(s):  
 Orthophoto (ESRI, 2023)



Figure D-7. Final Restoration Catchment Prioritization – Upper St. Croix River Watershed



Catchment Prioritization for Restoration  
Upper St. Croix River  
Compensation Planning Framework  
BSA 6 - Minnesota

Source(s):  
Orthophoto (ESRI, 2023)

