Watershed Management Plan – Appendix A: Land and Waters Resources Inventory

2025-2035

Prepared for
Bassett Creek Watershed Management Commission

DRAFT – November 2023

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Abbreviations

BCWMC	Bassett Creek Watershed Management Commission
BWSR	(Minnesota) Board of Water and Soil Resources
CAMP	Citizen Assisted Monitoring Program
DWSMA	Drinking Water Supply Management Area
FCP	Flood Control Project
FEMA	Federal Emergency Management Agency
LGU	Local Governmental Unit
MBS	Minnesota Biological Survey
MDH	Minnesota Department of Health
MDNR	Minnesota Department of Natural Resources
MLCCS	Minnesota Land Cover Classification System
MnDOT	Minnesota Department of Transportation
MPCA	Minnesota Pollution Control Agency
MPRB	Minneapolis Park and Recreation Board
MS4	Municipal Separate Storm Sewer System
MSP	Minneapolis/St. Paul International Airport
NAVD88	North American Vertical Datum (1988)
NGVD29	National Geodetic Vertical Datum (1929)
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resource Conservation Service
NWI	National Wetland Inventory
NWL	Normal Water Level
OHWL	Ordinary High Water Level
PWI	Public Waters Inventory
RCP	Reinforced Concrete Pipe
TCMA	Twin Cities Metropolitan Area
TMDL	Total Maximum Daily Load

TP	Total Phosphorus
TRPD	Three Rivers Park District
USACE	United States Army Corps of Engineers
UWEPA	United States Environmental Protection Agency
USFWS	Unites States Fish and Wildlife Service
WCA	Wetland Conservation Act
WHPP	Wellhead Protection Plan
WOMP	Watershed Outlet Monitoring Program

A Land and Water Resources Inventory

NOTE FOR REVIEWERS – This section will be included as an Appendix in the complete Plan document. Yellow highlight indicates text to be confirmed with City staff or otherwise updated based on future information.

This section summarizes the land and water resources located within the BCWMC. The inventory section contains information on:

- Land use and public utilities
- Climate and precipitation
- Topography, soils, geology and groundwater resources
- Surface water resource information
- Water quality monitoring
- Water quantity and flood risk
- Natural communities and rare species
- Fish and wildlife habitat
- Pollutant sources

This information is important because it describes the condition of the watershed and it informs decisions about infrastructure investments, land development/redevelopment, and ecological preservation.

A.1 Climate and Precipitation

The climate of the Minneapolis-St. Paul area is a humid continental climate, characterized by moderate precipitation (normally sufficient for crops), wide daily temperature variations, large seasonal variations in temperature, warm humid summers, and cold winters with moderate snowfall. Climate data is often presented according to 30-year "climate normal" periods, the most recent spanning the period from 1991-2020. Several of the wettest years on record have been observed during the most recent climate normal period, including several wet years since 2010. Climate data presented in this section is based on the 30-year period from 1991 through 2020, unless otherwise noted.

A.1.1 Current "Climate Normal"

The mean annual temperature for the Bassett Creek watershed is 46.6°F, as measured at the Minneapolis/St. Paul (MSP) airport station (1991-2020). Mean monthly temperatures vary from 15.9°F in January to 74.1°F in July (1991-2020). For the 1991-2020 climate normal period, the average frost-free period (growing season) is approximately 160 days.

Table A-1 summarizes monthly precipitation data for the approximate center of the BCWMC, based on the Minnesota Climatology Working Group precipitation dataset for the most recent complete climate normal period (1991-2020) and 10-year period (2011-2020). Average total annual precipitation is 33.44 inches (1991-2020). The mean monthly precipitation varies from 4.8 inches in June to 0.9 inches in January and February (1991-2020). From May to September, the growing season months, the average rainfall (1991-2020) is 21.1 inches, or 63% of the average annual precipitation. Snowfall averaged 52 inches annually at the MSP station during the 1991-2020 climate normal period.

Additional information about local and regional climate is available from the Minnesota Department of Natural Resources (MDNR) State Climatology office and NOAA at:

- Minnesota State Climatology Office: https://www.dnr.state.mn.us/climate/index.html
- National Oceanic and Atmospheric Administration (NOAA) National Climatic Data Center (NCDC): https://www.ncdc.noaa.gov/cdo-web/

Table A-1 Monthly Precipitation Summary (Climate Normal and 10-year Average)

Month	1991-2020 Precipitation (inches)	2011-2020 Precipitation (inches)
January	0.88	0.71
February	0.93	1.14
March	1.74	1.48
April	3.10	3.33
May	4.27	4.93
June	4.76	4.90
July	4.39	4.78
August	4.36	4.69
September	3.29	3.08
October	2.80	2.90
November	1.71	1.46
December	1.32	1.64
Total	**33.55**	**35.03**

Source: Minnesota Climatology Working Group gridded precipitation dataset

A.1.2 Precipitation Frequency (Atlas 14)

The amount, rate, and type of precipitation are important in determining flood levels and stormwater runoff rates. Average weather imposes little strain on the typical drainage system. Extremes of precipitation and snowmelt are important for design of flood control systems. The National Oceanic and Atmospheric Administration (NOAA) has data on extreme precipitation events that can be used to aid in the design of flood control systems. Extremes of snowmelt most often affect major rivers, the design of large stormwater storage areas, and landlocked basins, while extremes of precipitation most often affect the design of conveyance facilities.

NOAA published Atlas 14, Volume 8, in 2013. Atlas 14 is the primary source of information regarding rainfall in the region. Atlas 14 supersedes publications TP-40 and TP-49 issued by the National Weather Bureau (now the National Weather Service) in 1961 and 1964. Improvements in Atlas 14 precipitation estimates include denser data networks, longer (and more recent) periods of record, application of regional frequency analysis, and new techniques in spatial interpolation and mapping. Atlas 14 provides estimates of precipitation depth (i.e., total rainfall, in inches) and intensity (i.e., depth of rainfall over a specified period) for durations from 5 minutes up to 60 days.

NOAA is in the process of updating Atlas 14 precipitation data to account for temporal trends in historical data and incorporate future climate projections. These updates will be called Atlas 15 and are expected to be published in 2026. More information about Atlas 15 is available from NOAA.

Runoff from spring snowmelt is also important in this region, but is not provided in Atlas 14. The Soil Conservation Service's (now the Natural Resources Conservation Service) National Engineering Handbook, Hydrology, Section 4, presents maps of regional runoff volume. Table A-2 lists selected precipitation and runoff events used for design purposes.

Table A-2 Selected Rainfall and Snowmelt Runoff Events

Type	Event Frequency	Duration	Depth (inches)
Rainfall	2-year	24 hour	2.87
	5-year	24 hour	3.60
	10-year	24 hour	4.29
	25-year	24 hour	5.39
	50-year	24 hour	6.36
	100-year	24 hour	7.42
	10-year	10 day	6.83
	100-year	10 day	10.2
Snowmelt[1]	10-year	10 day	4.7
	25-year	10 day	5.7
	50-year	10 day	6.4
	100-year	10 day	7.1

Source: NOAA Atlas 14 – Volume 8. Station: Golden Valley (21-3202). Hydrology Guide for Minnesota (USDA Soil Conservation Service – NRCS)
[1] Snowmelt depth reported as liquid water.

A.1.3 Climate Trends and Future Precipitation

Even with wide variations in climate conditions, climatologists have found four significant recent climate trends in the Upper Midwest (NOAA, 2013):

- Warmer winters – a decline in severity and frequency of severe cold; more warming periods leading to mid-winter snowmelt
- Higher minimum temperatures
- Higher dew points
- Changes in precipitation trends – more rainfall is coming from heavy thunderstorm events and increased snowfall

NOAA's 2013 report on climate trends and scenarios for the Midwest indicates, total precipitation amounts in Midwest are trending upward. Precipitation records in the BCWMC show the annual average precipitation has increased. Annual precipitation in the BCWMC averaged 33.5 inches from 1991-2020, a 1.3 inch increase over the 1981-2010 climate normal period (32.2 inches). Annual precipitation exceeded the previous climate normal average (32.2 inches) in 6 of 10 years since 2011. In addition, a comparison of precipitation depths between TP-40 and Atlas 14 indicates increased precipitation depths for more extreme events.

According to the NOAA 2013 report, storm rainfall amounts are increasing, as are storm intensities. Higher intensity precipitation events typically produce more runoff than lower intensity events with similar total precipitation amounts; higher rainfall intensities are more likely to overwhelm the capacity of the land surface to infiltrate and attenuate runoff. Increased rainfall and rainfall intensities with less infiltration of native soils are concerning for two primary reasons: soil erosion and flooding.

The Minnesota Board of Water and Soil Resources (BWSR) report on climate change trends and action plan notes that frequent, heavier, or longer-duration rainfall leads to increased runoff rates and erosion. Increased soil erosion results in the release of more sediment and contaminants that reduce the water quality of downstream water bodies.

The Minnesota Pollution Control Agency's (MPCA) global warming website states that increased flooding could also result from more intense precipitation events: http://www.pca.state.mn.us/index.php/topics/climate-change/index.html.

The BWSR report on climate change trends and action plan also notes that flooding from increased precipitation can damage the built environment such as commercial buildings, residential buildings, roads, and more. In addition, increased precipitation can damage the natural environment by degrading natural wetlands, and destabilizing bluffs and trees.

A.2 Population, Demographics, and Land Use

The BCMWC is located within the Twin Cities Metropolitan Area and includes portions of nine cities in Hennepin County. The BCWMC is considered a fully developed watershed as over time, the land has been transformed from a natural landscape (see Section A.9) to urban and suburban land uses. Figure A-1 presents current land use data (Metropolitan Council, 2023).

Development of the watershed has coincided with population growth among the member cities. Population of BCWMC member cities increased by approximately 20% between 1990 and 2020 (including over 50% growth in Plymouth) leading to higher density land uses (data based on member city 2040 Comprehensive Plans). The population of BCWMC member cities is expected to increase by 5% to 15% by 2040 (see City 2040 Comprehensive Plans for additional information)

In addition to increasing total numbers, the population of within the BCWMC (and greater Hennpin County) has aged and grown more racially and ethnically diverse (Hennepin County, 2019). These trends are expected to continue during the lift of this Plan.

Additional population and demographics data for BCWMC communities is available from the Metropolitan Council at: Community Profile - Research Web Community Profiles (state.mn.us).

A.2.1 Land Use

Figure A-1 shows the current land use in the BCWMC (source: Metropolitan Council, 2023). Low density residential is the major land use found in the Bassett Creek watershed (49%), followed by parks, recreational, and natural areas (11%), industrial land uses (8%), and open water (6%). Additional land uses found in the watershed include: undeveloped areas, institutional, major highways, retail/commercial, office space, medium density residential and limited amounts of agriculture. The current vacant areas that are planned for development include areas in western Plymouth and other scattered infill locations within the BCWMC (note that the "vacant" land use designation includes undevelopable land such as wetlands). Proposed redevelopment areas are scattered throughout the watershed. The comprehensive plans for the BCWMC member cities contain more information about these future redevelopment areas.

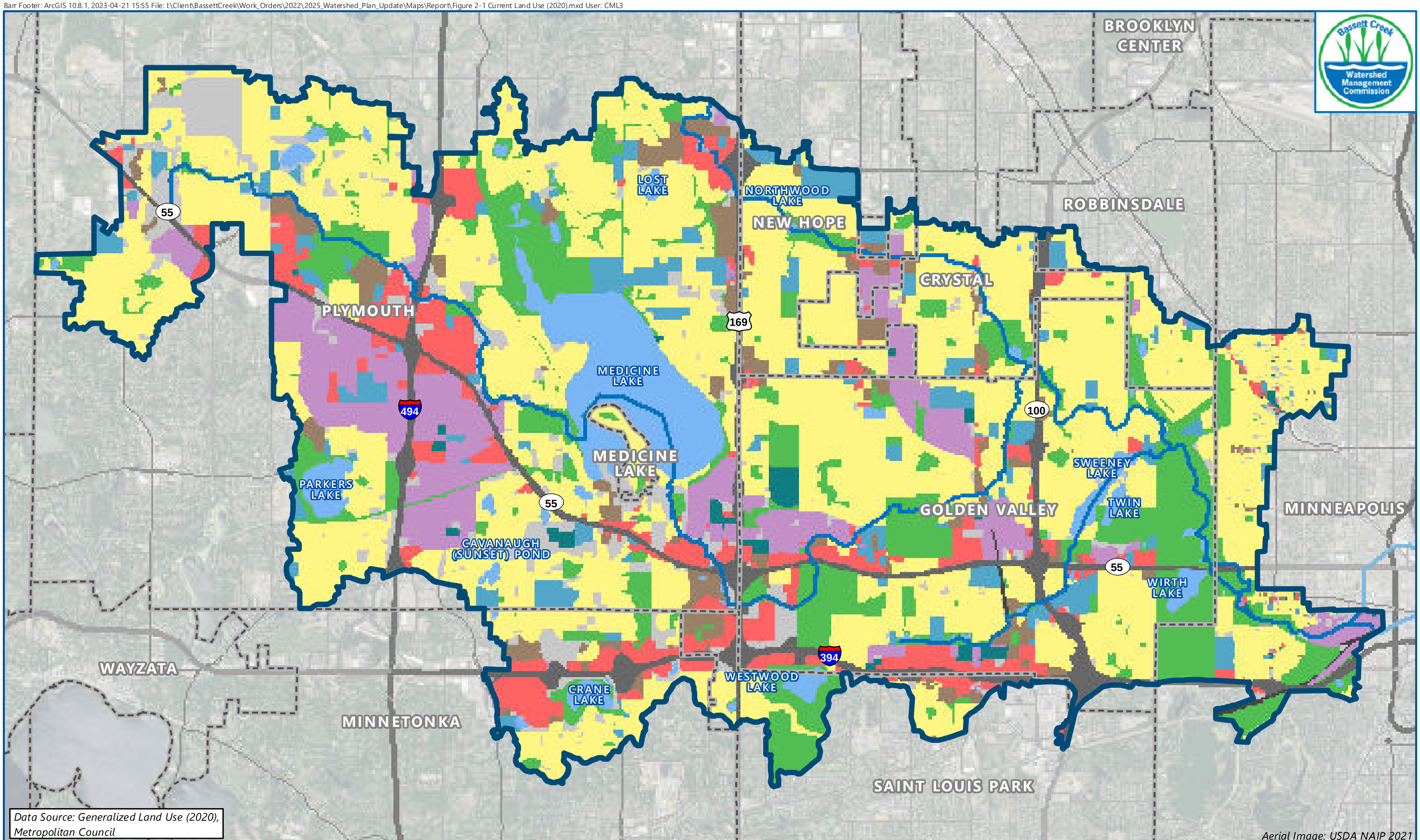
Figure A-2 shows the anticipated future land use based on Metropolitan Council 2040 data. The future land use anticipated in 1990 (and its associated impervious coverage) was the basis for the design of the Bassett Creek Flood Control Project and associated allowable flow rates. Prior to the adoption of the 2004 BCWMC Plan, the BCWMC tracked discrepancies between the projected future land use and actual land use in the watershed. Discrepancies between the planned future land use (and associated impervious coverage) and actual land were mitigated, when necessary. In areas that developed to a higher intensity than was projected, for example, mitigation in the form of additional flood storage was provided. BCWMC's policies included in this Plan require no increase in peak discharge from current conditions (see Section X) and are independent of the proposed future land use. Knowledge of future land use remains useful, however, to identify areas where redevelopment might offer opportunities for additional stormwater treatment or retrofits of existing stormwater infrastructure.

A.2.2 Water and Wastewater Service Areas

Wastewater collection facilities are now available throughout the watershed, the entirety of which is now included within the Metropolitan Urban Services Area (MUSA). The MUSA is the area delineated by the Metropolitan Council where urbanization is expected to occur and where metropolitan service systems (particularly sanitary sewer service and major highways/interchanges) will be provided to accommodate growth.

Stormwater and sanitary sewer waste for much of the City of Minneapolis was formerly discharged to a combined storm sewer and sanitary sewer system. Efforts began in the 1930s to build separate systems and separate the existing flows. The Bassett Creek Flood Control Project design assumed that the entire tributary area from the City of Minneapolis was separated and that the stormwater drains to the creek rather than to wastewater treatment facilities. Therefore, whenever additional projects are completed to separate the remaining combined systems, they are already accounted for in the Project's design capacity.

The City of Minneapolis obtains its water supply from the Mississippi River for municipal purposes. In addition, Minneapolis supplies the cities of Golden Valley, Crystal and New Hope with their municipal water supplies. The cities of Plymouth, Robbinsdale, Minnetonka, St. Louis Park, and Medicine Lake obtain their water supplies from groundwater aquifers (see Section A.5, Geology and Groundwater Resources). In the extreme western portions of the Bassett Creek watershed, some residents still obtain their domestic water supplies from private supply wells. Some residents in Medicine Lake also obtain water from private supply wells.



BCWMC Jurisdictional Boundary
Municipal Boundary
Creek

Land Use *(Met Council, 2020, Hennepin County Parcels 2022)*

- Agricultural
- Single Family Residential
- Multifamily Residential
- Commercial
- Industrial
- Institutional
- Mixed Use
- Park, Recreational or Preserve
- Rights-of-Way (i.e., Roads)
- Railway (inc. LRT)
- Vacant or Unknown
- Water

N

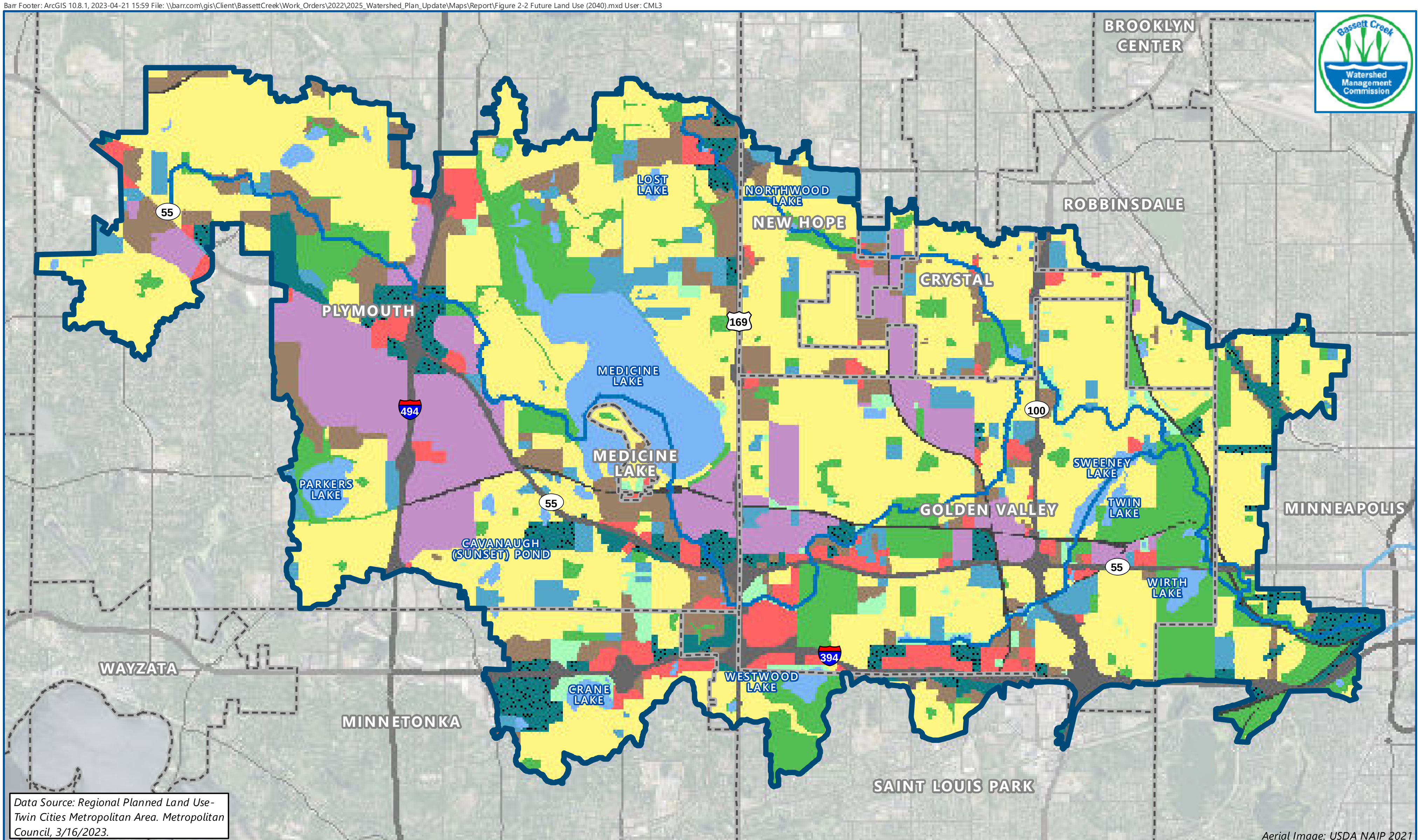
0 6,000 12,000
Feet

FIGURE A-1

CURRENT LAND USE (2020)

Bassett Creek Watershed Management Commission
2025 Watershed Management Plan

Barr Footer: ArcGIS 10.8.1, 2023-04-21 15:59 File: \\barr.com\gis\Client\BassettCreek\Work_Orders\2022\2025_Watershed_Plan_Update\Maps\Report\Figure 2-2 Future Land Use (2040).mxd User: CML3



BCWMC Jurisdictional Boundary
Municipal Boundary
Creek

Planned Land Use *(Met Council, 2023)*

- Rural or Large-Lot Residential
- Single Family Residential
- Multifamily Residential
- Commercial
- Industrial
- Institutional
- Mixed Use
- Multi-Optional Development
- Park and Recreation
- Open Space or Restrictive Use
- Rights-of-Way (i.e., Roads)
- Railway (inc. LRT)
- Open Water

N

0 3,000 6,000
Feet

FIGURE A-2

PLANNED LAND USE (2040)
Bassett Creek Watershed Management Commission
2025 Watershed Management Plan

A.3 Topography

The topographic relief of the Bassett Creek watershed is minor with land sloping generally from higher elevations in the west to lower elevations in the east with only a net drop of 210 feet. The watershed high points include areas west of Parkers Lake and west of Schmidt Lake with elevations ranging from approximately 980 to 1,010 feet, respectively. From this point east, the northern and southern watershed boundaries drop to an elevation of approximately 800 at the point where the creek enters the Mississippi River as can be seen in Figure A-3. The extensive urbanization of the watershed has greatly altered the natural topography of the watershed. With these alterations, drainage patterns have become more defined. Many of the wetland areas that existed prior to urbanization have been eliminated or altered, especially in the older developed areas, concentrated downstream of Medicine Lake. The location of steep slopes within the watershed is of interest as these areas limit options for land development and have a higher potential for erosion.

A.4 Soils

Surface soils throughout much of the Bassett Creek watershed contain varied amounts of clay, loam and sand. Soils in the western part of the watershe generally contain more sand than the easter portion of the watershed which contains more loam. Soils in the watershed are principally of the "Hayden" series and are moderately permeable and have high available moisture capacity depending on the relative amounts of clay and loam..

Areas of poorly-drained "Cordova" soils occur in swales and on flats have a surface layer of black silty clay loam and a subsoil of clay loam. These soils have a high available moisture capacity and a moderately low permeability.

Additionally, areas of "Peaty Muck" occur throughout the watershed. The very poorly-drained Peaty Muck soils in depressions consist of deep organic materials. They have a very high available moisture capacity and a low fertility.

While these soil types are common within the Bassett Creek watershed, surficial soils are highly varied and can change quickly over short vertical and horizontal distances. Additional information about surficial soils is available from the Geologic Atlas of Hennepin County, Minnesota. Additionally, surficial soils in much of the watershed have been disturbed by development activity.

A.4.1 Hydrologic Soil Groups and Infiltration

Soil composition, slope and land management practices determine the impact of soils on water resource issues. Soil composition and slope are important factors affecting the rate and volume of stormwater runoff. The shape and stability of aggregates of soil particles—expressed as soil structure—influence the permeability, infiltration rate, and erodibility (i.e., potential for erosion) of soils. Slope is important in determining stormwater runoff rates and susceptibility to erosion.

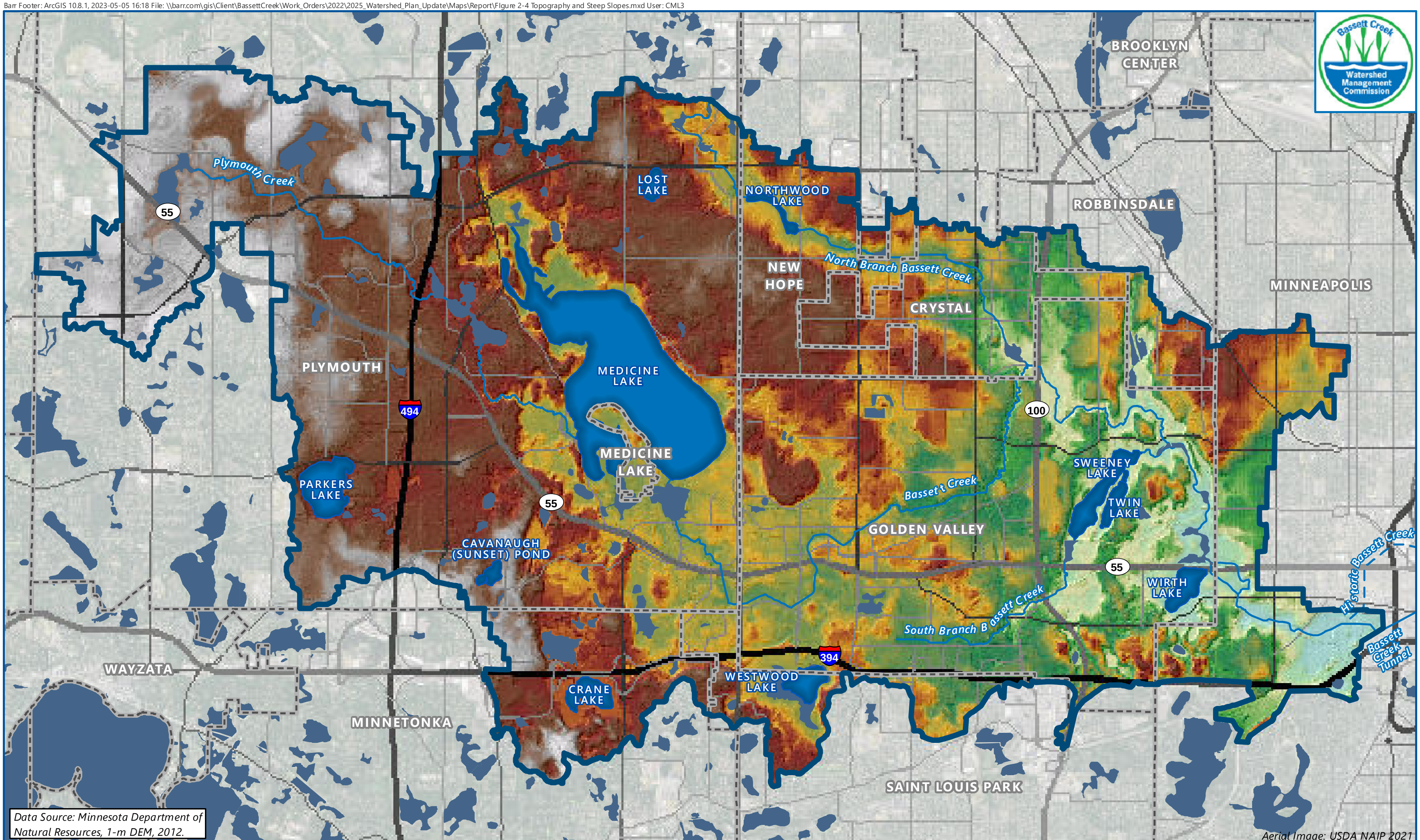
Infiltration capacities of soils affect the amount of direct runoff resulting from rainfall. Higher infiltration rates result in lower potential for runoff from the land, as more precipitation is able to enter the soil. Conversely, soils with low infiltration rates produce high runoff volumes and high peak discharge rates, as most or all of the rainfall moves as overland flow. For more information on infiltration rates see the Minnesota Stormwater Manual.

The Natural Resources Conservation Service (NRCS – formerly the Soil Conservation Service) has established four general hydrologic soil groups. These groups are:

- Group A Low runoff potential—high infiltration rate
- Group B Moderate infiltration rate
- Group C Slow infiltration rate
- Group D High runoff potential—very slow infiltration rate

Combined with land use, the hydrologic soil group may be used to estimate the amount of runoff that will occur over a given area for a particular rainfall amount. The most current hydrologic soil group data for the Bassett Creek watershed are based on the Soil Survey Geographic dataset (SSURGO) from the NRCS and are presented in Figure A-4.

Barr Footer: ArcGIS 10.8.1, 2023-05-05 16:18 File: \\barr.com\gis\Client\BassettCreek\Work_Orders\2022\2025_Watershed_Plan_Update\Maps\Report\Figure 2-4 Topography and Steep Slopes.mxd User: CML3



BCWMC Jurisdictional Boundary
Municipal Boundary
BCWMC Priority Lake
Public Waters Basin
Creek

Elevation (m)
High (320 m)
Low (243 m)

N

0 6,000 12,000
Feet

FIGURE A-3

TOPOGRAPHY
Bassett Creek Watershed Management Commission
2025 Watershed Management Plan

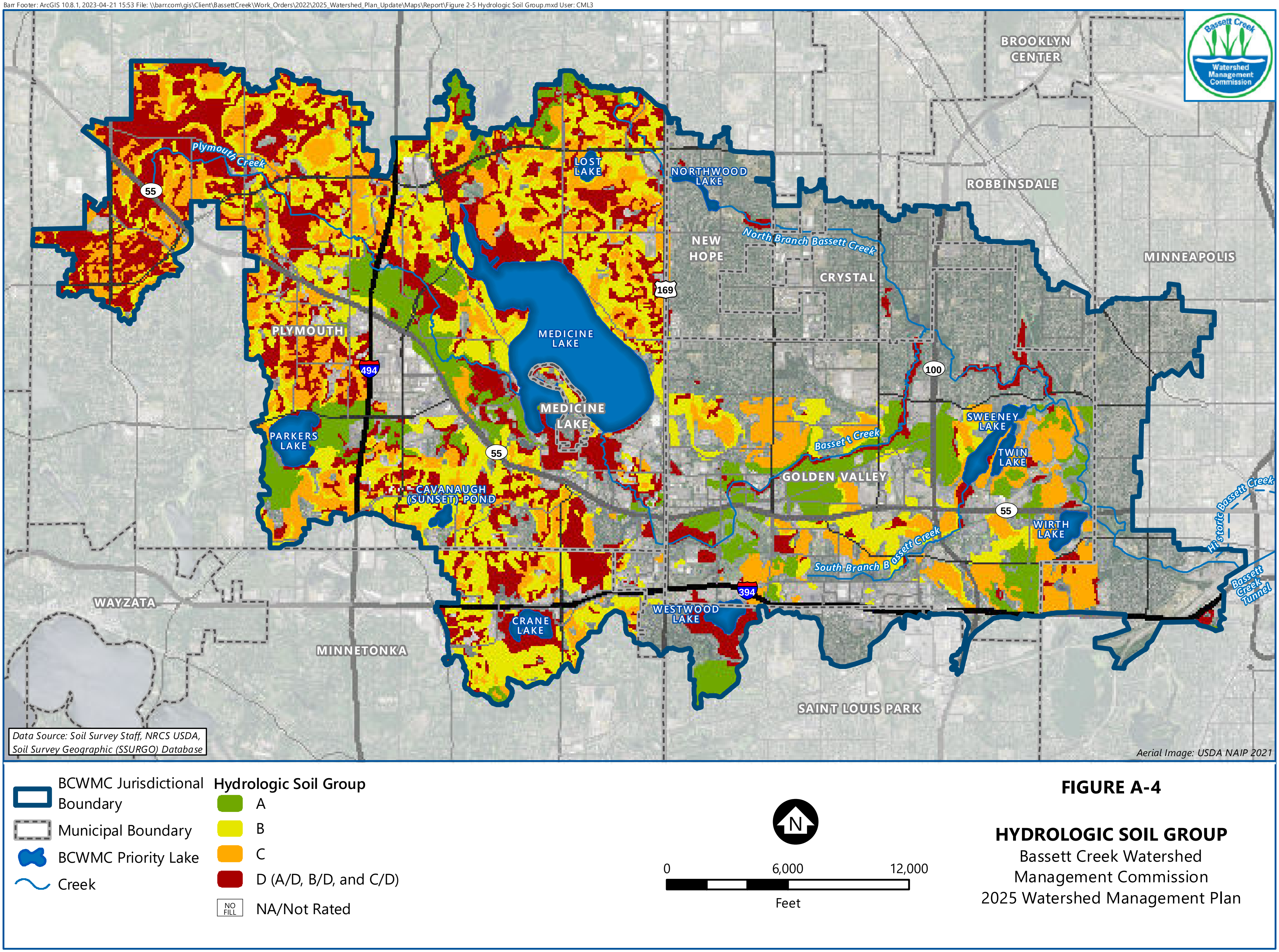


FIGURE A-4

HYDROLOGIC SOIL GROUP
Bassett Creek Watershed
Management Commission
2025 Watershed Management Plan

Large portions of the eastern half of the watershed fall within the Not Rated/Not Available category (47%). This classification is typically assigned to areas where development has altered the existing soil, or data were unavailable prior to development; hydrologic soil groups or infiltration rates are typically not determined after development. Of the remaining 53% of the watershed that has available soil information, the majority of this portion consists of hydrologic soil group B (30%), group C (26%), and group C/D soils (20%). The majority of the western portion of the watershed has soil with moderate to slow infiltration rates. Hydrologic soil group A soil, which indicates high infiltration rates, are present in approximately 13% of the rated portion of the Bassett Creek watershed. With only a small portion of the watershed consisting of soils with higher infiltration rates, the Bassett Creek watershed has the potential to produce high volumes of runoff.

Development may increase the potential for high runoff volumes. As land is developed, much of the soil is covered with impervious surfaces, and soils in the remaining areas are significantly disturbed and altered. Development often results in compaction of the soil and tends to reduce infiltration capacity of otherwise permeable soils, resulting in less infiltration and greater amounts of runoff. Grading, plantings, and tended lawns tend to dominate the pervious landscape in urbanized areas and may become more important factors in runoff generation than the original soil type.

The hydrologic soil groups map (Figure A-4) provides general guidance about the infiltration capacity of the soils throughout the watershed. Soils should be evaluated on a site-by-site basis for infiltration capacitiy as projects are considered.

A.5 Geology and Groundwater

A.5.1 Geology

The Bassett Creek watershed is located in the northwestern portion of the Twin Cities basin – a bowl-like bedrock structure underlying the Minneapolis-St. Paul metropolitan area that gently slopes to the southeast. The bedrock is overlain by a layer of glacial drift that varies from over 250 feet thick (in the western portion and along the eastern border of the watershed) to less than 50 feet thick (in the southeastern portion of the watershed in Minneapolis).

Generally, the elevation of the bedrock surface is independent of surface topography. The watershed is underlain by up to 40 feet of Platteville and Glenwood Formation limestone and shale in the southern and eastern portions of the watershed. The northern portion of the watershed is underlain by up to 160 feet of St. Peter Sandstone, except in the northwest portions and in the extreme eastern portions, where pre-glacial Mississippi River valleys of glacial drift cut through the sandstone and into the Prairie du Chien Dolomite.

Additional information about bedrock geology is available from the Geologic Atlas of Hennepin County, Minnesota.

A.5.2 Groundwater Resources

The cities of Plymouth, Robbinsdale, Minnetonka, St. Louis Park, and Medicine Lake obtain their water supplies from groundwater aquifers. In the extreme western portions of the Bassett Creek watershed and in Medicine Lake, some residents still obtain their domestic water supplies from private supply wells.

A.5.2.1 Bedrock Aquifers

The watershed is underlain by four major bedrock aquifers: (1) St. Peter Sandstone, (2) Prairie du Chien-Jordan, (3) Wonewoc Sandstone (formerly Ironton-Galesville Sandstone), and (4) Mt. Simon-Hinckley Sandstone.

The following cities within the BCWMC obtain their water supplies from the associated groundwater sources:

- Plymouth – 16 wells in the Prairie du Chien-Jordan aquifer (4 new wells proposed)
- Minnetonka – 14 wells in the Prairie du Chien-Jordan aquifer, 3 wells in the Jordan aquifer, and 1 well in the Prairie du Chien-St. Lawrence aquifer
- Robbinsdale – 4 wells in the Prairie du Chien-Jordan aquifer and 1 well in the St. Peter-Prairie du Chien aquifer
- St. Louis Park –6 wells in the Prairie du Chien-Jordan aquifer, 4 wells in the Mt. Simon-Hinckley aquifer, and 1 well in the Platteville-St. Peter aquifer.
- Medicine Lake – private wells

The Joint Water Commission (Crystal, Golden Valley, and New Hope) also maintains emergency supply wells in the Prairie du Chien-Jordan.

The Prairie du Chien-Jordan aquifer is high-yielding, more easily tapped than deeper aquifers, has very good water quality, and is continuous throughout most of the area. This is the most heavily used aquifer in Hennepin County, with yields above 2,000 gallons per minute throughout much of the Bassett Creek watershed. The MDNR closely reviews permits for groundwater withdrawals from the Prairie du Chien-Jordan aquifer to prevent or minimize impacts to nearby water resources of regional significance.

The Mt. Simon-Hinckley aquifer is a regional aquaifer with excellent water quality, but it is more expensive to use than the Prairie du Chien-Jordan because of its greater depth. Yields from the Mt. Simon-Hinckley aquifer range from 1,000 to 1,500 gallons per minute in the western portion of the Bassett Creek watershed to over 1,500 gallons per minute in the eastern portion of the watershed. Minnesota statutes limit appropriations from the Mt. Simon-Hinckley aquifer to potable water uses where there are no feasible or practical alternatives and where a water conservation plan is incorporated with the appropriations permit.

Additional information about bedrock aquifers is available from the Groundwater Atlas of Hennepin County, Minnesota.

A.5.2.2 Surficial (Quaternary) Aquifers

Surficial aquifers are water-bearing layers of sediment, usually sand and gravel, which lie close to the ground surface. Many private domestic wells in the watershed draw water from these aquifers. Because surficial aquifers are more susceptible to pollution, they are generally not used for municipal or public supply wells. The depth of the water table varies across the watershed, but is on the order of tens of feet.

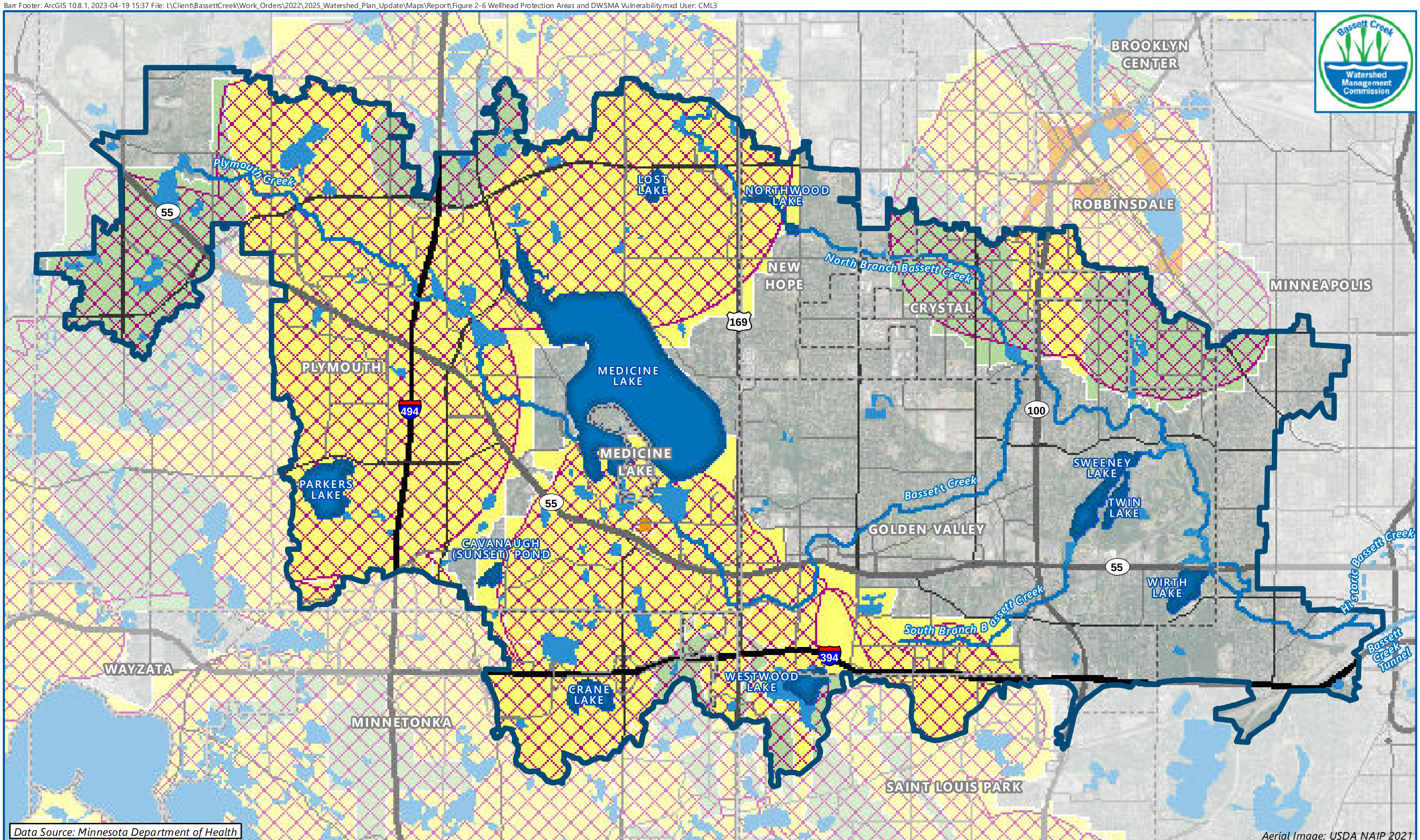
Recharge to the surficial aquifers is primarily through the infiltration of precipitation and standing water. The ponds, lakes, and wetlands scattered throughout the watershed recharge the groundwater. Some of these waterbodies are landlocked and their only outlet is to the groundwater; some landlocked lakes may be perched above the regional level of the shallow groundwater in the watershed. Some surficial aquifers may also be recharged during periods of high stream stage. Surficial aquifers may discharge to local lakes, streams or to the underlying bedrock.

Additional information about surficial aquifers is available from the Groundwater Atlas of Hennepin County, Minnesota.

A.5.3 Wellhead and Drinking Water Protection

The growing population in the Twin Cities metropolitan area has put increased pressure not only on groundwater quantity but also on its quality. The Minnesota Department of Health (MDH) is responsible for the protection of groundwater qualityand seeks to minimize contamination of water supply wells through its wellhead protection program. The MDH provides guidance to limit the potential for groundwater contamination and requires public water suppliers to develop wellhead protection plans (WHPPs) and delineate drinking water supply management areas (DWSMAs). The MPCA's Construction Stormwater General Permit also prohibits the use of infiltration as a stormwater management BMP where site characteristics increase the risk of groundwater contamination. Figure A-5 shows the location of the municipal wellhead protection areas and DWSMAs within and around the Bassett Creek watershed. Each of the communities within the BCWMC that obtains its municipal water supply from groundwater has an MDH-approved WHPP.

Barr Footer: ArcGIS 10.8.1, 2023-04-19 15:37 File: I:\Client\BassettCreek\Work_Orders\2022\2025_Watershed_Plan_Update\Maps\Report\Figure 2-6 Wellhead Protection Areas and DWSMA Vulnerability.mxd User: CML3



BCWMC Jurisdictional Boundary

Municipal Boundary

BCWMC Priority Lake

Public Waters Basin

Creek

Wellhead Protection Area

Drinking Water Supply Management Area Vulnerability

Low

Moderate

High

N

0 6,000 12,000

Feet

FIGURE A-5

WELLHEAD PROTECTION AREAS AND DWSMA VULNERABILITY

Bassett Creek Watershed Management Commission

2025 Watershed Management Plan

A.6 Surface Water Resources

The Bassett Creek watershed has numerous streams, creeks, lakes, ponds, and wetlands. The Commission subdivided the watershed into 18 subwatersheds based on the drainage areas tributary to major surface water resources (see Figure A-6). Table X summarizes the physical characteristics of major BCWMC lakes and ponds. Other governmental units have identified or inventoried surface water resources within the BCWMC specifically related to their management jurisdictions; these include:

- Public waters basins, watercourses, and wetlands – Minnesota Department of Natural Resources (MDNR)
- Public ditches – Hennepin County
- National Wetland Inventory (NWI) – US Fish and Wildlife Service (USFWS)

A.6.1 Public Waters

The MDNR designates certain water resources as public waters to indicate those lakes, wetlands, and watercourses over which the MDNR has regulatory jurisdiction. By statute, the definition of public waters includes both "public waters" and "public waters wetlands." The collection of public waters, public waters watercourses, and public waters wetlands designated by the MDNR is generally referred to as the public waters inventory, or PWI.

Public waters are all basins and watercourses that meet the criteria set forth in Minnesota Statutes, Section 103G.005, Subd. 15 that are identified on public water inventory maps and lists authorized by Minnesota Statutes, Section 103G.201.

The regulatory boundary of public waters and public waters wetlands is called the ordinary high water level (OHWL). A MDNR permit is required for work within designated public waters. The MDNR maintains a web-based mapping tool for viewing PWI maps. The PWI maps and lists are available on the MDNR's website: http://www.MDNR.state.mn.us/waters/watermgmt_section/pwi/maps.html.

Public waters (e.g., lakes) are identified with a number and the letter "P". Public waters wetlands are identified with a number and the letter "W". Public waters wetlands include, and are limited to, types 3, 4, and 5 wetlands (as defined in U.S. Fish and Wildlife Service Circular No. 39, 1971 edition)_that have not been designated public waters.

Figure A-7 shows the MDNR public waters located in the Bassett Creek watershed.

A.6.2 Public Ditches

Judicial ditches and county ditches are public drainage systems. They are established under Chapter 103E of Minnesota Statutes and are under the jurisdiction of the county. Per Minnesota Statute 363B.61, cities or watershed management organizations (WMOs) within Hennepin County may petition the county to transfer authority over public ditches to the city or WMO (see Section 3.8.2).

Barr Footer: ArcGIS 10.8.1, 2023-04-19 15:38 File: I:\Client\BassettCreek\Work_Orders\2022\2025_Watershed_Plan_Update\Maps\Report\Figure 2-7 BCWMC Major Subwatershed.mxd User: CML3

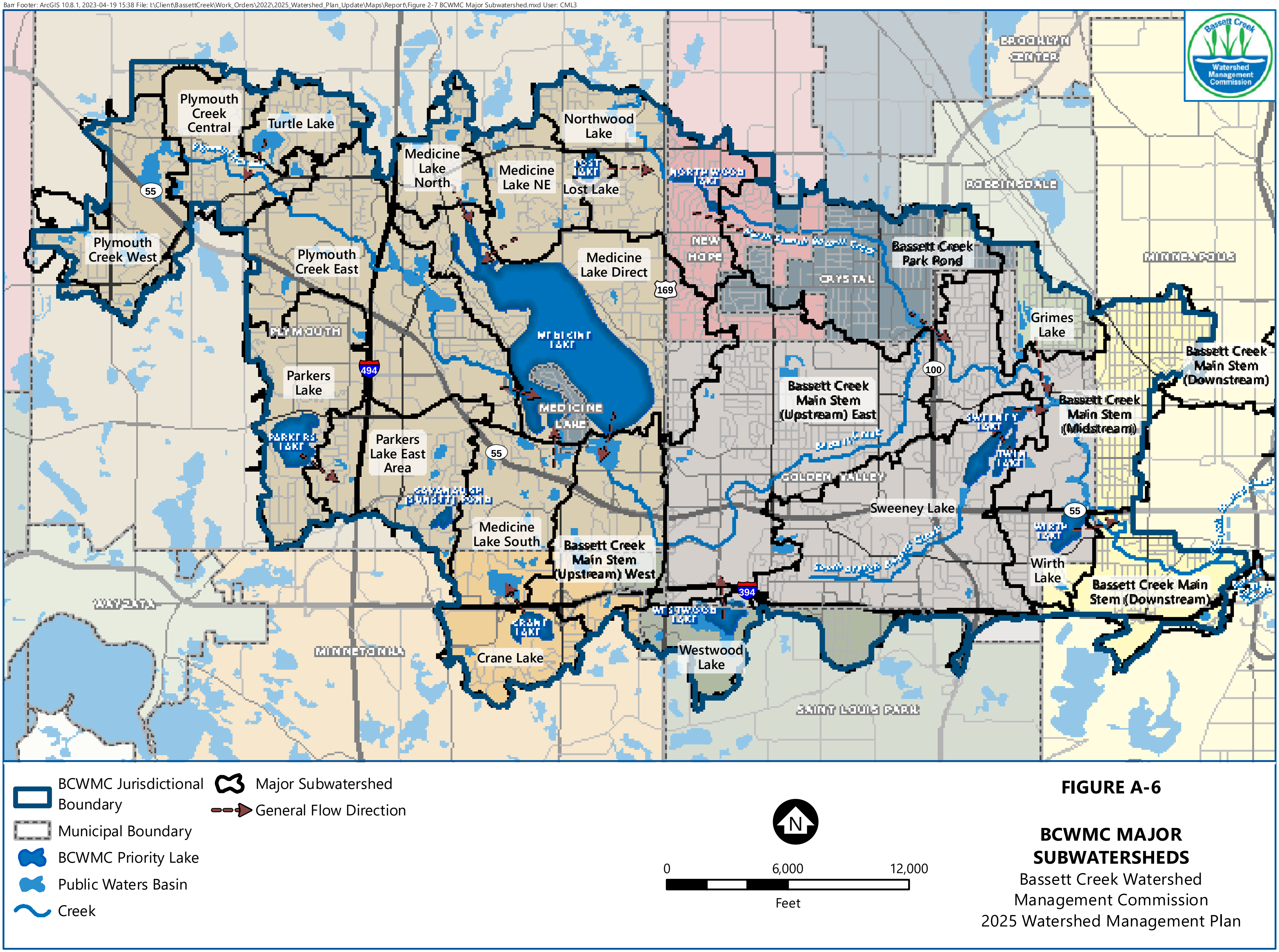
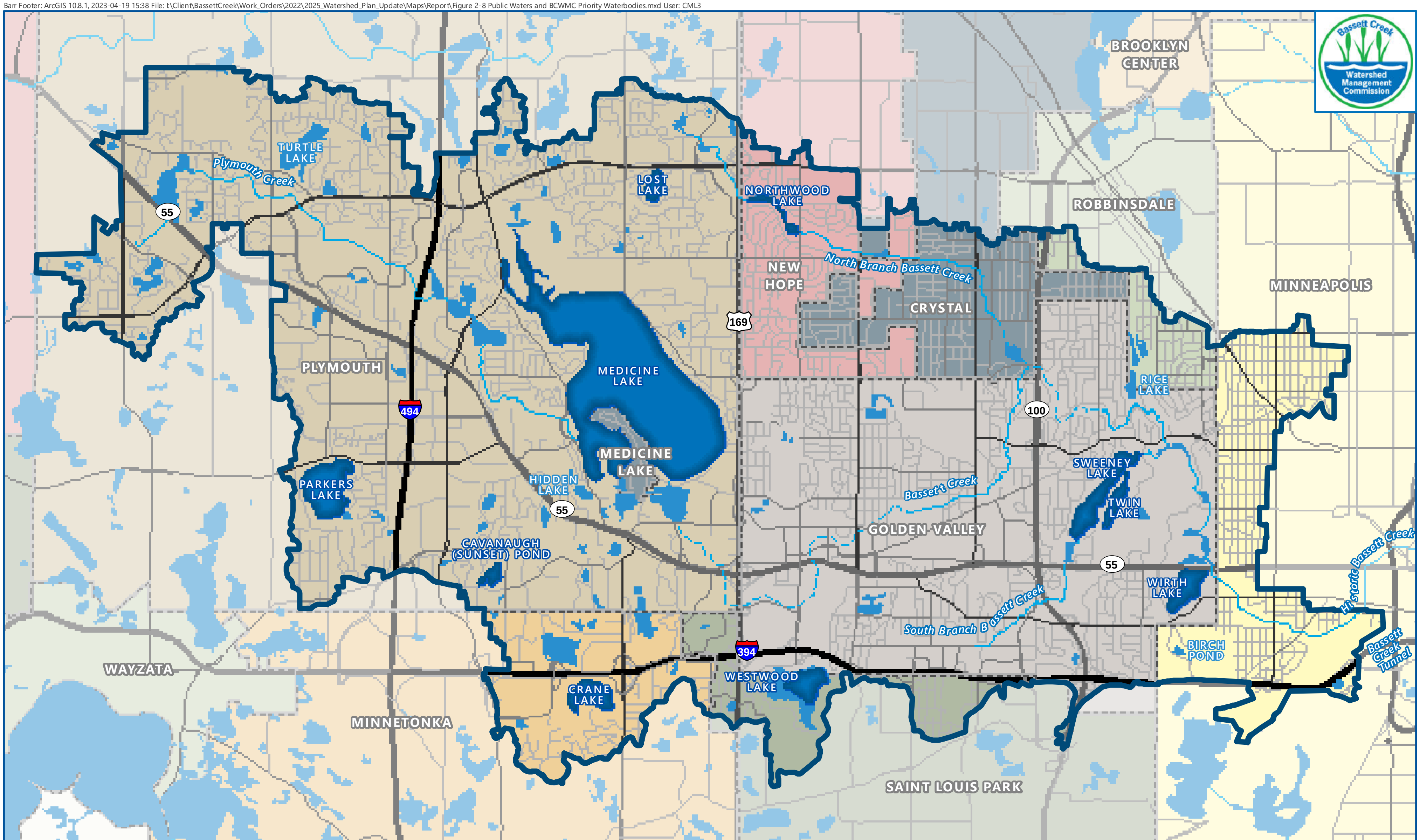


FIGURE A-6

BCWMC MAJOR SUBWATERSHEDS

Bassett Creek Watershed Management Commission
2025 Watershed Management Plan



BCWMC Jurisdictional Boundary
Municipal Boundary
BCWMC Priority Lake
Public Waters Basin
Public Water Watercourse
Public Ditch/Altered Natural Watercourse

N

0 6,000 12,000
Feet

FIGURE A-7

PUBLIC WATERS AND BCWMC PRIORITY WATERBODIES

Bassett Creek Watershed Management Commission
2025 Watershed Management Plan

Figure A-7 also identifies the public ditches within the BCWMC, which includes a large portion of the Main Stem of Bassett Creek between Medicine Lake and Brookview Golf Course, and downstream of Highway 100. The original function of public ditches was to provide drainage for agricultural lands. Some of the systems shown as public ditches are no longer in existence, but the public ditch designation has not been removed.

A.6.3 Wetlands

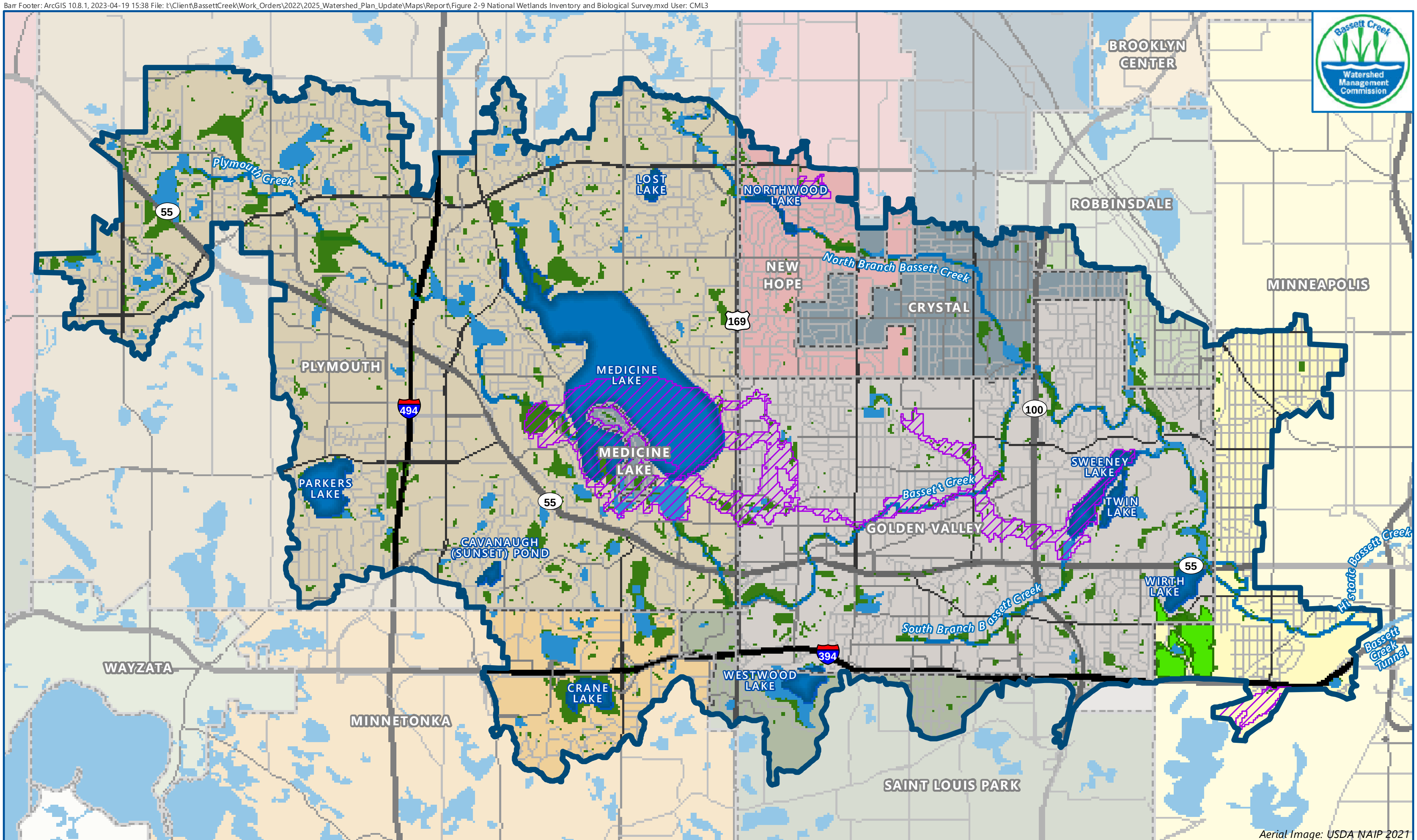
Prior to development, much of the land within the BCWMC was wetland. Most wetland areas were drained or filled – many originallyfor farming and then impacts expanded to make way for urban development Today, wetlands represent only about 6% of the watershed (based on Minnesota Land Cover Classification System, MLCCS, data).

Presently, wetlands are protected by the Minnesota Wetland Conservation Act (WCA, see Section X.X). The BCWMC currently acts as the local governmental unit (LGU) responsible for administering WCA in the Cities of St. Louis Park, Robbinsdale, and Medicine Lake. The remaining BCMWC member cities serve as the LGUs for their own communities.

The extent of wetlands inventoried within the BCWMC varies by member city. Nationally, the U.S. Fish and Wildlife Service (USFWS) has mapped wetlands across the country using a combination of aerial photography and limited field verification. The USFWS maintains a wetlands database called the National Wetland Inventory (NWI). The NWI is periodically updated based on available imagery.

Figure A-8 shows the location of all NWI wetlands within the Bassett Creek watershed. There are additional wetlands (especially those smaller than 0.5 acre) in the BCWMC that are not included in the NWI.

BCWMC member cities identify and classify wetlands as part of local wetland inventories and/or require developers to delineate and classify wetlands as part of the development review process. In Minnesota, wetlands are typically classified according to their functions and values.



BCWMC Jurisdictional Boundary
Municipal Boundary
BCWMC Priority Lake
Public Waters Basin
Creek

Minnesota Biological Survey Sites of Biodiversity Significance

Moderate
Ecological Corridor *(Minnesota Dept. of Natural Resources)*
Wetland *(National Wetlands Inventory)*

N

0 6,000 12,000
Feet

FIGURE A-8

NATIONAL WETLANDS INVENTORY AND BIOLOGICAL SURVEY

Bassett Creek Watershed Management Commission
2025 Watershed Management Plan

A.6.4 Lakes and Ponds

The following sections summarize significant lakes and ponds in the Bassett Creek watershed, including all priority lakes (see Section A.7.2.2). Waterbodies are listed alphabetically. Additional information about priority lakes is available on the BCWMC website.

A.6.4.1 Bassett Creek Park Pond (PWI 27-064600P)

Table A-3 Bassett Creek Park Pond Size and Depth

Lake Size (Acres)	Max Depth (ft)	Mean Depth (ft)	Ordinary High Water Level (ft NAVD88)	100-year Water Level (ft NAVD88)
9.7	7.4	2.6	840.6	850.9

Bassett Creek Park Pond is a public water lake located in the City of Crystal in the northeast portion of the BCWMC. The North Branch of Bassett Creek flows through the pond so the contributing watershed areaof approximately 2,564 acres, includes the Bassett Creek Park Pond direct watershed along with the Northwood Lake and the North Branch Bassett Creek watersheds. Portions of the cities of Crystal and Golden Valley drain directly into Bassett Creek Park Pond; additionally, portions of New Hope and Plymouth are tributary to Bassett Creek Park Pond via the North Branch of Bassett Creek. The pond drains southeast through two 36 x 58.5 inch arch culverts into the Bassett Creek Main Stem.

The Bassett Creek Park Pond watershed (including the Northwood Lake and North Branch Bassett Creek watersheds) is almost fully-developed, with only a few small parcels available for new development. Low density residential is the major land use (67%), followed by parks and recreational use (10%) andindustrial (8%). Other land uses include medium density residential, natural space, commercial, and institutional.

Bassett Creek Park Pond is not classified as a BCWMC priority waterbody and is not listed as impaired by the MPCA. Bassett Creek Park Pond is not regularly monitored by the BCWMC. Bassett Creek Park Pond is part of the BCWMC Flood Control Project (see Section A.8.1), and part of the BCWMC's trunk system ("trunk system storage" – see Figure A-11).

A.6.4.2 Cavanaugh Lake (Sunset Pond) (PWI 27-011000P)

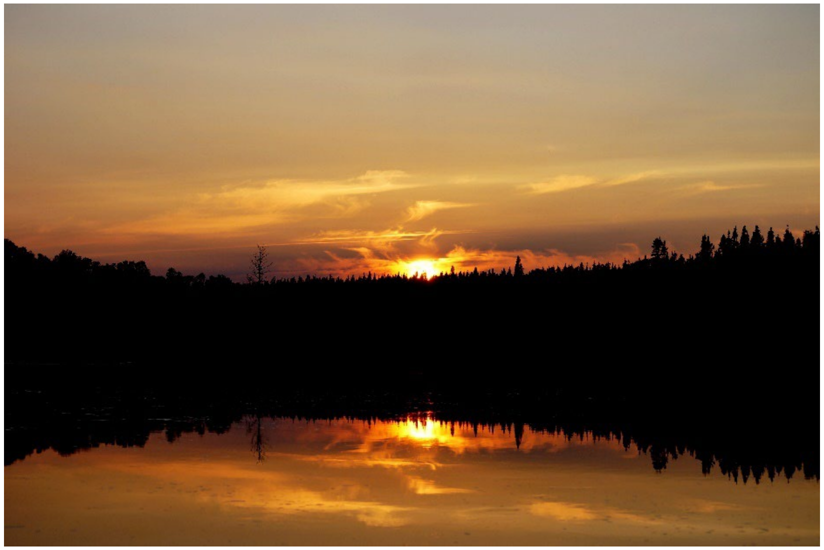


Table A-4 Cavanaugh Lake (Sunset Pond) Size and Depth

Lake Size (Acres)	Max Depth (ft)	Mean Depth (ft)	Ordinary High Water Level (ft NAVD88)	100-year Water Level (ft NAVD88)
13	10.8	5.3	--	--

Cavanaugh Pond (also known as Sunset Hills Pond or Sunset Pond) is a small public water lake located in southeastern Plymouth, just north of Sunset Hill Elementary School. Cavanaugh lake does not have any public access.

Cavanaugh Lake has a small drainage area of 126 acres which includes primarily single-family residential land use, institutional land use (the elementary school) and 3.6 acres of high quality wetlands. The watershed is fully developed.

The BCWMC classified Cavanaugh Lake as BCWMC Priority 2 Shallow Lake waterbody. The "shallow" classification is based on the MPCA's shallow/deep classification (shallow lakes have a maximum depth of less than 15 feet or a littoral area greater than 80% of the total lake surface area). Cavanaugh Lake is not part of the BCWMC's trunk system (see Figure A-11).

The BCWMC regularly monitors Cavanuagh Lake (see Section A.7.1.1). The lake is not included on the MPCA's impaired waters 303(d) list. BCWMC monitoring indicates that the lake has good water quality and a nice native plant community. A small patch of the aquatic invasive species curly-leaf pondweed (see Section A.9.4) was identified in 2019.

A.6.4.3 Crane Lake (PWI 27-073400P)

Table A-5 Crane Lake Size and Depth

Lake Size (Acres)	Max Depth (ft)	Mean Depth (ft)	Ordinary High Water Level (ft NAVD88)	100-year Water Level (ft NAVD88)
30	5	3.3	920.5	920.2

Crane Lake is a public water lake located in the City of Minnetonka in the southern portion of the Bassett Creek watershed. Crane Lake does not have any boat access or public beach areas; the lake is bordered to the north by a natural area called Crane Reserve Park. Due to the lake's shallow nature, submerged macrophytes can be found on the entire lake bottom. Emergent vegetation can be found around its circumference. Crane Lake has a contributing drainage area of approximately 591 acres, draining portions of Minnetonka. Crane Lake drains northerly into Medicine Lake at the north side through a 21-inch reinforced concrete pipe (RCP) at an elevation of 917.1 feet (NAVD88 datum).

The Crane Lake watershed is almost fully-developed, with only a few small parcels available for new development. Low density residential is the major land use (43%), followed by retail and commercial (including the Ridgedale Mall area) (20%) and parks and recreational use (10%). Other land uses include open water, institutional, office space, major highway, and industrial.

The BCWMC classified Crane Lake as a BCWMC Priority 2 Shallow Lake waterbody and is regularly monitored by the BCWMC (see Section A.7.1.1). The "shallow" classification is based on the MPCA's shallow/deep classification (shallow lakes have a maximum depth of less than 15 feet or a littoral area greater than 80% of the total lake surface area). The lake is likely to be included on the MPCA's 2024 impaired waters list for high chlorides. Crane Lake is also part of the BCWMC's trunk system ("trunk system storage" – see Figure A-11).

A.6.4.4 Grimes Pond (PWI 27-064400W)

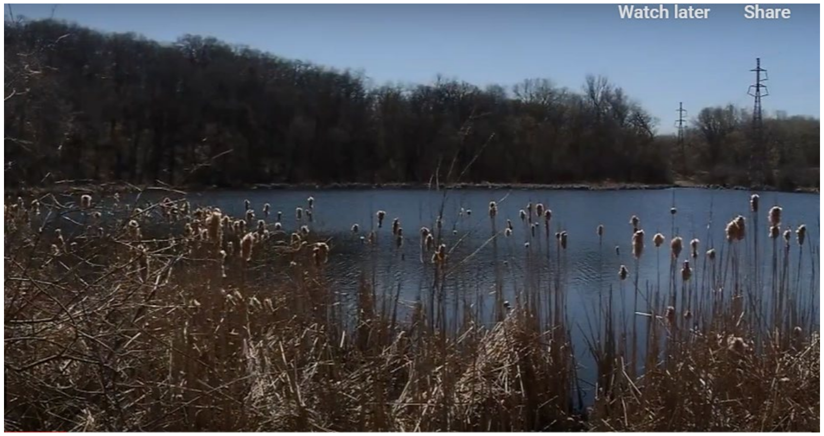


Table A-6 Grimes Pond Size and Depth

Lake Size (Acres)	Max Depth (ft)	Mean Depth (ft)	Normal Water Level (ft NAVD88)	100-year Water Level (ft NAVD88)
6.1	--	2.6	832.5	836.7

Grimes Pond is a public water wetland located in the City of Robbinsdale just east of North Rice Pond in the northeast portion of the BCWMC. The city's South Halifax park surrounds the north half of the pond. Including a trail, which provides opportunities for aesthetic viewing and fishing.

Grimes Pond has a contributing drainage area of approximately 114 acres that drains a portion of the City of Robbinsdale. Runoff enters Grimes Pond through two open channels and one storm sewer outlet. The Grimes Pond outlet to North Rice Pond consists of two submerged 24-inch corrugated metal culverts through the railroad embankment located on the west side of the pond.

The Grimes Pond watershed is almost fully-developed, with only a few small parcels available for new development. Low density residential is the major land use (82%), followed by parks and recreational use (5.6%) and open water (4.4%). Other land uses include: industrial, institutional, and retail/commercial.

Grimes Pond is classified as a wetland by the MDNR rather than a lake. It is not classified as a BCWMCs priority waterbody and is not regularly monitored by the BCWMC. Although very high in nutrients, the pond pond is also not listed as impaired by the MPCA due to its wetland classification. Grimes Pond is part of the BCWMC's trunk system ("trunk system storage" – see Figure A-11).

A.6.4.5 Lost Lake (PWI 27-010300P)

Table A-7 Lost Lake Size and Depth

Lake Size (Acres)	Max Depth (ft)	Mean Depth (ft)	Normal Water Level (ft NAVD88)	100-year Water Level (ft NAVD88)
22	6.5	3.5	940.2	941.2

Lost Lake is a public water lake located in the City of Plymouth in the northern portion of the BCWMC. It has no public access, as it is surrounded completely by residential homes.

Lost Lake's littoral area consists of the entire area of the lake (22 acres). Being such a shallow lake, Lost Lake has submerged vegetation throughout most of its lake bottom. Lost Lake has a contributing drainage area of approximately 55 acres. A small portion of the City of Plymouth drains to Lost Lake. Lost Lake is landlocked and therefore does not discharge to any major resource in the Bassett Creek watershed.

The Lost Lake watershed is fully-developed, with no parcels available for new development. Low density residential and open water are the only two land use categories for the Lost Lake watershed.

The BCWMC classified Lost Lake as a Priority 2 Shallow Lake waterbody. The "shallow" classification is based on the MPCA's shallow/deep classification (shallow lakes have a maximum depth of less than 15 feet or a littoral area greater than 80% of the total lake surface area). The BCWMC regularly monitors Lost Lake for water quality (see Section A.7.1.1). Lost Lake was added to MPCA's list of impaired waters in 2024 due to excess nutrients.

A.6.4.6 Medicine Lake (PWI 27-010400P)

Table A-8 Medicine Lake Size and Depth

Lake Size (Acres)	Max Depth (ft)	Mean Depth (ft)	Ordinary High Water Level (ft NAVD88)	100-year Water Level (ft NAVD88)
902	49	17.5	889.3	890.4

Medicine Lake is a public water lake located in the cities of and Plymouth and Medicine Lake in approximately the center of the BCWMC. The lake is a major recreational resource for the area. French Regional Park, public beaches and a public boat landing provide opportunities for swimming, fishing, boating, birding, and biking or walking adjacent trails. Medicine Lake is also an important resource for wildlife.

Medicine Lake has a shoreline of approximately 8.9 miles and a littoral area of 397.0 acres. Shallow areas near the shoreline of the lake allow for both emergent and submerged vegetation growth. The Medicine Lake tributary watershed is approximately 11,015 acres (including the drainage area of upstream lakes ultimately tributary to Medicine Lake, see Figure A-6). Portions of the cities of Plymouth, Medicine Lake, New Hope, Golden Valley, and Minnetonka all drain to Medicine Lake.

Medicine Lake receives outflows from Plymouth Creek, Crane Lake, Turtle Lake, and Hidden Lake. Plymouth Creek discharges directly into Medicine Lake near its southwest corner and an unnamed creek from the Crane Lake watershed discharges to Medicine Lake at the south end of the southwest bay. Additionally, over 30 storm sewers have been identified that discharge into the lake. The Medicine Lake outlet is located at the south end of the main basin and is the origin of the Main Stem of Bassett Creek. A composite overflow weir structure, fourteen feet wide at the normal water level of 887.9 feet (NAVD88 datum), discharges water directly into the main stem of Bassett Creek; the weir is owned by Hennepin County and regulated by the MDNR. The overflow structure is approximately three feet above the level of the creek channel to deter fish migration into the lake.

The Medicine Lake watershed (including the watersheds of upstream waterbodies ultimately tributary to Medicine Lake) is almost fully-developed, with only a few small parcels available for new development. Low density residential is the major land use (46%), followed by open water (21%) and parks and recreation (13%). Other land uses include: medium density residential, natural space, industrial, commercial, institutional, agricultural, and office.

The BCWMC classified Medicine Lake as a Priority 1 Deep Lake waterbody. The "deep" classification is based on the MPCA's shallow/deep classification. Medicine Lake is also part of the BCWMC's trunk system ("trunk system storage" – see Figure A-11).

Medicine Lake is regularly monitored by the BCWMC and others (see Section A.7.1). The lake is currently listed on the 303(d) impaired waters list for mercury, excess nutrients, and fish bioassessments. The lake's mercury impairment is addressed by the statewide mercury Total Maximum Daily Load (TMDL) approved by the US Environmental Protection Agency (USEPA) in 2007 (MPCA, 2007). A TMDL study was prepared for Medicine Lake to address the nutrient impairment (LimnoTech, 2010). The presence of excess nutrients in the lake periodically makes the water unsuitable for swimming and wading due to low clarity and excessive algae growth. As part of the MPCA's 2014 Metro Chloride Asseessment, Medicine Lake was classified as a "high risk water" for chloride impairment, but was not listed as impaired for chloride.

Curlyleaf pondweed, an aquatic invasive plant (see Section A.9.4), is present in Medicine Lake. The Medicine Lake TMDL identified growth and die-off of curlyleaf pondweed as a source of internal nutrient loading in Medicine Lake, and recommended management of the plant (Limnotech, 2010). The City of Plymouth, Three Rivers Park District (TRPD), BCWMC, MDNR and others established a Medicine Lake Aquatic Vegetation Management Group and developed an aquatic vegetation management plan for the lake. In the spring of 2004, 2005, and 2006, approximately 300 acres of the lake were treated with herbicide. Monitoring performed from 2004 through 2007 identified decreased curlyleaf pondweed frequency in the spring of each year, but recommended ongoing treatment (Three

Rivers Park District (TRPD), 2008). From 2008 through 2014, the City of Plymouth has treated areas ranging from 15 to 80 acres (Blue Water Science, 2014). In 2017, the BCWMC, with financial assistance from TRPD, continued annual herbicide treatments of curlyleaf pondweed in small patches totaling about 63 acres per year. In 2022, the MDNR approved an Aquatic Vegetation Management Plan for the lake which allows for larger herbicide treatments of curlyleaf pondweed. In 2022 and 2023, 119.5 acres were treated each year.

In 2017, zebra mussels were discovered in Medicine Lake and they have since colonized areas around the lake. No treatments for zebra mussels was initiated. In 2018, starry stonewort was discovered in the lake near the public boat launch at French Regional Park and is now in many areas around the lake. Starry stonewort near the boat launch is annually treated with herbicide by the DNR to reduce the chance of it spreading to other lakes.

A.6.4.7 North Rice Pond (PWI 27-064400W)

Add photo here

Table A-9 North Rice Pond Size and Depth

Lake Size (Acres)	Max Depth (ft)	Mean Depth (ft)	Normal Water Level (ft NAVD88)	100-year Water Level (ft NAVD88)
3.7	5	2.6	832.5	836.6

North Rice Pond is a public water wetland located in the City of Robbinsdale in the northeast portion of the Bassett Creek Watershed. Sochacki Park, a Three Rivers Park District park operated in partnership with Golden Valley and Robbinsdale, surrounds the pond; The park trails provide opportunities for aesthetic viewing.

North Rice Pond has a contributing watershed area of approximately 233 acres which includes the North Rice Pond direct watershed and the Grimes Pond watershed. Portions of the cities of Crystal, Golden Valley, Minneapolis, and Robbinsdale drain to North Rice Pond. North Rice Pond receives outflows from Grimes Pond through overflows from three wetland basins. A 30-inch corrugated metal culvert with a submerged manhole skimming structure connects North Rice to South Rice Pond, which discharges into Bassett Creek.

The North Rice Pond watershed (including the Grimes watershed) is almost fully-developed, with only a few small parcels available for new development. Low density residential is the major land use (73%), park and recreational use (15%) and undeveloped (5.8%). Other land uses include: retail and commercial, institutional, open water, and industrial.

North Rice Pond is classified by the MDNR as a public water wetland and shares a PWI number with Grimes Pond. The BCWMC has not classified North Rice Pond as a BCWMC priority waterbody and does not regularly monitor North Rice Pond. Although very high in nutrients, the pond pond is also not listed as impaired by the MPCA because it is classified as a wetland rather than a lake. Grimes Pond is part of the BCWMC's trunk system ("trunk system storage" – see Figure A-11).

A.6.4.8 Northwood Lake (PWI 27-062700P)

Table A-10 Northwood Lake Size and Depth

Lake Size (Acres)	Max Depth (ft)	Mean Depth (ft)	Ordinary High Water Level (ft NAVD88)	100-year Water Level (ft NAVD88)
15	5	2.7	885.7	891.2

Northwood Lake is a public water lake located in the City of New Hope. Parkland adjacent to the lake provides opportunities for fishing, picnicking, and aesthetic viewing making Northwood Lake an important recreation resource. The lake is also used for non-motorized boating.

Northwood Lake's 1,294 acre tributary watershed includes the direct watershed and a portion of the North Branch Bassett Creek watersheds. The North Branch of Bassett Creek discharges into Northwood Lake through a 66-inch culvert that comes from under Hwy 169 to the west. Portions of the cities of Plymouth and New Hope drain to Northwood Lake through four storm sewers. Northwood Lake has an outlet structure located at the east side of the lake at Boone Ave. A 10-foot wide weir set at an elevation of 884.6 discharges to a culvert that crosses Boone Ave. This culvert then discharges into the North Branch of Bassett Creek, which flows towards Bassett Creek Park Pond, ultimately discharging into the Bassett Creek Main Stem.

The Northwood Lake watershed is almost fully-developed, with only a few small parcels available for new development. Low density residential is the major land use (67%), followed by institutional (10%) and parks and recreational use (7.1%). Other land uses include: natural space, commercial, retail, major highways, open water, and industrial.

The BCWMC classified Northwood Lake as a Priority 1 Shallow Lake waterbody. The "shallow" classification is based on the MPCA's shallow/deep classification (shallow lakes have a maximum depth of less than 15 feet or a littoral area greater than 80% of the total lake surface area). Northwood Lake is part of the BCWMC's trunk system ("trunk system storage" – see Figure 3-X).

The BCWMC regularly monitors water quality in Northwood Lake (see Section A.7.1.1). The lake is currently listed on the MPCA's 303(d) impaired waters list for excessive nutrients (phosphorus) and chloride. A TMDL study has not yet been conducted to address the nutrient impairment for Northwood Lake. The TCMA Chloride TMDL addresses the lake's chloride impairment.

A.6.4.9 Parkers Lake (PWI 27-010700P)

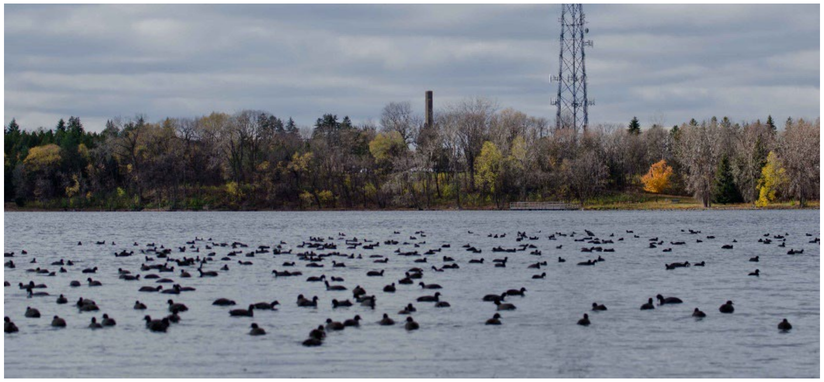


Table A-11 Parkers Lake Size and Depth

Lake Size (Acres)	Max Depth (ft)	Mean Depth (ft)	Ordinary High Water Level (ft NAVD88)	100-year Water Level (ft NAVD88)
97	37	12	936.1	--

Parkers Lake is a public water lake located in the City of Plymouth at the western edge of the Bassett Creek watershed. The lake is a major recreational resource for the area with a public beach and public boat landing that provide opportunities for swimming, fishing, boating and aesthetic viewing.

Parkers Lake has a maximum a littoral area of approximately 68 acres. Shallow areas near the shoreline of the lake allow for both emergent and submerged vegetation growth. Parkers Lake has a contributing watershed of approximately 1,065 acres. A portion of the City of Plymouth drains to the lake and discharges into it through five storm sewers. Parkers Lake discharges through a 24-inch concrete outlet at the southeast corner of the lake and is ultimately tributary to Medicine Lake.

The Parkers Lake watershed is almost fully-developed, with only a few small parcels available for new development. Low density residential is the major land use (37%), followed by industry (32%) and open water (9%). Other land uses include: medium density residential, natural, parks and open space, commercial, developed parks, golf course, institutional, highways, and industrial/office.

The BCWMC classified Parkers Lake as a Priority 1 Deep Lake waterbody. The "deep" classification is based on the MPCA's shallow/deep classification. The lake is included on the 303(d) impaired waters list for chlorides which primarily enter the lake as deicing salts in stormwater running off parking lots and roads to the north of the lake. The TCMA Chloride TMDL addresses the lake's chloride impairment. The lake is also on the 303(d) impaired waters list for mercury however,it is not covered by the statewide mercury TMDL due to measured concentrations of mercury in fish tissue exceeding a threshold value specified in the TMDL (see Table A-22).

A.6.4.10 South Rice Pond (PWI 27-064500W)

Table A-12 South Rice Pond Size and Depth

Lake Size (Acres)	Max Depth (ft)	Mean Depth (ft)	Ordinary High Water Level (ft NAVD88)	100-year Water Level (ft NAVD88)
3.2	3	1.7	N/A	834.2

South Rice Pond is a public water wetland located in the cities of Robbinsdale and Golden Valley in the northeast portion of the Bassett Creek watershed, just south of North Rice Pond. Sochacki Park, a Three Rivers Park District park operated in partnership with Golden Valley and Robbinsdale, surrounds the pond; The park trails and dock at the south end of the pond provide opportunities for aesthetic viewing.

South Rice Pond's 514-acre tributary watershed includes both the South Rice Pond direct watershed and the North Rice Pond and Grimes Pond watersheds. Portions of the cities of Crystal, Golden Valley, Minneapolis, and Robbinsdale drain to South Rice Pond. South Rice Pond receives outflows from North Rice Pond as well as Grimes Pond. South Rice Pond discharges to Bassett Creek via a small channel located at the south end of the pond.

The South Rice Pond watershed (including the North Rice Pond and Grimes Pond watersheds) is almost fully-developed, with only a few small parcels available for new development. Low density residential is the major land use (75%), followed by park and recreational use (16%). Other land uses include: institutional, industrial, open water, and retail/commercial.

South Rice Pond is classified as a wetland rather than a lake by the MDNR. It is not classified as a BCWMCs priority waterbody and is not regularly monitored by the BCWMC. Although very high in nutrients, the pond pond is also not listed as impaired by the MPCA due to its wetland classification. South Rice Pond is part of the BCWMC's trunk system ("trunk system storage" – see Figure A-11).

A.6.4.11 Sweeney Lake (PWI 27003501P)

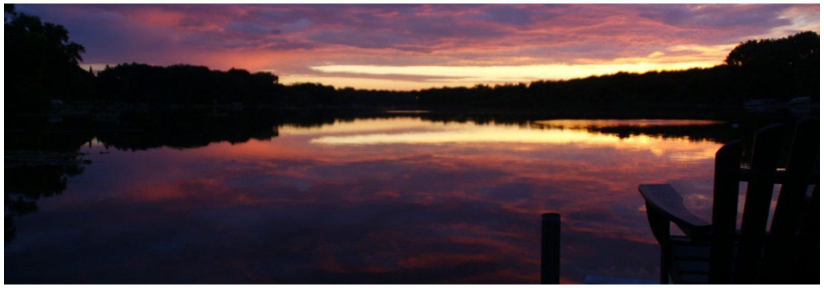


Table A-13 Sweeney Lake Size and Depth

Lake Size (Acres)	Max Depth (ft)	Mean Depth (ft)	Normal Water Level (ft NAVD88)	100-year Water Level (ft NAVD88)
67	25	12	827.2	831.8

Sweeney Lake is a public water lake located in the City of Golden Valley in the eastern portion of the BCWMC. Sweeney Lake is a recreation waterbody frequently used by residents for swimming, fishing, boating and aesthetic viewing. A private access in the northern end of the lake and a public access at the southern end of the lake offer carry-in boat access.

Sweeney Lake has a littoral area of approximately 34 acres. Shallow areas near the shoreline of the lake allow for both emergent and submerged vegetation growth. Sweeney Lake has a contributing drainage area of approximately 2,396 acres including both the Sweeney Lake direct watershed and the Ring Ponds, Cortlawn Pond, and Schaper Pond watersheds. Portions of St. Louis Park and Golden Valley drain into Sweeney Lake. Sweeney Lake receives outflows from the Ring Ponds, Cortlawn Pond, Schaper Pond and Twin Lake and drains northeast into the Sweeney Lake Branch of Bassett Creek, which connects to the Bassett Creek Main Stem shortly downstream. A precast concrete dam serves as the outlet structure for Sweeney Lake at an elevation of 827.5 feet.

The Sweeney Lake watershed (including the contributing ponds' watersheds) is almost fully-developed. Low density residential is the major land use (46%), followed by highway (13%) and office (6.6%). Other land uses include: medium density residential, natural space, park, and open space, commercial, developed parks, golf course, institutional, open water, and industry.

Sweeney lake was included on the 303(d) list of impaired waters for many years due to high nutrients. For many years, the Sweeney Lake Association operated an aeration system to limit the releast of nutrients from lake sediment (SEH and Barr, 2011). Aeration was discontinued in 2018 Sweeney Lake was finally removed from the list in 2024 due to nutrient reduction efforts and projects by the BCWMC, City of Golden Valley, and Sweeney Lake Association. Efforts included aquatic vegetation management, in lake alum treatment, and carp removal.

The BCWMC classified Sweeney Lake as a Priority 1 Deep Lake waterbody. The "deep" classification is based on the MPCA's shallow/deep classification. Sweeney Lake is part of the BCWMC's trunk system ("trunk system storage" – see Figure A-11). The BCWMC regularly monitors Sweeney Lake (see Section A.7.1.1). Sweeney Lake is listed on the 303(d) impaired waters list for chloride. The TCMA Chloride TMDL addresses the lake's chloride impairment.

A.6.4.12 Turtle Lake (PWI 27-010101P/27-010102P)

Table A-14 Turtle Lake Size and Depth

Lake Size (Acres)	Max Depth (ft)	Mean Depth (ft)	Normal Water Level (ft NAVD88)	100-year Water Level (ft NAVD88)
28	0.5	0.3	962.9	967.0

Turtle Lake is a public water lake located in the City of Plymouth in the northwest portion of the Bassett Creek watershed. Parkland is available for use by residents for aesthetic viewing and fishing. No boat launch is available.

Turtle Lake has a tributary watershed area of 420 acres. A portion of the City of Plymouth drains into Turtle Lake. A small open channel between the north wetland and Turtle Lake acts as an inlet to the lake. Two wetland basins also overflow into the southeast portion of the lake and one storm sewer discharges at the east side. The Turtle Lake outlet is located at the southwest corner of the lake. A small channel conveys water to an 18-inch corrugated metal pipe at County Road 9, which discharges to Plymouth Creek.

The Turtle Lake watershed is almost fully-developed, with only a few small parcels available for new development. Low density residential is the major land use (72%), followed by open water (9.4%) and undeveloped areas (8.0%). Other land uses include: parks and recreational uses, institutional, retail, commercial, and agricultural.

Turtle Lake is not classified as a BCWMC priority waterbody and is not regularly monitored by the BCWMC. Turtle Lake is classified as a wetland by the MPCA owing to its shallow depth (despite being classified as a lake by the MDNR). Turtle Lake is part of the BCWMC's trunk system ("trunk system storage" – see Figure A-11). Turtle Lake is not listed as impaired by the MPCA due to its wetland classification.

A.6.4.13 Twin Lake (PWI 27-003502P)

Table A-15 Twin Lake Size and Depth

Lake Size (Acres)	Max Depth (ft)	Mean Depth (ft)	Normal Water Level (ft NAVD88)	100-year Water Level (ft NAVD88)
21	56	25.7	827.2	831.8

Twin Lake is a public water lake located in the City of Golden Valley in the eastern portion of the Bassett Creek Watershed and is connected to Sweeney Lake through a navigable channel. The southern half of the lake is located within Theodore Wirth Regional Park. The lake has the best water quality of all the BCWMC priority waterbodies and is used for swimming, non-motorized boating, fishing, and aesthetic viewing.

Twin Lake has a littoral area of approximately 8 acres. Shallow areas near the shoreline support emergent and submerged vegetation growth. Floating leaf vegetation is primarily seen in the northern portion of the lake. Twin Lake's watershed area is 131 acres. A portion of the City of Golden Valley drains to Twin Lake through one open channel at the south side of the lake. An outlet channel discharges beneath a bridge at the north side of the lake into a wetland that is hydraulically connected to Sweeney Lake. The Twin Lake watershed is fully developed. The watershed area surrounding Twin Lake has three major land uses: park, recreational, or preserve (60%), institutional (20%) and low density residential (20%).

The BCWMC classified Twin Lake as a Priority 1 Deep Lake waterbody. The "deep" classification is based on the MPCA's shallow/deep classification. Twin Lake is part of the BCWMC's trunk system ("trunk system storage" – see Figure A-11).

The BCWMC regularly monitors Twin Lake (see Section A.7.1.1). The lake is not listed as impaired by the MPCA. The relatively high ratio of lake surface to drainage area and lack of high-imperviousness land use around the lake have prevented Twin Lake from experiencing many of negative effects of urbanization (i.e., increased stormwater runoff and pollutant loading).

In 2008 and 2009, summer average phosphorus concentrations in Twin Lake increased significantly, The BCWMC performed a study (*Twin Lake Phosphorus Internal Loading Investigation*, March 2011) that identified the causes of the increased phosphorus concentrations as increased phosphorus release from lake sediments (internal loading) and enhanced transport of phosphorus from bottom waters to the surface. The BCWMC performed a feasibility study to evaluate management options (BCWMC, February 2013). Based on the study, the BCWMC performed an alum treatment on Twin Lake in 2015. As of 2023, the 10-year summer average phosphorus concentration in Twin Lake is approximately 15 ug/L (well below the 40 ug/L standard, see Table A-24). The BCWMC will consider a second alum treatment in the future if conditions warrant.

A.6.4.14 Westwood Lake (PWI 27-071100P)

Table A-16 Westwood Lake Size and Depth

Lake Size (Acres)	Max Depth (ft)	Mean Depth (ft)	Normal Water Level (ft NAVD88)	100-year Water Level (ft NAVD88)
38	5		887.6	889.9

Westwood Lake is a public water lake located in the City of St. Louis Park in the southern portion of the Bassett Creek watershed. Although the lake does not have a public beach, the adjacent parkland and Westwood Hills Nature Center trails surrounding the lake provides residents opportunities for canoeing or kayaking, aesthetic viewing, birding, and hiking.

The majority of the lake bottom is covered with submerged vegetation due to the shallow nature of the lake and emergent vegetation can be found around the lake's entire circumference. Westwood Lake has a watershed area of approximately 463 acres. Portions of the cities of St. Louis Park, Golden Valley, and Minnetonka drain towards Westwood Lake. Runoff draining to Westwood Lake enters through five storm sewers located around its edge. A 400-foot-long open channel at the north side of the lake discharges to a 27-inch RCP storm sewer at an elevation of 886.0.

The Westwood Lake watershed is almost fully-developed. Single family residential is the major land use (34%), followed by park and recreational land use (27%) and golf course (25%). Other land uses include: major highway, office space, and open water.

The BCWMC classified Westwood Lake as a Priority 1 Shallow Lake waterbody. The "shallow" classification is based on the MPCA's shallow/deep classification. Westwood Lake is part of the BCWMC's trunk system ("trunk system storage" – see Figure A-11).

The BCWMC regularly monitors Westwood Lake (see Section A.7.1.1). The lake is not listed as impaired by the MPCA.

A.6.4.15 Wirth Lake (PWI 27-003700P)

Table A-17 Wirth Lake Size and Depth

Lake Size (Acres)	Max Depth (ft)	Mean Depth (ft)	Ordinary High Water Level (ft NAVD88)	100-year Water Level (ft NAVD88)
38	26	14	819.1	826.5

Wirth Lake is a public water lake located in the City of Golden Valley in the southeast portion of the Bassett Creek watershed. The lake is located in Theodore Wirth Regional Park, which is owned and maintained by the Minneapolis Park and Recreation Board. The lake is an important recreational resource to the residents of north Minneapolis and surrounding inner-ring suburbs. A public beach and parkland surrounding the lake provide opportunities for swimming, fishing, picnicking, and aesthetic viewing, and non-motorized boating.

Wirth Lake has a littoral area of approximately 23.3 acres. Shallow areas near the shoreline of the lake allow for both emergent and submerged vegetation growth. Floating leaf vegetation is primarily seen in the northern portion of the lake. Wirth Lake has a 405-acre tributary watershed including portions of the cities of Golden Valley and Minneapolis. The lake has four main inlets, three storm sewers and one open channel in the northern portion of the lake. The Wirth Lake outlet was modified in 2012 to prevent backflow from Bassett Creek to Wirth Lake. The new outlet includes a fabricated steel lift gate which closes during period of high water in Bassett Creek.

The Wirth Lake watershed is almost fully-developed. Parks and recreation is the major land use (46%), followed by low density residential (36%) and open water (9%). Other land uses include: medium density residential, commercial, golf course, institutional, highways and industrial/office.

The BCWMC classified Wirth Lake as a Priority 1 Deep Lake waterbody. The “deep” classification is based on the MPCA’s shallow/deep classification.

The MPRB regularly monitors Wirth Lake (see Section A.7.1). The lake is currently listed on the 303(d) impaired waters list for mercury and chloride. The lake’s mercury impairment is addressed through the statewide mercury TMDL. The TCMA Chloride TMDL addresses the lake’s chloride impairment.

Wirth Lake was previously listed as impaired for excessive nutrients and a TMDL study was performed (Barr Engineering Company, 2010). Wirth Lake was removed from the impaired waters list due to water quality improvement projects by the BCWMC, its member cities and the MPRB.

A.6.5 Streams

The Bassett Creek Watershed is characterized by Bassett Creek and its tributary streams. The BCWMC has classified the following as priority streams:

- Bassett Creek (Main Stem)
- North Branch Bassett Creek
- Plymouth Creek
- Sweeney Branch Bassett Creek

Priority streams are presented in Figure A-7. The priority streams are also part of the BCWMC's trunk system (see Figure A-11). In addition to BCWMC priority streams, there are several smaller tributaries that drain to BCWMC priority waterbodies, including several draining to Medicine Lake and other waterbodies.

A.6.5.1 Plymouth Creek

The furtherest upstream reaches of the watershed originate upstream of Medicine Lake in western Plymouth as Plymouth Creek. This creek flows generally east and south, relatively parallel to Highway 55, until it reaches the southwest bay of Medicine Lake. Plymouth CreekThis branch drains large portions of south and central Plymouth. The length of the creek is about 6 miles and the area tributary to the creek prior to its discharge into Medicine Lake is approximately eight square miles. Plymouth Creek flows through a large public water wetland complex nearWest Medicine Lake Park prior to entering Medicine Lake.

The BCWMC classified Plymouth Creek as a Priority 1 stream. Plymouth Creek is included on the MPCA's Impaired Waters 303(d) list in 2014 as impaired for aquatic life (due to chloride) and aquatic recreation (due to *Escherichia coli*) (see Table A-22). Plymouth Creek was included in the Upper Mississippi River Bacteria TMDL and Protection Plan (MPCA, 2014), which was approved by the US EPA in 2014 and addresses the Plymouth Creek impairment due to *Escherichia coli*. Plymouth Creek was also listed as impaired due to macroinvertebrate bioassessments in 2024.

A.6.5.2 Main Stem of Bassett Creek

The Main Stem of Bassett Creek begins at the Medicine Lake outlet, at the south end of the southeast bay of the lake. The Main Stem flows southeast through Plymouth, then easterly through Golden Valley, Crystal, and Minneapolis to the Mississippi River, the last portion of which is through a 1.7-mile long tunnel.

The drainage area upstream of the Main Stem of Bassett Creek (i.e., the area tributary to Medicine Lake) is about 18 square miles. From Medicine Lake to the entrance of the tunnel is about 12 miles. Two branches of Bassett Creek, the North Branch and the Sweeney Lake Branch, join the Main Stem between Medicine Lake and the tunnel, and prior to its confluence with the Mississippi River. I. An. Ultimately, the entire 39 square mile drainage area of the BCWMC is tributary to the Main Stem of Bassett Creek upstream of the tunnel. The creek enters the Mississippi River downstream of the Upper St. Anthony Falls Lock and Dam.

The 1.7-mile-long-tunnel at the downstream end of Bassett Creek replaced an "old tunnel" which still conveys up to 50 cubic feer per second (cfs) of flow and discharges to the Mississippi River through an arched tunnel downstream of Plymouth Avenue and the North Bridge in Minneapolis.

The BCWMC classified the Main Stem of Bassett Creek as a Priority 1 stream. The Main Stem of Bassett Creek is included on the MPCA's impaired waters 303(d) list as impaired for aquatic life (due to chloride, fish bioassessments, and macroinvertebrate bioassessments) and aquatic recreation (due to fecal coliform) (see Table A-22). The Main Stem of Bassett Creek was included in the Upper Mississippi River Bacteria TMDL and Protection Plan (MPCA, 2014), which was approved by the US EPA in 2014 and addresses the Main Stem of Bassett Creek impairment due to fecal coliform.

A.6.5.3 North Branch of Bassett Creek

The North Branch drains portions of eastern Plymouth and southern portions of New Hope and Crystal (and a very small portion of Golden Valley). It begins near Rockford Road (County Road 9) west of Highway 169, and flows east through New Hope and Crystal. The North Branch of Bassett Creek flows through Northwood Lake and Bassett Creek Park Pond, before joining the Main Stem of Bassett Creek immediately upstream of Highway 100. The drainage area tributary to the North Branch upstream of its confluence with the Main Stem is approximately four square miles and its length is 4.6 miles

The BCWMC classified the North Branch of Bassett Creek as a Priority 1 stream. The North Branch of Bassett Creek is included on the MPCA's impaired waters 303(d) list in 2014 as impaired for aquatic recreation (due to Escherichia coli) (see Table A-22). This impairment is addressed by the Upper Mississippi River Bacteria TMDL and Protection Plan (MPCA, 2014).

A.6.5.4 Sweeney Lake Branch of Bassett Creek

The Sweeney Lake Branch drains northern St. Louis Park and southern portions of Golden Valley. The Sweeney Lake Branch flows northeast through Schaper Pond and Sweeney Lake and joins the Main Stem in Theodore Wirth Regional Park near Golden Valley Road just downstream of Sweeney Lake. The drainage area of the Sweeney Lake Branch prior to its confluence with the Main Stem of Bassett Creek is approximately four square miles.

The BCWMC classified the Sweeney Lake Branch of Bassett Creek as a Priority 1 stream. The Sweeney Lake Branch of Bassett Creek is included on the MPCA's impaired waters 303(d) as impaired for aquatic recreation due to *Escherichia coli* (see Table A-22). This impairment is addressed by the Upper Mississippi River Bacteria TMDL and Protection Plan (MPCA, 2014).

A.7 Surface Water Quality

The lakes, ponds, streams, and wetlands of the Bassett Creek watershed are important community assets providing ecological and recreational benefits. The BCWMC prioritizes achieving and maintaining good water quality in the waterbodies in its jurisdiction and has taken action to protect and improve these resources (*add reference to issues section*). These actions generally include:

- adopting water quality management goals and policies,
- classifying specific waterbodies as priority waterbodies,
- collecting water quality data
- performing studies to identify and evaluate improvements

- implementing projects and programs to improve water quality
- establishing performance standards for development and redevelopment for minimal impact to water resources

Stormwater runoff carries with it a number of contaminants affecting water quality. The principal pollutants found in runoff include phosphorus and other nutrients, sediments, organic materials, pathogens, hydrocarbons, metals, pesticides, chlorides, trash and debris. Table A-18 summarizes the source of these pollutants and their impacts. Phosphorus and suspended sediment are particularly detrimental to the ecological health and recreational use of lakes and streams. The BCWMC has established water quality treatment performance standards addressing these pollutants based on MPCA's Mnimal Impact Design Standards (MIDS) (see BCWMC's Requirements for Improvements and Development Proposals (as amended)).

Table A-18 Pollutants Commonly Found in Stormwater Runoff

Stormwater Pollutant	Examples of Sources	Related Impacts
Nutrients: Nitrogen, Phosphorus	Decomposing grass clippings, leaves and other organics, animal waste, fertilizers, failing septic systems, atmospheric deposition	Algal growth, reduced clarity, other problems associated with eutrophication (oxygen deficit, release of nutrients and metals from sediments)
Sediments: Suspended and Deposited	Construction sites, other disturbed and/or non-vegetated lands, eroding streambanks and shorelines, road sanding	Increased turbidity, reduced clarity, lower dissolved oxygen, deposition of sediments, smothering of aquatic habitat including spawning sites, sediment and benthic toxicity
Organic Materials	Leaves, grass clippings	Oxygen deficit in receiving waterbody, fish kill, release of nutirents.
Pathogens: Bacteria, Viruses	Domestic and wild animal waste, failing septic systems	Human health risks via drinking water supplies, contaminated swimming beaches
Hydrocarbons: Oil and Grease, PAHs (Naphthalenes, Pyrenes)	Tar-based pavement sealant, industrial processes; automobile wear, emissions & fluid leaks; waste oil.	Toxicity to aquatic life, bioaccumulation in aquatic species and through food chain
Metals: Lead, Copper, Cadmium, Zinc, Mercury, Chromium, Aluminum, others	Industrial processes, normal wear of auto brake linings and tires, automobile emissions & fluid leaks, metal roofs	Toxicity to aquatic life, bioaccumulation in aquatic species and through the food chain, fish kill
Pesticides: PCBs, Synthetic Chemicals	Pesticides (herbicides, insecticides, fungicides, rodenticides, etc.), industrial processes	Toxicity to aquatic life, bioaccumulation in aquatic species and through the food chain, fish kill
Chlorides	Road salting and uncovered salt storage	Toxicity to aquatic life
Polycyclic Aromatic Hydrocarbons (PAH's)	Tar based pavement sealant	Carcinogenic to humans
Per- and polyfluoroalkyl substances (PFAS)	Commercial products (waterproof products, cookware, upholstery, etc.), industrial processes, fire-fighting foam	Toxic to humans, toxicity to aquatic life, bioaccumulation in aquatic species and through the food chain
Trash and Debris	Litter washed through storm drain networks	Degradation of the beauty of surface waters, threat to wildlife

Based on *Minnesota Urban Small Sites BMP Manual* (Barr Engineering Company, 2001).

A.7.1 Water Quality Monitoring Programs

The BCWMC and other entities have collected water quality data for many of the lakes, streams, and larger ponds in the watershed. Other organizations collecting water quality data include:

- Metropolitan Council
- Three Rivers Park District (TRPD)
- Minnesota Pollution Control Agency
- Minnesota Department of Natural Resources
- Minneapolis Park and Recreation Board (MPRB)
- Cities

The following sections summarize the various monitoring programs performed within the BCWMC including select monitoring performed by other entities. The BCWMC monitoring program is described in detail in Appendix X.

Figure A-9 shows the locations of water quality and stream monitoring locations within the BCWMC. The most current water quality data for BCWMC priority lakes and streams are available on the BCWMC website.

A.7.1.1 BCWMC Lake Monitoring

The BCWMC monitors the following priority waterbodies::

- Cavanaugh Lake (Sunset Pond)
- Crane Lake
- Lost Lake
- Northwood Lake
- Medicine Lake
- Parkers Lake
- Sweeney Lake
- Twin Lake
- Westwood Lake
- Historically, the BCWMC has also monitored water quality in North Rice Pond and South Rice Pond.

Parameters monitored by the BCWMC include:Water chemistry

- Water clarity
- Macrophytes (aquatic plants)
- Phytoplankton (algae)
- Zooplankton

Appendix X provides additional detail regarding monitoring parameters, methods, and frequency. The BCWMC analyzes water quality monitoring data to identify improving or degrading trends within BCWMC priority waterbodies and to assess whether BCWMC priority waterbodies are meeting the applicable water quality goals (see Section X). Table A-19 presents trends observed over the 10-year period from 2014-2023 for priority lakes.

Table A-19 Eutrophication Water Quality Trends of Priority Lakes

Priority Lake	Statistically Significant Trends[1]		
	Total Phosphorus	Chlorophyll a	Secchi Depth
Cavanaugh Lake (Sunset Pond)	TBD	TBD	TBD
Crane Lake	TBD	TBD	TBD
Lost Lake	TBD	TBD	TBD
Northwood Lake	TBD	TBD	TBD
Medicine Lake	TBD	TBD	TBD
Parkers Lake	TBD	TBD	TBD
Sweeney Lake	TBD	TBD	TBD
Twin Lake	TBD	TBD	TBD
Westwood Lake	TBD	TBD	TBD
Wirth Lake	TBD	TBD	TBD

(1) At a 95% confidence level using linear least squares regression applied to data collected from 2014-2023.

A.7.1.2 BCWMC Stream Biotic Monitoring

The BCWMC conducts biotic (invertebrate) monitoring of priority streams ito assess water quality and ecological health. Monitoring for the presence of benthic macroinvertebrates (bottom-dwelling aquatic organisms, mainly insects) in a stream provides a long-term assessment of its water quality. The benthic invertebrates are exposed to all of the temporal variations in stream water quality and 'integrate' the quality of passing water.

Stressors such as low dissolved oxygen caused by nutrient and organic loaiding, high suspended solids concentration, or high metals concentrations can negatively affect the macroinvertebrate community. The presence or absence of pollutant tolerant organisms demonstrates the water quality impacts of urban runoff better than grab samples of water flowing in the creek. The inventory of benthic organisms also indicates whether there is a suitable food supply for fish.

The BCWMC has collected and inventoried benthic organisms from several Bassett Creek locations since 1980. Since 2000, biotic monitoring has been performed by the BCWMC or MPCA at three year intervals. BCWMC biotic monitoring locations are presented in Figure A-9 and include:

- Main Stem of Bassett Creek at Rhode Island Avenue in Golden Valley.
- Main Stem of Bassett Creek south of Zane Avenue North in Golden Valley.
- Main Stem of Bassett Creek at Irving Avenue, upstream of the double box culvert, in Minneapolis.
- North Branch of Bassett Creek at 32nd Street and Adair in Crystal (note: monitoring was performed just north of Zane Avenue prior to 1995, at which point the location silted in).

- Sweeney Lake Branch of Bassett Creek at Turner's Crossroad (Xenia Avenue) in Golden Valley.
- Plymouth Creek at Industrial Park Boulevard in Plymouth.

At each monitoring location, samples are collected from riffle areas where the flow is fairly rapid and the substrate was composed of gravel and small stones. Samples are collected by disturbing the creek bottom and allowing dislodged invertebrates to drift into a net downstream. Rocks and other substrate materials are also examined for invertebrates.

The BCWMC uses biological indices to assess relative water quality from biotic monitoring results. A biological index is calculated based on the tolerance of each collected species to various pollutants. Historically, the BCWMC has used the Hilsenhoff Biotic Index (HBI) and the Invertebrate Community Index (ICI). More recently, the BCWMC has also calculated the Minnesota Macroinvertebrate Index of Biological Integrity (MIBI) for consistency with MPCA methods and water quality standards.

The most recent biotic monitoring data for BCWMC priority streams are available on the BCWMC website. Table A-20 presents trends observed in IBIs over the year period from 2000 through 2023 for priority streams. The BCWMC Monitoring Plan (see Appendix X) describes the BCWMC stream biotic monitoring program in greater detail.

Table A-20 Biotic Monitoring Trends of Priority Streams

Biotic Monitoring Location	Statistically Significant Trends[1]		
	Hilsenhoff Biotic Index (HBI)	Invertebrate Community Index (ICI)	MN Macro-invertebrate Index of Biological Integrity (MIBI)
Bassett Creek Main Stem – Rhode Island Avenue	TBD	TBD	TBD
Bassett Creek Main Stem – Zane Avenue	TBD	TBD	TBD
Bassett Creek Main Stem – Irving Avenue	TBD	TBD	TBD
North Branch Bassett Creek – 32nd Street and Adair	TBD	TBD	TBD
Plymouth Creek – Industrial Park Boulevard	TBD	TBD	TBD
Sweeney Branch Bassett Creek – Xenia Avenue	TBD	TBD	TBD

(1) At a 95% confidence level using linear least squares regression applied to data collected from 2000-2023.

A.7.1.3 Watershed Outlet Monitoring Program (WOMP) and BCWMC Stream Water Quality Monitoring

In 2000, the BCWMC and Metropolitan Council Environmental Services (MCES) began monitoring the Main Stem of Bassett Creek as part of the MCES' Watershed Outlet Monitoring Program (WOMP).

The Bassett Creek WOMP site is currently located at Van White Memorial Boulevard, just upstream of the tunnel that carries Bassett Creek beneath downtown Minneapolis to the Mississippi River (see Figure A-9). Data collection consists of continuous measurements of stream flow, temperature and conductivity, as well as base flow grab samples and storm event composite samples. The samples are analyzed in the MCES laboratory for many water quality parameters including nutrients and sediment. MCES publishes reports documenting the results of this monitoring.

Following adoption of the 2015 Watershed Management Plan, BCWMC began monitoring North Branch Bassett Creek, Plymouth Creek, and Sweeney Lake Branchfor approximately two year periods on a rotating basis (see Appendix X).

Table A-21 presents the trends observed in stream water quality over the 10-year period from 2014-2023 for priority streams. The most current water quality data for BCWMC priority streams are available on the BCWMC website.

Table A-21 Water Quality Trends of Priority Streams

Priority Lake	Statistically Significant Trends[1]		
	Total Phosphorus	Chloride	Total Suspended Solids
Bassett Creek Main Stem	TBD	TBD	TBD
North Branch Bassett Creek	--[2]	--[2]	--[2]
Plymouth Creek	--[2]	--[2]	--[2]
Sweeney Branch Bassett Creek	--[2]	--[2]	--[2]

(2) At a 95% confidence level using linear least squares regression applied to data collected from 2014-2023.
(3) Insufficient data collected from 2014-2023 to assess trend.

A.7.1.4 Three Rivers Park District/City of Plymouth

Three Rivers Park District (TRPD) and the City of Plymouth monitor Parkers Lake, Medicine Lake, two locations on Plymouth Creek, a location on a tributary to Plymouth Creek, and two stormwater inflows to Parkers Lake. The BCWMC and the City of Plymouth used the data collected to develop the Medicine Lake TMDL.

When requested by the BCWMC, TRPD has conducted additional monitoring of the southwest basin (where Plymouth Creek discharges to Medicine Lake) on behalf of the BCWMC. On these occasions, TRPD also collects samples for phytoplankton and zooplankton analysis funded by the BCWMC (see Section A.7.1.1). The most recent water quality data for Medicine Lake and the southwest basin, specifically, are available on the BCWMC website. More information is available on the TRPD water resources website.

A.7.1.5 Minneapolis Park and Recreation Board

The Minneapolis Park and Recreation Board (MPRB) monitors Birch Pond, Wirth Lake, and Spring Lake within the BCWMC. The BCWMC incorporates MPRB data for Wirth Lake into its water quality analyses. Additional information is available on the MPRB Lake Resources website.

The Metropolitan Council implements the Citizen Assisted Monitoring Program (CAMP). Through CAMP, volunteers have collected water quality data on several Twin Cities metropolitan area lakes since 1980. Several waterbodies within the BCWMC have been routinely monitored as part of the CAMP program including Medicine Lake, Parkers Lake, Sweeney Lake, Twin Lake, Westwood Lake, Northwood Lake, Lost Lake, and Sunset Lake.and. In recent years, funding for the CAMP monitoring of waterbodies has been provided by the BCWMC.

More information about CAMP is available onthe Metropolitan Council's lake monitoring website.

A.7.1.6 Member City Monitoring

The BCWMC's nine member cities are responsible for managing lakes and ponds not identified as BCWMC priority waterbodies (see Section A.7.2). City management of these waterbodies may include classifying, monitoring, tracking trends, conducting studies, and implementing other lake water quality management actions.

Barr Footer: ArcGIS 10.8.1, 2023-05-05 16:19 File: \\barr.com\gis\Client\BassettCreek\Work_Orders\2022\2025_Watershed_Plan_Update\Maps\Report\Figure 2-10 Monitoring Locations.mxd User: CML3

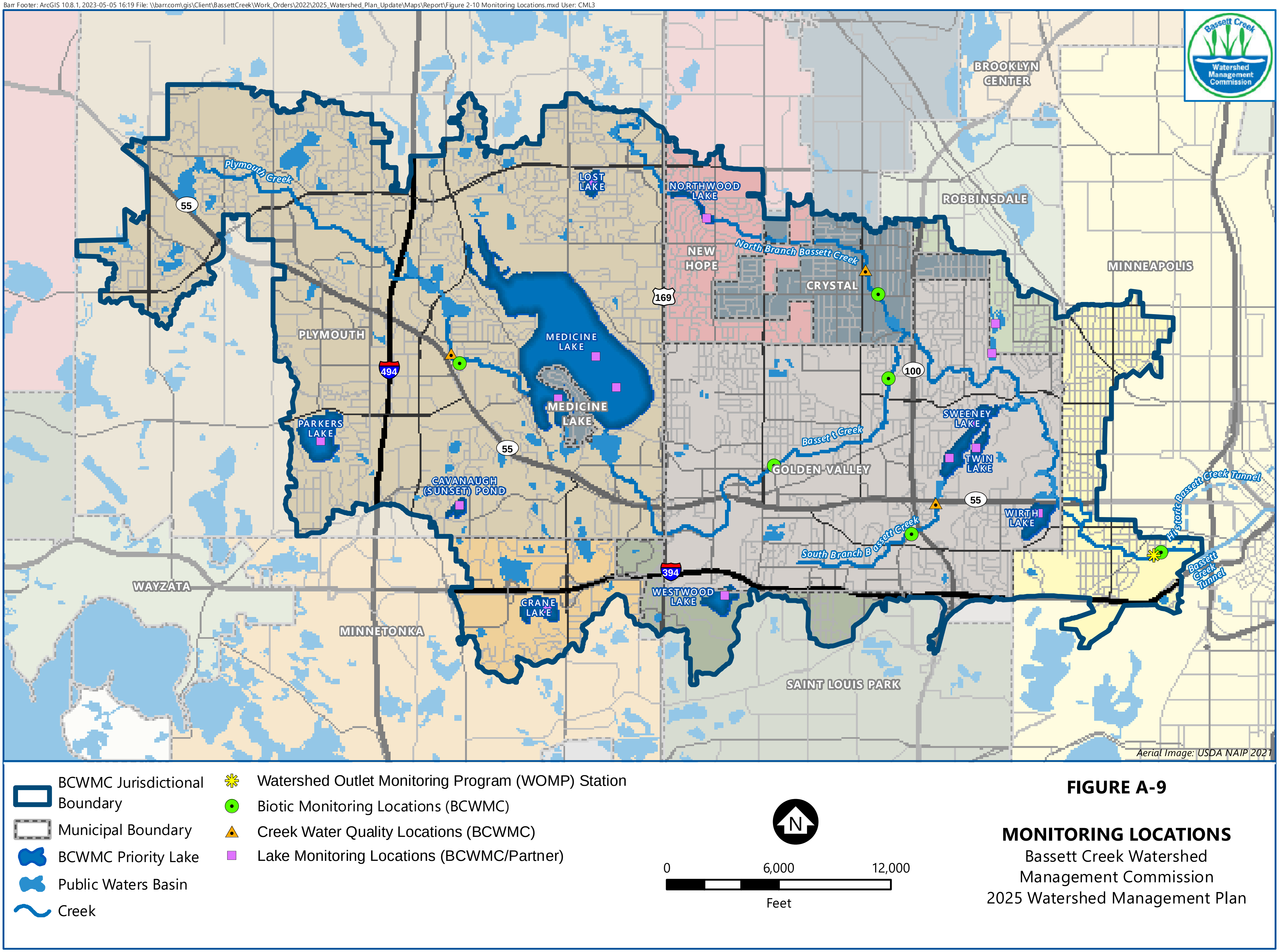


FIGURE A-9

MONITORING LOCATIONS

Bassett Creek Watershed Management Commission

2025 Watershed Management Plan

A.7.2 Management and Classification

A.7.2.1 MPCA Impaired Waters

The federal Clean Water Act (CWA) requires states to adopt water quality standards to protect the nation's waters. To that end, the MPCA developed criteria for Minnesota lakes and streams to establish water quality goals and determine appropriate uses of the lakes and streams, as outlined in the guidance document *Guidance for Assessing the Quality of Minnesota Surface Waters for Determination of Impairment: 305(b) Report and 303(d) List* (MPCA, 2023, as amended).

Standards for lakes and streams vary by MPCA ecoregion and MPCA classification. The MPCA classifies lakes as "shallow" or "deep"; "shallow" lakes have a maximum depth of 15 feet or less or support aquatic plant growth over 80% or more of the lake area.

Table A-24 presents water quality standards for parameters of primary concern to the BCMWC. The MPCA also established water quality standards for parameters in addition to those presented in Table A-24; these standards are published in Minnesota Rules 7050 and may be applicable to BCWMC lakes, ponds, and streams.

In compliance with Section 303(d) of the CWA, the MPCA identifies and establishes priority rankings for waters that do not meet the water quality standards. The list of impaired waters, sometimes called the 303(d) list, is updated by the MPCA every 2 years.

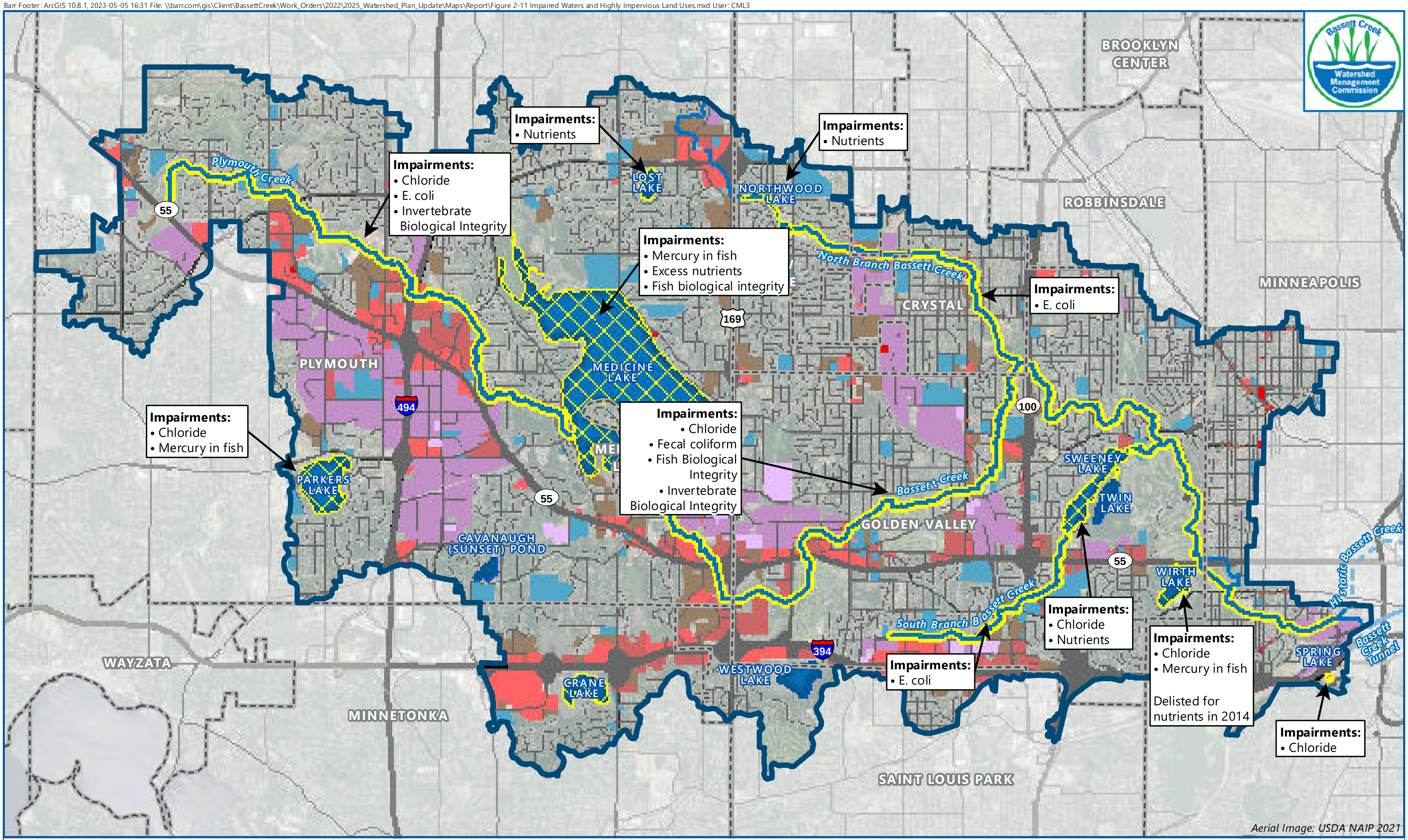
Several waterbodies within the BCWMC have been listed on the MPCA 2024 impaired waters (303(d)) list for a variety of impairments. Table A-22 and Figure A-10 present the impaired waters in the BCWMC. Waterbodies on the impaired waters list are required to have an assessment completed that addresses the causes and sources of the impairment. This process is known as a total maximum daily load (TMDL) analysis.

Current impaired waters listings are available onhe MPCA website: www.pca.state.mn.us/index.php/water/water-types-and-programs/minnesotas-impaired-waters-and-tmdls/impaired-waters-list.html

Table A-22 Summary of Impaired Waters within the BCWMC (draft 2024)

Waterbody	Impaired Use	Pollutant or Stressor	Year Listed	TMDL Study Target Start	TMDL Study Target Completion	TMDL Study Approved
Parkers Lake[2]	Aquatic Consumption	Mercury in Fish Tissue	1998	1998	2025	--
	Aquatic Life	Chloride	2014	2009	2015	--
Medicine Lake[3]	Aquatic Consumption	Mercury in Fish Tissue	2004	--	--	2008[4]
	Aquatic Recreation	Nutrients/Eutrophication	2004	--	--	2010
	Aquatic Life	Fish Bioassessments	2024	--	--	--
Sweeney Lake[1]						
	Aquatic Life	Chloride	2014	2009	2015	--
Wirth Lake[1]	Aquatic Consumption	Mercury in Fish Tissue;	1998	--	--	2008[4]
	Aquatic Life	Chloride	2014	2009	2015	--
Lost Lake	Aquatic Recreation	Nutrients/Eutrophication	2024	--	--	--
Northwood Lake	Aquatic Recreation	Nutrients/Eutrophication	2004	2020	2024	--
Bassett Creek (Main Stem)	Aquatic Life	Chloride	2010	2009	2015	--
	Aquatic Life	Macroinvert. Bioassess.	2022	--	--	--
	Aquatic Life	Fish Bioassessments	2004	2012	2016	--
	Aquatic Recreation	Fecal Coliform	2008	2008	2015	2014[5]
Plymouth Creek	Aquatic Life	Macroinvert. Bioassess.	2024	--	--	--
	Aquatic Life	Chloride	2014	2009	2015	--
	Aquatic Recreation	Escherichia coli	2014	2008	2015	2014[5]
North Branch Bassett Creek	Aquatic Recreation	Escherichia coli	2014	2008	2015	2014[5]
Sweeney Branch Bassett Creek	Aquatic Recreation	Escherichia coli	2024	--	--	--
Spring Lake	Aquatic Life	Chloride	2014	2009	2015	--

[1] Wirth Lake and Sweeney Lake were delisted for aquatic recreation due to nutrients/eutrophication based on improved water quality in 2014 and 2024, respectively.
[2] Mercury impairment for Parkers Lake is not covered by the statewide mercury TMDL due to mercury in fish tissue exceeding a threshold value of 0.57 mg/kg.
[3] Medicine Lake is a "high risk water" for chloride impairment per the MPCA's 2014 Metro Chloride Assessment, but is not listed as impaired for chloride.
[4] Covered under the statewide mercury TMDL, approved in 2007.
[5] Covered under the Upper Mississippi River Bacteria TMDL Study and Protection Plan, approved in 2014



BCWMC Jurisdictional Boundary
Municipal Boundary
BCWMC Priority Lake
Creek
Impaired Lake *(Draft 2024)*
Impaired Stream *(Draft 2024)*

High Impervious Land Use
(Met Council, 2020, Hennepin County Parcels 2022)

- Multifamily
- Mixed Use Commercial and Other
- Mixed Use Industrial
- Office
- Retail and Other Commercial
- Industrial or Utility
- Institutional
- Transportation Right-of-Way

N
0 3,000 6,000
Feet

FIGURE A-10

IMPAIRED WATERS AND HIGHLY IMPERVIOUS LAND USES

Bassett Creek Watershed Management Commission
2025 Watershed Management Plan

A.7.2.2 BCWMC Classification Systems

The BCWMC identified specific waterbodies as priority waterbodies to focus management activies and improvement projects. The BCWMC classified four streams and 10 lakes as priority waterbodies (see Table A-23).

Priority streams include include MDNR public waters watercourses within the BCWMC. Priority lakes include those lakes at least 10 acres in size and with a "P" public waters designation. Priority lakes are further subdivided into lakes with public access (Priority 1 lakes) and without public access (Priority 2 lakes) and according to their MPCA classification as "deep" or "shallow" (all Priority 2 lakes are shallow lakes).

The BCWMC adopts water quality standards for priority lakes and streams consistent with MPCA water quality standards published in Minnesota Rules 7050 (note that Minnesota Rules 7050 applies to waterbodies regardless of BCWMC classification). Table A-24 presents BCWMC water quality standards for priority waterbodies. The BCWMC established goals for watershed and waterbody quality (see Section X) with consideration for applicable water quality standards and existing water quality.

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Table A-23 BCWMC Management Classifications for Priority Waterbodies

BCWMC Classification	Waterbodies
Priority Streams	• Main Stem Bassett Creek • North Branch Bassett Creek* • Plymouth Creek • Sweeney Branch Bassett Creek
Priority 1 Deep Lakes	• Medicine Lake • Parkers Lake • Sweeney Lake • Twin Lake • Wirth Lake
Priority 1 Shallow Lakes	• Northwood Lake • Westwood Lake
Priority 2 Shallow Lakes	• Cavanaugh Lake (Sunset Pond) • Crane Lake • Lost Lake

* Includes Bassett Creek Park Pond

Table A-24. BCWMC Water Quality Standards for Priority Waterbodies

Priority Waterbody Name	BCWMC Classification[1]	BCWMC Water Quality Standards[2]							
		Total Phosphorus, summer average (ug/L)	Chlorphyll *a*, summer *average* (ug/L)	Secchi Disc Transparency, summer average(m)	Total Suspended Solids (mg/L)	Daily Dissolved Oxygen Flux (mg/L)	Biological Oxygen Demand (5-day) (mg/L)	*Escherichia coli* (# per 100 mL)	Chloride (mg/L)
Plymouth Creek North Branch Bassett Creek Sweeney Branch Bassett Creek Main Stem Bassett Creek	Priority 1 Stream	100	18	NA	30	3.5	2	126 [3]	230
Medicine Lake Twin Lake Sweeney Lake Wirth Lake Parkers Lake	Priority 1 Deep Lake	40	14	1.4	NA	NA	NA	126 [3]	230
Westwood Lake Northwood Lake	Priority 1 Shallow Lake	60	20	1	NA	NA	NA	126 [3]	230
Crane Lake Lost Lake Cavanaugh (Sunset Hill) Pond	Priority 2 Shallow Lake	60	20	1	NA	NA	NA	126 [3]	230

[1] Deep/shallow classification is based on MPCA classification; shallow lakes have a maximum depth of less than 15 feet or littoral area greater than 80% of the total lake surface area.

[2] BCWMC standards are based on existing MPCA standards included in MN Rules 7050. Revisions to MN Rule 7050 will supersede BCWMC standards. Note that MN Rule 7050.0220 includes water quality standards for additional parameters that are enforced by the MPCA.

[3] 126 organisms per 100 mL as a geometric mean of not less than five samples within any month, nor shall more than 10% of all samples within a month exceed 1,260 organisms per 100 mL. The standard applies from April 1 through October 31.

A.7.3 Water Quality Modeling

The BCWMC performs water quality modeling to estimate existing pollutant loads, estimate future changes in pollutant loading from development or redevelopment, and evaluate the potential benefits of proposed improvement projects

A.7.3.1 Watershed-wide P8 Model

As part of developing lake and stream watershed management plans, the BCWMC developed models to estimate total flow and phosphorus loadings to lakes and streams using the water quality model P8. P8 (Program for Predicting Polluting Particle Passage through Pits, Puddles and Ponds) is a model for estimating the generation and transport of stormwater runoff pollutants in urban watersheds.

The BCWMC performed a comprehensive update to watershed P8 models in 2012-2013.

Data required to update the P8 models included watershed information (e.g., area, curve number, imperviousness, etc.) and BMP information (e.g., permanent pool area, permanent pool volume, flood pool area, and flood pool volume). Sources of information for the 2012 model construction included data collected from municipalities and other government agencies, information from previously constructed P8 models, field surveys, estimation from GIS, and calculations from XPSWMM hydrologic and hydraulic models (i.e., outlet rating curve calculations). P8 modeling results were then compiled and compared to the available monitoring data from the Bassett Creek WOMP station during the water year monitoring periods between 2001 and 2011 to determine whether changes to the modeling were warranted for calibration. More detailed information regarding data sources, model updates, and model calibration is included in a report entitled *Bassett Creek Water Quality Modeling* (BCWMC, 2013).

The updated P8 water quality modeling provides a tool for the BCWMC and member cities to track pollutant reduction progress and to evaluate the expect impact of potential water quality improvements..

The BCWMC updates the P8 model periodically for to reflect land use changes and constructed BMPs based on plans provided annually by member cities.

A.8 Water Quantity and Flood Risk

The BCWMC was originally formed in 1969 to address flooding issues in the watershed and flood risk reduction remains a primary focus of the BCWMC (see Section X). To minimize flood risk along the Bassett Creek trunk system, the BCWMC:

- Manages the BCWMC Flood Control Project
- Monitors water levels on the lakes and streams in the watershed
- Establishes flood levels and reviews proposed activities in the floodplains
- Reviews development and redevelopment projects to make sure there are no detrimental flooding impacts to the trunk system

The BCWMC defines the trunk system as those reaches, structures, and designated storage facilities shown in Figure A-11 and listed in Appendix X.

Beginning in the 1960s, aging stormwater facilities and rapid urbanization resulted in flooding problems in the Bassett Creek watershed. For decades, flooding caused damages to homes, businesses, and recreational areas along Bassett Creek averaging in excess of $2 million annually. The worst problems occurred along the 1.5-mile long (old) Bassett Creek Tunnel, which was undersized and severely deteriorated. The BCWMC partnered with the US Army Corps of Engineers (USACE), MnDOT, MDNR, and member cities to address these issues with the Bassett Creek Flood Control Project (BCWMC Flood Control Project).

A.8.1 BCWMC Flood Control Project

Between 1987 – 1996, the USACE constructed the $40 million (at the time of construction) Flood Control Project in cooperation with MnDOT, MDNR, the BCWMC, and the BCWMC member cities. The project manages flooding in portions of Golden Valley, Plymouth, Minneapolis, and Crystal and reduced flood elevations along the Bassett Creek corridor by 2 feet in Golden Valley, 1½ feet in Crystal, and up to 4½ feet in Minneapolis. The BCWMC Flood Control Project also reduced average annual flood damages by 62 percent. BCWMC Flood Control project elements are listed in Table A-25 and shown in Figure A-11. The BCWMC Flood Control Project differs from the system referred to as the BCWMC "Trunk System" (also shown in Figure A-11).

The principal feature of the BCWMC Flood Control Project is the new 1.7-mile tunnel through downtown Minneapolis phases between 1979 and 1992. The tunnel was built in three phases, at a cost of $28 million. Phase 1 was constructed in 1979, at a cost of $12 million ($50.1 million in 2023 dollars), Phase 2 was constructed in 1990, at a cost of $2.8 million ($6.5 million in 2023 dollars), and Phase 3 was constructed in 1992, at a cost of $13.4 million ($30 million in 2023 dollars). The tunnel diverts Bassett Creek, where it plunges underground at Glenwood and Colfax Avenues in Minneapolis, into the Mississippi River. The original tunnel, some sections of which were built more than a century ago, was undersized and deteriorating. The tunnel could no longer accommodate increased drainage and was on the verge of collapse. Such a collapse would have caused major flooding. The new tunnel provides cooperative storm drainage for Bassett Creek, Interstate Highways 94 and 394, and portions of the City of Minneapolis. The tunnel empties into the Mississippi River just south (downstream) of St. Anthony Falls.

With the BCWMC Flood Control Project in place, runoff from the watershed area tributary to the old tunnel no longer flows to Bassett Creek. In 2000, the BCWMC, the City of Minneapolis, and the Mississippi WMO entered into a joint and cooperative agreement to reflect the changed drainage conditions resulting from the new tunnel (see Appendix X). The agreement transferred 1,002 acres from the BCWMC to the Mississippi WMO. The City of Minneapolis is currently responsible for maintenance of the old tunnel. The joint and cooperative agreement includes obligations related to the old and new tunnels, and requires BCWMC approval for any modifications affecting peak flows or hydraulic capacity in the new tunnel (see Appendix X).

The BCWMC Flood Control Project also included construction of the following six major features:

- Highway 100 control structure
- Wisconsin Avenue control structure
- Highway 55 control structure
- Markwood/Edgewood area modifications – Edgewood control structure, Edgewood Avenue basin, and Markwood channel improvements
- Golden Valley Country Club control structure
- Medicine Lake outlet structure

Other Flood Control Project control structures consist of low flow orifices with overflow weirs to restrict flows.

Other principal features of the BCWMC Flood Control Project include the Bassett Creek Park Pond project, replacing ten street crossings, flood-proofing five homes, and making channel improvements. In addition to providing flood control benefits, some of the project features provide water quality benefits (e.g., Bassett Creek Park Pond and the fish barrier at the tunnel). The features of the BCWMC Flood Control Project are shown on Figure A-11 and listed in Table A-25. The project also included the monitoring and disposal of hazardous materials from an area of the project where contaminated soils were present (Irving Avenue dump site).

Each control structure leaves the creek virtually unaffected during normal flow conditions. For large storm events, the storage upstream of control structures generally results in higher water levels than under pre-project conditions. Maintenance may be required in storage areas after significant rainfall events. Each control structure reduces peak discharges immediately downstream of the structure. Implementation of all the control structures and the storage they provide resulted in a smaller tunnel and fewer measures needed to increase stream capacity.

In the vicinity of Glenwood Inglewood Waters and the abandoned Fruen Mill, downstream of Glenwood Avenue, the Flood Control Project proposed removal of an existing stone dam and retaining walls and installing a concrete drop structure, new retaining walls, and widening of the creek channel. This work was not supported by the City of Minneapolis and was deleted from the BCWMC Flood Control Project.

The watershed south of 36th Avenue and west of Hampshire Avenue in the City of Crystal, was diverted to a ponding area downstream of 36th Avenue by the construction of approximately 1,150 feet of culvert. Large inlet structures were constructed on 36th Avenue and on each side of Hampshire Avenue and Louisiana Avenue.

Creekside residents immediately benefited from the modifications even prior to the full completion of the BCWMC Flood Control Project. When an 8-inch rainstorm struck the area in July 1987, the Highway 55 control structure, completed just one month previously, protected homes and businesses downstream of the structure from over $1 million ($2.7 million in 2023 dollars) in flood damages.

The BCWMC established and maintains specific funds for emergency repairs to the Flood Control Project system and long-term maintenance and repair of the BCWMC Flood Control Project system.The BCWMC's Flood Control Project policies (see Section X) also allow significant repairs to be funded via the BCWMC capital improvement program (see Section X).

A.8.2 Other Watershed Flood Control Projects

The BCWMC and member cities have implemented other structural flood risk reduction projects in addition to the BCWMC Flood Control Project. Improvements include:

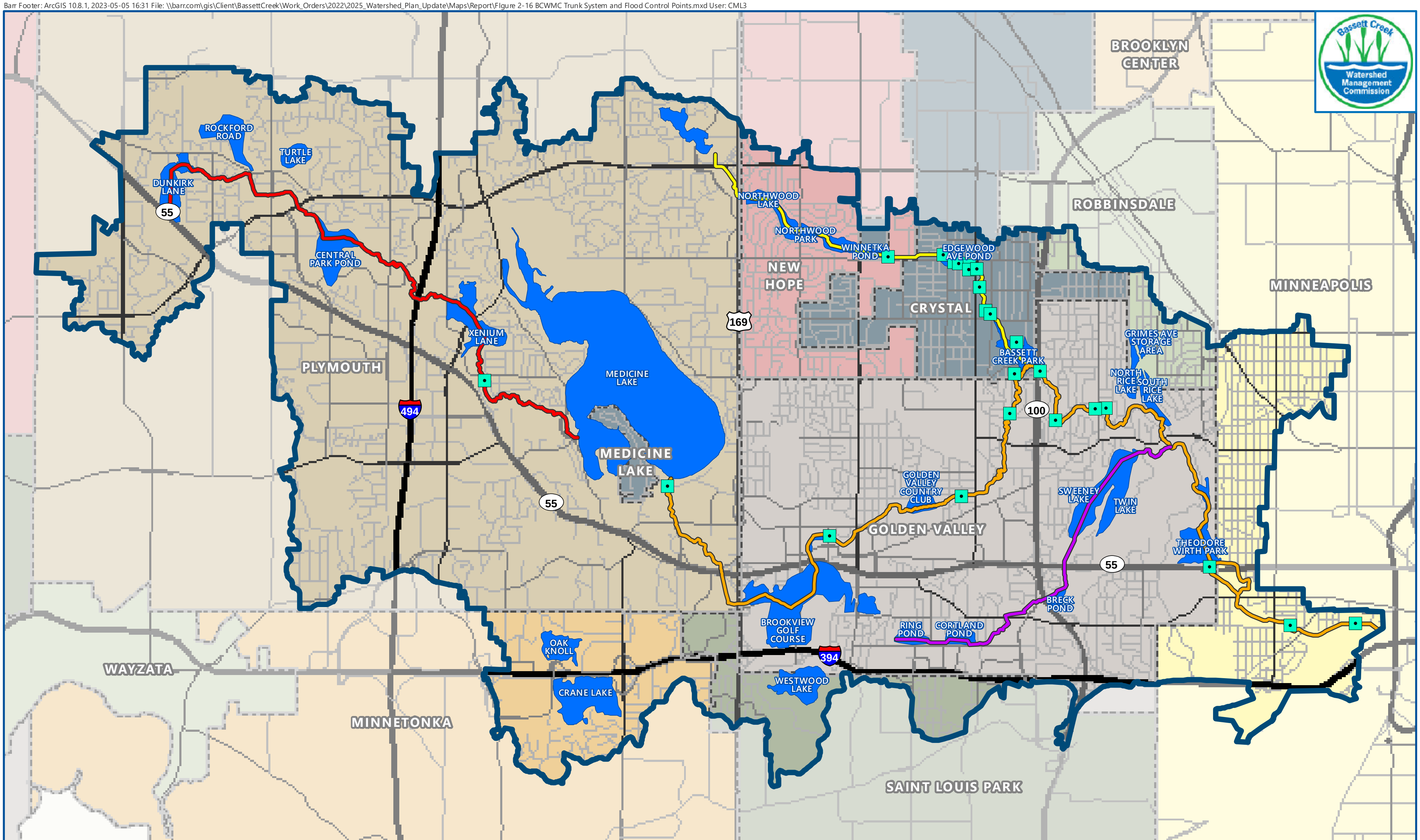
- Breck Stormwater Storage Area – The City of Golden Valley and MnDOT cooperatively constructed a storage area on the Sweeney Lake Branch of Bassett Creek upstream of Sweeney Lake.
- Cortlawn and Ring Ponds – The City of Golden Valley constructed ponds in the headwaters of the Sweeney Lake Branch of Bassett Creek to provide flood risk reduction and and water quality benefits.
- North and South Rice Pond Floodplain Acquisition – The cities of Golden Valley and Robbinsdale acquired area around the ponds to preserve wetland and natural inundation area for stormwater storage.
- Dresden Lane Crossing – The crossing of the creek at Dresden Lane restricts downstream discharge and increases upstream storage in North and South Rice Ponds.
- Flood Storage Easements – Several BCWMC member cities have acquired easements for the purposes of temporary flood storage and flowage
- Plymouth Creek Storage Sites – The City of Plymouth constructed five major stormwater storage sites on or tributary to Plymouth Creek.
- DeCola Ponds B & C Improvement Project – The City of Golden Valley constructed this project, with funding from the BCWMC.
- SEA School – Wildwood Park Flood Storage Project– The City of Golden Valley constructed this project, with funding from the BCWMC.
- Medley Park Stormwater Treatment Facility– The City of Golden Valley constructed this project, with funding from the BCWMC.

Sites recognized as flood storage areas within the BCWMC are identified in Figure A-11. Not all flood storage areas shown in Figure A-11 are part of the BCWMC Flood Control Project described in Section A.8.1).

The BCWMC also performs nonstructural flood risk reduction activitiesto minimize flood damages along the BCWMC trunk system. Examples include:

- Monitoring lake and stream water levels
- Using models (e.g., XPSWMM) to assess flood risk
- Reviewing proposed projects with potential floodplain impacts
- Establishing policies and/or requirements to:
    - Set minimum building elevations
    - Preserve floodplain storage
    - Limit alteration to existing structures

Barr Footer: ArcGIS 10.8.1, 2023-05-05 16:31 File: \\barr.com\gis\Client\BassettCreek\Work_Orders\2022\2025_Watershed_Plan_Update\Maps\Report\Figure 2-16 BCWMC Trunk System and Flood Control Points.mxd User: CML3



BCWMC Jurisdictional Boundary

Municipal Boundary

Flood Control Project

BCWMC Trunk System Components

Main Stem Bassett Creek

North Branch Bassett

Plymouth Creek

Sweeney Branch Bassett Creek

Trunk System Storage

N

0 6,000 12,000

Feet

FIGURE A-11

BCWMC TRUNK SYSTEM AND FLOOD CONTROL PROJECTS

Bassett Creek Watershed Management Commission

2025 Watershed Management Plan

A.8.3 FEMA Floodplain and Flood Insurance Studies

The Federal Emergency Management Agency (FEMA) performs flood insurance studies (FIS) and develops maps to show areas prone to flooding during the 100-year (and sometimes 500-year) storm events. Each of the BCWMC member cities has a FIS. The FIS, together with a city's floodplain ordinance, allow the city to take part in the national flood insurance program (NFIP). Homeowners within FEMA-designated floodplains are required to purchase flood insurance. FEMA flood insurance rate maps (FIRMs) are available from the FEMA website.

In some cases, homes shown within FEMA-designated floodplains on FIRMs may not actually be in the floodplain. To waive the mandatory flood insurance requirements, homeowners may remove their homes from the FEMA-designated floodplain by obtaining a Letter of Map Amendment (LOMA).

A.8.4 BCWMC Floodplain

Independent of the FEMA-delineated floodplain, the BCWMC delineated its own 100-year floodplain based on hydrologic and hydraulic modeling of the watershed (see Section A.8.7). The BCWMC establishes policy and performance standards relative to the BCWMC floodplain and associated flood elevations.

Figure A-12 shows the BCWMC mapping of the 100-year floodplain in the BCWMC.

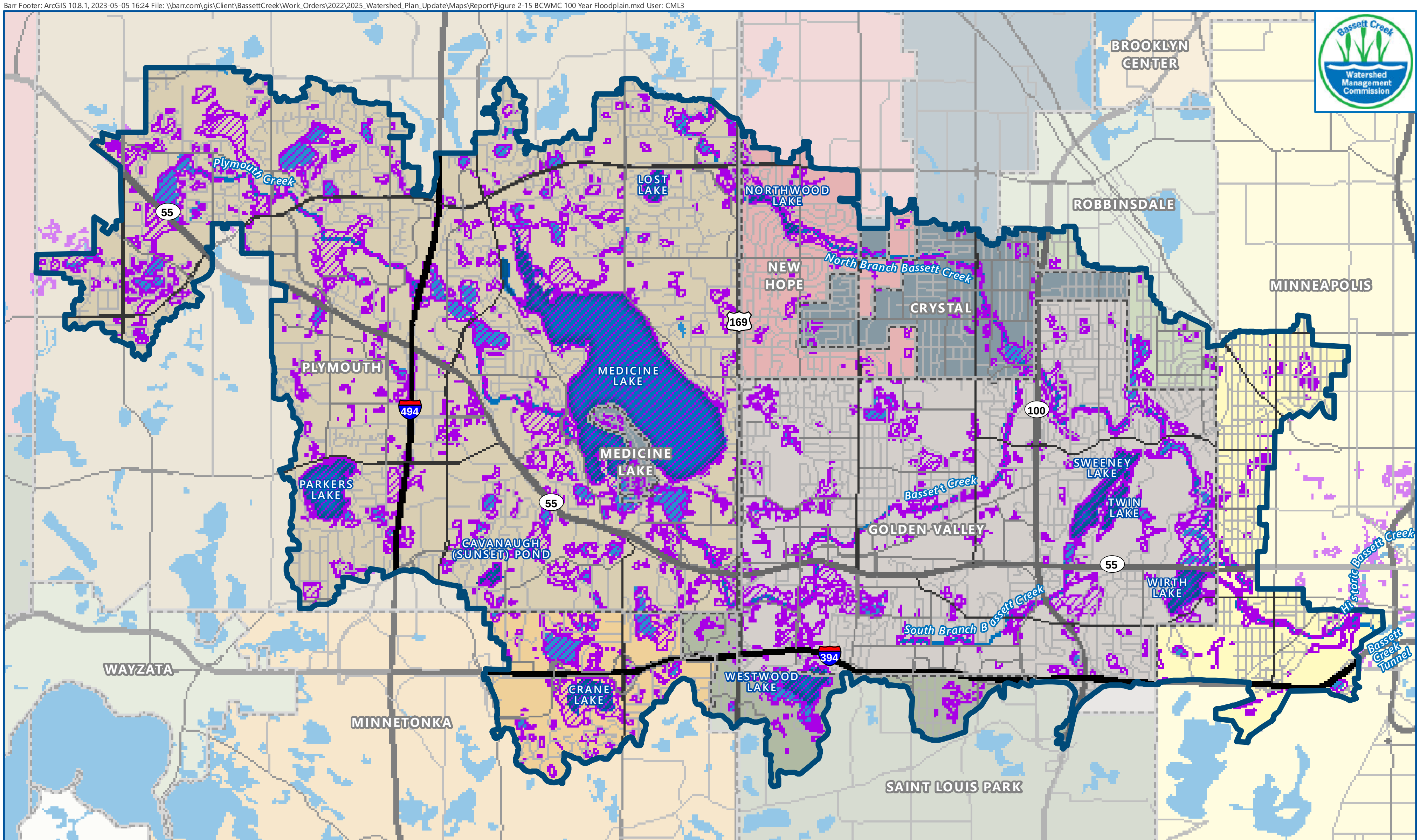
A.8.5 Regulatory Water Levels and Flow Rates

The BCWMC uses flood profiles based on its watershed-wide hydrologic and hydraulic mode (see Section A.8.7)l in its review of improvements and development proposals. Appendix X lists the flood profiles and critical event flow rates in effect at the time of Plan adoption. The BCWMC uses the most recent precipitation data published by the National Oceanic and Atmospheric Administratin (NOAA) when updating flood profiles and flow rates (e.g., Atlas 14, see Section A.1).

Table A-25 Summary of BCWMC Flood Control Project Features

Feature	Location	Year Built	Partners	Cost[1]
Phase I Tunnel: 2nd Street Tunnel	Minneapolis	1979	BCWMC, USACE, MnDOT	$12,000,000 ($50,140,000)
Golden Valley Flood Control Project Regent Avenue Crossing Noble Avenue Crossing Minnaqua Drive Bridge Removal Highway 100 Control Structure 32nd Avenue Crossing Brunswick Avenue Crossing 34th Avenue Crossing Edgewood Ave Control Structure & Embankment Edgewood Avenue Storage Basin Georgia Avenue Crossing 36th Avenue Crossing Hampshire Avenue Crossing Markwood Channel Improvements Floodproofing Five Homes	 Golden Valley Golden Valley Golden Valley GV/Crystal Crystal Crystal Crystal Crystal Crystal Crystal Crystal Crystal Crystal Crystal Crystal	1981-1984	BCWMC USACE Golden Valley Crystal	$1,600,000 ($5,300,000)
Douglas Drive Crossing	Crystal	1987	BCWMC, Crystal Hennepin County	$100,000 ($270,000)
Wisconsin Avenue Control Structure	Golden Valley	1987	BCWMC Golden Valley	$100,000 ($270,000)
Highway 55 Control Structure	Golden Valley	1987	BCWMC, USACE, MDNR, Minneapolis	$85,000 ($230,000)
Plymouth Creek Fish Barrier	Plymouth	1987	BCWMC, MDNR, Plymouth Hennepin County	$60,000 ($160,000)
Phase 2 Tunnel: Third Ave. Tunnel	Minneapolis	1990	BCWMC, USACE, Minneapolis, MDNR. MnDOT	$2,800,000 ($6,500,000)
Phase 3 Tunnel: Box Culvert Double Box Culvert Channel Improvements	Minneapolis	1992	BCWMC, USACE, Minneapolis MDNR, MnDOT	$13,400,000 ($30,000,000)
Markwood/Edgewood Area Modifications Control Structure, Edgewood Avenue Basin, Markwood Channel Improvements	Crystal	1992	BCWMC, USACE Crystal, MDNR	500,000 ($1,1020,000)
Westbrook Road Crossing	Golden Valley	1993	BCWMC, USACE Golden Valley, MDNR	200,000 ($420,000)
Golden Valley Country Club Control Structure	Golden Valley	1994	BCWMC, USACE Golden Valley, MDNR	450,000 ($920,000)
Bassett Creek Park Pond	Crystal	1995	BCWMC, USACE, Crystal, MnDOT, MDNR	1,300,000 ($2,600,000)
Medicine Lake Outlet Structure	Plymouth	1996	BCWMC, Plymouth Hennepin County, MDNR	100,000 ($194,000)

[1] 2023 dollars are included in parentheses



BCWMC Jurisdictional Boundary

Municipal Boundary

BCWMC Priority Lake

Public Waters Basin

Creek

100-Year Inundation

Notes:
Map is based on 2022 BCWMC-approved XP-SWMM model results incorporating storage and conveyance of projects implemented through 2021 and compared to MDNR 2011 LiDAR data to show inundation.

N

0 6,000 12,000
Feet

FIGURE A-12

BCWMC 100 YEAR FLOODPLAIN

Bassett Creek Watershed Management Commission
2025 Watershed Management Plan

A.8.6 Water Quantity Monitoring

A.8.6.1 Lake Levels

The BCWMC has collected water level data on several waterbodies since the 1970s. Ordinary high water levels (OHWLs), if known, are presented in Table A-26. The BCWMC typically measures water levels once per month . More detailed information is available from the MDNR lakefinder website and from the BCWMC, upon request.

Watershed residents have periodically raised concerns regarding Medicine Lake water levels Water level data for Medicine Lake is available dating back to 1926, although water level data was not measured regularly until 1972. From 1972 to 2023, water levels have fluctuated from an observed low of 885.7 feet in 1972 to an observed high of 889.8 feet in 1991 (NAVD88 datum). The average measured water level from 1972 through 2023 is 888.0 feet (NAVD88 datum). The normal water level for Medicine Lake is 887.8 feet (NAVD88 datum), which is the elevation of the outlet.

Table A-26 BCWMC Priority Waterbody Lake Levels

Priority Waterbody	Ordinary High Water Level[1] (feet, NAVD88 datum)	Normal Water Level (feet, NAVD88 datum)
Cavanaugh (Sunset Hill) Pond	--	--
Crane Lake	920.5	917.2[2]
Lost Lake	--	939.1
Medicine Lake	889.2	887.8
Northwood Lake	885.6	--
Parkers Lake	936.0	934.1
Sweeney Lake	827.8	827.6
Twin Lake	--	827.6
Westwood Lake	887.9	886.1
Wirth Lake	819.0	818

(1) MNDR Lakefinder data: LakeFinder | Minnesota DNR (state.mn.us)

(2) Outlet elevation of Crane Lake is 917.2 feet.

A.8.6.2 Stream Gaging and Flow Data

The BCWMC monitors flow in the Main Stem of Bassett Creek through the Metropolitan Council's watershed outlet monitoring program (WOMP, see Section 0) dating back to 2000. The Bassett Creek WOMP site is located at Van White Memorial Boulevard, just upstream of the tunnel that carries Bassett Creek beneath downtown Minneapolis to the Mississippi River (see Figure A-9). The most current data are available from the BCWMC website.

A.8.7 Hydrologic and Hydraulic Modeling

The BCWMC performs water quantity modeling to estimate flood levels and floodplain extents, estimate peak flow rates, design hydraulic structures, and assess impacts of projects proposed by the BCWMC and others. This section describes water quantity models developed by the BCWMC.

A.8.7.1 Watershed-wide XPSWMM Model

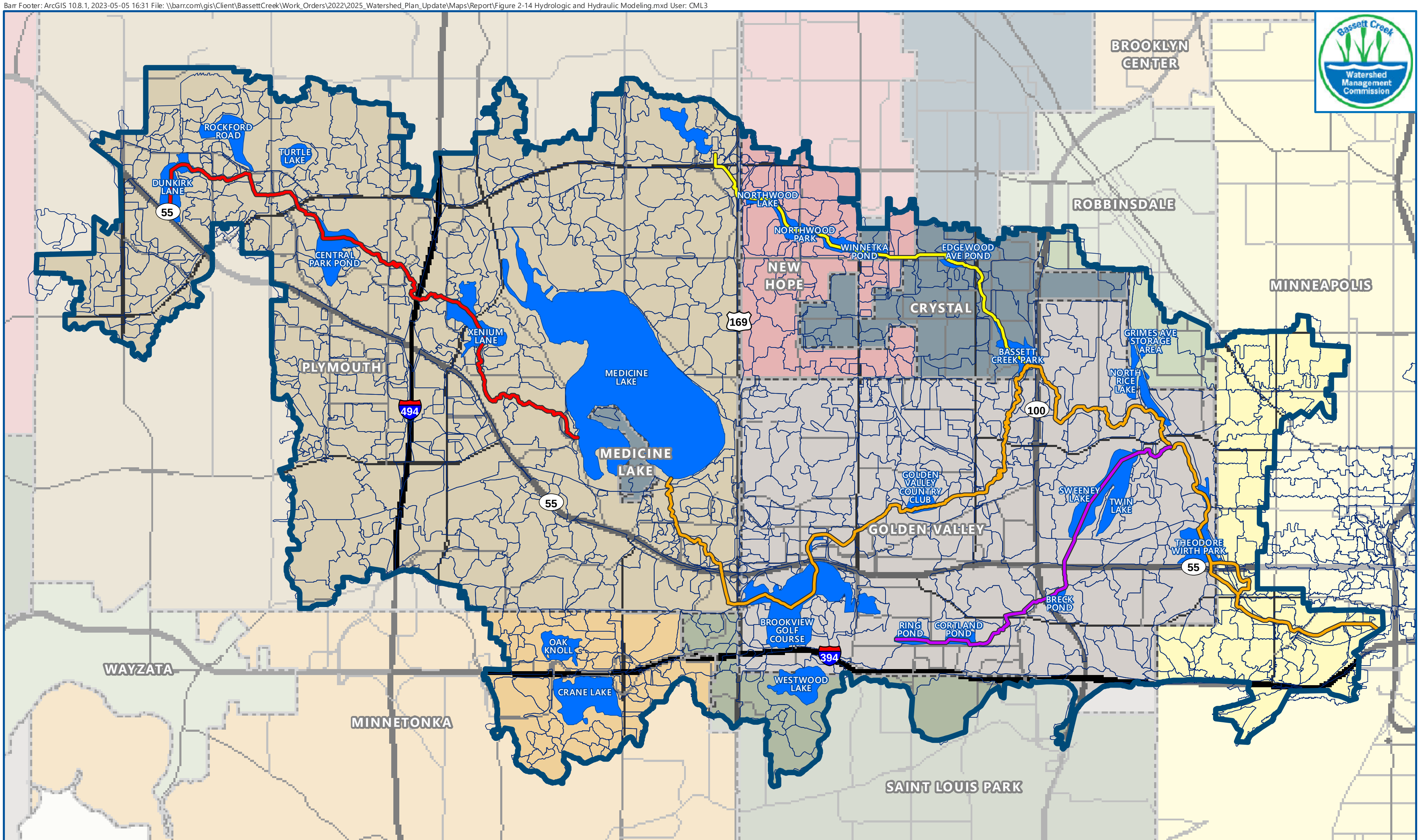
The original hydrologic and hydraulic models of the Bassett Creek watershed were created in the 1970's. In 2012 and 2013, the BCWMC developed a watershed-wide hydrologic-hydraulic model using XPSWWM software (which uses the EPA's Storm Water Management Model with a priopríetary interface).

The 2012-2013 model update divided the BCWMC into 55 subwatersheds. The BCWMC has performed further model updates to reflect subsequent redevelopment activity and stormwater management improvements within the watershed. Figure A-13 presents the watershed divides corresponding to the most recent iteration of the XPSWMM model.

The XPSWMM model was initially used to compare relative changes in flow rate or water surface elevations between existing and proposed conditions. Since the 2012-2013 update, the BCWMC XPSWMM model has been further refined to incorporate member city stormwater systems, additional subwatershed divides, and details of stormwater management BMPs. By incorporating these changes, the modeled runoff rates to the creek system provide a more realistic representation of the actual conditions and may be used to estimate absolute (versus relative) water surface elevations and flow rates.

The BCWMC periodically updates the XPSWMM model to reflect redevelopment and stormwater infrastructure improvements based on data provided annually by member cities..

Barr Footer: ArcGIS 10.8.1, 2023-05-05 16:31 File: \\barr.com\gis\Client\BassettCreek\Work_Orders\2022\2025_Watershed_Plan_Update\Maps\Report\Figure 2-14 Hydrologic and Hydraulic Modeling.mxd User: CML3



BCWMC Jurisdictional Boundary

Municipal Boundary

Hydrologic Modeling Subwatershed

BCWMC Trunk System Components

Main Stem Bassett Creek

North Branch Bassett

Plymouth Creek

Sweeney Branch Bassett Creek

Trunk System Storage

N

0 6,000 12,000

Feet

FIGURE A-13

HYDROLOGIC AND HYDRAULIC MODELING

Bassett Creek Watershed Management Commission

2025 Watershed Management Plan

A.9 Natural Communities, Wildlife, and Habitat

A.9.1 Historical Vegetation

Prior to western settlement, the Bassett Creek watershed was covered by two major natural communities. From the Mississippi River to Medicine Lake, a predominantly oak forest interrupted by tall grass prairie and marsh covered the watershed. A dense deciduous forest known as the "Big Woods" covered the area west of Medicine Lake characterized by elm, sugar maple, and basswood. Scattered remnants of this forest are still present throughout much of its original range. The Minnesota Biological Survey website contains additional information about remaining areas of native plant communities.

Minnesota Land Cover Classification System (MLCCS) information is currently available for the entire Bassett Creek watershed, making it a good source of information that can be used as a management tool. Sites of biological significance are shown in Figure A-8.

Natural vegetation in the Bassett Creek watershed over time has been greatly altered by agricultural development followed by urbanization. In addition to the loss of forested areas, numerous wetlands once present in the central and eastern portions of the watershed have been drained or filled for development. Remaining wetland areas are concentrated in the western part of the watershed and some are the remnants of approximately 1,500 acres of marsh, which once existed between Medicine Lake and the southeast corner of the watershed.

A.9.2 Natural Communities and Rare Species

The Minnesota Biologicla Survey mantains a database of sites of biodiversity significance (see Figure A-8). Sites of biodiversity significance in the BCWMC include a tamarack swamp in Theodore Wirth Regional Park. The National Heritage Information System (NHIS) also notes five occurrences of federally- or state-listed rare animal species in the watershed. Blanding's turtles, trumpeter swans, peregrine falcons, and hooded warblers are rare species that occur in the watershed. Habitat for these species should be protected and improved where feasible.

A.9.3 Wetland Health Evaluation Program

Hennepin County coordinates the Wetland Health Evaluation Program (WHEP). Through the program, volunteers are trained and work as part of a community-based team to collect data on wetland plants and macroinvertebrates using sampling methods and evaluation metrics developed by the MPCA to evaluate wetland health. Metrics are developed for vegetation and invertebrates and converted to an A through F grade (Hennepin County grading scale) or a poor/moderate/excellent rank (MPCA grading scale).

Generally, cities utilize WHEP data as baseline data for specific sites to monitor changes over time. BCWMC member cities have periodically participated in WHEP. BCWMC member cities and partners most recently participating in WHEP include the City of Minnetonka and the Minneapolis Park and Recreation Board.

A.9.4 Aquatic Invasive Species

Aquatic invasive species (AIS) is a term given to invasive species that inhabit lakes, wetlands, rivers, or streams and overrun or inhibit the growth of native species. Aquatic invasive species pose a threat to natural resources and local economies that depend on them. The presence of AIS can impair the ecological, aesthetic, and recreational functions of aquatic, wetland, and shoreland areas.

Several waterbodies within the Bassett Creek watershed are known to contain AIS populations. Some AIS contribute directly to nutrient loading in lakes and streams (e.g., curly-leaf pondweed, carp). Other AIS impact lake ecology by creating less diverse habitats that support fewer species and are less resilient to climate extremes. AIS of particular concern in the Bassett Creek watershed include:

- **Curly-leaf pondweed** *(Potamogeton crispus)*: This submersed aquatic plant grows vigorously during early spring, outcompeting native species for nutrients. After curly-leaf pondweed dies out in early to mid-summer, decay of the plant releases nutrients and consumes oxygen, creating conditions that can increase sediment release of phosphorus. This process may result in algal blooms during the peak of the recreational use season, which further inhibit native macrophytes by reducing water clarity and blocking sunlight necessary for growth.

- **Zebra mussels** (*Dreissena polymorpha*): Zebra mussels were identified Medicine Lake in 2017 and are present in several surrounding watersheds. Their huge populations attach to hard surfaces, clog intake pipes for water treatment and power generating plants, encrust boat motors and hulls, may greatly reduce lakefront property values, and their sharp shells cut swimmers feet. Ecologically, they filter enormous quantities of microscopic algae, alter energy flow through aquatic systems, smother and cause extinctions of native bivalves, and promote toxic bluegreen algal blooms through their selective filtration.

- **Common carp**: Carp feeding techniques disrupt shallow-rooted plants, which can reduce water clarity and possibly release phosphorus bound in sediment, leading to increased algal blooms and a decline in native aquatic plants. Common carp are present throughout the watershed. Common carp are typically spread between lakes by the accidental inclusion and later release of live bait but can also migrate through natural or built channels as adults.

- **Starry stonewort** (*Nitellopsis obtusa*): Starry stonewort is an invasive green alga that can grow tall and dense, forming mats on the surface that interfere with recreation and potentially displace native plant species (MAISRC, 2017c). The spread of starry stonewort is estimated to be through human movement of fragments from lake to lake. It was first recorded in Minnesota in 2015 and identified in Medicine Lake in 2018.

- **Eurasian watermilfoil** (*Myriophyllum spicatum*): This invasive aquatic plant that reproduces from fragments and seeds. Any fragment of the plant stem that includes a node (whorl of leaves) can produce a new viable plant. Eurasian watermilfoil (EWM) stores carbohydrates which enables the plant to survive over the winter and outcompete native species in the spring. The plants often form a canopy throughout the summer that shades out native plants. EWM is spread most commonly by inadvertent transport by boaters. EWM’s fast growth rate, ability to spread rapidly by fragmentation, and its ability to effectively block out sunlight needed for native plant growth often result in monotypic stands. Monotypic stands of EWM provide only a single habitat and threaten the integrity of aquatic communities, including disrupting predator-prey relationships. Dense stands of EWM also inhibit recreational uses like swimming, boating, and fishing. Cycling of nutrients from sediments to the water column by EWM may lead to deteriorating water quality and algae blooms of infested lakes.

The BCWMC developed an *AIS Rapid Response Plan* (BCWMC, 2018) addressing seven BCWMC lakes. The plan seeks to reduce the potential establishment, spread, and harmful impacts of a species when new infestations are detected through coordinated containment and suppression/eradication. The BCWMC also partners with the Minnesota Department of Natural Resources (MDNR) in AIS management efforts. The MDNR administers a statewide Invasive Species Program. More information is available at: [Aquatic Invasive Species - Programs, Reports, and Partners | Minnesota DNR (state.mn.us)]

A.9.5 Aquatic Plants (Macrophytes)

Aquatic plants, or macrophytes, are a natural and integral part of most lake communities. A lake's aquatic plants, generally located in the shallow areas near the shoreline of the lake, provide habitat for fish, insects, and small invertebrates, provide food for waterfowl, fish and wildlife, produce oxygen, provide spawning areas for fish, help stabilize and protect shorelines from wave erosion, and provide nesting sites for waterfowl.

The BCWMC has performed macrophyte surveys of most of its priority waterbodies. Macrophyte surveys are generally performed during the same year as BCWMC water quality monitoring and include two surveys (typically June and August). Macrophyte monitoring includes the identification of native and key invasive species that are present in the waterbodies (see Section A.9.4). Results of aquatic macrophyte monitoring is presented in lake monitoring reports included on the BCWMC website.

A.9.6 MDNR Fisheries Surveys and Stocking

Several BCWMC waterbodies support diverse fish populations. Fish populations can both affect and be an indicator of overall lake health. The MDNR has surveyed the fish populations of several BCWMC lakes and has periodically stocked walleye in both Medicine Lake and Wirth Lake. Results of recent fish surveys of BCWMC priority lakes are summarized in Table A-27. Due to the presence of mercury in fish tissue, the Minnesota Department of Health has issues fish consumption guidance applicable to BCWMC waterbodies.

Table A-27 Fisheries Survey Data

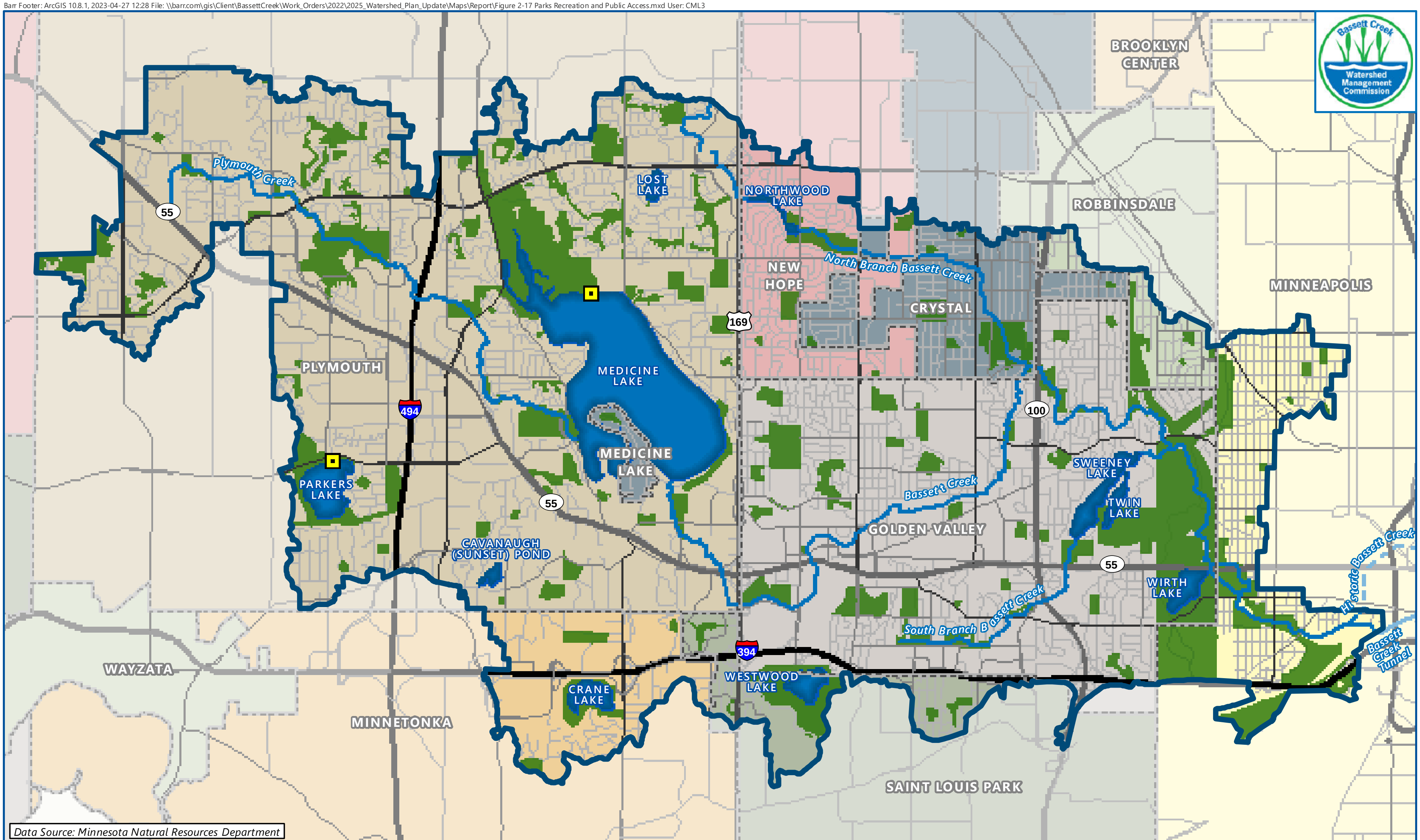
Priority Waterbody	Fishing Access	Year of Last Survey[1]	Primary Fish Species Present[1]
Medicine Lake	Two boat ramps (one maintained by TRPD)	2020	Black Crappie, Bluegill, Largemouth Bass, Pumpkinseed, Northern Pike, Walleye, Yellow Bullhead
Parkers Lake	Boat ramp on north side; fishing pier on west side	2017	Bluegill, Hybrid Sunfish, Largemouth Bass, Northern Pike, Pumpkinseed, Yellow Bullhead
Sweeney Lake and Twin Lake	No public fishing access	2013	Black Bullhead, Bluegill, Common Carp, Largemouth Bass, Northern Pike, Pumpkinseed, White Sucker, Yellow Bullhead
Wirth Lake	Public fishing pier (part of MDNR Fishing in the Neighborhood Program)	2018[2]	Black Crappie, Bluegill, Hybrid Sunfish Largemouth Bass, Pumpkinseed, Northern Pike

(1) MNDR Lakefinder data: [LakeFinder | Minnesota DNR (state.mn.us)]

(2) No Walleye were observed in Wirth Lake in 2018 despite recent stocking.

A.9.6.1

Barr Footer: ArcGIS 10.8.1, 2023-04-27 12:28 File: \\barr.com\gis\Client\BassettCreek\Work_Orders\2022\2025_Watershed_Plan_Update\Maps\Report\Figure 2-17 Parks Recreation and Public Access.mxd User: CML3



BCWMC Jurisdictional Boundary

Municipal Boundary

BCWMC Priority Lake

Creek

City, County, or Regional Park

Public Trailer Water Access

N

0 6,000 12,000

Feet

FIGURE A-14

PARKS, RECREATION, AND PUBLIC ACCESS

Bassett Creek Watershed Management Commission
2025 Watershed Management Plan

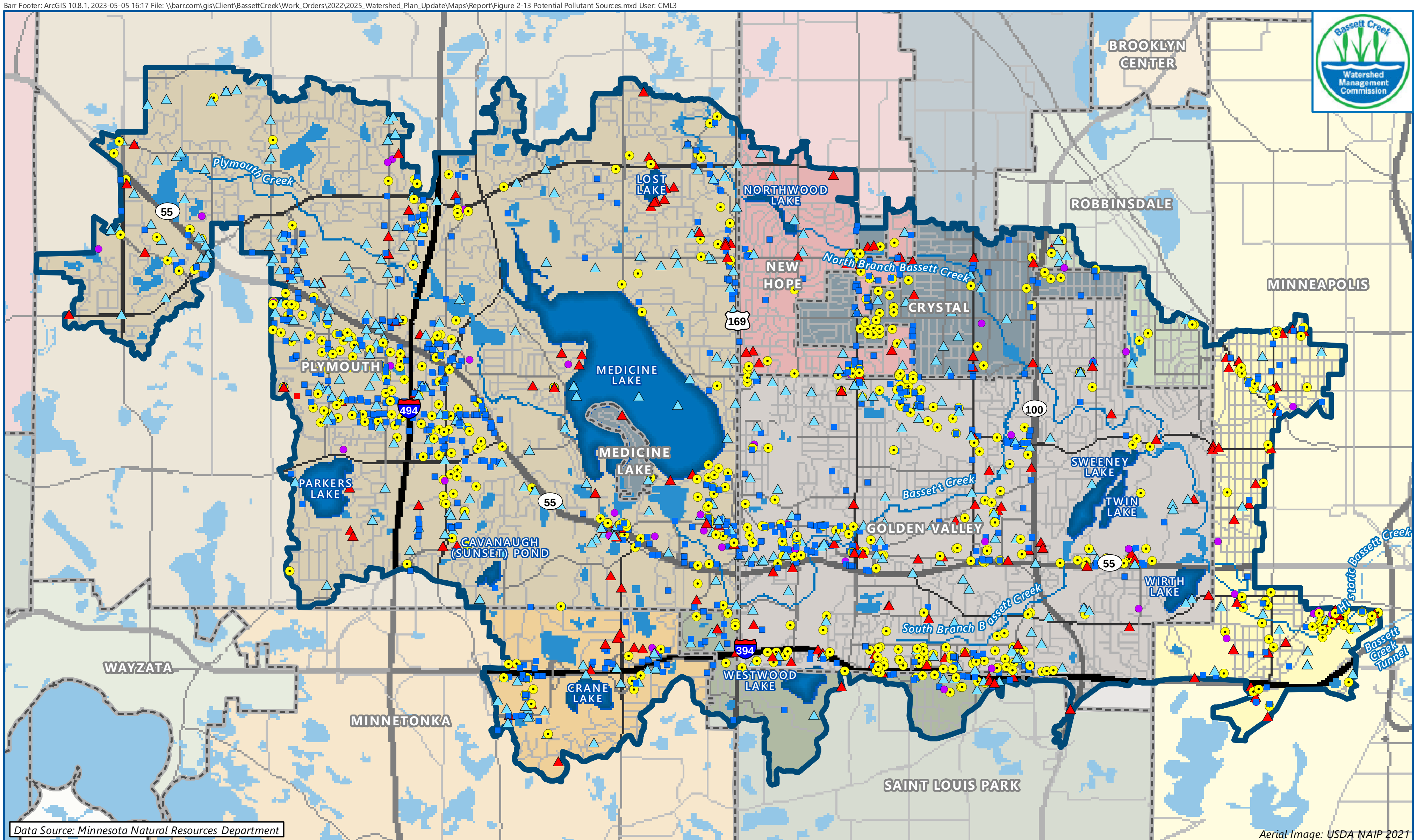
A.10 Pollutant Sources

The sources of water pollution in the Bassett Creek watershed are many and varied. There are many permitted sites, hazardous waste generators, and contaminated sites within the BCWMC. The MPCA maintains a database of these sites, which includes permitted sites (air, industrial stormwater, construction stormwater, wastewater discharge), hazardous waste generating sites, leak sites, petroleum brownfields, tank sites, unpermitted dump sites, and sites enrolled in the Voluntary Investigation and Cleanup (VIC) program. This information is available online through the MPCA's What's In My Neighborhood program, and is presented in Figure A-15. The location of these potentially contaminated or hazardous waste sites should be considered as sites are redeveloped and BMPs are implemented. The presence of soil contamination at many of these sites, if not removed, may limit or prevent infiltration as a stormwater management option

In contrast to sites with known hazards, non-point source pollution cannot be traced to a single source or pipe. Instead, pollutants are carried from land to water in stormwater or snowmelt runoff, in seepage through the soil, and in atmospheric transport. Discharge from stormwater pipes is considered a non-point source discharge as the pollutants coming from the pipe are generated across the watershed contributing to the pipe, not at a single location. Point sources frequently discharge continuously throughout the year, while non-point sources discharge in response to precipitation or snowmelt events. For most waterbodies, non-point source runoff, especially stormwater runoff, is the major contributor of pollutants. Table A-18 summarizes the principal pollutants found in stormwater runoff and provides example sources and possible impacts of each pollutant.

Some areas within the BCWMC are served by subsurface sewage treatment systems (SSTS). Failing or substandard SSTS may be a non-point source of pollutants. Improperly sited, installed or maintained systems may achieve inadequate treatment of sewage. In addition to the public health risks of untreated or inadequately treated sewage (e.g., contamination of wells), sewage contains the nutrient phosphorus, which if discharged into waterbodies can cause excessive algae and aquatic plant growth leading to degradation in water quality. The MPCA implements an SSTS regulatory program to manage the environmental and public health impacts of SSTS.

More information about potential pollutant sources is available from the MPCA website: http://www.pca.state.mn.us/index.php/data/wimn-whats-in-my-neighborhood/whats-in-my-neighborhood.html



BCWMC Jurisdictional Boundary
Municipal Boundary
BCWMC Priority Lake
Public Waters Basin
Creek

Potential Pollutant Source
("What's in my Neighborhood," MPCA)

- Feedlot
- Hazardous Waste
- Investigation and Cleanup
- Solid Waste
- Tanks and Leaks
- Water Quality
- Multiple Activities

N

0 6,000 12,000
Feet

FIGURE A-15

POTENTIAL POLLUTANT SOURCES
Bassett Creek Watershed Management Commission
2025 Watershed Management Plan

A.11 References

References to be added.

Flysheet Line 1

Flysheet Line 2

Flysheet Line 3