BCMWC 2015 Watershed Management Plan

Section 2 – Land and Water Resources Inventory

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2.0 Land and Water Resource Inventory

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 flooding, natural communities and rare species, fish and wildlife habitat, and pollutant. This information is important because it describes the condition of the watershed and it affects decisions about infrastructure, development, and ecological preservation.

2.1 Land Use

Almost all of the land in the BCWMC is now fully developed. Figure 2-1 shows the current land use in the BCWMC (source: Metropolitan Council, 2010). 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. 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.

Figure 2-2 shows the anticipated future land use based on Metropolitan Council 2030 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 4.0) 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.

2.1.1 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. While almost all of the discharges have now been separated into two systems, there is still some stormwater and clear water conveyed by the sanitary sewer system. 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 2.5, 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.

2.2 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.

The mean annual temperature for the Bassett Creek watershed is 46.2°F, as measured at the Minneapolis/St. Paul (MSP) airport station (1981-2010). Mean monthly temperatures vary from 15.6°F in January to 73.8°F in July (1981-2010). According to NOAA National Climatic Data Center (NCDC) extreme temperatures recorded at MSP (or downtown Minneapolis prior to April 1938, when the location of official measurement was changed to MSP) were a high of 108°F on July 14, 1936 and a low of -34°F on January 1, 1936 and January 19, 1970. For the 1981-2010 climate normal period, the average date for latest occurrence of freezing temperatures was April 26, while the average date for the first autumn frost was October 7. The average frost-free period (growing season) is approximately 160 days.

Table 2-1 summarizes precipitation data for the MSP airport station. Average total annual precipitation at the MSP airport station is 30.6 inches (1981-2010). Annual precipitation recorded at downtown Minneapolis and MSP has ranged from a low of 11.5 inches in 1910 to a high of 40.2 inches in 1911. The mean monthly precipitation varies from 4.3 inches in August to 0.9 inches in January (1981-2010). From May to September, the growing season months, the average rainfall (1981-2010) is 19.03 inches, or about 62 percent of the average annual precipitation. Precipitation amounts vary across the Minneapolis-St. Paul metropolitan area. For example, the average annual precipitation measured at a local volunteer weather observation site in New Hope (within the Bassett Creek watershed) is 34.2 inches (1981-2010). At this site, the average monthly precipitation varies from 4.7 inches in June to 0.9 inches in January, and the average May-September rainfall is 21.0 inches, or 61 percent of the average annual precipitation at the site.

Figure 2-3 shows the average high and low temperatures for the Minneapolis-St. Paul International Airport. The figure also displays average precipitation events for the area.

Snowfall averages 54.4 inches annually at the MSP airport station (1981-2010). Extreme snowfall records range from 98.6 inches during the 1983-1984 season to 14.2 inches during the 1930-1931 season.

Table 2-1 Historical Precipitation Summary for Minneapolis-St. Paul Area

Month	Rainfall							Snowfall		
	Mean (in)	Max (in)	Year of Max	Min (in)	Year of Min	1-day Max (in)	Year of 1-day Max	Mean (in)	Max (in)	Year of Max
January	0.90	3.63	1967	0.05	1892	1.21	1967	12.2	46.4	1982
February	0.77	3.25	1922	0.03	1894	1.90	1930	7.7	26.5	1962
March	1.89	4.75	1965	0.09	1910	1.66	1965	10.3	40.0	1951
April	2.66	7.00	2001	0.16	1987	2.58	2006	2.0	21.8	1983
May	3.36	10.33	1906	0.21	1934	3.39	2012	0.0	3.0	1946
June	4.25	9.82	1990	0.22	1988	3.28	2003	0.0	T	1995
July	4.04	17.90	1987	0.11	1936	10.00	1987	0.0	T	1994
August	4.30	9.32	2007	0.20	1925	7.36	1977	0.0	T	1992
September	3.08	7.77	1903	0.30	2012	4.96	1903	0.0	1.7	1942
October	2.43	6.42	1911	0.01	1952	4.83	2005	0.6	8.2	1991
November	1.77	5.29	1991	0.02	1939	2.91	1940	9.3	46.9	1991
December	1.16	4.27	1982	T	1943	2.47	1982	11.9	33.2	1982
Annual	30.61	40.15	1911	11.54	1910	--	--	54.4	101.5	1983

Mean values based on 1981-2010 period; minimum and maximum values based on downtown Minneapolis (1891-1938) and MSP (1938-2014) records
T = trace amount
Source: Minnesota Climatology Working Group (www.climate.umn.edu)

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.

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 2-2 lists selected precipitation and runoff events used for design purposes.

Table 2-2 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.

Even with wide variations in climate conditions, climatologists have found four significant recent climate trends in the Upper Midwest (Minnesota Weather Almanac, Seeley, 2006):

- Warmer winters
- Higher minimum temperatures
- Higher dew points
- Changes in precipitation trends – more rainfall is coming from heavy thunderstorm events and increased snowfall

According to the Soil and Water Conservation Society's (SWCS) 2003 report on climate change, total precipitation amounts in the United States (and in the Great Lakes region) are trending upward, 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. Precipitation records in the Twin Cities area show the annual average precipitation has increased, as shown in the following examples:

- Minneapolis-St. Paul Airport station – the average annual precipitation increased from 28.32 inches (1961–1990 average) to 30.61 inches (1981–2010 average), an 8.1% increase (data from the Climatology Working Group website: http://climate.umn.edu/).
- St. Paul station – the average annual precipitation increased from 30.30 inches (1961–1990 average, from the Minnesota Department of Natural Resources [MDNR] State Climatology Office) to 33.45 inches (1981–2010 average), a 10.4% increase (data from the Climatology Working Group website: http://climate.umn.edu/).

Comparison of precipitation depths between TP-40 and Atlas 14 indicates increased precipitation depths for more extreme events. As noted by the SWCS, increased storm intensities result in increased soil erosion and increased runoff. 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.

2.3 Topography

The topographic relief of the Bassett Creek watershed is not extreme with land sloping generally from higher elevations in the west to lower elevations in the east with only a net loss 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 2-4. 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. Areas of known erosion and sedimentation are identified in Figure 2-4.

2.4 Soils

2.4.1 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.

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 grouping symbols (A-D) may be used to estimate the amount of runoff that will occur over a given area for a particular rainfall amount. The most current soils data for the Bassett Creek watershed are based on the Soil Survey Geographic dataset (SSURGO) from the NRCS and are presented in Figure 2-5.

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 is another factor that may increase the potential for high volumes of runoff. As land is developed for urban use, much of the soil is covered with impervious surfaces, and soils in the remaining areas are significantly disturbed and altered. Development often results in consolidation of the soil and tends to reduce infiltration capacity of otherwise permeable soils, resulting in significantly 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 2-5) provides general guidance about the infiltration capacity of the soils throughout the watershed. Soils should be inspected on a site-by-site basis as projects are considered.

2.4.2 Surficial Soils

Surface soils throughout much of the Bassett Creek watershed are principally of the Hayden series and are predominantly found in two major associations – the Hayden-Cordova-Peaty Muck Association and the Hayden-Peaty Muck Association. Hayden soils comprise 40 to 50 percent of these associations. Hayden soils are found on low knolls and hills, are generally well-drained, and have a surface layer of grayish loam or clay loam and a subsoil of light clay loam. These associations are moderately permeable and have high available moisture capacity.

Of the Hayden-Cordova-Peaty Muck Association, the Hayden soils make up about 40 percent, Cordova soils about 10 percent, Peaty Muck soils about 5 percent, and minor soils about 45 percent of the association. Poorly-drained Cordova soils in swales and on flats have a surface layer of black silty clay loam and a subsoil of clay loam. They have a high available moisture capacity and a moderately low permeability. The very poorly-drained Peaty Muck soils in depressions consist of deep organic materials. Important minor soils in this association include the very poorly-drained Glencoe soils in depressions, the poorly-drained Hamel, Dundas, Minnetonka and Shields soils in drainageways and on the flats, and the moderately well-drained Dalbo soils on the low knolls and hills.

Of the Hayden-Peaty Muck Association, the Hayden soils comprise about 50 percent, the Peaty Muck soils about 10 percent, and minor soils about 40 percent of the association. The very poorly-drained Peaty Muck soils consist of deep organic materials. They have a very high available moisture capacity and a low fertility. The minor soils in this association include the Glencoe, Cordova, Dundas, Hamel, Nessel, and Dalbo soils. The very poorly-drained Glencoe soils are found in shallow depressions and the poorly-drained Hamel, Cordova, and Dundas soils are found in drainageways. The moderately well-drained Nessel and Dalbo soils occur in low knolls and on the crowns of the larger hills.

In the vicinity of Parkers Lake in the western portion of the Bassett Creek watershed, the surface soils tend to be of the Estherville series. Estherville soils have a surface layer of very dark brown sandy loam and a subsoil of dark yellowish-brown sandy loam. The underlying material is calcareous sand and gravel.

Surface soils downstream of Cedar Lake Road in Minneapolis are of the Hubbard series, which are common in the Mississippi River valley train. Hubbard soils formed under prairie vegetation have a dark surface horizon that grades into bright brown-colored subsoil. Larger medium sands are typical of the Hubbard profile.

These soil units are named for the major soil types present but contain many unique soil types in varying amounts and patterns.

2.5 Geology and Groundwater Resources

2.5.1 Geology

The Bassett Creek watershed is located in the northwestern portion of a bowl-like bedrock structure underlying the Minneapolis-St. Paul metropolitan area (called the Twin Cities basin), which has a gentle slope to the southeast. A generalized geologic section is presented in Figure 2-6. The bedrock is overlain by a layer of glacial drift, which 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, there is no uniform relationship between the existing surface topography and the bedrock structure. 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 cut through the sandstone and into the Prairie du Chien Dolomite. Three buried erosional valleys cut deep into the bedrock and bisect the glacial drift. One valley extends north and southeast from Medicine Lake. The north branch cuts into the Prairie du Chien Dolomite and the southeast branch cuts into the St. Peter Sandstone. These valleys are filled with up to 250 feet of glacial drift. Another valley extends northerly from Wirth Lake to the watershed border, cutting into the St. Peter Sandstone and filled with up to 200 feet of drift. The third valley extends through the very southeastern portion of the watershed between Highway 55 and Interstate 394. It cuts through the Prairie du Chien Dolomite and is filled with up to 400 feet of glacial drift.

2.5.2 Groundwater Resources

While the City of Minneapolis and the cities where it supplies water (Golden Valley, Crystal, and New Hope) obtain their water supply from the Mississippi River, 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, some residents still obtain their domestic water supplies from private supply wells. Some residents in Medicine Lake also obtain water from private supply wells.

Two types of aquifers are present in the watershed: surficial aquifers and bedrock aquifers. The following paragraphs provide detailed information about the aquifers located in the BCWMC.

2.5.2.1 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. In addition, there are numerous aquifers in the glacial drift. Some groundwater from the glacial drift and the St. Peter aquifer discharge into Bassett Creek. The remaining aquifers discharge into the Minnesota and Mississippi rivers; movement of groundwater within these aquifers is complicated by the intersecting buried bedrock valleys.

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

In addition to the above cities, the Joint Water Commission (Crystal, Golden Valley, and New Hope) plans to construct at least one emergency supply well in the Prairie du Chien-Jordan aquifer within the next few years.

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 ensure that the withdrawals will not cause drawdown effects on nearby water resources of regional significance.

The groundwater level in the Prairie du Chien-Jordan aquifer varies from about 800 feet to 900 feet above mean sea level within the Bassett Creek watershed, as shown in the Hennepin County Geologic Atlas (1989). The aquifer is recharged in areas where thin permeable drift overlies the limestone layers. Some recharge of this aquifer occurs locally from percolation through the overlying glacial deposits or St. Peter sandstone. However, hydrogeologic characteristics suggest this recharge would be a minimal contribution to the aquifer flow. Regional recharge of the Prairie du Chien-Jordan aquifer occurs to the south of the Minneapolis-St. Paul metropolitan area. Groundwater movement in the aquifer is generally from west to east, toward the Mississippi River.

The regional aquifer with the highest water quality is the Mt. Simon-Hinckley aquifer, 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. The groundwater level of the Mt. Simon-Hinckley ranges from about 600 to 700 feet above mean sea level within the Bassett Creek watershed. Recharge of the Mt. Simon-Hinckley takes place far northwest of the county, where the bedrock is closer to the surface, and occurs by percolation through the overlying drift and bedrock. The pattern of flow in the Mt. Simon-Hinckley aquifer differs greatly from the pattern in the overlying Prairie du Chien-Jordan aquifer. Groundwater movement in the aquifer below the Bassett Creek watershed is generally to the southeast towards a cone of depression located just outside the Bassett Creek watershed and formed by major pumping centers (groundwater levels below 600 feet above mean sea level). In general, the Mt. Simon-Hinckley aquifer has little or no hydraulic connection with the surficial groundwater system or major streams.

2.5.2.2 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. Since the surficial aquifers are more susceptible to pollution, they are generally not used for municipal or public supply wells. In some locations in the BCWMC, the aquifer could provide sufficient water yield for some non-potable industrial uses. 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 downward percolation of local precipitation. 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.

2.5.3 Wellhead Protection Areas

The increasing 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 quality and aims to prevent contaminants from entering the recharge zones of public water supply wells through its wellhead protection program. This includes the development of wellhead protection plans (WHPPs) and guidance to limit potential for groundwater contamination (see Section 3.6). Wellhead protection efforts may restrict or prevent the use of certain stormwater BMPs within these areas to prevent possibly contaminated stormwater from reaching groundwater supplies

Figure 2-7 shows the location of the municipal water supply wells and the delineated wellhead protection areas within the Bassett Creek watershed. Each of the communities within the BCWMC that obtains its municipal water supply from groundwater has an MDH-approved wellhead protection plan.

2.6 Surface Water Resources

The Bassett Creek watershed has numerous streams, creeks, lakes, ponds, and wetlands. The watershed is subdivided into 18 subwatersheds based on the drainage areas tributary to its major surface water resources (see Figure 2-8). Table 2-3 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 Army Corps of Engineers (USACE)

The following sections further describe the surface water resources within the BCWMC, including those identified in the above inventories. Note that for water quality management purposes, the BCWMC has further classified specific water resources as priority waterbodies (see Section 2.7.2).

2.6.1 MDNR 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 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. Public waters wetlands include all type 3, type 4, and type 5 wetlands, as defined in U.S. Fish and Wildlife Service Circular No. 39, 1971 edition, that are 10 acres or more in size in unincorporated areas or 2.5 acres or more in size in incorporated areas (see Minnesota Statutes Section 103G.005, Subd. 15a and 17b.) A MDNR permit is required for work within designated public waters.

The MDNR uses county-scale maps to show the general location of the public waters and public waters wetlands under its regulatory jurisdiction. These maps are commonly known as public waters inventory (PWI) maps. PWI maps also show public waters watercourses and ditches (see Section 2.6.2). The regulatory boundary of these waters and wetlands is called the ordinary high water level (OHWL). PWI maps are available on a county-by-county basis. Additionally, county-by-county lists of these waters are available in tabular form. The MDNR also 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 that have not been designated public waters.

Figure 2-9 shows the MDNR public waters located in the Bassett Creek watershed and shows their associated drainage patterns.

Table 2-3 Characteristics of Major BCWMC Waterbodies

2.6.2 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).

Figure 2-9 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. One such system is located along Highway 100 in Golden Valley and Crystal. The public ditch system shown following Highway 100 is currently all in a storm sewer pipe and is no longer ditched.

2.6.3 Wetlands

Prior to development, much of the land within the BCWMC was wetland. Many wetland areas were drained or filled as the BCWMC member cities developed (prior to the establishment of regulations protecting wetlands). Presently, wetlands are protected by the Wetland Conservation Act (WCA, see Section 3.5). 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) is responsible for mapping wetlands across the country, including those in Minnesota. Using the National Aerial Photography Program (NAPP) in conjunction with limited field verification, the USFWS identifies and delineates wetlands, produces detailed maps on the characteristics and extent of wetlands, and maintains a national wetlands database as part of the National Wetland Inventory (NWI). The NWI is periodically updated based on available imagery.

Figure 2-10 shows the location of all NWI wetlands within the Bassett Creek watershed. There may be additional wetlands (especially those smaller than 0.5 acre) in the BCWMC that are not included in the NWI. Based on land use information, wetlands represent approximately 6% of the watershed.

2.6.4 Lakes and Ponds

Figure 2-8 identifies the major subwatersheds and drainage patterns for the Bassett Creek Watershed. Many of the subwatersheds are delineated and named according to the lake or pond located within that subwatershed. The physical characteristics of the following lakes and ponds are summarized in Table 2-3. Additional information on the BCWMC and MPCA classifications of these lakes and ponds is included in Section 2.7.2. [Normal water elevations and 100-year flood elevations for waterbodies in Sections 2.6.4.1 – 2.6.4.14 and Table 2.10 were updated in May 2017 using new XPSWMM model and with NAVD88 datum.]

2.6.4.1 Bassett Creek Park Pond

Bassett Creek Park Pond is a 9.7-acre waterbody located in the City of Crystal in the northeast portion of the BCWMC. The pond was created by the City of Crystal out of an existing inundation area. Bassett Creek Park Pond has a maximum depth of 7.4 feet and an average depth of 2.6 feet. The normal water elevation is estimated at 840.6 feet (NAVD88 datum) and the 100-year elevation is approximately 851.2 feet (NAVD88 datum). The Bassett Creek Park Pond has a contributing watershed area of approximately 2,564 acres, which includes both the Bassett Creek Park Pond direct watershed and the Northwood Lake and the North Branch Bassett Creek watersheds. The North Branch of Bassett Creek discharges to the pond at its northwest corner. 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 receives outflows from Northwood Lake and 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 (66%), followed by parks and recreational use (10%) and institutional (7%). Other land uses include: medium density residential, natural space, commercial, and industrial.

Bassett Creek Park Pond is not listed on the BCWMC's priority list. The pond is also not listed as impaired by the MPCA. Bassett Creek Park Pond is part of the BCWMC Flood Control Project (see Section 2.8.1).

2.6.4.2 Crane Lake

Crane Lake is a 30-acre lake located in the City of Minnetonka in the southern portion of the Bassett Creek watershed. Crane Lake does not have any parkland, boat access, or public beach areas.

Crane Lake has a maximum depth of approximately 5 feet and a mean depth of 3.3 feet. The ordinary high water level of the lake is estimated at 920.4 feet (NGVD29 datum). The 100-year elevation is 920.2 feet (NAVD88 datum). 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 917.3 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 (40%), followed by retail and commercial (21%) and parks and recreational use (10%). Other land uses include: open water, institutional, office space, major highway, and industrial.

Crane Lake is a BCWMC Priority 2 Shallow Lake waterbody. Classification as "shallow" 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 not listed as impaired by the MPCA.

2.6.4.3 Grimes Pond

Grimes Pond is a 6.1-acre waterbody located in the City of Robbinsdale just east of North Rice Pond in the northeast portion of the BCWMC. A parkland area to the north of the pond provides opportunities for aesthetic viewing and fishing.

Grimes Pond has an average depth of 2.6 feet, a normal water elevation of 832.5 feet (NAVD88 datum), and a 100-year elevation of approximately 836.4 feet (NAVD88 datum). 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 (81%), followed by parks and recreational use (6.3%) and open water (4.3%). Other land uses include: industrial, institutional, open water, and retail/commercial.

Grimes Pond is not listed on the BCWMC's priority waterbody list. The pond is also not listed as impaired by the MPCA.

2.6.4.4 Lost Lake

Lost Lake is a 22-acre lake located in the City of Plymouth in the northern portion of the BCWMC. Lost Lake has no public access, as it is surrounded completely by residential homes.

Lost Lake has a maximum depth of 6.5 feet, a mean depth of 3.5 feet, and its 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. The normal water elevation is approximately 940.2 feet (NAVD88 datum) and the 100-year elevation is 941.2 feet (NAVD88 datum). Lost Lake has a contributing drainage area of approximately 61 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.

Lost Lake is a BCWMC Priority 2 Shallow Lake waterbody. Classification as "shallow" 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 not listed as impaired by the MPCA.

2.6.4.5 Medicine Lake

Medicine Lake is a 902-acre 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, a littoral area of 397.0 acres, an estimated mean depth of 17.5 feet, and a maximum depth of 49 feet. The lake's ordinary high water level is 889.1 feet (NGVD29 datum) and its 100-year elevation is 890.4 feet (NAVD88 datum). 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 2-8). 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. 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 (11%) and parks and recreation (10%). Other land uses include: medium density residential, natural space, industrial, commercial, golf courses, institutional, agricultural, and office.

Medicine Lake is a BCWMC Priority 1 Deep Lake waterbody. Classification as "deep" is based on MPCA's shallow/deep classification. The lake is currently listed on the 303(d) impaired waters list for mercury and excess nutrients. 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 (see Section 5.1.1.8) 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 Assessment, 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 3.5.2), 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, 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, 2008). From 2008 through 2014, the City of Plymouth has treated areas ranging from 15 to 80 acres (Blue Water Science, 2014).

Additionally, the Minnesota Department of Health website contains advice on consuming fish caught in Medicine Lake, as the concentrations of mercury in fish tissue exceed the water quality standard.

2.6.4.6 North Rice Pond

North Rice Pond is a 3.7-acre waterbody located in the City of Robbinsdale in the northeast portion of the Bassett Creek Watershed. Parkland adjacent to the lake provides opportunities for aesthetic viewing.

North Rice pond has a maximum depth of 5 feet and a mean depth of 2.6 feet. The normal water elevation of North Rice Pond is approximately 832.5 (NAVD88 datum) and the 100-year elevation is approximately 836.4 feet (NAVD88 datum). 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 (6.3%). Other land uses include: retail and commercial, institutional, open water, and industrial.

North Rice Pond is not listed by the BCWMC as a priority waterbody. The pond is also not listed as impaired by the MPCA.

2.6.4.7 Northwood Lake

Northwood Lake is a 15-acre lake located in the City of New Hope in the northern portion of the Bassett Creek Watershed. Parkland is located around the lake providing 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 has a maximum depth of 5 feet, an average depth of 2.7 feet, an ordinary high water level of 885.5 feet (NGVD1929 datum), and a 100-year elevation of 891.4 feet (NAVD88 datum). Its 1,294 acre tributary watershed includes both the Northwood Lake 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. 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 884.8 feet (NAVD88 datum) 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 (including a portion of the North Branch Bassett Creek 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 (9%) and parks and recreational use (6.7%). Other land uses include: natural space, commercial, retail, major highways, open water, and industrial.

Northwood Lake is a BCWMC Priority 1 Shallow Lake waterbody. Classification as "shallow" 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 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 for Northwood Lake.

2.6.4.8 Parkers Lake

Parkers Lake is a 97-acre 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. A public beach and public boat landing provide opportunities for swimming, fishing, boating and aesthetic viewing.

Parkers Lake has a maximum depth of 37 feet, an average depth of 12 feet, and a littoral area of approximately 68 acres. Shallow areas near the shoreline of the lake allow for both emergent and submerged vegetation growth. The lake has an ordinary high water level of 935.9 feet (NGVD29 datum), a normal water elevation of approximately 934.4 feet (NAVD88 datum), and a 100-year elevation of 938.6 feet (NAVD88 datum). 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 (31%) 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.

Parker Lake is a BCWMC Priority 1 Deep Lake waterbody. Classification as "deep" is based on MPCA's shallow/deep classification. The lake is currently listed on the 303(d) impaired waters list for mercury. Parkers Lake 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 2-5). Parkers Lake is also listed in on the 303(d) impaired waters list for chloride.

The Minnesota Department of Health website contains advice on consuming fish caught in Parkers Lake, as the concentrations of mercury in fish tissue exceed the water quality standard. The lake is, however, suitable for swimming and wading with good clarity and low algae levels throughout the open water season.

2.6.4.9 South Rice Pond

South Rice Pond is a 3.2-acre waterbody located in the cities of Robbinsdale and Golden Valley in the northeast portion of the Bassett Creek watershed, just south of North Rice Pond. Parkland adjacent to the lake provides opportunities for aesthetic viewing.

South Rice Pond has a maximum depth of 3 feet and an average depth of 1.7 feet. The lake has a 100-year water elevation of 834.3 feet (NAVD88 datum). Its 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 (76%), followed by park and recreational use (15%). Other land uses include: institutional, industrial, open water, and retail/commercial.

South Rice Pond is not list by the BCWMC as a priority waterbody. The pond is also not listed as impaired by the MPCA.

2.6.4.10 Sweeney Lake

Sweeney Lake is a 67-acre 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 public access at the southern end of the lake offers carry-in boat access.

Sweeney Lake has an estimated mean depth of 12 feet, a maximum depth of 25 feet, and a littoral area of approximately 34 acres. Shallow areas near the shoreline of the lake allow for both emergent and submerged vegetation growth. A precast concrete dam serves as the outlet structure for Sweeney Lake. The normal water elevation is at approximately 827.2 feet (NAVD88 datum) and the 100-year elevation is approximately 831.9 feet (NAVD88 datum). 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.

The Sweeney Lake watershed (including the contributing ponds' watersheds) is almost fully-developed, with only a few small parcels available for new development. Low density residential is the major land use (44.5%), followed by highway (12%) and industry (7%). Other land uses include: medium density residential, natural space, park, and open space, commercial, developed parks, golf course, institutional, open water, and office.

Following severe summer algal blooms in the early 1970s, lakeshore residents for the Sweeney Lakeshore Owners Association organized efforts to protect and improve Sweeney Lake water quality. Residents have operated an aeration system since the 1970s. Initially, residents installed aeration at a few locations; the system has expanded to up to 18 aerators currently distributed throughout the lake. The intent of the aerators is to keep oxygen levels high near the lake bottom, preventing the anoxic release of phosphorus bound in lake sediments. The system is permitted by MDNR and operates fully during the summer months; winter aeration occurs on a limited basis (SEH and Barr, 2011). Sweeney Lake is a BCWMC Priority 1 Deep Lake waterbody. Classification as “deep” is based on the MPCA’s shallow/deep classification. The lake is currently listed on the 303(d) impaired waters list for excess nutrients (phosphorus). A TMDL study has been conducted for Sweeney Lake. Due to excessive phosphorus, the lake is not always suitable for swimming or wading because of low clarity and excessive algae growth. Sweeney Lake is also listed in on the 303(d) impaired waters list for chloride.

2.6.4.11 Turtle Lake

Turtle Lake is a 28-acre waterbody located in the City of Plymouth in the northwest portion of the Bassett Creek watershed. Turtle Lake is classified as a wetland by the MPCA, owing to its shallow depth, and as a public waters wetland by the MDNR (see Section 2.6.1). Parkland is available for use by residents for aesthetic viewing and fishing. No boat launch is available.

Turtle Lake has a maximum depth of 0.5 feet and an average depth of 0.3 feet. The normal water level of Turtle Lake is at approximately 962.9 feet (NAVD88 datum) and the 100-year elevation is at 967.0 feet (NAVD88 datum). 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 (70%), followed by open water (9.4%) and undeveloped areas (8.6%). Other land uses include: parks and recreational uses, institutional, retail, commercial, and agricultural.

Turtle Lake is not listed as a BCWMC priority waterbody owing to its classification as a wetland by the MDNR and MCPA. Turtle Lake is not listed as impaired by the MPCA.

2.6.4.12 Twin Lake

Twin Lake is a 21-acre 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 is used for swimming, non-motorized boating, fishing, and aesthetic viewing.

Twin Lake has a maximum depth of 56 feet, an average depth of 25.7 feet, and a littoral area of approximately 8 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. The lake's normal water elevation is estimated at 827.2 feet (NAVD88 datum) with a 100-year elevation at 831.9 feet (NAVD88 datum). 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%).

Twin Lake is a BCWMC Priority 1 Deep Lake waterbody. Classification as "deep" is based on MPCA's shallow/deep classification. 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 concentrations of phosphorus in Twin Lake increased significantly (see Appendix F – Water Quality Summary), The BCWMC performed a study (*Twin Lake Phosphorus Internal Loading Investigation*, March 2011) to determine the causes of these increased phosphorus levels, which were identified as increased release of phosphorus from lake sediments (internal phosphorus 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); the study identified alum treatment as the most feasible option based upon cost, probability for success, and maintenance. As part of the feasibility study, the BCWMC ordered fish surveys of Twin Lake (Blue Water Science, 2013). An alum treatment of Twin Lake was performed in 2015.

2.6.4.13 Westwood Lake

Westwood Lake is a 38-acre 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.

Westwood Lake has a maximum depth of 5 feet, a normal water elevation of 887.6 feet (NAVD88 datum), and a 100-year elevation of 890.0 feet (NAVD88 datum). 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 886.2 feet (NAVD88 datum).

The Westwood Lake watershed is almost fully-developed, with only a few small parcels available for new development. 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.

Westwood Lake is a BCWMC Priority 1 Shallow Lake waterbody. Classification as “shallow” is based on the MPCA’s shallow/deep classification. The lake is not listed as impaired by the MPCA.

2.6.4.14 Wirth Lake

Wirth Lake is a 38-acre 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 an estimated mean depth of 14 feet, a maximum depth of 26 feet and 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 an ordinary high water level of 818.9 feet (NGVD1929 datum) and a 100-year elevation of 822.0 feet (NAVD88 datum). 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, with only a few small parcels available for new development. Parks and recreation is the major land use (46%), followed by low density residential (37%) and open water (10%). Other land uses include: medium density residential, commercial, golf course, institutional, highways and industrial/office.

Wirth Lake is a BCWMC Priority 1 Deep Lake waterbody. Classification as “deep” is based on the MPCA’s shallow/deep classification. 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 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 303(d) list because of water quality improvement projects by the BCWMC, its member cities and the MPRB (see Table 5-5). The Minnesota Department of Health website has advice on consuming fish caught in Wirth Lake, as the concentrations of mercury in fish tissue exceed the water quality standard.

2.6.5 Streams and Open Channels

Several streams and open channels in the Bassett Creek watershed have also been classified on BCWMC’s priority waterbody list. Figure 2-8 presents the BCWMC priority streams and open channels in the BCWMC as well as the BCWMC major subwatersheds and their drainage patterns. In addition to BCWMC priority streams, there are several smaller tributaries that drain to BCWMC priority waterbodies, including several draining to Medicine Lake and others (see Figure 2-8).

2.6.5.1 Plymouth Creek

Bassett Creek originates upstream of Medicine Lake in western Plymouth as a branch called Plymouth Creek. This branch flows generally east and south, relatively parallel to Highway 55, until it reaches the southwest bay of Medicine Lake. This branch drains large portions of south and central Plymouth. 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 near Medicine Lake Park prior to entering Medicine Lake.

Plymouth Creek is a BCWMC 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 2-5). 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*.

2.6.5.2 Main Stem of Bassett Creek

The Main Stem of Bassett Creek begins downstream of 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. 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. The additional drainage area to the Main Stem of Bassett Creek between Medicine Lake and the confluence with the North Branch of Bassett Creek is approximately six square miles and includes areas of Plymouth, Golden Valley, St. Louis Park, Minnetonka, New Hope, and Crystal. An additional 2.5 square miles of drainage area from Golden Valley, Crystal, Robbinsdale and Minneapolis is tributary to the Main Stem of Bassett Creek between the confluence with the North Branch of Bassett Creek and the confluence with the Sweeney Lake Branch. 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 Main Stem of Bassett Creek is a BCWMC 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 and fish bioassessments) and aquatic recreation (due to fecal coliform) (see Table 2-5). 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 Plymouth Creek impairment due to fecal coliform.

2.6.5.3 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.

The North Branch of Bassett Creek is a BCWMC 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 2-5). The North Branch 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 Plymouth Creek impairment due to *Escherichia coli*.

2.6.5.4 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 Sweeney Lake Branch of Bassett Creek is a BCWMC Priority 1 stream.

2.7 Water Quality

The lakes, ponds, streams, and wetlands of the Bassett Creek watershed are important community assets. These resources supply aesthetic and recreational benefits, in addition to providing wildlife and fisheries habitat and refuge. The BCWMC recognizes the need for good water quality in the waterbodies in its jurisdiction, including groundwater, and has taken steps to protect and improve these resources. These steps include adopting water quality management policies, classifying specific waterbodies as priority waterbodies, collecting water quality data (including biological data) for priority waterbodies, participating in developing TMDLs (both as the sponsoring entity and as a cooperator), developing an implementation program to meet BCWMC and MPCA water quality goals, establishing water quality performance standards based on the MPCA's Minimal Impact Design Standards (MIDS), and reviewing proposed projects for conformance with BCWMC policies.

Stormwater runoff carries with it a number of contaminants affecting water quality. The principal pollutants found in runoff include nutrients, sediments, organic materials, pathogens, hydrocarbons, metals, pesticides, chlorides, trash and debris. Table 2-4 summarizes the source of these pollutants and their impacts. Of these pollutants, the BCWMC recognizes that phosphorus and suspended sediment are particularly detrimental to the ecological health and recreational use of lakes and streams. As a result, the BCWMC has established water quality treatment performance standards based on MPCA's MIDS. The BCWMC's water quality goals and polices are detailed in Section 3 of this Plan and the BCWMC's Requirements for Improvements and Development Proposals (as amended).

Table 2-4 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 nutrients.
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 of water column and sediment, 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 of water column and sediment, bioaccumulation in aquatic species and through the food chain, fish kill
Pesticides: PCBs, Synthetic Chemicals	Pesticides (herbicides, insecticides, fungicides, rodenticides, etc.), industrial processes	Toxicity of water column and sediment, bioaccumulation in aquatic species and through the food chain, fish kill
Chlorides	Road salting and uncovered salt storage	Toxicity of water column and sediment
Polycyclic Aromatic Hydrocarbons (PAH's)	Tar based pavement sealant	Carcinogenic to humans
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).

2.7.1 Water Quality Monitoring Programs

Water quality data have been collected for many of the lakes and larger ponds within the BCWMC. These data have been collected by several entities, including the BCWMC, the Metropolitan Council, Three Rivers Park District (TRPD) (formerly Hennepin Parks and Suburban Hennepin Regional Park District), the Minnesota Pollution Control Agency, the Minnesota Department of Natural Resources, Minneapolis Park and Recreation Board (MPRB), municipalities, and others.

The monitored waterbodies and extent of monitoring vary from year to year. The BCWMC performs detailed monitoring on a limited number of waterbodies each year on a rotating basis. The following sections describe the various monitoring programs performed within the BCWMC, including those performed by other entities. The BCWMC will continue to monitor the water quality for all priority waterbodies within the watershed (priority waterbodies are described in Section 0).

Appendix F summarizes the historical water quality data collected for major waterbodies within BCWMC. Figure 2-11 shows the locations of water quality and water quantity monitoring locations within the BCWMC.

2.7.1.1 BCWMC Lake Monitoring

The BCWMC has monitored major waterbodies within the watershed, including:

- Cavanaugh Lake (Sunset Hill Pond)
- Crane Lake
- Lost Lake
- North Rice Pond
- Medicine Lake
- South Rice Pond
- Sweeney Lake
- Twin Lake
- Westwood Lake

BCWMC lake monitoring has included assessment of chemical water quality (e.g., total phosphorus, nitrogen chlorophyll a, transparency, pH, dissolved oxygen, conductivity), water clarity (secchi disc transparency), phytoplankton, zooplankton, and aquatic macrophytes. Chemical water quality, phytoplankton, and zooplankton sampling is typically performed at monthly intervals during the growing season (and twice monthly in early summer). Macrophyte surveys are typically performed twice per growing season, in June and August. Water quality data collected by the BCWMC is presented in Appendix F.

Prior to the adoption of its 2004 watershed management plan, the BCWMC developed lake and watershed management plans (lake plans) for specific waterbodies based on the results of historical water quality monitoring and water quality modeling of those lakes. The BCWMC also developed a watershed management plan for the Main Stem of Bassett Creek in 2000; similar to the lake plans, this management plan included management recommendations to achieve water quality goals based on observed data and P8 water quality modeling of the creek. Several of the actions proposed in those watershed management plans have been implemented (see Table 5-5). The BCWMC continues to analyze 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 standards (see Section 0). Future water quality monitoring of priority waterbodies by the BCWMC is described in the BCWMC monitoring plan (see Appendix A).

2.7.1.2 BCWMC Stream Monitoring

The BCWMC conducts biotic (invertebrate) monitoring of streams in the watershed on a regular basis and analyzes the data to determine if the water quality is improving or degrading. The biological data are indicators (bioindicators) of water quality. The BCWMC Monitoring Plan (see Appendix A) describes the biotic monitoring and planned chemical water quality monitoring of BCWMC streams.

Temperature and flow data provide an incomplete measure of a stream's suitability for fish and other aquatic species. A second approach to assessing the ecological health of a stream is to sample the organisms that are living in the stream. Monitoring for the presence of biological indicator organisms provides evidence of the water quality of Bassett Creek, including transitory changes in stream water quality related to stormwater runoff. Evaluating 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. Therefore 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 types of organisms living on the stream bottom depend on the available habitat, and the habitat quality is affected by the water quality. Water quality is degraded when pollutants enter a stream. Organic pollutants and nutrients cause a loss of oxygen in the stream. Organisms sensitive to low oxygen concentrations in the water are only able to survive in the highest water quality. There are tolerant invertebrate species that can survive in low oxygen conditions, and their presence indicates low water quality (i.e., organic pollution). Other stressors, such as high suspended solids concentration or high metals concentrations, can also affect the macroinvertebrate community.

Benthic organisms have been collected and inventoried from several Bassett Creek locations since 1980. Since 2000, biotic monitoring has been performed by the BCWMC or MPCA at three year intervals (2000, 2003, 2006, 2008/2009, and in 2012). Biotic monitoring includes the collection of invertebrate species at specific stream locations. From the collected samples, numeric scores representing overall stream health (generally referred to as indices of biological integrity) are calculated using prescribed methods (see Section 2.7.1.2.1 and Appendix A – BCWMC Monitoring Plan). BCWMC biotic monitoring locations include:

- Main Stem of Bassett Creek at Rhode Island Avenue in Golden Valley.
- Main Stem of Bassett Creek south of Zane Avenue North in Crystal.
- 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.

Figure 2-11 shows the location of the biotic index sampling stations. 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. Future biotic monitoring efforts are described in the BCWMC monitoring plan (see Appendix A).

2.7.1.2.1 Biotic Index Monitoring Results

To assess relative water quality from biotic monitoring results, a biotic index is often used. The index is calculated based on the tolerance of each collected species to various pollutants (referred to as tolerance indicator values, or TIVs). The BCWMC has used two biotic indices to evaluate the water quality of BCWMC streams: the Hilsenhoff Biotic Index (HBI) and the Invertebrate Community Index (ICI). The HBI is an indicator of organic pollution, while ICI is an indicator of a broader range of pollutants.

The BCWMC has used the HBI in all of the surveys to assess water quality at the sample stations, based on the macroinvertebrate communities (Hilsenhoff, 1982 and 1987). The HBI uses TIVs assigned to certain species. TIVs indicate the species' ability to survive in low-oxygen conditions and range from 0 to 10. The lower the value, the less tolerant the species to low dissolved oxygen. A tolerance value of 0 is assigned to species collected only in unaltered streams of very high water quality, and a 10 is assigned to species known to occur in severely polluted or significantly disturbed streams; the lower the calculated HBI, the higher the stream quality.

Beginning in 1995, the BCWMC supplemented the HBI with the ICI, developed by the Ohio Environmental Protection Agency (DeShon, 1995). The ICI-based index uses the same data collected for the HBI, but includes a wider range of invertebrates. The scale for the ICI varies from 0 to 60, with 60 being the highest quality. Like the HBI, the numeric scores are grouped according to water quality categories, ranging from poor to exceptional.

Results of BCWMC biotic monitoring were summarized in the report *A Biotic Index Evaluation of Bassett Creek and Plymouth Creek: 2012* (BCWMC, 2013). The 2012 evaluation of the HBI and ICI values indicated the following:

- The 2012 HBI evaluation identified very good water quality in the Main Stem of Bassett Creek (Rhode Island Avenue) and in Plymouth Creek,
- The 2012 HBI evaluation identified good water quality in the Main Stem of Bassett Creek (Zane Avenue, Dresden Land, and Irving Avenue) and
- The 2012 HBI evaluation identified fair water quality in the Sweeney Lake Branch of Bassett Creek.
- No locations were evaluated as less than fair water quality in 2012; since 2000, only the 2009 HBI evaluation the North Branch location has identified poor water quality.
- Water quality in the Main Stem of Bassett Creek at the upstream location at Rhode Island from 2008/2009 to 2012 showed significant improvement.

- The Main Stem at Zane Avenue was not sampled during 2008-2009. Water quality changes between 2006 and 2012 were not significant, but indicated an improvement.
- Water quality changes between 2008-2009 and 2012 were not significant at Plymouth Creek (from good to very good) and the Sweeney Lake Branch of Bassett Creek (from fair to fair).
- Water quality changes between 2009 and 2012 at the Main Stem of Bassett Creek at Dresden Lane and Irving Avenue were not significant (both remained in the good range), but indicated degradation.

Notable changes in water quality should prompt a look at stormwater flow patterns, land use changes, and watershed management practices. To identify the actual stressors, water quality monitoring of additional parameters is necessary and will be included in future BCWMC stream monitoring efforts (see Appendix A). Such monitoring will include collection of storm event runoff using automatic samplers and flow loggers. Water quality parameters will include total and dissolved phosphorus, total suspended solids, chloride, and metals.

The MPCA is developing the Macroinvertebrate Index of Biological Integrity (MIBI). The BCWMC will use the MIBI for future biotic monitoring efforts. Ultimately, the BCWMC seeks to re-evaluate historical biotic index values using the MIBI to develop a consistent data record.

2.7.1.3 Watershed Outlet Monitoring Program

In 2000, the BCWMC, in cooperation with Metropolitan Council Environmental Services (MCES), began monitoring the Main Stem of Bassett Creek as part of the MCES' Watershed Outlet Monitoring Program (WOMP). The WOMP is coordinated by MCES and consists of a network of monitoring stations located throughout the Twin Cities Metro Area. The objective of this program is to collect water quality and quantity (stream flow) data needed to assess current conditions, develop target pollutant loads, and provide continued monitoring after BMPs are implemented in the watersheds.

The Bassett Creek WOMP site is located at Irving Avenue, one-fourth mile upstream of the tunnel that carries Bassett Creek beneath downtown Minneapolis to the Mississippi River (see Figure 2-11). Data collection consists of continuous measurements of stream flow, temperature and conductivity, as well as monthly 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.

Prior to installation of the WOMP station, the BCWMC collected continuous water quality monitoring data for Bassett Creek in 1980 and 1992, at two different locations.

2.7.1.4 Hennepin County Environment and Energy Department – River Watch

The Hennepin County Environment and Energy Department manages the River Watch program. The program has been in place since 1995, and provides hands-on environmental education opportunities for students in Hennepin County. Each spring and fall, students collect macroinvertebrate data to assess the overall health of the biological communities within streams throughout Hennepin County. Some of the monitoring stations for Bassett Creek have been in place since 1999. The BCWMC assists with funding and support of this program.

The River Watch program uses the macroinvertebrate data collected by students to provide a letter grade for each site monitored. The grading scale uses three major biotic indices. The Family Biotic Index measures the community of invertebrates and their tolerance to pollution. The EPT (Ephemeroptera, Plecoptera, and Trichoptera) assess the presence of the most sensitive species and indicates the presence or absence of the species. The third index tabulates the number of families present and measures the abundance of families or total diversity of the family units. This information may be used to supplement the BCWMC's own biotic monitoring (see Section 2.7.1.2.1), but uses different biotic indices not directly comparable to the BCWMC's HBI and ICI. While these data are not directly comparable to the BCWMC biotic monitoring data, this program has value as an educational program.

2.7.1.5 Three Rivers Park District/City of Plymouth

Three Rivers Park District (TRPD) and the City of Plymouth have monitored Parkers Lake and Medicine Lake, both located within Plymouth. The TRPD headquarters is within the Plymouth Creek sub-watershed and the TRPD's French Regional Park lies on the north end of Medicine Lake. French Regional Park offers Medicine Lake amenities to the area that include a boat landing and beach. The TRPD has monitored the water quality conditions in Medicine Lake for over 20 years, and has been instrumental in monitoring the water quality of the creeks coming into the lake. The data collected has been used by the BCWMC and the City of Plymouth to develop their Medicine Lake plans and the Medicine Lake TMDL. The TRPD has monitored Parkers Lake since 2001.

Three Rivers Park District, using funds from the Environmental Protection Agency EMPACT Program, operated a Remote Underwater Sampling Station (RUSS Unit) on Medicine Lake from 2001 to 2003. The RUSS unit documented wind-driven de-stratification events on the lake, during which phosphorus released from the bottom sediments is transported to the lake surface where it is used by algae. This monitoring program suggests that the majority of internal loading of phosphorus in the lake appears to come from wind-driven mixing.

The TRPD continues to monitor Medicine Lake annually. When requested by the BCWMC, the TRPD has conducted additional monitoring of the southwest basin on behalf of the BCWMC for minimal cost. On these occasions, the TRPD also collects samples for phytoplankton and zooplankton analysis funded by the BCWMC (see Section 2.7.1.1). The southwest basin is where Plymouth Creek discharges into Medicine Lake. Water quality data for Medicine Lake and the southwest basin, specifically, are presented in Appendix F.

2.7.1.6 Minneapolis Park and Recreation Board

The Minneapolis Park and Recreation Board (MPRB) monitors several lake locations within the BCWMC, including Birch Pond, Wirth Lake, and Spring Lake. The MPRB formerly monitored Bassett Creek as a participant in the MCES's WOMP (see Section 2.7.1.3). The objectives of the MPRB lake monitoring program are to: protect public health, establish a database for tracking water quality trends, quantify and interpret both immediate and long-term changes in water quality, provide water quality information to develop responsible water quality goals, provide a basis for water quality improvement projects, and evaluate the effectiveness of implemented best management practices.

Most lakes are sampled once per month in February, April, and October, and twice per month during the period of May through September. Historical data is used to calculate the trophic state index (TSI) trends and estimate fertility for each lake. Observations are then made about whether the lake has improving, stable, or degrading water quality indicators.

2.7.1.7 Metropolitan Council (CAMP)

Volunteers have collected water quality data on a number of Twin Cities metropolitan area lakes since 1980 through the Metropolitan Council's Citizen Assisted Monitoring Program (CAMP). On a bi-weekly basis (April - October), citizen volunteers collect a surface water sample for laboratory analysis of total phosphorus, total Kjeldahl-nitrogen, and chlorophyll-a, obtain a Secchi transparency measurement, and provide some user perception information about each lake's physical and recreational condition. Several waterbodies within the BCWMC have been monitored as part of the CAMP program including Medicine Lake, Parkers Lake, Sweeney Lake, Twin Lake, Westwood Lake, Northwood Lake, and South Rice Lake. In recent years, funding for the CAMP monitoring of waterbodies has been provided by the BCWMC and member cities.

For more information about the CAMP program, please see the following website: http://www.metrocouncil.org/environment/RiversLakes/Lakes/index.htm

2.7.1.8 Minnesota Pollution Control Agency (CLMP)

The MPCA's Citizen Lake Monitoring Program (CLMP) is a cooperative program combining the technical resources of the MPCA and the volunteer efforts of citizens who collect water quality data on their lakes. This program provides low-cost Secchi discs to participants for measuring water clarity on an approximate weekly basis.

2.7.1.9 Member Cities

The BCWMC's nine member cities are responsible for managing lakes and ponds not identified as BCWMC priority waterbodies (see Section 2.7.2) to achieve the cities' goals. City management of these waterbodies may include classifying, monitoring, tracking trends, conducting studies, and implementing other lake water quality management actions.

2.7.2 Management and Classification

2.7.2.1 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 eutrophication 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 Manual for Assessing the Quality of Minnesota Surface Waters for Determination of Impairment: 305(b) Report and 303(d) List* (MPCA, 2014).

Standards for lakes vary by MPCA ecoregion and whether the MPCA classifies a lake as "shallow" or "deep." The MPCA defines "shallow" lakes as having a maximum depth of 15 feet or less or having at least 80% of the lake area shallow enough to support aquatic plants. The MPCA's listing of waterbodies on the impaired waters 303(d) list depends upon their classification of a waterbody as a wetland, shallow lake, or deep lake. Generally, the MPCA does not list waterbodies classified as wetlands as impaired for biological indicators. In 2014, the MPCA adopted region-based eutrophication water quality standards for streams, including a revised total suspended solids (TSS) standard. Eutrophication-related water quality standards applicable to BCWMC waterbodies are presented in Table 2-7.

The MPCA also established water quality standards for parameters in addition to those presented in Table 2-7; these standards are published in Minnesota Rules 7050 and are applicable to BCWMC lakes, ponds, and streams. Standards for several parameters included in Minnesota Rules 7050 vary according to the MPCA-determined designated use of the waterbody (e.g., drinking water, industrial use).

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 impaired waters (303(d)) list for a variety of impairments. 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.

There are currently five lakes and two streams (Main Stem of Bassett Creek and Plymouth Creek) in the Bassett Creek watershed that are included on the MPCA's draft 2014 impaired waters 303(d) list. Locations of impaired waters are shown in Figure 2-12. Table 2-5 summarizes the impaired waters within the Bassett Creek Watershed. Current impaired waters listings are available from the MCPA website: www.pca.state.mn.us/index.php/water/water-types-and-programs/minnesotas-impaired-waters-and-tmdls/impaired-waters-list.html

Table 2-5 Summary of Impaired Waters within the BCWMC (including 2014 proposed listings and Wirth Lake delisting[1])

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
Sweeney Lake	Aquatic Recreation	Nutrients/Eutrophication	2004	--	--	2011
	Aquatic Life	Chloride	2014	2009	2015	--
Wirth Lake	Aquatic Consumption	Mercury in Fish Tissue;	1998	--	--	2008[4]
	Aquatic Life	Chloride	2014	2009	2015	--
	Aquatic Recreation[1]	Nutrients/Eutrophication	2002	--	--	2010
Northwood Lake	Aquatic Recreation	Nutrients/Eutrophication	2004	2020	2024	--
Bassett Creek (Main Stem)	Aquatic Life	Chloride	2010	2009	2015	--
	Aquatic Life	Fish Bioassessments	2004	2012	2016	--
	Aquatic Recreation	Fecal Coliform	2008	2008	2015	2014[5]
Plymouth Creek	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]
Spring Lake	Aquatic Life	Chloride	2014	2009	2015	--

[1] Wirth Lake was delisted for aquatic recreation due to nutrients/eutrophication in 2014.
[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

2.7.2.2 BCWMC Classification Systems

The BCWMC classified specific waterbodies within the watershed as priority waterbodies based on the desired water quality standards and uses for those waterbodies. The degree to which a waterbody can support a particular recreational use is primarily controlled by the quality of its water. In lakes, wetlands, and streams, nutrients (primarily phosphorus) and suspended solids control what recreational activities can occur in the Bassett Creek watershed. Phosphorus controls the recreational uses of waterbodies because it is the nutrient that limits the growth of algae. High algal growth is a major cause of poor water clarity, which is often the determining factor in the recreational use suitability of a waterbody.

The BCWMC identified 14 priority waterbodies and divided these priority waterbodies into four classes as shown in Table 2-6 and Appendix C. Priority 1 streams include MDNR public waters watercourses within the BCWMC. Waterbodies identified as MDNR public waters lakes (i.e., "P" designation in the public waters identification number) and at least 10 acres in size are classified as Priority 1 or 2 lakes. Priority lakes with public access or adjacent to public land are classified as Priority 1 lakes, while those without public access or adjacent public land are classified as Priority 2 lakes. Priority 1 and 2 lakes are further subdivided based on whether they are classified as "deep" or "shallow" by the MPCA, as deep and shallow lakes are subject to different nutrient water quality standards. Appendix C lists selected characteristics for major BCWMC waterbodies, include those criteria used to identify priority waterbodies.

The BCWMC adopted water quality standards for priority lakes and streams that are consistent with MPCA water quality standards published in Minnesota Rules 7050 (note that Minnesota Rules 7050 applies to waterbodies within the BCWMC regardless of their BCWMC classification). BCWMC water quality standards for priority waterbodies are presented in Table 2-7. The distinction between "deep" and "shallow" lakes is based on MPCA criteria (see Section 2.7.2.1). All deep lakes are considered priority 1 waterbodies. Water quality data collected by the BCWMC will be compared to BCWMC water quality standards to determine the need for water quality improvements. Historically, the BCWMC found that previous water quality goals could not be met without taking measures to control and improve storm water runoff in the subwatersheds draining to the waterbodies. As a result, watershed management, including review of land development, remains a major component in the management program for the lakes and streams of the Bassett Creek watershed.

Per the BCWMC's adoption of water quality performance standards based on the MPCA's MIDS, the BCWMC requires the implementation of BMPs on construction sites throughout the watershed. Such practices are seen as particularly important in areas of the watershed where regional treatment has not been established or is not feasible. Projects must also meet water quality treatment requirements as specified in the MPCA's NPDES Construction Stormwater permit as well as any requirements specified in the member city's MS4 permit.

Table 2-6 BCWMC Management Classifications for Priority Waterbodies

BCWMC Classification	Waterbodies
Priority Streams	• Main Stem Bassett Creek • North Branch Bassett Creek* • Plymouth Creek • Sweeney Lake 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 (Sunset Hill) Pond • Crane Lake • Lost Lake •

* Includes Bassett Creek Park Pond

Table 2-7 BCWMC Water Quality Standards for Waterbody Classifications

2.7.3 Water Quality Modeling

Water quality modeling serves many purposes, including estimating existing pollutant loads to BCWMC waterbodies, and evaluating the potential benefits of implementing water quality improvements within the watershed. This section describes water quality models developed by the BCWMC.

2.7.3.1 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 within the Bassett Creek watershed using the water quality model P8. P8 (Program for Predicting Polluting Particle Passage through Pits, Puddles and Ponds) is a model for predicting the generation and transport of stormwater runoff pollutants in urban watersheds. The BCWMC has updated the P8 models in relation to TMDL studies performed since development of the stream and lake watershed management plans. In 2012-2013, a water quality modeling project was completed to update the existing Bassett Creek P8 models.

Eleven P8 models, distributed throughout the Bassett Creek watershed, were updated to simulate the quantity and quality of water annually added to Bassett Creek during stormwater runoff events (see Figure 2-13). Data required to update the P8 models included watershed information (area, curve number, imperviousness, etc.) and device information (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 XP-SWMM (i.e., outlet rating curve calculations). The 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 use in tracking the progress of the BCWMC and the member cities towards TMDL implementation for impaired waterbodies, not only within BCWMC, but also downstream of Bassett Creek. When projects are proposed and/or completed, the updated P8 model could be used to estimate the loading reduction that will be achieved by the projects. The updated P8 modeling may also be used to evaluate the effect of proposed projects, such as projects that come under BCWMC review and BCWMC capital improvement program projects (see Table 5-3).

The BCWMC plans to maintain the P8 model for future BCWMC and member city use. Each year, member cities shall provide the BCWMC with plans for BMPs constructed within their city. The BCWMC will update the model annually to incorporate completed BCWMC capital improvements and BMP information provided by the member cities. The BCWMC will develop a summary report of the water quality model results and provide that report to the member cities to assist in their MS4 reporting.

2.8 Water Quantity and Flooding

The BCWMC was originally formed to address flooding issues in the watershed, so flood control was the first major responsibility of the organization. To reduce flooding 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 manages 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 2-14 and Figure 2-15 and listed in Table 2-9.

Beginning in the 1960s, aging stormwater control facilities and rapid urbanization caused the Bassett Creek watershed to experience flooding problems. For decades, flooding caused damages averaging in excess of $2 million annually to homes, businesses, and recreational areas along Bassett Creek. The worst problem was the 1.5-mile long Bassett Creek Tunnel, which was undersized and severely deteriorated. The Bassett Creek Flood Control Project (BCWMC Flood Control Project), a $40 million cooperative effort of the US Army Corps of Engineers (USACE), MnDOT, MDNR, the BCWMC, and the member cities addressed these flooding issues.

2.8.1 BCWMC Flood Control Project

The largest structural Flood Control Project undertaken by the BCWMC was the Bassett Creek Flood Control Project. From 1987 – 1996, the USACE constructed the $40 million Flood Control Project. The project was the cooperative effort of the USACE, MnDOT, MDNR, the BCWMC, and the BCWMC member cities. The project controls 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. Table 2-8 lists all of the features of the BCWMC Flood Control Project. Figure 2-14 identifies the BCWMC Flood Control Project structures. Note that the BCWMC Flood Control Project differs from the system referred to as the BCWMC “Trunk System.” The extent of the trunk system is presented in Figure 2-15.

The principal feature of the BCWMC Flood Control Project is the new 1.7-mile tunnel through downtown Minneapolis. 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 ($39 million in 2014 dollars), Phase 2 was constructed in 1990, at a cost of $2.8 million ($5.1 million in 2014 dollars), and Phase 3 was constructed in 1992, at a cost of $13.4 million ($22.8 million in 2014 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 for a boundary change to reflect these changed drainage conditions (see Appendix I). The boundary change 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 I).

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

The 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 2-14 and listed in Table 2-8. 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 lowers 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 ($1.9 million in 2014 dollars) in flood damages.

A construction account was set up for the BCWMC Flood Control Project. Cash contributions to the account totaled over $6.9 million and included contributions from the member cities (assessments), MnDOT (drainage to tunnel), the MDNR (grants), Hennepin County (grant), General Mills (grant), and interest earned on investments. After paying for the project and paying back $215,000 owed to the BCWMC Administrative account, there was $1,535,000 remaining in the construction account. The BCWMC decided to use the remaining funds for future work related to the BCWMC Flood Control Project: floodproofing of remaining homes in the floodplain, emergency repairs to the Flood Control Project system, and long-term maintenance and repair of the BCWMC Flood Control Project system.

2.8.1.1 Irving Avenue Dump Site

As part of the Flood Control Project, the City of Minneapolis was required to furnish a disposal site for the material excavated during channel widening and tunnel construction. The site selected for disposal of the fill material was a vacant area located on the south side of Bassett Creek, to the west of the City of Minneapolis impound lot. The site was selected because it could be easily acquired by the city and was close to the tunnel inlet and the channel modifications. Unfortunately, the disposal site was formerly used as an unlicensed dump site (Irving Avenue Dump), primarily for demolition debris. The MPCA designated the site as a hazardous waste site.

The City of Minneapolis and the MPCA prepared a report that summarized information on site history, potential sources of the hazardous wastes, and the extent of contamination at the site. Investigation work at the site identified contaminated soil and shallow groundwater, which appeared to be the result of sporadic dumping of hazardous materials. The contaminants present at the site include trace metals and chemicals generally associated with oil wastes. Since there was limited potential for direct contact with the contaminated soil after it was covered with the clean fill material, the potential risks to human health and environment posed by the site were related to contamination of groundwater and Bassett Creek.

The City of Minneapolis completed additional investigative activities, including determination of any impacts of the site on water quality in Bassett Creek, and determination of groundwater quality and flow direction. The groundwater monitoring program involved sampling of existing wells and installation and sampling of several new wells. The monitoring well network was used to assess the movement of groundwater contaminants and to determine groundwater quality before and after placement of fill material at the site.

Based on the results of the investigation, the MPCA agreed that the materials could be left in place with a cover over the material ("cap"). The material was left in place with a cap, which will ensure that the material does not contaminate the groundwater at the site.

2.8.2 Other Watershed Flood Control Projects

Other structural flood control projects were undertaken to implement the 1990 BCWMC Plan. The City of Golden Valley and MnDOT cooperatively constructed the Breck stormwater storage area, upstream of Sweeney Lake on the Sweeney Lake Branch of Bassett Creek. The City of Golden Valley also constructed Cortlawn Pond and Ring Ponds, in the headwaters of the Sweeney Lake Branch of Bassett Creek; these ponds provide both flood control and water quality benefits.

Along the Main Stem of Bassett Creek, the cities of Golden Valley and Robbinsdale acquired all of the area around North and South Rice Ponds to preserve this wetland and natural inundation area for temporary stormwater storage. The crossing of the creek at Dresden Lane restricts downstream discharge and causes floodwaters to be temporarily stored in the North and South Rice Ponds area.

Upstream of Trunk Highway 55, the Minneapolis Park and Recreation Board and Soo Line Railroad Company dedicated four easements to the City of Minneapolis for use of the land as flood storage and flowage.

The City of Crystal acquired easements for temporary storage of stormwater in a pond at 36th Avenue and Winnetka Avenue on the North Branch of Bassett Creek, near the New Hope boundary. In the City of New Hope, temporary stormwater storage is provided in Northwood Park along the creek and on Northwood Lake. At the headwaters of the North Branch of Bassett Creek, the City of Plymouth acquired temporary stormwater storage areas and constructed control structures for them in cooperation with land developers.

The City of Plymouth constructed five major stormwater storage sites on or tributary to Plymouth Creek, as called for in the BCWMC 1990 Plan. The City of Minnetonka adopted a wetland preservation ordinance to protect the natural stormwater storage capability of the Oak Knoll wetland and Crane Lake. Sites recognized as flood storage areas within the BCWMC are identified in Figure 2-14 (not all flood storage areas shown in Figure 2-14 are part of the BCWMC Flood Control Project described in Section 2.8.1).

The BCWMC also implements nonstructural flood control measures, which prevent flood damages from occurring along the BCWMC trunk system. Examples of these measures include:

- Monitoring water levels on lakes and streams in the watershed
- Developing models (e.g., XP-SWMM) to assess flood risk

- Review of proposed projects with potential impacts to floodplains
- Establishing policy and/or requirements to:
  - Set minimum building elevations
  - Preserve floodplain storage
  - Limit alteration to existing structures

2.8.3 Regulatory Water Levels and Flow Rates

Following the construction of the BCWMC Flood Control Project, the BCWMC worked with the USACE to approve revised flood profiles along sections of Bassett Creek for the National Flood Insurance Program's Flood Insurance Rate Map (FIRM). The Federal Emergency Management Agency (FEMA) approved the proposed revisions to the FIRM for Bassett Creek in 2002. Minor adjustments to the mapping were finalized in 2003 and were incorporated into the Hennepin County FIRM.

The BCWMC uses the revised flood profiles in its review of improvements and development proposals. Table 2-9 lists the flood profiles and critical event flow rates that are now in effect. When the BCWMC updates flood profiles and flow rates, the BCWMC will use updated precipitation data published in Atlas 14 (see Section 2.2 and Policy 25 in Section 4.2.2).

Prior to the 2004 Plan, the BCWMC compared proposed development to the assumed future land use to determine if additional mitigation of flow rates was required (see Section 2.1). Current BCWMC policy requires no net increase in peak flow rates for specific storm events (see Section 4.0); the current requirements are independent of assumed future land use.

2.8.4 Flood Insurance Studies

The Federal Emergency Management Agency (FEMA) performs flood insurance studies (FIS) and develops flood maps to determine 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. In some cases, homes within FEMA-designated floodplains on the FEMA floodplain maps may actually not be in the floodplain. To waive the mandatory flood insurance requirements for their homes, residents must remove their homes from the FEMA-designated floodplain by obtaining a Letter of Map Amendment (LOMA). Figure 2-16 shows the FEMA and BCWMC mapping of the 100-year floodplain in the BCWMC.

The member cities have prepared local water management plans. These plans have more detailed information regarding storm sewer systems and localized flooding issues. Additional flooding information is also available from the Flood Insurance Studies (FIS) for the cities within the BCWMC.

Table 2-8 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 ($39,760,000)
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 ($3,980, ,000)
Douglas Drive Crossing	Crystal	1987	BCWMC, Crystal Hennepin County	$100,000 ($220,000)
Wisconsin Avenue Control Structure	Golden Valley	1987	BCWMC Golden Valley	$100,000 ($220,000)
Highway 55 Control Structure	Golden Valley	1987	BCWMC, USACE, MDNR, Minneapolis	$85,000 ($190,000)
Plymouth Creek Fish Barrier	Plymouth	1987	BCWMC, MDNR, Plymouth Hennepin County	$60,000 ($130,000)
Phase 2 Tunnel: Third Ave. Tunnel	Minneapolis	1990	BCWMC, USACE Minneapolis, MDNR MnDOT	$2,800,000 ($5,740,000)
Phase 3 Tunnel: Box Culvert Double Box Culvert Channel Improvements	Minneapolis	1992	BCWMC, USACE, Minneapolis MDNR, MnDOT	$13,400,000 ($26,360,000)
Markwood/Edgewood Area Modifications Control Structure Edgewood Avenue Basin Markwood Channel Improvements	Crystal	1992	BCWMC, USACE Crystal, MDNR	500,000 ($850,000)
Westbrook Road Crossing	Golden Valley	1993	BCWMC, USACE Golden Valley, MDNR	200,000 ($370,000)
Golden Valley Country Club Control Structure	Golden Valley	1994	BCWMC, USACE Golden Valley, MDNR	450,000 ($810,000)
Bassett Creek Park Pond	Crystal	1995	BCWMC, USACE, Crystal, MnDOT, MDNR	1,300,000 ($2,360,000)
Medicine Lake Outlet Structure	Plymouth	1996	BCWMC, Plymouth Hennepin County, MDNR	100,000 ($180,000)

[1] 2014 dollars are included in parentheses

Table 2-9 BCWMC Flood Profiles (elevations in NAVD88 datum), revised May 2017

Location (Description)	Creek Distance Above the Mississippi River (feet)	100-Year		10-Year		2-Year	
		Flood Elevation (feet)	Flow Rate (cfs)	Flood Elevation (feet)	Flow Rate (cfs)	Flood Elevation (feet)	Flow Rate (cfs)
BASSETT CREEK MAIN STEM [1]							
Tunnel Inlet	8,000	810.9	1,380	805.7	830	802.4	420
Van White Memorial Blvd (DS)	---	811.0	1,400	805.9	820	803.0	420
Van White Memorial Blvd (US)	---	811.0	1,530	805.9	680	803.1	420
Irving Avenue Bridge (DS)	9,800	811.2	1,380	806.9	830	805.7	420
Irving Avenue Bridge (US)	---	811.3	1,380	807.0	680	806.1	420
Cedar Lake Rd (DS)	---	812.9	1,380	810.8	680	809.6	420
Cedar Lake Rd (US)	10,900	813.3	1,380	811.2	680	809.9	420
MN&S RR Bridge	11,600	813.7	1,370	811.7	680	810.3	420
Penn Ave Bridge & Culvert (DS)	12,410	814.5	1,370	812.4	680	811.1	420
Penn Ave Bridge & Culvert (US)	---	814.5	1,370	812.5	680	811.2	420
BN RR Bridge(DS)	---	814.5	1,370	812.5	680	811.2	420
BN RR Bridge	12,670	814.5	1,370	812.5	680	811.2	420
MN&S RR Bridge (DS)	13,930	815.6	1,370	813.7	680	812.7	420
MN&S RR Bridge (US)	---	815.8	1,370	813.9	680	812.9	420
Fruen Mill Dam (DS)	14,150	817.2	1,370	815.6	680	814.9	420
Fruen Mill Dam (US)	---	819.8	1,370	818.1	680	817.3	420
Glenwood Ave (DS)	---	822.1	1,370	819.7	680	818.6	420
Glenwood Ave (US)	14,855	822.2	1,290	819.7	620	818.6	380
Hwy 55 (DS)	16,500	823.4	1,190	821.0	620	819.7	380
Hwy 55 (US)	---	826.5	1,500	823.9	690	822.1	430
Golf Cart Bridge	---	826.6	1,520	823.9	710	822.2	460
MN&S RR Bridge (DS)	---	826.6	1,520	823.9	710	822.2	460
MN&S RR Bridge (US)	---	826.6	1,520	823.9	710	822.2	460
Plymouth Ave Bridge	19,500	826.7	1,550	824.0	750	822.3	470
Wirth Parkway (DS)	20,480	826.7	1,450	824.0	740	822.3	480
Wirth Parkway (US) Bridge	---	826.8	1,460	824.3	750	822.4	480
Confluence w/ Sweeney Lake Branch	22,000	827.2	1,460	824.9	760	823.8	490

[1] BCWMC Phase 2 XP-SWMM Model, August 2017. The BCWMC intends to actively update the XP-SWMM Model on an annual basis to reflect projects and changes within the watershed. The most current version of the model must be used.
DS = Downstream; US = Upstream

Table 2-9 BCWMC Flood Profiles (continued, elevations in NAVD88 datum), revised May 2017

Location (Description)	Creek Distance Above the Mississippi River (feet)	100-Year		10-Year		2-Year	
		Flood Elevation (feet)	Flow Rate (cfs)	Flood Elevation (feet)	Flow Rate (cfs)	Flood Elevation (feet)	Flow Rate (cfs)
BASSETT CREEK MAIN STEM [1] (continued)							
Golden Valley Road (DS)	---	828.2	1,350	826.8	640	826.2	400
Golden Valley Road (US)	23,800	833.8	1,340	828.6	640	827.3	400
Dresden Lane (DS)	---	834.1	1,340	830.4	630	829.6	400
Dresden Lane (US)	---	834.1	1,350	831.1	630	830.0	410
Bassett Creek Drive (DS)	---	834.4	1,290	832.3	610	830.9	400
Bassett Creek Drive (US)	---	837.0	1,300	833.0	610	831.3	400
Noble Lane (DS)	29,200	838.7	1,320	836.8	610	836.3	400
Noble Lane (US)	---	839.7	1,300	837.3	600	836.5	400
Regent Avenue (DS)	30,800	843.0	1,300	841.1	600	840.2	400
Regent Avenue (US)	---	843.7	1,280	841.3	600	840.3	400
Minnaqua Avenue	31,650	844.0	1,260	842.0	590	841.0	400
Highway 100 (DS)	---	844.8	1,300	842.8	590	842.1	410
Highway 100 (US)	34,020	851.2	1,040	847.9	1,040	845.2	1,040
DS Confluence N. Branch	34,400	851.2	1,040	847.9	1,040	845.2	1,040
Westbrook Road (DS)	37,000	859.0	870	857.9	520	857.2	370
Westbrook Road (US)	---	860.0	870	858.4	520	857.5	360
Duluth Street (DS)	38,400	861.9	850	860.7	510	859.9	360
Duluth Street (US)	---	862.6	830	861.0	500	860.0	360
St. Croix Avenue (DS)	39,800	864.5	830	863.3	500	862.5	360
St. Croix Avenue (US)	---	864.7	800	863.7	490	862.7	350
MN&S RR (DS) (Wooden Pile Trestle)	41,660	870.3	700	869.3	410	868.8	290
MN&S RR (US) (also 2 pedestrian bridges)	---	870.5	690	869.5	410	868.9	290
Douglas Drive (DS)	---	871.0	700	869.8	410	869.2	290
Douglas Drive (US)	---	871.8	690	870.2	410	869.4	290
Florida Avenue (DS)	42,820	872.6	690	870.7	410	869.8	290
Florida Avenue (US)	---	873.0	690	871.1	410	870.1	290
Hampshire Ave (DS)	43,410	873.4	690	871.7	410	870.8	290
Hampshire Ave (US)	---	874.0	670	872.1	400	871.1	290
GV Country Club (DS)	44,320	876.1	660	874.6	400	873.7	290

[1]BCWMC Phase 2 XP-SWMM Model, August 2017. The BCWMC intends to actively update the XP-SWMM Model on an annual basis to reflect projects and changes within the watershed. The most current version of the model must be used.

DS = Downstream; US = Upstream

Table 2-9 BCWMC Flood Profiles (continued, elevations in NAVD88 datum), revised May 2017

Location (Description)	Creek Distance Above the Mississippi River (feet)	100-Year		10-Year		2-Year	
		Flood Elevation (feet)	Flow Rate (cfs)	Flood Elevation (feet)	Flow Rate (cfs)	Flood Elevation (feet)	Flow Rate (cfs)
BASSETT CREEK MAIN STEM [1] (continued)							
GV Country Club (US)	---	880.6	650	879.3	380	876.7	260
Pennsylvania Avenue (DS)	46,500	881.6	650	880.3	380	879.5	260
Pennsylvania Avenue(US)	---	882.9	550	881.1	350	880.1	250
C&NW RR (DS)	47,200	884.1	560	882.4	350	881.6	250
C&NW RR (US)	---	885.0	450	883.2	310	882.4	230
Winnetka Ave (DS)	48,000	885.1	440	883.4	300	882.6	210
Winnetka Ave (US)	---	885.3	430	883.6	300	882.9	210
Wisconsin Ave (DS)	49,750	886.0	430	884.8	320	884.0	210
Wisconsin Ave (US)	50,100	887.6	370	885.9	260	884.5	150
Golden Valley Road (DS)	---	887.7	340	885.9	220	884.6	140
Golden Valley Road (US)	---	887.7	340	885.9	220	884.6	140
Westbound Hwy 55 (DS)	51,250	887.7	340	885.9	220	884.7	140
Eastbound Hwy 55 (US)	---	887.8	410	885.9	210	884.7	130
Boone Ave (DS)	---	887.9	320	886.3	190	885.2	120
Boone Ave (US) General Mills Blvd	---	887.9	220	886.3	120	885.3	90
Hwy 169 (DS)	56,500	888.3	300	887.1	140	886.1	90
Hwy 169 (US)	---	888.4	240	887.1	110	886.1	70
Hwy 55 Ramp (DS)	58,300	888.4	220	887.1	70	886.1	50
Hwy 55 Ramp (US)	---	888.4	220	887.1	70	886.1	40
Hwy 55 Eastbound (DS)	58,500	888.4	220	887.1	70	886.1	40
Hwy 55 Eastbound (US)	---	888.4	220	887.1	70	886.1	40
Hwy 55 Westbound (DS)	---	888.4	220	887.1	70	886.1	40
Hwy 55 Westbound (US)	---	888.4	220	887.1	70	886.1	40
Hwy 169 ramp to W 55 (DS)	---	888.4	220	887.1	70	886.1	40
Hwy 169 ramp to W 55 (US)	---	888.5	220	887.1	70	886.1	40
Hwy 55 N Frontage Rd (DS)	58,850	888.5	220	887.1	70	886.1	40
Hwy 55 N Frontage Rd (US)	---	888.5	220	887.1	70	886.1	40
Pedestrian Bridge near Cub Foods	---	888.7	220	887.2	70	886.2	40
10^{th} Ave (DS)	---	889.0	220	887.2	80	886.2	50

[1]BCWMC Phase 2 XP-SWMM Model, August 2017. The BCWMC intends to actively update the XP-SWMM Model on an annual basis to reflect projects and changes within the watershed. The most current version of the model must be used.
DS = Downstream; US = Upstream

Table 2-9 BCWMC Flood Profiles (continued, elevations in NAVD88 datum), revised May 2017

Location (Description)	Creek Distance Above the Mississippi River (feet)	100-Year		10-Year		2-Year	
		Flood Elevation (feet)	Flow Rate (cfs)	Flood Elevation (feet)	Flow Rate (cfs)	Flood Elevation (feet)	Flow Rate (cfs)
BASSETT CREEK MAIN STEM [1] (continued)							
10th Ave (US)	---	889.2	220	887.2	70	886.2	30
C&NW RR Bridge (DS)	63,450	889.2	220	887.2	70	886.2	30
C&NW RR Bridge (US)	---	889.2	220	887.4	70	887.1	30
South Shore Drive (DS)	63,800	889.3	220	887.7	70	887.2	30
South Shore Drive (US)	---	889.4	220	887.8	70	887.3	30
Medicine Lake Weir (DS)	63,960	889.4	220	887.8	70	887.3	30
Inundation Areas							
Theodore Wirth Park	---	826.5	---	823.9	---	822.1	---
South Rice Pond	---	834.3	---	832.1	---	830.7	---
North Rice Pond	---	836.4	---	834.2	---	833.4	---
Grimes Avenue Pond	---	836.4	---	834.3	---	833.4	---
Golden Valley Country Club	---	880.6	---	879.3	---	876.7	---
Brookview Golf Course	---	887.8	---	885.9	---	884.7	---
Westwood Lake	---	890.0	---	888.9	---	888.4	---
Medicine Lake	---	890.4	---	889.4	---	888.8	---

[1]BCWMC Phase 2 XP-SWMM Model, August 2017. The BCWMC intends to actively update the XP-SWMM Model on an annual basis to reflect projects and changes within the watershed. The most current version of the model must be used.

DS = Downstream; US = Upstream

Table 2-9 BCWMC Flood Profiles (continued, elevations in NAVD88 datum), revised May 2017

Location (Description)	Creek Distance Above Confluence with Main Stem (feet)	100-Year		10-Year		2-Year	
		Flood Elevation (feet)	Flow Rate (cfs)	Flood Elevation (feet)	Flow Rate (cfs)	Flood Elevation (feet)	Flow Rate (cfs)
NORTH BRANCH [1]							
Hwy 100 Control (US)	---	851.2	1,040	847.9	1,040	845.2	1,040
Confluence w/Main Stem	0	851.2	1,740	847.9	750	845.2	250
29th Avenue (DS)	200	851.2	1,740	847.9	750	845.2	250
29th Avenue (US)	---	851.2	1,290	847.9	600	845.2	420
32nd Avenue (DS)	2,600	851.2	1,290	847.9	600	845.2	420
32nd Avenue (US)	---	852.7	560	851.3	350	847.8	240
Brunswick Avenue (DS)	3,000	852.7	560	851.3	350	847.8	240
Brunswick Avenue (US)	---	856.7	510	855.3	320	852.7	230
34th Culvert (DS)	4,200	861.5	520	861.1	330	860.9	300
34th Culvert (US)	---	867.2	500	864.5	400	863.7	300
Apartment Drive Crossing (DS)	---	868.3	570	867.0	320	866.5	230
Apartment Drive Crossing (US)	---	869.6	580	867.6	320	866.9	230
Douglas Drive (DS)	4,200	869.6	580	867.6	320	866.9	230
Douglas Drive (US)	---	870.5	380	869.6	240	868.2	180
Edgewood Emb (DS)	5,600	871.0	380	869.6	240	868.2	180
Edgewood Emb (US)	---	880.4	340	875.6	350	872.1	240
Georgia Avenue (DS)	6,250	880.4	460	875.6	390	872.1	200
Georgia Avenue (US)	---	880.8	520	875.8	340	873.0	210
36th & Hampshire (DS)	6,800	880.8	480	875.8	300	873.0	190
36th & Hampshire (US)	6,980	881.3	280	876.3	180	874.9	140
Louisiana Ave. (DS)	8,000	883.3	490	883.0	190	881.8	110
Maryland Ave.	8,500	886.0	260	885.8	90	882.8	60
Oregon Ave.	9,000	888.5	90	886.2	70	883.5	60
MN & S RR	8,500	889.6	90	886.4	70	884.1	60
Inlet of 42" CMP	9,500	890.9	100	887.3	100	884.9	100
Service Road (DS)	---	890.9	190	887.3	90	884.9	60
Service Road (US)	10,000	891.1	190	887.5	90	885.0	60
Winnetka Ave. (DS)	10,600	891.1	220	887.5	100	885.0	70
Winnetka Ave. (US)	---	891.3	270	887.8	130	885.2	70

[1]BCWMC Phase 2 XP-SWMM Model, August 2017. The BCWMC intends to actively update the XP-SWMM Model on an annual basis to reflect projects and changes within the watershed. The most current version of the model must be used.
DS = Downstream; US = Upstream

Table 2-9 BCWMC Flood Profiles (continued, elevations in NAVD88 datum), revised May 2017

Location (Description)	Creek Distance Above Confluence with Main Stem (feet)	100-Year		10-Year		2-Year	
		Flood Elevation (feet)	Flow Rate (cfs)	Flood Elevation (feet)	Flow Rate (cfs)	Flood Elevation (feet)	Flow Rate (cfs)
NORTH BRANCH [1] (continued)							
Boone Ave. (DS)	13,500	891.4	730	887.9	240	885.6	240
Boone Ave. (US)	---	891.4	270	888.3	170	886.9	140
Northwood Lake	---	891.4	270	888.3	170	886.9	140
TH 169 (DS)	16,850	893.0	270	889.2	170	887.6	140
TH 169(US)	---	893.1	750	891.0	360	888.9	280
Rockford Road (DS)	18,350	893.1	750	891.0	360	888.9	280
Rockford Road (US)	---	897.2	---	895.0	---	893.3	---
Inundation Areas							
Bassett Creek Park	---	851.2	---	847.9	---	845.2	---
Edgewood Avenue Pond	---	880.4	---	875.6	---	872.2	---
Winnetka Pond (DS of Winnetka Avenue)	---	890.9	---	887.3	---	884.9	---
Northwood Park	---	891.3	---	887.8	---	885.2	---
Northwood Lake	---	891.4	---	888.3	---	886.9	---

[1]BCWMC Phase 2 XP-SWMM Model, August 2017. The BCWMC intends to actively update the XP-SWMM Model on an annual basis to reflect projects and changes within the watershed. The most current version of the model must be used.

DS = Downstream; US = Upstream

Table 2-9 BCWMC Flood Profiles (continued, elevations in NAVD88 datum), revised May 2017

Location (Description)	Creek Distance Above Confluence with Main Stem (feet)	100-Year		10-Year		2-Year	
		Flood Elevation (feet)	Flow Rate (cfs)	Flood Elevation (feet)	Flow Rate (cfs)	Flood Elevation (feet)	Flow Rate (cfs)
SWEENEY LAKE BRANCH [1]							
Confluence w/Main Stem	---	827.2	1,460	824.9	760	823.8	490
Courage Center Downstream Crossing (DS)	---	827.2	170	824.9	130	823.8	90
Courage Center Downstream Crossing (US)	---	828.0	170	826.4	130	825.3	90
Courage Center Upstream Crossing (DS)	700	828.0	170	826.4	130	825.3	90
Courage Center Upstream Crossing (US)	---	830.6	170	828.4	130	826.3	90
Courage Center & Hidden Lakes Parkway (DS)	1,330	830.6	170	828.4	130	826.3	90
Courage Center & Hidden Lakes Parkway (US)	---	831.9	170	829.2	130	826.8	90
Precast Concrete Dam (DS)	1,700	831.9	170	829.2	130	826.8	90
Sweeney Lake	---	831.9	170	829.2	130	828.4	90
Union Pacific RR (DS)	6,800	831.9	400	829.2	230	828.4	130
Union Pacific RR (US)	---	836.3	480	831.7	480	829.9	480
Hwy 55 (DS)	---	836.8	860	835.0	550	833.5	350
Hwy 55 (US)	---	838.4	310	836.1	210	834.1	150
MN & S RR (DS)	9,000	838.4	260	836.1	190	834.1	140
MN & S RR (US)	---	841.7	260	837.8	190	835.1	140
Breck Pond & Control Structure (US)	9,580	842.5	270	838.3	220	835.4	160
TH 100 (DS) (Breck Pond)	10,400	842.5	440	838.3	400	835.4	350
TH 100 (US)	---	851.0	500	844.9	500	844.2	490
Turners Crossroad (US)	10,950	857.2	430	851.8	340	849.2	270
Glenwood Pond A	---	857.2	---	851.8	---	849.2	---
MN & S RR (DS)	---	857.2	440	851.8	350	849.2	320
MN & S RR (US)	---	857.2	440	851.9	350	849.2	320
Glenwood Pond B [2]	---	857.2	---	851.9	---	849.2	---

[1]BCWMC Phase 2 XP-SWMM Model, August 2017. The BCWMC intends to actively update the XP-SWMM Model on an annual basis to reflect projects and changes within the watershed. The most current version of the model must be used.

[2]Normal flows discharge from Ravine Storage Area east through 36" culvert at MN & S RR to Duck Pond; then north through 48" culvert at Glenwood Avenue to Glenwood Pond B

DS = Downstream; US = Upstream

Table 2-9 BCWMC Flood Profiles (continued, elevations in NAVD88 datum), revised May 2017

Location (Description)	Creek Distance Above Confluence with Main Stem (feet)	100-Year		10-Year		2-Year	
		Flood Elevation (feet)	Flow Rate (cfs)	Flood Elevation (feet)	Flow Rate (cfs)	Flood Elevation (feet)	Flow Rate (cfs)
SWEENEY LAKE BRANCH [1] (continued)							
Glenwood Ave (DS) [2]	---	857.2	100	851.9	50	849.2	50
Glenwood Ave (US) [2]	---	857.2	100	852.2	80	849.4	50
Duck Pond [2]	---	857.2	---	852.2	---	849.4	---
MN & S RR (DS) [2]	---	857.2	560	852.2	310	849.4	210
MN & S RR (US) [2]	---	859.4	300	856.0	80	853.0	40
Ravine Storage Area [2 4]	---	859.4	90	856.0	40	853.0	20
Cortlawn Pond [4]	---	873.6	120	873.2	40	871.9	20
East Ring Pond [4]	---	879.4	180	877.3	50	876.1	20
78" RCP Equalizer	18,800	879.4	480	877.3	170	876.1	80
West Ring Pond [4]	---	879.4	---	877.3	---	876.1	---
Ravine Storage Area Overflow							
Glenwood Pond B [3]	---	857.2	---	851.9	---	849.2	---
MN & S RR (DS) [3]	---	857.2	---	852.2	---	849.4	---
MN & S RR (US) [3]	---	858.9	---	852.6	---	850.3	---
Storage Area [3]	---	858.9	---	852.6	---	850.3	---
Glenwood Ave (DS) [3]	---	858.9	---	852.6	---	850.3	---
Glenwood Ave (US) [3]	---	859.4	---	856.0	---	853.0	---
Ravine Storage Area [3 4]	---	859.4	---	856.0	---	853.0	---
Inundation Areas							
Sweeney Lake	---	831.9	---	829.2	---	828.4	---
Twin Lake	---	831.9	---	829.2	---	828.4	---
Breck Pond	---	842.5	---	838.3	---	835.4	---
Cortlawn Pond [4]	---	873.6	---	873.2	---	871.9	---
East Ring Pond [4]	---	879.4	---	877.3	---	876.1	---
West Ring Pond [4]	---	879.4	---	877.3	---	876.1	---

[1]BCWMC Phase 2 XP-SWMM Model, August 2017. The BCWMC intends to actively update the XP-SWMM Model on an annual basis to reflect projects and changes within the watershed. The most current version of the model must be used.
[2]Normal flows discharge from Ravine Storage Area east through culvert at MN & S RR to Duck Pond; then north through 48" culvert at Glenwood Avenue to Glenwood Pond B
[3]High flows may discharge from Ravine Storage Area north through culvert at Glenwood Avenue to storage area; then east through 78" culvert at MN & S RR to Glenwood Pond B
[4]West and East Ring Ponds connected to Cortlawn Pond and the Ravine storage area via a series of storm sewer pipes not listed in this table.
DS = Downstream; US = Upstream

Table 2-9 BCWMC Flood Profiles (continued, elevations in NAVD88 datum), revised May 2017

Location (Description)	Creek Distance Above Medicine Lake (feet)	100-Year		10-Year		2-Year	
		Flood Elevation (feet)	Flow Rate (cfs)	Flood Elevation (feet)	Flow Rate (cfs)	Flood Elevation (feet)	Flow Rate (cfs)
MEDICINE LAKE BRANCH (PLYMOUTH CREEK) [1]							
Medicine Lake	---	890.4	---	889.4	---	888.8	---
Pedestrian Crossing (DS)	---	890.4	---	889.4	---	888.8	---
Pedestrian Crossing (US)	---	890.4	690	889.4	300	888.8	150
West Medicine Lake Drive (DS)	1,300	890.7	690	890.4	340	890.2	190
West Medicine Lake Drive (US)	---	893.6	690	893.0	340	892.5	190
Fish Barrier (DS)	---	916.1	240	915.6	110	915.4	70
Fish Barrier (US)	---	923.0	240	922.0	110	921.6	70
26th Avenue N. (DS)	7,350	924.5	240	923.3	110	922.8	70
26th Avenue N. (US)	---	925.1	240	923.5	110	923.0	70
28th Avenue N. Dike (DS)	---	930.0	240	928.7	110	928.1	70
28th Avenue N. Dike (US)	---	932.3	270	930.9	120	929.1	80
County Road 61 (DS)	---	932.3	270	930.9	120	929.1	80
County Road 61 (US)	---	934.1	240	931.3	120	929.3	80
Xenium Lane (DS)	11,700	934.1	440	931.4	190	930.0	130
Xenium Lane (US)	---	934.5	460	931.5	460	930.1	460
Crowne Plaza Downstream Crossing (DS)	---	934.5	460	931.5	460	930.1	460
Crowne Plaza Downstream Crossing (US)	---	937.6	440	936.8	170	932.6	90
Crowne Plaza Upstream Crossing (DS)	---	937.7	440	936.8	170	932.7	90
Crowne Plaza Upstream Crossing (US)	---	938.0	440	937.6	180	935.1	110
I-494 (DS)	13,350	938.1	440	937.7	180	935.3	110
I-494 (US)	---	938.9	410	937.8	180	935.4	110
Annapolis (DS)	---	941.9	280	941.3	160	940.6	90
Annapolis (US)	---	942.8	280	941.7	160	940.8	90
Fernbrook Lane (DS)	15,850	946.7	280	945.8	160	944.9	90
Fernbrook Lane (US)	---	946.8	280	945.8	160	944.9	90
Central Park Pond Outlet Structure (DS)	---	949.8	280	948.9	160	948.0	90

[1]BCWMC Phase 2 XP-SWMM Model, August 2017. The BCWMC intends to actively update the XP-SWMM Model on an annual basis to reflect projects and changes within the watershed. The most current version of the model must be used.

DS = Downstream; US = Upstream

Table 2-9 BCWMC Flood Profiles (continued, elevations in NAVD88 datum), revised May 2017

Location (Description)	Creek Distance Above Medicine Lake (feet)	100-Year		10-Year		2-Year	
		Flood Elevation (feet)	Flow Rate (cfs)	Flood Elevation (feet)	Flow Rate (cfs)	Flood Elevation (feet)	Flow Rate (cfs)
MEDICINE LAKE BRANCH (PLYMOUTH CREEK) [1] (continued)							
Central Park Pond Outlet Structure (US)	---	955.0	690	952.5	690	951.2	690
37th Avenue	19,750	955.1	690	952.5	690	951.3	690
County Road 9	21300	955.3	390	952.6	180	951.3	90
Vicksburg Lane (DS)	22,150	963.0	380	961.5	180	960.3	90
Vicksburg Lane (US)	---	963.7	280	961.6	140	960.3	70
Pedestrian Crossing/41st Street Extension (DS)	---	966.8	200	965.7	100	965.2	60
Pedestrian Crossing/41st Street Extension (US)	---	967.6	140	965.9	100	965.2	60
Yuma Lane (DS)	---	967.9	140	966.9	100	966.5	60
Yuma Lane (US)	---	970.3	110	969.3	80	968.3	70
Dunkirk Lane (US)	25,300	978.1	140	977.4	70	977.1	50
Dunkirk Lane (DS)	---	983.0	140	981.4	80	980.3	50
Field Crossing (DS)	---	983.1	100	982.0	70	981.2	40
Field Crossing (US)	---	983.1	110	982.1	70	981.6	40
T.H. 55 (DS)	29,150	983.1	100	982.1	70	981.6	40
T.H. 55 (US)	---	984.0	---	982.5	---	981.8	---
Inundation Areas							
Xenium Lane	---	934.5	---	931.5	---	930.1	---
Central Park Pond	---	955.0	---	952.5	---	951.2	---
Turtle Lake	---	967.0	---	965.2	---	964.2	---
Rockford Road	---	968.5	---	967.2	---	966.6	---
Dunkirk Lane	---	983.0	---	981.4	---	980.3	---
Oak Knoll Pond	---	918.6	---	917.5	---	916.9	---
Crane Lake	---	920.2	---	919.2	---	918.7	---

[1]BCWMC Phase 2 XP-SWMM Model, August 2017. The BCWMC intends to actively update the XP-SWMM Model on an annual basis to reflect projects and changes within the watershed. The most current version of the model must be used.

DS = Downstream; US = Upstream

2.8.5 Water Quantity Monitoring

2.8.5.1 Lake Levels

The BCWMC has collected water level data on several waterbodies since the 1970s. Water level periods of record and ordinary high water levels (OHWLs), if known, are presented in Table 2-10.

Table 2-9 BCWMC Priority Waterbody Lake Levels, revised May 2017

Priority Waterbody	MDNR Lakefinder Data http://www.dnr.state.mn.us/lakefind/index.html		Normal Water Level (feet, NAVD88 datum)	BCWMC Period of Record
	Period of Record	OHWL (feet, NGVD1929 datum)		
Cavanaugh (Sunset Hill) Pond	--	--	--	--
Crane Lake	--	--	917.3	1974 – present
Lost Lake	--	--	940.2	--
Medicine Lake	1926 – present	889.1	887.9	1972 – present
Northwood Lake	1993 – 1999	885.5	884.8	1993 – present
Parkers Lake	1960 – present	935.9	934.4	1972 – present
Sweeney Lake	1958 – 1999	827.7	827.2	1972 – present
Twin Lake	--	--	827.2	--
Westwood Lake	1974 – 1999	887.8	887.6	1974 – present
Wirth Lake	1883 – 2014	818.9	817.7	2006 – present

The BCWMC typically measures water levels twice per month during the open water period and once per month in winter. More detailed information is available from the MDNR lakefinder website (http://www.dnr.state.mn.us/lakefind/index.html) and from the BCWMC, upon request.

During the development of this Plan, Medicine Lake water levels were identified as an area of concern (see Section 3.2). 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 2014, water levels have fluctuated from an observed low of 885.6 feet (NGVD1929 datum) in 1972 to an observed high of 889.7 feet (NGVD1929 datum) in 1991. The average water level over this period is approximately 888 feet (NGVD1929 datum). The normal water level for Medicine Lake is 887.7 feet (NGVD1929 datum), which is the elevation of the outlet. Figure 2-17 presents Medicine Lake water levels observed since 1972.

2.8.5.2 Stream Gaging and Flow Data

In 2000, the BCWMC, in cooperation with Metropolitan Council Environmental Services (MCES), began monitoring flow and stage in the Main Stem of Bassett Creek as part of the Watershed Outlet Monitoring Program (WOMP, see Section 2.7.1.3). The Bassett Creek WOMP site is located at Irving Avenue, one-fourth mile upstream of the storm sewer tunnel that runs beneath downtown Minneapolis to the Mississippi River (see Figure 2-11). Data collection consists of continuous measurements of stage (which is converted to stream flow using a rating curve), temperature and conductivity.

2.8.6 Water Quantity Modeling

Water quantity modeling is necessary to establish flood levels and determine floodplain extents, design hydraulic structures adequate to meet their intended functions, and assess hydraulic impacts of projects proposed by the BCWMC and other entities. This section describes water quantity models developed by the BCWMC.

2.8.6.1 Watershed-wide XP-SWMM Model

The original hydrologic and hydraulic models of the Bassett Creek watershed were created in the 1970's. Although there have been significant changes in the watershed, there have only been minor updates to these original models, which were developed using the USACE's HEC-1 and HEC-2 programs. In 2012 and 2013, the BCWMC converted the HEC models to XP-SWMM, which is an integrated hydrologic-hydraulic model using the EPA's Storm Water Management Model (SWMM) with an interface developed by XP software. XP-SWMM was used for more detailed modeling in select areas of the watershed.

XP-SWMM allows for calculating both hydrology and hydraulics within one modeling program, rather than requiring two separate programs, as with the HEC-1 and HEC-2 models. The model update was split into two phases, with the first phase in 2012 and 2013 including:

- Updating watershed divides based on recent digital topographic data,
- Modifying hydrologic inputs (because of the changes in watershed divides and available methodology).
- Enhancing detail along the creeks by using updated channel geometry and current bridge and culvert geometry.

The updated XP-SWMM model divides the BCWMC into 55 subwatersheds (see Figure 2-18). This 2012-2013 modeling update did not include further subdividing watersheds, incorporating additional municipal storm sewers, or incorporating additional upstream stormwater storage.

The 2012 XP-SWMM model can be used to compare relative changes in flow rate (i.e., existing vs. proposed conditions runoff rates), or relative changes in water surface elevations (i.e., existing vs.

proposed conditions maximum water surface elevations in the creeks or storage areas). The 2012 XP-SWMM model is not intended to be used to determine absolute flow or water surface results (i.e., flood elevations based on a particular design storm event). Model updates necessary to accurately estimate absolute flow and water surface elevations would require:

- Subdividing the 55 watersheds (from the original HEC-1 model) into approximately 850 watersheds (consistent to the watersheds in the P8 water quality model),
- Incorporating additional municipal storm sewer systems between upstream modeled ponds,
- Integrating detailed storage in modeled ponds upstream of the creek system, and
- Incorporating Atlas 14 precipitation depths (see Section 2.2) and updated soils data (see Section 2.4).

By incorporating these changes, the modeled runoff rates to the creek system will likely more realistically represent actual conditions, resulting in an acceptable calibration. If a second phase of model improvement is implemented, the resultant XP-SWMM model could be used to determine (and compare) absolute water surface elevations and flow rates. The revised model results could be beneficial to the BCWMC and member cities for revising the BCWMC's jurisdictional flood elevations. The results could also be submitted to FEMA for possible use in future Hennepin County flood insurance rate maps. The model could also be useful to the member cities to assess flood elevations at other ponds or wetlands throughout the watershed.

2.9 Natural Communities and Rare Species

Prior to 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. Elm, sugar maple, and basswood are representative Big Woods tree species. Although scattered remnants of this forest are still present throughout much of its original range, only two remnants are present within the BCWMC, according to the map *Natural Communities and Rare Species of Carver, Hennepin, and Scott Counties* (Minnesota County Biological Survey, 1998). 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 2-10.

Natural vegetation in the Bassett Creek watershed over time has been greatly altered by agricultural development and urbanization. In recent years, due to limited areas for expansion, former agricultural areas have been urbanized. Remaining vegetation in the watershed is typical of that found at the interface between the Eastern Deciduous Forest and the Temperate Grassland. In addition to the forested areas, numerous wetlands were once present in the central and eastern portions of the watershed, but the majority 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. The county biological survey map notes the presence of 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, and the habitat for these species should be protected and improved where feasible.

2.10 Fish and Wildlife Habitat

2.10.1 MDNR Fisheries Surveys and Stocking

2.10.1.1 Medicine Lake

Medicine Lake offers a diverse sport fish community consisting of black crappie, bluegill, largemouth bass, pumpkinseed, northern pike, walleye, and yellow perch. Fishing access is available from two boat launches, one of which is a public launch maintained by the Three Rivers Park District (see Figure 2-19). Since 1999, the MDNR has stocked walleye every other year. The most recent fish survey was performed by the MDNR in 2012.

The relative abundance and size of northern pike have increased over three surveys from 2006 to 2012. The abundance of walleye is less than average for this type of lake in the 2012 survey, although the sampled fish were of good size. The abundance of yellow perch has steadily declined since 2000. Bluegill and black crappie were caught in average abundances and at average sizes.

Due to the presence of mercury in fish tissue, fish consumption guidelines for Medicine Lake are in effect for bluegill sunfish, bullhead, carp, crappie, largemouth bass, and northern pike.

2.10.1.2 Parkers Lake

Boat access to Parkers Lake is through a city-maintained concrete boat ramp on the north end of the lake and shore access is available from a public fishing pier located on the west side of the lake (see Figure 2-19). The MDNR most recently performed a fish survey in Parkers Lake in 2007. That survey identified northern pike and bluegill as the most abundant gamefish, but also noted largemouth bass as an important game fish in this lake. Northern pike abundance was at an all-time high for Parkers Lake in 2007. Bluegill abundance was high compared with similar lakes and was the highest bluegill abundance observed for Parkers Lake. Other sunfish species sampled during the 2007 survey include pumpkinseed, hybrid, and green sunfish. Black crappie and yellow bullhead were also present.

Due to the presence of mercury in fish tissue, fish consumption guidelines for Parkers Lake are in effect for bluegill sunfish, bullhead, northern pike, and white sucker.

2.10.1.3 Sweeney Lake and Twin Lake

The MDNR performed a fish survey on Sweeney Lake and Twin Lake in 1991 and an electrofishing assessment of fish on Sweeney Lake in 2013. The 1991 fish survey identified northern pike, largemouth bass, several species of sunfish (pumpkinseed, green, bluegill, and hybrid), crappie, carp, black and yellow bullhead, and white sucker in both lakes. Golden shiner was the only species identified in Twin Lake but not in Sweeney Lake. Yellow perch and white crappie were present in Sweeney Lake but not in Twin Lake.

In the 2013 MDNR survey of Sweeney Lake, 13 different species were sampled including bluegill, largemouth bass, black crappie, and yellow bullhead as the most abundant, respectively. Seven common carp were netted and measured. One buffalo (Ictiobus sp.) was observed but could not be netted. No gizzard shad were sampled in the 4 standard transects. However, areas of "rippling" water were observed off shore. Upon investigation, these "ripples" were found to be caused by schools of gizzard shad. The water was calm and the schools were observed in many areas throughout the lake. All gizzard shad that were shocked ranged from 3 to 5 inches. The MDNR reported that gizzard shad are not common in lakes of this type but they seemed relatively abundant in Sweeney Lake. Gizzard shad are documented as having an impact on game fish population through competition with other forage and game species at the larval stage, and by growing too large for largemouth bass and other sport fish to eat.

The BCWMC performed a trapnet fish survey of Sweeney and Twin Lakes in 2013. The 2013 survey sampled 11 fish species in Sweeney Lake and 10 species in Twin Lake. Bluegill sunfish and black crappie were the most abundant fish observed in Sweeney Lake. Gamefish present in Sweeney Lake included largemouth bass and northern pike. Bluegill sunfish and yellow bullhead were the most abundant fish observed in Twin Lake. The number of fish caught per net was generally lower in Twin Lake than in Sweeney Lake in 2013.

Due to the presence of mercury in fish tissue, fish consumption guidelines for Sweeney Lake are in effect for largemouth bass.

2.10.1.4 Wirth Lake

Wirth Lake has a public fishing pier. Wirth Lake is part of the MDNR's Fishing in the Neighborhood program. Fishing in the Neighborhood is aimed at increasing fishing opportunities, public awareness and environmental stewardship within the seven-county metro region. A winter aeration system is operated by the MPRB to maintain oxygen levels to maintain fish populations through the winter.

Wirth Lake was most recently surveyed by the MDNR during the summer of 2012. Bluegill abundance has increased since 2007 and considered average for this lake type. The bluegill population is dominated by smaller fish and bluegill growth rates were below average. Black crappie abundance has increased since 2007 and considered average for this lake type. Northern pike abundance was less than 2007, but still considered average for this lake type; the population is dominated by larger individuals. Yellow perch abundance has increased since 2007 and considered average for this lake type. Other fish species sampled in the 2012 survey include black bullhead, brown bullhead, green sunfish, largemouth bass, pumpkinseed, and yellow bullhead.

Walleye have been sampled in past surveys but none were captured in 2012 despite stocking adult walleye every five years (most recently in 2007 and 2012). Walleye fingerlings were stocked in 2011 and 2008.

Due to the presence of mercury in fish tissue, fish consumption guidelines for Wirth Lake are in effect for carp, crappie, northern pike, walleye and white sucker.

2.10.2 Aquatic Plant (Macrophyte) Monitoring

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 chemical water quality monitoring and include two surveys (typically June and August). Macrophyte monitoring includes the identification of key invasive macrophytes (e.g., curlyleaf pondweed and Eurasian watermilfoil) that are present in the waterbodies.

Curlyleaf pondweed is an invasive aquatic macrophyte that displaces native aquatic species. Because of the timing of its growth and die-back cycle, curlyleaf pondweed can be a significant source of phosphorus in a lake during the mid-summer months. Eurasian watermilfoil is another invasive macrophyte that can displace native species and significantly interfere with the recreational uses of a lake by forming dense mats at the water surface.

Eurasian watermilfoil has been identified in the following BCWMC waterbodies:

- Medicine Lake
- Parkers Lake
- Wirth Lake

Curlyleaf pondweed has been identified in the following BCWMC waterbodies:

- Crane Lake
- Lost Lake
- Medicine Lake
- Northwood Lake
- Sweeney Lake
- Twin Lake
- Westwood Lake

- Wirth Lake

Future macrophyte monitoring efforts planned by the BCWMC are described in the BCWMC monitoring plan (see Appendix A). Curlyleaf pondweed management actions in Medicine Lake are described in Section 2.6.4.5).

2.10.3 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.

2.11 Pollutant Sources

The sources of water pollution in the Bassett Creek 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 2-20. 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 2-4 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