APPENDIX B

Inventory and Condition Assessment

Appendix B INVENTORY AND CONDITION ASSESSMENT

B.1 INTRODUCTION

This section documents existing conditions and resource characteristics within the Shingle Creek and West Mississippi watersheds. The Second Generation Watershed Management Plan included a more detailed inventory of conditions that is not repeated here. A summary of that information is provided for context, with new or updated information presented in more detail. The Physical Environment subsection describes the watersheds' physical setting, geology and geomorphology, soils, and water resources. The Biological Environment subsection describes vegetation, biodiversity and native communities, unique features, and the biology of lakes and streams. The subsection Human Environment describes land use and growth patterns, recreational resources, and potential environmental hazards. The lakes, streams, and wetlands of the two watersheds are described in Appendix E as part of the Resource Management Plan for each resource.

B.2 WATERSHED PHYSICAL ENVIRONMENT

B.2.1 Location

The Shingle Creek watershed covers 44.5 square miles in east-central Hennepin County. There are nine municipalities with land in the watershed (Table B-1). The West Mississippi watershed covers 23 square miles in northeastern Hennepin County. There are five municipalities with land in the watershed (Table B-1).

Table B-1. Cities in the Shingle Creek and West Mississippi watersheds.

Shingle Creek Watershed		West Mississippi Watershed		Combined
Cities	**Area (sq mi)**	**Cities**	**Area (sq mi)**	**Area (sq mi)**
Brooklyn Center	5.89	Brooklyn Center	2.47	8.36
Brooklyn Park	11.15	Brooklyn Park	14.20	25.35
		Champlin	5.12	5.12
Crystal	3.92			3.92
Maple Grove	7.73	Maple Grove	0.82	8.55
Minneapolis	3.15			3.15
New Hope	3.32			3.32
Osseo	0.45	Osseo	0.33	0.78
Plymouth	6.56			6.56
Robbinsdale	2.39			2.39
Total	44.56		22.94	67.50

B.2.2 Topography and Drainage

The drainage pattern in the two watersheds is typical of a glaciated area comprised of moraines and outwash plains. The western part of the Shingle Creek watershed has varied topographical features. The eastern portion flattens out into a level outwash plain. The drainage system is composed of Shingle Creek, which is the major waterway, several tributaries, intermittent streams, and a few man-made ditches. Figure B-1 shows the major Shingle Creek watershed drainage features, including subwatershed boundaries, lakes, streams, and ditches.

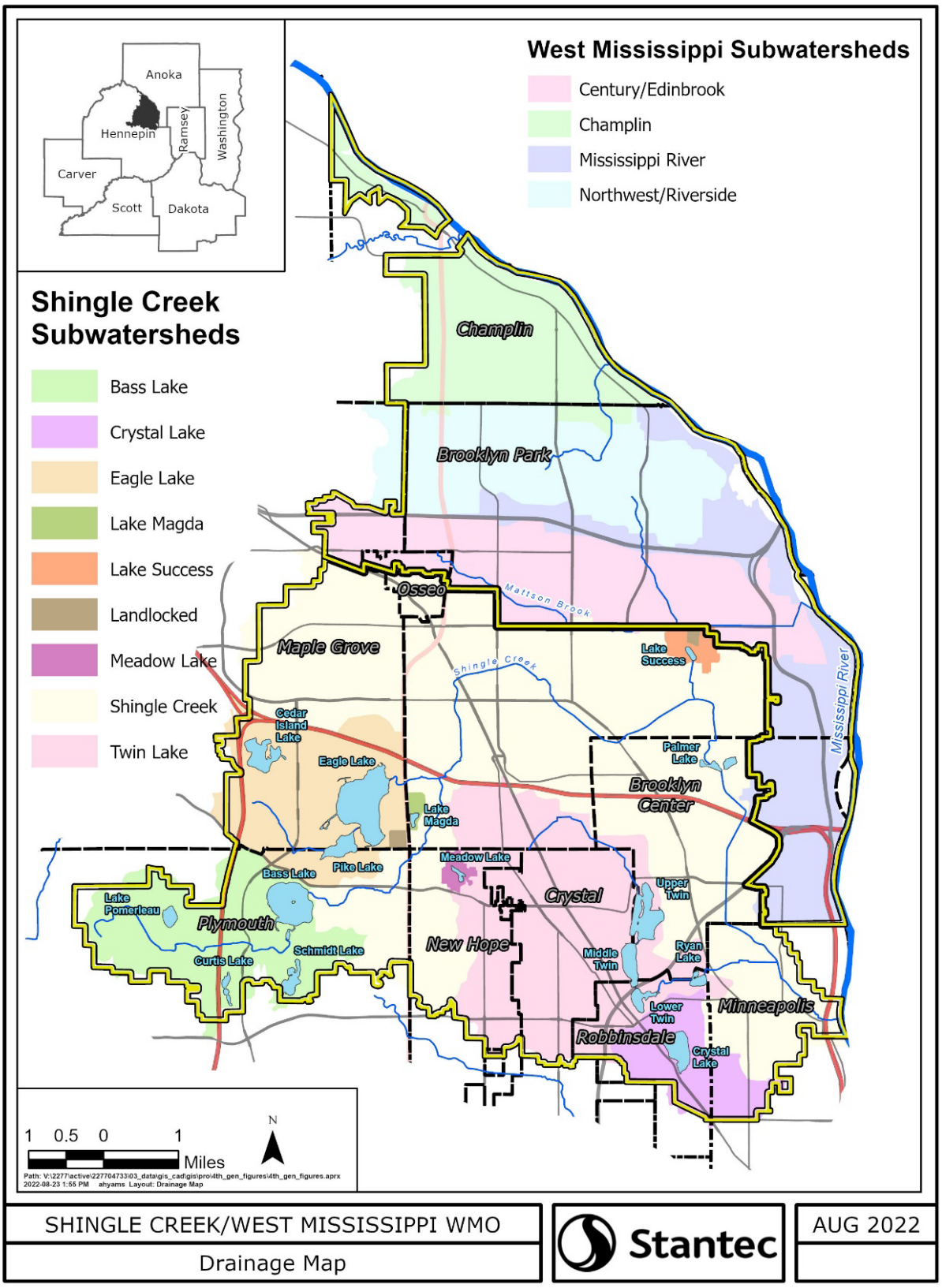

Figure B-1. Shingle Creek and West Mississippi watershed drainage systems.

Shingle Creek is formed at the junction of Bass Creek and Eagle Creek in Brooklyn Park, flows 11 miles and drops approximately 66 feet in elevation from its source to its confluence with the Mississippi River in Minneapolis. Palmer Lake is the only lake directly on Shingle Creek. Several tributaries discharge to Shingle Creek. Bass Creek and Eagle Creek drain most of the southwestern watershed before forming Shingle Creek. Twin Creek and Twin Lake drain the central watershed. Ryan Creek originates as the outlet of Lower Twin Lake, flows to and out of Ryan Lake, and then joins the main stem of Shingle Creek 1.2 miles upstream of the Mississippi River outlet. Crystal Lake does not have a natural outlet, but a pumping system discharges into storm sewer when the lake reaches a specific elevation.

The West Mississippi watershed is relatively flat with little relief. much of the watershed is within the Anoka Sandplain. There are only a few channels and no lakes in the watershed. The southern portion of the watershed is drained by the man-made Century/Edinbrook Channel. A few small streams, notably Oxbow Creek and Mattson Brook, are also present. Figure B-1 shows the major West Mississippi watershed drainage features, including subwatershed boundaries, lakes, streams, and drainage ditches. There are many small ditches and channels within the watersheds, some formerly private agricultural ditches and some public, such as highway ditches. These ditches are generally the smallest conveyance components and function intermittently. However, Shingle Creek between Xerxes Avenue in Brooklyn Park and 44th Avenue in Minneapolis was established as Hennepin County Ditch No. 13 in 1910 and remains under the administration of Hennepin County.

B.2.3 Climate

The climate is predominately continental. Sitting close to the middle of North America, the weather in the watershed can vary widely and rapidly. Both temperature and precipitation can change abruptly. Table B-2 shows the watershed's temperature normal, or averages, for the last 30 years.

Table B-2. Temperature normal in °F for the Shingle Creek and West Mississippi watersheds.

Hennepin County (1991-2020)													
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Annual**
Maximum	14.27	18.90	31.80	45.55	68.47	78.13	82.21	79.74	72.07	57.64	40.93	27.59	45.16
Minimum	6.02	10.12	22.74	35.15	47.45	57.77	62.29	59.92	51.67	38.74	25.39	12.80	35.84
Mean	14.27	18.90	31.80	45.55	57.96	67.96	72.26	69.84	61.88	48.19	33.16	20.19	45.16

Source: The Minnesota State Climatology Office and Minnesota Department of Natural Resources

In a normal year, around 32 inches of precipitation falls on the watershed. Table B-3 shows the watershed's precipitation normal. Winter snowfall averages about 52 inches, with a little less falling in the western areas. Snow generally stays on the ground from mid-December to early March. Snow and rainfall data for the watershed is obtained at weather stations in Minneapolis and New Hope.

Table B-3. Precipitation normal in inches for the Shingle Creek and West Mississippi watersheds.

Hennepin County (1991-2020)													
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Annual**
Precipitation	0.73	0.78	1.55	2.92	4.19	4.63	4.13	4.33	3.33	2.69	1.54	1.04	31.86
Snow	10.69	9.85	8.74	4.68	0.04	0.00	0.00	0.00	0.00	1.56	7.09	11.81	52.48

Source: The Minnesota State Climatology Office, Minnesota Department of Natural Resources and National Centers for Environmental Information (NOAA)

B.2.4 Soils

Most of the watersheds' area is composed of well-drained soils. Texture is generally sandy or loamy with scattered organic or marsh soils areas. These soils have low to moderate susceptibility to erosion by water. Wind erodibility is also generally low to moderate. Highly to moderately permeable soils dominate the watershed, as indicated by the large areas covered by soil hydrologic groups A and B. Soil hydrologic group characteristics are detailed Table B-4. A map of soil groups in the watersheds is provided in the Third Generation Plan Inventory and Condition Assessment.

Soils data are useful in describing the general characteristics of the major soil associations for summary purposes. The Hennepin County Soil Survey should be consulted for site-specific information.

Table B-4. Soil characteristics and infiltration rates by Hydrologic Soils Group (HSG).

HSG	Infiltration Rate/Hour	Texture	Unifies Soil Classification System
A	1.63”	Gravel, sandy gravel, silty gravels, gravelly sands, sand	GW – Well-graded gravels, fine to coarse gravel GP – Poorly graded gravel GM – Silty gravel SW – Well-graded sand, fine to coarse sand
	0.8”	Sand, loamy sand, sandy loam	SP – Poorly graded sand
B	0.45”	Silty sands	SM – Silty sand
	0.3”	Loam, silt loam	MH – Elastic silt
C	0.2”	Sandy clay, loam, silts	ML – Silt
D	0.06”	Clay loam, silty clay, loam, sandy clay, silty clay or clay	GC – Clayey gravel SC – Clayey sand CL – Lean clay OL – Organic silt CH – Fat clay OH – Organic clay, organic silt

Source: Minnesota Stormwater Manual

B.2.5 Geology and Geomorphology

The Second Generation Watershed Management Plan detailed the geology and geomorphology of the watersheds, and the reader is referred to that document for more detail.

Two major geomorphic regions are found in the watersheds: the Mississippi Valley Outwash area and the Emmons-Faribault moraine area. The outwash area is predominant in the eastern half of the watersheds, while the western portion is within the Emmons-Faribault moraine. The surficial geology in the west ranges from areas of lacustrine sand and silt and clay and silt in the south to the sandy and loamy till in the north that characterizes northwestern Hennepin County. Significant deposits of sand and gravel are apparent in the gravel mining area of Maple Grove. The bedrock underlying the watersheds is primarily St. Peter Sandstone in the south and St. Lawrence and Franconia Formations in the north, with Prairie du Chien and Jordan Sandstone exposed in a narrow band through the central part of the watersheds. Significant Jordan outcroppings occur in northern Brooklyn Park, Champlin, and southeastern Maple Grove.

B.3 WATERSHED BIOLOGICAL ENVIRONMENT

B.3.1 Vegetation

Prior to settlement by the Europeans in the mid-19th century, vegetation in the watersheds was oak savannah (oak openings and barrens) and prairie, punctuated with small areas of maple-basswood forest (big woods), and wet prairie. Since the area has been used for urban uses and agriculture only a few remnants of the presettlement vegetation remain. The Minnesota County Biological Survey (MCBS) has identified those locations in the watershed with intact native plant communities, and those with biodiversity significance (see the Third Generation Management Plan Inventory and Condition Assessment for a map).

Rare, Threatened, and Endangered Species. The DNR Natural Heritage and Nongame Research Program maintains a database of observations of rare plant and animal species compiled from historical records from museum collections and published information supplemented with data from years of field

work. Table B-5 shows the rare plant species listed in that database as being observed recently or at some time in the past within the watershed.

Table B-5. Rare plant species observed in the SCWM watersheds.

Scientific Name	Name	Last Observed	Federal Status	State Status
Decodon verticillatus	Water willow	1946/1953	None	Special concern
Hiercaium longipilum	Long-bearded Hawkweed	1998/2000	None	Tracked

Note: Current as of 2012. Not based on a comprehensive survey of the state or watershed. Absence of observation does not mean other species are not present. Multiple years under "Last Observed" indicates multiple occurrences.
Source: Natural Heritage and Nongame Research Program of the Division of Ecological and Water Resources, Minnesota Department of Natural Resources (DNR).

The MCBS identifies native plant communities, which are a group of native plants that interact with each other and the surrounding environment in ways not greatly altered by humans or by introduced plant or animal species. Table B-6 indicates the native plant community types that have been identified in the watershed.

Table B-6. Native plant community types observed in the SCWM watersheds.

Community Type	Last Observed
Floodplain forest	1969
Red oak-sugar maple-basswood – (bitternut hickory) forest	1995
Southern mesic maple-basswood forest	1995

Note: Current as of 2012. Not based on a comprehensive survey of the state or watershed. Absence of observation does not mean other species or community types are not present.
Source: Natural Heritage and Nongame Research Program of the Division of Ecological and Water Resources, Minnesota Department of Natural Resources (DNR).

B.3.2 Fish and Wildlife

Lakes. Fishing is possible on many of the lakes in the Shingle Creek watershed, with most having a public access and several a DNR fishing pier. Ryan Lake and Webber Pond are included in the DNR's Fishing in the Neighborhood (FIN) program, which provides education and programming to encourage and support youth fishing. Several of the lakes, including the FIN lakes, are regularly stocked with fish by the DNR (Table 5-7.) The Shingle Creek Commission has not conducted any fish surveys on the lakes in the watershed. The DNR Lakefinder website may be consulted to find the latest fish survey information for each lake. The TMDL reports for the lakes that are impaired waters also include fish community information where available.

Table B-7. DNR fish stocking in lakes in the SCWM watersheds, 2011-2021.

Lake	Year(s) Stocked	Fish Stocked
Bass	2007	Walleye
Crystal	2017	Tiger Muskellunge
Eagle	2012, 2013, 2015 – 2019 & 2021	Walleye & Muskellunge
Ryan	2013, 2014, 2017 – 2019 & 2021	Yellow Perch, White Crappie, Pumpkinseed Sunfish, Norther Pike, Largemouth Bass, Bluegill Sunfish, Black Crappie, Walleye
Schmidt	2012 – 2016	Largemouth Bass, Smallmouth Bass, Hybrid Sunfish, Bluegill Sunfish
Webber	2012	Bluegill Sunfish

Source: Minnesota DNR.

Streams. Shingle Creek and its tributary Bass Creek are listed as Impaired Waters for biotic integrity. Specifically, Shingle Creek is listed as having an impaired macroinvertebrate community and Bass Creek as having an impaired fish community. A TMDL has been completed and approved for these impairments. Minnesota uses an Index of Biotic Integrity (IBI) to assess the fish and macroinvertebrate

communities in streams. The IBI evaluates and integrates multiple attributes of the aquatic community, or "metrics," to evaluate a complex biological system. Each metric is based on a structural (e.g., species composition) or functional (e.g., feeding habits) aspect of the aquatic community that changes in a predictable way in response to human disturbance. Fish and macroinvertebrate IBIs are expressed as a score that ranges from 0-100, with 100 being the best score possible. A stream's biota is considered to be impaired when the IBI falls below the threshold established for that category of stream. Table B-8 shows the Index of Biotic Integrity scores used to evaluate Shingle and Bass Creeks for biotic impairment.

Table B-8. Index of Biotic Integrity listing criteria and relevant Shingle and Bass Creek data.

Stream and IBI	Impairment Threshold	IBI Score
Shingle Creek – fish	46	0
Shingle Creek – macroinvertebrates	54	25
Bass Creek – fish	46	4
Bass Creek – macroinvertebrates	54	20

Note: IBI data for Shingle Creek – fish are 2010 Wenck collections and macroinvertebrates are from 2020 Wenck collections, IBI data for Bass Creek – fish are from 2010 MPCA collections and macroinvertebrates are from 2020 MPCA.

A Stressor Identification study completed for the TMDL evaluated the potential causes of the impaired biotic integrity of both streams. Potential candidate causes of the impairments that were ruled out include: temperature, pH, nutrients, turbidity/TSS, and toxic chemicals. Five stressors that are potential candidate causes were examined in more detail: low dissolved oxygen; altered habitat; loss of connectedness; altered hydrology; and ionic strength, specifically chloride. The evidence for altered hydrology is strongest followed closely by low dissolved oxygen and lack of habitat. While the loss of connectedness and ionic strength are plausible stressors and are likely contributing to the impairment, there is less direct evidence of their role. The TMDL Implementation Plan set forth a number of potential actions that could be taken to address these stressors and improve biotic integrity in the streams. The reader is directed to the Shingle and Bass Creeks Impaired Biota and Dissolved Oxygen TMDL for more information about the impairment and for actual fish and macroinvertebrate data.

Rare, Threatened, and Endangered Species. The DNR Natural Heritage and Nongame Research Program maintains a database of observations of rare plant and animal species compiled from historical records from museum collections and published information supplemented with data 2-10 Shingle Creek and West Mississippi Watershed Management Commissions Third Generation Watershed Management Plan April 2013 from years of field work. Table B-9 shows the rare fish and wildlife species listed in that database as being observed recently or at some time in the past within the two watersheds.

Table B-9. Rare animal species observed in the SCWM watersheds.

Scientific Name	Name	Last Observed	Federal Status	State Status
Emydoidea blandingii	Blanding's Turtle	1985/1988/1994	None	Threatened
Etheostoma miroperca	Least darter	1931/2006	None	Special Concern
Falco peregrinus	Peregrine falcon	2011	None	Special Concern
Haliaeetus leucocephalus	Bald eagle	2001/2005	None	Delisted
Notropis anogenus	Pugnose shiner	2006	None	Threatened
Ligumia recta	Black sandshell	1998	None	Special Concern
Colonial waterbird nesting site		1998/2001/2003/2010		Special Concern

Note: Current as of 2012. Not based on a comprehensive survey of the state or the watershed. Absence of observation does not mean other species are not present. Multiple years under "Last Observed" indicates multiple occurrences.
Source: Natural Heritage and Nongame Research Program of the Division of Ecological and Water Resources, Minnesota Department of Natural Resources (DNR).

Aquatic Invasive Species. Six lakes in the watershed have been determined by the Department of Natural Resources (DNR) to be infested with Eurasian watermilfoil, an invasive exotic plant species: Bass, Eagle, Schmidt, and Upper, Middle, and Lower Twin.

B.3.3 Unique Features and Scenic Areas

The Mississippi River forms the eastern boundary of the watersheds and is the watersheds' most prominent unique and scenic feature. Along the banks are bluffs, flats, parks, private homes, and views of islands. The segment within the watersheds is part of the Mississippi National River and Recreation Area (MNRAA) and the Mississippi River Critical Area. The Coon Rapids Dam is a major feature; adjacent to it is one of the two regional parks that abut substantial stretches of the river: the Coon Rapids Dam Regional Park in Brooklyn Park, under the jurisdiction of Three Rivers Park District. North Mississippi Regional Park in Brooklyn Center and Minneapolis is about four miles downstream and is under the jurisdiction of Three Rivers Park District and the Minneapolis Park Board.

Water resources of interest are: the Palmer Lake Basin and adjacent wetland areas; the Eagle/Pike Lakes fishery; and multi-purpose Twin Lake. Eagle and Pike Lakes in the Shingle Creek watershed have been designated Priority Lakes by the Metropolitan Council. Priority Lakes are those that have been identified by the Metropolitan Council as being of highest priority for the development of management plans and for improvement. A Priority Lake impacted by a project that requires an EAW must be evaluated for nutrient budget impact.

Other regional resources in the watersheds are Eagle Lake Regional Park and several regional trail systems, including the Minneapolis Grand Rounds, the Shingle Creek Regional Trail and the Rush Creek Regional Trail are located all or in part in the watersheds

B.4 WATERSHED HUMAN ENVIRONMENT

Dakota and Anishinaabe native tribes of the Woodland Period were the first settlers in the Shingle Creek and West Mississippi watersheds. White settlers began arriving in 1850-1851, and by the time the Public Land Survey was conducted in the area a few years later, much of the land was already claimed. Much of the southern part of the watersheds developed as truck farms for growing vegetables and flowers. The northern, sandier soils were perfect for growing potatoes. The western part of the watersheds was mainly row crops and pasturage. Osseo Road, now called Brooklyn Boulevard, and CR 81, now called Bottineau Boulevard, were built on former Indian trails and served as transportation corridors between the trade centers of Robbinsdale and Osseo and the markets of Minneapolis.
By the turn of the 20th century, pockets of development pushed out from Minneapolis, and many of the settled areas began incorporating as villages and later cities. As the post-World War II housing boom began farmland was subdivided and the area became almost completely suburbanized.

B.4.1 Current Land Use

The predominant land use in the watersheds is single family residential (Table B-10). Commercial and industrial land uses are concentrated in the Shingle Creek watershed, although in the past decade West Mississippi along the TH 169 and TH 610 corridors has experienced non-residential development. The entire area except a small portion of the southwest corner of the Shingle Creek watershed in Plymouth is within the existing Metropolitan Urban Service Area (MUSA). Of that area of Plymouth in the Shingle Creek watershed currently outside the MUSA, most lies within the MUSA 2020 expansion area.

Since the publication of the Third Generation Plan, single family residential land uses in the watersheds has been the largest change (increase) of land use. Undeveloped land in both watersheds has been reduced.

Table B-10. 2020 land use in the Shingle Creek and West Mississippi watersheds.

Land Use	Shingle Creek		West Mississippi		Total	
	Area (acres)	%	Area (acres)	%	Area (acres)	%
Single Family Residential	13,334	47%	8,447.2	53%	21,782.2	49%
Parks and Open Space	2,778.3	10%	1,839.3	11%	4,17.9	10%
Golf course	179.9	0%	180.8	1%	360.7	1%
Undeveloped	1,561	6%	981.1	6%	2,542.3	6%
Multi-Family Residential	968	3%	253.0	2%	1,221.6	3%
Industrial	2,727.8	10%	667.9	4%	3,395.7	8%
Commercial	1,602.8	6%	421.5	3%	2,024.2	5%
Highway	1,230.5	4%	973.8	6%	2,204.2	5%
Institutional	1,502.7	5%	778.6	5%	2,281.2.	5%
Water	1,317.5	5%	687.6	4%	2,005.1	5%
Agriculture	4.8	0%	644.4	4%	669.2	1%
Extractive	502.9	2%	0.0	0%	502.9	1%
Airport	383.9	1%	0.0	0%	383.9	1%
Railway	87.2	0%	5.5	0%	92.7	0%
Office	453	2%	174.8	1%	627.8	1%
Total	28,637		16,075.5		44,712.5	

Source: Metropolitan Council, 2020.

B.4.2 Population and Density

There has been significant development in the northern and western parts of the watersheds since the Second Generation Plan was completed. Population grew from the approximately 196,000 persons counted in the 2000 Census to an estimated 206,000 persons counted in the 2010 Census. Racial and ethnicity makeup of the watershed as of 2020 is as follows:

Table B-11. 2020 Census population in the Shingle Creek and West Mississippi watersheds by ethnicity.

Brooklyn Center	
Race/Ethnicity	**Percent of Total Population**
Asian	18.9%
Black	27.6%
American Indian	0.7%
White	32.9%
Hispanic	13.8%
Native Hawaiian and Other Pacific Islander	0.0%
More the one race	5.5%
Other	0.5%
Brooklyn Park	
Race/Ethnicity	**Percent of Total Population**
Asian	18.8%
Black	29.2%
American Indian	0.4%
White	38.8%

Hispanic	7.6%
Native Hawaiian and Other Pacific Islander	0.0%
More the one race	4.7%
Other	0.5%
Champlin	
Race/Ethnicity	**Percent of Total Population**
Asian	4.8%
Black	8.1%
American Indian	0.4%
White	78.1%
Hispanic	3.5%
Native Hawaiian and Other Pacific Islander	0.0%
More the one race	4.6%
Other	0.5%
Crystal	
Race/Ethnicity	**Percent of Total Population**
Asian	4.4%
Black	13.8%
American Indian	0.4%
White	66.3%
Hispanic	8.7%
Native Hawaiian and Other Pacific Islander	0.0%
More the one race	5.7%
Other	0.7%
Maple Grove	
Race/Ethnicity	**Percent of Total Population**
Asian	7.6%
Black	6.4%
American Indian	0.3%
White	77.3%
Hispanic	3.5%
Native Hawaiian and Other Pacific Islander	0.0%
More the one race	4.5%
Other	0.5%
Minneapolis	
Race/Ethnicity	**Percent of Total Population**
Asian	5.8%
Black	18.9%
American Indian	1.2%
White	58.0%
Hispanic	10.4%
Native Hawaiian and Other Pacific Islander	0.0%
More the one race	5.2%
Other	0.5%

New Hope	
Race/Ethnicity	**Percent of Total Population**
Asian	4.3%
Black	21.9%
American Indian	0.5%
White	59.9%
Hispanic	7.6%
Native Hawaiian and Other Pacific Islander	0%
More the one race	5.5%
Other	0.5%
Osseo	
Race/Ethnicity	**Percent of Total Population**
Asian	2.0%
Black	6.5%
American Indian	0.3%
White	79.4%
Hispanic	5.0%
Native Hawaiian and Other Pacific Islander	0.0%
More the one race	6.6%
Other	0.2%
Plymouth	
Race/Ethnicity	**Percent of Total Population**
Asian	11.4%
Black	6.3%
American Indian	0.2%
White	73.7%
Hispanic	3.9%
Native Hawaiian and Other Pacific Islander	0.0%
More the one race	4.1%
Other	0.4%
Robbinsdale	
Race/Ethnicity	**Percent of Total Population**
Asian	3.0%
Black	15.3%
American Indian	0.5%
White	67.0%
Hispanic	6.6%
Native Hawaiian and Other Pacific Islander	0.0%
More the one race	6.7%
Other	0.8%

Source: Metropolitan Council.

Figure B-2 shows 2020 population and development density. The central and southeastern part of the watersheds is developed, with density increasing to the southeast. Minneapolis within the watershed is

very dense, as are portions of Robbinsdale, Brooklyn Center, and Brooklyn Park. Significant areas of commercial/industrial development cluster around major highways: TH 100, TH 169, CSAH 81, I-94. Completion of TH 610 through northern Brooklyn Park is expected to continue to attract dense mixed-use development, especially at its intersection with TH 169.

Only three significant undeveloped or lightly developed areas of the watershed remain: Brooklyn Park north of 85th Avenue, now quickly developing; in Maple Grove, the area around and including part of the gravel pits, being developed as the large Arbor Lakes multi-use development; and some remaining tracts in northwestern Plymouth.

B.4.3 Future Land Use

Areas of projected urban growth are shown in Figure B-3. This data was compiled by the Metropolitan Council from cities' most recent Comprehensive Plans, and represents cities' expected 2020 land use. Most of the currently undeveloped or lightly developed areas of Champlin, northern Brooklyn Park, southeastern Maple Grove, and northwestern Plymouth are planned for development. Growth is expected to be a mix of development at different densities, and to include residential, commercial, and industrial uses.

B.4.4 Potential Environmental Hazards

Groundwater connections, hazardous waste, leaking above- and below-ground storage tanks, and feedlots can be potential sources of surface and groundwater contamination. The MPCA maintains a current on-line mapping tool with information about air quality, hazardous waste, remediation, solid waste, tanks and leaks, and water quality. This tool is available at http://www.pca.state.mn.us/udgx680. There are no registered feedlots in the watersheds.

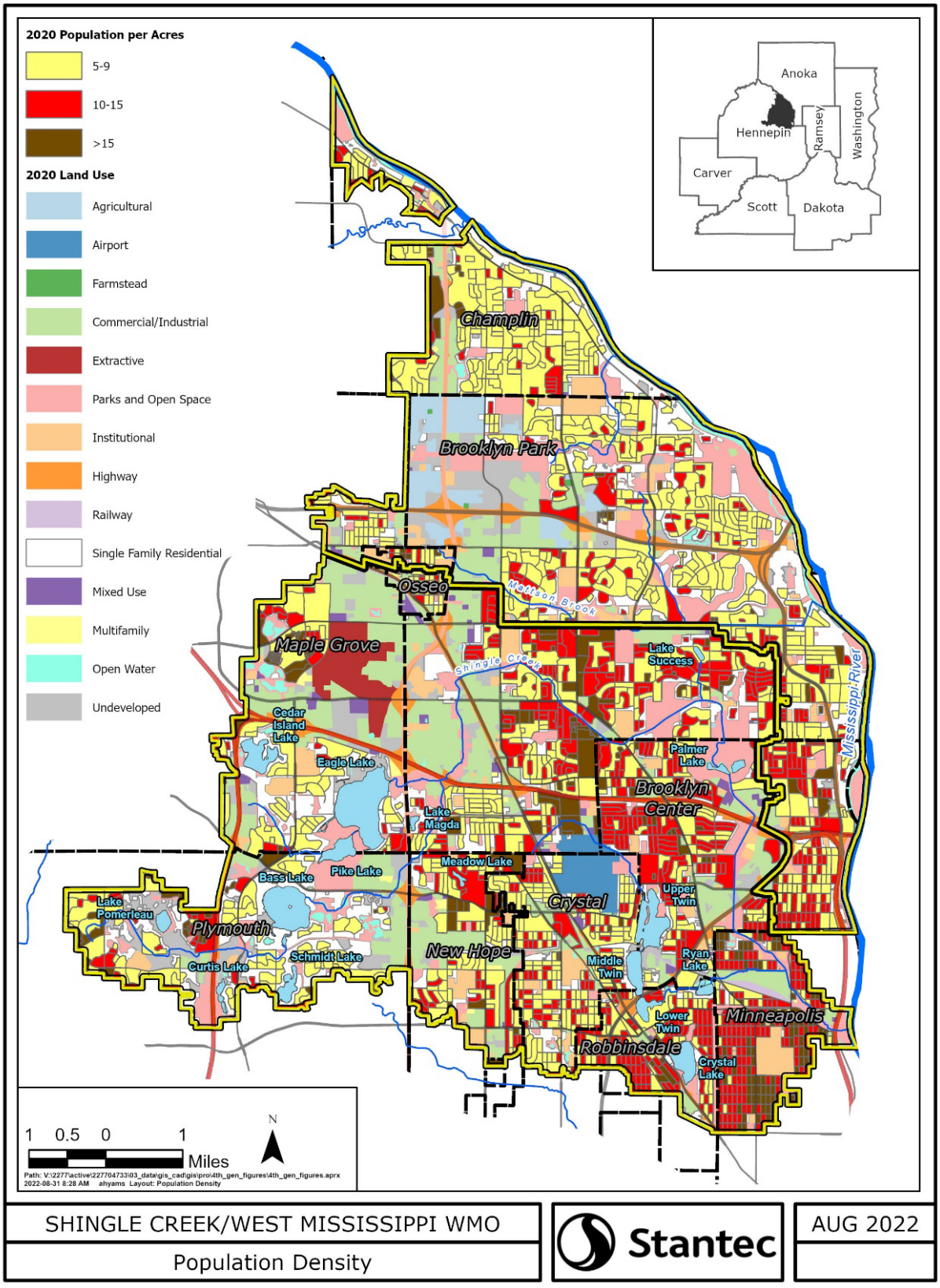

Figure B-2. Population density in the Shingle Creek and West Mississippi Watersheds

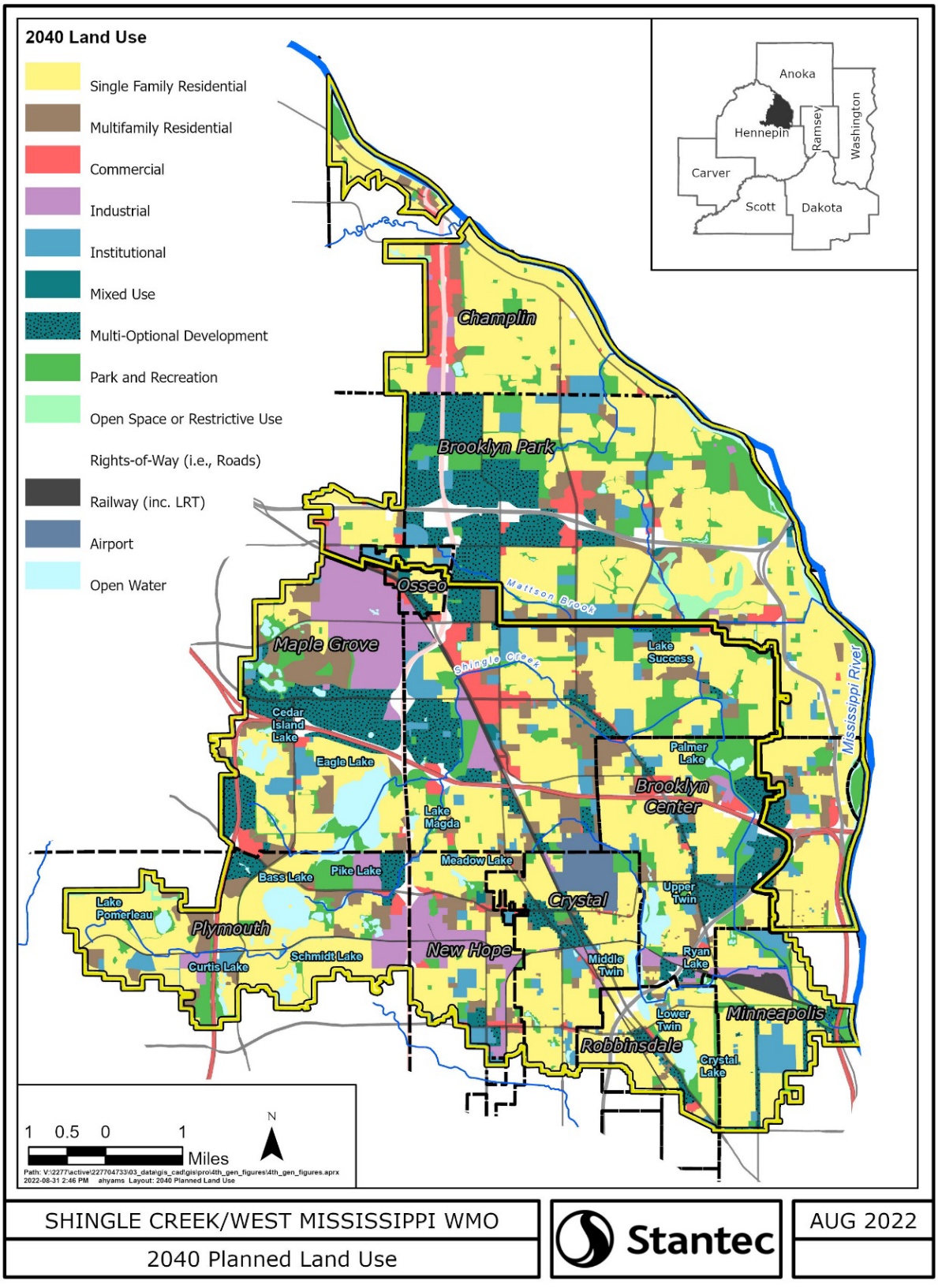

Figure B-3. Future 2040 land use in the Shingle Creek and West Mississippi Watersheds.

B.4.5 Vulnerability

Populations in both Watersheds are diverse, incorporating many different racial and socioeconomic backgrounds. Hennepin County did an analysis of vulnerable communities to environmental injustice in Hennepin County based on a composite score of 14 variables in six categories including:

- Asthma hospitalization rates
- COPD hospitalization rates
- Households with no vehicle
- Limited English language proficiency
- Median household income
- No high school degree
- People of color
- Population 5 and under
- Population below 185% poverty threshold
- Population density
- Population over 65
- Population with any disability
- Renter housing units
- Unemployment rates

Results are shown in Figure B-4. About 2/3 of the land area in Shingle Creek and parts of West Mississippi are home to communities that are the most vulnerable to environmental injustice based on the factors listed above.

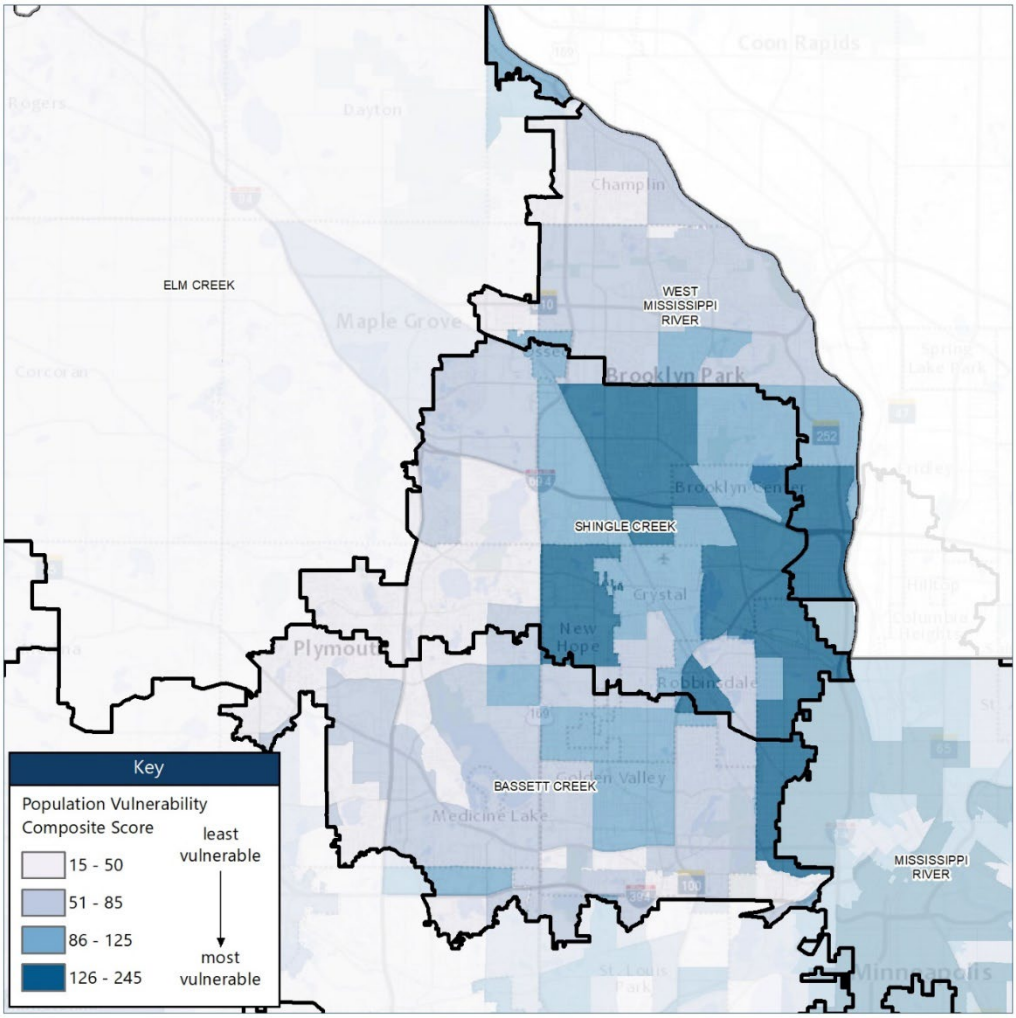

Figure B-4. Vulnerable communities in the Watersheds based on a composite score.

B.5 WATERSHED WATER RESOURCES

B.5.1 Lakes

There are sixteen lakes in Shingle Creek watershed, and none in the West Mississippi watershed. Two of those lakes – Lake Success, and Curtis Lake – are classified by the DNR as wetlands. The Minnesota DNR lake identification number and lake morphometry are show in Table B-12.

Table B-12. Characteristics of lakes in the Shingle Creek watershed.

Lake	DNR ID#	Surface Area (ac)	Volume (ac-ft)	Max Depth (ft)	Mean Depth (ft)
Bass Lake	27-0098	175	1,760	31	10.1
Cedar Island Lake	27-0119	79	285	7	3.6
Crystal Lake	27-0034	89	937	39	10
Curtis Lake*	27-0593W	31	--	--	--
Eagle Lake	27-0111-01	287	2,991	34	10.4
Lake Magda	27-0065	10	22 (est)	6 (est)	2 (est)
Meadow Lake	27-0057	12	17	4	1.4
Palmer Lake	27-0059	30	--	4	2
Pike Lake	27-0111-02	60	514	22	8.6
Pomerleau Lake	27-0100	30	329	26	10.9
Ryan Lake	27-0058	15	235	36	15
Schmidt Lake	27-0102	37	202	27	5.5
Success Lake*	27-0634W	8	--	--	--
Lower Twin Lake	27-0042-03	30	208	21	6.9
Middle Twin Lake	27-0042-02	54	786	42	14.5
Upper Twin Lake	27-0042-01	118	448	10	3.8

Sources: Minnesota Department of Natural Resources, Minnesota Pollution Control Agency
*Classified by the DNR as Type 4 wetlands.

Impaired Lakes. Ten of the lakes in the Shingle Creek watershed have been designated by the MPCA and EPA as Impaired Waters and are listed on the State's 2022 Impaired Waters List for not meeting state nutrient concentration standards. TMDLs and Implementation Plans have been completed for all these lakes (Table B-13). Water quality data and other information about the lakes are presented in Appendix E.

Table B-13. Nutrient impaired lakes in the Shingle Creek watershed.

Lake	EPA Approval	Implementation Plan Approval
Upper and Middle Twin	November 9, 2007	November 13, 2007
Crystal	July 7, 2009	July 7, 2009
Pomerleau and Bass	September 25, 2009	December 3, 2009
Meadow	March 23, 2010	June 14, 2010
Cedar Island, Pike and Eagle	April 14, 2010	May 18, 2010
Magda	September 30, 2010	October 1, 2010

Source: Minnesota's 2022 Impaired Waters List, Minnesota Pollution Control Agency.

In addition, five lakes have been listed as Impaired Waters for other contaminants for which the MPCA has completed or will complete a regional or statewide TMDL (Table B-14).

Table B-14. Other lake impairments in the Shingle Creek watershed.

Lake	Pollutant or Stressor	Year TMDL Approved
Upper, Lower and Middle Twin	Mercury in fish tissue	2007
Upper, Lower and Middle Twin	PCB in fish tissue	Not Started
Upper, Lower and Middle Twin	PFOS in fish tissue	Not Started
Eagle and Pike	Mercury in fish tissue	2007

Source: Minnesota's 2022 Impaired Waters List, Minnesota Pollution Control Agency.

B.5.2 Streams

Shingle Creek. The Shingle Creek watershed is named for the primary stream draining the 44 square mile watershed. Shingle Creek is formed at the confluence of Eagle and Bass Creeks in Brooklyn Park. It flows 11 miles, discharging to the Mississippi River just upstream of the Camden Bridge in Minneapolis. Other streams include Pike Creek in Maple Grove and Plymouth; Twin Creek in Brooklyn Park; and Ryan Creek in Robbinsdale and Minneapolis. Lower Bass Creek flows from the outlet weir of Boulder Ridge Pond to the confluence with Eagle Creek; Upper Bass Creek flows from its headwaters near Vicksburg Lane in Plymouth to Bass Lake. Table B-15 details stream characteristics of the major streams in the watershed.

West Mississippi. There are only a few natural streams in West Mississippi, and they are typically seasonal and intermittent, including Oxbow Creek in Champlin and Mattson Brook in Brooklyn Park. Edinbrook/Century Channel drains a wide area of central Brooklyn Park. It is mostly an excavated channel, although some segments are aligned with historic intermittent/ seasonal channels. It discharges into Mattson Brook near West River Road. **Table B-15** below details the major streams in the West Mississippi watershed.

Table B-15. Stream characteristics in the Shingle Creek and West Mississippi watersheds.

Shingle Creek Watershed		West Mississippi Watershed	
Stream	**Length (mi)**	**Stream**	**Length (mi)**
Shingle Creek	11.15	Edinbrook/Century	5.42
Lower Bass Creek	2.37	Mattson Brook	0.35
Upper Bass Creek	3.54	Oxbow Creek	0.60
Eagle Creek	0.55		
Pike Creek	0.82		
Twin Creek	1.54		
Ryan Creek*	0.77		

*Excludes segment confined to storm sewer

Impaired Streams. Shingle Creek and Bass Creek have been designated by the Minnesota Pollution Control Agency (MPCA) and Environmental Protection Agency (EPA) as Impaired Waters, and are listed on the State's 2022 Impaired Waters List for not meeting water quality standards as shown in Table B-16. The biotic impairments are discussed in Section B.3.2 above. TMDLs and Implementation Plans have been completed for all but the Bass Creek chloride impairment. Regionally, both Shingle Creek and West Mississippi discharge into the Mississippi River; the reach between the Rum River and St. Anthony Falls is listed as impaired for fecal coliform and a regional TMDL has been completed by the MPCA.

Table B-16. Impaired streams in the Shingle Creek watershed.

TMDL	AUID	EPA Approval	Implementation Plan Approval
Shingle Creek Dissolved Oxygen	07010206-506	November 4, 2011	January 30, 2012
Shingle Creek *E. coli*	07010206-506	2014	
Shingle and Bass Creeks Chloride	07010206-506, 07010206-784	February 12, 2007 (Shingle) 2016 (Bass)	March 5, 2007 (Shingle)
Shingle and Bass Creek Benthic Macroinvertebrates Bioassessments	07010206-506, 07010206-784	2011	2011
Shingle and Bass Creek Fish Bioassessments	07010206-784	2011	2011
Mississippi River Fecal Coliform	07010206-805		

Source: Minnesota's 2022 Impaired Waters List, Minnesota Pollution Control Agency.

Since-publication of the Third Generation Plan, the South Metro Mississippi turbidity TMDL (2015) and the Lake Pepin and Mississippi River Eutrophication TMDL (2021) have been completed. The Lake Pepin TMDL calls for a 20% reduction in TP loads in the Twin Cities Metro upstream of Lock & Dam #1 in St. Paul. The South Metro Mississippi TMDL proposed a 20% reduction in sediment from non-point sources in the Mississippi River basin.

Stream Conditions. Shingle Creek and Bass Creek are routinely monitored. Continuous flow monitoring and water quality data is collected at two locations on Shingle Creek. Station SC-0, also referred to as the outlet monitoring site, is located upstream of the 45th Avenue crossing in Minneapolis. The SC-3 monitoring station is located downstream of Brooklyn Boulevard in Brooklyn Park. SC-0 collects drainage from about 41 square miles, or approximately 92% of the Shingle Creek watershed. The SC-3 drainage area covers about 17 square miles, or about 39% of the watershed. For a number of years the upper watershed site was located just upstream of Zane Avenue and numbered SC-2, but in 2007 it was moved upstream and renumbered SC-3. Bass Creek is monitored at BCP in Bass Creek Park in New Hope. BCP drains approximately 8 square miles, or approximately 18% of the watershed.

There is also a long-term USGS monitoring station on Shingle Creek at Queen Avenue near the border of Minneapolis and Brooklyn Center. This site is located upstream of SC-0 and drains approximately 31 square miles (70% of the watershed). The Shingle Creek WMC and USGS collected continuous flow and storm event samples at this location from 1996 through 1999. The USGS resumed monitoring continuous flow at this site in 2001 and then began monitoring continuous conductivity at this site year around beginning in 2004. Real-time data is available through the USGS website. (https://waterdata.usgs.gov/monitoring-location/05288705/#parameterCode=00065&period=P7D)

Flow in Shingle Creek is shown in Table B-17. The average water yield from the watershed over the past nine years is 6.7 inches, which is within the range of 4-7 inches per year typically seen in the urbanized part of the Twin Cities Metro Area.

Water quality in Shingle Creek is typical of an urban stream in the Twin Cities and is dominated by runoff from impervious surfaces. While state water quality standards are based on pollutant concentrations, annual loads are also helpful for assessing potential impacts to downstream water resources. Table B-18 and Table B-19 present 2014 to 2021 pollutant loads for each station. Loads are typically higher in years with more storm events and higher annual runoff volumes.

Table B-17. Shingle Creek flow estimates, 2013-2021.

Year	Precipitation (in)	BCP Runoff		SC-3 Runoff		USGS Runoff		SC-0 Runoff	
		Acre-feet	Inches	Acre-feet	Inches	Acre-feet	Inches	Acre-feet	Inches
2013	35.2	3,744	8.6	7,033	6.2	9,744	5.8	9,916	4.5
2014	36.6	6,837	15.7	11,735	10.4	13,576	8.1	17,511	7.9
2015	25.8	1,927	4.4	5,158	4.6	8,639	5.2	8,629	3.9
2016	42.9	4,107	9.5	17,247	15.3	16,637	9.9	17,007	7.7
2017	36.1	5,537	12.8	13,130	11.6	14,531	8.7	16,150	7.3
2018	36.7	2,754	6.3	7,015	6.2	10,448	6.2	9,886	4.5
2019	45.8	6,754	15.6	19,594	17.4	23,528	14.1	24,764	11.2
2020	26.4	2,562	5.9	6,620	5.9	9,087	5.4	14,340	6.5
2021	26.0	1,565	3.6	3,617	3.2	4,976	3.0	8,482	3.8
Average	33.2	3,976	9.9	10,128	9.7	12,352	7.9	14,076	6.7

Table B-18. SC-0 historic pollutant loads.

Parameter	2014	2015	2016	2017	2018	2019	2020	2021
Flow (acre/feet)								
TP								
OP								

TSS								
VSS								
Nitrate								
TKN								

Table B-19. SC-3 historic pollutant loads.

Parameter	2014	2015	2016	2017	2018	2019	2020	2021
Flow								
TP								
OP								
TSS								
VSS								
Nitrate								
TKN								

Figure B-5 shows historic monitored Total Phosphorus concentrations in Shingle Creek. Average concentrations are on the low end of those found in typical urban streams, although concentrations can be high during rain wash-off events.

Figure B-5. Total phosphorus in Shingle Creek, May to September, 2006-2019.

Figure B-6 shows total suspended solids (TSS) data collected since 1996. Higher than ecoregion typical values could be a result of streambank erosion, however the Shingle Creek Corridor Study concluded that both Shingle and Bass Creeks were generally stable and the found only a few locations of evident aggradation or excess embeddedness, or areas with a silty streambed. Most of those sites were downstream of storm sewer outfalls or in low- velocity areas. The likely source of higher than typical TSS is fine sediments conveyed in stormwater runoff from developed areas.

Figure B-7 shows dissolved oxygen data for Shingle Creek at the stations monitored for the dissolved oxygen TMDL. The state standard is a minimum DO concentration of 5 µg/L, and a number of readings are below that threshold. The determination of impairment is based on data collected before 9 AM as that is the period when DO is typically the lowest. The TMDL determined that the likely causes of low DO were low-oxygen discharge from headwaters wetlands and excessive sediment oxygen demand resulting from the overwide channel. Stream restoration to create a low-flow channel, add reaeration structures, and improvements to headwaters wetlands would have the most impact in increasing dissolved oxygen.

Figure B-6. TSS data for Shingle Creek, 1996-2009.

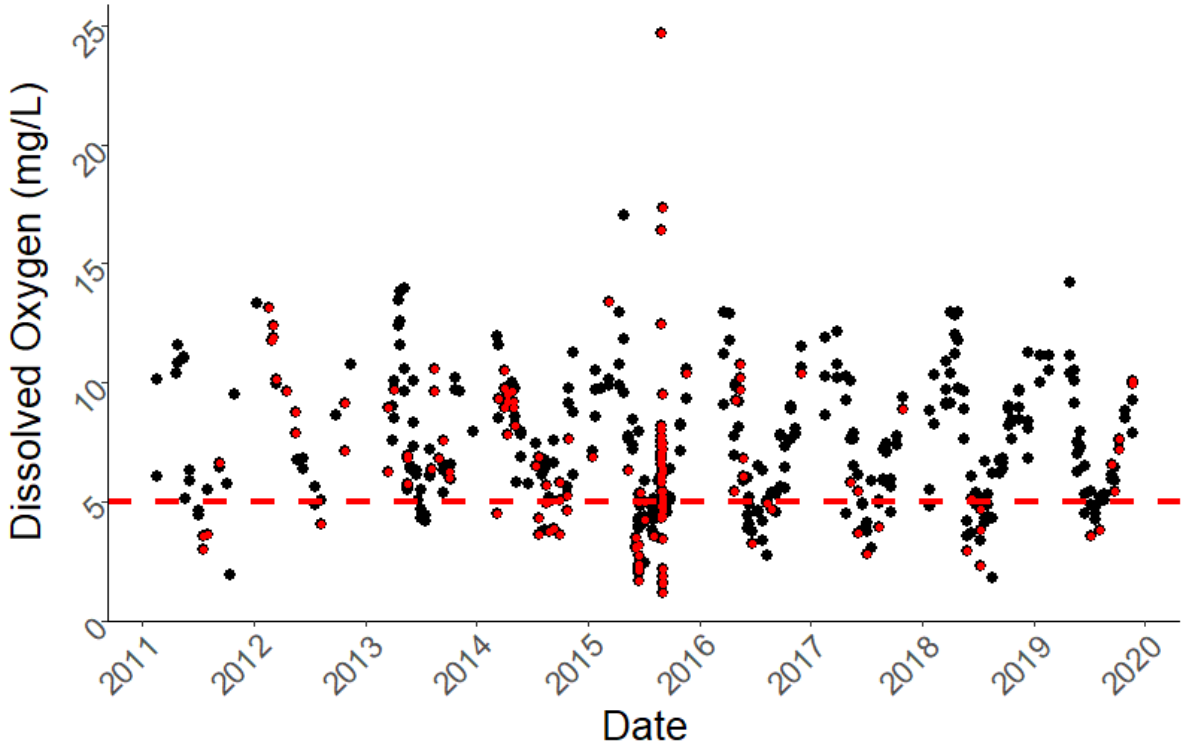

Figure B-7. Dissolved oxygen data for all Shingle Creek stations. Measurements taken before 9 am are colored in red.

The chloride TMDL found that the source of excess chloride was road salt applied for winter ice control, primarily on streets and highways but also in parking lots and other private facilities. An overall 71 percent reduction in chloride from all sources in the entire watershed is required to meet the state chloride standard for streams.

B.5.3 Wetlands

The US Fish and Wildlife Service compiled wetland maps from aerial photo interpretation as part of the National Wetland Inventory (NWI) (Figure 2.13). Wetland scientists use two common classification schemes to identify wetland type – the US Fish and Wildlife Service's "Circular 39" system, and a replacement classification system developed by Cowardin et al. for the Fish and Wildlife Service, commonly referred to as the Cowardin system. The Circular 39 system was originally developed as a means for classifying wetlands for waterfowl habitat purposes. Eight of the Circular 39 freshwater wetland types are found in Minnesota. The Cowardin scheme is a hierarchical classification based on landscape position, substrate, flooding regime, and vegetation. While the Cowardin scheme has been officially adopted by the Fish and Wildlife Service and other agencies, the Circular 39 system is still commonly used because of its simplicity and ease of use.
According to the NWI, wetlands, including lakes, cover approximately 14 percent of the watersheds' surface (Table B-20.) It should be noted that the NWI was developed in the 1980s. Subsequent development and fill has impacted many of those wetlands, so the NWI map is not considered definitive. A delineation of wetland boundaries is required to be completed any time development or other impacts may occur near or in a wetland.

Table B-20. NWI wetland area by type, Shingle Creek and West Mississippi watersheds combined.

Circular 39 Type	Acres	Percent
1 – Seasonally Flooded	130	0.3
2 – Wet Meadow	132	0.3

Cowardin Type	Acres	Percent
Emergent (EM)	2,671	6.0
Forested (FO)	1,067	2.4

3 – Shallow Marsh	2,444	5.5
4 – Deep Marsh	231	0.5
5 – Shallow Open Water	1,408	3.2
6 – Shrub Swamp	385	0.9
7 – Wooded Swamp	1,034	2.3
90 – Riverine	277	0.6
Upland	38,633	86.4
Grand Total	44,674	100.0

Scrub-shrub (SS)	385	0.9
Unconsolidated Bottom (UB)	1,914	4.2
Unconsolidated Shore (US)	5	0.0
Upland	38,633	86.5
Grand Total	44,674	100.0

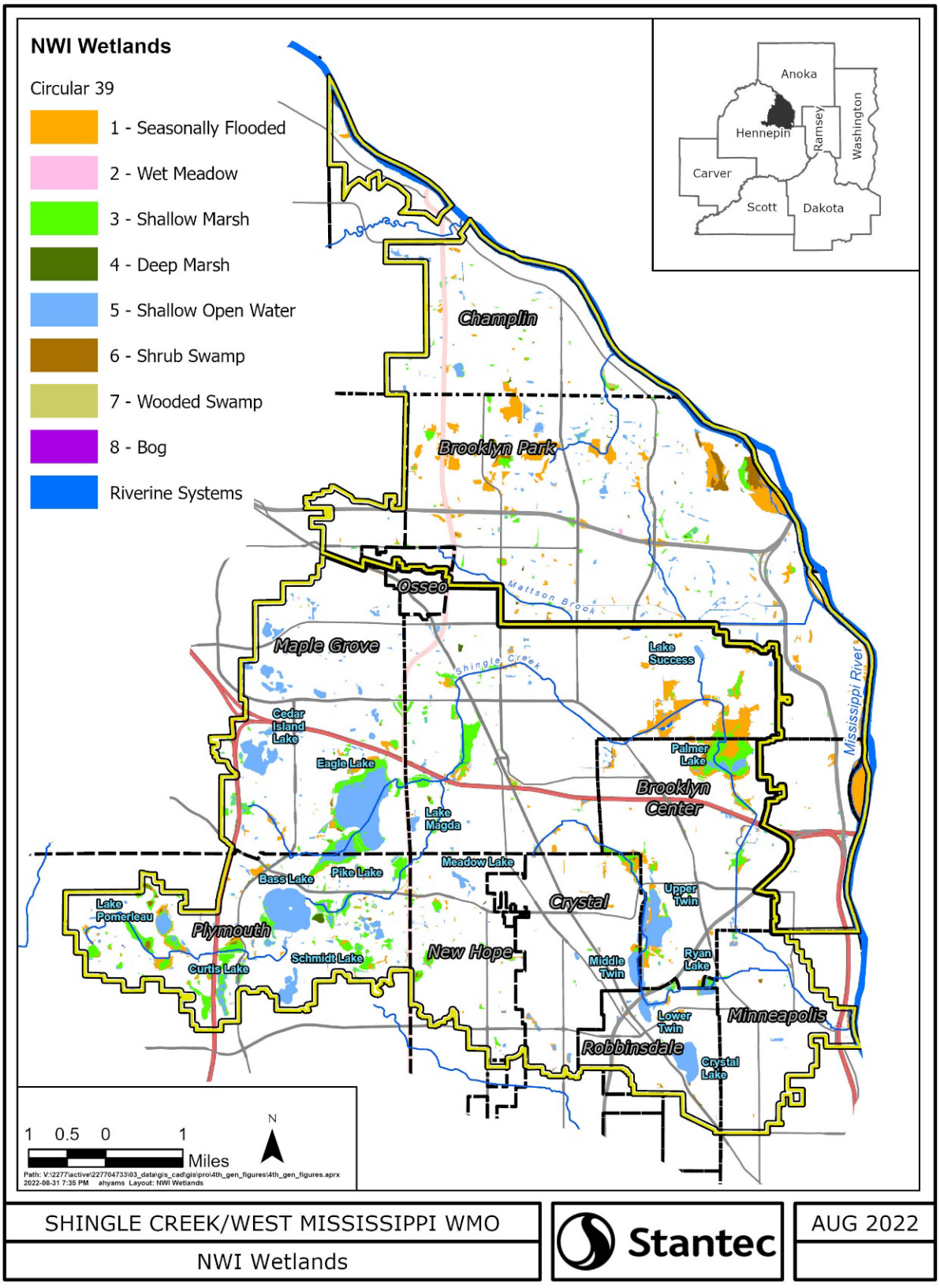

Figure B-8. National Wetlands Inventory wetlands in Shingle Creek and West Mississippi.

B.5.4 Public Waters

State Statutes classify certain waterbodies as Waters of the State and the DNR maintains maps and lists on the Public Waters Inventory (PWI). Public Waters wetlands include all type 3, type 4, and type 5 wetlands (as defined in U.S. Fish and Wildlife Service Circular No. 39, 1971) that are 25 acres or more in size in unincorporated areas or 10 acres or more in size in incorporated areas. Public watercourses are defined as natural and altered watercourses with a total drainage area greater than two square miles or natural and altered watercourses designated by the DNR commissioner as trout streams. Work within waterbodies designated on the PWI is regulated by the DNR. Public waters wetlands and watercourses are listed in the tables below and shown on Figure B-11.

Table B-21. Lakes in SCWM designated as Public Waters.

Name	PWI Number	City(ies)	Name	PWI Number	City(ies)
Crystal Lake	34P	Robbinsdale	Bass Lake	98P	Plymouth
Upper Twin	42P	Brooklyn Center, Crystal	Pomerleau Lake	100P	Plymouth
Middle Twin	42P	Brooklyn Center, Crystal, Robbinsdale	Schmidt Lake	102P	Plymouth
Lower Twin	42P	Robbinsdale	Eagle	111P	Maple Grove
Meadow Lake	57P	New Hope	Pike	111P	Maple Grove, Plymouth
Ryan Lake	58P	Brooklyn Center, Minneapolis, Robbinsdale	Cedar Island Lake	119P	Maple Grove
Palmer Lake	59P	Brooklyn Center, Brooklyn Park	Curtis Lake	593P	Plymouth
Magda Lake	65P	Brooklyn Park	Success	634P	Brooklyn Park

Source: Minnesota DNR

Table B-22. Wetlands in Shingle Creek designated as Public Waters.

Name	PWI Number	City(ies)	Name	PWI Number	City(ies)
Civic Center	637W	Brooklyn Center	Webber Pond	1118N	Minneapolis
Unnamed	638W	Brooklyn Center	Unnamed	569W	New Hope
Unnamed	639W	Brooklyn Center	Unnamed	570W	New Hope
Unnamed	640W	Brooklyn Center	Unnamed	628W	New Hope
Unnamed	560W	Brooklyn Park	Unnamed	571W	Plymouth
Unnamed	561W	Brooklyn Park	Unnamed	572W	Plymouth
Unnamed	562W	Brooklyn Park	Unnamed	573W	Plymouth
Unnamed	563W	Brooklyn Park	Unnamed	574W	Plymouth
Unnamed	564W	Brooklyn Park	Unnamed	575W	Plymouth
Mueller Marsh	565W	Brooklyn Park	Unnamed	577W	Plymouth
Unnamed	566W	Brooklyn Park	Unnamed	578W	Plymouth
Unnamed	635W	Brooklyn Park	Unnamed	579W	Plymouth
Unnamed	131W	Champlin	Unnamed	580W	Plymouth
Unnamed	248W	Champlin	Unnamed	583W	Plymouth
Unnamed	249W	Champlin	Unnamed	584W	Plymouth
Unnamed	250W	Champlin	Unnamed	585W	Plymouth
Unnamed	60W	Champlin	Unnamed	586W	Plymouth
Unnamed	639W	Crystal	Unnamed	589W	Plymouth
Memory Lane	641W	Crystal	Unnamed	590W	Plymouth
Hagermeister	642W	Crystal	Unnamed	591W	Plymouth
Gaulke	643W	Crystal	Unnamed	592W	Plymouth
Unnamed	541W	Maple Grove	Unnamed	594W	Plymouth
Unnamed	542W	Maple Grove	Unnamed	597W	Plymouth
Unnamed	543W	Maple Grove	Unnamed	599W	Plymouth
Unnamed	551W	Maple Grove	Unnamed	600W	Plymouth
Unnamed	553W	Maple Grove	Unnamed	605W	Plymouth
Unnamed	554W	Maple Grove	Unnamed	96W	Plymouth

Name	PWI Number	City(ies)	Name	PWI Number	City(ies)
Unnamed	555W	Maple Grove	Mud Lake	99W	Plymouth
Unnamed	557W	Maple Grove	Unnamed	97R	Plymouth
Unnamed	89W	Maple Grove	Unnamed	640W	Robbinsdale

Source: Minnesota DNR

Table B-23. Wetlands in West Mississippi designated as Public Waters.

Name	PWI Number	City(ies)	Name	PWI Number	City(ies)
Civic Center	202W	Brooklyn Park	Unnamed	255W	Brooklyn Park
Unnamed	203W	Brooklyn Park	Unnamed	283W	Brooklyn Park
Unnamed	204P	Brooklyn Park	Unnamed	559W	Brooklyn Park
Unnamed	205W	Brooklyn Park	Unnamed	60W	Brooklyn Park
Unnamed	206W	Brooklyn Park	Unnamed	632W	Brooklyn Park
Unnamed	207W	Brooklyn Park	Unnamed	632W	Brooklyn Park
Unnamed	208W	Brooklyn Park	Unnamed	633W	Brooklyn Park
Unnamed	210W	Brooklyn Park	Unnamed	131W	Champlin
Unnamed	212W	Brooklyn Park	Unnamed	248W	Champlin
Unnamed	250W	Brooklyn Park	Unnamed	249W	Champlin
Unnamed	251W	Brooklyn Park	Unnamed	250W	Champlin
Unnamed	254W	Brooklyn Park	Unnamed	60W	Champlin

Source: Minnesota DNR

B.5.5 Floodplain

Flooding effects may range from personal nuisance to property damage or loss to injury or death. Floodplain areas flood most often and severely. Land use regulations define the floodplain as the area covered by the flood that has a one percent chance of occurring each year, also known as the 100-year flood. The floodplain is divided into two zoning districts: the floodway and flood fringe. The floodway includes the river channel and nearby land areas which must remain open to discharge the 100-year flood. The flood fringe, while in the flood plain, lies outside the floodway. Regulations usually allow development in the flood fringe but require flood-proofing or raising to the legal flood protection elevation.

In 1968, Congress created the National Flood Insurance Program (NFIP) to make flood insurance available to property owners at federally subsidized rates. The NFIP required communities to adopt local laws to protect lives and future development from flooding. The Federal Emergency Management Agency (FEMA) first must formally notify a community that it has special flood hazard areas (SFHA) before it can join the NFIP. FEMA notifies communities by issuing a Flood Hazard Boundary Map (FHBM). This map shows the approximate boundaries of the community's 100-year flood plain. Each participating community has a Flood Insurance Study (FIS). Each of the communities in Shingle Creek and West Mississippi has a Flood Insurance Study. In 2021-2022 the Shingle Creek Commission worked with the DNR to update the special hazard area hydrologic and hydraulic modeling, a process known as the 'HUC-8 Study." This modeling will be used by the DNR and FEMA to reevaluate boundaries o the 100-year (1% chance) floodplain, which will likely be complete by the mid 2020's. Until that time the current boundaries remain effective. Figure B-9 shows the approximate 100-year (0.1%) and 500-year (0.02%) floodplain in the watersheds.

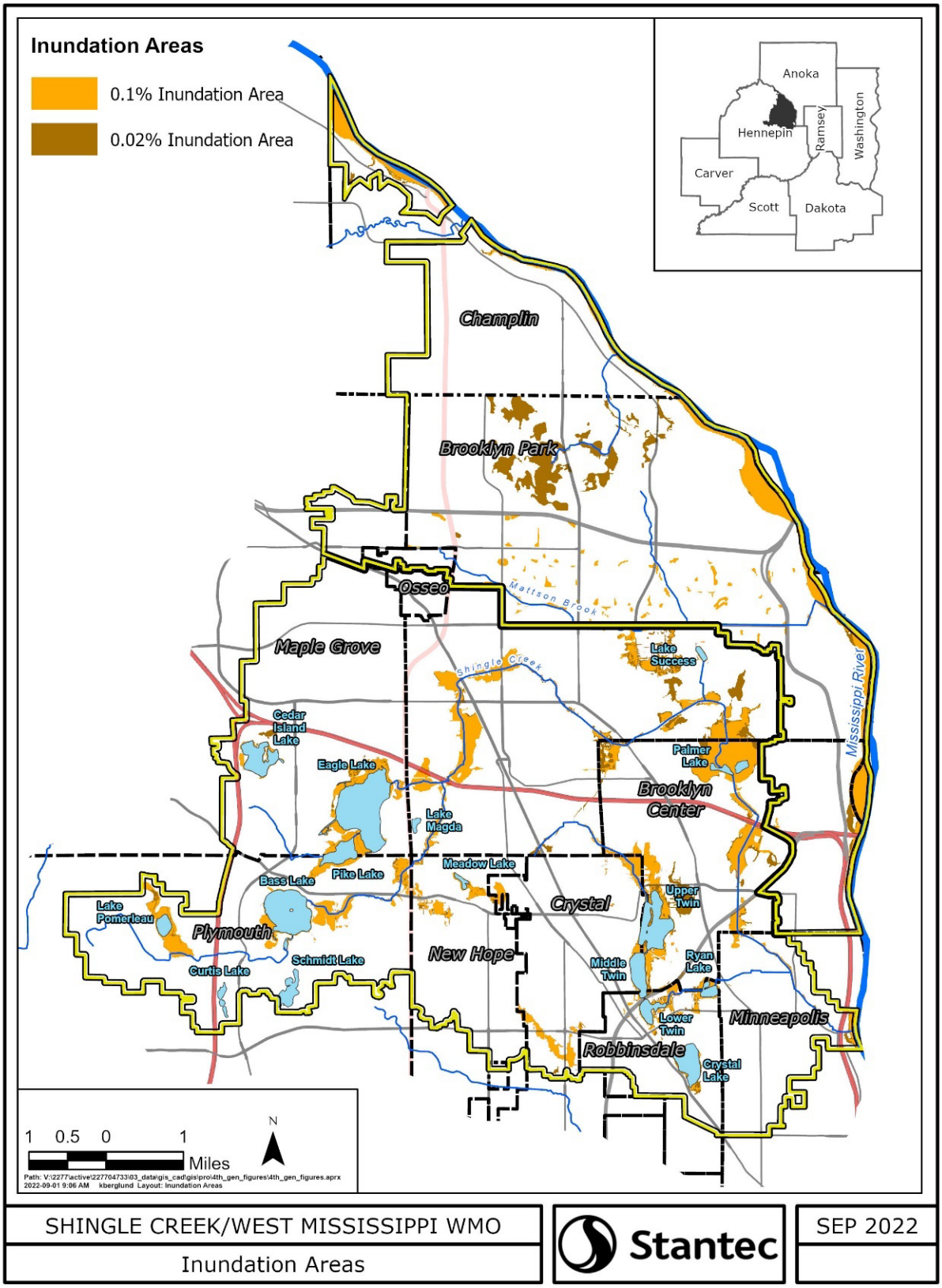

Figure B-9. Floodplain in the Shingle Creek and West Mississippi watersheds for the 100-year (0.1%) storm event and the 500-year (0.02%) storm event.

B.5.6 Groundwater

Aquifers. The Second Generation Watershed Management Plan detailed the groundwater resources in the two watersheds, and the reader is directed to that plan for more detail. In general, most of the north and east areas of the watersheds overlay sand and gravel outwash and glacial till, and thus are more vulnerable to contamination because they are closer to the surface. The southern part of Shingle Creek is underlain by the Prairie du Chien/Jordan aquifer. Seven out of the ten member cities obtain their water from surficial or deep wells, while Minneapolis obtains its drinking water from the Mississippi River and also sells it to Crystal and New Hope.

The cities that obtain their water from groundwater have completed Wellhead Protection Studies. These studies model groundwater flow and identify areas that should be managed to reduce the risk of contamination of groundwater. See the Third Generation Plan for locations of Wellhead Protection Areas in the watersheds. Emergency Response Areas show where immediate action should be taken to clean up spills of contaminants to protect groundwater.