

2019 ANNUAL WATER QUALITY REPORT

APRIL 2020



The Monitoring Program

The Shingle Creek and West Mississippi Watershed Management Commissions annually monitor water quality in the lakes, streams and outfalls of the watersheds. Data has been collected from Shingle Creek since 1996 and at West Mississippi river outfalls since 2010. In 2012 Shingle Creek expanded its volunteer-based lake monitoring program to start systematic detailed lake monitoring. The program has also expanded to incorporate fish, macroinvertebrate, and aquatic vegetation monitoring in the lakes and streams. Student and adult volunteers collect additional lake water quality and stream and wetland macroinvertebrate data. A Water Quality report summarizing current and historic conditions in the watersheds has been published annually since 1998.



Surface water quality in the watersheds is typical of urban lakes and streams in the Twin Cities metropolitan area. Agriculture followed by urban development have changed drainage patterns, increased pollutants to the waters, and reduced habitat for aquatic and terrestrial life. Both Shingle Creek and Bass Creek do not meet state water quality standards for chloride, bacteria, and dissolved oxygen, and have severely impacted fish and macroinvertebrate communities. Thirteen of the 16 lakes were listed as Impaired Waters of the State because of their high concentrations of phosphorus. Diagnostic and feasibility studies completed between 2007 and 2011 have identified actions that can be taken in the watersheds to help improve water quality.

In the more than ten years since the results have been heartening. Three of the impaired lakes **now meet state standards** and have been removed from the list of Impaired Waters. Long-term stream water quality monitoring shows a **clear improvement** in suspended sediment and nutrient concentrations in both Shingle Creek and Bass Creek, a result of ongoing efforts to stabilize streambanks, increase the frequency of street sweeping, enhance erosion control on construction sites, and install Best Management Practices to treat stormwater before it is discharged into the streams. However, chloride concentrations in the streams, mostly from road salt applied in the winter for snow and ice control, continue to be high.

Why Do We Monitor?

- ▶ To quantify the **current status** of streams and lakes throughout the watershed and compare to water quality standards.
- ▶ To quantify **changes over time**, or trends, in stream and lake water quality
- ▶ To **identify problem areas** for potential BMPs
- ▶ To quantify the **effectiveness** of implemented BMPs throughout the watershed

What's in the watershed?

West Mississippi

- ▶ 25 square miles
- ▶ High impervious urban development (25%) and low-moderate impervious urban development (38%)
- ▶ 4 stream sites and 18.3 miles of streams
- ▶ No lakes, few wetlands

Middle Shingle Creek

- ▶ 15 square miles
- ▶ High impervious urban development (45%) and low-moderate impervious urban development (28%)
- ▶ 1 stream and 10.34 miles of streams
- ▶ 2 lakes

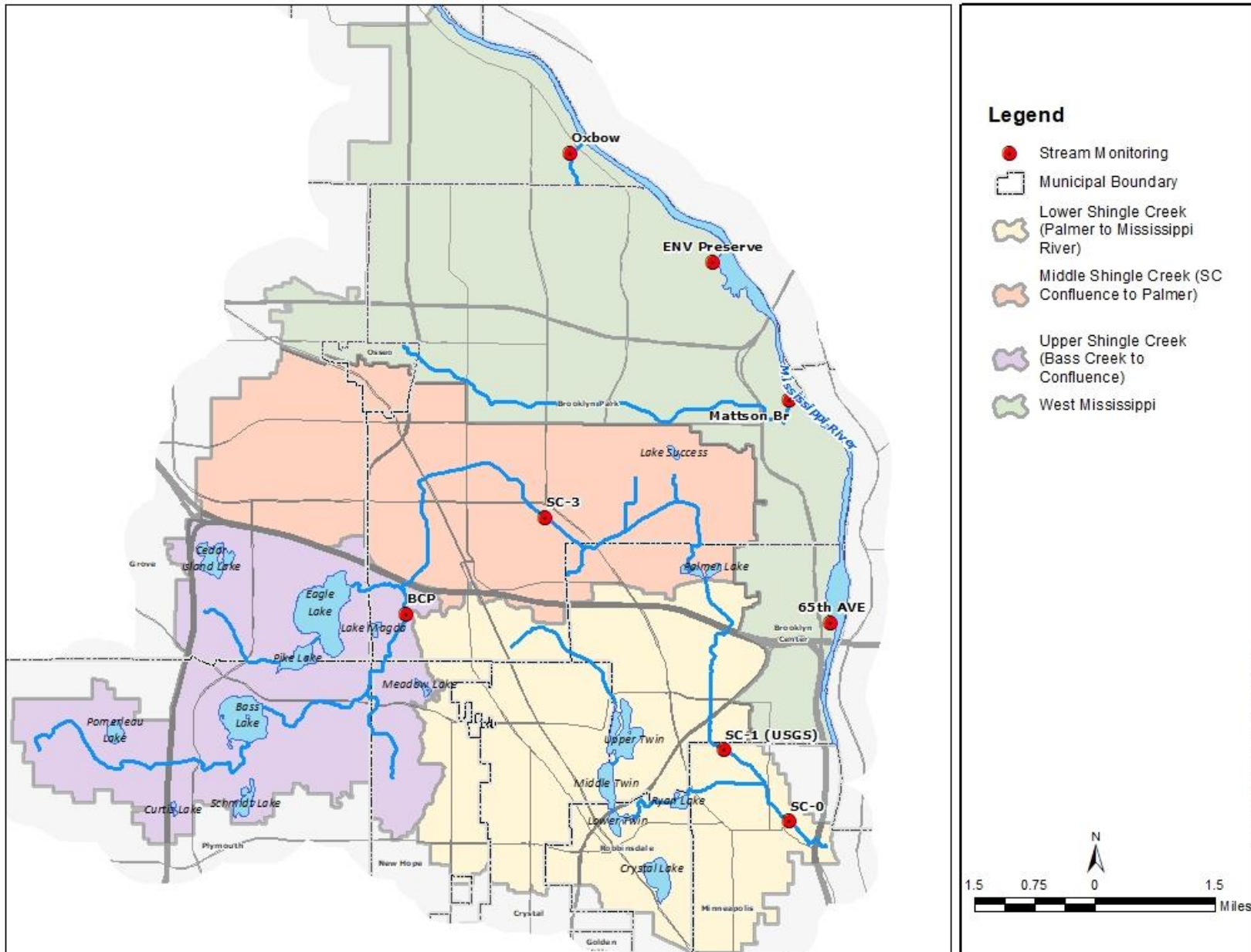
Upper Shingle Creek

- ▶ Headwaters of Shingle Creek
- ▶ 13 square miles
- ▶ High impervious urban development (28%) and low-moderate impervious urban development (26%)
- ▶ 3 streams and 16.2 miles of streams
- ▶ 9 lakes

Lower Shingle Creek

- ▶ Shingle Creek discharges to the Mississippi River
- ▶ 17 square miles
- ▶ High impervious urban development (71%) and low-moderate impervious urban development (8%)
- ▶ 2 streams and 18.9 miles of streams
- ▶ 5 lakes





Monitoring in 2019

Stream Monitoring:

Routine Flow and Water Quality: Three sites along Bass/Shingle Creek were monitored biweekly April-October: the outlet in Minneapolis (SC-0); mid-watershed in Brooklyn Park (SC-3); and in Bass Creek (BCP) in the upper watershed. Winter chloride was sampled monthly from November-March at the three locations mentioned and the USGS gage site (SC-1). In the West Mississippi Watershed, the Environmental Preserve (ENVP) and Mattson Brook (MB) were monitored monthly April-October.

RiverWatch: Stream macroinvertebrates were monitored by high school students at two sites on Shingle Creek through the Hennepin County RiverWatch program. Shingle Creek at Park Center High school has been monitored for 24 years by science students from the school. Shingle Creek at Webber Park was monitored by students from Patrick Henry High School between 2001 and 2012, and for the last two years by students from the Avail Academy.

Lake Monitoring:

Routine Water Quality: Water quality in Schmidt Lake in Plymouth was monitored biweekly. Aquatic vegetation was surveyed once in late spring and once in late summer, and the fish population was surveyed in July 2019.

CAMP: Each year the Commission sponsors volunteer lake water quality monitoring through the Met Council's Citizen Assisted Monitoring Program (CAMP). Meadow Lake was monitored in 2019.

Grant Projects: Bass and Pomerleau Lakes were monitored biweekly for water quality. Bass and Pomerleau, which have both been listed as impaired for nutrients, are undergoing active management. Water quality in Lower, Middle, and Upper Twin was monitored monthly during the 2019 field season, following two years of carp removal. Water quality monitoring in the lakes has helped our understanding of changes in lake health following management activities.



Wetland Monitoring:

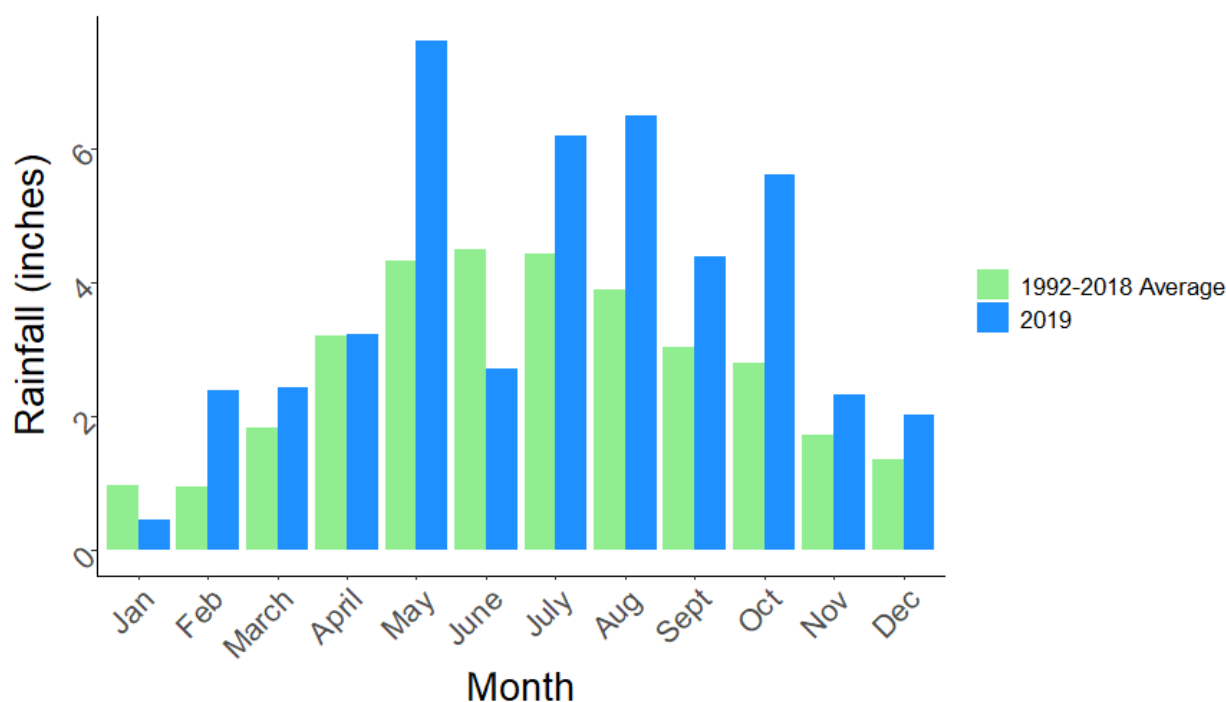
Macroinvertebrate communities and vegetation were monitored in four wetlands by volunteers through the Wetland Health Evaluation Program (WHEP) administered by Hennepin County. Two wetlands in each watershed were monitored. A wetland within the Environmental Preserve in Brooklyn Park and Wetland 639 were both chosen as monitoring sites because of their relevance to ongoing monitoring and projects.

2019 in Review

This summary provides an overview of findings and conditions in the two watersheds in 2019. A more detailed assessment and data are available in the technical appendices, which can be found at shinglecreek.org/water-quality.html.

Rainfall

Water quality in the lakes, streams and wetland is heavily influenced by precipitation and storm water runoff. 2019 was Minnesota's wettest year on record and within the Shingle Creek and West Mississippi watersheds rainfall exceeded the historic average (1992-2018) each month except January and June. Total rainfall in 2019 was 45.8 inches, 13.3 inches more than the historic average.



Streams

Shingle Creek and Bass Creek are in good or exceptional condition for nutrients (i.e., inorganic nitrate and nitrite (NO_3/NO_2) and total phosphorus (TP)) and total suspended solids (TSS). Outfalls in West Mississippi range in condition for nutrients and TSS, although dissolved oxygen is notably in good condition for all West Mississippi sites. Shingle and Bass Creeks do not meet state standards for dissolved oxygen, which continue to be consistently low. Invertebrate and fish indices of biological integrity (IBI) are poor or degraded in Shingle and Bass Creeks, in part due to lack of dissolved oxygen as well as lack of habitat and altered flow conditions. Both streams are also impaired by high concentrations of *E. coli* and chloride, which showed no improvement in 2019.

The greater than average precipitation in 2019 increased the amount of stormwater running off to the streams, and more intense rainfalls caused an increase in *E. coli* counts, higher phosphorus concentrations, and higher TSS than samples collected not during storms.

Trends: Water quality data has been collected in Shingle Creek since 1996, and trend analysis shows significant changes to stream water quality. TP concentrations are improving in both Shingle and Bass Creeks. Dissolved oxygen concentrations are declining at the upper watershed site on Shingle Creek, indicating a need to continue focusing on dissolved oxygen management. Trend analysis could not be completed for sites within West Mississippi because data are limited.

Moving forward: Shingle and Bass Creeks will continue to be monitored for the typical parameters in 2020. In West Mississippi, the 65th Avenue Outfall and the Environmental Preserve will be monitored. The 5-year review of Shingle Creek and Bass Creek Biota and Dissolved Oxygen TMDL will be undertaken in 2020 and 2021 to understand and document the Commission's progress toward improving conditions in Shingle and Bass Creek.

Lakes

Schmidt Lake was intensively monitored by the Commission in 2019. Water quality in the lake, measured as Secchi depth, TP concentration, and chlorophyll-*a* concentration, continues to meet state standards. Submersed aquatic vegetation, measured as Floristic Quality Index (FQI) and species richness, is in poor condition; however, the overall fish abundance is in the normal range for Minnesota lakes. The Northern Pike population in Schmidt Lake exceeds normal ranges and indicates a stable, healthy habitat with consistently good over-wintering conditions.



Many lakes within Shingle Creek are undergoing active management. In 2019, we saw significant improvements to lake phosphorus levels and water clarity in Bass and Pomerleau, both lakes that received aluminum sulfate treatments in May 2019. Submersed aquatic vegetation was found at deeper locations within both the lakes compared to previous surveys, indicating increased light availability as a result of improved water clarity. The condition of vegetation in both lakes is still in the degraded or poor range, perhaps influenced by the presence of the invasive species, curly-leaf pondweed. Active management and continued curly-leaf pondweed management may improve conditions in the future. Water quality in Upper, Middle, and Lower Twin Lakes was monitored in 2019 and showed continued nutrient impairment. Details from submersed aquatic vegetation (SAV) surveys, fish surveys, and water quality sampling that occurred in 2019 in Bass, Pomerleau, Schmidt, and Twin Lakes can be found in Appendix E.

Trends: Trend analysis shows significant changes to lake water quality in many of the watershed's lakes. TP concentrations have degraded (increased) over time in three lakes in the Upper Shingle Creek Watershed: Bass, Eagle, and Pike. TP is improving (decreasing) over time in Crystal, Lower Twin and Schmidt Lakes. Chlorophyll concentrations are improving (decreasing) over time in Pomerleau Lake. Secchi depth is improving (increasing) over time in Schmidt, Eagle, and Lower Twin Lakes. Secchi depth is degrading (decreasing) over time in Cedar Island and Success.

Volunteer Stream and Wetland Monitoring

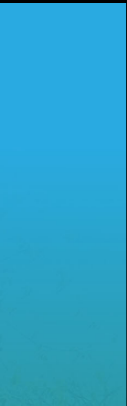
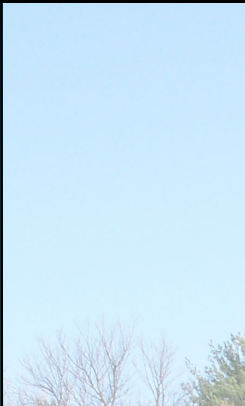

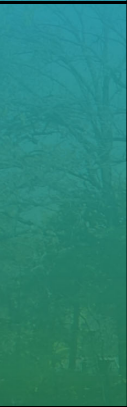
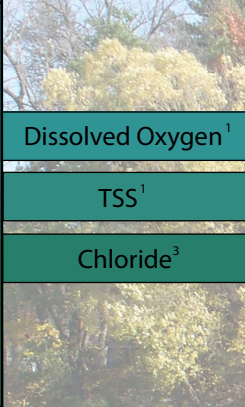
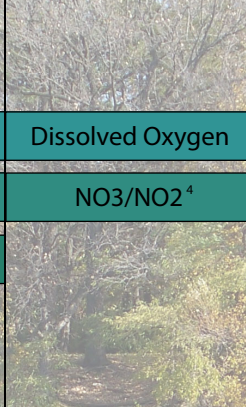


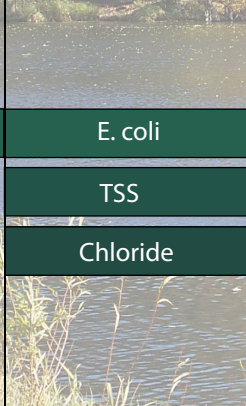



Through the RiverWatch program, high school students collect macroinvertebrates (small aquatic organisms such as insects, worms and snails) from streams, and identify and classify them. Because these organisms are directly impacted by conditions in the stream, the type and abundance of different organisms can be an indicator of general stream health. The site on Shingle Creek near Park Center High School, where the stream has recently been restored with stabilized streambanks and new habitat features, received a score of 5.1 (good) in 2019. This is a significant improvement over pre-restoration scores, which typically were poor to very poor. The site on Shingle Creek in Webber Park scored 4.3 (very good). This is an improvement over previous conditions, which typically scored average for urban streams in Hennepin County.

Through the WHEP program, adult volunteers monitored macroinvertebrates and vegetation in four wetlands in the watersheds. These sites typically scored as in moderate condition for vegetation diversity, and poor condition for invertebrate community diversity.

Moving Forward

Eagle and Pike Lakes will undergo routine monitoring in 2020. As part of the ongoing active management projects, Bass, Pomerleau, and Crystal Lakes will also be monitored. Curly-leaf pondweed management is planned for Bass, Pomerleau, and Twin Lakes. Aluminum sulfate applications for phosphorus management are planned for Bass and Pomerleau Lakes in late August. Volunteers will monitor Upper, Middle, and Lower Twin Lakes, Ryan, Meadow, and Success Lakes. Active management is expected to begin in Fall 2020 on Meadow Lake with a planned water level drawdown to consolidate the sediments and significantly reduce or eliminate the invasive vegetation and fathead minnows that degrade water quality and clarity.

The following pages show the conditions of streams and lakes within the watershed using the most recent year of data for each site and parameter. We identified thresholds for each parameter to classify its condition as degraded, poor, good, or exceptional. The thresholds used for this report can be found in Appendix F. If there has been a significant trend in a parameter's value over time, it is shown with an upwards or downwards arrow that describes the direction of change (i.e., improving or degrading). Superscripts next to each parameter indicate the most recent year of data collection.

		West Mississippi Management Unit			
		Oxbow	Environmental Preserve	Mattson Brook	65th Avenue
Exceptional					
			TSS		TSS ²
Good					
			Dissolved Oxygen ¹		Dissolved Oxygen ²
			TSS ¹		TP ²
			Chloride ³		NO3/NO2 ⁴
Poor					
			E. coli		E. coli ⁴
					Chloride
Degraded					
			TP ¹		TP

*Subscripts indicate last measurement was before 2019

1) Last measurement taken in 2018

2) Last measurement taken in 2017

3) Last measurement taken in 2015

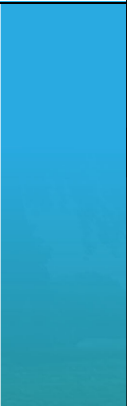
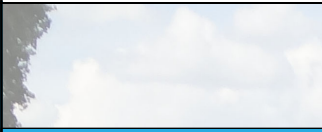


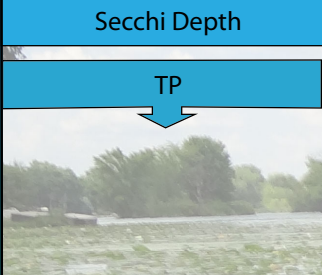

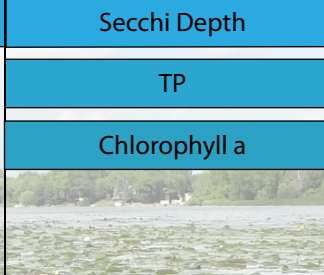
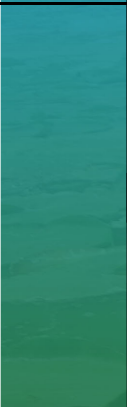
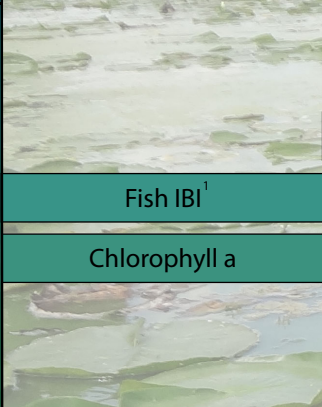
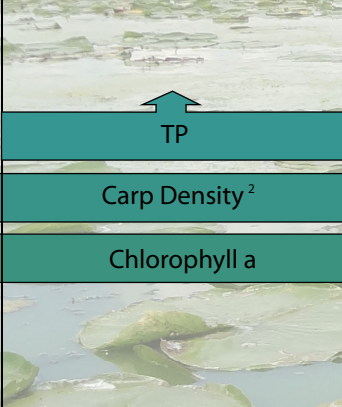
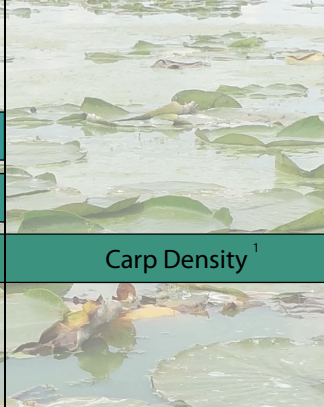

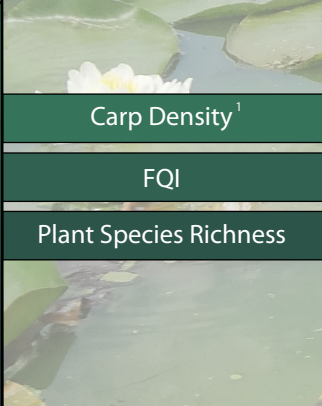
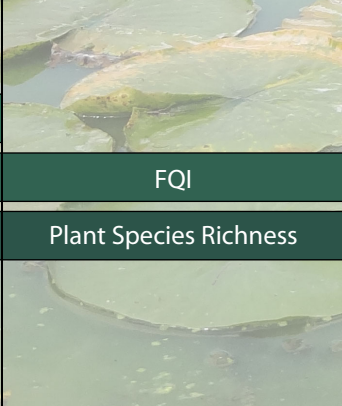

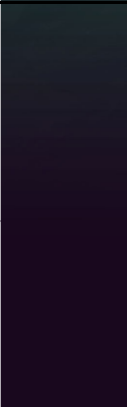


4) Last measurement taken in 2011

		Upper Shingle Management Unit	Lower Shingle Management Unit	Middle Shingle Management Unit
		BCP	SC-0	SC-03
Exceptional				
		TP	TP	TP
				
		TSS	TSS	TSS
Good				
		NO3/NO2 ¹	NO3/NO2 ¹	NO3/NO2 ¹
				
		Fish IBI ¹	Fish IBI ¹	Fish IBI ¹
Poor				
		Chloride	Chloride	Chloride
				
		Dissolved Oxygen	Dissolved Oxygen	Dissolved Oxygen
Degraded				
		E. coli	E. coli	E. coli
				
		Invert IBI ¹	Invert IBI ¹	Invert IBI ¹
Degraded				
		Fish IBI ¹	Fish IBI ¹	Fish IBI ¹

*Arrows depict parameter level change since previous measurement

**Subscripts indicate last measurement was before 2019

1) Last measurement taken in 2018








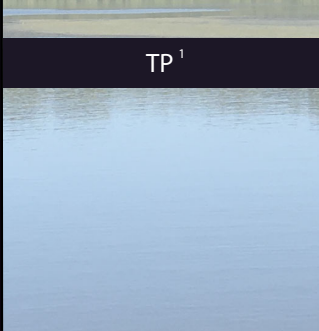


		Upper Shingle Management Unit		
		Bass	Schmidt	Pomerleau
Exceptional				
		Secchi Depth	Secchi Depth	Secchi Depth
		TP		TP
				
Good			TP	
		Fish IBI ¹	Carp Density ²	
		Chlorophyll a	Chlorophyll a	Carp Density ¹
				
Poor		Carp Density ¹		
		FQI	FQI	
		Plant Species Richness	Plant Species Richness	
				
Degraded				
				FQI
				Plant Species Richness

*Arrows depict parameter level change since previous measurement

**Subscripts indicate last measurement was before 2019

1) Last measurement taken in 2017

2) Last measurement taken in 2016

		Upper Shingle Management Unit		
		Cedar Island	Eagle	Pike
Exceptional				
Good				
			Secchi Depth ²	
			Fish IBI ⁶	
			FQI ⁴	
			Plant Species Richness ⁴	Secchi Depth ²
Poor		Carp Density ³	Carp Density ¹	Carp Density ¹
		Plant Species Richness ⁵		Plant Species Richness ⁴
		FQI ⁵		FQI ⁴
		Chlorophyll a ⁴	Chlorophyll a ²	Chlorophyll a ²
Degraded		Secchi Depth ¹	TP ²	TP ²
				
				
		TP ¹		
				

*Arrows depict parameter level change since previous measurement

**Subscripts indicate last measurement was before 2019

1) Last measurement taken in 2018


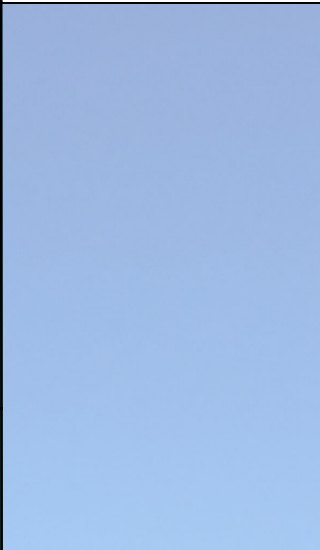
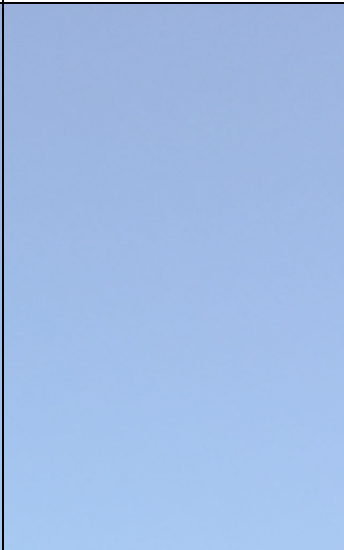
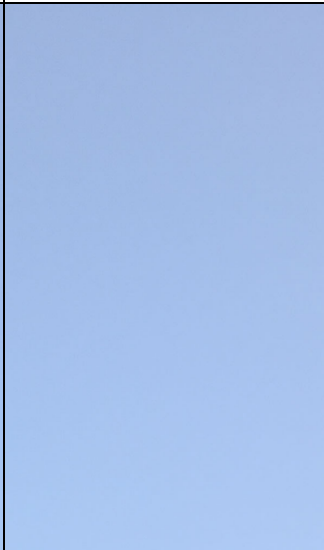
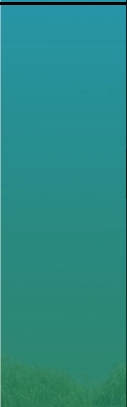
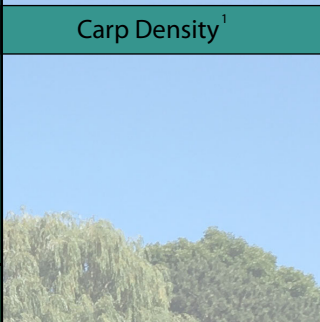
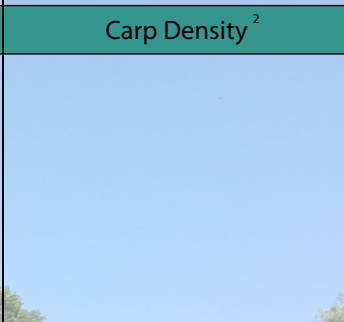

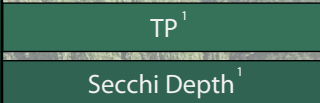

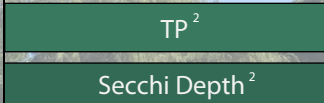

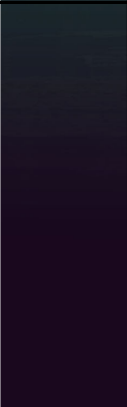



2) Last measurement taken in 2017

3) Last measurement taken in 2016

4) Last measurement taken in 2015

5) Last measurement taken in 2013

6) Last measurement taken in 2011










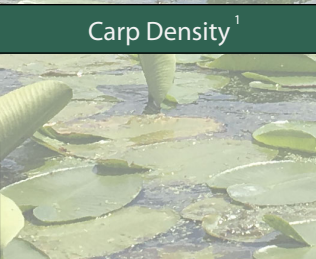

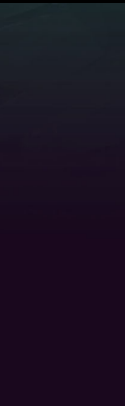

		Upper Shingle Management Unit		Middle Shingle Management Unit
		Magda	Meadow	Success
Exceptional				
Good		Carp Density ¹	Carp Density ²	Carp Density ²
				Chlorophyll a ²
Poor				
		TP ¹		TP ²
		Secchi Depth ¹		Secchi Depth ²
		Chlorophyll a ¹		
		FQI ¹		
		Plant Species Richness ¹		
Degraded			FQI ²	FQI ²
			Plant Species Richness ²	Plant Species Richness ²
			Chlorophyll a ²	
			Secchi Depth ²	
			TP ²	
				

*Arrows depict parameter level change since previous measurement

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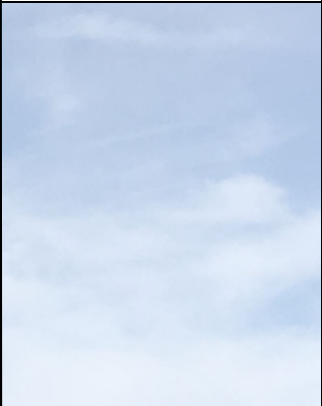



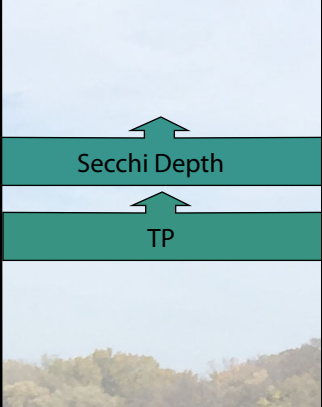



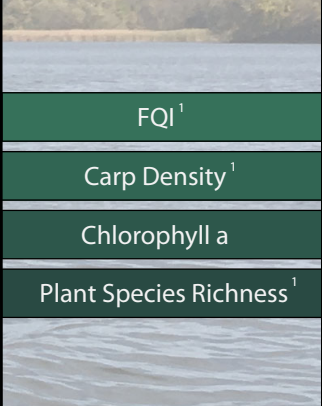



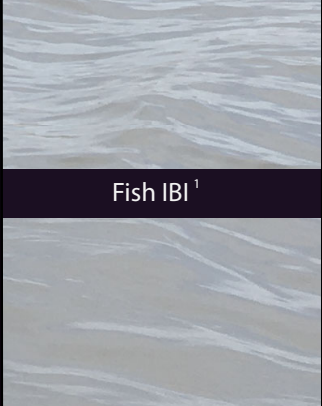


1) Last measurement taken in 2017

2) Last measurement taken in 2016

		Middle Shingle Management Unit	Lower Shingle Management Unit	
		Palmer	Upper Twin	Middle Twin
Exceptional				
Good				
Poor			FQI ¹	Chlorophyll a
			Plant Species Richness ¹	TP
			Secchi Depth	Secchi Depth
Degraded			Fish IBI ¹	Fish IBI ¹
			Carp Density ¹	Carp Density ¹
			Chlorophyll a	FQI ¹
			TP	Plant Species Richness ¹

*Subscripts indicate last measurement was before 2019

1) Last measurement taken in 2018

		Lower Shingle Management Unit		
		Lower Twin	Ryan	Crystal
Exceptional				
			Secchi Depth ¹	
Good				
			Secchi Depth	
			Carp Density ²	
			TP	
Poor				
			FQI ¹	TP ¹
			Carp Density ¹	Secchi Depth
			Chlorophyll a	Chlorophyll a ¹
			Plant Species Richness ¹	
Degraded				
			Fish IBI ¹	FQI ¹
			Plant Species Richness ¹	Plant Species Richness ¹
				Carp Density ¹

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1) Last measurement taken in 2018

2) Last measurement taken in 2016