



Milwaukee



2013 Milwaukee River Basin Report Card



Menomonee



Kinnickinnic

Dear Friend of the River,

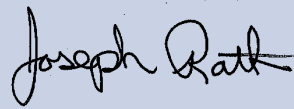
Welcome to our fourth annual Milwaukee River Basin Report Card. This year's Report Card summarizes the 2013 water quality of the Milwaukee River Basin, which includes the Kinnickinnic and Menomonee River Watersheds, in addition to the entire Milwaukee River Watershed (consisting of the Cedar Creek, East & West Branch, North Branch, and South Branch Subwatersheds). In 2013, the Milwaukee River Basin received an overall C grade, which is slightly improved from the 2012 grade of C-. Grades for the Milwaukee, Menomonee, and Kinnickinnic Rivers all improved from last year's report card, which is great news. It is also notable that these water quality grades are based on increasing quantity and quality of data from both our dedicated Milwaukee Riverkeeper stream monitoring volunteers, as well as data from the Milwaukee Metropolitan Sewerage District (MMSD) and the Wisconsin Department of Natural Resources (WDNR).

While some good progress towards improved water quality is being made, we are still failing to meet our targets for many water quality indicators, most notably bacteria, phosphorus, and chloride. We also continue to see failing grades for turbidity or sediment in the lower half of the Basin. The vast majority of our surveys for macroinvertebrates (aquatic organisms) rank in the fair to poor category, instead of the good to excellent level that we would like to reach.

Our Report Card provides a snapshot of the health of the river at subwatershed, watershed, and basin levels. We measured basic water quality parameters such as dissolved oxygen, temperature, turbidity, pH, and macroinvertebrates (aquatic organisms), as well as pollutants of concern. Lastly, the Report Card provides ideas for what you can do to help improve the water quality of our watersheds. We all need to all work together to be the "solution" to pollution affecting our watersheds.

This year we changed the format and simplified maps, reorganized information, summarized more of the data with tables, and provided more specific geographical information on all of the subwatersheds. We also included more information on the regulatory status of waterways and local land uses, which are an important factor to better understand the types of pollution that runs off the land and into our local rivers. Let us know what you think!

Sincerely,



Joe Rath, Water Quality Specialist



Cheryl Nenn, Riverkeeper



Joe Rath, Water Quality Specialist



Cheryl Nenn, Riverkeeper

If you are interested in becoming a citizen stream monitor, please contact us!

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Water Quality Monitoring Program at a Glance

Who is monitoring?

83 Volunteer Stream Monitors & Milwaukee Riverkeeper Staff (not including MMSD and WDNR).

What do we monitor?

We monitor water temperature, dissolved oxygen, pH, turbidity, phosphorus, chloride, streamflow, bacteria and macroinvertebrates.

Why do we monitor?

Collection of water quality data helps to identify sources of pollution and to inform river permitting and management decisions that impact the rivers. Data also helps us measure the effectiveness of policies and projects that have been implemented to improve river health. Ultimately, monitoring measures our progress to attaining the Clean Water Act goals of clean, fishable and swimmable rivers.

Where do we monitor?

We monitor throughout the Milwaukee River Basin, which contains three major watersheds: the Milwaukee; Menomonee; and Kinnickinnic Rivers (see monitoring points on maps inside).

How do we monitor?

We monitor water quality using protocols created by WDNR and UW-Extension for volunteer stream monitoring. We send water samples out for laboratory analysis for parameters such as phosphorus, chloride and bacteria. We also monitor effectiveness of best management practices in removing pollutants from stormwater runoff.



What Our Grades Mean

Grades for each water quality parameter were based on the percentage of time that the data points for the monitoring stations in each subwatershed meet our targets relating to overall aquatic ecosystem health. Grades were assigned on a typical percentage basis (90-100%=A; 80-89%=B; 70-79%=C; 60-69%=D and below 60%=F). Overall grades for each subwatershed were determined by averaging grades for each individual parameter. The overall watershed grade was determined by averaging the overall grades for each subwatershed. The overall Milwaukee River Basin grade was determined by averaging overall grades for the three watersheds. For more information on how we determine water quality grades and set targets for watershed health see pages 28-29 or visit our website at www.milwaukeekeeper.org.

It's also important to note that there are many issues that are not factored into our grading system, such as legacy contamination levels, emerging pollution concerns, and stream condition. In addition to water chemistry data, legacy pollutants such as PCBs, heavy metals, and petroleum products can impair stream health. Likewise, many of our streams are channelized with concrete or have other impairments that make meeting fish and habitat goals difficult despite how good or poor the water quality data. There are many "emerging" pollutants that we are just beginning to understand and to monitor--these range from personal care products to flame retardants to pharmaceuticals (yes, our rivers and our fish are "on drugs" and we are not sure what to do about it).

A

All water quality indicators meet desired targets 90-100% of the time. Streams or river segments have "good" water quality, which are capable of supporting fish and other aquatic life.

B

Most water quality indicators meet desired targets roughly 80-89% of the time. Quality of these streams and river segments tend to be good; most areas are capable of supporting fish and other aquatic life.

C

There is a mix of healthy and unhealthy water quality indicators, or indicators are only meeting water quality targets 70-79% of the time. Water quality of these waters tends to be fair, as well as fair conditions for fish and most aquatic life.

D

Few water quality indicators meet desired targets, or only meet water quality targets 60-69% of the time. Water quality and wildlife habitat of these waters tend to be poor.

F

Very few or no water quality indicators meet desired targets. Quality of these streams and river segments are very poor, most often leading to poor conditions for fish and aquatic life.

Milwaukee River Basin

The Milwaukee River Basin contains three major watersheds, the Milwaukee, Menomonee, and Kinnickinnic, which drain to the Basin. The Basin includes about 860 square miles of land in Southeast Wisconsin. The Basin discharges to Lake Michigan, which is the source of drinking water to over 1 million people. About 20% of the Basin is urban or suburban, and about 80% is dominated by agricultural/rural uses.

The Milwaukee River Watershed is the largest, and contains four subwatersheds: the East & West Branches of the Milwaukee River, the North Branch of the Milwaukee River, the Milwaukee River South, and Cedar Creek. The Menomonee River and Kinnickinnic River are smaller urban watersheds, and considered major tributaries to the Milwaukee River.

Collectively, the Basin contains approximately:

- 600 miles of perennial streams;
- 450 miles of intermittent or ephemeral streams;
- 68,000 acres of wetlands;
- 57 named lakes and ponds; and
- 168 miles of impaired streams.

The Basin received an overall C grade for 2013, which is slightly improved over 2012. Despite some indications that water quality is improving in many areas, the Basin still does not meet goals for many water quality parameters of concern, and there is significant geographical variability in grades. The northern half of the Basin also tends to be higher in water quality than the southern half, which is more urban and developed.

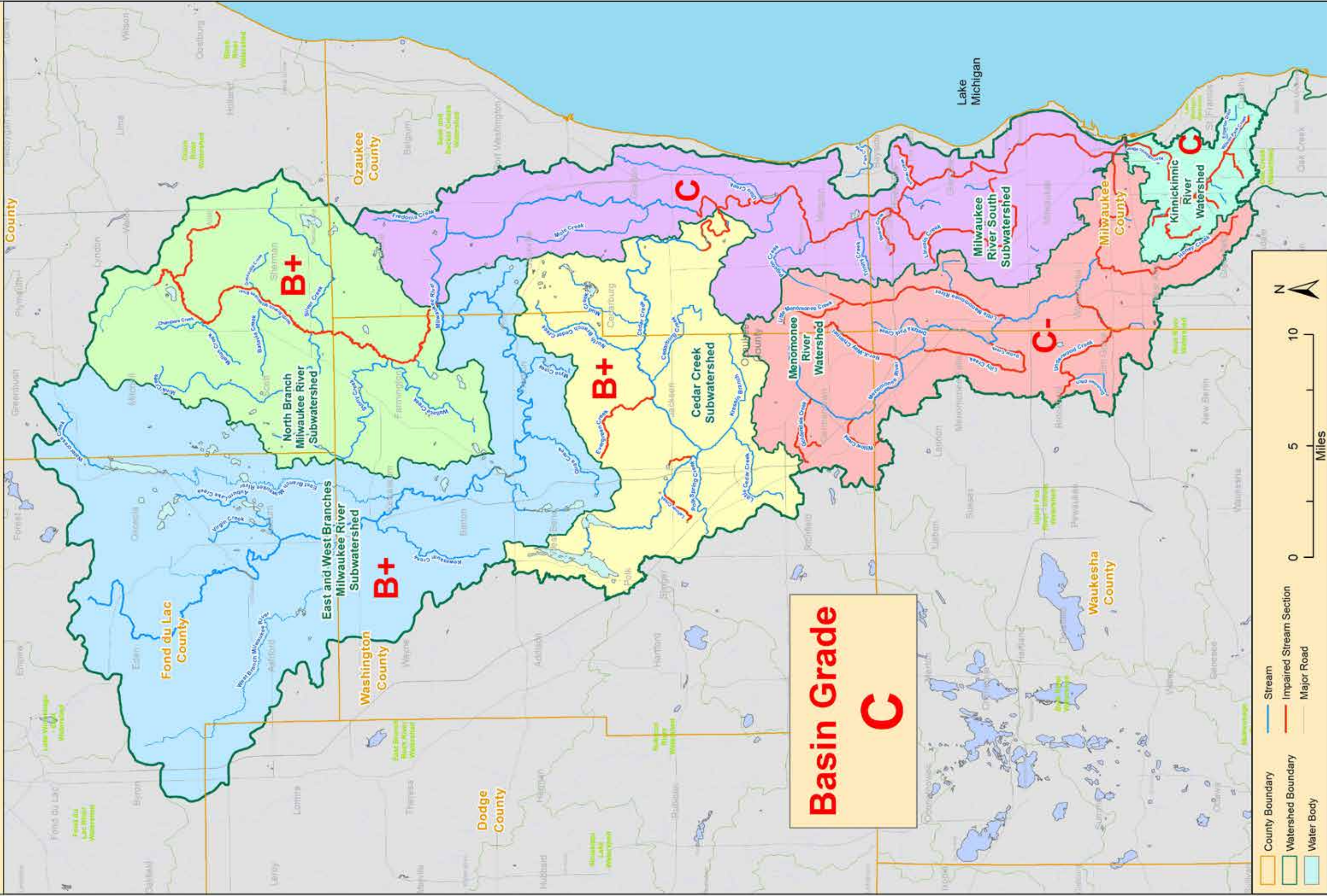
The Basin received:

- A grades for temperature and pH;
- B grades for dissolved oxygen and chloride (although there are still problems if looking only at data for winter months, this grade is an F);
- D grades for phosphorus and turbidity; and
- F grades for conductivity and several bacteria indicators.

It should be noted that MMSD collects baseline data throughout the entire calendar year, as opposed to our volunteers who sample from May through October. One exception is chloride and conductivity monitoring, where we only collect samples in months when road salt is applied to local roads. Generally, Milwaukee Riverkeeper and MMSD results were similar with a few exceptions. MMSD showed higher rates of turbidity, lower concentrations of phosphorus, and lower chloride concentrations.

		Overall Grade
2013	Grade	C
	% meet target	74.2
	# samples	10509
2012	Grade	C-
	% meet target	71.7
	# samples	7078
2011	Grade	D+
	% meet target	68.5
	# samples	7712

Milwaukee River Basin With Impaired Stream Sections





Milwaukee River Watershed

So how healthy is the Milwaukee River and its tributaries? The Milwaukee River Watershed earned an overall water quality grade of C+ in 2013, which is a slight improvement from C grades the Watershed received in our 2012 and 2011 Report Cards. The Watershed received A grades for temperature, oxygen, and pH. The chloride grade for the whole year was an A grade, but many of the smaller creeks in the Watershed (e.g., Ulao, Lincoln) have chloride levels exceeding what is considered safe for fish during winter and early spring months.

The turbidity grade, which looks at the cloudiness of the water or amount of sediment, was a C overall. The northern subwatersheds mostly received A grades, but the Milwaukee River South Subwatershed drags down the grade for turbidity, with a C- (more monitoring sites and samples were taken in the South Subwatershed too).

The Watershed has received an F grade almost every year for phosphorus and conductivity. Interestingly, both the Milwaukee River South Subwatershed at the bottom and the Milwaukee River East-West Branch near the headwaters received F grades this year, with Cedar Creek receiving a D and the North Branch receiving a D+. This is indicative of the widespread problem we are facing with phosphorus contamination

in our largest watershed, regardless of land use (e.g., urban or rural). Phosphorus is a limiting nutrient in most freshwater systems, and excess phosphorus causes growth of nuisance algae as well as a cascade of water quality problems as it is broken down biologically in the stream.

Conductivity data is only available for the Milwaukee River South and Cedar Creek Subwatersheds, but both received F grades. Conductivity is a measure of the ability of water to pass an electrical current. High levels of conductivity usually indicate human discharges of pollutants to streams of “charged” contaminants that can range from heavy metals in industrial waste to chloride or road salt, to byproducts of fertilizers (phosphates and nitrates). Bacteria data is only available for the southern part of the Watershed. Every year, due largely to agricultural and urban runoff, as well as likely failing sewer infrastructure and septic tanks, the Watershed receives an F for bacteria.

The following pages go into more detail about the water quality and characteristics of each of the Milwaukee River’s four subwatersheds.

- Counties**
 Dodge
 Fond du Lac
 Milwaukee
 Ozaukee
 Sheboygan
 Washington
- Communities**
 Adell
 Bayside
 Brown Deer
 Campbellsport
 Cascade
 Cedarburg
 Fox Point
 Fredonia
 Germantown
 Glendale
 Grafton
 Fredonia
 Jackson
 Kewaskum
 Lyndon
 Mequon
 Milwaukee
 Newburg
 Random Lake
 Richfield
 River Hills
 Saukville
 Shorewood
 Slinger
 Thiensville
 West Bend
 Whitefish Bay

		Overall Grade	Dissolved Oxygen	pH	Turbidity	Water Temp	Phosphorus	Conductivity	Chloride	Bacteria
2013	Grade	C+	A	A	C	A	F	F	A	F
	% meet target	77.3	93.9	99.0	74.7	100.0	53.1	7.9	96.6	45.5
	# samples	4326	609	597	601	611	548	368	684	308
2012	Grade	C	A	A	D	A	F	F	C-	D+
	% meet target	75.4	93.7	99.5	65.4	99.8	42.5	5.2	71.4	68.5
	# samples	3106	557	549	552	591	188	349	28	292
2011	Grade	C	A	A	D	A	F	F	A	F
	% meet target	74.0	95.9	99.8	69.6	100.0	NA	9.8	NA	48.8
	# samples	3234	548	552	557	551	NA	429	NA	512

A Note About Impaired Streams

This year, in addition to reporting water quality monitoring results, we also included lists and maps of stream sections that have been identified as “impaired” by the WDNR. These waters are flagged for special attention because they do not meet water quality standards for different pollutants. Section 303(d) of the Clean Water Act requires that states, authorized tribes, and other delegated authorities develop these impaired waters lists every two years.

Our report card reflects those waters listed in 2012, because the 2014 list has yet to be approved by EPA. The law requires that states set priority rankings for waters on the Impaired Waters Lists, and develop a Total Maximum Daily Load or TMDL for all

impaired waters. A TMDL is a calculation of the maximum amount of a pollutant that a waterbody can receive and still safely meet water quality standards.

As of 2012, there are 168 miles of impaired streams, including 72 segments of 36 different streams. They are listed for a diverse set of pollutants ranging from specific pollutants such as bacteria to PCBs (an industrial pollutant) to more general concerns of aquatic toxicity or degraded habitat. Many streams are listed as impaired for multiple pollutants at a time. The state can add or remove impairments to existing 303d listed streams.

Wisconsin is working on what is called a “third party” TMDL right now, led by MMSD,

but with WDNR oversight, for the entire Milwaukee River Basin. These TMDLs are being developed for bacteria, phosphorus, and total suspended solids, which are all generally increasing in our local rivers. The watershed approach is necessary because many downstream sections of river that are impaired will not improve if upstream sources of pollution are not addressed. We anticipate these TMDLs will be released in 2015.

Many stream segments with special impairments are being remedied through projects such as the Superfund cleanup of the Little Menomonee River, or dredging projects on the KK, Burnham Canal, and the Milwaukee River in Lincoln Park.

Milwaukee River South Subwatershed

The Milwaukee River South ranges from portions of the densely urban City of Milwaukee, through the northern suburbs, to mostly rural areas north of Saukville and west of Port Washington in Ozaukee County. According to the WDNR, the Watershed's land use is 33% urban, 25% agriculture, and another 39% consists of grasslands, forests

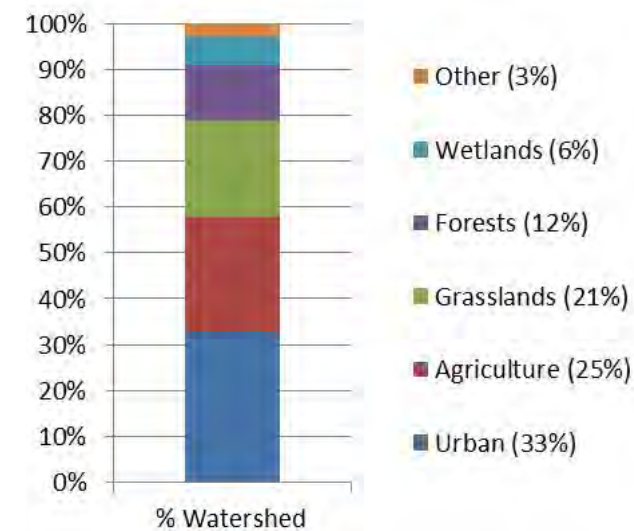
and wetlands. There is a lot of exciting work happening in this Subwatershed including: removal of fish passage impediments in Ozaukee County; large-scale restoration of Ulao and Mole Creeks; removal of contaminated sediments in Lincoln Park; and restoration and trail improvements within the Milwaukee River Greenway.

Milwaukee River South (154.92 sq mi)

Notable Streams	Length (mi)
Milwaukee River	103.8
Lincoln Creek	9.7
Ulao Creek	8.5
Mole Creek	8.4
Pigeon Creek	5.2

Source: WDNR GIS Stream Layer, 2007

Land Use



Source: DNR Watershed Description, 2001

Impaired Streams

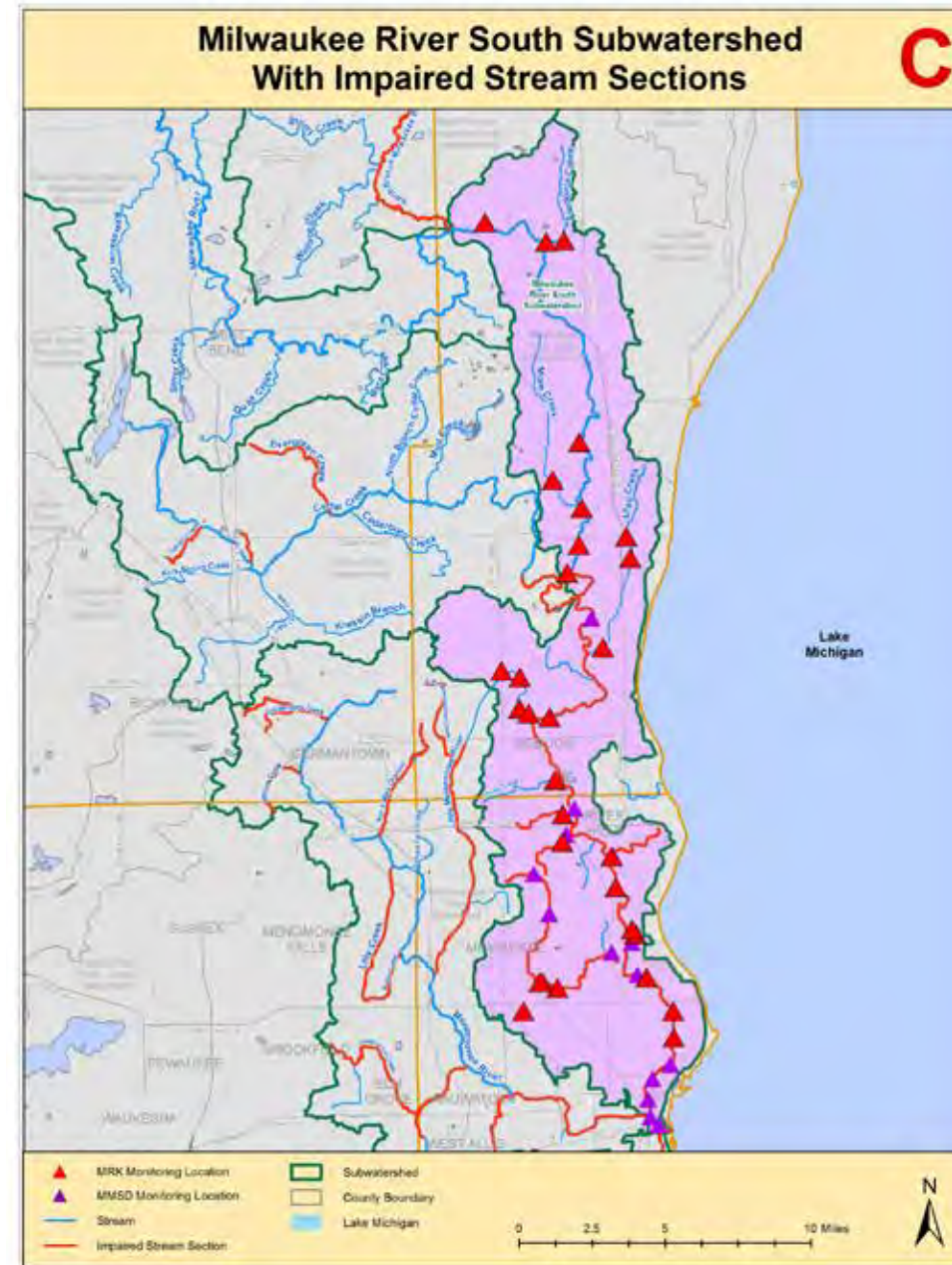
Several Milwaukee River tributaries in the Milwaukee River South Subwatershed are on the WDNR Impaired Waters List. We are proud to say that WDNR greatly relies on our volunteer data to make these designations (see description of Impaired Waters).



Volunteers use a turbidity tube.

Impaired Streams	
Bacteria	Sediment / TSS
Milwaukee River	Indian Creek
	Lincoln Creek
	Southbranch Creek
Chloride	
Lincoln Creek	
Metals	Total Phosphorus
Indian Creek	Beaver Creek
Lincoln Creek	Fredonia Creek
Milwaukee River	Indian Creek
	Lincoln Creek
PCBs / PAHs	Milwaukee River
Cedar Creek	Southbranch Creek
Lincoln Creek	Trinity Creek
Milwaukee River	Ulao Creek

Source: WDNR Impaired Waters List, 2012



Results

In 2013, seventeen Milwaukee Riverkeeper volunteers monitored thirty sites in the Milwaukee River South Subwatershed. The overall grade did not change much between 2010 and 2013. The grade dropped from a C in 2010 to a C- in 2011 and 2012, but then improved to a C in 2013.

MMSD monitored fourteen locations in the Subwatershed, contributing over 3,000 data points to our analysis. This additional data affected overall chloride grades. MMSD chloride data covered the entire year, which weighted the average and resulted in an A grade for chronic and acute levels of chloride toxicity. Milwaukee Riverkeeper data only includes results from the winter road salt season, and results in F's for chronic and acute chloride levels in 2013. The only other major discrepancy is turbidity, where Milwaukee Riverkeeper volunteer data came in at a B+ and MMSD at a D-, likely due to a greater sample size by MMSD.

		Overall Grade	Dissolved Oxygen	pH	Turbidity	Water Temp	Phosphorus	Conductivity	Chloride	Bacteria
2013	Grade	C	A	A	C-	A	F	F	A	F
	% meet target	75.8	94.1	99.4	70.1	100.0	51.8	7.9	96.6	45.5
	# samples	3810	508	495	502	507	440	366	684	308
2012	Grade	C-	A-	A	F	A	F	F	F	D+
	% meet target	72.7	93.0	98.5	59.4	100.0	30.0	5.3	55.6	68.5
	# samples	2517	440	439	438	471	80	339	18	292
2011	Grade	C-	A	A	D	A	F	F	B	F
	% meet target	73.0	97.4	100.0	66.6	100.0	40.0	7.5	89.7	53.1
	# samples	3234	548	552	557	551	25	466	68	467
2010	Grade	C	A	A	D	A	NA	F	NA	F
	% meet target	73.8	96.8	99.8	67.3	100	NA	9.8	NA	48.8
	# samples	3190	567	570	550	559	NA	429	NA	512

Cedar Creek Subwatershed

The Cedar Creek Subwatershed is primarily a rural watershed, bordering the northern suburbs in Ozaukee and Washington Counties. The Subwatershed includes portions of Germantown, Slinger and Cedarburg, as well as the Village of Jackson.

Besides Cedar Creek and its major tributaries, other prominent waterbodies within the Subwatershed include

Big and Little Cedar Lake, the Jackson Marsh Wildlife Refuge, and Cedarburg Bog State Natural Area.

A stretch of Cedar Creek, downstream from the “ruck pond” in downtown Cedarburg to the confluence with the Milwaukee River, is contaminated with PCBs and is a Federal Superfund site. Planning for clean-up is currently underway after nearly a decade of delay.

Cedar Creek Subwatershed (128 sq mi)

Notable Streams	Length (mi)
Cedar Creek	33.6
Little Cedar Creek	7.8
North Branch Cedar Creek	7.7
Mud Creek	6.5
Cedarburg Creek	6.4
Evergreen Creek	5.2
Kressin Branch	5.1
Polk Spring Creek	4.7
Lehner Creek	2.1

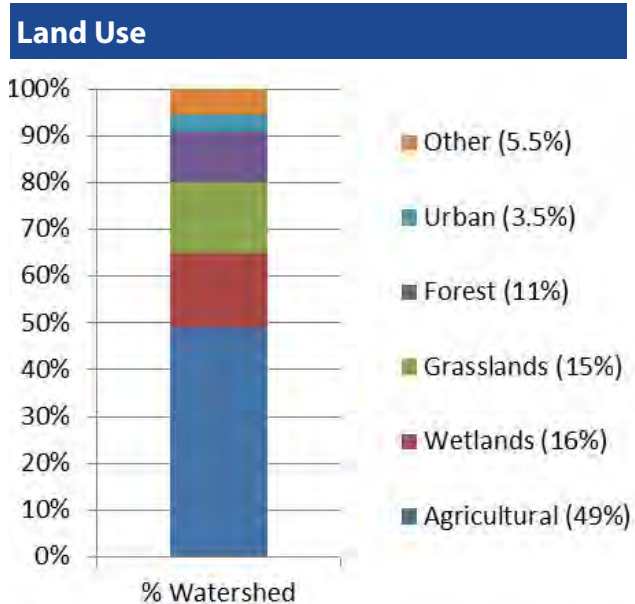
Source: WDNR GIS Stream Layer, 2007

Notable Lakes	Area (acres)
Cedar Lake	937.2
Little Cedar Lake	260.2
Mud Lake	148.0
Gilbert Lake	43.2
Long Lake	39.0

Source: WDNR GIS Waterbody Layer, 2014

Notable Wetlands	Area (acres)
Jackson Marsh	2,312
Cedarburg Bog	1,750

Source: WDNR GIS Stream Layer, 2007



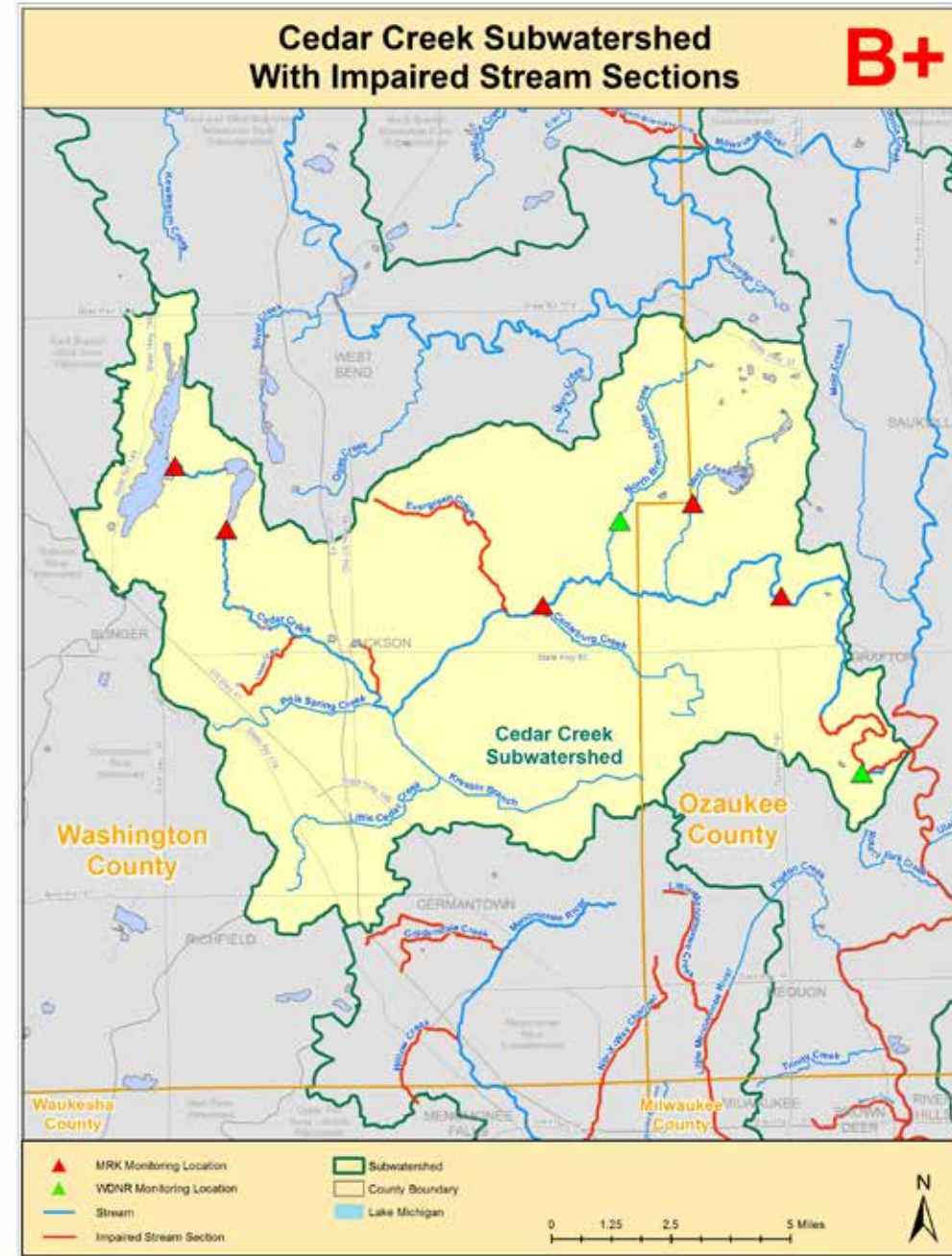
Impaired Streams

Cedar Creek has a legacy of industrial pollution, largely stemming from Mercury Marine, a boat manufacturing plant which operated from 1951 to 1982 and to a lesser extent from historic operations of an automotive supplier, Amcast. The lower five miles of Cedar Creek, including a few ponds, are impaired.

A few smaller creeks, Evergreen, Lehner and Jackson, have been listed for excessive sediment and total suspended solids (TSS), and the entire length of Cedar Creek upstream from the PCB contamination has been proposed to be listed for total phosphorus.

Impaired Streams	
PCBs	Cedar Creek
Sediment / TSS	Evergreen Creek Lehner Creek Jackson Creek

Source: WDNR Impaired Waters List, 2012



Results

In 2013, six volunteers monitored five locations within the Cedar Creek Subwatershed. Basic parameters (dissolved oxygen, water temperature, pH and turbidity) scored A's. However, total phosphorus (tested monthly at all sites) failed to meet standards one-third of the time. There were only two samples taken for conductivity, and they did not meet our water quality targets. This suggests impairment to aquatic life, as levels fell outside the generally accepted range for a healthy aquatic ecosystem. No chloride samples were taken, as funds were only available for sampling a small subset of streams in 2013.

		Overall Grade	Dissolved Oxygen	pH	Turbidity	Water Temp	Phosphorus	Conductivity	Chloride
2013	Grade	B +	A	A	A -	A	D	F	NA
	% meet target	88.1	100.0	95.8	90.9	100.0	65.4	0.0	NA
	# samples	123	23	24	22	25	26	2	NA
2012	Grade	B	A -	A	B	A	D -	F	NA
	% meet target	84.3	90.0	100	83.3	100	62.1	0.0	NA
	# samples	159	30	30	30	34	29	6	NA
2011	Grade	B	A	A	A	A	D	F	A
	% meet target	83.1	94.9	100.0	93.9	94.9	62.5	4.8	100
	# samples	207	39	39	33	39	24	21	10
2010	Grade	A	A	A	A	A	NA	NA	NA
	% meet target	97.9	95.0	100	92.5	100	NA	NA	NA
	# samples	160	40	40	40	40	NA	NA	NA

North Branch Milwaukee River Subwatershed

The North Branch Milwaukee River Subwatershed is primarily rural and spans three counties: Ozaukee, Sheboygan, and Washington. According to WDNR, agriculture accounts for 57% of the land use, with grasslands and forests covering another 23%. Less than one half of one percent is considered urban land, with only three incorporated municipalities: the Villages of Adell, Cascade, and Random Lake. The North Branch also contains several small lakes and contains the largest tract of undeveloped land in Southeast Wisconsin.

The North Branch Milwaukee River Wildlife and Farming Heritage Area is located here and is a long-term WDNR

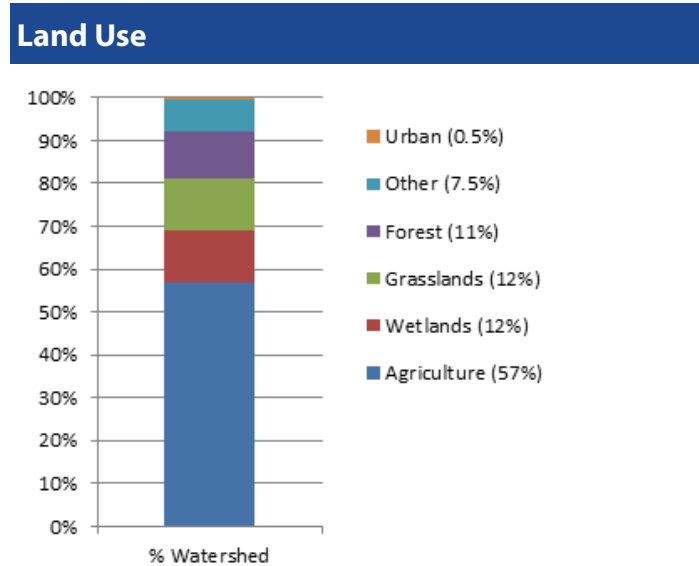
land acquisition project with a goal of preserving natural areas and the rural-agricultural landscape of the region.

As of 2009, this area included thirteen parcels of state-owned land totaling 765 acres, two privately owned properties totaling 171 acres (with public easements), 407 acres under the federal waterfowl production program and 134 acres owned by the Ozaukee Washington Land Trust. Most of these areas are open for passive use and hunting. This Subwatershed also includes the 612 acre Nichols Creek Wildlife Area on the river, which contains coldwater seeps and runs that constitute a Class I trout stream with naturally reproducing brook and brown trout.

North Branch Milwaukee River Subwatershed (148.5 sq mi)

Notable Streams	Length (mi)
Milwaukee River	103.8
North Branch Milwaukee River	27.8
Silver Creek	14.5
Mink Creek	14.5
Stony Creek	13.5
Wallace Creek	8.4
Batavia Creek	5.0
Melius Creek	3.1
Chambers Creek	2.9
Gooseville Creek	2.4
Erler Creek	1.3

Source: WDNR GIS Stream Layer, 2007



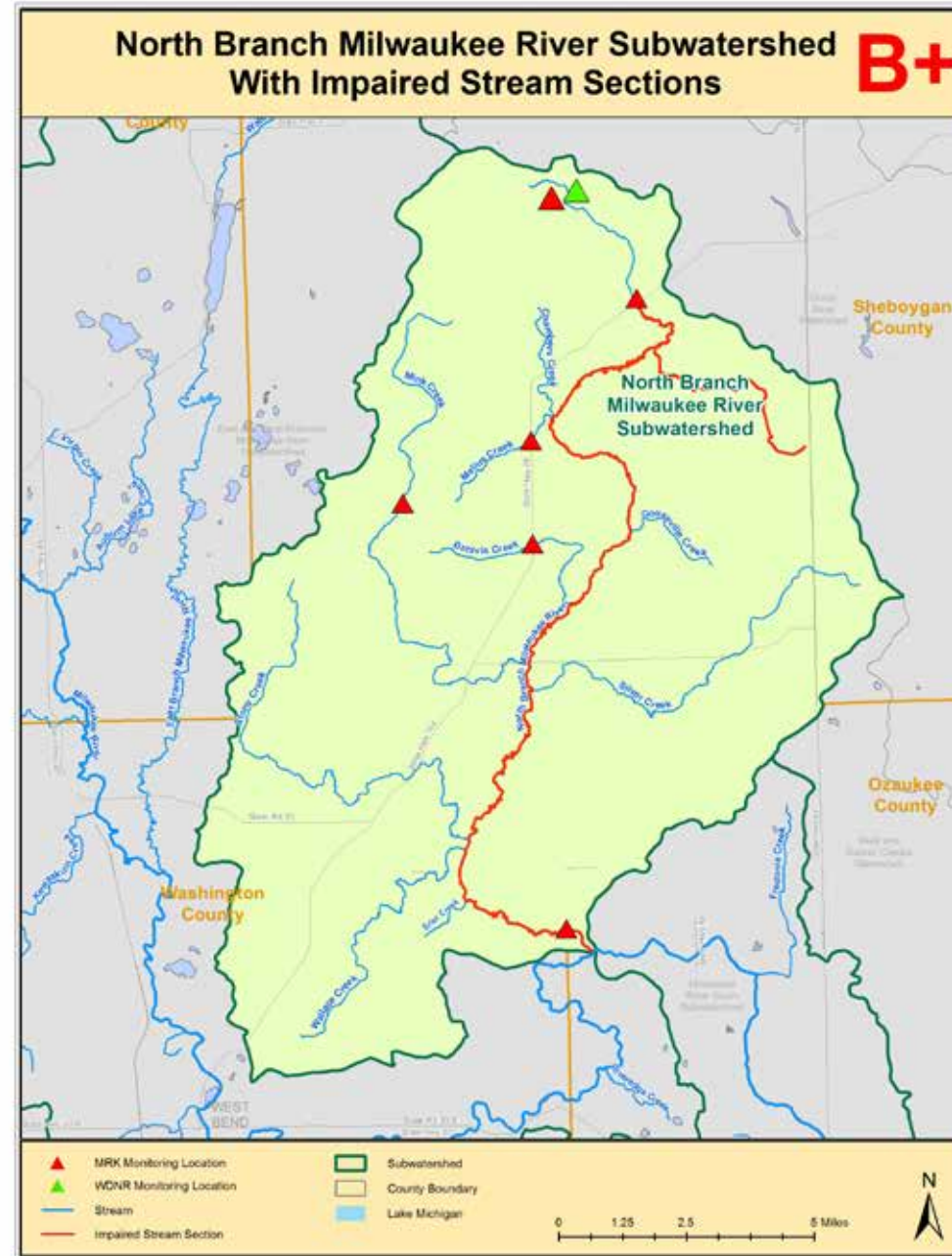
Source: DNR Watershed Description, 2001

Impaired Streams

The WDNR has listed two streams as impaired in this Subwatershed: the North Branch Milwaukee River for total phosphorus and the Adell Tributary for sediment and TSS. Batavia Creek and Mink Creek have been proposed to be listed for total phosphorus.

Impaired Streams
Sediment / TSS Adell Tributary
Total Phosphorus North Branch Milwaukee River

Source: WDNR Impaired Waters List, 2012



Results

In 2013, four volunteers monitored six locations in the North Branch. Grades for this Subwatershed have proven to be the most dynamic from 2010 to 2013, with a steady improvement in turbidity, from a grade of C in 2010 to a grade of A for 2013. Dissolved oxygen and phosphorus received grades of C+ and D+, respectively.

The WDNR collected one phosphorus sample on the North Branch Milwaukee River in August which met the acceptable stream standard of 0.075 mg/L. The North Branch is heavily impacted by agricultural runoff, which is likely the cause of the D+ grade for phosphorus. Streams are also small and tend to decrease in volume and flow during late summer, impacting oxygen levels. The North Branch falls outside of the MMSD monitoring range, as such, there is no data from MMSD in our results.

		Overall Grade	Dissolved Oxygen	pH	Turbidity	Water Temp	Phosphorus	Conductivity
2013	Grade	B+	C+	A	A	A	D+	NA
	% meet target	88.0	78.6	100	100	100.0	67.6	NA
	# samples	150	28	28	28	29	37	NA
2012	Grade	B	A	A	B+	A	F	F
	% meet target	85.6	100	100	87.9	100	50.0	0.0
	# samples	167	33	29	33	33	38	1
2011	Grade	C+	C	A	B	A	F	F
	% meet target	78.8	70.0	100.0	85.0	100	38.9	0.0
	# samples	99	20	20	20	20	18	1
2010	Grade	B	D	A	C	A	NA	NA
	% meet target	85.3	64.7	100	76.5	100	NA	NA
	# samples	68	17	17	17	17	NA	NA

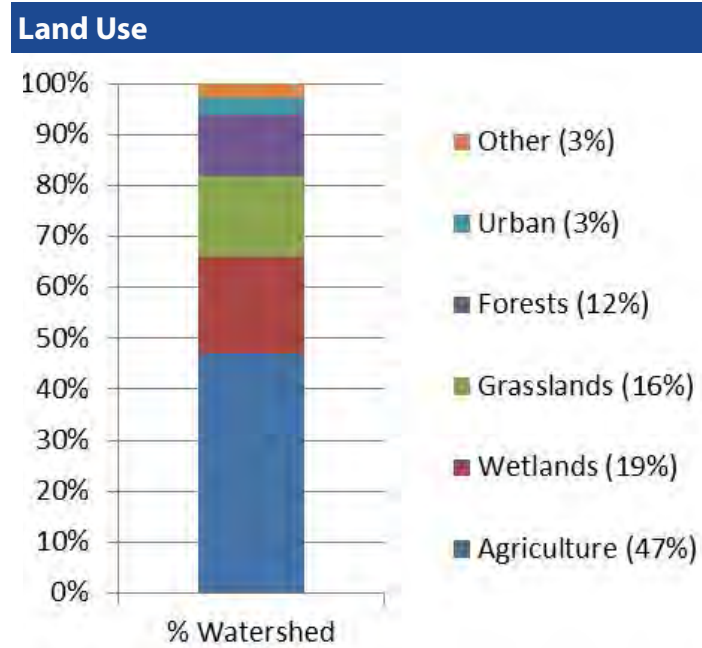
East & West Branches Milwaukee River Subwatershed

The East and West Branches of the Milwaukee River cover the largest land area in the Milwaukee River Watershed. This Subwatershed spans across portions of Dodge, Fond du Lac, Ozaukee, Sheboygan, and Washington counties. The Subwatershed is mostly rural, with agriculture dominating 47% of the land use and 47% represented by wetlands, grasslands and forests, according to the WDNR. Major cities include West Bend, Kewaskum, Newburg and Campbellsport.

The West Branch meets the Milwaukee River mainstem north of Kewaskum and the East Branch joins south of

Kewaskum and runs through the Kettle Moraine State Forest. The two branches join to form the mainstem that continues to flow downstream to the east and then south through the Milwaukee River South Watershed. Restoration upstream of the former Campbellsport Dam continued in 2013, after removal of the 165-year-old dam in 2011 and a horrible drought in 2012 that hampered restoration efforts. The river has returned to a wilder and more natural state, and fish are now able to access the uppermost 25 miles of the Milwaukee River as well as 22 acres of wetlands for potential spawning.

East & West Branches Milwaukee River Subwatershed (268.62 sq mi)



Source: DNR Watershed Description, 2001

Impaired Streams

The WDNR has proposed a portion of the Milwaukee River in this Subwatershed to be listed for total phosphorus, but no other streams in this watershed are currently on the Impaired Waters List.

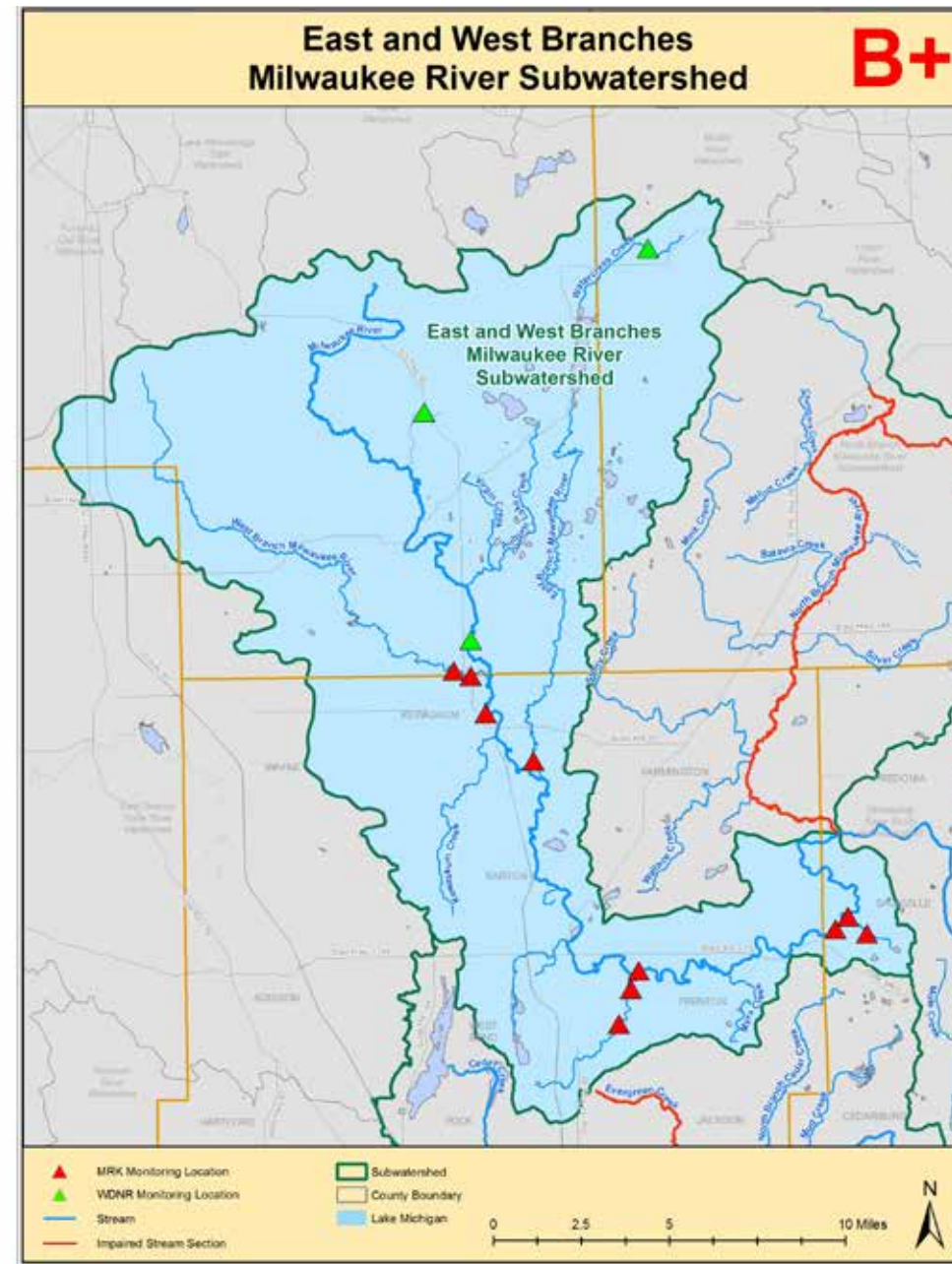
Source: WDNR Impaired Waters List, 2012

Notable Streams	Length (mi)
Milwaukee River	103.8
West Branch Milwaukee River	21.3
East Branch Milwaukee River	18.4
Silver Creek	14.5
Kewaskum Creek	7.8
Auburn lake Creek	7.8
Quaas Creek	6.3
Watercress Creek	5.0
Virgin Creek	3.8
Myra Creek	3.7
Unnamed (WBIC 43500)	3.0
Riveredge Creek	2.3
Junk Creek	1.1
Engmon Creek	1.0

Source: WDNR GIS Stream Layer, 2007

Notable Lakes	Area (acres)
Long Lake	423.6
Kettle Moraine Lake	209.0
Silver Lake	122.4
Crooked Lake	93.6
Auburn lake	90.0
Smith Lake	85.2
Mauthe Lake	70.2
Lucas Lake	69.3
Forest Lake	50.6
Mud Lake	47.7

Source: WDNR GIS Waterbody Layer, 2014



Results

Milwaukee Riverkeeper had five volunteers monitoring ten different sites in the Subwatershed. Our results have been consistent from 2010 to 2013. The overall score has remained fairly steady with A to B to B+ grades from 2010 to 2012, respectively. The 2013 grade for the Subwatershed is a B+.

The only failing grade in 2013 was for total phosphorus. The WDNR monitored three sites in 2013, two of which were monitored solely for total phosphorus, and one of these samples breached the stream standard. Only 46.7% of the forty-five samples taken by our volunteers met the state standard of 0.075 mg/L. This is most likely from agriculture, urban runoff and treated effluent from wastewater treatment plants. We had no funds to test for conductivity or chloride in 2013.

The Subwatershed was not monitored by MMSD because it lies outside of their service area.

		Overall Grade	Dissolved Oxygen	pH	Turbidity	Water Temp	Phosphorus	Conductivity
2013	Grade	B+	A	A	A	A	F	NA
% meet standard		88.9	98.0	96.0	100	100	46.7	NA
# samples		244	50	50	49	50	45	NA
2012	Grade	B+	A	A	A-	A	F	F
% meet standard		89.7	98.1	98.0	92.2	100	58.5	0.0
# samples		253	54	51	51	53	41	3
2011	Grade	B	A	A	A	A	F	F
% meet standard		86.5	100	100	100	100	46.2	0.0
# samples		74	15	14	14	15	13	3
2010	Grade	A	A	A	A	A	NA	NA
% meet standard		97.9	100	100	91.7	100	NA	NA
# samples		48	12	12	12	12	NA	NA



Menomonee River Watershed

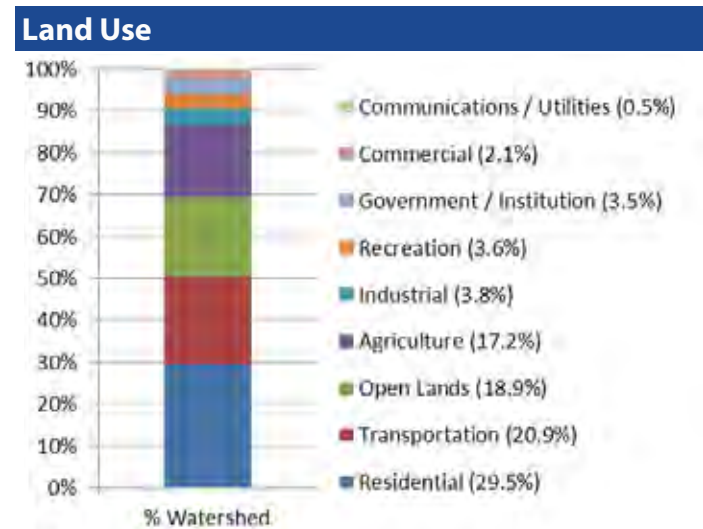
The Menomonee River Watershed covers 136 square miles, is the second most urban watershed in our Basin, and straddles portions of four counties, stretching from the Milwaukee River Estuary northwest to the Germantown area. According to 2010 SEWRPC data, the major land uses are urban, with two thirds of the area falling into residential and transportation categories. Open lands such as grasslands, wetlands and forests account for slightly more than twenty percent. A 2004 analysis of the Menomonee River Watershed in Milwaukee County shows streambank conditions in the Menomonee fare a bit better than our other urban watershed, the Kinnickinnic. Nearly sixty-three percent of the streams in the Watershed have natural streambeds. The remaining streambanks are reinforced with concrete (e.g., Honey Creek, Underwood Creek, Nor-X-Way Channel), enclosed (portions of Honey Creek, Dretzka Creek, Underwood Creek), walled (e.g., Honey Creek, lower Menomonee), or bolstered with rip rap (big chunks of concrete).

The Menomonee River fishery is characterized as a poor fishery, despite an increase in fish species in recent years due largely to removal of the Falk Dam and colonization by Lake Michigan fishes migrating up river from downstream. Other factors impact the health of the fisheries including land use changes and increased imperviousness in the watershed--such as conversion of farms to parking lots--that has caused habitat degradation and stagnated fish diversity. Development has created many impassable culverts, filled in or altered habitat, and created other artificial barriers like small dams and drop structures. In addition, filling, dredging, channel

relocation, and engineering destroyed approximately half of the spawning wetlands in the watershed as well as the ecological functions they once provided. Wetland and marsh fish spawning habitat for northern pike and walleye is absent from the lower reaches of the Menomonee River and Milwaukee Estuary. However, habitat suitable for sustaining potadromous fish populations (that migrate from the lake upstream to spawn) is present throughout the upper Menomonee River and some of its major tributaries (estimated at 3,700 acres of riparian wetlands).

Many exciting projects happened in the lower Menomonee River during 2013, most notably, the first phase of concrete channel removal between Miller Park and Miller Brewery began. Fish movement upstream will improve as a result. Sediments contaminated with metals and petroleum byproducts were dredged from the western portion of Burnham Canal in 2013, as part of an alternative Superfund clean-up adjacent to Miller Compressing. Riverkeeper helped the City of Menomonee Falls to stabilize and revegetate approximately 250 feet of streambank in Rotary Park in Menomonee Falls, as well as additional 80 feet of failing streambank along Lilly Creek in the Bowling Green Industrial Park. Plans are also in the works by MMSD and other partners to restore Burnham Canal to a wetland in future years.

Menomonee River Watershed (135.77 sq mi)



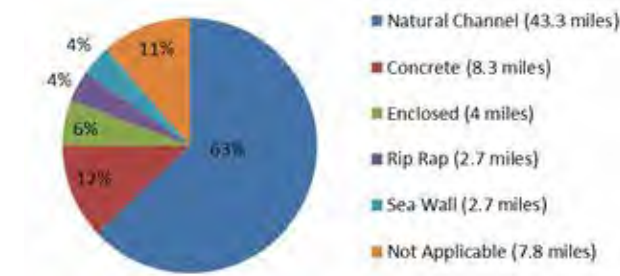
Source: SEWRPC GIS Land Use Layer, 2010

- | | | |
|--------------------|---|---|
| Counties | Milwaukee
Ozaukee | Washington
Waukesha |
| Communities | Brookfield
Butler
Elm Grove
Germantown
Greendale
Greenfield
Menomonee Falls | Mequon
Milwaukee
New Berlin
Richfield
Wauwatosa
West Allis
West Milwaukee |

Notable Streams	Length (mi)
Menomonee River	30.5
Little Menomonee River	10.1
Underwood Creek	8.5
Honey Creek	6.4
Lily Creek	4.8
Nor-X-Way Channel	4.8
Little Menomonee Creek	4.0
Dretzka Park Creek	3.3
Goldendale Creek	3.2
Dousman Ditch	3.1
Willow Creek	2.6
Noyes Park Creek	2.3
South Branch Underwood Creek	1.9
Butler Creek	1.7

Source: WDNR GIS Stream Layer, 2007

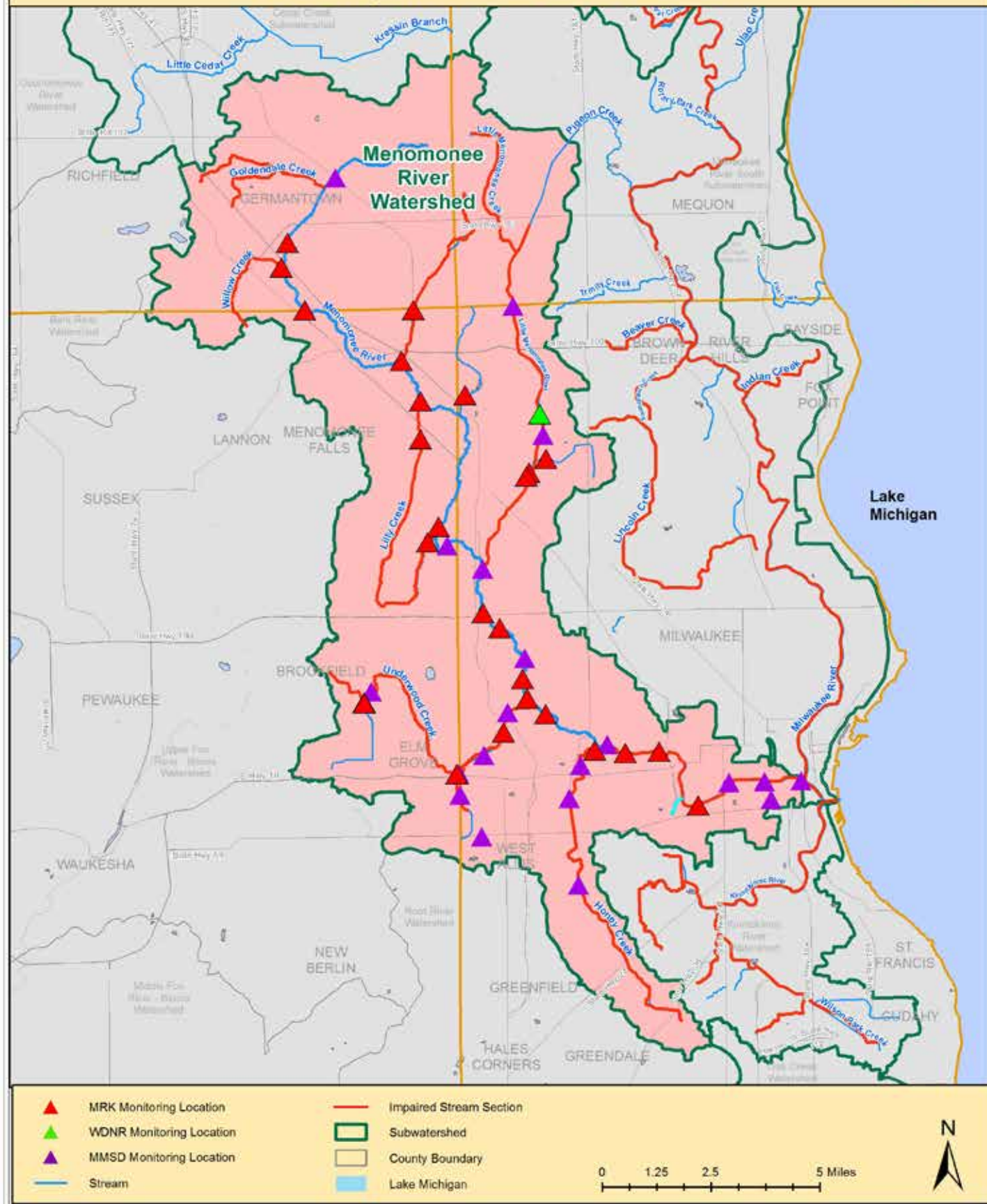
Streambank Type (68.84 mi assessed)



Source: Inter-Fluve Milwaukee County Streambank Study, 2004

Menomonee River Watershed With Impaired Stream Sections

C-



Menomonee Watershed Monitoring Results

In 2013, sixteen Milwaukee Riverkeeper volunteers monitored at twenty-five sites across the Watershed. The Watershed improved slightly from a D in 2012 to a C- in 2013. The 2013 grade was once again sunk by very poor grades for bacteria, conductivity and turbidity.

0.75 mg/L, exceeds the DNR's stream standard of 0.075 mg/L by 100 times. The Milwaukee Riverkeeper grade for phosphorus was also an F with only 39 of 75 samples meeting the new phosphorus standard.

DNR staff only monitored one location on the Little Menomonee River, solely for phosphorus. The result,

The MMSD surface water team monitored 21 sites throughout the Watershed, contributing over 3,500 data points to our analysis.

		Overall Grade	Dissolved Oxygen	pH	Turbidity	Water Temp	Phosphorus	Conductivity	Chloride	Bacteria
2013	Grade	C-	B+	A	D+	A	C	F	B-	F
	% meet target	70.4	87.1	100	66.7	100.0	74.3	2.5	82.1	28.2
	# samples	4184	511	496	508	520	471	400	792	486
2012	Grade	D	B	A	C-	A	F	F	C	F
	% meet target	66.5	84.5	99.7	70.1	99.8	36.9	2.8	75.0	44.3
	# samples	2490	394	394	381	419	65	359	12	537
2011	Grade	D	B	A	D	A	F	F	C	F
	% meet target	64.2	85.6	99.8	67.6	100.0	42.1	5.1	79.4	39.6
	# samples	2993	445	450	447	449	19	431	34	718

Impaired Streams

Eleven miles of stream are listed as impaired. Over five miles of the Little Menomonee River have been designated as a Superfund site since 1984 for cresote contamination. Clean-up ended in 2009, but the site will be monitored every five years by the EPA until 2026! A legacy of industrial pollution remains an issue with roughly the lower three miles of the Menomonee River, listed as impaired for both "unspecified metals" and PCB's.

Impaired Streams	
Bacteria	PCBs / Unspecified Metals
Butler Creek	Menomonee River
Goldenthal Creek	
Honey Creek	
Lily Creek	
Little Menomonee Creek	Total Phosphorus
Little Menomonee River	Dretzka Park Creek
Menomonee River	Honey Creek
Nor-X-Way Channel	Little Menomonee River
Underwood Creek	Menomonee River
West Br Menomonee River	Nor-X-Way Channel
Willow Creek	S Br Underwood Creek
	Underwood Creek
Creosote	
Little Menomonee River	

Source: WDNR Impaired Waters List, 2012

Improving Fish Passage

In 2013, Riverkeeper finished our project to identify and prioritize stream impediments for removal as well as opportunities to address aquatic habitat fragmentation in the Menomonee River Watershed. We identified and assessed over 382 different potential stream impediments along the natural mainstem and tributary reaches, and found that 126 of these obstructions were likely barriers to fish passage. We also identified 75 areas of promising spawning habitat for northern pike--largely adjacent floodplains and wetland areas. The goal of this project was to identify and prioritize stream impediments as a cost-effective way of improving aquatic life diversity and abundance of native fish species, as well as enhancing recreational and educational opportunities in the Menomonee River Watershed. Moving forward, we are working on cost estimates and designs for priority barriers, and fundraising for efforts to remove impediments to fish passage. We also plan to work with our volunteers to remove human debris and trash ranging from wood pallets and trash, to collapsed bridges and "rock fill" areas that are affecting fish movement and stream connectivity.



Kinnickinnic River Watershed

The Kinnickinnic River Watershed is the most urban watershed (90%) in the Milwaukee River Basin. The main land uses are residential, which is fairly high density, and transportation, with the interstate and General Mitchell Airport and its surrounding property composing most of this category.

The streams have been greatly modified over the past century. According to a survey conducted for Milwaukee County in 2004, of the 32.9 miles of streams assessed:

- over 32% are enclosed streams, essentially flowing in enclosed pipes;
- another 26% have been lined in concrete;
- 17% near the Milwaukee Harbor Estuary are confined by sea walls; and
- a mere 25% have a natural stream bed.

The preponderance of impervious surfaces in the watershed coupled, with concrete channelized

streams developed to convey water quickly away from neighborhoods, has led to major problems with both water quantity (e.g., flooding from too much water, too fast during rain events) and water quality, caused by stormwater runoff draining from these hard surfaces.

The good news is that the MMSD has plans to remove concrete lining from the bed of the Kinnickinnic River from 43rd Street to 6th Street in the upcoming years, as well as to remove portions of concrete from several major tributaries such as Lyons Park Creek and Wilson Park Creek.

There is also a lot of work being done to put more green infrastructure into the watershed to help capture, slow down, and infiltrate rain water to minimize stormwater runoff and the resulting flooding and water quality problems it creates.

contamination. Even though we consider any count of bacteria over 1,000 CN / 100 mL (Copy Number per 100 mL of sample) to be of concern, the extent of the problem has led us to intensely focus on (and work with municipalities to fix) those areas with repeated bacteria counts over 10,000 CN / 100 mL. The results are sobering, as nearly 60% of samples collected at stormwater outfalls (where storm sewers empty into a stream) in 2013 showed significant levels of human bacteria contamination (>1,000 CN/100 mL). See pie chart to the right.

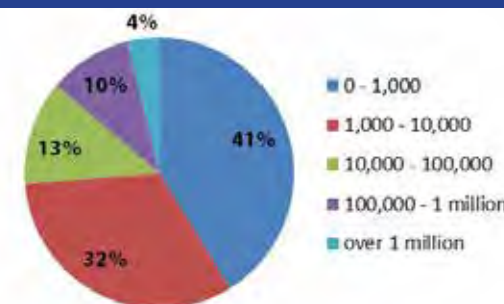
Kinnickinnic River Watershed (33.4 sq mi)

Notable Streams	Length (mi)
Kinnickinnic River	7.9
Wilson Park Creek	5.8
Holmes Avenue Creek	1.8
Lyons Park Creek	1.7
Cherokee Creek	1.6
Edgerton Ditch	1.3
43rd Street Ditch	1.2

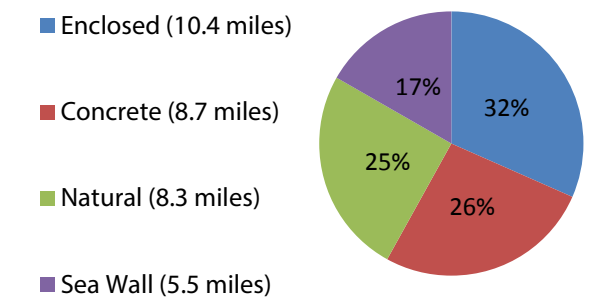
Source: WDNR GIS Stream Layer, 2007

- Counties**
Milwaukee
- Communities**
Cudahy St Francis
Greenfield West Allis
Milwaukee West Milwaukee

Human Bacteria Counts/Sample (CN / 100 mL)

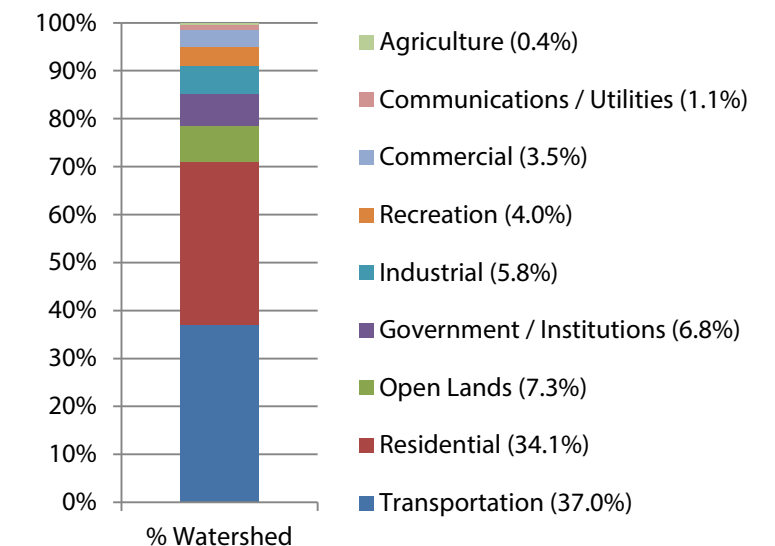


Streambank Type (32.9 mi assessed)



Source: Inter-Fluve Milwaukee County Streambank Study, 2004

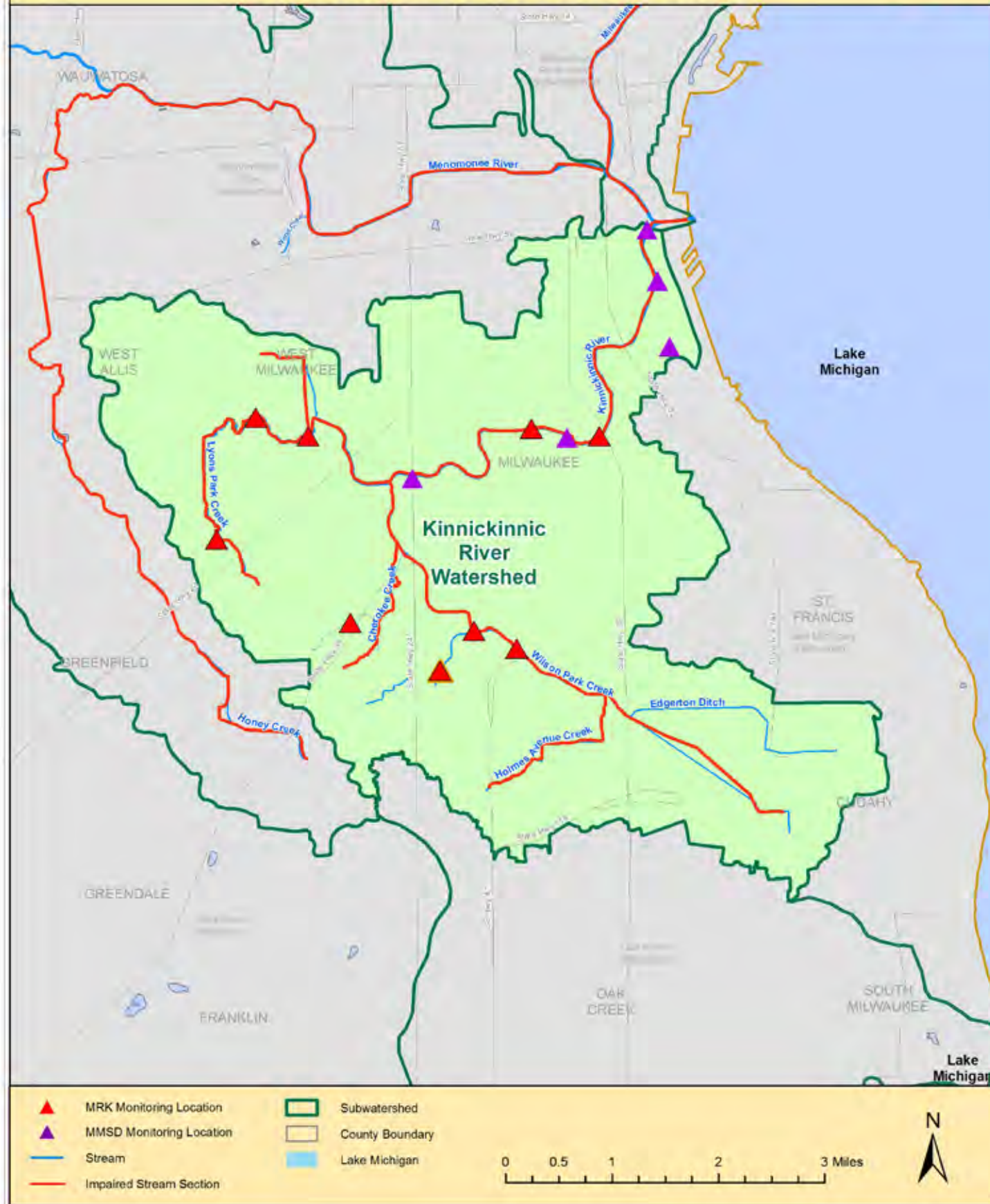
Land Use



Source: SEWRPC GIS Land Use Layer, 2010

Kinnickinnic River Watershed With Impaired Stream Sections

C-



Kinnickinnic Watershed Monitoring Results

In 2013, twelve volunteers monitored nine locations in the Watershed. Grades have remained fairly constant over the three years we have analyzed data. Bacteria, conductivity and phosphorus have consistently received failing or poor grades. Turbidity fell to a D- in 2013 from a D in 2012. Dissolved oxygen improved to a B in 2013 from a B- in 2012.

Chloride received a B+ for 2013 which is an improvement from an F in 2012. However, the positive change in chloride

results may be a bit misleading. In 2013, for the first time, we were able to incorporate extensive, year-round MMSD chloride data. Milwaukee Riverkeeper only collects data during winter months. We expect winter chloride levels to be much higher than spring, summer and fall due to the application of road salt in the winter. Including data from months when road salt is not applied minimizes the full impact to the river from road salt application and results in an inflated grade.

		Overall Grade	Dissolved Oxygen	pH	Turbidity	Water Temp	Phosphorus	Conductivity	Chloride	Bacteria
2013	Grade	C	B	A	D-	A	C-	F	B+	F
	% meet target	75.4	85.7	99.2	62.7	100.0	71.1	22.3	89.4	40.4
	# samples	1999	244	242	244	248	246	215	424	136
2012	Grade	C-	B-	A	D	A	F	F	F	F
	% meet target	72.4	82.6	98.5	64.2	100	42.1	27.0	0.0	49.6
	# samples	1111	201	195	193	207	38	159	2	127
2011	Grade	D-	C	A	F	A	C	F	F	F
	% meet target	62.3	76.7	100.0	51.4	100.0	77.8	12.6	35.7	34.9
	# samples	1105	180	177	179	180	9	174	14	192

Improvements with Stormwater BMPs

Since 2011, Riverkeeper partnered on a project led by Sixteenth Street Community Health Center and Groundwork Milwaukee to implement and evaluate a systematic approach to clustering residential stormwater best management practices (known as BMPs), such as rain gardens and rain barrels, in the KK River Watershed. The project focused on a neighborhood on the south side of the KK River from 14th to 16th Streets, as well as on a neighborhood adjacent to Lyons Creek Park. We grabbed pre and post stormwater samples before and after BMPs were installed with a goal of showing measurable improvement in water quality discharging to the Kinnickinnic River.

Approximately 6,778 square feet of rain gardens and 50 rain barrels (55 gallons each) were installed, with an estimated 33,000 gallons of water captured per year, and an estimated total of 173 pounds of TSS removed per year. The water quality data we collected, although varying considerably in different target areas (due to sewer condition, street maintenance, plant establishment, etc.), revealed promising trends in reductions of bacteria, total suspended solids, and biological oxygen demand (an indicator of the amount of oxygen needed to break down organic material in waterways). We were able to show significant reductions in phosphorus in several of the target areas. In short, our data indicates that stormwater BMPs can play a great role in minimizing pollutants running off into our local rivers.

Impaired Streams

WDNR has listed several stream sections as impaired in the Kinnickinnic Watershed. Streams not meeting standards for bacteria include sections of the Kinnickinnic River, 43rd Street Ditch, Cherokee Creek, Holmes Avenue Creek and Wilson Park Creek. The lowest 2.84 miles of the Kinnickinnic River are listed for PCB's and unspecified metals. Chloride was added to the list for the 2.84 to 5.50 mile section of the Kinnickinnic and total phosphorus impairs the 43rd Street Ditch along with the entire length of the Kinnickinnic River.

Impaired Streams

Bacteria	PCBs
43rd Street Ditch	Kinnickinnic River
Cherokee Creek	Total Phosphorus
Holmes Avenue Creek	43rd Street Ditch
Kinnickinnic River	Kinnickinnic River
Wilson Park Creek	Unspecified Metals
Chloride	Kinnickinnic River

Source: WDNR Impaired Waters List, 2012



Caddisflies, Stoneflies, & Mayflies, Oh My!

What are macroinvertebrates and why do we care about them? A very literal definition of macroinvertebrates would be small animals that are “macro” or can be seen with the naked eye, and “invertebrate” or lacking a backbone. Macroinvertebrates generally live on stream bottoms for at least a portion of their life cycle. They include insect larvae, worms, snails, mollusks, crustaceans and other aquatic life. They form the base of a stream food chain, and provide food for fish and other wildlife. They are also abundant and not very mobile (like fish) and are continuously

exposed to water quality in one area, which makes them ideal in assessing stream health over the long term.

Our introductory water quality volunteers are trained to test for aquatic macroinvertebrates using a protocol developed by the WDNR and UW-Extension called Water Action Volunteers. Most of our advanced volunteers no longer test for macroinvertebrates because the existing protocol does not generate data with the specificity required for WDNR regulatory purposes.

Macroinvertebrate monitoring inspires our volunteers in a way that chemical monitoring does not. Also, while chemical monitoring is a “snapshot” of water quality at one point in time, macroinvertebrate monitoring is a type of biological monitoring that is a good indicator of overall stream health over an extended time period. The quantity and quality of the macroinvertebrate community is a reflection of many different water quality parameters and stressors such as dissolved oxygen, temperature, toxic pollutants, turbidity (too much sediment), etc.

Macroinvertebrates are generally lumped into several categories based on their sensitivity or tolerance to pollution and oxygen demands (e.g., some require high levels of oxygen generally found in high quality streams). Based on the presence/absence of these groups of organisms, biotic index scores are calculated and streams are rated as having poor, fair, good or excellent water quality.

How are our macroinvertebrate communities doing? Sadly, both the Menomonee and Milwaukee River South watersheds received “F”

grades for 2013. Our goal is a “good” or “excellent” rating and only 2 of 11 surveys on the Menomonee or 18.2% met that goal. Likewise, only 5 of 12 surveys in the Milwaukee River South or 41.7% met that goal.

Unfortunately, our monitoring efforts for macroinvertebrates have been decreasing, instead of increasing in recent years largely due to a conundrum between wanting volunteers to gather important biological data while also ensuring high quality of data at a reasonable level of effort. Many programs like ours involve collecting organisms from the stream using fine nets and identifying them at the streamside using simple picture keys corresponding to the taxonomic level of order. The “pros” of this streamside survey are that volunteers receive an immediate indication of stream health, albeit a rough estimate. This type of survey is also great for engaging large numbers of people, has great educational value, is more fun, and ensures that critters can be caught and released back into the river. The “con” is lack of specificity or quality required for many WDNR regulatory needs, as most insects

using our protocol are identified to order and some non-insect groups are identified more coarsely at a class (WDNR protocols require a genus or species level identification). In addition, there is a concern that these protocols may overestimate stream health since certain orders, like caddisflies, can tolerate pollution more than others.

What’s the alternative? Professional taxonomists use microscopes and generally can identify macroinvertebrates at the family, genus, or species level. This type of monitoring would be required for the WDNR to “use” our macroinvertebrate data for regulatory purposes (such as listing streams as “impaired” or delisting them). This type of monitoring can be done by volunteers but requires expertise, training, and a lot of time. The “time” requires the invertebrates to be preserved or killed. We could ship samples to professionals for identification, but this process would be costly and take months or years to receive results. We do not want to lose the “fun factor” and educational piece for our volunteers. We are not

giving up, however, and are looking into whether we can implement a hybrid approach where a subset of invertebrates are collected and sent for identification to accredited labs (e.g., like a “most wanted” list). We can learn a lot about water quality from macroinvertebrates and we plan to expand our program.



Volunteers use a dichotomous key to identify macroinvertebrates.



A sampling of macroinvertebrates.

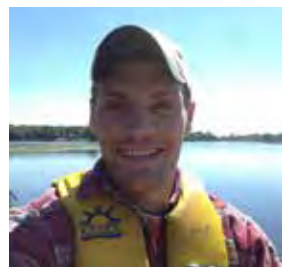


Volunteer Monitor Spotlight

Renee Kubesh Family

Renee Kubesh and her family have been faithfully monitoring the Milwaukee River at Good Hope Road for four years. The Kubesh-Morely clan added a major tributary, the Southbranch Creek, to their itinerary two years ago and have also taken on monitoring phosphorus. Renee and her family have a really good time monitoring and generally enjoy being around the stream. The Kubesh family confirms our suspicions that “happy” volunteers make excellent volunteers!

Thanks to Renee and the entire Kubesh-Morely clan!



Samm Posnanski & Alexandra Labonte

Samm joined our volunteer stream monitoring team two summers ago and has been among our most enthusiastic and dedicated monitors. Not only has Samm monitored his Underwood Creek site, but he has also enlisted several friends to join him, one of whom, Alexandra Labonte, became a trained volunteer stream monitor last year. Samm has embraced a primary tenet of our volunteer stream monitoring program - educating others on the importance of stream water quality. Alex is monitoring a stream near her childhood home, Fredonia Creek. Samm’s education at UW-Whitewater spurred his interest in the Milwaukee River Watershed and learning about the Watershed’s ecological, economical and sociological importance to Southeast Wisconsin. He not only monitors out of a sense of concern for water quality, but also admits, “it sounds kinda nerdy, but going out to my site is usually the highlight of my weekend.” Both Alex and Samm truly enjoy their experience and sharing their knowledge with their peers.



Thanks Samm and Alexandra!

Top 10 List

Ways You Can Help Improve and Restore Our Waters!

1. **Use water wisely** both inside and outside the home. Minimize use of water during heavy rain storms to reduce stress on local sewers and protect rivers from sewage overflows.
2. **Reduce, minimize or eliminate use of salt, fertilizers and pesticides** on your property.
3. **Vote GREEN** and advocate for fishable, swimmable, drinkable rivers and lakes. Contact elected officials and let them know that the health of the rivers and Lake Michigan is important to you. **Attend our advocacy events!**
4. **Stay engaged** by following Milwaukee Riverkeeper on facebook and twitter @mkeriverkeeper.
5. **Adopt a River!** Keep an eye on a section of river near you and report potential sources of pollution from construction sites or stormwater outfalls, eroding areas, and other problems to Milwaukee Riverkeeper at 414-287-0207 or to the WDNR at 1-800-TIP-WDNR.
6. **Pick up after your pets!** Pet waste is a major source of bacteria to our rivers.
7. **Become a monitor.** We will train a new group of volunteers in the spring. This is a great way to get involved and learn more about water quality and river health.
8. **Stay up to date** on current issues affecting water quality and wildlife habitat. Sign up for Riverkeeper news at www.milwaukeekeeper.org to get updates!
9. **Reduce runoff!** Install rain gardens, rain barrels, cisterns, and plant native vegetation to decrease the amount of paved surfaces around your home or business. This will reduce stormwater runoff by catching and encouraging slow infiltration of rain and snow melt. Attend our rain barrel workshop in the spring!
10. **Get involved!** Join us for river cleanups, volunteer water quality monitoring, and other community events to protect our rivers and the land that drains to them. Find these events at www.milwaukeekeeper.org!

Learn more about the health of the Milwaukee River Basin at www.milwaukeekeeper.org

BONUS: Donate and support Milwaukee Riverkeeper in our work of restoring streambanks, identifying pollution and fighting for strong policies and enforcement of laws to keep our water clean.

Donate at www.milwaukeekeeper.org.

How We Grade Our Water Quality Parameters

Below are descriptions of water quality parameters used for the Report Card. Water quality data was assessed against targets and goals as described below to determine the health and condition of our waterways. Where there is a regulatory standard or Federal guidance, that is generally listed as the goal; however, in some cases, we have created our own targets based on what we feel is the reasonable potential of our streams to support fish and recreational activities.

DISSOLVED OXYGEN (DO)

Dissolved oxygen is crucial for aquatic life. Many streams and stream segments in the urban portion of the Milwaukee River Basin have regulatory variances (per State of Wisconsin Administrative Code) allowing DO concentrations as low as 2 mg/L, which is suitable only for the most pollution tolerant fish species. These classifications have not been updated for decades. We believe all streams and stream segments in the Milwaukee River Basin are capable of reaching at least the **Warm Water Sport Fishery (WWSF) DO standard of 5 mg/L** (most streams in the watershed are designated WWSF). This was the target we used to determine if waterways were meeting our DO goal, and could support a diverse ecosystem of fish and aquatic life. We did not assess variance streams to variance standards. While many streams in the Basin already meet or are capable of meeting cool or cold water standards for fish and aquatic life, we did not use cold water sport fishery standards.

WATER TEMPERATURE

Water temperature also greatly affects fish and aquatic life. Since the majority of streams and stream segments in the Milwaukee River Basin are classified as existing or attainable WWSF streams, we targeted water temperature should remain below the WWSF continuous water temperature **maximum standard of 31.7°C**. Both instantaneous water temperatures (measured monthly using meters)

and continuous water temperatures (measured hourly by thermistors) were analyzed against this standard.

pH LEVEL

pH is a measure of acidity, or the amount of hydrogen (H+) ions in the water. pH ranges from 0 to 14 (0 being most acidic, 14 being most basic) with a value of 7 representing a “neutral” solution. Milwaukee River Basin streams generally run on the basic side of neutral, with values typically between 7 or 8 on the pH scale. It is generally accepted that a **pH range of 6-9** can support a healthy aquatic ecosystem.

TURBIDITY

Turbidity, or water clarity, affects both the light and energy inputs available to aquatic ecosystems. Our volunteers measure turbidity using transparency tubes; clear, plastic tubes that are filled and/or emptied of stream water until they barely reveal the black and white pattern on the bottom of the tube (similar to a lake secchi disc). A height of at least **54.7 cm of stream water in a 120 cm transparency tube** indicates a healthy water turbidity acceptable for aquatic life, and this was used as the target for stream health.

PHOSPHORUS (TOTAL P)

Phosphorus is an essential nutrient for plants, animals, and aquatic life. Phosphorus is typically low to absent in natural freshwater systems. Human

activities have led to large inputs of phosphorus into our rivers and lakes. These activities include fertilization of lawns and fields, sewage treatment discharge, and the addition of phosphorus into our water supply as an anti-corrosion inhibitor for old, lead pipes. Phosphorus entering our waterways causes growth of nuisance algae as well as a cascade of water quality problems. A subset of Milwaukee Riverkeeper volunteers take monthly water samples that are shipped to the State Lab of Hygiene for total phosphorus analysis. These sample results are assessed against Wisconsin phosphorus standards, which are **0.075 mg/L for smaller streams and 0.1 mg/L for larger rivers and the Milwaukee Estuary**.

MACROINVERTEBRATES

To assess aquatic macroinvertebrates, Milwaukee Riverkeeper volunteers use a simple biotic index developed by a group of Wisconsin scientists and specifically designed for streams in Wisconsin. Index score classifications range from Excellent-Good-Fair-Poor. Our target for sites in the Milwaukee River Basin is a **“good” classification**. Because macroinvertebrates cannot readily migrate like fish, they provide a good overall indicator of the health of a certain reach of stream and tend to be classified per their tolerance to a range of oxygen conditions.

CHLORIDE

High chloride concentrations in rivers and streams are toxic to aquatic organisms. Road salt runoff

constitutes a large source of chloride. Elevated levels of chloride can disrupt an organism’s ability to maintain a natural internal water balance, which leads to impaired survival, growth, and/or reproduction. The Environmental Protection Agency (EPA) has set an **acute chloride standard at 860 mg/L and a chronic chloride standard of 230 mg/L** as targets for healthy streams. These levels recognize that high levels of chloride can be acutely or instantly toxic to fish, but that lower levels of chloride over a longer period of time or chronic exposure can be just as toxic. Chloride data was assessed against these targets to determine grades. Grades for acute and chronic criteria were averaged to determine an overall grade.

CONDUCTIVITY

Conductivity is a measure of the ability of water to pass an electrical current. Conductivity in water is affected by charged particles (ions), which can be both positive (cation) and negative (anion). Anions (negative ions) include chloride, nitrate, sulfate, and phosphate. Positive ions (cations) include sodium, magnesium, calcium, iron, and aluminum. Conductivity in streams is naturally affected by geology; for instance bedrock streams tend to have lower conductivity whereas streams passing through clay soils tend to have higher conductivity. Anthropogenic discharges to streams -- such as discharge of industrial waste (e.g., heavy metals), sewage, or other “charged” contaminants such as chloride, phosphate and nitrate -- can raise conductivity. A **conductivity reading of 150 - 500 umhos/cm** provides for a healthy aquatic ecosystem with mixed fisheries according to Federal guidance, and this threshold was used as the target for determining water quality grades for this parameter.

BACTERIA

High bacteria concentrations impact not only stream health, but also human health. Regulatory agencies such as MMSD and WDNR regularly test for fecal coliform and E. coli bacteria. According to State of Wisconsin Recreational Use Standards, **fecal coliform levels should never exceed 200 CFU/100 mL (colony forming units/100 milliliter sample) in waterways, and the EPA established an E. coli standard of 235 CFU/100 mL for beaches**. The percentage of samples meeting these recreational health targets was used to determine water quality grades for bacteria.

HUMAN BACTEROIDES

Historically high levels of bacteria along stretches of the Menomonee and Kinnickinnic Rivers in Milwaukee and Wauwatosa led Milwaukee Riverkeeper (along with the University of Wisconsin - Milwaukee School of Freshwater Sciences) to investigate the possibility that failing sewer infrastructure was the culprit. Sandra McLellan’s Lab at UWM has developed techniques to identify and quantify the presence and concentration of human bacteria in stormwater using a genetic test called qPCR, which can count DNA sequences in a sample that are associated with human sewage. We looked at the **percentage of samples that tested negative** for human strains of Bacteroides to determine our grade. For example, at least 90% of samples testing negative would be an A grade.

NOTE: Grades for each water quality parameter are based on the percentage of time that the data points for the monitoring stations in each subwatershed meet our targets relating to overall aquatic ecosystem health. Grades were assigned on a typical percentage basis (90-100%=A, 80-89%=B, 70-79%=C, 60-69%=D and below 60%=F). Overall grades for each subwatershed were determined based on averaging grades for each individual parameter, and the overall watershed grade was determined by averaging the overall grades for each subwatershed. The overall Milwaukee River Basin grade was determined by averaging overall grades for the Milwaukee, Menomonee, and Kinnickinnic Watersheds.

Targets and Goals

Dissolved Oxygen	5.0 mg/L
Water Temperature	< 31.7°C
Phosphorus	
Total P Large Stream	0.1 mg/L
Total P Small Stream	0.075 mg/L
pH	6 - 9
Turbidity	54.7 cm
Conductivity	150-500 umhos/cm
Chloride	
Chloride (Acute)	860 mg/L
Chloride (Chronic)	230 mg/L
Bacteria	
Fecal coliform	200 CFU/100 mL
E. coli	235 CFU/100 mL
Macroinvertebrates	“Good”



Our Mission

Milwaukee Riverkeeper's mission is to protect water quality and wildlife habitat in the river corridors and to advocate for sound land use in the Milwaukee, Menomonee, and Kinnickinnic River Watersheds. We envision a future where all people within the Milwaukee River Basin can enjoy clean drinking water and fishable, swimmable rivers.

Milwaukee Riverkeeper serves as an advocate and voice for the Milwaukee, Menomonee, and Kinnickinnic Rivers. Our core programming involves patrolling, monitoring, and advocating on behalf of the rivers. We also coordinate hands-on river restoration projects and organize thousands of volunteers each year in river cleanups. We connect people to water through river-focused events and educate our community about water quality and river health.

Milwaukee Riverkeeper is a licensed member of the Waterkeeper Alliance, an international coalition dedicated to clean water and healthy communities.



Help us monitor and advocate for our rivers.
Donate at www.milwaukeekeeper.org.



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