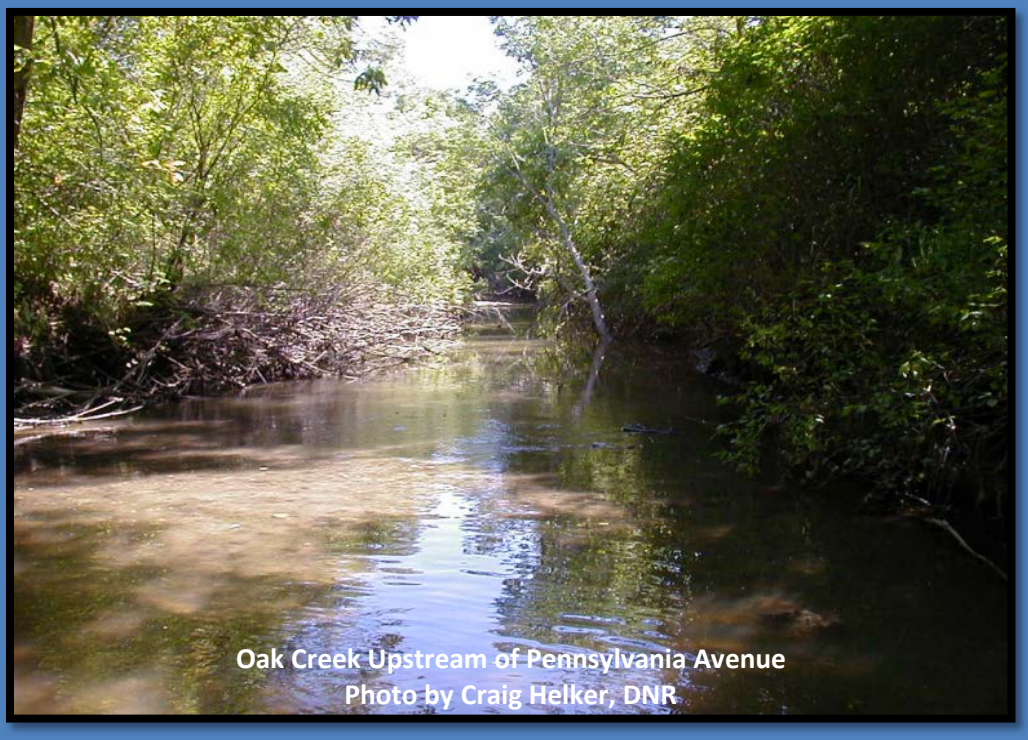
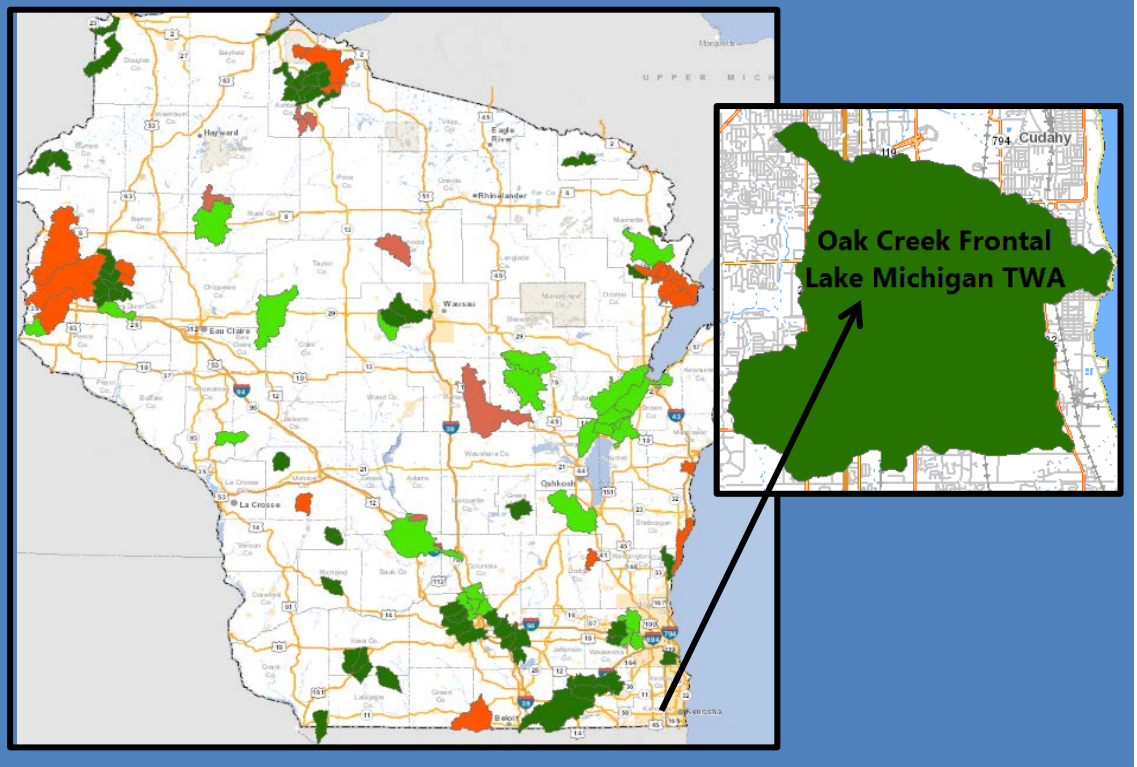
A Watershed Report created by the Bureau of Water Quality in support of the Clean Water Act.



Oak Creek Upstream of Pennsylvania Avenue
Photo by Craig Helker, DNR

OAK CREEK FRONTAL LAKE MICHIGAN TWA WQM PLAN 2017

Oak Creek (SE05)
HUC: 040400020102
Monitored 2015



WISCONSIN
DEPT. OF NATURAL RESOURCES

EGAD # 3200-2017-11
Water Quality Bureau,
Wisconsin DNR

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Oak Creek upstream of Pennsylvania Avenue

Photo by Craig Helker, DNR

Wisconsin Water Quality Monitoring and Planning

This Water Quality Management Plan was created under the state's Water Quality Management Planning and Water Resources Monitoring Programs. The plan reflects Water Quality Bureau and Water Resources Monitoring Strategy 2015-2020 goals and priorities and fulfills Areawide Water Quality Management Planning milestones under the Clean Water Act, Section 208. Condition information and resource management recommendations support and guide program priorities for the plan area.

This plan is hereby approved by the Wisconsin DNR Water Quality Program and is a formal update to the Southeast Areawide Water Quality Management Plan and Wisconsin's Statewide Areawide Water Quality Management Plan. This plan will be forwarded to USEPA for certification as a formal plan update.

Water Quality Field Supervisor - Acting — Date 11/29/2018

Greg Searle, Water Quality Bureau Field Operations Director — Date 2/6/18

Timothy Asplund, Water Quality Bureau Monitoring Section Chief — Date 2/6/18

Basin/Watershed Partners

- Southeastern Wisconsin Regional Planning Commission (SEWRPC)
- Milwaukee County

Report Acknowledgements

- Craig Helker, Primary Author and Investigator, Eastern District, Wisconsin DNR
- Victoria Ziegler, Program Support, Water Quality Bureau, Wisconsin DNR
- Lisa Helmuth, Program Coordinator, Water Quality Bureau, Wisconsin DNR

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List of Abbreviations

BMP: **Best Management Practice**. A practice that is determined effective and practicable (including technological, economic, and institutional considerations) in preventing or reducing pollution generated from nonpoint sources to a level compatible with water quality goals.

DNR: **Department of Natural Resources.** Wisconsin Department of Natural Resources is an agency of the State of Wisconsin created to preserve, protect, manage, and maintain natural resources.

FIBI: **Fish Index of biological integrity (Fish IBI).** An Index of Biological Integrity (IBI) is a scientific tool used to identify and classify water pollution problems. An IBI associates anthropogenic influences on a water body with biological activity in the water and is formulated using data developed from biosurveys. In Wisconsin, Fish IBIs are created for each type of natural community in the state's stream system.

HUC: **Hydrologic Unit Code.** A code or sequence of numbers that identify one of a number of nested and interlocked hydrologic catchments delineated by a consortium of agencies including USGS, USFS, and Wisconsin DNR.

MIBI: **Macroinvertebrate Index of biological integrity.** In Wisconsin, the MIBI, or macroinvertebrate Index of biological integrity, was developed specifically to assess Wisconsin's macroinvertebrate community (see also Fish IBI).

Natural Community. A system of categorizing waterbodies based on their inherent physical, hydrologic, and biological assemblages. Both Streams and Lakes are categorized using an array of "natural community" types.

Monitoring Seq. No. Monitoring Sequence Number, refers to a unique identification code generated by the Surface Water Integrated Monitoring System (SWIMS), which holds much of the state's water quality monitoring data.

SWIMS ID. Surface Water Integrated Monitoring System (SWIMS) Identification Code is the unique monitoring station identification number for the location where monitoring data was gathered.

TWA: **Targeted Watershed Assessment.** A statewide study design a rotating watershed approach to gathering of baseline monitoring data with specialized targeted assessments for unique and site specific concerns, such as effectiveness monitoring of management actions.

WATERS ID: The Waterbody Assessment, Tracking and Electronic Reporting System Identification Code (WATERS ID) is a unique numerical sequence number assigned by the WATERS system, also known as "Assessment Unit ID code".

WBIC: **Water Body Identification Code.** WDNR's unique identification codes assigned to water features in the state. The lines and information allow the user to execute spatial and tabular queries about the data, make maps, and perform flow analysis and network traces.

Watershed Discussion & Management Recommendations

Watershed Goals

The overall goal of this plan is to improve and protect water quality in the basin. This Targeted Watershed Assessment monitoring project provided substantial data to analyze current conditions and to make recommendations for future management actions in the area. This plan is designed to present monitoring study results, identify issues or concerns in the area found during the project and to make recommendations to improve or protect water quality consistent with Clean Water Act guidelines and state water quality standards.

Watershed Overview

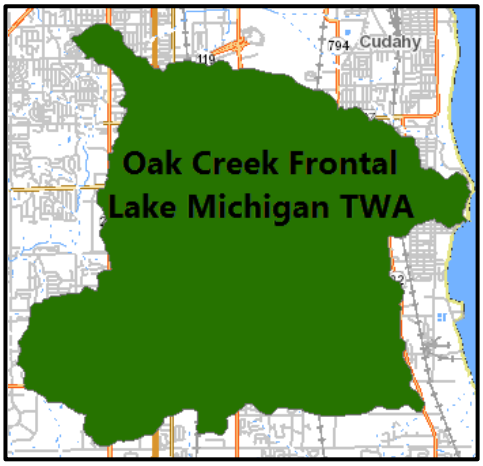


Figure 1: Oak Creek Frontal Lake Michgan TWA Watershed.

The Oak Creek Watershed is located entirely within Milwaukee County. Oak Creek originates in the City of Franklin, with the majority of flow contributed by urban runoff. As it makes its way east, Oak Creek receives flows from the North Branch and Mitchell Field Drainage Ditch. In South Milwaukee, Oak Creek meanders through to Grant Park, and ultimately into Lake Michigan. The stream drains about 26 square miles. Principal land cover in the Oak Creek Watershed is a mix of urban and grassland (38% and 32% respectively). The remaining land uses include agriculture (11%), Forest (14%) and Wetland (3%). Oak Creek drains portions of the Cities of Greenfield, Franklin, Oak Creek, South Milwaukee, and Milwaukee. The one named lake found in this watershed is the Oak Creek Parkway Pond, an impoundment created by the Old Mill Dam, located in Grant Park in South Milwaukee. The Pond is 5 acres in size.

Population, Land Use, Site Characteristics

The Oak Creek watershed is 26.19 mi². Land use in the watershed is primarily suburban (41%), urban (29%) and a mix of forest (12%) and other uses (17%). This watershed has 48.46 stream miles, 28.09 lake acres and 440.81 wetland acres.

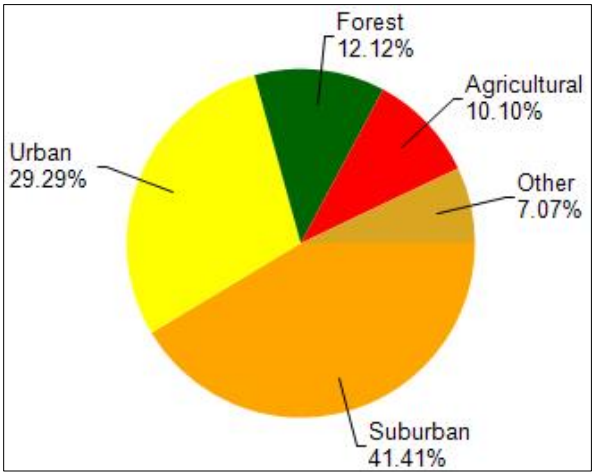


Figure 2: Land use in Oak Creek Watershed (SE05).

Hydrology

The hydrologic cycle describes the various ways water is exchanged from one form or location to another. In Wisconsin, precipitation, in the form of rain, snow, and everything in-between, falls onto the earth's surface. It either soaks into the ground or flows across the land. The water that soaks into the ground recharges the groundwater table, or flows laterally through the ground into a lake or stream. Water generally moves more quickly in coarse sand, sometimes as much as several feet per day. When precipitation infiltrates the more sandy soils in this watershed, the water quickly moves vertically through the soils into the shallow Sand and Gravel Aquifer. Oak Creek is a heavily developed watershed, characterized by limited wetland complexes and only one named lake.

Ecological Landscapes

The Southern Lake Michigan Coastal Ecological Landscape is located in the southeastern corner of Wisconsin along Lake Michigan. The landforms in this Ecological Landscape are characteristic of glacial lake influence, with ridge and swale topography, clay bluffs, and lake plain along Lake Michigan. Further inland, ground moraine is the dominant landform. Soils typically have a silt-loam surface overlying loamy and clayey tills. The historic vegetation in the northern part of this Ecological Landscape was dominated by sugar maple-basswood-beech forests with some oak while the southern part was dominated by oak forest, oak savanna and prairies. Wet, wet-mesic, and lake plain prairies were common in this area. Black ash and relict cedar and tamarack swamps were found in this Ecological Landscape. Today, most of the area is dominated by dairy and cash grain agriculture and intense urban development. Only about 8% of the Ecological Landscape is forested. Maple-beech forests are about half of the remaining forest types with the remainder split equally between oak-hickory and lowland hardwood forest types. There are some of wet-mesic and wet prairie but only small preserves remain since the landscape is heavily disturbed and fragmented. Because of this isolation, fragmentation, and high level of disturbance, non-native plants are abundant.

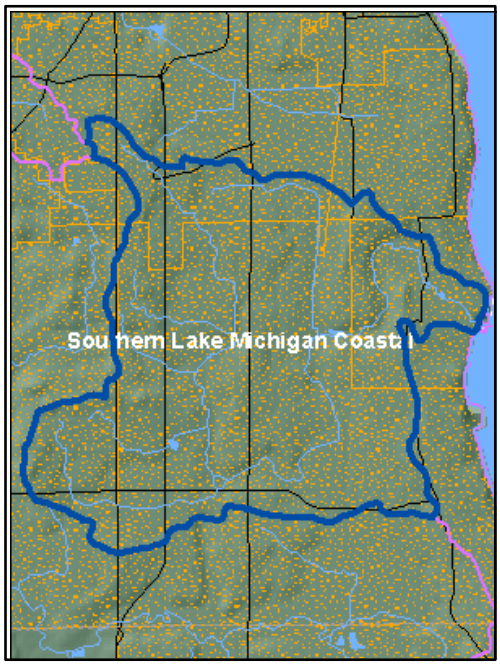


Figure 3: Ecological Landscapes in Oak areas Creek Watershed (SE05).

Study Summary

The streams of the Oak Creek watershed tend to contain fish resembling a cool-warm thermal regime. The streams typically have five-to-ten species, most considered transitional or warmwater species, with the exception of Oak Creek below the South Milwaukee dam, where seasonal runs of trout and salmon from Lake Michigan occur. Small numbers of Iowa Darters were found in a few locations. These fish are intolerant of environmental degradation. However, most of the species found in the Oak Creek watershed are considered tolerant to environmental degradation and are therefore a reflection of the conditions of these historically manipulated waterways. These waterways have many sections that have been straightened to enhance drainage, which leads to degraded habitat within the individual streams and promotes sediment delivery downstream.

Nine locations on Oak Creek (WBIC 14500) and tributaries (WBICs 14800 and 14900) were sampled for fish, qualitative habitat, and total phosphorus. An additional five Total Phosphorus samples were taken at the pour point location.

Management Recommendations

- Work with local area experts and DNR staff from multiple programs to identify areas throughout the watershed where stream habitat can be restored and connectivity improved.
- Work with partners and state grant programs to encourage local entities to seek funds to support habitat restoration and corridor continuity.

- Identify the primary sources of phosphorus and chlorides in the watershed by monitoring, investigations and potentially modeling.
- Investigate and pursue local runoff management and river grants to help initiate management actions that reduce inputs of pollutants (i.e. phosphorus and chloride) into water resources.
- Identify potential partners and stakeholders to participate in an overall awareness and behavioral change program in the watershed that results in reduced erosion and phosphorus inputs.

Ecological, Aquatic Resources

Trout Waters

DNR uses three categories to classify the different types of trout streams throughout Wisconsin. These are evident in Wisconsin Trout Stream Maps, which provides a comprehensive list of trout streams and a set of trout stream maps covering the majority of the state. Efforts have been made to list all trout streams in the State of Wisconsin, but it is recognized that this listing in not exhaustive. While there are no officially listed trout waters within the Sauk Creek Watershed, the lower portions of Oak Creek do have populations of Lake Michigan run Rainbow and Brown Trout. Additionally, Oak Creek Parkway pond in South Milwaukee is occasionally stocked with Rainbow Trout to enhance urban fishery opportunities.

Species of Special Concern

Prairie Crayfish and the Plains Emerald dragonfly have been reported in the drainage area of Oak Creek. Least darters were historically reported, but have not been documented in recent times.

Impaired Waters

Every two years, Section 303(d) of the Clean Water Act requires states to publish a list of all waters that do not meet water quality standards. The list, also known as the Impaired Waters List, is updated to reflect waters that are newly added or removed based on new information. Impaired waters in this watershed are impaired for historical discharges, mine tailings, and runoff issues (Table 1).

Table 1: List of impaired waters in Oak Creek – Frontal Lake Michigan Watershed

WBIC	Waterbody Name	Start Mile	End Mile	Size (mi)	Pollutants	Impairments
14500	Oak Creek	0	13.32	13.32	Unknown Pollutant, Total Phosphorus, Chloride	Chronic Aquatic Toxicity, Degraded Biological Community, Acute Aquatic Toxicity
20	Lake Michigan			103.38	PCBs, Mercury	Contaminated Fish Tissue

Fish Consumption

Wisconsin's fish consumption advisory is based on the work of public health, water quality, and fisheries experts from eight Great Lakes states. Based on the best available scientific evidence, these scientists determined how much fish is safe to eat over a lifetime based on the amount of contaminants found in the fish and how those contaminants affect human health. Advisories are based on concentrations of contaminants, along with angler habits, fishing regulations, and other factors.

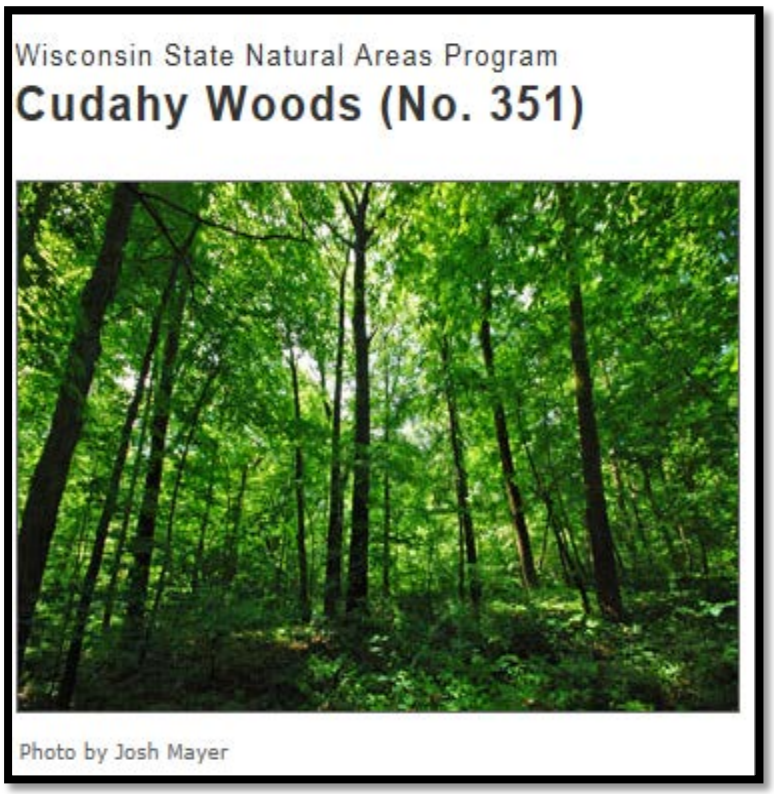
In 2001, Wisconsin adopted a statewide general fish consumption advisory that applies to all (non-Great Lakes) waters of the state based on statewide distribution of mercury in fish and species differences in mercury concentrations. The statewide general advisory eliminated the need for many of the pre-2001 advisories because the equivalent of more stringent advice now applied through the general advisory. In addition to the statewide general advisory, some waters still require more stringent advice or exceptions to the general advisory. Exceptions to the general advice apply to some species of fish from specific waters where higher concentrations of mercury, PCBs, or other chemicals require advice more stringent than the general advisory. More information about the specific consumption advisory can be found in the publication: Choose wisely: a health guide for eating fish in Wisconsin [PUB-FH-824], which is found online at http://dnr.wi.gov/topic/fishing/consumption/index.html. Lake Michigan has had a specific fish consumption advisory in effect for polychlorinated biphenyls (PCBs) since 2009.

Aquatic Invasive Species

Lake Michigan hosts a variety of Aquatic Invasive Species, including the following: Eurasian Water Milfoil, Fishhook Waterfleas, Spiny Waterfleas, Zebra Mussels, Rainbow Smelt, and Round Goby.

State Natural and Wildlife Areas

Cudahy Woods features an outstanding example of the hardwood forests that once covered most of Milwaukee County prior to European settlement and includes dry-mesic, lowland, and mesic forest communities. Occupying the northern portion is dry-mesic forest dominated by red oak, white oak, black cherry, and shagbark hickory. To the south, the woods is moister and supports an old-growth stand of mesic forest containing sugar maple, American beech, red oak, white ash, and ironwood. A small stream separates the two forest types and once contained American elm, killed by Dutch elm disease. More than 160 species of native plants are known to inhabit the natural area, among them the state-endangered Blue-stemmed Goldenrod (Solidago caesia). The forest floor harbors a rich spring flora, including Trout Lily, Gleason's Trillium, Blue cohosh, Bloodroot, Hepatica, and Spring Beauty. Other species include Witch Hazel, Alternate-leaved Dogwood, Arrow-wood, both Red and White baneberry, Sweet Cicely, False Solomon's Seal, and Wild Leek. Cudahy Woods is owned by Milwaukee County and was designated a State Natural Area in 2002.



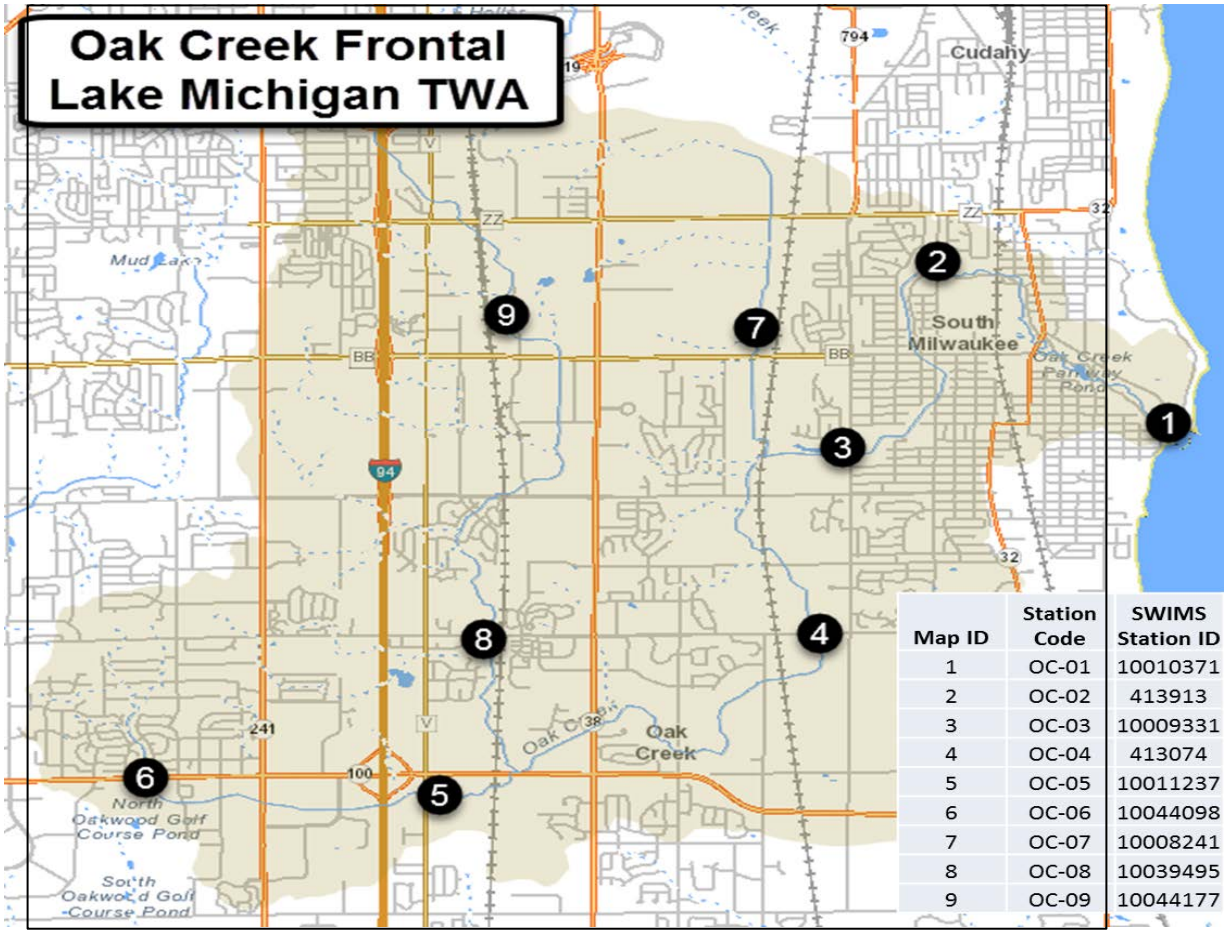
Monitoring Project Discussion

Purpose of Project

In 2015, the aquatic biological communities, chemistry and habitat of the Oak Creek – Frontal Lake Michigan Watershed was monitored to provide information for the Restoration Plan for the Oak Creek Watershed, currently being drafted by the Southeast Wisconsin Regional Planning Commission (SEWRPC). This HUC 12, located within the larger Root-Pike Basin, is the last watershed in the Basin without a watershed plan in place. The watershed was surveyed and assessed under Section 305(b) of the Clean Water Act; data gathered through the project was used to evaluate problems and determine impaired waters (CWA 303(d)). Finally, this monitoring study provides data to assess the overall watershed condition and to make recommendations for DNR and partner management actions.

Site Selection and Study Design

This 2015 study collected data on fish assemblage, qualitative habitat, and macroinvertebrates at nine sites (Figure 4 and Table 2). Phosphorus data was collected five times during the growing season from the pour point of the watershed, near the mouth of Oak Creek, as well as one time at each of the other sites. Data was collected during the field season (May to September) of the 2015 calendar year and was entered into the Fish Database and SWIMS.



Map ID	Station Code	SWIMS Station ID
1	OC-01	10010371
2	OC-02	413913
3	OC-03	10009331
4	OC-04	413074
5	OC-05	10011237
6	OC-06	10044098
7	OC-07	10008241
8	OC-08	10039495
9	OC-09	10044177

Figure 4: Map of monitored stations in the Oak Creek Frontal Lake Michigan TWA.

Table 2: Monitoring Stations Oak Creek Frontal Lake Michigan TWA

Water Body Name	WBIC	Station Code	Station ID	Station Name
Oak Creek	14500	OC-01	10010371	Oak Creek at Beach Bridge (63m Upstream)
Oak Creek	14500	OC-02	413913	Oak Creek at 15th Ave N of Beech St
Oak Creek	14500	OC-03	10009331	Oak Creek at Pennsylvania Ave
Oak Creek	14500	OC-04	413074	Oak Creek at Puetz Road, upstream of RR tracks
Oak Creek	14500	OC-05	10011237	Oak Creek at 13th Street
Oak Creek	14500	OC-06	10044098	Oak Creek at Ryan Road
Unnamed	14800	OC-07	10008241	Mitchell Field Drainage Ditch at Rawson Avenue
Unnamed	14900	OC-08	10039495	North Branch Oak Creek at Puetz Avenue
Unnamed	14900	OC-09	10044177	North Branch Oak Creek along 6th Street

Methods, Equipment and Quality Assurance

The fisheries assemblage at each site was determined by electroshocking a section of stream with a minimum station length of 35 times the mean stream width. A stream tow barge with a generator and two probes was used at most sites, with a single-probe backpack shocker used at sites generally less than three meters wide. All collected fish were identified and counted, with gamefish measured for length. At each site, qualitative notes on average stream width and depth, riparian buffers and land use, evidence of sedimentation, fish cover and potential management options were also recorded. A qualitative habitat survey (Simonson, et. al., 1994) was also performed at each site. Macroinvertebrate samples were obtained by kick sampling using a D-frame net at these same sites in the watershed during the fall of 2015, and sent to the University of Wisconsin-Stevens Point for analysis.

Additionally, five water samples were collected once per month throughout the growing season by DNR staff at one site near the mouth of Oak Creek. One water sample was also collected at each fish sampling location in the watershed. All water samples were analyzed for Total Phosphorus (TP).

Project Results

Nine monitoring stations were sampled during the 2014 field season in the Oak Creek Frontal Lake Michigan TWA. Based on fish surveys (Table 4) in the watershed, the modeled natural communities at each of the nine monitoring stations were able to be verified (Table 3). Sauk Creek has a cool-warm transitional headwater natural community at eight of the nine monitoring stations. Fish surveyed at Station ID 10044098 indicate a cool-warm transition headwater natural community, not the modeled natural community of cool-cold transition headwater Table 3).

Table 3: Natural Community Modeled and Verified for the Oak Creek TWA

Station Name	Station Code	Station ID	Modeled Natural Community	Verified Natural Community
Oak Creek at Beach Bridge	OC-01	10010371	Cool-Warm Transition Headwater	Cool-Warm Transition Headwater
Oak Creek at 15th Avenue	OC-02	413913	Cool-Warm Transition Headwater	Cool-Warm Transition Headwater
Oak Creek at Pennsylvania Avenue	OC-03	10009331	Cool-Warm Transition Headwater	Cool-Warm Transition Headwater

Station Name	Station Code	Station ID	Modeled Natural Community	Verified Natural Community
Oak Creek at Puetz Road, upstream of RR tracks	OC-04	413074	Cool-Warm Transition Headwater	Cool-Warm Transition Headwater
Oak Creek at 13th Street	OC-05	10011237	Cool-Warm Transition Headwater	Cool-Warm Transition Headwater
Oak Creek at Ryan Road	OC-06	10044098	Cool-Cold Transition Headwater	Cool-Warm Transition Headwater
Mitchell Field Drainage Ditch at Rawson Avenue	OC-07	10008241	Cool-Cold Transition Headwater	Cool-Cold Transition Headwater
North Branch Oak Creek at Puetz Avenue	OC-08	10039495	Cool-Warm Transition Headwater	Cool-Warm Transition Headwater
North Branch Oak Creek along 6th Street	OC-09	10044177	Cool-Warm Transition Headwater	Cool-Warm Transition Headwater

Table 4: Number of fish species per site during summer 2015

Station Code	OC-1	OC-2	OC-3	OC-4	OC-5	OC-6	OC-7	OC-8	OC-9
Fish	**Count of Fish**								
Black Bullhead	2		1						
Bluegill			1						
Brook Stickleback		14	3	69	2	7	7	152	12
Central Mudminnow		21	15	523		7	1		
Creek Chub	21	157	103	28	5	25	29	732	26
Common Carp		1							
Fathead Minnow	3	7	4	12		4	12	80	5
Goldfish			3						
Green Sunfish	12	21	20	3	1	3		3	8
Iowa Darter			40	49		3			
Johnny Darter		2	23	32		14			
Pumpkinseed Sunfish		1							
Rainbow Trout	4								
Round Goby	62								
White Crappie	4								
White Sucker	16	194	128	41			1		

Water chemistry and biological parameters were taken at all nine monitoring stations. Six total phosphorus samples were taken at OC-01 (SWIMS Station ID: 10010371) throughout the growing season (May – October) and one phosphorus grab sample was taken at the other 8 monitoring stations (Table 5). Total phosphorus concentrations ranged from 0.03mg/l at OC-06 to 0.172 mg/L at OC-05. Dissolved

oxygen was taken once at each of the monitoring stations during 2015 and ranged from 4.1mg/L (OC-09) to 13.0mg/L (OC-04) (Table 5).

Table 5: Total phosphorus and dissolved oxygen concentration

Station Code	Total Phosphorus (TP) (mg/L)	Dissolved Oxygen (DO) (mg/L)
OC-01	0.051	7.29
	0.065	
	0.123	
	0.089	
	0.042	
OC-02	0.106	5.9
OC-03	0.097	6.0
OC-04	0.066	13.0
OC-05	0.172	8.0
OC-06	0.03	5.71
OC-07	0.150	4.6
OC-08	0.089	12.21
OC-09	0.160	4.1

The Hilsenhoff Biotic Index ranged Poor with a score 7.98 (OC-09) to Good with a score of 5.304 (SC-01) (Table 6). The Macroinvertebrate IBI (MIBI) score ranged from 1.358 (Poor) to 5.26 (Good). The Fish IBI (FIBI) score ranged from Poor with a score of 0 (OC-02) to Good with a score of 50 (OC-01 and OC-06) (Table 6). The Qualitative Fish Habitat score ranged from Fair with a score of 23 (OC-04) to Good with a score of 62 (OC-06 and OC-09) (Table 6).

Oak Creek at Pennsylvania Avenue

Table 6: Hilsenhoff's Biotic Index, MIBI, FIBI, and Qualitative Fish Habitat scores and ratings for Oak Creek TWA 2015

Station Code	Hilsenhoff's Biotic Index Score	Hilsenhoff's Biotic Index Rating	Macroinvertebrate IBI Score	Macroinvertebrate IBI Rating	Appropriate Fish Index of Biotic Integrity* Score	Appropriate Fish Index of Biotic Integrity* Rating	Qualitative Fish Habitat Score	Qualitative Fish Habitat Rating
OC-01	5.304	Good	1.397	Poor	50	Good	48	Fair
OC-02	5.469	Good	3.503	Fair	0	Poor	52	Fair
OC-03	5.412	Good	5.14	Good	30	Fair	42	Fair
OC-04	6.562	Fairly Poor	4.463	Fair	40	Fair	23	Fair
OC-05	5.54	Good	1.358	Poor	20	Poor	30	Fair
OC-06	6.306	Fair	3.5	Fair	50	Good	62	Good
OC-07	7.135	Fairly Poor	5.26	Good	20	Poor	37	Fair
OC-08	5.741	Fair	3.03	Fair	20	Poor	58	Fair
OC-09	7.98	Poor	2.42	Poor	20	Poor	62	Good

Discussion

River/Stream Health

Natural Community Analysis

Most of the streams in the Oak Creek watershed are modelled as cool-warm transitional headwaters. The department has developed a method to determine whether or not the modeled natural community is accurate based on the fishery assemblage and climate conditions (Lyons, 2013). In most cases, the thermal composition of species (cold, warm, or transitional) indicated the sampled stream sites resemble *cool-warm systems*, with the exception of Mitchell Field Drainage Ditch (OC-03) (Table 3), where fish indicate a cool-warm warm community but historical manipulations point to a historical cool-cold community. Diversity of game and nongame fish species in the sampled sites was limited, with coldwater species almost entirely absent, except where access from Lake Michigan was possible.

Fish Species Found

The majority of the species found during sampling in the Oak Creek watershed are species tolerant to low dissolved oxygen and/or disturbed habitat conditions. These were Brook Stickleback, Central Mudminnow, Common Carp, Creek Chub, Fathead Minnow, Green Sunfish, White Sucker, Black Bullhead, and Goldfish (Table 4). The only intolerant species found was the Iowa Darter, which were found at three locations.

Gamefish diversity was limited in the surveys upstream of Oak Creek Parkway pond, with the exception of Green Sunfish (found at most sites), Bluegill, and Pumpkinseed. Below Parkway Pond, White Crappie and Rainbow Trout were collected.

Index of Biological Integrity Findings

The fishery is only one environmental indicator of condition and for this reason, the quality of the resources should be looked at in the context of overall parameters, including habitat and macroinvertebrates.

The cool water FIBIs (Lyons, 2012), when applied to the natural community indicated by the fishery assemblage, reveals a fishery ranging from ***"poor" to "good".*** The "good" scores are generally related to the presence of Darter species or a lack of an overabundance of tolerant species such as White sucker.

The macroinvertebrate data varied at sites throughout the watershed (Table 6). The macroinvertebrate index of biotic integrity (MIBI) has shown the ***combination of watershed land cover and local riparian and instream conditions strongly influence one another (Weigel, 2003).*** The MIBI scores in this watershed suggest challenging conditions resulting from watershed inputs and overall degraded channel conditions. The Hilsenhoff Biotic Index (HBI) scores indicate there is varied nutrient loading across the different sites, but significant enough, when combined with Total Phosphorus scores, to support Oak Creek's listing on the Federal Impaired Waters List.

Sample Sites

Oak Creek (OC-01), located upstream of the mouth of Oak Creek, but downstream of the Oak Creek Parkway Pond dam, has a fish community that reflects the access from Lake Michigan. This section scores as "Good" for fish, one of only two "Good" sites sampled (Table 6). Rainbow Trout were found, as

were White Crappie. Unfortunately, the invasive Round Goby was also found in large numbers. Gobies are being found in a majority of Lake Michigan tributaries, and may present a risk to native Darter species. The macroinvertebrate community of Oak Creek scores as "Poor", perhaps reflecting the water's channelized condition. However, the Hilsenhoff (HBI) macroinvertebrate score is "Good", suggesting some organic pollution. Total Phosphorus at this location was measured five times during the growing season, with two of those readings above 0.075 mg/L, indicating impaired conditions (Table 5). The next assessed stream portion (OC-2) was 2.58 miles upstream of the mouth at 15th Street, near South Milwaukee High School. This section has a "Poor" fishery. The macroinvertebrate community (MIBI) scores as "Fair", with a Hilsenhoff macroinvertebrate score (HBI) of "Good". The Total Phosphorus reading was 0.106 mg/L (Table 5).

Oak Creek at Pennsylvania Avenue (OC-3) is approximately 4.5 miles upstream of the mouth. This site has a "Fair" fish community, with darter species in good numbers (Table 6). The macroinvertebrate community (MIBI) score of "Good" was the second highest of sites surveyed with an equally high "Good" HBI score for some organic pollution. The Total Phosphorus reading was 0.0.097 mg/L (Table 5).
Oak Creek at Puetz Road (OC-4) is 6.5 miles upstream of the mouth. This site was, like a majority of Oak Creek, historically ditched. It was the most heavily affected by sedimentation of sites visited and had a significant aquatic plant population. The fish community scored as "Fair", and had a significant population of Iowa and Johnny Darters. It had a "Fair" MIBI score, and a "Fairly Poor" HBI score suggesting significant organic pollution (Table 6). Total Phosphorus was 0.066 mg/L (Table 5).

Oak Creek at 13th (OC-5) is 10 miles upstream of the mouth, and is bordered on both sides by agricultural fields. It is deeply entrenched, and during the site visit, was inundated by backwater from an active beaver dam. The fish community scored as "Poor", as did the MIBI score. The HBI score of "Good" suggests some organic pollution (Table 6). The Total Phosphorus reading was 0.172 mg/L, over the impairment threshold (Table 5).

The last sample site on the mainstem of Oak Creek is at Ryan Road (OC-6). This site has a "Good" fish community, and scores "Fair" for both macroinvertebrate indexes (Table 6). Total Phosphorus was 0.03 mg/L (Table 5).

OC-7 is a site on Mitchell Field Drainage Ditch, a tributary to Oak Creek approximately five miles upstream of the mouth. This site is classified as a Cool-Cold Natural Community and has a fish community considered "Poor" (Table 6). The macroinvertebrate community under the MIBI scored as "Good", but with a "Fairy Poor" HBI score, suggesting significant organic pollution. Measured Total Phosphorus was 0.150 mg/L, which exceeds the impairment threshold (Table 5).

The North Branch Oak Creek was sampled at two locations, one nearer the headwaters adjacent to 6th Street (OC-9), and one adjacent to the Oak Creek Public Works building on Puetz Road (OC-8).
OC-8 had the largest populations of fish of all sample sites, collecting just under a 1000 fish. However, the fish community scores a "Poor", due to the overabundance of fish tolerant of disturbed conditions. The macroinvertebrate scores were "Fair" for both the MIBI and HBI. The Total Phosphorus reading was 0.089 mg/L (Table 5). OC-9 had the worst conditions of all sites sampled, scoring "Poor" for all metrics. The HBI macroinvertebrate score suggests very significant organic pollution. The Total Phosphorus result was 0.160 mg/L (Table 5).

Watershed Condition

The majority of the streams within the Oak Creek watershed have natural community classifications of cool-warm transition headwaters. Overall, the water quality of Oak Creek and tributaries ranges from good to poor. Fish and macroinvertebrate communities rated good to poor, with ratings varying at each site, depending upon the index used (Table 6).

Across the watershed, stream habitat is a limiting factor. Stream channelization, along with associated sedimentation from runoff and bank erosion impairs fish and macroinvertebrate populations. Conversely, some areas of Oak Creek have been hardened with concrete, leading to increased water velocities the scour away fish and macroinvertebrate habitat. Water chemistry monitoring was done in 2015 at all of the monitored sites and showed elevated concentrations for TP that exceed Wisconsin's water quality standard for the majority of sample locations. Dissolved oxygen levels did not appear to be a problem at most sampling sites, with the exception of Mitchell Field Drainage Ditch. The DO reading here, as well as biological indicators of occasional anoxic conditions, suggests ongoing challenges with this tributary.

Management Actions

Management Priorities

- Identify areas throughout the watershed where stream habitat can be restored and connectivity improved. Seek funds and programs to support these efforts.
- Identify the primary sources of phosphorus and chlorides in the watershed and pursue local runoff management and river/stream grants to reduce phosphorous and chloride inputs into local water resources.
- Identify potential partners and stakeholders to participate in an overall awareness and behavioral change program in the watershed that could result in reduced erosion and phosphorus inputs.

Restoration Goals

- Work with partners and grant programs to reduce overall nutrient loads to the watershed to protect existing conditions and reduce impacts to impaired or nearly impaired waters.
- Expand aquatic life passage.
- Improve fish and aquatic life habitat.
- Expand and improve existing wetlands.

Monitoring and Assessment Recommendations

- Continue to support Citizen Based Monitoring volunteer efforts to track total phosphorus and chloride in Oak Creek and tributaries.
- Monitor dissolved oxygen conditions on Mitchell Field Drainage Ditch.
- Water quality biologists should continue to monitor Oak Creek and tributaries in order to document existing conditions and capture the potential improvements from BMP installations.
- Oak Creek at Ryan Road was modeled as a cool-cold transition headwater, and should be changed to a cool-warm transition headwater.

Management Recommendations for DNR

- Provide input and support for the on-going development of the "Restoration Plan for the Oak Creek Watershed" which is currently being drafted by the Southeastern Wisconsin Regional Planning Commission with support from the surrounding communities and the Fund For Lake Michigan.

- Federal, state, local governments, and the agricultural community should continue working to improve water quality by decreasing sedimentation, nutrient loads, chloride addition, and stormwater runoff to Oak Creek and tributaries.
- Recruit Citizen-Based Stream Monitors to assist with on-going Watershed monitoring.
- Minimize runoff from agricultural areas in the watershed. Goals should include reducing soil erosion, runoff, and meeting nutrient management requirements. Stream bank buffers should be encouraged, as well as relaxing the slope of existing entrenched stream banks.
- Map invasive species.
- Continue to expand fishing opportunities within the Watershed and remove fish passage impediments including drop structures, channel blocking woody debris, and beaver dams where documented and appropriate.
- Encourage all communities within the Watershed to continue construction site erosion and stormwater management ordinance enforcement to minimize polluted runoff in developed areas.
- Review wastewater and stormwater discharges in the watershed for compliance.

Management Recommendations for External Partners

- The watershed communities should continue effective implementation of their stormwater programs.
- Continue information and education programs within the municipalities bordering Oak Creek and tributaries.
- Facilitate and provide incentives for increased management by private landowners, organizations, businesses, municipalities and agencies to monitor and control the invasion of non-native species in the watershed.
- Restore and manage wetlands, woodlands, and shorelands in the watershed.
- Continue to promote stream bank buffers along Oak Creek and tributaries, including lowering stream banks to increase hydraulic connectivity to wetlands.
- DNR and community partners should continue to work on and promote habitat improvement projects on Oak Creek and tributaries, including pursuing the removal of concrete channels where appropriate. Additionally, where land and partners are available, pursue re-meandering straightened sections of Oak Creek and tributaries.

Oak Creek Upstream of Pennsylvania Avenue

Appendix A: References

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Appendix B: Stream Narratives

Lake Michigan

WBIC: 20

(2009 Overview) Bacterial pollution in coastal waters is caused by a combination of point and nonpoint sources of pollution. Although point sources of bacterial contamination (e.g., industry, wastewater treatment facilities) are significant, nonpoint source pollution poses a much greater threat to the integrity of recreational water bodies because it comprises a diverse mixture of chemical and biological contaminants and is discharged from countless undefined sites within a given watershed. Pollutants accumulate in storm water as it is washed off impervious surfaces and discharged into local waterways. With increasing urbanization of the nation's coastal areas, pollution of waterways by storm water is a growing concern. In a report to Congress, the EPA states that nonpoint sources of pollution are the greatest threat to the nation's water quality.9 Examples of point and nonpoint sources of pollution include these: -Sanitary sewage overflows (SSOs) -Combined sewer overflows (CSOs) -Septic systems -Boating waste discharge -Urban storm water runoff -Agricultural runoff -Waste from domestic pets and wildlife From: http://www.actionbioscience.org/environment/Jensen_McLellan.html

Mitchell Field Ditch

WBIC: 14800

(2011 Overview) Mitchell Field Ditch, in the Oak Creek Watershed, is a 4.00 mile river that falls in Milwaukee County. This river is managed for fishing and swimming and is currently not considered impaired.

North Branch Oak Creek

WBIC: 14900

(2011 Overview) North Branch Oak Creek, in the Oak Creek Watershed, is a 6.84 mile river that falls in Milwaukee County. This river is managed for fishing and swimming and is currently not considered impaired.

Oak Creek

WBIC: 14500

(2011 Overview) Oak Creek, in the Oak Creek Watershed, is a 13.32 mile river that falls in Milwaukee County. This river is managed for fishing and swimming and is currently considered impaired.

(2015 Impaired Waters) Oak Creek was assessed during the 2016 listing cycle and chloride sample data exceed 2016 WisCALM chronic and acute listing criteria for the Fish and Aquatic Life use.

(2017 Impaired Waters) The 2018 assessments of Oak Creek showed continued impairment by chloride; new chloride sample data exceeded 2018 WisCALM listing criteria for the Fish and Aquatic Life use. Based on the most updated information, no change in existing impaired waters listing is needed.

Oak Creek Parkway Pond

WBIC: 14700

(2009, 1964 - Overview) Oak Creek Parkway Pond, in the Oak Creek Watershed, is a 4.02 acre lake that falls in Milwaukee County. This lake is managed for fishing and swimming and is currently not considered impaired. This is a small impoundment on Oak Creek in the City of South Milwaukee, created by a dam with 13-foot head in 1930. The pond lies within a 727.5-acre county parkway. Stream drainage is its major source. The water is clear and sustains a fishery for bullheads, carp and some of the sunfishes. Significant numbers of waterfowl frequent the pond.

Appendix C: Monitored Waters

WBIC	Waterbody Name	Station ID	Station Name	Earliest Fieldwork Date	Latest Fieldwork Date
14900	Unnamed	10044177	North Branch Oak Creek along 6th St	10/22/2015	04/11/2017
14800	Unnamed	10011281	Airport Tributary at Railroad Tracks (110m Upstream)	11/25/1985	04/11/2017
14500	Oak Creek	413913	Oak Creek US of 15th Ave N of Beech St	10/08/1996	04/11/2017
14800	Unnamed	413835	Oak Creek Unnamed Tributary To - To Oak Cr -75 Ft Upstr Of College Ave	10/08/1996	01/11/2017
14900	Unnamed	413833	Oak Creek North Branch - 200 Ft Upstr Of Puetz RdX Noc-1	11/01/1979	10/30/2016
14500	Oak Creek	413670	Oak Creek east of 13th and south of Ryan Rd	05/17/1979	10/23/2016
14500	Oak Creek	413824	Oak Creek-Parkway Pond - Upstream Of Dam	10/08/1996	11/20/2015
14500	Oak Creek	413074	Oak Creek at Puetz Rd And Rr Track	05/08/1975	11/05/2015
14900	Unnamed	10039495	Oak Creek at Puetz Rd	06/24/2015	11/05/2015
14500	Oak Creek	10011237	Oak Creek - Oak Creek at 13th Street(124m Downstream)	08/25/2015	10/22/2015
14500	Oak Creek	10010371	Oak Creek1at Beach Bridge (63m Upstream)	10/06/2003	10/22/2015
14500	Oak Creek	10009331	Oak Creek 1 At Pennsylvania Ave	11/13/2000	10/22/2015
14500	Oak Creek	10044098	Oak Creek at Ryan Ave	06/16/2008	10/22/2015
14800	Unnamed	10008241	Mitchell Field Drainage Ditch	11/16/2001	10/22/2015
14500	Oak Creek	10028781	Oak Creek US Oak Creek Parkway Bridge	08/10/2015	08/10/2015
5037694	Unnamed	10044225	Unnamed stream (WBIC=5037694) 13th St S of Violet Dr	06/18/2015	06/18/2015
NA	null	10047396	Wetland [ID 41423692708]	01/01/2015	01/01/2015
14500	Oak Creek	413672	Oak Creek at Oak Creek Parkway 3m(Bi)	05/17/1979	01/01/2015
14800	Unnamed	10029785	Oak Creek South of Rawson Ave	06/23/2008	09/18/2013
5576584	Unnamed	10040087	Milwaukee Co. Parks - Grant Park - 3	07/03/2013	08/29/2013
14700	Oak Creek Parkway Pond	10040103	Milwaukee Co. Parks - Oak Creek Parkway	07/02/2013	08/28/2013
14500	Oak Creek	10008112	Oak Creek	08/24/2011	11/30/2011
14700	Oak Creek Parkway Pond	10004038	Oak Creek Parkway Pond	09/12/2010	09/12/2010
14500	Oak Creek	413068	Oak Creek at Pennsylvania Ave	05/27/1975	04/09/2009
14700	Oak Creek Parkway Pond	10037958	Oak Creek US of dam near dam	06/12/2001	06/12/2001

WBIC	Waterbody Name	Station ID	Station Name	Earliest Fieldwork Date	Latest Fieldwork Date
14900	Unnamed	10008115	Un Trib To Oak Creek - 274 M Upstream Puetz Road	11/13/2000	11/13/2000
5300	Unnamed	10016402	Un Cr 5 - Upstream Of Drexel Rd.	10/09/1997	10/09/1997
5300	Unnamed	10016403	Uncr 5 (61) - Upstream Of Drexel Rd.	10/09/1997	10/09/1997
14500	Oak Creek	413826	Oak Creek - Approx. 150 Ft Downstream Of I-94 Oc-3	06/10/1997	06/10/1997
14500	Oak Creek	413825	Oak Creek - Upstream Of Confluence W/ N.Br. Oak Cr	06/10/1997	06/10/1997
14900	Unnamed	413834	Oak Creek North Branch - Downstream Of Rawson Ave Noc-2	06/10/1997	06/10/1997
NA	null	413546	Harley-Davidson Co. - 002 *** Permit	10/08/1996	10/08/1996
14500	Oak Creek	10015873	Oak Creek - Upstream Of Ryan Rd. And Approx.60 Ft. Downstream Of C And Nw R.R. Xing	10/08/1996	10/08/1996
NA	null	413546	Harley-Davidson Co. - 002 *** Permit	10/08/1996	10/08/1996
14500	Oak Creek	10016515	Oak Creek - Approx. 650 Ft Downstream Of Howell Ave.	10/08/1996	10/08/1996
14900	Unnamed	10010544	Unnamed (60)	05/17/1979	10/08/1996
14500	Oak Creek	413064	Oak Creek - 600 Yds Bel Dam Grant Pk	05/08/1975	05/17/1993
14500	Oak Creek	10016379	Oak Creek - Downstream Of 15th Ave. Bridge Ins. Milwaukee Ca. Usgs Station	11/25/1985	11/25/1985
14500	Oak Creek	10016397	Oak Creek - Downstream Of Olo Mill Dam And Upstream Of Emerson Electric Outfall-S. Milw	11/25/1985	11/25/1985
14500	Oak Creek	10016263	Oak Creek at Michigan Ave. Extended Just Downstream Of Pedestrian Bridge	11/25/1985	11/25/1985

WBIC	Waterbody Name	Station ID	Station Name	Earliest Fieldwork Date	Latest Fieldwork Date
14500	Oak Creek	413671	Oak Creek at Forest Hill Rd 2m(Bi)	05/17/1979	11/25/1985
14500	Oak Creek	10016508	Oak Creek - 600 Feet Downstream Of Hwy 38 (Howellave.)-Oak Crk.	11/25/1985	11/25/1985
14500	Oak Creek	10016205	Oak Creek - Ca. 75 Feetdownstream Of Marquette Ave. -Oak Crk.	11/25/1985	11/25/1985
NA	null	413270	Applied Plastics Company	10/26/1982	10/26/1982
NA	null	413568	Oak Creek - Ladish Company - 001	12/15/1975	01/09/1979
14500	Oak Creek	413432	Root River - Union Oil Truck Stop (Oak Creek)	06/24/1976	08/21/1978
NA	null	413417	Oak Creek - Appleton Elec (Light Div) - 002	01/05/1976	05/02/1978
NA	null	413416	Oak Creek - Appleton Elec (Light Div) - 001	01/05/1976	03/22/1978
NA	null	413508	Oak Creek - Bucyrus-Erie Company - 002	04/21/1976	04/28/1977
NA	null	413510	Oak Creek - Bucyrus-Erie Company - 004	04/28/1977	04/28/1977
NA	null	413512	Oak Creek - Bucyrus-Erie Company - 006	04/23/1976	04/28/1977
NA	null	413415	Oak Creek - Appleton Electric Co (5th St)	12/09/1975	09/22/1976
NA	null	413511	Oak Creek - Bucyrus-Erie Company - 005	04/21/1976	04/21/1976
NA	null	413507	Oak Creek - Bucyrus-Erie Company - 001	04/21/1976	04/21/1976
NA	null	413509	Oak Creek - Bucyrus-Erie Company - 003	04/21/1976	04/21/1976
14900	Unnamed	413076	Oak Ceek Trib To at W Marquette	04/17/1975	04/12/1976

Appendix D: Watershed Report – Fish and Aquatic Life[i]

WBIC	Waterbody Name	Start Mile	End Mile	Current Use	Attainable Use	Supporting Attainable Use	Designated Use	Impairments	Sources	Assessment	Impaired Status
20	Lake Michigan	0	103.38	WWSF	WWSF	Supporting	Default FAL	NA	NA	Monitored	303d Listed
14500	Oak Creek	0	13.32	FAL	FAL	Not Supporting	Default FAL	Chronic and Acute Toxicity, Degraded Biological Community	Municipal & rural Non-Point Source	Monitored	303d Listed
14700	Oak Creek Parkway Pond	0	5	Small	FAL	Not Assessed	Default FAL	NA	NA	No Assessment	NA
14800	Mitchell Field Ditch	0	2.3	FAL	FAL	Fully Supporting	Default FAL	NA	NA	Monitored	NA
14800	Local Water	2.3	4	FAL	FAL	Not Assessed	Default FAL	NA	NA	Not Assessed	NA
14900	North Branch Oak Creek	0	5.7	FAL	FAL	Not Assessed	Default FAL	NA	NA	No Assessment	NA
5037240	Local Water	0	1.19	FAL	FAL	Not Assessed	Default FAL	NA	NA	Not Assessed	NA
5037305	Local Water	0	2.42	FAL	FAL	Not Assessed	Default FAL	NA	NA	Not Assessed	NA
5037407	Local Water	0	1.73	FAL	FAL	Not Assessed	Default FAL	NA	NA	Not Assessed	NA
5037655	Local Water	0	0.59	FAL	FAL	Not Assessed	Default FAL	NA	NA	Not Assessed	NA
5037694	Local Water	0	2.36	FAL	FAL	Not Assessed	Default FAL	NA	NA	Not Assessed	NA
5037792	Local Water	0	0.85	FAL	FAL	Not Assessed	Default FAL	NA	NA	Not Assessed	NA
5037833	Local Water	0	0.37	FAL	FAL	Not Assessed	Default FAL	NA	NA	Not Assessed	NA
5576479	Local Water	0	3.44	FAL	FAL	Not Assessed	Default FAL	NA	NA	No Assessment	NA
5576495	Local Water	0	3.23	FAL	FAL	Not Assessed	Default FAL	NA	NA	No Assessment	NA
5576946	Local Water	0	7.94	FAL	FAL	Not Assessed	Default FAL	NA	NA	No Assessment	NA

[i] The watershed assessment table reflects the condition of waters in the study area watershed. This table data is stored in the Water Assessment Tracking and Electronic Reporting System (WATERS) and is updated on an ongoing basis via monitoring data and assessment calculations. The following definitions apply:

- Current Use – current condition of water based on monitoring data.
- Attainable Use – "ecological potential" of water based on water type, natural community, lack of human-induced disturbances.
- Supporting Attainable Use – decision on whether the water's current condition is supporting its designated use under "water quality standards".
- Designated Use – the water's classified use under NR102, Wisconsin Water Quality Standards, for Fish and Aquatic Life.
- Impairments – documented impacts on water condition due to pollution sources or changes in hydro-geomorphological changes.
- Assessment – field indicates what type of data or information supports the decisions in the table (current, attainable, and supporting attainable).
- Impaired Water Status – This column indicates the status of the impaired water for TMDL development. `