CENTER LAKE USE REPORT UPDATE LR-3

Prepared by the Southeastern Wisconsin Regional Planning Commission for Kenosha County, Wisconsin October 2017









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BACKGROUND

Kenosha County's lakes are vital natural resource assets adding significant value to the aesthetic and ecological value of the County and Region. The Lakes are enjoyed by large numbers of lakeshore residents and local citizens as well as those seeking water-based recreation living in nearby urban areas such as Milwaukee, Racine, Kenosha, and Chicago. Kenosha County has 34 named Lakes ranging in size from about two to about 640 acres.¹ Of the 20 that are considered "major lakes" (i.e., lakes with a surface area of 50 acres or more), 12 lie in unincorporated or recently incorporated portions of the County. Between 1968 and 1970, the Wisconsin Department of Natural Resources (WDNR) produced a series of individual Lake Use Reports for each of the 12 named major lakes within Kenosha County. Center Lake was the subject of one such report.² This report updates the earlier Lake Use Report.

In addition to the original 1969 Lake Use Report, Center Lake was the subject of a number of other studies. These studies include two County-wide surface water resources reports published in 1961 and 1982 prepared by the Wisconsin Conservation Department (now the WDNR).^{3,4} Several consulting firms have also been retained over the years by the Camp and Center Lakes Rehabilitation District (CCLRD) to study water quality, the aquatic plant community, and lake management.^{5,6,7,8,9,10} The CCLRD maintains a website (www.cclrd. org). The website is used to post a wide variety of information Lake users may find interesting. In addition to the above report, Center Lake was also part of a 2017 lake and stream classification project developed for Kenosha County by Southeastern Regional Planning Commission (SEWRPC).¹¹

INTRODUCTION

Center Lake is located in the Village of Salem Lakes, Kenosha County, Wisconsin. The Lake's fishery, natural beauty, and location give it significant local economic and recreational value. In addition, its healthy and relatively diverse aquatic plant community and large contiguous marshlands provide noteworthy fish and wildlife habitat. The Lake provides significant value to local ecology.

PHYSICAL DESCRIPTION

Lake Characteristics

Based upon recent orthophotography, Center Lake has a surface area of 146 acres.¹² As shown on Map 1, Center Lake has an elongated basin with a northeast-southwest orientation and a maximum depth of 28 feet. According to 1960 depth soundings published by the WDNR, Center Lake contains 1,136 acre-feet of water. The Lake has a normal water surface elevation of 741.50 feet above National Geodetic Vertical Datum, 1929

¹ Wisconsin Department of Natural Resources Publication No. PUB-FH-800 2005, Wisconsin Lakes, 2005.

² Wisconsin Department of Natural Resources, Center Lake, Kenosha County, An Inventory with Planning Recommendations, Lake Use Report No. FX-27, Prepared by the WDNR for SEWRPC, 1969.

³ Wisconsin Conservation Department, Surface Water Resources of Kenosha County, 1961.

⁴ Wisconsin Department of Natural Resources, Surface Water Resources of Kenosha County, 1982.

⁵ The CCLRD is a Chapter 33, Wisconsin Statutes public inland lake protection and rehabilitation district that oversees management of both Camp and Center Lakes; the District's website is: www.cclrd.org

⁶ *Hey and Associates, incorporated,* Aquatic Plant Survey and Aquatic Plant Management Plan: Camp and Center Lakes, Kenosha County, Wisconsin, *October 1995.*

⁷ *Hey and Associates, incorporated,* Aquatic Plant Management Plan for Camp and Center Lakes, Kenosha County, Wisconsin, *May 2006*.

⁸ *R. A. Smith and Associates, Incorporated, Draft Report Camp and Center Lakes – Kenosha County, Water Quality Monitoring Project for Camp and Center Lakes Rehabilitation District, 1998.*

⁹ Lake and Pond Solutions Company, Aquatic Plant Management Plan for Camp and Center Lakes, April 18, 2012.

¹⁰ Lake and Pond Solutions Company, Aquatic Plant Management Plan Update, Camp and Center Lakes, February 7, 2017.

¹¹ SEWRPC Memorandum Report No. 222, Lake and Stream Resources Classification Project for Kenosha County, Wisconsin: 2017.

¹² Reported lake areas commonly fluctuate over time and between documents. The apparent size of a lake depends upon the lake's water level at time of measurement, the type and condition of shoreline vegetation, and the accuracy of available tools and techniques. For example, nearly all lakes are larger when water levels are higher. Conversely, lakes can appear smaller on aerial photographs when shorelines are covered by dense tree canopy. See Table 1 for more detail.

Map 1 **Center Lake**



LAKE OUTLET STRUCTURE -15'-WATER DEPTH CONTOUR IN FEET SURFACE-WATER FLOW PATH **RIPARIAN PARCEL BOUNDARY** STREAM AND FLOW DIRECTION PARCEL BOUNDARY SURFACE WATER 900 Feet 450 WETLAND

Source: Wisconsin Department of Natural Resources and SEWRPC

adjustment.¹³ Sixteen percent of Center Lake is three feet deep or less, yielding an average depth of ten feet. Additional information regarding Center Lake's hydrology and morphometry is summarized in Table 1.

According to WDNR records, Center Lake's bottom sediments are composed mostly of muck (about 85 percent) with a little sand (ten percent) and a small amount of gravel (five percent). The areas of sandy shoreline in the southeastern and northwestern parts of the Lake account for about nine percent of the Lake's shoreline length; the one small area of gravel shoreline is found along the western shoreline. A number of channels were dug through the extensive marshlands abutting the Lake. Most of these channels are located at the southern end of the Lake, although a few are also found along the northeast shoreline. As evidenced by historical aerial photographs, most of these channels were excavated sometime before 1937. The 6.53 miles of shoreline listed in Table 1 includes these artificial channels.¹⁴

Hydrology

Based upon its depth and the topography of surrounding lands, the WDNR classifies Center Lake as a deep lowland lake. It receives most of its water supply from surface-water runoff and discharges most of its water via a surface outlet, a situation also classifying the Lake as a drainage lake. The WDNR uses these parameters to set water quality goals for the Lake.

A low-head dam forms the Lake's outlet discharging to a dug channel passing under County Trunk Highway (CTH) SA at the southwest corner of the Lake (Figure 1, Map 1). This water enters Camp Lake a short distance downstream. Flow from Center Lake to Camp Lake may likely be imperceptible during extended dry weather due to the small elevation difference between the Lakes and low flow volume. Some groundwater also discharges to Center Lake and its tributary streams.

Watershed Characteristics and Land Use

Table 1 Hydrology and Morphometry of Center Lake

Parameter	Measurement
Size	
Surface Area of Lake ^a	146 acres
Watershed Area ^b	2,356 acres
Lake Volume	1,136 acre-feet
Residence Time ^C	0.84 years
Shape	
Length	0.9 mile
Width	0.4 mile
Shoreline Length	6.53 miles
Shoreline Development Factor ^d	4.0
General Lake Orientation	NE to SW
Depth	
Maximum Depth	28 feet
Mean Depth	10 feet
Area under 3 feet	16 percent
Area over 20 Feet	19 percent

^a The lake surface area used in this study was believed by SEWRPC to best represent the present ordinary high water mark open water area of the Lake. It generally includes connected channels and sparsely vegetated marsh, and therefore tends toward the larger side of published values. Various sources have reported Center Lake's surface area to be as low as 126 acres and as high as 146 acres. Reported lake surface area varies widely by source and over time. Some of the reasons why this may happen include water elevation changes, differences in vegetation over the years, inclusion or exclusion of fringing marsh, and inclusion or exclusion of channels leading off the main body of the lake or actual changes in the lake shoreline over the 60-year period of record.

- ^b Excludes Center Lake.
- ^C Residence time is the estimated time period required for a volume of water equivalent to the volume of the lake to enter and be discharged from the lake during years of normal precipitation.
- ^d Shoreline development factor is the ratio of the Lake's shoreline length to the circumference of a circular lake of the same area. The closer to a value of 1.0, the more nearly circular a lake is. Center Lake's high development factor is due largely to the artificial channel along the south, east, and north sides of the Lake.
- Source: Wisconsin Department of Natural Resources, U.S. Geological Survey, and SEWRPC

Center Lake's watershed lies primarily to the north and east of the Lake — 2,356 acres drain to Center Lake. A lake's watershed is the physical area from which surface-water runoff can drain to a lake. Center Lake has a modest-sized watershed for its size, with a watershed to lake area ratio of about 16.1:1. Lakes with ratios above 10:1 tend to develop water-quality problems.¹⁵ Lakes with large watersheds are comparatively more vulnerable to human disturbance. Gently rolling topography dominates Center Lake's watershed. Many areas are relatively flat and marshy. Areas to the west of Center Lake have hillier terrain.

¹⁴ Wisconsin Department of Natural Resources, Lake Use Report No. FX-27, op. cit..

¹⁵ Uttormark, Paul D. and Mark L. Hutchins, Input Output Models as Decision Criteria for Lake Restoration, University of Wisconsin-Madison, Wisconsin Water Resources Center Technical Report Number 78-03, 1978.

¹³ Wisconsin Department of Natural Resources, Detailed Information for Dam Center Lake. The dam report is available by searching the following website: https://dnr.wi.gov/damsafety/damSearch.aspx.

Figure 1 Center Lake Outlet Structure



Note: The outlet dam in the foreground is used to control Center Lake's elevation. After leaving Center Lake, water passes under County Trunk Highway SA and the Canadian National Railroad before reaching Camp Lake.

Source: SEWRPC

Land use immediately adjacent to Center Lake has not significantly changed since 1970 (see Figures 2 and 3). Land use as of 2010 in the Center Lake watershed is illustrated on Map 2 and summarized in Table 2. In 2010, agricultural lands accounted for about 45 percent of total watershed land use. Wetlands and woodlands covered another 12 and 6 percent, respectively, of the total watershed area. Urban uses accounted for about 29 percent of the watershed, with residential and transportation/communication/utility land uses accounting for about 80 percent of the urban land use total. Planned 2035 land use (Table 2) suggests significant changes within the Center Lake watershed. The forecast suggests that nearly all agricultural lands within the watershed will be converted to residential use, resulting in a nearly 60 percent decrease in total rural land uses and a 144 percent increase in urban land uses. Low-density and multi-family residential uses, and recreational uses, account for most of the planned increase in urban land use.

WATER QUALITY

The WDNR re-evaluated Center Lake's water quality as part of the recent impairment listing cycle and found that the Lake's water quality clearly meets State thresholds for recreation and fish and aquatic life uses.¹⁶

Historical water quality gives insight into changes that may be occurring within the Lake and its watershed. By comparing this data and evaluating trends, causes for change may be identified and management

¹⁶ Wisconsin Department of Natural Resources, Center Lake, Kenosha County website, "conditions" dnr.wi.gov/water/ waterDetail.aspx?key=10433

Figure 2 1970 Aerial Photograph of Center Lake



Date of Photography: 1970



Figure 3 2015 Orthophotograph of Center Lake



Date of Photography: 2015



Map 2 2010 Land Use Within the Center Lake Watershed



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2,200 Feet

1,100 2, Source: SEWRPC

Table 2 Existing and Planned Land Use Within the Center Lake Watershed: 2010 and 2035

	2010		2035		Change: 2010-2035	
Land Use Categories ^a	Acres	Percent of Total	Acres	Percent of Total	Acres	Percent
Urban						
Residential						
Single-Family, Suburban Density	43	1.8	46	2.0	3	7.0
Single-Family, Low Density	180	7.6	857	36.1	677	376.1
Single-Family, Medium Density	162	6.8	165	7.0	3	1.9
Single-Family, High Density						
Multi-Family	23	1.0	148	6.3	125	543.5
Commercial	16	0.7	34	1.5	18	112.5
Industrial	2	0.1	41	1.6	39	1,950.0
Governmental and Institutional	38	1.6	82	3.5	44	115.8
Transportation, Communication, and Utilities	143	6.1	143	6.1	0	0.0
Recreational	86	3.6	174	7.4	88	102.3
Subtotal	693	29.3	1,690	71.5	997	143.9
Rural						
Agricultural	1,063	45.0	72	3.0	-992	-93.2
Other Open Lands	190	8.0	185	7.8	-5	-2.6
Wetlands	276	11.7	275	11.7	0	0.0
Woodlands	132	5.6	132	5.6	0	0.0
Water ^b	11	0.4	11	0.4	0	0.0
Extractive						
Landfill						
Subtotal	1,672	70.7	675	28.5	-997	-59.7
Total	2,365	100.0	2,365	100.0	0	

Note: The land use summary table includes internally drained areas. Internally drained areas do not contribute surface-water runoff to the Lake and are therefore not included in the Lake's watershed area listed in Table 1.

^a Parking included in associated use

^b Excludes Center Lake

Source: SEWRPC

actions can be taken to help protect the Lake. Historically, only limited water quality data was collected at Center Lake, starting with a few baseline measurements taken by the WDNR in 1966. From the late 1980s through the early 2000s, Lake residents participated in the University of Wisconsin Extension (UWEX) Citizen Lakes Monitoring Network (CLMN). Citizen volunteers measured lake water quality parameters such as water clarity, phosphorus concentrations, and dissolved oxygen concentrations. The CLMN is an extremely useful program to provide long-term water quality data. Water quality data is compiled and is available on the WDNR Lakes page.¹⁷

Water clarity is a commonly used and easily understood surrogate for perceived water quality. Many people equate "clear" water with "clean" water. While this is not always true, methods have

Figure 4 Measuring Water Clarity with a Secchi Disk



Source: www. burnsville.org and SEWRPC

been developed to allow lake water clarity to be compared and contrasted. Water clarity is measured with a Secchi disk (Figure 4). "Secchi depth" is the distance below the water surface a Secchi disk can be seen

¹⁷ Water quality data and other information about Center Lake can be found at the WDNR Lakes page: dnr.wi.gov/lakes/ LakePages/LakeDetail.aspx?wbic=747300.

Figure 5 Summer (June Through August) Secchi Depth Ranges for Center Lake



under carefully prescribed conditions. Secchi depth has been occasionally measured in the Lake and the results over time are summarized graphically in Figure 5. On average, water clarity has been rather poor, with Secchi depth readings ranging between three and six feet and typically averaging around four to slightly more than five feet. Water clarity has also been estimated from satellite imagery,¹⁸ averaging 3.6 feet between 2003 and 2011, which generally agrees with values actually measured on the Lake. Furthermore, more recent remote sensing techniques suggest that the Lake is fairly turbid in most areas.¹⁹ Based upon the available information, Center Lake's water clarity is rather poor and has not changed significantly since monitoring began.

Lake trophic state index (TSI) is calculated using physical and chemical indicators of lake nutrient enrichment. Lakes with low numeric scores (i.e., less than 40) generally have clear water of excellent quality and are termed oligotrophic. Lakes with TSI values between 50 and 60 are termed eutrophic and have limited water clarity, fewer algal species, overly-abundant aquatic plant growth, and deep areas that are commonly devoid of oxygen during summer. Mesotrophic lakes (TSI values between 40 and 50) have conditions intermediate between oligotrophic and eutrophic lakes, while hypereutrophic lakes (TSI values above 70) commonly can experience algal blooms, poor water clarity, and, in extreme cases, summer fish kills. Hypereutrophic conditions rarely occur in nature and are generally associated with human activity.

Center Lake's TSI values are plotted over time in Figure 6. As can be seen from this graphic, TSI values have been relatively static over the past 30 years, indicating persistent eutrophic conditions. The WDNR classifies Center Lake as eutrophic. Unlike neighboring Camp Lake, chlorophyll-a TSI values have only slightly decreased over the time period with a corresponding and logical slight increase in secchi depth TSI. Similar to Camp Lake, Spring and fall total phosphorus concentrations decreased between 2001 and 2016, suggesting that water quality is improving.²⁰

¹⁸ Environmental Remote Sensing Center data and information about the program can be found at Lakesat.org.

¹⁹ Water clarity information is available at the WDNR's Lakes and AIS Viewer website: dnrmaps.wi.gov/H5/?viewer=Lakes_ AIS_Viewer

²⁰ Lake and Pond Solutions Company, February 2017, op. cit.





Note: Comparatively little data was available for Center Lake. June-August data of each year was averaged to produce the resultant values.

Source: Wisconsin Department of Natural Resources and SEWRPC

Center Lake is not particularity deep with a maximum recorded depth of 28 feet. According to late summer 2016 data, Lake waters deeper than approximately 12 feet may not contain significant oxygen to fully support fish when the Lake is stratified in summer, while portions of the Lake deeper than 18 feet can be devoid of oxygen. Water depth under most of the central portion of the Lake is greater than 12 feet suggesting that large a portion of the Lake's water volume is not capable of supporting fish during summer.

NATURAL RESOURCES

Aquatic Plants

Center Lake's aquatic plant community was examined in 1967, 1993, 2004, 2005, 2011, and 2016. The 1967 survey was less detailed than subsequent surveys. Table 3 lists the frequency of occurrence of plant species noted in these studies.

The 1967 survey reported spiny naiad (*Najas marina*) and muskgrass (*Chara spp*.) as the most common species.²¹ Other species present at that time included yellow pond lily (*Nuphar advena*), white water lily (*Nymphaea odorata*), and common cattail (*Typha spp*.). Aquatic plant growth along the shoreline was dense enough to impede boat traffic.

Quantitative plant surveys completed between 1967 and 2016 reveal gradual shifts in aquatic plant abundance and diversity. Submerged aquatic plant diversity significantly decreased during the first decade of this period but recovered during the mid-2000's. Submerged aquatic plant diversity is now the highest recorded at the Lake. Increasing plant diversity has been accompanied by decreased abundance of exotic

²¹ Wisconsin Department of Natural Resources Lake Use Report No. FX-27, op cit..

Table 3Center Lake Aquatic Plant Surveys: 1967 Through 2016

		Per Cent Frequency of Occurrence in Vegetated Ar				d Areas
	August	August	June, July	September	August	August
Aquatic Plant Species	1967	1993	2004	2005	2011	2016
Floating Plants						
Lemna spp.	sparse					
Lemna minor (small duckweed)		2.0		2.7	16.7	23.1
Lemna trisulca (forked duckweed)				2.3	6.1	6.7
Nuphar advena (yellow pond lily)		6.1				
Nuphar spp.	scattered					
Nuphar variegatum (spatterdock)		2.1		1.3	3.5	9.0
Nymphaea odorata (white water lily)		8.2		1.7	13.2	26.4
Nymphaea spp.	scattered					
Nymphaea tuberosa (white water lily)		8.2		1.7	13.2	26.4
Spirodela polyrhiza (large duckweed)				0.3		
Emergent Plants						
Carex comosa (bottle brush sedge)					0.9	
Cyperaceae spp.	scattered					
Decodon verticillatus (swamp loosestrife)	sparse			0.3		
Lythrum salicaria (purple loosestrife)					11.8	0.7
Phragmites australis (common reed)						0.7
Sagittaria latifolia (common arrowhead)	sparse				0.4	
Schoenoplectus tabernaemontani (softstem buirush)	sparse			 a	0.4	0.3
Typha augustifolia (narrow-leaved cattall)		4.1			22.8	9.4
	moderate					
Submerged Plants						
Ceratophyllum demersum (coontail)	scattered	71.4	78.0	42.3	83.3	74.3
Chara vulgaris (muskgrass)	heavy	28.6	19.5	15.0	3.1	27.8
Elodea canadensis (waterweed)	sparse				0.4	15.4
Heteranthera dubia (water stargrass)		8.2		0.7	1.8	14.7
Myriophyllum sibiricum (northern water milfoil)		4.1				
Myriophyllum spicatum (Eurasian water milfoil)		83.7	95.1	88.0	6.6	19.7
Myriophyllum spp.	scattered					
Najas flexilis (bushy pondweed)			22.0	8.0	0.9	8.7
Najas guadalupensis (southern naiad)		8.2				
Najas marina (spiny naiad)	heavy	44.9		2.7	0.9	1.7
Potamoaeton crispus (curly-leaf pondweed)	sparse	10.2	4.9		4.0	1.3
Potamogeton gramineus (variable pondweed)		4.1	7.3	2.3		
Potamogeton illinoensis (Illinois pondweed)			2.4	17	0.9	10.7
Potamogeton natans (floating-leaf pondweed)	sparse					
Potamogeton praelongus (white-stem pondwood)					0.4	2.2
Potamogeton providus (white-stern pondweed)					0.4	0.7
Potumogeton pustitus (smail pondweed)					0.9	0.7
Potamogeton zosterijormis (nat-stem pondweed)					1.8	9.7
Polumoyeton spp.		8.2				
Ruppla maritima (widgeon-grass)	sparse	6.1	14.6	24.7	7.0	9.0
Stuckenia pectinata (Sago pondweed)	scattered	42.7	17.1	11.7	4.8	37.8
Utricularia vulgaris (common bladderwort)	sparse	4.1				3.7
Vallisneria americana (water celery)	sparse	40.8	26.8	13.0	12.7	27.4

Notes: Frequency of occurrence of a species is derived from a combination of the number of occurrences of a species and the number of sampling sites that had some kind of vegetation present. It indicates dominance of a species within a plant community.

Nonnative species above are listed in red print; all other species are native.

NR107 Wisconsin Administrative Code high-value species are printed in green print.

^a Vegetation was noted as present but not statistically measured.

Source: Belonger, Hey and Associates, Inc., R. A. Smith, Inc., Lake and Pond Solutions Co., and SEWRPC

submerged aquatic plants. Eurasian water milfoil (EWM, *Myriophyllum spicatum*) was the most dominant submerged aquatic plant in the Lake during 1993, 2004, and 2005. More recently (2011 and 2016), native coontail (*Ceratophyllum demersum*) and water celery (*Vallisneria americana*) have been the most abundant submerged aquatic plants in the Lake. The long term trend of decreasing muskgrass (*Chara, spp.*) abundance warrants concern since this aquatic algae can be an important mechanism to sequester phosphorus. Muskgrass abundance recovered to some degree in the most recent survey.

A diverse array of native aquatic plant species is generally indicative of a healthy aquatic plant community. The loss of dominance by Eurasian water milfoil since 2004 combined with a resurgence of native species, especially pondweeds, in the 2016 survey, are signs of a recovering aquatic plant community. Twelve high-value species are identified under Chapter NR 107, "Aquatic Plant Management," of the *Wisconsin Administrative Code* as plants that contribute important ecosystem services to lakes. Five have recently been found in Center Lake including softstem bullrush (*Schoenoplectus tabernaemontani*), Illinois pondweed (*Potamogeton praelongis*),Sago pondweed (*Stuckenia pectinata*), and water celery.

Aquatic plants have been noted to grow to a depth of 11 feet below the Lake surface in Center Lake. Since a substantial portion of the Lake's water depth is less than maximum plant rooting depth, much of the Lake supports rooted aquatic plant growth.

Aquatic Invasive Species

The terms "nonnative" and "invasive" are often confused and incorrectly assumed to be synonymous. Nonnative is an overarching term describing living organisms introduced to new areas beyond their native range with intentional or unintentional human help. Nonnative species may not necessarily harm ecological function or human use values in their new environments. Invasive species are the subset of nonnative species that damage the ecological health of their new environments and/or are commonly considered nuisances to human use values. In summary, invasive species are non-native but not all non-native species are invasive.

Eurasian Water Milfoil (Myriophyllum spicatum) and Eurasian/Northern Water Milfoil Hybrids

EWM, one of eight milfoil species found in Wisconsin, is the only milfoil species known to be exotic/nonnative (see Figure 7). This plant can grow profusely in nutrient-rich lakes impeding boating and recreational use. Because of this management concern, EWM is actively managed by mechanical and chemical means in many Southeastern Wisconsin lakes. In recent years, EWM/native northern milfoil hydrids have been observed in some Wisconsin lakes. These hybrids pose a difficult management problem: not only do hybrids grow quickly like EWM, but hybrids appear to be more tolerant to aquatic herbicides such as 2, 4-D and Endothall that are commonly used to manage EWM.²² Although hybrid milfoils have not yet been documented in Center Lake, they have been identified in Camp Lake which is essentially contiguous with Center Lake.

EWM has commonly been one of the most frequently occurring plants in the Lake since 1993 and likely was present earlier and simply identified as "water milfoil." The presence of this milfoil species in the Lake is a management concern. The CCLRD manages nuisance aquatic vegetation using mechanical harvesters and herbicides. Increasing vigilance has been devoted to protecting native aquatic plants to promote their spread into areas infested with EWM. In 1999 and 2001, weevils were stocked in an area of dense EWM in Center Lake to control EWM. However, in 2005 there was no evidence of weevils or any EWM control by the insects.²³ However, EWM abundance has significantly decreased since 2005. The total volume of aquatic plants harvested from the Lake has significantly decreased over the past 15 years.

Curly-leaf Pondweed (Potamogeton crispus)

Curly-leaf pondweed (see Figure 8) is an invasive plant that thrives in cool water and exhibits an earlyseason growth cycle that helps give it a competitive advantage over native plants. However, curly-leaf pondweed begins to die off during the summer when lake water temperatures start to peak. Therefore, it is not normally considered a nuisance during summer months. Furthermore, the abundance of curly-leaf pondweed abundance significantly decreased between the 1993 and 2004 surveys, and has remained low thereafter.

²² T. Groves, P. Hausler, and P. Tyning, Water Resources Group, Progressive AE, Hybrid Milfoil: Management Implications and Challenges, The Michigan Riparian, Winter 2015.

²³ Hey and Associates, Inc. Aquatic Plant Management Plant for Camp and Center Lakes, Kenosha County, Wisconsin, opt cit.

Identifying Features

- Stems spaghetti-like, often pinkish, growing long with many branches near the water surface
- Leaves with 12 to 21 pairs of leaflets
- Produces no winter buds (turions)

Eurasian water milfoil is similar to northern water milfoil (*M. sibiricum*). However, northern water milfoil has five to 12 pairs of leaflets per leaf and stouter white or pale brown stems

Ecology

- Hybridizes with native northern water milfoil, resulting in plants with intermediate characteristics
- Invasive, growing quickly, forming canopies, and getting a head-start in spring due to an ability to grow in cool water
- Grows from root stalks and stem fragments in both lakes and streams, shallow and deep; tolerates disturbed conditions
- Provides some forage to waterfowl, but supports fewer aquatic invertebrates than mixed stands of aquatic vegetation







Source: Wisconsin Department of Natural Resources and Skawinski, P. M. (2014). Aquatic Plants of the Upper Midwest: A Photographic Field Guide to Our Underwater Forests, 2nd Edition, Wausau, Wisconsin, USA: Self-Published

Spiny Niad (Najas marina)

Spiny Naiad (see Figure 9) is a nonnative plant that is native to other states, including Minnesota, but was introduced to Wisconsin. Spiny naiad can grow to nuisance levels in northern Wisconsin lakes and since 2015 is officially recognized as an invasive species in Wisconsin²⁴. Spiny naiad was the most common plant species in the 1967 survey and was common in the 1993 survey, was not found during the 2004 survey, and has only been infrequently found in subsequent surveys.

Purple loosestrife (Lythrum salicaria)

Purple loosestrife (see Figure 10) spreads profusely, outcompeting native plant species and reducing the quality of fish and wildlife habitat, while adding little ecological benefit. This species is declared a noxious weed in the State of Wisconsin and is subject to an ongoing control program. Purple loosestrife is present in wetlands fringing Center Lake. Center Lake's extensive marshlands make large areas particularly susceptible to purple loosestrife infestation. Swamp loosestrife (*Decedon verticillatus*) was noted to be present in 1967. However, given the current presence of exotic purple loosestrife, one can speculate that purple loosestrife was already present on Center Lake in 1967 but was mistakenly identified as swamp loosestrife

²⁴ Wisconsin Administrative Code, Chapter NR 40, Invasive Species Identification, Classification, and Control.



Source: Wisconsin Department of Natural Resources, SEWRPC, and Skawinski, P. M. (2014). Aquatic Plants of the Upper Midwest: A Photographic Field Guide to Our Underwater Forests, 2nd Edition, Wausau, Wisconsin, USA: Self-Published.

Fisheries and Wildlife

As of 1961, Center Lake was managed as a northern pike (Esox lucius), largemouth bass (*Micropterus salmonoides*) panfish and bullhead fishery.²⁵ The WDNR''s 1969 Lake Use Report described Center Lake's fishery as comprised of bluegills, black crappies (*Poxomis nigromaculatus*), bullhead catfish, white bass (*Morone chrysops*), largemouth bass, northern pike, and walleye (Sander vitreus). Northern pike and largemouth bass were thought to be reproducing naturally in the Lake. Carp were noted to be present but not at levels causing management concern.²⁶

As of 2005, the WDNR listed largemouth bass as "abundant," northern pike and panfish (bluegill and crappie) as "common," and walleye as "present."²⁷ Fish surveys were conducted in 2012 and 2017 by the WDNR. The 2012 survey identified six species: white crappie (*Pomoxis annularis*), black crappie, bluegill (*Lepomis macrochiras*), largemouth bass, northern pike, and walleye. Bluegill were the most abundant species and ranged in size mostly from three to seven inches; largemouth bass were the second most abundant species with fish mostly in the eight to 17 inch size range. The 2017 survey focused on walleye, finding fish mostly in the 15 to 20 inch length and in increased abundance compared to the 2012 survey. One species of special concern has been found in Center Lake, the lake chubsucker (see Figure 11). Several other aquatic species

²⁵ Wisconsin Conservation Department, 1961, op cit.

²⁶ Wisconsin Department of Natural Resources Lake Use Report No. FX-27, op cit.

²⁷ Wisconsin Department of Natural Resources Publication No. PUB-FH-800, 2005, op cit.

Identifying Features

- Stems stiff and spiny, often branching many times
- Leaves stiff, 1.0 to 4.0 millimeters thick, with coarse teeth along the margins and midvein on the underside

Spiny naiad is quite distinct from other naiads due to its larger, coarsely toothed leaves and the irregularly pitted surface of its fruits. Spiny naiad is presumably introduced in Wisconsin but it is considered native in other states, including Minnesota



Ecology

• Alkaline lakes, water quality ranging from good to

• An annual, regenerating from seed each year

Occurs as separate male and female plants

• Capable of growing aggressively

poor

Source: Wisconsin Department of Natural Resources and Skawinski, P.M. (2014). Aquatic Plants of the Upper Midwest: A Photographic Field Guide to Out Underwater Forests, 2nd Edition, Wausau, Wisconsin, USA,: Self-Published.

listed as threatened, endangered, or special concern are believed to exist in the local area and may also exist in Center Lake.

Center Lake has a long history of game fish stocking. Largemouth bass were last reported stocked in 1951. Northern pike were stocked intermittently between 1953 and 1969, and again in 1991. Several thousand walleye were stocked in 2005, 2010, 2011, 2013, 2015, and 2017.

The wetland areas dominating the northeastern and eastern shorelines of Center Lake provide excellent habitat for associated wetland species and migratory waterfowl. Herons and bitterns have been reported as commonly present. Wetlands are likely inhabited by a wide range of animals such as muskrat, mink, red-winged black birds, common yellow throats, and marsh wrens.

Environmentally Significant Areas

The Center Lake watershed contains several environmentally significant areas. These areas generally represent the best remaining natural resource areas in the Lake's watershed. Many important interdependent relationships occur between living organisms and their environment in such areas. Destruction or deterioration of any one element of a natural environment may unravel the value and stability of the overall resource. Therefore, it is important to protect such areas.

As shown on Map 3, primary environmental corridor areas occupy 507 acres of land and water area (including the Lake itself) in the Lake's watershed, much of it in close proximity to the Lake along the eastern and northeastern shorelands. Preserving these areas is critically important to maintaining the ecological integrity of the Lake. Some of the wetland areas to the north and to the northeast of the Lake are among the 88 acres designated as isolated natural resource areas in the Lake's direct watershed.

Identifying Features

- Terrestrial or semi-aquatic emergent forb
- Stems often angled with four, five, or more sides
- Grow one to two meters tall
- Flowers deep pink or purple, six-parted, 12 to 25 millimeters wide, and in groups
- Leaves lance-like, four to 11 centimeters long and either opposite or in whorls of three

Purple loosestrife, if small, is similar to winged loosestrife (*Lythrum alatum*), but winged loosestrife differs in having leaves generally smaller (<5.0 centimeters long), leaves mostly alternate (only lower leaves opposite), and flowers mostly held singly in the leaf axils rather than in pairs or groups



Ecology/Control

- Found in shallows, along shores, and in wet to moist meadows and prairies
- Invasive and continues to escape from ornamental plantings
- Galerucella beetles have been successfully used to control purple loosestrife. Plants may also be dug or pulled when small, placed in a landfill, or burned. Several herbicides are effective, but application near water may require permits and aquatic-use formulas.





Silver Lake Bog State Natural Area lies in the northwest corner of the Center Lake watershed (see Map 3). This 18-acre tract contains one of the better acid bogs in the Region. This area is designated as a natural area of State-wide significance. Center Lake Woods and Wetlands (see Map 3) is a 72-acre tract containing species-rich ravine woods associated with good quality wetlands; it is considered an area of local significance. Center Lake has been designated as critical aquatic habitat area under the SEWRPC's Critical Habitat Designation program on the basis of its ability to provide ideal waterfowl, marsh wildlife, and critical fish species habitat.28 The Lake is considered an aquatic area of local significance, important to the overall health of aquatic plants and animals.

Aesthetic Features

Even though Center Lake is located in a densely populated area, significant amounts of undeveloped shoreline are present. Center Lake's extensive marshlands, along with the wildlife they attract, provide an opportunity for Lake users to experience the area's native beauty. The channels through marshlands allow boaters to access and explore natural areas in more intimate detail.

Figure 11 Special Concern Species Found in Center Lake



Lake Chubsucker (Erimyzon sucetta)

Source: SEWRPC

LAKE USE

Recreational Use

During summer and winter 2014 and 2015, SEWRPC staff conducted recreational surveys to examine public lake use. The surveys reveal that swimming, fishing, and water skiing/tubing were the most popular on-water activities during the summer (Figure 12). The most popular winter activity observed was ice fishing (Figure 13). Snowmobiling is also a popular local winter pastime.

Public Access

A public boat launch site is located on the west side of Center Lake (see Map 4). The sight has a single paved launch ramp with parking for vehicles and boat trailers. Launch fess are charged. The WDNR deems the Lake to have adequate public recreational boating access pursuant to standards set forth in Chapter NR 1, "Natural Resources Board Policies," of the *Wisconsin Administrative Code*.

Cottages and Homesites

According to recent records, 195 lakefront lots abut Center Lake. Lot sizes average 2.4 acres and range from less than 0.1 acre to 117 acres.²⁹ The population and number of households in the Center Lake watershed is projected to significantly increase by 2035 (Table 4).

²⁸ SEWRPC Planning Report Number 42, A Regional Natural Areas and Critical Species Habitat Protection and Management Plan for Southeastern Wisconsin, September 1997.

²⁹ SEWRPC Memorandum Report No. 222, op.cit.

Map 3 Environmentally Significant Areas Within the Center Lake Waterhsed: 2015







PRIMARY ENVIRONMENTAL CORRIDORS

SECONDARY ENVIRONMENTAL CORRIDORS

- ISOLATED NATURAL RESOURCE AREA
- WETLANDS





Source: SEWRPC

Figure 13 Typical Winter Activities Center Lake



Source: SEWRPC

Map 4 Recreational Use on Center Lake: 2015



Note: For additional lake information or boating regulations go to: dnr.wi.gov/lakes/lakepages/Results.aspx

No No

Yes

No No

Yes

Yes

Yes

No

Boat Launch Village of Salem Lakes

Community Park

(Access from 256th Street



Table 4Population and Households in theCenter Lake Watershed: 1960-2035

Year	Population	Households
1960	855	292
1970	877	295
1980	1,035	369
1990	1,263	472
2000	1,731	622
2010	2,126	841
Planned 2035	3,856	1,477

Source: U.S. Bureau of Census and SEWRPC.

EXISTING PROTECTIVE MEASURES

Sewage Disposal

All riparian residential lands in the Center Lake watershed are now served by public sanitary sewer systems. As such, water pollution from onsite septic systems is not an ongoing concern.

Shoreline Protection and Erosion Control

Center Lake's shoreline includes stretches of protected shoreline (either artificial or natural) as well as some areas of unprotected shoreline, such as where a riparian owner mows lawn to the water's edge (see Map 5). About 82 percent of Center Lake's shoreline is protected by natural features (63 percent) or artificial shoreline protective structures such as riprap or bulkhead (19 percent). Never the less, many actively eroding shoreline areas were noted as part of SEWRPC's August 2014 field survey.³⁰, ³¹

Land Use Regulations

Comprehensive zoning ordinances are one of the most important tools available to local units of government for encouraging orderly development and land use that contributes to long-term human and environmental welfare. Center Lake and its watershed are subject to ordinances and regulations adopted by the Village of Salem Lakes. The Village of Salem Lakes was incorporated on February 14, 2017, and, as an interim measure, continues to follow the ordinances adopted by the Town of Salem and Kenosha County. Table 5 summarizes general and special-purpose zoning ordinances for the civil divisions within the Center Lake watershed.

Water Use Regulations

Center Lake is subject to Village of Salem Lakes boating ordinances, which as mentioned in the previous paragraph, were originally adopted by the Town of Salem. These ordinances apply to persons, boats, watercraft, and objects upon, in, and under the waters of Center Lake. This ordinance is consistent with Chapter 30 of the Wisconsin Statutes and applies to persons, boats, watercraft, and objects upon, in, and under the jurisdiction of the Village and limits the times during which boats may operate on Center Lake.

Table 5Land Use Regulations Within theCenter Lake Watershed inKenosha County by Civil Division: 2016

	Community			
	Kenosha Village of Salem			
Type of Ordinance	County	Lakes		
General Zoning	Adopted	Regulated under		
		County ordinance		
Floodplain Zoning	Adopted	Regulated under		
		County ordinance		
Shoreland Zoning	Adopted	Regulated under		
		County ordinance		
Subdivision Control	Adopted ^a	Adopted ^a		
Construction Site Erosion	Adopted ^a	Adopted ^a		
Control and Stormwater				
Management				

^a Both the Kenosha County and Village of Salem Lakes subdivision ordinances and erosion control and stormwater management ordinances apply within the Village.. In the event of conflicting regulations, the more restrictive regulation applies

Source: SEWRPC

³⁰ Ibid.

³¹ Digital versions of shoreline photographs taken during August 2014 are available through Kenosha County and SEWRPC.

