Prepared by: EOR

For the Beaver Dam Lake Management District, October 2025

Beaver Dam Lake Restoration and Management Plan

(Approved by the Beaver Dam Lake Management District)

Cover Image

Norwegian Bay (Photo: Marty Peters)

Acknowledgements

The following Lake Restoration and Management Plan was prepared for the Beaver Dam Lake Management District by Emmons & Olivier, Inc. (EOR) staff:

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EXECUTIVE SUMMARY

Cumberland and its surrounding communities have a deep connection to Beaver Dam Lake as a prominent part of their local landscape and an important part of the area's identity. Successive generations have called this place home, a seasonal retreat, and a rest stop to the Northwoods. Years of management by the Beaver Dam Lake Management District have helped address pressing concerns about aquatic plant management and invasive species yielding significant reductions in the extent of aquatic vegetation. The Beaver Dam Lake Management Plan is intended to guide future investments in stewarding the health of this lake through capital projects and programs that focus primarily on improving water quality throughout the lake.

The Plan outlines historic and present uses of the lake. It contextualizes the work completed and underway in Cumberland and surrounding communities of Maple Plain and Crystal Lake. Preliminary modelling conducted through the preparation of this Plan explores loading rates for nutrients and sediments to the lake from surrounding subwatersheds, including subwatersheds draining to the East Lake through Norwegian Bay via a diversion ditch. The Plan compiles the most current information related to threats facing the lake, the aquatic environment, habitats, and regulatory processes to paint a comprehensive picture of the state of lake management. Additional data and analysis requirements for further management decision-making are identified where applicable.

The Plan establishes goals in four areas related to lake health; invasive species; human use, aesthetics, and recreation, and financing strategies. These goals are supported by implementation actions that aim to address gaps in the state of lake management to improve environmental, social, and economic characteristics of the immediate area tied to the lake. A list of projects and programs working towards these goals is outlined along with a financing strategy to support future grant efforts and fundraising. These implementation actions build upon existing work that has contributed to improving condition in Beaver Dam Lake West and seeks to extend these actions to better understand and respond to water resource issues in Beaver Dam Lake East through new monitoring and mitigation projects in the coming five years and beyond.

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List of Acronyms

AIS	Aquatic Invasive Species
APM	Aquatic Plant Management
BDLMD	Beaver Dam Lake Management District
BMPs	Best Management Practices
CLP	Curly-lead Pondweed
EWM	Eurasian Watermilfoil
FQI	Floristic Quality Index
LWRMP	Land & Water Resource Management Plan
NPDES	National Pollutant Discharge Elimination System
SDI	Simpson's Diversity Index
TP	Total Phosphorus
TSS	Total Suspended Solids
WiIMS	Wisconsin Lake Modeling Suite
WinSLAMM	Source Loading and Management Model for Windows
WDNR	Wisconsin Department of Natural Resources
WisDOT	Wisconsin Department of Transportation

1 BEAVER DAM LAKE DESCRIPTION

1.1 General Description

Beaver Dam Lake is a 1,163-acre lake in Barron County, Wisconsin, located predominantly in the City of Cumberland (T35N R13W S7) with portions of the lake in the Town of Maple Plain (northwest), Town of Crystal Lake (southwest), and Town of Cumberland (southeast) in Northwest Wisconsin. The Wisconsin DNR (WDNR) maintains a list of waterbodies and has catalogued Beaver Dam Lake with the waterbody identification code WBIC 2081200. A map of the project area is shown in Figure 1.

Beaver Dam Lake is separated into west and east basins, with downtown Cumberland in between. Beaver Dam Lake West is the largest basin of the lake with several bays including Tiger Bay (at the north end of the lake), Williams Bay (west of Eagle Point) and Rabbit Island Bay (south of Williams Bay through the narrow sand bar). This west basin contains the lake's deepest point with a maximum depth of approximately 106 feet at normal water level. The Beaver Dam Lake East basin includes several bays: Norwegian Bay, at the lake's north end, City Bay to the east of downtown Cumberland, and Cemetery Bay south of Highway 48/Elm. This basin is predominantly open water except for several smaller unnamed bays with extensive aquatic vegetation communities. The two lake basins are connected to each other by a channel underneath the newly constructed Highway 63 bridge.

Beaver Dam Lake is surrounded by several smaller lakes including Library Lake and Collingwood Lake near downtown Cumberland, Kidney lake (north end), and Upper and Lower Spirit Lakes. The lake is surrounded almost entirely by lakeshore residential development with a few exceptions including Eagle Point Campground, and undeveloped areas in west Rabbit Island Bay, and the north side of East Lake.

Downtown Cumberland, WI (Photo: Marty Peters)

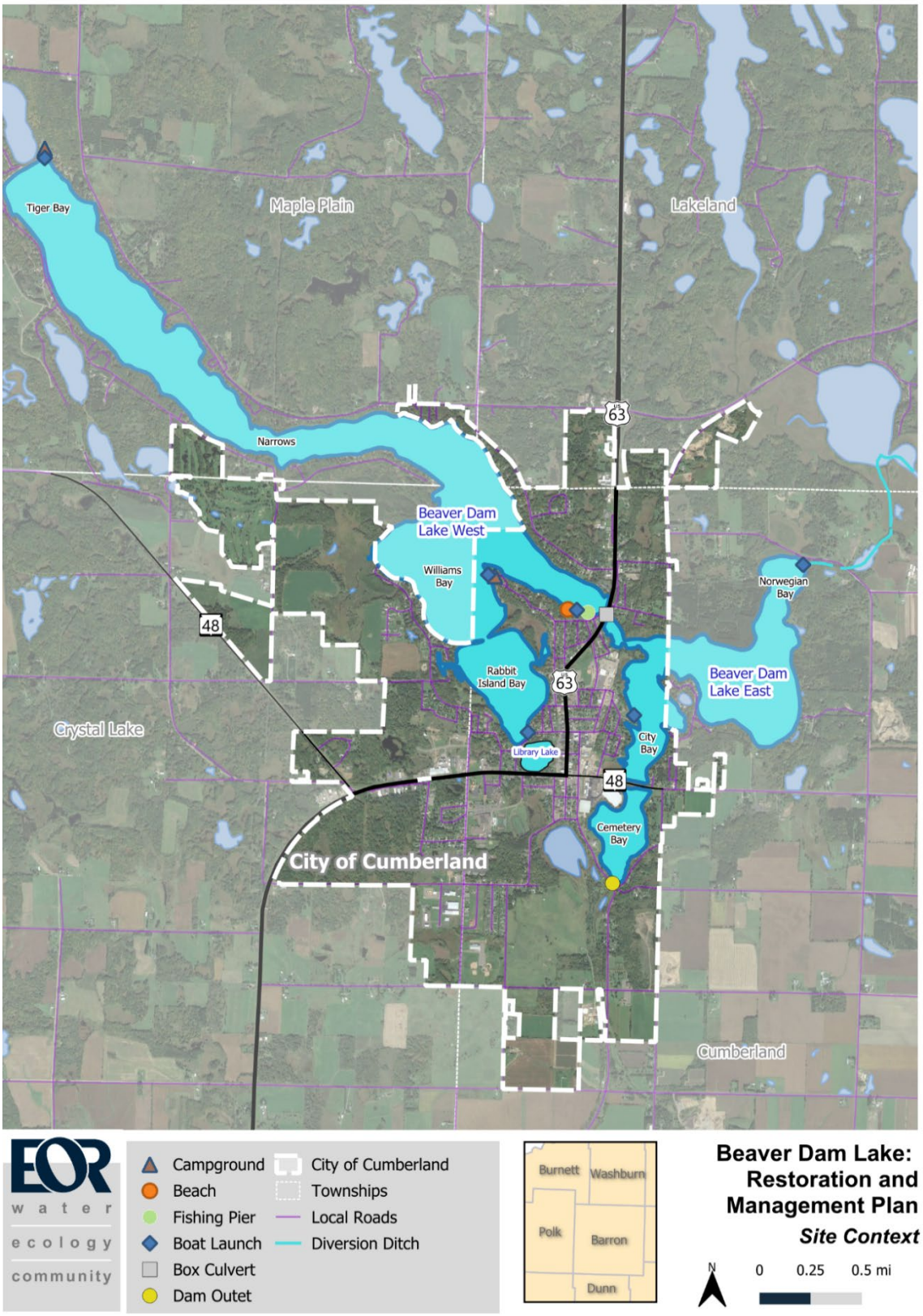
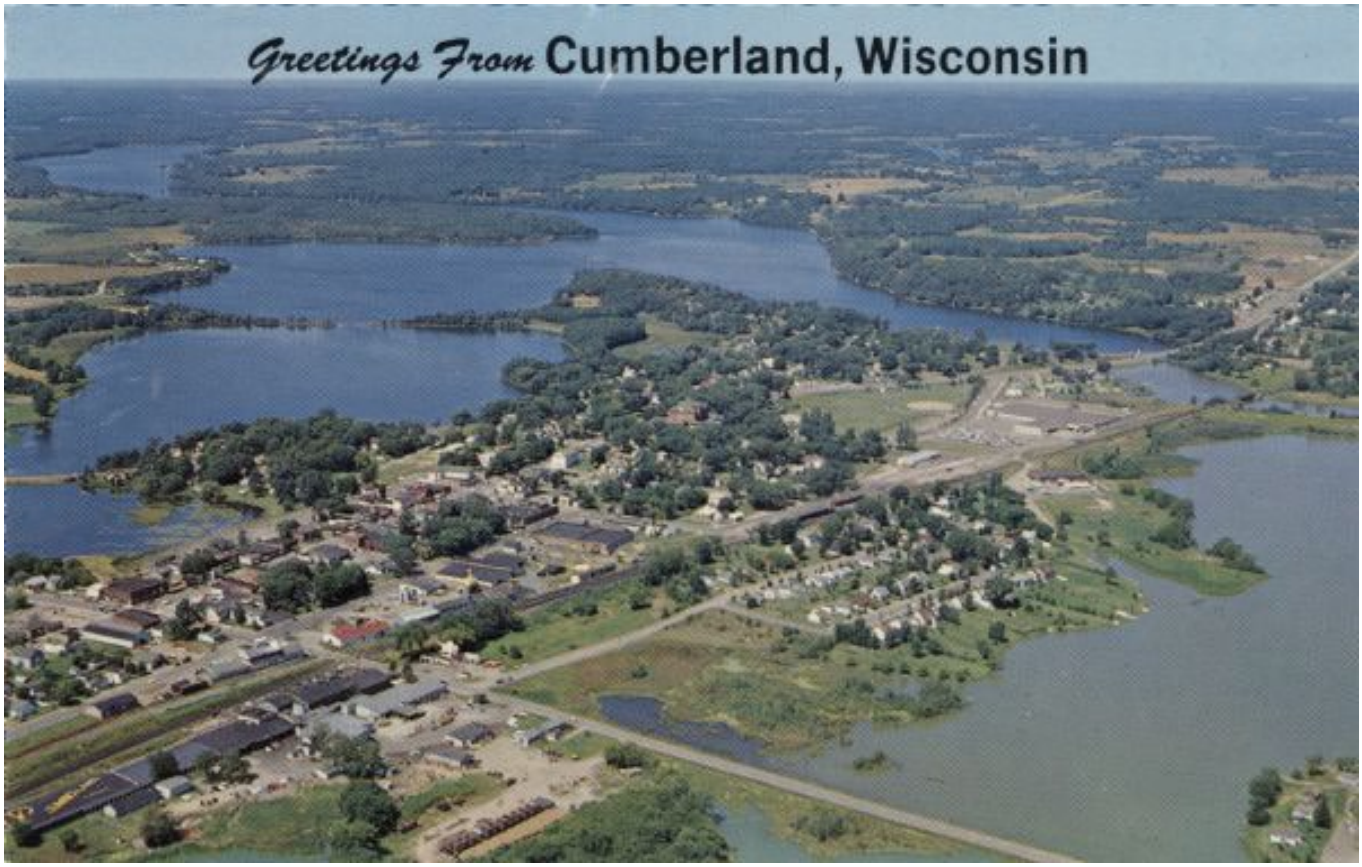


Figure 1. Beaver Dam Lake surrounding area

1.2 Lake History

Beaver Dam Lake helped give Cumberland its namesake, the "Island City". Prior to the construction of Highway 63 and Lake Street, Highway 48/Elm Street, and Highway 63 south of Library Lake, downtown Cumberland was an island surrounded by Beaver Dam Lake, Library Lake, and Collingwood Lake. As Cumberland grew, gradual infilling of the surrounding waterbodies made the City's island quality less apparent for those entering downtown.



Greetings from Cumberland Wisconsin postcard, 1950 (Wisconsin Historical Society)

1.3 Historical Water Flow Patterns

Beaver Dam Lake's drainage area has grown over time owing to the creation of a diversion ditch entering Norwegian Bay. Constructed in 1937 during a drought, the diversion ditch adds 11,943 acres to the lake's natural drainage area of 6,755 acres, more than doubling it to a total area of 16,819 acres. The merits of keeping the diversion ditch have been a source of debate since 1989 due to eutrophication concerns, particularly in Norwegian Bay.

Several road construction projects have also altered the flow of water between areas of the lake. A box culvert underneath Highway 63 and Lake Street connecting Beaver Dam Lake West and Beaver Dam Lake East was installed in 1938. WisDOT is preparing to remove the box culvert and replace it with a single span bridge. This will also include the removal of a portion of Lake Street and lake dredging to increase the navigational clearance to nine feet. A small dam at the south end of Cemetery Bay at 1st Avenue near the intersection of Bonnet Street and Berdan St was constructed in 2000, which controls the outflow of water from Beaver Dam Lake downstream into the Hay River.

1.4 Lake Water Quality

Beaver Dam Lake Management District has sampled lake water quality using Secchi disk readings at 16 locations in most years since 1992. The Secchi depth reported is the depth at which the black and white Secchi disk is no longer visible when it is lowered into the water. Table 1 indicates the most recent Secchi Disk readings for eight areas of the lake. Charts illustrating the change in Secchi Disk readings over time are included in **Appendix I: Detailed Water Quality Data.**

Notably, significant data disparities exist between the west and east basins. Western areas of the lake have more consistent data records, whereas eastern portions of the lake have sporadic periods of readings (for example East Lake and Cemetery Bay go through three short periods of observation with long gaps in between). Water quality is generally better in the west basin with a trophic state varying from Mesotrophic to Oligotrophic compared to Eutrophic and Hypereutrophic states in the east basin.

What does the trophic state tell us?

A lake's trophic state tells us how biologically productive a water body is. A trophic state index (TSI) is used to understand this using a scale of 1 to 100 using mean values for phosphorus, chlorophyll a, and Secchi depth. Values range from Oligotrophic (low plant growth and high water transparency) to Eutrophic (high plant growth and low transparency). Mesotrophic conditions occur between Oligotrophic and Eutrophic conditions. Hypereutrophic conditions occur when Eutrophic waterbodies become so productive they create issues with plant and algae growth.

Table 1.Beaver Dam Lake most recent Secchi Disk readings (source: Barr, 2024)

Lake Area	Basin	Station ID	Most Recent Year	Secchi Min (ft)	Secchi Max (ft)	TSI Secchi	Trophic State
West Lake (West End)	West	033130	2024	13.0	14.0	40.2	Mesotrophic
West Lake (NE of Eagle Point)	West	033131	2023	11.0	13.0	47.9	Mesotrophic
Williams Bay	West	033132	2023	11.0	12.0	42.0	Mesotrophic
Rabbit Island Bay	West	033133	2023	11.0	13.0	42.8	Mesotrophic
Cemetery Bay	East	033137	2012	1.5	3.0	67.5	Eutrophic to Hypereutrophic
City Bay	East	033136	1995	5.0	15.0	53.9	Mesotrophic
East Lake	East	10043673	2018	4.0	10.0	N/A	N/A
Norwegian Bay	East	033135	2012	4.0	9.5	54.1	Mesotrophic

1.5 Lake Watershed

The lake's direct watershed (land that drains directly to Beaver Dam Lake) includes the City of Cumberland, the Town of Maple Plain to the northwest, the Town of Cumberland to the southeast, and a small portion of the Town of Crystal Lake.

Areas for the direct watershed were generated using stormwater reports for stormwater best management practices (BMPs) installed throughout the City of Cumberland along with topography and storm sewer data. Land use layers were generated by combining the following sources:

- For impervious surfaces (streets, parking lots, rooftops), EOR had previously delineated these areas within the city. The layer was updated where needed, and all areas contained in this layer were modeled as impervious surfaces.
- For watershed areas outside of the EOR impervious layer, a free, open-source geospatial software (QGIS) tool called "Curve Number Generator" was used to obtain the current National Resource Conservation Service Soil Survey Geographic Database (NRCS SSURGO) soils layer and the National Land Cover Database (NLCD) Land Cover layer to assign Runoff Curve Numbers based on land use and soil types. The Wiscland 2.0 land cover data set from the Wisconsin Department of Natural Resources (WDNR) was also used, which gives a representation of Wisconsin land cover as of 2016.

Table 2 outlines the land use types found within the Beaver Dam Lake direct watershed. It also contains information on modeled pollutant loads, which are discussed in more detail later in this Section.

Table 2. Land cover statistics and pollutants generated by land cover type for Beaver Dam Lake (direct drainage area)

Land Cover Type	Acres	Percent	Total Phosphorus		Total Suspended Solids	
			Annual Loading Rate (lb/yr/ac)	Annual Load (lb/yr)	Annual Loading Rate (lb/yr/ac)	Annual Load (lb/yr)
Paved Parking	58	0.8%	0.07	4.0	41.3	2,399
Roofs	40	0.5%	0.05	2.1	11.7	474
Streets	300	4%	3.32	993.7	1,205.3	360,990
Small Landscaped Areas	4	0.1%	0.52	2.2	72.1	304
Large Landscaped Areas	93	1.2%	2.15	201.4	299.1	27,969
Undeveloped Areas	5,755	76%	0.20	1,125.7	5.1	29,240
Water Body Areas	1,347	18%	0	0	0	0
TOTAL	**7,598**	**100%**		**2,329.1**		**421,376**

A diversion ditch was constructed in 1937 diverting water from Duck Lake into Norwegian Bay, adding approximately 11,943 acres to the overall potential contributing watershed, which includes area from the Town of Lakeland, Town of Maple Plain, Town of Cumberland, and a small portion of the Town of Roosevelt. The land cover in the Duck Lake watershed is mostly northern hardwood forests and isolated wetlands, many of which are connected through constructed drainage ditches. The Beaver Dam Lake Improvement and Protection Project Report from 1992 by SEH estimated an annual water loading of 390 ac-ft for the Diversion Ditch (SEH, 1993). A map of the watershed area is shown in Figure 2.

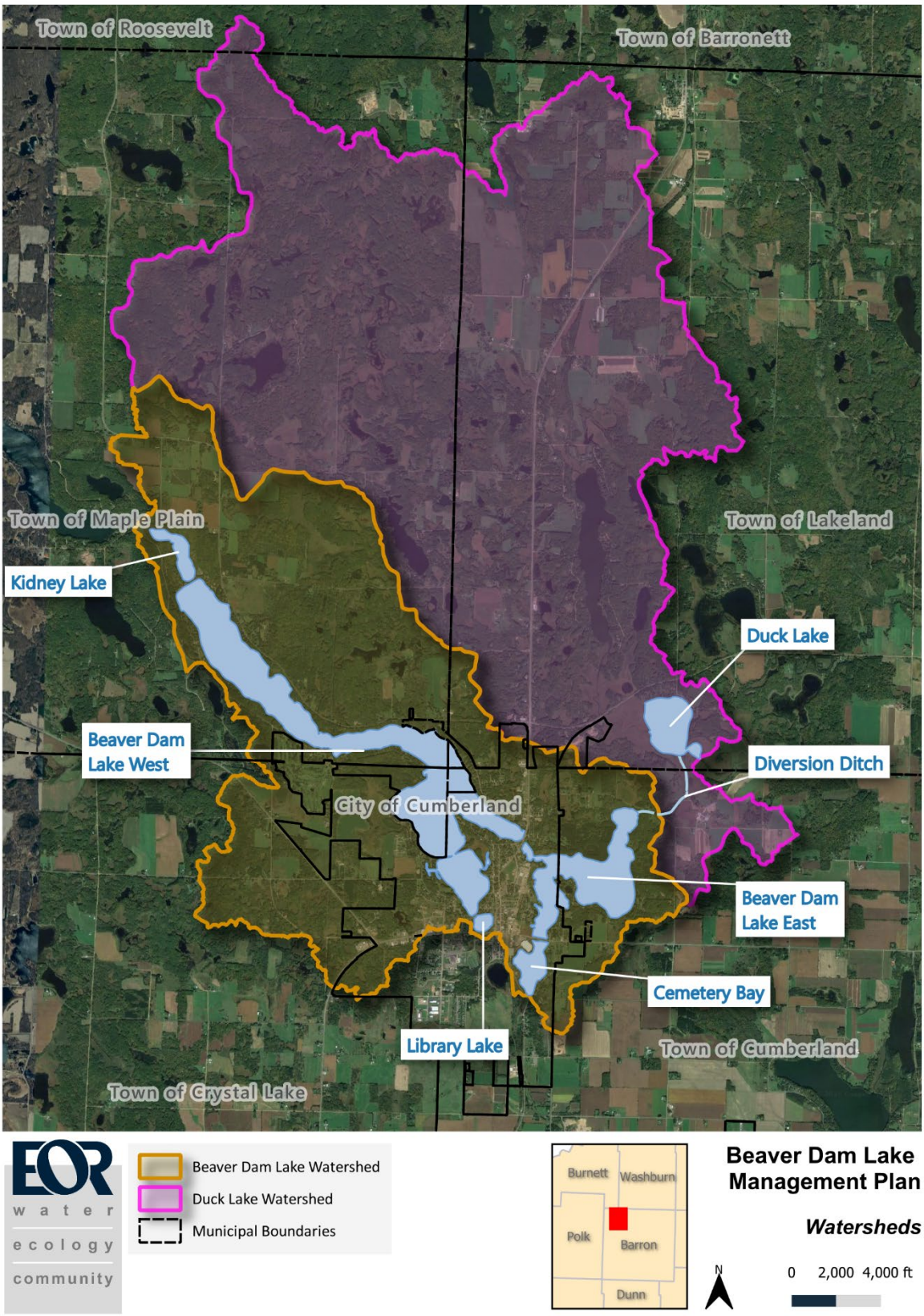


Figure 2. Beaver Dam Lake drainage areas and waterbodies (including Duck Lake drainage area)

The mapped information was used to estimate, through modeling software, the amount of pollutants that are carried in runoff to Beaver Dam Lake from the watershed. Estimation of pollutant loading for different areas of the watershed is useful for identifying pollutant loading hotspots to help prioritize potential water quality improvement project locations. Due to the uncertainty in modeling pollutant transfer from Duck Lake to Norwegian Bay (and by extension other areas within Beaver Dam Lake East), a greater emphasis was placed on modeling the pollutant loading from the direct watershed to a finer scale, while the pollutant loading to Duck Lake was estimated using a broader scale and more simplistic method. The annual total suspended solids and total phosphorous generation from the Beaver Dam Lake direct watershed was estimated using the Source Loading and Management Model for Windows (WinSLAMM) modelling software version 10.5.0. The annual total phosphorus generation from the Duck Lake watershed was estimated using the Wisconsin Lake Modeling Suite (WiLMS) modeling tool from WDNR (also used to obtain the watershed area).

The total pollutants generated annually by each land cover type in the subwatershed areas of Beaver Dam Lake are listed in Table 2, along with the annual loading per acre of land cover type. Table 2 shows that urban areas, despite being less than 7 percent of the Beaver Dam Lake watershed, contribute around 52 percent of the annual total phosphorus (TP) and 93 percent of the annual total suspended solids (TSS) generated in the Beaver Dam Lake watershed.

The pollutant loading contributed by the subwatershed areas discharging to the three sections of Beaver Dam Lake is summarized in Table 3 for current land use conditions and compared to Duck Lake. The pollutant loading estimates for Beaver Dam Lake include the effect of various BMPs in the subwatersheds, serving to reduce pollutants contributed by those subwatersheds. Average annual loading on a per-acre basis is summarized by subwatershed and grouped based on loading rates. The subwatersheds were divided into four tiers based on the loading rates to Beaver Dam Lake: Tier 1 Subwatersheds have the highest loading rates and Tier 4 Subwatersheds have the lowest loading rates. Subwatersheds have been labeled and numbered based on the major drainage area they are in. Figure 3 and Figure 4 illustrate the TP and TSS loading for each subwatershed under current land use conditions; Table 4 summarizes the resulting tiers.

The modeling shows Beaver Dam Lake East has the highest loading rates (lbs/yr/ac drainage area), followed by Cemetery Bay, then Beaver Dam Lake West. Higher loading rate corresponded to a higher proportion of urban areas within the subwatershed, combined with a lower number of BMPs or less effective BMPs in that subwatershed. The subwatersheds in the heart of the City of Cumberland discharged the most pollutants, due to the large percentage of developed areas within the subwatershed and few BMPs to reduce pollutants in the runoff before discharging to the lake. The subwatersheds surrounding Library Lake and the less developed watersheds in the west-central portion of the Beaver Dam Lake watershed discharged the least pollutants, due to many BMPs present that reduce pollutants in the runoff and a lower portion of impervious urban area, respectively.

While this method gives an estimate for the pollutant loading to Beaver Dam Lake from the watershed, further modeling/monitoring would be required to investigate loading from a greater range of sources, such as internal loading (the cycling of nutrients between the sediment and water column in a lake) or loading from upstream lakes like Duck Lake. It's likely the contribution from Duck Lake would only have the potential to impact Beaver Dam Lake East, but quantifying its impact, as well as the impact from internal loading in all three sections of the lake, would require a lake response model, necessitating further modeling and monitoring outside the scope of this report. The 1992 Beaver Dam Lake Improvement and Protection Project Report estimated the Diversion Ditch would contribute only 17 percent of the annual phosphorus loading to Beaver Dam Lake East, indicating its impact may be small relative to the direct watershed of Beaver Dam Lake (SEH, 1993).

Table 3. Particulate solids and pollutant loading to Beaver Dam Lake and comparison to Duck Lake

Water Body	Drainage Area (acres)	Total Phosphorus (TP)		Total Suspended Solids (TSS)	
		Annual Load (lbs/yr)	Annual Loading Rate (lbs/yr/ac drainage area)	Annual Load (lb/yr)	Annual Loading Rate (lbs/yr/ac drainage area)
Beaver Dam Lake East*	1,387	609	0.44	120,142	87
Cemetery Bay	189	56	0.29	13,181	70
Beaver Dam Lake West	6,021	1,633	0.27	277,641	46
Duck Lake**	11,943	1,846	0.15	-	-
TOTAL* **	**7,598**	**2,297**	**-**	**410,964**	**-**

** The Diversion Ditch from Duck Lake outlets to Beaver Dam Lake East (Norwegian Bay), but it was not included in this estimate.*
*** Duck Lake TP load and drainage area estimated from WiLMS (TSS not provided by WiLMS).*
**** Total for Beaver Dam Lake only (includes the three sections, excludes Duck Lake).*

Table 4. Particulate solids and pollutant loading to Beaver Dam Lake from subwatersheds and comparison to Duck Lake

Watershed Name	Drainage Area (Acres)	Total Phosphorus		Total Suspended Solids		Tier
		Annual Load (lb/yr)	Annual Loading Rate (lbs/yr/ac drainage area)	Annual Load (lb/yr)	Annual Loading Rate (lbs/yr/ac drainage area)	
2nd Avenue/Moser Field	40	198.2	4.95	34,633	865	1
Lake Street	5	8.1	1.64	2,640	535	1
Arcade Avenue	42	45.0	1.08	13,888	333	1
3rd Avenue	7	7.5	1.10	2,208	326	1
14th and Carlone	114	59.2	0.52	15,959	140	1
Cemetery Bay	189	55.7	0.29	13,181	70	2
Goldsmith	71	25.4	0.36	4,694	66	2
Golf Course	877	292.6	0.33	51,898	59	2
Beaver Dam Lake West	2,831	782.7	0.28	166,269	59	2
Beaver Dam Lake East	1,306	365.7	0.28	71,621	55	2
NW Library Lake	13	3.7	0.27	649	48	3
Cifaldi Lundquist	26	8.3	0.32	960	37	3
East Spirit Lake	43	9.2	0.21	1,473	34	3
Kidney Lake	209	46.9	0.22	5,773	28	3
Kwik Trip	4	0.5	0.12	82	20	3
Maple Plain Ravine*	470	108.8	0.23	8,673	18	3
Library Lake	23	3.5	0.15	384	17	4
Beaver Dam Lake NW	941	206.4	0.22	12,969	14	4
NE Library Lake	3	0.4	0.14	37	13	4
Beaver Dam Lake North	374	69.3	0.19	2,964	8	4
SE Library Lake	9	0.3	0.03	10	1	4
Duck Lake**	11,943	1846.0	0.16	-	-	4
TOTAL* **	**7,598**	**2,297.3**	**-**	**410,964**	**-**	**-**

** WinSLAMM bases loading rates on land cover alone and does not capture the effect of increased loading due to erosion of the ravine, so this number may be lower than reality*
*** Duck Lake tier based on annual TP loading rate (WiLMS does not give estimate for TSS loading).*
**** Total for Beaver Dam Lake only (includes drainage to the three sections and excludes Duck Lake).*

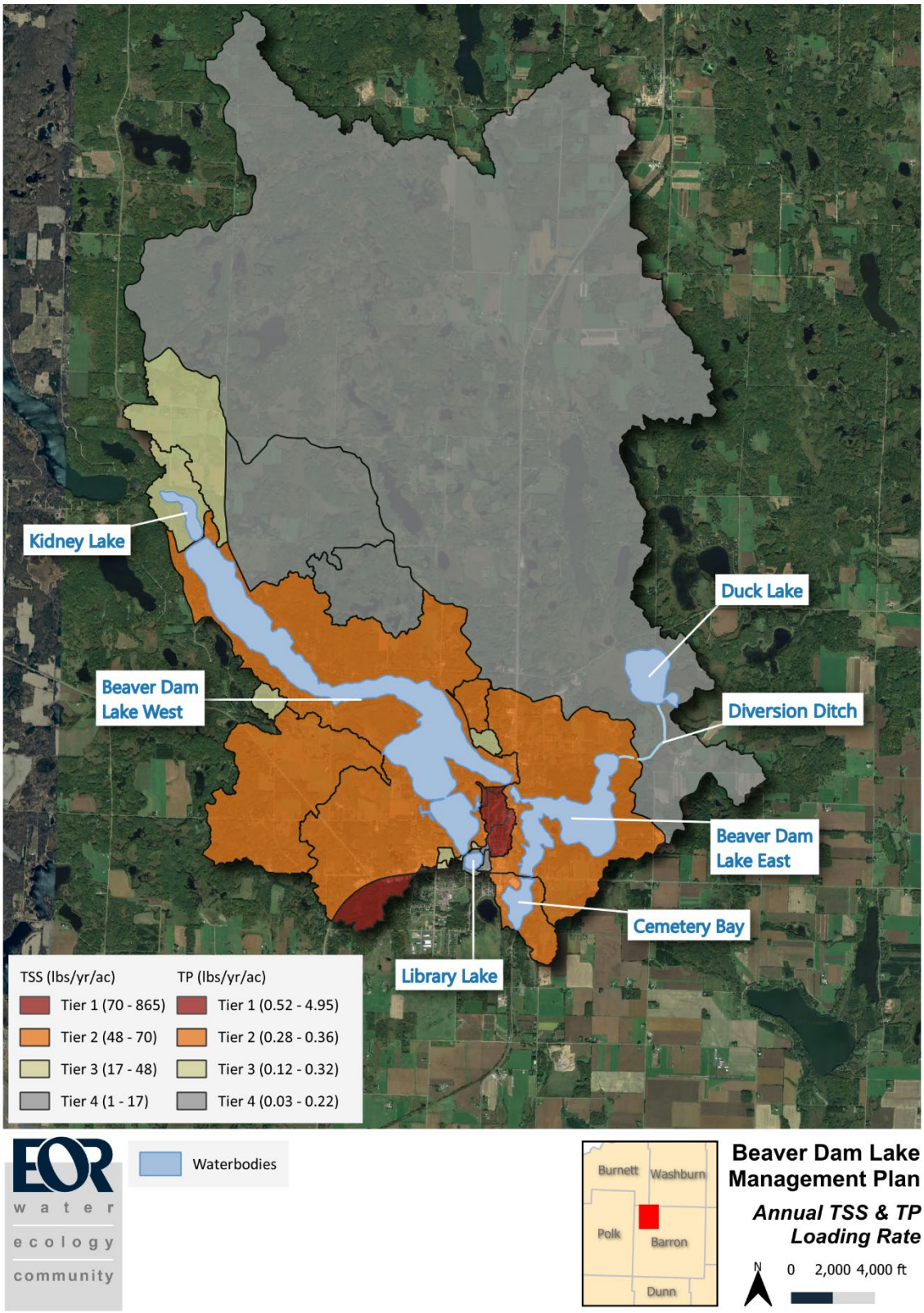


Figure 3. Average annual total phosphorous and suspended solids loading rates normalized by subwatershed area (existing land use)

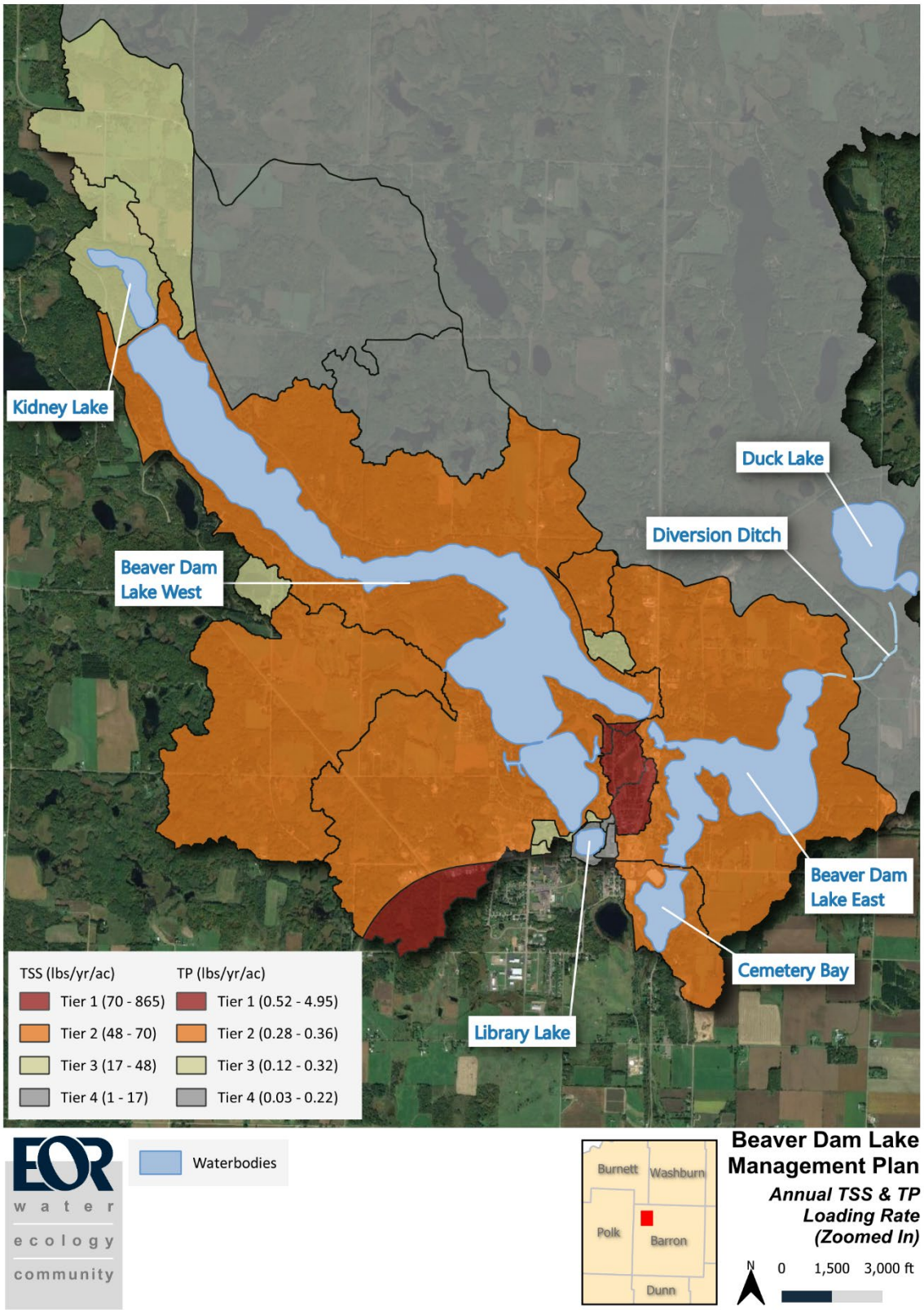


Figure 4. Average annual total phosphorous and suspended solids loading rates normalized by subwatershed area (existing land use) – zoomed in

2 WATER QUALITY PROBLEMS AND THREATS

2.1 Stormwater Runoff

Cumberland contains 20 storm sewer outfalls that feed directly into Beaver Dam Lake, including eight in Rabbit Island Bay, three in Beaver Dam Lake West, six in City Bay, one in Beaver Dam Lake East, and two in Cemetery Bay. There are no known point sources of pollution within Cumberland. Outside of the City of Cumberland, stormwater runoff flows based on the topography of the landscape with drainage ditches being the primary human intervention in the landscape. These were typically constructed to mitigate localized flooding impacting roads or other assets.

The Plan models annual TP and TSS leaving city subwatersheds and categorizes them into tiers based on the highest average annual TP and TSS loading rates. This is described in detail in **Section 1.5**. The higher tier subwatersheds are more urgent priorities for the implementation of stormwater BMPs including better site design practices, structural BMPs (such as stormwater ponds or green infrastructure), and programmatic BMPs (such as street sweeping or construction-site erosion control enforcement).

2.2 Wastewater Management

Wastewater in the City of Cumberland is managed through a sanitary sewer system that feeds to a wastewater treatment center located at 1165 Saint Anthony St adjacent to the Hay River. Treated wastewater is discharged from this location to the Hay River and does not enter Beaver Dam Lake.

Properties adjacent to Beaver Dam Lake and in surrounding upland areas are managed through septic systems and holding tanks. Depending on the age of these systems, they can pose a risk of septic leaks which can contribute excess nutrients to waterbodies, but these leaks are difficult to detect and septic tank locations are not typically well-documented. No evidence of septic leaks has been identified.

2.3 Sediment Accumulation and Dredging

Sediment samples have been collected at several sites throughout the lake. Samples collected in October 2009 from three sites near a storm sewer outfall delta on the northeast side of Rabbit Island Bay were tested for organic and inorganic compounds, and metals. Parameters tested are listed in Appendix II. None of the organic constituents at these sites resulted in data above the minimum detection limit. A few metals did appear in the sediment levels above the Threshold Effect Concentration (TEC) and, in some cases, above the Midpoint Environmental Concentration (MEC) or Probable Environmental Concentration (PEC).

Recent dredging efforts have focused predominantly on the adjoining Library Lake with dredging work undertaken in 2021, and 2025. Dredging of Wickre Harbor on the west side of Rabbit Island Bay is underway in 2025 to improve boating access by increasing the depth of the channel to six feet. WisDOT intends to dredge a portion of the lake underneath Highway 63 during its reconstruction, anticipated to take place in 2026. Following the completion of this project, consideration should be given to additional dredging to improve the channel between Beaver Dam Lake West and Beaver Dam Lake East. Other opportunities to improve boat access to shoreline residential properties should be carefully considered including the Wickre Channel on the west side of Rabbit Island Bay, properties on 3rd Street with lake access to the east side of Rabbit Island Bay, and properties on Bay Street and 7th Street with lake access to East Lake/City Bay.

What do these concentrations mean?

Concentration levels refer to likelihood of a toxic response give how much or how little a contaminant is present based on a sample. The *Threshold Effect Concentration (TEC) signifies that a toxic responses is not expected given the concentration level, while the Probable Environmental Concentration (PEC) signifies that a toxic response is expected if the concentration is exceeded. The Midpoint Environmental Concentration (MEC) reflects a midpoint between the TEC and PEC.*

Wickre Harbor (Source: EOR)

2.4 Shoreline Conditions Modification

Historical aerial photos indicate that the overall open water extent of Beaver Dam Lake has experienced relatively few major changes. These changes are concentrated around downtown Cumberland. In some smaller bays, changes to the lake's shoreline have reduced the open water extent in areas near Highway 48/Elm Street and Babcock Avenue (City Bay), and the channel connecting Beaver Dam Lake West and Beaver Dam Lake East. Figure 5 indicates the extent of shoreline modification and change in downtown Cumberland between 1939 and 2014.

Between 2012 and 2013 the District assessed shoreline properties to better understand the condition of the shoreline and encourage voluntary establishment of buffer areas surrounding the lake. At the time of this assessment 86% of the shoreline was characterized as natural, followed by 11% characterized by riprap. In upland areas surrounding the lake, 67% of this area was characterized as natural, followed by 25% characterized by lawn (Barr, 2024).

In recent years, there has been an increase in shoreland properties converting natural shoreland and shoreline through redevelopment. This includes the introduction of more hardscape and turfgrass which convey more runoff into the lake compared to diverse plant communities. These changes also include shoreline changes such as the armoring of the lake edge through riprap and retaining walls, and in some rare cases the creation of beaches, all of which reduce habitat for aquatic life. Maintaining and restoring shoreland buffers represents an important management practice to reduce nutrient and sediment loading to the lake through surface water runoff.

2.5 Invasive Species Management

The City of Cumberland conducts boat inspections throughout the summer through WDNR grant funding via the Clean Boats/Clean Waters program. Inspections occur Friday, Saturday, and Sunday between noon and 8 PM from Memorial Day through Labor Day. Boats are monitored entering and leaving the lake at two locations (Eagle Point and Tourist Park) and have historically also occurred in City Bay (though not since 2016). Boat inspections have successfully detected and intercepted invasive species such as zebra mussels from entering the lake (Barr Engineering, 2024).

Beaver Dam Lake District conducts regular management of invasive aquatic plant species, detailed in **3.3 Invasive Aquatic Plant Species.**

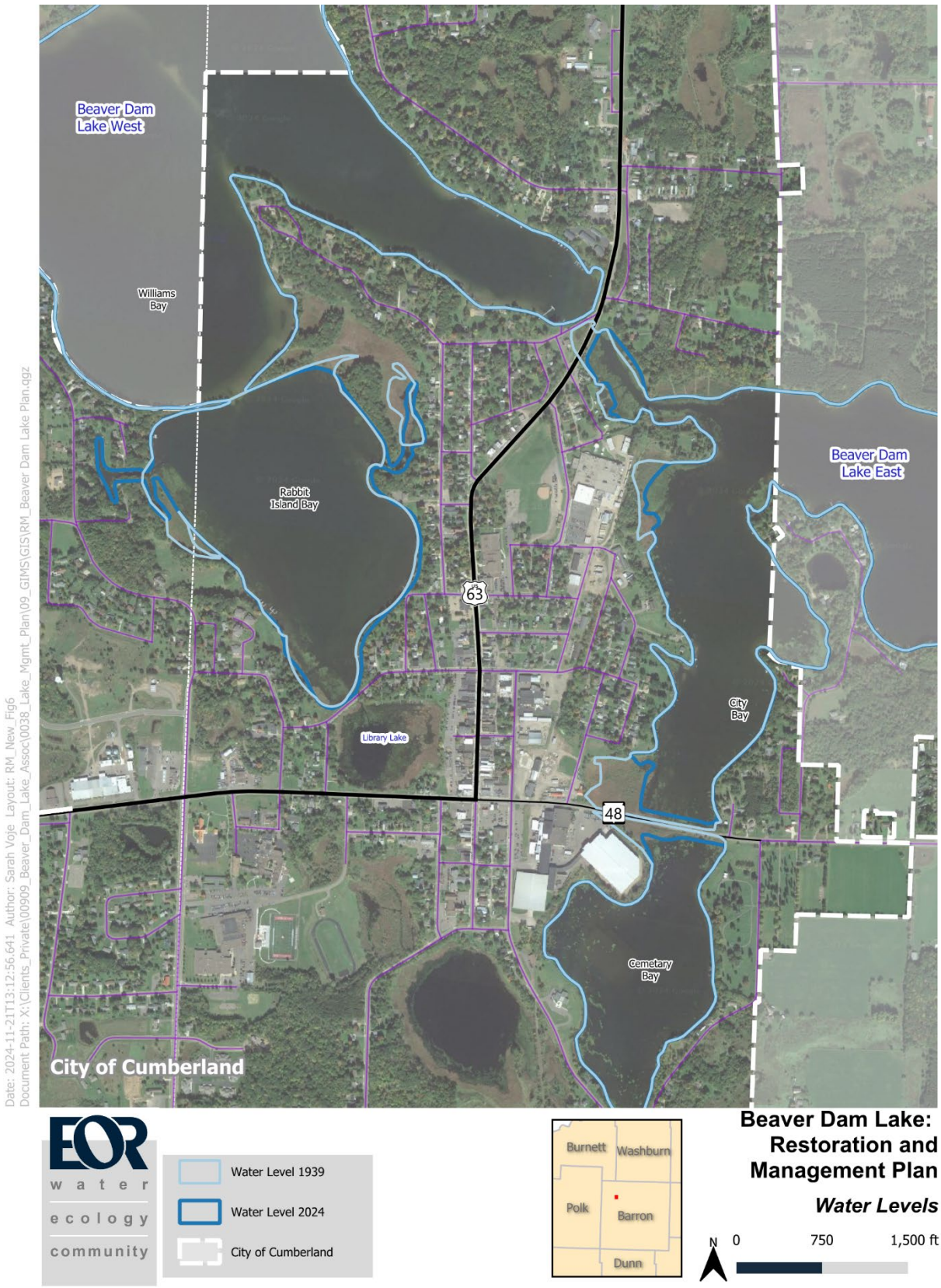


Figure 5. Changes in Beaver Dam Lake shoreline

3 AQUATIC HABITATS AND FISHERIES

3.1 Fisheries

Beaver Dam Lake has a long history of fish stocking and serves as a sport fishery for the area. It is listed on the State's Two-Story Fishery List signifying that it supports coldwater fish species. Its great depths but low fertility rates make the lake unlike other lakes nearby and contributes to a need for fish stocking to continue. The east basin of the lake supports a more robust fishery than the west basin of the lake. The east basin's physical characteristics and fish communities are similar to other lakes in the area. Walleye has been the focus of most stocking efforts since stocking began at Beaver Dam Lake in 1933. Although stocking continues, the population of walleye in the lake reached a record low as of the 2013 Fisheries Assessment with only 0.4 fish per acre (WDNR 2013). This is largely due to the lack of naturally occurring walleye replenishing the fishery population. An 830′ walleye spawning reef was constructed in 2001 in an effort to increase populations, but the effects of this strategy have not been studied.

Trout species have also been major contributors to the Beaver Dam Lake fishery. Rainbow and brown trout were first introduced in the 1970's-80's to combat the illegally stocked rainbow smelt population. Trout stocking only lasted a few years but was later brought back in 2006 when the rainbow smelt population continued to persist in the lake. Lake trout were also stocked at this time (495 individuals) but died due to extreme summer heat in 2007 and hypereutrophic waters in the lake (WDNR 2013). Since 2007, brown trout are the only trout species that continue to be stocked, with size and bag restrictions contributing to a more stable fish population. These trout come from the nearby St. Croix Falls State Fish Hatchery. As of 2013, there was no evidence of rainbow smelt in Beaver Dam Lake, although this is attributed more to the warm weather events of 2007 than the introduction of brown trout.

Other notable fish species in the lake include the largemouth bass, smallmouth bass, and the northern pike. Both species of bass have low density populations with good size structure. Largemouth bass tend to be more abundant and older than the smallmouth bass population in Beaver Dam Lake. Still, the lake serves as one of only a few in the area with a fishable small mouth population. The northern pike are the most abundant gamefish in Beaver Dam Lake, particularly in Beaver Dam Lake East where it is shallower with denser vegetation. However, this fish has a poor size structure and the harvest of small pike with a maximum length limit is encouraged to promote better structure.

All species found at the time of survey in 2013 included: walleye, largemouth bass, smallmouth bass, northern pike, brown trout, bluegill, black crappie, pumpkinseed, green sunfish, yellow perch, rock bass, common carp, white sucker, cisco, and bullheads (Cole, 2014).

Obtaining golden wall-eyed pike spawn from Beaver Dam Lake at Cumberland, 1932 (Source: Wisconsin Historical

3.2 Aquatic Plant Management

The BDLMD has commissioned an annual point intercept study of aquatic plants in Beaver Dam Lake since 2009. Each summer, Endangered Resource Services samples 1,339 points on Beaver Dam Lake to complete this survey. In 2023, 46 different plant species were found, and plants grew to a depth of 17.5 feet (Table 5). The Simpson's Diversity Index (SDI) value for Beaver Dam Lake was 0.94. This value indicates the probability that two individual plants randomly selected from Beaver Dam Lake will belong to different species (Barr Engineering, 2024).

The floristic quality index rating (FQI) for Beaver Dam Lake in 2023 was 46, and ranged from 45 in 2015, 2019, and 2021 to 49 in 2016. An FQI of 46 is more than double the median value for lakes in the same eco-region (Nichols, 1999). In all lake areas throughout Beaver Dam Lake, the FQI was higher in 2023 than the median value for lakes in the same eco-region.

The Floristic Quality Index (FQI) is an index developed by Dr. Stanley Nichols of the University of Wisconsin-Extension. This index is a measure of the plant community response to development and human influence on the lake. It considers the species of aquatic plants present and their tolerance for changing water quality and habitat characteristics. A plant's tolerance is expressed as a coefficient of conservatism (C). Native plants in Wisconsin are assigned a conservatism value between 0 and 10. A plant with a high conservatism value has more specialized habitat requirements and is less tolerant of disturbance and/or water quality changes. Those with lower values are more able to adapt to disturbed or changing conditions and can therefore be found in a wider range of habitats.

The FQI is calculated using the number of species present and these plants' conservatism values. A higher FQI generally indicates a healthier aquatic plant community.

3.3 Invasive Aquatic Plant Species

3.3.1 Eurasian Watermilfoil (EWM)

Barr Engineering has guided aquatic plant management (APM) for Beaver Dam Lake and Library Lake focusing specifically on controlling EWM since 2006. EWM poses perhaps the greatest threat to recreation and biodiversity in Beaver Dam Lake and Library Lake of any invasive species. EWM was accidentally introduced into Beaver Dam Lake in 1991. By 1999 it covered approximately 73% of the littoral area of the lake (based on a BDLMD survey). The APM Plan recommends annual treatment of AWM infested areas with 2,4-D, with treatments to occur generally twice during each growing season. The district utilizes an adaptive management approach, striving for continuous improvement. The implementation of this treatment approach has been very successful to date, reducing the extent of EWM by 98% - from 176 acres in the fall of 2008 (the highest recorded since 2006) to 3.9 acres in the fall of 2023.

The 2024 APM changed the EWM goal so that EWM is controlled so that it is <3% of the littoral area in all named parts of Beaver Dam Lake, and 0% of the littoral area of all navigation areas and heavy use areas including Tiger Bay, Brigadoon, the Narrows, the sand dam area between Williams and Rabbit Bay, the Grove Street bridge area, the Highway 63 and 48 channels to and from the bridges and boat landings. This compels the District to continue to manage EWM in order to maintain desired levels (Barr Engineering, 2024).

3.3.2 Curly-leaf Pondweed (CLP)

CLP has been documented in Beaver Dam Lake since 1999. CLP has been periodically managed by the BDLMD since 2007 (Barr Engineering, 2024). This management has historically occurred in Norwegian Bay and East Lake, however in 2023 no CPL was observed in July and October in East Lake or Cemetery Bay, nor was it observed in October in Norwegian Bay and Rabbit Island Bay. In Fall 2023, CLP was found in 0.5% of Beaver Dam Lake's littoral area below the District's goal of CLP presence in 7% or less of the littoral zone.

3.3.3 Purple Loosestrife

Purple loosestrife has been observed in the area since the mid-1990s, however its impacts are most prevalent in Library Lake where efforts to contain the infestation have seen success thanks to purple loosestrife-eating beetles. In 2023, the plant was observed in five locations throughout Beaver Dam Lake including three locations in Rabbit Island Bay (the bay nearest to Library Lake), one location in City Bay, and one location in East Lake. Given the limited spread of this invasive species beyond Library Lake today, the APM plan recommended removal of these plants to avoid further spread.

Table 5. Aquatic plant species present in Beaver Dam Lake (2023)*

Species	Common Name
Aquatic Moss	
Brasenia schreberi	Watershield
Carex comosa	Bottle brush sedge
Ceratophyllum demersum	Coontail
Chara sp.	Muskgrass
Decondon verticillatus	Swamp loosestrife
Dulichium arundinaceum	Three-way sedge
Eleocharis acicularis	Needle spikerush
Eleocharis erythropoda	Bald spikerush
Eleocharis palustris	Spike-rush
Elodea canadensis	Common waterweed
Heteranthera dubia	Water star-grass
Juncus pelocarpus f. submersus	Brown-fruited rush
Leersia oryzoides	Rice cutgrass
Lemna minor	Small duckweed
Lemna trisulca	Forked duckweed
Lythrum salicaria	Purple loosestrife
Myriophyllum spicatum	Eurasian watermilfoil
Myriophyllum tenellum	Slender watermilfoil
Myriophyllum verticillatum	Whorled milfoil
Najas flexilis	Slender naiad
Najas gracillima	Northern naiad
Nitella sp.	Nitella
Nuphar variegate	Spatterdock
Nymphaea odorata	White water lily
Phalaris arundinacea	Reed Canary Grass
Pontederia cordata	Pickerelweed
Potamogeton amplifolius	Large-leaf pondweed
Potamogeton crispus	Curly leaf pondweed
Potamogeton epihydrus	Ribbonleaf pondweed
Potamogeton foliosus	Leafy pondweed
Potamogeton friesii	Flat-stalked pondweed
Potamogeton gramineus	Variable pondweed
Potamogeton illinoensis	Shining pondweed
Potamogeton natans	Broad-leaved pondweed
Potamogeton praelongus	White-stem pondweed
Potamogeton pusillus	Small pondweed
Potamogeton richardsonii	Richardson's pondweed
Potamogeton robbinsii	Robbins (fern) pondweed
Potamogeton spirillus	Snail-ssed pondweed

Potamogeton vaseyi	Vasey's pondweed
Potamogeton zosteriformis	Flat-stem pondweed
Riccia fluitans	Slender riccia
Sagittaria cristata	Bulltongue arrowhead
Sagittaria latifolia	Common arrowhead
Sagittaria rigida	Sessile-fruited arrowhead
Schoenoplectus acutus	Hardstem bulrush
Schoenoplectus subterminalis	Water bulrush
Schoenoplectus tabernaemontani	Softstem bulrush
Sparganium androcladum	Floating weed
Spirodela polyrhiza	Large duckweed
Stuckenia pectinata	Fennel-leaved pondweed
Typha latifolia	Broad-leaved cattail
Typha X glauca	Hybrid cattail
Utricularia gibba	Creeping bladderwort
Utricularia minor	Small bladderwort
Utricularia purpurea	Purple blafferwort
Utricularia vulgaris	Common bladderwort
Valisneria americana	Wild celery
Woffia columbiana	Common watermeal

**Survey performed July 14-18TH, 2023 by Endangered Resource Services, LLC – includes species observed visually and by boat survey as well as point intercept survey.*

4 WETLANDS

Beaver Dam Lake is surrounded by both freshwater emergent and forested shrub wetlands, these wetland types represent 75% of total wetland areas in Wisconsin. There are also sections of riverine wetlands bordering Hay River, Johnson Creek, and several unnamed streams connecting small nearby lakes. Several ponds have been excavated on the northwestern corner of Cumberland for the Cumberland Golf Course however, there are no indictors of filled or dammed wetlands or ponds nearby. Overall, the wetland areas surrounding Beaver Dam Lake are characteristic of those within Wisconsin forested regions.

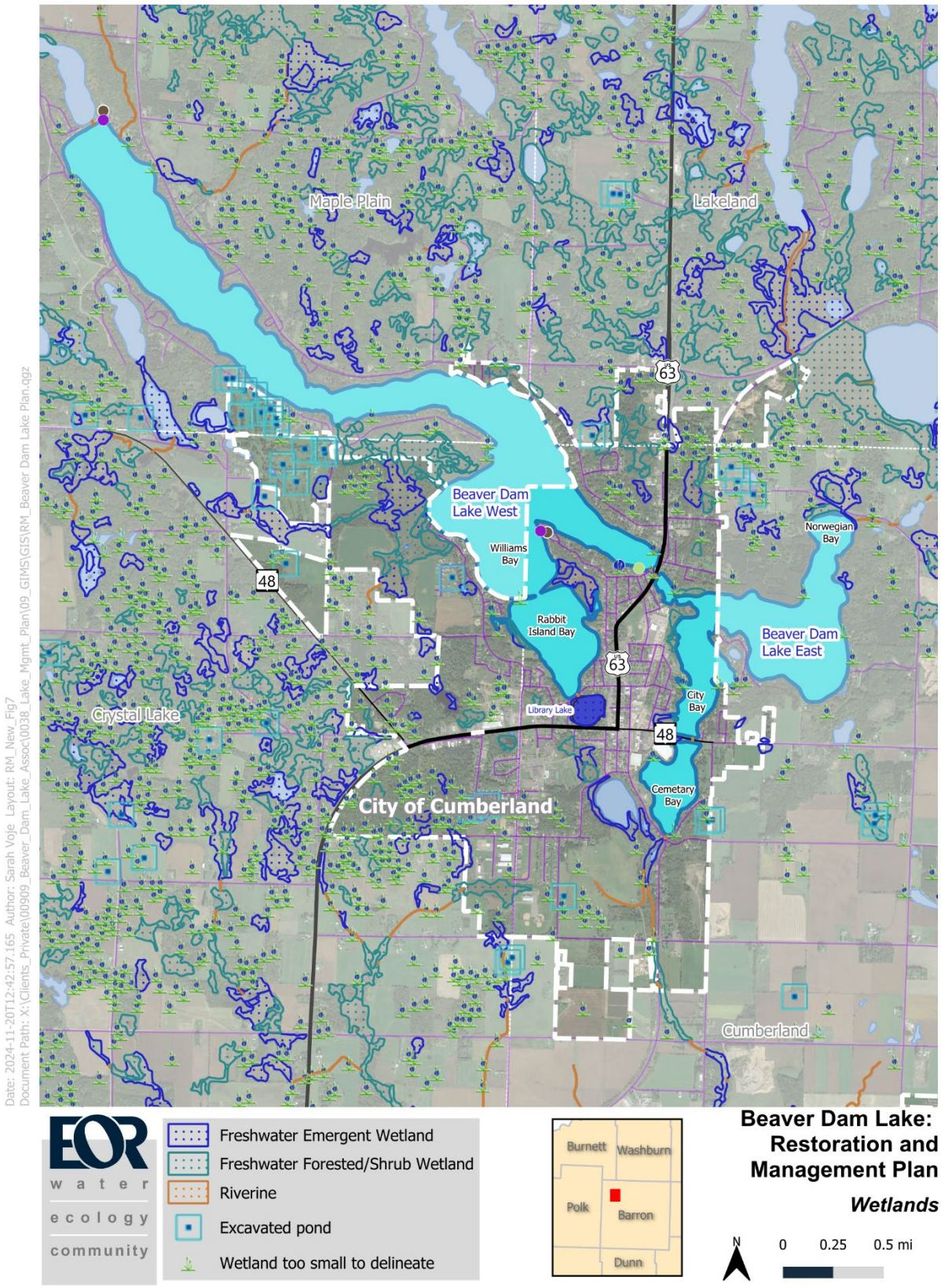


Figure 6 Beaver Dam Lake area wetlands

5 HABITAT ASSESSMENT

WDNR prepared a general overview of wildlife on Beaver Dam Lake in 2012. The overview was intended to provide a non-exhaustive review of wildlife species present in and around the lake. Numerous waterfowl are observed on the lake including mallards, wood ducks, Canada geese, and several other species of ducks that arrive during seasonal spring and fall migrations. Common loons, bald eagles, osprey, and great blue herons are also present. Beaver and muskrat are found on the lake, and river otters are present in other lakes in the area. A variety of amphibian and reptile species are also found including painted turtles, snapping turtles, spring peeper, wood frog, chorus frog, eastern gray tree frog, green frog, leopard frog, mink frog, and American toad, common garter snake, smooth green snake, western fox snake, and red-bellied snake.

Generally, areas of emergent vegetation provided the most suitable locations for observing these species given the presence of food and cover. Development of the lake's shoreline has left few sections of undeveloped shoreline and upland areas limiting the availability of habitat for many of these species. The WDNR's findings suggested that greater effort should be placed in allowing herbaceous and woody vegetation to develop along the shoreline to provide more effective habitat for these species.

Several State and Federal threatened and endangered species may be found near Beaver Dam Lake and are listed in Table 6.

Table 6. Threatened and Endangered species in the area of Beaver Dam Lake

Species	Group	State Status	Federal Status
Vasey's pondweed (Potamogeton vaseyi)	Plant	Species of Special Concern	
Purple bladderwort (Utricularia purpurea)	Plant	Species of Special Concern	
Northern Long-eared Bat (Myotis septentrionalis)	Mammal	Threatened	Endangered
Salamander Mussel (Simpsonaias ambigua)	Clam	Threatened	Proposed Endangered
Karner Blue Butterfly (Lycaeides melissa samuelis)	Insect	None	Endangered
Monarch Butterfly (Danaus Plexippus)	Insect	Insufficient Data	Candidate

6 HUMAN USE AND AESTHETICS

Recreational opportunities and aesthetic enjoyment are additional ecosystem services provided by Beaver Dam Lake. These contribute directly to human health and well-being and are critical factors to measure, promote, and protect for the community of Cumberland.

6.1 Recreation

Beaver Dam Lake's recreational uses are an important part of the community's identity and sense of place. The lake offers numerous recreation opportunities including six boat landings to access the lake, two swimming beaches, one fishing pier, one campground at Eagle Point, and Tourist Park

Currently motorized boats and other watercraft larger than a canoe or kayak are unable to travel between Beaver Dam Lake West and Beaver Dam Lake East of the lake due to lack of a navigable channel under Highway 63. Replacement of the box culvert at Highway 63 separating the west and east basins will enable recreational boat traffic between these two areas of the lake.

Opportunities exist to provide connections throughout the City of Cumberland linking waterfront resources and recreation areas through the development of a trail system as part of a Parks and Open Space Plan. Improvements at lakeside parks and boat launches include facilities and amenities to foster community gathering and recreation.

6.2 Aesthetics

Passive enjoyment of the lake factored highly among respondents in a 2011 survey of residents. Among the respondents, the lake's aesthetic qualities including the view that it offers and the opportunity to observe waterfowl and wildlife were among the top five lake uses.

View of Beaver Dam Lake from Eagle Point, July 2022 (Source: Jeff and Renee Ranallo)

7 REGULATORY AND PLANNING FRAMEWORK

Beaver Dam Lake's drainage area is shared by the City of Cumberland, the Town of Maple Plain, the Town of Cumberland, and a small portion of the Town of Crystal Lake. An overview of city and town plans and ordinances follows. It should be noted that the Town of Cumberland and the Town of Crystal Lake do not have any registered ordinances.

7.1 State of Wisconsin Regulations

State of Wisconsin regulations, which apply within the BDLMD, also provide lake and river protection.

7.1.1 Chapter 30, Wisconsin Statutes – Navigable Water[1]

DNR provides oversight for this important program. Chapter 30 permits are required for a myriad of activities on navigable water bodies. These activities include (among others) dredging, shoreline stabilization, grading, intake/outfall structures, stream crossings, boat ramps, and buoys.

7.1.2 Dredging Regulations (Sec 30.20 Wis. Stats.)[2]

A general permit or an individual permit is required to dredge material from the bed of a navigable waterway. An individual permit is required for in-lake dredging. This permit requires submitting the proposed dredge area and shoreline cross sections, where spoils will be deposited, and floodplain and wetland boundaries. The cross sections must include the normal water level and a profile of the existing bottom and proposed dredged bottom. Sediment testing for hazardous materials may be required. Permit review may take three months or longer. Local zoning permits and U.S. Army Corps of Engineers permits may also be required.

7.1.3 NR 216, WI Admin. Code

The NPDES program is designed to require stormwater management plans and erosion control plans for sites larger than one acre as required under the Environmental Protection Agency's Clean Water Act. The intent is to keep water leaving construction sites clean through filters, sediment basins, and diversions and to plan for long term stormwater management. DNR stormwater specialists work with local land conservation and zoning departments to implement this program. Under subchapter III of NR 216, Wis. Admin. Code, a notice of intent shall be filed with the DNR by any landowner who disturbs one or more acres of land. This disturbance can create a point source discharge of storm water from the construction site to waters of the state.

7.1.4 Phosphorus Use

Wisconsin law prohibits application of fertilizer with phosphorus to turf beginning April 2010. Phosphorus can be used on first-year lawns and phosphorus-poor soils. Retailers will be barred from displaying fertilizer with phosphorus. Phosphorus runoff contributes to algae growth in state waters.

7.1.5 Aquatic Plant Management (NR107 and NR109)

The DNR regulates the removal of aquatic plants when chemicals are used, when plants are removed mechanically, and when plants are removed manually from an area greater than thirty feet in width along the shore. The requirements for chemical plant removal are described in ***Administrative Rule NR 107 – Aquatic Plant***

[1] More information about water regulations requirements is found online at http://www.dnr.state.wi.us/waterways.
[2] Information from http://dnr.wi.gov.org/water/fhp/waterway/dredging.

Management. A permit is required for any aquatic chemical application in Wisconsin. Additional requirements exist when a lake is considered an ASNRI.[3]

The requirements for manual and mechanical plant removal are described in ***NR 109 – Aquatic Plants: Introduction, Manual Removal & Mechanical Control Regulations***. A permit is required for manual and mechanical removal except for when a riparian (waterfront) landowner manually removes or gives permission to someone to manually remove plants (with the exception of wild rice), from their shoreline up to a 30-foot corridor. A riparian landowner may also manually remove the invasive plants EWM, CLP, and purple loosestrife along his or her shoreline without a permit. Manual removal refers to the control of aquatic plants by hand or hand–held devices without the use or aid of external or auxiliary power.

7.2 Barron County

7.2.1 Barron County Ordinances Governing Land Use and Development

Outside of the City of Cumberland, Barron County's Zoning Ordinance governs the development and use of land. The following land use districts are either immediately adjacent to the lake or within the lake's drainage area:

- C-1 Wetland Conservancy District
- R-1 Residential Low Density District
- RR Recreational-Residential District
- A-1 Exclusive Agricultural District
- AG-2 Agricultural District

7.2.1.1 17.41 Shoreland Protection Overlay Area

The Shoreland Overlay District applies to unincorporated land that is within 1,000 feet of the ordinary high-water mark of a lake, pond, or flowage. This district will also apply to streams, rivers, and the landward side of the floodplain. The ordinance specifies dimensional standards including setback requirements, shoreland vegetation buffer requirements, impervious surface standards, and regulation pertaining to filling, grading, lagooning, dredging, ditching, and excavating. Mitigation options are outlined for development activity within the overlay area. Beaver Dam Lake is subject to this ordinance where it lies outside of the municipal boundary of the City of Cumberland.

7.2.2 Barron County Land & Water Resource Management Plan 2020-2029

The County's Land & Water Resource Management Plan (LWRMP) provides a 10-year workplan for the department directing land and water resource conservation and improvement projects. The plan identifies priorities for the Upper Hay River watershed including the reduction of non-point pollutants and the reduction of soil erosion.

Land surrounding Beaver Dam Lake is predominantly Forest, with Urban/Developed land in the City of Cumberland, and other land covers such as agriculture, grassland, wetland, and shrubland mixed sporadically. The LWRMP notes that woodlands play an important role in mitigating runoff. Threats to woodland areas include fragmentation of these areas by development, grazing by animals in woodlots reducing regeneration, and invasive species spread which can negatively impact stormwater management functions.

[3] Data from Wisconsin DNR Surface Water Data Viewer: http://dnrmaps.wisconsin.gov.

The LWRMP includes objectives that this Lake Management Plan should seek to align itself including:

Goal: Protect and Improve Water Quality

- Reduce sedimentation of wetlands, streams, rivers and lakes by soil erosion
- Reduce phosphorus runoff from urban areas and lakeshores

Goal: Preserve and Restore Lakeshore Habitat

- Protect and improve lakeshore sites

Goal: Protect and Enhance Local Resources

- Control invasive species infestations

Goal: Maintain or Increase Forested Areas

- Educate residents on the importance of forestry habitat

7.3 City of Cumberland Plans and Ordinances

7.3.1 City of Cumberland Comprehensive Plan (2017-2037)

The City of Cumberland completed a 20-year comprehensive plan in 2017, with planning assistance from West Central Wisconsin Regional Planning Commission. Several areas of the plan cover areas of focus related to this lake's Management Plan. Goals related to Transportation; Utilities and Community Facilities; Agricultural, Natural, and Cultural Resources; and Economic Development contain related goals associated with land use impacts associated with surface water management into Beaver Dam Lake. City of Cumberland Ordinance No. 618

7.3.2 City of Cumberland Stormwater Plan

The City of Cumberland approved an update to the City's Stormwater Management Plan in 2023. The Plan guides the City's actions for the protection and improvement of its surface water resources including, Beaver Dam Lake, Library Lake, Collingwood Lake, and the Hay River.

The Plan models annual total phosphorus (TP) and total suspended solids (TSS) leaving city subwatersheds and categorizes them into tiers based on the highest average annual TP and TSS loading rates.

7.3.3 City of Cumberland Ordinances

7.3.3.1 Chapter 9. Orderly Conduct

New regulations relating to water traffic, boating, and water sports in Section 9.26 focus on establishing "slow-no-wake" areas, defined by buoys, at two specific locations on Beaver Dam Lake:

a) The area south of a line commencing at a north-south line from Second Avenue in a northeasterly direction terminating north of Nedvidek Street.
b) The channel between Eagle Point Park in Section 6, T35N, R13W, and the point of land lying directly west in Section 1, T35N, R14W, and the bay of such lake lying southwest thereof.

7.3.3.2 Chapter 14. Building Code

Adopts Chapters COMM 20-25 (Wisconsin Uniform Dwelling Code). This code includes construction site erosion control requirements for 1 and 2 family dwellings. The city building inspector enforces the Uniform Dwelling Code.

7.3.3.3 Chapter 17. Zoning Code

The zoning code establishes zoning districts and specifies allowable uses, lot dimensions, and building specifications within each district. The official zoning map is kept at the office of the City Clerk. Among the purposes of the ordinance is to "Protect and conserve the natural resources of the City including agricultural, forests, wetlands and surface and groundwater by conserving most appropriate use of land."

Special Regulations for Conservancy Areas are detailed in Chapter 17.32. The purpose to preserve and perpetuate in an open state certain areas, such as, but not limited to, lakes and waterways, wetlands and marshes, floodplains and streambeds, woodlands, grasslands and prairies, and other areas of aesthetic value which, because of their unique physical features, are deemed desirable and functional as natural drainageways and water retention areas, natural habitat for plant and animal life, green belts and other multiple purpose uses beneficial to the community.

Special regulations for Shoreland Areas are detailed in Chapter 17.36. Shoreland areas include land within 1,000 feet of lakes, ponds, or flowages and within 300 feet of navigable rivers or streams. These areas have special requirements for lot sizes depending upon whether or not they are served by a public or private sewer system. Setback requirements are established for septic tanks, buildings and other structures, and boat houses. There are limits on the amount of shore cover (trees and shrubbery) that can be removed near the water. Filling and grading requires a conditional use permit. Permits may require erosion control and stormwater management conditions such as minimizing disturbance, establishing temporary groundcover, and creating diversions and siltation basins to capture sediment.

The land use map (Figure 7) highlights the predominantly residential and parkland land uses surrounding Beaver Dam Lake in Cumberland, with some commercial, manufacturing, and utilities located in Beaver Dam Lake East. Outside of Cumberland, land uses surrounding the lake include various low-density residential, recreational, agricultural, and wetland conservation zoning classifications.

7.3.3.4 Chapter 18. Subdivisions

The subdivision chapter regulates the division of land. While stormwater drainage facilities are covered in Section (18.08(7)), the focus is on the ability of facilities to safely accommodate the maximum potential volume of flow - not to reduce or treat stormwater pollutants.

7.3.3.5 Chapter 19. Shoreland-Wetland Zoning

Shoreland-wetland zoning applies within shoreland areas as defined above. Within wetland areas in this zone, there are limits on building and limited uses and special protections for wetlands. Conditional use permits may require erosion control and landscaping and planting screens among other conditions.

7.4 Town of Maple Plain Ordinances

7.4.1 No. 2021-01 Slow No Wake Area

Establishes a Slow-no-wake zone offshore of the municipal beach at Tourist Park.

7.4.2 No.2020-02 UDC Building Ordinance

Adopts Chapters COMM 20-25 (Wisconsin Uniform Dwelling Code). This code includes construction site erosion control requirements for 1 and 2 family dwellings. The city building inspector enforces the Uniform Dwelling Code.

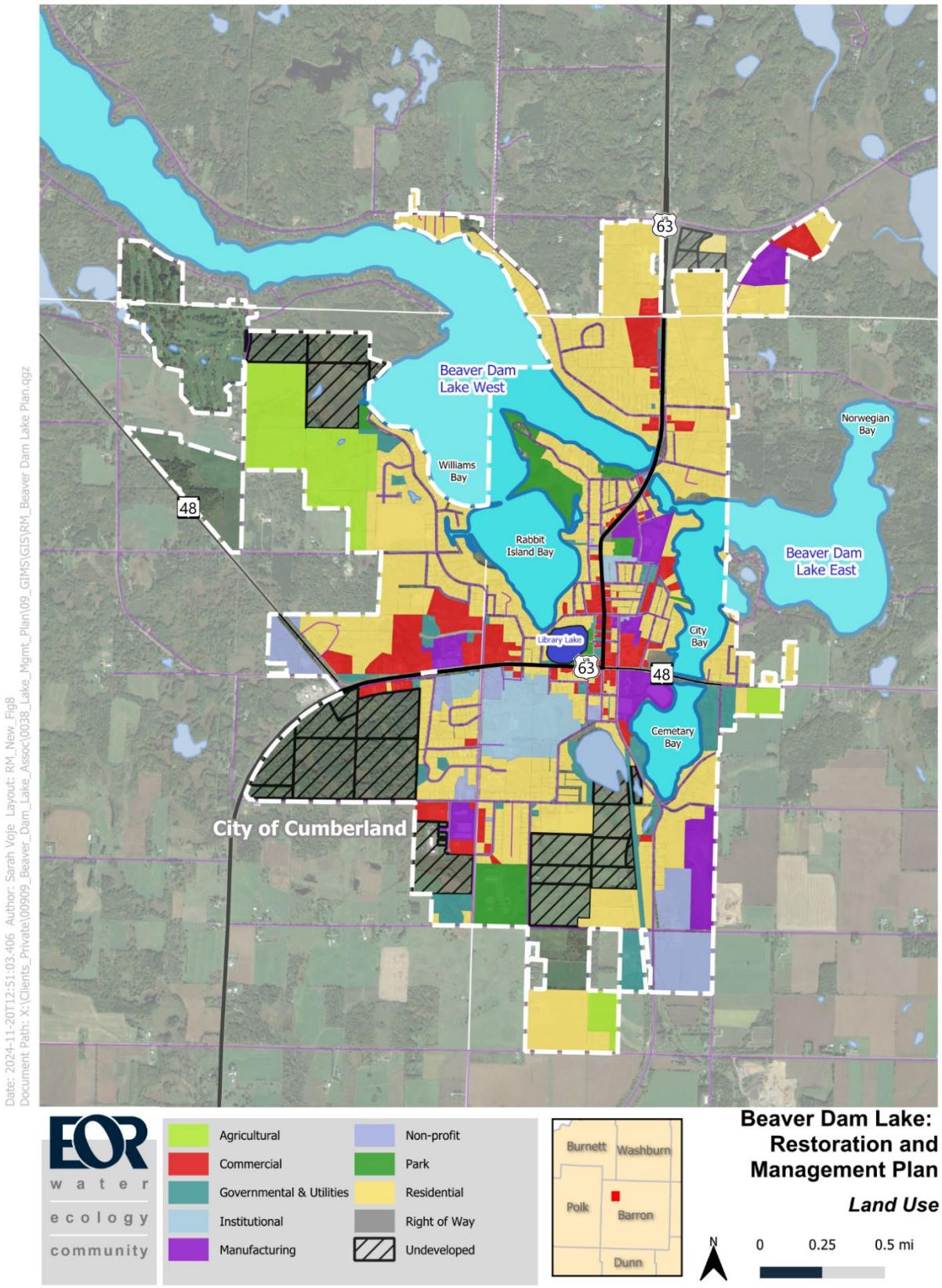


Figure 7. City of Cumberland land use map

Ordinance Gap Analysis

Cumberland's Stormwater Management Plan (2023) conducted an Ordinance Gap Analysis (Chapter 8) identifying potential revisions to various City ordinances to align these with the goals and objectives of the City's Comprehensive Plan. These potential revisions were identified with the goal to improve stormwater management and water quality. The gap analysis identified the following opportunities to close gaps in the City's ordinance:

- Requirements for new and infill developments to follow stormwater management requirements for TSS, peak discharge, infiltration, and protective areas.
- Clarify the meaning of terms such as "Hard Surfacing"
- Altering requirements for parking materials to encourage permeable materials.
- Diverting water from the municipal system through grading towards landscaping and downspout disconnection.
- Education and enforcement of the Well Head Protection Program
- Increasing the tax levy to fund stormwater management
- Adding provisions to the Shoreland-Wetland Zoning District such as a ban on the use of pesticides and fertilizers
- Creation of an Illicit Discharge Program Ordinance.
- Creating a maximum lot clearance area requirement for lakeshore areas.

Coordination between the City of Cumberland and Barron County to align their ordinances carries the potential to ensure a consistent and clear set of development requirements across the lake.

As the City of Cumberland works towards improving ordinance provisions related to stormwater management, aligning the City's changes with Barron County's zoning ordinance will be an important step to ensure a consistent and clear set of development requirements applied across the lake.

8 IDENTIFIED RESOURCE AND HUMAN USE CONCERNS

The following are water resource concerns for Beaver Dam Lake:

- Untreated sediment loading from unmitigated stormwater outfalls in Downtown Cumberland.
- Loss of natural shoreland area providing stormwater management, habitat, and aesthetic benefits.
- Presence of invasive aquatic plant species: EWM, CLP, and purple loosestrife.
- Risk of invasive aquatic species being introduced into the lake.

The following is a list of human use concerns in the area surrounding Beaver Dam Lake:

- Accumulation of sediment and aquatic plant life negatively impacts boating and recreational use.
- Sedimentation reduces lake navigability between different sections of the lake.
- Sedimentation reduces water clarity and quality reducing enjoyment of views and recreational use of the lake.
- Lack of trail connections between recreational areas around the lake.

The following is a list of administrative concerns associated with implementation:

- Insufficient staff resources to provide development oversight to ensure compliance with regulations and ordinances impacting the lake.

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9 GOALS AND IMPLEMENTATION

9.1 Lake Health

Efforts to maintain and improve Beaver Dam Lake's overall health will rely on the identification and implementation of projects that target sediment, nutrient, and thermal loading from surface water runoff. Programmatic changes and new projects involving community members throughout the lake will help realize lake health improvements already being seen in recent efforts undertaken in nearby Library Lake. These programs and projects include both upland, riparian, and shoreland areas.

Goal 1: Reduce stormwater runoff volume and treat runoff pollutants to meet or maintain at minimum mesotrophic status in all areas of the lake.

- Continue lake monitoring program and expand monitoring locations to fill gaps, primarily in the East Lake section.
- Prioritize projects addressing TSS and nutrient loading from Tier 1 and 2 areas of the lake.
- Develop projects with lakeshore landowners focused on wetland, prairie, and woodland renaturalization. Potential sites to explore include the Cumberland Golf Course and Camp Brigadoon.
- Outreach to and identification of opportunities to implement farming best management practices to improve water quality and reduce water quantity runoff from farmland.
- Identify opportunities for complementary uses on farmlands with potential water benefits, such as solar panels, agrivoltaics, and field conversion.

Goal 2: Preserve, restore, and improve native aquatic and shoreland habitats

- Develop and administer a new shoreland review program in the City of Cumberland.
- Coordinate shoreline management guidelines, regulation, and enforcement between the five local government units in the Beaver Dam Lake watershed, and Barron County
- Implement a lake-wide public education and engagement campaign highlighting benefits of naturalized shoreland and resources available to manage shoreland areas.
- Restore native shoreline on public property such as Eagle Point and Cumberland Tourist Park & Beach.
- Develop and implement a cost-share program for private properties to implement shoreline naturalization.

9.2 Invasive Species

Efforts to manage invasive aquatic plant species in Beaver Dam Lake have yielded an effective management program that has halted the spread and continues to reduce the extent of key aquatic plant species of concern. Ongoing management of these species will help maintain native plant communities on the lake and their functions, and an open water extent that supports recreational activity. Ongoing work to monitor and mitigate the potential introduction of invasive species, primarily through boats launching into the lake, remains an important priority to control the spread of invasive species such as zebra mussels.

Goal 3: Protect Beaver Dam Lake from the spread of invasive species

- Continue EWM, CPL, and Purple Loosestrife treatments.
- Continue boat launch inspections.
- Add inspection stations with boat cleaning facilities to boat launch sites around the lake.

9.3 Human Use, Aesthetics, and Recreation

Beaver Dam Lake occupies an important part of the identity of the City of Cumberland and supports a wide variety of recreational uses. These uses depend upon the efforts to maintain and improve the lake's health. Recreation

projects present the opportunity to realize co-benefits through the redevelopment and upgrading of public land along the lakeshore.

Goal 4: Improve navigation and access between the west and east sections of Beaver Dam Lake

- Manage aquatic vegetation in the channel between Beaver Dam Lake West and Beaver Dam Lake East.
- Investigate channel obstructions in anticipation of projects that will improve access between the west and east sections of the lake.

Goal 5: Implement projects that encourage people to access and spend time on or near Beaver Dam Lake

- Develop a lakefront/lake-access trail system.
- Undertake projects that provide amenities that encourage people to spend time on the waterfront.
- Upgrade aging facilities in lakeside parks.
- Connect public access points
- Establish trailheads for non-motorized watercraft such as kayaks.

9.4 Financing Improvements

The City of Cumberland and the Beaver Dam Lake Management District have a long history of funding lake improvement projects through public grants and loans as well as sponsorships and funds raised from private citizens. Continued efforts to fund projects that deliver benefits to residents and businesses in Cumberland and Barron County presents the opportunity to further develop amenities utilized by locals and visitors alike.

Goal 6: Collaborate with residents and businesses across the Lake Management District to identify and fund community projects.

- Continue to pursue state and federal grants to finance projects to improve lake health and recreational opportunities.
- Develop a fundraising plan to complement grant funding.
- Keep the community informed of planning improvements and impending projects through news releases, social media posts, and public meetings.

10 IMPLEMENTATION PLAN AND SCHEDULE

The following projects listed in Table 7. Implementation Plan and Schedule represent implementation actions to achieve the goals outlined in Section 9 Goals and Implementation.

Table 7. Implementation Plan and Schedule

Projects	Target Implementation Year	Goal Alignment	Partners	Comments
Aquatic Plant Management	**2025+**	**2, 3, 4**	• **Lake residents**	Continues existing management of aquatic plants in Beaver Dam Lake associated with AIS management, recreation management, and shoreline vegetation protection/restoration.
Beaver Dam Lake East Water Quality Monitoring	**2026+**	**1, 6**	• **Beaver Dam Lake East Residents**	Develop management projects based on annual water quality monitoring in East Lake, Norwegian Bay, City Bay, and Cemetery Bay.
Norwegian Bay Diversion Ditch Reassessment	**2026-2027**	**1, 6**	• **Beaver Dam Lake East Residents** • **DNR**	Revisiting the Diversion Ditch Loading Study (1990) and non-point source monitoring into East Lake, Norwegian Bay. City Bay, and Cemetery Bay to identify mitigation project opportunities.
Maple Plain Ravine Stabilization	**2026**	**1**	• **Camp Brigadoon**	Upstream stabilization projects aimed at erosion prevention and sediment control, and nutrient runoff projects. Including but not limited to farmland conversion to wetland and/or native vegetation with potential for solar development.
Highway 63 Channel Assessment	**2026**	**4**	• **City of Cumberland** • **WisDOT**	Work with WisDOT to assess opportunities for improved navigation between the west and east lake sections as they implement their bridge replacement project.
Outfall Mitigation and Sediment Dredging – Wickre Harbor Channel (West Leg)	**2026**	**2**	• **City of Cumberland**	Shoreline naturalization and dredging in the Wickre Harbor Channel

Projects	Target Implementation Year	Goal Alignment	Partners	Comments
Improving Policy and Programs	**2026+**	**2**	• **City of Cumberland** • **Town of Maple Plain** • **Town of Crystal Lake** • **Town Lakeland** • **Cumberland Twp** • **Barron County**	Collaborate between local government units and Barron County to ensure consistent guidelines and regulation, and enforcement of policies impacting lake health, such as shoreline management.
Outfall Mitigation – Tourist Park	**2027**	**1, 2, 5, 6**	• **City of Cumberland**	Installation of stormwater BMPs including naturalized landscapes and sump catch basins through refurbishment of parklands.
Beaver Dam Lake East Improvement Projects	**2028+**	**1, 6**	• **Beaver Dam Lake East Residents**	Implementation of management projects based on the Diversion Ditch Reassessment including but not limited to shoreline and shoreland restoration, and septic system management. Implementation of lake health BMPs associated with new development. Implementation of other projects tailored to public enjoyment of the lake including but not limited to strategic aquatic plant harvesting for navigable channels.
Outfall Mitigation – Jeffery Boulevard	**2028**	**1**	• **City of Cumberland**	Installation of sump catch basins through transportation projects.
Runoff Mitigation – Cumberland Golf Course	**2029**	**1**	• **Cumberland Golf Course** • **Barron County** • **USDA**	Installation of stormwater BMPs including naturalized landscapes, wetland restoration, and sump catch basins.

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APPENDIX I: DETAILED WATER QUALITY DATA

The following charts prepared by Barr Engineering in the *2024 Aquatic Management Plan* detail historic water quality data for several measurement stations across Beaver Dam Lake.

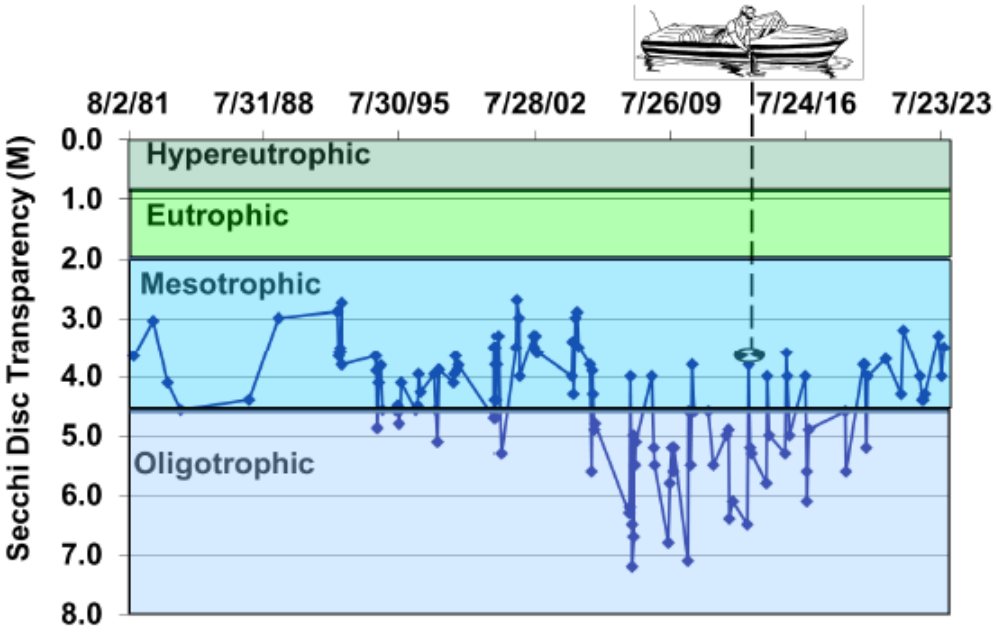

Figure 8. 1975-2021 Beaver Dam Lake Secchi Disk Transparencies: West Lake (West End)

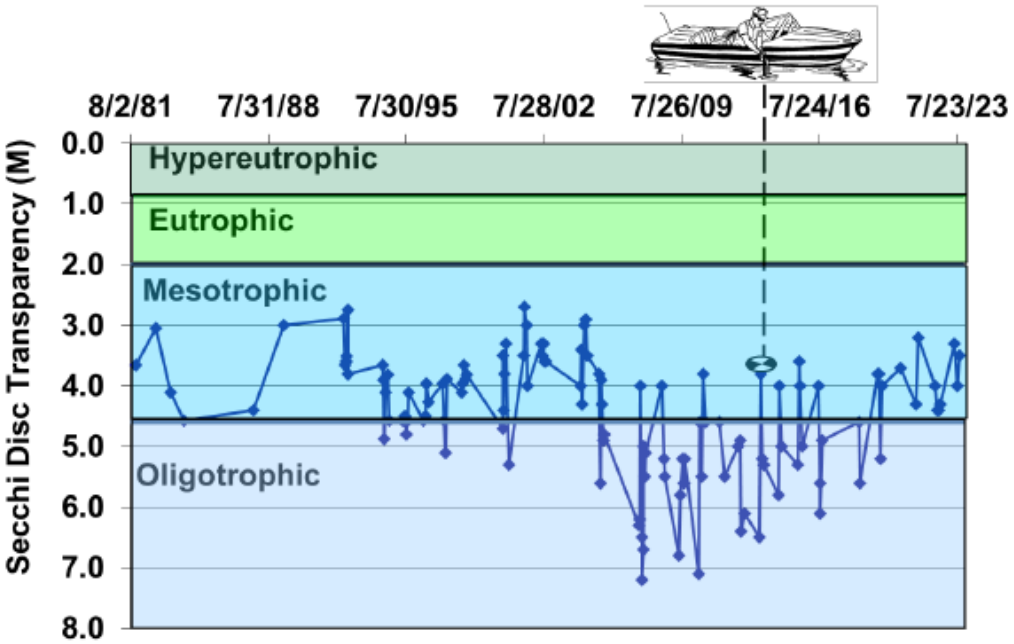

Figure 9. 1981-2023 Beaver Dam Lake Secchi Disk Transparencies: West Lake (NE of Eagle Point)

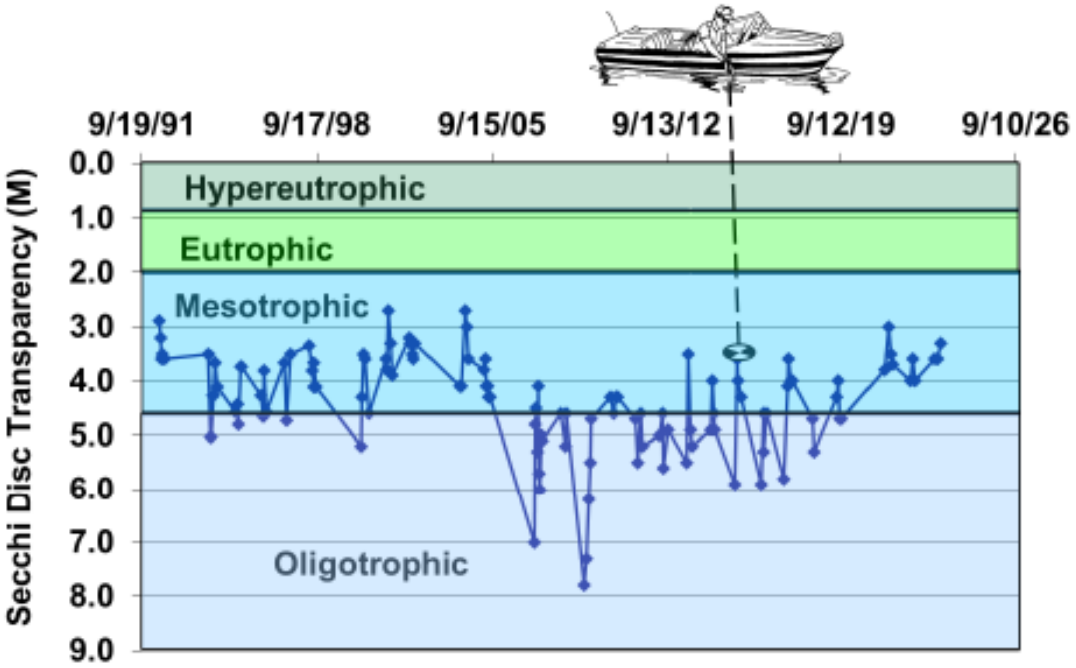

Figure 10. 1992-2021 Beaver Dam Lake Secchi Disk Transparencies: Williams Bay

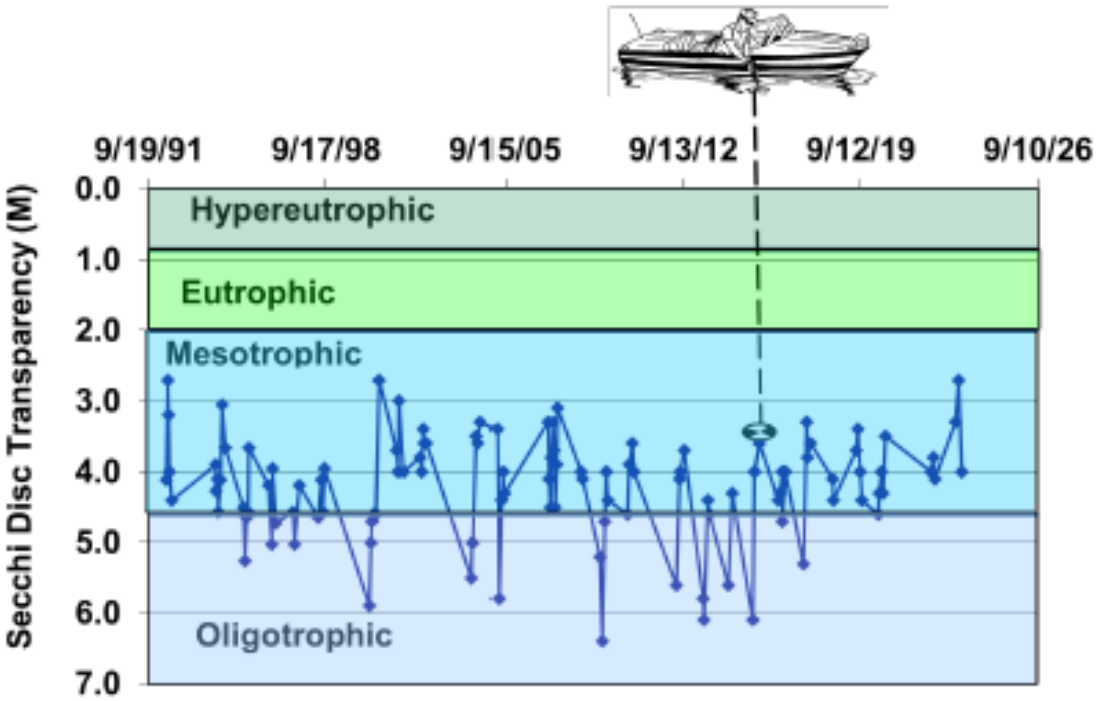

Figure 11. 1992-2023 Beaver Dam Lake Secchi Disk Transparencies: Rabbit Island Bay

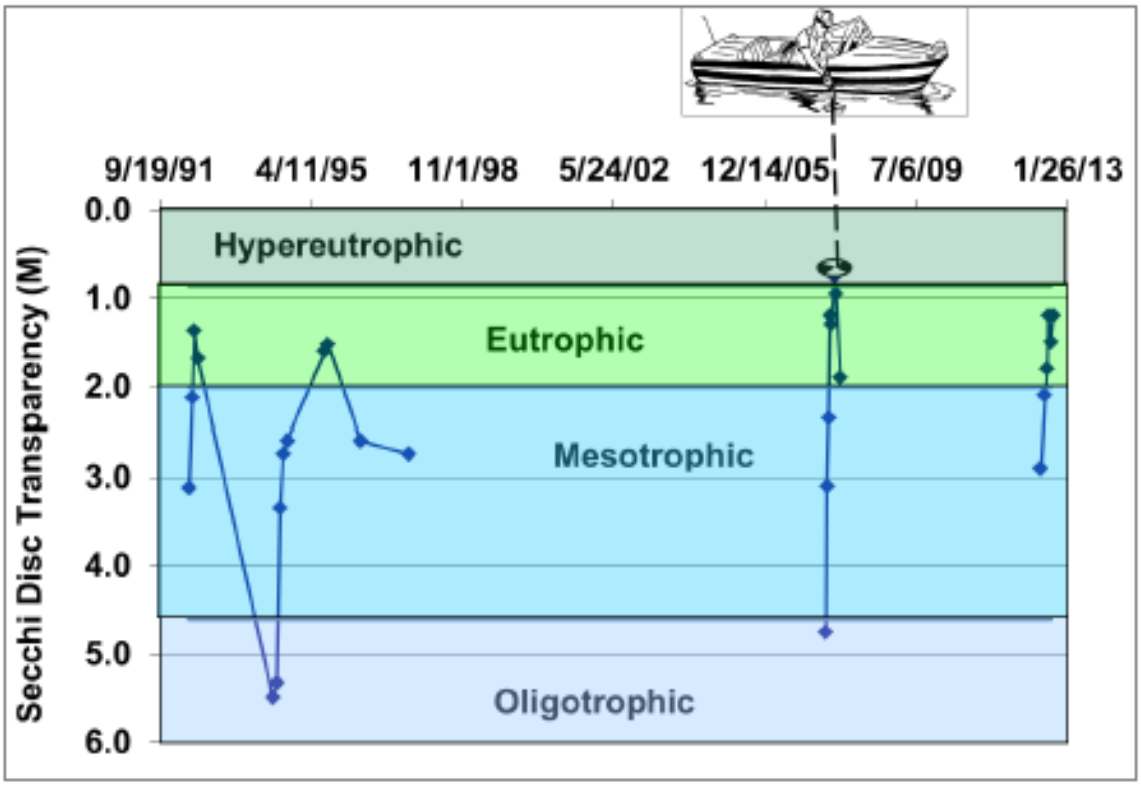

Figure 12. 1992-2012 Beaver Dam Lake Secchi Disk Transparencies: East Lake

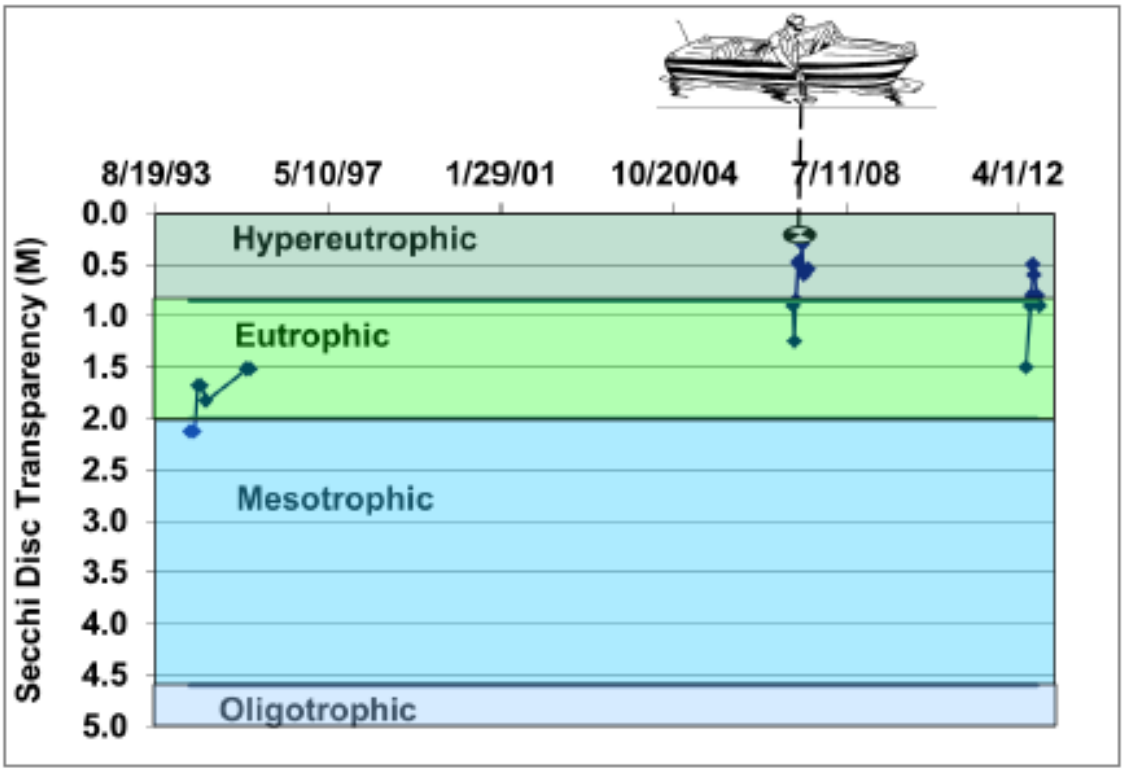

Figure 13. 1994-2012 Beaver Dam Lake Secchi Disk Transparencies: Cemetery Bay

APPENDIX II: SEDIMENT TESTING PARAMETERS

The following parameters were assessed for three sample sites located at a storm sewer outfall on Rabbit Island Bay. Results were collected October 5th, 2009.

Inorganic Analysis

- Cyanide Total
- % Moisture
- Nitrate/Nitrate as N
- Nitrate as N
- Ammonia as N
- Total Kjeldahl as N
- Total Organic Carbon
- Phosphorus, Total as P
- % Solids

Metals Analysis

- Arsenic, Total
- Barium, Total
- Cadmium, Total
- Chromium, Total
- Copper, Total
- Iron, Total
- Lead, Total
- Manganese, Total
- Mercury, Total
- Nickel, Total
- Selenium, Total

Organic Analysis

- Aldrin
- Alpha-BHC
- Beta-BHC
- Delta-BHC
- Gamma-BHC (Lindane)
- 4,4'DDD
- 4,4'DDE
- 4,4'DDT
- Dieldrin
- Endosulfan I
- Endosulfan II
- Endosulfan sulfate
- Endrin
- Endrin aldehyde
- Endrin ketone
- Heptachlor
- Heptachlor epoxide
- Methoxychlor
- Toxaphene
- PCB-1016
- PCB-1221
- PCB-1232
- PCB-1242
- PCB-1248
- PCB-1254
- PCB-1260
- Oil & Grease (HEM)

APPENDIX III: DETAILED SUPPORTING PLAN GOALS

Cumberland Comprehensive Plan

Transportation

Goal: Transportation improvement shall balance environmental factors with transportation needs and the desired land uses as identified in the future land use section of the Comprehensive Plan.

Objective: Plan, design, and construction transportation improvements that respect the natural environment and reflect the aesthetic character and values of the citizens of Cumberland and Barron County.

Goal: The future transportation system should be flexible and multi-modal and provide for the needs of the City of Cumberland.

Objective: Support efforts to expand walking, bicycling, and other modes of transportation.

- Work with local organizations interested in walking, bicycling, and other modes of transportation.
- Improve multimodal transportation services in the City of Cumberland and designate routes for trails and transit corridors within the community.

Utilities and Community Facilities

Goal: Implement the City of Cumberland Stormwater Management Plan

Objective: The City of Cumberland will require necessary stormwater BMPs for new development and develop solutions to keep pace with evolving water quality regulations.

Objective: Establish stormwater rates and financing mechanisms to fully implement the stormwater utility [to] help pay for stormwater management projects and activities.

Objective: Work with BDLMD to increase awareness about water quality issues in Cumberland.

Goal: Maintain and enhance community facilities and services, which contribute to the quality of life for area residents.

Objective: Promote use of existing facilities and encourage development of public facilities, such as new parks, green spaces, and trails (e.g., walking, biking, skiing, and snowmobile trails).

Agricultural, Natural, and Cultural Resources

Goal: Conserve, protect, manage, and enhance the City's natural resources, including but not limited to, lakes, rivers, streams, wetlands, groundwater, forestlands, and other wildlife habitats in order to provide the highest quality of life for the City of Cumberland's citizens and visitors.

Objective: Enforce setback requirements for water resources by enforcing City shoreland standards when applicable.

- Educate residents about the importance of natural areas and wildlife corridors.

Objective: Endorse the Wisconsin DNR watershed initiatives to educate shoreland and basin property owners on the appropriate safe levels, application, timing and safe types of fertilizers and pesticides applied to lawns and field in the City.

Objective: Work with the Lake District to protect surface water quality, improve aquatic habitat, control invasive species, and related public education.

- Implement the recommendations of the City's Stormwater Management Plan.
- Support efforts to continue the monitoring of the quality and quantity of runoff, such as phosphorus and sediment loading.

Objective: Endorse the Wisconsin DNR watershed initiatives to restore altered shoreland vegetation and prohibit removal of natural vegetation in critical shoreland areas.

- Encourage Barron County and the Wisconsin DNR to fund buffer strips along streams and lake shores.
- Collaborate with state and local organizations whose charge is to enhance water quality.

Objective: Educate the public on BMPs that will ensure the protection of natural resources.

- Publish or obtain information that can be distributed to residents on the disposal of hazardous materials, such as paint, waste oils, computers, insecticides, etc.

Objective: Protect and manage local forested areas and other wildlife habitats.

- Encourage selective cutting in forest stands.
- Coordinate with Wisconsin DNR to identify and protect wildlife habitats.
- Inventory and map sensitive resources that should be preserved to the greatest extent possible.
- Encourage "low impact" development that strives to retain natural vegetation.
- Discourage habitat fragmentation by encouraging development on the fringes of identified habitat areas and by encouraging the linking of habitats and natural areas through environmental corridors.
- Work and cooperate with local land trust and similar organizations on forest and wildlife habitat protection, management, and preservation.

Goal: Provide adequate amount of parkland, greenspace, and desired recreational facilities to serve existing and new development.

Objective: Implement the recommendations of the City of Cumberland Outdoor Recreation Plan, Placemaking Cumberland report, and the Library Lake Management Plan related to outdoor recreational improvements.

- Improve Library Lake, including dredging and installation of a marina or piers, improvement of a walkway around the lake, and a permanent band shell.

Economic Development

Goal: Cumberland should be a strong economic center.

Objective: Support downtown Cumberland as a distinct opportunity for commercial and service establishments and housing. Encourage a variety of retail services for area residents and promote supportive programming that fills vacant commercial buildings.

- Continue efforts to improve and develop Library Lake as a central-gathering place that is well connected to [the] rest of downtown and community, as well as an accessible destination for boat traffic.

Cumberland Stormwater Management Plan

Goal: Treat stormwater runoff prior to discharge to city of Cumberland waterbodies to reduce pollutant loading

<u>Objectives</u>

2.1 Implement structural stormwater best management practices in priority watersheds.

2.2 Implement programmatic best management practices.

2.3 Restore trophic status of Beaver Dam Lake West including Rabbit Island Bay and Library Lake from eutrophic to mesotrophic.

2.4 Restore trophic status of Beaver Dam Lake East including Cemetery Bay and Norwegian Bay from hypereutrophic to mesotrophic.

2.5 Continue on-going total phosphorus, chlorophyll a and Secchi depth monitoring.

2.7 Conduct sediment sampling at major storm sewer outfalls to prioritize dredging.

Goal: Protect and improve native aquatic and shoreland habitats

Objectives

3.1 Protect native shoreline habitat from erosion, scouring and sediment deposition at storm sewer outfalls.

3.2 Through water quality improvements, enhance the Beaver Dam Lake fishery as it has a diverse fishery and is only one of a handful of lakes in Barron County that has a fishable population of smallmouth bass.

3.3 Continue on-going aquatic plant surveys.

Goal: Promote Cumberland's status as a recreation destination by protecting the waters of Beaver Dam Lake

Objectives

4.1 Protect native shoreline habitat from erosion, scouring and sediment deposition at storm sewer outfalls.

4.3 Improve public access to Beaver Dam Lake and Library Lake through the implementation of active and passive recreation amenities.

4.4 Perform strategic dredging operations to remove sediment build-up from storm sewer outfalls in Library Lake and Beaver Dam Lake.

APPENDIX IV: ADDITIONAL ORDINANCE INFORMATION

17.29 C-1 Wetland Conservancy District

The goal of the C-1 District is to protect against the development and alterations of natural function of wetlands. Barron County recognizes the ecological importance of these lands and has added these additional protections; wetlands in shorelands within C-1 are also included in Wetland Overlay Area restrictions. Permitted uses within the C-1 District include: farming, harvesting of wild crops, hunting and fishing, hiking, forest management, and natural preservation.

17.32 R-1 Residential Low Density District

Residential Low Density restrict the number of dwelling units and their characteristics. Both single family and two family dwellings are allowed excluding mobile homes. No more than two detached accessory buildings are allowed on each lot and the restrictions of these buildings are laid out in this code.

17.36 RR Recreational-Residential District

The Recreational-Residential District provides for a mixture of uses with an emphasis on commercial uses related to recreational opportunity or serve residential properties. These areas are located near navigable waters on lands suited for development. Allowed uses include R-1 District housing, C-1 conservation uses, recreational vehicles, and campgrounds.

17.28 A-1 Exclusive Agricultural District

The A-1 District protects agricultural land and natural areas from development that may be contrary to agricultural use. The goal is to minimize fragmentation of productive land and preserve natural resources. In general, permitted uses include: crop or forage production, keeping livestock, floriculture, aquaculture, forest management, and conservation payment program land.

17.37 AG-2 Agricultural District

Lands within the AG-2 District are similar to those within the A-1 District but is less restrictive and can be used for some non-farm housing uses. This is largely due to the productivity potential of the land based on soil characteristics, location, required agricultural intensity, topography, and other considerations.