Boardman Lake

Grand Traverse County
Boardman River Watershed

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Environment

Boardman Lake is a 339-acre lake in the northwestern lower peninsula of Michigan. The lake is located inside the City of Traverse City in Grand Traverse County (Figure 1). The Boardman River flows through Boardman Lake, and thus the lakeshed for Boardman Lake starts to the east of the village of Kalkaska in the headwaters of the stream (Figure 2). The lake bottom is predominately sand, with some areas of organic material and cobble. The lake has an average depth of approximately 25 ft. and a maximum depth of 71 ft (Figure 3). Boardman Lake is a eutrophic lake characterized by low oxygen concentrations in the hypolimnion (1 ppm at 56 ft. (49° F) in 1976 and 0.1 ppm at 61 ft. (48° F) in 1986 (Kalish 2003)). The inlet and outlet of the lake is the Boardman River, and downstream of Boardman Lake the river is currently impounded by the Union Street dam, resulting in the lake being 9.1 feet higher than its natural elevation. The dam was originally constructed in 1867 to supply power to a flour mill. A fish ladder was constructed adjacent to the dam in 1987 to allow jumping migratory species access upstream to Sabin Dam, which is no longer in place. The dam is owned and maintained by the City of Traverse City, and is currently slated to be replaced.

The land use surrounding the Boardman Lake lakeshed is predominately forested, with a good mix of deciduous forest, evergreen forest, mixed forest, and herbaceous land covers (Figure 4). There are a few small pockets of development around the villages of Kalkaska, Fife Lake, and Kingsley, but the area of heaviest development in the lakeshed surrounds Boardman Lake itself. A mixture of low, medium, and high intensity development surrounds the lake.

The shoreline of Boardman Lake is mostly natural, despite being heavily developed with condominiums, various industrial sites, and the municipal water treatment facility. The 2021 fisheries survey included a habitat component, which documented three large docks, 15 small docks, and 49 home sites around the lake. Almost all of the home sites are multi-family sites such as high-end apartments or condominiums. The shoreline inventory counted 281 submerged logs/trees in the nearshore area, and was found to be 15% armored by rip rap or seawalls.

Boardman Lake has one public boat launch at the north end of the lake which is located at Hull Park, and a kayak or canoe launch at the south end at Medalie Park. Both facilities are managed by the City of Traverse City Parks and Recreation Department.

History

Stocking
The earliest documented fish stocking in Boardman Lake took place in 1897 when 15,000 Lake Trout were stocked (Table 1). Walleye were stocked in 1905 and 1910, and Atlantic Salmon were stocked in 1909; neither of these species proved to be successful at the time. Starting in 1939, Bluegill were stocked

in an effort to establish a better panfish population. This was repeated in 1940, 1941, and 1943, but when concurrent surveys caught no Bluegill, this stocking effort was discontinued. Smallmouth Bass were stocked for a few years in the early 1940's, but there is little discussion of this program in the historical files. Brown Trout were stocked into Boardman Lake from 1958 to 1963, however the program was halted after a 1966 survey collected very few Brown Trout. Fisheries Division instituted a Walleye fry stocking program from 1977 to 1983 in an effort to develop a naturally reproducing population of Walleye in the lake; that effort was successful and natural reproduction supports the fishery to this day.

Surveys

The first documented fisheries survey on Boardman Lake took place in July 1938. Gill nets and seines were used to collect Rock Bass, Yellow Perch, Northern Pike, Smallmouth Bass, White Sucker, Johnny Darter, Largemouth Bass, Bluntnose Minnow, Iowa Darters, and Sculpin.

The next series of fisheries surveys occurred in 1942, 1944, and 1947 and were assessment surveys aimed at evaluating the stocking of Bluegill. Gill nets were used to collect Northern Pike, Rock Bass, and Yellow Perch, but no Bluegill were encountered. It wasn't until 1952 that anglers reported catching Bluegill, and even then, the numbers were not enough to conclude that the stocking efforts were successful (Fisheries Division files, Traverse City).

Fisheries Division surveyed Boardman Lake again in 1966 using trap, fyke, and gill nets to evaluate the Brown Trout stocking program. This effort resulted in the collection of Bluegill, Northern Pike, Largemouth Bass, and five Brown Trout from 10-19 inches in length.

In 1975 Fisheries Division once again surveyed the lake using gill nets, which resulted in a catch of Northern Pike, Yellow Perch, Smallmouth Bass, White Sucker, Black Bullhead, Rock Bass, and Pumpkinseed Sunfish. All the Smallmouth Bass and the Age-I Northern Pike were growing significantly higher than the State average length-at-age, while Age-II Northern Pike were growing below State average. Overall the fish community was deemed to be "good" at the time.

The following year in August 1976 a limnological analysis of Boardman Lake was completed by Fisheries Division. A water temperature and oxygen profile was completed, showing a thermocline at 26 feet with an oxygen concentration of 3ppm (parts per million). At a depth of 56 feet the oxygen concentration reached a low of 1ppm; these low oxygen concentrations in the hypolimnion may partially explain why the brown trout stocking program in the 1950's and 1960's was unsuccessful.

In order to evaluate the 1977 thru 1979 walleye stocking efforts, a Fisheries Division crew conducted an electro-fishing survey of Boardman Lake using a boom electrofishing boat. Only five Age-II Walleye were collected, however their growth rates were significantly higher than the State average length-at-age. Many Walleye were observed but not collected during this effort because of the extensive weed growth in the lake which made netting fish difficult.

Fisheries Division again evaluated the Walleye stocking efforts, this time with a gill- and fyke-net survey in 1981. Two separate efforts were completed, one in April and one in June. April's survey collected Northern Pike, Walleye, Yellow Perch, Brown Bullhead, White Sucker, and Rock Bass. Only six Walleye were collected, growing slightly below State average, but still within an acceptable range. The

June survey collected Walleye, Northern Pike, Yellow Perch, Smallmouth Bass, Brown Bullhead, Pumpkinseed Sunfish, and Bluegill. Most fish were collected in shallow water, as once again oxygen was a limiting factor below 30 feet. Fifty Walleye ranging from six to eighteen inches were collected, and growth rates were all within acceptable ranges.

In 1986 gill net and fyke nets were used to evaluate the Walleye population. A total of thirty-eight Walleye were collected, all growing above State average. Collectively the Walleye caught averaged 13.2 inches long, with 24% of the catch being over 15 inches (the minimum size limit). The presence of fish younger than Age IV indicated that natural reproduction had occurred since the most recent stocking of Walleye had occurred in 1982. Additionally, eight-year classes of Yellow Perch were collected, with nearly 70% of the perch caught being larger than seven inches. Other species observed in the survey included Bluegill, Smallmouth Bass, Largemouth Bass, Pumpkinseed Sunfish, Brown Bullhead, Rock Bass, and White Sucker.

A fish community survey of Boardman Lake was conducted in May 2003 using minnow seines, experimental gill nets, large-mesh fyke nets, small-mesh fyke nets, and trap nets. The majority of the catch was composed of White Sucker, Rock Bass, Smallmouth Bass, Walleye, and Yellow Perch. Common Shiner, Sand Shiner, Johnny Darter, Grass Pickerel, Northern Pike, Pumpkinseed Sunfish, Steelhead, Black Crappie, and Brown Bullhead were also collected in smaller numbers. The survey crew collected 70 Walleyes that ranged in length from three to 19 inches. Six age classes were collected (Age-I thru Age-XI), and all age classes were growing above State average, with the exception of Age-IV. The average growth index for Walleye collected in 2003 was +1.4. Fisheries Division also collected 16 Northern Pike, 33 Pumpkinseed Sunfish, 78 Smallmouth Bass, 117 Rock Bass, and 467 Yellow Perch. The average growth index for these species were all above State averages. The fisheries population (specifically Yellow Perch, Walleye, Pumpkinseed Sunfish, and Smallmouth Bass) in Boardman Lake appeared to be doing well based on growth indices, length-at-age distributions, average size, and numbers collected.

Current Status

The most recent survey of Boardman Lake was conducted using Status & Trends protocols (Wehrly et al. 2009), and took place in May, June, and August of 2021. On May 24th three large-mesh fyke nets, two experimental gill nets, and two small-mesh fyke nets were set in randomized locations. The large-mesh fyke nets and experimental gill nets were set for three net nights each, while the small-mesh fyke nets were set for two net nights each. Each net was moved to a new randomized location each day after it was lifted and the fish removed, for a total of 22 net nights of survey time.

On June 15th four beach-seine hauls and four boom-electrofishing transects were conducted in the late afternoon and evening. All of the seine hauls and three 600-second-long electrofishing transects were conducted according to Status & Trends protocols (Wehrly et al. 2009) and thus were completed in randomly selected transects, while an additional 1,542-second-long electrofishing transect was added to the effort to sample the area where the Boardman River exits Boardman Lake, resulting in 1.95 miles of shoreline being sampled.

On August 12th the limnological component to the survey was conducted. This included a temperature/dissolved oxygen/pH profile starting at the surface and going down to 57 feet of water,

Secchi disk readings, and shoreline sampling, including counting the number of homes, docks, and woody debris present along the shore.

Gamefish species including Bluegill, Pumpkinseed Sunfish, Walleye, Yellow Perch, Largemouth Bass, Smallmouth Bass, Brown Trout, Rainbow Trout, and Northern Pike were measured to the nearest 0.1 inches (Schneider et al. 2000). Aging structures (10 per inch group) were collected from each gamefish species for age and growth analysis. Scales were collected from panfish species less than 6.0-inches and bass less than 10.0-inches. Anal fin spines were collected from panfish greater than 6.0-inches, bass greater than 10.0-inches, and all Northern Pike. Dorsal spines were collected from all Walleye captured.

A total of 1,504 fish were collected representing 17 species (Table 2) at a combined weight of 296 pounds, with only three species (Northern Pike 20.9%, White Sucker 24.3%, and Walleye 27.3%) comprising 72.5% of the total biomass. White Sucker comprised the majority of the fish by number with 956 individuals, followed by Yellow Perch at 257 individuals, and Rock Bass at 111 individuals. Walleye represented the heaviest weight by species with 80.9 pounds, followed by - White Sucker with 71.8 pounds, Northern Pike with 61.7 pounds, and Smallmouth Bass with 25.0 pounds.

Of the eight species which had ageing structures collected, only Northern Pike, Walleye, and Yellow Perch had enough individuals to calculate a Mean Growth Index, which requires a minimum of five fish per age group in order to be statistically conclusive (Table 3).

Analysis and Discussion

The 2021 Fisheries Division survey collected residential development information such as the total number of dwellings around the lake, as well as the number of docks present. A total of 49 dwellings were counted, equating to 7.27 dwellings per kilometer of shoreline (Google Earth measurements approximate Boardman Lake's shoreline at 4.18 miles, or 6.74 kilometers). According to Wehrly et al. (2015), this classifies Boardman Lake as having a "medium dwelling density" in comparison to other lakes across the state. The total number of docks counted was 18, equating to 2.67 docks per kilometer of shoreline placing Boardman Lake in the "medium dock density" category (Wehrly et al. 2015). Trees that fall into the water along the shoreline are the primary source of large woody debris in most lakes. Shoreline counts in Boardman Lake documented 281 felled trees or limbs.

The two most recent surveys, 2003 and 2021, were conducted in similar time frames (mid to late May) and similar water temperatures and weather conditions were documented, meaning that environmental conditions most likely did not contribute to the differences in the catch. One species worth noting that was not in the catch in 2003 but was common in the 2021 catch was Round Goby. Grass Pickerel were observed in the 2003 catch, but absent from the 2021 catch. Forage fish species such as Iowa Darter, Johnny Darter, and Mimic Shiner have been present in the catches but in very low number; it appears that juvenile White Sucker are the predominate forage as hundreds of one-inch fish were observed in both surveys. The 2021 survey documented fewer Walleye growing at slower rates, fewer Yellow Perch but a better overall size distribution and larger fish, more Northern Pike, and more White Suckers.

None of the changes in individual fish species are a cause for concern, and overall changes to the fish community were positive. The fish community in Boardman Lake seems to be stable and should continue to provide a good fishery for a diverse group of species.

Management Direction

Fisheries Division should conduct a spring population estimate survey targeting Walleye and Northern Pike on Boardman Lake. This type of survey will provide information needed to better understand the population level, recruitment, and exploitation of naturally reproducing Northern Pike and Walleye.

Fisheries Division should conduct a passive fish survey utilizing post cards or cameras to help better understand angler use. While the fishery here appears to be stable and provides for good angling opportunities, anecdotally it also appears to be an under-utilized resource. It may be that the history of industrial use on the lake has anglers worried about contamination in the lake or contaminants accumulated in the fish they harvest; there is currently a consumption advisory on Boardman Lake for Northern Pike, White Sucker, and Walleye due to concerns with mercury (Michigan Department of Health and Human Services 2023).

The shoreline survey conducted of Boardman Lake indicates that the lake is moderately developed, and the nearshore littoral zone habitat is only somewhat compromised due to human activity. Fisheries Division should continue to work with the Department of Environment, Great Lakes, and Energy (EGLE) to review permit applications and work with riparian property owners to choose softer engineering approaches in conjunction with native plantings over seawalls and sheet piling when it comes to shoreline stabilization.

Fisheries Division and EGLE should also encourage riparian landowners to reduce nutrient loading in the form of lawn fertilizer and chemical treatments. Slowing the process of eutrophication along with other best management practices (BMP's) would add resistance to changes in climate the lake might be subject to.

References

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Wehrly, K. E., G. S. Carter, and J. E. Breck. 2009 Draft. Standardized sampling methods for the inland lakes status and trends program. Chapter 27 in Manual of Fisheries Survey Methods. Michigan Department of natural Resources, Fisheries Division internal document, Ann Arbor.

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Table 1. Historic Boardman Lake fish stocking, 1897 to present.

Year	Species	Number	Size/Age
1897	Lake Trout	15,000	N/A
1905	Walleye	425,000	Fry
1909	Atlantic Salmon	7,000	Fry and Fingerling
1910	Walleye	75,000	Fry
1939	Bluegill	35,000	4 month
1940	Bluegill	1,000	Yearling
1941	Bluegill	10,000	4 month
	Smallmouth	300	4 month
1943	Bluegill	1,200	Yearling
	Bluegill	400	Adult
	Smallmouth	1,200	4 month
1959	Brown Trout	2,000	Legal
1963	Brown Trout	2,000	Legal
1964	Brown Trout	2,000	Legal
1965	Brown Trout	5,000	Legal
1979	Walleye	750,000	Fry
1980	Walleye	1,750,000	Fry
1981	Walleye	1,750,000	Fry
1982	Walleye	1,750,000	Fry
1983	Walleye	900,000	Fry

Table 2. Number, weight, and length of fish collected from Boardman Lake with large mesh fyke nets, seines, trap nets, inland gillnets, and electrofishing in May and June of 2021.

Species	Number	Percent by number	Weight (Pounds)	Percent by weight	Length range (inches)
Bluegill	3	0.20%	0.1	0.00%	1-5
Bluntnose Minnow	1	0.10%	0	0.00%	1
Brown Trout	5	0.30%	12.4	4.20%	12-21
Brown Bullhead	1	0.10%	0.6	0.20%	10
Brook Stickleback	1	0.10%	0	0.00%	1
White Sucker	956	63.60%	71.8	24.30%	1-23
Iowa Darter	15	1.00%	0.1	0.00%	1-2
Largemouth Bass	1	0.10%	0	0.00%	3
Mimic Shiner	5	0.30%	0	0.00%	1-2
Northern Pike	29	1.90%	61.7	20.90%	11-28
Pumpkinseed Sunfish	14	0.90%	0.2	0.10%	1-4
Rainbow Trout	3	0.20%	0.6	0.20%	8
	40	2.70%	0	0.00%	1-3
Rock Bass	111	7.40%	20.7	7.00%	1-10
Smallmouth Bass	13	0.90%	25	8.50%	6-19
Walleye	49	3.30%	80.9	27.30%	6-27
Yellow Perch	257	17.10%	21.9	7.40%	2-13
Total	1504	100.00%	296	100%	

Table 3. Age and Growth data for Boardman Lake, 2021.

Species	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII	XIV	Mean Growth Index
Bluegill		5.90 (1)													--
Brown Trout		12.20 (1)	19.20 (3)	15.10 (1)											--
Northern Pike	12.68 (5)	19.13 (6)	21.19 (9)	24.60 (2)	24.47 (3)	27.63 (3)									+0.9
Pumpkinseed		3.75 (2)													--
Rainbow Trout	8.00 (1)	8.25 (2)													--
Smallmouth	6.70 (3)		9.00 (1)	14.60 (1)	16.30 (4)			18.00 (1)	18.50 (2)	19.00 (1)					--
Walleye	7.70 (2)		11.03 (4)	13.04 (20)	15.10 (1)	16.30 (2)		18.80 (5)	19.48 (4)	19.73 (6)	20.15 (2)		24.10 (1)	26.30 (2)	-3.0
Yellow Perch	4.17 (3)	4.92 (14)	6.43 (24)	7.12 (7)	9.78 (6)	9.25 (2)	11.90 (1)	9.69 (3)	13.07 (3)						+0.1

Figure 1. Location of Boardman Lake.

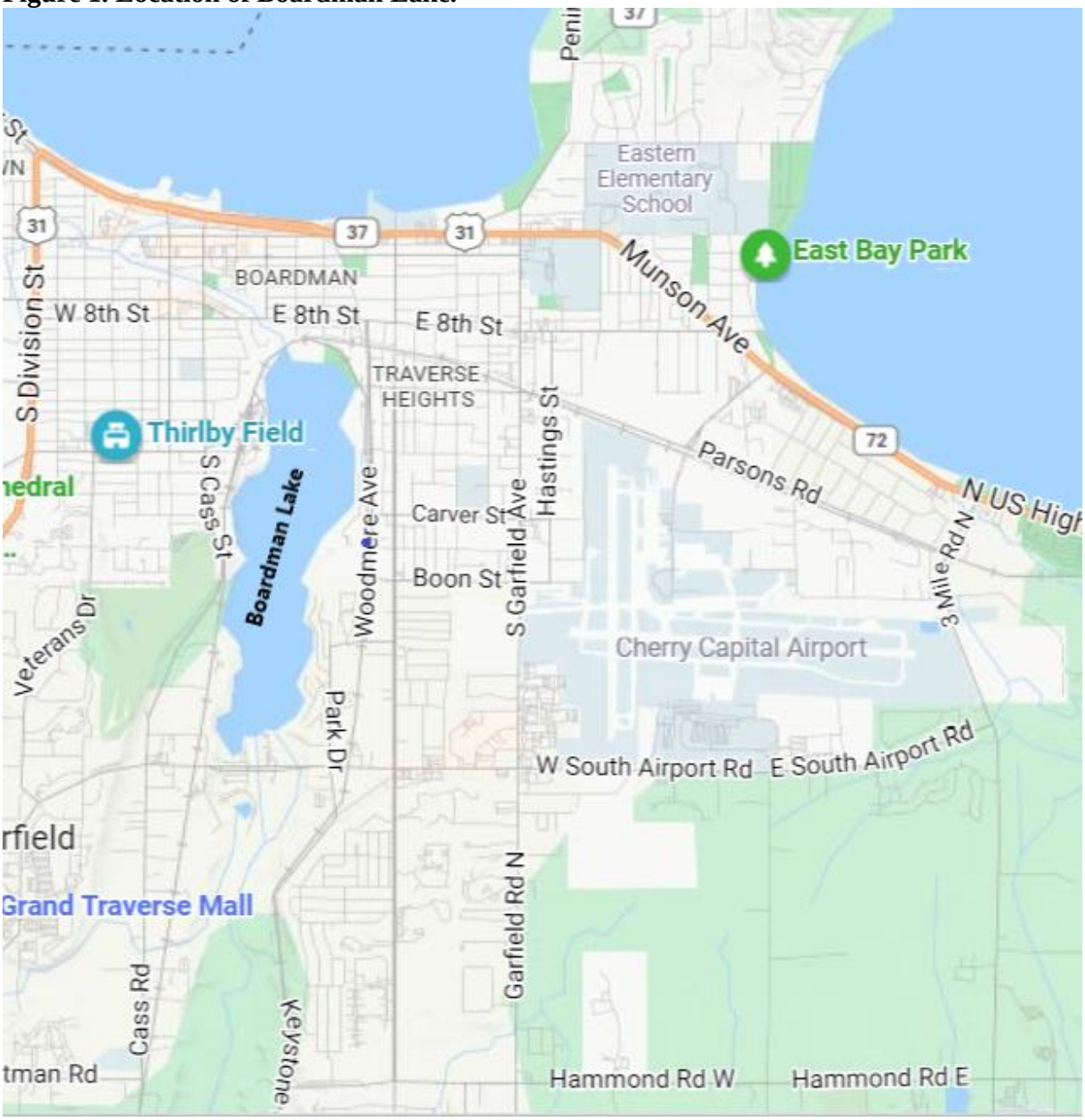

Figure 2. Boardman Lake satellite lakeshed map.

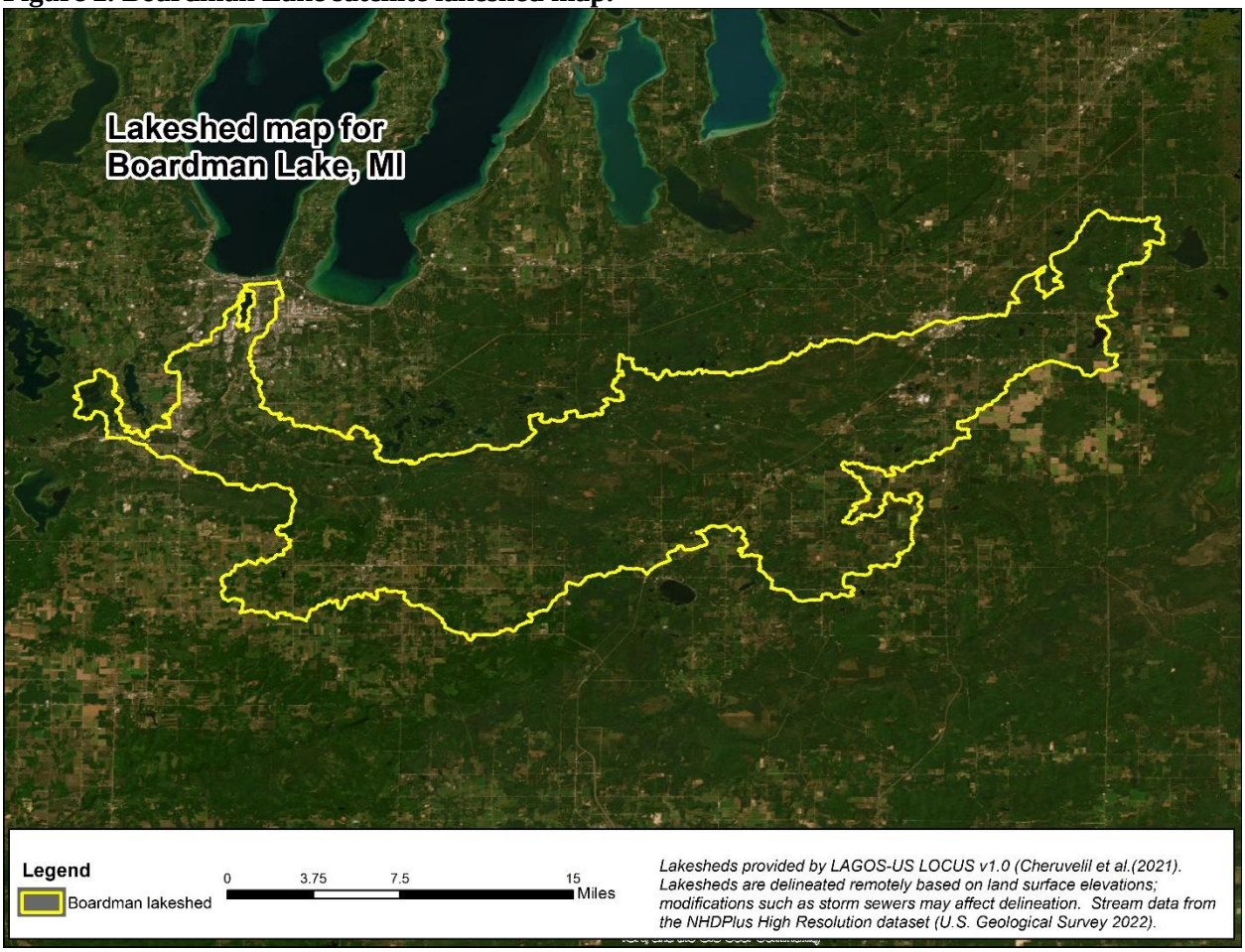

Figure 3. Boardman Lake bathymetric map.

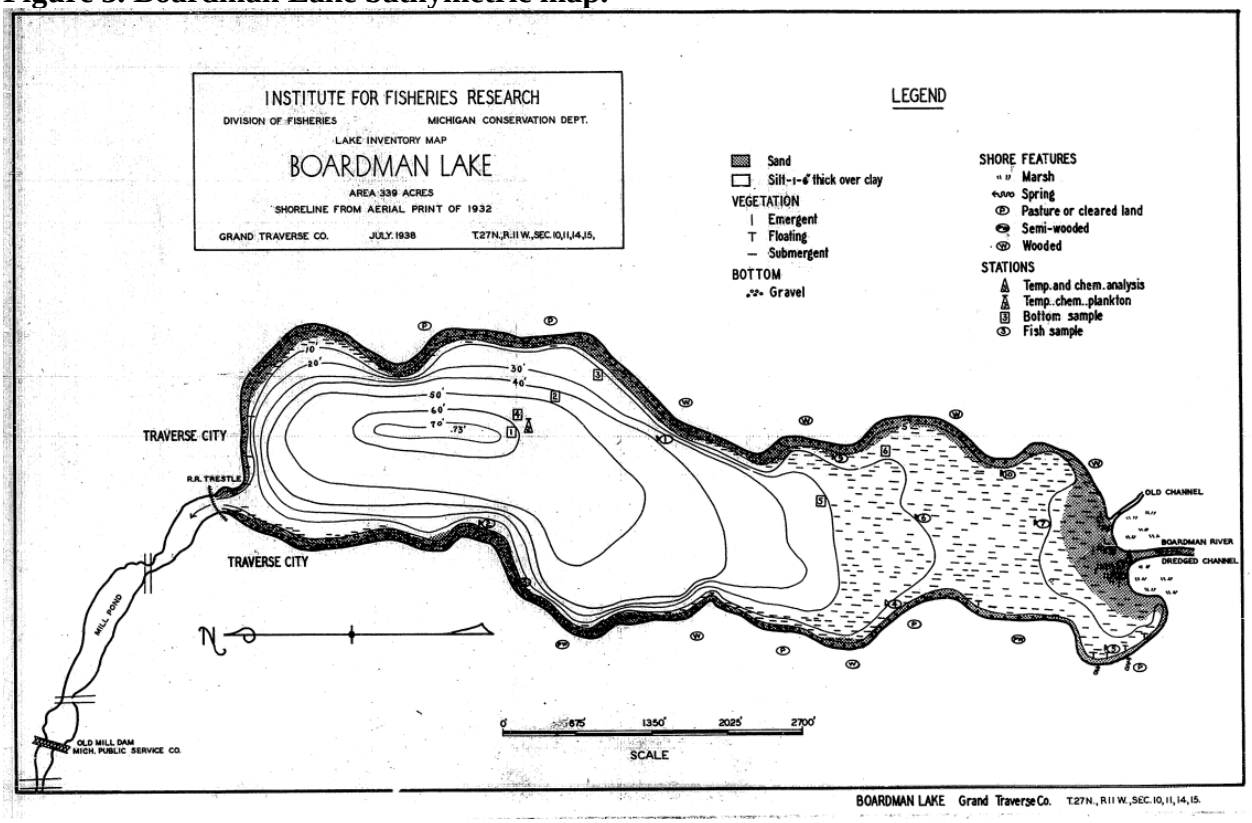

Figure 4. Land use map for the Boardman Lake lakeshed.