Assessment of the greenbelt at Michigan Department of Natural Resource Boat Launches in Cheboygan and Emmitt County, Michigan

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Introduction

Riparian zones are critical to the health of aquatic ecosystems. The riparian zone serves as a habitat for diverse plant and animal communities. These zones serve to protect the water from disturbances, control nutrient fluxes, and act as a buffer of vegetation to protect against anthropogenic erosion and pollution. Due to high moisture availability, riparian zones are well-suited for plant growth and nutrient uptake that facilitate a healthy aquatic system (Swanson et al. 1982). The part of the riparian zone referred to as the greenbelt is defined as the shoreline vegetation. Alterations to this vegetative buffer can result in degradation of water quality and the alteration of system ecology. Specifically, the removal of the greenbelt leads to a reduction of shade and allochthonous carbon input, in turn affecting the surrounding aquatic habitat (Naiman & Decamps 1997; Swanson et al. 1982).

A healthy greenbelt contains a variety of different herbaceous and woody plant species. This diversity allows for the longterm success of the plant community (Hooper *et al.* 1997). Invasive species, such as knapweed (*Centaurea maculosa*) and the planting of turfgrass are a threat to this plant diversity. The presence of emergent vegetation is also important as this vegetation helps to reduce resuspension of sediment from erosion (Dieter 1990) as well as to prevent eutrophication and remove environmental contaminants (Qinghia *et al.* 2011). Finally, increased greenbelt density offers a large root network to stabilize erosion and buffer pollution (Shields *et al.* 1995). The deeper and more expansive the greenbelt, the greater these effects.

Boat launches serve as one of the major threats to healthy greenbelts. For example, over-maintenance such as mowing and removal of native vegetation near the shoreline is common having potential negative effects on aquatic systems. The presence of a healthy greenbelt helps to drastically reduce the impact of boat launch pollutants.

The Michigan Department of Natural Resources (MDNR) owns and maintains boat launches around the lakes of Northern Michigan. Based on previous Tip of the Mitt assessments several of the MDNR properties require improvement of their greenbelts. The purpose of this survey is to assess the quality of greenbelts on MDNR boat launches around Northern Michigan as well as present solutions for maintaining healthier lakes through greenbelt improvements. The MDNR properties evaluated included boat launches on Black, Burt, Lancaster, Long, Mullett, Munro, and Paradise Lakes, and on the Cheboygan River. Each site was assessed across multiple parameters: greenbelt length and depth, turfgrass presence, density and vertical structure of vegetation, species diversity, emergent vegetation, man-made structures, water chemistry, the presence of invasive species, and the overabundance of cladophora.

Methods

Thirteen total boat launches were assessed. On July 27, 2013 data were collected from Mullett Lake at the Jewell Road and Mullett Village locations. On July 31, 2013 data were collected from Lancaster, Munro, Paradise, and Burt Lake. At Burt Lake, data were collected from the Maple Bay State Forest Campground and Burt Lake State Park. On August 3, 2013 data were collected from Cheboygan River, Black Lake, and Long Lake. Data from the Cheboygan River were collected at the Dam and Forks locations. Data from Black Lake were collected from Onaway State Park and the State Forest Campground. All locations are mapped in Figure 1.

At each site, the same sampling and measuring techniques were used. Greenbelts were assessed by the length of total shoreline which the greenbelt occupied and the depth away from the shoreline in meters. The length of the shoreline covered by greenbelt was approximated into percentages which correlated to a categorical numerical value. If no greenbelt was present, a score of zero was assigned. For less than 10 percent of the shoreline, the score assigned was one, for 10 to 25 percent, two, for 25 to 75 percent, three, and for 75 percent or greater, four. A score of zero represented poor greenbelt length and a score of four represented excellent greenbelt length. The depth of the greenbelt was approximated by feet. If there was no depth, a score of zero was assigned ;one for less than 10 feet, two for 10 to 40 feet, and three for a depth greater than 40 feet.

Density was a subjective measure that took into account the number of plants per unit area. Density was given a score from zero to three. A score of zero was given for no greenbelt density, one for sparse vegetation, two for medium density vegetation, and three for dense vegetation. Diversity was also scored from zero to three. Zero was given for no plant diversity, one for uniform diversity, two for the presence of several species, and three for the presence of many species. Emergent vegetation was given a score of zero or one for absence or presence, respectively.

Total greenbelt score was the sum of the length, depth, density, diversity, and emergent vegetation scores. A score of zero to four represents an inadequate greenbelt, a score of five to nine represents an adequate greenbelt, and a score of 10 to 14 represents an exceptional greenbelt.

To further assess the greenbelt, the percent of turfgrass which covered the total shoreline was approximated. Turfgrass was not considered to be a viable greenbelt. The vertical structure of each greenbelt was assessed for the presence of groundcover, understory, or overstory. The presence of cladophora and invasive species such as zebra mussels and spotted knapweed were noted. Structures such as sea walls, riprap, and storm drains were recorded. In each location conductivity measurements were taken to determine the presence of ions. Water samples were taken from the shore at each boat launch and sent to the lab for chemical analysis of total nitrogen, nitrate, total phosphorus, and phosphate levels.

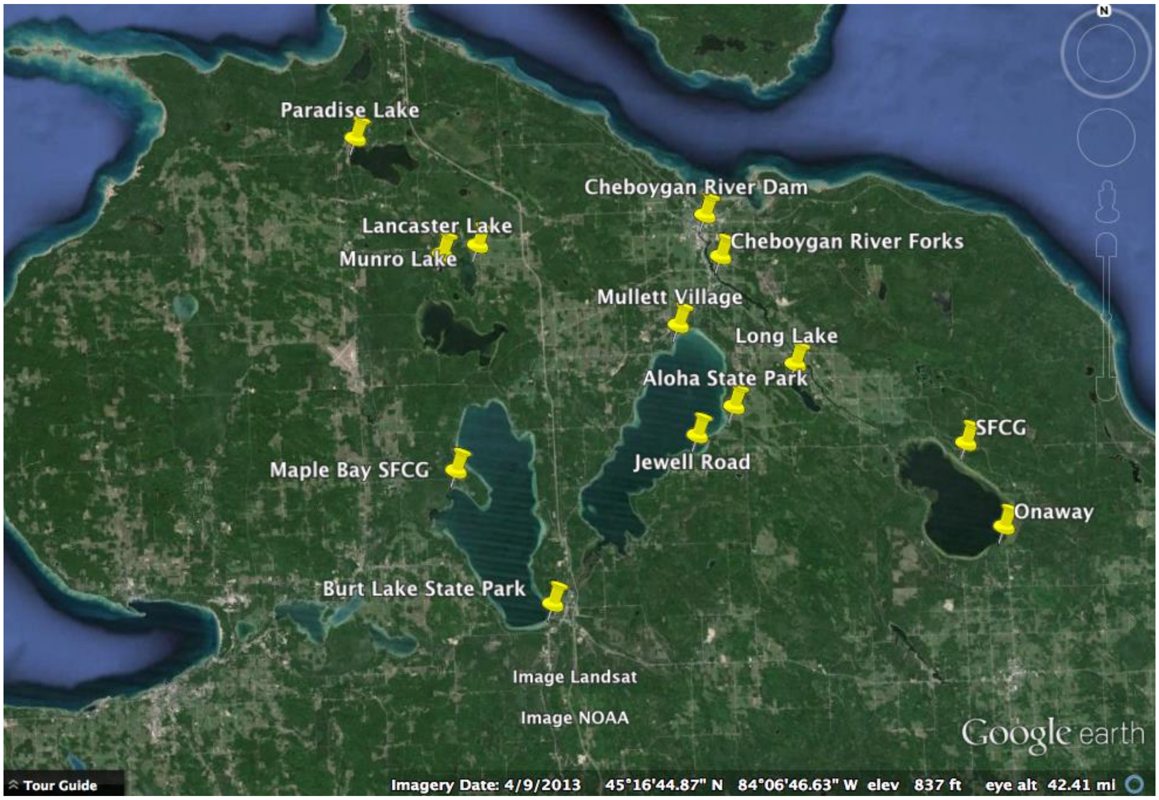

Figure 1: Map of all 13 assessed MDNR-owned boat launches throughout Cheboygan and Emmet County from July 27th to August 3rd, 2013.

Results

The Cheboygan River Dam, Jewell Road (Mullett Lake), Burt Lake State Park, Munro Lake, Maple Bay State Forest Campground (Burt Lake), and Onaway State Park (Black Lake) boat launches received greenbelt scores of zero to four and were determined to have inadequate greenbelts. Each of these locations had 0% or <10% greenbelt length of total shoreline, and insignificant measures of depth. Vertical structure never exceeded ground cover, and density was sparse or none. Species diversity was uniform or consisted of a few species, and typically threatened by invasive spotted knapweed. Generally, emergent vegetation was absent, but present at Munro Lake and Cheboygan River Dam. Onaway, Cheboygan River Dam, and Jewell had riprap or boulders along the shoreline, whereas Burt Lake State Park and Munro did not. Munro and Jewell had >75% turfgrass along the shoreline, whereas the others had only sand or boulders. In general, boat launches with inadequate greenbelts had sparse groundcover, low diversity of vegetation, no emergent vegetation, and boulders rather than vegetation or turfgrass along the shoreline.

Aloha State Park (Mullett Lake), Long Lake, and Mullett Village (Mullett Lake) boat launches received scores of five to nine and were determined to have adequate greenbelts. Long Lake and Mullett Village had greenbelt depths of <10 ft and greenbelt lengths of 25 to 75% and >75% of total shoreline, respectively, whereas Aloha State Park had a greenbelt slightly deeper than 10 ft, but that only accounted for <10% of the total shoreline. Turfgrass consisted of 0% or <10% of the total shoreline, with sparse to medium vegetation density and several species present, often accompanied by spotted knapweed. Emergent vegetation was absent at Long Lake and Mullett Village but present at Aloha State Park. These adequate greenbelts generally had sparse to medium density of groundcover with several species, and no emergent vegetation.

Black Lake State Forest Campground, Paradise Lake, Forks (Cheboygan River), and Lancaster Lake boat launches received scores of 10 to 14 and were determined to have exceptional greenbelts. These boat launches had greenbelt lengths of >75% of total shoreline and 10 to 40 ft of greenbelt depth, with the exception of Paradise Lake which had <10 ft depth. Paradise Lake also differed in that the greenbelt had groundcover only, whereas the other sites had groundcover, understory, and overstory. Species diversity ranged from several species to many species present and was not threatened by spotted knapweed. All exceptional sites, excluding Black Lake State Forest Campground had emergent vegetation. Generally, these exceptional greenbelts included greenbelt lengths of >75% of the shoreline, 10 to 40 ft depth, diverse species and vertical structures, and presence of emergent vegetation.

Launch	Length	Width	Density	Diversity	Emergent	Total
Cheboygan River Dam	0	0	0	0	0	0
Jewell Road, Mullett Lake	0	0	0	0	0	0
Burt Lake State Park, Burt Lake	0	0	0	0	0	0
Munro Lake	0	0	1	1	1	3
Maple Bay SFCG, Burt Lake	1	1	1	1	0	4
Onaway State Park, Black Lake	1	1	1	1	0	4
Aloha State Park, Mullett Lake	1	1	2	2	1	7
Long Lake	3	1	1	2	0	7
Mullett Village, Mullett Lake	4	1	1	2	0	8
State Forest Campground, Black Lake	4	2	2	2	0	10
Paradise Lake	4	1	3	2	1	11
Cheboygan River Forks	4	2	2	3	1	12
Lancaster Lake	4	2	3	3	1	13

Table 1: Numeric values of greenbelt presence in MDNR boat launches in northern Lower Michigan. Total values: 0-4 inadequate, 5-9 adequate, 10-14 exceptional.

Location	PO_4P (µg-P/L)	TP (µg-P/L)	NO_3N (µg-N/L)	TN (µg-N/L)	Conductivity (µS)
Cheboygan River Dam	2.3	7.8	5.0	192	302.6
Cheboygan River Forks	2.0	11.4	1.6	227	301.5
Jewell Road	1.6	3.1	3.3	175	314
Lancaster Lake	1.6	13.2	2.7	500	285.1
Long Lake	0.6	5.5	1.1	238	226.9
Maple Bay State Forest Campground, Burt Lake	1.7	3.8	11.4	227	288.2
Mullett Village, Mullett Lake	1.9	3.2	3.9	143	283.7
Munro Lake	1	9	1.1	584	168.7
Paradise Lake	0.8	9.9	0.8	386	210.2
Onaway State Park, Black Lake	2.6	7.2	5.2	230	298.66
State Forest Campground, Black Lake	2.3	8.3	5.3	246	296.7
Burt Lake State Park, Burt Lake	1.4	6.8	25	250	297.1
Aloha State Park, Mullett Lake	25.9	56.3	5.8	463	352.3

Table 2: Phosphate, nitrate, total phosphorus, total nitrogen, and conductivity data for MDNR boat launches in northern Lower Michigan.

Discussion

In general, the launches discussed are lacking sufficient groundcover, understory, and overstory growth. Sites are dominated by turfgrass, mowed to riprap boundaries or to the shoreline itself. This shoreline turfgrass does not factor into species diversity that is poor in many of the locations. Invasive knapweed is found at many of the sites, decreasing the diversity of the plants in the surrounding area (Huenneke *et al.* 1995). Riprap is used for erosion control in many of the sites, but a dense, diverse, woody and herbaceous greenbelt is a sufficient and preferable erosion control. Greenbelt depth was never greater than 40 ft and was most commonly less than 10 ft. When present, greenbelt length rarely covered the entirety of the shoreline, leaving shorelines vulnerable to chemical leaching. Greater depth, density, and diversity provide more habitat and food sources for native animals and plants. Emergent vegetation serves to suspend sediments entering the system and was absent at numerous locations. Sediment runoff can affect fish cycles, growth, and reproduction (Zimmerman *et al.* 2003). Overall, where greenbelts were present, the greenbelts lacked the necessary depth and diversity necessary to be efficient. Greenbelts are natural growth areas and can easily be established and maintained.

Below are specific sites chosen for discussion as representations of the study: Aloha State Park (Mullett Lake), Paradise Lake, Burt Lake State Park, Jewell Road (Mullett Lake).

Aloha State Park

Visual cues and water chemistry data indicated that the launch at Aloha State Park is especially at risk from outside contamination. Phosphorus and total nitrogen levels were by far the highest of all the sites. Phosphorus levels were elevated so that nitrogen is limiting primary productivity in the region around the boat launch, whereas phosphorus is typically the limiting nutrient for freshwater systems in the region (Schindler 1977). These elevated nutrient levels are probably a result of human input from both the surrounding campsites and the storm drain that empties into the inlet. The excess primary productivity as a result of these nutrients could result in eutrophication of this area. Although the greenbelt at this site received an adequate score of seven, establishing a strong vegetative buffer in this region is paramount because of these elevated nutrient levels. This can be easily achieved through no mow practices from the campground to the shoreline. When maintaining this buffer, herbaceous species should be emphasized, as these are especially efficient at buffering phosphorous (Kim *et al.* 2001); however, as nitrate levels are highly elevated, the presence of woody species is critical as well. Additionally, maintaining a strong greenbelt at a well-visited site like Aloha State Park is especially important as a healthy greenbelt demonstrates proper shoreline management techniques to the general public.

Paradise Lake

Previous surveys conducted by the Tip of the Mitt identified Paradise Lake MDNR boat launch as a problem site lacking a greenbelt and effective maintenance practices. Restoration work has been done by the MDNR to improve the green belt and health of the launch. Since June 2013, a boat washing station has been added to the site. The beginnings of a greenbelt were established along the shoreline previously dominated by turfgrass. Although lacking slightly in width and diversity, the Paradise Lake site generally demonstrated an exceptional greenbelt. Current groundcover is being allowed to develop into understory and overstory herbaceous and woody growth. Dense, diverse vegetation includes emergent species. Zebra mussels and resultant chlodophera were found, but invasive knapweed was not. With an increased greenbelt depth and width and a no mow policy from shore to road, this site could present an effective and exemplary greenbelt.

Burt Lake State Park

In our assessment of the Burt Lake State Park boat launch, the area had recently been clear-cut, and now consists only of a large expanse of sand and dirt. This site received a score of zero for a total lack of any greenbelt, indicating that there is currently no pollution buffer or erosion control in the area around the boat launch. Because we noticed a lot of organic material along the shore from the clearing of vegetation, you might expect to see nutrient spikes, causing algal blooms and allowing for cladophora to dominate the shorelines.

Jewell Road

This site received an overall score of zero. The primary species of vegetation is turfgrass. The species diversity increases roughly one meter from the shoreline, but this area is still being maintained and shows little overstory growth. Riprap covers approximately five to ten percent of the shoreline, directly on either side of the launch itself. If no mow practices were utilized, this small area of riprap would not be necessary as a form of erosion control, as a successful greenbelt is more effective than riprap (Fongers and Fulcher 2002). No mow practices should be utilized at this site, as the area that is being maintained serves no recreational purpose.

Recommendations

One of the simplest strategies for improving the boat launch greenbelts involves a “no mow” policy. Repeated mowing along the shoreline is not conducive to a healthy riparian zone. Allowing the grass to grow will facilitate natural succession, initially leading to denser and more diverse groundcover. With time, a woody understory and overstory will begin to develop. Previous studies have demonstrated that such a greenbelt can help to drastically improve water quality (Osborne and Kovacic 2006). Furthermore, forested overstory is more successful at sequestering nitrate, whereas grassy, herbaceous groundcover and understory are more effective in sequestering dissolved phosphorus (Osborne and Kovacic 1993; Fennessy and Cronk 1997). In order to maximize the filtering and removal of incoming pollutants, the greenbelt should be allowed to grow to the road, ensuring that the greenbelt’s depth is maximized. Increased greenbelt density offers a larger root network to stabilize erosion and buffer pollution (Shields *et al.* 1995). Because we recognize that areas with turfgrass are needed for recreational purposes such as ingress of kayaks or canoes, a small area on the property, not directly adjacent to the boat launch, may be left unmowed.

In addition to this passive regrowth of greenbelts, which is a long-term goal, the active planting of native grass, wild flowers, and various herbaceous and woody species can greatly expedite greenbelt growth. Invasive spotted knapweed is associated with reductions in biodiversity and wildlife as well as increased erosion. Hand pulling in small areas can be an effective method of control (Sheley *et al.* 1998). Allowing for increased density and diversity of the greenbelt also creates a greater wildlife habitat, moderates water temperatures, and contributes to the input of allochthonous organic matter that drives much of the life in aquatic systems.

One example of long-term success from such a greenbelt restoration project is currently in effect in the rivers of Austin, Texas, facilitated by their Watershed Protection Department. After conducting similar assessments, management strategies were developed and set into place. Plans included allowing a no-mow grow zone of 25 ft on either side of the river, allowing for passive regrowth and occasionally community and volunteer-based active planting, coordinating trash and invasive plant removal, and installation of educational and boundary signs around the grow zones. If similar concrete actions could be taken with the MDNR boat launches in Northern Michigan, results could be just as exemplary.

This is not the only way to ensure cleaner runoff into the lake from boat launches and developed areas. Storm drains are also an effective measure of water control, riprap can be used to control erosion, and boat-washing stations help keep invasive species out. However, a healthy greenbelt is an inexpensive, low-maintenance, and natural method of preventing hazardous runoff into aquatic systems. Current expense for grounds keeping would be reduced and conserved if resources could be used for other conservation efforts. Greenbelts are self-sustaining and need little to no maintenance.

Greenbelt assessment would benefit from more in-depth aquatic chemical analyses. A stronger comparison between natural greenbelts and boat launches is needed, as well as comparisons with the pelagic zone of the lake. Additionally, an expanded scoring system including emergent vegetation, species density, and species diversity would create a better picture of overall greenbelt health. These additional parameters are important for erosion control, greenbelt sustainability, and greenbelt functionality. Finally, boundary and educational signage would be useful in informing the public on the presence and necessity of greenbelts.

We recommend a pilot project between the MDNR and the Tip of the Mitt watershed council to establish and maintain optimal greenbelts. Several sites could be selected and greenbelts developed as a trial. Funding is not necessary for this pilot project if a no-mow approach is taken. Ideally, all MDNR boat launches will exemplify proper greenbelt establishment and maintenance. Through MDNR examples and Tip of the Mitt educational programs, the public can be educated and our lakes and rivers protected from hazardous erosion, runoff, and pollutants.

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Assessment Rubric

Tip of the Mitt Watershed Council-Shoreline Greenbelt Survey

Note: Surveying should be done from the Ordinary High Water Mark (OHWM)

Date : Lake:

TOMWC Parcel ID #: Parcel ID #:

Check one: Developed ☐ Undeveloped ☐

Greenbelt length (of total shoreline):

☐ None (0%) ☐ <10% ☐ 10-25% ☐ 25-75% ☐ >75%

Greenbelt average depth: ☐ <10 ft. ☐ 10-40 ft. ☐ >40 ft.

Max.__________ft. Min.__________ft.

Turf (percent of total shoreline):

☐ None (0%) ☐ <10% ☐ 10-25% ☐ 25-75% ☐ >75%

Vertical Structure (check all that apply):

☐ Ground cover ☐ Understory ☐ Overstory

Density (check one):

☐ Sparse ☐ Medium ☐ Dense

Species diversity (check one):

☐ Uniform ☐ Several spp. ☐ Many spp.

Emergent vegetation: ☐ Present ☐ Absent

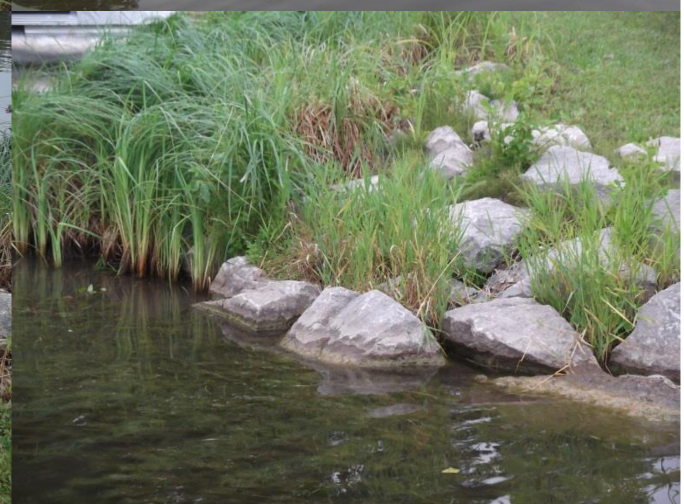
Structures (check all that apply):

☐ Sea wall ☐ Biotechnical ☐ XXL Riprap ☐ Other

Photographs

Aloha State Park – Burt Lake

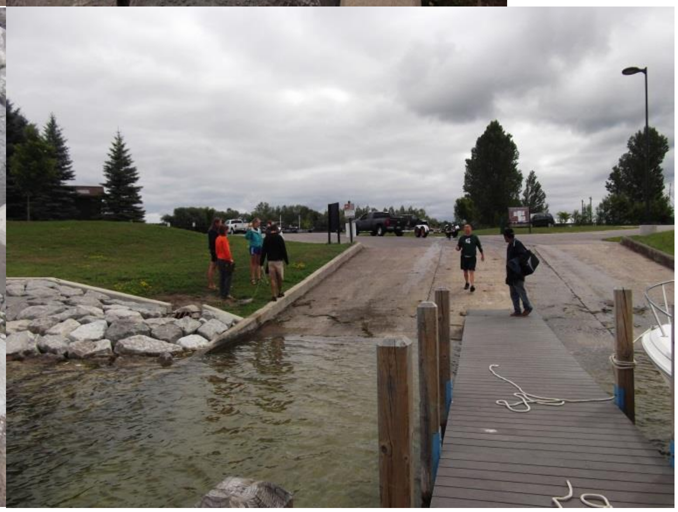


Burt Lake SFCG – Burt Lake



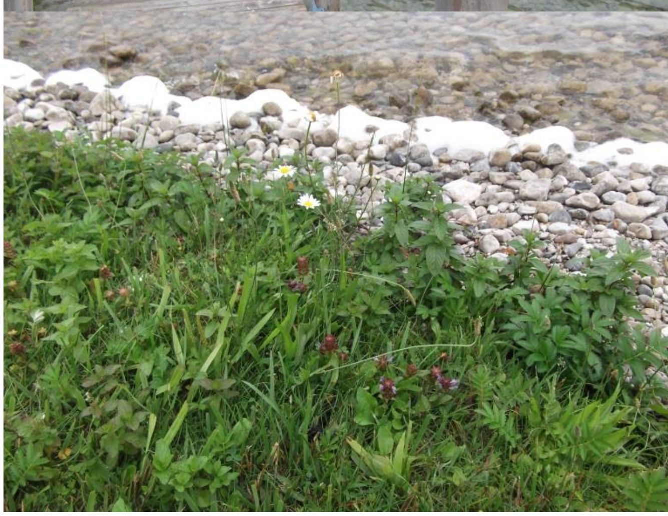

Cheboygan River Dam



Forks – Cheboygan River

Jewell Road - Mullett Lake






Lancaster Lake




Long Lake




Maple Bay SFCG – Burt Lake



Mullett Village – Mullet Lake

Munro Lake

Onaway – Black Lake

Paradise Lake

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