Science Brief:
Impacts of Argo Dam and Benefits for its Removal on the Huron River, Ann Arbor, Michigan

June 9, 2009

rev. June 24, 2009

Prepared by the
Huron River Watershed Council

Huron River Watershed Council

Protecting the river since 1965

1100 N. Main Street Suite 210
Ann Arbor, MI 48104
(734) 769-5123
www.hrwc.org

Dam removal is the culmination of a history of decision points.

The issue of dam removal is not as new and radical as some today might suspect. The roots of the current controversy surrounding the removal of dams extend deep into our past, a past speckled with battles waged by local townsfolk to stop the construction of a particular dam. Over time, our perspectives have changed, as dams have become a familiar part of our landscape. Now, it seems, it is the dam and not the free flowing river that people remember and to which they attach sentimental value. In the end any battle to remove a dam today or in the future is just a continuation of a discussion initiated when the dam was first proposed. We are but one discussion in a long series of decision points regarding the management of the rivers. What decision we make now, through carefully balancing today's issues, will directly affect the battles or need for battles in the future.

--Laura Wildman, Ecological Restoration Engineer, American Rivers

Overview of Ecological Impacts of Dams

Dams serve a wide range of purposes such as hydroelectric power, water supply and irrigation, recreation, shipping, and flood control, and have become integral to the identity of some communities. Yet, dams impact rivers by altering chemical, physical and biological processes (Figure 1). Dams block free flowing river systems and impede a river's flushing function that enables transport of sediment and nutrients downstream; instead sediment builds up behind the dam. Dams fragment rivers and block movement of fish, mussels and other species. Dams have contributed to or caused many species to become threatened, endangered or extinct, in part, because they are located on prime spawning habitat. Many fish species require high gradient, well-oxygenated water and gravelly streambeds for spawning, which are the same parameters that provide a favorable dam site. Dams alter water temperatures, dissolved oxygen levels, turbidity and salinity both upstream and downstream of the structure. Essentially, dams prevent a river and its tributaries from their most basic function – to flow.

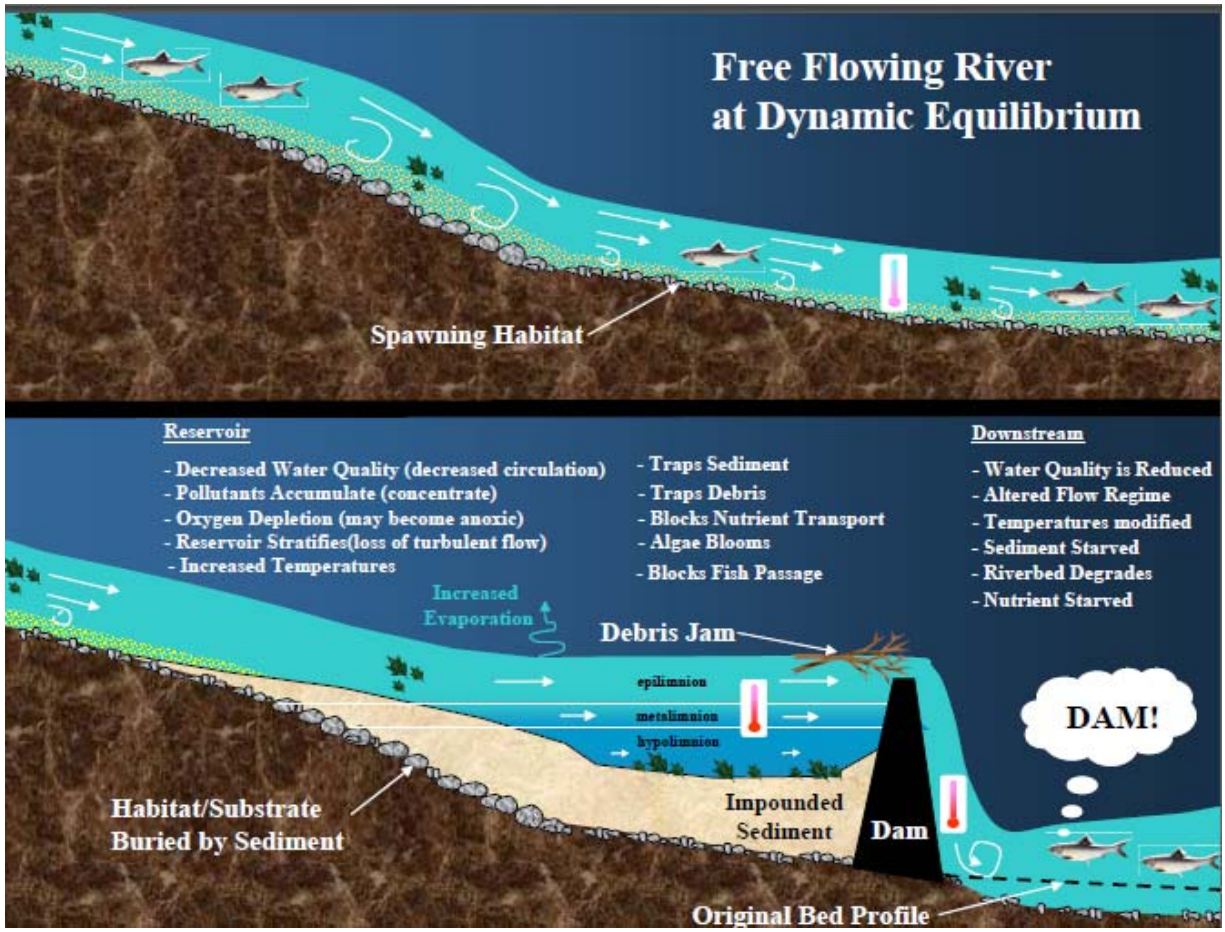

Figure 1. Impacts of dams on rivers. *graphic: Laura Wildman, American Rivers*

Ecological Impacts of Argo Dam and Benefits with Argo Dam Removal

The Huron River Watershed Council has met and consulted with fisheries biologists and aquatic ecologists to review the current national, state, and local data on the ecological benefits of dam removal (Jeff Braunscheidel, Paul Seelbach, Sharon Hanshue, and Chris Freiburger, MDNR Fisheries Division; Catherine Riseng, The University of Michigan, School of Natural Resources and Environment; Bryan Burroughs, Trout Unlimited; Steve Blumer and Jeff Schaeffer, USGS; Paul Steen, HRWC; Dan Hayes, Michigan State University; and Tom Edsall, retired fisheries biologist).

Dam removal literature and studies show tremendous benefits to river restoration. For a comprehensive list of references on the impacts of dams and dam removals in the peer-reviewed literature, see Burroughs, B. A. Effects of the Stronach Dam Removal on Fluvial Geomorphology in the Pine River, Manistee County, Michigan; Chapter One of a 2007 Dissertation entitled: Effects of Dam Removal on Fluvial Geomorphology and Fish. Department of Fisheries and Wildlife, Michigan State University; East Lansing.

Specifically for Argo Pond data are available that point to the benefits of Argo Dam removal, which are consistent with the findings in the broader literature review. The two strongest cases for the ecological benefit of Argo Dam removal can be made from temperature and flow data.

Temperature

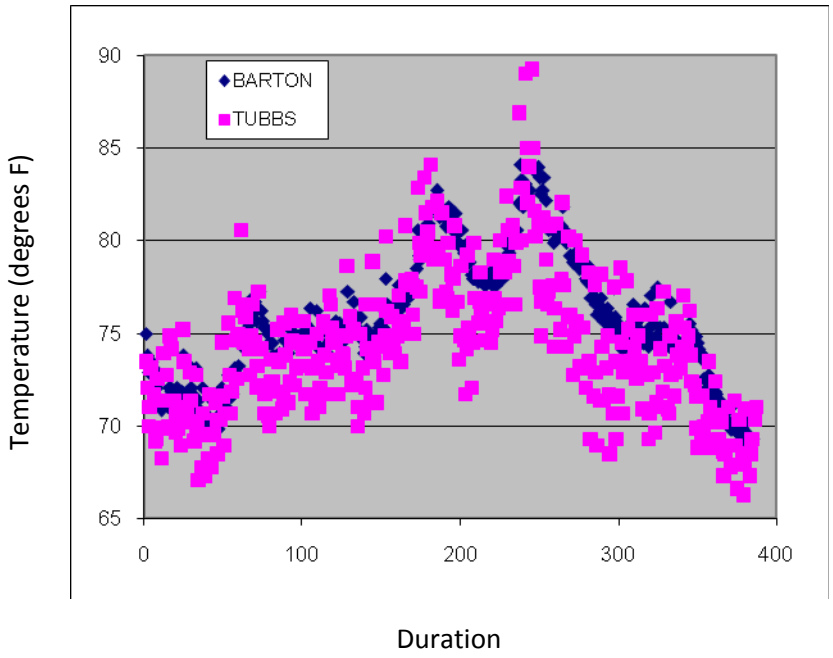

Figure 2. Trout Unlimited (Ann Arbor Area Chapter) paired readings of water temperatures above and below Barton Dam, June-September, 2006 (n = 387)

Since temperature data from Argo Pond is unavailable, the temperature data for Barton Pond and upstream serve as proxy to convey how impoundments behind dams warm river water. Figure 2 shows the warming of the Huron River in Barton Pond and the reduction in annual temperature variance (a reduction in the lower temperatures at night). Water leaving Barton Pond via the turbines or by spill over the dam is warmer than the water entering the impoundment from the river at Tubbs Rd. In fact, 76% of the measured temperatures in the river at Tubbs Rd are less than the temperatures of the water leaving Barton Pond. Argo Pond has a similar effect: slow-moving water with a large surface area absorbs solar radiation resulting in increase water temperatures and evaporation (C. A. Riseng. June 2009. Personal communication). So Argo Pond is receiving warmer water from Barton Pond and Argo Pond further warms the river due to the same dynamics caused by Argo Dam.

Another effect of the impoundment is that the resulting temperature is more constant and warmer. Impoundments not only raise the mean and the maximum temperatures, but they also limit the natural cooling that goes on each night as shown in Figure 2. This dynamic is clear in the data above and limits the fish and other biology in the river. Figure 3 provides another view of the Trout Unlimited data. The box and whiskers plots highlight the wider range of temperature in the river at Tubbs Rd compared to the water downstream of Barton Pond, and the cooler mean temperature in the free flowing river at Tubbs compared to the warmer waters just downstream of Barton Pond.

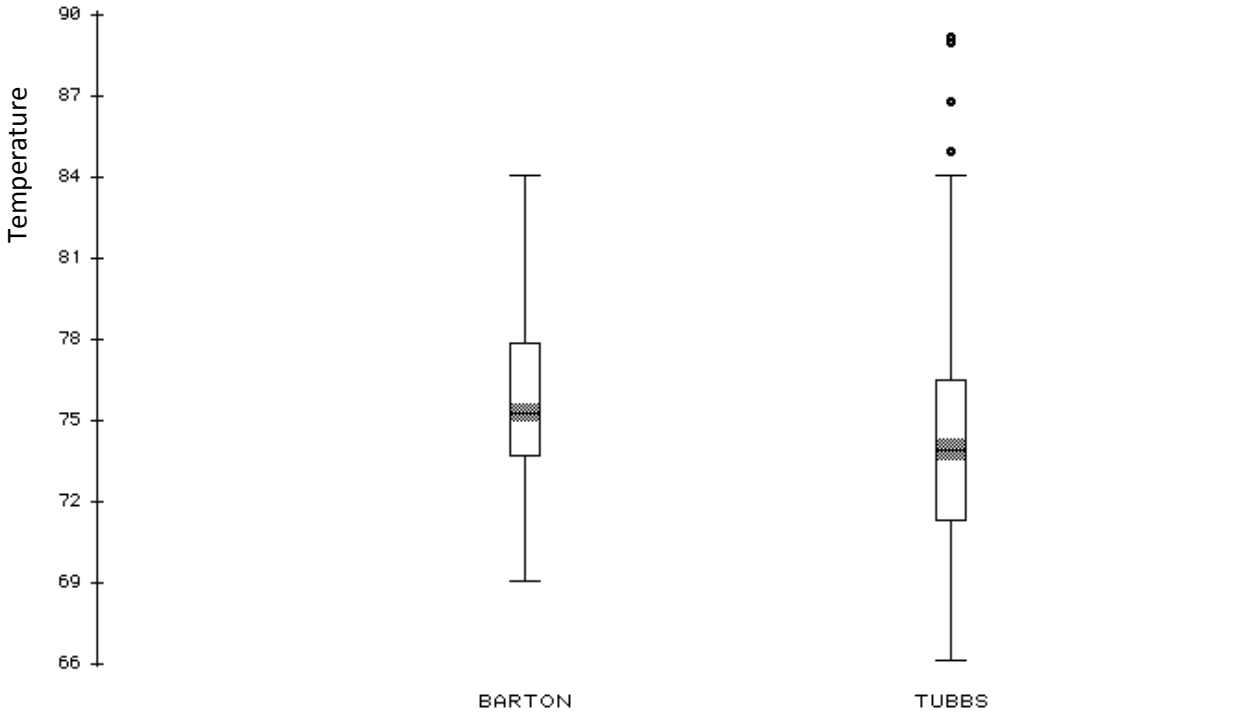

Figure 3. Box and whiskers plot showing temperatures downstream of Barton Pond and at Tubbs Road

In Table 1 below, the difference in the mean temperatures of the two study sites is shown to be 1.5 degrees F during the months of June through September. The difference in the mean temperatures of the two sites shows is even greater during August alone when the water in Barton Pond is more than 2 degrees warmer than the Huron River at Tubbs Road.

August					
Percentile	16				
Variable	Total Cases	Mean	Median	Lower ith %tile	Upper ith %tile
BARTON	124	77.1	76.0	74.3	80.9
TUBBS	124	74.9	74.3	70.8	78.8
	Diff	**2.2**	**1.7**		
June-Sept					
Percentile	16				
Variable	Total Cases	Mean	Median	Lower ith %tile	Upper ith %tile
BARTON	387	75.7	75.3	71.9	79.9
TUBBS	387	74.2	73.9	70.4	78.0
	Diff	**1.5**	**1.4**		

Table 1. Difference of mean temperatures based on data from Trout Unlimited
Analysis by C. A. Riseng, Ph.D., Assistant Research Scientist, University of Michigan

Flow

Removing Argo Dam will restore a more natural flow regime to the Huron River for a 6-mile stretch. The U.S. Geological Survey, which maintains a stream gage downstream of the dam, cites Argo Dam as one of two dams in Michigan that most dramatically alters the natural stream hydrology of a river (S. P. Blumer, USGS. 2003. Personal communication). Figure 4 shows a sample hydrograph from USGS gage #4174500 with sample river discharge in the Huron River at Wall Street, just downstream of Argo Dam. This hydrograph shows erratic river flow, as indicated by the steep peaks and valleys, and is typical of the gage data recorded at this site regardless of weather and precipitation.

The USGS gage station at Hamburg on the mainstem of the Huron River, upstream of Ann Arbor, serves as a comparison in Figure 5. Paul Seelbach, MDNR and University of Michigan fisheries biologist, has stated that flow fluctuation is the "Number 1 variable in the river that we care about" as an indicator for fisheries health.

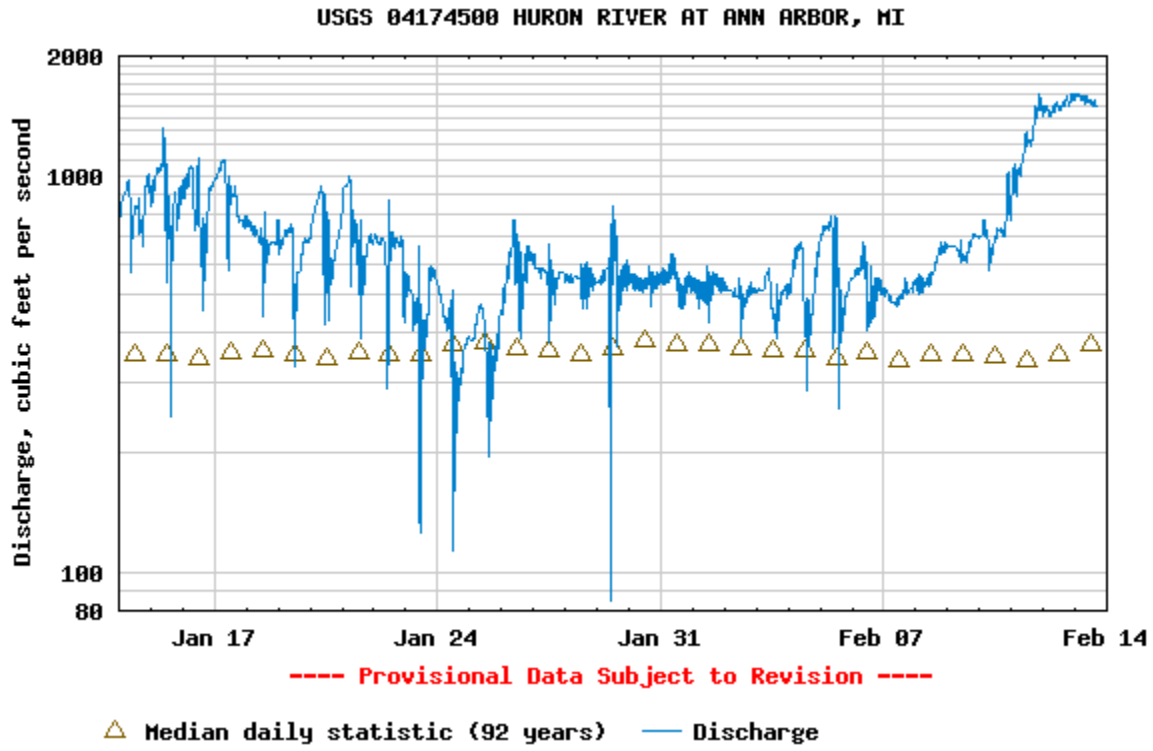

Figure 4: Hydrograph of the Huron River downstream of Argo Dam at Wall Street shows erratic stream discharge (flow)

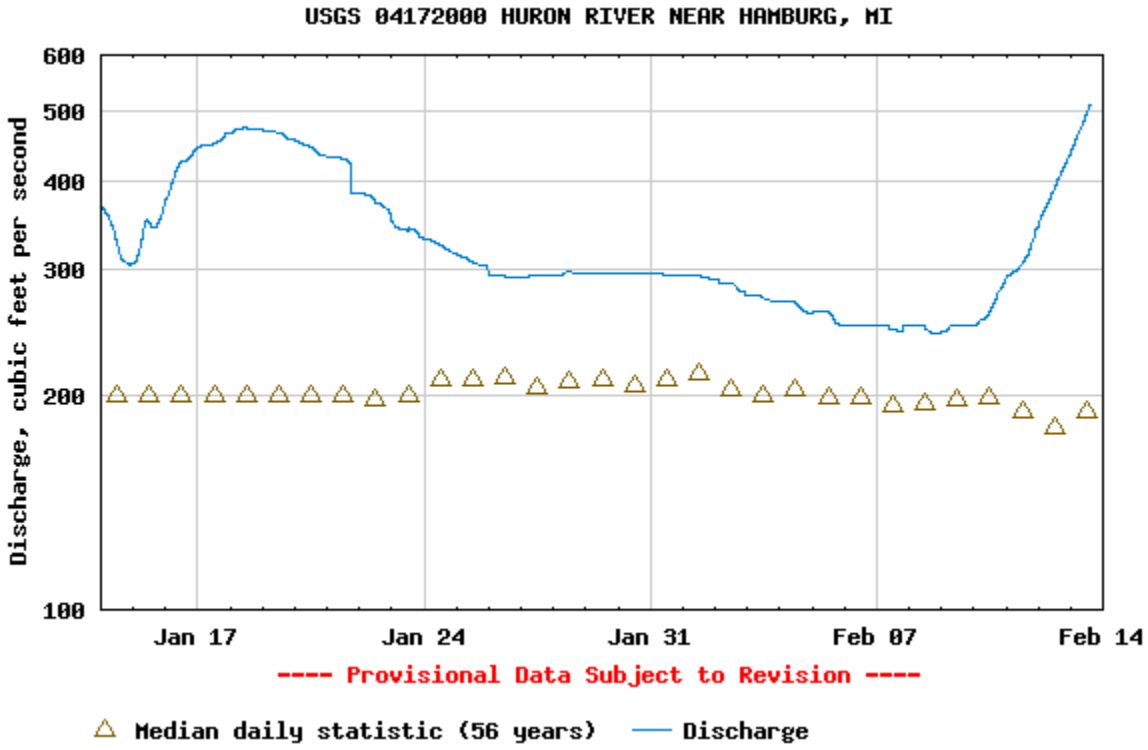

Figure 5: Hydrograph of the Huron River near Hamburg shows more natural stream flow

Floodplains

A free flowing river has both longitudinal and lateral connectivity and provides an important role of interfacing with groundwater sources that supply water to the river. During periods of high flow, the streamside network of floodplains and wetlands provides storage as the river expands laterally. Periodic flooding spreads seeds and return nutrients to the floodplains. This flooding is a part of the natural system. Dams can prevent this process since they constrict the river and impact connectivity at the site of the dam, upstream and downstream (Poff, N. L., J. D. Allan, M. B. Bain, J. R. Karr, K. L. Prestegaard, B. D. Richter, R. E. Sparks and J. C. Stromberg. The Natural Flow Regime. *BioScience*, Vol. 47, No. 11 (Dec., 1997), pp. 769-784.)

Argo Dam removal would result in 23 acres that will serve as floodplain and filter pollutants in runoff as impounded waters recede (Barr Engineering. 2003. Letter to HRWC).

Fisheries

Argo Pond does not support a high quality fishery. The Michigan Department of Natural Resources conducted fish stocking in Argo Pond as recently as 1991. Stocked fish species included channel catfish, smallmouth bass and walleye. The current fish community is fairly homogenous and dominated by bluegill and rock bass. In 2001, the Fisheries Division recommended discontinuation of fish stocking in Argo Pond due to declining quality of the Pond, and declining recreational fishing use.

The removal of Argo Dam would increase the available habitat for many fish species throughout the Ann Arbor area, including sport fisheries both upstream and downstream. Habitat would be characterized as swift-flowing rapids and riffles with some deep pools, and a riverbed of gravel, cobble and some boulders. The fish community would become more diverse and dominated by riverine fish such as smallmouth bass that were once dominant. For example, MDNR fisheries surveys record a healthy smallmouth bass population on a downstream stretch of the Huron River in Ypsilanti yet only a few largemouth bass and primarily bluegill and rock bass in Argo Pond (MDNR, Fisheries Division. 2007. Status & Trends Report for the Huron River at Ypsilanti; Species Evaluation, Argo Pond.) Further, the fish community in the Huron River at Ypsilanti has 33% more species and 15 times as many fish as the dammed impoundment at Argo. These surveys suggest even a short stretch of free flowing river is better than an impoundment for the fish community. In addition, a riverine reach with increased gradient would provide spawning habitat for walleye. Finally, a free-flowing river is less conducive to aquatic invasions, such as the zebra mussel that currently lives in Argo Pond (Johnson, P. TJ., J. D. Olden, and M. J. Vander Zanden. 2008. Dam invaders: impoundments facilitate biological invasions into freshwaters. Frontiers in Ecology and the Environment: Vol. 6, No. 7, pp. 357-363).

Once the Huron River is reconnected between Barton Dam and Geddes Dam, the aquatic community in general would increase in habitat diversity as water temperatures lower, high gradient stretches reemerge, and water quality increases along the 6 miles.

The MDNR is supportive of Argo Dam removal and is writing a letter to the City to that effect and has offered to provide comments at the City Council meeting. *See the MDNR's presentation to the HRIMP committee from 2006 for background.*

Mussels

Mussels are the most endangered group of freshwater organisms in North America (Williams, J. D., M. L. Warren, Jr., K. S. Cummings, J. L. Harris, and R. J. Neves. Conservation Status of Freshwater Mussels of the United States and Canada. *Fisheries,* Vol. 18, No. 9. pp 6-22.) During a 1930s survey of the Huron River downstream of Barton Dam, 13 species were found in this vicinity, alive and in abundant numbers (van der Schalie 1938). During the 1969 survey, 10 species were taken of which only six species were alive. Of these six, only two species were present in any appreciable number (van der Schalie 1970). Van der Schalie noted the lack of young specimens and concluded that the ecological changes from a flowing river to an impoundment no longer allowed for the successful completion of the life cycle of riverine species. Hay-Chmielewski et al noted that it is extremely unlikely that riverine mussel populations can reestablish themselves along the river while dams impound the water due to their sessile nature (Huron River Assessment, Fisheries Special Report No. 16. Michigan Department of Natural Resources, Fisheries Division. April 1995. Lansing, Michigan).

Argo Dam removal will increase habitat for rare freshwater mussels. A high gradient reach with good water quality would encourage return of native mussels.

Summary

Removing Argo Dam would replace an ecologically poor pond with an ecologically diverse stretch of a free flowing riverine environment, rare itself in Michigan due to the frequency of dams. Reconnecting the river would eliminate the eutrophic (excessive nutrification) conditions of Argo Pond in favor of a free flowing, well-oxygenated river. The removal of Argo Dam would improve water quality by increasing flow and dissolved oxygen content and decreasing water temperature. Excessive aquatic plant growth would not occur because increased water velocity would prevent undesirable, invasive plants from becoming established. Moreover, nutrients and sediments that lead to excessive aquatic plant growth in the impoundment would be transported through the river system as larger particles that are biologically unavailable to plants. Finally, a free flowing river is less conducive to aquatic invasions from aggressive, non-native organisms such as the zebra mussel.