US Army Corps
of Engineers
Detroit District

FEASIBILITY STUDY FOR THE BOARDMAN RIVER

GRAND TRAVERSE COUNTY, MICHIGAN

ENVIRONMENTAL ASSESSMENT

GREAT LAKES FISHERIES AND ECOSYSTEM RESTORATION PROGRAM

June 2014

US Army Engineer District, Detroit
477 Michigan Avenue
Detroit, MI 48226-2523

Summary

The U.S. Army Corps of Engineers (USACE), Detroit District, in coordination with the non-federal sponsor, Grand Traverse County, prepared this Environmental Assessment (EA) to evaluate the potential restoration of habitat for coldwater aquatic species by removing or modifying three dams on the Boardman River. The existing dams impair the quality and reduce the quantity of rare coldwater habitat by fragmenting, degrading, and thermally disrupting the Boardman River system. In addition, the Union Street Dam blocks passage of the remnant lake sturgeon populations from moving upstream to spawn. Restoring and providing access to 26 miles of main stem and 176 total river miles, while restoring the lower 8 miles of warmwater impoundments to coldwater stream by removing or modifying the Union Street, Sabin, and Boardman Dams would provide ecological benefits to the target species of brook trout, dace, and other coldwater fish.

This project was initiated as a Section 206, Ecosystem Restoration Project under the USACE Continuing Authorities Program (CAP). As a result of funding constraints within the CAP, as well as the project's strong emphasis on fisheries, USACE and project sponsor determined that the project falls under the Section 506 authority (Great Lakes Fishery and Ecosystem Restoration or GLFER) of the Water Resources Development Act of 2000. A Preliminary Restoration Plan was subsequently prepared under that authority in fiscal years 2005 and 2006, resulting in a determination that sufficient Federal interest exists to recommend that the study continue into the Feasibility Phase.

Proposed Action

The Proposed Action for this project involves the removal of the Boardman Dam and the Sabin Dam, and modification of the Union Street Dam. The action would restore the natural aquatic ecosystem as well as provide internal connectivity to Grand Traverse Bay of Lake Michigan. Removing Boardman and Sabin Dams and modification of Union Street Dam provides connection of the upper Boardman River with Lake Michigan for a variety of fish species. The removal of Boardman and Sabin Dams would eliminate fish passage barriers, while modifications to the existing Union Street Dam would provide downstream passage of all fish species and trap-and-transfer operations would move lake sturgeon upstream. The function of the existing fish ladder and fish weir would be maintained. Restoration components of the Proposed Action would reconnect and restore habitat within the Boardman River system, a Great Lakes tributary, allowing movement of woody debris and sediment through the river system, eliminating thermal disruption, and restoring the natural balance between coldwater and coolwater species.

Purpose and Need

This EA examines the potential socioeconomic and environmental impacts of the reestablishment of Great Lakes tributary habitat for fish by restoring the internal connectivity and coldwater characteristics of the Boardman River and potentially increasing the diversity of species moving between the Great Lakes and the river. The EA evaluates the impacts of the

potential modification or removal of the three dams (Boardman Dam, Sabin Dam, and Union Street Dam). Restoration of habitat has been identified as a high priority for the entire Great Lakes Basin through the support plan for the GLFER program.[1] The purpose of the Proposed Action is to reestablish the coldwater aquatic ecosystem of the river, which has been severely degraded by the increased water temperatures of the existing impoundments. The need for the project stems from lack of suitable habitat for coldwater fish species within the Boardman River between the upstream end of the Boardman Dam impoundment and West Grand Traverse Bay of Lake Michigan.

The project objectives include reconnecting and restoring the Boardman River habitat, a tributary to the Great Lakes, allowing unimpeded movement of woody debris and sediment through the river system, negating thermal disruption, and restoring the natural balance between coldwater and coolwater species. Expected results include enhanced populations, diversity, and movement of fish species between the Boardman River system and Grand Traverse Bay of Lake Michigan. These project objectives and expected outcomes constitute a high basin-wide priority, as indicated in the GLFER support plan.

Alternatives

A variety of alternatives were considered including all combinations of no action, dam removal and dam modification at each of the three dams (see Sections 2.2 of the EA). The proposed project alternatives that were carried into the final analysis include the following:

1. **No action –** This alternative provides no benefits to brook trout, dace, sturgeon, or other coldwater fish species and is included for baseline reference purposes.
5. **Modify the Union Street Dam and Remove the Sabin and Boardman Dams –** This alternative is the recommended alternative. This alternative provides some habitat improvements for all coldwater species including brook trout, sturgeon, and dace. It opens up new habitat to the sturgeon and eliminates the negative impacts caused by the Sabin and Boardman Dams.
6. **Remove Sabin Dam** – This alternative provides habitat improvements for coldwater species including brook trout and dace. It removes Sabin Dam and allows a free-flowing river to be restored from the Boardman Dam to Boardman Lake including the draining of Sabin Pond.

[1] In 2003, in accordance with Title 42 of the United States Code Section 1962d–22, a GLFER support plan was developed in cooperation with State, provincial, tribal, international, and regional organizations and Federal agencies in the United States and Canada that have the responsibilities or programs related to the management and/or protection of the Great Lakes fishery and ecosystem or research on these topics. The support plan outlines the opportunities and priorities for Great Lakes fishery and ecosystem restoration projects.

Summary of Environmental Consequences and Mitigation Measures

The EA contains an evaluation of the existing conditions and environmental consequences of implementing the Action Alternatives and the No Action Alternative, as required by the National Environmental Policy Act (NEPA). Impacts resulting from the Action Alternatives could occur to the following: land use, geology, soils, water resources, the coastal zone, natural and biological resources, cultural resources, noise, visual and aesthetic resources, traffic and transportation, utilities and infrastructure, hazardous materials, public services, and socioeconomics and environmental justice.

The potential cumulative effects to the environment were evaluated by reviewing other recent, current, and foreseeable projects in the vicinity of the project area. NEPA requires that the cumulative effects to the environment be evaluated by reviewing projects that have recently been conducted, are underway, or may be conducted in the foreseeable future. An ongoing project informing the development and outcomes of this study is the removal of the former Brown Bridge Dam.

The Boardman River Dams Committee (BRDC) was established in 2005 by Traverse City and Grand Traverse County to "assess the environmental, economical [sic] and social benefits and detriments of retaining, modifying and removing the Boardman River dams" (BRDC 2010). The BRDC completed an engineering feasibility study in 2009, recommending the removal of the Sabin, Boardman, and Brown Bridge Dams and modification of the Union Street Dam to enhance fish passage. In September 2011, the BRDC announced that the Michigan Department of Environmental Quality had approved and issued permits for interim drawdown of the impoundments at the Brown Bridge and Sabin Dams. This drawdown is being undertaken in advance of actions to remove the dams. In November 2011, the BRDC decided to remove the Brown Bridge Dam with local support. Work at the project site commenced in July 2012, the drawdown was planned and approved at a maximum rate of 12-inches per day through the use of a temporary dewatering structure (TDS). On October 6, 2012, during the drawdown process, an abrupt release of water occurred in the area of the TDS which caused damage to approximately 50 riverfront properties. The project team immediately worked with property owners to assist with damage mitigation. Following clean up, DEQ issued a work plan to the contractor and work resumed the week of October 29. Dam removal was completed by late December 2012. Follow up grading and vegetation work occurred during the spring of 2013.

The No Action Alternative would not cause a change to the current conditions, but the future without project conditions would gradually change with the passage of time.

Table 1 summarizes the adverse impacts of the Action Alternatives. Identified impacts were determined to not be significant.

Table 1: Summary of Environmental Impacts and Minimization/Avoidance Measures for the Action Alternatives

Impact Category	1. No Action Alternative Degree of Impact			5. Modify Union Street Dam and Remove Boardman and Sabin Dam Alternative Degree of Impact			6. Remove Sabin Dam Alternative Degree of Impact			
	Significant	**Insignificant**	**No Impact**	**Significant**	**Insignificant**	**No Impact**	**Significant**	**Insignificant**	**No Impact**	**Summary of Impacts and Activities to Avoid or Minimize Impacts**
Resources Eliminated From Further Consideration										
Coastal Zone			X			X			X	No significant direct effects on the coastal zone are expected to result from construction or operation of the project. Erosion and turbidity controls would be used during construction until vegetation is established to provide natural erosion control on the drawn down impoundments.
Air Quality			X			X			X	Air quality effects associated with this project would arise from emissions of construction equipment. All equipment would be required to meet emission standards and emissions are expected to be minor. Construction of the proposed project would be short term. Thus, the proposed project would be exempted as de minimis and meet the Conformity Requirements under Section 176(c) of the Clean Air Act, as amended, and Title 40 of the Code of Federal Regulations Section 93.153.
Noise			X			X			X	Although temporary/transient noises occur in the project area (e.g., from vehicles or boats), no notable sources of noise pollution are known to be present. This project would not have significant adverse noise effects. Temporary and minor noise effects would occur during construction. All motorized construction equipment would be required to have an approved noise reduction system to minimize any potential noise impacts. Neither of the Action Alternatives would result in direct impacts to noise resources within the project area.
Climate			X			X			X	Neither of the Action Alternatives would have significant effects on climate.
Geology			X			X			X	No significant direct effects on geology are expected to result from construction or operation of the project as the drawdown of the impoundments would not require significant excavation below pre-dam alluvium within the project area. Additionally, geologic/natural hazards are not expected within the project area that would impact the proposed action.
Public Services			X			X			X	The Action Alternatives could result in temporary impacts on schools and hospitals due to temporary road closures and/or reduced capacity for a short time. Emergency vehicle response times may be increased as a result of the bridge closure; however, significant impacts to public service resources, such as police, fire protection, or local hospitals, within the project area are not expected.

Table 1: Summary of Environmental Impacts and Minimization/Avoidance Measures for the Action Alternatives

Impact Category	1. No Action Alternative Degree of Impact			5. Modify Union Street Dam and Remove Boardman and Sabin Dam Alternative Degree of Impact			6. Remove Sabin Dam Alternative Degree of Impact			
	Significant	**Insignificant**	**No Impact**	**Significant**	**Insignificant**	**No Impact**	**Significant**	**Insignificant**	**No Impact**	**Summary of Impacts and Activities to Avoid or Minimize Impacts**
Environmental Justice			X			X			X	The Action Alternatives would have no direct impacts on environmental justice as the implementation of these alternatives would not impact specific socioeconomic groups. Additionally, the project area does not have low income or minority populations, therefore there is not potential for adverse effects under Environmental Justice. Impacts to residential properties would be due to the change in the existing lakefront property turning into riverfront or floodplain bordered property.
Resources Evaluated in Environmental Assessment										
Land Use			X		X			X		Implementing the Action Alternatives would not result in direct impacts to a majority of the land use associated with the Boardman River. Improvements to stream habitat and reconnection of the river to the Great Lakes, in addition to increased wetland habitat and riparian upland areas post-drawdown, would minimally alter the land use within the project area.
Water Resources			X		X			X		Surface water resources and water quality would be impacted by the removal of the Sabin and Boardman Dams and draining of the impoundments. The thermal effects of the impoundments would be eliminated and coldwater species such as brook trout, dace, and sturgeon would thrive. Warmwater fish habitat and associated recreational opportunities within the impoundments would be lost as a result of dam removal. These impacts would not be significant.
Natural and Biological Resources			X		X			X		Implementation of the alternatives would decrease water levels in the ponds; consequently, both wetland acreage and type would change within the former impoundments through an increase in wetland acreage and addition of emergent habitat. These changes would impact terrestrial wildlife and aquatic habitats within the project area. A change in vegetation, as well as opportunities for invasive/nuisance species introduction is possible; however, measures would be taken to minimize the potential for invasive/nuisance species introduction and/or spread. These impacts would not be significant.
Cultural Resources			X		X			X		Construction and ground disturbance for the Action Alternatives have the potential to encounter extant structural elements of the three dam structures. However, these structures are not listed or eligible for listing in the National Register of Historic Places. Further, modifications to the existing dam elements could present a visual impact to extant historic properties, especially in the vicinity of the Union Street Dam, which is located within an older section of Traverse City.
Visual Resources			X		X			X		The Action Alternatives would have minimal effects on visual resources. The area of the impoundments would be changed to a river channel, but would still provide a natural landscape. The removal of the dam structures would impact the visual resources in the area; however, this impact would not be significant.

Table 1: Summary of Environmental Impacts and Minimization/Avoidance Measures for the Action Alternatives

Impact Category	1. No Action Alternative Degree of Impact			5. Modify Union Street Dam and Remove Boardman and Sabin Dam Alternative Degree of Impact			6. Remove Sabin Dam Alternative Degree of Impact			
	Significant	**Insignificant**	**No Impact**	**Significant**	**Insignificant**	**No Impact**	**Significant**	**Insignificant**	**No Impact**	**Summary of Impacts and Activities to Avoid or Minimize Impacts**
Traffic and Transportation			X	X				X		The Action Alternatives would be expected to have minimal effects on traffic and transportation outside of the construction period. The current Cass Road would be removed at the point where the new river channel intersects the road. Temporary vehicular barriers and signage would be placed when the road is cut. It is expected that the Grand Traverse County Road Commission would replace the Cass Road Bridge prior to or in conjunction with the dam removal project. Bridge and road work would not be part of the federal project and the federal project is not contingent on the local bridge project.
Utilities Infrastructure			X		X			X		The removal of the Boardman and Sabin Dams would require the movement of any utility infrastructure that exists at those structures; however, the removal and replacement of such utilities would be temporary and would not have significant impacts on the project area.
Hazardous Materials			X		X			X		Various industrial activities have been conducted along Boardman River and around the impoundments; these activities have the potential to impact subsurface conditions along the waterway and may have deposited chemical compounds in the sediment. Non-ASTM environmental concerns also at the dam structure include potential asbestos-containing materials, potential lead-based paint, and heavy metal-containing materials. With proper sediment management and placement, the Action Alternatives should have no significant effect on the project area. Any structural demolition would be done in accordance with requirements to prevent the release of non-ASTM contaminants.
Socioeconomic			X		X			X		The impacts on socioeconomic resources would be short term and temporary in the form of construction activities. The overall project would result in high-quality coldwater habitat allowing additional recreational fishing, boating on the river, and use of existing parkland.
Recreation			X		X			X		Recreational activities within the river system would increase and replace those recreational activities within the impoundments. The impacts on existing recreation would be minimal as lake recreation would be converted to river recreational opportunities.

Conclusions

Based on the findings of this EA, implementation of the Recommended Alternative (Alternative 5), or Alternative 6, would not have significant adverse, direct, indirect, or cumulative effects on the quality of the environment. The Recommended Alternative would restore the aquatic ecosystem of the Boardman River from Boardman Pond through Boardman Lake. The Recommended Alternative restoration would improve habitat by restoring the coldwater temperature regime; allowing sediment, organic material, and woody debris to move downstream; removing barriers to fish passage for brook trout, dace, and other fish species within the Boardman River; and providing for lake sturgeon to pass upstream and downstream at the Union Street Dam, opening up additional habitat for this State-listed threatened species. Alternative 6 would not allow for sturgeon passage above the Union Street Dam and only restore aquatic habitat associated with Sabin Dam and its impoundment.

The Recommended Alternative is preferable to Alternative 6 because it provides increased habitat improvements for all coldwater species considered, opens up new habitat to sturgeon, and eliminates the negative impacts of the Sabin and Boardman Dams by removing both. Based on the analysis of potential impacts, implementing the Recommended Alternative does not constitute a major Federal action that significantly affects the quality of the environment. The analysis documented in this EA indicates that no significant impact on the human environment would result from the Recommended Alternative. Therefore, a Preliminary Finding of No Significant Impact (FONSI) is included as Section 6.0 of this EA. A final decision regarding the need for an Environmental Impact Statement will be made after a review of all comments received during public review.

Public Involvement/Comment

Formal notification and opportunities for public participation, as well as informal coordination with government agencies and city planners, have been incorporated into the EA process. Agencies, organizations, and members of the public having a potential interest in the Proposed Action have been invited to comment on the proposed project. Early coordination letters requesting concerns or comments regarding potential impacts of the Proposed Action on the human environment and/or cultural resources were sent to State and Federal agencies and Native American organizations including U.S. Fish and Wildlife Service, the Michigan State Historic Preservation Office, U.S. Environmental Protection Agency and the Michigan Department of Environmental Quality, and local tribes. Responses received to date are included in **Appendix A**. Additionally, comments received during the 30-day public review will be considered in the final determination of the project.

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1 Introduction

The U.S. Army Corps of Engineers (USACE), Detroit District, in coordination with the non-federal sponsor, Grand Traverse County, prepared this Environmental Assessment (EA) to evaluate the environmental effects of restoration of the coldwater habitat in the Boardman River. The Boardman River is a Great Lakes tributary. By restoring the internal connectivity and coldwater characteristics of the lower 8 miles of the Boardman River, which is severely impacted by the presence of three dams, the diversity and abundance of desirable coldwater species would increase (e.g., brook trout, longnose dace) and targeted migratory species (lake sturgeon) would be able to move between the Great Lakes and the river (with upstream assistance for lake sturgeon).

This project falls under the Section 506 authority (Great Lakes Fishery and Ecosystem Restoration or GLFER) of the Water Resources Development Act of 2000. A Preliminary Restoration Plan was prepared under that authority in fiscal years 2005 and 2006, resulting in a determination that sufficient Federal interest exists to recommend that the study continue into the Feasibility Phase. A Detailed Project Report (DPR) was developed concurrently with this EA to address the need for and desirability of undertaking actions to restore aquatic habitat in the Boardman River. The DPR and its appendices are available upon request from the USACE and on the USACE, Detroit District website. Appendices to the DPR include the following: Appendix A: Engineering; Appendix B: Economic Analysis; Appendix C: Cost Engineering; Appendix D: Real Estate Plan; Appendix E: Habitat Analysis; and Appendix F: Monitoring Plan.

The Boardman: A River Reborn, an ongoing project of the Boardman River Dams Committee (BRDC) was consulted in the development of this EA. The BRDC was established in 2005 by Traverse City and Grand Traverse County to “assess the environmental, economical [sic] and social benefits and detriments of retaining, modifying and removing the Boardman River dams” (BRDC 2010). The BRDC completed an engineering feasibility study in 2009 recommending the removal of the Sabin, Boardman, and Brown Bridge Dams and modification of the Union Street Dam to enhance fish passage. The project team has taken information from this study and conducted an independent review of the Boardman River system.

Traverse City and Grand Traverse County have evaluated various alternatives, such as minimal repairs to the dams, lowering the pools above these dams to ensure compliance with applicable regulations, or removing/modifying the dams. Traverse City owned the recently removed Brown Bridge Dam and owns the Union Street Dam, and Grand Traverse County owns the Boardman and Sabin Dams. To meet Michigan Dam Safety Regulations for spillway capacity of the Boardman and Brown Bridge Dams, during the fall of 2006, Grand Traverse County lowered the water level of Boardman Pond (also known as Keystone Pond) by 17 feet, and, during the fall of 2007, Traverse City lowered the water level behind the Brown Bridge Dam by 3 feet in preparation for dam removal.

In September 2011, the BRDC announced that the Michigan Department of Environmental Quality (MDEQ) had approved and issued permits for interim drawdown of the impoundments at the Brown Bridge and Sabin Dams. This drawdown was undertaken in advance of actions to

remove the dams. In November 2011, Traverse City informed the USACE that the Brown Bridge Dam would be removed in a project separate and distinct from the outcomes of this feasibility study (USFWS 2012b). Work at the Brown Bridge Dam commenced in July 2012, the drawdown was planned and approved at a maximum rate of 12-inches per day through the use of a temporary dewatering structure (TDS). On October 6, 2012, during the drawdown process, an abrupt release of water occurred in the area of the TDS which caused damage to approximately 50 riverfront properties. The project team immediately worked with property owners to assist with damage mitigation. Following clean up, DEQ issued a work plan to the contractor and work resumed the week of October 29. Dam removal was completed by late December 2012. Follow up grading and vegetation work occurred during the spring of 2013.

The objective of this EA is to determine the magnitude of the socioeconomic and environmental impacts of the Action Alternatives. The preliminary conclusions of this EA are that there would be no significant impact on the human environment; therefore, a Preliminary Finding of No Significant Impact (FONSI) is included in Section 6.0 of this EA. A final determination on the environmental impacts according to criteria established in Title 40 of the Code of Federal Regulations (CFR) Section 1508.27 would be made after the consideration of all comments received during the public review of this EA. However, if the project impacts are found to be significant, the proposed project would be modified to reduce the level of impact or a Notice of Intent would be published in the *Federal Register* and an Environmental Impact Statement would be prepared prior to implementing the Recommended Alternative.

1.1 Study Area

The Boardman River is located in the northwestern portion of Michigan's Lower Peninsula and originates in central Kalkaska County, where it flows southwest into Grand Traverse County and turns north and flows into West Grand Traverse Bay, Lake Michigan in Traverse City, Michigan. The Boardman River watershed drains a surface area of approximately 291 square miles and includes 179 lineal stream miles, 12 natural lakes, and 2 impoundments created by dams (Boardman and Sabin impoundments) and one lake enlarged by a dam (Boardman Lake). The Boardman River is designated a Natural River and is considered one of the top 10 best trout streams in Michigan, containing nearly 36 lineal miles of Blue Ribbon Trout Stream.[2] This pristine fish habitat includes important locations for both trout and anglers. The watershed also hosts other water activities such as canoeing, kayaking, and waterfowl hunting.

For the purpose of this study, the "study area" and "project area" refer to two different expanses. The "study area" includes the entire environmental and socioeconomic context of Grand Traverse County (**Figure 1**). The project area includes three distinct areas that are within the lower 8 miles of the Boardman River's main stem. The three areas include the area immediately

[2] A designation made by the State government or other authority identifying a recreational fishery of very high quality, considering criteria such as water quality and quantity, accessibility, spawning capacity, angling pressure, and specific species.

around Union Street Dam and the areas around Sabin and Boardman Dam that include the dam and impoundment. All three locations are within Grand Traverse County. These are the areas that would be directly impacted by any action at the dams. Three dams are located along the waterway within the project area: the Union Street Dam at river mile 1.1, the Sabin Dam at river mile 5.3, and the Boardman Dam (also known as Keystone Dam) at river mile 6.1. The City of Traverse City owns a fish weir at river mile 0.75 and Michigan Department of Natural Resources (MDNR) operates and maintains the James P. Price Trap and Transfer facility located at the weir to manage the fish species that move upstream. The project area is shown in **Figure 2**.

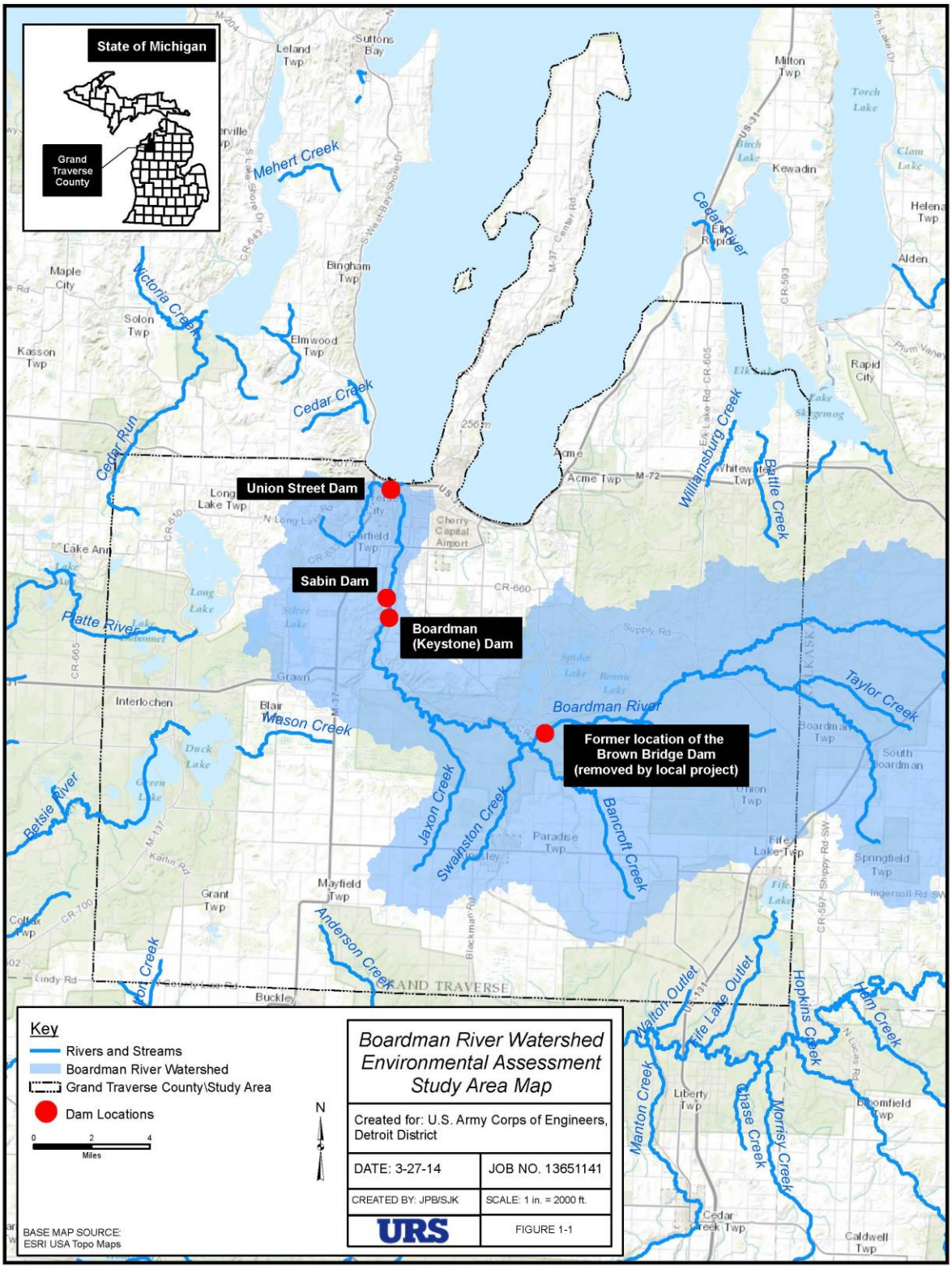


Figure 1: Boardman River Study Area

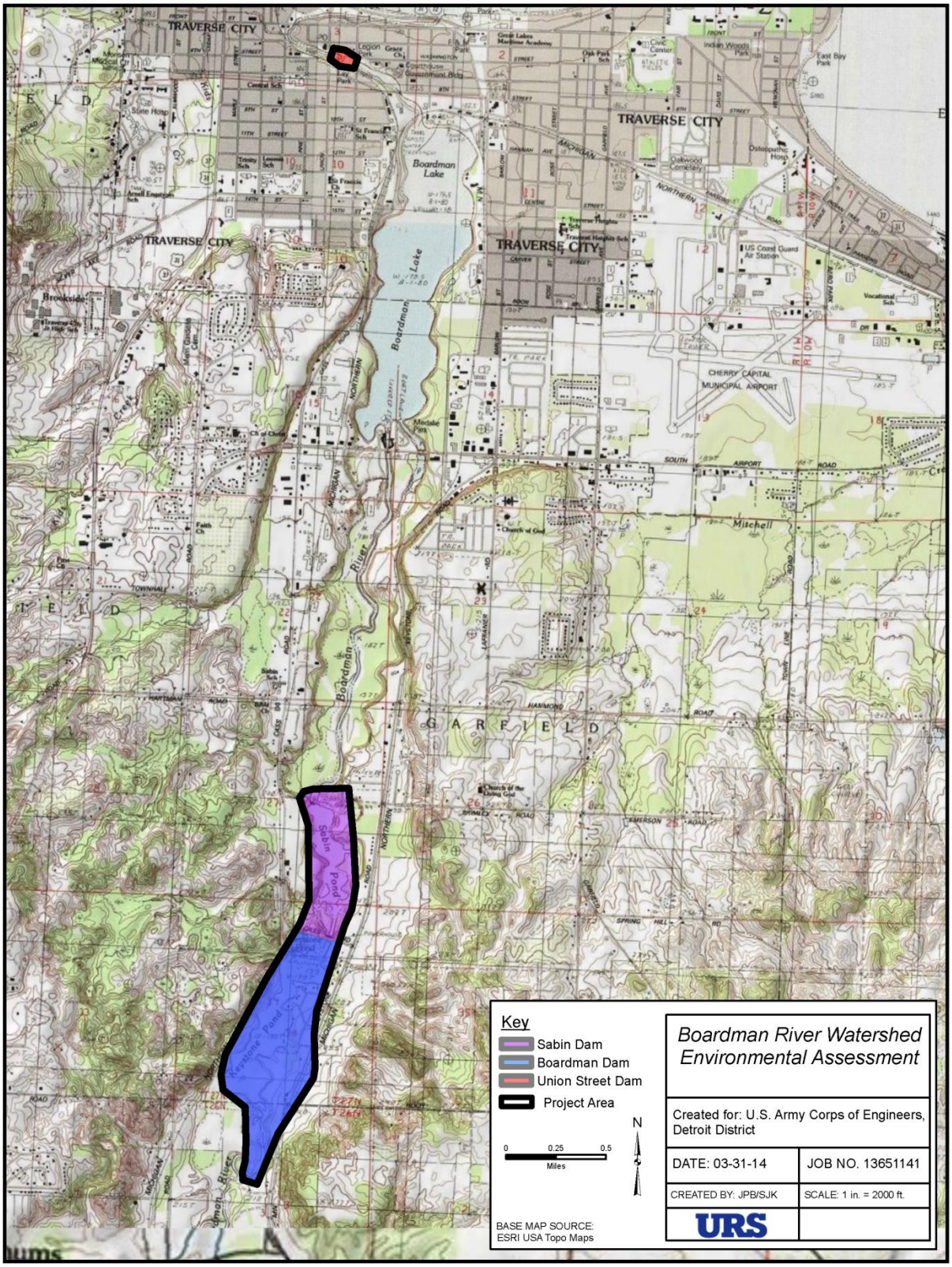


Figure 2: Boardman River Project Area

1.1.1 Dams and Structures

Three dams are located along the Boardman River: Union Street, Sabin, and Boardman. A fourth dam, the Brown Bridge Dam, was removed in 2012 by the Implementation Team (IT)[3] and is not part of the alternatives included in this EA, nor is it within in the Project area. However, the removal of the Brown Bridge Dam is discussed as a separate project in Section 3.5. The Boardman River fish weir is located approximately 0.75 miles upstream from Lake Michigan on the Boardman River and about 0.35 miles downstream from the Union Street Dam which is located at river mile 1.1. The weir is owned by the City of Traverse City and the James P. Price Trap and Transfer facility is operated and maintained by the MDNR. The MDNR harvests salmon during their fall run and sells the eggs and fish for further processing. The weir is an MDNR backup egg collection site. The MDNR is committed to the continual, future operation and maintenance of the trap and transfer facility. If other Great Lakes sites do not provide sufficient eggs for the hatchery, eggs from the Boardman weir are used to supplement those collected at other weirs. **Figure 3** shows the Boardman River profile, including elevations from the Brown Bridge Dam to Lake Michigan.

[3] The BRDC is led by the IT, which makes recommendations concerning the dams. The IT represents dam owners and interested organizations and agencies, including Grand Traverse Band of Ottawa and Chippewa Indians, City of Traverse City, Grand Traverse County, MDNR, Michigan Hydro Relicensing Coalition, Traverse City Light and Power, USFWS, Conservation Resource Alliance, Grand Traverse Conservation District, Grand Traverse County Road Commission, Rotary Camps and Services, and Watershed Center Grand Traverse Bay.

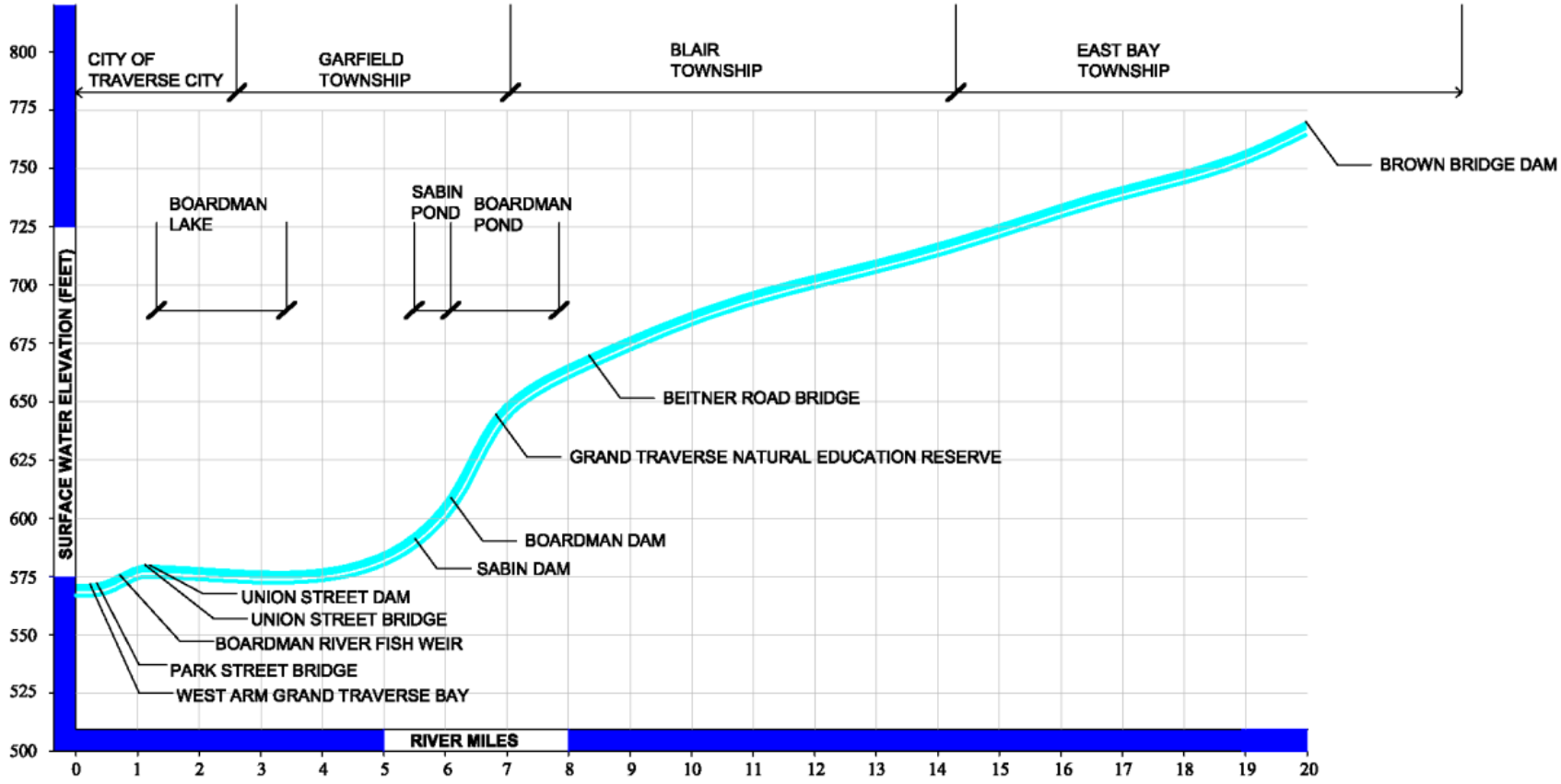


Figure 3: Boardman River Profile

All three dams have undergone structural inspections in the last 3 years, focusing on major safety concerns and the maintenance necessary to keep the dams in place. The results of those structural inspections are summarized below. This EA does not evaluate specific actions to maintain the dams as they are, as routine maintenance is beyond the scope and authority of this study.

1.1.2 Union Street Dam

The Union Street Dam is located in Traverse City at river mile 1.1, upstream from where the Boardman River discharges into Grand Traverse Bay. The dam was constructed in 1867 to supply power to a flour mill. Currently, the Union Street Dam is used to regulate the water level in Boardman Lake. A natural lake of 259 acres, Boardman Lake increased to 339 acres with the damming of the river. The Union Street Dam consists of 250 lineal feet of earthen embankment, two spillways, and a fish ladder. The second or auxiliary spillway is smaller and is located along the left bank (south side) beside at the fish ladder. Overall, the dam is reported to be in good condition and is subject to good maintenance practices. Seepage was recently observed at the downstream toe of the embankment, as well as turbulent flow in some of the discharge culverts, possibly indicating deterioration of the culverts. No major rehabilitation appears to be required in the immediate future to maintain dam safety. The fish ladder is designed to allow the passage of salmon and trout while preventing upstream travel of sea lamprey and it appears to be structurally sound. However, in 2011, the U.S. Fish and Wildlife Service (USFWS) surveyed the extent of the sea lamprey presence in the Boardman River. This inspection identified several gaps between the stop logs and concrete sill that are sufficient for passing sea lamprey. The USFWS requested that the upstream Sabin Dam not be removed until repairs were completed. During a subsequent dam inspection conducted by the City of Traverse City repairs were made in conjunction with the USFWS that corrected the previously identified deficiencies related to sea lamprey blockage. These repairs included replacing deteriorated stop logs, cleaning the concrete sill, and evaluating the seals between stoplogs and the concrete sills.

Figure 4: Union Street Dam

1.1.3 Sabin Dam

The Sabin Dam, located at river mile 5.3, was constructed in 1906 and completely rebuilt in 1930. Power generation ceased at the dam in 2006. The Sabin Dam consists of earthen embankments, a powerhouse, a stop-log spillway, and a tainter gate spillway. A 1917 map shows a fish ladder just east of the powerhouse; this feature no longer exists. The structure exhibits minor cracks in the powerhouse superstructure, concrete deterioration on the downstream side of the powerhouse, a leaking roof, and minor corrosion at brick mortar joints and window lintels. No major rehabilitation appears necessary at this time to maintain dam safety. Routine maintenance is required.

Figure 5: Sabin Dam

1.1.4 Boardman Dam

The Boardman Dam is located at river mile 6.1. The dam consists of earthen embankments, an emergency spillway, and a concrete structure and penstock intake. The Cass Road Bridge is located over the top of the penstock intake and is directly tied to the dam structure. The Boardman Dam was constructed in 1894 and rebuilt in 1930. Power generation ceased at the Boardman Dam in 2007. The concrete portions of the dam exhibit significant cracking in the walls of the structure (which also serve as substructural supports for the bridge). The concrete beams that form the bridge superstructure are cracked and there is significant spalling on the fascia beams, exposing steel girders. The bridge barrier railing is in significant disrepair. The bridge requires considerable repairs. The Grand Traverse County Road Commission (GTCRC) has secured a Michigan Department of Transportation grant and is in the process of developing plans for a replacement bridge.

Figure 6: Boardman Dam

1.1.5 Boardman River Analysis Segments

To present the existing data in a framework useful for characterizing existing conditions and evaluating environmental consequences of the alternatives of the Boardman River Dams, this EA divides the Boardman River into 10 segments. These segments are based on the spatial extent of the hydrologic impacts of the dams and possible spatial extents of impacts from dam management alternatives. These segments are included within the study area for the project and are summarized in **Table 2**.

Table 2: Boardman River Habitat Analysis Segments

Segment	River Miles	Length (Miles)	Description
1	0–1.14	1.14	From Union Street Dam downstream to Lake Michigan, including Hospital (Kids) Creek
2	1.14–3.28	2.14	Union Street Dam to upstream end of Boardman Lake
3	3.28–5.43	2.15	From Sabin Dam downstream to Boardman Lake
4	5.43–6.47	1.04	Sabin Dam impoundment, also known as Sabin Pond, upstream to Boardman Dam
5	6.47–7.81	1.34	Boardman Dam impoundment, also known as Boardman Pond or Keystone Pond
6	7.81–19.84	12.03	From Former Brown Bridge Dam downstream to Boardman Dam impoundment
7	19.84–21.47	1.63	Former Brown Bridge Dam impoundment, also known as Brown Bridge Pond
8	21.47–28.42	6.95	From the confluence of the North and South Branches of the Boardman River, also known as the Forks, downstream to the former Brown Bridge Dam impoundment
9A	28.42–31.42A	3.00	North Branch of the Boardman River
9B	28.42–31.42B	3.00	South Branch of the Boardman River

Note: Analysis was conducted prior to Brown Bridge Dam removal.

Figure 7 shows the Boardman River segments that were used for analysis. It should be noted that this analysis was conducted prior to the removal of the Brown Bridge Dam impoundment. The Project Area impacts the first five segments shown in the below figure. The free-flowing segments located further upstream experience better overall habitat quality and should be used as a model for river conditions on the lower segments once the project has been completed.

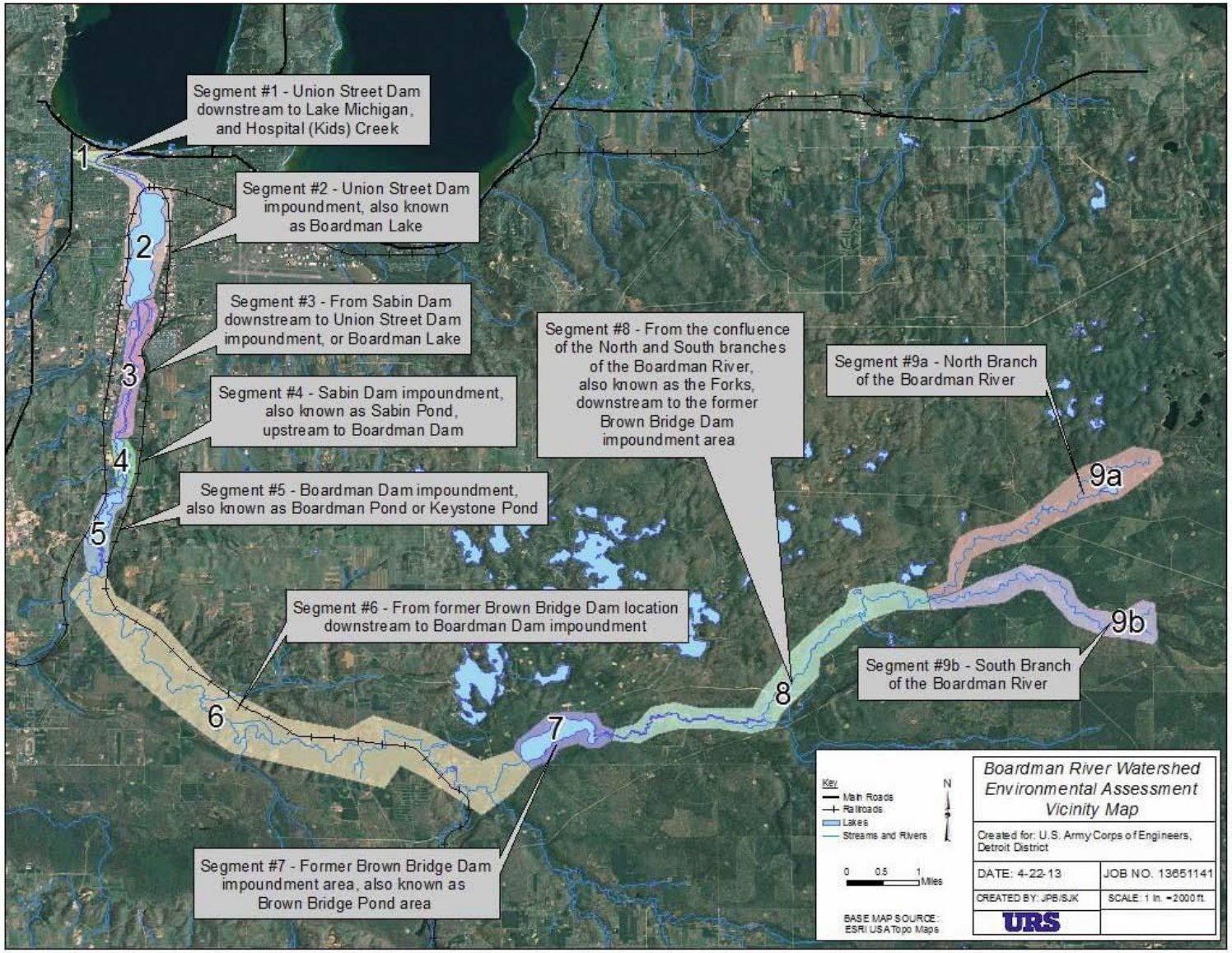


Figure 7: Boardman River Analysis Segments

1.2 Proposed Action

The Proposed Action is the implementation of an aquatic ecosystem restoration project along the Boardman River in Traverse City, Michigan. Components of the Proposed Action would include: the removal of two existing dams (Boardman and Sabin) and modification of one dam (Union Street). Removing Boardman and Sabin Dams and modification of Union Street Dam provides connection of the upper Boardman River with Lake Michigan for a variety of fish species. The removal of Boardman and Sabin would eliminate fish passage barriers, while modifications to the existing Union Street Dam would provide downstream passage of all fish species and trap-and-transfer operations would move lake sturgeon upstream. These actions would result in restoration of coldwater stream segments within and downstream of the Sabin and Boardman Dam impoundments on the Boardman River, thus improving instream fishery habitat and wildlife habitat by replacing a warmwater impoundment with a coldwater stream, enhancing wetland and upland habitat within the riparian river corridor while also enhancing water quality.

The project would result in benefits to the local fishery through the restoration of about 8 miles of the lower Boardman River from warmwater stream / impoundment sequence to coldwater river channel for coldwater-dependent species, such as brook trout, and would restore a prime sturgeon spawning reach of steep gradient that is currently an impoundment between the Boardman and Sabin Dams. Aquatic habitat would be improved by restoration of the free movement of woody debris and sediment as would occur in a natural river system. Lake sturgeon would be moved upstream of Union Street Dam by a trap and transfer program, and would be able to pass back downstream with the modifications to the auxiliary spillway at Union Street Dam.

1.3 Purpose and Need

The purpose of the Proposed Action is to restore and reconnect the coldwater stream ecosystem in the lower 8 miles of the Boardman River. This segment of the river is currently a warmwater stream fragmented by dams and impoundments. The project would reconnect the river with Lake Michigan and reduce water temperatures by removing dams. This connectivity would provide access for lake sturgeon from Lake Michigan to spawning habitat in the Boardman River.

Restoration of habitat has been identified as a high priority for the entire Great Lakes Basin through the support plan for the GLFER program. The need for the project stems from a lack of suitable coldwater habitat within the Boardman River and a lack of connectivity with the Great Lakes. The presence of two abandoned hydroelectric dams and their impoundments in the lower 8 miles of the Boardman River has created a warmwater environment, restricted internal connectivity of the river, and blocks fish passage from Lake Michigan.

2 Description of Alternatives

2.1 Aquatic Resources within the Study Area

The Boardman River is a State highly regarded coldwater trout stream that is degraded in its lower 16 miles because of the presence of the Boardman, Sabin, and Union Street Dams. The dams block fish passage between the Great Lakes and important riverine spawning and foraging habitat. The Boardman River in its upper reaches provides significant spawning grounds for several species of fish, including lake sturgeon (*Acipenser fulvescens*), brook trout (*Salvelinus fontinalis*), dace, and other coldwater species. The dams support a warmwater fishery with a lentic (pond) environment, which provides habitat for multiple species of fish, birds, and other wildlife. **Table 3** provides a general overview, based on MDEQ and MDNR studies, of common characteristics found within each of the 10 segments that make up the Boardman River study area.

Table 3: Summary of Aquatic Habitat and Fisheries

Segment	Description	Macroinvertebrate Community Conditions*	Habitat Conditions*	Abundant Species*	Year Information was Obtained*
1	From Union Street Dam downstream to Lake Michigan, including Hospital (Kids) Creek	acceptable tending towards poor	good/marginal	sea lamprey, salmon, and steelhead	2003
2	Union Street Dam impoundment, also known as Boardman Lake	acceptable to poor with zebra mussels comprising 53–77% of all bottom-dwelling organisms	good/marginal	walleye, smallmouth bass, and northern pike	2003
3	From Sabin Dam downstream to Union Street Dam impoundment, or Boardman Lake	acceptable, neutral	good	brown trout, smallmouth bass, white sucker, rainbow trout, and chinook salmon	2003, 2006
4	Sabin Dam impoundment, also known as Sabin Pond, upstream to Boardman Dam	not assessed	not assessed	northern pike and white sucker	2007

Segment	Description	Macroinvertebrate Community Conditions*	Habitat Conditions*	Abundant Species*	Year Information was Obtained*
5	Boardman Dam impoundment, also known as Boardman Pond or Keystone Pond	not assessed	not assessed	rock bass, white sucker, smallmouth bass, and northern pike	2007
6	From former Brown Bridge Dam downstream to Boardman Dam impoundment	good	excellent	moderate densities of brown trout, low densities of brook trout	2004, 2005
7	Former Brown Bridge Dam impoundment, also known as Brown Bridge Pond	not assessed	not assessed	rock bass is most abundant; bluegill, pumpkinseed sunfish, white sucker, yellow perch, largemouth bass, smallmouth bass, and northern pike also common	2007
8	From the confluence of the North and South Branches of the Boardman River, also known as the Forks, downstream to the former Brown Bridge Dam impoundment	good	excellent	brown trout, brook trout, and sculpins	2004, 2005
9A	North Branch of the Boardman River	acceptable tending towards excellent	good with slight impairment	brown trout and brook trout	1998, 2003, 2002, 2004
9B	South Branch of the Boardman River	acceptable tending towards excellent	acceptable tending towards excellent	brown trout and brook trout	1998, 2002, 2003

*Data drawn from the Boardman Lake Management Plan and the Boardman River Feasibility Study: A Report on the Boardman River Fisheries Habitat Survey & Data Collection (ECT 2009), which includes varying and inconsistent data across the river segments collected prior to Brown Bridge Dam removal.

Lentic environments in Northern Michigan, similar to the current state of the Boardman River impoundments, are common, whereas coldwater, steep gradient streams are rare. Removing the existing dams would replace this regionally common habitat with a relatively rare river type in addition to restoring original river habitat within the Boardman River.

2.2 Alternative Formulation

The DPR documents a preliminary screening of measures. The development of alternative plans followed a two-step process. First, measures to address problems and opportunities were developed. The measures were evaluated using conceptual-level costs and with respect to their ability to meet project objectives. Some measures or variants of measures were eliminated from further consideration based on their inability to meet the objectives of the study or were not cost effective. The remaining measures were combined into alternatives, which were evaluated to identify a selected alternative.

Measures were developed to address the identified problems and opportunities of the project. These measures focus on modifying the dams to allow fish passage over or around the dams and the removal of the dams and restoration of the waterway. Measures were developed for each dam to accommodate the particular constraints and conditions at individual locations. The measures were further refined through a Value Engineering process (see Section 2.5). For the purposes of the measures identified for this study, the following definitions apply:

- **Dam modification** measures involve maintaining the existing dam structures and impoundments and constructing or modifying fish passage structures and providing cooling mechanisms to mitigate thermal disruption. Modification also encompasses non-structural measures such as trap-and-transfer activities.
- **Dam removal** involves partial or complete dam removal resulting in the complete removal of the impoundment.

The measures carried forward into the formulation of alternative plans include:

- No Action
- Modification of the Union Street Dam to enable fish passage
- Removal of the Sabin Dam
- Removal of the Boardman Dam

Detailed descriptions of the measures may be found in Appendix A: Engineering, of the DPR. The remaining measures were combined to create eight alternatives which were evaluated using USACE's Institute for Water Resources Planning Suite. Those combinations of measures, called alternatives, are summarized in **Table 4**. Details on the preliminary screening of alternatives are provided in the DPR.

Table 4: Preliminary Alternatives Selected for Cost-Effectiveness Analysis

Alternative	Union Street Dam	Sabin Dam	Boardman Dam
Alternative 1	No Action	No Action	No Action
Alternative 2	Modify	No Action	No Action
Alternative 3	Modify	Remove	No Action
Alternative 4	Modify	No Action	Remove
Alternative 5	Modify	Remove	Remove
Alternative 6	No Action	Remove	No Action
Alternative 7	No Action	No Action	Remove
Alternative 8	No Action	Remove	Remove

Cost Effectiveness and Incremental Cost Analyses (CE/ICA) were used to evaluate this ecosystem restoration project. Environmental outputs were expressed as average annual habitat units (AAHUs) and the net AAHU is the difference between the with-project and without-project (No Action Alternative) values.

Alternatives 5 and 6 were identified as the most efficient plans at creating AAHUs, with Alternative 5 producing the most AAHUs of all the alternatives. The CE/ICA is not intended to lead to a single best solution (as in an economic cost-benefit analysis); however, the analyses improve the quality of decisions by ensuring a supportable approach for considering and selecting an alternative. Details of the CE/ICA are available in Appendix B: Economics, of the DPR.

The project team conducted a trade-off analysis of the remaining alternatives. Varied costs and impacts on the surrounding environment are projected for each alternative. This is because of the many variables involving the multiple dams, river segments, and impoundments. The final array of alternative plans were compared using four formulation criteria suggested by the U.S. Water Resources Council and the USACE Planning Guidance Notebook (ER 1105-2-100)(USACE 2000). These criteria are completeness, effectiveness, efficiency, and acceptability. Alternatives that proved to be the most efficient plans at creating AAHUs and contain measures that met project objectives under the evaluation criteria are evaluated in the EA. For the purposes of evaluating the overall impacts of the alternatives, only alternatives 1, 5, and 6 were incorporated into the EA.

Therefore this EA evaluates the following alternatives: Alternative 1. No Action, Alternative 5. Modify Union Street Dam and Remove Sabin and Boardman Dams, and Alternative 6 Remove Sabin Dam. For a complete alternative formulation description, see the DPR Section 4, Alternatives Development.

2.3 Description of the Proposed Action Alternatives

Three alternatives were developed based on the goal of maximizing habitat benefits using the least cost solution and accounting for the non-Federal sponsor requirement that the Union Street Dam continue to raise the water level of Boardman Lake by approximately 9 feet. Furthermore,

the alternatives analysis assumed that the drawdown of Boardman Pond at the Boardman Dam is permanent. The three following combinations of measures were found to be suitable for detailed evaluation in this EA:

1. **No action** – Under the No Action alternative, no action would be taken and all of the dams would remain as they currently exist. This alternative provides no benefit to coldwater fish species, including brook trout, dace, and sturgeon.
5. **Modify the Union Street Dam and Remove the Sabin and Boardman Dams** – This alternative is the recommended alternative. This alternative consists of retaining the Union Street Dam, modifying the auxiliary spillway for downstream sturgeon passage, trap-and-transfer activities for upstream passage of sturgeon, and removing Sabin and Boardman Dams to create a free-flowing river. This alternative provides some habitat improvements for all coldwater species considered, including brook trout, dace, and sturgeon. It opens up new habitat to the sturgeon and removes negative impacts from the Sabin and Boardman Dams.
6. **Remove Sabin Dam –** This alternative involves the removal of Sabin Dam to allow a free-flowing river to be restored from the Boardman Dam to Boardman Lake and includes the draining of Sabin Pond. This alternative would retain the Union Street Dam along with the existing fish ladder and MDNR weir operation. The fish ladder would be operated as it currently does. This alternative provides some coldwater habitat for coldwater species considered, including brook trout, and dace. However, the Boardman Dam would remain in place and downstream river segments would continue to be affected by the warming effects of the impoundment, blockage of fish passage, and loss of stream functions such as the natural movement of woody debris. Additionally, the pool elevation of Boardman Dam would remain lowered to meet the Dam Safety Act requirements of the MDEQ

Table 5 summarizes these alternatives and detailed descriptions follow.

Table 5: Alternatives for Detailed Analysis

Alternative	Union Street Dam	Sabin Dam	Boardman Dam
Alternative 1	No Action	No Action	No Action
Alternative 5	Modify	Remove	Remove
Alternative 6	No Action	Remove	No Action

2.3.1 Alternative 1: No Action Alternative

Under the No Action alternative, no action would be taken and the measures proposed in Appendix A: Engineering, of the DPR would not be implemented. This alternative consists of retaining all of the dams as they currently exist. The dams would not be modified to allow increased fish passage and migratory fish passage would continue to be blocked at the weir and Union Street Dam. The fish ladder at Union Street would continue to be maintained, along with the fish weir operated by the MDNR. Under the No Action Alternative, the ecosystem would not be restored under the USACE Ecosystem Restoration Program. As such, the No Action Alternative does not fulfill the project's purpose and need. It is included in this analysis because

it provides a baseline against which the beneficial and adverse impacts of the Action Alternatives can be compared.

2.3.2 Alternative 5: Modify Union Street Dam, Remove Sabin and Boardman Dams

This alternative is to modify the Union Street Dam, remove the Sabin Dam, and remove the Boardman Dam. This alternative is the Selected Alternative and provides the greatest benefits. It allows for a high percentage of sturgeon passage from Lake Michigan to the Boardman River via a trap-and-transfer operation requiring small changes to the existing fish weir located along the lower Boardman River. The Sabin and Boardman Dams removal maximizes available habitat for all species considered.

The ecological restoration of the Boardman River, through the removal of Boardman and Sabin Dams and the modification of Union Street Dam, is focused on restoring the historic form, function and natural characteristics of the river system while protecting critical infrastructure. The result of this approach would be a natural river in form, function and character that requires little to no long term maintenance.

Removing the Sabin Dam and Boardman Dam alleviates the problems currently associated with these dams, including increased water temperature, the blockage of fish passage, fragmentation of the coldwater habitat, and trapping of sediment and organic material, and it has the potential to achieve all of the project objectives. The removal of the Boardman and Sabin Dams would allow the exposed bottomlands to be restored to a free-flowing channel through the former impoundments. Sediment management would occur using grade control structures, sediment traps immediately upstream of the existing dams, slow drawdown, and active sediment removal along the exposed banks by land-based excavators (to provide an appropriately dimensioned floodplain). This measure meets all of objectives of the project. It would eliminate the thermal impacts of the dams; eliminate fragmentation of the coldwater habitat; allow for natural movement of suspended sediment, sediment bedload, and organic material; and allow for fish passage. The Proposed Action at each dam is described below.

2.3.2.1 Union Street Dam Modifications

Historically, lake sturgeon have been found in the Boardman River below the Union Street Dam (USFWS 2008). The dam blocks movement upstream for foraging or spawning purposes. The Union Street Dam is proposed for modification to pass lake sturgeon in a downstream direction and block ANS travel from the Great Lakes up the Boardman River. Upstream passage of Lake Sturgeon would be achieved by trapping and transferring via truck to a location above the Union Street Dam.

The trap-and-transfer operation would be conducted at the James P. Price Trap and Transfer facility and modifications would be made to the Union Street Dam to allow downstream passage of Lake Sturgeon. Upstream passage of lake sturgeon would be accomplished by trapping and transferring sturgeon at the existing trap-and-transfer facility and relocating them upstream of the Union Street Dam. Traps and/or nets would be used for sturgeon collection. Operational constraints in the form of a sturgeon-specific “standard operating procedure” would be

developed to limit mortality to adult sturgeon and other fish species present during the collection activities. Minimizing mortality must be a primary concern of the trap-and-transfer operation because the numbers of spawning sturgeon are low.

Downstream passage would be accomplished by modifying the existing Union Street Dam to be more conducive to passing adult sturgeon while maintaining the existing level of ANS (e.g., sea lamprey) protection. This measure is expected to require the following:

- Two fishery technicians to perform the upstream trapping and transfer operation for 20 hours per week while sturgeon are moving upstream (approximately mid-April to early May).
- Traps and nets for sturgeon collection.
- Elevator system at weir facility to bring sturgeon and water to truck level.
- Stairs to safely allow fishery technicians to move from the water level to the weir level.
- A truck suitable for transporting sufficient water to support sturgeon to the discharge location. The truck would need to be modified to hold and discharge fish and water as the discharge location may not have a launch.
- Modification to the Union Street Dam to facilitate downstream passage of adult sturgeon. The modification would include the modification or replacement of the existing auxiliary spillway (200 cubic yards of concrete, two 48-inch diameter culverts, 150 lineal feet long) and developing inlet characteristics that would attract sturgeon and accommodate downstream passage (Amaral et al. 2002). The existing fish ladder would be maintained to continue facilitating the upstream passage of salmonids and other species. The existing hydraulic conditions at the modified auxiliary spillway would not be changed and would maintain the existing level of ANS protection.

This measure meets the objective of reconnecting Lake Michigan with the Boardman River. The existing Union Street Dam and the existing fish ladder would remain, and the auxiliary spillway would be rebuilt to improve its ability to pass sturgeon downstream. These modifications would also increase the efficiency of downstream passage for other species.

2.3.2.2 Sabin Dam Removal

Currently, the Sabin Dam blocks fish movement, fragments coldwater habitat, traps sediment and organic material, and warms the water within the impoundment and downstream of the dam. Dam removal would include removal of the auxiliary spillway and a floodplain bench through the earthen dam adjacent to the auxiliary spillway, but would retain the existing powerhouse. An engineered riffle is proposed at the site of the existing auxiliary spillway to provide grade control and proper substrate and to tie the pre-dam river elevation through the impoundment into the existing channel alignment below the dam.

The exposed bottomlands would be restored using permanent seeding on 10 acres and live staking and plantings on 1 acre of steep slopes, and the remaining (approximately 29 acres) area

would be allowed to passively re-vegetate using the native seed bank. Erosion from the exposed bottomlands would be controlled by restoration activities in areas of steep slopes. Approximately 4,600 feet of free-flowing channel would form through the former impoundment. The river would be allowed to choose its own path and, in doing so, it would move sediment and self-armor with existing gravel, cobble, and boulders. Based on bathymetry and depth of refusal data, the restored river is expected to follow the pre-dam river channel.

Approximately 600 feet of stream bank protection (toe revetments, root wad revetments, brush mattresses, etc.) are expected in areas of tight meanders. Sediment management would occur using sediment traps immediately upstream and downstream of the existing dam, sediment traps as needed within the impoundment, slow drawdown, and active sediment removal along the exposed banks by land-based excavators (to provide an appropriately dimensioned floodplain). Approximately 94,800 cubic yards of sediment is expected to be moved and disposed of onsite during removal of the Sabin Dam and restoration of this segment of the Boardman River. The proposed drawdown and construction methods are designed to limit the quantity of sediment that would be transported downstream.

The breaching operation would consist of notching the concrete spillway down in 6-inch increments. The structural stability and integrity of the existing concrete spillway would allow for controlled removal of concrete. The incremental height would be subject to modification based on field observations of sediment migration. The spillway structure would continue to be lowered to 2 feet below the proposed river profile to accommodate the construction of the engineered riffle.

This measure would eliminate the thermal impacts of the dam; eliminate fragmentation of coldwater habitat; allow for natural movement of suspended sediment, sediment bedload, and organic material; and allow for fish passage.

The Sabin impoundment has elevated concentrations of some contaminants. These contaminants might need to be managed to protect human health. Soil and sediment data collected to date (see Section 3.4.5 for detailed analysis) indicate that arsenic levels are above background levels but below the applicable nonresidential MDEQ Direct Contact Criteria (DCC) . Thus, no capping is expected; however, additional testing may be required to verify that contaminant levels are below MDEQ-specified limits. Additionally, the drawdown and construction phase is designed to limit the quantity of sediment that would be transported downstream. This would be accomplished by the controlled breaching method, sediment trapping and removal methods, and proper soil and erosion control methods.

2.3.2.3 Boardman Dam Removal

The Boardman Dam is being considered for removal or modification to eliminate the environmental impacts caused by the dam. Currently, the Boardman Dam blocks fish movement, fragments coldwater habitat, traps sediment and organic material, and warms the water within the impoundment and downstream of the dam.

The dam removal would re-route the Boardman River to the west through the earthen embankment and through the current Cass Road. This is the historic location of the channel, thus this action would restore the Boardman River to its pre-dam alignment. Relocation of the channel allows for the existing powerhouse to remain in place.

The exposed bottomlands would be restored using permanent seeding, live staking and plantings on steep slopes, and passive revegetation using the native seed bank. An approximately 8,000 feet of free-flowing channel would form through the former impoundment following the pre-dam river channel. In doing so, it would move sediment and self-armor with existing gravel, cobble, and boulders. Approximately 1,000 feet of stream bank protection is expected in the form of toe revetments, root wad revetments, or brush mattresses in areas of tight meanders.

Sediment management would occur using sediment traps immediately upstream and downstream of the existing dam, sediment traps as needed throughout the impoundment, slow drawdown, and active sediment removal along the exposed banks by land-based excavators (to provide an appropriately dimensioned floodplain). Approximately 207,400 cubic yards of sediment, earthen embankment, and road fill is expected to be moved and disposed of onsite during removal of the Boardman Dam and restoration of this segment of the Boardman River. The proposed drawdown and construction methods are designed to limit the quantity of sediment that would be transported downstream.

The breaching operation would consist of initially pumping down the impoundment at a rate of 1 foot per day. During the drawdown, the contractor would begin removing the earthen berm, while constantly maintaining a minimum of 5 feet of freeboard until the impoundment level is within 3 feet of the proposed river profile. At such time, the contractor would complete removal of the earthen dam. As a redundant safety measure, the contractor would have onsite flexible hard armor mats (ArmorFlex) to place in a constructed channel across the earthen berms, should the pumps fail. This would prevent excessive scour, provide structural support for the earthen berm, and greatly reduce the potential for an uncontrolled release of water and sediment.

This measure would eliminate thermal impacts of the dam; eliminate fragmentation of coldwater habitat; allow for natural movement of suspended sediment, sediment bedload, and organic material; and allow for fish passage.

The Boardman impoundment has high levels of some contaminants. These contaminants might need to be managed to protect human health. Soil and sediment data collected to date (see Section 3.4.5) indicate that arsenic levels are above background levels but below the applicable nonresidential MDEQ DCC. Thus, no capping is expected; however, additional testing may be required to verify that contaminant levels are below MDEQ-specified limits. If these levels are exceeded, then capping with 6 inches of material with at least 2 percent organic matter may be required. Further, the drawdown and construction phase is designed to limit the quantity of sediment that would be transported downstream. This would be accomplished by the breaching method, sediment trapping methods, and proper soil and erosion control methods.

Integration with MDNR facilities and coordination with MDNR fishery staff is not required for this measure.

2.3.3 Alternative 6. Remove Sabin Dam

Similar to Alternative 5, Alternative 6 would involve the removal of Sabin Dam. The Sabin Dam currently blocks fish movement, fragments coldwater habitat, traps sediment and organic material, and warms the water within the impoundment and downstream of the dam. Dam removal would include removal of the auxiliary spillway and a floodplain bench through the earthen dam adjacent to the auxiliary spillway, but would retain the existing powerhouse. An engineered riffle is proposed at the site of the existing auxiliary spillway to provide grade control and proper substrate and to tie the pre-dam river elevation through the impoundment into the existing channel alignment below the dam.

In general, surface water resources would be impacted by the removal of the Sabin Dam and the draining of its impoundment. By breaching the dam, the impoundment would be drained and warmwater lake habitat would revert back to coldwater riverine habitat. Approximately 40 acres of warmwater lake habitat would be converted to coldwater habitat at Sabin Pond. The thermal effects of the Sabin Pond (i.e., increased water temperatures within the impoundment) would be eliminated and habitat for coldwater species would improve. However due to Boardman Dam remaining in place upstream, the improvement in coldwater fish habitat and the elimination of thermal effects would not be fully realized. Additionally, with the implementation of this alternative the Boardman River would not be returned to its natural, free-flowing state in its entirety. Removing the Sabin Dam while retaining the Boardman Dam would open and restore less than 1 mile of additional coldwater habitat for brook trout and dace.

The exposed bottomlands would be restored and erosion from the exposed bottomlands would be controlled by restoration activities in areas of steep slopes. Approximately 4,600 feet of free-flowing channel would form through the former impoundment. Stream bank protection, sediment management, and the breaching operation would be conducted as explained in Alternative 5 above.

The Sabin impoundment has elevated concentrations of some contaminants. These contaminants might need to be managed to protect human health. Soil and sediment data collected to date (see Section 3.4.5 for detailed analysis) indicate that arsenic levels are above background levels but below the applicable nonresidential MDEQ DCC. Thus, no capping is expected; however, additional testing may be required to verify that contaminant levels are below MDEQ-specified limits. Additionally, the drawdown and construction phase is designed to limit the quantity of sediment that would be transported downstream. This would be accomplished by the controlled breaching method, sediment trapping and removal methods, and proper soil and erosion control methods.

2.4 Habitat Suitability Index

As part of the Boardman River DPR, an effort was undertaken to measure and quantify the habitat effects to fisheries, wetlands, and sea lamprey protection for each of the proposed project alternatives. With the quantified habitat effects, different project alternatives and their associated

impacts to fish and wetland habitat can be compared, as well as analyzed economically to ensure that improvements to these habitats are cost effective.

Quantifying the effects to fish habitat was accomplished using habitat suitability index (HSI) models developed by the USFWS. These HSI models were used to assess riverine habitat for specific fish species and to calculate annual average habitat units (AAHUs) that would be lost or gained for each project alternative. Representative fish species were selected for the purpose of habitat evaluation and analysis. By using these selected indicator species for coldwater stream habitat analysis and design, many other coldwater species with similar habitat requirements would also benefit. Both the current status of the Boardman River and the project alternatives were analyzed in terms of habitat suitability for each of the selected indicator species, which include lake sturgeon, brook trout, and dace, within 10 river segments.

The species-specific HSI scores for each river segment were then used to calculate AAHU scores for each of the project alternatives. To produce AAHU scores, HSI scores were multiplied by the river segment lengths (in miles) to produce an AAHU score that accounts for distance and available habitat. This allowed the AAHU scores to take into account not only the quality of habitat but also the amount of habitat. These AAHU scores estimate how critical fish species and their associated habitat would be impacted by project alternatives. **Table 6** includes a summary of the AAHU fisheries scores.

Table 6: Fisheries AAHU Scores for Project Alternatives

Alternative	Segment										Total
	1	2	3	4	5	6	7	8	9A	9B	
Length (miles)	**1.14**	**2.14**	**2.15**	**1.04**	**1.34**	**12.03**	**1.63**	**6.95**	**3.00**	**3.00**	
1: No Action	70	43	0	21	0	1143	178	806	324	324	2908
5: Modify Union and Remove Sabin and Boardman	70	70	38	227	283	1353	206	928	377	377	3928
6: Remove Sabin Dam	70	43	0	202	0	1143	178	806	324	324	3089

To assess wetland habitat, the Michigan Rapid Assessment Method (MiRAM) was applied to provide a function and value score for individual wetlands impacted by each project alternative. The MiRAM scores for individual wetlands were then multiplied by the wetland size (in acres) and available habitat to produce an AAHU score. This allowed the wetland-specific AAHU scores to take into account not only the quality of habitat but also the quantity of habitat. The AAHU scores estimate how individual wetlands would be impacted by the different project alternatives. The results of these MiRAM and AAHU assessments were considered when selecting project alternatives and would be used to improve the wetland habitat associated with the Boardman River.

The benefits related to controlling sea lamprey were quantified using miles of river protected by a physical barrier to prevent infestation. Protected river miles were designated as AAHU values

to measure how the opening of river segments for increased fish passage can also result in the colonization of the invasive sea lamprey and the degradation of aquatic habitat. The results of the sea lamprey control analysis indicate that modifying the Union Street Dam to continue preventing the migration of sea lamprey is the best technique to limit this invasive species' impact on the Boardman River.

Table 7 contains an overall summary of the total AAHU scores and the net AAHUs. The net AAHU is the difference between the with-project and without-project (No Action Alternative) values. A detailed summary of the HSI and AAHU analysis is provided in the DPR Appendix E.

Table 7: Total AAHU Score for Project Alternatives

Alternative	Fisheries AAHUs Score	Wetlands AAHUs Score	Sea Lamprey Control AAHUs Score	Total AAHUs Score	Net AAHUs
1: No Action	2908	1726	3328	7962	0
5: Modify Union and Remove Sabin and Boardman	3928	4787	3328	12043	4081
6: Remove Sabin Dam	3089	3371	3328	9788	1826

2.5 Value Engineering

A Value Engineering (VE) study was conducted for this project per USACE policy (ER11-1-321) because the cost is expected to exceed $10 million. The VE Team undertook the task using the VE work plan and approach. Complete documentation of the VE study is provided in Appendix A: Engineering, of the DPR.

During the speculation phase of this VE study, 37 creative ideas were identified, 12 of these ideas were developed into VE recommendations, and 14 ideas were developed into design comments with cost implications where applicable. Many of the ideas represented changes in design approach, reconsideration of criteria, and in some cases, modification of the project scope. In general, the idea evaluation took into account the economic impact, benefits obtained, and the effect on the overall project objectives. The VE study presents the ideas that were developed into recommendations and design comments with cost implications where applicable. Because cost is an important issue for comparison of VE proposals, the costs presented in the VE report are based on original design quantities with unit rates obtained from the estimate as prepared by the design team and included in their submission, published cost databases, and VE Team member experience.

After further review and discussion with the design team and non-Federal sponsor, the following VE Team recommendations were accepted and implemented into the feasibility study design:

- Retain the Boardman and Sabin Dam powerhouses in lieu of removal.
- Route the restored Boardman River alignment through the existing Sabin Dam auxiliary spillway in lieu of the historic channel to the East of the spillway and powerhouse.

- Optimize the designed floodplain width in the restored segment of the Boardman River to narrow it where possible to reduce excavation costs.
- Improve sediment management efficiency by using fewer and larger placement areas.
- Increase the use of targeted restoration using live stakes on steep banks and slopes in lieu of passive and/or seeding restoration options.

These recommendations are discussed in detail in the VE report included in Appendix A: Engineering, of the DPR.

2.6 Proposed Construction Measures and Sequence

The construction sequencing and schedule for this project is discussed in detail in the DPR Engineering Appendix and would be primarily driven by two factors; sediment management during the drawdown process and minimizing traffic interruption on Cass Road. This section puts forth construction measures and best management practices (BMPs) that would be undertaken to minimize construction impacts to air quality, water resources, soil, and other regulated resources.

The ecological restoration of the Boardman River, through the removal of Boardman and Sabin Dams and the modification of Union Street Dam, is focused on restoring the historic form, function and natural characteristics of the river system. The exception to this approach would be in areas proximate to critical infrastructure that must be protected such as the Cass Road Bridge and in areas where the topography, soils or geology has been modified through activities such as dam and road construction. The result of this approach would be a natural river in form, function and character that requires little to no long term maintenance.

The drawdown and breaching operation for the Sabin and Boardman Dams would consist of slowly breaching the dams and allowing the water level within the impoundment to equalize prior to further lowering the impoundment. Boardman impoundment would be lowered in 1 foot increments and Sabin impoundment in 6 inch increments.

Sediment traps would be installed to capture sediment during construction. During this time, sediment would need to be removed from the sediment traps as it is mobilized by the river. Additionally, to minimize risk of sediment migration the Boardman Dam would be breached prior to the Sabin Dam. This would allow for any sediment that could potentially be released during the Boardman drawdown to be captured in the Sabin impoundment.

Boardman Dam breaching would be accomplished by pumping the water over the earthen embankment and removing the earthen dam in the dry streambed. The earthen embankment is composed of fill material and a reinforced concrete core wall. A sheet pile curtain wall extends a minimum of 10 feet below the concrete core wall. Portable pumps would be installed on this newly created “work pad” on the west side of the embankment. Fused high density polyethylene (HDPE) pipes would be connected to the pumps for suction and discharge lines. As a redundant safety measure, the contractor would have onsite flexible hard armor mats (ArmorFlex) to place in a constructed channel across the embankment, in the event that the pumps fail or capacity is

exceeded. Additionally, the contractor would maintain a minimum of 5 feet of freeboard on the earthen berm until the impoundment level is within 3 feet of the proposed river profile. At such time, the contractor would complete removal of the earthen dam. A float activated alarm system would be installed on the upstream side of the impoundment to notify the contractor if the water level begins to rise.

The river restoration efforts in both impoundments would begin concurrently as the breaching operations. Work would begin with excavating floodplain benches in the upper reaches of the impoundments and progress downstream as the water level is drawn down. Channel and bank stabilization measures would be installed once the river reaches its expected final elevation. Restoration would be completed with seeding and planting.

Improvements at the Union Street Dam and MDNR trap-and-transfer facility would have minimal impacts on infrastructure and public use. Work at the Union Street Dam would disrupt use of the park and the water main that runs across the dam would have to be protected. In addition, work on these structures has the potential to impact spawning patterns and harvesting operations as spawning times for species of concern are typically in the spring and fall months. Therefore, construction is scheduled to occur during the summer months.

An approximate construction schedule for the selected alternative is included in **Table 8**.

Table 8: Approximate Construction Schedule for Selected Alternative

Task Name	Duration	Start Date *	Finish Date *
Define Channel DS of Boardman and into Sabin	40 days	06/01/2016	07/11/2016
Boardman Breach	60 days	07/02/2016	08/31/2016
Sabin Breach	30 days	08/15/2016	09/14/2016
Boardman Restoration	120 days	07/02/2016	10/30/2016
Sabin Restoration	120 days	07/02/2016	10/30/2016
Union Street Dam and MDNR Trap-and-Transfer Facility Modifications	30 days	07/02/2016	08/01/2016

* The dates provided are simply representative and would need to be finalized during the design phase.

2.7 Alternatives Considered but Eliminated

Several alternatives were considered but eliminated because of expected high costs, constructability issues, and potential negative habitat impacts. These alternatives are shown in **Table 4** above. The alternatives considered but eliminated include the following:

- **Modify Union Street Dam (Alternative 2)** - This alternative consists of modifying the Union Street Dam to allow downstream passage of sturgeon and block aquatic nuisance species (ANS) from the Great Lakes from traveling up the Boardman River. Upstream passage of lake sturgeon would be achieved by trapping and transferring using a truck to a location above the Union Street Dam. The trap-and-transfer operation would be conducted at the James P. Price Trap and Transfer facility and modifications would be made to the

Union Street Dam to allow downstream passage of Lake Sturgeon. The modification would include the modification or replacement of the existing auxiliary spillway (200 cubic yards of concrete, two 48-inch diameter culverts, 150 lineal feet long) and developing inlet characteristics that would attract sturgeon and accommodate downstream passage (Amaral, et al. 2002). The existing fish ladder would be maintained to continue facilitating the upstream passage of salmonids and other species. This alternative was eliminated because the benefits to the aquatic habitat are not as great as other alternatives and the cost per habitat unit gained were the highest among the alternatives considered.

- **Modify Union Street Dam and Remove Sabin Dam (Alternative 3)** – This alternative would modify the Union Street Dam to improve fish passage. The fish ladder at Union Street would be replaced with a trap-and-transfer facility that maintains the current Boardman Lake level, but would allow the passage of sturgeon from the Great Lakes into the Boardman River and vice versa. The Sabin Dam would be removed to allow a free-flowing river to be restored from the Boardman Dam to Boardman Lake. The Boardman Dam would be retained and the pool elevation would remain lowered to meet the Dam Safety Act requirements of the MDEQ. This alternative was eliminated because the benefits to the aquatic habitat are not as great as for other alternatives. Removing the Sabin Dam while retaining the Boardman Dam opens and restores less than 1 mile of additional coldwater habitat for brook trout and dace.
- **Modify Union Street Dam and Remove Boardman Dam (Alternative 4)** – This alternative would modify the Union Street Dam to improve fish passage. The fish ladder at Union Street would be modified or replaced with a lift or trap-and-transfer facility that would maintain the current Boardman Lake level, but would facilitate manual trap and transfer from the Great Lakes into the Boardman River and vice versa. ANS would be prevented from passing the dam. The Sabin Dam would be maintained as it currently exists. The Boardman Dam would be removed and Boardman Pond would return to a more natural riverine state in a channel with a location yet to be determined. This alternative was eliminated because the benefits to aquatic habitat are less and it is more costly than other alternatives. Removing the Boardman Dam while retaining the Sabin Dam opens and restores less than 1 mile of additional coldwater habitat for brook trout and dace.
- **Remove Boardman Dam (Alternative 7)** – This alternative would retain the Union Street Dam along with the existing fish ladder and MDNR weir operation. The Sabin Dam would be maintained as it currently exists. The Boardman Dam would be removed and Boardman Pond would return to a more natural riverine state in a channel with a location yet to be determined. This alternative was eliminated because the benefits to aquatic habitat are less and it is more costly than other alternatives. Removing the Boardman Dam while retaining the Sabin and Union Street Dams restores less than 1 mile of additional coldwater habitat for brook trout and dace and none for sturgeon.
- **Remove Sabin Dam and Remove Boardman Dam (Alternative 8)** – This alternative would retain the Union Street Dam, along with the existing fish ladder and MDNR weir

operation. The Sabin Dam would be removed to allow a free-flowing river to be restored from the Boardman Dam to Boardman Lake. The Boardman Dam would be removed and Boardman Pond would return to a more natural riverine state in a channel with a location yet to be determined. This alternative was eliminated because the benefits to aquatic habitat are less than other alternatives. Removing the Sabin and Boardman Dams while retaining the Union Street Dam restores significant additional coldwater habitat for brook trout and dace, but none for sturgeon.

One potential project measure that was also considered for several alternatives is the construction of a sea lamprey barrier downstream of the Boardman River's confluence with Kids Creek. This measure would eliminate the threat of sea lamprey infestation upstream of segment 1 and protect the currently colonized Kids Creek and the upper portion of segment 1 from future spawning adult lampreys. Additionally, it would allow the Union Street Dam to be converted from a gate-controlled, flow-through dam to a free-flowing, flow-over dam featuring a rock ramp, engineered riffle, or step pools downstream to accommodate the passage of all desired fish species common to the area. However, because of potential flooding issues and increased project costs, this potential project measure was eliminated.

3 Affected Environment and Environmental Consequences

This section describes the existing environment that could be affected by the Action Alternatives. Information gathered from site visits, existing documentation, and correspondence with Federal, State, and local agencies were used to characterize the existing environment.

This section also identifies the potential direct and indirect environmental consequences of the Action Alternatives and the No Action Alternative to resource areas such as surface water, groundwater, wetlands, vegetation, geology, soils, terrestrial wildlife, aquatic habitat/fisheries, threatened and endangered species, exotic/nuisance species, floodplains, land use, recreation, and visual resources and aesthetics.

Finally, this section describes the potential cumulative effects to the environment of the alternatives when combined with recent, present, and reasonably foreseeable future projects. Measures that would be implemented to avoid or minimize potential impacts to the environment also are presented.

3.1 Resources Eliminated from Further Evaluation

EAs typically address numerous resource areas that may be impacted by implementing the Proposed Action. The following resources were examined and determined not to warrant further consideration because impacts to these resources by the Action Alternatives are negligible or non-existent. This section describes these resources that were not considered further and provides rationale for this determination. Resources eliminated from further evaluation include: coastal zone management, air quality, noise, climate, geology, public services, and environmental justice.

3.1.1 Coastal Zone Management

Michigan's coastal zone boundary generally extends a minimum of 1,000 feet inland from the Ordinary High Water Mark of the Great Lakes and connecting channels, or further to include coastal lakes, river mouths and bays, floodplains, coastal wetlands, designated sand dune areas, public parks, recreation and natural areas and urban areas. There is a coastal zone within the project area that extends from Grand Traverse Bay south to just upstream of Sabin Pond. The coastal zone follows the Boardman River corridor from the mouth to Boardman Dam (MDEQ 2011). A potential impact on the coastal zone may include increased sedimentation from temporary construction-related activities at the Union Street Dam and the fish weir. Because of the presence of Boardman Lake, no sediment from construction activities at the Sabin or Boardman Dams is expected to be transported to the Great Lakes. No significant effects on the coastal zone are expected to result from construction or operation of the project as appropriate erosion and turbidity controls would be used during construction until vegetation is established to provide natural erosion control on the drawn down impoundments. Implementing the Action Alternatives would not result in significant impacts to coastal zone management resources within the project area. Additionally, the project would be consistent to the maximum extent practicable with the Coastal Zone Management Act and the Michigan Coastal Program.

3.1.2 Air Quality

Under the authority of the Clean Air Act (CAA), the Environmental Protection Agency (EPA) has established nationwide air quality standards to protect public health and welfare, with an adequate margin of safety. These Federal standards, known as National Ambient Air Quality Standards (NAAQS), represent the maximum allowable atmospheric concentrations and were developed for six criteria pollutants: ozone, nitrogen dioxide, carbon monoxide, sulfur dioxide, lead, and particulate matter, which includes respirable particulate matter. EPA also identifies primary and secondary standards for the NAAQS. Primary standards protect against adverse health effects, while secondary standards protect against welfare effects, such as damage to crops, vegetation, and buildings.

The criteria provided under the CAA classify the country into attainment and nonattainment areas, usually by county or metropolitan statistical area. Areas not meeting the NAAQS are designated as nonattainment for the specific pollutant. Section 107(d) of the CAA defines a nonattainment area as "any area that does not meet (or that contributes to ambient air quality in a nearby area that does not meet) the national primary or secondary ambient air quality standards for the pollutant." The nonattainment status for ozone is further classified as marginal, moderate, serious, severe, or extreme, with extreme having the highest level of NAAQS exceedances. Each State is required to demonstrate how nonattainment areas would be brought into compliance with NAAQS and other components of the CAA through a State Implementation Plan. Ambient air quality in Grand Traverse County, MI, is in attainment for all applicable air quality criteria pollutants (MDEQ 2011).

Effects on air quality associated with this project would arise from emissions of construction equipment. All equipment would be required to meet emission standards and emissions are expected to be minor. Construction of the proposed project would be short term. Thus, the proposed project would be exempted as de minimis (Latin for 'of minimal importance') and meet the Conformity Requirements under Section 176(c) of the CAA, as amended and 40 CFR 93.153.

3.1.3 Noise

EPA's Noise Control Act of 1972 (Title 42 of the United States Code [U.S.C.] §§ 4901–4918), as amended by the Quiet Communities Act of 1978, states that the policy of the United States is to promote an environment for all Americans that is free from noise that jeopardizes health or welfare. Noise is generally defined as loud or undesirable sound. Sound is most commonly measured in decibels (dB), with the Day-Night Average Sound Level (DNL) used as an average measure of sound in dB. The DNL descriptor is accepted by Federal agencies as a standard for estimating sound impacts and establishing guidelines for compatible land uses. EPA guidelines, and those of many other Federal agencies, state that outdoor sound levels in excess of 55 dB DNL are "normally unacceptable" for "outdoors in residential areas and farms and other outdoor areas where people spend widely varying amounts of time," which would include the project area (EPA 1974).

Although temporary/transient noises occur in the project area (e.g., from vehicles or boats), no notable sources of noise pollution are known to be present. This project would not have significant adverse effects on noise. Temporary and minor noise effects would occur during construction. All motorized construction equipment would be required to have an approved noise reduction system to minimize any potential noise impacts. Implementing the Action Alternatives would not result in adverse noise effects within the project area.

3.1.4 Climate

Although the actual climatic effects that may occur at any given project site are largely uncertain, some general assumptions can be made based on long-term global climatic trends, which vary between warming and cooling over periods typically measurable in hundreds of years. As we are currently in a warming trend, effects of a warming climate on weather patterns can be generally anticipated.

Modeling of global atmospheric circulation patterns indicate that under a continuing global warming trend, air mass differences would become greater in the Great Lakes and upper Midwest regions during the fall and spring (transition) seasons, with stronger resultant atmospheric disturbances. This suggests future precipitation events in the project region would be more frequent and more intense. As such, there is a possibility that river and stream systems in the Great Lakes region could experience more frequent events of intense rain falling during a short time, which would increase the potential for stream bank erosion, stream sediment loading, and flashiness of flood flows. The summer seasons are anticipated to be hotter and drier in this region over the years to come; less arctic air in the region would mean less winter snowfall and milder winter temperatures. Neither alternative would result in direct, indirect, or cumulative impacts on the climate. Neither of the Action Alternatives would, in conjunction with long-term climatic change, result in adverse effects such as induced flooding or erosion.

3.1.5 Geology and Geologic/Natural Hazards

The Boardman River Watershed encompasses a variety of physiographic systems and landforms due to three glacial ice advances and retreats. Current soils and landforms of the watershed developed from this mosaic of glacial deposits and may reach depths greater than 500 feet. The river valley is composed of flat, sandy outwash plains, ranging from 6 to 14 miles wide and pitted by small, shallow depressions. Glacial lake plains occur in the northwest portion of the watershed in the Traverse City area adjacent to Grand Traverse Bay (ECT 2009e). The bedrock geology within the Boardman River Watershed is composed of a silty shale formation, approximately 500 feet thick in the project area and extending over the western part of Michigan, with minor elements of siltstone and sandstone included (USGS 2004). Depth to bedrock in the project area is approximately 300 to 350 feet below ground surface (WMU 1981). Economic mineral resources found in the Ellsworth Shale Formation and near the project area include sand and gravel, clay, and iron. No operating quarries or mining sites are located in the project area (USGS n.d.). Neither Action Alternative would result in adverse effects to the geology of the project area.

The risk of the project area experiencing geologic or natural hazards such as landslides, earthquakes, volcanic hazards, caves, or sinkholes is low. U.S. Geological Survey (USGS) maps suggest Grand Traverse County is located in a low seismic risk zone (USGS 2008). No active geologic faults are mapped within the Boardman River Watershed project area (USGS 2012).

3.1.6 Public Services

Implementing either alternative would potentially result in temporary impacts on schools and hospitals due to temporary road closures and/or reduced capacity for a short time. However, significant direct, indirect, or cumulative impacts to public service resources, such as police, fire protection, or local hospitals, within the project area are not expected other than temporary construction closures. Detours and alternative traffic routes would be planned at the local level to lessen temporary adverse impacts on public services. The closing of the Cass Road Bridge and other traffic and transportation impacts are discussed in section 3.4.3.

3.1.7 Environmental Justice

Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, is intended to ensure fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Fair treatment means that no group of people, including racial, ethnic, or socioeconomic groups, should bear a disproportionate share of the negative environmental consequences resulting from industrial, municipal, and commercial operations or the execution of Federal, State, tribal, and local programs and policies. There are no minority or low-income populations within the project area; therefore, those populations would not be disproportionately affected by the project. Impacts to environmental justice would not occur as a result of restoration of the ecological environment.

3.2 Recent, Present, and Reasonably Foreseeable Future Projects

In the evaluation of the impacts of the proposed project alternatives, the EA accounts for recent, present, and reasonably foreseeable future projects. Those projects within the project area include the following:

- Removal of the Brown Bridge Dam – This project was undertaken by the BRDC. The Great Lakes Fishery Trust has awarded $1 million to the City of Traverse City that was used to remove the Brown Bridge Dam on the Boardman River and restore 1.5 miles of coldwater trout stream, 156 acres of wetlands, and 25 acres of riparian upland habitat (The Boardman River Dams Project 2012). In November 2011, the BRDC decided to remove the Brown Bridge Dam with local support. Work at the project site commenced in July 2012, the drawdown was planned and approved at a maximum rate of 12-inches per day through the use of a temporary dewatering structure (TDS). On October 6, 2012, during the drawdown process, an abrupt release of water occurred in the area of the TDS which caused damage to approximately 50 riverfront properties. The project

team immediately worked with property owners to assist with damage mitigation. Following clean up, DEQ issued a work plan to the contractor and work resumed the week of October 29. Dam removal was completed by late December 2012.

- Repairs to the Union Street Dam – Based on the current states of the Union Street Dam, no major rehabilitation appears to be required in the immediate future to maintain dam safety. However, in 2011, the USFWS surveyed the extent of the sea lamprey presence in the Boardman River and identified several gaps between the stop logs and concrete sill that are sufficient for passing sea lamprey. The USFWS requested that the Sabin Dam not be removed until repairs were completed to the Union Street Dam. During a subsequent dam inspection conducted by the City of Traverse City repairs were made in conjunction with the USFWS that corrected the previously identified deficiencies related to sea lamprey blockage. These repairs included replacing deteriorated stop logs, cleaning the concrete sill, and evaluating the seals between stoplogs and the concrete sills.
- Repairs or replacement of the bridge at Cass Road – Based on the current state of the bridge at Cass Road future repairs are necessary. The Grand Traverse County Road Commission has been awarded a $3.5 million grant for the reconstruction of the Cass Road Bridge over the Boardman River. This grant is expected to be utilized by 2015. Coordination with potential future dam removal and river restoration projects would reduce the impact of this construction effort, but are not required.

Cumulative effects from these projects together with the Proposed Action are discussed in Section 3.6.

3.3 Affected Environment

3.3.1 Natural and Biological Resources

Biological resources consist of plants, animals, and their habitats. Surface water, groundwater, and wetland resources are included in this section as an integral part of the project area and natural resources. This section describes plant and animal species that occur or are likely to occur in the project area, as well as the geology and soils within the project area. These resources provide aesthetic, recreational, and socioeconomic benefits to the human environment.

3.3.1.1 Surface Water Resources and Water Quality

The project area covers segments 1 through 5 of the Boardman River and focuses on three dams (Boardman Dam, Sabin Dam, and Union Street Dam) and two impoundments (Sabin Pond and Boardman Pond) on the Boardman River. Above the dams, the Boardman River is a coldwater, high-quality trout stream with high densities of brook trout and other coldwater species (ECT 2009c). Mean summer water temperatures, above the former location of the Brown Bridge Dam, are approximately 58.5 degrees Fahrenheit (° F) with maximum temperatures from June to August remaining below 70° F, which are ideal conditions for coldwater fish (ECT 2009c). However, river conditions change because of the warming effects of the dam impoundments.

Segment 1 is approximately 1.14 miles and extends from the Union Street Dam downstream to Lake Michigan, including the approximate 4.5-mile tributary Kids (Hospital) Creek. This river segment flows through downtown Traverse City and is channelized along its entire course. The Union Street Dam is located at river mile 1.1 and is the first dam encountered moving upstream from the mouth of the Boardman River at Grand Traverse Bay. The impeded sediment transport due to the Union Street Dam, channelization, and impoundment effects from Lake Michigan impact this entire river segment. The channelization of this river segment includes vertical side slopes, concrete-lined banks, and loss of floodplain. Consequently, river segment 1 can be viewed as impaired from natural conditions over its entire length. Additionally, the MDNR owns and operates a weir at the Union Street Dam to control the passage of fish.

Segment 2 is the Union Street Dam impoundment, otherwise known as Boardman Lake. Boardman Lake is a natural lake; the construction of the Union Street Dam increased the size of Boardman Lake, from its original 259 acres to 339 acres. Although Boardman Lake would not directly be impacted by the proposed project, the auxiliary spillway at the Union Street Dam would be modified for downstream passage of sturgeon.

Segment 3 is approximately 2.15 miles and extends from Sabin Dam downstream to Boardman Lake. Impacts to aquatic habitat and natural hydrological conditions are present for a distance approximately 0.53 miles downstream of Sabin Dam and impoundment effects on habitat are evident from Union Street Dam (ECT 2009d). Consequently, this entire river segment is impacted by the Boardman River dams. A small coldwater trout stream enters the Boardman River approximately a 0.1-mile below the Sabin Dam in segment 3.

The Sabin Dam is located at approximately river mile 5.7 and its impoundment constitutes river segment 4. Sabin Pond is approximately 40 acres in size. Segment 5 is Boardman Pond (also known as Keystone Pond), a 78-acre impoundment, created by the Boardman Dam located at river mile 6.1. Because of the warming effects of these two impoundments, water temperatures become sub-optimal (>70° F) for coldwater fishes. Recorded maximum water temperatures are between 75 to 77° F during July and August, which is potentially lethal to coldwater fishes (ECT 2009c). Consequently, below Sabin Pond, brook trout and longnose dace are absent.

A fourth dam, the Brown Bridge Dam which was removed in 2012, was located at river mile 18.5, and created a 192-acre impoundment named Brown Bridge Pond. This dam was removed prior to any potential work on the Sabin or Boardman Dams and is outside of the project area.

3.3.1.2 Groundwater Resources

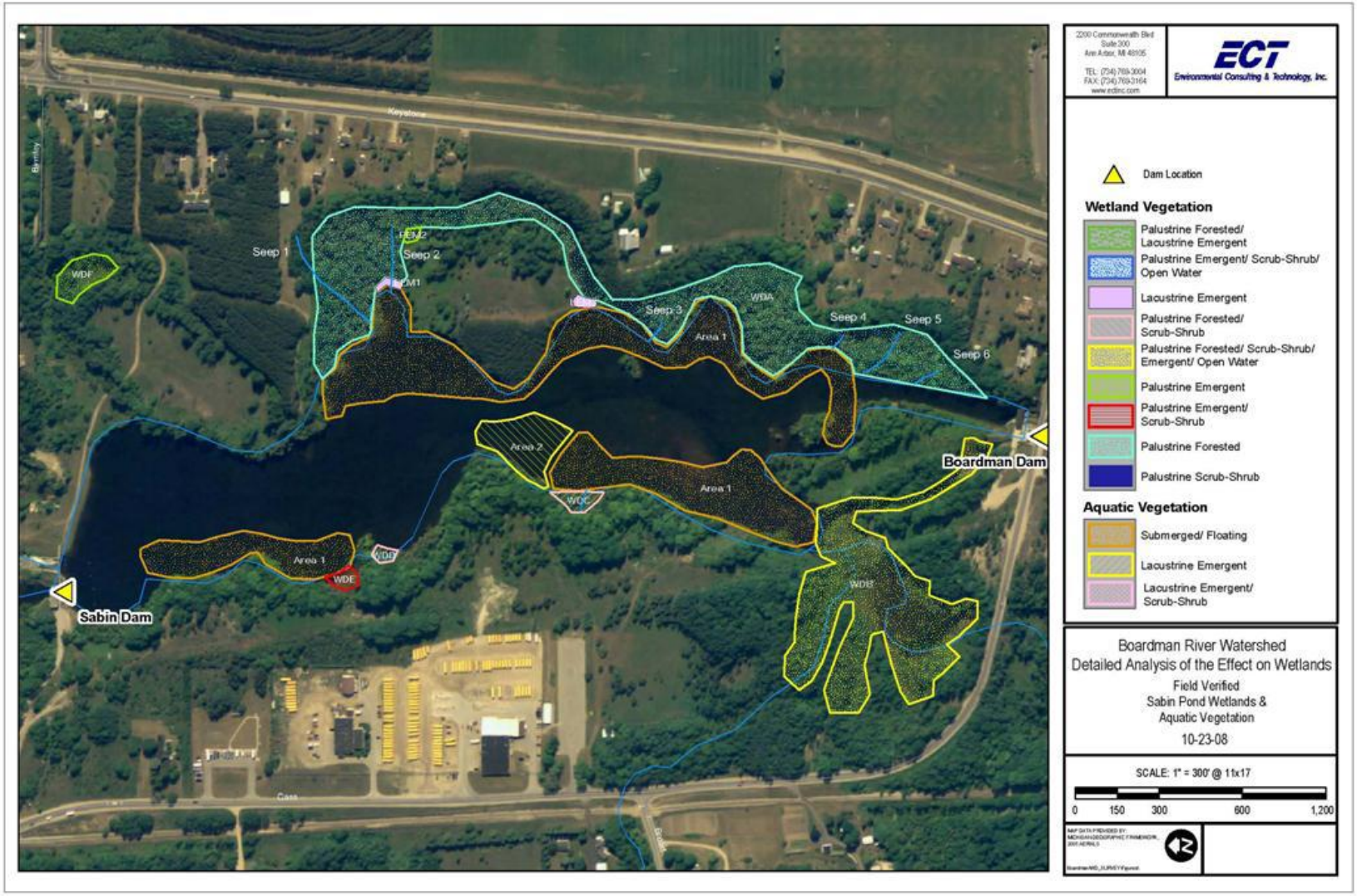
Groundwater elevations in the immediate vicinity of Sabin and Boardman Ponds are between 610 and 660 feet above mean sea level (MDNR 2000). Under existing conditions, the impoundments may create conditions that raise the groundwater surface elevations of the near-surface aquifer. Consequently, modifications or removal of dams that cause a change in the elevation of the impoundment surfaces could impact shallow wells less than 40 feet deep. Nearby wells are used primarily for residential and public water supply.

Three properties located hydrologically up gradient of the Union Street Dam are identified as having recognized environmental conditions to the Union Street Dam area. These sites include Randy's Old Towne Shell, at 430 S. Union Street, the Traverse City Iron Works property, and the eastern adjoining property on the south riverbank. Further details concerning these sites are contained in Section 3.3.4.1.

3.3.1.3 Wetland Resources

Wetlands associated within the Project area were classified in accordance with the *Classification of Wetlands and Deepwater Habitats of the United States* (Cowardin et al. 1979). The Sabin Dam impoundment is approximately 40 acres and contains roughly 15 acres of aquatic vegetation dominated by submerged, floating, and emergent vegetation. The plant community within this type of habitat is characterized by relatively low species diversity. Approximately 16.7 acres of diverse wetland habitat occur near or adjacent to the Sabin Pond impoundment, which is classified as palustrine. Palustrine wetlands are inland wetlands dominated by trees, shrubs, and/or persistent emergents that lack flowing water and ocean-derived salts, and are non-tidal. This higher quality habitat consists of 0.1 acres of palustrine emergent (PEM)/palustrine scrub-shrub (PSS) wetland, 9.4 acres of palustrine forested (PFO) wetland, 0.3 acres of PFO/PSS wetland, and 6.9 acres of PFO/PSS/PEM/open water (OW) wetland (ECT 2009h). Although some of these wetlands are influenced by inundation from the impoundment, most are primarily fed by groundwater seepage and occur on very poorly drained sapric muck. **Figure 8** provides a map of the existing wetland habitat associated with Sabin Pond. **Appendix C** provides a wetland plant species list.

The impoundment behind the Boardman Dam was originally 103 acres. However, following an emergency drawdown in 2007, during which the water level in the impoundment was dropped approximately 17 feet, the pond is now about 78 acres. Since 2007, wetland habitat associated with the impoundment has changed with the creation and loss of individual wetlands. Approximately 13.1 acres of diverse wetland habitat occur near or adjacent to the Boardman Pond, consisting of predominately PEM wetlands (URS 2012). Although some of these wetlands are influenced by inundation from the impoundment, most occur along the banks of the impoundment and are primarily fed by groundwater seepage. They occur on poorly and very poorly drained mucky sand. **Figure 9** provides a map of the existing wetland habitat associated with Boardman Pond (URS 2012). **Appendix C** includes a wetland plant species list.



Source: ECT 2009h

Figure 8: Existing Wetland Habitat Associated with Sabin Pond

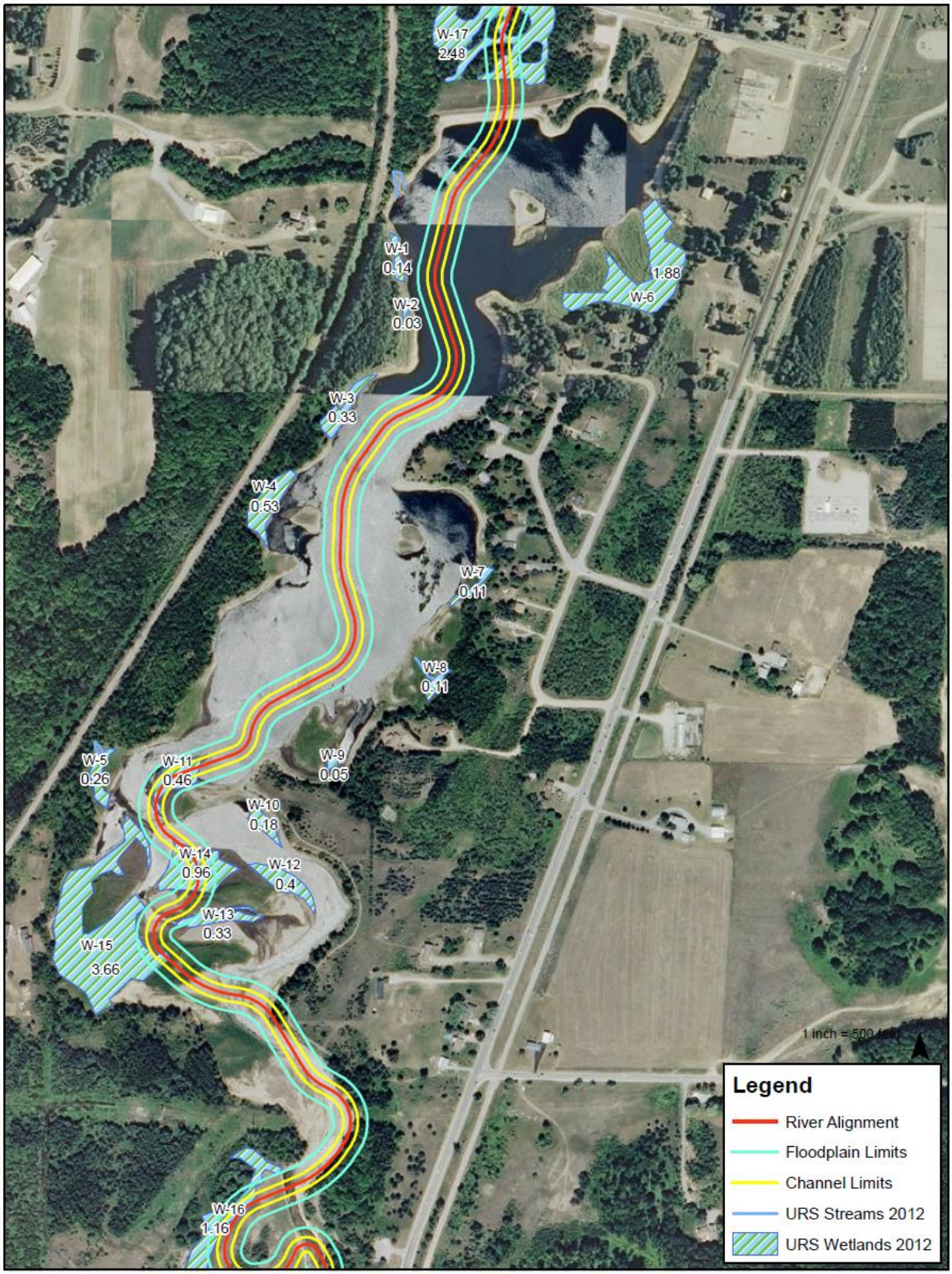


Figure 9: Existing Wetland Habitat Associated with Boardman Pond

3.3.1.4 Vegetation

According to a classification of the regional landscape ecosystems of Michigan (Albert et al. 1986), the Boardman River Watershed is located within Region II, Northern Lower Michigan (ECT 2009e). This region is characterized by a cooler, more variable climate than the southern portions of the State, with greater contrasts between the Great Lakes shore and inland areas. Riparian upland areas adjacent to the impoundments and river corridor are predominately forested and may include these community types from Region II, Northern Lower Michigan (ECT 2009e):

- Mixed riparian upland forest dominated by jack pine (*Pinus banksiana*) and northern pin oak (*Quercus ellipsoidalis*)
- Mixed riparian upland forests generally dominated by quaking aspen (*Populus tremuloides*), red maple (*Acer rubrum*), and Eastern white pine (*Pinus strobus*)
- Northern hardwood forest communities dominated by American beech (*Fagus grandifolia*), sugar maple (*Acer saccharum*), eastern hemlock (*Tsuga canadensis*), American basswood (*Tilia americana*), northern red oak (*Quercus rubra*), and Eastern white pine
- Black oak (*Quercus velutina*), white oak (*Quercus alba*), and bigtooth aspen (*Populus grandidentata*) communities

Wetland vegetation within the project area is described in Section 3.3.1.3 and listed in **Appendix C**.

3.3.1.5 Soils

The dry, sandy, and acidic soils derived from glacial outwash deposits are classified mostly as those of the Rubicon-Grayling and Rubicon-Kalkaska series. These soils are very permeable and have low nutrient availability. A significant portion of the river's flow volume is derived from groundwater discharge through these permeable glacial outwash soils. At its headwaters, upstream of Kalkaska, broad areas of peat and muck soils have also developed. The morainal deposits have evolved into sandy loam soils with sand and reddish clay substrata, primarily classified as those of the Emmet and Roselawn series. Depending on the percentage of sand, these soils are generally dry and acidic with low to medium nutrient availability. These soils play a major role in shaping the native plant communities of the Boardman River Watershed (ECT 2009e).

3.3.1.6 Terrestrial Wildlife

A majority of the wildlife found in the greater Project vicinity can also be found within the Boardman River, Sabin Pond, Boardman Pond, and the riparian forests along the river. Fauna is represented by species associated with wetlands, ponds, rivers, and riparian corridors. Numerous field surveys were performed by ECT on the Boardman River corridor from April through July 2007 (ECT 2009a).

Species were identified based on sightings, calls and songs, and catch-and-release techniques using live traps. During the field surveys, several reptile, amphibian, bird, and mammal species were observed within the project area. Reptile and amphibian species observed during fieldwork include Northern spring peeper (*Pseudacris crucifer*), Western chorus frog (*Pseudacris triseriata*), wood frog (*Rana sylvatica*), gray tree frog (*Hyla versicolor*), green frog (*Rana clamitans*), Northern leopard frog (*Rana pipiens*), Eastern American toad (*Bufo americanus*), mudpuppy (*Necturus maculosus*), wood turtle (*Glyptemys insculpta*), painted turtle (*Chrysemys picta*), and five-lined skink (*Eumeces fasciatus*). During a small mammal survey, the following species were collected: Northern short-tailed shrew (*Blarina brevicauda*), meadow vole (*Microtus pennsylvanicus*), white-footed mouse (*Peromyscus leucopus*), and meadow jumping mouse (*Zapus hudsonius*) (ECT 2009a). Bird surveys along the Boardman River near Sabin and Boardman Ponds recorded multiple waterfowl, songbird, water bird, and raptor species. A detailed list of waterfowl observed within the impoundments is included in **Appendix C**.

3.3.1.7 Aquatic Habitat / Fisheries

Based on data collected prior to the removal of Brown Bridge Dam, the Boardman River is a high-quality coldwater trout stream in the North and South Branches. From the confluence of the two branches, the main stem of the Boardman River downstream to the former Brown Bridge Dam impoundment is also a coldwater, high-quality trout stream with high densities of brown and brook trout. However, the impoundments associated with the inactive hydroelectric dams elevate the water temperature. Consequently, the warmer temperature supports lower densities of trout in the lower five segments of the Boardman River. Brown trout are still relatively common upstream of the Boardman Dam impoundment, though prior to removal of the Brown Bridge Dam, brown trout were found at approximately half the density below the dam as upstream of the Brown Bridge Dam. Below the Sabin Dam, water temperatures become suboptimal for coldwater fishes; brook trout are absent and brown trout are only found in very low densities (ECT 2009c).

Segment 1 starts at the Union Street Dam and extends downstream to the river's confluence with the waters of Lake Michigan and includes a fish migration weir. The average width of the river in this segment is 68 feet and approximately 96 percent of the segment contains run habitat and 4 percent contains pool bedforms. Approximately 56 percent of the stream provides water depths of 2.5 feet or greater, while the percentage of stream containing wood material is low, at 4 percent. The percentage of the stream covered by aquatic vegetation is 24 percent and the average composition of streambed substrates, from qualitative observations, are 0 percent clay, 0 percent silt, 32 percent sand, 45 percent gravel, 16 percent cobble, and 6 percent boulders. Similar to river segment 3, this segment is quite wide and dominated by gravel, cobble, and boulders. The stream in this segment has been impacted by the impoundment effects from Lake Michigan, impeded sediment transport due to the Union Street Dam, and channelization via vertical side slopes, concrete-lined banks, and loss of floodplains. Consequently, river segment 1 can be viewed as impaired from natural conditions over its entire length.

However, segment 1 of the river also receives migrations of fish from Lake Michigan. The occurrence of coarse gravel and cobble in this segment likely provides opportunity for some of these migratory fish to spawn. This segment also provides some cover for limited resident fish, in the form of deepwater and ample aquatic vegetation (ECT 2009d). Fish species sampled in this segment of the Boardman River include: American brook lamprey (*Lampetra lamottei*), western banded killifish (*Fundulus diaphanous menona*), blacknose dace (*Rhinichthys atratulus*), bluntnose minnow (*Pimephales notatus*), brook stickleback (*Culaea inconstans*), brook trout (*Salvelinus fontinalis*), brown trout (*Salmo trutta*), Chinook salmon (*Oncorhynchus tshawytscha*), coho salmon (*Oncorhynchus kisutch*), common carp (*Cyprinus carpio*), creek chub (*Semotilus atromaculatus*), goldfish (*Carassius auratus*), Iowa darter (*Etheostoma exile*), lake sturgeon (*Acipenser fulvescens*), rainbow trout (*Oncorhynchus mykiss*), rock bass (*Ambloplites rupestris*), round goby (*Neogobius melanostomus*), sea lamprey (*Petromyzon marinus*), smallmouth bass (*Micropterus dolomieui*), and yellow perch (*Perca flavescens*). The MDNR stocks this segment of the river with rainbow trout (steelhead) yearlings and coho salmon yearlings. Additionally, Kids Creek receives Chinook salmon fingerlings. Adult spawning-phase sea lamprey are captured annually in traps located downstream of the Union Street Dam in April, May, and June. Water temperatures measured at the trap site indicated that water temperatures were already approaching marginal levels for coldwater fish (>70° F) by June. Both the Boardman River downstream of the Union Street Dam and Kids Creek are treated for sea lamprey (ECT 2009c).

Segment 2 or Boardman Lake, with a maximum depth of approximately 73 feet, provides a sport fishery for four species of popular game fish (smallmouth bass, walleye, northern pike, and yellow perch), produces low to moderate relative abundances of those species, and relatively low proportions of those species of legal size or greater. Therefore, it appears to provide a fair to average coolwater fishery (ECT 2009c). Boardman Lake contains the following fish species: black bullhead (*Ictalurus melas*) , black crappie (*Pomoxis nirgomaculatus*), bluegill (*Lepomis macrochirus*), bluntnose minnow, brown bullhead (*Ictalurus nebulosus*), brown trout, common shiner (*Notropis cornutus*), grass pickerel (*Esox americanus*), Iowa darter, Johnny darter (*Etheostoma nigrum*), largemouth bass (*Micropterus salmoides*), northern pike (*Esox lucius*), pumpkinseed sunfish (*Lepomis gibbosus*), rainbow trout, rock bass, sand shiner (*Notropis stramineus*), sculpin (*Cottus spp*.), smallmouth bass, walleye (*Sander vitreus*), white sucker (*Catostomus commersoni*), and yellow perch.

Segment 3 between Sabin Dam and Boardman Lake is very wide, approximately 177 feet, immediately downstream of the dam and gravel substrate is abundant (60 percent). After approximately 0.53 miles downstream, the river becomes narrower (~66 feet) and sand is the most dominate substrate (80–85 percent). Segment 3 is deep (~70 percent was >2.5 feet deep) and aquatic vegetation is abundant (~20 percent). This river stretch is entirely run bed form and wood debris averaged 10 percent. No cobble or boulders were seen and silt was scarce. Impacts to aquatic habitat and natural hydrological conditions are present for a distance approximately 0.53 miles downstream of the Sabin Dam and impoundment effects on habitat are evident from the Union Street Dam (ECT 2009d). Consequently, this entire river segment is impacted by the

Boardman River dams. This river segment, although seriously impaired from natural conditions, does provide some unique fisheries habitat. The short gravel-filled section downstream of the Sabin Dam likely provide some limited spawning habitat for fish requiring gravel for spawning. The rest of this river segment provides ample deep water habitat, some wood debris, and ample aquatic vegetation. In combination, this segment provides ample protective cover for certain fish species and larger-sized individual fish (ECT 2009d). Fish species within this segment of the Boardman River include: American brook lamprey, bluntnose minnow, brown trout, central mudminnow (*Umbra lime*), Chinook salmon, coho salmon, Iowa darter, Johnny darter, largemouth bass, northern pike, rainbow trout, rock bass, sculpin, smallmouth bass, white sucker, and yellow perch. During a 2006 MDNR fish survey, brown trout density was low (33 fish/acre), but growth in this river segment was quite high relative to State averages.

Sabin Pond, river segment 4, contains the following fish species: American brook lamprey, black bullhead, bluegill, bluntnose minnow, brook trout, brown trout, coho salmon, golden shiner (*Notemigonus crysolueucas*), mimic shiner (*Notropis volucellus*), northern pike, pumpkinseed sunfish, rock bass, sculpin, smallmouth bass, white sucker, and yellow perch (ECT 2009c). When Sabin Pond fisheries were assessed in 2007, only northern pike and white sucker were abundant. Given the low relative abundances of most sportfish, and the small average size of northern pike, the Sabin Dam reservoir appears to provide a poor warmwater fishery (ECT 2009c).

Segment 5, Boardman Pond, contains the following fish species:, black bullhead, bluegill, brown bullhead, brown trout, common shiner, hornyhead chub (*Nocomis biguttatus*), largemouth bass, northern pike, pumpkinseed sunfish, rock bass, sand shiner, white sucker, yellow bullhead (*Ictalurus natalis*), and yellow perch. In June 2007, a fisheries survey of Boardman Pond found that rock bass and white sucker were the most the abundant species present; smallmouth bass and northern pike were common; and bluegill, yellow perch, largemouth bass, and pumpkinseed sunfish were present in relatively low numbers. Consequently, the Boardman (Keystone) Pond reservoir appears to provide a fair smallmouth bass fishery and poor fisheries for other game fish (ECT 2009c).

Segment 6, upstream of Boardman Pond, was evaluated prior to Brown Bridge Dam being removed. At that time the river segment, with the exception of water temperature, provided good fisheries habitat. River segment 6 starts at the downstream side of the location of the former Brown Bridge Dam and extends downstream for 13.7 miles before reaching the upstream extent of impoundment effects from the Boardman Dam. The average width of the river in this segment is 56 feet and approximately one-quarter of the stream provides water depths of 2.5 feet or greater. The percentage of stream containing wood material is 11 percent and the percentage of the stream covered by aquatic vegetation is 17 percent. Based on qualitative observations, the average composition of streambed substrates are 2 percent clay, 5 percent silt, 16 percent sand, 58 percent gravel, 15 percent cobble, and 3 percent boulders (ECT 2009d). Fish species found in river segment 6 include American brook lamprey, blacknose dace, bluntnose minnow, central mudminnow, coho salmon, common shiner, creek chub, golden shiner, green sunfish, largemouth bass, longnose dace, northern pike, pumpkinseed sunfish, rock bass, sculpins,

smallmouth bass, white sucker, and yellow perch (ECT 2009c). Additionally, this river segment appears to have moderate densities of brown trout and low densities of brook trout based on MDNR fisheries data. A list of fish and mussel species found within the entire Boardman River is included as **Appendix C**.

3.3.1.8 Protected Species

The potential occurrence of federally or State-listed threatened or endangered species was evaluated based on information from USFWS, MDNR, and Michigan Natural Features Inventory (MNFI) Web sites and information received directly from Federal and State natural resources agencies. Federally listed threatened and endangered species and federally designated critical habitat receive protection under the Endangered Species Act of 1973 (ESA) (16 U.S.C. §§ 1531–1544). Federal candidate species are not specifically afforded the same protection under the ESA as threatened or endangered species; however, Federal agencies are required to consider them in the agency's planning and decision making processes.

According to the USFWS website, three federally listed species occur in Grand Traverse County including the endangered Kirkland's warbler (*Dendroica kirtlandii*), the threatened Pitcher's thistle (*Cirsium pitcheri*), and the eastern massasauga (*Sistrurus catenatus*), a candidate species. The Kirtland's warbler is dependent upon large, relatively homogeneous stands of jack pine (*Pinus banksiana*) with scattered small openings (Olson 2002). The Pitcher's thistle typically grows on open sand dunes and occasionally on lag gravel associated with shoreline dunes. All of its habitats are along the Great Lakes shores, or in very close proximity (Higman and Penskar 1999). Neither jack pine stands nor sand dune habitat is located within the project area. The eastern massasauga is found in a variety of wetland habitats, including bogs, fens, shrub swamps, wet meadows, marshes, moist grasslands, wet prairies, and floodplain forests (Lee and Legge 2000). Consequently, some habitat is available to this candidate species within the project area; however, no records exist of it occurring specifically within the project area.

State-listed threatened and endangered species are protected by laws and regulations contained in Part 365, Endangered Species Protection of the Natural Resources and Environmental Protection Act (Act 451 of the Michigan Public Acts of 1994). While special concern species are not afforded legal protection under the Act, many of these species are of concern because of declining or relict populations in the State. Known occurrences of State and federally listed threatened and endangered species were obtained from the MNFI, the Michigan Loon Preservation Association, and the MDNR (ECT 2009a).

The Migratory Bird Treaty Act of 1918 (MBTA) implements various treaties and conventions between the United States and Canada, Japan, Mexico, and Russia for the protection of migratory birds. Under the MBTA, the taking, killing, or possessing of migratory birds is unlawful, unless permitted by regulation. The MBTA requires Federal agencies to ensure that any action it authorizes, funds, or conducts does not "adversely impact" migratory bird species or "destroy or adversely modify" any part, nest, or egg of any such bird. Under the MBTA, most bird species are considered migratory and are protected. Additionally, the Bald and Golden Eagle Act of 1940 provides for the protection of the bald eagle (*Haliaeetus leucocephalus*), the national

emblem, and the golden eagle (*Aquila chrysaetos*) by prohibiting, except under certain specified conditions, the taking, possession, and commerce of such birds.

Appendix C contains a list of protected species known to occur within Grand Traverse County according to MNFI data. Several of these threatened species have been observed within the project area, including the common loon (*Gavia immer*) and red-shouldered hawk (*Buteo lineatus*), which are listed as State threatened, and the wood turtle (*Glyptemys insculpta*), listed by the State of Michigan as a species of special concern. Lake sturgeon (*Acipenser fulvescens*) are currently listed as a State-threatened species; they prefer large shallow lakes and rivers and the Great Lakes shorelines. Within the United States, Michigan and Wisconsin hold the last major populations of these fish and they occur within the project area. No listed endangered species have been observed within the project area according to MNFI records and past field surveys (ECT 2009a).

Common loons have been recorded on Brown Bridge Pond (which was permanently drained and the dam removed in 2012), Boardman Pond, and Boardman Lake. Loons have nested within Brown Bridge and Boardman Ponds for several years and were active during ECT field surveys performed in 2008. Additionally, residents of Boardman Pond report that loons successfully nested there in the summer of 2012. Loons are also often seen on Boardman Lake in the summer months (ECT 2009a).

Two red-shouldered hawk occurrences have been recorded within a mile of the project area approximately midway between Boardman Pond and the former Brown Bridge Pond. The two records are dated as last observed in 2004. In Michigan, this species historically nests in mature deciduous or mixed forest complexes, while foraging in forested floodplains and wetlands, including beaver ponds and wet meadows. Species decline has been attributed to habitat loss.

The two wood turtle MNFI element occurrence records are dated 1991 and 2005. Occurrence locations are on the main stem of the Boardman River between the former Brown Bridge Dam and Boardman Pond. Wood turtles prefer coldwater stream habitats and their decline has been attributed to incidental, illegal collection, heavy nest predation, and habitat degradation by human development, principally roadways, dams, and home development (ECT 2009a).

Sabin Pond and Boardman Pond do not appear to be important stopovers for migratory bird species, unlike other waterbodies in the vicinity, such as Boardman Lake (ECT 2009a).

3.3.1.9 Exotic/Nuisance Species

Exotic species are those species introduced to an ecosystem from other geographic areas. Many exotics are also nuisance species because, having not been a long-term part of the local ecosystem, they tend to upset the natural balance that has been achieved over time. Nuisance species often crowd out native species and multiply to occupy large portions of the habitat area, thereby substantially diminishing the habitat quality through loss of diversity and quality of plant and animal components.

An “invasive species” is defined by Executive Order 13112, *Invasive Species*, as a species that is, “1) non-native (or alien/exotic) to the ecosystem under consideration, and 2) whose introduction

causes or is likely to cause economic or environmental harm or harm to human health" (USACE 2012). Invasive species known to occur at the edges of the impoundments and adjacent wetlands include narrowleaf cattail (*Typha angustifolia*), purple loosestrife (*Lythrum salicaria*), nodding smartweed (*Polygonum lapathifolium*), common reed (*Phragmites australis*) and reed canary grass (*Phalaris arundinacea*), and rice cutgrass (*Leersia oryzoides*). Within Boardman Lake, Sabin Pond, and Boardman Pond, mute swans (*Cygnus olor*) have also been observed foraging and nesting.

Known aquatic invasive species within Grand Traverse Bay, the Boardman River, and its tributaries could also be problematic following dam removal. Potential invaders to river segments upstream from the Union Street Dam include: sea lamprey (*Petromyzon marinus*; Grand Traverse Bay), fishhook water flea (*Cercopagis pengoi*; Grand Traverse Bay), rusty crayfish (*Orconectes rusticus*; Grand Traverse Bay), spiny water flea (*Bythotrephes cederstroemi*; Grand Traverse Bay), Eurasian ruffe (*Gymnocephalus cernuus*; Grand Traverse Bay), round goby (*Neogobius melanostomus*; Grand Traverse Bay), alewife (*Alosa pseudoharengus*; Grand Traverse Bay), and Eurasian water milfoil (*Myriophyllum spicatum*; Grand Traverse Bay). Currently, these invasive animals are blocked from accessing Boardman Lake and the Boardman River upstream of Union Street Dam because of the MDNR fish weir and the Union Street Dam. One invasive species currently residing in Boardman Lake is the zebra mussel (*Dreissena polymorpha*). Zebra mussels comprise approximately 53 to 77 percent of all bottom-dwelling organisms found in Boardman Lake (WCGTB et al. 2003).

3.3.1.10 Floodplains

The Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps for Grand Traverse County were reviewed for floodplains in the project area. However, a majority of the project area, including Sabin and Boardman Ponds, is currently officially unmapped. Preliminary mapping was made available for Garfield Township in December 2011, but has not yet been approved and become official. Preliminary mapping only shows the 100-year floodplain within the project area for Traverse City and Garfield Township (**Figure 10**). No published floodplain information is available for Blair Township, which contains Boardman Pond and affected sections of the Boardman River.

Floodplain information is available for Traverse City and Garfield Township, which includes the Union Street, Sabin, and Boardman Dams. Area around the dams, the Boardman River, the impoundments, and small areas of riparian habitat are labeled as Special Flood Hazard Areas (SFHAs), which represent the 1-percent-annual-chance flood (100-year flood), also known as the base flood. This is the flood that has a 1 percent chance of being equaled or exceeded in any given year. **Figure 10** is an unofficial floodplain map of the study area with the exception of the SFHA within Blair Township.

Recent available data on flood history for the Boardman River reveal that no recent natural flood events have occurred. The Kalkaska soil that composes the riverbed plays a key role in mitigating flood events within the watershed. It is a sandy, porous soil that drains quickly and helps keep the river from flooding during heavy rains.

Moreover, the dams situated along the Boardman River were constructed for purposes of power generation, and were not intended to be used as flood control structures. Analysis of the flood attenuation properties of the Boardman and Sabin Dams show that, in large storm events (100-year and greater), the dams do not significantly attenuate runoff. The Boardman Dam reduces flows by less than 2 percent for less than 5 hours. The Sabin Dam reduces flows by less than 1 percent for less than 1 hour.

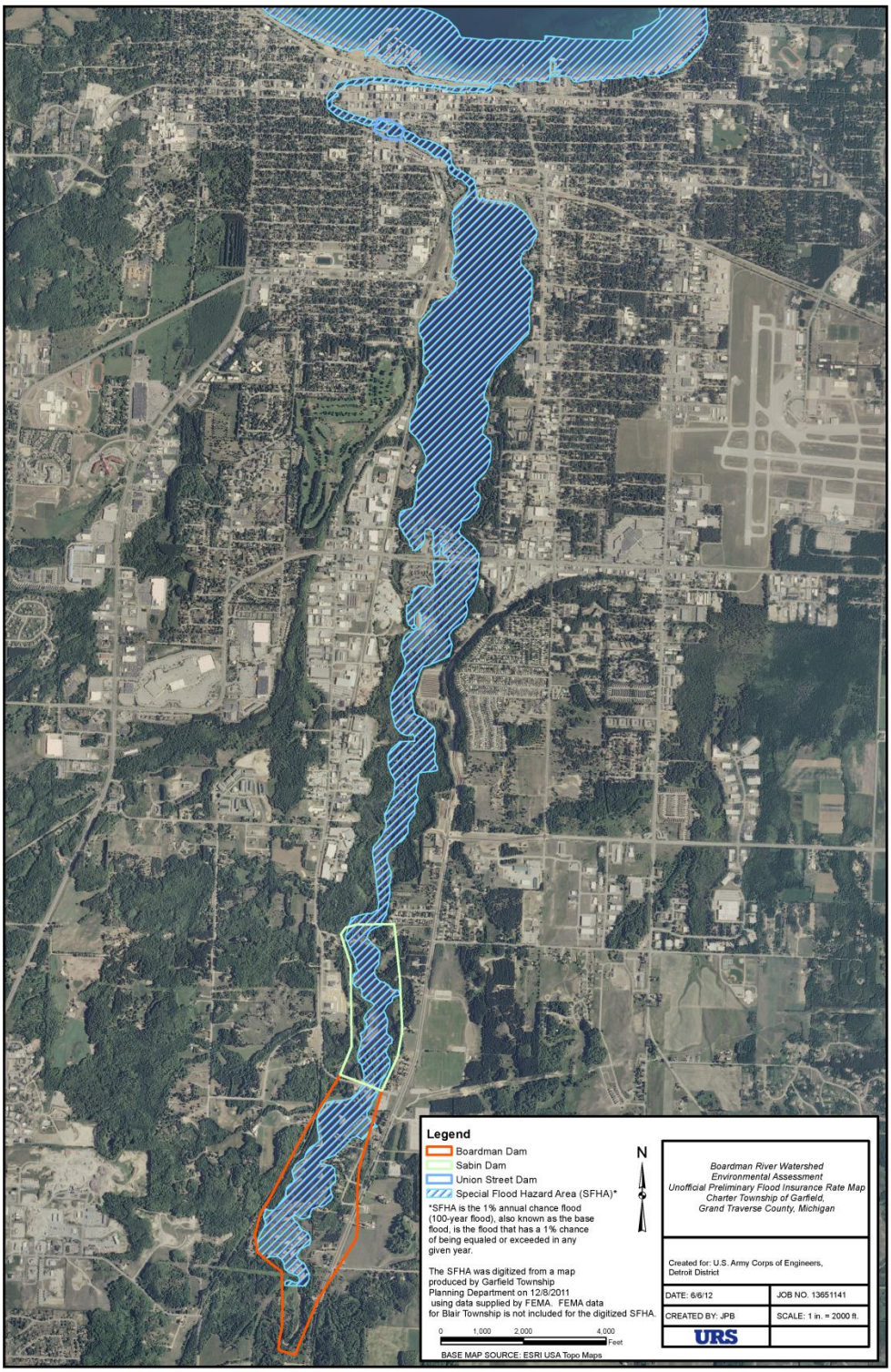


Figure 10: Floodplains Associated with the Boardman, Sabin, and Union Street Dams

3.3.2 Land Use, Recreation, Visual Resources, and Aesthetics

Land use and recreation facilities were classified based on their characteristics compiled from the Grand Traverse County Equalization Department Geographic Information System (GIS) Division. In addition, field site visits were used to ground truth the land use and recreation facility data. Visual resources refer to the natural and constructed features that give a particular environment its aesthetic qualities. This section describes the land use, recreation, visual resources, and aesthetics that occur within the project area.

3.3.2.1 Land Use

According to the Grand Traverse County 2012 GIS Land Use/Cover Data, the majority of the Boardman River watershed is open wooded areas (approximately 56 percent) consisting of fallow fields, woods, camps, parklands, and beaches. This rest of the watershed is approximately 24 percent residential, 9 percent agriculture, 5 percent commercial/industrial, and 5 percent open water.

As defined in **Figure 2**, approximately 40 percent of the Boardman River project area is water or beach / riverbank. Various forested cover types comprise 35.1 percent of the project area, with shrub / grass / other open spaces, residential, and transportation / communications / utilities making up 12.4 percent, 10.7 percent, and 1.2 percent, respectively. In addition, a minimal 0.4 percent of land use consists of commercial services and institutional (governmental and schools) uses. These estimates incorporate data from the 2012 GIS Land Use/Cover for Grand Traverse County and are summarized in **Table 9** and mapped in **Figure 11**. These estimates are based on GIS land use/cover for a desktop review of these features and are not based on field delineations.

Table 9: Summary of 2012 Land Use for Boardman River Project Area

2012 Land Use / Cover	Acres of Project Area	Percent (%) of Project Area
Water	93.3	27.6
Wooded Wetland	62.5	18.4
Beach/Riverbank	42.5	12.5
Single Family / Duplex Residential	35.8	10.6
Broad Leaf Forest	30	8.8
Grass Shrublands	19.9	5.9
Coniferous Forest	15.6	4.6
Open Land Recreation	11.7	3.5
Mixed Broad Leaf / Coniferous Forest	11.2	3.3
Cropland	8.8	2.6
Transportation/Communications/Utilities	3.8	1.2
Non Wooded Wetland	1.7	0.5
Institutional	1.2	0.4
Multi-Family Residential	0.6	0.2
Commercial Services	0.1	0.03
Other Agricultural Lands	0.03	0.01
Total	338.7	100.0

Source: Grand Traverse County 2012 GIS Land Use

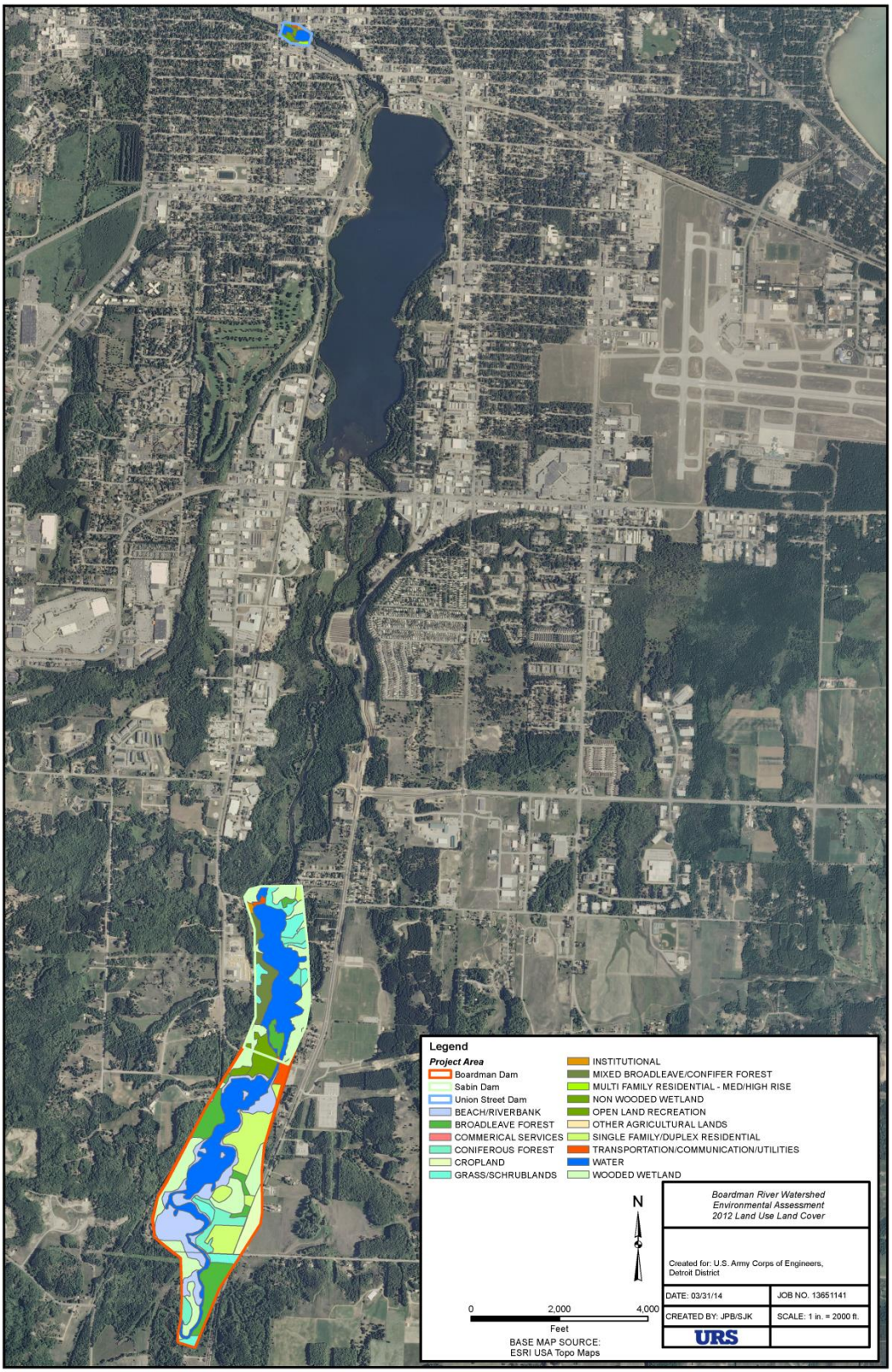


Figure 11: Land Use in Boardman River Area

3.3.2.2 Recreation

The Boardman River Study Area provides an attractive destination for outdoor recreation. Fishing, canoeing, hiking, camping, hunting, and wildlife viewing account for much of the outdoor recreation that occurs in the area around the Boardman River (MDNR 2007).

There are many recreational facilities surrounding the river that offer a diverse range of recreational opportunities for locals and tourists. The Boardman Valley Nature Preserve is located adjacent to Sabin Pond and includes over 100 acres for hiking, mountain biking, nature watching, hunting, and fishing. The Natural Education Reserve abuts the Boardman Valley Nature Preserve to the south and has 505 acres and 7 miles of trails along both banks of the Boardman River. **Table 10** lists the recreation facilities on or near the Boardman River and **Figure 12** displays the locations of the facilities. These facilities offer diverse recreational opportunities, including fishing, hunting, canoeing, boating, horseback riding, hiking, and wildlife viewing (MDNR 2007).

According to the Traverse City Convention and Visitors Bureau, 36 percent of tourists visit the Traverse City area because of its waterfront, parks, and beaches (Traverse City Convention and Visitors Bureau 2007). Fishing, canoeing, hiking, and swimming all rank among the top five summer recreational activities undertaken by tourists.

Table 10: Recreation Facilities on or Near Boardman River

State or National Forests / Lakeshore	State Park / Game Area	City and County Parks	Trail Systems*	Other
Arbutus Number 4 State Forest CCC Bridge State Forest Guernsey Lake State Forest Pere Marquette State Forest Pickerel Lake State Forest Schecks Place State Forest	Interlochen State Park Petobego State Game Area Traverse City State Park	Grand Traverse Natural Education Reserve Medalie Park Peninsula Township Park Veterans Memorial Park Whitewater Township Park Hannah Park Beitner Park Lay Park Legion Park Hull Park (Boardman Lake Public Access)	Boardman River Walkway (1) Boardman Valley Trail (north) (2) Cedar Cathedral Trail (3) Cistern Spur (east) (4) Cistern Spur (west) (5) Copper Ridge Trail (6) East Boardman Lake Trail (7) Fife Lake Trail (8) Garfield Trail (9) Grawn Trail (10) Meadows Loop (11) Mission Point Trail (12) North Long Lake Trail (13) Old Orchard Trail (14) Oleson's Trail (15) South Long Lake Trail (16) Streamside Loop (17) Tanglewood Trail (18) TART Trail Connector (19) West Boardman Lake Trail (20) West Boardman Lake Trail Connector (21) Unnamed Trail (22) Sabin Pond Trail (23) Beaver Pond Trail (24)	East Boardman Lake Trail West Boardman Lake Trail Boardman Valley Trail Boardman River Walkway Brown Bridge Pond Natural Area/Nature Preserve Muncie Lake Pathway Traverse City Golf and Country Club Ranch Rudolph Tart Trail Tart Trail Connector Fife Lake Trail Platt River State Fish Hatchery Sand Lake Quiet Area Shore-to-Shore Riding/Hiking Trail Grand Traverse Bay YMCA Traverse Area Recreation Trail Traverse Bay Keystone Soccer Field Vasa Pathway

Source: ECT 2009 and Grand Traverse County 2012 Recreation GIS Dataset

- Trail System numbers correspond to Figure 12

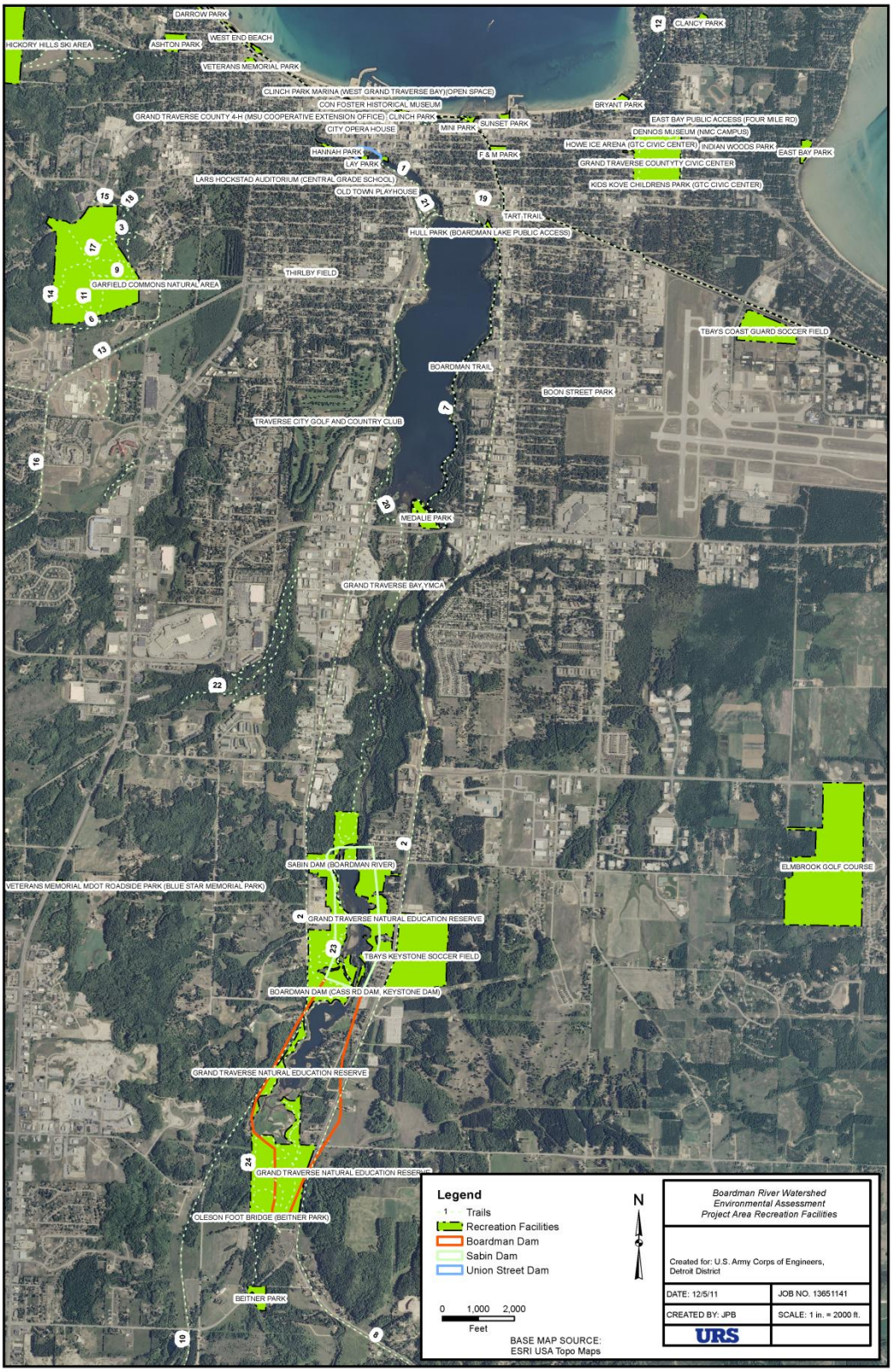


Figure 12: Recreation on or near the Boardman River

3.3.2.3 Visual Resources and Aesthetics

The existing scenic or aesthetic resources within the project area are generally defined as both the natural and built landscape features that can be seen and that contribute to the public's experience and appreciation of the environment. The Union Street Dam project area for visual resources and aesthetics is focused on the immediate area surrounding the dam containing the earthen embankment dam structure and open space water along the Boardman River. This area includes the visual resources adjoining the river representative of the commercial neighborhood characteristics found in downtown Traverse City, such as landscaping, surface parking lots, streets, and buildings.

Further upstream, both the Sabin Dam and the Boardman Dam project areas are located outside the limits of Traverse City and subsequently contain less urban and more rural characteristics. These areas are dominated by the open space water consisting of the Sabin Pond and Boardman (Keystone) Pond and respective downstream portions of the Boardman River. In addition, these areas are complemented with riparian forests, scrub shrub wetlands, and other natural open space landscapes. Limited rural development patterns exist with large-lot residential properties and access roads.

3.3.3 Socioeconomic Resources

Socioeconomic resources are defined as the basic attributes associated with the human environment, particularly population and economic activity. Population is described as the magnitude, characteristics, and distribution of people. Economic activity is described in terms of employment distribution, personal income, and business growth. This section also discusses transportation, traffic, utilities, and infrastructure.

In comparison to the 2000 U.S. Census, the 2010 U.S. Census shows the population of Grand Traverse County as growing older with minor growth in the overall population. This is in contrast to the population of the State of Michigan, which is experiencing an overall decrease in population. **Table 11** presents demographic and socioeconomic data from the 2010 U.S. Census for Grand Traverse County and Michigan.

Table 11: Summary of 2010 Census Demographics

Description	Grand Traverse County	Percent Change	State of Michigan	Percent Change
Population	86,986	+12.0	9,883,640	-0.6
Persons Under 5 Years	4,907	+3.9	596,286	-11.3
Persons 18 Years and Over	67,791	+17.0	7,539,572	+2.7
Persons 65 Years and Over	13,028	+28.4	1,361,530	+11.7
Median Age in Years	41.3	+9.5	38.9	+9.6
Total Households	35,328	+16.2	3,872,508	+2.3
Number of Housing Units	41,599	+19.4	4,532,233	+7.0
Owner-Occupied Housing Units	26,489	+12.6	2,793,342	+0.0
Source: (U.S. Census Bureau 2010) *Percent Population Change is calculated from the year 2000 to 2010.				

The portion of the Grand Traverse County population impacted by the project includes the residential homeowners along the Boardman River and impoundments. Lands along the Boardman River upstream and downstream of the Boardman and Sabin Dams are characterized by low density residential use and as such are owned by private landowners. However, all land associated with the project is owned by the local sponsor. The entire impounded area as well as the riparian upland areas containing the dams have been allocated to the project. Construction activities associated with the project utilize much of the surrounding riparian upland area for work and storage activities and the impoundments would be used for sediment placement. Consequently, the project would not require the relocation of any residences or businesses. Additionally, land that is adjacent to the project area is not considered to have riparian rights.

Overall, real household income decreased in Grand Traverse County and statewide since the last U.S. Census in 2000. Compared with Michigan, Grand Traverse County has higher incomes, fewer people below the poverty level, a lower unemployment rate, and more people with a higher education. Between 2006 and 2010, the unemployment rate increased considerably in Michigan. **Table 12** summarizes data from the U.S. Census Bureau American Community Survey for Grand Traverse County and Michigan (2010a).

Table 12: American Community Survey 5-Year Estimates (2006–2010)

Description	Grand Traverse County	Percent Change	Michigan	Percent Change
Median Household Income (2010 $)	50,647	-10.4	48,432	-17.2
Mean Household Income (2010 $)	66,488	-4.0	63,692	-16.0
Below Poverty Level	5.9%	+0.0	10.6%	+1.0
Unemployment Rate	8.2%	+78.3	11.5%	+98.3
High School Graduate or Higher	92.8%	+3.9	88.0%	+5.5
Bachelor's Degree of Higher	28.9%	+10.7	25.0%	+14.7

In Grand Traverse County, the largest industries are retail trade, arts, entertainment, recreation, accommodation, and food services (U.S. Census Bureau 2010a). **Figure 13** shows the socioeconomic resources directly serving the project area and vicinity. Resources specific to the project area include parks, preserves, and recreation opportunities, as well as one mobile home park.

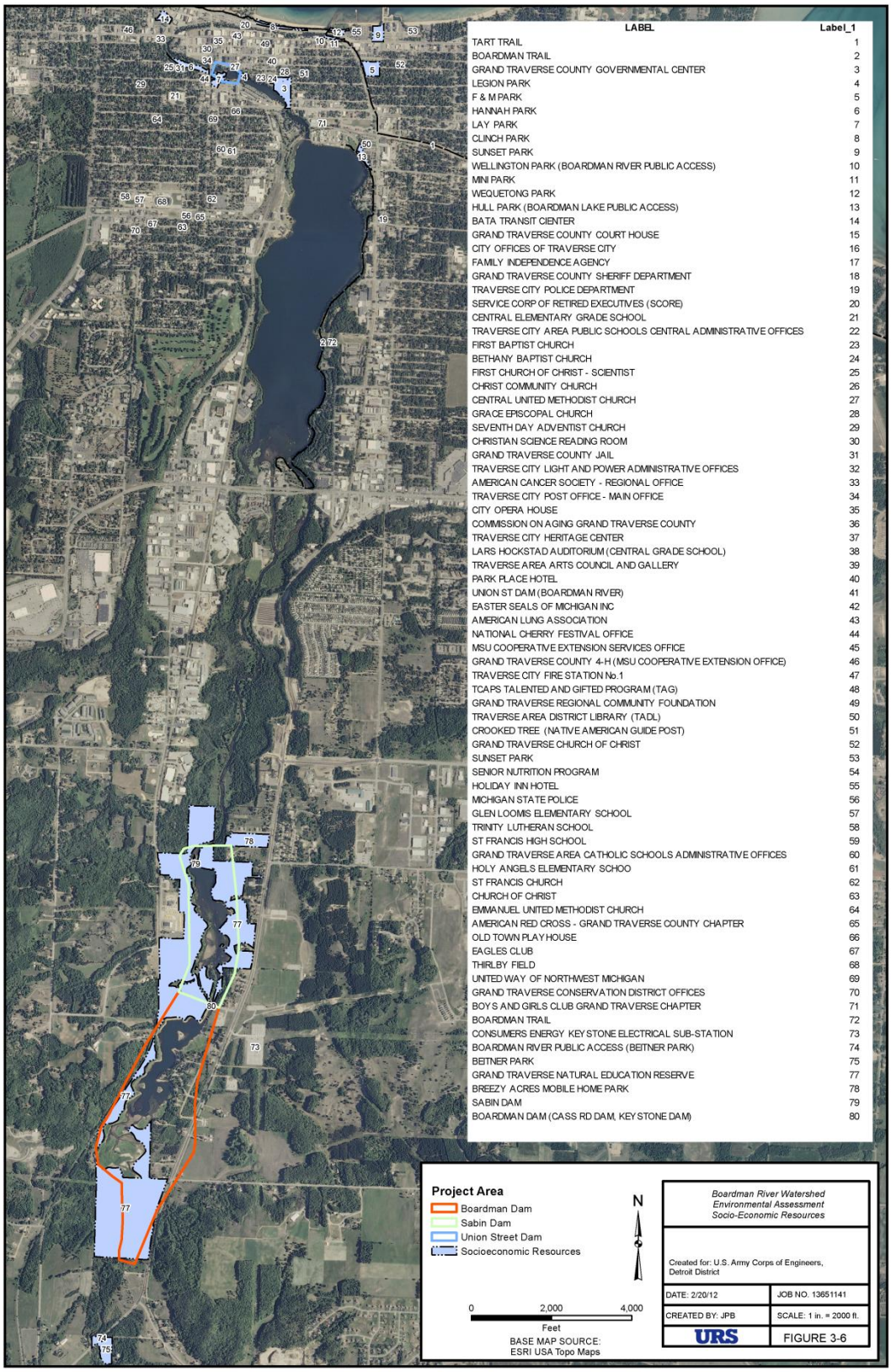


Figure 13: Socioeconomic Resources near the Boardman River

3.3.3.1 Transportation and Traffic

This section presents an overview of the traffic and transportation characteristics to provide a context from which to assess impacts of the proposed project. **Figure 14** depicts the roadways in the project area. The Union Street Dam does not have any roads crossing over it, but it is bounded by S. Union Street to the west, East State Street to the north, Cass Street to the east, and a few side streets to the south, Rivers Edge Drive, 7th Street, and Lake Avenue. The Sabin Dam also does not have any roads crossing the dam, but is bounded by Cass Road to the east and Keystone Road to the west. Two access roads off of Cass and Keystone lead to the Sabin Dam, Birmley Road, and an unnamed road leading the public to the Boardman River Nature Center. The Boardman Dam is bounded by Keystone Road to the east and Cass Road to the west. Cass Road takes a slight curve to the west toward Keystone Road and crosses over the Boardman Dam.

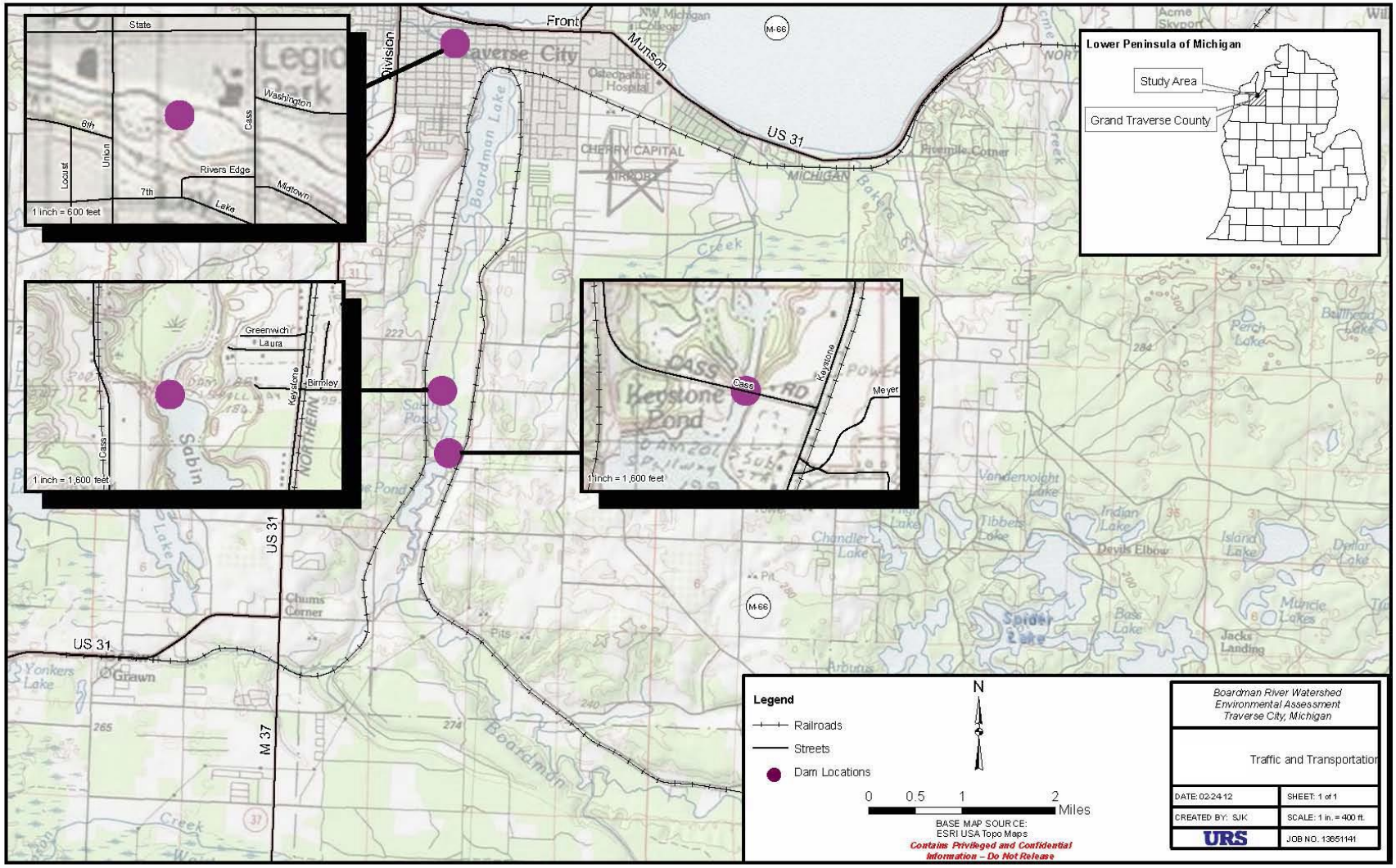


Figure 14: Transportation Resources within the Project Area

3.3.3.2 Utilities and Infrastructure

Utility infrastructure refers to the system of public works that provides the underlying framework for a community. Utilities include electric, gas, telephone, sanitary sewer, and domestic water. The project area was examined for the existence of public utilities.

The Union Street Dam is currently a pedestrian bridge over the Boardman River in downtown Traverse City. A water main in the dam is owned by the city. Overhead electrical wires and an electric station in the area surrounding the dam are owned by Traverse City Light and Power.

The Sabin Dam is a non-active hydroelectric dam. The dam's electrical utilities include a powerhouse, owned by Traverse City Light and Power, previously used for electricity with the overhead electrical wires crossing the dam.

The Boardman Dam is a non-active hydroelectric dam. The dam's electrical utilities include an electrical station in the southeast corner of the property and a powerhouse previously used for electricity with the overhead electrical wires crossing the dam. All electrical utilities are owned by Traverse City Light and Power.

3.3.4 Hazardous, Toxic, and Radiological Waste

The terms "hazardous materials" refers to any item or agent (biological, chemical, or physical) that has the potential to cause harm to humans, animals, or the environment, either by itself or through interaction with other factors. Issues associated with hazardous materials typically center around waste streams, underground storage tanks (USTs), aboveground storage tanks, and the storage, transport, use, and disposal of pesticides, fuels, lubricants, and other industrial substances. When such materials are improperly used, they can threaten the health and well-being of wildlife species, habitats, soil and water systems, and humans. The presence of existing and/or potential sources of hazardous, toxic, and radioactive wastes (HTRW) in the project area is outlined in this section.

URS Corporation (URS) personnel conducted an HTRW survey of the project area on June 9, 2011. The following potential environmental concerns and recognized environmental conditions[4] at the three dams were identified based on site reconnaissance observations, historical use as indicated by aerial photographs, and/or regulatory database listings. The American Society for Testing and Materials (ASTM E1527-05) defines these substances as substances that may be present on a property in quantities and under conditions that may lead to contamination of the property or of nearby properties but are not included in Comprehensive Environmental

[4] A *recognized environmental condition* is defined in the American Society for Testing and Materials (ASTM) standard E 1527-05 as the presence or likely presence of hazardous substances or petroleum products on a property under conditions that indicate an existing release, a past release, or a material threat of a release of any hazardous substances or petroleum products into structures on the property or into the ground, ground water, or surface water of the property. A *material threat* is a physically observable or obvious threat that is reasonably likely to lead to a release that, in the opinion of the environmental professional, is threatening and might result in impact to public health or the environment.

Response, Compensation, and Liability Act's (CERCLA) definition of hazardous substances or do not otherwise present potential CERCLA liability. Non-ASTM environmental concerns include potential asbestos-containing materials, potential lead-based paint, heavy metal-containing materials, radon and mold.

AMEC Environment & Infrastructure, Inc. (AMEC) conducted a hazardous materials building survey of the Sabin Dam powerhouse in October and November 2011. AMEC's results are included in the discussion of the Sabin Dam below.

3.3.4.1 Union Street Dam

The following properties located within the immediate vicinity of the subject property and hydrologically up gradient are identified as recognized environmental conditions to the Union Street Dam:

- The eastern adjoining property on the south bank was identified as a State Hazardous Waste Site (SHWS) with an applied Activity and Use Limitation. During a 2002 soil investigation at this adjoining property, chromium, mercury, selenium, fluoranthene, and phenanthene were detected above MDEQ ground surface water interface criteria.
- The Traverse City Iron Works property was listed as a SHWS in 2005 because of subsurface impacts of arsenic, benzo(a)pyrene, copper, lead, and polynuclear aromatics (PNAs) resulting from historical steel foundry activities. An Activity and Use Limitation was applied to this property on February 9, 2010, as a result of these impacts.
- Randy's Old Towne Shell, at 430 S. Union Street, is located 0.125 mile south-southwest of the subject property. This property was listed as a SHWS in 2004 because of subsurface impacts from xylene and gasoline. An interim response has reportedly been conducted and no further remediation activities are anticipated. Groundwater flow at this property is to the north-northeast towards Boardman River.

An additional Environmental Data Resources (EDR) database report was ordered for properties surrounding Boardman Lake because the lake is hydrologically up gradient from the Union Street Dam and current and because of historical industrial development around the lake. Based on the EDR of listed properties surrounding Boardman Lake, the following constituents have the potential to have impacted lake sediments: petroleum products, pesticides, PCBs, dry-cleaning compounds, heavy metals, solvents, PNAs, volatile organic compounds (VOCs), and sodium chlorides and bicarbonates. Environmental concerns not within the ASTM E1527-05 scope that URS investigated at the dam structure include potential asbestos-containing material (ACM), potential lead-based paint, and heavy metal-containing materials. Potential PCB-containing equipment was also inspected. Potential ACM observed includes roofing materials and wire insulation on and within the concrete-block storage building located on the south bank of the dam.

3.3.4.2 Sabin Dam and Sabin Pond

The following potential recognized environmental conditions were identified at the Sabin Dam and its associated impoundment:

- Western Adjoining Maintenance Facility – The Traverse City Area Public Schools (TCAPS) Maintenance Department facility, at 1180 Cass Road, is located west of the impoundment. This property was identified in the EDR report and in the Resource Conservation and Recovery Act, UST, and Leaking Underground Storage Tank databases. Because of the presence of USTs and vehicle maintenance activities at this property since 1970 and the potential for offsite discharge of stormwater into Sabin Pond, the TCAPS property represents a potential recognized environmental condition to the subject property. Sediment within Sabin Pond may be impacted with petroleum products and other vehicle fluids as a result of current and historical operations at this property.

Non-ASTM environmental concerns investigated at the dam structure include potential ACM, potential lead-based paint, and heavy metal-containing materials. Potential PCB-containing equipment was also inspected. The following potential ACMs were observed at the Sabin Dam: weathered and damaged caulk on windows, sealant materials, and roofing materials. Possible lead-based paint was observed within the interior of the powerhouse; the paint was peeling and in poor condition. Lead-encased wiring may also be present. Fluorescent light tubes installed within the powerhouse may contain mercury. Possible PCB-contaminated or PCB-containing equipment observed includes: weathered and damaged window caulking, fluorescent light ballasts, oil staining on the main level of powerhouse from removed equipment, electrical switches and other equipment, and a pad-mounted transformer located on the west bank.

AMEC conducted a hazardous materials building survey of the powerhouse at the Sabin Dam in October and November 2011. The survey was conducted on the interior and exterior of the building, excluding the roof, areas along the dam embankment adjacent to the spillway, and lower levels of the powerhouse. The survey included a National Emission Standards for Hazardous Air Pollutants asbestos building survey, a lead-based paint survey, an inventory of building components that may contain PCBs, mercury, chlorofluorocarbons, refrigerants, and other potentially hazardous materials. The samples collected during the building survey and their analytical results are summarized below.

- AMEC collected four bulk samples for asbestos analysis, including window caulk, white powder underlying paint, and two samples of exterior brick mortar. All results of bulk samples analyzed for asbestos fibers were non-detect, indicating that they may be considered non-asbestos. The roof, which was not sampled, is constructed of concrete with a rubber membrane and stone surface, according to AMEC.
- AMEC collected 13 paint chip samples from various interior and exterior surfaces. Only one of the paint samples, taken from dark grey paint in the interior of the powerhouse, exhibited a lead concentration of 0.75 percent (0.5 percent and above is considered lead-based paint by the Department of Housing and Urban Development). This paint was

observed on eight vertical beams on the northern and southern walls of the main room in the powerhouse. The other paint chip samples were below 0.5 percent.

- AMEC noted the following potentially mercury-containing items at the powerhouse: a thermostat along the north interior wall, an emergency alarm lamp on the east exterior wall, 3 high-intensity lamps along the exterior walls, and 12 fluorescent lighting lamps inside the powerhouse.
- AMEC noted the following potentially PCB-containing items at the powerhouse: six fluorescent lighting ballasts and one pad-mounted transformer located on the embankment by the powerhouse. AMEC had a sample of window caulk analyzed for PCBs; the caulk was determined to be non-PCB.
- AMEC did not identify any other potentially hazardous materials at the Sabin Dam powerhouse.

Based on the results of their hazardous materials building survey, AMEC recommended the following in regards to demolition of the powerhouse at the Sabin Dam[5]:

- Although no ACM was identified, a *Notification of Intent to Renovate/Demolish* form must be submitted to the Michigan Department of Labor and Economic Growth – Asbestos Program at least 10 working days prior to demolition activities.
- The appropriate precautions must be taken during demolition of the lead-based paint coated beams in the powerhouse to comply with the Federal lead construction standards (29 CFR 1926.62).
- The building materials potentially containing mercury and PCBs should be removed prior to demolition and disposed by a licensed disposal company.

A copy of AMEC's hazardous materials building survey report for the powerhouse at the Sabin Dam is available upon request.

3.3.4.3 Boardman Dam and Boardman (Keystone) Pond

Non-ASTM environmental concerns investigated at the dam structure include potential ACM, potential lead-based paint, and heavy metal-containing materials. Potential PCB-containing equipment was also inspected. The following potential ACMs were observed at Boardman Dam: weathered and damaged caulk on windows, sealant materials, terrazzo flooring, wire insulation in lighting fixtures, suspended acoustical ceiling tile in the east upper office, original electrical conduits encased in concrete walls, electrical panel insulation, and roofing materials. Possible lead-based paint was observed within the interior of the powerhouse; the paint was peeling and in poor condition in some locations. Lead-encased wiring may also be present. Fluorescent light tubes installed within the powerhouse may be mercury-containing. Possible PCB-contaminated

[5] Note that the powerhouse is not being removed under the Section 506 project.

or PCB-containing equipment observed includes: weathered and damaged window caulking, oil staining on the main level of powerhouse and in equipment shafts from removed equipment, hydraulic oil reservoir at lift gates, electrical switches and other equipment, original electrical conduits embedded in concrete walls, and a pad-mounted transformer located on the west embankment.

3.3.5 Sediment Quality and Contamination

Given the potential for sediment contamination within the impoundments, a discussion of sediment quality and potentially contaminated sediments is included in this section for Boardman Pond (also known as Keystone Pond) and Sabin Pond. Multiple sediment sampling efforts have been conducted within the impoundments by the MDEQ, the Great Lakes Environmental Center, Inc. (GLEC), and Environmental Consulting and Technology, Inc. (ECT) in 1997, 2005, 2010, and 2012. Based on a review of prior sediment sampling activities and lab analytical data, the following criteria were used to evaluate the impoundment sediments:

- EPA Threshold Effect Concentrations (TECs)
- EPA Probable Effect Concentrations (PECs)
- MDEQ Michigan Default Background Levels
- Drinking Water Protection Criteria (DWPC)[6]
- Direct Contact Criteria (DCC)[7]
- Groundwater / Surface Water Protection Criteria (GSIPC).[8]

The MDEQ Surface Water Quality Division, in conjunction with the USEPA, conducted sediment sampling in 1997 in Boardman Lake and the Boardman River extending down to the Union Street Dam. Additional sediment sampling as well as toxicity testing on samples from the northern portion of Boardman Lake and the Boardman River halfway up to the Union Street

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[6] The drinking water criteria (DWC) were developed pursuant to Sections 20120a(1)(a), (b), and (d); 20120(a)(3) and (5); and 21304a(1) (2) of the Natural Resources and Environmental Protection Act (NREPA). The DWC represent concentrations of hazardous substances in drinking water that are safe for long-term consumption.

[7] NREPA Part 201, Rule 299, Cleanup Criteria Requirements for Response Activity was established based on authority conferred on the director of the Department of Environmental Quality by sections 20104(1) and 20120a(18) of 1994 PA 451, MCL 324.20104(1) and 324.20120a(18). The soil DCC, included in Rule 299, represents a soil concentration that is protective against adverse health effects due to long-term ingestion of and dermal contact with contaminated soil. The DCC were developed pursuant to Sections 20120a(1)(a) and; 20120(a)(3); and 21304a(1)(2) of NREPA.

[8] The Groundwater Surface Water Interface (GSI) is the location at which groundwater vents to a surface water body. Generic cleanup criteria for the GSI pathway have been developed pursuant to Sections 20120a(1) and 21304a of NREPA, R 299.5706a(4), and R 299.5716(6). The MDEQ has identified water quality standards for hazardous substances developed under Part 31 of NREPA that constitute generic GSI criteria consistent with R 299.5716(6). Water quality standards include chronic chemical-specific values that represent the most restrictive of the water quality values protective for aquatic life, human health, or wildlife; acute chemical-specific values protective of aquatic life; acute and chronic toxic units protective of aquatic life from groundwater toxicity testing; and standards for water quality characteristics (including physical characteristics, taste, and odor, etc.).

Dam were conducted by GLEC following the 1997 study to comply with MDEQ and USACE quality assurance standards and dredging guidance. ECT also collected sediment samples from Boardman and Sabin Ponds in 2005 and GLEC collected sediment samples from Boardman and Sabin Ponds in late fall 2010.

Given the potential for contaminated sediments within the impoundments, GLEC was again retained to conduct sediment sampling upstream of the Boardman and Sabin Dams in regard to the Proposed Action. Sampling took place in May 2012. Approximate sampling locations are included in **Figure 15** and **Figure 16**.

- At Sabin Pond, a total of 10 locations were sampled; four using GLEC's vibracore boat and the remaining using a combination of Wildco and handheld vibracore sediment sampling equipment. This sampling was conducted where water depths ranged up to 20 feet deep. Sediment samples were collected in clear, cellulose acetate butyrate liners (**Figure 15**).
- At the Boardman impoundment, 15 locations were sampled; of these 15 locations, four locations were sampled using GLEC's 26-foot long vibracore boat, the remaining 11 sediment sample locations were sampled using a combination of handheld vibracore and Wildco core sampling equipment (**Figure 16**).

Generally, samples were analyzed for pesticides, PCBs, PAHs, and 10 trace metals (arsenic, barium, cadmium, chromium, copper, lead, mercury, selenium, silver and zinc), unless stated otherwise below. Analysis of these sampling events is included in this section.

Figure 15: Sabin Pond Sampling

Figure 16: Boardman Pond Sampling

3.3.5.1 Union Street Dam

Previous environmental investigations have identified sediment contamination within Boardman Lake and River. Because these dams are located upstream of the Union Street Dam, the contaminants may have migrated via water flow patterns to the immediate Union Street Dam area and represent a potential recognized environmental condition to the subject property.

- The MDEQ Surface Water Quality Division, in conjunction with the EPA, conducted sediment sampling in 1997 in Boardman Lake and Boardman River extending up to the Union Street Dam. The purpose of the investigation was to determine if sediments within the lake have been impacted by discharges of contaminants from point and nonpoint sources located around the lake. The lowest effect level[9] was exceeded in several sediment samples for the following constituents and polynuclear aromatic hydrocarbons (PAHs), respectively: arsenic, chromium, copper, iron, mercury, and manganese; and phenanthrene, fluoranthene, pyrene, benzo (a) pyrene, benzo (a) anthracene, and chrysene. And the severe effect level[10] was exceeded in several sediment samples for cadmium, chromium, copper, iron, mercury, manganese, phenanthrene, fluoranthene, and pyrene. The metals were distributed throughout the entire area of Boardman Lake, whereas the PAHs were present in the northern portion of the lake and within Boardman River extending to the Union Street Dam. Solvents/metal degreasing compounds were detected in the northwestern portion of the lake.
- As a result of the 1997 MDEQ study, GLEC conducted additional sediment sampling as well as toxicity testing on samples from the northern portion of Boardman Lake and the Boardman River halfway to the Union Street Dam. GLEC collected three to five sediment samples from each station. The samples from the north-central area of the lake, a potential deposition zone, exceeded the PEC[11] for phenanthrene, fluoranthrene, pyrene, benzo(a)anthracene, chrysene, and benzo(a)pyrene; exceeded the TEC[12] for cadmium, chromium, copper, lead, and zinc; exceeded the EPA Ecological Data Quality Limits for cadmium, chromium, copper, iron, manganese, nickel, lead, and zinc; and exhibited elevated values for benzo(b)fluoranthene and benzo(k)fluoranthene. Locations between Boardman Lake and the Union Street Dam exceeded the TEC and some PEC values for

[9] The *lowest effect level* is the lowest concentration or amount of a substance found by experiment or observation that causes an adverse alteration of morphology, function, capacity, growth, development, or lifespan of a target organism distinguished from normal organisms of the same species under defined conditions of exposure.

[10] The *severe effect level* is the concentration at which pronounced effects can be expected for the benthic community as part of established guidelines for evaluating sediment concentration of trace elements and synthetic organic compounds as based on freshwater biota.

[11] The *probable effect concentration* is the level of a concentration in the media to which a plant or animal is directly exposed that is likely to cause an adverse effect.

[12] The *threshold effect concentration* is the concentration in the media to which a plant or animal is exposed, above which some effect (or response) will be produced and below which it will not.

copper, mercury, phenanthrene, anthracene, fluoranthrene, pyrene, benzo(a)anthracene, chrysene, and benzo(a)pyrene. Six PAHs were found at each station at high levels: phenanthrene, fluoranthrene, pyrene, benzo(a)anthracene, chrysene, and benzo(a)pyrene. Based on the toxicity study, GLEC concluded that these PAHs have a potential negative impact on benthic organisms within the lake and river.

The Watershed Center Grand Traverse Bay, Ball Environmental Associates, and GLEC conducted a watershed study of Boardman Lake in 2003. Environmental concerns identified in the 2003 watershed study report are summarized below:

- Twenty-nine contaminated sites exist within the Boardman Lake watershed and present potential impacts to the lake and river.
- Impervious surfaces within the watershed exceed the threshold known to result in degraded water quality by 2.5 times.
- Nutrient loading, bacterial contamination, heavy metal concentrations, and/or thermal pollution were documented within six tributaries to Boardman River, at seven stormwater inlets along the river, and at one location on the lake.
- Aesthetics have been impacted along the banks of Boardman Lake adjacent to the former Boot Lake Dump and along Boardman River at the former Keystone Dump. The former Boot Lake dump is located south of 2662 Cass Road along Boardman Lake, just beyond Traverse City's southern limit. Keystone Road dump is located along Keystone Road approximately one mile south of South Airport Road, within a 100-year floodplain of the Boardman River.
- Nutrient and bacterial pollution exist at two stormwater inlets within Traverse City.
- A dead zone was identified at the bottom of Boardman Lake just east of the terminus of 13th and 14th Streets.
- Two sediment contamination "hot spots" were identified in the river bottom of the Boardman River. Both are located between Boardman Lake and the Union Street Dam.

GLEC recommended that further investigation and possible remediation activities be considered for the identified environmental concerns.

3.3.5.2 Boardman (Keystone) Pond Sediment Sampling Results

ECT collected sediment samples from Boardman Pond in 2005. The sediment samples were analyzed for pesticides, PCBs, PAHs, and 10 trace metals (arsenic, barium, cadmium, chromium, copper, lead, mercury, selenium, silver, and zinc). The analytical results obtained for the Boardman Pond sediment sampling effort in 2005 indicated the following:

- For Boardman Pond, arsenic exceeded the State default background level and MDEQ residential direct contact criterion, but did not exceed the nonresidential criteria.

- ECT noted that all of the sediment samples were received by the laboratory and analyzed in excess of the maximum allowable holding time; therefore, the analytical results cannot be fully relied upon. ECT recommended that six additional sediment samples be collected from each impoundment and be analyzed for total nickel, total manganese, total mercury, pesticides, PCBs, and PAHs.

GLEC collected sediment samples from Boardman Pond in late fall 2010. The sampling was done to comply with MDEQ and USACE quality assurance standards and dredging guidance. Sediment core and hand-held dredge samples were collected from six sites at Boardman Pond and were analyzed for 10 metals, PAHs / semivolatile organics (SVOCs), PCBs, organochlorine pesticides, total organic carbon, and percent moisture. The analytical results obtained for the Boardman Pond sediment sampling effort in fall 2010 indicated the following:

- No organochloride pesticides, PCBs, or SVOCs were detected in the sediment samples. Arsenic and cadmium were found in four of the six samples in Boardman Pond slightly above the TEC but below the PEC. Barium, manganese, and selenium exceeded MDEQ-issued background sediment concentrations for wadeable streams in two or three of the six sample locations in Boardman Pond.
- In summary, arsenic and cadmium were detected at levels above the EPA-established TECs. No metals were detected at levels above the EPA-established PECs. The following metals were detected at levels well above the MDEQ-established Michigan Default Background Levels: arsenic, barium, cadmium, chromium, lead, manganese, mercury, selenium, and zinc. In addition, arsenic and manganese were above the MDEQ-established residential DWPC, arsenic was above the DEQ-established residential DCC, and arsenic, mercury, selenium, and silver were above the DEQ-established GSIPC. No metals were above the MDEQ established nonresidential DCC.

GLEC sediment sampling of the Boardman Pond was conducted in May 2012. The sediment samples were analyzed for trace metals, including arsenic, barium, cadmium, chromium, copper, lead, manganese, nickel, selenium, zinc, silver, and mercury, PAHs, and PCBs. In addition, select sediment samples from both ponds were analyzed for Synthetic Precipitation Leaching Procedure (SPLP) for the above listed metals. The SPLP analytical data is typically used to evaluate the in-situ mobility of soil contaminants and determine whether or not the leaching of soil contaminants into groundwater sources is/would be causing unacceptable exposure risks especially at sites where drinking water and/or groundwater surface water interface are complete/relevant exposure pathways. The analytical results obtained for the Boardman Pond sediment sampling effort in May 2012 indicated the following:

- Arsenic was detected in sediment samples at concentrations exceeding the EPA-established TECs, and MDEQ-established Michigan Default Background Levels, residential DWPC, residential DCC, and GSIPC. It was not above the nonresidential DCC.
- No metals were detected at levels above the PECs or nonresidential DCC.

- Arsenic, manganese, and selenium were detected at concentrations exceeding the MDEQ-established Michigan Default Background Levels. However, none of these three metals or the remaining metals analyzed exceeded the Michigan background sediment concentrations as reported in *Reference Site Sediment Report for Wadeable Streams* (MDEQ 1999).
- Arsenic, mercury, selenium, and silver were detected at concentrations exceeding the MDEQ-established GSIPC.
- No PAHs or PCBs were detected above the method detection limits (MDLs) reported by the analytical laboratory.
- Based on the Boardman Pond sediments SPLP analytical data obtained for the select sediment samples analyzed, manganese exceeded the MDEQ-established residential Drinking Water Criterion (DWC) and silver exceeded the MDEQ-established Groundwater / Surface Water Criterion (GSIC). None of the remaining metals analyzed exceeded the DWC or GSIC. While arsenic exceeded soil concentration criteria (above) it did not exceed the criteria for arsenic in water extract (SPLP).

In summary, in the 2012 sampling results report no organochlorine pesticides, PCBs, or semi-volatile organics were detected in any of the samples collected from the Boardman Pond. The MDEQ requires that any negative impacts to human health caused by movement of the sediment be considered. Several of the metals tested exceeded MDEQ and EPA background levels. Arsenic exceeded residential DCC in some areas, but no samples exceeded the nonresidential DCC. Based on landuse of the exposed sediment the nonresidential DCC is applicable. If a sediment sample is found to be below these levels, no mitigation is required.

3.3.5.3 Sabin Pond Sediment Sampling Results

ECT collected sediment samples from Sabin Ponds in 2005. The sediment samples were analyzed for pesticides, PCBs, PAHs, and 10 trace metals (arsenic, barium, cadmium, chromium, copper, lead, mercury, selenium, silver, and zinc). The analytical results obtained for Sabin Pond sediment sampling effort in 2005 indicated the following:

- Selenium exceeded the Apparent Effects Threshold (AET) in one sample. ECT noted that all of the sediment samples were received by the laboratory and analyzed in excess of the maximum allowable holding time; therefore, the analytical results cannot be fully relied upon.
- ECT recommended that six additional sediment samples be collected from the impoundment and be analyzed for total nickel, total manganese, total mercury, pesticides, PCBs, and PAHs.

GLEC collected sediment samples from Sabin Pond in late fall 2010. The sampling was done to comply with MDEQ and USACE quality assurance standards and dredging guidance. Sediment core and hand-held dredge samples were collected from six sites at Sabin and were analyzed for 10 metals, PAHs/SVOCs, PCBs, organochlorine pesticides, total organic carbon, and percent

moisture. The analytical results obtained for the Sabin Pond sediment sampling effort in fall 2010 indicated the following:

- No organochloride pesticides, PCBs, or SVOCs were detected in the sediment samples. In Sabin Pond, all metals were below the TEC levels. No metals exceeded MDEQ-issued background sediment concentrations for wadeable streams in Sabin Pond.
- Arsenic levels exceeded the EPA-established TECs. No metals within the impoundment were found to be above the EPA-established PECs.
- The following metals were detected at levels well above the MDEQ-established Michigan Default Background Levels: arsenic, barium, lead, manganese, and selenium. In addition, arsenic and manganese were above the MDEQ-established residential DWPC, and arsenic, mercury, selenium, and silver exceeded the MDEQ-established GSIPC. No metals exceeded the MDEQ-established nonresidential DCC.

GLEC sediment sampling from the Sabin Pond was conducted in May 2012. The sediment samples were analyzed for trace metals, including arsenic, barium, cadmium, chromium, copper, lead, manganese, nickel, selenium, zinc, silver, and mercury, PAHs, and PCBs. In addition, select sediment samples from both ponds were analyzed for SPLP for the above listed metals. The analytical results obtained for the Sabin Pond sediment sampling effort in May 2102 indicated the following:

- Selenium was detected at concentrations exceeding the EPA-established ESL.
- No metals were detected at concentrations above the EPA-established TECs or PECs.
- Arsenic and manganese were detected at soil/sediment concentrations exceeding the MDEQ-established Michigan Default Background Levels. However, neither of these two metals nor the remaining metals analyzed exceeded the Michigan background sediment concentrations as reported in *Reference Site Sediment Report for Wadeable Streams* (MDEQ 1999).
- Arsenic, selenium, and manganese were detected at concentrations exceeding the MDEQ-established residential DWPC.
- No metals were detected at concentrations above the MDEQ-established nonresidential DCC.
- Arsenic, mercury, and silver were detected at concentrations exceeding the MDEQ-established GSIPC.
- No PAHs or PCBs were detected above the MDLs reported by the analytical laboratory.

Based on the Sabin Pond sediments SPLP analytical data obtained for the select sediment samples analyzed, lead and manganese exceeded the MDEQ-established residential DWC and GSIC. Again, arsenic did not exceed the criteria for arsenic in water extract (SPLP).

3.3.6 Cultural Resources

Cultural resources are defined as prehistoric or historic districts, sites, buildings, structures, or objects considered important to a culture, subculture, or community for scientific, traditional, religious, or other purposes. They include archaeological resources, historic architectural or engineering resources, and other traditional resources. As part of the NEPA process, consideration of the effects of the Project upon any historic properties, under Section 106 of the National Historic Preservation Act (NHPA) of 1966 (16 U.S.C 470 et seq., as amended), is required. The Section 106 process, as well as guidance from the Michigan State Historic Preservation Office (SHPO) and Office of the State Archaeologist (OSA), typically involves archival research, tribal consultation, and field reconnaissance.

The three dam locations included within the project were originally constructed between 1867 and 1906, and have been modified in the modern era:

- The Union Street Dam. Located within the limits of Traverse City, the Union Street Dam was originally constructed in 1867 as a power source for a 19th-century flour mill. The earthen embankment of the dam measures approximately 250 feet in length, and contains two concrete spillways and a concrete fish ladder. Improvements to the dam were made in 1955 and 1965.
- The Sabin Dam. Originally constructed in 1906 by the Boardman Light & Power Company, this earthen dam measures approximately 200 feet in length. The dam was rebuilt in 1930, and purchased by Grand Traverse County in 1969. In 1986, a turbine generator was installed, and the dam was eventually decommissioned as a power generation facility in 2006.
- The Boardman Dam. Constructed in 1894 and rebuilt in 1930, this dam was purchased by Grand Traverse County in 1969. A turbine generator was installed in 1986; the power generating function of the dam was terminated in 2007. The Cass Road Bridge traverses the top of the dam structure.

Correspondence with the Michigan SHPO (dated 13 July 2005, 13 October 2005, and 22 August 2007) indicated that no historic aboveground properties would be affected by the project. However, this correspondence included a request from the Michigan SHPO that an archaeological survey be conducted of the former impoundments, following drawdown, and targeted on the former shorelines of the Boardman River.

3.3.6.1 Cultural Literature Review

URS conducted a cultural resources literature review for the project in July 2011 through an examination of the archives maintained by the Michigan SHPO and OSA. This review focused on the assembly and synthesis of data from previously identified cultural resources and reports inventoried within a 20-mile by 2-mile study area, centered on the Boardman River and encompassing all three dam locations. This research identified 13 prehistoric sites, 1 historic-era archaeological site, 13 aboveground resources listed in the Michigan State Register of Historic Places (SRHP), and 7 properties listed in the National Register of Historic Places (NRHP),

located within the study area. Although none of these resources have been defined within the impoundment areas, the presence of water atop each of these locations since the early 20th century has prevented any systematic archaeological survey during the modern era.

The background research conducted by URS produced the following data set for the Archival Study Area:

- A total of 14 Michigan SHPO-listed archaeological resources have been recorded within 1 mile of the project locations. This inventory includes 13 prehistoric sites, ranging from isolated find spots to several large occupations (including mound groups and a possible Late Prehistoric village), and a 1910–1920 historic-era farmstead. Although three of these 14 resources have been assessed as Not Eligible for the NRHP, the other 11 did not have information sufficient for determining NRHP eligibility at the time of inventory with the Michigan SHPO.
- A total of 13 aboveground historic resources have been inventoried in the Michigan SRHP, with the majority representing urban elements of Traverse City, MI, from the 1880s through to the mid-20th century. Three of these 13 resources have also been listed in the NRHP, given their relevance to the historic development of the city, with the remaining 10 not assessed for NRHP eligibility.
- Seven properties (including the three referenced in the bullet point above) have been listed in the NRHP within 1 mile of the Union Street Dam, including a pair of early-mid-20th century bridges, an 1885 mental health care facility, a residential property, the 1891 Traverse City Opera House, the Boardman Neighborhood Historic District, and the Central Neighborhood Historic District. These latter two properties contain approximately 174 residential structures and 459 residential structures, respectively, and represent an integral component of Traverse City history. These NRHP resources are located within the northernmost 2 miles of the 20-mile-long Archival Study Area, around the Union Street Dam location.

None of the previously inventoried cultural resources detailed above occur within the footprint of any of the dam locations or associated impoundments currently included within the scope of the project.

3.3.6.2 Phase I Archeological Survey

The Project area has been subject to two different Phase I archaeological surveys over the past 2 years, both designed to examine potentially intact relict shorelines of the Boardman River after partial drawdown of the impoundments, per Michigan SHPO correspondence. The first of these surveys, conducted by Andrews Cultural Resources and AMEC in 2011, examined exposed landforms in the Brown Bridge and Sabin Pond impoundments on the eastern side of the current Boardman River channel. The second, completed by URS in 2012, considered landforms along the western side of the river channel.

In November 2011, Andrews Cultural Resources and AMEC, under contract to the Grand Traverse Band of Ottawa and Chippewa Indians, conducted a Phase I archaeological survey of

exposed landforms located in the former impounded areas that were exposed from partial drawdown at the Brown Bridge and Sabin Pond impoundments within the Boardman River watershed. This survey work resulted in the identification of prehistoric archaeological deposits along the pre-20th century shoreline of the Boardman River none of which were recommended as eligible for the NRHP.

In June 2012, URS conducted a Phase I archaeological survey on three survey areas located along the Boardman River in Grand Traverse County situated within the former impoundment areas associated with partial drawdown of the Boardman Dam and the Sabin Dam impoundments. The three survey areas collectively totaled 9.88 acres (4.0 hectares) and were tested through visual pedestrian inspection and hand-excavated shovel tests at each location per Michigan SHPO and OSA guidelines. As a result of these archaeological investigations, no archaeological resources were identified within or adjacent to the three survey areas, and no evidence of intact remnant shorelines was encountered.

3.3.6.3 Phase I Historic Architecture Survey

Concurrent with the 2012 archaeological survey, URS conducted an historic architecture examination of aboveground resources fronting and adjacent to Boardman Pond and Sabin Pond, as requested by the Michigan SHPO in correspondence dated 8 July 2008. This examination attempted to document extant buildings via photographs from the public right-of-way. These investigations concluded that none of the developed properties adjacent to the Boardman Pond are 50 years or older. For Sabin Pond, two structures, 50 years or older, were identified. Based on analysis of the public right-of-way, neither of the two properties appears to be eligible for the NRHP. In addition, both properties front onto Keystone Road, and Sabin Pond is obscured by trees at the back of the properties.

3.3.6.4 Section 106 National Historic Preservation Process

As part of the NEPA process, consideration of the effects of the project upon any historic properties, under Section 106 of the NHPA of 1966 (16 U.S.C 470 et seq., as amended), is required. Section 106 of the NHPA requires that Federal agencies identify whether any historic or cultural resources that are listed, or potentially eligible for listing, on the NRHP could potentially be affected by the Recommended Alternative. The NRHP is an index of America's historic places, and identifies districts, sites, buildings, structures, and objects that are significant in American history, architecture, engineering, and culture. As evidenced in the SHPO response (see Appendix A), the consultation with the SHPO resulted in a determination that the Union, Sabin, and Boardman Dams are not eligible for the NRHP.

Project coordination with Native American Tribal Organizations in Michigan occurred in June 2012. Responses received from tribes and Michigan SHPO are included in **Appendix A**.

3.4 Environmental Consequences

This section describes the environmental consequences (or impacts), both direct and indirect, to the resources in Section 3.3 from the alternatives being considered within the existing Boardman River environment.

3.4.1 Natural and Biological Resources

The assessment of effects on natural and biological resources considered the direct and indirect impacts to wildlife, threatened and endangered species and their designated critical habitat, aquatic habitat including surface water and wetlands, the spread of invasive species, and changes to other ecologically sensitive areas.

3.4.1.1 Alternative 1. No Action Alternative

No new construction or development activities would occur under the Corps Section 506 Program for the No Action Alternative; therefore, the Boardman River and associated dam impoundments would remain in their current state. As a result the existing degraded coldwater stream habitat in the lower eight miles of the river would remain degraded and associated negative impacts on coldwater-dependent species would continue. Under the No-Action Alternative, coldwater fish and invertebrates and their associated habitats would continue to be affected by the warming effects of the impoundments, blockage of fish passage, and loss of stream functions such as the natural movement of woody debris.

Under the No Action Alternative (as well as Alternatives 5 and 6) the recent removal of the Brown Bridge Dam improves the river segment upstream of Boardman Pond; however, it does not significantly impact the project area because it is located approximately 12 river miles upstream.

3.4.1.2 Alternative 5. Modify Union Street and Remove Sabin and Boardman Dams

Alternative 5 would have the greatest impact of the three alternatives currently under review on the natural and biological resources of the Boardman River. Alternative 5 would entail modification of the Union Street Dam to allow the downstream passage of sturgeon and manual transfer upstream, and removal of the Sabin and Boardman Dams, including the draining of their impoundments. Excluding the effects of the Union Street Dam, Alternative 5 would restore the Boardman River to its natural, free-flowing state.

3.4.1.2.1 Surface Water Resources and Water Quality

In general, surface water resources would be impacted by the removal of the Sabin and Boardman Dams and draining of the impoundments. By breaching the dams, the impoundments would be drained and warmwater lake habitat would revert back to coldwater riverine habitat. Approximately 40 acres of warmwater lake habitat would be converted to coldwater habitat at Sabin Pond (segment 4) and 78 acres would be removed within Boardman Pond (segment 5). The loss of warmwater habitat would be moderated by the creation of a high-quality riverine environment and coldwater fishery, which is deemed more valuable because of its rarity within

the region. Additionally, the Boardman River would be returned to its natural state by removing manmade barriers. The thermal effects of the impoundments (i.e., increased water temperatures within the impoundments and in segment 3 below the dams) would be eliminated and habitat for coldwater species, such as brook trout and dace, would increase.

Although only segments 4 and 5 would be physically impacted by draining the impoundments and stream channel restoration, the entire project area (segments 1 through 5) has the potential to be impacted indirectly. The proposed project measures of altering the Union Street Dam auxiliary spillway for the downstream passage of sturgeon could impact other river segments within the project area. Potential impacts include increased downstream fish passage and negative effects to water quality due to construction activities. The Clean Water Act Section 404(b) (1) Evaluation Report is included as **Appendix B**, and addresses water quality impacts of the proposed action.

Construction activities from dam removal and spillway alteration could produce temporary negative effects to surface water quality and fisheries habitat unless protective measures are implemented. Fast and uncontrolled transport of sediment and organic material from the impoundments can destroy fish habitat. Excessive sediment can blanket spawning beds and foraging habitat making them unusable, while large organic loads can cause drops in the dissolved oxygen level, killing fish. To minimize the potential for adverse effects on surface waters, appropriate protective measures and BMPs would be taken, including installing sediment traps, straw bales, geotextile barriers, and other means to prevent sediment and organic materials from moving out of the construction zone and into downstream areas.

3.4.1.2.2 Groundwater Resources

Under existing conditions, the impoundments create conditions that raise the groundwater elevations of the near surface aquifer. Consequently, the removal of the Sabin and Boardman Dams would cause a change in the elevation of the impoundment surfaces that would impact groundwater levels around the impoundments. With Alternative 5, the existing water surface elevation (taking into account the current drawdowns) is expected to drop a maximum of approximately 15 feet at the Sabin Dam and 15 feet at the Boardman Dam. Based on these values, water wells less than 40 feet deep would be impacted.

In no instance would the depth of a screened well be above the water table after dam removal. Thus, based on the expected surface water elevations and known locations of wells, there would be no impact from dam removal.

3.4.1.2.3 Wetland Resources

Alternative 5 includes the removal of the Sabin and Boardman Dams, which would decrease water levels in the pond, consequently both wetland acreage and type would change within the former impoundments.

3.4.1.2.4 Sabin Dam Impoundment

Overall, approximately 30.5 acres of wetland are anticipated to form following drawdown of the impoundment (ECT 2009g) and the necessary sediment management. Former impoundment areas are anticipated to develop into emergent wetlands initially.

New emergent wetlands would likely be dominated by a more diverse set of wetland species than those that currently exist, including blue vervain (*Verbena hastata*), swamp milkweed (*Asclepias incarnata*), broadleaf cattail (*Typha latifolia*), black bulrush (*Scirpus atrovirens*), hardstem bulrush (*Schoenoplectus acutus*), spotted joe-pye-weed (*Eupatorium maculatum*), jewelweed (*Impatiens capensis*), common boneset (*Eupatorium perfoliatum*), sensitive fern (*Onoclea sensibilis*), yellow marsh marigold (*Caltha palustris*), swamp goldenrod (*Solidago patula*), northern blue flag (*Iris versicolor*), and beggar-ticks (*Bidens spp.)* (ECT 2009g and URS 2012).

Over time, these new emergent wetlands would be expected to convert to and remain emergent/scrub-shrub wetlands (ECT 2009g and URS 2012). These permanently emergent/scrub-shrub portions would be similar in structure and composition to areas found elsewhere along the Boardman River and would likely be dominated by common elder, silky dogwood (*Cornus amomum*), red-osier dogwood (*Cornus stolomfera*), sandbar willow (*Salix exigua*), speckled alder (*Alnus rugosa*), blue vervain, swamp milkweed, spotted joe-pye-weed, common boneset, common cattail, green bulrush (*Scirpus atrovirens*), sedges (*Carex spp*.), hardstem bulrush, and burreed (*Sparganium spp*.) (ECT 2009g and URS 2012). However, some new emergent wetlands could eventually succeed to forested/scrub-shrub wetlands with dominants such as northern white-cedar (*Thuja occidentalis*), red maple, common elder (*Sambucus canadensis*), and marsh fern (*Thelypteris palustris*) (ECT 2009g).

Field observations recorded in May 2012, by URS, indicate that existing wetland habitat was unaffected by the recent drawdown of Sabin Pond. Because of the presence of groundwater seepage, these wetlands are unlikely to convert to riparian uplands following drawdown. However, when surface water influences are removed as the water elevation is lowered, these wetlands may shift from emergent/scrub-shrub to a slightly drier species composition with dominance by wetland trees and shrubs (ECT 2009g).

The 6.9-acre PFO/PSS/PEM/OW wetland located southwest of the impoundment would be temporarily impacted by construction of the river channel. Construction impacts to wetland habitat due to river channel and floodplain construction are expected to be temporary because hydrophytic vegetation would return. **Figure 17** shows wetland locations and **Table 13** provides wetland acreages based on estimates from ECT and URS fieldwork (ECT 2009g, URS Corp 2012). Numbers included in **Table 13** differ from **Table 9** because they were field delineated and verified. The wetland impacts associated with the removal of the Sabin and Boardman Dams are listed separately to highlight the impacts of individual dam removal, which is necessary for project alternative formulation and selection.

Table 13: Wetland Habitat Impacts for Sabin Dam Removal

Category	Dam In (acres)	Dam Out (acres)
Impoundment-Open Water	25.0	0.0
Impoundment-Aquatic Vegetation	15.0	0.0
River Channel-Open Water	1.6	6.4
Total Surface Water	41.6	6.4
PEM/PSS	0.1	0.1
PFO	9.4	9.4
PFO/PSS	0.3	0.3
PFO/PSS/PEM/OW	6.9	6.9
Total Wetlands Outside Impoundment	16.7	16.7
PEM/PSS Forming Within Impoundment	0.0	30.5
Total Riparian Upland	1.4	6.1
Total Area	59.7	59.7
Wetland Gain/Loss	**0.0**	**+30.5**

PEM = palustrine emergent wetland
PSS = palustrine scrub-shrub wetland
PFO = palustrine forested wetland
OW = open water wetland
Source: ECT 2009g, URS Corporation 2012

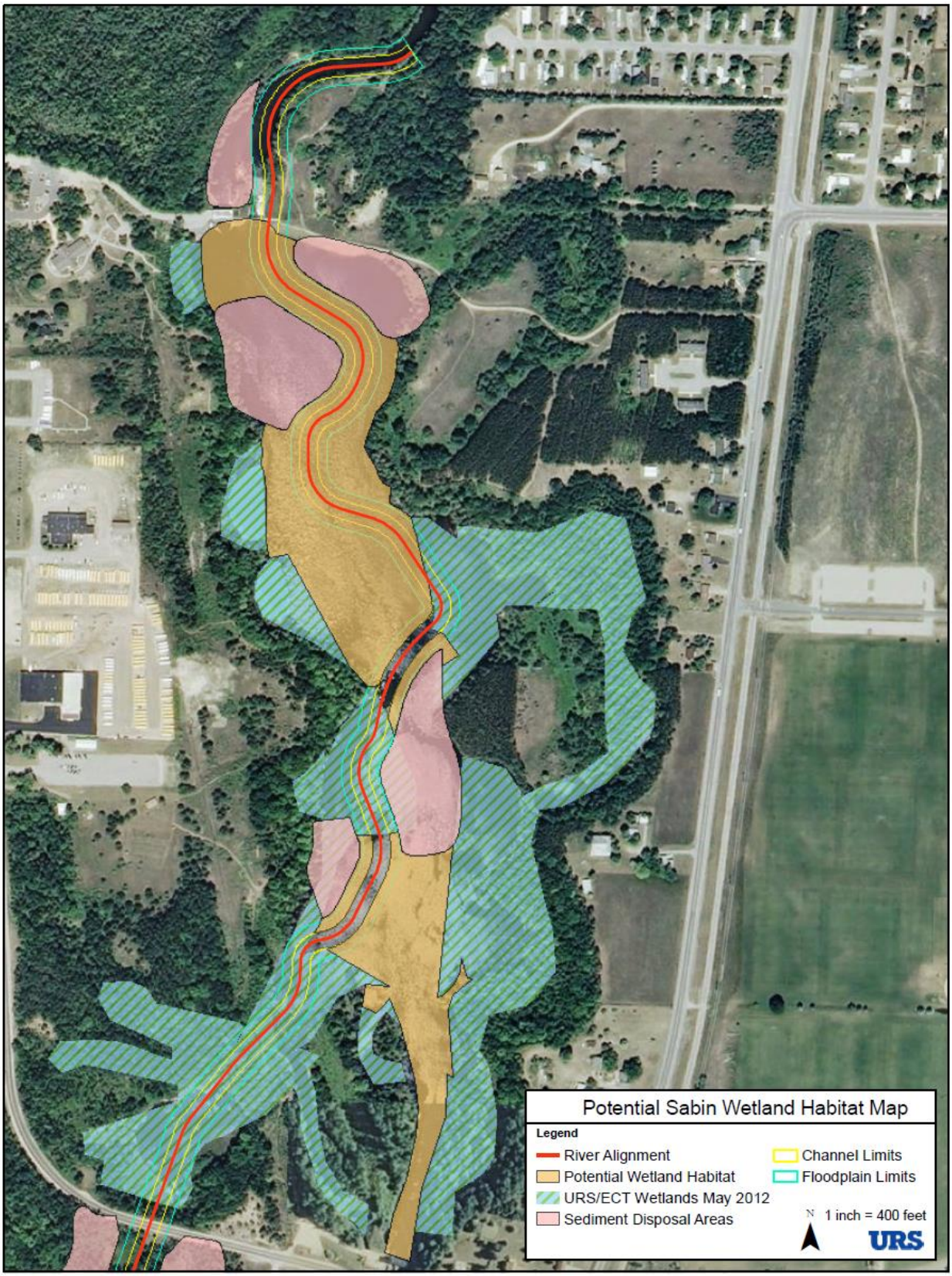

Figure 17: Potential Wetland Habitat Associated with Sabin Pond

3.4.1.2.5 Boardman Dam Impoundment

Draining Boardman Pond would also change the wetland acreage and type within the Boardman Dam impoundment. Overall, the net gain of wetland habitat due to dam removal activities is estimated to be approximately 26.5 acres. The new emergent wetlands would likely be dominated by blue vervain, nodding bur-marigold (*Bidens cernnuus*), nodding smartweed (*Polygonum lapathifolium*), rice-cut grass (*Leersia oryzoides*), swamp goldenrod, northern blue flag, yellow marsh marigold, broadleaf cattail, common boneset, spotted joe-pye-weed, hardstem bulrush, common three-square (*Schoenoplectus pungens*), and sedges (ECT 2009g and URS 2012).

Over time, these new emergent wetlands would be expected to convert to and remain emergent/scrub-shrub wetland. These permanently emergent/scrub-shrub portions would be similar in structure and composition to areas found elsewhere along the Boardman River and would likely be dominated by common elder, silky dogwood , red-osier dogwood, sandbar willow, speckled alder, blue vervain, swamp milkweed, spotted joe-pye-weed, common boneset, common cattail, green bulrush, sedges, hardstem bulrush, and bur reed (ECT 2009g and URS 2012). However, some new emergent wetlands could eventually succeed to forested/scrub-shrub wetlands with dominants such as northern white-cedar, red maple, common elder, and marsh fern (ECT 2009g and URS 2012).

Because of the presence of groundwater seepage, some existing wetlands associated with Boardman Pond are unlikely to convert to riparian uplands following drawdown. When surface water influences are removed as the water elevation is lowered, these wetlands may shift from emergent/scrub-shrub to a slightly drier species composition with dominance by wetland trees and shrubs (ECT 2009g). However, some wetlands adjacent to the southern central portion of the impoundment that have formed since the 2007 drawdown are dependent on seasonal inundation. When the river channel is restored, these wetlands may no longer have sufficient hydrology and could convert to riparian upland.

The 2.5-acre PEM/PSS/PFO wetland located north of the earthen berm would be temporarily and permanently impacted by construction of the river channel and sediment placement. The permanent impact would be to approximately 1.4 acres as a result of sediment management along the newly constructed river channel. Construction impacts to wetland habitat due to river channel and floodplain development are expected to be temporary as hydrophytic vegetation would return. **Figure 18** shows wetland locations and **Table 14** provides wetland acreages based on estimates from ECT and URS fieldwork after the 2007 drawdown (ECT 2009g, URS Corp 2012). Numbers included in **Table 14** differ from **Table 9** because they were field delineated and verified.

Table 14: Wetland Habitat Impacts for Boardman Dam Removal

Category	Dam In (acres)	Dam Out (acres)
Impoundment-Open Water	78.0	0.0
River Channel-Open Water	0.0	11.0
Total Surface Water	78.0	11.0
PEM/PSS/PFO*	2.5	1.4
Total Wetlands Outside Impoundment	2.5	1.1
PEM	10.6	0.0
PEM/PSS	0.0	38.5
Total Wetlands Forming Within Impoundment	10.6	38.5
Total Riparian Upland	0.0	40.5
Total Area	91.1	91.1
Wetland Gain/Loss	**0.0**	**+26.5**

* Wetland boundaries and size are estimated because of access issues; estimations are based of field observations sand map review.

PEM = palustrine emergent

PSS = palustrine scrub-shrub

PFO = palustrine forested

Source: ECT 2009g, URS Corp 2012

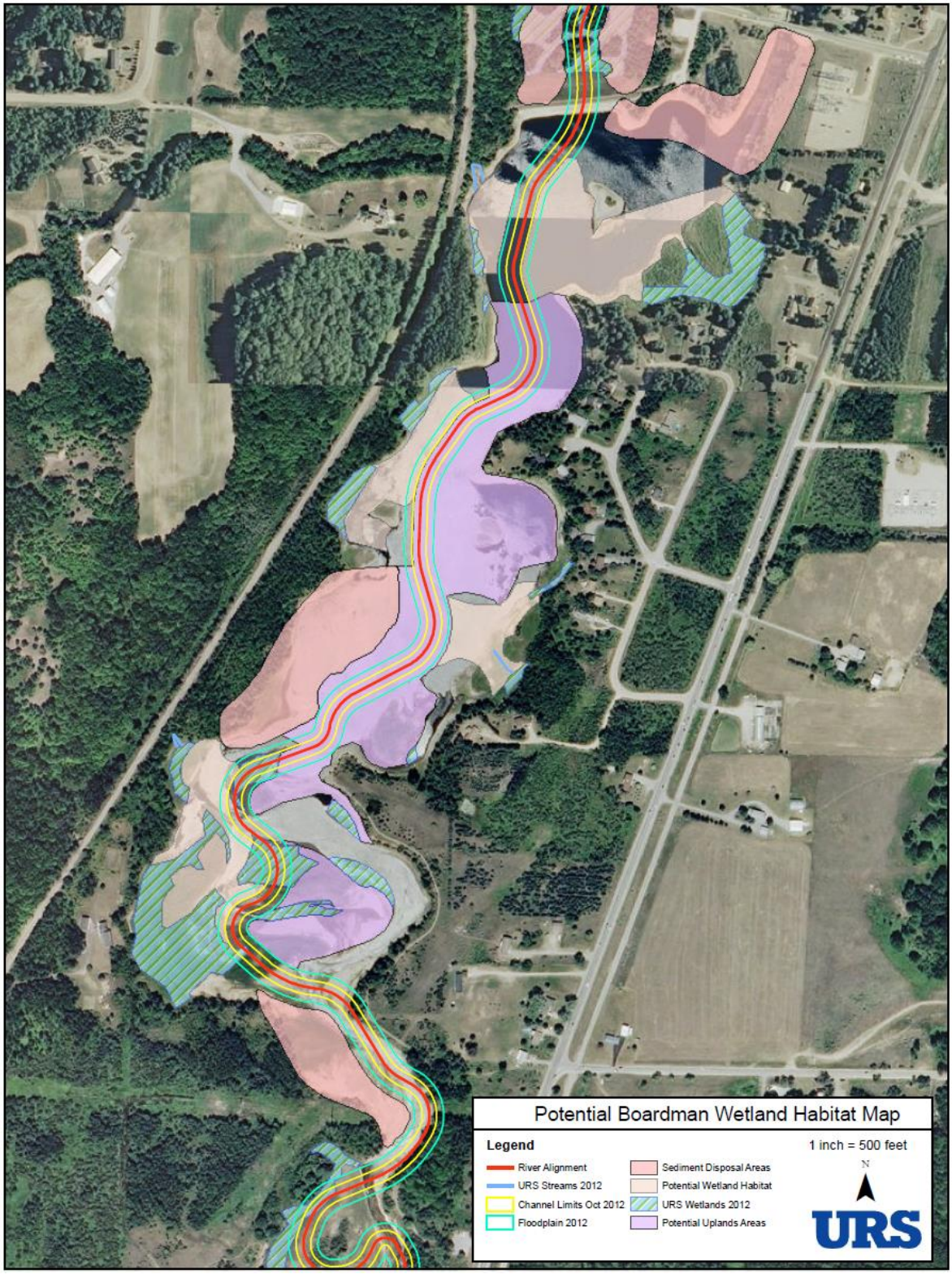

Figure 18: Potential Wetland Habitat Associated with Boardman Pond

3.4.1.2.6 Soils

Impacts on soils would be minimal with the implementation of Alternative 5. Soils would be affected by excavation and removal as discussed above. Additionally, soils would be exposed after the drawdown of the impoundment.

3.4.1.2.7 Terrestrial Wildlife

Stream restoration and removal of the Sabin and Boardman Dams would result in the loss of its impounded water or lake-like, slower-moving water conditions and the transition to the river's historic riparian habitats, similar to those still found along the free-flowing, un-impounded sections of the river. The restored river would contain shallow, open water habitat that would be free flowing and not the still water associated with the shallow areas of impoundments. Consequently, wildlife species living in the project area would experience a habitat shift from lake-like conditions to a riverine habitat. This shift to a riverine/wetland habitat would allow new wildlife species to inhabit the area and provide some existing species with increased habitat. However, some wildlife may potentially need to relocate to new areas with more lake-like conditions.

Potential habitat for displaced species includes a nearby complex of approximately a dozen lakes, just north and east of the former Brown Bridge impoundment and 5 to 8 miles east of the Boardman Pond impoundment (ECT 2009a). Displaced species would be those dependent on shallow, open water habitat, including some species of frogs, turtles, wading birds, waterfowl, and mammals like muskrat and beaver. However, the newly created stream and riparian habitat would benefit other animal species, such as white-tailed deer, mink, otter, bobcat, game birds, songbirds, and raptors. Additionally, as the new wetland and riparian habitats transform through natural plant succession, wildlife species inhabiting these different habitat types would also change.

3.4.1.2.8 Aquatic Habitat / Fisheries

Under this alternative, both the lake-like impoundment habitats and their warmwater fisheries within river segments 4 and 5 would be eliminated. The poor warmwater fishery within Sabin Pond (segment 4), which is dominated by undersized northern pike and white sucker and has a low relative abundance of most sportfish, would be lost. Similarly, the fair smallmouth bass fishery and poor fisheries for other gamefish with Boardman Pond (segment 5) could also be destroyed. The warmwater fish species within the impoundments that are not capable of adapting to the new environment would move to nearby suitable habitat or perish. However, many warmwater species are present within river segment 8, which starts at the confluence of the North and South Branches of the Boardman River and continues downstream to the location of the former Brown Bridge Dam impoundment. Species like northern pike, smallmouth bass, largemouth bass, yellow perch, and white sucker are able to survive in this pristine coldwater stretch of the Boardman River.

This loss of warmwater fish is negligible on a regional basis because of the abundance of such warmwater species in the region and would be offset by the creation of a high-quality riverine

environment and coldwater fishery, which is more valuable as a result of its rarity. Coldwater streams are considered more valuable than warmwater lotic habitat because they are a limited resource in the lower peninsula of Michigan, making up only about 25 percent of stream segments (Seelbach et al. 1997). These streams naturally tend to have higher densities of game fish and could provide spawning grounds and nursery areas for Great Lakes fish such as lake sturgeon. Consequently, they are an important recreational fishery resource in Michigan. Streams with characteristics typical of the Boardman River have average angler-day per mile values of 831 per year, with an estimated economic value of $22,437 per mile per year (MDNR creel census records; dollar values based on an estimated angler-day value of $27 from the U.S. Department of the Interior 2001). Additionally, warmwater lakes in Grand Traverse County are common, totaling approximately 10,049 acres and compose approximately 60 percent of all lake habitat. These factors support the importance of protecting/restoring coldwater streams in Michigan.

The Boardman River is a designated Natural River under the State of Michigan Natural Rivers Program and, outside of the study area, it features 36 lineal miles of Blue Ribbon Trout Stream designated by the MDNR Fisheries Division. The river is considered one of the top ten best trout streams in Michigan and supports self-sustaining populations of brown, brook, and rainbow trout. Mitigating the ecosystem disruption to the study area by removing the Boardman Dams would add miles of top quality trout stream, restore internal connectivity and coldwater characteristics of the Boardman River, and potentially increase the diversity of species moving between the Great Lakes and the river. Additionally, the Boardman River would be returned to its natural state by removing manmade barriers.

Removal of the dam and stream restoration efforts would also improve fish passage and provide additional spawning and foraging habitat for coldwater species. The modification of the Union Street Dam would give sturgeon access to the entire Boardman River system. Modifying the Union Street Dam would allow downstream passage of lake sturgeon, the adults of which currently cannot pass through the existing ladder. Upstream passage of lake sturgeon would be achieved by a trap-and-transfer operation overseen by the MDNR at the Boardman River fish weir located downstream from the Union Street Dam. Sturgeon transferred past the fish weir and the Union Street Dam would then be able to use additional suitable habitat in Boardman Lake and the Boardman River upstream to the Sabin Dam. Fishery management goals for the Boardman River would determine what fish (other than lake sturgeon) may or may not be passed upstream of the weir; such goals are outside the scope of the USACE study authority, and so are not addressed in this EA.

One possible scenario for lake sturgeon trap-and-transfer activities could entail collecting sturgeon downstream of the Union Street Dam and transporting them for release upstream of Boardman Lake. Technicians would examine, weigh, and measure sturgeon and implant them with a Passive Integrated Transponder tag for tracking purposes. Storage troughs would be examined to ensure only lake sturgeon are collected and that nuisance species, such as sea lamprey, are excluded. More detailed trap and transfer techniques would be developed based on site conditions, available equipment, and characteristic of the Boardman River sturgeon fishery.

To pass adult sturgeon back downstream, the current auxiliary spillway at the Union Street Dam would be modified. Juvenile sturgeon would pass via the spillway or modified auxiliary spillway.

Lake sturgeon have been observed using the river segment between the Union Street Dam and Lake Michigan. MDNR has identified the Boardman River as historically supporting a sturgeon population (MDNR 1997). By removal of both Sabin and Boardman Dams and manually transporting lake sturgeon past the fish weir and Union Street Dam, the entire river would be available to sturgeon as potential spawning and foraging habitat. Additionally, juveniles could use the river and Boardman Lake as a nursery prior to entering Lake Michigan. These two additional river segments (Boardman Lake and the river between Boardman Lake and the Sabin Dam) have been assessed as having medium to high suitability for sturgeon based on HSI modeling and medium suitability according to the MDNR (MDNR 1997). The Union Street Dam modification would provide an opportunity to establish a lake sturgeon fishery within the Boardman River downstream of Sabin Dam and benefit restoration efforts of this protected species within the Great Lakes.

Although lake sturgeon would benefit from restored fish passage and internal connectivity, the interaction is not without the possibility for undesirable outcomes. By allowing a large and long-lived Great Lakes fish such as the sturgeon upstream, bioaccumulating contaminants such as mercury, dichlorodiphenyltrichloroethane (DDT), and PCBs could be introduced into the food chain of the Boardman River system, which could impact both aquatic and terrestrial wildlife. However, the amount of contamination within sturgeon tissue varies with location in the Great Lakes and the Boardman River Watershed is not known to have bioaccumulation contaminant problems. According to the MDNR, the passage of Great Lakes lake sturgeon into historic spawning rivers is unlikely to cause contaminant concerns. The species suffers very little mortality from spawning stress, is not a forage item because of its size, and returns to the Great Lakes after spawning (MDNR 1997). For these reasons, effects of any bioaccumulated contaminants in lake sturgeon would be negligible in the Boardman River system. Over 33 river miles would become accessible to adult and juvenile sturgeon through the implementation of Alternative 5. The potential for chemical contaminant introduction from passage of sturgeon remains low. Sturgeon do not pose a significant threat of introducing chemical contaminants such as PCBs, DDT, and mercury.

3.4.1.2.9 Protected Species

According to the USFWS Web site, three federally listed species occur in Grand Traverse County, including the endangered Kirkland's warbler (*Dendroica kirtlandii*), the threatened Pitcher's thistle (*Cirsium pitcheri*), and the eastern massasauga (*Sistrurus catenatus*), a candidate species. The Kirtland's warbler is dependent upon large, relatively homogeneous stands of jack pine (*Pinus banksiana)* with scattered small openings (Olson 2002). The Pitcher's thistle typically grows on open sand dunes and occasionally on lag gravel associated with shoreline dunes. All of its habitats are along the Great Lakes shores, or in very close proximity (Higman and Penskar 1999). Neither jack pine stands nor sand dune habitat is located within the project

area so these federally protected species are unlikely to be present. Consequently, the project alternatives would have "No Effect" on the Kirtland's warbler and the Pitcher's thistle.

The eastern massasauga is found in a variety of wetland habitats, including bogs, fens, shrub swamps, wet meadows, marshes, moist grasslands, wet prairies, and floodplain forests (Lee and Legge 2000). Consequently, some habitat is available to this candidate species within the project area; however, no records exist of it occurring specifically within the project area. Alternative 5 "may affect, not likely to adversely affect" the eastern massasauga because suitable habitat is present but no occurrences are recorded. Additionally, the project would actually create more habitats for this snake species and only temporarily impact a small portion the suitable habitat.

Besides the lake sturgeon, other State-listed or rare species may be affected by Alternative 5 through a conversion of habitat in the project area. Common loons have been reported to nest on Boardman Pond in recent years and are likely to be impacted by this project alternative. According to the MDNR (1993), lakes showing the highest potential for loon occupancy are those that range from 16 to 100 acres in size, have relatively stable water levels, contain an island or bog mat, and have relatively pristine conditions on the shoreline. Consequently, any displaced loons could inhabit nearby waterbodies, including a complex of approximately a dozen lakes, just north and east of the location of the former Brown Bridge impoundment and 5 to 8 miles east of the Boardman Pond impoundment (ECT 2009a).

The red-shouldered hawk is a State-listed raptor species that has been known to occur within a mile of the project area. Because it forages in floodplain forests, wetlands, and ponds for reptiles and amphibians, removal of the dams could alter the adjacent wetland and shoreline foraging habitat that is influenced by water levels in the impoundments, such as the beaver pond marsh near the delta of Sabin Pond (ECT 2009a). Wetland habitat types may change and lake shoreline would be replaced by riverine habitats, which do not have the prey base of amphibians and reptiles that are generally more abundant along the impoundment shorelines. However, this loss would be minimized by the increase in both wetland and riparian upland forested habitat, which are used by this hawk species for nesting and foraging. Because the red shouldered hawk is not known to nest near the Sabin and Boardman impoundments, dam removal is not expected to have a significant impact on this species (ECT 2009a).

The wood turtle, a species of special concern, is known to occur in the natural, free-flowing sections of the river between Boardman Pond and the former Brown Bridge Pond. Generally, the wood turtle is most common in slow-moving, meandering sections of streams (Harding 1997) and is not known to use the lake-like habitat found in the Boardman River impoundments. Consequently, dam removal would not likely result in the loss of wood turtle habitat.

3.4.1.2.10 Exotic / Nuisance Species

Because the project area is predominately Sabin Pond, Boardman Pond, the Boardman River, and adjacent wetlands, the majority of the potential exotic and invasive species that could become established and flourish as a result of ground disturbances are aquatic plants and animals.

Alternative 5 involves dam removal and draining the impoundments. This would expose formerly submerged land and provide the ideal conditions and opportunity for the colonization of invasive plant species. These plant species could use the exposed former impoundment areas and quickly dominate any native vegetation. Invasive species known to occur at the edges of the impoundments and adjacent wetlands include narrowleaf cattail, purple loosestrife, nodding smartweed, reed canary grass, common reed, and rice cutgrass.

To combat the potential invasion of exotic and/or nuisance species after construction of Alternative 5, potential wetland areas within the former impoundment that are at risk of exotic species establishment would be seeded using native wetland seed mixes and tree/shrub seedlings to colonize open soil areas quickly. This would prevent invasive species and noxious weeds from becoming established and promote a diverse and natural wetland riparian habitat along the new river channel.

Disturbed riparian upland areas should also be seeded with temporary and permanent mixes to establish cover. If any nuisance species become established, control options include herbicides, mechanical removal, and/or biological controls such as a leaf-feeding beetle (*Galerucella* spp.) that controls purple loosestrife. The project area would be monitored to determine when control measures are needed to prevent invasive species from dominating the former impoundment area.

The draining of the impoundment associated with Alternative 5 would also cause current exotic species using the degraded warmwater habitat to perish or be displaced. Exotic mute swans would be displaced and would no longer be able to forage and nest in Sabin Pond and Boardman Pond.

The purpose of the project is to improve river segment connectivity and restore the Boardman River to its natural, free-flowing state; however, there are potential unintended consequences to fish populations. Whereas Alternative 5 would increase suitable coldwater stream habitat for native fish species like brook trout and longnose dace, it could also benefit non-native coldwater species like brown trout and rainbow trout. While it is recognize that these non-native trout species have the potential to depress native brook trout populations, overall benefits of river restoration outweighs the increase in these non-target fish species. Additionally, dam removal would not introduce brown trout or rainbow trout to additional river segments since they are already found throughout the Boardman River and in every non-impounded rivers segment where brook trout currently exist.

The restoration of sturgeon passage and river internal connectivity brings with it the possibility that aquatic invasive species, such as sea lamprey, would also be allowed access upstream into the Boardman River. However, the modification of Union Street Dam has two safeguards against introduction of exotic species. First, the MDNR would continue to operate the fish weir to minimize the impacts of potential exotic and nuisance species on the Boardman River and its fisheries. And second, sturgeon would only pass the Union Street Dam via trap-and-transfer activities. This technique would allow for the passage of only sturgeon and technicians would examine all sturgeon and storage troughs for potential nuisance species. Therefore, while the

introduction of exotic/nuisance species into the river is a possibility with the modification of Union Street Dam it is not an anticipated impact of Alternative 5.

3.4.1.2.11 Floodplains

Because effective official FEMA floodplain maps are currently unavailable, quantifying the amount of floodplain habitat expected to be lost or gained by Alternative 5 is not possible. FEMA generally considers open water as part of the floodplain, and by draining the impoundments the open water area of the floodplain would be reduced and replaced with more natural and traditional floodplain habitat. Stream restoration efforts would include the creation of 40-foot floodplain areas on each side of the river channel forming a natural riparian corridor. Additionally, most of the new wetland habitat created by Alternative 5 would also be considered floodplain. Unlike the current impounded areas along the Boardman River, Alternative 5 would produce areas that serve the more traditional and natural role of floodplain habitat along a riparian corridor. There are also no flood attenuation issues expected with any of the alternatives. Therefore, the project would not be expected to adversely impact the floodplain.

3.4.1.3 Alternative 6. Remove Sabin Dam

Alternative 6 would have a greater impact on the natural and biological resources of the Boardman River than Alterative 1 (No Action Alternative), but less than Alternative 5. Alternative 6 would entail the removal of the Sabin Dam, including the draining of Sabin Pond. This alternative would restore the Sabin Pond area (segment 4) to a free-flowing river segment and reduce the thermal effects of the impoundment on the downstream portions of the river (segment 3). However unlike Alternative 5, Boardman Dam would remain in place and downstream river segments would continue to be affected by the warming effects of the impoundment, blockage of fish passage, and loss of stream functions such as the natural movement of woody debris.

3.4.1.3.1 Surface Water Resources and Water Quality

In general, surface water resources would be impacted by the removal of the Sabin Dam and the draining of its impoundment. By breaching the dam, the impoundment would be drained and warmwater lake habitat would revert back to coldwater riverine habitat. Approximately 40 acres of warmwater lake habitat would be converted to coldwater habitat at Sabin Pond (segment 4). The loss of warmwater habitat in the impoundments and river would be moderated by the creation of an improved riverine environment and coldwater fishery, which is deemed more valuable because of its rarity within the region. The thermal effects of the Sabin Pond (i.e., increased water temperatures within the impoundment and in segment 3 below the dam) would be eliminated and habitat for coldwater species would improve. However due to the Boardman Dam upstream remaining in place, improvement in coldwater fish habitat and the elimination of thermal effects would not be fully realized and the Boardman River would not be returned to its natural, free-flowing state in its entirety.

Although only segment 4 would be physically impacted by draining Sabin Pond and stream channel restoration, downstream river segments (segments 1 through 3) have the potential to be impacted indirectly. Construction activities associated with dam removal could have negative effects to the water quality of downstream river segments.

Construction activities from dam removal could produce temporary negative effects to surface water quality and fisheries habitat unless protective measures are implemented. Fast and uncontrolled transport of sediment and organic material from the impoundment can destroy fish habitat. Excessive sediment can blanket spawning beds and foraging habitat making them unusable, while large organic loads can cause drops in the dissolved oxygen level, killing fish. To minimize the potential for adverse effects on surface waters, appropriate protective measures and BMPs would be taken, including installing sediment traps, straw bales, geotextile barriers, and other means to prevent sediment and organic materials from moving out of the construction zone and into downstream areas.

3.4.1.3.2 Groundwater Resources

Under existing conditions, Sabin Pond creates conditions that raise the groundwater elevations of the near surface aquifer. Consequently, the removal of Sabin Dam would cause a change in the elevation of the impoundment surfaces that would impact groundwater levels around the impoundment. With the implementation of Alternative 6, the water surface elevation is expected to drop a maximum of approximately 15 feet at the Sabin Dam. Based on these values, water wells less than 40 feet deep would be impacted. In no instance would the depth of a screened well be above the water table after dam removal. Thus, based on the expected surface water elevations and known locations of wells, there would be no impact from dam removal.

3.4.1.3.3 Wetland Resources

Alternative 6 includes the removal of Sabin Dam, which would decrease water levels in the pond; consequently both wetland acreage and type would change within the former impoundment. Similar to Alternative 5, approximately 30.5 acres of wetland are anticipated to form following drawdown of the Sabin Dam impoundment (ECT 2009g) and the necessary sediment management. Former impoundment areas are anticipated to develop into emergent wetlands initially and overtime convert to and remain emergent/scrub-shrub wetlands (ECT 2009g and URS 2012). These permanently emergent/scrub-shrub portions would be similar in structure and composition to areas found elsewhere along the Boardman River. However, some new emergent wetlands could eventually succeed to forested/scrub-shrub wetlands (ECT 2009g). Field observations recorded in May 2012, by URS, indicate that existing wetland habitat was unaffected by the recent drawdown of Sabin Pond and, due to the presence of groundwater seepage, these wetlands are unlikely to convert to riparian uplands following drawdown. However, when surface water influences are removed as the water elevation is lowered, these wetlands may shift from emergent/scrub-shrub to a slightly drier species composition with dominance by wetland trees and shrubs (ECT 2009g).

The 6.9-acre PFO/PSS/PEM/OW wetland located southwest of the impoundment would be temporarily impacted by construction of the river channel. Construction impacts to wetland habitat due to river channel and floodplain construction are expected to be temporary because hydrophytic vegetation would return. Further details can be found in the Wetland Resources section for Alternative 5 (Section 3.4.1.2.3) including wetland locations, acreages, and plant species.

3.4.1.3.4 Soils

Impacts on soils would be minimal with the implementation of Alternative 6. Soils would be affected by excavation and removal as discussed above in Alternative 5. Additionally, soils would be exposed after the drawdown of the impoundment.

3.4.1.3.5 Terrestrial Wildlife

Stream restoration and removal of Sabin Dam would result in the loss of its impounded water or lake-like, slower-moving water conditions and the transition to the river's historic riparian habitats, similar to those still found along the free-flowing, un-impounded sections of the river. The restored river segment would contain shallow, open water habitat that would be free flowing and not the still water associated with the shallow areas of Sabin Pond. Consequently, wildlife species living in the project area would experience a habitat shift from lake-like conditions to a riverine habitat. This shift to a riverine/wetland habitat would allow new wildlife species to inhabit the area and provide some existing species with increased habitat. However, some wildlife may potentially need to relocate to new areas with more lake-like conditions.

Potential habitat for displaced species includes a nearby complex of approximately a dozen lakes, just north and east of the former Brown Bridge impoundment and 5 to 8 miles east of the Boardman Pond impoundment (ECT 2009a). Displaced species would be those dependent on shallow, open water habitat, including some species of frogs, turtles, wading birds, waterfowl, and mammals like muskrat and beaver. However, the newly created stream and riparian habitat would benefit other animal species, such as white-tailed deer, mink, otter, bobcat, game birds, songbirds, and raptors. Additionally, as the new wetland and riparian habitats transform through natural plant succession, wildlife species inhabiting these different habitat types would also change.

3.4.1.3.6 Aquatic Habitat / Fisheries

Under this alternative, both the lake-like impoundment habitats and their warmwater fisheries within river segment 4 would be eliminated. The poor warmwater fishery within Sabin Pond (segment 4), which is dominated by undersized northern pike and white sucker and has a low relative abundance of most sportfish, would be lost. The warmwater fish species within the impoundment that are not capable of adapting to the new environment would move to nearby suitable habitat or perish. Many warmwater species are present within river segment 8, which starts at the confluence of the North and South Branches of the Boardman River and continues downstream to the location of the former Brown Bridge Dam impoundment. Species like

northern pike, smallmouth bass, largemouth bass, yellow perch, and white sucker are able to survive in this pristine coldwater stretch of the Boardman River. Additionally, the thermal effects of the upstream Boardman Dam would continue, which could prevent segments 3 and 4 from supporting only coldwater fisheries.

This loss of warmwater fish is negligible on a regional basis because of the abundance of such warmwater species in the region and would be offset by the creation of an improved riverine environment and coldwater fishery, which is more valuable as a result of its rarity. Coldwater streams are considered more valuable than warmwater impoundments and river habitat because they are a limited resource in the lower peninsula of Michigan, making up only about 25 percent of stream segments (Seelbach et al. 1997). These streams naturally tend to have higher densities of game fish and are an important recreational fishery resource in Michigan. However, the coldwater fish habitat created by Alternative 6 would not be as high quality compared to the aquatic habitat restored by Alternative 5. The restored segment 4 and associated downstream segments would still experience the warming effects, fish passage issues, and loss of stream functions associated with the upstream Boardman Dam, which would remaining in place.

3.4.1.3.7 Protected Species

Similar to Alternative 5, no suitable habitat is located within the project area for the federally protected Kirtland's warbler and the Pitcher's thistle. Consequently, Alternative 6 would have "No Effect" on these species. However, some suitable habitat is present for the eastern massasauga, a federal candidate species, although no records exist of it occurring specifically within the project area. Alternative 6 "may affect, not likely to adversely affect" the eastern massasauga because suitable habitat is present but no occurrences are recorded. Additionally, the project would actually create more habitats for this snake species and only temporarily impact a small portion the suitable habitat.

State-listed or rare species may also be affected by Alternative 6 through a conversion of habitat in the project area. Common loons have been reported to nest on the nearby Boardman Pond in recent years. According to the MDNR (1993), lakes showing the highest potential for loon occupancy are those that range from 16 to 100 acres in size, have relatively stable water levels, contain an island or bog mat, and have relatively pristine conditions on the shoreline. Consequently, any displaced loons could inhabit nearby waterbodies, including a complex of approximately a dozen lakes, just north and east of the location of the former Brown Bridge impoundment and 5 to 8 miles east of the Boardman Pond impoundment (ECT 2009a).

The red-shouldered hawk is a State-listed raptor species that has been known to occur within a mile of the project area. Because it forages in floodplain forests, wetlands, and ponds for reptiles and amphibians, removal of the dams could alter the adjacent wetland and shoreline foraging habitat that is influenced by water levels in the impoundment, such as the beaver pond marsh near the delta of Sabin Pond (ECT 2009a). Wetland habitat types may change and lake shoreline would be replaced by riverine habitats, which do not have the prey base of amphibians and reptiles that are generally more abundant along the impoundment shorelines. However, this loss

would be minimized by the increase in both wetland and riparian upland forested habitat, which are used by this hawk species for nesting and foraging. Because the red shouldered hawk is not known to nest near the Sabin impoundment, dam removal is not expected to have a significant impact on this species (ECT 2009a).

The wood turtle, a species of special concern, is known to occur in the natural, free-flowing sections of the river between Boardman Pond and the former Brown Bridge Pond. Generally, the wood turtle is most common in slow-moving, meandering sections of streams (Harding 1997) and is not known to use the lake-like habitat found in the Boardman River impoundments. Consequently, dam removal would not likely result in the loss of wood turtle habitat.

3.4.1.3.8 Exotic / Nuisance Species

The project area for Alternative 6 is predominately Sabin Pond, therefore, the majority of the potential exotic and invasive species that could become established and flourish as a result of ground disturbances are aquatic plants and animals. Removing Sabin Dam and draining the impoundment would expose formerly submerged land and provide the ideal conditions and opportunity for the colonization of invasive plant species. These plant species could use the exposed former impoundment areas and quickly dominate any native vegetation. Invasive species known to occur at the edges of the impoundments and adjacent wetlands include narrowleaf cattail, purple loosestrife, nodding smartweed, reed canary grass, common reed, and rice cutgrass.

To combat the potential invasion of exotic and/or nuisance species after construction of Alternative 6, potential wetland areas within the former impoundment that are at risk of exotic species establishment would be seeded using native wetland seed mixes and tree/shrub seedlings to colonize open soil areas quickly. This would prevent invasive species and noxious weeds from becoming established and promote a diverse and natural wetland riparian habitat along the new river channel.

Disturbed riparian upland areas should also be seeded with temporary and permanent mixes to establish cover. If any nuisance species become established, control options include herbicides, mechanical removal, and/or biological controls. The project area would be monitored to determine when control measures are needed to prevent invasive species from dominating the former impoundment area.

The draining of the Sabin Dam impoundment associated with Alternative 6 would also cause current exotic species using the degraded warmwater habitat to perish or be displaced. Exotic mute swans would be displaced and would no longer be able to forage and nest in Sabin Pond.

The purpose of the project is to improve connectivity and aquatic habitat of the Boardman River; however, there are potential unintended consequences to fish populations. Whereas Alternative 6 would improve suitable coldwater stream habitat for native fish species like brook trout and longnose dace, it could also benefit non-native coldwater species like brown trout and rainbow

trout. While it is recognize that these non-native trout species have the potential to depress native brook trout populations, overall benefits of river restoration outweighs the increase in these non-target fish species. Additionally, dam removal would not introduce brown trout or rainbow trout to additional river segments since they are already found throughout the Boardman River and in every non-impounded river segment where brook trout currently exist.

3.4.1.3.9 Floodplains

Because effective official FEMA floodplain maps are currently unavailable, quantifying the amount of floodplain habitat expected to be lost or gained by Alternative 6 is not possible. FEMA generally considers open water as part of the floodplain and by draining Sabin dam, the open water area of the floodplain would be reduced and replaced with more natural and traditional floodplain habitat. Stream restoration efforts would include the creation of 40-foot floodplain areas on each side of the river channel forming a natural riparian corridor. Additionally, most of the new wetland habitat created by Alternative 6 would also be considered floodplain. Unlike the current Sabin Dam impoundment, Alternative 6 would produce areas that serve the more traditional and natural role of floodplain habitat along a riparian corridor. There is also no flood attenuation issues expected with Alternative 6.

3.4.2 Land Use, Recreation, and Visual Resources and Aesthetics

Land use, recreation, and visual resources and aesthetics impacts for each alternative are described below. Mitigation measures were identified if deemed necessary based on the impact assessment.

3.4.2.1 Alternative 1. No Action Alternative

No new construction, structural improvements, or development activities would occur under the No Action Alternative; therefore, the No Action Alternative would not directly impact land use, recreation, or visual resources and aesthetics. The No Action Alternative would not contribute to indirect or cumulative impacts to land use, recreation, visual resources, and aesthetics.

3.4.2.2 Alternative 5. Modify Union Street Dam and Remove Sabin and Boardman Dams

3.4.2.2.1 Land Use

Alternative 5 would have insignificant direct impacts on the current land use for the modifications to the Union Street Dam. By modifying the auxiliary spillway at the dam, the impoundment would remain as open water land use along the Boardman River. The direct impacts incurred would be short term and temporary during construction activities.

Alternative 5 also involves removing both the Sabin Dam and the Boardman Dam. Currently, two manmade impoundments (Sabin Pond and Keystone Pond) exist upstream of the Sabin Dam and the Boardman Dam, respectively. This alternative would restore these ponds to a free-flowing river and result in changing the type of land use. Based on the 2012 GIS Land Use/Cover for Grand Traverse County, of the approximate 93 acres consisting of open water

land use for Sabin Pond and Boardman (Keystone) Pond, this alternative would change the land use of approximately 63 acres of the open water area. In addition, other land use categories within the study area would be impacted by the change in land use. The restored free-flowing river would directly impact the existing land uses shown in **Table 15**. These estimates are based on GIS layers and are not based on field delineations.

Table 15: 2012 Land Use within Alternative 5

Land Use Type	Existing Acreage	Impacted Acreage
Lake/Pond/River/Stream	93.3	67
Wooded Wetland	62.5	5
Beach/Riverbank	42.5	10.1
Single Family/Duplex Residential	35.8	0
Broad Leaf Forest	30	1.6
Grass Shrublands	19.9	0.6
Coniferous Forest	15.6	0
Open Land Recreation	11.7	0.5
Mixed Broad Leaf/Coniferous Forest	11.2	0
Cropland	8.8	0
Transportation/Communications/ Utilities	3.8	0
Non Wooded Wetland	1.7	0.8
Institutional	1.2	0
Multi-Family Residential	0.6	0
Commercial Services	0.1	0
Other Agricultural Lands	0.03	0
Source: Grand Traverse County 2012 GIS Land Use		

Following the drawdown of the impoundment, the increased public access to the river is a positive indirect impact for land use. This alternative, with site improvements, would allow for improved access for public use on public lands (former impoundment bottom).

3.4.2.2.2 Recreation

The Recommended Alternative 5 would have insignificant direct impacts on the recreational facilities for the modifications to the Union Street Dam. Modifying the auxiliary spillway at the dam located within Lay Park would allow greater opportunities for fish passage through the park, including Great Lakes fishes. Boardman Lake would remain as open water with no impacts to the parks, trails, and public access points along the Boardman River. The direct impacts incurred to recreational facilities, including the Union Street Dam and Lay Park, would be short term and temporary during construction activities. These minimal impacts would be offset by the restored free-flowing river, which would provide benefits to fish passage and recreational opportunities.

Alternative 5 also involves removing both the Sabin Dam and the Boardman Dam. The removal of Sabin and Boardman Dams would have insignificant direct impacts to recreation within the project area. Activities such as fishing and boating that occur within the existing impoundments would continue to occur in the restored river system following dam removal.

Direct and permanent impacts would occur to the trail system and land use around Sabin and Boardman impoundments due to this Alternative (Figure 19). Direct impacts to the Grand Traverse Nature Education Reserve would be impacted at two locations. Impact to portions of the Beaver Pond Trail totaling 2 acres would occur due to the proposed Boardman River alignment to the west of the existing Boardman Dam. A second impact due to the new river totaling 4 acres would occur south of Boardman impoundment to trails across Sabin Dam. Trail impacts at Sabin Dam would occur where access is provided across the river and at two locations. The first trail impact is a connector loop to both the Fox Den Trail and Sabin Pond trail that crosses over the Sabin Dam. A second trail impact is located on the Beaver Pond Trail Loop at the south end of Sabin impoundment.

In addition, open water and wetland areas that comprise Sabin impoundment (41 acres) would be replaced with a river (6 acres). The locations at Boardman Dam impacted by the Alternative include the section of Boardman Pond Trail that runs along the top of Boardman Dam. In addition, open water and wetland areas that comprise Boardman impoundment (74 acres) would be replaced with a river (7 acres). Other impacts may occur related to the type of water activities that occur in the impoundments. For example, fishing, boating swimming, wading, and wildlife viewing currently occur within, adjacent and near to the impoundments. These activities would occur after the project but the nature of the activity may change. All other recreation activities and areas in the Study Area and Project Area would not be impacted.

Planning efforts for the post Sabin Dam and Boardman Dam removals would most likely provide an increase in both passive and active recreational opportunities for surrounding parks and recreation facilities along the Boardman River. A proposed major trail known as the Boardman Valley Trail (North) would need to be slightly realigned based on data from 2012 GIS Land Use/Cover for Grand Traverse County. The realignment would follow the river waterfront closely based on the Boardman River being restored to its natural conditions and channel formation.

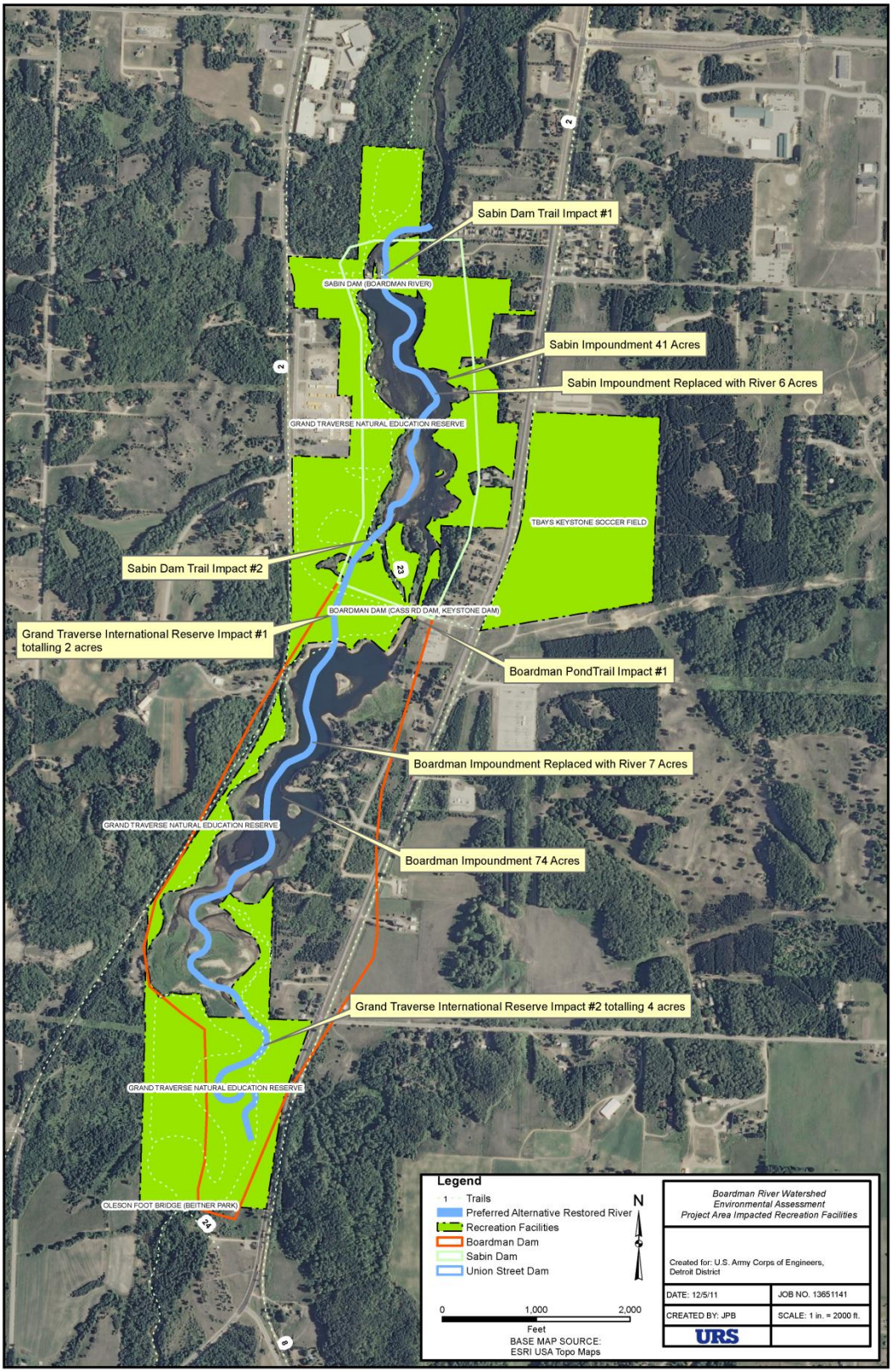

Figure 19. Recreation Facility Impacts within Sabin and Boardman Project Area.

3.4.2.2.3 Aesthetics

The Recommended Alternative 5 would have an insignificant direct impact on the aesthetics of the project area. Modifying the auxiliary spillway at the dam would cause no permanent visual changes to the surrounding landscape. The direct impacts incurred would be short term and temporary as a result of construction activities. Alternative 5 also involves removing both the Sabin Dam and the Boardman Dam. This removal would have an insignificant direct impact and would involve the relocation of the minor trail systems with only short-term and temporary aesthetic impacts during construction activities. These actions would be site improvements and result in no permanent adverse visual effects. The visual landscape for existing landowners would be changed from views of open water to possibly a view of vegetation associated with Alternative 5, as the river finds its natural course and the bottomlands are exposed for vegetative growth.

The elements of ecological restoration associated with this Project would provide an indirect and direct positive impact of overall visual enhancement and beneficial use of the natural resources. Any aesthetic direct negative impacts would be temporary and would involve increased construction activities for the purpose of restoring the natural landscape setting. The consideration of aesthetics is difficult to determine for the viewshed of residential homes within the vicinity of the Sabin Pond and Keystone Pond.

3.4.2.3 Alternative 6. Remove Sabin Dam

3.4.2.2.4 Land Use

Alternative 6 involves removing the Sabin Dam and restoring the pond to a free-flowing river segment, which results in changing the type of land use. Based on the 2012 GIS Land Use/Cover for Grand Traverse County, this alternative would change the land use of Sabin Pond (open water area). In addition, other land use categories within the project area would be impacted by the change in land use. The restored river segment would directly impact the following existing land uses: Lake/Pond/River/Stream, Wooded Wetland, Beach/Riverbank, Broad Leaf Forest, Grass Shrublands, Open Land Recreation, and Non Wooded Wetland.

Following the drawdown of the impoundment, the increased public access to the river is a positive indirect impact for land use. This alternative, with site improvements, would allow for improved access for public use on public lands (former impoundment bottom).

3.4.2.2.5 Recreation

Alternative 6 would have insignificant direct impacts on the recreational facilities for the removal of Sabin Dam. The removal of Sabin Dam would have insignificant direct impacts to recreation within the project area. Activities such as fishing and boating that occur within the existing impoundments would continue to occur in the restored river system following dam removal.

Direct and permanent impacts would occur to the trail system and land use around Sabin impoundments due to this Alternative. Direct impacts to the Grand Traverse Nature Education

Reserve would be impacted at two locations. Impact to portions of the Beaver Pond Trail totaling 2 acres would occur due to the proposed Boardman River alignment to the west of the existing Boardman Dam. A second impact due to the new river totaling 4 acres would occur south of Boardman impoundment to trails across Sabin Dam. Trail impacts at Sabin Dam would occur where access is provided across the river and at two locations. The first trail impact is a connector loop to both the Fox Den Trail and Sabin Pond trail that crosses over the Sabin Dam. A second trail impact is located on the Beaver Pond Trail Loop at the south end of Sabin impoundment.

In addition, open water and wetland areas that comprise Sabin impoundment (41 acres) would be replaced with a river (6 acres). Other impacts may occur related to the type of water activities that occur in the impoundments. For example, fishing, boating swimming, wading, and wildlife viewing currently occur within, adjacent and near to the impoundments. These activities would occur after the project but the nature of the activity may change. All other recreation activities and areas in the Study Area and Project Area would not be impacted.

Indirect and cumulative impacts would be positive for recreation. Planning efforts for the post Sabin Dam removal would most likely provide an increase in both passive and active recreational opportunities for surrounding parks and recreation facilities along the Boardman River. A proposed major trail known as the Boardman Valley Trail (North) would need to be slightly realigned based on data from 2012 GIS Land Use/Cover for Grand Traverse County. The realignment would follow the river waterfront closely based on the Boardman River being restored to its natural conditions and channel formation.

3.4.2.2.6 Aesthetics

Alternative 6 would have an insignificant direct impact on the aesthetics of the project area. Dam removal would have an insignificant direct impact and would involve the relocation of the minor trail systems with only short-term and temporary aesthetic impacts during construction activities. These actions would be site improvements and result in no permanent adverse visual effects. The visual landscape for existing landowners would be changed from views of open water to possibly a view of vegetation associated with Alternative 6, as the river finds its natural course and the bottomlands are exposed for vegetative growth.

The elements of ecological restoration associated with this project would provide an indirect and direct positive impact of overall visual enhancement and beneficial use of the natural resources. Any aesthetic direct negative impacts would be temporary and would involve increased construction activities for the purpose of restoring the natural landscape setting. The consideration of aesthetics is difficult to determine for the viewshed of residential homes within the vicinity of the Sabin Pond and Keystone Pond.

3.4.3 Socioeconomic Resources

The assessment of effects on socioeconomic resources, including traffic and transportation and utilities and infrastructure, were considered for direct, indirect, and cumulative impacts. These

impacts were assessed based on whether the proposed project effect is significant, insignificant, or no impact.

3.4.3.1 Alternative 1. No Action Alternative

No new construction, structural improvements, or development activities would occur under the No Action Alternative; therefore, the No Action Alternative would not directly or indirectly impact socioeconomic resources.

3.4.3.2 Alternative 5. Modify Union Street Dam and Remove Sabin and Boardman Dams

3.4.3.2.1 Socioeconomic Resources

The Recommended Alternative 5 would have insignificant direct impacts on socioeconomic resources in the project area. By modifying the auxiliary spillway at the Union Street dam, the impoundment would remain as open water land use along the Boardman River. The direct impacts incurred to Lay Park would be short term and temporary as a result of construction activities. However, these minimal impacts would be offset by the improved fish passage and restoration of the free-flowing river.

Alternative 5 also involves removing both the Sabin Dam and the Boardman Dam. The manmade impoundments, Sabin Pond and Boardman Pond, are immediately upstream of the Sabin Dam and Boardman Dam, respectively. This alternative would restore these ponds to a free-flowing river. The removal of the dams would provide an opportunity for short-term, local construction employment. Dam removal would have an insignificant effect on socioeconomic resources. There would be short-term and temporary socioeconomic impacts to Breezy Acres Mobile Home Park, Grand Traverse Natural Education Reserve, and adjacent residential dwellings as a result of construction activities, which would entail limiting access and usage, altering the viewscape, as well as general disturbances associated with construction. Additionally, the issue of riparian rights of the landowners may arise as the changes to the river occur, however no riparian rights of existing landowners have been established to date.

The indirect and cumulative impacts to land use for Alternative 5 would be restoration of higher quality open space related to sustainable measures achieved and greater access and use of the area following stream restoration and dam removal. Access to the Nature Education Reserve would temporarily be restricted during construction. The alternative, including the removal of the dams would result in no displacement of the adjacent residences. Impacts to the viewshed, including those from the adjacent residences, would change from a view of a lake like system to that of a riverine system.

3.4.3.2.2 Transportation and Traffic

Alternative 5 consists of modifying the Union Street Dam by adding a fish passageway, and removing the Sabin and Boardman Dams. This alternative would include the removal of the current Cass Road where the new river channel intersects it just downstream of where the dam is to be breached. Traffic and transportation impacts to Cass Road would need to be considered

during final design of removal of the Boardman Dam. Impacts to traffic would depend upon plans being developed by the Grand Traverse County Road Commission to restore the Cass Road crossing of the Boardman River. It is currently expected that the Road Commission would build a bridge to span the area where the current road would be removed. The design, demolition and construction of the bridge would be funded through a state grant and would not be a part of the federally funded ecosystem restoration project.

Building the bridge would require detouring of traffic for an extended period, and an increase in truck traffic would also be expected during construction. Specific temporary transportation impacts such as detours for emergency vehicles, school buses, and everyday traffic during the reconstruction would be identified and minimized by the county during design and construction phases. The construction of the bridge would not result in permanent impacts. Temporary impacts in the form of changing traffic routes and patterns would result from a change in the bridge crossing at this location. Additionally, the bridge would be changed from its existing one lane to two lanes which would provide improved traffic flow. If the Road Commission decided not to build a bridge to re-open Cass Road, traffic patterns in the area would be permanently altered. Cass Road is a minor arterial road with approximately 7,000 vehicles per day in 2007 and over 14,000 vehicles per day predicted in 2035 (TC-TALUS 2010).

During the construction at the Union Street Dam and the Sabin Dam, temporary impacts including traffic backups may be caused by small dozers, excavators, and dump trucks on haul roads. All traffic impacts would be temporary as a result of construction. Construction is scheduled for the summer months to avoid interferences with school and bus traffic. All truck traffic to and from the project sites would use approved hauling routes and abide by local, State, and Federal requirements.

3.4.3.2.3 Utilities

Anticipated impacts to utilities during the reconstruction would be minor and temporary. Specific impacts would be identified and addressed by the County during design and construction phases.

Traverse City owns and maintains a public sanitary sewer system in the Union Street Dam project area as well as a public storm sewer system. The public water main system was also examined in this EA for possible project impacts. The dam also provides river crossing for a 12-inch diameter cast iron water main that is located on the surface of the dam crest. With the modification of the dam, no impacts to the water main are expected. Any electrical utilities, including overhead wires, and transformers/ electrical stations may need to be temporarily relocated during dam modification for construction safety causing temporary impacts to the area. Traverse City Light and Power owns all the electrical utilities in the Union Street Dam area.

The Sabin and Boardman Dams are non-active hydroelectric dams with electrical utilities surrounding the study area. Relocations of gas lines, electrical utilities, transformers/electrical infrastructures and any overhead electrical wires are possible results of implementing the action

alternatives. At the Boardman Dam, there is an electrical station to the southeast of the property. All electrical utilities are owned by Traverse City Light and Power.

Utilities that would be impacted by construction activities would be either protected or relocated as required. Utility relocations are expected to have minimal effects, but would need to be coordinated with the utility companies to avoid schedule delays.

3.4.3.3 Alternative 6. Remove Sabin Dam

3.4.3.3.1 Socioeconomic Resources

Alternative 6 would have insignificant direct impacts on socioeconomic resources in the project area. The removal of Sabin Dam would provide an opportunity for short-term, local construction employment. Dam removal would have an insignificant effect on socioeconomic resources. There would be short-term and temporary socioeconomic impacts to Breezy Acres Mobile Home Park, Grand Traverse Natural Education Reserve, and adjacent residential dwellings as a result of construction activities, which would entail limiting access and usage, altering the viewscape, as well as general disturbances associated with construction.

The indirect and cumulative impacts to land use for Alternative 6 would include the restoration of high quality open following stream restoration and dam removal. Overall, the alternative could remove the dam and restore the natural ecosystem. No displacement of the adjacent residences would be required. Access to the Nature Education Reserve would be temporarily restricted during construction.

3.4.3.3.2 Transportation and Traffic

Unlike Alternative 5, Alternative 6 does not involve the closing the Cass Road Bridge for the removal of Boardman Dam. Consequently, impacts to traffic and transportation impacts for this alternative are lessened. During the construction at Sabin Dam, any traffic impacts would be temporary as a result of construction. Any temporary disruptions would result from an increase in the use of roads by construction-related equipment including traffic caused by small dozers, excavators, and dump trucks on haul roads. All truck traffic to and from the project sites would use approved hauling routes and abide by local, State, and Federal requirements.

3.4.3.3.3 Utilities

The Sabin Dam is a non-active hydroelectric dam with electrical utilities surrounding the project area. Relocations of gas lines, electrical utilities, transformers/electrical infrastructures and any overhead electrical wires are possible results of implementing Alternative 6.

Anticipated impacts to utilities during the reconstruction would be minor and temporary. Utilities that would be impacted by construction activities would be either protected or relocated as required. Utility relocations are expected to have minimal effects, but would need to be coordinated with the utility companies to avoid schedule delays. Specific impacts would be identified and addressed by the County during the design and construction phases.

3.4.4 Hazardous, Toxic, and Radiological Waste

The assessment of effects on HTRW was considered for direct and indirect impacts. These impacts were assessed based on whether the proposed project effect is significant, insignificant, or no impact. Subsequently, mitigation measures were identified if deemed necessary based on the impact assessment.

3.4.4.1 Alternative 1. No Action Alternative

No new construction, structural improvements, or development activities would occur under the No Action Alternative; therefore, the No Action Alternative would not directly impact HTRW. The No Action Alternative would not contribute to indirect or cumulative impacts to HTRW.

3.4.4.2 Alternative 5. Modify Union Street Dam and Remove Sabin and Boardman Dams

3.4.4.2.1 Union Street Dam

Sediments in the immediate vicinity of the Union Street Dam may be impacted as a result of several environmental issues. These issues include a SHWS along the south bank directly east of the dam and another SHWS to the south-southwest. These properties are known to be impacted with chromium, mercury, selenium, fluoranthene, phenanthene, arsenic, benzo(a)pyrene, copper, lead, and PNAs, and gasoline components, respectively. Previous environmental investigations of Boardman Lake and River have identified sediment contamination within these waterways. Because they are located upstream of the Union Street Dam, these impacted sediments may have migrated via water flow patterns to the immediate Union Street Dam area. Contaminants that have been identified in Boardman Lake include heavy metals (arsenic, cadmium, chromium, copper, iron, lead, mercury, manganese, nickel, and zinc) and PAHs (benzo (a) anthracene, benzo (a) pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, fluoranthene, phenanthrene, and pyrene).

Various industrial activities have been conducted along Boardman River and around Boardman Lake. These current and historic activities have the potential to impact subsurface conditions along the waterway. Contaminants from these industries may have migrated via water flow patterns to the immediate Union Street Dam area. Based on information provided in environmental databases, sediments in the Boardman waterway and dam area may also be impacted with petroleum hydrocarbons, pesticides, PCBs, dry-cleaning compounds, heavy metals, solvents, PNAs, VOCs, sodium, chloride, and bicarbonates.

Non-ASTM environmental concerns investigated at the dam structure included potential ACM, potential lead-based paint, and heavy metal-containing materials. Potential PCB-containing equipment was also inspected. Potential ACM observed includes roofing materials and wire insulation on and within the concrete-block storage building located on the south bank of the dam.

3.4.4.2.2 Sabin Dam and Impoundment

An offsite property representing a recognized environmental condition to Sabin Pond was identified along the western bank of the impoundment. The TCAPS Maintenance Department facility, at 1180 Cass Road, was identified in environmental databases, and observations during the site inspection suggest that stormwater runoff from this property discharges into Sabin Pond. Therefore, sediment within Sabin Pond may be impacted with petroleum products and other vehicular fluids (i.e., antifreeze, solvents) from the property. Appropriate precautions, testing, material handling and management would be employed in the event that the removal of Sabin Dam and modification of the associated impoundment are pursued. Any demolition would be conducted in accordance with approved removal procedures and applicable State and Federal regulations for handling hazardous materials.

A hazardous material survey was conducted at the Sabin Dam powerhouse in 2011. Lead-based paint and potentially mercury-containing and PCB-containing items were identified. No ACM was identified in the powerhouse. As the powerhouse is not being removed as part of this Section 506 project, no adverse effects are anticipated. Any demolition work associated with this project that potentially could affect the powerhouse would be conducted in accordance with approved removal procedures and applicable State and Federal regulations for handling hazardous materials.

3.4.4.2.3 Boardman Dam and Impoundment

The following potential ACM was observed at Boardman Dam: weathered and damaged caulk on windows, sealant materials, terrazzo flooring, wire insulation in lighting fixtures, suspended acoustical ceiling tile in east upper office, original electrical conduits encased in concrete walls, electrical panel insulation, and roofing materials. Possible lead-based paint was observed within the interior of the powerhouse; the paint was peeling and in poor condition in some locations. Lead-encased wiring may also be present. Fluorescent light tubes installed within the powerhouse may be mercury-containing. Possible PCB-contaminated or PCB-containing equipment observed includes weathered and damaged window caulking, oil staining on the main level of powerhouse and in equipment shafts from removed equipment, hydraulic oil reservoir at lift gates, electrical switches and other equipment, original electrical conduits embedded in concrete walls, and a pad-mounted transformer located on the west embankment. No sampling or testing for asbestos, lead, mercury, or PCBs has been conducted on building materials or items at the Boardman Dam powerhouse. While the powerhouse is not being removed under this Section 506 dam removal project, any demolition work associated with this project that potentially could affect the powerhouse would be conducted in accordance with approved removal procedures and applicable State and Federal regulations for handling hazardous materials.

3.4.4.3 Alternative 6. Remove Sabin Dam

As discussed in Section 3.4.4.2.2 above, sediment within Sabin Pond may be impacted with petroleum products and other vehicular fluids (i.e., antifreeze, solvents) from the surrounding property. Appropriate precautions, testing, material handling and management would be

employed in the event that the removal of Sabin Dam and modification of the associated impoundment are pursued. Any demolition would be conducted in accordance with approved removal procedures and applicable State and Federal regulations for handling hazardous materials. Additionally, a hazardous material survey was conducted at the Sabin Dam powerhouse in 2011. Lead-based paint and potentially mercury-containing and PCB-containing items were identified. No ACM was identified in the powerhouse. The powerhouse would not be demolished as part of this project.

3.4.5 Sediment Quality, Contamination, and Management

Alternative 5 and 6 would require management of sediment, some of which has arsenic levels above residential DCC, but none of it has reported values above nonresidential DCC. Based on the reported arsenic levels no special handling or mitigation is required. Alternative would not disturb existing sediments or involve drawdown of the Boardman and Sabin impoundments below their existing levels. Therefore, only Alternative 5 and 6 are discussed here.

Based on current site conditions and foreseeable recreational site use following the dam removals and river restoration, the most plausible exposure pathway is direct contact. Arsenic is the only metal that was found to exceed the MDEQ-established residential DCC. No metals exceeded the nonresidential DCC. It is appropriate that the nonresidential land use DCC be applied to the Boardman and Sabin Ponds. Based on this criterion sediment does not pose unacceptable exposure risk if moved from bottomland/riverbeds and spread on floodplain areas or sediments exposed in the bottomlands/riverbeds as a result of the drawdown of both impoundments. Dredging conducted within the impoundments would require sampling of stockpiled sediments, not the in-situ sediments in a submerged state, to determine proper management actions in compliance with Federal and State regulations. The required sampling plan would be developed in cooperation with the MDEQ and consistent with USACE policy during planning engineering and design (PED). If the sediment is determined unsuitable for reuse on site, it would be removed to an appropriate placement/soil management location. Precautions would be taken to prevent loss of impacted sediments into the environment.

3.4.5.1 Alternative 5. Modify Union Street and Remove Sabin and Boardman Dams

The preliminary sediment management framework for Boardman (Keystone) Pond assumes that all sediment exists at a contamination level below thresholds requiring special handling and management techniques. Areas for sediment management/placement have been identified within the existing impoundment boundaries that account for all of the expected sediment removed during restoration.

Implementing Alternative 5 would move sediment and self-armor with existing gravel, cobble, and boulders. Sediment would be managed using multiple methods, with the goal of limiting movement and transport of particles classified as fine sand and larger. Sediment management would be accomplished with sediment traps immediately upstream of the existing dams, slow drawdown, and active sediment removal along the exposed banks by land-based excavators (to provide an appropriately dimensioned floodplain). Other management options may include

maintaining inactive storage of sediment within the impoundment and/or creating a covered placement area on site.

For Sabin Pond, a total sediment volume to be mobilized in the establishment of the proposed cross-section and profile has been identified. Natural processes would be allowed to establish the proposed channel (bankfull) alignment. Sediment traps would be constructed near the Sabin and Keystone Dams to capture naturally mobilized sediment from channel formation within the upper reaches of each pond. Mechanical excavation would likely be required to establish a floodplain bench to provide a naturally functioning restored river channel. While natural processes would mobilize sediment within the two Ponds, mechanical excavation would be required to breach existing dams and establish proposed channel alignments in these areas.

The construction activities associated with the channel restoration and dam breaching would result in fine silts and clays being transported downstream to Boardman Lake. This material would be managed via a slow drawdown of the impoundment which would limit, but not eliminate movement of fine grained material. The magnitude and duration of fine sediment that is released downstream during construction should be monitored. During the projects engineering and design phase (PED), water quality based expectations related to turbidity and fine material levels shall be developed with the regulatory agencies and in accordance with USACE policy. This approach to managing the short and long term impacts of mobilized material would reflect a level of control commensurate with the environmental risk they pose during transport and settlement in Boardman Lake. Sediment quality sampling reported that all contaminants sampled were below the PEC and only arsenic and cadmium were above the TEC which indicates there should be limited to no toxicity from the mobilized sediments. This conclusion is further supported by the lack of sediment quality related water quality or aquatic toxicity issues in either Boardman or Sabin ponds. Sediment sampling shall be conducted as required by the regulatory agencies, and in accordance with USACE policy, to analyze and approve the sediment management approach developed during PED.

During construction a large area would be devoid of vegetation and the potential for soil erosion would be present. During PED, a detailed soil erosion and sedimentation control plan that meets local, state and federal regulatory requirements would be developed in coordination with regulatory agencies and USACE policy. This plan shall limit erosion and sedimentation within the limits of construction using adequate and efficient control measures during the construction phase.

3.4.5.2 Alternative 6. Remove Sabin Dam

Implementing Alternative 6, removal of Sabin Pond, would require sediment exposed from drawdown and moved for channel restoration to be managed in accordance with applicable state and federal regulations. The sediment volume mobilized would include that required to establish the proposed cross section and profile identified. Natural processes and mechanical excavation would be used to establish the proposed (bankfull) channel alignment. Sediment traps would be constructed near Sabin Dam to capture naturally mobilized sediment from channel formation within the upper reaches of the pond. Mechanical excavation would likely be required to

establish a floodplain bench to provide a naturally functioning restored river channel. While natural processes would mobilize sediment within the Pond, mechanical excavation would be required to breach the existing dam and establish proposed channel alignments in this area.

3.4.6 Cultural Resources

The assessment of potential effects to cultural resources was considered for direct, indirect, and cumulative impacts. These impacts were assessed based on whether the proposed project would have an effect on historic properties or would have no adverse effect. Construction and ground disturbance for the Action Alternatives have the potential to encounter extant structural elements of the pre-1962 components of the three dam structures. Further, modifications to the existing historic-era dam elements could present a visual impact to extant historic properties, especially in the vicinity of the Union Street Dam, which is located within an older section of Traverse City.

In correspondence dated July 13, 2005, October 13, 2005, and August 22, 2007, the Michigan SHPO and OSA indicated that no historic properties would be affected by the proposed undertaking. Therefore, the modification and/or removal of the dam structures would not represent an adverse effect to historic properties. However, this same correspondence did request the completion of a Phase I archaeological field reconnaissance, after impoundment drawdown, of accessible remnants of the former shorelines of the Boardman River. Consequently, two separate Phase I archaeological surveys were conducted on portions of the former impoundments following drawdown, neither of which encountered any NRHP-eligible archaeological resources. A historic architecture survey undertaken concurrently with the 2012 archaeological survey was likewise negative for any NRHP-eligible resources.

In correspondence dated June 26, 2013 (**Appendix A**), the Michigan SHPO concurred with the determination of the USACE that no historic properties are affected within the area of potential effects of the Boardman River Dam Removals. This concurrence letter fulfills the USACE's compliance with 36 CFR § 800.4(d)(1) and the fulfillment of the USACE's responsibility to notify the SHPO. Contract specifications would include precautionary clauses to provide protection for any unknown cultural resources that may be encountered during construction. Michigan SHPO would be notified immediately upon any such discovery.

3.4.6.1 Alternative 1. No Action Alternative

No new construction, structural improvements, or development activities would occur under the No Action Alternative; therefore, the No Action Alternative would not directly impact existing cultural resources. The No Action Alternative would not contribute to indirect or cumulative impacts to cultural resources.

3.4.6.2 Alternative 5. Modify Union Street Dam and Remove Sabin and Boardman Dams

The proposed modifications to the concrete infrastructure of the Union Street Dam structure may impact extant pre-1962 elements of the dam with the modification of the auxiliary spillway for downstream passage of lake sturgeon and other fish. The impoundment would remain as open water with no aesthetic impacts to the concrete structure. The modification of the auxiliary

spillway would require alterations to the concrete infrastructure of the dam. The removal of the Sabin Dam and Boardman Dam would permanently impact the pre-1962 elements of both dam structures, and represent an aesthetic alteration to the surrounding landscape. The two archaeological field reconnaissance surveys and concurrent historic architecture survey did not identify any NRHP-eligible resources within the landforms of the former impoundments or visible from either the Sabin Dam or the Boardman Dam. Therefore, this alternative would not impact any NRHP-eligible archaeological deposits or historic aboveground resources.

3.4.6.3 Alternative 6. Remove Sabin Dam

Under this alternative, the removal of the Sabin Dam would permanently impact the pre-1962 elements of the dam structure and represent an aesthetic alteration to the surrounding landscape. The two archaeological field reconnaissance surveys and concurrent historic architecture survey did not identify any NRHP-eligible resources within the landforms of the former impoundment or visible from the Sabin Dam. Therefore, this alternative would not impact any NRHP-eligible archaeological deposits or historic aboveground resources.

3.5 Cumulative Effects

This section presents the recent, present, and foreseeable future projects that were considered during the assessment of cumulative effects of each alternative. Cumulative effects can result from individually minor but collectively significant actions taking place over time. The Council on Environmental Quality guide *Considering Cumulative Effects under the National Environmental Policy Act* (1997) states: “for cumulative effects analysis to help the decision maker and inform interested parties, it must be limited through scoping to effects that can be evaluated meaningfully.”

The potential for cumulative effects to the environment from the Action Alternatives were evaluated by reviewing historical aerials to identify recent projects, and by reviewing ongoing and planned projects within the vicinity of the sites that could affect the same environmental resources as each alternative. Actions that were considered include construction projects that were recently completed, are currently underway, or are scheduled to occur within the near future.

The Recommended Alternative (Alternative 5) for this Proposed Action involves the removal of the Boardman Dam and the Sabin Dam, and modification of the Union Street Dam within the Boardman River Watershed. This proposed project would restore the natural aquatic ecosystem of the Boardman River by allowing unimpeded movement of woody debris and sediment materials through the river system, eliminating thermal disruption, and restoring the natural balance between coldwater and coolwater species. Restoration of habitat has been identified as a high priority for the entire Great Lakes Basin through the support plan for the GLFER program. The purpose of the Proposed Action is to reestablish the coldwater aquatic ecosystem of the river, which has been severely degraded by the increased water temperatures of the existing impoundments.

Additionally, Alternative 5 would provide connectivity to Grand Traverse Bay of Lake Michigan for the State-protected lake sturgeon, via a modification to the auxiliary spillway for downstream passage and trap-and-transfer activities for upstream passage. By moving lake sturgeon upstream to spawn in the Boardman River and associated tributary habitat, the primary goal is to increase suitable and accessible spawning habitat to improve sturgeon reproduction. When combined with other lake sturgeon rehabilitation projects and restrictions in recreational fishing, the long-term goal is to produce significant increases in the Great Lakes sturgeon population.

The Brown Bridge Dam, which is no longer in existence, was included within the Boardman River Watershed, along with the Boardman, Sabin, and Union Street Dams as impoundments involved in the Proposed Action. In 2005, Traverse City Light and Power, Traverse City, and Grand Traverse County organized the BRDC and decided to close and remove three of the dams along the river, starting with the Brown Bridge Dam (USFWS 2012b). The project had an initial cost of $5 to $8 million and, therefore, the Boardman River Project is being funded through Federal, State, tribal, local government, and private funding sources. USFWS is a partner along with the Grand Traverse Band of Ottawa and Chippewa Indians, Traverse City, Grand Traverse County, the MDNR, the Michigan Hydro Relicensing Coalition, Traverse City Light and Power, and several non-governmental organizations to implement this project.

The Boardman River Project received two grants from the Service's Tribal Wildlife Grant Program. The first grant of $250,000, received in 2005, led to the completion of the Engineering and Feasibility Study to determine whether dam removal would be the preferred alternative for the owners moving forward, subsequent to expiration of their associated Federal Energy Regulatory Commission licenses. In 2010, a second grant was awarded that allowed the Grand Traverse Band of Ottawa and Chippewa Indians, along with other project partners, to set up the initial contract for developing and implementing the engineering, design, permitting, and other components that defined the path to dam removal and the reconnection and restoration of the river (USFWS 2012a).

Data collection and assessment for the removal of the Brown Bridge Dam began in March 2011. By the end of May 2011, a finalized design, engineering, and restoration plan had been put in place for the Brown Bridge Dam removal. The end of September brought the Brown Bridge Dam Reservoir drawdown to completion. Between September 2011 and May of 2012, pre-deconstruction activities took place to get the dam ready for removal. Work at the project site commenced in July 2012, the drawdown was planned and approved at a maximum rate of 12-inches per day through the use of a temporary dewatering structure (TDS). On October 6, 2012, during the drawdown process, an abrupt release of water occurred in the area of the TDS which caused damage to approximately 50 riverfront properties. The project team immediately worked with property owners to assist with damage mitigation. Following clean up, DEQ issued a work plan to the contractor and work resumed the week of October 29. Dam removal was completed by late December 2012. Follow up grading and vegetation work occurred in the spring of 2013. Final restoration for all three dam removals is slated to be complete by 2018 (USFWS 2012a).

The Brown Bridge Dam removal in conjunction with the Proposed Action presented in this EA would provide additional environmental, community, regional, and educational benefits.

Environmental benefits would be realized through the restoration of over 3 miles of river, which would connect with nearly 160 miles of pristine riverine habitat upstream, providing fisheries benefits. The Brown Bridge Dam removal provides a free-flowing coldwater habitat downstream to within 10 miles of the Great Lakes and in combination with the alternatives proposed would replace the warmwater species with coldwater species in the Boardman River throughout the lower river. Benefits from the connection of the coldwater upstream river with the downstream habitat would create a contiguous system for coldwater and coolwater species to spawn and inhabit. Increased income to the community from recreational use of the river, such as fishing and canoeing would occur. There is also the potential for regional benefits through increased cooperation between interested parties, various levels of government, and non-government organizations from the removal effort of the Brown Bridge Dam and the Proposed Action. An educational benefit would also result the creation of a place where schools can conduct scientific research in the field to assess the impacts of dam removal (USFWS 2012a).

Based on the current state of the Union Street Dam, no major rehabilitation appears to be required in the immediate future to maintain dam safety. However, in 2011, the USFWS surveyed the extent of the sea lamprey presence in the Boardman River and identified several gaps between the stop logs and concrete sill that are sufficient for passing sea lamprey. The USFWS requested that Sabin Dam not be removed until repairs were completed to the Union Street Dam. Repairs to the Union Street Dam would be required regardless of the dam removal project. During a subsequent dam inspection conducted by the City of Traverse City repairs were made in conjunction with the USFWS that corrected the previously identified deficiencies related to sea lamprey blockage. These repairs included replacing deteriorated stop logs, cleaning the concrete sill, and evaluating the seals between stoplogs and the concrete sills. Additionally, future repairs may be required at the bridge at Cass Road. The Grand Traverse County Road Commission has been awarded a $3.5 million grant for the reconstruction of the Cass Road Bridge over the Boardman River. This grant is expected to be used by 2015. Coordination with potential future dam removal and river restoration projects would reduce the impact of this construction effort and would have a positive effect on the proposed dam removal project.

Negative cumulative impacts associated with the removal of the Sabin, and Boardman Dams would result from the loss of lake frontage by residential land owners. These landowners would be and have already been impacted by the drawdown of these impoundments. With the completion of the project, the former impoundments would be replaced with a natural stream channel.

The events surrounding the removal of the Brown Bridge Dam increase the potential for negative cumulative effects from multiple dam removals. During the removal of the Brown Bridge Dam there was a failure in the drawdown process that caused an abrupt release of water in the area of the temporary dewatering structure (TDS) which damaged approximately 50 riverfront properties. The project team immediately worked with property owners to assist with damage mitigation. Following clean up, DEQ issued a work plan to the contractor and work resumed the week of October 29. The implementation of these multiple dam removal projects poses a

potential negative impact of flooding to riverfront properties if the drawdown process is not properly conducted.

The Brown Bridge dam removal in combination with the removal of the Sabin, and Boardman Dams would create the largest dam removal in Michigan's history. Currently, within the project area, the Brown Bridge Dam has been removed and is the only recent and foreseeable project that impacts the Boardman River Watershed. The cumulative effects of the Brown Bridge Dam Removal Project in combination with the Proposed Action would extend the beneficial environmental, recreational, community and regional benefits to the Boardman River Watershed.

4 Agency and Tribal Coordination

Coordination was conducted with the USFWS, MDEQ, U.S.EPA, Michigan Land Use Institute, Northern Michigan Environmental Action Council Watershed Center, Michigan SHPO and tribal organizations to request information regarding the resources on and near the project area. Initial coordination occurred in 2007 when the USACE requested comments on the project. The USACE sent out a coordination notice in July 2012 updating the 2007 coordination effort. Coordination responses are included in **Appendix A**.

Additionally, the project alternatives formulation and iterative process has had an active and ongoing review from the Implementation Team (IT). The IT represents dam owners and interested organizations and agencies, including:

- Grand Traverse Band of Ottawa and Chippewa Indians
- City of Traverse City
- Grand Traverse County
- Michigan Department of Natural Resources (MDNR)
- Michigan Hydro Relicensing Coalition
- Traverse City Light and Power
- U.S. Fish and Wildlife Service (USFWS)
- Conservation Resource Alliance
- Grand Traverse Conservation District
- Grand Traverse County Road Commission
- Rotary Camps and Services
- Watershed Center Grand Traverse Bay

4.1 U.S. Fish and Wildlife Service Coordination (USFWS)

The USFWS responded with comments on August 2, 2012. They were in support of the proposed alternatives for dam removal and modification. Mr. Rick Westerhof, USFWS, is involved with the Implementation Team (IT) and USFWS commented that he should be informed of all decisions regarding the dam removal. Additionally, USFWS commented that the project would not impact federally listed species or known bald eagles and that implementation of post-dam removal preventative measures to limit the colonization of the river from sea lamprey should be included in the project.

In an email response sent to the Corps on October 3, 2012, Ms. Jessica Barber of USFWS provided some clarification to items contained in the USEPA correspondence. Ms. Barber commented that the Trail Creek fishway is not open for free passage and that it can be operated as a trap and transfer facility when needed. Additionally, Ms. Barber commented that if a new

sea lamprey barrier were to be constructed, it would be operated as a trap and transfer facility and that free passage would not be supported.

In the Recommended Alterative the Union Street Dam would be modified to allow downstream passage of the State-listed lake sturgeon while maintaining the existing level of ANS (e.g., sea lamprey) protection. Upstream passage of lake sturgeon would be achieved by a trap-and-transfer operation overseen by the MDNR at the Boardman River fish weir located downstream from the Union Street Dam. Boardman Lake and the Boardman River, downstream of the Sabin Dam, would be usable to lake sturgeon upon manual transfer past the weir/dam. Other than lake sturgeon, the MDNR would determine what additional Great Lakes species may or may not pass upstream of the weir. Additional discussion is addressed in Section 3.4.1.2.2. of the EA.

4.2 Michigan Department of Environmental Quality (MDEQ)

Coordination with the MDEQ was ongoing throughout the project. In an email received by the Corps on August 9, 2012, the MDEQ expressed concern regarding elevated arsenic levels in the sediments in the then-existent Brown Bridge Pond and the Boardman Pond. The email correspondence also referred to elevated levels of manganese and selenium in Sabin Pond. The MDEQ suggested that a background study be conducted in the area to determine if these are naturally occurring levels, additionally, a leach test on the sediments from the Sabin Pond was requested for determining handling/placement requirements.

Given the potential for contaminated sediments within the impoundments and in response to MDEQ and project team concerns, GLEC conducted sediment sampling downstream of the Boardman and Sabin Dams in May 2012. Generally, samples were analyzed for pesticides, PCBs, PAHs, and 10 trace metals (arsenic, barium, cadmium, chromium, copper, lead, mercury, selenium, silver and zinc), unless stated otherwise below. Analysis of these sampling events is included in Section 3.3.5 of the EA.

The MDEQ suggested conducting background level studies to investigate potential elevated arsenic levels within the then-existent Brown Bridge and the Boardman Ponds. Additionally, MDEQ raised a concern regarding the placement of fill material on the bottomlands. These issues were addressed by conducting additional sampling and identifying expected seeps, tributaries and wetlands on the maps showing sediment placement locations. Further details regarding these issues are addressed in Section 3.4.5 of the EA and Section 4.1.1 of DPR Appendix A: Engineering.

4.3 U.S. Environmental Protection Agency Coordination (USEPA)

The U.S. EPA responded with comments on September 4, 2012, in accordance with the National Environmental Policy Act (NEPA), the Council on Environmental Quality's NEPA Implementing Regulations (40 CFR 1500-1508), and Section 309 of the Clean Air Act. USEPA commented that Alternative 5, Modify Union Street Dam and Remove Sabin and Boardman Dams, would have their greatest support.

USEPA commented that they were a proponent of an in-stream lamprey barrier being installed at Union Street as they have suggested on previous projects. Section 2.4 and 2.7 of the EA discuss the construction of a sea lamprey barrier downstream of the Boardman River's confluence with Kids Creek. The implementation of a separate lamprey barrier downstream would, because of the constrained river channel through Traverse City, result in significant flooding of property and public works and for that reason, in addition to increased project costs, was eliminated from consideration.

In regards to contaminated sediment behind the dams, USEPA recommended that this EA disclose the estimated cubic yards of sediment behind each dam and discuss sampling, placement options, and coordination with MDEQ. These issues are addressed in Section 3.4.5 of the EA and Section 4.1.1 of the DPR Appendix A: Engineering.

USEPA recommended that the EA propose specific construction measures and best management practices (BMPs) for construction to minimize construction impacts to the surrounding resources. Construction measures and BMPs are addressed in Section 2.6 of this EA.

Lastly, USEPA requested that the EA address which entities would be responsible for the trap-and-transfer activities at the MDNR weir and whether a contingency plan is in place in the event that MDNR can no longer facilitate trap-and-transfer due to budget constraints. The James P. Price Trap-and-Transfer facility has historically been operated and maintained by the MDNR. This operation is integral to maintaining the salmon population of the Great Lakes, as well as, the health of the river. The MDNR is committed to continuing its operation of the weir and trap-and-transfer program.

In an email response sent to the Corps on October 3, 2012, Ms. Jessica Barber of USFWS provided some clarification to items contained in the USEPA correspondence. This correspondence is discussed in Section 4.1.

4.4 Michigan Land Use Institute, Northern Michigan Environmental Action Council and Watershed Center – Grand Traverse Bay Coordination

On July 19, 2012, the Michigan Land Institute, Northern Michigan Environmental Action Council and the Watershed Center provided comments reflecting the views of all three organizations to the proposed action specifically regarding the replacement of the Cass Road Bridge. Since the replacement of the Cass Road Bridge is being pursued by the GTCRC this information was provided to them for consideration.

They requested that the Cass Road Bridge be replaced within the existing Cass Road corridor to minimize disturbance of natural features and habitat, maintain and improve the existing road system, and utilize existing road infrastructure as much as possible to ensure proper use of transportation funding. Replacing the existing bridge crossing within the existing corridor is consistent with the Grand Vision, which is a community supported vision for transportation, land use, economic development and environmental stewardship in the region. Additionally, the

Grand Vision includes non-motorized connectivity features on Cass Road including the new bridge structure.

The Michigan Land Use Institute, Northern Michigan Environmental Action Council and the Watershed Center are in support of the replacement of the bridge consisting of 100-foot pier span of the river with possible additional spans on either side of the bridge piers. Benefits to this large span include unencumbered passage of fish populations, trail options, and wildlife passage. They recommended that the bridge span be as large as possible.

4.5 Grand Traverse County Parks & Recreation Coordination

In correspondence dated July 26, 2012, Grand Traverse County Parks and Recreation, on behalf of the Natural Education Reserve (NER) Advisory Committee, advocated that agencies involved in the removal of the dams support provisions for accommodating wildlife, non-motorized access, and the needs of the "general citizenry." NER requested that the dam removal be coordinated with the GTCRC bridge design and construction to accommodate this passage through trails on both the east (NER trails) and west (NER & TART trails) sides of the river. These goals and proposed future trail expansion, according to NER, are in line with the 2002 Grand Traverse County Comprehensive Plan and enhancement of "Green Infrastructure" and local "placemaking" aspirations.

4.6 Michigan State Historic Preservation Office (SHPO) and Tribal Coordination

In correspondence dated July 13, 2005, October 13, 2005, August 22, 2007, and July 8, 2008, the Michigan SHPO and OSA indicated that no historic properties would be affected by the proposed undertaking. Therefore, the modification and/or removal of the dam structures would not represent an adverse effect to historic properties. However, this same correspondence requested the completion of a Phase I archaeological field reconnaissance, after impoundment draw-down, of accessible remnants of the former shorelines of the Boardman River.

Two separate Phase I archaeological surveys were therefore conducted on portions of the former impoundments following draw-down, neither of which encountered any NRHP-eligible archaeological resources. An historic architecture survey undertaken concurrently with the 2012 archaeological survey was likewise negative for any NRHP-eligible resources. The results of the cultural resources surveys and additional coordination documentation are included in Section 3.4.6 of the EA and the Phase I Report prepared for the proposed action.

In correspondence dated June 26, 2013, the Michigan SHPO concurred with the determination of the USACE that no historic properties are affected within the area of potential effects of the Boardman River Dam Removals. This concurrence letter fulfills the USACE's compliance with 36 CFR § 800.4(d)(1) and the fulfillment of the USACE's responsibility to notify the SHPO. The letter is included in Appendix A. The SHPO also requested that if the scope of work changes in any way, or if artifacts or bones are discovered, they be notified. Project contract specifications would include precautionary clauses to provide protection for any unknown

cultural resources that may be encountered during construction. Michigan SHPO would be notified immediately upon any such discovery.

In accordance with Section 106 of the NHPA, letters requesting preliminary comments concerning the identified area, and the potential for impact, if any, to cultural resources in the project area were sent to various Native American organizations. Those organizations included the following: Bureau of Indian Affairs, U.S. Department of the Interior; Great Lakes Agency, Bureau of Indian Affairs; Minnesota Agency, Bureau of Indian Affairs; Inter-Tribal Council of Michigan; Sault Ste. Marie Tribe of Chippewa Indians; Little Traverse Bay of Odawa Indians, Inc.; Pokagon Bond of Potawatomi Indians; and Grand Traverse Band of Ottawa & Chippewa Indians of Michigan. Response letters from the tribes are included in **Appendix A**.

5 Conclusions

This EA contains an evaluation of the existing conditions and environmental consequences of the Action Alternatives. Three categories of potential impacts were evaluated: direct, indirect, and cumulative. Several resources included in Section 3.1 were initially evaluated and determined not to warrant further consideration because of their lack of relevance to the alternatives. Additionally, the Clean Water Act Section 404(b) (1) Evaluation Report is included as **Appendix B** and addresses water quality impacts of the proposed action.

Based on the analysis of impacts provided in this EA, neither Action Alternative would have significant adverse direct, indirect, or cumulative effects on the quality of the human environment. **Table 17** summarizes these findings and identifies measures that would be implemented to avoid or minimize impacts. The Action Alternatives would restore fish habitat by restoring the internal connectivity and coldwater characteristics of the Boardman River and would increase the diversity of species moving between the Great Lakes and the river. The Recommended Alternative 5 is preferable to Alternative 6 because it provides the greatest benefits; it restores 8 miles of coldwater versus 1 miles restored by Alternative 6. Additionally, Alternative 5 allows for sturgeon passage from Lake Michigan to the Boardman River via a trap-and-transfer operation requiring small changes to the existing fish weir located along the lower Boardman River. The Sabin and Boardman Dams would be removed to maximize available habitat for brook trout, dace, lake sturgeon, and other coldwater species. The No Action Alternative was considered, but it does not meet the project's purpose and need.

This EA concludes that: 1) no significant cumulative or long-term adverse environmental impacts are associated with the long-term use of the material placement site; 2) the benefits outweigh the minor, temporary impacts that may result from project construction; and 3) this project does not constitute a major Federal action significantly affecting the human environment. As such, a Preliminary FONSI is included in Section 6.

The EA and Preliminary FONSI will be available to the public for comment and review for a period of 30 days at the Traverse City Government Offices and posted to the USACE Web site, the web address is provided in the Public Notice that this EA is attached to. A notice of availability for the EA will also be mailed to Federal, State, and local agencies, interest groups, and citizens.

At the end of the 30-day comment period, the USACE will consider all comments submitted by individuals, agencies, and organizations. As appropriate, the USACE Detroit District Engineer may then sign the FONSI and proceed with implementing the Recommended Alternative. If it is determined that implementing the Recommended Alternative would result in potentially significant impacts, project re-design or mitigation measures would be proposed to reduce the impact(s) below a level of significance, or the USACE would either publish a Notice of Intent to prepare an Environmental Impact Statement in the Federal Register or choose not proceed with the Recommended Alternative.

Table 17: Summary of Environmental Impacts and Minimization/Avoidance Measures for the Action Alternatives

Impact Category	1. No Action Alternative Degree of Impact			5. Modify Union Street Dam and Remove Boardman and Sabin Dam Alternative Degree of Impact			6. Remove Sabin Dam Alternative Degree of Impact			
	Significant	**Insignificant**	**No Impact**	**Significant**	**Insignificant**	**No Impact**	**Significant**	**Insignificant**	**No Impact**	**Summary of Impacts and Activities to Avoid or Minimize Impacts**
Resources Eliminated From Further Consideration										
Coastal Zone			X			X			X	No significant direct effects on the coastal zone are expected to result from construction or operation of the project. Erosion and turbidity controls would be used during construction until vegetation is established to provide natural erosion control on the drawn down impoundments.
Air Quality			X			X			X	Air quality effects associated with this project would arise from emissions of construction equipment. All equipment would be required to meet emission standards and emissions are expected to be minor. Construction of the proposed project would be short term. Thus, the proposed project would be exempted as de minimis and meet the Conformity Requirements under Section 176(c) of the Clean Air Act, as amended, and Title 40 of the Code of Federal Regulations Section 93.153.
Noise			X			X			X	Although temporary/transient noises occur in the project area (e.g., from vehicles or boats), no notable sources of noise pollution are known to be present. This project would not have significant adverse noise effects. Temporary and minor noise effects would occur during construction. All motorized construction equipment would be required to have an approved noise reduction system to minimize any potential noise impacts. Neither of the Action Alternatives would result in direct impacts to noise resources within the project area.
Climate			X			X			X	Neither of the Action Alternatives would have significant effects on climate.
Geology			X			X			X	No significant direct effects on geology are expected to result from construction or operation of the project as the drawdown of the impoundments would not require significant excavation below pre-dam alluvium within the project area. Additionally, geologic/natural hazards are not expected within the project area that would impact the proposed action.
Public Services			X			X			X	The Action Alternatives could result in temporary impacts on schools and hospitals due to temporary road closures and/or reduced capacity for a short time. Emergency vehicle response times may be increased as a result of the bridge closure, however, significant impacts to public service resources services, such as police, fire protection, or local hospitals, within the project area are not expected.

Table 17: Summary of Environmental Impacts and Minimization/Avoidance Measures for the Action Alternatives

Impact Category	1. No Action Alternative Degree of Impact			5. Modify Union Street Dam and Remove Boardman and Sabin Dam Alternative Degree of Impact			6. Remove Sabin Dam Alternative Degree of Impact			
	Significant	**Insignificant**	**No Impact**	**Significant**	**Insignificant**	**No Impact**	**Significant**	**Insignificant**	**No Impact**	**Summary of Impacts and Activities to Avoid or Minimize Impacts**
Environmental Justice			X			X			X	The Action Alternatives would have no direct impacts on environmental justice as the implementation of these alternatives would not impact specific socioeconomic groups. Additionally, the project area does not have low income or minority populations, therefore there is not potential for adverse effects under Environmental Justice. Impacts to residential properties would be due to the change in the existing lakefront property turning into riverfront or floodplain bordered property
Resources Evaluated in Environmental Assessment										
Land Use			X		X			X		Implementing the Action Alternatives would not result in direct impacts to a majority of the land use associated with the Boardman River. Improvements to stream habitat and reconnection of the river to the Great Lakes, in addition to increased wetland habitat and riparian upland areas post-drawdown, would minimally alter the land use within the project area.
Water Resources			X		X			X		Surface water resources and water quality would be impacted by the removal of the Sabin and Boardman Dams and draining of the impoundments. The thermal effects of the impoundments would be eliminated and coldwater species such as brook trout, dace, and sturgeon would thrive. Warmwater fish habitat and associated recreational opportunities within the impoundments would be lost as a result of dam removal. These impacts would not be significant.
Natural and Biological Resources			X		X			X		Implementation of the alternatives would decrease water levels in the ponds; consequently, both wetland acreage and type would change within the former impoundments through an increase in wetland acreage and addition of emergent habitat. These changes would impact terrestrial wildlife and aquatic habitats within the project area. A change in vegetation as well as opportunities for invasive/nuisance species introduction is possible; however, measures would be taken to minimize the potential for invasive/nuisance species introduction and/or spread. These impacts would not be significant.
Cultural Resources			X		X			X		Construction and ground disturbance for the Action Alternatives have the potential to encounter extant structural elements of the three dam structures. However, these structures are not listed or eligible for listing in the National Register of Historic Places. Further, modifications to the existing dam elements could present a visual impact to extant historic properties, especially in the vicinity of the Union Street Dam, which is located within an older section of Traverse City.
Visual Resources			X		X			X		The Action Alternatives would have minimal effects on visual resources. The area of the impoundments would be changed to a river channel, but would still provide a natural landscape. The removal of the dam structures would impact the visual resources in the area; however, this impact would not be significant.

Table 17: Summary of Environmental Impacts and Minimization/Avoidance Measures for the Action Alternatives

Impact Category	1. No Action Alternative Degree of Impact			5. Modify Union Street Dam and Remove Boardman and Sabin Dam Alternative Degree of Impact			6. Remove Sabin Dam Alternative Degree of Impact			
	Significant	**Insignificant**	**No Impact**	**Significant**	**Insignificant**	**No Impact**	**Significant**	**Insignificant**	**No Impact**	**Summary of Impacts and Activities to Avoid or Minimize Impacts**
Traffic and Transportation			X		X			X		The Action Alternatives would be expected to have minimal effects on traffic and transportation outside of the construction period. The current Cass Road would be removed at the point where the new river channel intersects the road. Temporary vehicular barriers and signage would be placed when the road is cut. It is expected that the Grand Traverse County Road Commission would replace the Cass Road Bridge prior to or in conjunction with the dam removal project. Bridge and road work would not be part of the federal project and the federal project is not contingent on the local bridge project.
Utilities Infrastructure			X		X			X		The removal of the Boardman and Sabin Dams would require the movement of any utility infrastructure that exists at those structures; however, the removal and replacement of such utilities would be temporary and would not have significant impacts on the project area.
Hazardous Materials			X		X			X		Various industrial activities have been conducted along Boardman River and around the impoundments; these activities have the potential to impact subsurface conditions along the waterway and may have deposited chemical compounds in the sediment. Non-ASTM environmental concerns also at the dam structure include potential asbestos-containing materials, potential lead-based paint, and heavy metal-containing materials. With proper sediment management and placement, the Action Alternatives should have no significant effect on the project area. Any structural demolition would be done in accordance with requirements to prevent the release of non-ASTM contaminants.
Socioeconomic			X		X			X		The impacts on socioeconomic resources would be short term and temporary in the form of construction activities. The overall project would result in high-quality coldwater habitat allowing additional recreational fishing, boating on the river, and use of existing parkland.
Recreation			X		X			X		Recreational activities within the river system would increase and replace those recreational activities within the impoundments. The impacts on existing recreation would be minimal as lake recreation would be converted to river recreational opportunities.

6 Preliminary Finding of No Significant Impact (FONSI)

In accordance with the National Environmental Policy Act of 1969, U.S. Army Corps of Engineers (USACE), Detroit District, in coordination with the non-federal sponsor, Grand Traverse County, has assessed the environmental impacts of the restoration of the Boardman River coldwater habitat. Although a wide range of alternatives were considered, only three were carried forward to the final step of evaluation. The three alternatives evaluated were: Alternative One, the No action alternative, which would assume that all of the dams would remain as they currently exist; Alternative Five, Modify the Union Street Dam and Remove the Sabin and Boardman Dams which is the recommended alternative, and Alternative Six, Remove Sabin Dam which would remove Sabin Dam and Boardman Dam would remain in place. Other potential alternatives were eliminated because they were less efficient or effective.

The Proposed Action for this project involves the removal of the Boardman Dam and the Sabin Dam, and modification of the Union Street Dam. The action would restore the natural aquatic ecosystem as well as provide connectivity to Grand Traverse Bay of Lake Michigan. Restoration components of the Proposed Action would reconnect and restore habitat within the Boardman River system, a Great Lakes tributary, allowing unimpeded movement of woody debris and sediment through the river system, eliminating thermal disruption, and restoring the natural balance between coldwater and coolwater species. The project reach for the proposed action extends through the lower 8 miles of the Boardman which is severely impacted by the presence of three dams, within Grand Traverse County, Michigan.

An Environmental Assessment (EA) of the proposed action has been completed. The EA indicates that the proposed dam removal and modification would not result in significant adverse environmental effects nor would it be expected to result in any significant cumulative or long term adverse environmental effects. Adverse effects would be minor, including short-term noise and air emissions from equipment operation; temporary turbidity from construction operations; disruption of traffic patterns at Cass Road Bridge, disruption of riparian vegetation, and temporary displacement of fish and other wildlife. The loss of warmwater impoundment and river habitat would be moderated by the creation of a high-quality riverine environment and coldwater fishery, which is deemed more valuable because of its rarity within the region.

The project would be beneficial through the re-establishment of fish habitat by restoring the internal connectivity and coldwater characteristics of the Boardman River and would potentially increase the diversity of species moving between the Great Lakes and the river. The project would restore 8 miles of coldwater habitat and allow for sturgeon passage from Lake Michigan to the Boardman River via the trap-and-transfer operation. The removal of the dams would maximize available habitat for brook trout, dace, lake sturgeon, and other coldwater species. The conversion of lake habitat to stream habitat would result in gains in wetland habitat. Construction impacts to wetland habitat due to river channel and floodplain development are expected to be temporary as hydrophytic vegetation would return.

The proposed action would be consistent to the maximum extent practicable with the Coastal Zone Management Act and the Michigan Coastal Program. The project incorporates backwater

areas and natural vegetation to accommodate floodwaters; therefore no adverse impact on the floodplain is expected. The project would have no effect on Federally listed species known to be present in the project area. Additionally, the project would not represent an adverse effect to historic properties and would be in compliance with Section 106 of the National Historic Preservation Act (NHPA) and Michigan State Historic Preservation Office (SHPO) recommendations.

Pursuant to the Clean Water Act (CWA), a Section 404(b)(1) Evaluation of the environmental effects of the discharge of fill material into waters of the U.S. has been prepared. The Evaluation concludes that "the proposed action is in compliance with Section 404 of the Clean Water Act."

The EA and Section 404(b)(1) Evaluation, along with a review of comments received during public review of the EA, indicates that construction of the proposed dam removal project along the Boardman River for the lower 8 miles in Grand Traverse County, Michigan, does not constitute a major Federal action significantly affecting the quality of the human environment; therefore, an Environmental Impact Statement will not be prepared.

Date signed	Robert J. Ells Lieutenant Colonel, U.S. Army District Engineer

7 Preparers

Name	Affiliation	Degree & Certifications	Experience	Role in Preparation
Michael J. Donahue	URS Corporation	Ph.D. Urban, Technological and Env. Planning, MPP Public Policy, BS Resource Policy & Management	30+ years project management	Project Manager
Troy Naperala	URS Corporation	MS and BS in Civil and Environmental Engineering	13 years project management, water resources engineering, and natural resource assessments	Environmental Engineer
Sherry Slocum	URS Corporation	MS Environmental Management & Policy, BS Biological Sciences	10 years natural resource assessments	Environmental Resources
Scott Johnson	URS Corporation	MS Environmental Science, BS Biology, CHMM, LEED AP	10+ years environmental assessments	HTRW Specialist
Chris Bergman	URS Corporation	Ph.D. & BA Archaeology	20+ years cultural resources assessments	Cultural Resources Project Manager
Crista Haag	URS Corporation	MA & BA Anthropology	5+ years cultural resources assessments	Archaeologist
Jason Bibby	URS Corporation	AICP, MS Urban Planning, BS	10 years environmental assessment	Environmental Resources, GIS Support
Sara Wade	URS Corporation	J.D. & BA Political Science	3 years environmental assessments	Environmental Resources
Brendan Earl	URS Corporation	MS Biological Science, BS Biology	7 years natural resource assessment	Environmental Resources
Josh Zylstra	URS Corporation	BS Environmental Science	1 years natural resource assessment	Environmental Resources
Stephanie Kozlowicz	URS Corporation	MS Geography and Planning, BS Natural Resource Management	5 years natural resource assessment	Environmental Resources GIS mapping
Andery Richert	URS Corporation	MS Environmental Geosciences, BS Vertebrate Zoology	7+ years natural resource assessment	Phase I ESA, Environmental Resources
Paul Allerding	USACE	MS Natural Resources, BS Forestry	23 years environmental assessments	Document Review

8 Acronyms and Abbreviations

° F	degrees Fahrenheit
AAC	average annual cost
AAHU	average annual habitat unit
ACM	asbestos-containing material
AET	Apparent Effects Threshold
AMEC	AMEC Environment & Infrastructure, Inc.
ANS	aquatic nuisance species
BRDC	Boardman River Dams Committee
CAA	Clean Air Act
CAP	Continuing Authorities Program
CE	cost-effectiveness (analysis)
CFR	Code of Federal Regulations
dB	decibel
DCC	Direct Contact Criterion
DDT	dichlorodiphenyltrichloroethane
DNL	Day-Night Average Sound Level
DPR	Detailed Project Report
DWC	Drinking Water Criterion
DWPC	Drinking Water Protection Criteria
EA	Environmental Assessment
ECT	Environmental Consulting Technology, Inc.
EDR	Environmental Data Resources
EPA	Environmental Protection Agency
ESA	Endangered Species Act of 1973
ESL	Ecological Screening Level
FEMA	Federal Emergency Management Agency
FONSI	Finding of No Significant Impact
GIS	Geographic Information System
GLEC	Great Lakes Environmental Center, Inc.
GLFER	Great Lakes Fishery and Ecosystem Restoration
GSIC	Groundwater / Surface Water Criterion
HSI	Habitat Suitability Index
HTRW	Hazardous, Toxic, and Radiological Waste
ICA	incremental cost analysis
MBTA	Migratory Bird Treaty Act
MDEQ	Michigan Department of Environmental Quality
MDL	method detection limit
MDNR	Michigan Department of Natural Resources
MNFI	Michigan Natural Features Inventory
MiRAM	Michigan Rapid Assessment Method
NAAQS	National Ambient Air Quality Standards

NEPA	National Environmental Policy Act of 1969
NHPA	National Historic Preservation Act
NRHP	National Register of Historic Places
OW	open water wetland
PAH	polycyclic aromatic hydrocarbons
PCB	polychlorinated biphenyls
PEC	Probable Effect Concentration
PEM	palustrine emergent wetland
PFO	palustrine forested wetland
PNA	polynuclear aromatics
PSS	palustrine scrub-shrub wetland
SHPO	State Historic Preservation Office
SFHA	Special Flood Hazard Area
SHWS	State Hazardous Waste Site
SPLP	Synthetic Precipitation Leaching Procedure
SRHP	State Register of Historic Places
SVOC	semivolatile organic
TCAPS	Traverse City Area Public Schools
TEC	Threshold Effect Concentration
URS	URS Corporation
USACE	U.S. Army Corps of Engineers
U.S.C.	United States Code
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
UST	underground storage tank
VE	Value Engineering
VOC	volatile organic compounds

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ECT. 2009f. Boardman River Feasibility Study: Economic and Social Analysis of the Boardman River Dams. January 2009.

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APPENDIX A

CORRESPONDENCE WITH AGENCIES AND NATIVE AMERICAN ORGANIZATIONS

IN REPLY REFER TO:

United States Department of the Interior

FISH AND WILDLIFE SERVICE
East Lansing Field Office (ES)
2651 Coolidge Road, Suite 101
East Lansing, Michigan 48823-6316

August 2, 2012

Mr. Charles A. Uhlarik
Chief, Environmental Analysis Branch
Detroit District, Corps of Engineers
477 Michigan Avenue
Detroit, MI 48226-2550

Re: Boardman River Dam Removal Study, Grand Traverse County, Michigan

Dear Mr. Uhlarik:

This letter is in response to the July 9, 2012 request from the Planning Office of the U. S. Army Corps of Engineers (Corps) for the Boardman River Feasibility Study for dam removal, Grand Traverse County, Michigan. The Corps intends to write an Environmental Assessment (EA) looking into the options for the removal of three dams; the Union Street Dam, Sabin Dam, and Boardman Dam along the lower reach of the Boardman River. We appreciate the opportunity to make comments on the pre-EA for the Corps consideration.

There are four main issues we would like to see the USACE recognize or address:

- Currently, there are no federally listed species or known nesting bald eagles at the proposed sites of dam removal,
- We are in agreement with the three preliminary alternatives currently being explored: Alternative 1. No Action, Alternative 2, Modify Union Street Dam, and Alternative 5, Modify the Union Street Dam and Remove the Sabin and Boardman Dams,
- The Service is represented by Rick Westerhof (USFWS Fisheries Biologist) who is involved with the Implementation Team (IT). Rick should be informed of all decision regarding the pending dam removal,
- Implementation of post-dam removal preventive measures to limit the colonization of the river from invasive sea lamprey (*Petromyzon marinus*).

We appreciate the opportunity to cooperate with you in conserving endangered species. If you have any questions regarding these comments, please contact Jamie Bettaso of this office at 517-351-5293 or james_bettaso@fws.gov.

Sincerely,

Acting for

Scott Hicks
Field Supervisor

cc: Barry Peterman, MDNR, Wildlife Division, Lansing
Rick Westerhof, USFWS, Fisheries Branch, Alpena

Allerding, Paul H LRE

From: Antieau, Christopher (DEQ) [ANTIEAUC@michigan.gov]
Sent: Thursday, August 09, 2012 5:19 PM
To: Allerding, Paul H LRE
Subject: RE: Boardman River Dam Removal Study Update (UNCLASSIFIED)

Paul,

Here's the comments I received:
*
*

We have information that indicates that the sediments in the Brown Bridge Pond and Boardman Pond contain elevated arsenic. Sediments in the Sabin Pond contain elevated manganese and selenium. I suggest that a background study be conducted in the area to determine if these are naturally occurring levels. In addition leach test should be done on sediments from the Sabin Pond to assist in determining if these sediments require any special handling/disposal.

Duane Roskoskey
WMD, DEQ

*
*

I have no comments other than to express my support of this project going forward.

Regards,

Philip J. Schneeberger
Lake Superior Basin Coordinator
MDNR

*
*

The only issue I saw with the Brown Bridge project and will likely be a concern with Sabin Dam project is the placement of fill material on the bottomlands. The newly exposed bottomlands are likely to support development of wetlands, especially since the hydrology and wet habitats will be relocated down gradient of their current locations. Thanks-

Robyn L. Schmidt
Department of Environmental Quality
Water Resources Division
Cadillac District Office

*
*

Once the USACE completes their sediment sampling of Sabin and keystone Ponds, send me the results and I will have them reviewed and quickly as possible.

Thanks for the opportunity to review the project.

Michael Alexander, Chief

Lakes Erie, Huron and Superior Unit
Surface Water Assessment Section
Water Resources Division
Department of Environmental Quality

*
*

If you have any questions please contact me,

Chris Antieau
Great Lakes Shorelands Unit
Water Resources Division
Department of Environmental Quality
(517) 373 - 3894, antieauc@michigan.gov

-----Original Message-----
From: Allerding, Paul H LRE [mailto:Paul.H.Allerding@usace.army.mil]
Sent: Monday, July 09, 2012 3:23 PM
To: Antieau, Christopher (DEQ); Scott_Hicks@fws.gov; westlake.kenneth@epa.gov
Cc: Rick_Westerhof@fws.gov
Subject: FW: Boardman River Dam Removal Study Update (UNCLASSIFIED)

Classification: UNCLASSIFIED
Caveats: NONE

Please see attached advance copy of the notice that went out today.

Thanks, Paul

_____
Paul Allerding
Environmental Analysis Branch
U.S. Army Corps of Engineers, Detroit District 313-226-7590

Classification: UNCLASSIFIED
Caveats: NONE

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

SEP 04 2012

REPLY TO THE ATTENTION OF: E-19J

Paul Allerding
Environmental Analysis Branch
U.S. Army Corps of Engineers – Detroit District
477 Michigan Avenue
Detroit, Michigan 48226-2550

Re: Scoping Request for Boardman River Dam Removal Study, Grand Traverse County, Michigan

Dear Mr. Allerding:

The U.S. Environmental Protection Agency (USEPA) reviewed the scoping materials dated July 9, 2012, concerning the above-mentioned project. Our comments in this letter are provided in accordance with our responsibilities under the National Environmental Policy Act (NEPA), the Council on Environmental Quality's NEPA Implementing Regulations (40 CFR 1500-1508), and Section 309 of the Clean Air Act.

The U.S. Army Corps of Engineers (USACE) is updating its 2007 Boardman River Feasibility Study (Study) for dam removal. The 2007 Study included four dams – Union Street, Sabin, Boardman, and Brown Bridge. The current revision will include only three of the original four dams – Union Street, Sabin, and Boardman - with Brown Bridge dam removal currently being coordinated by the U.S. Fish and Wildlife Service (USFWS).

Dam removal is intended to remedy fragmentation of the Boardman River (River). Fragmentation has produced discontinuous River segments, blocking fish passage and degrading fisheries and aquatic invertebrate habitat by restricting the downstream transport of woody debris, vegetation, and sediment. The ultimate goal is the restoration of the lower eight miles of the River to cold water streams. Restoration and connectivity to Lake Michigan will enhance fish habitat existing in much of the River system. USACE will pursue dam removal under the constraints that any dam removal project does not induce flooding or result in the movement of exotic /nuisance species upstream from Lake Michigan.

Two action alternatives have been selected for further evaluation. Alternative 2, Modify Union Street Dam, proposes modifying or replacing the Union Street Dam fish ladder to allow downstream passage of lake sturgeon. Upstream passage would be accomplished by trapping and trucking desirable fish to a point upstream of Boardman Lake, while blocking invasive species. This alternative opens Boardman Lake and approximately 3 miles of stream to

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connectivity with Lake Michigan, but does not address river blockage at the Sabin and Boardman dams.

Alternative 5, Modify the Union Street Dam and Removal of the Sabin and Boardman Dams, proposes to modify the Union Street Dam fish ladder and remove the Sabin and Boardman dams to provide a free-flowing river with upstream reach connectivity. Removal of the Boardman Dam would include replacement of the Cass Road Bridge over the River. The River would be directed through its former channel locations at each dam and the engineered channels would be backfilled. Sediment management would occur via grade control structures, sediment traps upstream of the existing dam, and active sediment removal along exposed banks to provide an approximately-dimensioned floodplain.

Based on the information provided, USEPA offers the following comments:

Alternatives

- Scoping information indicates that two action alternatives were retained for further evaluation. We look to the revised Study to include criteria by which proposed action alternatives were evaluated, resulting in the elimination of Alternatives 3, 4, etc.
- USEPA would most support Alternative 5. Ideally, the Union Street dam would be removed and replaced with an in-stream sea lamprey barrier. USEPA has recently provided similar comments to USACE for the Harpersfield Dam rehabilitation in the Grand River, Harpersfield, Ohio. Additionally, USEPA is aware that other USACE districts have pursued installation of sea lamprey barriers in other high quality Great Lakes tributaries. Specifically, USACE Detroit District, in partnership with the Indiana Department of Natural Resources, the Great Lakes Fishery Commission (GLFC), and the USFWS, recently installed a sea lamprey barrier on Trail Creek, a salmonid tributary to Lake Michigan located in LaPorte County, Indiana. This steel sheet pile barrier was constructed with insertable stop logs and a lip to ensure sea lamprey could not attach to the barrier and ascend over it, and was designed with riprap jumping pools to allow jumping fish species to pass over the barrier and a fishway to catch sea lampreys. During periods when sea lamprey are not migrating, gates at each end of the fishway and the lamprey trap itself are open to allow free movement of fish past the barrier. USEPA strongly recommends that dam deconstruction and installation of a sea lamprey barrier be evaluated.
- Information provided for Alternative 2 indicates that modification of the Union Street Dam to a flow-over-rock-ramp-structure for fish passage was deemed impracticable because of "backwater effects associated with a separate sea lamprey barrier that would be needed if the Union Street Dam was not maintained in its current form." From the information provided, it is not clear why conversion is impractical. Is installation of a sea lamprey barrier possible in light of dam removal?

Contaminated Sediment

- The scoping information indicates contaminants are associated with some of the sediments at the impoundments. The Boardman-Charlevoix watershed has segments listed on the 2008 Clean Water Act Section 303(d) list for polychlorinated biphenyls (PCBs). We recommend the forthcoming environmental assessment (EA) disclose the estimated cubic yards of sediment behind each dam. The scoping information also states that further sampling and

evaluation is being conducted to determine appropriate actions for sediment handling relative to removing Sabin and Boardman Dams, and we assume this includes a Tier 1 analysis, at a minimum. We look to the revised Study to discuss the extent of sediment testing, disposal options, and coordination with Michigan Department of Environmental Quality, if necessary.

Construction Impacts

- USEPA recommends the forthcoming EA recommend specific measures and best management practices (BMPs) that will be undertaken to minimize construction impacts to air quality, water resources, soil, and other regulated resources. The EA should discuss proposed construction measures, including a discussion of staging areas and their locations, access to the worksite, and a discussion of any proposed in-stream construction. USEPA recommends that equipment not work from the active river, and that dewatering measures such as temporary portable dams or cofferdams be installed to isolate river flow from any active work areas.

Miscellaneous

- Information provided for Alternative 2 indicates that trap and transfer activities would be "overseen" by the Michigan Department of Natural Resources (MDNR). We look to the revised Study to discuss which entities will be involved and what their responsibilities will be. Because this activity will continue for the indefinite future, we look to the revised Study to also discuss how trap and transfer activities might be handled if budget constraints preclude MDNR from handling these activities.

Thank you for the opportunity to comment early in the process. Please send us a copy of the draft EA once it is available. If you have any questions, please contact staff members Kathy Kowal (312-353-5206 or via email at kowal.kathleen@epa.gov) or Liz Pelloso (312-886-7425 or via email at pelloso.elizabeth@epa.gov).

Sincerely,

Kenneth A. Westlake
Chief, NEPA Implementation Section
Office of Enforcement and Compliance Assurance

cc: MDEQ Water Resources Division
Jeff Slade, USFWS-Ludington Biological Station
Scott Hicks, USFWS-East Lansing Field Office

Allerding, Paul H LRE

Subject:

Importance: High

From: Jessica_Barber@fws.gov [mailto:Jessica_Barber@fws.gov]
Sent: Wednesday, October 03, 2012 2:19 PM
To: Platz, Carl A LRE
Subject: Allerding letter from EPA

Carl:

Please see attached letter. Will the Corps be drafting a letter back to Mr. Westlake? If so, there are a few things that should be noted in that response.

1) Please update the cc:line to my name (Jessica Barber, USFWS-Marquette Biological Station) instead of Jeff Slade.

2) Page 2 (second bullet) indicates that the Trail Creek fishway is open during times when sea lamprey are not migrating. This is not the case. The fishway is never open for free passage; it can be operated as a trap and transfer facility when needed.

3) Also on Page 2 (third bullet), there seems to be some confusion about the installation of a new sea lamprey barrier. If a new sea lamprey barrier was built, it would also be operated as a trap and transfer facility; free passage will not be supported.

Thanks for the opportunity to comment,
Jess

(See attached file: EPA letter to ACE - Boardman River 090412.pdf)

Classification: UNCLASSIFIED
Caveats: NONE

Michigan Land Use Institute **Northern Michigan Environmental Action Council**
Watershed Center ~ Grand Traverse Bay

July 19, 2012

Frank Dituri, Chair
Boardman River Dams
Implementation Team
400 Boardman Ave
Traverse City, MI 49684

Carl Platz, Project Manager
US Army Corps of Engineers
307 S. Harbor Drive
PO Box 629
Grand Haven, MI 49417-0629

Re: Cass Road Crossing and Boardman Dam Removal

Dear Mssrs. Dituri and Platz

This is to express the comments of the signatory organizations below regarding the replacement of the Cass Road crossing of the Boardman River as your organizations plan and implement the removal of the Boardman Pond dam. These comments relate to both the location of the replacement crossing as well as the design. Please include this letter as part of the public comment for the environmental review process related to the Boardman Dam project.

Bridge Location

For both ecological and financial reasons, we believe the Cass Road crossing should be replaced within the existing Cass Road corridor. Utilizing the existing corridor will minimize disturbance of natural features and habitat. Utilizing the existing road infrastructure, as much as possible, will also make most efficient use of scarce transportation funding. It is also our understanding that in order to maximize federal support for the new crossing, through funding from the Corps of Engineers, that the crossing needs to be replaced within the existing corridor.

We understand the crossing may be moved a few hundred feet west of the current powerhouse structure where it is anticipated the restored river channel will be located. This supports the overall river restoration goal of the dam removal project. We also understand that the crossing may need to be placed slightly to the north or south of the existing roadway in order to facilitate continued vehicular use of Cass Road while dam removal and river restoration activities take place.

Locating the replacement crossing within the existing corridor is also consistent with the Grand Vision, which includes a transportation guiding principle to "maintain and improve the existing road system." The Grand Vision, which received input from more than 12,000 people in our six-county region, is a community vision for the future of transportation, land use, economic development and environmental stewardship in our region.

The importance of Cass Road was also highlighted in Grand Vision technical studies. As part of the Grand Vision's transportation analysis, the consulting firm Mead & Hunt prepared a Functional Classification Map Update for TC-TALUS (Task 4.1, August 2010). This Functional Classification Map Update classifies Cass Road, in the area of the river crossing, as a "Rural Major or Urban Collector" and, north of the river crossing, as a "Rural or Urban Minor Arterial."

As part of the Grand Vision, Mead & Hunt also prepared a Transportation Gap Analysis and Refined Corridor/Intersection Analysis Report (Tasks 3.6 and 4.2, October 2010) for TC-TALUS. This gap analysis states:

> ...it is important to maintain a connection at Cass Road and Keystone Road, along with a crossing of the Boardman River. The existing river crossing is at a dam location and is a one-lane, one-way traffic signal controlled crossing. Because the other existing and anticipated Boardman River crossings are at Beitner Road to the south and Airport Road to the north, this crossing is a critical link in the regional transportation network and should be maintained. The benefits of maintaining this crossing include providing emergency access in the event one of the other structures is closed, providing an alternate route for local traffic to cross the river, and providing non-motorized connectivity. This gap analysis assumes that this crossing will be funded and conducted as part of the ongoing Boardman River Dam Removal project. (pp 42-43) (*Note: While the above quote refers to the current crossing as "one-lane" it should be understood that while it is functionally a one-lane crossing at this time, the structure itself is two lanes but has been restricted in recent years to a signaled one-lane configuration due to structural safety issues on the crossing.*)

Bridge Design

It is our understanding that the Corps and the Implementation Team are considering, at least at this early stage in the process, a possible bridge replacement option that would consist of a 100-foot pier span of the river, with possible additional spans on either side of the bridge piers. It is our understanding that this length would effectively span the floodplain in the area of Cass Road and the future restored river channel, providing important hydrologic and ecosystem benefits. We view this option as a good starting point for discussion. We understand that this option will likely accommodate, in addition to unencumbered passage of existing fish populations, a trail and some measure of wildlife passage.

This option would be the largest span on the Boardman River, while at the same time helping to accomplish the important river restoration and aquatic habitat connectivity goals of the dam removal project. Most importantly, this option would eliminate the absolute barrier to fish passage and other negative habitat impacts posed by the dam while serving as a model for future bridge replacements elsewhere on the Boardman River.

We would prefer to see the span be as large as possible, or an exploration of a possible second span to facilitate wildlife passage. We also understand that the ultimate decision will be based on a cost/benefit analysis related to the habitat restoration goals of the dam removal project, as well as available funding. We encourage all the parties involved, including the Grand

Traverse Road Commission and MDOT, to explore transportation funding avenues such as Transportation Enhancement funding, to maximize both wildlife and human connectivity opportunities with the bridge design.

The Grand Vision also includes a transportation guiding principle to "Expand transportation infrastructure serving pedestrians and bicyclists." We strongly encourage the Implementation Team and the Corps to include non-motorized connectivity features on Cass Road, including the new bridge structure, as emphasized in the gap analysis referenced above. We also encourage you to consider context sensitive design standards in order to ensure the bridge aesthetically fits into its surrounding environment.

* * *

Thank you for considering these comments. We look forward to working with the Implementation Team and the Corps as you move forward with this important project. If you have any questions regarding these comments, please direct them to Andy Knott at the Watershed Center at aknott@gtbay.org or 231.935.1514.

Sincerely,

Hans Voss, Executive Director
Michigan Land Use Institute
148 E. Front St., Suite 301
Traverse City, MI 49684

Greg Reisig, President
Northern Michigan Environmental
Action Council
PO Box 1166
Traverse City, MI 49685

Andy Knott, Executive Director
Watershed Center Grand Traverse Bay
13272 S. W. Bay Shore Drive
Traverse City, MI, 49684

c: Grand Traverse County Road Commission
Grand Traverse County Commission
Traverse City Commission
Rise Raisch, MDOT

GRAND TRAVERSE COUNTY PARKS & RECREATION
we create community...

1213 w. civic center dr.
traverse city, mi 49686
phone: 231-922-4818
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email and website:
jjones@grandtraverse.org
mzielins@grandtraverse.org
www.grandtraverse.org/parks

July 26, 2012

Carl Platz, Project Manager
US Army Corps of Engineers
307 S. Harbor Drive
PO Box 629
Grand Haven, MI 49417-0629

Re: Cass Road Crossing of the Boardman River

Dear Mr. Platz,

The mission of the Natural Education Reserve (NER), which was created in July of 1976, is to "provide safe, enjoyable, quiet recreational experiences and environmental education opportunities while protecting the resource for visitors to the Reserve."

It is to that end that The NER Advisory Committee is advocating that all agencies involved in the replacement of the Cass Road Bridge support significant provisions for accommodating the wildlife that seek safe passage along this vital north/south river corridor as well as accommodating safe, non-motorized human access to enable the education mission of the NER to be realized. In addition, we believe that meeting the health, recreational, aesthetic, and "spiritual" needs of the general citizenry and visitors alike should be an important component of any plan.

Given that habitats significant to environmental education and appreciation are located on both sides of the river, it is essential that bridge design and construction accommodate wildlife and human passage (trails) on both the east (NER trails) and west (NER & TART trails) sides of the river. The NER Plans contemplate a loop of nature education trails providing access to the varied habitats extending on both sides of the river.

On page 7, in the Executive summary of the 2002 Grand Traverse County "Comprehensive Plan" it states:

"Grand Traverse County will continue to grow in harmony with the natural environment, protecting the area's unique resources while assuring that the economic, cultural, and recreational advantages of life are within reach of all of its citizens."

recycled paper

Moreover, on page 4 of The Executive Summary of the "Grand Vision", as a guide for future actions it states the need to:

"Maintain and improve the existing road system and place increased investment in public transportation, bicycling, and pedestrian infrastructure to maximize system efficiencies, provide choices in mobility, and support energy conservation."

And further to:

"Protect and preserve the water resources, forests, natural areas and scenic beauty of the region."

The Boardman River Valley provides extremely significant "Green Infrastructure" that demands our support. The proper and deliberate design and construction of this Cass Road Bridge replacement will serve to enhance that Green Infrastructure, fulfill the ethos of the Grand Vision and the Grand Traverse County Master Plan, increase the economic viability and attractiveness of our county and region and, in so doing, actualize our "placemaking" aspirations.

To this end it is hoped that possibly the realignment that fostered a closer relationship between HUD, the EPA, and FHA might provide the framework from which additional funding might be obtained to supplement the present Army Corps of Engineers partial funding for a more robust and inclusive transportation, "placemaking," and ecologically significant Cass Road Bridge replacement project.

Respectfully submitted,

W. Peter Doren, President
Grand Traverse County Parks and
Recreation Commission

Evan Smith, Chaiperson
Natural Education Reserve
Advisory Committee

JENNIFER GRANHOLM
GOVERNOR

STATE OF MICHIGAN
DEPARTMENT OF HISTORY, ARTS AND LIBRARIES
LANSING

DR. WILLIAM ANDERSON
DIRECTOR

July 8, 2008

RICK WESTERHOF
U S FISH AND WILDLIFE SERVICE
GREEN BAY NATIONAL FISH AND
WILDLIFE CONSERVATION OFFICE
6644 TURNER ROAD
ELMIRA MI 49730

RE: ER05-457 Boardman and Sabin Dams Alternative Options, Grand Traverse County (FWS)

Dear Mr. Westerhof:

Under the authority of Section 106 of the National Historic Preservation Act of 1966, as amended, we have reviewed the above-cited undertakings at the locations noted above. We have previously reviewed the historical significance of the Boardman and Sabin Dams and have concluded that neither appears to meet the criteria for listing in the National Register of Historic Places. We have not reviewed the possible eligibility for the national register of any properties that front on the ponds created by these dams. If the dams are removed, the ponds will disappear.

We request information on whether properties fronting on the ponds contain any cottages or other buildings or other features such as park developments that are or may be more than fifty years old. Such properties could include potentially national register-eligible historic resources. We request photographs and historical information on any properties that are fifty years of age or older, whose land fronts on the ponds.

In addition, in previous correspondence from our office dated July 13, 2005, October 13, 2005 and August 22, 2007 (enclosed), the State Archaeologist, Dr. John Halsey, noted that archaeological resources may be affected at the project sites. He requested that archaeological survey should be conducted for the emergent (former) shorelines after the draw-down has been completed, prior to the actual removal of the dams. Therefore, we reiterate our survey request.

Please note that the Section 106 review process cannot proceed until we are able to consider the information requested above. This letter does not clear the project. If you have any questions, please contact Brian Grennell, Environmental Review Specialist, at (517) 335-2721 or by email at ER@michigan.gov. **Please reference our project number in all communication with this office regarding this undertaking.** Thank you for this opportunity to review and comment, and for your cooperation.

Sincerely,

Martha MacFarlane Faes
Environmental Review Coordinator

for Brian D. Conway
State Historic Preservation Officer

MMF:JRH:ROC:bgg

Enclosure(s)

Copy: Sandra Sroonian, Boardman River Dams Committee
Karen Krepps, COE

COPY

STATE OF MICHIGAN
DEPARTMENT OF HISTORY, ARTS AND LIBRARIES
LANSING

JENNIFER GRANHOLM
GOVERNOR

DR. WILLIAM ANDERSON
DIRECTOR

August 22, 2007

LES WEIGUM
DETROIT DISTRICT CORPS OF ENGINEERS
PO BOX 1027
DETROIT MI 48231-1027

RE: ER05-457 Boardman River Dam Removals, Grand Traverse County (FERC)

Dear Mr. Weigum:

We have received the information you submitted regarding the initiation of a feasibility phase study for the above-cited undertaking at the location noted above. As mentioned in your letter, we originally commented on this undertaking in our letters dated July 13, 2005 and October 13, 2005 (enclosed). At that time, we determined that that for this project there will be no historic properties affected in regard to above-ground resources, however, the State Archaeologist, Dr. John Halsey, noted that archaeological resources may be affected at the project sites. He requested that archaeological survey should be conducted for the emergent (former) shorelines after the draw-down has been completed, prior to the actual removal of the dams. Therefore, we reiterate our survey request. We have no additional concerns at this time, and we look forward to continued consultation.

If you have any questions, please contact Brian Grennell, Environmental Review Specialist, at (517) 335-2721 or by email at ER@michigan.gov. **Please reference our project number in all communication with this office regarding this undertaking.** Thank you for this opportunity to review and comment, and for your cooperation.

Sincerely,

Brian D. Conway
State Historic Preservation Officer

BDC:JRH:ROC:bgg

Enclosure(s)

Copy: Karen Krepps, COE

STATE HISTORIC PRESERVATION OFFICE, MICHIGAN HISTORICAL CENTER
702 WEST KALAMAZOO STREET • P.O. BOX 30740 • LANSING, MICHIGAN 48909-8240
(517) 373-1630
www.michigan.gov/hal

STATE OF MICHIGAN
JENNIFER GRANHOLM
GOVERNOR
DEPARTMENT OF HISTORY, ARTS AND LIBRARIES
LANSING
DR. WILLIAM ANDERSON
DIRECTOR

FILE COPY

July 13, 2005

KYLE KRUGER
MDNR FISHERIES DIVISION
MIO FIELD OFFICE
191 S. MT TOM ROAD
MIO MI 48647

RE: ER05-457 Boardman River Dam Removals, Grand Traverse County (FERC)

Dear Mr. Kruger:

We have received your request for review of the above-cited undertaking at the location noted above. The information that you have sent has prompted us to ask for additional details. Please send the following information so that we may complete our review:

- The information provided on the Brown Bridge, Boardman, Sabin, and Union Street dams and hydroelectric plants is insufficient for us to complete a review of their potential eligibility for the National Register of Historic Places. We request a complete copy of *A History of Traverse City Light and Power,* only a portion of which was provided with your April 8 letter, plus copies of any available site plans and elevation drawings for each entire dam and hydroelectric plant.

In addition, the State Archaeologist, Dr. John Halsey, notes that archaeological resources may be affected at the project sites; therefore, an archaeological survey should be conducted for the emergent (former) shorelines after the draw-down has been completed. Enclosed, for your convenience, is a list of archaeologists who have been found to meet or exceed the professional requirements for archaeologists.

Please note that the Section 106 review process cannot proceed until we are able to consider the information requested above. This letter does not clear the project. If you have any questions, please contact Brian Grennell, Environmental Review Specialist, at (517) 335-2721 or Dr. John Halsey, State Archaeologist at (517) 373-6358. **Please reference our project number in all communication with this office regarding this undertaking.** Thank you for your cooperation.

Sincerely,

B Conway

Brian D. Conway
State Historic Preservation Officer

BDC:JRH:ROC:bgg

Enclosure(s)

Copy: Magalie Salas, FERC

FILE COPY

JENNIFER GRANHOLM
GOVERNOR

STATE OF MICHIGAN
DEPARTMENT OF HISTORY, ARTS AND LIBRARIES
LANSING

DR. WILLIAM ANDERSON
DIRECTOR

October 13, 2005

MAGALIE SALAS
FEDERAL ENERGY REGULATORY COMMISSION
888 FIRST STREET NE
MAIL CODE PJ12.1
WASHINGTON DC 20426

RE: ER05-457 Boardman River Dam Removals, Grand Traverse County (FERC)

Dear Ms. Salas:

Under the authority of Section 106 of the National Historic Preservation Act of 1966, as amended, we have reviewed the above-cited undertaking at the location noted above. Based on the information provided for our review, it is the opinion of the State Historic Preservation Officer (SHPO) that **no historic properties are affected** within the area of potential effects of this undertaking.

Please note that, as indicated in our letter dated July 13, 2005 (enclosed), archaeological resources may be any affected at the project sites. If and when removal of the dams is necessary, an archaeological survey must be conducted for the emergent (former) shorelines after the draw-down has been completed and submitted to our office for review and comment. Therefore, consultation with our office will be required prior to the removals.

The views of the public are essential to informed decision making in the Section 106 process. Federal Agency Officials or their delegated authorities must plan to involve the public in a manner that reflects the nature and complexity of the undertaking, its effects on historic properties and other provisions per 36 CFR § 800.2(d). We remind you that Federal Agency Officials or their delegated authorities are required to consult with the appropriate Indian tribe and/or Tribal Historic Preservation Officer (THPO) when the undertaking may occur on or affect any historic properties on tribal lands. **In all cases**, whether the project occurs on tribal lands or not, Federal Agency Officials or their delegated authorities are also required to make a reasonable and good faith effort to identify any Indian tribes or Native Hawaiian organizations that might attach religious and cultural significance to historic properties in the area of potential effects and invite them to be consulting parties per 36 CFR § 800.2(c-f).

This letter evidences the Federal Energy Regulatory Commission's compliance with 36 CFR § 800.4 "Identification of historic properties", and the fulfillment of the Federal Energy Regulatory Commission's responsibility to notify the SHPO, as a consulting party in the Section 106 process, under 36 CFR § 800.4(d)(1) "No historic properties affected".

The State Historic Preservation Office is not the office of record for this undertaking. You are therefore asked to maintain a copy of this letter with your environmental review record for this undertaking. If the scope of work changes in any way, or if artifacts or bones are discovered, please notify this office immediately.

If you have any questions, please contact Brian Grennell, Environmental Review Specialist, at (517) 335-2721 or by email at ER@michigan.gov. **Please reference our project number in all**

communication with this office regarding this undertaking. Thank you for this opportunity to review and comment, and for your cooperation.

Sincerely,

Brian D. Conway
State Historic Preservation Officer

BDC:ROC:bgg

Copy: Joe Kaltenbach, Traverse City Light & Power
Kyle Kruger, MDNR

Little Traverse Bay Bands of Odawa Indians
Cultural Preservation/NAGPRA Department
7500 Odawa Circle
Harbor Springs, Michigan 49740
Ph. (231) 242-1451 fax (231) 242-1455
jmitchell@ltbbodawa-nsn.gov

Department of the Army
Detroit District, Corps of Engineers,
477 Michigan Avenue
Detroit, Michigan 48226-2550
ATTN: Dr. Karen Krepps, District Archaeologist and Tribal Liaison.

13 August 2007

Ms. Krepps,

In response to the notification dated 09 July 2007, concerning the feasibility phase study re: possible modification or removal of some or all four dams on the Boardman River in Traverse City, Grand Traverse County, Michigan.

At this time, the Cultural Preservation/NAGPRA Department of the Little Traverse Bay Bands of Odawa Indians in Michigan has determined the above listed as:

____ No interest in the area geographically.

____ No comment on the proposed undertaking.

✓ No objections. However, if human skeletal remains and/or any objects falling under NAGPRA are uncovered during excavation/construction, please stop immediately and notify our NAGPRA Representative, Ms. Winnay J. Wemigwase, at our above address.

____ Have an objection or require additional project information. Please send the following:

_____.

Respectfully,

Leonard J. Mitchell

Leonard J. Mitchell
Cultural Preservation Coordinator/NAGPRA Tech.
Little Traverse Bay Bands of Odawa Indians

US Army Corps
of Engineers
Detroit District

FEASIBILITY STUDY FOR THE BOARDMAN RIVER

GRAND TRAVERSE COUNTY, MICHIGAN

CLEAN WATER ACT 404(b)(1) EVALUATION

GREAT LAKES FISHERIES AND ECOSYSTEM RESTORATION PROGRAM

US Army Corps of Engineers, Detroit District
477 Michigan Avenue
Detroit, MI 48226-2523

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1.0 Project Description

1.1 Introduction and Purpose of Project

This project falls under the Section 506 authority (Great Lakes Fishery and Ecosystem Restoration or GLFER) of the Water Resources Development Act of 2000. A Preliminary Restoration Plan was prepared under that authority in fiscal years 2005 and 2006, resulting in a determination that sufficient Federal interest exists to recommend that the study continue into the Feasibility Phase. A Detailed Project Report (DPR) and Environmental Assessment (EA) were developed concurrently with this Clean Water Act Section 404(b)(1) Evaluation to address the proposal. The Section 404(b)(1) Evaluation is an attachment to the EA. The DPR and its appendices (some of which are referenced in this 404(b)(1) Evaluation), are available upon request from the USACE and on the USACE, Detroit District website. Appendices to the DPR include the following: Appendix A, Engineering Appendix; Appendix B, Economic Analysis; Appendix C, Real Estate Plan; Appendix D, Cost Appendix; and Appendix E, Habitat Analysis.

1.1.1 Project Description

The Proposed Action is to implement a U.S. Army Corps of Engineers (USACE) aquatic ecosystem restoration project along the Boardman River in Grand Traverse County, Michigan. Components of the Proposed Action would include the removal of Sabin Dam and Boardman Dam, modification of Union Street Dam, and the restoration of coldwater stream segments for the lower 8 miles of the Boardman River. The purpose of the Proposed Action is to improve in stream fishery habitat by replacing warmwater impoundments with coldwater stream habitat. Additionally wetland and upland habitat within the riparian river corridor would be enhanced while improving the water quality of the Boardman River.

The Proposed Action is needed to improve the coldwater aquatic ecosystem of the Boardman River that has been severely degraded through elevated water temperatures caused by the existing impoundments and to improve fish passage within the river with the possibility of opening river habitat to spawning Great Lakes sturgeon (*Acipenser fulvescens*). The removal of the Sabin and Boardman Dams would reduce thermal impacts to a coldwater fishery, eliminate a barrier to fish movement, and restore sediment transport. Modification of the Union Street Dam could provide access to the Boardman River system to spawning Great Lakes sturgeon.

The Boardman River is located in the northwestern portion of Michigan's Lower Peninsula and originates in central Kalkaska County, flowing southwest into Grand Traverse County where it turns north and flows into West Grand Traverse Bay, Lake Michigan in Traverse City, MI. The Boardman River Watershed drains a surface area of approximately 291 square miles and includes 179 lineal stream miles and 12 natural lakes. The Boardman River is designated a Natural River and is considered one of the top 10 best trout streams in Michigan. Upstream of the project area, the Boardman River includes nearly 36 lineal miles of Blue Ribbon Trout

Stream with high densities of brown trout (*Salmo trutta*) and brook trout (*Salvelinus fontinalis*).[1] The project area includes the lower 8 miles of the Boardman River's main stem, from the mouth of the river at Grand Traverse Bay upstream to the inlet of Boardman Pond (Keystone Pond), located in Grand Traverse County. This is the area that would be directly impacted by any action at the dams. The project area contains three dams (Union Street Dam, Sabin Dam, and Boardman Dam) and two impoundments (Sabin Pond and Boardman Pond). The impounded water behind Union Street Dam is represented by an increase in the elevation and surface area of Boardman Lake.

The three dam locations included in the project were originally constructed between 1867 and 1906, and have been modified in the modern era. These include:

1. **The Union Street Dam** is located at river mile 1.1 within the limits of Traverse City. It was originally constructed in 1867 as a power source for a 19th-century flour mill. The earthen embankment of the dam measures approximately 250 feet in length and contains two concrete spillways and a 6-foot-wide concrete fish ladder. Improvements to the dam were made in 1955 and 1965. The dam's impoundment, Boardman Lake, is a natural lake that was originally 259 acres and increased to 339 acres after the Union Street Dam was constructed. However, the project area only includes the dam and associated fish ladder, not Boardman Lake.
2. **The Sabin Dam** was originally constructed in 1906 by the Boardman Light & Power Company. This earthen dam measures approximately 200 feet in length. It was rebuilt in 1930 and purchased by Grand Traverse County in 1969. In 1986, a turbine generator was installed, but the dam was eventually decommissioned as a power-generation facility in 2006.
3. **The Boardman Dam** was constructed in 1894, rebuilt in 1930, and purchased by Grand Traverse County in 1969. A turbine generator was installed in 1986 and the power-generating capacity of the dam was terminated in 2007. The Cass Road Bridge traverses the top of the dam structure.

In the unaltered upper reaches of the Boardman River, mean summer water temperatures are approximately 58.5 degrees Fahrenheit (° F) with maximum temperatures from June to August remaining below 70° F, making it ideal for coldwater fish (ECT 2009a). However, river conditions change downstream because of the now inactive hydroelectric dams and their impoundments. The Boardman Dam is located at river mile 6.1 and creates Boardman Pond, a 78-acre impoundment. Approximately 0.8 miles downstream is the Sabin Dam whose impoundment is about 40 acres. Because of the warming effects of these two impoundments, water temperatures become suboptimal for coldwater fishes (>70° F). Recorded maximum water temperatures were between 75 and 77° F during July and August, which is potentially lethal to

[1] This is a designation made by the State government or other authority identifying a recreational fishery of very high quality, considering criteria such as water quality and quantity, accessibility, spawning capacity, angling pressure, and specific species.

coldwater fishes (ECT 2009a). The consequence of the warmer temperature is lower densities of trout. Brown trout are still relatively common downstream to the Boardman Dam impoundment, though at approximately half the density as upstream. Below the Sabin Dam, water temperatures become suboptimal for coldwater fishes, and brook trout are absent while brown trout are only found in very low densities (ECT 2009a).

Additionally, the presence of the dams segments the river into discontinuous reaches. Such segmentation has a particularly adverse impact on resident brook and brown trout by increasing their vulnerability to adverse environmental conditions (e.g., pollution, habitat degradation, wetland filling) while decreasing their genetic diversity. Fragmentation also limits access to areas with suitable spawning habitat, optimal food availability, and protection from predators. Related to and exacerbated by fragmentation, habitat degradation has multiple dimensions with adverse impacts on aquatic species mix, diversity, and populations. The presence of the dams limits downstream transport of woody debris, sediment, and vegetation critical to sustaining healthy populations of trout and other desirable fish and invertebrate species. Woody debris provides food, refuge, cover, and channel diversity to fish and invertebrate species, as well as protection from excessive riverbank erosion. Riparian vegetation provides similar benefits while also stabilizing banks and filtering pollutants and excess nutrients from the river. The presence of the dams decreases the diversity of such vegetation, given that they limit the downstream dispersal of reproductive material. Sediment transport is also compromised by the presence of the dams, “starving” downstream areas by reducing sediment loads and increasing bank and riverbed erosion in those downstream reaches. Dam impoundments trap and immobilize sediment as a result of decreased flow velocities and in so doing compromise spawning areas for invertebrates and fish species. Sediment deposition in the impoundments also widens the river in areas upstream of the dams, decreasing depth, raising temperatures and, in general, compromising the quality of the habitat.

1.1.2 Regulatory Authority

This Section 404(b) (1) analysis has been completed for the USACE’s Boardman River Ecosystem Restoration Project. The 404(b) (1) analysis addresses 40 CFR Part 230 Subparts B-H of the Clean Water Act (CWA). Subparts B through H include the following components:

Subpart B - Compliance with the Guidelines
Subpart C - Potential Impacts on the Physical and Chemical Characteristics of the Aquatic Ecosystem
Subpart D - Potential Impacts on Biological Characteristics of the Aquatic Ecosystem
Subpart E - Potential Impacts on Special Aquatic Sites
Subpart F - Potential Impacts on Human Use Characteristics
Subpart G -Evaluation and Testing
Subpart H - Summary of Impacts and Proposed Mitigation Measures

This document fulfills the requirements of Section 404(b)(1) of the CWA whose purpose is to identify and evaluate practicable alternatives as defined in Title 33 of the Code of Federal Regulations (CFR) Section 230.3 that minimize the impacts to waters of the U.S. The overall

objective of the CWA is to restore and maintain the chemical, physical, and biological integrity of the Nation's waters (Sec 101(a)). For the Boardman River, this objective is achieved through the overall project goal of eliminating the dam restrictions to allow for a naturally flowing river. The Section 404(b) (1) guidelines are the substantive criteria with which discharges must comply before a Section 404 permit may be issued by the USACE.[2] These guidelines have been developed by the U.S. Environmental Protection Agency (EPA) in coordination with the USACE.

The fundamental precept of the guidelines is that discharges of dredged or fill material into waters of the United States, including wetlands, should not occur unless it can be demonstrated that such discharges, either individually or cumulatively, would not result in unacceptable adverse effects on the aquatic ecosystem. Discharge of dredged or fill material from the proposed project must comply with restrictions set forth in the guidelines. These restrictions include the following:

1. No discharge of dredged or fill material shall be permitted if there is a practicable alternative to the proposed discharge that would have a less adverse impact on the aquatic ecosystem, so long as the alternative does not have other significant adverse environmental consequences.
2. Discharge is not permitted if it causes or contributes to violation of applicable state water quality standards; violates toxic effluent standards; jeopardizes the continued existence of species listed under the Endangered Species Act of 1973; adversely affects designated critical habitat; or adversely affects any designated marine sanctuary under the Marine Protection, Research, and Sanctuaries Act of 1972.
3. Discharge is not permitted that would cause or contribute to significant degradation of the waters of the United States, including significant adverse effects on aquatic organisms and ecosystems.
4. No discharge of dredged or fill material shall be permitted unless appropriate and practicable steps have been taken that would minimize potential adverse impacts of the discharge on the aquatic ecosystem.

These restrictions provide the general basis for the subsequent sections of the Section 404(b) (1) analysis.

[2] Under its civil works program the 404(b)(1) evaluation is the Section 404 compliance as the USACE does not issue Section 404 permits to itself.

1.2 Subpart B: Compliance with the Guidelines (i.e., Alternatives Analysis)

Subpart B deals with the aspect of the regulations commonly referred to as the Alternatives Analysis. In this analysis, it must be demonstrated that there are no practicable alternatives which would result in less adverse impacts on the aquatic ecosystem as long as the alternative does not have other significant environmental consequences.

Alternative 5 (Recommended Alternative) would restore the aquatic ecosystem of the Boardman River from Boardman Pond to Grand Traverse Bay. Alternative 5 would improve habitat by restoring the coldwater temperature regime; allow sediment, organic material and woody debris to move downstream; remove barriers to fish passage for brook trout, longnose dace (*Rhinichthys cataractae*), and other coldwater species within the Boardman River; and provide sturgeon additional habitat by providing passage by the Union Street Dam via manual transfer upstream and passage downstream via the auxiliary spillway, which is to be modified to pass adult sturgeon downstream . The auxiliary spillway is located on the left (south) bank adjacent to the fish ladder.

1.2.1 Summary of Alternatives Considered

Alternatives were developed based on the goal of implementing an aquatic ecosystem restoration project along the Boardman River. Additionally, alternatives were developed based on the goal of maximizing habitat benefits using the least cost solution and account for the Union Street Dam existence which would continue to raise the water level of Boardman Lake by approximately 9 feet. Furthermore, the alternatives were generated assuming that the drawdown at Boardman Dam is permanent and that the nearby Brown Bridge Dam was already removed. Preliminary restoration alternatives were developed for eighteen potential combinations of measures using habitat and cost data. From those eighteen, eight alternatives were further evaluated for cost effectiveness using USACE's Institute for Water Resources (IWR) Planning Suite. Several alternatives were considered but eliminated because of expected high costs, constructability issues, and potential negative habitat impacts. The following combinations of measures were found to be suitable for detailed evaluation.

1.2.2 Alternative 1: No Action Alternative

Under the No Action alternative, no action would be taken and the measures proposed in the Engineering Appendix for this study would not be implemented. This option consists of retaining all of the dams as they currently exist. Water levels and impoundment size would not be changed and the dams would continue to degrade the aquatic habitat of the Boardman River via thermal effects and the reduction of sediment and woody debris transport. The dams would not be modified to provide increased fish passage, and Great Lakes migratory fish passage would be blocked at the weir and the Union Street Dam. The fish ladder at Union Street would be maintained, along with the fish weir operated by the Michigan Department of Natural Resources (MDNR). As such, the No Action Alternative does not fulfill the project's purpose and need.

1.2.3 Alternative 5: Modify Union Street Dam and Remove Sabin and Boardman Dams

This option consists of modifying the Union Street Dam by altering the auxiliary spillway to provide downstream passage for lake sturgeon, while maintaining current Boardman Lake levels. Removal of the dam was not considered because the dam acts as a barrier to the invasive sea lamprey (*Petromyzon marinus*). Upstream passage of lake sturgeon would be achieved by a trap-and-transfer operation overseen by the MDNR. Other than lake sturgeon, the MDNR would dictate what additional Great Lakes species may or may not pass upstream of the unaffected fish weir. Alternative 5 would provide spawning and foraging habitat in Boardman Lake and the entire Boardman River for lake sturgeon that were manually transferred past the weir/dam. Supplying manual upstream passage for sturgeon to use additional spawning habitat in the Boardman River could allow for increased natural reproduction. It would provide an opportunity to create a lake sturgeon fishery within the Boardman River and benefit restoration efforts of this protected species within the Great Lakes.

Additionally, this alternative includes removing both the Sabin and Boardman Dams to eliminate the problems currently associated with these dams and their impoundments and return the river to its natural, free-flowing state. Alternative 5 would eliminate the thermal impacts of the dam; eliminate fragmentation of the coldwater habitat; allow for natural movement of suspended sediment, sediment bedload, and organic material; and allow for fish passage. This measure has the potential to meet all of the project objectives.

1.2.4 Alternative 6: Remove Sabin Dam

This alternative includes removing Sabin Dam and would eliminate the problems currently associated with Sabin Dam and its impoundment. The river would be returned to its natural, free-flowing state for approximately one mile. Dam removal would also decrease fragmentation of the coldwater habitat, increase fish passage, and allow for the limited movement of suspended sediment, sediment bedload, and organic material.

However, the Boardman Dam would be retained with the pond level remaining lowered to meet the Dam Safety Act requirements of the Michigan Department of Environmental Quality (MDEQ). With the Boardman Dam still in place, the restored river segment and downstream areas would continue to be affected by the warming effects of the Boardman Pond and the river would continue to experience a blockage of fish passage and loss of stream functions ,such as, the natural movement of woody debris. These issues may limit the restoration success of Alternative 6. Additionally, Union Street Dam would not be modified to allow passage of lake sturgeon and trap-and-transfer activities would not occur. Consequently, Alternative 6 would meet some, but not all project objectives.

2.0 Factual Determinations

2.1 Subpart C: Potential Impacts on Physical and Chemical Characteristics of the Aquatic Ecosystem

The Boardman River Environmental Assessment (EA) contains a detailed evaluation of the existing conditions and environmental consequences of Alternative 5 and Alternative 6. The environmental impacts associated with the alternatives under consideration are presented in detail within the EA on **Table ES.1**. Alternative 6 would meet some of the project goals by providing limited aquatic habitat improvement through the removal of Sabin Dam. Alternative 5 would meet all of the project goals and provide aquatic ecosystem restoration along a large section of the Boardman River. Based on the analysis of impacts provided in the EA, implementation of either alternative would restore fish habitat by restoring the internal connectivity of the Boardman River and would potentially increase the diversity of species moving between the Great Lakes and the river.

Alternative 5 is preferable to Alternative 6 because it provides the greatest habitat benefits. In summary, Alternative 6 would provide some habitat improvements for brook trout, longnose dace (*Rhinichthys cataractae*), mottled sculpin (*Cottus bairdi*), and other coldwater species, but no suitable habitat would be provided for lake sturgeon. Alternative 5 provides habitat improvements for all coldwater species within the Boardman River. Alternative 5 would also open up new habitat to the sturgeon and eliminate the negative impacts caused by both Sabin and Boardman Dams.

Based on the findings of the EA, implementation of Alternative 5 (Recommended Alternative) or Alternative 6 (Remove Sabin Dam) would not have significant adverse, direct, indirect, or cumulative effects on the quality of the environment. The Recommended Alternative would improve habitat by restoring the coldwater temperature regime; allow sediment, organic material and woody debris to move downstream, remove barriers to fish passage for coldwater species like brook trout and longnose dace within the Boardman River, and provide passage for sturgeon around the Union Street Dam via trap-and-transfer activities, opening up additional habitat for this State-listed (threatened) species.

Subpart C deals with potential impacts on the physical, chemical, and biological characteristics of the aquatic ecosystem. The individual components of Subpart C include substrate; suspended particulates/turbidity; contaminants; water; current patterns and water circulation; normal water fluctuations; and salinity gradients. The following discussion provides the environmental impact analysis for each of the factors or criteria that must be considered for Alternatives 5 and 6, as set forth in Subpart C of the Section 404(b) (1) guidelines. Alternative 1 (No Action Alternative) represents the existing conditions and serves as a baseline to evaluate the impacts of the action alternatives.

2.1.1 Substrate

The project area covers segments 1 through 5 of the Boardman River and focuses on three dams (Boardman Dam, Sabin Dam, and Union Street Dam) and two impoundments (Sabin Pond and Boardman Pond) on the Boardman River. See **Figure 1** for a map and description of the Boardman River segments as identified in preliminary field studies and feasibility reports performed by Environmental Consulting and Technology, Inc. (2009).

Segment 1 is approximately 1.14 miles and extends from the Union Street Dam downstream to Lake Michigan including the approximate 4.5-mile tributary Kids (Hospital) Creek. Compositions of streambed substrates, from qualitative observations, are: 0% clay, 0% silt, 32% sand, 45% gravel, 16% cobble, and 6% boulders. Similar to river segment 3, this segment is quite wide and dominated by gravel, cobble and boulders. Segment 2 is Boardman Lake. The construction of the Union Street Dam increased the size of Boardman Lake, from its original 259 acres to 339 acres. Segment 3 is approximately 2.15 miles and extends from Sabin Dam downstream to Boardman Lake. Segment 3 between Sabin Dam and Boardman Lake is very wide, approximately 54 meters, immediately downstream of the dam and gravel substrate is abundant (60%). After approximately 860 meters downstream, the river becomes narrower (~20 meters) and sand is the most dominate substrate (80-85%). Segment 3 is deep (~70% was >2.5 feet deep) and aquatic vegetation is abundant (~20%). This river stretch is entirely run bed form and wood debris averaged 10%. No cobble or boulders were seen and silt was scarce. This river segment, while seriously impaired from natural conditions, does provide some unique fisheries habitat. The short gravel-filled section downstream of Sabin Dam likely provides some limited spawning habitat for fish requiring gravel for spawning. Sabin Dam is located at approximately river mile 5.7 and its impoundment constitutes river segment 4. Sabin Pond is approximately 40 acres. Located at river mile 6.1, segment 5 is a 78-acre impoundment created by the Boardman Dam known as Boardman Pond (also called Keystone Pond) (ECT 2009b).

Alternative 5 would relieve the environmental impacts caused by the Boardman and Sabin Dams, while Alternative 6 would only involve Sabin Dam. Currently, the dams traps sediment and organic material within the impoundments and “starves” downstream areas by reducing sediment loads and increasing bank and riverbed erosion in those downstream reaches. Removal of both Boardman and Sabin dams has the potential to achieve all of the objectives within all of the project constraints. Both dam removals would include removal of the concrete spillway and a minimum of two bankfull widths of the earthen dam at each site. The exposed bottomlands would be restored to a free-flowing channel through the former impoundment. The river would be allowed to choose its own path. In doing so, it would move sediment and self-armor with existing gravel, cobble, and boulders and likely follow the pre-dam river channel. Sediment management would occur via sediment traps immediately upstream of the existing dam, slow drawdown, and active sediment removal along the exposed banks by land-based excavators (to provide an appropriately dimensioned floodplain).

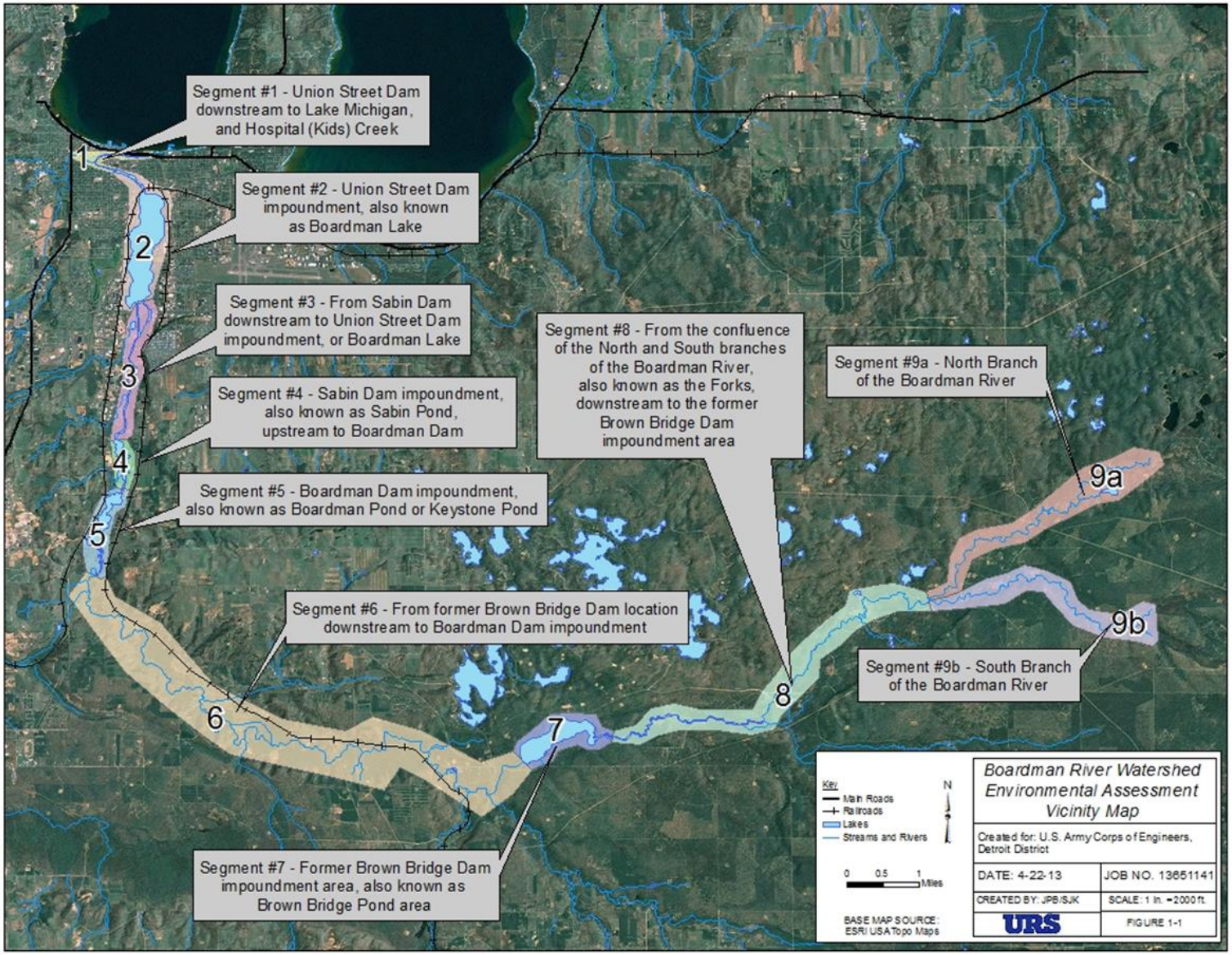


Figure 1: Boardman River Feasibility Study – River Segments

2.1.2 Suspended Particulates and Turbidity

Construction activities from dam removal associated with both alternatives and the spillway modification included in Alternative 5 could produce short-term increases in suspended sediments and turbidity levels unless protective measures are implemented. Fast and uncontrolled transport of sediment and organic material from the impoundments can destroy fish habitat. Excessive sediment can blanket spawning beds and foraging habitat making them unusable, while large organic loads can cause drops in the dissolved oxygen level, killing fish. To minimize the potential for adverse effects on surface waters, appropriate protective measures would be taken, including installing sediment traps, straw bales, geotextile barriers, and other means to prevent sediment and organic materials from moving out of the construction zone and into downstream areas.

Alternative 6 would result in less suspended materials and turbidity compared to the Recommended Alternative (Alternative 5) since it only involves one dam removal. Alternative 5 is expected to have greater short-term adverse impact on suspended particulates and turbidity due to the fact that it involves two dam removals and one dam modification. The Boardman River impoundments hold large volumes of sediment that could potentially be mobilized during dam removal and released downstream if not controlled. Following the dam removals, sediment may become re-suspended into the free-flowing river. This short-term influx of sediments into the stream flow can negatively affect water quality and damage spawning grounds and habitat; however, over the long term, natural sediment transport conditions would be restored.

Sediment fate and transport modeling and analysis were conducted to support the feasibility design and construction purposes. Modeling results assisted in selecting appropriate sediment control measures necessary to ensure successful drawdowns of the impoundments. Sediment control would be accomplished by the controlled breaching method, sediment trapping and removal methods, and proper soil and erosion control measures. Attachment 1 of the Boardman River Feasibility Study Engineering Appendix includes a detailed description of the modeling and analysis conducted to support the feasibility-level design.

2.1.3 Contaminants

Alternative 6 would result in a lower risk of mobilizing contaminants over the Recommended Alternative (Alternative 5). Since Alternative 6 involves only one dam removal, there would be less potential impacts from contaminants within impounded sediment. Additionally, Alternative 5 involves providing passage for a large and long-lived Great Lakes fish such as the sturgeon upstream and bioaccumulating contaminants such as mercury, dichlorodiphenyltrichloroethane (DDT), and polychlorinated biphenyls (PCBs) could be introduced into the food chain of the Boardman River system, which could impact both aquatic and terrestrial wildlife. However, the amount of contamination within sturgeon tissue is dependent on location and the Boardman River Watershed is not known to have bioaccumulation contaminant problems. According to the MDNR, the passage of Great Lakes lake sturgeon into historic spawning rivers is unlikely to cause contaminant concerns. The species suffers very little mortality from spawning stress, is not a forage fish because of its size, and returns to the Great Lakes after spawning, therefore, effects

of any bioaccumulated contaminants in lake sturgeon would be negligible in the Boardman River watershed (MDNR 1997).

Along with the limited potential risk of bioaccumulating contaminants associated with migrating Great Lakes fish, Alternative 5 also has the greater potential for the mobilization of contaminated sediments within the impoundments. Consequently, sediment sampling was conducted as part of this project. The contamination level of the sediment in each impoundment was evaluated in the sediment fate and transport studies as discussed in the Boardman River EA and Attachment A of the Boardman River Feasibility Study Engineering Appendix.

In summary, both the Boardman and Sabin impoundments have elevated concentrations of some contaminants. Contaminants, which attach to smaller sediments, can pose a threat to downstream habitats and fish and wildlife. These contaminants would need to be managed to protect human and aquatic health. Alternative 5 and 6 would require management of sediment, some of which has elevated levels of arsenic. Alternative 1would not disturb existing sediments or involve drawdown of the Boardman and Sabin impoundments below their existing levels.

Based on current site conditions and foreseeable recreational site use following the dam removals and river restoration, the most plausible exposure pathway is direct contact. Because arsenic is the only metal that was found to exceed the MDEQ-established residential direct contact criterion (DCC), a Site-Specific Recreational Use DCC was developed for arsenic and was conservatively developed as 18 mg/kg. This site-specific cleanup criterion, which was approved by the MDEQ, indicates that the detected concentrations of arsenic in both Boardman and Sabin Ponds would not pose unacceptable exposure to sediments to be moved from bottomland/riverbeds and spread on floodplain areas or sediments exposed in the bottomlands/riverbeds as a result of the drawdown of both impoundments. Dredging conducted within the impoundments would require sampling of stockpiled sediments to determine proper management actions in compliance with Federal and State regulations. If the sediment is determined unsuitable for reuse on site, it would be removed to an appropriate placement/soil management location.

Precautions would be taken during impoundment drawdown and construction activities to prevent loss of sediments into the environment. Sediment management would be accomplished through the use of controlled breaching, sediment trapping and removal, and proper soil and erosion control measures.

2.1.4 Water

Alternative 5 would eliminate the environmental impacts caused by the Boardman and Sabin Dams, while Alternative 6 only remedies the impacts of the Sabin Dam. Currently, the dams blocks fish movement, fragments cold water habitat, traps sediment and organic material, and warms the water within the impoundments and downstream of the dams. Stream restoration and removal of the Sabin and Boardman Dams would result in the loss of its lentic slower-moving water conditions and transition to the coldwater river with historic riparian habitats similar to those still found along the free-flowing, un-impounded sections of the river. Complete dam removal has the potential to achieve all of the project objectives.

Alternative 5 would have the greatest impact on the natural and biological resources of the Boardman River. Surface water resources and aquatic habitat would be impacted by the removal of the Sabin and Boardman Dams and draining of the impoundments. By breaching the dams, the impoundments would be drained and warmwater lake habitat would revert back to coldwater riverine habitats. Approximately 40 acres of warmwater lake habitat would be converted to coldwater habitat at Sabin Pond (segment 4) and 78 acres would be removed within Boardman Pond (segment 5). Alternative 6 would only impact the aquatic habitat with Sabin Pond.

The loss of warmwater lotic habitat would be moderated by the restoration of a high-quality riverine environment and coldwater fishery, which is deemed more valuable because of its rarity within the region. Additionally, the Boardman River would be returned to its natural state by removing manmade barriers. The thermal effects of the impoundments (i.e., increased water temperatures within the impoundments and in segment 3 below the dams) would be eliminated and habitat for coldwater species, such as brook trout and longnose dace, would increase. For Alternative 6, due to the Boardman Dam upstream remaining in place, improvement in coldwater fish habitat and the elimination of thermal effects may not be fully realized and the Boardman River would not be returned to its natural, free-flowing state in its entirety.

Construction activities from dam removal associated with both alternatives and the spillway modification included in Alternative 5 could produce temporary negative effects to surface water quality and fisheries habitat unless protective measures are implemented. Fast and uncontrolled transport of sediment and organic material from the impoundments can destroy fish habitat. Excessive sediment can blanket spawning beds and foraging habitat making them unusable, while large organic loads can cause drops in the dissolved oxygen level, killing fish. To minimize the potential for adverse effects on surface waters, appropriate protective measures and best management practices (BMPs) would be implemented, including installing sediment traps, straw bales, geotextile barriers, and other means to prevent sediment and organic materials from moving out of the construction zone and into downstream areas.

2.1.5 Current Patterns, Water Circulation, and Normal Water Fluctuations

The implementation of the Recommended Alternative (Alternative 5) or Alternative 6 would impact current patterns, water circulation, and normal water fluctuations. A hydraulic model, using the USACE's Hydrologic Engineering Center's River Analysis System (HEC-RAS), was developed for the Boardman River (USACE 2008). The model was used to characterize existing water levels and river profiles during the 100-year and 500-year flood events as well as those that would occur under future conditions with removal of Sabin and Boardman Dams. The hydraulic model includes about 24 miles of stream beginning at the U.S. Geological Survey (USGS) Flow Gage at Ranch Rudolph (approximately 2 miles upstream of the former Brown Bridge Dam) and ending at Grand Traverse Bay. The model was modified and updated in May 2009 as part of the SIAM Modeling Baseline Conditions Study by USACE-Detroit. The existing model of the Boardman River covers the entire project area to encompass the base case and future conditions scenario.

According to hydraulic modeling, removal of the dams resulted in no loss of flood storage and downstream water levels were estimated to not increase. Within the existing impoundments, the water levels decrease substantially due to the draining of the reservoirs.

The data showed that removal of the vast majority of the sediments stored in the existing impoundments and construction of proposed floodplain areas are critical to providing adequate flood conveyance and floodplain storage for larger events after removal of Boardman and Sabin Dams. During larger flood events, vegetated floodplains (with trees, shrubs, etc.) would reduce peak discharge rates and increase duration by slowing the flow of floodwaters as they extend to fill the wide floodplain area.

The dam removal measures associated with Alternatives 5 and 6 would drop the water level until only river habitat exists. The drawdown and breaching operation for Sabin and Boardman Dams would consist of breaching the dams at approximately one-foot increments allowing the water level within the impoundments to equalize prior to lowering the subsequent one foot increment. The river restoration efforts in both impoundments would begin concurrently as the breaching operations. Work would begin with excavating floodplain benches in the upper reaches of the impoundments and progress downstream as the water level is drawn down.

2.1.6 Salinity Gradients

Salinity gradients form where saltwater from the ocean meets and mixes with fresh water from land. There are no salinity influences within the Boardman River, therefore salinity impacts would not occur from any of the alternatives.

2.2 Subpart D: Potential Impacts on Biological Characteristics of the Aquatic Ecosystem.

Subpart D deals with potential impacts to biological characteristics of aquatic ecosystems. Any of the proposed alternatives would have impacts to aquatic organisms (such as fish and macroinvertebrates) and food web conditions within the project area. Subpart D addresses impacts to threatened and endangered species, aquatic organisms and food webs, and other wildlife. The individual parts of Subpart D are discussed below.

2.2.1 Threatened and Endangered Species

The potential occurrence of federally or State-listed threatened or endangered species was evaluated based on information from U.S. Fish and Wildlife Service (USFWS), MDNR, and Michigan Natural Features Inventory (MNFI) Web sites and information received directly from Federal and State natural resources agencies.

According to the USFWS website, three federally listed species occur in Grand Traverse County including the endangered Kirkland's warbler (*Dendroica kirtlandii*), the threatened Pitcher's thistle (*Cirsium pitcheri*), and the eastern massasauga (*Sistrurus catenatus catenatus*), a candidate species. The Kirtland's warbler is dependent upon large, relatively homogeneous stands of jack pine (*Pinus banksiana*) with scattered small openings (Olson 2002). The Pitcher's thistle typically grows on open sand dunes and occasionally on lag gravel associated with shoreline dunes. All of its habitats are along or very near the Great Lakes shoreline (Higman and Penskar 1999). Neither jack pine stands nor sand dune habitat is located within the project area so these federally protected species are unlikely to be present in the project vicinity. Consequently, the project alternatives would have "No Effect" on the Kirtland's warbler and the Pitcher's thistle.

The eastern massasauga is found in a variety of wetland habitats, including bogs, fens, shrub swamps, wet meadows, marshes, moist grasslands, wet prairies, and floodplain forests (Lee and Legge 2000). Consequently, some habitat is available to this candidate species within the project area; however, no records exist of it occurring specifically within the project area. Alternative 5 "May Affect, not likely to adversely affect" the eastern massasauga because suitable habitat is present but no occurrences are recorded. Additionally, the project would actually create more habitats for this snake species and only temporarily impact a small portion of the suitable habitat.

Appendix C of the Boardman River EA (the appendix following this 404(b)(1) Evaluation) contains a list of State and federally protected species known to occur within Grand Traverse County according to MNFI data. Several of these threatened species have been observed within the project area, including the common loon (*Gavia immer*) and red-shouldered hawk (*Buteo lineatus*), which are listed by the State of Michigan as threatened, and the wood turtle (*Glyptemys insculpta*), listed by the State as a species of special concern. No listed endangered species have been observed within the project area according to MNFI records and past field surveys (ECT 2009c).

Alternative 5 consists of modifying the Union Street Dam and trap-and-transfer activities to provide passage of the State-listed (threatened) lake sturgeon into Boardman Lake and upstream river segments. Lake sturgeon would gain access to foraging and spawning habitat within the entire Boardman River system.

Other State-listed or rare species may be affected by Alternatives 5 and 6 through a conversion of habitat in the project area. Common loons have been reported to nest on Boardman Pond in recent years and are likely to be impacted by this project alternative. According to the MDNR (1993), lakes showing the highest potential for loon occupancy are those that range from 16 to 100 acres in size, have relatively stable water levels, contain an island or bog mat, and have relatively pristine conditions on the shoreline. Consequently, any displaced loons could inhabit nearby waterbodies, including a complex of approximately a dozen lakes, just north and east of the former Brown Bridge impoundment and 5 to 8 miles east of the Boardman Pond impoundment (ECT 2009c).

The red-shouldered hawk is a State-listed raptor species that has been known to occur within a mile of the project area. Because it forages in floodplain forests, wetlands, and ponds for reptiles and amphibians, dam removal activities associated with the project alternatives could alter the adjacent wetland and shoreline foraging habitat that is influenced by water levels in the impoundments, such as the beaver pond marsh near the delta of Sabin Pond (ECT 2009c). Wetland habitat types may change and shoreline habitat would be replaced by riverine habitats, which do not have the prey base of amphibians and reptiles that are generally more abundant along the impoundment shorelines. However, this loss would be minimized by the increase in both wetland and upland forested habitat, which are used by this hawk species for nesting and foraging. Because the red shouldered hawk is not known to nest near the Sabin and Boardman impoundments, dam removal is not expected to impact on this species (ECT 2009c).

The wood turtle, a species of special concern, is known to occur in the natural, free-flowing sections of the river between Boardman Pond and the former impoundment area of the recently removed Brown Bridge Dam. Generally, the wood turtle is most common in slow-moving, meandering sections of streams (Harding 1997) and is not known to use the lake-like habitat found in the Boardman River impoundments. Consequently, dam removal would not likely result in the loss of wood turtle habitat.

2.2.2 Fish, Crustaceans, Mollusks, and Other Aquatic Organisms in the Food Web

The Boardman River is a high-quality coldwater trout stream in the North and South Branches. From the confluence of the two branches, the main stem of the Boardman River downstream to the former Brown Bridge Dam impoundment is also a coldwater, high-quality trout stream with high densities of brown trout (*Salmo trutta*) and brook trout. However, the impoundments associated with the inactive hydroelectric dams elevate the water temperature. Consequently, the warmer temperature supports lower densities of trout in the lower five segments of the Boardman River (within the project area). Brown trout are still relatively common downstream to the Boardman Dam impoundment, though at approximately half the density as upstream of the former Brown Bridge Dam. Since the Brown Bridge Dam was recently removed, this reach is expected to improve. Below the Sabin Dam, water temperatures become sub-optimal for

coldwater fishes; brook trout are absent and brown trout are only found in very low densities (ECT 2009a).

Under the Alternative 1 (No Action Alternative), all of the dams would be maintained as they currently exist. The dams would not be modified to provide increased fish passage, and migratory fish passage would continue to be blocked at the weir and Union Street Dam. Under the No Action Alternative, the ecosystem would not be restored under the USACE ecosystem restoration program. As such, the No Action Alternative would not have an impact (neither beneficial nor detrimental) on fish or other aquatic organisms.

The Recommended Alternative (Alternative 5) consists of providing downstream passage of sturgeon by modifying the existing Union Street Dam auxiliary spillway to be more conducive to passing adult sturgeon downstream. Upstream passage would be accomplished by a trap-and-transfer operation operated at the Boardman River fish weir. By manually transporting lake sturgeon past the fish weir and Union Street Dam, potential spawning and foraging habitat within the Boardman River would be reachable by sturgeon. Additionally, juveniles could use the river and Boardman Lake as a nursery prior to entering Lake Michigan. Alternative 5 also involves removing Sabin and Boardman Dams, while Alternative 6 removes just Sabin Dam. Under these alternatives, the lake-like impoundment habitats and their warmwater fisheries would be eliminated. The poor warmwater fishery within Sabin Pond (segment 4), which is dominated by undersized northern pike (*Esox lucius*) and white sucker (*Catostomus commersoni*) and has a low relative abundance of most sportfish, may be lost. Similarly, the fair smallmouth bass (*Micropterus dolomieui*) fishery and poor fisheries for other gamefish associated with Boardman Pond (segment 5) could also be destroyed. The warmwater fish species within the impoundments that are not capable of adapting to the new environment would move to nearby suitable habitat or perish. However, many warmwater species are present within river segment 8, which starts at the confluence of the North and South Branches of the Boardman River and continues downstream to the location of the former Brown Bridge Dam impoundment. Species like northern pike, smallmouth bass, largemouth bass (*Micropterus salmoides*), yellow perch (*Perca flavescens*), and white sucker are able to survive in this pristine coldwater stretch of the Boardman River. For Alternative 6, the thermal effects of the upstream Boardman Dam would continue, which could prevent segments 3 and 4 from supporting only coldwater fisheries.

Benthic macroinvertebrates would also be impacted by dam removal activities. Coldwater stream restoration would cause a shift in the benthic invertebrate community of the impoundment areas from species preferring warmwater, soft-bottomed habitat to those inhabiting coldwater, hard-bottomed habitat. The invertebrate community of the restored river segments would be comprised of less oligochaetes, bloodworms, and mollusks, including the invasive zebra mussel (*Dreissena polymorpha*), and feature more mayflies, stoneflies, and caddisflies, which are associated with improved water quality. Invertebrate species finding the restored coldwater habitat unsuitable would be displaced or perish due to the change in water temperature and increased water velocity.

This loss of warmwater fish and benthic invertebrate communities is negligible on a regional basis because of the abundance of such warmwater species in the region and would be offset by

the restoration of a high-quality riverine environment and coldwater fishery, which is more valuable as a result of its rarity. Coldwater streams are considered more valuable than warmwater lotic habitat because they are a limited resource in the lower peninsula of Michigan, making up only about 25 percent of stream segments (Seelbach et al. 1997). These streams naturally tend to have higher densities of game fish and could provide spawning grounds and nursery areas for Great Lakes fish such as lake sturgeon. Additionally, warmwater lakes in Grand Traverse County are common, totaling approximately 10,049 acres and compose approximately 60 percent of all lake habitat. These factors support the importance of protecting/restoring coldwater streams in Michigan, which support a variety of coldwater-dependent fish, mussel, and macroinvertebrate species.

2.2.3 Other Wildlife

The stream restoration and dam removals associated with Alternative s 5 and 6 would result in the loss of its impounded water or lake-like, slower-moving water conditions and the transition to the river's historic riparian habitats, similar to those still found along the free-flowing, un-impounded sections of the river. The restored river would contain shallow, open water habitat that would be free flowing and not the still water associated with the shallow areas of impoundments. Consequently, wildlife species living in the project area would experience a habitat shift from lake-like conditions to a riverine habitat. This shift to a riverine/wetland habitat would allow new wildlife species to inhabit the area and provide some existing species with increased habitat. However, some wildlife may potentially need to relocate to new areas with more lake-like conditions.

Potential habitat for displaced species includes a nearby complex of approximately a dozen lakes, just north and east of the former Brown Bridge impoundment and 5 to 8 miles east of the Boardman Pond impoundment (ECT 2009c). Displaced species would be those dependent on shallow, open water habitat, including some species of frogs, turtles, wading birds, waterfowl, and mammals like muskrat (*Ondatra zibethicus*)and beaver (*Castor canadensis*). However, the newly created stream and riparian habitat would benefit other animal species, such as white-tailed deer (*Odocoileus virginianus*), mink (*Neovison vison*), otter (*Lontra canadensis*), bobcat (*Lynx rufus*), game birds, songbirds, and raptors. Additionally, as the new wetland and riparian habitats transform through natural plant succession, wildlife species inhabiting these different habitat types would also change.

2.3 Subpart E: Potential Impacts on Special Aquatic Sites

Subpart E deals with potential impacts to special aquatic sites. Special aquatic sites include sanctuaries and refuges, wetlands, mud flats, vegetated shallows, coral reefs, and riffle and pool complexes.

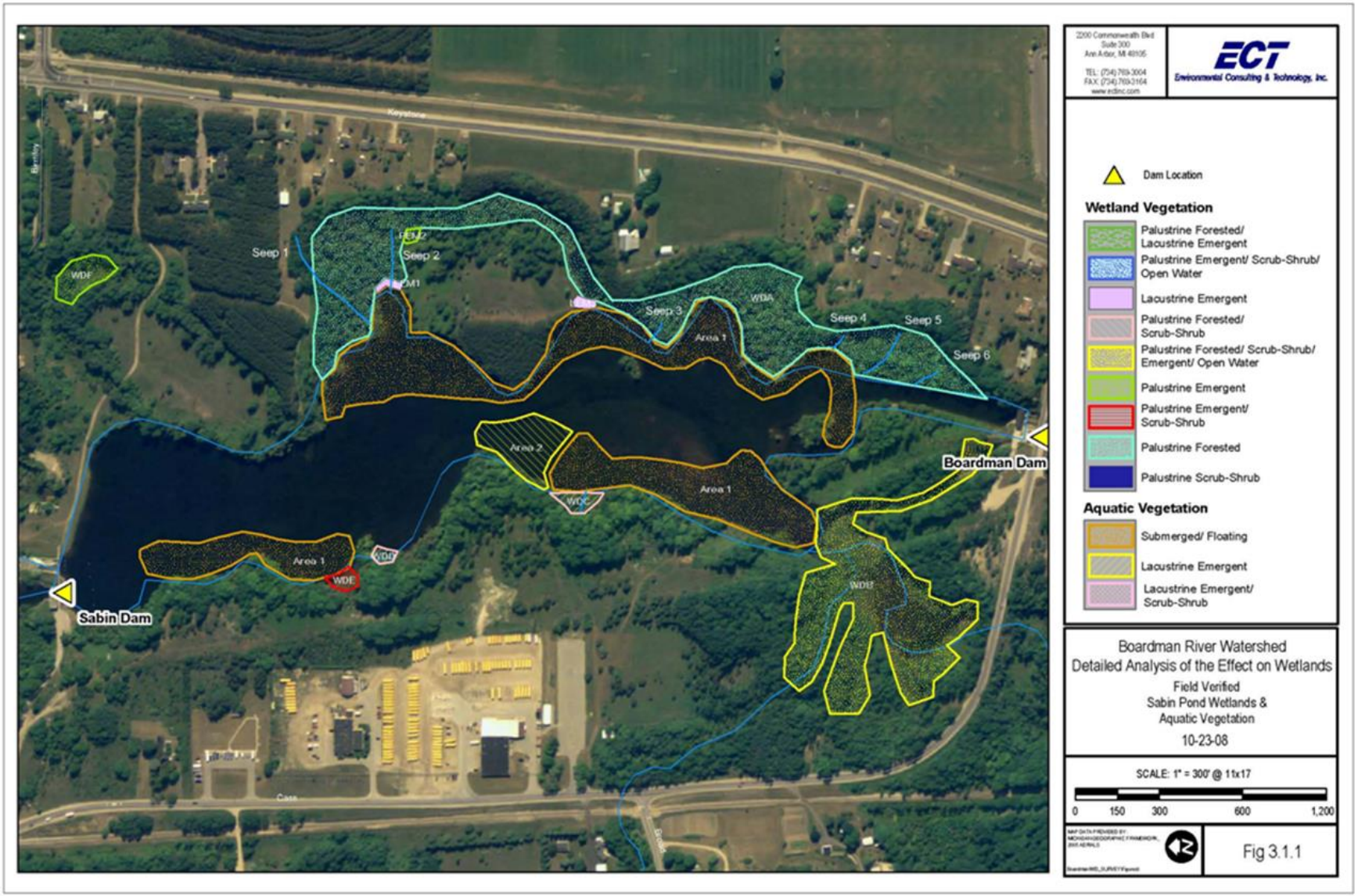
2.3.1 Sanctuaries and Refuges

There are no sanctuaries or refuges located within the project area.

2.3.2 Wetlands

Wetlands associated within the project area were classified in accordance with the Classification of Wetlands and Deepwater Habitats of the United States (Cowardin et al. 1979). The Sabin Dam impoundment is approximately 40 acres and contains roughly 15 acres of aquatic vegetation dominated by submerged, floating, and emergent vegetation. The plant community within this type of habitat is characterized by relatively low species diversity. Approximately 16.7 acres of diverse wetland habitat occur near or adjacent to the Sabin Pond impoundment, which is classified as palustrine. Palustrine wetlands are inland wetlands dominated by trees, shrubs, and/or persistent emergents that lack flowing water and ocean-derived salts, and are non-tidal. This higher quality habitat consists of 0.1 acres of palustrine emergent (PEM)/palustrine scrub-shrub (PSS) wetland, 9.4 acres of palustrine forested (PFO) wetland, 0.3 acres of PFO/PSS wetland, and 6.9 acres of PFO/PSS/PEM/open water (OW) wetland (ECT 2009d). Although some of these wetlands are influenced by inundation from the impoundment, most are primarily fed by groundwater seepage and occur on very poorly drained sapric muck. **Figure 2** provides a map of the existing wetland habitat associated with Sabin Pond.

The impoundment behind the Boardman Dam was originally 103 acres. However, following an emergency drawdown in 2007, during which the water level in the impoundment was dropped approximately 17 feet, the pond is now about 78 acres. Since 2007, wetland habitat associated with the impoundment has changed with the creation and loss of individual wetlands. Approximately 13.1 acres of diverse wetland habitat occur near or adjacent to the Boardman Pond, consisting of predominately PEM wetlands (URS 2012). Although some of these wetlands are influenced by inundation from the impoundment, most occur along the banks of the impoundment and are primarily fed by groundwater seepage. They occur on poorly and very poorly drained mucky sand. **Figure 3** provides a map of the existing wetland habitat associated with Boardman Pond (URS 2012). Appendix C of the Boardman River EA (the appendix following this 404(b)(1) Evaluation) contains a list of wetland plant species associated with Sabin and Boardman Ponds.



Source: ECT 2009d

Figure 2: Existing Wetland Habitat Associated with Sabin Pond

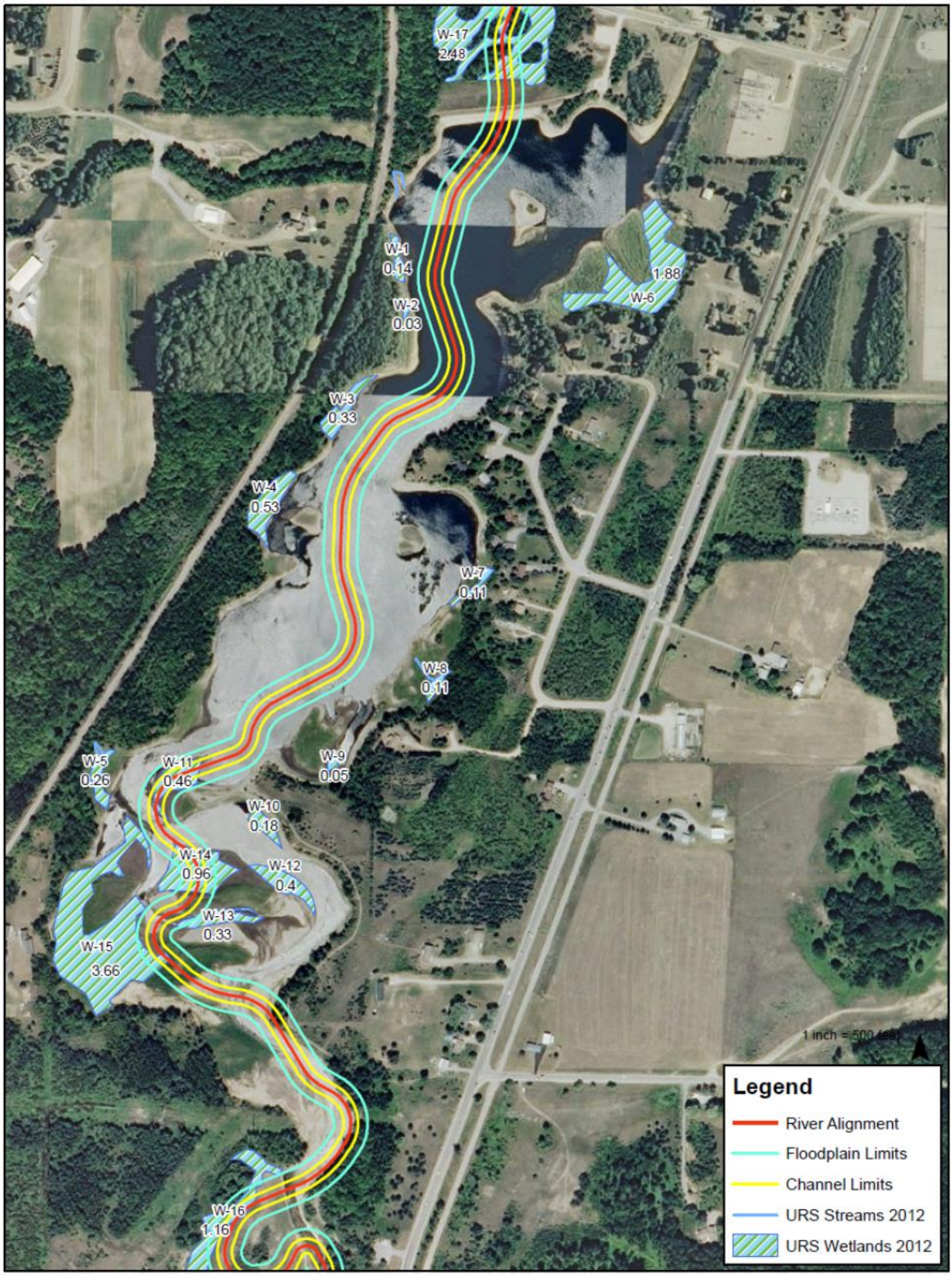


Figure 3: Existing Wetland Habitat Associated with Boardman Pond

2.3.2.1 **Recommended Alternative (Alternative 5)**

Alternative 5 includes the removal of the Sabin and Boardman Dams, which would decrease water levels in the pond; consequently, both wetland acreage and type would change within the former impoundment areas. Anticipated wetland impacts from each dam removal are discussed below.

2.3.2.1.1 Sabin Dam Impoundment

Overall, approximately 30.5 acres of wetland are anticipated to form following drawdown of the impoundment (ECT 2009e) and the necessary sediment management. Former impoundment areas are anticipated to develop into emergent wetlands initially.

New emergent wetlands would likely be dominated by a more diverse set of wetland species than those that currently exist, including blue vervain (*Verbena hastata*), swamp milkweed (*Asclepias incarnata*), broadleaf cattail (*Typha latifolia*), black bulrush (*Scirpus atrovirens*), hardstem bulrush (*Schoenoplectus acutus*), spotted joe-pye-weed (*Eupatorium maculatum*), jewelweed (*Impatiens capensis*), common boneset (*Eupatorium perfoliatum*), sensitive fern (*Onoclea sensibilis*), yellow marsh marigold (*Caltha palustris*), swamp goldenrod (*Solidago patula*), northern blue flag (*Iris versicolor*), and beggar-ticks (*Bidens spp.)* (ECT 2009e and URS 2012).

Over time, these new emergent wetlands would be expected to convert to and remain emergent/scrub-shrub wetlands (ECT 2009e and URS 2012). These permanently emergent/scrub-shrub portions would be similar in structure and composition to areas found elsewhere along the Boardman River and would likely be dominated by common elder (*Sambucus canadensis*), silky dogwood (*Cornus amomum*), red-osier dogwood (*Cornus stolomfera*), sandbar wouldow (*Salix exigua*), speckled alder (*Alnus rugosa*), blue vervain, swamp milkweed, spotted joe-pye-weed, common boneset, broadleaf cattail, green bulrush (*Scirpus atrovirens*), sedges (*Carex spp*.), hardstem bulrush, and burreed (*Sparganium spp*.) (ECT 2009e and URS 2012). However, some new emergent wetlands could eventually succeed to forested/scrub-shrub wetlands with dominants such as northern white-cedar (*Thuja occidentalis*), red maple (*Acer rubrum*), common elder (*Sambucus canadensis*), and marsh fern (*Thelypteris palustris*) (ECT 2009e).

Field observations recorded in May 2012, by URS, indicate that existing wetland habitat was unaffected by the recent drawdown of Sabin Pond. Because of the presence of groundwater seepage, these wetlands are unlikely to convert to uplands following drawdown. However, when surface water influences are removed as the water elevation is lowered, these wetlands may shift from emergent/scrub-shrub to a slightly drier species composition with dominance by wetland trees and shrubs (ECT 2009e).

The 6.9-acre PFO/PSS/PEM/OW wetland located southwest of the impoundment would be temporarily impacted by construction of the river channel. Construction impacts to wetland habitat due to river channel and floodplain construction are expected to be temporary because hydrophytic vegetation would return. **Figure 4** shows wetland locations and **Table 1** provides wetland acreages based on estimates from ECT and URS fieldwork.

Table 1: Wetland Habitat Impacts for Sabin Dam Removal

Category	Dam In (acres)	Dam Out (acres)
Impoundment-Open Water	25.0	0.0
Impoundment-Aquatic Vegetation	15.0	0.0
River Channel-Open Water	1.6	6.4
Total Surface Water	41.6	6.4
PEM/PSS	0.1	0.1
PFO	9.4	9.4
PFO/PSS	0.3	0.3
PFO/PSS/PEM/OW	6.9	6.9
Total Wetlands Outside Impoundment	16.7	16.7
PEM/PSS Forming Within Impoundment	0.0	30.5
Total Upland	1.4	6.1
Total Area	59.7	59.7
Wetland Gain/Loss	**0.0**	**+30.5**

PEM = palustrine emergent wetland
PSS = palustrine scrub-shrub wetland
PFO = palustrine forested wetland
OW = open water wetland
Source: ECT 2009g, URS Corporation 2012

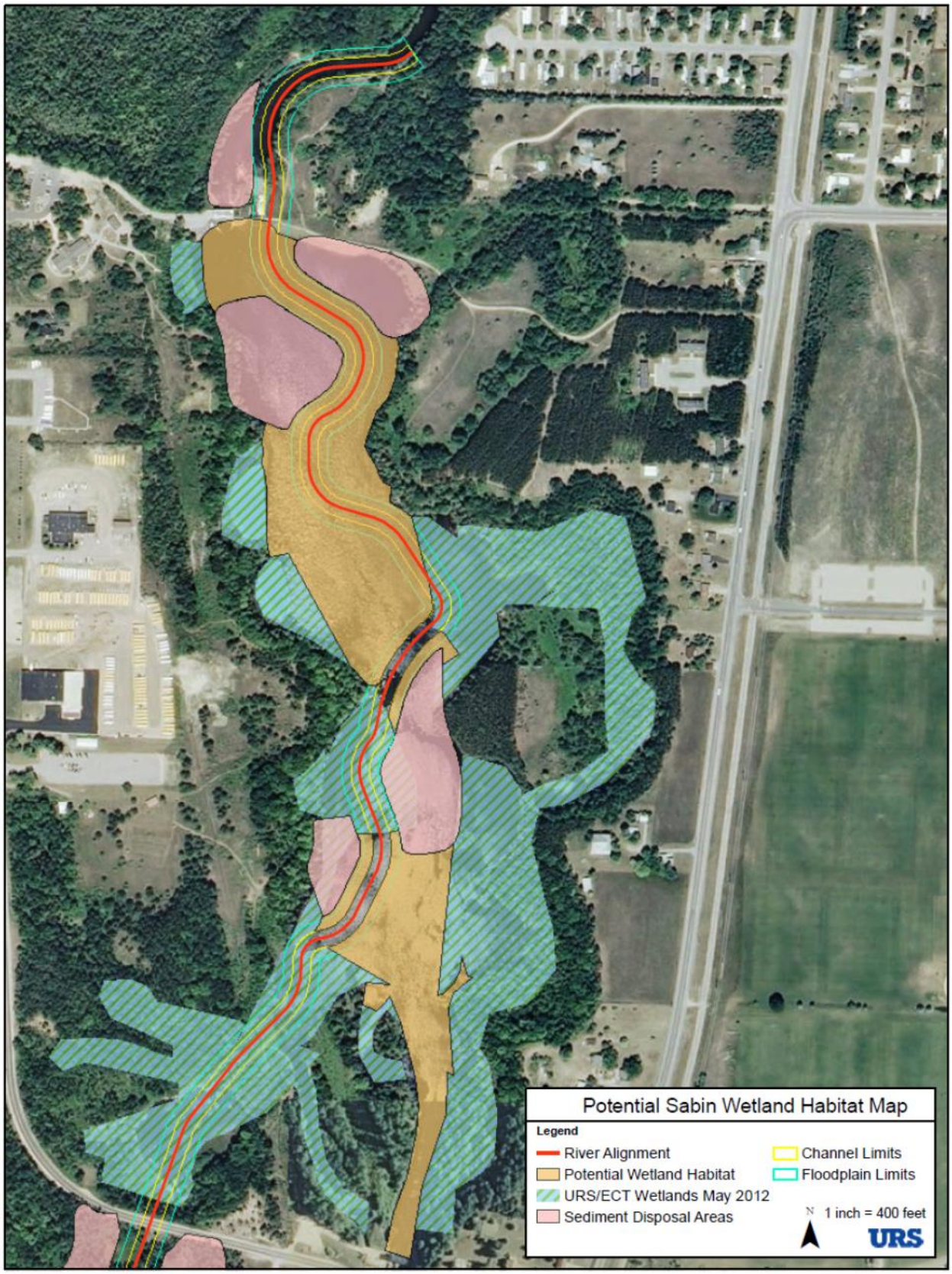


Figure 4: Potential Wetland Habitat Associated with Sabin Pond

2.3.2.1.2 Boardman Dam Impoundment

Draining Boardman Pond would also change the wetland acreage and type within the Boardman Pond impoundment. Overall, the net gain of wetland habitat due to dam removal activities is estimated to be approximately 26.5 acres. The new emergent wetlands would likely be dominated by blue vervain, nodding bur-marigold (*Bidens cernnuus*), nodding smartweed (*Polygonum lapathifolium*), rice-cut grass (*Leersia oryzoides*), swamp goldenrod, northern blue flag, yellow marsh marigold, broadleaf cattail, common boneset, spotted joe-pye-weed, hardstem bulrush, common three-square (*Schoenoplectus pungens*), and sedges (ECT 2009e and URS 2012).

Over time, these new emergent wetlands would be expected to convert to and remain emergent/scrub-shrub wetland. These permanently emergent/scrub-shrub portions would be similar in structure and composition to areas found elsewhere along the Boardman River and would likely be dominated by common elder, silky dogwood , red-osier dogwood, sandbar wouldow, speckled alder, blue vervain, swamp milkweed, spotted joe-pye-weed, common boneset, common cattail, green bulrush, sedges, hardstem bulrush, and bur reed (ECT 2009e and URS 2012). However, some new emergent wetlands could eventually succeed to forested/scrub-shrub wetlands with dominants such as northern white-cedar, red maple, common elder, and marsh fern (ECT 2009e and URS 2012).

Because of the presence of groundwater seepage, some existing wetlands associated with Boardman Pond are unlikely to convert to uplands following drawdown. When surface water influences are removed as the water elevation is lowered, these wetlands may shift from emergent/scrub-shrub to a slightly drier species composition with dominance by wetland trees and shrubs (ECT 2009e). However, some wetlands adjacent to the southern central portion of the impoundment that have formed since the 2007 drawdown are dependent on seasonal inundation. When the river channel is restored, these wetlands may no longer have sufficient hydrology and could convert to upland.

The 2.5-acre PEM/PSS/PFO wetland located north of the earthen berm would be temporarily and permanently impacted by construction of the river channel and sediment disposal. The permanent impact would be to approximately 1.4 acres as a result of sediment management along the newly constructed river channel. Construction impacts to wetland habitat due to river channel and floodplain development are expected to be temporary as hydrophytic vegetation would return. **Figure 5** shows wetland locations and **Table 2** provides wetland acreages based on estimates from ECT and URS fieldwork after the 2007 drawdown.

Table 2: Wetland Habitat Impacts for Boardman Dam Removal

Category	Dam In (acres)	Dam Out (acres)
Impoundment-Open Water	78.0	0.0
River Channel-Open Water	0.0	11.0
Total Surface Water	78.0	11.0
PEM/PSS/PFO*	2.5	1.4
Total Wetlands Outside Impoundment	2.5	1.1
PEM	10.6	0.0
PEM/PSS	0.0	38.5
Total Wetlands Forming Within Impoundment	10.6	38.5
Total Upland	0.0	40.5
Total Area	91.1	91.1
Wetland Gain/Loss	**0.0**	**+26.5**

* Wetland boundaries and size are estimated because of access issues; estimations are based of field observations and map review.

PEM = palustrine emergent

PSS = palustrine scrub-shrub

PFO = palustrine forested

Source: ECT 2009g, URS Corporation 2012

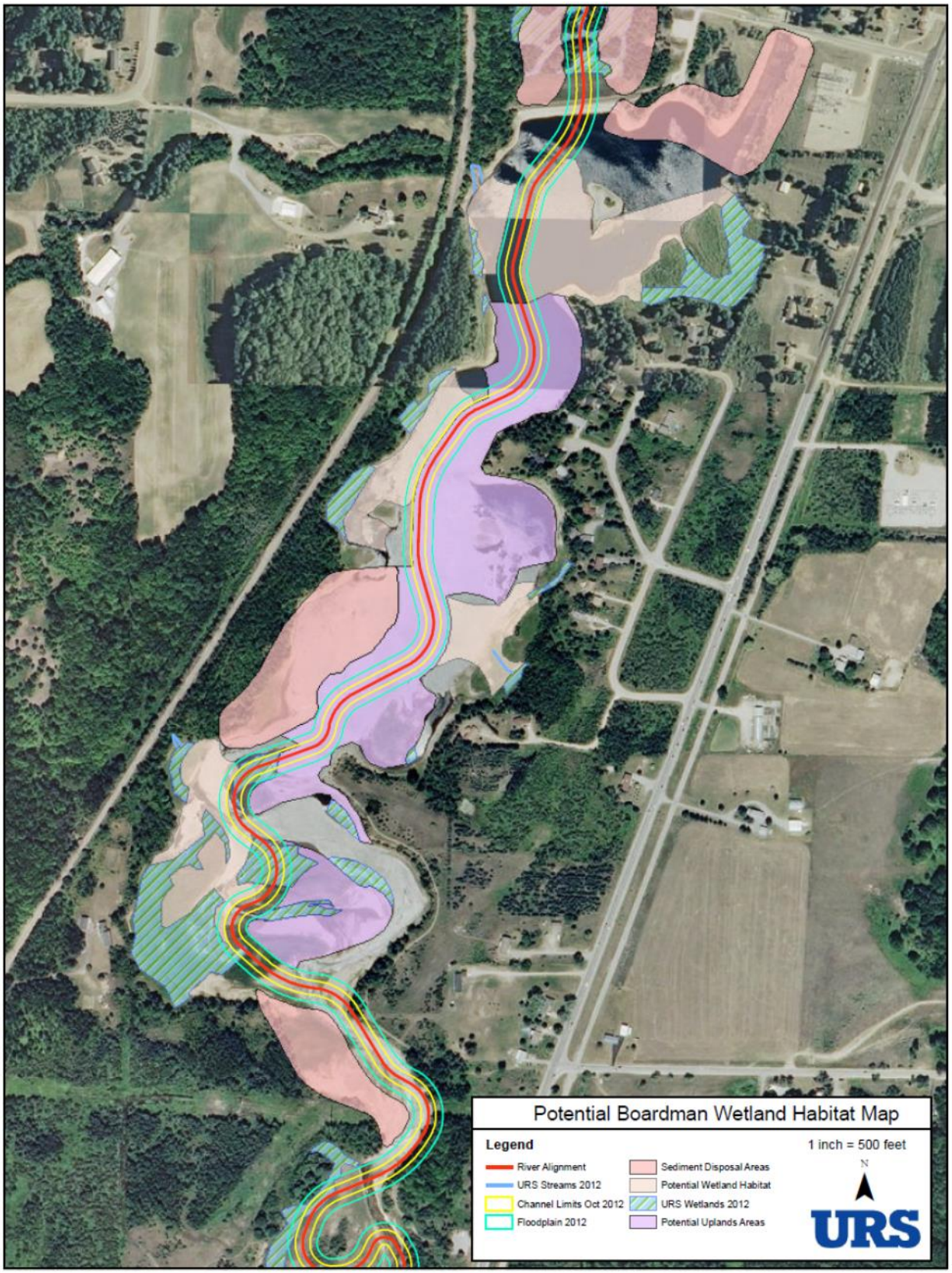


Figure 5: Potential Wetland Habitat Associated with Boardman Pond

2.3.2.2 **Alternative 6. Remove Sabin Dam**

Alternative 6 includes the removal of Sabin Dam, which would decrease water levels in the pond; consequently both wetland acreage and type would change within the former impoundment. Similar to Alternative 5, approximately 30.5 acres of wetland are anticipated to form following drawdown of the Sabin Dam impoundment (ECT 2009e) and the necessary sediment management. Former impoundment areas are anticipated to develop into emergent wetlands initially and overtime convert to and remain emergent/scrub-shrub wetlands (ECT 2009e and URS 2012). These permanently emergent/scrub-shrub portions would be similar in structure and composition to areas found elsewhere along the Boardman River. However, some new emergent wetlands could eventually succeed to forested/scrub-shrub wetlands (ECT 2009e).

Field observations recorded in May 2012, by URS, indicate that existing wetland habitat was unaffected by the recent drawdown of Sabin Pond and, due to the presence of groundwater seepage, these wetlands are unlikely to convert to uplands following drawdown. However, when surface water influences are removed as the water elevation is lowered, these wetlands may shift from emergent/scrub-shrub to a slightly drier species composition with dominance by wetland trees and shrubs (ECT 2009e).

The 6.9-acre PFO/PSS/PEM/OW wetland located southwest of the impoundment would be temporarily impacted by construction of the river channel. Construction impacts to wetland habitat due to river channel and floodplain construction are expected to be temporary because hydrophytic vegetation would return. Further details can be found in the Wetlands section for Alternative 5 (**Section 5.2.1**) including wetland locations, acreages, and plant species.

2.3.3 Mudflats

The proposed project would consist of activities within the Boardman River and associated impoundments. There are no mudflats located within the project area. Neither the project nor any of the alternatives would result in a discharge into or the dredging of mudflats.

2.3.4 Vegetated Shallows

The proposed project would consist of activities within the Boardman River and associated impoundments. There are no vegetated shallows located anywhere within the project area. Neither the project nor any of the alternatives would result in a discharge into or the dredging of vegetated shallows.

2.3.5 Coral Reefs

The proposed project would consist of activities within the Boardman River and associated impoundments. No coral reefs are present in this area. Neither the proposed project, nor any of the alternatives would result in a discharge of dredged or fill material into the ocean where coral reefs are located.

2.3.6 Riffle and Pool Complexes

Survey efforts have taken place along approximately 24 miles of stream, beginning at Medalie Park just upstream of Boardman Lake and ending approximately 2 miles upstream of the then

existent Brown Bridge Dam impoundment. Data were collected for stratified bed material and sediment along the Boardman River and within the ponds. Numerous photographs were taken to document the river condition and establish reference reaches along the Boardman River. The reference reaches represent stable sections of river and include full riffle/pool sequences.

The dam removals associated with the Recommended Alternative (Alternative 5) would restore habitat above and between the dams and reestablish riffle/pool sequences, allow for varying speeds in river current, which would result in a more diverse substrate. Alternative 5 would include engineered riffles/grade control structures at the locations of the existing Boardman and Sabin Dams. Alternative 6 would only include engineered riffles/grade control structures at the existing Sabin Dam. These riffles would add stability to the restored channel in areas of relatively steep slopes. In addition, engineered rock riffles would provide habitat and fish passage in the restored channel.

2.4 Subpart F: Potential Effects on Human Use Characteristics

Subpart F deals with potential impacts to human use characteristics. The individual portions of Subpart F have been analyzed to include the following: municipal and private water supplies, recreations and commercial fisheries, water related recreation, aesthetics, and parks, National and historic monuments, National seashores, wilderness areas, research sites, and similar preserves,..

2.4.1 Municipal and Private Water Supplies

Under existing conditions, the impoundments may create conditions that raise the groundwater surface elevations of the near surface aquifer. Consequently, the removal of the Sabin and Boardman Dams would cause a change in the elevation of the impoundment surfaces that would impact groundwater levels around the impoundments. With Alternative 5, the water surface elevation is expected to drop a maximum of approximately 15 feet at the Sabin Dam and 15 feet at the Boardman Dam. Only the water surface elevation associated with Sabin Dam would drop under Alternative 6. Based on these values, water wells less than 40 feet deep would be impacted.

In no instance would the depth of a screened well be above the water table after dam removal. Thus, strictly based on the expected surface water elevations and known locations of wells, there would be no impact from dam removal.

2.4.2 Recreational and Commercial Fisheries

Alternative 5 involves modifying the Union Street Dam with a fish passage that would have minor impacts on recreational facilities. Modifying the auxiliary spillway at the dam located within Lay Park would provide greater opportunities for fish passage through the park, including the downstream movement of lake sturgeon. However, being a State-listed species (threatened), the fishing regulations for lake sturgeon are highly restrictive. The direct impacts that would occur to recreational facilities including the Union Street Dam and Lay Park would be short term and temporary only during construction activities.

Alternatives 5 and 6 would provide benefits to recreational fishing for river segments associated with dam removal and draining of the impoundments. The poor warmwater fishery within Sabin Pond (segment 4), which is dominated by undersized northern pike (*Esox lucius*) and white sucker (*Catostomus commersoni*) and has a low relative abundance of most sportfish, may be lost under both alternatives. With Alternative 5, the fair smallmouth bass (*Micropterus dolomieui*) fishery and poor fisheries for other gamefish associated with Boardman Pond (segment 5) could also be destroyed.

This loss of warmwater fish is negligible on a regional basis because of the abundance of such warmwater species in the region and would be offset by the restoration of a high-quality riverine environment and coldwater fishery, which is more valuable as a result of its rarity. Coldwater streams are considered more valuable than warmwater lotic habitat because they are a limited resource in the lower peninsula of Michigan, making up only about 25 percent of stream segments (Seelbach et al. 1997). These streams naturally tend to have higher densities of game

fish and could provide spawning grounds and nursery areas for Great Lakes fish such as lake sturgeon. Consequently, they are an important recreational fishery resource in Michigan. Streams with characteristics typical of the Boardman River have average angler-day per mile values of 831 per year, with an estimated economic value of $22,437 per mile per year (MDNR creel census records; dollar values based on an estimated angler-day value of $27 from the U.S. Department of the Interior 2001). Additionally, warmwater lakes in Grand Traverse County are common, totaling approximately 10,049 acres and compose approximately 60 percent of all lake habitat. These factors support the importance of protecting/restoring coldwater streams in Michigan.

Additionally, the Boardman River is a designated Natural River under the State of Michigan Natural Rivers Program and, outside of the project area, it features 36 lineal miles of Blue Ribbon Trout Stream designated by the MDNR Fisheries Division. The river is considered one of the top ten best trout streams in Michigan and supports self-sustaining populations of brown, brook, and rainbow trout (*Oncorhynchus mykiss*). Mitigating the ecosystem disruption to the study area by removing the Boardman Dams would add miles of top quality trout stream, restore internal connectivity and coldwater characteristics of the Boardman River, and potentially increase the diversity of species moving between the Great Lakes and the river. Additionally, the Boardman River would be returned to its natural state by removing manmade barriers.

The purpose of the project is to improve river segment connectivity and restore the Boardman River to its natural, free-flowing state; however, there are potential unintended consequences to fish populations. Whereas Alternatives 5 and 6 would increase suitable coldwater stream habitat for native fish species like brook trout and longnose dace, it could also benefit non-native coldwater species like brown trout and rainbow trout. While it is recognized that these non-native trout species have the potential to depress native brook trout populations, overall benefits of river restoration outweighs the increase in these non-target fish species. Additionally, dam removal would not introduce brown trout or rainbow trout to additional river segments since they are already found throughout the Boardman River and in every non-impounded rivers segment where brook trout currently exist.

2.4.3 Water-Related Recreation

Other than recreational fishing, the Boardman River provides water-related recreation in the form of boating, canoeing, wading, and swimming. Both Alternatives 5 and 6 involve dam removal activities so both would have impacts to water-related recreation. Recreational activities within the impoundments that are typical of deeper, slow-moving waterbodies like boating would be replaced with activities associated with river habitat like kayaking, wading, and canoeing.

In addition to temporary negative impacts during construction activities to recreation facilities, including the Grand Traverse Natural Education Reserve, Traverse Bays Keystone Soccer Field, Oleson Foot Bridge, and two trail systems (Fife Trail and Boardman Valley Trail), Alternative 5 would have minor permanent impacts involving the relocation of existing minor trail systems. Alternative 6 would only impact the Grand Traverse Natural Education Reserve and the trail systems. These actions would be deemed site improvements and result in positive impacts by

providing better access to the Boardman River and an increase in recreational opportunities. The long-term improved recreational opportunities as a result of greater active and passive recreation use and an increase in the areas and lengths of existing recreation facilities would outweigh any short-term or permanent negative impacts.

Indirect and cumulative impacts would be positive for recreation. Planning efforts for the post Sabin Dam and Boardman Dam removals would most likely provide an increase in both passive and active recreational opportunities for surrounding parks and recreation facilities along the Boardman River. A proposed major trail known as the Boardman Valley Trail (North) would need to be slightly realigned based on data from 2012 GIS Land Use/Cover for Grand Traverse County. The realignment would follow the river waterfront closely based on the Boardman River being restored to its natural conditions and channel formation.

2.4.4 Aesthetics

Alternative 5 would have insignificant impacts on aesthetics as a result of the modifications to the Union Street Dam. Modifying the auxillary spillway at the dam would involve no permanent visual changes to the surrounding landscape. The impoundment would remain as open water with no impacts to existing cultural resources in the area. Any impacts incurred would be short term and temporary and would involve increased construction activities for the purpose of restoring the natural landscape setting.

The elements of ecological restoration associated with the dam removals included in both Alternatives 5 and 6 would provide both a direct and an indirect positive impact of overall visual enhancement and beneficial use of the natural resources. These alternatives would involve the relocation of the minor trail systems with only short-term and temporary aesthetic impacts during construction activities. These actions would be site improvements and result in no permanent adverse visual effects.

Stakeholder engagement regarding the project has included the community vision for the future of the Boardman River. The loss of the impoundments as a result of the two dams being removed is in line with the community goal to provide an enhanced environment and positive change to the visual landscape as a result of the natural ecosystem being restored. Any aesthetic negative impacts would be temporary and would involve increased construction activities for the purpose of restoring the natural landscape setting. The consideration of aesthetics is difficult to determine for the viewshed of residential homes within the vicinity of the Sabin Pond and Keystone Pond. Residential landowners would experience a change in their viewshed from existing views of open water to a view of vegetation associated with Alternatives 5 and 6.

2.4.5 Parks, National and Historical Monuments, National Seashores, Wilderness Areas, Research Sites, and Similar Preserves

Alternative 5 would have insignificant impacts on parks and similar preserves with the modification of the auxillary spillway at Union Street Dam. The direct impacts incurred to Lay Park would be short-term and temporary due to construction activities. However, these minimal impacts would be offset by the improved auxillary spillway providing improved downstream fish

passage and greater accessibility of fish along the river with the prevention of invasive species migration.

In addition, Alternative 5 would have impacts to recreation facilities, including the Grand Traverse Natural Education Reserve, Traverse Bays Keystone Soccer Field, Oleson Foot Bridge, and two trail systems (Fife Trail and Boardman Valley Trail) because of dam removal activities. The existing 228 acres of open land recreation at Grand Traverse Natural Education Reserve would decrease to 213 acres as a result of Alternative 5. The restored river alignment would impact 15 acres of open land recreation, and 0.5 linear mile of trails would be converted back to a free-flowing river. Specific impacts to existing recreation facilities based on the restored river alignment are shown in **Table 3**.

Table 3: Recreation Facilities Impacted by Alternative 5

Recreation Facility	Existing Site Area or Length (Acres or Linear Miles)	Alternative 5 Site Impacts
Grand Traverse Natural Education Reserve	228 Acres	15 Acres
Unnamed Existing Minor Trail	31.4 Linear Miles	0.4 Linear Mile
Boardman Valley Trail (Proposed)	10.5 Linear Miles	0.1 Linear Mile

Alternative 6 would still impact the Grand Traverse Natural Education Reserve and two trail systems (Fife Trail and Boardman Valley Trail), however, the impacts would be lessened and only associated with the Sabin Dam and its impoundment.

Besides the relocation of existing minor trail systems and impacts to the Grand Traverse Natural Education Reserve due to the new river channel alignment, the impacts associated with Alternatives 5 and 6 would be short-term and temporary due to during construction activities. All actions would be deemed site improvements and result in positive impacts by providing better access to the Boardman River and an increase in recreational opportunities. Consequently, associated positive impacts would outweigh any short-term negative impacts.

2.5 Subpart G: Evaluation and Testing

2.5.1 Chemical, Biological, and Physical Evaluation and Testing

Alternative 1 would not disturb impounded sediments or involve drawdown of the Boardman and Sabin impoundments below their existing levels. However, Alternatives 5 and 6 both involve sediment contamination and management. Given the potential for sediment contamination within the impoundments, multiple sediment sampling efforts have been conducted within the impoundments by the Great Lakes Environmental Center, Inc. (GLEC) and ECT in 2005, 2010, and 2012.

Based on a review of prior sediment sampling activities and lab analytical data, the following criteria were used to evaluate the impoundment sediments: Threshold Effect Concentrations (TECs), Probable Effect Concentrations (PECs), and MDEQ Michigan Default Background Levels, Drinking Water Protection Criteria (DWPC),[3] Direct Contact Criteria (DCC),[4] and Groundwater / Surface Water Protection Criteria (GSIPC).[5]

ECT collected sediment samples from Boardman and Sabin Ponds in 2005. The sediment samples were analyzed for pesticides, PCBs, polynuclear aromatic hydrocarbons PAHs, and 10 trace metals (arsenic, barium, cadmium, chromium, copper, lead, mercury, selenium, silver, and zinc). For Sabin Pond selenium exceeded Apparent Effects Threshold (AET) in one sample. For Boardman Pond arsenic exceeded the State default background level and MDEQ residential direct contact criterion. ECT noted that all of the sediment samples were received by the laboratory and analyzed in excess of the maximum allowable holding time; therefore, the analytical results cannot be fully relied upon. ECT recommended that six additional sediment samples be collected from each impoundment and be analyzed for total nickel, total manganese, total mercury, pesticides, PCBs, and PAHs.

GLEC collected sediment samples from Boardman and Sabin Ponds in late fall 2010. Sediment core and hand-held dredge samples were collected from six sites at Sabin Pond and six sites at Boardman Pond and were analyzed for 10 metals, PAHs / semivolatile organics (SVOCs), PCBs, organochlorine pesticides, total organic carbon, and percent moisture.

For Sabin Pond, all metals were below the TEC levels, and none exceeded MDEQ-established background sediment concentrations for wadeable streams. Arsenic levels exceeded the EPA-

[3] The drinking water criteria (DWC) were developed pursuant to Sections 20120a(1)(a), (b), and (d); 20120(a)(3) and (5); and 21304a(1) (2) of the Natural Resources and Environmental Protection Act (NREPA). The DWC represent concentrations of hazardous substances in drinking water that are safe for long-term consumption.

[4] The soil DCC represents a soil concentration that is protective against adverse health effects due to long-term ingestion of and dermal contact with contaminated soil. The DCC were developed pursuant to Sections 20120a(1)(a), (b), and (d); 20120(a)(3); and 21304a(1)(2) of NREPA.

[5] The Groundwater Surface Water Interface (GSI) is the location at which groundwater vents to a surface water body. Generic cleanup criteria for the GSI pathway have been developed pursuant to Sections 20120a(1) and 21304a of NREPA, R 299.5706a(4), and R 299.5716(6). The MDEQ has identified water quality standards for hazardous substances developed under Part 31 of NREPA that constitute generic GSI criteria consistent with R 299.5716(6). Water quality standards include chronic chemical-specific values that represent the most restrictive of the water quality values protective for aquatic life, human health, or wildlife; acute chemical-specific values protective of aquatic life; acute and chronic toxic units protective of aquatic life from groundwater toxicity testing; and standards for water quality characteristics (including physical characteristics, taste, and odor, etc.).

established TECs. No metals within the impoundment were found to be above the EPA-established PECs. The following metals were detected at levels well above the DEQ-established MI Default Background Levels: arsenic, barium, lead, manganese, and selenium. In addition, arsenic and manganese were above the DEQ-established residential DWPC, and arsenic, mercury, selenium and silver exceeded the DEQ-established GSIC. No metals exceeded the DEQ-established residential DCC.

No organochloride pesticides, PCBs, or SVOCs were detected in the sediment samples taken at Boardman Pond. Arsenic and cadmium were found in four of the six samples, slightly above the TEC but below the PEC. Barium, manganese, and selenium exceeded MDEQ-issued background sediment concentrations for wadeable streams in two or three of the six sample locations in Boardman Pond. Arsenic and cadmium were detected at levels well above the EPA-established TECs. No metals were detected at levels above the EPA-established PECs. The following metals were detected at levels well above the MDEQ-established Michigan Default Background Levels: arsenic, barium, cadmium, chromium, lead, manganese, mercury, selenium, and zinc. In addition, arsenic and manganese were above the MDEQ-established residential DWPC, arsenic was above the DEQ-established residential DCC, and arsenic, mercury, selenium, and silver were above the DEQ-established GSIPC.

GLEC sediment sampling of the Boardman and Sabin Ponds was conducted in May 2012. The sediment samples were analyzed for trace metals, including arsenic, barium, cadmium, chromium, copper, lead, manganese, nickel, selenium, zinc, silver, and mercury, PAHs, and PCBs. In addition, select sediment samples from both ponds were analyzed for Synthetic Precipitation Leaching Procedure (SPLP) for the above listed metals. The SPLP analytical data is typically used to evaluate the in-situ mobility of soil contaminants and determine whether or not the leaching of soil contaminants into groundwater sources is/would be causing unacceptable exposure risks especially at sites where drinking water and/or groundwater surface water interface are complete/relevant exposure pathways.

For Sabin Pond no metals were detected at concentrations above the EPA-established TECs or PECs. Arsenic and manganese were detected at concentrations exceeding the DEQ-established MI Default Background Levels; however, none of the metals analyzed exceeded the Michigan background sediment concentrations as reported in Reference Site Sediment Report for Wadeable Streams (MDEQ 1999). Arsenic, selenium and manganese were detected at concentrations exceeding the DEQ-established residential DWPC. Arsenic, mercury and silver were detected at concentrations exceeding the DEQ-established GSIPC, but no metals were detected at concentrations above the DEQ-established residential DCC. There were no PAHs or PCBs detected above the MDLs reported by the analytical laboratory.

Arsenic was detected in Boardman Pond sediment at concentrations exceeding the EPA-established TECs and DEQ-established MI Default Background Levels, residential DWPC, residential DCC, and GSIPC. No metals were detected at levels above the PECs. Arsenic, manganese and selenium were detected at concentrations exceeding the DEQ-established MI Default Background Levels; however, there were not any metals analyzed that exceeded the Michigan background sediment concentrations as reported in Reference Site Sediment Report for

Wadeable Streams (MDEQ 1999). Arsenic and manganese were detected at concentrations exceeding the DEQ-established residential DWPC, and only arsenic was detected at concentrations exceeding the DEQ-established residential DCC. Arsenic, mercury, selenium and silver were detected at concentrations exceeding the DEQ-established GSIPC. No PAHs or PCBs were detected above the method detection limits (MDLs) reported by the analytical laboratory.

Based on current site conditions and foreseeable recreational site use following the dam removals and river restoration, the most plausible exposure pathway is direct contact. Because arsenic is the only metal that was found to exceed the MDEQ-established residential DCC, a Site-Specific Recreational Use DCC was developed for arsenic and was conservatively developed as 18 mg/kg. This site-specific cleanup criterion, which was approved by the MDEQ, indicates that the detected concentrations of arsenic in both Boardman and Sabin Ponds would not pose unacceptable exposure to sediments to be moved from bottomland/riverbeds and spread on floodplain areas or sediments exposed in the bottomlands/riverbeds as a result of the drawdown of both impoundments. Dredging conducted within the impoundments would require sampling of stockpiled sediments to determine proper management actions in compliance with Federal and State regulations. If the sediment is determined unsuitable for reuse on site, it would be removed to an appropriate disposal/soil management location. Precautions would be taken to prevent loss of impacted sediments into the environment.

2.6 Subpart H: Actions Taken to Minimize Adverse Effects

Based on the findings of the Boardman River EA, implementation of the Recommended Alternative (Alternative 5) or Alternative 6 Remove Sabin Dam, would not have significant adverse, direct, indirect, or cumulative effects on the quality of the environment. The Recommended Alternative would restore the aquatic ecosystem of the Boardman River from Boardman Pond to Grand Traverse Bay. The Recommended Alternative restoration would improve habitat by restoring the coldwater temperature regime; allow sediment, organic material and woody debris to move downstream; remove barriers to fish passage for brook trout, longnose dace, and other coldwater fish within the Boardman River; and provide upstream passage for sturgeon around Union Street Dam via trap-and-transfer activities, opening up additional habitat for this State-listed (threatened) species. Alternative 6 would not provide sturgeon passage around the Union Street Dam and the restoration of segment 4 would be limited due to the presence of Boardman Dam.

The Recommended Alternative (Alternative 5) is preferable to Alternative 6 because it provides unconstrained habitat improvements for all coldwater fish species, opens up more habitat to sturgeon, and eliminates the negative water quality impacts created by both Sabin and Boardman Dams. Actions taken to minimize adverse effects to the aquatic ecosystem are discussed throughout the above analysis. However, a summary of all planned actions intended to minimize adverse effects to the aquatic environment are provided below.

- Aquatic invasive species (i.e. sea lamprey) would be prohibited from accessing upstream waters at the MDNR fish weir and the Union Street Dam. The Union Street Dam would be left in place as part of the chosen alternative (Alternative 5).
- The floodplain and channel excavation around Boardman Dam is anticipated to be completed in the dry.
- Erosion and turbidity controls would be used during construction until vegetation is established to provide natural erosion control on the drawn down impoundments.
- The incremental drawdown of the impoundment would be broken down into one-foot increments to minimize the amount of sediment being transported at any given time.
- To minimize risk of sediment migration Boardman Dam would be breached prior to Sabin Dam. This would allow for any sediment not detained by the sediment management techniques planned at Boardman Dam to be captured in the Sabin impoundment.
- Proposed fill areas avoid existing wetlands and developing wetlands, except for when channel excavations are necessary. These disturbances are expected to be minor and mostly temporary due to wetland plant species recolonizing newly excavated floodplains.

3.0 Finding of Compliance or Non-Compliance

a. Based on the above, the proposed action is determined to be in compliance with Section 404(b)(1) Guidelines of the 1977 Clean Water Act.

b. Alternatives considered in detail include 1) No Action, 5) Modify Union Street Dam and Remove Sabin and Boardman Dams, 6) Remove Sabin Dam. Alternative 5 is the proposed action. Implantation of the proposed action would not violate applicable State of Michigan water quality standards. A Section 401 (CWA) water quality certification, or waiver thereof, would be obtained from the State of Michigan prior to construction.

c. Implementing the proposed action would not result in significant adverse effects on human health or welfare, municipal and private water supplies, recreational fishing, aquatic life, wildlife dependent on the aquatic ecosystem, or the diversity, productivity and stability of the aquatic ecosystem at the project site. The proposed action has been coordinated under Section 7 of the Endangered Species act. The project would have no effect on Federally listed endangered or threatened species or their critical habitats.

d. Appropriate steps would be taken to minimize adverse environmental impacts on the aquatic ecosystem. Contract specifications would include specific environmental protection clauses to ensure protection of natural resources, such as construction in the dry to the maximum extent possible, use of erosion and turbidity controls, controlled drawdown to limit sediment movement, sequential dam breaching to minimize impacts.

e. The completed action would improve habitat in the lower 8 miles of the Boardman River above Union Street Dam by restoring the coldwater temperature regime; allow sediment, organic material and woody debris to move downstream; remove barriers to fish passage for brook trout, longnose dace, and other coldwater fish within the Boardman River; and provide upstream passage for sturgeon around Union Street Dam via trap-and-transfer activities, opening up additional habitat for this State-listed (threatened) species.

f. On the basis of the *Guidelines for Specification of Disposal Sites for Dredged or Fill Material* (40 CFR part 230), it has been determined that the proposed action is in compliance with Section 404 of the Clean Water Act.

g. No significant adaptations of the Section 404(b)(1) Guidelines were made relative to this evaluation.

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APPENDIX C

NATURAL AND BIOLOGICAL RESOURCES APPENDIX

Boardman River Common Wetland Plant Species			
Scientific Name	**Common Name**	**Wetland Type**	**Location**
Acer rubrum	Red Maple	Forested	Sabin Dam
Alnus rugosa	Speckled Alder	Scrub-Shrub	Sabin Dam Boardman Dam
Betula alleghaniensis	Yellow Birch	Forested	Sabin Dam
Bidens cernnuus	Nodding Bur-Marigold	Forested, Scrub-Shrub, Emergent	Boardman Dam
Carex spp.	Sedges	Emergent	Boardman Dam
Caltha palustris	Yellow Marsh Marigold	Forested, Scrub-Shrub, Emergent	Sabin Dam Boardman Dam
Chara spp.	Stonewort	Submerged	Sabin Dam Boardman Dam
Cornus amomum	Silky Dogwood	Scrub-Shrub	Sabin Dam Boardman Dam
Cornus stolonifera	Red-osier Dogwood	Scrub-Shrub	Sabin Dam Boardman Dam
Eupatorium maculatum	Spotted Joe-Pye-Weed	Emergent	Sabin Dam Boardman Dam
Eupatorium perfoliatum	Boneset	Emergent	Sabin Dam Boardman Dam
Fraxinus nigra	Black Ash	Forested	Sabin Dam
Impatiens capensis	Jewelweed	Forested, Emergent	Sabin Dam
Juncus articulatus	Jointed Rush	Emergent	Sabin Dam Boardman Dam
Juncus nodosus	Knotted Rush	Emergent	Sabin Dam Boardman Dam
Leersia oryzoides	Rice Cutgrass	Emergent	Boardman Dam
Lythrum salicaria	Purple Loosestrife	Emergent	Sabin Dam Boardman Dam
Onoclea sensibilis	Sensitive Fern	Forested, Emergent	Sabin Dam Boardman Dam
Nuphar advena	Yellow Pond-Lily	Submerged	Sabin Dam
Phalaris arundinacea	Reed Canary Grass	Emergent	Sabin Dam Boardman Dam
Phragmites australis	Common Reed	Emergent	Boardman Dam
Physocarpus opulifolius	Ninebark	Scrub-Shrub	Boardman Dam
Polygonum lapathifolium	Nodding Smartweed	Emergent	Boardman Dam
Populus tremuloides	Quaking Aspen	Forested	Sabin Dam

Boardman River Common Wetland Plant Species			
Scientific Name	**Common Name**	**Wetland Type**	**Location**
Potamogeton natans	Floating Pondweed	Submerged	Sabin Dam
Potamogeton pectinatus	Sago Pondweed	Submerged	Sabin Dam
Rosa multiflora	Multiflora Rose	Scrub-Shrub	Sabin Dam
Sambucus canadensis	Common Elder	Scrub-Shrub	Sabin Dam Boardman Dam
Salix exigua	Sandbar Willow	Scrub-Shrub	Sabin Dam Boardman Dam
Salix nigra	Black Willow	Scrub-Shrub	Sabin Dam Boardman Dam
Schoenoplectus pungens	Common Three-Square	Emergent	Boardman Dam
Schoenoplectus acutus	Hardstem Bulrush	Submerged, Emergent	Sabin Dam Boardman Dam
Thelypteris palustris	Marsh Fern	Forested, Emergent	Sabin Dam
Thuja occidentalis	Northern White-Cedar	Forested	Sabin Dam Boardman Dam
Typha angustifolia	Narrowleaf Cattail	Emergent	Sabin Dam Boardman Dam
Typha latifolia	Broadleaf Cattail	Emergent	Sabin Dam Boardman Dam
Verbena hastata	Blue Vervain	Emergent	Boardman Dam
Vinca minor	Myrtle	Scrub-Shrub	Sabin Dam
Vitis riparia	Riverbank Grape	Scrub-Shrub	Sabin Dam

Boardman River Fish and Mussel Species List	
Common Name	**Scientific Name**
American Brook Lamprey	*Lampetra lamottei*
Banded Killifish	*Fundulus diaphanus*
Black Bullhead	*Ictalurus melas*
Black crappie	*Pomoxis nirgomaculatus*
Blacknose dace	*Rhinichthys atratulus*
Blacknose shiner	*Notropis heterolepis*
Bluegill	*Lepomis macrochirus*
Bluntnose Minnow	*Pimephales notatus*
Brook Stickleback	*Culaea inconstans*
Brook Trout	*Salvelinus fontinalis*
Brown Bullhead	*Ictalurus nebulosus*
Brown Trout	*Salmo trutta*
Central Mudminnow	*Umbra limi*
Chinook Salmon	*Oncorhynchus tshawytscha*
Coho Salmon	*Oncorhynchus kisutch*
Common Carp	*Cyprinus carpio*
Common Shiner	*Notropis cornutus*
Creek Chub	*Semotilus atromaculatus*
Finescale Dace	*Phoxinus neogaeus*
Golden Shiner	*Notemigonus crysolueucas*
Goldfish	*Carassius auratus*
Grass Pickerel	*Esox americanus vermiculatus*
Green Sunfish	*Lepomis cyanelus*
Hornyhead Chub	*Nocomis biguttatus*
Iowa Darter	*Etheostoma exile*
Johnny Darter	*Etheostoma nigrum*
Lake Sturgeon	*Acipenser fulvescens*
Largemouth Bass	*Micropterus salmoides*
Longnose Dace	*Rhinichthys cataractae*
Mimic Shiner	*Notropis volucellus*
Mottled Sculpin	*Cottus bairdi*
Northern Brook Lamprey	*Ichthyomyzon fossor*

Boardman River Fish and Mussel Species List	
Common Name	**Scientific Name**
Northern Pike	*Esox lucius*
Northern Redbelly Dace	*Phoxinus eos*
Pumpkinseed	*Lepomis gibbosus*
Rock Bass	*Ambloplites rupestris*
Round Goby	*Neogobius melanostomus*
Sand Shiner	*Notropis stramineus*
Sea Lamprey	*Petromyzon marinus*
Slimy Sculpin	*Cottus cognatus*
Smallmouth Bass	*Micropterus dolomieui*
Spottail Shiner	*Notropis hudsonius*
Steelhead / Rainbow Trout	*Oncorhynchus mykiss*
Tiger Trout	*Hybrid cross of brown & brook trout*
Walleye	*Stizodstedion vitreum vitreum*
White Sucker	*Catostomus commersoni*
Yellow Bullhead	*Ictalurus natalis*
Yellow Perch	*Perce flavescens*
Zebra Mussel	*Dreissena polymorpha*

Source: ECT 2009, Fisheries Data

Grand Traverse County Threatened and Endangered Species List			
Scientific Name	**Common Name**	**Federal Status**	**State Status**
Accipiter gentilis	Northern goshawk	-	SC
Ammodramus savannarum	Grasshopper sparrow	-	SC
Antennaria parvifolia	Pussy-toes	-	SC
Atrytonopsis hianna	Dusted skipper	-	SC
Bog	-	-	-
Buteo lineatus	Red-shouldered hawk	-	T
Cirsium hillii	Hill's thistle	-	SC
Cirsium pitcheri	Pitcher's thistle	T	T
Cistothorus palustris	Marsh wren	-	SC
Coregonus artedi	Lake herring or Cisco	-	T
Cygnus buccinator	Trumpeter swan	-	T
Cypripedium arietinum	Ram's head lady's-slipper	-	SC
Dendroica kirtlandii	Kirtland's warbler	E	E
Dry Northern Forest	Dry Woodland, Upper Midwest Type	-	-
Dry-Mesic Northern Forest	-	-	-
Emergent Marsh	-	-	-
Gavia immer	Common loon	-	T
Glyptemys insculpta	Wood turtle	-	SC
Great Lakes Marsh	-	-	-
Haliaeetus leucocephalus	Bald eagle	-	SC
Hardwood-Conifer Swamp	-	-	-
Ixobrychus exilis	Least bittern	-	T
Lanius ludovicianus migrans	Migrant loggerhead shrike	-	E
Mesic Northern Forest	-	-	-
Northern Fen	Alkaline Shrub/herb Fen, Upper Midwest Type	-	-
Oak-Pine Barrens	-	-	-
Pandion haliaetus	Osprey	-	SC
Pine Barrens	Barrens, Upper Midwest Type	-	-
Pterospora andromedea	Pine-drops	-	T

Grand Traverse County Threatened and Endangered Species List			
Scientific Name	**Common Name**	**Federal Status**	**State Status**
Rallus elegans	King rail	-	E
Rich Conifer Swamp	-	-	-
Sistrurus catenatus catenatus	Eastern massasauga	C	SC
Tanacetum huronense	Lake Huron tansy	-	T
Utterbackia imbecillis	Paper pondshell	-	SC
Williamsonia fletcheri	Ebony boghaunter	-	SC
Wooded Dune and Swale Complex	-	-	-

Source: MNFI 2011
E = Endangered
T = Threatened
C = Candidate
SC = Special Concern

Sabin and Boardman Ponds Waterfowl List		
Scientific Name	**Common Name**	**Dam Area**
Actitis macularia	Spotted Sandpiper	Boardman
Anas platrhynchos	Mallard	Sabin and Boardman
Anas rubripes	American Black Duck	Sabin and Boardman
Aix sponsa	Wood Duck	Boardman
Aythya sp.	Scaup species	Sabin
Bucephala clangula	Common Goldeneye	Boardman
Bucephala albeola	Bufflehead	Sabin and Boardman
Butorides virescens	Green Heron	Sabin
Charadrius vociferus	Killdeer	Boardman
Coregonus artedi	Hooded Merganser	Sabin and Boardman
Cygnus buccinator	Common Merganser	Boardman
Cygnus olor	Mute Swan	Sabin and Boardman
Cypripedium arietinum	Ring-billed Gull	Sabin
Gavia immer	Common Loon	Sabin
Phalacrocorax auritus	Double-crested Cormorant	Boardman

Source: ECT 2009, Wildlife Data