DRAFT ENVIRONMENTAL ASSESSMENT (EA)

PROPOSED UPSTREAM AND DOWNSTREAM FISH PASSAGE FOR LAKE STURGEON AT MENOMINEE DAM AND PARK MILL DAM ON THE LOWER MENOMINEE RIVER IN THE CITIES OF MARINETTE WISCONSIN AND MENOMINEE MICHIGAN

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1. Purpose and Need

1.1. Purpose

North East Wisconsin Hydro Inc. (N.E.W. Hydro) proposes, in conjunction with the Menominee/Park Mill Implementation Team (IT), to construct and operate upstream and downstream fish passage facilities at their hydroelectric facility located on the Menominee River within the cities of Marinette, Wisconsin and Menominee, Michigan (Figure 1.1). The proposed facilities would be designed and operated to pass lake sturgeon (*Acipenser fulvescens*) upstream of the hydroelectric dams and to provide protection and bypass for all fish species moving downstream through the hydroelectric project. The facilities would be constructed adjacent to two active hydroelectric dams that are currently licensed by the Federal Energy Regulatory Commission (FERC). The

facilities are proposed to be constructed within the existing FERC project boundary, under the jurisdiction of the current FERC license (FERC Project No. P-2744). The Proposed Action would be implemented as a partnership between the licensee (N.E.W. Hydro) and The River Alliance of Wisconsin (RAW), U.S. Fish and Wildlife Service (FWS), Wisconsin Department of Natural Resources (WDNR), Michigan Department of Natural Resources (MDNR), and Michigan Hydro Relicensing Coalition (MHRC), collectively referred to as the Implementation Team (IT). It is important to note that N.E.W. Hydro is a small company, and as such, economic viability of the hydroelectric operations would need to be considered when selecting an alternative for the proposed project.

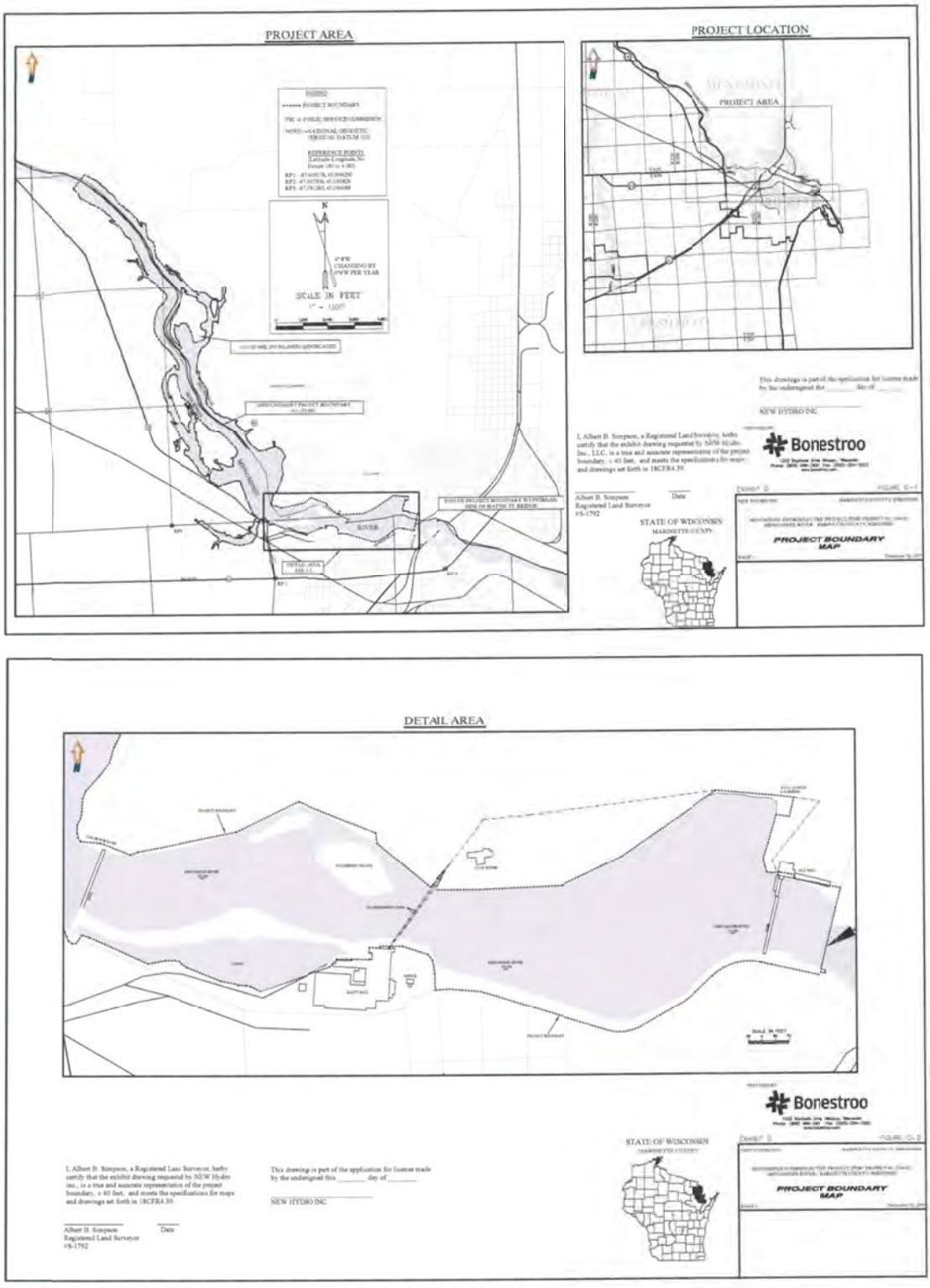

Figure 1.1: Map of the Menominee/Park Mill Hydroelectric Project. Source: N.E.W. Hydro

1.2. Need

The selected alternative should meet the following needs:

- A practical, effective, and economical means to allow fish to pass safely downstream of both Menominee and Park Mill dams.

- A practical and effective means to provide additional spawning and juvenile rearing habitat for lake sturgeon by providing passage upstream of both Menominee and Park Mill dams.

- An effective barrier to prevent the upstream passage of invasive species and harmful pathogens while minimizing upstream transfer of environmental contaminants.

1.3. Decisions That Need to Be Made

The U.S. Fish and Wildlife Service's (FWS) Regional Director at Bloomington, MN will select one of the alternatives analyzed in detail and will determine, based on the facts and recommendations contained herein, whether this Environmental Assessment (EA) is adequate to support a Finding of No Significant Impact (FONSI) decision, or whether an Environmental Impact Statement (EIS) will need to be prepared.

1.4. Background

The lake sturgeon is identified as a threatened species in Michigan, a species of special concern in Wisconsin, and a federal species of concern by the FWS. Numerous reports and plans, including the Great Lakes Fishery Commission's Fish Community Objectives for Lake Michigan (Eshenroder et al. 1995), Michigan Department of Natural Resources Lake Sturgeon Rehabilitation Strategy (Hay-Chielewski and Whelan 1997), Menominee River Fisheries Plan (coauthored by Wisconsin and Michigan Department of Natural Resources; Thuemler and Schnicke 1992), Wisconsin's Lake Sturgeon Management Plan (WDNR 2000), Wisconsin's Wildlife Action Plan (WDNR 2005), and Michigan's Wildlife Action Plan (Eagle et al. 2005) recommend reduction of and mitigation for threats to lake sturgeon in the Great Lakes and their tributaries. The most critical threat identified in these plans is habitat loss and fragmentation caused by the presence of dams, which has resulted in artificial barriers to migration and spawning. Because of this critical threat, all of the current fisheries management plans and recommendations relative to

the Lake Michigan and the Menominee River indicate the need for upstream and downstream fish passage around existing dams. The expected benefit of fish passage would be the reduction of habitat fragmentation and improved access to spawning and rearing habitat. The purpose of the proposed action would be to provide upstream and downstream fish passage at the lower two hydroelectric dams on the Menominee River, a tributary of Lake Michigan. For the purpose of this Environmental Assessment (EA), the only species targeted and analyzed for upstream passage would be the lake sturgeon. Downstream passage would be non-selective and would allow passage for any species.

Development of fish passage facilities integrated with an invasive species and pathogenic barrier at this site would be a major step forward in the restoration of historic fisheries on the Menominee River system as well as the waters of Lake Michigan. According to a recent Great Lakes Fisheries Trust (GLFT) funded study quantifying lake sturgeon habitat availability, an additional 22.5% of the total of high quality spawning habitat in the entire Menominee River would become available to Lake Michigan sturgeon after completion of fish passage at the lower two dams on the Menominee River (Daugherty 2006 and Daugherty et al. 2007). Added to the spawning habitat currently available below the lowermost Menominee River dam (Menominee Dam), the total amount of lake sturgeon spawning habitat would increase from 26 to 58 acres (Daugherty 2006 and Daugherty et al. 2007). Juvenile lake sturgeon rearing habitat (currently a critical deficiency) would increase from 212 to 1,610 acres (Daugherty 2006 and Daugherty et al. 2007). The integration of invasive species control into the fish passage structures at the Menominee Dam would continue to prevent undesirable species, such as sea lamprey (*Petromyzon marinus*), from moving into upstream river reaches and preclude the need for additional lamprey control measures. By continuing to exclude (or block) lamprey and by coordinating with the U.S. Fish and Wildlife Service's Sea Lamprey Control program to enhance lamprey trapping at this location, the Proposed Action would also help to control lamprey populations within the Great Lakes.

Project History

In 1985, the FERC issued a license for the Menominee / Park Mill Hydroelectric Project (FERC Project No. P-2744). This license attempted to address issues related to fish entrainment from turbine mortality through implementation of Article 401 of the project license which "requires the licensee (N.E.W. Hydro), after consultation with the MDNR, WDNR, and FWS, to develop a study plan to assess the impacts of project

operations on fish resources". To develop this plan, the parties involved had to determine monetary compensation values of fish, appropriate fish passage protection devices, costs of fish protection measures, a fish protection fund, and compensatory mitigation. Given the inability to reach consensus on these issues, the concerned parties used the FERC's *Dispute Resolution Service* and convened meetings beginning on July 25, 2002. On January 24, 2005, FERC issued an order approving the resultant settlement regarding the implementation of Article 401 of the license. To satisfy the requirements of Article 401, the licensee (N.E.W. Hydro) took several actions, including:

- Establishment of a *Fish Passage and Protection Fund* (FPPF) and annual monetary contributions of $7,644 (in 1992 dollars adjusted from Consumer Price Index) until the license expires in 2015.

- Contribution of an additional $100,000 to the FPPF through two equal deposits on or before January 1, 2006, and on or before January 1, 2007.

- Establishment of a team to implement the settlement agreement (Menominee/Park Mill Implementation Team). The Implementation Team (IT) is made up of representatives from N.E.W. Hydro, FWS, WDNR, MDNR, RAW, and MHRC.

The FERC ordered that the FPPF shall be used to assist with funding the design, construction, operation and maintenance of fish passage and protection facilities at the Park Mill Dam. However, construction and operation of fish passage and protection facilities is not explicitly required as part of this Article. Planning for fish passage facilities for the Menominee Dam was also included by mutual agreement by the Implementation Team (IT). Since 2004, the IT has met regularly to develop fish protection and passage plans for both Park Mill and Menominee dams with the purpose of reconnecting lake sturgeon with historical spawning and rearing habitat in the Menominee River upstream of the dams, while also reconnecting the remnant upstream lake sturgeon population with the Lake Michigan population.

The IT held regular meetings from 2004 through 2009 to develop conceptual plans and cost estimates for installing fish passage and protection facilities at both dams. On July 13, 2009, the IT unanimously approved the first version (Version 1.0) of the "Fish Passage and Protection Plan for Menominee/Park Mill Hydroelectric Complex (FERC Project No. 2744): Alternatives, Conceptual Designs and Cost Estimates" (Utrup et al.,

2009), also known as the Conceptual Report. On October 29, 2009, the IT amended the Conceptual Report and unanimously approved the second and most up-to-date version (Version 1.1). This report outlines the preliminary development of fish passage concepts for the two dams and forms for the framework for the Proposed Action. The Conceptual Report, as amended, is available in Appendix A.

In 2009, funding became available through the Great Lakes Restoration Initiative (GLRI) for the purpose of restoring habitat for lake sturgeon and other organisms in the Great Lakes. The River Alliance of Wisconsin, a member of the IT and a not-for-profit organization, used the Conceptual Report to develop and submit applications for two GLRI grants.

In 2010, the IT (by way of RAW) was awarded two GLRI funded grants totaling $3 million (and a total committed match of $1.39 million from the dam owner, N.E.W. Hydro). The first grant was awarded through the National Fish and Wildlife Foundation (NFWF) for the purpose of constructing downstream fish passage and protection facilities to allow protection and safe passage of fish moving downstream past the Park Mill Dam on their way to Lake Michigan. A total of $1.5 million was received through the NFWF grant with a private match commitment of $662,000 to be provided by the dam owner (N.E.W. Hydro). The second grant was funded through the U.S. Environmental Protection Agency (EPA) for the purpose of constructing an upstream fish passage facility to allow lake sturgeon, migrating from Lake Michigan, to carry out their spawning migration by reconnecting the population to 21 miles of available spawning and rearing habitat above the lower two dams, while also maintaining a barrier to invasive species and harmful pathogens (to be achieved by passing fish through a sorting and holding/testing facility). A total of $1.5 million was received through the EPA grant with a private match commitment of $724,250 to be provided by the dam owner (N.E.W. Hydro).

Through federal funds (provided by the GLRI) and private match (committed by the dam owner, N.E.W. Hydro), the IT has received $4.39 million to begin construction of upstream and downstream fish passage at Menominee and Park Mill Hydroelectric dams. The IT is ready to move forward with construction, pending the results of this EA.

1.5. Scope of Analysis

This Environmental Assessment (EA) fulfills the requirements of the National Environmental Policy Act (NEPA).

The overall scope of this EA involves investigating potential negative environmental consequences from constructing and operating upstream and downstream fish passage

facilities at the lower two dams on the Menominee River located in the cities of Marinette, Wisconsin and Menominee, Michigan (Figure 1.1). More specifically, this EA will investigate whether there are any significant negative environmental consequences from constructing an upstream fish passage and passing lake sturgeon from below the Menominee Dam to above the Park Mill Dam. In addition, this EA will investigate whether there are any significant negative environmental consequences from constructing a downstream fish passage and providing an open bypass for all fish species to move volitionally from above Park Mill Dam to the intermediate reservoir between Park Mill Dam and Menominee Dam, whereby the fish will either maintain residence or be transported downstream volitionally through the Menominee Dam spillway.

1.6. List of Acronyms Used

AOC	Area of Concern
BMP	Best Management Practice
CFS	Cubic Feet per Second
CZMA	Coastal Zone Management Act
EA	Environmental Assessment
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
EPRI	Electric Power Research Institute
FERC	Federal Energy Regulatory Commission
FONSI	Finding Of No Significant Impact
FPA	Federal Power Act
FPPF	Fish Passage and Protection Fund
FPS	Feet per Second
FWCA	Fish and Wildlife Coordination Act
FWS	U.S. Fish and Wildlife Service
GLFT	Great Lakes Fisheries Trust
GLRI	Great Lakes Restoration Initiative
Hg	Mercury
IT	Implementation Team
MDNR	Michigan Department of Natural Resources
MHRC	Michigan Hydro Relicensing Coalition
NEPA	National Environmental Policy Act
N.E.W. Hydro	North East Wisconsin Hydro Inc.

NFWF	National Fish and Wildlife Foundation
NHPA	National Historic Preservation Act
NPS	National Park Service
OCRM	Ocean and Coastal Resource Management
PAH	Polyaromatic Hydrocarbons
PCB	Polychlorinated Biphenyls
RAP	Remedial Action Plan
RAW	River Alliance of Wisconsin
SF	Significance Factor
SHPO	State Historic Preservation Officers
SI	Overall quality of habitat
USGS	U.S. Geological Survey
VHS	Viral Hemorrhagic Septicemia
WDNR	Wisconsin Department of Natural Resources

1.7. Internal Scoping

The IT has intervened regular meetings since 2004 to discuss options for fish passage at Menominee and Park Mill dams. Because of this intensive collaboration, the IT has developed a Conceptual Report (Appendix A), as amended, that outlines Alternatives, Conceptual Designs, and Cost Estimates for upstream and downstream fish passage. The proposed action of fish passage has two natural components:

- Upstream passage facilities to provide movement of lake sturgeon from Lake Michigan to the Menominee River above Park Mill Dam.

- Downstream passage and protection facilities to provide safe bypass for all fish species (including adult and juvenile lake sturgeon) that are migrating or moving downstream past Park Mill and Menominee dams to Lake Michigan

Through careful deliberation, the IT has established an alternative for the Proposed Action, and various other alternatives, some of which have been eliminated from further consideration because of, but not limited to, high cost, maintenance concerns, dam safety concerns, operation constraints, and overall low feasibility.

1.8. Summary of Authorizing Programs and Laws

Fish and Wildlife Coordination Act

The Fish and Wildlife Coordination Act (FWCA) provides the basic authority for the FWS's involvement in evaluating impacts to fish and wildlife from proposed water resource development projects. It requires that fish and wildlife resources receive equal consideration to other project features. It also requires Federal agencies that construct, license or permit water resource development projects to first consult with the FWS (and the National Marine Fisheries Service in some instances) and State fish and wildlife resource agencies regarding the impacts on fish and wildlife resources, and measures to mitigate these impacts.

Federal Power Act

The Federal Power Act (FPA) provides for federal regulation and development of water power and resources, authorizing the FERC to issue licenses for hydroelectric project works, including dams, reservoirs and other works to develop and improve navigation and to develop and use power. Regulations within the FPA that are relevant to fish and wildlife resources include:

- Section 4(e) - Land management agencies can require license conditions
- Section 10(a) - Recommendations of resource agencies and Tribes must be considered
- Section 10(j) - U.S. Fish and Wildlife Service recommendations must be included in the project license unless inconsistent with other Federal Law
- Section 18 – The Department of the Interior, through the FWS, is given the right to mandatory prescription of fishways at dams where warranted

Endangered Species Act

To facilitate compliance with Section 7(c) of the Endangered Species Act of 1973, as amended, Federal agencies are required to obtain information from the FWS concerning any species, listed or proposed to be listed, that may be present in the area of proposed action.

National Environmental Policy Act (NEPA)

The National Environmental Policy Act (NEPA) requires federal agencies to integrate environmental values into their decision making processes by considering the environmental impacts of their proposed actions and reasonable alternatives to those actions. To meet NEPA requirements, federal agencies prepare an environmental analysis known as an Environmental Assessment (EA). If it is determined that there may be significant impacts to the human environment, a more detailed statement, known as an Environmental Impact Statement (EIS), is prepared.

National Historic Preservation Act

The National Historic Preservation Act (NHPA) requires federal agencies to manage cultural resources under their jurisdiction and authorizes the Secretary of the Interior to maintain the National Register of Historic Places (National Register). Section 106 of the NHPA requires federal agencies to take into account the effect of the proposed undertaking on any district, site, building, structure, or object that is included in or eligible for inclusion in the National Register. The agency must afford the Advisory Council on Historic Preservation, established under Title II of NHPA, a reasonable opportunity to comment on such undertaking.

Clean Water Act

Under Section 401(a)(1) of the Clean Water Act, an applicant for a federal license or permit to conduct an activity that may result in a discharge into waters of the United States must provide the licensing or permitting agency with water quality certification that the discharge would not violate water quality standards from the applicable state. The federal agency may not authorize the activity unless certification has been obtained or the state has waived certification through failure to act on the request for certification within one year after the receipt of that request.

2. Alternatives, Including the Proposed Action

For a detailed account of the initial scoping process and preliminary alternatives analysis, please refer to the Conceptual Report (Appendix A).

2.1. Alternatives Not Considered for Detailed Analysis

Conventional Fish Ladders to Allow Volitional Fish Passage

The first and most conventional option that was discussed for fish passage was the construction and operation of a fish ladder or rock ramp. Because the target species is lake sturgeon, any fish ladder would need to be constructed at a much shallower angle with slower water velocities than what is typical for salmonid species. Because there are no known prototype fish ladders or rock ramps for lake sturgeon passage, the IT considered this to be an experimental technology. As such, it was determined by the IT to not consider this alternative as a viable means for fish passage, relative to lake sturgeon.

Another constraint for a volitional (or passive) fish passage alternative, such as a fish ladder, is uncontrolled movement of invasive species. One of the Needs for this project

is to maintain an effective barrier to prevent the upstream passage of invasive species and harmful pathogens (see Section 1.2 above). A passive form of fish passage would be unacceptable and was therefore not considered for further analysis.

Behavioral Modifiers to Capture Fish and/or Manipulate Fish Movement

Behavioral modifiers are typically used to "spook" or "herd" fish by using a combination of air bubbles, sound, and strobe lighting. The intention would be to either keep fish away from the dams or direct the fish to a bypass or other means of fish passage. This technology is considered experimental and has not been proven effective in either attracting or guiding fish in the Menominee River (Amaral et al. 1998). Field evaluations of behavioral modifiers at the White Rapids Dam on the Menominee River do not support further testing or application of these devices at sites similar to White Rapids in design and with similar biological and environmental conditions (Amaral et al. 1998). Menominee and Park Mill Dams are similar in design and have the same biological and environmental conditions as White Rapids Dam, therefore this alternative was removed from further consideration.

Dam Removal

It is anticipated that members of the IT and local stakeholders would not participate in any dam removal alternative. N.E.W. Hydro has confirmed that dam removal is not a viable option because it would result in lost hydropower production. The hydropower plant is currently licensed by FERC and must be operated and maintained according to the license. Dam removal is not allowed under the current license and is not being considered in the upcoming relicensing (new license expected to be issued in 2015). This alternative was therefore removed from further consideration.

A summary of management alternatives not considered for detailed analysis can be found in Table 2.1.

Table 2.1: Summary of Management Alternatives Not Considered for Detailed Analysis

Alternative	**Activity**	**Comments**
Conventional Fish Ladder to Allow Volitional Fish Passage	Upstream and downstream movement through a constructed fish ladder or rock ramp with volitional fish and water movement	Would not maintain a barrier to invasive species, environmental contaminants, and harmful pathogens

Behavioral Modifiers to Capture and/or Manipulate Fish Movement	Behavioral manipulation would create a false barrier to migration or aim to direct fish to a trap or fish bypass structure	Considered an experimental technology Field studies have suggested that behavioral modifiers would be ineffective for sturgeon or other fishes in the Menominee River (Amaral et al. 1998)
Dam Removal	Complete removal of the dams would allow free and unencumbered passage upstream and downstream of the current dams	Would be an unacceptable alternative for FERC, the dam owner, and the local community Would not maintain a barrier to invasive species and harmful pathogens and would not minimize upstream transfer of environmental contaminants.

2.2. Alternatives Carried Forward for Detailed Analysis

The following Alternatives are considered the most feasible by the IT and meet at least one of the Needs outlined in Section 1.2 above.

Table 2.2 provides a summary of the Alternatives carried forward along with comments from the detailed analysis.

2.2.1. Alternative A – Upstream Fish Elevator / Downstream Fish Bypass (Proposed Action)

As determined through the scoping process, the IT identified two main objectives for the Proposed Action: 1) Upstream passage of lake sturgeon past Menominee and Park Mill dams and 2) Downstream protection and bypass of all fish species past Park Mill Dam and then Menominee Dam. To fulfill these objectives, and meet the Needs outlined in Section 1.2 above, N.E.W. Hydro, in conjunction with the IT, would construct

and operate both upstream and downstream fish passage and protection facilities as follows:

Upstream Fish Passage

Through careful consideration of all available alternatives, it had been determined by the IT that a fish elevator would be the most practical, effective, and economical means for passing lake sturgeon from below the Menominee Dam to above the Park Mill Dam. Fish elevator technology has evolved over the past 30 years and is widely accepted as a practical, low cost, means for passing fish over high-head dams. Fish elevators are currently in use at many dams throughout the world and have been documented to successfully pass sturgeon at rivers on both the East and West Coasts of North America. Because an elevator would only deliver fish to a sorting tank, this technology would ensure maintenance of an absolute barrier between the tailwater of Menominee Dam and the Park Mill headwaters, thus fulfilling the need to maintain a barrier to invasive species and harmful pathogens while minimizing the upstream transfer of environmental contaminants (see Section 1.2 above).

Under the Proposed Action (Alternative A), N.E.W. Hydro, in conjunction with the IT, would construct a fish elevator inside an empty turbine bay within the existing Menominee Dam Powerhouse. More specifically, the elevator would be placed within Turbine Bay #5, located within the northern most flume of the Menominee Dam Powerhouse (Appendix B). The bottom of the elevator entrance channel would be located approximately three feet from the river bottom directly in front of the empty Turbine Bay #5. The entranceway would extend upstream into the empty turbine bay where the elevator hopper would be located. The elevator hopper would be submerged while fishing and, when raised, would crowd the fish into a hopper pool for vertical transport of approximately 27 feet. Upon reaching the top of the vertical transport, the hopper would discharge the contents into a primary sorting tank located within the secure confines of the Menominee Dam Powerhouse Service Area. Upon entry in to the primary sorting tank, trained biologists, including representatives from state and federal agencies, would hand select lake sturgeon that would be translocated to above Park Mill Dam. All other by-catch (including non-target native species and non-native or invasive species) would be safely returned to the Menominee Dam tailrace via a sluice pipe. See Conceptual Plans for the Upstream Fish Elevator in Appendix B. N.E.W. Hydro would not be primarily responsible for handling or sorting activities, however, they may provide assistance to the Agencies as needed.

Lake sturgeon selected for passage upstream would be sluiced into a waiting transport trailer (e.g. large mobile fish tank) and transported upstream via transport truck. All lake sturgeon sorting, transport, and translocation activities would be monitored and implemented jointly by WDNR and MDNR, with assistance from FWS as needed. Initially, the IT would plan to pass a maximum of 90 reproductively active lake sturgeon upstream annually at a ratio of five males to one female (or approximately 75 males and 15 females).

Please see Appendix C for the "Upstream Lake Sturgeon Passage Operation Plan"

Downstream Fish Passage and Protection

To date, the majority of safe and successful downstream passage around hydropower dams in the Northeast United States are provided by way of an angled bar rack or louver system (referred to in this EA as an "Angled Fish Guidance Rack"). This method works by guiding downstream moving fish along an angled trash rack to a bypass built into the power canal of a hydroelectric powerhouse. Successful laboratory demonstration of this alternative for Menominee River fishes, including lake sturgeon, is demonstrated by Amaral (2001).

Under the Proposed Action (Alternative A), N.E.W. Hydro, in conjunction with the IT, would construct an angled fish guidance rack upstream of the existing trash racks of the Park Mill Dam Powerhouse. This guidance rack would connect to a bypass structure designed to safely direct migrating or downstream-moving fish around the Park Mill Dam. This bypass structure would connect to a pipe conveyance enabling safe passage to the Park Mill Dam tailrace. See Conceptual Plans for the Downstream Fish Passage and Protection in Appendix D.

Under the Proposed Action (Alternative A), downstream migration and movement of all fish species would be facilitated by a constructed fish bypass system. Under the Proposed Action, N.E.W. Hydro would fulfill the requirements of Article 401 of the FERC license because appropriate fish protection and entrainment mitigation would have been achieved. The Proposed Action would likely release N.E.W. Hydro from its obligation to provide annual contributions to the FPPF in the amount of $7,644 (in 1992 dollars adjusted from Consumer Price Index) until the license expires in 2015. This alternative would provide protection from potential impingement and entrainment of downstream migrating and moving fish through the hydroelectric turbines at Park Mill Dam and would provide a more effective reconnection of the upstream and downstream fishery.

To facilitate safe passage to below Menominee Dam, one alternative that has been discussed would be for N.E.W. Hydro to modify or open an existing Tainter Gate at the Menominee Dam to allow bypassed fish to spill safely through the Menominee Dam spillway gates to below the Menominee Dam. Economics of such an alternative, as it relates to period of passage, would still need to be negotiated relative to project operation. However, notwithstanding any approved tainter gate modification, fish would still be able to move downstream of Menominee Dam through normal run-of-the-river operation when the river discharge exceeds the hydraulic capacity of the hydroelectric turbines and the spill gates are open.

Figure 2.2.1 provides a conceptual overview of the Proposed Action (Alternative A) Please refer to Appendix E for the "Downstream Fish Passage Operation Plan".

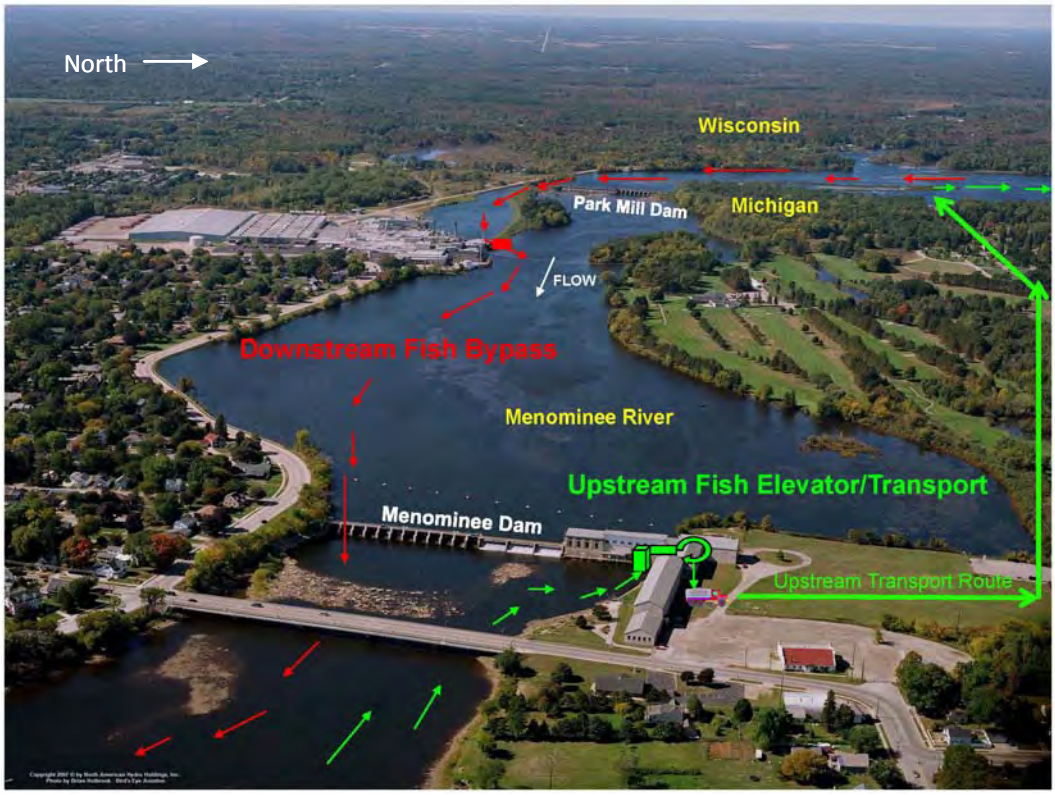

Figure 2.2.1: Conceptual overview of the Proposed Action (Alternative A). The downstream pointed arrows denote the downstream migration/movement of fish. The upstream pointed arrows denote the upstream migration/movement of lake sturgeon.

2.2.2. Alternative B – No Action

Under the No Action Alternative (Alternative B), no changes would occur to the existing conditions at the Menominee / Park Mill Hydroelectric dams. Alternative B assumes the dam operations remain status quo and fish would not be transported upstream or downstream of the dams by way of a fishway. It is reasonable to assume that under this alternative, N.E.W. Hydro would not construct upstream fish passage facilities for lake sturgeon at Menominee Dam. Also under this alternative, it is reasonable to assume N.E.W. Hydro would not improve fish protection or provide effective bypass around the dams for fish migrating or moving downstream. N.E.W. Hydro has a vested interest in maintaining the dams for their economic value, and has spent money to maintain the dams and continue with fish passage studies. The state and federal agencies have a vested interest in providing fishery access above the dams. Based upon dam inspections, there are no apparent structural deficiencies in the dams. Furthermore, it is likely that the dams would be maintained for the foreseeable future. This alternative would continue to restrict upstream migrating lake sturgeon from accessing historical spawning grounds in the headwaters of the Menominee River. Lake sturgeon habitat would remain fragmented and fish populations would continue to be negatively impacted under the No Action alternative.

Under the No Action Alternative (Alternative B), downstream migration and movement of all fish species would continue to be interrupted by the existing hydroelectric dams. Under the No Action Alternative, N.E.W. Hydro would continue to make annual contributions to the FPPF in the amount of $7,644 (in 1992 dollars adjusted from Consumer Price Index) until the license expires in 2015. This alternative would continue to allow for potential impingement and entrainment of downstream migrating and moving fish through the hydroelectric turbines at Park Mill Dam and prevent effective reconnection of the upstream and downstream fishery. While this alternative would maintain current protections against upstream movement of invasive species and disease, lake sturgeon habitat would remain fragmented and fish populations would continue to be negatively impacted under the No Action Alternative.

2.2.3. Alternative C – Trap and Transfer with No Facilities

Trap and transfer is considered the most rudimentary form of fish passage. This alternative would involve manual capture of fish below the Menominee Dam (i.e., by netting or electrofishing), sorting of target species in a boat or on-shore, and manual transfer of fish to a location upstream of the Park Mill Dam via transport trailer (e.g.

large mobile fish tank). Arguably, this alternative is not so much fish passage as it is fish translocation.

This method has been attempted before with lake sturgeon and has been fairly inefficient. In addition, this alternative would be more stressful on the fish. Large fish, such as sturgeon, are more susceptible to injuries from electrofishing and/or netting, which may result in higher stress to the fish and an increased chance of aborted or interrupted spawning. While capture by means of electrofishing and netting is acceptable for research purposes, impacts from long term use of these methods for translocation has not been analyzed. It should be noted that studies have shown the capacity of sturgeon eggs to undergo final maturation could be adversely affected by the sturgeon's own physiological or metabolic response to unfavorable environmental or husbandry conditions, such as abrupt temperature changes and rough or frequent handling (Chapman and Eenennaam 2007). Netting and electrofishing would also be non-selective, meaning there would be a high likelihood that lake sturgeon captured with this alternative may not be ready to spawn.

Under Alternative C, downstream migration and movement of all fish species would continue to be interrupted by the existing hydroelectric dams. Under Alternative C, N.E.W. Hydro would continue to make annual contributions to the FPPF in the amount of $7,644 (in 1992 dollars adjusted from Consumer Price Index) until the license expires in 2015. This alternative would continue to allow for potential injury of downstream migrating and moving fish through the hydroelectric turbines at Park Mill Dam and prevent effective reconnection of the upstream and downstream fishery. Lake sturgeon habitat would remain fragmented and fish populations would continue to be negatively impacted under Alternative C.

Table 2.2: Summary of Management Alternatives Considered for Detailed Analysis

Alternative	**Activity**	**Comments**
Alternative A – Upstream Fish Elevator / Downstream Fish Bypass (Proposed Action)	Fish elevator to move spawning lake sturgeon upstream of Menominee and Park Mill dam and a downstream bypass to allow young lake sturgeon and other river fishes to safely reach Lake Michigan	Would meet all the needs presented Section 1.2 Would allow for restricted upstream movement of fish and control of invasive species, environmental contaminants, and harmful

	from above Park Mill Dam	pathogens.
Alternative B – No Action	Status quo	Would continue to block lake sturgeon from migrating upstream to spawn Would continue to pose a potential entrainment and impingement risk to downstream moving fish at Park Mill Dam Would continue to block invasive species, environmental contaminants, and harmful pathogens from infesting the upper reaches of the river Would not meet the needs for downstream passage
Alternative C – Trap and Transfer with No Facilities	Manual capturing of lake sturgeon in the Menominee Dam tailwater with nets and electrofishing for field sorting and manual transfer upstream of Park Mill Dam	Would not meet the needs for downstream passage Would allow for restricted upstream movement of lake sturgeon and control of invasive species, environmental contaminants, and harmful pathogens.

3. Affected Environment

3.1. Physical Characteristics

Basin description

The Menominee River flows generally southeastward across Precambrian crystalline bedrock at gradients of about 7 feet per mile, with some reaches having gradients of 20 to 30 feet per mile. For the last of its 147 mile course, the Menominee River flows at a gradient of about 2 feet per mile across ground moraine and glacial lake deposits overlying the Paleozoic sedimentary bedrock.

The surface area of the basin is about 96% land and 4% water, taking into consideration only that water area which includes streams at least 1/8 mile wide and lakes greater than 10 acres.

On the land area of the basin, 67% is in public and private forests, 17% is agricultural, and 2% is Urban, and 14% is "other" land which includes small lakes and streams, ungrazed wetlands and swamps, and various county owned parcels.

The basin is covered by both stratified and un-stratified drift. Most of the stratified drift consists of outwash and ice-contact deposits in the upper reaches and lacustrine deposits in the Marinette area. The stratified deposits are generally sand or loamy sand with layers of silt. Occasional deposits of loess mantle the outwash deposits. Un-stratified drift is found in the middle portion of the basin and underlying the stratified drift in the upper reaches of the basin. The un-stratified drift is typically ground or end moraine consisting of cobbly silty sand and till.

Area of Concern

Portions of the cities of Menominee, Michigan and Marinette, Wisconsin, including the area below Park Mill Dam, has been designated as an Area of Concern (AOC) by the Environmental Protection Agency (http://www.epa.gov/glnpo/aoc/menominee.html) and is the subject of a Plan of Action (POA) to isolate and treat contaminated groundwater and contaminated sediment along the river, including the Ansul industrial site and a paint sludge dump site. Beneficial Use Impairments (BUI) resultant from water and sediment contamination within the AOC includes the following:

- Restrictions on fish and wildlife consumption
- Beach closings
- Degradation of benthos
- Restriction on dredging activities

- Degradation of fish and wildlife populations
- Loss of fish and wildlife habitat

Dam operation

The Menominee and Park Mill Hydroelectric Dams are operated in Run-of-river mode, meaning the outflow of water from the dams must approximate the inflow of water to the dams.

Run-of-river operation impacts on water quality at hydroelectric generating facilities are minimal and include temperature (solar heat gain in reservoirs), and dissolved oxygen issues. Stable reservoir operating elevations minimize shoreline erosion and attendant habitat destruction. Turbulence in the tailrace and/or dam spillway is a compensating impact, tending to increase downstream dissolved oxygen.

Existing Habitat Plans

The Proposed Action is in conformance with the goals and objectives of Fish Community Objectives for Lake Michigan, Great Lakes Fishery Commission Special Publication 953 (Eshenroder et al. 1995); Lake Michigan Lake Wide Management Plan, U.S. Environmental Protection Agency (LaMP 2000); Menominee River Fisheries Plan, Michigan and Wisconsin DNR (Thuemler and Schnicke 1992); Wisconsin's Lake Sturgeon Management Plan, WDNR Bureau of Fisheries Management and Habitat Protection (WDNR 2000); Wisconsin's Wildlife Action Plan (WDNR 2005); Michigan's Lake Sturgeon Rehabilitation Strategy (Hay-Chielewski and Whelan 1997); and Michigan's Wildlife Action Plan (Eagle et al. 2005).

In particular, the Upper Green Bay Basin Integrated Management Plan (WDNR 2001) specifies that agencies should "…continue to support the study of fish passage technology at hydroelectric dams and implement those technologies where appropriate to reduce habitat fragmentation."

Providing passage around the dams for lake sturgeon and other fishes is also consistent with the goals and objectives of Michigan's Lake Sturgeon Rehabilitation Strategy (Hay-Chielewski and Whelan 1997), which states "The primary goal…is to conserve and rehabilitate self-sustaining populations of lake sturgeon to a level that will permit delisting as a threatened species under the Michigan Endangered Species Act (Section 36505(1a), Part 324, of Act 451 of 1994)".

According to the Draft Fish and Wildlife Population and Habitat Management and Restoration Plan for the Lower Menominee River Area of Concern (Axness et al., 2011), one of the delisting goals is to "enhance the lake sturgeon population" in the AOC

through providing passage at Menominee and Park Mill Dams. Axness et al. (2011) recommends that upstream and downstream passage facilities be constructed at Menominee and Park Mill dams by 2015.

3.2. Biological Environment

The Project waters consist of two reservoirs with a total surface area of 682 acres, and 11.6 miles of shoreline. The lower of the two reservoirs (below Park Mill Dam) is located within the Menominee River Area of Concern (see Section 3.1 above, Figure 3.2).

The river within the AOC is on the 303 (d) Impaired Waters List, pertaining to Section 303 of the Clean Water Act. This impairment is due, in large part, to contaminated river sediment and fish tissue from arsenic, Hg, PAHs, PCBs. (http://www.dnr.state.wi.us/water/Water_AdvSrch.aspx and http://www.dnr.wi.gov/Water/ImpairedWater_AdvSearch.aspx)

There are existing fish consumption advisories for this area of the river, as well as other BUI's for aquatic life, recreational use, and fish health (See Section 3.1 above). (http://www.epa.gov/glnpo/aoc/menominee.html)

A portion of this AOC is also designated as a Superfund Alternative Site. (http://www.epa.gov/region5superfund/npl/sas_sites/WIN000509952.htm)

Figure 3.2: Menominee River Area of Concern. The "Upper Scott Paper Company Dam" labeled on the map is also known as the Park Mill Dam.

Several studies have been conducted to determine the species present in the Project waters, and their abundance. Data for tables 3.2.1 and 3.2.2 is from the cited references on the tables. Two studies focused on the Lower Scott Flowage (between the Menominee and Park Mill Dams), and two studies focused on the Upper Scott Flowage (above the Park Mill Dam). The studies were conducted over a 19 year period and used several methods for data collection.

Table 3.2.1: Documented Species in Project Waters, tabulates the results obtained from two studies in the Lower Scott flowage, and two studies in the Upper Scott Flowage.

Species	Lower Scott Flowage		Upper Scott Flowage	
	(Korney 1991)	(Donofrio 2006a)	(Harza 1988)	(Donofrio 2006b)
Black Bullhead	**x**			
Black crappie	**x**	**X**	**X**	**X**
Bluegill	**x**	**X**	**X**	**X**
Bowfin		**X**		**X**
Brown bullhead	**x**	**X**		
Bullhead sp				**x**
Burbot			**X**	
Channel catfish	**x**		**X**	
Common Carp		**X**		
Fantail Darter			**X**	
Gizzard Shad		**X**		
Johnny Darter			**X**	
Lake Sturgeon			**X**	**X**

Largemouth Bass	**x**			**X**
Least Darter			**X**	
Muskellunge				
Northern Pike	**x**	**X**	**X**	**X**
Pumpkinseed	**x**	**X**	**X**	**X**
Rainbow trout		**X**		
Redhorse spp		**X**	**X**	**X**
Rock Bass	**x**	**X**	**X**	**X**
Smallmouth Bass	**x**	**X**	**X**	**X**
Splake		**X**		
Sucker sp				**x**
Tadpole madtom			**X**	
Walleye	**x**	**X**	**X**	**X**
White sucker		**X**	**X**	**X**
Yellow Bullhead	**x**			**X**
Yellow Perch	**x**	**X**	**X**	**X**

Table 3.2.2: Upper Scott Flowage and Lower Scott Flowage-Comparative Species Abundance, compares species and their relative abundance in the two reservoirs.

SPECIES	**LOWER FLOWAGE** (Donofrio 2006a) % TOTAL	**UPPER FLOWAGE** (Harza 1988) % TOTAL
Black crappie	**5%**	**6%**

Bluegill	**16%**	**2%**
Bowfin	**2%**	**0%**
Brown bullhead	**1%**	**0%**
Burbot	**0%**	**3%**
Channel catfish	**0%**	**1%**
Common Carp	**1%**	**0%**
Fantail Darter	**0%**	**1%**
Gizzard Shad	**1%**	**0%**
Johnny Darter	**0%**	**3%**
Lake Sturgeon	**0%**	**4%**
Least Darter	**0%**	**1%**
Muskellunge	**11%**	**0%**
Northern Pike	**6%**	**3%**
Pumpkinseed	**2%**	**1%<**
Rainbow trout	**1%**	**0%**
Redhorse sp	**1%**	**1%**
Rock Bass	**33%**	**45%**
Smallmouth Bass	**10%**	**24%**
Splake	**2%**	**0%**
Tadpole madtom	**0%**	**1%<**
Walleye	**6%**	**1%**
White sucker	**2%**	**3%**
Yellow Perch	**2%**	**1%**

3.3. Invasive Species, Environmental Contaminants, and Harmful Pathogens

The Menominee Dam is the first dam upstream from the confluence of the Menominee River and Lake Michigan and presents an absolute barrier to fish species attempting upstream migration and a partial barrier to fish species attempting downstream migration. The Menominee Dam is also an absolute barrier to upstream infestation of the upper Menominee River basin by invasive species, environmental contaminants, and harmful pathogens.

Any concerns for invasive species, environmental contaminants, and harmful pathogens resulting from installation of a downstream fish bypass facility would not affect the

biological environment of the Menominee River because it is already a natural occurrence at these dams.

Invasive Species

At least 25 non-native species of fish have entered the Great Lakes since the 1800s, including sea lamprey (*Petromyzon marinus*), alewife (*Alosa pseudoharengus*), Eurasian ruffe (*Gymnocephalus cernuus*), round goby (*Neogobius melanostomus*) and others. These fish have had significant impacts on the Great Lakes aquatic ecosystem and the food web by competing with native fish for food and habitat. Invasive animals have also been responsible for increased degradation of coastal wetlands, including loss of plant cover and diversity.

Non-native mussels and mollusks have also caused turmoil in the food chain and with habitat. In 1988, zebra mussels (*Dreissena polymorpha*) were inadvertently introduced to Lake St. Clair, and quickly spread throughout the Great Lakes and into many inland lakes, rivers, and canals. Since then, they have caused severe problems at power plants and municipal water supplies, clogging intake screens, pipes, and cooling systems. They have also nearly eliminated the native clam population in the ecosystem.

The spiny water flea (*Cercopagis pengoi*) is the most recent species to enter the Great Lakes. This organism, a native of Middle Eastern seas, is a tiny predatory crustacean that can reproduce both sexually and, more commonly, parthenogenically (without fertilization).

The Great Lakes have also been troubled by fast-growing invasive plants such as common reed (*Phragmites australis*), reed canary grass (*Phalaris arundinacea*), purple loosestrife (*Lythrum salicaria*), curly pondweed (*Potamogeton crispus*), Eurasian milfoil (*Myriophyllum spicatum*), frogbit (*Hydrocharis morsus-ranae*), and two types of non-native cattails (*Typha angustifolia* and *Typha glauca*).

Some of these plants are prolific seed producers, which allows them to spread rapidly over large areas. Invasive purple loosestrife, for example, are 2-3 meters tall and can produce 2.7 million seeds each year. Others reproduce from fragments of root or rhizome, which hinders removal and control. All have become established quickly in the Great Lakes, displacing the native plant populations that support wildlife habitat and prevent erosion. Their prevalence in recreational waters also hinders swimming and boating.

Based on the problems caused by existing non-native species in the Great Lakes, resource agencies are closely watching other species that have invaded nearby

ecosystems or that are likely to invade in the future. Asian carp are of particular concern because they have been found in nearby waterways that eventually connect to the Great Lakes.

The selected alternative would have to incorporate measures to prevent or minimize risks from invasive species infestation into the upper reaches of the Menominee River.

Environmental Contaminants

The predominant contaminants in the Menominee River are from historic industrial inputs and improper storage of chemicals by industry. Contaminants deposited in sediment and water bioaccumulate in fish tissues, and biomagnify throughout the food chain posing risk to aquatic and piscivorous species (Bowerman et al. 1990). Contaminants are prevalent in Great Lakes fishes (Giesy et al. 1994a) and toxicants in fish above threshold levels can pose reproductive impairments to piscivorous wildlife (Giesy et al. 1994b, Best et al. 2010).

The lower Menominee River is classified as one of the Great Lakes Areas of Concern (AOC). An AOC is a waterway that is heavily contaminated with pollutants that affect the health of wildlife in that system. The Menominee AOC includes the lower 4.8 kilometers of the Menominee River from the Park Mill Dam to the river mouth, and 5 kilometers north and south of the river mouth. Arsenic, PCBs, polyaromatic hydrocarbons (PAHs), Hg, dioxins, lead, cyanide, coal tar, and paint sludge are among some of the contaminants in the lower Menominee River AOC (USEPA 2011). Beneficial use impairments (BUIs) for the AOC include restrictions on dredging activities due to arsenic in sediment; fish consumption advisories from polychlorinated biphenyls (PCBs), mercury (Hg), and pesticides; degraded fish and wildlife populations; degraded benthos; loss of fish and wildlife habitat; and recreational use restrictions particularly for swimming due to fecal coliform or bacterial counts exceeding water quality standards (USEPA 2011). Remedial Action Plans (RAPs) are being developed by multiple agencies (USEPA, WDNR, MI Department of Environmental Quality, FWS, and Lake Michigan Forum) that may lead to the clean-up and delisting of the BUIs. For example, the Menominee River AOC Technical Advisory Committee currently has restoration and sediment remediation projects scheduled for 2012 and 2013.

Anadromous fish in Lake Michigan are restricted from entering the Menominee River above the lowermost dam (Menominee Dam). The creation of upstream fish passage in the lowermost dam could allow resident fish in the AOC and Superfund area and migratory fish from Lake Michigan access to the upper reaches of the Menominee River. Bald eagles (*Haliaeetus leucocephalus*) are piscivorous species and susceptible to

exposure from bioaccumulative chemical compounds found in their diet (Bowerman et al. 2009). In the Great Lakes, bald eagles are widely used as bioindicator species for contaminants in waterways (International Joint Commission 1997-1999, Elliott and Harris 2001, Bowermen et al. 2002, Cesh et al. 2008, Dykstra et al. 2010). Studies have found a negative association with total concentrations of PCBs in the eggs of eagles, and eagle reproductive success (Wiemeyer et al. 1984, Giesy et al. 1995) and productivity (Kubiak and Best 1991, Wiemeyer et al. 1993, Best et al. 1994). Piscivorous species that consume fish eggs are also at risk from the movement of contaminated fish upstream. Female fish can deposit concentrations of contaminants in their eggs, creating an exposure pathway to species that eat fish eggs.

It is important to note, however, that on August 9, 2007, the Bald Eagle was removed from the federal list of threatened and endangered species after exceeding recovery targets throughout its range, including in the Great Lakes. Contaminant levels in Lake Michigan have declined considerably since the 1970's. Though they still exceed the Great Lakes Water Quality Agreement Criteria for top predators, PCB levels in Lake Michigan are much improved and are currently declining (http://www.epa.gov/glindicators/fishtoxics/topfishb.html).

For a more detailed description of Environmental Contaminants in the Menominee River, and their potential impacts relative to fish passage, please refer to Appendix F.

Harmful Pathogens

Viral Hemorrhagic Septicemia (VHS) is a harmful virus that infects freshwater fish, particularly fish in cold water. This virus is the primary fish disease that is of concern to the WDNR and MDNR, who do not want to see it spread to above Park Mill Dam on the Menominee River, where it currently does not exist. The virus is not native to North America and is thought to have been transferred to Great Lakes waterways through ballast water transfer. The virus was first isolated by the Ontario Ministry of Natural Resources in 2005 while investigating a significant fish kill of drum in the Bay of Quinte, Lake Ontario. However, the earliest identification of VHS may have actually been from a muskellunge caught in Lake St. Clair in the spring of 2003.

Viral Hemorrhagic Septicemia (VHS) is a disease that has caused significant fish kills in the Great Lakes and must be reported to the World Organization for Animal Health and the U.S. Department of Agriculture – Animal and Plant Health Inspection Service (USDA – APHIS). VHS can be transferred through the water via reproductive fluids or urine and is documented to survive in the water up to 14 days. The virus weakens blood tissue and organs resulting in hemorrhaging of the internal organs. Fish that survive VHS

infection develop antibodies that will protect the individual from the disease in the future (Hanchin and Cwalinski 2010).

Lake sturgeon is not listed as a species susceptible to VHS by USDA – APHIS and, as such, is not regulated by title 9 CFR Parts 83.1 through 83.7, 93.900 and 93.910 through 93.916 (the Viral Hemorrhagic Septicemia Interim Rule).

Research from Dr. Mohamed Faisal at Michigan State University's Aquatic Animal Health Laboratory has recently suggested that lake sturgeon are immune to VHS and are not carriers of the disease (Gary Whelan, Michigan DNR, personal communication; Hanchin and Cwalinski 2010). From all of the evidence collected to date, lake sturgeon do not carry VHS as they likely do not have the receptor for the virus' glycoprotein. Michigan DNR has indicated that they have never found VHS in any lake sturgeon samples. In the laboratory, direct injections of high titer levels of the virus (i.e., stress tests) has only caused the virus to persist in sturgeon tissue for 1-2 days at most, after which is was cleared from the sturgeon. Thus, it was determined in the laboratory, that lake sturgeon are not VHS carriers and should not be a species of concern with this virus (Gary Whelan, Michigan DNR, personal communication).

3.4. Listed, Proposed and Candidate Species

The lake sturgeon is listed as a threatened species in Michigan and as a species of concern by WDNR and the FWS.

Currently, there are no other federal or state listed, proposed or candidate species (or critical habitats) located within the immediate vicinity of the project site.

3.5. Land Use

Public Use

Outdoor recreation opportunities within the Project Boundary include shoreline fishing, canoeing, and kayaking, limited power-boating and passive recreation (viewing) opportunities. Access to several locations along the shore is restricted.

The paper mill occupying a portion of the shoreline in the City of Marinette, Wisconsin restricts shoreline access within the plant-site for public safety and liability exposure reasons. A registered archaeological site in Menominee, Michigan is located near the shoreline and is fenced to prevent unauthorized access and removal of artifacts.

Aesthetic Resources

The aesthetic setting of the project is best described as mixture of urban, suburban, and industrial. On the right side of the river between the Park Mill Dam and the Menominee Dam, the Paper Mill and Park Mill Powerhouse are the prominent features and comprise the industrial setting. The balance of the right shore below the Park Mill Dam is urban Marinette, Wisconsin.

From the Park Mill Dam on the right bank (south bank) to the upstream Project Boundary, the setting is best described as suburban to natural. There is some private home site development in this stretch of the river, and some large tracts of undeveloped land.

The left side of the river (north side) from the Park Mill Dam to the upstream project boundary is similar to the south side of the river, featuring undeveloped (natural) tracts of land interspersed with river front home site development. At the left end of the Park Mill Dam, lies Riverside Cemetery. The balance of the left side, to the east end of the Project Boundary is occupied by urban Menominee, Michigan.

In both communities, waterfront urban development is interspersed with recreational properties including passive (sightseeing) recreation, shore fishing piers, and boat launch facilities.

Land Resources

The Project is completely within the corporate limits of the Cities of Marinette, Wisconsin and Menominee, Michigan. The common State Border lies in the river between the two cities, thus dividing the river between the respective cities and states.

Incorporated municipalities in Michigan and Wisconsin are responsible for zoning within their municipal corporate borders. The land adjacent to the project is zoned as industrial.

3.6. Cultural Resources

"The State Historic Preservation Officers (SHPO) of Wisconsin and Michigan and the Lac View Desert Tribal Historic Office have determined that the project would not affect any cultural resources that are eligible for or listed on the National Register of Historic Places (FERC Project License P-2744)" Should construction be required within the Project Boundaries (other than emergency) by any provision of a new license, it will be designed and constructed in consultation with respective SHPO's and tribes. N.E.W. Hydro, Inc. will abide by the "Programmatic Agreement Among The Federal Energy Regulatory Commission, The Advisory Council on Historic Preservation, The State of

Wisconsin, State Historic Preservation Officer, The State of Michigan, State Historic Preservation Officer, and Lac View Desert Tribal Historic Office, for managing historic properties that may be affected by new and amended licenses issuing for the continued operation of existing hydroelectric projects in the State of Wisconsin and adjacent portions of The State of Michigan" referred to as the "Programmatic Agreement."

3.7. Local Socio-economic Conditions

The website (http://www.city-data.com/city/Marinette-Wisconsin.html) presents socio-economic data for Marinette County, Wisconsin while the website (http://www.city-data.com/city/Menominee-Michigan.html) contains socio-economic data for Menominee, Michigan. The two cities adjoining the Project area, Marinette, Wisconsin and Menominee, Michigan are subsets of their namesake counties. County data is perhaps more representative of the population(s) impacted by the presence and operation of the hydroelectric dams, than the cities alone.

Included is information regarding population, household income, race, real estate, age, sex, education, and employment. No modifications to the existing dam operations are proposed.

4. Environmental Consequences

4.1. Alternative A – Upstream Fish Elevator / Downstream Fish Bypass (Proposed Action)

It has been concluded by the natural resource agencies in both Michigan and Wisconsin that one of the most effective means of providing sturgeon restoration in Lake Michigan is to provide sturgeon access to the spawning and rearing habitat upstream of the Menominee and Park Mill dams in the Menominee River. Upstream fish passage combined with downstream bypass around the Menominee and Park Hill Dams would provide sturgeon access to historic spawning and rearing habitat, and access by juveniles to Lake Michigan for continued growth to maturity.

The Proposed Action (Alternative A) assumes that N.E.W. Hydro, in conjunction with the IT, would participate in the construction and operation of upstream and downstream fish passage around the two dams.

4.1.1. Habitat Impacts

Construction of upstream and downstream fish passage facilities would be contained within the existing infrastructure of the hydropower facilities and would not significantly impact existing aquatic or terrestrial habitat for fish or wildlife resources.

Historically, lake sturgeon could migrate as far as 71 miles up the Menominee River to Sturgeon Falls, near Norway, Michigan. Currently there are five hydroelectric dams that block this historic migration corridor (Figure 4.1.1). The lower most dam on the Menominee River (Menominee Dam) is approximately 2.75 miles upstream from Lake Michigan. About one mile of flowage then exists between Menominee Dam and Park Mill Dam. Above Park Mill Dam, there are approximately 21 miles of river up to the third dam (Grand Rapids Dam). Lake sturgeon habitat availability surveys in the Menominee River indicate that 9.8% of the high quality (i.e., excellent to optimal) spawning habitat in the river is located downstream of the Menominee Dam, however, access to more than 90% of the remaining habitat in the Menominee River is blocked to Lake Michigan sturgeon due to the presence of the five dams below Sturgeon Falls (Daugherty 2006).

Above Park Mill Dam, there are approximately 21 miles of river containing high quality lake sturgeon habitat up to the next dam (Grand Rapids Dam). Surface acreage of this habitat up to Grand Rapids Dam is estimated to be 1,668 acres as previously estimated during normal summer conditions (Daugherty, 2006). The Menominee River downstream of the Menominee Dam to Lake Michigan is about 2.75 miles and contains approximately 238 acres of sturgeon habitat. The lake sturgeon habitat blocked by the dams is distributed throughout the river reaches impounded by the Park Mill Dam (22%), Grand Rapids Dam (38%), and Chalk Hill Dam (27%) (Daugherty 2006, Figure 4.1.1). These sections of river do currently support isolated lake sturgeon populations but the dams block upstream migration from Lake Michigan. The specific habitat values for sturgeon spawning, staging, and juvenile rearing habitat were identified in previous studies (Daugherty et al. 2008 and 2007, Daugherty 2006).

With implementation of the Proposed Action (Alternative A), 21 miles of river and 1,668 acres of optimal habitat would be opened up to the Lake Michigan sturgeon population. As a result of this reconnection, available spawning habitat would increase from 26 to 58 acres (out of 236 available up to Sturgeon Falls), and juvenile rearing habitat (currently a critical deficiency) would increase from 212 to 1,610 acres (out of 4,560 available up to Sturgeon Falls). Details regarding the size and quality of the habitat in this reach are presented in Table 4.1.1a. Table 4.1.1b provides a summary of ecosystem

outputs comparing the Proposed Action (Alternative A) with the No Action Alternative (Alternative B) and Alternative C (Trap and Transfer).

Figure 4.1.1: Hydroelectric dams in the lower Menominee River currently blocking migration of lake sturgeon. Sturgeon Falls Dam is in the location of the upper limit of historical sturgeon migration.

Table 4.1.1a: Sturgeon Spawning and Rearing Habitat from Daugherty (2006).

Menominee River and Reach Location	Spawning (Acres) Excellent/good	Rearing (Acres) Excellent/good
Downstream of Menominee Dam	26/101	210/47
Downstream of Menominee Dam + Upstream of Park Mill Dam	58/664	1609/0.35
Menominee River up to Sturgeon Falls Dam	261/2353	4771/1055

Table 4.1.1b: Summary of ecosystem outputs associated with Proposed Action (Alternative A) compared to the No Action Alternative (Alternative B) and Alternative C (Trap and Transfer).

Alternatives/Action	Excellent Habitat (Acres)	(SI) Quality (0-10)	(SF) Importance (1 to 5)	Ecosystem Output
Alternative A – Proposed Action	1,668	9	5	75,060
Alternative B - No Action	1,668	9	1	15,012
Alternative C – Trap and Transfer	1,668	9	3	45,036

Overall quality (SI) of lake sturgeon habitat within the 21 mile river reach from Lake Michigan to Grand Rapids Dam was estimated on a scale of 0 to 10, with 0 being of no habitat value and 10 being a habitat of the very highest value. The significance factor (SF) or importance of the habitat was related to things such as scarcity of the habitat, whether it was increasing or decreasing, whether it was connected to other habitats and whether a lack of access to this type of habitat would limit species diversity or abundance. Ecosystem output was calculated as the product of all the estimated values (Acres * SI * SF = Ecosystem Output). From the available data, summarized by Daugherty (2006), suitable sturgeon spawning and rearing habitat appeared to be the limiting factor in sturgeon populations in Lake Michigan and the rest of the Great Lakes. The Menominee River has an abundance of the required spawning and juvenile rearing habitat that is not available to lake sturgeon from Lake Michigan because of the dams.

While some adult sturgeon reside in the river and spawn in this 21 mile river reach, more spawning and rearing habitat is available than fish. Therefore, under the No Action alternative, the quality of habitat is listed as 9 and the significance factor (SF) is listed as a 1 because of insufficient spawning sturgeon to effectively use the habitat. With the Proposed Action (Alternative A), the quality was rated as a 9 because the river reach contains 58 acres of excellent habitat for spawning and 1,610 acres of excellent

habitat for rearing. The SF was rated as a 5 since all the available habitat would be used for spawning and nursery and the juveniles and adults would be able to migrate back to Lake Michigan, thus affecting the sturgeon populations within Lake Michigan and beyond. With Alternative C (Trap and Transfer), the ecosystem outputs would be similar to Alternative A for upstream access to excellent habitat, however, downstream migration would remain impeded by the dams. This lack of downstream connectivity would result in an SF rated at 3 (or about half of the Alternative A rating).

The high proportion of spawning habitat available in the impounded reaches of the Menominee River, coupled with management objectives of restoring lake sturgeon throughout their historic range in this system, suggests that fish passage (by means of Alternative A) would be an appropriate and practical step to help rehabilitate lake sturgeon in the Menominee River and in Lake Michigan.

4.1.2. Biological Impacts

The Menominee River is a major tributary to Lake Michigan and forms the political border between Michigan and Wisconsin. This picturesque river once featured several waterfalls which made good sites for hydroelectric dams. The waterfalls had been ideal habitat for lake sturgeon, which migrated upstream from Lake Michigan to spawn there. Today, five hydroelectric dams block lake sturgeon from their historical spawning and rearing habitat upstream (Figure 4.1.1). This, combined with overfishing in the 1800's, has resulted in a 99% decline in population abundance with diminished spawning and recruitment (Hay-Chielewski and Whelan 1997). The estimated sturgeon population in Lake Michigan prior to 1900 was estimated to be between 1 and 2.4 million individuals (Hay-Chielewski and Whelan 1997). Today, the population abundance in Lake Michigan is approximately between 3,000 and 5,000 individuals, or a 99% decline from historical abundance (Hay-Chielewski and Whelan 1997).

Construction of upstream and downstream fish passage facilities would be contained within the existing infrastructure of the hydropower facilities and would not significantly impact local biotic communities. As such, construction operations would employ Best Management Practices (BMP) so as to avoid any undue disturbances to avian and terrestrial wildlife, in particular, migratory birds. The FWS, WDNR, and MDNR would consult on this project to ensure BMP's be followed as recommended. Detailed BMP's for construction of upstream and downstream fish passage facilities can be found in Appendix H and Appendix I, respectively.

Operation of the upstream fish passage facility would provide access to spawning and rearing habitat, which would yield an increase in overall sturgeon recruitment and population abundance. If disease, contaminants, and invasive species transmission could be controlled, fish passage could also increase access to spawning habitat for other fish species such as suckers, smallmouth bass, northern pike and lake whitefish. Connecting river habitat for these and all migratory species would benefit the overall species diversity of the Menominee River and Lake Michigan. It is important to note, however, that passing species other than lake sturgeon would be outside the scope of this EA, and thus, should not be considered as part of the Proposed Action (Alternative A).

Additional benefits could also include sturgeon viewing at the transfer facility (i.e., sorting facility) and the potential for fishing opportunities, if the adult population rebounds.

Operation of the downstream fish passage facility would be a critical component to minimize potential risks from impingement and entrainment in the hydroelectric intake and turbines and for providing an effective passage route to Lake Michigan. Resource agencies consider downstream passage a critical component of an effective fishway for both protection and improved recruitment.

Under the Proposed Action (Alternative A), N.E.W. Hydro would have satisfied the requirements of the Settlement Agreement (Article 401 of the FERC license) and would likely be released from its monetary obligation to the FPPF upon relicensing in 2015. Lake sturgeon habitat would be defragmented and fish populations would be protected from entrainment and impingement stress or mortality under the Proposed Action (Alternative A).

4.1.1. Invasive Species, Environmental Contaminants, and Harmful Pathogens

Any concerns for invasive species, environmental contaminants, and harmful pathogens resulting from construction and operation of a downstream fish bypass facility would not affect the biological environment of the Menominee River because downstream movement of fish and water is already a natural occurrence at these dams.

Invasive Species

The IT requires that the selected Alternative provide an effective barrier to prevent the upstream passage of all current and future invasive species (examples include sea lamprey, alewife, gobies, carps, etc.).

Under the Proposed Action (Alternative A), a sorting and holding/testing facility would be incorporated into the upstream passage facilities. All sorting activity would be conducted by the MDNR, WDNR, or FWS and only selected lake sturgeon would be transported, by truck, upstream of the Park Mill Dam (Appendix C). All non-target fish (including invasive/non-native species) would be returned to below Menominee Dam (Appendix C) or collected/destroyed (ie. lamprey). Addition of any new target species (e.g., walleye) may require further analysis from the state and federal agencies regarding threats from disease, contaminants, and invasive/non-native species transmission to upstream of Park Mill Dam.

Because the Menominee Dam would remain a barrier to non-sturgeon species from Lake Michigan, the Proposed Action (Alternative A) would not be expected to infest the upper reaches of the Menominee River with invasive species.

Environmental Contaminants

The unique life-history of lake sturgeon lends support that the species provides limited contaminant exposure to piscivorous wildlife. Large, migrating, sturgeon are not typically preyed upon by other wildlife and generally return downstream post spawning (with little to no spawning mortality). Therefore, the potential risk of contaminated lake sturgeon flesh to upstream piscivorous wildlife is likely low. Based on the screening level risk assessment (Appendix F), efforts to provide upstream passage for lake sturgeon from below the Menominee Dam to upstream of Park Mill Dam would be unlikely to pose a significant risk to piscivourous wildlife upstream, however there would always be an inherent risk.

The risk that contaminants in sturgeon eggs pose to wildlife that feed on fish eggs is unknown and has not been assessed. However, the total number of eggs produced from female sturgeon passed upstream would be a relatively small percentage (< 0.1%) of the total egg biomass produced by resident fishes upstream of the Park Mill Dam (Michael Donofrio, Wisconsin DNR, personal communication). Although there would always be an inherent risk, it is unlikely that contaminants from sturgeon eggs would pose a significant risk to oophagous wildlife upstream.

Because lake sturgeon are the only target species being considered, the Proposed Action (Alternative A) would not be expected to significantly contaminate the environment upstream of the Park Mill Dam. The Proposed Action is also not expected to pose a significant risk to wildlife upstream of the Park Mill Dam.

Harmful Pathogens

A recent study from Michigan State University's Fish Health Lab provides evidence (see Section 3.3 above) that lake sturgeon are immune to the disease known as Viral Hemorrhagic Septicemia (VHS). It was also determined that lake sturgeon do not act as carriers of the virus (Gary Whelan, Michigan DNR, personal communication; Hanchin and Cwalinski 2010). Because lake sturgeon would not be considered a threat for transmission of VHS, official transfer of sturgeon upstream would only require a visual inspection prior to upstream passage. If necessary, based on visual health inspection or findings from new research, the sorting facility in the Proposed Action (Alternative A) would have the capability of holding fish for testing.

Because lake sturgeon are the only target species, and lake sturgeon are considered immune to VHS (Gary Whelan, Michigan DNR, personal communication; Hanchin and Cwalinski 2010), the Proposed Action (Alternative A) would not be expected to infect the upper reaches of the Menominee River with VHS.

4.1.2. Listed, Proposed, and Candidate Species

The lake sturgeon is a threatened species in the state of Michigan and a species of concern for the state of Wisconsin and the FWS. The Proposed Action (Alternative A) would not be expected to adversely impact lake sturgeon populations. Operation of a fish passage for lake sturgeon, as proposed in Alternative A, would address needs outlined in various lake sturgeon management plans (see Section 3.1 above).

There are no other federal or state listed, proposed or candidate species, or critical habitat located in the project area or that would otherwise be affected by the Proposed Action (Alternative A).

4.1.3. Cultural Resources

There are no historical or archeologically significant properties impacted by the Proposed Action (Alternative A).

4.1.4. Environmental Justice

The Proposed Action (Alternative A) would not be expected to have a negative impact on the human environment, any minority population or ethnic group, or the economically disadvantaged.

4.1.5. Cumulative Impacts

The Proposed Action (Alternative A) would likely have a positive impact on the lake sturgeon populations in both Lake Michigan as well as the Menominee River. The Menominee River Fisheries Plan (Thuemler and Schnicke 1992) suggests that present lake sturgeon populations in the river are only 30% of the estimated carrying capacity for the system because of the habitat fragmentation caused by the dams. The Proposed Action (Alternative A) would address several objectives of the Menominee River Fisheries Plan:

- Restore lake sturgeon populations to historic levels throughout their former range
- Block movement of invasive species into areas of the river above the first dam
- Prevent potential hydro-operational fish injuries through construction and operation of fish protection and bypass structures

Based on estimates from other unexploited riverine populations, it has been suggested that lake sturgeon densities could reach 5 to 7 fish per acre (Ontario Ministry of Natural Resources, 1987). Based on the sturgeon habitat measured from Park Mill Dam to Grand Rapids Dam (approximately 1,668 acres), it may be possible to sustain a lake sturgeon population of 8,000 to 11,000 individuals within this reach. Based on these figures, the current population of approximately 1,700 sturgeon (population estimate of individuals greater than 36 inches in length from Michael Donofrio, Wisconsin DNR, personal communication) could increase substantially with the Proposed Action (Alternative A). Thuemler and Schnicke (1992) suggest that lake sturgeon passage up to Sturgeon Falls Dam, the extent of their historical migration, could result in a carrying capacity of approximately 20,000 to 25,000 sturgeon, which is the goal of Objective #1 of the Menominee River Fisheries Plan.

This potential increase in the Menominee River sturgeon population would likely also increase the population size in Lake Michigan as well, which currently only has an adult population abundance of about 3,000 individuals (Hay-Chielewski and Whelan 1997). The downstream bypass and protection provision in the Proposed Action (Alternative A)

would likely improve downstream movement and migration of lake sturgeon, increasing the likelihood that these fish will make it to Lake Michigan and recruit to the Lake's population.

The one objective of the Menominee River Fisheries Plan that the Proposed Action (Alternative A) falls short of meeting is the restoration of historic runs of northern pike, smallmouth bass, muskellunge, walleye, and whitefish from Lake Michigan into and throughout the Menominee River system. Though passage of these fish species would be possible with the Proposed Action's technology, it would not to be considered as part of this EA. The concerns relative to invasive species, environmental contaminants, and harmful pathogens make this scenario too risky at this time. It is suggested that further studies and risk assessments be conducted before any additional target species are considered for passage.

4.2. Alternative B – No Action

The No Action Alternative (Alternative B) assumes that N.E.W. Hydro would not construct or operate a fish passage around the two dams. The existing FERC license for the project was issued on March 11, 1985 and amended May 11, 1987. The license expires on February 28, 2015. N.E.W. Hydro, as owners of the dams, has indicated that they are not under any statutory mandate to provide fish passage under the existing license. N.E.W. Hydro would continue to operate and maintain the dams because of their importance for hydropower production. Although the hydro projects are currently undergoing relicensing proceedings through the FERC, any specific FERC requirements for N.E.W. Hydro to provide fish passage, as part of the relicensing process, would be speculative.

4.2.1. Habitat Impacts

Historically, lake sturgeon could migrate as far as 71 miles up the Menominee River to Sturgeon Falls, near Norway, Michigan. Currently there are five hydroelectric dams that block this historic migration corridor (Figure 4.1.1). The lower most dam on the Menominee River (Menominee Dam) is approximately 2.75 miles upsteam from Lake Michigan. About one mile of flowage then exists between Menominee Dam and Park Mill Dam. Above Park Mill Dam, there are approximately 21 miles of river containing high quality lake sturgeon habitat before the next dam (Grand Rapids Dam). Surface acreage of the optimal river habitat up to Grand Rapids Dam is estimated to be 1,668 acres as previously estimated during normal summer conditions (Daugherty, 2006). The

Menominee River downstream of the Menominee Dam to Lake Michigan is about 2.75 miles and contains approximately 238 acres of sturgeon habitat. Specific estimates of the quantity of habitat for sturgeon spawning, staging, and juvenile rearing were identified in previous studies (Tables 4.1.1a and 4.1.1b).

Under the No Action Alternative (Alternative B), access to 21 river miles and 1,668 acres of spawning and nursery habitat above the Menominee and Park Mill dams would continue to be blocked to migrating sturgeon. The successful downstream migration of juveniles would continue to be restricted. Due to the presence of the dams, river habitat access and degradation of populations due to lack of fish passage would likely persist.

4.2.2. Biological Impacts

The Menominee River is a major tributary to Lake Michigan and forms the political border between Michigan and Wisconsin. This picturesque river once featured several waterfalls which made good sites for hydroelectric dams. The waterfalls had been ideal habitat for lake sturgeon, which migrated upstream from Lake Michigan to spawn there. Today, five hydroelectric dams block lake sturgeon from their historical spawning and rearing habitat upstream (Figure 4.1.1). This, combined with overfishing in the 1800's, has resulted in a 99% decline in population abundance with diminished spawning and recruitment. The sturgeon population in Lake Michigan prior to 1900 was estimated to be between 1 and 2.4 million individuals (Hay-Chielewski and Whelan 1997). Today, the population abundance in Lake Michigan is approximately between 3,000 and 5,000 individuals, or a 99% decline from historical abundance (Hay-Chielewski and Whelan 1997).

Currently, lake sturgeon migration ends at the Menominee Dam in the cities of Marinette and Menominee. This area is poor sturgeon habitat and most young sturgeon cannot survive to recruit to the Lake Michigan population. Alternative B would result in continued poor survivability and recruitment for lake sturgeon spawning below Menominee Dam due to the lack of an effective upstream fish passage structure. Lake sturgeon and other river fishes would continue to be subjected to potential turbine entrainment and impingement injury or mortality due to the lack of an effective downstream bypass.

Under the No Action Alternative (Alternative B), downstream migration and movement of all fish species would continue to be interrupted by the existing hydroelectric dams.

Under this scenario, N.E.W. Hydro would continue to make annual contributions to the FPPF in the amount of $7,644 (in 1992 dollars adjusted from Consumer Price Index) until the license expires in 2015. This alternative would continue to allow for potential injury of downstream migrating and moving fish through the hydroelectric turbines at each dam and prevent effective reconnection of the upstream and downstream fishery. Lake sturgeon habitat would remain fragmented and fish populations would continue to be negatively impacted under the No Action Alternative (Alternative B).

4.2.3. Invasive Species, Environmental Contaminants, and Harmful Pathogens

Though always a risk from bait bucket introductions, terrestrial/avian animal movements, or other stochastic events; under the No Action Alternative (Alternative B), the Menominee Dam would remain an absolute barrier to movement of invasive species, environmental contaminants, and harmful pathogens into the upper Menominee River by means of volitional aquatic transport from Lake Michigan.

4.2.4. Listed, Proposed, and Candidate Species

The lake sturgeon is a Threatened species in the state of Michigan and a Species of Concern for the state of Wisconsin and the FWS. The No Action Alternative (Alternative B) would not help to rehabilitate Lake Michigan or Menominee River sturgeon populations.

There are no other federal or state listed, proposed or candidate species located in the project area or that would otherwise be affected by the No Action Alternative (Alternative B).

4.2.5. Cultural Resources

There are no historical or archeologically significant properties impacted by the No Action Alternative (Alternative B).

4.2.6. Environmental Justice

The No Action Alternative (Alternative B) would not have a negative impact on the human environment, minority population or ethnic groups, or the economically disadvantaged.

4.2.7. Cumulative Impacts

Under the No Action Alternative (Alternative B), the Menominee Dam would continue to block sturgeon migration in the Menominee River and would serve as the upstream

most point for sturgeon spawning. In addition, the Park Mill and Menominee dams would remain a barrier to downstream migration/movement of all fish species. Park Mill and Menominee dams would also remain a potential threat to turbine entrainment injury and mortality as well as impingement injury and mortality.

Under the No Action Alternative (Alternative B), N.E.W. Hydro would continue to make annual contributions to the FPPF in the amount of $7,644 (in 1992 dollars adjusted from Consumer Price Index) until the license expires in 2015. This alternative would continue to allow for potential injury of downstream migrating and moving fish through the hydroelectric turbines at each dam and prevent effective reconnection of the upstream and downstream fishery. Lake sturgeon habitat would remain fragmented and fish populations would continue to be negatively impacted.

Lake sturgeon populations in Lake Michigan have declined nearly 99% from historical numbers and have not been able to rebound largely due to the migration and spawning impedance as a result of dams (Eshenroder et al. 1995, Hay-Chielewski and Whelan 1997, LaMP 2000, Thuemler and Schnicke 1992). The No Action Alternative (Alternative B) would not mitigate for this problem and would not address management recommendations for fish passage on the Menominee River.

4.3. Alternative C – Trap and Transfer with No Facilities

Under Alternative C, there would be no construction of fish passage facilities for either upstream or downstream fish passage. Upstream passage would rely on manual netting and/or electrofishing and manual transport upstream. Downstream passage would rely on natural run-of-river flows through spillway gates and/or through the existing turbine units.

4.3.1. Habitat Impacts

Implementation of Alternative C (trap and transfer) would open approximately 21 miles of river historically used for spawning and nursery habitat. Lake sturgeon habitat availability surveys in the Menominee River indicate that 9.8% of the high quality (i.e., excellent to optimal) spawning habitat in the river is located downstream of the Menominee Dam (Daugherty 2006). However, Daugherty (2006) indicates that access to more than 90% of the remaining high quality spawning habitat in the Menominee River is blocked to Lake Michigan sturgeon due to the presence of the dams. The high quality sturgeon spawning habitat blocked by the dams is distributed throughout the river reaches impounded by the Park Mill Dam (22%), Grand Rapids Dam (38%), and Chalk Hill Dam (27%) (Daugherty 2006, Figure 4.1.1). These sections of river do currently support

isolated lake sturgeon populations but the dams block upstream migration from Lake Michigan.

Details regarding the size and quality of the habitat in this reach are presented in Table 4.1.1a. Table 4.2.1b provides a summary of ecosystem outputs comparing the Proposed Action (Alternative A), the No Action Alternative (Alternative B) and Alternative C (Trap and Transfer). The outputs for Alternative C would be similar to Alternative A for upstream passage if it is assumed that lake sturgeon trapping and transport is as effective with Alternative C and the operation is maintained at high effectiveness indefinitely. It is important to note, however, that trapping and transporting lake sturgeon using nets and electrofishing gear has been attempted in the Menominee River with poor results relative to spawning stage females. Downstream passage would remain blocked with Alternative C.

4.3.2. Biological Impacts

The biggest concern with Alternative C is the potential to stress or harm the sturgeon. Large fish, such as sturgeon, are more susceptible to injuries from electrofishing and/or netting, which may result in higher stress to the fish and an increased chance of aborted or interrupted spawning. While capture by means of electrofishing and netting is acceptable for research purposes, impacts from long term use of these methods for translocation has not been analyzed. It should be noted that studies have shown the capacity of sturgeon eggs to undergo final maturation could be adversely affected by the sturgeon's own physiological or metabolic response to unfavorable environmental or husbandry conditions, such as abrupt temperature changes and rough or frequent handling (Chapman and Eenennaam 2007). Netting and electrofishing would also be non-selective, meaning there would be a high likelihood that lake sturgeon captured with this alternative may not be ready to spawn.

Another potential concern would be relative to trap and transfer efficiency. Current guidelines adopted by the Lake Michigan agencies for implementing sturgeon reintroduction in a given river are to collect gametes from four to 10 different females and 20 to 50 different males per year for 25 years. By trap and transfer methods, the agencies have had difficulty collecting gametes from enough sturgeon from the Menominee River and have fallen short of their established goals. This past experience supports the concern that the trap and transfer Alternative (Alternative C) would not be efficient enough to effectively rehabilitate lake sturgeon populations.

In addition to potential harm from upstream passage handling and inefficient capture probability, Alternative C would not provide adequate protection from turbine entrainment and impingement at the project powerhouses. Downstream migration and movement of all fish species would continue to be interrupted by the existing hydroelectric dams. Under Alternative C, N.E.W. Hydro would continue to make annual contributions to the FPPF in the amount of $7,644 (in 1992 dollars adjusted from Consumer Price Index) until the license expires in 2015. This alternative would continue to allow for potential injury of downstream migrating and moving fish through the hydroelectric turbines at each dam and prevent effective reconnection of the upstream and downstream fishery.

4.3.3. Invasive Species, Environmental Contaminants, and Harmful Pathogens

Invasive Species

Though always a risk from bait bucket introductions, terrestrial/avian animal movements, or other stochastic events, under Alternative C the Menominee Dam would remain an absolute barrier to movement of invasive species into the upper Menominee River by means of volitional aquatic transport from Lake Michigan. Because lake sturgeon is the only species considered for upstream transfer with Alternative C, no invasive or non-target species would be transferred upstream of Park Mill Dam.

Environmental Contaminants

The unique life-history of lake sturgeon lends support that the species provides limited contaminant exposure to piscivorous wildlife. Large, migrating, sturgeon are not typically preyed upon by other wildlife and generally return downstream post spawning (with little to no spawning mortality). Therefore, the potential risk of contaminated lake sturgeon flesh to upstream piscivorous wildlife is likely low. Based on the screening level risk assessment (Appendix F), efforts to provide upstream passage for lake sturgeon from below the Menominee Dam to upstream of Park Mill Dam would be unlikely to pose a significant risk to piscivourous wildlife upstream, however there would always be an inherent risk.

The risk that contaminants in sturgeon eggs pose to wildlife that feed on fish eggs is unknown and has not been assessed. However, the total number of eggs produced from female sturgeon passed upstream would be a relatively small percentage (< 0.1%) of the total egg biomass produced by resident fishes upstream of the Park Mill Dam (Michael Donofrio, Wisconsin DNR, personal communication). Although there would

always be an inherent risk, it is unlikely that contaminants from sturgeon eggs would pose a significant risk to oophagous wildlife upstream.

Because lake sturgeon are the only target species being considered for Alternative C, Trap and Transfer would not be expected to significantly contaminate the environment upstream of the Park Mill Dam. Alternative C is also not expected to pose a significant risk to wildlife upstream of the Park Mill Dam.

Harmful Pathogens

A recent study from Michigan State University's Fish Health Lab provides evidence (see Section 3.3 above) that lake sturgeon are immune to the disease known as Viral Hemorrhagic Septicemia (VHS). It was also determined that lake sturgeon do not act as carriers of the virus (Gary Whelan, Michigan DNR, personal communication; Hanchin and Cwalinski 2010). Because lake sturgeon would not be considered a threat for transmission of VHS, official transfer of sturgeon upstream would only require a visual inspection prior to upstream passage. Because there are no holding and testing facilities proposed under Alternative C, any sturgeon not cleared for upstream passage by WDNR or MDNR would be returned to the Menominee Dam tailwater.

4.3.4. Listed, Proposed, and Candidate Species

The lake sturgeon is a Threatened species in the state of Michigan and a Species of Concern for the state of Wisconsin and the FWS. Selection of Alternative C would not be expected to have a significant adverse effect on lake sturgeon populations in the area. Alternative C would not quite address the needs outlined in the various lake sturgeon management plans described in Section 3.1 (above).

There are no other federal or state listed, proposed or candidate species located in the project area or that would otherwise be affected by Alternative C.

4.3.5. Cultural Resources

There are no historical or archeologically significant properties impacted by this Alternative.

4.3.6. Environmental Justice

Alternative C would not have a negative impact on the human environment, minority population or ethnic groups, or the economically disadvantaged.

4.3.7. Cumulative Impacts

Alternative C assumes that N.E.W. Hydro would not construct an upstream or downstream fish passage around the two dams. The 21 river miles and 1,668 acres of spawning and nursery habitat would continue to be blocked to migrating sturgeon. The successful downstream migration of juveniles would continue to be restricted. Without fishery passage, the dams would continue to suppress the aquatic ecosystem into the foreseeable future unless the fragmentation caused by the dams is mitigated. Due to the presence of the dams, the issues of river habitat access and degradation of populations due to lack of fish passage, would persist. This would likely continue into the future since there is limited local funding to properly restore this site to provide sturgeon access, both downstream and upstream.

Alternative C also assumes that state resource agencies would coordinate with N.E.W. Hydro to conduct a long term trap and transfer program for lake sturgeon. Such an agreement has not been established and would be speculative at this time.

Although Trap and Transfer activities would likely have a positive impact on lake sturgeon populations in the upper reaches of the Menominee River, it would not be expected to improve conditions below Menominee Dam. Without the presence of an effective downstream migration route, Alternative C may potentially depopulate the sturgeon below the Menominee Dam as a result of poor recruitment from upstream spawning. Downstream passage and protection is considered a priority for resource agencies because it provides a route for downstream migration and recruitment while also providing much needed protection from potential turbine injury and mortality.

4.4. Summary of Environmental Consequences by Alternative

Table 4.4 briefly summarizes the environmental consequences of the alternatives carried forward for more detailed analysis:

Table 4.4: Comparison of Environmental Consequences of the Alternatives

Condition	**Alternative A – Fish Elevator/bypass (Proposed Action)**	**Alternative B – No Action**	**Alternative C – Trap and Transfer**
Habitat Impacts	No impacts from construction	River would remained blocked to	Would provide net-captured sturgeon access to 21 miles of

	Would open 21 miles of river Would provide 1,668 acres of habitat for Lake Michigan's sturgeon population	migration Existing 238 acres of habitat below Menominee Dam would remain accessible but would continue to produce few if any recruits to the population	additional river and 1,668 acres of habitat
Biological Impacts	No impacts from construction Increase in the sturgeon recruitment and population abundance Protection from potential turbine entrainment and impingement injury or mortality	No impacts to current sturgeon recruitment and population abundance Potential for turbine entrainment and impingement injury or mortality would remain	Some positive impacts to sturgeon population upstream of Park Mill Dam Potential negative impact to sturgeon population in Lake Michigan No downstream bypass Potential for turbine entrainment and impingement injury or mortality would remain
Invasive Species, Environmental Contaminants, and Harmful Pathogens	No impacts when only sorting for and passing lake sturgeon upstream No impacts from downstream passage	No impacts	No impacts when only sorting for and passing lake sturgeon upstream
Listed, Proposed, and Candidate Species	Improved recruitment and abundance of	Would not improve recruitment and	Improved recruitment and

	lake sturgeon	abundance of lake sturgeon	abundance of lake sturgeon upstream on Park Mill Dam Potential depopulation of the sturgeon population below Menominee Dam because of low recruitment from upstream
Cultural Resources	No impacts	No impacts	No impacts
Environmental Justice	No impacts	No impacts	No impacts

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6. Consultation and Coordination with the Public and Others

Following nearly eight years of informal scoping and consultation with state and federal agencies, and other non-governmental stakeholders, N.E.W. Hydro Inc., in conjunction with the IT, began formal scoping and consultation with the general public in 2011. The official public scoping meeting was held on February 22, 2011 at the Spies Public Library in Menominee, MI. The announcement was placed in the local newspaper, the Menominee Marinette Eagle Herald, as well as several other news outlets, on February 4, 2011 (Appendix G.1). Minutes and attendance from this meeting are summarized in Appendix G.2. On the following evening, a member of the IT presented the same information for comment at the Lower Menominee River AOC Open House and Citizens Advisory Committee Meeting, which was held at the University of Wisconsin-Marinette Main Building on February 23, 2011. Minutes and attendance from this meeting are summarized in Appendix G.3. On March 18, 2011, a member of the IT was invited to present the Proposed Action before the Mayor and City Council of the City of

Menominee, MI. The agenda from this meeting can be found in Appendix G.4. The Draft Environmental Assessment was released for public review on September 21, 2011 and was open for public comment for 30 days until October 20, 2011. Copies of the Draft EA were made available online at http://www.fws.gov/midwest/ and at the local public libraries in the cities of Marinette, WI and Menominee, MI.

7. Public Comments on Draft EA and Response

Detailed minutes from the public scoping meetings can be found in Appendix G. During the official public scoping meeting on February 22, 2011, the audience had several questions. One audience member asked the question "can juvenile sturgeon migrate from the Menominee Dam out to the lake". Whereby, Rob Elliot, FWS fish biologist, stated that while lake sturgeon larvae can survive, their survival is greatly reduced where the spawning site is located close to the open lake. Rob suggested lake sturgeon need the river environment for the first summer of life. It is worth noting that lake sturgeon can only gain access to the river environment through upstream fish passage. At a later point during the meeting an audience member asked whether the public would be able to view the fish passage operation. The IT responded in saying that public access and viewing is a top priority and would be incorporated into the final design. Another audience member asked "who will be the biologist what will be identifying the fish, will it be state or federal". A reply from one of the IT members stated that it will be a shared effort. Another audience member directed a question to one of the state biologists as asked "why are you not paying more attention to the whitefish?" A reply from one of the IT biologists stated that, right now, the main focus is on sturgeon mainly because they appear [based on stress tests in the laboratory] to be immune to VHS. One audience member asked what will happen after the fish are lifted with the elevator. A member of the IT stated that sturgeon will be tagged, weighed, measured, and visually inspected for disease. Finally, a question was asked as to why the existing fish ladder at the dam is not being used. A member of the IT responded "they are steep and narrow and were built for salmon to jump from weir to weir, sturgeon would not be able to jump in the manner. Also, the drop is too steep and there is no way to control invasive species from entering upstream." The existing fish ladder must remain sealed. Detailed minutes from this meeting can be found in Appendix G.2.

On February 23, 2011, members from the IT presented this same information at the Lower Menominee River AOC Open House and Citizens Advisory Committee Meeting on the University of Wisconsin-Marinette campus. A member of the Citizens Advisory Committee expressed the need to do more to promote the passage effort in the

community. A member of the audience suggested a viewing platform be incorporated into the design for upstream fish passage. Minutes from this meeting can be found in Appendix G.3.

On March 18, 2011, Nick Utrup, FWS biologist and IT member, was invited to speak about the Proposed Action before the Mayor and Council of the City of Menominee, MI. One member of the City Council recommended incorporating public access and viewing in the project design. Another City Council member applauded the project and was eager to see it constructed. The city engineer recommended consulting about any building permits that may be necessary. An agenda from the meeting can be found in Appendix G.4.

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Appendix I –Quality Assurance Project Plan for Downstream Fish Passage Construction and Operation

Fish Passage and Protection Plan
Menominee/Park Mill Hydroelectric Complex
(FERC Project No. 2744)

Alternatives, Conceptual Designs and Cost Estimates

Version 1.1

Prepared by:

Menominee/Park Mill Implementation Team

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Menominee/Park Mill Fish Passage and Protection Plan:
Alternatives, Conceptual Designs and Cost Estimates

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Introduction

The Lake Sturgeon (*Acipenser fulvescens*) is identified as a threatened species in Michigan, a species of special concern in Wisconsin, and a federal species of concern by the U.S. Fish and Wildlife Service. Numerous reports and plans, including the Great Lakes Fishery Commission's Fish Community Objectives for Lake Michigan (Eshenroder et al. 1995), Michigan Department of Natural Resources Lake Sturgeon Rehabilitation Strategy (Hay-Chielewski and Whelan 1997), Menominee River Fisheries Plan (coauthored by Wisconsin and Michigan Department of Natural Resources; Thuemler and Schnicke 1992), Wisconsin's Lake Sturgeon Management Plan (WDNR 2000), Wisconsin's Wildlife Action Plan (WDNR 2005), and Michigan's Wildlife Action Plan (Eagle et al. 2005) recommend reduction of and mitigation for threats to lake sturgeon in the Great Lakes and their tributaries. The most critical threat identified in these plans is identified as habitat loss and fragmentation caused by dam construction, which has resulted in artificial barriers to migration and spawning. Because of this critical threat, all of the current management plans and recommendations indicate the need for upstream and downstream fish passage around existing hydroelectric dams. The expected benefit of fish passage is the reduction of habitat fragmentation and improved access to spawning and rearing habitat. The proposed project is to design and construct upstream and downstream fish passage at the lower two hydroelectric dams on the Menominee River, a tributary of Green Bay, Lake Michigan. Although the overall goal is to have upstream and downstream passage of all non-invasive fish species (e.g., smallmouth bass, walleye, muskellunge, lake whitefish and northern pike), the primary target species for upstream and downstream fish passage will be the lake sturgeon.

This proposed project would contribute considerably to the overall objective of rehabilitating self-sustaining populations of lake sturgeon throughout their historic range in the Great Lakes and their tributaries (Eshenroder et al. 1995, Hay-Chielewski and Whelan 1997, WDNR 2000). On a more local scale, this project would substantially improve the lake sturgeon population in Lake Michigan and the Menominee River, a designated Area of Concern (AOC) by the U.S. Environmental Protection Agency. This project would assist in delisting the Menominee River AOC by improving two of the listed Beneficial Use Impairments; (1) degradation of fish and wildlife populations and (2) loss of fish and wildlife habitat. This project would also directly address the top management objective of the Menominee River Fisheries Plan by "restoring lake sturgeon populations to historic levels throughout their former range in the Menominee River." To meet this objective, this project would address the recommended management action of providing upstream and downstream passage throughout the lower Menominee River. This project is supported by numerous reports and management plans indicating the need for habitat reconnection to aid lake sturgeon rehabilitation and rearing (Thuemler and Schnicke 1992, Eshenroder et al. 1995, Hay-Chielewski and Whelan 1997, WDNR 2000, Eagle et al. 2005, Daugherty 2006, Daugherty et al. 2007 and 2008).

Project Location

The Menominee River forms the border between northeastern Wisconsin and the Upper Peninsula of Michigan. The basin includes over 4,000 square miles of drainage area (Figure 1). The Menominee River is formed at the confluence of the Brule and Michigamme rivers and then flows in a southerly direction for 118 miles before joining the waters of Green Bay at the cities of Marinette, Wisconsin and Menominee, Michigan.

The project location involves areas in Menominee County of Michigan and Marinette County of Wisconsin at and between the Menominee (a.k.a. Lower Scott Paper) and the Park Mill (a.k.a. Upper Scott Paper) dams in the City of Menominee, Michigan and the City of Marinette, Wisconsin respectively (Figure 2). These are the first two barriers to upstream fish and invasive species passage and are approximately 2.75 miles upstream from the Menominee River's confluence with Green Bay. The two dams are approximately 1.25 miles apart (Figure 2). The impoundments created by these two dams are described as the Lower Scott and Upper Scott impoundments. Upon construction of fish passage, fish downstream of the dams would have access to 21 additional miles of river and fish upstream of the dams would have access to Green Bay and Lake Michigan. It should also be noted that the Menominee Dam provides a barrier to the natural spread of Viral Hemorrhagic Septicemia virus (VHSv) between Green Bay waters, where VHSv has been confirmed, and the upstream waters of the Menominee River, where the virus has not been found to date.

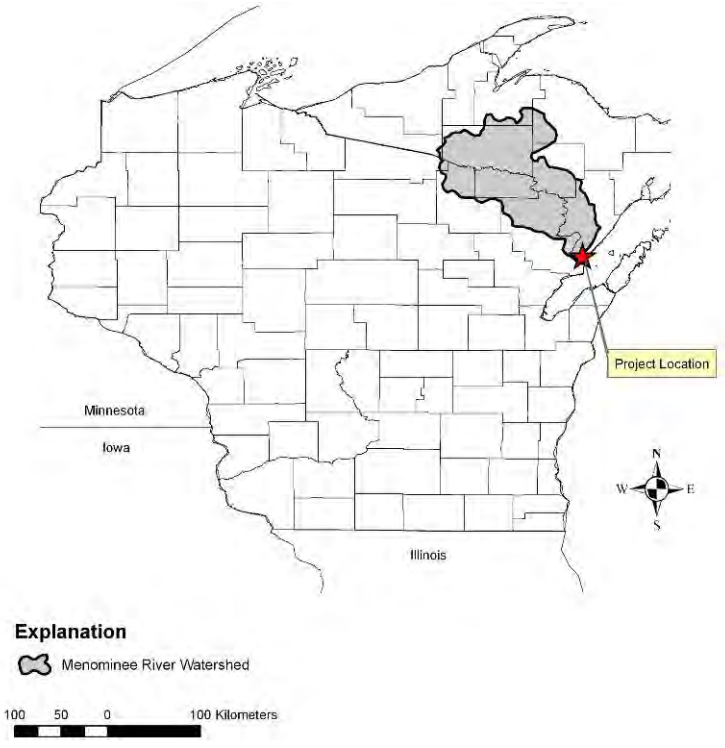

Figure 1. Map of the Menominee River watershed and its proximity to Wisconsin, Michigan, and the project location.

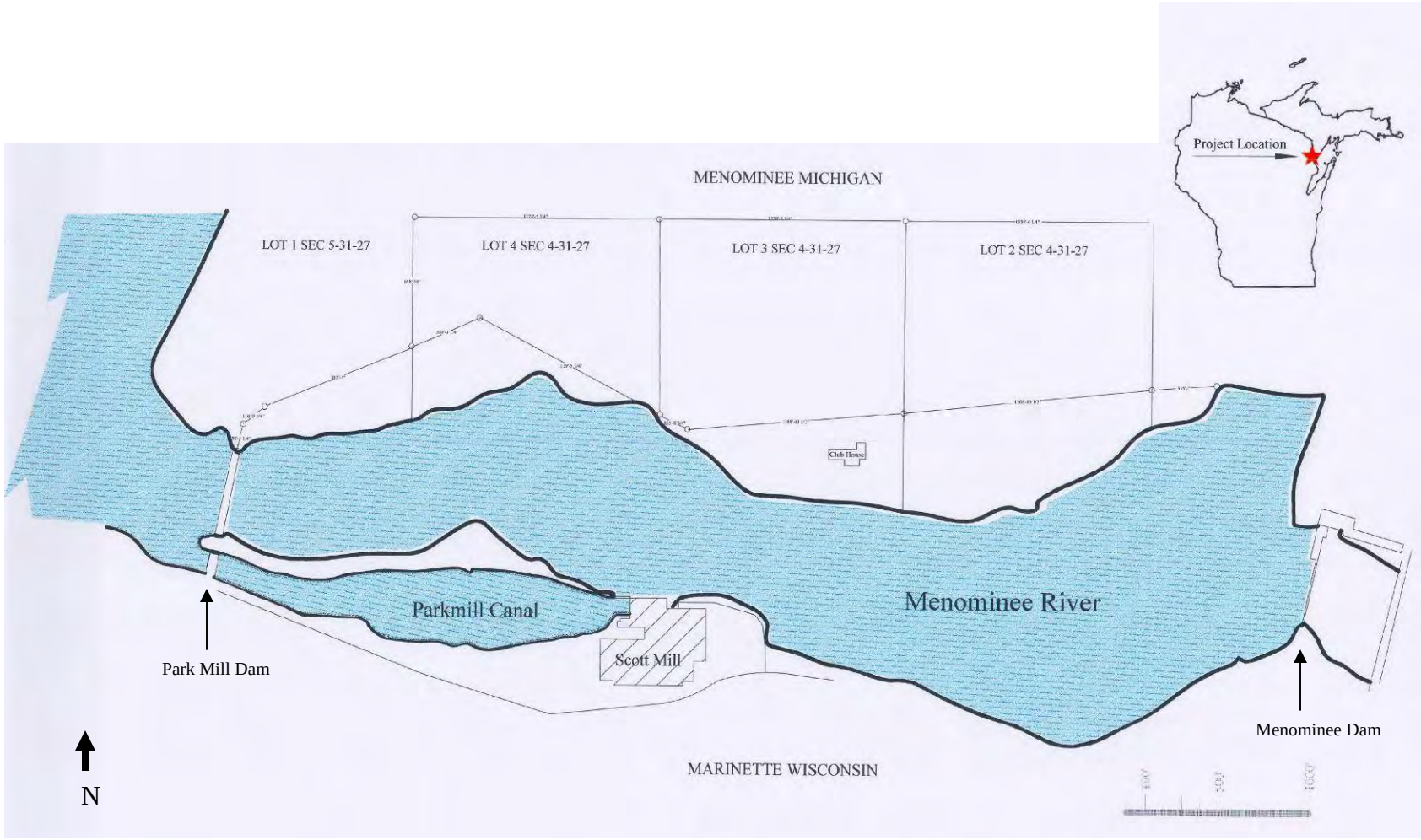

Figure 2. Map of project location showing the upstream Park Mill Dam and the downstream Menominee Dam, Menominee, Michigan and Marinette, Wisconsin.

Project Rational

Development of fish passage integrated with an invasive species and pathogenic barrier at this site is a major step forward in the restoration of historic fisheries on the Menominee River system as well as the waters of Green Bay. According to a recent Great Lakes Fisheries Trust (GLFT) funded study quantifying lake sturgeon habitat availability, an additional 22.5% of the total of high quality spawning habitat in the entire Menominee River would become available to Green Bay lake sturgeon after completion of fish passage at these two dams (Daugherty 2006 and Daugherty et al. 2007). Added to the spawning habitat currently available below the lower Menominee Dam, the total amount of lake sturgeon spawning habitat would increase from 26 to 58 acres (Daugherty 2006 and Daugherty et al. 2007). Juvenile lake sturgeon rearing habitat (currently a critical deficiency) would increase from 212 to 1,610 acres (Daugherty 2006 and Daugherty et al. 2007). The integration of invasive species control into the fish passage structures at the Menominee Dam would continue to prevent undesirable species, such as sea lamprey (*Petromyzon marinus*), from moving into upstream river reaches and preclude the need for additional lamprey control measures. By continuing to exclude (or block) lamprey and by coordinating with the U.S. Fish and Wildlife Service's Sea Lamprey Control program to enhance lamprey trapping at this location, this project will help to control lamprey populations within the Green Bay waters.

Integrating a pathogen barrier into the passage facilities would prevent the upstream spread of potentially harmful pathogens such as VHSv. A gate would be incorporated into the design that could be closed at anytime as a form of environmental adaptive management. This affords the resource managers the ability to close the fishway and render the dam a barrier in response to specific pathogen conditions. This design would allow for upstream fish movement while also providing some protection of the upper watershed from pathogens such as VHSv. It should be noted that a fishway with a gate is not a guarantee against the movement of VHSv upstream but rather a pragmatic means of balancing fish passage and the potential impacts of VHSv moving further up into the watershed. As a further safeguard, a holding tank would be incorporated into the design to allow for quarantine and health screening of fish prior to allowing their access to the upper watershed.

Integrating a lake sturgeon gamete collection facility with the selected passage structures would also allow for increased fishery evaluation and research capabilities. Current guidelines adopted by the Lake Michigan agencies for implementing sturgeon reintroduction in a given river are to collect gametes from four to 10 different females and 20 to 50 different males per year for 25 years. By current methods, the agencies have had difficulty collecting gametes from enough sturgeon from the Menominee River and have fallen short of their established goals. With the addition of this proposed upstream passage and sorting facility, it is possible that gametes could be collected from migrating sturgeon to help meet the goals established by the agencies.

History of Project

In 1985, the Federal Energy Regulatory Commission (FERC) issued a license for the Park Mill and Menominee hydroelectric projects (FERC Project No. 2744). This license attempted to address passage issues related to fish entrainment from turbine mortality through implementation of Article 401 which "requires the licensee, after consultation with the Michigan Department of Natural Resources (MDNR), Wisconsin Department of Natural Resources (WDNR), and U.S. Fish and Wildlife Service (FWS) to develop a study plan to assess the impacts of project operations on fish resources". To develop this plan, the parties involved had to determine monetary compensation values of fish, appropriate fish passage protection devices, costs of fish protection measures, a fish protection fund, and compensatory mitigation. Given the inability to reach consensus on these issues, the concerned parties used the FERC's *Dispute Resolution Service* and convened meetings beginning on July 25, 2002. On January 24, 2005, FERC issued an order approving the resultant settlement regarding the implementation of Article 401 of the license. To satisfy the requirements of Article 401, the licensee (N.E.W. Hydro Inc.) took several actions, including:

- Establishment of a *Fish Passage and Protection Fund* (FPPF) and annual monetary contributions of $7,644 (in 1992 dollars adjusted from Consumer Price Index) until the license expires in 2015.

- Contribution of an additional $100,000 to the FPPF through two equal deposits on or before January 1, 2006, and on or before January 1, 2007.

- Establishment of a team to implement the settlement (Implementation Team).

The FERC ordered that the FPPF shall be used to assist with funding the design, construction, operation and maintenance of fish passage and protection facilities at the Park Mill Project. However, construction and operation of fish passage and protection structures is not explicitly required as part of this Article. Planning for fish passage facilities for the Menominee Dam was also included by mutual agreement by the Implementation Team. Since 2004, the Implementation Team has met regularly to develop fish protection and passage plans for both Park Mill and Menominee dams. This conceptual report was developed as a result of this cooperative effort.

It is important to note that the current license for FERC Project No. 2744 does not mandate construction and operation of fish protection and passage facilities. However, the licensee, N.E.W. Hydro Inc., in an effort to be environmentally responsible, has expended significant time and resources in a proactive effort to provide safe passage and protection facilities for lake sturgeon and other species.

Current Project Status

A great deal of work has gone into this effort to date. Since the spring of 2004, a cooperative group of Federal, State (both Michigan and Wisconsin), and local agencies,

non-governmental organizations (NGOs), and the licensee have aggressively pursued the development of fish passage at Park Mill and Menominee dams. This Implementation Team has convened and actively participated in regular meetings to discuss new and existing methods for fish passage and protection. Methods that have been discussed include:

- Angled fish guidance rack
- Angled louver array
- Fish screens
- Tainter gate insert/modification
- Sub-surface guidance
- Pipe conduit
- Parallel berm channel conduit
- Vertical slot fish ladder
- Decommissioned fish ladder modification
- Fish lift
- Spiral fishway
- Nature-like channel
- Flushing pool
- Air bubblers
- Screens
- Acoustic and Strobe devices
- Trap and transfer

Methods that are no longer being considered for permanent application because of impracticality include: sub-surface guidance, parallel berm channel conduit, flushing pool, air bubblers, acoustic devices, strobe devices, and trap and transfer.

Substantial progress has been made on the development of fish passage and protection around dams and hydroelectric barriers. Conceptual designs and costs estimates of the most promising alternatives are included in this report.

Project Evaluation

Upon construction and operation of the fish passage facilities (fishway), biologists from WDNR, MDNR, and FWS, in coordination with the other project partners and the dam owner, will conduct annual counts and use radio telemetry and Passive Inductive Transponder (PIT) tags to track and monitor fish as they move through the fishway and into the river upstream of the dams. The Agencies and NGOs will also coordinate with the dam owner to monitor the health of the fish as they pass through the sorting facility. The invasive species and pathogen control point would be used to perform fish sorting, tagging, tracking, sea lamprey control (e.g., monitoring, sterilization, and destruction), selection of desired species (e.g., lake sturgeon) to be passed upstream, and quarantine when necessary. Pre and post evaluations of the Lake Michigan and riverine sturgeon populations will be used to document long-term project success based on increased lake sturgeon recruitment and population size. Results from these evaluations will be combined with existing and future Menominee River fisheries studies to determine the effectiveness of the fishway. Short-term project success will be evaluated based on the number, health and behavior of the fish that are documented passing through the fishway.

A fishway is defined as a system that provides safe, timely, and effective passage past a barrier. Therefore, successful fish passage will be evaluated based on the following criteria when monitoring fish as they enter and exit the fishway:

- Safety – Less than 1% mortality rate of all target species (e.g., lake sturgeon) passing through the fishway.
- Timeliness – All target species entering the fishway must be able to pass without undue hindrance.
- Effectiveness – At least 50% of the target species entering the fishway must have passed through to the other side and continue their migration.

Expected Results

The expected outcome of upstream and downstream fish passage at this hydroelectric facility is increased sustainability and abundance of lake sturgeon and other fish species and improved spawning activity and reproduction in the river reaches upstream of the two dams as well as within the waters of Green Bay.

Specifically, upstream and downstream passage at the lower two dams on the Menominee River would open up 21 miles of river to lake sturgeon migrating upstream from Lake Michigan. With the associated increases in spawning and juvenile rearing habitat associated with this river access, the population of lake sturgeon in Lake Michigan could increase by as many as 20,000 adults within a 50 to 100 year timeframe.

Disclaimer

This report is an adaptable document aimed at tracking the development of alternatives, conceptual designs, and cost estimates for fish passage and protection at the Menominee/Park Mill Hydroelectric Complex. This report should be considered final as of the most recent version which, as such, supersedes all previous versions. Contact Nick Utrup of the Implementation Team (920/866-1736; nick_utrup@fws.gov) for the most recent version of this report. An administrative record (Appendix A) will track changes incorporated into this adaptive document.

The purpose of this report is to explore fish passage alternatives that will allow for safe and effective passage of lake sturgeon past the Menominee and Park Mill hydroelectric dams for the first time in over a hundred years at this site. All alternatives, designs and estimates in this report are conceptual and must be subject to further review and advanced engineering before being constructed and implemented on site.

Scoping and Method Development

Purpose

To reconnect lake sturgeon with historical spawning and rearing habitat in the Menominee River upstream of the Menominee and Park Mill Hydroelectric project while also reconnecting the remnant upstream lake sturgeon population with the Green Bay population.

Need

- Develop a practical and effective method that will allow lake sturgeon to pass safely downstream through the Menominee and Park Mill Hydroelectric projects

- Develop a safe, practical, and effective method for passing lake sturgeon upstream of both Menominee and Park Mill dams

Proposed Alternatives

Through the scoping process, the Implementation Team identified several different alternatives for passing lake sturgeon upstream and downstream of the Menominee and Park Mill dams. These alternatives centered around four main objectives:

1. Downstream Passage and Fish Protection at the Park Mill Dam
2. Downstream Passage and Fish Protection at the Menominee Dam
3. Upstream Passage at the Park Mill Dam
4. Upstream Passage at the Menominee Dam

The following is a list of all alternatives that were discussed, along with potential pros and cons associated with each.

1. Downstream Passage and Fish Protection at the Park Mill Dam

1.1 *Angled fish guidance rack and bypass around powerhouse, located in the power canal immediately upstream of the existing powerhouse trash racks.*

- **Pros:** Generally accepted as most effective downstream fish passage technology, the power canal can be dewatered to allow for construction, repairs, and maintenance of the angled fish guidance rack
- **Cons:** High cost, high maintenance

1.2 *Angled fish guidance rack and bypass through power canal berm, located immediately downstream from the power canal head gate structure.*

- **Pros:** Generally accepted as most effective downstream fish passage technology, the power canal can be dewatered to allow for construction, repairs, and maintenance of the angled fish guidance rack

- **Cons:** High cost, high maintenance, may affect structural integrity of embankment

1.3 *Angled fish guidance rack and bypass around spill gates, located immediately upstream from the power canal head gate structure.*

- **Pros:** Generally accepted as most effective downstream fish passage technology
- **Cons:** High cost, high maintenance, may affect structural integrity of embankment, impoundment drawdown/coffer dam would be needed for construction

1.4 *Nature-like channel through power canal berm with angled fish guidance rack in power canal.*

- **Pros:** Capable of passing all species, low cost, low maintenance, high aesthetic value, creates additional potential spawning habitat for a variety of fishes
- **Cons:** May affect structural integrity of embankment

1.5 *Nature-like channel on north side of spillway with angled fish guidance rack upstream of power canal.*

- **Pros:** Capable of passing all species; low cost, low maintenance, high aesthetic value of nature-like channel, creates additional potential spawning habitat for a variety of fishes
- **Cons:** High cost and maintenance of fish guidance rack, impoundment drawdown/coffer dam needed for construction of fish guidance rack

2. Downstream Passage and Fish Protection at the Menominee Dam

2.1 *Pipe constructed down the south side of the impoundment.*

- **Pros:** Capable of passing all species, no need to attract fish into another downstream passage structure around the Menominee project, reduced need for protection at Menominee powerhouse
- **Cons:** Need to get property easements, need to work around public utilities such as outfall pipes

2.2 *Pipe constructed to cross the river and down the north side of the impoundment.*

- **Pros:** Capable of passing all species, no need to attract fish into another downstream passage structure around the Menominee project, reduced need for protection at Menominee powerhouse
- **Cons:** Added cost of crossing impoundment

2.3 *Steel tower guidance device integrated into an existing decommissioned fishway.*

- **Pros:** Capable of passing all species, low to moderate cost
- **Cons:** High cost of fish protection, unable to use proportion of operational flows to produce electrical power

2.4 *Tainter gate modification.*

- **Pros:** Capable of passing all species
- **Cons:** Will tie up a tainter gate that may be needed for flow release, unable to use portion of operational flows to produce electrical power

2.5 *Angled fish guidance rack in front of powerhouse in combination with 2.3 and 2.4 above.*

- **Pros:** Better protection than 2.3 and 2.4
- **Cons:** Very high cost, high maintenance, impoundment drawdown/coffer dam would be needed for construction

3. Upstream Passage at the Park Mill Dam

3.1 *Nature-like channel on north side of the Menominee impoundment (bypass impoundment entirely).*

- **Pros:** Capable of passing all species, low cost, low maintenance, high aesthetic value, eliminates the need to attract fish into another upstream passage structure around the Park Mill dam, creates additional potential spawning habitat for a variety of fishes
- **Cons:** Need to acquire property easement

3.2 *Conventional fish lift constructed near the tailrace of the Park Mill powerhouse (or below the spill gates up at the dam).*

- **Pros:** Capable of passing all species
- **Cons:** High construction cost, need a coffer dam and possible reservoir drawdown to construct

3.3 *Nature-like channel through power canal berm.*

- **Pros:** Capable of passing all species, low cost, low maintenance, high aesthetic value, creates additional potential spawning habitat for a variety of fishes
- **Cons:** May affect structural integrity of embankment, unsure of fish guidance to entrance

3.4 *Nature-like channel on north side of spillway.*

- **Pros:** Capable of passing all species, low cost, low maintenance, high aesthetic value, creates additional potential spawning habitat for a variety of fishes
- **Cons:** Unsure of fish guidance to entrance

3.5 *Spiral (side-baffle) fishway at powerhouse into an upstream passage device.*

- **Pros:** Low cost, low maintenance, small footprint
- **Cons:** Technology not field tested

4. Upstream Passage at the Menominee Dam

4.1 *Fish lift constructed in the tailrace of the Menominee powerhouse (sorting in warehouse).*

- **Pros:** Capable of passing all species, room for expansion, able to use attraction flow to produce electricity
- **Cons:** High cost

4.2 *Fish lift constructed in an unused turbine bay of the Menominee powerhouse.*

- **Pros:** Capable of passing all species, able to use attraction flow to produce electricity, ideal location for fish attraction
- **Cons:** High cost, limited space for holding and sorting fish

4.3 *Nature-like channel on north side of river.*

- **Pros:** Capable of passing all species, low cost, low maintenance, high aesthetic value, creates additional potential spawning habitat for a variety of fishes
- **Cons:** Not enough room for installation, unable to use portion of operational flows to produce electrical power

4.4 *Spiral (side-baffle) fishway on north side of river (sorting in warehouse).*

- **Pros:** Capable of passing all species, low cost, low maintenance, small footprint, room for expansion
- **Cons:** Unsure of fish guidance to entrance, technology not field tested, unable to use portion of operational flows to produce electrical power

4.5 *Vertical-slot fishway.*

- **Pros:** Capable of passing all species
- **Cons:** Unsure of fish guidance to entrance, high cost, size constraints, difficult to use operational flows to produce electrical power

4.6 *Fish lock in unused turbine bay.*

- **Pros:** Capable of passing all species
- **Cons:** High cost, difficult to use operational flows to produce electrical power

Alternatives Analysis

Alternatives were analyzed based on feasibility relative to several biological, economical, and technical considerations, which included: (1) number of fish species capable of passing, (2) estimated cost of construction, (3) estimated maintenance requirement, (4) estimated loss of electricity production, and (5) extraordinary considerations. Based on these criteria, a feasibility rating of "High" or "Low" was assigned to each alternative. A matrix of the Alternatives Analysis is presented in Table 1. Only those alternatives with a feasibility rating of "High" were selected for further consideration. These alternatives are described in greater detail below.

Selected Alternatives for Downstream Fish Passage/Protection

Park Mill Dam

- **Alternative 1.1 (Preferred)** - Angled fish guidance rack in the power canal, located immediately upstream of the existing powerhouse trash racks.

Through the alternatives analysis (Table 1) it was determined that the most feasible method for fish passage and protection is the installation of an angled fish guidance rack in the power canal just upstream of the existing trash rack at Park Mill Dam (Alternative 1.1). This method includes construction of an angled fish guidance rack fish diversion structure spanning the width of the power canal. This structure is designed to guide fish moving downstream through the power canal into a chute and around the powerhouse into the tailrace or other conveyance. Although the target fish species is lake sturgeon, the angled fish guidance rack is expected to provide effective downstream passage and protection to all fish species.

Menominee Dam

- **Alternative 2.1 (Preferred)** - Pipe constructed down the south side of the impoundment.

- **Alternative 2.2** - Pipe constructed across the river and down the north side of the impoundment.

Alternative 2.1 (Preferred) involves the construction of a pipe along the south side of the Menominee Dam impoundment to transport fish from the downstream fish passage structure at the Park Mill powerhouse (see Alternative 1.1) to an area downstream of the Menominee Dam, thus entirely bypassing the Menominee (Lower Scott) impoundment. A gated fish collection structure would be included for effectiveness studies. The new fishway would be designed to prevent possible upstream passage of invasive species such as the sea lamprey. The main target fish species is the lake sturgeon. Through consensus

among the members of the Implementation Team, Alternative 2.1 was selected as the Preferred Alternative.

Alternative 2.2 involves a pipe constructed to cross the river and run along the north side of the impoundment to transport fish from the downstream fish passage structure at the Park Mill powerhouse (see Alternative 1.1) to an area downstream of the Menominee Dam, thus entirely bypassing the Menominee (Lower Scott) impoundment. A gated fish collection structure would be included for effectiveness studies. The new fishway would be designed to prevent possible upstream passage of invasive species such as the sea lamprey. The main target fish species is the lake sturgeon.

Selected Alternatives for Upstream Fish Passage

Park Mill Dam

- **Alternative 3.1 (Preferred) -** Nature-like channel on north side of the Menominee impoundment (bypass impoundment entirely).

- **Alternative 3.2 -** Conventional fish lift constructed near the tailrace of the Park Mill powerhouse.

Alternative 3.1 (Preferred) involves a nature-like channel constructed on the north side of the Menominee (Lower Scott) impoundment. The channel would allow upstream migrating species to swim in an isolated channel from the upstream passage device at the Menominee Dam into the Upper Scott impoundment above the Park Mill Dam, thus bypassing the Menominee impoundment entirely. The main target fish species is the lake sturgeon. This channel would also create additional potential spawning habitat for a variety of fishes. Through consensus among the members of the Implementation Team, Alternative 3.1 was selected as the Preferred Alternative.

Alternative 3.2 involves a conventional fish lift constructed near the tailrace of the Park Mill powerhouse. Fish would be lifted from the tailrace area and passed into the power canal upstream from an angled fish guidance rack fish diversion structure. The main target fish species is the lake sturgeon.

Menominee Dam

- **Alternative 4.1 (Preferred) -** Fish lift constructed in the tailrace of the Menominee powerhouse.

- **Alternative 4.2** - Fish lift constructed in an unused turbine bay of the Menominee powerhouse.

Alternative 4.1 (Preferred) involves the use of a conventional fish lift constructed in the tailrace of the Menominee powerhouse. Fish would be lifted from the tailrace and passed into a sorting facility in an unused open area of the adjacent warehouse. Fish would then

be sorted to remove invasive species, such as sea lamprey, or held until adequate fish health screening is achieved, and then passed into a low turbulence area of the forebay upstream from the powerhouse or into a nature-like channel for passage to an area upstream of the Park Mill Dam. This configuration could use an existing, unused turbine bay of the powerhouse to route attraction flows through a newly installed turbine to generate electricity. The main target fish species is the lake sturgeon. Through consensus among the members of the Implementation Team, Alternative 4.1 was selected as the Preferred Alternative.

Alternative 4.2 involves the use of a conventional fish lift constructed inside an unused turbine bay of the Menominee powerhouse. Fish would be sorted from invasive species, such as sea lamprey, inside the turbine bay and then lifted and passed into a low turbulent area of the forebay upstream from the powerhouse or into a nature-like channel for passage to an area above the Park Mill Dam. This configuration could utilize an adjacent existing, unused turbine bay of the powerhouse to route attraction flows through a newly installed turbine to generate electricity. The main target fish species is the lake sturgeon.

Deciding Between Multiple Alternatives

There are several instances where there is more than one acceptable alternative. Even though there is a preferred alternative, final selection of the best and most feasible alternative will need to be based on information that is not yet available.

Downstream Passage/Protection at Park Mill Dam

Construction of an angled fish guidance rack in the power canal, located immediately upstream of the existing powerhouse trash racks, is the preferred alternative (Alternative 1.1) and is currently the only feasible alternative. A decision tree will be used to help guide future decisions based on newly acquired knowledge (Figure 3)

Downstream Passage/Protection at Menominee Dam

Construction of a pipe down the south side of the impoundment is the preferred alternative (Alternative 2.1). However, it is presently unknown whether it is possible to acquire the necessary permits and easements from property owners along the south side of the Menominee (Lower Scott) impoundment. A decision tree will be used to help guide future decisions based on newly acquired knowledge (Figure 4).

Upstream Passage at Park Mill Dam

Construction of a Nature-like channel along the north side of the Menominee (Lower Scott) impoundment is the preferred alternative (Alternative 3.1). However, it is presently unknown whether it is possible to acquire the necessary permits and easements from property owners along the south side of the Menominee (Lower Scott) impoundment. In addition, detailed surveys are needed to determine whether the

construction of a nature-like channel is feasible. A decision tree will be used to help guide future decisions based on newly acquired knowledge (Figure 5).

Upstream Passage at Menominee Dam

Construction of a fish lift in the tailrace of the Menominee Dam is the preferred alternative agreed to by the Implementation Team. When deciding where to place the fish lift, it is important to consider economics, safety, effectiveness, practicality, and ease of use and incorporation into adjoining facilities. A decision tree will be used to help guide future decisions based on newly acquired knowledge (Figure 6).

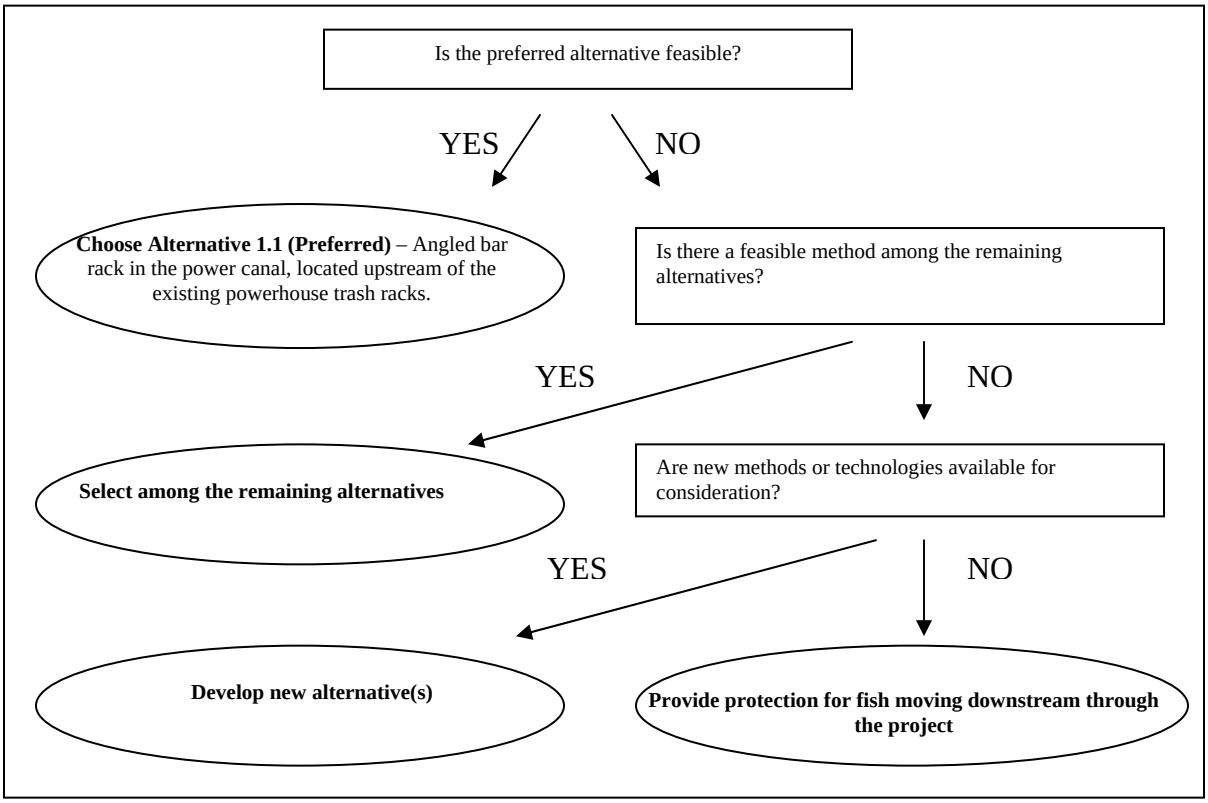

Figure 3. Decision tree outlining the process by which the Implementation Team will choose downstream fish passage and protection at Park Mill Dam.

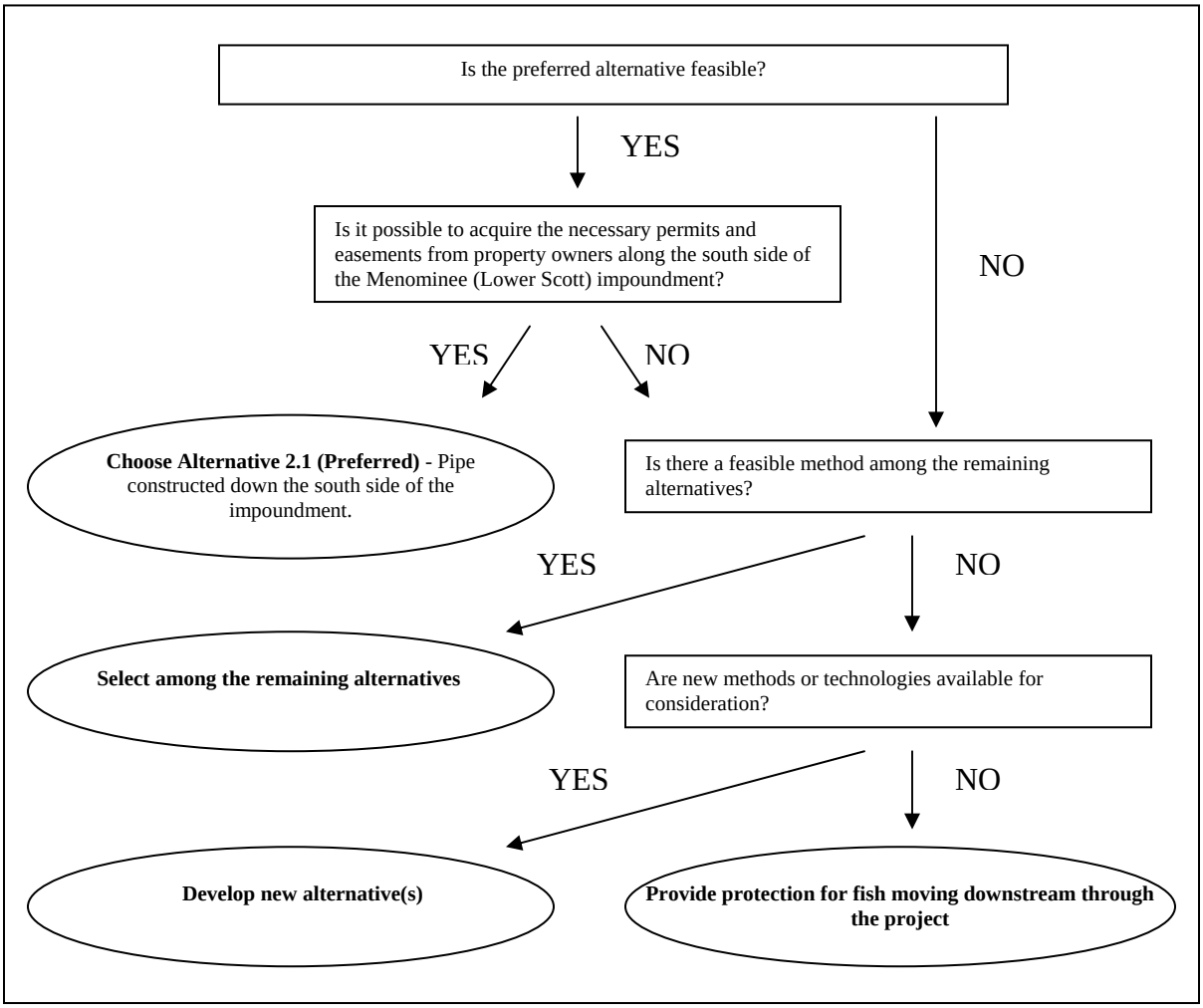

Figure 4. Decision tree outlining the process by which the Implementation Team will choose downstream fish passage and protection at Menominee Dam.

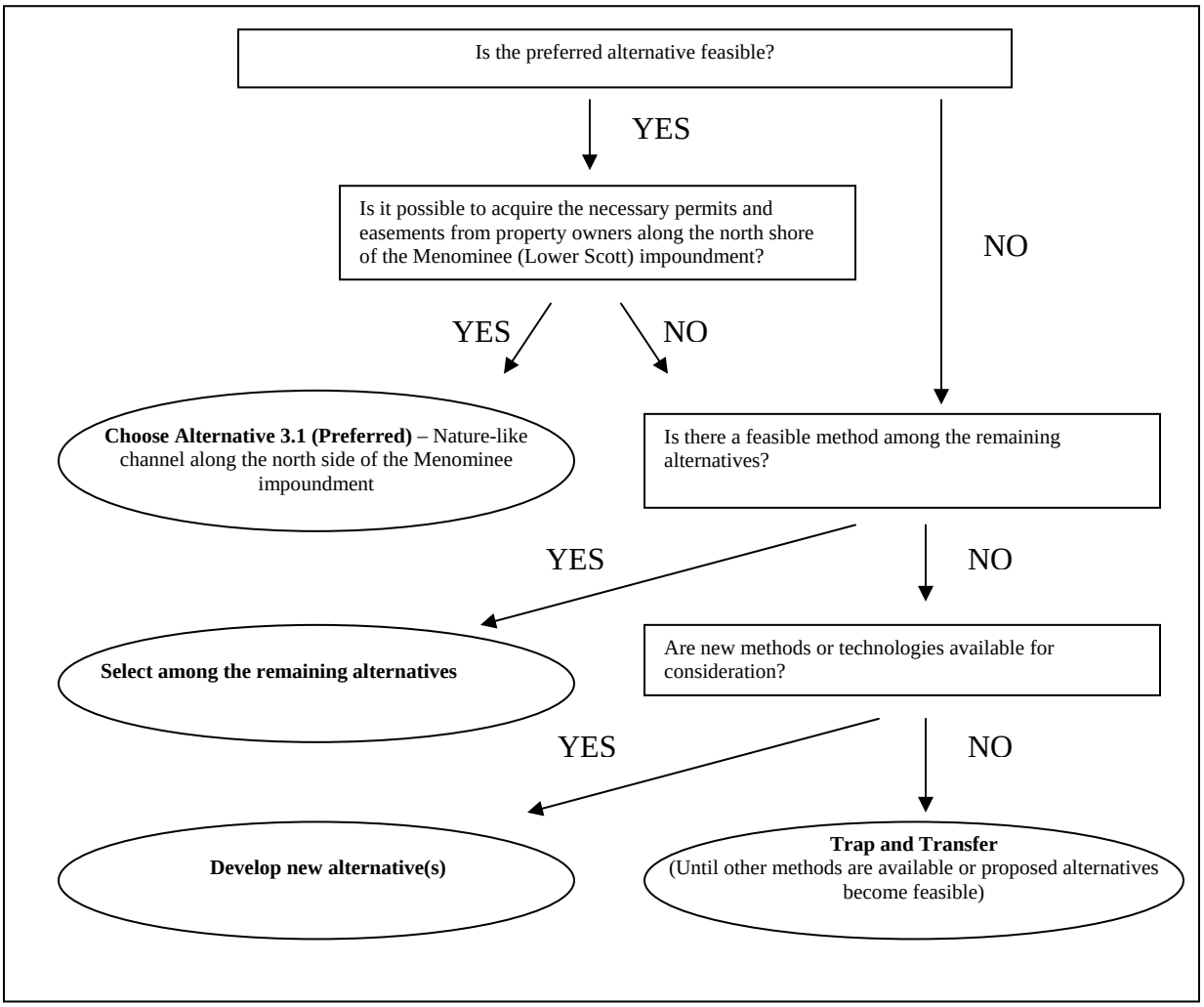

Figure 5. Decision tree outlining the process by which the Implementation Team will choose upstream fish passage at Park Mill Dam.

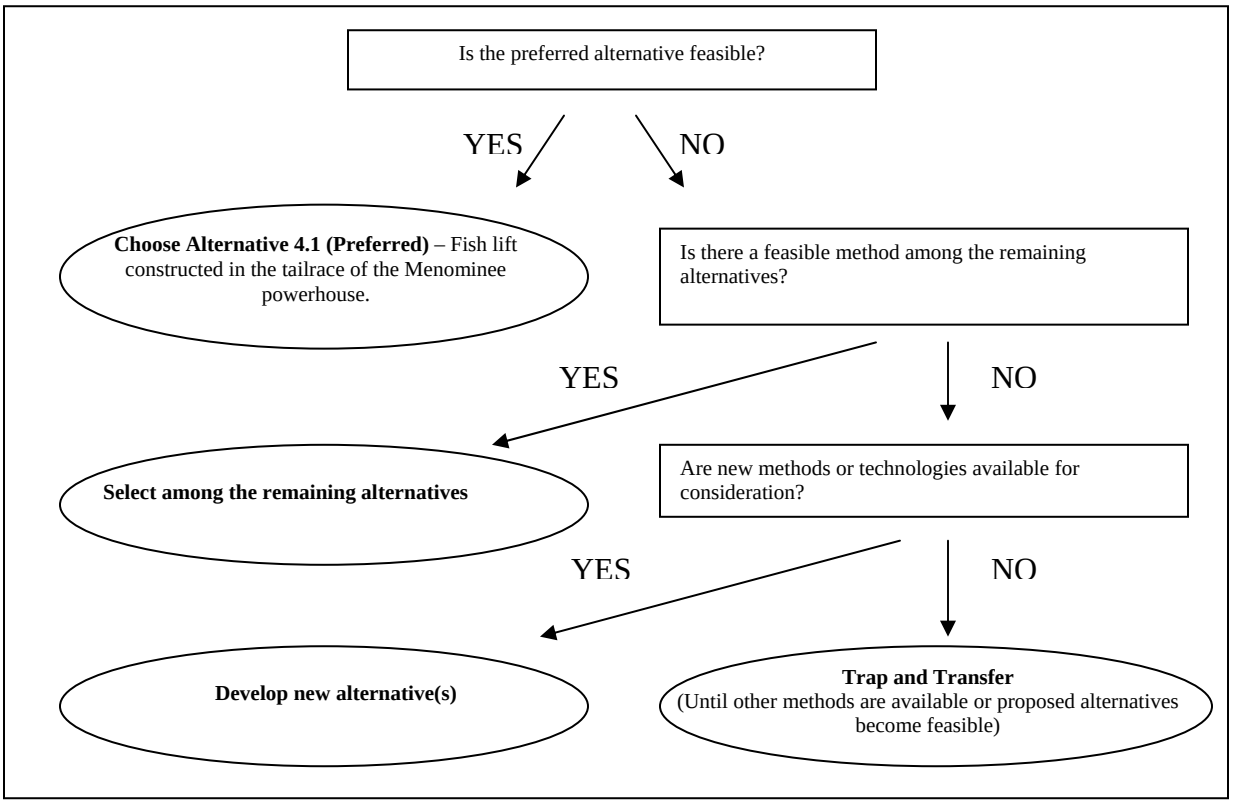

Figure 6. Decision tree outlining the process by which the Implementation Team will choose upstream fish passage at Menominee Dam.

Conceptual Plan, Drawings, and Cost Estimates

As described above in the Alternatives Analysis, the Preferred Alternatives form the core of the conceptual plan for fish passage and protection at the Menominee/Park Mill Hydroelectric projects. The conceptual plan is composed of four phases that are associated with the Preferred Alternatives. Although these phases are listed numerically, they can and should be addressed concurrently with priority of completion based on numerical order. Downstream passage and protection at Park Mill Dam (Phase 1) is the highest priority and should be made operational prior or concurrent to completion of Phase 3. Operation of the upstream facility at Menominee (Phase 2) could be used for fish collection and sorting prior to completion of Phase 4. Phases 1 and 2 must be operational prior or concurrent to Phases 3 and 4, respectively.

- Phase 1 (Alternative 1.1) – Install an angled fish guidance rack above the existing trash racks of the Park Mill Dam powerhouse. This guidance rack will connect to a bypass structure designed to safely direct downstream-moving fish around the Park Mill Dam. This bypass structure will connect to a pipe conveyance enabling safe passage around the Menominee Dam (see Phase 3). Phase 1 will provide fish protection and safe and effective bypass around Park Mill Dam. Interim measures will be used to safely convey fish below Menominee Dam until completion of the pipe conveyance described in Phase 3.

- Phase 2 (Alternative 4.1) – Construct a fish lift in the tailrace directly below the Menominee Dam powerhouse. This lift will use attraction flows generated from the existing turbines to guide fish to a hopper that will lift these fish above the dam and into a sorting facility designed to separate the undesirable invasive species (e.g., sea lamprey) from the lake sturgeon, screen for fish health, and collect sturgeon gametes. The sorted sturgeon will be deposited into a natural stream channel for movement upstream (see Phase 4). Phase 2 will provide a permanent, effective, and mechanized way to get lake sturgeon above Menominee Dam with minimal physical trauma from handling. Interim measures will be put in place to transport lake sturgeon safely upstream until completion of the natural stream channel described in Phase 4.

- Phase 3 (Alternative 2.1) – Construct a pipe conveyance next to the Menominee impoundment, connected to the bypass structure from Phase 1. This pipe will be designed to safely convey fish downstream and into the tailwater below Menominee Dam to facilitate fish passage all the way to Lake Michigan. Phase 3 will provide a permanent, safe, timely and effective passage for fish moving downstream around Menominee Dam.

- Phase 4 (Alternative 3.1) – Construct a natural stream channel near the shore of the Menominee impoundment. This channel will connect to the fish lift at the

Menominee Dam (see Phase 2) and will act as a natural conveyance for upstream-moving fish into the Menominee River above the Park Mill Dam. This phase will provide a permanent, continuous, and effective method for lake sturgeon to get above Park Mill Dam with no physical trauma from handling.

Conceptual Fish Passage Plan

Downstream Fish Passage/Protection

The downstream fish passage and protection plan will consist of an angled fish guidance rack in the power canal of the Park Mill Dam directing downstream moving fish into a pipe conveyance designed to move the fish to a point below the downstream Menominee Dam. The angled fish guidance rack will have two purposes: it will act as both a screen to minimize fish entrainment at the Park Mill Dam and also as a guidance structure for directing downstream moving fish into the pipe conveyance. The pipe will bypass the Park Mill Powerhouse and will be placed along the south shore of the Menominee impoundment. A fish collection and observation structure will be placed at the lower part of the conveyance pipe to allow for monitoring of the fish by biologists. Protections will be in place to ensure sea lamprey and other invasive species cannot move upstream through the conveyance. See Figure 7 for an illustration of the downstream movement path.

Upstream Fish Passage

The upstream fish passage plan will consist of a fish lift at the Menominee Dam combined with a nature-like channel fishway. Fish moving upstream in the Menominee River from Green Bay will be attracted using targeted flows to the north side of the Menominee Dam Powerhouse where an inclined fish lift will trap the fish and elevate them to a holding pond in the powerhouse. Trained biologists will then sort non-target and invasive species from target species (e.g., lake sturgeon). Targeted and disease free fish will be directed into a nature-like channel fishway leading upstream of the Park Mill Dam. See Figure 7 for an illustration of the upstream movement path.

Conceptual Drawings

Phase 1 – Angled Fish guidance rack and Entrance Structure (Figures 8, 9, and 10)

The Park Mill Hydroelectric Dam currently employs a steel trash rack approximately 80 feet long by 20 feet high. The trash rack protects the turbines from ingesting debris that could damage turbine parts during normal operation. The trash rack system must be designed to withstand the full hydraulic force of water in front of it in the event the rack becomes plugged with ice or other debris. The trash racks are constructed of steel slats approximately 4” x 3/8” by 20 feet long with 1.75” clear horizontal spacing between each slat. The trash racks are supported by a system of structural steel supports that are affixed to the bottom of the forebay and the existing building structure. The structural steel supports also hold up the trash rack walkway.

The new angled trash rack system (i.e., fish guidance rack) is to be installed on a support system at a 28º pitch with the whole structure at a 45º angle to guide fish into the downstream conduit system (Figures 8 and 9). In addition, angled guides will be incorporated into the approach at a shallower 25º pitch to better guide fish toward the entrance structure near the top of the water column (Figures 8 and 9).

The angled fish guidance rack will guide downstream moving fish into an entrance structure (Figure 10). This will be a steel reinforced concrete intake structure with an upwards slanting ramp that empties into a collection basin whereby the fish can enter the downstream pipe conduit (see Phase 3). Flow will be controlled using a secondary gate that will also allow water to be released back into the turbine bay for electricity production. This structure will serve as a "funnel" to direct downstream moving fish into the pipe conduit.

Fish entering the bypass system will encounter a smooth acceleration of transport velocities in a downstream direction toward the safe bypass route.

Phase 2 – Fish Lift and Sorting Facility (Figures 11 and 12)

Prior to entering the nature-like channel fishway, all upstream migrating fish will be attracted to a basket designed to trap and lift the fish up and into a holding and sorting tank (Figures 11 and 12) where trained biologists will sort undesired organisms (e.g., sea lamprey and other invasive species) from the desired fish (e.g., lake sturgeon and other target species). This sorting facility will include a fish health testing area with holding tanks to insure that fish passed upstream are disease- free. The desired fish will then pass into a corral pond and eventually will be directed by flow into the nature-like fishway (Figure 11; see Phase 4). Undesirable organisms will either be returned to the river downstream of Menominee Dam or will be destroyed.

The fish lift will be operated for those parts of the year when target fish are migrating upstream. Other requirements and considerations relative to the fish lift need to be investigated further as we move into the advanced design phase of this project. Two very important considerations include location of the fish lift entrance and attraction of fish into this entrance.

Entrance Location

The location takes into account the locations where fish hold before attempting to pass the barrier and routes by which they will approach the barrier and passageway. Attraction flow is available from the outflow of the proposed new turbine as well as from the return flow of the upstream passage/nature-like channel (Figure 11). To better understand the ability to guide lake sturgeon using attraction flows, the Implementation Team has conducted experiments using an artificial attraction flow installed in an empty turbine bay. These experiments were successful in attracting lake sturgeon, giving us confidence that we can successfully attract and pass lake sturgeon upstream.

There are no specific fishway entrance flow criteria. The entrance flow must be adequate to compete with spillway or powerhouse discharge flow for fish attraction but also be manageable for target species such as lake sturgeon. For example, lab studies by Peake et al. (1995) determined that velocity should not exceed 4 fps for upstream passage of lake sturgeon. Site conditions, especially tailwater hydraulics, channel width, and proximity to the bank will ultimately determine entrance flow requirements. Ideally, it would be oriented along the edge of the high flow hydraulic barrier. A benefit of an angled entrance is that the entrance flow penetrates the tailwater to a greater extent than if aligned perpendicular to a turbulent, high velocity tailrace condition. Protrusion of the angled entrance into the stream (Figure 11) provides an abutment and a velocity shadow behind which fish can move upstream (Figure 12).

Phase 3 – Pipe Conduit and Fish Observation Structure (Figures 13 and 14)

Downstream migrating fish will be guided into a pipe conduit for conveyance downstream of the Menominee Dam, completely bypassing the Lower Scott flowage (see Figure 7 for proximity of pipe to reservoir). The conduit diameter will be wide enough to accept the largest of species and will have a smooth surface, appropriate flow parameters, and slow bends so as to limit or avoid stress or injury to the fish (Figure 13).

The pipe conduit will extend to a point below the Menominee Dam where it will connect with a steel reinforced concrete structure anchored to the embankment (Figure 14). This structure will have two purposes: (1) to act as an anchor point at the downstream terminus of the pipe conduit that will allow for a flexible joint that can move with the water level and (2) to serve as an observation and collection facility to monitor and assess the condition, composition, and abundance of downstream moving fish.

After passing through the observation structure, downstream moving fish will pass through a flexible pipe at a steep angle before being safely discharged into the project tailrace. The steep angle of the pipe will allow for the fast discharge velocity (> 12 fps) required to prevent upstream spread of invasive species (e.g., sea lamprey; Mcauley 1996). To prevent upstream spread of invasive species, this plan will incorporate three redundant and proven safeguards:

1. Water velocities at the terminus of the downstream pipe will not be less than 12 fps to prevent upstream movement of sea lamprey and other invasive species (Mcauley 1996).

2. The final foot of downstream pipe will be perforated to prevent sea lamprey suction.

3. The flexible section of downstream pipe will be a minimum of 18 inches above the water at all times to prevent upstream access to sea lamprey and other species.

Phase 4 – Nature-like Channel Fishway (Figures 15, 16, 17, and 18)

Fish migrating upstream (i.e., lake sturgeon migrating upstream to spawn) will be able to do so naturally using a constructed channel on the north side of the Lower Scott flowage (see Figure 7 for proximity of constructed channel to reservoir). The benefits of allowing natural migration by way of a constructed fishway include: (1) low cost in operation and maintenance, and (2) less stress on fish when compared to manually moving the fish.

Stream Bed Composition and Hydraulics

The following mix of fill/bed material provides the best streambed function and fish passage (Figure 15):

- 30% fines (dirt or silt; this allows the new streambed to "seal" and remain stable in the channel)
- 30% small rock (½" - 6" diameter)
- 30% large rock (6"- 8" Class I)
- 10% "shadow" rock (Class II- Class III; these simulate undercut banks, large wood, and boulders and should remain in place during flood events)

Class I rock is the size (diameter) of the largest rock found naturally in the stream. Class II – Class III rock is 50-100% larger than the largest rock found naturally in the stream. Shadow rock should protrude 30-50% above the final streambed elevation. During construction, the small rock, large rock, and fines should be mixed before placing. The final surface should be washed with water to allow the fines to work into interstitial spaces and provide a good seal, and demonstrate that this seal has occurred. Although there are no specific criteria in place to date, streambed function must be accounted for in a Stream Simulation Method, and deviations from the above mix should be justified. The values should be based on multiple stream measurements above and below the site and outside areas where channel characteristics have been influenced by any existing structure along the site. Most notably is the existing golf course where existing structures are present. It is necessary to consider the impacts to the surrounding area stream, ponds and utilities when placing the new structure. Precast concrete box culverts (Figures 16 and 17) will be installed to eliminate the need for cast-in-place concrete, assuring accurate grade control.

Hydraulic simulation will be performed to ensure the stream to pass all debris and sediment. While it may be difficult to provide passage for all fish by designing for specific hydraulic conditions, natural channel conditions including dimension, pattern, and profile will be approximated. The size of channel required will depend upon the assumed design discharge, the slope, hydraulic roughness and shape (whether wide and shallow or narrow and deep). For design purposes, the hydraulic engineer can divide the proposed channel into reaches of similar gradient. Knowing the proposed gradient, channel shape, and roughness, we can compute a water surface profile and determine the probable water depths and velocities in each reach.

Hydraulic roughness is an important factor in the hydraulic computations. For a given discharge, an increase in roughness reduces the velocity and increases the depth of flow. In the Manning formula for flow in channels, roughness is represented by an empirical coefficient which may vary from 0.012 for concrete-lined canals to 0.025 or more for unlined earth channels. The roughness coefficient for natural streams may range from 0.03 up to about 0.08, depending on the coarseness of the bed materials and the vegetation growing in the bed and banks (Figure 15).

Water Velocity

A uniform transportation velocity from 1.0 to 4.0 fps will be maintained with 2.0 fps as the normal operating standard. Laboratory studies have not found an optimum velocity within that range consistent for all species. However, for lake sturgeon (the primary target species), Peake et al. (1995) determined that velocity should not exceed 4 fps. Velocity will be easily controlled using both upstream and downstream control outlets.

The minimum and maximum sizes of target species may determine maximum velocities and minimum depths in the stream design. Swimming capabilities are a function of fish size and are an important consideration in the design of possible culverts and modifications to falls.

Upstream Passageway Exit

Fish exiting the passageway into a forebay or river will be directed by an exit structure (Figure 18) into the current along the shoreline above Park Mill Dam. An automated bladder spillway gate will control pool elevation to within a few tenths of a foot and offer a safe and controlled exit to the river (Figure 18). Flow control will prevent high velocities which can cause fish to become disoriented and fallback instead of exiting the passageway.

The exit (Figure 18) will have a trash boom and/or coarse trash rack. Debris racks will have a maximum normal velocity no greater than 2.0 fps. Vertical bars will have a minimum of 24 inches of clear horizontal spacing and horizontal bars will be spaced no closer than 18 inches apart. Horizontal bars should be inset, or on the back side of the vertical bars, so debris can slide up the racks. A curtain wall above the trash rack and flush with its face will be helpful for diverting floating debris when there is adequate depth. A properly designed curtain wall allows larger debris to accumulate during high flows and makes debris removal easier. The slope of the trash rack face should be 1:4 or 1:5 (vertical to horizontal) for leverage and easy manual cleaning. A sturdy railing will be installed for cleaning with lights for night maintenance.

Cost Estimates

Phase 1 – Angled fish guidance rack and bypass structure

Inlet Structure	$820,000.00	
Angled Fish Guidance Rack Structure and Cleaner	$780,000.00	
Gates and Operating Equipment	$115,000.00	
Power, Electronics, and Communications	$85,000.00	
Design, Engineering, and Project Management	$80,000.00	
15% Contingency	$282,000.00	$2,162,000.00

Phase 2 – Fish lift and sorting facility

Elevator	$790,000.00	
Crowder	$220,000.00	
Interior Equipment and Piping	$245,000.00	
Building Structural Renovation	$365,000.00	
Design, Engineering, and Project Management	$175,000.00	
15% Contingency	$269,250.00	$2,064,250.00

Phase 3 – Pipe conveyance structure

Transfer Conduit	$1,325,000.00	
Structures and Saddles	$340,000.00	
Outfall/Gate Systems	$312,000.00	
Design, Engineering, and Project Management	$160,000.00	
Legal and Administrative Fees for Easements	$25,000.00	
15% Contingency	$324,300.00	$2,486,300.00

Phase 4 – Nature-like channel fishway

Site Preparation		
Civil Design and Survey	$112,000.00	
Stream Simulation Model	$6,200.00	
Engineering and Drafting	$68,000.00	
Legal and Administrative Fees for Easements	$35,000.00	
15% Contingency	$33,180.00	$254,380.00
Construction		
Excavation and Stream Construction	$1,800,000.00	
Gates and Other Appurtenances	$386,000.00	
Upstream Forebay and Controls	$380,000.00	
Project Management	$120,000.00	
15% Contingency	$402,900.00	$3,088,900.00

TOTAL ESTIMATED PROJECT COST	**$10,055,830.00**

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Table 1. Analysis of all the alternative methods discussed as part of the scoping process for upstream and downstream fish passage at the Menominee/Park Mill Hydroelectric Complex. Shaded alternatives were selected for further consideration due to high feasibility.

	Alternatives	Fish Species	Cost	Maintenance	Electricity Production	Feasibility	Extraordinary Considerations
Downstream Park Mill Dam	1.1 - Angled rack upstream of powerhouse	All	High	High	**	High	Generally accepted as most effective downstream fish passage technology
	1.2 - Angled rack downstream of headgates	All	High	High	**	Low	May affect structural integrity of embankment
	1.3 - Angled rack upstream of headgates	All	High	High	**	Low	May affect structural integrity of embankment
	1.4 – Nature-like channel through berm	All	Low	Low	**	Low	May affect structural integrity of embankment
	1.5 – Nature-like channel north of spillway	All	Low	Low	**	Low*	High cost and maintenance
Downstream Menominee Dam	2.1 – Pipe conveyance on south side	All	Moderate	Moderate	Some	High*	Need property easements
	2.2 – Pipe conveyance across river to north side	All	High	Moderate	Some	High*	Added cost of crossing impoundment
	2.3 – Modified decommissioned fishway	All	Moderate	Low	None	Low	Unsure of fish guidance to entrance
	2.4 – Tainter gate modification	All	Low	Low	None	Low	Tainter gate may be needed for flow release
Upstream Park Mill Dam	3.1 – Nature-like channel on north side	All	Low	Low	Some	High*	Need property easement
	3.2 – Fish lift in tailrace	All	High	High	**	High	Impoundment drawdown/coffer dam needed for construction
	3.3 – Nature-like channel through berm	All	Low	Low	**	Low	May affect structural integrity of embankment
	3.4 – Nature-like channel north of spillway	All	Low	Low	**	Low*	Unsure of fish guidance to entrance
	3.5 – Spiral fishway	Unknown	Low	Low	**	Low	Not field tested
Upstream Menominee Dam	4.1 – Fish lift in tailrace	All	High	High	Yes	High	None
	4.2 – Fish lift in turbine bay	All	High	Moderate	Yes	High	Limited space available
	4.3 – Nature-like channel on north side	All	Low	Low	None	Low*	Limited space and unknown attraction
	4.4 – Spiral fishway	Unknown	Low	Low	Difficult	Low	Not field tested
	4.5 – Vertical slot fishway	Unknown	High	Moderate	Difficult	Low	Not field tested for sturgeon
	4.6 – Fish lock in turbine bay	Unknown	High	Moderate	Difficult	Low	Not field tested for sturgeon

** - indicates water will not be used for electricity production at Park Mill Dam but can be used downstream at the Menominee Dam.
* - assumes property easements can be obtained.

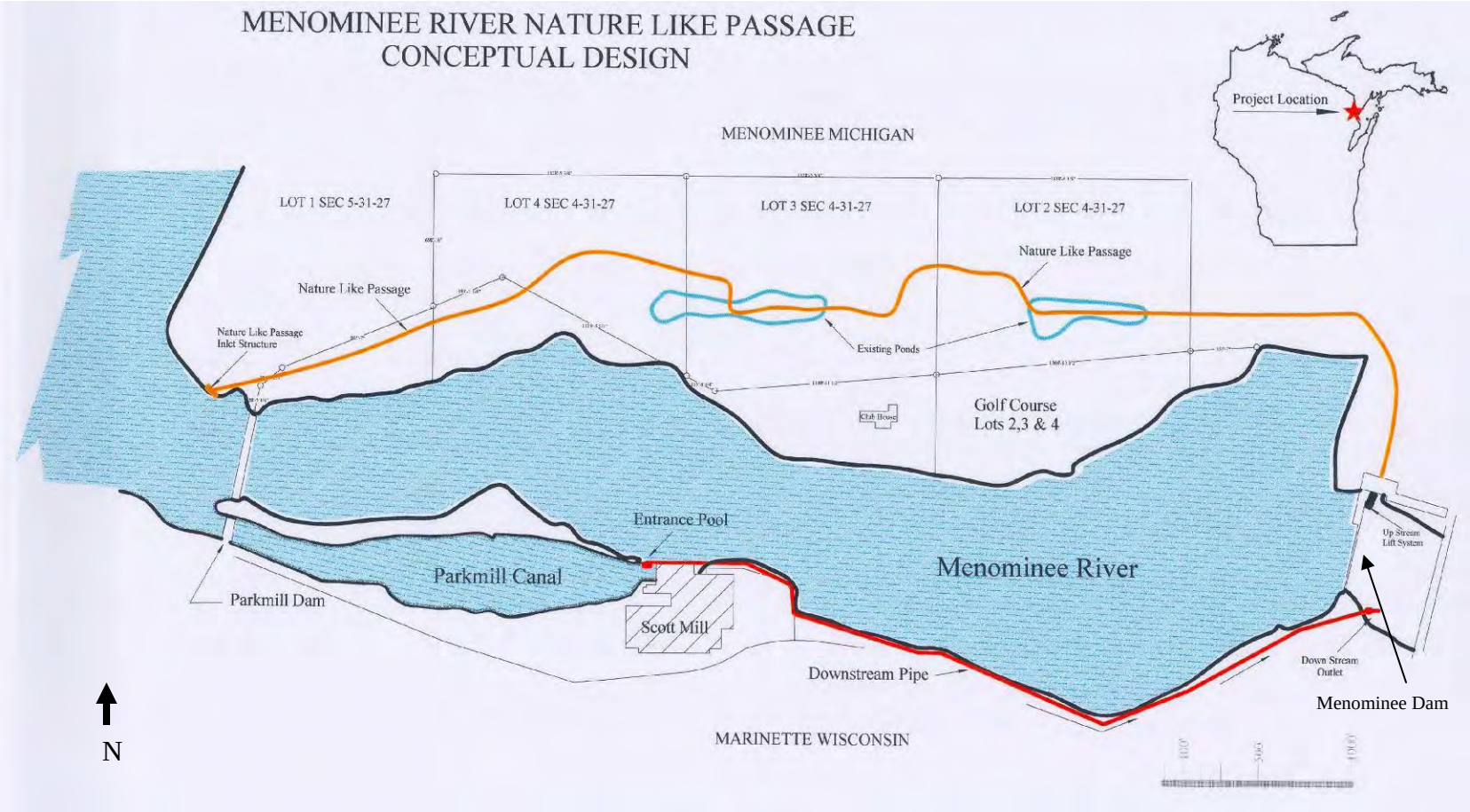

Figure 7. Proposed pathway for both upstream (orange shaded line) and downstream (red shaded line) fish passage at the Menominee/Park Mill Hydroelectric Complex.

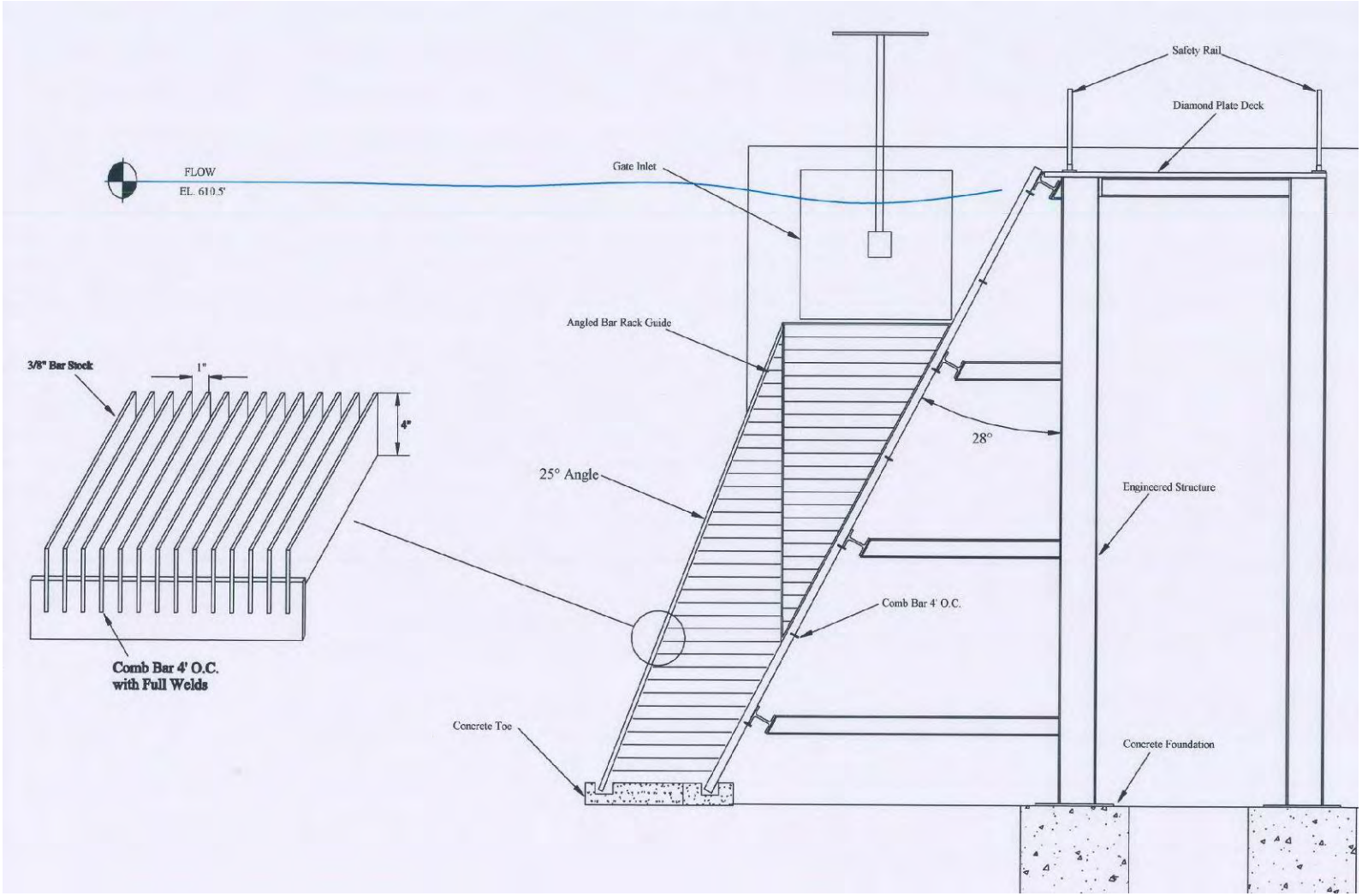

Figure 8. Conceptual design of angled fish guidance rack for placement in the Park Mill Dam power canal.

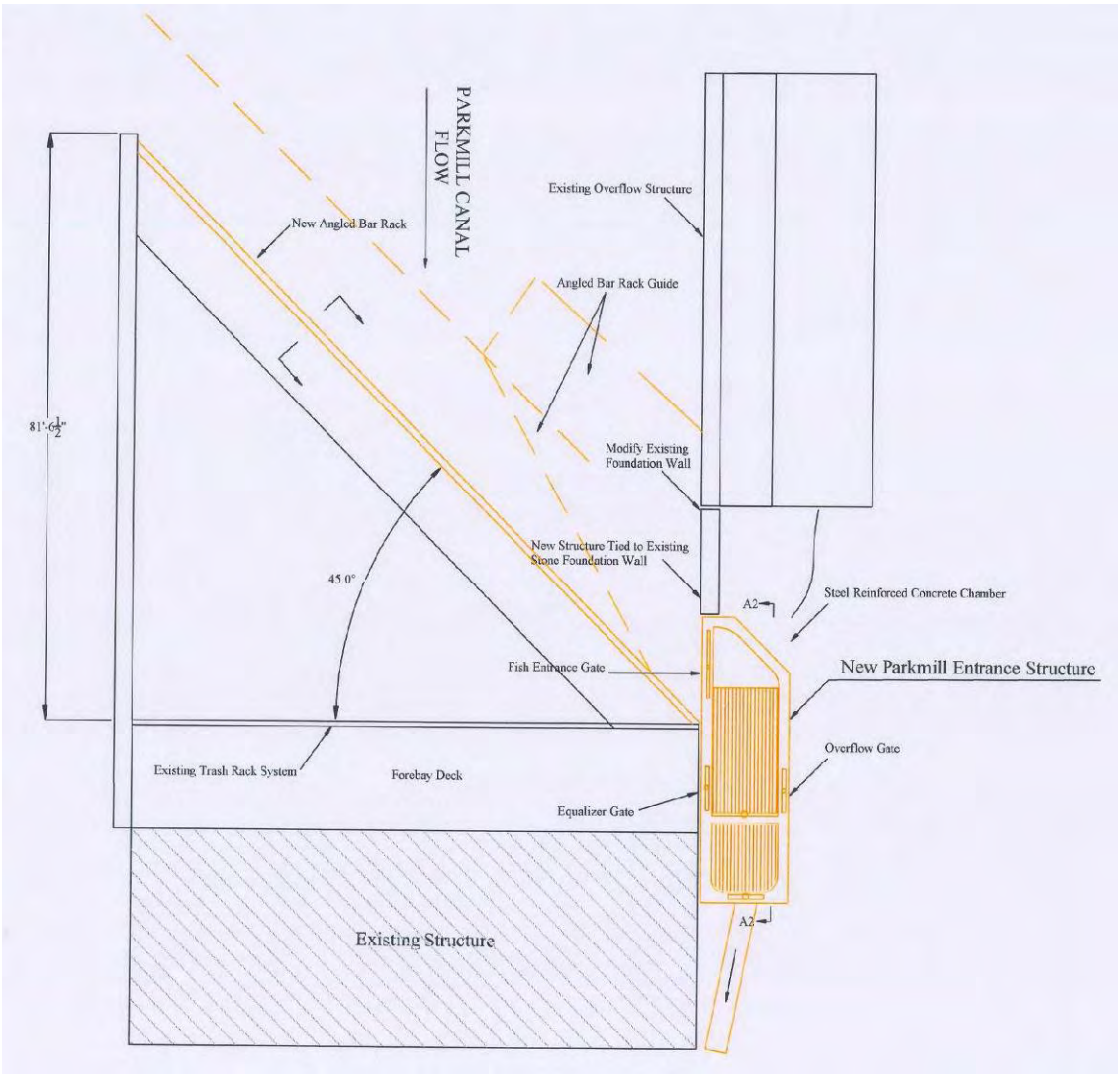

Figure 9. Conceptual layout and locations of angled fish guidance rack and downstream entrance structure in the power canal above the Park Mill Dam.

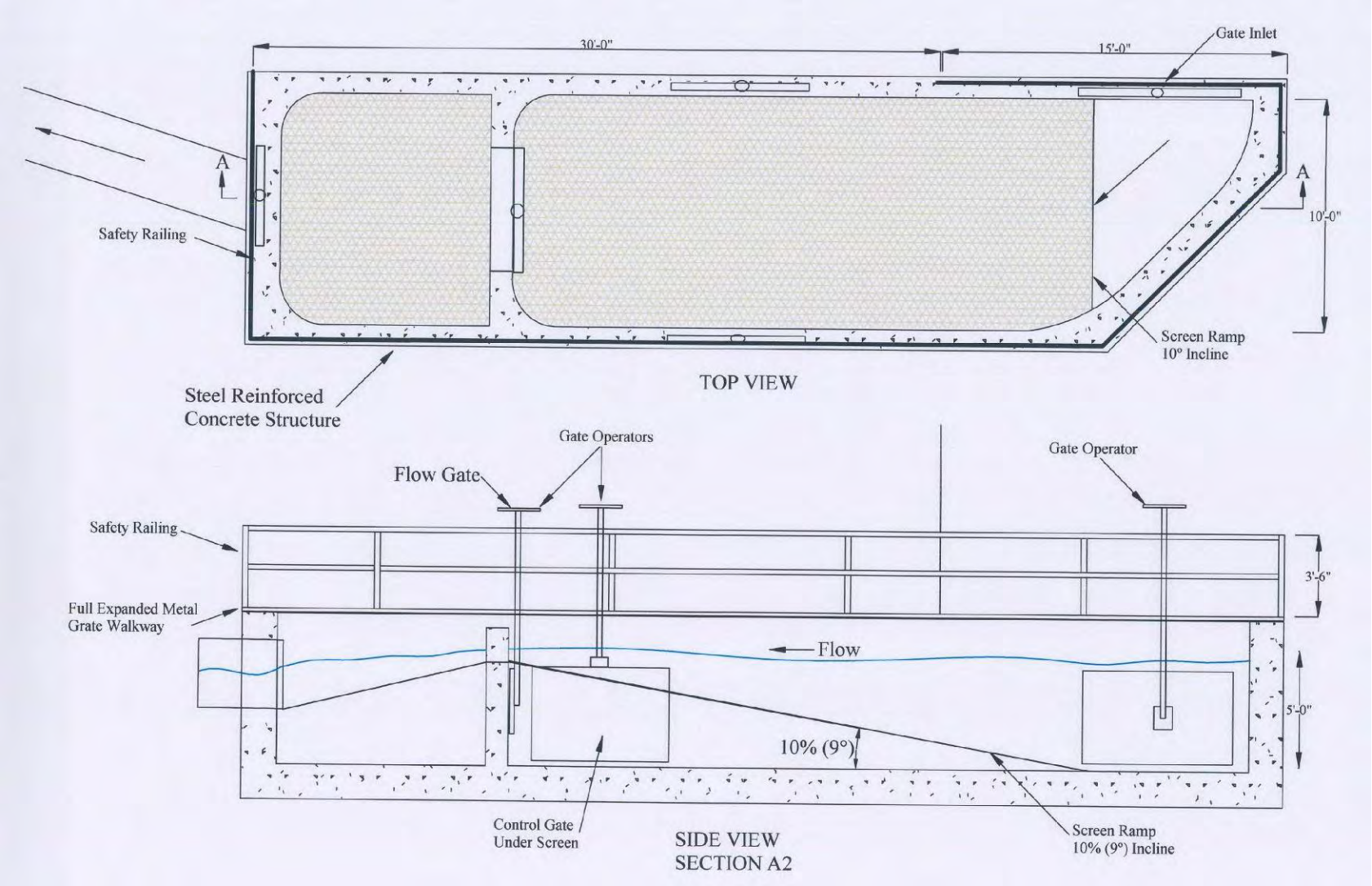

Figure 10. Conceptual drawing of downstream entrance structure at the Park Mill Dam.

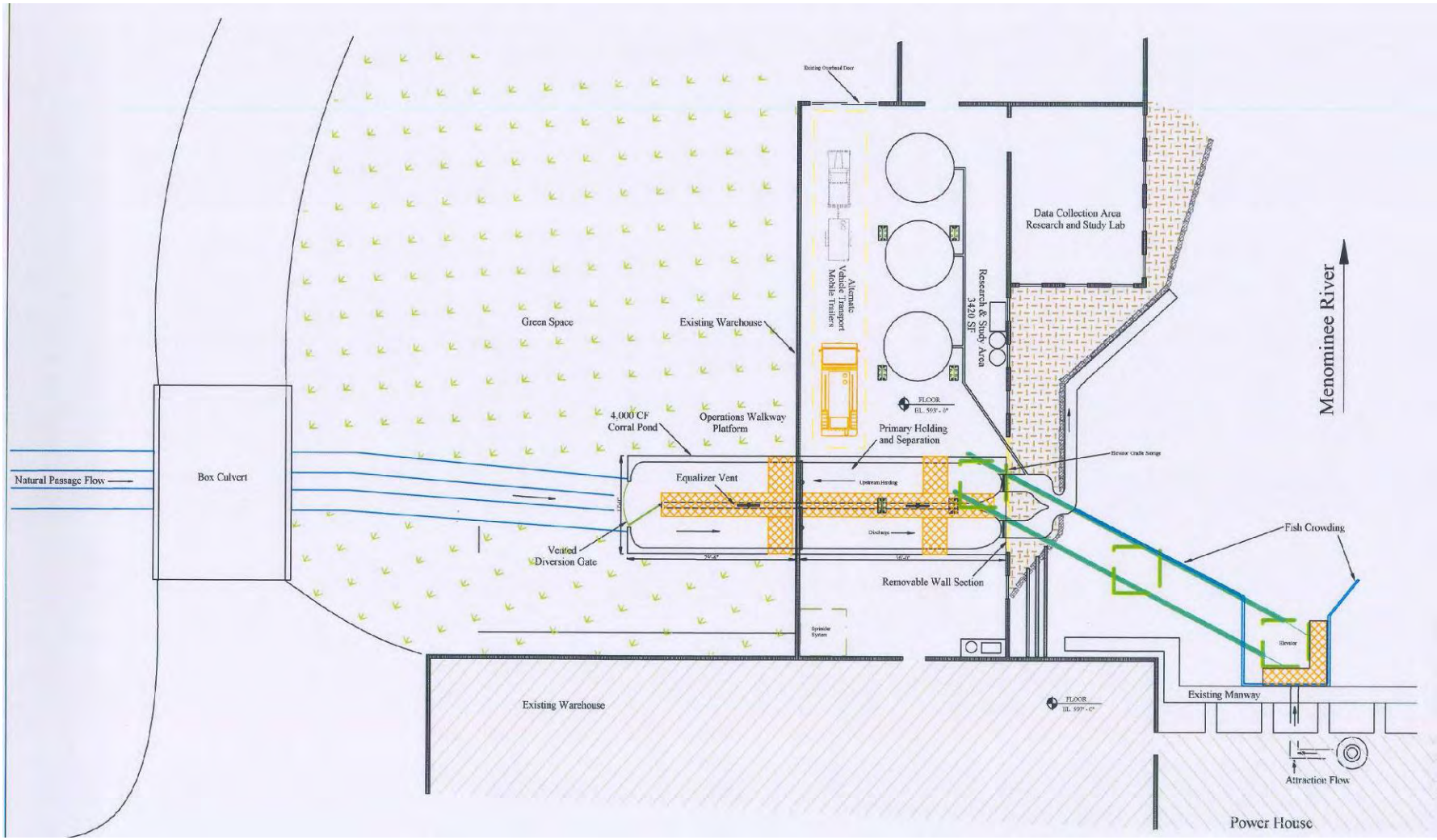

Figure 11. Conceptual layout of upstream passage structures below Menominee Dam showing approximate locations of elevator and nature-like channel fishway.

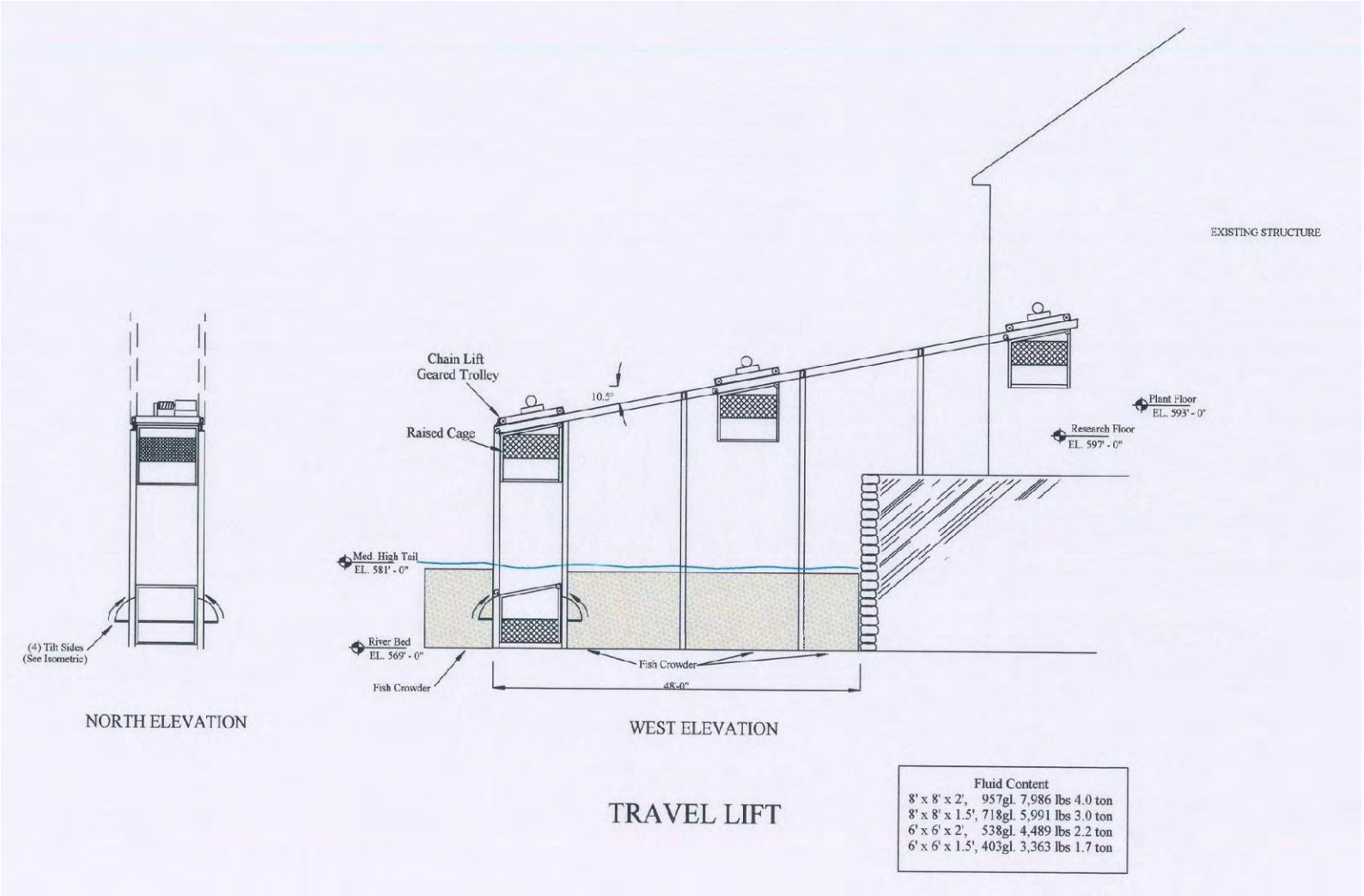

Figure 12. Conceptual drawing of fish elevator / travel lift for upstream passage at the Menominee Dam.

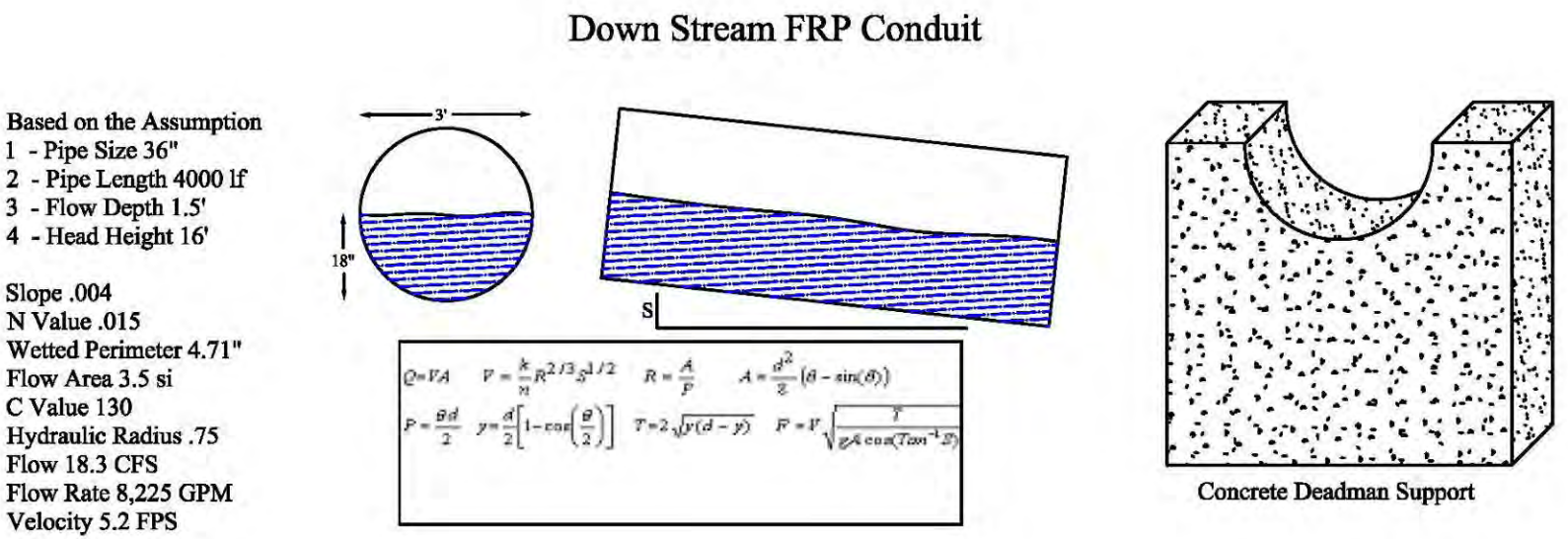

Figure 13. Conceptual Pipe design parameters to pass fish from the Park Mill power canal to downstream of Menominee Dam.

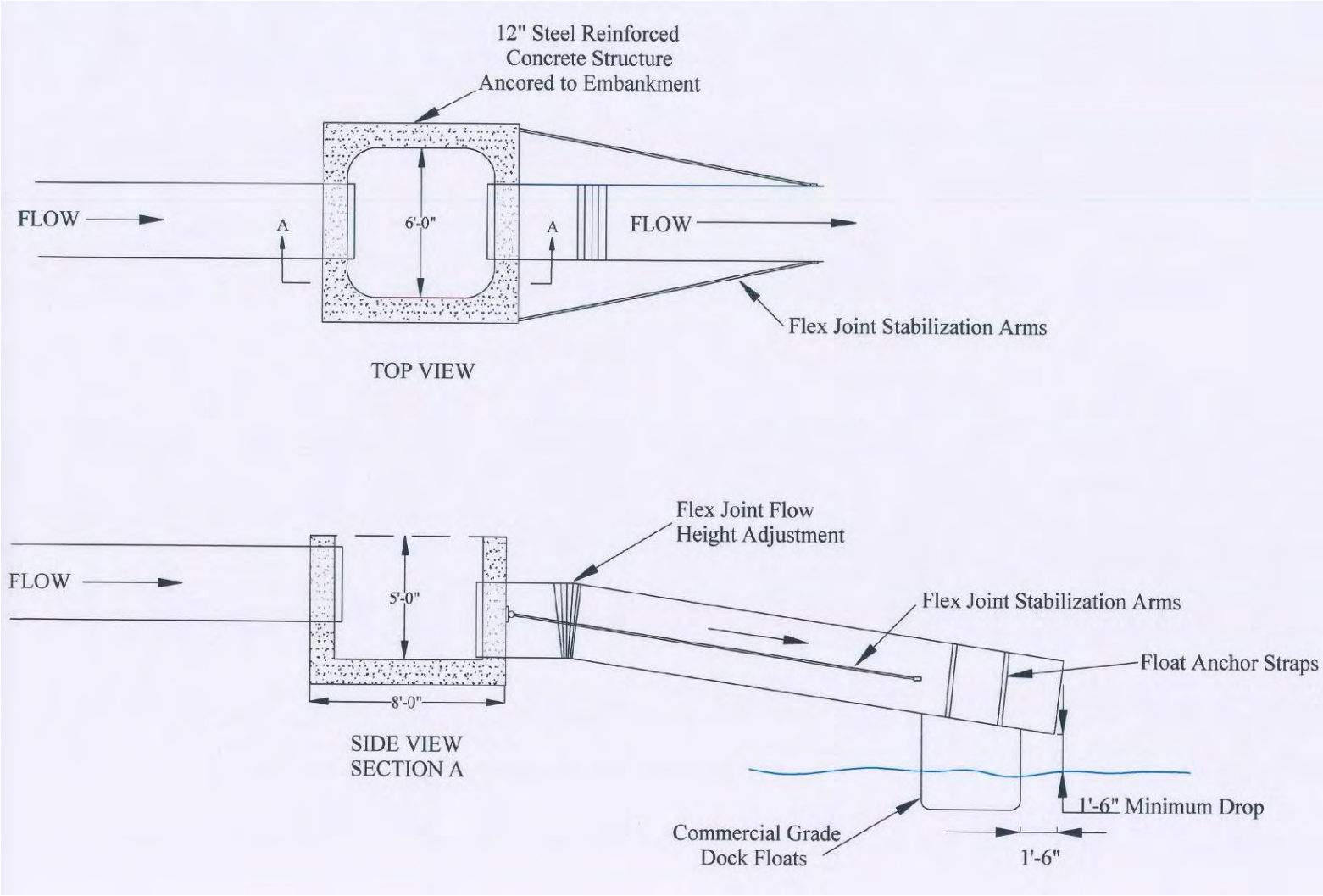

Figure 14. Conceptual drawing of downstream fish collection and pipe pivot structure located downstream of Menominee Dam.

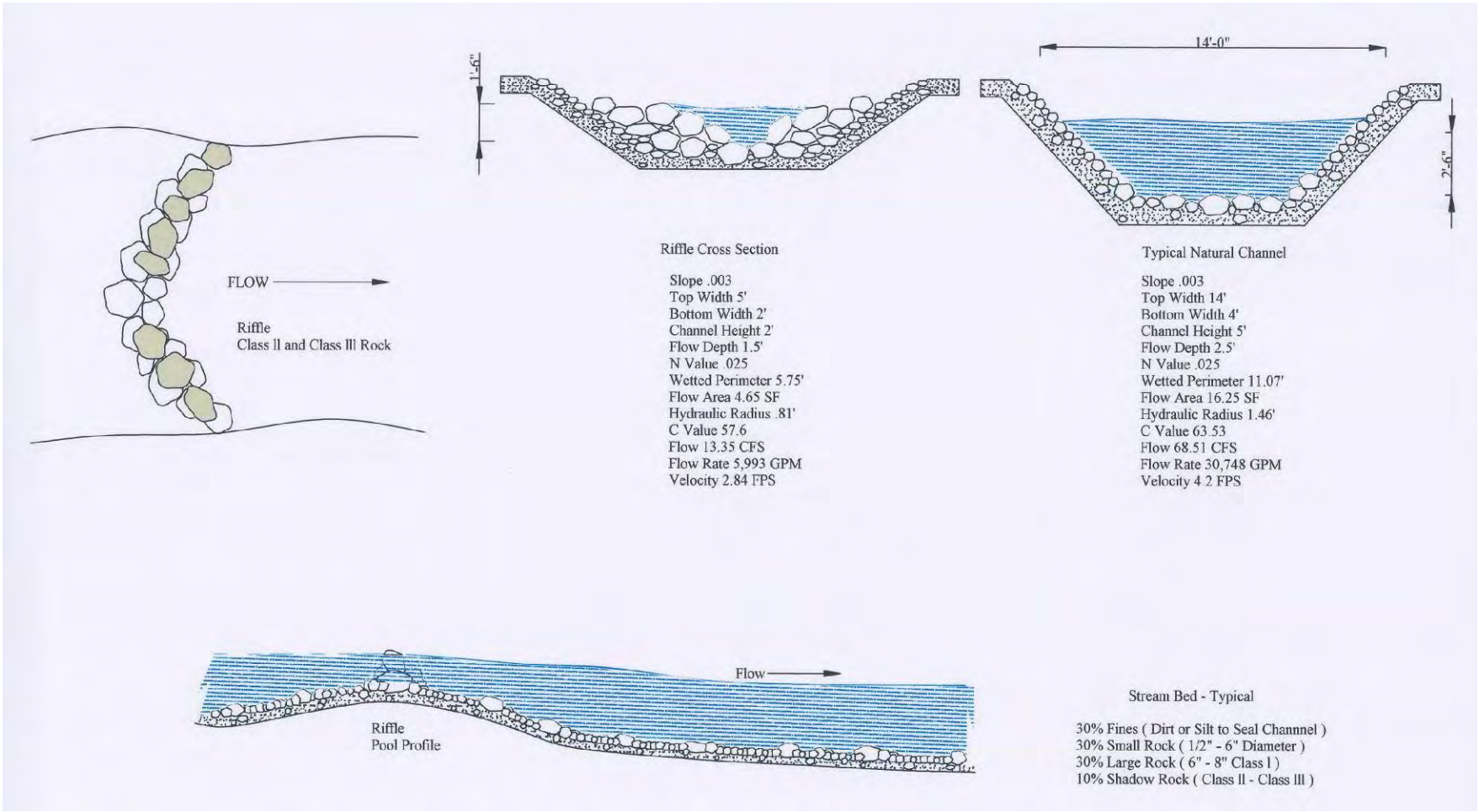

Figure 15. Conceptual design of nature-like channel fishway for upstream fish passage at the Menominee/Park Mill Hydroelectric Complex.

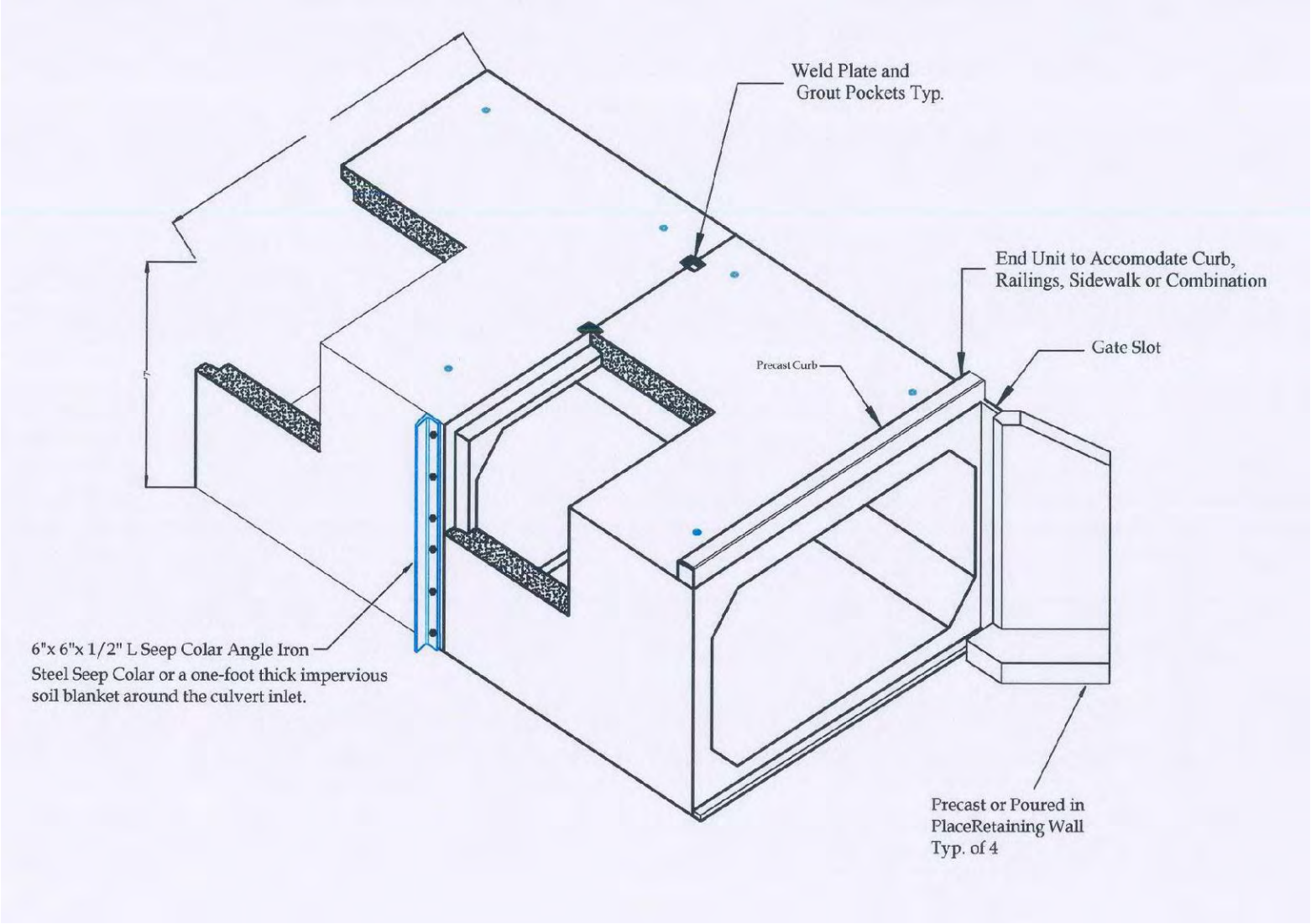

Figure 16. Conceptual drawing of upstream pre-engineered box inlet culvert for incorporation into the nature-like channel fishway at the Menominee/Park Mill Hydroelectric Complex.

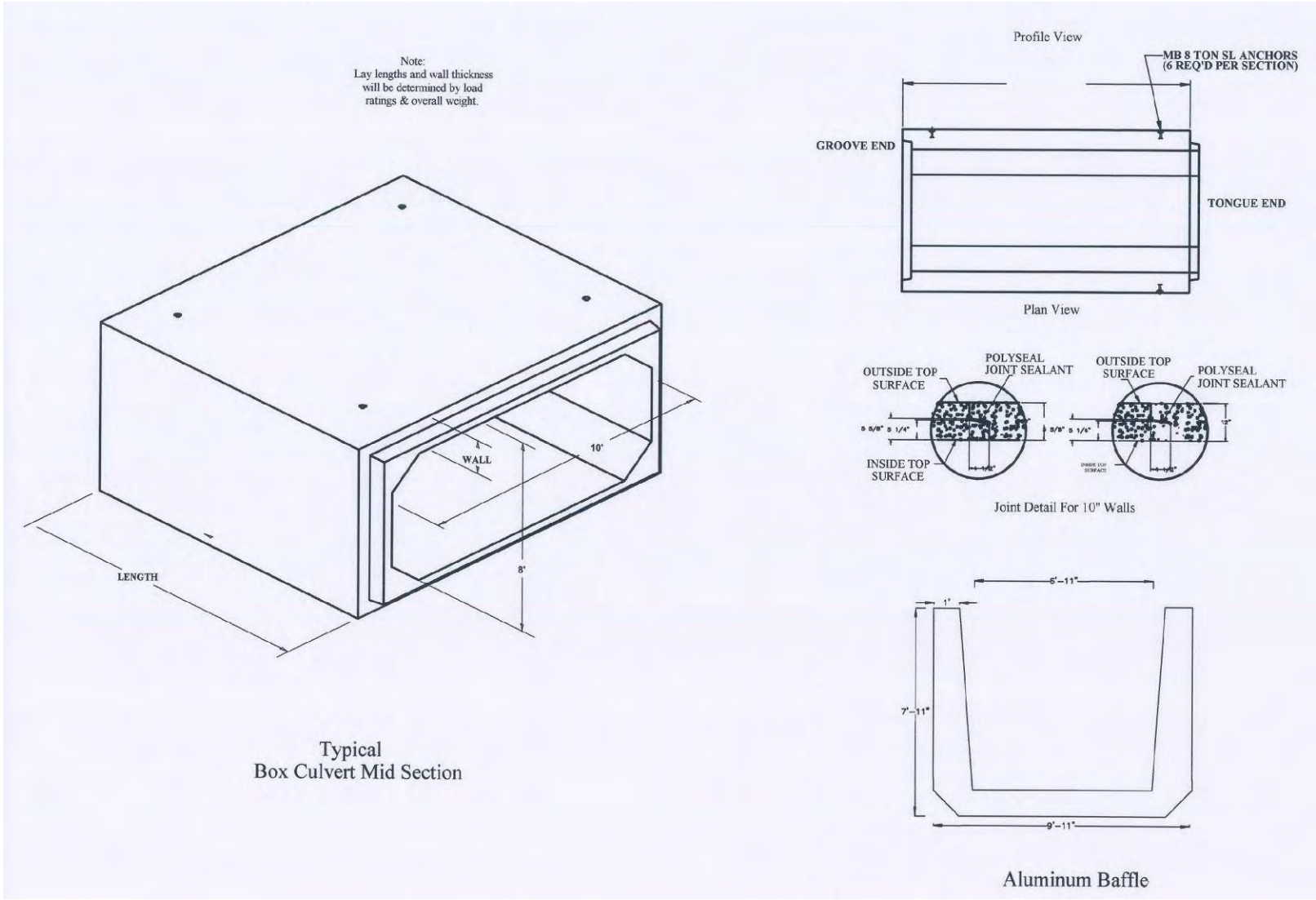

Figure 17. Typical box culvert mid-section for incorporation into the nature-like channel fishway at the Menominee/Park Mill Hydroelectric Complex.

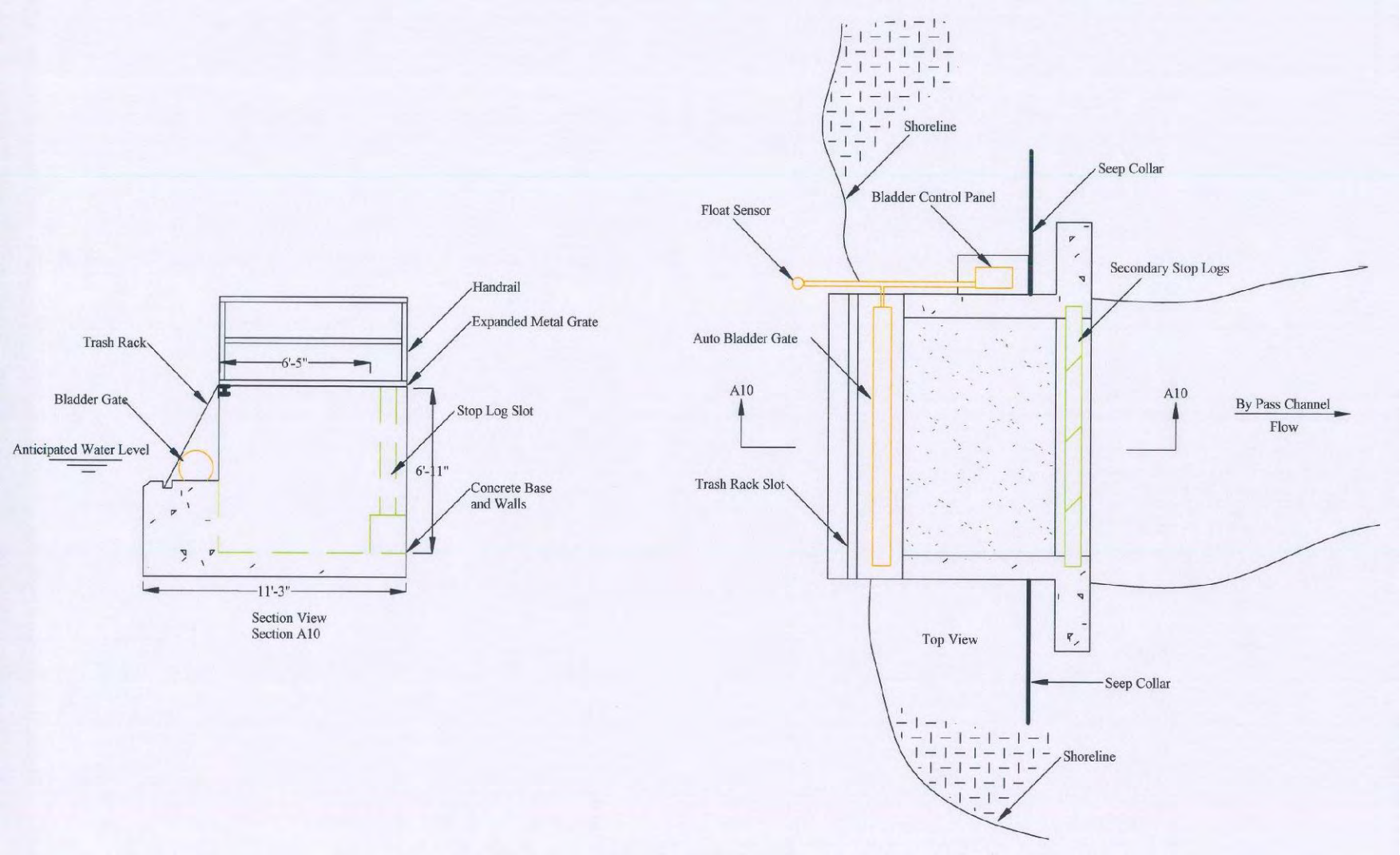

Figure 18. Conceptual drawing of upstream exit structure for the nature-like channel fishway at the Menominee/Park Mill Hydroelectric Complex.

APPENDICES

Appendix A: Administrative record of changes made to the Menominee/Park Mill Fish Passage and Protection Plan.

7/13/2009

First version of the report (Version 1.0) finalized and distributed. Report released after unanimous support from the Implementation Team at the July 10, 2009 meeting.

10/29/2009

Text was added and minor modifications made to the existing text for clarification and to update the report based on information required in grant applications. "Components" were changed to "Phases" and figures were rearranged to better match construction and operation priorities. Figure 19 of the previous version was removed. Draft Version 1.1 was distributed to the Implementation Team for review and approval of changes on 10/16/2009. Version 1.1 was finalized on 10/29/2009.

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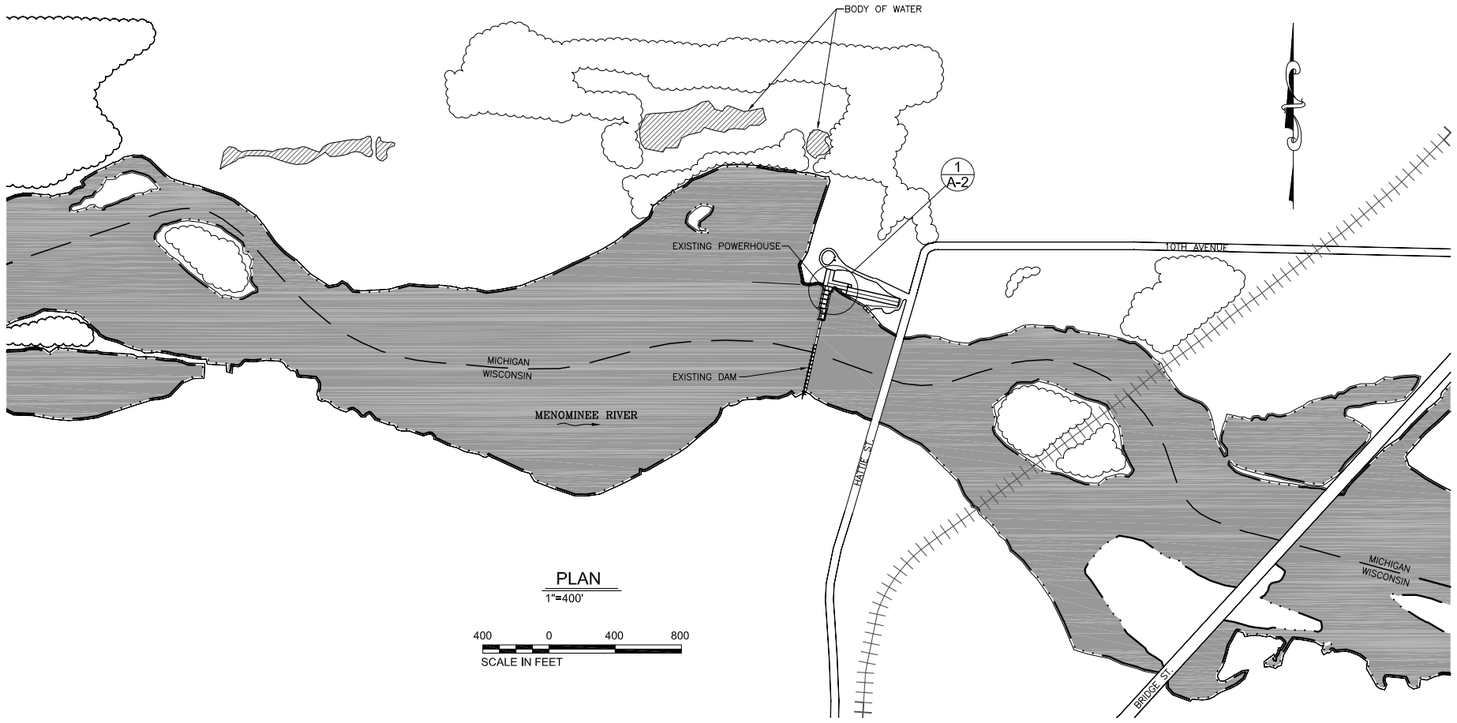

PLAN
1"=400'

400 0 400 800
SCALE IN FEET

GENERAL NOTES:

1. TARGET SPECIES IS LAKE STURGEON.
2. UPPER OPERATION LIMIT OF 10,500 CFS FOR RIVER FLOW (4 TIMES THE MEAN ANNUAL FLOW).
3. UPPER OPERATION LIMIT OF 583.0 FT FOR TAILWATER LEVEL.
4. LOWER OPERATION LIMIT OF 579.0 FT FOR TAILWATER LEVEL.
5. THE SYSTEM MUST ACCOMMODATE 6 FULL SIZE LAKE STURGEON WITH AN AVERAGE LENGTH OF 75 IN AND AN AVERAGE WEIGHT OF 120 LBS. THE SYSTEM MUST ALSO ACCOMMODATE FISH WITH A MAXIMUM LENGTH OF 84 IN.
6. THE FISH LIFT ENTRANCE ATTRACTION FLOW SHALL BE 75-120 CFS WITH A TARGET VELOCITY OF 3-4 FPS.
7. THE FISH LIFT ENTRANCE SHALL BE 5 FT WIDE WITH A MINIMUM DEPTH OF 4 FT.
8. PROVISIONS SHALL BE MADE FOR FUTURE INSTALLATION OF A V-TRAP.
9. FISH LIFT HOPPER VOLUME SHALL BE 232 CU. FT. WITH A CYCLE TIME OF 10-15 MINUTES.
10. THE FISH PASSAGE FACILITY SHALL BE OWNED AND MAINTAINED BY N.E.W. HYDRO.
11. THE FISH PASSAGE FACILITY SHALL BE OPERATED BY FISHERIES RESOURCE AGENCY STAFF.

LEGEND

— — = STATE BOUNDARY LINE
—·—·— = WATERLINE

No.	Revision	Date	Drawn	Checked
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Designed	Drawn	Checked
JEW	PJ	KAM

NORTH EAST WISCONSIN HYDRO
NESHKORO, WISCONSIN

MENOMINEE HYDROELECTRIC FACILITY
PHASE II FISH LIFT SYSTEM

OVERALL SITE PLAN

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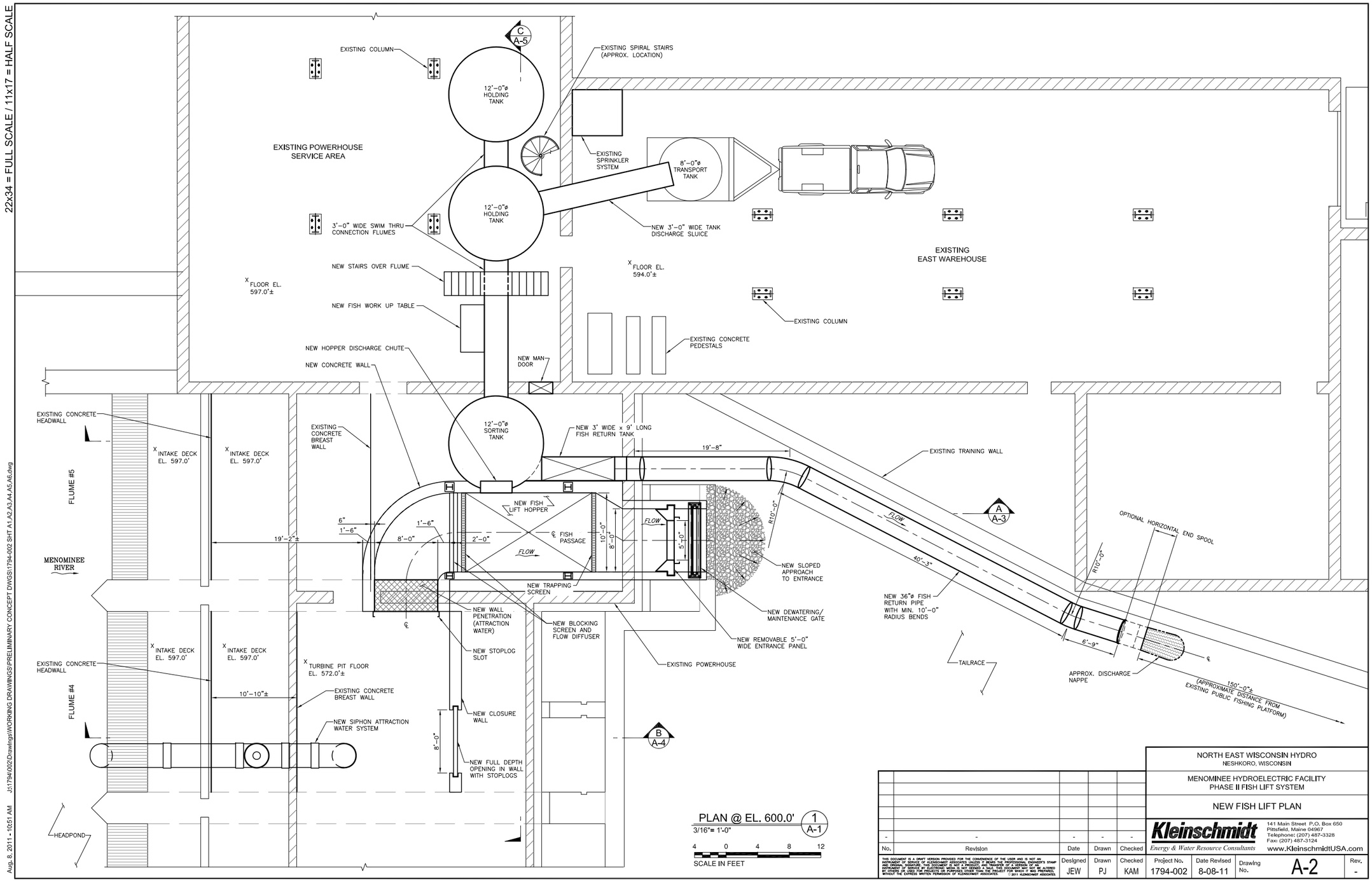
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EXISTING COLUMN
C A-5
EXISTING SPIRAL STAIRS (APPROX. LOCATION)
12'-0"ø HOLDING TANK
EXISTING POWERHOUSE SERVICE AREA
EXISTING SPRINKLER SYSTEM
8'-0"ø TRANSPORT TANK
12'-0"ø HOLDING TANK
3'-0" WIDE SWIM THRU CONNECTION FLUMES
NEW 3'-0" WIDE TANK DISCHARGE SLUICE
EXISTING EAST WAREHOUSE
NEW STAIRS OVER FLUME
X FLOOR EL. 597.0'±
X FLOOR EL. 594.0'±
NEW FISH WORK UP TABLE
EXISTING COLUMN
NEW HOPPER DISCHARGE CHUTE
NEW CONCRETE WALL
NEW MAN DOOR
EXISTING CONCRETE PEDESTALS
EXISTING CONCRETE HEADWALL
X INTAKE DECK EL. 597.0'
X INTAKE DECK EL. 597.0'
EXISTING CONCRETE BREAST WALL
12'-0"ø SORTING TANK
NEW 3' WIDE x 9' LONG FISH RETURN TANK
19'-8"
EXISTING TRAINING WALL
FLUME #5
NEW FISH LIFT HOPPER
FISH PASSAGE
FLOW
R10'-0"
A A-3
OPTIONAL HORIZONTAL END SPOOL
MENOMINEE RIVER
19'-2"±
6"
1'-6"
1'-6"
8'-0"
2'-0"
10'-0"
8'-0"
5'-0"
NEW SLOPED APPROACH TO ENTRANCE
40'-3"
NEW 36"ø FISH RETURN PIPE WITH MIN. 10'-0" RADIUS BENDS
NEW TRAPPING SCREEN
NEW WALL PENETRATION (ATTRACTION WATER)
NEW DEWATERING/ MAINTENANCE GATE
NEW BLOCKING SCREEN AND FLOW DIFFUSER
NEW REMOVABLE 5'-0" WIDE ENTRANCE PANEL
6'-9"
EXISTING CONCRETE HEADWALL
X INTAKE DECK EL. 597.0'
X INTAKE DECK EL. 597.0'
X TURBINE PIT FLOOR EL. 572.0'±
NEW STOPLOG SLOT
EXISTING POWERHOUSE
TAILRACE
APPROX. DISCHARGE NAPPE
150'-0"± (APPROXIMATE DISTANCE FROM EXISTING PUBLIC FISHING PLATFORM)
10'-10"±
EXISTING CONCRETE BREAST WALL
NEW SIPHON ATTRACTION WATER SYSTEM
FLUME #4
8'-0"
NEW CLOSURE WALL
B A-4
NEW FULL DEPTH OPENING IN WALL WITH STOPLOGS
HEADPOND
PLAN @ EL. 600.0'
3/16"= 1'-0"
1 A-1
4 0 4 8 12
SCALE IN FEET
NORTH EAST WISCONSIN HYDRO
NESHKORO, WISCONSIN
MENOMINEE HYDROELECTRIC FACILITY
PHASE II FISH LIFT SYSTEM
NEW FISH LIFT PLAN
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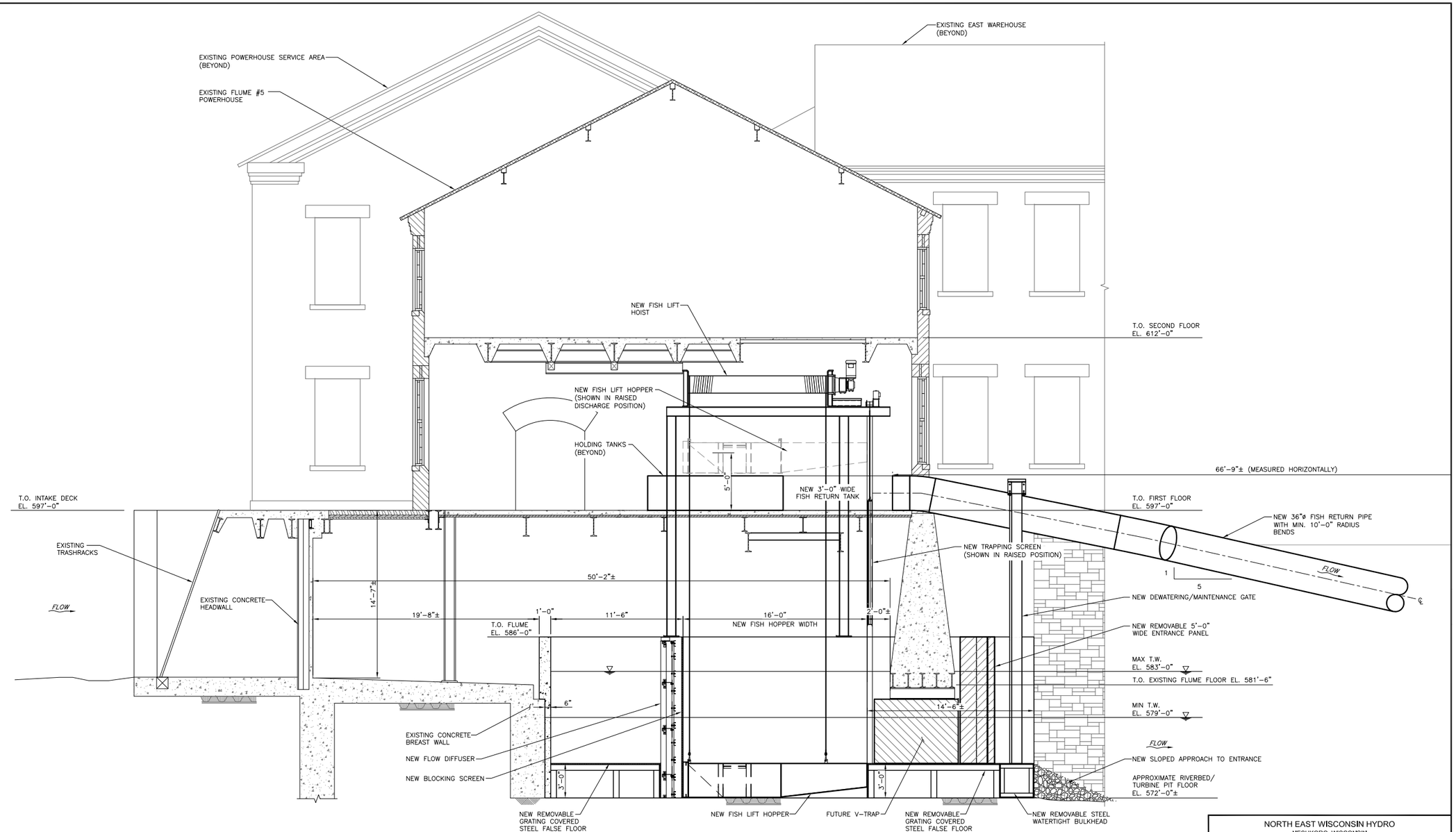

FLUME #5 SECTION A / A-2
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NORTH EAST WISCONSIN HYDRO
NESHKORO, WISCONSIN

MENOMINEE HYDROELECTRIC FACILITY
PHASE II FISH LIFT SYSTEM

NEW FISH LIFT
SECTION THRU FLUME #5

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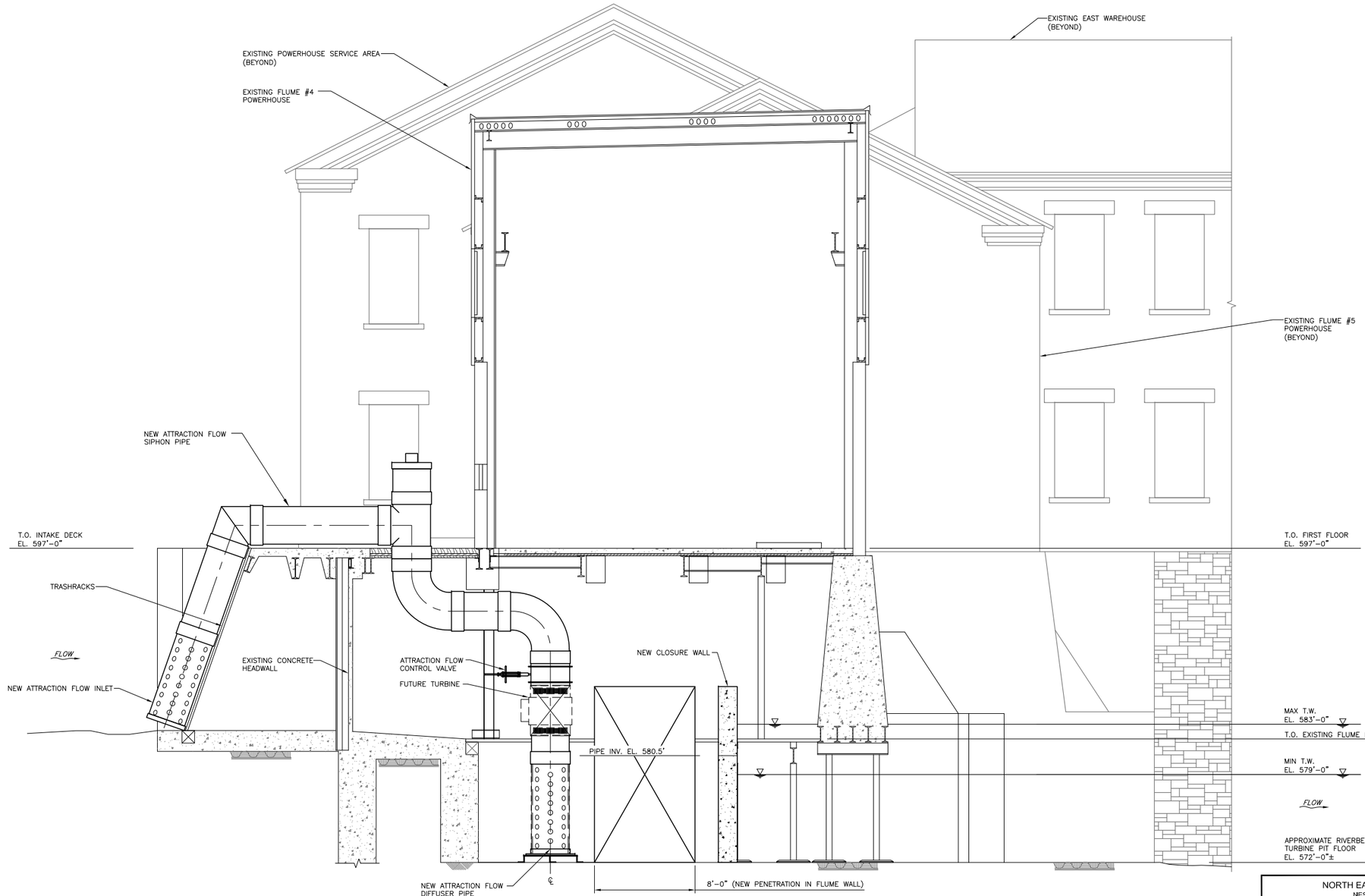

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NORTH EAST WISCONSIN HYDRO
NESHKORO, WISCONSIN

MENOMINEE HYDROELECTRIC FACILITY
PHASE II FISH LIFT SYSTEM

NEW FISH LIFT
SECTION THRU FLUME #4

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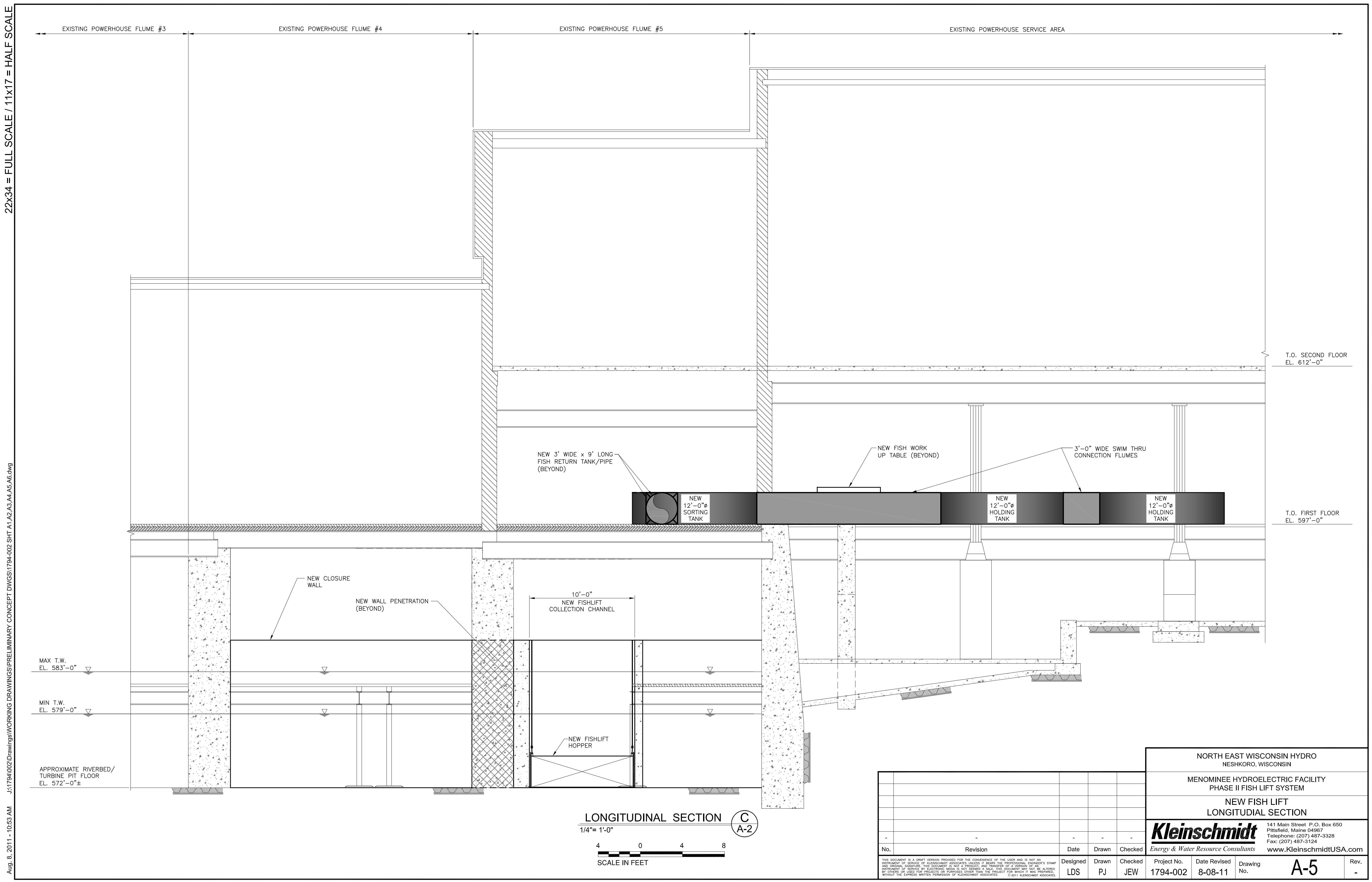
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EXISTING POWERHOUSE FLUME #3
EXISTING POWERHOUSE FLUME #4
EXISTING POWERHOUSE FLUME #5
EXISTING POWERHOUSE SERVICE AREA
T.O. SECOND FLOOR EL. 612'-0"
T.O. FIRST FLOOR EL. 597'-0"
NEW 3' WIDE x 9' LONG FISH RETURN TANK/PIPE (BEYOND)
NEW FISH WORK UP TABLE (BEYOND)
3'-0" WIDE SWIM THRU CONNECTION FLUMES
NEW 12'-0"ø SORTING TANK
NEW 12'-0"ø HOLDING TANK
NEW 12'-0"ø HOLDING TANK
NEW CLOSURE WALL
NEW WALL PENETRATION (BEYOND)
10'-0" NEW FISHLIFT COLLECTION CHANNEL
MAX T.W. EL. 583'-0"
MIN T.W. EL. 579'-0"
APPROXIMATE RIVERBED/ TURBINE PIT FLOOR EL. 572'-0"±
NEW FISHLIFT HOPPER
LONGITUDINAL SECTION
C A-2
1/4"= 1'-0"
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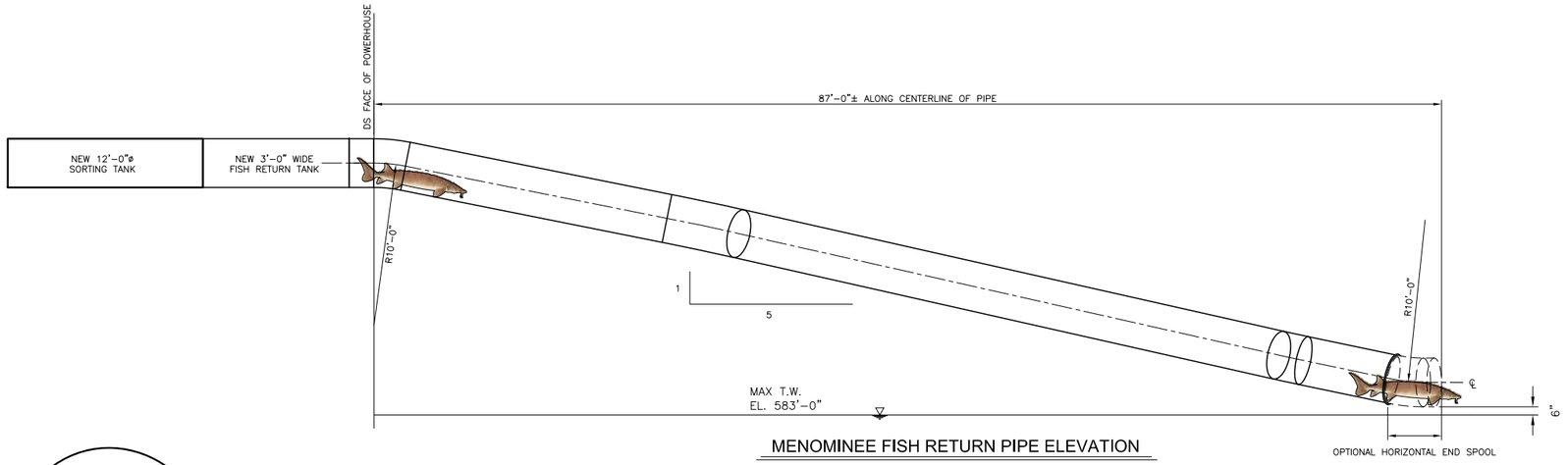
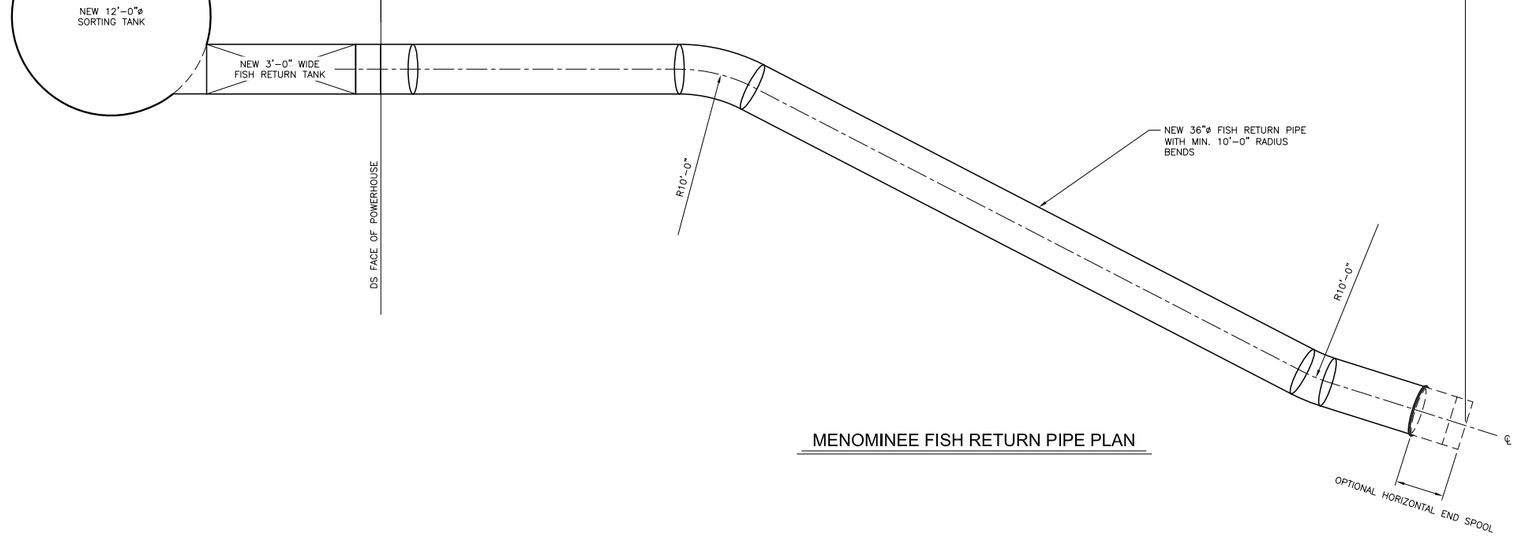


MENOMINEE FISH RETURN PIPE ELEVATION



MENOMINEE FISH RETURN PIPE PLAN

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NORTH EAST WISCONSIN HYDRO
NESHKORO, WISCONSIN

MENOMINEE HYDROELECTRIC FACILITY
PHASE II FISH LIFT SYSTEM

NEW FISH RETURN PIPE DIAGRAM

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The following is based on the Proposed Action (Alternative A) of building an upstream fish elevator and downstream bypass structure

Species

Lake sturgeon (*Acipenser fulvescens)* is the only target species considered for passage at this time. As more information is learned about pathogen concerns and species interactions, there may be some consideration to pass other species upstream of the Menominee Dam. Any other additional target species would be subject to an environmental assessment and risk analysis prior to passage.

Criteria for when other species could be passed and the numbers to be passed would be developed by the state and federal agencies prior to passing other species. Resources such as the Menominee River Fisheries Plan could be used as a starting point. The states' departments of natural resources would develop criteria for how to determine when or how to pass other species.

Description and Quantity of Sturgeon to be Passed Upstream

A conservative approach to passing fish upstream would be used initially. This approach could change as more is learned about how the passed sturgeon contribute to recruitment and population growth within the river, and when or if they move back downstream via the downstream passage facilities provided at Park Mill Dam.

The initial approach would be to pass only 90 sturgeon upstream annually with a 5 to 1 male to female ratio. The rationale for a conservative approach is to make sure too many fish are not being passed into an area with limited spawning habitat. An initial research study with translocation and telemetry would help determine appropriate planting locations. For reference, existing population estimates indicate that the population of sturgeon larger than 50 inches downstream of Menominee Dam is 1,182, whereas above the Park Mill Dam, there are 488 sturgeon greater than 50 inches. Sturgeon less than 50 inches in length have not been observed spawning in the river.

Lake sturgeon passed upstream will be no shorter than 50 inches long. The selected lake sturgeon will be transported by truck to the reach of the Menominee River above the Park Mill dam. Initially, the specific location for sturgeon translocation would be the 16th Avenue boat ramp, about five miles upstream from the Park Mill dam. However, further telemetry and adaptive management by the state's resource agencies may modify this exact translocation point.

Time of Year for Fish Passage, and Disease Considerations

Information from Michigan State University's Fish Health Lab indicates that lake sturgeon are not carriers of Viral Hemorragic Septicimia (VHS) (Gary Whelan, Michigan DNR, personal communication). This hypothesis will be continuously tested so we know whether or not fish have to be held for disease testing. Currently, Wisconsin and Michigan only require visual inspection of lake sturgeon prior to release upstream.

Initially, the IT would pass lake sturgeon upstream during the fall. This would allow for the sturgeon to acclimate to the new environment, overwinter, and allow staging prior to spawning in the spring. Sturgeon have been documented staging in the fall, making it highly probable that these fish would continue to migrate and spawn the following spring. Observations and data analysis through the operation of the fish passage, and data collected from sturgeon elsewhere in the Menominee system, would help determine the optimal time to pass the sturgeon. The fishery biologists fully expect to adapt their strategies on optimal passage time as more information is gained.

Upstream Lake Sturgeon Passage Operation Instructions

The following section describes how project fisheries biologists expect the fishway would be operated, based on applicable best practices. Because of the uncharted territory of passing lake sturgeon in this manner, the project team fully expects that these operational details would be adjusted and refined as the fishway would be operated.

Upstream fish passage would occur from October through November annually and would officially begin no earlier than October 2013. Operation of the upstream fishway would continue until 90 fish have been moved upstream (75 males and 15 females) or November 31st, whichever comes first.

The sequence of operation would commence as follows:

1. Allow fish elevator to fish for at least a continuous 1 hour interval

Prepare for lift:

2. Record date, time, environmental conditions (water temperature, flow velocity, water elevation), weather conditions (air temperature, barometric pressure, precipitation, etc.).

a. Water data (water temperature, flow velocity, and water elevation) would be derived from sensors located in the vicinity of the fish elevator. The sensors would be operated and maintained by the dam owner (N.E.W. Hydro).
b. Weather conditions (air temperature, barometric pressure, precipitation, etc.) would be derived from local sources such as the National Weather Service.

3. Record lift time and the duration of transport to sorting and holding tank.

4. Record count for all captured specimens in sorting and holding tank by species and by designated size categories as prescribed by state agencies. (Total length would be recorded to the nearest .5 cm.)
    a. Species would be identified by trained professional biologists using *Fishes of Wisconsin* species identification guide (George C. Becker, University of Wisconsin Press, 1983).

5. Remove, contain and dispose of all sea lamprey and other injurious species according to established U.S. Fish and Wildlife Service protocols outlined in the agency's "2011 Spawning Phase Assessment Work Plan." (Lamprey would be managed by U.S. Fish and Wildlife Service's Sea Lamprey Control Program.)

6. Any unknown species would be photographed and held until positive identification, then released and/or disposed of as specified in this protocol

7. Guide all non-target or non-sturgeon species into a downstream conveyance pipe for safe return back to Menominee Dam tailrace.

8. Measure total length (to the nearest .5 cm) and total weight (to the nearest .5 kg) of each sturgeon (or other species targeted for upstream passage).
    a. Fish handling would be such that fish remain in and are supported by water or are supported by weighing sling.

9. Examine all sturgeon and record all Tag ID data for all previously attached ID tags. This would be carried out by way of internal exam via PIT (passive integrated transponder) and CWT (coded wire tag) detectors, and externally via visual examination by trained biologists to aid in identification of fishes' original origin.
    a. Testing of accuracy and repeatability of detectors would be performed daily using dummy tag (with results recorded on data sheet) according to device

operations per manufacturers' instructions (e.g. freshly charged batteries, backup detectors, etc.)

10. Collect fin tissue sample from all designated sturgeon as described in Lake Michigan field sampling standard operating procedures guide.

11. Mark sample collected for VHS testing and preserved according to standard operating procedures developed by the Wisconsin Dept. of Natural Resources. For non-PIT tagged fish, insert appropriate sized PIT tag for later individual identification. (*This number is yet to be determined.)*

12. If sex determination is desired, scope fish using surgical exam and record results.

13. Record disposition for each captured fish (held for passing, released via downstream conveyance back to tailwater, or retained) based on target species, size, sex and season criteria specified by agencies.

14. All data to be recorded on specified data sheets or recording machines at the time of measurement. Duplicate records would be made daily and archived at specified multiple agency locations (e.g. the dam site, U.S. Fish and Wildlife Service Green Bay office, Wisconsin DNR Peshtigo regional office).

Tanks and Holding Guidelines

It would be recommended that circular tanks for sturgeon be used (12 foot diameter), with 50 gallons per minute running through the tank. All water used in holding and transport tanks should be derived from upstream sources. It would be acceptable to reuse the same water (from upstream sources) for two connected tanks but new or filtered water would be required for a third tank. When holding sturgeon for 30 days (awaiting disease tissue samples undergoing analysis) it would be acceptable to hold a total of 15 fish per tank. When holding sturgeon for 15 days it would be acceptable to hold a total of 20 fish per tank. Proper water flow and recharge parameters would be derived from established management practices at state agency-operated fish hatcheries or facilities at which adult fish are handled and held.

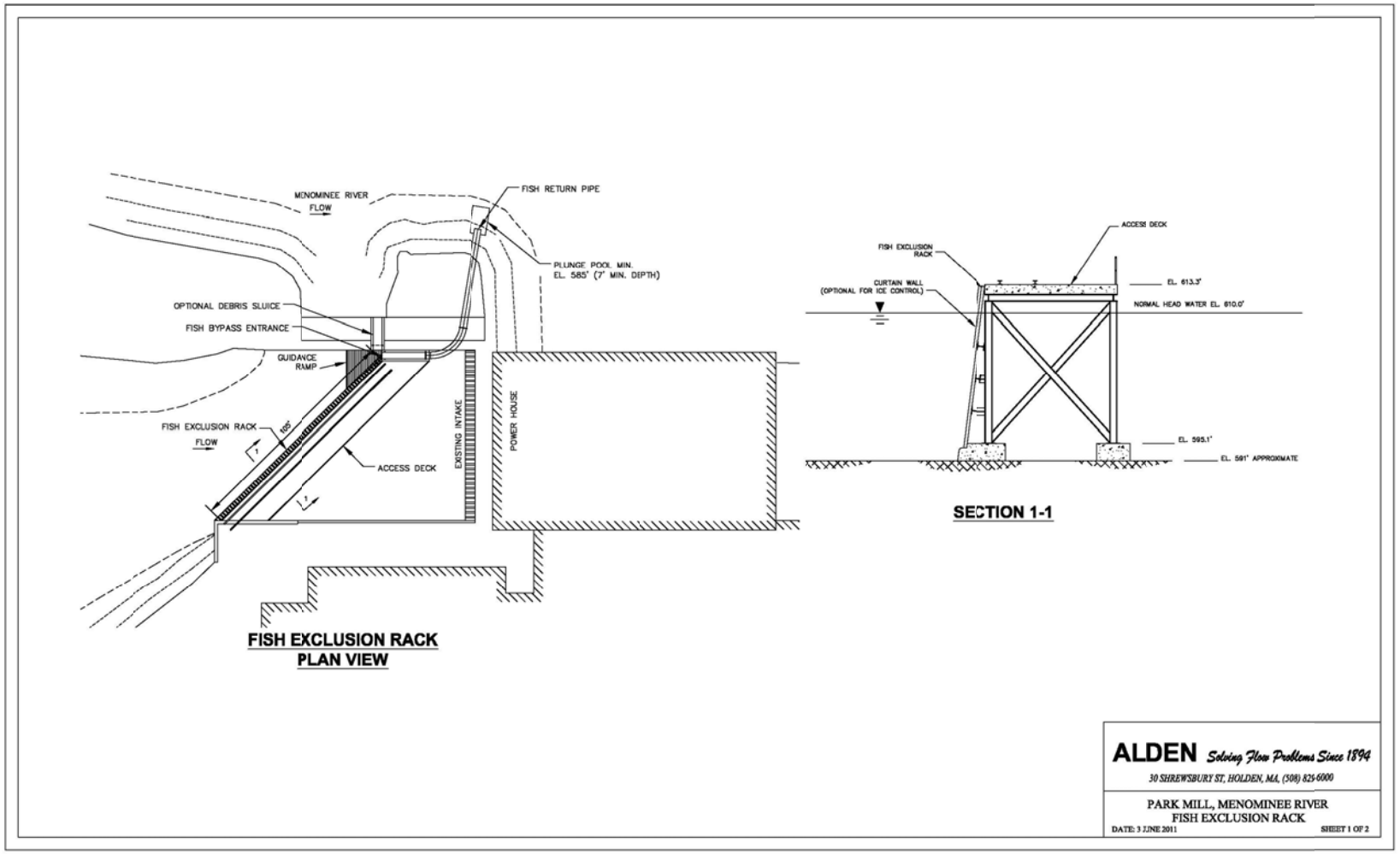
Fish Transport Guidelines

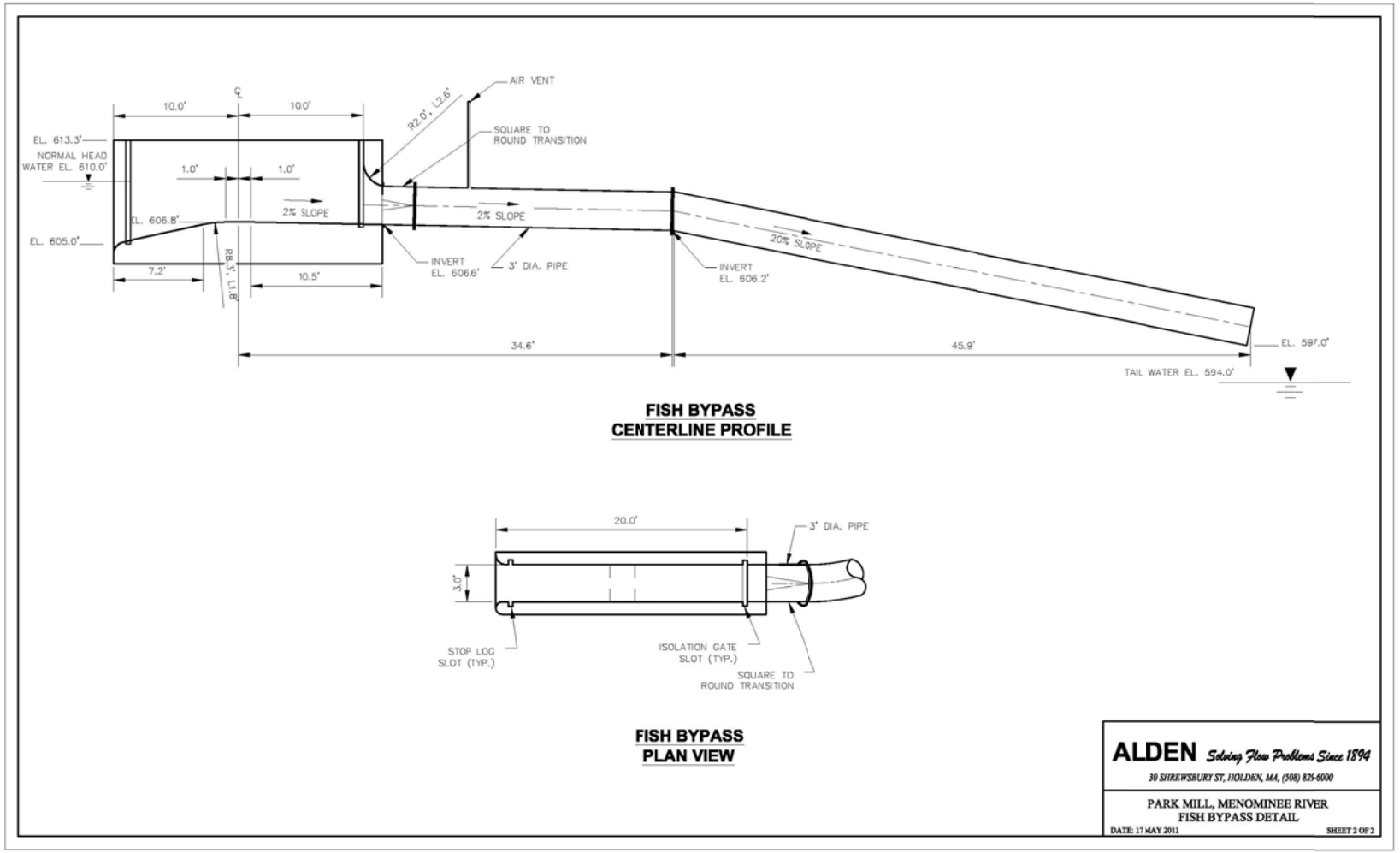
A truck in good working condition would be able to pull a goose neck or low boy trailer with a 1000-gallon insulated tank. The trailer would have operable electric brakes and have the capacity to haul this tank when full of water and fish. The tank would have secure latches on

the lids and the lids would be large enough to accommodate a dip net and fish up to 7 feet in length. The insulated tank would have aeration systems to maintain dissolved oxygen levels greater than 5 ppm. The insulated tank would maintain a water temperature within the tank so it would not exceed a 2 degree F temperature deviation from fill-up to stocking event. At no time would water used in transport or holding exceed 70 degrees F.

The fish would need to be dip-netted into and out of the tank but the tank would be able to be drained with an eight-inch bulkhead fitting. The tank could be made of fiberglass, aluminum or stainless steel, and would be able to handle up to 10 adult sturgeon per trip.

The following is based on the Proposed Action (Alternative A) of building an upstream fish elevator and downstream bypass structure




AIR VENT
SQUARE TO ROUND TRANSITION
R2.0', L2.6'
10.0'
10.0'
EL. 613.3'
NORMAL HEAD WATER EL. 610.0'
1.0'
1.0'
2% SLOPE
2% SLOPE
20% SLOPE
EL. 606.8'
EL. 605.0'
INVERT EL. 606.6'
3" DIA. PIPE
INVERT EL. 606.2'
R8.3', L1.8'
7.2'
10.5'
34.6'
45.9'
EL. 597.0'
TAIL WATER EL. 594.0'
FISH BYPASS
CENTERLINE PROFILE
20.0'
3" DIA. PIPE
3.0'
STOP LOG SLOT (TYP.)
ISOLATION GATE SLOT (TYP.)
SQUARE TO ROUND TRANSITION
FISH BYPASS
PLAN VIEW
ALDEN Solving Flow Problems Since 1894
30 SHREWSBURY ST, HOLDEN, MA, (508) 829-6000
PARK MILL, MENOMINEE RIVER
FISH BYPASS DETAIL
DATE: 17 MAY 2011
SHEET 2 OF 2

The following is based on the Proposed Action (Alternative A) of building an upstream fish elevator and downstream bypass structure

Species

While the downstream fish passage and protection structure would be designed specifically to maximize lake sturgeon (*Acipenser fulvescens)* passage effectiveness, the downstream passage operation would not be specific to any one species. The intention would be to allow bypass of all species that chose to pass through the fishway. The design of the angled bar rack and bypass structure would also be maximized to provide the most protection for all aquatic species.

Description and Quantity of Fish to be Passed Downstream

The downstream fish protection and bypass structure would not be operated to only pass a set quota or type of fish. Rather, the operation of the fishway would allow volitional downstream movement of fish that choose to use the bypass.

Time of Year for Fish Passage, and Disease Considerations

Initially, the downstream bypass would be operated continuously during ice-out conditions (i.e., the period of the year when ice is no longer stationary or flowing through the river). This timeframe will depend on environmental conditions from year-to-year but would essentially occur from April through November annually. As information would be gathered from the initial operation, the Implementation Team may modify the operation timeframe based on optimal performance and efficiency.

Because downstream water and fish movement is already a natural occurrence at these dams, the downstream fish passage would not be expected to create any additional concerns relative to invasive species, environmental contaminates, or harmful pathogens (such as Viral Hemorrhagic Septicemia).

Downstream Fish Passage Operation Guidelines

SPECIES:	All Aquatic Species
PERIOD OF OPERATION:	During Ice-out conditions (Approximately April – November)
MINIMUM BYPASS FLOW:	50 cubic feet per second

Screening Level Contaminants Risk Assessment

Menominee River Hydropower Dam Reconstruction for Fish Passage

Draft August 04, 2011

Prepared by the Wisconsin Ecological Services Office

U.S. Fish and Wildlife Service

Environmental Contaminants Program

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List of Figures and Tables

Definitions used in Risk Assessment:

Biomagnification Factor (BMF): The ratio of the contaminant in an organism to the concentration in the ambient environment at a steady state, where the organism can take in the contaminant through ingestion with its food as well as through direct content.

Hazard Quotients (HQ): The ratio of an exposure estimate to an effects concentration considered to represent a "safe" concentration or dose. Ecological risk can be estimated numerically using the ***Hazard Quotient*** (HQ) approach. The HQ is a ratio, which can be used to estimate if risk or harmful effects is likely or not due to the contaminant in question.

HQ > 1.0	Harmful effects are LIKELY due to the contaminant in question
HQ = 1.0	The contaminant *alone* is NOT likely to cause harmful effects
HQ < 1.0	Harmful effects are NOT likely

No Observable Adverse Effect Concentration (NOAEC): The concentration of contaminant where no adverse effects to the test organism are observed.

Risk: The probability of harmful effects to human or to ecological systems resulting from exposure to an environmental stressor.

Toxicity Reference Value (TRV): Species-specific and chemical-specific estimates of an exposure level that is not likely to cause unacceptable adverse effects to growth, reproduction, or survival.

Introduction

The Federal Energy Regulatory Commission (FERC) is an independent agency that regulates and reviews proposals for licensing hydropower projects. The U.S. Army Corp of Engineers proposes fish passage projects, part of the Great Lakes Fishery and Ecosystem Restoration Program, at hydropower dams for the purpose of restoring spawning habitat along the Menominee River; a river that forms the border between northeastern Wisconsin and southwestern Michigan. Under the authority of the Fish and Wildlife Coordination Act (FWCA), the preconstruction planning on hydropower dam construction is coordinated with the U.S. Fish and Wildlife Service (FWS). The Fish and Wildlife Coordination Act authorizes the FWS to determine possible effects of proposed fish passage projects to wildlife resources, make recommendations for preventing loss or damage to trust resources, and assist in developing ideas to improve fish passage projects.

As part of the Great Lakes Fishery and Ecosystem Restoration objectives, fish passage projects in dams along the Menominee River are currently being considered. The U.S. Army Corp Planning Aid Letter (PAL) associated with the Menominee River fish passage project provides specific recommendations and analysis for each of the three dam construction projects for creating fish passage. As stated in the PAL, the proposed fish passage project area is located in the downstream 80 miles of river identified as three separate segments of the river; Segment 1 is described as the lower river approximately 2 miles upstream from the river's outlet into Green Bay (includes Menominee and Park Mill Dams) to the Grand Rapids Dam; Segment 2 is described as Grand Rapids Dam upstream to the White Rapids Dam; and Segment 3 is described as White Rapids and Chalk Hill Dams to Sturgeon Falls Dam (Figure 1).

Under the FWCA, the FWS has authorization to examine the potential for contaminants, invasive species, and fish pathogens to be introduced into the watershed from fish passage at the Menominee Dam (the lowermost dam, Figure 1). As stated in the PAL, the primary target species for upstream and downstream fish passage is lake sturgeon (*Acipenser fulvescens*). Lake sturgeon is a long lived anadromous species that migrates upstream to spawn. Unlike other species that die after spawning or are easy prey for piscivorous wildlife, most sturgeon generally

return to the lower reaches of the river or bay after spawning. Lake sturgeon is listed as a species of Special Concern in Wisconsin, listed as Threatened in Michigan, and is a Federal trust species. The conservation of lake sturgeon populations in the Great Lakes is dependent on viable spawning and rearing habitat and the Menominee River provides critical habitat to local lake sturgeon populations. Although lake sturgeon is the primary species to be passed at this time, the PAL indicates that the overall goal of the fish passage project is to have upstream and downstream passage of all native fish species, (e.g. walleye (*Sander vitreus*), northern pike (*Esox lucius*), and suckers (*Catostomus*)).

This fish passage screening risk assessment was conducted by the U.S. Fish and Wildlife Service, Wisconsin Ecological Services Office, for the purpose of evaluating the impacts of re-establishing fish passage at the lowermost section of the Menominee River (below Segment 1)**.** This screening level risk assessment is designed to evaluate potential risk associated with concentrations of contaminants in multiple fish species that would be allowed to pass from the lowermost dam to the upper reaches of the Menominee River. This report discusses the potential for contaminants to be introduced into the watershed from fish passage construction by (1) reviewing literature and contaminants in fish of the Menominee River, (2) determining if fish below the lowermost dam have greater concentrations of contaminant burdens than fish above the lowermost dam, and (3) evaluating risk of fish passage to piscivorous wildlife species (i.e. Bald Eagle (*Haliaeetus leucocephalus*)) occupying the Menominee River Basin. This screening level risk assessment follows Environmental Protection Agency (EPA) guidelines (USEPA 1997, USEPA 1998).

Contaminants in the Menominee

The predominant contaminants in the Menominee River are from historic industrial inputs and improper storage of chemicals by industry. Contaminants deposited in sediment and water bioaccumulate in fish tissues, and biomagnify throughout the food chain posing risk to aquatic and piscivorous species (Bowerman *et al.* 1990). Contaminants are prevalent in Great Lakes fishes (Giesy *et al.* 1994a) and toxicants in fish above threshold levels can pose reproductive impairments to piscivorous wildlife (Giesy *et al.* 1994b, Best *et al.* 2010).

Menominee River AOC

The lower Menominee River is classified as one of the Great Lakes Areas of Concern (AOC). An AOC is a waterway that is heavily contaminated with pollutants that affect the health of wildlife in that system. The Menominee AOC includes the lower 4.8 kilometers of the Menominee River from the Park Mill Dam to the river mouth, and 5 kilometers north and south of the river mouth (Figure 1, 2). Arsenic, PCBs, polyaromatic hydrocarbons (PAHs), Hg, dioxins, lead, cyanide, coal tar, and paint sludge are among some of the contaminants in the lower Menominee River AOC (EPA 2011). Beneficial use impairments (BUIs) for the AOC include restrictions on dredging activities due to arsenic in sediment; fish consumption advisories from polychlorinated biphenyls (PCBs), mercury (Hg), and pesticides; degraded fish and wildlife populations; degraded benthos; loss of fish and wildlife habitat; and recreational use restrictions particularly for swimming due to fecal coliform or bacterial counts exceeding water quality standards (EPA 2011). Remedial Action Plans (RAPs) are being developed by multiple agencies (EPA, WI Department of Natural Resources (WI DNR), MI Department of Environmental Quality, FWS, and Lake Michigan Forum) that will lead to the clean-up and delisting of the BUIs. The Menominee River AOC Technical Advisory Committee has restoration and sediment remediation projects scheduled for 2012 and 2013.

WPSC Marinette MGP Superfund Alternative Site

The EPA established the former WPSC Marinette Manufactured Gas Plant facility as a Superfund Alternative Site in 2006. The gas plant, operating from 1910 to 1960, is responsible for contaminating 1.3 acres of sediment of the Menominee River. The contaminated area is located below the lowermost Menominee River dam approximately 2.5 kilometers from the Menominee River mouth. The former gas plant is responsible for contaminating soil, groundwater and sediment. Soil at the site still contains polynuclear aromatic hydrocarbons (PAHs), volatile organic compounds such as benzene, toluene, ethylbenzene, and xylene (BTEX). Groundwater contamination includes PAHs, cyanide, napthalene, and BTEX. Discharge from the site to the Menominee River is believed to have been via a former slough

that connected the gas plant to the river. Sediment removal was conducted in 2004 and routine groundwater monitoring continues. Additional investigation and mitigation of the remaining contamination is on-going (US EPA Region 5 Superfund 2008).

Menominee River Fish Advisories and Risk Assessments

Dioxins, Hg, and PCBs have been detected in fish at concentrations that have resulted in the State of Wisconsin and Michigan issuing fish consumption advisories (WI DNR 2010, MDEH 2010). The fish consumption advisories are most prevalent in the lower Menominee River and Green Bay waters. Fish consumption advisories have been in effect for multiple years. Areas from Piers Gorge to the lowermost dam of the Menominee River currently have advisories issued for common carp (*Cyprinus carpio*), panfish, and walleye due to PCB concentrations in fish tissues (WI DNR 2010). In Green Bay, advisories for multiple species due to PCB concentrations are issued for waters south of Marinette and its tributaries (except the Lower Fox River) including the Menominee, Oconto, and Peshtigo Rivers from their mouths up to the first dam (WI DNR 2010).

Anadromous fish in Green Bay are restricted from entering the Menominee River above the lowermost dam (Menominee Dam). The creation of fish passage in the lowermost dam would allow resident fish in the AOC and Superfund area and migratory fish from Green Bay and Lake Michigan access to the upper reaches of the Menominee River. Bald eagles are piscivorous species and susceptible to exposure from bioaccumulative chemical compounds found in their diet (Bowerman *et al.* 2009). In the Great Lakes, bald eagles are widely used as bioindicator species for contaminants in waterways (International Joint Commission 1997-1999, Elliott and Harris 2001, Bowermen *et al*. 2002, Cesh *et al.* 2008, Dykstra *et al.* 2010). Studies have found a negative association with total concentrations of PCBs in the eggs of eagles, and eagle reproductive success (Wiemeyer *et al.* 1984, Giesy *et al.* 1995) and productivity (Kubiak and Best 1991, Wiemeyer *et al.* 1993, Best *et al.* 1994)**.** Piscivorous species that consume fish eggs are also at risk from the movement of contaminated fish upstream. Female fish can deposit concentrations of contaminants in their eggs, creating an exposure pathway to species that eat

fish eggs. For example, brook trout (*Salvelinus fontinalis*) were found to ingest PCBs from eating contaminated salmon eggs (Merna 1986).

In previous Great Lakes fish passage risk assessments, bald eagles and mink (*Mustela vison*) have been used as the indicator species for wildlife risk based on their exposure and effects to contaminants via dietary intake (Giesy *et al.* 1994b). The availability of toxicity data specific to these species, their dietary preferences, and the known high sensitivity of mink to PCBs relative to other mammal species make them good wildlife indicators of contaminants (Giesy *et al.* 1994a, 1994b, 1995). The endpoint chosen in this risk assessment to measure the effects of contaminant concentrations in fish to eagles is eagle embryo survivability. Contaminants ingested by female eagles become deposited in the egg yolk and albumen of an egg, exposing developing embryos to concentrations of contaminants that may be above thresholds associated with embryo mortality. The eagle egg embryo endpoint is based on dose-response toxicity reference values, is the most sensitive endpoint for determining risk to reproduction, and has been accepted and widely used in other fish passage contaminant assessments (Kubiak and Best 1991, Giesy *et al.* 1995).

Methods

Contaminant Data and Collection Date

The contaminant concentrations used in this risk assessment are provided by the WI DNR, Fisheries Management Division. The fish were originally sampled by the WI DNR and tested for contaminant concentrations for the purpose of determining Fish Consumption Advisories for the Menominee River. These data consist of contaminant concentrations (mostly for total PCBs and total Hg) in individual fish, date of collection, GPS location, tissue type analyzed, and various biometric data. Only the total PCBs and total Hg data are used for this risk assessment due to sample sizes being large enough for statistical testing. Individual fish are separated by species and divided into two groups: fish below the Menominee Dam and fish above the Park Mill Dam.

The concentrations of total PCBs and total Hg used for the risk calculations include a dataset that is comprised of multiple year sampling; these data range from samples collected over a 31 year

sampling timeframe (1977 to 2008). Total PCBs and total Hg data are tested for normality and then for differences in contaminant concentrations between collecting dates to determine if all fish contaminant data should be utilized in the risk assessment (Mann-Whitney *U* Test, Minitab 16). Data from below the lowermost dams are used for this analysis because the large sample of fish from multiple years collected from this section provides good statistical power for determining a difference among years if one exists. Species life history characteristics, such as longevity information, are also taken into consideration.

Fish Tissue Contaminant Data and Conversion Factors

Individual fish contaminant information consists of concentrations analyzed from various tissue types (fillet with skin on, whole fish). Fillet to whole fish conversion factors are applied to all contaminant data expressed as fillet in order to compare contaminant concentrations on a whole fish basis. The conversion factor is a range from 1 to 2.5 (Jackson and Schinder 1996, Stow and Carpenter 1994, Amrhein et al. 1999, USACOE 1993, USEPA 2000). The conversion factor used in this risk assessment is the high end of the range (2.5 multiplication factor, USEPA 2000) and considered the most conservative value. The ratio of fillet to whole fish for Hg is approximately 1 (Lechich 1993); therefore, no multiplication factor is used for the Hg datasets.

Dietary Exposure to Eagles Below and Above Lowermost Dams

Concentrations in Fish Tissues

Descriptive statistics can indicate if fish below the lowermost dams, where fish passage is to occur, have greater contaminant concentrations than fish above the lowermost dams. Descriptive statistics for total PCBs and total Hg, on a whole fish basis, are calculated for contaminant concentrations in fish below and above the lowermost dams using Microsoft Excel Data Analysis Tool (Table 1, 2). Normality is tested on each dataset using the Kolmogorov-Smirnov test (Minitab 16). Since data did not meet homogeneity of variances, a non-parametric test comparing arithmetic means in fish below the lowermost dams to means in fish above the lowermost dams is conducted separately for each species (Mann-Whitney *U* Test, Minitab 16).

Proportion of Fish Species in Bald Eagle Diet

The descriptive statistics will indicate if fish below the lowermost dams have greater contaminant concentrations than fish above the lowermost dams, however, to further investigate risk to bald eagles, concentrations need to be adjusted for proportion in eagle diet.

The relative dietary proportion of fish species that bald eagles consume was determined by visual observation previously conducted in 1995-1997 in Green Bay WI, by the Department of Natural Resources, Division of Enforcement and Science, Integrated Science Services, Wildlife and Forestry Research Section (Table 3). Based on these data, 97.1 % of the bald eagle's diet consisted of fish. Birds accounted for only 2.5 %, and mammals accounted for only 0.4 % (Table 3). Based on this high percentage of fish in the diets of these eagles, the contribution of contaminants to their diet from sources other than fish is assumed to be negligible for this risk assessment. The proportion of different fish species in the eagle's diet is applied to corresponding concentrations of contaminants in those or closely related fish species to represent the constructed dietary concentration of contaminants that eagles consume.

The following equations are used for converting total PCBs and total Hg concentrations in whole fish to concentrations that are representative of exposure to bald eagles through dietary intake.

1) Total PCBs concentration in fish fillets from species *i* * 2.5 conversion factor from fillets to whole fish * proportion of species *i* in the eagle diet.

2) Total Hg concentration in fish species *i* * proportion of species *i* in the eagle diet.

Hazard Quotients – Risk to Bald Eagle Egg Embryo

Determining risk to the bald eagle egg embryo can be estimated numerically using the Hazard Quotients (HQ) which uses the contaminant concentrations that are adjusted for proportion in eagle diet. Hazard Quotients are based on concentrations of total PCBs and total Hg in the diet compared to toxicity threshold levels (TRVs).

The HQ for determining hazard to eagle embryos is calculated with the following equation:

$$HQ = \frac{[\text{concentration of contaminant in eagle diet (µg/g)}] * BMF}{\text{bald eagle egg NOAEC (ug/g)}}$$

(a) Concentration of contaminant in the eagle diet is based on concentrations in whole fish on a wet weight basis (equations 1, 2).

(b) BMF is the biomagnification factor of the contaminant from eagle diet to eagle egg. The BMFs for PCBs and Hg are 28 and 1, respectively, based on concentrations of contaminants in fish and eagle eggs from the Great Lakes region (Giesy *et al.* 1995).

(c) Bald eagle egg NOAEC is the No Observed Adverse Effect Concentration of contaminants in eagle eggs on a fresh wet weight basis. The NOAECs used is 4.0 ug/g egg for PCBs and 0.5 ug/g egg for Hg (Wiemeyer *et al*. 1984, Giesy *et al.* 1995).

Hazard Quotients are calculated to determine risk to bald eagles based on the percent contribution of species *i* to the eagle's diet (Table 4, 5). The diet-weighted concentrations for each species assume that the rest of the eagle diet is clean, which is not likely. Therefore, to determine risk to bald eagles based on dietary exposure, the sum of the diet-weighted concentration is used to calculate the HQ for the constructed diet below and above the lowermost dams (Table 4,5 - constructed eagle diet).

To estimate species-specific risk, HQs are calculated based on a diet that consists entirely of species *i* (Table 6, 7). This approach identifies what fish species causes a greater risk for an eagle foraging below and above the lowermost dams.

Results

Contaminant Data and Collection Date

The majority of fish species used in this assessment live to be at least 6 years old (Becker 1983), therefore, 6 is chosen as the time point on which to separate data based on collection date.

Lifespans for species include: common carp (average 9-15 years, maximum 47 years); lake sturgeon (female breeding age is from 24-26 years, maximum 100 years); northern pike (average 7 years, maximum 25 years); walleye (average 7 years, maximum 10-12 years) (Becker 1983). Total PCB concentrations did not differ between fish collected ≤ 6 years ago and fish collected > 6 year ago; common carp PCB P = 0.1832, Hg P=0.1360; walleye PCB P=0.9092, Hg P=0.2561; northern pike PCB P=1.000, Hg P=0.067. Data from 1977 to 2008 are combined within species for this risk analysis since no statistical difference is detected between the two time periods for the species selected, and because most species can live to be close to 31 years old.

Fish Tissue Contaminant Data

Species used in the risk assessment include common carp, lake sturgeon, northern pike, walleye, and the group other species. The group other species is the combined data from multiple fish species that have sample sizes too small for statistical testing and too small to be separated into a single species group. For total PCBs below the Menominee Dam the group other species includes white sucker *(Catostomus commersoni)*, redhorse species *(Moxostoma spp.)*, largemouth bass (*Micropterus salmoides*) and smallmouth bass *(Micropterus dolomieu)*; for data above the Park Mill Dam the group includes silver redhorse *(M. anisurum)* and redhorse species (*Moxostoma spp.*). The group other species includes white sucker and smallmouth bass for total Hg data below the Menominee Dam, and white sucker, redhorse species, silver redhorse, largemouth bass and smallmouth bass for total Hg above the Park Mill Dam.

The total PCB dataset for fish below the Menominee Dam includes a small sample of fish from the section between the Park Mill Dam and the Menominee Dam; however, most of the fish were collected from below the Menominee Dam. Small sample sizes for common carp (n=4), walleye (n=4), northern pike (n=1) and other species (n=1) are pooled with the dataset of fish collected from below the Menominee Dam. The total PCB concentrations in species collected in-between the dams are within the range of concentrations in species collected below the Menominee Dam

and are included in the analysis to increase sample size. The total Hg dataset includes fish from only below the Menominee Dam.

Dietary Exposure to Eagles Below and Above Lowermost Dams

Concentrations in Fish Tissues

Common carp (*P*=0.0238), lake sturgeon (*P*=0.0054), northern pike (*P*=0.0405), and walleye (*P*=0.0396) below the Menominee Dam have total PCB concentrations significantly greater compared to concentrations in fish above the Park Mill Dam (Table 1). For total Hg, lake sturgeon (*P* = 0.0008), northern pike (*P* = 0.0009), and walleye (*P* = 0.0000) have significantly greater concentrations below the Menominee Dam compared to above the Park Mill Dam (Table 2). Due to the importance of comparing species to species for this statistical test, the group other species is not included in this statistical comparative analysis.

Hazard Quotients – Risk to Bald Eagle Egg Embryo

Hazard Quotients for total PCBs based on the percent contribution of species *i* to the eagle diet indicate that common carp, northern pike, walleye, and the group other species below the Menominee Dam pose a likely risk to eagles, however, lake sturgeon HQs do not exceed one (Table 4). These diet-weighted calculations are based on the assumption that for each proportion of species *i* in the eagle diet the rest of the diet is comprised of "clean" fish, which is not likely. Therefore, to determine risk to bald eagles based on complete dietary exposure, the sum of the diet-weighted concentration is used to calculate the HQ for the constructed diet below and above the lowermost dams (Table 4 - see Constructed Eagle Diet). The HQs for the constructed eagle diet below the Menominee Dam are substantially higher compared to the HQ above the Park Mill Dam. The total PCB HQ for the constructed eagle diet below the Menominee Dam is 8.40 based on geometric means; therefore, the risk fish below the Menominee Dam pose to eagles is 8 times greater than the risk that fish above the Park Mill Dam pose (HQ=1.68). Hazard Quotients for total Hg based on diet-weighted calculations do not exceed one for any species of fish below the Menominee Dam (Table 5). Above the Park Mill Dam the group other species has HQs over one (Table 5). The Hg HQ for the constructed eagle diet is 2 times greater above the Park Mill Dam (HQ = 14.21) compared to the HQ below the Menominee Dam (HQ = 6.72) based on geometric means (Table 5).

To estimate risk from individual fish species, HQs are calculated based on a diet that consists entirely of species *i* (100% fish species *i*) (Table 6, 7). This approach identifies what fish species may cause a greater risk for an eagle foraging below and above the lowermost dams. Total PCB HQs exceed one for all species of fish below and above the lowermost dams (Table 6). The range exceeding one (from geometric means) below the Menominee Dam (6.58-20.86) is substantially greater compared to the range that exceeds one above the Park Mill Dam (1.12 to 4.27) (Table 6). The species with the greatest total PCB HQ values below the Menominee Dam are common carp and lake sturgeon, followed by walleye, northern pike, and the group other species (Table 6). For total Hg, all species have HQs over one, however, HQs above the Park Mill Dam are greater compared to HQs below the Menominee Dam (Table 7). The species with the greatest Hg HQ values below the Menominee Dam are lake sturgeon and walleye, followed by common carp, northern pike, and the group other species (Table 7).

Uncertainty Analysis

This risk assessment is prepared with the best available site-specific data known for the Menominee River; however, all risk assessments have an inherent amount of uncertainty based on limitations in data and information on both exposure and dose-response.

The fish tissue sampled by the Wisconsin Department of Natural Resources, Fisheries Management Division consists of various tissues (fillet and whole fish) and conversion factors are applied in order to compare contaminant concentrations across samples. The PCB conversion factors range from 1 to 2.5. The greatest conversion factor is applied to the concentrations of PCBs for this risk assessment in order to provide a conservative or cautious analysis. Fillet to whole fish conversion factors should be species-specific and site-specific. The conversion factors used in this risk analysis are based on methods developed by the USEPA for baseline ecological risk assessment, which are not specific to the Menominee River system. The high end value is used to address the unknown amount of uncertainty in applying conversion factors to species of fish in the Menominee River system.

Small sample sizes for common carp, walleye, northern pike, and an individual in the group other species were collected in-between the two lowermost dams (Park Mill Dam and Menominee Dam) and pooled with the dataset of fish collected from below the Menominee Dam. The total PCB concentrations in species collected in-between the dams are within the range of concentrations in species collected below the Menominee Dam, however, they fall on the low end of the range. This small sample is included in the risk assessment to improve sample size, although, if these individuals are left out of the analysis the averages and geometric means of total PCB concentrations in species would increase. In addition, the PCB HQs would be slightly greater if these individuals are left out of the risk assessment, however, the end results of the risk analysis and recommendations would not change.

Dietary information provided by Wisconsin DNR for eagles foraging in Green Bay from 1995-1997 is based on visual observations rather than a complete dietary analysis. There is uncertainty in inferring dietary composition of relative masses of different types of prey from the information provided from assuming that eagle diets are similar in the two areas. Bald eagles foraging in the lower Menominee River, below the lowermost dams and in to Green Bay, may be foraging on various taxa as described in the 1995-1997 diet observations. Dietary information for Menominee River eagles is unknown, especially for females that are depurating contaminants from their bodies into their eggs. The most robust measure of contaminants and effects to eagle embryo is contaminants in the diet of females prior to egg lying. Uncertainty in the diets of Menominee River bald eagles might impact conclusions of this risk assessment. If eagles are consuming more avian or mammal species, or bottom feeding fish species, concentrations of contaminants may be greater than what are presented in this screening level risk assessment.

The BMFs and NOAEC values selected for the HQ determinations are based on information in literature that is specific for Great Lakes bald eagles. The NOAEC values selected are the most sensitive ecotoxicological affects information that are available in the literature and are based on effects to bald eagle egg embryo. The BMFs for total PCBs and total Hg are calculated specifically from concentrations in eagle eggs and in fishes in samples taken from the Great Lakes region (Giesy *et. al.* 1995). The NOAECs of 4.0 mg PCB/kg and 0.5 mg Hg/kg used in

this risk assessment were determined by studies that calculated the egg embryo toxic threshold values for PCBs and Hg based on field studies (Wiemeyer *et. al.* 1984, 1993) and are supported in the literature (Ludwig *et. al.* 1993; Giesy *et. al.* 1995). Toxicity reference values are species-specific and no information for bald eagle egg thresholds is available from lab studies. The values used in this risk assessment are the closest representation of eagle egg thresholds that are available in the literature.

This screening level assessment only addresses the risk of total PCBs and total Hg to bald eagle egg embryos. The Menominee River, especially below the lowermost dams in the AOC and Superfund area, is a system that is polluted with a multitude of contaminants. It is highly unlikely that species are exposed and affected by only one or two contaminants, and effects of other contaminants and contaminant mixtures are not addressed in this risk assessment. Contaminants are likely acting in conjunction and may produce an additive or synergistic response in the exposed species. This screening level risk assessment does not address the risk of all contaminants in the Menominee River system.

Discussion and Recommendations

The Fish and Wildlife Coordination Act authorizes the FWS to determine possible effects of proposed fish passage projects to wildlife resources. The overall goal of the fish passage project is to have upstream and downstream passage of all native fish species, (e.g. walleye, northern pike, suckers), however the primary target species for upstream and downstream fish passage at this time will be lake sturgeon.

Information is limited on the proportion of the eagle diet that consists of lake sturgeon and a minimal value is used for this risk assessment. Hazard Quotients for lake sturgeon do not exceed one below or above the lowermost dams based on the proportion of sturgeon that might make up the bald eagle diet. When lake sturgeon is combined with other species of fish to create a constructed eagle diet, the HQ is over one for total PCBs and total Hg; however, only 3% of the constructed eagle diet consists of lake sturgeon. When HQs are calculated based on a diet that consists of 100% lake sturgeon, the HQs exceeded one. It is important to note that the

contaminant burdens in lake sturgeon provide a greater risk to piscivorous wildlife compared to contaminant burdens in other fish species (i.e., northern pike, walleye, common carp, and the group other species) based on a diet that is 100% one species, although it is unlikely that bald eagles and other piscivorous species will consume 100% lake sturgeon.

Risks of total PCBs in fish to piscivorous species are greater below the Menominee Dam compared to above the Park Mill Dam. Three different analyses suggest this risk; (1) fish below the Menominee Dam have significantly greater total PCB and Hg concentrations than fish above the Park Mill Dam, (2) the diet-weighted PCB HQs exceed one for common carp, northern pike, walleye, and the group other species below the Menominee Dam but do not exceed one above the Park Mill Dam, and (3) total PCB HQs calculated for the constructed eagle diet exceed one below and above the lowermost dams, but are substantially greater below the Menominee Dam compared to above the Park Mill Dam. These data indicate that the area above the Park Mill Dam is a cleaner system in terms of total PCBs in fish compared to the area below the Menominee Dam.

Above the Park Mill Dam, risks from total Hg in fish to piscivorous species may occur from fish species other than common carp, northern pike and walleye based on total Hg diet-weighted HQs. The total Hg HQs calculated for the constructed eagle diet exceed one below and above the lowermost dams, but are substantially greater above the Park Mill Dam. Total Hg concentrations in fish above the Park Mill Dam present a greater risk to piscivorous species compared to fish below the Menominee Dam.

Published data are limited on reproductive success rates and productivity for Menominee River and Green Bay piscivorous species. The two species that have been monitored throughout WI are the bald eagle and osprey (*Pandion haliaetus*). In 2010 there were 18 active bald eagle nests and potentially 17 osprey nests found along the Menominee River and in the surrounding river basin (information from Wisconsin DNR, personal communication). Information about reproductive success rates for bald eagles nesting along Green Bay could be an indication of rates for Menominee River bald eagles downstream of the lowermost dam. Comparative studies

between inland eagles and shoreline eagles suggest that populations along the shoreline in Green Bay experienced a reproductive loss from 1987 to 1996 and that depressed productivity rates were associated with high levels of exposure to organochlorine contaminants (i.e. total PCBs and DDE,) in food (Dykstra *et. al*. 2001). This study found that reproductive rates of Green Bay bald eagles were well below the rates needed to maintain healthy population numbers (Dykstra *et. al*. 2001). Although not statistically significant, productivity rates from 1992 to 1996 were marginally higher than rates from 1987 to 1991 (Dykstra *et. al*. 2001). From 1990 to 2001, productivity of eagles nesting along the Lake Michigan shoreline increased, although the reason for this increase was not correlated with a decline in contaminant levels (Dykstra *et. al.* 2005). Contaminant studies in Green Bay bald eagles are ongoing and can potentially help determine the health of local neighboring populations such as birds in the Menominee River area. Nest monitoring data from May of 2011 suggest that the percentage of successful nests of eagles nesting near Green Bay waters compared to eagles nesting near the Menominee River is similar. Contaminant data collected in 2011 for Green Bay eaglets are currently being analyzed by the WI DNR. Once available, these data will be important in determining the present risk of contaminants to eagle success.

The results of this screening level risk assessment provide information that supports efforts to further examine potential risks of contaminants in fish below the Menominee Dam to wildlife. Based on the available data, contaminants in fish species other than lake sturgeon are a potential concern below the Menominee Dam. Further investigations to determine if passing fish species other than lake sturgeon pose no risk to piscivorous wildlife should be determined based on findings from newly collected data. Therefore, the FWS recommends conducting a more in-depth or baseline risk assessment to determine if fish species other than lake sturgeon below the Menominee Dam pose no risk to piscivorous wildlife and are safe for fish passage. Recommendations of baseline risk assessments include (1) collecting and analyzing species-specific contaminant data that are current, (2) determining the hazard of contaminants in fish to other taxa (i.e. mink (*Mustela vison*), (3) assessing risk of contaminants in fish eggs to wildlife that consume fish eggs, (4) evaluating the risks from other contaminants that are not addressed in

this screening level risk assessment (i.e. pesticides, including dichlorodiphenyltrichloroethane (DDT) and dichlorodiphenyldichloroethylene (DDE), dioxin equivalents from PCBs, polychlorinated dibenzo-*p*-dioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs), and (5) evaluating the risks of contaminant mixtures to piscivorous wildlife.

The unique life-history and life-span of lake sturgeon lends support that the species provides limited exposure to piscivorous wildlife. Therefore, the risk that contaminants in lake sturgeon pose to wildlife is likely low. Based on this screening level risk assessment, the FWS supports current efforts to provide upstream passage of lake sturgeon from below the Menominee Dam to the upper reaches of the Menominee River. The FWS will continue to work with partners to determine justifiable numbers of lake sturgeon that should be passed at this time. The risk of contaminants in sturgeon eggs to wildlife that feed on fish eggs (i.e. other fish species) is not assessed in this risk assessment and should be a priority for future risk assessments.

Figure 1: Map or Assessment Area. Hydroelectric dams on the lower Menominee River within the Risk Assessment Area.

Figure 2: Map of Menominee River AOC. The orange shaded region of map includes the AOC area. The uppermost boundary of the AOC area is the Park Mill Dam.

Table 1. Descriptive Statistics for total PCB Concentrations in Fish Species below Menominee Dam and above the Park Mill Dam. Section (below and above the dams), Sample Size, Geometric Mean, Arithmetic Mean with Standard Error, Minimum and Maximum values are presented in the table. Arithmetic values with an asterisk indicate a significant difference between total PCB concentrations in fish below the Menominee Dam compared to concentrations in fish above the Park Mill Dam.

Descriptive Statistics for total PCBs concentrations (ug/g, ww) for whole fish in Menominee River							
Species	Section	Sample Size	Geometric Mean	Arithmetic Mean	Standard Error	Min	Max
Common Carp	below	15	2.98	*8.81	3.26	0.14	50.75
Common Carp	above	13	0.49	0.70	0.20	0.22	2.35
Lake Sturgeon	below	10	2.50	*4.16	1.36	0.45	13.00
Lake Sturgeon	above	11	0.61	0.66	0.08	0.19	1.08
Northern Pike	below	9	1.13	*1.82	0.73	0.45	7.00
Northern Pike	above	3	0.32	0.36	0.11	0.13	0.50
Walleye	below	21	0.98	*2.53	0.78	0.11	13.00
Walleye	above	8	0.25	0.29	0.06	0.11	0.50
Other Species	below	14	0.94	1.49	0.35	0.19	4.25
Other Species	above	11	0.16	0.17	0.01	0.11	0.24

Table 2. Descriptive Statistics for total Hg Concentrations in Fish Species below Menominee Dam and above the Park Mill Dam. Section (below and above the dams), Sample Size, Geometric Mean, Arithmetic Mean with Standard Error, Minimum and Maximum values are presented in the table. Arithmetic values with an asterisk indicate a significant difference between total Hg concentrations in fish above the Park Mill Dam compared to concentrations in fish below the Menominee Dam.

Descriptive Statistics for total Hg concentrations (µg/g, ww) for whole fish in Menominee River							
Species	Section	Sample Size	Geometric Mean	Arithmetic Mean	Standard Error	Min	Max
Common Carp	below	7	0.15	0.22	0.06	0.02	0.45
Common Carp	above	11	0.28	0.33	0.04	0.04	0.48
Lake Sturgeon	below	11	0.27	0.30	0.03	0.09	0.48
Lake Sturgeon	above	11	0.55	*0.58	0.06	0.28	0.91
Northern Pike	below	13	0.18	0.20	0.03	0.09	0.45
Northern Pike	above	34	0.31	*0.34	0.02	0.15	0.65
Walleye	below	23	0.22	0.28	0.05	0.07	0.76
Walleye	above	60	0.49	*0.60	0.06	0.10	2.50
other species	below	14	0.14	0.20	0.04	0.03	0.47
other species	above	40	0.40	0.49	0.04	0.05	1.10

Table 3. Diet Items of Bald Eagles Foraging in Green Bay (1995-1997). Total observations are 447, from which 434 of the prey items are fish, 11 are birds, and 2 are mammals. The percent dietary intake refers to the percent of each species consumed, calculated from total observations.

Diet of Green Bay Bald Eagles	Dietary intake (%)
Class Osteichthyes (FISH) (97.1%)	
Sucker (*Castostomus spp.*)	28.4
Northern Pike (*Esox lucius*)	16.6
Yellow Perch/Walleye (*Perca favescens* or *Stizostedion vitreum*)	16.0
Bass (*Micropterus spp.)*	10.7
Bullheads (*Ictalurus spp*)	8.9
Carp (*Cyprinus carpio*)	7.7
Other (*Centrarchids*)	4.7
Alewife (*Alosa pseudoharengus*)	0.6
Gizzard shad (*Dorosoma cepedianum*)	0.6
Coregonus (*Coregonus spp*.)	0.6
Trout (unknown spp.)	0.6
Class Aves (BIRDS) (2.5%)	
Gulls (*Larus* spp.)	3.0
Double-crested cormorant (*Phalacrocorax auritus*)	1.2
Duck (unknown spp.)	0.6
Class Mammalia (MAMMALS) (unknown spp.)(0.4%)	

Table 4. Risk to Bald Eagle Embryos from Total PCB Dietary Intake. Hazard Quotients derived from dietary proportions and the constructed eagle diet. Presented in table: % of species in eagle diet, BMF value, NOAEC value, Average and Geometric concentrations of total PCB (ug/g) ww, concentrations with diet contribution of fish species (% in diet * Average or Mean), and Hazard Quotient values.

Below Menominee Dam				From Arithmetic Average			From Geometric Means		
Diet Composition	**% in Diet**	**BMF**	**NOAEC**	**Average**	**Average/Diet Contribution**	**HQ**	**Mean**	**Mean/Diet Contribution**	**HQ**
Common Carp	0.08	28	4	8.81	0.70	4.93	2.98	0.24	1.68
Lake Sturgeon	0.03	28	4	4.16	0.12	0.84	2.50	0.08	0.56
Northern Pike	0.17	28	4	1.82	0.31	2.17	1.13	0.19	1.33
Walleye	0.16	28	4	2.53	0.40	2.83	0.98	0.16	1.12
Other Fish Species	0.56	28	4	1.49	0.83	5.81	0.94	0.53	3.71
Constructed Eagle Diet	1.00	28	4	18.81	2.36	16.52	8.53	1.20	8.40
Above Park Mill Dam				From Arithmetic Average			From Geometric Means		
Diet Composition	**% in Diet**	**BMF**	**NOAEC**	**Average**	**Average/Diet Contribution**	**HQ**	**Mean**	**Mean/Diet Contribution**	**HQ**
Common Carp	0.08	28	4	0.70	0.06	0.42	0.49	0.04	0.28
Lake Sturgeon	0.03	28	4	0.66	0.02	0.14	0.61	0.02	0.14
Northern Pike	0.17	28	4	0.29	0.05	0.35	0.25	0.04	0.28
Walleye	0.16	28	4	0.36	0.06	0.42	0.32	0.05	0.35
Other Fish Species	0.56	28	4	0.17	0.09	0.63	0.16	0.09	0.63
Constructed Eagle Diet	1.00	28	4	2.19	0.28	1.96	1.84	0.24	1.68

Table 5. Risk to Bald Eagle Embryos from Total Hg Dietary Intake. Hazard Quotients derived from dietary proportions and the constructed eagle diet. Presented in table: % of species in eagle diet, BMF value, NOAEC value, Average and Geometric concentration of total PCB (ug/g) ww, concentrations with diet contribution of fish species (% in diet * Average or Mean), and Hazard Quotient values.

Below Menominee Dam				From Arithmetic Average			From Geometric Means		
Diet Composition	**% in Diet**	**BMF**	**NOAEC**	**Average**	**Average*Diet Contribution**	**HQ**	**Mean**	**Mean*Diet Contribution**	**HQ**
Common Carp	0.08	28	4	0.22	0.02	0.14	0.15	0.01	0.09
Lake Sturgeon	0.03	28	4	0.30	0.01	0.07	0.27	0.01	0.06
Northern Pike	0.17	28	4	0.20	0.03	0.21	0.18	0.03	0.21
Walleye	0.16	28	4	0.28	0.04	0.28	0.22	0.03	0.24
Other Fish Species	0.56	28	4	0.20	0.11	0.77	0.14	0.08	0.56
Constructed Eagle Diet	1.00	28	4	1.20	1.20	8.40	0.96	0.96	6.72

Above Park Mill Dam				From Arithmetic Average			From Geometric Means		
Diet Composition	**% in Diet**	**BMF**	**NOAEC**	**Average**	**Average*Diet Contribution**	**HQ**	**Mean**	**Mean*Diet Contribution**	**HQ**
Common Carp	0.08	28	4	0.33	0.03	0.18	0.28	0.02	0.14
Lake Sturgeon	0.03	28	4	0.58	0.02	0.12	0.55	0.02	0.14
Northern Pike	0.17	28	4	0.34	0.06	0.40	0.31	0.05	0.35
Walleye	0.16	28	4	0.60	0.10	0.67	0.49	0.08	0.56
Other Fish Species	0.56	28	4	0.49	0.27	1.90	0.40	0.22	1.54
Constructed Eagle Diet	1.00	28	4	2.34	2.34	16.38	2.03	2.03	14.21

Table 6. Total Species Contribution Risk to Bald Eagle Embryos Based on Total PCB HQs. Presented in table: % of species in eagle diet, BMF value, NOAEC value, Average and Geometric means of total PCB (µg/g) ww, concentrations with diet contribution of fish species (% in diet * Average or Mean), and Hazard Quotient values.

Below Menominee Dam				From Arithmetic Average			From Geometric Means		
Diet Composition	**% in Diet**	**BMF**	**NOAEC**	**Average**	**Average*Diet Contribution**	**HQ**	**Mean**	**Mean*Diet Contribution**	**HQ**
Common Carp	1.00	28.00	4.00	8.81	8.81	61.67	2.98	2.98	20.86
Lake Sturgeon	1.00	28.00	4.00	4.16	4.16	29.12	2.50	2.50	17.50
Northern Pike	1.00	28.00	4.00	1.82	1.82	12.74	1.13	1.13	7.91
Walleye	1.00	28.00	4.00	2.53	2.53	17.71	0.98	0.98	6.86
Other Fish Species	1.00	28.00	4.00	1.49	1.49	10.43	0.94	0.94	6.58
Above Park Mill Dam				From Arithmetic Average			From Geometric Means		
Diet Composition	**% in Diet**	**BMF**	**NOAEC**	**Average**	**Average*Diet Contribution**	**HQ**	**Mean**	**Mean*Diet Contribution**	**HQ**
Common Carp	1.00	28.00	4.00	0.70	0.70	4.90	0.49	0.49	3.43
Lake Sturgeon	1.00	28.00	4.00	0.66	0.66	4.62	0.61	0.61	4.27
Northern Pike	1.00	28.00	4.00	0.29	0.29	2.03	0.25	0.25	1.75
Walleye	1.00	28.00	4.00	0.36	0.36	2.52	0.32	0.32	2.24
Other Fish Species	1.00	28.00	4.00	0.17	0.17	1.19	0.16	0.16	1.12

Table 7. Total Species Contribution Risk to Bald Eagle Embryos Based on Total Hg HQs. Presented in table: % of species in eagle diet, BMF value, NOAEC value, Average and Geometric mean of total PCB (µg/g) ww, concentrations with diet contribution of fish species (% in diet * Average or Mean), and Hazard Quotient values.

Below Menominee Dam				From Arithmetic Average			From Geometric Means		
Diet Composition	**% in Diet**	**BMF**	**NOAEC**	**Average**	**Average*Diet Contribution**	**HQ**	**Mean**	**Mean*Diet Contribution**	**HQ**
Common Carp	1.00	28	4	0.22	0.22	1.54	0.15	0.15	1.05
Lake Sturgeon	1.00	28	4	0.30	0.30	2.10	0.27	0.27	1.89
Northern Pike	1.00	28	4	0.20	0.20	1.40	0.18	0.18	1.26
Walleye	1.00	28	4	0.28	0.28	1.96	0.22	0.22	1.54
Other Fish Species	1.00	28	4	0.20	0.20	1.40	0.14	0.14	0.98
Above Park Mill Dam				From Arithmetic Average			From Geometric Means		
Diet Composition	**% in Diet**	**BMF**	**NOAEC**	**Average**	**Average*Diet Contribution**	**HQ**	**Mean**	**Mean*Diet Contribution**	**HQ**
Common Carp	1.00	28	4	0.33	0.33	2.31	0.28	0.28	1.96
Lake Sturgeon	1.00	28	4	0.58	0.58	4.06	0.55	0.55	3.85
Northern Pike	1.00	28	4	0.34	0.34	2.38	0.31	0.31	2.17
Walleye	1.00	28	4	0.60	0.60	4.20	0.49	0.49	3.43
Other Fish Species	1.00	28	4	0.49	0.49	3.43	0.40	0.40	2.80

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Appendix G.1: Newspaper article from the Eagle Herald in Menominee Michigan and Marinette Wisconsin. For the purpose of inviting the public to an open house and scoping meeting regarding the Menominee River Fish Passage Proposed Action. Publication date: February 4, 2011.

EH.
(2/4/2011)

Dam project topic of tour, meeting

MENOMINEE — As plans move forward to develop a fish passage to help Lake Michigan sturgeon return to their natural spawning areas in the Menominee River, the Menominee River Fish Passage Partnership is inviting the public to learn more about the project.

On Feb. 22, the public is invited to tour the Menominee dam and attend a meeting where progress on the fish passage and plans for the future will be discussed. The public meeting will give people a chance to dig a little deeper into what the project means for the community and give them an opportunity to ask questions.

"We want to make sure the public understands the purpose of this project and gets a chance to ask questions about it," says Denny Caneff, Executive Director of the nonprofit River Alliance of Wisconsin, one of the project partners.

For nearly a century, the sturgeon of Lake Michigan have not been able to return to their Menominee River spawning areas. But that will change soon. A consortium of private, federal, state and nonprofit organizations are working together to create a means for the sturgeon to move around the dams, owned by project partner North American Hydro Inc.

An Environmental Assessment for the Menominee River fish passage project will be written by the U.S. Fish and Wildlife Service. The Environmental Assessment is required for compliance with the National Environmental Policy Act. One of the purposes of the public meeting is to gather public input regarding the scope of the Environmental Assessment.

The public may also submit comments for the service's review of the project by one of the following methods:

U.S. mail or hand-delivery: Mr. Nick Utrup, U.S. Fish and Wildlife Service, Green Bay Ecological Services Field Office, 2661 Scott Tower Drive, New Franken, WI;

E-mail:menominee.passage@gmail.com; or

Fax: 920-866-1710 (Attention: Nick Utrup).

Comments must be received by March 11.

To learn more about the Menominee River Fish Passage Partnership and project partner River Alliance of Wisconsin, contact Denny Caneff, 608-257-2424 ext. 115, or dcaneff@wisconsinrivers.org.

Public is invited

- Menominee Dam Tour: Feb. 22, 4:30 p.m. at the Menominee Dam Powerhouse, 901 26th Street, Menominee.
- Project overview and public informational Meeting: Feb. 22, 6 to 7 p.m. at Spies Public Library, 940 First Street, Menominee.

Appendix G.2: Minutes from the Public Scoping Meeting regarding the Menominee River Fish Passage Proposed Action. Meeting date: February 22, 2011.

Menominee/Park Mill Fish Passage

Minutes from Public Scoping Meeting Pursuant to the National Environmental Policy Act (NEPA) Hosted at the Spies Public Library Menominee MI February 22, 2011 6:00 pm to 7:00 pm

Implementation Team

Chuck Alsberg ..... North American Hydro, Inc.

Rory Alsberg ..... North American Hydro, Inc.

Nick Utrup ..... US Fish & Wildlife Service

Jim Fossum ..... River Alliance of Wisconsin/Michigan Hydro Relicensing Coalition

Rob Elliott ..... US Fish & Wildlife Service

Jessica Mistak ..... Michigan DNRE

Mike Donofrio. ..... Wisconsin DNR

Attendance		
Name	**Affiliation**	**Contact Info**
Nick Utrup	USFWS	nick_utrup@fws.gov
Rick Loeffler	NAH	rick.loeffler@nahydro.com
Jim Fossum	RAW/MHRC	jfbio@yahoo.com
Denny Caneff	RAW	dcaneff@wisconsinrivers.org
Rob Elliott	USFWS	robert_elliott@fws.gov
Mike Donofrio	WDNR	
Kyle Kruger	MI DNRE	krugerk@michigan.gov
Chris Freiburger	MI DNRE	freiburgerc@michigan.gov
Sharon Baker	MI DNRE	Bakers9@michigan.gov
Tom Plante	NAH	taplante@charter.net
Steve Bradford	Local Resident	
Mike Grycowski	Local Resident	N2305 River Dr. Wallace, MI, mikegrycow@yahoo.com
Kathy Grycowski	Local Resident	N2305 River Dr. Wallace, MI
Sharon Davis	Local Resident	PO Box 82 Menominee, MI
Annita Fylorek	Local Resident	411 Second Street Menominee, MI
Keith Kazianka, c/o Rep. Dan Benishek	Congress Representative, MI District 1	500 S. Stephenson Ave, Iron Mtn, MI Keith.kazianka@mail.house.gov
Wendel Johnson	Local Resident	N2842 Shore Dr., Marinette, WI Wendel.johnson@new.si.com
Ron Henriksen	Local Resident	N9183 River Rd, Stephenson, MI Roncarol67@aol.com
Carol Henriksen	Local Resident	N9183 River Rd, Stephenson, MI Roncarol67@aol.com
Kevin Nichols	Local Resident	N2225 O-I Drive, Menominee, MI
Paul Campbell	Local Resident	N8325 River Rd, Stephenson, MI

AGENGA

Public Meeting Agenda

- 6:00 – 6:15 – Introductions and meeting purpose (Nick Utrup)
- 6:25 – 6:40 – Project overview and proposed action (Nick Utrup)
- 6:40 – 7:00 – Formal public questions and comments
- 7:00 – 7:30 – Informal poster viewing and one-on-one Q&A
- 7:30 – 8:00 – Adjourn and tear down

The meeting began at approximately 6:00 pm.

Nick began by explaining to the audience the reason for a scoping meeting. He states that, because federal funds have been awarded to construct fish passage, it is a requirement of the National Environmental Policy Act that the project partners (see Implementation Team above) engage with the public, prior to construction, to scope out any potential impacts the construction project may have to the human environment. Nick further explained that he will pass around a sign in sheet and asked the audience to introduce themselves only if they choose. He points to information about the project and mentions to the audience to contact him with comments or questions, but notes the deadline for comments of March 22, 2011.

He states that today's meeting will focus on the Environmental Scoping of the Menominee River Fish Passage Project. Nick shows the audience a list of the agencies and groups involved as a consortium with a collective interest in sturgeon and fish passage in general. At this point, Nick introduced the Implementation Team, noting some audience members are part of the Fish Passage Team, but not on the Implementation Team.

Nick goes on to explain that the project partners including North American Hydro, the owner of the two dams on the Menominee River, received Federal grants to begin construction of fish passage around the Menominee and Park Mill dams (09:51). He stated that the River Alliance of Wisconsin is the applicant for the grants and North American Hydro is acting as the matching contributor.

Nick continued, before work can begin, the USFWS needs to assess the project for any potential impacts to the human environment. This is required by the National Environmental Policy Act and this is why the USFWS is requesting feedback from the public (11:10). He stated that, the USFWS must comply with National Environmental Policy Act and therefore must complete an Environmental Assessment.

Nick went on to explain that, there are four more dams above the MNME/PKML project before Sturgeon Falls, which is the upper limit to where sturgeon historically migrated to. Nick gave the group statistics on the life of sturgeon along with the type of spawning habitat they require. Harvest rates are explained by Nick along with the declines in the numbers of sturgeon, which can be attributed to commercial fishing, dam construction and operation, pollution effects, and loss of spawning habitat.

Nick showed a map of known populations of sturgeon in Lake Michigan. Currently the population of sturgeon in Lake Michigan is approximately 3000 with the majority spawning in the Green Bay tributaries he explained. More than half of that population spawns in the Menominee River. The Menominee also has a resident population in the river. (20:14) Nick goes on to explain that the Menominee River has only 2.75 miles of river currently available for spawning habitat and produces few fish. Fish passage at the Menominee and Park Mill Dams will open 21 miles of river to spawning. A question is asked if juvenile sturgeon can migrate from the lower dam out to the lake. Nick replied "yes they can". Rob stated that the survival of larvae is greatly reduced where the spawning site is close to the open lake. He also states that larvae need the river environment for the first summer of life.

Nick continued, the Implementation Team has been meeting every few months for more than seven years. In 2009 they agreed on a conceptual plan for fish passage at the two facilities. The goals of the plans are to improve fish protection and reconnect fragmented populations, maintain a barrier to the spread of invasive species, and to meet delisted targets for the Menominee River Area of Concern.

Nick went on to explain that the group has received federal grants to begin construction of Phase I and II of the fish passage plan. Nick explained the different phases of the fish passage plan to the attendees and states that Phases III and IV are still conceptual at this point and would require another scoping meeting prior to any construction. He states that it is important to note that Phases I and II will get us to a functional fish passage, albeit it is not the complete system.

The Phase I grant totaled 1.5 million and was funded by the National Fish and Wildlife Foundation. North American Hydro has agreed to provide an additional$662,000.00 is in matching contributions. Nick then explained the potential environmental impacts of the project, stating that the Implementation Team expects there to be no significant impacts to the human environment, resulting from the construction and operation of Phase I. Construction is scheduled for 2012.

The Phase II grant totaled $1.5 million and was funded by US Environmental Protection Agency and North American Hydro is providing additional matching contributions of $564,250.00. Nick explained the design of the Phase II plan. An audience member asks if the public will be able to view the fish passage operation. Nick replied that a plan is in place to allow visitor viewing, but liability issues need to be worked out. The potential environmental impacts of Phase II are, invasive species transport, disease transport, and contaminate transport. He explained the details of these three concerns and described how the Implementation Team plans to address these concerns in the Operations Plan. Construction of this phase is also scheduled for 2012.

Nick expressed the importance of audience comments and questions and states that you can ask questions now or write them down and submit them later, also noting his secure email site.

A question is asked by an attendee, "who will be the biologists that will be identifying the fish, will it be state or federal". A reply by one of the Implementation Team members stated that it will be a shared effort. (48:30)

Another question asked to the biologists was, why they are not paying more attention to the Whitefish? A reply by one of the Implementation Team biologists stated that, right now, the main focus is on sturgeon mainly because they appear to be immune to VHS (51:37). Also stated was, when Phase III and IV are in operation, different types of fish will be passed.

Nick stated that the Implementation Team is working closely with fishway engineers that have been designing and building successful fish passages for more than 30 years. He also stated that if you can pass sturgeon, you should be able to pass almost any fish in the system.

Jim mentioned ongoing work and progress at the White Rapids Project. (This statement is in reference to a prototype upstream fishway below White Rapids Dam that has demonstrated success at guiding and trapping sturgeon into an elevator type design).

Someone asked, what is done after you lift and sort the fish from the river. Nick replied, the sturgeon will be tagged, weighed, measured and screened for disease. The sturgeon will then be held in tanks before being released upstream (subject to approval from the state biologists). Some sturgeon may be used to collect eggs for research and hatchery propagation.

Rick asked Nick to address the audience on why the fish passage ladders built into the dams in the 1920's are not in use. Nick replied, "They are steep and narrow and were built for salmon to jump from weir to weir, sturgeon would not be able to jump in this manner. He also stated the drop is too steep and there is no way to control invasive species from entering upstream.

End of Public Scoping Meeting (1:03:29).

Appendix G 2: Continued… Public Sign-in Sheet

Date 2-22-2011

MENOMINEE/PARK MILL
FERC # 2744
NEPA SCOPING MEETING
SIGN UP SHEET

NAME (PRINT)	ADDRESS	EMAIL
TOM PLANTE	229 E. SAGOLA KINGS MICH	TPLANTE@[illegible].NET
Steve Bradford		
MIKE GRYCOWSKY	N2305 RIVER DR. WALLACE MI	
KATHY GRYCOWSKI	MIKEGRYCOW@YAHOO.COM	
Sharon Baker	MDNRE SOON MDEQ	Bakers3@Michigan.gov
Sharon Bayes	P.O. Box 82 Menominee, Mich. 49858	
Anita Sikorski	411 Second Street Menominee Mich 49858	
Rick Loeffler	Neshoro, WI 54960	
Keith Kaziunka % Congress.	500 S. Stephenson Ave, Iron Mtn. MI	Keith@Kaziunka@mail.house.
Wendel Johnson	N2242 Shore Dr. Marinette, WI	wendel_johnson@wi.rr.com
Ron+Carol Henriksen	N9183 River Rd Stephenson, MI 49887	RONCarol610@AOL.COM
KYLE KRUGER	DNRE	KRUGERK@MICHIGAN.GOV
Chris Freiburger	DNRE	Freiburgerc@michigan.gov
Mike Donofrio	WDNR	Michael.Donofrio@wisconsin.gov
KEVIN NICHOLS	N2225 0-1 DR. MENOMINEE, MI	knickel6666@hotmail.com
Paul Campbell	N8325 River Rd Stephenson MI 49887	

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Appendix G.3: Minutes from an Open House and Citizens Advisory Committee Meeting. On the agenda was a discussion about the Menominee River Fish Passage Proposed Action. Meeting date: February 23, 2011.

Lower Menominee River Area of Concern

Open House and Citizens Advisory Committee Meeting

February 23, 2010

7:00 – 9:00 p.m. CST

UW-Marinette Main Building Cafeteria

Northwest Corner of University Dr and Bay Shore St, Marinette, WI

([Map of UW-Marinette Campus])

Attending: Gail Clark (M&M GLSF), John Clark (M&M GLSF), Mark Erickson (Lloyd Flanders), John Groleau (Fibrek), Jon Kukuk (Nestegg Marine), Trygve Rhude (Chappee Rapids Audubon), Rick Stoll (WDNR), Ben Uvaas (WDNR), Keith West (UW-Marinette), Steve Zander (Place Perfect Realty), Robert Grager (Citizen), LaVern Grager (Citizen), Bob Fraik (Marinette County Supervisor), Jim Rettke (Citizen), Bruee Peters (Citizen), John Huff (WDNR), Brian Hinrichs (Foth & Associates), Les Martin (citizen), Tammie Paoli (WDNR), Nancy Douglas (Menominee Business Development Corp.), Nick Utrup (USFWS), Sharon Baker (MDNRE)

Open House Summary of Events:

Displays included such topics as; background on the CAC and AOC programs, fish passage efforts in the Menominee River, the Fish & Wildlife Population and Habitat Management Plan, Strawberry Island a bird habitat, Green Island development, managing phragmites reed, Menominee River fisheries, stormwater management in the City of Marinette, and aquatic invasive species.

Only three feedback forms were collected regarding the open house, but it was confirmed that some people did hear about the meeting through press releases in the local papers.

CAC Meeting Summary and Action Items:

Welcome and introductions – Mark Erickson and Steve Zander, CAC Co-Chairs

Co-Chairs started the meeting; round of introductions.

Fish Passage in the Menominee River –Nick Utrup, USFWS

Nick Gave a presentation on the fish passage effort in the Menominee River, which included a life history of Sturgeon, their historical range and abundance, and reasons for their decline. Dams and other obstructions were identified as migration barriers to vital spawning habitat for sturgeon. Nick also explained that the Menominee River is home to almost half the adult sturgeon in all of Lake Michigan, and with restoration, has the greatest potential to benefit the Lake Michigan Sturgeon population.

Restoration partners have received $3 million in grant funding and North American Hydro has contributed $1.4 million to begin fish passage efforts on the Park Mill and Menominee Dams.

- CAC members expressed a need to do more to promote the passage effort to the Community.
- Members also noted that design work for phase 2 should accommodate a viewing platform.

Phragmites Management at Seagull Bar State Natural Area – John Huff, WDNR

John provided some background information on Seagull Bar State Natural Area. As a State Natural Area, Seagull is considered critical habitat for rare and endangered species. John went on to say that all water and shorebird species present in the Bay have been seen at Seagull Bar. Many species, like the endangered piping plover, use the Bar to raise their young before migrating to South American to overwinter. These characteristics make Seagull Bar a resource of global concern.

Efforts to eliminate phragmites from Seagull Bar have been underway for years. Aerial chemical sprays took place in 2006 and 2010, a prescribed burn in 2007, backpack chemical spraying has taken place yearly since 2007 and is planned for future years.

The Wisconsin Department of Natural Resources has received an $800,000 grant from the U.S. Environmental Protection Agency to control phragmites reed along the western shore of Green Bay. Public and private lands are targeted for management, but private landowners must grant the Department permission, or their phragmites will not be treated

- Riparian landowners at the meeting expressed their concerns relating to phragmites and access to their waterfront.
- Concerns about only treating private property with landowner approval were also expressed. At this time the Department does not have the authority to treat private property without landowner consent.

Fish & Wildlife Populations and Habitat Management Plan - Sharon Baker, MDNRE

Sharon released the initial draft of the above plan for public comment. Public comments will be received prior to March 25th will be incorporated into a second draft released at the next CAC meeting. If you would like a copy of the plan, or you would like to comment contact Sharon Baker by e-mail at BakerS9@michigan.gov.

River Sediment Characterization and Fish Cleaning Station Projects – Brian Hinrichs, Foth

The sediment characterization project would map the river bed, soft sediment thickness, and sediment depositional areas in the AOC. Sediments in depositional zones would then be sampled for contaminates like PCBs and mercury. The other proposal would upgrade the City of Marinette fish cleaning station to retain and freeze fish entrails for processing into fertilizer offsite. The environmental benefit of the project is the removal of mercury found in fish entrails from the wastewater stream and Lake Michigan basin.

Neither the sediment characterization project nor the fish cleaning station project were funded last year. Brian suggested that if the CAC were to become more involved in the projects they have a better chance of getting funded.

- Citizens and attending agency representatives expressed concerns about the duplication of sediment monitoring efforts, citing existing monitoring data and funded future work.
- It also was emphasized that the CAC does not have the ability to apply for grant funds directly.

Green Island Development – Steve Zander, Co-Chair

The CAC has written a letter addressed it to the County Board expressing environmental concerns related to the proposed development "Anna's Vineyard at Green Island". The CAC feels that their concerns have been expressed, and will wait to see how the issue develops before further discussion.

Strawberry Island Habitat Improvement–Ben Uvaas, WDNR

Habitat improvement activities have been canceled on the island this year due to thin ice and access issues. Habitat improvement activities will likely resume in the fall of 2011, watch your e-mail for more information.

- John Kukuk of NestEgg Marine mentioned that he was a flat workboat that might be ideal to assist habit work on Strawberry Island during open water.

Other News and Updates

- Ben Uvaas mentioned two funding opportunities through the Wisconsin Office of Great Lakes.
- There was overwhelming support of conducting a beach or riparian cleanup next summer
- CAC members discussed changing meeting dates to accommodate local reporter's schedules
- A general discussion of how the CAC might promote itself ensued
- Ben Uvaas said that he will draft proposals for CAC promotion and a beach cleanup for the Office of the Great Lakes funding opportunities
- The next CAC meeting will be held on March 30th from 6:30-8:30 pm at the University YMCA/ Max E. Peterson Field House geology/ geography classroom as normal

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Minutes respectfully submitted by Benjamin Uvaas.

Appendix G 3: Continued… Public Sign-in Sheet

Menominee River Area of Concern Citizens Advisory Committee
February 23, 2011

Please sign in!

NAME	ORGANIZATION	CONTACT INFORMATION e-mail or phone, (if not previously provided)
Robert Grager	—	715-732-9037
LaVern Grager		715 732 9037
John Grolleau	Fabrick	
Bob Fesik	Marinette City	
Jim Reinke	Property Owner	
Bruce Peters	Property Owner	
John Hugo	WDNR	
Jon Kukuk	Nestegg Marine	JON@NESTEGGMARINE.COM
Brian Hinrichs	Foth	bhinrichs@Foth.com bhin53575@Yahoo.com
Les Stanton	Property owner	
Tammie Paoli	WDNR	
Rick Stolz	WDNR	
Nancy Douglas	Menominee Bus. Dev. Org.	
John Clark	MHMCLSF	
Gail Clark	MHMCLSF	
Mark Erickson CO-Chair	Wayd/Rinder	
Steve Zander CO-Chair		
Nick Utrup	USFWS	Nick_Utrup@fws.gov 920-866-1736
Trygve Rhude	(Check my e-mail)	
Sharon Baker	MDNRE	
Ben Evans	WDNR	

Appendix G 4: Agenda from City of Menominee, MI, City Council Meeting. On the agenda was a public hearing regarding the Menominee River Fish Passage Proposed Action. Hearing date: March 18, 2011.

E-4

March 18, 2011

CITY OF MENOMINEE, MICHIGAN
MENOMINEE CITY COUNCIL
AGENDA FOR MARCH 21, 2011
HELD AT CITY HALL - 2511 10th STREET – 6 p.m.

A) CALL THE MEETING TO ORDER.

B) PLEDGE OF ALLEGIANCE TO THE FLAG.

C) ROLL CALL.

D) APPROVAL OF MEETING AGENDA.

E) MINUTES OF PREVIOUS MEETINGS:
1) Special meeting of February 16, 2011.
2) Regular meeting of February 21, 2011.
3) Special meeting of March 5, 2011.
4) Special meeting of March 6, 2011.

F) PUBLIC HEARINGS:
1) Proposed rezoning of the property located at 2008-11th Avenue from PL to R-2.

G) PUBLIC COMMENT:
(1) Maximum 15-minute public comment session. Statements, not debate, limited to three minutes per person on agenda items only.

H) COMMUNICATIONS:
1) Report from Joe Peacock and the Downtown Business Association.
2) Report from Nancy Douglas on Menominee Business Development Corporation activities.
3) Presentation from Nick Utrup, U.S. Fish and Wildlife Service, on the fish passage project planned at the American Hyrdo dam.
4) Sheriff Ken Marks on the Emergency Response/24-Hour Road Patrol millage.

QUALITY ASSURANCE PROJECT PLAN
Great Lakes Protection Initiative
EPA-R5-GL20010-1
For River Alliance of Wisconsin, Inc.
Effective Date of this QAPP: November 2010 – June 2013

A. PROJECT MANAGEMENT

A.1. TITLE AND APPROVAL SHEET

Project Title: Clearing A Path: Revitalizing Lake Michigan's Sturgeon

Approvals:

5/25/11
(signature and date signed)
Denny Caneff, Executive Director
River Alliance of Wisconsin
Project Co-Manager

5/26/11
(signature and date signed)
Nick Utrup, Wisconsin Hydropower Coordinator
U.S. Fish and Wildlife Service
Project Co-Manager and QA Manager for this project

5-24-11
(signature and date signed)
Rajen Patel, Project Officer
U.S. EPA Great Lakes National Program Office

5-24-11
(signature and date signed)
Louis Blume, Quality Assurance
U.S. EPA Great Lakes National Program Office

A.2. TABLE OF CONTENTS

A.3. DISTRIBUTION LIST FOR QAPP REVISIONS AND FINAL GUIDANCE

Each time this QAPP is revised, the following individuals will receive a notice of revision, and a copy via email.

James Fossum, Project Consultant to the River Alliance jfbio@yahoo.com

Charles Alsberg, CEO, North American Hydro chuck@nahydro.com

Rory Alsberg, Project Manager of Midwest Plant Operations, North American Hydro rory.alsberg@nahydro.com

Rick Loeffler, Environmental Compliance Officer, North American Hydro, rick.loeffler@nahydro.com

Mark Doubek, Senior Project Manager and Coordinator, North American Hydro, mkdoubek1@yahoo.com

Michael Donofrio, Fisheries Supervisor, Wisconsin Dept. of Natural Resources, Michael.Donofrio@wisconsin.gov

Jessica Mistak, Senior Fisheries Biologist, Michigan Dept. of Natural Resources and Environment, mistakj@michigan.gov

Nicholas Utrup, Wisconsin Hydropower Coordinator, U.S. Fish and Wildlife Service, Nick_Utrup@fws.gov

Robert Elliott, Fishery Biologist, U.S. Fish and Wildlife Service, Robert_Elliott@fws.gov

Sharon White, Business Manager, River Alliance of Wisconsin, swhite@wisconsinrivers.org

Paul Piszczek, Fisheries Biologist, Michigan Dept. of Natural Resources, piszczekp@michigan.gov

Denny Caneff, Executive Director, River Alliance of Wisconsin, dcaneff@wisconsinrivers.org

Rajen Patel, Project Officer, USEPA GLNPO, Patel.Rajen@epamail.epa.gov

A.4 PROJECT AND TASK ORGANIZATION

This project is a unique collaboration among federal and state government agencies, a nongovernmental organization, and a private enterprise. That private enterprise, North American Hydro, has pledged $724,250 toward this project to develop a fish lift and sorting facility at the Menominee dam. That formal agreement of that contribution by North American Hydro is captured in a Memorandum of Understanding between the company (dba N.E.W. Hydro) and the grantee, River Alliance of Wisconsin. (See Appendix 1)
The project team has been meeting for years, developing a conceptual plan for all four phases of this project to enable the passage of lake sturgeon up- and downstream around two hydro dams on the lower Menominee River.
http://www.wisconsinrivers.org/documents/Fish%20Passage%20Presentation%20GRANTS.pdf

Key individuals and their responsibilities are described here:

River Alliance executive director **Denny Caneff** will oversee the project on behalf of the River Alliance. This includes ensuring that all financial and narrative reports are completed on time; overseeing the project budget and funds; and providing insights to the management of the overall project. Along with Nick Utrup, of the U.S. Fish and Wildlife Service, Denny is project co-manager.

River Alliance hydropower consultant **James Fossum** is the organization's resident expert on fish biology related to fish passage. He is a retired U.S. Fish and Wildlife Service biologist (33 years of service) who has represented River Alliance on this and several other hydro projects since 2006. Jim's role is to bring his fisheries biology expertise to the project, especially in the context of hydropower operations and fish passage planning. He is a member of the project Implementation Team (IT) that reviews plans and design drawings; evaluates prospective contractors; and advises the contractors on particular issues about the project as they concern fish health and vitality. Jim is also part of an IT sub-committee developing telemetric equipment needs to measure fish passage success at the upstream and downstream fish passage facilities when installed at the Park Mill and Menominee hydro projects.

Rory Alsberg, Project Manager at North American Hydro Holdings, Inc., is responsible for the construction of the Menominee/Park Mill Fish Passage projects. Rory is the direct contact between the Implementation Team, design and engineering firms, construction contractors, relicensing team, employees at North American Hydro Holdings, and others involved in the project. Rory's goal is to ensure the construction of the Menominee/Park Mill Fish Passage is successful by meeting timelines and budget requirements, and reviewing invoices before payment for design and construction services North American Hydro is overseeing.

River Alliance business manager **Sharon White** is responsible for accounting, bookkeeping, banking and invoicing for the organization and will participate fully in grant funds management and accounting. She will disburse funds for this project, once the project team determines how the funds will be spent; oversees the financial reporting to funders; and will oversee any and all audits for the organization and this project.

Chuck Alsberg, chief executive officer and co-founder of North American Hydro Holdings, Inc., is a certified professional engineer and has over 30 years experience working in the hydroelectric industry. North American Hydro Holdings, Inc. is the operator of the Menominee/Park Mill Hydroelectric Project in Menominee, Michigan and Marinette, Wisconsin, and is agent for the Project licensee/owner, N.E.W. Hydro, Inc. (licensee). Chuck's role is to ensure that NAH's interests and concerns relative to hydro operations, licensing and financial commitments are met.

Rick Loeffler works in the environmental compliance department of North American Hydro Holdings, Inc. Among other duties, he develops fish passage with participating partners at hydroelectric projects operated by North American Hydro Holdings, Inc. throughout the Midwest. Rick has over 20 years experience working in the hydroelectric industry. Rick's tasks include being NAH's "eyes and ears" at the dam sites and ensuring that fish passage structures remain compatible with hydro operations. Along with many other team members, Rick reviews plans and design drawings, evaluates prospective contractors, and directly negotiates with those contractors to ensure the work is carried out to the team's specifications.

Mark Doubek is senior project manager and coordinator for North American Hydro. In this particular project, he will provide Project design and engineering, project estimating, project management and closeout.

Nick Utrup, a fish and wildlife biologist and FERC hydropower coordinator for the U.S. Fish and Wildlife Service (FWS), has nearly 10 years experience working in fisheries, including the past five years as a biologist for the agency. Nick has spent the last five years working with sturgeon (including lake sturgeon, pallid sturgeon, and shovelnose sturgeon) and is currently the FWS regulatory coordinator for all FERC-licensed hydropower projects in the state of Wisconsin. Nick is currently working on five other fish passage-related projects in Wisconsin in addition to this project. Along with Denny Caneff, Nick is project co-manager. Nick reviews plans and design drawings, evaluates prospective contractors, is chair of the sub-team developing fish monitoring protocols for the project, and generally ensures that the project design and construction are compatible with fish health and vitality.

Curt Orvis, a hydraulic engineer team leader for the U.S. Fish and Wildlife Service (FWS), has more than 30 years experience with hydraulic engineering work on rivers, dams, and fishways. Curt has spent the past 17 years working on fish passage projects with the FWS and has contributed to over 10 different fish passage projects currently in operation. Curt will advise the project team on the design and management of the fish passage structures.

Robert Elliott, a 15-year veteran of the U.S. Fish and Wildlife Service and a Great Lakes fish biologist, is the Service's lake sturgeon lead for Lake Michigan. He serves as chair of the Lake Michigan Lake Sturgeon Task Group of the Lake Michigan Committee that implements and coordinates lake sturgeon rehabilitation efforts across the Lake Michigan basin and its tributaries. Rob participates in the sub-team developing the fish monitoring protocols.

Michael Donofrio, a fisheries supervisor with Wisconsin Department of Natural Resources, has 21 years experience as a fisheries biologist. Michael represents Wisconsin on all FERC licenses and fisheries management on the Menominee River. His role is to ensure that the fish lift will pass the species of interest and to ensure an adequately equipped and managed fish sorting facility. He also participates in the sub-team developing the fish monitoring protocols, and will advise and inform federal fishery biologists of the final decisions Wisconsin natural resource managers require for fishway management.

Paul Piszczek is a fisheries biologist with the Michigan Department of Natural Resources (DNR) Habitat Management Unit. Paul possesses nearly 15 years of combined work experience and formal education with fisheries and water resources in the Midwest, Southeast, and Northeast United States, and to a limited extent the Pacific Northwest. He has specific experience as a state regulator, having written and implemented Clean Water Act Section 401 Water Quality Certifications that included provisions for upstream and downstream fish passage associated with hydroelectric facilities in the Northeast. He has also written and implemented Quality Assurance Project Plans for various water quality monitoring programs and projects. He represents MDNR as a participating member of the Implementation Team (IT), offering technical assistance on fish passage design and operation to meet DNR fisheries management objectives. Paul will advise and inform federal fishery biologists of the final decisions Wisconsin natural resource managers require for fishway management. He participates in the sub-team developing the fish monitoring protocols, and will offer advice and assistance on QAPP preparation and maintenance.

Ben Rizzo, a retired U.S. Fish and Wildlife Service hydraulic engineer and now private engineering consultant, has over 45 years experience in hydraulic engineering and fish passage. Ben has worked on over 40 major fish lifts, locks, and pool/chute type fishways. Like Curt Orvis, Ben will lend his expertise on an as-needed basis on the design and management of the fish passage structures.

Luther Aadland, a fishery biologist for the Minnesota Department of Natural Resources based in Fergus Falls, Minnesota, has extensive experience with nature-like fishway channels. Nature-like fishway channels have been used extensively throughout the world with a high degree of success for passing large fishes such as lake sturgeon. Luther has designed many of these fishway channels in Minnesota and the Midwest, and contracts as a professional design consultant on such projects. Like Ben Rizzo and Curt Orvis, Luther will advise the team from time to time on the design and management of the fish passage structures. Luther's expertise will come into play in a later phase of the project when he can advise the project on a natural fishway or bypass channel that may be constructed at this site.

Quality Assurance Manager

The quality assurance manager for this project is Nick Utrup, who with Denny Caneff also acts project co-manager. He is a fisheries biologist with the U.S. Fish and Wildlife Service and has been actively engaged in the project's development for five years. Even though is an integral part of the project team, Nick's main role in the process is as Regulatory Advisor and Project Planning Assistant tasked with protecting the health and well-being of fish and wildlife resources pursuant to Federal statutory requirements. Protecting the health and well-being of the sturgeon is a matter of professional integrity, and he is ideally suited to judge whether the project details are in the best interest of improving the viability of the lake sturgeon population.

Backing up Nick in quality assurance will be the U.S. Fish and Wildlife Service's senior hydraulic engineer, Curt Orvis. Per FWS policy, all final decisions regarding fishway construction will go through Curt, who when combined with the FWS's National Fish Passage Team, brings decades of experience analyzing, researching, planning and assisting the construction of fish passage structures throughout the country. The FWS's fish passage team will act as additional and independent quality assurance for the project and will provide ongoing advice to the project team.

They will be consulted only at strategic points in the development of the project and will not be involved in the week-to-week and month-to-month deliberations and decisions. In this regard, the FWS's fish passage team will have sufficient independence from those decisions to offer critical insights for quality assurance for the project.

Subcontractors

At the time of this writing, no subcontractors have been hired for the work that is funded by the EPA GLRI grant. Once they are, their participating individuals and related responsibilities will be outlined in a revised QAPP and circulated to the distribution list.

Organization Flow Charts

We have included two organization flow charts (Appendix 2) – one which represents typical lines of authority and responsibility and the various committees formed to manage the project. The second represents the collaborative decision-making structure of the

partnership and individuals' responsibilities. Each partner brings unique perspective and expertise to the project, and decisions are usually made by consensus.

A.5. PROJECT DEFINITION AND BACKGROUND

Problem to Be Solved

This project's goal is to revitalize the ancient lake sturgeon of Lake Michigan by allowing the fish to satisfy their instinct to spawn in a river. Dams now block their passage. This project will move the fish around two dams on the Menominee River, which are about a mile apart and two miles from the river's mouth. **EPA funds provided through a Great Lakes Restoration Initiative grant will help pay for the second phase of this four-phase project: to build a fish lift (elevator) and fish sorting facility that will enable the sturgeon to eventually move upstream past both dams.** (See Appendix 3 for visual overview of the project.)

Historical and Background Information

This project directly addresses a critical issue for Lake Michigan: the decline of spawning habitat for lake sturgeon (*Acipenser fulvescens*). The project has been informed by decades of research. Lake sturgeon is identified as a threatened species in Michigan, a species of special concern in Wisconsin, and a federal species of concern by the U.S. Fish and Wildlife Service. Numerous reports and management plans recommend that threats to lake sturgeon in the Great Lakes and their tributaries be reduced and mitigated. For example, the Lake Michigan Fish Community Objectives (Eshenroder et al. 1995) state that Lake Michigan "sturgeon populations should be enhanced by assuring passage over barriers in historically used spawning streams" such as the Menominee River. Correspondingly, the top management objective of the Menominee River Fisheries Plan (Thuemler and Schnicke 1992) is to restore lake sturgeon populations to their historic levels throughout their former range by providing upstream and downstream passage at existing hydroelectric dams on the Menominee River. Other reports and management plans with similar objectives include Joint Strategic Plan for Management of Great Lakes Fisheries – (GLFC 2007); Lake Michigan Lake Wide Management Plan – (LaMP 2000); Wisconsin's Lake Sturgeon Management Plan (WDNR 2000); Wisconsin's Wildlife Action Plan – (WDNR 2005); Michigan's Lake Sturgeon Rehabilitation Strategy – (Hay-Chielewski and Whelan 1997); and Michigan's Wildlife Action Plan – (Eagle et al. 2005).

In addition to directly addressing top objectives in numerous management plans and strategies in the Great Lakes (described herein in Section (i)), this project is also located within the USEPA's designated Menominee River Area of Concern (AOC). http://www.epa.gov/greatlakes/aoc/menominee.html. The Great Lakes Water Quality Agreement calls for Remedial Action Plans (RAPs) to restore and protect 14 beneficial uses in Areas of Concern, such as the Menominee River. An "Impaired Beneficial Use" means a change in the chemical, physical or biological integrity of the Great Lakes system. This project will contribute toward delisting the Menominee River as an AOC by clearly

addressing two of the listed Beneficial Use Impairments (BUI): "loss of fish and wildlife habitat" and "degradation of fish and wildlife populations."

To address the "loss of fish and wildlife habitat" BUI, this project will improve habitat within the Menominee River AOC by providing access to 21 additional miles of lake sturgeon habitat upstream of the AOC. Because a large portion of the AOC is impounded by two dams, it is not possible to restore lake sturgeon habitat within the existing AOC. By providing access to upstream habitat via a fish passage corridor, sturgeon migrating upstream annually to spawn would increase from none currently to as many as 200 individuals immediately upon project completion.

To address the "degradation of fish and wildlife populations" BUI, this project will help grow the existing Lake Michigan sturgeon population by providing a mechanism to improve population recruitment. As sturgeon pass upstream through the proposed fish passage corridor, they will have access to more and better spawning and juvenile habitat, improving reproduction and survival. As the sturgeon migrate downstream through the downstream fish passage corridor (to be constructed using funds from another federal grant), more fish will pass and they will live longer, leading to more sturgeon in Lake Michigan. Immediately upon completion of the downstream fish passage corridor (the first phase of the project), 50-200 sturgeon annually would reach Lake Michigan, unharmed and unimpeded by the hydroelectric turbines.

Applicable Technical, Regulatory or Program-Specific Quality Standards and Objectives

This project must undergo a National Environmental Protection Act (NEPA) environmental assessment before any work commences. In addition, the Federal Energy Regulatory Commission must review and approve any changes to the hydro dams' structure and operations. In addition, the two state natural resources agencies and the U.S. Fish and Wildlife Service all have internal protocols for fish handling and management as it pertains to passing lake sturgeon at the two dams. The agencies will be guided by existing protocols that detail how to prevent the spread of invasive species (such as sea lamprey or quagga mussels) and the spread of fish disease (e.g. viral hemoraggic septicemia).

In addition to these quality standards, both natural resources departments will review the changes in both dams that the project engenders to seek if regulatory (e.g. water quality, shoreland changes) permits will be necessary.

A.6. PROJECT DESCRIPTION

Measurements Made, Data Obtained

The result of this project is very straightforward: a fish lift (elevator) and a fish sorting facility will be constructed at the Menominee dam, so that lake sturgeon migrating upstream from Lake Michigan can pass two hydro dams and continue their journey to spawning areas upstream. Data collected will consist of the number, type, and characteristics (e.g. weight, sex, relative health) of lake sturgeon passed through the fishway.

The proposed fish lift will use attraction flows generated from the existing hydro facility to guide fish to a hopper. The hopper will then lift fish above the dam and into a holding and sorting facility designed to separate undesirable invasive species (e.g., sea lamprey) from the lake sturgeon. This sorting facility will also offer researchers the ability to collect important data necessary for monitoring both native and invasive species moving in the Menominee River. It can also be used to collect sturgeon gametes that are necessary for hatchery propagation and stocking efforts. The lift will be operated during the times of the year when sturgeon are migrating upstream.

This facility will be operated using a fish health screening protocol and quarantine to ensure that fish passed upstream are disease-free. Undesirable organisms will either be returned to the river downstream of the dam or be destroyed. The sorted sturgeon will eventually be deposited into a natural stream channel for movement upstream (Phase 4). Until that phase is completed, though, the natural resource agencies will transport the sorted sturgeon by truck to a safe location above the Park Mill Dam where they can carry on their upstream migration. Fish passage will be operated according to a fish passage operation plan, approved by the agencies, which would allow temporarily suspending fishway operation if a threat is detected (e.g., virus outbreak, new invasive). This operation plan will be adapted as threats and conditions change over time.

Measurements to Be Made/Data to Be Obtained

The ultimate measures of success, and the data gathered as the benchmark of that success are the following: 50-200 sturgeon passed upstream per year immediately after construction of the fish lift, and over time, 21 miles of habitat re-opened, and sturgeon population increased from 3,000 currently to up to 20,000 adults in 50-100 years.

Measuring the number of sturgeon passed upstream will be straightforward: fish will be passed only when fish biologists operate the fish lift, and they will collect essential data on the sturgeon (e.g. weight and length, sex, estimated age, general health) and, if the fish had been previously tagged with a PIT tag (in essence, an electronic ID card), that sturgeon's file will be updated. Fish lift operators will also track the number and types of other aquatic species finding their way into the fish lift.

Other data include to what extent changing the volume of water passing through both the downstream and upstream structures affects how the fish are attracted to them.

Special Personnel and Equipment Requirements

Several specialties and types of expertise are involved in this project. (See Appendix 2 for names, organizations and positions.) North American Hydro brings expertise in hydro dam operations. State and federal agency resource professionals bring hydrology, hydraulic, and fish biology to the project. The NGO brings public communications and grant administration. The particular expertise of each participating individual is provided on Pages 4 – 7 of this QAPP.

Equipment requirements are very highly specialized and expressly designed for this project. Downstream passage will entail constructing a underwater gate or rack that will direct sturgeon to an opening in the dam, through which they will through and on downstream. Upstream passage involves constructing an elevator, or fish lift, complete with an underwater entrance channel that has "attraction flow" to draw fish toward the elevator through it but prohibits fish from turning around and heading away from the elevator.

Work Schedule and Timeline

A detailed work schedule and timeline for the project years 2010 through 2013, in the form of a flowchart, are included as Appendix 4 to this QAPP. The table below provides a narrative version of the milestones and timelines represented in the flowcharts. The flowchart that is Appendix 4 still accurately depicts the work schedule as of the date of this version of the QAPP (May 2011).

Production schedule of project outputs, expected outcomes and anticipated dates of completion.

Dates	Outputs	Outcomes
April – August 2010	Analyze attraction flow study; design team finalizes plan	Partners review options and adjust plans based on data and expert advice; required permits will be sought.
September – December 2010	Finalize advanced engineering and design plans for fish lift and sorting facility and submit for approval	Final plans will be determined by partners and prepared for submittal to the permitting agency (Federal Energy Regulatory Commission, or FERC).
January – September 2011	Review and approval of final engineering designs; order elevator and gate.	FERC will review and approve engineering designs for permit approval. Elevator and gate will be purchased.

September – 2011-Jan. 2012	Install turbine, order transport trailer and overhead crane for sorting facility, begin seeking construction bids.	Turbine is installed (attraction flow); overhead crane is ordered. Transport trailer is purchased.
Feb. – June 2012	Award building contracts, break ground, upgrade electrical, rough in piping, install elevator.	All the work necessary to build and operate the elevator is completed.
July – September 2012	Complete sorting facility and install fish lift/elevator	Foundation is modified, observation deck built, overhead crane and other equipment installed.
September – December 2012	Test all elements of fish elevator and sorting facility	Elevator and sorting facility operate according to design
April 2013	Operate fishlift and sorting facility for 2013 spawning season	First sturgeon will have moved through the fishway elevator to the sorting facility
June 2013	Submit final report for this grant to EPA	Final report with full accounting of expenditure of funds and data on fish passage (to be submitted following the 2013 spawning season)

A final report would be submitted to EPA no later than June of 2013, following what would likely be the first full spawning season of full implementation of the upstream fish passage facility. The project partners are committed to keeping EPA apprised of project developments, and will submit bi-annual reports on project progress and fund expenditures.

A.7. QUALITY OBJECTIVES AND CRITERIA

Project partners expect that by the time an EPA GLRI grant will have been expended on Phase 2 of this project (i.e., fish lift and sorting facility) at the end of 2013, approximately 50-200 sturgeon will have had the opportunity to migrate from below the Menominee Dam to above the Park Mill Dam. As for long-term outcomes, partners expect that:

- 21 miles of river will be opened up to the Lake Michigan sturgeon population
- Available spawning habitat will increase from 26 to 58 acres

- Juvenile rearing habitat (currently a critical deficiency) will increase from 212 to 1,610 acres

Measures	Current Status	Changes in 2-3 years (post project)	Long-term changes (by 2020)
No. of sturgeon moving upstream past the hydro dams	0	50-200	1,200
No. of acres of new spawning habitat	26	58	58 (additional acres possible if passage is built at Grand Rapids dam)
No. of "new" miles of river opened to lake sturgeon	0	21	21 (or an additional 25 if passage is built at Grand Rapids dam)
No. of acres of juvenile sturgeon rearing habitat	212	1,610	1,610 (or additional acres possible if passage is built at Grand Rapids dam)

Ultimately, with unimpeded fish passage at these two dams, the adult lake sturgeon population in Lake Michigan could increase by as many as 20,000 individuals within a 50- to 100-year timeframe (compared to a current population of approximately 3,000 adults).

The only data that will be collected as a result of this project will be fish health data for the fish that are passed up over the dam by the fish lift and processed at the fish sorting facility. (See description on Page 9.) These data will be collected only after the objective of this project – fish lift and fish sorting facility – are completed, and have no direct bearing on the preparation for and the construction of the fish lift and sorting facility.

Secondary Data

Data being brought to bear on the actual construction of the fish lift and sorting facility come from a variety of sources. Much of that advance research is compiled in a document entitled "Fish Passage and Protection Plan, Menominee/Park Mill Hydroelectric Project," © North American Hydro July 2009). (This plan is Appendix 5.) This Plan is replete with alternatives analysis, and it includes, on Page 25, a bibliography of scientific studies that informed the development of the Plan.

In addition to the research on fish passage that informed the Plan, research to determine the effectiveness of "attraction flow" was conducted on another Menominee River dam, upstream from the dams in question. Project partner and fisheries biologist Jim Fossum worked with the dam owner to create a video record of sturgeon entering a device intended to create "attraction flow" so that sturgeon could find an elevator or other device to move them upstream. Though this research will conducted at a different dam on the Menominee than the ones that are the subject of this project, scientists believe the findings are applicable. A summary of these video data can be found in this QAPP as Appendix 6, *"Progress Report:*

White Rapids Fish Passage Entrance Channel Effectiveness Testing, 2009-2010," December 30, 2009. James Fossum, author).

A comprehensive overview and compilation of fish passage research on the Menominee River, including a review of the scientific literature informing the local research, can be found in, "Selected laboratory and field studies conducted since 1991 to support a planning effort to install fish passage structures for lake sturgeon and other fish species at the White Rapids and Chalk Hill Hydro Projects, Menominee River, Wisconsin and Michigan," prepared in July 2010 by James Fossum. This research has been brought to bear on the development of the conceptual plan and ongoing plans and strategies at Menominee and Park Mill dams, the subject of this project. (This research can be found as Appendix 7.)

Quality Assurance for Contractors

A critical element of quality control and assurance in dealing with contractors (in this instance, architecture and engineering firms) is clarity, up front, in describing the scope of work and expectations for them. The project partners, led by North American Hydro, have developed a "Request for Proposals/Submission of Qualifications" that provides such clarity of expectations, including a potential contractor's "past record of performance on contracts with government agencies and private industry with respect to such factors as control of costs, quality of work, and ability to meet schedules." This document is included in this QAPP as Appendix 8.

In addition, the project team has developed performance and acceptance criteria for the contractors who will engage with the project team to provide construction and other services. Each contractor that engages with the project team to do any kind of work on this project is subject to this quality control protocol: That contract, entitled "Agreement Between Owner and Engineer for Professional Services," and included with this QAPP as Appendix 9, contains this language relating to quality control (Exhibit A, Page 5):

> The consultant shall be responsible for the professional quality, technical accuracy and coordination of other services furnished by the consultant under this contract. **The consultant shall provide a Quality Control Plan which describes the procedures to be utilized to verify, independently check, and review all design drawings, specifications, and other documentation prepared as a part of the contract.** (emphasis added) The consultant shall describe how the checking and review processes are to be documented to verify that the required procedures were followed. The Quality Control Plan may be utilized by the consultant as part of their normal operation or it may be one specifically designed for this project. The consultant shall submit a Quality Control Plan for approval within twenty calendar days of the written Notice to Proceed. A marked up set of prints from a Quality Control review will be sent in with each phase review submittal. The responsible Professional Engineer that performed the Quality Control review will sign a statement certifying that the review was conducted. The consultant shall, without additional compensation, correct all errors or deficiencies in the designs, drawings, specifications and/or other services.

Contracts made with contractors for this project will also include these "engineer's certifications:"

> Engineer certifies that it has not engaged in corrupt, fraudulent, or coercive practices in competing for or in executing the Agreement. For the purposes of this Paragraph:
>
> "Corrupt practice" means the offering, giving, receiving, or soliciting of anything of value likely to influence the action of a public official in the selection process or in the Agreement execution.
> "Fraudulent practice" means an intentional misrepresentation of facts made (a) to influence the selection process or the execution of the Agreement to the detriment of Owner, or (b) to deprive Owner of the benefits of free and open competition.
> "Coercive practice" means harming or threatening to harm, directly or indirectly, persons or their property to influence their participation in the selection process or affect the execution of the Agreement.

The project team will ensure that these quality control measures are adhered to. The entire team is involved in the vetting of bids, review of contractor applications, oversight of contractor proposals, and oversight of all phases of a contractor's work. (See also Section C, "Assessments and Response Actions," Page 19 of this document.)

An additional layer of quality assurance for this project comes in the form of the review of both conceptual and engineering plans by hydraulics engineers and fish passage experts Curt Orvis and Ben Rizzo. Neither are formal members of the project team but they will provide strategic advice and input at each major decision point in the project.

A.8. SPECIAL TRAINING REQUIREMENTS AND CERTIFICATIONS

Most project partners are seasoned veterans with, collectively, hundreds of years of experience in hydropower dam operation, construction, fish biology, and grant management. Still, the operation of a fish lift and sorting facility will be new to all parties involved and partners will need to learn and adapt as the fishway is operated.

Project partners have gotten and will continue to receive advice and insights about actual operation of fish passage devices from fishway operators, both the dam operators and fish biologists, in Massachusetts and Connecticut. In addition, U.S. Fish and Wildlife Service hydraulic engineers Curt Orvis and Ben Rizzo will offer their expert advice throughout the project period, and beyond.

No formal certifications are expected to be acquired for the purposes of this project. Project participants have professional certifications and licensing requirements that they will maintain.

A.9. DOCUMENTATION AND RECORDS

At the outset, records associated with this project will be, by and large, conceptual plans, architectural and engineering plans and designs, scopes of work and related budgets submitted by contractors, detailed photographs of the products of the project (fish lift and fish sorting facility), and all interim and final reports submitted to the USEPA.

Once the elevator and fish sorting facility are operational, fish biologists from the natural resources agencies will keep extensive logs for the data they collect about the fish and the operations of the fish passage devices. Project partners will devise a means to display these data on-line for the edification of the public.

Reports required for USEPA will act as a means of recording problems encountered and solutions devised. Because of their frequency and thoroughness, these reports will act as occasional Quality Assurance checks for the project team, as well as fulfilling our obligation to funding agencies. The reports will be compiled and submitted as outlined below:

Quarterly reports to the USEPA's Great Lakes Accountability System (GLAS) starting January 2011, then April, July, October of that year; January, April, July and October of 2012; and the same months of 2013 until the project is completed by mid 2013. These reports pertain to the contributions of the project as to Goals, Objectives and Measures under the GLRI Action Plan.

Semi-annual progress reports made to this project's EPA Project Officer (Rajen Patel). These reports will be submitted by April 30 and October 30 of 2011, 2012 and April 2013. These reports will address quantifiable work accomplished for the period; Object Class Category changes; corrective actions; projected new work; percent completion of scheduled work; percent of budgeted amount spent; any change in principal investigators; any change needed in project period; date and amount of latest drawdown request; and delays and adverse conditions that may hinder achieving projected outcomes.

Annual progress reports to the USEPA Region 5 MBE/WBE Coordinator, detailing how this project has complied with Fair Share Objectives. Lists of these qualified MBEs and WBEs. These businesses are qualified as such by the state of Wisconsin's Dept. of Commerce or Dept. of Administration.
http://www.commerce.state.wi.us/php/mbe-od/sic_result_page.php#E

http://www.doa.state.wi.us/mbe/minority_search.asp?locid=0

We will attempt to purchase the same or similar construction, supplies, services and equipment in the same or similar relevant geographic buying market as the Wisconsin Dept. of Natural Resources, as prescribed by USEPA in our grant agreement.

Both the U.S. Fish and Wildlife Service Green Bay, Wisconsin, office and the River Alliance of Wisconsin will act as repositories of these documents and records, in paper and (where possible) digital form. This intentional redundancy ensures easier access to those documents by interested parties and ensures a backup copy in the unlikely event a set of documents is

damaged or destroyed at one site. Digital records are backed up on a weekly basis. Paper and digital records will be stored for 7 years beyond the termination of the project, or 2020.

B. MEASUREMENT AND DATA ACQUISITION

Introduction to this Section

This project not lend itself well to the nature of the standard QAPP form and required content. While this does involve data collection, processing and some analysis, it is NOT an original scientific experiment in which typical scientific research protocols apply.

The authors have instead endeavored to explain, to the extent they are understood at this early point in the project, those elements of the project that involve data collection – the procedures for managing and handling the fish as they enter the fishway and are processed in the sorting facility.

What is described here is preliminary and tentative. Given that a QAPP is designed to be flexible, the protocols described herein may very well be revised once or several times, with each operation of the fishway. No fishway of this kind exists anywhere for lake sturgeon; therefore it is impossible for the fishery biologists involved in the project to determine precisely the measurements, protocols, designs and requirements until they actually operate the fishway. Until then, they can only use as a basis for their fishway operations those protocols and procedures used to manage fish in other similar circumstances and settings.

Because this project is not a scientific experiment, the following narrative does not follow precisely the suggested outline of the QAPP. This narrative is intended to address information sought in QAPP Sections B.1, B.2, B.3, B.4, B.6, and B.7. B.5, B.9 and B.10 are addressed separately.

Fishway Operational Details

Species

We propose only initially passing lake sturgeon in the fish passage structures. As more information is learned about pathogen concerns and species interactions, we may look to pass other species upstream of the Menominee Dam.

Criteria for when other species can be passed and the numbers to be passed will be developed by the state and federal agencies prior to passing other species. Resources such as the Menominee River Fisheries Plan can be used as a starting point. The states' departments of natural resources will develop criteria for how to determine when or how to pass other species before the fishway's first operations, then adaptively manage the passing of other fish species as more information is acquired.

Number of Sturgeon to be Passed

A conservative approach to passing fish upstream will be used initially. This approach can change as more is learned about how the passed fish contribute to recruitment and population growth within the river, and when or if they move back downstream via the downstream passage facilities provided at Menominee and Park Mill dams.

Our initial approach is to pass only 90 sturgeon upstream annually with a 5 to 1 male to female ratio. Our rationale for a conservative approach is to make sure we are not passing too many fish into an area with limited spawning habitat. An initial research study with translocation will help determine appropriate planting locations. For reference, existing PIT tag data tells us that the population of sturgeon larger than 50 inches downstream of Menominee Dam is 1,182 fish, whereas within Segment 1 there are 488 fish of greater than 50 inches. (See map on the following page.) Sturgeon less than 50 inches long have not been observed spawning in the river.

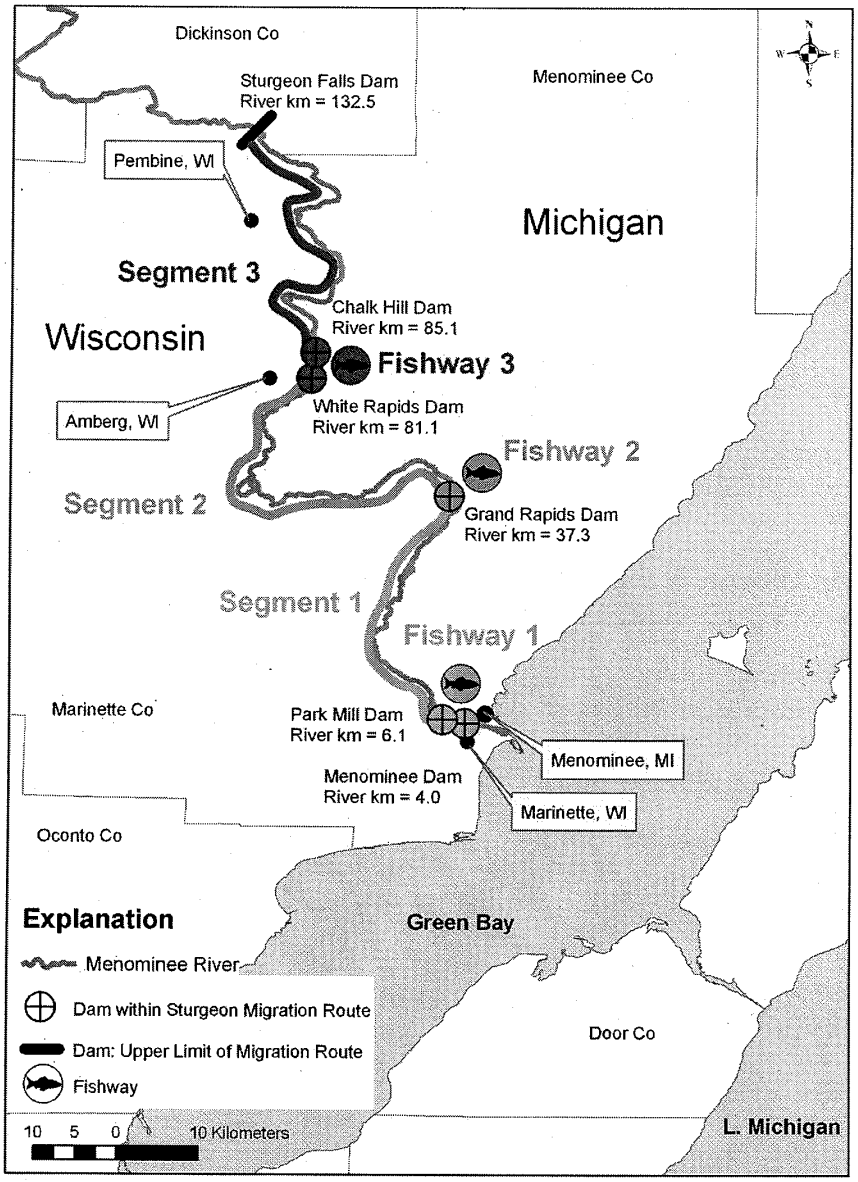
Fish passed will be no shorter than 50 inches long. The selected lake sturgeon will be transported by truck to the section of the Lower Menominee, above the Park Mill dam, indicated on the map on the next page as Segment 1. That specific location is the 16th Avenue boat ramp, about five miles upstream from the Park Mill dam.

No fish will be moved up above the Grand Rapids dam by truck or other translocation means until fish passage structures are developed at the Grand Rapids dam.

Time of Year for Fish Passage, and Disease Considerations

Information from Michigan State University's Fish Health Lab indicates that lake sturgeon are not carriers of Viral Hemorragic Septicimia (VHS). This hypothesis will be continuously tested so we know whether or not fish have to be held for disease testing. Because sturgeon need to be held for disease verification for 30 days, our ability to hold and pass spawning females in the spring is limited.

Therefore, it has been determined that fish passage in the fall (October) may be better than the spring, and not only because holding them in the spring (for disease verification) would pose problems for spawning. The sturgeon have actually been documented staging during this time of year, making fall a better time to pass them. Observations and data analysis through the operation of the fishway, and data collected from sturgeon elsewhere in the Menominee system, will help determine the optimal time to pass the sturgeon. The fishery biologists fully expect to adapt their strategies on optimal passage time as more information is gained.



Map of the five dams on the Menominee River that are within the historical migration route of Lake Michigan's sturgeon population. The overall fish passage goal is to construct three fishways, which divide the migration route into three Segments. Until this is achieved, fish will be translocated from Fishway 1 (currently scheduled for construction) to Segment 1 by transport truck.

Upstream Fish Passage Instructions

The following section describes how project fisheries biologists expect the fishway will be operated, based on applicable best practices. Because of the uncharted territory of passing lake sturgeon in this manner, the project team fully expects that these operational details will be adjusted and refined as the fishway is operated. At the time of the writing of this QAPP, it is the best available knowledge and understanding of these procedures.

Upstream fish passage will officially begin no earlier than October 2013, and will continue until 90 fish have been moved upstream annually. Moving sturgeon upstream via the fishway will continue until spawning and juvenile rearing habitat is at carrying capacity, and that will be determined through annual fishery surveys in the spawning areas.

Here are the measures proposed to be taken and data recorded:

1. Record date, time, environmental conditions (water temperature, flow velocity, water elevation), weather conditions (air temperature, barometric pressure, precipitation, etc.).
    a. Water data (water temperature, flow velocity, and water elevation) will be derived from sensors located in the vicinity of the fish elevator. The sensors will be operated and maintained by the dam owner (North American Hydro).
    b. Weather conditions (air temperature, barometric pressure, precipitation, etc.) will be derived from local sources such as the National Weather Service.

2. Record lift time, number of fish captured for the day (eventually for each of two fish passage structures), and the duration of transport to sorting and holding tank.

3. Record count for all captured specimens in sorting and holding tank by species and by designated size categories as prescribed by state agencies. (Total length will be recorded to the nearest .5 cm.)
    a. Species will be identified by trained professional biologists using *Fishes of Wisconsin* species identification guide (George C. Becker, University of Wisconsin Press, 1983).

4. Remove, contain and dispose of all sea lamprey and other injurious species according to established U.S. Fish and Wildlife Service protocols outlined in the agency's "2011 Spawning Phase Assessment Work Plan." (Lamprey will be managed by U.S. Fish and Wildlife Service's Sea Lamprey Control Program.)

5. Any unknown species will be photographed and held until positive identification, then released and/or disposed of as specified in a protocol that must be developed by the state natural resource agencies and the U.S. Fish and Wildlife Service before passage begins.

6. Guide all non-target or non-sturgeon species into downstream conveyance pipe for safe return back to Menominee Dam tailrace.

7. Measure total length (to the nearest .5 cm) and total weight (to the nearest .5 kg) of each sturgeon (or other species targeted for upstream passage).
    a. Fish handling will be such that fish remain in and are supported by water or are supported by weighing sling.

8. Examine all sturgeon and record all Tag ID data for all previously attached ID tags. This will be carried out by way of internal exam via PIT (passive integrated transponder) and CWT (coated wire tag) detectors, and externally via visual examination by trained biologists to aid in identification of fishes' original origin.
    a. Testing of accuracy and repeatability of detectors will performed daily using dummy tag (with results recorded on data sheet) according to device operations per manufacturers' instructions (e.g. freshly charged batteries, backup detectors, etc.)

9. Collect fin tissue sample from all designated sturgeon as described in Lake Michigan field sampling standard operating procedures guide (see Appendix 10 for draft Standard Operating Procedures)

10. X___ sample collected for VHS testing and preserved according to standard operating procedures developed by the Wisconsin Dept. of Natural Resources. For non-PIT tagged fish, insert appropriate sized PIT tag for later individual identification. *(This number is yet to be determined.)*
    a. Tags provided by agencies. Follow appropriate PIT tag SOP.

11. If sex determination is desired, scope fish using surgical exam and record results.

12. Record disposition for each captured fish (held for passing, released via downstream conveyance back to lower river, or retained) based on target species, size, sex and season criteria specified by agencies.
    a. Refer to Final Fish Passage Operation Plan, to be completed by the agencies prior to scheduled operation in October 2013.

13. All data to be recorded on specified data sheets or recording machines at the time of measurement. Duplicate records will be made daily and archived at specified multiple agency locations (e.g. the dam site, U.S. Fish and Wildlife Service Green Bay office, Wisconsin DNR Peshtigo regional office.)

Tanks and Holding Instructions

It is recommended that circular tanks for sturgeon be used (12 foot diameter), with 50 gallons per minute running through the tank. It is acceptable to reuse the same water for two connected tanks but new or filtered water will be required for a third tank. When holding sturgeon for 30 days (awaiting disease tissue samples undergoing analysis) it is acceptable to hold a total of 15 fish per tank. When holding sturgeon for 15 days it is acceptable to hold a total of 20 fish per tank. Proper water flow and recharge parameters will be used per established management practices at state agency-operated fish hatcheries or facilities at which adult fish are handled and held.

Fish Transport General Instructions

Moving this quantity and size of lake sturgeon by truck has never been done before in Wisconsin or Michigan. Fishery biologists associated with this project will proceed cautiously, using known (and applicable) management practices already in use by the state agencies for transporting other fish species by truck.

A truck in good working condition will be able to pull a goose neck or low boy trailer with a 1000-gallon insulated tank. The trailer will have operable electric brakes and have the capacity to haul this tank when full of water and fish. The tank should have secure latches on the lids and the lids should be large enough to accommodate a dip net and fish for up to 7 feet in length. The insulated tank shall have aeration systems to maintain dissolved oxygen levels greater than 5 ppm. An insulated tank should maintain a water temperature within the tank so it does not exceed a 2 degree F temperature deviation from fill-up to stocking event. At no time shall water used in transport or holding exceed 70 degrees F.

The fish will need to be dip-netted into and out of the tank but the tank should be able to be drained with an eight-inch bulkhead fitting. The tank can be made of fiberglass, aluminum or stainless steel, and it should be able to handle up to 10 adult sturgeon per trip.

B.5. Quality Control Requirements

As regards quality control requirements for construction and system operation, per the EPA QAPP reviewer's question, Rory Alsberg of NEW Hydro (North East Wisconsin Hydro, Inc.) will be the Quality Control (QC) manager for the construction for the fish passage and will be on-site during construction. He will consult with Kleinschmidt Associates (the engineer of record for the project) on a regular basis. NEW Hydro has also retained the services of OTIE (Oneida Total Integrated Enterprises) for additional QC assistance as necessary.

Rory will provide general project oversight during construction and he and NAH staff will ensure the highest standards of workmanship and compliance with all engineering plans and specifications, including the inspection of construction materials and supplies before they are used. Should any problems or discrepancies be encountered, Kleinschmidt Associates will be consulted and their recommendations will be implemented. Representatives from Kleinschmidt Associates will be scheduled to visit the site as often as needed and will be present during all critical phases of construction.

The entire project, from start to finish, will be fully documented with numerous photographs. Photos will be taken before, during and after all phases of construction and written descriptions will be provided for all key photos. Video recording will also be used as needed to show key construction activities to ensure proper quality control measures and documentation.

Most of the fish passage construction work will take place within the powerhouse structure so we do not anticipate any significant ground disturbance. However, we will be prepared to take any steps that may be necessary to mitigate erosion (such as erecting silt fences) if any ground disturbing activities are needed.

Upon completion of the project a check-off and approval list will be completed by the engineer of record before final payment is made to the contractor. Full documentation pertaining to the operation and maintenance of the equipment will be provided along with a final construction report.

B.8. Inspection/Acceptance Requirements for Supplies and Consumables

See section B.5 of this QAPP for details of inspecting construction supplies and materials.

B.9. Data Acquisition Requirements for Non-Direct Measurements

While the application of this element of the QAPP to this project is not clear under the circumstances, it is even less clear given the unclear Comment #3 written by EPA's QA reviewer(s) (Memo dated March 23, 2011, "Review of QAPP for 'Clearing A Path.'"

Perhaps once EPA's QA reviewers read what has been supplied in the rest of this section, the requirements they see to satisfy this section can be more easily delineated.

B.10. Data Management

In addition to what is spelled out in Section A.9 of this QAPP, the fishery biologists will collect, analyze and store fish biology data collected at the fishway by usual and established means and protocols. Raw data are uploaded by the state agency biologists to central fishery data bases operated by each state's natural resources departments. A draft field form for the sorting facility is included as Appendix 10.

Analysis of stored data is typically downloaded from the central data bases into Excel spreadsheets, by which the biologists can easily sort and arrange the data for ease of analysis. Those analyses will be stored on hard drives or servers located in the regional fisheries offices of the two state agencies (Peshtigo, Wisconsin, and Marquette, Michigan), as well as the Green Bay office of the U.S. Fish and Wildlife Service.

C.1. ASSESSMENTS AND RESPONSE ACTIONS

Assessments

The project team has several processes by which to assure quality of services provided and work produced to construct the fish life and fish sorting facility. It starts with a careful assessment and thorough vetting of potential contractors, aided by a clear and precise "request for proposals document" already referenced in this QAPP (page 12) and included as Appendix 8. The RFP ensures that only qualified, capable and reputable firms will proceed to providing proposals.

(In addition, all RFPs will be provided to minority-owned and women-owned business enterprises with applicable expertise in engineering and construction, per the Fair Share Objectives of 40 CFR, Part 33, Subpart D.)

In addition to that preliminary assessment step, the project reviews all proposals, then interviews, in person, those firms whose proposals reflect the most appropriate capacity and technical ability to perform the work, in particular their knowledge of and experience with hydroelectric dams. It is at this interview stage that each candidate firm will be asked if they are barred for any reason from accepting federal funds.

Once a provisional finalist has been chosen, team members will further vet that candidate through interviews with past or current customers of that candidate firm; they will be names provided either by the candidate firm or through the knowledge of the industry of one of the team members. By the time a proposal is vetted through this by the project team, the contractor's capabilities will be well understood.

The next step of assessment is ensuring the contractor provides a high quality of product or service following the specifications provided and in the time frame expected. Their commitment to quality will be assessed by the quality control plan they will submit as part of their obligations to the project team. This quality control plan will be carefully reviewed the project team, and the quality control plan for each firm that contracts for services for this project will become part of this QAPP. (See this language on Page 13 of this QAPP, as excerpted from the contract agreement, which is included here as Appendix 9.)

The ultimate assessment will be, of course: "Can the fish lift lift fish?" and, "Will the sorting facility optimally serve its purpose of allowing healthy lake sturgeon to be assessed for research purposes, and passed upstream, meanwhile preventing the upstream passage of unwanted species? " Thorough testing of both devices will be conducted to ensure they work before final payment is made to the contractor building those devices.

Response and Corrective Actions

Any corrective actions required in this project will be undertaken by the project team. The project team, in particular North American Hydro, whose dam the project work will directly affect, will work closely with the contractor. At any time a project team member finds a problem with the work being conducted by a contractor, that team member will inform the project team, which will then ask the contractor to suspend its work until the issue is

resolved. In the unlikely event that a contractor is clearly incapable of completing a job on time, on budget and with reasonable assurance of quality, their contract will be terminated under conditions spelled out in the contract agreement (Appendix 9).

Individuals responsible for any corrective actions are the members of the project team, who have been listed elsewhere in this document. (See Appendix 2 and Section A.4. of this QAPP.) EPA specifically asks to "include a person who will be responsible for corrective actions." We reiterate here that the project team will act with consensus for corrective actions, with each individual or party to the team (e.g. North American Hydro, fish biologists, grant manager) using their particular expertise to call for a corrective action and getting the consent of the team to take that action.

C.2. REPORTS TO MANAGEMENT

As required by USEPA, the project team will generate quarterly reports to the GLRI which will also serve as "reports to management" of the participating organizations. These reports will be submitted via the Great Lakes Restoration Initiative "Great Lake Accountability System" web site, and digital documents of the reports will be distributed to management representatives of the participating organizations who are not members of the project team. They include Louise Clemency, Field Supervisor, U.S. Fish and Wildlife Service, New Franken, WI Louise_Clemency@fws.gov; Mike Staggs, Fisheries Bureau Chief, Wisconsin Dept. of Natural Resources; George Boronow, Northeast Wisconsin Regional Fisheries Supervisor; Kelley Smith, Fisheries Division Chief, Michigan Dept. of Natural Resources and Environment smithk@michigan.gov; Jim Dexter, Lake Michigan Basin Coordinator, Michigan Dept. of Natural Resources and Environment dexterj1@michigan.gov; Top management representatives of two other partner organizations, the River Alliance of Wisconsin (executive director Denny Caneff) and North American Hydro (CEO Chuck Alsberg), are members of the project team and will be intimately involved with the project. In addition, the River Alliance of Wisconsin Board of Directors will be apprised of project developments at their quarterly meetings.

Content of the reports are as follows: reports submitted to the GLAS on-line reporting system are periodic reports of progress, in our case, on one measure: how many miles of river have been opened for fish habitat as a result of the project. We will have to report "0 miles" for several months until the fishway is operational.

As for the content of semi-annual reports submitted to EPA Region 5 GLRI Project Officer Rajen Patel, those reports follow a prescribed outlined by EPA. The first of these reports has already been submitted, to the satisfaction of Mr. Patel, in early May 2011.

1. What work was accomplished for this reporting period? Quantify results as measurable products (i.e. numbers, acres, contacts, water quality improvements, etc.)

2. What if any changes were made from the Object Class categories listed in Section B of the SF-424A? (Categories applicable to this grant are personnel, equipment, contractual, and other.)

3. If a problem was encountered, what action was taken to correct it?

4. What work is projected for the new reporting period activity?

5. Is the project work on schedule? List activities from the Work Plan, and any required Quality System documentation, and report as percent completed.
    a. This reporting period
    b. For the project from its inception (9/1/2010)

6. Does the project funding rate support the work progress? Report as percent spent of budgeted amounts for federal and non-federal.

7. Is there a change in the principal investigator?

8. Will the project take longer than the approved project period? If so, have you formally requested an amendment in writing?

9. What is the date and amount of your latest drawdown request? If no request has been submitted, please explain.

10. Have there been delays or adverse conditions which materially impair your ability to meet the outputs/outcomes specified in the assistance agreement work plan?

Frequency and Distribution of Reports

	Project Status	Project Status	Performance Evals and Audits	Periodic data quality assessments and QA problems
What	Quarterly reports to GLAS reporting system	Semi-annual progress reports to EPA project officer	Annual financial audit	Ongoing reviews of contractor progress
Who: Primary (secondary)	Denny Caneff (Jim Fossum)	Denny Caneff (Jim Fossum, Nick Utrup)	Sharon White (Denny Caneff), Wegner CPAs (contractor)	Alsberg, Utrup (project team)
When	January 30, April 30, July 30, October 30 thru end of project	April 30 and October 30 thru end of project	Annually (approved February of each year)	Monthly
Format of report	Goals, Objectives and Measures Under GLRI Action Plan	Work accomplished; object class category changes; corrective actions; projected new work; percent completion of scheduled work; percent of budgeted amounts spent; any change in principal investigator; any change needed in project period; date and amount of latest drawdown request; and delays or adverse conditions impairing project outcomes	Audit report to River Alliance board of directors	Emails, meeting minutes

The web address provided to this grantee for semi-annual reports is http://www.epa.gov/greatlakes/fund/applicationpac/management/progressreport.pdf

D. DATA REVIEW, VALIDATION AND VERIFICATION

D.1. Criteria for Accepting, Rejecting or Qualifying Data

As reported elsewhere in this QAPP, the actual construction of the fish lift involves very little generation, collection and analysis of original data. The single most important data to measure the success of this project is the number of lake sturgeon that will be attracted to and moved up and around Menominee Dam via the fish lift (elevator). Those data, projected through 2013, are as follows:

- 21 miles of river will be opened up to the Lake Michigan sturgeon population
- Available spawning habitat will increase from 26 to 58 acres
- Juvenile rearing habitat (currently a critical deficiency) will increase from 212 to 1,610 acres

Long-term data measuring the success of the project: with unimpeded fish passage at these two dams, the adult lake sturgeon population in Lake Michigan could increase by as many as 20,000 individuals within a 50- to 100-year timeframe (compared to a current population of approximately 3,000 adults).

There are no project-specific calculations or algorithms.

The project team members who are fisheries biologists – Donofrio, Utrup, Elliott, Mistak and Fossum – will lead the data collection and validation effort by developing the data collection protocols and procedures used to capture several parameters of interest to the biologists and to parties interested in fish passage generally: number, size (length and weight), gender, approximate age and general health of the lake sturgeon that will be passed upstream. The biologists will also track the quantity and nature of other species attracted to and lifted to the sorting facility by the fish lift, including any undesirable invasives (which will be handled using established protocols of both states' fisheries bureaus).

All three agencies will invoke established internal protocols and procedures for reviewing and verifying these data before they are released to the public. Any issues to be resolved over the understanding or analysis of the data will be discussed and resolved among the fisheries biologists and eventually approved by the project team.

These data will be shared through a variety of means: both states' natural resources agencies have means of disseminating fisheries data throughout the agencies' fisheries bureaus. The U.S. Fish and Wildlife Service will disseminate these data through means that agency has developed for sharing such data, including publication in established national and international fisheries biology academic journals. The River Alliance of Wisconsin will be responsible for distributing information about the project through its own outreach devices

(printed and electronic newsletters, newspaper columnists). For its part, North American Hydro will disseminate information about project results to the power utility and hydropower communities.

D.2. Validation and Verification Methods

It was clear from the "launching meeting" for Phase 2 of this fish passage project, on April 28, 2011, that there will be constant validation, verification and corrective actions that will need to be undertaken as this unprecedented project moves forward. The April 28 launching meeting included all the project partners plus engineers from Kleinschmidt Associates, the firm contracted with to design the fishway and sorting facility.

Thanks to the new and fresh eyes of their engineers, plus the fact it had been many months since the project team had delved into the minute details of the fishway and sorting facility, several new possibilities for its design and operation emerged. That day concluded with the Kleinschmidt engineers being asked to sketch two options for developing the fishway.

Another conclusion was that because of the number of unknowns with the project, the project team will be in constant communication with Kleinschmidt's engineers and also the hydraulic engineering consultants of the U.S. Fish and Wildlife Service (Orvis and Rizzo). Reconciliation of designs from as-designed to as-built will be grounded in thorough research and review and decided by consensus of the project team members.

It seems highly unlikely that there will be "non-conformities. . . related to construction activities," between what gets designed and what gets built, as implied in USEPA's QAPP review of March 23, 2011. Nothing will proceed on the project without a thorough review of each design by all the experts and specialists involved and with vigorous and extensive dialogue across the project team, Kleinschmidt, and the construction firm to be hired by North American Hydro. Final decisions will be made by North American Hydro, with consultation of the team members and with the expertise of Kleinschmidt.

D.3. Reconciliation with User Requirements

In the end, the most important measure to be reconciled will be: were 20 miles of river habitat opened for lake sturgeon? And will 200-300 adult sturgeon of reproductive age have been passed? The success of the project will be measured by those two very quantifiable objectives.

Appendices and other attachments not included for Appendix H are available upon request. Contact Nick Utrup at nick_utrup@fws.gov or 920-866-1736

QUALITY ASSURANCE PROJECT PLAN
Sustain Our Great Lakes – National Fish and Wildlife Foundation
Project #2010-0074-003
Proposal ID 21412
For River Alliance of Wisconsin, Inc.
Effective Date of this QAPP: November 2010 – June 2013

A. PROJECT MANAGEMENT

A.1. TITLE AND APPROVAL SHEET

Project Title: Clearing A Path: Revitalizing Lake Michigan's Sturgeon

Approvals:

_____ (signature and date signed)

Denny Caneff, Executive Director
River Alliance of Wisconsin
Project Co-Manager

_____ (signature and date signed)

Nick Utrup, Wisconsin Hydropower Coordinator
U.S. Fish and Wildlife Service
Project Co-Manager and QA Manager for this project

_____ (signature and date signed)

Todd Hogrefe, Great Lakes Program Directort
National Fish and Wildlife Foundation
Great Lakes Program Director and program officer for this project

A.2. TABLE OF CONTENTS

A.3. DISTRIBUTION LIST FOR QAPP REVISIONS AND FINAL GUIDANCE

Each time this QAPP is revised, the following individuals will receive a notice of revision, and a copy via email.

James Fossum, Project Consultant to the River Alliance jfbio@yahoo.com

Charles Alsberg, CEO, North American Hydro chuck@nahydro.com

Rory Alsberg, Project Manager of Midwest Plant Operations, North American Hydro rory.alsberg@nahydro.com

Rick Loeffler, Environmental Compliance Officer, North American Hydro, rick.loeffler@nahydro.com

Michael Donofrio, Fisheries Supervisor, Wisconsin Dept. of Natural Resources, Michael.Donofrio@wisconsin.gov

Jessica Mistak, Senior Fisheries Biologist, Michigan Dept. of Natural Resources and Environment, mistakj@michigan.gov

Nicholas Utrup, Wisconsin Hydropower Coordinator, U.S. Fish and Wildlife Service, Nick_Utrup@fws.gov

Robert Elliott, Fishery Biologist, U.S. Fish and Wildlife Service, Robert_Elliott@fws.gov

Sharon White, Business Manager, River Alliance of Wisconsin, swhite@wisconsinrivers.org

Paul Piszczek, Fisheries Biologist, Michigan Dept. of Natural Resources, piszczekp@michigan.gov

Denny Caneff, Executive Director, River Alliance of Wisconsin, dcaneff@wisconsinrivers.org

Todd Hogrefe, Great Lakes Program Directort
National Fish and Wildlife Foundation
Todd.Hogrefe@nfwf.org

A.4 PROJECT AND TASK ORGANIZATION

This project is a unique collaboration among federal and state government agencies, a nongovernmental organization, and a private enterprise. That private enterprise, North American Hydro, has pledged $662,000 toward this project to enable lake sturgeon to pass downstream around and through the Park Mill dam on the Menominee River. The formal agreement of that contribution by North American Hydro is captured in a Memorandum of Understanding between the company (dba N.E.W. Hydro) and the grantee, River Alliance of Wisconsin. (See Appendix 1)

The project team has been meeting for years, developing a conceptual plan for all four phases of this project to enable the passage of lake sturgeon up- and downstream around two hydro dams on the lower Menominee River.
http://www.wisconsinrivers.org/documents/Fish%20Passage%20Presentation%20GRANTS.pdf

Key individuals and their responsibilities are described here:

River Alliance executive director **Denny Caneff** will oversee the project on behalf of the River Alliance. This includes ensuring that all financial and narrative reports are completed on time; overseeing the project budget and funds; and providing insights to the management of the overall project. Along with Nick Utrup, of the U.S. Fish and Wildlife Service, Denny is project co-manager.

River Alliance hydropower consultant **James Fossum** is the organization's resident expert on fish biology related to fish passage. He is a retired U.S. Fish and Wildlife Service biologist (33 years of service) who has represented River Alliance on this and several other hydro projects since 2006. Jim's role is to bring his fisheries biology expertise to the project, especially in the context of hydropower operations and fish passage planning. He is a member of the project Implementation Team (IT) that reviews plans and design drawings; evaluates prospective contractors; and advises the contractors on particular issues about the project as they concern fish health and vitality. Jim is also part of an IT sub-committee developing telemetric equipment needs to measure fish passage success at the upstream and downstream fish passage facilities when installed at the Park Mill and Menominee hydro projects.

Rory Alsberg, Project Manager at North American Hydro Holdings, Inc., is responsible for the construction of the Menominee/Park Mill Fish Passage projects. Rory is the direct contact between the Implementation Team, design and engineering firms, construction contractors, relicensing team, employees at North American Hydro Holdings, and others involved in the project. Rory's goal is to ensure the construction of the Menominee/Park Mill Fish Passage is successful by meeting timelines and budget requirements, and

reviewing invoices before payment for design and construction services North American Hydro is overseeing.

River Alliance business manager **Sharon White** is responsible for accounting, bookkeeping, banking and invoicing for the organization and will participate fully in grant funds management and accounting. She will disburse funds for this project, once the project team determines how the funds will be spent; oversees the financial reporting to funders; and will oversee any and all audits for the organization and this project.

Chuck Alsberg, chief executive officer and co-founder of North American Hydro Holdings, Inc., is a certified professional engineer and has over 30 years experience working in the hydroelectric industry. North American Hydro Holdings, Inc. is the operator of the Menominee/Park Mill Hydroelectric Project in Menominee, Michigan and Marinette, Wisconsin, and is agent for the Project licensee/owner, N.E.W. Hydro, Inc. (licensee). Chuck's role is to ensure that NAH's interests and concerns relative to hydro operations, licensing and financial commitments are met.

Rick Loeffler works in the environmental compliance department of North American Hydro Holdings, Inc. Among other duties, he develops fish passage with participating partners at hydroelectric projects operated by North American Hydro Holdings, Inc. throughout the Midwest. Rick has over 20 years experience working in the hydroelectric industry. Rick's tasks include being NAH's "eyes and ears" at the dam sites and ensuring that fish passage structures remain compatible with hydro operations. Along with many other team members, Rick reviews plans and design drawings, evaluates prospective contractors, and directly negotiates with those contractors to ensure the work is carried out to the team's specifications.

Nick Utrup, a fish and wildlife biologist and FERC hydropower coordinator for the U.S. Fish and Wildlife Service (FWS), has nearly 10 years experience working in fisheries, including the past five years as a biologist for the agency. Nick has spent the last five years working with sturgeon (including lake sturgeon, pallid sturgeon, and shovelnose sturgeon) and is currently the FWS regulatory coordinator for all FERC-licensed hydropower projects in the state of Wisconsin. Nick is currently working on five other fish passage-related projects in Wisconsin in addition to this project. Along with Denny Caneff, Nick is project co-manager. Nick reviews plans and design drawings, evaluates prospective contractors, is chair of the sub-team developing fish monitoring protocols for the project, and generally ensures that the project design and construction are compatible with fish health and vitality.

Curt Orvis, a hydraulic engineer team leader for the U.S. Fish and Wildlife Service (FWS), has more than 30 years experience with hydraulic engineering work on rivers, dams, and

fishways. Curt has spent the past 17 years working on fish passage projects with the FWS and has contributed to over 10 different fish passage projects currently in operation. Curt will advise the project team on the design and management of the fish passage structures.

Robert Elliott, a 15-year veteran of the U.S. Fish and Wildlife Service and a Great Lakes fish biologist, is the Service's lake sturgeon lead for Lake Michigan. He serves as chair of the Lake Michigan Lake Sturgeon Task Group of the Lake Michigan Committee that implements and coordinates lake sturgeon rehabilitation efforts across the Lake Michigan basin and its tributaries. Rob participates in the sub-team developing the fish monitoring protocols.

Michael Donofrio, a fisheries supervisor with Wisconsin Department of Natural Resources, has 21 years experience as a fisheries biologist. Michael represents Wisconsin on all FERC licenses and fisheries management on the Menominee River. His role is to ensure that the fish lift will pass the species of interest and to ensure an adequately equipped and managed fish sorting facility. He also participates in the sub-team developing the fish monitoring protocols, and will advise and inform federal fishery biologists of the final decisions Wisconsin natural resource managers require for fishway management.

Paul Piszczek is a fisheries biologist with the Michigan Department of Natural Resources (DNR) Habitat Management Unit. He has written and implemented Quality Assurance Project Plans for various water quality monitoring programs and projects. He represents MDNR as a participating member of the Implementation Team (IT), offering technical assistance on fish passage design and operation to meet DNR fisheries management objectives. Paul will advise and inform federal fishery biologists of the final decisions that Michigan natural resource managers require for fishway management. He participates in the sub-team developing the fish monitoring protocols, and will offer advice and assistance on QAPP preparation and maintenance.

Ben Rizzo, a retired U.S. Fish and Wildlife Service hydraulic engineer and now private engineering consultant, has over 45 years experience in hydraulic engineering and fish passage. Ben has worked on over 40 major fish lifts, locks, and pool/chute type fishways. Like Curt Orvis, Ben will lend his expertise on an as-needed basis on the design and management of the fish passage structures.

Luther Aadland, a fishery biologist for the Minnesota Department of Natural Resources based in Fergus Falls, Minnesota, has extensive experience with nature-like fishway channels. Nature-like fishway channels have been used extensively throughout the world with a high degree of success for passing large fishes such as lake sturgeon. Luther has designed many of these fishway channels in Minnesota and the Midwest, and contracts as a professional design consultant on such projects. Like Ben Rizzo and Curt Orvis, Luther

will advise the team from time to time on the design and management of the fish passage structures. Luther's expertise will come into play in a later phase of the project when he can advise the project on a natural fishway or bypass channel that may be constructed at this site.

Quality Assurance Manager

The quality assurance manager for this project is Nick Utrup, who with Denny Caneff also acts project co-manager. He is a fisheries biologist with the U.S. Fish and Wildlife Service and has been actively engaged in the project's development for five years. Even though is an integral part of the project team, Nick's main role in the process is as Regulatory Advisor and Project Planning Assistant tasked with protecting the health and well-being of fish and wildlife resources pursuant to Federal statutory requirements. Protecting the health and well-being of the sturgeon is a matter of professional integrity, and he is ideally suited to judge whether the project details are in the best interest of improving the viability of the lake sturgeon population.

Backing up Nick in quality assurance will be the U.S. Fish and Wildlife Service's senior hydraulic engineer, Curt Orvis. Per FWS policy, all final decisions regarding fishway construction will go through Curt, who when combined with the FWS's National Fish Passage Team, brings decades of experience analyzing, researching, planning and assisting the construction of fish passage structures throughout the country. The FWS's fish passage team will act as additional and independent quality assurance for the project and will provide ongoing advice to the project team.

They will be consulted only at strategic points in the development of the project and will not be involved in the week-to-week and month-to-month deliberations and decisions. In this regard, the FWS's fish passage team will have sufficient independence from those decisions to offer critical insights for quality assurance for the project.

Subcontractors

Any subcontractors, their participating individuals and related responsibilities and funded by the SOGL grant will be outlined in a revised QAPP and circulated to the distribution list.

Organization Flow Charts

We have included two organization flow charts (Appendix 2) – one which represents typical lines of authority and responsibility and the various committees formed to manage the project. The second represents the collaborative decision-making structure of the partnership and individuals' responsibilities. Each partner brings unique perspective and expertise to the project, and decisions are usually made by consensus.

A.5. PROJECT DEFINITION AND BACKGROUND

Problem to Be Solved

This project's goal is to revitalize the ancient lake sturgeon of Lake Michigan by allowing the fish to satisfy their instinct to spawn in a river. Dams now block their passage. This project will move the fish around two dams on the Menominee River, which are about a mile apart and two miles from the river's mouth. **SOGL funds provided through the Great Lakes Restoration Initiative grant will help pay for the first phase of this four-phase project: to build a means by which lake sturgeon can pass around and through the Park Mill hydro dam to facilitate breeding and spawning.** (See Appendix 3 for visual overview of the project.)

Historical and Background Information

This project directly addresses a critical issue for Lake Michigan: the decline of spawning habitat for lake sturgeon (*Acipenser fulvescens*). The project has been informed by decades of research. Lake sturgeon is identified as a threatened species in Michigan, a species of special concern in Wisconsin, and a federal species of concern by the U.S. Fish and Wildlife Service. Numerous reports and management plans recommend that threats to lake sturgeon in the Great Lakes and their tributaries be reduced and mitigated. For example, the Lake Michigan Fish Community Objectives (Eshenroder et al. 1995) state that Lake Michigan "sturgeon populations should be enhanced by assuring passage over barriers in historically used spawning streams" such as the Menominee River. Correspondingly, the top management objective of the Menominee River Fisheries Plan (Thuemler and Schnicke 1992) is to restore lake sturgeon populations to their historic levels throughout their former range by providing upstream and downstream passage at existing hydroelectric dams on the Menominee River. Other reports and management plans with similar objectives include Joint Strategic Plan for Management of Great Lakes Fisheries – (GLFC 2007); Lake Michigan Lake Wide Management Plan – (LaMP 2000); Wisconsin's Lake Sturgeon Management Plan (WDNR 2000); Wisconsin's Wildlife Action Plan – (WDNR 2005); Michigan's Lake Sturgeon Rehabilitation Strategy – (Hay-Chielewski and Whelan 1997); and Michigan's Wildlife Action Plan – (Eagle et al. 2005).

In addition to directly addressing top objectives in numerous management plans and strategies in the Great Lakes (described herein in Section (i)), this project is also located within the USEPA's designated Menominee River Area of Concern (AOC). http://www.epa.gov/greatlakes/aoc/menominee.html. The Great Lakes Water Quality Agreement calls for Remedial Action Plans (RAPs) to restore and protect 14 beneficial uses in Areas of Concern, such as the Menominee River. An "Impaired Beneficial Use" means a change in the chemical, physical or biological integrity of the Great Lakes system. This project will contribute toward delisting the Menominee River as an AOC by clearly

addressing two of the listed Beneficial Use Impairments (BUI): "loss of fish and wildlife habitat" and "degradation of fish and wildlife populations."

To address the "loss of fish and wildlife habitat" BUI, this project will improve habitat within the Menominee River AOC by providing access to 21 additional miles of lake sturgeon habitat upstream of the AOC. Because a large portion of the AOC is impounded by two dams, it is not possible to restore lake sturgeon habitat within the existing AOC. By providing access to upstream habitat via a fish passage corridor, sturgeon migrating upstream annually to spawn would increase from none currently to as many as 200 individuals immediately upon project completion.

To address the "degradation of fish and wildlife populations" BUI, this project will help grow the existing Lake Michigan sturgeon population by providing a mechanism to improve population recruitment. As sturgeon pass upstream through the proposed fish passage corridor, they will have access to more and better spawning and juvenile habitat, improving reproduction and survival. As the sturgeon migrate downstream through the downstream fish passage corridor (to be constructed using funds from another federal grant), more fish will pass and they will live longer, leading to more sturgeon in Lake Michigan. Immediately upon completion of the downstream fish passage corridor (the first phase of the project), 50-200 sturgeon annually would reach Lake Michigan, unharmed and unimpeded by the hydroelectric turbines.

Applicable Technical, Regulatory or Program-Specific Quality Standards and Objectives

This project must undergo a National Environmental Protection Act (NEPA) environmental assessment before any work commences. In addition, the Federal Energy Regulatory Commission must review and approve any changes to the hydro dams' structure and operations. In addition, the two state natural resources agencies and the U.S. Fish and Wildlife Service all have internal protocols for fish handling and management as it pertains to passing lake sturgeon at the two dams. The agencies will be guided by existing protocols that detail how to prevent the spread of invasive species (such as sea lamprey or quagga mussels) and the spread of fish disease (e.g. viral hemoraggic septicemia).

In addition to these quality standards, both natural resources departments will review the changes in both dams that the project engenders to seek if regulatory (e.g. water quality, shoreland changes) permits will be necessary.

A.6. PROJECT DESCRIPTION

This project removes barriers to downstream fish migration on the Menominee River by constructing an angled fish guidance rack and bypass structure in the power canal of the Park Mill Dam (Phase 1). This guidance rack will serve two purposes: (1) protect downstream migrating fish from turbine entrainment and (2) guide fish past the dam's intake area to a bypass structure designed to safely direct fish around the dam. The angled fish guidance rack that will be used for this project has been laboratory-tested by Alden Research Laboratory, Inc., of Holden, Massachusetts, and field-tested at the Greenville Hydroelectric dam in Norwich, Connecticut, where it is proven to be effective at guiding riverine fish species to a bypass.

The angled fish guidance rack will direct fish to a bypass structure, to be constructed on the outside of the power canal adjacent to the powerhouse. Fish will be guided to a gated porthole, through the side of the power canal and into a steel reinforced concrete bypass structure. There they will be safely directed to a downstream conveyance.

This project will allow lake sturgeon and other native river species to pass around the Park Mill Dam safely, thereby reducing or eliminating mortality from turbine entrainment and making possible their movement to Lake Michigan. This conveyance through the dam will be tied into a permanent downstream conveyance, the details of which are still being worked out. This, the third phase of the project, will consist of a 3-foot diameter conduit that will safely and permanently direct the fish around the Menominee Dam, enabling a free and unencumbered swim to Lake Michigan.

Measurements to Be Made/Data to Be Obtained

The ultimate measures of success of all four phases of this project, and the data gathered as the benchmark of that success, are the following: 50-200 sturgeon passed upstream per year immediately after construction of the fish lift (Phase 2), and over time, 21 miles of habitat re-opened, and sturgeon population increased from 3,000 currently to up to 20,000 adults in 50-100 years.

Measuring the number of sturgeon passed upstream will be straightforward: fish will be passed only when fish biologists operate the fish lift, and they will collect essential data on the sturgeon (e.g. weight and length, sex, estimated age, general health) and, if the fish had been previously tagged with a PIT tag (in essence, an electronic ID card), that sturgeon's file will be updated. Fish lift operators will also track the number and types of other aquatic species finding their way into the fish lift.

Measuring the quantity and general health of the fish being moved downstream through the bypass constructed by this project will be more difficult, as the intake and output portals of

the conveyance will not be regularly manned, though fish will be passing through the conveyance at all times.

Other data include to what extent changing the volume of water passing through both the downstream and upstream structures affects how the fish are attracted to them.

Special Personnel and Equipment Requirements

Several specialties and types of expertise are involved in this project. (See Appendix 2 for names, organizations and positions.) North American Hydro brings expertise in hydro dam operations. State and federal agency resource professionals bring hydrology, hydraulic, and fish biology to the project. The NGO brings public communications and grant administration. The particular expertise of each participating individual is provided on Pages 4 – 7 of this QAPP.

Equipment requirements are very highly specialized and expressly designed for this project. Downstream passage will entail constructing a underwater gate or rack that will direct sturgeon to an opening in the dam, through which they will through and on downstream. Upstream passage involves constructing an elevator, or fish lift, complete with an underwater entrance channel that has "attraction flow" to draw fish toward the elevator through it but prohibits fish from turning around and heading away from the elevator.

Work Schedule and Timeline

The table below provides a narrative version of the milestones and timelines represented in the flowcharts. A flowchart was developed before the NFWF grant was acquired, and that document is well out of date. A new one is being developed as of this writing, and it will be forwarded to NFWF to be appended to this QAPP as Appendix 4.

Production schedule of project outputs, expected outcomes and anticipated dates of completion.

Dates	Outputs	Outcomes
February-June 2011	Begin advanced engineering and design	Partners review options and adjust plans based on data and expert advice; required permits will be sought.
July – September 2011	Finalize advanced engineering and design plans for angled rack and fish conveyance	Final plans will be determined by partners and prepared for submittal to the permitting agency (Federal Energy Regulatory Commission, or FERC).

January – May 2012	Fabricate and install angled bar rack Build and install fish conveyance tube	Rack will be built and installed Conveyance tube will be built and installed.
July – September 2012	Conduct tests and trial runs of fish bypass structure	Fish will be carefully observed and counted to ensure proper operation
December 2012	Project completed	

A final report would be submitted to NFWF no later than January of 2013, following what would likely be the first full operating season of the downstream fish passage facility. The project partners are committed to keeping NFWF apprised of project developments, and will submit reports on project progress and fund expenditures, per the contract agreement between River Alliance of Wisconsin and NFWF, and under obligations of the EPA GLAS (Great Lakes Accountability System) reporting requirements.

A.7. QUALITY OBJECTIVES AND CRITERIA

Project partners expect that by the time a NFWF SOGL grant will have been expended on Phase 1 of this project by early 2013, hundreds of sturgeon will have had the opportunity to migrate from above the Park Mill Dam to below the downstream Menominee dam. As for long-term outcomes, with all four phases completed, partners expect that:

- 21 miles of river will be opened up to the Lake Michigan sturgeon population
- Available spawning habitat will increase from 26 to 58 acres
- Juvenile rearing habitat (currently a critical deficiency) will increase from 212 to 1,610 acres

Measures	Current Status	Changes in 4-5 years (post project – all four phases)	Long-term changes (by 2020)
No. of sturgeon moving upstream past the hydro dams	0	50-200	1,200
No. of acres of new spawning habitat	26	58	58 (additional acres possible if passage is built at Grand Rapids dam)
No. of "new" miles of river opened to lake sturgeon	0	21	21 (or an additional 25 if passage is built at Grand Rapids dam)
No. of acres of juvenile sturgeon rearing habitat	212	1,610	1,610 (or additional acres possible if passage is built at Grand Rapids dam)

Ultimately, with unimpeded fish passage at these two dams, the adult lake sturgeon population in Lake Michigan could increase by as many as 20,000 individuals within a 50- to 100-year timeframe (compared to a current population of approximately 3,000 adults).

Secondary Data

Data being brought to bear on the actual construction of the fish lift and sorting facility come from a variety of sources. Much of that advance research is compiled in a document entitled "Fish Passage and Protection Plan, Menominee/Park Mill Hydroelectric Project," © North American Hydro July 2009). (This plan is Appendix 5.) This Plan is replete with alternatives analysis, and it includes, on Page 25, a bibliography of scientific studies that informed the development of the Plan.

In addition to the research on fish passage that informed the Plan, research to determine the effectiveness of "attraction flow" for Phase 2 was conducted on another Menominee River dam, upstream from the dams in question. Project partner and fisheries biologist Jim Fossum worked with the dam owner to create a video record of sturgeon entering a device intended to create "attraction flow" so that sturgeon could find an elevator or other device to move them upstream. Though this research will conducted at a different dam on the Menominee than the ones that are the subject of this project, scientists believe the findings are applicable. A summary of these video data can be found in this QAPP as Appendix 6, *"Progress Report: White Rapids Fish Passage Entrance Channel Effectiveness Testing, 2009-2010,"* December 30, 2009. James Fossum, author).

A comprehensive overview and compilation of fish passage research on the Menominee River, including a review of the scientific literature informing the local research, can be found in, "Selected laboratory and field studies conducted since 1991 to support a planning effort to install fish passage structures for lake sturgeon and other fish species at the White Rapids and Chalk Hill Hydro Projects, Menominee River, Wisconsin and Michigan," prepared in July 2010 by James Fossum. This research has been brought to bear on the

development of the conceptual plan and ongoing plans and strategies at Menominee and Park Mill dams, the subject of this project. (This research can be found as Appendix 7.)

Quality Assurance for Contractors

A critical element of quality control and assurance in dealing with contractors (in this instance, architecture and engineering firms) is clarity, up front, in describing the scope of work and expectations for them. The project partners, led by North American Hydro, have developed a "Request for Proposals/Submission of Qualifications" that provides such clarity of expectations, including a potential contractor's "past record of performance on contracts with government agencies and private industry with respect to such factors as control of costs, quality of work, and ability to meet schedules." This document is included in this QAPP as Appendix 8.

In addition, the project team has developed performance and acceptance criteria for the contractors who will engage with the project team to provide construction and other services. Each contractor that engages with the project team to do any kind of work on this project is subject to this quality control protocol: That contract, entitled "Agreement Between Owner and Engineer for Professional Services," and included with this QAPP as Appendix 9, contains this language relating to quality control (Exhibit A, Page 5):

> The consultant shall be responsible for the professional quality, technical accuracy and coordination of other services furnished by the consultant under this contract. **The consultant shall provide a Quality Control Plan which describes the procedures to be utilized to verify, independently check, and review all design drawings, specifications, and other documentation prepared as a part of the contract.** (emphasis added) The consultant shall describe how the checking and review processes are to be documented to verify that the required procedures were followed. The Quality Control Plan may be utilized by the consultant as part of their normal operation or it may be one specifically designed for this project. The consultant shall submit a Quality Control Plan for approval within twenty calendar days of the written Notice to Proceed. A marked up set of prints from a Quality Control review will be sent in with each phase review submittal. The responsible Professional Engineer that performed the Quality Control review will sign a statement certifying that the review was conducted. The consultant shall, without additional compensation, correct all errors or deficiencies in the designs, drawings, specifications and/or other services.

Contracts made with contractors for this project will also include these "engineer's certifications:"

> Engineer certifies that it has not engaged in corrupt, fraudulent, or coercive practices in competing for or in executing the Agreement. For the purposes of this Paragraph:
>
> "Corrupt practice" means the offering, giving, receiving, or soliciting of anything of value likely to influence the action of a public official in the selection process or in the Agreement execution.

> "Fraudulent practice" means an intentional misrepresentation of facts made (a) to influence the selection process or the execution of the Agreement to the detriment of Owner, or (b) to deprive Owner of the benefits of free and open competition.
> "Coercive practice" means harming or threatening to harm, directly or indirectly, persons or their property to influence their participation in the selection process or affect the execution of the Agreement.

The project team will ensure that these quality control measures are adhered to. The entire team is involved in the vetting of bids, review of contractor applications, oversight of contractor proposals, and oversight of all phases of a contractor's work. (See also Section C, "Assessments and Response Actions," Page 19 of this document.)

An additional layer of quality assurance for this project comes in the form of the review of both conceptual and engineering plans by hydraulics engineers and fish passage experts Curt Orvis and Ben Rizzo. Neither are formal members of the project team but they will provide strategic advice and input at each major decision point in the project.

A.8. SPECIAL TRAINING REQUIREMENTS AND CERTIFICATIONS

Most project partners are seasoned veterans with, collectively, hundreds of years of experience in hydropower dam operation, construction, fish biology, and grant management. Still, the operation of a fish passage system will be new to all parties involved and partners will need to learn and adapt as the fishway is operated.

Project partners have gotten and will continue to receive advice and insights about actual operation of fish passage devices from fishway operators, both the dam operators and fish biologists, in Massachusetts and Connecticut. In addition, U.S. Fish and Wildlife Service hydraulic engineers Curt Orvis and Ben Rizzo will offer their expert advice throughout the project period, and beyond.

No formal certifications are expected to be acquired for the purposes of this project. Project participants have professional certifications and licensing requirements that they will maintain.

A.9. DOCUMENTATION AND RECORDS

At the outset, records associated with this project will be, by and large, conceptual plans, architectural and engineering plans and designs, scopes of work and related budgets submitted by contractors, detailed photographs of the products of the project (angled bar rack and conveyance), and all interim and final reports submitted to the USEPA and NFWF.

Once Phase 1 (downstream conveyance) and Phase 2 (elevator and fish sorting facility) are operational, fish biologists from the natural resources agencies will keep extensive logs for the data they collect about the fish and the operations of the fish passage devices. Project partners will devise a means to display these data on-line for the edification of the public.

Reports required for USEPA and NFWF will act as a means of recording problems encountered and solutions devised. Because of their frequency and thoroughness, these reports will act as occasional Quality Assurance checks for the project team, as well as fulfilling our obligation to funding agencies. The reports will be compiled and submitted as outlined below:

Quarterly reports to the USEPA's Great Lakes Accountability System (GLAS) starting January 2011, then April, July, October of that year; January, April, July and October of 2012; and the same months of 2013 until the project is completed by mid 2013. These reports pertain to the contributions of the project as to Goals, Objectives and Measures under the GLRI Action Plan.

Interim programmatic report to NFWF, due September 30, 2011.

Annual financial report to NFWF, due October 30, 2011.

Final programmatic report to NFWF, due December 30, 2012.

Annual (final) financial report to NFWF, due December 30, 2012.

Programmatic reports will consiste of written statements of project accomplishments since the project's inception (or since the last reporting period). Financial reports will account for all project receipts, expenditures and variances (if any). Reports will also include photographs and any materials or products related to the project.

Semi-annual progress reports made to this project's EPA Project Officer (Rajen Patel). These reports will be submitted by April 30 and October 30 of 2011, 2012 and April 2013. These reports will address quantifiable work accomplished for the period; Object Class Category changes; corrective actions; projected new work; percent completion of scheduled work; percent of budgeted amount spent; any change in principal investigators; any change needed in project period; date and amount of latest drawdown request; and delays and adverse conditions that may hinder achieving projected outcomes.

Annual progress reports to the USEPA Region 5 MBE/WBE Coordinator, detailing how this project has complied with Fair Share Objectives. Lists of these qualified MBEs and WBEs. These businesses are qualified as such by the state of Wisconsin's Dept. of Commerce or Dept. of Administration.
http://www.commerce.state.wi.us/php/mbe-od/sic_result_page.php#E

http://www.doa.state.wi.us/mbe/minority_search.asp?locid=0

Both the U.S. Fish and Wildlife Service Green Bay, Wisconsin, office and the River Alliance of Wisconsin will act as repositories of these documents and records, in paper and (where possible) digital form. This intentional redundancy ensures easier access to those documents by interested parties and ensures a backup copy in the unlikely event a set of documents is damaged or destroyed at one site. Digital records are backed up on a weekly basis. Paper and digital records will be stored for 7 years beyond the termination of the project, or 2020.

B. MEASUREMENT AND DATA ACQUISITION

Introduction to this Section

This project does not lend itself well to the nature of the standard QAPP form and required content. While this does involve data collection, processing and some analysis, it is NOT an original scientific experiment in which typical scientific research protocols apply.

The authors have instead endeavored to explain, to the extent they are understood at this early point in the project, those elements of the project that involve data collection – the procedures for managing and handling the fish as they enter the fishway and are processed in the sorting facility.

Because very little if any data, other than occasional spot checks at the exit of the conveyance tube for fishing coming through, will be collected, emphasis on measurement and data acquisition in this QAPP will focus on Phase 2 of this fish passage project, an EPA (GLRI) funded endeavor to move fish upstream around the Menominee dam, about a mile downstream from the Park Mill dam, the subject of the NFWF SOGL grant.

What is described here is preliminary and tentative. Given that a QAPP is designed to be flexible, the protocols described herein may very well be revised once or several times, with each operation of the fishway. No fishway of this kind exists anywhere for lake sturgeon; therefore it is impossible for the fishery biologists involved in the project to determine precisely the measurements, protocols, designs and requirements until they actually operate the fishway. Until then, they can only use as a basis for their fishway operations those protocols and procedures used to manage fish in other similar circumstances and settings.

Because this project is not a scientific experiment, the following narrative does not follow precisely the suggested outline of the QAPP. This narrative is intended to address information sought in QAPP Sections B.1, B.2, B.3, B.4, B.6, and B.7. B.5, B.9 and B.10 are addressed separately.

Fishway Operational Details

Species

Fish biologists will have little control over the number and kinds of fish that will pass downstream through the conveyance tube, as they directed there by the angled bar rack. While this passage device is designed with sturgeon in mind, clearly other fish species will be drawn into it.

Biologists can and will close off the passageway from time to time for maintenance or when ecological conditions are such that passing fish would be unwise or problematic.

Number of Sturgeon to be Passed

Biologists hope that hundreds of sturgeon will eventually pass downstream where they can move to Lake Michigan, and eventually, back upstream around the two dams and onto ancient spawning habitat.

NOTE: The following information is not directly germane to Phase 1, that element of the project supported by a NFWF grant and for which this QAPP is developed. But we include details about upstream passage (Phase 2) as it is integral to the quality of the entire project.

As for upstream passage, a conservative approach to passing fish upstream will be used initially. This approach can change as more is learned about how the passed fish contribute to recruitment and population growth within the river, and when or if they move back downstream via the downstream passage facilities provided at Menominee and Park Mill dams.

Our initial approach is to pass only 90 sturgeon upstream annually with a 5 to 1 male to female ratio. Our rationale for a conservative approach is to make sure we are not passing too many fish into an area with limited spawning habitat. An initial research study with translocation will help determine appropriate planting locations. For reference, existing PIT tag data tells us that the population of sturgeon larger than 50 inches downstream of Menominee Dam is 1,182 fish, whereas within Segment 1 there are 488 fish of greater than 50 inches. (See map on the following page.) Sturgeon less than 50 inches long have not been observed spawning in the river.

Fish passed will be no shorter than 50 inches long. The selected lake sturgeon will be transported by truck to the section of the Lower Menominee, above the Park Mill dam, indicated on the map on the next page as Segment 1. That specific location is the 16th Avenue boat ramp, about five miles upstream from the Park Mill dam.

No fish will be moved up above the Grand Rapids dam by truck or other translocation means until fish passage structures are developed at the Grand Rapids dam.

Time of Year for Fish Passage, and Disease Considerations

Information from Michigan State University's Fish Health Lab indicates that lake sturgeon are not carriers of Viral Hemorragic Septicimia (VHS). This hypothesis will be continuously tested so we know whether or not fish have to be held for disease testing. Because sturgeon need to be held for disease verification for 30 days, our ability to hold and pass spawning females in the spring is limited.

Therefore, it has been determined that upstream fish passage in the fall (October) may be better than the spring, and not only because holding them in the spring (for disease verification) would pose problems for spawning. The sturgeon have actually been documented staging during this time of year, making fall a better time to pass them. Observations and data analysis through the operation of the fishway, and data collected from sturgeon elsewhere in the Menominee system, will help determine the optimal time to pass

the sturgeon. The fishery biologists fully expect to adapt their strategies on optimal passage time as more information is gained.

Map of the five dams on the Menominee River that are within the historical migration route of Lake Michigan's sturgeon population. The overall fish passage goal is to construct three fishways, which divide the migration route into three Segments.

Upstream Fish Passage Instructions

Because there is no upstream fish passage associated with Phase 1, the subject of the QAPP, those processes and protocols are not described here, but instead are included as Appendix 11. This section was taken verbatim from the QAPP developed for Phase 2 of this project, funded by USEPA. Because both downstream and upstream passage are critical to the success of this project, the upstream component (not funded by NFWF or subject to this QAPP) is included for background and context. Appendix 11 shows the operational details and protocols for upstream passage (Phase 2, at Menominee Dam). Appendix 12 is the outline of the downstream passage operation plan for Phase 1, at the Park Mill Dam.

B.5. Quality Control Requirements

As regards quality control requirements for construction and system operation, Rory Alsberg of NEW Hydro (North East Wisconsin Hydro, Inc.) will be the Quality Control (QC) manager for the construction for the fish passage and will be on-site during construction. He will consult with Mead&Hunt (the engineer of record for the project) on a regular basis.

Rory will provide general project oversight during construction and he and NAH staff will ensure the highest standards of workmanship and compliance with all engineering plans and specifications, including the inspection of construction materials and supplies before they are used. Should any problems or discrepancies be encountered, Mead&Hunt will be consulted and their recommendations will be implemented. Representatives from Mead&Hunt will be scheduled to visit the site as often as needed and will be present during all critical phases of construction.

The entire project, from start to finish, will be fully documented with numerous photographs. Photos will be taken before, during and after all phases of construction and written descriptions will be provided for all key photos. Video recording will also be used as needed to show key construction activities to ensure proper quality control measures and documentation.

Most of the fish passage construction work will take place within the power canal and the side wall of the dam, so we do not anticipate any significant ground disturbance. However, we will be prepared to take any steps that may be necessary to mitigate erosion (such as erecting silt fences) if any ground disturbing activities are needed.

Upon completion of the project a check-off and approval list will be completed by the engineer of record before final payment is made to the contractor. Full documentation pertaining to the operation and maintenance of the equipment will be provided along with a final construction report.

B.8. Inspection/Acceptance Requirements for Supplies and Consumables

See section B.5 of this QAPP for details of inspecting construction supplies and materials.

B.9. Data Acquisition Requirements for Non-Direct Measurements

While the application of this element of the QAPP to this project is not clear under the circumstances.

B.10. Data Management

In addition to what is spelled out in Section A.9 of this QAPP, the fishery biologists will collect, analyze and store fish biology data collected at the downstream fish passage by usual and established means and protocols. Raw data are uploaded by the state agency biologists to central fishery data bases operated by each state's natural resources departments. A draft field form for the sorting facility is included as Appendix 10.

Analysis of stored data is typically downloaded from the central data bases into Excel spreadsheets, by which the biologists can easily sort and arrange the data for ease of analysis. Those analyses will be stored on hard drives or servers located in the regional fisheries offices of the two state agencies (Peshtigo, Wisconsin, and Marquette, Michigan), as well as the Green Bay office of the U.S. Fish and Wildlife Service.

C.1. ASSESSMENTS AND RESPONSE ACTIONS

Assessments
The project team has several processes by which to assure quality of services provided and work produced to construct the fish life and fish sorting facility. It starts with a careful assessment and thorough vetting of potential contractors, aided by a clear and precise "request for proposals document" already referenced in this QAPP and included as Appendix 8. The RFP ensures that only qualified, capable and reputable firms will proceed to providing proposals.

(In addition, all RFPs will be provided to minority-owned and women-owned business enterprises with applicable expertise in engineering and construction, per the Fair Share Objectives of 40 CFR, Part 33, Subpart D, of the USEPA contract with grantee River Alliance of Wisconsin.)

In addition to that preliminary assessment step, the project reviews all proposals, then interviews, in person, those firms whose proposals reflect the most appropriate capacity and technical ability to perform the work, in particular their knowledge of and experience with hydroelectric dams. It is at this interview stage that each candidate firm will be asked if they are barred for any reason from accepting federal funds.

Once a provisional finalist has been chosen, team members will further vet that candidate through interviews with past or current customers of that candidate firm; they will be names provided either by the candidate firm or through the knowledge of the industry of one of the team members. By the time a proposal is vetted through this by the project team, the contractor's capabilities will be well understood.

The next step of assessment is ensuring the contractor provides a high quality of product or service following the specifications provided and in the time frame expected. Their commitment to quality will be assessed by the quality control plan they will submit as part of their obligations to the project team. This quality control plan will be carefully reviewed the project team, and the quality control plan for each firm that contracts for services for this project will become part of this QAPP. (See this language on Page 14 of this QAPP, as excerpted from the contract agreement, which is included here as Appendix 9.)

The ultimate assessment will be, of course: "Can the device pass fish downstream?" Thorough testing of both the upstream and downstream passage devices will be conducted to ensure they work before final payment is made to the contractor building those devices.

Response and Corrective Actions
Any corrective actions required in this project will be undertaken by the project team. The project team, in particular North American Hydro, whose dam the project work will directly affect, will work closely with the contractor. At any time a project team member finds a problem with the work being conducted by a contractor, that team member will inform the project team, which will then ask the contractor to suspend its work until the issue is resolved. In the unlikely event that a contractor is clearly incapable of completing a job on

time, on budget and with reasonable assurance of quality, their contract will be terminated under conditions spelled out in the contract agreement (Appendix 9).

Individuals responsible for any corrective actions are the members of the project team, who have been listed elsewhere in this document. (See Appendix 2 and Section A.4. of this QAPP.) EPA specifically asks to "include a person who will be responsible for corrective actions." We reiterate here that the project team will act with consensus for corrective actions, with each individual or party to the team (e.g. North American Hydro, fish biologists, grant manager) using their particular expertise to call for a corrective action and getting the consent of the team to take that action.

C.2. REPORTS TO MANAGEMENT

As required by NFWF, members of the project team (Jim Fossum and Sharon White) will generate monthly narrative and financial reports, respectively, to NFWF which will also serve as "reports to management" of the participating organizations. In addition to the monthly brief summaries, the following reports will be filed with NFWF, per the grant agreement:

October 31, 2010 annual financial report
September 30, 2011 interim programmatic report
October 31, 2011 annual financial report
December 30, 2012 final programmatic report
December 30, 2012 final financial report

These reports will be submitted via the NFWF "EasyGrants" reporting system. Copies of the reports will be distributed to management representatives of the participating organizations who are not members of the project team. They include Louise Clemency, Field Supervisor, U.S. Fish and Wildlife Service, New Franken, WI Louise_Clemency@fws.gov; Mike Staggs, Fisheries Bureau Chief, Wisconsin Dept. of Natural Resources; George Boronow, Northeast Wisconsin Regional Fisheries Supervisor; Kelley Smith, Fisheries Division Chief, Michigan Dept. of Natural Resources and Environment smithk@michigan.gov; Jim Dexter, Lake Michigan Basin Coordinator, Michigan Dept. of Natural Resources and Environment dexterj1@michigan.gov;

Top management representatives of two other partner organizations, the River Alliance of Wisconsin (executive director Denny Caneff) and North American Hydro (CEO Chuck Alsberg), are members of the project team and will be intimately involved with the project. In addition, the River Alliance of Wisconsin Board of Directors will be apprised of project developments at their quarterly meetings.

Frequency and Distribution of Reports

	Project Status	Finances	Performance Evals and Audits	Periodic data quality assessments and QA problems
What	Narrative and financial reports to NFWF Interim and final programmatic reports	Monthly financial reports	Annual financial audit	Ongoing reviews of contractor progress
Who:	Denny Caneff (primary responsible), Jim Fossum	Sharon White	Sharon White (Denny Caneff), Wegner CPAs (contractor)	Alsberg, Utrup (project team)
When	Monthly 9/30/11, 12/30/12	10/31/11, 12/30/12		Monthly
Format of report	Narrative, photos if helpful	Spread sheets, records of expenditures and invoicdes	Audit report to River Alliance board of directors	Emails, meeting minutes

D. DATA REVIEW, VALIDATION AND VERIFICATION

D.1. Criteria for Accepting, Rejecting or Qualifying Data

As reported elsewhere in this QAPP, the actual construction of this fish passage device involves very little generation, collection and analysis of original data. The most important data to measure the success of this project are the number of lake sturgeon that will be moved around both the Park Mill Dam (Phase 1) and the Menominee Dam via the fish lift (elevator) (Phase 2). Those data, projected through 2013, are as follows:

- 21 miles of river will be opened up to the Lake Michigan sturgeon population
- Available spawning habitat will increase from 26 to 58 acres
- Juvenile rearing habitat (currently a critical deficiency) will increase from 212 to 1,610 acres

Long-term data measuring the success of the project: with unimpeded fish passage at these two dams, the adult lake sturgeon population in Lake Michigan could increase by as many as 20,000 individuals within a 50- to 100-year timeframe (compared to a current population of approximately 3,000 adults).

There are no project-specific calculations or algorithms.

The project team members who are fishery biologists – Donofrio, Utrup, Elliott, Piszczek and Fossum – will lead the data collection and validation effort by developing the data collection protocols and procedures used to capture several parameters of interest to the biologists and to parties interested in fish passage generally: number, size (length and weight), gender, approximate age and general health of the lake sturgeon that will be passed upstream. The biologists will also track the quantity and nature of other species attracted to and lifted to the sorting facility by the fish lift, including any undesirable invasives (which will be handled using established protocols of both states' fisheries bureaus).

All three agencies will invoke established internal protocols and procedures for reviewing and verifying these data before they are released to the public. Any issues to be resolved over the understanding or analysis of the data will be discussed and resolved among the fisheries biologists and eventually approved by the project team.

These data will be shared through a variety of means: both states' natural resources agencies have means of disseminating fisheries data throughout the agencies' fisheries bureaus. The U.S. Fish and Wildlife Service will disseminate these data through means that agency has developed for sharing such data, including publication in established national and international fisheries biology academic journals. The River Alliance of Wisconsin will be responsible for distributing information about the project through its own outreach devices

(printed and electronic newsletters, newspaper columnists). For its part, North American Hydro will disseminate information about project results to the power utility and hydropower communities.

D.2. Validation and Verification Methods

The most essential – and to date, very effective – validation and verification method for this project is the weekly Monday morning briefing by the project partners. These briefings, organized by North American Hydro, serve to inform partners of project developments; review and resolve issues and questions that have emerged; review plans and engineering drawings; and generally ensure that the project is on track and hurdles are managed.

Nothing will proceed on the project without a thorough review of each design by all the experts and specialists involved and with vigorous and extensive dialogue across the project team, the engineering firm Mead&Hunt, and the construction firm to be hired by North American Hydro. Final decisions will be made by North American Hydro, with consultation of the team members and with the expertise of Mead&Hunt.

D.3. Reconciliation with User Requirements

In the end, the most important measure to be reconciled will be: were 20 miles of river habitat opened for lake sturgeon? And will 200-300 adult sturgeon of reproductive age have been passed? The success of the project will be measured by those two very quantifiable objectives.

National Fish and Wildlife Foundation

Sustain Our Great Lakes

Appendices for Quality Assurance Project Plan

For Project #2010-0074-003
Proposal ID 21412

Clearing A Path: Revitalizing Lake Michigan's Sturgeon

Appendix 1: Memorandum of Understanding between River Alliance of Wisconsin (grantee) and North East Wisconsin Hydro, Inc. dated, October 1, 2010.

Appendix 2: Flow charts (2) representing the collaborative decision-making structure of the Menominee River fish passage partnership.

Appendix 3: Aerial photo depiction of project site, and a map of the area of the project.

Appendix 4: Fish passage construction schedule flow chart NOT INCLUDED. When completed (ca. October 15, 2011), will be sent and included in the QAPP as Appendix 4.

Appendix 5: Fish Passage and Protection Conceptual Plan, Menominee/Park Mill Hydroelectric Project. (Due to file size, a full paper copy of this plan is NOT included with this QAPP. This plan can be found at **http://tinyurl.com/3keu2b6**

Appendix 6: Progress Report, "White Rapids Fish Passage Entrance Channel Effectiveness Testing, 2009-2010."

Appendix 7: "Selected laboratory and field studies conducted since 1991 to support a planning effort to install fish passage structures for lake sturgeon and other fish species at the White Rapids and Chalk Hill Hydro Projects."

Appendix 8: Request for Proposals document

Appendix 9: Agreement Between Owner and Engineer for Professional Services

Appendix 10: Examples of Standard Operating Procedures -- checklist for handling fish; Lake Michigan sturgeon field sampling; and a sample data form.

Appendix 11: Operational details and protocols for upstream fish passage.

Appendix 12: Operational details and protocols for downstream fish passage (Appendix E noted on this document indicates it was part of another document submission – the environmental assessment.

Appendices and other attachments not included for Appendix I are available upon request. Contact Nick Utrup at nick_utrup@fws.gov or 920-866-1736