2018

Little Manistee River Sea Lamprey Barrier and Trap, Manistee County, Michigan

Draft Feasibility Report and Environmental Assessment

Section 506 Great Lakes Fishery & Ecosystem Restoration and Great Lakes Restoration Initiative

Detroit District
US Army Corps of Engineers
May 2018

PRELIMINARY FINDING OF NO SIGNIFICANT IMPACT
Little Manistee River Sea Lamprey Barrier and Trap
Manistee, Michigan

The U.S. Army Corps of Engineers, Detroit District (USACE), has prepared a Draft Feasibility Report and Environmental Assessment (FR/EA), dated May 2018, in accordance with the National Environmental Policy Act of 1969, as amended, and an evaluation of the effects of placing fill in the waters of the United States in accordance with Section 404(b)(1) of the Clean Water Act of 1977. The USACE assessed the potential environmental effects of the reconstruction of the spillway weir at the Little Manistee River egg collection facility managed by the Michigan Department of Natural Resources (MDNR) (Alternative 3 of the Feasibility Report FR/EA). The proposed action (Alternative 3) is to construct a permanent attractant water trap (AWT) sea lamprey trap in one bay of the existing MDNR fish weir, raise the walkway for access and lamprey removal, remove the existing concrete spillway, construct a steel sheet pile (SSP) weir with stop logs across the entire existing spillway apron to provide a drop barrier, install a fish guidance weir downstream of the spillway to direct fish to the collection facility, replace the existing canoe portage pathway located within the existing spillway, and provide scour and erosion protection. The study is authorized by Section 506 of the Water Resources Development Act of 2000, as amended by Section 5011 of WRDA 2007.

In addition to the “no action” alternative, two action alternatives with varying levels of aquatic habitat restoration were evaluated, including the recommended plan. The recommended plan was identified as the National Environmental Restoration (NER) plan and is the environmentally-preferred alternative. All practicable means to avoid and minimize adverse environmental effects have been incorporated into the recommended plan. The recommended plan would not result in any impacts to federally-listed threatened or endangered species as proposed or their designated critical habitat, would have no impact to sites listed on or eligible for inclusion on the National Register of Historic Places, would minimally affect wetlands and result in minimal acreage loss of waters of the U.S., nor any important wildlife habitat, and would maintain floodwater conveyance through the project reach. Therefore, no compensatory mitigation is required. The Section 404(b)(1) evaluation concludes that the proposed action is in compliance with Section 404 of the Clean Water Act. The non-federal sponsor will obtain any necessary state permits, which will include a Section 401 water quality certification or waiver thereof. USACE has completed the “No Effects” Coastal Zone Management Act (CZMA) consistency determination as the project is located over 4 miles from the state designated CZMA boundary.

Technical and economic criteria used in the formulation of alternative plans were those specified in the Water Resource Council’s 1983 Economic and Environmental Principles for Water and Related Land Resources Implementation Studies. All applicable laws, executive orders, and regulations were considered in the evaluation of the alternatives. Based on the findings of the EA, Section 404(b)(1) evaluation, and

evaluation of public/agency review comments received, it is my determination that the recommended plan does not constitute a major federal action that would significantly affect the quality of the human environment; therefore, preparation of an Environmental Impact Statement is not required.

_____	_____
Date	Dennis P. Sugrue Lieutenant Colonel, U.S. Army District Engineer

ACRONYMS

AOC	Area of Concern
AWT	Attractant Water Trap
BMP	Best Management Practice
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CFS	Cubic Feet Per Second
CWA	Clean Water Act
E.O.	Executive Order
EA	Environmental Assessment
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
ER	Engineer Regulation
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
FIS	Flood Insurance Study
FONSI	Finding of No Significant Impact
FPPA	Farmland Protection Policy Act
FR	Feasibility Report
GIS	Geospatial Information System
GLFC	Great Lakes Fishery Commission
HTRW	Hazardous, Toxic and Radioactive Waste
IGLD	International Great Lakes Datum
MDEQ	Michigan Department of Environmental Quality
MDM	MSC Decision Meeting
MDNR	Michigan Department of Natural Resources
MSC	Major Subordinate Command
NEPA	National Environmental Policy Act of 1969
NFIP	National Flood Insurance Program
NOI	Notice of Intent
NRHP	National Register of Historic Places
PCB	Polychlorinated biphenyl
P.L.	Public Law
SHPO	Michigan State Historic Preservation Office
TFM	3-trifluoromethyl-4’-nitrophenol
USACE	U.S. Army Corps of Engineers, Detroit District
SC	U.S. Code
SLB	Sea Lamprey Barrier
USFWS	U.S. Fish and Wildlife Service

WQC	Water Quality Certification
WRDA	Water Resources Development Act

EXECUTIVE SUMMARY

This report was prepared under the authority of Section 506 of the Water Resources Development Act of 2000, as amended. The report reflects efforts by Great Lakes Fishery Commission (GLFC), as the non-Federal sponsor, and the U.S. Army Corps of Engineers (USACE) to provide an engineeringly feasible solution for sea lamprey control on the Little Manistee River, Manistee County, Michigan. This summary is intended to inform the reader of the major factors which were considered in the investigation and influenced the decisions documented in the Draft Feasibility Report (FR) and Environmental Assessment (EA).

The sea lamprey (*Petromyzon marinus*) is a destructive invasive species in the Great Lakes that contributed to the collapse of lake trout (*Salvelinus namaycush*) and other native species populations in the mid-20th century and continues to affect efforts to restore and rehabilitate the fish community. Sea lampreys attach to large bodied fish and extract blood and body fluids. It is estimated that about half of sea lamprey attacks result in the death of their prey and an estimated 18 kg (40 lbs) of fish are killed by every sea lamprey that reaches adulthood. The Sea Lamprey Management Program (SLMP) is an international effort administered by the Great Lakes Fishery Commission (GLFC) and implemented by two control agents: the Department of Fisheries and Oceans Canada (DFO) and the United States Fish and Wildlife Service (USFWS). Lamprey control is a critical component of fisheries management in the Great Lakes because it facilitates the rehabilitation of important fish stocks by significantly reducing sea lamprey-induced mortality.

The GLFC has tried a wide variety of sea lamprey control measures across the Great Lakes basin. They have identified the most effective as barriers, traps, and lampricide. Because of the finite array of common measures generally available for feasible implementation in sea lamprey projects, alternatives may be comprised of just one measure. However, the most effective plans tend to be comprised of multiple measures. In the case of this study, there is a de facto barrier to lamprey migration on the Little Manistee River called the Michigan Department of Natural Resources (MDNR) Weir and Egg Collection facility. The purpose of this feasibility study is to determine the most cost effective means to reduce spawning of Sea Lamprey in the Little Manistee River and the resulting impacts to the Great Lakes fishery.. Alternatives considered in this study include:

- **Alternative 1** – No Action (continued use of temporary traps and lampricide treatment)
- **Alternative 2** – Demolition of the Existing MDNR Weir Structure and Construction of a Permanent Lamprey Barrier and Trap at the Weir Location
- **Alternative 3** – Modify the existing spillway at the MDNR weir structure

Although cost effectiveness and incremental cost analysis do not provide a discrete decision criterion, they do provide for the ability to compare the relevant changes in cost and environmental outputs upon which such decisions may be made. Alternative 3 has the lowest annual average cost per average annual habitat unit and it also has a low incremental cost over Alternative 1. In addition, there are the benefits of annual lampricide costs and fish restocking savings that also favor Alternatives 2 and 3 over the Alternative 1. These savings free up funds and resources to be put toward other projects that create a positive externality for the project that cannot be effectively quantified. Given these reasons, Alternative 3 is identified as the NER or Tentatively Selected Plan (TSP) (**Table 1**).

Table 1 Cost Effectiveness Analysis in 2017 Dollars

Alternative	Average Annual Costs	Incremental Cost	Average Annual Habitat Units (LIFT)	Incremental Output	Incremental Cost Per HU
Alternative 1	$132,000	$132,000	130	130	$1,015
Alternative 2*	$226,000	$69,000	315	185	$373
Alternative 3**	$157,000	$25,000	315	185	$135

* Alternative 2 is not cost effective.

** Incremental cost of Alternative 3 is compared against Alternative 1 because Alternative 3 provides equal AAHU to Alternative 2.

In conclusion, the TSP, **Alternative 3**, consists of the installation of a temporary rock ford to provide access during removal of the existing concrete spillway, installation of a steel sheet pile (SSP) weir (lamprey barrier) with stop logs to maintain the required 18 inch differential between the barrier crest height and the tailwater surface elevation to prevent upstream lamprey migration at the 4% (25 year) discharge event, installation of a fish guidance weir at the downstream confluence of the spillway channel and river, armoring the spillway banks, and reconstruction of the portage and the walkway over the existing weir to safely access the attractant water trap (AWT) placed into the far bay of the MDNR weir. The project is located on riparian bottomlands of the Little Manistee River at the MDNR weir and egg collection facility. There is a public interest in the control of sea lamprey of which this project is one component. The trap project is designed to enhance the fishery of the Great Lakes, thus assisting in protecting the public trust in the Great Lakes fishery.

Little Manistee River Sea Lamprey Barrier and Trap, Manistee County, Michigan

Draft Feasibility Report & Environmental Assessment

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1 INTRODUCTION

1.1 STUDY PURPOSE AND SCOPE

Sea lamprey (*Petromyzon marinus*) are primitive, eel-like fish that are invasive to the Great Lakes, having entered through the St. Lawrence Seaway from the Atlantic Ocean. As adults, sea lamprey are parasitic, attaching to large fish, such as salmon and lake trout, to feed. It is estimated that each adult lamprey in the Great Lakes kills forty (40) pounds of fish in their lifetime. Unchecked, sea lamprey can cause high mortality and steep population declines of native fishes, as was demonstrated shortly after sea lamprey first entered the Great Lakes; the lake trout commercial catch in Lake Huron dropped from 5.5 million pounds in 1947 to essentially zero pound in 1953. A bi-national convention was held in 1954 to respond to the rapid declines in fish populations through the creation of the Great Lakes Fishery Commission (GLFC). The GLFC was tasked with formulating and implementing a comprehensive sea lamprey control program and was successful in developing a lampricide that has been used to treat affected tributaries to the Great Lakes since the late 1950s. Targeted lampricide treatment in the tributaries around the Great Lakes has led to an estimated sea lamprey population decrease of 90 percent since 1961.

Even with the progress made in reducing sea lamprey populations, the species remains a basin-wide problem and is still found throughout the Great Lakes. In addition, although there has been no evidence of long-term negative effects of lampricides on aquatic systems, there is concern about the heavy dependence on chemical treatment and its unintended consequences on native species and about public apprehension regarding widespread pesticide use. Finally, lampricide treatment has become more costly to implement and opportunities for a more integrated approach are being pursued by both the GLFC (non-Federal Sponsor) and the U.S. Fish and Wildlife Service (USFWS), who serves as the sea lamprey control agent to the GLFC.

Sea lamprey traps and barriers have been identified as additional methods for sea lamprey control. Barriers block sea lamprey adults from progressing upstream, which limits available spawning habitat. Traps allow for the removal of adult lamprey before they are able to spawn, reducing the number of larval sea lamprey being produced in a given year. Trapping also creates a more diverse approach to sea lamprey management when used in conjunction with lampricide by capturing adults while lampricide treatment is only effective on larval sea lamprey. In January 2000, the GLFC's Sea Lamprey Barrier Transition Team adopted seven criteria to be used in ranking streams suitable for enhanced lamprey control through traps and barriers: sea lamprey production, lampricide treatment cost, potential reduction in treatment, treatment problems, site feasibility, multi-purpose functions, and biological effects. Using these criteria, the USFWS analyzed 243 tributaries to the Great Lakes that were already receiving at least one lampricide treatment every seven years and identified 90 candidate streams for new barrier and/or trap construction.

The Little Manistee River, Manistee County, Michigan has been identified as a priority stream for enhanced sea lamprey management. In a letter dated July 13, 2017, the GLFC requested the U.S. Army Corps of Engineers (USACE) Detroit District study, design, and construct a suitable sea lamprey control project on the Little Manistee River, under the authority of Section 506 of the Water Resources Development Act (WRDA 2000, as amended by Section 5011 of WRDA 2007). Given the known threat of sea lamprey to native fish populations of the Great Lakes, it is in the Federal interest to be proactive in developing integrated approaches to manage their populations to ensure control measures can be sustained into the future.

The functionality of this sea lamprey project relies on another agency (USFWS funded by the non-Federal sponsor) to "operate" the completed project after construction for the project to be as effective as intended.

Before any sea lamprey project is constructed, the feasibility of the project must be determined through the development of a Feasibility Report (FR). A FR contains an in-depth review of existing conditions versus the potential benefits gained from a proposed project and an analysis of specific restoration measures. This FR and Environmental Assessment (EA) includes the recommendation of the most cost efficient, engineering feasible, and environmentally beneficial alternative (in coordination with the GLFC and USFWS), a preliminary design of the recommended alternative, a detailed construction cost estimate, and an evaluation of the potential environmental effects of the recommended alternative under the National Environmental Policy Act (NEPA). Continued Federal interest and justification in developing a sea lamprey control project on the Little Manistee River is considered through development of the Draft FR and EA.

1.2 LOCATION

1.2.1 Study Area

The Little Manistee River is a tributary of Lake Michigan and is located in west, central Michigan in Lake, Mason, and Manistee counties (Figure 1). The Little Manistee River watershed drains 145,280 acres and originates from several wetlands in eastern Lake County, about eight miles east of the Village of Luther. Below the Luther Dam it flows northwest through most of Lake County, the northeast tip of Mason County, and then southwestern Manistee County (Figure 1). Manistee Lake empties into Lake Michigan through a channel in the town of Manistee.

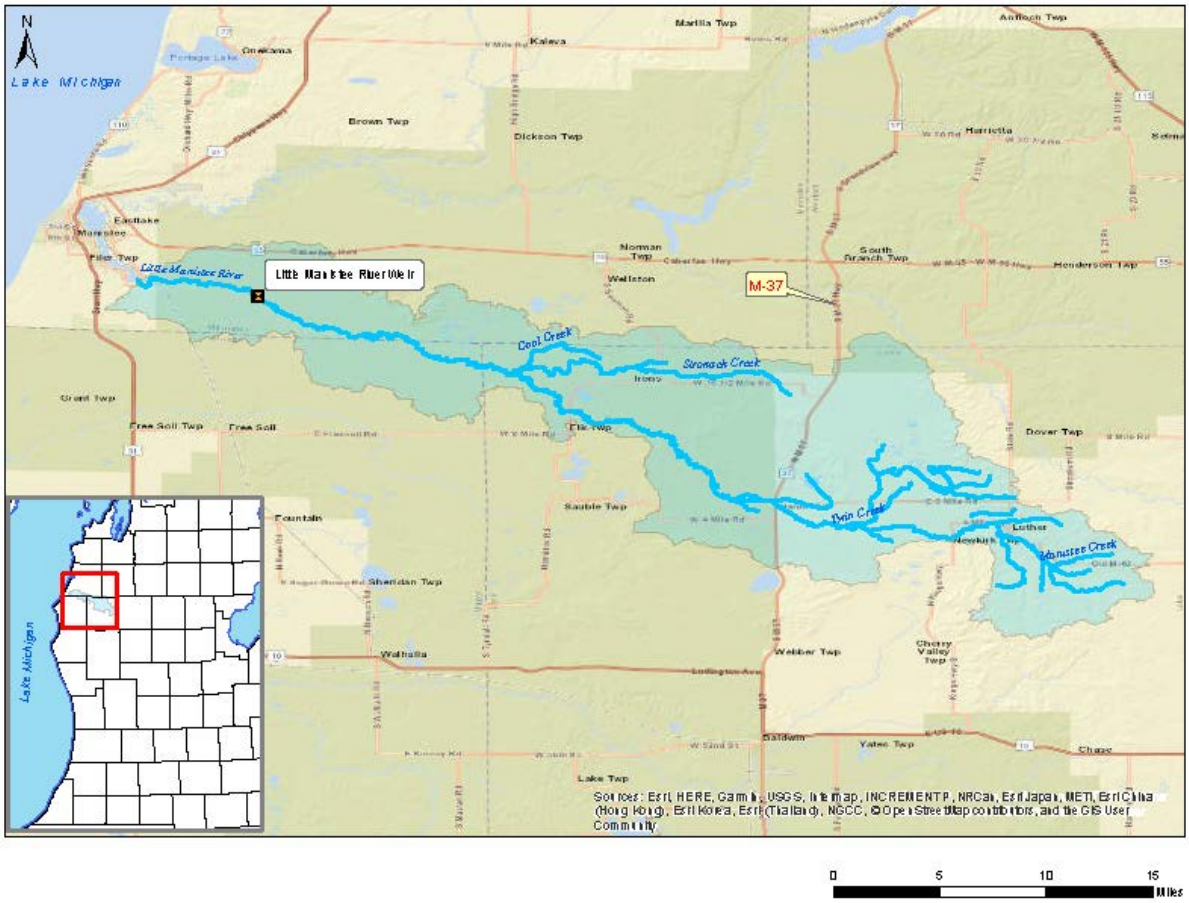


Figure 1 Map of the Little Manistee River Watershed

Land use in the watershed is primarily forest and rural residential. Upstream of Michigan Highway 37 (M-37), about half of the land through which the river flows is public, owned by the State of Michigan as part of the Pere Marquette State Forest. There is more public land below M-37. Overall, 53.2% of the land in the Little Manistee River watershed is owned by either the State of Michigan as part of the Pere Marquette State Forest or by the United States Forest Service (USFS) as part of the Manistee National Forest (USDA Forest Service 2001). The Little Manistee River flows through two municipalities, the villages of Luther and Stronach, and the only significant agricultural land in the watershed is in the Cool Creek subwatershed and the headwaters area upstream from Luther.

The USFS lists the Little Manistee River as a candidate river for national wild and scenic designation (USDA Forest Service 2001). Therefore, Manistee National Forest lands within 1/4 mile of the river are currently managed in accordance with national wild and scenic designation guidelines.

1.2.2 Project Area

The Little Manistee weir (Figure 2) has been in operation since 1968. The weir is part of an egg collection and salmon harvest facility and is used to block fish on the Little Manistee River using dam boards and stop logs in the spring and fall. Steelhead eggs are collected in the spring and Chinook salmon eggs are collected each fall. The eggs are then sent to the state fish hatcheries where they are

raised and eventually the smolts are stocked all over Michigan. Eggs from this facility are also supplied to several other states. The emergency spillway weir, which is part of the egg collection facility does not effectively block the migration of adult sea lamprey in the spring as they swim upstream to spawn. This site was identified as the optimal location to improve sea lamprey control because there is an existing partial barrier, the land is owned by the State of Michigan and any sea lamprey control structure built would be co-located with the existing state facility. Other locations for sea lamprey control were considered during the feasibility phase as outlined in the Preliminary Restoration Plan (May 2013).

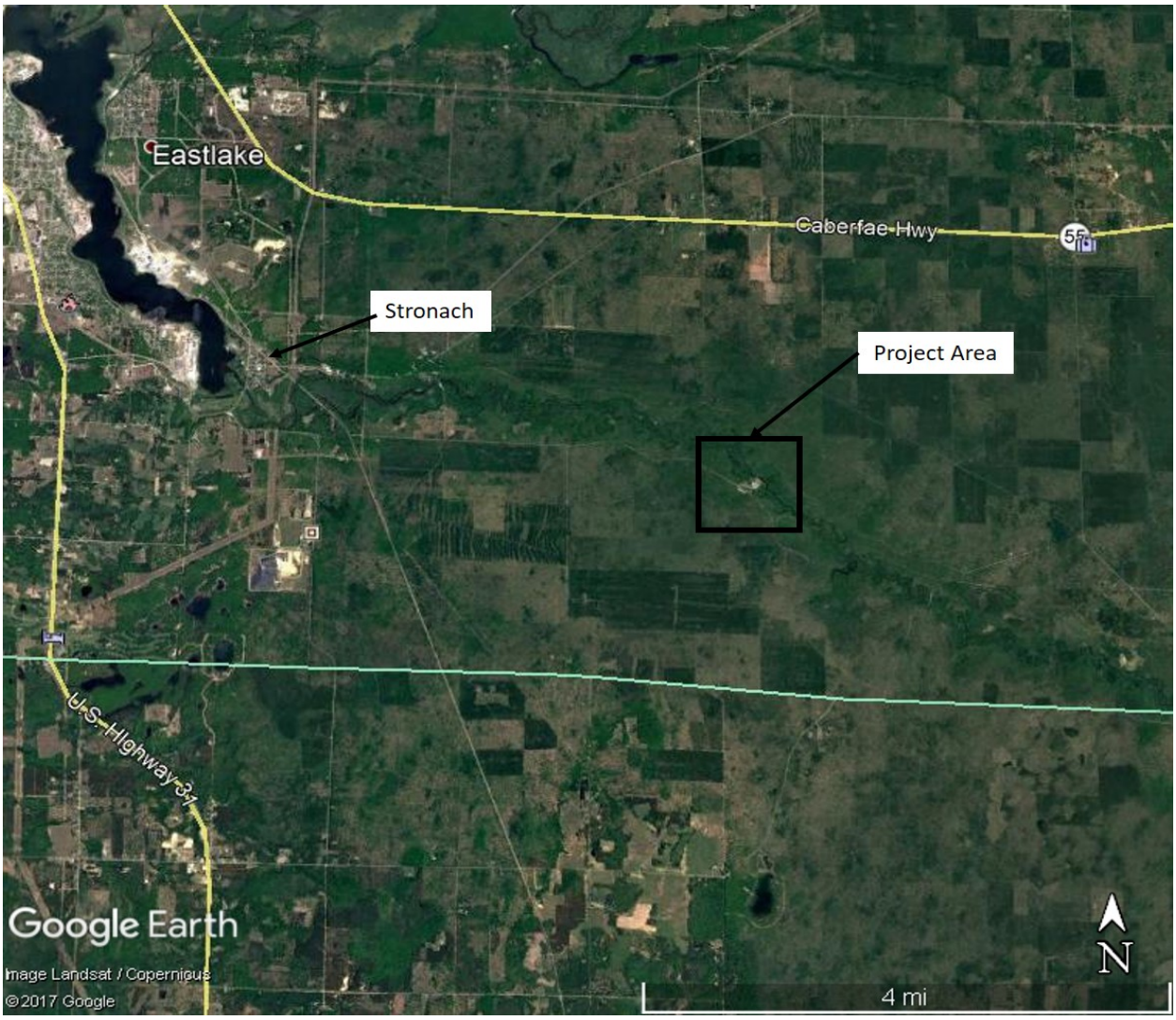
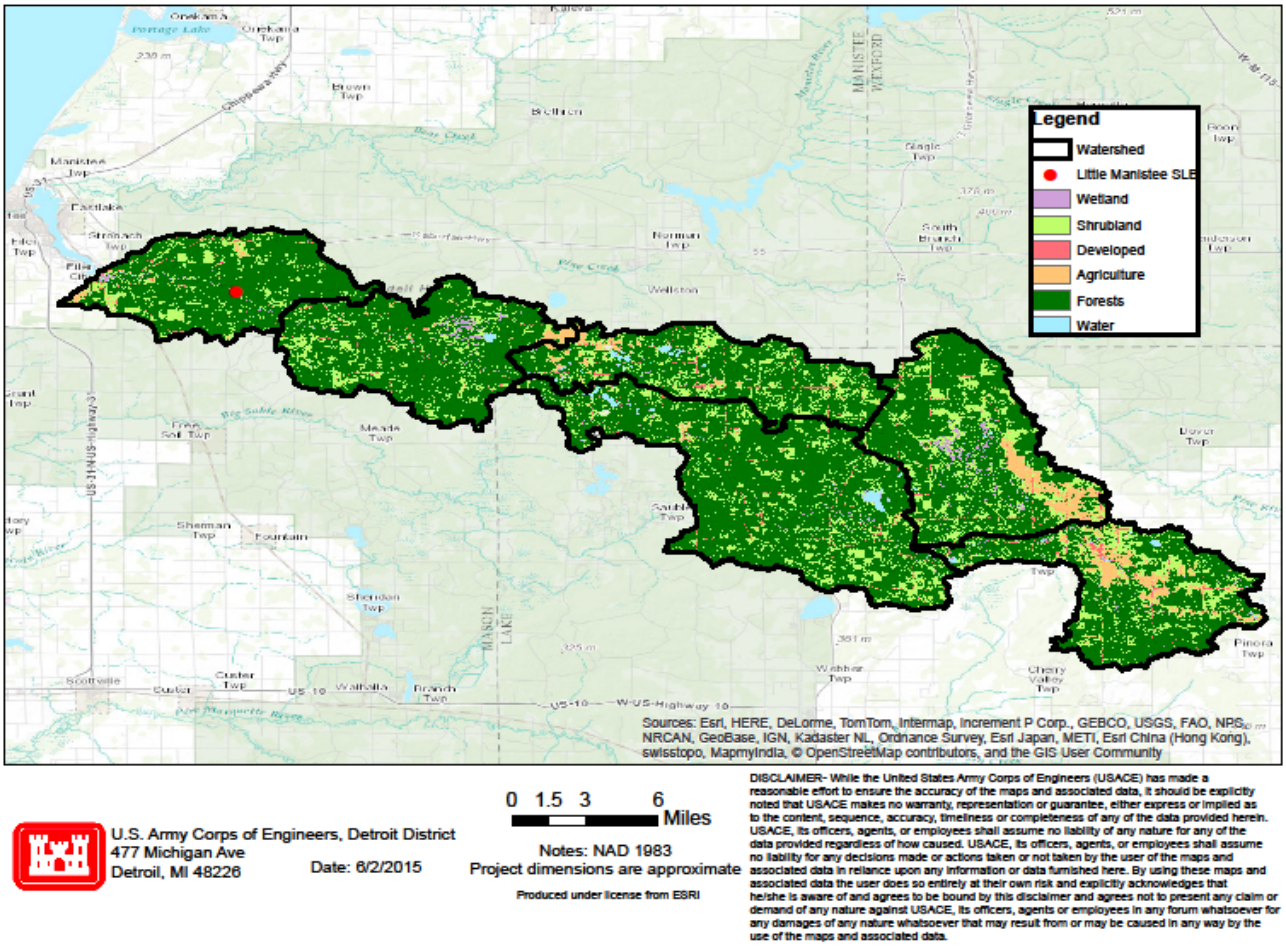


Figure 2 Aerial photograph showing project area for the Little Manistee Sea Lamprey Barrier project

The Little Manistee weir is located approximately 4.8 miles east of Filer City, Michigan, about seven miles east of Manistee, Michigan, and about 17 miles north of Scottville, Michigan. Access to the river is abundant, given the amount of public land throughout the watershed. The area near the project site is primarily forested with some shrub dominated lands and wetlands along the weir and egg collection facility (**Figure 3**).



U.S. Army Corps of Engineers, Detroit District
477 Michigan Ave
Detroit, MI 48226

Date: 6/2/2015

0 1.5 3 6 Miles

Notes: NAD 1983
Project dimensions are approximate

Produced under license from ESRI

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Figure 3 Map of the land use within the Little Manistee River watershed. Data from Michigan Department of Natural Resources: Forest, Mineral, and Fire Management Division.

1.3 STUDY AUTHORITY

Section 506 of WRDA 2000, as amended by Section 5011 of WRDA 2007, authorizes the Secretary of the Army to develop a plan for activities of the Corps of Engineers that support the management of the Great Lakes fisheries in cooperation with the signatories to the Joint Strategic Plan for Management of the Great Lakes Fisheries and other affected interests. That plan, coined the "Support Plan", provides the guidance for the planning, design, construction, and evaluation of projects to restore, the fishery, ecosystem, and beneficial uses of the Great Lakes in cooperation with other Federal, State, and local agencies and the Great Lakes Fisheries Commission. Costs for the planning, design, construction, and evaluation of restoration projects are cost-shared 65 percent Federal and 35 percent non-Federal. Non-Federal interests may contribute up to 100 percent of their share for projects in the form of Lands, Easements, Right of Ways, Relocations and soil borrow and disposal areas plus other materials, supplies, or work in-kind contributions. Non-Federal interests will receive credit for lands, easements, rights–of –way, relocations, and dredged material disposal areas needed for project construction and must be responsible for the operation, maintenance, repair, rehabilitation, and replacement of projects. Non-Federal interests may include private and non-profit entities.

1.4 RELEVANT PRIOR STUDIES AND REPORTS

The following reports were reviewed and used to develop this report.

Conservation Resource Alliance. *Little Manistee Watershed Management Plan*. June 2001. The management plan describes strategies designed to protect existing natural resources and identifies areas that require improvement in the Little Manistee River Watershed.

Great Lakes Fishery Commission. *Strategic Vision of the Great Lakes Fishery Commission 2011-2020*. December 2011. The Strategic Vision describes the role of the GLFC in the health of the Great Lakes ecosystem. The report outlines historical and future strategies and goals for a healthy and sustainable Great Lakes ecosystem and fishery.

Michigan Trout Unlimited. *Little Manistee River Instream Fish Habitat Assessment*. February 2015. This report provides summaries of the results of a 2014 habitat survey, and interpretations and recommendations of it that represent Trout Unlimited' s professional staff's best professional judgment.

USACE, Detroit. *Preliminary Restoration Plan Little Manistee River Sea Lamprey Barrier, Section 506 (GLFER), Manistee County, Michigan*. May 2013. The Preliminary Restoration Plan describes the existing condition in the Little Manistee River Watershed and identifies the ecosystem degradation and preliminary restoration solution.

USDA Forest Service Eastern Region. *Huron-Manistee National Forests Land and Resource Management Plan (as amended January 2012)*. March 2006. The Land and Resource Management Plan (Forest Plan) establishes direction for natural resource management on the Huron-Manistee National Forests. The Final Environmental Impact Statement which accompanies the Forest Plan describes the analysis which was used in development of the Forest Plan.

2 AFFECTED ENVIRONMENT - EXISTING CONDITIONS

2.1 CLIMATE

The Little Manistee River watershed is characterized by a continental climate, which is heavily influenced by Lake Michigan. This modification or "lake effect" can manifest itself by a moderation of temperature (both warm and cold) and increased precipitation during certain times of the year. This is due to winds blowing over the lake and being influenced by the water temperature and evaporation from the lake. This can have a cooling effect in the watershed in the summer compared to other parts of the Midwest, and can result in warmer temperatures in the winter months.

National Oceanic and Atmospheric Administration data indicate that the average daily maximum air temperature at the Manistee 3 SE station, (5 miles west of site) in July is approximately 80.0°F, and the average daily minimum in January is approximately 18.3°F. Humidity data were not available at the Manistee 3 SE station, but should be similar to those recorded by the Great Lakes Environmental Research Laboratory in Muskegon, Michigan, approximately 70 miles south. Average mid-afternoon relative humidity is approximately 64%. Humidity is higher in the mornings, averaging 82%.

Precipitation is generally well distributed throughout the year but is slightly lower in December through March. Precipitation is moderate and averages approximately 34.7 inches annually. Average annual snowfall is 93.7 inches.

2.2 SOILS AND GEOLOGY

2.2.1 Topology

Overall, the topography of the Little Manistee River is flat with the steepest sections of the river throughout its middle reaches. Gravel bottoms are present in the riffles through the middle reach of the river **(Figures 4, 5)**.

Figure 4 Typical gravel river bottom

Figure 5 Sandy river bottom of Little Manistee

2.2.2 Soil Associations

The Little Manistee River drains mostly forests and shrublands and has sandy-gravelly soils. Based on available reports and water quality data, the overall water and sediment quality are considered to be good and because of this the river supports very healthy macroinvertebrate communities and wild trout stocks. Soils mostly consist of deep, permeable sand with a few areas of loamy soils or hydric soils. Though bedload sands move downriver, sedimentation is not a primary concern in the Little Manistee River except in some steep riverbank areas as the heavily vegetated riverbank limits overland runoff.

2.3 SURFACE WATER AND OTHER AQUATIC RESOURCES

2.3.1 Coastal Zone

The Little Manistee River weir and the project site are located approximately four miles upstream of the Coastal Zone Management Boundary as indicated by the Michigan Department of Environmental Quality (MDEQ) Coastal Zone Boundary Map for Flier, Manistee, and Stronach townships, in Manistee County. Michigan's coastal zone boundary generally extends approximately 1,000 feet inland from the ordinary high water mark of the Great Lakes shoreline or into the backwaters of the drowned rivermouth lakes. The confluence of the Little Manistee River with Manistee Lake is the state designated CZMA boundary.

2.3.2 Surface Water

There are relatively few tributaries to the Little Manistee River, particularly in the lower two-thirds of the watershed. The Little Manistee River is fed by several small unnamed tributaries and Manistee Creek before reaching Luther. Between Luther and M-37, the Little Manistee River is fed by tributaries including Lincoln Creek, Fairbanks Creek, Little Widewaters Creek, Twin Creek, and Syers Creek (which actually joins the Little Manistee River just below M-37). Between M-37 and Manistee Lake, only a few tributaries flow into the Little Manistee. Butterfly Creek enters several miles below M-37, and Cool Creek comes in about midway between M-37 and Manistee Lake. The two largest tributaries to the Little Manistee River are Twin Creek and Cool Creek. Twin Creek is significant in that it hosts substantial natural reproduction of steelhead and brown trout (Tonello, 2003).

The MDEQ Flood Discharge data for the Little Manistee River in the project area was reviewed, and those range of discharge frequencies were used in the hydraulic analysis to determine potential flooding impacts. The 50% (2-year), 20% (5-year), 10% (10-year), 4% (25-year), 2% (50-year), 1% (100-year), 0.5% (200-year), and 0.2% (500-year) annual chance exceedance discharges developed by the MDEQ and used in the analysis are shown in Table 1.

Table 1 MDEQ Flood Event Discharges

Discharge Event	**50% (2-Yr)**	**20% (5-Yr)**	**10% (10-Yr)**	**4% (25-Yr)**	**2% (50-Yr)**	**1% (100-Yr)**	**0.5% (200-Yr)**	**0.2% (500-Yr)**
Flow (cfs)	410	550	650	750	850	900	1000	1100

Figure 6 MDNR weir structure

The weir and egg collection facility were constructed in 1968. The base of the weir is the existing structure without any stop logs. The weir structure has a sill elevation of 597.94 ft., this elevation was confirmed in a survey completed by Gourdie-Fraser in 2014. Stop logs can be used to raise the crest water surface elevation to 601.32 ft. There are 6 bays, each 9 ft. wide with 1 ft. between them. Gates and stop logs are used to control the flow through the bays on a seasonal basis. Trash racks are installed on the upstream face of the weir. The total width of the weir if there were no bays is 59 ft (**Figure 6**). Additional information about the existing hydraulic conditions can be found in **Appendix B.**

2.3.3 Groundwater

The Little Manistee River is a high quality cold water stream primarily groundwater-fed given that the watershed has mostly sandy soils (**Table 2** depicts the MDNR river classification systems). The most substantial areas for groundwater are about nine miles upstream of the project area between Spencer's Bridge and DeWitt's Bridge and in from the six mile to nine mile stretch of river. Both of these areas have large moraines, which are sources for large amounts of groundwater.

Table 2 Little Manistee River water temperature range

Classification	Temperature Range
Cold*	< 63.5 Degrees Fahrenheit
Cold-Transitional	63.5 – 67.1 Degrees Fahrenheit
Cool	67.1 – 69.8 Degrees Fahrenheit
Warm	> 69.8 Degrees Fahrenheit

*Little Manistee River Temperature Range

2.3.4 Flood Plains

FEMA designates areas of flooding at the 1% annual exceedance. As an official FEMA Zone A approximate floodplain, there is not an official baseflood elevation. Instead, the requirement is to show no negative impacts to the floodplain for the 1% annual exceedance event. The proposed project will implemented in the floodplain. The changes in water surface elevations for the 1% floodplain for the proposed and existing conditions can be found in **Appendix B.**

The Little Manistee River watershed drains approximately 145,300 acres from Lake, Mason, and Manistee counties. The Little Manistee River originates from several swamps in eastern Lake County about eight miles east of the Village of Luther. Much of the river between Luther and M-37 flows through lowland conifer and tag-alder swamp. Below Luther Dam it flows northwest through most of Lake County, the very northeast tip of Mason County, and then southwestern Manistee County. Below the Luther Dam, the Little Manistee River is free-flowing for 55 miles before entering Manistee Lake in the Village of Stronach. Manistee Lake empties into Lake Michigan through a channel in the town of Manistee. Average spring monthly-flows, when sea lamprey migration is taking place, range between 160 and 250 cubic feet per second (cfs) (**Table 3**).

Table 3 Little Manistee Monthly Flows in cubic feet per second (cfs).

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
95%	120	120	140	160	130	130	130	120	120	120	130	130
Mean	160	160	190	250	210	190	160	150	150	160	170	170

2.3.5 Wetlands

Available information, including aerial photographs, USFWS National Wetlands Inventory (NWI), MDEQ wetlands map viewer, current land-use and a summer 2014 site visit, were reviewed. Both the USFWS NWI and the MDEQ wetlands viewer indicates that there is shrub/scrub wetlands at the project site. (**Figure 7**) In August of 2016 the Detroit District completed a wetland delineation of the project site. The results of the District's wetland delineation are depicted in **Figure 8**, with the exception a narrow wetland fringe that is located in some areas along the riverbanks of the emergency spillway.

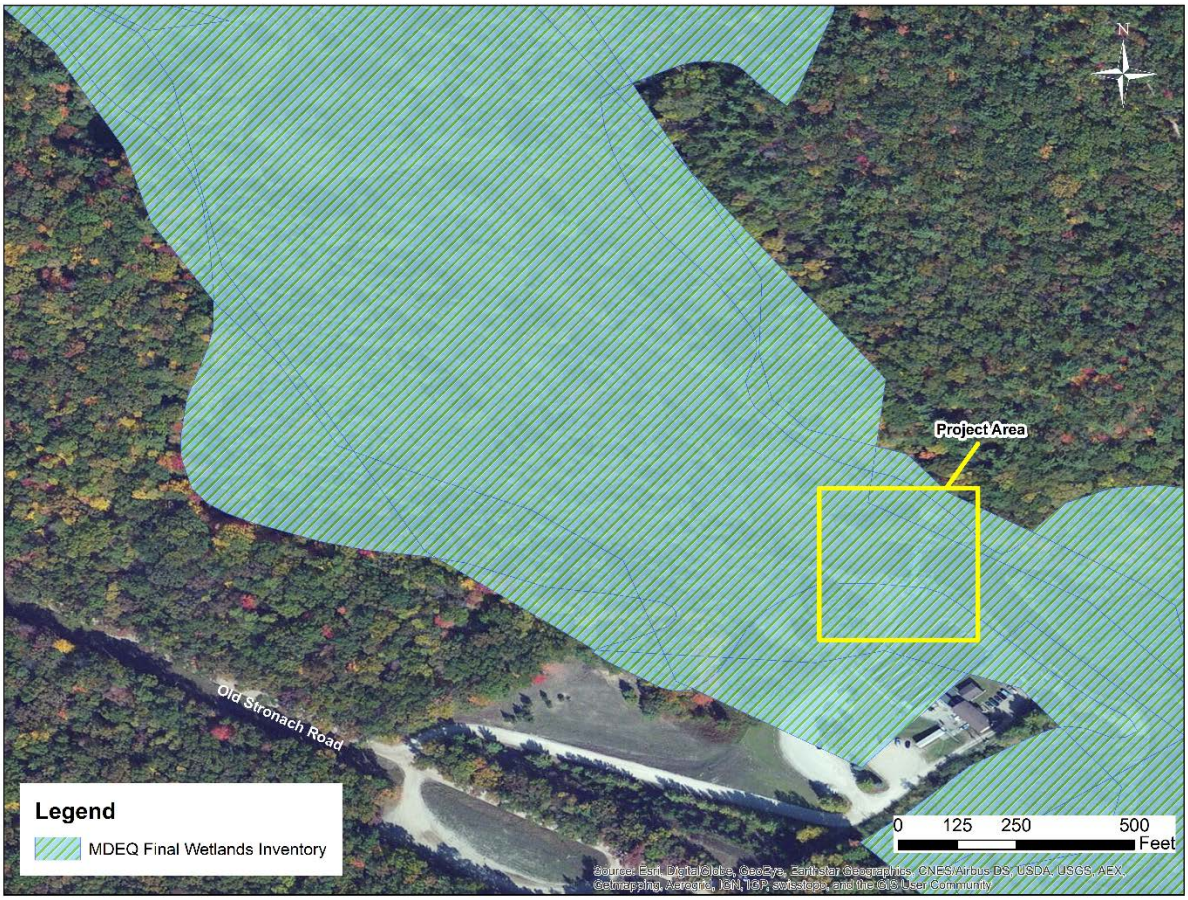

Figure 7 Wetlands in the general project area. Data from the MDEQ Final Wetlands Inventory. The USFWS National Wetland Inventory was also consulted and showed a similar, although slightly smaller, distribution.

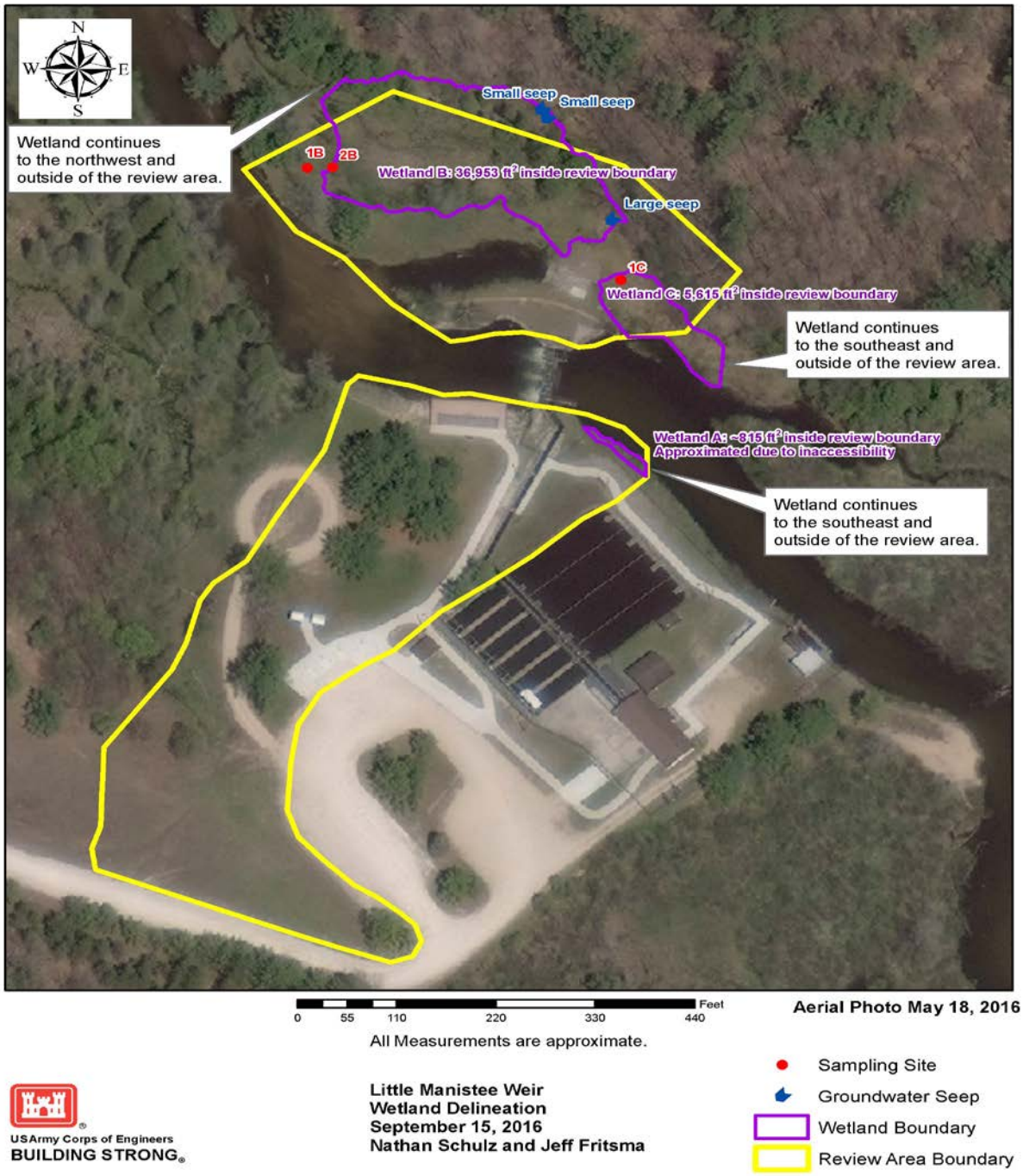

Figure 8 Wetlands delineated within Little Manistee Weir project site. Data collected by Detroit District.

2.4 FISH AND WILDLIFE HABITATS

2.4.1 Terrestrial and Aquatic Vegetation

The surrounding area is mostly forested so there is sufficient terrestrial vegetation. Aquatic vegetation is scarce (about 7% of the total streambed area).

2.4.2 Fauna

Given the large percentage of forest in the watershed and very few developed areas around the project site, the site provides habitat to a variety of birds, small mammals, deer, and other woodland favoring wildlife at or near the site.

The Little Manistee River has an excellent invertebrate population with crayfish, amphipods, seven (7) families of mayflies, three (3) families of stoneflies, both dobson flies and alder flies of the Order Megaloptera, five (5) families of caddis flies with numerous beetles and dipterans. Snails and bivalve mollusks were extremely limited. A total of 30 taxa of macro invertebrates were identified within two sampling stations on the river upstream of the project site.

2.4.3 Existing Terrestrial and Aquatic Habitats

Land surrounding the project area is primarily forested; however, there is some agricultural land to the south of the project.

The coldwater conditions resulting from the largely groundwater-fed system of the Little Manistee River and the mostly forested watershed, contribute to the River's excellent water quality and create optimal conditions for trout. Chinook salmon, steelhead, brook trout, brown trout, and coho salmon, as well as the aquatic organisms to support these fish, are common to the Little Manistee River. The brown trout population has been estimated to be over 100 pounds per acre, juvenile steelhead populations are often estimated to be over 2,000 fish per acre and juvenile coho populations have been measured at over 1,000 fish per acre, although it is thought coho populations have more variability in the Little Manistee than steelhead or brown trout as there are great fluctuations in the data. No other fish production data has been estimated by the resource agencies.

An analysis of aquatic habitat quality in the Little Manistee River was completed by Michigan Trout Unlimited in February 2015. The study focused on the 32 miles of river from the Little Manistee Fish Weir (project site) upstream to North Wide Water Road. Overall, the Little Manistee River has good quantity and diversity of in-stream habitat, with some segments that would benefit from increased habitat availability. Deep water habitat is most common followed by woody debris. Some aquatic vegetation is found in the river although it is limited. Although deep water habitat is abundant, pool habitat is lacking which is to be expected given the low gradient of the river.

The riverbed from the Little Manistee Fish Weir to Skocelas Road (1st 6.6 river miles upstream) is about 43% fines and 57% hard substrates comprised of 0% clay, 2% silt, 41% sand, 49% gravel, 6% cobble, and 2% boulder. The river characteristics of this section are estimated as 48% Run, 3% Pool, and 49% Riffle Habitat; In-stream habitat is found in approximately 53% of the total streambed area between the MDNR weir and Skocelas Road (28% deep water, 18% wood, and 7% vegetation). This segment of the Little Manistee is well-balanced in the aquatic habitat it provides. Gravel is the most common substrate in this segment of the river, providing habitat for significant trout, salmon and sea lamprey spawning. This area has the highest abundance of spawning habitat for salmonids and the most diversity in habitat types.

Due to a combination rip-rap / scour stone for bank stabilization and high velocity water over the apron during the last thirty years, there is no significant amount of vegetation or habitat located at the study site just downstream of the spillway apron.

2.5 ENDANGERED AND THREATENED SPECIES

2.5.1 Federal

The USACE reviewed the USFWS "County Distribution of Federally-Listed Threatened, Endangered, Proposed and Candidate Species" for Manistee County, Michigan, revised October 2016. The distribution list in **Table 4** indicates that several threatened, endangered or proposed species are present in Manistee County.

Table 4 Federally Listed Threatened and Endangered Species

Species[1]	Status[1]	Habitat Type[1]	Habitat Present At Site?
Piping plover (*Charadrius melodus*)	Endangered	Beaches along shorelines of the Great Lakes	no
Indiana bat *(Myotis sodalist)*	Endangered	Small to medium river and stream corridors with well-developed riparian woods	near
Northern long-eared bat *(Myotis septentrionalis)*	Threatened	Hibernates in caves and mines - swarming in surrounding wooded areas in autumn. Roosts and forages in upland forests during spring and summer.	near
Rufa Red knot *(Calidris canutus rufa)*	Threatened	Only actions that occur along coastal areas during the Red Knot migratory window of MAY 1 - SEPTEMBER 30	no
Eastern massasauga Snake (*Sistrurus catenatus*)	Threatened	Shallow wetlands and adjacent uplands	yes
Pitcher's thistle (*Cirsium pitcheri*)	Threatened	Stabilized dunes and blowout areas	no

1 - "County Distribution of Federally-Listed Threatened, Endangered, Proposed and Candidate Species" for Manistee County, Michigan, Revised October 2016.

The wetlands and non-developed riverbank of the Little Manistee River watershed provides habitat for the threatened Eastern massasauga rattlesnake. The snake has been seen in the area of the weir facility. The massasauga is known to overwinter in crayfish burrows.

Both the Indiana bat and the northern long-eared bats are Federally listed species that may be present in the vicinity of the project.

The bald eagle was recently (circa 2007) removed from protection under the Federal Endangered Species Act and Section 7 consultation with the USFWS is no longer necessary. However, the bald eagle remains protected under the Bald and Golden Eagle Protection Act. The closest known bald eagle nest is approximately two miles from the project site.

2.5.2 State

A review of the Michigan Natural Features Inventory was also conducted. The following state listed plant and animal species were listed for the Little Manistee River sub-basin: state special concern wood

turtle (*Glyptemys insculpta*), state special concern secretive locust (*Appalachia arcane*), state special concern Hill's Thistle (*Cirsium hillii*), endangered Kirtland's warbler (*Dendroica kirtlandii*), state special concern eastern massasauga (*Sistrurus catenatus catenatus*), threatened red-shouldered hawk (*Buteo lineatus*), threatened cisco or lake herring (*Coregonus artedi*), threatened common loon (*Gavia immer*), state special concern northern goshawk (*Accipiter gentilis*), and state special concern Alleghany or sloe plum (*Prunus alleghaniensis var. davisii*). Of these species, those that prefer wetland habitat (wood turtle, Blanding's turtle) may be in the general vicinity of the project activities, but are not likely to occur on the actual project site.

There are 40 state-listed species in Manistee County (**Table 5**). In total, there are four endangered, fifteen threatened, and 21 special concern species. Fifteen of these species are birds, six are fish, seven are flowering plants, one is an insect, four are mammals, one is a mussel, five are reptiles, and one is a snail. Of these species, 10 have habitat preferences that are consistent with those found within the project area.

Table 5 List of State Listed Species in Manistee County

Common Name	Scientific Name	State Status	Habitat Preference	Habitat in Immediate Project Area
Northern goshawk	*Accipiter gentilis*	Special Concern	Forested habitats ranging from boreal forests to northern hardwoods; commonly nest in deciduous trees such as aspen, birch, beech, and maple and less frequently in conifers	Yes
Lake sturgeon	*Acipenser fulvescens*	Threatened	Large rivers and shallow areas of large lakes; spawning on gravel bottom streams and sometimes on rocky, wave-swept lake shore and island areas	No
Grasshopper sparrow	*Ammodramus savannarum*	Special Concern	Grasslands, cultivated fields, hayfields; prefer drier sites with tall dense grassy vegetation	No
American bittern	*Botaurus lentiginosus*	Special Concern	Wet to wet-mesic habitats with herbaceous or herbaceous-shrub cover; typically only found in larger wetlands	No
Red-shouldered hawk	*Buteo lineatus*	Threatened	Mature forests in or adjacent to wet meadows and swamps	Yes
Piping plover	*Charadrius melodus*	Endangered	Wide, flat, open, sandy beach with sparse vegetation and scattered cobble	No
Northern harrier	*Circus cyaneus*	Special Concern	Open habitats dominated by herbaceous vegetation	No
Hill's thistle	*Cirsium hillii*	Special Concern	Most commonly pine barrens, but also other savanna and prairie types, openings within forests, and on limestone pavement	No
Pitcher's thistle	*Cirsium pitcher*	Threatened	Open sand dunes with sparse vegetation	No
Marsh wren	*Cistothorus palustris*	Special Concern	Narrow-leafed cattail and cord-grass marshes	No

Spotted turtle	*Clemmys guttata*	Threatened	Clean, shallow bodies of standing or slow-flowing water with muddy or mucky bottoms with aquatic or emergent vegetation	No
Lake herring/Cisco	*Coregonus artedi*	Threatened	Deep inland lakes and the Great Lakes at depths from 18-53 meters	No
Kiyi	*Coregonus kiyi*	Special Concern	Deep, cold water in Great Lakes	No
Shortjaw cisco	*Coregonus zenithicus*	Threatened	Deep, cold water in Great Lakes with clay substrates	No
Trumpeter swan	*Cygnus buccinators*	Threatened	Variety of wetland types	No
Cerulean warbler	*Dendroica cerulean*	Threatened	Mesic sites, typically in the canopy of large tracts of mature deciduous forest	Yes
Blanding's turtle	*Emydoidea blandingii*	Special Concern	Clean, shallow water with abundant aquatic vegetation and soft muddy bottoms; nest in open uplands adjacent to wetland habitat	No
Common loon	*Gavia immer*	Threatened	Nest in sheltered islands on large, undeveloped inland lakes; rearing in quiet, shallow, sheltered coves	No
Wood turtle	*Glyptemys insculpta*	Special Concern	In or near moving water and associated riparian habitats; prefer clear, medium-sized hard-bottomed streams and rivers with sand or gravel substrates and moderate flow; also need shaded, wet-mesic herbaceous vegetation for forage	Yes
Bald eagle	*Haliaeetus leucocephalus*	Special Concern	nest in wide variety of habitats close to open water	Yes
Dwarf-bulrush	*Hemicarpha micrantha*	Special Concern	Sandy-peaty shore of soft water lakes	No
Least bittern	*Ixobrychus exilis*	Threatened	Dense stands of emergent vegetation, typically near an opening	No
Migrant loggerhead shrike	*Lanius ludovicianus migrans*	Endangered	Grasslands and open, agricultural areas characterized by short vegetation and scattered trees and shrubs	No
Woodland vole	*Microtus pinetorum*	Special Concern	Deciduous woodlands with loose, sandy soils, deep hummus, and heavy leaf litter	Yes
Northern long-eared bat	*Myotis septentrionalis*	Special Concern	Loose bark, in cavities, or in crevices of both live trees and snags	Yes
Indiana bat	*Myotis sodalis*	Endangered	Loose bark or in hollows and cavities of mature trees in floodplain forest	Yes
Pugnose shiner	*Notropis anogenus*	Endangered	Clear vegetated lakes and vegetated pools and runs of low gradient streams and rivers	No
Bigmouth shiner	*Notropis dorsalis*	Special Concern	Moderately fast moving creeks and streams less than 3 feet deep	No
Broomrape	*Orobanche fasciculate*	Threatened	Sand dunes	No

Ginseng	*Panax quinquefolius*	Threatened	Rich, shaded forests with loamy soils and heavy canopies	No
Osprey	*Pandion haliaetus*	Special Concern	Above or near water in snags or on man-made structures	No
Eastern pipistrelle	*Perimyotis subflavus*	Special Concern	Open water of streams and ponds as well as forest edges; found in open woods near edges of water	No
Round pigtoe	*Pleurobema sintoxia*	Special Concern	Mud, sand, or gravel substrates of medium to large river	No
Brown walker	*Pomatiopsis cincinnatiensis*	Special Concern	Vegetated canopy along stream banks	No
Alleghany or Sloe plum	*Prunus alleghaniensis var. davisii*	Special Concern	Pine barrens, oak-pine savanna, and oak savanna remnants	No
Louisiana waterthrush	*Seiurus motacilla*	Threatened	Broad forested areas along clear streams	No
Eastern massasauga	*Sistrurus catenatus catenatus*	Special Concern	Variety of wetland habitats	Yes
Eastern box turtle	*Terrapene carolina Carolina*	Special Concern	Forested habitats with sandy soils near a source of water	Yes
Lake Huron locust	*Trimerotropis huroniana*	Threatened	Sparsely vegetated, high-quality Great Lakes sand dunes	No
Wild rice	*Zizania aquatica var. aquatic*	Threatened	In rivers, lakes, and ponds usually in water less than 2 feet deep in areas with a slight current over a mucky or silty bottom	No

2.5.3 Critical Habitat

There is no designated Critical Habitat in Manistee County.

2.6 INVASIVE SPECIES

Sea lamprey are present upstream and downstream of the barrier on the Little Manistee River and sea lamprey control is the focus of this study. The USFWS performs trapping using temporary, portable traps at the project site during the spawning season which typically runs March through June. Periodic (every 3-5 years) 3-trifluoromethyl-4'-nitrophenol (TFM) treatments are conducted in approximately 40 miles of the Little Manistee River.

Since the proposed study is at an existing barrier upstream of Manistee Lake, any aquatic nuisance species found in the Great Lakes that moves solely through the aquatic pathway must possess either: 1) self-propelled mobility or 2) the ability to "hitchhike" on other organisms to travel upstream. This eliminates most organisms that rely on current for dispersal such as algae and other plants. However, downstream drift is a mechanism that some invasive species established upstream in the river system can use to move to the study area.

Eurasian ruffe (*Gymnocephalus cernuus*), threespine stickleback (*Gasterosteus aculeatus*), round goby (*Neogobius melanostomus*) and tubenose goby (*Proterorhinus marmoratus*) are invasive fish species

that are found in the Great Lakes. The ruffe, three spine stickleback, round goby and tubenose goby are associated with river mouths and estuaries of large river systems. Literature from Europe and Russia indicate the ruffe and tubenose goby do inhabit upper river systems but no ruffe or tubenose goby have been collected locally in any upper Great Lakes (Huron, Michigan and Superior) river tributaries to date. Three spine stickleback have been collected in a very few upper river locations. The round goby has been found in small numbers in upper river systems across Michigan but this species is not anticipated to be a significant problem in the Little Manistee River.

The parasitic organism that causes whirling disease has been documented in the Little Manistee River. Steelhead and brook trout tested positive for the disease in the late 1990s, but another sampling in the early 2000s had no detections.

Although not observed at the proposed trap location or in work and storage areas, other aquatic pest species in the watershed include viral hemorrhagic septicemia virus (VHSv), zebra mussels (can drift downstream as larvae), rusty crayfish, spiny water flea, purple loosestrife, and Eurasian milfoil.

2.7 RECREATIONAL, SCENIC, AND AESTHETIC RESOURCES

2.7.1 Land Use

The Little Manistee River was very heavily forested and inhabited by Native Americans until European fur trappers began exploring the area in the late 1600s. Fur trapping remained the primary European use of the area through the mid-1800s when Europeans began to permanently settle in the area. Logging became more prevalent in the region beginning in the late 1800s. Today, 74% of the Little Manistee watershed is forested, 3.5% is agriculture lands, and 1.6% is developed (Figure 3). The remainder is shrublands, wetlands, and sand/exposed rock. Over half of the Little Manistee River watershed is public land, owned by either the State of Michigan or the United States Forest Service. Recreation is very popular throughout the watershed as the Little Manistee River is designated a Michigan Department of Natural Resources Blue Ribbon Trout Stream from King's Highway (County Road 633) to the Manistee County line. It is also a candidate river for the National Wild and Scenic River designation due to its outstanding recreational and natural values.

Kayaking and canoeing are the favorite forms of recreational boating on the Little Manistee River. The varying river flows provide a navigational experience that ranges from novice to mildly challenging. The USFS and the MDNR provide several places along the river to safely access to float and portage throughout the river. The MDNR egg collection station is another popular attraction on the Little Manistee River. The facility is visited by hundreds of school age students and adults during the annual egg collection activities.

2.7.2 Local Resources

A stretch of river upstream of the barrier from King's Highway (County Road 633) to the Manistee County line has a special MDNR designation as a Blue Ribbon Trout Stream.

2.7.3 Regional Resources

The Little Manistee has been designated a National Scenic Study River by Congress (P.L. 102-249). It was determined as an eligible candidate because it is free-flowing and possesses both fish and recreation outstandingly remarkable values (ORVs). Based on the eligibility, it was placed into the scenic class as it qualifies under, "those rivers or sections of rivers that are free of impoundments, with shorelines or watersheds still largely primitive and shorelines largely undeveloped, but accessible in places by roads,"

(P.L. 90-542, Section 2(b)(1)) . The final step is to determine if the candidate river should be recommended for the National System through a suitability analysis. The U.S. Forest Service has been tasked with completing this final step for 42 miles of the Little Manistee River. To date, the suitability study has not been completed. The Little Manistee National Scenic Study River is currently managed under the Standards and Guidelines outlined in the Huron-Manistee National Forests Land and Resource Management Plan (Chapter III, Management Area 9.2).

2.8 CULTURAL RESOURCES

2.8.1 Cultural History

The Little Manistee fish egg collection facility (Figure 2) has been in operation since 1968 when the Michigan Department of Natural Resources constructed the facility. The riverbanks and immediate adjacent lands were disturbed with the installation of the weir, parking lot and buildings. Upgrades have been made to the facility since its initial construction. The weir is part of an egg collection and salmon harvest facility and is used to block fish on the Little Manistee River using dam boards and stop logs in the spring and fall. Steelhead eggs are collected in the spring and Chinook salmon eggs are collected each fall. The eggs are then sent to the state fish hatcheries where they are raised and eventually the smolts are stocked all over Michigan. The emergency spillway weir, which is part of the egg collection facility does not effectively block the migration of adult sea lamprey in the spring as they swim upstream to spawn, thus the requested project modification. The fish egg collection facility is not a National Historic Landmark or listed on the National Register of Historic Places. No known archeological investigations were conducted at the site during initial facility construction.

2.8.2 Previous Investigations

No known previous cultural investigations have been completed in the project area or the immediate vicinity.

2.9 AIR QUALITY

The USEPA and Michigan Department of Environmental Quality (MDEQ) monitor air quality across the State of Michigan. Data specific for Stronach, Michigan were not available at the time of this assessment. MDEQ Action Day data from 1994 through 2015 were reviewed for Traverse City, which is the Air Quality Index (AQI) station that represents Manistee County. One air quality action day was observed in Traverse City for each of the following years: 2005, 2007, 2008, and 2011, and two air quality action days were observed in 2006. These air quality action days all occurred during the summer months. Manistee County is not designated as a “nonattainment” or “maintenance” area by the USEPA. Overall, air quality in Manistee County is considered good.

2.10 NOISE

Noise and Traffic in the vicinity of the study area is typical of that found in a relatively undeveloped, rural area near a small sized downtown of Stronach, Michigan. Immediately surrounding the site is undeveloped woods.

Vehicle access to the site is present from the southwest side of the river via Old Stronach Road. Traffic is light in the area, with traffic at the site consisting of Michigan DNR and USFWS employees and recreational users of the barrier (viewing the dam and fishing). There is regular noise at the site in association with water rushing over the barrier and visitor vehicles. An anticipated noise range that would be considered typical during the day at the site would be 45-65 decibels (dB), depending on proximity to the dam. The table below presents noise levels in relative terms for interpretation (**Table 6**).

Table 6 Approximate Sound Levels and Human Response

Overall Noise Level (dBA)	Common Sounds	Effect
0		Threshold of hearing
10-30	Just audible to soft whisper at 15 feet	Negligible to very quiet
40	Bird calls	Very quiet
50	Light auto traffic at 100 feet; Quite suburban residential environment (i.e., 630 people /square mile)	Quiet
60	Air conditioning unit at 100 feet; dishwasher (rinse); conversation	Intrusive
70	Noisy restaurant; vacuum cleaner; passenger car at 65 mph; freeway traffic at 50 feet; very noisy urban residential environment (i.e., 63,000 people/square mile)	Moderately loud, telephone use difficult
80	Alarm clock at 2 feet; food blender or garbage disposal	Annoying
90	Power mower; heavy truck at 50 feet or motorcycle at 25 feet; city traffic	Very annoying
100-110	Riveting machine; rock band; jet flyover at 1,000 feet	Very loud, very annoying, difficult to hear talking
110-130	On construction site during pile-driving; Jet takeoff at 200 feet; auto horn at 3 feet	Uncomfortably loud, maximum vocal effort necessary

Data from: Federal Interagency Committee on Noise 1992, USEPA 1971, 1974, 1978

2.11 AESTHETICS

The Little Manistee, a small river with spectacular scenery, is a candidate for designation as a National Wild & Scenic River, a federal classification given to waterways that have characteristics that are deemed “outstandingly remarkable.” The Little Manistee River, which originates from several swamps in eastern Lake County just east of Luther, flows freely for 55 miles below the Luther Dam through northern hardwood and conifer forests into Manistee Lake. Largely ground-water fed, the Little Manistee is among the coldest and most-stable streams in Michigan.

Historically, when folks thought of the Little Manistee, they thought of trout; every tributary large enough to have a name is a designated trout stream. But trout weren't always the main focus of anglers. The coldwater streams in Michigan were once the home of the arctic grayling, historical account say the

fish would “lay like cordwood” in the river. Extreme habitat loss from logging, fishing overharvest and possibly competition from introduced trout all likely contributed to the grayling's demise.

In the 1960’s the MDNR constructed the fish weir and egg collecting station. The proposed lamprey barrier project will be located within the footprint of the weir facility.

2.12 HAZARDOUS AND TOXIC SUBSTANCES

The purpose of a HTRW investigation is to ascertain the environmental history and current conditions of a site as it relates to HTRW, within practical measures and using reasonably available resources. By conducting such an investigation, the uncertainty regarding the potential for HTRW in connection with the project is reduced, though not eliminated. There is always some risk of encountering unknown HTRW elements during project construction, thus contract clauses incorporate wording on how to address such conditions should they be discovered.

A review of the following were conducted: the U.S. Environmental Protection Agency’s (USEPA’s) Envirofacts (including several sub-searches such as Superfund / National Priorities List sites, toxic releases, water dischargers/permits, air emissions, and hazardous wastes), Enforcement and Compliance History Online, and Cleanups in My Community; MDEQ’s Part 201 (contaminated) Site List and Storage Tank Information Center. The details from the database and resource reviews are included below.

A search of USEPA’s Envirofacts site lists indicates that no impacted properties are located at the project site or in the immediate vicinity. Three facilities were located in the Little Manistee watershed. The closest site is approximately 3.4 miles southeast of the project site at the LR Pow Wow Grounds. This area has been cleaned-up through the Brownfields program in 2006. The other two facilities are approximately 11 miles upstream of the project site. One site is a petroleum wholesaler that has reporting requirements to the USEPA and the other is a Brownfields site, which has been assessed and found to contain lead, (Polycyclic Aromatic Hydrocarbons) (PAHs), Volatile Organic Compounds (VOCs), and Semivolatile Organic Compounds (SVOCs), but no clean-up efforts have occurred to date.

A search for contaminated sites (as defined under the Michigan Natural Resources and Environmental Protection Act 451 of 1994, as amended) on the MDEQ’s Part 201 and Part 213 site lists indicates that there is one site in the watershed downstream of the project location.

2.13 SOCIOECONOMIC AND ENVIRONMENTAL JUSTICE

The 2010 U.S. census lists the permanent resident population of Manistee County at 24,000 people. The census identified the county population as 94% Caucasian, 1.5% African American, and 1.5% Native American. Median household income was below the state average.

Several principles were considered while evaluating the proposed action for environmental justice to evaluate if the recommended alternative would cause disproportionately high and adverse effects on low-income, minority and tribal populations. These included considerations such as the human composition of the affected area (e.g., low-income and minority groups), recognizing the interrelated cultural, social, occupational, historical, or economic factors that may amplify the natural and physical environmental effects of the proposed action, and coordination with local tribes. In addition, the public

will be encouraged to participate in the decision making process via pubic review and comment on this document.

3 PLAN FORMULATION

3.1 PROBLEMS AND OPPORTUNITIES

3.1.1 Problems

Sea lamprey continue to live, breed, and thrive in the Little Manistee River. The Little Manistee River has about 45 miles of suitable lamprey spawning habitat. Mature adult sea lamprey **(Figure 9)** migrate into streams to spawn from late March through June (water temperature dependent) in various parts of the Great Lakes basin. Adults die almost immediately after spawning and the larvae (ammocoetes) that develop from the eggs take up residence in soft sediments in the stream bottom. The ammocoetes feed on organic debris and algae present in the stream until they transform to their adult parasitic form and return to the lakes after an average of approximately three to six years (**Figure 10**).

Figure 9 Adult Sea Lamprey

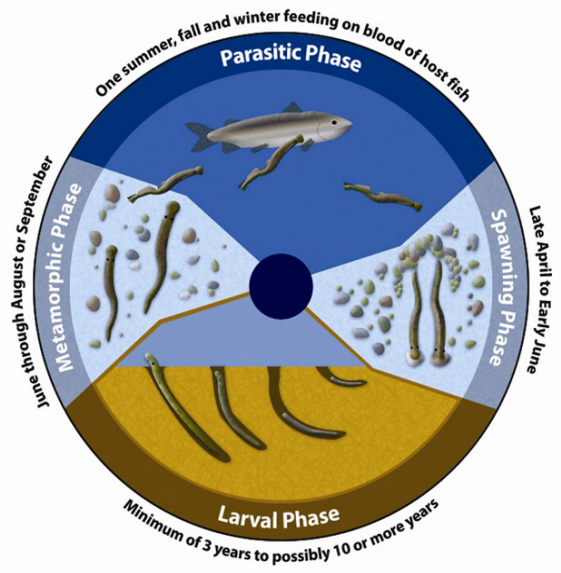

Figure 10 Sea Lamprey Life Cycle

Upon returning to the lakes as parasites they attach to large fish such as salmon (*Oncorhynchus spp.*) and lake trout (*Salvelinus namaycush*) to feed on body fluids. During their 12 to 18 months as parasites, a single sea lamprey kills an estimated 40 pounds of fish. The Little Manistee River is capable of producing a large population of larvae, hence sea lamprey control at this location is a high priority to the GLFC and the USFWS. Each female may spawn up to 100,000 eggs.

Lampricide application remains a key sea lamprey control method due to its high effectiveness (~95%) at killing larval sea lamprey. However, lampricides are not effective on adult lamprey and thus do not directly reduce adult reproduction. The GLFC convened an expert panel in the late 1990s and they concluded that along with lampricides, the adult/spawning-phase assessment program was integral to the integrated pest management program. Integrated management, including increased capture of adults, continues to be a key goal of the GLFC and USFWS as outlined in the GLFC's "Strategic Vision of the Great Lakes Fishery Commission, 2011-2020".

There is a desire to improve adult capture rates (for assessment purposes, removal of individuals from the ecosystem, and research) and increase the use of non-chemical tactics (i.e., pheromones) because of the high cost of the lampricide program. There is also the added concern that continued use of chemicals could become socially unacceptable over time, while a broader spectrum of control methods ensures better and more adaptable long-term management.

3.1.2 Opportunities

Opportunities exist to significantly reduce the destructive impact of sea lamprey on desirable game fish in Lake Michigan and the Great Lakes in general. Conversely, the opportunity also exists to increase the populations of the indigenous fish in Lake Michigan, which, in turn, increases recreational and commercial fishing opportunities within the Great Lakes ecosystem. Specific opportunities identified in relation to sea lamprey reduction in the Little Manistee River are as follows:

- Reduce the reproduction of sea lamprey (via capture and removal) and limiting habitat availability to minimize their adverse effects on Great Lakes fish stocks;
- Increase collection of adult/spawning-phase sea lamprey for research and study purposes (i.e., research associated to pheromones that could potentially attract lamprey to traps and/or repel them from spawning areas), and to prevent them from spawning;
- Improve the cost effectiveness of controlling sea lamprey reproduction in the Little Manistee River system to make funds available for control efforts elsewhere; and
- Reduce the reliance of the sea lamprey control program on lampricides to provide more integrated pest management that is less sensitive to the potential failure (or increased cost) of a single management technique.

3.2 OBJECTIVES AND CONSTRAINTS

3.2.1 Planning Objectives

The Planning Objectives of this study are:

- Block and remove a greater number of adult sea lamprey than are currently being removed by temporary traps from the Little Manistee River to prevent them from gaining access to spawning habitat upstream of the MDNR Weir Facility.
- Reduce the population of spawning-phase sea lampreys (prior to them spawning) in the Little Manistee River to reduce subsequent damage to the Lake Michigan (native) fishery; and
- Improve integrated sea lamprey control to potentially reduce or eliminate use of lampricide treatments.
- Reduce the number of river miles treated with lampricide from 45 miles to 6 miles.
- Solution must provide protection against lamprey migration through the spillway during the 4% (25 year) event.

3.2.2 Planning Constraints

Planning constraints are items of consideration that limit the extent of the planning process and are used along with the objectives in the formulation and evaluation of solutions. The establishment of planning constraints is done in concert with the entire study team and in cooperation with stakeholders. A list of planning constraints for the project is as follows:

- Avoid solutions and locations for the project that result in unacceptable changes to the water surface profiles both up and downstream of the project site; No stage increase or harmful interference with flows.
- Avoid solutions and locations for the project that result in additional obstacles to fish passage by native species;
- Avoid solutions and locations for the project that negatively impact the functioning and operations of the MDNR weir;
- Avoid solutions that would negatively impact the native fishery and the aquatic ecosystem of the Little Manistee River;
- Avoid any solutions that would introduce a potential safety risk to people, property or non-targeted flora and fauna.
- Final design must be agreed upon by MDNR, owner of the weir, and USFWS.
- Avoid solutions that would jeopardize the River's Wild and Scenic designation
- Minimize potential habitat impacts for the Federally listed Eastern massasauga rattlesnake

3.3 MOST PROBABLE FUTURE WITHOUT PROJECT CONDITIONS

The future without-project conditions for the proposed project site in general would remain the same in terms of river hydraulics, geomorphology, non-native species, TFM treatments and habitat impacts. The MDNR will continue to operate the egg collection facility and will implement their capital improvement plans for certain components of the weir facility. The concrete spillway will continue to allow lamprey to escape upstream during spring runoff. USFWS and MDNR personnel will continue to coordinate weir operations during the sea lamprey migration season (March – June), including gate settings and the placement of temporary traps. Without the installation of a lamprey barrier and trap on this river, there will be continued impacts on the native fish species by sea lamprey which will result in the continued suppression of the native and desirable fish populations in the Great Lakes. Finally, the TFM treatments will not be reduced, with a possible negative impact to some of the native species in the river.

3.4 Measures to Achieve Planning Objectives

3.4.1 Preliminary Structural and Non-Structural Measures

The formulation, evaluation, and comparison of alternative plans comprise the third, fourth, and fifth steps of the USACE planning process. These steps are often referred to collectively as "plan formulation." Plan formulation is an iterative process that involves cycling through these steps to develop a reasonable range of alternatives, and then narrow those plans down to a final alternative, which is feasible for implementation.

Plan formulation for ecosystem restoration presents a challenge because alternatives have non-monetary benefits. In this case, the formulation process is further influenced by the special nature of the sea lamprey projects, as the USACE will be further guided in plan selection by the USFWS, based on their field experience and expertise in trapping lamprey. The evaluation of alternatives for sea lamprey trap configurations and locations is more determined on maximum effectiveness and feasibility of the location, and much less on the comparison of benefits afforded from traditional ecosystem restoration projects.

The USACE evaluated a very limited array of management measures identified as acceptable by the USFWS (acting on behalf of the GLFC). The USACE plan formulation and evaluation process was followed

to create alternatives using the limited number of locations. The USFWS then recommended to the USACE which of the alternatives and configurations of installation would be most effective at trapping lamprey at the project location.

3.4.1.1 Structural Measures

The USFWS has tried a wide variety of sea lamprey control measures across the Great Lakes basin. They have identified the most effective as barriers, traps, and lampricide. Because of the small array of common measures generally available for feasible implementation in sea lamprey projects, alternatives may be comprised of just one measure. However, the most effective plans tend to be comprised of multiple measures. In the case of this study, the MDNR weir facility acts as a de facto barrier up to the 10% (10 year) flood event and the project purpose is to provide upstream protection up to the 4% (25 year) flood event in the spillway. The following measures have been identified for this Section 506 project:

- New barrier construction;
- Modification of the existing MDNR weir structure.
- Installation of a permanent trap

Control efforts first began with the construction of barriers to prevent the passage of adults during upstream spawning. In 1944, a weir, a kind of low dam, was constructed on the Ocqueoc River in Michigan as part of a study on lamprey biology. The weir was the first of many barriers built to prevent sea lamprey migration during the next two decades. Barriers and weirs were experimental during this period and were moved frequently between streams, rarely staying in one place for more than four years. During the peak years of barrier use (1950s), there were as many as 20 barriers in tributaries to Lake Huron, 65 around Lake Michigan, and 67 around Lake Superior. These barriers allowed lamprey control personnel to catch as many as 64,435 individual lampreys in a given year, but barriers alone were not enough to control the sea lamprey population.

Figure 11 Low head sea lamprey barrier

Figure 12 Combination sea lamprey barrier and trap and fish way

The primary barriers used today are “low-head” barriers, designed with the intention of preventing sea lamprey migration while still allowing jumping fish to pass **(Figure 11)**. Some barriers are designed as

"trap-and-sort" systems, where sea lamprey can be removed while non-jumping fish species are allowed to pass **(Figure 12)**.

3.4.1.2 Non-structural Measures

Where barriers cannot be used to prevent sea lamprey passage, chemical treatments are used to kill the larvae. Chemicals called "lampricides" are used to kill lamprey larvae while they are still burrowed in stream sediments. These chemicals work by disrupting the energy metabolism of lamprey larvae. Sea lamprey have low levels of the enzymes needed to break down lampricides, which makes it possible to apply the chemicals in doses that are lethal to sea lamprey but relatively low impact for other species and the ecosystem as a whole. There are two lampricides, referred to as TFM (3-trifluoromethyl-4'-nitrophenol) and granular Bayluscide (2', 5-dichloro-4'-nitrophenol) used in FWS lamprey control program (**Figure 13**).

The use of TFM throughout the Little Manistee River system is one of two non-structural measures that would be applicable to lamprey control. The chemical measure would not involve the construction of a new barrier or modification to the existing MDNR weir and would not address the problem of adult spawning phase lamprey migration. However, a temporary trap would still be used to catch spawning phase lamprey. The second non-structural measure is the Attractant Water Trap (AWT). Sea lampreys tend to seek out attractant water flow as they migrate upstream in river systems, the water flowing through the MDNR weir provides the attractant flow and a prime location for trapping lamprey as they continue to seek a way upstream. The AWT traps are designed to take advantage of the lampreys swimming behavior using flow to lure the animal into the trap.

Figure 13 Lampricide application

3.4.2 Excluded Measures

Preliminary measure / alternative development included several potential locations for new barrier, modification of the existing MDNR weir structure, or reliance on lampricide. The focused measures are all inclusive in terms of sea lamprey control on the Little Manistee River.

3.5 FORMULATION AND COMPARISON OF ALTERNATIVE SOLUTION SETS

On simpler projects, alternatives may be comprised of only one management measure. The measures listed in **Section 3.4** are analyzed in tandem, in terms of costs and benefits. The USFWS has indicated they expect to continue to treat the lower Little Manistee River downstream of the weir with lampricide regardless of the alternative implemented, but the amounts and frequency of upstream treatments may vary depending on the effectiveness of the implemented alternative from this project and flood flows during the spawning season. Downstream lampricide treatment will continue under all alternatives, the following discussion of alternative benefits and costs will focus on the implementation of a combination of lampricide treatment and barrier implementation. The USFWS and the USACE collaborated on this task.

3.5.1 Alternative Plan Descriptions

Alternative 1 - No Action - The No Action alternative would not change the sea lamprey control operations currently in use by the USFWS. The existing spillway apron and weir does not block sea lamprey during the spring migration. Therefore, current control also involves intensive application of a lampricide to further reduce lamprey populations in the Little Manistee River. The USFWS estimates that the Little Manistee River could have a maximum larval population of approximately 615,000. In order to decrease the population, the Little Manistee River system is treated with lampricide every three years.

Alternative 2 – Demolition of the Existing MDNR Weir Structure and Construction of a Permanent Lamprey Barrier and Trap at the Weir Location: This alternative consists of demolishing and disposing of the existing MDNR weir structure. The portion of the MNDR egg collection facility such as the holding tanks and raceways, the concrete spillway, the MDNR building where the salmon eggs are taken, and facility pump station would be integrated with the new barrier structure. The new barrier will consist of replacing the existing structure in kind and installing a new adjustable steel sheet pile barrier/spillway adjacent to the concrete structure. The new spillway structure would be constructed to block and trap lamprey during the 4% (25 year) flood event (**Figure 14**). Stoplog sections would be incorporated on the barrier to allow FWS and MDNR personnel to manipulate outflows and to increase the effectiveness of downstream fish passage and lamprey trapping at the barrier. A walkway would be constructed over the barrier and outfitted with davit lifts to allow FWS lamprey control or MDNR egg collection personnel access to traps and to remove and replace stop logs in the adjustable structure. In addition, a fish guidance weir will be installed downstream to ensure fish approach the egg collection facility.

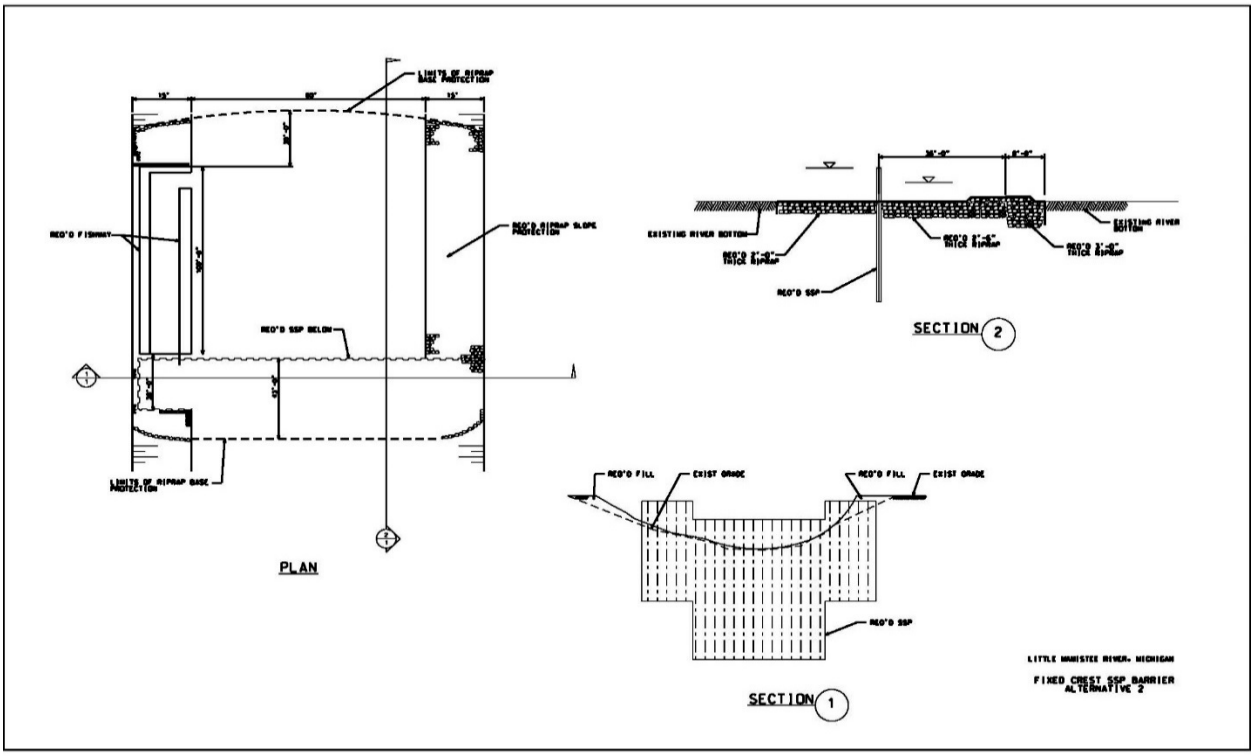

Figure 14 Alternative 2 Plan and Cross-section

Alternative 3 – Modify the existing spillway at the MDNR weir structure – Alternative 3 consists of removing the existing earthen and concrete spillway apron (1500 CYD) and constructing a low head adjustable (stop logs) spillway that would block lamprey migration up to the 4% (25 year) flood event; raising the existing walkway at the weir facility to an elevation that would accommodate the 1% (100 year) flood event and extend the walkway across the entire structure; create an area to allow FWS personnel to install an Attractant Water Trap (AWT) (sea lamprey trap). Scour stone will be placed on the upstream and downstream toe of the new spillway. A directional blocking weir at the confluence of the spillway discharge and the main river will be installed to divert fish toward the MDNR egg collection facility. Riprap or field stone will be placed on both banks of the spillway to protect the channel banks from scour; the existing canoe/kayak portage will reconstructed **Alternative 3 (Figure 15)**. See full size engineering plans in **Appendix A**.

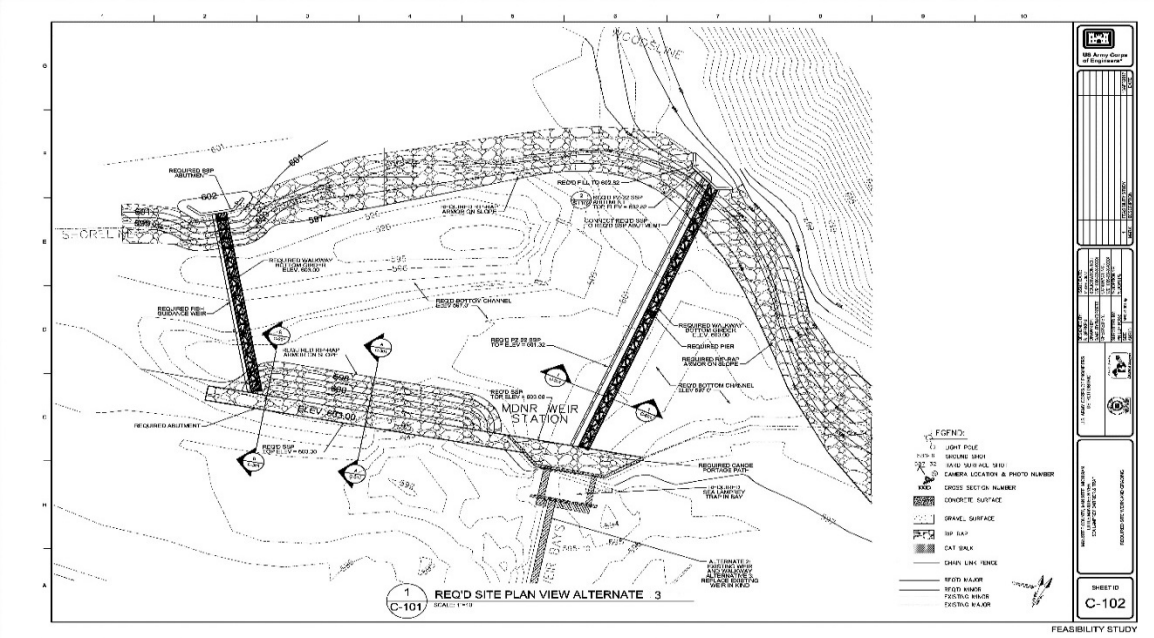

Figure 15 Plan View of Alternative 3

3.5.2 Economic Analysis of Alternatives

The *Principles and Guidelines* (March 10, 1983) states that the Federal objective of water and land related resource planning is to contribute to national economic development (NED) consistent with protecting the nation's environment. This guidance directs Federal agencies to formulate plans that are economically and environmentally sound. Generally, the economic effectiveness of plans or alternatives developed for Federal water resource projects are evaluated through the use of a benefit-cost analysis. However, this analysis is impractical when evaluating environmental benefits.

The U.S. Army Corps of Engineers Institute for Water Resources (IWR) provides step-by-step guidance on how to conduct cost effectiveness and incremental cost analyses (CE/ICA) in their *Evaluation of Environmental Investment Procedures Manual* (IWR Report # 95-R-1). CE/ICA is recommended when evaluating the effectiveness of environmental restoration projects. When utilizing these tools, the costs and non-monetary outputs of each plan are weighed against each other to aid in the identification of the National Environmental Restoration (NER) plan. Cost effectiveness (CE) is used to screen out those inefficient alternatives that produce fewer environmental benefits at a higher cost. Once these inefficient alternatives have been eliminated, incremental cost analysis (ICA) is applied to reveal changes in costs as levels of environmental outputs increase. For these two analyses to be useful in decision-making, the non-monetary outputs produced by each plan must be quantified in the same unit of output or measurement (i.e. habitat units, environmental units) to ensure that all plans are comparable. In addition, the alternatives must be incremental in nature, either by feature or benefits achieved.

3.5.2.1 Ecosystem Restoration Outputs

Habitat units (HU) are an assessment tool for examining the environmental impacts or outcomes for each of the proposed alternatives. For this study, a HU is defined as the removal of a sea lamprey by trapping. The removal of one sea lamprey would equate to one habitat unit.

3.5.2.2 Economic Benefits

Table 7 shows the benefits associated with the cost savings from utilizing a barrier with lampricide. The utilization of barriers has also been shown to have positive impacts on controlling sea lamprey populations. Barriers prevent the sea lamprey from returning to more favorable spawning habitats which lowers the reproduction rate of adults and lowers the survival rate of sea lamprey spawn. Barriers also limit the area in which lampricide needs to be applied.

Table 7 – Little Manistee Lampricide Treatment Cost Benefits

Alternatives	**Lamprey protection (flood event)**	**Post implementation treatment costs**	**Total project cost**	**Treatment cost saved over 50 yrs.**
Alternative 1- **No Action**	10% (10 year)	$209,000/3 yrs.[2]	$3,483,333[1]	0
Alternative 2 - **Construct a Permanent Lamprey Barrier at the MNDR Weir**	10%/4% (10/25 year)	$81,000/3 yrs.[3]	$1,350,000[1]	$2,133,333
Alternative 3 - **Modify the existing spillway at the MDNR weir structure**	10%/4% (10/25 year)	$81,000/3 yrs.[3]	$1,350,000[1]	$2,133,333

[1]Based on post implementation treatment costs application for a 50 year project life (ex: $209k/3*50)
[2]Treatment cost for 45 miles of river
[3]Treatment cost for 6 miles of river

The proposed alternatives would come with enhanced permanent sea lamprey traps. In combination with the barrier on upstream movement, the lamprey will go back and forth at the face of the dam resulting in increased capture rates. The increased efficiency over temporary traps is estimated to lead to an improvement from 25% to 60%. See **Table 8** for breakdown of lamprey trap efficiency.

Table 8 – Little Manistee Fish Restocking Benefits

Alternatives	**Lamprey Trap Catch Estimate**	**Efficiency**	**Net Increase in Catch**	**Net Pounds of Fish Saved[1]**	**Number of 9lbs Fish Saved[2]**	**Yearlings Stocked per year Avoided[3]**	**Annual Cost Savings Compared to Stocking[4]**
Alternative 1 – **No Action**	130	25%	0	0	0	0	$0
Alternative 2 - **Construct a Permanent Lamprey Barrier at the MNDR Weir**	315	60%	185	7,400	822	2,055	$6,884
Alternative 3 - **Modify the existing spillway at the MDNR weir structure**	315	60%	185	7,400	822	2,055	$6,884

1: Lamprey kill an average of 40 lbs. of fish
2: Average size of Lake Michigan Lake Trout per Michigan Department of Natural Resources (MDNR)
3: Estimates that it takes the restocking of 2.5 yearlings to replace one mature Lake Trout per MDNR
4: Yearling stocking cost is assumed to be $3.35 based on MDNR

A NER project does not consider economic benefits as the basis for justification. Economic benefits are considered a secondary benefit and are developed and shown for that purpose. A combined breakdown of these savings are shown in **Table 9**.

Table 9 – Combined Average Annual Benefits

Alternatives	**Annual Lampricide Treatment Cost Savings**	**Annual Cost Savings Compared to Stocking**	**Total Annual Benefits**
Alternative 1 – **No Action**	$0	$0	$0
Alternative 2 - **Construct a Permanent Lamprey Barrier at the MNDR Weir**	$42,667	$6,884	$49,551
Alternative 3 - **Modify the existing spillway at the MDNR weir structure**	$42,667	$6,884	$49,551

3.5.2.3 Project Costs

Parametric costs for each alternative were developed by the Detroit District (USACE) for each of the examined alternatives and are presented in **Table 10**. In addition to the parametric costs, **Table 10** includes the economic costs associated with implementing each of the alternatives.

Economic costs are the costs of the resources required or displaced to achieve each of the plans. This is commonly known as opportunity costs. The primary economic costs in this study was interest during construction. This is the lost value of money that was expended before the project reached completion and was effective. It is based on the expected time to complete each alternative and the FY18 federal discount rate of 2.75%.

All of the costs were calculated in 2017 dollars.

Alternative 1 is the least expensive alternative at $132,000 in annual average cost. These costs are solely based on future lampricide costs.

Alternative 2 is the most expensive with an average annual cost of $226,000. This alternative requires the movement and rebuild of the existing weir to fit the desired outcome of the project.

Alternative 3 has an average annual cost of $157,000. It alters the existing weir to meet the desired outcome of the project.

An additional breakdown of the parametric costs can be found in the **Cost Engineering** appendix.

Table 10 – Cost of Alternatives

Including Interest During Construction, and Present Values 2017 dollars, FY18 Interest Rate of 2.75%			
Costs	**Alt 1**	**Alt 2**	**Alt 3**
Construction Costs	Without Project Conditions	Permanent Lamprey Barrier at/or downstream of MNDR Weir	Modify the existing weir structure
Construction Cost	$ -	$ 2,615,000	$ 1,617,000
Contingency	$ -	$ 654,000	$ 312,000
TOTAL CONSTRUCTION COSTS*[1]	**$ -**	**$ 3,269,000**	**$ 1,929,000**
Non Construction Costs			
***LERRDs*[2]**	**$ -**	**$ 12,000**	**$ 12,000**
Planning, Engineering & Design(PED)			
Total PED*	**$ -**	**$ 795,000**	**$ 486,000**
Construction Management			
Total Construction Management*	**$ -**	**$ 424,000**	**$ 260,000**
OMRR&R Costs[3]	$ -	$ 58,000	$ 36,000
TOTAL PROJECT COST[1]	**$ -**	**$ 4,500,000**	**$ 2,687,000**
Interest During Construction[4]	$ -	$ 33,000	$ 28,000
Cost of Lampricide Costs[5]	$ 3,483,333	$ 1,350,000	$ 1,350,000
TOTAL ALTERNATIVE COSTS[1]	**$ 3,483,000**	**$ 5,883,000**	**$ 4,065,000**
TOTAL PV OF ALTERNATIVE COSTS – FY17[1]	**$ 132,000**	**$ 223,000**	**$ 154,000**
Annual Monitoring Costs[6]	$ -	$ 3,000	$ 3,000
TOTAL AVERAGE ANNUAL COSTS[7]	**$ 132,000**	**$ 226,000**	**$ 157,000**

* Further breakdown of Construction, PED and Construction Management costs see the cost appendix
1. Costs have been rounded to the nearest thousand
2. Lands, Easements, Rights-Of-Way, Relocation and Disposal
3. Operation, Maintenance, Repair, Restoration and Rehabilitation costs are presented in present value terms
4. Interest During Construction calculation is based on a 8 month construction period at FY18 rate of 2.75%
5. Costs associated with ongoing lampricide treatments
6. Monitoring costs are assumed to be $3,000 annually for collecting data and reporting project performance
7. Utilizing a 50 year project life and FY18 rate of 2.75%

3.5.2.4 Cost Effectiveness and Incremental Cost Analysis

In order to select a cost effective plan, it is necessary to quantify the habitat or output produced by each alternative. The habitat for each alternative is expressed as a unitary measure and is based on a yearly average (Average Annual Habitat Unit, AAHU). HUs that are expected to exist in the future without-project conditions are estimated and then compared to each action-oriented alternative so that the "lift" or net production of each alternative can be identified.

In this study, a habitat unit is the level of lamprey removed or avoided from the Great Lakes and surrounding watershed. The number of units before any action is taken is assumed to be 520 adult

spawning capable sea lamprey. This is based on historical trapping and surveying. Historical trapping though has been done in limited scale and with temporary traps. This likely has led to an underestimation of actual lamprey in the area.

Under the existing project environment, the No Action Plan, or Alternative 1, 130 sea lamprey are expected to be annually captured in the project area. Alternatives 2 and 3 both are expected to capture 315 sea lamprey. **Table 11** shows a breakdown of the cost effectiveness of each alternative.

Table 11 – Cost Effectiveness Analysis in 2017 Dollars

Alternative	Average Annual Cost	Average Annual Habitat Units	AAC/AAHU (Lift)	Cost Effective
Alternative 1	$132,000	130	$1,015	Y
Alternative 2	$226,000	315	$717	N
Alternative 3	$157,000	315	$498	Y

Based on the cost effective analysis, Alternative 1 has an annual average cost per average annual habitat unit of $1,015. Alternative 2 has an annual average cost per average annual habitat unit of $717. Alternative 3 has an annual average cost per average annual habitat unit of $498. Because Alternative 2 has the same AAHU as Alternative 3 and costs more money, it is not considered cost effective. **Figure 16** shows a graphical depiction of the Average Annual Costs per Habitat Unit of each alternative.

Figure 16 – Average Annual Cost per Habitat Unit in 2017 Dollars

Figure 17 shows the average annual cost vs. the average annual habitat units for each alternative. In it you can see that Alternative 2 is not cost effective because it has the same output as Alternative 3 but at a higher cost.

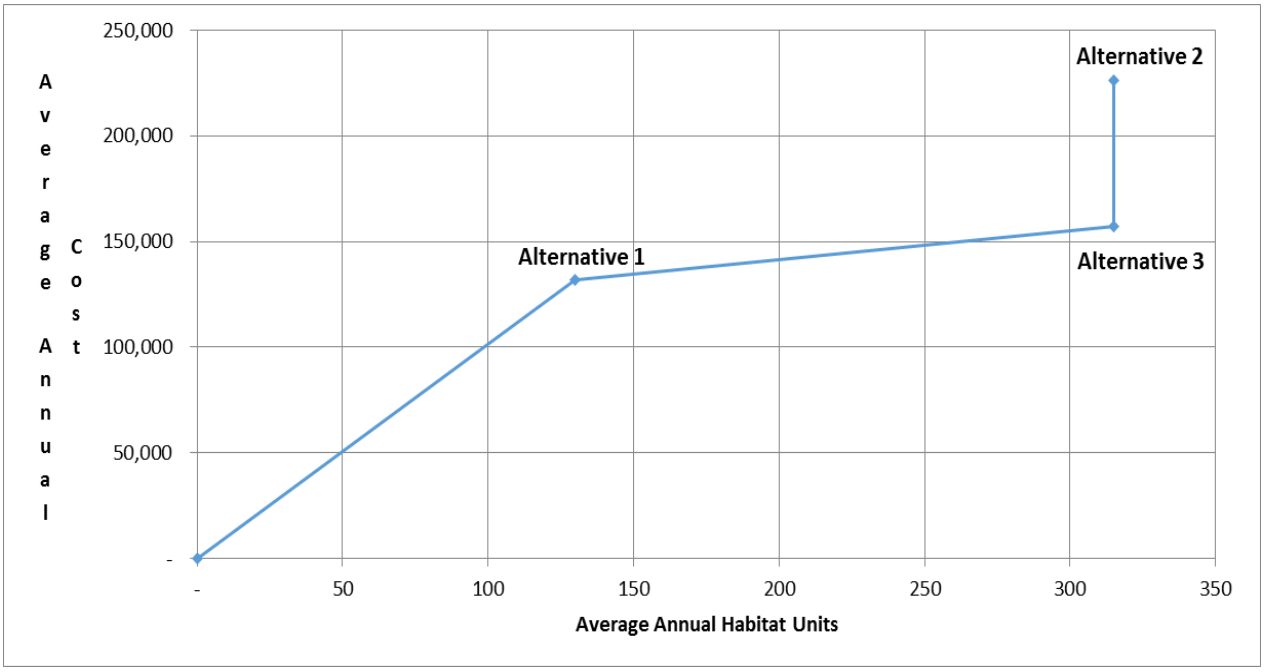

Figure 17 – Cost Effectiveness Frontier

Incremental cost analysis is utilized to determine if there is a benefit to increasing the scope of project. It is similar to marginal benefit vs. marginal cost analysis. If the incremental cost per AAHU increases from one alternative to the next, it would not necessarily be considered cost effective. If the incremental cost were to decrease from an extension of one project to the next, then there is a greater justification to expand the scope of the project. Given that Alternative 1 is the Without Project Condition, we will compare its incremental costs against that of Alternatives 2 and 3 (**Table 12**).

Table 12 – Incremental Cost Analysis in 2017 Dollars

Alternative	Average Annual Costs	Incremental Cost	Average Annual Habitat Units (LIFT)	Incremental Output	Incremental Cost Per HU
Alternative 1	$132,000	$132,000	130	130	$1,015
Alternative 2*	$226,000	$69,000	315	185	$373
Alternative 3**	$157,000	$25,000	315	185	$135

* Alternative 2 is not cost effective.

** Incremental cost of Alternative 3 is compared against Alternative 1 because Alternative 3 provides equal AAHU to Alternative 2.

Alternative 1, the no action plan, actually has the action of lampricide taking place every three years and temporary traps at the existing weir annually. A true No Action Plan would remove those costs and any benefit. As a result, Alternative 1 is compared against a zero cost/zero benefit scenario.

Alternative 1 has an incremental cost per habitat unit that is equivalent to its average annual cost per average annual habitat unit which is $1,015.

Alternative 2 has an incremental cost that is $69,000 annually more than Alternative 1 while providing an incremental benefit of 185 AAHU. This means that the incremental cost per HU for Alternative 2 is $373, which means it would be effective to select Alternative 2 over Alternative 1.

Alternative 3 is compared against Alternative 1 for incremental costs and benefits because Alternative 2 and Alternative 3 have the same expected annual habitat units, meaning one is not cost effective.

Alternative 3 has an incremental cost that is $25,000 annually more than Alternative 1 while providing an incremental benefit of 185 AAHU. This means that the incremental cost per HU for Alternative 3 is $135. The incremental cost is less than Alternative 2, which means Alternative 2 is not cost effective. As a result, it is effective to select Alternative 3 over Alternative 1 and Alternative 2.

Since Alternative 1 is the current without project condition, for an additional $25,000 average annual cost, we can increase AAHU by 185 when selecting Alternative 3.

3.5.2.5 Economics Conclusion

Although cost effectiveness and incremental cost analysis do not provide a discrete decision criterion, they do provide for the ability to compare the relevant changes in cost and environmental outputs upon which such decisions may be made. Alternative 3 has the lowest annual average cost per average annual habitat unit and it also has a low incremental cost over Alternative 1. In addition, there are the benefits of annual lampricide costs and fish restocking savings that also favor Alternatives 2 and 3 over the Alternative 1. These savings free up funds and resources to be put toward other projects that create a positive externality for the project that cannot be effectively quantified. Given these reasons, Alternative 3 is identified as the NER or Tentatively Selected Plan.

It should be noted that under each of these alternatives, there is an additional considerable benefit that is not quantified from the reduction of available spawning area and the remaining larval sea lamprey after lampricide treatments. The USFWS reported that over the period from 1995-2012 an estimated 3,600,000 larval spawns occurred in the Manistee watershed. Though it is unknown the quantity of transformers that become adult sea lamprey, the No Action alternative has led to a 90% reduction in the larval population which Alternative 3 would continue to improve.

3.5.2.6 Acceptability, Completeness, Effectiveness, Efficiency

Acceptability: Acceptability is the extent to which the alternative plans are acceptable in terms of applicable laws, regulations and public policies. In addition, an ecosystem restoration plan should be acceptable to State and Federal resource agencies, local governments and stakeholders. There should be evidence of broad-based public consensus and support for the plan. The recommended alternative must be acceptable to the study cost-sharing partner (the GLFC). However, this does not mean that the recommended alternative must be the locally preferred plan.

The recommended alternative calls for a less-costly, more-effective method to trap and remove spawning-phase, adult sea lamprey from the system, with the least negative impact(s) to the Little Manistee River ecosystem and hydraulic function. This plan is most congruent with the desired future conditions of the Little Manistee River watershed, in which local, state and Federal agencies are working together to maintain existing riverine conditions. Officials and operators of the MDNR fish weir and egg harvesting facility have stated that implementation of Alternative 3 would provide additional flow control and enhance their ability to control the salmonid migration. USFWS operators indicated that the implementation of Alternative 3 should help to reduce their reliance on lampricide upstream of the weir. Representatives from the US Forest Service also found the modification of the existing MDNR fish

weir, Alternative 3, more acceptable than alternative locations because it minimizes the impacts to the Wild and Scenic River designation.

All three resource agencies expressed concern with Alternative 2, the demolition of the MDNR weir and construction of a new weir in-kind. Construction of a new lamprey barrier at the existing fish weir would disrupt fish migration and the functionality of the egg harvesting facility. A new barrier and trap complex would require additional real estate, cause impacts to wetlands and could jeopardize the river's Wild and Scenic designation.

Completeness: Completeness is the extent to which the alternative plans provide and account for all necessary investments or other actions to ensure the realization of the planning objectives, including actions by other Federal and non-Federal entities.

A plan must provide and account for all necessary components or other actions needed to ensure the realization of the planned restoration outputs. This may require relating the plan to other types of public or private actions (i.e. TFM treatments) if these actions are crucial to the outcome of the restoration objective. Real estate, operations and maintenance, monitoring, and sponsorship factors must be considered. Where there is uncertainty concerning the functioning of certain restoration features and an adaptive management and/or operation plan has been proposed, it must be accounted for in the plan.

Both action alternatives are complete alternatives and would effectively meet the objective of capturing and removing spawning-phase, adult sea lamprey from the Little Manistee River without additional actions from public or private entities.

Effectiveness: Effectiveness is the extent to which the alternative plans contribute to achieve the planning objectives. An ecosystem restoration plan must make a significant contribution to addressing the specified restoration problems or opportunities (i.e. restore important ecosystem structure or function to some meaningful degree). The problems identified that may be addressed under Section 506 authority are directly related to the presence and proliferation of sea lamprey in the Little Manistee River and their negative impacts to the native fishery of Lake Michigan.

Table 13 below uses a ranking of the project objectives 1 to 4, with 4 being the most important, and multiplies it with a benefit evaluation assigned to each alternative. The scale is 1 – 5 with 1 being the most beneficial and 5 being the least. The evaluations are based on discussions with project stakeholders and members of the PDT. It should be noted that when we consider the "total" performance for each alternative, the "no-action" alternative clearly provides the least amount of benefit to the Little Manistee River ecosystem.

Table 13 Alternative Evaluation

Alternatives	Impact to egg collection process (3)[1]	Ability to control adult lamprey (4)[1]	Impact to "Wild and Scenic" (1)[1]	Total
Alternative 1- No Action (continued treatment)	3[2]	20	1	24
Alternative 2 - Construct a Permanent Lamprey Barrier at MNDR Weir	3[3]	4	5	12
Alternative 3 - Modify the existing weir structure	3	4	3	**10[4]**

1 – Project Objective Priority **()**
2 – Rankings (Benefit Scale) 1 – 5 with 1 = most beneficial; 5 = least beneficial
3 – Alternative Evaluations = Ranking x Objective priority
4 -The lower total indicates a more beneficial alternative

Alternatives 2 and 3 also contribute to the overall objective of the GLFER program by reducing the sea lamprey population to restore fisheries in the Great Lakes, and minimize the ecological effects of the control program. Both action alternatives provide protection from lamprey proliferation throughout the Little Manistee Watershed while reducing the FWS reliance on lampricide.

Efficiency: Efficiency is the extent to which a recommended alternative plan represents a cost-effective means of achieving the objectives. It is determined that the plan's restoration outputs cannot be produced more cost effectively by another planning alternative, or by another agency or institution. More detailed cost estimates are produced for alternatives carried through for a more detailed analysis after screening based on the acceptability, completeness, effectiveness, and efficiency evaluation criteria **(Table 14)**.

Table 14 Alternative comparison table

Alternatives	Lamprey protection (flood event)	Post implementation treatment costs	Treatment cost saved over 50 yrs.	Total project cost
Alternative 1- No Action[2]	10% (10 year)	$209,000/3 yrs.	0	$3,483,000[1]
Alternative 2 - Construct a Permanent Lamprey Barrier at the MNDR Weir[3]	10/4% (10/25 year)	$81,000/3 yrs.	$2,187,333	$5,885,000
Alternative 3 - Modify the existing weir structure[3]	10/4% (10/25 year)	$81,000/3 yrs.	$2,187,333	$4,066,000

[1]Based on treatment costs of $209,000/3 yr.-application for a 50 year project life (value rounded to nearest thousand)
[2]Treatment cost for 45 miles of river
[3]Treatment cost for 6 miles of river

3.5.2.7 Trade-off Analysis

Alternative 1 – No Action (temporary trap and TFM)
Advantages - This alternative would be the lowest cost alternative in the short term to implement because there would be no action on the part of the USACE, and the USFWS would continue to operate as it has by using temporary traps and TFM as scheduled, in coordination with the GLFC and the Michigan DNR that operates the fish egg taking weir for the collection of salmonid eggs for use in their hatchery operation.

Disadvantages - In this alternative, the capture of spawning-phase adult lamprey would continue to be more by chance than by design. Capture rates would continue to be lower as compared to a permanent trap, thus the GLFC and USFWS goal of increasing trapping efficiency of adults would not be advanced. The existing spillway is not an effective barrier to upstream lamprey migration and the costly and extensive treatment of the river upstream of the weir would continue to be required.

Conclusion - The No Action alternative is not nearly as effective as those action alternatives that implement AWT systems and provide sufficient head differential at the spillway to minimize lamprey passage during normal spring runoff events. Though TFM is an effective tool for controlling larval phase lamprey, the USFWS and the GLFC would like to reduce their costs and reliance on chemicals in the sea lamprey control program. This alternative is expected to involve higher costs compared to installing a more efficient lamprey blocking barrier at the spillway and AWT system. Since this alternative does not meet the goals of this study or the GLFC and the USFWS (the project sponsors/stakeholders and proponents), this alternative is not recommended for implementation.

Alternative 2 – Demolition of the Existing MDNR Weir Structure and Construction of a Permanent Lamprey Barrier and Trap at the Weir Location
Advantages - Alternative 2 provides the opportunity for the GLFC to realize reduced reliance on lampricide to control sea lamprey within the Little Manistee River, while also affording the MDNR an updated weir facility. The reconstructed weir would allow the MDNR to exert increased flow control with greater precision increasing sea lamprey trapping efficiency and the efficiency of the egg collection process. Finally, Alternative 2 is not likely to jeopardize the River's Wild and Scenic nomination.

Disadvantages –The costs involved in reconstruction of the existing egg take weir do not contribute to lamprey removal. While upgrades to the MDNR facility are desirable, they are not required for accomplishment of project purpose, lamprey blockage, which is the primary purpose of the environmental project. Construction of a blocking weir limits the passage of desirable fish species.

Conclusion - While this alternative meets the goals of this study and is considered integrated sea lamprey control (when combined with lampricide or other measures such as emerging pheromone technology) that combines measures that effectively address both spawning-phase adults and larvae, this alternative is not recommended for implementation based on costs and environmental impacts.

Alternative 3 – Modify the existing weir structure
Advantages - Alternative 3 provides a cost effective method to execute sea lamprey control in the Little Manistee River and an opportunity to reduce the reliance on lampricide within the lamprey control program. Alternative 3 removes the concrete spillway and establishes a weir system that will block lamprey passage up to the 4% discharge (25 year) event, raises the access walkway above the 100 year flood event and results in the installation of a permanent AWT at the egg collection weir. MDNR collaboration on weir refurbishment allows the project to take advantage of state funds

Disadvantages – The existing MDNR egg collection weir is not reconstructed to be more efficient but the purpose of the project is improved lamprey blockage.

Conclusion - This alternative meets the goals of this study and demonstrates significant additional lamprey control ecosystem benefits. The reconstruction of the spillway to a weir design is considered integrated sea lamprey control (when combined with lampricide or other measures such as emerging pheromone technology) that combines measures that effectively address both spawning-phase adults and larvae. This alternative is recommended for implementation as it is the most cost effective alternative and the locally preferred alternative.

3.5.2.8 Significance

Institutional Recognition of Significance
Significance based on institutional recognition means that the importance of an environmental resource is acknowledged in the laws, adopted plans, and other policy statements of public agencies, tribes, or private groups. Sources of institutional recognition include public laws, executive orders, rules and regulations, treaties, and other policy statements of the Federal Government; plans, laws, resolutions, and other policy statements of states with jurisdiction in the planning area; laws, plans, codes, ordinances, and other policy statements of regional and local public entities with jurisdiction in the planning area; and charters, bylaws, and other policy statements of private groups. The institutional recognition pertaining to this sea lamprey project includes:

GLFER, Section 506 of the WRDA 2000, as amended by Section 5011 of WRDA 2007 – [a USACE program for implementing projects for restoration of aquatic habitat in the Great Lakes watershed.] Frequently, the program is implemented in partnership with the GLFC. A GLFER Project Review Committee helps solicit, review and evaluate GLFER proposals for potential projects.

Executive Order (EO) 13340, Establishment of Great Lakes Interagency Task Force and Promotion of a Regional Collaboration of National Significance for the Great Lakes (2004) – This EO identified the Great Lakes as a national treasure and defined a Federal policy to support local and regional efforts to restore and protect the Great Lakes ecosystem through the establishment of regional collaboration. A number of activities have been accomplished by Federal agencies working in partnership with state, tribal and local governments in response to the EO. The USACE has been a major participant in these activities. The EO established the Great Lakes Interagency Task Force. The Task Force worked with the governors of the eight Great Lakes states, mayors, and tribal leaders to establish the Great Lakes Regional Collaboration. The initial goal of the Collaboration was to develop a

"strategy for the protection and restoration of the Great Lakes" within 1 year. The Collaboration developed the strategy by using teams consisting of 1,500 stakeholders. The teams identified eight priority issues, of which "habitat/species" restoration and protection and "invasive species" are addressed by this study.

P.L. 111-88 - Interior Department and Further Continuing Appropriations, Fiscal Year 2010 (2009) – This P.L. authorized funding for the Great Lakes Restoration Initiative [GLRI]). Invasive species control is one of the main focus areas for the GLRI as is habitat improvements within the Great Lakes.

E.O. 13112 – Safeguarding the Nation from the Impacts of Invasive Species – Policy of the U.S. to prevent the introduction, establishment, and spread of invasive species, as well as to eradicate and control populations of invasive species that are established.

Fish and Wildlife Conservation Act of 1980 – All Federal departments and agencies to the extent practicable and consistent with the agencies' authorities should conserve and promote conservation of non-game fish and wildlife, and their habitats. Actions to control the invasive sea lamprey directly benefit the Great Lakes fish, and indirectly benefit wildlife dependent on Great Lakes fish.

EO 11514, Protection and Enhancement of Environmental Quality (1970), as amended by EO 11991 (1977) – The Federal Government shall provide leadership in protecting and enhancing the quality of the Nation's environment to sustain and enrich human life. Actions to control the invasive sea lamprey directly benefit the Great Lakes ecosystem.

Convention on Great Lakes Fisheries between the United States of America and Canada (1954) – International agreement authorizing the creation of the GLFC. Article I included "eradicate or minimize the populations of the sea lamprey" in the Great Lakes.

Executive Order 11988 Floodplain Management requires federal agencies to avoid to the extent possible the long and short-term adverse impacts associated with the occupancy and modification of flood plains and to avoid direct and indirect support of floodplain development wherever there is a practicable alternative.

Public Recognition of Significance

Public recognition means that some segment of the general public recognizes the importance of an environmental resource, as evidenced by people engaged in activities that reflect an interest or concern for that particular resource. Such activities may involve membership in an organization, financial contributions to resource-related efforts, and providing volunteer labor and correspondence regarding the importance of the resource.

The devastating effect sea lamprey had on Great Lakes fisheries is commonly known. As evident by the length of time the sea lamprey control program has been in existence, support of lamprey control is generally well accepted by the public due to the great importance of commercial and recreational fisheries within the Great Lakes. The Little Manistee Watershed Conservation Council (LMWCC) is a non-profit group represented by officials from state and local agencies to restore, preserve and protect the coldwater ecosystem of the Little Manistee River. Their efforts include collaboration with MDNR, U.S. Forest Service, USFWS, the tribes,

Trout Unlimited and local communities to mobilize resources to accomplish a variety of projects in the Little Manistee Watershed. Their efforts also include coordination with school districts throughout the State of Michigan to provide educational opportunities to children of all ages.

Technical Recognition of Significance

Technical recognition means that the resource qualifies as significant based on its "technical" merits, which are based on scientific knowledge or judgment of critical resource characteristics. Whether a resource is determined to be significant may of course vary based on differences across geographical areas and spatial scale. Although the technical significance of a resource may depend on whether a local, regional, or national perspective is undertaken, typically a watershed or larger (e.g., ecosystem, landscape, or ecoregion) context should be considered. Technical significance should be described in terms of one or more of the following criteria or concepts: scarcity, representation, status and trends, connectivity, limiting habitat, and biodiversity.

Scarcity is a measure of a resource's relative abundance within a specified geographic range. Generally, scientists consider a habitat or ecosystem to be rare if it occupies a narrow geographic range (i.e., limited to a few locations) or occurs in small groupings. Unique resources, unlike any others found within a specified range, may also be considered significant, as well as resources that are threatened by interference from both human and natural causes.

Compared to coldwater habitat, warmwater habitat is abundant in the area near the project; there are over 100 warmwater lakes in Grand Traverse County and Kalkaska County and more than 11,000 inland lakes in the State (MDNR 2012b) of which the vast majority are warmwater lakes. Conversely, less than 20 percent of rivers in Michigan's Lower Peninsula have coldwater characteristics (Seelbach et. al 1997). Conversely, less than 20 percent of rivers in Michigan's Lower Peninsula have coldwater characteristics (Seelbach et. al 1997). Coldwater streams naturally tend to have higher densities of game fish and other aquatic species and provide spawning grounds and nursery areas for Great Lakes species. These factors support the importance of protecting coldwater tributaries of the Great Lakes. The Little Manistee River is a state recognized Blue Ribbon Trout Stream.

While the Great Lakes Basin supports scarce habitat types and species, nonnative and invasive organisms pose a threat to these unique and endemic species of the Great Lakes Basin. Invasive species have already changed the Great Lakes by competing with native species for food and habitat. It is estimated that over the past 200 years, more than 180 nonnative species have entered the Great Lakes (Sharp 2007). The action alternatives would reduce the impact of the parasitic lamprey on the Great Lakes Fishery. Thus, the alternative plans would protect the Great Lakes and their scarce resources.

Representation is a measure of a resource's ability to exemplify the natural habitat or ecosystems within a specified range. The presence of a large number and percentage of native species–and the absence of exotic species–implies representation, as does the presence of undisturbed habitat.

Ecologically, the landscape of the Little Manistee River features and complex habitat types are globally unique, supporting a rich and diverse variety of species. Important migration corridors and critical breeding, feeding, and resting areas are present for numerous species of migratory and resident birds. Overall, 53.2% of the land in the Little Manistee River watershed is owned by either the State of Michigan as part of the Pere Marquette State Forest or by the United States Forest Service (USFS) as

part of the Manistee National Forest (USDA Forest Service 2001). The USFS maintains three rustic campgrounds within the watershed (Old Grade, Driftwood Valley, and Bear Track) and the Michigan Department of Natural Resources (MDNR) maintains one rustic campground at Carrieville. The Little Manistee River is a U.S. Forest Service Wild and Scenic River nominee. If the Little Manistee is adopted into the Wild and Scenic River System the watershed will remain largely undisturbed.

Status and Trends measures the relationship between previous, current, and future conditions. In the past, the fragile nature of the Great Lakes was not recognized, and the lakes were mistreated for economic gain, placing the ecosystem under tremendous stress from human activities. History has shown that the Great Lakes are highly sensitive to biological and chemical stresses. The GLFC recognizes the importance of sea lamprey control in restoring the Great Lakes Fishery. The international organization is works to balance sea lamprey control activities against impacts to native fisheries.

Connectivity is the measure of a resource's connection to other significant natural habitats. Connectivity within the Great Lakes may be described at both the regional scale and the national scale. At the regional scale, the Great Lakes cover about 302,000 mi2 (782,176.4 km2) and include part or all of the eight U.S. states of Minnesota, Wisconsin, Illinois, Indiana, Michigan, Ohio, Pennsylvania, and New York, and the Canadian provinces of Ontario and Quebec. The GLB also features an extensive watershed with approximately 5,000 tributaries, more than 1,000 mi (1,609.3 km) of shoreline, and approximately 35,000 islands. Within the region are significant ecological communities (sand dunes, cobble beaches, coastal wetlands, alvars, prairies, savannas, forests, fens, etc.) that are globally unique and support approximately 279 species plus habitat types that have been documented as globally rare. The aforementioned ecological communities are all significant habitats at the regional scale that are connected to some extent by the Great Lakes and their contributing tributaries.

Limiting Habitat measures the resources that support significant species. Coldwater streams are areas or reaches of streams and small rivers with water cold enough throughout the year to support coldwater fish such as brook trout. Brook trout, Atlantic salmon, and the non-native brown and rainbow trout thrive in cold water. Other species that inhabit these streams include slimy sculpin, blacknosed and longnose dace, and white suckers. The Little Manistee River is the sole source of steelhead eggs for the vast majority of the steelhead stocked in Michigan. (Tonello, 2005) The Little Manistee provides critical spawning and foraging habitat for species that significant to the ecological and economic health of the Great Lakes Fishery.

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3.5.2.9 Climate Change

The USACE Climate Hydrology Assessment Tool was used to examine observed streamflow trends in the vicinity of the project. The tool was used to examine the streamflow trends in the annual maximum daily discharge. The hydrologic time series of annual maximum daily discharge at the gage on the Little Manistee River about 12 miles upstream of the project area near Wellston, MI (412550) is shown in the **figure 18** below. The gage exhibits an increasing trend in annual maximum daily streamflow; however, this trend is not statistically significant as indicated by the high p-value (0.16123). This indicates that overall, there has been no change in flood risk, as measured by the annual maximum flood, over the last 19-year period of record (1996-2015). The risk that the proposed project would be influenced by the fluctuating water levels of Lake Michigan is low because the project is location four miles upstream of the lake.

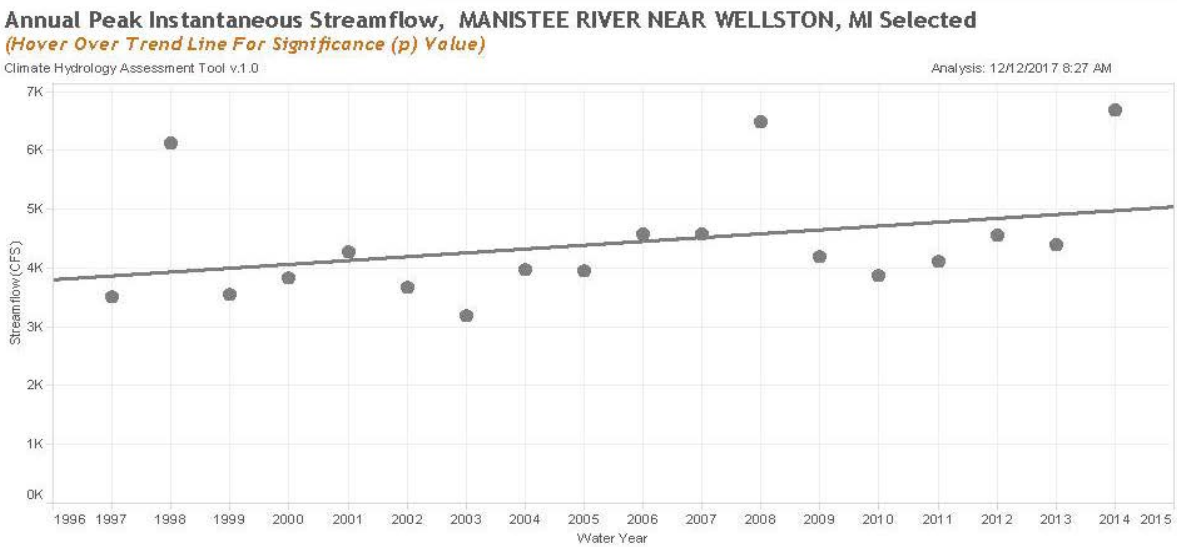


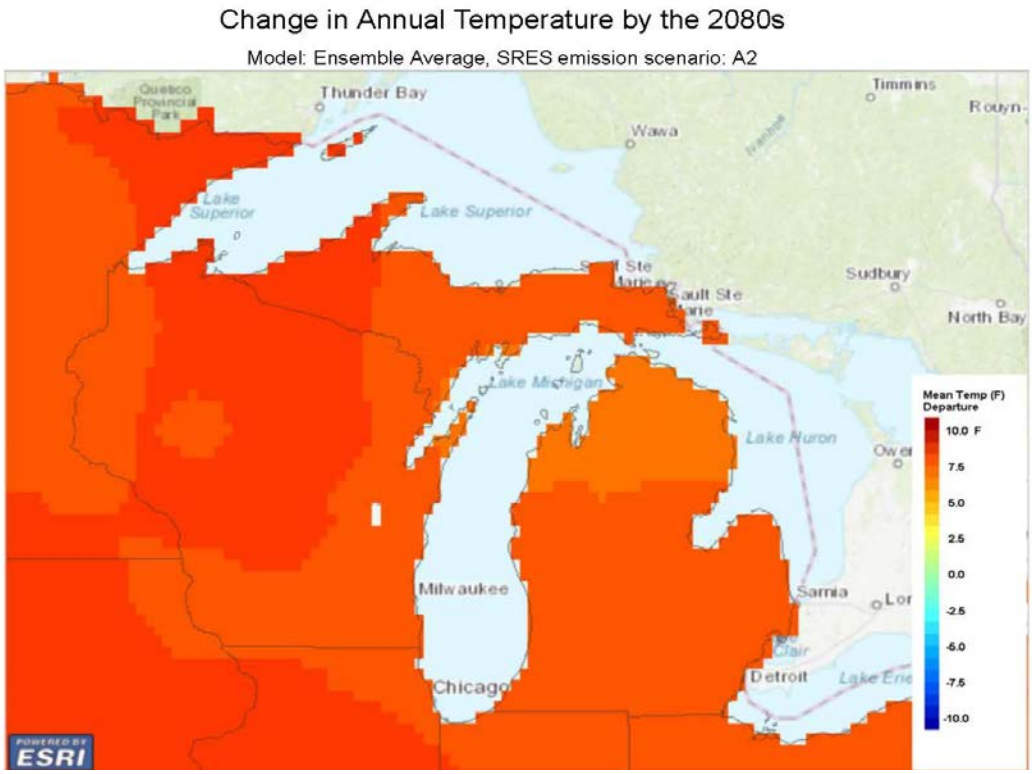
Figure 18 Historical streamflow trend

Further, the USACE Watershed Climate Vulnerability Assessment Tool was run for Hydrologic Unit Code 0406, which includes the Little Manistee River basin. The results of this investigation show that there no indicated threats ("no HUC's vulnerable") of note under the Ecosystem Restoration business line under both "wet" and "dry" for scenarios for the 2050 and 2085 timeframes. The tool does indicate an increase in annual peak discharges, which could result in higher discharges into the future, but (as discussed previously) due to the short period of record for this gage, this projection may be inaccurate. Recognizing this, the Nonstationarity Tool was instead launched for the Manistee River gage (which is a branch of the same system) at Sherman, MI (4124000). This gage has a continuous period of record that spans 80+ years on a river that has very similar land-use, climatological, and hydrologic characteristics as the Little Manistee. Model output for this gage shows that no Nonstationarity is detected for the Manistee River watershed as any noted changes are considered "statistically-insignificant".

Literature Review

The USACE publication *Recent US Climate Change and Hydrology Literature Applicable to US Army Corps of Engineers Missions* (April 28, 2015) is a climate change and hydrology literature synthesis for the USACE missions in the U.S. The text below is a summary of future climate projection findings for the Great Lakes region, including the Manistee River Basin:

"There is strong consensus in the literature that air temperatures will increase in the study region over the next century. The projected increase in mean annual air temperature ranges from 0 to 7ºC by the latter half of the 21st century. Reasonable consensus is also seen in the literature with respect to projected increases in extreme temperature events, including more frequent, longer, and more intense summer heat waves (the figure below indicates a warming trend in the air temperatures of the Great Lakes Region over the next 60 plus years).



Map data Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

Figure 19 Regional temperature outlook

However, projections of precipitation in the study area are less certain than those associated with air temperature. Most studies project increases, but other studies project decreases, and some project variability within the region or by season. Similarly, while the projections tend toward more intense and frequent storm events than the recent past, some show a reduction in parts of the Great Lakes region.

As such, significant uncertainty exists in hydrologic projections for this region. Projections generated by coupling GCMs with macro–scale hydrologic models in some cases indicate a reduction in future streamflow but in other cases indicate a potential increase in streamflow in portions of the Great Lakes region."

> Furthermore, climate change is likewise expected to result in increased water temperatures of flowing water ecosystems in the Great Lakes and these increases in water temperature are expected to closely mirror air temperature increases (Kling et al. 2003, Allan et al. 2005). The response of stream temperature to climate change is complex and dependent on topography and geography of the drainage basin (Meisner et al. 1988) and surrounding vegetation (Hauer and Hill 1996). The temperature change presents a low risk to lamprey barrier operations because lamprey migration is triggered by a change in temperature. Warm water temperatures earlier in the year could contribute to a longer migration season and greater operational costs.

3.5.3 Risk and Uncertainty

When the costs and outputs of alternative restoration plans are uncertain and/or there are substantive risks that outcomes will not be achieved (which may often be the case) the selection of a Recommended

Alternative becomes more complex. It is essential to document the assumptions made and uncertainties encountered during the course of planning analyses. Restoration of some types of ecosystems may have relatively low risk, or remove existing risk. For example, removal of a dam to restore hydrologic function and fish passage to a river removes the existing risk of flooding from a dam failure as opposed to adding risk. When identifying the Recommended Alternative, the associated risk and uncertainty of achieving the proposed level of outputs must be considered.

Also, if two plans have similar outputs but one plan costs slightly more, according to cost effectiveness guidelines, the more expensive plan would be dropped from further consideration. However, it might be possible that, due to uncertainties beyond the control or knowledge of the planning team, the slightly more expensive plan will actually produce greater ecological output than originally estimated, in effect qualifying it as a cost effective plan. But without taking into account the uncertainty inherent in the estimate of outputs, that plan would have been excluded from further consideration.

There is minimal uncertainty anticipated with the proposed barrier design, Alternative 3. The design was modeled hydraulically and barrier performance over a range of river discharge scenarios is well understood. The design requirements for lamprey blockage are well understood and even with effective blockage, lampricide treatments downstream of the weir will continue to be required but overall treatment costs will be diminished with the much shorter river length requiring TFM treatment for larval lamprey control. See the project specific risk and uncertainty table in **Appendix G**.

3.6 RECOMMENDED PLAN

3.6.1 Recommended Plan Description

The recommended alternative, **Alternative 3**, consists of the installation of a temporary rock ford to provide access during removal of the existing concrete spillway, installation of a SSP weir (lamprey barrier) with stop logs to maintain the required 18 inch differential between the barrier crest height and the tailwater surface elevation to prevent upstream lamprey migration at the 4% (25 year) discharge event, installation of a fish guidance weir at the downstream confluence of the spillway channel and river (**Figure 14)**, armoring the spillway banks, reconstruction of the portage and the walkway over the existing weir to safely access the AWT placed into the far bay of the MDNR weir. There is a public interest in the control of sea lamprey of which this project is one component. The trap project is designed to enhance the fishery of the Great Lakes, thus assisting in protecting the public trust in the Great Lakes fishery. The project is located on riparian bottomlands of the Little Manistee River at the MDNR weir and egg collection facility (See **Appendix A** for additional design detail).

Construction of the temporary ford for equipment access for the spillway removal and weir construction, as part of the implementation of **Alternative 3**, will be required for the removal 1500 CYD of material using 370 CYD of cut material for backfill to shape the existing riverbanks; construction of a low head adjustable (stop logs) spillway that would block lamprey migration up to the 4% (25 year) flood event; raising the existing walkway to an elevation that would accommodate the 1% (100 year) flood event (See **Appendix B** for additional detail); extending the walkway across the entire structure to allow for access for operations and maintenance. Scour stone will be placed on the upstream and downstream toe of the new spillway. A directional weir on pilings will be installed at the confluence of the spillway discharge and the main river to divert fish toward the MDNR egg collection facility. Rock riprap or field stone will be placed on both banks of the spillway to protect the riverbanks from scour; the existing canoe/kayak portage path will be reconstructed in-kind; construct an area to accommodate

an Attractant Water Trap (AWT) in one bay of the weir; a fish guidance weir will be installed downstream of the proposed spillway weir. The threatened Eastern massasauga rattlesnake has been seen in the vicinity of the weir facility. USFWS and USFS personnel, through environmental coordination, agree that special considerations need to be incorporated into the construction sequence to minimize potential construction impacts caused by the implementation of **Alternative 3**. Finally, the selected alternative has the least costs other than the No Action alternative, minimizes potential impacts to T&E species known to be in the vicinity, causes no stage increase or harmful interference to existing water surface elevations and minimizes additional impacts to the river study designation as Wild and Scenic.

3.6.2 Estimated Project Costs and Schedule.

Once the Project Partnership Agreement (PPA) is executed, the USACE would begin preparing plans and specifications for the proposed project. Upon completion of plans and specifications, the construction contract would be advertised. The USACE would award, supervise, and administer the construction contract (**Table 15**). Duration of construction would be approximately four months. After construction, the USACE would transfer the project to the project partner(s) for operation and maintenance, and would provide an operation and maintenance manual. The estimated schedule for implementing major project phases is provided in **Table 16** and would be documented in a Project Management Plan for the Design and Implementation Phase.

Table 15 Estimated Project Costs and Apportionment

	FY2017	FY20xx+1	FY20xx+2	FY20xx+3
Feasibility Study Costs*				
FED share	$ 269,000			
non-FED	$ 91,000			
Design & Implementation Costs				
Design Analyses, Plans & Specs		$ 953,000		
Construction		$ 2,421,000		
LERRDs		$ 13,000		
FED share		$ 2,193,000		
non-FED		$ 1,193,000		
non-FED cash/WIK				
non-FED LERRD		$ 13,000		
Total Project Cost	**$ 360,000**	**$ 3,387,000**		
FED share	$ 269,000	$ 2,021,000		
non-FED	$ 91,000	$ 1,100,000		

*Up to first $100,000 is 100% federal responsibility. All costs after PPA execution are 65%/35%

Table 16 Implementation Schedule

Milestone	Scheduled	Actual
Initiate Feasibility Phase	April 2013	February 2013
Submit Federal Interest Determination Report	May 2013	May 2013
MSC Approved FID report	August 2013	August 2013
Execute Feasibility Cost Share Agreement	N/A	N/A
Submit MDM Draft DPR	February 2018	
MSC Approved MDM Draft DPR	May 2018	
Submit draft Final DPR	August 2018	
MSC Approved Decision Document	October 2018	
Project Approval - Initiate D&I phase	October 2018	
Fully Executed PPA	March 2019	
RE Certification	April 2019	
ATR Certified Construction Plans and Specifications	June 2019	
Construction Contract Award	February 2020	
Construction Complete	September 2020	
Project Closeout	November 2020	

3.6.3 Non-Federal Sponsor Responsibilities

Prior to the initiation of the implementation phase, the Federal Government and the non-Federal sponsor will execute a PPA. As listed in the table above, the estimated non-Federal share of the project is about **$1,135,000**.

The O&M discussed in **Section 6.4**, along with additional repair, rehabilitation and replacement (i.e. "OMRR&R") of the project will also be the responsibility of the non-Federal sponsor for the proposed project. The non-Federal sponsor shall, prior to implementation, agree to perform the following items of local cooperation:

1. Provide 35 percent of the separable project costs allocated to environmental restoration as further specified below
   a) Provide the non-Federal share of all complete planning and design work upon execution of the PPA
   b) Provide all lands, easements, and rights-of-way, including suitable borrow and dredged or excavated material disposal areas, and perform or ensure the performance of all relocations determined by the government to be necessary for the construction and O&M of the project
   c) Provide or pay to the government the cost of providing all features required for the construction of the project
   d) Provide, during construction, any additional costs as necessary to make its local contribution equal to 35 percent of the project costs allocated to the implementation of the completed Section 506 project.
2. Contribute all project costs in excess of the Corps GLFER program per-project limitation of $10,000,000
3. For so long as the project remains authorized, operate, maintain, repair, replace, and rehabilitate the completed project or the functional portion of the project at no cost to the government in accordance with applicable federal and state laws and any specific directions prescribed by the government
4. Give the government a right to enter, at reasonable times and in a reasonable manner, upon land that the local sponsor owns or controls for access to the project for the purpose of

inspection and, if necessary, for the purpose of completing, operating, maintaining, repairing, replacing, or rehabilitating the project

5. Assume responsibility for operation, maintenance, repair, replacement, and rehabilitation (OMRR&R) of the project of completed functional portions of the project, including mitigation features, without cost to the government in a manner compatible with the project's authorized purpose and in accordance with applicable federal and state laws and specific directions prescribed by the government in the OMRR&R manual and any subsequent amendments thereto
6. Comply with Section 221 of Public Law (P.L.) 91-611, Flood Control Act of 1970, as amended, and Section 103 of the WRDA of 1986, as amended, which provide that the Secretary of the Army shall not commence the construction of any water resource project or separable element thereof until the nonfederal sponsor has entered into a written agreement to furnish its required cooperation for the project or separable element
7. Hold and save the United States free from damages due to construction of or subsequent maintenance of the project except those damages due to the fault or negligence of the United States or its contractors
8. Keep and maintain books, records, documents, and other evidence pertaining to costs and expenses incurred pursuant to the project to the extent and in such detail as will properly reflect total project costs
9. Perform or cause to be performed such investigations for hazardous substances that are determined necessary to identify the existence and extent of any hazardous substances regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 *U.S. Code* 9601 through 9675, that may exist in, on, or under lands, easements, or rights-of-way necessary for the construction, and O&M of the project, except that the nonfederal sponsor shall not perform investigations of lands, easements, or rights-of-way that the government determines to be subject to navigation servitude without prior written direction by the government
10. Assume complete financial responsibility for all necessary cleanup and response costs for CERCLA-regulated material located in, on, or under lands, easement, or rights-of-way that the government determines necessary for the construction and O&M of the project
11. To the maximum extent practicable, conduct OMRR&R of the project in a manner that will not cause liability to arise under CERCLA
12. Prevent future encroachment or modifications that might interfere with proper functioning of the project
13. Comply with the applicable provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, P.L. 91-646, as amended in Title IV of the Surface Transportation and Uniform Relocation Assistance Act of 1987, P.L. 100-17, and the uniform regulation contained in Part 24 of Title 49, *Code of Federal Regulations* (CFR), in acquiring lands, easements, and rights-of-way for construction and subsequent O&M of the project, and inform all affected persons of applicable benefits, policies, and procedures in connection with said acts
14. Comply with all applicable federal and state laws and regulations, including Section 601 of Title VI of the Civil Rights Act of 1964, P.L. 88-352, and Department of Defense Directive 5500.11 issued pursuant thereto and published in 32 CFR, Part 300, as well as Army Regulation 600-7 entitled "Non-Discrimination on the Basis of Handicap in Programs and Activities Assisted or Conducted by the Department of the Army"

15. Provide 35 percent of that portion of the total cultural resource preservation, mitigation, and data recovery costs attributable to environmental restoration that are in excess of 1 percent of the total amount authorized to be appropriated for environmental restoration
16. Shall not use funds from other Federal programs, including any non-Federal contribution required as a matching share therefor, to meet any of the non-Federal obligations for the project unless the Federal agency providing the Federal portion of such funds verifies in writing that expenditure of such funds for such purpose is authorized

The specific provisions will be contained in the PPA executed by the Corps and the NFS. These provisions will control.

For the draft final report, revisions to this subsection should be coordinated with the non-federal sponsor and limited to those revisions necessitated to resolve Major Subordinate Command (MSC) review comments identified during review of the Major Subordinate Command Decision Meeting (MDM) draft, input from stakeholder and the public during the NEPA public review period and resolve any final non-federal sponsor concerns.

4 ENVIRONMENTAL EFFECTS OF RECOMMENDED PLAN

4.1 – NEPA Organization and Preliminary Scoping

Relevant NEPA appendices are as follows: **Appendix D – Clean Water Act 404(b)(1) Evaluation** and **Appendix H – Agency Coordination**.

In compliance with NEPA, the CEQ guidelines, and Engineer Regulation (ER) 200-2-2, Policy and Procedures for Implementing NEPA, the evaluation of environmental impacts (EA) focuses on those resources and conditions potentially subject to effects and on potentially significant environmental issues deserving of study, and deemphasizes insignificant issues. Some environmental resources and conditions that are often analyzed in an FR and EA have been omitted from detailed analysis because of their inapplicability to this proposed action. The following provides the basis for such exclusions.

Sustainability and Greening. The proposed sea lamprey trap does not require significant resources for construction or operation, nor produce significant emissions once constructed. Methods to implement green building technologies (i.e., utilizing recycled material or recycling waste such as concrete or steel) would be implemented where feasible and are not discussed in detail within this FR and EA.

Environmental Justice. All work occurs in the water and on state lands. No negative impacts will occur to minorities or require displacement of low income citizens. The implementation of the recommended alternative is not expected to impact families or children.

4.2 – Physical Setting and Land Use

4.2.1 – Existing Environment

Climate

Manistee County has a humid continental climate with cold, snowy winters (lake effect snow) and moderately warm summers. Manistee County averages 34.75 inches of precipitation annually of which snowfall equates to nearly 94 inches of snow a year. With the lake effect snows, numerous ski resorts are located within an hour drive from the work site. Monthly average temperatures range from a low of 13 °F in January with average highs in the low 30's to an average high of 78 °F in July.

Topography and Geology

The majority of the Little Manistee River watershed is forested with northern hardwoods and conifers. Soils consist mostly of deep, permeable sand, although there are areas with loamy soils and some with hydric soils. Several large wetland complexes exist in the watershed; one of note is the Baylor Swamp from which both branches of Twin Creek flow. Much of the river between Luther and M-37 flows through lowland conifer and tag-alder swamp.

Land Use

The Little Manistee River watershed drains approximately 145,000 acres in Lake, Mason, and Manistee Counties. The Little Manistee River originates from several swamps in eastern Lake County about eight

miles east of the Village of Luther. Below Luther Dam it flows northwest through most of Lake County, the very northeast tip of Mason County, and then southwestern Manistee County **(Figure 2)**. Below the Luther Dam, the Little Manistee River is free flowing for 55 miles before entering Manistee Lake in the Village of Stronach. Manistee Lake empties into Lake Michigan at the town of Manistee.

Land use in the watershed is primarily forest and rural residential. Upstream of M-37, about half of the land through which the river flows is public, owned by the State of Michigan as part of the Pere Marquette State Forest. There is more public land downstream below M-37. Overall, 53% of the land in the Little Manistee River watershed is owned by either the State of Michigan as part of the Pere Marquette State Forest or by the United States Forest Service (USFS) as part of the Manistee National Forest (USDA Forest Service 2001). The USFS maintains three rustic campgrounds within the watershed (Old Grade, Driftwood Valley, and Bear Track) and the Michigan Department of Natural Resources (MDNR) maintains one rustic campground at Carrieville, Michigan. The Little Manistee River flows through the villages of Luther and Stronach **(Figure 1)**, and the only significant agricultural land in the watershed is in the Cool Creek subwatershed and the headwaters area upstream from Luther.

The USFS lists the Little Manistee River as a candidate river for national wild and scenic designation (USDA Forest Service 2001). Therefore, Manistee National Forest lands within 1/4 mile of the river are currently managed in accordance with national wild and scenic designation.

4.2.2 – Environmental Consequences

No Action

By taking no action, there would be minimal changes to current conditions, and therefore, no impacts to the climate, topography, geology or land use would occur. The No Action Alternative would not contribute to cumulative impacts to the physical setting or land uses.

Recommended Alternative

The proposed action (Alternative 3) is to construct a permanent AWT sea lamprey trap in one bay of the existing MDNR fish weir, raise the walkway for access and lamprey removal, remove the existing concrete spillway, construct a steel sheet pile (SSP) weir with stop logs across the entire existing spillway apron to provide a drop barrier, install a fish guidance weir downstream of the spillway to direct fish to the collection facility, replace the existing canoe portage pathway located within the existing spillway, and provide scour and erosion protection. The proposed work will be conducted at the location of the existing MDNR egg collection facility and is relatively small scale so as to not impact river flows, thus having no measurable effect on the floodplain, environment, climate, geology or land use at the site or in the region. New or expanded impacts within the wild and scenic river corridor are minimized with spillway reconstruction located at the existing facility. Potential impacts to recreation are discussed below in the “Recreation” section. The spillway would be reconstructed to provide for necessary lamprey blockage during higher flow events (4% discharge event). The banks of the spillway would be armored to minimize riverbank erosion. Though construction is within a Wild and Scenic River area, reconstruction of the spillway at the existing facility at this location has the least visual impacts to the pristine nature of the river watershed compared to a new location on the river. The work would have no measureable impacts on climate, topography or land use.

4.3 –Coastal Zone Management, Floodplains and Hydrology

4.3.1 – Existing Environment

Coastal Zone. The proposed work site is located four miles upstream of the designated Coastal Zone Management Boundary (CZM) as indicated by the Michigan Department of Environmental Quality (MDEQ) Coastal Zone Boundary Map. Michigan's coastal zone boundary extends to the eastern end of Manistee Lake. The enforceable policies of the state have been reviewed. The MDEQ has indicated that a permit will be required from the state for construction of the proposed facility. The non-Federal sponsor will obtain the necessary MDEQ permit and when issued, the state permit will also provide the necessary CZMA consistency and water quality certification. The proposed work will likely be evaluated under the state statute, NREPA 1994 PA 451, as amended Parts 31, 91, 301, and 303. The work area is four (4) miles upstream of the CZMA boundary.

Floodplains & Hydrology. The Federal Emergency Management Agency (FEMA) National Flood Insurance Program (NFIP) Flood Insurance Rate Map (FIRM) does have a printed panel covering the work site (Stronach Township) and the riverine work area is designated as Zone A and within the floodplain. The project is consistent with state floodplain regulations (NREPA, Part 31) and Executive Order 11988 in that there is no practicable alternative to taking action in the floodplain, and the project will not induce growth or have an adverse impact within the floodplain.

The Little Manistee River has an average annual monthly discharge during the sea lamprey spawning months from March through July of from 160 cfs in July to 260 cfs in March. The river drops in elevation from approximately 1165 feet IGLD 85 near Luther to 580 feet IGLD 85 at Manistee Lake. The MDNR weir was constructed in 1967-68 with the DNR conducting upgrades to the facility over time.

4.3.2 – Environmental Consequences

<u>No Action</u>

By taking no action, no anticipated changes to existing conditions are expected. The No Action alternative would not result in impacts to the coastal zone, floodplain resources, or hydrology at the site. Also, the No Action alternative would not contribute to any cumulative or secondary impacts to coastal zone management, floodplain or hydrology resources.

<u>Recommended Alternative</u>

Coastal Zone. The USACE has determined that the proposed action will have no effect on any coastal use or resource of the State of Michigan and that no further coordination is required with the State of Michigan. The Coastal Zone Management Act requires federal agency activities that "affect any coastal use or resource" to be undertaken in a manner consistent to the maximum extent practicable with the enforceable policies of approved management programs. 15 C.F.R. § 930.30. When a federal agency activity "affects any coastal use or resource", the federal agency must draft a written CZMA federal consistency determination and provide it to the State. 15 C.F.R. § 930.39. Therefore, to determine which federal agency activities require a CZMA federal consistency determination, federal agencies must first decide which of their activities "affect any coastal use or resource". Effects are determined by looking at reasonably foreseeable direct and indirect effects. In making a determination of effects, agencies shall review relevant management program enforceable policies. 15 C.F.R. § 930.33. If a

federal agency determines that a Federal agency activity has no effects on any coastal use or resource, and a negative determination is not required, then the Federal agency is not required to coordinate with the State.

The Little Manistee River is defined as an inland water under Part 301 of the NREPA. However, the entire project is located approximately four river miles outside of the coastal zone boundary designated in Michigan's Coastal Zone Management Program. No dredging or filling will occur within the coastal zone and no impacts or effects will occur downstream to Manistee Lake or Lake Michigan, both areas which are within Michigan's designated coastal zone boundary. The Great Lakes Fish Commission, in conjunction with state, Federal and our Canadian counterparts are conducting multiple activities designed to minimize the impacts of sea lamprey predation of the fish populations of the Great Lakes including adult trapping, barrier construction, larval lampricide treatment and experimental control measures. By itself, installation of this proposed facility will not measurably affect fish populations within the Great Lakes but in conjunction with all the combined actions, lamprey control occurs at or near target control levels. The USACE has reviewed the following enforceable policies of the State of Michigan Coastal Zone Management Program, being Parts 91, 301, 303, and 31 of the NREPA, as part of USACE's effort to determine whether the project affects any coastal use or resource. Part 91 requires that earth change activities conducted above the ordinary high water mark minimize sediment return to the receiving water. The project has stabilization measures incorporated into the design including riverbank riprap, seeding and silt fencing where required to comply with Part 91 requirements. Parts 301 and 303 require evaluation if fill material is placed in wetlands or on bottomlands of inland lakes or streams. The work area is upstream of the coastal boundary by four river miles and soil erosion control practices are included with the spillway reconstruction to stabilize the fill and minimize erosion. Therefore, no sediments will migrate downstream to the coastal zone and as such no fill will be deposited within the coastal boundary. Therefore, the spillway reconstruction work will not affect any coastal use or resource of the State of Michigan. Similarly, placement of concrete fill to form a flat base for the permanent lamprey trap, driving pilings and construction of the SSP weir and the fish guidance weir as structures on bottomlands does not cause an effect on any coastal use or resource within Michigan's coastal zone boundary. The proposed work does not cause a harmful interference with flows so the work does not affect any coastal use or resource identified under Part 31 for the discharge of river waters into the coastal zone. Some riverbank wetlands will be removed with the placement of rock riprap but the overall impacts are minor and will not cause any effects to the coastal zone. With the inclusion of silt screens around the work area and flow diversion, phased construction and isolating work areas, the USACE has determined the project will have no effect on any coastal use or resource of the State of Michigan and a negative determination is not required. The USACE does not need to complete a CZMA federal consistency determination for the proposed work and coordination with the State of Michigan is not required.

4.4 –Hazardous, Toxic, and Radioactive Waste (HTRW) Analysis

4.4.1 – Existing Environment and Hazardous, Toxic & Radioactive Waste (HTRW) Analysis

The purpose of a HTRW investigation is to ascertain the environmental history and current conditions of a site as it relates to HTRW, within practical measures and using reasonably available resources. By conducting such an investigation, the uncertainty regarding the potential for HTRW in connection with the project is reduced, though not eliminated. There is always some risk of encountering unknown HTRW elements during project construction, thus contract clauses incorporate wording on how to address such conditions should they be discovered.

Nonpoint source sedimentation (in the form of bedload sands) remains an issue along some portions of the Little Manistee River. There is no fish consumption advisory for fish from the Little Manistee River though there is for lake run fish for PCB. The work site is recently developed (1960's) forest area. The potential for HTRW contaminants either on site or within the river system upstream of the existing facility is very limited. Contaminated sites and clean-up sites are located upstream and downriver near Manistee Lake but no HTRW identified site is located in close proximity of the work area.

Hazardous, Toxic & Radioactive Waste (HTRW) Analysis

The location for the proposed SSP spillway work, fish guidance weir and AWT lamprey trap are at the existing MDNR fish collection weir that was constructed in the 1960's. The work site has no history of contamination. The proposed work is not anticipated to exasperate any potential for exposing contamination in the area.

All appropriate statutes and executive orders including the NEPA criteria will be met if this project proceeds. The proposed project is being coordinated with the U.S. Environmental Protection Agency (EPA), U.S. Fish and Wildlife Service (FWS), tribal entities and Michigan Department of Environmental Quality (MDEQ) and the Michigan Department of Natural Resources (MDNR), the facility manager.

No Phase I HTRW investigation has been performed for this project and no Phase I evaluation is required. The purpose of a HTRW investigation is to ascertain the environmental history and current conditions of a site as it relates to HTRW, within practical measures and using reasonably available resources. By conducting such an investigation, the uncertainty regarding the potential for HTRW in connection with the project is reduced, though not eliminated. There is always some risk of encountering unknown HTRW elements during a project, thus contract clauses incorporate wording on how to address such conditions should they be discovered. Based on the proposed work being located on MDNR property and the historic non-use of the parcel until recently for construction of the egg collection facility, a Phase I investigation is not necessary and will not be completed.

4.4.2 – Environmental Consequences

<u>No Action</u>

By taking no action, there would be minimal changes to current conditions, and therefore no impacts to HTRW resources in the area would occur. The No Action Alternative would not contribute to cumulative impacts to HTRW resources.

<u>Recommended Alternative</u>

No HTRW sites or superfund cleanup sites are known to be present in the immediate vicinity of the project site, thus none are expected to be impacted by the proposed construction or operation of the AWT. Based on available information regarding site conditions and the general area, it is not anticipated that construction of the proposed work would encounter contaminated materials or cause a release of any contaminated materials. The proposed spillway reconstruction will have soil erosion control requirements. The lamprey trap and fish guidance weir will be supported on steel piles that will be set into the bottomlands of the river. As a precaution, the construction contract would contain standard language on procedures to follow to ensure that there are no releases and that the materials are

properly remediated where applicable, in the event that contaminated materials are encountered. Excavated material (approximately 1500 CYD) will be deposited on site outside of the floodplain and wetland areas and stabilized with seed.

4.5 –Water and Sediment Quality

4.5.1 – Existing Environment

The Little Manistee River originates from several swamps in eastern Lake County and flows through Mason and Manistee County. The Little Manistee River watershed drains approximately 145,000 acres (approximately 10% of the Manistee River watershed) which includes approximately 63 miles of river and ultimately flows into Manistee Lake which empties into Lake Michigan. The watershed includes two permanent dams as well as several large wetland complexes. The Little Manistee River is surrounded by hardwood and conifer forests and is relatively undeveloped. The combination of significant stretches of undeveloped forests and groundwater inflow create one of the coldest and discharge stable streams in Michigan. All named tributaries of the Little Manistee River are Designated Trout Streams.

Due to the sandy geology of the watershed, the Little Manistee River is primarily a groundwater-fed system. Groundwater-fed streams with forested, relatively undeveloped watersheds are cooler and have much more stable flow regimes than those in agricultural or urban areas. This is why the Little Manistee River is among the coldest, most stable streams in Michigan. Two areas of the Little Manistee River in particular receive large amounts of groundwater. The first is the area between Spencer's Bridge and DeWitt's Bridge where the river passes through a large moraine (an accumulation of earth and stones carried and deposited by a glacier), which adds significant groundwater flow and the second area is in the 6-Mile to 9-Mile reach. Here the river flows at the base of another large moraine locally known as the Udell Hills. These high hills act as "water towers", forcing groundwater into the Little Manistee River. The river bed within the work area is primarily sand. Sands and gravel in non-developed areas do not contain contaminants at regulated levels. Based on sediments at the site, site history and the location, there is no reason to believe the sediments contain contaminants at regulated levels.

4.5.2 – Environmental Consequences

No Action

By taking no action, there would be minimal changes to current conditions, and therefore no impacts to water and sediment quality would occur. The No Action Alternative would not contribute to cumulative impacts to water and sediment quality.

Recommended Alternative

Potential threats to water quality of the river at the project site include sediment from runoff during reconstruction of the earthen spillway from the excavation and leaks from equipment used for construction. Since no contaminated sediments are anticipated to be encountered, the proposed construction would not exacerbate any contamination. The river does carry a bedload of sand and placement of the stoplogs would temporarily restrict the movement of the bedload materials. Downstream sediment bedload movement would resume and not be impacted when the stop logs were removed at the end of the lamprey spawning season.

Erosion Control: Although there would be excavation at the earthen spillway, appropriate erosion control measures would be implemented to prevent sediment runoff from entering the Little Manistee River during the installation of the SSP weir and riverbank armoring. The river flows would be through the main river over the fish weir during spillway reconstruction. Work within the spillway would be conducted in slack water. The contractor will prepare a sediment control plan and obtain any required local soil erosion control permits. Soil erosion control methods would be put in place prior to beginning construction activities and maintained during construction. Other erosion control measures such as the use of silt fencing, straw bales, geo-fabrics, hydroseeding, or various other immediate re-vegetation tactics would be developed and implemented prior to, during and after construction, as needed. Disturbed surface areas or temporary construction sites would be stabilized or re-vegetated to similar conditions for long-term erosion control, or restored as applicable, upon project completion.

Construction Equipment: The proposed construction access will occur from the south bank using land-based construction equipment, but activities are not anticipated to significantly impact the water quality. If equipment is used from within the water, vegetable oil would be required in place of hydraulic fluid. Hydraulic hoses and connections on the equipment would be inspected daily at a minimum, and equipment would be removed from service if a leak is detected. Equipment would be stored over-night and fueled in a designated area separated from the river waters to minimize any potential leaks or spills from entering the river. In addition, debris and construction waste materials would be removed from the project site unless reused in other construction activities.

Materials Placed: The proposed project will include construction of a temporary rock ford downstream of the existing MDNR weir to provide equipment access to the concrete spillway and far bank work location using approximately 30 CYD rock. The rock ford will be removed upon completion of the work. The rock ford location was previously used for the initial facility construction. The existing concrete spillway will be excavated to riverbed elevation to drive the SSP for the spillway weir. The work on the spillway will occur in a no flow scenario and much of the work will occur in the dry. Approximately 1500 cubic yards (CYD) of earth will be excavated to form the new river spillway channel removing 800 square feet of concrete spillway, an additional 800 square feet of upland and about 1600 square feet of riverine bank fringe wetlands along 550 lineal feet (LF) of spillway shoreline (300 LF on north bank and 250 LF on south bank of the spillway) and additional 3400 square feet of wetland seeps that are located on the northern riverbank up to the 1% discharge event (100 year). The width of the riverine shrub/scrub wetland at the riverbank varies from 0 feet to 6 feet in width, depending on location. In total, the project will impact 1/8 acres of wetlands being approximately 5400 square feet. The excavated earth will be disposed into an upland site approximately 0.75 acre in size near the site access driveway. Rock riprap (380 CYD) armor stone will line both sides of the spillway discharge channel. Steel piles will be installed into the river bed of the spillway to anchor the fish guidance weir, gates and provide bases for the stoplogs. The permanent sea lamprey trap will be set on a concrete pad, anchored with steel piles as will the fish guidance weir. Pursuant to the Clean Water Act (CWA), a Section 404 (b)(1) evaluation of the environmental effects of the discharge of fill material into waters of the United States has been prepared (**Appendix D**). The proposed work includes the placement of 30 cubic yards of concrete to set the pilings and placement of a concrete pad under the fish guidance weir and permanent lamprey trap. Additionally, 50 CYD total of riprap will be placed for scour protection on the upstream and downstream sides of the new SSP weir. The placement of the concrete will occur in the dry likely through the placement of a temporary wood or SSP cofferdam. The Section 404(b)(1) evaluation concludes with the determination that "the proposed action is in compliance with Section 404 of the CWA." A Section 401 (of the CWA) water quality certification (WQC), or waiver thereof, would be obtained from the MDEQ by

the non-Federal sponsor through the issuance of the state permit prior to initiation of in-water construction activities.

4.6 –Prime Farmland and Wetlands

4.6.1 – Existing Environment

Farmland. Based on review of available information such as web data, aerial photographs, current land-use, there is no prime or unique farmland located at the project site or in the immediate vicinity. In the upstream watershed in Lake County, approximately half of the lands within Lake County are agriculturally oriented consisting primarily of milk and dairy, and also of other crops including hay and cattle production with about 40% of the county forested, woodlands or wetlands. In Manistee County, where the project is located, approximately 44,000 acres are in agricultural production consisting primarily of fruit, nursery and cattle production.

Wetlands. Based on review of available information such as aerial photographs, USFWS National Wetlands Inventory (NWI), MDEQ wetlands map viewer, current land-use and a 2016 site wetlands delineation review of the project site, there are wetlands located immediately adjacent the project site with a riverbank fringe of wetlands within the proposed work areas at the project site. Wetland acreage of the Little Manistee River watershed is about 12,000 acres. Wetland acreage in Lake County where the majority of the watershed is located contains about 40,000 acres of wetlands. The work will occur on regulated bottomlands of the Little Manistee River. The USACE Regulatory staff conducted a wetlands evaluation of the project site.

4.6.2 – Environmental Consequences

No Action

By taking no action, there would be minimal changes to current conditions, and therefore no impacts to the existing farmland or wetlands would occur. The No Action Alternative would not contribute to cumulative impacts to farmland or wetlands.

Recommended Alternative

No farmland is present at the site. The proposed project is compliant with the Farmland Protection Policy Act (FPPA) Subtitle I of Title XV, Section 1539-1549, of the Agriculture and Food Act of 1981 (Public Law 97-98) and the proposed action would not impact prime or unique farmland.

The proposed project will remove approximately 5,400 ft2 (1/8 acre) of wetlands lining sections of the spillway riverbank. The project calls for lining the 5,400 ft2 of riverbank with armor stone for erosion control during high discharge events. In doing this work along the riverbank, two beneficial actions will result: 1. The new armor stone lining the river bank will create 1,500 ft2 of hard substrate of new aquatic habitat located below the waterline; 2. Excavation of the currently existing upland spillway and approach areas will restore 1,600 ft2 of riverbed aquatic habitat that were lost when the spillway was constructed. While there is a loss of 5400 ft2 of shoreline wetlands, this overall loss is small and inconsequential when compared to the total project benefits, and the construction of 3,100 ft2 of replacement aquatic habitat types of hard, rocky substrate and riverbed areas.

4.7 –Groundwater and Drinking Water Supply

4.7.1 – Existing Environment

MDEQ water well log records do not indicate any private wells within a half mile of the project site.

4.7.2 – Environmental Consequences

No Action

By taking no action, there would be minimal changes to current conditions, and therefore, no impacts to the groundwater or drinking water supply would occur. The No Action alternative would not contribute to cumulative impacts to the groundwater or drinking water supply.

Recommended Alternative

The recommended alternative is a small scale project and would have no impacts to the groundwater or drinking water supplies. The recommended alternative would not contribute to cumulative impacts to groundwater or drinking water supply.

4.8 –Vegetation, Wildlife Habitat and Wildlife

4.8.1 – Existing Environment

The work area consists of manmade fish collection facilities, a weir and concrete and earthen spillway. Work will occur on the river bottomlands and the earthen spillway. The crest elevation of the spillway will be excavated approximately four (4) feet for the placement of the SSP forming the base of the weir and installation of stop logs for water level adjustment. The earthen spillway has little to no general wildlife habitat but may provide a sunning area for the Federally listed T&E species, the Eastern massasauga rattlesnake. The watershed is listed as Tier 1 habitat for the massasauga rattlesnake. Sections of the riverbank contain a wetland fringe that may also provide habitat for the snake. The far riverbank is wooded. Grass and forest surround the MDNR work site.

4.8.2 – Environmental Consequences

No Action

By taking no action, there would be minimal changes to current conditions, and therefore no impacts to vegetation, wildlife habitat or wildlife in the area would occur. The No Action alternative would not contribute to cumulative impacts to vegetation and wildlife resources.

Recommended Alternative

Based on the nature of the work site and lack of wildlife habitat except for the short grass on the spillway, there would be minimal impacts from implementing the proposed alternative. The short grass adjacent to the spillway could be used for sunning by snakes, including the massasauga rattlesnake though rattlesnake use has not been documented on the spillway but sightings of the snake have been made within 2 miles of the project site. The proposed work area and the work and storage areas will be

fenced off with a snake fence (silt fence) to prevent snake access during construction. For two weeks following installation of the snake fence, the work sites will be walked at the start of each day and any reptiles removed from the enclosures. Thereafter, the snake fence will be inspected weekly to insure integrity and the work areas also scanned to remove any reptiles. Other wildlife that may use the spillway would temporarily avoid the area during construction but would be expected to return upon completion of the project. Construction of the spillway is anticipated to be 12-16 weeks.

4.9 –Aquatic Resources

4.9.1 – Existing Environment

The fish community of the Little Manistee River is described as a coldwater water fish community dominated by trout and salmon, and the river is considered a prime attraction location for fishermen. The river is world renowned as an excellent fishing river, having a variety of substrates, littoral areas, and excellent water quality. The great diversity of salmonids in the river reflect the high water quality with brook, rainbow and brown trout along with the lake run fish being coho, steelhead and king salmon. The invertebrate community in the river reflects the excellent water quality and is highly diverse.

4.9.2 – Environmental Consequences

No Action

By taking no action, there would be minimal changes to current conditions, and therefore no significant impacts to aquatic resources in the area would occur.

Recommended Alternative

Based on the expected footprint of the project and lack of habitat, negligible effects would be expected at the site of the proposed, permanent (AWT) sea lamprey trap and the SSP weir at the spillway. There could be some minor, short-term effects on aquatic resources during construction in the vicinity, but these effects would mainly be on fish that could leave the area during construction and return post-construction.

No long-term or significant cumulative effects are expected to result by implementing the Recommended Alternative. There exists a potential long-term benefit if successful sea lamprey management at this location maintains lamprey blockage that results in a reduced need for lampricide application upstream of the weir.

4.10 –Threatened and Endangered Species

4.10.1 – Existing Environment

The USACE reviewed the USFWS "County Distribution of Federally-Listed Threatened, Endangered, Proposed and Candidate Species" for Manistee County, Michigan, revised October 2016 (**Table 18**). The list indicates that several threatened or endangered species that are present in Manistee County.

Table 17 Federally Listed Threatened and Endangered Species

Species	Status	Habitat	Habitat Present At Site?
Northern long-eared bat *Myotis septentrionalis*	Threatened	Hibernates in caves and mines - swarming in surrounding wooded areas in autumn. Roosts and forages in upland forests during spring and summer.	Near
Indiana bat (*Myotis sodalist)*	Endangered	Summer habitat includes small to medium river and stream corridors with well developed riparian woods; woodlots within 1 to 3 miles of small to medium rivers and streams; and upland forests. Caves and mines as hibernacula.	Near
Piping plover (*Charadrius melodus*)	Endangered	Beaches along shorelines of the Great Lakes	No
Rufa Red knot *(Calidris canutus rufa)*	Threatened	Only actions that occur along coastal areas during the Red Knot migratory window of **MAY 1 - SEPTEMBER 30**	No
Eastern massasauga *Sistrurus catenatus*	Threatened	Shallow wetlands and adjacent uplands	Yes
Pitcher's thistle (*Cirsium pitcheri*)	Threatened	Stabilized dunes and blowout areas	No

1 -"County Distribution of Federally-Listed Threatened, Endangered, Proposed and Candidate Species" for Manistee County, Michigan, Revised October 2016.
2 -http://www.USFWS.gov/midwest/endangered/reptiles/eama/index.html

The short grass on the earthen spillway may provide sunning habitat for snakes and may provide habitat for the massasauga rattlesnake. The work location and many reaches of the river are listed as Tier 1 habitat by the USFWS for the massasauga rattlesnake. The remainder of the work area does not provide habitat for any of the other Federally listed species though the north bank of the river is wooded and could provide suitable habitat for either of the listed bat species.

4.10.2 – Environmental Consequences

No Action

By taking no action, there would be no changes to current conditions, and therefore no impacts to federally listed species in the area would occur. The No Action alternative would have no effect on federally listed species, and would not contribute to cumulative impacts to federally-listed species.

Recommended Alternative

Habitat for listed endangered, threatened or candidate species is not known to be present in the immediate work area except possibly for the massasauga rattlesnake at the spillway. Several wetland areas along the river may provide suitable habitat for the massasauga rattlesnake, including open upland areas potentially useable by the snake for sunning. As a precaution, the spillway work area and

the work and storage area will be screened with an appropriate silt screen as a snake fence before and during construction to prevent snakes from entering the work area. For a two week period, the work areas will be inspected daily before work begins to remove any reptiles located within the work area. After two weeks, the fence will be inspected daily and the work site weekly to insure no reptiles are located within the work site. Therefore, the USACE determined the proposed action may affect but not likely to adversely affect the federally-listed massasauga rattlesnake if the proposed inspection actions are taken to verify no snakes are located within the work area after setting the snake fence. This determination is being coordinated with the USFWS. See **Appendix H** for USFWS coordination letter dated 7 April 2016. In addition, due to lack of habitat and the small scale nature of the proposed action, no effects are anticipated on migratory birds or bald eagles.

The Little Manistee River forested watershed adjacent to the river likely provides some suitable habitat for the two federally listed bat species. At this time there is no identified need to remove any trees that provide bat habitat and we do not anticipate needing to remove any trees for construction. However, if once on site, it is determined that a few trees do need to be removed and the trees are large enough to support summer colonies of the northern long-eared bat or Indiana bat, tree cutting will occur outside of the bat window cutting restrictions and occur between October 15 and March 31.
All appropriate statutes and executive orders including the NEPA, the Endangered Species Act (ESA) of 1973, as amended, and the Fish and Wildlife Coordination Act criteria will be met if this project proceeds. No additional field data collection for threatened or endangered species was conducted during development of this FR.

4.11 –Exotic and Invasive Species

4.11.1 – Existing Environment

Sea lamprey are present in all of the Great Lakes and the USFWS performs trapping in all of the Great Lakes using temporary, portable and permanent traps at barriers. Presently at the weir project site, a temporary trap is placed and operated during the spawning season which typically runs March through June or July, weather dependent. TFM lampricide treatments are conducted both upstream and downstream of the weir and the primary concern with this site is lamprey movement upstream during spring storm events when lamprey can pass over the spillway. The proposed spillway modifications are designed to assist in insuring spawning phase lamprey are prevented from upstream migration except during the 4% discharge or larger event because of the size of the river and the larval rearing habitat available upstream that requires treatment if lamprey gain access and spawn upstream of the weir.

Eurasian ruffe (*Gymnocephalus cernuus*), threespine stickleback (*Gasterosteus aculeatus*), round goby (*Neogobius melanostomus*) and tubenose goby (*Proterorhinus marmoratus*) are invasive fish species that are found in the Great Lakes, including Lake Michigan. The ruffe, three spine stickleback, round goby and tubenose goby are associated with river mouths and estuaries of large river systems. Literature from Europe and Russia indicate the ruffe and tubenose goby do inhabit upper river systems but no ruffe or tubenose goby have been collected locally in the upper third of Great Lakes river tributaries to date. Three spine stickleback have been collected in a very few upper river locations.

Although not observed at the proposed trap location or in work and storage areas, other aquatic pest species in the watershed include whirling disease (which can be transported downstream via fish, mainly associated with all salmonids), zebra and quagga mussels (can drift downstream as larvae), rusty

crayfish, spiny water flea, purple loosestrife, and Eurasian milfoil. Viral hemorrhagic septicemia virus (VHSv) has not been observed in the watershed.

4.11.2 – Environmental Consequences

No Action

By taking no action, there would be minimal changes to current conditions and no significant impacts to exotic and invasive species would be expected; however, the sea lamprey would continue to be present in the river, spawn, and reproduce at numbers requiring treatment with TFM. The No Action alternative would not contribute significantly to cumulative impacts to exotic and invasive species if the USFWS continues to perform temporary trapping of adult lamprey and chemically treat for sea lamprey larvae throughout the river.

Recommended Alternative

The MDNR fish weir will remain in-place for the foreseeable future, continuing to act as a barrier to upstream movement of some native and non-native fish species. Implementation of the recommended alternative is not anticipated to impact invasive species or their habitat except the target species, the sea lamprey. Placement of concrete and the structural steel support pilings does not provide increased suitable habitat for invasive species. The proposed SSP spillway modifications are expected to result in increased probability of preventing upstream movement of spawning-phase sea lamprey during discharge events less than 4%.

The use of the lampricide has been shown to have reasonably low to no impact to the other aquatic communities; however it is costly to implement. The USFWS anticipates that they would continue treating the Little Manistee River downstream of the weir but hope to decrease the frequency of treatments by reducing the overall number of sea lamprey in the river with the installation of the weir and permanent AWT. The impacts from the proposed action would negatively affect the sea lamprey, and thereby would beneficially affect Lake Michigan and the Great Lakes' aquatic resources. Reducing sea lamprey numbers in the Great Lakes is a multi-agency and State of Michigan goal to help protect the Great Lakes fishery and ecosystem. The implementation of the proposed barrier project will allow the GLFC to use the cost savings, realized through the reduction of river miles that require lampricide treatment, towards other rivers and tributaries throughout the Great Lakes.

National and State laws regulate control, management and transport of non-indigenous and invasive species. Federal laws include the National Invasive Species Act (NISA) created in 1996 to reauthorize and amend a previous measure, the Non-indigenous Aquatic Nuisance Prevention and Control Act of 1990, as amended (NANPCA). Nonnative organisms are discussed in Part 413 of Michigan's Natural Resources and Environmental Protection Act (1994 P.A. 451, as amended). Best Management Practices (BMP's) and special equipment handling may include, but not be limited to:

- Clean boats, equipment and trailers that are being introduced into the water at the site before and after launch. This may include physically removing animals or plant pieces, disinfecting (i.e., bleach solution), or off-site power-washing.
- Drain water from bilges and livewells at the ramp before leaving a body of water.
- Dry boats, equipment and storage areas (i.e. bilges) thoroughly before using in a different body of water.

- Re-vegetate disturbed areas with native or regionally appropriate species to help prevent establishment of non-native and invasive plant species.

4.12 –Cultural Resources

4.12.1 – Existing Environment

The Michigan DNR fish egg collection facility was constructed in the 1960's and is not a National Historic Landmark or listed on the National Register of Historic Places. The proposed work will continue to be appropriately coordinated with the National Park Service, and has been coordinated with the SHPO and the tribes.

4.12.2 – Environmental Consequences

No Action

By taking no action, there would be minimal changes to current conditions, and therefore no impacts to cultural resources in the area would occur. The No Action alternative would not contribute to cumulative impacts to cultural resources.

Recommended Alternative

In compliance with Section 106 of the National Historic Preservation Act (NHPA) of 1996, as amended, and Executive Order 11593 (Protection and Enhancement of the Cultural Environment, May 1971), the National Register of Historic Places (NRHP) and the State Historic Preservation Office (SHPO) was consulted and the project site, including the barrier, has been reviewed for the presence of historic and cultural resources in October 2017. The USACE determined that there would be "no historic properties affected" as there are no historic properties within the Area of Potential Effect. Coordination was sent out to local federally recognized tribes on 22 March 2016. No comments were received from any of the federally recognized tribes regarding this project. The Michigan State Historic Preservation Office concurred with the USACE no historic property affected determination on 19 December 2017. The project site was previously disturbed by original construction of the facility including the spillway. Construction contracts would include clauses protective of any discovered cultural resources. If any unusual sites / items that may have historical value are encountered during the course of proposed construction, work would stop and the sites / items would be protected while the appropriate authorities, including the USACE, Detroit District Archeologist, are contacted. It is not anticipated that the proposed construction of a sea lamprey AWT or SSP spillway modifications would affect cultural resources.

4.13 –Air Quality, Noise, Traffic and Aesthetics

4.13.1 – Existing Environment

Air Quality – Air quality in Manistee County is ranked as good with no days exceeding the National Ambient Air Quality Standards (24 hour). Manistee County is designated as an air attainment areas for all NAAQS pollutants. The prevailing winds are from the west and northwest coming across Lake Michigan.

Noise and Traffic – No population centers are in the immediate vicinity of the proposed work area nor are any homes located in the immediate vicinity of the weir. The MDNR fish weir receives numerous visitors when the weir is in operation. Recreational and commercial traffic ply the US-31 corridor adjacent to the coast. Recreation vessels and freighters traverse the Great Lakes and access ports through the Federal navigation channels during the boating season. There is regular noise at the site in association with water flowing over the weir but overall the site is isolated and generates limited noise. An anticipated noise range that would be considered typical during the day at the site would be 55-75 decibels (dB).

Aesthetics – The public parking lot at the MDNR facility is existing and the public forests provide access to the river in multiple locations.

4.13.2 – Environmental Consequences

No Action

By taking no action, there would be minimal changes to current conditions, and therefore no impacts to air quality, noise, traffic or aesthetics would occur. The No Action alternative would not contribute to cumulative impacts to these resources.

Recommended Alternative

Air Quality – Impacts to air quality would arise from emissions of motorized construction equipment and minor fugitive dust associated with the proposed construction activities. Emissions and exposed soil conditions associated with the proposed construction would be short-term and temporary. The proposed project is relatively small scale and would likely involve the use of only a few pieces of equipment at a time (i.e., a crane, pile driver, an excavator, and dump truck delivering supplies / removing excavated materials, etc.). Fugitive dust control methods such as spraying down dust with water and re-vegetating exposed soils as soon as possible would be implemented throughout the project.

In addition, the proposed work area is a relatively remote section of the river indicating few potential sensitive receptors would be present at the site during construction for any extended period of time. Trees in the vicinity would aid in reducing transport of dust particles. Any impacts would be short-term and minor. All equipment would be required to meet emission standards.

Air impacts during operations at the sea lamprey trap would be negligible. Once construction activities are complete, the project would not produce air emissions.

Noise and Traffic – Temporary and minor noise and traffic disturbances would occur from the presence and operation of heavy machinery during the proposed construction activities, they would not be significant or long-term. Effects beyond the site are not expected to exceed levels necessary for the protection of public health and welfare, which is typically identified as 70 db for NEPA assessments based on USEPA publications. Intensity of noise decreases with increased distance from the source due to the spreading of the sound energy over an increased area. As distance doubles, the noise level decreases by approximately 6 dB. The table below represents approximate noise levels that would be expected during construction activities (**Table 18)**.

Table 18 – Predicted Noise Associated with Construction Activities

Construction Equipment	Noise Levels 50 feet From Source (dBA)		Noise Levels 100 feet From Source (dBA)
	Typical	Range	Typical
Backhoe	80	75-95	74
Bulldozer	85	81-96	79
Crane (mobile)	83	75-87	77
Front Loaders	85	72-84	79
Generators	81	71-81	75
Grader	85	79-93	79
Pile Driver (diesel, sonic)	96	94-105	90
Truck	88	81-95	82

*Data from: Federal Interagency Committee on Noise 1992, USEPA 1974, 1978

Predicted noise levels would continue to decrease at distances further from the noise source. Levels would fluctuate throughout the day during construction and could be impacted by intervening buildings, vegetation, wind direction, and atmospheric conditions. The proposed project is relatively small scale in the sense that it would involve the use of only a few pieces of equipment at a time (i.e., a crane, pile driver, an excavator, and truck(s) delivering supplies / removing excavated sediment, etc.). Based on this analysis, excessive noise above what might be considered typical in the project vicinity is not anticipated. Potential effects from noise would be minimized by ensuring that construction activities would only occur during times of the day designated by local ordinances.

Construction activities such as initial mobilization for the project, transport of materials to the construction site, and transport of materials off-site (expected to be minimal) would not cause general traffic in the area to be heavier than normal, but impacts would be short-term, minimal and not have significant effects. All equipment and / or materials hauled to and from the project site would use approved hauling routes and abide by local, state, and federal hauling requirements. The contractor would be required to coordinate with the local authorities regarding use of access routes and obtain the appropriate permit(s) as necessary. Access to the project site for trap construction is expected to be from the south bank. The site has a canoe portage and during construction a temporary portage would be identified and marked; therefore construction activities would not interfere with river recreational use.

There would be negligible noise and traffic associated with operation of the proposed sea lamprey trap and spillway weir. The USFWS would likely drive a vehicle to the MDNR weir, install the trap and remove the trap in July. No measurable additional work traffic is anticipated during peak sea lamprey trapping season. Traffic may include a daily vehicle trip to check traps during peak trapping season (lasting approximately 12 weeks each year).

Aesthetics – Minimal impacts to aesthetics at the site are expected. There would be short-term, minor effects during construction activities, and negligible long-term effects. The sea lamprey trap, associated walkway and the SSP spillway would be located in the river at the MDNR facility. Public viewing access is permitted but fishing is not permitted where the weir is located.

4.14 –Social Setting and Environmental Justice

4.14.1 – Existing Environment

Several principles were considered while evaluating the proposed action for environmental justice to evaluate if the recommended alternative would cause disproportionately high and adverse effects on low-income, minority and tribal populations. These included consideration such as the human composition of the affected area (e.g., low-income and minority groups, family and residential developments and schools in the area), recognizing the interrelated cultural, social, occupational, historical, or economic factors that may amplify the natural and physical environmental effects of the proposed action, and coordination with local Tribes. In addition, the public will be encouraged to participate in the decision making process via pubic review and comment on this FR and EA.

4.14.2 – Environmental Consequences

No Action

By taking no action, there would be minimal changes to current conditions, and therefore no impacts to community cohesion, desirable community growth, tax revenues, property values, public facilities, public services, regional growth, employment or the labor force, business and industrial activity, or human-made resources; nor would the project cause displacement of people or a disproportionately high and adverse effect on low-income, minority, tribal or child populations.

Recommended Alternative

Neither the presence and operation of construction equipment, nor the proposed weir modifications would significantly affect the social setting of the area or the immediate project vicinity. The site is owned by the Michigan DNR and located adjacent public lands. The public cannot access the work location and public access and use of the site would not change after construction of the SSP weir and the permanent AWT. Recreation is discussed in further detail in the next section.

There could be some short-term, negligible effects during construction. Construction activities will be coordinated with MDNR personnel to minimize impacts to operations at the egg collection facility. There are no residential facilities located near the work area. The proposed SSP weir is designed to greatly reduce the frequency of chemical sea lamprey treatments upstream of the MDNR weir and provide a long-term beneficial impact to users of aquatic resources.

The proposed project would not have a measurable impact on community cohesion, desirable community growth, tax revenues, property values, public facilities, public services, regional growth, employment or the labor force, business and industrial activity, or human-made resources; nor would the project cause displacement of people. The action would not cause disproportionately high and adverse effects on low-income, minority, tribal or child populations as none are located in the immediate work area.

4.15 –Recreation

4.15.1 – Existing Environment

Recreational fishing, wildlife viewing, rustic camping and other leisure activities are popular along the Manistee and Little Manistee River. The MDNR egg collection weir has visitor tours and viewing platform that are heavily used during egg take operations (call and schedule a time) and the Manistee area has several local attractions, public parks and public access for residents and visitors alike.

A canoe and kayak portage is located on the spillway to provide for safe movement around the weir. The river has several public access sites for recreational use that are also used as canoe and kayak launch sites.

The Little Manistee River first attracted anglers for access to the native fish, the grayling, which died out in the late 1800's. The Little Manistee River remains a premier fishing stream with significant spawning habitat used by a variety of salmonids.

4.15.2 – Environmental Consequences

No Action

By taking no action, there would be minimal changes to current conditions, and therefore no additional impacts to recreational resources, including the local fishery would occur with the no action alternative. The No Action alternative would not contribute to cumulative impacts to these resources.

Recommended Alternative

Recreational use (e.g., fishing, wildlife and birding, viewing and camping) along the river would not be impacted during construction activities. Disturbances would be short-term and minor, and likely not noticeable by the public. Construction at the spillway would require the creation of an alternate portage route around the spillway work area but the overall project would not significantly impact recreation or tourism. Conditions and restrictions would not vary significantly from that caused by the existing operations. It is anticipated that public access and therefore public recreation would not be permitted on the MDNR weir – which is not a significant impact because fishing is currently not allowed in the vicinity of the weir where the AWT is proposed to be located. The property is owned by the MDNR. The USFWS operates the lamprey trap during the lamprey spawning season and check the traps on a daily basis. No other recreational activities on the Little Manistee River would be significantly impacted.

4.16 –Climate Change

4.16.1 – Existing Environment

Climate Change: Global climate change is expected to lead to six major types of (physical) changes in the Great Lakes basin: 1) increased annual averages in air and surface water temperatures (with greater extremes in hottest temperatures), 2) increased duration of the stratified (thermocline) period, 3) changes in the direction and strength of wind and water currents, 4) flashier precipitation (increases in the intensity of storms and drier periods in between) and river flows, 5) greater variation in annual ice

cover/greater water surface evaporation/larger lake effect snow events, and 6) greater variations in lake levels. The work will not affect the local climate or have a measurable impact on the climate.

4.16.2 – Environmental Consequences

No Action

By taking no action, there would be minimal changes to current conditions, and therefore no climate change impacts would occur with the no action alternative. The No Action alternative would not contribute to cumulative impacts to these resources.

Recommended Alternative

Measurable climate change impacts would not occur with project implementation. Exhaust from construction equipment operation would occur during project construction. Long term operation of the project would not change or increase the expected types of climate impacts within the Great Lakes basin as listed above. Conditions and restrictions would not vary significantly from that caused by the existing operations at the egg collection facility. If climate changes do occur, the likelihood is the potential decline in the Little Manistee River stage caused by more frequent drought and the subsequent increase in river water temperatures, which would not have a near-term impact on lamprey spawning or any other portion of their life-cycle aside from a potentially earlier spawning run. Seasons and water temperatures directly affect when spawning-phase sea lamprey enter streams in the spring to spawn. Use of permanent traps would not be affected by fluctuating water temperatures because the USFWS would be able to install traps into the trapping complex earlier or later to account for variability in the timing of spawning runs.

4.17 – Recommended Alternative

4.17.1 – Existing Environment

The MDNR egg collection facility at the weir with the viewing platform is anticipated to remain in operation for the foreseeable future. The facility will remain open to the public for scheduled tours and provide fish eggs for the state run fish hatcheries.

4.16.2 – Environmental Consequences

No Action

By taking no action, there would be minimal changes to current conditions, and therefore no measurable changes would occur with the no action alternative. The No Action alternative would not contribute to cumulative impacts to these resources.

Recommended Alternative

Recommended Alternative. The recommended alternative (TSP) is Alternative 3, reconstruction of the existing spillway with a SSP weir and stoplogs, installation of the fish guidance weir, armoring of the spillway weir and spillway river banks to protect from scour to provide needed discharge capacity, and reconstructing the portage. Additional work includes alterations to the walkways, modifications of the weir to install the permanent AWT and installation of the temporary rock ford for access across the river.

All construction will be in accordance with Federal and state regulations and local ordinances. The MDNR or the USFWS will obtain the necessary permits and water quality certification required under Section 401 prior to construction. Some variation in project design details may occur as a result of unanticipated design improvements, site conditions, or cost-savings measures. Any variations that result in a significant change to the project design or significant environmental impacts that are to be included into this project would be further evaluated under the NEPA.

Table 19 summarizes the Potential Effects of No Action, Recommended Alternative (TSP) and Cumulative Effects of Recommended Alternative.

Table 19 Potential Effects of Project Alternatives to Evaluated Ecological and Social Factors.

	POTENTIAL EFFECTS		
RESOURCE	***No Action***	***Recommended Alternative***	***Cumulative Effects of Recommended Alternative***
Physical Setting–Climate, Topography, Geology, & Land Use	No effects	No effects; Negligible localized effects on topography at immediate construction site	No cumulative effects
Coastal Zone Management	No effects	No negative effects	No cumulative effects
Floodplains & Hydrology	No effects	Negligible effects on hydrology at immediate project site; No effects on floodplains	Negligible cumulative effects on hydrology; no cumulative effects on floodplains
Hazardous, Toxic and Radioactive Waste (HTRW)	No effects	No effects	No cumulative effects
Water and Sediment Quality	No effects	Potential short-term, minor negative effects	Negligible cumulative effects
Prime Farmland	No effects	No effects	No cumulative effects
Wetlands	No effects	Minor loss of 1/8 acre wetland; net loss of 0.05 acres of aquatic habitat	No cumulative effects
Groundwater and Drinking Water Supply	No effects	No effects	No cumulative effects

	POTENTIAL EFFECTS		
RESOURCE	***No Action***	***Recommended Alternative***	***Cumulative Effects of Recommended Alternative***
Vegetation, Wildlife Habitat, and Wildlife	No effects	Potential localized short-term, minor negative effects during construction. No effects post construction.	No cumulative effects
Aquatic Resources	No effects	Potential negligible to minor, short-term effects in the immediate construction site during construction. No effects post construction.	No significant cumulative effects expected. There exists potential long-term beneficial effects if successful sea lamprey management at this location results in a reduced need for lampricide application.
Threatened and Endangered Species	No effects	Not likely to adversely affect	No cumulative effects
Exotic and Invasive Species	Negligible effects	Long-term, moderate negative effects (on the sea lamprey- goal of the project). No effect (other species). BMPs would be implemented to reduce transport of other invasive species to or from the site.	Minor, negative cumulative effects- trapping efficiency would improve, reducing spawning-phase sea lamprey numbers.
Cultural Resources	No effects	No effects	No cumulative effects
Air Quality	No effects	Short-term, minor negative *de minimis* effects	No cumulative effects
Noise and Traffic	No effects	Short-term, minor negative effects	No cumulative effects
Aesthetics	No effects	Short-term, minor effects during construction; long-term negligible effects at immediate project site	No cumulative effects
Recreation	No effects	Short-term, minor negative effects during construction. No effects post construction.	No cumulative effects
Climate Change	No effects	No effects	No cumulative effects

Relevant NEPA appendices are as follows: **Appendix D – Clean Water Act 404(b)(1) Evaluation** and **Appendix E – Agency Coordination**.

5 MITIGATION OF ADVERSE EFFECTS

No mitigation is proposed. The broken concrete from the spillway will be removed and placed upland or recycled. The proposed project would remove approximately 5400 ft^2 of wetlands (1/8 acres) that line sections of the spillway riverbank that would be replaced with 5400 ft^2 armor stone for erosion protection with 1500 ft^2 of the armor stone located below the OHWM of the river. The armor stone will provide a hard substrate habitat for invertebrates but will remove the existing wetland functions found in the shrub/scrub and emergent riverbank habitats. Excavation of the existing spillway and approach will create 1600 ft^2 of river bottomlands from existing upland spillway with installation of the SSP weir. This action will provide a net loss of 2300 ft^2 of aquatic wetland riverbank habitat (0.05 acres) presently located above the OHWM. The overall footprint of wetlands loss through the armoring of the spillway channel is considered small and inconsequential compared to the overall project benefits. The project is in the public interest and the loss of less than 1/3 acre of wetlands is not expected to require mitigation under state or federal laws.,

6 IMPLEMENTATION REQUIREMENTS

6.1 PROJECT PARTNERSHIP AGREEMENT

In accordance with regulation **ER1105-2-100**, **Appendix D**, where the non-Federal sponsor's capability is clear, as in the instances where the sponsor has sufficient funds currently available or has a large revenue base and a good bond rating, the statement of financial capability need only provide evidence of such. The GLFC in a letter dated July 13, 2017 affirmed their intent to enter into a Project Partnership Agreement with USACE to construct a sea lamprey barrier and trap complex on the Little Manistee River, Manistee County, Michigan. The non-Federal sponsor (GLFC) is committed to its specific cost share of the Implementation Phase, and expresses willingness to share in the costs of construction. It is anticipated that the MDNR will provide a letter of intent, be a co-signatory on the PPA and provide all lands, easements and rights of way for the barrier/trap project.

6.2 LANDS, EASEMENTS, RIGHTS-OF-WAY, RELOCATIONS AND DISPOSAL AREAS

The Real Estate Plan for the project site was developed by the Detroit District's Real Estate Division. The Real Estate Plan is included as **Appendix E**. The MDNR, is the owner of the land where the work will be accomplished. The MDNR will provide all lands, easements and rights of way required for the project and the necessary placement site for the disposal of the excavated material removed for spillway reconstruction.

6.3 MONITORING AND ADAPTIVE MANAGEMENT

After the spillway weir is built, the USFWS would conduct larval lamprey surveys every other year upstream of the weir to determine if larval lamprey were located in the larval rearing areas. The river discharge records would be reviewed to determine if a 10%/4% (10/25 year) or greater discharge event occurred in the watershed from March-July during lamprey spawning migration. If larval lamprey were located upstream of the weir and no large discharge events had occurred, the USFWS and MDNR would inspect the weirs and stoplogs to verify that the stop logs were completely sealing the weir structures to prevent lamprey escapement. The MDNR would make necessary repairs to the weir and stoplogs. See **Appendix F** for additional detail on the project monitoring and adaptive management.

6.4 OPERATION, MAINTENANCE, REPAIR, REPLACEMENT, AND REHABILITATION

The USFWS operates and maintains the barrier and trap locations throughout the Great Lakes as part of the lamprey control program on behalf of the Great Lakes Fishery Commission (GLFC). Michigan Department of Natural Resource (MDNR) will coordinate with USFWS personnel on gate setting to insure proper flow control during spring runoff, storm events and the various migration periods. Average operation and maintenance cost include: the personnel costs associated with removing lamprey from the lamprey traps, weir operation, and periodic inspection. Maintenance costs would include walkway upkeep, replacing equipment such as lift cranes and periodic additions of riprap. The average O&M costs were calculated at 0.02% of the estimated construction cost. The use of the 0.02 percentage to calculate O&M costs is based on projects of similar scope.

6.5 REGULATORY REQUIREMENTS

The non-Federal sponsor will be required to obtain Section 401 water quality certification or waiver thereof from the Michigan Department of Environmental Quality and any other required state authorizations and have US Forest Service approval for the project insuring compliance with the Federal requirements of the Wild and Scenic Rivers Act.

7 PUBLIC INVOLVEMENT

7.1 PUBLIC VIEWS AND COMMENTS

The FR and EA Report and preliminary Finding of No Significant Impact (FONSI) for the proposed action of constructing sea lamprey barrier and trap complex at the MDNR weir and egg collection facility on the Little Manistee River in Manistee County, Michigan, will be available to the public for comment in March 2018 for a period of 30 days at: the Manistee Public Library located at 95 Maple Street, Manistee, MI 49660; the U.S. Post Office located at 35 Filer Street, Manistee City, MI 49660; and on the internet at the USACE Detroit District, USACE website at http://www.lre.usace.army.mil/Home.aspx (lower left of page under “Other Public Notices”).

At the end of the 30-day period, the USACE will consider all comments submitted by individuals, agencies, and organizations. A summary of participation will be added to this report after the review period. As appropriate, the USACE may then finalize and execute the FONSI and proceed with the implementation phase of the project. If it is determined that implementing the recommended alternative would result in potentially significant impacts, mitigation measures could be proposed to reduce the impact below a level of significance, or the USACE will either publish in the Federal Register a Notice of Intent to prepare an EIS or choose not proceed with the proposed action.

7.2 STAKEHOLDER AGENCY COORDINATION

7.2.1 Federal Agencies

The Great Lakes Fisheries Commission (GLFC) accepts the role as the non-Federal sponsor for the feasibility study, as stated in the attached Letter of Intent, dated July 13, 2017. The USFWS and Department of Fisheries and Oceans Canada are contracted by the GLFC to administer the sea lamprey control program. Development and implementation of alternative controls, including barriers and traps, and reducing/eliminating the use of TFM, are goals of the GLFC.

7.2.2 State Agencies

This study would be consistent with MDNR, and other natural resource agencies goals of eliminating the invasive sea lamprey population in the Great Lakes. These and other state agencies have helped implement similar successful sea lamprey barrier projects in the past. Coordination with these agencies has continued under the feasibility phase of the study.

8 FINDING OF NO SIGNIFICANT IMPACT

See the Preliminary Finding of No Significant Impact (FONSI) statement at the front of this Draft FR and EA.

9 RECOMMENDATION

I recommend that **Alternative 3 – Modify the existing spillway at the MDNR weir structure** be implemented. The Recommended Alternative (TSP), with the construction of a sea lamprey barrier and an area to accommodate the installation of a trap system, has a total project cost of approximately **$3,747,000**. This alternative, with an average annual O&M cost of about $47,000, would provide benefits to desirable fish species in Lakes Michigan and Huron. Anticipated costs (as shown in **Table 21**) are as follows:

Table 20 Cost Estimate to Implement Recommended Alternative ($000) FY 2018 Dollars

	Totals	Federal	Non-Federal
Feasibility Phase	**360**	269	91
Design (Plans & Specifications)	**613**	398	215
Implementation Phase (including management& Monitoring)	**2,761**	1,795	966
LERRDs	**13**		13
Totals	**3,747**	**2,462**	**1,285**

The construction of a sea lamprey barrier and installation of a permanent trap system at the MDNR weir and egg collection facility on the Little Manistee River is also part of a Great Lakes-wide plan to improve integrated sea lamprey control developed by a bi-national team of sea lamprey control specialists.

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Dennis P. Sugrue
Lieutenant Colonel, U.S. Army
Detroit District Commander

10 REFERENCES

McDermid, J.L., S.K Dicin, C.L. Winsborough, H. Switzman, S. Barr, J.A. Gleeson, G. Krantzberg, P.A. Gray. 2015. State of Climate Change in the Great Lakes Basin: A Focus on Climatological, Hydrologic and Ecological Effects. Prepare jointly be the Ontario Climate Consortium and Ontario Ministry of Natural Resources and Foresrty to advise Annex 9 – Climate Change Impacts under the Great Lakes Water Quality Agreement, October 2015.

Website://www.fws.gov/midwest/fisheries/sea-lamprey.html; U.S. Fish and Wildlife Service; Visited June 2017