ENVIRONMENTAL ANALYSIS

Department of Natural Resources (DNR)

Region or Bureau
Northeast Region

NOTE TO REVIEWERS: This document is a DNR environmental analysis that evaluates probable environmental effects

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Applicant: Fox River Navigation System Authority (FRNSA)

Address: 1008 Augustine Street, Kaukauna WI 54130

Title of Proposal: Rapide Croche Boat Transfer and Aquatic Invasive Species Cleansing Station

Location: County: Outagamie City/Town/Village: Town of Buchanan

Township Range Section(s): T.21N – R.19E., Section 4

PROJECT SUMMARY

1. Brief overview of the proposal including the DNR action (include cost and funding source if public funds involved)

The Fox River Navigational System Authority (FRNSA) has been authorized by the State of Wisconsin to repair, reopen, operate, and maintain 16 of the 17 locks on the Lower Fox River. In accordance with Wisconsin Statute 237, the Rapide Croche Lock must remain closed to prevent aquatic invasive species (AIS) from moving upstream. Because this lock must remain closed, the FRNSA is proposing to construct a Boat Transfer and Aquatic Invasive Species Cleansing Station at this site (Attachment 3). The proposed Project will include a method for transferring boats over the Rapide Croche lock site and cleansing them of AIS before they are placed upstream of the existing barrier. The WDNR must approve the boat transfer plans prior to construction.

A boat transfer station at the Rapide Croche lock will allow navigational access on the Lower Fox River between Green Bay and the Lake Winnebago system. The current Winnebago system consists of lakes Butte des Morts, Winneconne, Poygan, Winnebago and all their tributaries from their mouths upstream to the first dam on each tributary. This includes the Fox River from Lake Winnebago upstream to the dam above Princeton, and all its tributaries from their mouths upstream to the first dam. It also includes the Wolf River from its mouth upstream to the dam in the city of Shawano and all its tributaries from their mouths upstream to the first dam. Cincoe Lake, Partridge Crop Lake and Partridge Lake are also included. There are talks of expanding the definition of the Winnebago System up to the dam on Park Lake near Pardeeville. The Winnebago system falls within Calumet, Fond du Lac, Green Lake, Marquette, Outagamie, Shawano, Waupaca, Waushara and Winnebago counties.

2. Purpose and Need (include history and background as appropriate)

The purpose of the Project is to allow navigational access on the Lower Fox River between Green Bay and Lake Winnebago as required under Wisconsin Statute 237.03(2). The Project's AIS Cleansing Station is needed to protect Lakes Butte des Morts,

Winneconne, Poygan, Winnebago and all their tributaries, including the Fox River, the Wolf River, Cincoe Lake, Partridge Crop Lake, and Partridge Lake in Calumet, Fond du Lac, Green Lake, Marquette, Outagamie, Shawano, Waupaca, Waushara and Winnebago counties from the introduction of AIS through the movement of boats using the Project.

There are over 180 non-native species in the Great Lakes, of which many are considered "invasive" (AIS Plan 2008). Invasive species are species that are outside of their natural range (non-native), which often means they lack predators and other biological controls in the new environment. They may be able to outcompete native species, leading to declines in native populations and cause significant ecological impacts such as sea lamprey effects on lake trout and quagga mussel effects on food web in Lake Michigan. Invasive species may interfere with commercial, agricultural, or recreational activities. Lake Winnebago system sees $300 million annually from recreational fishing thus impacts to this fishery from invasive species could lead to significant economic impacts.

In 2010, St. Norbert College Survey Center was contracted by the FRNSA to conduct a mail survey of a random sub-sample of Wisconsin boat owners of registered watercraft in the lower Fox River/Winnebago pool lake counties and adjacent Lake Michigan counties. 2100 registered boat owners in Brown, Calumet, Fond du Lac, Outagamie, Waupaca and Winnebago counties and owners of boats greater than 26 feet in length registered in Door, Kewaunee, Manitowoc, Marinette, and Sheboygan counties were mailed a survey to determine opinions regarding:

- Development of an AIS cleansing and transfer station at the Rapide Croche lock.
- Demand for and usage of the Rapide Croche lock, and the proposed boat cleansing area and lift/transfer station.
- Number and type of boats that would use the facility each year.
- Number and type of visitors that would visit the facility each year.

Over 990 completed questionnaires were returned (a return rate of 48 percent) and analyzed. The margin of error for the survey was +/-3.1 percent at the 95 percent confidence level (St. Norbert College Survey Center 2010). Survey results were used to identify several facility scenarios that would profile the number and type of potential transfer station users based on a specific combination of responses from the survey. Based on the results, "Scenario #4" was adopted by the FRNSA, which predicts that over 1,300 boaters would use the proposed transfer station annually. The specific attributes of Scenario #4 are:

- "Boaters who use the Fox River between Green Bay and Rapide Croche two or more times per year AND use the Fox River between Lake Winnebago and Rapide Croche two or more times per year AND anticipate using the new proposed transfer station two or more times per year." (St. Norbert College Survey Center 2010)

Protecting the Lake Winnebago lake sturgeon (*Acipenser fulvescens)* population, which adds $3.5 million from spearing and $350,000 from sturgeon viewing to the economy, and other native fisheries from potential adverse impacts of AIS has remained one of FRNSA's top concerns when evaluating plans for a boat transfer station at the Rapide Croche site. The proposed boat cleansing system is an essential component of the design and will help provide an engineered system to control the upstream spread of AIS if designed and managed properly.

3. Authorities and Approvals (list local, state and federal permits or approvals required)

FRNSA is authorized by the State of Wisconsin Statute 237 to repair, reopen, operate, and maintain 16 of the 17 locks on the Lower Fox River. The Rapide Croche lock must remain closed in accordance with Wisconsin Statute 237 because a sea lamprey barrier is in place there that prevents sea lamprey from moving upstream, while the physical barrier prevents most other invasive species from moving upstream. Because this lock must remain closed, a boat transfer and AIS cleansing station is being proposed for this site to allow boat access to the Fox River between Green Bay and Lake Winnebago. According to Wisconsin Statute 237.10, FRNSA must submit a plan to the WDNR for approval prior to constructing a means of boat transfer. In addition, U.S. Army Corps of Engineers (USACE) approval is required before altering the locks, and Kaukauna Utilities (the dam and water rights owner) approval is required for flow alteration.

The project will involve the construction of piers with piling, grading, filling, sediment removal, ground disturbance and other work in and near the Fox River; therefore, Chapter 30 (Wis. Stats.) and NR 103 (Wis. Admin. Code) approvals will be necessary from the WDNR. In addition, USACE approval for filling the locks is required under both Section 10 of the Rivers and Harbors Act and Section 404 of the Clean Water Act. The Project scope may involve a joint WDNR/USACE Individual Permit process. This process typically involves preparation of design plans/drawings, completion of an application package, and collaboration with WDNR personnel. A public comment period and informational hearing would be required prior to final review and issuance of an Individual Permit.

The water bypass system culvert may need plan approval by WDNR.

A Wisconsin Pollutant Discharge Elimination System (WPDES) permit from the WDNR will be required for the discharge of water used in pressure washing the boat hulls (referred to as "pre-wash" because it will occur before the boat is placed in the heated water bath). The WDNR has already developed a general permit program for wastewater discharge resulting from the outside washing of vehicles, equipment and other objects. This will be applicable to the Project's boat pre-wash discharge water. The general permit application process involves submission of project-specific information / application to the WDNR prior to gaining permit coverage.

The Project will require soil disturbance, requiring compliance with Chapter 30, NR 151 and NR 216 Storm Water Construction Site Permit.

Because the site and buildings are listed on the National Register of Historic Places, the site plan and mitigation is subject to review and approval by the State Historic Preservation Office. A historic preservation study is currently being conducted by Anne Bieble of Cornerstone Preservation.

PROPOSED PHYSICAL CHANGES (more fully describe the proposal)

4. Manipulation of Terrestrial Resources (include relevant quantities - sq. ft., cu. yard, etc.)

The final design of the facility has not been developed, therefore, soil grading volumes, changes in impervious area, or grade changes cannot be provided at this time. The development of the Project at the Rapide Croche site would include below grade piping, launch piers on either side of the station, a ramp, loading dock, and concrete stairwells for access. A parking lot and pedestrian pathway with picnic areas would also be installed, as well as a future AIS education center. A pre-wash water treatment unit and an underground sludge holding tank would also be installed.

The Project will increase the amount of impervious surfaces at the site with the addition of a pedestrian pathway, parking lot, stairwells, piers, and chelated clay fill inside the current lock area. Parking lot and pathways may be built with pervious materials. The Project may require some shoreline tree removal for shoreline development and access between the shore facilities and the docking areas. An erosion control and site re-vegetation plan will be completed during final design and will comply with state standards.

5. Manipulation of Aquatic Resources (include relevant quantities - cfs, acre feet, MGD, etc.)

The design requires conversion of the existing lock system to the proposed transfer station. A majority of the construction will occur in the existing lock with the exception of regress / egress piers.

The current lock area would be filled with impervious material in order to create a boat inspection and pre-wash area, the hot water cleansing chamber, and an operations building. This would also involve the removal and storage of the existing lock gates, valves, and machinery which will be restored and placed on display.

Stormwater Treatment and Control

Stormwater may need to be controlled and treated if the future additions of a parking lot and paths are impervious surfaces. Alternatively, these additions could be permeable (i.e. porous pavement). Bio-retention areas, such as rain gardens and bank stabilization methods may also be considered.

Water Bypass System

A drop culvert that discharges at least 2 feet above 100 year flood high water will be installed to create a water bypass system to generate a flow in the downstream lock channel to help prevent stagnation of the water. In addition to flow velocity and height above 100-year flood elevation, the bypass will be designed in a manner to minimize the potential for AIS to enter and move upstream. It will also help maintain water quality in the channel to reduce the accumulation of blue green algae, which can produce an unpleasant odor and reduce dissolved oxygen content. The flushing rate and discharge volume are estimated to be approximately 30 cubic feet per second (cfs).

Section 408 of the River and Harbors Act of 1899, as amended in 1985, allows for the Secretary of the Army to grant permission

to alter public works if the alteration does not impair the usefulness of the project and is not injurious to the public interest. The water bypass system will comply with this act, and will require approval of the U.S. Army Corps of Engineers USACE). Kaukauna Utilities currently owns the water rights at the dam; therefore, installing a flow bypass will also require approval. The FRNSA has been coordinating with representatives of USACE and Kaukauna Utilities, and it is expected that approvals can be developed for the Project.

6. Buildings, Treatment Units, Roads and Other Structures (include size of facilities, road miles, etc.)

Boat Transfer and Cleansing Station

Small boats (less than 30 feet long) can be lifted and transported efficiently with a fork truck rather than a mobile hoist. Boats greater than 30 feet in length will be lifted and transferred with a mobile boat hoist. Based upon the specification for maximum boat sizes provided in Section 1.3, as an example, a Marine Travelift model 25 BFMII will be adequate for the needs at the station, which can handle boats up to 55 feet long and up to 55,000 pounds (27.5 tons). If FRNSA prefers to incorporate capacities for larger boats, a Model 35 BFMII would be able to handle boats up to 77,000 pounds (38.5 tons).

Aquatic Invasive Species Cleansing

By removing all boats from the water and disposing of any live fish or bait, the Project will minimize the potential for fish to be moved upstream. Angler's catch may need to be placed on ice to meet the criteria no live fish are moved upstream. To minimize the potential transfer of other AIS, the boat will be rinsed with high pressure water to dislodge any organisms adhering to the hull. The boat will then be placed in the 110°F water bath for a minimum of 10 minutes to kill any remaining organisms.

Additionally, sodium hypochlorite will be used for control of biological growth in the hot water bath when it is not being held at treatment temperature. The sodium hypochlorite will be introduced by a separate chemical metering pump on a batch basis to maintain the recommended concentration in the basin and will also serve to augment the heat-based AIS control.

Treatment System Process and Users

The cleansing operation will consist of a chamber/tank for immersing and cleansing relevant watercraft components. All surfaces that could come into contact with water from downstream should be treated. The following is a summary of the steps involved in the proposed cleansing process:

A. Passengers will exit the boat on an access dock. The boat will be lifted from the downstream side of the transfer station and transported to the inspection area with lift/transfer equipment.

1. Inspect boat

   The hull will be inspected for excessive fouling from mussels, algae, or other organisms. Criteria for inspection may be necessary to help staff determine if a boat will be allowed through the cleansing station or rejected. Until a method can be determined to adequately cleanse them, wakeboard boats with ballast bags will be rejected. The water inside the hull will be drained (from bilges, engine, live wells, bait containers, and ballast water). The scope of the inspection area and the drainage system will ensure that water does not drain to the upstream side of the transfer and cleansing station. Contaminated water will be captured and properly disposed of or treated.

2. Cleanse boat

   a. Hull and exposed components

      The hulls will first be sprayed from the gunwales to the keel with high pressure water (2,200 psi) to remove organisms adhering to the hull. The boat will then be placed in the hot water bath to allow contact of the boat hull and exposed components with 110°F cleansing water for a minimum contact period of 10 minutes. Tension on slings, lift straps, fork truck forks or other lifting device components would be released to ensure that the boat is free floating such that hull contact with lift components does not hinder hot water exposure to the boat and lift straps and forks. Raw water systems will be operated for the 10 minutes soak time. Canoes and/or kayaks, including their sealed fore and aft compartments, would be filled with hot water to achieve the minimum contact criteria above.

      Washwater from the hull could potentially be contaminated with paint and other residue from the washing process. This will also be captured and properly disposed of or treated if found to be contaminated.

b. Other boat components

Depending on the type of boat, other components would then be rinsed, flushed or soaked (including sailboat keel trunk, propulsion systems, intake/exhaust ports and cooling systems, bilge compartments if not dry, live wells, anchors, anchor ropes, anchor chains and lockers, skis and all other equipment that come in contact with water downstream such as wetsuits, lifejackets, bait containers and fishing equipment would be inspected and cleansed as necessary) for a minimum of 10 minutes contact time in a 110°F water bath. Some of these activities could be completed concurrently with those in 2(a).

c. Boater's footwear

Due to the tendency for boaters, especially kayak and canoe users, to enter the water with their footwear on, all boaters will be required to walk through a disinfecting solution or across a saturated pad that will need to be designed to kill any potential AIS. This process is similar to bio security methods used in fish hatcheries and food preparation industries.

d. Lifting/transfer equipment components

The boat lifting and transfer equipment that potentially came in contact with downstream water will be rinsed/dipped (i.e. mobile hoist slings, fork truck forks, etc.) in the 110°F cleansing water. Note – activities associated with this step could be accomplished concurrently with those in 3(a).

B. Transfer boat from cleansing chamber to upstream side

The boat will be lifted from the cleansing chamber with the lift equipment and transferred to the upstream side. The operators will verify that the components removed from the boat for cleansing are returned, drain plugs are replaced, etc. After the boat is placed in the water, passengers will be allowed to re-enter the boat from the access pier.

Boats traveling downstream through the transfer station will not require cleansing, since all AIS currently in the Lake Winnebago system are also in the Great Lakes. However the transfer equipment may need cleansing if it has not passed through the cleansing station after entering the downstream water. The station will have posted hours and will not operate unless a trained staff member is present. Additionally, the facility will be fenced such that no one may pass through the boat transfer station, including canoes and kayaks, when station staff is not present.

The hot water cleansing chamber will require a water recirculation system to both maintain the minimum desired water temperature in the cleansing chamber (110°F) and to remove sediments and other contaminants generated from the process. To accomplish this, preliminary plans include a treatment process consisting of a submersible pump delivering the water to a packaged treatment system followed by an inline electric or natural gas heating system. A recirculation system is required to remove accumulated suspended solids and floating oil that could potentially be discharged into the cleansing chamber from boats during the cleansing operation.

Water Temperature and Contact Time

Hot water is the preferred option for treating boats to remove AIS in an environmentally sound manner. The transfer and cleansing station will use a water bath temperature of 110°F for a minimum of 10 minutes in addition to the high pressure water wash. Boats and equipment will be subject to the 110°F water for a minimum of 10 minutes.

Boat Transfer Cycle Time

The approximate amount of time to process a boat through the transfer and cleansing station may vary considerably depending upon the ability of the boat driver to efficiently position the boat within the launch pier, passenger and equipment disembark time, size/type of boat (transfer method), weather conditions, cleanliness of boat hull, requirements for flushing of boat ports and drives, cleansing/immersion of auxiliary equipment, and other factors.

Smaller boats that can be transferred via the fork truck may be processed faster than boats requiring the mobile hoist. Small boats are estimated to take 15 to 20 minutes when traveling upstream, with boats traveling downstream requiring less time since they can bypass the cleansing process. Larger boats are estimated to take 30 to 60 minutes when traveling upstream, and again boats traveling downstream would require less time since they can bypass the cleansing process.

Effectiveness of Planned Treatment

The planned treatment will use a temperature of 110°F, with the addition of high pressure (2,200 psi) pre-wash to dislodge any organisms on the hull prior to the hot water bath. This temperature is below the ANS Task Force recommended 120°F, however the ANS Task Force recommends a 2 minute contact time while the Project will use a minimum 10 minute bath time. The ANS Task Force recommends using 140°F for the high pressure spray with the spray at 2,500 psi for 10 seconds. The proposed treatment temperature is also below the 2014 Interim Protocol for DNR Gear Disinfection for AIS (Attachment 7), which recommends the following washing treatments: 1) Steam cleaning (212°F), or 2) Boat decontamination unit (140°F and 2,500 psi), or 3) Commercial car wash (~120°F). A temperature of 98.6°F will instantaneously kill any juvenile zebra mussels still attached to the hull (McMahon and Ussery 1995, McMahon 1996). The quagga mussel (*Dreissena bugensis*) will be killed at temperatures above 86°F (Mills et al. 1996), while the spiny waterflea *(Bythotrephes longimanus*) has an upper lethal limit of 74°F (Yurista 1999). Recent work by DeStasio (2009) indicated that fishhook waterfleas (*Cercopagis pengoi*) have a higher thermal threshold than spiny waterfleas, requiring 110^{o}F for up to 10 minutes. The water bath will be maintained at a temperature that will maximize the potential for delivery of water at 110°F to affected areas, regardless of heat loss from contact with the boat or due to the time it may take heated water to arrive at hard to reach areas. Fishhook waterfleas produce a resting egg during the late fall, which are resistant to desiccation, freeze-drying, and ingestion by predators, can hatch even if the carrier female is dead. Operating the station only during times of year when the probability of this resistant life stage is absent and using cleansing methods effective on target organisms will increase the potential for safe transfer of boats over the AIS barrier. The New Zealand Mudsnail (*Potamopyrgus antipodarum*), which is a Prohibited invasive species under Wis. Admin. NR 40 has been discovered in WI and Lake Michigan and has a treatment temperature recommendation of 120°F to 140°F. See Attachment 8 for additional information on water temperature and other treatments and their effectiveness on aquatic invasive species and fish pathogens.

Energy Use Requirements

Electricity will be required to operate the facility pumps, treatment system, control systems and facility lighting and perhaps water heating. Natural gas may be used as well. Providing three phase power to the site will allow for procurement and use of standard electric heating and motor equipment.

Parking and Access

Boat passengers will exit their boats onto docks installed at the upstream and downstream launching pier locations. Stairs and walking paths will route passengers around the operational area of the station. Restroom and rest area facilities (i.e. pavilion and picnic tables) for passenger and visitor use will be included, as well as an information kiosk. Site provisions that require compliance with the Americans with Disabilities Act are uncertain at this time, but it is likely that ramps may be necessary at both the upstream and downstream sides of the facility. A wheel chair lift or elevator may be an alternative to ramps.

Future plans include a visitor center and a parking lot to be constructed north of the boat transfer and cleansing station. These will be connected with the pedestrian pathway leading to the picnic area. This will provide future parking for visitors and staff.

Utilities

Power is currently routed to the site from the Kaukauna Utilities Rapide Croche hydroelectric dam site. It will be used to power a pump system to withdraw upstream river water for the pre-wash and hot water bath systems.

Municipal water service is not available near the Rapide Croche lock site. An on-site well with a submersible pump would be necessary for supplying potable water

Municipal sewer service is also not available. Waste holding vaults or a septic system and drain field may be necessary for containment of waste water from restroom facilities. A contracted waste hauler will be necessary to periodically collect sludge material that accumulates from the hot water and pre-wash water treatment systems. Considering the need for waste hauler service, a holding tank configuration for the restroom facilities was assumed. Wastewater holding systems and contracted waste hauling are common practices for many remote boat launch and park sites.

7. Emissions and Discharges (include relevant characteristics and quantities)

Hazardous Materials

A coagulant and polymer will likely be necessary to enhance the water treatment unit performance. Due to the seasonal operation of the process, chemicals will be provided in 55 gallon drums and pumped by small chemical metering pumps directly from the

drums.

Both the fork truck and the mobile hoist use diesel fuel. Based upon discussions with the manufacturers and expected volume of traffic through the station, frequent refueling of the hoist is not anticipated (likely to be less than once per week). Considering that the station will likely experience a higher proportion of boat traffic suitable for transfer via the fork truck, more frequent re-fueling of the fork truck is anticipated. Direct re-fueling of the truck, hoist, and portable storage containers could be accomplished with routine or as-needed deliveries from a diesel fuel supplier (i.e. small tanker truck). Alternatively, a small on-site diesel fuel storage tank, in compliance with regulations, could be included in final plans for the site or subsequently installed depending on need.

Polychlorinated biphenyls (PCBs)

Polychlorinated biphenyls (PCBs) were used widely as dielectric and coolant fluids prior to being banned by the United States Congress in 1979. PCBs are known to be found in sediments throughout the Great Lakes. During 1989, the Corps of Engineers completed analysis of sediment collected from various locations throughout the Fox River Navigation project. The Corps of Engineers' study showed that the lower Fox River contained sediments that were contaminated with heavy metals and other compounds such as PCBs (USACE 1989). To determine if contaminated sediments exist near the Project, sediments will be tested prior to construction. Clean sediment may be land-spread or beneficially reused and any contaminated sediment, if present, will be handled following appropriate regulations.

Sludge

Sludge removed from the hot water treatment system will accumulate in an underground sludge storage tank. A wastewater/sludge hauler will be periodically contracted (as-needed basis) to vacuum the sludge tank and transport the sludge to a licensed facility to treatment and disposal. The frequency of contractor sludge collection will depend on usage of the boat transfer facility and cleanliness of boat hulls but it is expected to be infrequent because pre-washing of boats should limit significant impacts to or fouling of the hot water chamber system.

The anticipated pre-wash water treatment system will need to be periodically cleaned of grit, sediment, and any floatable materials removed from discharged pre-wash water. A contracted vacuum truck will be called as necessary based on visual inspections for accumulated material in the treatment system. Collected water and sediment material will be hauled to a licensed facility for treatment and disposal. Petroleum that could potentially accumulate in the floatable section of the treatment system will be collected and managed separately as wastewater.

Human and Animal Waste

Waste holding vaults or a septic system and drain field may be necessary for containment of waste water from restroom facilities. Wastewater holding systems and contracted waste hauling are common practices for many remote boat launch and park sites. A wastewater/sludge hauler will be contacted to vacuum waste and transport to a licensed facility for treatment and disposal.

A pet waste disposal system will be placed on site for the pick-up and disposal of pet-related waste. This will include posted signage, bags to facilitate clean-up, and garbage cans to dispose of waste. The waste will be disposed as garbage according to the guidelines in *Garbage and Recycling* below.

Garbage and Recycling

General trash from the site will be stored in a dumpster/bin for routine pickup by a contracted waste hauler. Recycling and garbage receptacles will be made available and signs will be posted to encourage appropriate disposal. A solid waste and recycling hauler will be contracted to transport and dispose garbage and recyclable waste form the site.

Chemical and Fuel Storage and Spills Response

Chemicals will be stored in 55 gallon drums. Additionally, diesel fuel will be needed for the lifting equipment. This can be accomplished either without storage of extra fuel through deliveries from a diesel fuel supplier, or in the future by having a small on-site diesel fuel storage tank. FRNSA will follow the WDNR and USCG Marina Standards when responding to any potential chemical or fuel spill.

8. Other Changes

Current and Future Monitoring for Aquatic Invasive Species

Monitoring has been conducted for AIS since 2006 and its continuation will be integral to the operation of the proposed Rapide Croche Boat Transfer and AIS Cleansing Station. Monitoring for AIS both currently and in the future is and will be conducted by

personnel from a local post-secondary academic institution, under the direction of a PhD-level Principal Investigator. Monitoring will occur between March and September. The people doing the sampling should have a Scientific Collectors permit and they should file reports on a regular basis.

The FRNSA has proposed the following sampling equipment and techniques:

Sampling Equipment

- Plankton: Wisconsin-type plankton net with retaining collar (mouth diameter=0.13m, mesh size=63um)
- Benthic Invertebrates: standard Ekman grab sampler (0.15m x 0.15 m box size), a wash bucket with mesh bottom (mesh size=500um), dip nets, and seine nets. Additionally, floating periphyton samplers (16 glass slides) will be used to sample invertebrates that attach to solid substrates from a planktonic phase.
- Fish: cod-end type traps, beach seine nets (1/4inch mesh, 20 foot length), and Smith-Root Model LR-20 Backpack Electrofisher. The DNR recommends 3 or 4 foot fyke nets to maintain consistency with other statewide data collection and standard boom shocker due to size of waterway.
- Sea Lamprey: a double-funnel system trap will be used to sample for sea lamprey, based upon the design of Morris and Maitland (1987).

Sampling Techniques and Methods

- Plankton: Oblique tows will be performed at the mid-channel location of each site using the Wisconsin-type plankton net. Samples will be preserved in 80% ethyl alcohol and examined the in the laboratory using 10X to 400X magnification. All zooplankton in the samples will be identified to the species level when possible.
- Benthic Invertebrates: mid-channel areas will be sampled using the standard Ekman grab sampler. Replicate grab samples will be collected at each site and filtered through the wash bucket. Both shorelines will also be sampled at each site using dip nets and beach seining techniques. The DNR recommends using dip nets and a Surber sampler. Animals captured will be washed into sorting trays and later preserved with 80% ethyl alcohol. Specimens will be identified to the species level in the laboratory when possible. For the floating periphyton samplers, each sampler will be anchored at each site for two-week sampling periods. The glass slides will be removed at the end of the two-week period and preserved in 80% ethyl alcohol, later being identified to the species level when possible.
- Fish: fish will be sampled using a combination of trapping, seining and electrofishing techniques. If possible, specimens from all sampling efforts will be identified to the species in the field and then released. Specimens of new species or specimens difficult to identify in the field will be saved live for later identification in the laboratory. Upon return to the laboratory, specimens will be frozen or transferred to 70% ethyl alcohol for preservation, and identified to the species if possible.
    - Traps: the traps will be deployed during two different periods of the summer at each site for a maximum of 24 hours before being emptied. Traps will be set with and without bait on different dates to optimize catch. Trapping will include mid-channel and shoreline locations at each site.
    - Seine: at least five (5) beach seine hauls will be conducted at each shoreline location on each sampling day.
    - Electrofishing: shoreline habitats will be sampled with electroshocking.

  The DNR recommends additional sampling in mid-water and deep water habitats as well as use of standard boom shocker for larger waterways.
- Sea Lamprey: traps will be placed at sites using a 4-foot metal stake pounded into the substrate. A rope will then be attached to the back of the trap and secured around the pole. If the substrate does not allow for a metal stake to be secured, ropes can be attached to both ends of the trap and secured to trees along the shoreline. The mouth of the trap will face upstream, and traps will be checked at least once every 24 hours. DNR believes sea lamprey should follow USFWS trapping protocols.

Proposed Sampling Locations

The monitoring program for the Project involves sampling points in the three navigation pools above and the three navigation pools below the Rapide Croche transfer and cleansing station. This monitoring program will help track the geographic distribution and potential spread of AIS in the system.

Targeted Species

The monitoring effort includes sampling for invertebrates and fishes. Species which are currently in the Great Lakes that are targeted from spreading into the Lake Winnebago system include: sea lamprey (*Petromyzon marinus*), round goby (*Neogobius melanostomus*), rainbow smelt (*Osmerus mordax)*, ruffe (*Gymnocephalus cernuus*) and Great Lakes lake trout (*Salvelinus namaycush*), salmon (*Oncorhynchus sp.*) and brown trout (*Salmo sp.*), the quagga mussel, non-indigenous waterfleas (fishhook and spiny waterfleas), Asian clam (*Corbicula flumiea*), and the bloody red shrimp (*Hemimysis anomala*). As other non-indigenous species or organisms appear in Green Bay or the Lower Fox River, they will be added to the list.

Contingency Plans

The DNR feels that a contingency plan needs to be developed in case AIS monitoring detects the presence of new AIS upstream of the Rapide Croche Dam. In May of 2007 Viral Hemorrhagic Septicemia virus (VHSv) was found in Little Lake Butte des Morts, the Menasha lock, the next lock upstream was shut down until it was determined that VHS was found upstream. While any contingency plan for this project will need to be discussed with the FRNSA there is precedence for this type of plan.

The FRNSA is concerned with developing a WDNR requested contingency plan to be implemented in the event that AIS is found upstream of the Rapide Croche boat transfer station. FRNSA believes that since AIS are already present upstream of the Rapide Croche dam and there are other vectors for AIS transport upstream it would be difficult to determine if upstream movement of AIS are from this project and thus it would be difficult to develop a contingency plan.

The FRNSA proposes to enhance the current AIS monitoring protocol in the navigation pools downstream of Rapide Croche Lock; the objective being to identify any new AIS threats approaching the transfer station from downstream and to modify, as necessary, the cleansing and decontamination protocol to address that threat. This will proactively prevent the upstream movement of non-native species rather than trying to respond to a breech in the system. The FRNSA will also include regional academic experts and local environmental interests as they move forward with development of the enhanced AIS monitoring protocol. As this Project develops the FRNSA will work with the WDNR to establish a framework for employing AIS Rapid Response guidelines (WDNR, 2012b).

It may be beneficial to monitor for AIS that may found on the upstream side of Rapide Croche. As an example VHSs was found in Lake Winnebago before Lake Michigan.

9. Identify the maps, plans and other descriptive material attached

Attachment 1 Project Location and Topography

Attachment 2 Project Location and Orthophotography

Attachment 3 Site Development Plan

Attachment 4 Plat map

Attachment 5 DNR Wetland Inventory Map

Attachment 6 Zoning Map

Attachment 7 DNR Interim Protocol for Boat and Gear Disinfection

Attachment 8 Treatment Table for Effectiveness on Aquatic Invasive Species and Fish Pathogens

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AFFECTED ENVIRONMENT (describe existing features that may be affected by proposal)

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10. Information Based On (check all that apply):

☒ Literature/correspondence (specify major sources)

- Rapide Croche Boat Transfer and Aquatic Invasive Species Cleansing Station Project Environmental Impact Report
- Voluntary Guidelines to Prevent the Spread of Aquatic Invasive Species Through Recreational Activities – anstaskforce.gov
- dnr.wi.gov

☒ Personal Contacts (list in item 26)

Field Analysis By: ☒ Author ☒ Other (list in item 26)

Past Experience With Site By: ☒ Other (list in item 26)

11. Physical Environment (topography, soils, water, air)

Topography and Soils

The topography of Outagamie and Brown Counties is relatively consistent with an elevation around 700ft. The only noticeable relief is near streams and rivers. The Rapide Croche lock site is located within the steep river valley of the Lower Fox River. The top of the valley is approximately 660ft and slopes down to approximately 600ft at the lock site. Slopes in this area vary from 20-45%.

According to the Natural Resource Conservation Service (NRCS) soil survey (NRCS 2013a) the project site is made up of Kewanee soils. These soils consist of very deep; well drained soils formed in clayey till and are commonly found on ground, end, and recessional moraines.

The majority of sediment annually deposited in the tributaries on the east side of the Lower Fox River (East River and Baird Creek) is from agricultural upland erosion, gully erosion, and stream bank erosion. Soils in this part of the basin are relatively fine in texture with slow permeability. In addition, the landscape consists of moderate to steep slopes and is subject to increased urbanization and significant agricultural land use. All of these conditions play a part in the increased erosion potential and delivery of sediment to the streams, especially for areas in close proximity to the streams (Cadmus 2012). This erosion can occur both from runoff and from boat wake impacts.

On the west side of the Lower Fox River (Apple, Ashwaubenon, and Duck Creek), soils typically consist of clay loam glacial till or sandy soils, which range from poorly-drained to well-drained. Upland erosion in this area of the basin contributes to high sediment loading to the tributary streams. Livestock operations that allow cattle access to streams are a key cause for eroding stream banks, loss of bank cover and vegetation, and degradation to the stream-bed and habitat. Eroding stream banks contribute to flashy stream conditions, which results in smaller tributaries experiencing little to no flow in summers, limiting fish and aquatic life uses. In addition, organic pollutants from livestock waste can cause in-stream temperatures to rise and dissolved oxygen levels to fall (Cadmus 2012).

Water Resources

Lakes

Lake Winnebago is a large (137,708 acre), freshwater lake that has a maximum depth of 21ft and an average depth of 15.5ft (WDNR 2004). This lake is the headwaters of the Lower Fox River and is located at the south end of the river. Lake Winnebago and upper lakes of Poygan, Winneconne and Butte des Morts are a heavily used fishery year round. Combined the Winnebago pool lakes consists of 166,000 surface acres of water (WDNR 2004). Over 2 million people live within 75 miles of the lakes, and the cities of Appleton, Neenah, Menasha, and Oshkosh all obtain drinking water directly from Lake Winnebago (WDNR 2004). Dams built in the 1850's altered the water levels of these lakes by 2.5 feet, creating deeper environments, more stable water levels and an altered hydrologic cycle that led to the loss of aquatic plant habitat and poor water clarity (WDNR 2004).

Green Bay is located at the mouth of the Lower Fox River, and is one of the largest freshwater estuaries in the world. Green Bay is 1639 square miles (1,049,425 acres) located along the south coast of Michigan's Upper Peninsula and the east coast of Wisconsin (Fox River and Green Bay Statistics 2013). The bay is navigable by large ships, and is also heavily utilized for recreation and sporting activities such as hunting and fishing.

Waterways (streams, creeks, and rivers)

The main source of water to the watershed at the project site is the Lower Fox River, which flows northeast for 39 miles from Lake Winnebago and its tributaries to Lake Michigan. The main tributaries to the Lower Fox River include Apple Creek, Ash-waubenon Creek, Baird Creek, Duck Creek, and the East River. The Wolf and Upper Fox river basins drain into the Lower Fox basin. The Lower Fox River drains 6,349 square mile area into Lake Michigan (WDNR 2013). Studies have shown the Lower Fox River to have high sediment and phosphorus loads, mostly due to a combination of point and nonpoint sources of pollution from within the watershed, plus there is a significant contribution of P and TSS discharging into the Lower Fox from Lake Winnebago. Additionally, industrial and residential development and a dominant paper industry in the Neenah, Appleton, and Green Bay areas have also contributed to excessive loadings of bacteria, PCB's, and heavy metals. This resulted in a degraded aquatic habitat, an unbalanced fish community with low population abundance and limited diversity, an advanced state of eutrophication, and high concentrations of toxic materials in bottom sediments and invertebrate organisms consumed by fish (WDNR 2013a). Dredging for the Fox River Cleanup Project began in 2009 to remove PCB contaminated sediment deposits and levels of PCB in fish and other aquatic organisms is expected to drop over time. This will enhance the river for fishing in the future and increase its recreational potential.

Groundwater
The Lower Fox River valley is underlain mostly by dolomite and limestone which yields water to domestic wells due to its secondary fractures and solution cavities (Kammerer et al. 1998). The fractures in this type of bedrock can contribute to increased groundwater contamination as there is less active filtering in these fractures than if the water were to infiltrate through the rock itself.

Nitrate and herbicides (or herbicide metabolites) have been detected in private wells in both Brown and Outagamie counties. Each county has had private wells test over the federal safe drinking water limit for nitrate of 10mg/L. Potential sources of nitrate contamination include infiltration from nitrate fertilizers, manure application, land application of sewage, and non-sewered residential development (USGS 2013a,b). Groundwater use between 1979 and 2005 has increased in Brown County and decreased in Outagamie County.

Air

According to the WDNR, air quality, as measured by ozone and fine particulates, from 2002 to 2011 for Brown and Outagamie counties has consistently been at or below the federal standards with the only exception being in 2007 (WDNR 2013b). In 2007 the city of Green Bay exceeded the 24h-particulate standard. It should be noted however that this was the same year that the Environmental Protection Agency decreased the standard from 65µg/m^3 to 35µg/m^3. From 2008 through 2011, Green Bay has been at or below the federal standard of 35µg/m^3. All samples for Outagamie County were taken in the city of Appleton; one of the largest cities in the county. Samples for ozone in Brown County were taken at the University of Wisconsin Green Bay and particulate samples were taken at Green Bay East High School.

Impervious Surface

The current impervious surfaces at the lock site are structures associated with the lock system. This includes concrete footings and pilings as well as small buildings which comprise approximately 2,500 square feet.

12. Biological Environment (dominant aquatic and terrestrial plant and animal species and habitats including threatened/endangered resources; wetland amounts, types and hydraulic value)

The two main terrestrial habitats in the Lower Fox River basin are agriculture and woodland. Aquatic habitats include wetland, riverine and lacustrine. The other dominant landscape is urban environment (WDNR 2001).

Dominant Aquatic Plant and Animal Species and Habitat

Plants
Within the lock itself, there are no known aquatic plants present and limited presence within the river. Any aquatic plants found in the river will likely be found around the banks or in back waters and bays. Examples of plants found in the aquatic habitats of the Lower Fox River and surrounding wetland, riverine and lacustrine habitats include the following: water lilies (*Nymphaea odorata*), pond weeds (*Potamogeton spp*.), duck weeds (*Lemna spp.*), cattails (*Typha spp*.), bulrush (*Scirpus spp.*), arrowhead (*Sagittaria spp.*), various rushes, sedges, and reeds, cottonwood (*Populous deltoides*), willow (*Salix spp.*), common elderberry (*Sambucus canadensis*), ash (*Fraxinus spp*.), elm (*Ulmus spp*.), maple (*Acer spp*.), red cedar (*Juniperus virginiana*), box elder (*Acer negundo*), and dog wood (*Cornus spp*.).

Within Lake Winnebago, dominant submergent aquatic plants include wild celery (*Vallisneria americana*), sago pondweed (*Stuckenia pectinata*), water milfoil (*Myriophyllum spp.*), including the non-native Eurasian water milfoil (*Myriophyllum spicatum*), water stargrass (*Zosterella dubia*), coontail (*Ceratophyllum demersum*), and common waterweed (*Elodea canadensis*). Curly-leaf pondweed (*Potamogeton crispus*), a non-native plant, can occasionally become locally dominant, but its presence is quite variable on an annual basis. Dominant emergent aquatic plants, typically found in shoreline marshes, are cattail (*Typha spp.*) and common reed (*Phragmites australis*). Occasional stands of hardstem bulrush (*Schoenoplectus acutus*) can be found in bays along the west shore of the lake.

Animals
The wetland, riverine and lacustrine environments in this area provide habitat for various species of fish, birds, mammals, reptiles and amphibians. Examples of common fish species include northern pike (*Esox lucius*), walleye (*Sander vitreus*), bass, sunfish, yellow perch (*Perca flavascens*), and shiners. Common bird species include mallards (*Anas platyrynchos*), blue-winged teal (*Anas discors*), wood ducks (*Aix sponsa*), osprey (*Pandion haliaetus*), bald eagles (*Haliaeetus leucocephalus*), red-winged blackbirds (*Agelaius phoeniceus*), sparrows, and other migratory songbirds. Mammals include muskrat (*Ondatra zibethicus*), woodchuck

(*Marmota monax*), mink (*Neovison vison*), otter (*Lontra canadensis*), raccoon (*Procyon lotor*), white-tailed deer (*Odocoileus virginianus*), coyotes (*Canis latrans*), fox and squirrels.

Within the river, dominant fish species include various panfish, bass, carp, and catfishes along with northern pike and walleye. Freshwater drum (*Aplodinotus grunniens*) is also common throughout the lower Fox River. A wide variety of clams, mussels, amphibians, and invertebrates are present in this river.

Most notably from a fisheries standpoint, Lake Winnebago is renowned for supporting the largest self-sustaining lake sturgeon population in the world 48,000 adults. Each winter, thousands of anglers participate in the unique annual spearfishing tradition that dates back to the Native Americans of the Fox Valley region. Sturgeon spearing generates $3.5 million and sturgeon viewing during spawning generates $350,000. Lake Winnebago is not only famous for its sturgeon, it is also known for supporting one of the best walleye fisheries in the United States (WDNR 2004). Lake Winnebago is home to many other popular sport fish as well, including musky, panfish, largemouth bass (*Micropterus salmoides*), smallmouth bass (*Micropterus dolomieu*), northern pike, and catfish. According to Winnebago County UW-Extension a 2006 survey of the economic impact of angling on the Winnebago pool lakes found that angling brought in $155.5 million of direct spending annually to the economic region. Almost 3,500 jobs are attributed to this direct spending. An additional indirect and induced impact of $78.5 million and 800 jobs are also felt in the region resulting in a total impact of $234 million and 4,300 jobs.

Habitat

Wetland, riverine and lacustrine habitats are all present within the potentially affected environment. Wetland habitats include submergent marsh, emergent marsh, shoreland wetlands, wet meadow, shrub-carr, forested or floodplain wetland.

The sealed lock area provides limited incidental aquatic habitat. Algae are present in the water and attached to portions of the lock structure itself.

Due to the high sediment loads throughout much of the watershed, the river substrate is likely very silty. And although the river is impounded by 12 dams and 17 locks, it maintains the characteristics of a large flowing stream and not a series of impoundments (WDNR 1988).

Dominant Terrestrial Plant and Animal Species and Habitat

The dominant terrestrial habitats are open land and woodland. Open land includes cropland, orchards, pastures and meadows, and comprises the majority of land within 0.5 miles of the Lower Fox River (WDNR 2001).

Plants

The area immediately surrounding the lock is mowed and maintained lawn. However, in areas were the river valley is steep it is dominated by mixed deciduous woodland including oaks (*Quercus spp.*), hickory (*Carya spp.*), and maple (*Acer spp.*) as well as various other upland understory shrubs including glossy buckthorn (*Rhamnus frangula)*, grasses and forbs. In flatter, floodplain areas cottonwood and box elder trees dominate the tree layer. The understory in these floodplain areas are dominated by various sedges (*Carex spp.*), rushes (*Juncus spp.*), and reed canary grass (*Phalaris arundinacea*).

Animals

Outside the banks of the river valley, this region is dominated by agriculture; mostly comprised of row crops as well as dairy farms and feed cattle.

Common species in the open land habitat include songbirds, white-tailed deer, rabbits, red fox (*Vulpes vulpes*), coyote, pheasant (*Phasianus colchicus)*, Hungarian partridge (*Perdix perdix)*, waterfowl and domesticated livestock (WDNR 2001). Additional animals include small mammals, bats, frogs, turtles, snakes and invertebrates. Many of these same species are present in the woodland habitats, and also include skunk, thrushes and woodpeckers.

Because the area around the lock has been mowed and maintained, few animals actually live in the immediate Project area. Animals likely to exist in the lock area include furbearers (raccoon, skunk), small mammals and songbirds.

Threatened, Endangered, and Rare Species and Natural Communities

A Natural Heritage Inventory (NHI) review was conducted for the Project. No threatened, endangered, or rare species or natural communities were identified in proximity to the Project area. The bald eagle (*Haliaeetus leucocephalus)* is protected under the Bald and Golden Eagle Protection Act and is described below. A second NHI review was conducted on January 15, 2014 by

James Doperalski Jr. to confirm the original review.

Raptors
Bald Eagles are known to be present around the Rapide Croche lock during the winter months and there is a recent nesting site known near the project. They utilize the open water areas around the dam for fishing and the trees along the bank for perching. The surrounding area also has habitat that contains suitable places for eagles to feed, perch, roost, and to build a nest site. It is also likely that Osprey can found fishing in the Lower Fox River during the summer months; however, it would be very unlikely that an Osprey would be found at this latitude during the winter.

State-listed raptors include the Peregrine Falcon (*Falco peregrinus*; endangered) and red-shouldered hawk (*Buteo lineatus*; threatened). None of these species were identified in proximity of the project area during the NHI inventory review.

Wetlands and Waterways

Wetlands, Shoreland, and Waterways
There are no wetlands located within the immediate project area. However, there are wetlands along Lake Winnebago, the Lower Fox River and Green Bay that provide critical fish spawning habitat for perch, northern walleye and spotted musky (See Section 3.2.1.3; Cadmus 2011) and help protect shorelines from erosion caused by boat traffic and wind-generated waves. Published information specific to the Lower Fox River regarding the current stability of the shoreline or the current level of bank erosion is not available. Although river bank instability is not cited as a major issue in the Lower Fox River Basin Integrated Management Plan (WDNR 2001), streambank erosion is a widespread problem and can be expected to occur currently along at least some portion of the Lower Fox basin. The fact that one of the goals of that Plan is to "Identify critical habitat sites for shoreline protection, restoration, or in-stream habitat restoration" (WDNR 2001) indicates that some problems with river bank erosion are likely to exist.

Turbidity remains a significant water quality problem on Lake Winnebago and throughout the system as well. Shoreline erosion particularly on the upper pool lakes and the rivers have contributed to the 303d listing of impaired waters on the system. This erosion comes from a variety of sources; artificially higher water levels, wind-generated wave action, etc. However, it also includes boat-generated wakes, which can be significant during summer, especially in the rivers and confined channels. Boat size plays an important part in the size of the wake generated. Increased erosion form boat wakes, especially from larger boats, poses the threat for increased turbidity problems on the Winnebago system.

In contrast to inland lakes, rivers tend to connect long stretches of habitat, have a dendritic tributary network that can touch large areas of land, collect water from large areas, and can act as corridors for the spread of disease, contaminants, nutrients, plants, and animals. Rivers also act as "conveyor belts" delivering sediment and flotsam from upstream sources. The connectivity that rivers have with the landscape also makes them important transportation corridors.

The Lower Fox River has been and remains an important navigation corridor for boat traffic of all kinds. Beginning with light watercraft used by Indians and early European traders and explorers to heavy transport traffic that continues in the estuary area to this day, the Fox River has been an important feature serving many human needs. The lock system installed along the Fox River was conceived as a way to allow uninterrupted inland navigation from the Great Lakes to the Gulf of Mexico. In practice, commercial lock use was limited to the section of the river between Green Bay and Lake Winnebago. This section of the river contains numerous rapids requiring a complicated sequence of locks to allow larger vessels to navigate upstream of De Pere. The lock system was expensive to operate and maintain. Following the establishment of the non-native sea lamprey in Lake Michigan, the Rapide Croche Lock was sealed in 1988 by USACE and WDNR to create a barrier preventing the migration of this destructive species into Lake Winnebago. Sixteen of the 17 locks in the Fox River system are currently undergoing renovation, and the system will reopen for navigation in the next two years. When the system renovation and boat transfer station is completed, boats will be able to navigate the entire stretch of river between Lake Winnebago and Green Bay.

Blue-green Algae
While there are advantages to having blue-green algae in an aquatic system, such as oxygen production and nitrogen fixation, in large amounts these algae can cause a variety of problems for an ecosystem. In high concentrations the algae can become toxic to domestic animals such as dogs. Also, when these large colonies start to decompose, they produce a foul odor and can greatly increase the nutrient load in that area, thus fueling future blooms. Water quality also suffers with excess algae through dissolved oxygen sags during night hours as the algae respire or during decomposition of the dead mats, toxins that some blue-green algae produce and the shading out more desirable rooted aquatic plants form dense mats on the surface. In freshwater, blue-green algae blooms commonly occur in shallow, stagnant, nutrient rich waters. Both the Lower Fox River and Lake Winnebago are known to experience blue-green algae blooms. Blue-green algae may have adverse aesthetic impacts.

Aquatic Invasive Species

Currently, according to the Wisconsin Department of Natural Resources (WDNR; WDNR 2013c), there are eight AIS already documented in the Lower Fox River system, including Eurasian Watermilfoil (*Myriophyllum spicatum*), Zebra Mussel (*Dreissena polymorpha*), Chinese Mystery Snail (*Bellamya chinensis*), Curly-leaf Pondweed (*Potamogeton crispus*), Flowering Rush (*Butomus umbellatus*), Viral Hemorrhagic Septicemia (*Novirhabdovirus Viral hemorrhagic septicemia virus),* Faucet Snail (*Bithynia tentaculata*) and Rusty Crayfish (*Orconectes rusticus*). AIS monitoring conducted by DeStasio for FRNSA from 2006 through 2012 also found, common carp (*Cyprinus carpio*), and the amphipod *Echinogammarus ischnus* above the Rapide Croche lock and dam (DeStasio 2013). Other non-native species have been detected above the dam, but are not thought to have established populations yet. These include *Daphnia lumholtzii*, a waterflea, and the amphipod *Gammarus fasciatus*.

Additional AIS of significant concern present in Lake Michigan that have not yet been found in the Winnebago Pool include asiatic clam (*Corbicula fluminea*), fishhook Waterflea (*Cercopagis pengoi*), rainbow smelt (*Osmerus mordax*), round goby (*Neogobius melanostomus*), spiny waterflea (*Bythotrephes longimanus*), sea lamprey (*Petomyzon marinus*), quagga mussel (*Dreissena bugensis*), bloody red shrimp (*Hemimysis anomala*), ruffe (*Gymnocephalus cernuus*) and alewife (*Alosa pseudoharengus*) (WDNR 2013c).

13. Cultural Environment

a. Land use (dominant features and uses including zoning if applicable)

Land use in the Lower Fox River basin's 403,657 acres, which encompasses the entire Lower Fox River and surrounding area from Lake Winnebago to Green Bay, can be separated into three main categories, agriculture (including barnyards), urban, and natural areas. Agriculture makes up the greatest portion of this area at 50.2% followed by urban and natural areas representing 34.6% and 14.7% respectively (active construction sites made up the remaining 0.6% at the time the study was conducted; Cadmus 2012).

b. Social/Economic (including ethnic and cultural groups)

Recreational Use

The Fox River State Recreational Trail runs for 25 miles, starting in the city of Green Bay. Seven miles of paved trail go south along the Fox River to the city of De Pere, and unpaved portions of the trail are open to horseback riding. Fishing, biking, walking, jogging and rollerblading are all popular recreational activities along the trail. Other popular trails along the Fox River include the Little Chute Heritage Trail, and the Menasha Trestle Trail.

The Lake Winnebago system and Lake Michigan are all utilized extensively for recreational, of which fishing is a large portion. Lake Winnebago alone features over 30 boat launching sites, 13 public lands/parks, and a beach (Nisbet and Davis-Foust 2013; WDNR 2013c). There are also numerous end-of-road and end-of-lane ramps in addition to recently installed kayak and canoe launches and portages. Additionally, the Winnebago Pool hosts 65 to 70 fishing tournaments a year. Due to their size and accessibility, lakes Winnebago and Michigan see significantly more recreational use than the Lower Fox River.

The 39-mile section of the Lower Fox River from Lake Winnebago to Green Bay has been identified as part of the 280-mile Fox-Wisconsin Water Trail, which was recently designated a National Recreational Trail by the National Park Service.

Boats

Boat traffic along the Lower Fox River includes both recreational and limited commercial use. However, currently the only way to move a boat around the Rapide Croche Lock is to portage over (canoes, kayaks, etc.) or trailer the boat around it. Thus, traffic on the 39-mile reach of river between Lake Winnebago and Green Bay is largely limited to boats owned by shoreline residents or smaller boats that can easily be launched at a ramp or the shoreline. Aerial photos show at least three private boat launches on this reach, but the river banks are steep and there are relatively few public boat launches on many reaches of the lower Fox River, some pools have no boat launch sites. This greatly limits public access to the waterway. Since 1988, navigation for power boats on the Lower Fox River has been limited to those that can be trailered. Power boating has generally been limited to the individual pools created by the numerous dams that exist along this reach.

The Lake Winnebago system is one of the most popular recreational boating lakes in Wisconsin. Over 78,000 boats are registered in the six counties bordering the Lake Winnebago system (WDNR 2012). These boats utilize Lakes Winnebago, Butte des Morts, Poygan, and Winneconne during most all of the open water period.

Canoes and Kayaks

With limited boating access to river between Kaukauna and Rapide Croche lock, canoes or kayaks are more likely to be used on this stretch of river than other boats, simply because they are easier to launch. Recent designation of this segment of the Fox River as part of a National Recreational Trail system has increased attention from canoe and kayak users. There has been increased interest in this pool and the next pool upstream from paddlers as a part of the Kaukauna City Plant dam FERC relicensing that is currently in process. Increased boat traffic, congestion and wakes, particularly those from larger vessels, could present resource use conflicts and a safety concern for these users.

Sport Fishing

The Winnebago system is home to one of the best walleye fisheries in the mid-west, with 10's of thousands of anglers plying its waters annually on a year-round basis for not only walleye by bass, panfish, and other species. It is host for 65 to 70 permitted fishing tournaments annually, with over 82,000 tournament angler hours alone logged. Bass fishing has been increasing over the last decade, and recently the panfishery has been flourishing (Kamke, Pers. Comm.). The system is also home to the largest self-sustaining lake sturgeon population in the world, which supports a winter spearing season. Approximately 12,000 spearers take part in the season annually. Recreational fishing on the Winnebago is a large economic engine in terms of area tourism The Winnebago recreational fishing industry, the tourism dollars it brings in and the jobs that is supports.

Employment, Labor Force, and Income

According to three-year estimates from the U.S Census Bureau (2010), the populations of employed civilian citizens age 16 and older in the work force in Brown and Outagamie Counties are 139,310 and 99,049 respectively. Unemployment rates for Brown and Outagamie Counties are 5.4% and 3.5% respectively, both of which are below the unemployment rates of Wisconsin and the U.S. rates of 5.7% and 6.6% respectively (date). Per capita income for Brown and Outagamie Counties are both above that of Wisconsin as a whole and slightly below that of the U.S. (Table 1).

Educational services/health care and social assistance, manufacturing, and retail trade respectively, make up the three largest employment industries in both Brown and Outagamie Counties (Table 2) (U.S. Census 2010). Despite the significant acreage of agricultural land in this area, the agriculture/forestry/fishing and hunting/mining industry is the smallest employment sector in both counties. This is likely due to the large industrial presence in the Appleton (Outagamie County) and Green Bay (Brown County) regions.

Table 1. Employment and Income Comparison (2010)

Location	Civilian Labor Force	Number Employed	Number Unemployed	Unemployment Rate	Per Capita Income
Brown County	139,310	128,469	10,688	5.4%	$27,224
Outagamie County	99,099	94,191	4,862	3.5%	$26,603
Wisconsin	3,089,541	2,826,631	258,986	5.7%	$26,562
United States	156,201,959	140,145,661	16,056,298	6.6%	$27,158

Source: U.S. Census Bureau 2010

Table 2. Brown and Outagamie County Employment by Industry (2010).

Industry	Brown County		Outagamie County	
	Employee Estimate	Percent of Total Employees	Employee Estimate	Percent of Total Employees
Agriculture, forestry, fishing and hunting, and mining	2,440	1.9%	1,551	1.6%
Construction	7,031	5.5%	5,058	5.4%
Manufacturing	21,735	16.9%	21,592	22.9%
Wholesale trade	4,787	3.7%	2,487	2.6%
Retail trade	13,303	10.4%	11,178	11.9%
Transportation and warehousing, and utilities	8,543	6.6%	4,548	4.8%
Information	2,808	2.2%	1,926	2.0%
Finance and insurance, and real estate and rental and leasing	8,101	6.3%	6,551	7.0%
Professional, scientific, and management, and administrative and waste management services	9,134	7.1%	7,653	8.1%
Educational services, and health care and social assistance	29,822	23.2%	17,543	18.6%
Arts, entertainment, and recreation, and accommodation and food services	11,171	8.7%	7,669	8.1%
Other services, except public administration	5,792	4.5%	3,554	3.8%
Public administration	3,802	3.0%	2,881	3.1%

Source: U.S. Census Bureau 2010

c. Archaeological/Historical

The Wisconsin Historical Society (WHS) lists the Rapide Croche Lock (WHS Record #27751) and the Dam (WHS Record #27752) on the State Register of Historic Places. Both are included in the Rapide Croche Lock and Dam Historic District (WHS Record #93001326), which is listed on both the State and National registers. Other facilities, including the Rapide Croche Lockkeepers House (WHS Record #27749), and the Rapide Croche Lock Shack (WHS Record #27750), are also included in the listing. Archaeological sites are not listed on the project site.

14. Other Special Resources (e.g., State Natural Areas, prime agricultural lands)

The Winnebago system consists of Lakes Butte des Morts, Winneconne, Poygan, Winnebago and all their tributaries from their mouths upstream to the first dam including the Fox river from Lake Winnebago upstream to the dam above Princeton and all its tributaries from their mouths upstream to the first dam and the Wolf river from its mouth upstream to the dam in the city of Shawano and all its tributaries from their mouths upstream to the first dam including Cincoe lake, Partridge Crop lake and Partridge lake in Calumet, Fond du Lac, Green Lake, Marquette, Outagamie, Shawano, Waupaca, Waushara and Winnebago counties (WDNR Regulations 2013). There are talks of expanding the definition of the Winnebago System up to the dam on Park Lake near Pardeeville.

As stated above, the Winnebago system supports a $234 million dollar fishing industry and also supports the largest naturally reproducing Lake Sturgeon population in the world valued at $3.85 million.

15. Physical (include visual if applicable)

Once the Project is operational, 39 miles of the Fox River will be opened for navigation between Lake Winnebago and the bay of Green Bay for all types of watercraft under 55 feet in length. The St. Norbert Boater Survey (2010) indicates that there is support for a proposed Rapide Croche Boat Transfer Station. The survey also shows most agree that during the lifting process boats should be cleaned so that the possible introduction of AIS from the Great Lakes system into Lake Winnebago Watershed is eliminated. Boating traffic in the Fox River upstream of the Project could increase. Increased boat traffic upstream on the Fox and Wolf Rivers and Winnebago system pool lakes and rivers could result in increased sediment and erosion in those waters. The Winnebago system pool lakes and rivers already are significantly affected by wake-generated erosion resulting in increased silt load and decreased water quality. The physical and visual effects of the predicted 1,300 additional boats (St. Norbert 2010) in comparison to the thousands of boats already using the Lake Winnebago system (based on the number and capacity of existing boat launch sites per Nisbet and Davis-Foust 2013), would be negligible.

More boats and boat traffic will mean additional wake waves, which can lead to river bank erosion problems in susceptible areas. Factors including a boat's speed, size and displacement affect the magnitude of wake waves. If increased boat activity is combined with sparse bank vegetation and unconsolidated soils, new bank erosion problems may result, especially along narrow reaches or steeply sloping banks. Installation of energy absorbing measures and/or establishment of boat speed rules in river segments susceptible to erosion may be necessary to minimize the effects of waves and wakes on the river's banks.

16. Biological (including impacts to threatened/endangered resources)

Effects of Boat Traffic

Boats may affect the biological community in several ways. Direct contact with boats/propellers can be a source of mortality for fish and wildlife such as shorebirds, waterfowl, herons, loons, turtles, frogs, and fish (i.e. sturgeon). Pollution from exhaust or spills can be toxic to some species. Boat movements can affect individual fish by disturbing their normal activities, and increased turbidity may affect sight-feeding species. Birds are especially sensitive to human disturbance, which may affect their nesting or feeding habits. Populations may also be affected by habitat alteration caused by waves and/or propeller damage (Asplund 2000). However, these waterways are already heavily trafficked by boats, and many of these impacts are already occurring. The areas near the station itself will see increased boat traffic once that river reach is navigable, and certain areas may require mitigation in the form of decreasing the maximum boat speed.

Aquatic Invasive Species

Increased boat numbers would increase the likelihood of AIS introduction, as recreational boating and fishing is one of the main vectors of transport for them. The goal of this Project is to provide a means to transfer and cleanse boats to minimize the risk for introduction of AIS upstream of the Project. Currently boats cannot travel through the Rapide Croche dam. Boats need to be trailered in order to travel around the Rapide Croche dam. Boats gaining access to the river upstream of Rapide Croche via boat launches may be inspected and have visible weeds removed, but for the most part are not being washed or otherwise decontaminated. However, it should be noted that these are likely smaller boats, which have much lower probability of having been used in the Bay of Green Bay or in Lake Michigan. The proposed cleansing station would be more effective at controlling AIS than simply transferring boats over the dam or trailering boats around the dam however it cannot guarantee one hundred percent effectiveness.

Two species that are common in Green Bay and that occur in the Lower Fox River below the Rapide Croche Dam, the white perch and the round goby, have a particularly high potential to cause harm to the Lake Winnebago system if they become established there. White perch first appeared in Green Bay in the late 1980's and were soon abundant. They regularly use the lower reaches of the Fox River for spawning (Cochran and Hesse 1994). In Oneida Lake, New York, a lake similar in size, morphometry, productivity, thermal regime, and fish community to Lake Winnebago, invasive white perch quickly became common when given access to the lake via artificial canals used for navigation (Scott and Christie 1963). Once established there, they consumed a wide range of zooplankton and benthic macroinvertebrates and potentially competed with juvenile yellow perch (Perca flavescens), the key prey species for walleye in the lake (Prout et al. 1990). White perch competition and perhaps predation also appear to have caused major declines in the white bass (Morone chrysops) population in Oneida Lake and in Lake Erie (Madenjian et al. 2000). Walleye, yellow perch, and white bass are key native components of the Lake Winnebago system fish community and fishery. In Missisquoi Bay, a shallow arm of Lake Champlain, Vermont, invasive white perch consumed enough Daphnia zooplankton to alter the composition of the overall plankton community, which may have fostered blue-green algae

blooms (Couture and Watzin 2008).

The round goby invaded Green Bay in the late 1990's and rapidly expanded into tributaries up to the first impassable dam or natural barrier. Round goby habitat modeling indicates that many areas upstream of these barriers, including the Lake Winnebago system, are highly vulnerable to invasion if the barriers were to be removed or bypassed (Kornis and Vander Zanden 2010). In the Great Lakes the round goby has become abundant in many shallow nearshore habitats and has had a major effect on the biological community (Kornis et al. 2012). Along the Door County shoreline of Green Bay, expanding round goby populations depressed the abundance of many benthic invertebrates including isopods, amphipods, and snails (Lederer et al. 2006, 2008). These invertebrates are important prey for many native gamefish and non-game fish species. The round goby has reduced or even completely displaced populations of benthic fishes, particularly several species of sculpins and darters (Jude et al. 1992; French and Jude 2001; Balshine et al. 2005). These benthic non-game fishes are important prey for many gamefish species. Finally, round gobies are known to consume the eggs of lake sturgeon (Nichols et al. 2003), the largest and most iconic fish species of the Lake Winnebago system.

Water Quality

Boat traffic has been shown to affect water clarity and can be a source of nutrients and algal growth in aquatic ecosystems (Asplund 2000). Shallow lakes, shallow parts of lakes and rivers, and channels connecting lakes are the most susceptible to impacts. Depth of impact varies depending upon many factors including boat size, engine size, speed, and substrate type. In silty substrates, the greatest increases in suspended solids have been observed at depths of 3 feet, and to a lesser degree at 6 feet deep. No changes have been observed below 8 feet deep (USACE 1994). Creating no-wake zones in shallow areas can help reduce boat-related increases in turbidity. Lake Winnebago is already in a eutrophic state according to 2013 water quality reports (available at http://dnr.wi.gov/lakes/waterquality/bycounty.aspx), which results in high turbidity. A substantial portion of the lower Fox River is fairly shallow, including the pool immediately above Rapide Croche dam (NOAA Recreation Chart 14916). Prop wash from larger boats could disturb this sediment adding to the turbidity in the river. Compared to the overall boat usage of the lake, the increased boat traffic due to the Project will likely have a negligible effect on water quality. Near the boat transfer and cleansing station itself, the water bypass system will help to reduce algal growth; however boat activity near the transfer station will disturb sediments and may result in turbid water, at least in the near term.

The upper pool lakes of the Winnebago system are shallow, riverine marsh impoundments. Disturbance of the soft bottom sediments from prop wash already occurs. Increased boat traffic on these lakes could increase the disturbance, which reduces water quality in those lakes.

There have been numerous studies on the effects of outboard motor exhaust and related pollution from fuel leakage. In general, these studies have shown minimal toxic effects on aquatic organisms because: 1) the amount of pollution is small compared to the volume of a lake; and 2) most hydrocarbons are volatile and quickly disperse. However, polyaromatic hydrocarbons and fuel additives have been detected in some cases. Build-up of certain compounds in sediments has been documented, especially near marinas or other high concentrations of boats, and may be detrimental to bottom dwelling organisms (Asplund 2000). However, the expected increase in boat numbers due to the boat transfer and cleansing station, spread over the boating season, is unlikely to create a situation similar to a marina (due to small numbers of boats, lack of fueling or other attractive services) and should, therefore, have a negligible effect on water quality.

The water bypass system and the discharge of clean wash water will help to discourage blue-green algae mats from forming.

Threatened, Endangered, and Rare Species and Natural Communities

Loss of shoreline habitat along the lock, island or river will have an adverse effect on raptor habitat. Large trees utilized by eagles and other raptors would be eliminated. Trees that would be removed are commonly oaks & cottonwoods that attain great height and width, which are great for perching. Eagles (November to April) or sometimes ospreys (March/April/May, September/October) use the site when the lock is not in use. Eagles/Osprey may nest in these and are known to adapt with some human interference. A re-vegetation plan with large poles (greater than 50 feet is recommended) could mitigate these impacts.

17. Cultural

a. Land Use (including indirect and secondary impacts)

Land use in the Lower Fox River basin is not expected to change due to the Project. The station will not alter any land other than the existing lock and surrounding property.

b. Social/Economic (including ethnic and cultural groups, and zoning if applicable)

Recreational Use

The Project is expected to increase recreational use of the Lower Fox River by increasing the accessibility for boats from downstream and upstream. Additionally, Lake Winnebago and Green Bay may also see additional recreational activity, in the form of boat traffic, due to increasing the ability for boats to move from one side of the lock to the other without having to use a boat landing and trailer. This may be especially important for larger recreational boats and limited commercial vessels that are too large to trailer on a regular basis. The boat cleansing and transfer station will increase the accessibility of recreation for people living downstream of the Rapide Croche dam, allowing access for recreational boating and fishing, as well as access to all of Lake Winnebago's recreational areas.

Increased boat traffic is expected on the Lower Fox River and potentially on Green Bay and Lake Winnebago as well. The Lower Fox River may see an increase in larger boat traffic, since the Project will allow for large boats to travel between the Green Bay or Lake Michigan and Winnebago System. According to the St. Norbert Boat Survey (2010) large boat owners travel between Lake Winnebago and Rapide Croche more often than smaller vessels and length of boat has a significant positive correlation with support for, and likelihood of using, the proposed Project at Rapide Croche. Smaller boat owners feel it is less important to be able to travel from Green Bay and the Great Lakes to Lake Winnebago.

Opening the lock system will make it easier to pass through the entire river and will increase the number of boats plying all reaches of the Lower Fox. The St. Norbert Survey (2010) suggests that over 1300 boats will annually utilize the transfer facility at Rapide Croche. This number can be considered the likely number of additional recreational watercraft to navigate between the Lower Fox River, Lake Winnebago, and Green Bay.

Since canoes and kayaks are easy to portage, the Project may not significantly alter canoe and kayak travel. However, the river is part of the Fox-Wisconsin Heritage Water Trail, recently designated as part of the National Recreational Trail system, is likely to garner more attention to the waterway. This designation is likely to increase the number of small craft navigators in the river system. The proposed Project will provide a means of cleansing canoes and kayaks to minimize the spread of AIS upstream into the Lake Winnebago system, which will increase in importance as the water trail becomes more popular. With the potential increase of larger boat traffic there may be an increase in user conflict between canoers and kayakers and larger boats.

Sport fishing may increase in association with improved access between Lake Winnebago and Lake Michigan (St. Norbert 2010). Because of the lack of public boat ramps on the river between Rapide Croche and the next upstream lock, even sport fishing boats that are easily trailered may use the transfer station to take advantage of the newly available angling territory.

Prior to restoration of the locks and dams in the Fox River they acted as barriers to the movement of AIS by boat traffic. Restoring the lock system and facilitating movement of boats from the bay of Green Bay and Lake Michigan risks opening a conduit for AIS movement throughout the lower Fox River. Should AIS be introduced to the Lake Winnebago system, they would have access to roughly 17 percent of Wisconsin's inland water acreage (WDNR 2004). Additionally, many of the Winnebago system's users take their boats to other water bodies throughout the State, increasing the risk for moving AIS to other inland waters around the State. AIS could alter aquatic ecosystem and fisheries community within the Lake Winnebago system. The cleansing station's goal is to reduce the threat of AIS transfer associated with boats traveling through the station, but cannot guarantee it.

Educational Use

The Project will be an educational facility that teaches boaters and anglers about the prevention and consequences of AIS in waterways. Educating boaters, who utilize both the Lake Winnebago system and Lake Michigan, may help reduce the potential for AIS spread.

Effects of Boat Traffic

Increased boat traffic can result in the crowding of lakes, decreased safety, decreased air quality, and increased noise. Motor noise can disturb aquatic wildlife as well as upset human inhabitants of lakes and waterways. Increased boat traffic is also likely to result in an increase in motor noise. This could result in decreased enjoyment for homeowners and other visitors. However, the increased boating activity associated with the limited number of boats using the transfer station on a daily basis is not expected to result in nuisance level effects, when compared to current boating use.

Staffing Levels

The boat transfer and AIS cleansing station will likely be operational from 10am to 11pm on Mondays through Thursdays,

and from 8am until midnight on Fridays, Saturdays, Sundays and holidays. This is the current operation schedule for the interior locks and is subject to change. It is anticipated that two station operators at a time will likely be necessary to facilitate efficient and orderly boat transfers. This represents 100 person-hours of operation each week, or two to three seasonal positions. These positions will need to be trained in not only how to operate the transfer/cleansing station, but also AIS. Understanding the ecology/biology of AIS will allow for a more comprehensive cleaning technique.

According to the 2008 Aquatic Invasive Species Strategic Plan for the Winnebago Pool (Winnebago Lakes Council 2008), angling in the Winnebago system is directly responsible for 3,500 jobs in the area, and indirectly adds an additional 800 jobs. The Project could contribute to additional jobs, both directly as a result of the jobs at the station itself, and indirectly as a result of increased angling and recreation.

Area Economy

Direct and indirect spending from fishing activities contributes greatly to the local economy. The Project is expected to increase the area economy, due to both direct fees from the boat transfer fee, the activities related with construction of the facilities, and indirectly through increased angling and other recreation activities. The 2011 National Survey of Fishing, Hunting and Wildlife-Related Recreation found that anglers in Wisconsin (both resident and visitors) spend an average of $29 per day of fishing. This equates to $1,129 per angler per year. Of this, approximately 21.5% goes towards food and lodging expenses, and 19.8% to travel expenses. The rest goes towards equipment and other miscellaneous expenditures.

Should AIS become established in the Lower Fox River upstream of the Project, particularly in the Winnebago system and negatively affect sport fisheries, there is a potential loss of some portion of $234 million annually to a 5 county region and up to 4,300 fishing dependent or related jobs in those counties.

Cost Effectiveness

If operation of the Project would have to be terminated at some point in the future if found not to be cost effective, the expected economic benefits will not come to bear. However, the protective AIS barrier will remain in place.

c. Archaeological/Historical

A State Process 44.40 form was sent to the Wisconsin Historical Society (WHS) regarding the Project. In order to construct the project the Rapide Croche Lock (WHS Record #27751) would need to be filled and the lock gates removed. The Rapide Croche Lockkeeper's House (WHS Record #27749) would remain; however, a future parking lot may be constructed in the vicinity of the house. The Rapide Croche Lock Shack (WHS Record #27750) may need to be removed. The WHS responded that the Project will have adverse impacts on historical properties and that further consultation is needed. No archaeological impacts are anticipated.

The FRNSA will continue to work with the WHS as it has on other projects to minimize and mitigate for historical impacts. These include restoration of the Lock Shack and Lock Gates. These and other components of the lock, such as operating machinery, will be used as part of educational displays at and around the Project and will also be supplemented with pictures and other documentation discussing the historic elements of the Lock and Dam, and the District. A Historic Preservation Study is currently being conducted by Anne Biebel of Cornerstone Preservation. A Historian has been contracted to work with WHS during final design.

18. Other Special Resources (e.g., State Natural Areas, prime agricultural lands)

The Winnebago system consists of Lakes Butte des Morts, Winneconne, Poygan, Winnebago and all their tributaries from Lake Winnebago upstream to the dams at Princeton and Shawano making it the largest lake system in the state of Wisconsin. This lake system is approximately 166,000 acres, comprising 17% of the freshwater in the state. The Lower Fox River includes approximately 39 miles from the Winnebago pool to Lake Michigan in the city of Green Bay.

The Lower Fox River and Winnebago system is an ancestral home to Native Americans and has a strong historical significance to the settlement of Wisconsin. Historically the Winnebago system is described as an area with abundant wild rice, fishing, furbearing animals and waterfowl. In the 1850's the system changed dramatically with new settlers and industrial development, including two dams constructed at the Fox River outlets of Lake Winnebago in Menasha and Neenah. Wood product and paper industries continue to be important industries in this region.

The Winnebago system is critical for the surrounding communities, providing drinking water to 250,000 people including the communities of Menasha, Neenah, Appleton, and Oshkosh, supplying water for myriad industries throughout the area and offering numerous recreational opportunities such as fishing, boating, swimming, camping, hunting, and wildlife viewing.

The Winnebago system provides important recreational outlets, making this system the most heavily used by boaters in the state, the majority of which are fishing boats under 22 feet. Over 2 million people reside within 75 miles of the lake, making it an ideal day trip. Additionally, the 39-mile section of the Lower Fox River from Lake Winnebago to Green Bay has been identified as part of the 280-mile Fox-Wisconsin Water Trail, which was recently designated a National Recreational Trail by the National Park Service.

Lake Winnebago contains a sustainably harvested lake sturgeon population that is managed by the WDNR. Thousands of tourists visit popular spawning viewing areas located at the Shawano dam in Shawano, Bamboo Bend in Shiocton, and the Wolf River Sturgeon Trail in New London. Sturgeon spearing and sturgeon spawning periods occur during winter and early spring, respectively, and annually provide an economic benefit of an estimated $3.5 million for spearing and $350,000 for viewing to local communities.

High Cliff State Park is a 1,187-acre park operated by the WDNR near Sherwood, Wisconsin on the northeast shore of Lake Winnebago. It is the only state-owned recreation area located on Lake Winnebago. The park includes a marina that has more than 100 slips available for rent and areas for fishing, hiking, and camping. Additional county and municipal marinas and facilities are located at Calumet Park, Stockbridge, Brothertown, Pipe, Fond du Lac, Oshkosh, Neenah, Menasha, Appleton, Kimberly, Little Chute, and Kaukauna.

19. Summary of Adverse Impacts That Cannot Be Avoided (more fully discussed in 15 through 18)

- Increased risk of introducing any of the myriad AIS species present in Green Bay and Lake Michigan to waters upstream of the project, including the Winnebago system and other inland waters of the state
- Increased boat traffic on the Lower Fox River and Winnebago system waters
- Potential increase in turbidity resulting from prop wash
- Increased shoreline erosion on the Lower Fox River and throughout the Winnebago system from boat wakes
- Decrease in water quality from increased turbidity
- Fish and wildlife population disruption associated with increased boat traffic
- Potential loss of millions of dollars in tourism dollars and associated jobs to a 5 county area from harmful AIS introduction
- Increased safety concerns for canoes, kayaks and other small craft from large boat wakes, congestion and collisions
- Decreased aesthetic qualities, safety concerns and user conflicts could discourage use of the newly designated Water Trail by paddle- sport enthusiasts
- The loss or alteration of state historical structures
- Potential to increase drinking water treatment costs due to increased turbidity, resulting in increased cost to citizens

Despite the efforts that will be made at the proposed boat transfer and AIS cleansing station, trailered boat access ramps still represent a threat for AIS introductions through other access points. There are a total of over 60 access points for boats on the Lake Winnebago system. Based on the number of available parking spaces in just the primary launch sites within the system (Nisbet and Davis-Foust 2013), and assuming only 30% capacity weekdays and 60% on weekends, more than 23,000 boats may be launched within the Lake Winnebago system in a given season. This number greatly exceeds the 1300 boats expected to pass through the proposed Rapide Croche boat transfer station during its annual period of operation (St. Norbert 2010). Unless all boaters and anglers take precautions to prevent the spread of AIS from lake to lake via trailered boats, this vector will remain a serious threat to the Lake Winnebago system.

In addition to the threat of AIS transfer via trailered boats and wildlife, AIS introductions can also occur through other vectors. According to the Aquatic Invasive Species Plan for the Winnebago Lakes Pool (July 2008 Draft), the following are all recognized potential threats for AIS transport:

•Nursery/Water Gardens/Aquarium Suppliers: plants can either be unintentionally introduced from water gardens, or may be mislabeled or misidentified as native species.

•Construction and Restoration Industry: installation of docks and other marine equipment, as well as the use of machinery in the water for installation of equipment, lake monitoring, habitat restoration, or AIS removal can create a vector of transport if not properly cleansed prior to new projects.

•Sea Planes: the pontoons of float planes may be contaminated with AIS similar to the hull of a boat.

Despite the operation of the Project, AIS may still be introduced to the Winnebago system through these vectors.

20. Environmental Effects and Their Significance

a. Discuss which of the primary and secondary environmental effects listed in the environmental consequences section are long-term or short-term.

Most of the environmental effects of the project, should they occur, would have long-term consequences. AIS introduction in particular has the potential to have long-term adverse effects on the region's ecosystem. The fish and aquatic systems on the Lower Fox River and upstream throughout the entire Winnebago system are particularly at risk. Because of the persistence of AIS in aquatic ecosystems despite efforts to eradicate them, even if the project shuts down for whatever reasons it is highly probable that the region would be faced with the effects of introduced AIS for a very long time.

The increased turbidity from shoreline erosion and prop wash would persist as long as there was increased larger boat traffic from the project. If the erosion on shorelines was significant, the possibility exists for erosion to continue even should boat traffic decrease unless actions are taken stabilize the eroding areas. In most instances it will not be possible to "reclaim" shoreline lost to erosive forces; only stabilize it from further losses. This could affect critical habitat areas, especially shallower areas and wetlands along the shorelines. These are some of the most productive habitat types for fish and wildlife species.

Any safety concerns and resource use conflicts would also be present as long as there was increased boat traffic on the system. Should the project cease operation these concerns would decrease with the decrease in boat traffic.

Any loss of revenue or fishing-related jobs from negative effects on the sport fishery in the 5 county area would likely be long-term as well. It is unknown at this time if there would be any increase in other revenues or jobs from the project that would serve to mitigate these possible losses.

The loss or modification of any historical structures would of course be long-term and irreplaceable.

b. Discuss which of the primary and secondary environmental effects listed in the environmental consequences section are effects on geographically scarce resources (e.g. historic or cultural resources, scenic and recreational resources, prime agricultural lands, threatened or endangered resources or ecologically sensitive areas).

The Winnebago system is home to the world's largest self-sustaining population of lake sturgeon (*Acipenser fulvescens*). This well managed fishery sustains a winter spear fishery that approximately 12,000 people participate in each year. This winter fishery is worth $1.5 million to communities around the system. In addition to the winter harvest season, thousands of citizens come to view these fish in the spring because of the "watchable" nature of their spawning behavior. Spawning on the banks of the Wolf and Upper Fox Rivers, they offer the public a chance to see these large, ancient fish. School groups use the opportunity for teaching children biology, ecology, conservation, habitat value, etc. This "watchable" nature experience has been estimated to contribute $350,000 to smaller communities on the rivers like New London, Shiocton and Shawano in the spring. The annual spring sturgeon spawning run and the spear season on the Winnebago system is deeply rooted in the people and culture around the system. The traditions, skills, family and friend oriented nature of the harvest and respect for the fish are deeply rooted in the people who live and work in the region. This has been documented many times in books and video productions.

In addition to the economic value of the lake sturgeon to the area, they are important culturally and spiritually to the Menominee Indian Nation as well. A large number of these native peoples live in and around their tribal reservation north of the city of Shawano. The Wolf River runs through this land and is been integral to their tribal history for centuries. Historically the sturgeon in the Winnebago system migrated up the Wolf River to ancestral spawning grounds. One of the largest concentrations of spawning fish was at the base of a steep rock cascade known as Keshena Falls. It was there that the Menominee people celebrated the return of the sacred fish which signaled the end of winter, the coming of warmer weather, and provide a valuable food source. The construction of the dam in Shawano in the early 1900's stopped the sturgeon from reaching Keshena Falls for over a hundred years. Recently Wisconsin DNR began working with the Menominee in a joint effort to restore sturgeon to the river above the Shawano dam, transferring 100 adult fish per year to reservation waters. In 2012, after more than 100 years of absence, sturgeon were again spawning below the falls at Keshena. Some older tribal members were so overwhelmed that they shed tears.

Besides sturgeon, the Winnebago system is home to excellent walleye and white bass populations whose historic spring

spawning runs up the Wolf and upper Fox Rivers have drawn thousands of anglers annually to fish for them. These traditional spring runs are important economically to the city of Oshkosh and smaller communities and businesses all along the rivers in spring.

The Winnebago system has a number of aquatic species that are of special concern, threatened or endangered. Some of these aquatic species include: Pugnose Minnow (*Opsopoeodus emiliae*), Lake Chubsucker (*Erimyzon sucetta*), Pugnose Shiner (*Notropis anogenus*), and Striped Shiner (*Luxilus chrysocephalus*)

The introduction of AIS, such as sea lamprey, could potentially reduce or devastate the sturgeon population in the Winnebago system. Other AIS could affect the sturgeon, walleye, white bass or other fisheries throughout the system. These reductions, should they occur, would result in the loss of money and jobs in and around a 5 county region. The scale of these losses would be dependent on the severity of the effects of the AIS on the fish population. Secondary effects could result in changes such as a shift in the fish community from sport and panfish to less desirable species, such as carp and rough fish; water quality could further decrease with trophic shifts in the ecology of the system and property values may be reduced as a result.

c. Discuss the extent to which the primary and secondary environmental effects listed in the environmental consequences section are reversible.

Should AIS be introduced above the project and to the Winnebago system it is almost certainly irreversible. There are numerous examples where great effort, time money were spent trying to eliminate AIS from aquatic environs, all with limited or no success. Once introduced, we can expect that each AIS will become a permanent addition to the system and its affects will be permanent.

Increased boat traffic, particularly of larger sized vessels, may increase congestion throughout the system, but particularly on the lower Fox River or in the more restricted areas of the Winnebago system, such as the river through Oshkosh. This more crowded situation could potentially create user conflicts and safety issues, especially between different resource user groups such as anglers and paddle sport enthusiasts. These concerns are reversible in that if the additional large boat traffic is diminished or stopped for whatever reason, the attendant congestion, larger wakes, maneuverability, etc. would diminish or be eliminated as well.

The effects of larger boats and increased boating on shoreline erosion and turbidity can be mitigated or restored to varying degrees. Should boating use decrease for whatever reason there would be less wake and prop-generated energy to contribute to shoreline erosion and/or sediment re-suspension, both of which are significant contributors to turbidity on the system. This would reduce turbidity by some amount, though it is at this time impossible to predict. Shoreline erosion can also be mitigated through the use of various shoreline stabilization techniques. These actions however can be quite costly and would need to be funded by either the individual land owner of the eroding property, the public through tax dollars or fees for direct work or a grant program or through a combination of both public/private funding such as a cost share program.

The alteration or loss of any historical structures would be irreversible. This could somewhat be mitigated through the use of kiosks, display, museums or other venues to display photos, narratives, original parts, miniatures, etc. of history or the lost features. Items that are salvageable could be displayed or reproductions made for display to preserve the history associated with the site.

21. Significance of Cumulative Effects

Discuss the significance of reasonably anticipated cumulative effects on the environment (and energy usage, if applicable). Consider cumulative effects from repeated projects of the same type. Would the cumulative effects be more severe or substantially change the quality of the environment? Include other activities planned or proposed in the area that would compound effects on the environment.

The largest threat of this project is the potential for the introduction of one or more AIS upstream of the Rapide Croche barrier and particularly if those AIS were to get into the Winnebago system and harm the systems fisheries resources. The system is home to the world's largest self-sustaining population of lake sturgeon (*Acipenser fulvescens*) as well as one of the best walleye (*Sander vitreus*) fisheries in the Midwest. These, along with good bass (*Micropterus spp.*), yellow perch (*Perca flavescens*) and panfish (*Lepomis spp.*) populations, are worth more than $312.5 million dollars annually to the regional economy around the Winnebago pool lakes.

AIS introduction into the lower Fox River upstream of the Rapide Croche barrier on a less catastrophic level still has the potential to cause ecosystem changes. These changes, which would depend on the type and number of AIS species that became established, could include habitat degradation or loss, degradation of water quality from turbidity and/or algae, replacement of native

zooplankton food resources for less desirable or nonedible varieties, reduction of native fish populations from competition with introduced exotic species or predation from exotics on native species eggs, fry or fingerlings and less desirable angling experiences thru reduced catches of desired species or frustration with inconvenience from species such as fishhook water flea.

Each addition of potential AIS compounds their deleterious effects, and their cumulative effects may become synergistic, further accelerating habitat, biological or ecological degradation

22. Significance of Risk

a. Explain the significance of any unknowns that create substantial uncertainty in predicting effects on the quality of the environment. What additional studies or analysis would eliminate or reduce these unknowns?

Introduction of AIS, especially the sea lamprey, into the Lake Winnebago system is a significant concern. Any of the AIS listed above, as well many that are not listed, have the potential to significantly alter this ecosystem. The lamprey could adversely affect fish populations including many sought after game fish such as walleye, pike, muskellunge, and lake sturgeon. Significant declines in these populations would not only affect the food web but could result in a decrease of sport fishing in this area thus, negatively affect the local economy. See number 21 for more information on the economic effects.

The cleansing system proposes to use a water bath that is heated to 110°F for a minimum of 10 minutes and pre-spraying with 2,200 psi high pressure wash. The ANS Task Force recommends using water heated to 120°F for two minutes and spraying with water heated to 140°F at 2,500 psi for 10 seconds. 2014 Interim Protocol for DNR Gear Disinfection for AIS recommends the following washing treatments: 1) Steam cleaning (212°F), or 2) Boat decontamination unit (140°F and 2,500 psi), or 3) Commercial car wash (~120°F). Using heat water bath of less than 120°F and a pressure water of less than 2,500 psi and less than 140°F may risk the effectiveness of the cleansing system's ability to prevent the spread of AIS upstream of the Rapide Croche dam when compared to the ANS Task Force Recommendations and WI DNR Interim Protocol for DNR Gear Disinfection.

If the boat transfer and cleansing system is not properly monitored, operated and managed there is a risk that the effectiveness could be reduced. To reduce this risk the staff will need to be trained in not only how to operate the transfer/cleansing station, but also AIS. Understanding the ecology/biology of AIS will allow for a more comprehensive cleaning technique.

Users of the boat transfer and cleansing system will need to fully comply with disinfection protocols in order to maintain maximum effectiveness of cleansing system. An AIS education center, which helps increase awareness of AIS concerns, and properly trained staff making sure users are in compliance, will reduce this risk.

There is currently an ongoing risk of AIS movement upstream of Rapide Croche Dam by other means. Boats can be trailered around Rapide Croche Dam without adequate decontamination. To reduce these risks increased inspections from qualified personnel at boat landings and increased cooperation of the boat operators to properly decontaminate boats prior to moving into upriver waters is needed.

b. Explain the environmental significance of reasonably anticipated operating problems such as malfunctions, spills, fires or other hazards (particularly those relating to health or safety). Consider reasonable detection and emergency response, and discuss the potential for these hazards.

Failure of the proposed facility to adequately inspect and clean water craft could result in the transference of AIS species above the facility, introducing those species to the Lower Fox River and the Winnebago system. Because of the wide use of Winnebago system waters by anglers from all over Wisconsin and other states, the AIS could expand to other inland waters far from the system.

The proposed project relies on electrical and mechanical systems that are susceptible to failure and power outages. These could affect the project negatively, and in particular its ability to maintain sufficiently high water temperature to kill anticipated AIS. This failure could affect the effectiveness of the facility to adequately cleanse and disinfect boats passing through the facility.

There is the possibility of human error in the disinfection of boats passing through the facility. Larger AIS species would be easy to see and remove by pressure washing or the temperature bath. It is the tiny, microscopic ones that are much more difficult to see and reach. These would include things like seeds, larvae, veligers, zoo or phyto plankton or viruses.

Sodium hypochorite will be used to control biological growth in the hot water bath. Failure of storage system or transfer mechanism moving the chemical to the hot water bath could lead to the chemical leaking in the Fox River. Proper transport

and storage, regular inspections, and a spill response and prevention plan would reduce the potential for leakage and effects of any leakage should one occur.

23. Significance of Precedent

Would a decision on this proposal influence future decisions or foreclose options that may additionally affect the quality of the environment? Describe any conflicts the proposal has with plans or policy of local, state or federal agencies. Explain the significance of each.

The FRNSA is working on rebuilding and opening all the locks in the Lower Fox except the Rapide Croche lock. In accordance with Wisconsin Statute 237, the Rapide Croche Lock must remain closed to prevent aquatic invasive species from moving upstream. This project would allow boat traffic to move between the bay of Green Bay and Lake Michigan and the Winnebago system, which would increase the risk of AIS being moved upriver. Based on most AIS introductions into aquatic systems, once one is detected it has already become established. Eradication is not possible and efforts to control it, if possible, can be extremely costly. The ecological effects are almost always permanent.

Kaukauna Utilities is working with the Federal Energy Regulatory Commission (FERC) and DNR on possibly placing a public boat lauch in the pool upriver from the Rapide Croche dam. There currently is no public launch on this pool. While the potential boat launch project is separate from the Rapide Croche Boat Transfer and AIS Cleansing Station Project there is consideration of potential effects of both projects on AIS movements and public access.

24. Significance of Controversy Over Environmental Effects

Discuss the effects on the quality of the environment, including socio-economic effects, that are (or are likely to be) highly controversial, and summarize the controversy.

The St. Norbert Boater Survey (2010) indicates that there is support for a proposed Rapide Croche Boat Transfer Station that eliminates the possible introduction of AIS from the Great Lakes system into the Lake Winnebago Watershed, however a majority do not feel it is important to be able to travel all the way from the Bay of Green Bay and the Great Lakes to Lake Winnebago and vice versa. According to the St. Norbert Boat Survey (2010) large boat owners travel between Lake Winnebago and Rapide Croche more often than smaller vessels and length of boat has a significant positive correlation with support for, and likelihood of using, the proposed Project at Rapide Croche. Smaller boat owners feel it is less important to be able to travel from Green Bay and the Great Lakes to Lake Winnebago.

Among environmental and angler advocacy groups there is concern about the potential for the Project to result in AIS moving upstream and the need to address in the facility's design all identified potential for spreading AIS via the proposed Project. The Survey also indicated a concern with the funding source of this project. Several comments mentioned a concern with the thought of using tax dollars.

ALTERNATIVES

25. Briefly describe the impacts of no action and of alternatives that would decrease or eliminate adverse environmental effects. (Refer to any appropriate alternatives from the applicant or anyone else.)

Alternative Site Location

No alternative site location was considered; however, early design alternatives included a plan that would site the project adjacent to the lock rather than on top of it and a plan that would site the project in the canal below the Rapide Croche Lock. An alternate Site Location would have higher cost and has been removed from further consideration.

Alternative Design

During project planning, ten conceptual boat transfer station alternatives were identified, characterized and evaluated. A conceptual cleansing operation was also developed that would be generally common to the boat transfer alternatives. Based on decision analysis methods and results, several priority/preferred boat transfer alternatives were identified:

- Mobile Boat Hoist and Fork Truck
- Mobile Boat Hoist
- Fork Truck
- Strap-Style Transporter with Launching Ramps
- Bunk-Style Transporter with Launching Ramps

It is possible that increasing the water temperature in the water bath and high pressure water spray to be more in line with the

ANS Task Force and WI DNR 2014 Interim Protocol for DNR Gear Disinfection could alter the effectiveness of the AIS treatment however it could lead to concerns of potential effects to the watercraft using the AIS treatment system.

No-Build Alternative

The no-build alternative would result in the continued lack of navigational access to the Fox River between Lake Winnebago and Lake Michigan. The sea lamprey barrier would remain in place. Under the no-build alternative, the current AIS monitoring taking place above and below the Rapide Croche Lock by FRNSA may no longer occur. AIS monitoring though other programs and FERC would continue. AIS monitoring requirements in FERC licenses is typically for organisms such as Eurasian watermilfoil and purple loosestrife rather than for white perch, spiny water fleas, and round gobies.

The no-build alternative would also preserve the Rapide Croche Lock and associated buildings in place. These structures are currently designated as state and national historical sites.

The FRNSA preferred alternative includes a boat transfer station on top of the lock that would allow navigation, meet statutory requirements, manage the risk of AIS transport, have the lowest cost of the build alternatives.

Under all alternatives the threat of spread of AIS from other vectors (i.e. boat trailers) would remain.

SUMMARY OF ISSUE IDENTIFICATION ACTIVITIES

26. List agencies, citizen groups and individuals contacted regarding the project (include DNR personnel and title) and summarize public contacts, completed or proposed).

Date	Contact	Comment Summary
Ongoing	James Doperalski Jr.-DNR	EA Review
Ongoing	Rob McLennan-DNR	EA Review
Ongoing	Christina Wolbers-DNR	AIS
Ongoing	Kendal Kamke-DNR	Fisheries/AIS
Ongoing	Ryan Koenings-DNR	Fisheries/AIS
Ongoing	Steve Hogler-DNR	Fisheries/AIS
Ongoing	Andy Hudak-DNR	EA Review
3/25/14	Arthur Techlow III-DNR	Fisheries
1/29/14	James Woodford-DNR	Endangered Resources
6/4/14	John Lyons-DNR	Fisheries/AIS
1/8/14	John Gumtow-Stantec	EIR
6/25/14	Steve Hewett - DNR	EA Review

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