United States Department of the Interior

FISH AND WILDLIFE SERVICE
Louisiana Ecological Services
200 Dulles Drive
Lafayette, Louisiana 70506

June 23, 2022

Colonel Stephen Murphy
District Commander
U.S. Army Corps of Engineers
7400 Leake Avenue
New Orleans, Louisiana 70118

Dear Colonel Murphy:

This document transmits the Fish and Wildlife Service's (Service) revised biological opinion (enclosed), regarding the Maurepas Swamp Alternative (MSA) proposed as mitigation for the West Shore Lake Pontchartrain Flood Risk Reduction Project which is currently being constructed. The MSA would be located in St. Charles, and St. John the Baptist Parishes, Louisiana. The enclosed biological opinion addresses potential MSA-related effects on the endangered pallid sturgeon (*Scaphirhynchus albus*), the threatened West Indian manatee (*Trichechus manatus*), and the threatened Gulf sturgeon (*Acipenser oxyrhynchus desotoi*) in accordance with section 7 of the Endangered Species Act (Act) of 1973, as amended (16 United States Code [U.S.C.] 1531 *et seq*.).

The enclosed biological opinion, is based on information provided by the U.S. Army Corps of Engineers' December 20, 2021, biological assessment (BA). A complete administrative record of this consultation (Service Log No. 2022-0046653) is on file at the Service's Louisiana Ecological Services Office.

The Service appreciates the USACE's continued cooperation in the conservation of the threatened and endangered species, and their critical habitats. If you have any questions regarding the enclosed biological opinion, please contact Mr. Ronny Paille (337-291-3117) of this office.

Sincerely,

BRIGETTE FIRMIN
Digitally signed by BRIGETTE FIRMIN
Date: 2022.06.23 14:16:22 -05'00'

Brigette D. Firmin
Acting Field Supervisor
Louisiana Ecological Services Office

Enclosure

cc (w/Enclosure):
FWS, Atlanta, GA (Attn: Heath Rauschenberger)
LDWF, Wildlife Diversity Program, Baton Rouge, LA

Revised Biological Opinion

Maurepas Swamp Alternative

FWS Log #: 2022-0046653

Prepared by:

U.S. Fish and Wildlife Service
Louisiana Ecological Services Field Office
200 Dulles Drive
Lafayette, LA 70506

June 23, 2022

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EXECUTIVE SUMMARY

This Endangered Species Act Biological Opinion (BO) of the U.S. Fish and Wildlife Service (Service) addresses the potential effects of the Maurepas Swamp Alternative (MSA) which has been proposed to mitigate impacts associated with construction of the West Shore Lake Pontchartrain Flood Risk Reduction Project (WSLP Project).

The proposed project consists of features intended to convey sediment, freshwater, and nutrients from the Mississippi River at approximately River Mile (RM) 145 in the vicinity of the town of Ironton, in St. John the Baptist Parish, Louisiana, to the southern Maurepas swamps to nourish and maintain the deteriorating swamps north of Interstate 10. Initially the Maurepas Diversion was planned as a swamp restoration project funded in part by RESTORE Act funds. Later, however, the Louisiana Coastal Protection and Restoration Authority (CPRA) requested that the Corps evaluate the diversion project as potential mitigation to compensate for impacts to swamp associated with the WSLP Project.

The project involves construction of an intake channel through the Mississippi River batture and a gated control structure beneath the Mississippi River levee. Water discharged through the control structure would be transported through a conveyance channel and discharged in Hope Canal just north of Interstate 10. The U.S. Army Corps of Engineers (USACE) has determined that the Action is likely to adversely affect the pallid sturgeon (*Scaphirhynchus albus*) and requested formal consultation with the Service. The BO concludes that the Action is not likely to jeopardize the continued existence of this species. This conclusion fulfills the requirements applicable to the Action for completing consultation under §7(a)(2) of the Endangered Species Act (ESA) of 1973, as amended, with respect to these species and designated critical habitats.

The USACE has also determined that the Action is not likely to adversely affect the West Indian manatee (*Trichechus manatus*) and that the Action would have no effect on the Gulf sturgeon (*Acipenser oxyrhynchus desotoi*). The USACE has requested the Service's concurrence with its determinations. The Service concurs with those determinations and provides our basis for this concurrence in section 3 of the BO. This concurrence fulfills the requirements applicable to the Action for completing consultation with respect to these species. There are no designated critical habitats being affected; therefore, critical habitat will not be discussed further.

It is the Service's opinion that the project would not jeopardize the continued existence of the pallid sturgeon.

The BO includes an Incidental Take Statement that requires the USACE to implement reasonable and prudent measures that the Service considers necessary or appropriate to minimize the impacts of anticipated taking on the listed species. Incidental taking of listed species that is in compliance with the terms and conditions of this statement is exempted from the prohibitions against taking under the ESA.

In the Conservation Recommendations section, the BO outlines voluntary actions that are relevant to the conservation of the listed species addressed in this BO and are consistent with the authorities of the USACE.

Reinitiating consultation is required if the USACE retains discretionary involvement or control over the Action (or is authorized by law) when:

- the amount or extent of incidental take is exceeded;
- new information reveals that the Action may affect listed species or designated critical habitat in a manner or to an extent not considered in this BO;
- the Action is modified in a manner that causes effects to listed species or designated critical habitat not considered in this BO; or
- a new species is listed or critical habitat designated that the Action may affect.

CONSULTATION HISTORY

This section lists key events and correspondence during the course of this consultation. A complete administrative record of this consultation is on file in the Service's Louisiana Ecological Services Office.

2021-06-03 - The Service provided the USACE with a Planning Aid Letter regarding the possible effects of the Maurepas Swamp Mitigation Alternative. That letter stated that the pallid sturgeon may be impacted by the proposed project and recommended the USACE consult with the Service regarding project impacts to this species.

2021-08-17 – The USACE formally requested federal, state, and tribal agencies to be cooperating or commenting agencies for National Environmental Policy Act Supplemental Environmental Impact Statement (SEIS) for the West Shore Lake Pontchartrain Hurricane and Storm Damage Risk Reduction Project (WSLP Project). That SEIS would provide an assessment of proposed alternative mitigation projects to compensate for the WSLP Project impacts.

2021-11-18 – The USACE requested Service comment on Gulf sturgeon turbidity impact text. Subsequently, the Service provided additional information.

2021-11-30 – The USACE provided the Service with a draft biological assessment (BA) for Service review of recommended Conservation Measures.

2021-12-02 – The Service accepted the USACE's offer to be a cooperating agency in the preparation of a SEIS for the WSLP Project.

2021-12-14 – The USACE's and the Service's staff held a conference call to discuss possible project impacts to the Gulf sturgeon. A no effect determination was agreed to on that call.

2021-12-15 – The USACE provided the Service with cold stress information regarding the West Indian manatee. The Service agreed that the subject information was appropriate for inclusion in the BA.

2021-12-22 - The USACE provided the Service with a BA and requested initiation of formal consultation for pallid sturgeon impacts.

2022-1-13 – The USACE provided the Service with an amended BA to describe the WSLP Project as a swamp enhancement rather than swamp preservation project. This did result in any changes to the project's environmental effects.

BIOLOGICAL OPINION

1. INTRODUCTION

A biological opinion (BO) is the document that states the opinion of the U.S. Fish and Wildlife Service (Service) under the Endangered Species Act (ESA) of 1973, as amended, as to whether a Federal action is likely to:

- jeopardize the continued existence of species listed as endangered or threatened; or
- result in the destruction or adverse modification of designated critical habitat.

The Federal action addressed in this BO is the proposed Maurepas Swamp Mitigation Alternative Project (the Action) being considered by the U.S. Army Corps of Engineers' New Orleans District (USACE) as mitigation for impacts resulting from the West Shore Lake Pontchartrain Hurricane and Storm Damage and Risk Reduction Project (WSLP Project). This BO considers the effects of the Action on the pallid sturgeon (*Scaphirhynchus albus*).

The USACE also determined that the Action is not likely to adversely affect the West Indian manatee (*Trichechus manatus*) and would have no effect on the Gulf sturgeon (*Acipenser oxyrhynchus desotoi).* Note that the Gulf sturgeon is also known as the Atlantic sturgeon. The Service concurs with these determinations for reasons we explain in section 3 of the BO.

A BO evaluates the consequences to listed species and designated critical habitat caused by a Federal action, activities that would not occur but for the Federal action, and non-Federal actions unrelated to the proposed Action that are reasonably certain to occur (cumulative effects), relative to the status of listed species and the status of designated critical habitat. A Service opinion that concludes a proposed Federal action is *not* likely to jeopardize species and is *not* likely to destroy or adversely modify critical habitat fulfills the Federal agency's responsibilities under §7(a)(2) of the ESA.

"*Jeopardize the continued existence*" means to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species (50 CFR §402.02). "*Destruction or adverse modification*" means a direct or indirect alteration that appreciably diminishes the value of designated critical habitat for the conservation of a listed species. Such alterations may include, but are not limited to, those that alter the physical or biological features essential to the conservation of a species or that preclude or significantly delay development of such features (50 CFR §402.02).

This BO uses hierarchical numeric section headings. Primary (level-1) sections are labeled sequentially with a single digit (e.g., 2. PROPOSED ACTION). Secondary (level-2) sections within each primary section are labeled with two digits (e.g., 2.1. Action Area), and so on for level-3 sections. The basis of our opinion for each listed species and each designated critical habitat identified in the first paragraph of this introduction is wholly contained in a separate level-1 section that addresses its status, environmental baseline, effects of the Action, cumulative effects, and conclusion.

2. PROPOSED ACTION

The USACE is proposing to construct, operate, and maintain the MSA. The proposed project consists of a multi-component river diversion system intended to convey sediment, fresh water, and nutrients from the Mississippi River at river mile (RM) 145 near the town of Garyville, in St. John the Baptist Parish, Louisiana, to the southern Maurepas swamps. After passing through a proposed intake structure on the Mississippi River, the water would be transported through a 5.5 mile-long conveyance channel to an outfall area located in swamps south of Lake Maurepas and north of Interstate 10, in St. John the Baptist, St. James, and Ascension Parishes (Figure 1).

It should be noted that the specific construction details and drawings referenced in the Biological Assessment (BA) and this BO are based on the latest designs available at the time of submittal, approximately 95 percent design. As the project continues toward final design and ultimately construction, some project details are likely to be modified and refined during final design, value engineering, and other project optimization steps. Any such changes and modifications are not expected to change the mechanisms of impact to listed species and habitats discussed in the BA and this BO, and therefore, would not change the analyses or conclusions in this BO.

The design elements of the proposed project are separated into 3 categories. For general locations see Figure 2.

- River-side Features – These features consist of the intake channel and temporary features such as docks and coffer dams to facilitate construction.
- Gated Control Structure – The gated control structure will consist of three 10-foot by 10-foot box culverts beneath the Mississippi River flood protection levee.
- Swamp-side Features – Immediately down-stream of the control structure is a sediment trapping basin, and then the 5.5 mile-long conveyance channel with guide levees on either side. Two outfall management structures will be installed along the east bank of Blind River, to preclude short-circuiting of introduced water into Blind River. Additionally, gaps in canal spoil banks and an abandoned earthen railroad embankment, located in the swamp, will be constructed to improve distribution of introduced water.

The proposed project will require 3 years to construct. A detailed description of the major project elements from construction through operation and maintenance are discussed below.

Gated Control Structure: The proposed intake structure will be located approximately 100 feet (ft) south of the crown of the levee (Figure 3). Its platform will support a control house at elevation 31ft NAVD88 to protect against high river stages. Placing the structures close to the levee provides a solid foundation and minimizes the required length of the culverts. The sluice gate and culvert elevations were set as high as possible to minimize excavation costs. The culverts will be installed flat, since they will operate under outlet control and slope is irrelevant to their hydraulic performance. The culverts must pass under the roadside drainage ditch along LA 44, which has an invert of +7ft NAVD88. Subtracting 1ft for depth of cover yields a top-of-culvert elevation of +6ft NAVD88. The top wall of the culverts is expected to be up to 3ft thick, resulting in a top-of-gate elevation of +3ft NAVD88. The stage of the Mississippi River is the driving force for delivering the target flow to the conveyance channel. The water levels in the river and the channel are thus the starting points for designing the intake gates. To maximize the duration of peak flow conditions, the head-losses through the intake structure must be kept to a minimum. A group of three 10ft x 10ft gates was selected as the optimum configuration to balance the flow delivery capacity against the construction cost.

Sedimentation Basin: There is a high concentration of sand, silt and clay in the Mississippi River water. To re-nourish the Maurepas Swamp, the fine silt and clay particles must be carried through the conveyance channel to receiving area swamps. However, the sand particles must be removed upstream of the conveyance channel, lest they settle in the downstream reaches where they would have to be removed by dredging. A sedimentation basin was designed to remove the unwanted sand from the diversion flow-stream. The sedimentation basin was designed to remove all sand particles ≥ 0.2 millimeter (mm) in diameter and the storage capacity to accumulate six months of sediment without requiring cleaning. The settling velocity of a 0.2 mm particle of sand in water is approximately 4ft per minute. Based on that value and the design flow rate, the surface area of the sediment basin was established. The cross-sectional area of the basin was then calculated to achieve a flow velocity of approximately 1 foot per second (ft/s), which would prevent re-suspension of the settled solids due to turbulence. The percent sand in the river water at Maurepas was derived by interpolating from data recorded at St. Francisville and Belle Chasse, which are upstream and downstream of the site, respectively. Data from the Caernarvon project provided a ratio of the percent sand in a diversion to that in the adjacent river water. Applying that ratio to the subject site yielded the percent sand expected in the influent to the Maurepas diversion. Based on that value, the mass and volumetric accumulation rate of sand expected in the sedimentation basin was calculated. This enabled determination of the additional basin volume required to contain a six month accumulation. The designed basin will have a central section 265ft-long by 66ft-wide, with 3:1 side slopes adding 60ft of width on each side.

Pump Station: A 250 cubic feet per second (cfs) pump station will be constructed approximately 2,500ft north of U.S. Highway 61. The station will transfer the gravity flow from the Hope and Bourgeois Canals into the proposed conveyance channel. The station is required to restore the drainage pattern in the area, since the guide levees of the channel will cut-off the existing hydraulic route of the two canals. The proposed pump station will consist of three 125 cfs pumps. The pumps will alternate duty cycles to provide a peak flow of 250 cfs with two pumps in service; the third pump will serve as a back-up. The proposed pumps are of the vertical line shaft type, which are designed to move large volumes of flow against relatively low head. An approach basin will be constructed upstream of the pump intakes to impart a uniform velocity distribution to the inflowing water. The approach to the basin will be gradually sloped to the design elevation of the pump intakes. Both canals will be dredged and improved in the immediate vicinity to provide uninterrupted flow to the pump station. The pumps will discharge through three, 48-inch diameter pipes over the eastern levee of the conveyance channel to an armored outlet structure. The pumps will be driven by motors connected to the impeller shaft by a direct coupling, the most energy efficient means of connection. Natural gas motors were selected because there is no adequate electrical power supply in the area that can be routed to the remote project site.

Conveyance Channel: The 5.5-mile conveyance channel alignment is 5.5 miles long and the right-of-way is 300ft wide. The side slopes have also been adjusted to minimize potential sloughing. South of the Kansas City Southern Railroad (KCSRR) crossing the channel will have an adjusted typical bottom width of 40ft, a flattened side slope of 4H:1V (4ft horizontal to 1ft vertical) within the wetted portion of the channel, and the same 3H:1V slope on the outsides. North of the KCSRR, the bottom width has been widened to 60ft and the water-side slope will remain 5H:1V while the land-side slope will be changed to 3H:1V.

River Road (LA 44) Crossing: The LDOTD advised that River Road could only be closed for 45 days during construction. A detailed seven phase sequence of construction was developed to comply with the LDOTD's restriction on the road closure. Two very significant changes were: 1) the design of a 35 mph temporary by-pass roadway through the construction area made to maintain traffic per LDOTD requirements, and 2) the incorporation of multiple temporary retaining structures (TRS) in the design to provide stability and enable access to the bottom of the excavation. Geotechnical stability analyses were performed for each of the seven phases of the revised design to insure that the USACE's factors of safety are met for each stage of construction.

Canadian National Railroad (CNRR) Crossing: The CNRR turn-out will be permanently relocated to the east of its existing location. This will provide the CNRR with an additional 1260ft of siding. Two tracks will pass over the reinforced box culvert crossing.

Kansas City Southern Railroad (KCSRR) Crossing: The crossing consists of a 105ft-long span railroad bridge.

Airline Highway (US 61) Crossing: This crossing consists of six 9ft x 9ft box culverts.

Once construction has been completed, the project will be operated to provide seasonal inputs of Mississippi River water during spring months. The discharge of diverted Mississippi River water will depend on the river stage at the intake structure. Discharges will be halted for roughly a month during April, and again during July through December to allow drainage and dewatering of the swamp floor to avoid flooding impacts to receiving area swamps.

The expected annual operational period for the diversion will be between January 1 and July 1. The precise timing, discharge rate, and duration of the pulses will be modified to maximize benefit to the swamp. The CPRA has also proposed that the first 3 years of operation consist of gradually increasing flow duration and magnitude (i.e., a "ramp-up" period). This ramp-up period is intended to reduce the initial shock to the system and enable adaptive management based upon observed water flow and environmental responses.

The current Operations Plan is as follows: Year 1 – Start operations at 250 cfs on January 1 and increase by 250 cfs increments to 1,000 cfs over the course of six weeks. After five weeks at 1,000 cfs, increase to 1,500 cfs for one week, then to 2,000 cfs for one week, then shut off the flow on April 1. Restart operations at 500 cfs on May 13, let water flow for 15 days, and increase to 750 cfs. Then increase the water flow to 1,000 cfs, let water flow for 20 days and shut off the flow on June 30 (Figure 4). The structure design is such that the maximum Mississippi River water discharge is capped at 2,000 cfs during high river stages. At low river stages/discharge, the control structure will be unable to sustain this maximum discharge and water flow may decrease to 200 cfs or less.

Year 2 – Start operations at 250 cfs on January 1 and increase water flow by 250 cfs every 10 days until 2,000 cfs is achieved. Let the water flow at 2,000 cfs until April 1 and then shut off the flow. Restart operations at 500 cfs on May 13 and increase the water flow by 500 cfs every 10 days until 2,000 cfs is achieved. Let the water flow until June 30 and then shut off the flow (Figure 5).

Year 3 – Start operations at 500 cfs on January 1 and increase the water flow by 500 cfs every 15 days until 2,000 cfs is achieved. Let the water flow at 2,000 cfs until April 1 and then shut off the flow. Restart operations at 500 cfs on May 13 and increase the water flow by 500 cfs every 10 days until 2,000 cfs or maximum operating capacity is achieved based on river conditions. Let the water flow until June 30 and then shut off the flow (Figure 6).

Years 4–50 – Start operations at 2,000-cfs or maximum operating capacity based on river conditions on January 1, let the water flow until April 1, and then shut off the flow. Restart operations at 2,000-cfs on May 13, let the water flow until June 30 and then shut off the flow (Figure 7).

The proposed MSA includes a monitoring and adaptive management plan to evaluate system performance and environmental response. This plan may prescribe operational changes when necessary to improve system performance or if certain threshold environmental conditions are reached.

Proposed conservation measures to be implemented during construction of the proposed project include environmental protection measures and best management practices (BMPs) to avoid or minimize potential environmental effects. The USACE will develop an Environmental Protection Plan (EPP) detailing the BMPs and environmental protection measures (EPMs) for the prevention and/or control of pollution and habitat disruption that may occur during construction and operations.

<u>West Indian Manatee Protection Measures</u>

During in-water work in areas that potentially support manatees all personnel associated with the project should be instructed about the potential presence of manatees, manatee speed zones, and the need to avoid collisions with and injury to manatees. All personnel should be advised that there are civil and criminal penalties for harming, harassing, or killing manatees, which are protected under the Marine Mammal Protection Act of 1972 and the Endangered Species Act of 1973. Additionally, personnel should be instructed not to attempt to feed or otherwise interact with the animal, although passively taking pictures or video would be acceptable. All on-site personnel are responsible for observing water-related activities for the presence of manatee(s). We recommend the following to minimize potential impacts to manatees in areas of their potential presence:

- All work, equipment, and vessel operation should cease if a manatee is spotted within a 50-foot radius (buffer zone) of the active work area. Once the manatee has left the buffer zone on its own accord (manatees must not be herded or harassed into leaving), or after 30 minutes have passed without additional sightings of manatee(s) in the buffer zone, in-water work can resume under careful observation for manatee(s).

- If a manatee(s) is sighted in or near the project area, all vessels associated with the project should operate at "no wake/idle" speeds within the construction area and at all times while in waters where the draft of the vessel provides less than a four-foot clearance from the bottom. Vessels should follow routes of deep water whenever possible.

- If used, siltation or turbidity barriers should be properly secured, made of material in which manatees cannot become entangled, and be monitored to avoid manatee entrapment or impeding their movement.

- Temporary signs concerning manatees should be posted prior to and during all in-water project activities and removed upon completion. Each vessel involved in construction activities should display at the vessel control station or in a prominent location, visible to all employees operating the vessel, a temporary sign at least 8½ " X 11" reading language similar to the following: "CAUTION BOATERS: MANATEE AREA/ IDLE SPEED IS REQUIRED IN CONSTRUCTION AREA AND WHERE THERE IS LESS THAN FOUR FOOT BOTTOM CLEARANCE WHEN MANATEE IS PRESENT". A second temporary sign measuring 8½ " X 11" should be posted at a location prominently visible to all personnel engaged in water-related activities and should read language similar to the following: "CAUTION: MANATEE AREA/ EQUIPMENT MUST BE SHUTDOWN IMMEDIATELY IF A MANATEE COMES WITHIN 50 FEET OF OPERATION".

- Collisions with, injury to, or sightings of manatees should be immediately reported to the Service's Louisiana Ecological Services Office (337-291-3100) and the Louisiana Department of Wildlife and Fisheries, Natural Heritage Program (225-765-2821). Please provide the nature of the call (i.e., report of an incident, manatee sighting, etc.); time of incident/sighting; and the approximate location, including the latitude and longitude coordinates, if possible.

Pallid Sturgeon Protection Measures

- If bucket dredging is performed, the Contractor should induce pallid sturgeon to leave the immediate work area prior to any bucket dredging work regardless of water depth.
- The bucket will be dropped into the water and retrieved empty one (1) time.
- After the bucket has been dropped and retrieved, a one (1)-minute no work period must be observed.
- During this no dredging period, personnel should carefully observe the work area in an effort to visually detect pallid sturgeon.

- If pallid sturgeon are sighted, no work should be initiated until the sturgeon have left the work area.
- If the water turbidity makes such visual sighting impossible, work may proceed after the one (1)-minute no work period has elapsed.
- If more than fifteen minutes elapses with no work, then the empty bucket drop/retrieval process shall be performed again prior to re-initiating work efforts.
- If cutterhead dredging is performed, the contractor should minimize disturbance to pallid sturgeon.
- The cutterhead should remain completely buried in the bottom material during dredging operations.
- If pumping water through the cutterhead is necessary to dislodge material or to clean the pumps or cutterhead, etc., the pumping rate should be reduced to the lowest rate possible until the cutterhead is at mid-depth, where the pumping rate can then be increased.
- During dredging, the pumping rates should be reduced to the slowest speed feasible while the cutterhead is descending to the channel bottom.

Pile Driving Noise Attenuation
A pile-driving plan to guide pile-driving operations will be developed. The plan will identify locations, approximate timing, and installation methods including any noise attenuation methods.

Stormwater Pollution Prevention Plan
The stormwater pollution prevention plan (SWPPP) will be prepared to meet National Pollutant Discharge Elimination System (NPDES) permit requirements and implemented to minimize and control pollution and erosion due to stormwater runoff. A temporary erosion and sediment control (TESC) plan is required to prevent erosive forces from damaging project sites, adjacent properties, and the environment. The TESC plan may be a component of the SWPPP.

Spill Prevention, Control and Countermeasure Plan
A spill prevention, control and countermeasure (SPCC) plan would be prepared by the contractor to prevent and minimize spills that may contaminate soil or nearby waters.

Monitoring and Adaptive Management Plan (MAMP)
A MAMP should be developed by the USACE which will guide field monitoring of species, habitats, and water quality considerations during operation of the diversion. The plan will include monitoring efforts and management actions that may affect operations based on identified thresholds and planning processes. Specific measures for monitoring project impacts on pallid sturgeon are included in the Terms and Conditions (Section 5.3) of this Opinion.

2.1. Action Area

For purposes of consultation under ESA §7, the action area is defined as "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action" (50 CFR § 402.02). The action area includes the proposed MSA location and all surrounding areas where effects due to the freshwater diversion may reasonably be expected to occur (upper Pontchartrain/Maurepas Basin). The action area also includes the Mississippi River in the vicinity of the project features in St. John the Baptist Parish, Louisiana (Figure 1).

2.2. Non-Federal Activities caused by the Federal Action

A BO evaluates the effects of a proposed Federal action. "Effects of the action are all consequences to listed species or critical habitat that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action. A consequence is caused by the proposed action if it would not occur but for the proposed action and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action" (50 CFR §402.02).

Activities that would not occur but for the proposed Federal action include relocation or modification of existing infrastructure within the action area (i.e., roads, railways, pipelines, utilities, levees). Such road and railroad crossings over the conveyance channel are described above. These proposed activities are not anticipated to impact federally listed species or designated critical habitat under the Service's jurisdiction. Therefore, these proposed activities will not be discussed further in this BO.

2.3.Tables and Figures for Proposed Action

Figure 1. Maurepas Swamp Alternative influence areas.

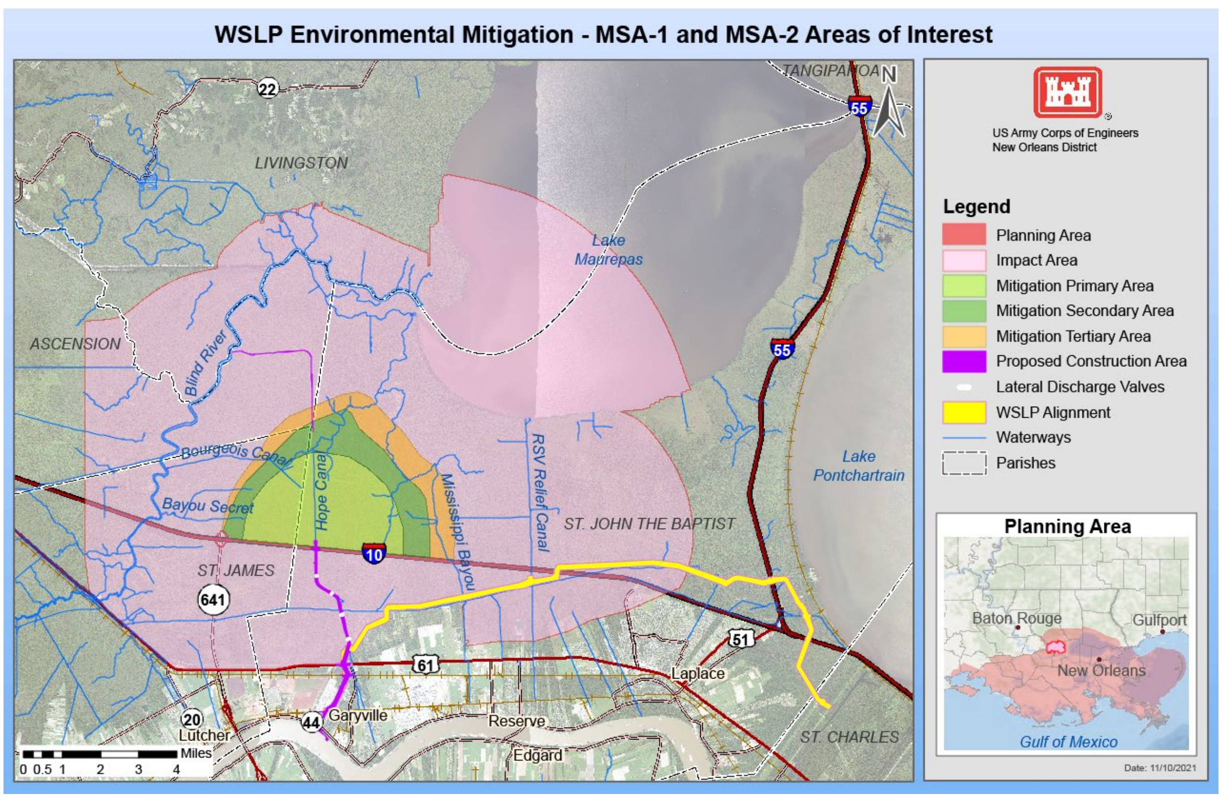


Figure 2. Map showing MSA project features.

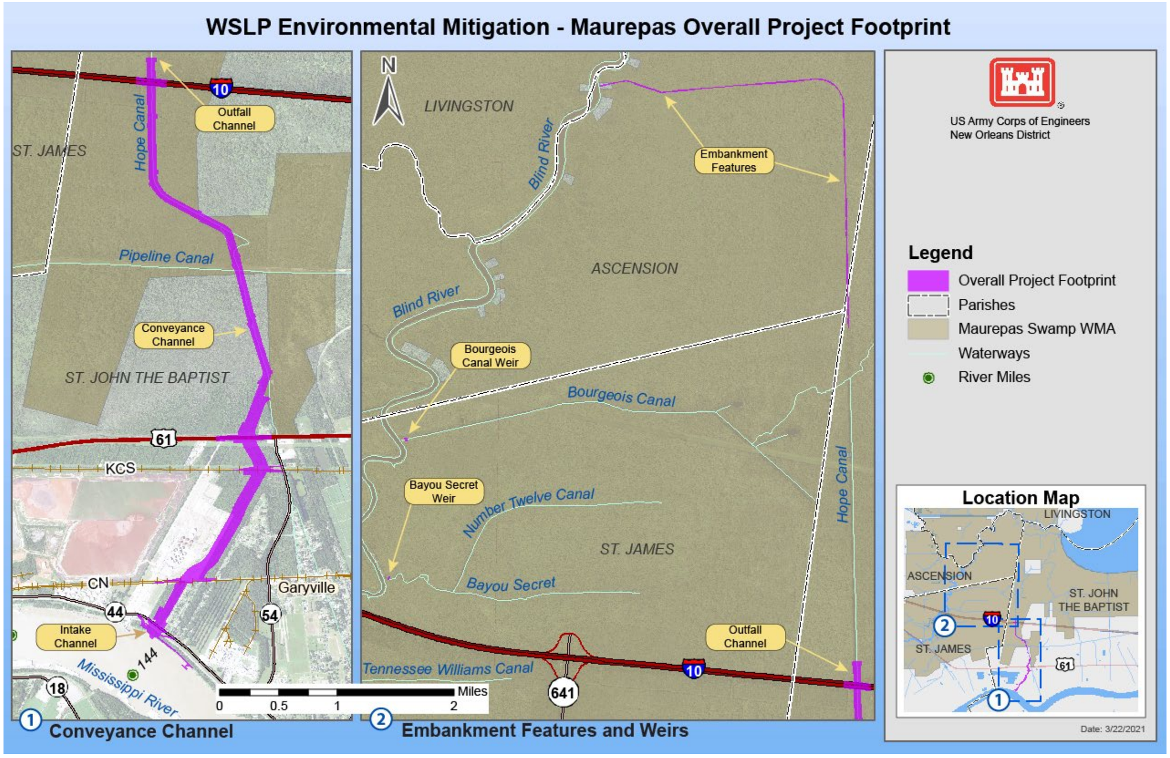


Figure 3. Illustration of River-side project features.

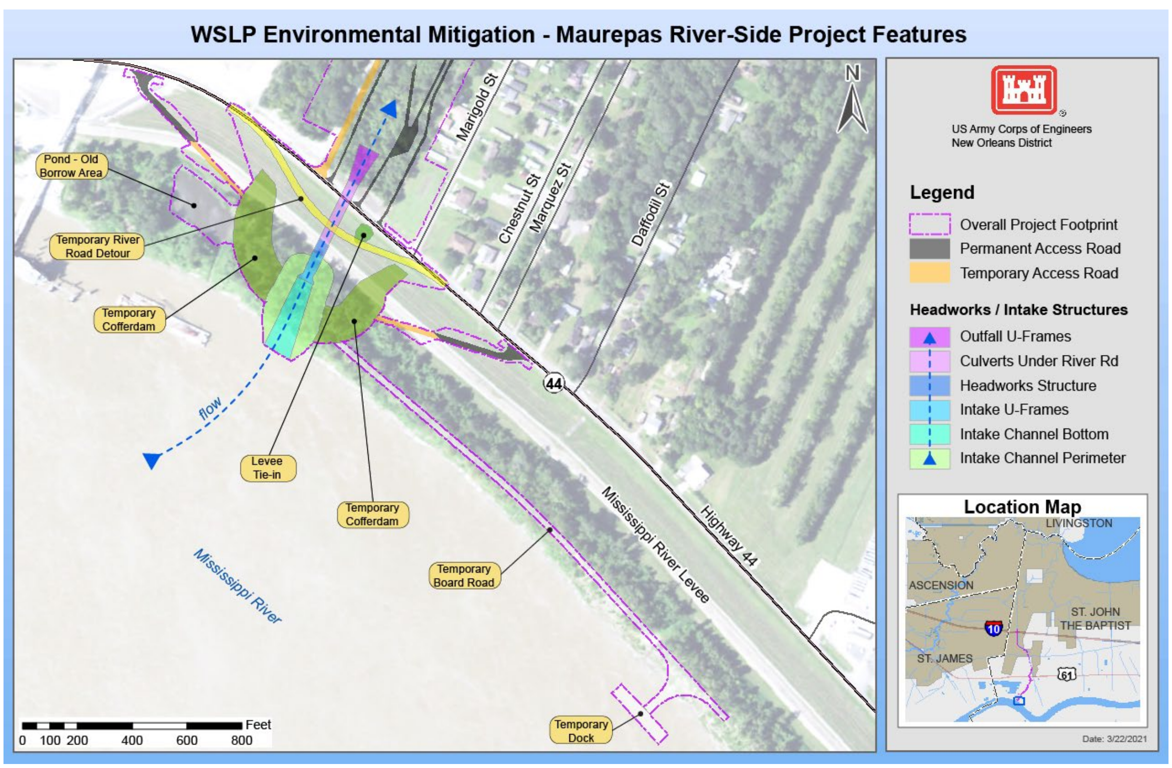


Figure 4. Year one proposed diversion hydrograph.

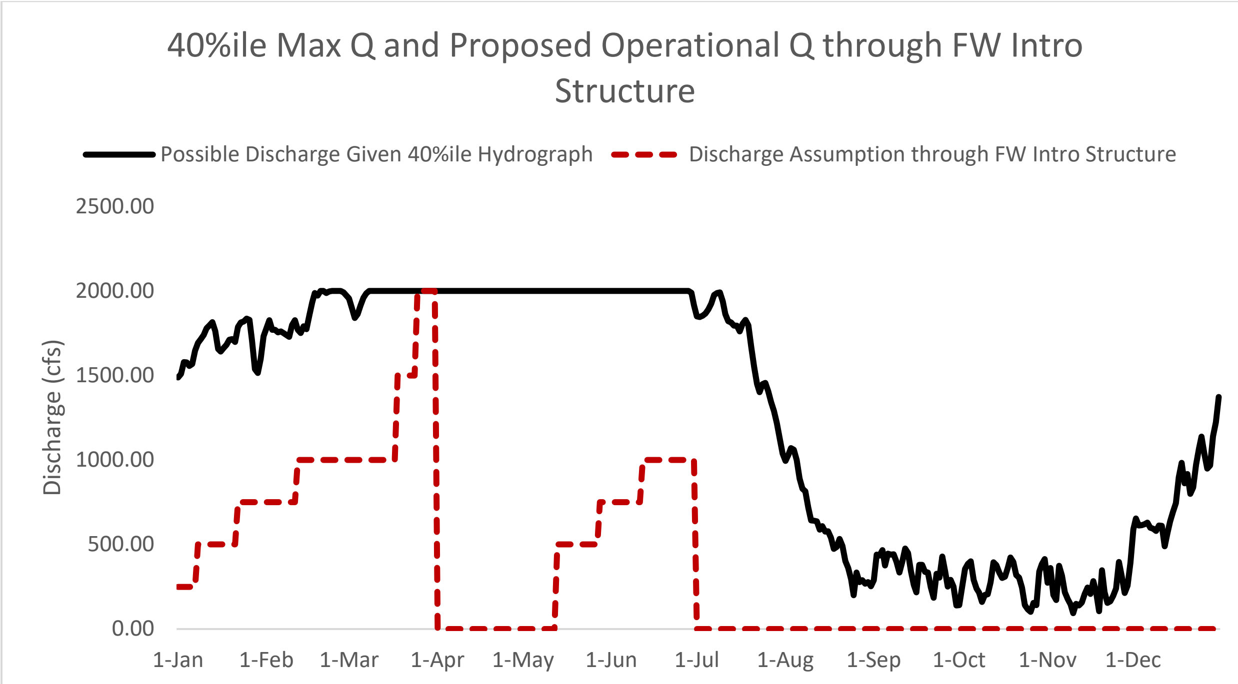


Figure 5. Year two proposed diversion hydrograph.

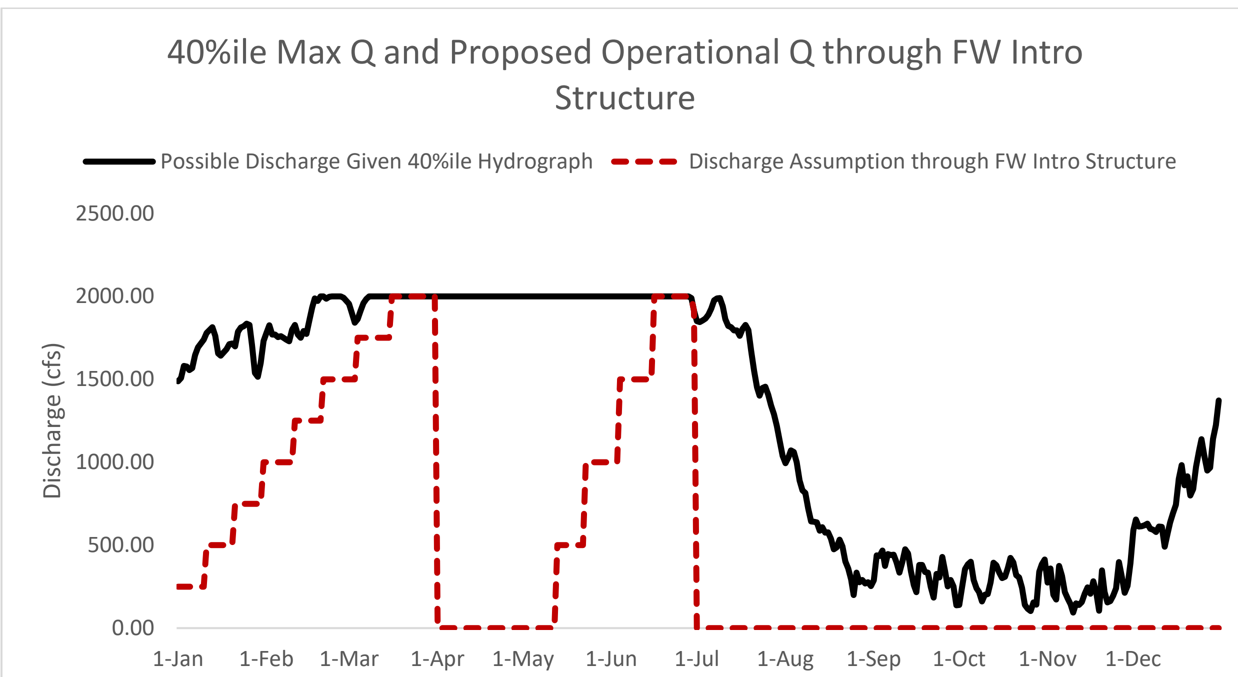


Figure 6. Year three proposed diversion hydrograph.

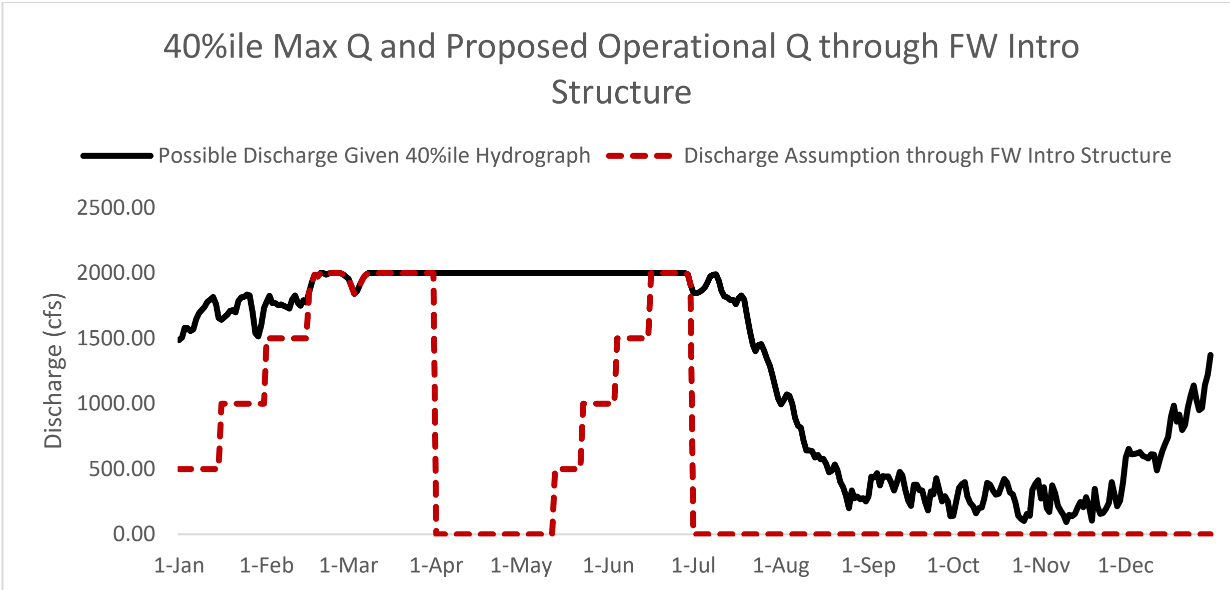
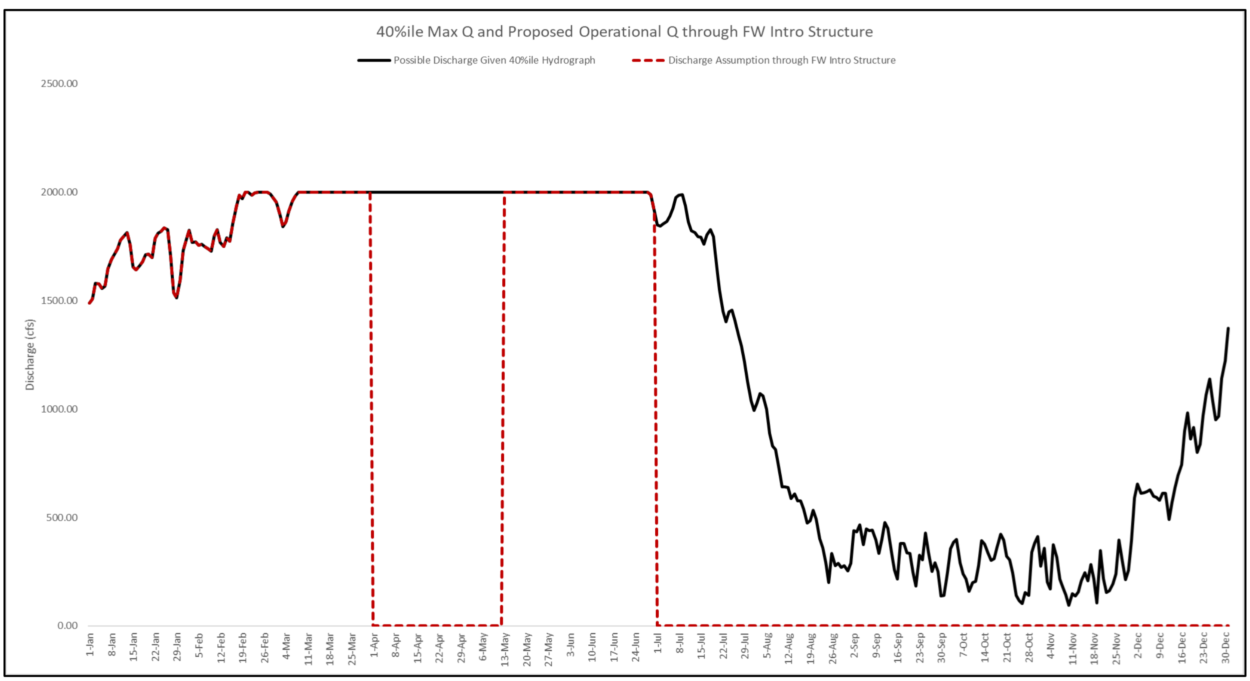


Figure 7. Years 4 – 50 proposed diversion hydrograph.



3. CONCURRENCE

The USACE has determined that the Action would have no effect on the Gulf sturgeon and that the Action may affect but is not likely to adversely affect the West Indian manatee. The Service concurs with that determination for reasons we explain in this section. No concurrence is needed for a "no effect" determination.

<u>Gulf sturgeon</u>

During their spring and fall migration to and from coastal rivers, Gulf sturgeon may seasonally occur in areas that would receive introduced Mississippi River water such as Lake Maurepas, Blind River, and the Amite River. The diversion may operate at or near peak discharge during the spring migration resulting in greater turbidity. Since the sturgeon are thought not to feed during those migrations, any project-induced turbidity effects should not impact foraging success. Additionally construction related impacts to water bottoms occurs in the Mississippi River, Hope Canal, and southern portions of Blind River, all are locations where Gulf sturgeon have not been documented or thought to frequent. Accordingly, the USACE determined that there would be no effect on the Gulf sturgeon.

<u>West Indian Manatee</u>

The West Indian manatee is a large gray or brown marine mammal known to regularly occur in Lakes Pontchartrain and Maurepas and their associated coastal waters and streams. It also can be found less regularly in other Louisiana coastal areas, most likely while the average water temperature is warm. Based on data maintained by the LDWF, there were 269 reported manatee sightings from 1990-2020 in Louisiana. Presence of manatee in the action area is possible; however, they are transient visitors during warmer months and are not a resident species. While construction activities may temporarily disturb or displace manatees present near construction activities, manatee protection measures identified in Section 2 are anticipated to avoid or minimize impacts to manatees. Operation of the diversion is predicted to reduce water temperatures in Hope Canal and other receiving area waterbodies during the January through June diversion discharge months, which are months when manatees are less likely to occur in Louisiana. The diversion of nutrient-rich Mississippi River water may encourage increased growth of submerged aquatic vegetation, and increase manatee forage opportunities within the area. Accordingly, the Service concurs with the USACE's determination that the proposed project may affect, but is not likely to adversely affect the West Indian manatee.

4. PALLID STURGEON

4.1. Status of Pallid Sturgeon

This section summarizes best available data about the biology and current condition of pallid sturgeon throughout its range that are relevant to formulating an opinion about the Action. The Service published its decision to list the pallid sturgeon as endangered on October 9, 1990 (55 FR 36641-36647). The reasons for listing were habitat modification, apparent lack of natural reproduction, commercial harvest, and hybridization in parts of its range. Critical habitat has not been proposed or designated for the pallid sturgeon. The Service conducted a 5-year review of the species' status and revised the recovery plan in 2014, and determined that no status change was needed at that time. Most of the background information on pallid sturgeon biology and status presented throughout this BO is taken directly from information presented in the revised recovery plan (Service 2014a) and eight other BOs involving the species (Service 2009; Service 2010a; Service 2010b; Service 2014b; Service 2018; Service 2020; Service 2021a; Service 2021b).

4.1.1. Description of Pallid Sturgeon

The pallid sturgeon is a benthic, riverine fish that occupies the Mississippi River Basin, including the Mississippi River, Missouri River, and their major tributaries (i.e., Platte, Yellowstone, and Atchafalaya rivers) (Service 1990).

Recent studies have documented extensive hybridization between pallid sturgeon and shovelnose sturgeon in the Lower Mississippi River (Coastal Plain Management Unit) (Jordan et al., 2019). These studies also confirmed that small numbers of genetically pure pallid sturgeon continue to occupy the Lower Mississippi River; however, genetic analysis is required for their accurate identification. There is currently no official Service policy for the protection of hybrids under the Act, and the protection of hybrid progeny of endangered or threatened species is evaluated as necessary. For example, the protection of hybrids to facilitate law enforcement is recognized as appropriate under the Act (§4(3)) in cases where they are sympatric with pure species and morphologically difficult to distinguish. The duration and significance of hybridization between pallid sturgeon and shovelnose sturgeon is currently unknown, and it is not possible to visually distinguish pure pallid sturgeon from introgressed pallid sturgeon; therefore, for the purposes of management and consultation, we are considering all phenotypic pallid sturgeon as protected under the Act.

The pallid sturgeon can grow to lengths of over 6ft (1.8 meters [m]) and weights in excess of 80 pounds (lb) (36 kilograms [kg]) in the upper Missouri River portion of its range. In the Mississippi River, specimens seldom exceed 3ft (1m) in length, or 20lb (9kg) in weight. Pallid sturgeon have a flattened, shovel-shaped snout, a long, slender, and completely armored caudal peduncle, and lack a spiracle (Smith 1979). As with other sturgeon, the mouth is toothless, protrusible, and ventrally positioned under the snout. The skeletal structure is primarily cartilaginous (Gilbraith et al. 1988). Pallid sturgeon are similar in appearance to the more common and darker shortnose sturgeon, and may be visually distinguished by the proportional lengths of inner and outer barbels, mouth width, proportion of head width to head length, proportion of head length to body length, and other characteristics. As noted above, morphological pallid sturgeon require genetic analysis to determine hybridization.

4.1.2. Life History of Pallid Sturgeon

Habitat

Pallid sturgeon habitats can generally be described as large, free-flowing, warm water, turbid river habitats with a diverse assemblage of physical attributes that are in a constant state of change (Service 1993, 2014a). Floodplains, backwaters, chutes, sloughs, islands, sandbars and main channel waters form the large river ecosystem that provide the macrohabitat requirements for all life stages of pallid sturgeon. Throughout its range, pallid sturgeon tend to select main channel habitats (Bramblett 1996; Sheehan et al. 1998; Service 2014a; Schramm et al. 2017); in the Lower Mississippi River (LMR), they have been found in a variety of main channel habitats, including natural and engineered habitats (Herrala et al. 2014).

Pallid sturgeon are thought to occupy the sandy main channel in the Mississippi, Missouri, and Yellowstone rivers most commonly, but also are collected over gravel substrates (Service 2014a; Bramblett and White 200l; Hurley et al. 2004; Garvey et al. 2009; Koch et al. 2012). Several studies have documented pallid sturgeon near islands and dikes, and these habitats are thought to provide a break in water velocity and an increased area of depositional substrates for foraging (Garvey et al. 2009; Koch et al. 2012). Increased use of side channel and main channel islands has been noted in spring, and it is hypothesized that these habitats may be used as refugia during periods of increased flow (Garvey et al. 2009; Koch et al. 2012; Herrala et al. 2014). Recent telemetry monitoring of adult pallid sturgeon in the LMR indicates use of most channel habitats, including dikes, revetment, islands, secondary channels, etc. (Herrala et al. 2014). Islands and secondary channels are important in recruitment of larval sturgeon in the LMR (Hartfield et al. 2013).

Pallid sturgeon occur within a variety of flow regimes (Garvey et al. 2009). In their upper range, adult pallid sturgeon are collected in depths that vary between 1.97-47.57ft with bottom water velocities ranging from 2.20 feet per second (ft/s) and 2.62ft/s (Service 2014a; Bramblett and White 2001; Gerrity 2005). Pallid sturgeon in the LMR have been collected at depths greater than 65ft with a mean value of 32.81ft, and water velocities greater than 5.91ft/s with a mean value of 2.30ft/s (U.S. Army Engineer Research and Development Center [ERDC] unpublished data; Herrala et al. 2014). Turbidity is thought to be an important factor in habitat selection by pallid sturgeon, which have a tendency to occupy more turbid habitats than shovelnose sturgeon (Blevins 2011). In the LMR, pallid sturgeon have been collected in turbidities up to 340 Nephelometric Turbidity Units (NTUs) with a mean value of 90 NTUs (ERDC unpublished data).

Much of the natural habitat throughout the range of pallid sturgeon has been altered by humans, and this is thought to have had a negative impact on this species (Service 2014a). Habitats were once very diverse, and provided a variety of substrates and flow conditions (Baker et al. 1991; Service 1993). Extensive modification of the Missouri and Mississippi rivers over the last 100 years has drastically changed the form and function of the river (Baker et al. 1991; Prato 2003). Today, habitats are reduced and fragmented and much of the Mississippi River basin has been channelized to aid in navigation and flood control (Baker et al. 1991). The extent of impacts from range-wide habitat alteration on the pallid sturgeon is unknown, but recent studies have shown that in the unimpounded reaches (i.e., LMR), suitable habitat is available and supports a diverse aquatic community (Service 2007).

Movement

Like other sturgeon, pallid sturgeon is a migratory fish species that moves upstream annually to spawn (Koch et al. 2012). Movements are thought to be triggered by increased water temperature and flow in spring months (Garvey et al. 2009; Blevins 2011). Pallid sturgeon may remain sedentary, or remain in one area for much of the year, and then move either upstream or downstream during spring (Garvey et al. 2009; Herrala and Schramm 2017). It is possible that because movement in large, swift rivers requires a great amount of energy, this relatively inactive period may be a means to conserve energy (Garvey et al. 2009). Most active periods of movement in the upper Missouri River were between March 20 and June 20 (Bramblett and White 2001). In one study, individual fish traveled an average of 3.73 miles per day (mi/day) and one individual traveled over 9.94 mi/day (Garvey et al. 2009). Pallid sturgeon in the Missouri River have been reported to travel up to 5.90 mi/hour and 13.30 mi/day during active periods (Bramblett and White 2001). Based on a surrogate study that documented recaptures of shovelnose sturgeon in the Missouri River originally tagged in the LMR, pallid sturgeon may similarly undertake long-distance, multi- year upstream movements. Upstream distances approaching 1,245 mi have been recorded (ERDC unpublished data) and similar distances have been recorded for downstream movements (Service unpublished data).

Aggregations of pallid sturgeon have been reported in several locations in the middle Mississippi River, particularly around gravel bars, including one annual aggregation at the Chain of Rocks Dam, which is thought to be related to spawning activities (Garvey et al. 2009). Aggregations of pallid sturgeon in the lower 8.70 mi of the Yellowstone River are also thought to be related to spawning activities of sturgeon from the Missouri River (Bramblett and White 2001). Pallid sturgeon have been found to have active movement patterns during both the day and night, but they move mostly during the day (Bramblett and White 2001). There have been no verified spawning areas located in the LMR.

Feeding

Sturgeon are benthic feeders and are well adapted morphologically (ventral positioning of the mouth, laterally compressed body) for the benthic lifestyle (Service 1993; Findeis 1997). Adult pallid sturgeon are primarily piscivorous (but still consume invertebrates), and are thought to switch to piscivory around age 5 or 6 (Kallemeyn 1983; Carlson et al. 1985; Hoover et al. 2007; Grohs et al. 2009). In a study of pallid sturgeon in the middle and lower Mississippi River, fish were a common dietary component and were represented primarily by Cyprinidae, Sciaenidae, and Clupeidae (Hoover et al. 2007). Other important dietary items for pallid sturgeon in the Mississippi River were larval Hydropsychidae (lnsecta: Trichoptera), Ephemeridae (lnsecta: Ephemeroptera), and Chironomidae (lnsecta: Diptera) (Hoover et al. 2007). Pallid sturgeon diet varies depending on season and location, and these differences probably are related to prey availability (Hoover et al. 2007). In a Mississippi River dietary study, Trichoptera and Ephemeroptera were consumed in greater quantities in winter months in the lower Mississippi River, while the opposite trend was observed in the middle Mississippi River (Hoover et al. 2007). Hoover et al. (2007) also found that in both the middle Mississippi River and the lower Mississippi River, dietary richness is greatest in winter months.

4.1.3. Numbers, Reproduction, and Distribution of Pallid Sturgeon

Spawning

Freshwater sturgeon travel upstream to spawn between the spring equinox and summer solstice, and it is possible that either a second or an extended spawning period may occur in the fall in southern portions of the range (i.e., Mississippi River) (Service 2007; Wildhaber et al. 2007; Schramm et al. 2017). These spawning migrations are thought to be triggered by several cues, including water temperature, water velocity, photoperiod, presence of a mate, and prey availability (Keenlyne 1997; DeLonay et al. 2007; DeLonay et al. 2009; Blevins 2011). Gamete development is completed during the upstream migration and sturgeon are thought to spawn near the apex of their migration (Bemis and Kynard 1997). Data suggests that female *Scaphirhynchus* spp. do not reach sexual maturity until ages 6-17 and spawn every 2-3 years, and that males do not reach sexual maturity until ages 4-9 (Keenlyne and Jenkins 1993; Colombo et al. 2007; Stahl 2008; Divers et al. 2009). Pallid sturgeon and shovelnose sturgeon at lower latitudes (e.g., lower Mississippi River) may begin spawning at an earlier age than those in upper portions of the range (e.g., Upper and Middle Mississippi and Missouri Rivers) because they are thought to have shorter lifespans and smaller sizes (George et al. 2012). Also, LMR pallid sturgeon may be more highly fecund than those in northern portions of their range (George et al. 2012). It is thought that pallid sturgeon, like shovelnose sturgeon spawn over gravel substrates, but spawning has never been observed in this species (Service 1993; DeLonay et al. 2007; DeLonay et al. 2009).

Rearing

Pallid sturgeon hatch when they reach a total length (TL) of approximately ¼-inch. Larvae feed on yolk reserves and drift downstream for l l-17 days, until yolk reserves are depleted (Snyder 2002; Braaten et al. 2008; DeLonay et al. 2009). Length of drift and rate of yolk depletion are dependent on several factors, including water temperature, photoperiod, and water velocity (Snyder 2002; DeLonay et al. 2009). Larval drift is not completely understood and the impacts of artificial structures, as well as the role of eddies, are unknown (Kynard et al. 2007; Braaten et al. 2008). During drift, sturgeon repeat a "swim up and drift" pattern, in which they swim up in the water column from the bottom (<10 in) and then drift downstream (Kynard et al. 2002; Kynard et al. 2007). A hatchery series of shovelnose sturgeon from the Natchitoches National Fish Hatchery (NNFH) in Louisiana (J. Dean, 2005 unpublished data) reports complete yolk sac absorption at days 8-9 post-hatch, which is several days sooner than shovelnose sturgeon from Gavins Point National Fish Hatchery in South Dakota, so there could be a latitudinal difference in yolk absorption and larval maturation rates throughout the range of pallid sturgeon (Snyder 2002). The timing of exogenous feeding, which begins when yolk reserves are depleted and drifting has ceased, can differ latitudinally (DeLonay et al. 2009). The switch from endogenous to exogenous feeding is known as the “critical period", because mortality is likely if sturgeon do not find adequate food (Kynard et al. 2002; DeLonay et al. 2009). Pallid sturgeon begin exogenous feeding around 11-12 days post-hatch in upper portions of their range, but exogenous feeding was observed in fish as small as 17.82mm TL in the lower Mississippi River (Harrison et al. 2012, unpublished data), which could be as young as 6-8 days (based on unpublished age and growth data from NNFH) post-hatch (Braaten et al. 2007). The diets of young of year and juvenile pallid sturgeon and shovelnose sturgeon in upper portions of their ranges are much like those of the adult shovelnose sturgeon, and are primarily composed of aquatic insects and other benthic macroinvertebrates (Braaten et al. 2007; Wanner et al. 2007; Grohs et al. 2009). Young of year and juvenile pallid sturgeon in the LMR feed primarily on Chironomidae over sand in channel habitats (Harrison et al. 2012, unpublished data). Juvenile pallid sturgeon are thought to switch to piscivory around ages 5-6 (Kallemeyn 1983; Carlson et al. 1985; Hoover et al. 2007; Grohs et al. 2009).

Kynard et al. (2002) found larval pallid sturgeon to be photopositive and showed little preference to substrate color, except for a slight preference for light substrates when exogenous feeding began. It is thought that pallid sturgeon become increasingly photonegative starting around day 11 post-hatch (Kynard et al. 2002). In this same study, larval sturgeon swam in open habitats, seeking no cover under rocks in the swimming tube, and aggregated in small groups around days 3-5 post-hatch (Kynard et al. 2002). The black tail phenotype of these young sturgeon is thought to aid in recognition and aggregation (Kynard et al. 2002). Pallid sturgeon have been observed swimming and drifting at a wide range (2-118 in) above the bottom depending on water velocities (although most fish are thought to stay in the lower 20 in of the water column), and drift velocities are thought to range from 0.98-2.29 ft/s (Kynard et al. 2002; Kynard et al. 2007; Braaten et al. 2008). Drift distance of larval sturgeon is thought to be between 85.75-329.33 mi (Kynard et al. 2007; Braaten et al. 2008). Juvenile pallid sturgeon have been found in water depths ranging from an average of 7.58-8.14 ft in the upper Missouri River (Gerrity 2005). Maximum critical swimming speeds for juvenile pallid sturgeon range from 0.32 ft/s to 0.82 ft/s, depending on size, with larger juveniles (6-8 in TL) able to withstand higher water velocities than their smaller counterparts (5-6 in TL) (Adams et al. 1999). In the Lower Mississippi River, larval sturgeon collections are associated with flooded sand bars in secondary channels and sand/gravel reefs in the main channel (Hartfield et al. 2013; Schramm et al. 2017).

Distribution and Abundance

Pallid sturgeon occur in parts of the Mississippi River Basin, including the Mississippi River below the confluence of the Missouri River, and its distributary, the Atchafalaya River; and the Missouri River and its tributaries the Yellowstone and Platte Rivers (Kallemeyn 1983; Killgore et al. 2007a). Recovery efforts have divided the extensive range of pallid sturgeon into four management units (Service 2014a) based on population variation (i.e., morphological, genetic) and habitat differences (i.e., physiographic regions, impounded, unimpounded reaches) throughout the extensive range of the pallid sturgeon (Service 2014a). These are:

> *Great Plains Management Unit (GPMU)*: The GPMU extends from Great Falls of the Missouri River, Montana, to Fort Randall Dam, South Dakota, and includes the Yellowstone, Marias, and Milk Rivers.
>
> *Central Lowlands Management Unit (CLMU)*: The CLMU includes the Missouri River from Fort Randall Dam, South Dakota, to the confluence of the Grand River, Missouri, and includes the lower Platte and lower Kansas Rivers.
>
> *Interior Highlands Management Unit (IHMU)*: The IHMU includes the Missouri River from the confluence of the Grand River, Missouri, to the confluence of the Mississippi

River, Missouri, and the Mississippi River from Keokuk, Iowa, to the confluence of the Ohio River, Illinois.

Coastal Plain Management Unit (CPMU): The CPMU includes the LMR from the confluence of the Ohio River, Illinois, to the Gulf of Mexico, Louisiana (the action area of this consultation), and the Atchafalaya River distributary system, Louisiana.

To date, more than 1,100 pallid sturgeon have been captured in the CPMU since listing (more than 500 pallid sturgeon from the LMR, and more than 600 from the Atchafalaya River) (Killgore et al. 2007a), exceeding capture numbers from all other management units combined. Pallid to shovelnose ratios range between 1:6 to l:3 in the LMR, depending upon river reach, and 1:6 in the Atchafalaya River (Killgore et al. 2007a; Service 2007). The ratio of pallid to shovelnose sturgeon in the lower Mississippi River reach where the BCS is located is typically 1:3 (ERDC 2013). Age-0 pallid sturgeon have been captured in both the LMR and the Atchafalaya, although it is unclear exactly where and when spawning occurs (ERDC, unpublished data; Hartfield et al. 2013). Age-0 and immature pallid sturgeon are difficult to distinguish from shovelnose sturgeon (Hartfield et al. 2013); however, capture data indicates annual recruitment of immature pallid sturgeon since 1991 (Service database 2013). The occurrence of *Scaphirhynchus* was extended from River Mile 85 downstream 50 miles to River Mile 33, when ERDC collected two young-of-year *Scaphirhynchus* sturgeon with a trawl in the lower Mississippi River in November of 2016 (USACE 2017).

4.1.4. Conservation Needs of and Threats to Pallid Sturgeon

Much of the following information is taken from Service documents (Service 2000, 2007, 2014b, 2018). The pallid sturgeon was listed due to the apparent lack of recruitment for over 15 years, and the habitat threats existing at the time of listing. Destruction and alteration of habitats by human modification of the river system is believed to be the primary cause of declines in reproduction, growth, and survival of the pallid sturgeon. The historic range of pallid sturgeon as described by Bailey and Cross (1954) encompassed the middle and lower Mississippi River, the Missouri River, and the lower reaches of the Platte, Kansas, and Yellowstone Rivers. Bailey and Cross (1954) noted a pallid sturgeon was captured at Keokuk, Iowa, at the Iowa and Missouri state border. Duffy et al. (1996) stated that the historic range of pallid sturgeon once included the Mississippi River upstream to Keokuk , Iowa, before that reach of the river was converted into a series of locks and dams for commercial navigation (Coker 1930).

Habitat destruction/modification and the curtailment of range were primarily attributed to the construction and operation of dams on the upper Missouri River and modification of riverine habitat by channelization of the lower main stems of the Missouri and Mississippi Rivers. Dams substantially fragmented pallid sturgeon range in the upper Missouri River. However, free-flowing riverine conditions currently exist throughout the lower 2,000 mi (3,218 km) (60 percent) of the pallid sturgeon historical range. Although the lower Missouri River continues to be impacted by regulated flows and modified habitats, actions have been developed and are being implemented to address habitat issues. Recent studies and data from the Mississippi River suggests that riverine habitats are less degraded than previously believed, and that they continue to support diverse and productive aquatic communities, including pallid sturgeon. Although there are ongoing programs to protect and improve habitat conditions in the four management units, positive effects from these programs on pallid sturgeon have not been quantified.

Carlson and Pflieger (1981) stated that pallid sturgeon are rare but widely distributed in both the Missouri River and in the Mississippi River downstream from the mouth of the Missouri River. A comparison of pallid sturgeon and shovelnose sturgeon catch records provides an indication of the rarity of pallid sturgeon. At the time of their original description, pallid sturgeon composed 1 in 500 river sturgeon captured in the Mississippi River at Grafton, Illinois (Forbes and Richardson 1905). Pallid sturgeon were more abundant in the lower Missouri River near West Alton, Missouri, representing one-fifth of the river sturgeon captured (Forbes and Richardson 1905). Carlson et al. (1985) captured 4,355 river sturgeon in 12 sampling stations on the Missouri and Mississippi Rivers. Field identification revealed 11 (0.25 percent) pallid sturgeon. Grady et al. (2001) collected 4,435 river sturgeon in the lower 850 mi (1,367 km) of the Missouri River and 100 mi (161 km) of the middle Mississippi River from November 1997 to April 2000. Field identification revealed nine wild (0.20 percent) and nine hatchery-origin pallid sturgeon.

Today, pallid sturgeon, although variable in abundance, are ubiquitous throughout most of the free flowing Mississippi River. When the pallid sturgeon was listed as endangered they were only occasionally found in the following areas; from the Missouri River: 1) between the Marias River and Fort Peck Reservoir in Montana; 2) between Fort Peck Dam and Lake Sakakawea (near Williston, North Dakota); 3) within the lower 70 mi (113 km) of the Yellowstone River downstream of Fallon, Montana; 4) in the headwaters of Lake Sharpe in South Dakota; 5) near the mouth of the Platte River near Plattsmouth, Nebraska; and, 6) below River Mile 218 to the mouth in the State of Missouri.

Keenlyne (1989) updated previously published and unpublished information on distribution and abundance of pallid sturgeon. He reported pre-1980 catch records for the Mississippi River from its mouth upstream to its confluence with the Missouri River, a length of 1,153 mi (1,857 km); in the lower 35 mi (56 km) of the Yazoo/Big Sunflower and St. Francis Rivers (tributaries to the Mississippi); in the Missouri River from its mouth to Fort Benton, Montana, a length of 2,063 mi (3,323 km); and, in the lower 40 mi (64 km) of the Kansas River, the lower 21 mi (34 km) of the Platte River, and the lower 200 mi (322 km) of the Yellowstone River (tributaries to the Missouri River). The total range is approximately 3,500 mi (5,635 km) of river.

Currently, the Missouri River (1,154 mi) (1,857 km) has been modified significantly with approximately 36 percent of the riverine habitat inundated by reservoirs, 40 percent channelized, and the remaining 24 percent altered due to dam operations (Service 1993). Most of the major tributaries of the Missouri and Mississippi Rivers have also been altered to various degrees by dams, water depletions, channelization, and riparian corridor modifications.

The middle Mississippi River, from the mouth of the Missouri River to the mouth of the Ohio River, is principally channelized with few remaining secondary channels, sand bars, islands and abandoned channels. The middle Mississippi River has been extensively diked; navigation channels and flood control levees have reduced the size of the floodplain by 39 percent.

Levee construction along the lower Mississippi River, from the Ohio River to the Gulf, has eliminated major natural floodways and reduced the land area of the floodplain by more than 90 percent (Fremling et al. 1989). Fremling et al. (1989) also report that levee construction isolated many floodplain lakes and raised river banks. As a result of levee construction, 15 meander loops were severed between 1933 and 1942.

Destruction and alteration of big-river ecological functions and habitats once provided by the Missouri and Mississippi Rivers were believed to be the primary cause of declines in reproduction, growth, and survival of pallid sturgeon (Service 2014a). The physical and chemical elements of channel morphology, flow regime, water temperature, sediment transport, turbidity, and nutrient inputs once functioned within the big-river ecosystem to provide habitat for pallid sturgeon and other native species. On the main stem of the Missouri River today, approximately 36 percent of riverine habitat within the pallid sturgeon range has been transformed from river to lake by construction of six massive earthen dams by the USACE between 1926 and 1952 (Service 1993). Another 40 percent of the river downstream of the dams has been channelized. The remaining 24 percent of river habitat has been altered by changes in water temperature and flow caused by dam operations.

The channelized reach of the Missouri River downstream of Ponca, Nebraska, once a diverse assemblage of braided channels, sandbars, and backwaters, is now confined within a narrow channel of rather uniform width and swift current. Morris et al. (1968) found that channelization of the Missouri River reduced the surface area by approximately 67 percent. Funk and Robinson (1974) calculated that, following channelization, the length of the Missouri River between Rulo, Nebraska, and its mouth (~500 river miles) (310 km) had been reduced by 8 percent, and the water surface area had been reduced by 50 percent.

Missouri River aquatic habitat between and downstream of main stem dams has been altered by reductions in sediment and organic matter transport/deposition, flow modification, hypolimnetic releases, and narrowing of the river through channel degradation. Those activities have adversely impacted the natural river dynamics by reducing the diversity of bottom contours and substrates, slowing accumulation of organic matter, reducing overbank flooding, changing seasonal patterns, severing flows to backwater areas, and reducing turbidity and water temperature (Hesse 1987). The Missouri River dams also are believed to have adversely affected pallid sturgeon by blocking migration routes and fragmenting habitats (Service 2014a).

The pattern of flow velocity, volume, and timing of the pre-development rivers provided the essential life requirements of native large-river fishes like the pallid sturgeon and paddlefish. Hesse and Mestl (1993) found a significant relationship between the density of paddlefish larvae and two indices (timing and volume) of discharge from Fort Randall Dam. They concluded that when dam operations caused discharge to fluctuate widely during spring spawning, the density of drifting larvae was lower, and when annual runoff volume was highest, paddlefish larval density was highest. Hesse and Mestl (1987) also modeled these same two indices of discharge from Fort Randall Dam with an index of year-class strength. They demonstrated significant negative relationships between artificial flow fluctuations in the spring and poor year-class development for several native and introduced fish species including river carpsucker, shorthead redhorse, channel catfish, flathead catfish, sauger, smallmouth buffalo, and bigmouth buffalo. The sample size of sturgeon was too small to model in that study; however, a clear relationship existed between poor year-class development in most native species studied and the artificial hydrograph.

Modde and Schmulbach (1973) found that during periods of low dam releases, the secondary subsidiary channels, which normally feed into the river channel, become exposed to the atmosphere and thus cease to contribute littoral benthic organisms into the drift. Schmulbach (1974) states that use of sandbar habitats were second only to cattail marsh habitats as nursery ground for immature fishes of many species.

Even though extensive flood control, water supply, and navigation projects constrict and control the Missouri and Mississippi Rivers with reservoirs, stabilized banks, jetties, dikes, levees, and revetments, relatively unaltered remnant reaches of the Missouri River and the Mississippi River from the Missouri River confluence to the Gulf of Mexico still provide habitat useable by pallid sturgeon. However, anthropogenic alterations (i.e., levee construction) effectively increased river stage and velocities at higher discharges by preventing overbank flows on the adjacent floodplains (Baker et al. 1991).

The upper ends of the reservoirs in the upper basin may be influencing the recruitment of larval sturgeon. Both shovelnose sturgeon and pallid sturgeon larvae have a propensity to drift after hatching (Kynard et al. 1998a, 1998b). Bramblett (1996) found that the pallid sturgeon may be spawning in the Yellowstone River between River Mile 9 and River Rile 20 upriver, and that from historic catch records, there is some evidence to indicate that the occurrence of pallid sturgeon catches coincide with the spring spawning at the mouth of the Tongue River (Service 2000). Shovelnose sturgeon have been found to spawn in the tributaries of the Yellowstone River as well as such areas as the Marias, Teton, Powder and Tongue Rivers (Service 2000). Shovelnose sturgeon are successfully recruiting and reproducing in the river stretches in the upper basin and this may be directly related to the amount of larval and juvenile habitat they have available downstream of the spawning sites.

Early indications in culturing pallid sturgeon indicate that sturgeon larvae will not survive in a silty substrate. In 1998, most of the larval sturgeon held in tanks at Gavins Point National Fish Hatchery (NFH), experienced high mortality when the water supply contained a large amount of silt which settled on the bottom of the tanks. Migration routes to spawning sites on the lower Yellowstone River have been fragmented by low-head dams used for water supply intakes. Such habitat fragmentation has forced pallid sturgeon to spawn closer to reservoir habitats and reduced the distance larval sturgeon can drift after hatching.

Historically, pallid, shovelnose, and lake sturgeon were commercially harvested in all States on the Missouri and Mississippi Rivers (Helms 1974). The larger lake sturgeon and pallid sturgeon were sought for their eggs which were sold as caviar, whereas shovelnose sturgeon were historically destroyed as bycatch. Commercial harvest of all sturgeon has declined substantially since record-keeping began in the late 1800s. Most commercial catch records for sturgeon have not differentiated between species and combined harvests as high as 430,889 lb (195,450 kg) were recorded in the Mississippi River in the early 1890s, but had declined to less than 20,061 lb (9,100 kg) by 1950 (Carlander 1954). Lower harvests reflected a decline in shovelnose sturgeon abundance since the early 1900s (Pflieger 1975). Today, commercial harvest of SS is still allowed in 5 of the 13 states where pallid sturgeon occur.

Mortality of pallid sturgeon occurs as a result of illegal and incidental harvest from both sport and commercial fishing activities (Service 2000). Sturgeon species, in general, are highly vulnerable to impacts from fishing mortality due to unusual combinations of morphology, habits, and life history characteristics (Boreman 1997). In 1990, the head of a pallid sturgeon was found at a sport-fish cleaning station in South Dakota, and in 1992 a pallid sturgeon was found dead in a commercial fisherman's hoop net in Louisiana. In 1997, four pallid sturgeon were found in an Illinois fish market (Sheehan et al. 1997). It is probable that pallid sturgeon are affected by the illegal take of eggs for the caviar market. In 1999, a pallid sturgeon that was part of a movement and habitat study on the lower Platte River was harvested by a recreational angler (Service 2000). Bettoli et al. (2008) found 1.8 percent of the total sturgeon catch in Tennessee caviar harvest were composed of pallid sturgeon. In addition, such illegal and incidental harvest may skew pallid sturgeon sex ratios such that hybridization with shovelnose is exacerbated. Killgore et al. (2007b) indicated that higher mortality rates for pallid sturgeon in the Middle Mississippi River may be a result of habitat limitation and incidental take by the commercial shovelnose fishery.

Currently, only a sport and/or aboriginal fishery exist for lake sturgeon, due to such low population levels (Todd 1998). SS are commercially harvested in eight states and a sport fishing season exists in a number of states (Mosher 1998). Although information on the commercial harvest of shovelnose sturgeon is limited, Illinois reported the commercial harvest of shovelnose sturgeon was 43,406 lb (19,689 kg) of flesh and 233 lb (106 kg) of eggs in 1997 and Missouri reported a 52-year mean annual harvest of 8,157 lb (3,700 kg) of flesh (Todd 1998) and an unknown quantity of eggs for 1998. Missouri also has a sport fishery for shovelnose sturgeon but has limited data on the quantities harvested (Mosher 1998).

The previous lack of genetic information on the pallid sturgeon and shovelnose sturgeon led to a hybridization debate. In recent years, however, several studies have increased our knowledge of the genetic, morphological, and habitat differences of those two species. Campton et al. (1995) collected data that support the hypothesis that pallid sturgeon and shovelnose sturgeon are reproductively isolated in less altered habitats, such as the upper Missouri River. Campton et al. (2000) suggested that natural hybridization, backcrossing, and genetic introgression between pallid sturgeon and shovelnose sturgeon may be reducing the genetic divergence between those species. Sheehan has identified 86 separate loci for microsatellite analysis that are being used to differentiate between pallid sturgeon, shovelnose sturgeon, and suspected hybrid sturgeon (Service 2000).

Bramblett (1996) found substantial differences in habitat use and movements between adult pallid sturgeon and shovelnose sturgeon in less altered habitats. Presumably, the loss of habitat diversity caused by human-induced environmental changes inhibits naturally occurring reproductive isolating mechanisms. Campton et al. (1995) and Sheehan et al. (1997) note that hybridization suggests that similar areas are currently being used by both species for spawning.

Carlson et al. (1985) studied morphological characteristics of 4,332 sturgeon from the Missouri and middle Mississippi Rivers. Of that group, they identified 11 pallid sturgeon and 12 pallid sturgeon /shovelnose sturgeon hybrids. Suspected hybrids have recently been observed in commercial fish catches on the lower Missouri and the middle and lower Mississippi Rivers (Service 2000). Bailey and Cross (1954) did not report hybrids, which may indicate that hybridization is a recent phenomenon resulting from environmental changes caused by human-induced reductions in habitat diversity and measurable changes in environmental variables such as turbidity, flow regimes, and substrate types (Carlson et al. 1985). A study by Keenlyne et al. (1994) concluded that hybridization may be occurring in half the river reaches within the range of pallid sturgeon and that hybrids may represent a high proportion of remaining sturgeon stocks. Hartfield and Kuhajda (2009) stated that hybridization rates in the Mississippi River have been overestimated, and there is no direct evidence linking the morphological or genetic variation defined as hybridization between pallid sturgeon and shovelnose sturgeon in the lower Missouri, Mississippi, or Atchafalaya Rivers with recent anthropogenic activities. Hybridization could present a threat to the survival of pallid sturgeon through genetic swamping if the hybrids are fertile, and through competition for limited habitat (Carlson et al. 1985). Keenlyne et al. (1994) noted few hybrids showing intermediacy in all characteristics as would be expected in a first generation cross, indicating the hybrids are fertile and reproducing.

Hubbs (1955) indicated that the frequency of natural hybridization in fish was a function of the environment, and the seriousness of the consequences of hybridization depends on hybrid viability. Hybridization can occur in fish if spawning habitat is limited, if many individuals of one potential parent species lives in proximity to a limited number of the other parent species, if spawning habitat is modified and rendered intermediate, if spawning seasons overlap, or where movement to reach suitable spawning habitat is limited (Hubbs 1955). Any of those conditions, or a combination of them, could be causing the apparent breakdown of isolating mechanisms that prevented hybridization between these species in the past (Keenlyne et al. 1994). Hartfield and Kuhajada (2009) examined three of the five original specimens used to describe the pallid sturgeon and found that the character indices currently used to distinguish the fish identify some of the type specimens as hybrids. In conclusion, they stated they found no evidence directly linking habitat modification and hybridization particularly in the Mississippi River and no evidence that hybridization constitutes an anthropogenic threat to the pallid sturgeon.

More recent studies have documented extensive hybridization between pallid sturgeon and shovelnose sturgeon in the Lower Mississippi River (Coastal Plain Management Unit) (Jordan et al. 2019). These studies also confirmed that small numbers of genetically pure pallid sturgeon continue to occupy the Lower Mississippi River; however, genetic analysis is required for their accurate identification. Please refer to Section 3.1 Species Description for an explanation of why we consider all phenotypic pallid sturgeon as protected under the Act for the purposes of management and consultation.

Although more information is needed, pollution is also likely an exacerbating threat to the species over much of its range. Pollution of the Missouri River by organic wastes from towns, packing houses, and stockyards was evident by the early 1900s and continued to increase as populations grew and additional industries were established along the river. Due to the presence of a variety of pollutants, numerous fish-harvest and consumption advisories have been issued over the last decade or two from Kansas City, Missouri, to the mouth of the Mississippi River. That distance represents about 45 percent of the pallid sturgeon total range. Currently there are no advisories listed by the U.S. Environmental Protection Agency (EPA) south of Tennessee (approximately 710 miles).

Polychlorinated biphenyls (PCBs), cadmium, mercury, and selenium have been detected at elevated, but far below lethal, concentrations in tissue of three pallid sturgeon collected from the Missouri River in North Dakota and Nebraska. Detectable concentrations of chlordane, dichlorodiphenyldichloroethylene (DDE), dichlorodiphenyltrichloroethane (DDT), and dieldrin also were found (Ruelle and Keenlyne 1994). The prolonged egg maturation cycle of pallid sturgeon, combined with bioaccumulation of certain contaminants in eggs, could make contaminants a likely agent adversely affecting eggs and embryos, as well as development or survival of fry, thereby reducing reproductive success.

In examining the similarities and differences between shovelnose sturgeon and pallid sturgeon, Ruelle and Keenlyne (1994) concluded that, while the shovelnose sturgeon may not meet all the traits desired for a surrogate, it may be the best available for contaminant studies. Conzelmann et al. (1997) reported that trace element concentrations in Old River Control Complex (ORCC) shovelnose sturgeon in Louisiana were generally higher than in shovelnose sturgeon from other areas. Certain trace elements can adversely affect reproduction, development, and may ultimately be lethal if concentrations are excessive. Most trace element levels were unremarkable; however, cadmium, copper, lead, and selenium concentrations were elevated in ORCC samples and may warrant concern (Conzelmann et al. 1997).

Conzelmann et al. (1997) also reported that organochlorine (OC) pesticide concentrations are the main environmental concern in Louisiana's shovelnose sturgeon, and consequently, in the pallid sturgeon. Shovelnose sturgeon OC concentrations were generally greater than were observed in fishes from other areas, and ORCC shovelnose sturgeon toxaphene levels were elevated compared to the National Contaminants Biomonitoring Program. Toxaphene possesses known carcinogenic, teratogenic, xenotoxic, and mutagenic properties; can cause suppression of the immune system; and may function as an endocrine system imitator, blocker, or disrupter (Colburn and Clements 1992). Those factors make toxaphene the greatest OC concern in ORCC SS and, by extension, the ORCC pallid sturgeon (Conzelmann et al. 1997). Further investigations are needed to identify contaminant sources in the Mississippi and Atchafalaya Rivers and to assess the role, if any, of contaminants in the decline of pallid sturgeon populations.

Another issue that is negatively impacting pallid sturgeon throughout its range is entrainment. The loss of pallid sturgeon associated with water intake structures has not been accurately quantified. The EPA published final regulations on Cooling Water Intake Structures for Existing Facilities per requirements of Section 316(b) of the Clean Water Act. The rule making was divided into three phases. However, only Phase I and II appear applicable to inland facilities; Phase III applies to coastal and offshore cooling intake structures associated with coastal and offshore oil and gas extraction facilities. The following rule summaries are based on information found at https://www.epa.gov/cooling-water-intakes. Phase I rules, completed in 2001, require permit holders to develop and implement techniques that will minimize impingement mortality and entrainment. Phase II, completed in 2004, covers existing power generation facilities that are designed to withdraw 50 million gallons per day or more with 25 percent of that water used for cooling purposes only. Phase II and the existing facility portion of Phase III were remanded to EPA for reconsideration and a final rule combined the remands into one rule in 2014. This rule, implemented through National Pollutant Discharge Elimination System permits, is intended to minimize negative effects associated with water cooling structures.

Section 316(b) of the Clean Water Act requires the EPA to insure that aquatic organisms are protected from impingement or entrainment. As part of the Phase II ruling, some power plants have begun conducting required entrainment studies. Preliminary data on the Missouri River suggests that entrainment may be a serious threat that warrants more investigation. Initial results from work conducted by Mid-America at their Neal Smith power facilities found hatchery-reared pallid sturgeon were being entrained (Jordan in litt. 2006; Ledwin in litt. 2006; Williams in litt. 2006). Over a 5-month period, four known hatchery-reared pallid sturgeon have been entrained, of which two were released alive and two were found dead. Ongoing entrainment studies required by the Clean Water Act will provide more data on the effects of entrainment. However, addressing entrainment issues may not occur immediately and continued take of hatchery reared or wild pallid sturgeon will limit the effectiveness of recovery efforts. In addition to cooling intake structures for power facilities, concerns have been raised regarding entrainment associated with dredge operations and irrigation diversions. Currently little data are available regarding the effects of dredge operations. However, the USACE St. Louis District, and the Dredging Operations and Environmental Research Program have initiated work to assess dredge entrainment of fish species and the potential effects that these operations may have on larval and juvenile *Scaphirhynchus*. Data for escape speed, station-holding ability, rheotaxis and response to noise, and dredge flow fields are being used to develop a risk assessment model for entrainment of sturgeon by dredges. Entrainment has been documented in the irrigation canal supplied by the Intake Dam on the Yellowstone River (Jaeger et al. 2004). Given that entrainment has been documented to occur in the few instances it has been studied, further evaluation of entrainment at other water withdrawal points is warranted across the pallid sturgeon range to adequately evaluate this threat. Entrainment of pallid sturgeon stocked in the Mississippi River into the Atchafalaya River via the ORCC has been documented by the capture of a tagged stocked sturgeon that was released into the Mississippi River.

BOs which allow the take of pallid sturgeon also represent a factor that should be considered when examining factors that could have an influence on the pallid sturgeon population. The table below (Table 1) presents all completed BOs for the LMR.

4.1.5. Tables and Figures for Status of Pallid Sturgeon

Table 1. BOs conducted for actions occurring on the Lower Mississippi River that impacted pallid sturgeon. Critical habitat is not designated for this species; thus, none is included here.

BOs (year)	Action Affecting PALLID STURGEON	Authorized Take	Take Reported
2003	BO addressing the Natchitoches National Fish Hatchery's Collection of Endangered Pallid Sturgeon from Louisiana Waters for Propagation and Research	90 adults/season for 5 season (harassment) 8 adults/season for 5 seasons (death)	23 harassment (2003)
2004	Modification to revise 2003 IT estimates for BO (4-7-3-702) on Natchitoches National Fish Hatchery's Activities	120 adults/season for 5 (harassment) 14 adults/season for (death) potential	329 (Atchafalaya) harassment (through 2010) 7 dead (2004)
2004	Programmatic BO addressing the effects of the Southeast region's Section 10(a)(1)(A) Permitting on the pallid sturgeon (5-years)	28 adults in captive propagation/year (death) 2,500 to 15,000 captive year-class 90 days old or older (one-time loss-death) 200 larval/juvenile/year sampling (death) 3, 5-inch or greater fish/year netting (death or injury) 3 fish/year external tagging (death or injury) 1 fish/year transport (death) 5 fish/year radio-tracking (death or injury)	461 (LMR) harassment (through 2012) 1 dead (2006) 2 dead (2007) 1 dead (2009)
2005	Modification 2 – adding new forms of take to the 2004 revised Incidental Take Statement (4-7-04-734) for the 2003 BO (4-7-03-702) on Natchitoches National Fish Hatchery's Activities	14 wild pallid sturgeon/season (death) 15,000 hatchery-reared pallid sturgeon/season (death)	NA
2009	BO addressing the 2008 Emergency Opening of Bonnet Carré Spillway, USACE	14 adults (harassment) 92 adults (death)	14 adult harassment Unknown deaths
2010	BO addressing the Medium White Ditch Diversion	23 adults/year (death) potential	0
2010	BO addressing the small diversion at Convent/Blind River	7 adults/year (death) potential	0
2010	BO addressing the Taxonomic ID study	100 adults (death)	76
2013	Modification of the Programmatic BO	21 adults/year(death) potential	0
2013	BO addressing the USACE CIP	Unspecified	0
2014	BO addressing the USACE Permits for Sand and Gravel Mining in the Lower Mississippi River	Unspecified	NA
2018	BO addressing the Bonnet Carré Spillway 2011 and 2016 Emergency Operations	2011 – 20 adults (harassment) 82 adults (death) 2016 – 26 adults (death)	2011 – 20 adults Unknown deaths 2016 – N/A Unknown deaths
2020	BO addressing the Bonnet Carré Spillway 2018 Emergency Operation	14 adults (death) 2 adults (harassment)	4 adults – 2 harassment, 2 dead
2021	BO addressing the Bonnet Carré Spillway 2019 Emergency Operations	83 adults (death) 18 adults (harassment)	19 adults – 18 harassment, 1 dead
2021	BO addressing the Bonnet Carré Spillway 2020 Emergency Operations	9 adults (death) 9 adults (harassment)	12 adults – 9 harassment, 3 dead
2021	BO addressing the Mid-Barataria Sediment Diversion	48 adults/year (death) Harassment	
Total		160 adults/year (harassment) 445 adults (death) 14-28/year (potential death) 200 larval fish/year (potential death) 2,500-15,000 year-class 90 days old or older (one-time loss-death)	867 adult harassment 90 adult known dead Unknown <200/year larvae collected

Note: The above listed 2010 small diversion at Convent/Blind River is not a funded project. And, the above listed Medium Diversion at White's Ditch has been superseded by the Mid-Breton Sediment Diversion project.

4.2. Environmental Baseline

This section is an analysis of the effects of past and ongoing human and natural factors leading to the current status of the pallid sturgeon, its habitat, and ecosystem within the Action Area. The environmental baseline refers to the condition of the listed species or its designated critical habitat in the Action Area, without the consequences to the listed species or designated critical habitat caused by the proposed action. The environmental baseline includes the past and present impacts of all Federal, State, or private actions and other human activities in the Action Area, the anticipated impacts of all proposed Federal projects in the Action Area that have already undergone formal or early section 7 consultation, and the impact of State or private actions which are contemporaneous with the consultation in process. The consequences to listed species or designated critical habitat from ongoing agency activities or existing agency facilities that are not within the agency's discretion to modify are part of the environmental baseline (50 CFR §402.02).

4.2.1. Action Area Numbers, Reproduction, and Distribution

The Action under consultation occurs within the LMR area of the Coastal Plains Management Unit. The range-wide status of the pallid sturgeon within the action area is discussed within the STATUS OF THE SPECIES/CRITICAL HABITAT section above. As noted in that section, the abundance of pallid sturgeon in the Mississippi River is not precisely known; however, collection efforts show the species is widespread and not uncommon in the LMR. Pallid sturgeon have been captured 2 to 3 miles upriver of the project (Kirk et al. 2008), and they have also been collected south of the project area in the Bonnet Carré Spillway (RM 133) tail waters after spillway operations (ERDC-EL 2013). In the project area upriver of New Orleans, there is an estimated 95 percent probability that the population has at least 6.44 pallid sturgeon (age 3+) per RM (Friedenberg and Siegrist 2019).

The hard substrates that act as natural spawning habitat for pallid sturgeon are lacking in the LMR; therefore, spawning is assumed not to occur in this reach of the river (Baker et al. 1991; Dryer and Sandvol 1993; Friedenberg and Siegrist 2019). Based on the scarcity of juveniles in this reach of the river, the entrainment risk for juvenile pallid sturgeon is thought to be "low", however, the entrainment risk for subadults and adults is "medium" (Kirk et al. 2008).

4.2.2. Action Area Conservation Needs of and Threats

The action area conservation needs and threats would be among those previously discussed under STATUS OF THE SPECIES/CRITICAL HABITAT, but would include only those pertaining to the southern portion (LMR) of the species' range as previously described. This section of the river has been heavily modified for the purposes of navigation and has few remaining natural features necessary for the pallid sturgeon. Contaminants in water, sediments, or prey species could float down river and be in the vicinity of the action area which could affect any pallid sturgeon present.

The Action Area would occur at RM 144 of the Mississippi River. North of this area is the Old River Control Complex which is suspected to entrain pallid sturgeon (into the Atchafalaya

River). South of the project area, the Davis Pond and Caernarvon Freshwater Diversion projects are also suspected of entraining pallid sturgeon. Approximately 11 miles south of the project area, the Bonnet Carré Spillway (RM 133) is known to entrain pallid sturgeon. Since the pallid sturgeon has been listed, the Bonnet Carré Spillway has been opened nine times (1994, 1997, 2008, 2011, 2016, 2018, twice in 2019, and 2020). Entrainment rates of pallid sturgeon through the Bonnet Carré Spillway depend on water volume and velocity through structure, length of operation, and time of year of operation. At RM 50, below the Action Area, the USACE constructs a temporary sand weir using dredge material during low water months to manage salinity. It is believed that individuals below the temporary weir may be lost from the population due to low quality habitat as well as seasonal inhibition to upstream movement due to the weir.

4.3. Effects of the Action

This section analyzes the effects of the Action on the pallid sturgeon. Effects of the Action are all consequences to listed species or critical habitat that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action. A consequence is caused by the proposed action if it would not occur but for the proposed action and it is reasonably certain to occur. Effects of the Action may occur later in time and may include consequences occurring outside the immediate area involved in the Action (50 CFR §402.02). Our analyses are organized according to the description of the Action and the defined Action Area in Section 2 of this BO.

4.3.1. Effects of Project Construction

Pallid sturgeon are known to occur within the Mississippi River near the proposed diversion. During construction activities in the Mississippi River, such as dredging, vessel operations, pile driving and pier construction, there is a potential to disturb or injure pallid sturgeon near the action area. Construction related noise would be added to the baseline sound conditions of the Mississippi River. Noises from natural sources, such as wind-driven waves, storms, fish, currents, and vocalizing marine mammals are represented as ambient underwater sound levels. Underwater noise levels increase when anthropogenic sources are added to ambient noises. Anthropogenic underwater sound in the Mississippi River could be generated by fishing and recreational vessels, large commercial vessels, pile-driving, and dredging.

Collaboratively, NOAA, the Service, and the U.S. Federal Highway Administration established underwater sound levels for noise thresholds for fish behavior disruption and injury shown in Table 2 (WSDOT 2008). "Effective quiet" or safe exposure levels recognized by the National Marine Fisheries Service (NMFS) are as low as 150 decibels (dB); therefore, sounds below that level of effective quiet will not harass fish (NMFS 2016). While vessel operations that occur in the river could produce in-water noise disturbance, those noise levels are less than the injury effects threshold (i.e., 206 dB_{PEAK}) and are composed of a different sound signature than pile driving activities.

Underwater noise calculations for impact pile driving in the Mississippi River are expected to produce underwater sound levels of up to 208 dB_{Peak}, 190 dB_{RMS}, and 180 dB SEL, while vibratory pile driving is expected to produce underwater sounds levels of 182 dB_{Peak}, 165 dB_{Rms}, and 165 dB SEL (NOAA 2018). Over a duration of 1 month, an unknown number of pilings would be installed in the river using impact pile driving. Other pilings would be installed on the batture

Underwater sounds would be generated from impact pile driving activities to construct a pier and the cofferdam may be encountered by sturgeon within 3,281ft of these activities which could potentially injure those sturgeon, while behavioral impacts could extend to approximately 15,230 ft. The sounds from the impact pile driving activities would be the loudest underwater sound the species will encounter. These activities will be located along the eastern bank of the Mississippi River, where the river is approximately one-half mile wide near RM 144, which might not allow for unobstructed passage by fish through the areas of higher noise. Barotraumas (injuries caused by pressure waves, such as hemorrhage and rupture of internal organs), temporary stunning, and alterations in behavior are known to be caused by high underwater sound pressure levels (SPL) which can injure and/or kill fish (Turnpenny et al. 1994; Hastings and Popper 2005). Sturgeon have swim bladders which makes them more susceptible to barotraumas from impulsive sounds than fish without swim bladders. Juvenile white sturgeon have been found to be more susceptible to barotrauma after initial feeding due to the potential for herniation in their intestines. While the swim bladders partially inflate later in development because of the physiology of the swim bladder in sturgeon, gas transfers from the swim bladder can be released through the sturgeon's mouth (Brown et al. 2013).

Although behavioral responses in fish due to elevated underwater sound are not well understood, the responses could include a startle response, delayed foraging, or avoidance of the area. Feist et al. (1992) found that broad-band pulsed noise, such as impact pile driving noise, rather than continuous, pure tone noise like vibratory pile driving were more effective at altering fish behavior. Studies found that juvenile salmonids (40- to 60-millimeter in length) exhibit a startle response followed by an adjustment to low frequency noise in the 7 to 14 hertz (Hz) range (Knudsen et al. 1992 and Mueller et al. 1998). Those same studies also showed that noise intensity level must be 70 dB to 80 dB above the hearing threshold of 150 Hz to achieve a behavior response. To produce a behavioral response in herring, Olsen (1969) found ambient sound must be at least 24 dB less than the minimum audible field of the fish, and pile driving noise levels have to be 20 dB to 30 dB higher than sound levels. Juvenile sturgeon and herring are of similar size; therefore, herring can serve as a surrogate. Behavioral responses of pallid sturgeon are expected to be short-term and intermittent while construction is being conducted (approximately 8-12 hours/day).

To construct the project water control structure, a 140-foot-wide temporary earthen cofferdam would be constructed largely on the Mississippi River batture (at elevations mostly greater than 15 ft NAVD88). The cofferdam would isolate approximately 4 acres of the batture. Three of those acres would be excavated to construct the diversion intake channel. Within that cofferdam a sheetpile anti-seepage structure would also be constructed via impact hammer driving. Dredging of the Mississippi River to construct the intake channel would be to a depth of -4.0ft North American Vertical Datum 1988 (NAVD88). Downstream of the control structure and temporary cofferdam a temporary pile supported dock would be constructed. An unknown number of pilings would be driven using an impact hammer to drive the pilings. Construction of that dock would take approximately 1 month.

The isolated area of the river using the cofferdam could reduce habitat available to sturgeon, and any fish within the cofferdam area during installation may be lost. Temporary construction activities of the project could potentially alter pallid sturgeon habitat downstream, such as scour holes, sandbars, and flow refugia, due to the alteration of the Mississippi River flow volumes downstream of the construction area; however, because of the dynamic system of the river these alterations are not likely to be significant. Habitats used by larvae, juveniles, or migrating adults could be altered, but spawning habitat for pallid sturgeon is not known to occur in the area of the river near the proposed project area so spawning habitat will not be altered.

Studies have collected pallid sturgeon from a range of turbidity conditions, including highly altered areas with consistently low turbidities (i.e., 5-100 NTU) to comparatively natural systems such as the Yellowstone River that has seasonally high turbidity levels (>1,000 NTU) (Erickson 1992). Highly turbid river systems such as the Mississippi River are components of natural ecological processes in which pallid sturgeon evolved. Therefore, increased turbidity in the river from the construction activities is not anticipated to directly impact the pallid sturgeon.

Table 2. Guidance on Fish Underwater Noise Thresholds.

Functional Hearing Group	Noise Thresholds	
	Behavioral Disruption Threshold	Injury Threshold
Fish > 2 grams Fish < 2 grams Fish all sizes	150 dB RMS	187 dB Cumulative SEL 183 dB Cumulative SEL Peak 206 dB
SEL = sound exposure level = 1 dB re 1 μPa2 -sec RMS = For pile driving, this is the square root of the mean square of a single pile driving impulse pressure event Source: WSDOT 2018, NMFS 2018		

4.3.2. Effects of Diversion Operation

Depths utilized by pallid sturgeon have been reported throughout its range; however, because of the varying total depth of the rivers throughout its range this information may have limited applicability to the LMR, unless depth is expressed as a percent of the total river depth. Water depth elevations in the Mississippi River where the training walls and intake channel of the structure occur are at a depth of -4 feet NAVD88. The average relative depth (depth/total depth) utilized by pallid sturgeon on the Yellowstone and Missouri Rivers is approximately 0.70 (Bramblett 1996 cited in Constant et al. 1997; Constant et al. 1997). That relative depth indicates that pallid sturgeon typically use deeper portions of the river channel and may be unlikely to use the batture in front of the structure during its operation. However, the usage of this habitat has never been quantified (incidental usage or actively used) or documented in literature. Incomplete knowledge of pallid sturgeon life history, especially in the LMR, does not preclude high water usage of the batture as feeding habitat or velocity refugia.

The proposed diversion is anticipated to operate at flows up to 2,000 cfs for approximately 5 months per year (January through March, and May through June). During past operations of the Bonnet Carré Spillway (at RM 133), entrainment of pallid sturgeon was dependent on factors such as flow, length of opening, and temperature (Service 2021a). During the 2011 emergency operation of the Bonnet Carré Spillway, which had a maximum flow of 315,930 cfs, entrainment of 20 pallid sturgeon was recorded compared to the entrainment of one pallid sturgeon recorded after the emergency operations in 2020 with a maximum flow of 90,000 cfs (Service 2021b). Schultz (2013) found that small numbers of pallid sturgeon were entrained by the Davis Pond Freshwater Diversion (RM 119), while no pallid sturgeon were detected at smaller diversions that were sampled (at RM 83.8, 81.5, 64.5, and 63.9).

The Pallid Sturgeon Lower Basin Recovery Workgroup (Workgroup) has identified information gaps essential to the consultation and recovery processes in the Lower Mississippi River Basin. These include the following: relative abundance of pallid sturgeon, demographics, feeding habits, habitat use, hybridization ratios, presence of fish diseases in the wild, population anomalies, and reliable separation and identification of pallid sturgeon, shovelnose sturgeon, and hybrids. A more recent information gap identified by the Workgroup is the entrainment of adult and juvenile pallid sturgeon through the Old River Control Complex (ORCC) and potential entrainment through the existing coastal wetland restoration diversions. The implications of the Maurepas operations on sturgeon populations within the LMR can be better understood due to the completion of the "Entrainment Studies of Pallid Sturgeon Associated with Water Diversions in the Lower Mississippi River" (ERDC 2013), although some data gaps remain. The ERDC is currently conducting sturgeon entrainment studies at the ORCC and has documented entrainment of sonic-tagged pallid sturgeon and shovelnose sturgeon. While the specific reasons for sturgeon entrainment are unknown, researchers hypothesize one or more of the following reasons: (1) sturgeon located near the structure during the opening are immediately entrained; (2) sturgeon actively swim into the structure to obtain refuge or prey, or to move into a perceived transit path; or, (3) sturgeon are entrained passively or actively during down-river migration. Pallid sturgeon, as well as other sturgeon species, have positive rheotaxis and will orient into the direction of water flow. Previous captures of pallid sturgeon after Bonnet Carré Spillway emergency operations, near the spillway structure in channels and depressions, provide evidence that the sturgeon may remain near the structure due to this rheotaxis. Consequently, it is possible that pallid sturgeon entrained through the Maurepas Diversion control structure may remain near that structure and may swim back into the river should the structure be operated to reduce discharges prior to the summary/fall closure, or should river stages drop in June and naturally result in reduced discharges prior to the summer/fall structure closure.

There are no known topographic or hydrographic features (apart from current) that would appear to attract the sturgeon to the vicinity of the Maurepas Diversion intake structure. The shallow depth of the diversion intake channel (-4ft NAVD88) may tend to discourage pallid sturgeon use of that area if sturgeon prefer to use waters near the edge of the deep channel (Kirk et al. 2008).

Effects of the action on larval, fry, and juvenile fish

The presence of two larval *Scaphirhynchus* collected at RM 33 provided evidence for the presence of early life stages south of the proposed project area (Friedenberg and Siegrist 2019). The methods to collect larval and young-of-year (YOY) *Scaphirhynchus* have been refined during the past decade; therefore, the numbers of larval *Scaphirhynchus* collected within the Mississippi River have increased (Herzog et al. 2005; Hrabik et al. 2007; Phelps et al. 2010). In 1985, a shovelnose sturgeon larva was collected at White Castle (River Mile 193) (Constant et al. 1997). Larval shovelnose sturgeon have also been collected near Vicksburg, Mississippi, (River Mile 435) approximately 291 miles upstream of the proposed Maurepas project site (Constant et al. 1997; Hartfield et al. 2013; Schramm et al. 2017). Kynard et al. (2002) and Braaten et al. (2008) reported longer larval drift times; thus, greater distances were traveled by pallid sturgeon larva when compared to shovelnose sturgeon larva. Pallid sturgeon larvae were determined to travel at approximately the mean river velocity for the first 11 days after hatching and then slightly slower for the next 6 days because of the sturgeon's transition to a benthic life stage. Distances covered during larval drift are affected by water velocity; however, water temperature can affect larval/fry development rates (warmer temperatures increase development rates) which would also affect drift distances. Higher water velocities occur with larger flood events (USACE 2009). Water velocities in the Mississippi River south of Baton Rouge (River Mile 231) have been documented to range from 4.4 fps to 1.5 fps depending on the discharge. South of Baton Rouge the river channel is larger and the slope of the river decreases; thus, velocities are slower than those above Baton Rouge (Wells 1980). Surface water velocities measured north of Baton Rouge range from 2.9 fps to 5.6 fps for discharges of 200,000 cfs to l million cfs, respectively. Three surface velocity cross-sections taken south of Baton Rouge at discharges of 350,000, 460,000, and 470,000 cfs never had velocities greater than 4 fps, but a surface velocity cross-section taken north of Baton Rouge measured velocities in excess of 5 fps for a discharge of 310,000 cfs (Wells 1980). The most southern pallid sturgeon spawning sites are unknown; however, potential gravel bar spawning sites occur at various locations between Baton Rouge, Louisiana, and Vicksburg, Mississippi, (River Mile 435) approximately 291 miles upstream of the Maurepas site. If a mean water velocity of 5.9 fps (4 miles per hour) is assumed to have occurred from Vicksburg to the Maurepas site, larvae could travel as much as 96 miles per day, barring entrainment into the eddies, the batture, and other areas.

One seven-day and one nine-day post-hatch larval sturgeon were collected near Vicksburg, Mississippi, on May 20, which indicated that hatching occurred on the 13 and 11 of May, respectively. The previously mentioned larval sturgeon captured at White Castle was collected on May 15. Other larval sturgeon recently captured between Greenville and Vicksburg, Mississippi, (approximate Rivers Miles 540 and 440, respectively) would indicate hatching occurred in early to mid-May (Schramm et al. 2017). Although there could be limited spawning as early as late March, most spawning in the LMR occurs during late April through mid-May.

Normal Maurepas diversion operations include halting all diversion discharges during roughly a 1.5 month long period during April to mid-May, to promote temporary swamp floor dewatering (see Figure 7). The timing of this no-discharge period will be determined through adaptive management and may vary by a week or two depending on weather and forecast river stage conditions. It is possible therefore, that the annual spring no-discharge period may partly coincide with the late April to May period when larval sturgeon may occur in the vicinity of the diversion structure. Consequently, diversion entrainment impacts to larval sturgeon may be reduced should larval sturgeon be present.

Effects of the action on sub-adult and adult

Hoover et al. (2005) examined swimming performance of juvenile pallid sturgeon (maximum size 6.3 inches) at different velocities. Minimum escape speeds for pallid sturgeon ranged from

1.6 to 1.7 fps and burst speeds were determined to range from 1.7 to 2.95 fps; however, because they frequently failed to exhibit rheotaxis, their ability to avoid entrainment based on swimming performance was determined to be relatively low. Overall, approximately 18 percent were not positively rheotactic; however, Adams et al. (1999) found only 7 percent were non-rheotactic. White and Mefford (2002) examined swimming behavior and performance of shovelnose sturgeon ranging from 25.2 to 31.5 inches in length. Their ability to navigate the length of the test flume was best (60 to 90 percent) over a smooth bottom followed by coarse sand, gravel, and then cobble, but the small sample size and large variability precluded this from being a definitive conclusion. The greatest success at negotiating the flume was determined to occur between the range of 2 and 4 fps; however, success at greater velocities (6 fps) did occur. Approximately 30 percent failed to exhibit rheotactic behavior at velocities below 1.6 fps. Conversely, Adams et al. (1997) found all adult shovelnose to be positively rheotactic. Pallid sturgeon are believed to avoid areas that have very little or no water velocity (DeLonay and Little 2002, cited in Quist 2004; Erickson 1992 cited in Service, no date) and leave areas that no longer have flows (Backes et al. 1992; Constant et al. 1997).

The timing of pallid sturgeon movements and migration in the LMR may differ from that of other rivers and other portions of the Mississippi River (Constant et al. 1997). Migrations and movement in the Atchafalaya River was associated with water temperatures between 14 and 21 degrees Celsius (ºC) (Constant et al. 1997) and spring and early summer seasons (Schramm and Dunn 2008). During winter months, when water temperatures fall below 12ºC, pallid sturgeon have been caught in deeper water and reduced growth and survival of juvenile *Scaphirhynchus spp.* was noted; therefore, pallid sturgeon may be at a lower entrainment risk during winter (DeVries et al. 2015; Friedenberg and Siegrist 2019). This is supported by the observation of few pallid sturgeon entrained through the Bonnet Carré Spillway during the January emergency operation in 2016 (Service 2018). Given that the Maurepas Diversion would operate for roughly 5 months/year and because January and February (low water temperature months) are two of those five months, the sturgeon entrainment risks will be reduced.

4.3.3 Summary of Effects of the Action

The most comprehensive data on pallid sturgeon entrainment is that associated with the Bonnet Carré Spillway. Using Bonnet Carré Spillway data, in combination with a Bayesian analysis, the entrainment risk was estimated at 4.491 pallid sturgeon per billion meter cubed (B $m^{3)}$ water diverted. Given that the Maurepas Project would divert annually 0.645 B m^3, the expected Maurepas entrainment risk is 2.90 pallid sturgeon per year (with 95 percent confidence limits of 1.33 and 6.36) for age 3+ pallid sturgeon per year. See Table 3 below. Age 3+ fish are most often captured during field sampling, hence the confidence in population estimates is greatest for these older individuals. Assuming that age 3+ fish comprise 79 percent of the total population, then the expected average take for all fish would be 3.67 fish per year, with a 95 percent confidence range of 1.68 to 8.04 individuals per year).

Table 3. Estimates of volumetric entrainment rates of Pallid Sturgeon per billion cubic meters of diverted water from the current and previous studies. Estimates shown are using methods from the USFWS 2018 Biological Opinion, the 2019 reanalysis for estimation of take at the Mid-Barataria Sediment Diversion (2019), and the current analysis based on Bonnet Carré studies (MSA-2). Expected entrainment assumes diversion of 0.645 B m^3 annually (Friedenberg 2022).

			Expected entrainment per year at MSA-2 age 3+ (age 1+)		
Analysis	**Detection probability**	**Age 3+ (age 1+) entrainment per B m^3**	**Mean**	**95% LCL**	**95% UCL**
2018	0.100	3.58 (4.53)	2.31 (2.92)	-	-
2019	0.208	2.15 (2.72)	1.39 (1.75)	-	-
MSA-2	0.231	4.49 (5.69)	2.90 (3.67)	1.33 (1.68)	6.36 (8.04)

Within the lower Mississippi River, Killgore et al. (2007a) estimated the population density of 3+ aged pallid sturgeon between in the lower Mississippi River from New Orleans to the Ohio River (LMR) as 6.44 individuals per river mile. In the 217 river miles between the Old River Control Structure and New Orleans (217 RMs) there would be 1,397 age 3+ pallid sturgeon. Thus the estimated annual Maurepas Project entrainment for age 3+ fish equates to a per capita entrainment risk of 0.002 in the local population. Assuming that age 1 and 2 fish experience the same per capita risk, the Maurepas Project would result in a 0.1 to 0.5% mortality in the local population (for ages 1+). Considering the Mississippi River from New Orleans to the confluence of the Ohio River (858 RM), the Maurepas Project would impose an annual mortality on age 3+ pallid sturgeon of 0.02-0.11%, which is below the LMR annual total mortality rate of 7% (Killgore et al. 2007b).

4.4.Cumulative Effects

For purposes of consultation under ESA §7, cumulative effects are those caused by future state, tribal, local, or private actions that are reasonably certain to occur in the Action Area. Future Federal actions that are unrelated to the proposed action are not considered, because they require separate consultation under §7 of the ESA.

The MSA Project is estimated to result in a take of 1 to 8 pallid sturgeon/year from the river below New Orleans, and was determined not likely to jeopardize the continued existence of the species. Given that the magnitude of the estimated take for the MSA Project is small relative to the authorized take for the Mid-Barataria Sediment Diversion Project, it is unlikely that the cumulative effects of the existing diversions would be materially different than that of the Mid-Barataria Sediment Diversion Project. An additional large diversion below New Orleans, the Mid-Breton Sediment Diversion is currently in the planning phase. That project is a separate federal action that will require separate consultation under ESA §7. No additional non-federal actions are known within the action area that may affect the pallid sturgeon. Therefore, cumulative effects did not alter the conclusion reached in this BO for the action.

4.5. Conclusion

In this section, we summarize and interpret the findings of the previous sections for the pallid sturgeon (status, baseline, effects, and cumulative effects) relative to the purpose of a BO under §7(a)(2) of the ESA, which is to determine whether a Federal action is likely to:

a) jeopardize the continued existence of species listed as endangered or threatened; or
b) result in the destruction or adverse modification of designated critical habitat.

"*Jeopardize the continued existence*" means to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species (50 CFR §402.02).

The proposed MSA Project would involve construction, operation, and maintenance of a gated water control structure beneath the Mississippi River levees which would discharge fresh water, and nutrients from the Mississippi River to an outfall area within the southern Maurepas swamps. Construction activities on the river side would include pile driving as well as the isolation and dewatering (using a cofferdam) of approximately 4 acres in within the Mississippi River. Construction activities are estimated to take 3 years, in which impact pile driving activities would occur for one month in the river. Pallid sturgeon near this area of construction are anticipated to avoid the area during in-water pile driving activities due to increased underwater noise but would likely return to the area once noise returns to ambient levels. Any pallid sturgeon isolated in the cofferdam area may be lost but the isolation area is mostly shallow water portions of the river or batture lands that are flooded only during high river stages.

Operation of the MSA Project poses the risk of entrainment of all life stages of pallid sturgeon present in the area near the structure. As explained above, the MSA Project may result in the entrainment of 3.67 pallid sturgeon per year. Those individuals are assumed to be lost to the population. It is possible, however, that should velocities through the gated control structure decrease sufficiently, that previously entrained sturgeon could return to the river. Should this happen, it would reduce the already low entrainment loss rate. However, no information on the likelihood of this happening exists.

The projected entrainment loss is a very small portion of the local population (0.3% or less). Although small, this loss would have a negative effect on the pallid sturgeon population. However, based on our analysis, this loss would not be appreciable for the survival and recovery of the pallid sturgeon.

After reviewing the current status of the pallid sturgeon, the estimated effects of the construction, operation, and maintenance of the MSA Project, and the cumulative effects, it is the Service's biological opinion that the MSA Project is not likely to jeopardize the continued existence of the species.

5. INCIDENTAL TAKE STATEMENT

ESA §9(a)(1) and regulations issued under §4(d) prohibit the take of endangered and threatened fish and wildlife species without special exemption. The term "take" in the ESA means "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct" (ESA §3). In regulations at 50 CFR §17.3, the Service further defines:

- "harass" as "an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering;"
- "harm" as "an act which actually kills or injures wildlife. Such act may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding or sheltering;" and
- "incidental take" as "any taking otherwise prohibited, if such taking is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity."

Under the terms of ESA §7(b)(4) and §7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered prohibited, provided that such taking is in compliance with the terms and conditions of an incidental take statement (ITS).

For the exemption in ESA §7(o)(2) to apply to the Action considered in this BO, the USACE must undertake the non-discretionary measures described in this ITS, and these measures must become binding conditions of any permit, contract, or grant issued for implementing the Action. The USACE has a continuing duty to regulate the activity covered by this ITS. The protective coverage of §7(o)(2) may lapse if the USACE fail to:

- assume and implement the terms and conditions; or
- require a permittee, contractor, or grantee to adhere to the terms and conditions of the ITS through enforceable terms that are added to the permit, contract, or grant document.

In order to monitor the impact of incidental take, the USACE must report the progress of the Action and its impact on the species to the Service as specified in this ITS.

5.1. Amount or Extent of Take

This section specifies the amount or extent of take of listed wildlife species that the Action is reasonably certain to cause, which we estimated in the "Effects of the Action" section(s) of this BO. We reference, but do not repeat, these analyses here.

The Service estimated incidental loss (by death or serious injury) of 3.6 pallid sturgeon per year and 145 over the 50 years. The pallid sturgeon estimated as incidental loss are those anticipated to be entrained through the diversion of Mississippi River water as a result of implementing the proposed Action.

5.2. Reasonable and Prudent Measures

The Service believes the following reasonable and prudent measures (RPMs) are necessary or appropriate to minimize the impact of incidental take caused by the Action on the pallid sturgeon.

RPM 1. Gate operation that would significantly increase or decrease the velocity through the structure should be implemented over several hours to allow fish sufficient time to migrate back to the river or swim away from the structure.

RPM 2. The USACE will coordinate with the Service to develop a Fish Monitoring and Removal Plan for pallid sturgeon. This plan will need to be completed and approved by the Service prior to the construction of the cofferdam.

RPM 3. A local study should be conducted over several fall and winter periods to determine acceptable levels of entrainment using estimates of abundance, mortality, and recruitment in age-structure population models.

RPM 4: Ensure that the terms and conditions are accomplished and completed as detailed in this incidental take statement including the completion of reporting requirements.

5.3. Terms and Conditions

In order for the exemption from the take prohibitions of §9(a)(1) and of regulations issued under §4(d) of the ESA to apply to the Action, the USACE must comply with the terms and conditions (T&Cs) of this statement, provided below, which carry out the RPMs described in the previous section. These T&Cs are mandatory. As necessary and appropriate to fulfill this responsibility, the USACE must require any permittee, contractor, or grantee to implement these T&Cs through enforceable terms that are added to the permit, contract, or grant document.

T&C 1. RPM 1. The Service's Louisiana Ecological Services Office (337-291-3126) should be notified of any proposed changes to the proposed action described in the biological opinion, so that re-initiation of consultation under Section 7 of the ESA can proceed as quickly and efficiently as possible.

T&C 2. RPM 2. Develop a plan to be implemented for the proposed MSA Project that identifies potential avoidance and minimization measures for pallid sturgeon. Live sturgeon captured in the structure or the cofferdam area should be tagged and returned to the river.

T&C 3. RPM 3. A local study in the vicinity of the MSA Project to determine acceptable levels of entrainment would be conducted by qualified individuals. To the extent practicable, study data would be collected in coordination with other ongoing USACE pallid sturgeon studies in the LMR below the ORCC in order to understand pallid sturgeon populations in the vicinity of MSA Project, including impacts of migration/movement and/or entrainment in other structures between MSA Project and the ORCC on pallid sturgeon populations in the vicinity of MSA Project. The findings of this study will be used to inform operations of the MSA Project to minimize take of pallid sturgeon and may improve knowledge of impacts of diversion entrainment on pallid sturgeon populations in the LMR generally. A final report of the findings from the study would be submitted to the Louisiana Ecological Services Office once it has been completed.

T&C 4. RPM 4. Upon locating a dead, injured, or sick individual of an endangered or threatened species, the USACE must notify the Louisiana Ecological Services Office at Lafayette, Louisiana at (337) 291-3100 within 48 hours. Care should be taken in handling sick or injured individuals and in the preservation of specimens in the best possible state for later analysis of cause of death or injury.

T&C 5. RPM 4. A report describing the actions taken to implement the terms and conditions of this ITS shall be submitted to the Field Supervisor, U.S. Fish and Wildlife Service, 200 Dulles Drive, Lafayette, LA 70506, within 60 days of the completion of project construction. This report shall include the dates of work, assessment, and actions taken to address impacts to the pallid sturgeon, if they occurred.

5.4. Monitoring and Reporting Requirements

In order to monitor the impacts of incidental take, the USACE must report the progress of the Action and its impact on the species to the Service as specified in the ITS (50 CFR §402.14(i)(3)). This section provides the specific instructions for such monitoring and reporting (M&R). As necessary and appropriate to fulfill this responsibility, the USACE must require any permittee, contractor, or grantee to accomplish the monitoring and reporting through enforceable terms that are added to the permit, contract, or grant document. Such enforceable terms must include a requirement to immediately notify the Service if the amount or extent of incidental take specified in this ITS is exceeded during Action implementation.

M&R 1- Monitoring of the diversion structure for the entrainment of pallid sturgeon should be conducted, once the diversion is in operation. This monitoring should be conducted yearly, once flows through the diversion structure are halted for the summer. This report should include the number of pallid sturgeon captured in or downstream of the diversion structure throughout the year, time of year they were captured, flow volumes, and how the captures coincide with the flow.

M&R 2- A monitoring report will be submitted to the Service after the summer no-flow operations have occurred. This report should include any data sheets, maps, and the findings of the pallid sturgeon monitoring efforts.

6. CONSERVATION RECOMMENDATIONS

§7(a)(1) of the ESA directs Federal agencies to use their authorities to further the purposes of the ESA by conducting conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary activities that an action agency may undertake to avoid or minimize the adverse effects of a proposed action, implement recovery plans, or develop information that is useful for the conservation of listed species. The Service offers the following recommendations that are relevant to the listed species addressed in this BO and that we believe are consistent with the authorities of the USACE.

- Support pallid sturgeon monitoring and studies throughout the Lower Mississippi River to aid in the determination of future diversion impacts to the pallid sturgeon population, as well as to improve our understanding the species.

7. REINITIATION NOTICE

Formal consultation for the Action considered in this BO is concluded. Reinitiating consultation is required if the USACE retains discretionary involvement or control over the Action (or is authorized by law) when:

a. the amount or extent of incidental take is exceeded;
b. new information reveals that the Action may affect listed species or designated critical habitat in a manner or to an extent not considered in this BO;
c. the Action is modified in a manner that causes effects to listed species or designated critical habitat not considered in this BO; or
d. a new species is listed or critical habitat designated that the Action may affect.

In instances where the amount or extent of incidental take is exceeded, the USACE is required to immediately request a reinitiation of formal consultation.

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