Biological Opinion

Impact to Four Federally Listed Mussel Species From the U.S. Army Corps of Engineer's Authorization of Pine Bluff Materials Commercial Dredging Ohio River Miles 956 to 962

FWS Log #: 04EK1000-2021-F-1139

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EXECUTIVE SUMMARY

This Endangered Species Act (ESA) Biological Opinion (BO) of the U.S. Fish and Wildlife Service (Service) is related to a request from Pine Bluff Materials, LLC (PBM) to perform commercial sand and gravel dredging on the Ohio River from mile 956-962 in Ballard County, Kentucky. The U.S. Army Corps of Engineers (Corps) proposes to issue a Department of the Army Permit (DA Permit) which would authorize the discharge of dredge or fill material into Waters of the United States (WOTUS) associated with the commercial dredging activities (the Action). The Corps determined that the Action is likely to adversely affect the fat pocketbook (*Potamilus capax*), pink mucket (*Lampsilis abrupta*), orangefoot pimpleback (*Plethobasus* cooperianus), and sheepnose (*Plethobasus cyphus*) mussels and requested formal consultation with the Service. The BO concludes that the Action is not likely to jeopardize the continued existence of these 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 Corps also determined that the Action is not likely to adversely affect the clubshell (*Pleurobema clava*), fanshell (*Cyprogenia stegaria*), northern riffleshell (*Epioblasma torulosa rangiana*), rabbitsfoot (*Quadrula cylindrica cylindrica*), ring pink (*Obovaria retusa*), rough pigtoe (*Pleurobema plenum*), spectaclecase (*Cumberlandia monodonta*) or designated critical habitat for the rabbitsfoot, and the Corps requested Service concurrence on these determinations. We provided our concurrences with these determinations by letter dated August 31, 2021.

The BO includes an Incidental Take Statement (ITS). Incidental taking of listed species that is in compliance with the terms and conditions of the ITS 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 Corps.

Reinitiating consultation is required if the Corps 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.

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 Kentucky Field Office.

August 11, 2021	The Corps requested initiation of formal consultation pursuant to section 7(a)(2) of the Endangered Species Act for the fat pocketbook, pink mucket, orangefoot pimpleback, and sheepnose mussels, and requested concurrence with several "may affect – not likely to adversely affect" determinations for other species and designated critical habitat. A Biological Assessment (BA) dated March 2021 was also provided and accompanied the requests to initiate formal consultation and concur with the Corps' "may affect – not likely to adversely affect" determinations.
August 31, 2021	The Corps provided clarifying information regarding the estimated harvest and discharge associated with the Action as well as the duration of the permit.
August 31, 2021	The Service provided a letter acknowledging receipt of the BA and request for formal consultation. This letter also provided concurrence with the Corps effects determinations for other species and designated critical habitat not addressed in this formal consultation.
November 2, 2021	The Service provided a Draft Biological Opinion to the Corps for review.
November 9, 2021	The Corps notified the Service that they have no comments on the Draft Biological Opinion
November 9, 2021	The Service provided the Final Biological Opinion to the Corps.

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 of 1973, as amended (ESA), 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 U.S. Army Corps of Engineers (Corps) proposed issuance of a DA Permit for the Applicant's (Pine Bluff Materials, LLC (PBM)) proposed commercial dredging project (the Action). This BO considers the effects of the Action on the fat pocketbook (*Potamilus capax*), pink mucket (*Lampsilis abrupta*), orangefoot pimpleback (*Plethobasus cooperianus*), and sheepnose (*Plethobasus cyphus*) mussels.

The Service has designated critical habitat for the rabbitsfoot in this portion of the Ohio River (Unit RF20). The Service previously concurred with the Corps' determination that the Action may affect, but is not likely to adversely affect critical habitat for the rabbitsfoot. Because the Action will not adversely affect designated critical habitat, this BO does not address critical habitat.

The Corps previously determined that the proposed project will have "no effect" on the following federally listed species: gray bat (*Myotis grisescens*), northern long-eared bat *(Myotis septentrionalis*), and Indiana bat (*Myotis sodalis*). There is no statutory requirement to request concurrence with a "no effect" determination; however, the Service acknowledged these determinations in a letter dated August 31, 2021, and provided no additional comments or concerns regarding these species due to the lack of suitable habitat for these species in the project area. The Service also concurred with the Corps' determination that the Action is not likely to adversely affect the clubshell (*Pleurobema clava*), fanshell (*Cyprogenia stegaria*), northern riffleshell (*Epioblasma torulosa rangiana*), orangefoot pimpleback (*Plethobasus cooperianus*), pink mucket *(Lampsilis abrupta*), rabbitsfoot (*Quadrula cylindrica cylindrica*), ring pink (*Obovaria retusa*), rough pigtoe (*Pleurobema plenum*), sheepnose mussel (*Plethobasus cyphyus*), and spectaclecase (*Cumberlandia monodonta*) or designated critical habitat for the rabbitsfoot in the same August 31, 2021 letter. These species and critical habitat are not further addressed in this BO.

A BO evaluates the effects of a Federal action along with those resulting from other activities that are but for the Federal action and reasonably certain to occur, and from non-Federal actions unrelated to the proposed Action (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. (50 CFR §402.02).

2. PROPOSED ACTION

The proposed Action is the Corps' issuance of a Department of the Army (DA) authorization (LRL-2021-00419) for impacts to Waters of the United States (WOTUS) associated with the Pine Bluff Materials, LLC (PBM) request to commercially dredge sand and gravel from the bottom of the Ohio River between ORM 956 and 962. The dredging would occur between the left descending shore and the sailing line but would exclude any areas lying within the State of Illinois. The applicant is requesting authorization to harvest an estimated 4 million tons/year from this reach, with an estimated 5% discharge rate of unsuitable removed material. The estimated discharged dredged material would be 200,000 tons/year. Dredging activities would be conducted using one or more of the six hydraulic cutter suction dredges operated by PBM. These dredges use a modern cutter head with submerged pump technology. These dredges are sometimes referred to as floating plants because they not only dredge material from the river, but also classify and segregate the materials to meet customer specification, thus eliminating the need for land-based gradation facilities. The floating plants are used to recover materials from the owned and/or leased natural sand deposits in the Ohio River as well as to process and load the dredged materials into barges for transport to material yards and customers.

The floating plants require depths of at least 15 to 20 feet of water to operate properly and so PBM cannot engage in dredging operations in shallow areas of the river. Additionally, PBM does not operate their floating plants or any dredging operation within 150 feet of the shore or sailing line during normal pool. Maximum dredging depth is 70 feet from the surface of the pool in which they are operating. To prepare for dredging, a tug assists with locating the floating plant over the area where dredging will occur. To secure the dredge, a starboard and port-side anchor are usually used to secure the dredge as well as starboard and port-side spuds. During the dredging process, the spuds are used to hold the dredge in place, while the anchors are used to move the dredge side-to-side as needed. The dredge operator and/crew monitor the dredged material to ensure that the product meets applicable specifications. Once pumped to the surface, the material is passed through deck shaker screens where the substrate is separated into specific classifications and directed to barges fleeted to the floating plant in a condition ready for PBM's customers. These barges are then ready for transport to PBM's material yards or to other locations. Any material not needed, such as large rocks, unnecessary gravel, or wood debris, would be returned to the river near where it was dredged via a chute extending beneath the floating plant. The proposed permit duration is five years.

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" for this consultation includes the maximum footprint of the proposed commercial dredging area ranging from Ohio River Mile 956 to 962, between the 150 feet lateral buffer areas extending from the sailing line and the left descending shore of the Ohio River and excluding any areas in Illinois within this extent (Figure 1). This

action area includes all areas of the river that will be affected by the proposed dredging activities. Water quality degradation from turbidity is expected within the areas actively being dredged and where towboats are operating. Some of this turbidity may drift downstream. However, due to the large size of the proposed project area, it is unlikely that significant amounts would leave the project area. Additionally, given the size and flow of the Ohio River at this location, any turbid water leaving the action area will quickly be diluted by the flow. The maximum size of the action area is 3,900 feet wide (at its widest extent across the river) and 31,860 feet long (at its longest extent along the river, and encompasses approximately 2,308 acres, or 9,340,000 square meters.

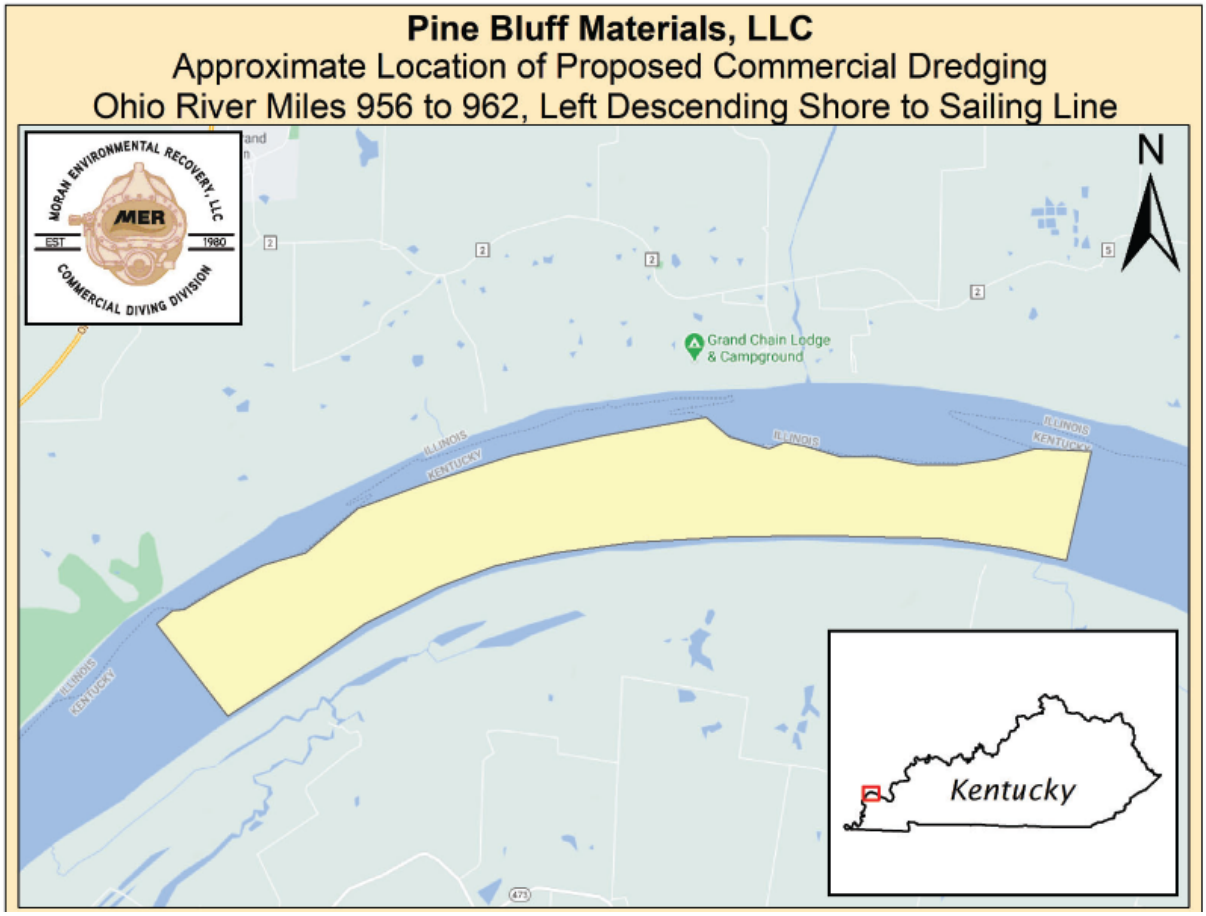


Figure 1. Map of the Action Area (Prepared by MER 2021)

2.2. Conservation Measures

PBM has committed to a variety of design and facility operational measures to avoid and minimize impacts of the proposed commercial dredging on the surrounding aquatic habitat and federally listed species. PBM has committed to the following:

1. PBM will utilize a modern cutter head and submerged pumps with their floating plants rather than the older 'digger chain' and surface-mounted pumps. 'Digging chain' dredging methods create significantly more turbidity, in addition to more violently and

percussively extracting the substrate for transport to the surface, which would be much more prone to crushing mussels than PBM's current setup.

2. PBM will employ crew members to monitor the dredged substrate as it is pumped up to the floating plants to ensure that mussels are not present in the material. If mussels are detected, the dredging operation will be shut down and the Service will be contacted.

3. PBM has agreed to contribute to the Kentucky Waterways Alliance's (KWA) Kentucky Aquatic Resources Fund (KARF), to minimize the anticipated take of fat pocketbook, orangefoot pimpleback, sheepnose, and pink mucket mussels. Based on the individuals of the listed mussels of each of the four listed species estimated to be impacted, those being a maximum of approximately 165 individual fat pocketbook mussels, four individual sheepnose mussels, one individual orangefoot pimpleback mussels, and one pink mucket mussel, PBM has agreed to contribute a total of $74,585.00 for these mussels. These funds will be used in propagation, culture, and other recovery efforts for these listed species. The total contribution will be made in one payment prior to the initial dredge event to:

   Kentucky Aquatic Resources Fund
   Attention: Ward Wilson, Executive Director
   Kentucky Waterways Alliance
   330 North Hubbards Lane
   Louisville, Kentucky 40207

   The KWA's office telephone number is 502-589-8008. Mr. Wilson will be contacted to determine if the contribution will be made by mail, direct deposit or a wire transfer.

2.3. Action Components

The Service's evaluation of the proposed dredging project resulted in the identification of three activities that may result in negative impacts to the federally endangered mussels: (1) tow boat operation, (2) spudding and anchoring, and (3) dredging.

2.3.1. Action Component 1: Tow Boat Operation

Tow boats will be used to position the floating plant and position barges to the floating plant. Tow boats produce propeller wash, which is a strong under current caused by the boats' engines and can result in water turbulence for some distance behind a tow boat. In shallow water, propeller wash can disturb channel substrates.

Based on our evaluation of the proposed tow boat activities, this activity is likely to result in the following stressors: sediment disturbance and water quality degradation. These stressors and their effects are discussed in section 5.

2.3.2. Action Component 2: Spudding and Anchoring

Spuds and anchors will be used to position the floating plant. Usually two anchors and two spuds will be sufficient to position the floating plant. Movement of the floating plant will be dependent on availability of sufficient material to dredge.

Based on our evaluation of the use of spuds and anchors, this activity is likely to result in the following stressor: crushing/shell damage, sediment disturbance, and water quality degradation. These stressors and their effects are discussed in section 5.

2.3.3. Action Component 3: Dredging

PBM's dredge operation will be carried out using "floating plants". The floating plants require depths of at least 15 to 20 feet of water to operate properly, so PBM cannot engage in dredging operations in shallow areas of the river. Additionally, PBM does not operate their floating plants or any dredging operation within 150 feet of the shore or sailing line during normal pool. Maximum dredging depth is 70 feet from the surface of the pool in which they are operating.

Based on our evaluation of this action component, this dredging activity is likely to result in the following stressors: crushing/shell damage, sediment disturbance, and water quality degradation. These stressors and their effects are discussed in section 5.

2.4. Other Activities Caused by the Action

A BO evaluates all consequences to species or critical habitat caused by the proposed Federal action, including the consequences of other activities caused by the proposed action, that are reasonably certain to occur (see definition of "effects of the action" at 50 CFR §402.02). Additional regulations at 50 CFR §402.17(a) identify factors to consider when determining whether activities caused by the proposed action (but not part of the proposed action) are reasonably certain to occur. These factors include, but are not limited to:

(1) past experiences with activities that have resulted from actions that are similar in scope, nature, and magnitude to the proposed action;
(2) existing plans for the activity; and
(3) any remaining economic, administrative, and legal requirements necessary for the activity to go forward.

In its request for consultation, the Corps described its proposed Federal Action (the issuance of Corps 404 permits) and the other activities caused by the Action that involve the applicant's commercial dredging of sand and gravel. This BO addresses the effects of the Action, including the effects of "other activities" caused by the Action.

3. CUMULATIVE EFFECTS

A BO must assess the consequences to species that are reasonably certain to occur as a result of future non-Federal activities within the action area, *i.e.,* cumulative effects. Cumulative effects are those effects of future State or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation" (50 CFR §402.02). Additional regulations at 50 CFR §402.17(a) identify factors to consider when determining whether activities are reasonably certain to occur. These factors include, but are not limited to: existing plans for the activity; and any remaining economic, administrative, and legal requirements necessary for the activity to go forward.

In its request for consultation, the Corps did not describe, and the Service is not aware of, any future non-Federal activities that are reasonably certain to occur within the Action Area.

Because we anticipate no cumulative effects, cumulative effects will not be further discussed in this BO.

4. STATUS OF THE SPECIES

This section summarizes best available data about the biology and current condition of the addressed mussel species throughout their ranges that are relevant to formulating a biological opinion about the Action.

4.1. Fat Pocketbook

The fat pocketbook was listed as endangered on June 14, 1976 (41 FR 24062-24067). A recovery plan was written in 1985, revised in 1989, and amended in 2019 (USFWS 2019). The fat pocketbook has a round to oblong shell that is greatly inflated and has a strong s-shaped hinge line. The beak cavity is very deep (Cummings and Mayer 1992). The shell is thin to moderately thick and the periostracum varies in color from light brown, yellow, or olive, and becoming dark brown in older individuals. The shell is typically rayless, smooth, and very shiny. Both anterior and posterior ends of the shell are rounded. The fat pocketbook is known to grow to a length of 5 inches. Internal morphology includes two pseudocardinal teeth in each valve, and both are thin, compressed, and elevated. There are two lateral teeth in the left valve and one in the right valve. Lateral teeth are thin and greatly curved in both valves. The nacre is bluish white and often iridescent; however, it may include some pink or salmon color in some specimens (Cummings and Mayer 1992). The fat pocketbook is a large-river species that is typically found in slow-flowing water with a mud (silt/clay), sand, or gravel substrate, at depths of a few inches to eight or more. It is a long-term brooder, with females becoming gravid in the fall, retaining glochidia over winter, and releasing the progeny during spring and summer. The main reason for decline of the species is channelization, impoundment and dredging of rivers, but contributing factors include siltation and pollution, and possibly range reductions of fish hosts. The freshwater drum (*Aplodinotus grunniens*) is the primary host fish for the species (Barnhart 1997, Watters 2007).

Historically, the fat pocketbook mussel was widely distributed in the Mississippi River drainage from the confluence of the Minnesota and St. Croix rivers, downstream to the White River system, with documented occurrences in Minnesota, Wisconsin, Iowa, Illinois, Indiana, Missouri, Kentucky and Arkansas (Service 2019). The range of the Fat Pocketbook has increased in recent years, over the historically documented extent. While it remains extirpated in the upper Mississippi River, it has expanded its range into the Lower Mississippi River and is known to occupy approximately 1,000 channel miles in three distinct drainages. Over the last thirty years, the fat pocketbook has been reported from several locations along the lower Ohio River. In the most recent Five-Year Review for this species, the Service (2019) recommended delisting due to recovery.

4.2. Pink Mucket

The pink mucket was listed as endangered on June 14, 1976 (Service 1976). This species features an elliptical to quadrangular shell and the yellow-brown surface of the shell is smooth except for relatively dark, concentric growth marks and wide greenish rays (Service 1985). Male pink mucket release sperm into the water in late summer or autumn and females take the sperm and then brood fertilized larvae over the winter in their gill pouches and release them the

following spring. The pink mucket inhabits shallow riffles and shoals of major rivers and tributaries and is found in rubble, gravel or sand substrates that have been swept free of silt by the current (Service 1985). The construction of dams and reservoirs on major rivers is likely the greatest factor in the decline of the pink mucket because the species is unable to adapt to reduced and sporadic flows, altered water temperatures and seasonal oxygen deficiencies. Heavy loads of silt have also been introduced into most watersheds where the pink mucket occurs from strip mining, coal washing, dredging and intensive logging (Service 2018).

Historically, the pink mucket was known from the Mississippi, Tennessee, Ohio, and Cumberland River systems; however, this species has never been collected in large numbers and has usually been considered rare (Service 1985). The pink mucket is still geographically widespread but remains in only 16 of the 25 rivers it once inhabited (NatureServe 2021). This species has been reported from the Clinch River in Tennessee; lower Ohio and Green Rivers in Kentucky; Big, Black, Little Black, and Gasconade Rivers in Missouri; and the Current River in Arkansas. Rivers with evidence of Pink Mucket recruitment include the Tennessee, Cumberland, Paint Rock, and Meramec (Service 1985). This species is considered extirpated from Ohio, except for possibly small parts of the Ohio River, and from Pennsylvania (NatureServe 2021).

4.3. Orangefoot Pimpleback

The orangefoot pimpleback was listed as an endangered species on June 14, 1976 (41 FR 24062-24067). It is a medium-sized mussel, growing to a length of approximately 3.5 inches and living to about 30 years of age. It is often found in substrate of silt, sand and gravel. Nacre color varies from white to pink inside the pallial line, being more intense toward the hinge-teeth. Historical records for the orangefoot pimpleback indicate this species is strictly an Ohioan or Interior Basin species (i.e., Ohio, Cumberland and Tennessee River drainages). This species is considered extremely rare wherever it is found. The best remaining populations of this species occurs in the lower, free-flowing reach of the Ohio River, and in the riverine portion of Kentucky Lake downstream of Pickwick Landing Dam in Tennessee. The fish host is unknown. No critical habitat has been designated for this species.

4.4. Sheepnose

The Service listed the sheepnose as endangered on March 13, 2012 (Service 2012). The sheepnose has an oblong and slightly inflated shell that can be up to five inches in length. The shell surface is mostly smooth with a row of knobs/tubercles on the center of valve, which may become worn down in older specimens. The outermost layer of the shell has no rays and is often yellowish color, but may also become dark brown with age (Cummings and Mayer 1992). The sheepnose is a short-term brooder, spawning and releasing young within a few weeks during the summer between mid-May and early August (Watters et al. 2009). The sheepnose primarily inhabits medium to large rivers in shallow areas with moderate to swift current that flows over gravel or mixed sand and gravel substrate (Cummings and Mayer 1992). It has also been found in habitats composed of mud, cobble and boulders, and in large rivers it may be found in deep runs (Service 2012). Large-river habitat throughout most of the Sheepnose range has been impounded, leaving short, isolated patches of habitat in areas between dams. These conditions result in population fragmentation, isolation, and other genetic-related concerns (Service 2020). Other threats include channelization, chemical contaminants, mining, sedimentation, disease or

predation, inadequacy of existing regulatory mechanisms, invasive species, oil and gas development, temperature, climate change, and overutilization for commercial, recreational, scientific, or educational purposes (Service 2020).

Records indicate the sheepnose historically occurred in at least 76 streams, comprising portions of 14 States, including Alabama, Illinois, Indiana, Iowa, Kentucky, Minnesota, Mississippi, Missouri, Ohio, Pennsylvania, Tennessee, Virginia, West Virginia, and Wisconsin. Extant populations of the sheepnose are known from 25 streams in all 14 states of historical occurrence. (Service 2020). It is known to occur within the Ohio River from the confluence with the Mississippi River upstream to Pennsylvania, including extant populations in western Kentucky and southern Indiana (Haag and Cicerello 2016). Currently, populations are considered to be stable to increasing in 2 streams, stable in 8 streams, declining in 4 streams, and unknown in 11 streams (Service 2020).

5. ENVIRONMENTAL BASELINE

In accordance with 50 CFR 402.02, 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 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.

5.1. Status of the Species within Action Area

During an October 29th, 2020 ground truthing survey, twenty-seven locations were sampled for river bottom substrate and each were searched for five minutes during a qualitative mussel survey, seven mussels from five species were found (MCD 2020; Appendix). Three of those seven mussels were found at one of the twenty-seven ground truthing locations, the substrate of which was comprised of scattered boulders in a bed of medium to large gravel and sand. The surveyed area between Ohio River miles 956 and 962 was noted to be primarily composed of sand and generally in some combination with smaller amounts of other substrates, principally gravel, but occasionally with silt near the shore. There were areas of clay along the left descending shore, as well as patches of higher density gravel/cobble within the river but these patches were more concentrated on the downstream half of the surveyed area, with the large majority of the entire action area consisting of unstable shifting sand composed into waves of various sizes, even in substrates where scattered large cobble and boulders were identified.

Although no federally listed mussel species were detected during the ground truthing survey, this search was not intended to determine presence and/or probable absence of federally listed mussels within the action area. This survey provided an initial evaluation of the mussel community and habitats available within the action area. The Corps has determined that the fat pocketbook, pink mucket, orangefoot pimpleback and sheepnose mussels are relatively certain to

occur within the Action Area and to be affected by the Action. Since these species were not detected during the Survey, the density of these species was determined using the results of three larger quantitative survey efforts that occurred in close proximity to the Action Area. The full methodology is described in the BA (MER 2021) and estimates that the proposed action will affect 165 fat pocketbook, 4 sheepnose, 1 pink mucket and 1 orangefoot pimpleback.

5.2. Factors Affection the Species within the Action Area

Substrate Conditions
The substrate within the Action Area is primarily composed of sand and some combination with other substrates, principally gravel, but occasionally with silt near the shore. There are areas of clay along the left descending shore, as well as patches of higher density gravel/cobble within the river. However, these patches are more concentrated on the downstream half of the surveyed area, with the upstream half more characterized by unstable shifting sand composed into varying wave dimensions. Altogether, the large majority of the proposed dredging area was observed through side scan sonar imagery to be comprised of unstable shifting sand or sand-based substrates in wave formations spanning from very short periods to very wide periods.

Water Quality
Another factor potentially affecting the species' environment in the Action Area includes the makeup of water quality upstream of the Action Area, including possible contaminants from urban runoff, sewer outfalls, and industrial complexes located upstream.

Dam
Dams are a barrier in the Ohio River that may impact host fish movement upstream and downstream, possibly limiting the amount of contact between fish and mussels at times when a gravid mussel is ready to release larvae. By preventing upstream movement, it is possible that a dam could cause a fish host to slow its movement upstream, and spend more time just downstream of the dam, thereby increasing its contact time with a mussel.

Barge Traffic
Barge traffic moves both upstream and downstream of the project site. In 2007, a barge hit Lock and Dam 52 and leaked approximately 7,000 to 8,000 gallons of cumene (i.e., isopropylbenzene). Lock and Dam 52 has since been decommissioned and demolished.

Other activities
Private actions that may impact the Action Area are primarily urban runoff and point source releases from the city and industries and agriculture-related activities, such as row crop farming, that may increase sedimentation and turbidity. Private boating and commercial navigation activities also occur in the Ohio River and are expected to continue. Effects from urban and agricultural activities on mussels could include increased sediment deposition, turbidity, and herbicide/pesticide levels in localized portions of the Ohio River. However, these effects, if they are occurring, are indeterminable.

Zebra Mussels
No zebra mussels were observed during the mussel survey in the Action Area; however, zebra mussels have been observed near the Action Area since the early 1990s (USGS 2021).

6. EFFECTS OF THE ACTION

In accordance with 50 CFR 402.02, effects of the Action are all consequences to listed species or critical habitat that are caused by the Action, including the consequences of other activities that are caused by the 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 (see § 402.17).

The Service established additional requirements for making the determination of reasonably certain to occur, which must be followed after October 28, 2019, the effective date of new regulations under 50 CFR 402. After determining that the "activity is reasonably certain to occur," based on clear and substantial information, using the best scientific and commercial data available, there must be another conclusion that the consequences of that activity (but not part of the proposed action or activities reviewed under cumulative effects) are reasonably certain to occur. In this context, conclusion of reasonably certain to occur must be based on clear and substantial information, using the best scientific and commercial data available after consideration of three factors in 402.17(b)(1-3).

There is no intent that the 2019 regulatory changes alter how we will analyze the effects of a proposed action or the scope of effects. We will continue to review all relevant effects of a proposed action as we have in past decades, but the Service determined it was not necessary to attach labels to various types of effects through regulatory text. That is, we intend to capture all of those effects (now "consequences") previously listed in the regulatory definition of effects of the action— direct, indirect, and the effects from interrelated and interdependent activities—in the new definition. These effects are captured in the new regulatory definition by the term ''all consequences'' to listed species and critical habitat.

Based on the description of the Action and the species' biology, we have identified three stressor(s) to the four federally listed mussel species (i.e., the alteration of the environment that is relevant to the species) that may result from the Action. These stressors are: (1) sediment disturbance (2) water quality degradation, and (3) crushing/shell damage. Below, we discuss the best available science relevant to each stressor. Then, we describe the Stressor-Exposure-Response pathways that identify the circumstances for an individual's exposure to the stressor (i.e., the overlap in time and space between the stressor and the species). Finally, we identify and consider how proposed conservation measures may reduce the severity of the stressor or the probability of an individual's exposure for each pathway.

Stressor by Action Component

	Action Component		
Stressor	*Tow Boat Operation*	*Spudding and Anchoring*	*Dredging*
Sediment Disturbance	X	X	X
Water Quality Degradation	X	X	X
Crushing/Shell Damage		X	X

6.1. Stressor 1: Sediment Disturbance

Mussels may be affected by the spudding and anchoring needed to position the floating plants, the tow boat operation needed to move them, and the actual dredging. Spudding is the placement of posts or poles, usually located at the four corners of a work barge or along the edge of a work barge, which are lowered into the substrate. Sediment may be disturbed by the tow boats operating in shallow water as the need arises for repositioning of the floating plant and by dredging activities. The floating plant will be located at least 150 feet from a shoreline and in water at least 15 feet deep and tow boats will be used to move and position the floating plant. When the tow boats are operating in shallow water, their propeller wash has the potential to impact mussels by disturbing the river substrate resulting in substrate being disturbed in some locations and deposited in others. The effects of propeller wash decrease as water depth increases, with effects expected to be insignificant at depths of 20 feet or greater. Additionally, use of the cutter head while dredging material will result in sediment disturbance.

Effects Pathway #1	
Activity: Spudding and Anchoring	
Stressor: Sediment Disturbance	
Exposure (time)	Year-round, whenever operating, for life of the Corps' 5-year permit
Exposure (space)	Areas adjacent to spud and spar barges and anchors
Resource affected	Individuals (larvae, juveniles, adults), and habitat
Individual response	• Reduced respiration and feeding from clogged gills or smothering • Disruption of metabolic processes, leading to reduced fitness and growth rates • Reduced recruitment due to elimination of interstitial spaces used by juveniles • Movement due to alteration or loss of habitat
Conservation Measures	None
Interpretation	Sediment disturbance will occur where the spud piles and anchors contact the substrate, and sediment deposition may occur adjacent to the structures from the accumulation of displaced sediment. However, the effects from sediment disturbance from spudding and anchoring will be insignificant due to the small area and short duration of disturbance.
Effect	Insignificant

Effects Pathway #2	
Activity: Tow Boat Operation	
Stressor: Sediment Disturbance	
Exposure (time)	Year-round, whenever operating, for life of the Corps' 5-year permit
Exposure (space)	Portions of the Action Area where tow boats are operating in less than 20 feet of water depth.
Resource affected	Individuals (larvae, juveniles, adults), and habitat
Individual response	• Reduced respiration and feeding from clogged gills or smothering • Disruption of metabolic processes, leading to reduced fitness and growth rates • Reduced recruitment due to elimination of interstitial spaces used by juveniles • Movement due to alteration or loss of habitat
Conservation Measures	None
Interpretation	Mussels exposed to sediment disturbance may be smothered or buried, resulting in individual harm or mortality (Marking and Bills 1980; Waters 1995). Depending on the depth of the substrate disturbance and/or deposition, some mussels may be able to adjust their position such that the disturbance does not result in death. Sediment disturbance may also render habitat unsuitable for mussels by making the substrate more unstable, and alter flow characteristics, further degrading habitat conditions.
Effect	Adverse (Harm, Mortality)

Effects Pathway #3	
Activity: Dredging	
Stressor: Sediment Disturbance	
Exposure (time)	Year-round, whenever operating, for life of the Corps' 5-year permit
Exposure (space)	Where active dredging is occurring
Resource affected	Individuals (larvae, juveniles, adults), and habitat
Individual response	• Reduced respiration and feeding from clogged gills or smothering • Disruption of metabolic processes, leading to reduced fitness and growth rates • Reduced recruitment due to elimination of interstitial spaces used by juveniles • Movement due to alteration or loss of habitat
Conservation Measures	Utilization of modern cutter head and submerged pumps with floating plants minimizes the amount of substrate disturbance and loose sediment in the water.
Interpretation	Mussels exposed to sediment disturbance may be smothered or buried, resulting in individual harm or mortality (Marking and Bills 1980;

	Waters 1995). Depending on the depth of the substrate disturbance and/or deposition, some mussels may be able to adjust their position such that the disturbance does not result in death. Sediment disturbance may also render habitat unsuitable for mussels by making the substrate more unstable, and alter flow characteristics, further degrading habitat conditions.
Effect	Adverse (Harm, Mortality)

6.2. Stressor 2: Water Quality Degradation

The presence of the spud and spar barges in the fleeting areas may result in minor flow modifications that could cause water quality degradation; however, the turbidity generated by these activities is likely to be low and only present for a short duration. When operating in shallow water, tow boats are likely to disturb substrate as a result of propeller wash. Similarly, the operation of the cutter head during dredging will result in water quality degradation through the disturbance of sediments. Turbidity from dredging activities will be reduced compared to standard dredging activities by the use of modern cutter head and submerged pumps with floating plants. Both dredging and tow boat operation may cause a local degradation of water quality in the form of increased turbidity and decreased dissolved oxygen levels.

Effects Pathway #4	
Activity: Spudding and Anchoring	
Stressor: Water Quality Degradation (Turbidity)	
Exposure (time)	Year-round, whenever operating, for life of the Corps' 5-year permit
Exposure (space)	Areas adjacent to spuds and anchors
Resource affected	Individuals (larvae, juveniles, adults)
Individual response	• Increased turbidity and low dissolved oxygen levels could lead to reduced fitness, reduced fecundity, and/or increased mortality. • Reduced reproduction due to inability of fish hosts to detect mussels due to increased turbidity
Conservation Measures	None
Interpretation	Water quality degradation may impair the ability of mussels to respire, reproduce, and feed, reducing the fitness of individual mussels and the population (Watters et. al 2009). This stressor will be distributed across the Action Area wherever spudding and anchoring is conducted. However, the turbidity generated by these activities is likely to be low and only present for a short duration.
Effect	Insignificant

Effects Pathway #5	
Activity: Tow Boat Operation, Dredging	
Stressor: Water Quality Degradation (Turbidity)	
Exposure (time)	Year-round, whenever operating, for life of the Corps' 5-year permit
Exposure (space)	Area around cutter head near front of floating plant and shallow portions of the mooring area where tow boats may be operating

Resource affected	Individuals (larvae, juveniles, adults)
Individual response	• Increased turbidity and low dissolved oxygen levels could lead to reduced fitness, reduced fecundity, and/or increased mortality. • Reduced reproduction due to inability of fish hosts to detect mussels due to increased turbidity • Reduced aquatic food organism diversity and abundance could negatively impact mussel growth, survival, and reproduction
Conservation Measures	Utilization of modern cutter head and submerged pumps with floating plants reduces the amount of substrate disturbance and turbidity
Interpretation	Water quality degradation may impair the ability of mussels to respire, reproduce, and feed, reducing the fitness of individual mussels and the population (Watters et. al 2009). This stressor will be distributed across the Action Area wherever the dredging activity, tow boat operations, and spudding and anchoring is conducted. The exposure to this stressor is expected to occur periodically over the duration of the project whenever mussels are encountered
Effect	Adverse (Harm, Mortality)

6.3. Stressor 3: Crushing/Shell Damage

Dredging will be accomplished by use of a cutter head and submerged pumps that will collect extracted material from the river bottom and transport the material up to the floating plant for processing. Mussels may be injured and/or crushed through operation of the cutter head. Mussels located at the cutter head will likely be impacted by contact with the cutter head and/or substrate excavation during dredging. In addition, during positioning and repositioning the floating plant, spuds and anchor may be placed directly on mussels, causing shell damage or crushing of individuals.

Effects Pathway #5	
Activity: Spudding and Anchoring, Dredging	
Stressor: Crushing/Shell Damage	
Exposure (time)	Year-round, whenever operating, for life of the Corps' 5-year permit
Exposure (space)	Area in cutter head near front of floating plant, beneath spuds and anchors
Resource affected	Individuals (juveniles and adults)
Individual response	Harm or mortality from being crushed or struck by material or equipment
Conservation Measures	• Utilization of modern cutter head and submerged pumps with floating plants reduces the chance of damaging mussels versus traditional dredging techniques. • PBM will employ crew members to monitor the dredged substrate as it is pumped up to the floating plants to ensure that mussels are not present in the material. If mussels are detected, the dredging operation will be shut down and the Service will be contacted.
Interpretation	This stressor will be distributed across the Action Area wherever the

	dredging, spudding, and anchoring activities are conducted. Both adult and juvenile mussels could be affected. Shells protect the soft tissue of the mussel from injury. If the shell is broken and/or crushed, damage to the inner tissue can result in injury and/or death. The exposure to this stressor is expected to occur periodically over the duration of the project whenever fat pocketbook mussels are encountered.
Effect	Adverse (Harm, Mortality)

6.3.1. Summary of the Effects of the Action

The proposed Action is likely to expose the fat pocketbook, pink mucket, orangefoot pimpleback, and sheepnose mussels to the three stressors evaluated above and summarized in the table below. Through the implementation of conservation measures, effects of the following stressors – sediment disturbance, water quality degradation, and crushing/shell damage – would be minimized on the species. No wholly beneficial effects have been identified or are expected to occur as a result of the Action; however, the proposed contribution to the KARF will be used to promote the conservation and recovery of the species.

7. CONCLUSION

In this section, we summarize and interpret the findings of the previous sections for each species (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). "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 (50 CFR §402.02).

After reviewing the current status of each species, the environmental baseline for the Action Area, the effects of the Action and the cumulative effects, it is the Service's biological opinion that the Action is not likely to jeopardize the continued existence of the fat pocketbook, pink mucket, orangefoot pimpleback, or sheepnose mussels.

We reached this determination based on our effects analysis in this BO and how those effects relate to the resiliency, redundancy, and representation of the fat pocketbook, pink mucket, orangefoot pimpleback, and sheepnose mussels:

- These species are expected to occur in low numbers across the Action Area due to most of the area being unsuitable for these species and the number of individuals likely to be impacted by the Action represent a small fraction of each species' total population. For these reasons we do not expect the resiliency of the fat pocketbook, pink mucket,

orangefoot pimpleback, and sheepnose mussel to be significantly reduced by the proposed Action.

- The proposed Action does not occur within a known mussel bed and no individuals were detected during the ground truthing survey. For these reasons we do not expect the redundancy of the fat pocketbook, pink mucket, orangefoot pimpleback, and sheepnose mussel to be significantly reduced by the proposed Action.
- Although little is known about the genetic diversity within and among populations of these species, the small number of individuals likely to be impacted is not expected to reduce the overall diversity of these species. Additionally, the Action Area represents a small portion of their overall ranges. For these reasons, we do not expect the representation of the fat pocketbook, pink mucket, orangefoot pimpleback, and sheepnose mussel to be significantly reduced by the proposed Action.

Based on this analysis, we conclude that the effects of the action will not appreciably reduce the likelihood of both the survival and recovery of the fat pocketbook, pink mucket, orangefoot pimpleback, and sheepnose mussel.

After reviewing the current status of the species, the environmental baseline for the Action Area, the effects of the Action and the cumulative effects, it is the Service's biological opinion that the Action is not likely to jeopardize the continued existence of the fat pocketbook, pink mucket, orangefoot pimpleback, and sheepnose mussel.

Designated critical habitat for the rabbitsfoot does occur within the Action Area. On August 31, 2021, the Service concurred that the Action may affect, but is not likely to adversely affect designated critical habitat for the species based conservation measures put in place. Therefore, it is the Service's biological opinion that the Action is not likely to result in the destruction or adverse modification of designated critical habitat for the rabbitsfoot.

8. 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).

8.1. Amount or Extent of Take

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

The Service estimated the number of individuals reasonably likely to occur in the Action Area (see section 4, Environmental Baseline). We evaluated the potential for these individuals to be exposed to the stressors resulting from the proposed Action. Finally, we evaluated how the individuals' responses to their exposure to these stressors would apply to the statutory and regulatory definition of take (see Effects of the Action section).

From our evaluation, the proposed Action is reasonably certain to cause the incidental take of 165 fat pocketbook, 1 pink mucket, 1 orangefoot pimpleback, and 4 sheepnose mussels within the Action Area and consistent with the definition of harm. The Service believes the incidental taking of these mussels associated with the Action will be difficult to detect due to the cryptic nature of mussels in the substrate of the river. This taking is expected in the form of harm/mortality. Harm/mortality will occur when mussels are crushed and/or shells damaged, sediment disturbed, and/or water quality is impacted due to project activities.

8.2. Reasonable and Prudent Measures

The Action includes conservation measures, discussed previously, to avoid and minimize impacts to fat pocketbook, pink mucket, orangefoot pimpleback, and sheepnose mussels. The analysis of effects of the Action in this BO considers that the Corps will authorize all activities under the Action in a manner that is consistent with the description of activities provided in the Biological Assessment, including all applicable conservation measures. Based on appropriate implementation of these measures, the Service believes that no additional "reasonable and prudent measures" will be necessary to minimize incidental take of fat pocketbook, pink mucket, orangefoot pimpleback, and sheepnose mussels caused by the Action.

8.3. Terms and Conditions

No reasonable and prudent measures to minimize incidental take caused by the Action are provided in this ITS; therefore, no terms and conditions for carrying out such measures are necessary.

8.4. Monitoring and Reporting Requirements

In order to ensure that the impacts of incidental take are appropriately monitored, the Corps must ensure that the progress of the Action and its impact on the species to the Service are reported as specified in the incidental take statement (50 CFR §402.14(i)(3)). As necessary and appropriate to fulfill this responsibility, the Corps 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 are exceeded during implementation of the Action covered by this BO.

9. 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 has not identified any conservation recommendations for this BO.

10. REINITIATION NOTICE

Formal consultation for the Action considered in this BO is concluded. Reinitiating consultation is required if the Corps 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.

This consultation was assigned FWS ID #2021-F-1139. Please refer to this number in any correspondence concerning this consultation.

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